TECO Westinghouse

INVERTER

F510

START-UP AND INSTALLATION MANUAL

230V Class 3~

Open Chassis / NEMA 1	0.75 – 132 kW 1 – 175 HP

460V Class 3~

Open Chassis / NEMA 1	0.75 – 600 kW 1 – 800 HP

- Read all operating instructions before installing, connecting (wiring), operating, servicing, or inspecting the inverter.
- Ensure that this manual is made available to the end user of the inverter.
- Store this manual in a safe, convenient location.
- The manual is subject to change without prior notice.

DOCUMENT - TECO-F510IM
Ver 02: 2019:09

*****STATEMENT*****

Si Desea descaraga el manual en espanol a este Link: www.tecowestinghouse.com

Table of Contents

The complete F510 Instruction Manual can be found at www.tecowestinghouse.com

Preface

The F510 product is an inverter designed to control a three-phase induction motor. Please read this manual carefully to ensure correct operation, safety and to become familiar with the inverter functions.

The F510 inverter is an electrical / electronic product and must be installed and handled by qualified service personnel.

Improper handling may result in incorrect operation, shorter life cycle, or failure of this product as well as the motor.

All F510 documentation is subject to change without notice. Be sure to obtain the latest editions for use or visit our website at www.tecowestinghouse.com

Available Documentation:

1. F510 Start-up and Installation Manual
2. F510 Instruction Manual

Read this instruction manual thoroughly before proceeding with installation, connections (wiring), operation, or maintenance and inspection.

Ensure you have sound knowledge of the inverter and familiarize yourself with all safety information and precautions before proceeding to operate the inverter.

Please pay close attention to the safety precautions indicated by the warning  and caution  symbol.

Warning	Failure to ignore the information indicated by the warning symbol may result in death or serious injury.
Caution	Failure to ignore the information indicated by the caution symbol may result in minor or moderate injury and/or substantial property damage.

Chapter 1 Safety Precautions

1.1 Before Supplying Power to the Inverter

Warning

- The main circuit must be correctly wired. For single phase supply use input terminals (R/L1, T/L3) and for three phase supply use input terminals (R/L1, S/L2, T/L3). Terminals U/T1, V/T2, W/T3 must only be used to connect the motor. Connecting the input supply to any of the U/T1, V/T2 or W/T3 terminals will cause damage to the inverter.

Caution

- To avoid the front cover from disengaging or other physical damage, do not carry the inverter by its cover. Support the unit by its heat sink when transporting. Improper handling can damage the inverter or injure personnel, and should be avoided.
- To avoid the risk of fire, do not install the inverter on or near flammable objects. Install on nonflammable objects such as metal surfaces.
- If several inverters are placed inside the same control panel, provide adequate ventilation to maintain the temperature below 40℃/104℉ (50℃/122℉ without a dust cover) to avoid overheating or fire.
- When removing or installing the digital operator, turn off the power first, and then follow the instructions in this manual to avoid operator error or loss of display caused by faulty connections.

Warning

- This product is sold subject to IEC 61800-3. In a domestic environment this product may cause radio interference in which case the user may need to apply corrective measures.
- Over temperature protection function on motor is provided, please follow the description of control circuit terminals, and refer to the parameter group 08.

1.2 Wiring

Warning

- Always turn OFF the power supply before attempting inverter installation and wiring of the user terminals.
- Always turn OFF the power supply before attempting inverter installation and wiring of the user terminals.
- Wiring must be performed by a qualified personnel / certified electrician.
- Make sure the inverter is properly grounded. (200V Class: Grounding impedance shall be less than 100Ω. 400V Class: Grounding impedance shall be less than 10Ω.) It is required to disconnect the ground wire in the control board to avoid the sudden surge causing damage on electronic parts if it is improperly grounded.
- Please check and test emergency stop circuits after wiring. (Installer is responsible for the correct wiring.)
- Never touch any of the input or output power lines directly or allow any input or output power lines to come in contact with the inverter case.
- Do not perform a dielectric voltage withstand test (megger) on the inverter or this will result in inverter damage to the semiconductor components.

Caution

- The line voltage applied must comply with the inverter's specified input voltage.
- Connect braking resistor and braking unit to the designated terminals.
- Do not connect a braking resistor directly to the DC terminals P(+) and N(-),otherwise fire may result.
- Use wire gauge recommendations and torque specifications.
- Never connect input power to the inverter output terminals U/T1, V/T2, W/T3.
- Do not connect a contactor or switch in series with the inverter and the motor.
- Do not connect a power factor correction capacitor or surge suppressor to the inverter output.
- Ensure the interference generated by the inverter and motor does not affect peripheral devices.

1.3 Before Operation

Warning

- Make sure the inverter capacity matches the parameters 13-00 before supplying power.
- Reduce the carrier frequency (parameter 11-01) If the cable from the inverter to the motor is over 80 ft (25m). A high-frequency current can be generated by stray capacitance between the cables and result in an overcurrent trip of the inverter, an increase in leakage current, or an inaccurate current readout.
- Be sure to install all covers before turning on power. Do not remove any of the covers while power to the inverter is on, otherwise electric shock may occur.
- Do not operate switches with wet hands, otherwise electric shock may result.
- Do not touch inverter terminals when energized even if inverter has stopped, otherwise electric shock may result.

1.4 Parameter Setting

Caution

- Do not connect a load to the motor while performing an auto-tune.
- Make sure the motor can freely run and there is sufficient space around the motor when performing a rotational auto-tune.

1.5 Operation

Warning

- Be sure to install all covers before turning on power. Do not remove any of the covers while power to the inverter is on, otherwise electric shock may occur.
- Do not connect or disconnect the motor during operation. This will cause the inverter to trip and may cause damage to the inverter.
- Operations may start suddenly if an alarm or fault is reset with a run command active. Confirm that no run command is active upon resetting the alarm or fault, otherwise accidents may occur.
- Do not operate switches with wet hands, otherwise electric shock may result.
- An external emergency stop switch is enabled when parameter 08-30 is set for the run permissive function.
- It provides an independent external hardware emergency switch, which emergently shuts down the inverter output in the case of danger.

- If automatic restart after power recovery (parameter 07-00) is enabled, the inverter will start automatically after power is restored.
- Make sure it is safe to operate the inverter and motor before performing a rotational auto-tune.
- Do not touch inverter terminals when energized even if inverter has stopped, otherwise electric shock may result.
- Do not check signals on circuit boards while the inverter is running.
- After the power is turned off, the cooling fan may continue to run for some time.

Caution

- Do not touch heat-generating components such as heat sinks and braking resistors.
- Carefully check the performance of motor or machine before operating at high speed, otherwise Injury may result.
- Note the parameter settings related to the braking unit when applicable.
- Do not use the inverter braking function for mechanical holding, otherwise injury may result.
- Do not check signals on circuit boards while the inverter is running.

1.6 Maintenance, Inspection and Replacement

Warning

- Wait a minimum of 5 minutes after power has been turned OFF before starting an inspection. Also confirm that the charge light is OFF and that the DC bus voltage has dropped below 25Vdc. Wait a minimum of 15 minutes while inverter is over 20HP.
- Never touch high voltage terminals in the inverter.
- Make sure power to the inverter is disconnected before disassembling the inverter.
- Only authorized personnel should perform maintenance, inspection, and replacement operations. (Take off metal jewelry such as watches and rings and use insulated tools.)

Caution

- The Inverter can be used in an environment with a temperature range from 14°-104℉ (-10-40℃) and relative humidity of 95% non-condensing.
- The inverter must be operated in a dust, gas, mist and moisture free environment.

1.7 Disposal of the Inverter

Caution

- Please dispose of this unit with care as an industrial waste and according to your required local regulations.
- The capacitors of inverter main circuit and printed circuit board are considered as hazardous waste and must not be burned.
- The Plastic enclosure and parts of the inverter such as the top cover board will release harmful gases if burned.

Equipment containing electrical components may not be disposed of together with domestic waste. It must be separately collected with electrical and electronic waste according to local and currently valid legislation.

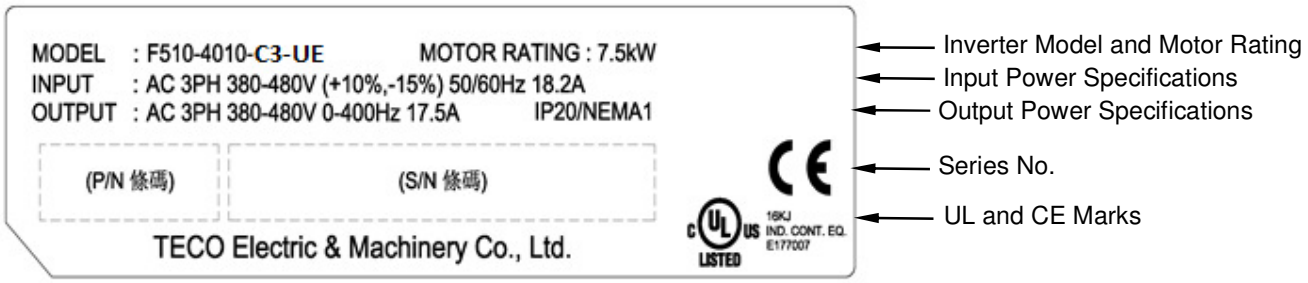
Chapter 2 Model Description

2.1 Nameplate Data

It is essential to verify the F510 inverter nameplate and make sure that the F510 inverter has the correct rating so it can be used in your application with the proper sized AC motor.

Unpack the F510 inverter and check the following:

(1) The F510 inverter and quick setting guide are contained in the package.
(2) The F510 inverter has not been damaged during transportation there should be no dents or parts missing.
(3) The F510 inverter is the type you ordered. You can check the type and specifications on the main nameplate.
(4) Check that the input voltage range meets the input power requirements.
(5) Ensure that the motor HP matches the motor rating of the inverter.



2.2 Model Identification

F510 - 4 010 – C 3 - U E

F510 Inverter Series

Voltage Rating
2: 200V
4: 400V

Motor Rating
001: 1HP
002: 2HP
003: 3HP
005: 5HP
008：8HP
150: 150HP
175: 175HP
215: 215HP
535：535HP
800：800HP

Operator Type
H: Standard Type (LED Keypad)
C: Standard Type (LCD Keypad)
E: Enhanced Type (LED Keypad)
C: Enhanced Type (LCD Keypad)

Input
Blank: 1Ph/3Ph
3: 3Ph

Enhanced Type

Inverter Models – Motor Power Rating：

230V Class

Voltage	A510 Model	Applied Motor (HP)	Applied Motor (KW)	Filter	
				with	without
1ph/3ph, 200~240V +10%/-15% 50/60Hz	**F510-2001-C-UE**	1	0.75		◎
	F510-2002-C-UE	2	1.5		◎
	F510-2003-C-UE	3	2.2		◎
3ph, 200~240V +10%/-15% 50/60Hz	**F510-2005-C3-UE**	5	3.7		◎
	F510-2008-C3-UE	7.5	5.5		◎
	F510-2010-C3-UE	10	7.5		◎
	F510-2015-C3-UE	15	11		◎
	F510-2020-C3-UE	20	15		◎
	F510-2025-C3-UE	25	18.5		◎
	F510-2030-C3-UE	30	22		◎
	F510-2040-C3-UE	40	30		◎
	F510-2050-C3-UE	50	37		◎
	F510-2060-C3-UE	60	45		◎
	F510-2075-C3-UE	75	55		◎
	F510-2100-C3-UE	100	75		◎
	F510-2125-C3-UE	125	94		◎
	F510-2150-C3-UE	150	112		◎

460V Class

Voltage (Vac) & Frequency (Hz)	F510 Model	Motor Power (Hp)	Applied Motor (kW)	Filter	
				with	without
3ph 380~480V +10%/-15% 50/60Hz	F510-4001-C3-UE	1	0.75		◎
	F510-4002-C3-UE	2	1.5		◎
	F510-4003-C3-UE	3	2.2		◎
	F510-4005-C3-UE	5	3.7		◎
	F510-4008-C3-UE	7.5	5.5		◎
	F510-4010-C3-UE	10	7.5		◎
	F510-4015-C3-UE	15	11		◎
	F510-4020-C3-UE	20	15		◎
	F510-4025-C3-UE	25	18.5		◎
	F510-4030-C3-UE	30	22		◎
	F510-4040-C3-UE	40	30		◎
	F510-4050-C3-UE	50	37		◎
	F510-4060-C3-UE	60	45		◎
	F510-4075-C3-UE	75	55		◎
	F510-4100-C3-UE	100	75		◎
	F510-4125-C3-UE	125	94		◎
	F510-4150-C3-UE	150	112		◎
	F510-4175-C3-UE	175	130		◎
	F510-4215-C3-UE	215	160		◎
	F510-4250-C3-UE	250	185		◎
	F510-4300-C3-UE	300	220		◎
	F510-4375-C3-UE	375	280		◎
	F510-4425-C3-UE	425	317		◎
	F510-4535-C3-UE	535	400		◎
	F510-4670-C3-UE	670	500		◎
	F510-4800-C3-UE	800	600		◎

Chapter 3 Environment and Installation

3.1 Environment

The environment will directly affect the proper operation and the life span of the inverter. To ensure that the inverter will give maximum service life, please comply with the following environmental conditions:

Protection	
Protection Class	IP20/ IP21/ NEMA 1, IP00
	IP55/ NEMA 12
Ambient Environment	
Operating Temperature	IP20/IP21/IP55: -10℃ - +40℃ (14 -104 ℉) IP00 (Without Cover): -10℃ - +50℃ (14-122 ℉) Enhanced type frame 5 is 50℃ without de-rating. The maximum operating temperature is **60℃,** but it is required to derate 2% of current at each additional 1℃. If several inverters are placed in the same control panel, provide a heat removal means to maintain ambient temperatures
Storage Temperature	-20℃ - +70℃ (-4 -158 ℉)
Humidity	95% non-condensing Relative humidity 5% to 95%, free of moisture. (Follow IEC60068-2-78 standard)
Altitude	Altitude: Below 1000 m (3281 ft.) It is required to derate 1% of current at each additional 100 m. The maximum altitude is **3000 m**.
Installation Site	Avoid direct sunlight.
	Avoid exposure to rain or moisture.
	Avoid oil mist and salinity.
	Avoid corrosive liquid and gas.
	Avoid dust, lint fibers, and small metal filings.
	Avoid electromagnetic interference (soldering machines, power machines).
	Keep away from radioactive and flammable materials.
	Avoid vibration (stamping, punching machines etc.). Add a vibration-proof pad if the situation cannot be avoided.
Shock	Maximum acceleration: 1.2G (12m/s²), from 49.84 to 150 Hz Displacement amplitude : 0.3mm (peak value), from 10 to 49.84 Hz (Follow IEC60068-2-6 standard)

3.2 Installation

3.2.1 Installation Spaces

- When installing the inverter, ensure that inverter is installed in upright position (vertical direction) and there is adequate space around the unit to allow normal heat dissipation as per the following Fig. 3.2.1

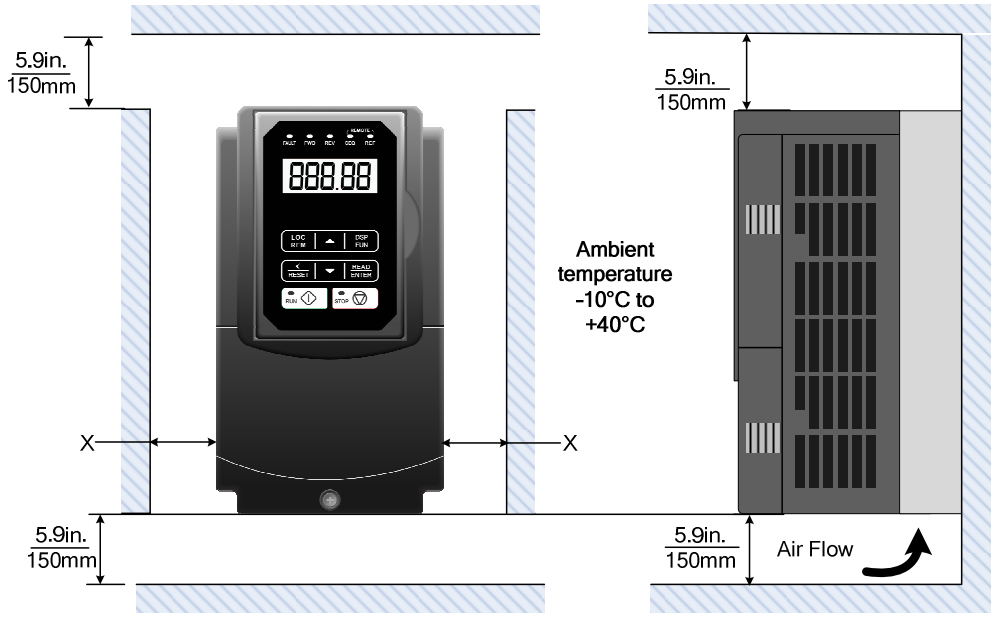


Fig 3.2.1: F510 Installation space

X = 1.18" (30mm) for inverter ratings up to 18.5kW

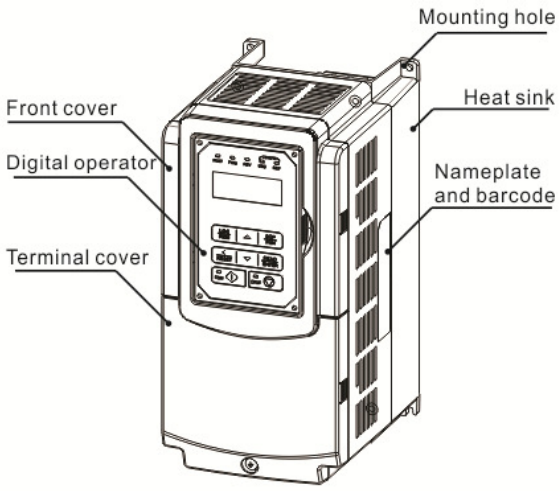
X = 1.96" (50mm) for inverter ratings 22kW or higher

- **Important Note:** The inverter heatsink temperature can reach up to 90℃/ 194℉ during operation; make sure to use insulation material rated for this temperature.

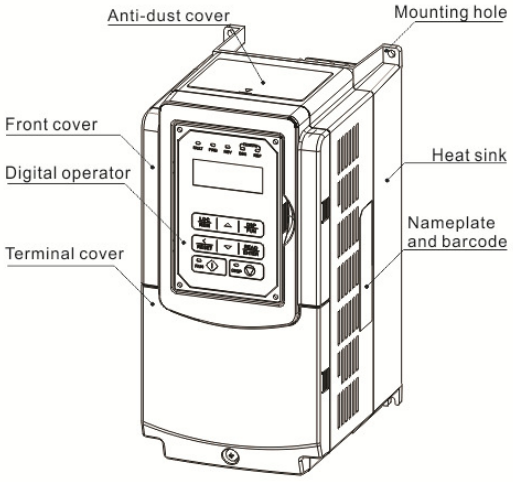
3.2.2 External View

3.2.2.1 External View (IP00/ IP20)

(a) 200V 1-7.5HP/ 400V 1-10HP

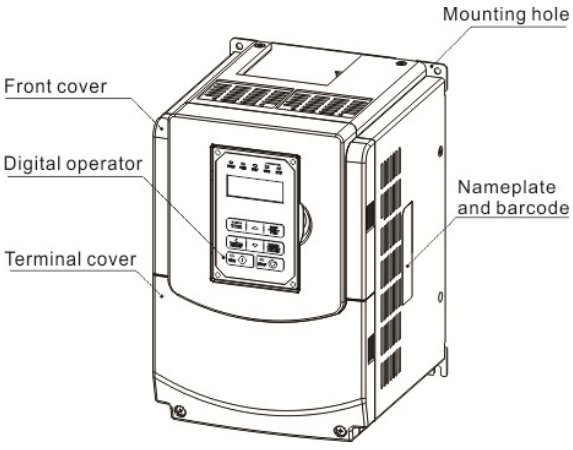


(Wall-mounted type, IEC IP00)

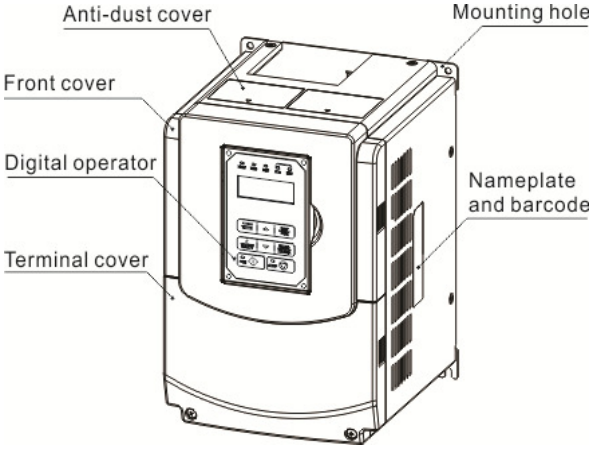


(Wall-mounted type, IEC IP20, NEMA1)

(b) 200V 10-30HP/ 400V 15-40HP

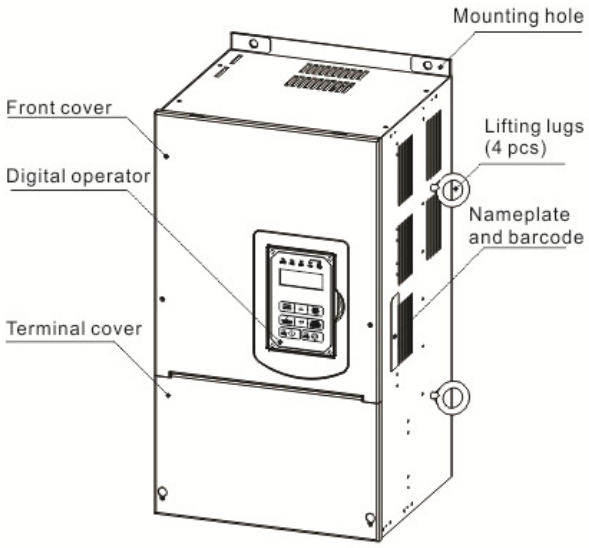


(Wall-mounted type, IEC IP00)



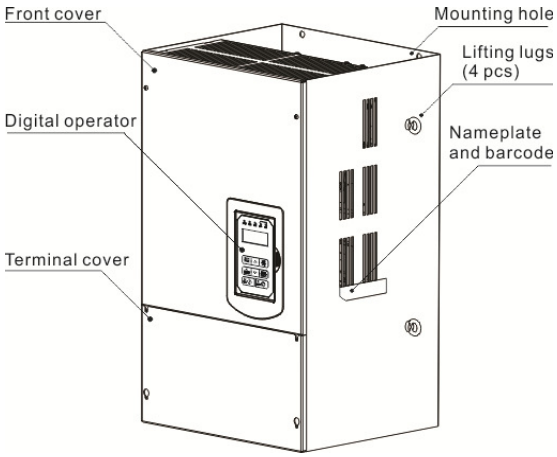
(Wall-mounted type, IEC IP20, NEMA1)

(c) 200V 40-50HP/ 400V 50-75HP

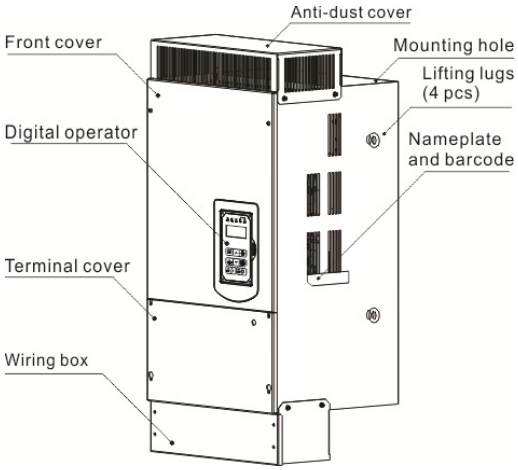


(Wall-mounted type, IEC IP20, NEMA1)

(d) 200V 60-125HP/ 400V 100-250HP

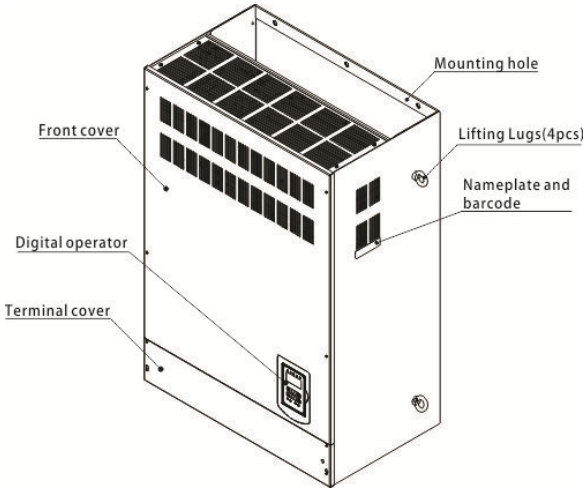


(Wall-mounted type, IEC IP00)

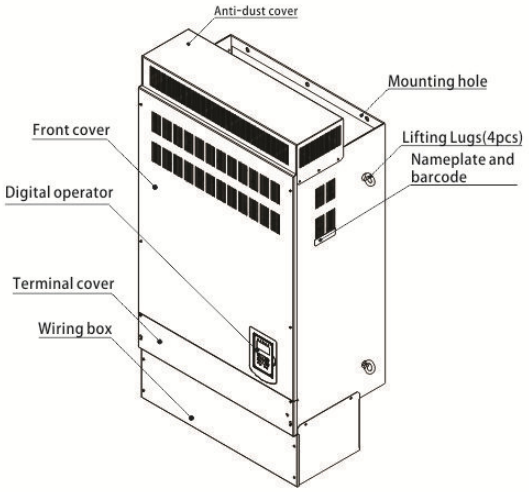


(Wall-mounted type, IEC IP20, NEMA1)

(e) 200V 150-175HP/ 400V 300-425HP

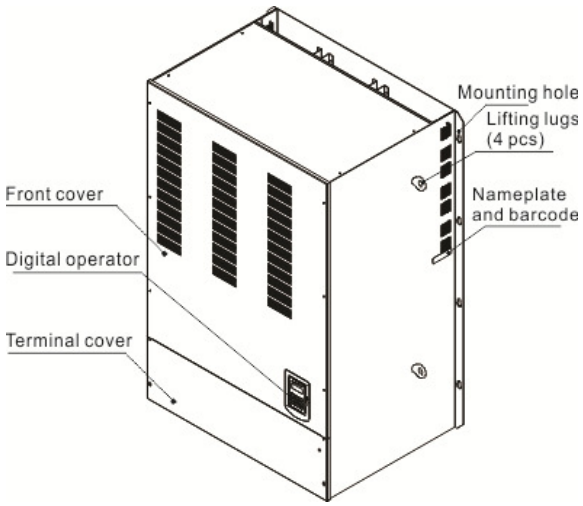


(Wall-mounted type, IEC IP00)

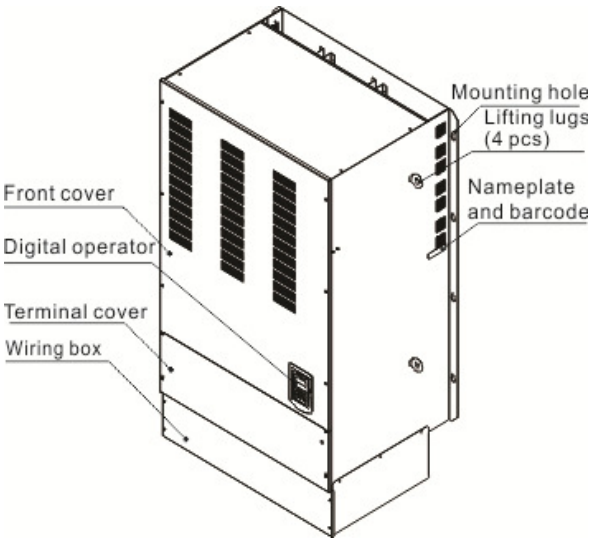


(Wall-mounted type, IEC IP20)

(f) 400V 535-800HP



(Wall-mounted type, IEC IP00)



(Wall-mounted type, IEC IP20)

3.2.3 Warning Labels

Important:

Warning information located on the front cover must be read upon installation of the inverter.

(a) 200V: 1-7.5HP/ 400V: 1-10HP (IP20)

(b) 200V: 10-15HP/ 400V: 15-20HP (IP20)

(c) 200V: 20-175HP/ 400V: 25-800HP(IP20)

3.2.4 Removing the Front Cover and Keypad

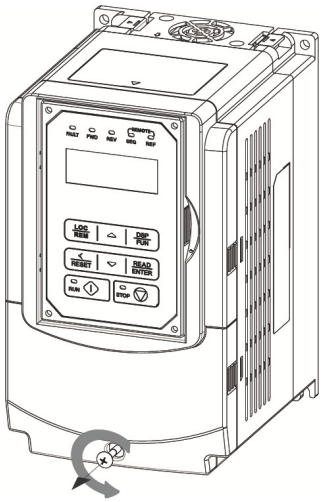
- Before making any wiring connections to the inverter, the front cover needs to be removed.

IP00/ IP20 Type

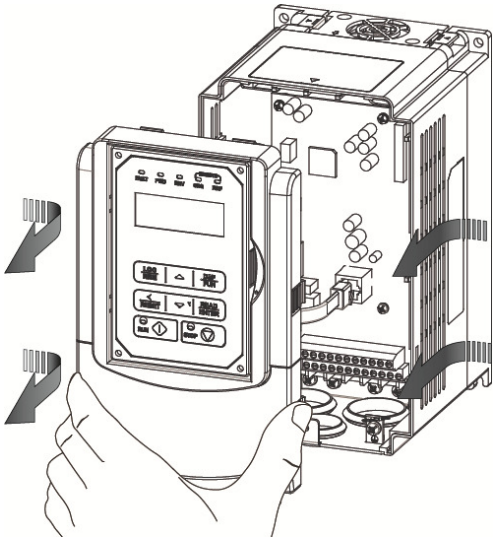
⚠ Caution
• It is not required to remove the digital operator before making any wiring connections. • Models 200V,1– 30 HP and 400V, 1 – 40 HP have a plastic cover. Loosen the screws and remove the cover to gain access to the terminals and make wiring connections. Place the plastic cover back and fasten screws when wiring connections have been made. • Models 200V, 40 - 175HP and 400V, 50 - 800HP have a metal cover. Loosen the screws and remove the cover to gain access to the terminals and make wiring connections. Place the metal cover back and fasten screws when wiring connections have been made.

3.2.4.1 IP00/ IP20 Type

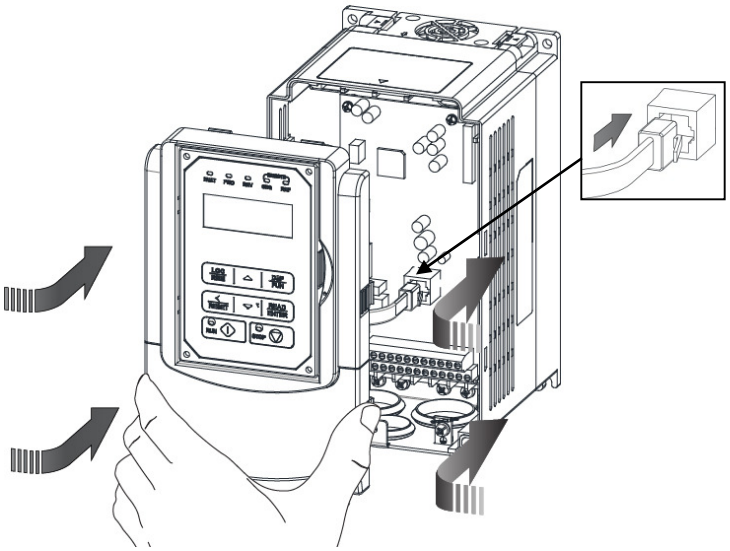
(a) 200V 1-3HP/ 400V 1-3HP



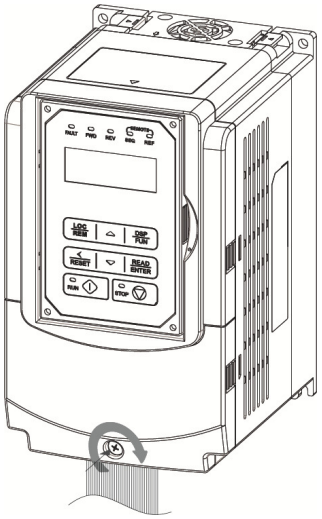
Step 1: Unscrew



Step 2: Remove whole top cover, and unlock RJ45 connector

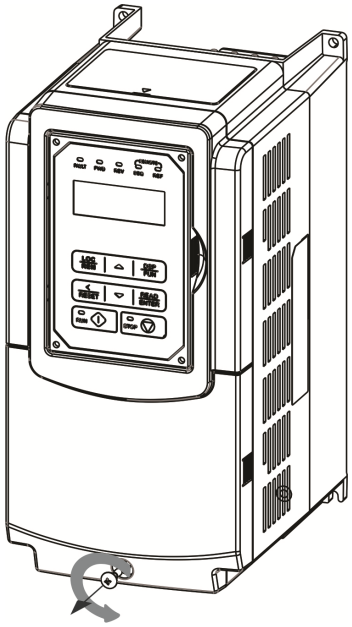


Step 3: Make wire connections, lock RJ45 connector and place top cover back

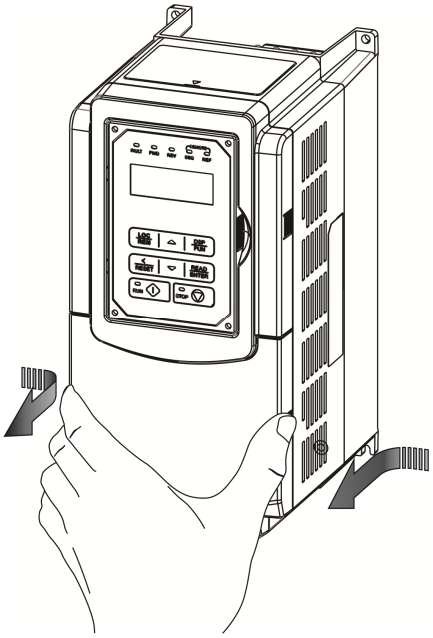


Step 4: Fasten screw

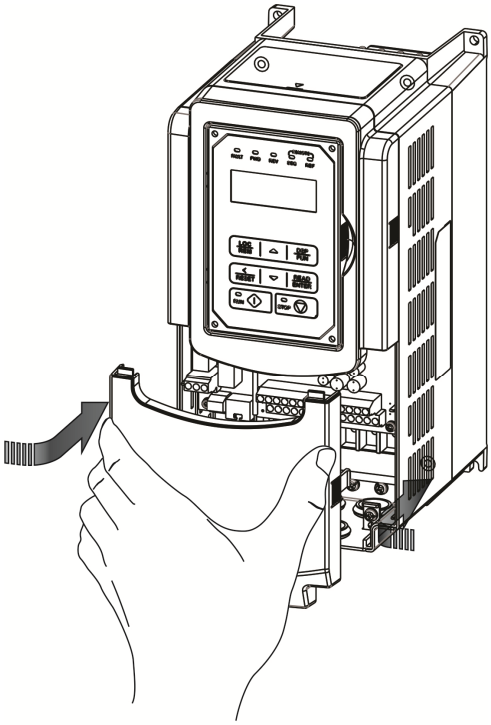
(b) 200V 5-7.5HP(U Type) 5~10HP (UE Type) /400V 5-10HP



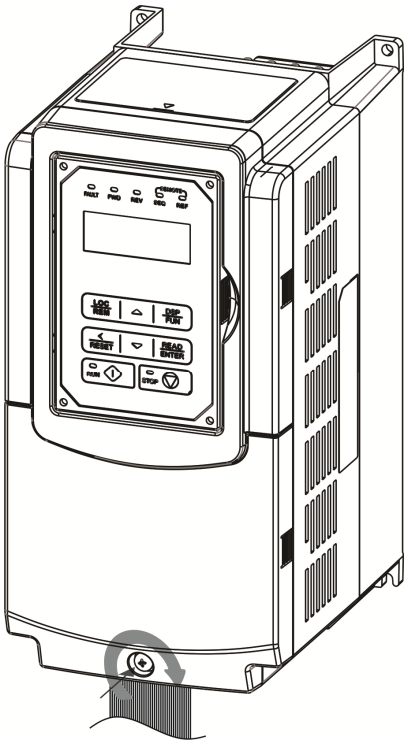
Step 1: Unscrew



Step 2: Remove cover

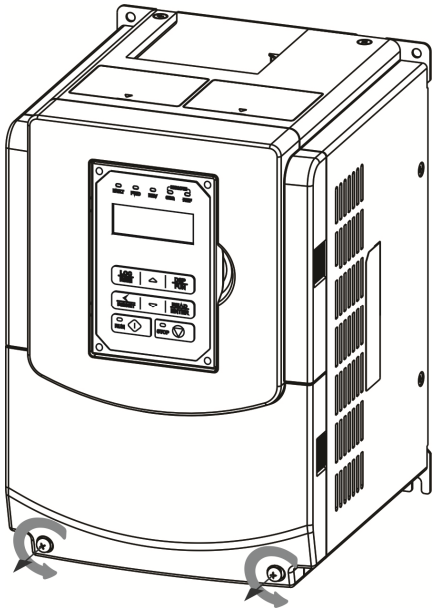


Step 3: Make wire connections and place cover back

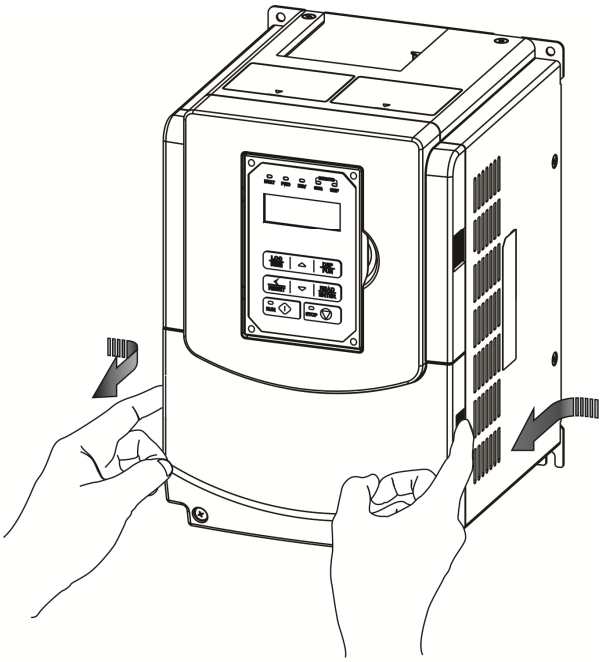


Step 4: Fasten screw

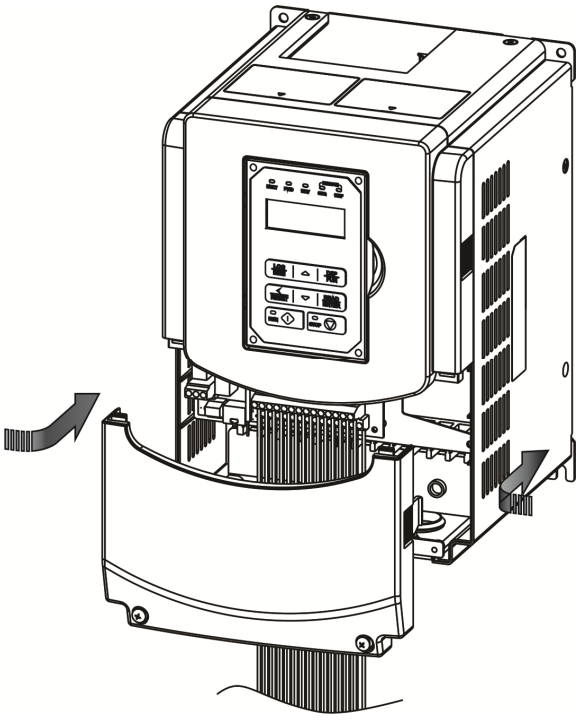
(c) 200V 10-30HP/ 400V 15-40HP



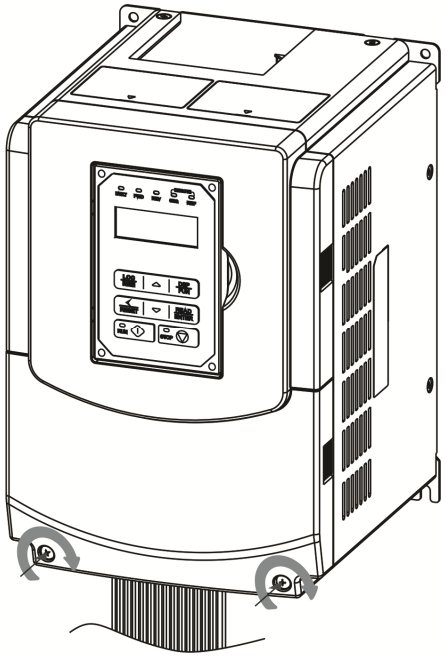
Step 1: Unscrew



Step 2: Remove cover

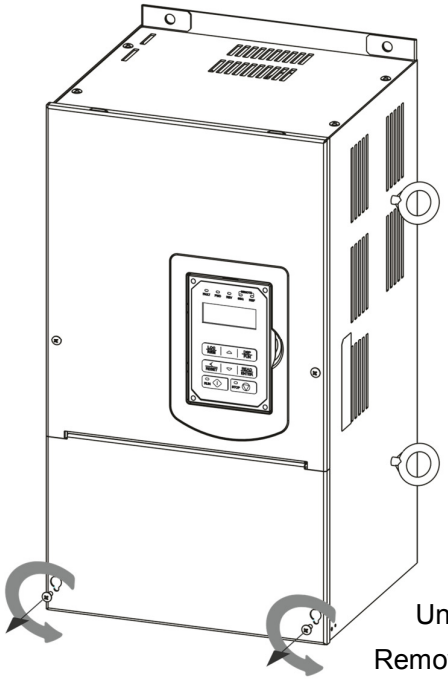


Step 3: Make wire connections and place cover back



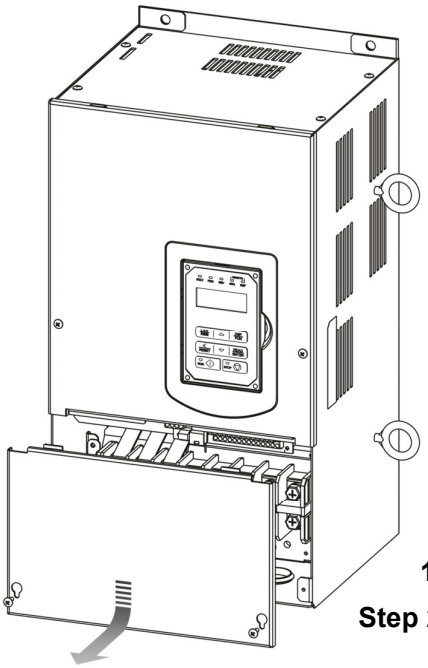
Step 4: Fasten screw

(d) 200V 40-50HP/ 400V 50-75HP (U Type) 50~100HP (UE Type)

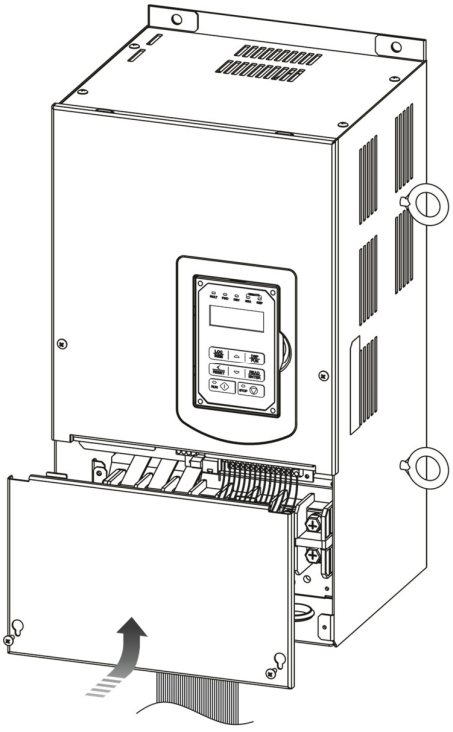


Step 1: Unscrew cover

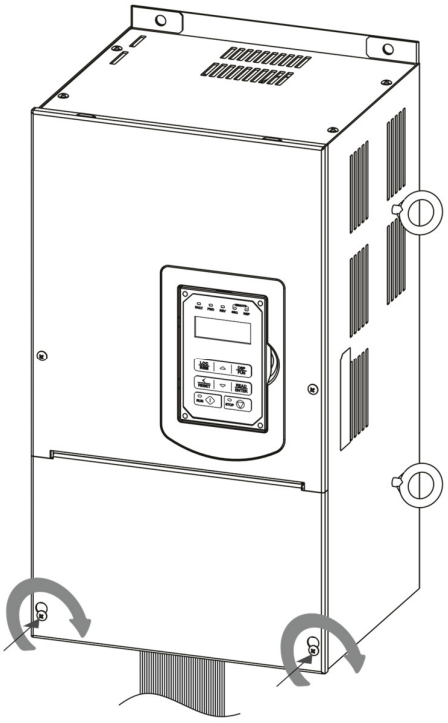
Remove cover



Step 2:

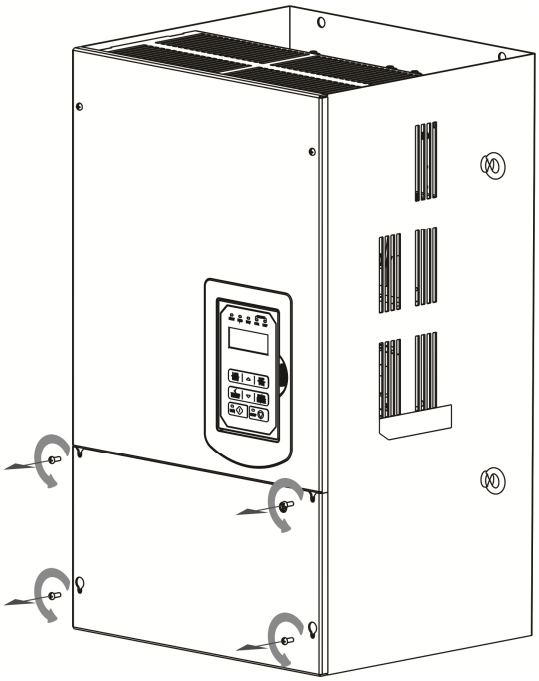


Step 3: Make wire connections and place cover back

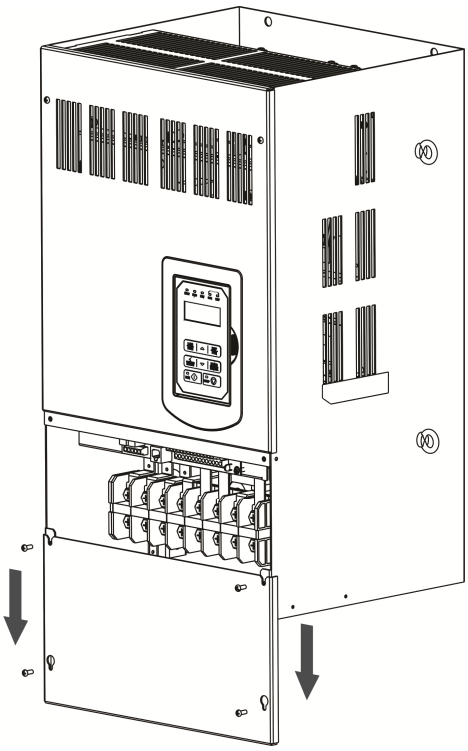


Step 4: Fasten screw

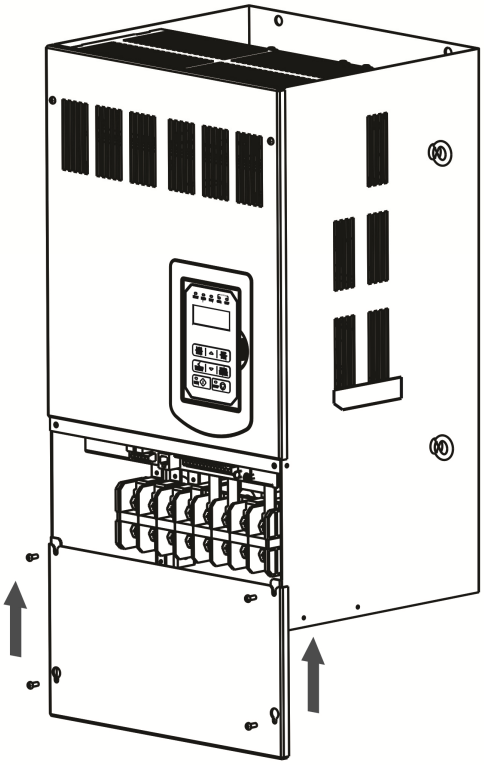
(e) 200V 60-125HP/ 400V 100-250HP



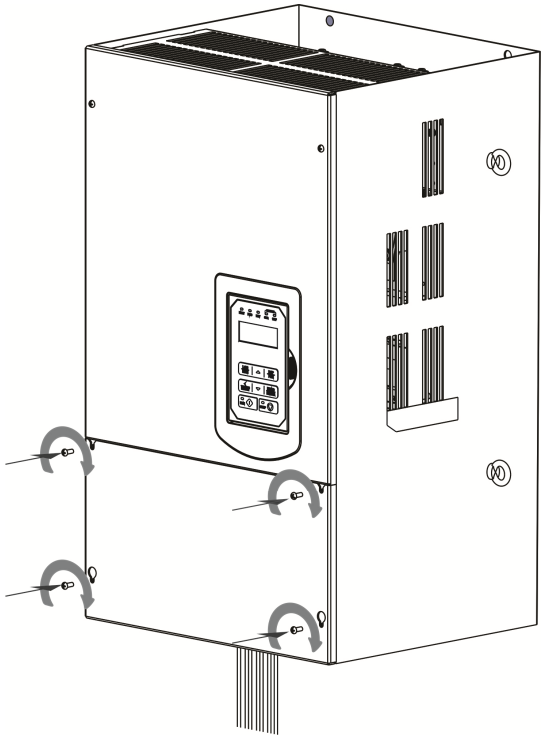
Step 1: Unscrew cover



Step 2: Remove cover

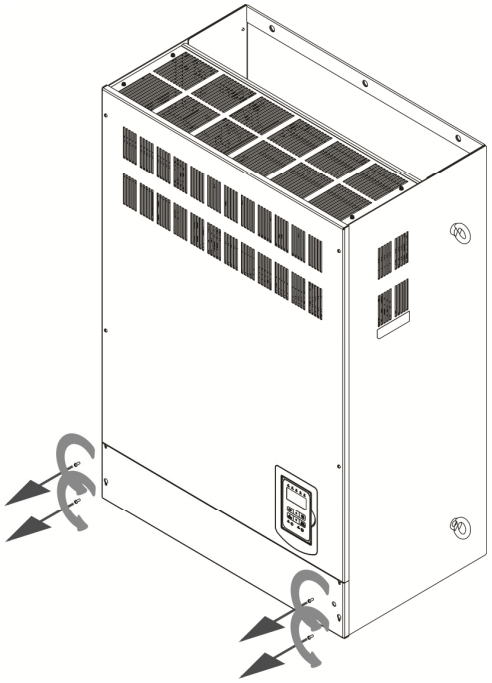


Step 3: Make wire connections and place cover back

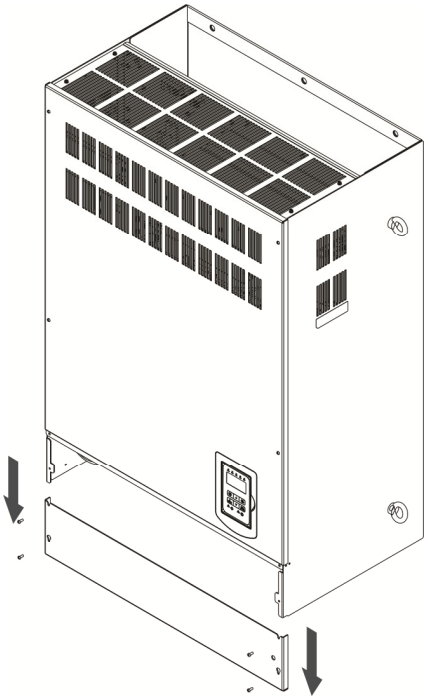


Step 4: Fasten screw

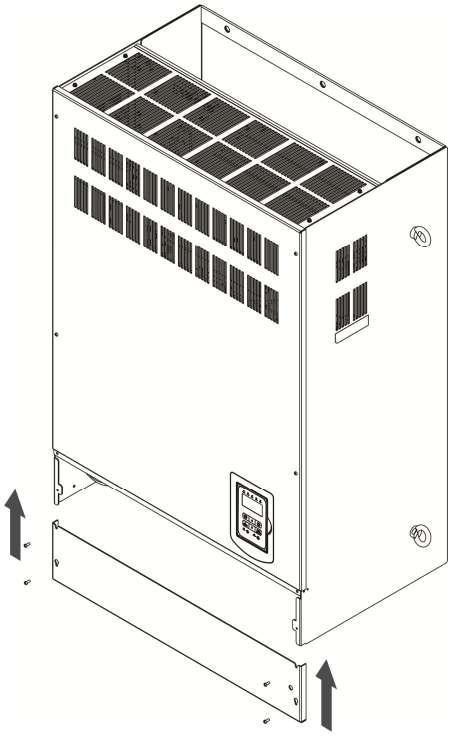
(f) 200V 150-175HP/ 400V 300-425HP



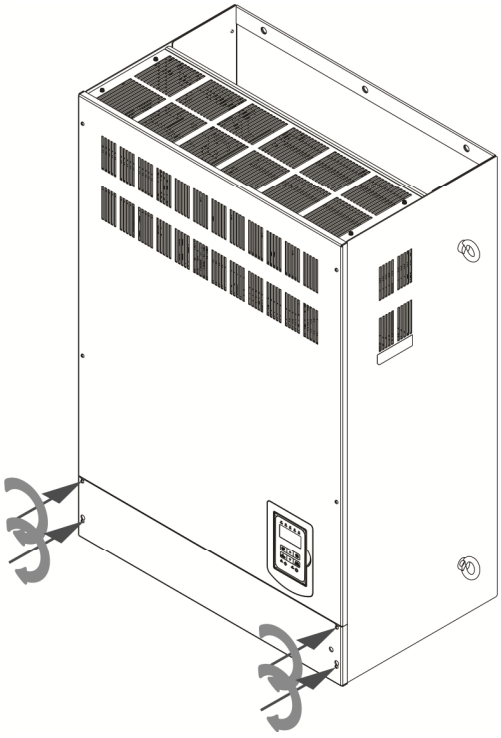
Step 1: Unscrew cover



Step 2: Remove cover

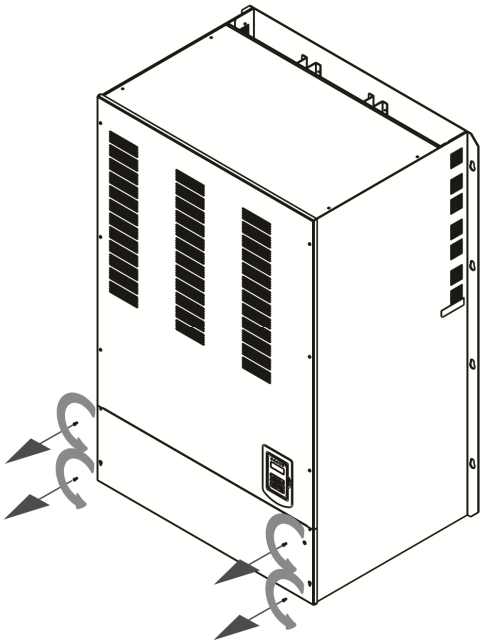


Step 3: Make wire connections and place cover back

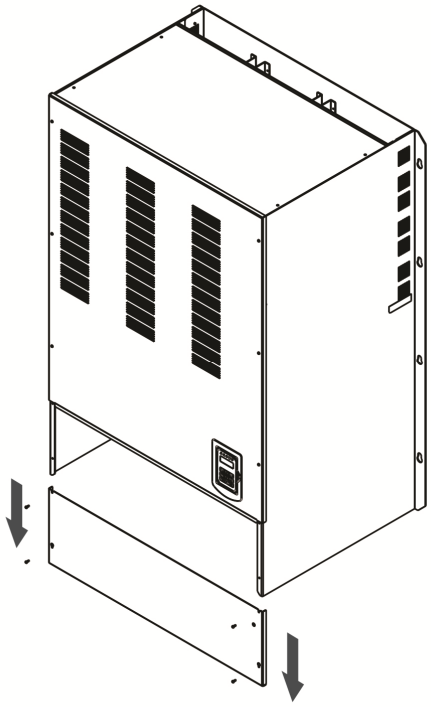


Step 4: Fasten screw

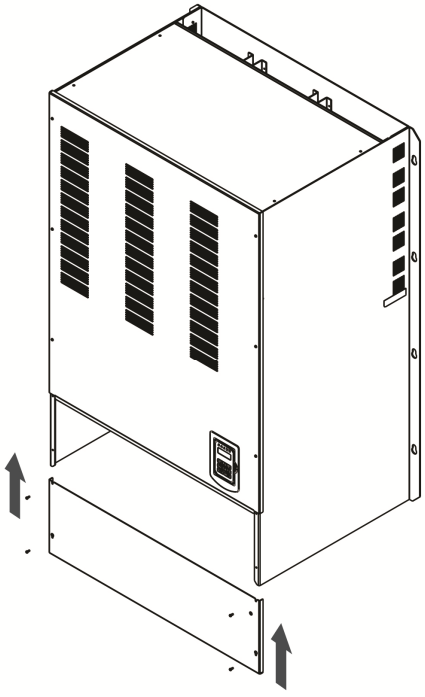
(g) 400V 535-800HP



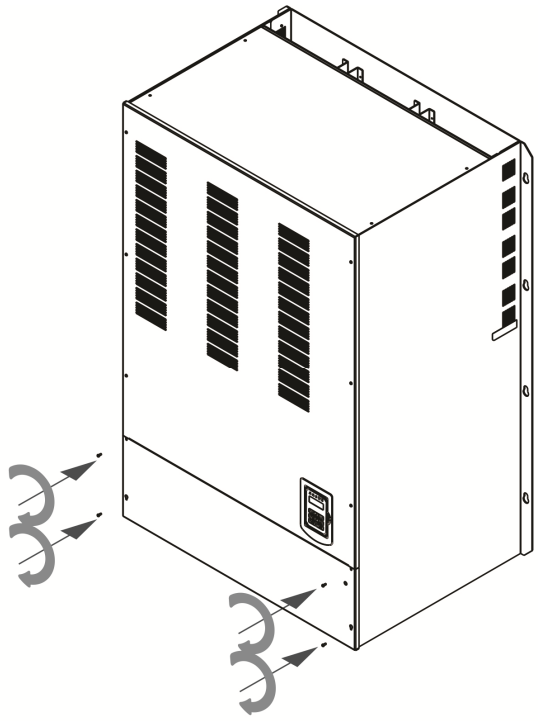
Step 1: Unscrew cover



Step 2: Remove cover



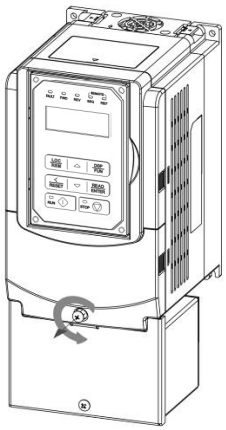
Step 3: Make wire connections and place cover back



