



SAFETY INSTRUCTIONS

To prevent injury and property damage, follow these instructions during the installation and operation of the inverter.

Incorrect operation due to ignoring these instructions may cause harm or damage. The following symbols are used throughout the manual to highlight important information.



DANGER

This symbol indicates death or serious injury can occur if you do not follow instructions.



WARNING

This symbol indicates the possibility of death or serious injury.



CAUTION

This symbol indicates the possibility of damage to the inverter or other components.

■ The meaning of each symbol in this manual and on your equipment is as follows.



This is the safety alert symbol.

Read and follow instructions carefully to avoid a dangerous situation.



This symbol alerts the user to the presence of “dangerous voltage” inside the product that might cause bodily harm or electric shock.

■ This manual should be placed in a location where it can be accessed by users.

■ This manual should be given to the person who actually uses the inverter and is responsible for its maintenance.



WARNING

- **Do not remove the cover while power is applied or the unit is in operation.**
Otherwise, electric shock could occur.
- **Do not operate the inverter with the front cover removed.**
Otherwise, electric shock can occur due to the exposed terminals and bus bars.
- **Do not remove the cover except for periodic inspections or wiring, even if the input power is not applied.**
Otherwise, electric shock can occur due to accessing capacitor banks.
- **Wiring and periodic inspections should be performed at least 10 minutes after disconnecting the input power and after checking the DC link voltage is discharged with a meter (below 30VDC).**
Otherwise, electric shock could occur.
- **Operate the switches with dry hands.**
Otherwise, electric shock could occur.
- **Do not use the cable when its insulating tube is damaged.**
Otherwise, electric shock could occur.
- **Do not subject the cables to scratches, excessive stress, heavy loads or pinching.**
Otherwise, electric shock could occur.



CAUTION

- **Install the inverter on a non-flammable surface. Do not place flammable materials nearby.**
Otherwise, fire could occur.
- **Disconnect the input power if the inverter has been damaged.**
Otherwise, it could result in a secondary accident and fire.
- **Do not touch the inverter after shutting down or disconnecting it. It will remain hot for a couple of minutes.**
Otherwise, bodily injuries such as skin-burn or damage could occur.
- **Do not apply power to a damaged inverter or to an inverter with parts missing even if the installation is complete.**
Otherwise, electric shock could occur.

Do not allow lint, paper, wood chips, dust, metallic chips or other foreign material into the drive.

Otherwise, fire or accident could occur.

- **Equipment is intended for installation in closed electrical operating areas only**
- **On User's Manual it shall be made clear that maintenance adjustments should be made by qualified personnel.**

OPERATING PRECAUTIONS

(1) Handling and installation

- The iP5A series inverter can be heavy. Lift according to the weight of the product. Use a hoist or crane to move and install the iP5A series inverter if necessary. Failure to do so may result in personal injury or damage to the inverter.
- Do not stack the inverter boxes higher than the number recommended.
- Install the inverter according to instructions specified in this manual.
- Do not open the cover during delivery.
- Do not place heavy items on the inverter.
- Check that the inverter mounting orientation is correct.
- Do not drop the inverter, or subject it to hard impact.
- Verify the ground impedance 100ohm or less for 230 V Class inverters and 10ohm or less for 460V class inverters.
- Take protective measures against ESD (Electrostatic Discharge) before touching the pcb boards during inspection, installation or repair.
- The inverter is designed for use under the following environmental conditions:

| | | |
|-------------|----------------------|--|
| Environment | Ambient temp. | - 10 ~ 50 °C (14°F ~ 122°F) Decrease 2% of rated current for every 1 °C increase in above 40°C. |
| | Relative humidity | 90% Relative Humidity or less (non-condensing) |
| | Storage temp. | - 20 ~ 65 °C (-4°F ~ 149°F) |
| | Location | Protected from corrosive gas, combustible gas, oil mist or dust (Pollution Degree 2 Environment) |
| | Altitude, Vibration | Max. 1,000m (3,300ft) above sea level, Max. 5.9m/sec ² (0.6G) or less |
| | Atmospheric pressure | 70 ~ 106 kPa (20.67 in Hg ~ 31.3 in Hg) |

(2) Wiring

- Do not connect power factor correction capacitors, surge suppressors, or RFI filter to the output of the inverter.
- The connection orientation of the motor output cables U, V, W will affect the direction of rotation of the motor. Verify correct wiring before starting inverter.
- Incorrect terminal wiring could result in inverter and/or equipment damage.
- Reversing the polarity (+/-) of the terminals could damage the inverter.
- Only authorized personnel familiar with LS inverter should perform wiring and inspections.

- Always install the inverter before wiring. Otherwise, electric shock or bodily injury can occur.
- Wire insulation recommended for main power circuits.(Refer to Appendix A)

(3) Trial run

- Check all parameters during operation. Parameter values might require adjustment depending on the application.
- Always apply voltage within the permissible range of each terminal as indicated in this manual. Otherwise, inverter damage may result.

(4) Operation precautions

- When the Auto restart function is selected, the inverter will restart after a fault has occurred.
- The Stop key on the keypad can only be used to stop the inverter when keypad control is enabled. Install a separate emergency stop switch if necessary.
- If a fault reset is made with the run command and /or reference signal present, a sudden start will occur. Check that the run command and /or reference signal is turned off in advance of resetting any faults. Otherwise an accident could occur.
- Do not modify the inverter.
- Depending on the motor specifications and user ETH overload settings, the motor may not be protected by electronic thermal function of inverter.
- The operation of the inverter is intended to be controlled by either keypad command or control input signals. Do not use a magnetic contactor or any other device that routinely disconnects the inverter and reconnects the inverter to the input supply power for the purpose of starting and stopping the motor.
- A noise filter may be installed to reduce the effect of electromagnetic interference. Otherwise nearby electronic equipment may be affected.
- In cases with input voltage unbalances, install an AC input reactor.
- Power Factor capacitors and generators may become overheated and damaged due to harmonics created by the inverter.
- Use an insulation-rectified motor or take measures to suppress the micro surge voltage when driving 460V class motor with inverter. A micro surge voltage attributable to wiring constant is generated at motor terminals, and may deteriorate insulation and damage motor.
- Before operating unit and prior to user programming, reset user parameters to default settings.
- The Inverter can be set to operate a motor at high-speeds. Verify the speed capability of motor and machinery prior to operating inverter.
- Holding torque is not produced when using the DC-Brake function. Install separate equipment when holding torque is required.

(5) Fault prevention precautions

- If required, provide a safety backup such as an emergency mechanical brake to prevent any hazardous conditions if the inverter fails during operation.

(6) Maintenance, inspection and parts replacement

- Do not megger (hi-pot or insulation resistance) test the power or control circuit of the inverter.
- Refer to Chapter 8 for periodic inspection and parts replacement details.

(7) Disposal

- Handle the inverter as an industrial waste when disposing of it.

(8) General instructions

Many of the diagrams and drawings in this instruction manual show the inverter without a cover. Prior to operating the unit, be sure to restore covers and circuit protection according to specifications.

(9) Protective requirements

The accessible connections and parts listed below are of protective class 0, it means that the protection of these circuits relies only upon basic insulation and becomes hazardous in the event of a failure of the basic insulation. Therefore, devices connected to these circuits must provide electrical-shock protection as if the device was connected to supply mains voltage. In addition, during installation these parts must be considered, in relation with electrical-shock, as supply mains voltage circuits.

This applies to the following circuits :

STARTING CONTACT FUNCTION SELECT

M1,M2,M3, FX [M7], RX [M8], JOG [M6], BX [M5], RST [M4], CM, 24

ANALOG FREQUENCY SETTING

V+, V-, I, A0, B0, 5G (~30kW), CM(37kW~)

EXTERNAL MOTOR THERMAL DETECTION

NT (~30kW), ET (37kw ~), 5G

BUILT-IN RS485 TERMINAL

C+, C-, CM

ANALOG OUTPUT

S0, S1, 5G

CONTACT

3A, 3C, 3B, "A1~4, C1~4"

CONSOLE PORT

FAN CIRCUITS

Table of Contents

| | |
|--|------|
| CHAPTER 1 - BASIC INFORMATION | 1-1 |
| 1.1 INSPECTION..... | 1-1 |
| 1.2 BASIC CONFIGURATION | 1-2 |
| CHAPTER 2 - SPECIFICATION | 2-1 |
| 2.1 200~230V CLASS (0.75~30kW / 1~40HP)..... | 2-1 |
| 2.2 380~480V CLASS (0.75~30kW / 1~40HP) | 2-1 |
| 2.3 525~600V CLASS (5.5~30kW / 7.5~40HP) | 2-2 |
| 2.4 380 ~ 480V CLASS (37~90kW / 50~125HP) | 2-2 |
| 2.5 525 ~ 600V CLASS (37~110kW / 50~150HP) | 2-3 |
| 380 ~ 480V CLASS (110~450kW / 150~700HP) | 2-3 |
| 2.6 525 ~ 600V CLASS (132~280kW / 200~400HP) | 2-4 |
| 2.7 COMMON SPECIFICATIONS | 2-5 |
| 2.8 DIMENSIONS..... | 2-7 |
| CHAPTER 3 - INSTALLATION..... | 3-1 |
| 3.1 INSTALLATION PRECAUTIONS | 3-1 |
| 3.2 WIRING | 3-4 |
| CHAPTER 4 - OPERATION..... | 4-1 |
| 4.1 PROGRAMMING KEYPADS | 4-1 |
| 1.1 SET..... | 4-2 |
| 4.2 OPERATING EXAMPLE | 4-7 |
| 4.3 VARIOUS FUNCTION SETTING & DESCRIPTION..... | 4-12 |
| 4.4 OPERATION EXAMPLE | 4-18 |
| CHAPTER 5 - PARAMETER LIST | 5-1 |
| 5.1 PARAMETER GROUPS | 5-1 |
| 5.2 PARAMETER LIST | 5-2 |
| CHAPTER 6 - PARAMETER DESCRIPTION..... | 6-1 |
| 6.1 DRIVE GROUP [DRV] | 6-1 |
| 6.2 FUNCTION 1 GROUP [FU1]..... | 6-8 |
| 6.3 FUNCTION 2 GROUP [FU2]..... | 6-21 |
| 6.4 INPUT/OUTPUT GROUP [I/O]..... | 6-33 |
| 6.5 APPLICATION GROUP [APP]..... | 6-51 |
| CHAPTER 7 - TROUBLESHOOTING & MAINTENANCE | 7-1 |
| 7.1 FAULT DISPLAY | 7-1 |
| 7.2 TROUBLESHOOTING | 7-5 |
| 7.3 HOW TO CHECK POWER COMPONENTS | 7-6 |
| 7.4 MAINTENANCE..... | 7-8 |
| CHAPTER 8 - OPTIONS | 8-1 |
| 8.1 OPTION LIST | 8-1 |
| 8.2 EXTERNAL OPTIONS | 8-2 |
| CHAPTER 9 - RS485 COMMUNICATION | 9-1 |
| 9.1 INTRODUCTION..... | 9-1 |

| | |
|---|-------------|
| 9.2 SPECIFICATION | 9-2 |
| 9.3 OPERATION | 9-3 |
| 9.4 COMMUNICATION PROTOCOL (RS485)..... | 9-4 |
| 9.5 PARAMETER CODE LIST | 9-7 |
| 9.6 TROUBLESHOOTING | 9-11 |
| 9.7 ASCII CODE LIST..... | 9-13 |
| CHAPTER 10 - APPLYING DRIVES TO SINGLE-PHASE INPUT APPLICATION..... | 10-1 |
| 10.1 INTRODUCTION | 10-1 |
| 10.2 POWER(HP), INPUT CURRENT AND OUTPUT CURRENT | 10- 2 |
| 10.3 INPUT FREQUENCY AND VOLTAGE TOLERANCE | 10- 2 |
| 10.4 WIRING AND PERIPHERAL DEVICE | 10- 3 |
| 10.5 CONSIDERATIONS WHEN USING A THREE-PHASE DRIVE WITH SINGLE-PHASE INPUT..... | 10- 4 |
| APPENDIX A- UL MARKING..... | I |
| APPENDIX B- PERIPHERAL DEVICES..... | V |
| APPENDIX C- RELATED PARAMETERS | VIII |
| EMI / RFI POWER LINE FILTERS | X |

CHAPTER 1 - BASIC INFORMATION

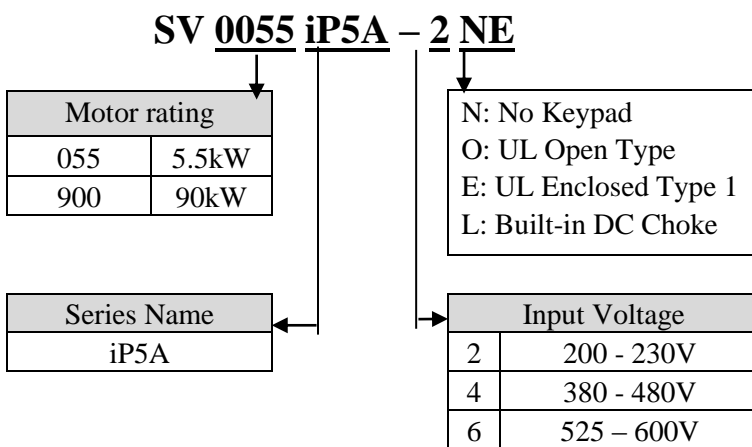
Read and understand this manual before installing, operating or servicing this inverter. The inverter must be installed according to this manual. The following conventions are used to indicate safety messages in this manual Failure to heed these messages could result in serious or possibly even fatal injury or damage to the products or to related equipment and systems.

1.1 Inspection

- Remove the inverter from its packing and inspect its exterior for shipping damage. If damage is apparent notify the shipping agent and your LSIS sales representative.
- Remove the cover and inspect the inverter for any apparent damage or foreign objects. Ensure that all mounting hardware and terminal connection hardware is properly seated, securely fastened, and undamaged.
- Check the nameplate on the iP5A inverter. Verify that the inverter unit is the correct horsepower and input voltage for the application.
- Inverter control is applied for AC asynchronous (Induction Motor) Synchronous motor is excluded.

1.1.1 Inverter model number

The numbering system of the inverter is as shown below.



* UL Open type : UL Open type product must be mounted on the panel in a house.

* UL Enclosed type 1 : UL Enclosed type1 product can be mounted without the panel in a house.

1.1.2 Installation


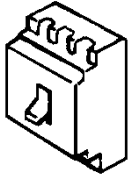
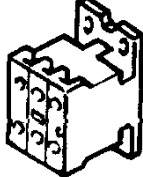
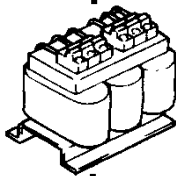

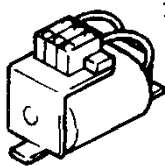
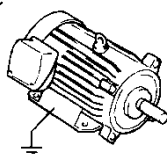
To operate the inverter reliably, install the inverter in a proper place with the correct direction and with the proper clearances.

1.1.3 Wiring

Connect the power supply, motor and operation signals (control signals) to the terminal block. Note that incorrect connection may damage the inverter and peripheral devices.

1.2 Basic configuration

The following devices are required to operate the inverter. Proper peripheral devices must be selected and correct connections made to ensure proper operation. An incorrectly applied or installed inverter can result in system malfunction or reduction in product life as well as component damage. You must read and understand this manual thoroughly before proceeding.

| | | |
|---|---|---|
|  | <p>AC Source Supply</p> | <p>Use a power source with a voltage within the permissible range of inverter input power rating.</p> |
|  | <p>MCCB or Earth leakage circuit breaker (ELB)</p> | <p>Select circuit breakers or fuses in accordance with applicable national and local codes.</p> |
|  | <p>Inline Magnetic Contactor</p> | <p>Install if necessary. When installed, do not use it for the purpose of starting or stopping the drive. It can reduce the life of inverter.</p> |
|  | <p>AC Reactor</p> | <p>An AC reactor can be used when the harmonics are to be reduced and power factor is to be improved. One must be used when the inverter is installed on a power source with greater than 10 times the KVA rating of the drive.</p> |
|  | <p>Inverter (SV-iP5A) Installation and wiring</p> | <p>To reliably operate the drive, install the inverter in the proper orientation and with proper clearances. Please pay attention, if the inverter is installed in the panel. Incorrect terminal wiring could result in the equipment damage. Control wire of control circuit must be wired separately with main circuit wire to reduce the electric noise.</p> |
|  | <p>DC Reactor</p> | <p>A DC reactor may be used together with or in place of an AC reactor if necessary to reduce harmonics or improve power factor.</p> |
|  | <p>To motor</p> | <p>Do not connect power factor capacitors, surge arrestors or radio noise filters to the output side of the inverter.</p> |

CHAPTER 2 - SPECIFICATION

2.1 200~230V Class (0.75~30kW / 1~40HP)

| Model Number (SVxxxIP5A-2) | | | | 008 | 015 | 022 | 037 | 055 | 075 | 110 | 150 | 185 | 220 | 300 | |
|-------------------------------|------------------|-----------------------------|----|-------------------------------------|---------------|--------------|---------------|---------------|-------------|-------------------------------|--------------|----------------|--------------|--------------|----------------------------|
| Capacity [kVA] ⁽¹⁾ | | | | 1.9 | 3.0 | 4.6 | 6.1 | 9.1 | 12.2 | 17.5 | 22.9 | 28.2 | 33.5 | 43.8 | |
| Output ratings | Fan or pump load | motor rating ⁽²⁾ | HP | 1 | 2 | 3 | 5 | 7.5 | 10 | 15 | 20 | 25 | 30 | 40 | |
| | | | kW | 0.75 | 1.5 | 2.2 | 3.7 | 5.5 | 7.5 | 11 | 15 | 18.5 | 22 | 30 | |
| | | Current[A] | | 5 | 8 | 12 | 16 | 24 | 32 | 46 | 60 | 74 | 88 | 115 | 110% 1Minute (Normal Duty) |
| | General load | motor rating ⁽²⁾ | HP | 0.5 | 1 | 2 | 3 | 5 | 7.5 | 10 | 15 | 20 | 25 | 30 | |
| | | | kW | 0.4 | 0.75 | 1.5 | 2.2 | 3.7 | 5.5 | 7.5 | 11 | 15 | 18.5 | 22 | |
| | | Current[A] | | 2.5 | 5 | 8 | 12 | 17 | 23 | 33 | 44 | 54 | 68 | 84 | 150% 1 Minute (Heavy Duty) |
| | Frequency | | | | 0.01 ~ 120 Hz | | | | | | | | | | |
| Voltage | | | | 200 ~ 230 V ⁽³⁾ | | | | | | | | | | | |
| Input ratings | Voltage | | | 3 ϕ 200 ~ 230 V (-15% ~ +10 %) | | | | | | | | | | | |
| | Frequency | | | 50/60 Hz (\pm 5 %) | | | | | | | | | | | |
| Protection degree | | | | IP20 / UL Type1 | | | | | | IP00 / UL Open ⁽³⁾ | | | | | |
| Weight [kg (lbs.)] | | | | 4.1 (9.0) | 4.2 (9.3) | 4.2 (9.3) | 4.9 (10.8) | 4.9 (10.8) | 6 (13.2) | 6 (13.2) | 13 (28.7) | 13.5 (29.8) | 20 (44.1) | 20 (44.1) | |

2.2 380~480V Class (0.75~30kW / 1~40HP)

| Model Number (SVxxxIP5A-4) | | | | 008 | 015 | 022 | 037 | 055 | 075 | 110 | 150 | 185 | 220 | 300 | |
|-------------------------------|-------------------|----------------------------------|----|-------------------------------------|---------------|---------------|---------------|---------------|-------------|-------------------------------|----------------|----------------|----------------|----------------|----------------------------|
| Capacity [kVA] ⁽¹⁾ | | | | 2.0 | 3.2 | 4.8 | 6.4 | 9.6 | 12.7 | 19.1 | 23.9 | 31.1 | 35.9 | 48.6 | |
| Output ratings | Fan or pump load | motor rating ⁽²⁾ | HP | 1 | 2 | 3 | 5 | 7.5 | 10 | 15 | 20 | 25 | 30 | 40 | |
| | | | kW | 0.75 | 1.5 | 2.2 | 3.7 | 5 | 7.5 | 11 | 15 | 18.5 | 22 | 30 | |
| | | Current[A] | | 2.5 | 4 | 6 | 8 | 12 | 16 | 24 | 30 | 39 | 45 | 61 | 110% 1Minute (Normal Duty) |
| | General load | motor rating ⁽²⁾ | HP | 0.5 | 1 | 2 | 3 | 5.5 | 7.5 | 10 | 15 | 20 | 25 | 30 | |
| | | | kW | 0.4 | 0.75 | 1.5 | 2.2 | 3.7 | 5.5 | 7.5 | 11 | 15 | 18.5 | 22 | |
| | | Current[A] /Built-in DCR Type | | 1.25 | 2.5 | 4 | 6 | 8.8 | 12 | 16 | 22/24 | 28/30 | 34/39 | 44/45 | 150% 1 Minute (Heavy Duty) |
| | Frequency | | | | 0.01 ~ 120 Hz | | | | | | | | | | |
| Voltage | | | | 380 ~ 480 V ⁽³⁾ | | | | | | | | | | | |
| Input ratings | Voltage | | | 3 ϕ 380 ~ 480 V (-15% ~ +10 %) | | | | | | | | | | | |
| | Frequency | | | 50/60 Hz (\pm 5 %) | | | | | | | | | | | |
| Protection degree | | | | IP20 / UL Type1 | | | | | | IP00 / UL Open ⁽³⁾ | | | | | |
| Weight [kg (lbs.)] | Standard Type | | | 4.1 (9.04) | 4.2 (9.26) | 4.2 (9.26) | 4.9 (10.8) | 4.9 (10.8) | 6 (13.2) | 6 (13.2) | 12.5 (27.6) | 13 (28.7) | 20 (44.1) | 20 (44.1) | |
| | Built-in DCL Type | | | - | - | - | - | - | - | - | 19.5 (42.9) | 19.5 (42.9) | 26.5 (58.3) | 26.5 (58.3) | |

2.3 525~600V Class (5.5~30kW / 7.5~40HP)

| Model Number (SVxxxiP5A-6) | | | | 055 | 075 | 110 | 150 | 185 | 220 | 300 | |
|-------------------------------|------------------|-----------------------------|----|-------------------------------------|------------|------------|-------------------------------|-------------|-------------|-------------|----|
| Capacity [kVA] ⁽¹⁾ | | | | 9.6 | 12.7 | 19.1 | 23.9 | 31.1 | 35.9 | 48.6 | |
| Output ratings | Fan or pump load | motor rating ⁽²⁾ | HP | 7.5 | 10 | 15 | 20 | 25 | 30 | 40 | |
| | | | kW | 5.5 | 7.5 | 11 | 15 | 18.5 | 22 | 30 | |
| | | Current [A] (110% overload) | | | 9 | 12 | 17 | 23 | 27 | 34 | 43 |
| | | 110% 1 Minute (Normal Duty) | | | | | | | | | |
| | General load | motor rating ⁽²⁾ | HP | 5.5 | 7.5 | 10 | 15 | 20 | 25 | 30 | |
| | | | kW | 3.7 | 5.5 | 7.5 | 11 | 15 | 18.5 | 22 | |
| | | Current [A] (150% overload) | | | 6.1 | 9 | 12 | 17 | 23 | 27 | 34 |
| | | 150% 1 Minute (Heavy Duty) | | | | | | | | | |
| Frequency | | | | 0.01 ~ 120 Hz | | | | | | | |
| Voltage | | | | 525 ~ 600 V ⁽³⁾ | | | | | | | |
| Input ratings | Voltage | | | 3 ϕ 525 ~ 600 V (-15% ~ +10 %) | | | | | | | |
| | Frequency | | | 50/60 Hz (\pm 5 %) | | | | | | | |
| Protection degree | | | | IP20 / UL Type1 | | | IP00 / UL Open ⁽³⁾ | | | | |
| Weight [kg (lbs.)] | | Standard Type | | 6.5 (14.4) | 7.0 (15.5) | 7.0 (15.5) | 11.7 (25.8) | 11.7 (25.8) | 18.9 (41.7) | 18.9 (41.7) | |

2.4 380 ~ 480V Class (37~90kW / 50~125HP)

| Model Number (SVxxxiP5A-4) | | | | 370 | 450 | 550 | 750 | 900 | |
|-------------------------------|------------------|-----------------------------|----|---|----------|----------|-----------|-----------|-----|
| Capacity [kVA] ⁽¹⁾ | | | | 59.8 | 72.5 | 87.6 | 121.1 | 145.8 | |
| Output ratings | Fan or pump load | motor rating ⁽²⁾ | HP | 50 | 60 | 75 | 100 | 125 | |
| | | | kW | 37 | 45 | 55 | 75 | 90 | |
| | | Current[A] (110% overload) | | | 75 | 91 | 110 | 152 | 183 |
| | | 110% 1 Minute (Normal Duty) | | | | | | | |
| | General load | motor rating ⁽²⁾ | HP | 40 | 50 | 60 | 75 | 100 | |
| | | | kW | 30 | 37 | 45 | 55 | 75 | |
| | | Current[A] (150% overload) | | | 61 | 75 | 91 | 110 | 152 |
| | | 150% 1 Minute (Heavy Duty) | | | | | | | |
| Frequency | | | | 0.01 ~ 120 Hz | | | | | |
| Voltage | | | | 380 ~ 480 V ⁽³⁾ | | | | | |
| Input ratings | Voltage | | | 2 ϕ /3 ϕ 380 ~ 480 V (-15% ~ +10 %) | | | | | |
| | Frequency | | | 50/60 Hz (\pm 5 %) | | | | | |
| Protection degree | | | | IP00 / UL Open ⁽³⁾ | | | | | |
| Weight [kg (lbs.)] | | Standard Type | | 27(59.5) | 27(59.5) | 29(64) | 42(92.6) | 43(94.8) | |
| | | Built-in DCL Type | | 39(86) | 40(88.2) | 42(92.6) | 67(147.4) | 68(149.9) | |

2.5 525 ~ 600V Class (37~110kW / 50~150HP)

| Model Number (SVxxxIP5A-6) | | | | 0370 | 0450 | 0550 | 0750 | 0900 | 1100 | |
|-------------------------------|------------------|--------------------------------|----|------------------------------------|---------------|-----------|-----------|-----------|----------|-----------------------------|
| Capacity [kVA] ⁽¹⁾ | | | | 59.8 | 72.5 | 87.6 | 121.1 | 145.8 | 178 | |
| Output ratings | Fan or pump load | motor rating ⁽²⁾ | HP | 50 | 60 | 75 | 100 | 125 | 150 | |
| | | | kW | 37 | 45 | 55 | 75 | 90 | 110 | |
| | | Current [A] (110% overload) | | 55 | 64 | 80 | 104 | 128 | 150 | 110% 1 Minute (Normal Duty) |
| | General load | motor rating ⁽²⁾ | HP | 40 | 50 | 60 | 75 | 100 | 125 | |
| | | | kW | 30 | 37 | 45 | 55 | 75 | 90 | |
| | | Current [A] (150% overload) | | 43 | 55 | 64 | 80 | 104 | 128 | 150% 1 Minute (Heavy Duty) |
| | Frequency | | | | 0.01 ~ 120 Hz | | | | | |
| Voltage | | | | 525 ~ 600 V ⁽³⁾ | | | | | | |
| Input ratings | Voltage | | | 3 ϕ 525 ~ 600 V (-15% ~ +10%) | | | | | | |
| | Frequency | | | 50/60 Hz (\pm 5%) | | | | | | |
| Protection degree | | | | IP00 / UL Open ⁽³⁾ | | | | | | |
| Weight [kg (lbs.)] | | Standard Type | | 32(70.65) | 32(70.65) | 32(70.65) | 46(101.5) | 46(101.5) | 101(223) | |

380 ~ 480V Class (110~450kW / 150~700HP)

| Model Number (SVxxxIP5A-4) | | | | 1100 | 1320 | 1600 | 2200 | 2800 | 3150 | 3750 | 4500 | |
|-------------------------------|------------------|-------------------------------|----|--|----------------|----------------|----------------|-----------------|----------------|----------------|----------------|-----------------------------|
| Capacity [kVA] ⁽¹⁾ | | | | 178 | 210 | 259 | 344 | 436 | 488 | 582 | 699 | |
| Output ratings | Fan or pump load | motor rating ⁽²⁾ | HP | 150 | 200 | 250 | 350 | 400 | 500 | 600 | 700 | |
| | | | kW | 110 | 132 | 160 | 220 | 280 | 315 | 375 | 450 | |
| | | Current[A] (110% overload) | | 223 | 264 | 325 | 432 | 547 | 613 | 731 | 877 | 110% 1 Minute (Normal Duty) |
| | General load | motor rating ⁽²⁾ | HP | 125 | 150 | 200 | 250 | 350 | 400 | 500 | 600 | |
| | | | kW | 90 | 110 | 132 | 160 | 220 | 280 | 315 | 375 | |
| | | Current[A] (150% overload) | | 183 | 223 | 264 | 325 | 432 | 547 | 613 | 731 | 150% 1 Minute (Heavy Duty) |
| | Frequency | | | | 0.01 ~ 120 Hz | | | | | | | |
| Voltage | | | | 380 ~ 480 V ⁽³⁾ | | | | | | | | |
| Input ratings | Voltage | | | 2 ϕ /3 ϕ 380 ~ 480 V (-15% ~ +10%) | | | | | | | | |
| | Frequency | | | 50/60 Hz (\pm 5%) | | | | | | | | |
| Protection degree | | | | IP00 / UL Open ⁽⁴⁾ | | | | | | | | |
| DCL (DC Choke) | | | | Built-in | | | | External Option | | | | |
| Weight [kg (lbs.)] | | | | 101 (222.7) | 101 (222.7) | 114 (251.3) | 200 (441.9) | 200 (441.9) | 243 (535.7) | 380 (837.7) | 380 (837.7) | |

2.6 525 ~ 600V Class (132~280kW / 200~400HP)

| Model Number (SVxxxIP5A-6) | | | 1320 | 1600 | 2200 | 2800 | |
|-------------------------------|-----------------------------|--------------------------------|-------------------------------|-------------------------------------|----------|----------|-----|
| Capacity [kVA] ⁽¹⁾ | | | 210 | 259 | 344 | 436 | |
| Output ratings | Fan or pump load | motor rating ⁽²⁾ | HP | 200 | 250 | 350 | 400 |
| | | | kW | 132 | 160 | 220 | 280 |
| | | Current [A] (110% overload) | | 200 | 242 | 333 | 424 |
| | 110% 1 Minute (Normal Duty) | | | | | | |
| | General load | motor rating ⁽²⁾ | HP | 150 | 200 | 250 | 350 |
| | | | kW | 110 | 132 | 160 | 220 |
| | | Current [A] (150% overload) | | 147 | 177 | 244 | 311 |
| | 150% 1 Minute (Heavy Duty) | | | | | | |
| | Frequency | | | 0.01 ~ 120 Hz | | | |
| | Voltage | | | 525 ~ 600 V ⁽³⁾ | | | |
| Input ratings | Voltage | | | 3 ϕ 525 ~ 600 V (-15% ~ +10 %) | | | |
| | Frequency | | | 50/60 Hz (\pm 5 %) | | | |
| Protection degree | | | IP00 / UL Open ⁽³⁾ | | | | |
| Weight [kg (lbs.)] | Standard Type | | 116(255) | 116(255) | 204(450) | 204(450) | |

2.7 Common Specifications

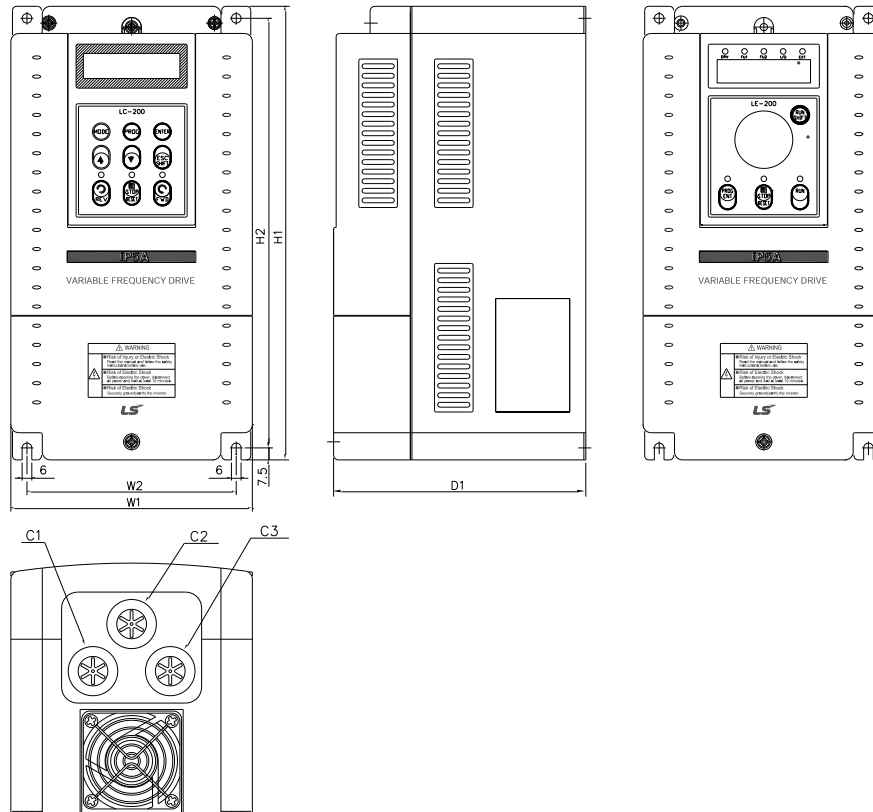
| | | | |
|----------------------|---|---|--|
| Cooling method | | Forced air cooling (Self-cooling for below 1.5kW-2, 2.2kW-4) | |
| Short Circuit Rating | | 65kA, suitable for use on a circuit capable of delivering not more than 100,000 RMS Symmetrical amperes, 240 (or 480V) volts maximum | |
| Agency Approvals | | UL and cUL listed, CE marked | |
| CONTROL | Control Method | V/F, Sensorless Vector, Slip Compensation, Easy Start Selectable | |
| | Frequency Setting Resolution | Digital Reference: 0.01 Hz (Below 100 Hz), 0.1 Hz (Over 100 Hz) Analog Reference: 0.01 Hz / 60 Hz | |
| | Frequency Accuracy | Digital: 0.01 % of Max. Output Frequency Analog: 0.1 % of Max. Output Frequency | |
| | V/F Ratio | Linear, Squared Pattern, User V/F | |
| | Overload Capacity | 110 % per 1 min, 120% per 1 min ⁽⁵⁾ | |
| | Torque Boost | Manual Torque Boost (0 ~ 15 % settable), Auto Torque Boost | |
| OPERATION | Operation Method | Keypad / Terminal / Communication Operation | |
| | Frequency Setting | Analog: 0 ~ 12V / -12V ~ 12V / 4 ~ 20mA or 0~20mA/ Pulse / Ext-PID Digital: Keypad | |
| | Input Signal | Start Signal | Forward, Reverse |
| | | Multi-Step | Up to 18 Speeds can be set including Jog (Use Programmable Digital Input Terminal, Including Jog/Dwell) |
| | | Multi Step Accel/Decel Time | 0.1~ 6,000 sec, Max 4 types can be set via Multi- Function Terminal. Accel/Decel Pattern: Linear, U-Curve, S-Curve Selectable |
| | | Emergency Stop | Interrupts the Output of Inverter |
| | | Jog | Jog Operation |
| | | Fault Reset | Trip Status is Reset when Protection Function is Active |
| | Output signal | Operating Status | Frequency Detection Level, Overload Alarm, Stalling, Over Voltage, Low Voltage, Inverter Overheating/ Running/ Stopping/ Constant running, Inverter By-Pass, Speed Searching |
| | | Fault Output | Contact Output (3A, 3C, 3B) – AC 250V 1A, DC 30V 1A |
| Indicator | | Choose 2 from Output Frequency, Output Current, Output Voltage, DC Link Voltage (Output Voltage: 0 ~ 10V) | |
| Operation Function | DC Braking, Frequency Limit, Frequency Jump, 2 nd Function, Slip Compensation, Reverse Rotation Prevention, Auto Restart, Inverter By-Pass, Auto-Tuning, PID Control, Flying Start, Safety Stop, Flux Braking, Low leakage, Pre-PID, Dual-PID, MMC, Easy Start, Pre-heater | | |
| PROTECTION | Inverter Trip | Over Voltage, Low Voltage, Over Current, Ground Fault, Inverter Overheat, Motor Overheat, Output Phase Open, Overload Protection, External Fault 1, 2, Communication Error, Loss of Speed Command, Hardware Fault, Option Fault etc | |
| | Inverter Alarm | Stall Prevention, Overload Alarm, Thermal Sensor Fault | |

| | | | |
|-------------|----------------------|---|--|
| DISPLAY | Keypad | Operation Information | Output Frequency, Output Current, Output Voltage, Frequency Set Value, Operating Speed, DC Voltage, Integrating Wattmeter, Fan ON time, Run-time, Last Trip Time |
| | | Trip Information | Trips Indication when the Protection Function activates. Max. 5 Faults are saved. Last Trip Time. |
| ENVIRONMENT | Ambient Temperature | - 10 ~ 50 °C (14°F ~ 122°F) Decrease 2% of rated current for every 1 °C increase in above 40 °C. | |
| | Storage Temperature | -20 °C ~ 65 °C (14°F ~ 149°F) | |
| | Ambient Humidity | Less Than 90 % RH Max. (Non-Condensing) | |
| | Altitude – Vibration | Below 1,000m (3,300ft), Below 5.9m/sec ² (0.6g) | |
| | Application Site | Pollution degree 2, No Corrosive Gas, Combustible Gas, Oil Mist, or Dust | |

- (1) Rated capacity ($\sqrt{3} \times V \times I$) is based on 220V for 200V class and 460V for 400V class.
- (2) Indicates the maximum applicable capacity when using a 4-Pole standard motor.
- (3) IP20 or UL Enclosed Type1 can be provided by the option.
- (4) IP20 or UL Enclosed Type1 is not provided.
- (5) Overload rating 120%, 1 min is based on ambient 25 °C.

2.8 Dimensions

1) SV008~055iP5A (200/400V Class) and SV0055~0110iP5A(600V Class)

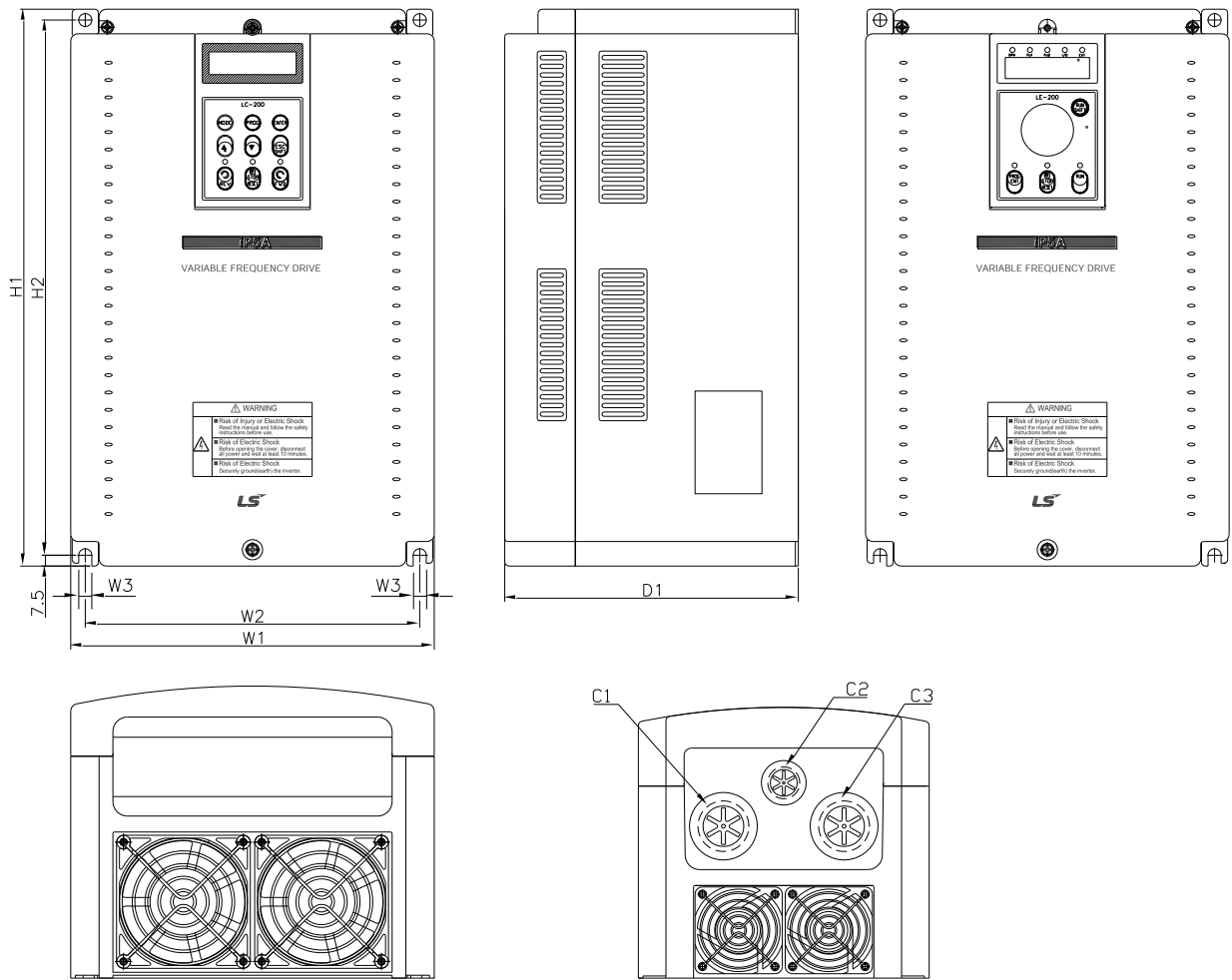


mm

(inches)

| Model | W1 | W2 | H1 | H2 | D1 | C1 | C2 | C3 | Enclosure Type |
|-----------------------|---------------|---------------|----------------|----------------|-----------------|----------------|--------------|----------------|--------------------|
| SV008~055iP5A -2/4 | 150 (5.91) | 130 (5.12) | 284 (11.18) | 269 (10.69) | 156.5 (6.16) | 24 (0.98) | 24 (0.98) | 24 (0.98) | IP20 UL Type 1 |
| SV0055~0110iP 5A-6 | 200 (7.87) | 180 (7.09) | 355 (13.98) | 340 (13.39) | 182.5 (7.19) | 28.5 (1.12) | 24 (0.94) | 28.5 (1.12) | IP 20 UL Type 1 |

2) SV075~300iP5A (200/400V Class) and SV0150~0300iP5A (600V Class)



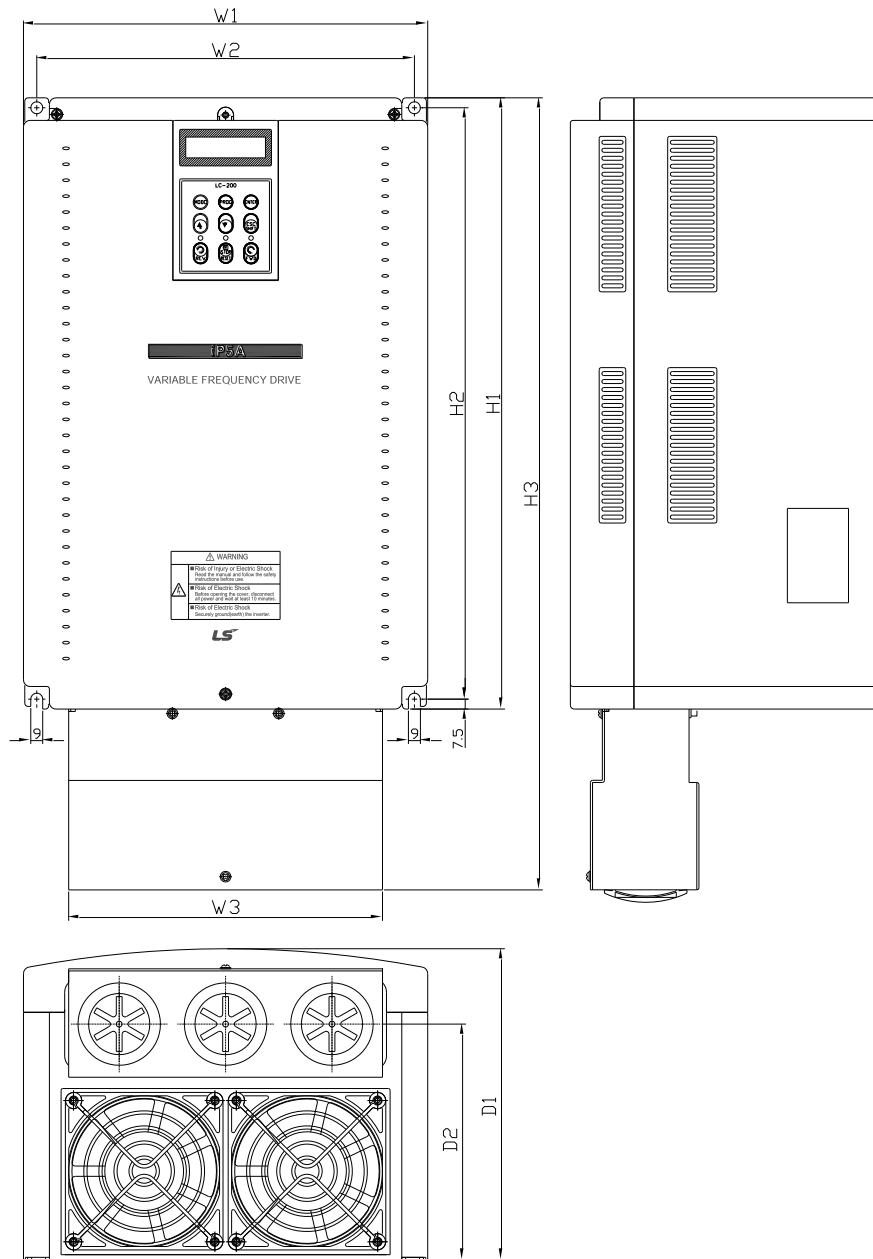
<SV150~300iP5A-2/4>

<SV075~110iP5A-2/4>

mm (inches)

| Model | W1 | W2 | W3 | H1 | H2 | D1 | C1 | C2 | C3 | Enclosure Type |
|---------------|----------------|----------------|-------------|----------------|----------------|---------------|--------------|--------------|--------------|-------------------|
| SV075iP5A-2/4 | 200 (7.87) | 180 (7.09) | 6 (0.23) | 284 (11.18) | 269 (10.69) | 182 (7.16) | 35 (1.37) | 24 (0.98) | 35 (1.37) | IP20 UL Type 1 |
| SV110iP5A-2/4 | 200 (7.87) | 180 (7.09) | 6 (0.23) | 284 (11.18) | 269 (10.69) | 182 (7.16) | 35 (1.37) | 24 (0.98) | 35 (1.37) | IP20 UL Type 1 |
| SV150iP5A-2/4 | 250 (9.84) | 230 (9.06) | 9 (0.35) | 385 (15.16) | 370 (14.57) | 201 (7.91) | - | - | - | IP00 UL Open |
| SV185iP5A-2/4 | 250 (9.84) | 230 (9.06) | 9 (0.35) | 385 (15.16) | 370 (14.57) | 201 (7.91) | - | - | - | IP00 UL Open |
| SV220iP5A-2/4 | 304 (11.97) | 284 (11.18) | 9 (0.35) | 460 (18.11) | 445 (17.52) | 234 (9.21) | - | - | - | IP00 UL Open |
| SV300iP5A-2/4 | 304 (11.97) | 284 (11.18) | 9 (0.35) | 460 (18.11) | 445 (17.52) | 234 (9.21) | - | - | - | IP00 UL Open |

3) SV150~300iP5A (UL Type 1 or UL Open Type with Conduit Option used, 200V/400V Class)



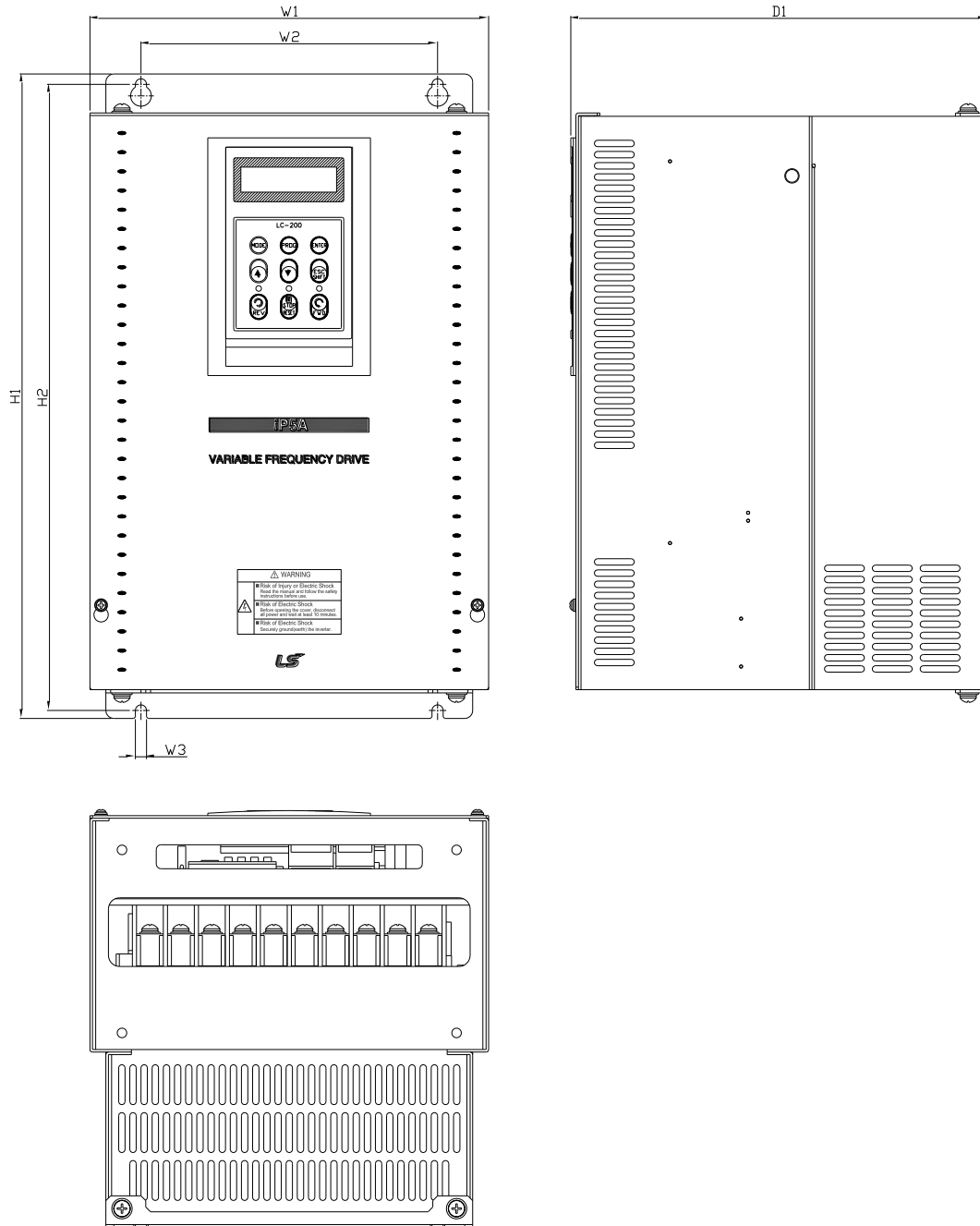
mm

(inches)

| Model | W1 | W2 | W3 | H1 | H2 | H3 | D1 | D2 | Enclosure Type |
|-------------------------------|----------------|----------------|----------------|----------------|----------------|------------------|---------------|-----------------|-------------------|
| SV150iP5A-2/4 SV0150iP5A-6 | 250 (9.84) | 230 (9.06) | 200.8 (7.9) | 385 (15.16) | 370 (14.57) | 454.2 (17.88) | 201 (7.91) | 146 (5.74) | IP20 UL Type 1 |
| SV185iP5A-2/4 SV0185iP5A-6 | 250 (9.84) | 230 (9.06) | 200.8 (7.9) | 385 (15.16) | 370 (14.57) | 454.2 (17.88) | 201 (7.91) | 146 (5.74) | IP20 UL Type 1 |
| SV220iP5A-2/4 SV0220iP5A-6 | 304 (11.97) | 284 (11.18) | 236 (9.29) | 460 (18.11) | 445 (17.52) | 599.2 (23.59) | 234 (9.21) | 177.5 (6.98) | IP20 UL Type 1 |
| SV300iP5A-2/4 SV0300iP5A-6 | 304 (11.97) | 284 (11.18) | 236 (9.29) | 460 (18.11) | 445 (17.52) | 599.2 (23.59) | 234 (9.21) | 177.5 (6.98) | IP20 UL Type 1 |

Note) Mounting NEMA 1 conduit option to the 15~90Kw(20~125HP) Open Type meets NEMA 1 but does not comply with UL Enclosed Type 1. To that end, please purchase UL Type 1 product.

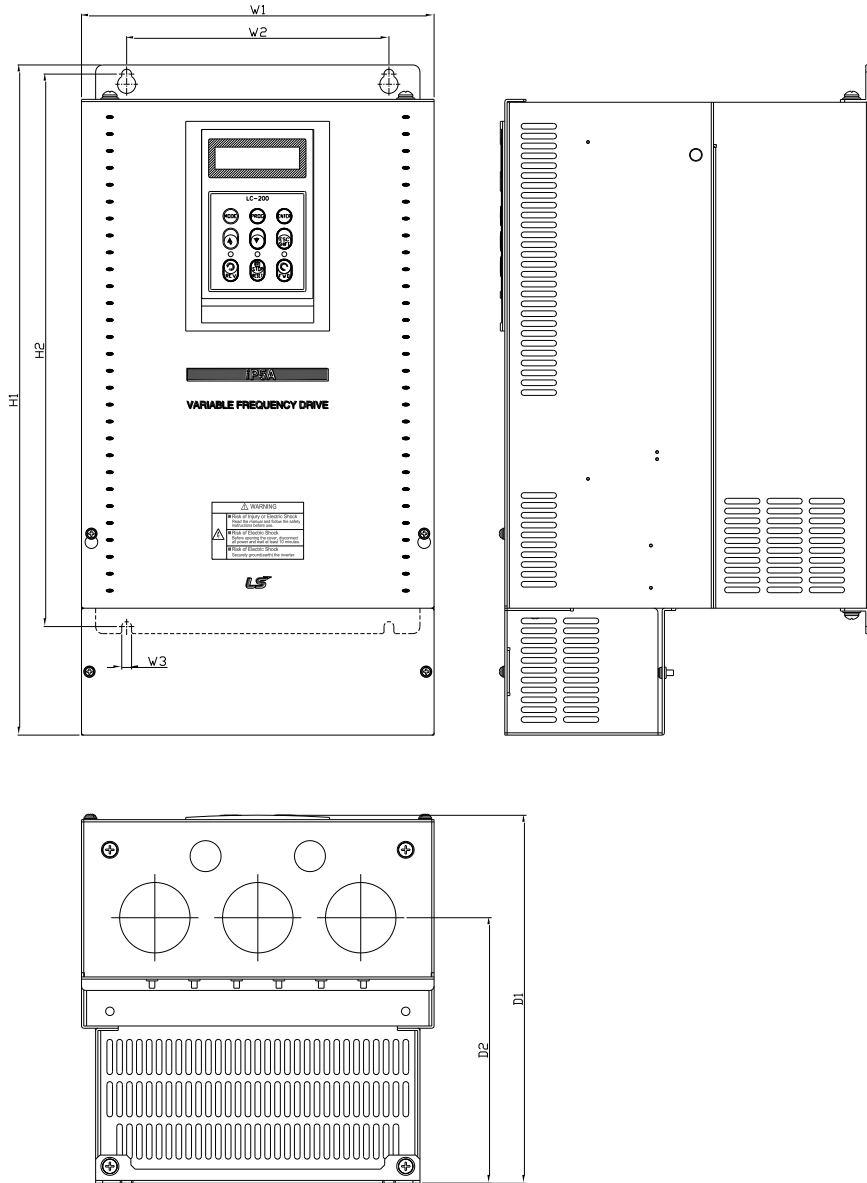
4) SV150 ~ SV300 iP5A (400V Class) – Built-in DCL Type



mm (inches)

| Model | W1 | W2 | W3 | H1 | H2 | D1 | Enclosure Type |
|--|----------------|---------------|-------------|------------------|------------------|------------------|-------------------|
| SV150, 185iP5A-4L (Built-in DCL Type) | 250 (9.84) | 186 (7.32) | 7 (0.28) | 403.5 (15.88) | 392 (15.43) | 261.2 (10.28) | IP00 UL Type 1 |
| SV220, 300iP5A-4L (Built-in DCL Type) | 260 (10.23) | 220 (8.66) | 7 (0.28) | 480 (18.89) | 468.5 (18.44) | 268.6 (10.57) | IP20 UL Type 1 |

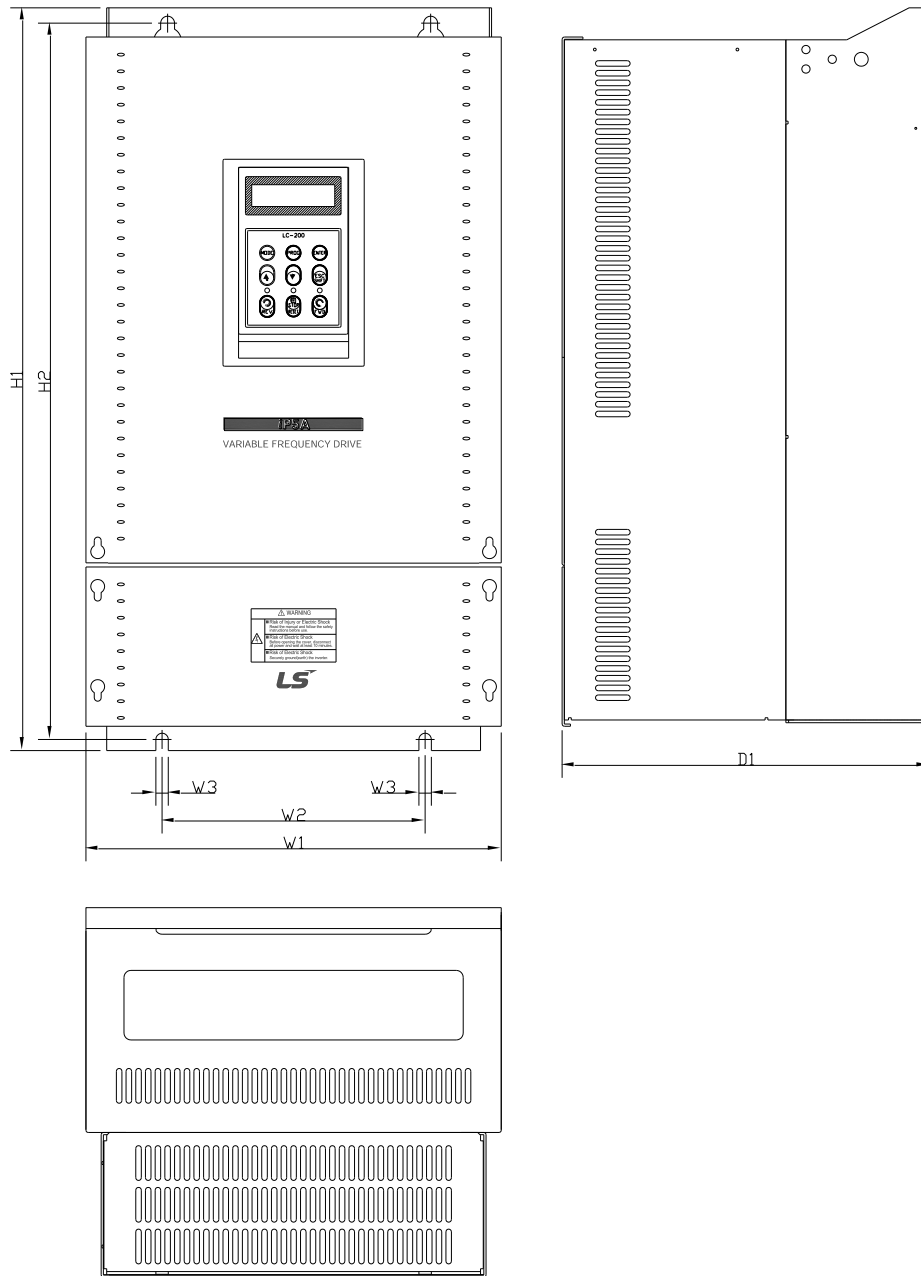
5) SV150 ~ SV300 iP5A (Built-in DCL Type, UL Type 1 or UL Open Type with Conduit Option used, 400V Class)



mm (inches)

| Model | W1 | W2 | W3 | H1 | H2 | D1 | D2 | Enclosure Type |
|--|----------------|---------------|-------------|------------------|------------------|------------------|-----------------|-------------------|
| SV150, 185iP5A-4L (Built-in DCL Type) | 250 (9.84) | 186 (7.32) | 7 (0.28) | 475.5 (18.72) | 392 (15.43) | 261.2 (10.28) | 188.4 (7.42) | IP20 UL Type 1 |
| SV220, 300iP5A-4L (Built-in DCL Type) | 260 (10.23) | 220 (8.66) | 7 (0.28) | 552 (21.73) | 468.5 (18.44) | 268.6 (10.57) | 188.8 (7.43) | IP20 UL Type 1 |

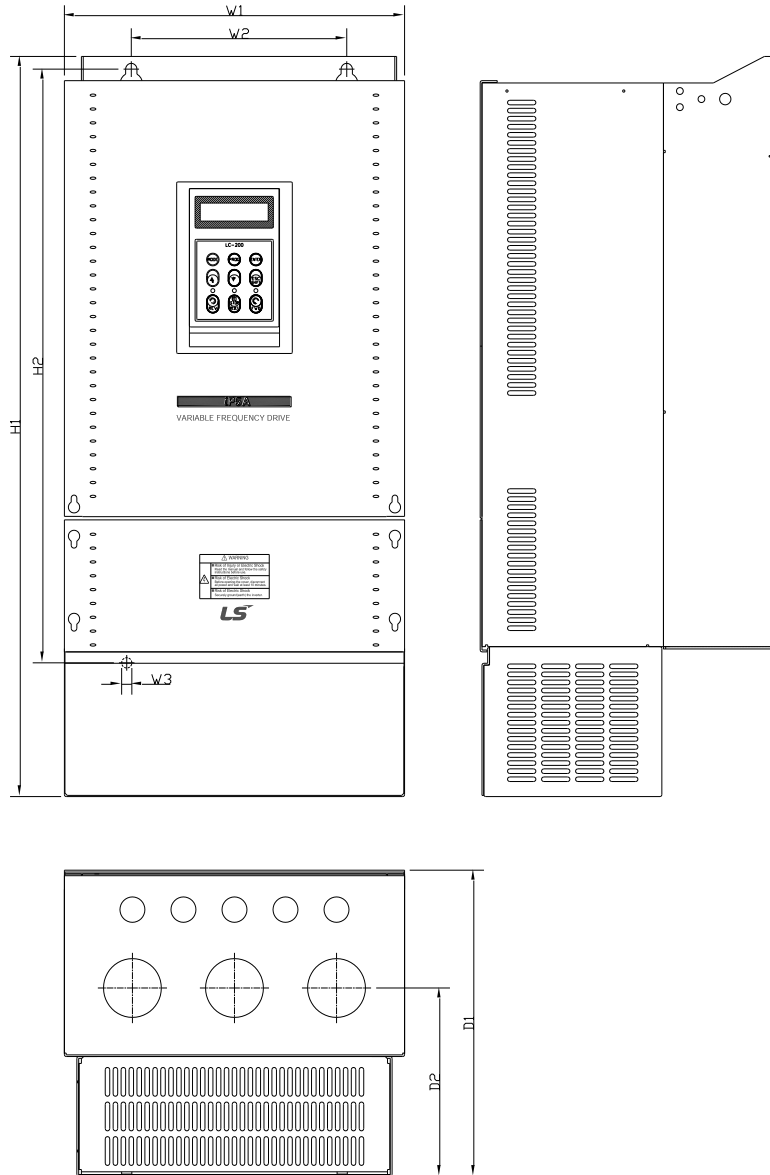
6) SV370 ~ 550iP5A (400V Class) and SV0370~0550iP5A (600V Class)



mm (inches)

| Model | W1 | W2 | W3 | H1 | H2 | D1 | Enclosure Type |
|--|----------------|---------------|-------------|----------------|----------------|------------------|-----------------|
| SV370, 450iP5A-4 | 300 (11.81) | 190 (7.48) | 9 (0.35) | 534 (21.02) | 515 (20.28) | 265.6 (10.46) | IP00 UL Open |
| SV550iP5A-4 SV0370~0550iP5A-6 | 300 (11.81) | 190 (7.48) | 9 (0.35) | 534 (21.02) | 515 (20.28) | 292.6 (11.52) | IP00 UL Open |
| SV370, 450iP5A-4L (Built-in DCL Type) | 300 (11.81) | 190 (7.48) | 9 (0.35) | 684 (26.92) | 665 (26.18) | 265.6 (10.46) | IP00 UL Open |
| SV550iP5A-4L (Built-in DCL Type) | 300 (11.81) | 190 (7.48) | 9 (0.35) | 684 (26.92) | 665 (26.18) | 292.6 (11.52) | IP00 UL Open |

7) SV370~550iP5A (UL Type 1 or UL Open Type with Conduit Option Used, 400V Class)

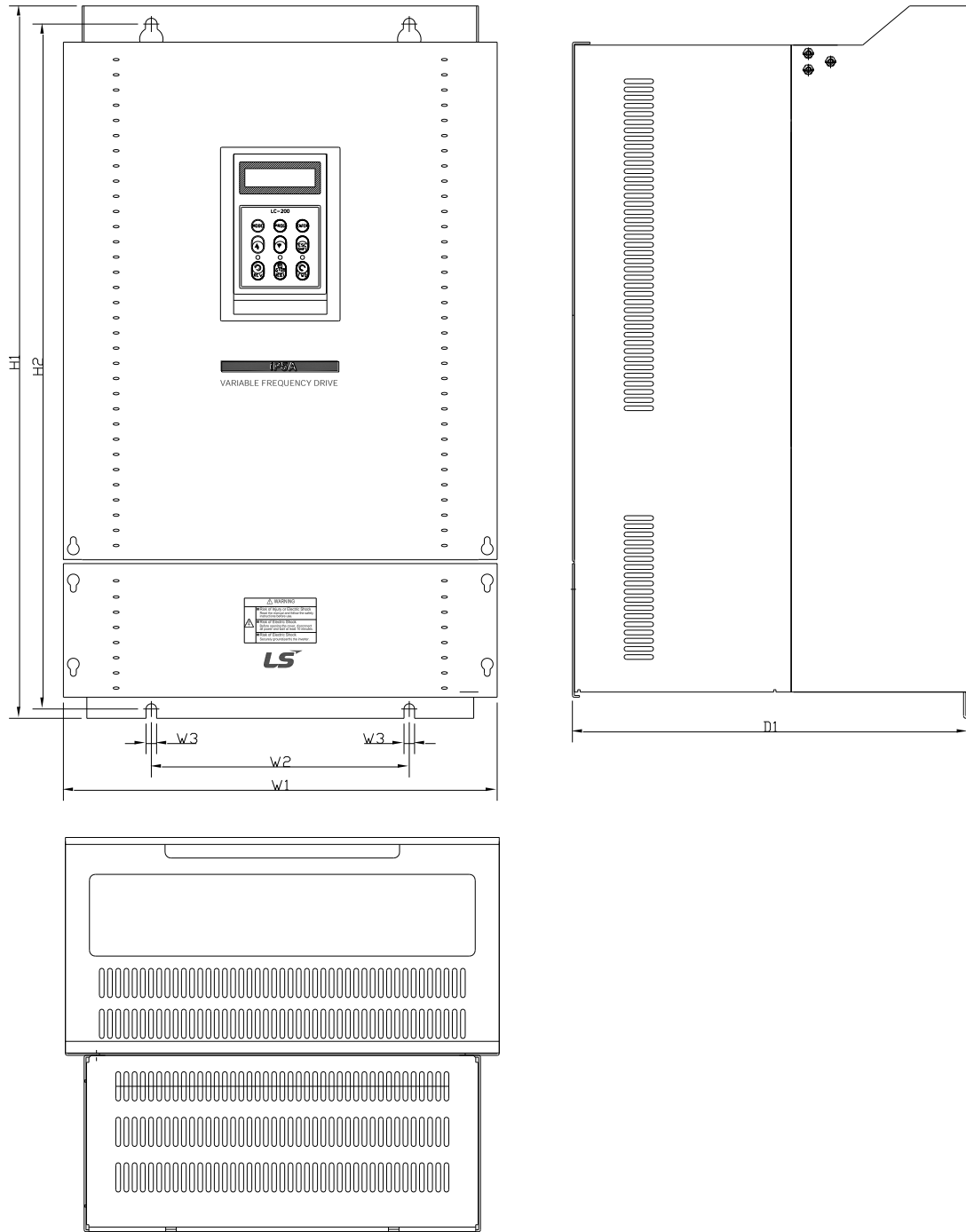


mm (inches)

| Model | W1 | W2 | W3 | H1 | H2 | D1 | D2 | Enclosure Type |
|--|----------------|---------------|-------------|----------------|----------------|------------------|-----------------|-------------------|
| SV370, 450iP5A-4 | 300 (11.81) | 190 (7.48) | 9 (0.35) | 642 (25.28) | 515 (20.28) | 265.6 (10.46) | 163.4 (6.43) | IP20 UL Type 1 |
| SV550iP5A-4 | 300 (11.81) | 190 (7.48) | 9 (0.35) | 642 (25.28) | 515 (20.28) | 292.6 (11.52) | 190.4 (7.5) | IP20 UL Type 1 |
| SV370, 450iP5A-4L (Built-in DCL Type) | 300 (11.81) | 190 (7.48) | 9 (0.35) | 792 (31.18) | 665 (26.18) | 265.6 (10.46) | 163.4 (6.43) | IP20 UL Type 1 |
| SV550iP5A-4L (Built-in DCL Type) | 300 (11.81) | 190 (7.48) | 9 (0.35) | 792 (31.18) | 665 (26.18) | 292.6 (11.52) | 190.4 (7.5) | IP20 UL Type 1 |

Note) Mounting NEMA 1 conduit option to the 15~90Kw(20~125HP) Open Type meets NEMA 1 but does not comply with UL Enclosed Type 1. To that end, please purchase UL Type 1 product.

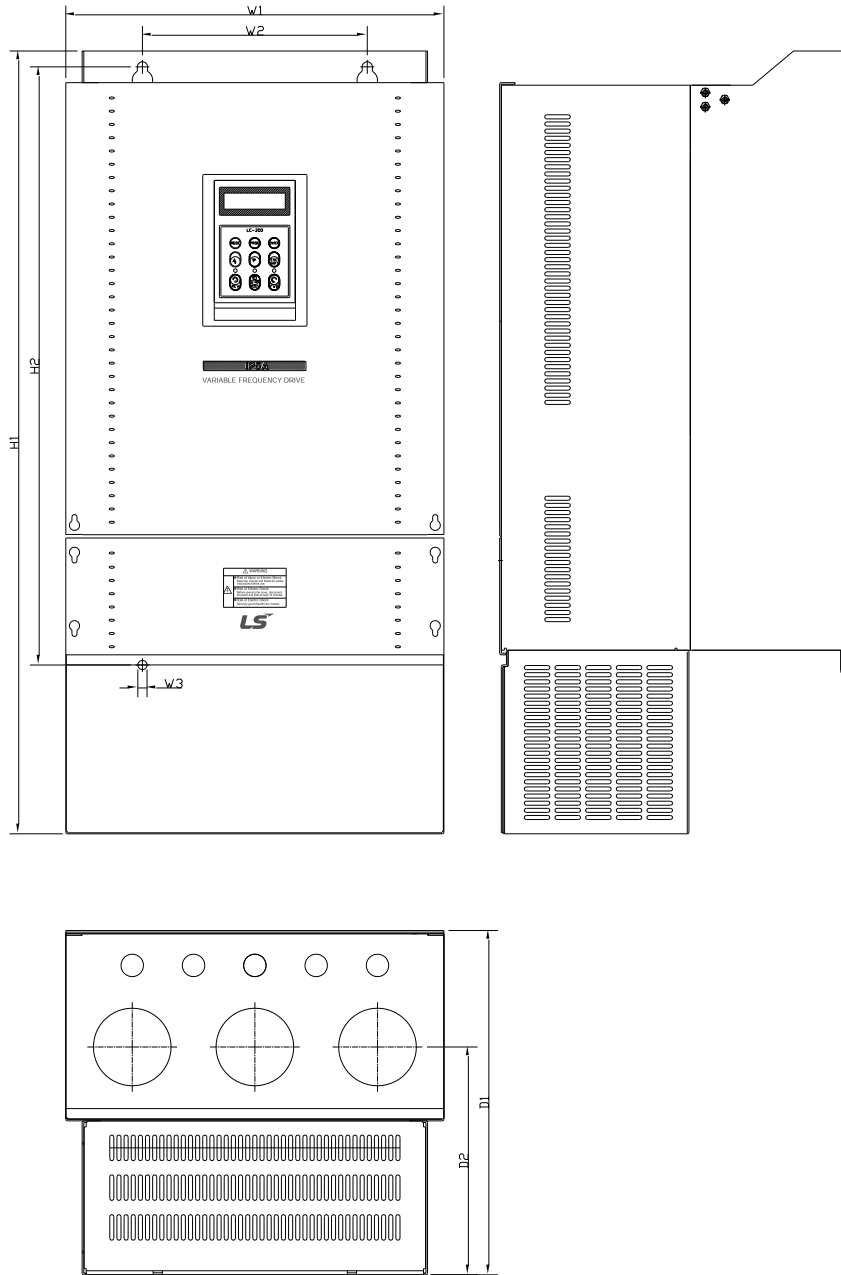
8) SV750, 900iP5A (400V Class) and SV0750~0900iP5A (600V Class)



mm (inches)

| Model | W1 | W2 | W3 | H1 | H2 | D1 | Enclosure Type |
|---------------------|---------|--------|--------|---------|---------|---------|----------------|
| SV750, 900iP5A-4 | 370 | 220 | 9 | 610 | 586.5 | 337.6 | IP00 |
| SV0750,0900iP5A-6 | (14.57) | (8.66) | (0.35) | (24.02) | (23.09) | (13.29) | UL Open |
| SV750, 900iP5A-4L | 370 | 220 | 9 | 760 | 736.6 | 337.6 | IP00 |
| (Built-in DCL Type) | (14.57) | (8.66) | (0.35) | (29.92) | (28.99) | (13.29) | UL Open |

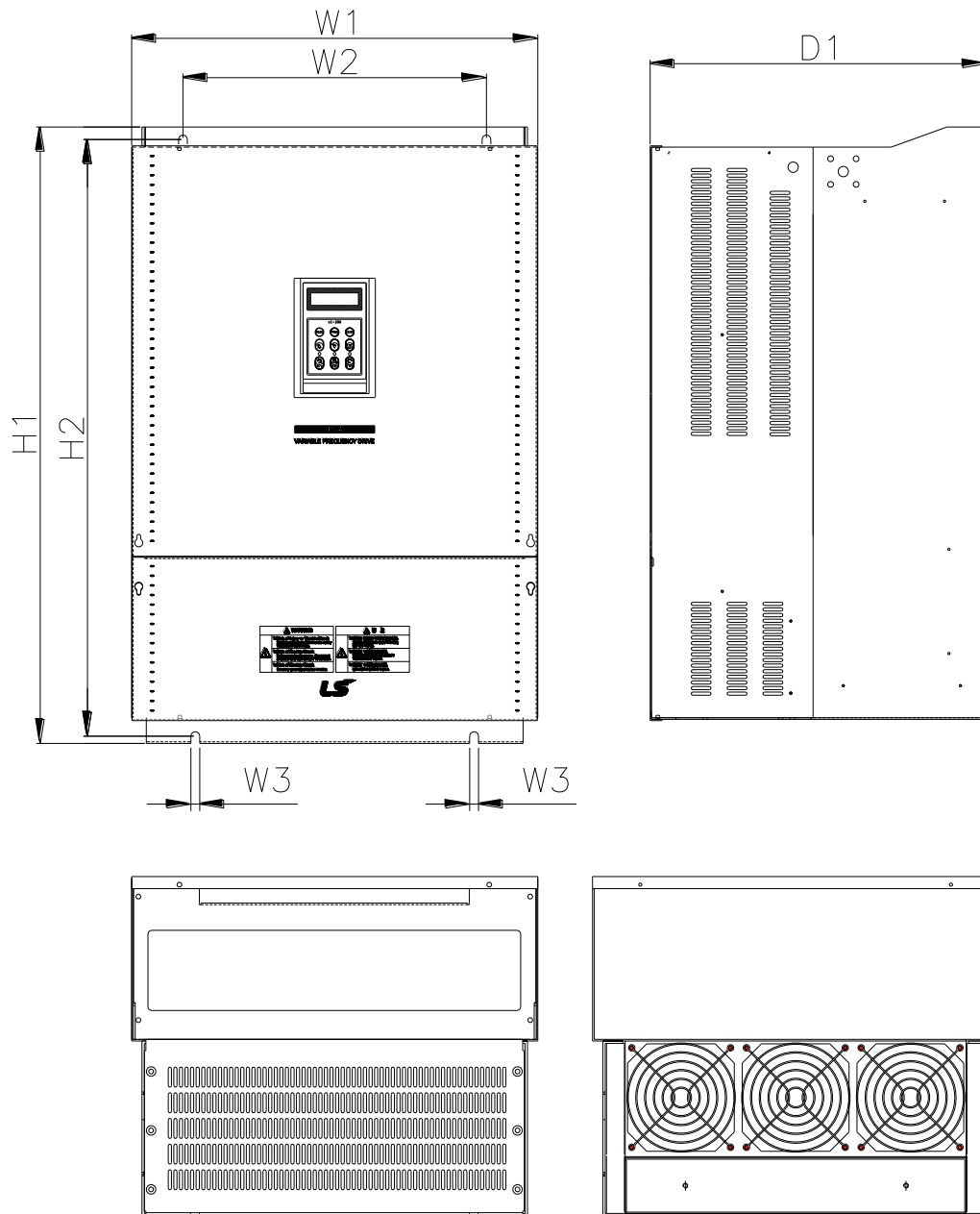
9) SV750, 900iP5A (UL Type 1 or UL Open Type with Conduit Option used, 400V Class)



| Model | mm (inches) | | | | | | | |
|---------------------|-------------|--------|--------|---------|---------|---------|-------|----------------|
| | W1 | W2 | W3 | H1 | H2 | D1 | D2 | Enclosure Type |
| SV750,900iP5A-4 | 370 | 220 | 9 | 767.5 | 586.5 | 337.6 | 223.4 | IP20 |
| SV0750,0900iP5A-6 | (14.57) | (8.66) | (0.35) | (30.22) | (23.09) | (13.29) | (8.8) | UL Type 1 |
| SV750, 900iP5A-4L | 370 | 220 | 9 | 917.5 | 736.5 | 337.6 | 223.4 | IP20 |
| (Built-in DCL Type) | (14.57) | (8.66) | (0.35) | (36.12) | (28.99) | (13.29) | (8.8) | UL Type 1 |

Note) Mounting NEMA 1 conduit option to the 15~90Kw(20~125HP) Open Type meets NEMA 1 but does not comply with UL Enclosed Type 1. To that end, please purchase UL Type 1 product.

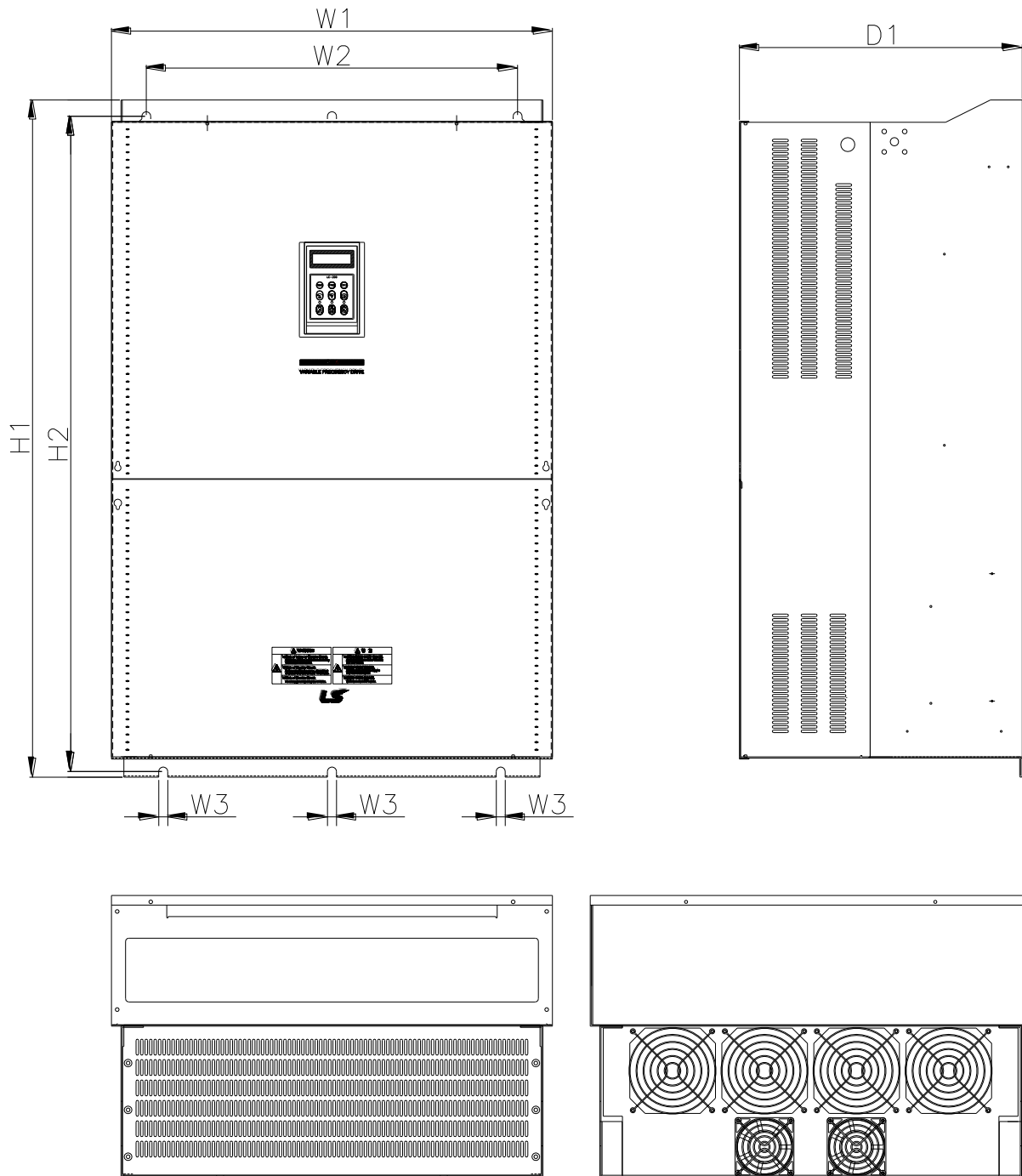
10) SV1100, 1600iP5A (400V Class) and SV1100iP5A(600V Class)



| Model | W1 | W2 | W3 | H1 | H2 | D1 | Enclosure Type |
|--------------------|---------|---------|--------|---------|---------|---------|----------------|
| SV1100,1320iP5A-4L | 510 | 381 | 11 | 783.5 | 759 | 422.6 | IP00 |
| SV1100iP5A-6L | (20.08) | (15.00) | (0.43) | (30.85) | (29.88) | (16.64) | UL Open |
| SV1600iP5A-4L | 510 | 381 | 11 | 861 | 836.5 | 422.6 | IP00 |
| SV1320,1600iP5A-6L | (20.08) | (15.00) | (0.43) | (33.90) | (32.93) | (16.64) | UL Open |

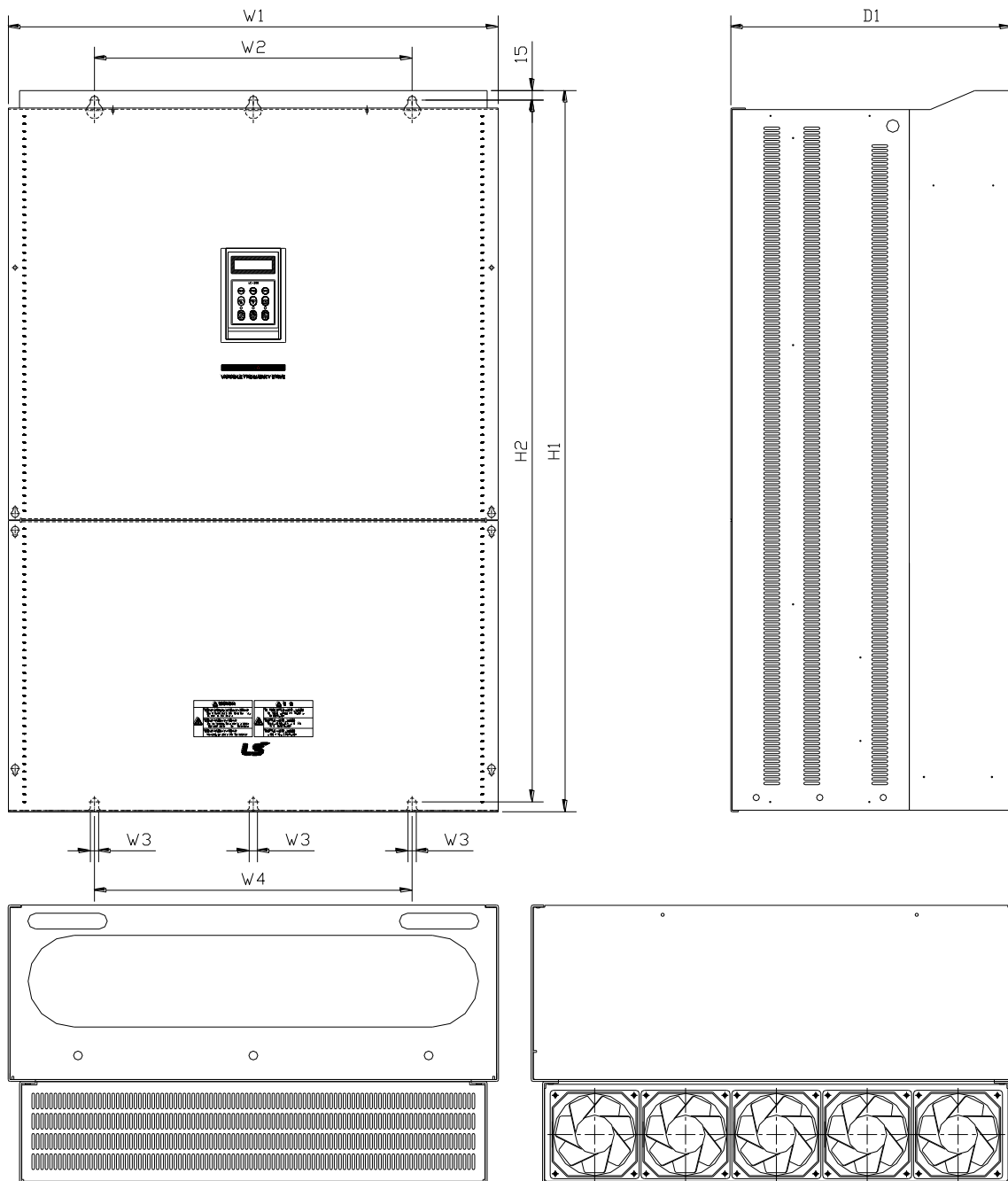
mm(inches)

11) SV2200, 2800iP5A (400V Class)



| Model | W1 | W2 | W3 | H1 | H2 | D1 | mm(inches) |
|---------------------|---------|---------|--------|---------|---------|---------|----------------|
| | | | | | | | Enclosure Type |
| SV2200, 2800iP5A-4L | 690 | 581 | 14 | 1063 | 1043.5 | 449.6 | IP00 |
| SV2200, 2800iP5A-6L | (27.17) | (22.87) | (0.55) | (41.85) | (41.08) | (17.70) | UL Open |

12) SV3150, 4500iP5A (400V Class)



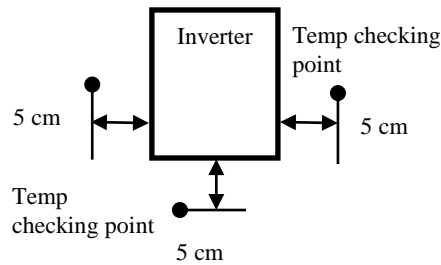
mm(inches)

| Model | W1 | W2 | W3 | W4 | H1 | H2 | D1 | Enclosure Type |
|-------------------|----------------|----------------|--------------|----------------|-------------------|-------------------|----------------|-----------------|
| SV3150iP5A-4 | 772 (30.39) | 500 (19.69) | 13 (0.51) | 500 (19.69) | 1140.5 (44.90) | 1110 (43.70) | 442 (17.40) | IP00 UL Open |
| SV3750,4500iP5A-4 | 922 (36.30) | 580 (22.83) | 14 (0.55) | 580 (22.83) | 1302.5 (51.28) | 1271.5 (50.06) | 495 (19.49) | IP00 UL Open |

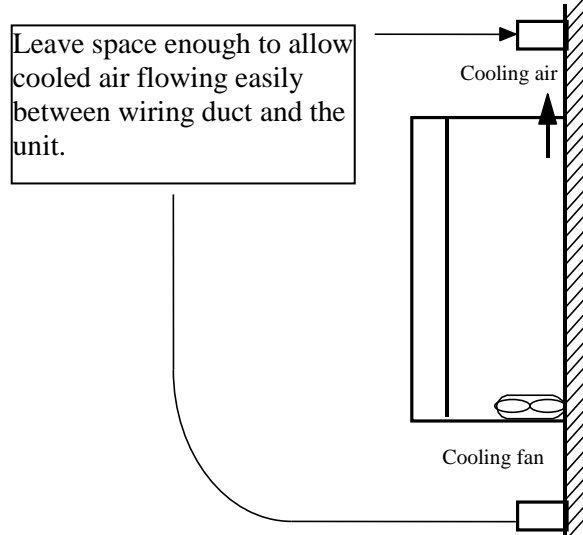
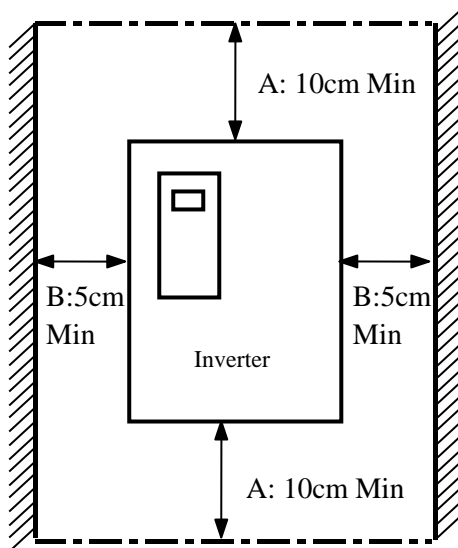
CHAPTER 3 - INSTALLATION

3.1 Installation precautions

- 1) Handle the inverter with care to prevent damage to the plastic components. Do not hold the inverter by the front cover.
- 2) Do not mount the inverter in a location where excessive vibration (5.9 m/sec^2 or less) is present such as installing the inverter on a press or other moving equipment.
- 3) Install in a location where temperature is within the permissible range ($-10\sim 40^\circ\text{C}$).



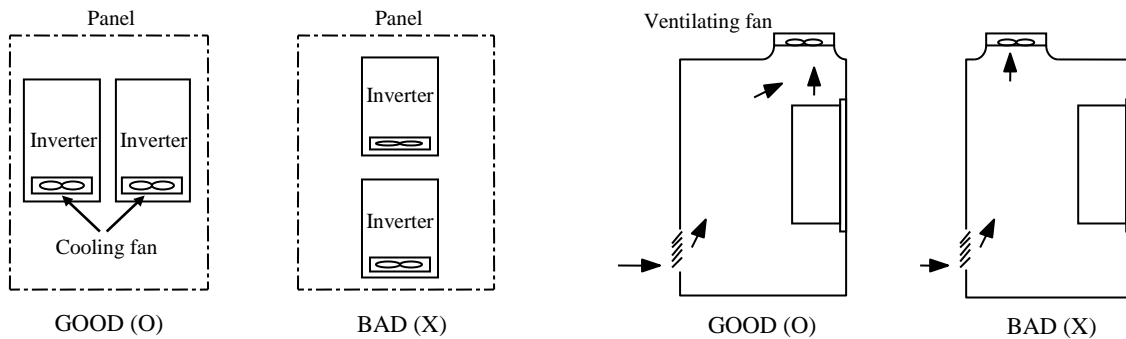
- 4) The inverter will be very hot during operation. Install it on a non-combustible surface.
- 5) Mount the inverter on a flat, vertical and level surface. Inverter orientation must be vertical (top up) for proper heat dissipation. Also leave sufficient clearances around the inverter. However, A= Over 500mm and B= 200mm should be obtained for inverters rated 30kW and above.



6) Do not mount the inverter in direct sunlight or near other heat sources.

7) The inverter shall be mounted in a Pollution Degree 2 environment. If the inverter is going to be installed in an environment with a high probability of dust, metallic particles, mists, corrosive gases, or other contaminants, the inverter must be located inside the appropriate electrical enclosure of the proper NEMA or IP rating.

8) When two or more inverters are installed or a ventilation fan is mounted in inverter panel, the inverters and ventilation fan must be installed in proper positions with extreme care taken to keep the ambient temperature of the inverters below the permissible value. If they are installed in improper positions, the ambient temperature of the inverters will rise.



[When installing several inverters in a panel]

[When installing a ventilating fan in a panel]

9) Install the inverter using screws or bolts to insure the inverter is firmly fastened.

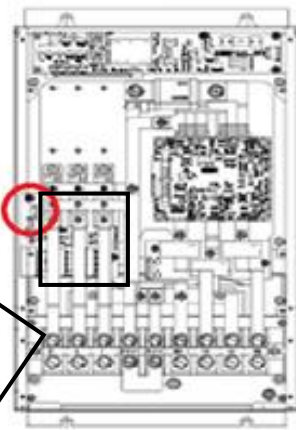
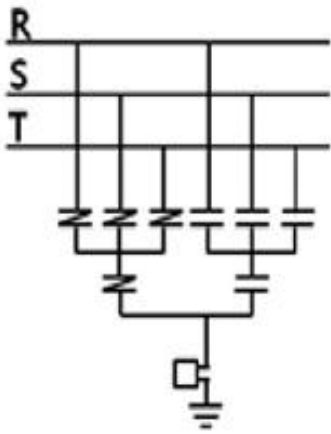
10) IP5A Series Drives contain protective MOVs and common mode capacitors that are referenced to ground. To guard against drive damage or operation problems, these devices must be properly configured according to below table

| Power Source Type | MOV Input Filter Caps | Benefits |
|--|-----------------------|--|
| 3-Phase AC grounded system | Connected | Reduced electrical noise, Most stable operation, Reduced voltage stress on components and motor bearings |
| 3-Phase ungrounded system Impedance grounded | Disconnected | Helps avoid severe equipment damage when ground fault occurs |

Note: 5.5~30kW and 575V Series are not supported.

⚠ To avoid drive's damage or electric shock, disconnect switch, When Drive's capacitors are discharged completely

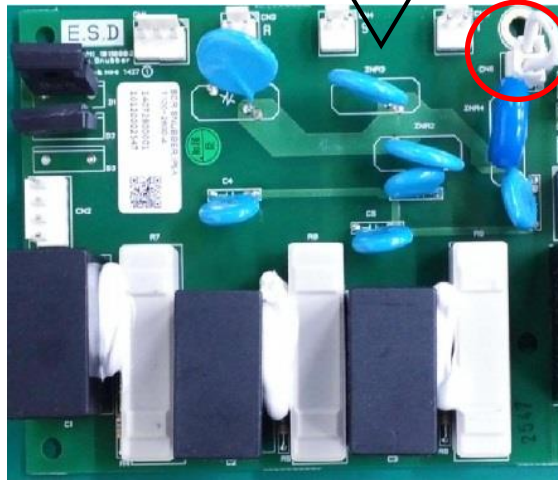
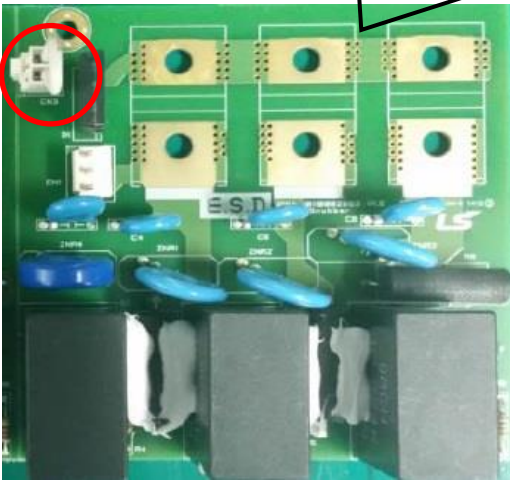
⚠ In case of surge and lightning don't flow in the grounded system , you can disconnect the switch.





<MOV and AC EMI Capacitor Phase to Ground >

< Example of 37~90kW-4 >

< Example of 110~450kW-4 >

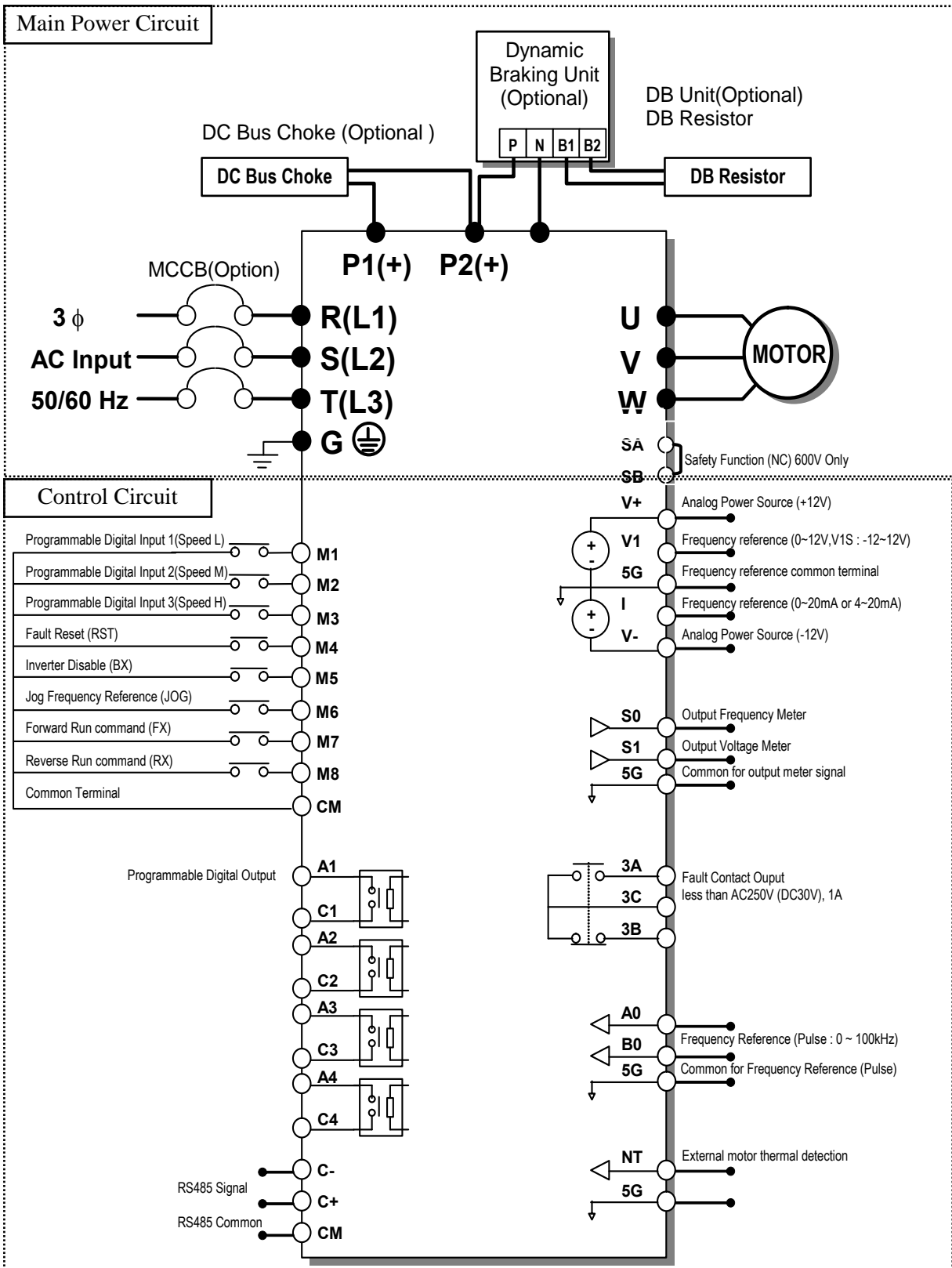


| | |
|--|--|
|  CAUTION | |
|  | <p>■ Risk of Electric Shock</p> <p>More than one disconnect switch may be required to de-energize the equipment before servicing.</p> |

3.2 Wiring

3.2.1 Basic wiring

1) For 0.75~30kW (1~40HP)



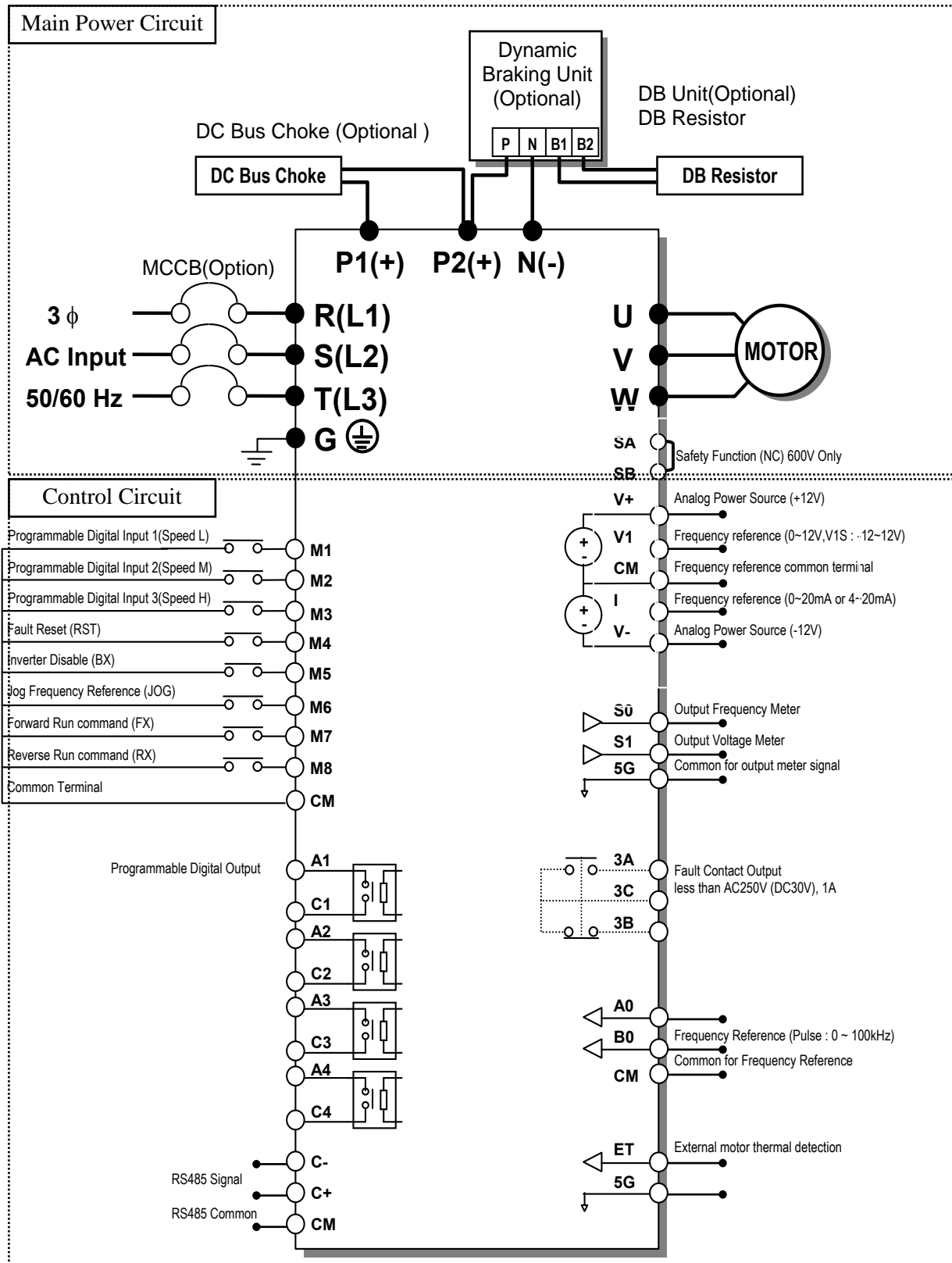
Note :1) 5G is Common Ground for Analog Input/Output. (Only applied to 0.75 ~ 30kW products)

2) Use terminal V1 for V1, V1S (0~12V, -12 ~ 12V) input.

3) To add DC reactor, Remove DC Bus Choke and connect to P1(+), P2(+).

4) SA,SB terminal is provided with 600V class model only.

2) For 37~90kW (50~125HP) / 315~450(500~700HP)



Note : 1) 5G is Common Ground for Analog Meter Output(S0,S1) and External motor thermal detection(ET).

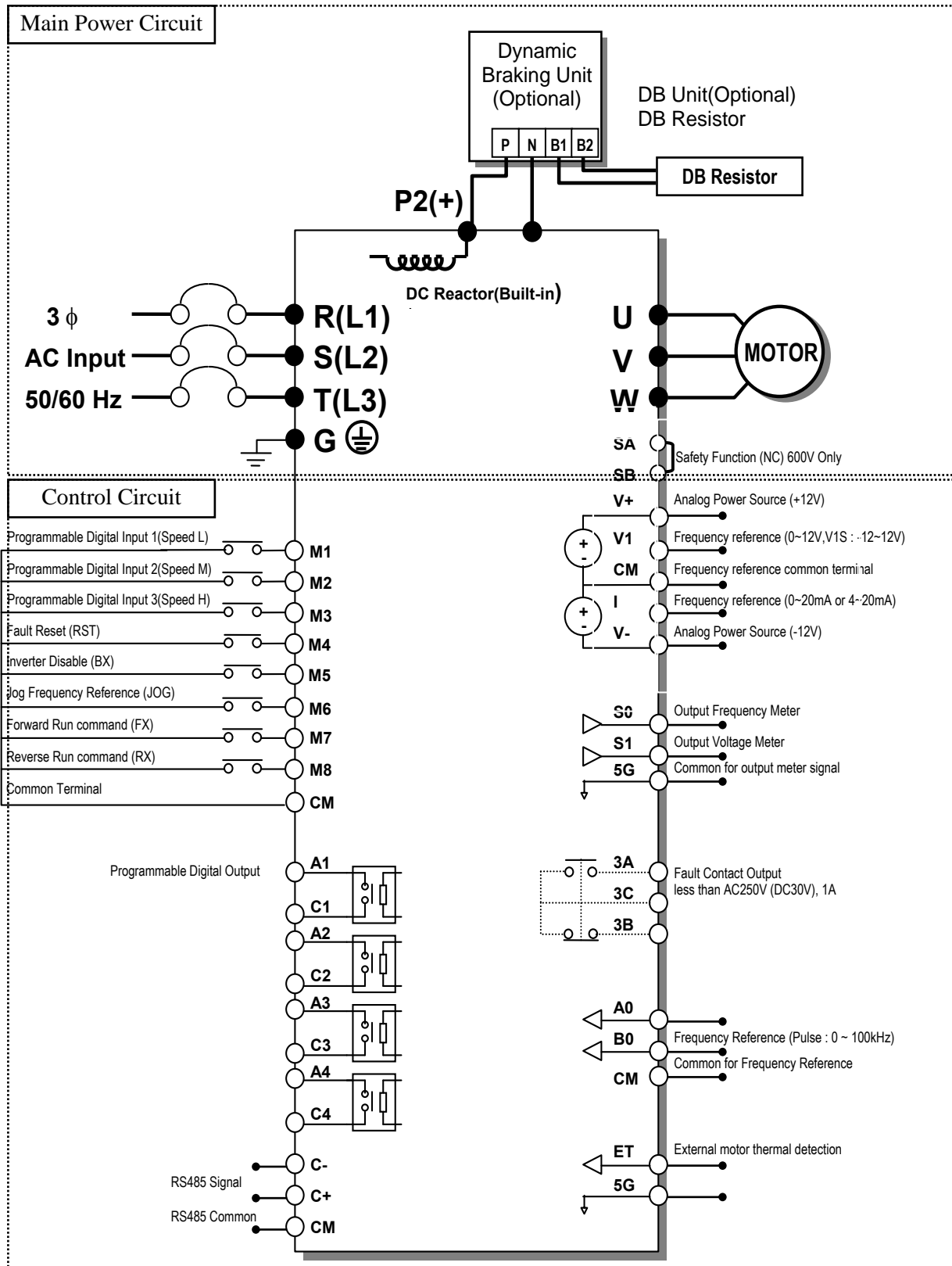
CM is Common Ground for Analog input.

2) Use terminal V1 for V1, V1S (0~12V, -12 ~ 12V) input.

3) To add DC reactor, remove DC Bus Choke and connect to P1(+), P2(+).

4) SA,SB terminal is provided with 600V class model only.

3) For 110~280kW (150~350HP)



Note : 1) 5G is Common Ground for Analog Meter Output(S0,S1) and External motor thermal detection(ET).

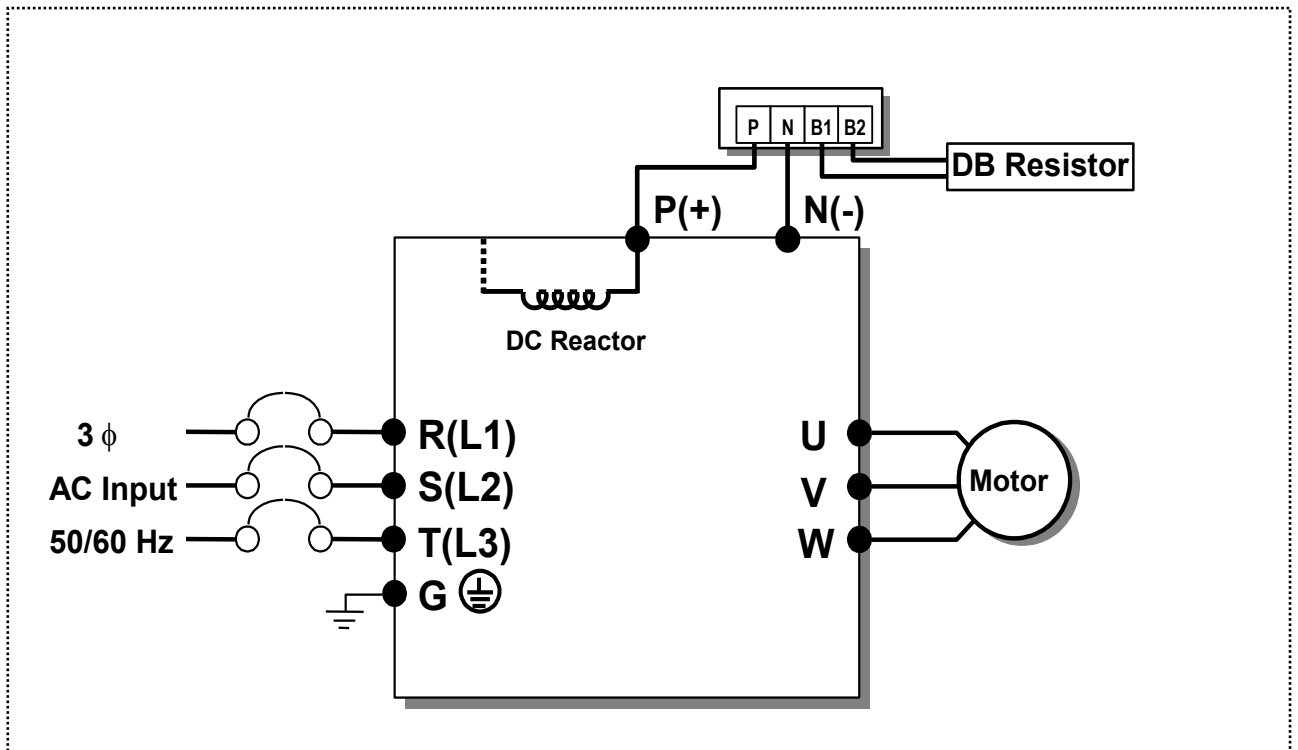
CM is Common Ground for Analog Input.

2) Use terminal V1 for V1, V1S (0~12V, -12 ~ 12V) input.

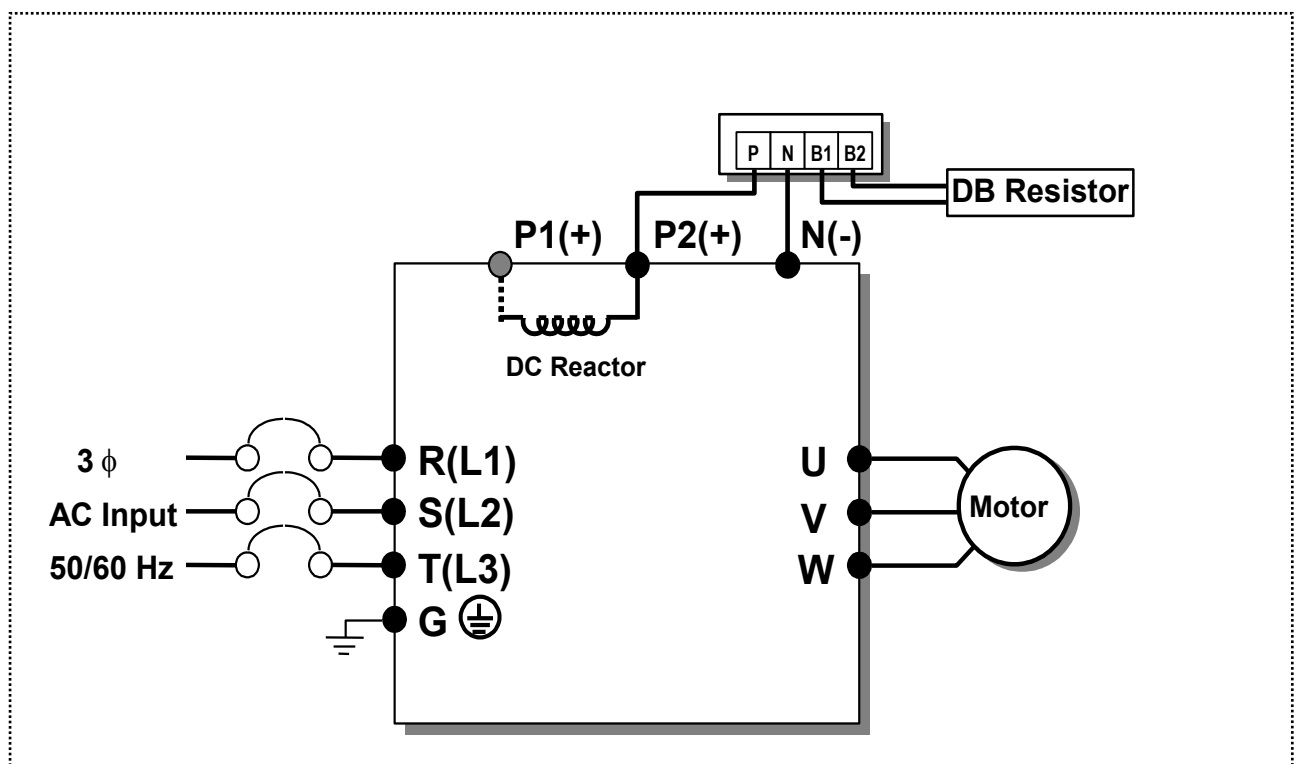
3) DC Reactor is built basically in the inverters for 110~280kW(150~350HP).

4) SA,SB terminal is provided with 600V class model only.

4) For 15~30kW (20~40HP) Built-in DCL Type



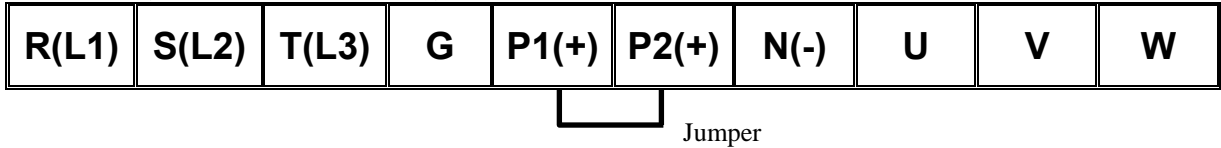
5) For 37~90kW (50~125HP) Built-in DCL Type



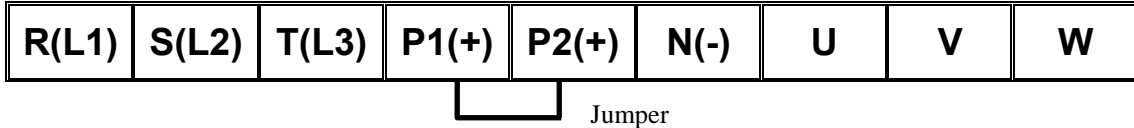
Note : P1(+) is not provided for wiring.

6) Power Terminals:

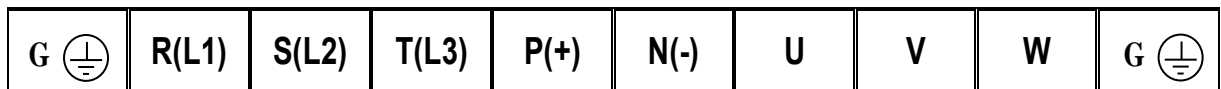
(1) 0.75 ~ 30 kW (200V/400V/600V Class)



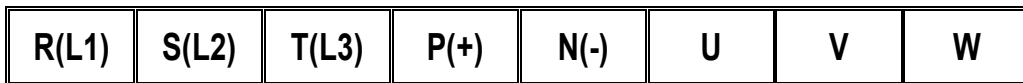
(2) 37~90kW (50~125HP) / 315~450kW (500~700HP) <400V/600V Class>



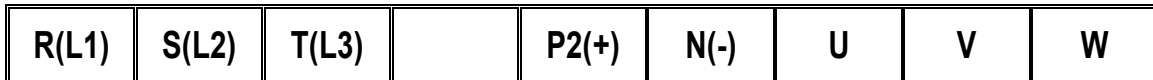
(3) 15~18.5kW (20~25HP) <Built-in DC Reactor Type, 400V Class>



(4) 22~30kW (30~40HP) <Built-in DC Reactor Type, 400V Class>



(5) 37~90kW (50~125HP) / 110 ~280kW (150~350HP) <Built-in DC Reactor Type, 400V Class>

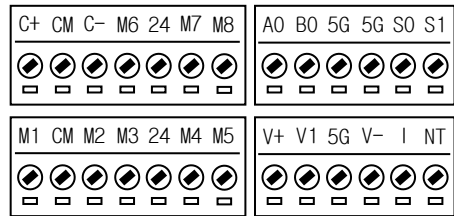
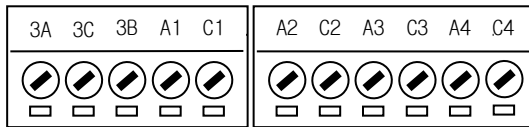
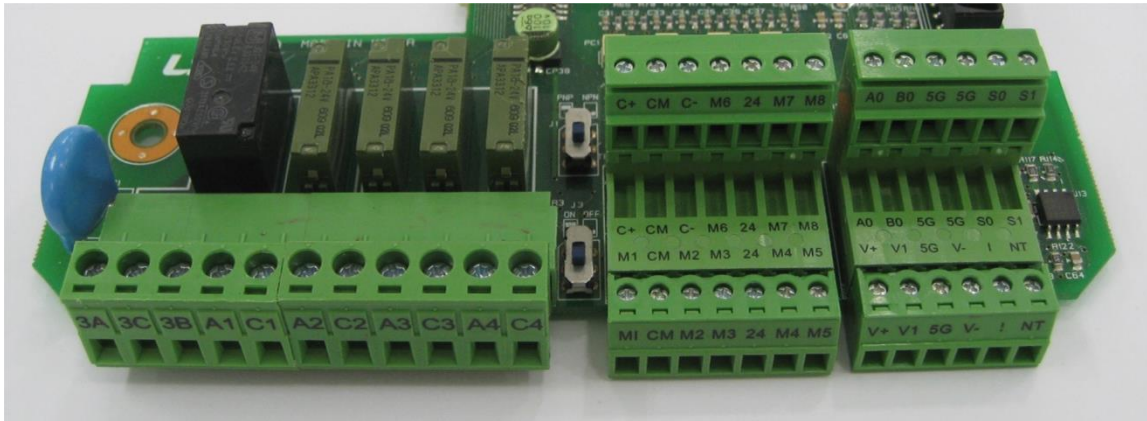


Note : P1(+) is not provided for wiring.

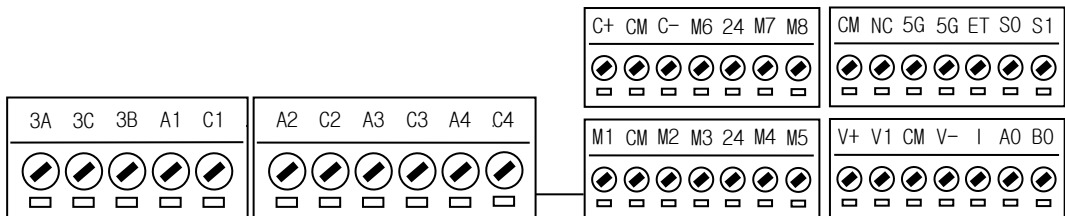
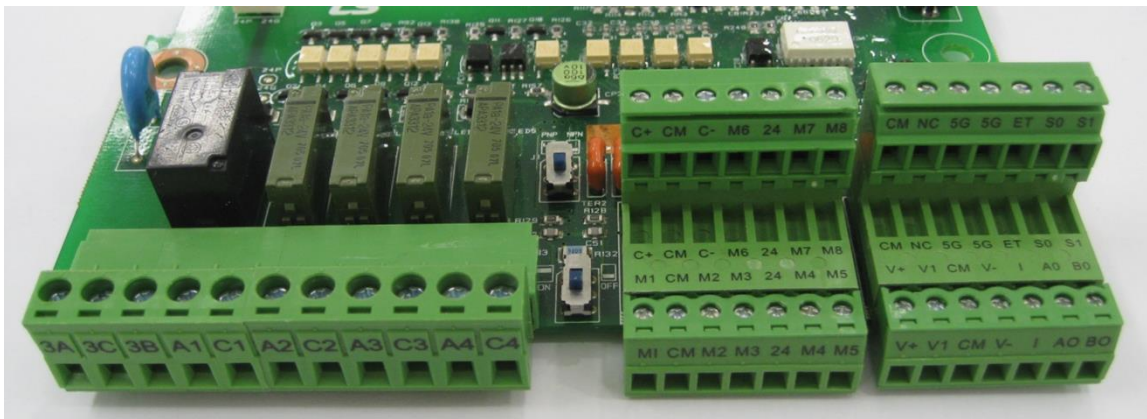
| Symbol | Description |
|---------------------------|--|
| R(L1), S(L2), T(L3) | AC Line Voltage Input |
| G | Earth Ground |
| P1(+), P2(+) | External DC Reactor (P1(+)-P2(+)) Connection Terminals (Jumper must be removed). |
| P2(+), N(-) or P(+), N(-) | DB Unit (P2(+)-N(-)) Connection Terminals |
| U, V, W | 3 Phase Power Output Terminals to Motor |

7) Control circuit terminal

0.75 ~ 30kW/1~40HP (200V/400V Class)



37 ~ 450 kW/ 50~700HP (400V Class)



Note) The terminal specification is subject to change according to decision of manufacturer.

| Type | Symbol | Name | Description | |
|--------------|----------------------------------|--|--|---|
| Input signal | Starting Contact Function Select | M1, M2, M3 | Programmable Digital Input 1, 2, 3 (Factory setting: Multi-Step Frequency 1, 2, 3) | |
| | | FX [M7] | Forward Run Command Forward Run When Closed and Stopped When Open. | |
| | | RX [M8] | Reverse Run Command Reverse Run When Closed and Stopped When Open. | |
| | | JOG [M6] | Jog Frequency Reference Runs at Jog Frequency when the Jog Signal is ON. The Direction is set by the FX (or RX) Signal. | |
| | | BX [M5] | Emergency Stop When the BX Signal is ON the Output of the Inverter is Turned Off. When Motor uses an Electrical Brake to Stop, BX is used to Turn Off the Output Signal. Take caution when BX Signal is OFF (Not Turned Off by Latching) and FX Signal (or RX Signal) is ON. If so, motor continues to Run. | |
| | | RST [M4] | Fault Reset Used for Fault Reset. | |
| | | CM | Sequence Common (NPN) Common terminal for NPN contact. | |
| | 24 | Sequence Common (PNP) Common 24V terminal for PNP contact input. (maximum output : +24V, 100mA) | | |
| | Analog frequency setting | V+, V- | Analog Power Source (+12V,-12V) Power supply for Analog Frequency Setting. Maximum Output: +12V, 100mA, -12V, 100mA. | |
| | | V1 | Frequency Reference (Voltage) Used by a DC 0-12V or -12~ 12 V input to set the frequency reference. (Input impedance is 20 kΩ) | |
| | | I | Frequency Reference (Current) Used by a 0-20mA input to set the frequency reference. (Input impedance is 249 Ω) | |
| | | A0, B0 | Frequency Reference (Pulse) Used by a pulse input to set the frequency reference. | |
| | | 5G (~30kW) CM(37kW~) | Frequency Reference Common Terminal Common Terminal for Analog Frequency Reference Signal. | |
| | External motor thermal detection | NT (~30kW) ET (37kw ~) | External motor thermal detection Motor thermal sensor input. Used to prevent motor from overheating by using a NTC or PTC thermal sensor. | |
| | | 5G | Common for NT(or ET) Common Terminal for External motor thermal detection. | |
| | Built-in RS485 terminal | C+, C- | RS485 signal High, Low RS485 signal | |
| | | CM | RS485 common Common Ground. Terminal for RS485 interface. | |
| | Output signal | Analog Output | S0, S1 | Programmable Voltage Output Voltage output for one of the following: Output Frequency, Output Current, Output Voltage, DC Link Voltage. Default is set to Output Frequency. (Maximum Output Voltage and Output Current are 0-12V and 1mA). |
| | | | 5G | Analog Common Terminal Common Terminal for Analog Output (S0, S1). |
| | | Contact | 3A, 3C, 3B | Fault Contact Output Energizes when a fault is present. (AC250V, 1A; DC30V, 1A) Fault: 3A-3C Closed (3B-3C Open) Normal: 3B-3C Closed (3A-3C Open) |
| | | | A1~4, C1~4 | Programmable Digital Output Defined by Programmable Digital Output terminal settings (AC250V, 1A or less; DC30V, 1A or less) |

Note) M1~M8 terminals are User Programmable. NC terminal is unavailable.

3.2.2 Wiring power terminals

◆ Wiring Precautions

- 1) The internal circuits of the inverter will be damaged if the incoming power is connected and applied to output terminals (U, V, W).
- 2) Use ring terminals with insulated caps when wiring the input power and motor wiring.
- 3) Do not leave wire fragments inside the inverter. Wire fragments can cause faults, breakdowns, and malfunctions.
- 4) For input and output, use wires with sufficient size to ensure voltage drop of less than 2%.
- 5) Motor torque may drop of operating at low frequencies and a long wire run between inverter and motor.
- 6) The cable length between inverter and motor should be less than 150m (492ft). Due to increased leakage capacitance between cables, overcurrent protective feature may operate or equipment connected to the output side may malfunction. (But for products of less than 30kW, the cable length should be less than 50m (164ft) when carrier frequency is more than 10 kHz.)
- 7) The main circuit of the inverter contains high frequency noise, and can hinder communication equipment near the inverter. To reduce noise, install line noise filters on the input side of the inverter.
- 8) Do not use power factor capacitor, surge killers, or RFI filters on the output side of the inverter. Doing so may damage these components.
- 9) Always check whether the LCD and the charge lamp for the power terminal are OFF before wiring terminals. The charge capacitor may hold high-voltage even after the power is disconnected. Use caution to prevent the possibility of personal injury.
- 10) Do not connect with MC at output pare of inverter and make MC On/Off during operation. It can cause the Trip or damage of inverter

◆ Grounding

- 1) The inverter is a high switching device, and leakage current may flow. Ground the inverter to avoid electrical shock. Use caution to prevent the possibility of personal injury. The ground impedance for 200V class is 100 ohm with 400V class 10ohm. (Protective Class : I)
- 2) Connect only to the dedicated ground terminal of the inverter. Do not use the case or the chassis screw for grounding.
- 3) The protective earth conductor must be the first one in being connected and the last one in being disconnected.
- 4) As a minimum, grounding wire should meet the specifications listed below. Grounding wire should be as short as possible and should be connected to the ground point as near as possible to the inverter.

| Inverter Capacity | | Grounding wire Sizes, AWG or kcmil (mm ²) | | |
|-------------------|-----------|---|------------|------------|
| kW | HP | 200V Class | 400V Class | 600V Class |
| 5.5 ~ 7.5 | 7.5 ~ 10 | 10 | 4 | 2.5 |
| 11 ~ 15 | 15 ~ 20 | 16 | 10 | 4 |
| 18.5 ~ 30 | 25 ~ 40 | 35 | 16 | 10 |
| 37 ~ 55 | 50 ~ 75 | - | 25 | 16 |
| 75 ~ 90 | 100 ~ 125 | - | 35 | 25 |
| 110 ~ 132 | 150 ~ 200 | - | 70 | 35 |
| 160 ~ 280 | 250 ~ 350 | - | 150 | 70 |
| 315 ~ 375 | 400 ~ 600 | - | 240 | - |
| 450 | 700 | - | 240 | - |

3.2.3 Wires and terminal lugs

Refer to below for wires, terminal lugs, and screws used to connect the inverter power input and output.

| Inverter capacity | Terminal screw size | Screw torque | | Wire size | | | | |
|-------------------|--------------------------|--------------|-------------|---------------------|--------------|-----------------|--------------|-----|
| | | | | R(L1), S(L2), T(L3) | | U, V, W | | |
| | | kgf · cm | lb · in | mm ² | AWG or kcmil | mm ² | AWG or kcmil | |
| 200V | 0.75kW(1HP) | M4 | 7.1 ~ 12.2 | 6.2 ~ 10.6 | 2.5 | 14 | 2.5 | 14 |
| | 1.5kW(2HP) | M4 | 7.1 ~ 12.2 | 6.2 ~ 10.6 | 2.5 | 14 | 2.5 | 14 |
| | 2.2kW(3HP) | M4 | 7.1 ~ 12.2 | 6.2 ~ 10.6 | 2.5 | 14 | 2.5 | 14 |
| | 3.7kW(5HP) | M4 | 7.1 ~ 12.2 | 6.2 ~ 10.6 | 4 | 12 | 4 | 12 |
| | 5.5kW(7.5HP) | M4 | 7.1 ~ 12.2 | 6.2~10.6 | 5.5 | 10 | 5.5 | 10 |
| | 7.5kW(10HP) | M5 | 24.5 ~ 31.8 | 21.2~27.6 | 8 | 8 | 8 | 8 |
| | 11kW(15HP) | M5 | | | 14 | 6 | 14 | 6 |
| | 15kW(20HP) | M6 | 30.6 ~ 38.2 | 26.6~33.2 | 22 | 4 | 22 | 4 |
| | 18.5kW(25HP) | M6 | | | 38 | 2 | 38 | 2 |
| | 22kW(30HP) | M8 | 61.2 ~ 91.8 | 53.1~79.7 | 38 | 2 | 38 | 2 |
| 30kW(40HP) | M8 | 60 | | | 1/0 | 60 | 1/0 | |
| 400V | 0.75kW(1HP) | M4 | 7.1 ~ 12.2 | 6.2 ~ 10.6 | 2.5 | 14 | 2.5 | 14 |
| | 1.5kW(2HP) | M4 | 7.1 ~ 12.2 | 6.2 ~ 10.6 | 2.5 | 14 | 2.5 | 14 |
| | 2.2kW(3HP) | M4 | 7.1 ~ 12.2 | 6.2 ~ 10.6 | 2.5 | 14 | 2.5 | 14 |
| | 3.7kW(5HP) | M4 | 7.1 ~ 12.2 | 6.2 ~ 10.6 | 2.5 | 14 | 2.5 | 14 |
| | 5.5kW(7.5HP) | M4 | 7.1 ~ 12.2 | 6.2~10.6 | 3.5 | 12 | 3.5 | 12 |
| | 7.5Kw(10HP) | M4 | | | 3.5 | 12 | 3.5 | 12 |
| | 11 kW(15HP) | M4 | | | 5.5 | 10 | 5.5 | 10 |
| | 15 kW(20HP) | M6 | 30.6~38.2 | 26.6~33.2 | 8 | 8 | 8 | 8 |
| | 18.5kW(25HP) | M6 | | | 14 | 6 | 14 | 6 |
| | 22~30kW(30~40HP) | M8 | 61.2~91.8 | 53.1~79.7 | 22 | 4 | 22 | 4 |
| | 37~55kW(50~75HP) | M8 | | | 38 | 2 | 38 | 2 |
| | 75~90kW (100~125HP) | M10 | 89.7~122.0 | 77.9~105.9 | 60 | 1/0 | 60 | 1/0 |
| | 110~132kW (150~200HP) | M12 | 182.4~215.0 | 158.3~186.6 | 100 | 4/0 | 100 | 4/0 |
| | 160kW(250HP) | M12 | | | 150 | 300 | 150 | 300 |
| 220kW(350HP) | M12 | 200 | | | 400 | 200 | 400 | |
| 280kW(400HP) | M12 | 250 | | | 500 | 250 | 500 | |
| 315kW(500HP) | M12 | 325 | | | 700 | 325 | 700 | |
| 375kW(600HP) | M12 | 2×200 | | | 2×400 | 2×200 | 2×400 | |
| 450kW(700HP) | M12 | 2×250 | | | 2×500 | 2×250 | 2×500 | |
| 600V | 5.5kW(7.5HP) | M4 | 7.1 ~ 12.2 | 6.2~10.6 | 3.5 | 12 | 3.5 | 12 |
| | 7.5Kw(10HP) | M4 | 7.1 ~ 12.2 | 6.2~10.6 | 3.5 | 12 | 3.5 | 12 |
| | 11 kW(15HP) | M4 | 7.1 ~ 12.2 | 6.2~10.6 | 5.5 | 10 | 5.5 | 10 |
| | 15 kW(20HP) | M6 | 30.6~38.2 | 26.6~33.2 | 8 | 8 | 8 | 8 |
| | 18.5kW(25HP) | M6 | | | 14 | 6 | 14 | 6 |
| | 22~30kW(30~40HP) | M8 | 61.2~91.8 | 53.1~79.7 | 22 | 4 | 22 | 4 |
| | 37~55kW(50~75HP) | M8 | | | 38 | 2 | 38 | 2 |
| | 75~90kW (100~125HP) | M10 | 89.7~122.0 | 77.9~105.9 | 60 | 1/0 | 60 | 1/0 |

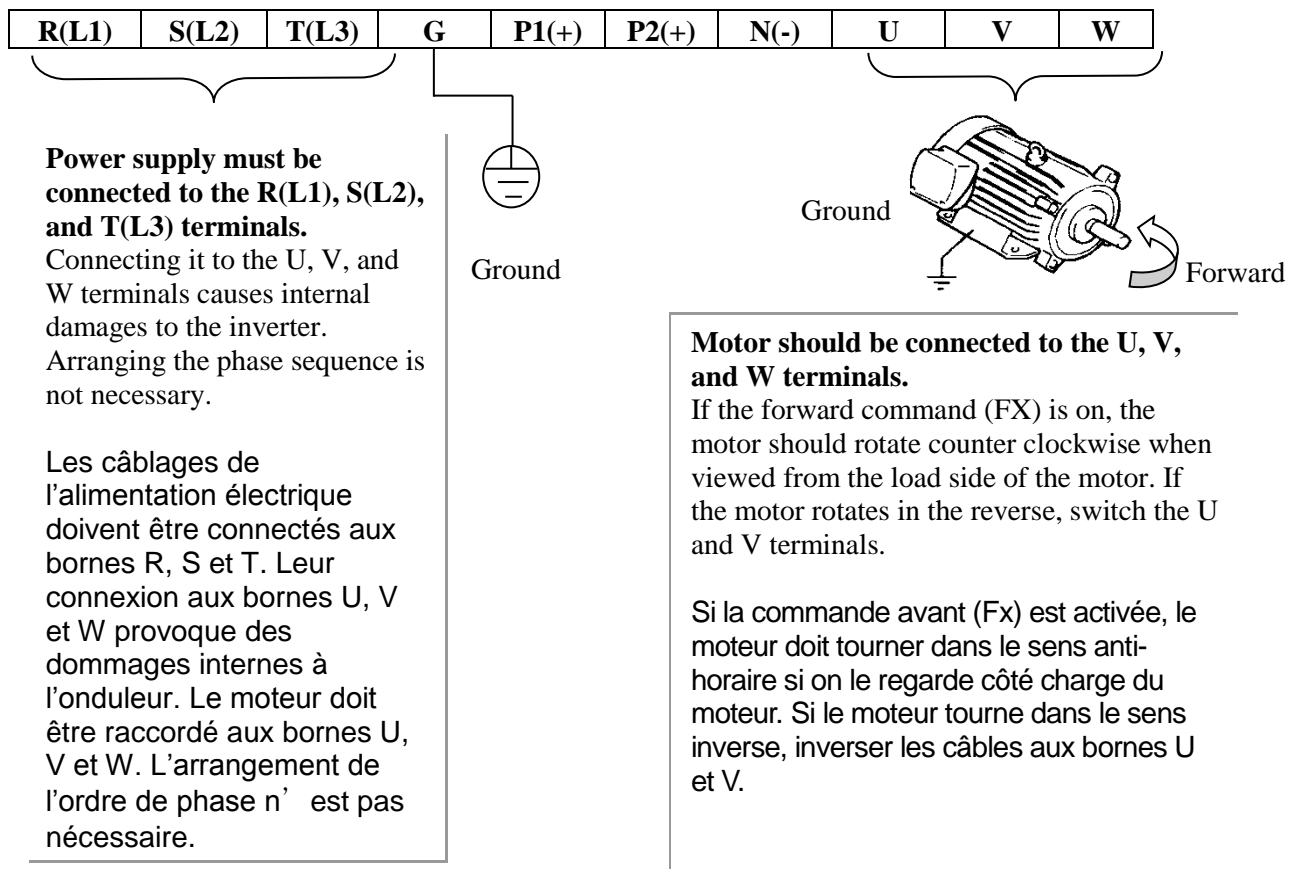
| | | | | | | | |
|--------------------------|-----|-------------|-------------|-----|-----|-----|-----|
| 110~280kW (150~400HP) | M12 | 182.4~215.0 | 158.3~186.6 | 100 | 4/0 | 100 | 4/0 |
|--------------------------|-----|-------------|-------------|-----|-----|-----|-----|

* Apply the rated torque to terminal screws.

* Loose screws can cause of short circuit or malfunction. Tightening the screw too much can damage the terminals and cause a short circuit or malfunction.

* Use copper wires only with 600V, 75°C ratings. For 7.5~11kW 240V type inverters, R(L1), S(L2), T(L3) and U, V, W terminals are only for use with insulated ring type connector.

Power and Motor Connection Example (5.5~30kW inverters)



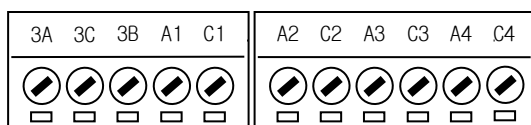
3.2.4 Control circuit wiring

1) Wiring Precautions

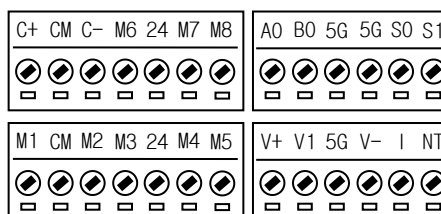
CM and 5G terminals are insulated each other. Do not connect these terminals together or to the power ground. Use shielded wires or twisted wires for control circuit wiring, and separate these wires from the main power circuits and other high voltage circuits (200V relay sequence circuit).

It is recommended to use the cables of 0.0804mm² (28 AWG) ~ 1.25mm² (16 AWG) for TER1, TER2 control terminals and the cables of 0.33mm² (22 AWG) ~ 2.0mm² (14 AWG) for TER3, TER4 control terminals.

2) Control terminal layout



TER4
0.33mm² (22 AWG) ~ 2.0mm² (14 AWG)



TER2
0.0804mm² (28 AWG) ~ 1.25mm² (16 AWG)

3) Sink mode(NPN mode) / Source mode(PNP mode)

SV-iP5A provides Sink/Source(NPN/PNP) modes for sequence input terminal on the control circuit. The logic of the input terminal is settable to Sink mode(NPN mode) / Source mode(NPN mode) by using the J1 switch. Connection method is shown below.

(1) Sink mode(NPN mode)

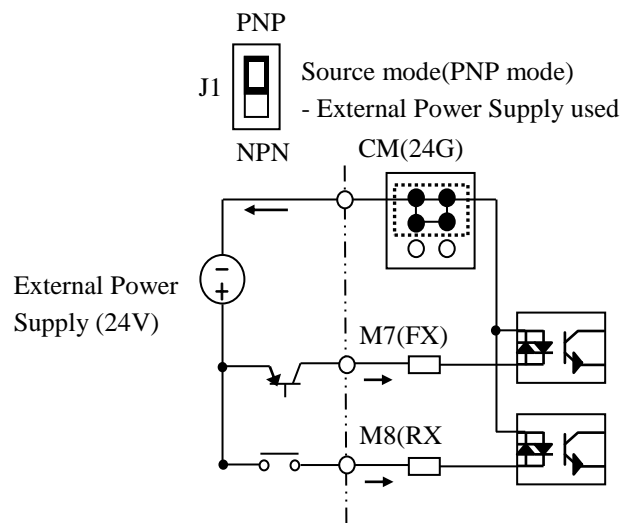
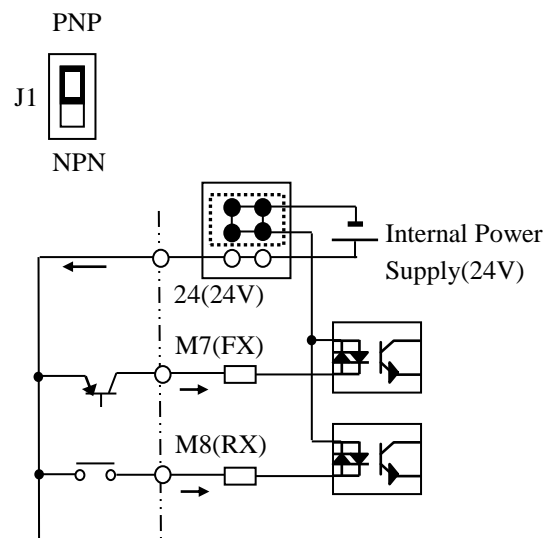
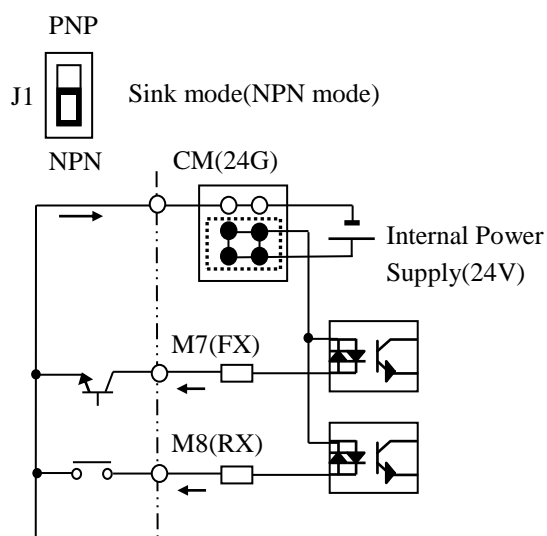
- Put J1 switch down to set to Sink mode(NPN mode). CM terminal (24V GND) is common terminal for contact signal input.
- The factory default is Sink mode(NPN mode).

(2) Source mode(PNP mode) - Internal Power Supply used

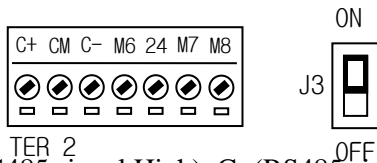
- Put J1 switch up to set to Source mode(PNP mode). Terminal 24 (24V Power Supply) is common terminal for contact input signal.

(3) Source mode(PNP mode) - External Power Supply used

- Put J1 switch up to set to Source mode(PNP mode).
- To use external 24V Power Supply, make a sequence between external Power Supply (-) terminal and CM(24V GND) terminal.



3.2.5 RS485 circuit wiring



Use C+ (RS485 signal High), C- (RS485 signal LOW) in TER 2. Turn the J3 switch ON (Upward) to connect the termination resistor (120 ohm). J3 switch is On the left side of the TER2.

| Item | Specification |
|-----------------------|--|
| Transmission type | Bus method, Multi drop Link System |
| Applicable inverter | SV-iP5A series |
| Number of inverters | Max.31 |
| Transmission distance | Within 1200m Max. (700m desired) |
| Recommendable cable | 0.75mm ² (18AWG), Shield Type Twisted-pair Wire |
| Installation | C+, C-, CM terminals on the control terminal block |
| Power supply | Insulated from the inverter power supply |

3.2.6 Check points on wiring

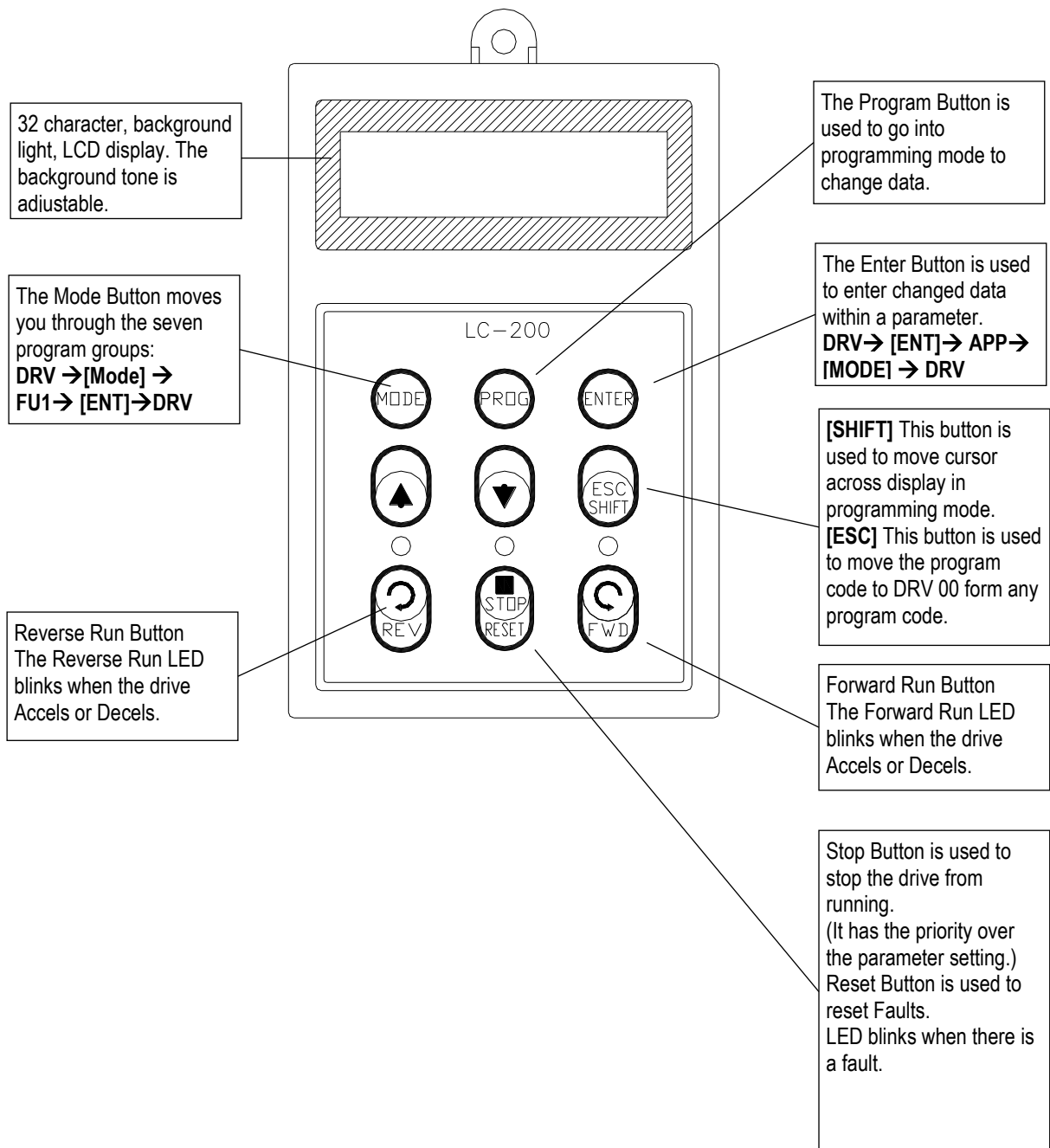
- 1) Electrical or mechanical interlock of MC1 and MC2 is required for Inverter Bypass Operation. Otherwise, chattering may occur or input power may flow to inverter output, damaging the inverter.
- 2) Make the sequence to disable the Auto restart after power failure if required. Otherwise, inverter will be automatically restarted.
- 3) Do not apply the voltage directly to control circuit input terminals such as FX, RX.

CHAPTER 4 - OPERATION

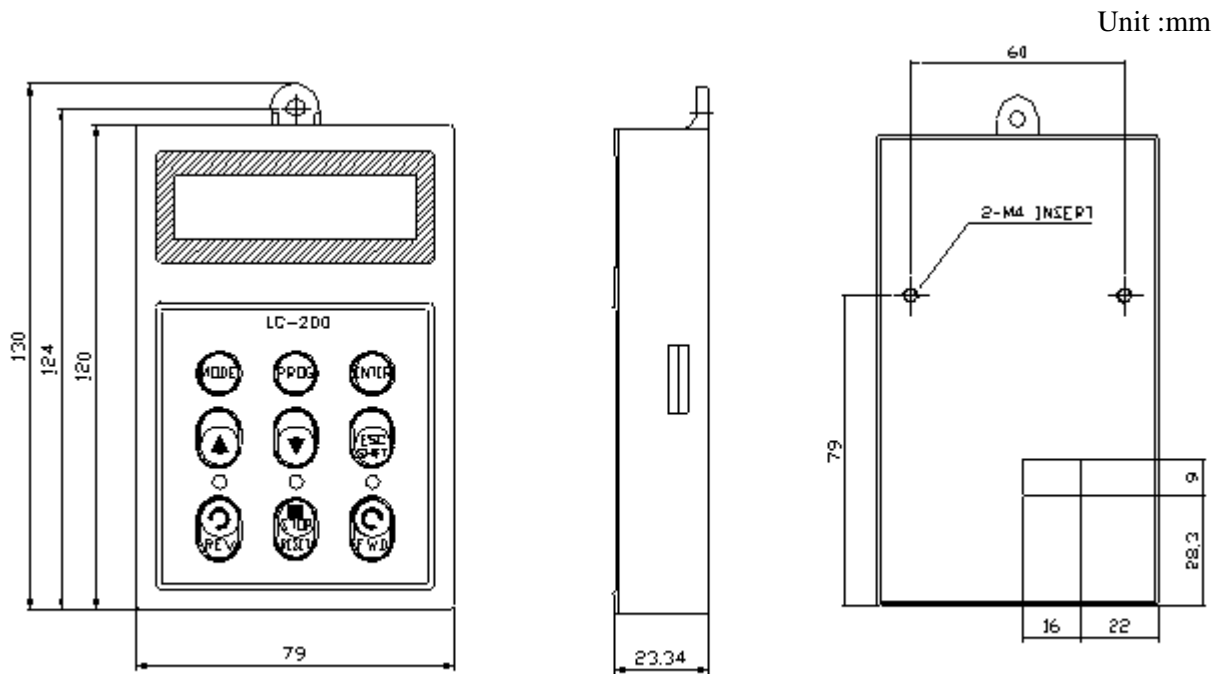
4.1 Programming Keypads

4.1.1 LCD Keypad

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

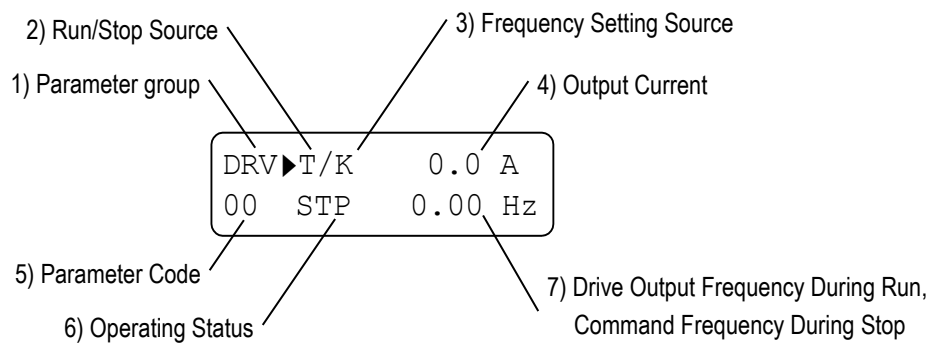


1) Keypad dimension



2) Detail description

(1) LCD Keypad Display



| Displays | Description |
|-----------------------------|---|
| 1) Parameter Group | Displays the parameter group. There are DRV, FU1, FU2, I/O, EXT, COM, APP groups. |
| 2) Run/Stop Source | Displays the source of motor Run and Stop K : Run/Stop using FWD, REV buttons on keypad T : Run/Stop using control terminal input FX, RX R : Run/Stop using RS485 O : Run/Stop via option board |
| 3) Frequency Setting Source | Displays the source of command frequency setting K : Frequency setting using keypad V : Frequency setting using V1 (0 ~12V) or V1 + I terminal W : Analog frequency reference (V1S: -12 ~ 12V) I : Frequency setting using I (4 ~ 20mA) terminal P : Frequency setting using Pulse input R : Frequency setting using RS485 U : Up terminal input when Up/Down operation is selected |

| Displays | Description |
|---|--|
| | D: Down terminal input when Up/Down operation is selected S: Stop status when Up/Down operation is selected O: Frequency setting via Option board X: Frequency setting via Sub board J: Jog terminal input 1 ~ 15: Step frequency operation (except Jog) |
| 4) Output Current | Displays the Output Current during operation. |
| 5) Parameter Code | Displays the code of a group. Use the ▲ (Up), ▼ (Down) key to move through 0~99 codes. |
| 6) Operating Status | Displays the operation information. STP: Stop Status FWD: During Forward operation REV: During Reverse operation DCB: During DC Braking LOP: Loss of Reference from Option Board (DPRAM fault) LOR: Loss of Reference from Option Board (Communication network fault) LOV: Loss of Analog Frequency Reference (V1: 0~12V, -10~12V) LOI: Loss of Analog Frequency Reference (I: 4~20mA) LOS: Loss of Reference from Sub-Board |
| 7) Inverter Output Frequency/ Command Frequency | Displays the Output Frequency during run. Displays the Command Frequency during stop. |

4.1.2 Parameter setting and changing

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

Note: Data cannot be changed when 1) the parameter is not adjustable during the inverter is running (see the function list), or 2) Parameter Lock function FU2-94 [Parameter Lock] is activated.

EX) Changing Accel time from 10 sec to 15 sec

1) LCD keypad

DRV ▶ Acc. time
01 10.0 sec

Move to the desired code to change.

DRV ▶ Acc. time
01 1█.0 sec

Press the [**PROG**] key.
A Cursor (█) will appear.

DRV ▶ Acc. time
01 15.0 sec

Use the [**SHIFT**] key to move the cursor.

DRV ▶ Acc. time
01 15.0 sec

Change the data using [**▲**], [**▼**] keys.

DRV ▶ Acc. time
01 10.0 sec

Press the [**ENT**] key to save the value into memory.
The Cursor will disappear.

4.1.3 Parameter groups

The iP5A series inverter has 5 parameter groups separated according to their applications as indicated in the following table.

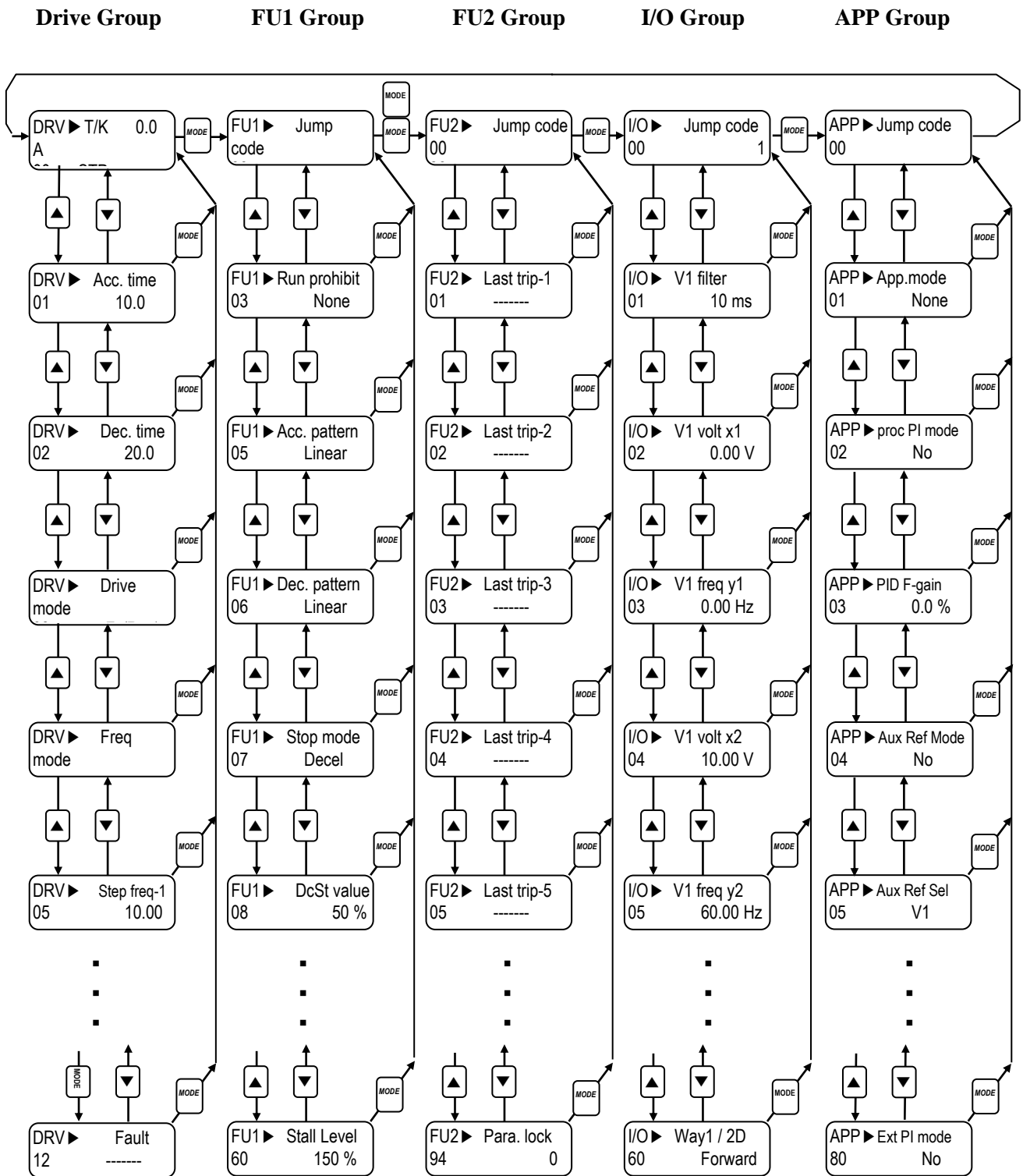
The iP5A series inverter provides two kinds of keypad. One is 32-character alphanumeric LCD keypad and the other is 7-Segment LED keypad.

| Parameter Group | LCD Keypad | Description |
|------------------------|-------------------|--|
| Drive Group | DRV | Command Frequency, Accel/Decel Time etc. Basic function Parameters |
| Function 1 Group | FU1 | Max. Frequency, Amount of Torque Boost etc. Parameters related to basic functions |
| Function 2 Group | FU2 | Frequency Jumps, Max/Min Frequency Limit etc. Basic Application Parameters |
| Input / Output Group | I/O | Programmable Digital Input/Output Terminal Setting, Auto Operation etc. Parameters needed for Sequence Operation |
| Application Group | APP | PID, MMC (Multi-Motor Control), 2 nd motor operation etc. Parameters related to Application function |

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

1) Parameter Navigation (LCD Keypad)

The parameter group moves directly to DRV group by pressing [SHIFT] key in any parameter code.



Note: This figure shows the group and code navigation through LCD display keypad. It can be different from the actual display due to the group addition or code change.

4.2 Operating Example

4.2.1 Easy Start Operation

Easy Start Operation is activated by pressing STOP key on the Keypad for 2~3 seconds and inverter begins operation via Keypad (FWD/REV RUN/STOP). **Drive mode is preset to V/F and reference frequency to JOG.**

4.2.2 Operation via Control terminal + Keypad

Setting: DRV-03 [Drive Mode (Run/Stop method)] = Fx/Rx-1

DRV-04 [Frequency Mode (Freq. setting method)] = Keypad

With above setting, Freq setting via terminal & Run/Stop via Keypad disabled

1) Check the LCD display when Power ON. Otherwise, change the setting correctly as shown above.

```
DRV ▶ T/K    0.0 A
00  STP    0.00Hz
```

2) Turn the FX (or RX) terminal ON. Then FWD (or REV) LED will be lit.

```
DRV ▶ T/K    0.0 A
00  FWD    0.00Hz
```

3) When setting the Ref. Freq to 60 Hz using **PROG/ENT/SHIFT**, **▲** keys, the motor will rotate at 60Hz. FWD (or REV) LED will be flickering during Acceleration/ Deceleration.

```
DRV ▶ Cmd. freq  0.00Hz  →  DRV ▶ Cmd. freq  60.00Hz  →  DRV ▶ T/K    5.0 A
00  █          →  00  █          →  00  FWD    60.00Hz
```

4) Turn the FX (or RX) terminal Off. Then Stop LED will be lit.

```
DRV ▶ T/K    0.0 A
00  STP    60.00Hz
```

Note) To enable Run/Stop via keypad & Freq setting via control terminal...

Setting: DRV-03 [Drive Mode (Run/Stop method)] = Keypad

DRV-04 [Frequency Mode (Freq. setting method)] = V1, V1S or I

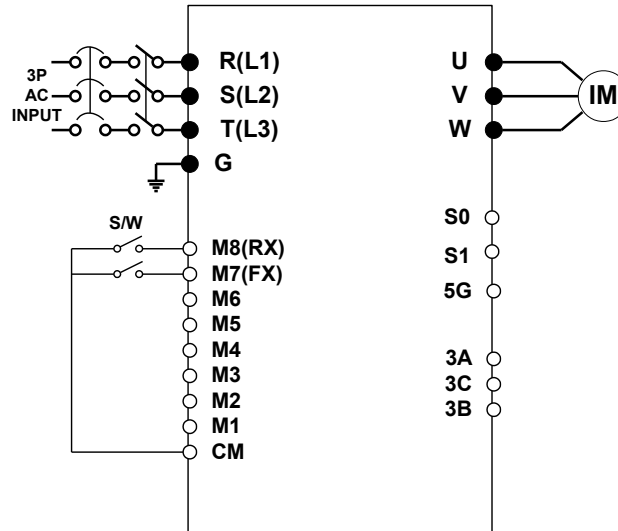
Operation Example (1)

Freq Setting via Keypad + Run/Stop via Terminal (FX/RX)

[Operation condition]

- Control mode: V/F control
- Ref. Frequency: 50[Hz] setting via keypad
- Accel/Decel time: Accel – 10 [sec], Decel – 20 [sec]
- Drive mode: Run/Stop via FX/RX terminal, Control terminal: NPN mode

[Wiring]



| Step | Parameter setting | Code | Description |
|------|-----------------------------|----------------|--|
| 1 | Drive Mode | DRV-3 | Set it to 1 FX/RX-1. |
| 2 | Frequency Mode | DRV-4 | Set it to 0 Keypad-1. |
| 3 | 50[Hz] freq command setting | DRV-0 | Set freq command 50[Hz] via Keypad. |
| 4 | Accel/Decel time | DRV-1 DRV-2 | Set Accel time to 10 [sec] in DRV-1. Set Decel time to 20 [sec] in DRV-2. |
| 5 | Terminal FX (M7) | I/O-26 | Motor starts to rotate in Forward direction at 50Hz with Accel time 10 [sec] when FX terminal is turned ON. Motor decelerates to stop with Decel time 20[sec] when FX terminal is turned OFF. |
| 6 | Terminal RX (M8) | I/O-27 | When RX terminal is turned ON motor starts to rotate in Reverse direction at 50[Hz] with Accel time 10 [sec]. When it is OFF, motor decelerates to stop with Decel time 20 [sec]. |

4.2.3 Operation via Control Terminal

Setting: DRV-03 [Drive Mode (Run/Stop method)] = **1 (Fx/Rx-1)**

DRV-04 [Frequency Mode (Freq. setting method)] = **2 (V1)**

1) Check the LCD display when Power ON. Otherwise, change the setting correctly as shown above.

| | |
|-----------|--------|
| DRV ▶ T/V | 0.0 A |
| 00 STP | 0.00Hz |

2) Turn the FX (or RX) terminal ON. Then FWD (or REV) LED will be lit.

| | |
|-----------|--------|
| DRV ▶ T/V | 0.0 A |
| 00 FWD | 0.00Hz |

3) Set the frequency using V1 (Potentiometer), Output freq (60Hz). Rotating direction (FWD or REV) and output current (5A) will be displayed on the LCD.

| | |
|-----------|---------|
| DRV ▶ T/V | 5.0 A |
| 00 FWD | 60.00Hz |

4) Output freq value is decreasing when turning the potentiometer counterclockwise. Inverter output stops at 0.00Hz and motor is stopped.

| | |
|-----------|--------|
| DRV ▶ T/V | 0.0 A |
| 00 FWD | 0.00Hz |

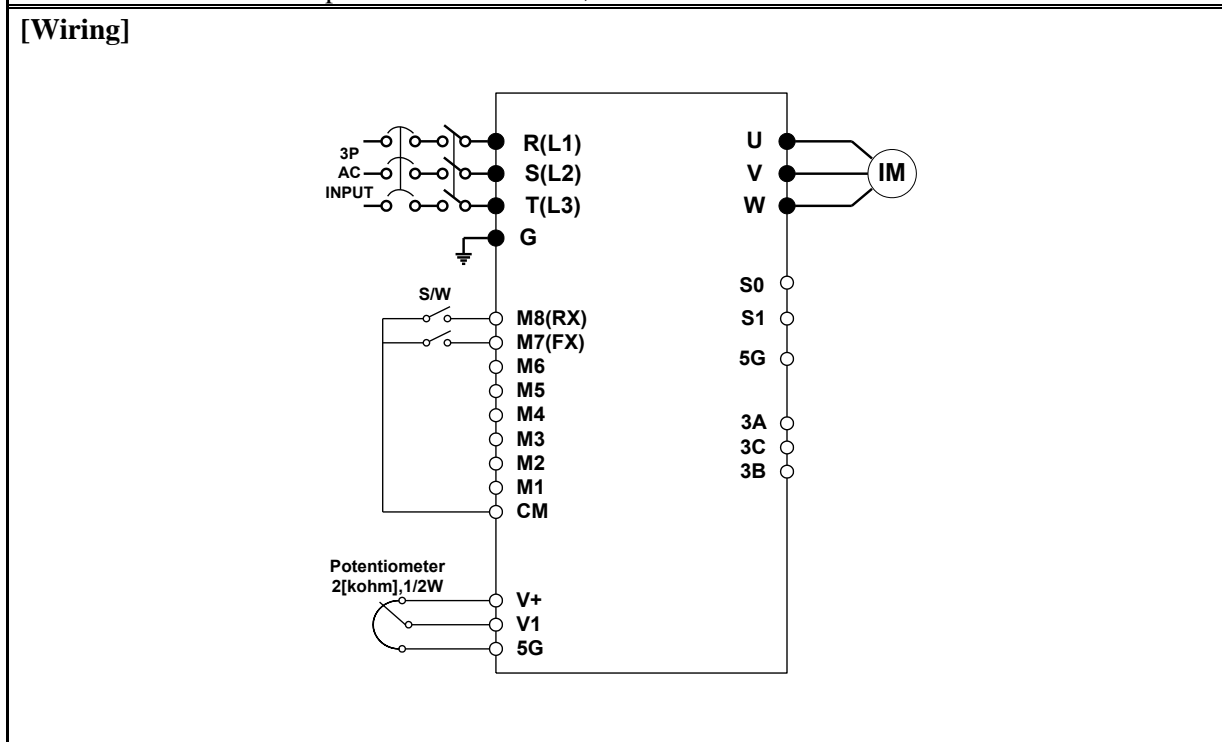
5) Turn FX (or RX) terminal OFF.

| | |
|-----------|--------|
| DRV ▶ T/V | 0.0 A |
| 00 STP | 0.00Hz |

| | |
|------------------------------|---|
| Operation Example (2) | Analog Voltage Input (V1) + Operation via Terminal (FX/RX) |
|------------------------------|---|

[Operation condition]

- Control mode: V/F control
- Reference Frequency: 50[Hz] analog input via V1 (Potentiometer)
- Accel/Decel time: Accel – 10 [sec], Decel – 20 [sec]
- Drive mode: Run/Stop via FX/RX terminal, Control terminal: NPN mode



| Step | Parameter setting | Code | Description |
|------|-----------------------------|----------------|--|
| 1 | Drive Mode | DRV-3 | Set it to 1 Fx/Rx-1. |
| 2 | Frequency Mode | DRV-4 | Set it to 2 V1 Analog input. |
| 3 | 50[Hz] freq command setting | DRV-0 | Set freq command 50[Hz] via V1 (potentiometer). |
| 4 | Accel/Decel time | DRV-1 DRV-2 | Set Accel time to 10 [sec] in DRV-1. Set Decel time to 20 [sec] in DRV-2. |
| 5 | Terminal FX (M7) | I/O-26 | Motor starts to rotate in Forward direction at 50Hz with Accel time 10 [sec] when FX terminal is turned ON. Motor decelerates to stop with Decel time 20[sec] when FX terminal is turned OFF. |
| 6 | Terminal RX (M8) | I/O-27 | When RX terminal is turned ON motor starts to rotate in Reverse direction at 50[Hz] with Accel time 10 [sec]. When it is OFF, motor decelerates to stop with Decel time 20 [sec]. |

☞ 0.75 ~ 30 kW products: Common terminal of frequency setting is 5G terminal.