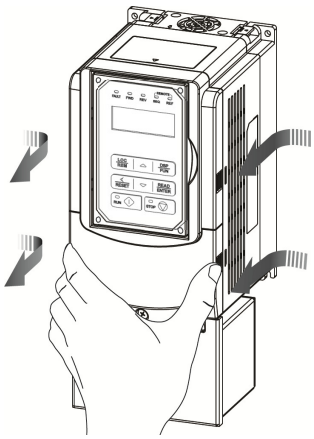
Step 4: Fasten screw

3.2.4.2 Built-in Filter Type (IP20/ IP00)

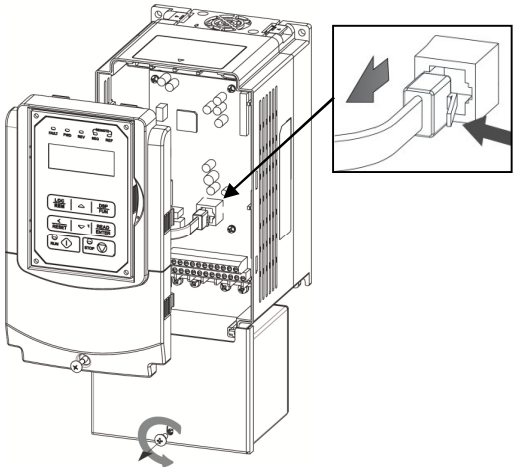
(a) 400V 1-3HP



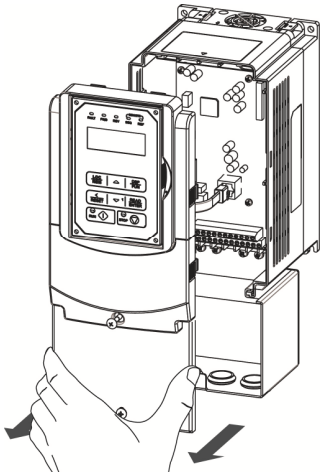
Step 1: Unscrew cover



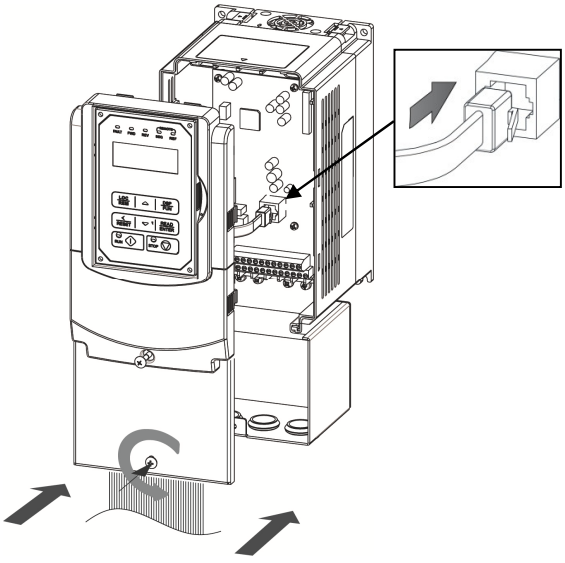
Step 2: Remove whole top cover



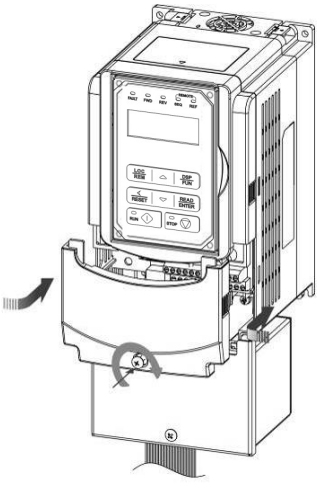
Step 3: Unlock RJ45 connector, Unscrew filter section



Step 4: Remove filter cover

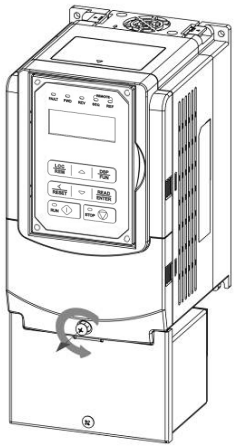


Step 5: Make wire connections, lock RJ45 cover back

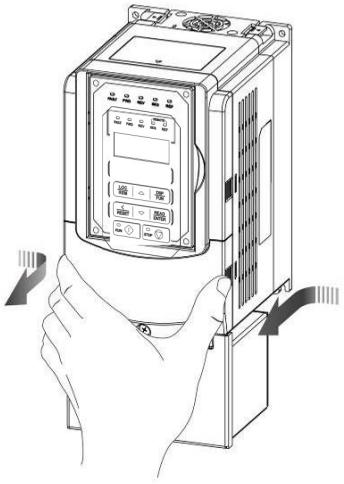


Step 6: Fasten screw connector and place top

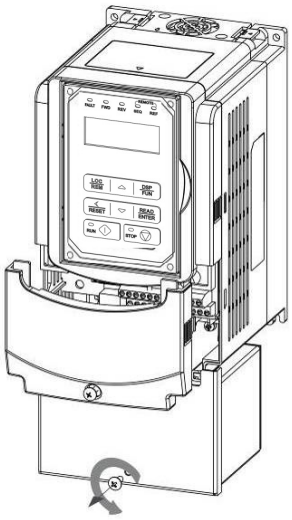
(b) 400V 5-75HP



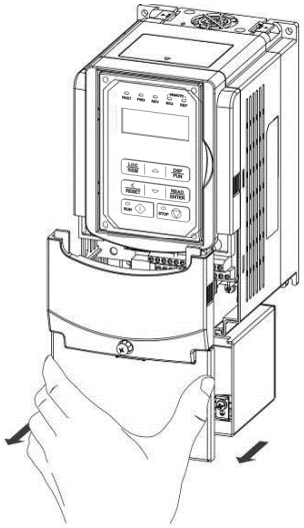
Step 1: Unscrew cover



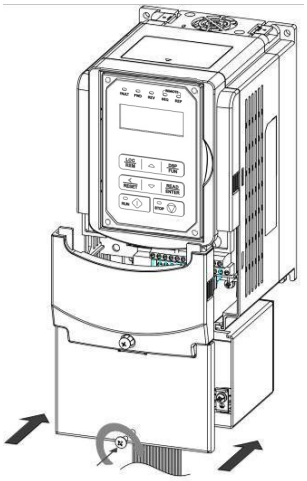
Step 2: Remove cover



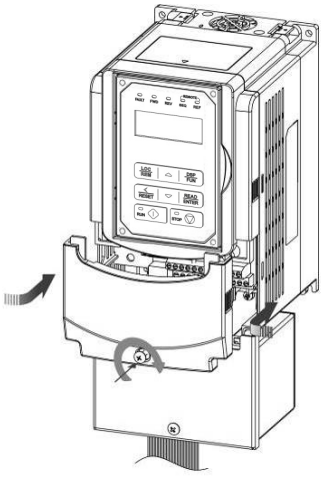
Step 3: Unscrew filter section



Step 4: Remove filter cover



Step 5: Make connections and place filter cover back



Step 6: Fasten screw

*****Filter Type Not Standard in US Market*****

3.3 Inverter Wiring

3.3.1 Wire Gauges and Tightening Torque

To comply with UL standards, use UL approved copper wires (rated 75° C) and round crimp terminals (UL Listed products) as shown in table below when connecting to the main circuit terminals. Teco recommends using crimp terminals manufactured by NICHIFU Terminal Industry Co., Ltd and the terminal crimping tool recommended by the manufacturer for crimping terminals and the insulating sleeve.

Table 3.3.1.1 Wire gauges and tightening torque terminal screw size

Wire size mm^2 (AWG)	Terminal Screw size	Model of round crimp terminal	Tightening torque kgf.cm (in.lbs)	Model of insulating sleeve	Model of crimp tool
0.75 (18)	M3.5	R1.25-3.5	8.2 to 10 (7.1 to 8.7)	TIC 1.25	NH 1
	M4	R1.25-4	12.2 to 14 (10.4 to 12.1)	TIC 1.25	NH 1
1.25 (16)	M3.5	R1.25-3.5	8.2 to 10 (7.1 to 8.7)	TIC 1.25	NH 1
	M4	R1.25-4	12.2 to 14 (10.4 to 12.1)	TIC 1.25	NH 1
2 (14)	M3.5	R2-3.5	8.2 to 10 (7.1 to 8.7)	TIC 2	NH 1 / 9
	M4	R2-4	12.2 to 14 (10.4 to 12.1)	TIC 2	NH 1 / 9
	M5	R2-5	22.1 to 24 (17.7 to 20.8)	TIC 2	NH 1 / 9
	M6	R2-6	25.5 to 30.0 (22.1 to 26.0)	TIC 2	NH 1 / 9
3.5/5.5 (12/10)	M4	R5.5-4	12.2 to 14 (10.4 to 12.1)	TIC 3.5/5.5	NH 1 / 9
	M5	R5.5-5	20.4 to 24 (17.7 to 20.8)	TIC 3.5/5.5	NH 1 / 9
	M6	R5.5-6	25.5 to 30.0 (22.1 to 26.0)	TIC 3.5/5.5	NH 1 / 9
	M8	R5.5-8	61.2 to 66.0 (53.0 to 57.2)	TIC 3.5/5.5	NH 1 / 9
8 (8)	M4	R8-4	12.2 to 14 (10.4 to 12.1)	TIC 8	NOP 60
	M5	R8-5	20.4 to 24 (17.7 to 20.8)	TIC 8	NOP 60
	M6	R8-6	25.5 to 30.0 (22.1 to 26.0)	TIC 8	NOP 60
	M8	R8-8	61.2 to 66.0 (53.0 to 57.2)	TIC 8	NOP 60
14 (6)	M4	R14-4	12.2 to 14 (10.4 to 12.1)	TIC 14	NH 1 / 9
	M5	R14-5	20.4 to 24 (17.7 to 20.8)	TIC 14	NH 1 / 9
	M6	R14-6	25.5 to 30.0 (22.1 to 26.0)	TIC 14	NH 1 / 9
	M8	R14-8	61.2 to 66.0 (53.0 to 57.2)	TIC 14	NH 1 / 9
22 (4)	M6	R22-6	25.5 to 30.0 (22.1 to 26.0)	TIC 22	NOP 60/ 150H
	M8	R22-8	61.2 to 66.0 (53.0 to 57.2)	TIC 22	NOP 60/ 150H
30/38 (3 / 2)	M6	R38-6	25.5 to 30.0 (22.1 to 26.0)	TIC 38	NOP 60/ 150H
	M8	R38-8	61.2 to 66.0 (53.0 to 57.2)	TIC 38	NOP 60/ 150H
50/ 60 (1/ 1/ 0)	M8	R60-8	61.2 to 66.0 (53.0 to 57.2)	TIC 60	NOP 60/ 150H
	M10	R60-10	102 to 120 (88.5 to 104)	TIC 60	NOP 150H
70 (2/0)	M8	R70-8	61.2 to 66.0 (53.0 to 57.2)	TIC 60	NOP 150H
	M10	R70-10	102 to 120 (88.5 to 104)	TIC 60	NOP 150H
80 (3/0)	M10	R80-10	102 to 120 (88.5 to 104)	TIC 80	NOP 150H
	M16	R80-16	255 to 280 (221 to 243)	TIC 80	NOP 150H
100 (4/0)	M10	R100-10	102 to 120 (88.5 to 104)	TIC 100	NOP 150H
	M12	R100-12	143 to 157 (124 to 136)	TIC 100	NOP 150H
	M16	R80-16	255 to 280 (221 to 243)	TIC 80	NOP 150H

3.3.2 Wiring Peripheral Power Devices

Caution

- After power is shut off to the inverter, the capacitors will slowly discharge. Do NOT touch the inverter circuitry or replace any components until the “CHARGE” indicator is off.
- Do NOT wire or connect/disconnect internal connectors of the inverter when the inverter is powered up or when powered off and the “CHARGE”” indicator is on.
- Do NOT connect inverter output U, V and W to the supply power. This will result in damage to the inverter.
- The inverter must be by properly grounded. Use terminal E to connect earth ground and comply with local standards.
- It is required to disconnect the grounded wire in the control board when the inverter is not grounded or floating ground power system.
- Do NOT perform a dielectric voltage withstand test (megger) on the inverter this will result in inverter damage to the semiconductor components.
- Do NOT touch any of the components on the inverter control board to prevent damage to the inverter by static electricity.

Caution

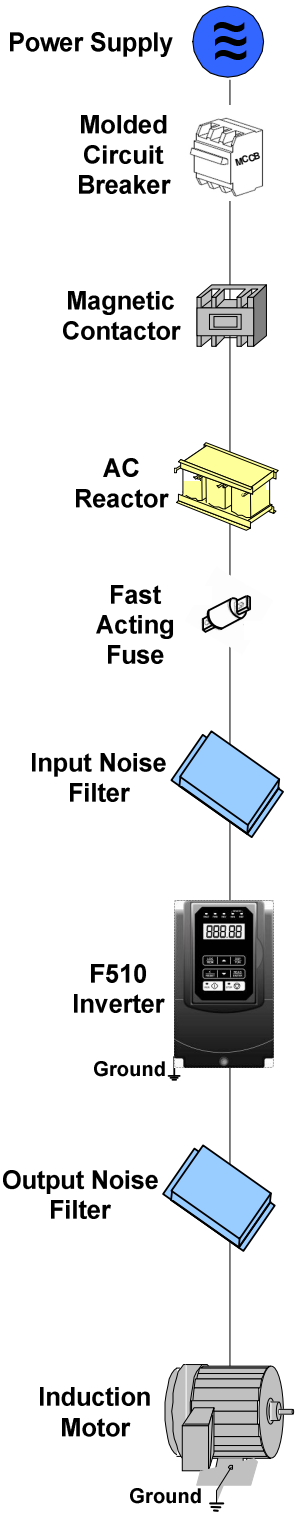
- Refer to the recommended wire size table for the appropriate wire to use. The voltage between the power supply and the input of the inverter may not exceed 2%.

  Phase-to-phase voltage drop (V) = $\sqrt{3}$ ×resistance of wire (Ω/km) × length of line m) × current×10^{-3}.

  (km=3280 x feet) / (m=3.28 x feet)

- Reduce the carrier frequency (parameter 11-01) If the cable from the inverter to the motor is greater than 25m (82ft). A high-frequency current can be generated by stray capacitance between the cables and result in an overcurrent trip of the inverter, an increase in leakage current, or an inaccurate current readout.

- To protect peripheral equipment, install fast acting fuses on the input side of the inverter. Refer to section 11.4 for additional information.



Power supply:

- ⚠ Make sure the correct voltage is applied to avoid damaging the inverter.

Molded-case circuit breaker (MCCB) or fused disconnect:

- A molded-case circuit breaker or fused disconnect must be installed between the AC source and the inverter that conforms to the rated voltage and current of the inverter to control the power and protect the inverter.
- ⚠ Do not use the circuit breaker as the run/stop switch for the inverter.

Ground fault detector / breaker:

- ⚠ Install a ground fault breaker to prevent problems caused by current leakage and to protect personnel. Select current range up to 200mA, and action time up to 0.1 second to prevent high frequency failure.

Magnetic contactor:

- Normal operations do not need a magnetic contactor. When performing functions such as external control and auto restart after power failure, or when using a brake controller, install a magnetic contactor.
- ⚠ Do not use the magnetic contactor as the run/stop switch for the inverter.

AC line reactor for power quality:

- When inverters are supplied by a high capacity power source (> 600KVA), an AC reactor can be connected to improve the power factor.

Install Fast Acting Fuse:

- To protect peripheral equipment, install fast acting fuses in accordance with the specifications in section 11.4 for peripheral devices.

Input Noise filter:

- A filter must be installed when there are inductive loads affecting the inverter. The inverter meets EN55011 Class A, category C3 when the TECO special filter is used. See section 11.3 for peripheral devices.

Inverter:

- Output terminals T1, T2, and T3 are connected to U, V, and W terminals of the motor. If the motor runs in reverse while the inverter is set to run forward, swap any two terminals connections for T1, T2, and T3.
- ⚠ To avoid damaging the inverter, do not connect the output terminals T1, T2, and T3 to AC input power.
- ⚠ Connect the ground terminal properly. (200V series: Rg <100Ω; 400V series: Rg <10Ω.)

Output Noise filter:

- An output noise filter may reduce system interference and induced noise.

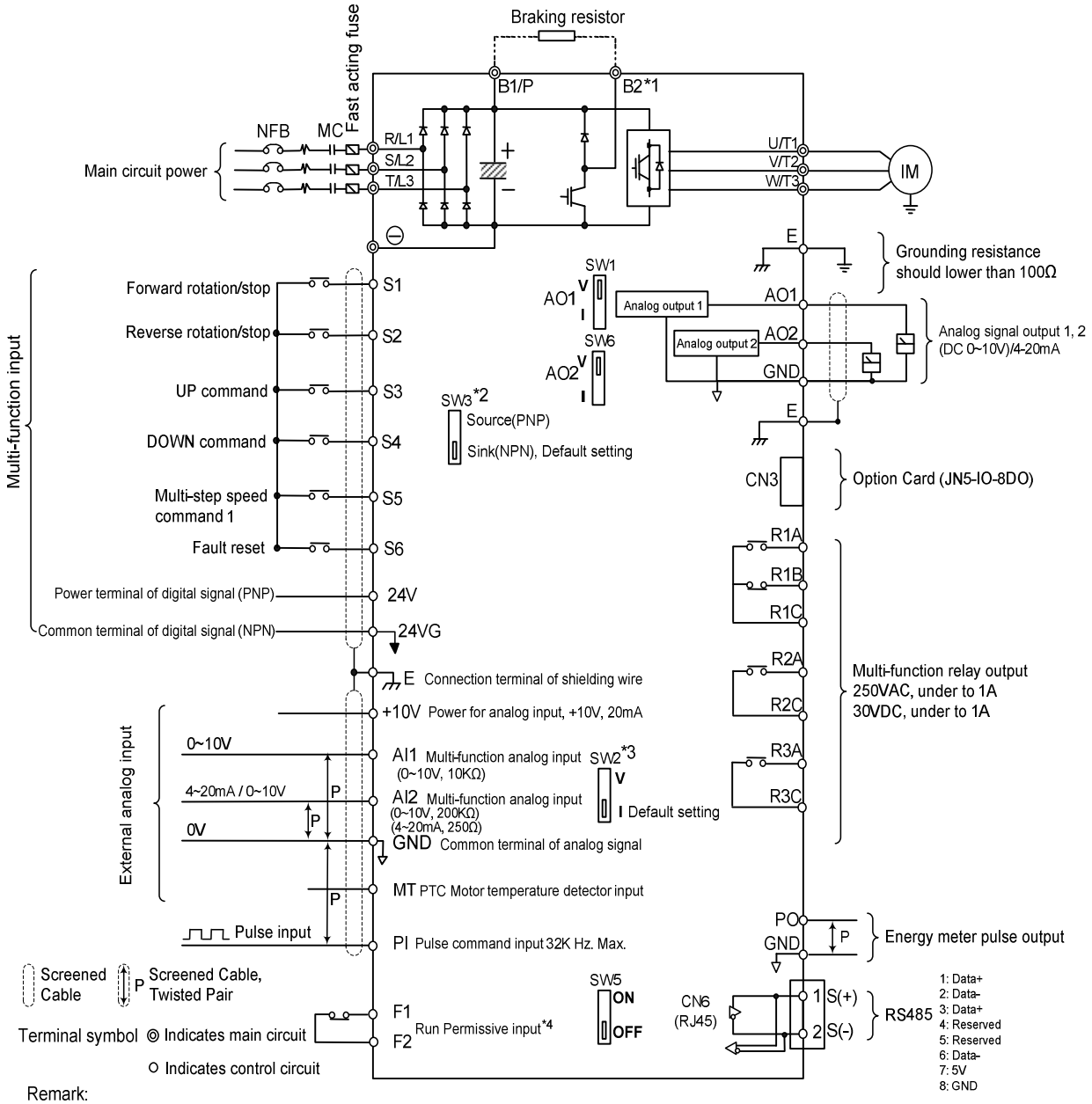
Motor:

- If the inverter drives multiple motors the output rated current of the inverter must be greater than the total current of all the motors.

3.3.3 General Wiring Diagram

3.3.3.1 General Wiring Diagram (For U type)

The following is the standard wiring diagram for the F510 inverter (◎ indicates main circuit terminals and ○ indicates control circuit terminals). Locations and symbols of the wiring terminal block might be different due to different models of F510. The description of control circuit terminals and main circuit terminals can be referred to Table 3.3.4.1, 3.3.5.1 and 3.3.5.2



Remark:

*1: Models IP20 200V 1~30HP, 400V 1~40HP and IP55 400V 1~25HP have a built-in braking transistor so that the braking resistor can be connected between terminal B1 and B2.

*2: The multi-function digital input terminals S1~S6 can be set to Source (PNP) or Sink (NPN) mode via SW3.

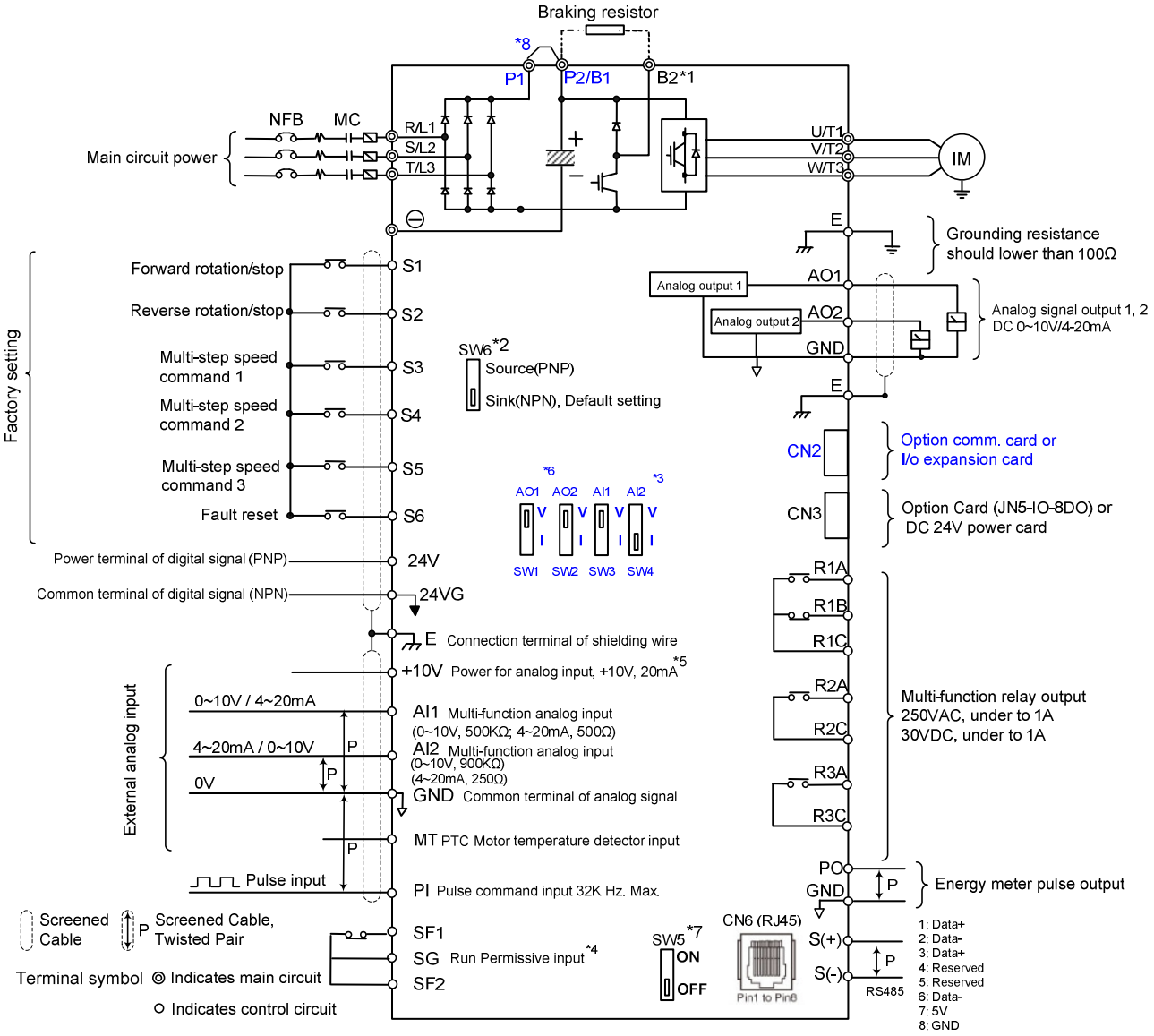
*3: Use SW2 to switch between voltage (0~10V) and current (4~20mA) input for Multi-function analog input 2 (AI2). Besides please also check parameter 04-00 for proper setting.

*4: Run permissive input F1 & F2 is a normally closed input. This input should be closed to enable the inverter output. To activate this input, open the link between F1 and F2.

*5: IP20 1~3HP don't support option card.

3.3.3.2 General Wiring Diagram (For UE type)

The following is the standard wiring diagram for the F510 inverter (◎ indicates main circuit terminals and ○ indicates control circuit terminals). Locations and symbols of the wiring terminal block might be different due to different models of F510. The description of control circuit terminals and main circuit terminals can be referred to Table 3.3.4.1, 3.3.5.1 and 3.3.5.2



Remarks:

*1: Models IP20 200V 1~30HP, 400V 1~40HP have a built-in braking transistor so that the braking resistor can be connected between terminal B1 and B2.

*2: The multi-function digital input terminals S1~S6 can be set to Source (PNP) or Sink (NPN) mode via SW6.

*3: Use SW3/SW4 to switch between voltage (0~10V) and current (4~20mA) input for Multi-function analog input 2 (AI2). Besides please also check parameter 04-00 for proper setting.

*4: Run permissive input SF1 & SF2 is a normally closed input. This input should be closed to enable the inverter output. To activate this input, open the link between SF1/ SF2 and SG.

*5: When using the open collector for pulse input, it doesn't need resistance because of built-in pull-up resistance.

*6: AO1 / AO2 default setting is 0~+10V.

*7: It need turn on the switch for the terminal resistor RS485 in the last inverter when many inverters in parallel connection.

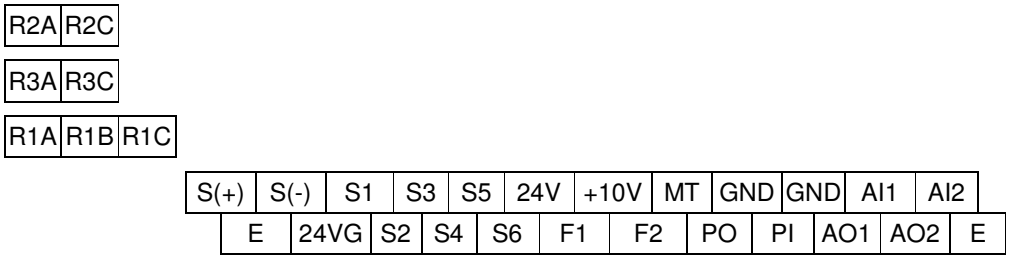
3.3.4 Wiring for Control Circuit Terminals

3.3.4.1 Wiring for Control Circuit Terminals (For U type)

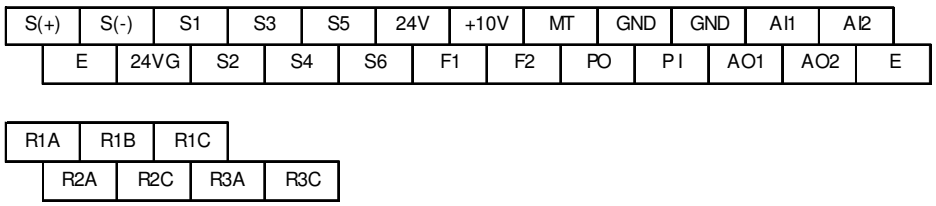
■ **Control circuit terminals identification**

◆ **IP00/IP20 type**

- 200V: 1-3HP，400V: 1-3HP



- 200V: 5HP~50HP，400V: 5HP~75HP



- 200V: 60HP~125HP，400V: 100HP~800HP

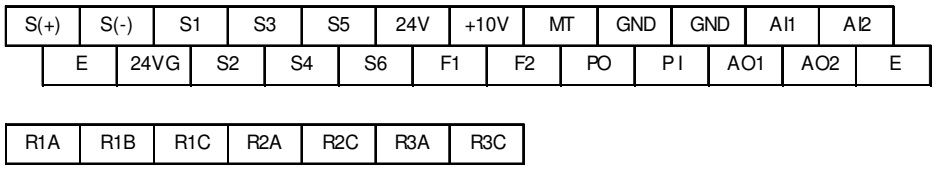


Table 3.3.4.1 Description of control circuit terminals

Type	Terminal	Terminal function	Signal level/ information
Digital input signal	S1	2-wire forward rotation/ stop command (default), multi-function input terminals * 1	Signal Level 24 VDC (opto-isolated) Maximum current: 8mA Maximum voltage: 30 Vdc Input impedance: 4.22kΩ
	S2	2-wire reversal rotation/ stop command (default), multi-function input terminals * 1	
	S3	Multi-speed/ position setting command 1 (default), multi-function input terminals * 1	
	S4	Multi-speed/ position setting command 2 (default), multi-function input terminals * 1	
	S5	Multi-speed/ position setting command 3 (default), multi-function input terminal* 1	
	S6	Fault reset (default), multi-function input terminal * 1	
24V Power supply	24V	Digital signal SOURCE point (SW3 switched to SOURCE)	±15%, Max. output current: 250mA (The sum of all loads connected)
	24VG	Common terminal of Digital signals Common point of digital signal SINK (SW3 switched to SINK)	
Analog input signal	+10V	Power for external speed potentiometer	±5% (Max. current: 20mA)
	MT	Motor temperature detector of externally connecting PTC	Refer to group 08 setting
	AI1	Multi-function analog input for speed reference (0-10V input)	From 0 to +10V Input impedance: 10KΩ Resolution: 12bit
	AI2	Multi-function analog input terminals *2, can use SW2 to switch voltage or current input (0~10V)/(4-20mA)	From 0 to +10V Input impedance: 200KΩ From 4 to 20 mA Input impedance: 250Ω Resolution: 12bit
	GND	Analog signal ground terminal	----
	E	Shielding wire's connecting terminal (Ground)	----
Analog output signal	AO1	Multi-function analog output terminals *3 (0~10V/ 4-20mA output)	From 0 to 10V Max. current: 2mA From 4 to 20 mA
	AO2	Multi-function analog output terminals *3 (0~10V/ 4-20mA output)	
	GND	Analog signals ground terminal	
Pulse output signal	PO	Pulse output, Band width 32KHz	Max. Frequency: 32KHz Open Collector output Load: 2.2 KΩ
	GND	Analog signals ground terminal	----
Pulse input signal	PI	Pulse command input, frequency width of 32KHz	L: from 0.0 to 0.5V H: from 4.0 to 13.2V Max. Frequency: 0 - 32KHz Impedance: 3.89 KΩ
	GND	Analog signals ground terminal	----

Table 3.3.4.1 Description of control circuit terminals (Continued)

Type	Terminal	Terminal function	Signal level/ information
Relay output	R1A- R1B- R1C	Relay A contact (multi-function output terminal) Relay B contact (multi-function output terminal) Relay contact common terminal, please refer to parameter group 03 in this manual for more functional descriptions.	Rating: 250Vac: 10 mA ~ 1A 30Vdc: 10 mA ~ 1A
	R2A-R2C	With the same functions as R1A/R1B/R1C	Rating: 250Vac: 10 mA ~ 1A 30Vdc: 10 mA ~ 1A
	R3A-R3C	With the same functions as R1A/R1B/R1C	
Safety input	F1	On: normal operation. Off: emergency stop. (Jumper wired has to be removed to use external safety function to stop.)	24Vdc, 8mA, pull-high
	F2	Safety command common terminal	24V Ground
RS-485 port	S (+)	RS485/MODBUS	differential input and output
	S (-)		
Grounding	E (G)	Grounding to earth Shield the connecting terminal	----

Notes:

*1: Multi-function digital input can be referred to in this manual.

- Group 03: External Terminals Digital Input / Output Function Group.

*2: Multi-function analog input can be referred to in this manual.

- Group 04 - External Terminal Analog Signal Input (Output) Function Group.

*3: Multi-function analog output can be referred to in this manual.

- Group 04 - External Terminal Analog Signal Input (Output) Function Group.

Caution

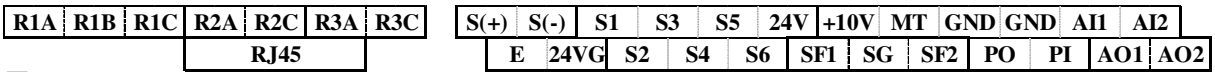
- Maximum output current capacity for terminal 10V is 20mA.
- Multi-function analog output AO1 and AO2 are for use for an analog output meter. Do not use these output for feedback control.
- Control board's 24V and 10V are to be used for internal control only. Do not use the internal power-supply to power external devices.

3.3.4.2 Wiring for Control Circuit Terminals (For UE type)

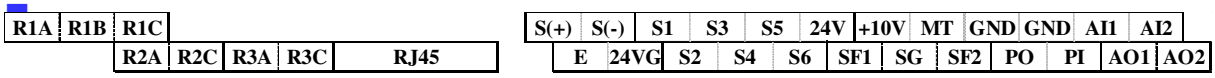
■ Control circuit terminals identification

IP00/IP20 type

- 200V: 1-3HP，400V: 1-3HP



- 200V: 5HP~50HP，400V: 5HP~75HP



- 200V: 60HP~125HP，400V: 125HP~800HP

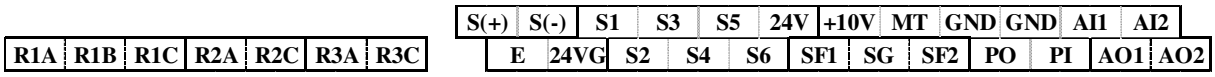


Table 3.3.4.2 Description of control circuit terminals

Type	Terminal	Terminal function	Signal level/ information
Digital input signal	S1	2-wire forward rotation/ stop command (default), multi-function input terminals * 1	Signal Level 24 VDC (opto-isolated) Maximum current: 8mA Maximum voltage: 30 Vdc Input impedance: 4.22kΩ
	S2	2-wire reversal rotation/ stop command (default), multi-function input terminals * 1	
	S3	Multi-speed/ position setting command 1 (default), multi-function input terminals * 1	
	S4	Multi-speed/ position setting command 2 (default), multi-function input terminals * 1	
	S5	Multi-speed/ position setting command 3 (default), multi-function input terminal* 1	
	S6	Fault reset (default), multi-function input terminal * 1	
24V Power supply	24V	Digital signal SOURCE point (SW6 switched to SOURCE)	±15%, Max. output current: 250mA (The sum of all loads connected)
	24VG	Common terminal of Digital signals Common point of digital signal SINK (SW6 switched to SINK)	
Analog input signal	+10V	Power for external speed potentiometer	±5% (Max. current: 20mA)
	MT	Motor temperature detector of externally connecting PTC	Refer to group 08 setting
	AI1	Multi-function analog input for speed reference, use SW3 to switch voltage and current input (0~10V) / (4-20mA)	From 0 to +10V Input impedance: 500KΩ From 4 to 20 mA Input impedance: 500KΩ Resolution: 12bit
	AI2	Multi-function analog input terminals *2, can use SW4 to switch voltage or current input (0~10V)/(4-20mA)	From 0 to +10V Input impedance: 900KΩ From 4 to 20 mA Input impedance: 250Ω Resolution: 12bit
	GND	Analog signal ground terminal	----
	E	Shielding wire's connecting terminal (Ground)	----
Analog output signal	AO1	Multi-function analog output terminals *3, use SW1 to switch voltage and current output (0~10V) / (4-20mA)	From 0 to 10V Max. current: 2mA From 4 to 20 mA
	AO2	Multi-function analog output terminals *3, use SW2 to switch voltage and current output (0~10V) / (4-20mA)	
	GND	Analog signals ground terminal	
Pulse output signal	PO	Pulse output, Band width 32KHz	Max. Frequency: 32KHz Open Collector output Load: 2.2 KΩ
	GND	Analog signals ground terminal	----
Pulse input signal	PI	Pulse command input, frequency width of 32KHz	L: from 0.0 to 0.5V H: from 4.0 to 13.2V Max. Frequency: 0 - 32KHz Impedance: 3.89 KΩ
	GND	Analog signals ground terminal	----

Table 3.3.4.2 Description of control circuit terminals (Continued)

Type	Terminal	Terminal function	Signal level/ information
Relay output	R1A- R1B- R1C	Relay A contact (multi-function output terminal) Relay B contact (multi-function output terminal) Relay contact common terminal, please refer to parameter group 03 in this manual for more functional descriptions.	Rating: 250Vac: 10 mA ~ 1A 30Vdc: 10 mA ~ 1A
	R2A-R2C	With the same functions as R1A/R1B/R1C	Rating: 250Vac: 10 mA ~ 1A 30Vdc: 10 mA ~ 1A
	R3A-R3C	With the same functions as R1A/R1B/R1C	
Safety input	F1	On: normal operation. Off: emergency stop. (Jumper wired has to be removed to use external safety function to stop.)	24Vdc, 8mA, pull-high
	F2	Safety command common terminal	24V Ground
RS-485 port	S (+)	RS485/MODBUS	differential input and output
	S (-)		
Grounding	E (G)	Grounding to earth Shield the connecting terminal	----

Notes:

*1: Multi-function digital input can be referred to in this manual.

- Group 03: External Terminals Digital Input / Output Function Group.

*2: Multi-function analog input can be referred to in this manual.

- Group 04 - External Terminal Analog Signal Input (Output) Function Group.

*3: Multi-function analog output can be referred to in this manual.

- Group 04 - External Terminal Analog Signal Input (Output) Function Group.

Caution

- Maximum output current capacity for terminal 10V is 20mA.
- Multi-function analog output AO1 and AO2 are for use for an analog output meter. Do not use these output for feedback control.
- Control board's 24V and 10V are to be used for internal control only. Do not use the internal power-supply to power external devices.

3.3.5 Wiring for Main Circuit Terminals

3.3.5.1 Wiring for Main Circuit Terminals (For U type)

Table 3.3.5.1.1 Description of main circuit terminals (IP00/IP20 Type)

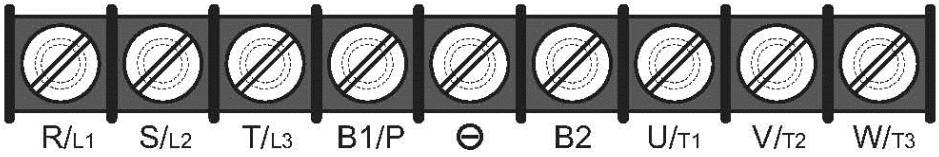
<table>
<tr><th>Terminal</th><th>200V : 1~30HP
400V : 1~40HP</th><th>200V : 40~175HP
400V : 50~800HP</th></tr>
<tr><td>R/L1</td><td colspan="2" rowspan="3">Input Power Supply</td></tr>
<tr><td>S/L2</td></tr>
<tr><td>T/L3</td></tr>
<tr><td>B1／P</td><td rowspan="2">• B1／P－B2：External braking resistor</td><td>-</td></tr>
<tr><td>B2</td><td rowspan="2">• ⊕ -⊖：Connect braking module</td></tr>
<tr><td>⊖</td><td rowspan="2">-</td></tr>
<tr><td>⊕</td></tr>
<tr><td>U/T1</td><td colspan="2" rowspan="3">Inverter output</td></tr>
<tr><td>V/T2</td></tr>
<tr><td>W/T3</td></tr>
<tr><td>E</td><td colspan="2">Ground terminal</td></tr>
</table>

*1. The model of 400V 25HP (18.5KW) or below is built-in braking transistor.
*2. Before connecting DC reactor, please remove short circuit between terminal ⊕1 and ⊕2.

■ Main circuit terminals identification and screw size

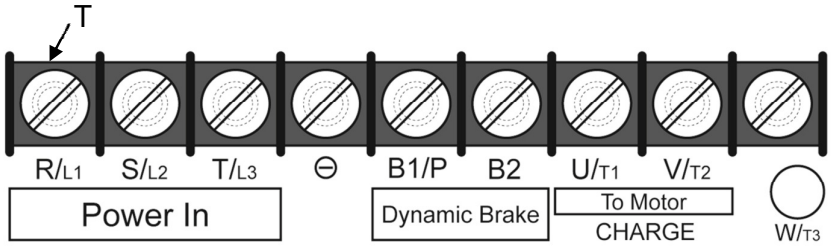
◆ IP20 Type

• 200V : 1-3HP/ 400V: 1-3HP



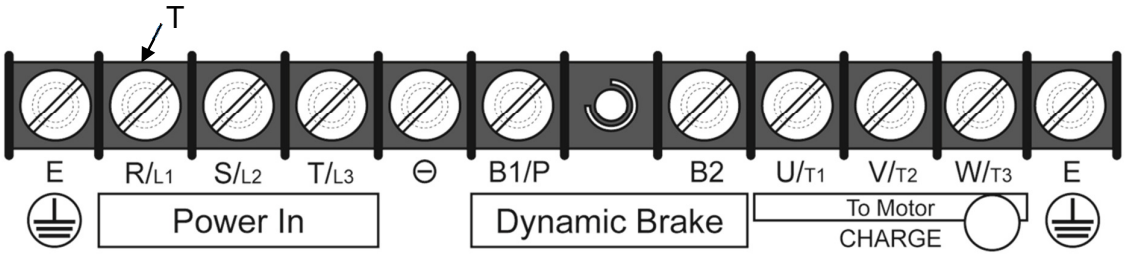
Terminal screw size	
T	⏚
M4	M4

• 200V: 5-7.5HP/ 400V: 5-10HP



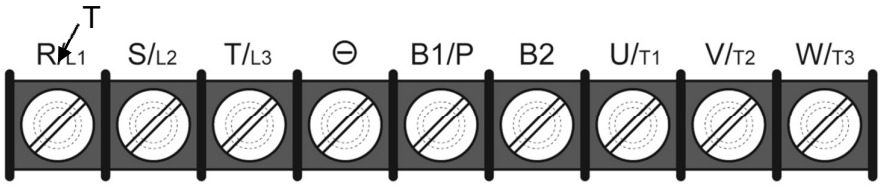
Terminal screw size	
T	⏚
M4	M4

• 200V: 10-15HP/ 400V: 15- 20HP



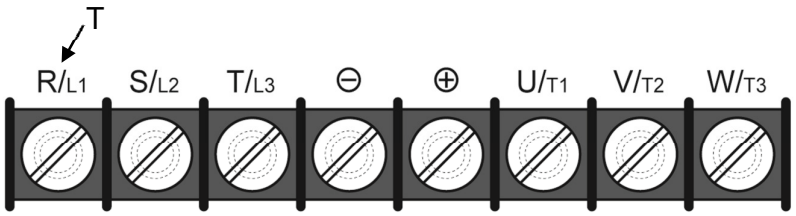
Terminal screw size	
T	⏚
M4	M4

• 200V: 20-30HP/ 400V: 25-40HP



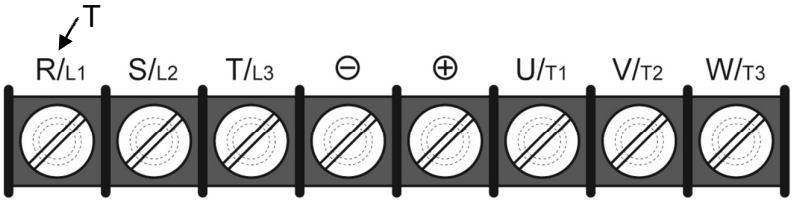
Terminal screw size	
T	⏚
M6	M6

• 200V: 40-50HP/ 400V: 50-75HP



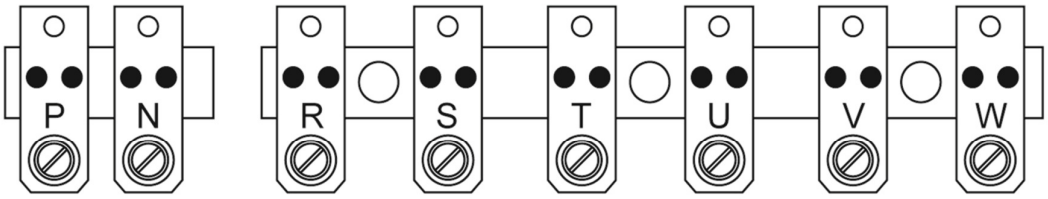
Terminal screw size	
T	⏚
M8	M8

• 200V: 60-75HP/ 400V: 100-125HP



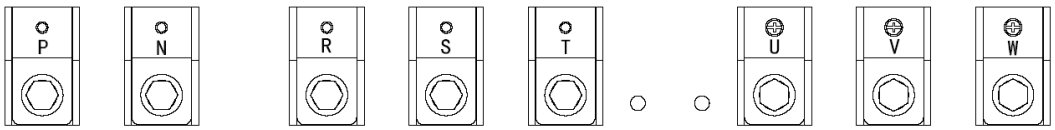
Terminal screw size		
Power supply	T	⏚
400V 100HP	M8	M10
200V 60-75HP/ 400V 125HP	M10	M10

• 200V: 100-125HP/ 400V: 150-250HP



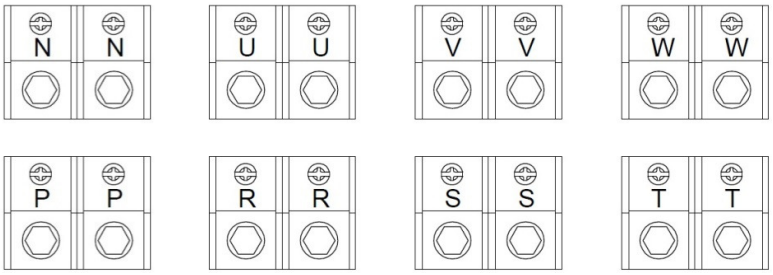
Terminal screw size	
T	⏚
M10	M10

• 200V: 150-175HP/ 400V: 300-425HP



Terminal screw size	
T	⏚
M12	M10

• 400V: 530-800HP



Terminal screw size	
T	⏚
M10	M10

3.3.5.2 Wiring for Main Circuit Terminals (For UE type)

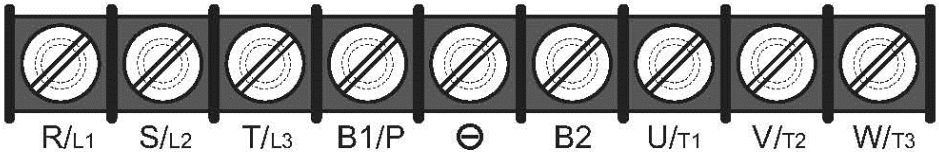
Table 3.3.5.2.1 Description of main circuit terminals (IP00/IP20 Type)

<table>
<tr><th>Terminal</th><th>200V : 1~30HP
400V : 1~40HP</th><th>200V : 40~175HP
400V : 50~800HP</th></tr>
<tr><td>R/L1</td><td colspan="2" rowspan="3">Input Power Supply</td></tr>
<tr><td>S/L2</td></tr>
<tr><td>T/L3</td></tr>
<tr><td>B1／P2</td><td rowspan="3">• B1／P－B2：External braking resistor</td><td rowspan="2">-</td></tr>
<tr><td>B2</td></tr>
<tr><td>⊖</td><td rowspan="2">• ⊕ -⊖：Connect braking module</td></tr>
<tr><td>⊕／P1</td><td>• ⊕／P1－B1／P2：External DCL</td></tr>
<tr><td>U/T1</td><td colspan="2" rowspan="3">Inverter output</td></tr>
<tr><td>V/T2</td></tr>
<tr><td>W/T3</td></tr>
<tr><td>E</td><td colspan="2">Ground terminal</td></tr>
</table>

■ Main circuit terminals identification and screw size (For UE type)

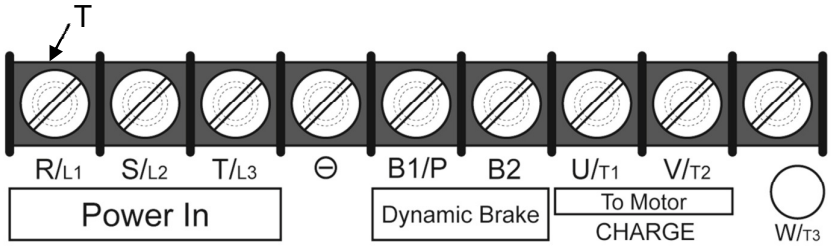
◆ IP20 Type

• 200V : 1-3HP/ 400V: 1-3HP



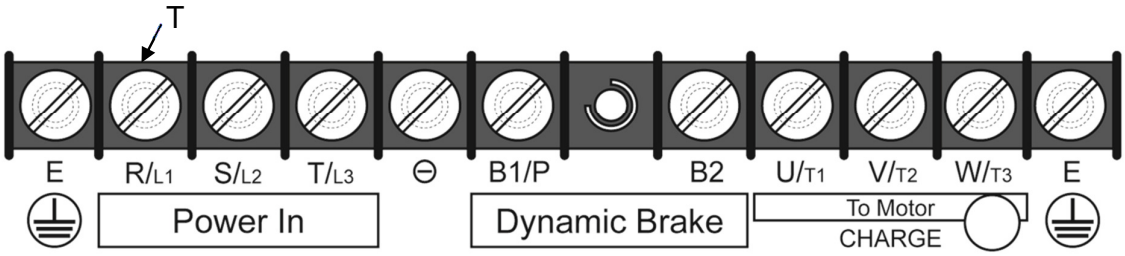
Terminal screw size	
T	⏚
M4	M4

• 200V: 5-7.5HP/ 400V: 5-10HP



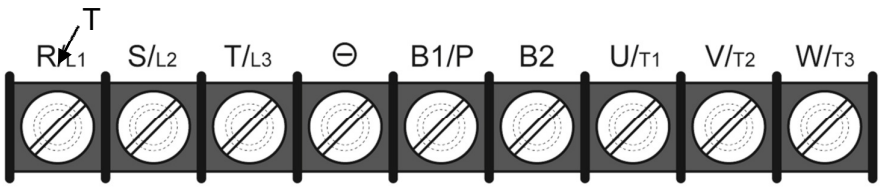
Terminal screw size	
T	⏚
M4	M4

• 200V: 10-15HP/ 400V: 15- 20HP



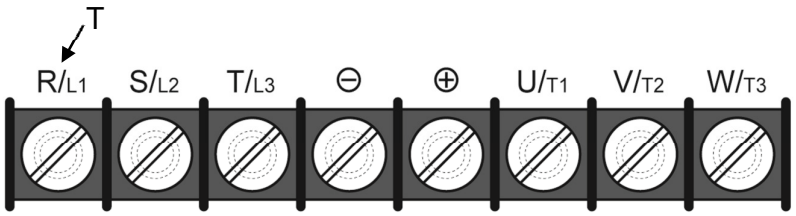
Terminal screw size	
T	⏚
M4	M4

• 200V: 20-30HP/ 400V: 25-40HP



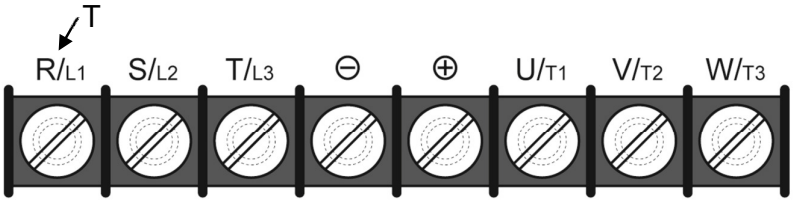
Terminal screw size	
T	⏚
M6	M6

• 200V: 40-50HP/ 400V: 50-75HP



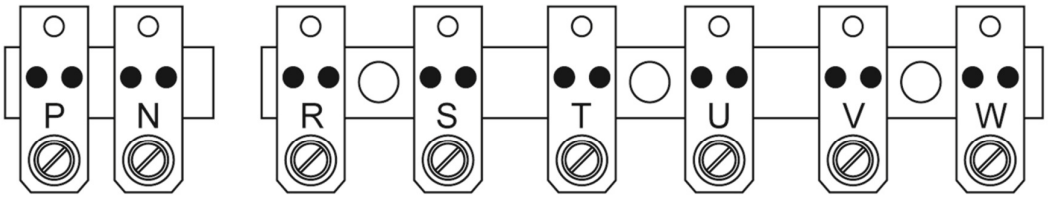
Terminal screw size	
T	⏚
M8	M8

• 200V: 60-75HP/ 400V: 100-125HP



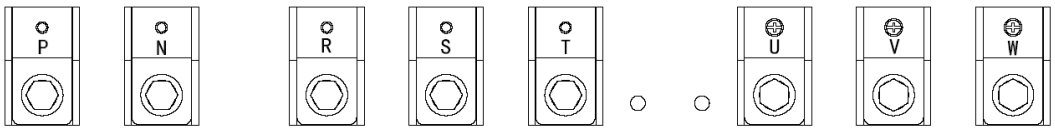
Terminal screw size		
Power supply	T	⏚
400V 100HP	M8	M10
200V 60-75HP/ 400V 125HP	M10	M10

• 200V: 100-125HP/ 400V: 150-250HP



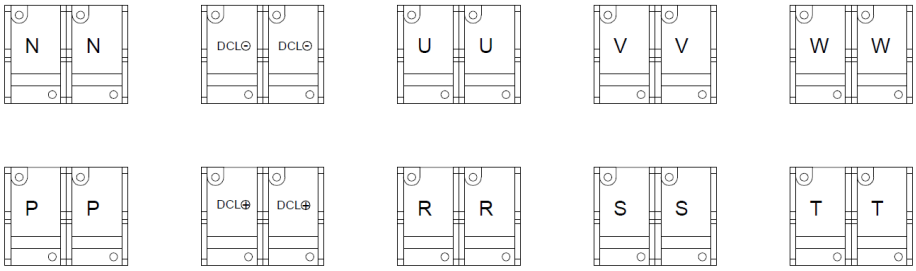
Terminal screw size	
T	⏚
M10	M10

• 200V: 150-175HP/ 400V: 300-425HP



Terminal screw size	
T	⏚
M12	M10

• 400V: 530-800HP



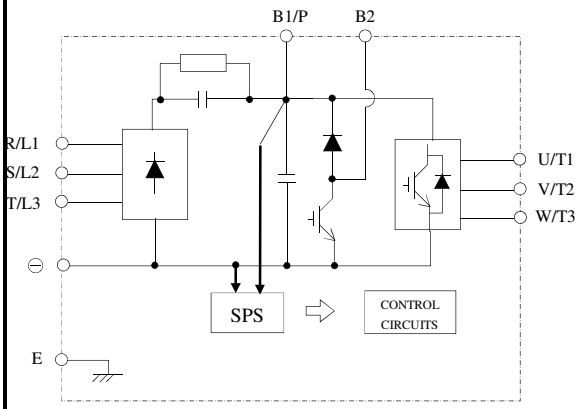
Terminal screw size	
T	⏚
M10	M10

■ Input / Output Power Section Block Diagram

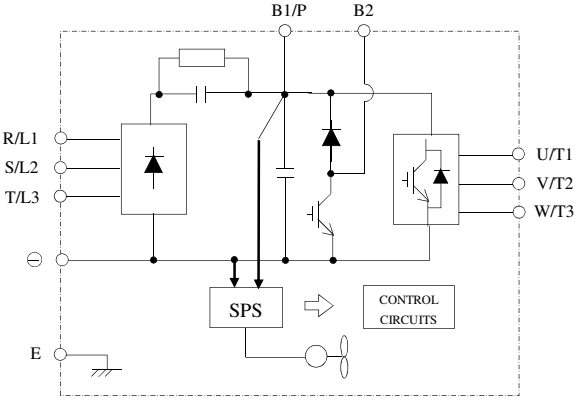
The following diagrams show the basic configuration of the power sections for the range of horsepower and input voltages. This is shown for reference only and is not a detailed depiction.

◆ IP00/IP20 Type

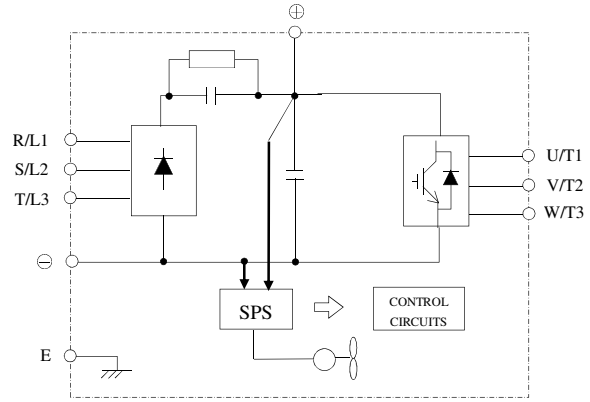
1. IP20 200V: 1HP 400V: 1~2HP



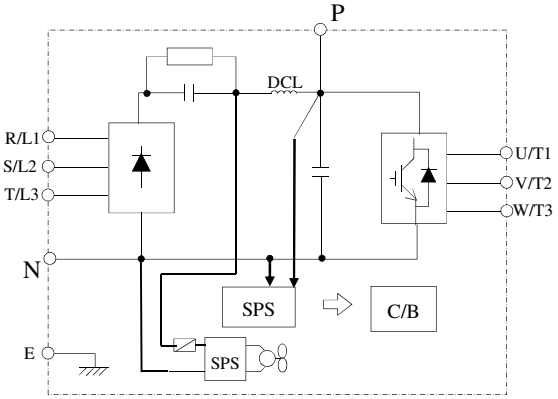
2. IP20 200V: 2~30HP 400V: 3~40HP



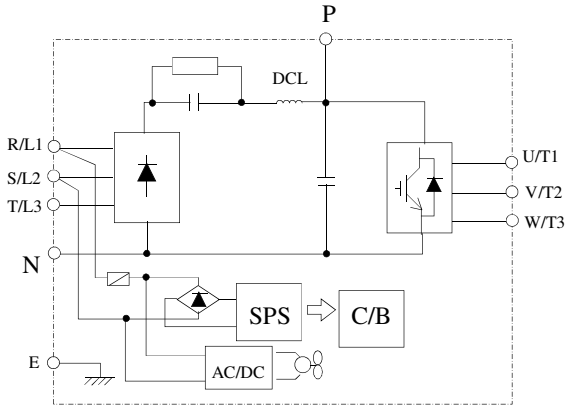
3. IP20 200V: 40~50HP 400V: 50~75HP



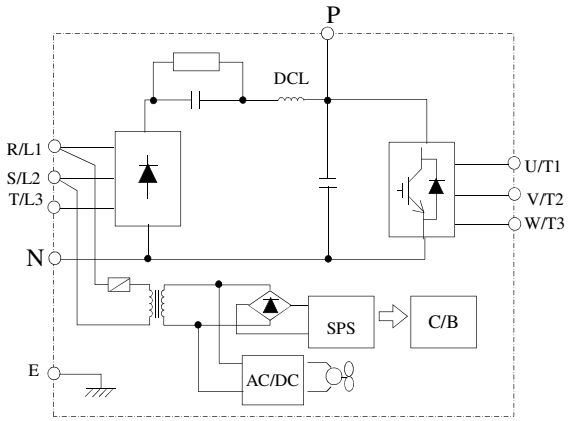
4. IP00/IP20 200V: 60~75HP 400V: 100~125HP



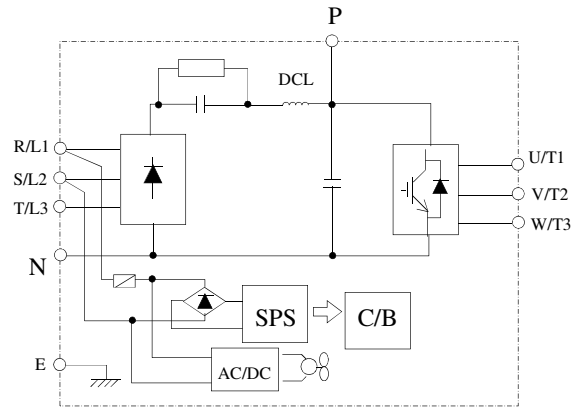
5. IP00/IP20 200V: 100~125HP



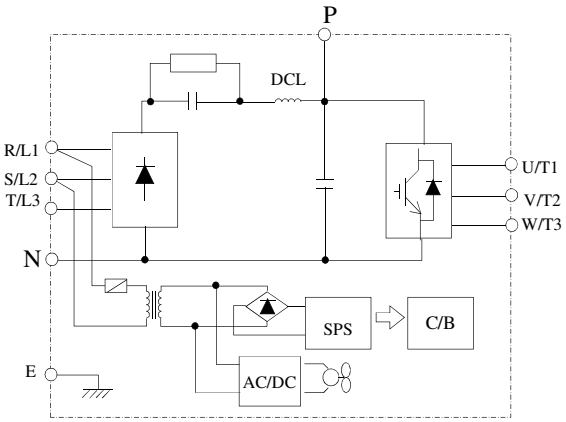
6. IP00/IP20 400V: 150~250HP



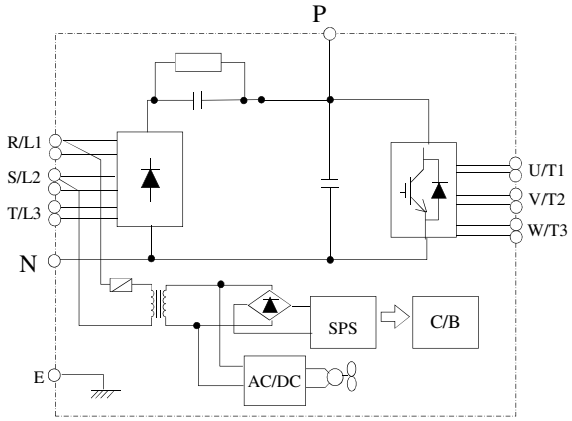
7. IP00/IP20 200V: 150~175HP



8. IP00/IP20 400V: 300~425HP



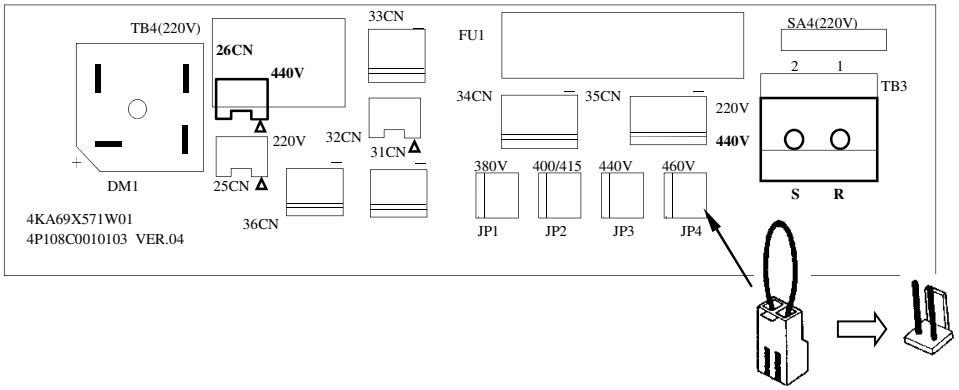
9. IP00/IP20 400V: 535~800HP



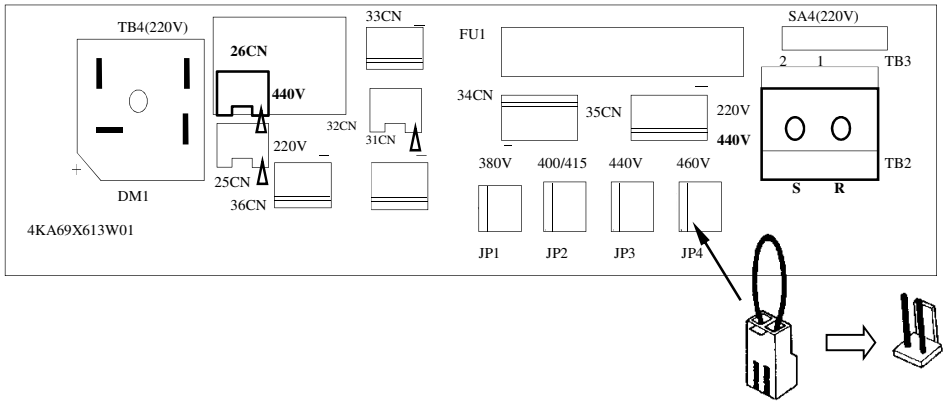
■ Cooling Fan Supply Voltage Selection (400V class)

The inverter input voltage range of the F510 400V class models ranges from 380 to 460Vac. In these models the cooling fan is directly powered from the power supply. Inverter models F510-4150/ 4175/ 4215/ 4250/ 4300/ 4375/ 4425/ 4535/ 4670/ 4800-H3 requires the user to select the correct jumper position based on the inverter input voltage ("400V" is the default position for these models). Please select the correct position according to the input voltage. If the voltage setting is too low, the cooling fan will not provide adequate cooling for the inverter resulting in an over-heat error. If the input voltage is greater than 460Vac, select the “460V” position.

(1) 400V： 150HP～250HP



(2) 400V：300HP～800HP



■ Power Input Wire Size, NFB and MCB Part Numbers

The following table shows the recommended wire size, molded case circuit breakers and magnetic contactors for each of the F510 models. It depends on the application whether or not to install a circuit breaker. The NFB must be installed between the input power supply and the inverter input (R/L1, S/L2, T/L3).

Note: When using a ground protection, make sure the current setting is above 200mA and trip delay time is 0.1 sec of higher.

Table 3.3.5.3 Wiring Instrument for 200V／400V class (IP00/IP20 type)

F510 Model				Wire size (mm^2)			NFB*3	MC*3
Power supply	Horse power (HP)	Rated KVA	Rated current (A)	Main circuit *1	Grounding E(G)	Control line*2		
200V 1 Ø / 3Ø	1HP	1.9	5	2～5.5	2～5.5	0.5～2	TO-50EC(15A)	CU-11
	2HP	2.9	7.5	2～5.5	3.5～5.5	0.5～2	TO-50EC(20A)	CU-11
	3HP	4.0	10.6	3.5～5.5	3.5～5.5	0.5～2	TO-50EC(30A)	CU-11
200V 3 Ø	5HP	5.5	14.5	3.5～5.5	3.5～5.5	0.5～2	TO-50EC(30A)	CU-16
	7.5HP	8.0	22	5.5	5.5	0.5～2	TO-50EC(30A)	CU-16
	10HP	11.4	30	8	5.5～8	0.5～2	TO-100EC(50A)	CU-18
	15HP	15	42	8	5.5～8	0.5～2	TO-100EC(50A)	CU-27
	20HP	21	56	14	8	0.5～2	TO-100EC(100A)	CU-50
	25HP	26	69	22	8	0.5～2	TO-100EC(100A)	CU-65
	30HP	30	80	22	14	0.5～2	TO-225E(125A)	CU-80
	40HP	42	110	38	14	0.5～2	TO-225E(150A)	CN-100R
	50HP	53	138	60	22	0.5～2	TO-225E(175A)	CN-125R
	60HP	64	169	80	22	0.5～2	TO-225E(200A)	CN-150
	75HP	76	200	100	22	0.5～2	TO-225E(225A)	CN-180
	100HP	95	250	150	22	0.5～2	TO-400S(300A)	CN-300
	125HP	119	312	200	38	0.5～2	TO-400S(400A)	CN-300
	150HP	137	400	300	38	0.5～2	TO-600S(600A)	CN-400
	175HP	172	450	250*2P	50	0.5～2	TO-800S(800A)	CN-630
400V 3 Ø	1HP	2.6	3.4	2～5.5	2～5.5	0.5～2	TO-50EC(15A)	CU-11
	2HP	3.1	4.1	2～5.5	3.5～5.5	0.5～2	TO-50EC(15A)	CU-11
	3HP	4.1	5.4	2～5.5	3.5～5.5	0.5～2	TO-50EC(15A)	CU-11
	5HP	7.0	9.2	2～5.5	3.5～5.5	0.5～2	TO-50EC(15A)	CU-18
	7.5HP	8.5	12.1	2～5.5	3.5～5.5	0.5～2	TO-50EC(15A)	CU-18
	10HP	13.3	17.5	3～5.5	3.5～5.5	0.5～2	TO-50EC(20A)	CU-18
	15HP	18	23	5.5	5.5	0.5～2	TO-50EC(30A)	CU-25
	20HP	24	31	8	8	0.5～2	TO-100EC(50A)	CU-25
	25HP	29	38	8	8	0.5～2	TO-100EC(50A)	CU-35
	30HP	34	44	8	8	0.5～2	TO-100EC(50A)	CU-50
	40HP	41	58	14	8	0.5～2	TO-100EC(75A)	CU-50
	50HP	55	73	22	8	0.5～2	TO-100EC(100A)	CU-65
	60HP	67	88	22	14	0.5～2	TO-100EC(100A)	CN-80
	75HP	79	103	38	14	0.5～2	TO-225E(150A)	CN-100R
	100HP	111	145	60	22	0.5～2	TO-225E(175A)	CN-150
	125HP	126	168	80	22	0.5～2	TO-225E(225A)	CN-150
	150HP	159	208	150	22	0.5～2	TO-400S(300A)	CN-300
	175HP	191	250	150	22	0.5～2	TO-400S(300A)	CN-300
	215HP	226	296	200	30	0.5～2	TO-400S(400A)	CN-300
	250HP	250	328	250	30	0.5～2	TO-400S(400A)	CN-400
	300HP	332	435	300	38	0.5～2	TO-600S(600A)	CN-630
	375HP	393	515	250*2P	50	0.5～2	TO-800S(800A)	CN-630

F510 Model				Wire size (mm^2)			NFB[*3]	MC[*3]
Power supply	Horse power (HP)	Rated KVA	Rated current (A)	Main circuit [*1]	Grounding E(G)	Control line[*2]		
	425HP	457	585	250*2P	50	0.5～2	TE-1000(1000A)	CN-630
	535HP	526	700	300*2P	50	0.5～2	TE-1000(1000A)	800
	670HP	640	875	300*2P	50	0.5～2	TE-1200(1200A)	1000
	800HP	732	960	300*2P	50	0.5～2	TE-1200(1200A)	1000

*1. The main circuit terminals: R/L1, S/L2, T/L3 , U/T1, V/T2, W/T3, B1／P, B2, ⊖, ⊕.

*2. Control line is the terminal wire on the control board.

*3. The NFB and MCB listed in the table are of TECO product numbers, products with same rated specification of other brands may be used. To reduce electrical noise interference, ensure that a RC surge absorber (R: 10Ω/ 5W, C: 0.1μf/1000VDC) is added to both sides of MCB coil.

Table 3.3.5.4 Wiring Instrument for 400V class (IP55 type)

F510 Model				Wire size(mm^2)			NFB[*3]	MC[*3]
Power supply	Horse power (HP)	Rated KVA	Rated current (A)	Main circuit[*1]	Grounding E(G)	Control line[*2]		
400V 3 Ø	1HP	2.6	3.4	2～5.5	2～5.5	0.5～2	TO-50EC(15A)	CU-11
	2HP	3.1	4.1	2～5.5	3.5～5.5	0.5～2	TO-50EC(15A)	CU-11
	3HP	4.1	5.4	2～5.5	3.5～5.5	0.5～2	TO-50EC(15A)	CU-11
	5HP	7.0	9.2	2～5.5	3.5～5.5	0.5～2	TO-50EC(15A)	CU-18
	7.5HP	8.5	12.1	2～5.5	3.5～5.5	0.5～2	TO-50EC(15A)	CU-18
	10HP	13.3	17.5	3～5.5	3.5～5.5	0.5～2	TO-50EC(20A)	CU-18
	15HP	18	23	5.5	5.5	0.5～2	TO-50EC(30A)	CU-27
	20HP	24	31	8	8	0.5～2	TO-100EC(50A)	CU-27
	25HP	29	38	8	8	0.5～2	TO-100EC(50A)	CU-38
	30HP	34	44	8	8	0.5～2	TO-100EC(50A)	CU-50
	40HP	41	58	14	8	0.5～2	TO-100EC(75A)	CU-50
	50HP	55	73	22	8	0.5～2	TO-100EC(100A)	CU-65
	60HP	67	88	22	14	0.5～2	TO-100EC(100A)	CN-80
	75HP	79	103	38	14	0.5～2	TO-225E(150A)	CN-100R
	100HP	111	145	60	22	0.5～2	TO-225E(175A)	CN-150

*1. The main circuit terminals: R(L1), S(L2), T(L3), ⊖, ⊕1, ⊕2, U(T1), V(T2), W(T3),B1, B2 (Polyethylene power line of 600V is recommended to be used.)

*2. Control line is the terminal wire on the control board.

*3. The NFB and MCB listed in the table are of TECO product numbers, products with same rated specification of other brands may be used. To reduce electrical noise interference, ensure that a RC surge absorber (R: 10Ω/ 5W, C: 0.1μf/1000VDC) is added to both sides of MCB coil.

3.3.6 Wiring Precautions

Danger	• Do **NOT** remove any protective covers or attempt any wiring while input power is applied. Connect all wiring before applying input power. When making wiring changes after power up, remove input power and wait a minimum of five minutes after power has been turned off before starting. Also confirm that the charge lamp is off and that DC voltage between terminals B1/P or (+) and (-) does not exceed 25V, otherwise **electric shock may result.** • Only authorized personnel should work on the equipment. (Take off metal jewelry such as watches and rings and use insulated tools.), otherwise **electric shock or injury may result.**

(A) Wiring for control circuit:

(1) Separate the wiring for control circuit terminals from main circuit wiring for terminals (R/L1, S/L2, T/L3, U/T1, V/T2, and W/T3).

(2) Separate the wiring for control circuit terminals (R1A, R1B, R1C / R2A, R2C /R3A, R3C) from wiring for terminals S1～S6, A01, A02, GND, +10V-, AI1, AI2, and GND wiring.

(3) Use shielded twisted-pair cables (#24 - #14 AWG / 0.5 -2 mm^2) shown in Fig. 3.3.6.1 for control circuits to minimize noise problems. The maximum wiring distance should not exceed 50m (165 ft).

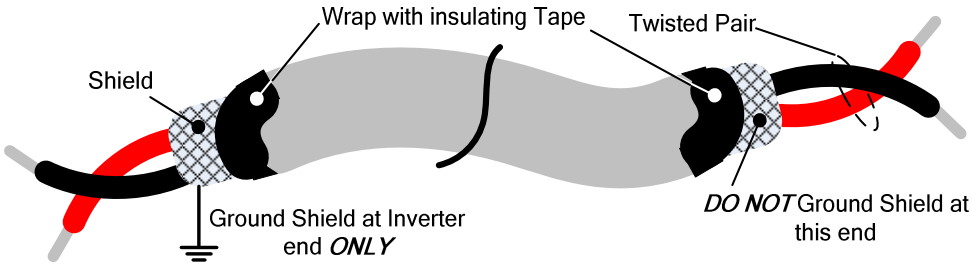


Figure 3.3.6.1 Shielded Twisted-Pair

(B) Wiring for main circuit:

(1) The Input power supply voltage can be connected in any phase sequence to power input terminals R/L1, S/L2, or T/L3 on the terminal block.

(2) DO NOT connect the AC input power source to the output terminals U/T1, V/T2 and. W/T3.

(3) Connect the output terminals U/T1, V/T2, W/T3 to motor lead wires U/T1, V/T2, and W/T3, respectively.

(4) Check that the motor rotates forward with the forward run source. If it does not, swap any 2 of the output cables to change motor direction.

(5) DO NOT connect phase correcting capacitors or LC/RC noise filter to the output circuit.

(C) Grounding:

(1) Connect the ground terminal (E) to ground having a resistance of less than 100Ω.

(2) Do not share the ground wire with other devices, such as welding machines or power tools.

(3) Always use a ground wire that complies with the local codes and standards for electrical equipment and minimize the length of ground wire.

(4) When using more than one inverter, be careful not to loop the ground wire, as shown below in Fig. 3.3.6.2.

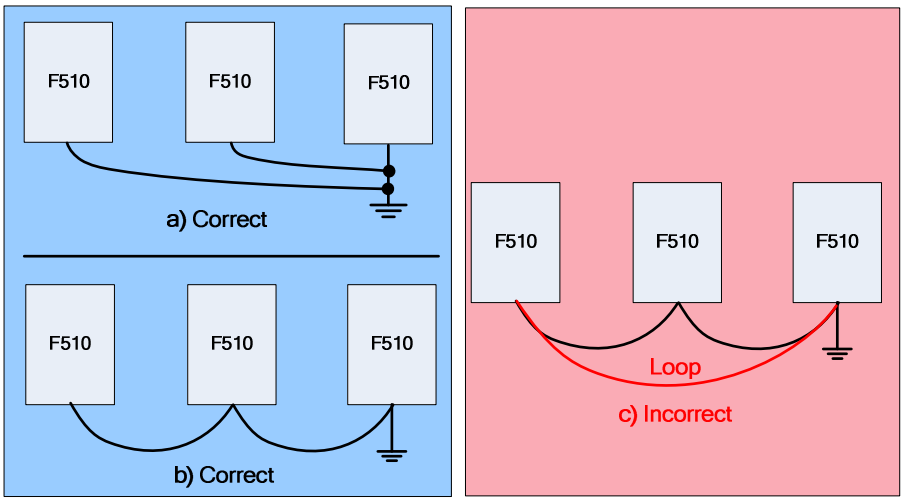


Figure 3.3.6.2 F510 Inverter Grounding

3.3.7 Input Power and Cable Length

■ Cable size

The length of the cables between the input power source and /or the motor and inverter can cause a significant phase to phase voltage reduction due to the voltage drop across the cables. The wire size shown in Tables 3.3.5.3 & 3.3.5.4 is based on a maximum voltage drop of 2%. If this value is exceeded, a wire size having larger diameter may be needed. To calculate phase tot phase voltage drop, apply the following formula:

Phase-to-phase voltage drop (V) = $\sqrt{3}$ ×resistance of wire (Ω/km) × length of line m) × current×10^{-3}.

(km=3280 x feet)

(m=3.28 x feet)

■ Cable length vs. Carrier frequency

The allowable setting of the PWM carrier frequency is also determined by motor cable length and is specified in the following Table 3.3.7.1.

Table 3.3.7.1 Cable Length vs. Carrier Frequency

Cable length between the inverter and Motor in m (ft.).	< 30 (100)	30 – 50 (100 – 165)	50 – 100 (166 - 328)	≥ 100 (329)
Recommended carrier frequency allowed Parameter 11-01	16kHz (max)	10 kHz (max)	5 kHz (max)	2 kHz (max)

■ Installing an AC line reactor

If the inverter is connected to a large-capacity power source (600kVA or more), install an optional AC reactor on the input side of the inverter. This also improves the power factor on the power supply side.

3.4 Inverter Specifications

■ Basic Specifications

(a) 200V class

	Inverter capacity (HP)	1	2	3	5	7.5	10	15	20	25	30	40	50	60	75	100	125	150	175
Output Rated	Rated Output Capacity (KVA)	1.9	2.9	4.0	5.5	8	11.4	15.2	21.3	26.2	30	41.9	52.5	64.3	76.2	95.2	118.8	152.4	171.4
	Rated Output Current (A)	5.0	7.5	10.6	14.5	22	30	42	56	69	80	110	138	169	200	250	312	400	450
	Maximum Applicable Motor *1HP (KW)	1 (0.75)	2 (1.5)	3 (2.2)	5 (3.7)	7.5 (5.5)	10 (7.5)	15 (11)	20 (15)	25 (18.5)	30 (22)	40 (30)	50 (37)	60 (45)	75 (55)	100 (75)	125 (90)	150 (110)	175 (130)
	Maximum Output Voltage (V)	3-phase 200V~240V																	
	Maximum Output Frequency (Hz)	Based on parameter setting 0.1~599.0 Hz																	
Power supply	Rated Voltage, Frequency	1-phase/ 3-phase	3-phase 200V~240V, 50/60Hz																
	Allowable Voltage Fluctuation	-15% ~ +10%																	
	Allowable Frequency Fluctuation	±5%																	

(b) 400V class

	Inverter capacity (HP)	1	2	3	5	7.5	10	15	20	25	30	40	50	60	75	100	125	150	175	215	250	300	375
Output Rated	Rated Output Capacity (KVA)	2.6	3.1	4.1	7.0	8.4	13.3	17.5	23.6	28.9	33.5	41.1	54.8	67	78.4	110	125	158	190	225	250	331	392
	Rated Output Current (A)	3.4	4.1	5.4	9.2	12.1	17.5	23	31	38	44	58	73	88	103	145	168	208	250	296	328	435	515
	Maximum Applicable Motor *1HP (KW)	1 (0.75)	2 (1.5)	3 (2.2)	5 (3.7)	7.5 (5.5)	10 (7.5)	15 (11)	20 (15)	25 (18.5)	30 (22)	40 (30)	50 (37)	60 (45)	75 (55)	100 (75)	125 (90)	150 (110)	175 (132)	215 (160)	250 (185)	300 (220)	375 (280)
	Maximum Output Voltage (V)	3-phase 380V~480V																					
	Maximum Output Frequency (Hz)	Based on parameter setting 0.1~599.0 Hz																					
Power supply	Rated Voltage, Frequency	3-phase 380V ~ 480V, 50/60Hz																					
	Allowable Voltage Fluctuation	-15% ~ +10%																					
	Allowable Frequency Fluctuation	±5%																					

	Inverter capacity (HP)	425	535	670	800
Output Rated	Rated Output Capacity (KVA)	445	525	640	731
	Rated Output Current (A)	585	700	875	960
	Maximum Applicable Motor *1HP (KW)	425 (315)	535 (400)	670 (500)	800 (600)
	Maximum Output Voltage (V)	3-phase 380V~480V			
	Maximum Output Frequency (Hz)	Based on parameter setting 0.1~599.0 Hz			
Power supply	Rated Voltage, Frequency	3-phase 380V ~ 480V, 50/60Hz			
	Allowable Voltage Fluctuation	-15% ~ +10%			
	Allowable Frequency Fluctuation	±5%			

*1: Take standard 4-pole induction motor as the base.

*2: F510 model is designed to be used in normal duty (ND), whose overload capability is 120% for 1 min.

*3: If it is greater than default carrier frequency, you need to adjust the load current based on the de-rating curve.

200V class	Carrier freq. default setting	Carrier freq. range	400V class	Carrier freq. default setting	Carrier freq. range
1~25HP	2KHz	2~16KHz	1~30HP	4KHz	2~16KHz
30HP	2KHz	2~12KHz	40HP	2KHz	2~16KHz
40~50HP	2KHz	2~12KHz (*4)	50~60HP	4KHz	2~12KHz (*4)
60~125HP	2KHz	2~10KHz (*4)	75~215HP	4KHz	2~10KHz (*4)
-	-	-	250HP	2KHz	2~8KHz
150~175HP	2KHz	2~5KHz	300~375HP	4KHz	2~5KHz
-	-	-	425HP	2KHz	2~5KHz
-	-	-	535~800HP	4KHz	2~5KHz

*4: If control mode is set to SLV mode and maximum frequency (01-02) is larger than 80 Hz, the carrier frequency range is 2~8Hz.

The following table shows the maximum output frequency for each control mode.

Control mode	Other settings	Maximum output frequency
V/F	Unlimited	599Hz
SLV	200V 1~15HP, 400V 1~20HP	150Hz
	200V 20~30HP, 400V 25HP	110Hz
	400V 30~40HP	100Hz
	200V 40~125HP, 400V 50~215HP, carrier (11-01) is set as 8K or below 8K.	100Hz
	200V 40~125HP, 400V 50~215HP, carrier (11-01) is set as above 8K.	80Hz
	200V 150~175HP, 400V 250~800HP	100Hz
PMSLV	Unlimited	599Hz

■ General Specifications

Control Characteristics	**Operation Modes**	LED keypad with seven-segment display *5 and LCD keypad (Optional HOA LCD keypad); all LCD keypad with parameter copy function
	Control Modes	V/F, SLV, PMSLV with space vector PWM mode
	Frequency Control Range	0.1Hz～599.0Hz
	Output Frequency Accuracy (Temperature change)	Digital references: ±0.01%(-10 to +40℃), Analog references: ±0.1% (25℃±10℃)
	Speed Control Accuracy	±0.5% (Sensorless Vector Control Mode)*1
	Frequency Setting Resolution	Digital references: 0.01Hz , Analog references: 0.06Hz/60Hz
	Output Frequency Resolution	0.01Hz
	Inverter Overload	120%/1 min
	Frequency Setting Signal	DC 0～+10V / 0~20mA or 4～20mA
	Acceleration/ Deceleration Time	0.0～6000.0 seconds (separately set acceleration and deceleration time)
	Voltage, Frequency Characteristics	Custom V/F curve based on parameters
	Braking Torque	About 20%
	Main Control Functions	Auto tuning, Soft-PWM, Over voltage protection, Dynamic braking, Speed search, Restart upon momentary power loss, 2 sets of PID control, Slip Compensation, RS-485 communication standard, Simple PLC function, 2 sets of analog outputs, Safety switch
	Other Functions	Accumulated power-on/ run time, 30 sets of fault history records and latest fault record state, Energy-saving function setting, Phase loss protection, Smart braking, DC braking, Dwell、S curve acceleration and deceleration, Up/Down operation, Modbus, BACnet MS/TP and Metasys N2 communication protocol, Display of multi-engineering unit, Local/ Remote switch, SINK/SOURCE input interface selection, User parameter settings
Protection Function	**Stall Prevention**	Current level can be setting (It can be set separately in acceleration or constant speed; it can be set with or without protection in deceleration)
	Instantaneous Over Current (OC) and Output Short-Circuit (SC) Protection	Inverter stops when the output current exceeds 160% of the inverter rated current
	Inverter Overload Protection (OL2)	If inverter rated current 120%/1min is exceeded, inverter stops. The factory default carrier frequency is 2~4KHZ*2
	Motor Overload Protection (OL1)	Electrical overload protection curve
	Over voltage (OV) Protection	If the main circuit DC voltage rises over 410V (200V class)/ 820V (400V class), the motor stops running.
	Under voltage (UV) Protection	If the main circuit DC voltage falls below 190V (200V class) /380V (400V class), the motor stops running.
	Auto-Restart after Momentary Power Loss	Power loss exceeds 15ms. Auto-restart function available after momentary power loss in 2 sec. ; 3HP below for 1sec
	Overheat(OH) Protection	Use temperature sensor for protection.
	Ground Fault (GF) Protection	Use current sensor for protection.
	DC Bus Charge Indicator	When main circuit DC voltage 50V, the CHARGE LED turns on.
	Input Phase Loss (OPL) Protection	If the IPL is detected, the motor stops automatically.
	Output Phase Loss (OPL) Protection	If the OPL is detected, the motor stops automatically.
	Short-circuit current rating (SCCR)	Per UL 508C, the drive is suitable for use on a circuit capable of delivering not more than 100KA symmetrical amperes (rms) when protected by fuses given in the fuse table.
Environment Specifications	**Installation Location**	Indoor (protected from corrosive gases and dust)
	Ambient Temperature	-10~+40℃(14℉~104℉) (IP20/NEMA1 or IP55/NEMA12), -10~+50℃(14℉~122℉) (IP00 or top anti-dust cover removed) without de-rating; with de-rating, its maximum operation temperature is 60℃(140℉). (Enhanced type frame 5 is 50℃ without de-rating
	Storage Temperature	-20~+70℃(-4℉~+158℉)
	Humidity	95%RH or less (no condensation)
	Altitude and Vibration	Altitude of 1000m (3181ft) or below, below 5.9m/s^2(0.6G)
	Pollution Degree	IP00/IP20/IP21 meet IEC 60721-3-3 Class 3C2, IP55 meet IEC 60721-3-3 Class 3C3

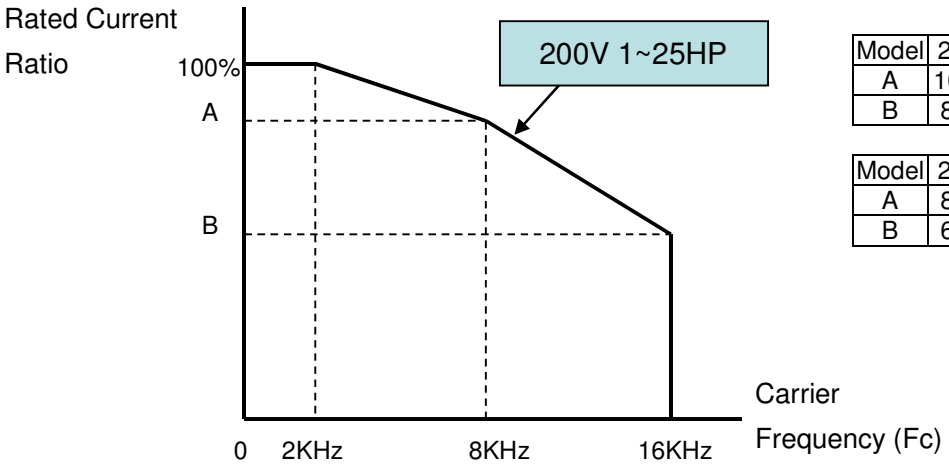
***1: Speed control accuracy will be different from the installation conditions and motor types.**
***2: The factory default carrier frequency is different from models.**

Communication Function		Built-in RS-485 as standard (Modbus protocol with RJ45/ BACnet/ Metasys N2)
PLC Function		Built-in
EMI Protection		The built-in noise filter complies with EN61800-3 available for inverters 400V 75HP or below (IP20) / 400V 60HP or below (IP55)
EMS Protection		in compliance with EN61800-3
Safety Certification	**CE Declaration**	in compliance with EN61800-3 (CE & RE) and EN61800-5-1 (LVD, Low-Voltage Directive)
	UL Certification	UL508C
Accessories		1 to 8 Pump card, HOA LCD keypad ; IP20 1-3HP don't support option card

3.5 Inverter De-rating Based on Carrier Frequency

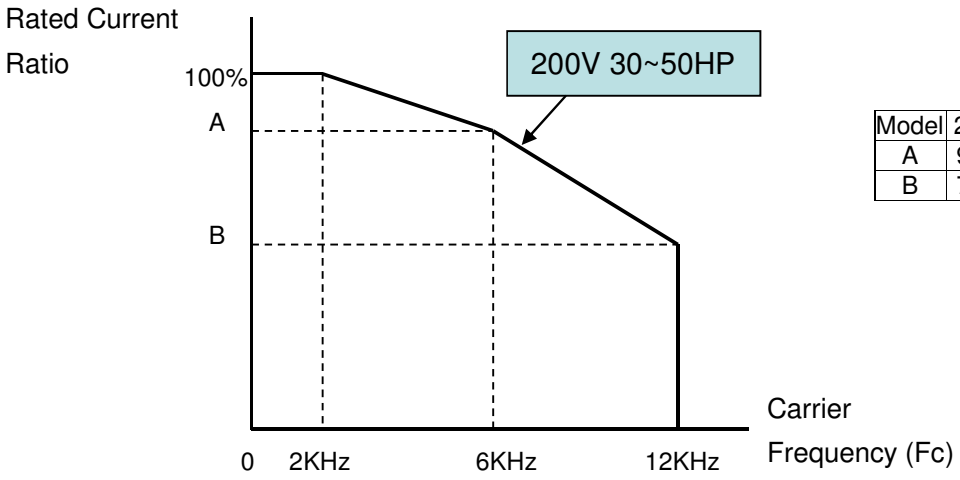
Note: De-rating curve current of carrier frequency means inverter rated current.

(a) 200V Models

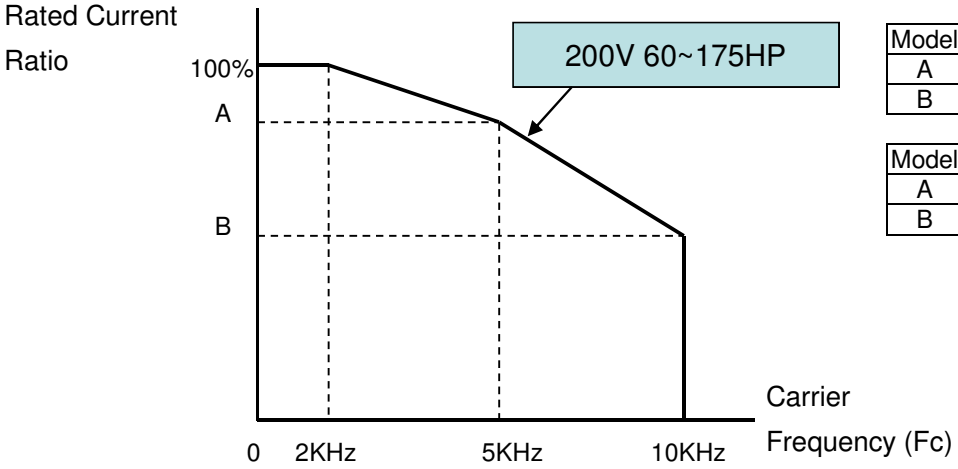


Model	2001	2002	2003	2005	2008
A	100%	67%	76%	76%	80%
B	80%	53%	60%	61%	68%

Model	2010	2015	2020	2025
A	83%	79%	84%	87%
B	67%	67%	67%	70%



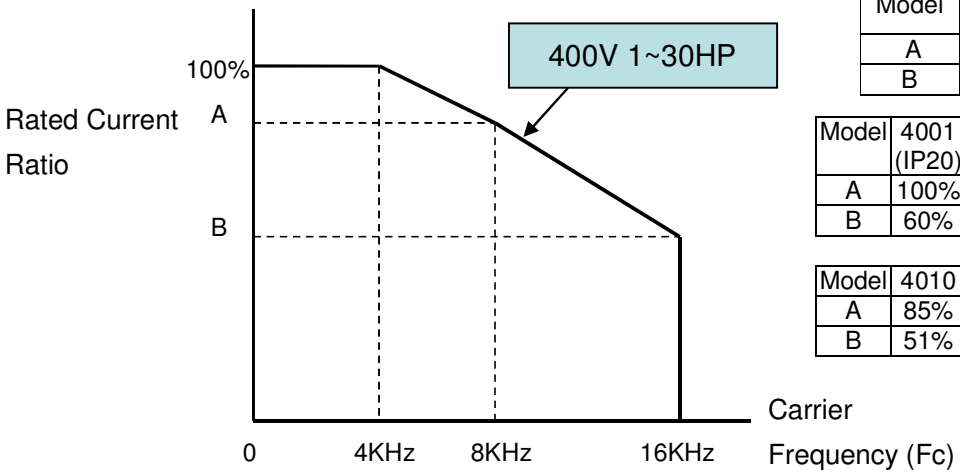
Model	2030	2040	2050
A	92%	77%	83%
B	74%	62%	67%



Model	2060	2075	2100
A	85%	90%	86%
B	68%	72%	69%

Model	2125	2150	2175
A	91%	87%	92%
B	73%	78%	83%

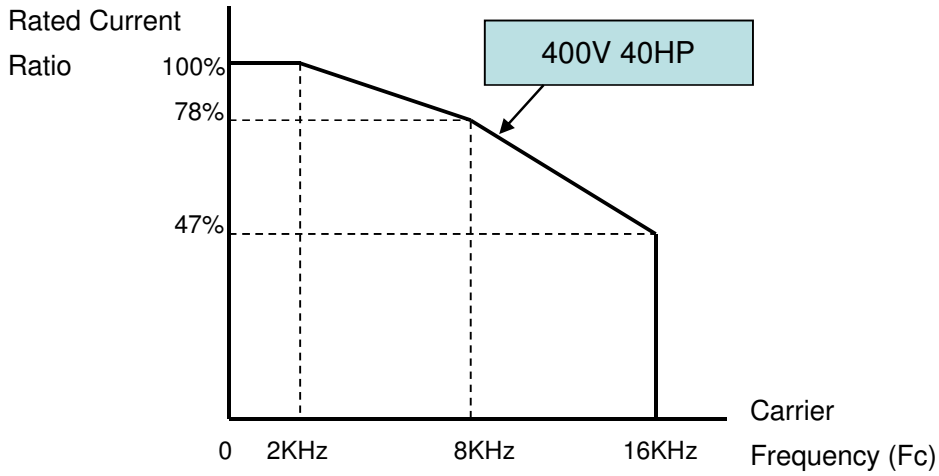
(b) 400V Models

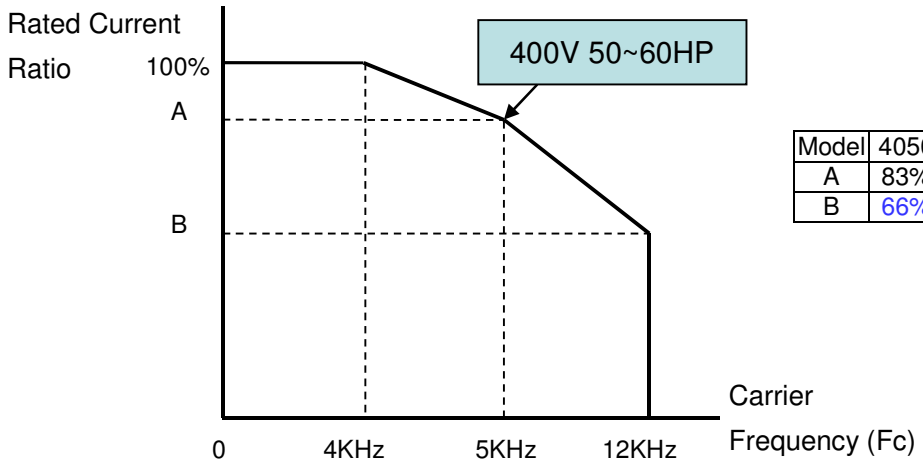


Model	4001 (IP55)	4002 (IP55)	4003 (IP55)
A	100%	100%	100%
B	60%	60%	60%

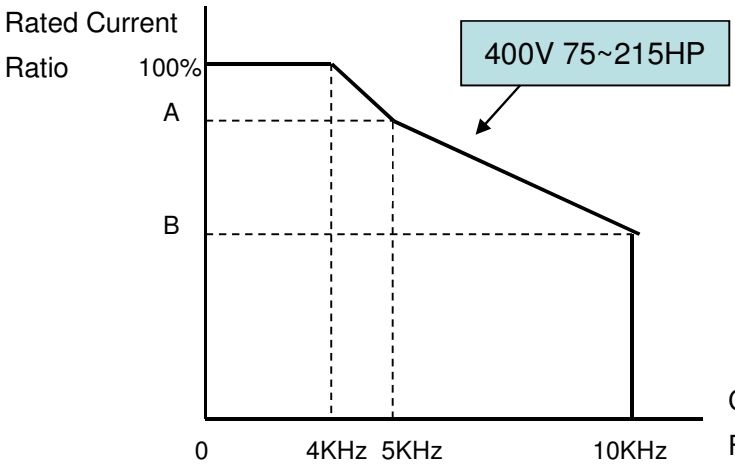
Model	4001 (IP20)	4002 (IP20)	4003 (IP20)	4005	4008
A	100%	83%	78%	100%	76%
B	60%	50%	47%	60%	46%

Model	4010	4015	4020	4025	4030
A	85%	78%	77%	82%	89%
B	51%	47%	46%	49%	53%



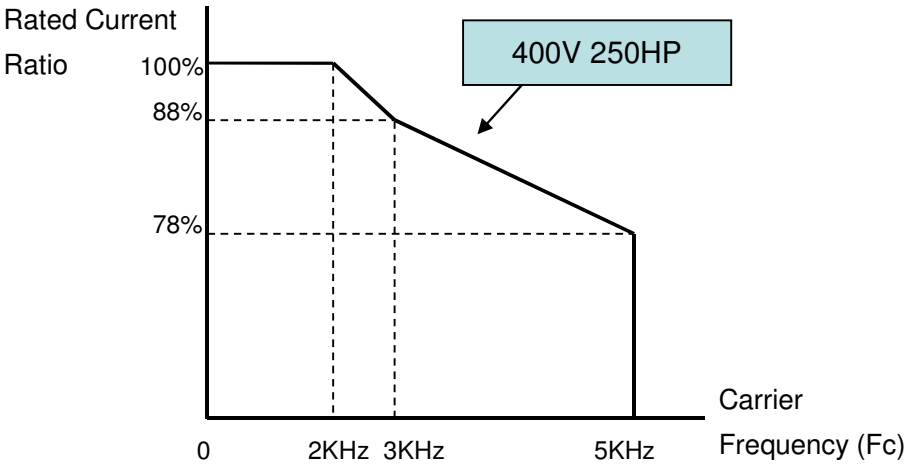


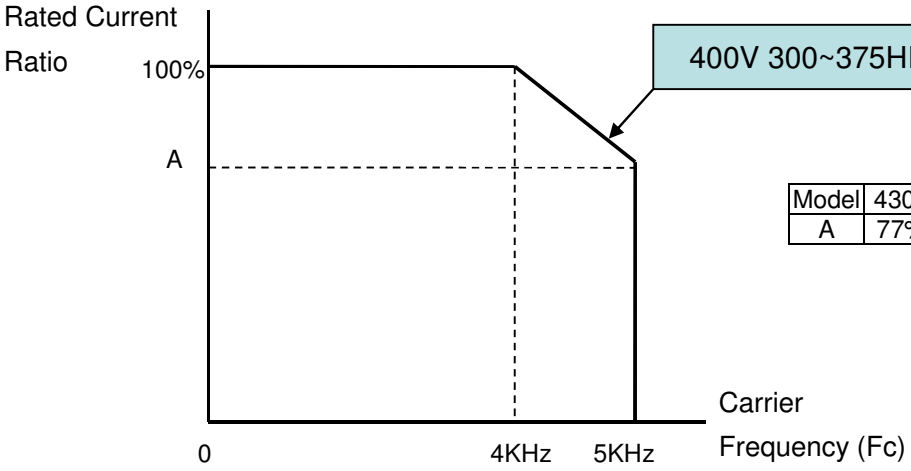
Model	4050	4060
A	83%	85%
B	66%	68%



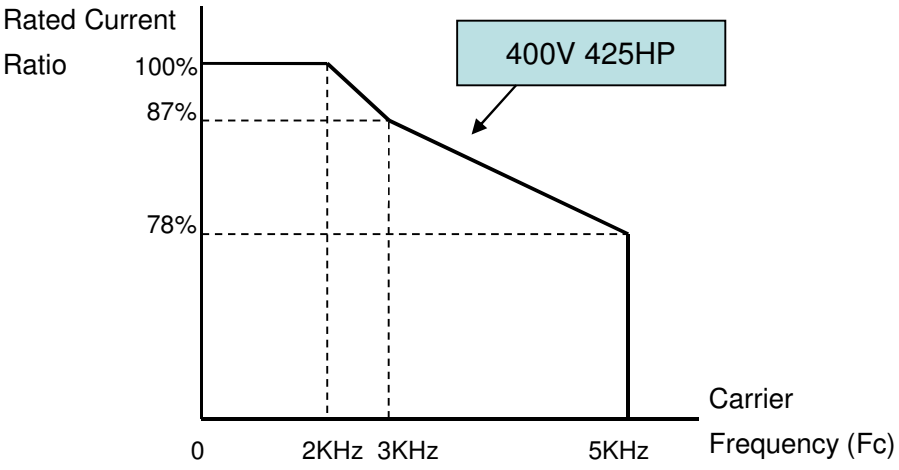
Model	4075	4100	4125
A	88%	81%	89%
B	62%	57%	63%

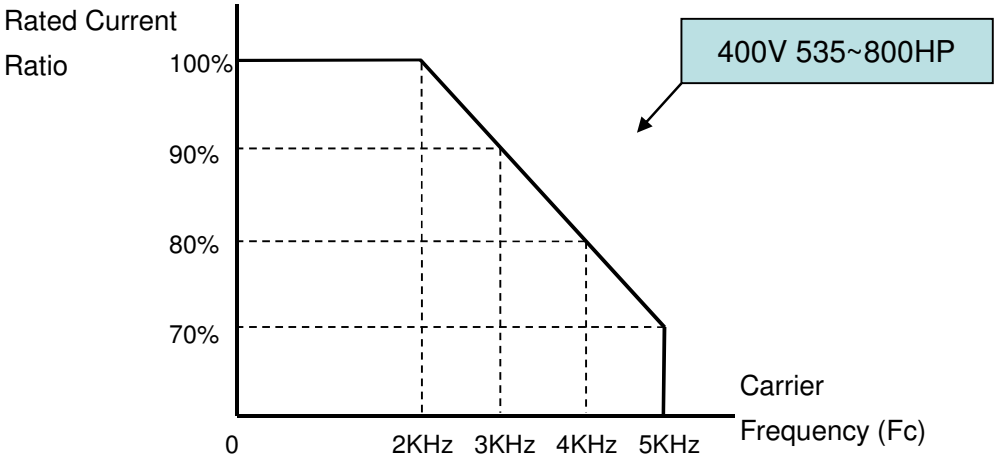
Model	4150	4175	4215
A	87%	86%	88%
B	61%	60%	61%



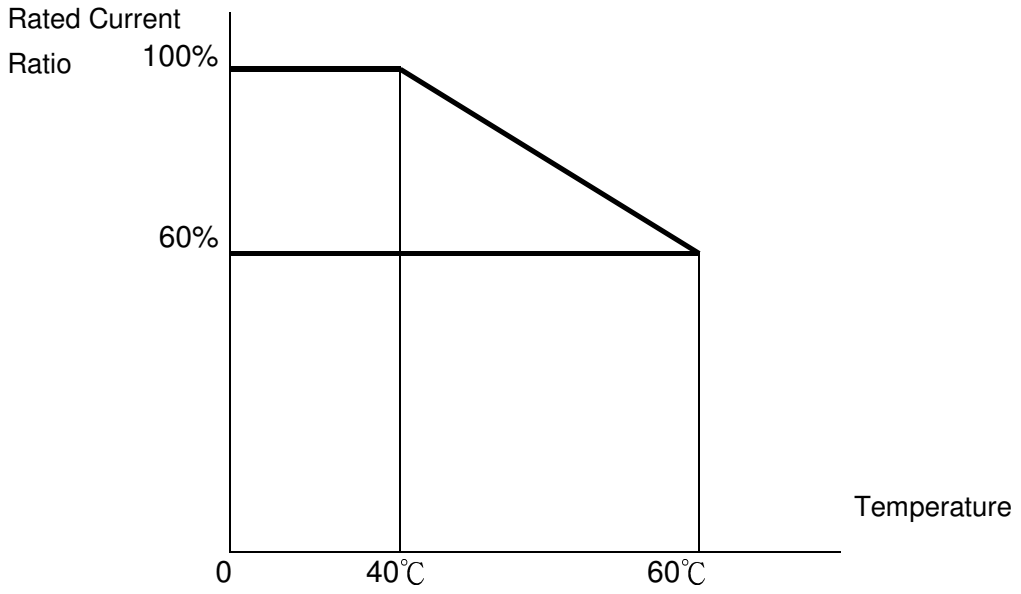


Model	4300	4375
A	77%	79%


Rated Current
Ratio
100%
87%
78%
400V 425HP
Carrier
Frequency (Fc)
0
2KHz
3KHz
5KHz


Rated Current
Ratio
100%
90%
80%
70%
400V 535~800HP
Carrier
Frequency (Fc)
0
2KHz
3KHz
4KHz
5KHz

3.6 Inverter De-rating Based on Temperature



Note: User needs to adjust the inverter rated current depending on ambient temperature to ensure the appropriate industrial application.

◆ Notes for using the PM motor

1. The inverter carry frequency (11-01) need to set upper than 6KHz.
2. The rating current of the inverter at 6KHz carry frequency (11-01) (need refer to the de-rating curve) must be bigger than the PM motor rating current.

◆ Capacitor reforming Guide after long storage

For correct performance of this product after long storage before use it is important that Inverter Capacitors are reformed according to the guide below:

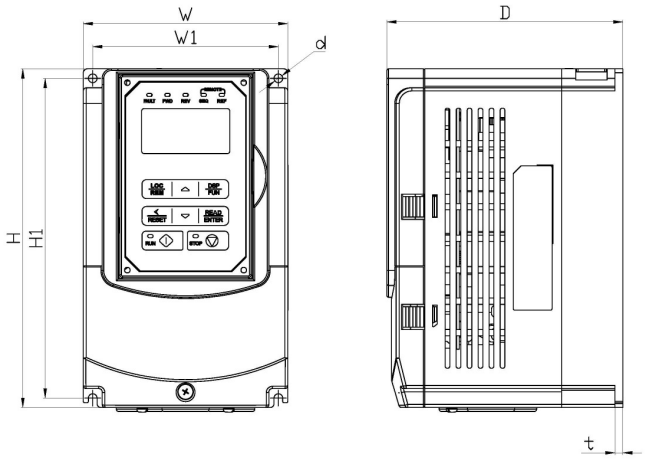
Storage time	Procedure to re-apply voltage
≦1year	Apply rated voltage(*1) of inverter in the normal way
Between 1-2 years	Apply rated voltage of inverter to the product for one hour
≧2 years	Use a variable AC power supply to 1. Connecting 25% of inverter rated voltage for 30 minutes. 2. Connecting 50% of inverter rated voltage for 30 minutes. 3. Connecting 75% of inverter rated voltage for 30 minutes. 4. Connecting 100% of inverter rated voltage for 210 minutes. Once the procedures completed, inverter just can be used normally.

*1：Rated voltage: please connects rated voltage according to model label of inverter.