☞ 37 ~ 450 kW products: Common terminal of frequency setting is CM terminal.

4.2.4 Operation via Keypad

Setting: DRV-03 [Drive Mode (Run/Stop method)] = **0 (Keypad)**

DRV-04 [Frequency Mode (Freq. setting method)] = **0 (Keypad-1)**

1) Check the LCD display when Power ON. Otherwise, change the setting as shown above.

| | |
|-----------|--------|
| DRV ▶ K/K | 0.0 A |
| 00 STP | 0.00Hz |

2) Set the Ref. Freq to 60 Hz using **PROG/ENT/SHIFT**, **▲** keys. Set freq is displayed during stop.

| | |
|-----------|---------|
| DRV ▶ K/K | 0.0 A |
| 00 STP | 60.00Hz |

3) When pressing **FWD/REV** key, motor starts running and output freq and output current are displayed.

| | |
|-----------|---------|
| DRV ▶ K/K | 5.0 A |
| 00 FWD | 60.00Hz |

4) Press **STOP/RESET** key. Then motor decelerates to stop. Set freq 60Hz is displayed.

| | |
|-----------|---------|
| DRV ▶ K/K | 0.0 A |
| 00 STP | 60.00Hz |

4.3 Various function setting & Description

4.3.1 Basic function parameter setting

It is the basic function setting. All settings are factory defaults unless users make change. It is recommended to use factory setting value unless the parameter change is necessary.

1) Common parameter setting

The following table shows common parameter setting that should be checked before use regardless of control mode.

| Parameter Name | Code | Description |
|--------------------------|--------------|--|
| Line Freq. | FU1-29 | Sets a freq of the inverter input power source. |
| Base Frequency | FU1-31 | Sets the Motor Base Frequency ¹⁾ . |
| Motor Rated Voltage | FU1-50 | Sets the Motor Rated Voltage ¹⁾ . |
| Motor Selection | FU2-40 | Selects motor and voltage rating suitable to the desired inverter. |
| Motor parameters | FU2-41 ~ 46 | Basic parameter value setting when selecting the motor rating. Note: If there is any discrepancy between parameter preset value and the actual motor parameter value, change the parameter value according to the actual motor. |
| Drive Mode | DRV-3 | Operation via Keypad, Fx/Rx-1, Fx/Rx-2 and Int 485 setting. |
| Frequency Mode | DRV-4 | Frequency reference source setting parameter |
| Accel/Decel time setting | DRV-1, DRV-2 | Accel/Decel time setting |

1) If FU1-31 and FU1-50 are set higher than motor nameplate value, it may cause motor overheat and if it is set smaller than that, it may cause Over voltage trip during deceleration. Make sure to enter the actual motor value.

2) V/F control

FU2-60 [Control mode] is set to 0 “V/F” as factory setting. Operation via V/F control is activated after the above common parameter setting is done and the followings are set.

| Parameter Name | Code | Description |
|--------------------|----------------|---|
| Starting freq. | FU1-32 | Set frequency to start the motor. |
| Torque boost | FU2-67 | Manual or Auto torque boost settable in this parameter |
| Torque boost value | FU2-68, FU2-69 | If FU1-67 [torque boost] is set to “manual”, user sets the desired value and the direction in code FU1-68 and 69. |

3) Slip compensation

Operation is done via Slip compensation if FU2-60 is set to 1 {Slip compen}. This control keeps motor speed constant regardless of load change.

4) Sensorless vector control

Set FU2-60 to “Sensorless” to enable Sensorless vector control. It is strongly recommended to perform **Auto-tuning** before starting Sensorless control in order to maximize performance.

| Parameter Name | Code | Description |
|----------------------------------|----------------|----------------------------|
| Control method selection | FU2-60 | Select Sensorless. |
| P, I gain for sensorless control | FU2-65, FU2-66 | Set gain for Sensorless. |
| Starting freq | FU1-32 | Starting freq of the motor |

Note) No-load current for Sensorless control is not entered by auto-tuning. Therefore enter the no-load current value in V/F operation. When other than LS standard motor is used, set this value according to the motor in use for better performance.

5) Auto-tuning of motor constant

This parameter enables auto-tuning of the motor constants. If FU2-61 is set to Yes and press the enter key, **Rs, Lsigma** values begin tuning with the motor stopped. Refer to motor nameplate for the rest of other parameters.

| Parameter Name | Code | Description |
|----------------|--------|-------------|
| Auto-tuning | FU2-61 | No, Yes |

Note) Motor no-load current and slip freq should be set correctly for safe and better performance. Be sure to check these values and set them properly. Refer to Chapter 5, FU2-40~66 for more.

4.3.2 Advanced function setting

SV-iP5A inverter features advanced function parameters to maximize efficiency and performance of the motor. It is recommended to use the factory setting unless parameter value change is inevitable.

1) V/F control

| Parameter Name | Code | Description |
|--------------------------------|----------------------|---|
| V/F Pattern | FU1-40 | Use it according to load characteristics. If User V/F is selected, user can select the optimum output V/F characteristic for the application and load characteristics in [FU1-41]~[FU1-48]. |
| Dwell operation | FU2-07 FU2-08 | Used to output torque in an intended direction. Inverter stops acceleration for the preset [FU2-08] Dwell time while running at Dwell frequency [FU2-07] and starts acceleration at commanded frequency. Setting [FU2-08] Dwell time to 0 disable the Dwell operation. |
| Jump Frequency | FU2-10 FU2-11~16 | When it is desired to avoid resonance attributable to the natural frequency of a mechanical system, these parameters allow resonant frequencies to be jumped. Up to three areas can be set, with the jump frequencies set to either the top or bottom point of each area. To enable the function, set [FU2-10] to ‘Yes’ and set the value in [FU2-11]~[FU2-16]. |
| Accel/Decel pattern S-curve | FU1-2, 3 FU1-4, 5 | This pattern has an effect on the prevention of cargo collapse on conveyor etc and reduction in an acceleration/ deceleration shock. |

2) Sensorless vector control

Related parameters for starting in **Sensorless vector control** when FU2-60 [Control Mode Selection] is set to Sensorless.

| Parameter Name | Code | Description |
|----------------|-----------|---|
| When starting | FU2-64 | Pre-excitation time setting |
| | I/O-20~27 | Programmable Digital Input terminals define |

3) Parameters to monitor motor and inverter status

| Parameter Name | Code | Description |
|--|------------------|---|
| Output current/ motor speed | DRV-8~9 | Displays output current and motor rpm. |
| DC link voltage | DRV-10 | Displays DC link voltage. |
| User display selection (Voltage and watt) | DRV-11 FU2-81 | Either output voltage or power selected in FU2-81 is displayed in DRV-11. |
| Fault display | DRV-12 | Displays the current inverter fault. |
| TAR / OUT Freq. display | DRV-14 | Displays Target freq. for Accel/Decel & Output freq during Accel/Decel. |
| REF/FBK display | DRV-15 | Displays PID Reference/ Feedback frequency display. |
| Speed (Hz / Rpm) selection | DRV-16 | Selects inverter output speed unit [Hz or Rpm] |
| PID parameter | DRV-18 | Displays related parameters of PID controller. |
| AD parameter | DRV-19 | Displays inverter analog input value to AD value. |
| EXT - PID parameter | DRV-20 | Displays related parameters of EXT-PID controller. |

Note) DRV-15, DRV-18 only displayed when APP-02 [proc PI mode] is set to “Yes.” DRV-20 only displayed when APP-80 [Ext PI mode] is set to “Yes.”

5) Parameter initialize

| Parameter Name | Code | Description |
|---|--------|---|
| Software version | FU2-82 | Displays the inverter software version. |
| Parameter Read/Write/Initialize/ Lock | FU2-91 | [FU2-91], [FU2-92]: Copying parameters from other inverter |
| | FU2-92 | [FU2-92]: Copying parameters from other inverter |
| | FU2-93 | [FU2-93]: Initializing parameters to factory setting values |
| | FU2-94 | [FU2-94]: Parameter write disabled |
| | FU2-95 | [FU2-95]: Parameter save |

Note: Motor parameters (FU2-40~46, FU2-62~63) returned to factory setting once Parameter Read/Write is executed.

6) Protection & Trip level setting

| Parameter Name | Code | Description |
|-----------------------|--|--|
| Electronic thermal | FU1-60 FU1-61 FU1-62 FU1-63 | Protection of the motor from overheating without the use of external thermal relay. Refer to parameter descriptions for more detail. |
| Overload alarm & trip | FU1-64 FU1-65 FU1-66 FU1-67 FU1-68 | Warning alarm outputs and displays the trip message when overcurrent above the threshold value keeps on. |
| Stall prevention | FU1-70 FU1-71 | Set the output current level at which the output freq will be adjusted to prevent the motor from stopping due to over-current etc. It activates during accel/ constant speed/decel to prevent the motor stall. |

7) Starting / Accel/ Decel / Stopping pattern setting

| Parameter Name | Code | Description |
|---------------------------|----------------------------|---|
| Accel/Decel pattern | FU1-02 FU1-03 | 2 types of Accel/Decel pattern: 'S-curve', 'U-curve' settable according to application and load characteristic. If 'S-curve' is selected, the desired value of [FU1-4], [FU1-5] is settable. |
| Starting/Stopping method | FU1-20 FU1-23 | 4 types of stopping method 'Decel', 'DC-brake', 'Free-run', 'Flux Brake' selectable. If 'DC-brake' is selected, the desired value of [FU1-21, 22], [FU1-24]~ [FU1-27] is settable. See function description of chapter 5 for more details. |
| Frequency Limit selection | FU1-33 FU1-34 FU1-35 | Limits the active frequency. Inverter operates at the freq range between upper freq limit [FU1-35] and bottom freq limit [FU1-34] and higher/ lower freq value is entered, it is automatically replaced by limit value. Setting range: [FU1-30] Maximum freq to [FU1-32] starting freq. |

8) Operation-starting method

| Parameter Name | Code | Description |
|------------------------|--------------------------------------|---|
| Starting method | FU2-20 FU2-21 FU2-25 FU2-26 | Motor starting method: [FU2-20]: Power-on run, [FU2-21] Restart after Fault Reset, [FU2-25] Number of Auto Restart Attempt [FU2-26] Delay Time Before Auto Restart See parameter description for more details. |
| Speed Search Selection | FU2-22 FU2-23 FU2-24 | Speed search function is available during Accel, trip, instant power failure, restart after fault reset and Speed search at auto restart. See parameter description for more details. |

4.3.3 Application function setting

1) PID operation

Inverter can be used to exercise process control, e.g. flow rate, air volume or pressure via PID feedback control.

| Parameter Name | Code | Description |
|---------------------|-----------------|------------------------------------|
| PID control setting | APP-02 ~ APP-17 | Parameters for PID control setting |

☞ See Chapter 6. PID feedback operation.

2) Ext PID operation

It is used for External PID feedback control.

| Parameter Name | Code | Description |
|----------------|-----------------|------------------------|
| ExtPID setting | APP-80 ~ APP-97 | Parameters for Ext PID |

☞ See Chapter 6. External PID operation.

3) Pre PID operation

It helps to begin smooth start of the PID control.

| Parameter Name | Code | Description |
|----------------|-----------------|----------------------------------|
| PrePID setting | APP-74 ~ APP-76 | Parameters for Pre PID operation |

☞ See Chapter 6. Pre PID operation.

4) MMC operation

Inverter controls a whole system by controlling Main motor connected directly to the inverter and Aux motors connected to the inverter relays and operated via relay On/Off.

| Parameter Name | Code | Description |
|----------------|------------------------------------|------------------------------|
| MMC setting | APP-40 ~ APP-71 I/O-20 ~ I/O-27 | Parameters for MMC operation |

☞ See Chapter 6. MMC operation.

5) Jog and Multi-speed operation

| Parameter Name | Code | Description |
|---|-------------------------------|---|
| Multi function input terminal setting | I/O-20 ~27 | If I/O-20 ~27 are set to Speed-H, Speed-M, Speed-L, multi- speed operation up to speed 17 is available. |
| Filter time constant for input terminal | I/O-29 | Effective for eliminating noise in the freq. Setting circuit |
| Speed reference value | DRV-05 ~07 I/O-31 ~ I/O-42 | Speed reference value for each step setting |
| Accel/Decel time setting for each step | I/O-50 ~ 63 | Accel/Decel time for each step setting |
| Jog freq. | I/O-30 | Jog freq for jog operation setting |

| Speed-X | Speed-H | Speed-M | Speed-L | JOG | Speed Command | Parameter value |
|---------|---------|---------|---------|-----|---------------|-----------------|
| 0 | 0 | 0 | 0 | 0 | Speed 0 | DRV-00 |
| 0 | X | X | X | 1 | Jog freq. | I/O-20 |
| 0 | 0 | 0 | 1 | 0 | Speed -1 | DRV-05 |
| 0 | 0 | 1 | 0 | 0 | Speed -2 | DRV-06 |
| .. | .. | .. | .. | .. | .. | .. |
| .. | .. | .. | .. | .. | .. | .. |
| 1 | 1 | 0 | 1 | 0 | Speed -13 | I/O-40 |
| 1 | 1 | 1 | 0 | 0 | Speed -14 | I/O-41 |
| 1 | 1 | 1 | 1 | 0 | Speed -15 | I/O-42 |

6) 2nd motor operation

2nd function setting is required to run the two motors by one inverter by exchange. If the terminal defined for 2nd function signal input is turned ON, 2nd motor operation is valid.

| Parameter Name | Code | Description |
|---|-----------------|---|
| Programmable Digital Input terminals setting | I/O-20 ~27 | 2 nd motor operation is available with Programmable Digital Input terminals M1 ~ M8 set to 7 {2 nd Func}. |
| Parameter setting for 2 nd motor operation | APP-20 ~ APP-29 | Setting parameters necessary to operate 2 nd motor such as base freq., Accel/Decl time, Stall. |

7) Energy-saving operation

FU1-51 [Energy Save Level] tunes the inverter output voltage to minimize the inverter output voltage during constant speed operation. Appropriate for energy-saving applications such as fan, pump and HVAC.

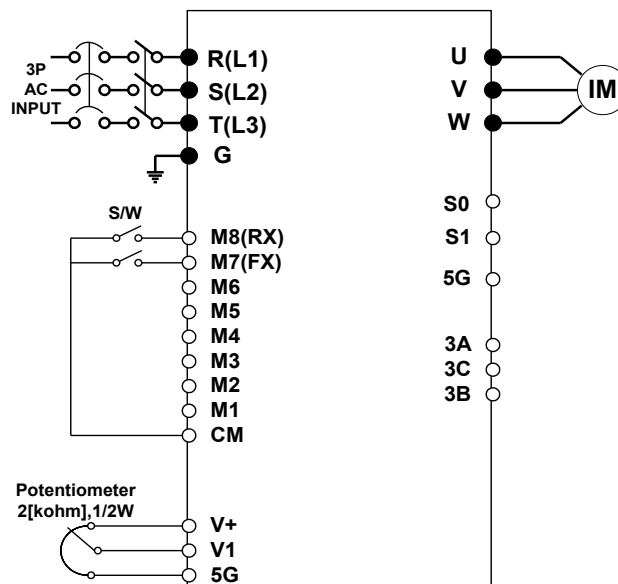
4.4 Operation Example

| | |
|------------------------------|---|
| Operation Example (1) | V/F Control + Analog Voltage Input (V1) + Operation via Terminal (FX/RX) |
|------------------------------|---|

[Operation condition]

- Control mode: V/F control
- Frequency command: 50[Hz] analog input via V1 terminal
- Accel/Decel time: Accel – 15 [sec], Decel – 25 [sec]
- Drive mode: Run/Stop via FX/RX terminal, Control terminal: NPN mode

[Wiring]



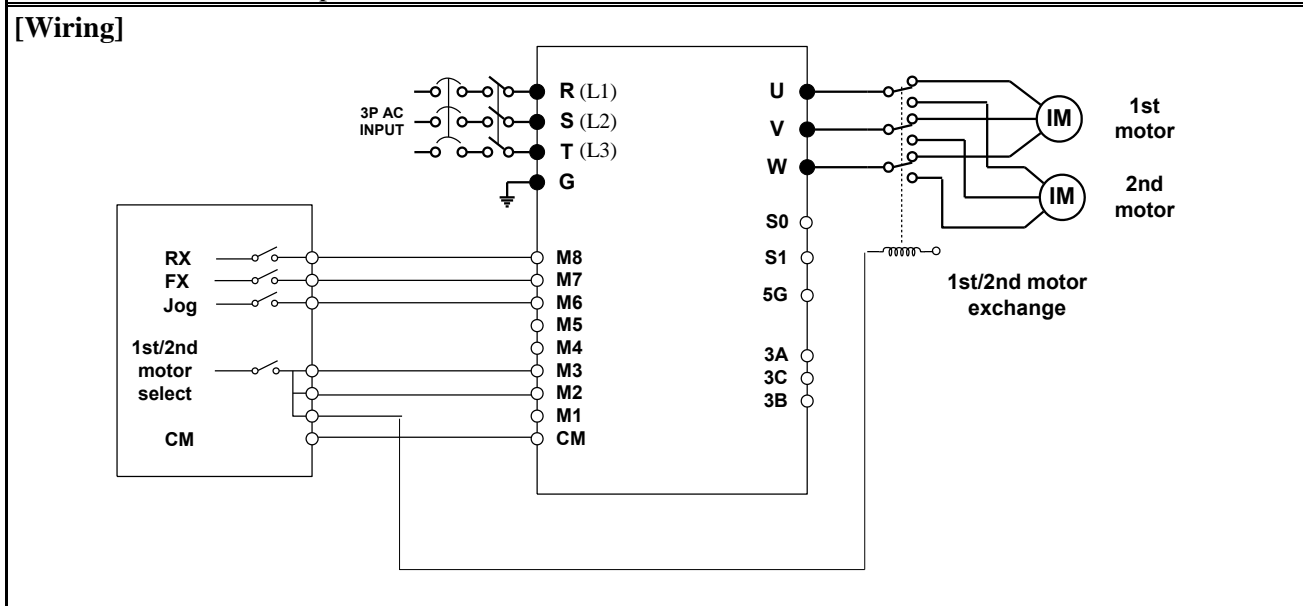
| Step | Parameter setting | Code | Description |
|------|-----------------------------|----------------|--|
| 1 | Control Mode Selection | FU2-60 | Set it to 0 {V/F}. |
| 2 | Drive Mode | DRV-3 | Set it to Fx/Rx-1. |
| 3 | Frequency Mode | DRV-4 | Set V1 Analog input value in frequency mode. |
| 4 | 50[Hz] freq command setting | DRV-0 | Set freq command 50[Hz] via V1 (potentiometer). |
| 5 | Accel/Decel time | DRV-1 DRV-2 | Set Accel time to 15 [sec] in DRV-2. Set Decel time to 25 [sec] in DRV-3. |
| 6 | Terminal FX | I/O-26 | Motor starts to rotate in Forward direction at 50Hz with Accel time 15 [sec] when FX terminal is turned ON. Motor decelerates to stop with Decel time 25[sec] when FX terminal is turned OFF. |
| 7 | Terminal RX | I/O-27 | When RX terminal is turned ON motor starts to rotate in Reverse direction at 50[Hz] with Accel time 15 [sec]. When it is OFF, motor decelerates to stop with Decel time 25 [sec]. |

☞ 0.75 ~ 30 kW products: Common terminal of frequency setting is 5G terminal.

☞ 37 ~ 450 kW products: Common terminal of frequency setting is CM terminal.

| | |
|------------------------------|---------------------------------------|
| Operation Example (2) | 2nd motor operation |
|------------------------------|---------------------------------------|

- [Operation condition]**
- Control mode: V/F control
 - 1st motor + 2nd motor Operation by exchange using [2nd Func] (Set Value different)
 - Frequency command: Using Multi-step operation 1st motor --- 50[Hz] as main speed
2nd motor --- 20[Hz] with M1 terminal set as multi- step operation)
 - Accel/Decel time: 1st motor --- Accel time: 15[sec], Decel time: 25 [sec]
2nd motor --- Accel time: 30[sec], Decel time: 40 [sec]
 - Drive mode: Run/Stop via FX/RX, Control terminal: NPN mode

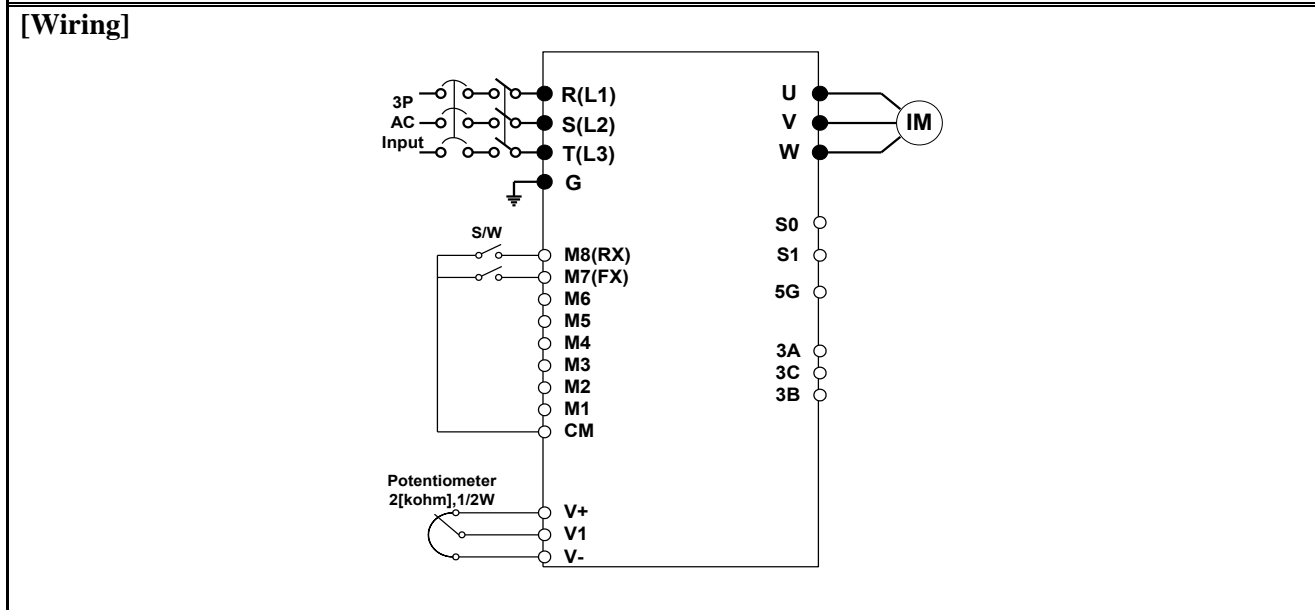


| Step | Parameter setting | Code | Description |
|------|--|----------------|---|
| 1 | Control Mode Selection | FU2-60 | Set it to 0 {V/F}. |
| 2 | Drive mode | DRV-3 | Set it to Fx/Rx-1. |
| 3 | Frequency Mode setting | DRV-4 | Set it to 0 {keypad-1}. 1 st motor freq setting |
| 4 | Programmable digital input terminal M1 | I/O-20 | Set M1 to 2nd Func. |
| 5 | Programmable digital input terminal M2 | I/O-21 | Set M2 to Speed-L. 2 nd motor freq setting |
| 6 | Freq setting for 1 st motor | DRV-0 | Set it to 50[Hz]. |
| 7 | Accel/Decel time setting for 1 st motor | DRV-1, DRV-2 | Set Accel/Decel time to 15[sec]/25[sec]. |
| 8 | Freq setting for 2 nd motor | DRV-5 | Set it to 10[Hz]. |
| 9 | Accel/Decel time setting for 2 nd motor | APP-20, APP-21 | Set Accel/Decel time to 30[sec]/50[sec]. |
| 10 | 1 st motor operation | | Set it as main motor by turning M1, M2, Output relay OFF. Run the motor in FWD/REV direction using FX/RX terminal. |
| 11 | 2 nd motor operation | | Set 2 nd motor parameters by turning terminal M1 ON. Change the freq setting to 20[Hz] by turning terminal M2 ON. Change to 2 nd motor terminal by turning output relay ON. Run the motor in FWD/REV direction by terminal FX/RX. |

| | |
|------------------------------|--|
| Operation Example (3) | V/F control + Analog input (V1S) + Operation via terminal FX/RX |
|------------------------------|--|

[Operation condition]

- Control mode: V/F control
- Frequency command: Setting 50[Hz] via Analog input (V1S)
- Accel/Decel time: Accel time 15 [sec], Decel time 25 [sec]
- Drive mode: Run/Stop via FX/RX, Control terminal: NPN mode

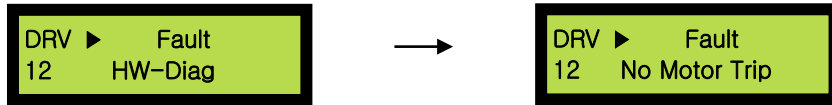


| Step | Parameter setting | Code | Description |
|------|--|----------------|--|
| 1 | Control mode selection | FU2-60 | Set it to 0 {V/F}. |
| 2 | Drive mode | DRV-3 | Set it to 1 {Fx/Rx-1}. |
| 3 | Frequency mode | DRV-4 | Set it to 3 {V1S}. |
| 4 | Operating frequency command 50[Hz] setting | DRV-0 | Set 50[Hz] via potentiometer (V1S). |
| 5 | Accel/Decel time setting | DRV-1 DRV-2 | Set Accel time to 15[sec] in DRV-1 with decal time to 25[sec] in DRV-2. |
| 6 | FX terminal (M7) | IO-26 | When FX terminal is turned ON, motor rotating in forward direction starts running at 50[Hz] for 15 [sec]. When FX terminal is turned OFF, motor decelerates to stop for 25[sec]. |
| 7 | RX terminal (M8) | IO-27 | When RX terminal is turned ON, motor rotating in reverse direction starts running at 50[Hz] for 15[sec]. When RX terminal is turned OFF, motor decelerates to stop for 25 [sec]. |

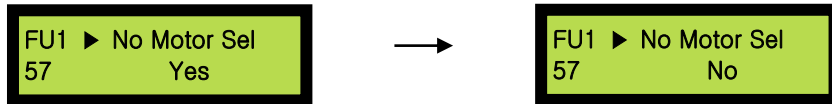
👁 **Note: V1S mode enables Forward/Reverse rotation using ±12V power via Analog input command. Refer to Chapter 6, Parameter description of DRV-00 for details.**

👁 **Note: Use V1 instead of V1S mode when FWD/REV Run Prevention is active. V1S mode enables the motor to run both FWD/REV directions.**

☞ **Note: If the inverter is operated without wiring a motor, trip occurs as below because the protection function is active automatically. In this case, refer to the related parameters(FU1 57 ~ 59). Trip is reset if the inverter is powered down and up once again.**



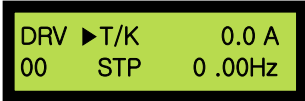

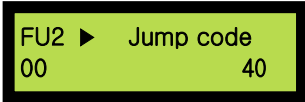

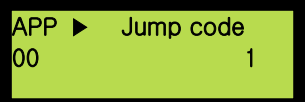
In case that a simple trial run is needed such as a check on basic operation state without a wiring a motor, FU1-57(No Motor Sel) should be set to [No].



CHAPTER 5 - PARAMETER LIST

5.1 Parameter groups

The parameters of SV-IP5A Series are divided into 5 functions groups in accordance with the application. Their names, principal contents and LCD keypad displays are shown below.

| Name of Group | LCD Keypad Display | Description |
|-----------------------------|---|--|
| Drive Group [DRV] |  | Target frequency and Accel/ Decel Time, etc. Basic parameters |
| Function1 Group [FU1] |  | Maximum Frequency and Protection, etc Parameters regarding basic functions |
| Function2 Group [FU2] |  | Frequency Jump and Frequency Limit, etc Parameters regarding application functions |
| Input/Output Group [I/O] |  | Programmable Digital terminal Define and Analog Command, etc Parameters necessary for sequence configuration |
| Application Group [APP] |  | PID, MMC, and 2 nd motor, etc Parameters regarding application functions |

5.2 Parameter list

[DRV Group]

| CODE | Comm. Addr | Description | LCD Keypad Display | Setting Range | Factory Default | Adj. During Run | Page |
|----------------|------------|---|--------------------|--|--------------------|-----------------|------|
| DRV-00 (1) | 9100 | Command Frequency (Output Frequency during motor run, Reference Frequency during motor stop), Output Current (LCD) | Cmd. freq | 0 to FU1-30[Hz] | 0 [Hz] | O | 6-1 |
| DRV-01 | 9101 | Acceleration Time | Acc. Time | 0 to 6000 [sec] | 20 [sec] | O | 6-2 |
| | | | | | 60 [sec] | | |
| DRV-02 | 9102 | Deceleration Time | Dec. time | 0 to 6000 [sec] | 30 [sec] | O | 6-2 |
| | | | | | 90 [sec] | | |
| DRV-03 | 9103 | Drive Mode (Run/Stop Method) | Drive mode | 0 (Keypad) 1 (Fx/Rx-1) 2 (Fx/Rx-2) 3 (Int. 485) | 1 (Fx/Rx-1) | X | 6-2 |
| DRV-04 | 9104 | Frequency Mode (Frequency setting method) | Freq mode | 0 (Keypad-1) 1 (Keypad-2) 2 (V1) 3 (V1S) 4 (I) 5 (V1+I) 6 (Pulse) 7 (Int. 485) 8 (Ext. PID) | 0 (Keypad-1) | X | 6-3 |
| DRV-05 (19) | 9105 | Step Frequency 1 | Step freq-1 | 0 to FU1-30[Hz] | 10 [Hz] | O | 6-3 |
| DRV-06 | 9106 | Step Frequency 2 | Step freq-2 | | 20 [Hz] | O | |
| DRV-07 | 9107 | Step Frequency 3 | Step freq-3 | | 30 [Hz] | O | |
| DRV-08 | 9108 | Output Current | Current | * [A] | * [A] | * | 6-4 |
| DRV-09 | 9109 | Motor Speed | Speed | * [rpm] | * [rpm] | * | 6-4 |
| DRV-10 | 910A | DC link Voltage | DC link Vtg | * [V] | * [V] | * | 6-4 |
| DRV-11 | 910B | User Display Selection | User disp | | Output voltage [V] | * | 6-4 |
| DRV-12 | 910C | Current Trip Display | Fault | * | * | * | 6-4 |
| DRV-14 (2) | 910E | Target/Output Frequency Display | Tar. Out. Freq. | * [Hz] | * [Hz] | * | 6-5 |
| DRV-15 (2) | 910F | Reference/Feedback Frequency Display | Ref. Fbk. Freq. | * [Hz] | * [Hz] | * | 6-5 |
| DRV-16 | 9110 | Speed Unit Selection | Hz/Rpm Disp | Hz or Rpm | Hz | O | 6-5 |
| DRV-18 (2) | 9112 | PID Parameter | R T F O | * [Hz] | * [Hz] | X | 6-5 |
| DRV-19 | 9113 | AD Parameter | V1 V2 V1S I | * | * | X | 6-6 |
| DRV-20 (3) | 9114 | EXT-PID Parameter | R T F O | % | % | X | 6-6 |
| DRV-22 | 9116 | Local/Remote Key | LocalRemKey | 0.(2nd Source) 1 (Cntl&RefStop) 2 (Control Stop) 3 (Ref Only) 4 (Cntl&Ref Run) 5 (Control Run) 6 (Disable) | 1.Cntl&RefStop | O | 6-6 |

| CODE | Comm. Addr | Description | LCD Keypad Display | Setting Range | Factory Default | Adj. During Run | Page |
|---------------|------------|------------------|--------------------|---|-----------------|-----------------|------|
| DRV-23 | 9117 | Keypad Mode | Key Ref Mode | 1 (Minimum Spd) 2 (Last Spd) 3 (Preset Spd 1) 4 (Stop) 5 (Fault) 6 (Disable) | 5 Disable | O | 6-7 |
| DRV-91 (4) | 915B | Drive mode 2 | Drive mode2 | 0 (Keypad) 1 (Fx/Rx-1) 2 (Fx/Rx-2) | 1 (Fx/Rx-1) | X | |
| DRV-92 | 915C | Frequency mode 2 | Freq mode2 | 0 (Keypad-1) 1 (Keypad-2) 2 (V1) 3 (V1S) 4 (I) 5 (V1+I) 6 (Pulse) | 0 (Keypad-1) | X | |

* The gray-highlighted codes are hidden parameters and will appear when the related functions are to be set.

(1) The speed unit is changed from [Hz] to [%] when DRV-16 is set to [Rpm]. Only User Unit will be displayed when APP-02 is set to [Yes] and when APP-06 is set to either I, V1 or Pulse and when one of I/O-86~ I/O-88 is set to either [Speed] (Hz or Rpm), [Percent], [Bar], [mBar], [kPa] or [Pa].

Output Frequency (Hz or Rpm; Unit of output speed) is displayed in DRV-00 during the Inverter is running. User Unit reference (Unit of PID controller selected) is displayed in DRV-00 during the Inverter is not running.

(2) DRV-15, DRV-18 will appear when APP-02 [Process PI Mode] is set to "Yes". Also User Unit is displayed when one of I/O-86~ I/O-88 is set to either [Speed](Hz or Rpm), [Percent], [Bar], [mBar], [kPa] or [Pa].

(3) DRV-20 will appear when APP-80 [ExtProcess PI Mode] is set to "Yes".

(4) DRV-91/92 will appear only when DRV-22 is set to [2nd Source].

[FU1 GROUP]

| CODE | Comm. Addr | Description | LCD Keypad Display | Setting Range | Factory Default | Adj. During Run | Page | |
|---------------|------------|---|--------------------|----------------------------------|-----------------|-----------------|------|------|
| FU1-00 | 9200 | Jump to Desired Code # | Jump code | 1 to 74 (Use Only LCD Keypad) | 1 | O | 6-8 | |
| FU1-01 | 9201 | Run Prevention | Run prevent | 0 | (None) | 0 (None) | X | 6-8 |
| | | | | 1 | (Fwd prev) | | | |
| | | | | 2 | (Rev prev) | | | |
| FU1-02 | 9202 | Acceleration Pattern | Acc. Pattern | 0 | (Linear) | 0 (Linear) | X | 6-8 |
| | | | | 1 | (S-curve) | | | |
| | | | | 2 | (U-curve) | | | |
| FU1-03 | 9203 | Deceleration Pattern | Dec. Pattern | 0 | (Linear) | 0 (Linear) | X | 6-8 |
| | | | | 1 | (S-curve) | | | |
| | | | | 2 | (U-curve) | | | |
| FU1-04 (5) | 9204 | Start Curve for S-Curve Accel/Decel Pattern | Start SCurve | 0 to 100 [%] | 50 [%] | X | 6-8 | |
| FU1-05 | 9205 | End Curve for S-Curve Accel/Decel Pattern | End SCurve | 0 to 100 [%] | 50 [%] | X | | |
| FU1-10 | 920A | Pre-Heat | Pre-Heat mode | 0 | (No) | 0 (No) | X | 6-9 |
| | | | | 1 | (Yes) | | | |
| FU1-11 | 920B | Pre-Heat Value | Pre Heat level | 1 to 50 [%] | 30 (%) | X | | |
| FU1-12 | 920C | Pre-Heat Duty | Pre Heat Perc | 1 to 100 [%] | 50 (%) | X | | |
| FU1-20 | 9214 | Start Mode | Start mode | 0 | (Accel) | 0 (Accel) | X | 6-10 |
| | | | | 1 | (Dc-start) | | | |
| | | | | 2 | (Flying-start) | | | |
| FU1-21 (6) | 9215 | Starting DC Injection Braking Time | DcSt time | 0 to 60 [sec] | 0.1 [sec] | X | 6-10 | |
| FU1-22 | 9216 | Starting DC Injection Braking Value | DcSt value | 0 to 150 [%] | 50 [%] | X | | |
| FU1-23 | 9217 | Stop Mode | Stop mode | 0 | (Decel) | 0 (Decel) | X | 6-10 |
| | | | | 1 | (Dc-brake) | | | |
| | | | | 2 | (Free-run) | | | |
| | | | | 3 | (Flux-brake) | | | |
| FU1-24 (7) | 9218 | DC Injection Braking On-delay Time | DcBlk Time | 0.1 to 60 [sec] | 0.1 [sec] | X | 6-11 | |
| FU1-25 | 9219 | DC Injection Braking Frequency | DcBrk freq | 0.1 to 60 [Hz] | 5 [Hz] | X | | |
| FU1-26 | 921A | DC Injection Braking Time | DcBr time | 0 to 60 [sec] | 1 [sec] | X | | |
| FU1-27 | 921B | DC Injection Braking Value | DcBr value | 0 to 200 [%] | 50 [%] | X | | |
| FU1-28 | 921C | Safety Stop | Safety Stop | 0 | (No) | 0 (No) | X | 6-12 |
| | | | | 1 | (Yes) | | | |
| FU1-29 | 921D | Power Source Freq | Line Freq | 40 to 120 [Hz] | 60.00 [Hz] | X | 6-12 | |
| FU1-30 | 921F | Maximum Frequency | Max Freq | 30 - 120 [Hz] | 60.00 [Hz] | X | 6-13 | |
| FU1-31 | 9220 | Base Frequency | Base Freq | 0.01 - 10 [Hz] | 60.00 [Hz] | X | 6-13 | |
| FU1-32 | 9220 | Starting Frequency | Start Freq | 0.01 to 10 [Hz] | 0.50 [Hz] | X | 6-13 | |
| FU1-33 | 9221 | Frequency Limit selection | Freq limit | 0 | (No) | 0 (No) | X | 6-13 |
| | | | | 1 | (Yes) | | | |

| CODE | Comm. Addr | Description | LCD Keypad Display | Setting Range | Factory Default | Adj. During Run | Page | |
|-------------|------------|--|--------------------|--|---------------------------------------|-----------------|------|------|
| FU1-34 (8) | 9222 | Freq Lower Limit | Lim Lo Freq | 0 – FU1-35 | 0.50 [Hz] | ○ | 6-13 | |
| FU1-35 | 9223 | Freq Upper Limit | Lim Hi Freq | FU1-34 – FU1-30 | 60.00 [Hz] | X | 6-13 | |
| FU1-40 | 9228 | Volts/Hz Pattern | V/F Pattern | 0 | (Linear) | 0 (Linear) | X | 6-14 |
| | | | | 1 | (Square) | | | |
| | | | | 2 | (User V/F) | | | |
| FU1-41 (9) | 9229 | User V/F – Frequency 1 | User freq 1 | 0 to FU1-30 | 15.00 [Hz] | X | 6-14 | |
| FU1-42 | 922A | User V/F – Voltage 1 | User volt 1 | 0 to 100 [%] | 25 [%] | X | | |
| FU1-43 | 922B | User V/F – Frequency 2 | User freq 2 | 0 to FU1-30 | 30.00 [Hz] | X | | |
| FU1-44 | 922C | User V/F – Voltage 2 | User volt 2 | 0 to 100 [%] | 50 [%] | X | | |
| FU1-45 | 922D | User V/F – Frequency 3 | User freq 3 | 0 to FU1-30 | 45.00 [Hz] | X | | |
| FU1-46 | 922E | User V/F – Voltage 3 | User volt 3 | 0 to 100 [%] | 75 [%] | X | | |
| FU1-47 | 922F | User V/F – Frequency 4 | User freq 4 | 0 to FU1-30 | 60.00 [Hz] | X | | |
| FU1-48 | 9230 | User V/F – Voltage 4 | User volt 4 | 0 to 100 [%] | 100[%] | X | | |
| FU1-49 | 9231 | Input voltage adjustment 200/400/(600V type) | VAC Voltage | 73 to 115.0 [%] (77.6 to 115.0 [%]) | 100.0 [%]/ 86.4 [%] (100.0 [%]) | X | 6-15 | |
| FU1-50 | 9232 | Motor Rated Voltage (600V type) | Motor Volt | 0 to 600 [V] | 220/380 [V] (575[V]) | X | 6-15 | |
| FU1-51 | 9233 | Energy Save | Energy save | 0 | (None) | 0 (None) | X | 6-15 |
| | | | | 1 | (Manual) | | | |
| | | | | 2 | (Auto) | | | |
| FU1-52 (10) | 9234 | Energy Save % | Manual save% | 0 to 30 [%] | 0 [%] | ○ | | |
| FU1-54(13) | 9236 | Integrating Wattmeter | KiloWattHour | M kWh | * | X | 6-16 | |
| FU1-55 | 9237 | Inverter Temperature | Inv. Temp. | 0 to 160 [degree] | * | X | 6-16 | |
| FU1-56 | 9238 | Motor Temperature | Motor Temp. | 0 to 160 [degree] | * | X | 6-16 | |
| FU1-57 | 9239 | No Motor Selection | No Motor Sel | 0 | (No) | 0 (No) | X | 6-16 |
| | | | | 1 | (Yes) | | | |
| FU1-58 | 923A | Trip Current Level | No Motor Level | 5 to 100 [%] | 15 [%] | X | 6-16 | |
| FU1-59 | 923B | Trip Time Setting | No Motor Time | 0.5 to 10.0 [sec] | 3.0 [sec] | X | 6-16 | |
| FU1-60 | 923C | Electronic Thermal Selection | ETH select | 0 | (No) | 1 (Yes) | ○ | 6-17 |
| | | | | 1 | (Yes) | | | |
| FU1-61 (11) | 923D | Electronic Thermal Level for 1 Minute | ETH 1min | FU1-62 to 200 [%] | 150 [%] | ○ | 6-17 | |
| FU1-62 | 923E | Electronic Thermal Level for Continuous | ETH Cont | 50 to FU1-61 (Maximum 150%) | 120 [%] | ○ | 6-17 | |
| FU1-63 | 923F | Characteristic Selection (Motor Type) | Motor type | 0 (Self-cool) 1 (Forced-cool) | 0 (Self-cool) | ○ | 6-17 | |
| FU1-64 | 9240 | Overload Warning Level | OL level | 30 to 110 [%] | 110 [%] | ○ | 6-18 | |
| FU1-65 | 9241 | Overload Warning Time | OL time | 0 to 30 [sec] | 10 [sec] | ○ | 6-18 | |
| FU1-66 | 9242 | Overload Trip Selection | OLT select | 0 | (No) | 0 (No) | ○ | 6-18 |
| | | | | 1 | (Yes) | | | |
| FU1-67 (12) | 9243 | Overload Trip Level | OLT level | 30 to 150 [%] | 120[%] | ○ | 6-18 | |
| FU1-68 | 9244 | Overload Trip Delay Time | OLT time | 0 to 60 [sec] | 60 [sec] | ○ | 6-18 | |
| FU1-69 | 9245 | Input/Output Phase Loss Protection | Trip select | 000 to 111 (Bit Set) | 100 | ○ | 6-19 | |
| FU1-70 | 9246 | Stall Prevention Selection | Stall Mode. | No Yes | No | X | 6-19 | |
| FU1-71 | 9247 | Stall Prevention Level | Stall level | 30 to 200 [%] | 120[%] | X | 6-19 | |

| CODE | Comm. Addr | Description | LCD Keypad Display | Setting Range | Factory Default | Adj. During Run | Page |
|-------------|------------|---|--------------------|--|-----------------|-----------------|------|
| FU1-72 | 9248 | Accel/Decel Change Frequency | Acc/Dec ch F | 0 to FU1-30 | 0 [Hz] | X | 6-19 |
| FU1-73 | 9249 | Reference Frequency for Accel and Decel | Acc/Dec freq | 0 (Max freq) 1 (Delta freq) | 0 (Max freq) | X | 6-20 |
| FU1-74 | 924A | Accel/Decel Time Scale | Time scale | 0 (0.01 sec) 1 (0.1 sec) 2 (1 sec) | 1 (0.1 sec) | O | 6-20 |
| FU1-75 | 924B | Up Down Save Mode | UpDnSaveMode | 0 (No) 1 (Yes) | 0 (No) | X | 6-20 |
| FU1-76 (31) | 924C | Up Down Save Freq | UpDnSaveFreq | startFreq to 120[Hz] | 0.00Hz | O | 6-20 |
| FU1-80 (32) | 9250 | Voltage Suppression | Suppression | Yes / No | Yes | O | 6-20 |
| FU1-81 | 9251 | FanfaultMode | FanfaultMode | None FanWarning FanTrip | FanWarning | O | 6-20 |

* The gray-highlighted codes are hidden parameters and will appear when the related functions are to be set.

(5) Only displayed when FU1-02, FU1-03 is set to [S-Curve].

(6) Only displayed when FU1-20 is set to [DC-start].

(7) Only displayed when FU1-23 is set to [DC-break].

(8) Only displayed when FU1-33 is set to [Yes].

(9) FU1-41~48 Only displayed when FU1-40 is set to [User V/F].

(10) Only displayed when FU1-51 is set to [Manual].

(11) Only displayed when FU1-60 is set to [Yes].

(12) Only displayed when FU1-66 is set to [Yes].

(13) It isn't proper measuring Input power because some error can be occurred by Kinds of Motor, Load, Output Freq etc.

(31) Only displayed when FU1-75 is set to [Yes].

(32) If you do not want to suppress output voltage, Set this parameter to [NO]

[FU2 GROUP]

| CODE | Comm. Addr | Description | LCD Keypad Display | Setting Range | Factory Default | Adj. During Run | Page | |
|-------------|------------|---|--------------------------|---|-----------------|-----------------|------|------|
| FU2-00 | 9300 | Jump to desired code # | Jump code | 1 to 95 (Use Only LCD Keypad) | 40 | O | 6-21 | |
| FU2-01 | 9301 | Last trip 1 | Last trip-1 | By pressing [PROG] and [UP] or [DOWN] key, the frequency, current, and operational status at the time of fault can be seen. | 0 (None) | * | 6-21 | |
| FU2-02 | 9302 | Last trip 2 | Last trip-2 | | 0 (None) | * | 6-21 | |
| FU2-03 | 9303 | Last trip 3 | Last trip-3 | | 0 (None) | * | 6-21 | |
| FU2-04 | 9304 | Last trip 4 | Last trip-4 | | 0 (None) | * | 6-21 | |
| FU2-05 | 9305 | Last trip 5 | Last trip-5 | | 0 (None) | * | 6-21 | |
| FU2-06 | 9306 | Erase trips | Erase trips | 0 | (No) | 0 (No) | O | 6-21 |
| | | | | 1 | (Yes) | | | |
| FU2-07 | 9307 | Dwell Frequency | Dwell time | 0 to 10 [sec] | 0 [sec] | X | 6-21 | |
| FU2-08 (12) | 9308 | Dwell Frequency | Dwell freq | FU1-32 to FU1-30 | 5 [Hz] | X | 6-21 | |
| FU2-10 | 930A | Frequency Jump Selection | Jump Freq | 0 | (No) | 0 (No) | X | 6-22 |
| | | | | 1 | (Yes) | | | |
| FU2-11 (13) | 930B | Jump Frequency 1 Low | jump lo 1 | 0 to FU2-12 | 10 [Hz] | O | 6-22 | |
| FU2-12 | 930C | Jump Frequency 1 High | jump Hi 1 | FU2-11 to FU1-30 | 15 [Hz] | O | | |
| FU2-13 | 930D | Jump Frequency 2 Low | jump lo 2 | 0 to FU2-14 | 20 [Hz] | O | | |
| FU2-14 | 930E | Jump Frequency 2 High | jump Hi 2 | FU2-13 to FU1-30 | 25 [Hz] | O | | |
| FU2-15 | 930F | Jump Frequency 3 Low | jump lo 3 | 0 to FU2-16 | 30 [Hz] | O | | |
| FU2-16 | 9310 | Jump Frequency 3 High | jump Hi 3 | FU2-15 to FU1-30 | 35 [Hz] | O | | |
| FU2-20 | 9314 | Power ON Start Selection | Power-on run RST restart | 0 | (No) | 0 (No) | O | 6-22 |
| | | | | 1 | (Yes) | | | |
| FU2-21 | 9315 | Restart after Fault Reset | RST restart | 0 | (No) | 0 (No) | O | 6-22 |
| | | | | 1 | (Yes) | | | |
| FU2-22 | 9316 | Start After Interrupt Power Fault Selection | IPF Mode | 0 | (No) | 0(No) | X | 6-23 |
| | | | | 1 | (Yes) | | | |
| FU2-23 | 9317 | Speed Search Type Selection | Search Type | estimated SS | estimated SS | O | 6-23 | |
| FU2-24 | 9318 | Retry Mode Sel | Retry Mode | No/Yes | 0 (NO) | O | 6-24 | |
| FU2-25 | 9319 | Number of Auto Retry | Retry number | 0 to 10 | 0 | O | 6-24 | |
| FU2-26 (15) | 931A | Delay Time Before Auto Retry | Retry delay | 0 to 60 [sec] | 1 [sec] | O | 6-24 | |
| FU2-27 | 931B | Speed Search Current Limit | Flying Perc | 30 to 160 | 70% | X | 6-23 | |

| CODE | Comm. Addr | Description | LCD Keypad Display | Setting Range | Factory Default | Adj. During Run | Page |
|------------------|------------|--|--------------------|--|---|-----------------|------|
| FU2-40 | 9328 | Motor Capacity selection Inverter (5.5 ~ 450 kW) | Motor select | 0 (0.75kW) 1 (1.5kW) 2 (2.2kW) 3 (3.7kW) 4 (5.5kW) 5 (7.5kW) 6 (11.0kW) 7 (15.0kW) 8 (18.5kW) 9 (22.0kW) 10 (30.0kW) 11 (37.0kW) 12 (45.0kW) 13 (55.0kW) 14 (75.0kW) 15 (90.0kW) 16 (110.0kW) 17 (132.0 kW) 18 (160.0 kW) 18 (220.0 kW) 20 (280.0 kW) 21 (315.0 kW) 22 (375.0 kW) 23 (450.0 kW) | * Depending on the inverter capacity | X | 6-25 |
| | | | | * A motor rating same as inverter capacity is automatically set. If different, set the correct value. | | | |
| FU2-41 | 9329 | Number of Motor Poles | Pole number | 2 to 12 | 4 | X | 6-25 |
| FU2-42 | 932A | Motor Slip | Rate-Slip | 0.00 to 10.00 | Depending on the motor capacity *Refer to Table2 | X | 6-25 |
| FU2-43 | 932B | Rated Current of Motor(rms) | Rated-Curr | 1.0 – 300.0 [A] | | X | |
| FU2-44 | 932C | No Load Motor Current(rms) | Noload-Curr | 1.0 – 300.0 [A] | | X | |
| FU2-46 | 932E | Load Inertia | Inertia rate | 0 to 40 | | X | |
| FU2-47 | 932F | Gain for Motor Speed Display | RPM DisplayGn | 1 to 1000 [%] | 100 [%] | O | |
| FU2-48 (Table 1) | 9330 | Carrier Frequency | Carrier freq | Refer to Table 1) | - | O | 6-26 |
| FU2-49 | 9331 | PWM Type Selection | PWMTechnique | 0 (Normal) | 0 (Normal) | X | 6-26 |
| | | | | 1 (Low leakage) | | | |
| FU2-52 (16) | 9334 | Safety Stop Dec. Rate | Dec Rate | 1.0 - 100.0 [sec] | 100.0 [sec] | X | 6-26 |
| FU2-53 | 9335 | Safety Stop Output Dec. Rate | safety_perc | 2 - 500 | 21 | X | 6-26 |
| FU2-60 | 933C | Control Mode Selection | Control Mode | 0 (V/F) | 0 (V/F) | X | 6-26 |
| | | | | 1 (Slip compen) | | | |
| | | | | 2 (Sensorless) | | | |
| FU2-61 | 933D | Auto Tuning Selection | AutoTuneEnbl | 0 (No) | 0 (No) | X | 6-28 |
| | | | | 1 (Static) | | | |
| FU2-62 | 933E | Stator Resistance of Motor | %Rs | 0.01-20[%] | 4[%] | X | |
| FU2-63 | 933F | Leakage Inductance of Motor | %Lsigma | 0.01-100[%] | 12[%] | X | 6-28 |
| FU2-64 (17) | 9340 | Pre-excitation Time | PreEx time | 0 to 60 [sec] | 1 [sec] | X | 6-28 |
| FU2-67 | 9343 | Manual/Auto Torque Boost Selection | Torque boost | 0 (Manual) | 0 (Manual) | X | 6-29 |
| | | | | 1 (Auto) | | | |
| FU2-68 (Table 2) | 9344 | Torque Boost in Forward Direction | Fwd boost | 0 to 15 [%] | 1.0 or 2.0[%] | X | |

| CODE | Comm. Addr | Description | LCD Keypad Display | Setting Range | Factory Default | Adj. During Run | Page | |
|---------------------|------------|-----------------------------------|--------------------|---|-----------------|-----------------|------|------|
| FU2-69 (Table 2) | 9345 | Torque Boost in Reverse Direction | Rev boost | 0 to 15 [%] | 1.0 or 2.0[%] | X | | |
| FU2-80 | 9350 | Power On display | PowerOn Disp | 0 to 12 | 0 | O | 6-30 | |
| FU2-81 | 9351 | User Select | User Disp | Voltage Watt | Voltage | O | 6-30 | |
| FU2-82 | 9352 | Software Version | iP5A S/W Ver | Ver X.X | Ver X.X | * | 6-30 | |
| FU2-83 | 9353 | Last Trip Time | LastTripTime | X:XX:XX:XX:XX:X | * | X | 6-30 | |
| FU2-84 | 9354 | Power On Time | On-time | X:XX:XX:XX:XX:X | * | X | | |
| FU2-85 | 9355 | Run-time | Run-time | X:XX:XX:XX:XX:X | * | X | | |
| FU2-87 | 9357 | Power Set | Power Set | 0.1~400 % | 100 | O | 6-31 | |
| FU2-90 | 935A | Parameter Display | Para. disp | 0 | Default | 0 (Default) | O | 6-31 |
| | | | | 1 | (All Para) | | | |
| | | | | 2 | (Diff Para) | | | |
| FU2-91 | 935B | Read Parameter | Para. Read | 0 | (No) | 0 (No) | X | 6-31 |
| | | | | 1 | (Yes) | | | |
| FU2-92 | 935C | Write Parameter | Para. Write | 0 | (No) | 0 (No) | X | 6-31 |
| | | | | 1 | (Yes) | | | |
| FU2-93 | 935D | Initialize Parameters | Para. Init | 0 (No) 1 (All Groups) 2 (DRV) 3 (FU1) 4 FU2) 5 (I/O) 6 (EXT) 7 (COM) 8(APP) | 0 (No) | X | 6-31 | |
| FU2-94 | 935E | Parameter Write Protection | Param. Lock | 0 to 9999 | 0 | O | 6-32 | |
| FU2-95 | 935F | Parameter Save | Param. save | 0 | (No) | 0 (No) | X | 6-32 |
| | | | | 1 | (Yes) | | | |

* The gray-highlighted codes are hidden parameters and will appear when the related functions are to be set.

(12) FU2-8 is displayed when FU2-07 is set to [1~10 sec].

(13) FU2-11 is displayed when FU2-10 is set to [Yes].

(15) FU2-26 is displayed when FU2-25 [Retry number] is set to [1~10].

(16) FU2-52 is displayed when FU1-28 is set to [Yes].

(17) FU2-64 is displayed when FU2-60 is set to [Sensorless].

| Inverter Capacity | (200V/400V) | | (600V) | |
|---------------------|----------------|-----------------|------------------|-----------------|
| | Setting Range | Factory Default | Setting Range | Factory Default |
| 0.75 ~ 3.7 kW | 0.7 ~ 15 [kHz] | 5.0 [kHz] | NA | NA 3.0[kHz] |
| 5.5 ~ 11kW | | | 0.7 ~ 10.0 [kHz] | |
| 15~22kW | | | 0.7 ~ 8.0 [kHz] | |
| 30 kW | 0.7 ~ 10 [kHz] | 4.0 [kHz] | | |
| 37 ~ 75 kW | 0.7 ~ 4 [kHz] | 3.0 [kHz] | | |
| 110 ~ 280 kW | 0.7 ~ 3 [kHz] | 2.0 [kHz] | | |
| 90kW / 315 ~ 450 kW | 0.7 ~ 2 [kHz] | | 0.7 ~ 2.0 [kHz] | NA |

| Inverter Capacity | (200V/400V) | | (600V) | |
|-------------------|---------------|-----------------|---------------|-----------------|
| | Setting Range | Factory Default | Setting Range | Factory Default |
| 0.75 ~ 3.7 kW | 0 to 15[%] | 2.0 [%] | 0 to 15[%] | NA |
| 5.5 ~ 11 kW | | | | 2[%] |
| 15 ~ 90 kW | | | | 1[%] |
| 110 kW | | 1.0 [%] | | |
| 132 ~ 450 kW | | 1.0 [%] | | NA |

Table 2) Initial value of motor Spec

| Capacity (kW) | 200V Motor ratedCurrent (A) | 400V Motor ratedCurrent (A) | 600VMotor ratedCurrent (A) | 200V No Load Current (A) | 400V No Load Current (A) | 600V No Load Current (A) | 200/400V Slip Frequency (Hz) | 600V Slip Frequency (Hz) |
|---------------|-----------------------------|-----------------------------|----------------------------|--------------------------|--------------------------|--------------------------|------------------------------|--------------------------|
| 0.8 | 3.6 | 2.0 | 2.0 | 1.6 | 0.8 | 0.8 | 30 | 30 |
| 1.5 | 6.1 | 3.1 | 3.1 | 2.8 | 1.4 | 1.4 | 23.4 | 23.4 |
| 2.2 | 8.6 | 4.0 | 4 | 3.5 | 2.6 | 2.6 | 20 | 20 |
| 3.7 | 12.9 | 6.5 | 6.5 | 4.9 | 3.3 | 3.3 | 23.4 | 23.4 |
| 5.5 | 22.0 | 11.0 | 8 | 6.6 | 3.9 | 4.2 | 23.4 | 10 |
| 7.5 | 28.0 | 14.0 | 10.1 | 9.0 | 5.7 | 4.5 | 23.4 | 13.3 |
| 11.0 | 42.0 | 21.0 | 14.8 | 12.5 | 7.5 | 6.6 | 13.3 | 11.7 |
| 15.0 | 54.0 | 27.0 | 19.2 | 17.5 | 10.1 | 7.5 | 16.7 | 11.7 |
| 18.5 | 68.0 | 34.0 | 23.9 | 19.4 | 11.6 | 7.9 | 13.3 | 10 |
| 22.0 | 80.0 | 40.0 | 29 | 25.3 | 13.6 | 9.6 | 13.3 | 10 |
| 30.0 | 104.0 | 52.0 | 36.8 | 33.6 | 19.3 | 12.1 | 13.3 | 8.3 |
| 37.0 | 122.0 | 65.0 | 45.6 | 40.6 | 23.3 | 15 | 13.3 | 8.3 |
| 45.0 | 150.0 | 77.0 | 55 | 50.0 | 28.6 | 18.2 | 13.3 | 6.7 |
| 55.0 | 190.0 | 96.0 | 69.2 | 63.3 | 35.3 | 22.8 | 13.3 | 6.7 |
| 75.0 | 250.0 | 124.0 | 87 | 83.3 | 46.3 | 28.7 | 13.3 | 6.7 |
| 90.0 | 250.0 | 156.0 | 112 | 83.3 | 42.0 | 37 | 13.3 | 6.7 |
| 110.0 | 300.0 | 180.0 | 134.4 | 121.9 | 67.7 | 44.4 | 13.3 | 6.7 |
| 132.0 | 350.0 | 240.0 | 161.3 | 146.3 | 81.2 | 53.2 | 13.3 | 6.7 |
| 160.0 | 370.0 | 302.0 | 192.6 | 173.3 | 98.4 | 63.6 | 13.3 | 6.7 |
| 220.0 | 490.0 | 361.0 | 268.8 | 238.3 | 135.3 | 88.7 | 13.3 | 6.7 |
| 260.0 | 490.0 | 414.0 | 313.6 | 238.3 | 135.3 | 103.5 | 13.3 | 6.7 |
| 280.0 | 600.0 | 477.0 | 336 | 303.3 | 172.2 | 110.9 | 13.3 | 6.7 |
| 315.0 | 675.0 | 590.0 | 380.8 | 341.2 | 193.7 | 125.7 | 13.3 | 6.7 |
| 375.0 | 803.5 | 731.0 | 448 | 406.2 | 230.6 | 147.8 | 13.3 | 6.7 |
| 450.0 | 964.2 | 864.0 | 537.6 | 487.4 | 276.7 | 177.4 | 13.3 | 6.7 |

[I/O GROUP]

| CODE | Comm. Addr | Description | LCD Keypad Display | Setting Range | Factory Default | Adj. During Run | Page |
|----------------|------------|---|--------------------|---|-----------------|-----------------|------|
| I/O-00 | 9400 | Jump to desired code | Jump code | 1 to 98 | 1 | O | 6-33 |
| I/O-01 (17) | 9401 | Filtering Time Constant for V1 Signal Input | V1 Filter | 0 to 9999 [msec] | 10 [msec] | O | 6-33 |
| I/O-02 | 9402 | V1 Input Minimum Voltage | V1 volt x1 | 0 to 12[V] | 0.00 [V] | O | |
| I/O-03 | 9403 | Frequency Corresponding to V1 Input Minimum Voltage | V1 Freq y1 | 0 to FU1-30 [Hz] 0 to 100.00 [**](18) | 0.00 [Hz] | O | |
| I/O-04 | 9404 | V1 Input Minimum Voltage | V1 volt x2 | 0 to 12[V] | 10 [V] | O | |
| I/O-05 | 9405 | V1 Input Maximum Voltage | V1 Freq y2 | 0 to FU1-30 [Hz] 0 to 100.00 [**] (18) | 60.00 [Hz] | O | |
| I/O-06 | 9406 | Filtering Time Constant for I Signal Input | I Filter | 0 to 9999 [msec] | 70 [msec] | O | |
| I/O-07 | 9407 | I Input Minimum Current | I curr x1 | 0 to 20 [mA] | 4 [mA] | O | |
| I/O-08 | 9408 | Frequency Corresponding to I Input Minimum Current | I Freq y1 | 0 to FU1-30 [Hz] 0 to 100.00 [**](18) | 0.00 [Hz] | O | |
| I/O-09 | 9409 | Filtering Time Constant for I Signal Input | I curr x2 | 0 to 20 [mA] | 20 [mA] | O | |
| I/O-10 | 940A | Frequency Corresponding to I Input Maximum Current | I Freq y2 | 0 to FU1-30 [Hz] 0 to 100.00 [**](18) | 60.00 [Hz] | O | |
| I/O-11 | 940B | Pulse input method | P Pulse set | 0 (A+B) 1 (A) | 1 (A) | O | 6-34 |
| I/O-12 | 940C | Pulse input filter | P filter | 0 to 9999 [msec] | 10 [msec] | O | |
| I/O-13 | 940D | Pulse input Minimum frequency | P pulse x1 | 0 to 10 [kHz] | 0 [kHz] | O | |
| I/O-14 | 940E | Frequency corresponding to I/O-13 Pulse input Minimum frequency | P freq y1 | 0 to FU1-30 [Hz] 0 to 100.00 [**](18) | 0 [Hz] | O | |
| I/O-15 | 940F | Pulse input Minimum frequency | P pulse x2 | 0 to 100 [kHz] | 10 [kHz] | O | |
| I/O-16 | 9410 | Frequency corresponding to I/O-15 Pulse input Maximum frequency | P freq y2 | 0 to FU1-30 [Hz] 0 to 100.00 [**](18) | 60.00 [Hz] | O | |
| I/O-17 | 9411 | Criteria for Analog Input Signal Loss | Wire broken | 0 (None) 1 (half of x1) 2 (below x1) | 0 (None) | O | 6-35 |
| I/O-18 | 9412 | Operating selection at Loss of Freq. Reference | Lost command | 0 (None) 1 (FreeRun) 2 (Stop) 3 (Protection) | 0 (None) | O | |
| I/O-19 | 9413 | Waiting Time after Loss of Freq. Reference | Time out | 0.1 to 120 [sec] | 1.0 [sec] | O | |

| CODE | Comm. Addr | Description | LCD Keypad Display | Setting Range | Factory Default | Adj. During Run | Page |
|--------|------------|---|--------------------|---|-----------------|-----------------|------|
| I/O-20 | 9414 | Programmable Digital Input Terminal 'M1' Define | M1 Define | 0 (Speed-L) 1 (Speed-M) 2 (Speed-H) 3 (XCEL-L) 4 (XCEL-M) 5 (XCEL-H) 6 (Dc-brake) 7 (2nd Func) 8 (Exchange) 9 (- Reserved -) 10 (Up) 11 (Down) 12 (3-Wire) 13 (Ext Trip) 14 (Pre-Heat) 15 (iTerm Clear) 16 (Open-loop) 17 (LOC/REM) 18 (Analog hold) 19 (XCEL stop) 20 (P Gain2) 21 -Reserved- 22 (Interlock1) 23 (Interlock2) 24 (Interlock3) 25 (Interlock4) 26 (Speed_X) 27 (RST) 28 (BX) 29 (JOG) 30 (FX) 31 (RX) 32 (ANA_CHG) 33 (Ext PID Run) 34 (Up/Dn Clr) | 0 (Speed-L) | X | 6-36 |
| I/O-21 | 9415 | Programmable Digital Input Terminal 'M2' Define | M2 define | Same as I/O-20 | 1 (Speed-M) | X | |
| I/O-22 | 9416 | Programmable Digital Input Terminal 'M3' Define | M3 define | Same as I/O-20 | 2 (Speed-H) | X | |
| I/O-23 | 9417 | Programmable Digital Input Terminal 'M4' Define | M4 define | Same as I/O-20 | 27 (RST) | X | |
| I/O-24 | 9418 | Programmable Digital Input Terminal 'M5' Define | M5 define | Same as I/O-20 | 28 (BX) | X | |
| I/O-25 | 9419 | Programmable Digital Input Terminal 'M6' Define | M6 define | Same as I/O-20 | 29 (JOG) | X | |

| CODE | Comm. Addr | Description | LCD Keypad Display | Setting Range | Factory Default | Adj. During Run | Page | |
|-------------|------------|--|--------------------|-----------------------------|-----------------|------------------|------|------|
| I/O-26 | 941A | Programmable Digital Input Terminal 'M7' Define | M7 define | Same as I/O-20 | 30 (FX) | X | 6-36 | |
| I/O-27 | 941B | Programmable Digital Input Terminal 'M8' Define | M8 define | Same as I/O-20 | 31 (RX) | X | | |
| I/O-28 | 941C | Terminal Input Status | In status | 00000000000/ 11111111111 | 00000000000 | * | | |
| I/O-29 | 941D | Filtering Time Constant for Programmable Digital Input Terminals | Ti Filt Num | 2 to 1000 [msec] | 15 | O | | |
| I/O-30 (19) | 941E | Jog Frequency Setting | Jog Speed | 0 to FU1-30 | 10 [Hz] | O | 6-39 | |
| I/O-31 | 941F | Step Frequency 4 | PresetSpd- 4 | | 40 [Hz] | O | | |
| I/O-32 | 9420 | Step Frequency 5 | PresetSpd -5 | | 50 [Hz] | O | | |
| I/O-33 | 9421 | Step Frequency 6 | PresetSpd -6 | | 40 [Hz] | O | | |
| I/O-34 | 9422 | Step Frequency 7 | PresetSpd -7 | | 30 [Hz] | O | | |
| I/O-35 | 9423 | Step Frequency 8 | PresetSpd -8 | | 20 [Hz] | O | | |
| I/O-36 | 9424 | Step Frequency 9 | PresetSpd -9 | | 10 [Hz] | O | | |
| I/O-37 | 9425 | Step Frequency 10 | PresetSpd -10 | | 20 [Hz] | O | | |
| I/O-38 | 9426 | Step Frequency 11 | PresetSpd -11 | | 30 [Hz] | O | | |
| I/O-39 | 9427 | Step Frequency 12 | PresetSpd -12 | | 40 [Hz] | O | | |
| I/O-40 | 9428 | Step Frequency 13 | PresetSpd -13 | | 50 [Hz] | O | | |
| I/O-41 | 9429 | Step Frequency 14 | PresetSpd -14 | | 40 [Hz] | O | | |
| I/O-42 | 942A | Step Frequency 15 | PresetSpd -15 | | 30 [Hz] | O | | |
| I/O-50 | 9432 | Acceleration Time 1 (for Step speed) | Acc time-1 | 0 to 6000 [sec] | 20 [sec] | O | 6-40 | |
| I/O-51 | 9433 | Deceleration Time 1 (for Step speed) | Dec time-1 | 0 to 6000 [sec] | 20 [sec] | O | | |
| I/O-52 (20) | 9434 | Acceleration Time 1 (for Step speed) | Acc time-2 | 0 to 6000 [sec] | 30 [sec] | O | | |
| I/O-53 | 9435 | Deceleration Time 2 | Dec time-2 | 0 to 6000 [sec] | 30 [sec] | O | | |
| I/O-54 | 9436 | Acceleration Time 3 | Acc time-3 | 0 to 6000 [sec] | 40 [sec] | O | | |
| I/O-55 | 9437 | Deceleration Time 3 | Dec time-3 | 0 to 6000 [sec] | 40 [sec] | O | | |
| I/O-56 | 9438 | Acceleration Time 4 | Acc time-4 | 0 to 6000 [sec] | 50 [sec] | O | | |
| I/O-57 | 9439 | Deceleration Time 4 | Dec time-4 | 0 to 6000 [sec] | 50 [sec] | O | | |
| I/O-58 | 943A | Acceleration Time 5 | Acc time-5 | 0 to 6000 [sec] | 40 [sec] | O | | |
| I/O-59 | 943B | Deceleration Time 5 | Dec time-5 | 0 to 6000 [sec] | 40 [sec] | O | | |
| I/O-60 | 943C | Acceleration Time 6 | Acc time-6 | 0 to 6000 [sec] | 30 [sec] | O | | |
| I/O-61 | 943D | Deceleration Time 6 | Dec time-6 | 0 to 6000 [sec] | 30 [sec] | O | | |
| I/O-62 | 943E | Acceleration Time 7 | Acc time-7 | 0 to 6000 [sec] | 20 [sec] | O | | |
| I/O-63 | 943F | Deceleration Time 7 | Dec time-7 | 0 to 6000 [sec] | 20 [sec] | O | | |
| I/O-70 | 9446 | S0 output selection | S0 mode | 0 | (Frequency) | 0 (Frequency) | O | 6-41 |
| | | | | 1 | (Current) | | | |
| | | | | 2 | (Voltage) | | | |
| | | | | 3 | (DC link Vtg) | | | |
| | | | | 4 | (Ext PID Out) | | | |

| CODE | Comm. Addr | Description | LCD Keypad Display | Setting Range | Factory Default | Adj. During Run | Page |
|----------------|------------|--|--------------------|--|-----------------|-----------------|------|
| I/O-71 | 9447 | S0 output adjustment | S0 adjust | 10 to 200 [%] | 100 [%] | O | 6-41 |
| I/O-72 | 9448 | S1 output selection | S1 mode | Same as I/O-70 | 2 (Voltage) | O | |
| I/O-73 | 9449 | S1 output adjustment | S1 adjust | 10 to 200 [%] | 100 [%] | O | |
| I/O-74 (21) | 944A | Frequency Detection Level | FDT freq | 0 to FU1-30 [Hz] | 30.00 [Hz] | O | 6-42 |
| I/O-75 | 944B | Frequency Detection Bandwidth | FDT band | 0 to FU1-30 [Hz] | 10.00 [Hz] | O | 6-42 |
| I/O-76 | 944C | Programmable Digital Output Terminal Define (Aux terminal) | RlyOut 1 Def | 0 (NONE) 1 (FDT-1) 2 (FDT-2) 3 (FDT-3) 4 (FDT-4) 5 (FDT-5) 6 (OL) 7 (IOL) 8 (Stall) 9 (OV) 10 (LV) 11 (OH) 12 (Lost Command) 13 (Run) 14 (Stop) 15 (Steady) 16 (INV line) 17 (COMM line) 18 (SpeedSearch) 19 (Ready) 20 (MMC) 21 (Fan Warning) 22 (RUN2) | 0 (NONE) | O | 6-42 |
| I/O-77 | 944D | Programmable Digital Output Terminal Define | Aux mode2 | Same as I/O-76 | 0 (NONE) | O | |
| I/O-78 | 944E | Programmable Digital Output Terminal Define | Aux mode3 | Same as I/O-76 | 0 (NONE) | O | |
| I/O-79 | 944F | Programmable Digital Output Terminal Define | Aux mode4 | Same as I/O-76 | 0 (NONE) | O | |
| I/O-80 | 9450 | Fault Output Relay Setting (3A, 3B, 3C) | Relay mode | 000 to 111 [bit] | 010 [bit] | O | 6-46 |
| I/O-81 | 9451 | Terminal Output Status | Out status | 00000000/11111111 | 00000000 | * | 6-47 |
| I/O-82 | 9452 | Waiting time after Fault Output Relay On | Relay On | 0 to 9999 | 0 | X | 6-47 |

| CODE | Comm. Addr | Description | LCD Keypad Display | Setting Range | Factory Default | Adj. During Run | Page | |
|----------------|------------|---|--------------------|---|------------------|-----------------|------|------|
| I/O-83 | 9453 | Waiting time after Fault Output Relay Off | Relay Off | 0 to 9999 | 0 | X | | |
| I/O-84 | 9454 | Fan Con Sel (37 ~ 90kW) | Fan Con. Sel | 0 (Power On Fan) | 0 (Power On Fan) | X | 6-47 | |
| | | | | 1 (Run Fan) | | | | |
| | | | | 2 (Temper-Fan) | | | | |
| I/O-85 | 9455 | Fan Temp (37 ~ 90kW) | Fan Temp | 0 to 70 [°C] | 70 [°C] | O | 6-47 | |
| I/O-86 | 9456 | Input User Unit Selection | Unit Sel | 0 (Percent) 1 (Bar) 2 (mBar) 3 (kPa) 4 (PSI) 5 (Pa) | 0 (Percent) | X | 6-47 | |
| I/O-87 | 9457 | Unit Maximum Selection | Unit Max Val | 1.0 to 999.9[%] | 100[%] | X | | |
| I/O-90 | 945A | Inverter Number | Inv No. | 1 to 250 | 1 | O | 6-48 | |
| I/O-91 (22) | 945B | Baud Rate Selection | Baud rate | 0 | (1200 bps) | 3 (9600 bps) | O | 6-37 |
| | | | | 1 | (2400 bps) | | | |
| | | | | 2 | (4800 bps) | | | |
| | | | | 3 | (9600 bps) | | | |
| | | | | 4 | (19200 bps) | | | |
| | | | | 5 | (38400 bps) | | | |
| I/O-92 | 945C | Operating method at loss of freq. reference | COM Lost Cmd | 0 | (None) | 0 (None) | O | 6-48 |
| | | | | 1 | (FreeRun) | | | |
| | | | | 2 | (Stop) | | | |
| I/O-93 | 945D | Waiting time after loss of freq. reference | COM Time Out | 0.1 to 120 [sec] | 1.0 [sec] | O | | |
| I/O-94 | 945E | Communication Response Delay time | Delay Time | 2 to 1000 [msec] | 5 [msec] | O | 6-48 | |
| I/O-95 | 945F | A or B contact | In No/Nc Set | 0000000000 /1111111111 | 0000000000 | X | 6-49 | |
| I/O-96 | 9460 | Input time | In CheckTime | 1 to 1000 | 1 [msec] | X | 6-49 | |
| I/O-97 | 9461 | Overheat trip selection | OH Trip Sel | 000 to 111 [bit] | 010 [bit] | X | 6-49 | |
| I/O-98 | 9462 | Motor overheat trip temperature | MotTripTemp | 0 to 255 [°C] | 110 [°C] | X | | |
| I/O-99 (17) | 9463 | Lost Cmd Pre freq Setting | Lost Preset | 0 to 60 [Hz] | 0 | O | 6-20 | |


| CODE | Comm. Addr | Description | LCD Keypad Display | Setting Range | Factory Default | Adj. During Run | Page | |
|------|------------|---|--------------------|---------------|-----------------|-----------------|------|--|
| | | <p>□ The gray-highlighted codes are hidden parameters and will appear when the related functions are to be set.</p> <p>(17) When DRV-04 is set to either V1, V1S, I or V1+I or Pulse, only selected item codes are displayed in I/O-1~I/O-19.</p> <p>(18) I/O-3,5,8,10,14,16 is displayed 0~100.00 [**] when App-02 is set to [proc PI mode] or APP-80 is set to [Ext PI mode] and APP-06 PID Feedback Signal Selection is set to one of I, VI, Pulse, after then, one of I/O-86 ~I/O-88 is set to percentage, Bar, mBar, kPa, Pa except for Speed. Unit will be changed to selected unit. Only user unit displayed when APP-02 or APP-80 is set to [Yes], after APP-06 is set to one of I, V, Pulse, after then one of I/O-86 ~I/O-88 is set to either speed, percentage, Bar, mBar, kPa, Pa..</p> <p>(19) I/O-30 displayed only when one of I/O-20~I/O-27 is set to JOG. DRV-5~DRV-7 and I/O-35 ~ I/O-42 displayed only when I/O-20~I/O-27 is set to Speed_L, Speed_M, Speed_H, Speed_X in combination with step frequency 1~16.</p> <p>(20) I/O-52~I/O-63 displayed only when one of I/O-20~I/O-27 is set to either XCEL_L, XCEL_M, XCEL_H in combination with 1~7th Accel/Decel time.</p> <p>(21) I/O-74 ~ I/O-75 displayed only when one of I/O-76 ~ I/O-79 is set to either FDT-1~FDT5</p> <p>(22) 38400 bps can be set only when the external communication option card is installed.</p> | | | | | | |