3.7 Inverter Dimensions

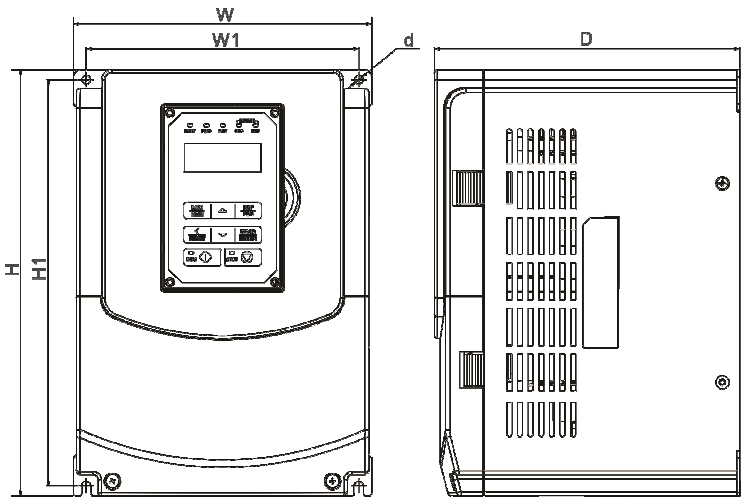
3.7.1 Standard Type (IP00/IP20)

(a) 200V: 1-7.5HP(U type) 1-10HP (UE type)/ 400V: 1-10HP



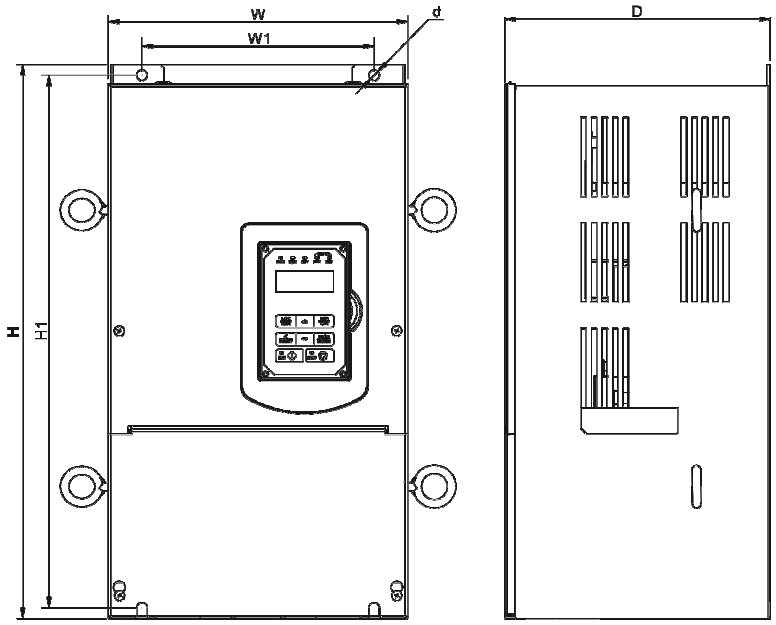
Inverter Model	Dimensions in mm (inch)							NW in kg(lbs)
	W	H	D	W1	H1	t	d	
F510-2001-C-UE	130 (5.12)	215 (8.46)	150 (5.91)	118 (4.65)	203 (7.99)	5 (0.20)	M5	2.2 (4.9)
F510-2002-C-UE	130 (5.12)	215 (8.46)	150 (5.91)	118 (4.65)	203 (7.99)	5 (0.20)	M5	2.2 (4.9)
F510-2003-C-UE	130 (5.12)	215 (8.46)	150 (5.91)	118 (4.65)	203 (7.99)	5 (0.20)	M5	2.2 (4.9)
F510-2005-C3-UE	140 (5.51)	279 (10.98)	177 (6.97)	122 (4.80)	267 (10.51)	7 (0.28)	M6	3.8 (8.4)
F510-2008-C3-UE	140 (5.51)	279 (10.98)	177 (6.97)	122 (4.80)	267 (10.51)	7 (0.28)	M6	3.8 (8.4)
F510-2010-C3-UE	140 (5.51)	279 (10.98)	177 (6.97)	122 (4.80)	267 (10.51)	7 (0.28)	M6	3.8 (8.4)
F510-4001-C3-UE	130 (5.12)	215 (8.46)	150 (5.91	118 (4.65)	203 (7.99)	5 (0.20)	M5	2.2 (4.9)
F510-4002-C3-UE	130 (5.12)	215 (8.46)	150 (5.91	118 (4.65)	203 (7.99)	5 (0.20)	M5	2.2 (4.9)
F510-4003-C3-UE	130 (5.12)	215 (8.46)	150 (5.91	118 (4.65)	203 (7.99)	5 (0.20)	M5	2.2 (4.9)
F510-4005-C3-UE	140 (5.51)	279 (10.98)	177 (6.97)	122 (4.80)	267 (10.51)	7 (0.28)	M6	3.8 (8.4)
F510-4008-C3-UE	140 (5.51)	279 (10.98)	177 (6.97)	122 (4.80)	267 (10.51)	7 (0.28)	M6	3.8 (8.4)
F510-4010-C3-UE	140 (5.51)	279 (10.98)	177 (6.97)	122 (4.80)	267 (10.51)	7 (0.28)	M6	3.8 (8.4)

(b) 200V: 10-30HP(U type) 15~30HP (UE type) / 400V: 15-40HP



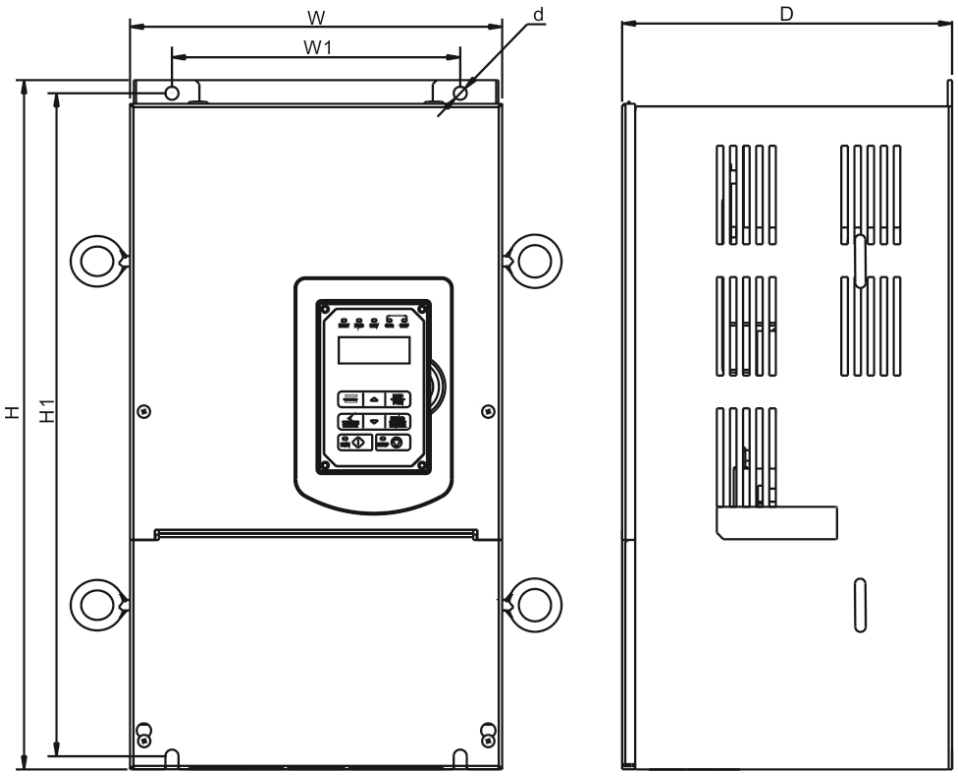
Inverter Model	Dimensions in mm (inch)							NW in kg(lbs)
	W	H	D	W1	H1	t	d	
F510-2010-C3-U	210 (8.27)	300 (11.81)	215 (8.46)	192 (7.56)	286 (11.26)	1.6 (0.06)	M6	6.2 (13.67)
F510-2015-C3-UE	210 (8.27)	300 (11.81)	215 (8.46)	192 (7.56)	286 (11.26)	1.6 (0.06)	M6	6.2 (13.67)
F510-2020-C3-UE	265 (10.43)	360 (14.17)	225 (8.86)	245 (9.65)	340 (13.39)	1.6 (0.06)	M8	10 (22.05)
F510-2025-C3-UE	265 (10.43)	360 (14.17)	225 (8.86)	245 (9.65)	340 (13.39)	1.6 (0.06)	M8	10 (22.05)
F510-2030-C3-UE	265 (10.43)	360 (14.17)	225 (8.86)	245 (9.65)	340 (13.39)	1.6 (0.06)	M8	10 (22.05)
F510-4015-C3-UE	210 (8.27)	300 (11.81)	215 (8.46)	192 (7.56)	286 (11.26)	1.6 (0.06)	M6	6.2 (13.67)
F510-4020-C3-UE	210 (8.27)	300 (11.81)	215 (8.46)	192 (7.56)	286 (11.26)	1.6 (0.06)	M6	6.2 (13.67)
F510-4025-C3-UE	210 (8.27)	300 (11.81)	215 (8.46)	192 (7.56)	286 (11.26)	1.6 (0.06)	M6	6.2 (13.67)
F510-4025-C3-U	265 (10.43)	360 (14.17)	225 (8.86)	245 (9.65)	340 (13.39)	1.6 (0.06)	M8	10 (22.05)
F510-4030-C3-UE	265 (10.43)	360 (14.17)	225 (8.86)	245 (9.65)	340 (13.39)	1.6 (0.06)	M8	10 (22.05)
F510-4040-C3-UE	265 (10.43)	360 (14.17)	225 (8.86)	245 (9.65)	340 (13.39)	1.6 (0.06)	M8	10 (22.05)

(c) 200V: 40-50HP/ 400V: 50-75HP (U type) 50~100HP (UE type)



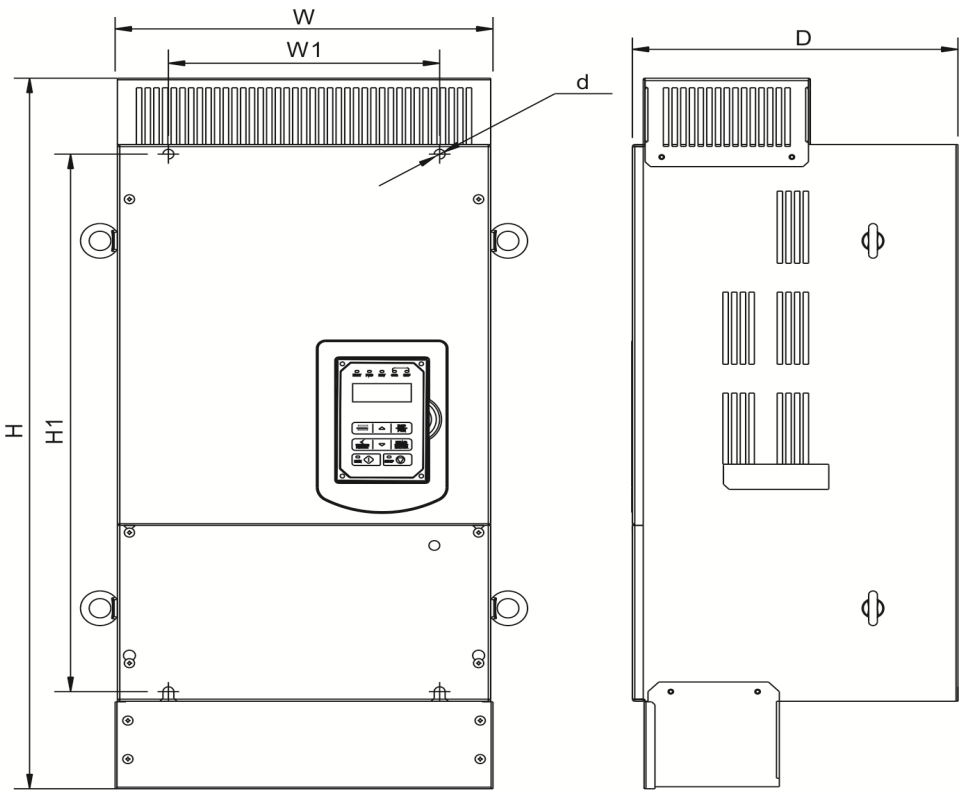
Inverter Model	Dimensions in mm (inch)							NW in kg(lbs)
	W	H	D	W1	H1	t	d	
F510-2040-C3-U	286.5 (11.28)	525 (20.67)	252 (9.92)	220 (8.66)	505 (19.88)	3.3 (0.13)	M8	24 (52.91)
F510-2050-C3-U	286.5 (11.28)	525 (20.67)	252 (9.92)	220 (8.66)	505 (19.88)	3.3 (0.13)	M8	24 (52.91)
F510-4050-C3-U	286.5 (11.28)	525 (20.67)	252 (9.92)	220 (8.66)	505 (19.88)	3.3 (0.13)	M8	24 (52.91)
F510-4060-C3-U	286.5 (11.28)	525 (20.67)	252 (9.92)	220 (8.66)	505 (19.88)	3.3 (0.13)	M8	24 (52.91)
F510-4075-C3-U	286.5 (11.28)	525 (20.67)	252 (9.92)	220 (8.66)	505 (19.88)	3.3 (0.13)	M8	24 (52.91)
F510-2040-C3-UE	286.5 (11.28)	525 (20.67)	272 (10.71)	220 (8.66)	505 (19.88)	3.3 (0.13)	M8	24 (52.91)
F510-2050-C3-UE	286.5 (11.28)	525 (20.67)	272 (10.71)	220 (8.66)	505 (19.88)	3.3 (0.13)	M8	24 (52.91)
F510-4050-C3-UE	286.5 (11.28)	525 (20.67)	272 (10.71)	220 (8.66)	505 (19.88)	3.3 (0.13)	M8	24 (52.91)
F510-4060-C3-UE	286.5 (11.28)	525 (20.67)	272 (10.71)	220 (8.66)	505 (19.88)	3.3 (0.13)	M8	24 (52.91)
F510-4075-C3-UE	286.5 (11.28)	525 (20.67)	272 (10.71)	220 (8.66)	505 (19.88)	3.3 (0.13)	M8	24 (52.91)
F510-4100-C3-UE	286.5 (11.28)	525 (20.67)	272 (10.71)	220 (8.66)	505 (19.88)	3.3 (0.13)	M8	24 (52.91)

(d) 200V: 60-125HP/ 400V: 100-250HP (U type) 125~250HP (UE type) (IP00)



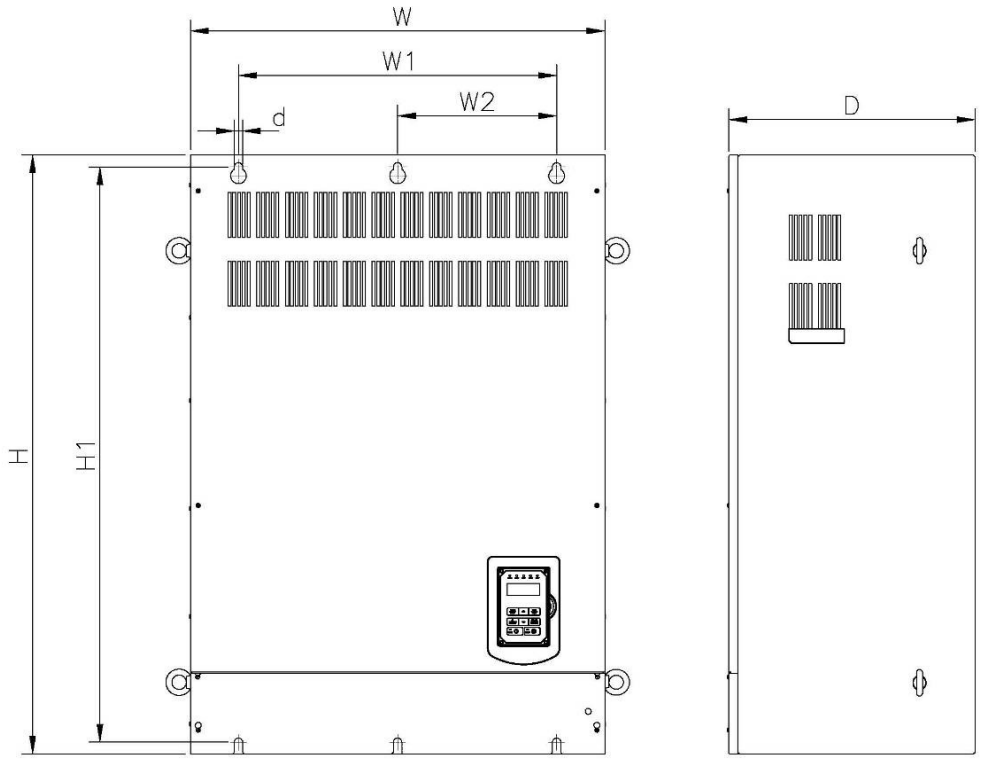
Inverter Model	Dimensions in mm (inch)							NW in kg(lbs)
	W	H	D	W1	H1	t	d	
F510-2060-C3-UE	344 (13.54)	580 (22.83)	300 (11.81)	250 (9.84)	560 (22.05)	1.6 (0.06)	M8	40 (88.18)
F510-2075-C3-UE	344 (13.54)	580 (22.83)	300 (11.81)	250 (9.84)	560 (22.05)	1.6 (0.06)	M8	40 (88.18)
F510-2100-C3-UE	459 (18.07)	790 (31.10)	324.5 (12.78)	320 (12.60)	760 (29.92)	1.6 (0.06)	M10	74 (163.14)
F510-2125-C3-UE	459 (18.07)	790 (31.10)	324.5 (12.78)	320 (12.60)	760 (29.92)	1.6 (0.06)	M10	74 (163.14)
F510-4100-C3-U	344 (13.54)	580 (22.83)	300 (11.81)	250 (9.84)	560 (22.05)	1.6 (0.06)	M8	40 (88.18)
F510-4125-C3-UE	344 (13.54)	580 (22.83)	300 (11.81)	250 (9.84)	560 (22.05)	1.6 (0.06)	M8	40 (88.18)
F510-4150-C3-UE	344 (13.54)	580 (22.83)	300 (11.81)	250 (9.84)	560 (22.05)	1.6 (0.06)	M8	40 (88.18)
F510-4150-C3-U	459 (18.07)	790 (31.10)	324.5 (12.78)	320 (12.60)	760 (29.92)	1.6 (0.06)	M10	74 (163.14)
F510-4175-C3-UE	459 (18.07)	790 (31.10)	324.5 (12.78)	320 (12.60)	760 (29.92)	1.6 (0.06)	M10	74 (163.14)
F510-4215-C3-UE	459 (18.07)	790 (31.10)	324.5 (12.78)	320 (12.60)	760 (29.92)	1.6 (0.06)	M10	74 (163.14)
F510-4250-C3-UE	459 (18.07)	790 (31.10)	324.5 (12.78)	320 (12.60)	760 (29.92)	1.6 (0.06)	M10	74 (163.14)

(e) 200V: 60-125HP/ 400V: 100-250HP (U type) 125~250HP (UE type) (IP20)



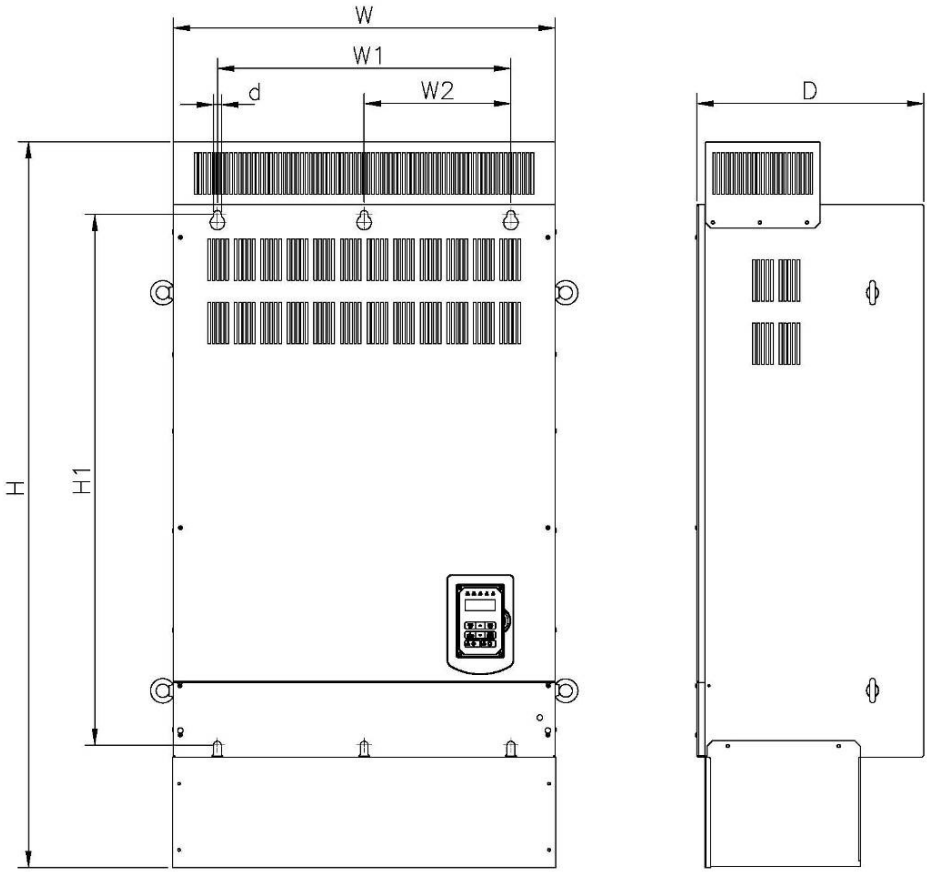
Inverter Model	Dimensions in mm (inch)							NW in kg(lbs)
	W	H	D	W1	H1	t	d	
F510-2060-C3-UE	348.5 (13.72)	740 (29.13)	300 (11.81)	250 (9.84)	560 (22.05)	1.6 (0.06)	M8	44 (97.00)
F510-2075-C3-UE	348.5 (13.72)	740 (29.13)	300 (11.81)	250 (9.84)	560 (22.05)	1.6 (0.06)	M8	44 (97.00)
F510-2100-C3-UE	463.5 (18.25)	1105 (43.50)	324.5 (12.78)	320 (12.60)	760 (29.92)	1.6 (0.06)	M10	81 (178.57)
F510-2125-C3-UE	463.5 (18.25)	1105 (43.50)	324.5 (12.78)	320 (12.60)	760 (29.92)	1.6 (0.06)	M10	81 (178.57)
F510-4100-C3-U	348.5 (13.72)	740 (29.13)	300 (11.81)	250 (9.84)	560 (22.05)	1.6 (0.06)	M8	44 (97.00)
F510-4125-C3-UE	348.5 (13.72)	740 (29.13)	300 (11.81)	250 (9.84)	560 (22.05)	1.6 (0.06)	M8	44 (97.00)
F510-4150-C3-UE	348.5 (13.72)	740 (29.13)	300 (11.81)	250 (9.84)	560 (22.05)	1.6 (0.06)	M8	44 (97.00)
F510-4150-C3-U	463.5 (18.25)	1105 (43.50)	324.5 (12.78)	320 (12.60)	760 (29.92)	1.6 (0.06)	M10	81 (178.57)
F510-4175-C3-UE	463.5 (18.25)	1105 (43.50)	324.5 (12.78)	320 (12.60)	760 (29.92)	1.6 (0.06)	M10	81 (178.57)
F510-4215-C3-UE	463.5 (18.25)	1105 (43.50)	324.5 (12.78)	320 (12.60)	760 (29.92)	1.6 (0.06)	M10	81 (178.57)
F510-4250-C3-UE	463.5 (18.25)	1105 (43.50)	324.5 (12.78)	320 (12.60)	760 (29.92)	1.6 (0.06)	M10	81 (178.57)

(f) 200V: 150-175HP/ 400V: 300-425HP (IP00)



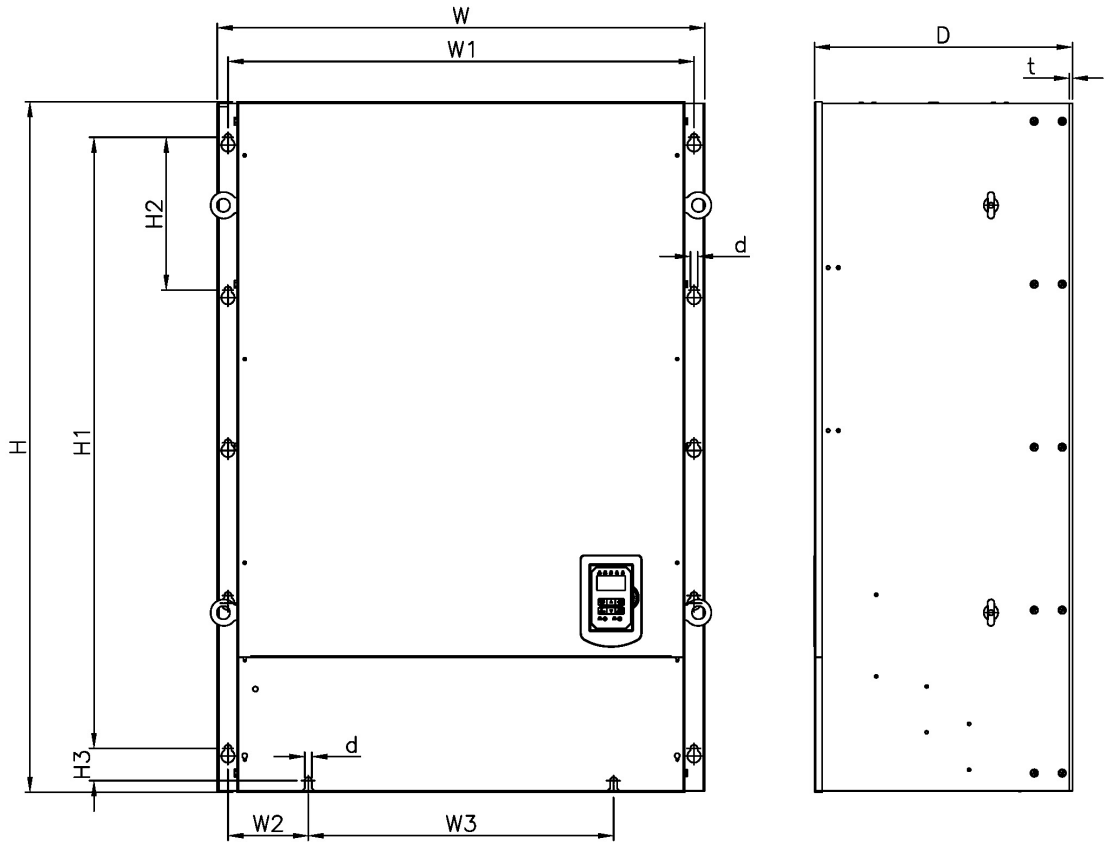
Inverter Model	Dimensions in mm (inch)								NW in kg(lbs)
	W	H	D	W1	W2	H1	t	d	
F510-2150-C3-UE	692 (27.24)	1000 (39.37)	410 (16.14)	530 (20.87)	265 (10.43)	960 (37.80)	1.6 (0.06)	M12	184 (405.65)
F510-2175-C3-UE	690 (27.17)	1000 (39.37)	410 (16.14)	530 (20.87)	265 (10.43)	960 (37.80)	1.6 (0.06)	M12	184 (405.65)
F510-4300-C3-UE	690 (27.17)	1000 (39.37)	410 (16.14)	530 (20.87)	265 (10.43)	960 (37.80)	1.6 (0.06)	M12	184 (405.65)
F510-4375-C3-UE	690 (27.17)	1000 (39.37)	410 (16.14)	530 (20.87)	265 (10.43)	960 (37.80)	1.6 (0.06)	M12	184 (405.65)
F510-4425-C3-UE	690 (27.17)	1000 (39.37)	410 (16.14)	530 (20.87)	265 (10.43)	960 (37.80)	1.6 (0.06)	M12	184 (405.65)

(g) 200V: 150-175HP/ 400V: 300-425HP (IP20)



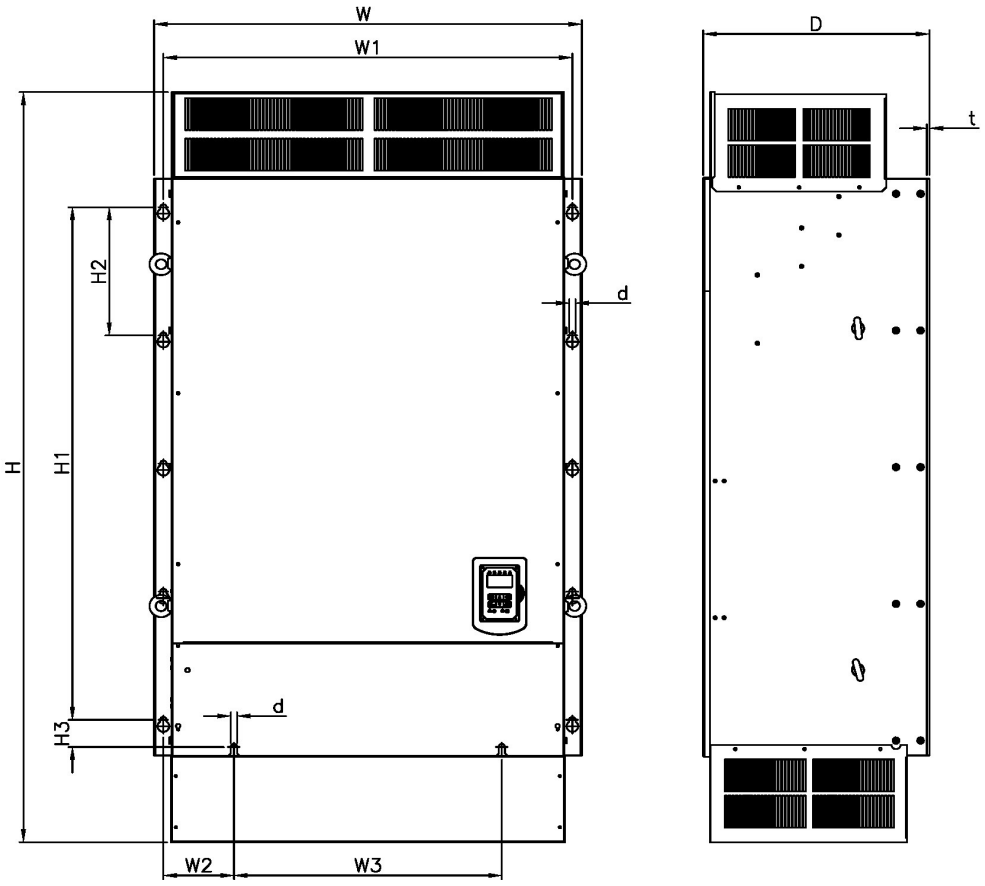
Inverter Model	Dimensions in mm (inch)								NW in kg(lbs)
	W	H	D	W1	W2	H1	t	d	
F510-2150-C3-UE	692 (27.24)	1313 (51.69)	410 (16.14)	530 (20.87)	265 (10.43)	960 (37.80)	1.6 (0.06)	M12	194 (427.70)
F510-2175-C3-UE	692 (27.24)	1313 (51.69)	410 (16.14)	530 (20.87)	265 (10.43)	960 (37.80)	1.6 (0.06)	M12	194 (427.70)
F510-4300-C3-UE	692 (27.24)	1313 (51.69)	410 (16.14)	530 (20.87)	265 (10.43)	960 (37.80)	1.6 (0.06)	M12	194 (427.70)
F510-4375-C3-UE	692 (27.24)	1313 (51.69)	410 (16.14)	530 (20.87)	265 (10.43)	960 (37.80)	1.6 (0.06)	M12	194 (427.70)
F510-4425-C3-UE	692 (27.24)	1313 (51.69)	410 (16.14)	530 (20.87)	265 (10.43)	960 (37.80)	1.6 (0.06)	M12	194 (427.70)

(h) 400V: 535-800HP (IP00)



Inverter Model	Dimensions in mm (inch)											NW in kg(lbs)
	W	H	D	W1	W2	W3	H1	H2	H3	t	d	
F510-4535-C3-UE	958 (37.72)	1356 (53.38)	507 (19.96)	916 (36.06)	158 (6.22)	600 (23.62)	1200 (47.24)	300 (11.81)	63.5 (2.50)	6.2 (0.24)	M12	335 (739)
F510-4670-C3-UE	958 (37.72)	1356 (53.38)	507 (19.96)	916 (36.06)	158 (6.22)	600 (23.62)	1200 (47.24)	300 (11.81)	63.5 (2.50)	6.2 (0.24)	M12	335 (739)
F510-4800-C3-UE	958 (37.72)	1356 (53.38)	507 (19.96)	916 (36.06)	158 (6.22)	600 (23.62)	1200 (47.24)	300 (11.81)	63.5 (2.50)	6.2 (0.24)	M12	335 (739)

(i) 400V: 535-800HP (IP20)

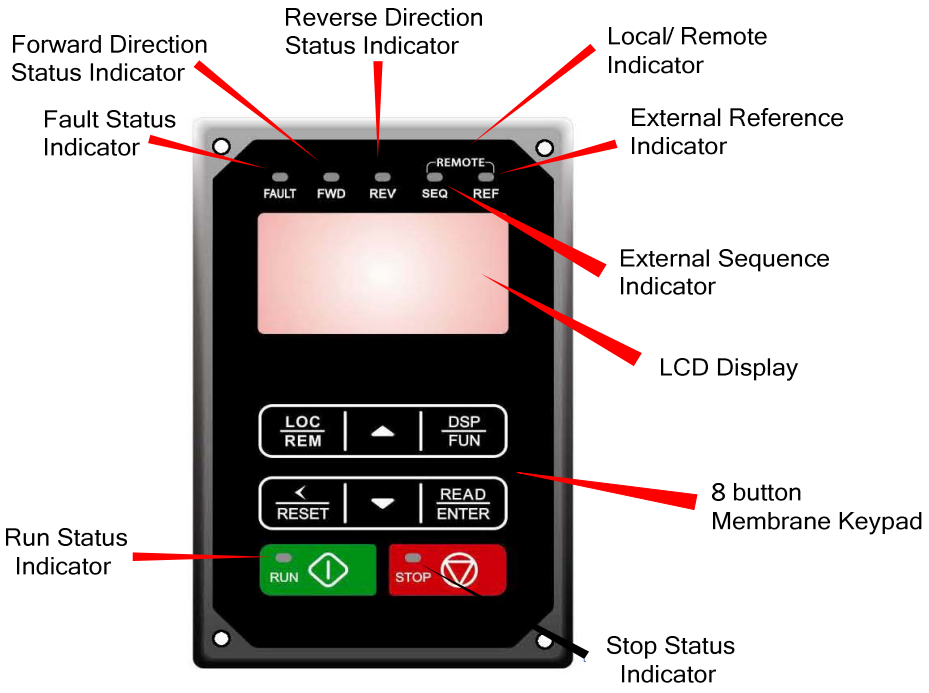


Inverter Model	Dimensions in mm (inch)											NW in kg(lbs)
	W	H	D	W1	W2	W3	H1	H2	H3	t	d	
F510-4535-C3-UE	958 (37.72)	1756 (69.13)	507 (19.96)	916 (36.06)	158 (6.22)	600 (23.62)	1200 (47.24)	300 (11.81)	63.5 (2.50)	6.2 (0.24)	M12	350 (772)
F510-4670-C3-UE	958 (37.72)	1756 (69.13)	507 (19.96)	916 (36.06)	158 (6.22)	600 (23.62)	1200 (47.24)	300 (11.81)	63.5 (2.50)	6.2 (0.24)	M12	350 (772)
F510-4800-C3-UE	958 (37.72)	1756 (69.13)	507 (19.96)	916 (36.06)	158 (6.22)	600 (23.62)	1200 (47.24)	300 (11.81)	63.5 (2.50)	6.2 (0.24)	M12	350 (772)

Chapter 4 Keypad and Programming Functions

4.1 LCD keypad

4.1.1 Keypad Display and Keys



DISPLAY	Description
LCD Display	Monitor inverter signals, view / edit parameters, fault / alarm display.
LED INDICATORS	
FAULT	LED **ON** when a fault or alarm is active.
FWD	LED **ON** when inverter is running in forward direction, flashing when stopping.
REV	LED **On** when inverter is running in reverse direction, flashing when stopping.
SEQ	LED **ON** when RUN command is from the external control terminals or from serial communication.
REF	LED **ON** when Frequency Reference command is from the external control terminals or from serial communication.

KEYS (8)	Description
RUN	RUN inverter
STOP	STOP inverter
▲	Parameter navigation Up, Increase parameter or reference value
▼	Parameter navigation down, decrease parameter or reference value
LOC/REM	Used to switch between Local Mode and Remote Mode REMOTE Mode: Set by parameters, controlled by control circuit terminals, communication or other ways. LOCAL Mode: Controlled by operator. It displays REMOTE Mode at power-up. Users can switch between LOCAL and REMOTE Mode if they press LOC/ REM keys when the inverter stops. Parameter of 23-41 can determine if LOC/REM keys are enabled or not.
DSP/FUN	Used to scroll to next screen Frequency screen→Function selection→Monitor parameter
◄ / **RESET**	Selects active seven segment digit for editing with the ▲▼ keys Used to reset fault condition.
READ / **ENTER**	Used to read and save the value of the active parameter.

Auto-Repeat Keys

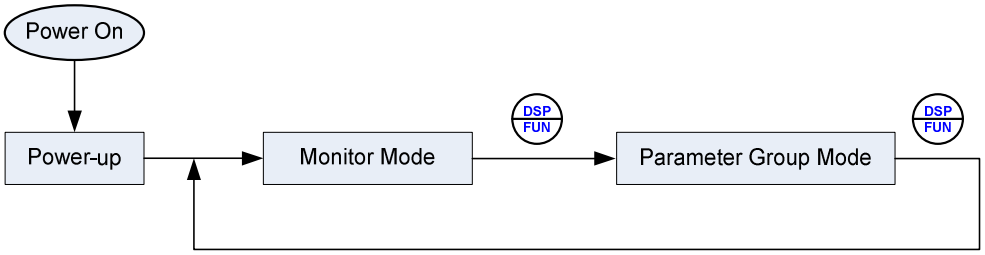
Holding the ▲UP or ▼DOWN key for a longer period of time will initiate the auto-repeat function resulting in the value of the selected digit to automatically increase or decrease.

Note: HOA LCD keypad is available with an optional accessory.

4.1.2 Keypad Menu Structure

◆ **Main Menu**

The F510 inverter main menu consists of two main groups (modes). The DSP/FUN key is used to switch between the monitor mode and the parameter group mode. Refer to Figure 4.2.2.1.



Mode	Description
Monitor Mode	View inverter status, signals and fault data.
Parameter Group Mode	Access to available parameter groups.

All the available parameter groups are listed in the Parameter Group Mode. Use the up and down keys to select a group and press READ/ ENTER to access its parameters.

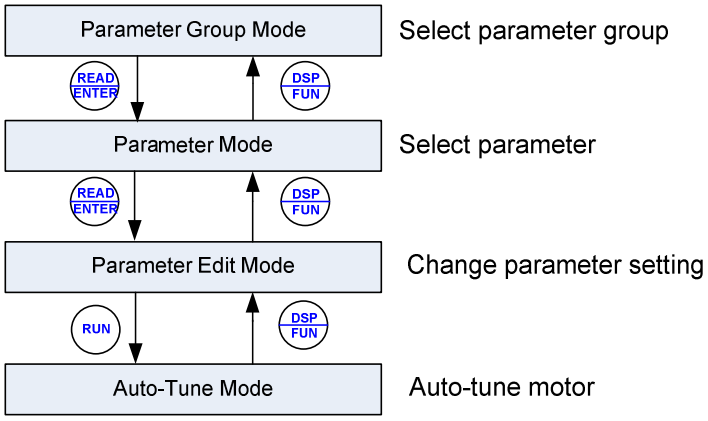


Fig. 4.1.2.1 Parameter Group Structure

Notes:

- Always perform auto-tune on the motor before operating the inverter in vector control (sensorless vector or flux vector). Auto-tuning mode will not be displayed when the inverter is running or when a fault is active.

- To scroll through the available modes, parameter groups or parameter list press and hold the up or down key.

◆ **Monitor Mode**

In monitor mode inverter signals can be monitored such as output frequency, output current and output voltage, etc…) as well as fault information and fault trace. See Fig 4.2.2.2 for keypad navigation.

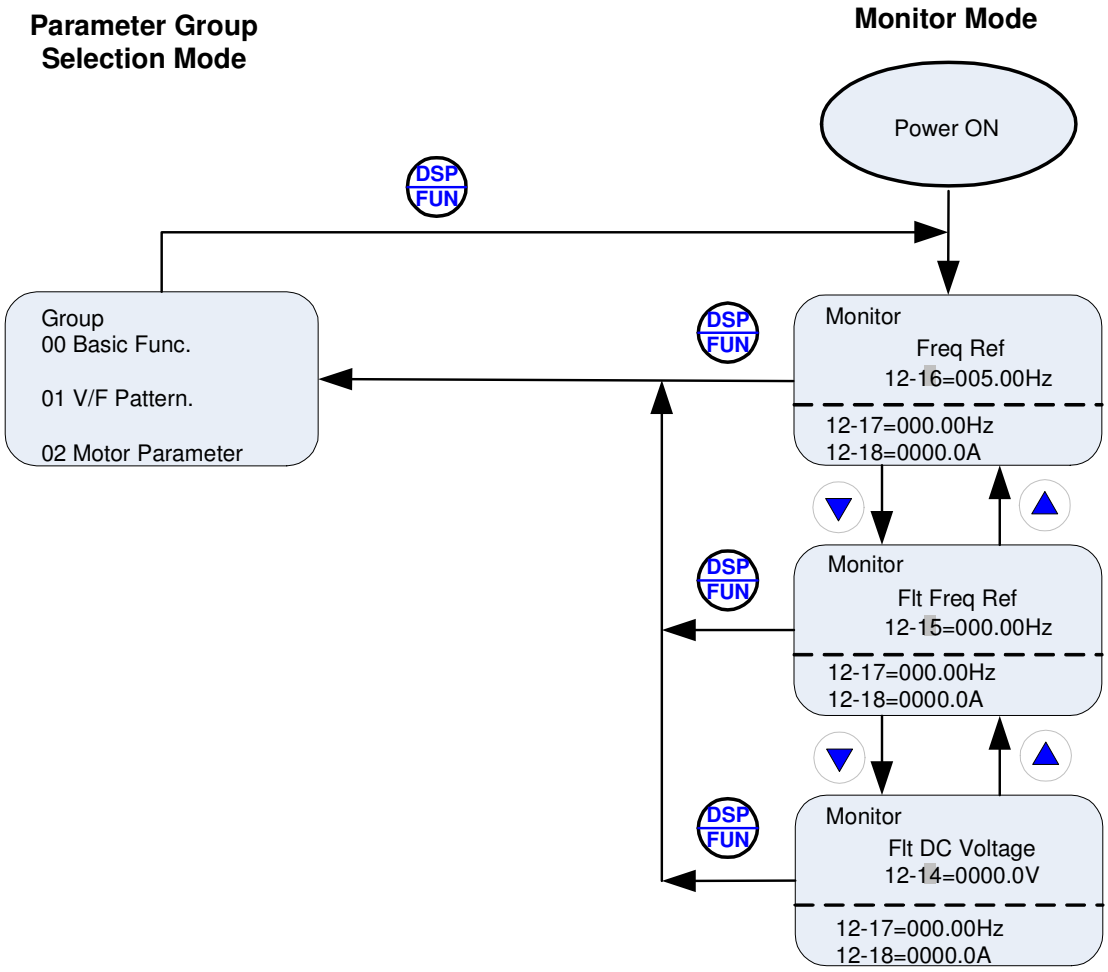


Fig 4.1.2.2 Monitor Mode

◆ Programming Mode

In programming mode inverter parameters can be read or changed. See Fig 4.1.2.3 for keypad navigation.

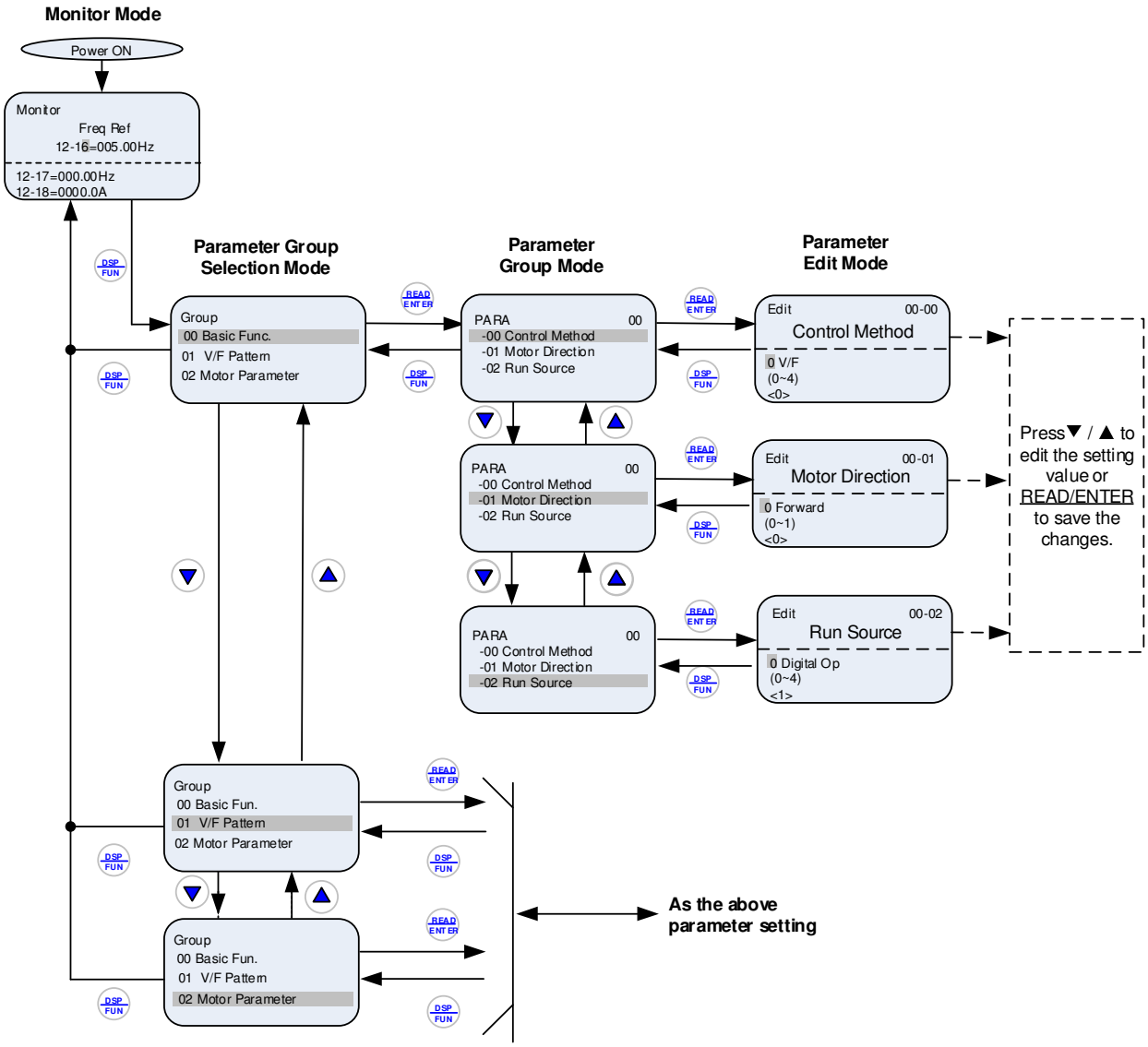


Fig 4.1.2.3 Programming Mode

Notes:

- **The parameters values can be changed from the data set/read screen with the ▲ (up) or ▼ (down) and < / RESET shift key.**
- **To save a parameter press the READ/ENTER key. Return to the previous sub-menu screen press DSP/FUN key.**
- **Press the ▲ (up) or ▼ (down) key to scroll parameter groups or parameter list. When pressing DSP/FUN in the parameter edit mode, it will return to the previous screen of parameter group mode; when pressing DSP/FUN in the parameter group mode, it will return to the previous screen of parameter group selection mode.**
- **Refer to section 4.4 for parameter details.**

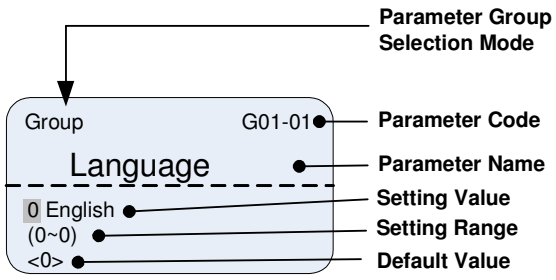


Fig 4.1.2.4 Parameter Group Selection Mode Screen

4.2 Parameters

Parameter Group	Name
Group 00	Basic Parameters
Group 01	V/F Control Parameters
Group 02	IM Motor Parameters
Group 03	External Digital Input and Output Parameters
Group 04	External Analog Input and Output Parameters
Group 05	Multi-Speed Parameters
Group 06	Automatic Program Operation Parameters
Group 07	Start/ Stop Parameters
Group 08	Protection Parameters
Group 09	Communication Parameters
Group 10	PID Parameters
Group 11	Auxiliary Parameters
Group 12	Monitoring Parameters
Group 13	Maintenance Parameters
Group 14	PLC Setting Parameters
Group 15	PLC Monitoring Parameters
Group 16	LCD Parameters
Group 17	IM Motor Automatic Tuning Parameters
Group 18	Slip Compensation Parameters
Group 19	Reserved
Group 20	Speed Control Parameters
Group 21	Torque Control Parameters
Group 22	PM Motor Parameters
Group 23	Pump & HVAC
Group 24	1 to 8 Pump Card Function Group

Parameter Attribute		
*1	Parameters can be changed during run operation	Note1: New added or modified parameters in software V1.02 Note2: New added or modified parameters in software V1.10 Note3: New added or modified parameters in software V1.10 Note4: New added or modified parameters in software V1.11 Note5: New added or modified parameters in software V1.11 Note6: New added or modified parameters in software V1.11 Note7: Parameter edit available for software V1.11 above Note8: New added or modified parameters in software V1.12
*2	Read-only parameters for communication	
*3	Parameter will not reset to default during a factory reset	
*4	Read-only parameter	
*5	Only displayed in using LED keypad	
*6 *7	Modified(*6) and New added (*7) parameters in software V1.02	
*8	The value will be modified depend on the setting of 13-08	
*9	For enhanced UE type only	
*10	Only available after I/O expansion card installed	

Group 00 Basic Parameters								
Code	Parameter Name	Setting Range	Default	Unit	Control Mode			Attribute
					V/F	SLV	PM SLV	
00-00	Control Mode Selection	0: V/F 1: Reserved 2: SLV 3~4: Reserved 5: PM SLV	0	-	O	O	O	*3
00-01	Motor's Rotation Direction	0: Forward 1: Reverse	0	-	O	O	O	*1
00-02	Main Run Command Source Selection	0: Keypad 1: External Terminal (Control Circuit) 2: Communication Control (RS-485) 3: PLC 4: RTC	0	-	O	O	O	
00-03	Alternative Run Command Source Selection	0: Keypad 1: External Terminal (Control Circuit) 2: Communication Control (RS-485) 3: PLC 4: RTC	2	-	O	O	O	
00-04	Language Selection (for LCD only)	0: English 1: Simple Chinese 2: Traditional Chinese 3: Turkish	0	-	O	O	O	
00-05	Main Frequency Command Source Selection	0: Keypad 1: External Terminal (Analog AI1) 2: Terminal Command UP/ DOWN 3: Communication Control (RS-485) 4: Reserved 5: Reserved 6: RTC 7. AI2 Auxiliary Frequency *7	0	-	O	O	O	
00-06	Alternative Frequency Command Source Selection	0: Keypad 1: External Terminal (Analog) 2: Terminal Command UP/ DOWN 3: Communication Control (RS-485) 4: Reserved 5: Reserved 6: RTC 7. AI2 Auxiliary Frequency *7	3	-	O	O	O	
00-07	Main and Alternative Frequency Command Modes	0: Main Frequency 1: Main Frequency + Alternative Frequency	0	-	O	O	O	
00-08	Communication Frequency Command Range	0.00-599.00 (Note8)	0.00	Hz	O	O	O	
00-09	Communication Frequency Command Memory Selection	0: Do not save when power is off. 1: Save when power is off.	0	-	O	O	O	

Group 00 Basic Parameters								
Code	Parameter Name	Setting Range	Default	Unit	Control Mode			Attribute
					V/F	SLV	PM SLV	
00-10	Minimum frequency detection	0: Show warning if lower than minimum frequency 1: Run as minimum frequency if lower than minimum frequency	0	-	O	O	O	Note2
00-11	Selection of PID Lower Limit Frequency	0: PID is bound to lower limit frequency when inverter sleeps. 1: PID is bound to 0Hz when inverter sleeps.	0	-	O	O	O	Note1
00-12	Upper Limit Frequency	0.1~109.0	100.0	%	O	O	O	
00-13	Lower Limit Frequency	0.0~109.0	0.0	%	O	O	O	
00-14	Acceleration Time 1	0.1~6000.0	-	s	O	O	O	*1
00-15	Deceleration Time 1	0.1~6000.0	-	s	O	O	O	*1
00-16	Acceleration Time 2	0.1~6000.0	-	s	O	O	O	*1
00-17	Deceleration Time 2	0.1~6000.0	-	s	O	O	O	*1
00-18	Jog Frequency	0.00~599.00 (Note8)	6.00	Hz	O	O	O	*1
00-19	Jog Acceleration Time	0.1~0600.0	-	s	O	O	O	*1
00-20	Jog Deceleration Time	0.1~0600.0	-	s	O	O	O	*1
00-21	Acceleration Time 3	0.1~6000.0	-	s	O	O	O	*1
00-22	Deceleration Time 3	0.1~6000.0	-	s	O	O	O	*1
00-23	Acceleration Time 4	0.1~6000.0	-	s	O	O	O	*1
00-24	Deceleration Time 4	0.1~6000.0	-	s	O	O	O	*1
00-25	Switch-Over Frequency of Acc/Dec Time 1 and Time 4	0.0~599.00 (Note8)	0.0	Hz	O	O	O	
00-26	Emergency Stop Time	0.1~6000.0	5.0	s	O	O	O	
00-27	Reserved							
00-28	Main Frequency Command Characteristic Selection	0: Positive Characteristic (0~10V/4~20mA is corresponding to 0~100%) 1: Negative Characteristic (0~10V/4~20mA is corresponding to 100~0%)	0	-	O	O	O	
00-29 ~ 00-31	Reserved							
00-32	Application Selection Presets	0: General 1: Water Supply Pump 2: Conveyor *7 3: Exhaust fan 4: HVAC 5: Compressor *7 6: Reserved 7: Reserved	0	-	O	O	O	
00-33	Modified Parameters (only for LCD)	0: Disable 1: Enable	0	-	O	O	O	
00-34 ~ 00-40	Reserved							

Group 00 Basic Parameters								
Code	Parameter Name	Setting Range	Default	Unit	Control Mode			Attribute
					V/F	SLV	PM SLV	
00-41	User Parameter 0	Set 13-06 = 1, and enable user parameter. Setting Range: 00-01 ~24-17, but except 00-41~00-56 and group 17 (only used in LCD keypad)	-		O	O	O	
00-42	User Parameter 1		-		O	O	O	
00-43	User Parameter 2		-		O	O	O	
00-44	User Parameter 3		-		O	O	O	
00-45	User Parameter 4		-		O	O	O	
00-46	User Parameter 5		-		O	O	O	
00-47	User Parameter 6		-		O	O	O	
00-48	User Parameter 7		-		O	O	O	
00-49	User Parameter 8		-		O	O	O	
00-50	User Parameter 9		-		O	O	O	
00-51	User Parameter 10		-		O	O	O	
00-52	User Parameter 11		-		O	O	O	
00-53	User Parameter 12		-		O	O	O	
00-54	User Parameter 13		-		O	O	O	
00-55	User Parameter 14		-		O	O	O	
00-56	User Parameter 15		-		O	O	O	

Group 01 V/F Control Parameters								
Code	Parameter Name	Setting Range	Default	Unit	Control Mode			Attribute
					V/F	SLV	PM SLV	
01-00	V/F Curve Selection	0~FF	F	-	O	X	X	*3
01-01	Reserved							
01-02	Maximum Output Frequency	4.8~599.00 (Note8)	50.0/ 60.0	Hz	O	O	O	*6*8
01-03	Maximum Output Voltage	200V: 0.1~255.0	-	V	O	X	X	*8
		400V: 0.2~510.0	-					
01-04	Middle Output Frequency 2	0.0~599.00 (Note8)	0.0	Hz	O	X	X	
01-05	Middle Output Voltage 2	200V: 0.0~255.0	0.0	V	O	X	X	*8
		400V: 0.0~510.0						
01-06	Middle Output Frequency 1	0.0~599.00 (Note8)	3.0	Hz	O	X	X	
01-07	Middle Output Voltage 1	200V: 0.0~255.0	15.5	V	O	X	X	*8
		400V: 0.0~510.0	77.0					
01-08	Minimum Output Frequency	0.0~599.00 (Note8)	1.5	Hz	O	O	O	
01-09	Minimum Output Voltage	200V: 0.0~255.0	6.6	V	O	X	X	*8
		400V: 0.0~510.0	13.2					
01-10	Torque Compensation Gain	0.0~2.0	0.5	-	O	X	X	*1
01-11	Selection of Torque Compensation Mode	0: Torque Compensation Mode 0	0	-	O	X	X	Note1
		1: Torque Compensation Mode 1						
01-12	Base Frequency	4.8~599.00 (Note8)	50.0/ 60.0	Hz	O	O	O	*8
01-13	Base Output Voltage	200V: 0.0~255.0	-	V	O	X	X	*8
		400V: 0.0~510.0	-					
01-14	Input Voltage Setting	200V: 155.0~255.0	-	V	O	O	O	*8
		400V: 310.0~510.0	-					
01-15	Torque Compensation Time	0~10000	200	ms	O	X	X	

Group 02 IM Motor Parameters								
Code	Parameter Name	Setting Range	Default	Unit	Control Mode			Attribute
					V/F	SLV	PM SLV	
02-00	No-Load Current	0.01~600.00	KVA	A	O	X	X	
02-01	Rated Current	25%~200% of inverter's rated current.	KVA	A	O	O	X	
02-02	Reserved							
02-03	Rated Rotation Speed	0~60000	KVA	Rpm	O	O	X	
02-04	Rated Voltage	200V: 50.0~240.0	-	V	O	O	X	*8
		400V: 100.0~480.0	-					
02-05	Rated Power	0.01~600.00	KVA	kW	O	O	X	
02-06	Rated Frequency	4.8~599.00 (Note8)	50.0/ 60.0	Hz	O	O	X	*8
02-07	Poles	2~16 (Even)	4	pole-	O	O	X	*6
02-08	Reserved							
02-09	Excitation Current	15.0~70.0	KVA	%	X	O	X	
02-10	Core Saturation Coefficient 1	1~100	KVA	%	X	O	X	
02-11	Core Saturation Coefficient 2	1~100	KVA	%	X	O	X	
02-12	Core Saturation Coefficient 3	80~300	KVA	%	X	O	X	
02-13	Core Loss	0.0~15.0	KVA	%	O	X	X	
02-14	Reserved							
02-15	Resistance between Wires	0.001~60.000	KVA	Ω	O	O	X	
02-19	No-Load Voltage	200V: 50~240	KVA	V	X	O	X	
		400V: 100~480						
02-20 ~ 02-32	Reserved							
02-33	Leakage Inductance Ratio	0.1~15.0	KVA	%	X	O	X	
02-34	Slip Frequency	0.10~20.00	KVA	Hz	X	O	X	

Group 03 External Digital Input and Output Parameters								
Code	Parameter Name	Setting Range	Default	Unit	Control Mode			Attribute
					V/F	SLV	PM SLV	
03-00	Multi-function Terminal Function Setting-S1	0: 2-Wire Sequence (ON: Forward Run Command)	0	-	O	O	O	
		1: 2-Wire Sequence (ON: Reverse Run Command)			O	O	O	
03-01	Multi-function Terminal Function Setting-S2	2: Multi-Speed Setting Command 1	1		O	O	O	
		3: Multi-Speed Setting Command 2			O	O	O	
		4: Multi-Speed Setting Command 3			O	O	O	
03-02	Multi-function Terminal Function Setting-S3	5: Multi-Speed Setting Command 4	2		O	O	O	*6
		6: Forward Jog Run Command			O	O	O	
03-03	Multi-function Terminal Function Setting-S4	7: Reverse Jog Run Command	3		O	O	O	*6
		8: UP Frequency Increasing Command			O	O	O	
03-04	Multi-function Terminal Function Setting-S5	9: DOWN Frequency Decreasing Command	4		O	O	O	*6
		10: Acceleration/ Deceleration Setting Command 1			O	O	O	
		11: Acceleration/ Deceleration Inhibition Command			O	O	O	
03-05	Multi-function Terminal	12: Main/Alternative Run command	17		O	O	O	

Group 03 External Digital Input and Output Parameters								
Code	Parameter Name	Setting Range	Default	Unit	Control Mode			Attribute
					V/F	SLV	PM SLV	
	Function Setting-S6	Switching						
		13: Main/Alternative Frequency Command Switching						
		14: Emergency Stop (Decelerate to Zero and Stop)						
		15: External Base block Command (Rotation freely to Stop)						
		16: PID Control Disable						
		17: Fault Reset (RESET)						
		18: Reserved			-	-	-	
		19: Speed Search 1(from the maximum frequency)			O	O	X	
		20: Manual Energy Saving Function			O	X	X	
		21: PID Integral Reset			O	O	O	
		22~23: Reserved			-	-	-	
		24: PLC Input						
		25: External Fault						
		26: 3-Wire Sequence (Forward/ Reverse Command)						
		27: Local/ Remote Selection			O	O	O	
		28: Remote Mode Selection						
		29: Jog Frequency Selection						
		30: Acceleration/ Deceleration Setting Command 2						
		31: Inverter Overheating Warning						
		32: Reserved			-	-	-	
		33: DC Braking			O	X	X	
		34: Speed Search 2 (from Frequency Command)			O	X	O	
		35: Timing Function Input						
		36: PID Soft Start Disable			O	O	O	
		37~40: Reserved			-	-	-	
		41: PID Sleep	17		O	O	O	
		42~46: Reserved			-	-	-	
		47: Fire Mode (Forced to Run Mode)			O	O	O	
		48: KEB Acceleration			O	X	X	
		49: Parameters Writing Allowable			O	O	O	
		50: Unattended Start Protection (USP)			O	O	O	
		51~52: Reserved			-	-	-	
		53: 2-Wire Self Holding Mode (Stop Command)						
		54: Switch PID1 and PID2						
		55: RTC Time Enable						
		56: RTC Offset Enable			O	O	O	
		57: Forced Frequency Run						
		58: Run Permissive Function						
		63: switch to Tolerance Range of Constant Pressure 2						
		64: Reserved			-	-	-	
		65: Short-circuit braking			X	X	O	

Group 03 External Digital Input and Output Parameters								
Code	Parameter Name	Setting Range	Default	Unit	Control Mode			Attribute
					V/F	SLV	PM SLV	
		66~67: Reserved			-	-	-	
		68: Ext. Fault 2 (Note6)			O	O	O	
		69: Ext. Overload (Note6)			O	O	O	
03-06 ~ 03-07	Reserved							
03-08	(S1~S6) DI Scan Time	0: Scan Time 4ms 1: Scan Time 8ms	1	-	O	O	O	
03-09	Multi-Function Terminal (S1-S4 Selection)	xxx0b:S1 A Contact xxx1b:S1 B Contact	0000b	-	O	O	O	
		xx0xb:S2 A Contact xx1xb:S2 B Contact						
		x0xxb:S3 A Contact x1xxb:S3 B Contact						
		0xxxb:S4 A Contact 1xxxb:S4 B Contact						
03-10	Multi-Function Terminal (S5-S6 Selection)	xxx0b:S5 A Contact xxx1b:S5 B Contact	0000b	-	O	O	O	
		xx0xb:S6 A Contact xx1xb:S6 B Contact						
		x0xxb: Reserved x1xxb: Reserved						
		0xxxb: Reserved 1xxxb: Reserved						
03-11	Relay (R1A-R1C) Output	0: During Running	0	-	O	O	O	*6
		1: Fault Contact Output						
		2: Frequency Agree						
03-12	Relay (R2A-R2C) Output	3: Setting Frequency Agree (03-13 ± 03-14)	1	-	O	O	O	*6
		4: Frequency Detection 1 (≧03-13+03-14)			O	O	O	
		5: Frequency Detection 2 (＜03-13+03-14)			O	O	O	
		6: Automatic Restart			O	O	O	
		7~8: Reserved			-	-	-	
		9: Baseblock			O	O	O	
		10~11: Reserved			-	-	-	
		12: Over-Torque Detection			O	O	O	
		13: Current Agree *7						
		14: Mechanical Brake Control (03-17~18) Note1			O	O	O	
		15~17: Reserved			-	-	-	
		18: PLC Status			O	O	O	
		19: PLC Control						
		20: Zero Speed						
		21: Inverter Ready						
		22: Undervoltage Detection						
		23: Source of Operation Command						
		24: Source of Frequency Command						
		25: Low Torque Detection						
		26: Frequency Reference Missing						
		27: Timing Function Output						
		28~31: Reserved			-	-	-	

Group 03 External Digital Input and Output Parameters								
Code	Parameter Name	Setting Range	Default	Unit	Control Mode			Attribute
					V/F	SLV	PM SLV	
		32: Communication Control Contacts			O	O	O	
		33: RTC Timer 1						
		34: RTC Timer 2						
		35: RTC Timer 3						
		36: RTC Timer 4						
		37: Detection Output of PID Feedback Loss *7						
		38: Brake Release *7			X	O	X	
		42: Over-High Pressure Note1			O	X	X	
		43: Over-Low Pressure Note1			O	X	X	
		44: Loss of Pressure Detection Note1			O	X	X	
		45: PID Sleep Note1			O	O	O	
		46: Over-High Flow Note1			O	O	O	
		47: Over-Low Flow Note1			O	O	O	
		48: Shortage of Low Suction Note1			O	O	O	
		49: Communication Error Note2			O	O	O	
		50: Frequency Detection 3 Note2			O	O	O	
		51: Frequency Detection 4 Note2			O	O	O	
		52: Frequency Detection 5 Note2			O	O	O	
		53: Frequency Detection 6 Note2			O	O	O	
		54: Turn on short-circuit braking Note2			X	X	O	
		57: Low Current Detection Note3			O	O	O	
		58: Frequency Deceleration Detection Note5			O	O	O	
		59: Over Temperature Detection Note6			O	O	O	
03-13	Frequency Detection Level	0.0~599.00 (Note8)	0.0	Hz	O	O	O	
03-14	Frequency Detection Width	0.1~25.5	2.0	Hz	O	O	O	
03-15	Current Agree Level	0.1~999.9	0.1	A	O	O	O	*7
03-16	Delay Time of Current Agree Detection	0.1~10.0	0.1	s	X	O	X	*7
03-17	Setting of Mechanical Brake Release Level Note1	0.00~599.00 (Note8)	0.00	Hz	O	O	O	
03-18	Setting of Mechanical Brake Operation Level Note1	0.00~599.00 (Note8)	0.00	Hz	O	O	O	
03-19	Relay(R1A-R3C)Type	xxx0b: R1 A Contact xxx1b: R1 B Contact	0000b	-	O	O	O	
		xx0xb: R2 A Contact xx1xb: R2 B Contact						
		x0xxb: R3 A Contact x1xxb: R3 B Contact						
		0xxxb: R4 A Contact 1xxxb: R4 B Contact						*10
03-20	Relay (R4A-R4C) Output	Range and definition are the same as those of 03-11, 03-12	2	-	O	O	O	*10
03-21	Photo-coupler Output Selection (DO2-DOG)	Range and definition are the same as those of 03-11, 03-12	3	-	O	O	O	*10

Group 03 External Digital Input and Output Parameters								
Code	Parameter Name	Setting Range	Default	Unit	Control Mode			Attribute
					V/F	SLV	PM SLV	
03-22 ~ 03-26	Reserved							
03-27	UP/DOWN Frequency Hold/ Adjust Selection	0: Keep UP/DOWN frequency when stopping. 1: Clear UP/DOWN frequency when stopping. 2: Allow frequency UP/DOWN when stopping. 3: Refresh frequency at acceleration.	0	-	O	O	O	
03-28	Reserved							
03-29	Photo-coupler Output Selection (DO2-DOG)	xx0xb: Photo-coupler 2 A Contact xx1xb: Photo-coupler 2 B Contact	0000b	-	O	O	O	*10
03-30	Pulse Input Selection	0: Common Pulse Input 1: PWM (Pulse Width Modulation)	0	-	O	O	O	*7
03-31	Pulse Input Scaling	50~32000	1000	Hz	O	O	O	*1
03-32	Pulse input gain	0.0~1000.0	100	%	O	O	O	*1
03-33	Pulse input bias	-100.0~100.0	0.0	%	O	O	O	*1
03-34	Pulse input filter time	0.00~2.00	0.1	Sec	O	O	O	*1
03-35 ~ 03-36	Reserved							
03-37	Timer ON Delay (DI/DO)	0.0~6000.0	0.0	s	O	O	O	
03-38	Timer OFF Delay (DI/DO)	0.0~6000.0	0.0	s	O	O	O	
03-39	Relay (R3A-R3C) Output	Setting range and definition are the same as those of 03-11 and 03-12.	20	-	O	O	O	
03-40	Up/down Frequency Width Setting	0.00~5.00	0.00	Hz	O	O	O	*7
03-41	Torque Detection Level	0~150	10	%	X	O	X	*7
03-42	Delay Time of Braking Action	0.00~65.00	0.00	s	X	O	X	*7
03-43	UP/DOWN Acceleration/ Deceleration Selection	0: Acceleration/ Deceleration Time 1 1: Acceleration/ Deceleration Time 2	0	-	O	O	O	Note1
03-44	Frequency Detection Level 2	0.0~599.00 (Note8)	0.0	Hz	O	O	O	Note2
03-45	Frequency Detection Width 2	0.1~25.5	2.0	Hz	O	O	O	Note2
03-46	Frequency Detection Level 3	0.0~599.00 (Note8)	0.0	Hz	O	O	O	Note2
03-47	Frequency Detection Width 3	0.1~25.5	2.0	Hz	O	O	O	Note2
03-48	Low Current Detection Level	0.0~999.9	0.1	A	O	O	O	Note3
03-49	Low Current Detection Delay Time	0.00~655.34 (Note6)	0.01	Sec	O	O	O	Note3
03-50	Frequency Detection Level 4	0.0~599.00 (Note8)	0.0	Hz	O	O	O	Note4
03-51	Frequency Detection Level 5	0.0~599.00 (Note8)	0.0	Hz	O	O	O	Note4
03-52	Frequency Detection Level 6	0.0~599.00 (Note8)	0.0	Hz	O	O	O	Note4
03-53	Current Agree Level 2	0.0~999.9	0.0	A	O	O	O	Note6

Group 04 External Analog Input and Output Parameters								
Code	Parameter Name	Setting Range	Default	Unit	Control Mode			Attribute
					V/F	SLV	PM SLV	
04-00	AI Input Signal Type	0: AI1: 0~10V AI2: 0~10V	1	-	O	O	O	
		1: AI1: 0~10V AI2: 4~20mA						
		2: Reserved						
		3: Reserved						
		4: AI1: 4~20mA AI2: 0~10V						*9
		5: AI1: 4~20mA AI2: 4~20mA						*9
04-01	AI1 Signal Scanning and Filtering Time	0.00~2.00	0.03	s	O	O	O	
04-02	AI1 Gain	0.0~1000.0	100.0	%	O	O	O	*1
04-03	AI1 Bias	-100.0~100.0	0	%	O	O	O	*1
04-04	Negative AI	0: Disable	0	-	O	O	O	Note6
		1: Enable						
04-05	AI2 Function Setting	0: Auxiliary Frequency	0	-	O	O	O	
		1: Frequency Reference Gain			O	O	O	
		2: Frequency Reference Bias			O	O	O	
		3: Output Voltage Bias			O	X	O	
		4: Coefficient of Acceleration and Deceleration Reduction			O	O	O	
		5: DC Braking Current			O	O	X	
		6: Over-Torque Detection Level			O	O	O	
		7: Stall Prevention Level During Running			O	X	X	
		8: Frequency Lower Limit			O	O	O	
		9: Jump Frequency 4			O	O	O	
		10: Added to AI1			O	O	O	
		11: Positive Torque Limit			X	O	O	
		12: Negative Torque Limit			X	O	O	
		13: Regenerative Torque Limit			X	O	O	
		14: Positive / Negative Torque Limit			X	O	O	
		15: Reserved			-	-	-	
		16: Torque Compensation			X	O	X	
		17: Reserved			-	-	-	
04-06	AI2 Signal Scanning and Filtering Time	0.00~2.00	0.03	s	O	O	O	
04-07	AI2 Gain	0.0~1000.0	100.0	%	O	O	O	*1
04-08	AI2 Bias	-100.0~100.0	0	%	O	O	O	*1
04-09	AI Input Signal Type of I/O card	0: AI3:0~10V 1: AI3:-10~10V 2: AI3:4~20mA	0	-	O	O	O	*10
04-10	AI3 Function Setting	Range and definition are the same as those of 04-05	10	-	O	O	O	*10

Group 04 External Analog Input and Output Parameters								
Code	Parameter Name	Setting Range	Default	Unit	Control Mode			Attribute
					V/F	SLV	PM SLV	
04-11	AO1 Function Setting	0: Output Frequency	0	-	O	O	O	
		1: Frequency Command			O	O	O	
		2: Output Voltage			O	O	O	
		3: DC Voltage			O	O	O	
		4: Output Current			O	O	O	
		5: Output Power			O	O	O	
		6: Motor Speed			O	O	O	
		7: Output Power Factor			O	O	O	
		8: AI1 Input			O	O	O	
		9: AI2 Input			O	O	O	
		10: Torque Command			X	O	O	
		11: q-axis Current			X	O	O	
		12: d-axis Current			X	O	O	
		13: Speed deviation			X	X	O	
		14: Reserved			-	-	-	
		15: ASR Output			X	X	O	
		16: Reserved			-	-	-	
		17: q-axis Voltage			X	O	O	
		18: d-axis Voltage			X	O	O	
		19~20: Reserved			-	-	-	
		21: PID Input			O	O	O	
		22: PID Output			O	O	O	
		23: PID Target Value			O	O	O	
		24: PID Feedback Value			O	O	O	
		25: Output Frequency of the Soft Starter			O	O	O	
		26~27: Reserved			-	-	-	
		28: Communication Control *6			O	O	O	
04-12	AO1 Gain	0.0~1000.0	100.0	%	O	O	O	*1
04-13	AO1 Bias	-100.0~100.0	0	%	O	O	O	*1
04-14 ~ 04-15	Reserved							
04-16	AO2 Function Setting	Setting range and definition are the same as 04-11	3	-	O	O	O	
04-17	AO2 Gain	0.0~1000.0	100.0	%	O	O	O	*1
04-18	AO2 Bias	-100.0~100.0	0	%	O	O	O	*1
04-19	AO Output Signal Type	0: AO1:0~10V AO2:0~10V	0		O	O	O	
		1: AO1:0~10V AO2:4~20mA						
		2: AO1:4~20mA AO2:0~10V						
		3: AO1:4~20mA AO2: 4~20mA						
04-20	Filter Time of AO Signal Scan	0.00~0.50	0.00	s	O	O	O	*1 *7
04-21	AI3 Signal Scanning and Filtering Time	0.00~2.00	0.03	s	O	O	O	*10
04-22	AI3 Gain	0.0~1000.0	100.0	%	O	O	O	*10
04-23	AI3 Bias	-100.0~100.0	0	%	O	O	O	*10

Group 05 Multi-Speed Function Group								
Code	Parameter Name	Setting Range	Default	Unit	Control Mode			Attribute
					V/F	SLV	PM SLV	
05-00	Acceleration and Deceleration Selection of Multi-Speed	0: Acceleration and deceleration time are set by 00-14 ~ 00-24 1: Acceleration and Deceleration Time are set by 05-17 ~ 05-48	0	-	O	O	O	
05-01	Frequency Setting of Speed-Stage 0	0.00~599.00 (Note8)	5.00	Hz	O	O	O	*1
05-02	Frequency Setting of Speed-Stage 1	0.00~599.00 (Note8)	5.00	Hz	O	O	O	*7
05-03	Frequency Setting of Speed-Stage 2	0.00~599.00 (Note8)	10.00	Hz	O	O	O	*7
05-04	Frequency Setting of Speed-Stage 3	0.00~599.00 (Note8)	20.00	Hz	O	O	O	*7
05-05	Frequency Setting of Speed-Stage 4	0.00~599.00 (Note8)	30.00	Hz	O	O	O	*7
05-06	Frequency Setting of Speed-Stage 5	0.00~599.00 (Note8)	40.00	Hz	O	O	O	*7
05-07	Frequency Setting of Speed-Stage 6	0.00~599.00 (Note8)	50.00	Hz	O	O	O	*7
05-08	Frequency Setting of Speed-Stage 7	0.00~599.00 (Note8)	50.00	Hz	O	O	O	*7
05-09	Frequency Setting of Speed-Stage 8	0.00~599.00 (Note8)	5.00	Hz	O	O	O	*7
05-10	Frequency Setting of Speed-Stage 9	0.00~599.00 (Note8)	5.00	Hz	O	O	O	*7
05-11	Frequency Setting of Speed-Stage 10	0.00~599.00 (Note8)	5.00	Hz	O	O	O	*7
05-12	Frequency Setting of Speed-Stage 11	0.00~599.00 (Note8)	5.00	Hz	O	O	O	*7
05-13	Frequency Setting of Speed-Stage 12	0.00~599.00 (Note8)	5.00	Hz	O	O	O	*7
05-14	Frequency Setting of Speed-Stage 13	0.00~599.00 (Note8)	5.00	Hz	O	O	O	*7
05-15	Frequency Setting of Speed-Stage 14	0.00~599.00 (Note8)	5.00	Hz	O	O	O	*7
05-16	Frequency Setting of Speed-Stage 15	0.00~599.00 (Note8)	5.00	Hz	O	O	O	*7
05-17	Acceleration Time Setting of Multi Speed 0	0.1~6000.0	10.0	s	O	O	O	
05-18	Deceleration Time Setting of Multi Speed 0	0.1~6000.0	10.0	s	O	O	O	
05-19	Acceleration Time Setting of Multi Speed 1	0.1~6000.0	10.0	s	O	O	O	
05-20	Deceleration Time Setting of Multi Speed 1	0.1~6000.0	10.0	s	O	O	O	
05-21	Acceleration Time Setting of Multi Speed 2	0.1~6000.0	10.0	s	O	O	O	

Group 05 Multi-Speed Function Group								
Code	Parameter Name	Setting Range	Default	Unit	Control Mode			Attribute
					V/F	SLV	PM SLV	
05-22	Deceleration Time Setting of Multi Speed 2	0.1~6000.0	10.0	s	O	O	O	
05-23	Acceleration Time Setting of Multi Speed 3	0.1~6000.0	10.0	s	O	O	O	
05-24	Deceleration Time Setting of Multi Speed 3	0.1~6000.0	10.0	s	O	O	O	
05-25	Acceleration Time Setting of Multi Speed 4	0.1~6000.0	10.0	s	O	O	O	
05-26	Deceleration Time Setting of Multi Speed 4	0.1~6000.0	10.0	s	O	O	O	
05-27	Acceleration Time Setting of Multi Speed 5	0.1~6000.0	10.0	s	O	O	O	
05-28	Deceleration Time Setting of Multi Speed 5	0.1~6000.0	10.0	s	O	O	O	
05-29	Acceleration Time Setting of Multi Speed 6	0.1~6000.0	10.0	s	O	O	O	
05-30	Deceleration Time Setting of Multi Speed 6	0.1~6000.0	10.0	s	O	O	O	
05-31	Acceleration Time Setting of Multi Speed 7	0.1~6000.0	10.0	s	O	O	O	
05-32	Deceleration Time Setting of Multi Speed 7	0.1~6000.0	10.0	s	O	O	O	
05-33	Acceleration Time Setting of Multi Speed 8	0.1~6000.0	10.0	s	O	O	O	
05-34	Deceleration Time Setting of Multi Speed 8	0.1~6000.0	10.0	s	O	O	O	
05-35	Acceleration Time Setting of Multi Speed 9	0.1~6000.0	10.0	s	O	O	O	
05-36	Deceleration Time Setting of Multi Speed 9	0.1~6000.0	10.0	s	O	O	O	
05-37	Acceleration Time Setting of Multi Speed 10	0.1~6000.0	10.0	s	O	O	O	
05-38	Deceleration Time Setting of Multi Speed 10	0.1~6000.0	10.0	s	O	O	O	
05-39	Acceleration Time Setting of Multi Speed 11	0.1~6000.0	10.0	s	O	O	O	
05-40	Deceleration Time Setting of Multi Speed 11	0.1~6000.0	10.0	s	O	O	O	
05-41	Acceleration Time Setting of Multi Speed 12	0.1~6000.0	10.0	s	O	O	O	
05-42	Deceleration Time Setting of Multi Speed 12	0.1~6000.0	10.0	s	O	O	O	
05-43	Acceleration Time Setting of Multi Speed 13	0.1~6000.0	10.0	s	O	O	O	
05-44	Deceleration Time Setting of Multi Speed 13	0.1~6000.0	10.0	s	O	O	O	

Group 05 Multi-Speed Function Group								
Code	Parameter Name	Setting Range	Default	Unit	Control Mode			Attribute
					V/F	SLV	PM SLV	
05-45	Acceleration Time Setting of Multi Speed 14	0.1~6000.0	10.0	s	O	O	O	
05-46	Deceleration Time Setting of Multi Speed 14	0.1~6000.0	10.0	s	O	O	O	
05-47	Acceleration Time Setting of Multi Speed 15	0.1~6000.0	10.0	s	O	O	O	
05-48	Deceleration Time Setting of Multi Speed 15	0.1~6000.0	10.0	s	O	O	O	

Group 06 Automatic Program Operation Parameters								
Code	Parameter Name	Setting Range	Default	Unit	Control Mode			Attribute
					V/F	SLV	PM SLV	
06-00	Automatic Operation Mode Selection	0: Disable 1: Execute a single cycle operation mode. Restart speed is based on the previous stopped speed. 2: Execute continuous cycle operation mode. Restart speed is based on the previous stopped speed. 3: After the completion of a single cycle, the on-going operation speed is based on the speed of the last stage. Restart speed is based on the previous stopped speed. 4: Execute a single cycle operation mode. Restart speed will be based on the speed of stage 1. 5: Execute continuous cycle operation mode. Restart speed will be based on the speed of stage 1. 6: After the completion of a single cycle, the on-going operation speed is based on the speed of the last stage. Restart speed is based on the previous stopped speed.	0	-	O	O	X	
06-01	Frequency Setting of Operation-Stage 1	0.00~599.00 (Note8)	5.00	Hz	O	O	X	*1
06-02	Frequency Setting of Operation -Stage 2	0.00~599.00 (Note8)	10.00	Hz	O	O	X	*1
06-03	Frequency Setting of Operation -Stage 3	0.00~599.00 (Note8)	20.00	Hz	O	O	X	*1

Group 06 Automatic Program Operation Parameters								
Code	Parameter Name	Setting Range	Default	Unit	Control Mode			Attribute
					V/F	SLV	PM SLV	
06-04	Frequency Setting of Operation -Stage 4	0.00~599.00 (Note8)	30.00	Hz	O	O	X	*1
06-05	Frequency Setting of Operation -Stage 5	0.00~599.00 (Note8)	40.00	Hz	O	O	X	*1
06-06	Frequency Setting of Operation -Stage 6	0.00~599.00 (Note8)	50.00	Hz	O	O	X	*1
06-07	Frequency Setting of Operation -Stage 7	0.00~599.00 (Note8)	50.00	Hz	O	O	X	*1
06-08	Frequency Setting of Operation -Stage 8	0.00~599.00 (Note8)	5.00	Hz	O	O	X	*1
06-09	Frequency Setting of Operation -Stage 9	0.00~599.00 (Note8)	5.00	Hz	O	O	X	*1
06-10	Frequency Setting of Operation -Stage 10	0.00~599.00 (Note8)	5.00	Hz	O	O	X	*1
06-11	Frequency Setting of Operation -Stage 11	0.00~599.00 (Note8)	5.00	Hz	O	O	X	*1
06-12	Frequency Setting of Operation -Stage 12	0.00~599.00 (Note8)	5.00	Hz	O	O	X	*1
06-13	Frequency Setting of Operation -Stage 13	0.00~599.00 (Note8)	5.00	Hz	O	O	X	*1
06-14	Frequency Setting of Operation -Stage 14	0.00~599.00 (Note8)	5.00	Hz	O	O	X	*1
06-15	Frequency Setting of Operation -Stage 15	0.00~599.00 (Note8)	5.00	Hz	O	O	X	*1
06-16	Time Setting of Operation -Stage 0	0.0~6000.0	0.0	s	O	O	X	*1
06-17	Time Setting of Operation -Stage 1	0.0~6000.0	0.0	s	O	O	X	*1
06-18	Time Setting of Operation -Stage 2	0.0~6000.0	0.0	s	O	O	X	*1
06-19	Time Setting of Operation -Stage 3	0.0~6000.0	0.0	s	O	O	X	*1
06-20	Time Setting of Operation -Stage 4	0.0~6000.0	0.0	s	O	O	X	*1
06-21	Time Setting of Operation -Stage 5	0.0~6000.0	0.0	s	O	O	X	*1
06-22	Time Setting of Operation -Stage 6	0.0~6000.0	0.0	s	O	O	X	*1
06-23	Time Setting of Operation -Stage 7	0.0~6000.0	0.0	s	O	O	X	*1
06-24	Time Setting of Operation -Stage 8	0.0~6000.0	0.0	s	O	O	X	*1
06-25	Time Setting of Operation -Stage 9	0.0~6000.0	0.0	s	O	O	X	*1
06-26	Time Setting of Operation -Stage 10	0.0~6000.0	0.0	s	O	O	X	*1

Group 06 Automatic Program Operation Parameters								
Code	Parameter Name	Setting Range	Default	Unit	Control Mode			Attribute
					V/F	SLV	PM SLV	
06-27	Time Setting of Operation -Stage 11	0.0~6000.0	0.0	s	O	O	X	*1
06-28	Time Setting of Operation -Stage 12	0.0~6000.0	0.0	s	O	O	X	*1
06-29	Time Setting of Operation -Stage 13	0.0~6000.0	0.0	s	O	O	X	*1
06-30	Time Setting of Operation -Stage 14	0.0~6000.0	0.0	s	O	O	X	*1
06-31	Time Setting of Operation -Stage 15	0.0~6000.0	0.0	s	O	O	X	*1
06-32	Direction Selection of Operation -Stage 0	0: Stop 1: Forward 2: Reverse	0	-	O	O	X	
06-33	Direction Selection of Operation -Stage 1	0: Stop 1: Forward 2: Reverse	0	-	O	O	X	
06-34	Direction Selection of Operation -Stage 2	0: Stop 1: Forward 2: Reverse	0	-	O	O	X	
06-35	Direction Selection of Operation -Stage 3	0: Stop 1: Forward 2: Reverse	0	-	O	O	X	
06-36	Direction Selection of Operation -Stage 4	0: Stop 1: Forward 2: Reverse	0	-	O	O	X	
06-37	Direction Selection of Operation -Stage 5	0: Stop 1: Forward 2: Reverse	0	-	O	O	X	
06-38	Direction Selection of Operation -Stage 6	0: Stop 1: Forward 2: Reverse	0	-	O	O	X	
06-39	Direction Selection of Operation -Stage 7	0: Stop 1: Forward 2: Reverse	0	-	O	O	X	
06-40	Direction Selection of Operation -Stage 8	0: Stop 1: Forward 2: Reverse	0	-	O	O	X	
06-41	Direction Selection of Operation -Stage 9	0: Stop 1: Forward 2: Reverse	0	-	O	O	X	
06-42	Direction Selection of Operation -Stage 10	0: Stop 1: Forward 2: Reverse	0	-	O	O	X	
06-43	Direction Selection of Operation -Stage 11	0: Stop 1: Forward 2: Reverse	0	-	O	O	X	
06-44	Direction Selection of Operation -Stage 12	0: Stop 1: Forward 2: Reverse	0	-	O	O	X	
06-45	Direction Selection of Operation -Stage 13	0: Stop 1: Forward 2: Reverse	0	-	O	O	X	
06-46	Direction Selection of Operation -Stage 14	0: Stop 1: Forward 2: Reverse	0	-	O	O	X	
06-47	Direction Selection of Operation -Stage 15	0: Stop 1: Forward 2: Reverse	0	-	O	O	X	

Group 07: Start /Stop Parameters								
Code	Parameter Name	Setting Range	Default	Unit	Control Mode			Attribute
					V/F	SLV	PM SLV	
07-00	Momentary Power Loss/ Fault Restart Selection	0: Disable 1: Enable	0	-	O	O	O	
07-01	Fault Auto-Restart Time	0~7200	0	s	O	O	O	
07-02	Number of Fault Auto-Restart Attempts	0~10	0	-	O	O	O	
07-03	Reserved							
07-04	Direct Start at Power on	0: When the external run command is enabled, direct start at power up 1: When the external run command is enabled, unable to direct start at power-up.	0	-	O	O	O	
07-05	Automatic start delay at power up	1.0~300.0	3.5	Sec	O	O	O	
07-06	DC Injection Braking Start Frequency	0.0~10.0	0.5	Hz	O	O	O	
07-07	DC Injection Braking Current	0~100	50	%	O	O	O	
07-08	DC Injection Braking Time at Stop	0.00~10.00	0.50	s	O	O	O	
07-09	Stop Mode Selection	0: Deceleration to Stop	0	-	O	O	O	
		1: Coast to Stop			O	O	O	
		2: DC Braking Stop			O	O	X	
		3: Coast to Stop with Timer			O	O	O	
07-10 ~ 07-12	Reserved							
07-13	Low Voltage Detection Level	200V: 150~300	190	V	O	O	O	
		400V: 300~600	380					
07-14	Pre-excitation Time	0.00~10.00	2.00	s	X	O	X	
07-15	Pre-excitation Level	50~200	100	%	X	O	X	*6
07-16	DC Injection Braking Time at Start	0.00~100.00	0.00	s	O	O	O	
07-17	Reserved							
07-18	Minimum Base block Time	0.1~5.0	-	Sec	O	O	O	
07-19	Direction-Detection Speed Search Operating Current	0~100	50	%	O	O	X	
07-20	Speed Search Operating Current	0~100	20	%	O	O	X	
07-21	Integral Time of Speed Searching	0.1~10.0	2.0	Sec	O	O	X	
07-22	Delay Time of Speed Searching	0.0~20.0	0.2	Sec	O	O	X	
07-23	Voltage Recovery Time	0.1~5.0	2.0	Sec	O	O	X	
07-24	Direction-Detection Speed Search Selection	0: Disable 1: Enable	1	-	O	O	X	
07-25	Low voltage Detection Time	0.00~1.00	0.02	Sec	O	O	O	
07-26	SLV Speed Search Function	0: Enable	0	-	X	O	X	

Group 07: Start /Stop Parameters								
Code	Parameter Name	Setting Range	Default	Unit	Control Mode			Attribute
					V/F	SLV	PM SLV	
		1: Disable						
07-27	Start Selection after Fault during SLV Mode	0: Speed search start 1: Normal Start	0	-	X	O	X	
07-28	Start Selection after External Base Block	0: Speed search start 1: Normal Start	0	-	X	O	X	
07-29	Run Command Available during DC Braking	0: Disable (Run command isn't available until the DC braking is completely done) 1: Enable	0	-	O	X	X	Note1
07-30 07-31	Reserved							
07-32	Speed Search Mode Selection	0: Disable 1: Mode1: Start a Speed Search at Power on 2: Mode 2: Start Speed Search upon the Motor Run	0		O	O	O	Note2
07-33	Start Frequency of Speed Search Selection	0: Maximum Output Frequency of Motor 1: Frequency Command	0		O	O	X	Note2
07-34	Short-circuit Braking Time at Start	0.00~100.00	0	Sec	X	X	O	Note2
07-35	Short-circuit Braking Time at Stop	0.00~100.00	0.5	Sec	X	X	O	Note2
07-36	Short-circuit Braking Current Limited Level	0.0~200.0	100	%	X	X	O	Note2
07-42	Voltage limit gain	0.0~50.0	0	%	X	O	X	Note3
07-43	Short-circuit Braking Time of PM Motor Speed Search	0.00~100.00	0.00	Sec	X	X	O	Note4
07-44	DC Braking Time of PM Motor Speed Search	0.00~100.00	0.00	Sec	X	X	O	Note4
07-45	STP2 Function Selection	0:STP2 Enable 1:STP2 Disable	0	-	O	O	O	Note6

Group 08 Protection Parameters								
Code	Parameter Name	Setting Range	Default	Unit	Control Mode			Attribute
					V/F	SLV	PM SLV	
08-00	Stall Prevention Function	xxx0b: Stall prevention is enabled in acceleration. xxx1b: Stall prevention is disabled in acceleration. xx0xb: Stall prevention is enabled in deceleration. xx1xb: Stall prevention is disabled in deceleration. x0xxb: Stall prevention is enabled in operation x1xxb: Stall prevention is disabled in operation 0xxxb: Stall prevention in operation decelerates based on deceleration time 1 1xxxb: Stall prevention in operation decelerates based on deceleration time 2	0000b	-	O	O	O	
08-01	Stall Prevention Level in Acceleration	20~200	120	%	O	O	O	
08-02	Stall Prevention Level in Deceleration	200V: 330~410	385	V	O	O	O	
		400V: 660~820	770					
08-03	Stall Prevention Level in Operation	30~200	120	%	O	X	X	
08-04	Reserved							
08-05	Selection for Motor Overload Protection (OL1)	xxx0b: Motor Overload Protection is disabled xxx1b: Motor Overload Protection is enabled xx0xb: Cold Start of Motor Overload xx1xb: Hot Start of Motor Overload x0xxb: Standard Motor x1xxb: Special motor 0xxxb: Reserved 1xxxb: Reserved	0101b	-	O	O	O	
08-06	Start-up Mode of Overload Protection Operation (OL1)	0: Stop Output after Overload Protection 1: Continuous Operation after Overload Protection.	0	-	O	O	O	
08-07	Motor Overload (OL1) Protection Level	0: Motor overload (OL1) Protection 0 1: Motor overload (OL1) Protection 1 2: Motor overload (OL1) Protection 2	0	-	O	O	O	Note3
08-08	Automatic Voltage Regulation	0: Enable	0	-	O	O	O	

Group 08 Protection Parameters								
Code	Parameter Name	Setting Range	Default	Unit	Control Mode			Attribute
					V/F	SLV	PM SLV	
	(AVR)	1: Disable						
08-09	Selection of Input Phase Loss Protection	0: Disable 1: Enable	0	-	O	O	O	
08-10	Selection of Output Phase Loss Protection	0: Disable 1: Enable	0	-	O	O	O	
08-11 ~ 08-12	Reserved							
08-13	Selection of Over-Torque Detection	0: Over-Torque Detection is Disabled. 1: Start to Detect when Reaching the Set Frequency. 2: Start to Detect when the Operation is Begun.	0	-	O	O	O	
08-14	Selection of Over-Torque Operation	0: Deceleration to Stop when Over-Torque is Detected. 1: Display Warning when Over-Torque is Detected. Go on Operation. 2: Coast to Stop when Over Torque is Detected	0	-	O	O	O	
08-15	Level of Over-Torque Detection	0~300	150	%	O	O	O	
08-16	Time of Over-Torque Detection	0.0~10.0	0.1	Sec	O	O	O	
08-17	Selection of Low-Torque Detection	0: Low-Torque Detection is Disabled. 1: Start to Detect when Reaching the Set Frequency. 2: Start to Detect when the Operation is Begun.	0	-	O	O	O	
08-18	Selection of Low-Torque Operation	0: Deceleration to Stop when Low-Torque is Detected. 1: Display Warning when Low-Torque is Detected. Go on Operation. 2: Coast to Stop when Low-Torque is Detected	0	-	O	O	O	
08-19	Level of Low-Torque Detection	0~300	30	%	O	O	O	
08-20	Time of Low-Torque Detection	0.0~10.0	0.1	Sec	O	O	O	
08-21	Limit of Stall Prevention in Acc over Base Speed	1~100	50	%	O	O	O	
08-22	Stall Prevention Detection Time in Operation	2~100	100	ms	O	O	O	
08-23	Ground Fault (GF) Selection	0: Disable 1: Enable	0	-	O	O	O	

Group 08 Protection Parameters								
Code	Parameter Name	Setting Range	Default	Unit	Control Mode			Attribute
					V/F	SLV	PM SLV	
08-24	Operation Selection of External Fault	0: Deceleration to Stop 1: Coast to Stop 2: Continuous Operation	0	-	O	O	O	
08-25	Detection selection of External Fault	0: Immediately Detect when the Power is Supplied. 1: Start to Detect during Operation	0	-	O	O	O	
08-26 ~ 08-29	Reserved							
08-30	Selection of Run Permissive Function	0: Deceleration to Stop 1: Coast to Stop	0	-	O	O	O	
08-31 ~ 08-34	Reserved							
08-35	Fault Selection of Motor Overheat	0: Disable 1: Deceleration to Stop 2: Coast to Stop	0	-	O	O	O	
08-36	Time Coefficient of PTC Input Filter	0.00 ~ 5.00	2.0	Sec	O	O	O	
08-37	Fan Control Function (*Note)	0: Start at Operation 1: Permanent Start 2: Start at High Temperature	0	-	O	O	O	
08-38	Delay Time of Fan Off	0~600	60	Sec	O	O	O	
08-39	Delay Time of Motor Overheat Protection	1~300	60	Sec	O	O	O	
08-42	PTC Trip Level	0.1~10.0	0.7	V	O	O	O	Note1
08-43	PTC Reset Level	0.1~10.0	0.3	V	O	O	O	Note1
08-45	PTC Disconnection Detection	0: Disable 1: Warning 2: Fault	0	-	O	O	O	Note3
08-46	Temperature Agree Level	0~254℃	0	℃	O	O	O	Note6
08-47	Temperature Reset Level	0~254℃	0	℃	O	O	O	Note6
08-48	Selection of Fire Mode	0: Disable 1: Enable	0	-	O	O	O	Note6
08-49	Multi-Function Input Terminal Status of Fire Mode	0：Reset after Power Off 1：Reset after Terminal Removed	0	-	O	O	O	Note6
08-50	Multi-Function Terminal Status of Fire Mode	XXX0b: S6 A contact XXX1b: S6 B contact	0000b	-	O	O	O	Note6
08-51	Motor Speed Setting Source of Fire Mode	0：Fire Mode Speed(08-52) 1：PID Control 2：AI2	0	-	O	O	O	Note6
08-52	Motor Speed of Fire Mode	0.00~100.00	100.00	%	O	O	O	Note6
08-53	PID Detection Level of Fire Mode	0~100	0	%	O	O	O	Note6
08-54	Delay Time of Fire Mode PID Loss	0.0~10.0	1.0	s	O	O	O	Note6
08-55	PID Feedback Loss Detection	0：Keep Running	1	-	O	O	O	Note6

Group 08 Protection Parameters								
Code	Parameter Name	Setting Range	Default	Unit	Control Mode			Attribute
					V/F	SLV	PM SLV	
	Selection of Fire Mode	1：Fire Mode Speed (08-52) 2：Maximum Output Frequency (01-02)						
08-56	Detection Level of Fire Mode AI2 Signal	0.0~100	80.0	%	O	O	O	Note6
08-57	Delay Time of Fire Mode AI2 Signal Loss	0.0~10.0	1.0	s	O	O	O	Note6
08-58	Selection of Fire Mode AI2 Signal Loss	0：Keep Running 1：Fire Mode Speed (08-52) 2：Maximum Output Frequency (01-02)	1	-	O	O	O	Note6
08-59	Fire Mode Motor Direction	0：Forward 1：Reverse	0	-	O	O	O	Note6
08-60	Fire Mode Password	00000~65534	0	-	O	O	O	Note6

***Note: 1. Standard U type, IP20 frame 6~9 do not have this function.**

2. Enhanced UE type, IP20 frame 6~8 do not have "Start at High Temperature" function.

3. Enhanced UE type, IP20 frame 9 do not have this function.

Group 09: Communication Parameters								
Code	Parameter Name	Setting Range	Default	Unit	Control Mode			Attribute
					V/F	SLV	PM SLV	
09-00	INV Communication Station Address	1~31	1	-	O	O	O	*2
09-01	Communication Mode Selection	0: MODBUS 1: BACNET 2: METASYS 3: PUMP in Parallel Connection	0	-	O	O	O	
09-02	Baud Rate Setting (bps)	0:1200 1:2400 2:4800 3:9600 4:19200 5:38400	4	-	O	O	O	*2 *6
09-03	Stop Bit Selection	0:1 Stop Bit 1: 2 Stop Bit	0	-	O	O	O	*2
09-04	Parity Selection	0: No Parity 1: Even Bit 2: Odd Bit	0	-	O	O	O	*2
09-05	Communications Data Bits Selection	0: 8 bits data 1: 7 bits data	0	-	O	O	O	Note1
09-06	Communication Error Detection Time	0.0~25.5	0.0	S	O	O	O	
09-07	Fault Stop Selection	0: Deceleration to Stop Based on Deceleration Time 1 when Communication Fault Occurs.	3	-	O	O	O	

Group 09: Communication Parameters								
Code	Parameter Name	Setting Range	Default	Unit	Control Mode			Attribute
					V/F	SLV	PM SLV	
		1: Coast to Stop when Communication Fault Occurs.						
		2: Deceleration to Stop Based on Deceleration Time 2 when Communication Fault Occurs.						
		3: Keep Operating when Communication Fault Occurs.						
		4. Run the Frequency Command given by AI2						
09-08	Comm. Fault Tolerance Count	1~20	1	-	O	O	O	
09-09	Waiting Time	5~65	5	ms	O	O	O	
09-10	Device Instance Number	1 ~ 254	1	-	O	O	O	

Note: Parameters in group 09 are not affected by parameter 13-08 (initialization).

Group 10: PID Parameters								
Code	Parameter Name	Setting Range	Default	Unit	Control Mode			Attribute
					V/F	SLV	PM SLV	
10-00	PID Target Value Source Setting	0: PUMP or HVAC function given (refer to group 23)	4	-	O	O	O	
		1: AI1 Given						
		2: AI2 Given						
		3: Reserved						
		4: 10-02/12-38						
		5: Reserved Note						
		6: Frequency Command (00-05) Note						
		7: Multi-speed Frequency Command Note4						
10-01	PID Feedback Value Source Setting	1: AI1 Given	2	-	O	O	O	
		2: AI2 Given						
		3: Reserved						
		4: AI1 - AI2 Given						
10-02	PID Target Value	0.0~100.0	0.0	%	O	O	O	
10-03	PID Control Mode	xxx0b: PID Disable	0000b	-	O	O	O	
		xxx1b: PID Enable						
		xx0xb: PID Positive Characteristic						
		xx1xb: PID Negative Characteristic						
		x0xxb: PID Error Value of D Control						
		x1xxb: PID Feedback Value of D Control						
		0xxxb: PID Output						
		1xxxb: PID Output + Frequency Command						
10-04	Feedback Gain	0.01~10.00	1.00	-	O	O	O	*1

Group 10: PID Parameters								
Code	Parameter Name	Setting Range	Default	Unit	Control Mode			Attribute
					V/F	SLV	PM SLV	
10-05	Proportional Gain (P)	0.00~10.00	3.00	-	O	O	O	*1
10-06	Integral Time (I)	0.00~100.00	7.00	s	O	O	O	*1
10-07	Differential Time (D)	0.00~10.00	0.00	s	O	O	O	*1
10-08	Reserved							
10-09	PID Bias	-100.0~100.0	0	%	O	O	O	*1
10-10	PID Primary Delay Time	0.00~10.00	0.00	s	O	O	O	*1
10-11	PID Feedback Loss Detection Selection	0: Disable 1: Warning 2: Fault	0	-	O	O	O	
10-12	PID Feedback Loss Detection Level	0~100	0	%	O	O	O	
10-13	PID Feedback Loss Detection Time	0.0~10.0	1.0	s	O	O	O	
10-14	PID Integral Limit	0.0~100.0	100.0	%	O	O	O	*1
10-15 10-16	Reserved							
10-17	Start Frequency of PID Sleep	0.00~599.00 (Note8)	30.00	Hz	O	O	O	
10-18	Delay Time of PID Sleep	0.0~255.5	0.0	s	O	O	O	
10-19	Frequency of PID Waking up	0.00~599.00 (Note8)	0.00	Hz	O	O	O	
10-20	Delay Time of PID Waking up	0.0~255.5	0.0	s	O	O	O	
10-21	Reserved							
10-22	Start Level of PID Enable	0.00~599.00 (Note8)	0.00	Hz	O	O	O	Note2
10-23	PID Limit	0.00~100.0	100.0	%	O	O	O	*1
10-24	PID Output Gain	0.0~25.0	1.0	-	O	O	O	
10-25	PID Reversal Output Selection	0: Do not Allow Reversal Output 1: Allow Reversal Output	0	-	O	O	O	
10-26	PID Target Acceleration/ Deceleration Time	0.0~25.5	0.0	s	O	O	O	
10-27	PID Feedback Display Bias	0~9999	0	-	O	O	O	
10-28	Reserved							
10-29	PID Sleep Selection	0: Disable 1: Enable 2: Set by DI	1	-	O	O	O	
10-30	Upper Limit of PID Target	0.0 ~ 100.0	100.0	%	O	O	O	
10-31	Lower Limit of PID Target	0.0 ~ 100.0	0.0	%	O	O	O	
10-32	PID Switching Function	0: PID1 1: PID2 2: Set by DI 3: Switch to PID2 when RTC Timer Enables	0		O	O	O	
10-33	PID Maximum Feedback Value	1~10000	999	-	O	O	O	
10-34	PID Decimal Width	0~4	1	-	O	O	O	
10-35	PID Unit	0: % 1: FPM 2: CFM	0	-	O	O	O	*6

Group 10: PID Parameters								
Code	Parameter Name	Setting Range	Default	Unit	Control Mode			Attribute
					V/F	SLV	PM SLV	
		3: PSI						
		4: GPH						
		5: GPM						
		6: IN						
		7: FT						
		8: /s						
		9: /m						
		10: /h						
		11: ℉						
		12: inW						
		13: HP						
		14: m/s						
		15: MPM						
		16: CMM						
		17: W						
		18: KW						
		19: m						
		20: ℃						
		21: RPM						
		22: Bar						
		23: Pa						
		24: KPa Note4						
10-36	PID2 Proportional Gain (P)	0.00~10.00	3.00	-	O	O	O	*1
10-37	PID2 Integral Time (I)	0.0~100.0	0.50	s	O	O	O	*1
10-38	PID2 Differential Time (D)	0.00~10.00	0.00	s	O	O	O	*1
10-39	PID Output Frequency Setting during disconnection	00.00~599.00 (Note8)	30.00	Hz	O	O	O	*6
10-40	Compensation Frequency Selection of PID Sleep	0: Disable 1: Enable	0	-	O	O	O	Note1
10-41 ~ 10-43	Reserved							
10-44	Precharge Frequency	0.0~120.0	0	Hz	O	O	O	Note3
10-45	Precharge Time	0~250	0	Sec	O	O	O	Note3
10-46	Precharge Target Level	0~10000	0	-	O	O	O	Note3
10-47	Proportional Gain 3(P)	0.00~10.00	3.00		O	O	O	Note6
10-48	Integral Time 3(I)	0.00~100.00	7.00	Sec	O	O	O	Note6
10-49	Differential Time 3(D)	0.00~10.00	0.00	Sec	O	O	O	Note6

Group 11: Auxiliary Parameters								
Code	Parameter Name	Setting Range	Default	Unit	Control Mode			Attribute
					V/F	SLV	PM SLV	
11-00	Direction Lock Selection	0: Allow Forward and Reverse Rotation 1: Only Allow Forward Rotation 2: Only Allow Reverse Rotation	0	-	O	O	O	
11-01	Carrier Frequency	0: Carrier Output Frequency Tuning 1: 1~16: 1~16KHz	KVA*a	-	O	O	O	
11-02	Soft PWM Function Selection	0: Disable 1: Soft PWM Function 1 2: Soft PWM Function 2	1(V/f) 0(SLV&PMSLV)	-	O	O	O	
11-03	Automatic carrier lowering selection	0: Disable 1: Enable	0	-	O	X	X	
11-04	S-curve Time Setting at the Start of Acceleration	0.00~2.50	0.20	s	O	O	O	
11-05	S-curve Time Setting at the End of Acceleration	0.00~2.50	0.20	s	O	O	O	
11-06	S-curve Time Setting at the Start of Deceleration	0.00~2.50	0.20	s	O	O	O	
11-07	S-curve Time Setting at the End of Deceleration	0.00~2.50	0.20	s	O	O	O	
11-08	Jump Frequency 1	0.0~599.00 (Note8)	0.0	Hz	O	O	O	
11-09	Jump Frequency 2	0.0~599.00 (Note8)	0.0	Hz	O	O	O	
11-10	Jump Frequency 3	0.0~599.00 (Note8)	0.0	Hz	O	O	O	
11-11	Jump Frequency Width	0.0~25.5	1.0	Hz	O	O	O	
11-12	Manual Energy Saving Gain	0~100	80	%	O	X	X	
11-13	Automatic Return Time	0~120	60	Sec	O	O	O	*6
11-14 ~ 11-17	Reserved							
11-18	Manual Energy Saving Frequency	0.00~599.00 (Note8)	0.00	Hz	O	X	X	
11-19	Automatic Energy Saving Function	0: Disabled 1: Enabled	0	-	O	X	X	
11-20	Filter Time of Automatic Energy Saving	0~200	140	ms	O	X	X	
11-21	Voltage Upper Limit of Energy Saving Tuning	0~100	100	%	O	X	X	
11-22	Adjustment Time of Automatic Energy Saving	0~5000	20	ms	O	X	X	*1
11-23	Detection Level of Automatic Energy Saving	0~100	10	%	O	X	X	
11-24	Coefficient of Automatic Energy Saving	0.00~655.34	KVA*a	-	O	X	X	
11-25 ~ 11-27	Reserved							
11-28	Frequency Gain of Overvoltage Prevention 2	1~200	100	%	O	X	X	Note4

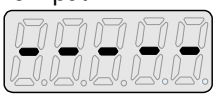
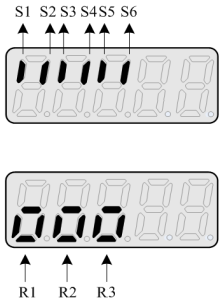
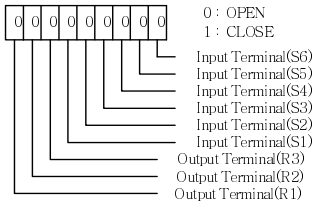
Group 11: Auxiliary Parameters								
Code	Parameter Name	Setting Range	Default	Unit	Control Mode			Attribute
					V/F	SLV	PM SLV	
11-29	Auto De-rating Selection	0: Disable 1: Enable	0	-	O	X	X	
11-30	Variable Carrier Frequency Max. Limit	2~16	KVA*a	KHz	O	X	X	
11-31	Variable Carrier Frequency Min. Limit	1~16	KVA*a	KHz	O	X	X	
11-32	Variable Carrier Frequency Proportional Gain	00~99	00	-	O	X	X	
11-33	Rise Amount of DC Voltage Filter	0.1~10.0	0.1	Vdc	O	X	X	Note4 *1
11-34	Fall Amount of DC Voltage Filter	0.1~10.0	5.0	Vdc	O	X	X	Note4 *1
11-35	Dead band Level of DC Voltage Filter	0.0~99.0	10.0	Vdc	O	X	X	Note4 *1
11-36	Frequency Gain of OV Prevention	0.000~1.000	0.050	-	O	X	X	Note2 *1
11-37	Frequency Limit of OV Prevention	0.00~599.00 (Note8)	5.00	Hz	O	X	X	Note2
11-38	Deceleration Start Voltage of OV Prevention	200V: 200~400V 400V: 400~800V	200V: 300 400V: 700	V	O	X	X	Note2
11-39	Deceleration Stop Voltage of OV Prevention	200V: 300~400V 400V: 600~800V	220V: 350 440V: 750	V	O	X	X	Note2
11-40	OV Prevention Selection	0: Disable 1: OV Prevention Mode 1 2: OV Prevention Mode 2 3: OV Prevention Mode 3	0	-	O	X	X	Note2
11-41	Reference Frequency Loss Detection	0: Deceleration to Stop when Reference Frequency Disappears 1: Operation is Set by 11-42 when Reference Frequency Disappears	0	-	O	O	O	
11-42	Reference Frequency Loss Level	0.0~100.0	80.0	%	O	O	O	
11-43	Hold Frequency at Start	0.0~599.00 (Note8)	0.0	Hz	O	O	O	
11-44	Frequency Hold Time at Start	0.0~10.0	0.0	s	O	O	O	
11-45	Hold Frequency at Stop	0.0~599.00 (Note8)	0.0	Hz	O	O	O	
11-46	Frequency Hold Time at Stop	0.0~10.0	0.0	s	O	O	O	
11-47	EB Deceleration Time	0.0~25.5	0.0	s	O	X	X	*1
11-48	KEB Detection Level	200V: 190~210 400V: 380~420	200 400	V	O	X	X	

Group 11: Auxiliary Parameters								
Code	Parameter Name	Setting Range	Default	Unit	Control Mode			Attribute
					V/F	SLV	PM SLV	
11-49 ~ 11-50	Reserved							
11-51	Braking Selection of Zero Speed	0: Disable 1: Enable	0	-	O	X	X	
11-52 ~ 11-53	Reserved							
11-54	Initialization of Cumulative Energy	0: Do not Clear Cumulative Energy 1: Clear Cumulative Energy	0	-	O	O	O	*1
11-55	STOP Key Selection	0: Stop Key is Disabled when the Operation Command is not Provided by Keypad. 1: Stop Key is Enabled when the Operation Command is not Provided by Keypad.	1	-	O	O	O	
11-56	UP/DOWN Selection	0: When UP/DOWN in Keypad is Disabled, it will be Enabled if Pressing ENTER after Frequency Modification. 1: When UP/DOWN in Keypad is Enabled, it will be Enabled upon Frequency Modification.	0	-	O	O	O	
11-57	Reserved							
11-58	Record Reference Frequency	0: Disable 1: Enable	0	-	O	O	O	*1
11-59	Gain of Preventing Oscillation	0.00~2.50	0.05		O	X	X	*7
11-60	Upper Limit of Preventing Oscillation	0~100	100	%	O	X	X	*7
11-61	Time Parameter of Preventing Oscillation	0~100	0		O	X	X	*7
11-62	Prevention of Oscillation Selection	0: Mode 1 1: Mode 2 2: Mode 3	1		O	X	X	*7
11-63	Flux-Strengthening Selection	0: Disable 1: Enable	1		X	O	X	Note1
11-64	Acceleration Speed Gain Adjustment	0.1~10.0	1.0	-	O	X	X	Note3
11-65	Target Main Circuit Voltage	200V: 200V~400V 400V: 400V~800V	370 740	-	O	X	X	Note3
11-66	2 Phase/ 3 Phase PWM Switch Frequency	6.00~60.00	20	Hz	O	O	X	Note3
11-67	Detection Range at Soft PWM Function 2	0~12000	0	Hz	X	O	O	Note3
11-68	Detecting Start Frequency at Soft PWM Function 2	6.00~60.00	20	Hz	X	O	O	Note3
11-69	Gain of Preventing Oscillation	0.00~200.00	5.00	%	O	X	X	Note2