[APP GROUP]

| CODE | Comm. Addr | Description | LCD Keypad Display | Setting Range | Factory Default | Adj. During Run | Page |
|----------------|------------|--|--------------------|---|-----------------|-----------------|------|
| APP-00 | 9700 | Jump to Desired Code # | Jump code | 1 to 80 | 1 | O | 6-51 |
| APP-01 | 9701 | Application Mode Selection | App mode | 0 (None) 1 (MMC) | 0 (None) | X | 6-51 |
| APP-02 | 9702 | PID Operation Selection | Proc PI mode | 0 (No) 1 (Yes) | 0 (No) | X | 6-51 |
| APP-03 (25) | 9703 | PID F Gain Selection | PID FFwd-Gn | 0 to 999.9[%] | 0.0 [%] | O | 6-57 |
| APP-04 (26) | 9704 | PID Auxiliary Reference Mode Selection | Aux Ref Enbl | 0 (No) 1 (Yes) | 0 (No) | X | 6-57 |
| APP-05 (27) | 9705 | PID Auxiliary Reference Signal Selection | Aux Ref Sel | 0 (Keypad-1) 1 (Keypad-2) 2 (V1) 3 (V1S) 4 (I) 5 (V1+I) 6 (Pulse) 7 (Int. 485) 8 (Ext. PID) | 2 (V1) | X | 6-57 |
| APP-06 | 9706 | PID Feedback Signal Selection | PID Fbk Src | 0 (I) 1 (V1) 2 (Pulse) | 0 (I) | X | 6-57 |
| APP-07 | 9707 | Meter I Maximum Value | Meter I Max | 0 to 20.00 mA | 20.00 mA | O | 6-57 |
| APP-08 | 9708 | Meter V Maximum Value | Meter V Max | 0 to 12.00 V | 10.00V | O | 6-57 |
| APP-09 | 9709 | Meter P Maximum Value | Meter P Max | 0 to 100.0kHz | 100.0kHz | O | 6-57 |
| APP-11 | 970B | P Gain for PID Control | PID P Gain | 0 to 999.9 [%] | 1.0 [%] | O | 6-58 |
| APP-12 | 970C | I Time for PID Control | PID I Time | 0 to 32.0 [sec] | 10.0 [sec] | O | 6-58 |
| APP-13 | 970D | D Time for PID Control | PID D Time | 0 to 100 [msec] | 0.0 [msec] | O | 6-58 |
| APP-14 | 970E | High Limit Frequency for PID Control | PID Hi Limit | 0.00 to FN1-30 | 60.00[Hz] | O | 6-58 |
| APP-15 | 970F | Low Limit Frequency for PID Control | PID LowLimit | FN1-32 to APP-10 | 0.5 [Hz] | O | |
| APP-16 | 9710 | PID Output Gain | PID OutScale | 0.0 to 999.9 [%] | 100.0 [%] | X | |
| APP-17 | 9711 | PID P2 Gain | PID P2 Gain | 0.0 to 999.9 [%] | 100.0 [%] | X | 6-58 |
| APP-18 | 9712 | P Gain Scale | P Gain Scale | 0.0 to 100.0 [%] | 100.0 [%] | X | |
| APP-19 | 9713 | PID Output Inverse | PID OutInvrt | 0 (No) 1 (Yes) | 0 (No) | X | 6-58 |
| APP-20 | 9714 | PID U curve feedback select | PID U Fbk | 0 (No) 1 (Yes) | 0 (No) | X | 6-58 |
| APP-23 | 9717 | PrePID Reference Frequency | PrePID Freq | 0 to FU1-30 | 0 [Hz] | O | 6-59 |
| APP-24 | 9718 | PrePID Exit Level | PrePID Exit | 0 to 100.0% | 0 [%] | O | |
| APP-25 | 9719 | PrePID Stop delay | PrePID Dly | 0 to 9999 | 600 [sec] | O | |
| APP-26 | 971A | Pipe Broken | Pipe Broken | 0 (No) 1 (Yes) | 0 (No) | X | 6-59 |
| APP-27 | 971B | Sleep Delay Time | Sleep Delay | 0.0 to 9999 [sec] | 60.0 [sec] | O | |
| APP-28 | 971C | Sleep Frequency | Sleep Freq | 0 to FU1-30 [Hz] | 0.00 [Hz] | O | |
| APP-29 | 971D | Wake-Up Level | WakeUp level | 0.0 to 100.0 [%] | 2.0[%] | O | |

| CODE | Comm. Addr | Description | LCD Keypad Display | Setting Range | Factory Default | Adj. During Run | Page |
|----------------|------------|---|--------------------|---------------------------------------|-----------------|-----------------|------|
| APP-30 (28) | 971E | 2nd Acceleration Time | 2nd Acc Time | 0 to 6000 [sec] | 5 [sec] | O | 6-60 |
| APP-31 | 971F | 2nd Deceleration Time | 2nd Dec Time | 0 to 6000 [sec] | 10 [sec] | O | 6-60 |
| APP-32 | 9720 | 2nd Base Frequency | 2nd BaseFreq | 30 to FN1-30 [Hz] | 60 [Hz] | X | 6-60 |
| APP-33 | 9721 | 2nd V/F Pattern | 2nd V/F | 0(Linear) 1(Square) 2(User V/F) | 0(Linear) | X | 6-60 |
| APP-34 | 9722 | 2nd Forward Torque Boost | 2nd F-Boost | 0.0 to 15.0 [%] | 2.0 [%] | X | 6-60 |
| APP-35 | 9723 | 2nd Reverse Torque Boost | 2nd R-Boost | 0.0 to 15.0 [%] | 2.0 [%] | X | 6-60 |
| APP-36 | 9724 | 2nd Stall Prevention Level | 2nd Stall | 30 to 150 [%] | 100 [%] | X | 6-60 |
| APP-37 | 9725 | 2nd Electronic Thermal Level for 1 minute | 2nd ETH 1min | FU2-28 to 200 [%] | 130[%] | O | 6-60 |
| APP-38 | 9726 | 2nd Electronic Thermal Level for continuous | 2nd ETH Cont | 50 to FU2-27 (Max 150%) | 120[%] | O | 6-60 |
| APP-39 | 9727 | 2nd Rated Motor Current | 2nd R-Curr | 1 to 200 [A] | 3.6[A] | X | 6-60 |
| APP-40 (29) | 9728 | Number of Auxiliary Motor Run Display | Aux Mot Run | * | * | * | 6-60 |
| APP-41 | 9729 | Aux. Motor Start Selection | Starting Aux | 1 to 4 | 1 | O | 6-62 |
| APP-42 | 972A | Operation Time Display on Auto Change | Auto Op Time | * | * | * | 6-63 |
| APP-43 | 972B | The Number of Aux Motor | Nbr Aux's | 0 to 7 | 4 | X | 6-63 |
| APP-44 | 972C | Aux.Motor Stop sequence | F-in L-Out | 0 (No) 1 (Yes) | 1 (Yes) | X | 6-63 |
| APP-45 | 972D | How to stop Aux. Motor | ALL Stop | 0 (No) 1 (Yes) | 1 (Yes) | X | 6-60 |
| APP-47 | 972F | Start Frequency of Aux. Motor 1 | Start freq 1 | 0 to FU1-30 | 49.99 [Hz] | O | 6-63 |
| APP-48 | 9730 | Start Frequency of Aux. Motor 2 | Start freq 2 | 0 to FU1-30 | 49.99 [Hz] | O | |
| APP-49 | 9731 | Start Frequency of Aux. Motor 3 | Start freq 3 | 0 to FU1-30 | 49.99 [Hz] | O | |
| APP-50 | 9732 | Start Frequency of Aux. Motor 4 | Start freq 4 | 0 to FU1-30 | 49.99 [Hz] | O | |
| APP-51 | 9733 | Stop Frequency of Aux. Motor 1 | Stop freq 1 | 0 to FU1-30 | 20.00 [Hz] | O | 6-63 |
| APP-52 | 9734 | Stop Frequency of Aux. Motor 2 | Stop freq 2 | 0 to FU1-30 | 20.00 [Hz] | O | |
| APP-53 | 9735 | Stop Frequency of Aux. Motor 3 | Stop freq 3 | 0 to FU1-30 | 20.00 [Hz] | O | |
| APP-54 | 9736 | Stop Frequency of Aux. Motor 4 | Stop freq 4 | 0 to FU1-30 | 20.00 [Hz] | O | |
| APP-58 | 973A | Delay Time before Operating Aux Motor | Aux start DT | 0.0 to 999.9 [sec] | 5.0 [sec] | O | 6-63 |
| APP-59 | 973B | Delay Time before Stopping Aux Motor | Aux stop DT | 0.0 to 999.9 [sec] | 5.0 [sec] | O | 6-63 |

| CODE | Comm. Addr | Description | LCD Keypad Display | Setting Range | Factory Default | Adj. During Run | Page |
|----------------|------------|--|--------------------|---|-----------------|-----------------|------|
| APP-60 | 973C | Accel time when the number of pump decreases | Pid AccTime | 0 to 600.0 [sec] | 2.0 [sec] | O | 6-63 |
| APP-61 | 973D | Decel time when the number of pump increases | Pid DecTime | 0 to 600.0 [sec] | 2.0 [sec] | O | 6-64 |
| APP-62 | 973E | PID Bypass Selection | Regul Bypass | 0 (No) 1 (Yes) | 0 (No) | X | 6-64 |
| APP-66 | 9742 | Auto Change Mode Selection | AutoCh_Mode | 0(EXCH_NONE), 1 (AUX_EXCH), 2 (MAIN_EXCH) | 0(EXCH_NONE) | X | 6-65 |
| APP-67 | 9743 | Auto Change Time | AutoEx-intv | 00:00 to 99:00 | 72:00 | O | 6-65 |
| APP-68 | 9744 | Auto Change Freq | AutoEx-Freq | FN1-32 to FN1-30 [Hz] | 20.0 [Hz] | O | 6-65 |
| APP-69 | 9745 | Inter-Lock Selection | Inter-lock | 0 (No) | 0 (No) | O | 6-66 |
| APP-71 | 9747 | Pressure difference for Aux motor Start | Aux Stt Diff | 0 to 100% | 2[%] | O | 6-68 |
| APP-72 | 9748 | Pressure difference for Aux motor Stop | Aux Stp Diff | 0 to 100% | 2[%] | O | 6-68 |
| APP-80 | 9750 | Ext PID Operation Selection | Ext PI Mode | 0 (No) 1 (Yes) | 0 (No) | X | 6-68 |
| APP-81 (30) | 9751 | Ext PID Reference Signal Selection | ExtPI RefSel | 0(I) 1 (V1) 2 (Pulse) 3(Keypad) | 3(Keypad) | X | 6-68 |
| APP-82 | 9752 | Ext PID Reference Level | Ext PI Ref % | 0 to 100.00 [%] | 50.00 [%] | X | 6-68 |
| APP-83 | 9753 | Ext PID Feedback Signal Selection | ExtPI FbkSel | 0 (I) 1 (V1) 2 (Pulse) | 0 (I) | O | 6-68 |
| APP-85 | 9755 | P Gain for ExtPID | ExtPID Pgain | 0 to 999.9 [%] | 1.0 [%] | O | 6-68 |
| APP-86 | 9756 | I Time for ExtPID | ExtPID Itime | 0 to 32.0 [sec] | 10.0 [sec] | O | 6-68 |
| APP-87 | 9757 | D Time for ExtPID | ExtPID Dtime | 0 to 2000 [msec] | 0 [msec] | O | 6-68 |
| APP-88 | 9758 | High Limit Frequency for ExtPID Control | ExtPID Lmt-H | 0 to 100.00 [%] | 100.00 [%] | O | 6-68 |
| APP-89 | 9759 | Low Limit Frequency for ExtPID Control | ExtPID Lmt-L | 0 to 30.00 [%] | 0 [%] | X | 6-68 |
| APP-90 | 975A | ExtPID Output Scale | ExtPID Scale | 0 to 999.9 | 100.0 [%] | X | 6-68 |
| APP-91 | 975B | ExtPID P2 Gain | ExtPI P2Gain | 0 to 999.9 | 100.0 [%] | X | 6-68 |
| APP-92 | 975C | ExtPID P Gain Scale | ExtPI PScale | 0 to 100.0 | 100.0 [%] | X | 6-68 |
| APP-93 | 975D | ExtPID F Gain | ExtPID F-gain | 0 to 999.9 [%] | 0.0 [%] | O | 6-68 |
| APP-95 | 975F | ExtPID Output Inverse | ExtPI OutInv | 0 (No) 1 (Yes) | 0 (No) | X | 6-68 |
| APP-97 | 9761 | ExtPID Loop Time | ExtPI LoopTm | 50 to 200 [msec] | 100 [msec] | O | 6-68 |

| CODE | Comm. Addr | Description | LCD Keypad Display | Setting Range | Factory Default | Adj. During Run | Page |
|---|------------|-------------|--------------------|---------------|-----------------|-----------------|------|
| <p>*  The gray highlighted codes are hidden parameters and will appear when the related functions are to be set.</p> <p>(25) Only APP-03 ~ APP-17 and APP-63 ~ APP-65 displayed when APP-2 is set to [Yes].</p> <p>(26) If APP-04 Aux Ref Mode is set to [No], DRV-04 setting will be reference of process PID and APP -05 setting will be ignored.</p> <p>(27) If APP-02 is set to [Yes], APP-04 will appear and APP -05 setting value will be reference of process PID, DRV-04 setting will be ignored.</p> <p>(28) Only APP-30 ~ APP-39 displayed only when one of I/O-20 ~ I/O-27 is set to either "2nd Func".</p> <p>(29) Only APP-40 ~ APP-71 displayed when APP-01 is set to [MMC].</p> <p>(30) Only APP-81 ~ APP-97 displayed when APP-80 Ext PI mode is set to [Yes].</p> | | | | | | | |

[EXT GROUP]

| CODE | Comm. Addr | Description | LCD Keypad Display | Setting Range | Factory Default | Adj. During Run | Page |
|--|------------|---|--------------------|---|-----------------|-----------------|--|
| EXT-00 | 9500 | Jump Code | Jump code | 1 to 45 | 1 | O | Refer to the corresponding option manual |
| EXT-01 | 9501 | Type of SUB Board | Sub B/D | Sub-E | * | * | |
| EXT-40 | 9528 | Current Output Terminal 1(CO1) Selection | AM1 mode | Frequency Current Voltage DC link Vtg Ext PID Out | Frequency | O | |
| EXT-41 | 9529 | Adjust Gain of Current Output Terminal 1(CO1) | AM1 adjust | 10 – 200 [%] | 100 [%] | O | |
| EXT-42 | 952A | Adjust Offset of Current Output Terminal 1(CO1) | AM1 Offset | 0 – 100 [%] | 0 [%] | O | |
| EXT-43 | 952B | Current Output Terminal 2(CO2) Selection | AM2 mode | Frequency Current Voltage DC link Vtg Ext PID Out | DC link Vtg | O | |
| EXT-44 | 952C | Adjust Gain of Current Output Terminal 2(CO2) | AM2 adjust | 10 – 200 [%] | 100 [%] | O | |
| EXT-45 | 952D | Adjust Offset of Current Output Terminal 2(CO2) | AM2 Offset | 0 – 100 [%] | 0 [%] | O | |
| <p>* Only the above EXT group displayed when the corresponding option board is installed.</p> <p>* Refer to the SUB board option manual for details.</p> | | | | | | | |

[COM GROUP]

| CODE | Comm. Addr | Description | LCD Keypad Display | Setting Range | Factory Default | Adj. During Run | Page |
|--------|------------|---------------------------|--------------------|---|-----------------|-----------------|--|
| COM-00 | 9600 | Jump Code | Jump code | 1 to 60 | 1 | O | Refer to the corresponding option manual |
| COM-01 | 9601 | Type of SUB Board | Opt B/D | RS485 DeviceNet Profibus BACnet LonWork | * | * | |
| COM-02 | 9602 | Option Mode | Opt mode | None Command Freq Cmd + Freq | None | X | |
| COM-03 | 9603 | Option Version | Opt Version | Ver X.X | Ver X.X | * | |
| COM-04 | 9604 | SWAP Select | SWAP SEL | YES/No | NO | O | |
| COM-13 | 960D | Device Net Input Instance | In Instance | 70/ 71 110/ 111 | 70 | X | |
| COM-17 | 9611 | PLC Station ID | Station ID | 0 to 63 | 1 | O | |
| COM-20 | 9614 | Profi MAC ID | Profi MAC ID | 1 to 127 | 1 | O | |
| COM-30 | 961E | Output Num | Output Num | 0 to 8 | 3 | O | |
| COM-31 | 961F | Output 1 | Output 1 | 0000 – FFFF (HEX) | 000A(HEX) | O | |
| COM-32 | 9620 | Output 2 | Output 2 | 0000 – FFFF (HEX) | 000E(HEX) | O | |
| COM-33 | 9621 | Output 3 | Output 3 | 0000 – FFFF (HEX) | 000F(HEX) | O | |
| COM-34 | 9622 | Output 4 | Output 4 | 0000 – FFFF (HEX) | 0000(HEX) | O | |
| COM-35 | 9623 | Output 5 | Output 5 | 0000 – FFFF (HEX) | 0000(HEX) | O | |
| COM-36 | 9624 | Output 6 | Output 6 | 0000 – FFFF (HEX) | 0000(HEX) | O | |
| COM-37 | 9625 | Output 7 | Output 7 | 0000 – FFFF (HEX) | 0000(HEX) | O | |
| COM-38 | 9626 | Output 8 | Output 8 | 0000 – FFFF (HEX) | 0000(HEX) | O | |
| COM-40 | 9628 | Input Num | Input Num | 0 - 8 | 2 | O | |
| COM-41 | 9629 | Input 1 | Input 1 | 0000 – FFFF (HEX) | 0005(HEX) | O | |
| COM-42 | 962A | Input 2 | Input 2 | 0000 – FFFF (HEX) | 0006(HEX) | O | |
| COM-43 | 962B | Input 3 | Input 3 | 0000 – FFFF (HEX) | 0000(HEX) | O | |
| COM-44 | 962C | Input 4 | Input 4 | 0000 – FFFF (HEX) | 0000(HEX) | O | |
| COM-45 | 962D | Input 5 | Input 5 | 0000 – FFFF (HEX) | 0000(HEX) | O | |
| COM-46 | 962E | Input 6 | Input 6 | 0000 – FFFF (HEX) | 0000(HEX) | O | |
| COM-47 | 962F | Input 7 | Input 7 | 0000 – FFFF (HEX) | 0000(HEX) | O | |
| COM-48 | 9630 | Input 8 | Input 8 | 0000 – FFFF (HEX) | 0000(HEX) | O | |
| COM-60 | 963C | Parity/Stop | Parity/Stop | 8None/1Stop 8None/2Stop 8Even/1Stop 8Odd/1Stop | 8None/1Stop | O | |
| COM-61 | 963D | Opt Para-1 | Opt Para-1 | 0 to FFFF | 0 | O | |
| COM-62 | 963E | Opt Para-2 | Opt Para-2 | 0 to FFFF | 0 | O | |
| COM-63 | 963F | Opt Para-3 | Opt Para-3 | 0 to FFFF | 0 | O | |
| COM-64 | 9640 | Opt Para-4 | Opt Para-4 | 0 to FFFF | 0 | O | |
| COM-65 | 9641 | Opt Para-5 | Opt Para-5 | 0 to FFFF | 0 | O | |
| COM-66 | 9742 | Opt Para-6 | Opt Para-6 | 0 to FFFF | 0 | O | |
| COM-67 | 9743 | Comm UpDate | Comm UpDate | 0 (No) 1 (Yes) | 0 (No) | X | |

* Only the above COM group displayed when the corresponding option board is installed.

* COM-61~66 parameter is used to LonWorks and BACnet communication.

CHAPTER 6 - PARAMETER DESCRIPTION

6.1 Drive group [DRV]

| | | | |
|--|----------|-------------|--|
| DRV-00: Command Frequency/ Output Current | | | |
| DRV▶ Cmd. Freq 00 0.00 Hz | F | 0.00 | |
| Factory Default: 0.00 Hz | | 0.00 | |

1) Digital frequency setting

- When DRV-04 [Frequency Mode] is set to 0 (Keypad-1) or 1 (Keypad-2), command freq is settable less than FU1-30 [Maximum Frequency].

2) Monitoring function setting

- Command frequency displayed during stop.
- Output current/frequency displayed during run.
Analog/digital frequency command source setting:
DRV-04 [Frequency Mode]

When DRV-04 [Frequency Mode] is set to V1, V1S, I, V1+I or Pulse, frequency command is set via I/O-01~16 [Analog Frequency command]. Refer to I/O-01~16 for detail description.

When setting APP-02 [PID operation selection] and/or APP-80 [Ext. PID operation select] to "Yes", I/O-86~88 parameter settings become available. Changing I/O-86~88 value will affect all of the unit display for reference values such as DRV-00 and I/O-01~16. See the related parameter description on the manual for more.

When APP-02 [PID operation selection] is set to "Yes" with APP-04 [PID Aux speed selection] to "No," the selection made among V1,V1S,I,V1+I,Pulse in DRV-04 [Freq mode] becomes PID reference input value and PID target output value becomes inverter reference frequency. See the PID description on the manual for more. Set APP-80 [Ext. PID operation selection] to "Yes" and control terminal "I" to "4~20mA", Ext. PID feedback value. Set one of the I/O-20~27 to [Ext PID Run]. When the selected terminal for [Ext PID Run] is turned ON, Ext. PID operation begins and Ext. PID output value becomes inverter command frequency. See APP-80~97 for details.

When DRV-16 [Speed Unit Selection] is set to 1 (Rpm), Hz display is changed to Rpm.

DRV-04 [Frequency Mode] setting guide

| Set | DRV-04 | Name | Programming Description |
|-----|-----------|-----------------------------|---|
| 0 | Key Pad-1 | Digital freq. command | 1. In DRV-00, press the [PROG] key. 2. Set the desired freq. 3. Press the [ENT] key to write the new value into memory. |
| 1 | Key Pad-2 | | 1. In DRV-00, press the [PROG] key. 2. Press the [↑(Up)] or [↓(Down)] key to set the desired freq. Speed is reflected to the inverter real time upon pressing the UP/DOWN keys. 3. Press the [ENT] key to write the new value into memory. |
| 2 | V1 | Analog freq. command | Voltage analog input (0 to 12V) to Control terminal "V1". See the description of I/O-01~05. |
| 3 | V1S | | Voltage analog input (-12 to 12V, FWD/REV Run) to Control terminal "V1". See the description of I/O-01~05. |
| 4 | I | | Current analog input (4 to 20mA) to Control terminal "I". See the description of I/O-06~10. |
| 5 | V1+I | | 0-12V/4-20mA Analog input Control terminal "V1","I". See the description of I/O-01~10. |
| 6 | Pulse | | Set the command frequency (0-100kHz) from control input terminal "A0 or B0". See the I/O-11~16. |
| 7 | Int. 485 | Communi- cation | Set the command frequency using RS485 (1200~19200bps) from "C+ or C-" control terminals. See the I/O-90~93. |
| 8 | Ext. PID | Ext.PID Reference frequency | Set APP-80 [Ext PI Mode] to [Yes]. Apply 4~20mA {Ext.PID feedback value} to control terminal "I". Set one of the I/O-20~27 to [Ext PID Run]. When the defined terminal is ON, inverter starts Ext.PID operation and the Ext.PID output value becomes inverter command frequency. See APP-80~97 for more. |

DRV-01, 02: Accel/Decel Time 0

DRV▶ Acc. time
01 20.0 sec **01** **20.0**

Factory Default: 20.0 sec **20.0**

DRV▶ Dec. time
02 30.0 sec **02** **30.0**

Factory Default: 30.0 sec **30.0**

The inverter targets FU1-73 when accelerating or decelerating. When FU1-73 is set to “Maximum Frequency”, the acceleration time is the time taken by the motor to reach FU1-30 from 0 Hz. The deceleration time is the time taken by the motor to reach 0 Hz from FU1-30 [Maximum Frequency]. When FU1-73 is set to “Delta Frequency”, the acceleration and deceleration time is the time taken to reach a target frequency (instead the maximum frequency) from a specific frequency.

The acceleration and deceleration time can be changed to a preset time via Programmable digital inputs. By setting M1~M8 to ‘XCEL-L’, ‘XCEL-M’, ‘XCEL-H’ respectively, the 1~7 Accel and Decel time set in I/O-50 to I/O-63 are applied by the binary inputs of the M1~M8.

Note: Set the Accel time more than 0.5 sec for smooth acceleration. Setting it too short may deteriorate the starting performance.

In case of the inverters for 110~450kW(150~700HP), the factory default of Accel/Decel Time is 60.0/90.0[sec] respectively.

| Code | LCD display | Name | XCEL -H | XCEL -M | XCEL -L | Default |
|--------|-------------|------------|---------|---------|---------|---------|
| DRV-01 | Acc time | Acc time 0 | 0 | 0 | 0 | 20 sec |
| DRV-02 | Dec time | Dec time 0 | 0 | 0 | 0 | 30 sec |
| I/O-50 | ACC-1 | Acc time 1 | 0 | 0 | 1 | 20 sec |
| I/O-51 | DEC-1 | Dec time 1 | 0 | 0 | 1 | 20 sec |
| I/O-52 | ACC-2 | Acc time 2 | 0 | 1 | 0 | 30 sec |
| I/O-53 | DEC-2 | Dec time 2 | 0 | 1 | 0 | 30 sec |
| I/O-54 | ACC-3 | Acc time 3 | 0 | 1 | 1 | 40 sec |
| I/O-55 | DEC-3 | Dec time 3 | 0 | 1 | 1 | 40 sec |
| I/O-56 | ACC-4 | Acc time 4 | 1 | 0 | 0 | 50 sec |
| I/O-57 | DEC-4 | Dec time 4 | 1 | 0 | 0 | 50 sec |

| Code | LCD display | Name | XCEL -H | XCEL -M | XCEL -L | Default |
|--------|-------------|------------|---------|---------|---------|---------|
| I/O-58 | ACC-5 | Acc time 5 | 1 | 0 | 1 | 40 sec |
| I/O-59 | DEC-5 | Dec time 5 | 1 | 0 | 1 | 40 sec |
| I/O-60 | ACC-6 | Acc time 6 | 1 | 1 | 0 | 30 sec |
| I/O-61 | DEC-6 | Dec time 6 | 1 | 1 | 0 | 30 sec |
| I/O-62 | ACC-7 | Acc time 7 | 1 | 1 | 1 | 20 sec |
| I/O-63 | DEC-7 | Dec time 7 | 1 | 1 | 1 | 20 sec |

FU1-73 [Reference Frequency for Accel and Decel]

Set the reference frequency for Accel/Decel time. It can be changed depending on the application.

| Setting Range | Description |
|---------------|---|
| Max freq | The Accel/Decel time is the time that takes to reach the maximum frequency from 0 Hz. |
| Delta freq | The Accel/Decel time is the time that takes to reach a target frequency from any frequency. |

FU1-74 [Accel/Decel time scale]

Set the Accel/Decel time unit.

| Setting | Unit | Description |
|---------|----------|---|
| 0 | 0.01 sec | Minimum 0 sec settable Maximum 60 sec settable |
| 1 | 0.1 sec | Minimum 0 sec settable Maximum 600 sec settable (Factory setting) |
| 2 | 1 sec | Minimum 0 sec settable Maximum 6000 sec settable* |

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

DRV▶ Drive mode
03 Fx/Rx-1 **03** **1**

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

Select the source of run/stop command.

| Setting Range | Description |
|---------------|--|
| Keypad | Run/Stop control by Keypad. |
| Fx/Rx-1 | Run/Stop control by Control Terminals command FX, RX. (Method 1) FX: Forward Run/Stop RX: Reverse Run/Stop |
| Fx/Rx-2 | Run/Stop control by Control Terminals FX, RX. (Method 2) |

| Setting Range | Description |
|---------------|---|
| | FX: Run/Stop command RX: Forward/Reverse selection |
| Int. 485 | Run/Stop control by Built-in RS485. |

Note: Please refer to option board user manual for run/stop command by option board.

DRV-04: Frequency Mode

| | | |
|-------------------------------|-----------|----------|
| DRV▶ Freq mode 04 Keypad-1 | 04 | 0 |
| Factory Default: Keypad-1 | | 0 |

If the DRV-04 [Frequency Mode] is set to V1, V1S, I, V1+I, see the description of I/O-01~16 [Analog Voltage/Current input signal adjustment].

| Setting Range | Description |
|---------------|--|
| Keypad-1 | Frequency is set at DRV-00. The frequency is changed by pressing PROG key and entered by pressing ENT key. |
| Keypad-2 | Frequency is set at DRV-00. Press PROG key and then by pressing the ▲ , ▼ key, the inverter immediately outputs the changed frequency. Pressing the ENT key saves the changed frequency. |
| V1 | Apply the frequency reference (0-12V) to the "V1" control terminal. Refer to the I/O-01 to I/O-05 for scaling the signal. |
| V1S | Apply the frequency reference -12~12V and forward/reverse run to terminal V1. Refer to the I/O-01 to I/O-05. Caution) To use this function, it is not recommended to use Run Prevention function of FU1-01 (Forward/Reverse Prohibition). |
| I | Apply the frequency reference (4~20mA) to the "I" control terminal. Refer to the I/O-06 to I/O-10 for scaling the signal. |
| I+I | Apply the frequency reference (0~12V, 4~20mA) to the "V1", "I" control terminals. The 'V1' signal overrides the 'I' signal. See I/O-01~10. |
| PULSE | Set the freq command using "A0, B0" terminals. Range: 0~100kHz. See I/O-11~16. |

| Setting Range | Description |
|---------------|---|
| Int. 485 | Set the freq command using "C+, C-" terminals via RS485 communication. (1200~19200bps) See I/O-90~93. |
| Ext. PID | Set APP-80 [Ext PI Mode] to "Yes." Apply Ext. PID feedback value "4~20mA" to control terminal "I". Set one of the I/O-20~27 to [Ext PID Run]. Inverter starts Ext.PID operation when the defined terminal is ON and Ext.PID output value becomes inverter command frequency. See APP-80~97 for details. |

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

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

The inverter outputs preset frequencies set in these codes according to the Programmable Digital Input terminals configured as 'Speed-L', 'Speed-M', 'Speed-H' and 'Speed-X'. The output frequencies are decided by the binary combination of M1~M8. See I/O-21~27 for Step Freq 4~7.

| Binary Input Combination | | | 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 |

Note: Speed 0 is the set value in DRV-04.

| DRV-04 data | DRV-00, 0 speed | Freq command source |
|-------------|----------------------|---------------------|
| KeyPad-1 | Digital command freq | Keypad |
| KeyPad-2 | Digital command freq | Keypad |

| DRV-04 data | DRV-00, 0 speed | Freq command source |
|-------------|-----------------------------|---------------------|
| V1 | Analog command freq | Terminal |
| V1S | Analog command freq | Terminal |
| I | Analog command freq | Terminal |
| V1+I | Analog command freq | Terminal |
| Pulse | Pulse command freq | Terminal |
| Int. 485 | Comm. command freq | Terminal |
| Ext. PID | Ext.PID reference frequency | Keypad or Terminal |

DRV-08: Output Current

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

This code displays the output current of the inverter in rms unit.

DRV-09: Motor RPM

| | | |
|-----------------------|-----------|----------|
| DRV▶ Speed 09 0rpm | 09 | 0 |
| Factory Default: 0rpm | | 0 |

This code displays the motor speed in RPM while the motor is running. Use the following equation to scale the mechanical speed using FU2-47 [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) * Gain for Motor Speed display [FU2-47].
Where, F= Output Frequency and P= the Number of Motor Poles

DRV-10: DC Link Voltage

| | | |
|--------------------------------|-----------|-------------|
| DRV▶ DC link vtg 10 ----- v | 10 | ---- |
| Factory Default: ---- v | | ---- |

This code displays the DC link voltage inside the inverter.

DRV-11: User Display Selection

| | | |
|----------------------------|-----------|------------|
| DRV▶ User disp 11 0.0 v | 11 | 0.0 |
| Factory Default: 0.0 v | | 0.0 |

This code displays the parameter selected in FU2-81 [User Display]. One of Voltage (factory default, output voltage display) or Watt (output power display) is selectable.

DRV-12: Current Trip Display

| | | |
|-----------------------|-----------|------------|
| DRV▶ Fault 12 None | 12 | n0n |
| Factory Default: None | | n0n |

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

[Fault Contents]

| Fault (Trip) | LCD Keypad display |
|--|--------------------|
| Over-Current 1 | Over Current 1 |
| Over-Voltage | Over Voltage |
| External Trip Input | Ext. Trip |
| Emergency Stop (Not Latched) | BX |
| Low-Voltage | Low Voltage |
| Ground Fault | Ground Fault |
| Over-Heat on Heat sink | Over Heat |
| Electronic Thermal Trip | E-Thermal |
| Over-Load Trip | Over Load |
| Inverter H/W Fault - EEP Error, ADC Offset, WDOG Error, In-Phase Open, No Motor Trip | HW-Diag |
| Over-Current 2 | Over Current 2 |
| Output Phase Loss | Out Phase Open |
| Inverter Over-Load | Inv. OLT |

Note: There are WDOG error, EEP error, Input Phase Open, ADC Offset, No Motor Trip for the inverter Hardware Fault. Inverter will not reset when H/W fault occurs. Repair the fault before turning on the power.

Note: Only the highest-level fault will be displayed when multiple faults occur. The rest of faults can be monitored in FU2-01~05 [Fault history]. Cycle the power when the fault is cleared.

Up to 5 faults can be saved in FU2-01~05 [Fault history]. The lowest hierarchy fault such as “Last trip 5” is the latest. After pressing [PROG] key, press [↑(Up)], [↓(Down)] key to check the operation information at the time of the fault (Output freq., current, Accel/Decel/Constant Run) and fault type. Press the [ENT] key to escape. FU2-06 [Erase fault history] clears the faults information. However, FU2-83 [Last Trip Time] is automatically reset when a trip occurs.

| Code | Display | Description |
|--------|-------------|-----------------|
| FU2-01 | Last trip-1 | Fault history 1 |
| FU2-02 | Last trip-2 | Fault history 2 |
| FU2-03 | Last trip-3 | Fault history 3 |
| FU2-04 | Last trip-4 | Fault history 4 |
| FU2-05 | Last trip-5 | Fault history 5 |

FU2-83 [Last Trip Time] shows the total time elapsed after the last trip occurs so it is possible to know the actual trip time by recounting.

DRV-14: Command/Output Frequency Display

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

Factory Default: 0.00Hz

This code shows the Command (Target) Frequency set in DRV-00 and inverter Output Frequency.

DRV-15: Reference/Feedback Frequency Display

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

Factory Default: 0.00Hz

This code shows the Reference Frequency and Feedback Frequency while PID operation. Appears only when ‘Yes’ is selected in APP-02.

Inverter PID controller’s reference and feedback value are displayed. When APP-02 [PID operation selection] is set to “YES,” reference and feedback values are displayed in Hz. When APP-02 [PID operation selection] is set to “YES,” and APP-06 [PID feedback selection] is set (one of the I, V1, Pulse) and the desired unit is set in I/O-86 [V1 Unit Sel], I/O-87 [I Unit Sel], I/O-88 [PulseUnitSel] according to the selection in APP-06, PID reference and feedback value will be displayed in user-selected unit.

Ex1) When [mBar] is set

```
DRV ▶REF  500.0 mBa
15  FBK  82.1 mBa
```

Ex2) When [kPa] is set

```
DRV ▶REF  500.0 kPa
15  FBK  82.1 kPa
```

DRV-16: Hz/Rpm Display

```
DRV▶ Hz/Rpm Disp
16                               0 Hz
```

16

0

Factory Default: 0 Hz

0

Set this parameter to 0 [Hz] to display frequency, or to 1[Rpm] to display speed.

DRV-18: PID Parameter (To monitor PID controller’s Reference/Feedback value and Inverter’s Command/output frequency)

Displays PID controller’s reference/feedback value and inverter’s command/output frequency. When APP-02 [PID operation selection] is set to “YES,” reference and feedback values are displayed in Hz. When APP-02 [PID operation selection] is set to “YES,” and APP-06 [PID feedback selection] is set (one of the I, V1, Pulse) and the desired unit is set in I/O-86 [V1 Unit Sel], I/O-87 [I Unit Sel], I/O-88 [PulseUnitSel] according to the selection in APP-06, PID reference and feedback value as well as Inverter command and output frequency will be displayed by percent [%] unit.

| | |
|----------|-----------|
| R 50.00% | T 45.3 Hz |
| F 8.24% | DRV 18 |

| | |
|----------|-----------|
| R 50.00% | T 45.3 Hz |
| F 8.24% | O 43.7 Hz |

DRV-19: AD Parameter (To monitor the AD conversion value of Analog input)

AD value of the Analog input used for Freq mode, PID or Ext. PID reference/feedback can be monitored in DRV-19.

Ex) When using V1 and I

| | |
|--------|-------|
| V1 274 | V2 0 |
| V1S 0 | I 103 |

DRV-20: EXT-PID Parameter (To monitor ExtPID controller's reference/ feedback/ output value)

Displays ExtPID controller's reference/ feedback/ output value.

When APP-80 [External PID operation] is set to "YES," reference and feedback are displayed in Percent unit.

When APP-02 [PID operation selection] is set to "YES," and APP-06 [PID feedback signal selection] is set (one of the I, V1, Pulse) and the desired unit is set in I/O-86 [V1 Unit Sel], I/O-87 [I Unit Sel], I/O-88 [PulseUnitSel] according to the selection in APP-06, PID reference and feedback value will be displayed by percent [%] unit.

| | |
|----------|------------|
| R 50.00% | T 45.32 Hz |
| F 8.24% | DRV 20 |

DRV-22: Local/Remote Key (To use the function of Local/Remote key)

DRV-22 [LocalRemKey] is set to exchanges the LOCAL/REMOTE control.

Definition:

-. Remote : This is set to run reference and frequency reference according to DRV-03, 04.

(Terminal, Communication, Multi-speed, etc.)

-. Local : It designates the panel with inverter which is can be controlled by Keypad.

| Code | Display | Description | Default | Range |
|--------|-------------|---|--------------|--|
| DRV-22 | LocalRemKey | The method of exchange from Remote to Local controlling | Cntl&RefStop | 2nd source Cntl&RefStop Control Stop Ref Only Cntl&Ref Run Control Run Disable |

<Function definition>

-. **2nd Source** : When 'LOC/REM' is inputted, the inverter will be stop according to designated stop method and the inverter will be operated with Run and Frequency reference set in DRV-91, 92.

Caution: In case of the external communication , the manual operation is operated set in DRV-03, 04.

-. **Cntl&RefStop** : When 'LOC/REM' is inputted, the inverter will be stop according to designated stop method. Inverter will be operated with Run and Frequency reference from keypad.

-. **Control Stop** : When 'LOC/REM' is inputted, the inverter will be stop according to designated stop method. Inverter will be operated with Run reference from keypad and Frequency reference set in DRV-04.

-. **Ref Only** : When 'LOC/REM' is inputted, the inverter will be operated with set frequency from keypad and Run reference set in DRV-03.

-. **Cntl&Ref Run** : When 'LOC/REM' is inputted, the inverter will keep the operating status in Remote status and it can be set Run and Frequency reference from keypad.

-. **Control Run** : When 'LOC/REM' is inputted, the inverter will keep the operating status. It can be set the Run reference from keypad and it can be operated with the Frequency reference set in DRV-04.

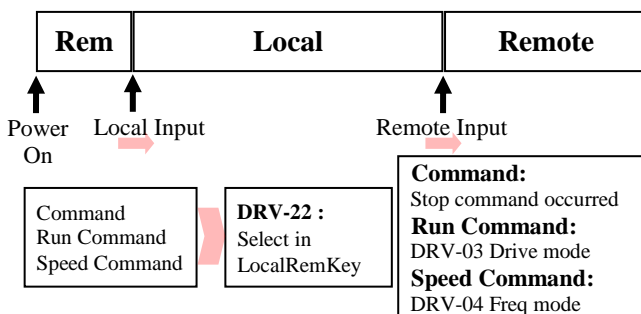
-. **Disable** : Not use the function.

| DRV-22 | Description |
|---------------|------------------------------|
| Cntl&Ref Stop | Run/Stop: Input Stop command |
| | Run command: CMD_KPD |

| DRV-22 | Description |
|-------------------------|--|
| | Speed command: FREQ_DIG1 |
| Control Stop | Run/Stop: Input Stop command |
| | Run command: CMD_KPD |
| | Speed command: DRV-04 Freq mode – keep the current state |
| Ref Only | Run/Stop: keep the current state |
| | Run command: DRV-03 Drive mode – keep the current state |
| | Speed command: FREQ_DIG1 |
| Cntl&Ref Run | Run/Stop: keep the current state |
| | Run command: CMD_KPD |
| | Speed command: FREQ_DIG1 |
| Control Run | Run/Stop: keep the current state |
| | Run command: CMD_KPD |
| | Speed command: DRV-04 Freq mode – keep the current state |
| Disable | Run/Stop: keep the current state |
| | Run command: DRV-03 Drive mode – keep the current state |
| | Speed command: DRV-04 Freq mode – keep the current state |

| Code | Display | Description | Default | Range |
|---------|---------------------|--|---------|---|
| DR V-23 | Key Ref Mode | Select the operation mode when keypad is removed (or comm. is disconnected.) | Disable | Minimum Spd Last Spd Preset Spd 1 Stop Fault Disable |

| DRV-23 | Description |
|--------------|--|
| Minimum Spd | Operates the inverter with minimum frequency when keypad is removed. |
| Last Spd | Operates the inverter with current frequency when keypad is removed. |
| Preset Spd 1 | Operates the inverter with set frequency in DRV-5 [Stop freq 1]. |
| Stop | Stop the inverter according to FU1-23 [Stop mode] when keypad is removed. |
| Fault | If keypad is removed, inverter will cut off its output and displays fault message. |
| Disable | This function disabled. (Factory Default) |



Note: When mode is exchanged from Local to Remote, inverter operates according to Run reference after stop.

DRV-23: Keypad Reference Mode (To select the operation mode after Keypad is removed.)

When keypad is removed from drive, drive reference changes to what you select here or controls stopping or faulting the drive. Inverter operation is according to the DRV-23 KeypadMode settings. This function will be operated only when DRV-03, 04 is set to keypad.

6.2 Function 1 Group [FU1]

FU1-00: Jump to Desired Code

FU1 ▶ Jump code
00 1

Factory Default: 1 1

Jumping directly to any parameter code can be accomplished by entering the desired code number.

This parameter is moved by pressing **PROG** key and set to 23 with [**↑**(UP)], [**↓**(DOWN)] key and then entered by pressing **ENT** key.

FU1 ▶ Stop mode
23 Decel

FU1-01: Run Prevention

FU1 ▶ Run prev.
01 None

01 0

Factory Default: None 0

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

| Setting Range | Description |
|---------------|--|
| None | Forward & Reverse run available. (Factory default) |
| Forward Prev | Forward run prohibited. |
| Reverse Prev | Reverse run prohibited. |

Note: If DRV-04 frequency mode is set to V1S mode, Forward/Reverse Prevention setting can not be designated.

FU1-02: Acceleration Pattern FU1-03: Deceleration Pattern

FU1 ▶ Acc. pattern
02 Linear

02 0

Factory Default: Linear 0

FU1 ▶ Dec. pattern
03 Linear

03

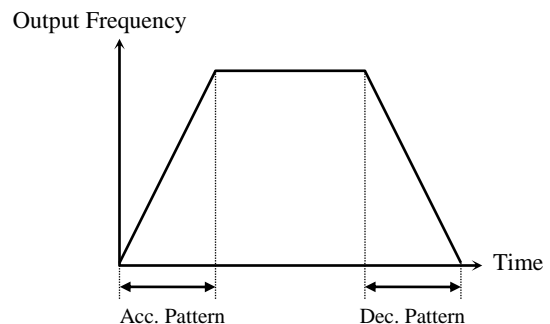
0

Factory Default: Linear 0

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

| Setting Range | Description |
|---------------|--|
| Linear | A general pattern for constant torque applications. (Factory default) |
| S-curve | This pattern allows the motor to accelerate and decelerate smoothly. The actual acceleration and deceleration time takes longer- about 40% than the time set in DRV-01 and DRV-02. This setting prevents shock during acceleration and deceleration, and prevents objects from swinging on conveyors or other moving equipment. * In case Acc/Dec reference freq. is set to max. frequency, - Curve ratio is determined by the part of Starting and Target curve. - S-curve can be made to several ways by setting the ratio of starting/ending point. * In case Acc/Dec reference freq. is set to Delta frequency, - Acc/Dec time that is based on preset freq. instead of max. freq. will be applied so perfect S curve is accomplished. * FU1-04: Start curve for S-curve, FU1-05: End curve for S-curve |
| U-curve | This pattern provides more efficient control of acceleration and deceleration in typical winding machine applications. |

Note: Setting value in DRV-01 and DRV-02 is ignored.



FU1-20: Start Mode
FU1-21: Starting DC Magnetizing Time
FU1-22: Starting DC Magnetizing Value

FU1▶ DcSt time
 21 0.0 sec **21** **0.0**

Factory Default: 0.0 sec **0.0**

FU1▶ DcSt value
 22 50 % **22** **50**

Factory Default: 50 % **50**

Inverter holds the starting frequency for Starting DC Magnetizing Time. It outputs DC voltage to the motor for FU1-21 [Starting DC Magnetizing Time] with the FU1-22 [Starting DC Magnetizing Value] before accelerating.
 Select the starting method of the inverter.

| | FU1-20 set data | Function description |
|---|-----------------|--|
| 0 | Accel | Acceleration to start (Factory default) |
| 1 | Dc-start | Inverter starts acceleration after magnetizing DC current. |
| 2 | Flying-start | Inverter starts RUN while a motor is rotating. |

- 1) The direction of Motor rotation and the command should be set equal to optimum use of Flying-start function. However, this function is effective with less than 50% to rated rpm when direction of motor rotation and reference command is opposite.
- 2) DC-start is disabled when FU1-21 or 22 is set to "0".
- 3) DC-start is deactivated in Sensorless mode.
- 4) It is possible to occur No Motor Trip in case that there is output phase loss when DC-start is operated

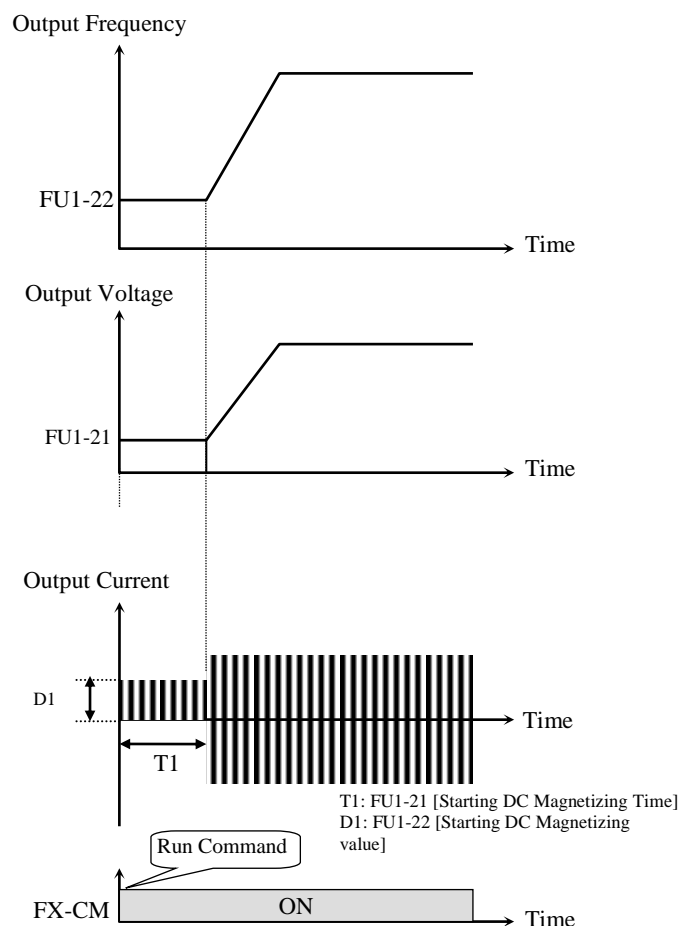
Inverter starts acceleration after FU1-21 [Starting DC Magnetizing Time] while FU1-22 [Starting DC Magnetizing Voltage] is operated.

[Operation of Flying Start]

| CODE | Function | Setting Method | | | | Operation |
|--------|------------------------------|----------------|----------------|-------------|----------|--|
| | | Flying Start | Power On Start | RST Resatrt | IPO Mode | |
| FU1-20 | Speed search on acceleration | Set | | | | Over-current is occurred on Free-Run |
| FU2-20 | Speed search at Power On | Set | Set | | | Speed search is activated according to |

| CODE | Function | Setting Method | | | | Operation |
|--------|--|----------------|----------------|-------------|----------|---|
| | | Flying Start | Power On Start | RST Resatrt | IPO Mode | |
| | | | | | | the setting of Flying start. |
| FU2-21 | Speed search at Trip Reset | | | Set | | Speed search must be activated on Trip Reset. |
| FU2-22 | Speed search at instantaneous interruption | | Set | | Set | Power On Start must be set to operate Speed search. |

| Code | LCD Display | Default | Setting |
|--------|-------------|---------|--------------|
| FU1-21 | DcSt time | 0 [sec] | 0 ~ 60 [sec] |
| FU1-22 | DcSt value | 50 [%] | 0 ~ 150 [%] |



[DC-start Operation]

FU1-22 [Starting DC Magnetizing Value] is the DC Current amount applied to the motor and is set as percent of FU2-43 [Rated Motor Current].

Note: Do not set FU1-22 [Starting DC Magnetizing Value] higher than Inverter Rated Current. Otherwise, Motor Overheating or Overload Trip may occur.

FU1-23: Stop Mode

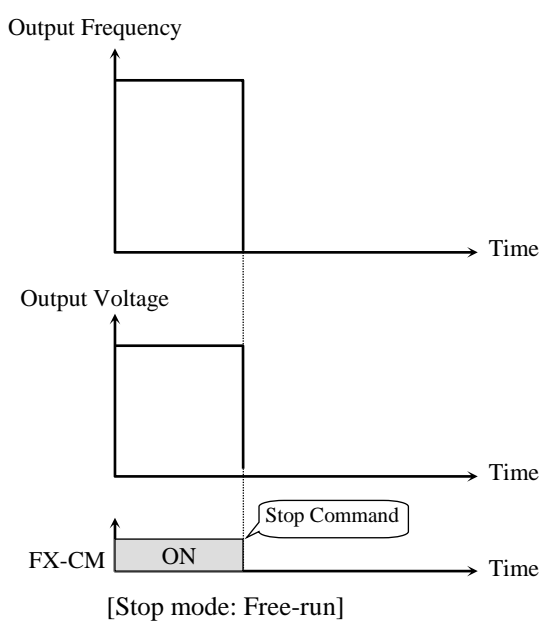
FU1▶ Stop mode
23 Decel **23** **0**

Factory Default: Decel **0**

Sets the stopping method for the inverter.

| Setting Range | Description |
|--------------------------|--|
| Decel | Inverter stops by the deceleration pattern. |
| Dc-brake | Inverter stops with DC injection braking. Inverter outputs DC voltage when the frequency reached the DC injection braking frequency during decelerating. |
| Free-run (Coast to stop) | Inverter cuts off its output immediately when the stop signal is commanded. In case of load to big inertia, the motor needs the long time to stop. |
| Flux brake | Fast stop is available by converting the regenerating energy into heat at the motor. |

Caution: Motor may be overheated due to frequent use of Flux Brake function.



FU1-24: DC Injection Braking Hold Time
FU1-25: DC Injection Braking Frequency
FU1-26: DC Injection Braking Time
FU1-27: DC Injection Braking Value

FU1▶ DcBlk time
24 0.10 sec **24** **0.10**

Factory Default: 0.10 sec **0.10**

FU1▶ DcBr freq
25 5.00 Hz **25** **5.00**

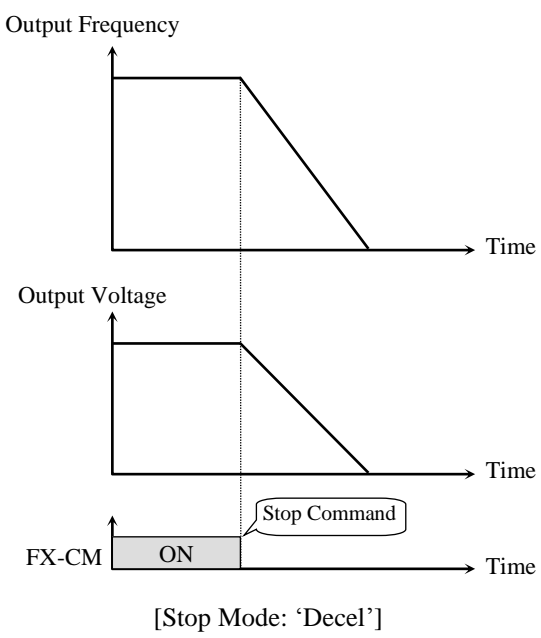
Factory Default: 5.00 Hz **5.00**

FU1▶ DcBr time
26 1.0 sec **26** **1.0**

Factory Default: 1.0 sec **1.0**

FU1▶ DcBr value
27 50 % **27** **50**

Factory Default: 50 % **50**



By introducing a DC voltage to the motor windings this function stops the motor immediately. Selecting 'DC-Brake' in FU1-23 activates FU1-24 through FU1-27.

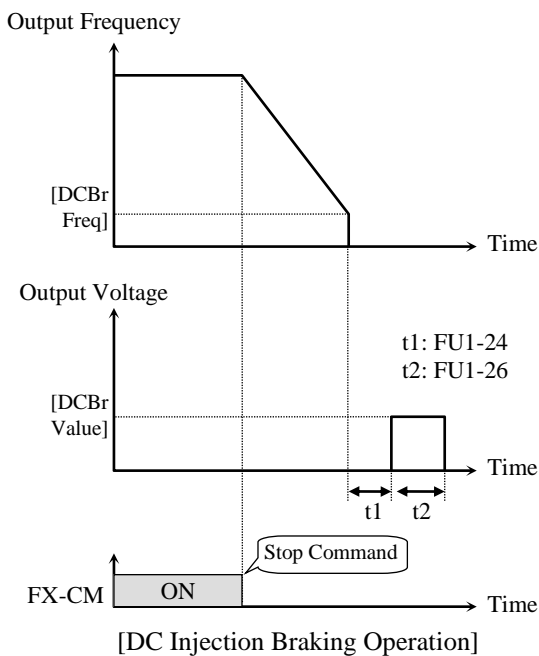
When FU1-23 [Stop mode] is set to “DC Brake”, inverter decelerates until FU1-25 [DC Injection Braking Frequency] and begins DC Braking at this frequency.

FU1-24 [DC Injection Braking Hold Time] is the inverter output blocking time before DC injection braking.

FU1-25 [DC Injection Braking Frequency] is the frequency at which the inverter starts to output DC voltage during deceleration.

FU1-26 [DC Injection Braking Time] is the time the DC current is applied to the motor.

FU1-27 [DC Injection Braking Value] is the DC voltage applied to the motor and is based on FU2-43[Rated Motor Current].



Note: Do not set the FU1-27 higher than Inverter rated current. Otherwise, it may lead to motor overheat or overload trip.

Note: Do not set FU1-25 [DC Braking Frequency] too high than its range (between 0~5Hz).

Otherwise, it may deteriorate its performance.

If the load inertia is large, Set DC brake value to high. If the apposite case, set DC brake value to low. Be careful that this function is used in the high load application like washing machine, dehydrator etc..

FU1-28: Safety Stop

| | | |
|---------------------|-----------|----------|
| FU1▶ Safety Stop | 28 | 0 |
| 28 No | | |
| Factory Default: No | | 0 |

FU2-46 [Inertia Rate] function set the Total Inertia of system in comparison with Motor Inertial itself. If the speed is same, Energy ($\text{Energy} = J * \omega^2 / 2$) that save in system is proportional to Inertia J. If J value in same deceleration time is larger, over-voltage will be occurred by regenerative voltage. If the set value is larger, deceleration ratio will become smaller.

This function is used to prevent potential danger from occurring when the whole system is stopped by power outage but the load keeps spinning due to high load inertia.

Inverter will changed the V/F ratio automatically and it can make the continuous operation when instantaneous voltage drop or instantaneous power failure is occurred in condition of Safety Stop selected. (The time differs from the system.) When momentary power failure occurs while Safety Stop is active, inverter stops the motor by deceleration. Deceleration time depends on load inertia energy.

If the load inertia rate is far different between the factory set value and an actual value, set the proper value in FU2-46 [Load Inertia] for optimum use of the Safety Stop function. When the load inertial is large, trip may occur during this function. In this case, increase the FU2-46 [Load Inertia] value little by little to find the proper value. For more stable Safety Stop Function, see FU1-90[Safety Stop Inertia Rate].

⚠ Caution: This function is effective for high load inertia.

FU1-29: Line Frequency

| | | |
|---------------------------|-----------|--------------|
| FU1▶ Line Freq | 29 | 60.00 |
| 29 60.00 Hz | | |
| Factory Default: 60.00 Hz | | 60.00 |

It sets input power frequency. Set 50 or 60Hz in FU1-29 [Line Frequency].

⚠ **Caution:** If line frequency is changed, related frequencies such as Max frequency, Base frequency are automatically changed. To set the related frequencies different to line, user should set the codes manually.

FU1-30: Maximum Frequency
FU1-31: Base Frequency
FU1-32: Starting Frequency

FU1▶ Max freq
 30 60.00 Hz **30** **60.00**

Factory Default: 60.00 Hz **60.00**

FU1▶ Base freq
 31 60.00 Hz **31** **60.00**

Factory Default: 60.00 Hz **60.00**

FU1▶ Start freq
 32 0.50 Hz **32** **0.50**

Factory Default: 0.50 Hz **0.50**

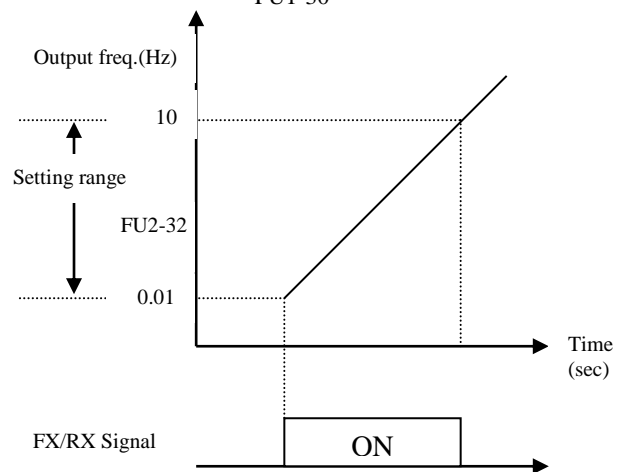
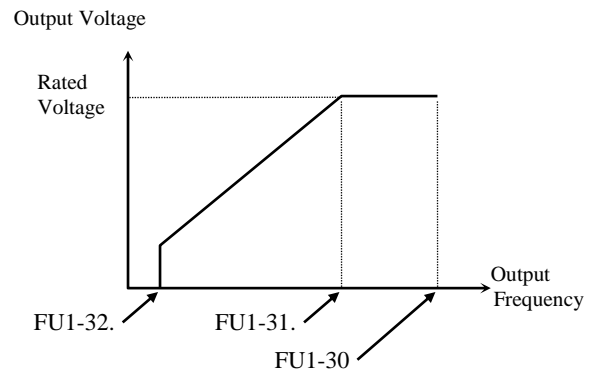
FU1-30 [Maximum Frequency] is the maximum output frequency of the inverter. Make sure this maximum frequency does not exceed the rated rotation speed of the motor.

FU1-31 [Base Frequency] is the frequency where the inverter outputs its rated voltage. Base frequency have to set in the range of maximum frequency. Output of inverter (frequency, voltage) must be set according to the rating of the motor. Rating of standard motor is 60Hz. If the motor is operated with commercial power, base frequency have to set matching with line frequency.

FU1-32 [Starting Frequency] is the frequency where the inverter starts to output its voltage. **If it is set to 5Hz, motor starts running from 5 Hz.**

⚠ **Caution:** Note that these codes setting is automatically changed when FU1-30 and FU1-31 are set before setting FU1-29 [Line Frequency].

⚠ **Caution:** Note that Overheat trip or torque shortage may occur if FU1-31 is set different to motor rated frequency.



Note: Motor starts running at 5Hz when FU2-32 is set to 5Hz.

FU1-33: Frequency Limit Selection
FU1-34: Low Limit Frequency
FU1-35: High Limit Frequency

FU1▶ Freq limit
 33 No **33** **0**

Factory Default: No **0**

FU1▶ Lim Lo Freq
 34 0.50 Hz **34** **0.50**

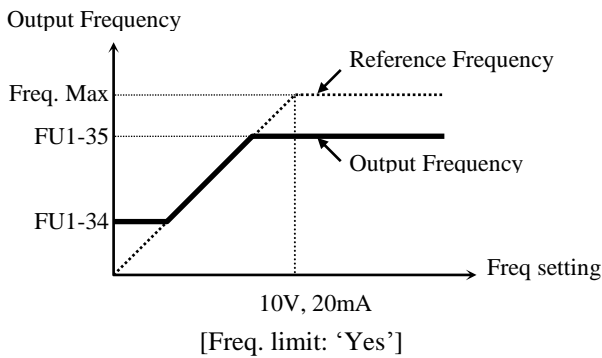
Factory Default: 0.50 Hz **0.50**

FU1▶ Lim Hi Freq
 35 60.00 Hz **35** **60.00**

Factory Default: 60.00 Hz **60.00**

FU1-33 selects the limits the inverter operating frequency. If FU1-33 is set to 'Yes', inverter operates within the upper and lower limit setting. The inverter operates at the upper or the lower limit

when the frequency reference is outside the frequency limit range.



Note: if freq set value is below freq low limit, inverter operates at the low limit.

Note: Normal Accel/Decel is performed for the range below low limit during Accel/Decel.

FU1-40: Volts/Hz Pattern

| | | |
|------------------|-----------|----------|
| FU1▶ V/F pattern | 40 | 0 |
| 40 Linear | | |

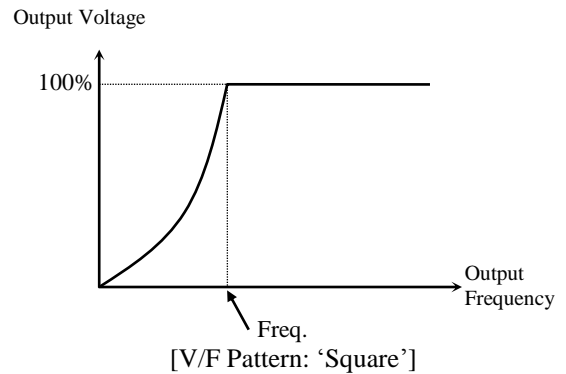
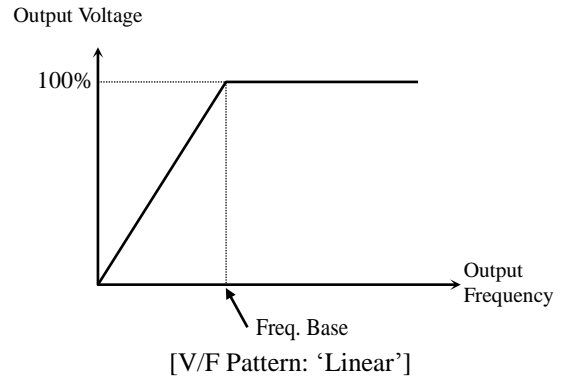
Factory Default: Linear **0**

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

[Linear] pattern is used where constant torque is required. This pattern maintains a linear volts/frequency ratio from zero to base frequency. This pattern is appropriate for constant torque applications. The performance will be improved with the help of FU2-67~69 [Torque boost].

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

[User V/F] pattern is used for special applications. Users can adjust the volts/frequency ratio according to the application. This is accomplished by setting the voltage and frequency, respectively, at four points between starting frequency and base frequency. The four points of voltage and frequency are set in FU1-41 through FU1-48.



FU1-41 ~ FU1-48: User V/F Frequency and Voltage

| | | |
|------------------|-----------|--------------|
| FU1▶ User freq 1 | 41 | 15.00 |
| 41 15.00 Hz | | |

Factory Default: 15.00 Hz **15.00**

| | | |
|------------------|-----------|-----------|
| FU1▶ User volt 1 | 42 | 25 |
| 42 25 % | | |

Factory Default: 25 % **25**

| | | |
|------------------|-----------|--------------|
| FU1▶ User freq 4 | 47 | 60.00 |
| 47 60.00 Hz | | |

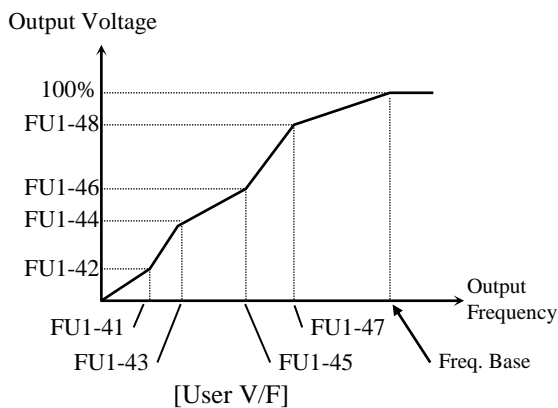
Factory Default: 60.00 Hz **60.00**

| | | |
|------------------|-----------|------------|
| FU1▶ User volt 4 | 48 | 100 |
| 48 100 % | | |

Factory Default: 100 % **100**

These functions are available only when 'User V/F' is selected in FU1-40 [V/F pattern]. Users can make the custom V/F pattern by setting four points between FU1-32 [Starting Frequency] and FU1-31 [Base Frequency].

| Description | LCD Display | Setting Range |
|--------------------|----------------|-------------------|
| No Motor Selection | No Motor Sel | 0 (No) 1 (Yes) |
| Trip Current Level | No Motor Level | 5 – 100 [%] |
| Trip Time Setting | No Motor Time | 0.5 – 10.0 [sec] |



Note: When the 'User V/F' is selected, the torque boost of FU1-67 through FU1-69 is ignored.

FU1-49: AC Input Voltage Adjustment

| | | | | |
|--------------------|----|--------|-----------|-------------|
| FU1▶ AC Input Volt | 49 | 86.4 % | 49 | 86.4 |
|--------------------|----|--------|-----------|-------------|

Factory Default: 86.4 % **86.4**

It should be set correctly when inverter input voltage and standard input power rating is far different. Otherwise, it will cause inverter damage. This set value affects inverter LV trip (low voltage trip) level. Used only when line fluctuation exceeds its permissible range or input power far different to its standard value is applied.

| Code | LCD Display | Default | Setting |
|--------|---------------|---------|--------------|
| FU1-49 | AC Input Volt | 100 [%] | 73 – 115 [%] |

Note: As soon as FU1-49 value is set through a button on the keypad, its set value is applied.

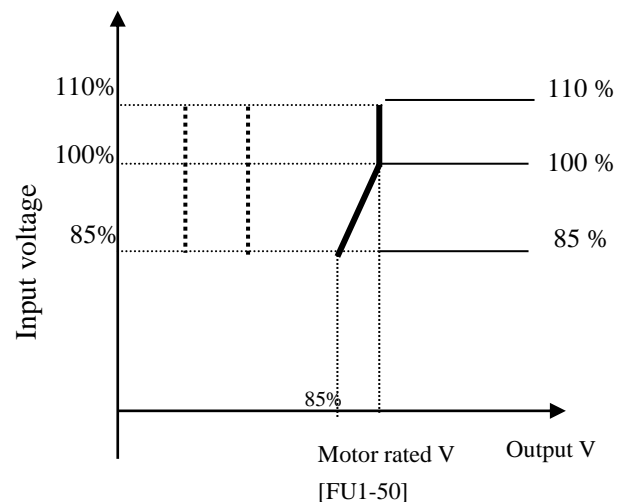
FU1-50: Motor Voltage

| | | | | |
|-----------------|----|-----|-----------|----------|
| FU1▶ Motor Volt | 50 | 0 v | 50 | 0 |
|-----------------|----|-----|-----------|----------|

Factory Default: 0 v **0**

Constant voltage output is possible regardless of input voltage fluctuation by setting this parameter.

Caution: When input voltage is less than FU1-50 [Motor rated voltage], Max output voltage cannot exceed input voltage.



FU1-51~52: Energy Save, Energy Save Level

| | | | | |
|------------------|----|------|-----------|----------|
| FU1▶ Energy save | 51 | None | 51 | 0 |
|------------------|----|------|-----------|----------|

Factory Default: 0 **0**

| | | | | |
|-------------------|----|-----|-----------|----------|
| FU1▶ Manual save% | 52 | 0 % | 52 | 0 |
|-------------------|----|-----|-----------|----------|

Factory Default: 0 % **0**

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

When Energy Save is ON, it may take longer during deceleration to stop.

| | FU1-51 setting | Description |
|---|----------------|---|
| 0 | None | Disabled (Factory setting) |
| 1 | Manual | Energy save ON by decreasing the output with the value set in FU1-52. |
| 2 | Auto | Energy save ON automatically. |

| Code | LCD | Name | Default | Range |
|--------|-------------|---------------|---------|----------|
| FU1-52 | Manual Save | Energy save % | 0 [%] | 0~30 [%] |

FU1-54: Integrating Wattmeter

- Displays both MWh and kWh in FU1-54.

Ex) 1500 kWh

FU1 ▶ KiloWattHour
54 1M 00.0kWh

- Max Cumulative value is displayed in FU1-54 as shown below. Ex) 9,999,999.9kWh

FU1 ▶ KiloWattHour
54 9999M 999.9kWh

- FU1-54 is not be reset.

⚠ Caution: FU1-54 value may differ from the actual value due to the tolerances.

FU1-55: Inverter temperature

| | | |
|-----------------|----|----|
| FU1 ▶ Inv. Temp | 55 | 44 |
| 55 | 44 | |

Factory Default: 44 **44**

IGBT's surface temperature is displayed in FU1-55.

FU1-56: Motor temperature

| | | |
|------------------|----|---|
| FU1 ▶ Motor Temp | 56 | 0 |
| 56 | 0 | |

Factory Default: 0 **0**

Motor temperature detected by external thermal sensor terminal (NT) is displayed in FU1-56.

FU1-57: No Motor Sel FU1-58: No Motor Level FU1-59: No Motor Set Time

FU1 ▶ No Motor Sel
57 YES

Factory Default: YES

FU1 ▶ NoMotorLevel
58 5 %

Factory Default: 5

FU1 ▶ NoMotorTime
59 3.0 sec

Factory Default: 3.0 sec

These functions can be used to generate Trip in the situation such that there is no actual inverter output but the Main Controller of its hardware does not recognize it. (Damage of SPS for Gate and Damage of Gate, etc.)

When FU1-57 [No Motor Sel] is set to 'Yes', the output current less than the value set in FU1-58 [No Motor Level] for a longer period of time than that set in FU1-59 [No Motor Time], a HW-Diag Trip will occur displaying the message 'No Motor Trip'. (The current level is based on the set Motor rated current.)

Trip occurs when the inverter is operated without wiring a motor.

FU1-60: Electronic Thermal (Motor i²t) Selection
FU1-61: Electronic Thermal Level for 1 Minute
FU1-62: Electronic Thermal Level for Continuous
FU1-63: Electronic Thermal Characteristic (Motor type) selection

These functions protect the motor from overheating without using external thermal relay. Inverter calculates the temperature rise in a motor based on several parameters and determines whether or not the motor is overheated from load current. Inverter will disable its output and display a trip message when the electronic thermal feature is activated.

| | | |
|-----------------------------------|-----------|----------|
| FU1▶ ETH select 60 --- Yes --- | 60 | 1 |
|-----------------------------------|-----------|----------|

| | |
|----------------------|----------|
| Factory Default: Yes | 1 |
|----------------------|----------|

This function activates the ETH parameters by setting 'Yes'. ETH level is set as the percentage of FU2-43 [Motor rated current].

| | | |
|---------------------------|-----------|------------|
| FU1▶ ETH 1min 61 150 % | 61 | 150 |
|---------------------------|-----------|------------|

| | |
|------------------------|------------|
| Factory Default: 150 % | 150 |
|------------------------|------------|

This is the reference current when the inverter determines the motor has overheated. For example, it trips in one minute when 150% of rated current of motor set in FU2-43 flows for one minute.

Note: The set value is the percentage of FU2-43 [Rated Current of Motor].

| | | |
|---------------------------|-----------|------------|
| FU1▶ ETH cont 62 120 % | 62 | 120 |
|---------------------------|-----------|------------|

| | |
|------------------------|------------|
| Factory Default: 120 % | 120 |
|------------------------|------------|

This is the current at which the motor can run continuously. Generally, this value is set to '100%', which means the motor rated current set in FU2-43. This value must be set less than FU1-61 [ETH 1min].

Note: The set value is the percentage of FU2-43 [Rated Motor Current].

| | | |
|---------------------------------|-----------|----------|
| FU1▶ Motor type 63 Self-cool | 63 | 0 |
|---------------------------------|-----------|----------|

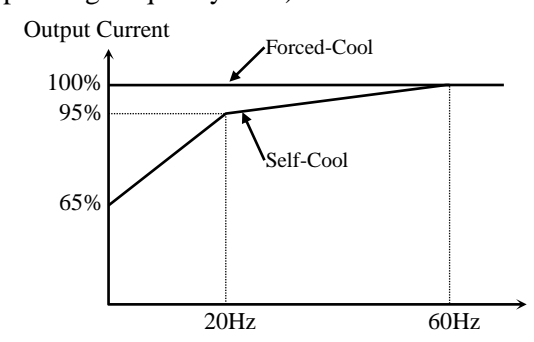
| | |
|----------------------------|----------|
| Factory Default: Self-cool | 0 |
|----------------------------|----------|

To make the ETH function (Motor i²t) work correctly, the motor cooling method must be selected correctly according to the motor.

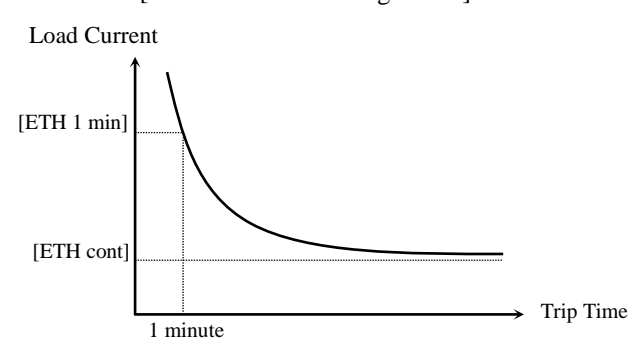
[Self-cool] is a motor that has a cooling fan connected directly to the shaft of the motor. Cooling effects of a self-cooled motor decrease when a motor is running at low speeds. The Motor is easily heated when operating at low speed, compared to the motor at high speed with the same current. The motor continuous allowable current is derated as the motor speed decreases as shown below figure.

[Forced-cool] is a motor that uses a separate motor to power a cooling fan. As the motor speed changes, the cooling effect does not change. FU1-62 [Electronic thermal level for continuous] set value is utilized regardless of operating frequency.

- ☞ When operating frequency exceeds 20Hz:
 Continuous allowable current[%] = (0.125 * Operating frequency + 92.5)
- ☞ When operating frequency not exceeds 20Hz:
 Continuous allowable current [%] = (1.5 * Operating frequency + 65)



[Load Current Derating Curve]



[Motor i^2t Characteristic Curve]

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

**FU1-64: Overload Warning Level
FU1-65: Overload Warning Time**

| | | |
|--------------------------------|-----------|------------|
| FU1▶ OL level 64 110 % | 64 | 110 |
|--------------------------------|-----------|------------|

| | |
|------------------------|------------|
| Factory Default: 110 % | 110 |
|------------------------|------------|

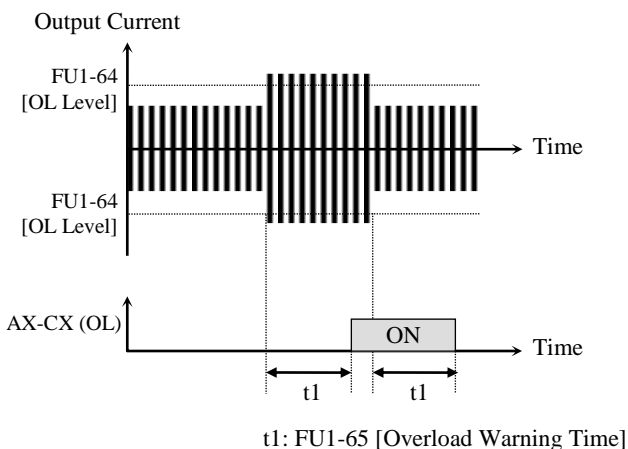
| | | |
|----------------------------------|-----------|-------------|
| FU1▶ OL time 65 10.0 sec | 65 | 10.0 |
|----------------------------------|-----------|-------------|

| | |
|---------------------------|-------------|
| Factory Default: 10.0 sec | 10.0 |
|---------------------------|-------------|

The inverter generates an alarm signal when the output current has reached the FU1-64 [Overload Warning Level] for the FU1-65 [Overload Warning Time]. The alarm signal persists for the FU1-65 even if the current has become the level below the FU1-64.

Programmable Digital Output Terminal (AX-CX) is used as the alarm signal output. To output the alarm signal, set I/O-76 [Multifunction Auxiliary Contact Output] to 'OL'. Continues the operation after output the overload alarm signal to Programmable Digital Output Terminal.

Note: FU1-64 is set as the percentage of FU2-43 [Rated Motor Current].



[Overload Warning]

**FU1-66: Overload Trip Selection
FU1-67: Overload Trip Level
FU1-68: Overload Trip Delay Time**

| | | |
|----------------------------------|-----------|----------|
| FU1▶ OLT select 66 --- No --- | 66 | 0 |
|----------------------------------|-----------|----------|

| | |
|---------------------|----------|
| Factory Default: No | 0 |
|---------------------|----------|

| | | |
|---------------------------------|-----------|------------|
| FU1▶ OLT level 67 120 % | 67 | 120 |
|---------------------------------|-----------|------------|

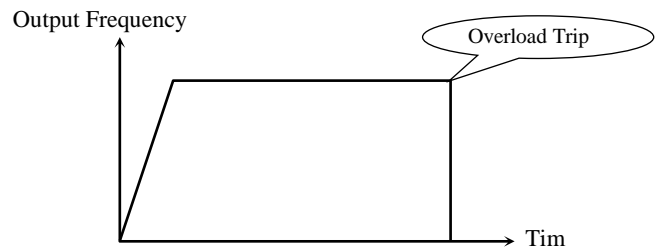
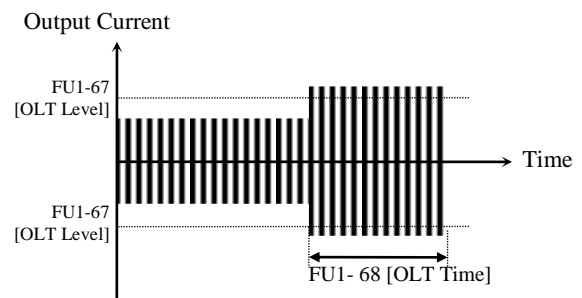
| | |
|------------------------|------------|
| Factory Default: 120 % | 120 |
|------------------------|------------|

| | | |
|-----------------------------------|-----------|-------------|
| FU1▶ OLT time 68 60.0 sec | 68 | 60.0 |
|-----------------------------------|-----------|-------------|

| | |
|---------------------------|-------------|
| Factory Default: 60.0 sec | 60.0 |
|---------------------------|-------------|

Inverter cuts off its output and displays fault message when the output current persists over the FU1-67 [Overload Trip Level] for the time of FU1-68 [Overload Trip Time]. This function protects the inverter and motor from abnormal load conditions.

Note: The set value is the percentage of FU2-43 [Rated Current of Motor].



[Overload Trip Operation]

FU1-69: Input/Output Phase Loss Protection (Bit Set)

| | | | | |
|------------------|----|-----|-----------|------------|
| FU1▶ Trip select | 69 | 100 | 69 | 100 |
|------------------|----|-----|-----------|------------|

Factory Default: 100 **100**

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

1st bit: Output phase loss protection

Enable/Disable

- 0: Disabled at Output phase loss protection.
 - 1: Enabled at Output phase loss protection.
- Inverter output is shut down and stopped.

2nd bit: Input phase loss protection

Enable/Disable

- 0: Input phase loss protection disabled.
- 1: Input phase loss protection enabled. Inverter output is shut down and stopped.

3rd bit: Direct input operation selection

Bit 3 cuts off the output when magnetic contactor from second system turns On/Off at direct input operation.

(This function is outputted to operation state at protection state but it is not outputted.)

- 0: Direct input operation protection disabled.
- 1: Direct input operation automatic protection enabled.

FU1-70~71: Stall Prevention Level

| | | | | |
|-----------------|----|----|-----------|-----------|
| FU1▶ Stall Mode | 70 | No | 70 | No |
|-----------------|----|----|-----------|-----------|

Factory Default: No **No**

| | | | | |
|------------------|----|-------|-----------|------------|
| FU1▶ Stall level | 71 | 110 % | 71 | 110 |
|------------------|----|-------|-----------|------------|

Factory Default: 100 % **110**

Set as a percentage of FU2-43 [Rated Current of Motor].

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

deceleration via bit combination.

Stall level will be automatically reduced if inverter is operated at a frequency higher than the base frequency.

Note: If the stall prevention level is above 120% of inverter rated current, the level will be limited at 120% of inverter rated current.

Note: Acceleration time may get longer due to stall prevention during Acceleration.

Note: Inverter starts deceleration when Stop command is applied while motor stall state persists.

Note: Output frequency may oscillates due to stall prevention during constant run.

Note: Deceleration time may get longer due to stall prevention during Deceleration.

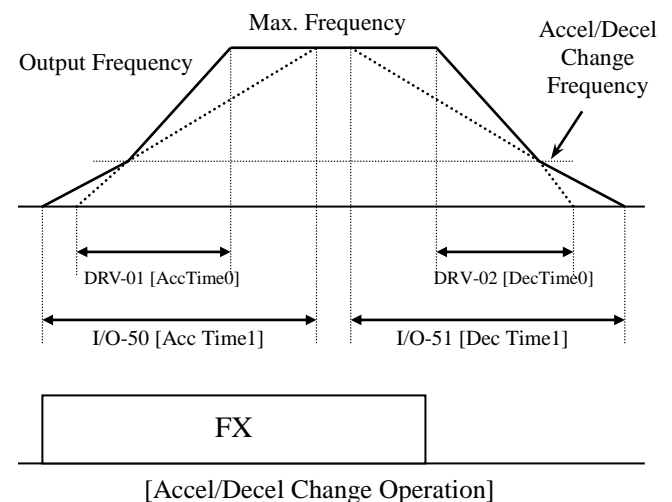
FU1-72: Accel/Decel Change Frequency

| | | | | |
|-------------------|----|---------|-----------|-------------|
| FU1▶ Acc/Dec ch F | 72 | 0.00 Hz | 72 | 0.00 |
|-------------------|----|---------|-----------|-------------|

Factory Default: 0.00 Hz **0.00**

This function is used to change Accel/Decel ramp at a certain frequency. This is useful in textile machine application. For example, when stop command is ON while inverter runs at 100Hz, inverter swiftly decelerates and changes the ramp at this frequency, leading to soft stop.

Note: If Accel/Decel change frequency is set and 'XCEL-L', XCEL-M', and XCEL-H' defined in Programmable digital terminals are ON, Multi Accel/Decel operation has the priority.



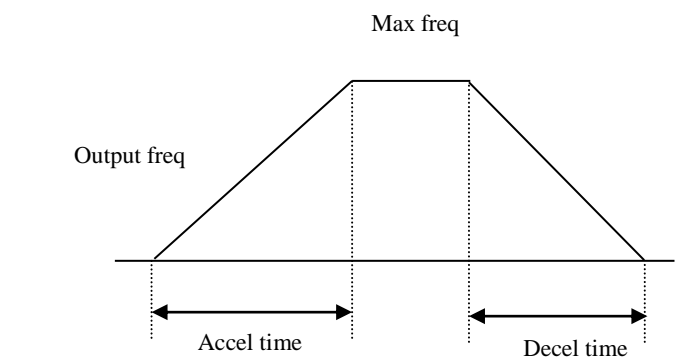
FU1-73: Reference Frequency for Accel/Decel

FU1▶ Acc/Dec freq
73 Max **73** **0**

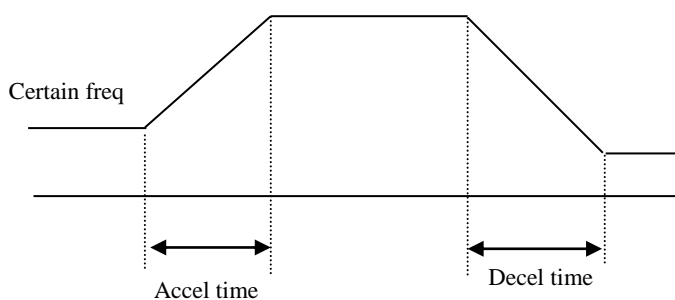
Factory Default: Max **0**

This is the reference frequency for acceleration and deceleration. If a pre-determined Accel/Decel time from a frequency to a target frequency is required, set this value to 'Delta freq'. It can changeable by application field.

| Setting Range | Description |
|----------------------------|---|
| Max freq (Factory default) | The Accel/Decel time is the time that takes to reach the maximum frequency from 0 Hz. |
| Delta freq | The Accel/Decel time is the time that takes to reach a target frequency from any frequency. |



[FU1-73: Max. Freq]
Next target freq



[FU1-73: Delta Freq]

FU1-74: Accel/Decel Time Scale

FU1▶ Time scale
74 0.1 sec **74** **1**

Factory Default: 0.1 sec **1**

This is used to change the time scale.

| Setting Range | Description |
|---------------|------------------------------------|
| 0.01 sec | The Accel/Decel time is changed by |

| | |
|---------------------------|--|
| | 10 msec. The maximum setting range is 60 seconds. |
| 0.1 sec (Factory default) | The Accel/Decel time is changed by 100 msec. The maximum setting range is 600 seconds. |
| 1 sec | The Accel/Decel time is changed by 1 sec. The maximum setting range is 6000 seconds. |

FU1-75: Up/Down Frequency Save Selection

FU1▶ UpDn Save
75 No **80** **0**

Factory Default: No **0**

FU1-76: Up/Down Frequency Save Display

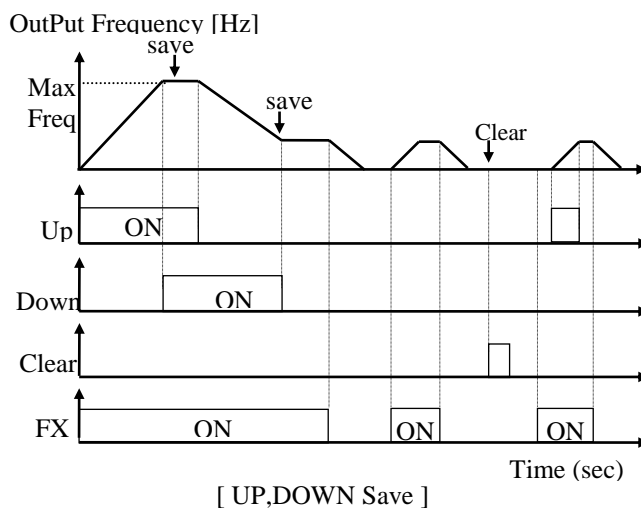
FU1▶ UpDnSave Frq
76 0.00Hz **81** **0**

Factory Default: 0.00Hz **0**

This function is used when Multi function Input terminal is set to Up/Down.

The Frequency at releasing point of Multi Function Input Terminal(Up/Down)is saved by FU1-75 and it is displayed in FU1-76.

The Frequency that is saved is reset by Multi Function Input Terminal(Clear).



FU1-80: Voltage Suppression

FU1▶ Suppression
80 Yes **80** **0**

When output current is much low (ex. no connected motor) inverter automatically suppress output voltage.If you set this parameter NO inverter not suppress output voltage.

⚠ CAUTION

If you not connect the motor or connect motor which is much lower capacity than inverter, this function is activated. So, output voltage is suppressed. If you do not want to use this function, Set this parameter [NO].

FU1-81: FAN Fault Mode

| | | |
|---------------------|-----------|----------|
| FU1▶ FAN Fault Mode | 81 | 1 |
| 81 FanWarning | | |

None[0] : Inverter not detect fan fault.
(OverHeat Trip can occur by temperature rising)

FanWarning [1] : If you set to FanWarning Inverter not block output in Fanfault state. But appear Warning Massage in the Keypad. Also If you set I/O-76~9 to FanWarning[21], Aux relay is activated in the Fanfault state.
(OverHeat Trip can occur by temperature rising)

FanTrip[2] : If fans have some problem or Fanfault state, inverter block output and occur Fan Trip.

6.3 Function 2 Group [FU2]

FU2-00: Jump to desired code #

| | |
|----------------|---|
| FU2▶ Jump code | |
| 00 | 1 |

| | | |
|------------------|---|----------|
| Factory Default: | 1 | 1 |
|------------------|---|----------|

Set the code number to which to jump within function group 2. Allows quick access to a desired parameter.

FU2-01~05: Last trip 1~5
FU2-06: Erase Trips

| | | |
|------------------|-----------|------------|
| FU2▶ Last trip-1 | 01 | n0n |
| 01 None | | |

| | | |
|------------------|------|------------|
| Factory Default: | None | n0n |
|------------------|------|------------|

| | | |
|------------------|-----------|------------|
| FU2▶ Last trip-5 | 05 | n0n |
| 05 None | | |

| | | |
|------------------|------|------------|
| Factory Default: | None | n0n |
|------------------|------|------------|

This code displays up to five previous fault (trip) status of the inverter. The lowest numbered fault such as “Last trip 1” is the most recent. Use the **PROG**, **▲** and **▼** key before pressing the **RESET** key to check the fault content(s) such as output frequency, output current, and the operation status whether the inverter was accelerating, decelerating, or in constant speed before the time of the fault occurred. Press the **ENT** key to escape. FU2-83 [Last Trip Time] is the time elapsed after last trip occurs. User can count the last trip time from this value.

| | | |
|------------------|-----------|----------|
| FU2▶ Erase trips | 06 | 0 |
| 06 --- No --- | | |

| | | |
|------------------|----|----------|
| Factory Default: | No | 0 |
|------------------|----|----------|

This function erases all fault histories of FU2-01 to FU-05 from the memory. However, FU2-83 [Last Trip Time] cannot be reset.

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

| | | |
|-----------------|-----------|------------|
| FU2▶ Dwell time | 07 | 0.0 |
| 07 0.0 sec | | |

| | | |
|------------------|---------|------------|
| Factory Default: | 0.0 sec | 0.0 |
|------------------|---------|------------|

| | | |
|-----------------|-----------|-------------|
| FU2▶ Dwell freq | 08 | 5.00 |
| 08 5.00 Hz | | |

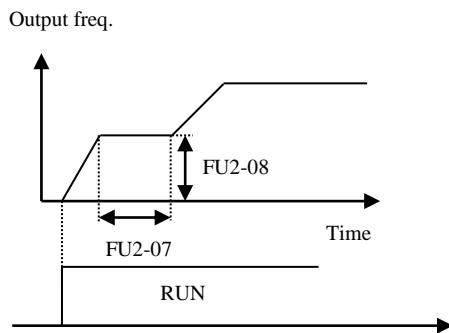
| | | |
|------------------|---------|-------------|
| Factory Default: | 5.00 Hz | 5.00 |
|------------------|---------|-------------|

Accerelation after momentary stop when starts the operation with heavy load.

Note: If the dwell time is set at ‘0’, this function is not available.

Note: Do not set the Dwell frequency above frequency command. Otherwise, it may lead to operation fault.

Note: this function is disabled in Sensorless control.



FU2-10 ~ FU2-16: Frequency Jump

| | | |
|---------------------------------|-----------|----------|
| FU2▶ Jump freq 10 --- No --- | 10 | 0 |
|---------------------------------|-----------|----------|

Factory Default: No **0**

| | | |
|-------------------------------|-----------|--------------|
| FU2▶ jump lo 1 11 10.00 Hz | 11 | 10.00 |
|-------------------------------|-----------|--------------|

Factory Default: 10.00 Hz **10.00**

| | | |
|-------------------------------|-----------|--------------|
| FU2▶ jump Hi 1 12 15.00 Hz | 12 | 15.00 |
|-------------------------------|-----------|--------------|

Factory Default: 15.00 Hz **15.00**

| | | |
|-------------------------------|-----------|--------------|
| FU2▶ jump lo 3 15 30.00 Hz | 15 | 30.00 |
|-------------------------------|-----------|--------------|

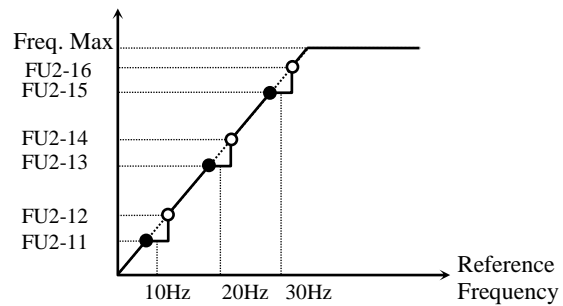
Factory Default: 30.00 Hz **30.00**

| | | |
|-------------------------------|-----------|--------------|
| FU2▶ jump Hi 3 16 35.00 Hz | 16 | 35.00 |
|-------------------------------|-----------|--------------|

Factory Default: 35.00 Hz **35.00**

Specifies whether or not certain frequencies will be jumped to help prevent undesirable resonance and vibration on the structure of the machine. Three different jump frequency ranges may be set. This avoidance of frequencies does not occur during acceleration or deceleration, only during continuous operation.

Output Frequency



[Frequency Jump]

When the reference frequency is set between the jump frequency low/high limit, the drive will run at the low limit frequency.

Note: If any 2 ranges are overlapped, the lowest limit will establish the combined low limit

Note: Jump freq. is ignored during Accel/Decel.

FU2-20: Power ON Start Selection

| | | |
|----------------------------|-----------|----------|
| FU2▶ Power-on run 20 No | 20 | 0 |
|----------------------------|-----------|----------|

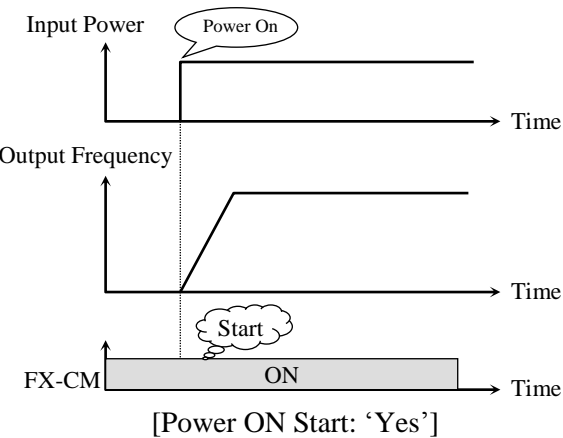
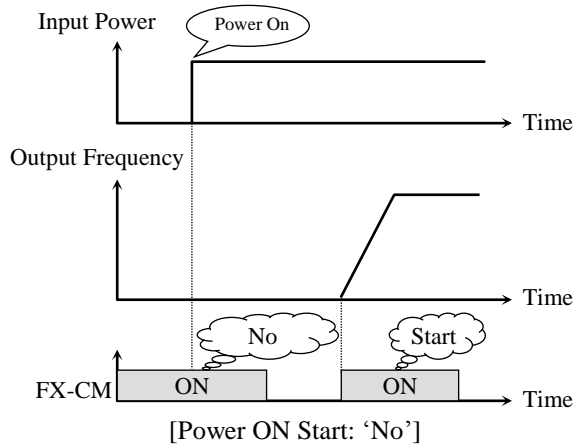
Factory Default: No **0**

Specifies whether or not the drive will automatically start when power is applied to the drive if a digital input that is programmed as a run command is on at the time power is applied. If FU2-20 is set to 'No', turn the terminal off and turn on to restart the inverter even though the FX/RX signal is ON.

If FU2-20 is set to 'Yes', the inverter will restart after power is restored. If the motor is rotating by inertia at the time power is restored, the inverter may trip. To avoid this trip, use 'Speed Search' function by setting bit 4 to '1'. If Speed search is not selected, inverter shows normal V/F pattern at acceleration.

⚠ CAUTION

Particular attention must be directed to this function as motor starts to run suddenly upon applying AC input power. Otherwise, it may result in personal damage.



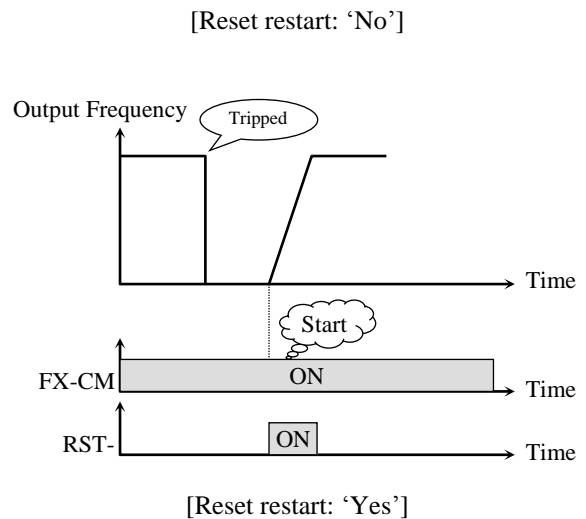
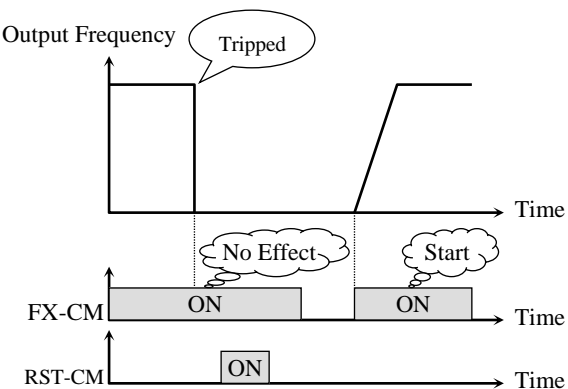
FU2-21: Restart After Fault Reset Selection

| | | |
|------------------|-----------|----------|
| FU2▶ RST restart | 21 | 0 |
| 21 No | | |

Factory Default: No **0**

If FU2-21 is set to 'No', restart the inverter by cycling the FX or RX terminal to CM terminal after the fault has been reset.

If FU2-21 is set to 'Yes', inverter will restart after the RST (reset) terminal has been reset a fault. If the motor is rotating by inertia at the time power is restored, the inverter may trip. To avoid this trip, use 'Speed Search' function by setting bit 2 to 'xx1x'.



FU2-22: Re-start Selection after Temporary Outage

| | | |
|---------------|-----------|----------|
| FU2▶ IPF Mode | 22 | 0 |
| 22 No | | |

Factory Default: No **0**

If FU2-22 is set to "Yes", it is used to start automatically the inverter without Trip while the power is restored after interrupt power fault. This function enables the inverter to Flying-start in order to reach target frequency without Trip regardless of FU1-20 Start Mode

Note that RUN command is functioned only when FU2-20 is set to Auto Restart for safety.

If FU2-22 is set to "No", turn the terminal off and turn on to restart the inverter even though the FX/RX signal is ON.

Note: Flying-start is used for Speed Search function.

FU2-23: Speed Search Type Selection

| | | |
|------------------|-----------|---------------------|
| FU2▶ Search Type | 24 | Estimated SS |
| 24 estimated SS | | |

Factory Default: estimated SS **estimated SS**

| Code | Display | Description | Default | Setting Range |
|--------|-------------|-----------------------------|--------------|---------------|
| FU2-23 | Search Type | Speed Search type selection | estimated SS | estimated SS |
| FU2-27 | Flying Perc | Speed Search Current Limit | 70 | 30 - 160 |

This function is used to permit automatic restarting after Power ON, Fault Reset and Instant Power Failure without waiting for the motor free run to stop.

FU2-27 [Flying Perc] limits the output current to set value of Flying Perc in operation of Flying start or Speed Search.

FU2-46[Load Inertia] must be set correctively. If Speed Search function is needed at FU2-20 Power On Start Selection, FU2-21 Restart After Fault Reset Selection and FU2-Retry mode, FU1-20 must be set Flying Start.

☞ Note: estimated SS does not need to set gain setting, real SS need to set the gaint setting of FU2-28 Ss_Kp and FU2-29 real Ss_Ki according to the case.

☞ Note: Speed search current limit level is set to percentage according to Motor rating current which is set in FU2-43 [Motor rating current]. It also freerun when meets stop signal on the way of speed search.

FU2-24~26: Auto Restart Tries

| | | |
|--|-----------|------------|
| FU2▶Retry Mode 24 No | 24 | No |
| Factory Default: No | | 0 |
| FU2▶Retry number 25 0 | 25 | 0 |
| Factory Default: 0 | | 0 |
| FU2▶Retry delay 26 1.0 sec | 26 | 1.0 |
| Factory Default: 1.0 sec | | 1.0 |

Allows a tripped drive to automatically reset itself after a fault thus making provisions for automatic restart. The number of retries is set in parameter FU2-25 and the delay before attempting the fault reset and restart of the drive is programmed in FU2-26. Should the reset/restart attempts exceed the number programmed in FU2-25, then the drive will latch the fault, display an appropriate fault message and prohibit an automatic restart.

If the auto restart function is used with tripped drive, FU2-24 [Retry Mode] should be set to YES.

If the trip persists after FU2-26, number of trip is increased and Auto restart function is disabled. For example, FU2-25 [Retry number] is 1 with FU2-26

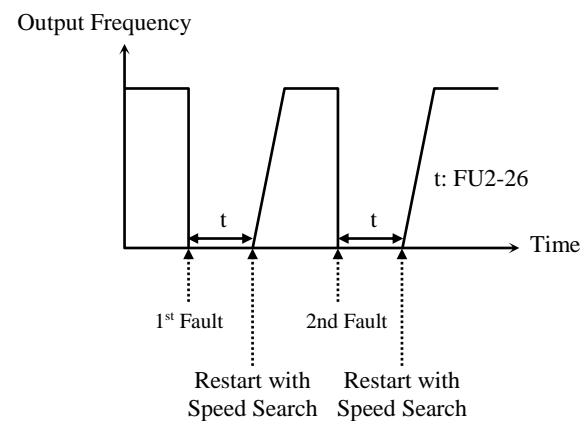
⚠ CAUTION

Particular attention must be directed to this function as motor starts to run suddenly after the fault is reset. Otherwise, it may result in personal damage.

[Retry delay] set to 10 sec, if trip persists over 10 seconds and then is reset (cleared), Auto restart is not performed. Inverter may be tripped out in Motor Free-run status when this function is issued. To avoid it, use the speed search function. Set FU2-21 to 'xx1x'. See FU2-21 ~ FU2-23. If Speed Search function is not selected, drive will be operated with normal V/F pattern.

Note: Disabled when a low voltage (LV) trip, inverter disable (BX) or Arm short occurs.

Note: Inverter decreases the retry number by one as a fault occurs. If trip does not occur after restarting for 30 seconds, the inverter increases the retry number by one and maximum number is limited by the value set in FU2-25.



⚠ CAUTION

Particular attention must be directed to this function as motor restarts automatically after the fault is reset. Otherwise, it may result in personal damage.

- FU2-40: Motor Capacity Selection
- FU2-41: Number of Motor Pole
- FU2-42: Rated Motor Slip
- FU2-43: Rated Motor Current
- FU2-44: No Load Motor Current
- FU2-45: Motor Efficiency
- FU2-46: Load Inertia

If users do not set these values, inverter will use factory default values.

| | | |
|------------------------------------|-----------|----------|
| FU2▶ Motor select 40 5.5kW | 40 | 4 |
|------------------------------------|-----------|----------|

Factory Default: 5.5 kW **4**
(This value is set automatically according to the inverter model.)

This parameter sets the motor capacity. FU2-42 [Rated Slip], FU2-43 [Rated Current], FU2-44 [No Load Current], FU2-62 [Stator Resistance], FU2-63 [Rotor Resistance], and FU2-64 [Leakage Inductance] are automatically changed according to motor capacity.
If FU2-44 [No load Curr] is incorrect, run the inverter without the load in V/F mode and check the current at the constant run state and enter this value to FU2-44 [No load Curr].

| | | |
|-------------------------------|-----------|----------|
| FU2▶ Pole number 41 4 | 41 | 4 |
|-------------------------------|-----------|----------|

Factory Default: 4 **4**

This is used to display the motor speed. If you set this value to 2, inverter will display 3600 rpm instead of 1800rpm at 60Hz output frequency. (See motor nameplate) When motor pole number is more than 4, select an inverter one rating higher than that of the motor because motor rated current is large.

| | | |
|---------------------------------|-----------|----------|
| FU2▶ Rated-Slip 42 2 Hz | 42 | 2 |
|---------------------------------|-----------|----------|

Factory Default: 2 Hz **2**
(This value is set according to the motor capacity set in FU2-40)

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

| | | |
|-----------------------------------|-----------|-------------|
| FU2▶ Rated-Curr 43 19.7 A | 43 | 19.7 |
|-----------------------------------|-----------|-------------|

Factory Default: 19.7 A **19.7**
(This value is set according to the motor capacity set in FU2-40)

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

| | | |
|-----------------------------------|-----------|------------|
| FU2▶ NoLoad-Curr 44 6.6 A | 44 | 6.6 |
|-----------------------------------|-----------|------------|

Factory Default: 6.6 A **6.6**
(This value is set according to the motor capacity set in FU2-40)

This parameter is only displayed when 'Slip Compen' is selected in FU2-60 [Control Method]. If this value is incorrect, check the current after operating in V/F mode without load connected and enter that current value.

Note: make sure to use correct value for FU2-44 [No-load Current]. Otherwise, Sensorless performance may be degraded.
Note: Preset motor parameters may differ with user motors. In this case, enter the nameplate value of your motor to the corresponding parameters. If motor rating exceeds inverter capacity, unsatisfactory control performance may result because all other control parameters follow inverter capacity.

| | | |
|--------------------------------|-----------|-----------|
| FU2▶ Inertia rate 46 0 | 46 | 10 |
|--------------------------------|-----------|-----------|

Factory Default: 0 **10**

This parameter is used for sensorless control, Minimum Accel/Decel, Optimum Accel/Decel and Speed search. For better control performance, this value must be set correctly. Install a DB unit or regenerative converter to improve the performance.

Set '0' for loads that has load inertia less than 10 times that of motor inertia.
Set '1' for loads that have load inertia about 10 times that of motor inertia.
Motor rated slip freq [Hz]=(Rated input freq. [Hz] – (Motor rpm * P/120))
P: Number of motor poles

(Ex) In the case of 60Hz, 4 pole, 1730 rpm motor
 Motor rated slip freq [Hz]= (60[Hz]-(1750[rpm] * 4/120))
 =60[Hz]-58.67[Hz]=1.33[Hz]

FU2-47: Gain for Motor Speed Display

| | | |
|----------------------------------|------------|------------|
| FU2▶ RPM factor 47 100 % | 47 | 100 |
| Factory Default: 100 % | 100 | |

This code is used to change the motor speed display to rotating speed (r/min) or mechanical speed (m/min). Speed value is displayed at DRV-09. The display is calculated by following equation.

Rotating speed (r/min) = 120 × F / P × Motor RPM
 Display Gain
 Where, F=Output frequency, P= Motor pole number

FU2-48: Carrier Frequency

| | | |
|-------------------------------------|------------|------------|
| FU2▶Carrier freq 48 5.0 kHz | 48 | 5.0 |
| Factory Default: 5.0 kHz | 5.0 | |

| Code | LCD Display | Factory Default | | Setting Range |
|--------|--------------|-----------------|---------|----------------|
| FU2-48 | Carrier freq | 0.75 ~ 2 kW | 5 [kHz] | 0.7 ~ 15 [kHz] |
| | | 30 kW | | 0.7 ~ 10 [kHz] |
| | | 37 ~ 75 kW | 4 [kHz] | 0.7 ~ 4 [kHz] |
| | | 90 ~ 280 kW | 3 [kHz] | 0.7 ~ 3 [kHz] |
| | | 315 ~ 450 kW | 2 [kHz] | 0.7 ~ 2 [kHz] |

This parameter affects the audible sound of the motor, noise emission from the inverter, inverter temperature, and leakage current. If the ambient temperature where the inverter is installed is high or other equipment may be affected by potential inverter noise, set this value lower. However, If it set lower than 1KHz, it can degrade performance. (It is recommend to use the factory default value.) If set above 10kHz, reduce the rated current by 5% per 1kHz. Setting Carrier frequency set below 1.5 [kHz] when the FU2-60 [Control mode selection] is set to Sensorless can result in reduced performance.

⚠ Caution: FU2-48 [Carrier freq] setting range varies as inverter capacity.

FU2-49: PWM Mode Selection (to reduce noise or leakage current by changing PWM method)

| | | |
|-----------------------------------|-----------|----------|
| FU2▶ PWM Select 49 Normal | 49 | 0 |
| Factory Default: Normal | 0 | |

Noise and leakage current can be reduced without changing carrier frequency by decreasing switching cycle.

When Normal is selected at motor starting, inverter changes switching frequency sequentially from low to set value . “Low Leakage” is used to reduce Leakage current by decreasing switching cycle.

| No | FU2-49 setting | Description |
|----|----------------|---|
| 0 | Normal | Operation via basic Carrier(switcing) frequency. |
| 2 | Low Leakage | Change (Carrier) switching frequency pattern to reduce leakage current. |

⚠ Caution: Reducing the Carrier frequency may increase noise.

⚠ Caution: When [Low leakage] is selected while carrier frequency is set lower than 2.0 kHz will be automatically set to 2.0kHz.

FU2-52~53: Safety Stop

| | | |
|------------------------------|------------|------------|
| FU2▶ Dec Rate 52 100 | 52 | 100 |
| Factory Default: 52 | 100 | |

Set the deceleration time at FU2-52 [Dec Rate] when Safety function is operating. Input the taking time that the motor free run to stop in operation.

Set the Output Voltage decreasing rate at FU2-53 [Safety Perc] when Safety functin is operating.

| Code | LCD Display | Factory Default | Setting Range | Description |
|--------|--------------|-----------------|-----------------|-----------------------------------|
| FU2-52 | Dec Rate | 100 [sec] | 1.0~100.0 [sec] | Safety Stop deceleration rate |
| FU2-53 | safety _perc | 21 | 2 ~ 500 | Safety Stop Ouput decreasing rate |

FU2-60: Control mode selection

| | | |
|---------------------------------|-----------|----------|
| FU2▶Control mode 60 V/F | 60 | 0 |
|---------------------------------|-----------|----------|

Factory Default: V/F **0**

Selects the control mode of the inverter

| FU2-60 setting | LCD Display | Description |
|----------------|-------------------|---|
| 0 | V/F | V/F Control |
| 1 | Slip compensation | Slip compensation |
| 2 | Sensorless | Sensorless vector control speed operation |

◆ **V/F control:**

This parameter controls the voltage/frequency ratio constant. It is recommended to use the torque boost function when a greater starting torque is required. Related function: FU2-67~69 [Torque boost].

◆ **Slip compensation:**

This function is used to maintain constant motor speed. To keep the motor speed constant, the output frequency varies within the limit of slip frequency set in FU2-42 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.

$$\text{Delta freq (Slip Comp. Freq.)} = \text{Motor Rated slip} * (\text{Output current} - \text{Motor No load current}) / (\text{Motor rated current} - \text{Motor No load current})$$

$$\text{Output freq} = \text{Reference freq} + \text{Delta freq}$$

FU2-40~46 [Motor parameters] is automatically determined by FU2-40 [Motor selection]. Most suitable motor capacity corresponding inverter capacity is set as factory setting, but the following parameters can be adjusted if necessary.

FU2-40~46 [Motor related parameters for Slip Compensation]

| Code | LCD Display | Description |
|--------|--------------|-----------------------|
| FU2-40 | Motor select | Select motor capacity |
| FU2-42 | Rated-Slip | Motor rated slip (Hz) |

| | | |
|--------|--------------|-----------------------------|
| FU2-43 | Rated-Curr | Motor rated current (rms) |
| FU2-44 | Noload-Curr | Motor no load current (rms) |
| FU2-45 | Efficiency | Motor efficiency (%) |
| FU2-46 | Inertia rate | Motor inertia rate |

Note: Incorrectly set FU2-44 [Motor No-load Current] value may weaken the Sensorless control.

◆ **Sensorless (Sensorless vector speed control) operation:**

Use it when 1) high starting torque is needed at low speed 2) load fluctuation is high 3) rapid response is needed. To use this function, set FU2-40~46 [Motor parameters] and FU2-60 [Control mode selection] properly.

If not using LG 220V/440V Class motor: Set “Yes” in FU2-61 [Auto tuning] first before using this control.

Related parameters: FU2-40~46, FU2-60, FU2-62~66

| Code | LCD display | Parameter |
|--------|-------------|--------------------|
| FU2-62 | RS | Stator resistance |
| FU2-63 | Lsigma | Leakage inductance |
| FU2-65 | SL P-gain | Sensorless P gain |
| FU2-66 | SL I-gain | Sensorless I gain |

[Guide for Optimal Use of Sensorless Vector Control]

For optimal use of the sensorless control, the following conditions should be met. If one of the following conditions is not satisfied, the inverter may malfunction due to insufficient torque, irregular rotation, or excessive motor noise. In this case, it is recommended to use V/F control.

- Use a motor capacity that is equal to or one horsepower level lower than the inverter capacity.
- Two types of motor parameters can be set for one inverter, but use only one type for sensorless control.
- Use a LG(HIGEN) 220V/440V(0.4kW~30kW) class motor. If other makers' motor or a LG 220V/380V dual rating motor is used, utilize the auto tuning feature in FU2-61 [Auto tuning] before starting.

- Set appropriate values for the electronic thermal function, the overload limit function and the stall prevention. The set values should exceed 100% of the rated motor current.
- When DRV-04 [Frequency Mode] is set to “V1”, “V1S”, “I”, or “V1+I”, wiring should be conducted to eliminate potential noise influence with the frequency reference.
- Pole number of the motor should be 2 pole, 4 pole, or 6 pole.
- The distance between the inverter and the motor should not exceed 100m (328 ft).

[Cautions on Sensorless Vector Control]

- Forced-cooling should be used for the motor when the average operating speed is under 20Hz and more than 100% load is used constantly.
- Motor may rotate 0.5% faster than the maximum speed if the motor temperature does not reach normal operating temperature.
- Utilize the auto-tuning feature when the motor reaches normal temperature (average temperature where the motor normally operates).
- Output torque may be reduced when an output filter option is used between the inverter and the motor.
- Overcurrent trip may occur if FU2-62 [Stator resistance] is set twice more than auto-tuned value.

[Detail Tuning Method for Sensorless Vector Control]

- Adjust the FU2-44 [No Load Motor Current (RMS)] value larger or smaller by 5% units if the current is larger or smaller than that of V/F control under small load.
- Adjust the FU2-42 [Rated Motor Slip] value larger or smaller by 5% units if the speed is faster or slower than that of V/F control with rated load.

FU2-61~63: Auto tuning

| | | |
|---------------------------|-----------|----------|
| FU2▶ Auto tuning 61 NO | 61 | 0 |
| Factory Default: NO | | 0 |

All of the motor parameters can be tuned by setting “YES (1)”. Auto tuning is deactivated when “No (0)” is selected.

| FU2-61 setting | LCD Display | Description |
|----------------|-------------|-------------------------------|
| 0 | No | Do not measure the parameter. |
| 1 | Yes | Measure all parameter. |

| Code | LCD Display | Description | Factory Default | Setting Range |
|--------|-------------|--------------------|-----------------|----------------|
| FU2-62 | %Rs | Stator resistance | 4 [%] | 0.01 – 20 [%] |
| FU2-63 | %Lsigma | Leakage Inductance | 12 [%] | 0.01 – 100 [%] |

The auto tuning function automatically measures the motor parameters needed for control selected in FU2-60 [Control mode] such as stator resistance, rotor resistance, leakage inductance, no-load current and Encoder feedback frequency.

The rated current, voltage, efficiency and slip described in the motor nameplate should be entered before performing auto tuning. If efficiency is not indicated on the nameplate, use the preset value.

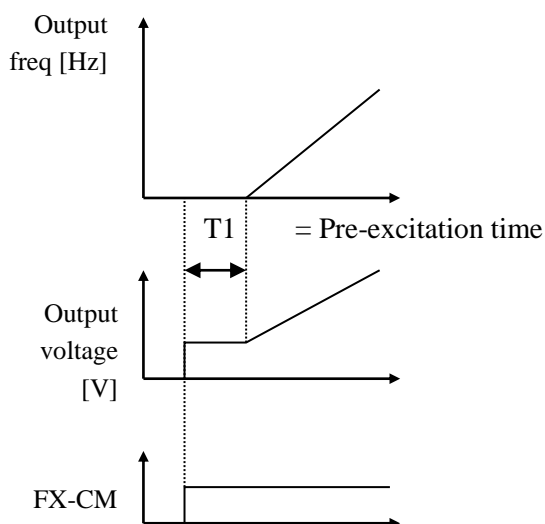
FU2-64: Pre-excitation Time

| | | |
|------------------------------|-----------|------------|
| FU2▶ PreExTime 64 1.0 sec | 64 | 1.0 |
| Factory Default: 1.0 sec | | 1.0 |

When the operation command (FWD, REV) is issued, the inverter conducts pre-exciting automatically for the time specified by this parameter.

After FU2-64 [Pre-excitation Time] elapses the inverter starts normal operation shown in the following graph.

| Code | LCD display | Default | Setting range |
|--------|-------------|---------|---------------|
| FU2-64 | PreExTime | 1 [sec] | 0 ~ 60 [sec] |



FU2-67: Manual/Auto Boost Selection
FU2-68: Torque Boost in Forward Direction
FU2-69: Torque Boost in Reverse Direction

| | | |
|-------------------------------------|-----------|----------|
| FU2▶ Torque boost 67 Manual | 67 | 0 |
|-------------------------------------|-----------|----------|

| | |
|----------------------------|----------|
| Factory Default: Manual | 0 |
|----------------------------|----------|

| | | |
|---------------------------------|-----------|------------|
| FU2▶ Fwd boost 68 2.0 % | 68 | 2.0 |
|---------------------------------|-----------|------------|

| | |
|---------------------------|------------|
| Factory Default: 2.0 % | 2.0 |
|---------------------------|------------|

| | | |
|---------------------------------|-----------|------------|
| FU2▶ Rev boost 69 2.0 % | 69 | 2.0 |
|---------------------------------|-----------|------------|

| | |
|---------------------------|------------|
| Factory Default: 2.0 % | 2.0 |
|---------------------------|------------|

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

[Manual Torque Boost]

When FU2-67 [Manual/Auto torque boost select] is set to “Manual”, FU2-68 [Forward torque boost] and FU2-69 [Reverse torque boost] set values are applied.

FU2-68 [Forward torque boost] is used for Forward rotation and FU2-69 [Reverse torque boost] is used

for Reverse rotation.

| Code | LCD display | Default | Setting range |
|--------|--------------|---------|---------------|
| FU2-67 | Torque boost | Manual | Manual/Auto |
| FU2-68 | Fwd boost | 2.0 [%] | 0~15 [%] |
| FU2-69 | Rev boost | 2.0 [%] | 0~15 [%] |

Note: The torque boost value is to be set as the percentage of inverter rated voltage.

Note: When FU1-40 [Volts/Hz Pattern] is set to ‘User V/F’, FU2-67~69 [Torque boost] is ignored.

Caution: Do not set the torque boost too high. Otherwise, motor may be over-magnetized.

Caution: Increase this value when torque shortage happens or inverter-motor wiring is distant. If this value is set too high, Overcurrent trip may be triggered.

Caution: It is possible to occur No Motor Trip in case that the torque boost value is 0 when DC Start is operated.

Caution: Output voltage can be limited to restrict the over-current which is occurred by the changes (On/Off) of output relay when output current of inverter is lower than no-load current.

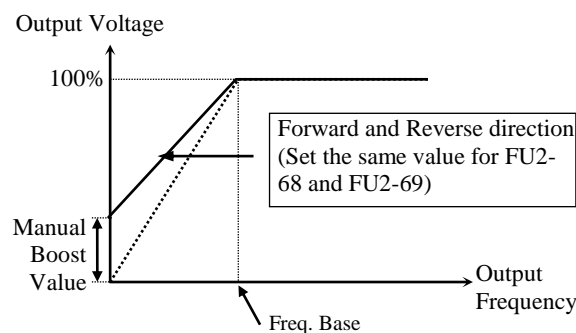
[Auto Torque Boost]

When FU2-67 [Manual/Auto torque boost select] is set to “Auto”, inverter outputs high starting torque by automatic boosting according to the load characteristic.

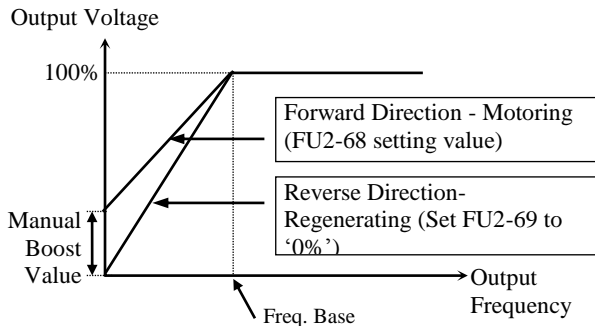
Caution: Auto torque boost is only applied to the 1st motor. Only Manual torque boost is available for the 2nd motor.

Caution: Auto torque boost is not available when FU2-60 [Control Mode] is set to ‘Sensorless’.

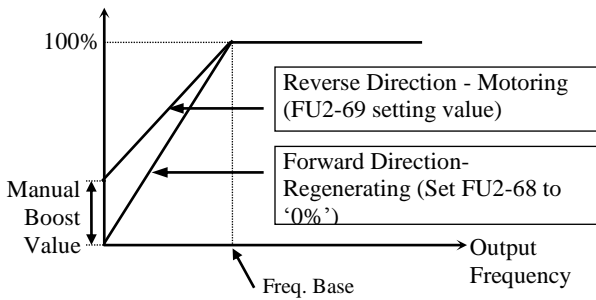
Caution: Conduct Auto tuning in FU2-61 [Auto tuning] first to use Auto torque boost effectively.



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



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



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

Related Functions: FU1-40 [Volts/Hz Pattern]
FU2-60 [Control Mode selection]

FU2-80: Power On Display

FU2▶ PowerOn disp 80 0 **80** **0**

Factory Default: 0 **0**

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

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

FU2-81: User display selection

FU2▶ User Disp 81 Voltage **81** **0**

Factory Default: 0 **0**

Related Function: DRV-11 [User display selection]
Select the display as shown below.

| Setting | FU2-81 | Name | Description |
|---------|---------|----------------|--|
| 0 | Voltage | Output voltage | Display output voltage of the inverter (Factory setting) |
| 1 | Watt | Output power | Display output power of the inverter |

Note: The displayed value of “Watt” is approximate value.

FU2-82: Software Version

FU2▶ S/W Version 82 Ver X.X **82** **X.X**

Factory Default: Ver. X.X **X.X**

Displays the software version. This will vary depending on software version integrated.

FU2-83, 84, 85: Last Trip Time, On-time, Run-time

FU2▶ LastTripTime 83 0:00:00:00:00 **83** **00.00**

Factory Default: 0:00:00:00:00 **00.00**

Displays time elapsed after last trip occurs.
Note: it is reset automatically upon trip occurs.

FU2▶ On-time 84 0:00:00:00:00 **84** **00.00**

Factory Default: 0:00:00:00:00 **00.00**

Displays time after Power is turned ON.
Note: it is not reset automatically.

FU2▶ Run-time 85 0:00:00:00:00 **85** **00.00**

Factory Default: 0:00:00:00:00 **00.00**

Displays time for inverter to be run.

Note: it is not reset automatically.
 FU2-83~85 display → X : XX : XX : XX : XX
 (Year:Month:Day:Hour:Minute)

FU2-87: PowerSet

FU2▶ PowerSet
 87 100 **87** **100**

Factory Default: 100% **100**

Used to adjust the current inverter output power and FU1-54 [KiloWattHour].
 Setting Range: 0.1 ~ 400%

FU2-90: Parameter Display

FU2▶ Para. disp
 90 Default **90** **1**

Factory Default: Default **1**

It is used to change the parameters to be viewed.

| No | FU2-90 Set data | Description |
|----|-----------------|---|
| 0 | Default | Displays basic parameters. (factory default) |
| 1 | All Para | Displays all parameters. |
| 2 | Diff Para | Displays parameters set differently from factory setting. |

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

FU2▶ Para. read
 91 --- No ---

Factory Default: No

FU2▶ Para. write
 92 --- No ---

Factory Default: No

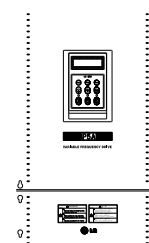
This is useful for programming multiple inverters to have same parameter settings. The LCD keypad can read (upload) the parameter settings from the inverter memory and can write (download) them to other inverters. This function is only available with LCD keypad.

Note: When FU2-91, 92 is used, motor parameters such as FU2-40~46, FU2-62~63 will be initialized.
 Perform Auto-tuning first before using Sensorless mode.

Note: Perform FU2-95 [Parameter save] first before FU2-91 [Parameter Read].

1) Set FU2-91 to “Yes” and press Enter key to read the parameters.

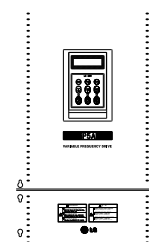
FU2▶ Para. read
 91 --- Yes ---



2) Take the LCD keypad out.



FU2▶ Para. write
 92 --- Yes ---



3) Install it to the subject inverter and set FU2-92 to “Yes” and press Enter to download the parameters.

FU2-93: Parameter Initialize

FU2▶ Para. init
 93 No **93** **0**

Factory Default: No **0**

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

Note: Set FU2-40~46 [Motor parameters] again after this function.

Note: Parameter initialize cannot clear trip information. Instead, use FU2-06 [Erase trips].

| Setting Range | Description |
|---------------|---|
| No | Displayed after initializing is finished. (Factory Default) |
| All Groups | All parameter groups initialized to factory default value. |
| DRV | Only Drive group initialized. |
| FU1 | Only Function 1 group initialized. |
| FU2 | Only Function 2 group initialized. |
| I/O | Only Input/Output group initialized. |
| EXT | Only External group initialized. |
| COM | Only Communication group initialized. |
| APP | Only Application group initialized. |

FU2-94: Parameter Lock

| | | |
|--|-----------|----------|
| FU2▶ Para. lock 94 0 | 94 | 0 |
|--|-----------|----------|

| | |
|-----------------------|----------|
| Factory Default: 0 | 0 |
|-----------------------|----------|

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

FU2-95: Parameter Save (Manual Save)

| | | |
|---|-----------|----------|
| FU2▶ Para. save 95 No | 95 | 0 |
|---|-----------|----------|

| | |
|-----------------------|----------|
| Factory Default: 0 | 0 |
|-----------------------|----------|

When FU2-95 is set to "Yes", the changed parameter value is saved into memory.

6.4 Input/Output Group [I/O]

I/O-00: Jump to Desired Code

I/O► Jump code
00 1

Factory Default: 1

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

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

This is used to adjust the analog voltage input signal when the frequency is referenced by the control terminal 'V1'. This function is applied when DRV-04 is set to 'V1', 'V1S', or 'V1+I'. User-selected Unit appears in [**]. To change the unit, more than one in APP-02 [PID operation selection] and APP-80 [Ext. PID operation selection] is set to "Yes" and then select the desired unit Percent, Bar, mBar, kPa, and Pa among in I/O-86 [V1 user unit selection].

| Code | Factory Default | Setting Range |
|--------|-----------------|-----------------|
| I/O-01 | 10 [msec] | 0~9999 [msec] |
| I/O-02 | 0 [V] | 0 ~ 12 [V] |
| I/O-03 | 0 [Hz] | 0 ~ Max Freq |
| | 0 [**] | 0 ~ 100.00 [**] |
| I/O-04 | 10 [V] | 0 ~ 12 [V] |
| I/O-05 | 60 [Hz] | 0 ~ Max Freq |
| | 0 [**] | 0 ~ 100.00 [**] |

I/O► V1 filter
01 10 ms

01 **10**

Factory Default: 10 ms

10

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

I/O► V1 volt x1
02 0.00 v

02 **0.00**

Factory Default: 0.00 v

0.00

This is the minimum voltage of the V1 input at

which inverter outputs minimum frequency.

I/O► V1 freq y1
03 0.00 Hz

03

0.00

Factory Default: 0.00 Hz

0.00

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

I/O► V1 volt x2
04 0.00 v

04

10.00

Factory Default: 10.00 v

10.00

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

I/O► V1 freq y2
05 60.00 Hz

05

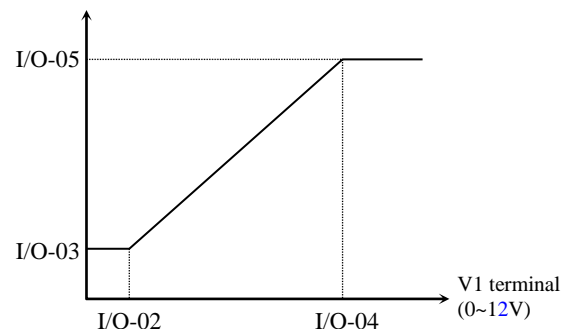
60.00

Factory Default: 60.00 Hz

60.00

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

Reference Frequency



V1 Min. Voltage V1 Max. Voltage

[Reference Frequency vs Analog Voltage Input (0 to 12V)]

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

This is used to adjust the analog current input signal when the terminal 'I' references the frequency. This function is applied when DRV-04 is set to 'I', or 'V1+I'. User-selected Unit appears in [**]. To change the unit, more than one in APP-02 [PID operation selection] and APP-80 [Ext. PID operation selection] is set to "Yes" and then select

the desired unit Percent, Bar, mBar, kPa, and Pa among in I/O-87 [I user unit selection].

| Code | Default | Setting |
|--------|-----------|-----------------|
| I/O-06 | 10 [msec] | 0 ~ 9999 [msec] |
| I/O-07 | 4 [mA] | 0 ~ 20 [mA] |
| I/O-08 | 0 [Hz] | 0 ~ Max freq |
| | 0 [**] | 0~100.00[**] |
| I/O-09 | 20[mA] | 0 ~ 20 [mA] |
| I/O-10 | 60[Hz] | 0 ~ Max freq |
| | 0 [**] | 0~100.00[**] |

I/O▶ I filter
06 10 ms

06 **10**

Factory Default: 10 ms **10**

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

I/O▶ I curr x1
07 4.00 mA

07 **4.00**

Factory Default: 4.00 mA **4.00**

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

I/O▶ I freq y1
08 0.00 Hz

08 **0.00**

Factory Default: 0.00 Hz **0.00**

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

I/O▶ I curr x2
09 20.00 mA

09 **20.00**

Factory Default: 20.00 mA **20.00**

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

I/O▶ I freq y2
10 60.00 Hz

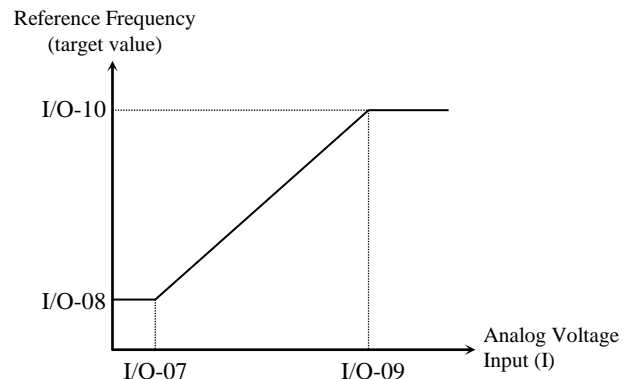
10 **60.00**

Factory Default: 60.00 Hz **60.00**

I/O▶ I freq y2
10 60.00 Hz

10 **60.00**

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



I Min. Current I Max. Current
[Reference Frequency vs Analog Current Input (0 to 20mA)]

I/O-11~16: Frequency command setting via pulse (A0/B0)

I/O▶ P pulse set
11 (A)

11 **1**

Factory Default: (A) **1**

I/O▶ P filter
12 10 msec

12 **10**

Factory Default: 10 msec **10**

-
-
-

I/O▶ P pulse x2
15 10.00 KHz

15 **10**

Factory Default: 10.0 KHz **10.0**

I/O▶ P pulse y2
16 60.00 Hz

16 **60.00**

Factory Default: 60.00 Hz **60.00**

Set the frequency command from high-level controller or motor encoder signal by input terminal A0 or B0. It is settable when DRV-04 [Frequency mode] is set to "Pulse".

User-selected Unit appears in [**]. To change the unit, more than one in APP-02 [PID operation

selection] and APP-80 [Ext. PID operation selection] is set to “Yes” and then select the desired unit Percent, Bar, mBar, kPa, and Pa among in I/O-88 [Pulse Input user unit selection].

| Code | Factory setting | Setting range |
|--------|-----------------|-------------------|
| I/O-11 | (A) | (A), (A)+(B) |
| I/O-12 | 10 [msec] | 0 ~ 9999 [msec] |
| I/O-13 | 0 [KHz] | 0 ~ 10 [KHz] |
| I/O-14 | 0 [Hz] | 0 ~ Max frequency |
| | 0 [**] | 0 ~ 100.00[**] |
| I/O-15 | 10 [KHz] | 10 ~ 100 [KHz] |
| I/O-16 | 60 [Hz] | 0 ~ Max frequency |
| | 0 [**] | 0 ~ 100.00[**] |

Note: Do not apply pulse to both A0, B0 terminals when I/O-12 set value is A.

Pulse information
5.5~30kW

| T/N | Default | Setting range |
|----------|-------------|---|
| A0 or B0 | Pulse Input | High: +3~+5V Max Low: +2V Max Max Input Freq.: 100KHz |

37~450kW

| T/N | Default | Setting range |
|----------|-------------|---|
| A0 or B0 | Pulse Input | High: +12~+15V Max Low: +2.5V Max Max Input Freq.: 100KHz |

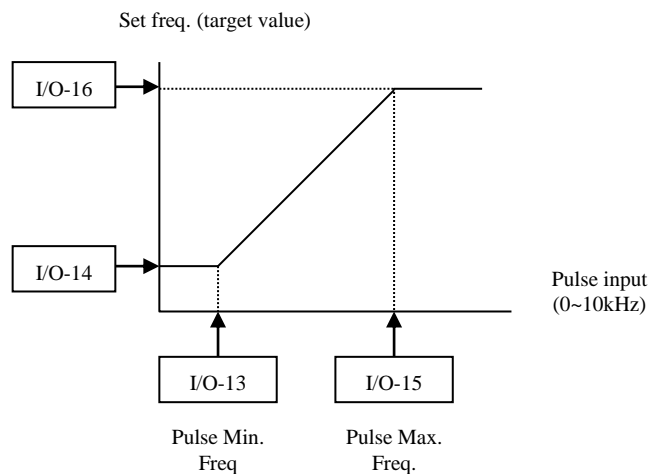
| Code | LCD Display | Description |
|--------|-------------|---|
| I/O-11 | P Pulse Set | Set one of the frequency setting input method either A or A+B. |
| I/O-12 | P filter | Set the embedded filter constant for P Pulse input. |
| I/O-13 | P Pulse x1 | Set the Minimum frequency for P Pulse input. |
| I/O-14 | P freq y1 | Set the output frequency corresponding to P Pulse input minimum frequency (I/O-13). |
| | P [**] y1 | Set the target value corresponding to P Pulse input minimum frequency (I/O-13) |
| I/O-15 | P Pulse x2 | Set the Maximum frequency for P Pulse input. |
| I/O-16 | P freq y2 | Set the output frequency corresponding to P Pulse input Maximum frequency (I/O-15). |
| | P [**] y2 | Set the target value corresponding to P Pulse input maximum frequency (I/O-15) |

Note: Increase filter time constant when the noise interference deteriorates stable operation. Increasing that makes response time slower.
Note: When setting P Pulse Input Min/Max Freq.

via motor encoder, set the value for encoder pulse as the following;

EX) To give 60Hz (1800 rpm) command from 1000 Pulse encoder

I/O-15 [Max Freq of P Pulse Input]=Rated rpm/60 sec * Number of Encoder Pulse
= 1800 [rpm]/60[sec]*1000=3000Hz,
Therefore, set I/O-15 to 3.0KHz



I/O-17, 18, 19: Criteria for Analog Input Signal Loss

| | | |
|---------------------------------|-----------|------------|
| I/O▶ Wire broken 17 None | 17 | 0 |
| Factory Default: None | | 0 |
| I/O▶ Lost command 18 None | 18 | 0 |
| Factory Default: None | | 0 |
| I/O▶ Time out 19 1.0 sec | 19 | 1.0 |
| Factory Default: 1.0 sec | | 1.0 |

This is to set the criteria for analog input signal loss when DRV-04 [Frequency Mode] is set to ‘V1’, ‘V1S’ ‘I’, ‘V1+I’ or ‘Pulse’. Analog input loss will be applied according to the I-O-17 setting [wire broken]. However, for “V1+I”, main speed is V1 so inverter does not respond when I signal is missing. Following table shows the setting value.

| Setting Range | Description |
|---------------|--|
| None | Disabled. (Factory Default) |
| half of x1 | The inverter determines that the frequency reference is lost when the analog input signal is less than half of the minimum set value (I/O-02, I/O-07, I/O-13). |
| below x1 | The inverter determines that the frequency reference is lost when the analog input signal is less than the minimum set value (I/O-02 or I/O-07, I/O-13). |

I/O-18 [Lost Command] selects the operation after determining the loss of frequency reference. The following table shows the selection in I/O-18.

| Setting Range | Description |
|---------------|---|
| None | Continuous operating after loss of frequency reference. |
| FreeRun | Inverter cuts off its output after determining loss of frequency reference. |
| Stop | Inverter stops by its Decel pattern and Decel time after determining loss of frequency reference. |
| Protection | 'Lost Cmd Trip' will be occurred when the frequency command is lost. |
| Preset | Inverter run at the preset frequency set in I/O-99, when the frequency command is lost. |

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

| Setting Range | Description |
|---------------|-----------------------------------|
| LOV | Loss of analog input signal, V1 |
| LOI | Loss of analog input signal, I |
| LOA | Loss of pulse reference frequency |

I/O-19 [Time out] sets the waiting time before determining the loss of reference signal. Inverter waits to determine the loss of a reference signal until time-out.

| Code | Factory setting | Setting range |
|--------|-----------------|-----------------|
| I/O-19 | 1.0 [sec] | 0.1 ~ 120 [sec] |

Reference frequency can be viewed as Rpm when DRV-16 [Hz/Rpm Display] is set to "rpm".

I/O-20~27: Programmable Digital Input Terminal 'M1, M2, M3', 'M4', 'M5', 'M6', 'M7', 'M8' Define

| | | |
|------------------------------|-----------|----------|
| I/O▶ M1 define 20 Speed-L | 20 | 0 |
| Factory Default: Speed-L | | 0 |
| I/O▶ M2 define 21 Speed-M | 21 | 1 |
| Factory Default: Speed-M | | 1 |
| I/O▶ M3 define 22 Speed-H | 22 | 2 |
| Factory Default: Speed-H | | 2 |

Programmable Digital input terminals can be defined for many different applications. The following table shows the various definitions for them.

| Code | LCD display | Default | Setting |
|--------|-------------|---------|---------------------|
| I/O-20 | M1 define | SPEED-L | See the table below |
| I/O-21 | M2 define | SPEED-M | |
| I/O-22 | M3 define | SPEED-H | |
| I/O-23 | M4 define | Reset | |
| I/O-24 | M5 define | BX | |
| I/O-25 | M6 define | JOG | |
| I/O-26 | M7 define | FX | |
| I/O-27 | M8 define | RX | |

Note: BX is Emergency Stop key. Parameter setting is disabled when BX is ON.

Selection of M1, M2, M3 M4, M5, M6, M7, M8 in I/O-20~27

| Setting Range | Description |
|---------------|---------------------------------------|
| Speed-L | Multi-step speed - Low |
| Speed-M | Multi-step speed - Mid |
| Speed-H | Multi-step speed - High |
| XCEL-L | Multi-accel/decel - Low |
| XCEL-M | Multi-accel/decel - Mid |
| XCEL-H | Multi-accel/decel - High |
| Dc-brake | DC injection braking during stop |
| 2nd Func | Exchange to 2 nd functions |
| Exchange | Exchange to commercial line |
| -Reserved- | Reserved for future use |
| Up | Up drive |
| Down | Down drive |
| 3-Wire | 3 wire operation |
| Ext Trip | External trip |

| Setting Range | Description |
|---------------|--|
| -Reserved- | Reserved for future use |
| iTerm Clear | Used for PID control |
| Open-loop | Exchange between PID mode and V/F mode |
| LOC/REM | Exchange the operation method |
| Analog hold | Hold the analog command frequency input signal |
| XCEL stop | Disable Accel and Decel |
| P Gain2 | Used for PID P2 gain control |
| -Reserved- | Reserved for future use |
| Interlock1 | Used for MMC operation |
| Interlock2 | |
| Interlock3 | |
| Interlock4 | |
| Speed-X | Additional Step frequency selection |
| Reset | Reset |
| BX | BX (Emergency stop) |
| JOG | Jog |
| FX | Forward Run/Stop |
| RX | Reverse Run/Stop |
| Ana Change | Analog input Switch-over |
| Pre excite | Pre excitation. |
| Ext.PID Run | External PID Run/Stop |
| Up/Dn Clr | Clear Up/Down save |

[Speed-L, Speed-M, Speed-H, Speed-X]

By setting M1, M2

, M3 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-27, I/O-30~IO/42 [Multi-step operation].

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

By setting M1, M2 and M3 terminals to 'XCEL-L', 'XCEL-M' and 'XCEL-H' respectively, up to 8 different Accel and Decel times can be used. The Accel/Decel time is set in DRV-01 ~ DRV-02 and I/O-50 ~ I/O-63.

[Dc-brake]

DC Injection Braking can be activated during inverter stop by configuring one of the Programmable digital input terminals (M1-M8) to 'Dc-bake'. The preset DC-start value in FU1-22 is applied. To activate the DC Injection Braking, close the contact of the assigned terminal while the inverter is stopped.

[2nd function]

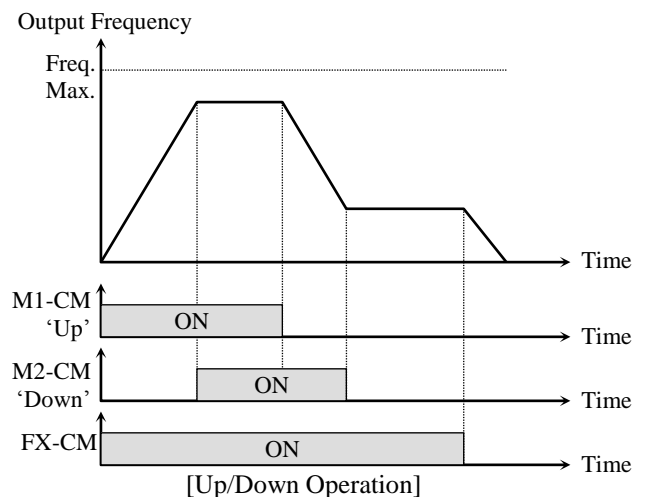
2nd function can be activated during inverter stop by configuring one of the Programmable digital input terminals (M1-M8) to '2nd func'. See APP 20~29 for details.

[EXCHANGE]

Exchange is used to bypass the motor from the inverter line to commercial power or the opposite. To bypass the motor to commercial line, set the 'Exchange' function in one of the Programmable digital input terminal in I/O-20~27 and 'INV line', 'COMM line' function in Programmable digital output terminal (AX-CX) in I/O-76~79.

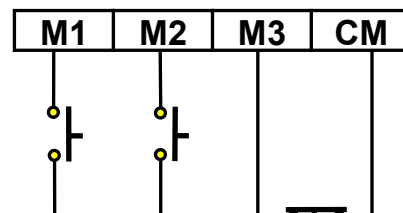
[Up, Down]

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. Setting limit is Maximum frequency.

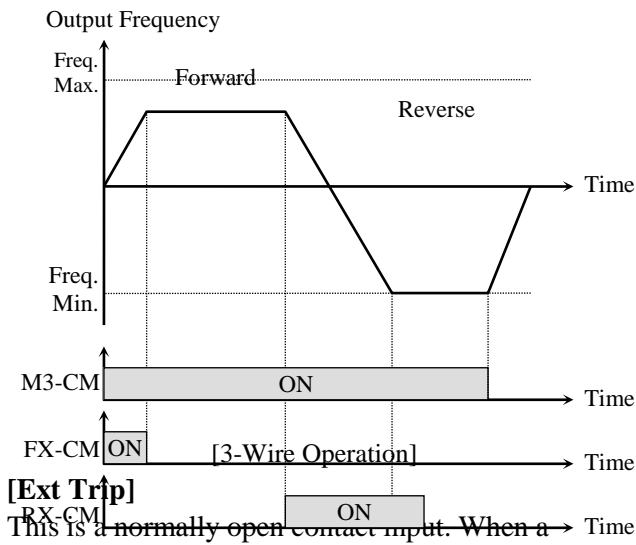


[3-Wire]

This function is for 3-wire start/stop control. This function is mainly used with a momentary push button to hold the current frequency output during acceleration or deceleration. (Ex. Set M1 terminal to FX, M2 terminal to RX, M3 terminal to 3-Wire.)



[Wiring for 3-Wire Operation, M3 set to '3-Wire']



[Ext Trip]

This is a normally open contact input. When a terminal set to 'Ext Trip' is ON, inverter cuts off its output and displays the fault. This can be used as an external latch trip. The logic is programmable in I/O-94 [Normal Open/Normal Close select].

[iTerm Clear]

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

[Open-loop]

This is used to exchange the control mode of inverter from PID mode (Close Loop) to V/F mode (Open Loop).

DRV-03 [Drive Mode] and DRV-04 [Frequency Mode] are applied when the mode has been changed.

Note: Only used when the inverter is stopped.

[LOC/REM]

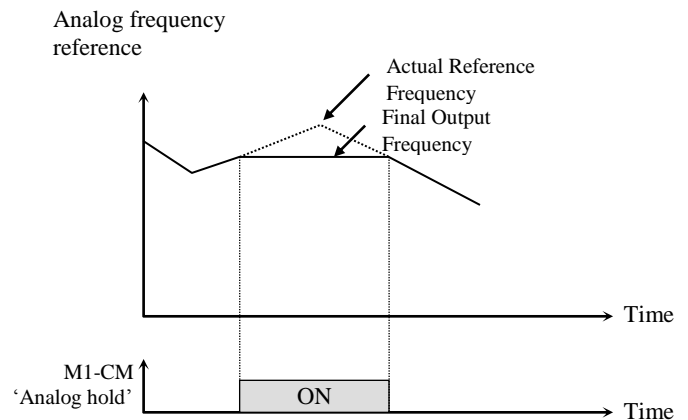
When an option board or embedded RS485 communication is used for the frequency setting and the run/stop command setting, and the setting is ON, the inverter operation can be changed to Option (or RS485) operation without changing parameters.

When 'LOC/REM' is inputted, it operates according to DRV-22[LocalRemKey].

Please refer to details for DRV-22 function.

[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. When the terminal is OFF, the actual frequency reference will be applied. This function is useful when a system requires constant speed after acceleration or freq reference is not necessary to be changed.



[Analog hold Operation]

[XCEL stop]

Inverter stops accelerating and decelerating when this terminal is ON.

[P Gain 2]

This function is used to change P-Gain during PID operation. When this terminal is ON, PID controller changes P-Gain to PID P2-Gain.

Refer to PID Control Block Diagram.

[Interlock 1, 2, 3, 4]

This function is used for MMC operation. When MMC is selected in APP-01 and interlock is set, M1, M2, M3 and M4 are automatically assigned for Interlock function. Therefore, these terminals cannot be used for setting other functions when interlock is active. Use M5, M6, M7, and M8 for other function setting. Refer to MMC operation.

[Reset]

This function is set to use it as fault reset terminal when ON.

[BX]

This function is set to use it as Emergency Stop

terminal when ON.

[JOG]

This function is set to use Jog operation terminal when ON.

[FX/RX]

This function is set to issue Forward/Reverse Run.

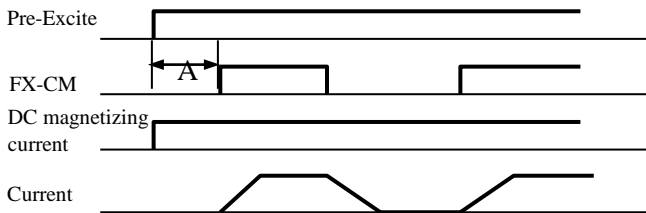
[Ana Change]

Inverter changes its frequency reference source from V1 to I when ON.

Ex) In the case of V1+I operation, V1 is the default setting and it is changed to I operation when the terminal is turned ON.

[Pre excite]

This setting switches the inverter to pre-excitation state. This function applies the DC magnetizing current to a motor to build the flux in Sensorless control. When the operation command is set to ON, the state changes from pre-excitation to normal.



A: Pre-exciting

[Ext.PID Run]

External PID controller begins operation when the defined terminal is turned ON. This can be operated regardless of inverter reference command or used in conjunction with internal PID operation. Refer to External PID operation for details

[Up/Dn Clr (Clear Up/Down save)]

This function is used for Reset (Clear) the saved frequency when FU1-80 (Up/Dn save) is set.

| I/O-28: Terminal Input Status | | | |
|--------------------------------------|----|------------|------|
| I/O▶ In status | 28 | 0000000000 | 0000 |
| Factory Default: | | 0000000000 | 0000 |

This code displays the input status of control terminals M1-M8, P4-P6. P4, P5, P6 will be only

displayed and used when the sub-board is installed.

[LCD Keypad Display]

| Input T/M | P6 | P5 | P4 | M8 | M7 | M6 | M5 | M4 | M3 | M2 | M1 |
|------------|--------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| | 10 bit | 9 bit | 8 bit | 7 bit | 6 bit | 5 bit | 4 bit | 3 bit | 2 bit | 1 bit | 0 bit |
| OFF status | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| ON status | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |

I/O-29: Programmable Digital Input Terminal filter time constant

| | | | | |
|------------------|----|-------|----|----|
| I/O▶ Ti Filt Num | 29 | 15 ms | 29 | 15 |
|------------------|----|-------|----|----|

| | | |
|------------------|-------|----|
| Factory Default: | 15 ms | 15 |
|------------------|-------|----|

Set the responsiveness of input terminals M1-M8 and P4-P6. It is effective when noise level is high. Increasing this will make response time slower and decreasing faster.

| Code | LCD display | Default | Setting range |
|--------|-------------|---------|---------------|
| I/O-29 | Ti Filt Num | 15 [ms] | 2~1000 [ms] |

Note: Set it higher than 100msec at Inverter-commercial line exchange operation. This will be useful to prevent chattering and momentary malfunction.

I/O-30: Jog Frequency

| | | | | |
|---------------|----|----------|----|-------|
| I/O▶ Jog freq | 30 | 10.00 Hz | 30 | 10.00 |
|---------------|----|----------|----|-------|

| | | |
|------------------|----------|-------|
| Factory Default: | 10.00 Hz | 10.00 |
|------------------|----------|-------|

This code sets the jog frequency. See I/O-31~42, DRV-05~ 07 for details.

I/O-31~42: Step Frequency 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15

| | | | | |
|------------------|----|----------|----|-------|
| I/O▶ Step freq-4 | 31 | 40.00 Hz | 31 | 40.00 |
|------------------|----|----------|----|-------|

| | | |
|------------------|----------|-------|
| Factory Default: | 40.00 Hz | 40.00 |
|------------------|----------|-------|

| | | | | |
|------------------|----|----------|----|-------|
| I/O▶ Step freq-5 | 32 | 50.00 Hz | 32 | 50.00 |
|------------------|----|----------|----|-------|

| | | |
|------------------|----------|-------|
| Factory Default: | 50.00 Hz | 50.00 |
|------------------|----------|-------|

The step frequencies are determined by the combination of M1, M2 and M3 terminals as shown in the following table.

| Code | Step speed Frequency | Spd-X | Spd-H | Spd-M | Spd-L | JOG |
|--------|----------------------|-------|-------|-------|-------|-----|
| DRV-00 | S. Freq-0 (Zero Spd) | 0 | 0 | 0 | 0 | 0 |
| I/O-30 | Jog Freq | X | X | X | X | 1 |
| DRV-05 | S. Freq-1 (Spd 1) | 0 | 0 | 0 | 1 | 0 |
| DRV-06 | S. Freq-2 (Spd 2) | 0 | 0 | 1 | 0 | 0 |
| DRV-07 | S. Freq-3 (Spd-3) | 0 | 0 | 1 | 1 | 0 |
| I/O-31 | S. Freq-4 (Spd-4) | 0 | 1 | 0 | 0 | 0 |
| I/O-32 | S. Freq-5 (Spd-5) | 0 | 1 | 0 | 1 | 0 |
| I/O-33 | S. Freq-6 (Spd-6) | 0 | 1 | 1 | 0 | 0 |
| I/O-34 | S. Freq-7 (Spd-7) | 0 | 1 | 1 | 1 | 0 |
| I/O-35 | S. Freq-8 (Spd-8) | 1 | 0 | 0 | 0 | 0 |
| I/O-36 | S. Freq-9 (Spd-9) | 1 | 0 | 0 | 1 | 0 |
| I/O-37 | S. Freq-10 (Spd-10) | 1 | 0 | 1 | 0 | 0 |
| I/O-38 | S. Freq-11 (Spd-11) | 1 | 0 | 1 | 1 | 0 |
| I/O-39 | S. Freq-12 (Spd-12) | 1 | 1 | 0 | 0 | 0 |
| I/O-40 | S. Freq-13 (Spd-13) | 1 | 1 | 0 | 1 | 0 |
| I/O-41 | S. Freq-14 (Spd-14) | 1 | 1 | 1 | 0 | 0 |
| I/O-42 | S. Freq-15 (Spd-15) | 1 | 1 | 1 | 1 | 0 |

0: OFF, 1: ON, X: Ignored (Jog first)

Speed-L: Lowest bit in Multi-Step speed input

Speed-M: Middle bit in Multi-Step speed input

Speed-H: High bit in Multi-Step speed input

Speed-X: Highest bit in Multi-Step speed input

Note 1: 'Speed 0' is set in DRV-04.

Note 2: If the 'Jog' terminal is ON, inverter operates at Jog frequency regardless of other terminal inputs.

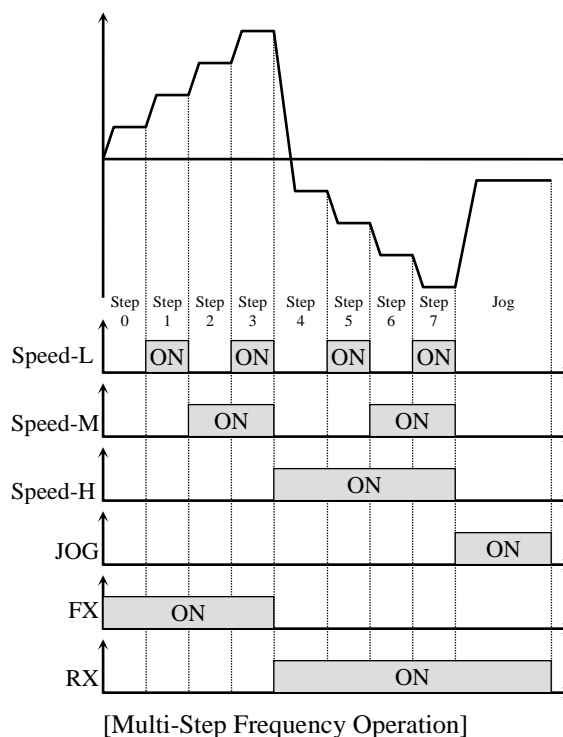
| DRV-04 Data | DRV-00 Speed 0 | Freq source |
|-------------|--------------------|--------------------|
| Keypad-1 | Digital Freq Ref | Keypad |
| Keypad-2 | Digital Freq Ref | Keypad |
| V1 | Analog Freq Ref. | Terminal |
| V1S | Analog Freq Ref. | Terminal |
| I | Analog Freq Ref. | Terminal |
| V1+I | Analog Freq Ref. | Terminal |
| Pulse | Pulse Freq Ref. | Terminal |
| Int. 485 | Communication | Terminal |
| Ext. PID | Ext. PID Freq Ref. | Keypad or Terminal |

♣ Setting example

M1=Speed-L, M2=Speed-M, M3=Speed-H,
M4=Jog

M5=BX, M7=FX, M8=RX

Step speed is to be set in DRV-05~06, I/O-31~42



I/O-50~63: 1st~7th Accel/Decel Time

I/O ▶ Acc time-1
50 20.0 sec

50

20.0

Factory Default: 20.0 sec

20.0

I/O ▶ Dec time-1
51 20.0 sec

51

20.0

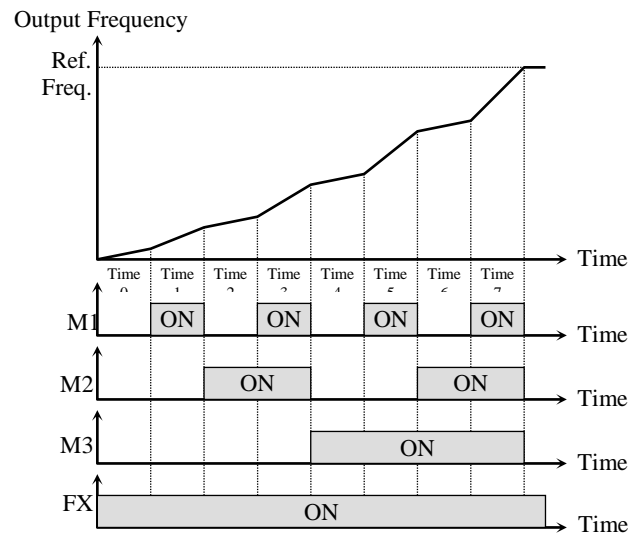
Factory Default: 20.0 sec

20.0

The Accel/Decel time is determined by the combination of M1, M2 and M3 terminals as shown in the following table.

| Parameter Code | Accel/Decel Time | XCEL -H (M3) | XCEL -M (M2) | XCEL -L (M1) | Factory default |
|----------------|------------------|--------------|--------------|--------------|-----------------|
| DRV-01 | Accel Time-0 | 0 | 0 | 0 | 10 sec |
| DRV-02 | Decel Time-0 | | | | 20 sec |
| I/O-50 | Accel Time-1 | 0 | 0 | 1 | 20 sec |
| I/O-51 | Decel Time-1 | | | | 20 sec |
| I/O-52 | Accel Time-2 | 0 | 1 | 0 | 30 sec |
| I/O-53 | Decel Time-2 | | | | 30 sec |
| I/O-54 | Accel Time-3 | 0 | 1 | 1 | 40 sec |
| I/O-55 | Decel Time-3 | | | | 40 sec |
| I/O-56 | Accel Time-4 | 1 | 0 | 0 | 50 sec |
| I/O-57 | Decel Time-4 | | | | 50 sec |
| I/O-58 | Accel Time-5 | 1 | 0 | 1 | 40 sec |
| I/O-59 | Decel Time-5 | | | | 40 sec |
| I/O-60 | Accel Time-6 | 1 | 1 | 0 | 30 sec |
| I/O-61 | Decel Time-6 | | | | 30 sec |
| I/O-62 | Accel Time-7 | 1 | 1 | 1 | 20 sec |
| I/O-63 | Decel Time-7 | | | | 20 sec |

0: OFF, 1: ON



[Multi-Accel/Decel Time Operation]

I/O-70~73: S0, S1 terminal select

I/O▶ S0 mode
70 Frequency **70** **0**

Factory Default: Frequency **0**

I/O▶ S0 adjust
71 100 % **71** **100**

Factory Default: 100 % **100**

I/O▶ S1 mode
72 Voltage **72** **0**

Factory Default: Voltage **2**

I/O▶ S1 adjust
73 100 % **73** **100**

Factory Default: 100 % **100**

Analog meter displays the inverter output Frequency, Current, Voltage, DC link voltage and External PID output with pulse signals on the S0, S1 terminal. The average output voltage range is 0V to 10V for S0 and S1 terminals. I/O-71, 73 are used to adjust the S0, S1 output gain value.

| Code | LCD Display | Description | Factory Default | Setting Range |
|--------|-------------|------------------------|-----------------|---|
| I/O-70 | S0 mode | Select S0 terminal | 0 (Freq.) | 0 (Frequency) 1 (Current) 2 (Voltage) 3 (DC link Vtg) 4 (Ext.PID Out) |
| I/O-71 | S0 adjust | S0 Output Voltage Gain | 100 [%] | 0 ~ 200 [%] |
| I/O-72 | S1 mode | Select S1 terminal | 2 (Vol.) | 0 (Frequency) 1 (Current) 2 (Voltage) 3 (DC link Vtg) 4 (Ext.PID Out) |
| I/O-73 | S1 adjust | S1 Output Voltage Gain | 100 [%] | 0 ~ 200 [%] |

[Frequency]

S0/S1 terminal outputs inverter output frequency. The output value is determined by,
 $S0/S1 \text{ Output Voltage} = (\text{Output freq.} / \text{Max. freq.}) \times 10V \times S0,S1 \text{ output gain (IO-71 or 73)} / 100$

[Current]

S0/S1 terminal outputs inverter output current. The output value is determined by,
 $S0/S1 \text{ Output Voltage} = (\text{Output current} / \text{Rated current}) \times 10V \times S0,S1 \text{ output gain (IO-71 or 73)} / 100$

[Voltage]

S0/S1 terminal outputs inverter output voltage. The output value is determined by,
 $S0/S1 \text{ Output Voltage} = (\text{Output voltage} / \text{Max. output voltage}) \times 10V \times S0,S1 \text{ output gain (IO-71 or 73)} / 100$

Note: Maximum output voltage for 200V class is 220V and for 400V class is 440V.

[DC link vtg]

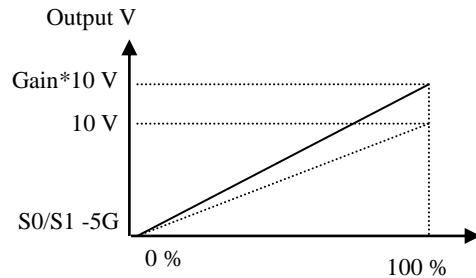
S0/S1 terminal outputs the DC link voltage of inverter. The output value is determined by,
 $S0/S1 \text{ Output Voltage} = (\text{DC link voltage} / \text{Max. DC link voltage}) \times 10V \times S0,S1 \text{ output gain (IO-71 or 73)} / 100$

Note: Maximum DC Link Voltage for 200V class is 410V and for 400V class is 820V.

[Ext.PID Out]

S0/S1 terminal outputs External PID output. The output value is determined by,
 $S0/S1 \text{ output voltage} = (\text{External PID output} / 10,000) \times 10V \times S0,S1 \text{ output gain (I/O-71,73)} / 100$

☞ Please refer to Chapter 2 Specification for rated current of motor.



I/O-74: FDT (Frequency Detection) Level I/O-75: FDT Bandwidth

| | | |
|---------------|-----------|--------------|
| I/O▶ FDT freq | 74 | 30.00 |
| 74 30.00 Hz | | |

| | |
|---------------------------|--------------|
| Factory Default: 30.00 Hz | 30.00 |
|---------------------------|--------------|

| | | |
|---------------|-----------|--------------|
| I/O▶ FDT band | 75 | 10.00 |
| 75 10.00 Hz | | |

| | |
|---------------------------|--------------|
| Factory Default: 10.00 Hz | 10.00 |
|---------------------------|--------------|

These functions are used in I/O-76-79 [Programmable Digital Auxiliary Output Terminal]. See [FDT-#] in I/O-76~79.

Use Sub-Boards if you need to use Programmable Digital output terminal Q1, Q2, and Q3.

I/O-76~79: Programmable Digital Auxiliary Contact Output mode 1, 2, 3, 4 define (AX-CX)

| | | |
|----------------|-----------|----------|
| I/O▶ Aux model | 76 | 0 |
| 76 None | | |

| | |
|-----------------------|----------|
| Factory Default: None | 0 |
|-----------------------|----------|

| Code | LCD Display | Description | Factory Default | Setting Range |
|--------|-------------|-----------------------------|-----------------|-----------------------|
| I/O-76 | Aux mode 1 | Multi-Aux. contact output 1 | None | Refer to below table. |
| I/O-77 | Aux mode 2 | Multi-Aux. contact output 2 | None | Refer to below table. |

| Code | LCD Display | Description | Factory Default | Setting Range |
|--------|-------------|-----------------------------|-----------------|-----------------------|
| I/O-78 | Aux mode 3 | Multi-Aux. contact output 3 | None | Refer to below table. |
| I/O-79 | Aux mode 3 | Multi-Aux. contact output 3 | None | Refer to below table. |

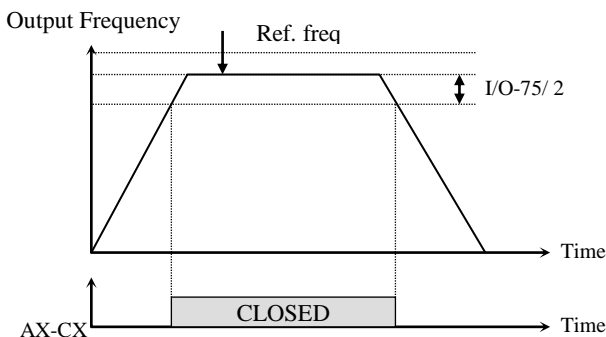
The auxiliary contact works (Close) when the defined condition has occurred.

| Setting Range | Description |
|---------------|--|
| None | None |
| FDT-1 | Output frequency arrival detection |
| FDT-2 | Specific frequency level detection |
| FDT-3 | Frequency detection with pulse |
| FDT-4 | Frequency detection 1 with contact closure |
| FDT-5 | Frequency detection 2 with contact closure |
| OL | Overload detection |
| IOL | Inverter overload detection |
| Stall | Stalling |
| OV | Over voltage detection |
| LV | Low voltage detection |
| OH | Inverter overheat detection |
| Lost Command | Lost command detection |
| Run | Inverter output detection |
| Stop | Inverter stop detection |
| Steady | Steady speed detection |
| INV line | Exchange signal outputs |
| COMM line | |
| Speedsearch | Speed search mode detection |
| Ready | Inverter ready detection |
| MMC | Used for MMC operation |
| Fan Warning | Fan Warning detection |
| Run2 | Inverter running detection |

[FDT-1]

When the output frequency reaches the reference frequency (target frequency), AX-CX terminal is CLOSED.

Detecting Condition: Value (Ref. Freq-Output Freq) ≤ Freq Detection Bandwidth (I/O-75)/2



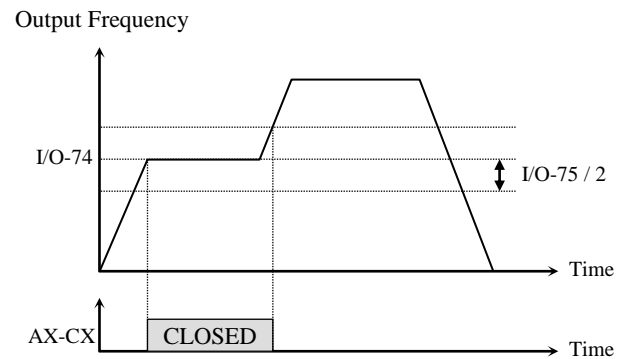
[AX-CX configured as 'FDT-1']

*AX: A1-A4, CX: C1-C4

[FDT-2]

AX-CX is CLOSED when the reference frequency is in I/O-75 [FDT Bandwidth] centered on I/O-74 [FDT Frequency], and the output frequency reaches I/O-75 centered on I/O-74.

Detecting Condition: FDT-1 condition & (Value (Output Freq- Freq Detection) ≤ Freq Detection Bandwidth (I/O-75)/2)

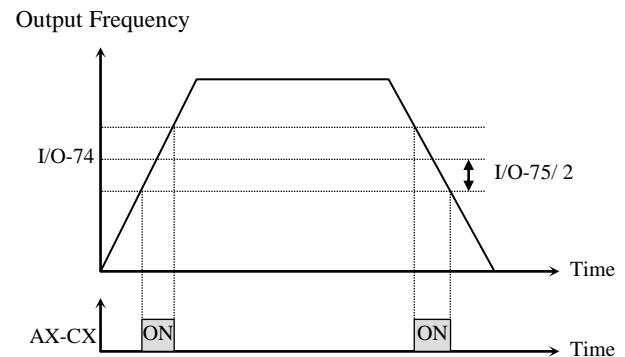


[AX-CX configured as 'FDT-2']

[FDT-3]

AX-CX 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.

Detecting Condition: Value (Freq Detection (I/O-74)-Output Freq) ≤ Freq Detection Bandwidth (I/O-75)/2



[AX-CX configured as 'FDT-3']

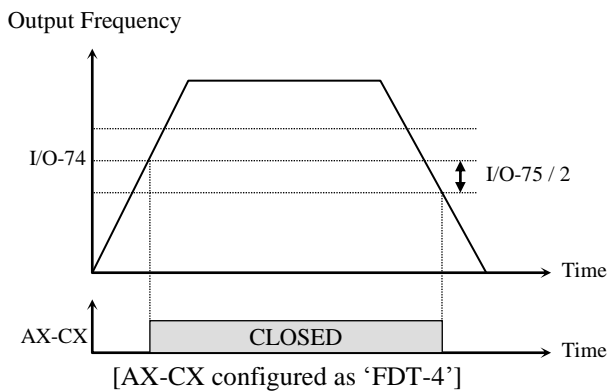
[FDT-4]

AX-CX 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.

Detecting Condition:

During Accel: Output freq \geq Freq Detection

During Decel: Output freq $>$ (Freq Detection (I/O-74) - Freq Detection Bandwidth (I/O-75)/2)



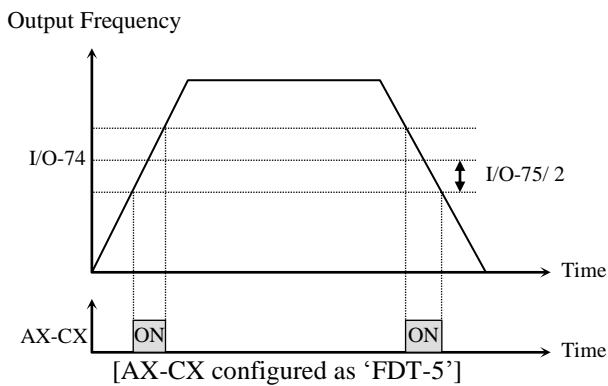
[FDT-5]

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

Detecting Condition:

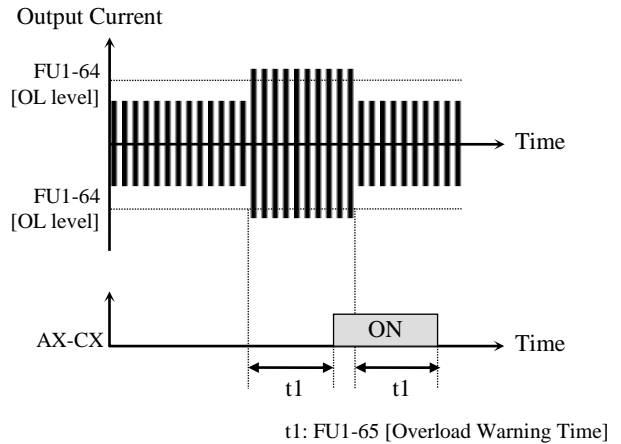
During Accel: Output freq \geq Freq Detection

During Decel: Output freq $>$ (Freq Detection (I/O-74) - Freq Detection Bandwidth (I/O-75)/2)



[OL]

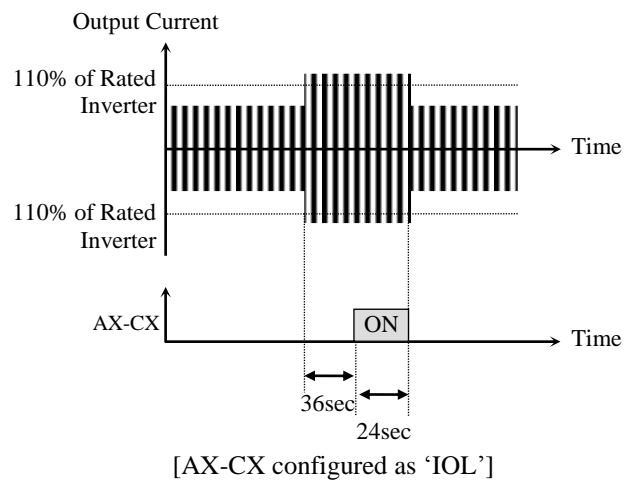
AX-CX is CLOSED when the output current has reached the FU1-64 [Overload Warning Level] for the FU1-65 [Overload Warning Time].



[AX-CX configured as 'OL']

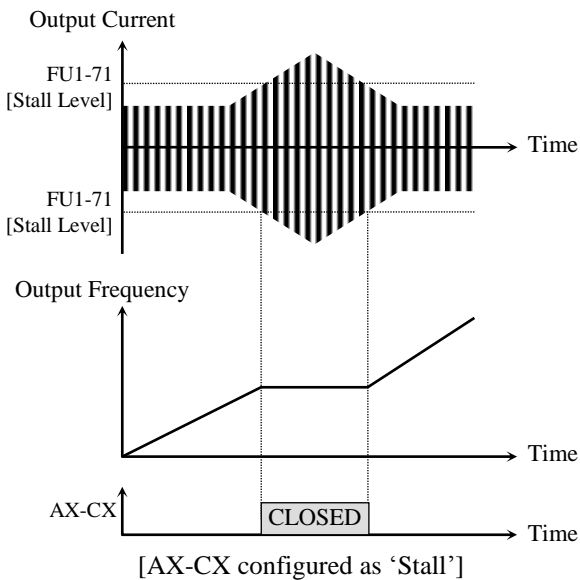
[IOL]

AX-CX is CLOSED when the output current is above the 110% of rated inverter current for 36 seconds. If this situation is continued for one minute, the inverter will cut off its output and displays 'IOL' (Inverter overload) Trip. See the nameplate for the rated inverter current. (IOL has the the inverse time characteristic (I^2t) and outputs the alarm signal when the time is passed 60% of the designated trip time.)



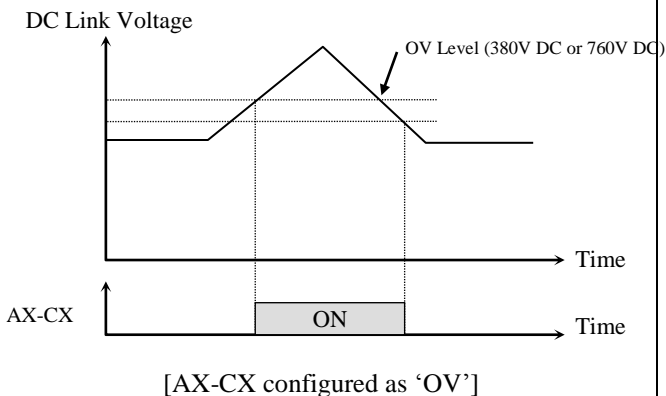
[Stall]

AX-CX is CLOSED when the inverter is on the stall prevention mode.