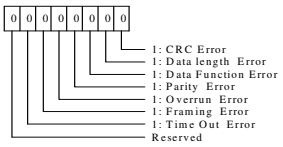
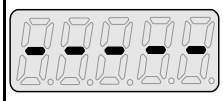
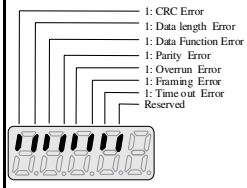
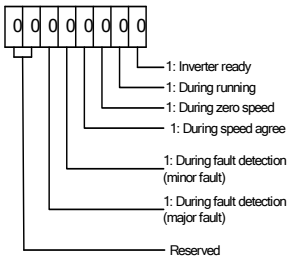
Group 11: Auxiliary Parameters								
Code	Parameter Name	Setting Range	Default	Unit	Control Mode			Attribute
					V/F	SLV	PM SLV	
	3							
11-70	Upper Limit of Preventing Oscillation 3	0.01~100.00	5.00	%	O	X	X	Note2
11-71	Time Parameter of Preventing Oscillation 3	0~30000	100	ms	O	X	X	Note2
11-72	Switch Frequency 1 for Preventing Oscillation Gain	0.01~300.00	30.00	Hz	O	X	X	Note2
11-73	Switch Frequency 2 for Preventing Oscillation Gain	0.01~300.00	50.00	Hz	O	X	X	Note2

***a: KVA means the default value of this parameter will be changed by different capacities of inverter.**

Group 12: Monitoring Parameters								
Code	Parameter Name	Setting Range	Default	Unit	Control Mode			Attribute
					V/F	SLV	PM SLV	
12-00	Display Screen Selection (LED)	00000~77777 From the leftmost bit, it displays the screen when press DSP key in order. 0: No display 1: Output Current 2: Output Voltage 3: DC Bus Voltage 4: Heatsink Temperature 5: PID Feedback 6: AI1 Value 7: AI2 Value	00321	-	O	O	O	*1 *5
12-01	PID Feedback Display Mode (LED)	0: Display the Feedback Value by Integer (xxx) 1: Display the Feedback Value by the Value with First Decimal Place (xx.x) 2: Display the Feedback Value by the Value with Second Decimal Place (x.xx)	0		O	O	O	*5
12-02	PID Feedback Display Unit Setting (LED)	0: xxxxx (no unit) 1: xxxPb (pressure) 2: xxxFL (flow)	0		O	O	O	*5
12-03	Line Speed Display (LED)	0~60000	1500/ 1800	RPM	O	O	O	*5
12-04	Line Speed Display Mode (LED)	0: Display Inverter Output Frequency 1: Line Speed Display at Integer.(xxxxx) 2: Line Speed Display at One Decimal Place. (xxxx.x) 3: Line Speed Display at Two Decimal Places. (xxx.xx) 4: Line Speed Display at Three Decimal Places. (xx.xxx)	0		O	O	O	*1 *5

Group 12: Monitoring Parameters								
Code	Parameter Name	Setting Range	Default	Unit	Control Mode			Attribute
					V/F	SLV	PM SLV	
12-05	Status display of digital input terminal (LED / LCD)	LED display is shown as below no input  correspondences to input and output  LCD display is shown as below  	-	-	O	O	O	
12-06 ~ 12-10	Reserved							
12-11	Output Current of Current Fault	Display the output current of current fault	-	A	O	O	O	
12-12	Output Voltage of Current Fault	Display the output voltage of current fault	-	V	O	O	O	
12-13	Output Frequency of Current Fault	Display the output frequency of current fault	-	Hz	O	O	O	
12-14	DC Voltage of Current Fault	Display the DC voltage of current fault	-	V	O	O	O	
12-15	Frequency Command of Current Fault	Display the frequency command of current fault	-	Hz	O	O	O	
12-16	Frequency Command	If LED enters this parameter, it only allows monitoring frequency command.	-	Hz	O	O	O	
12-17	Output Frequency	Display the current output frequency	-	Hz	O	O	O	
12-18	Output Current	Display the current output current	-	A	O	O	O	
12-19	Output Voltage	Display the current output voltage	-	V	O	O	O	
12-20	DC Voltage	Display the current DC voltage	-	V	O	O	O	
12-21	Output Power	Display the current output power	-	kW	O	O	O	

Group 12: Monitoring Parameters								
Code	Parameter Name	Setting Range	Default	Unit	Control Mode			Attribute
					V/F	SLV	PM SLV	
12-22	Motor's Rotation Speed	Display motor's current rotation speed in VF/SLV mode Motor's rotation speed = output power x(120/motor's pole number) In PG/SV mode, motor's rotation speed is calculated by feedback frequency. Max limit is 65535	-	rpm	O	O	O	
12-23	Output Power Factor	Display the current output power factor	-	-	O	O	O	
12-24	Control Mode	Display control mode 0 : VF 2 : SLV 5 : PM SLV	-	-	O	O	O	
12-25	AI1 Input	Display the current AI1 input (0V corresponds to 0%, 10V corresponds to 100%,)	-	%	O	O	O	
12-26	AI2 Input	Display the current AI2 input (0V or 4mA corresponds to 0%, 10V or 20mA corresponds to 100%)	-	%	O	O	O	
12-27	Motor Torque	Display the current torque command (100% corresponds to motor torque)	-	%	X	O	O	
12-28	Motor Torque Current (Iq)	Display the current q-axis current	-	%	X	O	O	
12-29	Motor Excitation Current (Id)	Display the current d-axis current	-	%	X	O	O	
12-30 ~ 12-35	Reserved							
12-36	PID Input	Display input error of the PID controller (PID target value - PID feedback) (100% corresponds to the maximum frequency set by 01-02 or 01-16)	-	%	O	O	O	
12-37	PID Output	Display output of the PID controller (100% corresponds to the maximum frequency set by 01-02 or 01-16)	-	%	O	O	O	
12-38	PID Setting	Display the target value of the PID controller (100% corresponds to the maximum frequency set by 01-02 or 01-16)	-	%	O	O	O	
12-39	PID Feedback	Display the feedback value of the	-	%	O	O	O	

Group 12: Monitoring Parameters								
Code	Parameter Name	Setting Range	Default	Unit	Control Mode			Attribute
					V/F	SLV	PM SLV	
		PID controller (100% corresponds to the maximum frequency set by 01-02 or 01-16)						
12-40	Reserved							
12-41	Heatsink Temperature	Display the heatsink temperature of IGBT temperature.	-	℃	O	O	O	
12-42	RS-485 Error Code	LCD Display:  LED Display: (without any error)  LED Display: (with certain error)  	-	-	O	O	O	*7
12-43	Inverter Status	LCD Display:  LED Display: Inverter ready 1 Running 2 Zero Speed 4 Frequency Agree 8 Warning 16 Error 32 Inverter status display is the summed up value. Ex: Display of the value 6 means the inverter is running in zero speed.	101B	-	O	O	O	
12-44	Reserved							

Group 12: Monitoring Parameters								
Code	Parameter Name	Setting Range	Default	Unit	Control Mode			Attribute
					V/F	SLV	PM SLV	
12-45	Recent Fault Message	Display current fault message	-	-	O	O	O	
12-46	Previous Fault Message	Display previous fault message	-	-	O	O	O	
12-47	Previous Two Fault Messages	Display previous two fault messages	-	-	O	O	O	
12-48	Previous Three Fault Messages	Display previous three fault messages	-	-	O	O	O	
12-49	Previous Four Fault Messages	Display previous four fault messages	-	-	O	O	O	
12-50	DIO Status of Current Fault	Display the DI/DO status of current fault Description is similar to 12-05	-	-	O	O	O	
12-51	Inverter Status of Current Fault	Display the inverter status of current fault Description is similar to 12-43	-	-	O	O	O	
12-52	Trip Time 1 of Current Fault	Display the operation time of current fault, 12-53 is the days, while 12-52 is the remaining hours.	-	Hr	O	O	O	
12-53	Trip Time 2 of Current Fault		-	day	O	O	O	
12-54	Frequency Command of Previous Fault	Display frequency command of previous fault	-	Hz	O	O	O	
12-55	Output Frequency of Previous Fault	Display output frequency of previous fault	-	Hz	O	O	O	
12-56	Output Current of Previous Fault	Display output current of previous fault	-	A	O	O	O	
12-57	Output Voltage of Previous Fault	Display output voltage of previous fault	-	V	O	O	O	
12-58	DC Voltage of Previous Fault	Display DC voltage of previous fault	-	V	O	O	O	
12-59	DIO Status of Previous Fault	Display DI/DO status of previous fault Description is similar to 12-05	-	-	O	O	O	
12-60	Inverter Status of Previous Fault	Display inverter status of previous fault Description is similar to 12-43	-	-	O	O	O	
12-61	Trip time 1 of last fault	Display the operation time of last time's fault, 12-62 is the days, while 12-61 is the remaining hours.	-	Hr	O	O	O	
12-62	Trip time 2 of last fault		-	day	O	O	O	
12-63	Recent warning messages	Display the recent warning messages	-	-	O	O	O	
12-64	Previous warning message	Display the previous warning messages	-	-	O	O	O	
12-65 ~ 12-66	Reserved							
12-67	Accumulative Energy (kWHr)	0.0 ~ 999.9		kWHr	O	O	O	
12-68	Accumulative Energy (MWHr)	0 ~ 60000		MWHr	O	O	O	
12-69	Accumulative Electricity Price	0 ~ 9999		$	O	O	O	

Group 12: Monitoring Parameters								
Code	Parameter Name	Setting Range	Default	Unit	Control Mode			Attribute
					V/F	SLV	PM SLV	
	($)							
12-70	Accumulative Electricity Price (10000$)	0 ~ 60000		$	O	O	O	
12-71	Flow Meter Feedback	1 ~ 50000		GPM	O	O	O	
12-72	RTC Date	12.01.01 ~ 99.12.31	12.01.01		O	O	O	
12-73	RTC Time	00:00 ~ 23:59	00:00		O	O	O	
12-74	Operating Pressure Setting	0.01 ~ 25.50	2.00	PSI	O	X	X	
12-75	Pressure Feedback Value	0.01 ~ 25.50	-	PSI	O	X	X	
12-76	Non-Load Voltage	0.0 ~ 600.0	-	V	X	O	X	
12-77	Flow Meter Target Setting	1 ~ 50000	-	GPM	O	O	O	*7
12-78	Reserved							
12-79	Pulse Input Percentage	0.0~100.0	-	%	O	O	O	*7
12-81	Relay Card Display	ON: LCD display is 1 OFF: LCD display is 0	-	-	O	O	O	Note5
12-82	Motor Load	0 ~ 200.0	-	%	O	O	O	Note6
12-85	AI3 Input	Display the current AI3 input (-10V corresponds to -100%, 10V corresponds to 100%)	-	%	O	O	O	*10

*** Models of inverter ratings above 200V 60HP (including 60HP) and 400V 100HP (including 100HP) in IP20 enclosure do not support functions of heatsink temperature display.**

*** Maximum upper limit in motor speed (rpm) of parameter 12-22 is 65534**

Group 13 Maintenance Function Group								
Code	Parameter Name	Setting Range	Default	Unit	Control Mode			Attribute
					V/F	SLV	PM SLV	
13-00	Inverter Rating Selection	00H~FFH	-	-	O	O	O	*4
13-01	Software Version	0.00-9.99	-	-	O	O	O	*4
13-02	Clear Cumulative Operation Hours Function	0: Disable to Clear Cumulative Operation Hours 1: Clear Cumulative Operation Hours	0		O	O	O	*1
13-03	Cumulative Operation Hours 1	0~23	-	hr	O	O	O	*4
13-04	Cumulative Operation Hours 2	0~65534	-	day	O	O	O	*4
13-05	Selection of Accumulative Operation Time	0: Accumulative time in power on 1: Accumulative time in operation	0		O	O	O	*1
13-06	Parameters Locked	0: Only parameter 13-06 and frequency setting parameters in main screen are writable 1: Only user parameter is enabled.	2		O	O	O	*1

Group 13 Maintenance Function Group								
Code	Parameter Name	Setting Range	Default	Unit	Control Mode			Attribute
					V/F	SLV	PM SLV	
		2: All parameters are writable.						
13-07	Parameter Password Function	00000~65534	00000	-	O	O	O	
13-08	Restore Factory Setting	0: No Initialization 2: 2 wire Initialization (220/440V, 60Hz) 3: 3 wire Initialization (220/440V, 60Hz) 4: 2 wire Initialization (230/415V, 50Hz) 5: 3 wire Initialization (230/415V, 50Hz) 6: 2 wire Initialization (200/380V, 50Hz) 7: 3 wire Initialization (200/380V, 50Hz) 8: PLC Initialization **9: 2 Wire Initialization (230V/460V, 60Hz)** **10: 3 Wire Initialization (230V/460V, 60Hz)** 11: 2 wire Initialization, 230V/400V, 60Hz 12: 3 wire Initialization, 230V/400V, 60Hz 13: 2 wire Initialization, 230V/400V, 50Hz 14: 3 wire Initialization, 230V/400V, 50Hz 15: 2 wire Initialization, (220/380V, 50Hz) Note4 16: 3 wire Initialization (220/380V, 50Hz) Note4	0	-	O	O	O	
13-09	Fault History Clearance Function	0: Do not Clear Fault History 1: Clear Fault History	0	-	O	O	O	*1
13-10	Parameter Situation 2	0 ~ 9999	0		O	O	O	
13-11	C/B CPLD Ver.	0.00~9.99	-		O	O	O	*7
13-12	Option Card Id	0~255	0		O	O	O	*7
13-13	Option Card CPLD Ver.	0.00~9.99	-		O	O	O	*7
13-14	Fault Storage Selection	0: Auto Restart Fault Messages are not saved in fault history. 1: Auto Restart Fault Messages are saved in fault history.	1		O	O	O	Note1
13-15 ~ 13-20	Reserved							
13-21	Previous Fault Message	Display Previous Fault Message	-	-	O	O	O	Note2
13-22	Previous Two Fault Message	Display Previous Two Fault	-	-	O	O	O	Note2

Group 13 Maintenance Function Group								
Code	Parameter Name	Setting Range	Default	Unit	Control Mode			Attribute
					V/F	SLV	PM SLV	
		Message						
13-23	Previous Three Fault Message	Display Previous Three Fault Message	-	-	O	O	O	Note2
13-24	Previous Four Fault Message	Display Previous Four Fault Message	-	-	O	O	O	Note2
13-25	Previous Five Fault Message	Display Previous Five Fault Message	-	-	O	O	O	Note2
13-26	Previous Six Fault Message	Display Previous Six Fault Message	-	-	O	O	O	Note2
13-27	Previous Seven Fault Message	Display Previous Seven Fault Message	-	-	O	O	O	Note2
13-28	Previous Eight Fault Message	Display Previous Eight Fault Message	-	-	O	O	O	Note2
13-29	Previous Night Fault Message	Display Previous Night Fault Message	-	-	O	O	O	Note2
13-30	Previous Ten Fault Message	Display Previous Ten Fault Message	-	-	O	O	O	Note2
13-31	Previous Eleven Fault Message	Display Previous Eleven Fault Message	-	-	O	O	O	Note2
13-32	Previous Twelve Fault Message	Display Previous Twelve Fault Message	-	-	O	O	O	Note2
13-33	Previous Thirteen Fault Message	Display Previous Thirteen Fault Message	-	-	O	O	O	Note2
13-34	Previous Fourteen Fault Message	Display Previous Fourteen Fault Message	-	-	O	O	O	Note2
13-35	Previous Fifteen Fault Message	Display Previous Fifteen Fault Message	-	-	O	O	O	Note2
13-36	Previous Sixteen Fault Message	Display Previous Sixteen Fault Message	-	-	O	O	O	Note2
13-37	Previous Seventeen Fault Message	Display Previous Seventeen Fault Message	-	-	O	O	O	Note2
13-38	Previous Eighteen Fault Message	Display Previous Eighteen Fault Message	-	-	O	O	O	Note2
13-39	Previous Nineteen Fault Message	Display Previous Nineteen Fault Message	-	-	O	O	O	Note2
13-40	Previous Twenty Fault Message	Display Previous Twenty Fault Message	-	-	O	O	O	Note2
13-41	Previous Twenty One Fault Message	Display Previous Twenty One Fault Message	-	-	O	O	O	Note2
13-42	Previous Twenty Two Fault Message	Display Previous Twenty Two Fault Message	-	-	O	O	O	Note2
13-43	Previous Twenty Three Fault Message	Display Previous Twenty Three Fault Message	-	-	O	O	O	Note2
13-44	Previous Twenty Four Fault Message	Display Previous Twenty Four Fault Message	-	-	O	O	O	Note2
13-45	Previous Twenty Five Fault Message	Display Previous Twenty Five Fault Message	-	-	O	O	O	Note2

Group 13 Maintenance Function Group								
Code	Parameter Name	Setting Range	Default	Unit	Control Mode			Attribute
					V/F	SLV	PM SLV	
13-46	Previous Twenty Six Fault Message	Display Previous Twenty Six Fault Message	-	-	O	O	O	Note2
13-47	Previous Twenty Seven Fault Message	Display Previous Twenty Seven Fault Message	-	-	O	O	O	Note2
13-48	Previous Twenty Eight Fault Message	Display Previous Twenty Eight Fault Message	-	-	O	O	O	Note2
13-49	Previous Twenty Nine Fault Message	Display Previous Twenty Nine Fault Message	-	-	O	O	O	Note2
13-50	Previous Thirty Fault Message	Display Previous Thirty Fault Message	-	-	O	O	O	Note2

Group 14: PLC Setting Parameters								
Code	Parameter Name	Setting Range	Default	Unit	Control Mode			Attribute
					V/F	SLV	PM SLV	
14-00	T1 Set Value 1	0~9999	0	-	O	O	O	Note7
14-01	T1 Set Value 2（Mode 7）	0~9999	0	-	O	O	O	Note7
14-02	T2 Set Value 1	0~9999	0	-	O	O	O	Note7
14-03	T2 Set Value 2（Mode 7）	0~9999	0	-	O	O	O	Note7
14-04	T3 Set Value 1	0~9999	0	-	O	O	O	Note7
14-05	T3 Set Value 2（Mode 7）	0~9999	0	-	O	O	O	Note7
14-06	T4 Set Value 1	0~9999	0	-	O	O	O	Note7
14-07	T4 Set Value 2（Mode 7）	0~9999	0	-	O	O	O	Note7
14-08	T5 Set Value 1	0~9999	0	-	O	O	O	Note7
14-09	T5 Set Value 2（Mode 7）	0~9999	0	-	O	O	O	Note7
14-10	T6 Set Value 1	0~9999	0	-	O	O	O	Note7
14-11	T6 Set Value 2（Mode 7）	0~9999	0	-	O	O	O	Note7
14-12	T7 Set Value 1	0~9999	0	-	O	O	O	Note7
14-13	T7 Set Value 2（Mode 7）	0~9999	0	-	O	O	O	Note7
14-14	T8 Set Value 1	0~9999	0	-	O	O	O	Note7
14-15	T8 Set Value 2（Mode 7）	0~9999	0	-	O	O	O	Note7
14-16	C1 Set Value	0~65534	0	-	O	O	O	Note7
14-17	C2 Set Value	0~65534	0	-	O	O	O	Note7
14-18	C3 Set Value	0~65534	0	-	O	O	O	Note7
14-19	C4 Set Value	0~65534	0	-	O	O	O	Note7
14-20	C5 Set Value	0~65534	0	-	O	O	O	Note7
14-21	C6 Set Value	0~65534	0	-	O	O	O	Note7
14-22	C7 Set Value	0~65534	0	-	O	O	O	Note7
14-23	C8 Set Value	0~65534	0	-	O	O	O	Note7
14-24	AS1 Set Value 1	0~65534	0	-	O	O	O	Note7
14-25	AS1 Set Value 2	0~65534	0	-	O	O	O	Note7
14-26	AS1 Set Value 3	0~65534	0	-	O	O	O	Note7
14-27	AS2 Set Value 1	0~65534	0	-	O	O	O	Note7
14-28	AS2 Set Value 2	0~65534	0	-	O	O	O	Note7
14-29	AS2 Set Value 3	0~65534	0	-	O	O	O	Note7
14-30	AS3 Set Value 1	0~65534	0	-	O	O	O	Note7

Group 14: PLC Setting Parameters								
Code	Parameter Name	Setting Range	Default	Unit	Control Mode			Attribute
					V/F	SLV	PM SLV	
14-31	AS3 Set Value 2	0~65534	0	-	O	O	O	Note7
14-32	AS3 Set Value 3	0~65534	0	-	O	O	O	Note7
14-33	AS4 Set Value 1	0~65534	0	-	O	O	O	Note7
14-34	AS4 Set Value 2	0~65534	0	-	O	O	O	Note7
14-35	AS4 Set Value 3	0~65534	0	-	O	O	O	Note7
14-36	MD1 Set Value 1	0~65534	1	-	O	O	O	Note7
14-37	MD1 Set Value 2	0~65534	1	-	O	O	O	Note7
14-38	MD1 Set Value 3	0~65534	1	-	O	O	O	Note7
14-39	MD2 Set Value 1	0~65534	1	-	O	O	O	Note7
14-40	MD2 Set Value 2	0~65534	1	-	O	O	O	Note7
14-41	MD2 Set Value 3	0~65534	1	-	O	O	O	Note7
14-42	MD3 Set Value 1	0~65534	1	-	O	O	O	Note7
14-43	MD3 Set Value 2	0~65534	1	-	O	O	O	Note7
14-44	MD3 Set Value 3	0~65534	1	-	O	O	O	Note7
14-45	MD4 Set Value 1	0~65534	1	-	O	O	O	Note7
14-46	MD4 Set Value 2	0~65534	1	-	O	O	O	Note7
14-47	MD4 Set Value 3	0~65534	1	-	O	O	O	Note7

Group 15: PLC Monitoring Parameters								
Code	Parameter Name	Setting Range	Default	Unit	Control Mode			Attribute
					V/F	SLV	PM SLV	
15-00	T1 Current Value 1	0~9999	0	-	O	O	O	
15-01	T1 Current Value 2 (Mode 7)	0~9999	0	-	O	O	O	
15-02	T2 Current Value 1	0~9999	0	-	O	O	O	
15-03	T2 Current Value 2 (Mode 7)	0~9999	0	-	O	O	O	
15-04	T3 Current Value 1	0~9999	0	-	O	O	O	
15-05	T3 Current Value 2 (Mode 7)	0~9999	0	-	O	O	O	
15-06	T4 Current Value 1	0~9999	0	-	O	O	O	
15-07	T4 Current Value 2 (Mode 7)	0~9999	0	-	O	O	O	
15-08	T5 Current Value 1	0~9999	0	-	O	O	O	
15-09	T5 Current Value 2 (Mode 7)	0~9999	0	-	O	O	O	
15-10	T6 Current Value 1	0~9999	0	-	O	O	O	
15-11	T6 Current Value 2 (Mode 7)	0~9999	0	-	O	O	O	
15-12	T7 Current Value 1	0~9999	0	-	O	O	O	
15-13	T7 Current Value 2 (Mode 7)	0~9999	0	-	O	O	O	
15-14	T8 Current Value 1	0~9999	0	-	O	O	O	
15-15	T8 Current Value 2 (Mode 7)	0~9999	0	-	O	O	O	
15-16	C1 Current Value	0~65534	0	-	O	O	O	
15-17	C2 Current Value	0~65534	0	-	O	O	O	
15-18	C3 Current Value	0~65534	0	-	O	O	O	
15-19	C4 Current Value	0~65534	0	-	O	O	O	
15-20	C5 Current Value	0~65534	0	-	O	O	O	
15-21	C6 Current Value	0~65534	0	-	O	O	O	
15-22	C7 Current Value	0~65534	0	-	O	O	O	

Group 15: PLC Monitoring Parameters								
Code	Parameter Name	Setting Range	Default	Unit	Control Mode			Attribute
					V/F	SLV	PM SLV	
15-23	C8 Current Value	0~65534	0	-	O	O	O	
15-24	AS1 Results	0~65534	0	-	O	O	O	
15-25	AS2 Results	0~65534	0	-	O	O	O	
15-26	AS3 Results	0~65534	0	-	O	O	O	
15-27	AS4 Results	0~65534	0	-	O	O	O	
15-28	MD1 Results	0~65534	0	-	O	O	O	
15-29	MD2 Results	0~65534	0	-	O	O	O	
15-30	MD3 Results	0~65534	0	-	O	O	O	
15-31	MD4 Results	0~65534	0	-	O	O	O	
15-32	TD Current Value	0~65534	0	-	O	O	O	

Group 16: LCD Function Parameters								
Code	Parameter Name	Setting Range	Default	Unit	Control Mode			Attribute
					V/F	SLV	PM SLV	
16-00	Main Screen Monitoring	5~82 (Parameter 12-05~12-82) When using LCD to operate, the monitored item displays in the first line. (default is frequency command)	16	-	O	O	O	*1 *6
16-01	Sub-Screen Monitoring 1	5~82 (Parameter 12-05~12-82) When using LCD to operate, the monitored item displays in the second line. (default is output frequency)	17	-	O	O	O	*1 *6
16-02	Sub-Screen Monitoring 2	5~82(Parameter 12-05~12-82) when using LCD to operate, the monitored item displays in the third line. (default is output current)	18	-	O	O	O	*1 *6
16-03	Selection of Display Unit	0~39999: Determine the display way and unit of frequency command 0: Frequency display unit is 0.01Hz 1: Frequency display unit 0.01% 2: Rpm display; motor rotation speed is set by the control modes to select IM (02-07)/ PM (22-03) motor poles to calculate. 3~39: Reserved 40~9999: Users specify the format, Input 0XXXX represents the display of XXXX at 100%. 10001~19999: Users specify the format; Input 1XXXX represents the display of XXX.X at 100%. 20001~29999: Users specify the format, Input 2XXXX represents the display of XX.XX at 100%. 30001~39999: Users specify the format, Input 3XXXX represents the display of X.XXX at 100%.	0	-	O	O	O	
16-04	Selection of Engineering Unit	0: No Unit 1: FPM 2: CFM 3: PSI 4: GPH 5: GPM 6: IN 7: FT 8: /s 9: /m 10: /h	0	-	O	O	O	*6

Group 16: LCD Function Parameters								
Code	Parameter Name	Setting Range	Default	Unit	Control Mode			Attribute
					V/F	SLV	PM SLV	
		11: ℉						
		12: inW						
		13: HP						
		14: m/s						
		15: MPM						
		16: CMM						
		17: W						
		18: KW						
		19: m						
		20: ℃						
		21: RPM						
		22: Bar						
		23: Pa						
		24: KPa Note4						
16-05	LCD Backlight	0~7	5	-	O	O	O	*1
16-06	Reserved							
16-07	Copy Function Selection	0: Do not copy parameters 1: Read inverter parameters and save to the operator. 2: Write the operator parameters to inverter. 3: Compare parameters of inverter and operator.	0	-	O	O	O	
16-08	Selection of Allowing Reading	0: Do not allow to read inverter parameters and save it to the operator. 1: Allow to read inverter parameters and save it to the operator.	0	-	O	O	O	
16-09	Selection of Operator Removed (LCD)	0: Keep operating when LCD operator is removed. 1: Display fault to stop when LCD operator is removed	0	-	O	O	O	*1
16-10	RTC Time Display Setting	0: Hide 1: Display	0		O	O	O	
16-11	RTC Date Setting	12.01.01 ~ 99.12.31	12.01.01		O	O	O	
16-12	RTC Time Setting	00:00 ~ 23:59	00:00		O	O	O	
16-13	RTC Timer Function	0: Disable 1: Enable 2: Set by DI	0		O	O	O	
16-14	P1 Start Time	00:00 ~ 23:59	08:00		O	O	O	
16-15	P1 Stop Time	00:00 ~ 23:59	18:00		O	O	O	
16-16	P1 Start Date	1:Mon, 2:Tue, 3:Wed, 4:Thu,:5:Fri,:6:Sat, 7:Sun	1		O	O	O	
16-17	P1 Stop Date		5		O	O	O	

Group 16: LCD Function Parameters								
Code	Parameter Name	Setting Range	Default	Unit	Control Mode			Attribute
					V/F	SLV	PM SLV	
16-18	P2 Start Time	00:00 ~ 23:59	08:00		O	O	O	
16-19	P2 Stop Time	00:00 ~ 23:59	18:00		O	O	O	
16-20	P2 Start Date	1:Mon,2:Tue,3:Wed, 4:Thu,:5:Fri,:6:Sat,7:Sun	1		O	O	O	
16-21	P2 Stop Date		5		O	O	O	
16-22	P3 Start Time	00:00 ~ 23:59	08:00		O	O	O	
16-23	P3 Stop Time	00:00 ~ 23:59	18:00		O	O	O	
16-24	P3 Start Date	1:Mon,2:Tue,3:Wed, 4:Thu,:5:Fri,:6:Sat, 7:Sun	1		O	O	O	
16-25	P3 Stop Date		5		O	O	O	
16-26	P4 Start Time	00:00 ~ 23:59	08:00		O	O	O	
16-27	P4 Stop Time	00:00 ~ 23:59	18:00		O	O	O	
16-28	P4 Start Date	1:Mon, 2:Tue, 3:Wed, 4:Thu, 5:Fri, 6:Sat, 7:Sun	1		O	O	O	
16-29	P4 Stop Date		5		O	O	O	
16-30	Selection of RTC Offset	0: Disable 1: Enable 2: Set by DI	0		O	O	O	
16-31	RTC Offset Time Setting	00:00 ~ 23:59	00:00	-	O	O	O	
16-32	Source of Timer 1	0: None, 1:P1, 2:P2, 3:P1+P2 4:P3, 5:P1+P3, 6:P2+P3, 7:P1+P2+P3, 8:P4, 9:P1+P4, 10:P2+P4, 11:P1+P2+P4 12:P3+P4 13:P1+P3+P4, 14:P2+P3+P4 15:P1+P2+P3+P4, 16:Off, 17:Off+P1 18:Off+P2, 19:Off+P1+P2 20:Off+P3, 21:Off+P1+P3 22:Off+P2+P3 23:Off+P1+P2+P3 24:Off+P4 25:Off+P1+P4 26:Off+P2+P4 27:Off+P1+P2+P4 28:Off+P3+P4 29:Off+P1+P3+P4 30:Off+P2+P3+P4 31:Off+P1+P2+P3+P4	1		O	O	O	
16-33	Source of Timer 2		2		O	O	O	
16-34	Source of Timer 3		4		O	O	O	
16-35	Source of Timer 4		8		O	O	O	

Group 16: LCD Function Parameters

Code	Parameter Name	Setting Range	Default	Unit	Control Mode			Attribute
					V/F	SLV	PM SLV	
16-36	Selection of RTC Speed	0: Off 1: By Timer 1 2: By Timer 2 3: By Timer 3 4: By Timer 4 5: By Timer 1+2	0		O	O	O	
16-37	Selection of RTC Rotation Direction	xxx0b: RTC Run1 Forward Rotation xxx1b: RTC Run1 Reverse Rotation xx0xb: RTC Run2 Forward Rotation xx1xb: RTC Run2 Reverse Rotation x0xxb: RTC Run3 Forward Rotation x1xxb: RTC Run3 Reverse Rotation 0xxxb: RTC Run4 Forward Rotation 1xxxb: RTC Run4 Reverse Rotation	0000b		O	O	O	

Group 17: IM Motor Automatic Tuning Parameters

Code	Parameter Name	Setting Range	Default	Unit	Control Mode			Attribute
					V/F	SLV	PM SLV	
17-00	Mode Selection of Automatic Tuning	0: Rotational Auto-tuning 1: Static Auto-tuning 2: Stator Resistance Measurement 3: Reserved 4: Loop Tuning 5: Rotational Auto-tuning Combination (Item: 4+2+0) Note 6: Static Auto-tuning Combination (Item: 4+2+1) Note	VF:2 SLV:6	-	O	O	X	
17-01	Motor Rated Output Power	0.00~600.00	-	KW	O	O	X	
17-02	Motor Rated Current	0.1~1200.0	-	A	O	O	X	
17-03	Motor Rated Voltage	200V: 50.0~240.0 400V:100.0~480.0	- -	V	O	O	X	
17-04	Motor Rated Frequency	4.8~599.00 (Note8)	50.0/ 60.0	Hz	O	O	X	
17-05	Motor Rated Speed	0~24000	KVA*a	rpm	O	O	X	
17-06	Pole Number of Motor	2~16 (Even)	4	Pole	O	O	X	*6
17-07	Reserved							
17-08	Motor No-load Voltage	200V: 50~240	KVA*a	V	O	O	X	

Group 17: IM Motor Automatic Tuning Parameters								
Code	Parameter Name	Setting Range	Default	Unit	Control Mode			Attribute
					V/F	SLV	PM SLV	
		400V: 100~480						
17-09	Motor Excitation Current	0.01~600.00 (15%~70% motor rated current)	KVA*a	A	O	O	X	■1
17-10	Automatic Tuning Start	0: Disable 1: Enable	0	-	O	O	X	
17-11	Error History of Automatic Tuning	0: No Error 1: Motor Data Error 2. Stator Resistance Tuning Error 3. Leakage Induction Tuning Error 4. Rotor Resistance Tuning Error 5. Mutual Induction Tuning Error 6. Reserved 7. DT Error 8. Motor Acceleration Error 9. Warning	0	-	O	O	X	
17-12	Leakage Inductance Ratio	0.1 ~ 15.0	3.4	%	X	O	X	
17-13	Slip Frequency	0.10 ~ 20.00	1.00	Hz	X	O	X	
17-14	Rotational Tuning Mode Selection	0: VF Mode 1: Vector Mode	0	-	O	O	X	Note1

***a: KVA means the default value of this parameter will be changed by different capacities of inverter.**

■1: It can be set when 17-00=1, 2, 6.

Group 18: Slip Compensation Parameters								
Code	Parameter Name	Setting Range	Default	Unit	Control Mode			Attribute
					V/F	SLV	PM SLV	
18-00	Slip Compensation Gain at Low Speed	0.00~2.50	VF: 0.00 SLV: 1.00	-	O	O	X	*1
18-01	Slip Compensation Gain at High Speed	-1.00~1.00	0.0	-	O	O	X	*1
18-02	Slip Compensation Limit	0~250	200	%	O	X	X	
18-03	Slip Compensation Filter Time	0.0~10.0	1.0	Sec	O	X	X	
18-04	Regenerative Slip Compensation Selection	0: Disable 1: Enable	0	-	O	X	X	
18-05	FOC Delay Time	1~1000	100	ms	X	O	X	
18-06	FOC Gain	0.00~2.00	0.1	-	X	O	X	

Group 19 Reserved

Group 20 Speed Control Parameters*								
Code	Parameter Name	Setting Range	Default	Unit	Control Mode			Attribute
					V/F	SLV	PM SLV	
20-00	ASR Gain 1	0.00~250.00	3.00	-	X	O	O	*1
20-01	ASR Integral Time 1	0.001~10.000	SLV: 0.500 PMSLV :0.08,	Sec	X	O	O	*1
20-02	ASR Gain 2	0.00~250.00	3.00	-	X	O	O	*1
20-03	ASR Integral Time 2	0.001~10.000	SLV: 0.500 PMSLV :0.08,	Sec	X	O	O	*1
20-04	ASR Integral Time Limit	0~300	200	%	X	O	O	
20-05 20-06	Reserved							
20-07	Selection of Acceleration and Deceleration of P/PI	0: PI speed control will be enabled only in constant speed. For accel/ decel, only use P control. 1: Speed control is enabled either in constant speed or accel/ decel.	1	-	X	O	X	
20-08	ASR Delay Time	0.000~0.500	0.004	Sec	X	O	O	
20-09	Speed Observer Proportional (P) Gain 1	0.00~2.55	0.61	-	X	O	X	*1
20-10	Speed Observer Integral(I) Time 1	0.01~10.00	0.05	Sec	X	O	X	*1
20-11	Speed Observer Proportional (P) Gain 2	0.00~2.55	0.61	-	X	O	X	*1
20-12	Speed Observer Integral(I) Time 2	0.01~10.00	0.06	Sec	X	O	X	*1
20-13	Low-pass Filter Time Constant of Speed Feedback 1	1~1000	4	ms	X	O	X	
20-14	Low-pass Filter Time Constant of Speed Feedback 2	1~1000	30	ms	X	O	X	
20-15	ASR Gain Change Frequency 1	0.0~599.00 (Note8)	4.0	Hz	X	O	O	
20-16	ASR Gain Change Frequency 2	0.0~599.00 (Note8)	8.0	Hz	X	O	O	
20-17	Torque Compensation Gain at Low Speed	0.00~2.50	1.00	-	X	O	X	*1
20-18	Torque Compensation Gain at High Speed	-10~10	0	%	X	O	X	*1
20-19 ~ 20-32	Reserved							
20-33	Constant Speed Detection Level	0.1~5.0	1.0		X	O	O	*7
20-34	Derating of Compensation Gain	0~25600	0	%	X	O	X	*7
20-35	Derating of Compensation Time	0~30000	100	ms	X	O	X	*7

***: This parameter group are enabled in SLV and PMSLV modes.**

Group 21 Torque Control Parameters								
Code	Parameter Name	Setting Range	Default	Unit	Control Mode			Attribute
					V/F	SLV	PM SLV	
21-00 ~ 21-04	Reserved							
21-05	Positive Torque Limit	0~160	160	%	X	O	O	
21-06	Negative Torque Limit	0~160	160	%	X	O	O	
21-07	Forward Regenerative Torque Limit	0~160	160	%	X	O	O	
21-08	Reversal Regenerative Torque Limit	0~160	160	%	X	O	O	

Group 22: PM Motor Parameters- only available when PM Control Mode is selected								
Code	Parameter Name	Setting Range	Default	Unit	Control Mode			Attribute
					V/F	SLV	PM SLV	
22-00	Rated Power of PM Motor	0.00~600.00	KVA	kW	X	X	O	
22-01	PM Motor Rated Voltage	200V: 50.0~240.0 400V: 100.0~480.0	220.0 440.0	V	X	X	O	Note8
22-02	Rated Current of PM Motor	0.1~999.9	KVA	A	X	X	O	
22-03	Pole Number of PM Motor	2~96	6	poles	X	X	O	
22-04	Rated Rotation Speed of PM Motor	6~60000 (22-04, 22-06, only need to set one of them, the program will calculate the other.)	1500	rpm	X	X	O	
22-05	Maximum Rotation Speed of PM Motor	6~60000	1500	rpm	X	X	O	
22-06	PM Motor Rated Frequency	4.8~599.00 (Note8)	75.0	Hz	X	X	O	
22-07	PM Type Selection	0:SPM 1:IPM	0		X	X	O	Note8
22-08 ~ 22-09	Reserved							
22-10	PM SLV Start Current	20 ~ 200% Motor Rated Current	100	%	X	X	O	
22-11	I/F Mode Start Frequency Switching Point	10 ~ 100%	10.0	%	X	X	O	Note2
22-12 22-13	Reserved (Note6)							
22-14	PM Motor Armature Resistance	0.001 ~ 30.000	1.000	Ω	X	X	O	
22-15	PM Motor D-axis Inductance	0.01 ~ 300.00	10.00	mH	X	X	O	
22-16	PM Motor Q-axis Inductance	0.01 ~ 300.00	10.00	mH	X	X	O	
22-17	PM No-Load Voltage	200V: 0~200 400V: 0~400"	150 300	V	X	X	O	Note8
22-18	Flux-Weakening Control	0~100	0	%	X	X	O	Note1
22-19 22-20	Reserved							
22-21	SLV PM Motor Tuning	0: Disable 1: Enable	0	-	X	X	O	

Group 22: PM Motor Parameters- only available when PM Control Mode is selected								
Code	Parameter Name	Setting Range	Default	Unit	Control Mode			Attribute
					V/F	SLV	PM SLV	
22-22	Fault History of SLV PM Motor Tuning	0. No Error 1~4: Reserved 5: Circuit tuning time out. 6: Reserved 7: Other motor tuning errors 8: Reserved 9: Current Abnormity Occurs while Loop Adjustment. 10: Reserved 11: Stator Resistance Measurement Timeout 12: Reserved	0	--	X	X	O	*4
22-25	Detection Mode Selection of Default Magnetic Pole	0: Angle before Stop 1: Mode 1 2: Mode 2	2 (Note8)	--	X	X	O	Note4
22-26	Estimator Mode	0~1 (in PMSLV mode)	0	-	X	X	O	Note6
22-27	Mode 2 Voltage Command	5~120 (Note8) (22-25=2 or 22-26=1is enabled)	50	%	X	X	O	Note4
22-28	Mode 2 Frequency Division Ratio	0~8 (Note8) (22-25=2 or 22-26=1is enabled)	2		X	X	O	Note4
22-29	Field-Weakening Voltage Control	80~110 (Note8)	100	%	X	X	O	Note4
22-30	SPM Speed Estimation Gain	1~100	85	%	X	X	O	Note6
22-31	SPM Speed Estimation Filter Value	1~2000	60	HZ	X	X	O	Note6
22-32	MTPA Selection	0: Disable 1: Mode 1	0	-	X	X	O	Note8
22-33	MTPA Gain	0~400%	200	%	X	X	O	Note8
22-34	IPM Estimator Gain	0.1~500.0	180	-	X	X	O	Note8

Group 23 Pump & HVAC Function Parameters								
Code	Parameter Name	Setting Range	Default	Unit	Control Mode			Attribute
					V/F	SLV	PM SLV	
23-00	Function Selection	0: Disable 1: Pump 2: HVAC 3: Compressor *7	0	-	O	O	O	
23-01	Setting of Single & Multiple Pumps and Master & Slave Machines	0: Single Pump 1: Master 2: Slave 1 3: Slave 2 4: Slave 3	0		O	O	O	
23-02	Operation Pressure Setting	0.10 ~ 650.00	4.00	PSI	O	O	O	*6
23-03	Maximum Pressure of Pressure Transmitter	0.10 ~ 650.00	10.00	PSI	O	O	O	*6

Group 23 Pump & HVAC Function Parameters								
Code	Parameter Name	Setting Range	Default	Unit	Control Mode			Attribute
					V/F	SLV	PM SLV	
23-04	Pump Pressure Command Source	0: Set by 23-02/12-74 1: Set by AI	0		O	O	O	
23-05	Display Mode Selection	0: Display of Target and Pressure Feedback * 1: Only Display Target Pressure 2: Only Display Feedback Pressure	0	%	O	O	O	
23-06	Proportion Gain (P)	0.00~10.00	3.00	-	O	O	O	
23-07	Integral Time (I)	0.0~100.0	7.0	Sec	O	O	O	
23-08	Differential Time (D)	0.00~10.00	0.00	Sec	O	O	O	
23-09	Tolerance Range of Constant Pressure	23-20=0 : 0.01 ~ 650.00 23-20=1 : 1~100	5	%/ PSI	O	O	O	*6
23-10	Sleep Frequency of Constant Pressure	0.00 ~ 599.00 (Note8)	30.00	Hz	O	O	O	
23-11	Sleep Time of Constant Pressure	0.0 ~ 255.5	0.0	Sec	O	O	O	
23-12	Maximum Pressure Limit	23-20=0 : 0.00 ~ 650.00 23-20=1 : 0~100	50	%/ PSI	O	O	O	*6
23-13	Warning Time of High Pressure	0.0 ~ 600.0	10.0	Sec	O	O	O	
23-14	Stop Time of High Pressure	0.0 ~ 600.0	20.0	Sec	O	O	O	
23-15	Minimum Pressure Limit	23-20=0 : 0.00 ~ 650.00 23-20=1 : 0~100	5	%/ PSI	O	O	O	*6
23-16	Warning Time of Low Pressure	0.0 ~ 600.0	0.0	Sec	O	O	O	
23-17	Fault Stop Time of Low Pressure	0.0 ~ 600.0	0.0	Sec	O	O	O	
23-18	Time of Loss Pressure Detection	0.0 ~ 600.0	0.0	Sec	O	O	O	
23-19	Proportion of Loss Pressure Detection	0 ~ 100	0	%	O	O	O	
23-20	Switching of Pressure or Percentage	0:Pressure 1:Percentage	1	-	O	O	O	Note4
23-21	Reserved							
23-22	Slave Trip Frequency	0.00 ~ 599.00 (Note8)	45.00	Hz	O	O	O	Note2
23-23	Direction of Water Pressure Detection	0: Upward Detection 1: Downward Detection	1	-	O	O	O	
23-24	Range of Water Pressure Detection	23-20=0 : 0.00 ~ 65.00 23-20=1 : 0~10	1	%/ PSI	O	O	O	*6
23-25	Period of Water Pressure Detection	0.0 ~ 200.0	30.0	Sec	O	O	O	
23-26	Acceleration Time of Water Pressure Detection	0.1 ~ 6000.0	KVA	Sec	O	O	O	
23-27	Deceleration Time of Water Pressure Detection	0.1 ~ 6000.0	KVA	Sec	O	O	O	
23-28	Forced Run Command	0.00 ~ 599.00 (Note8)	0.00	Hz	O	O	O	
23-29	Switching Time of Multiple Pumps in Parallel	0 ~ 240	3	Hr/ min	O	O	O	

Group 23 Pump & HVAC Function Parameters								
Code	Parameter Name	Setting Range	Default	Unit	Control Mode			Attribute
					V/F	SLV	PM SLV	
23-30	Detection Time of Multiple Pumps in Parallel Running Start	0.0 ~ 30.0	0.0	Sec	O	O	O	
23-31	Synchronous Selection of Multiple Pumps in Parallel	0: Disable 1: Pressure Setting and Run/Stop 2: Pressure Setting 3: Run/Stop	1		O	O	O	
23-32	Reserved							
23-33	Reserved							
23-34	Tolerance Range of Constant Pressure 2	23-20=0 : 0.01 ~ 650.00 23-20=1 : 1~100	5	%/ PSI	O	O	O	Note1
23-35	Selection of Multiple Pumps Shift Operation	0: No function 1: Timer Alternately Selection 2: Sleep Stop Alternately Selection 3: Timer and Sleep Stop Alternately Selection 4: Multiple Pumps Test Mode	1		O	O	O	Note2
23-36	PUMP Unit Display	Reference 16-04 Engineering Units	0		O	O	O	Note4
23-37	Leakage Detection Time	0.0~100.0	0.0	Sec	O	O	O	*7
23-38	Pressure Variation of Leakage Detection Restart	23-20=0 : 0.01 ~ 65.00 23-20=1 : 1~10	1	%/ PSI	O	O	O	*7
23-39	Pressure Tolerance Range of Leakage Detection Restart	23-20=0 : 0.01 ~ 650.00 23-20=1 : 1~100	5	%/ PSI	O	O	O	*7
23-40	Reserved							
23-41	Local/ Remote Key	0: Disable 1: Enable	1		O	O	O	
23-42	Energy Recalculating	0: Disable (Energy Accumulating) 1: Enable	0		O	O	O	
23-43	Electricity Price per kWh	0.000 ~ 5.000	0.000	$	O	O	O	
23-44	Selection of Accumulative Electricity Pulse Output Unit	0: Disable 1: Unit for 0.1kWh 2: Unit for 1kWh 3: Unit for 10kWh 4: Unit for 100kWh 5: Unit for 1000kWh	0		O	O	O	
23-45	Given Modes of Flow Meters Feedback	0: Disable 1: Analog Input 2: Pulse Input	1		O	O	O	
23-46	Maximum Value of Flow Meters	1 ~ 50000	10000	GPM	O	O	O	
23-47	Target Value of Flow Meters	1 ~ 50000	5000	GPM	O	O	O	
23-48	Maximum Flow Value of Feedback	0.01 ~ 99.00	80.00	%	O	O	O	

Group 23 Pump & HVAC Function Parameters								
Code	Parameter Name	Setting Range	Default	Unit	Control Mode			Attribute
					V/F	SLV	PM SLV	
23-49	Maximum Flow Warning Time of Feedback	0.0 ~ 255.0	3.0	Sec	O	O	O	
23-50	Maximum Flow Stop Time of Feedback	0.0 ~ 255.0	6.0	Sec	O	O	O	
23-51	Minimum Flow Value of Feedback	0.01 ~ 99.00	10.00	%	O	O	O	
23-52	Minimum Flow Warning Time of Feedback	0.0 ~ 255.0	3.0	Sec	O	O	O	
23-53	Minimum Flow Stop Time of Feedback	0.0 ~ 255.0	6.0	Sec	O	O	O	
23-54	Detection Function of Low Suction	0: Disable 1: PID Error Value 2: Current 3: Current and PID Error Value	0		O	O	O	
23-55	Detection Time of Low Suction	0 ~ 30.0	10.0	Sec	O	O	O	
23-56	PID Error Level of Low Suction	0 ~ 30	10	%	O	O	O	
23-57	Current Level of Low Suction(Motor Rated Current)	0 ~ 100	10	%	O	O	O	
23-58	Reaction of Low Suction	0: Disable 1: Warning 2: Fault 3: Fault & Restart	0		O	O	O	
23-59	Source of HVAC Pressure Command	0: Set by 23-47/12-77 1: Set by AI	0		O	O	O	
23-60	HVAC Unit Display	Reference 16-04 Engineering Units	0		O	O	O	Note4
23-66	Derating of Current Level	10~200	110	%	O	X	X	
23-67	Derating of Delay Time	1.0~20.0	10.0	Sec	O	X	X	
23-68	Derating of Frequency Gain	1~100	90	%	O	X	X	
23-69	OL4 Current Level	10~200	120	%	O	X	X	
23-70	OL4 Delay Time	0~20.0	5.0	Sec	O	X	X	
23-71	Maximum Pressure Setting	0.10~650.00	10.00	PSI	O	O	O	Note3
23-72	Switching Time of Alternation in Parallel	0: Hour 1: Minute	0		O	O	O	Note4
23-73	Slave Wake-up Selection	0: Disable 1: Enable	0		O	O	O	Note4
23-74	High Pressure Setting	0: Disable 1: High Pressure Warning 2: High Pressure Warning or Error	2		O	O	O	Note5
23-75	Low Pressure Setting	0: Disable 1: Low Pressure Warning 2: Low Pressure Warning or Error	0		O	O	O	Note5
23-76	High Flow Setting	0: Disable 1: High Flow Warning	2		O	O	O	Note5

Group 23 Pump & HVAC Function Parameters								
Code	Parameter Name	Setting Range	Default	Unit	Control Mode			Attribute
					V/F	SLV	PM SLV	
		2: High Flow Warning or Error						
23-77	Low Flow Setting	0: Disable 1: Low Flow Warning 2: Low Flow Warning or Error	2		O	O	O	Note5
23-78	Selection of Loss Pressure Detection	0: Disable 1: Loss Pressure Warning 2: Low Pressure Error	0		O	O	O	Note5

Group 24 Pump Control Function Parameters								
Code	Parameter Name	Setting Range	Default	Unit	Control Mode			Attribute
					V/F	SLV	PM SLV	
24-00	Selection of Pump Control Function	0: Function of 1 to 8 Pump Card is Disabled 1: Fixed Modes of Inverter Pump: First on and Last off; then Stop All. 2: Fixed Modes of Inverter Pump: Only Stop Inverter Pump. 3: Fixed Modes of Inverter Pump: First on and First Off; then Stop All. 4: Cycle Modes of Inverter Pump: First on and First Off; then Stop All. 5: Cycle Modes of Inverter Pump: Only Stop Inverter Pump. 6: 1 to 3 Relay of Cycle Modes of Inverter Pump: First on and First off; then Stop All 7: Cycle Modes of Inverter Pump: First on and First Off; then Stop All. And First Boot Relay in Cycling.Note1 8: Cycle Modes of Inverter Pump 1 to 3 Relay: First on and First Off; then Stop All. And First Boot Relay in Cycling.Note1 9: Cycle Modes of Inverter Pump 1 to 3 Relay: Only Stop Inverter Pump. And First Boot Relay in Cycling.Note3	0	-	O	O	O	
24-01	Selection of Relay 2-4 Function	xxx0b: Reserved xxx1b: Reserved xx0xb: Relay 2 Disable xx1xb: Relay 2 Enable x0xxb: Relay 3 Disable	0000b		O	O	O	

Group 24 Pump Control Function Parameters								
Code	Parameter Name	Setting Range	Default	Unit	Control Mode			Attribute
					V/F	SLV	PM SLV	
		x1xxb: Relay 3 Enable 0xxxb: Relay 4 Disable 1xxxb: Relay 4 Enable						
24-02	Selection of Relay 5-8 Function	xxx0b: Relay 5 Disable xxx1b: Relay 5 Enable xx0xb: Relay 6 Disable xx1xb: Relay 6 Enable x0xxb: Relay 7 Disable x1xxb: Relay 7 Enable 0xxxb: Relay 8 Disable 1xxxb: Relay 8 Enable	0000b		O	O	O	
24-03	Duration of Upper Limit Frequency	1.0 ~ 600.0	300.0	Sec	O	O	O	*1
24-04	Duration of Lower Limit Frequency	1.0 ~ 600.0	300.0	Sec	O	O	O	*1
24-05	Switching Time of Magnetic Contactor	0.1 ~ 20.0	1.00	Sec	O	O	O	*1
24-06	Allowable Bias of Pump Switch	0.0 ~ 20.0	0.0	%	O	O	O	*1
24-07	Pump Control Source Selection	0: 1 to 8 pump card 1: Built-in 1 to 3 control mode	0		O	O	O	
24-08	Relay Switching Time	0~240	1	Hr/ min	O	O	O	Note1
24-09	Frequency/ Target Switch	0: Disable 1: Enable	0		O	O	O	Note3
24-10	Stop Mode Selection on Mode 6/7/9	0: Disable 1: Enable	0		O	O	O	Note3
24-11	High Pressure Limit Level	0~10000	50.0	-	O	O	O	Note4
24-12	Delay Time of High Pressure Warning	0.0 ~ 600.0	10.0	Sec	O	O	O	Note4
24-13	Delay Time of High Pressure Error	0.0 ~ 600.0	20.0	Sec	O	O	O	Note4
24-14	Low Pressure Limit Level	0~10000	0	-	O	O	O	Note4
24-15	Delay Time of Low Pressure Warning	0.0 ~ 600.0	0.0	Sec	O	O	O	Note4
24-16	Delay Time of Low Pressure Error	0.0 ~ 600.0	0.0	Sec	O	O	O	Note4
24-17	PID Control during Increasing/ Decreasing pumps	0: PID Control is disabled during increasing/ decreasing pumps 1: PID Control is enabled during increasing/ decreasing pumps	0	-	O	O	O	Note6

4.3 Description of Common Parameters

Group 00-Basic Parameters

00- 00	Control Mode Selection
Range	【0】: V/F 【1】: Reserved 【2】: SLV 【3】: Reserved 【4】: Reserved 【5】: PMSLV

The inverter offers the following control modes:

00-00=0: V/F Mode

Select the required V/F curve (01-00) based on your motor and application.
Perform a stationary auto-tune (17-00=2). If the motor cable length is longer than 50m (165ft), see parameter 17-00 for details.

00-00=2: Sensorless Vector Control

Verify the inverter rating matches the motor rating. Perform rotational auto-tune to measure and store motor parameters for higher performance operation. Perform non-rotational auto-tune if it's not possible to rotate the motor during auto-tune. Refer to parameter group 17 for details on auto-tuning.

00-00=5: PM Sensorless Vector Control

Verify the inverter rating matches the motor rating. Set PM motor data in parameters 22-00 to 22-06. Refer to parameter 22-21 for details on PM Motor tuning. A braking resistor is recommended to be used to prevent drive from getting regenerative energy. A braking module is required for Inverters ratings 200V 30HP, 400V/40HP or greater.

Note: Parameter 00-00 is excluded from initialization.

00- 02	Main Run Command Source Selection
Range	【0】: Keypad control 【1】: External terminal control 【2】: Communication control 【3】: PLC 【4】: RTC

00-02=0: Keypad Control
Use the keypad to start and stop the inverter and set direction with the forward / reverse key. Refer to section 4-1 for details on the keypad.

00-02=1: External Terminal Control
External terminals are used to start and stop the inverter and select motor direction.

The inverter can be operated in 2-wire and 3-wire mode.

00- 03	Alternative Run Command Source Selection
Range	【0】: Keypad control 【1】: External terminal control 【2】: Communication control 【3】: PLC 【4】: RTC

00-03=0: Keypad Control

Use the keys (Stop/ Run or FWD/ REV) in the keypad via the setting of 00-03=0 to run the inverter (please refer to section 4.1 for details on the keypad).

00-03=1: External Terminal Control

External terminals are used to start and stop the inverter and select motor direction via the setting of 00-03=1.

Note: Assign the function of one of DI (S1 to S6) to be “Run Command Switch Over” (03-00~03-05=12), then the run command source can be switched over between the setting of main (00-02) and alternative (00-03).

■ 2-wire operation

For 2-wire operation, set 03-00 (S1 terminal selection) to 0 and 03-01 (S2 terminal selection) to 1.

Terminal S1	Terminal S2	Operation
Open	Open	Stop Inverter
Closed	Open	Run Forward
Open	Closed	Run Reverse (Only at 11-00=0)
Closed	Closed	Stop Inverter, Display EF9 Alarm after 500ms

Parameter 13-08 to 2, 4 or 6 for 2-wire program initialization, multi-function input terminal S1 is set to forward , operation/ stop, and S2 is set for reverse, operation / stop.