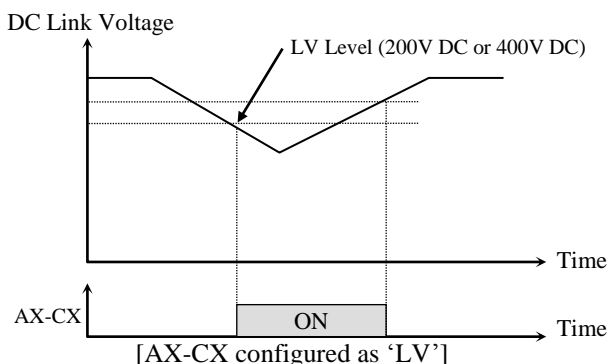
[OV]

AX-CX is CLOSED when the DC link voltage is above the Over-voltage level.



[LV]

AX-CX is CLOSED when the DC link voltage is below the Low-voltage level.



[OH]

AX-CX is CLOSED when the heat sink of the inverter is above the reference level.

[Lost Command]

AX-CX is CLOSED when frequency reference is lost. Refer to I/O-18, I/O-92 and I/O-93.

[Run]

AX-CX is CLOSED when the inverter outputs signal.

(Signal is not generated at DC braking.)

1) It outputs the signal from above start frequency (FU1-32).

- It does not output in 0Hz operation.

2) It outputs the signal when DC Start, DC Brake, Pre-Heat, etc..

- It does not output in auto-tuning.

[Stop]

AX-CX is CLOSED when the inverter is stopped.

[Steady]

AX-CX is CLOSED when the inverter is running at constant speed.

[INV line, COMM line]

This function is used in conjunction with 'Exchange' function of Programmable digital input for commercial line exchange.

1) Speed search function (FU2-22) is activated automatically during exchanging operation, enabling smooth exchange.

2) Before the operation, the below setting is necessary.

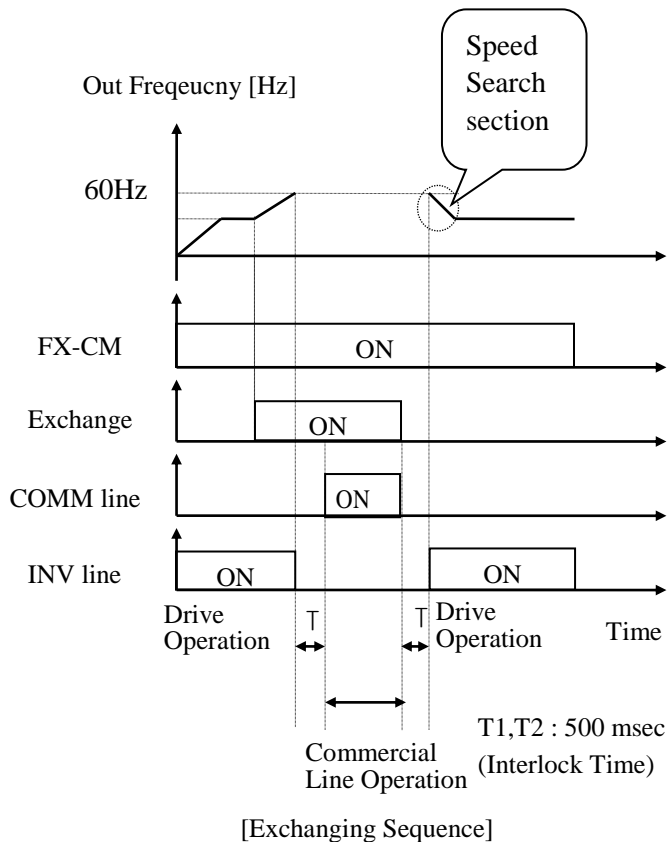
- Programmable input terminal set to 'Exchange'.

- Programmable output terminal set to 'INV line'.

- Programmable output terminal set to 'COMM line'.

Note: I/O-29 [Filtering Time Constant for Programmable Digital Input Terminals] must be set to more than 100 [msec] to prevent chattering and momentary malfunction during this function.

Note: The function is invalid in operation.

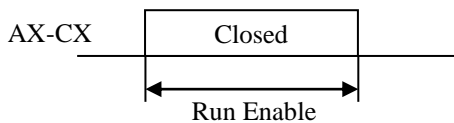


[Search]

AX-CX is CLOSED during the inverter is speed searching.

[Ready]

AX-CX is CLOSED when the inverter is ready to run.



[MMC]

Automatically set to 'MMC' when 'MMC' is selected in APP-01.

[FanWarning]

- None[0]** : Inverter not detect fan fault.
- FanWarning [1]** : If you set to FanWarning Inverter not block output in Fanfault state. But appear Warning Message in the Keypad. Also If you set I/O-76~9 to FanWarning[21], Aux relay activate in the Fanfault state. (OverHeat Trip can occur by temperature rising)
- FanTrip[2]** : If fans have some problem or Fanfault state, inverter block output and occur Fan Trip.

[Run2]

AX-CX is CLOSED when the inverter running. (Signal is not generated at DC braking.) Even though inverter output is 0hz, If inverter is running, AX-CX is CLOSED. This is difference of [Run] and [Run2]

I/O-80: Fault Output Relay (3A, 3B, 3C)

| | | |
|------------------|-----------|------------|
| I/O ▶ Relay mode | 80 | 010 |
| 80 | 010 | |
| Factory Default: | 010 | 010 |

This function is used to allow the fault output relay to operate when a fault occurs. The output relay terminal is 3A, 3B, 3C where 3A-3C is a normally open contact and 3B-3C is a normally closed contact.

| Bit | Setting | Display | Description |
|---------------|---------|---------|--|
| Bit 1 (LV) | 0 | 000 | Fault output relay does not operate at 'Low voltage' trip. |
| | 1 | 001 | Fault output relay operates at 'Low voltage' trip. |
| Bit 2 (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. (Over current, Over current protection, Over voltage, Electric Thermal, Arm short, Ground short, Overheat etc.) |
| Bit 3 (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 FU2-25 decreases to 0 by faults. Disabled while Auto retry is ON. |

When several faults occurred at the same time, Bit 1 has the first priority. (Active order: Bit 1->Bit 2->bit3)

I/O-81: Terminal Output Status

I/O► Out status **81** **0000**
81 00000000

Factory Default: 00000000 **0000**

This code displays the status of AXA-AXC 1~4, the output status of control terminals Q1~Q3 and the fault relay 3A,3C.

Use Sub-Boards if you need to use Programmable Digital output terminal Q1, Q2, and Q3.

[LCD Keypad Display]

| Output Terminals | 3A-3C | Q3 | Q2 | Q1 | AUX 4 | AUX 3 | AUX 2 | AUX 1 |
|------------------|-------|-------|-------|-------|-------|-------|-------|-------|
| | Bit 7 | Bit 6 | Bit 5 | Bit 4 | Bit 3 | Bit 2 | Bit 1 | Bit 0 |
| OFF status | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| ON status | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |

I/O-82, 83: Fault Relay On/Off Delay Time

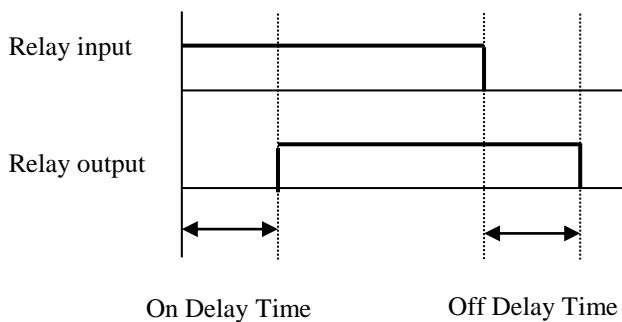
I/O► Relay On **82** **0.0**
82 0.0 sec

Factory Default: 0.0 sec **0.0**

I/O► Relay Off **83** **0.0**
83 0.0 sec

Factory Default: 0.0 sec **0.0**

Fault relay output is delayed for the set time and it is turned ON/OFF after the set time.



I/O-84: Cooling Fan Control Selection

0

I/O► Fan Con. Sel **84**
84 PowerOn_Fan

Factory Default: PowerOn_Fan **0**

| I/O-84 | | Description |
|--------|-------------|---|
| 0 | PowerOn Fan | Fan ON when inverter power is ON. |
| 1 | Run Fan | Fan ON when inverter runs (outputs its frequency). |
| 2 | Temper Fan | Fan ON when inverter temp exceeds the preset value in I/O-85. |

Caution: I/O-84, 85 are only available for inverters 37kW and higher.

I/O-86, -87: To Change the Unit of Analog Input

I/O► V1 Unit Sel **86** **0**
86 Percent

Factory Default: Percent **0**

I/O► Unit Max Val **87** **0**
87 Percent

Factory Default: Speed **0**

| No | I/O-86 set data | Description |
|----|-----------------|---|
| 0 | Percent | Flux, Pressure, Temperature are indicated by [%]. |
| 1 | Bar | Pressure is indicated by [Bar]. |
| 2 | mBar | Pressure is indicated by [mBar]. |
| 3 | kPa | Pressure is indicated by [kPa]. |
| 4 | PSI | Pressure is indicated by [PSI]. |
| 5 | Pa | Pressure is indicated by [Pa]. |

After Setting APP-02 [proc PI mode] to “Yes”, set one of the unit: Percent, Bar, mBar, kPa, PSI, Pa at I/O-86 [User unit selection]. Then, all the unit related to inverter target frequency is changed. Set APP-02 [proc PI mode] to “No” I/O-86 [User unit selection] is initialized by “Percent”.

| No | I/O-87 set data | Description |
|----|-----------------|-----------------------------|
| 0 | Unit Max Val | Set the Max. value of unit. |

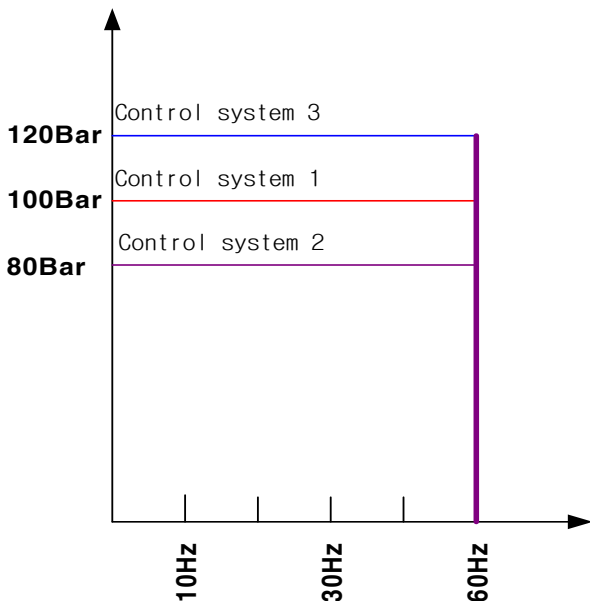
I/O-87 [Unit Max Val] indicates Max setting value for each unit which is possible to operate. Each system may have different value: Max Flux, Pressure, Temperature for max frequency according

| Code | LCD Display | Description | Factory Default | Setting Range |
|--------|-------------|---------------------|-----------------|--|
| I/O-90 | Inv. no | Inverter Station ID | 1 | 1 ~ 250 |
| I/O-91 | Baud rate | Baud Rate | 9600 bps | 1200 bps 2400 bps 4800 bps 9600 bps 19200 bps 38400 bps |

to the system, I/O-87 [User unit selection] is useful to user.

For example, There are 3 Control systems.

When Max frequency of inverter is 60 Hz, Each system indicates pressures: Control system 1 shows 100Bar, Control system 2 shows 80Bar, Control system 3 shows 120Bar. It makes easy to find the pressure corresponding to Max frequency of each control system by inputting in I/O-87 [Unit Max Val].



I/O-90, 91: Inverter Number, Baud Rate
I/O-92, 93: Operation method when communication signal is lost, Communication Time Out
I/O-94: Communication Delay Time

| | | |
|-------------------------------|-----------|----------|
| I/O► Inv No. 90 1 | 90 | 1 |
| Factory Default: 1 | | 1 |
| I/O► Baud rate 91 9600 bps | 91 | 3 |
| Factory Default: 9600 bps | | 3 |

I/O-90 [Inverter Number] sets the inverter ID to perform RS485 communication with PC. I/O-91 [Baud rate] sets the communication speed. To make the multi-drop system, connect the terminal C+ to other inverter's C+ and C- to C-.

| | | |
|------------------------------|-----------|----------|
| I/O► COM Lost Cmd 92 None | 92 | 0 |
|------------------------------|-----------|----------|

| | | |
|-----------------------|--|----------|
| Factory Default: None | | 0 |
|-----------------------|--|----------|

| | | |
|---------------------------------|-----------|------------|
| I/O► COM Time Out 93 1.0 sec | 93 | 1.0 |
|---------------------------------|-----------|------------|

| | | |
|--------------------------|--|------------|
| Factory Default: 1.0 sec | | 1.0 |
|--------------------------|--|------------|

I/O-92, 93 are only displayed when DRV-03 [Drive mode] or DRV-04 [Frequency mode] is set to "Int. 485".

In this case, the LCD display shows "LOR".

I/O-93 [Communication time out] determines whether the signal is lost.

Three types of operating method described on the table below are settable after loss of communication signal.

| Setting Range | Description |
|---------------------------|---|
| None (Factory Default) | Continuous operation after loss of communication signal. |
| FreeRun | Inverter cuts off its output after determining loss of communication signal and free-run to stop. |
| Stop | Inverter stops by its Decel pattern and Decel time after determining communication signal. |

| | | |
|-------------------------|-----------|----------|
| I/O► Delay Time 94 5 | 94 | 5 |
|-------------------------|-----------|----------|

| | | |
|-----------------------|--|----------|
| Factory Default: 5 ms | | 5 |
|-----------------------|--|----------|

I/O-94 setting is for communication using 232-485 converter. It should be set properly according to 232-485 converter specification.

| Code | LCD Display | Description | Factory Default | Setting Range |
|--------|-------------|------------------|-----------------|-----------------|
| I/O-94 | Delay Time | Comm. delay time | 5 [sec] | 2 ~ 1200 [msec] |

I/O-95: Normal Open/ Normal Close select

I/O► In No/NC Set **95** **0000**
 95 000000000000

Factory Default: 000000000000 **0000**

The input contact logic (Normal Open-A Contact/Normal Close-B Contact) for M1, M2, M3, M4, M5, M6, M7, M8, P4, P5 and P6 can be programmed in this code. Input terminals P4, P5 and P6 are settable only with Sub-board installed.

[LCD KEYPAD DISPLAY]

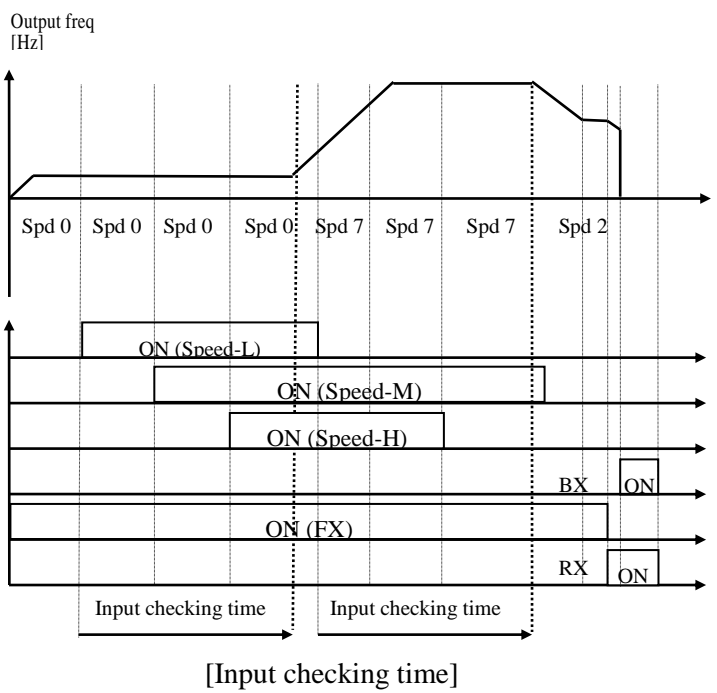
| Input T/M | P6 | P5 | P4 | M8 | M7 | M6 | M5 | M4 | M3 | M2 | M1 |
|-----------|--------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| | 10 bit | 9 bit | 8 bit | 7 bit | 6 bit | 5 bit | 4 bit | 3 bit | 2 bit | 1 bit | 0 bit |
| 0: NO | 0/1 | 0/1 | 0/1 | 0/1 | 0/1 | 0/1 | 0/1 | 0/1 | 0/1 | 0/1 | 0/1 |
| 1: NC | 0/1 | 0/1 | 0/1 | 0/1 | 0/1 | 0/1 | 0/1 | 0/1 | 0/1 | 0/1 | 0/1 |

I/O-96: Input Checking Time

I/O► In CheckTime **96** **1**
 96 1 ms

Factory Default: 1 ms **1**

When Multi-step speed or Multi-Accel/Decel operation is active, inverter determines the input to be valid after the I/O-95 [Input checking time] elapses.



I/O-97: Overheat Trip Selection

I/O► OH Trip Sel **97** **111**
 97 111

Factory Default: 111 **111**

I/O► Mot Trip Temp **98** **110**
 98 110

Factory Default: 110 [°C] **110**

Inverter Overheat protection is activated regardless of motor temp setting condition.

| Code | Bit set | | | Function | On | Off |
|--------|---------|---|---|---|----|-----|
| | 3 | 2 | 1 | | | |
| I/O-97 | | | ● | Motor overheat trip setting (tripped at I/O-98) | 1 | 0 |
| | | ● | | -Reserved- | 1 | 0 |
| | ● | | | External temperature sensor selection (PTC/NTC) | 1 | 0 |

Caution: Bit 2 is reserved for future use.

| Code | LCD Display | Description | Factory Default | Setting Range |
|--------|---------------|--|-----------------|-----------------|
| I/O-97 | OH Trip Sel | External temperature Sensor Trip setting | 111 | 000 ~ 111 (bit) |
| I/O-98 | Mot Trip Temp | Motor overheat Trip setting | 110[°C] | 0~256[°C] |

I/O-99: Lost Cmd Preset Freq Setting

I/O► Lost Preset **99** **0.00**
 99 0.00 Hz

Inverter run at the preset frequency set in I/O-99, when the frequency command is lost. Preset frequency can set less than FU1-30 Max Freq

Specification of External PTC/NTC Thermistor

| Sensor | Resistance based on 25 °C | Resistance by temperature | Measurable Temp range |
|--------|---------------------------|---|-----------------------|
| PTC | 1 kΩ (± 5%) | $R(T)=[1+A*(\text{Measured temp}-25)+B*(\text{Measured temp}-25)^2][k\Omega]$ A=7.635X10 ⁻³ , B=1.371 X10 ⁻⁵ | 0~125[°C] |
| NTC | 2.545 kΩ (± 5%) | See the table below for NTC resistance by temperature. | 0~150[°C] |

☞ **Note :** Measurable temp range varies by thermal sensors. Select the sensor after checking the measurable temp range specification.

NTC resistance according to temperature

| Temp [°C] | Resistance [kΩ] | Temp [°C] | Resistance [kΩ] | Temp [°C] | Resistance [kΩ] | Temp [°C] | Resistance [kΩ] | Temp [°C] | Resistance [kΩ] | Temp [°C] | Resistance [kΩ] | Temp [°C] | Resistance [kΩ] |
|-----------|-----------------|-----------|-----------------|-----------|-----------------|-----------|-----------------|-----------|-----------------|-----------|-----------------|-----------|-----------------|
| 80 | 0.3562 | 90 | 0.2649 | 100 | 0.2002 | 110 | 0.1536 | 120 | 0.1195 | 130 | 0.0942 | 140 | 0.0752 |
| 81 | 0.3455 | 91 | 0.2574 | 101 | 0.1949 | 111 | 0.1497 | 121 | 0.1167 | 131 | 0.0921 | 141 | 0.0736 |
| 82 | 0.3353 | 92 | 0.2502 | 102 | 0.1897 | 112 | 0.1459 | 122 | 0.1139 | 132 | 0.0900 | 142 | 0.0720 |
| 83 | 0.3254 | 93 | 0.2432 | 103 | 0.1847 | 113 | 0.1423 | 123 | 0.1112 | 133 | 0.0880 | 143 | 0.0705 |
| 84 | 0.3158 | 94 | 0.2364 | 104 | 0.1798 | 114 | 0.1387 | 124 | 0.1085 | 134 | 0.0860 | 144 | 0.0690 |
| 85 | 0.3066 | 95 | 0.2299 | 105 | 0.1751 | 115 | 0.1353 | 125 | 0.1060 | 135 | 0.0841 | 145 | 0.0675 |
| 86 | 0.2976 | 96 | 0.2236 | 106 | 0.1705 | 116 | 0.1319 | 126 | 0.1035 | 136 | 0.0822 | 146 | 0.0661 |
| 87 | 0.2890 | 97 | 0.2174 | 107 | 0.1661 | 117 | 0.1287 | 127 | 0.1011 | 137 | 0.0804 | 147 | 0.0647 |
| 88 | 0.2807 | 98 | 0.2115 | 108 | 0.1618 | 118 | 0.1255 | 128 | 0.0987 | 138 | 0.0786 | 148 | 0.0633 |
| 89 | 0.2727 | 99 | 0.2058 | 109 | 0.1577 | 119 | 0.1225 | 129 | 0.0965 | 139 | 0.0769 | 149 | 0.0620 |
| | | | | | | | | | | | | 150 | 0.0608 |

☞ **Note:** Use the external NTC having the specification above and adjust I/O-98 when the temp difference between inverter and external sensor is occurred.

☞ **Note:** Overheat protection can be monitored by setting one of the I/O-76~79 [Aux mode 1, 2, 3] to "OH".

6.5 Application group [APP]

APP-00: Jump to desired code

APP▶ Jump code
00 1

Factory Default: 1

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

APP-01: Application Mode Selection

APP▶ App. mode
01 None

01

0

Factory Default: None

0

This code sets the application mode.

| APP-01 Set data | Description |
|-----------------|---|
| None | Application mode is not selected. (Factory Default) |
| MMC | MMC (Multi-Motor Control) mode is selected in application group. Related parameters (APP-40~71) are displayed. I/O-76~79 [Programmable digital Aux. relay output] is automatically set to "MMC." If less than 4 aux motors are connected, the remainder relays can be used for other functions. |

Caution: I/O-76~79 value is not initialized automatically even though "None" is set after setting "MMC". In this case, set the I/O-76~79 again for desired selection.

APP-02: PID Operation Selection

APP▶ Proc PI mode
02 No

02

0

Factory Default: No

0

This function can be used for Process control like flow, pressure, and air volume control. To use this function, set APP-02 [proc PI mode] to "Yes". PID control detects the amount of feedback from a sensor and compares it with the target value. If the values differ, this function produces an output to eliminate the deviation. In other words, this control matches the feedback amount with the

target value.

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

Note: PID control can be bypassed to manual operation temporarily by defining one of the Programmable input terminals (M1~M8, P4~P6) 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.

[P Control]

An error will be occurred for the input during steady state when P control used alone without I control.

This control is to compensate the error for a system input proportionally. This is used to make the controller to respond fast for an error. When P control is used alone, the system is easily affected by an external disturbance during steady state. If I Control is included, error can be eliminated.

[I Control]

I control system to plant is unstable for Integral Gain Ki. This is to compensate the error of a system integrally but it makes the system unstable. This is used to compensate the steady state error by accumulating them. Using this control alone makes the system unstable and that application is rarely used. PI control is usually used to eliminate the error for the input during steady state.

[PI control]

If PI control is stable for the input (base input, disturbance), the error will not be occurred. This control is stable in many systems. If "D control" is added, it becomes the 3rd order system. In some systems this may lead to system instability since Proportional gain Kp is increased .

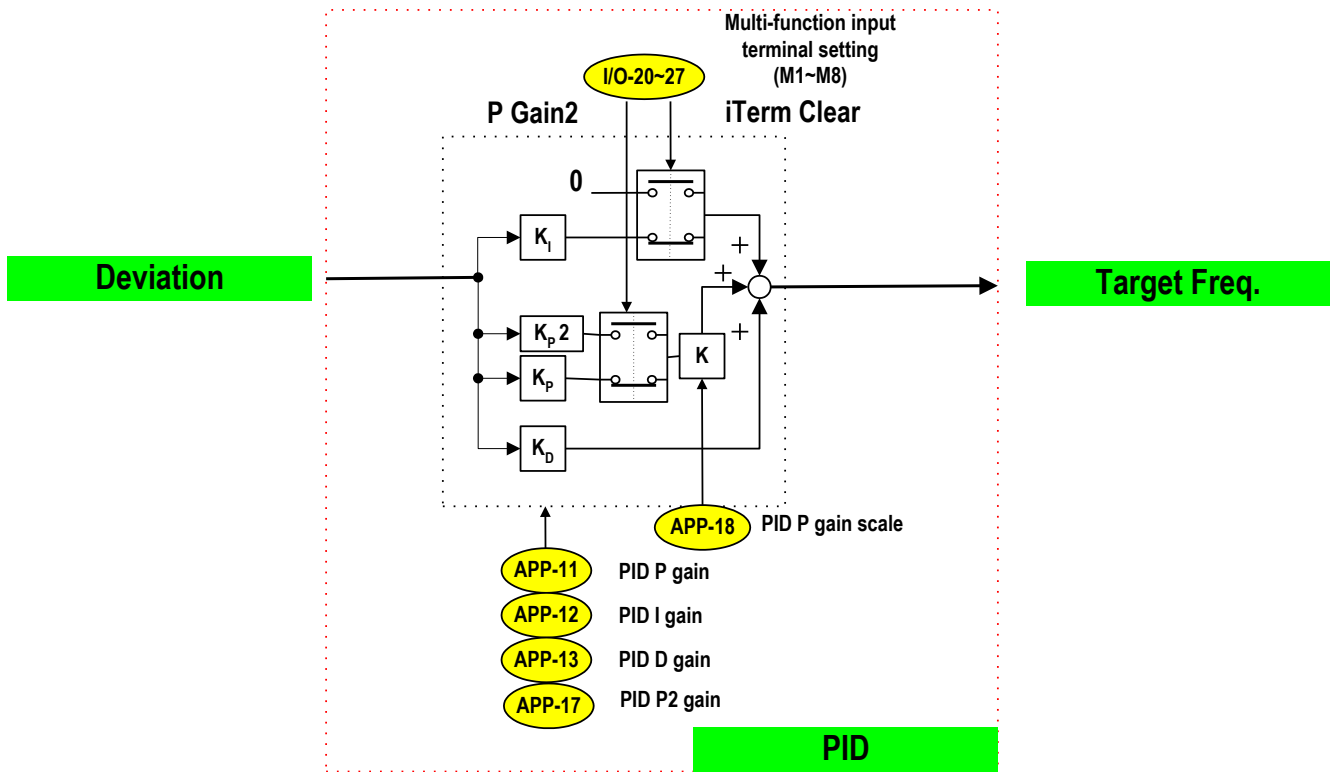
[D Control]

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

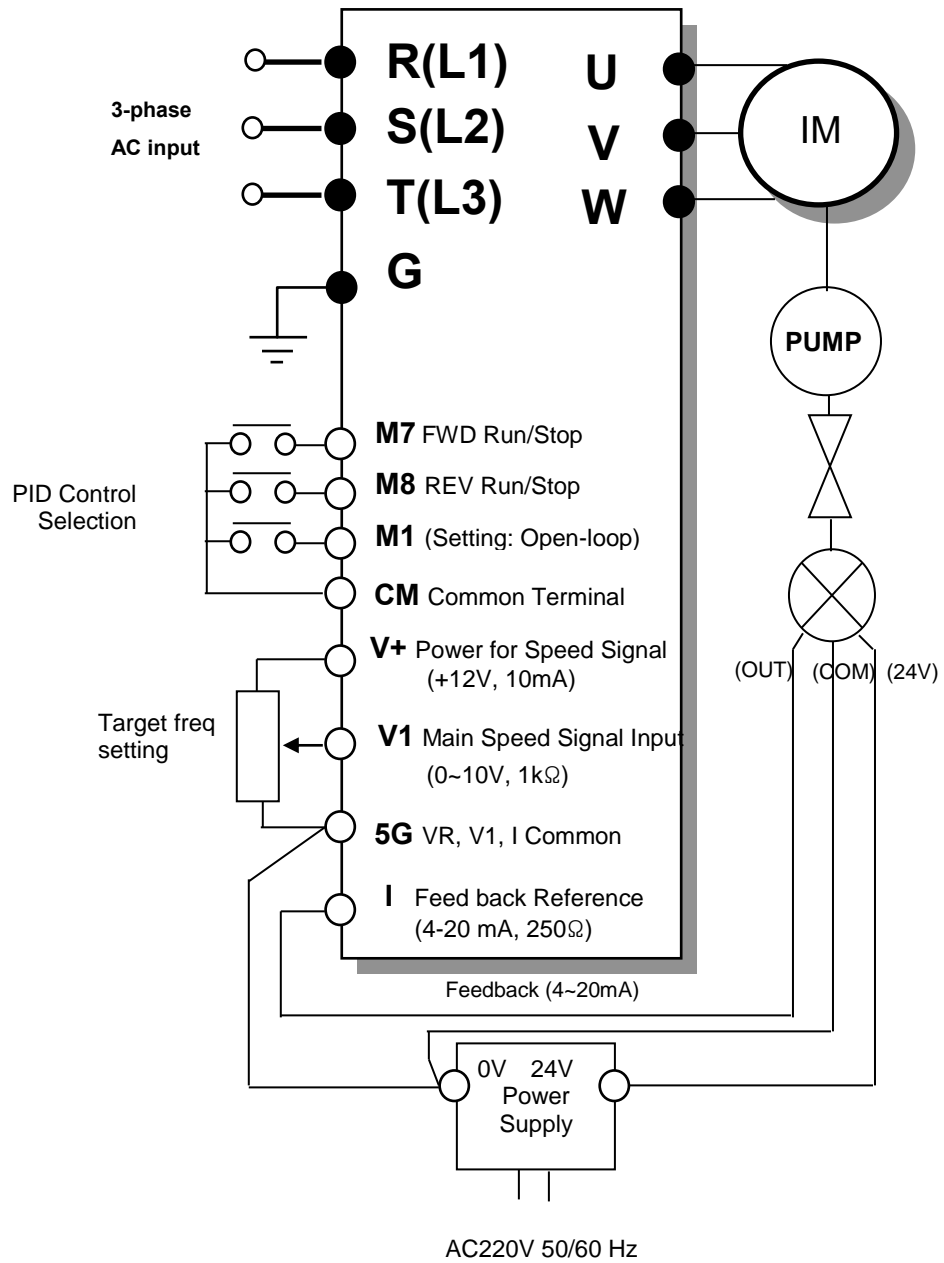
Parameter setting example for PID operation

- ① Set APP-02 [PID operation selection] to “Yes.”
- ② Set APP-06 [PID feedback selection] among I, V1 and Pulse.
- ③ Set the unit to view feedback value in I/O-86~88 [User unit selection]. Then, all the unit related to inverter target frequency is changed.
- ④ Set the appropriate value in APP-04~05 (Refer to the following PID block diagram).
- ⑤ When APP-04 is set to “No,” DRV-04 [Freq Mode] becomes PID reference. If APP-04 is set to “Yes”, the value set in APP-05 becomes PID reference. If setting one of I/O-20~27 [Programmable digital input terminal selection] to “Open loop” and tuning On/Off the selected terminal, it is decided whether DRV-04 [Freq Mode] becomes Target freq or Target freq becomes PID Output.

In general, the PID output becomes inverter's "Target Freq". In this case, PID is controlling the whole system and the PID output becomes the target freq of the system and inverter is operating according to Accel/Decel Time. PID control sampling time is 10msec.

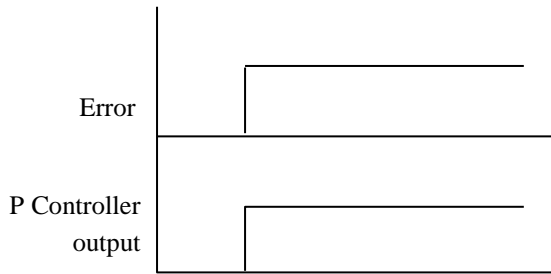


PID Wiring Example



- **P Gain**

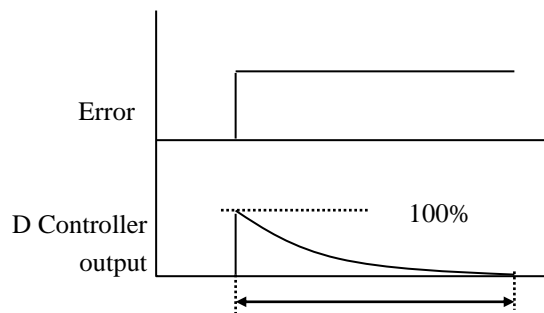
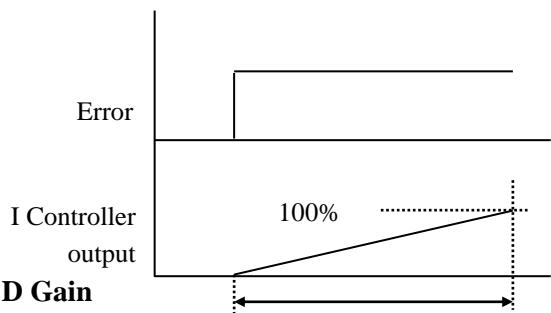
This controls the output that is proportional to the current error value. P Gain means that if Reference is supplied to 100% and Feedback is maintained to 0%, namely, error



keeps the value to 100%, output changed from 0% to 100% when Pgain is 100%. Output become 100% when maximum frequency is 100%. For example, Output frequency become 60Hz when maximum frequency is 60Hz. Hence, P controller has maximum P Gain, it can output the maximum output frequency with 10% error value.

- **I Gain**

This controls the output properly that is proportional to accumulated error. I controller must be displayed the time value. I Gain means the time to take the I controller output from 0% to 100% during x sec with 100% error when Reference is supplied to 100% and Feedback is maintained to 0%.



- **D Gain**

This controls the responding the rate of change or Error. It is multiplying this rate of change by this value. D controller is determined as below formula since D controller has the difference between the mathematical formula and actual application.

$$K_d \times \frac{E(n) - E(n - 1)}{T_s} \times (1 - e^{-D \text{time}})$$

The output by D Gain become to 100% when Referenc become to 100% and Feedback keep the value to 0%, namely, Error value become to 0 % at T=0 and it is changed to 100 % at next sampling and then it keeps the 100% value.

D time is determined by remaining time that the output is reduced to 3 % gradually.

APP-03: PID F Gain Selection
APP-04: PID Aux. Reference Mode Selection
APP-05: PID Aux. Reference Selection

APP▶ PID F-Gain **03** **0.0**
 03 0.0 %

Factory Default: 0.0% **0.0**

This code sets F Gain for use in Feed Forward control.
 When it is set to 100%, the responsiveness (%) of output F gain from the controller reference value is 100%. Used when fast response is needed.
Caution: Control System output may become unstable if this value is set too high.

APP▶ Aux Ref Mode **04** **0**
 04 No

Factory Default: No **0**

This code selects PID Aux Ref. Input Enable/Disable. See PID Block Diagram for details.

APP▶ Aux Ref Sel **05** **2**
 05 V1

Factory Default: V1 **2**

This code sets the source of Aux reference signal.
Caution: When APP-04 is set to “No,” DRV-04, Multi-step frequency, UP/DOWN, Jog frequency become PID controller’s reference and when set to “Yes,” PID reference is issued from the set value in APP-05 [PID Aux Reference signal selection].

APP-06: PID Feedback Signal Selection
APP-07: Meter I Max Value
APP-08: Meter V Max Value
APP-09: Meter P Max Value

APP▶ PID F/B **06** **0**
 06 I

Factory Default: I **0**

Select the feedback signal for PID control. This can be set one of ‘I’ (4-20mA), ‘V1’ (0~12V) and ‘Pulse’ (A0 and B0, 0~100kHz). Refer to I/O-06~10 for I, I/O-01~05 for V1, I/O-11~16 for Pulse.

APP▶ meter I max **07** **20**
 07 20mA

Factory Default: 20mA **20**

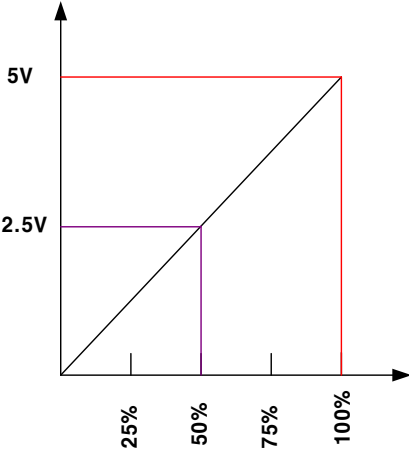
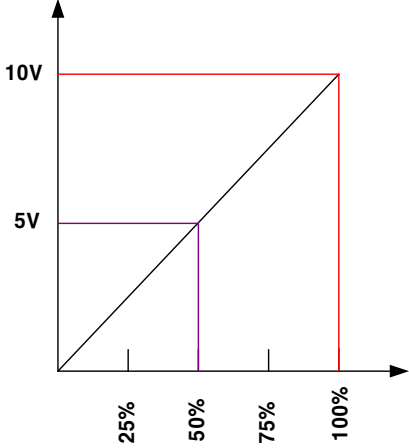
APP▶ meter V max **08** **10**
 08 10 V

Factory Default: 10 V **10**

APP▶ meter P max **09** **100**
 09 100 kHz

Factory Default: 100 kHz **100**

APP-07 [Meter I Max], APP-08 [Meter V Max], APP-09 [Meter P Max] are can be set according to APP-06 selection. FeedBack depends on system or sensor specification. Therefore, By using Max value of Feedback in calculation. Next Figure shows Max Feedback Max value is 10V and 5V respectively.



[FeedBack for Max value setting]

APP-11: P Gain for PID Control
APP-12: I Gain for PID Control
APP-13: D Gain for PID Control

| | | |
|-----------------------------------|-----------|------------|
| APP▶ PID P Gain 11 1.0 % | 11 | 1.0 |
| Factory Default: 1.0 % 1.0 | | |

This is P Gain of PID controller . If I Gain is 0 with 100% error, P Gain outputs the 100 % value. In addition, If I Gain is 0 with 100% error, P Gain output the 50% value.

| | | |
|---------------------------------------|-----------|-------------|
| APP▶ PID I Time 12 10.0 sec | 12 | 10.0 |
| Factory Default: 10.0 sec 10.0 | | |

This is I Time of PID controller. I Gain is 1 second that the output value is accumulated to 100% when P Gain is 0 with maintaining 100% error. Namely, I Gain is 30 seconds that means the output value is accumulated to 100% during 30 seconds with maintaining 100% error. 100% error means reference value is set but feedback value is 0.

| | | |
|--------------------------------------|-----------|------------|
| APP▶ PID D Time 13 0.0msec | 13 | 0.0 |
| Factory Default: 0.0 msec 0.0 | | |

This code sets the differential Gain of PID Controller.

APP-14: High limit freq for PID control
APP-15: Low limit freq for PID control
APP-16: PID Output Scale
APP-17: PID P2 Gain

| | | |
|--------------------------------------|-----------|--------------|
| APP▶ PID Hi Limit 14 60.00Hz | 14 | 60.00 |
| Factory Default: 60.00Hz | | |

| | | |
|-------------------------------------|-----------|------------|
| APP▶ PID Low Limit 15 0.5Hz | 15 | 0.5 |
| Factory Default: 0.5Hz 0.5 | | |

APP-14 &15 set high and low limit value of PID controller’s output.

| | | |
|--------------------------------------|-----------|--------------|
| APP▶ PID OutScale 16 100.0% | 16 | 100.0 |
| Factory Default: 100.0% 100.0 | | |

APP-16[PID Out Scale] sets PID controller’s conversion scale

| | | |
|--------------------------------------|-----------|--------------|
| APP▶ PID P2 Gain 17 100.0% | 17 | 100.0 |
| Factory Default: 100.0% 100.0 | | |

App-17 [PID P2 Gain] sets PID controller’s proportional gain 2 value.

APP-18: P Gain Scale
APP-19: PID Out Invert

| | | |
|--------------------------------------|-----------|--------------|
| APP▶ P Gainscale 18 100.0% | 18 | 100.0 |
| Factory Default: 100.0% 100.0 | | |

APP-18[P GainScale] sets PID controller’s conversion scale of proportional gain P and P2.

| | | |
|----------------------------------|-----------|----------|
| APP▶ PID OutInvert 19 No | 19 | 0 |
| Factory Default: NO 0 | | |

APP-19[PID Output Invert] sets PID controller’s output Invert. 6-58

| | | |
|------------------------------|-----------|----------|
| APP▶ PID U Fbk 20 No | 20 | 0 |
| Factory Default: NO 0 | | |

APP-20[PID U curve feedback select] converts sets PID controller’s feedback to “U”. (It is used when “square” operation as a proportional value of sensor feedback.)

This code is useful for fan and pumps application. It converts linear pattern of a feedback sensor to the squared pattern without any setting.

PID output value can be set to ‘0’ by setting a Programmable digital input terminals (M1 ~ M8) to ‘Open loop’ in I/O- I/O-20 ~ I/O-27.

The accumulated value by I-Gain can be set to '0' by setting a Programmable digital input terminal (M1 ~ M8) to 'iTerm Clear' in I/O-20 ~ I/O-27.

The P-Gain 2 can be selected for PID controller by setting a Programmable digital input (I/O-20 ~ I/O-27) to 'PID P2'.

When APP-02 [PID operation selection] is set to "Yes," a desired display unit in I/O-86, -87, -88 [User Unit selection] is set among Speed, Percent, Bar, mBar, kPa, Pa, which affects value display of APP-06 [PID feedback selection], all the parameter unit related to inverter target frequency is changed.

operate PID in PrePID operation, the PrePID operation is exit and start PID operation.

APP-25 [Pre PID Stop Delay]

After time that set in this code, if the detected value is under level than has set for PID operation, the system has a problem(Ex. The pipe Broken). So it must be set properly again.

APP-26 [Pipe Broken]

In case that the detected value is under the APP-24 and maintained over the time setted in APP-25, the system show "Pipe Broken" concluding the pipe has a problem.

**APP-23: PrePID Reference Frequency
APP-24: PrePID Exit Level
APP-25: PrePID Stop delay
APP-26: Pipe Broken**

| | | |
|--------------------------------------|-----------|------------|
| APP▶ PrePID Freq 23 0 | 23 | 0 |
| Factory Default: 0 | | 0 |
| APP▶ PrePID Exit 24 0 | 24 | 0 |
| Factory Default: 0 | | 0 |
| APP▶ PrePID Dly 25 600 | 25 | 600 |
| Factory Default: 600 | | 600 |
| APP▶ Pipe Broken 26 No | 26 | 0 |
| Factory Default: No | | 0 |

**APP-27: Sleep Delay Time
APP-28: Sleep Frequency
APP-29: Wake-Up Level**

| | | |
|---|-----------|-------------|
| APP▶ Sleep Delay 27 60.0sec | 27 | 60.0 |
| Factory Default: 60.0 sec | | 60.0 |
| APP▶ Sleep Freq 28 0.00Hz | 28 | 0.00 |
| Factory Default: 0.00Hz | | 0.00 |
| APP▶ WakeUp level 29 2.0% | 29 | 2.0 |
| Factory Default: 2.0% | | 2.0 |

PrePID is a function that activate before PID operation in order to run by good condition. For example, In Winder operation, this function make accel/decel speed operation before reach a certain speed of line speed.

APP-23 [PrePID Reference Frequency]

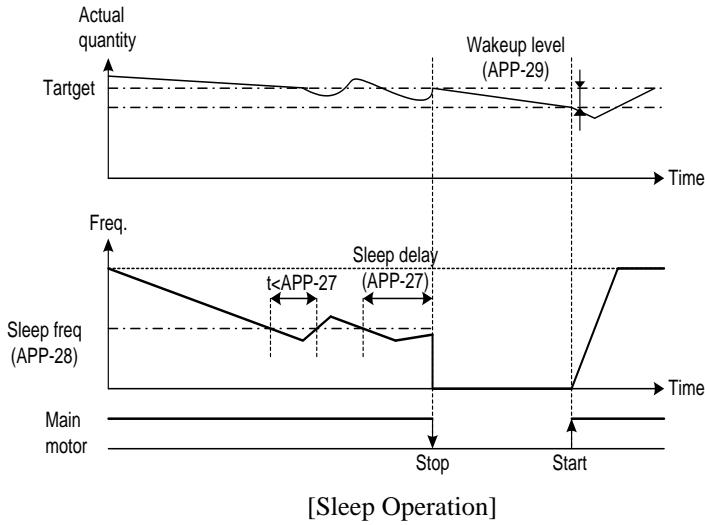
While select PrePID, it is a frequency that output until PrePID is completed by target frequency.

APP-24 [Pre PID Exit Level]

If the detected value like as pressure is capable to

Sleep function is initiated when flow demand is low. Inverter stops motor when the motor runs below Sleep Frequency (APP-28) during Sleep Delay Time (APP-27). While in the sleep state, the drive keeps monitoring and controlling, and initiates the Wake-Up function when the real value of the controlling amount is greatly different from the Wake-Up level (APP-29) based on Target Level.

Note: Sleep function is not operated if the Sleep Delay Time (APP-29) set to '0'.



APP-30 ~ APP-39: 2nd Functions

| | | |
|---|-----------|------------|
| APP▶2 nd Acc time 30 5.0 sec | 30 | 5.0 |
|---|-----------|------------|

| | |
|--------------------------|------------|
| Factory Default: 5.0 sec | 5.0 |
|--------------------------|------------|

| | | |
|--|-----------|-------------|
| APP▶2 nd Dec time 31 10.0 sec | 31 | 10.0 |
|--|-----------|-------------|

| | |
|---------------------------|-------------|
| Factory Default: 10.0 sec | 10.0 |
|---------------------------|-------------|

These functions APP-30 ~ APP-39 are displayed only when one of the multifunction inputs in codes I/O-20 to I/O-27 is set at '2nd func'.

When an inverter is controlling two motors by exchanging, different values can be set for the 2nd motor by using the multifunction input terminal. Following a cross reference table shows the 2nd functions corresponding to the 1st functions.

| Description | 1 st Functions | 2 nd Functions |
|------------------------|---------------------------|--------------------------------------|
| Acceleration time | DRV-01 [Acc. time] | APP-30 [2 nd Acc time] |
| Deceleration time | DRV-02 [Dec. time] | APP-31 [2 nd Dec time] |
| Base Frequency | FU1-31 [Base freq] | APP-32 [2 nd BaseFreq] |
| Volts/Hz mode | FU1-40 [V/F Pattern] | APP-33 [2 nd V/F] |
| Forward torque boost | FU2-68 [Fwd Boost] | APP-34 [2 nd F-boost] |
| Reverse torque boost | FU2-69 [Rev Boost] | APP-35 [2 nd R-boost] |
| Stall prevention level | FU1-60 [Stall Level] | APP-36 [2 nd Stall] |

| Description | 1 st Functions | 2 nd Functions |
|--------------------------|---------------------------|--------------------------------------|
| ETH level for 1 minute | FU1-61 [ETH 1min] | APP-37 [2 nd ETH 1min] |
| ETH level for continuous | FU1-62 [ETH cont] | APP-38 [2 nd ETH cont] |
| Motor rated current | FU2-43 [Rated-Curr] | APP-39 [2 nd R-Curr] |

The 1st functions are applied if the assigned multifunction terminal is not defined as '2nd Func' nor 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 same as the 1st function.

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

Note: The 'User V/F' function of FU1-40 [V/F Pattern] is commonly used for the 1st and the 2nd motor.

**APP-40: Number of Running Aux. Motor Display
APP-40~APP-72: MMC Operation Control**

| | | |
|-------------------------------|-----------|----------|
| APP▶ Aux Mot Run 40 0 | 40 | 0 |
|-------------------------------|-----------|----------|

| | |
|--------------------|----------|
| Factory Default: 0 | 0 |
|--------------------|----------|

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

[MMC]: The 'PID' control should be selected in APP-02 to use this function.

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

◆ In case that flow rate or flow pressure is beyond or below the reference so the main motor cannot control by itself, auxiliary motors are automatically turned on/off. Maximum four (Aux.1-4 output) auxiliary motors can be run. Each of Starting and

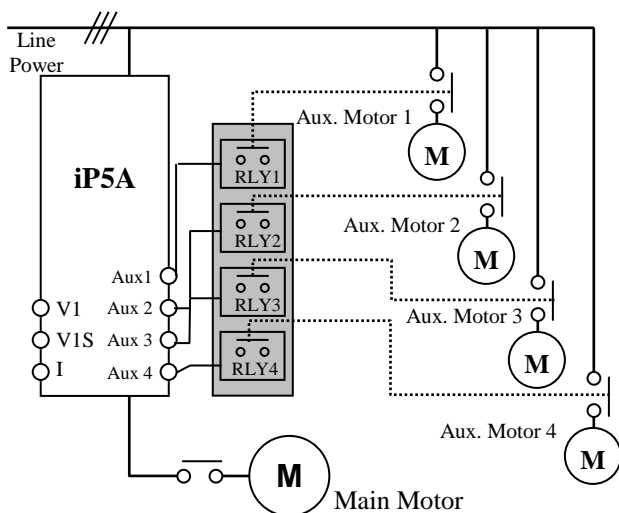
Stop Frequency should be set for automatically running four auxiliary motors.

◆ Auto Change can be selected to automatically switch the order of the running motors for keeping motor run-time constant. Set mode '1' for automatic changing of auxiliary motors only and set mode '2' for automatic changing of all motors including main motor. For mode '2', external sequence should be configured.

◆ Abnormal motor can be skipped from running by using the Programmable digital input terminals (M1, M2, M3, and M4). If a Programmable digital terminal (M1, M2, M3 and M4) is opened, the inverter stops all running motors and restarts operation with only normal motors except the abnormal (Off) motor.

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

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



[MMC Diagram]

| Code | LCD Display | Description | Factory Default | Setting Range |
|--------|--------------|--|-----------------|---------------|
| APP-40 | Aux Mot Run | The number of operating Aux. motor | * | * |
| APP-41 | Starting Aux | Select the starting Aux. motor | 1 | 1 – 4 |
| APP-42 | Auto Op Time | Operation time for Auto change function | * | * |
| APP-43 | Nbr Aux's | Select the number of Aux. motor | 4 | 0 - 4 |
| APP-44 | F-in L-out | The stop order of Aux. motor | Yes | No Yes |
| APP-45 | ALL Stop | The stop method of Aux. motor | Yes | No Yes |
| APP-47 | Start freq 1 | Starting freq. of No.4 Aux. motor | 49.99 Hz | 0-Max. freq. |
| APP-48 | Start freq 2 | Starting freq. of No.2 Aux. motor | 49.99 Hz | 0-Max. freq. |
| APP-49 | Start freq 3 | Starting freq. of No.3 Aux. motor | 49.99 Hz | 0-Max. freq. |
| APP-50 | Start freq 4 | Starting freq. of No.4 Aux. motor | 49.99 Hz | 0-Max. freq. |
| APP-51 | Stop freq 1 | Stop freq. of No.1 Aux. motor | 20.00 Hz | 0-Max. freq. |
| APP-52 | Stop freq 2 | Stop freq. of No.2 Aux. motor | 20.00 Hz | 0-Max. freq. |
| APP-53 | Stop freq 3 | Stop freq. of No.3 Aux. motor | 20.00 Hz | 0-Max. freq. |
| APP-54 | Stop freq 4 | Stop freq. of No.4 Aux. motor | 20.00 Hz | 0-Max. freq. |
| APP-58 | Aux start DT | Starting delay time of Aux. motor | 5.0 sec | 0 – 999.9 sec |
| APP-59 | Aux stop DT | Stop delay time of Aux. motor | 5.0 sec | 0 – 999.9 sec |
| APP-60 | Pid Acc Time | Acc time when number of pump is decreased. | 2.0 sec | 0 – 600.0 sec |
| APP-61 | Pid Dec Time | Dec time when number of pump is | 2.0 sec | 0 – 600.0 sec |

| Code | LCD Display | Description | Factory Default | Setting Range |
|--------|--------------|--|-----------------|----------------|
| | | increased. | | |
| APP-62 | Regul Bypass | Select the Bypass | No | No Yes |
| APP-63 | Sleep Delay | Sleep delay time | 60 sec | 0 – 999.9 sec |
| APP-64 | Sleep Freq | Sleep freq. | 0.0 Hz | 0-max. freq. |
| APP-65 | WakeUp level | WakeUp Level | 35.0 % | 0.0 – 100.0 % |
| APP-66 | AutoCh_Mode | Select Auto-change mode | 0 | 0 - 2 |
| APP-67 | AutoEx-intv | Time of Auto-change | 72:00 | 00:00 – 99:00 |
| APP-68 | AutoEx-Freq | Frequency of Auto-change | 20.00 Hz | 0 – max. freq. |
| APP-69 | Inter-lock | Select Inter-lock | No | No Yes |
| APP-71 | Aux Stt Diff | Difference of starting pressure of Aux motor | 2% | 0 – 100% |
| APP-72 | Aux Stp Diff | Difference of stop pressure of Aux motor | 2% | 0 – 100% |

APP-40 [Aux Mot Run] shows how many auxiliary motors are run by MMC control.

APP-41 [Starting Aux motor] defines the starting auxiliary motor for MMC control.

APP-42 [Auto Op Time] displays the operation time after Auto Change is accomplished.

APP-43 [Number of Aux] sets the number of auxiliary motors connected to the inverter.

APP-44 [F-in L-out] defines the stop order of auxiliary motor.

If it is set to 'Yes', first started motor will be stop later (FILO: First Input Last Output). If it is set to 'No', first started motor will be stop first (First Input First Output).

For example, auxiliary motor is started in the order of No.1 motor → No.2 motor → No.3 motor → No.4 motor,

If APP-44 is set to 'Yes', auxiliary motor will be stop in the order of No.4 motor → No.3 motor → No.2 motor → No.1 motor. If it is set to 'No', the order is opposite No.1 motor → No.2 motor → No.3 motor → No.4 motor.

APP-45 [ALL Stop] defines the stop method of aux. motor when motor is stop.

If it is set to 'Yes', auxiliary motor will be stop simultaneously. If not, auxiliary motor will be stop respectively with the APP-44 set order.

APP-47~50 [No.1~4 Aux motor starting frequency] sets the starting frequency of each auxiliary motor.

Inverter output frequency will be increased continuously when the flow pressure or quantity is lower than the set level.

- 1) The operation speed of main motor become higher than the set value in APP-44~50,
- 2) The delay time set in APP-58 is elapsed,
- 3) The difference of pressure between command value and feedback is higher than APP-71,

That is, Auxiliary contact AUX1~4 will be turned On in this order with above 3 conditions.

APP-51~54 [No.1~4 Aux motor stop frequency] sets the stop frequency of each auxiliary motor.

The speed of main motor will be decreased by built-in PID controller when flow pressure or quantity exceeds.

- 1) The operation frequency of main motor become lower than the set value in APP-51~54,
 - 2) The delay time set in APP-59 is elapsed,
 - 3) The difference of pressure is lower than APP-72,
- That is auxiliary contact AUX4~AUX1 will be turned Off in this order with 3 conditions.
- APP-58 [Aux.starting delay time], APP-59 [Aux. stop delay time] sets the time by 0.1 unit the inverter waits before starting (stop) the auxiliary motors.

APP-41: Starting Auxiliary Motor Selection

| | | |
|-------------------|---|--|
| APP▶ Starting Aux | | |
| 41 | 1 | |

41

1

| | | |
|------------------|---|----------|
| Factory Default: | 1 | 1 |
|------------------|---|----------|

1

This code defines the starting auxiliary motor for MMC control.

APP-42: Operation Time Display on Auto Change

| | | |
|------------------------------------|-----------|--------------|
| APP▶ Auto Op Time 42 00:00 | 42 | 00:00 |
| Factory Default: 00:00 | | 00:00 |

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

APP-43: The Number of Aux. Motors

| | | |
|------------------------------|-----------|----------|
| APP▶ Nbr Aux' s 43 4 | 43 | 4 |
| Factory Default: 4 | | 4 |

Sets the number of auxiliary motors connected to the inverter.

APP-47~50: Start Frequency of Aux. Motor 1~4

| | | |
|---------------------------------------|-----------|--------------|
| APP▶ Start Freq 1 47 49.99 Hz | 47 | 49.99 |
| Factory Default: 49.99 Hz | | 49.99 |

| | | |
|--------------------------------------|-----------|--------------|
| APP▶ Start freq4 50 49.99 Hz | 50 | 49.99 |
| Factory Default: 49.99 Hz | | 49.99 |

The inverter turns on AUX1, AUX2, AUX3, and AUX4 if the output frequency is over the frequencies set in APP-47 to APP-50, respectively, the time is over APP-58 and pressure difference between reference and feedback value exceeds the value set in APP-71 [Actual Pr Diff].

APP-51~54: Stop Frequency of Aux. Motor 1~4

| | | |
|-------------------------------------|-----------|--------------|
| APP▶ Stop freq1 51 20.00 Hz | 51 | 20.00 |
| Factory Default: 20.00 Hz | | 20.00 |

| | | |
|-------------------------------------|-----------|--------------|
| APP▶ Stop freq4 54 20.00 Hz | 54 | 20.00 |
| Factory Default: 20.00 Hz | | 20.00 |

The inverter turns off AUX4, AUX3, AUX2 and AUX1 in this order if the output frequency is below the frequencies set in APP-51 to APP-54, respectively, the time is over APP-59 and the pressure difference between reference and feedback value decreases below the set value set in APP-71 [Actual Pr Diff].

**APP-58: Delay Time before Starting Aux. Motor
APP-59: Delay Time before Stopping Aux. Motor
APP-60, 61: Accel/Decel time when the number of pumps is increasing/decreasing**

| | | |
|--------------------------------------|-----------|------------|
| APP▶ Aux Start DT 58 5.0 sec | 58 | 5.0 |
| Factory Default: 5.0 sec | | 5.0 |

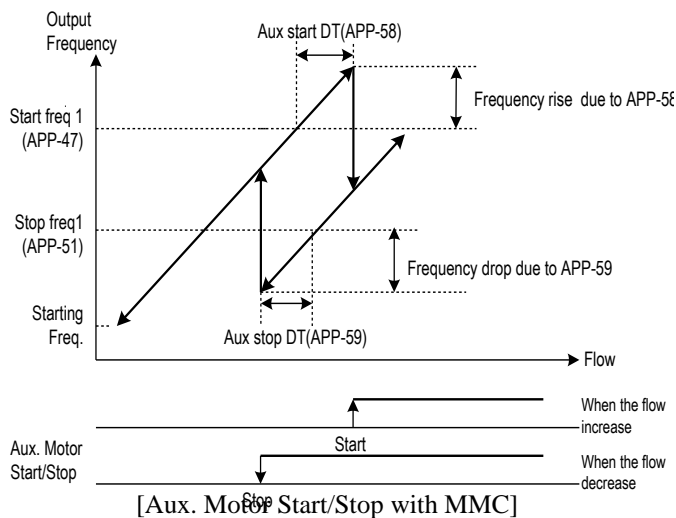
Sets the time the inverter waits before starting the auxiliary motors.

| | | |
|-------------------------------------|-----------|------------|
| APP▶ Aux Stop DT 59 5.0 sec | 59 | 5.0 |
| Factory Default: 5.0 sec | | 5.0 |

| | | |
|-------------------------------------|-----------|------------|
| APP▶ Pid AccTime 60 2.0 sec | 60 | 2.0 |
| Factory Default: 2.0 sec | | 2.0 |

| | | |
|-------------------------------------|-----------|------------|
| APP▶ Pid DecTime 61 2.0 sec | 61 | 2.0 |
| Factory Default: 2.0 sec | | 2.0 |

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

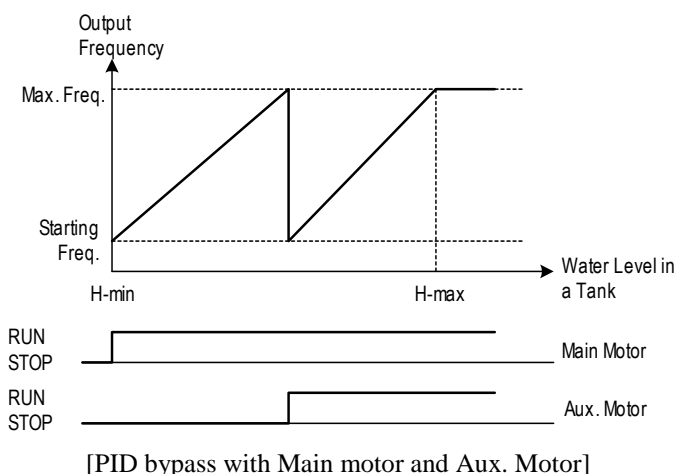


APP-58 and APP-59 sets the acceleration/ deceleration time of the Main motor by 0.1 sec when more/less aux motors are connected.

| APP-62: PID Bypass Selection | | |
|------------------------------|-----------|----------|
| APP▶ Regul Bypass 62 No | 62 | 0 |
| Factory Default: No | | 0 |

This is used to bypass the PID operation selected in APP-02. Select this code to 'Yes' when using MMC function without PID control. The frequency is determined by actual value (feedback) of control amount instead of PID controller output. The actual value is also used as the Start/Stop reference of Aux. motors.

The following figure shows the running pattern with this function applied for controlling the flow rate of a tank. To control the flow rate proportional to the water level of a tank, divide the water level in the tank into the region for the number of Aux. motors plus one, and map each region by starting frequency to maximum frequency. The inverter increases output frequency to lower the water level in the tank when the water level in the tank rises. When reaching maximum frequency, inverter connects aux. motors connected directly to commercial line. After connecting aux. motor, inverter starts again from the starting frequency. By selecting APP-61 [Regul Bypass] to 'Yes', PID operation is disabled and Control Mode is changed to 'V/F'. PID Bypass is available only when DRV-04 [Freq. Mode] is set to 'V1', 'I' or 'Pulse'.



To use MMC operation

A. Set MMC in APP-01

B. Set Process PI to Yes in APP-02

C. Set Pre PID operation enable/disable

- Used for trial operation to check such as pipe damage before operation.
- Used to know the starting set point before PID operation

D. Set PID target value input method in APP-04

- Keypad, V1, I ...
- Set target value

E. Set PID Feedback input method in APP-06

- Set according to sensor used.
- Analog input (4~20mA, 0~10V ...)
- Check whether the setting performs well.
 - Pre-operation is needed.
 - Checks whether output to feedback value is generated.

F. Set Multi-motor driving sequence in APP-66

- Mode 0,1: Main motor and Aux motor used
 - Available motor: Main motor 1 + Aux motor 4 (+3 when Option is used)
- Mode 2: Aux motor used
 - Available motor: Aux motor 4 (+3 when Option is used)

G. Set the number of Aux motor in APP-43

H. Set the starting Aux motor in APP-41

I. Set the start freq of Aux motor in APP-44~50

J. Set the stop freq of Aux motor in APP-51~57

K. Start operation.

Detailed MMC function setting

A. Energy-saving under light load

- Sleep, Wake up

B. To easily and effectively use Process PID operation

- Pre PID

C. To divide the load to the motor equally

- Auto Change

D. To associate other conditions with Aux motor operation

- INTERLOCK

E. Adjusting Aux motor ON/OFF condition and output (pressure, air/wind volume) variation

F. To change response characteristics

→ It is related to PID control. Refer to Process PID description.

APP-66: Auto Change Mode Selection

| | | |
|-------------------------|-----------|----------|
| APP▶ AutoCh_Mode | 66 | 0 |
| 66 0 | | |
| Factory Default: 0 | | 0 |

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

EXCH_NONE mode: Not using Auto Change Function

The inverter is driving the main motor, and tuning the relays ON to connect Aux motors. For example, starting from the Aux motor 3, inverter turns the relays ON from **RLY3** ⇒ **RLY4** ⇒ **RLY1** ⇒ **RLY2** and inverter will start the switching operation if inverter is run operation. If the number of pump is decreased, it turns off the aux motors oppositely from **RLY2** ⇒ **RLY1** ⇒ **RLY4** ⇒ **RLY3**.

AUX_EXCH mode: Auto Change Function is applied only to aux. motors. On/Off sequence is the same as **EXCH_NONE mode**. However, the difference is that starting Aux motor is fixed in **EXCH_NONE mode** but it is automatically changed by inverter in **AUX_EXCH mode** to prevent a specific motor from overusing. For example, when Aux motors running order is **RLY1** ⇒ **RLY2** ⇒ **RLY3** ⇒ **RLY4** and then the Auto change condition is met, inverter turns the relay On from **RLY 2** ⇒ **RLY3** ⇒ **RLY4** ⇒ **RLY1**.

⚠ Caution: **EXCH_NONE, AUX_EXCH mode are available when a Main motor is directly connected to the Inverter.**

MAIN_EXCH mode: Auto Change of Main/Aux motors. All motors are connected to relays and operated via relays. The operation procedure is the same as **AUX_EXCH mode**, except that there is no main motor directly connected to Inverter.

APP-67: Auto Change Time APP-68: Auto Change Level

| | | |
|--------------------------------|-----------|--------------|
| APP▶ AutoEx-intv | 67 | 72:00 |
| 67 72:00 | | |
| Factory Default: 72:00 | | 72:00 |
| APP▶ AutoEx-Freq | 68 | 20.00 |
| 68 20.00 Hz | | |
| Factory Default: 20.00 Hz | | 20.00 |

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

Auto Change is accomplished when the following conditions are satisfied:

- 1) The time set in APP-67 is over and it is **AUX_EXCH** mode.
- 2) The actual value of controlling amount is less than the value set in APP-68 and all Aux motors Off. (in **AUX_EXCH mode**)
- 3) One motor is running (in **MAIN_EXCH mode**).

When above three conditions are met, the inverter stops the running motor, and changes motor to run by the order set in APP-66 and then continues operation according to new order. Inverter starts counting only when auxiliary motor is running.

In **MAIN_EXCH** mode, when inverter output frequency is below Auto Change Level, inverter automatically stops the motor and perform Auto change function and operates next motor.

APP-69: Interlock Selection

APP▶ Inter-lock
69 No

69

0

Factory Default: No

0

When APP-69 [Interlock selection] is set to “Yes”, M1~M4 can be used as the same activating condition for AX1~AX4. Programmable digital input terminals are activated when turned ON. If one of them are turned Off, all motors will start running except the motor connected to the off terminal. If the input signal is turned off in the midst of running, inverter stops all the motors and restarts the operation with normal active motors.

Interlock during Stop

When Run signal is input during Stop, MMC operation is started with the Aux motors(Relays) turned ON.

Ex) When Interlock is not selected:

RLY1→RLY2→RLY3→RLY4

When Interlock is active (the terminal defined as Interlock/RLY2 is turned Off):

RLY1→RLY3→RLY4

Interlock during RUN

When Interlock is active during RUN (the terminal defined as interlock/RLY is turned Off during RUN), inverter stops all motors and restart MMC operation with aux motors except the interlocked one(terminal turned Off).

Ex)Normal operation:

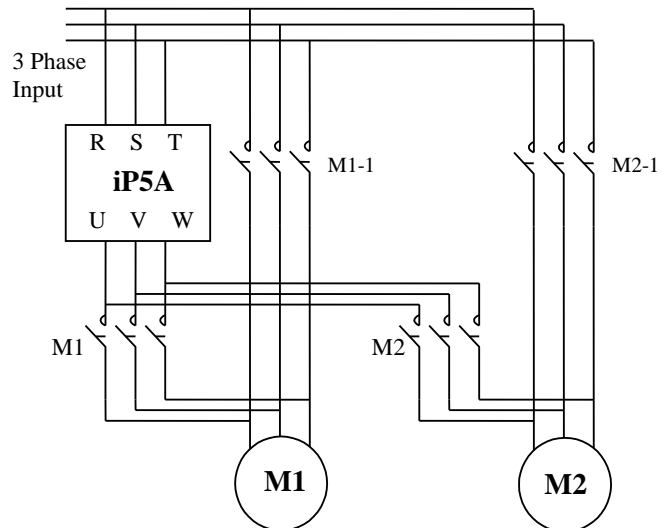
RLY1→RLY2→RLY3→RLY4

When Interlock is active (the terminal defined as Interlock/RLY3 is turned OFF), all Aux motors are turned Off and stopped. MMC operation is restarted except Aux motor 3 (RLY 3 Off).

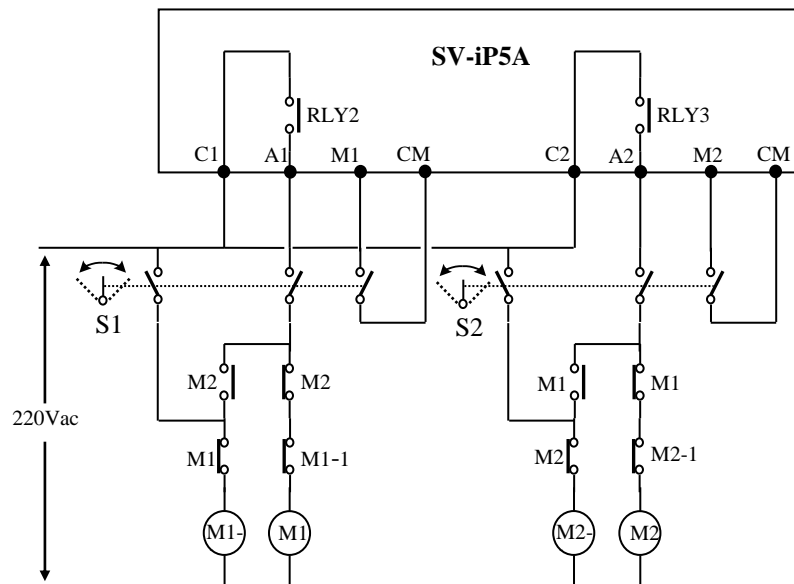
Aux motors start rotating in the order of

RLY1→RLY2→RLY4.

Please refer to the wiring example below when Interlock is used during Auto change MAIN_EXCH mode.



[Wiring Diagram for Inter-Lock Configuration]

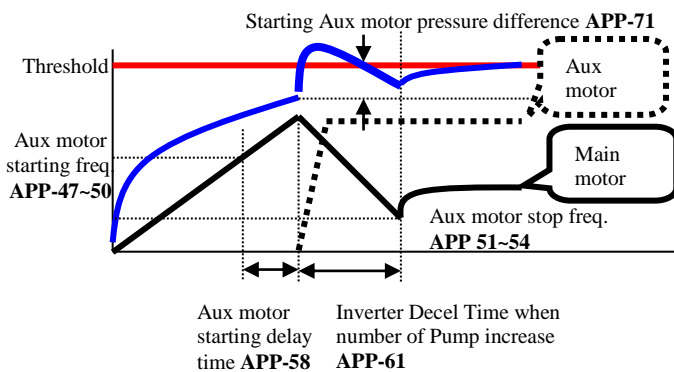


[Sequence Circuit for Inter-Lock Configuration]

Aux motor starting condition and output (Pressure, air volume..) adjustment

Inverter turns Aux motors ON automatically when it is impossible for a main motor to control increased load, causing shortage in flow rate or flow pressure. Maximum 4 Aux motors can be used. To turn on the 4 Aux motors automatically, starting frequency for each motor should be set.

| Code | LCD Display | Description | Factory Default | Setting Range |
|------------|----------------|--|-----------------|---------------|
| APP-47 ~50 | Start freq 1~4 | Starting freq. of No.1~4 Aux. motor | 49.99 Hz | 0 - Max Freq. |
| APP-58 | Aux start DT | Stop delay time of Aux. motor | 5.0 sec | 0 - 999.9 sec |
| APP-61 | Pid Dec Time | Dec time when number of pump is increased. | 2.0 sec | 0 - 600.0 sec |
| APP-71 | Aux Stt Diff | Difference of starting pressure of Aux motor | 2% | 0 - 100% |



Aux motor active condition: Main motor speed exceeds Aux motor starting frequency (APP-47~50), for the time over APP-58[Aux motor starting delay time], Difference between PID reference and Feedback value exceeds APP-71 [Starting Aux motor pressure difference].

APP-47~50: Frequency to turn Aux motor ON. It is set the same as main motor frequency outputting equally when aux motor is turned ON.

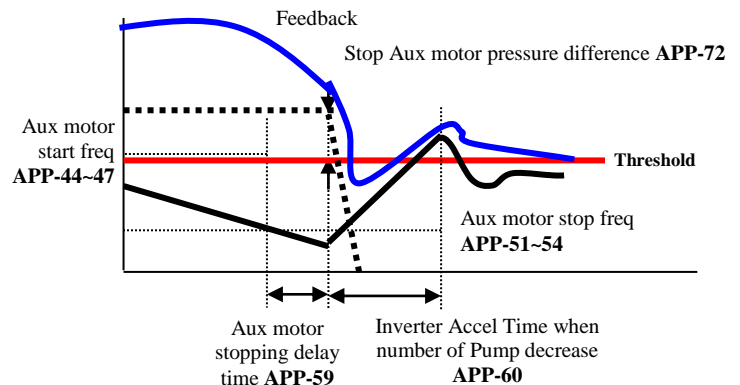
APP-58: It should be set greater than system delay time.

APP-71: It is set by comparing the pressure difference when Aux motor is turned ON and that of Aux motor starting frequency.

APP-61: This is the time inverter frequency is decreased after Aux motor is turned ON. It should be set higher than System delay time but it causes Aux motor ON state to become too long.

Aux motor stopping condition and output (Pressure, air volume..) adjustment

Inverter turns off the Aux motors when flow rate or flow pressure is too large due to decreased load. For Inverter to turn off Max 4 Aux motors automatically, 4 stopping frequency should be set separately.



Aux motors are opened when main motor rotates below APP-51~54 [Aux motor stopping frequency] for the time over APP-59 [Aux motor stopping delay time] and pressure difference between PID reference and Feedback value exceeds the set value in APP-71[Aux motor starting /stopping pressure difference].

APP-51~57: The Aux motors are turned off at this frequency. It is set as dF, whose output matches when Aux motor is off.
(dF = Aux motor On Freq - Aux motor Off Freq)

APP-59: It should be set higher than System Delay Time.

APP-60: This is the time inverter frequency is increased after Aux motor is turned OFF. It should be set higher than System delay time but it causes Aux motor OFF state to become too long.

**APP-71: Pressure Difference for Aux Motor Start
APP-72: Pressure Difference for Aux Motor Stop**

| | | |
|--------------------------------|-----------|----------|
| APP▶Aux Stt Diff 71 2% | 71 | 2 |
|--------------------------------|-----------|----------|

| | |
|---------------------|----------|
| Factory Default: 2% | 2 |
|---------------------|----------|

| | | |
|--------------------------------|-----------|----------|
| APP▶Aux Stp Diff 72 2% | 72 | 2 |
|--------------------------------|-----------|----------|

| | |
|---------------------|----------|
| Factory Default: 2% | 2 |
|---------------------|----------|

It sets the pressure difference between when Aux motors are ON and Aux motor starting frequency.

APP-80~97: External PID operation

| | | |
|------------------------------------|-----------|----------|
| APP▶ Ext Ref Sel 81 KeyPad | 81 | 3 |
|------------------------------------|-----------|----------|

| | |
|-------------------------|----------|
| Factory Default: KeyPad | 3 |
|-------------------------|----------|

| | | |
|------------------------------------|-----------|--------------|
| APP▶Ext Ref Perc 82 50.00% | 82 | 50.00 |
|------------------------------------|-----------|--------------|

| | |
|-------------------------|--------------|
| Factory Default: 50.00% | 50.00 |
|-------------------------|--------------|

| Code | LCD Display | Default | Range |
|--------|--------------|-------------|---|
| APP-80 | Ext PI mode | 0 (No) | 0 (No) 1 (Yes) |
| APP-81 | Ext Ref Sel | 3 (Key-Pad) | 0 (I) 1 (V1) 2 (Pulse) 3 (Key-Pad) |
| APP-82 | Ext Ref Perc | 50.00 [%] | 0 – 100.00 [%] |
| APP-83 | Ext Fbk Sel | 0 (I) | 0 (I) 1 (V1) 2 (Pulse) |
| APP-85 | ExtPID Pgain | 1.0 [%] | 0 – 999.9 [%] |
| APP-86 | ExtPID Itime | 10.0 [sec] | 0 – 32.0 [sec] |
| APP-87 | ExtPID Dtime | 0 [msec] | 0 – 2000 [msec] |

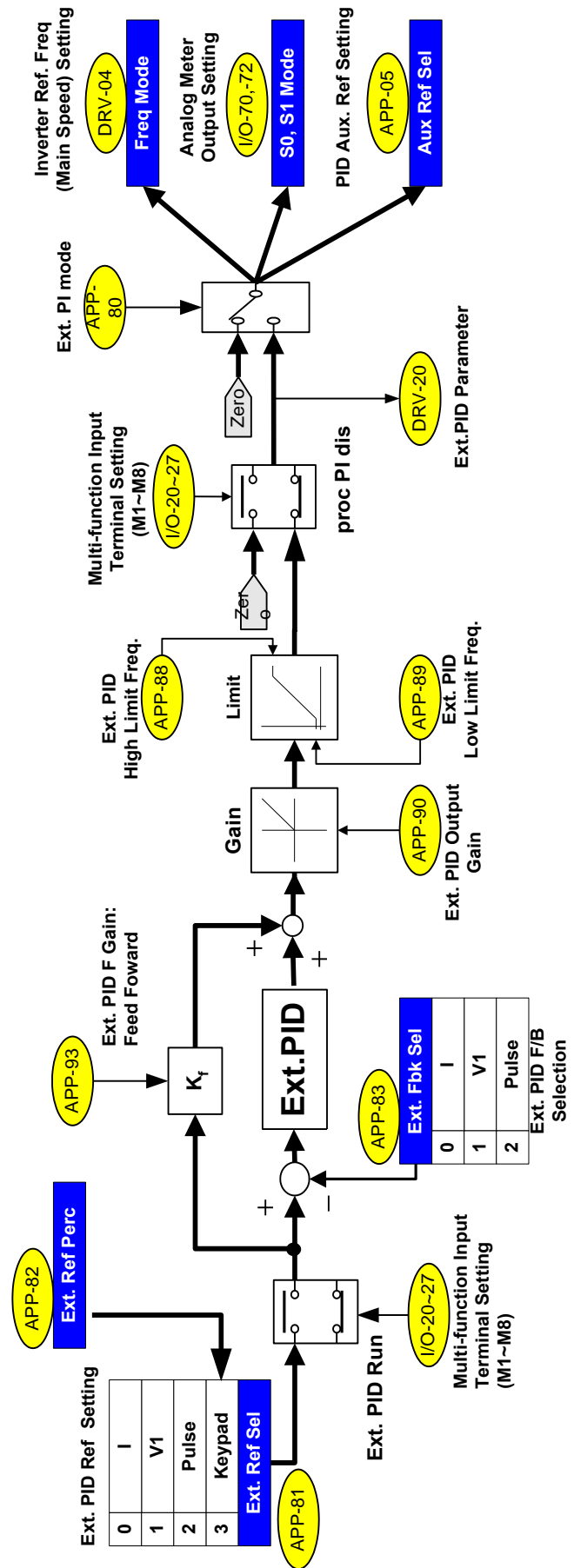
| Code | LCD Display | Default | Range |
|--------|---------------|------------|-------------------|
| APP-88 | ExtPID lmt-H | 100.00 [%] | 0 – 100.00 [%] |
| APP-89 | ExtPID lmt-L | 0.00 [%] | 0 – 30.00 [%] |
| APP-90 | ExtPID Scale | 100.0 [%] | 0 – 999.9 |
| APP-91 | Ext P2-gain | 100.0 [%] | 0 – 999.9 |
| APP-92 | Ext P Scale | 100.0 [%] | 0 – 100.0 |
| APP-93 | ExtPID F-gain | 0.0 [%] | 0 – 999.9 [%] |
| APP-95 | ExtPIDOut Inv | 0 (No) | 0 (No) 1 (Yes) |
| APP-97 | Ext Loop Time | 100 [msec] | 50 – 200 [msec] |

APP-80~96 setting value is the same as APP-02~17.

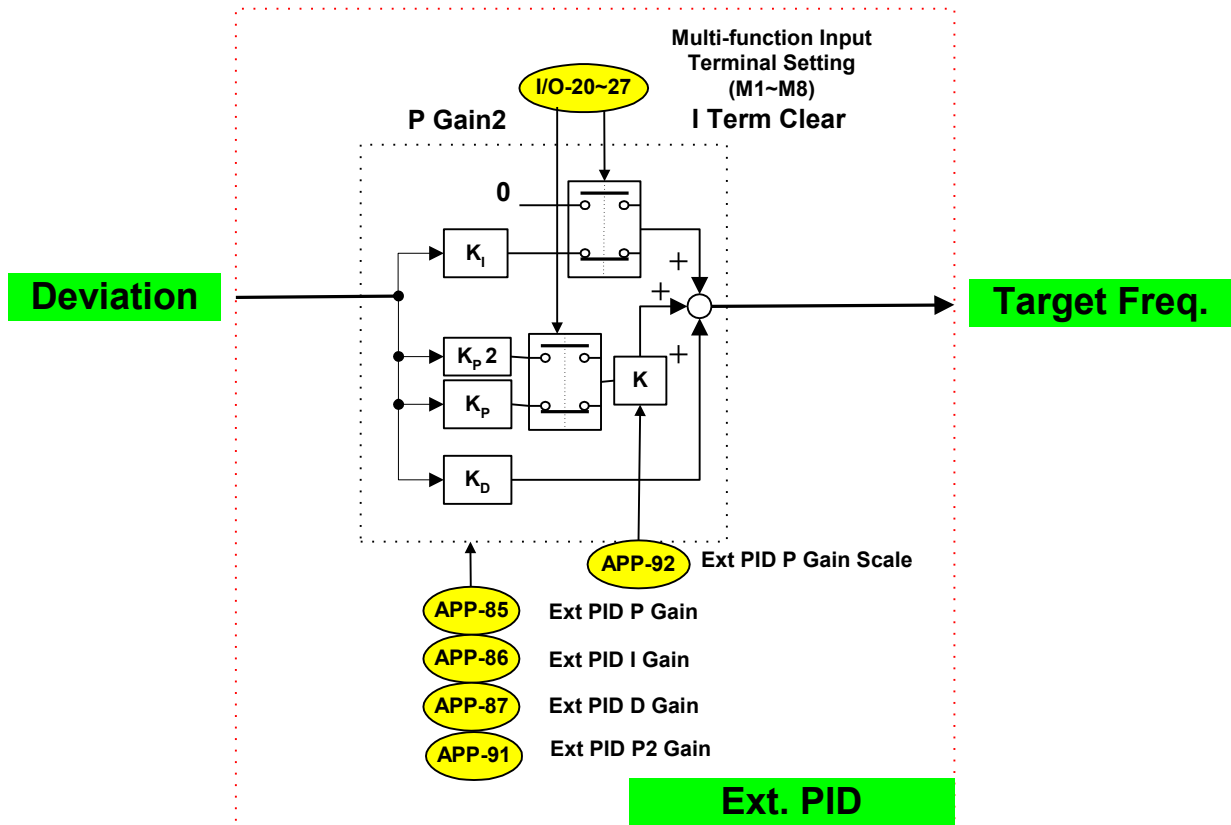
APP –82 [Ext PID Ref value] is settable when APP-81 [Ext PID Ref selection] is set to “Keypad”.

APP–97 [Ext PID Loop Time] sets the time to activate Ext PID controller. Set the desired value according to system.

Ext PID can be used for ①controlling other system independently as an external PID controller ② using both PID controller in APP-02 and External PID controller ③ using Ext PID output as an Inverter target frequency. See 10) APP-02, APP-80 (to use Dual PID operation) for more details.