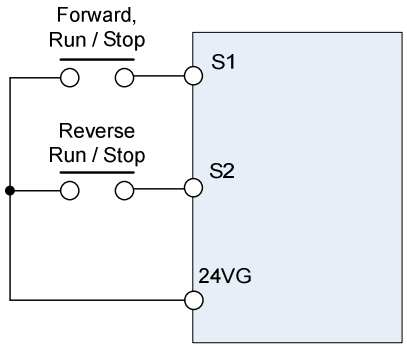


Figure 4.3.1 Wiring example of 2-wire

■ 3-wire operation

For 3-wire operation set any of parameters 03-02 to 03-05 (terminal S3 ~ S6) to 26 to enable 3-wire operation in combination with S1 and S2 terminals set to operation command and stop command.

Parameter 13-08 for 3-wire program initialization, multi-function input terminal S1 is set to run operation, S2 for stop operation and S5 for forward/reverse command. (Additionally must be 00-02=1, 11-00=0)

Note: Terminal S1 must be closed for a minimum of 50ms to activate operation.

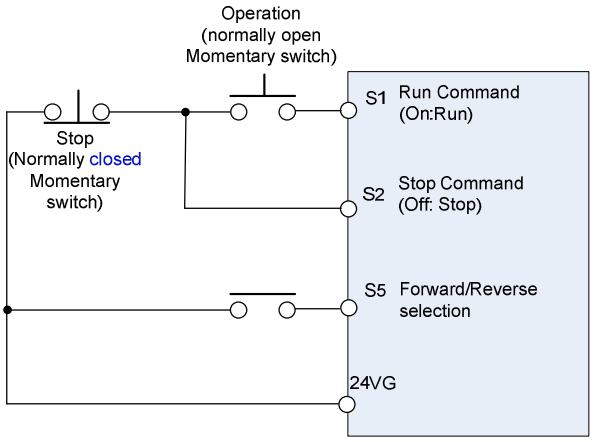


Figure 4.3.2 Wiring example of 3-wire

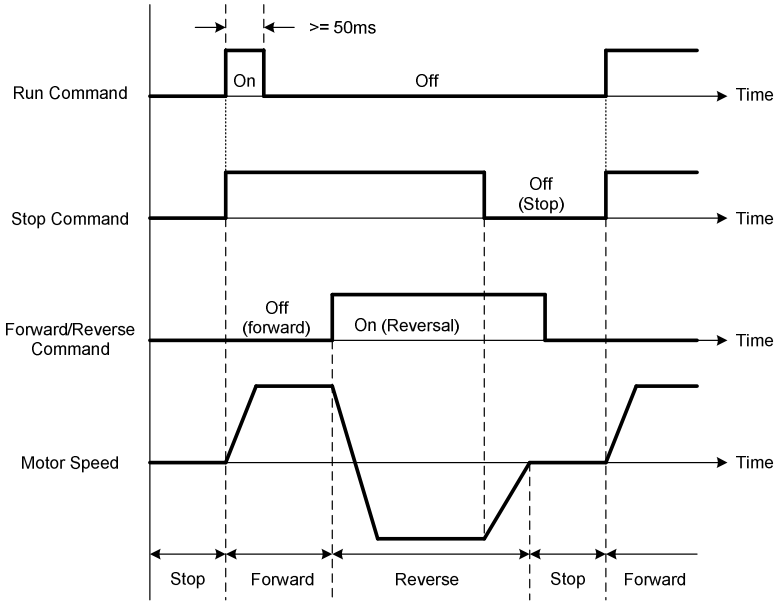
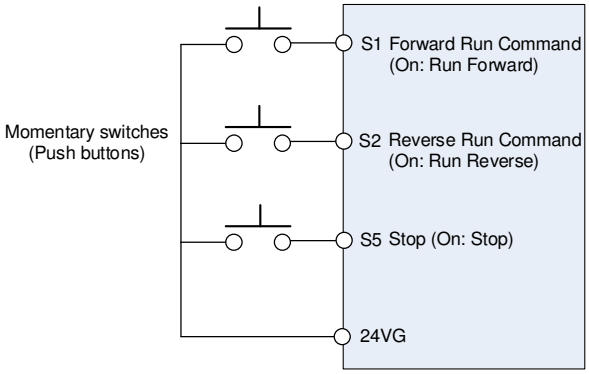


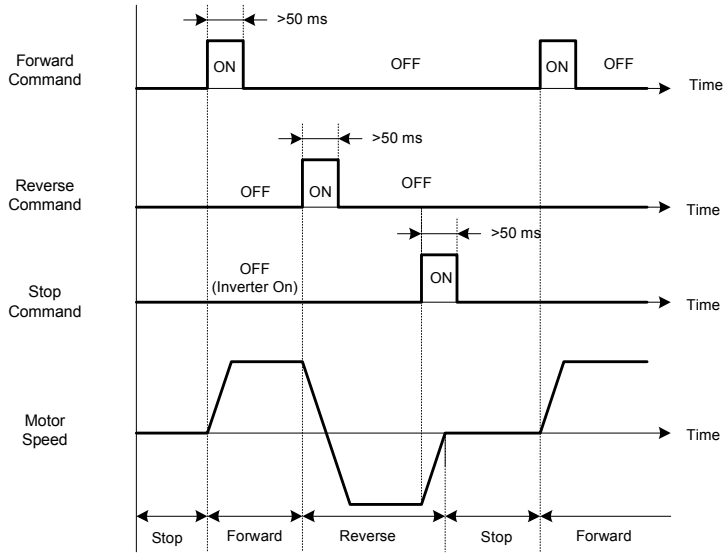
Figure 4.3.3 Timing chart of 3-wire operation

■ 2-wire self holding (latching) operation

Set one of parameters, 03-00 to 03-05 (terminal S1 ~ S6), to 53 in order to enable 2-wire self holding operation. After this mode is enabled, set terminal S1 (03-00=0) to forward and S2 (03-01=1) to reverse run command.



Note: Terminal S1, S2 and S5 must be closed for a minimum of 50ms to activate operation. The inverter will display SE2 error when input terminals S1-S6 is set to 53 and 26 simultaneously.



00-02=2: Communication control

The inverter is controlled by the RS-485 port. Refer to parameter group 9 for communication setup.

00-02=3: PLC control

The inverter is controlled by the inverter built-in PLC logic. Refer to section 4.3.

00-02=4: RTC control

The inverter is controlled by RTC timer when run command is set to RTC. Refer to function group 16.

00- 05	Main Frequency Command Source Selection
00- 06	Alternative Frequency Source Selection
Range	【0】: Keypad 【1】: External control (analog AI1) 【2】: Terminal UP / DOWN 【3】: Communication control 【4】: Reserved 【5】: Reserved 【6】: RTC 【7】: AI2 Auxiliary frequency

00-05/00-06= 0: Keypad

Use the keypad to enter the frequency reference or by setting parameter 05-01 (frequency reference 1). Note that once the frequency command is switched to alternative one, and 00-06=0, the frequency just can be adjusted via parameter 05-01. Refer to section 4.1.4 for details.

00-05/00-06= 1: External control (Analog Input)

When 04-05=0, give frequency reference command from control circuit terminal AI1 (voltage input). If auxiliary frequency is used, refer to the descriptions of multi-speed functions in parameter 03-00~05.

When frequency reference command is control by either AI1 or AI2, please regard the following setting:

① 00-05/ 00-06 are set individually to be 1 and 7.
② Set AI2 signal type in 04-00 (AI1 is always 0~10V).
③ Set 04-05=0 (Auxiliary frequency setting).
④ Set multi-function terminal function of 03-00~05 to be 13, then frequency reference command can be switched to AI1 control or AI2 control.

When 04-05=1, give frequency reference command from control circuit terminal AI1 (voltage input) or AI2 (current input, set by 04-00).

Use AI1 terminal when voltage input signal is the main frequency reference command.

Use AI2 terminal when current input signal (4-20mA) is the main frequency reference command.

Use analog reference from analog input AI1 or AI2 to set the frequency reference (as shown in Figure 4.3.4). Refer to parameter 04-00 to select the signal type.

	Voltage input	Current input	04-00 Setting (Default = 1)	Dipswitch SW2 (Default 'V')	Remark Default 04-05="10"
AI1 – Analog Input 1	0 ~ 10V	------	------	------	------
AI2 – Analog Input 2	0 ~ 10V	------	0: AI2 0~10V	Set to 'V'	Set 04-05="10" (Note)
	-------	4 ~ 20mA	1: AI2 4~20mA	Set to "I"	

Note: Set parameter 04-05 to 10 to add frequency reference AI2 to AI1.

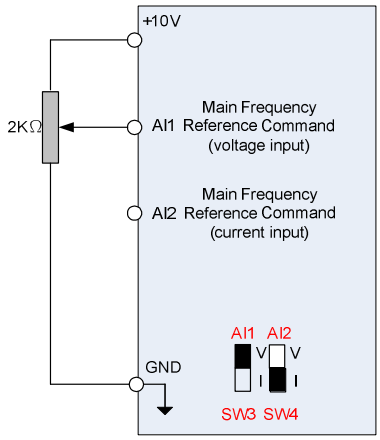


Figure 4.3.4 Analog input as main frequency reference command (For UE type)

00-05/00-06= 2: Terminal UP / DOWN

The inverter accelerates with the UP command closed and decelerates with the DOWN command closed. Please refer to parameter 03-00 ~ 03-05 for additional information.

Note: To use this function both the UP and DOWN command have to be selected to any of the input terminals.

00-05/00-06= 3: Communication Control

The frequency reference command is set via the RS-485 communication port using the MODBUS RTU/ BacNet/ MetaSys protocol.

Refer to parameter group 9 for additional information.

00-05/00-06= 6: RTC

Enables RTC control, reference frequency is controlled by the RTC function, Refer to parameter group 16 for RTC setup.

00-05/00-06=7: AI2 Auxiliary frequency[*1]

When 04-05 is set to 0 (auxiliary frequency), frequency command is set by multi-function analog input AI2. Maximum output frequency (01-02, Fmax) =100%; if 04-05 is not set to 0, the frequency is 0. Refer to the parmeters of 03-00~03-07 for descriptions of multi-speed functions.

00- 07	Main and Alternative Frequency Command Modes
Range	【0】: Main reference frequency 【1】: Main frequency + alternative frequency

When set to 0, the reference frequency is set by the main reference frequency selection of parameter 00-05. When set to 1, the reference frequency is sum of the main reference frequency (00-05) and alternative frequency (00-06).

Note: The inverter will display the SE1 error when 00-07 = 1 and parameter 00-05 and 00-06 are set to the same selection.

When parameter 00-06 is set to 0 (Keypad) the alternative frequency reference is set by parameter 05-01 (Frequency setting of speed-stage 0).

00-12	Upper Limit Frequency
Range	【0.1~109.0】%

Set the maximum frequency reference as a percentage of the maximum output frequency. Maximum output frequency depends on motor selection.
Motor 1: Maximum frequency parameter 01-02.
Motor 2: Maximum frequency parameter 01-16.

00-13	Lower Limit Frequency
Range	【0.0~109.0】%

Set the minimum frequency reference as a percentage of the maximum output frequency. Maximum output frequency depends on motor selection. Motor 1: Maximum frequency is set by parameter 01-02 and Motor 2 Maximum frequency is set by parameter 01-16.

Notes:

- When the frequency lower limit is set to a value greater than 0 and the inverter is started the output frequency will accelerate to the frequency lower limit with a minimum frequency defined by parameter 01-08 for motor 1 and parameter 01-22 for motor 2.
- Frequency upper limit has to greater or equal to the frequency lower limit otherwise the inverter will display a SE01 (Set range error).
- Frequency upper and lower limit is active for all frequency reference modes.

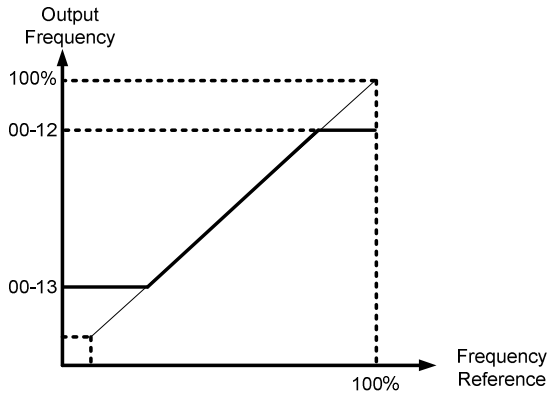


Figure 4.3.5 Frequency reference upper and lower limits

Note: The maximum frequency setting in the keypad is according to parameter 01-02 (Maximum Output Frequency) and 00-12 (Upper Frequency limit). The upper frequency limit is not over than 400Hz and maximum limit for AI frequency is 100% to parameter 01-02.

00-14	Acceleration Time 1
Range	【0.1~6000.0】 Sec
00-15	Deceleration Time 1

Acceleration time is the time required to accelerate from 0 to 100% of maximum output frequency. Deceleration time is the time required to decelerate from 100 to 0% of maximum output frequency. Motor 1: Maximum frequency is set by parameter 01-02 and Motor 2 Maximum frequency is set by parameter 01-16.

Note: Actual acceleration and deceleration times can be affected by the inverter driven load.

The default values for the acceleration, deceleration times are dependent on the inverter size.

Size		Acceleration / Deceleration Default Value
200V Class	400V Class	
1~15HP	1~20HP	10s
20~30HP	25~40HP	15s
40~175HP	50~800HP	20s

Group 01-V/F Control Parameters

01- 00	V/F Curve Selection
Range	【0~FF】

＊When restore factory setting (13-08), this parameter will not be changed.

The V/F curve selection is enabled for V/F mode. Make sure to set the inverter input voltage parameter 01-14.

There are three ways to set V/F curve:
(1) 01-00 = 0 to E: choose any of the 15 predefined curves (0 to E).
(2) 01-00 = 0F, use 01-02~01-09 and 01-12 ~ 01-13, with voltage limit.
(3) 01-00 = FF: use 01-02~01-09 and 01-12 ~ 01-13, without voltage limit.

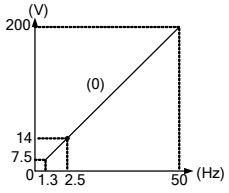
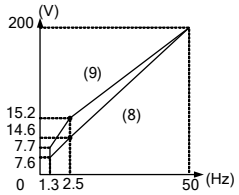
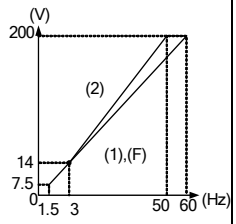
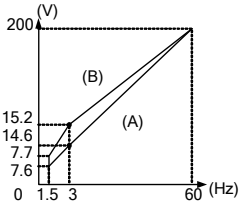
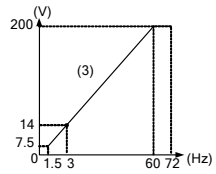
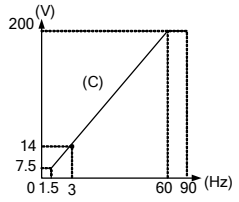
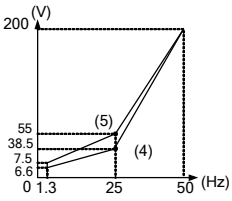
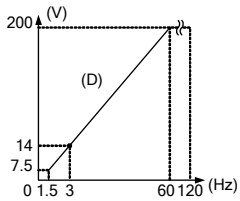
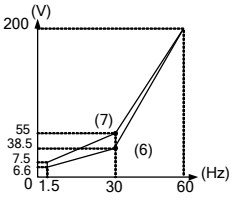
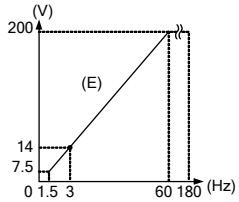
The default parameters (01-02 ~ 01-09 and 01-12 ~ 01-13) are the same when 01-00 is set to F (default) and 01-00 is set to 1.

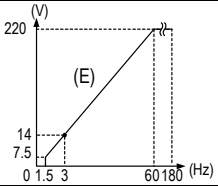
Parameters 01-02 ~ 01-13 are automatically set when any of the predefined V/F curves are selected.

This parameter will be affected to reset by the initialization parameter (13-08).

Consider the following items as the conditions for selecting a V/F pattern.
(1) The voltage and frequency characteristic of motor.
(2) The maximum speed of motor.

Table 4.3.2 1 - 30HP V/F curve selection

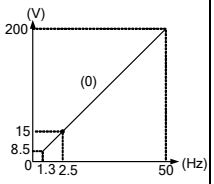
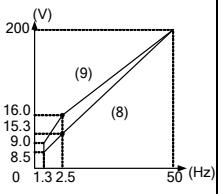
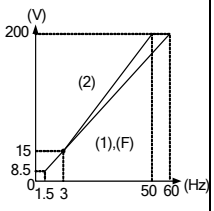
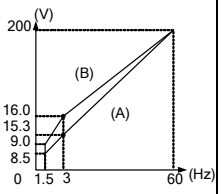
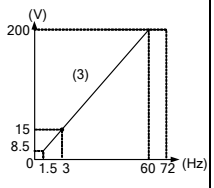
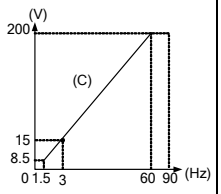
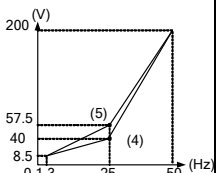
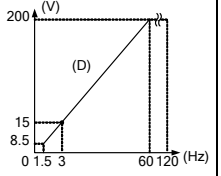
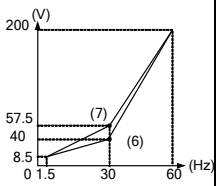
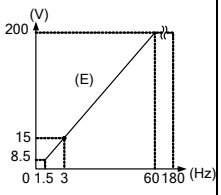
Type	Specification		01-00	V/F curve *1	Type	Specification		01-00	V/F *1
General purpose	50Hz		0		High Staring Torque‡	50Hz	Low Starting Torque	8	
			F				High Starting Torque	9	
	60Hz	60Hz Saturation	1			60Hz	Low Starting Torque	A	
			F (Def. Value)						
		50Hz Saturation	2				High Starting Torque	B	
Variable Torque Characteristic	72Hz		3		Constant-power torque(Reducer)	90Hz		C	
	50Hz	Variable Torque 1	4 (Def. Value for 50Hz)			120Hz		D	
		Variable Torque 2	5						
	60Hz	Variable Torque 3	6 (Def. Value for 60Hz)			180Hz		E	
		Variable Torque 4	7						

Type	Specification	01-00	V/F curve *1
Rated Horsepower Torque (Reducer)	180Hz	F	

*1. Values shown are for 200V class inverters; double values for 400V class inverters.

‡: Select high starting torque only for the following conditions.
(1) The power cable length is > 50m (492ft).
(2) Voltage drop at startup is high.
(3) An AC reactor is used on the input side or output side of the inverter.
(4) Motor power is lower than the inverter rated power.

Table 4.3.3 40HP and above V/F curve selection

Type	Specification		01-00	V/F curve *1	Type	Specification		01-00	V/F curve *1
General purpose	50Hz		0		High Staring Torque‡	50Hz	Low Starting Torque	8	
			F				High Starting Torque	9	
	60Hz	60Hz Saturation	1			60Hz	Low Starting Torque	A	
			F (Def. Value)						
		50Hz Saturation	2				High Starting Torque	B	
Variable Torque Characteristic	72Hz		3		Constant-power torque(Reducer)	90Hz		C	
	50Hz	Variable Torque 1	4 (Def. Value for 50Hz)			120Hz		D	
		Variable Torque 2	5						
	60Hz	Variable Torque 3	6 (Def. Value for 60Hz)			180Hz		E	
		Variable Torque 4	7						

*1. Values shown are for 200V class inverters; double values for 400V class inverters.

‡: Select high starting torque only for the following conditions.
(1) The power cable length is > 50m (492ft).
(2) Voltage drop at startup is high.
(3) An AC reactor is used on the input side or output side of the inverter.
(4) Motor power lower than the inverter rated power.

01- 02	Maximum Output Frequency
Range	【4.8~599.0】Hz
01- 03	Maximum Output Voltage
Range	200V:【0.1~255.0】V 400V:【0.2~510.0】V
01- 04	Middle output frequency 2
Range	【0.0~599.0】Hz
01- 05	Middle Output Voltage 2
Range	200V:【0.0~255.0】V 400V:【0.0~510.0】V
01- 06	Middle Output Frequency 1
Range	【0.0~599.0】Hz
01- 07	Middle Output Voltage 1
Range	200V:【0.0~255.0】V 400V:【0.0~510.0】V
01- 08	Minimum Output Frequency
Range	【0.0~599.0】Hz
01- 09	Minimum Output Voltage
Range	200V:【0.0~255.0】V 400V:【0.0~510.0】V
01- 12	Base Frequency
Range	【4.8~599.0】Hz
01- 13	Base Output Voltage
Range	200V:【0.0~255.0】V 400V:【0.0~510.0】V

V/F curve setting (01-02 ~ 01-09 and 01-12 ~ 01-13)

Select any of the predefined V/F curves setting '0' to 'E' that best matches your application and the load characteristic of your motor, choose a custom curve setting 'F' or 'FF' to set a custom curve.

Important:

Improper V/F curve selection can result in low motor torque or increased current due to excitation.

For low torque or high speed applications, the motor may overheat. Make sure to provide adequate cooling when operating the motor under these conditions for a longer period of time.

If the automatic torque boost function is enabled (parameter 01-10), the applied motor voltage will automatically change to provide adequate motor torque during start or operating at low frequency.

Custom V/F Curve Setting:

A custom curve selection allows users to set parameters 01-02 ~ 01-13 whereas a predefined curve selection does not.

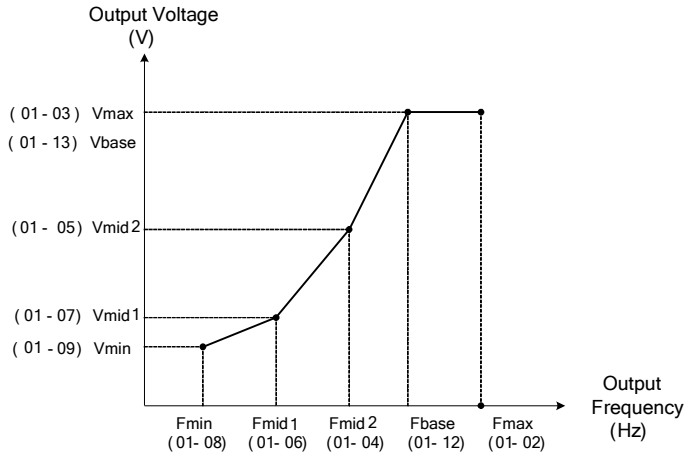


Figure 4.3.10 Custom V/F curve

When setting the frequency related parameters for a custom V/F curve values make sure that:

$$F_{max} \geqq F_{base} > F_{mid2} > F_{mid1} > F_{min}$$
(01-02) (01-12) (01-04) (01-06) (01-08)

The 'SE03' V/F curve tuning error is displayed when the frequency values are set incorrectly.

When 01-04 and 01-05 (or 01-18 and 01-09) are set to 0, the inverter ignores the set values of Fmid2 and Vmid2.

When the control mode is changed parameter 00-00, 01-08 (F_{min}) and 01-09 (V_{min}) will automatically be changed to the default setting of the selected control mode.

SLV (Sensorless vector control)

Enter the motor data in parameter group 17 for SV and SLV control mode (00-00) and perform auto-tuning.

In the SLV mode the V/F curve normally does not have to be re-adjusted after a successful auto-tune.

The maximum output frequency setting 01-02 (Fmax), base frequency 01-12 (Fbase) or minimum output frequency 01-08 (Fmin) can be adjusted but the voltage is automatically adjusted by the internal current controller.

Set the base frequency (01-12, Fbase) to the motor rated frequency on the motor nameplate.

Perform the auto-tuning procedure after adjusting parameters 02-19 or 17-04 to reduce the voltage at no-load operation.

Motor jitter can be reduced by lowering the no-load voltage. Please note that lowering the no-load voltage increases the current at no-load.

Group 02-IM Motor Parameter

02- 00	**No-load Current**
Range	**【0.01~600.00】A**
02- 01	**Rated Current**
Range	**25%~200% of inverter's rated current.**
02-03	**Rated Rotation Speed**
Range	**【0~60000】rpm**
02- 04	**Rated Voltage**
Range	**200V:【50.0~240.0】V** **400V: 【100.0~480.0】V**
02- 05	**Rated Power**
Range	**【0.01~600.00】KW**
02-06	**Rated Frequency**
Range	**【4.8~599.0】Hz**
02-07	**Poles**
Range	**【2~16】(Even)**

Please refer to parameter group 22 for permanent magnet motor parameters in the Instruction Manual

(1) Number of motor poles (02-07)
Set the number of motor pole according to the motor nameplate.

(2) Motor rated power (02-05)
Set the motor power according to the motor nameplate.

(3) Motor rated current (02-01)
Set the motor rated current according to the motor nameplate.

(4) Motor rated voltage (02-04)
Set the motor rated voltage according to the motor nameplate.

(5) Rated frequency of motor (02-06)
Set the motor rated frequency according to the motor nameplate.

(6) Rated rotation speed of motor (02-03)
Set the motor rpm according to the motor nameplate.

Group 03- External Digital Input and Output Parameters

03- 00	Multi-function terminal function setting – S1
03- 01	Multi-function terminal function setting – S2
03- 02	Multi-function terminal function setting – S3
03- 03	Multi-function terminal function setting – S4
03- 04	Multi-function terminal function setting – S5
03- 05	Multi-function terminal function setting – S6
Range	【0】: 2-Wire Sequence (ON: Forward Run Command) 【1】: 2-Wire Sequence (ON: Reverse Run Command) 【2】: Multi-Speed Setting Command 1 【3】: Multi-Speed Setting Command 2 【4】: Multi-Speed Setting Command 3 【5】: Multi-Speed Setting Command 4 【6】: Forward Jog Run Command 【7】: Reverse Jog Run Command 【8】: UP Frequency Increasing Command 【9】: DOWN Frequency Decreasing Command 【10】: Acceleration/ Deceleration Setting Command 1 【11】: Acceleration/ Deceleration Inhibition Command 【12】: Main/Alternative Run command Switching 【13】: Main/Alternative Frequency Command Switching 【14】: Emergency Stop (Decelerate to Zero and Stop) 【15】: External Baseblock Command (Rotation freely to Stop)*1 【16】: PID Control Disable 【17】: Fault Reset (RESET) 【18】: Reserved 【19】: Speed Search 1(from the maximum frequency)*1 【20】: Manual Energy Saving Function 【21】: PID Integral Reset 【22】~【23】: Reserved 【24】: PLC Input 【25】: External Fault 【26】: 3-Wire Sequence (Forward/ Reverse Command) 【27】: Local/ Remote Selection 【28】: Remote Mode Selection 【29】: Jog Frequency Selection 【30】: Acceleration/ Deceleration Setting Command 2 【31】: Inverter Overheating Warning 【32】: Reserved 【33】: DC Braking*1 【34】: Speed Search 2 (from Frequency Command)*1 【35】: Timing Function Input 【36】: PID Soft Start Disable 【37】~【40】: Reserved 【41】: PID Sleep 【42】~【46】: Reserved 【47】: Fire Mode (Forced to Run Mode) 【48】: KEB Acceleration 【49】: Parameters Writing Allowable 【50】: Unattended Start Protection (USP) 【51】~【52】: Reserved 【53】: 2-Wire Self Holding Mode (Stop Command) 【54】: Switch PID1 and PID2

	【55】: RTC Time Enable **【56】: RTC Offset Enable** **【57】: Forcing Frequency Run** **【58】: Run Permissive Function** **【63】: Switch to Tolerance Range of Constant Pressure 2** **【64】: Reserved** **【65】: Short-circuit braking** **【66】: Reserved** **【67】: Reserved** **【68】: External Fault 2** **【69】: External Overload**

***1: It can not be selected on the items 15, 19, 33, and 34 while using the permanent magnetic (PM) motor.**

Refer to the multi-function digital input and related parameters in the following Fig. 4.3.13

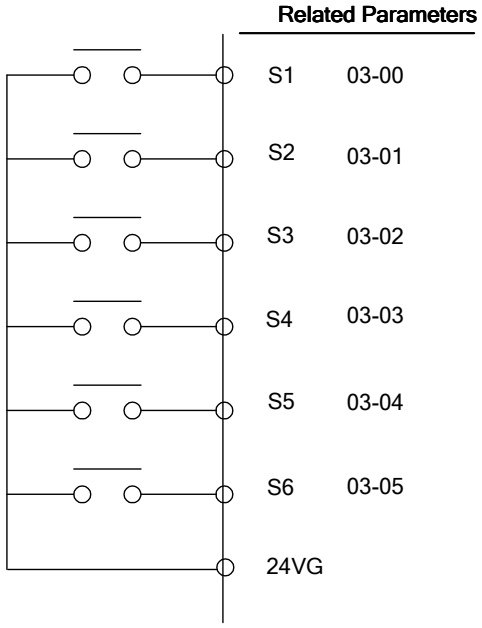


Figure 4.3.13 Multi-function digital input and related parameters

Table 4.3.4 Multi-function digital input setting (03-00 ~ 03-05) (“O”: Enable, “X”: Disable)

Value	Function		Description	Control mode		
	Name	LCD Display		V/F	SLV	PM SLV
0	2-wire type (Forward operation)	2-Wire (FWD-RUN)	2- wire (ON : Forward operation command).	O	O	O
1	2-wire type (Reverse operation)	2-Wire (REV-RUN)	2- wire (ON : Reverse operation command).	O	O	O
2	Multi-Speed Setting Command 1	Muti-Spd Ref 1	Multi-Speed Reference 1	O	O	O
3	Multi-Speed Setting Command 2	Muti-Spd Ref 2	Multi-Speed Reference 2	O	O	O
4	Multi-Speed Setting Command 3	Muti-Spd Ref 3	Multi-speed Reference 3	O	O	O
5	Multi-Speed Setting Command 4	Muti-Spd Ref 4	Multi-speed Reference 4	O	O	O
6	Forward Jog Run Command	FJOG	ON: Forward operation in jog mode (00-18)	O	O	O
7	Reverse Jog Run Command	RJOG	ON: Reverse operation in jog mode (00-18)	O	O	O
8	UP Frequency Increasing Command	UP command	ON: Command of output frequency increasing (only used by support of DOWN command).	O	O	O
9	DOWN Frequency Decreasing Command	DOWN command	ON: Command of output frequency decreasing (only used by support of UP command).	O	O	O
10	Acceleration/ Deceleration Setting Command 1	Acc/Decel Time Selection 1	Acceleration/deceleration time selection command1	O	O	O
11	Acceleration/ Deceleration Inhibition Command	ACC/DEC Inhibit	ON: Acceleration/deceleration prohibition	O	O	O
12	Main/Alternative Run command Switching	Run Change Sel	Run command source is set by alternative run command (00-03).	O	O	O
13	Main/Alternative Frequency Command Switching	Freq Change Sel	Frequency command source is set by alternative frequency command (00- 06).	O	O	O
14	Emergency Stop (Decelerate to Zero and Stop)	E-Stop	ON: Emergency stop input	O	O	O
15	External Baseblock Command (Rotation freely to Stop)	Ext. Baseblock	ON: Inverter base interdiction	O	O	O
16	PID Control Disable	PID Disable	ON: PID control disable	O	O	O
17	Fault Reset	Fault Reset	Fault reset	O	O	O
18	Reserved	Reserved	Reserved	-	-	-
19	Speed Search 1(from the maximum frequency)	Speed Search 1	ON: Search the speed from the maximum output frequency	O	O	X

Value	Function		Description	Control mode		
	Name	LCD Display		V/F	SLV	PM SLV
20	Manual Energy Saving Function	Energy saving	ON: Manual energy saving control is based on the settings of 11-12 and 11-18.	O	X	X
21	PID Integral Reset	PID I-Reset	ON: PID integral value reset	O	O	O
22~23	Reserved	Reserved	Reserved	-	-	-
24	PLC input	PLC Input	ON: Digital PLC input	O	O	O
25	External fault	Ext. Fault	ON: External fault alarm	O	O	O
26	3-Wire Sequence (Forward/ Reverse Command)	3-Wire (FWD/REV)	3-wire control (forward/reverse command). ON: Reverse; OFF: Forward. When the parameter is set to 26，terminal S1 and terminal will become operation command and stop command respectively, and their original functions will be closed.	O	O	O
27	Local/ Remote Selection	Local/Remote	ON: Local mode (via the digital operator) OFF: Frequency command and operation command will be determined according to the setting of parameter (00-02 and 00-05)	O	O	O
28	Remote Mode Selection	Remote Mode Sel	ON: RS-485 communication OFF: Control circuit terminal	O	O	O
29	Jog Frequency Selection	JOG Freq Ref	ON: Selection jog frequency command	O	O	O
30	Acceleration/ Deceleration Setting Command 2	Acc/Decel Time Selection 2	Acceleration/deceleration time selection command2	O	O	O
31	Inverter Overheating Warning (OH2)	Overheat Alarm	ON: Inverter overheat alarm (OH2) input(will display OH2)	O	O	O
32	Reserved	Reserved	Reserved	-	-	-
33	DC Braking	DC Brake Command	ON: Perform DC braking	O	X	X
34	Speed Search 2 (from Frequency Command)	Speed Search 2	ON: Search speed from set frequency	O	X	O
35	Timing Function Input	Timer Input	.Set the time function at 03-37, 03-38 .Set the time function output at 03-11, 03-12	O	O	O
36	PID Soft Start Disable	PID SFS Disable	ON: PID slow-start off	O	O	O
37~40	Reserved	Reserved	Reserved	-	-	-
41	PID Sleep	PID Sleep	ON: PID Sleep	O	O	O
42~46	Reserved	Reserved	Reserved	-	-	-
47	Fire Mode (Forced to Run Mode)	Fire Mode	ON: Inverter runs in the max. frequency of motor 1 (parameter 01-02). Note: If fault message of OC, SC, CUV, FUL, STO occur, function of fire mode will stop.	O	O	O
48	KEB Acceleration	KEB Accel.	ON: KEB acceleration start	O	X	X
49	Parameters Write-in Allowed	Write Enabled	ON: All parameters are writable. OFF: Except reference frequency (00-05) all parameters are write-protected.	O	O	O

Value	Function		Description	Control mode		
	Name	LCD Display		V/F	SLV	PM SLV
50	Unattended Start Protection (USP)	USP	ON: After power is input，the inverter ignores the operation command OFF: After power is input，the inverter will return the operation status before power is cut off.	O	O	O
51~52	Reserved	Reserved	Reserved	-	-	-
53	2-Wire Self Holding Mode (Stop Command)	2-Wire (STOP)	2-Wire Self Holding Mode (ON: Stop Command).	O	O	O
54	Switch PID1 and PID2	PID 2 Enable	ON: PID1 enabled OFF: PID2 enabled	O	O	O
55	RTC Time Enable	RTC Timer Switch	ON:RTC Time Function Enabled	O	O	O
56	RTC Offset Enable	Offset Time Switch	ON:RTC Offset Enabled	O	O	O
57	Forcing Frequency Run	Force Freq Cmd	ON: Run on Forcing Frequency (23-28) OFF: Determine frequency reference and run command depending on the setting of parameter (00-02 and 00-05)	O	O	O
58	Run Permissive Function	Safety Function	ON: Stop on the setting of 08-30	O	O	O
63	Switch to Tolerance Range of Constant Pressure 2	Switch Const.P. Range 2	ON: Use tolerance range of constant pressure 2 (23-34) for PUMP mode OFF: Use tolerance range of constant pressure 1 (23-09) for PUMP mode	O	O	O
64	Reserved	Reserved	Reserved	-	-	-
65	Short-circuit braking	SC Brk	ON: Excute short-circuit braking	X	X	O
66	Reserved	Reserved	Reserved	-	-	-
67	Reserved	Reserved	Reserved	-	-	-
68	External Fault 2	Ext. Fault 2	ON: the alarm of external Fault	O	O	O
69	External Overload	Ext. Overload	ON: the input of external overload	O	O	O

03-0X =00: 2-wire control: forward operation

03-0X =01: 2-wire control: reverse operation. Refer to the 2-wire operation mode in Figure 4.3.1.

03-0X =02: Multi-speed setting command 1.

03-0X =03: Multi-speed setting command 2.

03-0X =04: Multi-speed setting command 3.

03-0X =05: Multi-speed setting command 4.

03-0X =29: Jog frequency selection (setting =29).

Select frequency reference using the multi-function digital input.

Table 4.3.5 Multi-speed operation selection

Speed	Multi-function digital input (S1 ~ S6)					Frequency selection
	Jog frequency reference	Multi-speed frequency 4	Multi-speed frequency 3	Multi-speed frequency 2	Multi-speed frequency 1	
1	0	0	0	0	0	Frequency command 0 (05-01) or main speed frequency [*2]
2	0	0	0	0	1	(04-05=0) Auxiliary speed frequency or (04-05≠0) Frequency command 1 (05-02) [*3]
3	0	0	0	1	0	Frequency command 2 (05-03)
4	0	0	0	1	1	Frequency command 3 (05-04)
5	0	0	1	0	0	Frequency command 4 (05-05)
6	0	0	1	0	1	Frequency command 5 (05-06)
7	0	0	1	1	0	Frequency command 6 (05-07)
8	0	0	1	1	1	Frequency command 7 (05-08)
9	0	1	0	0	0	Frequency command 8 (05-09)
10	0	1	0	0	1	Frequency command 9 (05-10)
11	0	1	0	1	0	Frequency command 10 (05-11)
12	0	1	0	1	1	Frequency command 11 (05-12)
13	0	1	1	0	0	Frequency command 12 (05-13)
14	0	1	1	0	1	Frequency command 13 (05-14)
15	0	1	1	1	0	Frequency command 14 (05-15)
16	0	1	1	1	1	Frequency command 15 (05-16)
17	1 [*1]	—	—	—	—	Jog frequency command (00-18)

0: OFF, 1: ON, —: Ignore

*1. Jog frequency terminal has a higher priority than multi-speed reference 1 to 4.

*2. When parameter 00-05=0 (frequency reference input = digital operator), multi-speed frequency 1 will be set by 05-01 frequency reference setting1). When parameter 00-05=1 (frequency reference input=control circuit terminal), multi-speed frequency command 1 is input through analog command terminal AI1 or AI2.

*3. 05-02 is used for auxiliary speed frequency of AI2 as default setting. It is necessary to set 04-05$\neq 0$ to switch 05-02 to be for Frequency command 1. When PID control mode is enabled (10-03= xxx1b), Frequency of Speed - Stage 1 can not switch auxiliary speed frequency even though Multi-function Terminal Function Setting (03-00~03-05)=16 (PID control disable).

Wiring Example: Fig. 4.3.14 and 4.3.15 show an example of a 9-speed operation selection.

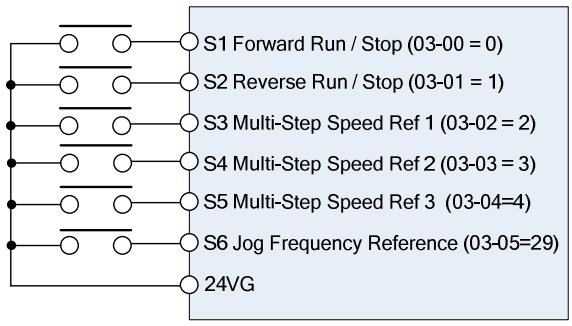


Figure 4.3.14 Control Terminal Wiring Example

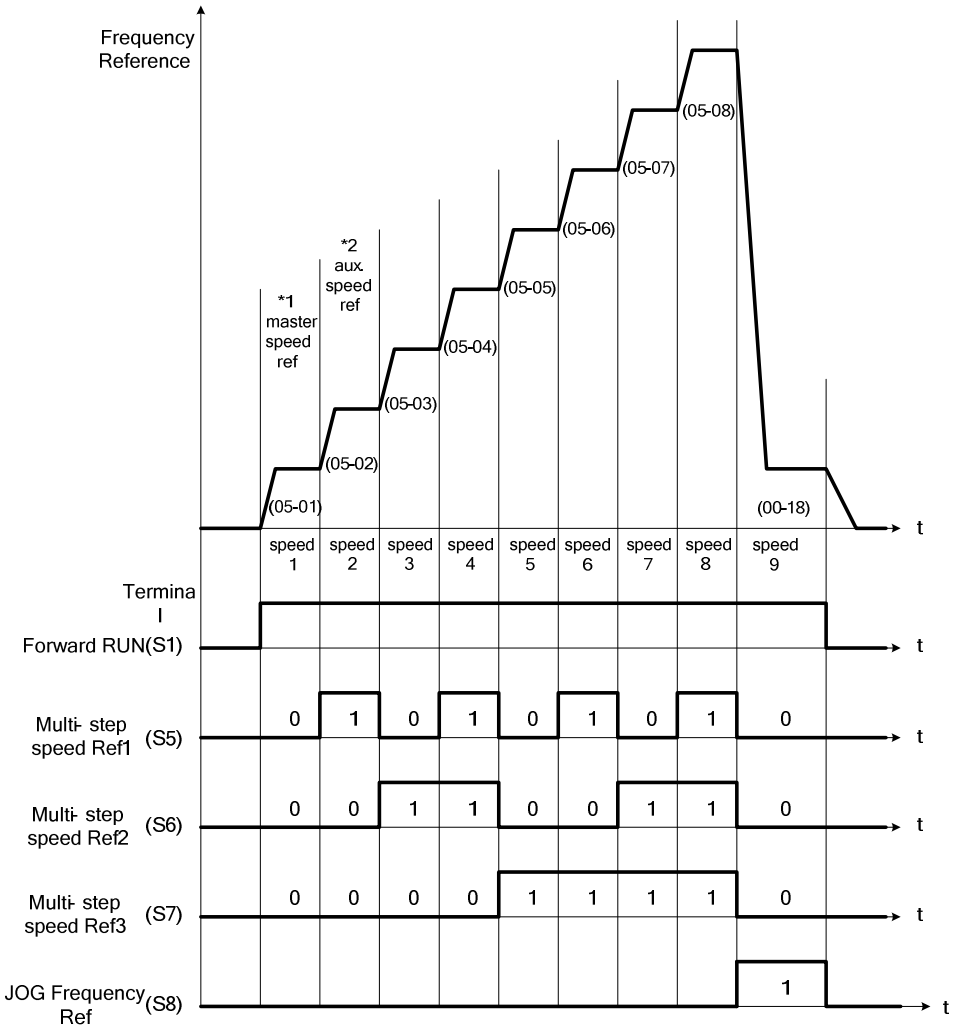


Figure 4.3.15 9-speed timing diagram

*1. When 00-05=1, multi-speed frequency reference is set by analog input AI1 or AI2.

03-0X =06: Forward jog run command, uses jog frequency parameter 00-18.
03-0X =07: Reverse jog run command, uses jog frequency parameter 00-18.

Notes:

- To excute the Forward jog or Reverse jog command need to set 00-02=1 at first.
- Jog command has a higher priority than other frequency reference commands.
- Jog command uses stop mode set in parameter 07-09 when Jog command is active > 500ms.
- When 11-00 (Direction Lock Selection) set to 1 (Only Allow Forward Rotation), if there is a motor reverse command, the “RUNER” warning will display.
- When 11-00 (Direction Lock Selection) set to 2 (Only Allow Reverse Rotation), if there is a motor forward command, the “RUNER” warning will display.

03-0X =12: Main/Alternative Run command Switching

Run command source is set by alternative run command (00-03) when function terminal is active. When function terminal is set to 27 (Local/ Remote control selection), the priority will higher than the switch of main/ alternative run command.

03-0X =13: Main/Alternative Frequency Command Switching
Frequency command source is set by alternative frequency command (00- 06) when function terminal is active. When function terminal is set to 27 (Local/ Remote control selection), the priority will higher than the switch of main/ alternative frequency command.

03-0X =14: Emergency stop (decelerate to zero and stop)
Refer to the "deceleration time of emergency stop" of parameter 00-26.

03-0X =15: External Baseblock Command (coast to stop)
Execute the base block command by the use of ON / OFF way of multi-function digital input terminal, and prohibit the inverter output.

During run: When an external base block command is activated, the keypad displays "BBn BaseBlock (Sn)", indicating the inverter output is turned off (n indicates the digital input number 1 – 6). Upon removing the base block signal, the motor will run at the frequency reference. If speed seach from frequency reference is active the inverter output frequency starts from the frequency reference and searches for the coasting motor speed and continue to operate. If speed search is not active the output frequency starts at 0Hz.

During deceleration: When an external base block command is activated, the keypad displays "BBn BaseBlock (Sn)", indicating the inverter output is turned off (n indicates the digital input number 1 – 6). Upon removing the base block signal, the motor is stopped or will coast to a stop and the inverter will remains in the stop condition.

During acceleration: When an external base block command is activated, the keypad displays "BBn BaseBlock (Sn)", indicating the inverter output is turned off (n indicates the digital input number 1 – 6). Upon removing the base block signal, the motor will run at the frequency reference. If speed seach from frequency reference is active the inverter output frequency starts from the frequency reference and searches for the coasting motor speed and continue to operate. If speed search is not active the output frequency starts at 0Hz.

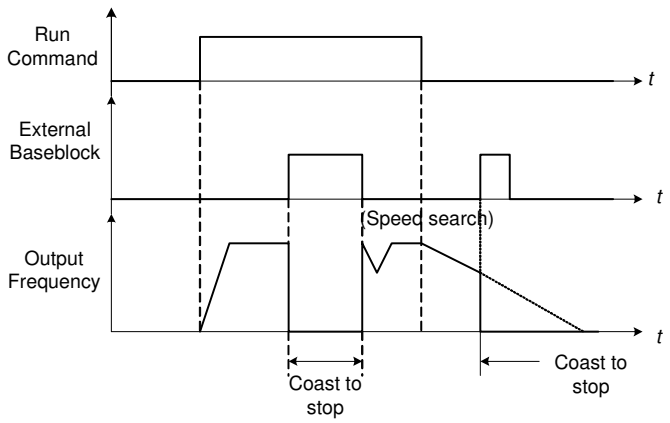


Figure 4.3.19 External base block operation

03- 09	Multi-function Terminal S1-S4 Type Selection
Range	【xxx0b】: S1 A contact 【xxx1b】: S1 B contact 【xx0xb】: S2 A contact 【xx1xb】: S2 B contact 【x0xxb】: S3 A contact 【x1xxb】: S3 B contact 【0xxxb】: S4 A contact 【1xxxb】: S4 B contact

03- 10	Multi-function Terminal S5-S6 Type Selection
Range	【xxx0b】: S5 A contact 【xxx1b】: S5 B contact 【xx0xb】: S6 A contact 【xx1xb】: S6 B contact

Parameter 03-09 and 03-10 selects the digital input type between a normally open and a normally closed switch/contact.

Each bit of 03-09/03-10 presents an input：

03-09= **0 0 0 0** **0**：normally open switch
s4 s3 s2 s1 **1**：normally closed switch

03-10= **x x 0 0** **0**：normally open switch
s6 s5 **1**：normally closed switch

Example: S1 and S2 wired to a normally closed contact / switch set 03-09=0011.

Do not set the operation command parameter 00-02 to terminal control before setting the digital input type. Failure to comply may cause death or serious injury.

03-11	**Relay (R1A-R1C) Output**
03-12	**Relay (R2A-R2C) Output**
03-20	**Relay(R4A-R4C) Output** *1
03-21	**Photo-coupler(DO2-DOG) Output** *1
03-39	**Relay (R3A-R3C) Output**
Range	**【0】: During Running** **【1】: Fault Contact Output** **【2】: Frequency Agree** **【3】: Setting Frequency Agree (03-13±03-14)** **【4】: Frequency Detection 1 (≧ 03-13 + 03-14)** **【5】: Frequency Detection 2 (＜ 03-13)** **【6】: Automatic Restart** **【7】~【8】: Reserved** **【9】: Baseblock** **【10】~【11】：Reserved** **【12】: Over-Torque Detection** **【13】: Current Agree** **【14】: Mechanical Brake Control (03-17~18)** **【15】~【17】: Reserved** **【18】: PLC Status** **【19】: PLC Control** **【20】: Zero Speed** **【21】: Inverter Ready** **【22】: Undervoltage Detection** **【23】: Source of Operation Command** **【24】:Source of Frequency Command** **【25】: Low Torque Detection** **【26】: Frequency Reference Missing** **【27】: Timing Function Output** **【28】~【31】: Reserved** **【32】: Communication Control Contacts** **【33】: RTC Timer 1** **【34】: RTC Timer 2** **【35】: RTC Timer 3** **【36】: RTC Timer 4** **【37】: Detection Output of PID Feedback Loss** **【38】: Brake Release** **【42】: Over-High Pressure** **【43】: Over-Low Pressure**

	【44】: Loss of Pressure Detection **【45】: PID Sleep** **【46】: Over-High Flow** **【47】: Over-Low Flow** **【48】: Shortage of Low Suction** **【49】: Communication Error** **【50】: Frequency Detection 3 (≧ 03-44+03-45)** **【51】: Frequency Detection 4 (< 03-44)** **【52】: Frequency Detection 5 (≧ 03-46+03-47)** **【53】: Frequency Detection 6 (< 03-46)** **【54】: Turn on short-circuit braking** **【57】: Low Current Detection** **【58】: Frequency Deceleration Detection** **【59】: Overheat Detection**

*1: The parameters are available when the I/O expansion card installed.

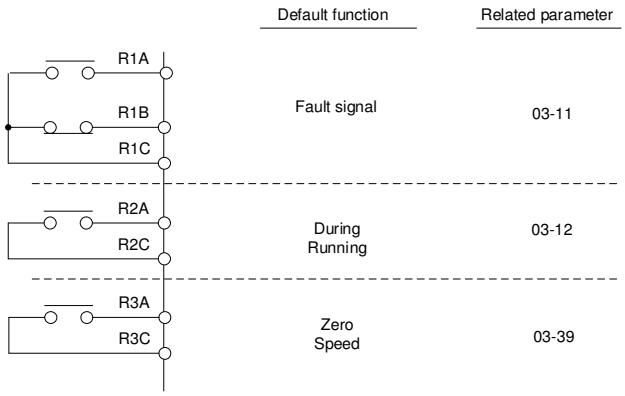


Figure 4.3.22 Multi-function digital output and related parameters

Table 4.3.6 Description of multi-function digital output

Value	Function		Description	Control Mode		
	Name	LCD Display		V/F	SLV	PM SLV
0	During Running	Running	ON: During running (Run Command is ON)	O	O	O
1	Fault Contact Output	Fault	ON: Fault contact output (except CF00 and CF01)	O	O	O
2	Frequency Agree	Freq. Agree	ON: Frequency agree (frequency agree width detection is set by 03-14)	O	O	O
3	Setting Frequency Agree	Setting Freq Agree	ON: Output frequency = allowed frequency detection level (03-13) ± frequency bandwidth (03-14)	O	O	O
4	Frequency Detection 1	Freq. Detect 1	ON: Output frequency ≧ 03-13 + 03-14	O	O	O
5	Frequency Detection 2	Freq. Detect 2	OFF: Output frequency ≧ 03-13 + 03-14	O	O	O
6	Automatic Restart	Auto Restart	ON: the period of automatic restart	O	O	O
7~8	Reserved	Reserved	Reserved	-	-	-
9	Baseblock	Baseblock	ON: During baseblock	O	O	O
10~11	Reserved	Reserved	Reserved	-	-	-
12	Over-Torque Detection	Over Torque	ON: Over torque detection is ON	O	O	O
13	Current Agree	Current Agree	ON: Output current > 03-15	O	O	O

Value	Function		Description	Control Mode		
	Name	LCD Display		V/F	SLV	PM SLV
14	Mechanical Brake Control (03-17~03-18)	Mechanical Brake Control	ON: Mechanical brake release frequency OFF: Mechanical brake operation frequency	O	O	O
15~17	Reserved	Reserved	Reserved	-	-	-
18	PLC Status	PLC statement	ON: when 00-02 is set to 3 (PLC operation command source)	O	O	O
19	PLC Control	Control From PLC	ON: Control from PLC	O	O	O
20	Zero Speed	Zero Speed	ON: Output frequency < Minimum output frequency (Fmin)	O	O	O
21	Inverter Ready	Ready	ON: Inverter ready (after power on, no faults)	O	O	O
22	Undervoltage Detection	Low Volt Detected	ON: DC bus voltage = < Low-voltage warning detection level (07-13)	O	O	O
23	Source of Operation Command	Run Cmd Status	ON: Operation command from LED digital operator (local mode)	O	O	O
24	Source of Frequency Command	Freq Ref Status	ON: Reference frequency from LED digital operator (local mode)	O	O	O
25	Low Torque Detection	Under Torque	ON: Low-torque detection is ON	O	O	O
26	Frequency Reference Missing	Ref. Loss.	ON: Reference frequency loss	O	O	O
27	Timing Function Output	Timer Output	Set time function parameter to 03-37 and 03-38，and the time function input is set by parameter from 03-00 and 03-05	O	O	O
28~31	Reserved	Reserved	Reserved	-	-	-
32	Communication Control Contacts	Control From Comm	ON: DO is set by communication control.	O	O	O
33	RTC Timer 1	RTC Timer 1	ON: 16-36 (RTC Speed Selection) selects Timer 1 and 16-32 (Source of Timer 1) is active in the set time.	O	O	O
34	RTC Timer 2	RTC Timer 2	ON: 16-36 (RTC Speed Selection) selects Timer 2 and 16-33 (Source of Timer 2) is active in the set time.	O	O	O
35	RTC Timer 3	RTC Timer 3	ON: 16-36 (RTC Speed Selection) selects Timer 3 and 16-34 (Source of Timer 3) is active in the set time.	O	O	O
36	RTC Timer 4	RTC Timer 4	ON: 16-36 (RTC Speed Selection) selects Timer 4 and 16-35 (Source of Timer 4) is active in the set time.	O	O	O
37	Detection Output of PID Feedback Loss	PID Fbk Loss	ON: PID Feedback Loss	O	O	O
38	Brake Release	Brake Relase	ON: Brake Release	X	O	X
42	Over-High Pressure	High PSI	ON:High PSI Warning/Fault	O	X	X
43	Over-Low Pressure	Low PSI	ON: Low PSI Warning/Fault	O	X	X
44	Loss of Pressure Detection	Fb PSI	ON: Fb PSI Fault	O	X	X

Value	Function		Description	Control Mode		
	Name	LCD Display		V/F	SLV	PM SLV
45	PID Sleep	PID Sleep	ON: During PID Sleep	O	O	O
46	Over-High Flow	Over GPM	ON: Over GPM Warning/Fault	O	O	O
47	Over-Low Flow	Low GPM	ON: Low GPM Warning/Fault	O	O	O
48	Shortage of Low Suction	Low Suction	ON: Low Suction Warning/Fault	O	O	O
49	Communication Error	RS-485 Err.	ON: Communication Error Warning	O	O	O
50	Frequency Detection 3	Freq. Detect 3	ON: output frequency > 03-44，Hysteresis range :03-45	O	O	O
51	Frequency Detection 4	Freq. Detect 4	OFF: output frequency > 03-44，Hysteresis range :03-45	O	O	O
52	Frequency Detection 5	Freq. Detect 5	ON: output frequency > 03-46，Hysteresis range :03-47	O	O	O
53	Frequency Detection 6	Freq. Detect 6	OFF: output frequency > 03-46，Hysteresis range :03-47	O	O	O
54	Turn on short-circuit braking	SC Brk	ON: Turn on short-circuit breaking	X	X	O
57	Low Current Detection	Low Current Detect	ON: Output Current ≦ 03-48 Low current detection level	O	O	O
58	Frequency Deceleration Detection	Freq. Decel to	ON: Output Frequency < Frequency Command – parameter 03-14 in deceleration	O	O	O
59	OH Detection	OH Detect	ON: Heat Sink Fin Temperature >08-46, hysteresis Zone 08-47	O	O	O

Group 04 External Analog Input and Output Parameters

04- 00	**AI Input Signal Type**
Range	**【0】: AI1 0~10V AI2 0~10V** **【1】: AI1 0~10V AI2 4~20mA** **【2】: Reserved** **【3】: Reserved** **【4】: AI1 4~20mA AI2 0~10V** **【5】: AI1 4~20mA AI2 4~20mA**
04- 09	**AI Input Signal Type on I/O expansion card** ***1**
Range	**【0】: AI3 0~10V** **【1】: AI3 -10~10V** **【2】: AI3 4~20mA**
04- 01	**AI1 Signal Scanning and Filtering Time**
Range	**【0.00~2.00】Sec**
04- 02	**AI1 Gain**
Range	**【0.0~1000.0】%**
04- 03	**AI1 Bias**
Range	**【-100~100.0】%**
04- 04	**AI negative Characteristics**
Range	**【0】: Disable** **【1】: Enable**
04- 05	**AI2 Function Setting**

04- 10	AI3 Function Setting *1
Range	【0】: Auxiliary Frequency 【1】: Frequency Reference Gain 【2】: Frequency Reference Bias 【3】: Output Voltage Bias 【4】: Coefficient of Acceleration and Deceleration Reduction 【5】: DC Braking Current* 【6】: Over-Torque Detection Level 【7】: Stall Prevention Level During Running 【8】: Frequency Lower Limit 【9】: Jump Frequency 4 【10】: Added to AI1 【11】: Positive Torque Limit 【12】: Negative Torque Limit 【13】: Regenerative Torque Limit 【14】: Positive / Negative Torque Limit 【15】: Reserved 【16】: Torque Compensation 【17】: Reserved
04- 06	AI2 Signal Scanning and Filtering Time
Range	【0.00~2.00】Sec
04- 07	AI2 Gain
Range	【0.0~1000.0】%
04- 08	AI2 Bias
Range	【-100.0~100.0】%
04- 21	AI3 Signal Scanning and Filtering Time *1
Range	【0.00~2.00】Sec
04- 22	AI3 Gain *1
Range	【0.0~1000.0】%
04- 23	AI3 Bias *1
Range	【-100.0~100.0】%

*1: The parameters are available when the I/O expansion card installed.