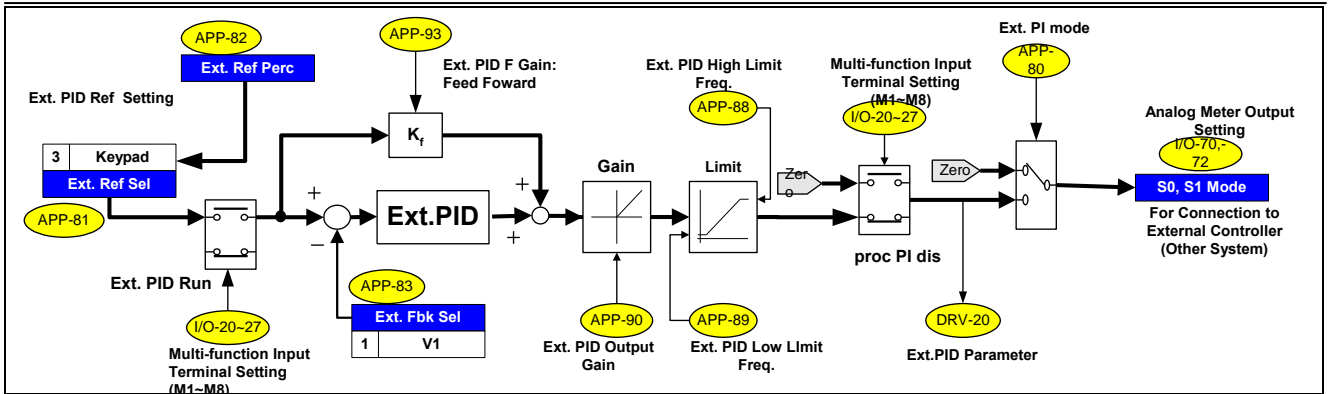
[Ext. PID internal block diagram]



APP-02 , APP-80 (to use Dual PID operation)

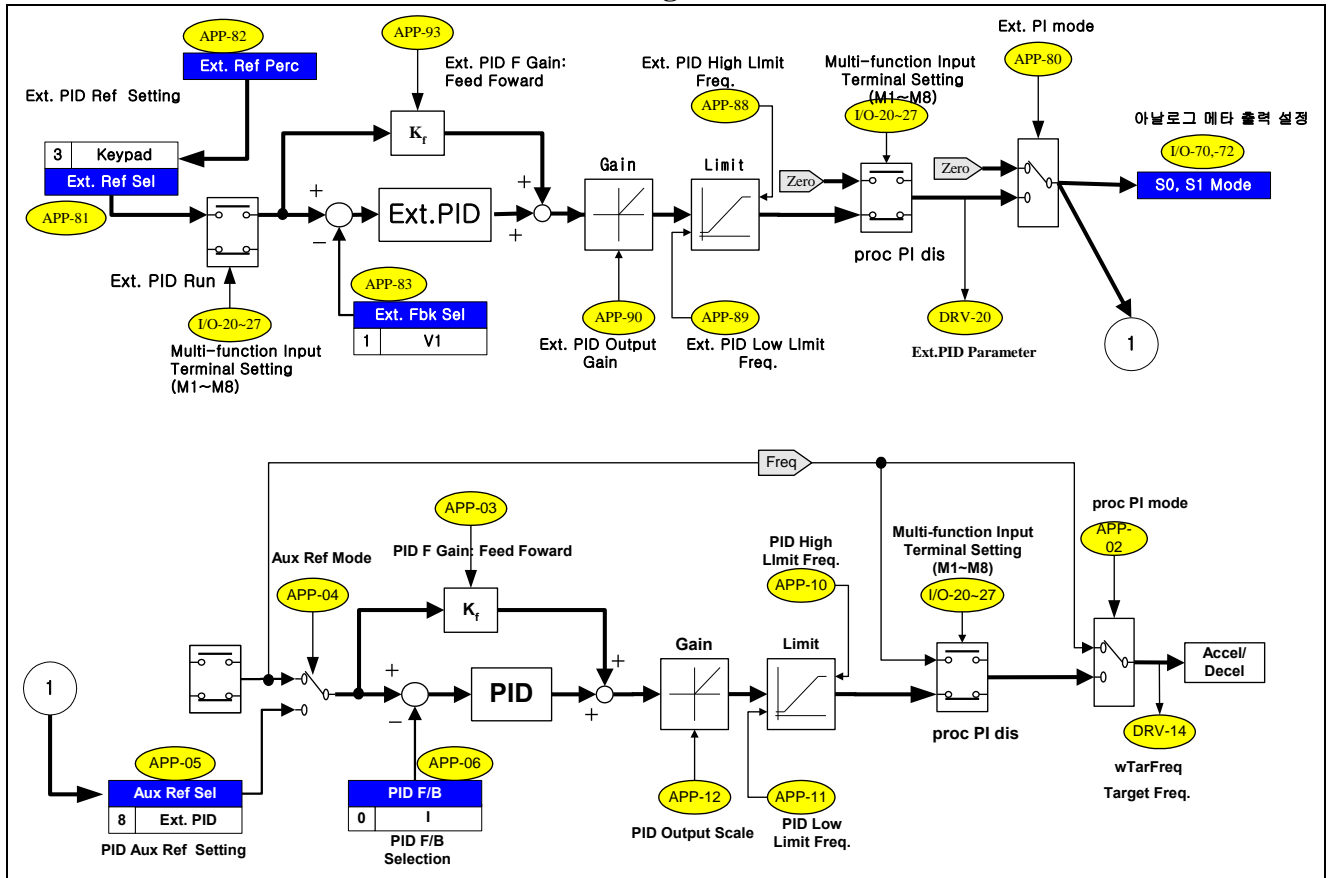
ExtPID can be used in the following three cases; ①controlling other system independently like an external PID controller ②using both PID controller in APP-02 and External PID controller ③using ExtPID output as an Inverter target frequency.

[Dual PID block diagram for case ①]



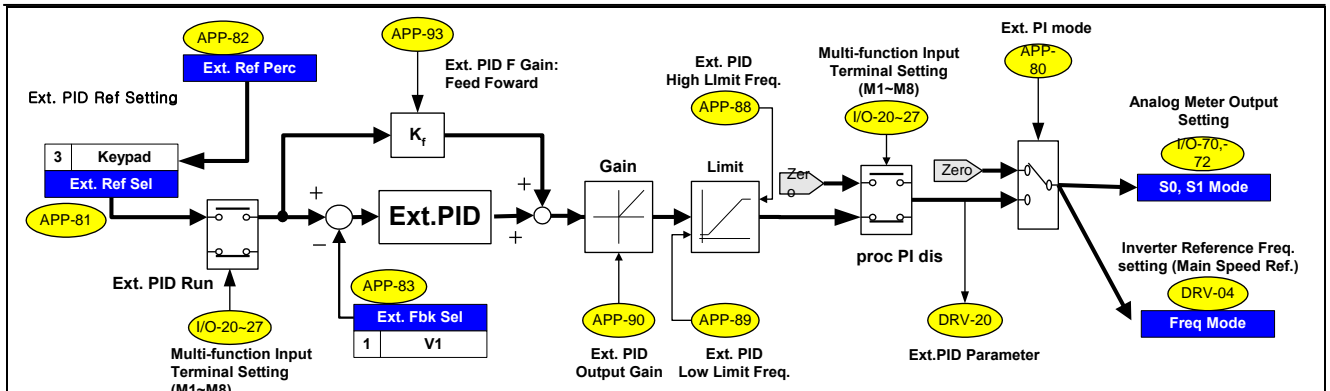
This illustrates controlling other system independently. Set I/O-70 or 72 [S0/S1 mode] to “Ext PID Out” and connect external system to S0 or S1 terminal. When Ext.PID Run signal is ON at the defined terminal in I/O-20~27, it starts output.

[Dual PID block diagram for case ②]



This illustrates dual use of PID controller (APP-02) and External PID controller. Set APP-81 [Ext. Ref Sel] to Analog Input (V1, I, or Pulse) and perform terminal wiring for analog input. To give the digital reference, set APP-81 [Ext. Ref Sel] to “Keypad” and set proper value in APP-82 [Ext. Ref Perc]. Set the Ext. PID Feedback among V1, I, Pulse in APP-83 and perform terminal wiring for analog input. External PID Ref. and feedback are connected to PID controller. When Ext.PID Run signal is ON to the defined terminal in I/O-20~27, it starts its output. S0/S1 terminal can be used to connect to other system.

[Dual PID block diagram for case ③]



ExtPID output can be used for inverter target frequency. To activate this function, set analog input (V1, I, Pulse) as a reference value to other system or set APP-81 [Ext. Ref Sel] to “Keypad” and set proper value in APP-82 [Ext. Ref Perc]. Set APP-83 [Ext. Fbk Sel] to Analog input (I, V1, Pulse) and conduct wiring. And set DRV-04 [Freq Mode] to “Ext. PID”, then ExtPID output functions as Inverter main speed reference (target frequency). When Ext.PID Run signal is ON in the defined terminal in I/O-20~27, it starts its output and inverter performs Accel/Decel with output frequency. Other system can be connected via S0/S1 terminal.

■ Notes :

CHAPTER 7 - TROUBLESHOOTING & MAINTENANCE

7.1 Fault Display

When a fault occurs, the inverter turns off its output and displays the fault status in DRV-12. The last 5 faults are saved in FU2-01 through FU2-05 with the operation status at the instance of fault. Reset the inverter when a fault occurs.

| Keypad Display | Protective Function | Description |
|--------------------------------|--|--|
| Over Current Over Current 1 | Over Current Protection | The inverter turns off its output when the output current of the inverter flows more than 200% of the inverter rated current. This may cause danger or damage the drive so it requires double protection. |
| Ground Fault | Ground Fault Protection | The inverter turns off its output when a ground fault occurs and the ground fault current is more than the internal setting value of the inverter. Over current trip function may protect the inverter when a ground fault occurs due to a low ground fault resistance. |
| Over Voltage | Over voltage protection | The inverter turns off its output if the DC voltage of the main circuit increases higher than the rated value when the motor decelerates or when regenerative energy flows back to the inverter due to a regenerative load. This fault can also occur due to a surge voltage generated at the power supply system. |
| Over Load | Current Limit Protection (Overload Protection) | The inverter turns off its output if the output current of the inverter flows at 120% of the inverter rated current. |
| Over Heat | Inverter Over Heat | The inverter turns off its output if the heat sink is over heated due to a damaged cooling fan or an alien substance in the cooling fan. |
| E-Thermal | Electronic Thermal | The internal electronic thermal of the inverter determines the over heating of the motor. If the motor is overloaded the inverter turns off the output. The inverter cannot protect the motor when driving a multi-pole motor or when driving multiple motors, so consider thermal relays or other thermal protective devices for each motor. Overload capacity: 130% for 1 min |
| Ext. Trip | External Trip | Use this function if the user needs to turn off the output by an external trip signal. (Normal Open Contact) Inverter blocks the output to protect motor overload by detecting through this terminal. |
| Low Voltage | Low Voltage Protection | The inverter turns off its output if the DC voltage is below the detection level because insufficient torque or over heating of the motor can occurs when the input voltage of the inverter drops. |
| Over Current 2 | IGBT Short | The inverter turns off the output if an IGBT short through or an output short occurs. |
| Output Phase Open | Output Phase open | The inverter turns off its output when the one or more of the output (U, V, W) phase is open. The inverter detects the output current to check the phase open of the output. |
| Input Phase Open | InputPhaseOpen | The inverter turns off its output if the one or more of the input (R, S, T) phase is open. The inverter detects the input current to check the phase open of the input. If smaller load is used, it can not be detected. |
| BX | BX Protection (Instant Cut Off) | Used for the emergency stop of the inverter. The inverter instantly turns off the output when the BX terminal is turned ON, and returns to regular operation when reset button is pressed and the BX terminal is turned OFF. Take caution when using this function. |
| HW-Diag | Inverter H/W Fault | A fault signal is output when an error occurs to the control circuitry of the inverter. There are the Wdog error, the EEP error, Input phase open, NTC open and the ADC Offset for this fault |
| COM Error CPU Error | Communication Error | This fault is displayed when the inverter cannot communicate with the keypad. |
| Inv. OLT | Inverter Overload | The inverter turns off its output when the output current of the inverter flows more than the rated level (110% for 1 minute, 130% for 4 seconds). |

| Keypad Display | Protective Function | Description |
|---------------------------------|---|--|
| NTC open | NTC Open | This fault is displayed when inverter internal NTC is opened. |
| LOP LOR LOV LOI LOX | Operating Method when the Frequency Reference is Lost | According to the I/O-48 [Operating Method when the Frequency Reference is Lost] setting, there are three modes: continuous operation, decelerate to stop, and free run to stop, LOP: Displayed when option frequency reference is lost (DPRAM time out) LOR: Displayed when option frequency reference is lost (Communication network fault) LOV: Displayed when 'V1' analog frequency reference is lost. LOI: Displayed when 'I' analog frequency reference is lost. LOX: Displayed when sub-board (V2, ENC) analog frequency reference is lost. |
| Lost cmd | | This fault is displayed when I/O 18 sets to Protection. |
| Fuse Open | Fuse Open | This fault is displayed when inverter internal fuse is opened by over current. (applied above 37 kW products) |
| Output Fault Trip | No Motor Trip | Trip has occurred according to setting of FU1 57~59. |
| Keypad Open | Keypad FLT | Indicats wire is separated from keypad. It is displayed only DRV-23 set to Fault. |

To reset fault, Press **RESET** key, close RST-CM terminals or cycle the input power.
If a problem persists, please contact the factory or your local distributor.

Operation methods and fault display in case of frequency loss

- I/O-18 <Lost Command> is as below description

| I/O-18 set data | Description |
|-----------------|---|
| None | Keep the operation because frequency command is lost. (Factory default) |
| FreeRun | Free Run to stop because frequency command is lost. |
| Stop | Deceleration to stop because frequency command is lost. |
| Protection | Lost Cmd Trip because frequency command is lost. |

- Load display when command is lost

| LCD display | Description |
|-------------|--|
| LOP | Displayed when option command is lost (DPRAM Time out) |
| LOR | Displayed when option command is lost (Abnormal communication network) |
| LOV | Displayed when V1 analog frequency command is lost. |
| LOI | Displayed when I analog frequency command is lost. |
| LOX | Displayed when sub board (V2, ENC) frequency is lost. |

If you want to check the previous state of inverter trip occurred and inverter trip description,

- Current faulty description

| Code | Display | Description |
|-------|--------------|--|
| DRV-7 | Over Current | Displayed the current trip message. (Over current) |

Use the **PROG**, **▲** and **▼** key before pressing the **RESET** key to check the fault content(s) such as output frequency, output current, and whether the inverter was accelerating, decelerating, or in constant speed at the time of the fault occurred. Press the **ENT** key to escape.
Press the **RESET** key to save the trip history in FU2-01~05.

- Last fault history
- This code displays up to five previous fault (trip) status of the inverter. The lowest numbered

fault such as “Last trip 1” is the most recent. Previous state of inverter trip occurred and inverter trip description can be checked.

- FU2-06 [Erase trips] initializes the FU2-01~05 [Last trip-x]. It becomes the value of factory default.

| Code | LCD display | Description |
|--------|-------------|----------------|
| FU2-01 | Last trip-1 | Trip history 1 |
| FU2-02 | Last trip-2 | Trip history 2 |
| FU2-03 | Last trip-3 | Trip history 3 |
| FU2-04 | Last trip-4 | Trip history 4 |
| FU2-05 | Last trip-5 | Trip history 5 |

Reset the trip (Abnormal inverter state)

There are 3 kinds of reset methods. Auto restart number is initialized after reset the inverter.

1. Reset by [RESET] key in loader.
2. Cut off the RST-CM of terminal block of inverter control circuit.
3. Turn off the inverter power and turn on the inverter.

| Protection function | LCD display | Description |
|---------------------------------|-------------------------------|--|
| Over Current 1 Protection | Over Current Over Current1 | Inverter output cuts off when the inverter output exceeds 200% of th rated current.. |
| Ground Fault Current Protection | Ground Fault | Inverter output cuts off when current above the prescribed amount flows due to earth in the inverter outputu part. Ground fault due to low ground resistor can be protective by over current trip. |
| Over Voltage Protection | Over Voltage | Inverter output cutss off when the DC current above the prescribed amount flows due to deceleration or regenerative energy. It can be occurred due to surge voltage from power system. |

Fault Remedy

| Protective Function | Cause | Remedy |
|--|---|--|
| Over Current Protection 1 | <ol style="list-style-type: none"> 1) Acceleration/Deceleration time is too short compared to the GD^2 of the load. 2) Load is larger than the inverter rating. 3) Inverter turns output on when the motor is free running. 4) Output short or ground fault has occurred. 5) Mechanical brake of the motor is operating too fast. 6) Components of the main circuit have overheated due to a faulty cooling fan. | <ol style="list-style-type: none"> 1) Increase Accel/Decel time. 2) Increase inverter capacity. 3) Operate after motor has stopped. 4) Check output wiring. 5) Check mechanical brake operation. 6) Check cooling fan. <p>(Caution) Operating inverter prior to correcting fault may damage the IGBT.</p> |
| Ground Fault Current Protection | <ol style="list-style-type: none"> 1) Ground fault has occurred at the output wiring of inverter. 2) The insulation of the motor is damaged due to heat. | <ol style="list-style-type: none"> 1) Investigate the output wiring of inverter. 2) Exchange motor. |
| Over Voltage Protection | <ol style="list-style-type: none"> 1) Acceleration time is too short compared to the GD^2 of load. 2) Regenerative load at the output 3) Line voltage is high. | <ol style="list-style-type: none"> 1) Increase deceleration time. 2) Use regenerative resistor option. 3) Check line voltage. |
| Current Limit Protection (Overload Protection) | <ol style="list-style-type: none"> 1) Load is larger than the inverter rating. 2) Incorrect inverter capacity selected. 3) Set incorrect V/F pattern. | <ol style="list-style-type: none"> 1) Increase capacity of motor and inverter. 2) Select correct inverter capacity. 3) Select correct V/F pattern. |
| Inverter Overheat | <ol style="list-style-type: none"> 1) Cooling fan damaged or an alien substance inserted. 2) Cooling system has faults. 3) Ambient temperature high. | <ol style="list-style-type: none"> 1) Exchange cooling fans and/or eliminate alien substance. 2) Check for alien substances in the heat sink. 3) Keep ambient temperature under 40 °C. |
| Electronic Thermal | <ol style="list-style-type: none"> 1) Motor has overheated. 2) Load is larger than inverter rating. 3) ETH level too low. 4) Incorrect inverter capacity selected. 5) Set incorrect V/F pattern. 6) Operated too long at low speeds. | <ol style="list-style-type: none"> 1) Reduce load and/or running duty. 2) Increase inverter capacity. 3) Adjust ETH level to an appropriate level. 4) Select correct inverter capacity. 5) Select correct V/F pattern. 6) Install a cooling fan with a separate power supply. |
| External Trip | External Trip has occurred. | Eliminate Trip at circuit connected to external trip terminal or remove external trip input. |
| Low Voltage Protection | <ol style="list-style-type: none"> 1) Line voltage low. 2) Load larger than line capacity is connected to line. (welding machine, motor with high starting current connected to the commercial line) 3) Faulty magnetic switch at the input side of the inverter | <ol style="list-style-type: none"> 1) Check line voltage. 2) Increase line capacity. 3) Exchange magnetic switch. |
| Over Current 2 | <ol style="list-style-type: none"> 1) Short has occurred between the upper and lower IGBT. 2) Short has occurred at the output of the inverter. 3) Acceleration/Deceleration time is too short compared to the GD^2 of load. | <ol style="list-style-type: none"> 1) Check IGBT. 2) Check output wiring of inverter. 3) Increase acceleration time. |
| Output Phase Open | <ol style="list-style-type: none"> 1) Faulty contact of magnetic switch at output 2) Faulty output wiring | <ol style="list-style-type: none"> 1) Check magnetic switch at output of inverter. 2) Check output wiring. |
| H/W Fault | <ol style="list-style-type: none"> 1) Wdog error (CPU fault) 2) EEP error (memory fault) 3) ADC Offset (current feedback circuit fault) | <ol style="list-style-type: none"> 1) Exchange inverter. 2) Check the input power wiring. |
| Communication Fault | <ol style="list-style-type: none"> 1) Faulty connection between inverter and keypad 2) Inverter CPU malfunction | <ol style="list-style-type: none"> 1) Check connector. 2) Exchange inverter. |
| Operating Method when the Speed | <ol style="list-style-type: none"> LOP (Loss of reference from the Option), LOR (Remote) LOV (V1), | Eliminate cause of fault. |

| Protective Function | Cause | Remedy |
|---------------------|---|---|
| Reference is Lost | LOI (I), LOX (Sub-V2, ENC) | |
| Inverter Overload | 1) Load is larger than inverter rating. 2) Incorrect inverter capacity selected. | 1) Increase motor and/or inverter capacity. 2) Select correct inverter capacity. |

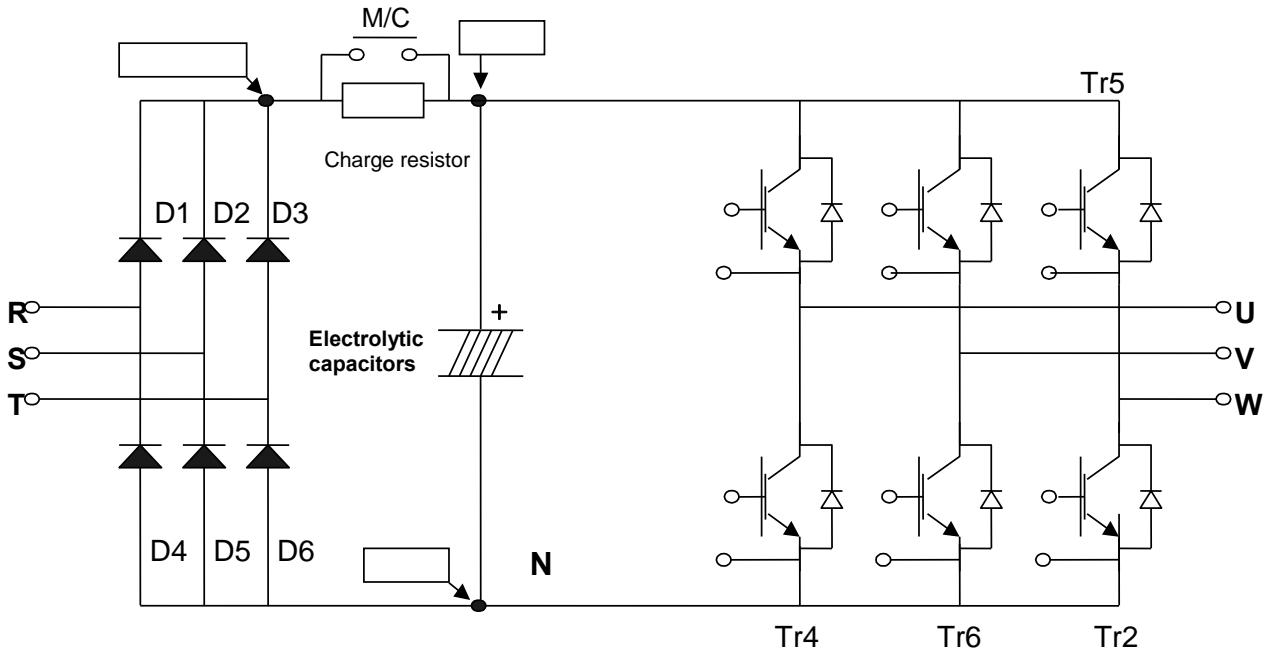
7.2 Troubleshooting

| Condition | Checking Point |
|---|---|
| The Motor Does Not Rotate. | 1) Main circuit inspection: - Is the input (line) voltage normal? (Is the LED in the inverter is lit?) - Is the motor connected correctly? 2) Input signal inspection: - Check the operating signal input to the inverter. - Check the forward and the reverse signal input simultaneously to the inverter? - Check the command frequency signal input to the inverter. 3) Parameter setting inspection: - Is the reverse prevention (FU1-01) function set? - Is the Drive mode (DRV-03) set correctly? - Is the command frequency set to 0? 4) Load inspection: - Is the load too large or is the motor jammed? (Mechanical brake) 5) Other: - Is the alarm displayed on the keypad or is the alarm LED lit? (STOP LED blinks) |
| The Motor Rotates in Opposite Directions. | - Is the phase sequence of the output terminal U, V, W correct? - Is the starting signal (forward/reverse) connected correctly? |
| The Difference Between the Rotating Speed and the Reference is Too Large. | - Is the frequency reference signal correct? (Check the level of the input signal) - Is the following parameter setting is correct? - Lower Limit Frequency (FU1-34), Upper Limit Frequency (FU1-35), Analog Frequency Gain (I/O-1~10) - Is the input signal line influenced by external noise? (Use a shielded wire) |
| The Inverter Does Not Accelerate or Decelerate Smoothly. | - Is the acceleration/deceleration time is set too short a period of time? - Is the load too large? - Is the Torque Boost (FU2-68, 69) value is too high that the current limit function and the stall prevention function do not operate? |
| The Motor Current is Too High. | - Is the load too large? - Is the Torque Boost Value (manual) too high? |
| The Rotating Speed Does Not Increase. | - Is the Upper Limit Frequency (FU1-35) value correct? - Is the load too large? - Is the Torque Boost (FU1-68, 69) value too high that the stall prevention function (FU1-71) does not operate? |
| The Rotating Speed Oscillates When the Inverter is Operating. | 1) Load inspection: - Is the load oscillating? 2) Input signal inspection: - Is the frequency reference signal oscillating? 3) Other: - Is the wiring too long when the inverter is using V/F control? (over 500m) |

7.3 How to Check Power Components

1) Diode module and IGBT module check (5.5~ 30kW)

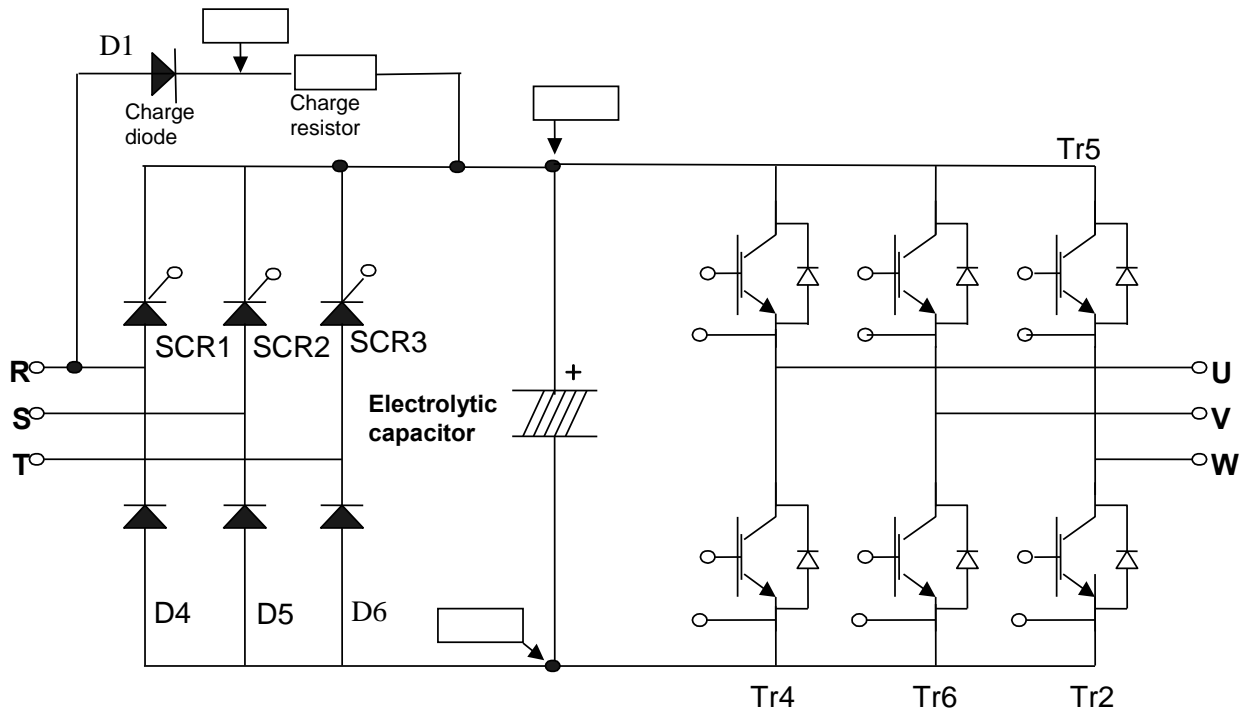
Before checking the power components, be sure to disconnect AC Input supply and wait until the Main Electrolytic Capacitors (DCP-DCN) is discharged.



- Turn the power off and disconnect RST/UVW wiring.
- Determine whether inverter terminals (R,S,T, U, V, W, P1(or P2),N) are energized or not using a tester.
- Wait until the Main Electrolytic Capacitors (DCP-DCN) is discharged to a safe level.
- Enormous amount of value such as Mega will be displayed when Open. When closed, the resistance value ranges from a few ohms to tens of Ω . Sometimes, it seems to be closed due to electrolytic capacitors but soon to be displayed mega value resistance.
- The displayed value is not always the same according to modules and tester types but should be similar.
- Modules number and checking point

| Module | | Test polarity | | Check value | Number | Test polarity | | Check value |
|--------|-----|---------------|------|-------------|--------|---------------|---|-------------|
| | | + | - | | | + | - | |
| Diode | D1 | R | DCP+ | Closed | D4 | R | N | Open |
| | | DCP+ | R | Open | | N | R | Closed |
| | D2 | S | DCP+ | Closed | D5 | S | N | Open |
| | | DCP+ | S | Open | | N | S | Closed |
| | D3 | T | DCP+ | Closed | D6 | T | N | Open |
| | | DCP+ | T | Open | | N | T | Closed |
| IGBT | Tr1 | U | DCP | Closed | Tr4 | U | N | Open |
| | | DCP | U | Open | | N | U | Closed |
| | Tr3 | V | DCP | Closed | Tr6 | V | N | Open |
| | | DCP | V | Open | | N | V | Closed |
| | Tr5 | W | DCP | Closed | Tr2 | W | N | Open |
| | | DCP | W | Open | | N | W | Closed |

2) Diode module and IGBT module check (37~ 90kW)



- Turn the power off and disconnect RST/UVW wiring.
- Determine whether inverter terminals (R,S,T, U, V, W, P1(or P2),N) are energized or not using a tester.
- Wait until the Main Electrolytic Capacitors (DCP-DCN) is discharged to a safe level.
- Enormous amount of value such as Mega will be displayed when Open. When closed, the resistance value ranges from a few ohms to tens of Ω . Sometimes, it seems to be closed due to electrolytic capacitors but soon to be displayed mega value resistance.
- The displayed value is not always the same according to modules and tester types but should be similar.
- Modules number and checking point

| Module | | Test polarity | | Check value | Number | Test polarity | | Check value |
|--------|-----|---------------|------|-------------|--------|---------------|---|-------------|
| | | + | - | | | + | - | |
| Diode | D1 | R | DCP+ | Closed | D4 | R | N | Open |
| | | DCP+ | R | Open | | N | R | Closed |
| | D5 | S | N | Open | D6 | T | N | Open |
| | | N | S | Closed | | N | T | Closed |
| IGBT | Tr1 | U | DCP | Closed | Tr4 | U | N | Open |
| | | DCP | U | Open | | N | U | Closed |
| | Tr3 | V | DCP | Closed | Tr6 | V | N | Open |
| | | DCP | V | Open | | N | V | Closed |
| | Tr5 | W | DCP | Closed | Tr2 | W | N | Open |
| | | DCP | W | Open | | N | W | Closed |

7.4 Maintenance

The iP5A series is an industrial electronic product with advanced semiconductor elements. However, temperature, humidity, vibration and aging parts may still affect it. To avoid this, it is recommended to perform routine inspections.

7.4.1 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 voltage between terminal P1-N (or P2-N) should be less than DC 30V). The bus capacitors in the electronic circuit can still be charged even after the power is turned off.
- ☞ The correct output voltage can only be measured by using a rectifier voltage meter. Other voltage meters, including digital voltage meters, are likely to display incorrect values caused by the high frequency PWM output voltage of the drive.

7.4.2 Routine Inspection

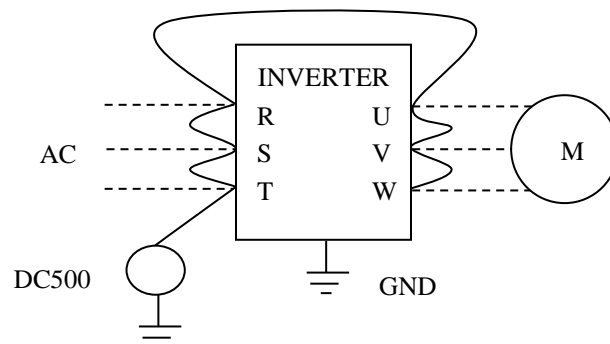
- ☞ Be sure to check the following before operation:
- ☞ The conditions of the installation location
- ☞ The conditions of the drive cooling
- ☞ Abnormal vibration or loud noise
- ☞ Abnormal heating or discoloration

7.4.3 Periodic Inspection

- ☞ Are there any loose bolt, nut or rust caused by surrounding conditions? If so, tighten them up or replace them.
- ☞ Are there any deposits inside the drive-cooling fan? If so, remove using air gun.
- ☞ Are there any deposits on the drive's PCB (Printed Circuit Boards)? If so, remove using air.
- ☞ Are there any abnormalities in the various connectors of the drive's PCB? If so, check the condition of the connector in question.
- ☞ Check the rotating condition of the cooling fan, the size and condition of the capacitors and the connections with the magnetic contactor. Replace them if there are any abnormalities.

7.4.4 Megger/Withstanding Voltage Test

Perform megger test after inverter wiring is disconnected. Test voltage should not be applied to the inverter. Megger test should be conducted only for the main circuit, not the control circuit. Use DC 500V megger. Dielectric test should not be conducted to the inverter. Otherwise, IGBT may be damaged.



7.4.5 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 |
| | Equipment | Is there any abnormal oscillation or noise? | O | | | Use sight and hearing. | No abnormality | |
| | Input Voltage | Is the input voltage of the main circuit normal? | O | | | Measure the voltage between the terminals R, S, T. | | Digital Multi-Meter/Tester |
| Main Circuit | All | 1) Megger check (between the main circuit and the ground) 2) Are any fixed parts removed? 3) Are there any traces of overheating at each component's cleaning? | | O | O | 1) Undo the inverter connections short the terminals R, S, T, U, V, W and measure between these parts and the ground. 2) Tighten the screws. 3) Visual check. | 1) Over 5M Ω 2), 3) No fault | DC 500V class Megger |
| | Conductor/Wire | 1) Is the conductor rusty? 2) Is the wire coating damaged? | | O | O | Visual check | No fault | |
| | Terminal | Is there any damage? | | O | | Visual check | No fault | |
| | IGBT Module /Diode Module | Check the resistance between each of the terminals. | | | O | Undo the inverter connection and measure the resistance between R, S, T \Leftrightarrow P, N and U, V, W \Leftrightarrow P, N with a tester. | (Refer 'How to Check Power Components') | Digital Multi-Meter/Analog Tester |
| | Smoothing Capacitor | 1) Is there any liquid coming out? 2) Is the safety pin out, and is there any swelling? 3) Measure the capacitance. | O | | O | 1), 2) Visual check 3) Measure with a capacitance-measuring device. | 1), 2) No fault 3) Over 85% of the rated capacity | Capacitance Measuring Device |
| | Relay | 1) Is there any chattering noise during operation? 2) Is there any damage to the contact | | O | | 1) Auditory check 2) Visual check | No fault | |
| | Resistor | 1) Is there any damage to the resistor insulation? 2) Is the wiring in the resistor damaged (open)? | | O | O | 1) Visual check 2) Disconnect one of the connections and measure with a tester. | 1) No fault 2) Error must be within $\pm 10\%$ the displayed resistance. | Digital Multi-Meter/Analog Tester |
| Control Circuit Protective Circuit | Operation Check | 1) Is there any unbalance between each phases of the output voltage? 2) Nothing must be wrong with display circuit after executing the sequence protective operation. | | O | O | 1) Measure the voltage between the output terminals U, V and W. 2) Short and open the inverter protective circuit output. | 1) The voltage balance between the phases for 200V (400V) class is under 4V (8V). 2) The fault circuit operates according to the sequence. | Digital Multi-Meter/Rectifying Voltmeter |
| Cooling System | Cooling Fan | 1) Is there any abnormal oscillation or noise? 2) Is the connection area loose? | O | | O | 1) Turn OFF the power and turn the fan by hand. 2) Tighten the connections. | 1) Must rotate smoothly. 2) 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 | 1) Are there any abnormal vibrations or noise? 2) Is there any unusual odor? | O | | | 1) Auditory, sensory, visual check. 2) Check for overheat and damage. | No fault | |
| | Insulation Resistor | Megger check (between the output terminals and the ground terminal) | | | O | Undo the U, V and W connections and tie the motor wiring. | Over 5M Ω | 500V class Megger |

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

Note: Life cycle of the Main components indicated above is based on continuous operation with rated load. It may vary with surrounded environment.

7.4.6 Parts replacement

| Part name | Period | Comments |
|------------------------|-----------|---|
| Cooling fan | 2-3 years | Exchange for a new part after consulting LS A/S center. |
| Electrolytic capacitor | 5 years | Check for the periodic inspection for 1 year. Exchange for a new part after consulting LS A/S center. The Recommended level to exchange a capacitor in main/control circuit is 85% or less of the initial value. |
| Relays | - | Exchange for a new part after consulting LS A/S center. |

The life expectancy of a part depends on the type of part, the environment, and operating conditions.

CHAPTER 8 - OPTIONS

8.1 Option List

iP5A series is available to connect below option device.

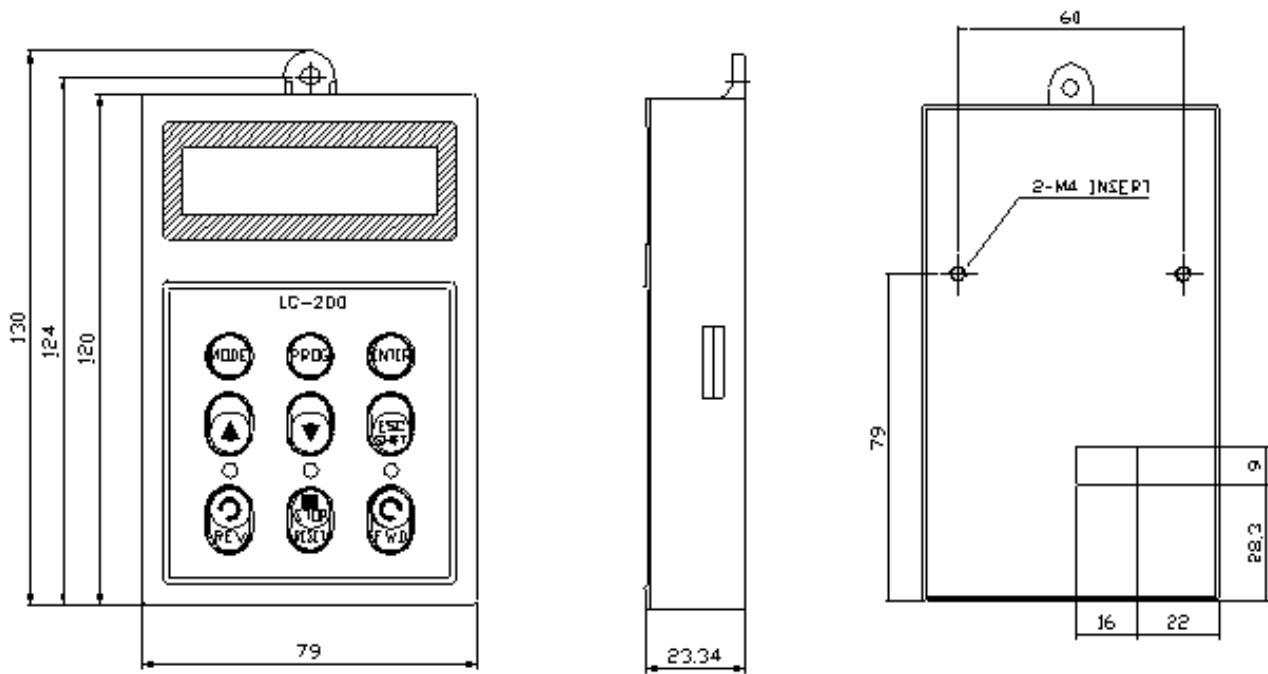
| | | | | |
|----------|-----------------|-------------------------|--|--------------------------------|
| External | Keypad | LCD | 32 character display keypad Download and Upload available | All units |
| | Remote | Remote cable | 2m, 3m and 5m long keypad cable enables users to control the inverter from a distant area. | Optional |
| | Dynamic braking | DB resistor | To enhance the regenerative braking performance, it makes the inverter to accelerate/decelerate rapidly. | According to inverter capacity |
| | | DB unit | If it need a regenerative braking, it is used with DB resistor. | |
| | Conduit option | Conduit for NEMA TYPE 1 | Install it to fit for NEMA TYPE 1 Enclosure or IP20. | 15~90kW (20~125HP) |

Note) Refer to Option manuals for details.

8.2 External options

8.2.1 Keypad dimensions

1) LCD Keypad (Weight: 140 g)



8.2.2 Remote cable

| Ordering No. | Description |
|--------------|-------------------|
| 051050025 | Remote cable – 2m |
| 051050026 | Remote cable – 3m |
| 051050027 | Remote cable – 5m |

8.2.3 Dynamic braking unit (DBU) and Resistors

Refer to DB Unit option manual for details.

1) Dynamic Braking Unit type

| UL | Type | Inverter | motor rating | DB Unit | Dimension | | |
|----------------|-----------------|-----------------------|--------------|-------------------|-----------------|------------|---------|
| Non UL type | TYPE B | 200V class | 11 ~ 15 kW | SV150DBU-2 | Group 7. | | |
| | | | 18.5 ~ 22 Kw | SV220DBU-2 | | | |
| | | | 30 ~ 37 kW | SV037DBH-2 | Group 2. | | |
| | | 400V class | 11 ~ 15 kW | 11 ~ 15 kW | SV150DBU-4 | Group 7 | |
| | | | | 18.5 ~ 22 kW | SV220DBU-4 | Group 2. | |
| | | | | 30 ~ 37 kW | SV037DBH-4 | | |
| | | | 45 ~ 55 kW | 75 kW | SV075DBH-4 | | Group 3 |
| | | | | | 220kW | SV2200DB-4 | Group 4 |
| | | | 280~450 kW | SV2200DB-4, 2Set | | | |
| | | TYPE C | 200V class | 11 ~ 15 kW | LSLV0150DBU-2LN | Group 7 | |
| | | | | 18.5 ~ 22 Kw | LSLV0220DBU-2LN | Group 7 | |
| | | | | 30 ~ 37 kW | LSLV0370DBU-2LN | Group 5 | |
| | LSLV0370DBU-2HN | | Group 6 | | | | |
| | 400V class | | 11 ~ 15 kW | 11 ~ 15 kW | LSLV0150DBU-4LN | Group 7 | |
| | | | | 18.5 ~ 22 kW | LSLV0220DBU-4LN | Group 7 | |
| | | | 30 ~ 37 kW | LSLV0370DBU-4LN | Group 5 | | |
| | | | | LSLV0370DBU-4HN | Group 6 | | |
| | | | 45 ~ 75 kW | LSLV0750DBU-4LN | Group 5 | | |
| | | | 90 kW | LSLV0900DBU-4HN | Group 6 | | |
| | | | 110~132 kW | LSLV1320DBU-4HN | | | |
| | | | 160 kW | LSLV1600DBU-4HN | | | |
| | 220 kW | LSLV2200DBU-4HN | | | | | |
| | 280~450 kW | LSLV2200DBU-4HN, 2Set | | | | | |
| | UL Type | TYPE A | 200V class | 11 ~ 15 kW | SV150DBU-2U | - | |
| 18.5 ~ 22 kW | | | | SV220DBU-2 U | - | | |
| 30 ~ 37 kW | | | | SV370DBU-2 U | Group 1 | | |
| 400V class | | | 11 ~ 15 kW | SV150DBU-4 U | - | | |
| | | | 18.5 ~ 22 kW | SV220DBU-4 U | - | | |
| | | | 30 ~ 37 kW | SV370DBU-4 U | Group 1 | | |
| | | | 45 ~ 55 kW | SV550DBU-4 U | | | |
| | | | 75 kW | SV750DBU-4 U | | | |
| | | | 90~110 kW | SV550DBU-4U, 2Set | | | |
| | | | 132~160 kW | SV750DBU-4U, 2Set | | | |
| | | | 220 kW | - | - | | |
| | | | 280~315 kW | - | - | | |
| 375~450 kW | | | - | - | | | |

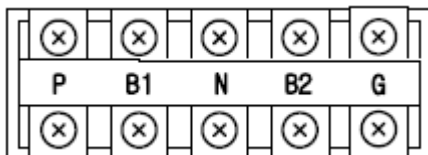
2) Terminal Configuration



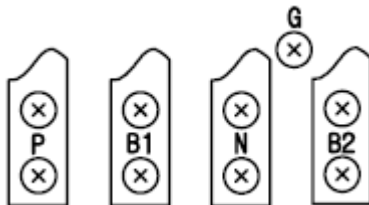
| Terminals | Functions |
|-----------|---|
| G | Ground Terminal |
| B2 | Terminal for connection with B2 of DBU |
| B1 | Terminal for connection with B1 of DBU |
| N | Terminal for connection with N of Inverter |
| P | Terminal for connection with P1 of Inverter |

Note: READ DBU User manual certainly when selecting DB resistors.

Group 3:



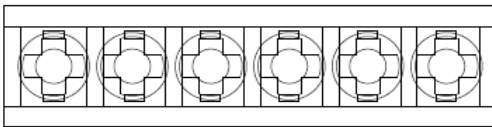
Group 4:



| Terminals | Functions |
|-----------|--|
| G | Ground Terminal |
| B2 | Terminal for connection with B2 of DBU |
| B1 | Terminal for connection with B1 of DBU |
| N | Terminal for connection with N of Inverter |
| P | Terminal for connection with P of Inverter |

Group 5:

P(+) N(-) B1 B2 N.C



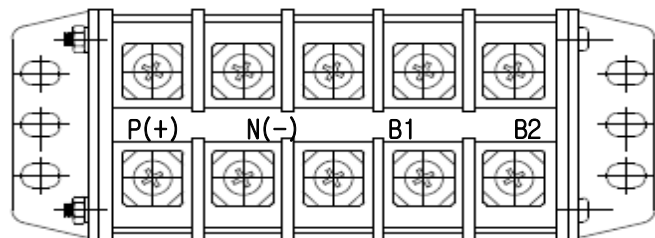
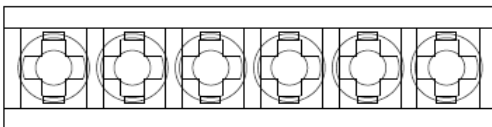
| Terminals | Functions |
|-----------|--|
| P(+) | Terminal for connection with P of Inverter |
| N(-) | Terminal for connection with N of Inverter |
| B1 | Terminal for connection with B1 of DBU |
| B2 | Terminal for connection with B2 of DBU |
| N.C | Unused |
| E | Ground Terminal |

Group 6:

A Frame

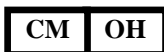
B Frame / C Frame

P(+) N(-) B1 B2 N.C



| Terminals | Functions |
|-----------|--|
| P(+) | Terminal for connection with P of Inverter |
| N(-) | Terminal for connection with N of Inverter |
| B1 | Terminal for connection with B1 of DBU |
| B2 | Terminal for connection with B2 of DBU |
| N.C | Unused |
| E | Ground Terminal |

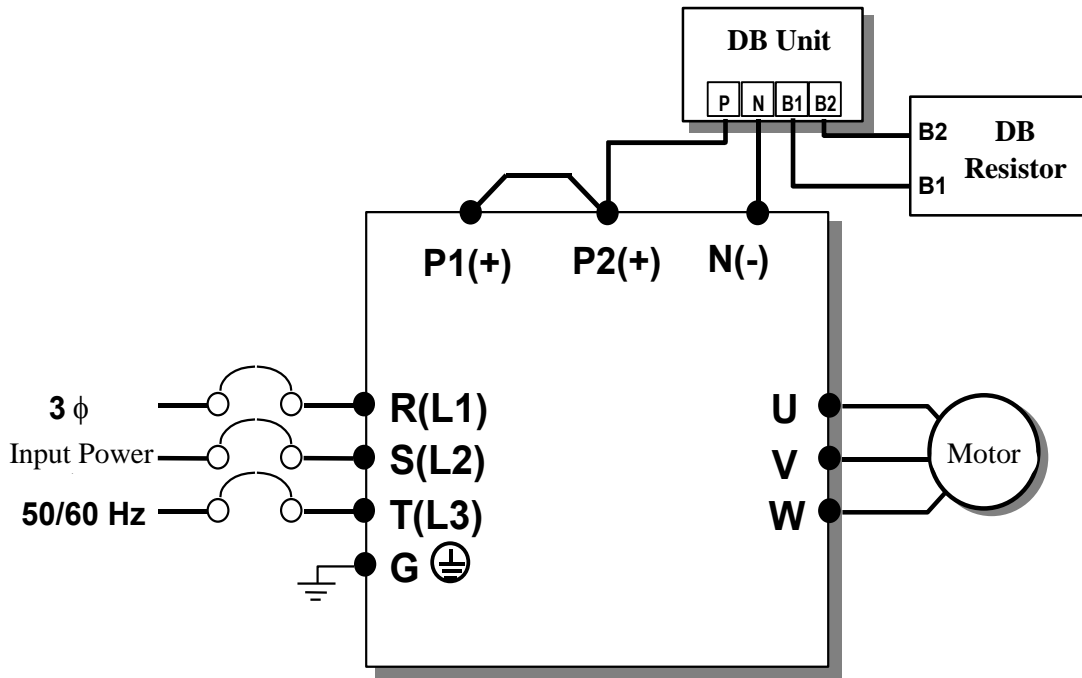
- Group 7:



⚠ Note

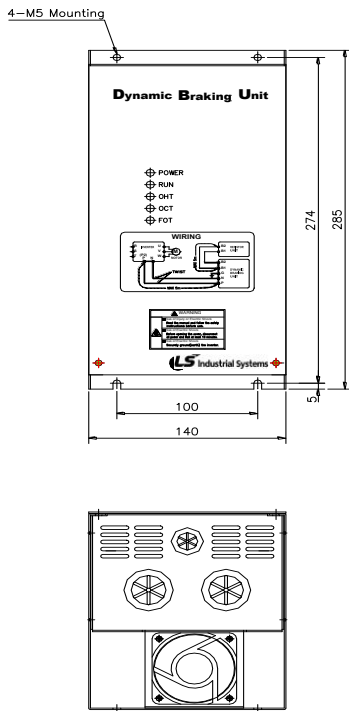
You must refer to dynamic braking unit manual for choice the braking resistor to use the dynamic braking unit.

3) Wiring for DB unit and DB resistor

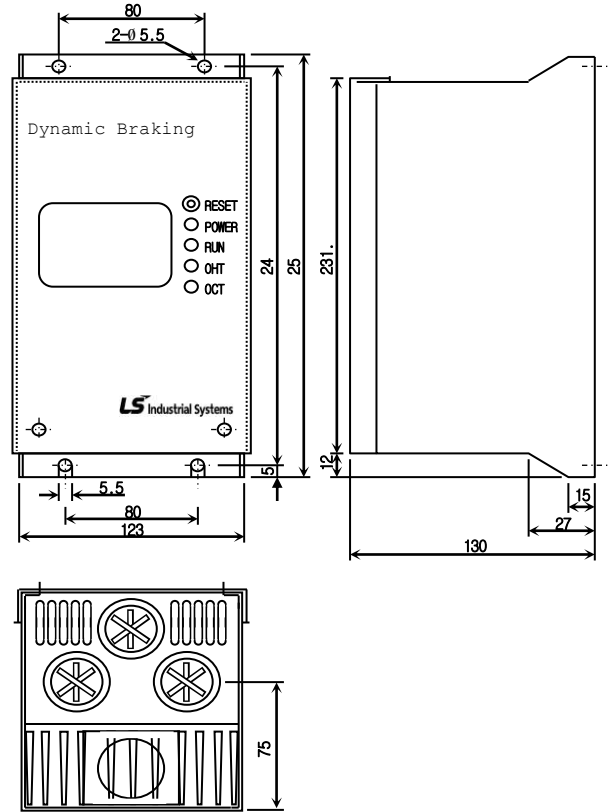


| DB resistor terminal | Description |
|----------------------|---|
| B1, B2 | Wire the terminal properly based on wiring block diagram. Connect a DB resistor to the DB Unit's B1, B2 terminals. |

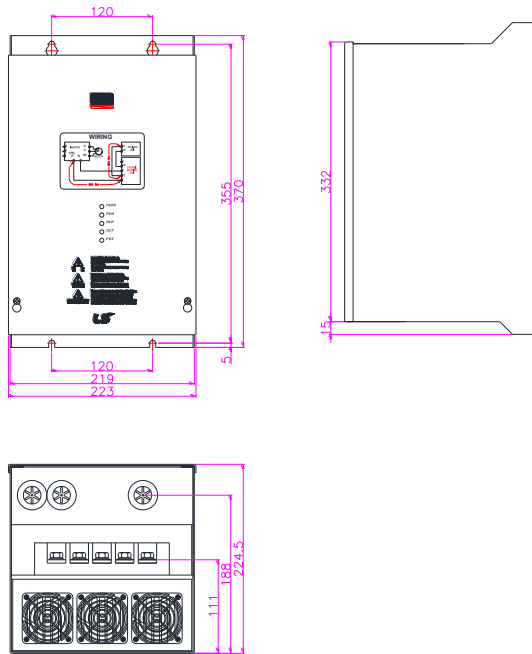
4) Dimensions
- Group 1



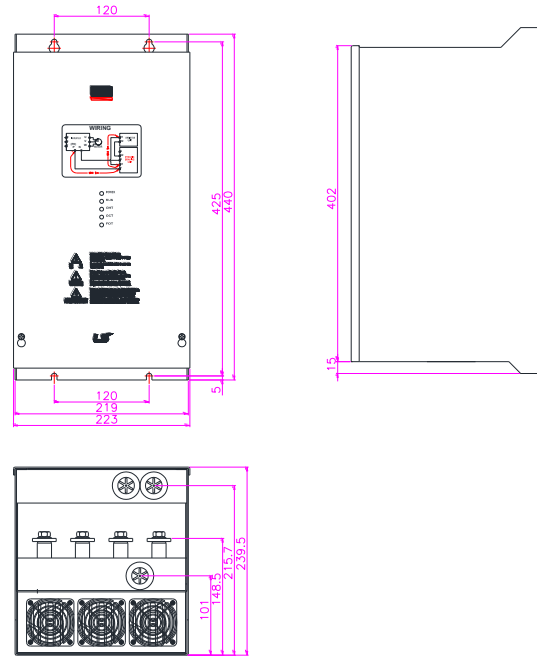
- Group 2



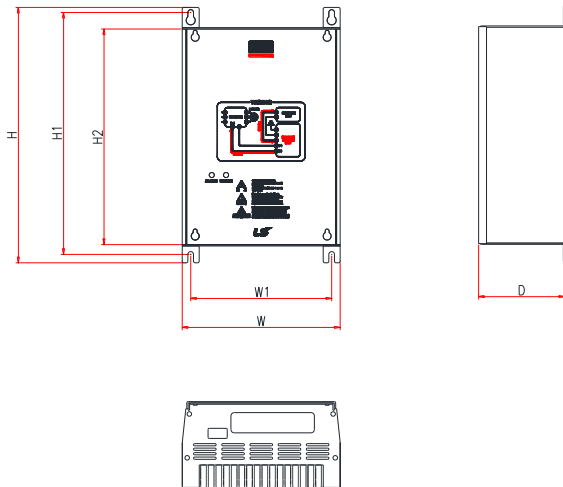
- Group 3



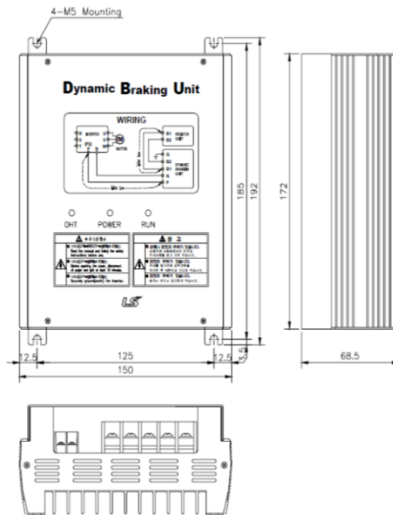
- Group 4



- Group 5

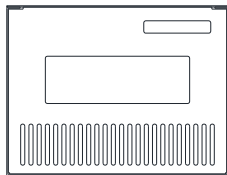
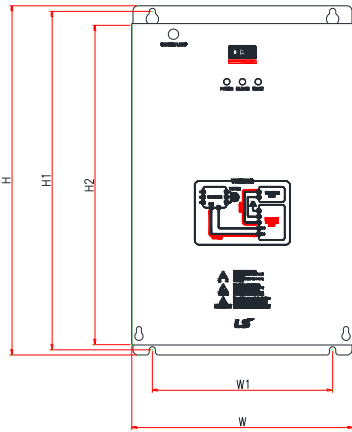
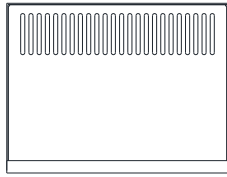


-Group 7



| Voltage | Capacity of applied motor | Dimension (mm) | | | | Hole position for installation | | Weight | Hole size for installation |
|---------|---------------------------|----------------|-------|-----|------|--------------------------------|-------|--------|----------------------------|
| | | W | H | H2 | D | W1 | H1 | | |
| [V] | [kW] | | | | | | | [kg] | (φ) |
| 220 | 15 | 140 | 227.4 | 192 | 76.4 | 125 | 215.4 | 1.50 | M4 |
| | 22 | | | | | | | 1.55 | |
| | 37 | | | | | | | 1.57 | |
| | 75 | | | | | | | 1.84 | |
| 440 | 15 | 140 | 227.4 | 192 | 76.4 | 125 | 215.4 | 1.53 | M4 |
| | 22 | | | | | | | 1.55 | |
| | 37 | | | | | | | 1.56 | |
| | 75 | | | | | | | 1.85 | |

- Group 6



| Frame | Voltage | Capacity of applied motor | %ED | Dimension (mm) | | | | Hole position for installation | | Cooling System | Weight | Hole size for installation |
|---------|---------|---------------------------|-----|----------------|-----|-----|-----------------|--------------------------------|-------|-----------------|-----------------|----------------------------|
| | [V] | [kW] | | W | H | H2 | D | W1 | H1 | | [kg] | (φ) |
| Frame A | 220 | 37 | 50 | 200 | 219 | 190 | 165 | 160 | 208.5 | Passive cooling | 3.77 | M6 |
| | 440 | 37 | 50 | | | | | | | Forced cooling | 3.84 | |
| | | 75 | 50 | | | | | | | | 3.98 | |
| Frame B | 220 | 75 | 50 | 215 | 340 | 311 | | 175 | 329.5 | Passive cooling | 8.26 | |
| | | 90 | 50 | | | | | | | Forced cooling | 8.48 | |
| | 440 | 90 | 50 | | | | | | | | Passive cooling | |
| | | 132 | 50 | | | | | | | Forced cooling | 8.40 | |
| | | | 160 | | | | | | | | 50 | |
| Frame C | 440 | 160 | 50 | 240 | 380 | 351 | | 200 | 369.5 | Forced cooling | 9.70 | |
| | | 220 | 50 | | | | Passive cooling | | | 9.40 | | |

5) Display Functions

DB Resistors connect with B1, B2 of DB Unit. DBU has 3 LEDs. Red LED which is located in middle displays supplying main power, one Green LED which is right side displays under braking and another green LED which is left side displays Over Heat Trip(OHT).

| Displays | Function description |
|--------------------|--|
| POWER (Red LED) | POWER LED is turned On when main power is supplied. Generally, POWER LED is turn On while main power supplied because DBU is connected with inverter. |
| RUN (Green LED) | RUN LED is turned off while DBU is ON by regenerative energy of Motor. |
| OHT (Green LED) | Under Braking, if the temperature is exceeded over setting value due to over heat of Heatsink, Cut the TURN ON signal of DBU and LED is turn on by working overheat protection function. |

8.2.4 DB Resistor

1) Option type Dynamic Braking Unit

Following table has reference that DC braking torque: 150%, %ED: 5%. Rating Watt of DBU has to be doubled when %ED is 10%.

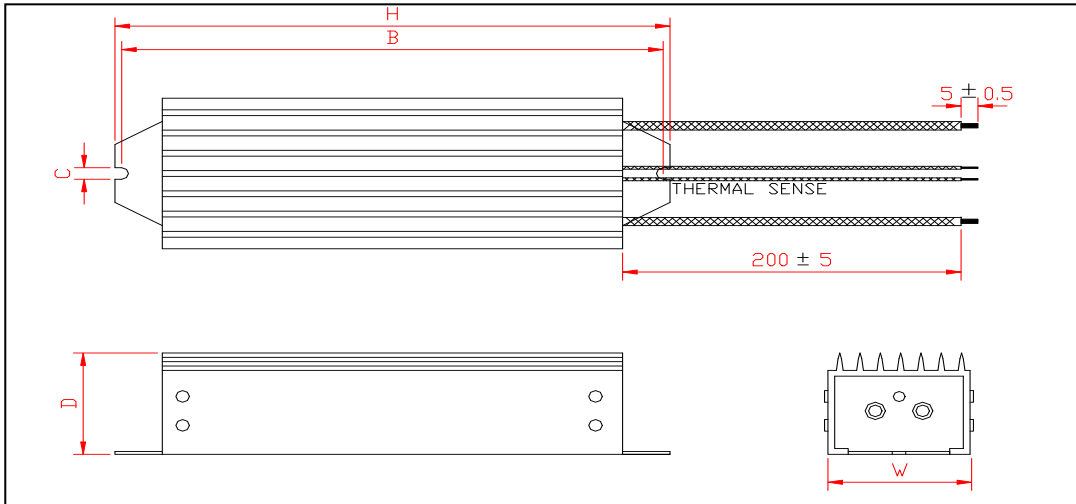
| Voltage | Applied inverter capacity (kW) | Apply DB Unit | Format | 150% braking torque, 5%ED | | | Wiring [mm ²] |
|-----------------|--------------------------------|---------------|-------------|---------------------------|----------|------------|---------------------------|
| | | | | Resistance [ohm] | Watt [W] | Appearance | |
| 200V Classes | 0.75 | | BR0400W150J | 150 | 150 | TYPE 1 | 1.25 |
| | 1.5 | | BR0400W060J | 60 | 300 | TYPE 1 | 1.25 |
| | 2.2 | | BR0400W050J | 50 | 400 | TYPE 1 | 2 |
| | 3.7 | | BR0600W033J | 33 | 600 | TYPE 2 | 3.5 |
| | 5.5 | | BR0800W020J | 20 | 800 | TYPE 3 | 6.63 |
| | 7.5 | | BR1200W015J | 15 | 1200 | TYPE 3 | 6.63 |
| | 11 | SV150DBU-2U | BR2400W010J | 10 | 2400 | TYPE 3 | 13.3 |
| | 15 | SV150DBU-2U | BR2400W008J | 8 | 2400 | TYPE 3 | 13.3 |
| | 18.5 | SV220DBU-2 U | BR3600W005J | 5 | 3600 | TYPE 3 | 13.3 |
| | 22 | SV220DBU-2 U | BR3600W005J | 5 | 3600 | TYPE 3 | 13.3 |
| | 30 | SV370DBU-2 U | - | 5 | 5000 | - | - |
| | 0.75 | | BR0400W600J | 600 | 150 | TYPE 1 | 1.25 |
| | 1.5 | | BR0400W300J | 300 | 300 | TYPE 1 | 2 |
| | 2.2 | | BR0400W200J | 200 | 400 | TYPE 1 | 2 |
| | 3.7 | | BR0600W130J | 130 | 600 | TYPE 2 | 2 |
| | 5.5 | | BR1000W085J | 85 | 1000 | TYPE 3 | 2.62 |
| | 7.5 | | BR1200W060J | 60 | 1200 | TYPE 3 | 2.62 |
| | 11 | SV150DBU-4U | BR2000W040J | 40 | 2000 | TYPE 3 | 13.3 |
| | 15 | SV150DBU-4U | BR2400W030J | 30 | 2400 | TYPE 3 | 13.3 |
| 18.5 | SV220DBU-4U | BR3600W020J | 20 | 3600 | TYPE 3 | 13.3 | |

| | | | | | | | |
|---|-----|-------------|-------------|------|--------|--------|------|
| 4 0 0 V C l a s s | 22 | SV220DBU-4U | BR3600W020J | 20 | 3600 | TYPE 3 | 13.3 |
| | 30 | SV370DBU-4U | - | 16.9 | 6,400 | - | - |
| | 37 | SV370DBU-4U | - | 16.9 | 6,400 | - | - |
| | 45 | SV550DBU-4U | - | 11.4 | 9,600 | - | - |
| | 55 | | - | 11.4 | 9,600 | - | - |
| | 75 | SV750DBU-4U | - | 8.4 | 12,800 | - | - |
| | 90 | | - | 4.5 | 15,000 | - | - |
| | 110 | | - | 3.5 | 17,000 | - | - |
| | 132 | | - | 3.0 | 20,000 | - | - |
| | 160 | | - | 2.5 | 25,000 | - | - |
| | 185 | | - | 2 | 30,000 | - | - |
| | 220 | | - | 2 | 30,000 | - | - |
| | 280 | | - | 1.5 | 40,000 | - | - |
| | | | | | | | |
| | | | | | | | |

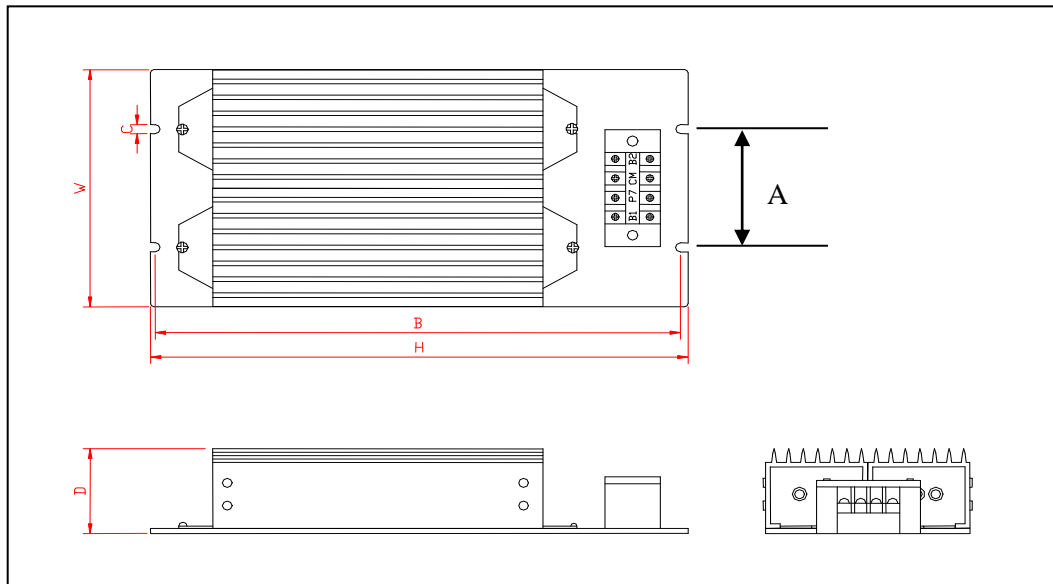
3) Appearance and size of braking resistor

| TYPE | Size [mm] | | | | | |
|------|-----------|-----|-----|-----|-----|-----|
| | W | H | D | A | B | C |
| 1 | 64 | 410 | 30 | - | 392 | 6 |
| 2 | 128 | 390 | 43 | 65 | 373 | 6 |
| 3 | 220 | 345 | 93 | 140 | 330 | 7.8 |
| 4 | 220 | 445 | 93 | 140 | 428 | 7.8 |
| 5 | 220 | 445 | 165 | 140 | 430 | 7.8 |

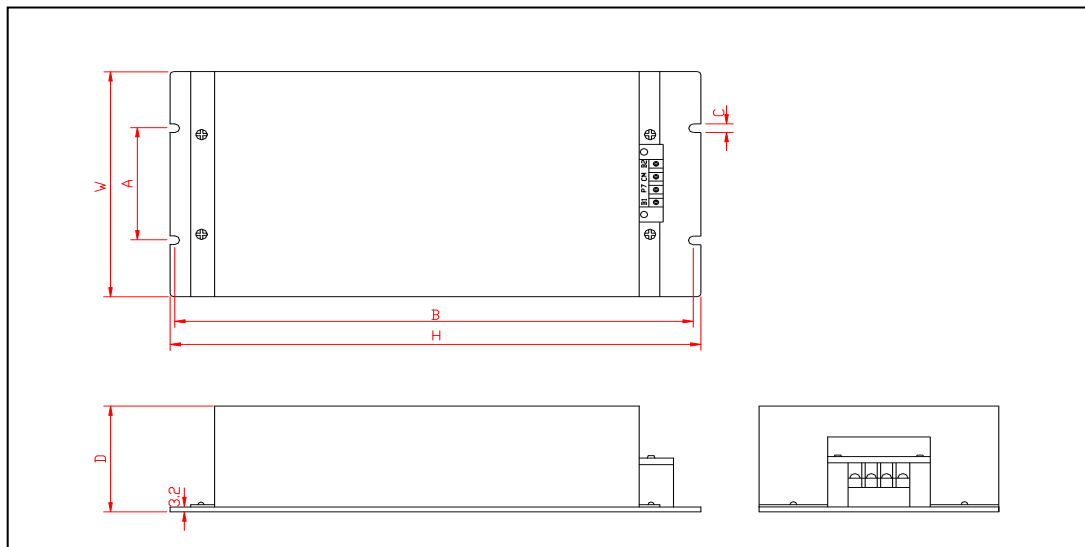
* Type 1 (Max 400 Watt)



* Type 2 (Max 600 Watt)



* Type 3



8.2.5 Micro surge filter (Designed for Inverter-driven 400V Class motor)

In the PWM type inverter, a surge voltage attributable to wiring constants is generated at the motor terminals. Especially for a 400V class motor, the surge voltage may deteriorate the insulation. When the 400V class motor is driven by the inverter, consider the following measures:

■ Rectifying the motor insulation

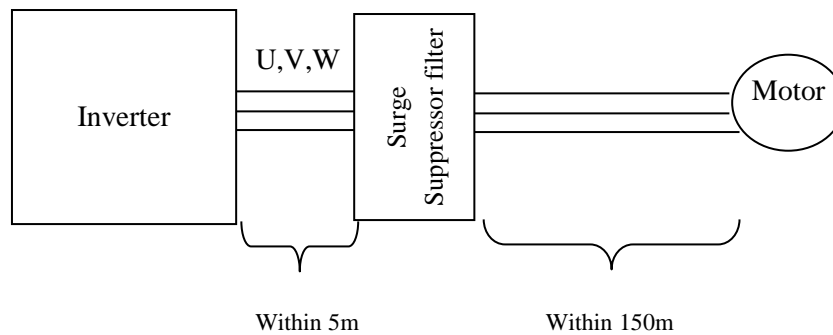
For the 400V class motor, use an insulation-rectified motor. Specifically, the “400V class inverter-driven, insulation-rectified motor”.

For the dedicated motor such as the constant-torque motor and low-vibration motor, use the “inverter-driven, dedicated motor”.

■ Suppressing the surge voltage on the inverter output side

On the secondary side of the inverter, connect the optional surge voltage suppression filter to reduce the motor terminal voltage less than 850 V.

■ Wiring



■ Caution

Check the Input/Output when wiring the filter.

Wiring distance from inverter output to filter input should not exceed 5 meter.

Wiring distance from filter to motor should not exceed 150 meter.

8.2.6 NEMA TYPE 1 Optional Conduit Box

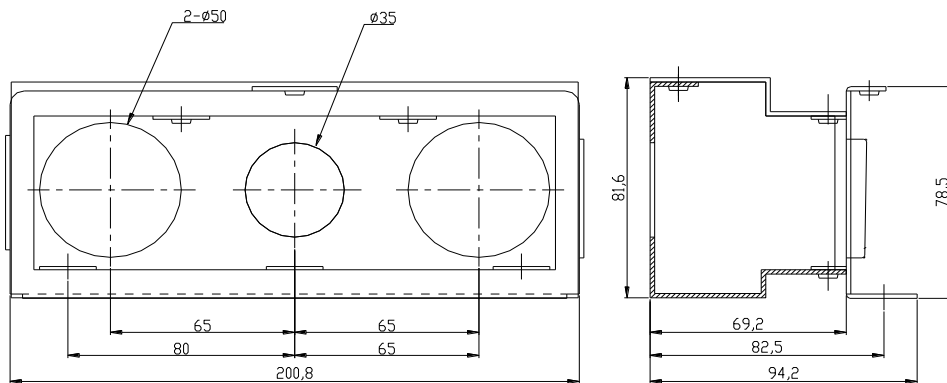
1) NEMA TYPE 1 Enclosure for conduit connection

■ General

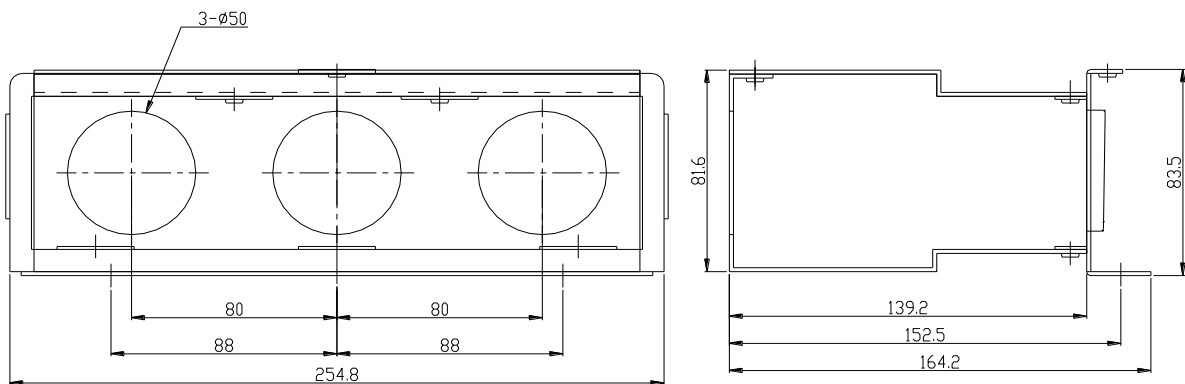
NEMA TYPE 1 Conduit Box: This kit enables an inverter to be installed on the wall without the inverter panel and meets NEMA Type 1. It should be installed to meet NEMA 1 for 15~90kW UL Open Type inverters. However, installing this option does not mean UL Type 1. Please purchase Standard UL Type 1 models if needed.

■ Installation:

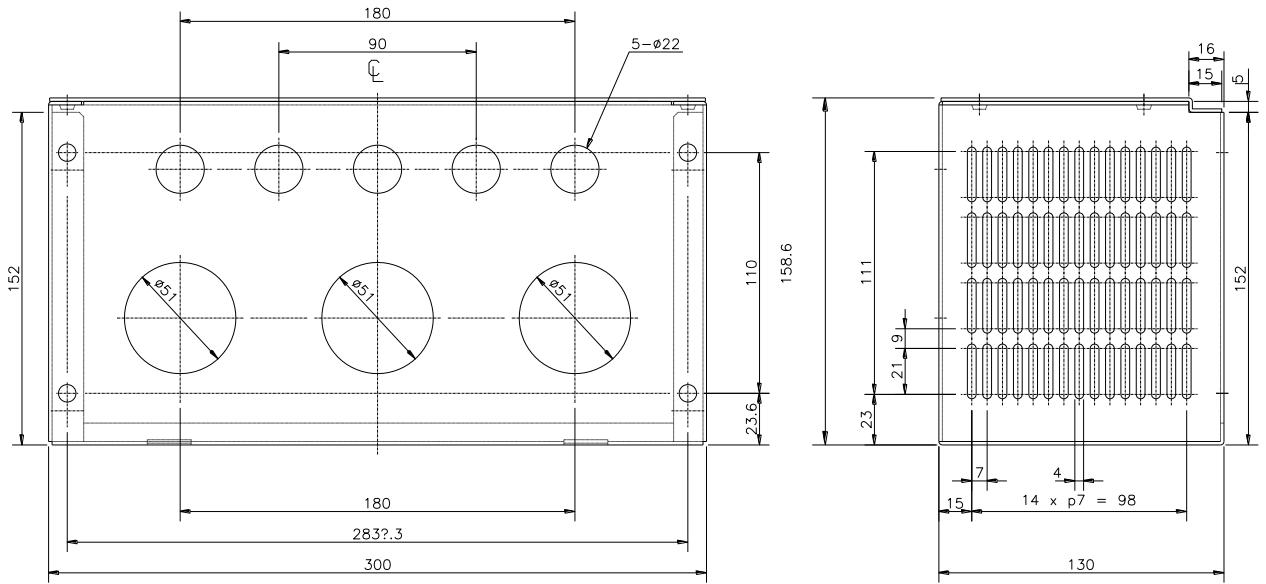
Remove the metal plate on the bottom with the driver and install this kit on to the same place by the screws from the metal plate.



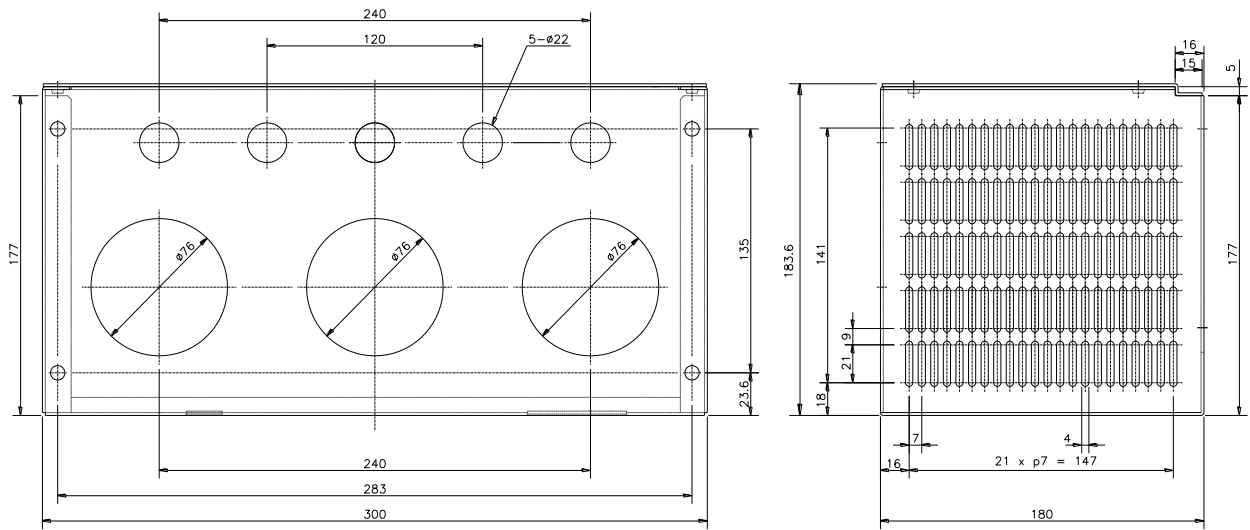
[Conduit box for 20~25 HP (15~18.5kW) iP5A]



[Conduit box for 30~40 HP (22~30 kW) iP5A]



[Conduit box for 50~75 HP (37~55kW) iP5A]



[Conduit box for 50~75 HP (75~90kW) iP5A]

■ Conduit Hole Size

mm(inches)

| Inverter | Conduit hole for control terminal | Trade Size of the Conduit |
|-----------------------|-----------------------------------|---------------------------|
| | Conduit hole for power terminal | |
| SV008~055iP5A -2/4 | 24 (0.98) | 16 (1/2) |
| | 24 (0.98) | 16 (1/2) |
| SV075iP5A-2/4 | 24 (0.98) | 16 (1/2) |
| | 35 (1.37) | 27 (1) |
| SV110iP5A-2/4 | 24 (0.98) | 16 (1/2) |
| | 35 (1.37) | 27 (1) |
| SV150iP5A-2/4 | 35 (1.37) | 27 (1) |
| | 50 (1.96) | 41 (3/2) |
| SV185iP5A-2/4 | 35 (1.37) | 27 (1) |
| | 50 (1.96) | 41 (3/2) |
| SV220iP5A-2/4 | 50 (1.96) | 41 (3/2) |
| | 50 (1.96) | 41 (3/2) |
| SV300iP5A-2/4 | 50 (1.96) | 41 (3/2) |
| | 50 (1.96) | 41 (3/2) |
| SV370iP5A-2/4 | 22(0.86) | 16(1/2) |
| | 51(2.00) | 41(3/2) |
| SV450iP5A-2/4 | 22(0.86) | 16(1/2) |
| | 51(2.00) | 41(3/2) |
| SV550iP5A-2/4 | 22(0.86) | 16(1/2) |
| | 51(2.00) | 41(3/2) |
| SV750iP5A-2/4 | 22(0.86) | 16(1/2) |
| | 76(2.99) | 63(5/2) |
| SV900iP5A-2/4 | 22(0.86) | 16(1/2) |
| | 76(2.99) | 63(5/2) |

☞ **Note: Choose the proper size of the Locknut, Bushing corresponding to trade size of the Conduit in use.**

CHAPTER 9 - RS485 COMMUNICATION

9.1 Introduction

Inverter can be controlled and monitored by the sequence program of the PLC or other master module.

Drives or other slave devices may be connected in a multi-drop fashion on the RS-485 network and may be monitored or controlled by a single PLC or PC. Parameter setting and change are available through PC.

9.1.1 Features

Inverter can be easily applied for Factory automation because Operation and monitoring is available by User-program.

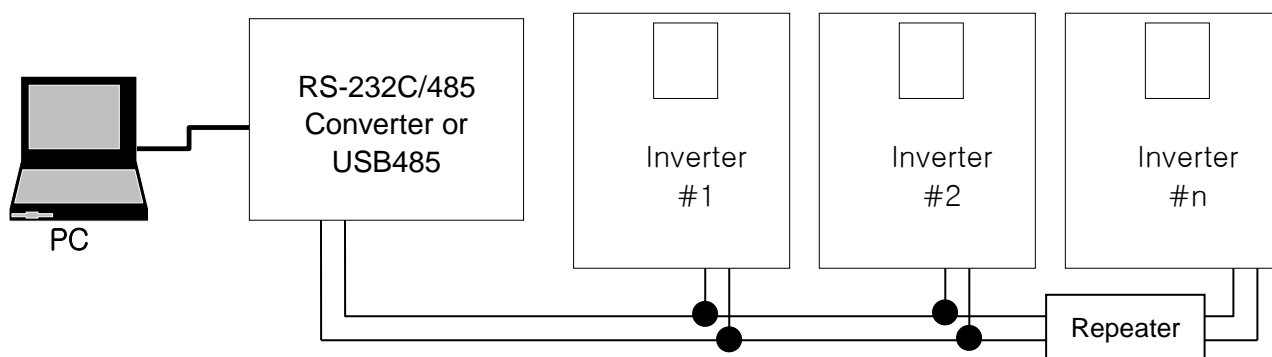
* Parameter change and monitoring is available via computer.

(Ex: Accel/Decel time, Freq. Command etc.)

* Interface type of RS485 reference:

- 1) Allows the drive to communicate with any other computers.
- 2) Allows connection of up to 31 drives with multi-drop link system.
- 3) Noise-resistant interface.

9.1.2 Connection guide for RS485 communication with PC , PLC and RS232/485



* REPEATER is not a required item but helps communication in long-distance communication or high noise environment.

9.1.3 Before installation

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

9.2 Specification

9.2.1 Performance specification

| Item | Specification |
|-----------------------|--|
| Transmission form | Bus method, Multi-drop Link System |
| Applicable inverter | SV-iP5A series |
| Connectable drives | Max 31 |
| Transmission distance | Max. 1,200m (Within 700m Recommended) |
| Recommended wire | 0.75mm ² (12AWG), Shield Type Twisted-Pair Wire |

9.2.2 Hardware specification

| Item | Specification |
|--------------|--|
| Installation | Use C+, C-,CM terminals on control terminal block |
| Power supply | Use Insulated power from the inverter power supply |

9.2.3 Communication specification

| Item | Specification |
|----------------------|---|
| Communication speed | 19,200/9,600/4,800/2,400/1,200 bps selectable |
| Communication system | Half duplex system |
| Character system | ASCII (8 bit) |
| Stop bit length | 1 bit |
| Sum check (CRC16) | 2 byte |
| Parity bit | None |
| Protocol supported | Parameter Read/Write, Monitoring parameter register/execution Broadcasting |

9.2.4 Installation

■ Connecting the communication line

- 1) Connect the RS485 communication line to the inverter's (C+), (C-) and CM terminals of the control terminals.
- 2) Connect the CM terminal among inverters for stable communication.
- 3) Check the connection and turn ON the inverter.
- 4) If the communication line is connected correctly set the communication-related parameters as the following.
- 5) Install a repeater to upgrade the communication speed or longer than 1200mm communication line is used. Repeater is required for upgrading communication quality in the noise-high environment.

■ Communication parameters

| Code | Display | Name | Set value | Unit | Default |
|-----------|--------------|---|---|------|----------|
| DRV_03 | Drive mode | Drive mode | Int. 485 | | Fx/Rx-1 |
| DRV_04 | Freq mode | Freq mode | Int. 485 | | KeyPad-1 |
| DRV_91 | Drive mode2 | Drive mode 2 | KeyPad Fx/Rx-1 Fx/Rx-2 | | Fx/Rx-1 |
| DRV_92 | Freq mode2 | Freq mode 2 | KeyPad-1 KeyPad-2 V1 V1S I V1+I Pulse | | KeyPad-1 |
| I/O_20~27 | M1 ~ M8 | Programmable Digital Inputs | Main-drive | | |
| I/O_90 | Inv No | Inverter number | 1~250 | | 1 |
| I/O_91 | Baud rate | Communication speed | 1200 bps 2400 bps 4800 bps 9600 bps 19200 bps | | 9600 bps |
| I/O_92 | COM Lost Cmd | Operating mode when communication signal is lost | None FreeRun Stop | | None |
| I/O_93 | COM Time Out | Time to determine whether Communication signal is lost. | 0.1~120.0 | sec | 1.0 |
| I/O_94 | Delay Time | Delay time of communication response | 1 ~ 1200 | msec | 5 |

9.3 Operation

9.3.1 Operating steps

- 1) Check whether the computer and the inverter are connected correctly.
- 2) 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.
- 3) If computer is a master, computer does not have RS485 port. RS232-485 converter is needed to communicate. The communication is delayed at transmitting/receiving when the RS232-485 converter is used. If delay is happened, retry the communication by increasing the I/O-94 [Delay Time].
- 4) Operate the inverter using the operating program for the inverter.
- 5) Refer to “13.8 Troubleshooting” if the communication is not operating normally.
- 6) User program or the “DriveView” program supplied from LSIS can be used as the operating program for the inverter.
- 7) Turn the inverter J3 switch ON to connect the terminating resistor for the end of network.

* Connect to C+,C-,CM terminal on the control terminal. Be careful for the polarity(+, -).

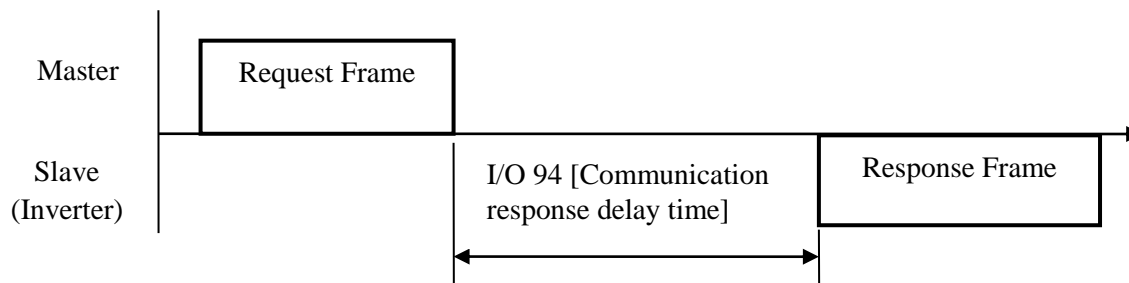
* Max connectable inverter is 31.

9.4 Communication protocol (RS485)

The configuration of RS485 is that PC or PLC is the Master and Inverter Slave.

Inverter responds the Master's Read/Write Requests.

When master sends Write Request to Inverter address # 255, all inverters perform Write action but do not return a Acknowledge response. This is used to drive multiple inverters at the same time via RS485.



9.4.1 Basic format

1) Command message (Request):

| ENQ | Inverter No. | CMD | Data | SUM | EOT |
|--------|--------------|--------|---------|---------|--------|
| 1 byte | 2 bytes | 1 byte | n bytes | 2 bytes | 1 byte |

* Normal response (Acknowledge Response):

| ENQ | Inverter No. | CMD | Data | SUM | EOT |
|--------|--------------|--------|-------------|---------|--------|
| 1 byte | 2 bytes | 1 byte | n * 4 bytes | 2 bytes | 1 byte |

* Negative response (Negative Acknowledge Response):

| ENQ | Inverter No. | CMD | Data | SUM | EOT |
|--------|--------------|--------|---------|---------|--------|
| 1 byte | 2 bytes | 1 byte | 2 bytes | 2 bytes | 1 byte |

2) Description:

* Request starts with "ENQ" and ends with "EOT".

* Acknowledge Response starts with "ACK" and ends with "EOT".

* Negative Acknowledge Response starts with "NAK" and ends with "EOT".

* "Inverter Number" is the number of Inverters used and indicated in 2 byte ASCII-HEX.

(ASCII-HEX: Hexadecimal consists of '0' ~ '9', 'A' ~ 'F')

* CMD: Capital letter ("IF Error" when small letter is used.)

| Character | ASCII-HEX | Command |
|-----------|-----------|---------------------------------------|
| 'R' | 52h | Read |
| 'W' | 57h | Write |
| 'X' | 58h | Request for monitoring registration |
| 'Y' | 59h | Execution for monitoring registration |

Data: ASCII-HEX

Ex) when data value is 3000: 3000 (dec) → '0' 'B' 'B' '8'h → 30h 42h 42h 38h

Error code: ASCII (20h ~ 7Fh)

Receive/Send buffer size: Receive= 39 byte, Send=44 byte

Monitor register buffer: 8 Word

SUM: to check the communication error

SUM= ASCII-HEX format of lower 8 bit of (Inverter No. + CMD + DATA)

Ex) Command Message (Request) for reading one address from address “9000”

| ENQ | Inverter No. | CMD | Address | Number of address to read | SUM | EOT |
|--------|--------------|--------|---------|---------------------------|---------|--------|
| 05h | “01” | “R” | “9000” | “1” | “AD” | 04h |
| 1 byte | 2 bytes | 1 byte | 4 bytes | 1 byte | 2 bytes | 1 byte |

$$\begin{aligned} \text{SUM} &= '0' + '1' + 'R' + '9' + '0' + '0' + '0' + '1' \\ &= 30h + 31h + 52h + 39h + 30h + 30h + 30h + 31h \\ &= 1ADh \text{ (except for ENA/ACK/EOT value)} \end{aligned}$$

9.4.2 Detail communication protocol

1) Request for Read: Request for read successive ‘N’ numbers of WORD from address “XXXX”

| ENQ | Inv No | CMD | Address | Number of Address | SUM | EOT |
|--------|-------------|--------|---------|-------------------|--------|--------|
| 05h | “01” ~ “FA” | “R” | “XXXX” | “1” ~ “8” = n | “XX” | 04h |
| 1 byte | 2 byte | 1 byte | 4 byte | 1 byte | 2 byte | 1 byte |

Total byte = 12

The quotation marks (“ ”) mean character.

1.1) Acknowledge Response:

| ACK | Inv No | CMD | Data | SUM | EOT |
|--------|-------------|--------|------------|--------|--------|
| 06h | “01” ~ “FA” | “R” | “XXXX” | “XX” | 04h |
| 1 byte | 2 byte | 1 byte | N * 4 byte | 2 byte | 1 byte |

Total byte = 7 * n * 4 = Max. 39

1.2) Negative Acknowledge Response:

| NAK | Inv No | CMD | Error code | SUM | EOT |
|--------|-------------|--------|------------|--------|--------|
| 15h | “01” ~ “FA” | “R” | “***” | “XX” | 04h |
| 1 byte | 2 byte | 1 byte | 2 byte | 2 byte | 1 byte |

Total byte = 9

2) Request for Write:

| ENQ | Inverter No | CMD | Address | Number of Address | SUM | EOT | EOT |
|--------|-------------|--------|---------|-------------------|---------------|--------|--------|
| 05h | “01” ~ “FA” | “W” | “XXXX” | “1” ~ “8” = n | “XXXX... ” | “XX” | 04h |
| 1 byte | 2 byte | 1 byte | 4 byte | 1 byte | n * 4 byte | 2 byte | 1 byte |

Total byte = 12 + n * 4 = Max. 44

2.1) Acknowledge response:

| ACK | Inverter No. | CMD | Data | SUM | EOT |
|--------|--------------|--------|------------|--------|--------|
| 06h | “01” ~ “FA” | “W” | “XXXX...” | “XX” | 04h |
| 1 byte | 2 byte | 1 byte | n * 4 byte | 2 byte | 1 byte |

Total byte = 7 + n * 4 = Max. 39

Note) When Request for Write and Acknowledge Response is exchanged between PC and Inverter for the first time, previous data is returned. From the second time of transmission, the current data will be received.

2.2) Negative response:

| NAK | Inverter No. | CMD | Error code | SUM | EOT |
|--------|--------------|--------|------------|--------|--------|
| 15h | “01” ~ “FA” | “W” | “***” | “XX” | 04h |
| 1 byte | 2 byte | 1 byte | 2 byte | 2 byte | 1 byte |

Total byte = 9

3) Request for Monitor Register: This is useful when constant parameter monitoring and data updates are required.
Request for Register of 'n' numbers of Address (non-successive)

| ENQ | Inverter No. | CMD | Number of Address | Address | SUM | EOT |
|--------|--------------|--------|-------------------|------------|--------|--------|
| 05h | "01" ~ "FA" | "X" | "1" ~ "8"=n | "XXXX..." | "XX" | 04h |
| 1 byte | 2 byte | 1 byte | 1 byte | n * 4 byte | 2 byte | 1 byte |

Total byte = 8 + n * 4 = Max 40

3.1) Acknowledge Response:

| ACK | Inverter No. | CMD | SUM | EOT |
|--------|--------------|--------|--------|--------|
| 06h | "01" ~ "FA" | "X" | "XX" | 04h |
| 1 byte | 2 byte | 1 byte | 2 byte | 1 byte |

Total byte = 7

3.2) Negative Acknowledge Response:

| NAK | Inverter No. | CMD | Error code | SUM | EOT |
|--------|--------------|--------|------------|--------|--------|
| 15h | "01" ~ "FA" | "X" | "**" | "XX" | 04h |
| 1 byte | 2 byte | 1 byte | 2 byte | 2 byte | 1 byte |

Total byte = 9

4) Execution Request for monitor register: Request for read of address registered by monitor register.

| ENQ | Inverter No. | CMD | SUM | EOT |
|--------|--------------|--------|--------|--------|
| 05h | "01" ~ "FA" | "Y" | "XX" | 04h |
| 1 byte | 2 byte | 1 byte | 2 byte | 1 byte |

Total byte = 7

4.1) Acknowledge response:

| ACK | Inverter No. | CMD | Data | SUM | EOT |
|--------|--------------|--------|------------|--------|--------|
| 06h | "01" ~ "FA" | "Y" | "XXXX..." | "XX" | 04h |
| 1 byte | 2 byte | 1 byte | n * 4 byte | 2 byte | 1 byte |

Total byte = 7 + n * 4 = Max 39

4.2) Negative response:

| NAK | Inverter No. | CMD | Error code | SUM | EOT |
|--------|--------------|--------|------------|--------|--------|
| 15h | "01" ~ "FA" | "Y" | "**" | "XX" | 04h |
| 1 byte | 2 byte | 1 byte | 2 byte | 2 byte | 1 byte |

Total byte = 9

* Request for Monitor Register should be made before Execution Request for monitor register. If inverter power is turned off, monitor register is cleared so redo the request for monitor register when Power ON.

5) Error code

| Error code | Description |
|------------|---|
| IF | ILLEGAL FUNCTION When master is sending codes other than Function code (R, W, X, Y). |
| IA | ILLEGAL ADDRESS - When parameter address does not exist |
| ID | ILLEGAL VALUE - When Data contains an out of range value for an inverter parameter during 'W' (Write). |
| WM | WRITE MODE ERROR - When the requested data cannot be changed (written) during 'W' (Write) such as Read Only, Not adjustable during Run parameters. |

9.5 Parameter code list

<Common area>: Area accessible regardless of inverter models (Note 3)

| Address | Parameter | Unit | Unit | R/W | Data value |
|---------|----------------------------------|------|------|-----|--|
| 0x0000 | Inverter model | | | R | 9 : SV-iP5A |
| 0x0001 | Inverter capacity | | | R | 0: 0.75kW(1HP) 1: 1.5kW(2HP) 2: 2.2kW(3HP) 3: 3.7kW(5HP) 4: 5.5kW(7.5HP), 5: 7.5kW(10HP), 6: 11kW(15HP), 7: 15kW(20HP), 8: 18.5kW(25HP), 9: 22kW(30HP), A: 30kW(40HP), B: 37kW(50HP), C: 45kW(60HP), D: 55kW(75HP), E: 75kW(100HP) F: 90kW(125HP) 10: 110kW(150HP) 11: 132kW(200HP) 12: 160kW(250HP) 13: 220kW(350HP) 14: 280kW(400HP) 15: 315kW(500HP) 16: 375kW(600HP) 17: 450kW(700HP) |
| 0x0002 | Inverter Input Voltage | | | R | 0 : 220V Class 1 : 400V Class |
| 0x0003 | S/W Version | | | R | (Ex) 0x0100 : Version 1.00 0x0101 : Version 1.10 |
| 0x0005 | Frequency Reference | 0.01 | Hz | R/W | |
| 0x0006 | Run Command (Option) (Note 1) | | | R/W | BIT 0: Stop (S) BIT 1: Forward run (F) BIT 2: Reverse run (R) BIT 3: Fault reset (0->1) BIT 4: Emergency stop BIT 5: Not used |
| | | | | R | BIT 6, BIT 7: Run/Stop command source 0(Terminal), 1(Keypad), 2(Option) 3(Int. 485) BIT 8 ~14: Freq. reference 0 ~ 16: Multi-step speed freq. (0, 2~16) 17 ~ 19: UpDown (Up, Down, UD Zero) 20 ~ 21: RESERVED 22 ~ 25: Analog (V1, V1S, I, V1I) 26: Pulse 27: Sub 28: Int. 485 29: Option, 30: Jog, 31 : PID BIT 15: set when Network error |
| 0x0007 | Acceleration Time | 0.1 | sec | R/W | |
| 0x0008 | Deceleration Time | 0.1 | sec | R/W | |
| 0x0009 | Output Current | 0.1 | A | R | |
| 0x000A | Output Frequency | 0.01 | Hz | R | |
| 0x000B | Output Voltage | 1 | V | R | |
| 0x000C | DC Link voltage | 1 | V | R | |
| 0x000D | Output power | 0.1 | kW | R | |
| 0x000E | Operating status of Inverter | | | R | BIT 0: Stop BIT 1: Forward running BIT 2: Reverse running BIT 3: Fault (Trip) BIT 4: Accelerating BIT 5: Decelerating |

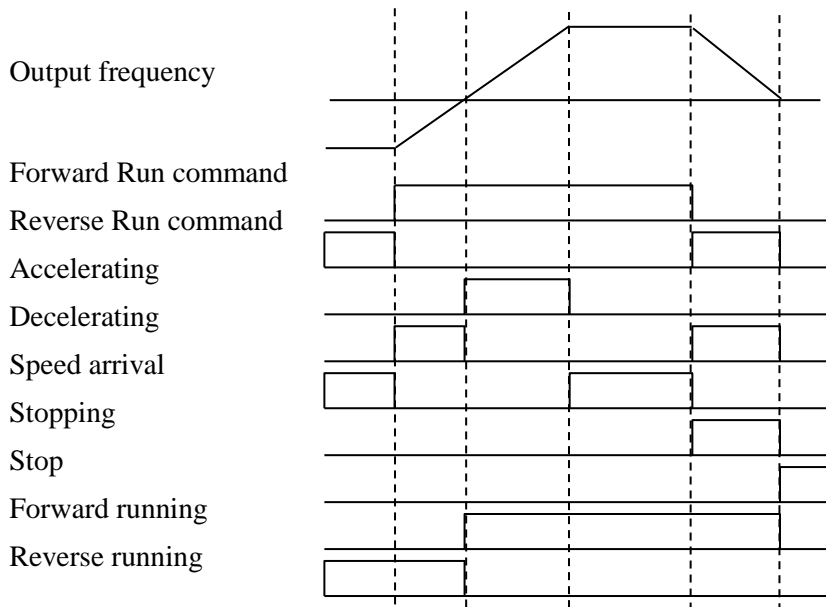
| Address | Parameter | Unit | Unit | R/W | Data value |
|---------|------------------------------|--------|------|-----|---|
| | | | | | BIT 6: speed arrival |
| 0x000E | Operating status of Inverter | | | R | BIT 7: DC Braking BIT 8: Stopping Bit 9: not Used BIT10: Brake Open BIT11: Forward run command BIT12: Reverse run command BIT13: REM. R/S (Int. 485, OPT) BIT14: REM. Freq. (Int. 485, OPT) |
| 0x000F | Trip information | | | R | BIT 0 : OCT1 BIT 1 : OV BIT 2 : EXT-A BIT 3 : BX BIT 4 : LV BIT 5 : RESERVE BIT 6 : GF(Ground Fault) BIT 6: OHT (Inverter overheat) BIT 7: ETH (Motor overheat) BIT 8: OLT (Overload trip) BIT10: HW-Diag BIT11: RESERVE BIT12: OCT2 BIT13: OPT (Option error) BIT14 : PO (Phase Open) BIT15: IOLT |
| 0x0010 | Input terminal status | | | R | BIT 0 : M1 BIT 1 : M2 BIT 2 : M3 BIT 3 : M4 BIT 4 : M5 BIT 5 : M6 BIT 6 : M7 BIT 7 : M8 BIT 8 : - BIT 9 : - BIT 10 : - |
| 0x0011 | Output terminal status | | | R | BIT 0 : AUX1 BIT 1 : AUX2 BIT 2 : AUX3 BIT 3 : AUX4 BIT 4 : - BIT 5 : - BIT 6 : - BIT 7 : 30AC |
| 0x0012 | V1 | 0~10V | | R | |
| 0x0013 | V2 | 0~10V | | R | |
| 0x0014 | I | 0~20mA | | R | |

| Address | Parameter | Unit | Unit | R/W | Data value |
|---------|----------------|------|------|-----|-----------------|
| 0x0015 | RPM | | | R | |
| 0x001A | Unit display | | | R | 0 : Hz, 1 : Rpm |
| 0x001B | Pole number | | | R | |
| 0x001C | Custom Version | | | R | |

Note 1) Detail description on Common area address 0x0006

| Bit | Value | R/W | Name | Description |
|------|--------|-----|-------------------|--|
| 0 | 0x01 | R/W | Stop | Issue a Stop command via communication (0->1) |
| 1 | 0x02 | R/W | Forward run | Issue a Forward run command via communication (0->1) |
| 2 | 0x04 | R/W | Reverse run | Issue a Reverse run command via communication (0->1) |
| 3 | 0x08 | R/W | Fault reset | Issue a Fault reset command via communication (0->1) |
| 4 | 0x10 | R/W | Emergency stop | Issue a Emergency stop command via communication (0->1) |
| 5 | | | Not used | Not Used |
| 6~7 | | R | Operating command | 0(Terminal),1(keypad),2(option),3(Int. 485) |
| 8~14 | | R | Frequency command | A. When operating command is issued via Terminal, Keypad or Option 0: DRV-00, 1: Not used, 2 : Multi-step speed 1, 3 : Multi-step speed 2, 4 : Multi-step speed 3 5 : Multi-step speed 4, 6 : Multi-step speed 5, 7 : Multi-step speed 6 8 : Multi-step speed 7, 9 : Multi-step speed 8, 10 : Multi-step speed 9 11: Multi-step speed 10, 12: Multi-step speed 11, 13: Multi-step speed 12 14: Multi-step speed 13, 15 : Multi-step speed 14 , 16 : Multi-step speed 15, 17 :Up, 18 : Down, 19: Up/Down Zero 20~21 : RESERVE 22 : V1, 23 : V1S, 24 : I, 25 : V1+I 26 : Pulse 27 : Sub 28 : Int. 485 29 : Option 30 : Jog 31 : PID |
| 15 | 0x8000 | R | Network error | Network malfunction |

9.5.1 iP5A operating status in Address E, Common area



< iP5A Address usage area by groups >

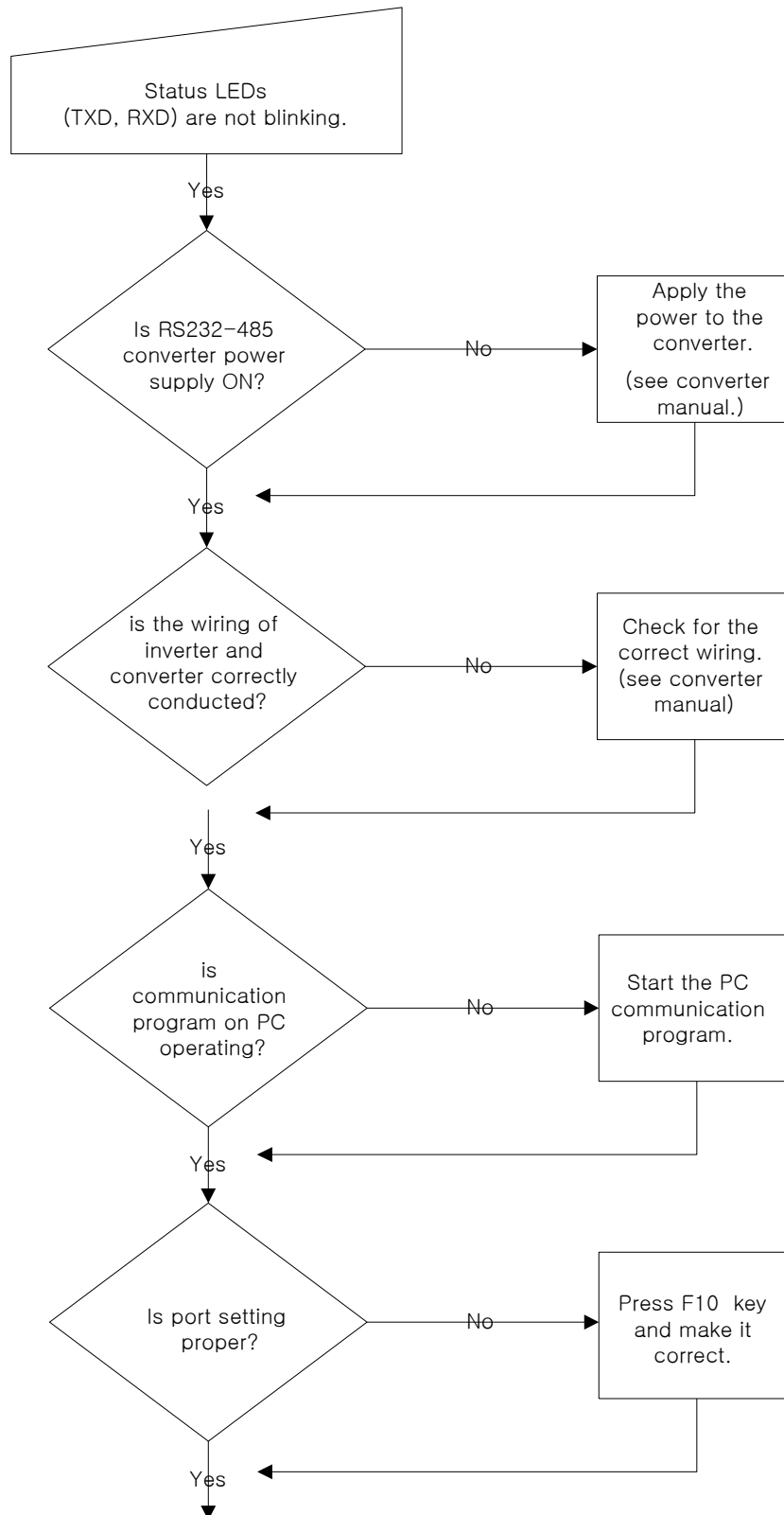
| | |
|-----|-------------|
| DRV | 9100 - 91FF |
| FU1 | 9200 - 92FF |
| FU2 | 9300 - 93FF |
| I/O | 9400 - 94FF |
| EXT | 9500 - 95FF |
| COM | 9600 - 96FF |
| APP | 9700 - 97FF |

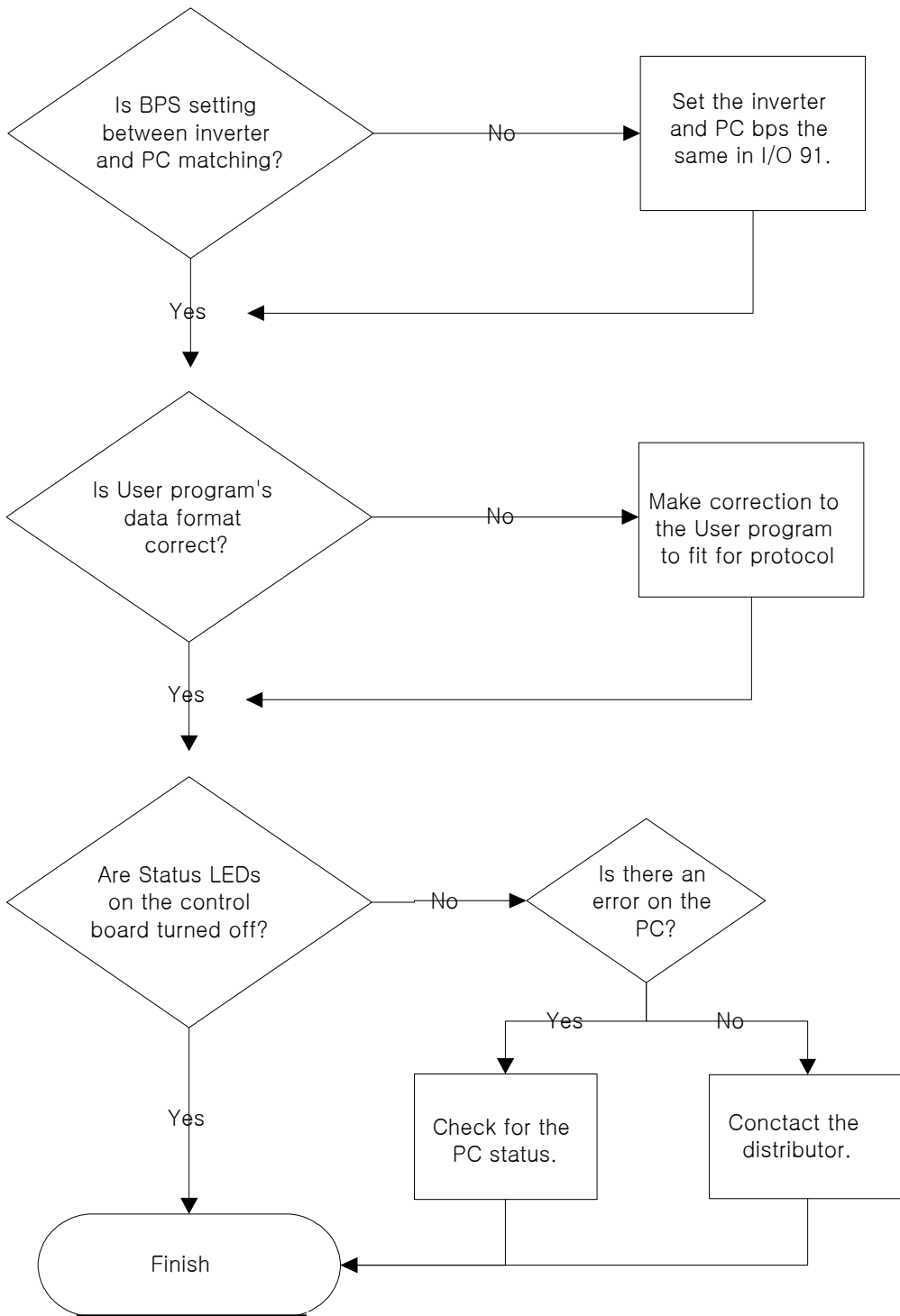
Address setting method to access the parameter using RS485: area assigned by inverter+ Address usage area by groups + Code no. (Hex).

Ex) To check the content of I/O-93 [COM Time Out], perform Read or Write the address 0x945D.

9.6 Troubleshooting

Refer to the below chart when RS485 communication error occurs.





9.7 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 |

CHAPTER 10 - APPLYING DRIVES TO SINGLE-PHASE INPUT APPLICATION

10.1 Introduction

SV-IP5A is a three-phase standard variable frequency drive(VFD). When applying single-phase power to a three-phase VFD, there are several constraints that need to be considered. Standard Pulse-Width-Modulated (PWM) VFDs use a 6-pulse diode rectifier. The 6-pulse rectification results in 360 Hz DC bus ripple when used with a three-phase 60 Hz supply. However, under single-phase use, the DC bus ripple becomes 120 Hz and the VFDs DC bus circuit is subject to higher stress in order to deliver equivalent power. Additionally, input currents and harmonics increase beyond those encountered with three-phase input. Input current distortion of 90% THD and greater can be expected under single-phase input, compared to approximately 40% with three-phase input as indicated in Figure 2. Therefore, single-phase use requires the three-phase VFD power rating be reduced (derated) to avoid over stressing the rectifier and DC link components.

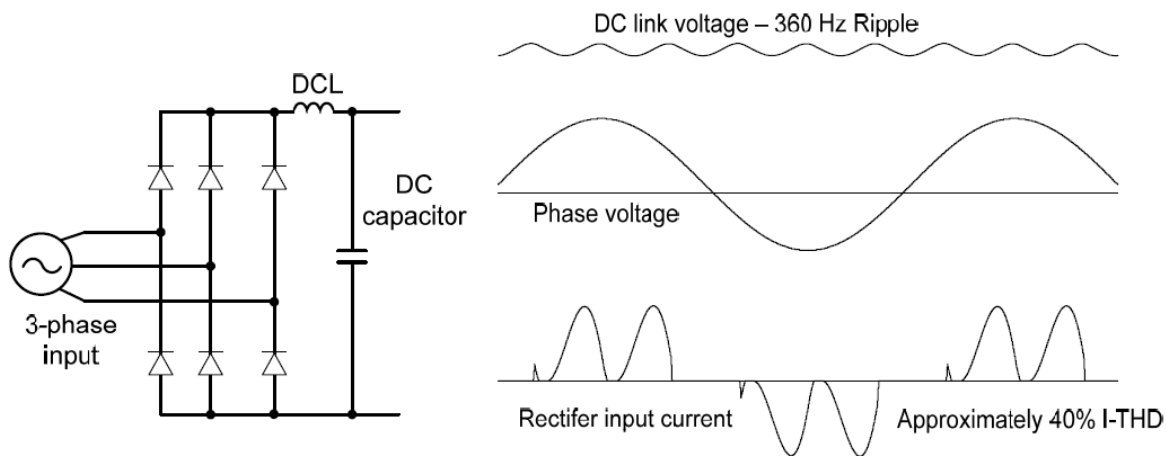


Figure-1 Typical Three-Phase Configuration

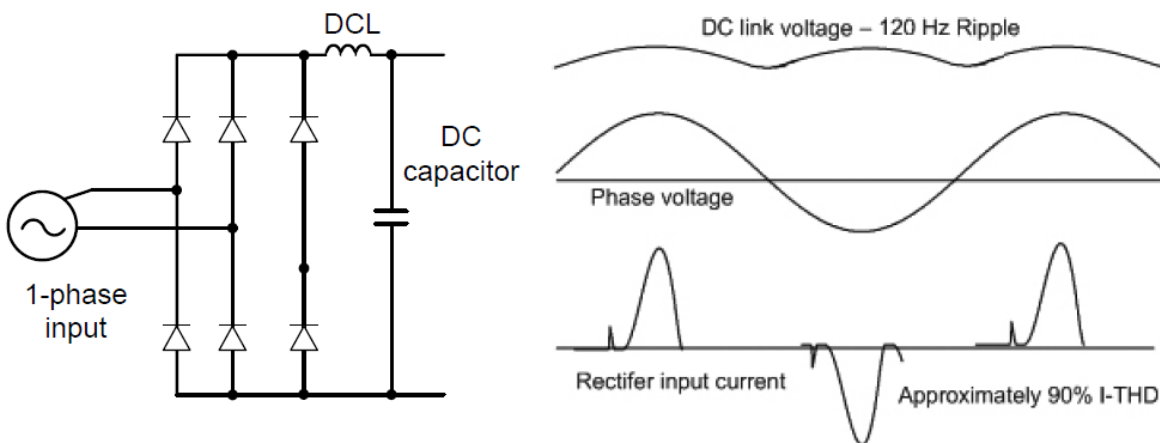


Figure-2 Typical Single-Phase Configuration

10.2 Power(HP), Input Current and Output Current

When using a three-phase VFD with single-phase input, derating the drive's output current and horsepower will be necessary because of the increase in DC bus ripple voltage and current. In addition, the input current through the remaining two phases on the diode bridge converter will approximately double, creating another derating consideration for the VFD. Input current harmonic distortion will increase beyond that with a three-phase supply making the overall input power factor low. Input current distortion over 100% is likely under single-phase conditions without a Reactor. Therefore, the Reactor is always required. When using a motor that is selected by the three-phase drive rating criteria when using single-phase input, it may result in poor performance, premature drive failure. The selected drive of single-phase current ratings must meet or exceed the motor current ratings as indicated in Table 1.

10.3 Input Frequency and Voltage Tolerance

The drive ratings in Table 1 are valid for 60Hz input only. Operation at input frequencies other than 60Hz will require further review by LSIS.

The AC supply voltage must be within the required voltage range of 240/480Vac +10% to -5% to maximize motor power production. Standard product with three-phase voltage input as an allowable range of +10% to -15%. Therefore, a stricter input voltage tolerance of +10 to -5% applies when using the drive with a single-phase supply.

The average bus voltage with single-phase input is lower than the equivalent of a three-phase input. Therefore, the maximum output voltage (motor voltage) will be lower with a single-phase input. The minimum input voltage must be no less than 228Vac for 240 volt models and 456Vac for 480 volt models, to ensure motor voltage production of 207Vac and 415Vac, respectively. Thus, if full motor torque must be developed near base speed (full power) it will be necessary to maintain a rigid incoming line voltage so that adequate motor voltage can be produced. Operating a motor at reduced speed (reduced power), or using a motor with a base voltage that is lower than the incoming AC supply rating (ex. 208Vac motor with a 240Vac supply), will also minimize the effect of voltage deprivation.

(240VAC Input → 208V motor, 480VAC Input → 400V motor)

10.4 Wiring and Peripheral Device

It is important that input wiring and branch circuit protection be selected based on the drive's single-phase input current rating indicated in Table 1-2.

The single-phase input current after derating differs from the three-phase input indicated on the VFD nameplate. Connect single-phase AC input wiring below Figure-3 (R(L1)-T(L3)).

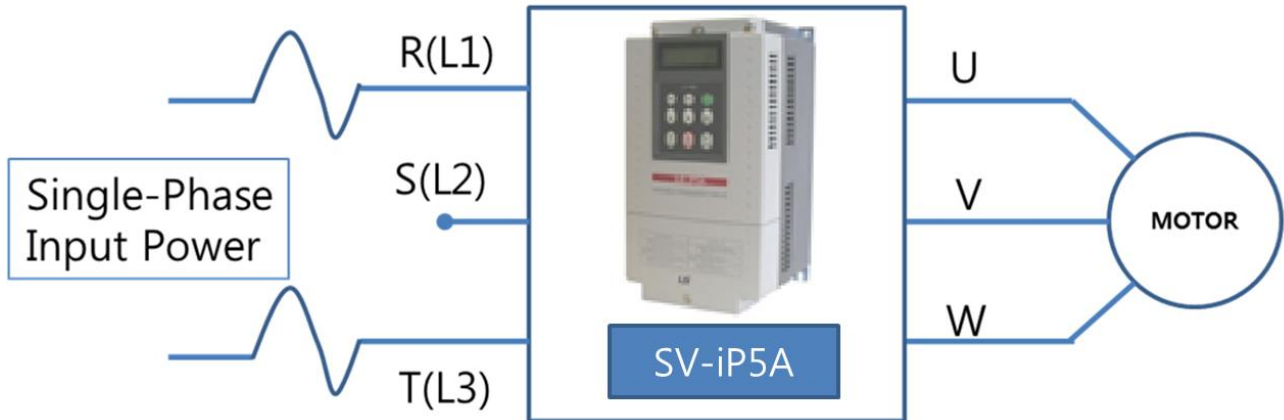


Figure-3 Terminal Wiring Diagram

| Single-Phase Rating (240V/60Hz) | | | | | | | | | | | |
|---------------------------------|------|-----------------------------|--------|------------|--------|----------------|-------|---------------|------|-------------|----------------------|
| [kW] | [HP] | Single-Phase Current Rating | | | | Wire Selection | | FUSE | | MCCB | Electronic Contactor |
| | | Input Amp | | Output Amp | | AWG | | [A] | [V] | | |
| | | HD [A] | ND [A] | HD [A] | ND [A] | R,S,T | U,V,W | LSIS(UL Type) | | | |
| 5.5kW | 7.5 | 20 | 25 | 8.5 | 12 | 10 | 10 | 40 | 500V | UTS150/50A | MC-32a |
| 7.5kW | 10 | 26 | 33 | 12 | 16 | 8 | 8 | 60 | | UTS150/60A | MC-40a |
| 11kW | 15 | 38 | 47 | 17 | 24 | 6 | 6 | 80 | | UTS150/100A | MC-50a |
| 15kW | 20 | 46 | 62 | 23 | 31 | 4 | 4 | 100 | | UTS150/125A | MC-65a |
| 18.5kW | 25 | 55 | 76 | 28 | 38 | 2 | 2 | 125 | | UTS150/150A | MC-100a |
| 22kW | 30 | 70 | 90 | 35 | 46 | 2 | 2 | 150 | | UTS250/175A | MC-130a |
| 30kW | 40 | 86 | 117 | 43 | 59 | 1/0 | 1/0 | 200 | | UTS250/225A | MC-150a |

Table 1. Single_Phase Rating(240V/60Hz)

| Single-Phase Rating (480V/60Hz) | | | | | | | | | | | | |
|---------------------------------|------|-----------------------------|--------|------------|--------|----------------|-------|------|-------------|---------------|----------------------|---------|
| [kW] | [HP] | Single-Phase Current Rating | | | | Wire Selection | | FUSE | | MCCB | Electronic Contactor | |
| | | Input Amp | | Output Amp | | AWG | | [A] | [V] | | | |
| | | HD [A] | ND [A] | HD [A] | ND [A] | R,S,T | U,V,W | | | LSIS(UL Type) | | |
| 5.5kW | 7.5 | 9 | 13 | 4.8 | 6.6 | 12 | 12 | 20 | 500V | UTE100/30A | MC-22b | |
| 7.5kW | 10 | 13 | 17 | 6.7 | 8.9 | 12 | 12 | 30 | | UTE100/30A | MC-22b | |
| 11kW | 15 | 20 | 25 | 9.1 | 14 | 10 | 10 | 40 | | UTS150/50A | MC-40a | |
| 15kW | 20 | 26 | 32 | 12 | 16 | 8 | 8 | 60 | | UTS150/60A | MC-50a | |
| 18.5kW | 25 | 33 | 41 | 15 | 20 | 6 | 6 | 70 | | UTS150/60A | MC-50a | |
| 22kW | 30 | 40 | 47 | 20 | 23 | 4 | 4 | 80 | | UTS150/100A | MC-65a | |
| 30kW | 40 | 51 | 63 | 23 | 32 | 4 | 4 | 100 | | UTS150/125A | MC-75a | |
| 37kW | 50 | 57 | 90 | 31 | 39 | 2 | 2 | 125 | | UTS150/150A | MC-105a | |
| 45kW | 60 | 69 | 109 | 39 | 47 | 2 | 2 | 150 | | UTS250/200A | MC-130a | |
| 55kW | 75 | 83 | 123 | 47 | 57 | 2 | 2 | 175 | | UTS250/250A | MC-150a | |
| 75kW | 100 | 113 | 162 | 57 | 78 | 1/0 | 1/0 | 250 | | UTS400/300A | MC-185a | |
| 90kW | 120 | 136 | 195 | 79 | 95 | 1/0 | 1/0 | 300 | | UTS400/350A | MC-225a | |
| 110kW | 150 | 174 | 237 | 95 | 116 | 4/0 | 4/0 | 350 | | 700V | UTS400/400A | MC-330a |
| 132kW | 180 | 206 | 281 | 113 | 134 | 4/0 | 4/0 | 400 | | | UTS600/500A | MC-400a |
| 160kW | 225 | 255 | 346 | 135 | 166 | 300 | 300 | 450 | UTS600/600A | | MC-400a | |

Table 2. Single-Phase Rating(480V/60Hz)

10.5 Considerations When Using a Three-Phase Drive with Single-Phase Input

Depending on the increased DC ripple, sensorless mode may result in poor performance, If phase open trip occurs, cancel the input phase open protection bit setting (FU1-69)

When applying single-phase power to a three-phase VFD, you can not limit the current to exceed the single-phase rating. Therefore, motor capacity, motor overload trip and E-thermal function must be set to protect motor.

The Reactor is always required. Therefore, Please purchase a built-in DC reactor product. IP5A 200V 5.5 ~ 30kW, 400V 5.5 ~ 11kW capacity products does not have a built-in DC reactor. The product does not have a built-in DC reactor, install an external AC reactor because it can not be equipped with a DC reactor.

APPENDIX A- UL MARKING

1. SHORT CIRCUIT RATING

“Suitable For Use On A Circuit Capable Of Delivering Not More Than Table1 RMS Symmetrical Amperes, 240V for 240V rated inverters, 480V for 480V rated inverters, 600V for 600V rated inverters Volts Maximum,”

Table 1. RMS Symmetrical Amperes for iP5A series.

| Model | Rating |
|---|----------|
| SV055iP5A-2, SV055iP5A-4,SV0055iP5A-6, SV075iP5A-2,SV075iP5A-4 SV0075iP5A-6, SV110iP5A-2,SV110iP5A-4,SV0110iP5A-6, SV0150iP5A-2, SV150iP5A-4, SV0150iP5A-6, SV185iP5A-2, SV185iP5A-4, SV0185iP5A-6 SV220iP5A-2, SV220iP5A-4, SV0220iP5A-6, SV300iP5A-2, SV300iP5A-4, , SV0300iP5A-6, SV370iP5A-4,SV0370iP5A-6, SV450iP5A-4, SV0450iP5A-6, SV550iP5A-4, SV0550iP5A-6, SV750iP5A-4, SV0750iP5A-6, SV900iP5A-4, SV0900iP5A-6, SV1100iP5A-4, SV1100iP5A-6, SV1320iP5A-4, SV1600iP5A-4, SV2200iP5A-4, SV2800iP5A-4, SV3150iP5A-4, SV3750iP5A-4, SV4500iP5A-4 | 100,000A |

2. SHORT CIRCUIT FUSE/BREAKER

Use Class H or K5 UL Listed Input Fuse and UL Listed Breaker Only. See the table below for the Voltage and Current rating of the fuses and the breakers.

| Input Voltage | Motor [kW] | Inverter | External Fuse | | Breaker | | Internal Fuse | | | |
|---------------|---------------|---------------|---------------|-------------|-------------|-------------|---------------|-------------|-----------------|-----------------|
| | | | Current [A] | Voltage [V] | Current [A] | Voltage [V] | Current [A] | Voltage [V] | Manufacturer | Model Number |
| 200V Class | 5.5 | SV055iP5A-2 | 40 | 500 | 50 | 230 | | | | |
| | 7.5 | SV075iP5A-2 | 60 | 500 | 60 | 230 | | | | |
| | 11 | SV110iP5A-2 | 80 | 500 | 100 | 230 | | | | |
| | 15 | SV150iP5A-2 | 100 | 500 | 100 | 230 | | | | |
| | 18.5 | SV185iP5A-2 | 125 | 500 | 225 | 230 | | | | |
| | 22 | SV220iP5A-2 | 150 | 500 | 225 | 230 | | | | |
| | 30 | SV300iP5A-2 | 200 | 500 | 225 | 230 | | | | |
| 400V Class | 5.5 | SV055iP5S-4 | 20 | 500 | 30 | 460 | | | | |
| | 7.5 | SV075iP5A-4 | 30 | 500 | 30 | 460 | | | | |
| | 11 | SV110iP5S-4 | 40 | 500 | 50 | 460 | | | | |
| | 15 | SV150iP5A-4 | 60 | 500 | 60 | 460 | | | | |
| | 18.5 | SV185iP5A-4 | 70 | 500 | 75 | 460 | | | | |
| | 22 | SV0220iP5A-4 | 80 | 500 | 100 | 460 | | | | |
| | 30 | SV0300iP5A-4 | 100 | 500 | 125 | 460 | | | | |
| | 37 | SV0370iP5A-4 | 125 | 500 | 125 | 460 | 160 | 660 | Hinode | 660GH-160SUL |
| | 45 | SV0450iP5A-4 | 150 | 500 | 150 | 460 | 160 | 660 | Hinode | 660GH-160SUL |
| | 55 | SV0550iP5A-4 | 175 | 500 | 175 | 460 | 200 | 660 | Hinode | 660GH-200SUL |
| | 75 | SV0750iP5A-4 | 250 | 500 | 225 | 460 | 250 | 660 | Hinode | 660GH-250SUL |
| | 90 | SV0900iP5A-4 | 300 | 500 | 300 | 460 | 315 | 660 | Hinode | 660GH-315SUL |
| | 110 | SV01100iP5A-4 | 350 | 700 | 400 | 460 | 200×2P | 660 | Hinode | 660GH-200SUL×2P |
| | 132 | SV01320iP5A-4 | 400 | 700 | 500 | 460 | 250×2P | 660 | Hinode | 660GH-250SUL×2P |
| | 160 | SV01600iP5A-4 | 450 | 700 | 600 | 460 | 315×2P | 660 | Hinode | 660GH-315SUL×2P |
| | 220 | SV02200iP5A-4 | 700 | 700 | 800 | 460 | 250×3P | 660 | Hinode | 660GH-250SUL×3P |
| | 280 | SV02800iP5A-4 | 800 | 700 | 1000 | 460 | 315×3P | 660 | Hinode | 660GH-315SUL×3P |
| 315 | SV03150iP5A-4 | 900 | 700 | 1000 | 460 | 800 | 690 | Ferraz | 6.9URD32TTF0800 | |
| 375 | SV03750iP5A-4 | 1000 | 700 | 1200 | 460 | 900 | 690 | Ferraz | 6.9URD32TTF0900 | |
| 450 | SV04500iP5A-4 | 1200 | 700 | 1200 | 460 | 1000 | 690 | Ferraz | 6.9URD32TTF1000 | |
| 600V Class | 5.5 | SV055iP5S-4 | 20 | 600 | 30 | 600 | | | | |
| | 7.5 | SV075iP5A-4 | 30 | 600 | 30 | 600 | | | | |

| Input Voltage | Motor [kW] | Inverter | External Fuse | | Breaker | | Internal Fuse | | | |
|---------------|------------|---------------|---------------|-------------|-------------|-------------|---------------|-------------|--------------|-----------------|
| | | | Current [A] | Voltage [V] | Current [A] | Voltage [V] | Current [A] | Voltage [V] | Manufacturer | Model Number |
| | 11 | SV110iP5S-4 | 40 | 600 | 50 | 600 | | | | |
| | 15 | SV150iP5A-4 | 60 | 600 | 60 | 600 | | | | |
| | 18.5 | SV185iP5A-4 | 70 | 600 | 75 | 600 | | | | |
| | 22 | SV0220iP5A-4 | 80 | 600 | 100 | 600 | | | | |
| | 30 | SV0300iP5A-4 | 100 | 600 | 125 | 600 | | | | |
| | 37 | SV0370iP5A-4 | 125 | 600 | 125 | 600 | 160 | 660 | Hinode | 660GH-160SUL |
| | 45 | SV0450iP5A-4 | 150 | 600 | 150 | 600 | 160 | 660 | Hinode | 660GH-160SUL |
| | 55 | SV0550iP5A-4 | 175 | 600 | 175 | 600 | 200 | 660 | Hinode | 660GH-200SUL |
| | 75 | SV0750iP5A-4 | 250 | 600 | 225 | 600 | 250 | 660 | Hinode | 660GH-250SUL |
| | 90 | SV0900iP5A-4 | 300 | 600 | 300 | 600 | 315 | 660 | Hinode | 660GH-315SUL |
| | 110 | SV01100iP5A-4 | 350 | 600 | 400 | 600 | 200×2P | 660 | Hinode | 660GH-200SUL×2P |

3. OVER LOAD PROTECTION

IOLT: IOLT(Inverter Overload Trip) protection is activated at 110% of the inverter rated current for 1 minute and greater.

Warning!

If the occurrence of IOLT is happened, Trip will be continued during 1 minute for the cooling of the inverter. In case of 600V product, the operation time of IOLT will be reduced at above 600Vac.

OLT : Inverter shuts off its output when inverter output current exceeds its overload trip level for overload trip time. OLT is selected when FU1-66 [Overload Trip Selection] is set to “Yes” and activated at 120% of FU1-67 [Overload Trip Level] for 60 sec set in FU1-68 [Overload Trip Delay Time].

4. OVER SPEED PROTECTION

Not Provided With Overspeed Protection.

5. FIELD WIRING TERMINAL

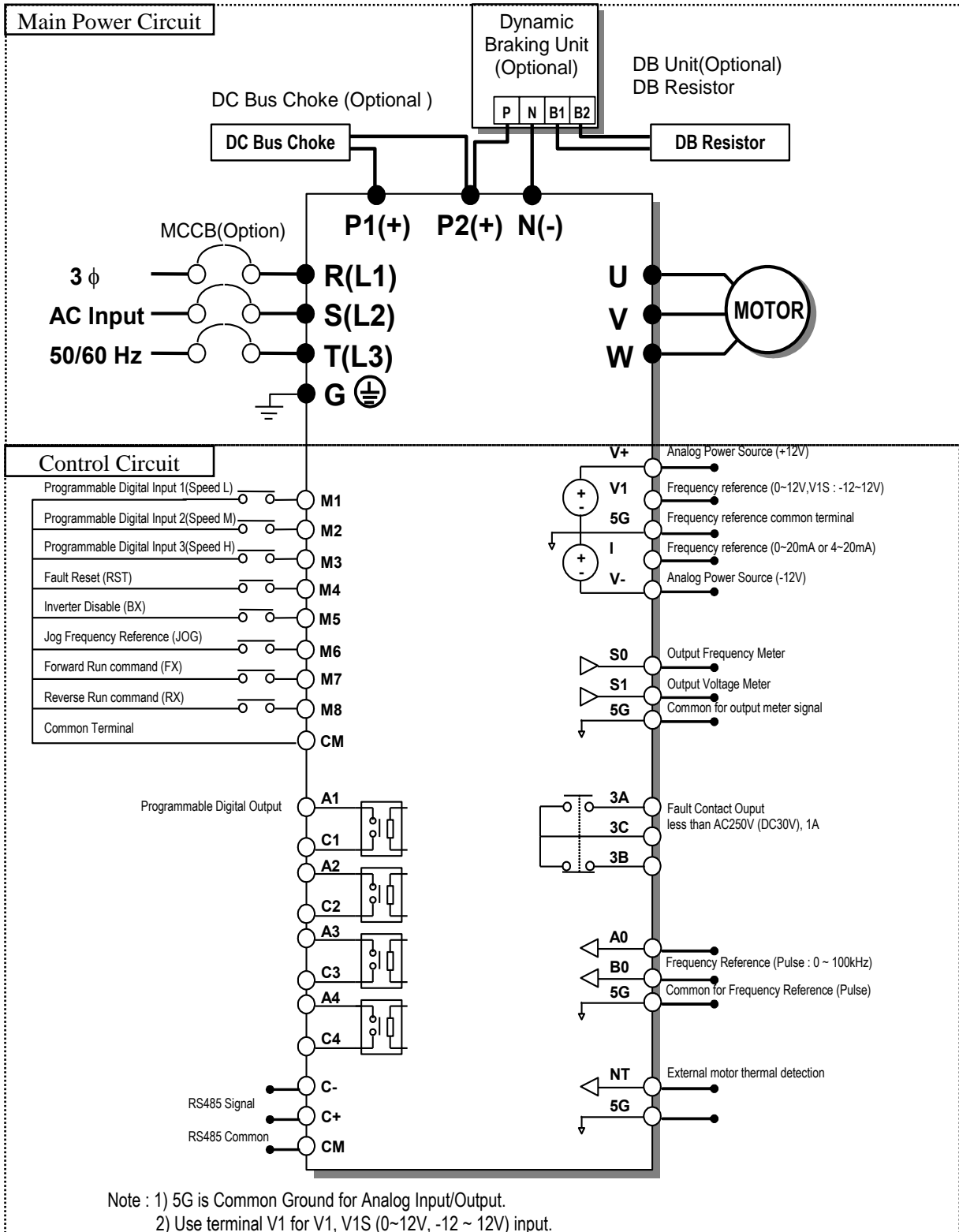
- 1) Use copper wires only with 600V, 75°C ratings
- 2) Tightening torque of power terminal blocks

| Inverter Capacity [kW] | | Terminal Screw Size | Screw Torque ¹ | | Wire ² | | | |
|------------------------|------|---------------------|---------------------------|-------------|-------------------|-------|--------------|-------|
| | | | Kgf.cm | lb-in | mm ² | | AWG or kcmil | |
| | | | | | R,S,T | U,V,W | R,S,T | U,V,W |
| 200V Class | 5.5 | M4 | 7.1 ~ 12.2 | 6.2~10.6 | 5.5 | 5.5 | 10 | 10 |
| | 7.5 | M5 | | | 8 | 8 | 8 | 8 |
| | 11 | M5 | 24.5 ~ 31.8 | 21.2~27.6 | 14 | 14 | 6 | 6 |
| | 15 | M6 | | | 22 | 22 | 4 | 4 |
| | 18.5 | M6 | 30.6 ~ 38.2 | 26.6~33.2 | 38 | 38 | 2 | 2 |
| | 22 | M8 | | | 38 | 38 | 2 | 2 |
| 30 | M8 | 61.2 ~ 91.8 | 53.1~79.7 | 60 | 60 | 1/0 | 1/0 | |
| 400V Class | 5.5 | M4 | 7.1 ~ 12.2 | 6.2~10.6 | 3.5 | 3.5 | 12 | 12 |
| | 7.5 | M4 | | | 3.5 | 3.5 | 12 | 12 |
| | 11 | M4 | | | 5.5 | 5.5 | 10 | 10 |
| | 15 | M6 | 30.6~38.2 | 26.6~33.2 | 8 | 8 | 8 | 8 |
| | 18.5 | M6 | | | 14 | 14 | 6 | 6 |
| | 22 | M8 | 61.2~91.8 | 53.1~79.7 | 22 | 22 | 4 | 4 |
| | 30 | M8 | | | 22 | 22 | 4 | 4 |
| | 37 | M8 | 67.3~87.5 | 58.4~75.9 | 38 | 38 | 2 | 2 |
| | 45 | M8 | | | 38 | 38 | 2 | 2 |
| | 55 | M8 | | | 38 | 38 | 2 | 2 |
| | 75 | M10 | 89.7~122.0 | 77.9~105.9 | 60 | 60 | 1/0 | 1/0 |
| | 90 | M10 | | | 60 | 60 | 1/0 | 1/0 |
| | 110 | M12 | 182.4~215.0 | 158.3~186.6 | 100 | 100 | 4/0 | 4/0 |
| | 132 | M12 | | | 100 | 100 | 4/0 | 4/0 |
| | 160 | M12 | | | 150 | 150 | 300 | 300 |
| | 220 | M12 | 182.4~215.0 | 158.3~186.6 | 200 | 200 | 400 | 400 |
| 280 | M12 | 250 | | | 250 | 500 | 500 | |
| 315 | M12 | 325 | | | 325 | 700 | 700 | |
| 375 | M12 | 182.4~215.0 | 158.3~186.6 | 2×200 | 2×200 | 2×400 | 2×400 | |
| 450 | M12 | | | 2×250 | 2×250 | 2×500 | 2×500 | |
| 600V Class | 5.5 | M4 | 2.0~6.1 | 1.8~5.2 | 3.5 | 3.5 | 12 | 12 |
| | 7.5 | M4 | | | 3.5 | 3.5 | 12 | 12 |
| | 11 | M4 | | | 5.5 | 5.5 | 10 | 10 |
| | 15 | M6 | 30.6~38.2 | 26.6~33.2 | 8 | 8 | 8 | 8 |
| | 18.5 | M6 | | | 14 | 14 | 6 | 6 |
| | 22 | M8 | 61.2~91.8 | 53.1~79.7 | 22 | 22 | 4 | 4 |
| | 30 | M8 | | | 22 | 22 | 4 | 4 |
| | 37 | M8 | 67.3~87.5 | 58.4~75.9 | 38 | 38 | 2 | 2 |
| | 45 | M8 | | | 38 | 38 | 2 | 2 |
| | 55 | M8 | | | 38 | 38 | 2 | 2 |
| | 75 | M10 | 89.7~122.0 | 77.9~105.9 | 60 | 60 | 1/0 | 1/0 |
| | 90 | M10 | | | 60 | 60 | 1/0 | 1/0 |
| 110~280 | M12 | 182.4~215.0 | 158.3~186.6 | 100 | 100 | 4/0 | 4/0 | |

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

- 3) For 7.5~11kW 240V type inverters, Input and motor output terminal blocks are intended only for use with ring type connectors.

6. BASIC WIRING



CAUTION



■ Risk of Electric Shock

More than one disconnect switch may be required to de-energize the equipment before servicing.

APPENDIX B- PERIPHERAL DEVICES

1. MCCB(Molded Case Circuit Breaker) ELCB and MC(Magnetic Contector)

| Voltage | CAP. [kW] | MCCB | | | | ELCB | | MC | |
|------------|-----------|----------|------------|----------|------------|----------|------------|---------|------------|
| | | Model | Rating[A] | Model | Rating[A] | Model | Rating[A] | Model | Rating[A] |
| 200V Class | 0.75 | UTE100N | 15 | ABS33c | 15 | EBS33c | 10 | MC-9b | 11 |
| | 1.5 | | 15 | | 15 | | 15 | MC-9b | 11 |
| | 2.2 | | 30 | | 30 | | 30 | MC-12b | 13 |
| | 3.7 | | 30 | | 30 | | 30 | MC-18b | 18 |
| | 5.5 | UTS150L | 50 | ABS53c | 50 | EBS53c | 50 | MC-32a | 32 |
| | 7.5 | | 60 | ABS63c | 60 | EBS63c | 60 | MC-40a | 40 |
| | 11 | | 100 | ABS103c | 100 | EBS103c | 100 | MC-50a | 55 |
| | 15 | | 125 | | 125 | EBS203c | 125 | MC-65a | 65 |
| | 18.5 | 150 | ABS203c | 150 | 150 | | MC-100a | 105 | |
| | 22 | 175 | | 175 | 175 | | MC-130a | 130 | |
| | 30 | UTS250L | 225 | | 225 | | 225 | MC-150a | 150 |
| 400V Class | 0.75 | UTE100N | 15 | ABS33c | 15 | EBS33c | 15 | MC-9b | 9 |
| | 1.5 | | 15 | | 15 | | 15 | | 9 |
| | 2.2 | | 15 | | 15 | | 15 | | 9 |
| | 3.7 | | 15 | | 15 | | 15 | MC-12b | 12 |
| | 5.5 | | 30 | | 30 | | 30 | MC-22b | 22 |
| | 7.5 | | 30 | | 30 | | 30 | | 22 |
| | 11 | UTS150L | 50 | ABS53c | 50 | EBS53c | 50 | MC-40a | 40 |
| | 15 | | 60 | ABS63c | 60 | EBS63c | 60 | MC-50a | 50 |
| | 18.5 | | 60 | | 60 | EBS103c | 60 | | 50 |
| | 22 | | 100 | ABS103c | 100 | EBS103c | 100 | MC-65a | 65 |
| | 30 | | 125 | ABS203c | 125 | EBS203c | 125 | MC-75a | 75 |
| | 37 | | 150 | | 150 | | 150 | MC-100a | 105 |
| | 45 | 200 | 200 | | 200 | | MC-130a | 130 | |
| | 55 | UTS250L | 250 | | 250 | | 250 | MC-150a | 150 |
| | 75 | UTS400L | 300 | ABS403c | 300 | EBS403c | 300 | MC-185a | 185 |
| | 90 | | 350 | | 350 | | 350 | MC-225a | 225 |
| | 110 | | 400 | | 400 | | 400 | MC-330a | 330 |
| | 132 | 500 | ABS603c | 500 | EBS603c | 500 | 400 | | |
| | 160 | UTS600L | | 600 | | 630 | | 630 | MC-400a |
| | 220 | UTS800L | 800 | ABS803c | 800 | EBS803c | 800 | MC-630a | 630 |
| | 280 | UTS1200L | 1000 | ABS1003b | 1000 | EBS1003c | 1000 | | 630 |
| 315 | 1200 | | ABS1203b | 1200 | EBS1203c | 1200 | MC-800a | 800 | |
| 375 | 1400A | 1400 | 1400A | 1400 | 1400A | 1400 | 900A | 900 | |
| 450 | 1600A | 1600 | 1600A | 1600 | 1600A | 1600 | 1000A | 1000 | |
| 600V Class | 5.5 | UTE100N | 30 | ABS33c | 30 | - | | MC-22b | 20 |
| | 7.5 | UTS150L | 50 | ABS53c | 50 | - | | MC-40a | 32 |
| | 11 | | 60 | ABS63c | 60 | - | | MC-50a | 43 |
| | 15 | | 60 | | 60 | - | | | 43 |
| | 18.5 | | 100 | ABS103c | 100 | - | | MC-65a | 60 |

| Voltage | CAP. [kW] | MCCB | | | | ELCB | | MC | |
|---------|-----------|---------|-----------|---------|-----------|-------|-----------|---------|-----------|
| | | Model | Rating[A] | Model | Rating[A] | Model | Rating[A] | Model | Rating[A] |
| | 22 | UTS250L | 100 | ABS203c | 100 | - | | MC-75a | 64 |
| | 30 | | 125 | | 125 | - | | MC-100a | 85 |
| | 37 | | 150 | | 150 | - | | MC-130a | 90 |
| | 45 | | 175 | | 175 | - | | MC-150a | 100 |
| | 55 | | 250 | | 250 | - | | MC-185a | 180 |
| | 75 | UTS400L | 300 | ABS403c | 300 | - | | MC-225a | 200 |
| | 90 | | 400 | | 400 | - | | MC-330a | 280 |
| | 110 | UTS150L | 50 | ABS53c | 50 | - | | MC-40a | 32 |

2. AC Input Fuse and AC / DC Reactor

| Voltage | Mortor [kW] | Inverter Model | AC Input Fuse [A] | AC Reactor | | DC Reactor | |
|------------|--------------|----------------|-------------------|------------|----------|------------|-----|
| | | | | [mH] | [A] | [mH] | [A] |
| 200V Class | 0.75 | SV008iP5A-2 | 10 | 2.13 | 5.7 | - | - |
| | 1.5 | SV015iP5A-2 | 15 | 1.2 | 10 | - | - |
| | 2.2 | SV022iP5A-2 | 20 | 0.88 | 14 | - | - |
| | 3.7 | SV037iP5A-2 | 30 | 0.56 | 20 | - | - |
| | 5.5 | SV055iP5A-2 | 40 | 0.39 | 30 | 1.37 | 29 |
| | 7.5 | SV075iP5A-2 | 60 | 0.28 | 40 | 1.05 | 38 |
| | 11 | SV110iP5A-2 | 80 | 0.20 | 59 | 0.74 | 56 |
| | 15 | SV150iP5A-2 | 100 | 0.15 | 75 | 0.57 | 71 |
| | 18.5 | SV185iP5A-2 | 125 | 0.12 | 96 | 0.49 | 91 |
| | 22 | SV220iP5A-2 | 150 | 0.10 | 112 | 0.42 | 107 |
| 400V Class | 30 | SV300iP5A-2 | 200 | 0.07 | 160 | 0.34 | 152 |
| | 0.75 | SV008iP5A-4 | 10 | 8.63 | 2.8 | - | - |
| | 1.5 | SV015iP5A-4 | 10 | 4.81 | 4.8 | - | - |
| | 2.2 | SV022iP5A-4 | 10 | 3.23 | 7.5 | - | - |
| | 3.7 | SV037iP5A-4 | 15 | 2.34 | 10 | - | - |
| | 5.5 | SV055iP5A-4 | 20 | 1.22 | 15 | 5.34 | 14 |
| | 7.5 | SV075iP5A-4 | 30 | 1.14 | 20 | 4.04 | 19 |
| | 11 | SV110iP5A-4 | 40 | 0.81 | 30 | 2.76 | 29 |
| | 15 | SV150iP5A-4 | 60 | 0.61 | 38 | 2.18 | 36 |
| | 18.5 | SV185iP5A-4 | 70 | 0.45 | 50 | 1.79 | 48 |
| | 22 | SV220iP5A-4 | 80 | 0.39 | 58 | 1.54 | 55 |
| | 30 | SV300iP5A-4 | 100 | 0.287 | 80 | 1.191 | 76 |
| | 37 | SV370iP5A-4 | 125 | 0.232 | 98 | 0.975 | 93 |
| | 45 | SV450iP5A-4 | 150 | 0.195 | 118 | 0.886 | 112 |
| | 55 | SV550iP5A-4 | 175 | 0.157 | 142 | 0.753 | 135 |
| | 75 | SV750iP5A-4 | 250 | 0.122 | 196 | 0.436 | 187 |
| | 90 | SV900iP5A-4 | 300 | 0.096 | 237 | 0.352 | 225 |
| | 110 | SV1100iP5A-4 | 350 | 0.081 | 289 | Built-in | |
| | 132 | SV1300iP5A-4 | 400 | 0.069 | 341 | Built-in | |
| | 160 | SV1600iP5A-4 | 450 | 0.057 | 420 | Built-in | |
| 220 | SV2200iP5A-4 | 700 | 0.042 | 558 | Built-in | | |
| 280 | SV2800iP5A-4 | 800 | 0.029 | 799 | Built-in | | |
| 315 | SV3150iP5A-4 | 900 | 0.029 | 799 | 0.090 | 836 | |
| 375 | SV3750iP5A-4 | 1000 | 0.024 | 952 | 0.076 | 996 | |
| 450 | SV4500iP5A-4 | 1200 | 0.024 | 952 | 0.064 | 1195 | |

| | | | | | | | |
|---------------|------|--------------|-----|-------|-----|-------|-----|
| 600V Class | 5.5 | SV0055iP5A-6 | 15 | 2.45 | 12 | 9.32 | 11 |
| | 7.5 | SV0075iP5A-6 | 20 | 1.80 | 16 | 6.27 | 15 |
| | 11 | SV0110iP5A-6 | 30 | 1.23 | 23 | 4.60 | 22 |
| | 15 | SV0150iP5A-6 | 40 | 0.900 | 32 | 3.82 | 30 |
| | 18.5 | SV0185iP5A-6 | 50 | 0.730 | 39 | 2.80 | 37 |
| | 22 | SV0220iP5A-6 | 60 | 0.614 | 47 | 2.27 | 44 |
| | 30 | SV0300iP5A-6 | 80 | 0.450 | 63 | 1.91 | 60 |
| | 37 | SV0370iP5A-6 | 100 | 0.365 | 78 | 1.40 | 75 |
| | 45 | SV0450iP5A-6 | 125 | 0.300 | 95 | 1.13 | 91 |
| | 55 | SV0550iP5A-6 | 150 | 0.245 | 116 | 0.933 | 111 |
| | 75 | SV0750iP5A-6 | 175 | 0.180 | 159 | 0.763 | 151 |
| | 90 | SV0900iP5A-6 | 250 | 0.150 | 190 | 0.560 | 181 |

APPENDIX C- RELATED PARAMETERS

| Use | Related parameter codes |
|--|--|
| Accel/Decel time, Pattern Adjustment | DRV-01 [Acceleration Time], DRV-02 [Deceleration Time], FU1-02 [Acceleration Pattern], FU1-03 [Deceleration Pattern] |
| Reverse Rotation Prevention | FU1-01 [Forward/Reverse Prevention] |
| Accel/Decel at Continuous Rating Range | FU1-02 [Acceleration Pattern], FU1-03 [Deceleration Pattern] |
| Braking Operation Adjustment | FU1-20 [Starting Mode], FU1-21~22 [DC Injection Braking at Starting] FU1-23 [Stop Mode], FU1-24~27 [DC Injection Braking], |
| Operations at freq. Over 60 Hz | FU1-30 [Max. Frequency], FU1-35 [Frequency High Limit], I/O-05 [Frequency Corresponding to V1 Max Voltage], I/O-10 [Frequency Corresponding to I Max Current], I/O-16 [Frequency Corresponding to P Pulse Input Max Freq.] |
| Selecting an Appropriate Output Characteristics for the Load | FU1-30 [Max. Frequency], FU1-31 [Base Frequency] |
| Motor Output Torque Adjustment | FU1-32 [Starting Frequency], FU1-71[Stall Prevention], FU2-67~69 [Torque Boost], FU2-40 [Motor Select] |
| Output Frequency Limit | FU1-33~35[Frequency High/Low Limit], I/O-01~16 [Analog Frequency Setting] |
| Motor Overheat Protection | FU1-60~62 [Electronic Thermal], FU2-40 [Motor Select] I/O-97, 98 [External Thermal Sensor] |
| Multi-step Operation | I/O-20~27 [Programmable Digital Input Define], DRV-00, 05~07, I/O-31~42 [Multi-step Frequency], FU1-34~35 [Frequency High/Low Limit] |
| Jog Operation | I/O-30 [Jog Frequency] |
| Frequency Jump Operation | FU2-10 [Frequency Jump] FU2-11~16 [Frequency High/Low Limit] |
| Electronic Brake Operation Timing | I/O-74~75 [Frequency Detection], I/O-76~79 [Programmable Digital Output Define] |
| Rotating Speed Display | DRV-09 [Motor Rpm], FU2-47 [Motor Rpm Display Gain] |
| Function Change Prevention | FU2-94 [Parameter Lock] |
| Energy Saving | FU1-51~52 [Energy Saving] |
| Auto Restart Operation after Alarm Stop | FU2-20~21 [Auto Restart] |
| 2 nd Motor Operation | APP-20~29 [2 nd Function] |
| PID Feedback Operation | APP-02~25 [PID Operation] |
| Adjusting Frequency Reference/Output | I/O-01~16 [Analog Frequency Setting] |
| Commercial Line<-> Inverter Switchover | I/O-20~27 [Programmable Digital Input Terminal], I/O-76~79 [Programmable Digital Output Terminal] |
| Frequency Meter Calibration | I/O-70~73 [S0/S1 Analog Output] |
| Operation via Communication with a PC | I/O-90 [Inverter Number], I/O-91 [Communication Speed], I/O-92~93 [Lost Command] |

Dongnam-gu, Chungcheongnam-do,

EMI / RFI POWER LINE FILTERS

LS inverters, iP5A series



RFI FILTERS

THE L.S. RANGE OF POWER LINE FILTERS FF (Footprint) - FE (Standard) SERIES, HAVE BEEN SPECIFICALLY DESIGNED WITH HIGH FREQUENCY LS INVERTERS. THE USE OF L.S. FILTERS, WITH THE INSTALLATION ADVICE OVERLEAF HELP TO ENSURE TROUBLE FREE USE ALONG SIDE SENSITIVE DEVICES AND COMPLIANCE TO CONDUCTED EMISSION AND IMMUNITY STANDARDS TO EN 50081 -> EN61000-6-3:02 and EN61000-6-1:02

CAUTION

IN CASE OF A LEAKAGE CURRENT PROTECTIVE DEVICES IS USED ON POWER SUPPLY, IT MAY BE FAULT AT POWER-ON OR OFF. IN AVOID THIS CASE, THE SENSE CURRENT OF PROTECTIVE DEVICE SHOULD BE LARGER THAN VALUE OF LAKAGE CURRENT AT WORST CASE IN THE BELOW TABLE.

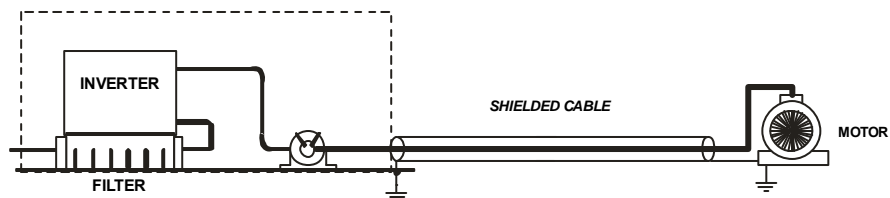
RECOMMENDED INSTALLATION INSTRUCTIONS

To conform to the EMC directive, it is necessary that these instructions be followed as closely as possible. Follow the usual safety procedures when working with electrical equipment. All electrical connections to the filter, inverter and motor must be made by a qualified electrical technician.

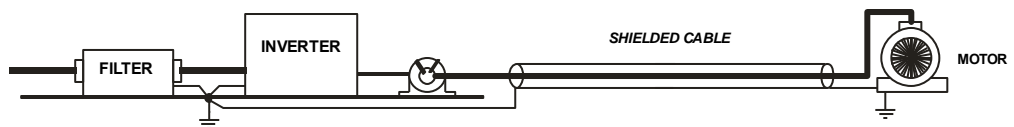
- 1-) Check the filter rating label to ensure that the current, voltage rating and part number are correct.
- 2-) For best results the filter should be fitted as closely as possible to the incoming mains supply of the wiring enclosure, usually directly after the enclosures circuit breaker or supply switch.
- 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.

FF SERIES (Footprint)



FE SERIES (Standard)

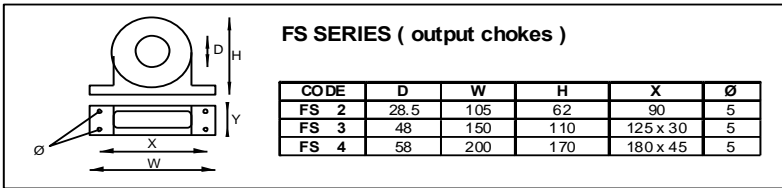


| iP5A series / Footprint Filters | | | | | | | | | | |
|---------------------------------------|-------|----------------|---------|---------|------------------|---------------------|-----------------|----------|-------|---------------|
| INVERTER | POWER | CODE | CURRENT | VOLTAGE | LEAKAGE CURRENT | DIMENSIONS L W H | MOUNTING Y X | WEIGHT | MOUNT | OUTPUT CHOKES |
| THREE PHASE | | | | | NOM. MAX. | | | | | |
| SV055iP5A-2 | 5.5kW | FFP5-T030-(x) | 30A | 250VAC | 0.3mA 18mA | 329x149.5x50 | 315x120 | 2 Kg. | M5 | FS - 2 |
| SV075iP5A-2 | 7.5kW | FFP5-T050-(x) | 50A | 250VAC | 0.3mA 18mA | 329x199.5x60 | 315x160 | 2.5 Kg. | M5 | FS - 2 |
| SV110iP5A-2 | 11kW | | 100A | 250VAC | 0.3mA 18mA | | | | | FS - 3 |
| SV150iP5A-2 | 15kW | | | | | | | | | |
| SV185iP5A-2 | 18kW | | | | | | | | | |
| SV220iP5A-2 | 22kW | | | | | | | | | |
| SV300iP5A-2 | 30kW | | 150A | 250VAC | 0.3mA 18mA | | | | | FS - 3 |
| SV055iP5A-4 | 5.5kW | FFP5-T030-(x) | 30A | 380VAC | 0.5mA 27mA | 329x149.5x50 | 315x120 | 2 Kg. | M5 | FS - 2 |
| SV075iP5A-4 | 7.5kW | FFP5-T031-(x) | 31A | 380VAC | 0.5mA 27mA | 329x199.5x60 | 315x160 | 2.5 Kg. | M5 | FS - 2 |
| SV110iP5A-4 | 11kW | FFP5-T050-(x) | 50A | 380VAC | 0.5mA 27mA | 329x199.5x60 | 315x160 | 2.5 Kg. | M5 | FS - 2 |
| SV150iP5A-4 | 15kW | FFP5-T060-(x) | 60A | 380VAC | 0.5mA 27mA | 466x258x65 | 440.5x181 | 2.8 Kg. | M5 | FS - 2 |
| SV185iP5A-4 | 18kW | | | | | | | | | |
| SV220iP5A-4 | 22kW | FFP5-T070-(x) | 70A | 380VAC | 0.5mA 27mA | 541x312x65 | 515.5x235.3 | 6.1 Kg. | M8 | FS - 2 |
| SV300iP5A-4 | 30kW | | | | | | | | | |
| iP5A series / Standard Filters | | | | | | | | | | |
| INVERTER | POWER | CODE | CURRENT | VOLTAGE | LEAKAGE CURRENT | DIMENSIONS L W H | MOUNTING Y X | WEIGHT | MOUNT | OUTPUT CHOKES |
| THREE PHASE | | | | | NOM. MAX. | | | | | |
| SV055iP5A-2 | 5.5kW | FE-T030-(x) | 30A | 250VAC | 0.3mA 18mA | 270x140x60 | 258x106 | 2.4 Kg. | --- | FS - 2 |
| SV075iP5A-2 | 7.5kW | FE-T050-(x) | 50A | 250VAC | 0.3mA 18mA | 270x140x90 | 258x106 | 3.2 Kg. | --- | FS - 2 |
| SV110iP5A-2 | 11kW | FE-T100-(x) | 100A | 250VAC | 0.3mA 18mA | 420x200x130 | 408x166 | 13.8 Kg. | --- | FS - 3 |
| SV150iP5A-2 | 15kW | | | | | | | | | |
| SV185iP5A-2 | 18kW | FE-T120-(x) | 120A | 250VAC | 0.3mA 18mA | 420x200x130 | 408x166 | 13.8 Kg. | --- | FS - 3 |
| SV220iP5A-2 | 22kW | | | | | | | | | |
| SV300iP5A-2 | 30kW | FE-T150-(x) | 150A | 250VAC | 0.3mA 18mA | 490x200x160 | 468x166 | 15 Kg. | --- | FS - 3 |
| SV055iP5A-4 | 5.5kW | FE-T030-(x) | 30A | 380VAC | 0.5mA 27mA | 270x140x60 | 258x106 | 2.4 Kg. | --- | FS - 2 |
| SV075iP5A-4 | 7.5kW | | | | | | | | | |
| SV110iP5A-4 | 11kW | FE-T050-(x) | 50A | 380VAC | 0.5mA 27mA | 270x140x90 | 258x106 | 3.2 Kg. | --- | FS - 2 |
| SV150iP5A-4 | 15kW | | | | | | | | | |
| SV185iP5A-4 | 18kW | FE-T060-(x) | 60A | 380VAC | 0.5mA 27mA | 270x140x90 | 258x106 | 3.5 Kg. | --- | FS - 2 |
| SV220iP5A-4 | 22kW | FE-T070-(x) | 70A | 380VAC | 0.5mA 27mA | 350x180x90 | 338x146 | 7.5 Kg. | --- | FS - 3 |
| SV300iP5A-4 | 30kW | | | | | | | | | |
| SV370iP5A-4 | 37kW | FE-T100-(x) | 100A | 380VAC | 1.3mA 150mA | 425x200x130 | 408x166 | 13.8 Kg. | --- | FS - 3 |
| SV450iP5A-4 | 45kW | FE-T120-(x) | 120A | 380VAC | 1.3mA 150mA | 425x200x130 | 408x166 | 13.8 Kg. | --- | FS - 3 |
| SV550iP5A-4 | 55kW | | | | | | | | | |
| SV750iP5A-4 | 75kW | FE-T170-(x) | 170A | 380VAC | 1.3mA 150mA | 480x200x160 | 468x166 | 16 Kg. | --- | FS - 3 |
| SV900iP5A-4 | 90kW | FE-T230-(x) | 230A | 380VAC | 1.3mA 150mA | 580x250x205 | 560x170 | 22.6 Kg. | --- | FS - 4 |
| SV1100iP5A-4 | 110kW | FE-T400-(x) | 400A | 380VAC | 1.3mA 150mA | 392x260x116 | 240x235 | 10.3 Kg. | --- | FS - 4 |
| SV1320iP5A-4 | 132kW | | | | | | | | | |
| SV1600iP5A-4 | 160kW | FE-T600-(x) | 600A | 380VAC | 1.3mA 150mA | 392x260x116 | 240x235 | 11 Kg. | --- | FS - 4 |
| SV2200iP5A-4 | 220kW | | | | | | | | | |
| SV2800iP5A-4 | 280kW | FE-T1000-(x) | 1000A | 380VAC | 1.3mA 150mA | 460x280x166 | 290x255 | 18 Kg. | --- | FS - 4 |
| SV3150iP5A-4 | 315kW | | | | | | | | | |
| SV3750iP5A-4 | 375kW | | | | | | | | | |
| SV4500iP5A-4 | 450kW | FE-T1600-(x) | 1600A | 380VAC | 1.3mA 150mA | 592x300x166 | 340x275 | 27 Kg. | --- | FS - 4 |

(x)

(1) Industrial environment EN50081-2 (A class) -> EN61000-6-4:02

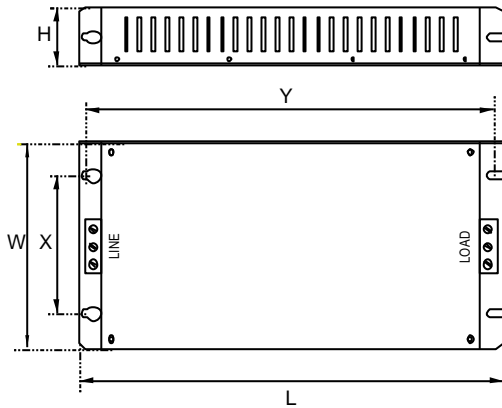
(3) Domestic and industrial environment EN50081-1 (B class) -> EN61000-6-3:02



DIMENSIONS

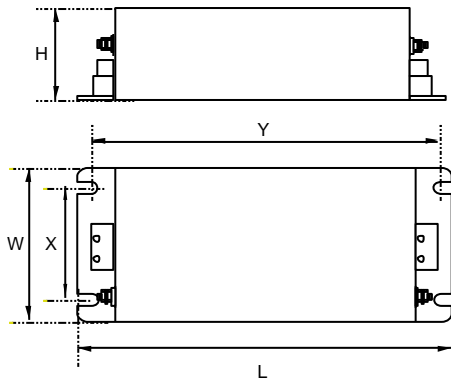
FF SERIES (Footprint)

FFP5-T030-(x) ~ FFP5-T070-(x)

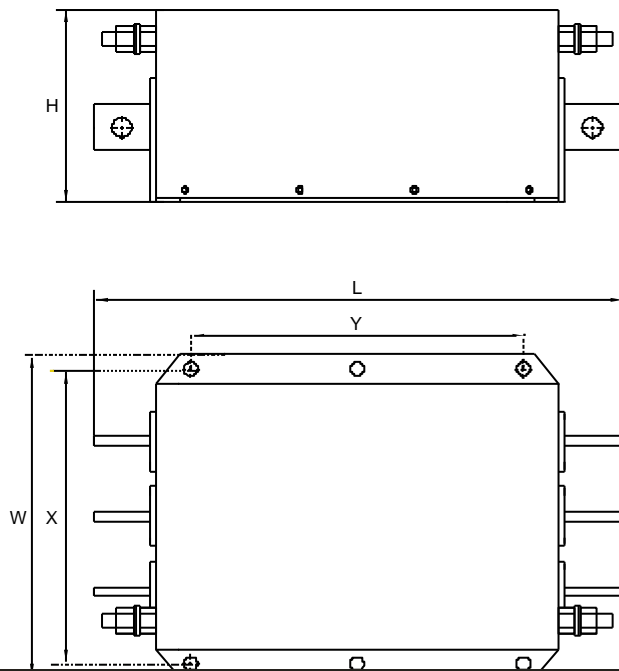


FE SERIES (Standard)

FE-T030-(x) ~ FE-T230-(x)



FE-T400-(x) ~ FE-T1600-(x)



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Warranty

| | | | | |
|-----------------------------------|----------------|--|-------------------------------------|--|
| Maker | LSIS Co., Ltd. | | Installation (Start-up) Date | |
| Model No. | SV-iP5A | | Warranty Period | |
| Customer Information | Name | | | |
| | Address | | | |
| | Tel. | | | |
| Sales Office (Distributor) | Name | | | |
| | Address | | | |
| | Tel. | | | |

Warranty period is 12 months after installation or 18 months after manufactured when the installation date is unidentified. However, the guarantee term may vary on the sales term.

■ IN-WARRANTY service information

If the defective part has been identified under normal and proper use within the guarantee term, contact your local authorized LS distributor or LS Service center.

■ OUT-OF WARRANTY service information

The guarantee will not apply in the following cases, even if the guarantee term has not expired.

Damage was caused by misuse, negligence or accident.

Damage was caused by abnormal voltage and peripheral devices' malfunction (failure).

Damage was caused by improper repair or altering by other than LS authorized distributor or service center.

Damage was caused by an earthquake, fire, flooding, lightning, or other natural calamities.

When LS nameplate is not attached.

When the warranty period has expired.

Revision History

| No. | Date | Edition | Changes |
|-----|----------------|--------------------------|---|
| 1 | October, 2004 | First Release | - |
| 2 | June, 2005 | 2 nd Edition | CI changed |
| 3 | June, 2006 | 3 rd Edition | Revised for new kW(HP) ratings |
| 4 | November, 2006 | 4 th Edition | S/W Version up (V0.4) |
| 5 | December, 2006 | 5 th Edition | Contents added and revised |
| 6 | June, 2008 | 6 th Edition | Contents added and revised |
| 7 | April, 2009 | 7th Edition | New Controller contents added |
| 8 | April, 2011 | 8th Edition | 600V Drive added |
| 9 | Dec, 2014 | 9 th Edition | SW version up 2.3 and error revised |
| 10 | DEC 2015 | 10 th Edition | Single-Phase input application added and DB unit revised |
| | | | |
| 12 | JUL 2016 | 2 | SW version up 2.4 and error revised |
| 13 | JAN,2018 | 3 | Error Revised |
| 14 | MAY 2018 | 4 | SW version up 2.5 and error Revised (600V 132~280kW Capacity added) |