For Standard H & C type:
Refer to the followings for the details of parameter 04-00 (AI input signal type)
AI2=0~10V, Set 04-00=0, tune SW2 on the control board ro V.
AI2=0~20mA, Set 04-00=0, tune SW2 on the control board to I.
AI2=4~20mA, Set 04-00=1, tune SW2 on the control board to I.
AI2=2~10V, Set 04-00=1, tune SW2 on the control board to V.

For Enhanced E & G type:
Refer to the followings for the details of parameter 04-00 (AI input signal type)
AI1=0~10V, Set 04-00=0 or 1, tune SW3 on the control board to V.
AI1=4~20mA, Set 04-00=4 or 5, tune SW3 on the control board to I.
AI2=0~10V, Set 04-00=0 or 2 or 4, tune SW4 on the control board to V
AI2=4~20mA, Set 04-00=1 or 3 or 5, tune SW4 on the control board to I.

For I/O expansion card:
Refer to the followings for the details of parameter 04-09 (AI input signal type)
AI3=0~10V, Set 04-09=0, tune SW7 on the I/O expansion card to V.
AI3=-10~10V, Set 04-09=1, tune SW7 on the I/O expansion card to V.
AI3=4~20mA, Set 04-09=2, tune SW7 on the I/O expansion card to I.

(1) Analog Input Level Adjustment AI1, AI2, AI3 (04-02, 04-03, 04-04, 04-07, 04-08, 04-22, 04-23)

Each analog input AI1and AI2 has a separate gain and bias parameter associated with it.

Analog input signal AI1 can be adjusted with parameter 04-02 and 04-03; Analog input signal AI2 can be adjusted with parameter 04-07 and 04-08, Analog input signal AI3 can be adjusted with parameter 04-22 and 04-23. Refer to Fig.4.4.25.

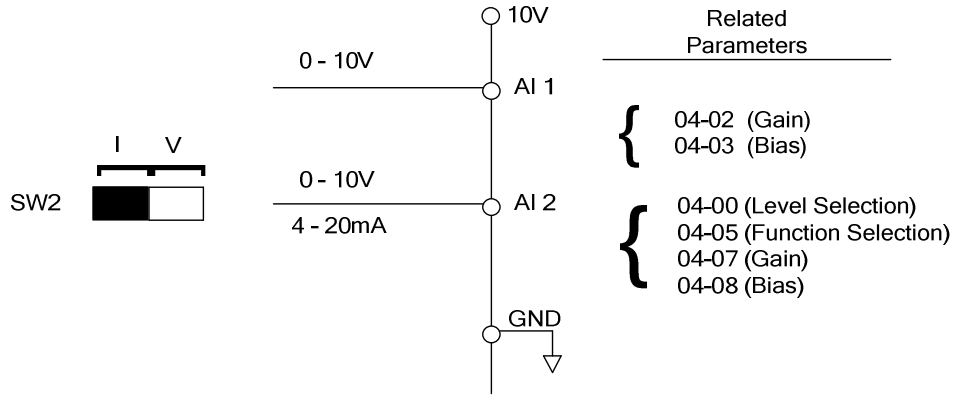


Figure 4.4.25 Analog inputs and related parameters (For Standard H & C type)

Gain setting: Sets the level in % that corresponds to a 10V or 20mA signal at the analog input.

Bias setting: Sets the level in % that corresponds to a 0V or 4mA signal at the analog input.

Use both gain and bias setting to scale the input signal.

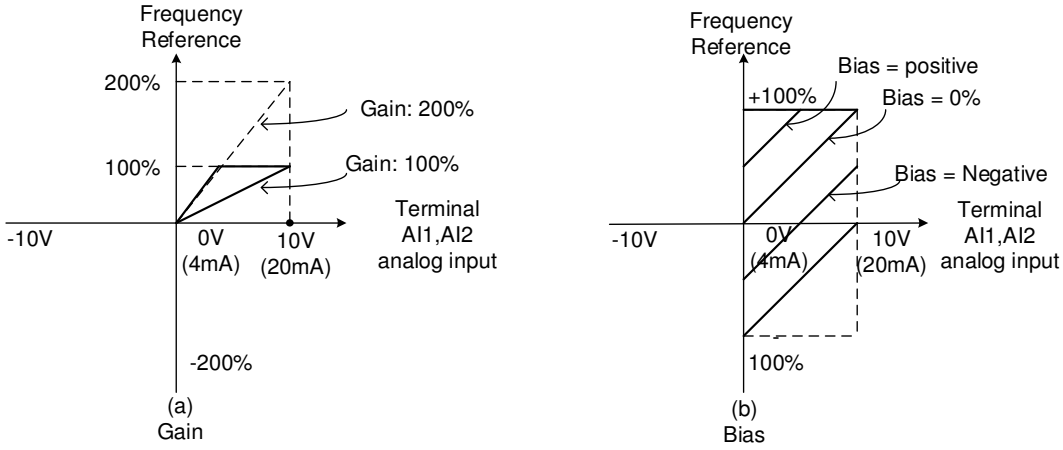
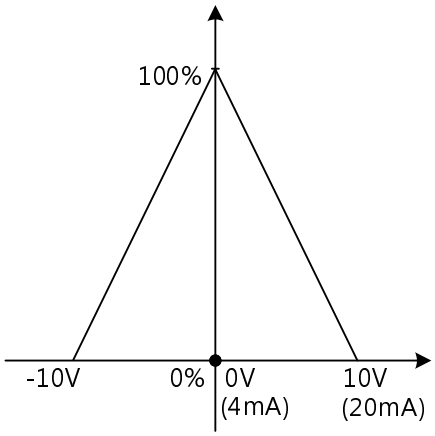


Figure 4.4.26 Gain and bias operations (for frequency reference signal)

04-04 (**AI negative characteristics**)
Through the following figure negative characteristics diagram find out the AI Input 10V, -10V, or 20mA input relative frequency reference to be used for the ratio of maximum output frequency (set the maximum output frequency 01-02 to 100%), the ratio will be presented in reverse.



(1) AI1 signal filtering time (04-01)

(2) AI2 signal filtering time (04-06)

(3) AI3 signal filtering time (04-21)

All analog inputs (AI1, AI2, AI3) have a 1st order programmable input filter that can be adjusted when noise is present on each of the incoming analog signal to prevent erratic drive control.

The filter time constant (range: 0.00 to 2.00 seconds) is defined as the time that the input step signal reaches 63% of its final value.

Note: Increasing the filter time causes the drive operation to become more stable but less responsive to change to the analog input.

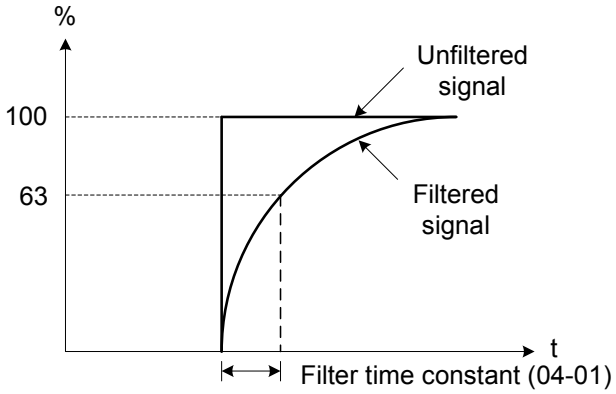


Figure 4.4.27 Filter time constant

(4) AI2 function setting (04-05/04-10)

AI2 is multi-function analog input terminal function selection. Refer to Table 4.4.8 for function overview

Table 4.4.8 Multi-function analog input list (04-05/04-10 setting)

Value	Function		Description	Control mode		
	Name	LCD Display		V/F	SLV	PM SLV
0	Auxiliary Frequency	AUX.Freq Ref	Max Output Frequency (01-02, Fmax) =100%	O	O	O
1	Frequency Reference Gain (FGAIN)	Freq Ref Gain	Aggregated gain= AI1 = 04-02 * FGAIN	O	O	O

Value	Function		Description	Control mode		
	Name	LCD Display		V/F	SLV	PM SLV
2	Frequency Reference Bias (FBIAS)	Freq Ref Bias	Aggregated bias = AI1 = 04-03 * FBIAS	O	O	O
3	Output Voltage Bias (VBIAS)	Output Volt Bias	Aggregate output voltage =V/F curve voltage + VBIAS	O	X	O
4	Coefficient of Acceleration and Deceleration Reduction (K)	Tacc/Tdec Scaling	Actual acceleration and deceleration time = accel. and decal. time / K	O	O	O
5	DC Braking Current	DC Inj Current	Adjust the DC braking current (0 ~ 100%) based on analog input. When the inverter rated current = 100%, DC braking current 07-07 is disabled.	O	O	O
6	Over-Torque Detection Level	Over Tq Level	Change over-torque detection level based on over-torque detection level, at this time, 08-15 is disabled.	O	O	O
7	Stall Prevention Level During Running	Run Stall Level	Adjust the action level (30% ~ 200%) of stall prevention in operation based on analog input. The inverter rated current =100%	O	X	O
8	Frequency Lower Limit	Ref. Low Bound	Adjust the lower limit (0 ~ 100%) of frequency command based on analog input, the maximum output = 100%. The lower limit of frequency command is the greater one of the actual frequency command's lower limit 00-13 or the multi-function analog input.	O	O	O
9	Jump Frequency 4	Jump Freq 4	Jump frequency 4. 100% = maximum output frequency	O	O	O
10	Added to AI1	Add to AI1	Added to AI1. 100% = maximum output frequency	O	O	O
11	Positive Torque Limit	Positive Tq Limit	100% = Motor's rated torque	X	O	O
12	Negative Torque Limit	Negative Tq Limit	100% = Motor's rated torque	X	O	O
13	Regenerative Torque Limit	Regen. Tq Limit	100% = Motor's rated torque	X	O	O
14	Positive / Negative Torque Limit	+/- Tq Limit	100% = Motor's rated torque	X	O	O
15	Torque Limit	Tq Limit	100% = Motor's rated torque	X	X	X
16	Torque Compensation	Tq Compensation	100% = Motor's rated torque	X	O	X
17	Reserved	No Function	Reserved	O	O	O

Note: When the setting of AI2 and AI3 are the same, use AI2 signal only.

04-05=0: Auxiliary frequency

When parameter 00-05 = 1 (main frequency from external control) the auxiliary speed reference frequency can be activated via the multi-speed input commands (see table 4.4.5). The auxiliary frequency command can be set via AI2/AI3. The maximum output frequency is set by 01-02, Fmax =100%.

04-05/04-10=1: Frequency Reference Gain (FGAIN)

Multi-function analog input AI2/AI3 can be used to adjust the frequency reference gain of analog input AI1. The total frequency reference gain of terminal AI1 is the internal gain set by parameter 04-02 times FGAIN. The maximum frequency reference for AI1 is 100%.

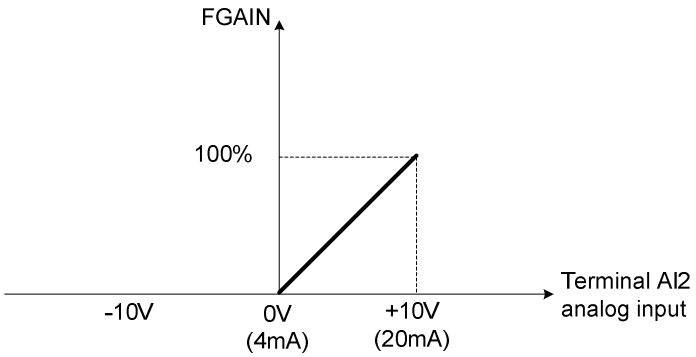


Figure 4.4.28 Frequency gain adjustment

Example:
When the internal gain of AI1 (04-02) is set to 100% and AI2 to 5V (for example FGAIN = 50%), the reference frequency of terminal AI1 will be 50%, as shown in Fig. 4.4.29.

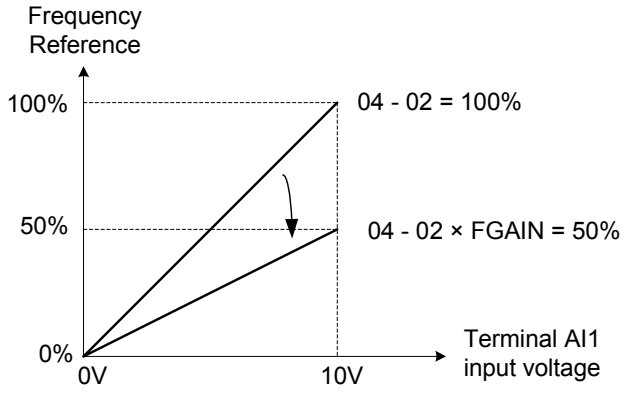


Figure 4.4.29 Frequency reference gain adjustment (example)

04-05/04-10=2: Frequency Reference bias (FBIAS)
Multi-function analog input terminal AI2 can be used to adjust the frequency reference bias of AI1.
The total frequency reference bias of terminal AI1 is the sum of internal bias set by parameter 04-03 and FBIAS. The maximum frequency reference for AI1 is 100%.

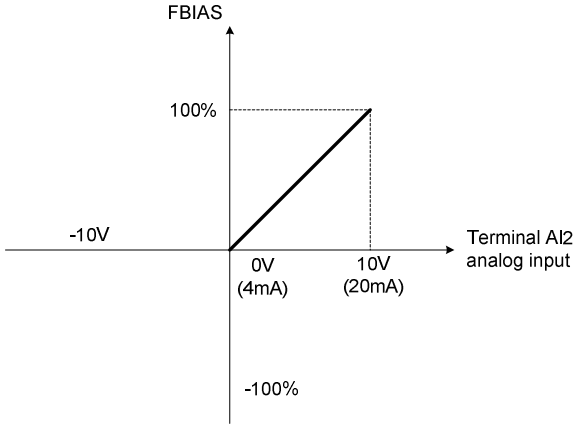


Figure 4.4.30 Bias adjustment

Example:
Terminal AI1 input is 0V, 04-02 = 100% (AI1 gain), 04-03 = 0% (AI1 bias) and terminal AI2 input is 3V. The reference frequency will be 30% as shown in Fig.4.4.31.

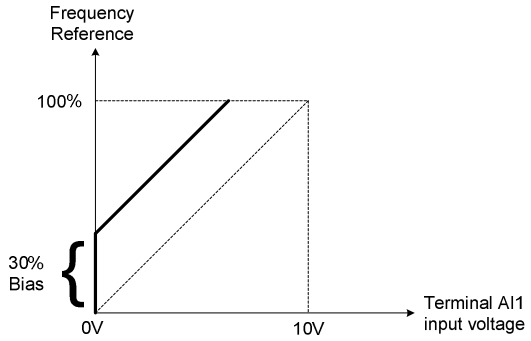


Figure 4.4.31 Frequency Reference bias adjustment (example)

04-05/04-10=3: Output Voltage Bias (VBIAS)
Multi-function analog input AI2/AI3 can be used to adjust the output voltage. The total output voltage of inverter is the sum of output voltage based on the selected V/F curve (01-00=F) and VBIAS.
The maximum output voltage will be limited by 01-03, Vmax = 100%

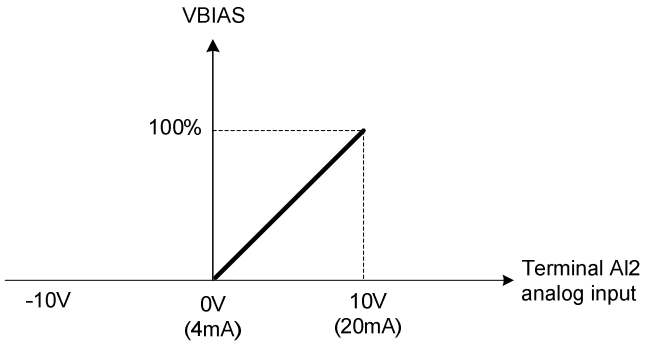


Figure 4.4.32 Bias adjustment

04-11	AO1 Function Setting
Range	【0】: Output Frequency 【1】: Frequency Command 【2】: Output Voltage 【3】: DC Voltage 【4】: Output Current 【5】: Output Power 【6】: Motor Speed 【7】: Output Power Factor 【8】: AI1 Input 【9】: AI2 Input 【10】: Torque Command 【11】: q-axis Current 【12】: d-axis Current 【13】: Speed Deviation 【14】: Reserved 【15】: ASR Output 【16】: Reserved 【17】: q-axis Voltage 【18】: d-axis Voltage 【19】~【20】: Reserved 【21】: PID Input 【22】: PID Output

	【23】: PID Target Value 【24】: PID Feedback Value 【25】: Output Frequency of the Soft Starter 【26】: Reserved 【27】: Reserved 【28】: Communication Control
04-12	AO1 Gain
Range	【0.0~1000.0】%
04-13	AO1 Bias
Range	【-100.0~100.0】%
04-16	AO2 Function Setting
Range	Setting range and definition are the same as those of 04-11.
04-17	AO2 Gain
Range	【0.0~1000.0】%
04-18	AO2 Bias
Range	【-100.0~100.0】%
04-19	AO Output Signal Type
Range	【0】: AO1 0~10V AO2 0~10V 【1】: AO1 0~10V AO2 4~20mA 【2】: AO1 4~20mA AO2 0~10V 【3】: AO1 4~20mA AO2 4~20mA

For the analog output and related parameters, refer to Fig.4.4.40.

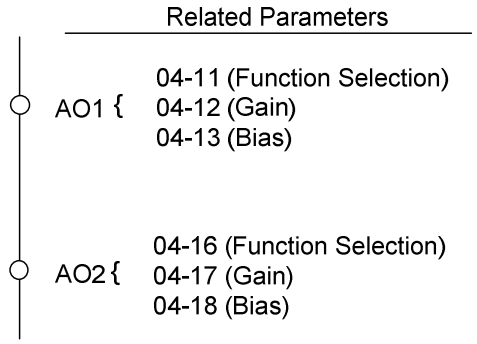


Figure 4.4.40 Analog outputs and related parameters

Analog output AO1 and AO2 adjustment (04-12, 04-13 and 04-17, 04-18)

Signal: Use parameter 04-11 to select the analog output signal for AO1 and parameter 04-16 to select the analog output signal for AO2.

Gain: Use parameter 04-12 to adjust the gain for AO1 and parameter 04-17 to adjust the gain for AO2. Adjust the gain so that the analog output (10V/20mA) matches 100% of the selected analog output signal (04-11 for AO1 and 04-16 for AO2).

Bias: Use parameter 04-13 to adjust the bias for AO1 and parameter 04-18 to adjust the bias for AO2. Adjust the bias so that the analog output (0V/4mA) matches 0% of the selected analog output signal (04-11 for AO1 and 04-16 for AO2).

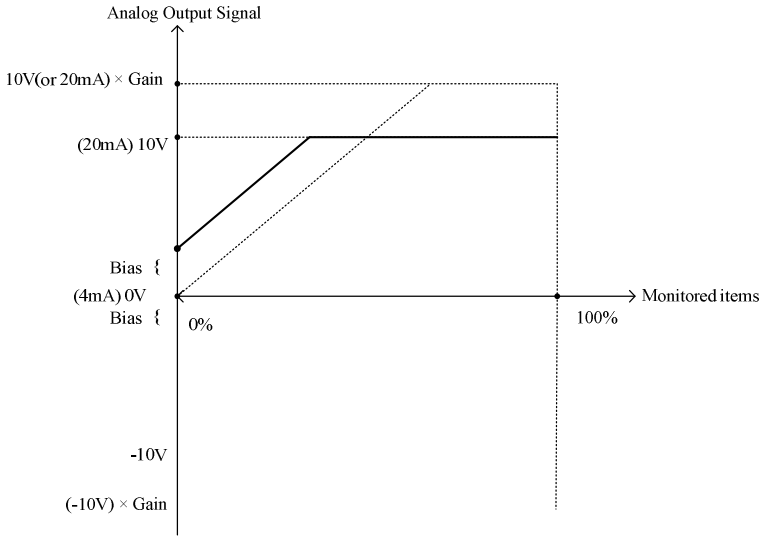


Figure 4.4.41 Analog output level adjustment

Table 4.4.9 Selection of analog output terminals function (04-11 and 04-16)

04-11, 04-16 Parameter setting	Function (Keypad display)	Monitoring Parameters Group 12	Control Mode		
			VF	SLV	PM SLV
0	Output Freq	12-17	O	O	O
1	Freq Ref	12-16	O	O	O
2	Output Voltage	12-19	O	O	O
3	DC Voltage	12-20	O	O	O
4	Output Current	12-18	O	O	O
5	Output KW	12-21	O	O	O
6	Motor Speed	12-22	O	O	O
7	Output PF	12-23	O	O	O
8	AI1 Input	12-25	O	O	O
9	AI2 Input	12-26	O	O	O
10	Torque Ref	12-27	X	O	O
11	Current Iq	12-28	X	O	O
12	Current Id	12-29	X	O	O
13	Speed Deviation	12-30	X	O	O
14	Reserved	-	X	X	X
15	ASR Output	12-32	X	X	X
16	Reserved	-	X	X	X
17	Voltage Ref Vq	-	X	O	O
18	Voltage Ref Vd	-	X	O	O
19~20	Reserved	-	X	X	X
21	PID Input	12-36	O	O	O
22	PID Output	12-37	O	O	O
23	PID Setpoint	12-38	O	O	O
24	PID Feedback	12-39	O	O	O
25	Output Freq (SFS)	-	O	O	O
26~27	Reserved	-	X	X	X
28	Comm Control	-	O	O	O

Group 07: Start /Stop Parameters

07- 00	Momentary Power Loss/Fault Restart Selection
Range	【0】 : Disable 【1】 : Enable

07-00=0: Inverter trips on “UV” fault if power loss time is greater than 8ms.
07-00=1: Inverter restarts after restarting the power at the momentary power loss.

Note: When 07-00=1, inverter restore automatically the motor rotation after restarting the power even if momentary power loss occurs.

07- 01	Fault Auto-Restart Time
Range	【0~7200】 Sec

07-01 = 0 sec.: Automatic restart time interval is set by minimum baseblock time (07-18).
07-01 <07-18: Automatic restart time interval is set by minimum baseblock time (07-18).
07-01> 07-18: Automatic restart time interval is set by fault reset time (07-01).

Note:
Automatic restart time interval is time of 07-18 plus 07-01 and delay time of peed search (07-22).

Refer to Fig.4.4.45 for setting automatic restart interval.

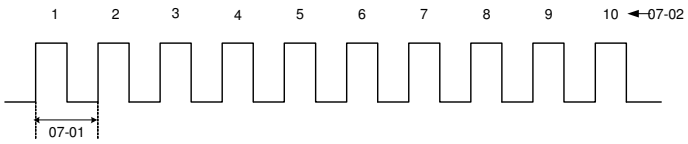


Figure 4.4.45 Automatic restart operation

07- 02	Number of Fault Auto-Restart Attempts
Range	【0~10】

When the automatic restart function is enabled the internal automatic restart attempt counter is reset based on the following actions:

a) No fault occurs in 10 minutes or longer after the automatic restart
b) Reset command to clear fault via input terminal or using the keypad (ex: press reset/ ◄ key)
c) Power to the inverter is turned off and back on again

Note:
Multi-function digital output R1A-R1C, R2A-R2C, R3A-R3C can be programmed to activate during an automatic reset attempt, refer to parameter 03-11, 03-12 and 03-39.

Automatic restart operation:

a) Fault is detected. The inverter turn off the output, displays the fault on the keypad and waits for the minimum baseblock time parameter 07-18 to expire before accepting another run / automatic restart command.

b) After the minimum baseblock time (07-18) has expired, the active fault is reset and a speed search operation is performed. The time between each fault restart attempt is set by parameter 07-01.

c) When the total numbers of restart attempts exceed the number of automatic restart attempts set in parameter 07-02, the inverter will turn off the output and the fault contact is activated.

Please refer to Figure 4.4.46 for the automatic restart operation.

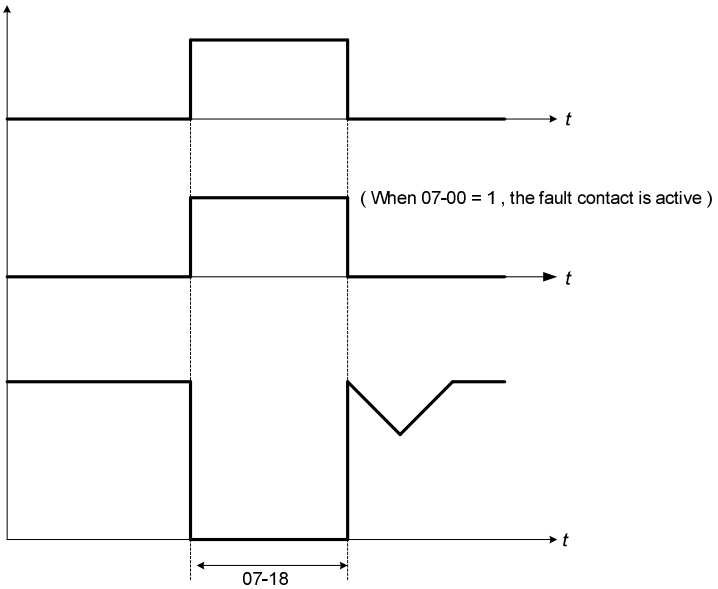


Figure 4.4.46 Auto-restart operation

The automatic restart function is active for the following faults. Please note that when the fault is not listed

in the table the inverter will not attempt an automatic restart.

Parameter Name	Faults		Numbers of Restart
07-00	**UV** (under voltage)		**Unlimited**
07-01 **07-02**	**OC** (over current) **OCA** (over current in ACC.) **OCC** (over current in constant speed) **OCd** (over current in DEC) **OL1** (motor overload) **UT** (Under torque detection) **IPL** (input phase loss)	**GF** (ground failure) **OV** (overvoltage) **OL2** (Inverter overload) **OT** (Over-torque detection) **OPL** (Output phase loss) **CF07** (SLV motor control setting fault) **CF08** (PMSLV motor control setting fault)	**Depend on parameter 07-02**

Notes:

1. Fault restart function contains momentary power loss restart and auto reset restart.
2. Refer to chapter 10 for the details of troubleshooting and fault diagnostics.
3. Refer to speed search function (07-19~07-24) for the selection of speed search modes.

Note:
Automatic restart function is only active in the state of no harm to the safety or to the application devices.

Warning - Excessively use of the automatic restart function will damage the inverter.

07- 04	Automatic start at power up
Range	【0】: Automatic start at power up when external run command is enabled 【1】: Without automatic start at power up when external run command is enabled

07- 04 = 0:
If the running switch is in conducting state when power supply is on, the inverter will start automatically.

07- 04 =1:
If the running switch is not in conducting state when power supply is on , the inverter will not start automatically and STP1 will flash. It is required to switch off the running switch and make it be in conducting state so as to start the inverter.

07- 05	Automatic start delay at power up
Range	【1.0~300.0】 Sec

When 07- 04 = 0, if power supply is on, the inverter automatically start at power up and it will count the delay time set by 07–05. The inverter starts running only when the delay time ends.

! Warning:

- When **07- 04 = 0** and run command source is set to external control **(00- 02/00- 03 = 1)**, if running switch is in conducting state and the inverter starts automatically when power supply is on, customers are suggested to switch off the power supply and running switch at power loss to prevent from the damage to the inverter and user when reconnecting.

When **07- 04 = 1** and run command source is set to external control **(00- 02/00- 03 = 1)**, if running switch is not in conducting state when power supply is on, the inverter will not	**Stop Mode Selection**

start automatically and STP1 will flash. It is required to switch off the running switch and then make it be in conducting state and start the inverter after the delay time of automatic start at power up ends. **07- 09**	
Range	**【0】：Deceleration to Stop** **【1】：Coast to Stop** **【2】：DC Braking Stop** **【3】：Coast to Stop with Timer**

When a stop command is issued the inverter stops according to the stop mode selected. There are four types of stop modes,

Note: When using the permanent magnet motor, only the option of deceleration to stop mode is available.

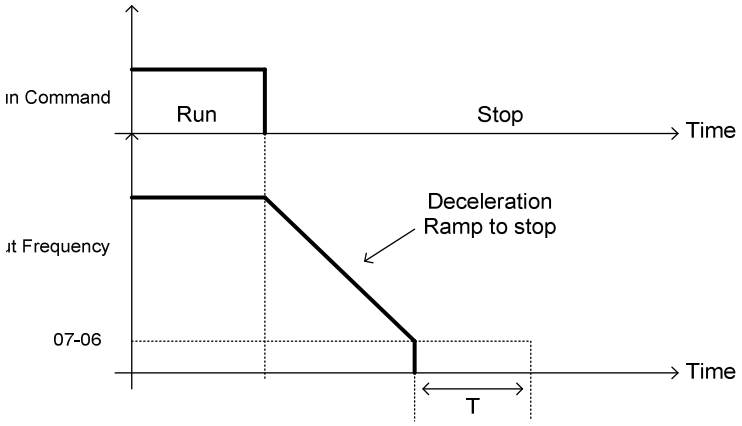
07-09=0: Deceleration to stop

When a stop command is issued, the motor will decelerate to the minimum output frequency (01-08) Fmin and then stop. Deceleration rate depends on the deceleration time (factory default: 00-15).

When the output frequency reaches the DC braking stop frequency (07-06) or the minimum output frequency (01-08), DC injection braking is activated and the motor stops.

$$\text{Deceleration time} = \frac{\text{Output frequency when stop command is issued}}{\text{Maximum output frequency } F_{max} \text{ (01-02)}} \times \text{deceleration time setting}$$

Note: S curve setting will add to the overall stop time



T: DC Braking Time at stop (07-08)

Figure 4.4.48 Deceleration to stop

07-09=1: Coast to stop

When a stop command is issued, the motor will coast to a stop. Stop time depends on motor load and friction of the system.

The inverter waits for the time set in the minimum baseblock time (07-18) before accepting the next run command.

In SLV mode (00-00=2) the speed search function is automatically enabled upon the next run command.

Note: When using a mechanical brake set parameter 07-26 to 1.

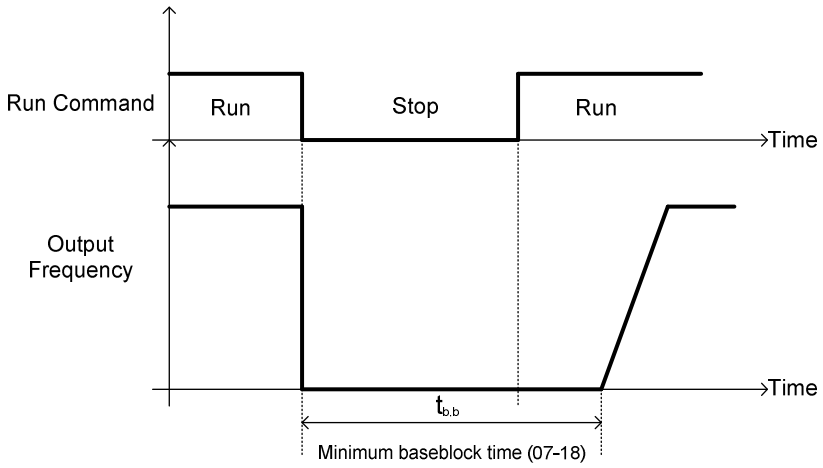


Figure 4.4.49 Coast to stop

07-09=2: DC braking to stop

When a stop command is issued, the inverter will turn off the output (Baseblock) and after the minimum Baseblock time (07-18) has expired activate DC braking (07-07). Refer to Fig.4.4.50.

The DC braking time (t_{DCDB}) of Figure 4.4.50 is determined by the value of 07-08 (DC Braking start time) and the output frequency at the time the stop command was issued.

$$t_{DCDB} = \frac{(07\text{-}08) \times 10 \times \text{output frequency}}{\text{Fmax (01-02)}}$$

Note: Increase the minimum Baseblock time (07-18) in case an Overcurrent trip occurs during the DC braking.

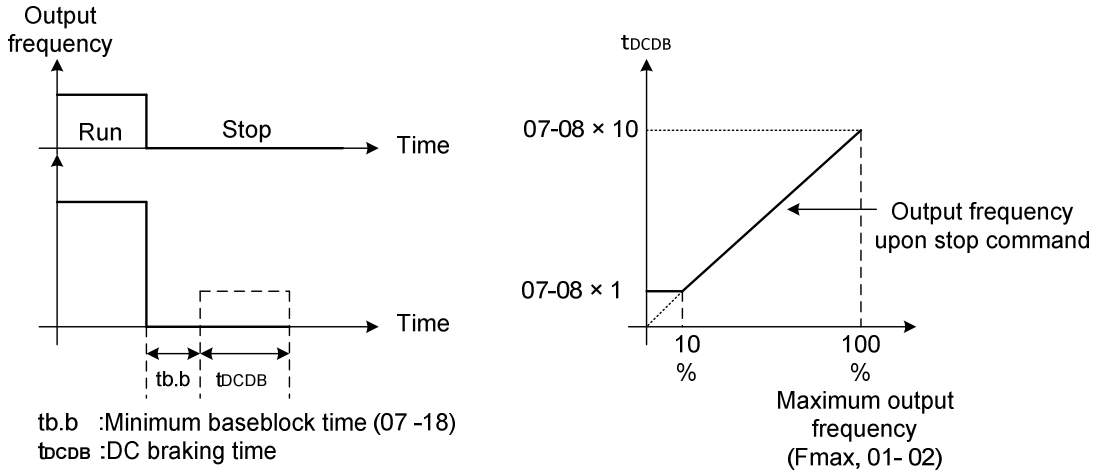


Figure 4.4.50 DC braking to stop

07-09=3: Coast to stop with timer

When a stop command is issued the motor will coast to a stop after the minimum Baseblock time (07-18) has expired. The inverter ignores the run command until the total time of the timer has expired.

The total time of the timer is determined by the deceleration time (00-15, 17, 22 or 24) and the output frequency upon stop. Refer to Fig.4.4.51

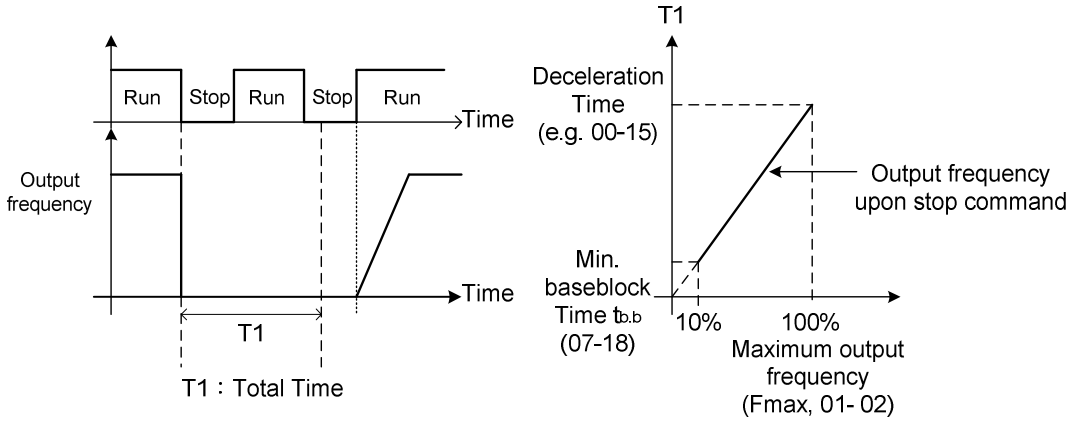


Figure 4.4.51 Coast to stop with timer

Group 10: PID Parameters

10- 00	PID Target Value Source Setting
Range	【0】: Keypad Given (for PUMP or HVAC mode) 【1】: AI1 Given 【2】: AI2 Given 【3】: Reserved 【4】: 10-02 Given 【5】: Reserved 【6】: Frequency Command (00-05) 【7】: Multi-speed Frequency Command

Operation Pressure Setting (23-02) or Target Value of Flow Meters (PUMP or HVAC function selection) can be set as PID's target value only when 10-00=0 and 23-00=1 or 2.

When 10-00=1 or 2, signal source proportional is corresponding to PID target via analog input terminal. For example, 0~10V is corresponding to the target of 0~100% so given 2V is equivalent with the target value of 20%.

For normal use of PID, set 10-00 to 4 and set PID target value in parameter 10-02.

When 10-00=4, in addtition to the percentage setting of 10-02 (PID target value), it allows PID setting (12-38) in the main screen monitor. The maximum target value is set via parameter 10-33 (PID maximum feedback value), the decimals are set via parameter 10-34 (PID decimal width) and the unit is set via parameter 10-35 (PID unit). For example:

When 10-33 = 999, 10-34 = 1, 10-35 = 3 and 10-02 = 10%, then 12-38 = 9.9 PSI displayed in the main screen monitor. User can also modify the value of 12-38 in the main screen monitor but the maximum calue is 99.9 PSI (depending on the setting value of 10-33).

10-00=6 (from frequency command), it means the setpoint is the perecnetage of frequency reference corresponding to the rated frequency. (ie: setpoint = 50 %, if the frequency reference is 30Hz and the rated frequency is 60Hz). And this frequency source refers to the setting of 00-05.

When 10-00=7, DI multi-speed frequency command (refer to the setting description of parameter group 3) is proportionally corresponding to PID target via multi-speed stage frequenfy setting of 05-01~05-16.

Note: Speed-stage 1 cannot set PID target value by switching auxiliary frequency via 04-05=0 or 4-10=0.

10- 01	PID Feedback Value Source Setting
Range	【1】: AI1 Given 【2】: AI2 Given 【3】: Reserved 【4】: AI1 - AI2 Given

Note: Parameter 10-00 and 10-01 cannot be set to the same source. If both parameters are set to the same source the keypad will show a SE05 alarm.

Note: When AI1 - AI2 is minus, it will be set to zero.

10- 02	PID Target Value
Range	【0.0~100.0】%
10- 03	PID Control Mode
Range	【xxx0b】：PID Disable 【xxx1b】：PID Enable 【xx0xb】：PID Positive Characteristic 【xx1xb】：PID Negative Characteristic 【x0xxb】：PID Error Value of D Control 【x1xxb】：PID Feedback Value of D Cotrol 【0xxxb】：PID Output 【1xxxb】：PID Output + Frequency Command

PID target value source setting(10-00) / PID feedback value source setting(10-01)
Please confirm parameter 04-00 conform the need (0V~10 V or 4mA~20 mA) if AI2 as PID target or PID feedback. And check the dip switch from control board to the input type (V or I), please refer to wiring diagram for more detail.

When 10-03 is set to xxx0b, PID will is disabled; if it is set to xxx1b, PID is enabled.

Note:

- LCD keypad will be switched automatically (16-00).
- Main Screen Monitoring will be changed to PID Setting (12-38).
- Sub-Screen Monitoring 1 will be changed to PID Feedback (12-39).
- Sub-Screen Monitoring 2 will be changed to Output Frequency (12-17).

At this time, if the setting is disabled, it will be switched automatically back to frequency command as the main page. When switching to PID setting in the LED keypad, it displays the modes selection of parameter 23-05.
Note: when 23-05=0, set the value in the conditions of 10-33 < 1000 and 10-34=1, or the inverter will display the signal of PID setting error (SE05).

When 10-03 is set to xx0xb, PID output occurs forward;
When 10-03= xx1xb: PID output is reverse. PID output is chosen to reverse, If PID input is negative, the output frequency of PID will gain. On the contrary,

When 10-03 is set to x1xxb, PID control for feedback differential value is enabled; if it is set to x0xxb, basic PID control is enabled. Refer to Fig.4.4.69 and Fig.4.4.70.

When 10-03 is set to 0xxxb, PID output is enabled and it is corresponding to the frequency of 01-02 at 100%.

When 10-03 is set to 1xxxb, PID output and frequency command are enabled. The output percentage of frequency command (corresponding to the selected main frequency command of 00-05/ 00-06) will be cumulated when the inverter starts to run, and PID control starts.

10- 04	Feedback Gain
Range	【0.01~10.00】
10- 05	Proportional Gain (P)
Range	【0.00~10.00】
10- 06	Integral Time (I)
Range	【0.0~100.0】Sec
10- 07	Differential Time (D)

Range	【0.00~10.00】Sec

PID Adjustments

Gain control: The error signal (deviation) between the input command (set value) and the actual control value (feedback). This error signal or deviation is amplified by the proportional gain (P) to control the offset between the set value and the feedback value.

Integral control: The output of this control is the integral of the error signal (difference between set value and feedback value) and is used to minimize the offset signal that is left over from the gain control. When the integral time (I) is increased, the system response becomes slower.

Differential control: This control is the inverse from integral control and tries to guess the behavior of the error signal by multiplying the error with the differential time. The result is added to the PID input. Differential control slows down the PID controller response and may reduce system oscillation.
Note: Most applications that PID control (fan and pump) do not require differential control.
Refer to Fig. 4.4.68 for PID control operation

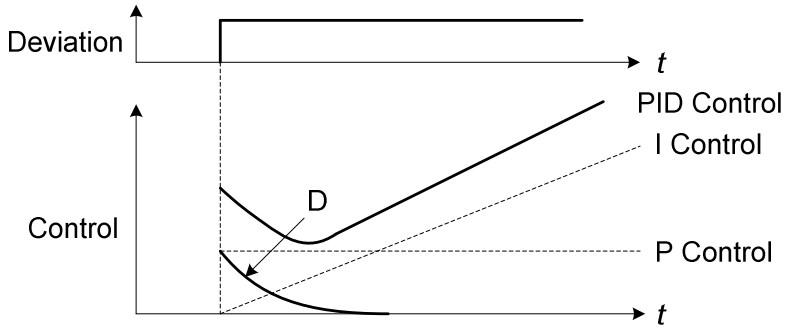


Figure 4.4.68 PID Control

PID Control Type

The inverter offers two types of PID control:

(a) PID control with differential feedback: (10-03 = x1xxb)

Make sure to adjust the PID parameters without causing system instability. Refer to Fig. 4.4.69 for PID control for feedback value differential.

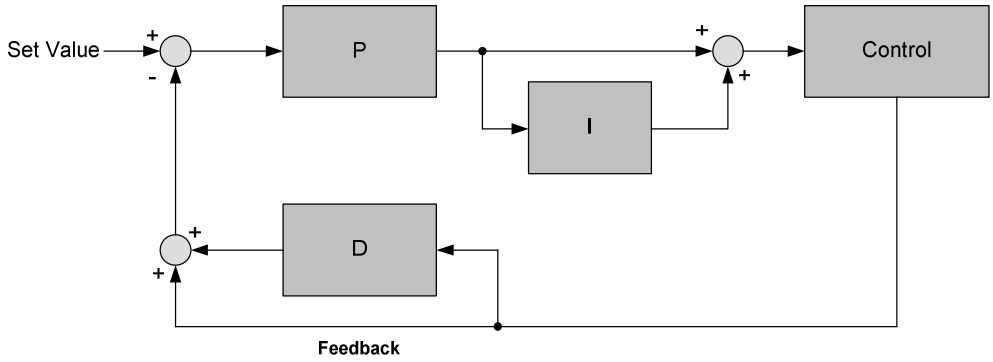


Figure 4.4.69 PID control for feedback differential value

(b) Basic PID control: (10-03 = x0xxb)

This is the basic type of PID control. Refer to the Fig. 4.4.70.

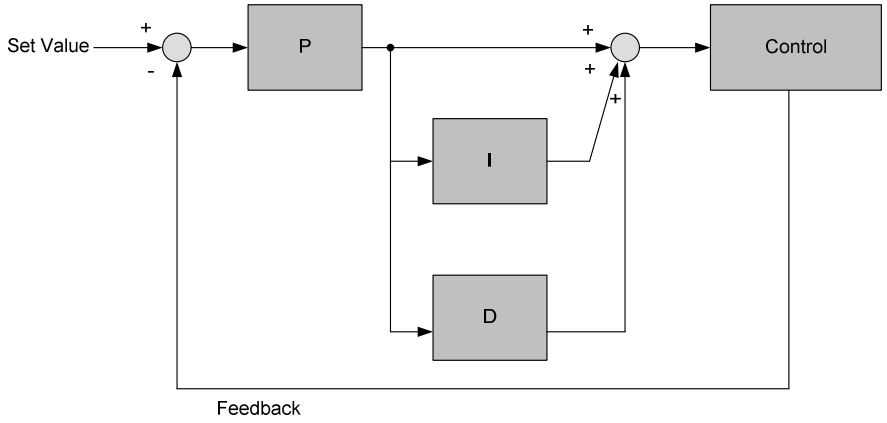


Figure 4.4.70 Basic PID control

PID Setup

Enable PID control by setting parameter 10-03, PID target value (10-00) and PID feedback value (10-01).

10-00: PID target value
= 0: keypad given
= 1: analog AI1 given (default)
= 2: analog AI2 given
= 3: Reserved
= 4:10-02

10-01: PID feedback value
= 1: Analog AI1 given
= 2: Analog AI2 given
= 3: Reserved

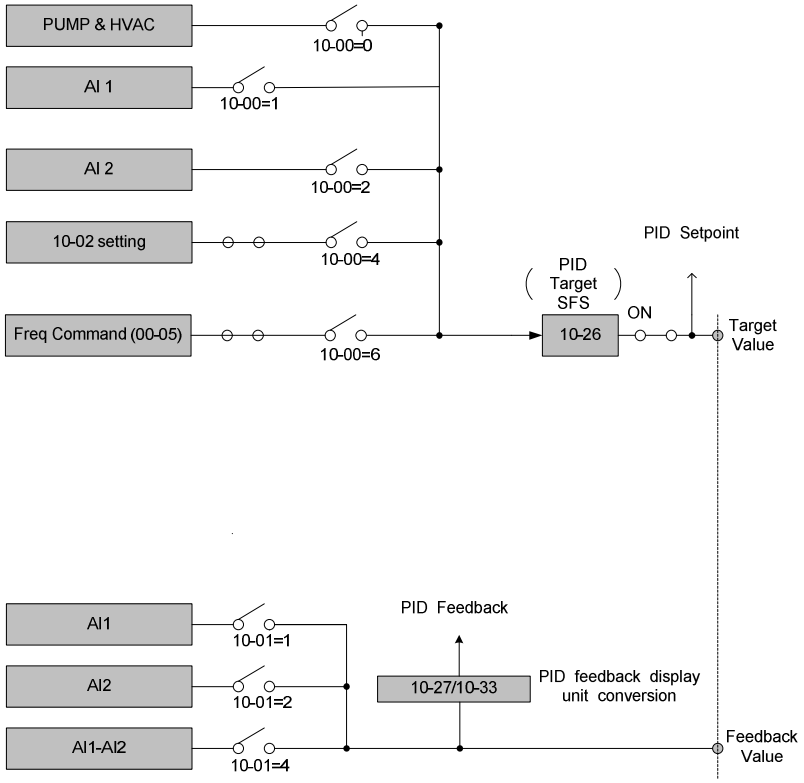


Figure 4.4.71 PID input selection

PID Control Setting

PID control block diagram.

The following figure shows the PID control block diagram.

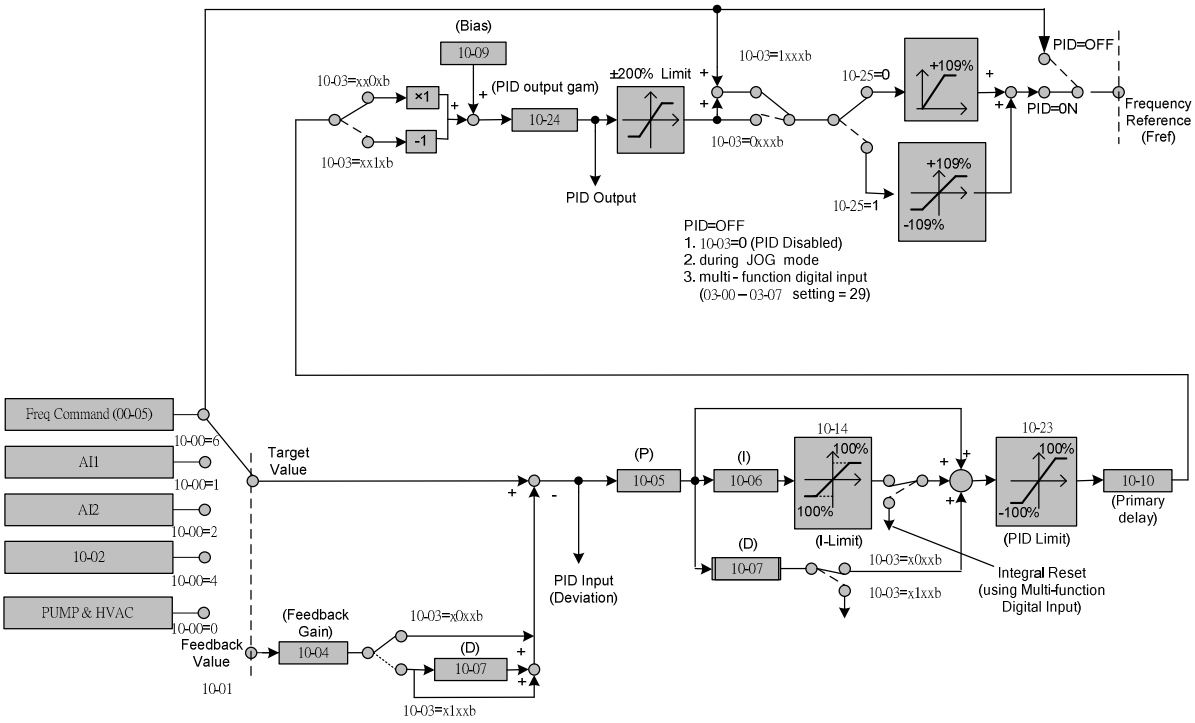


Figure 4.4.72 PID control block diagram

PID Tuning

Use the following procedures to start PID control,

(1) Enable PID control (set 10-03 to a value greater than "xxx0b").
(2) Increase the proportional gain (10-05) to the highest value possible without causing the system to become unstable.
(3) Decrease the integral time (10-06) to the lowest value possible without causing the system to become unstable.
(4) Increase the differential time (10-07) to the highest value possible without causing the system to become unstable.

The PID control serves to maintain a given process within certain limits whether it is pressure, flow etc. To do this the feedback signal is compared to the set value and the difference becomes the error signal for the PID control.

The PID control then responds by trying to minimize this error. The error is multiplied times the value of the proportional gain set by parameter 10-05. An increased gain value results in a larger error. However, in any system as the gain is increased there is a point that the system will become unstable (oscillate).

To correct this instability, the response time of the system may be slowed down by increasing the Integral time set by parameter 10-06. However slowing the system down too much may be unsatisfactory for the process.

The end result is that these two parameters in conjunction with the acceleration time (01-14) and deceleration (01-15) times require to be adjusted to achieve optimum performance for a particular application.

PID output polarity can be selected with parameter 10-03 (setting = xx0xb: PID output forward, setting =

xx1xb: PID output reversal). When the PID output is set for reverse operation the output frequency decreased when the PID target value increases.

PID feedback value can be adjusted using parameter 10-04 (PID feedback gain) as well as with the analog input gain and bias for terminal AI1 or AI2.

10-14: PID integral limit: Used to limit the integral output to prevent motor stall or damage to the system in case of a rapid change in the feedback signal. Reduce the value of 10-14 to increase the inverter response.

10-23: PID limit: Used to limit the output of the PID control. Maximum output frequency is 100%.

10-10: Primary delay time: Low pass filter situated after the PID limit block that can be used to prevent PID output resonance. Increase the time constant to a value greater than the resonance frequency cycle and reduce time constant to increase the inverter response.

10-09: PID bias: Used to adjust the offset of the PID control. The offset value is added to the frequency reference as compensation. Use parameter 10-24 (PID output gain) to control the amount of compensation.

In case the PID control output value goes negative, parameter 10-25 (PID reversal output selection) can be used to reverse the motor direction.

Note: The PID output remains at zero when reverse operation is disabled.

10-26: PID target SFS: Sets the PID target value acceleration and deceleration ramp time. The PID target SFS can be disabled by setting the multi-function digital inputs 03-00 ~ 03-05 to 36 (PID target SFS is off). Reduce the acceleration / deceleration time in case load resonance or system instability is encountered.

PID Fine Tuning

All PID control parameters are related to each other and require to be adjusted to the appropriate values. Therefore, the procedure achieving the minimum steady-state is shown as following:

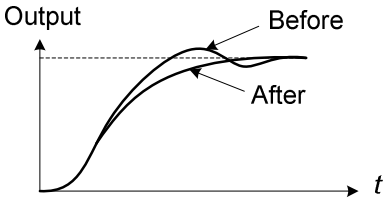
(1) Increase or decrease the proportion (P) gain until the system is stable using the smallest possible control change.

(2) The integral (I) reduces the system stability which is similar to increasing the gain. Adjust the integral time so that the highest possible proportional gain value can be used without affecting the system stability. An increase in the integral time reduces system response.

(3) Adjust the differential time if necessary to reduce overshoot on startup. The acceleration / deceleration time can also be used for the same purpose.

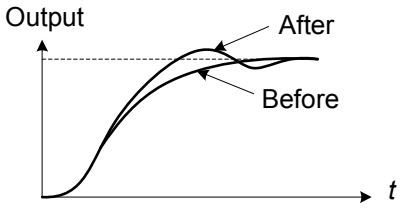
Fine-tuning PID control parameters:

(1) Reduce overshoot



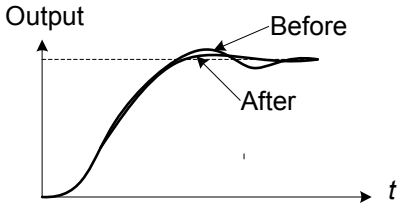
In case overshoot occurs, reduce the derivative time (D) and increase the integral time (I).

(2) Stabilize PID control



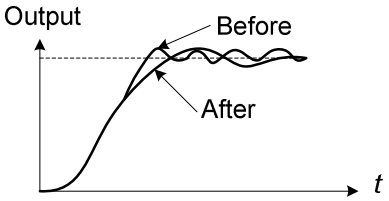
To quickly stabilize the PID control, reduce the integral time (I) and increase the differential time (D) in case overshoot occurs.

(3) Reduce long-period oscillation



Adjust the integral time (I) in case of long-periodical system oscillation.

(4) Reduce short-period oscillation



Adjusting the differential time (D) and proportional (P) gain when experiencing short-periodical oscillation.

10-17	***Start Frequency of PID Sleep**
Range	**【0.00~599.00】Hz**
10-18	**Delay Time of PID Sleep**
Range	**【0.0~255.5】Sec**
10-19	***Frequency of PID Waking up**
Range	**【0.00~599.00】Hz**
10-20	**Delay Time of PID Waking up**
Range	**【0.0~255.5】Sec**

The PID Sleep function is used to stop the inverter when the PID output falls below the PID sleep level (10-17) for the time specified in the PID sleep delay time parameter (10-18).

The inverter wakes up from a sleep condition when the PID output (Reference frequency) rises above the PID wake-up frequency (10-19) for the time specified in the PID wake-up delay time (10-20).

Use parameter 10-29 to enable / disable PID sleep function.

10-29 =0: PID Sleep function is disabled.

10-29 =1: PID sleep operation is based on parameters of 10-17 and 10-18.

10-29 =2: PID sleep mode is enabled by multi-function digital input

Refer to Fig.4.4.74 (a), (b) and (c) for PID sleep / wakeup operation.

Note: Parameter 10-17 is the general start frequency of PID sleep, and it is not applied to the sleep frequency of constant pressure (parameter 23-10) by PUMP.

***: (When the motor's maximum output frequency is over than 300Hz, the frequency resolution is 0.1Hz.)**

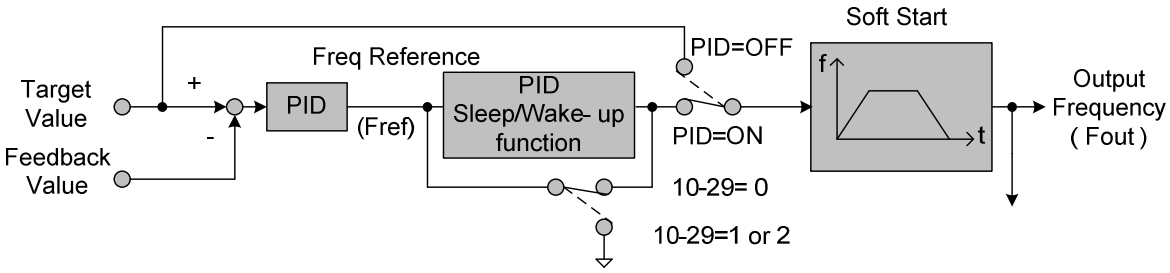


Figure 4.4.74: (a) PID control bock diagram

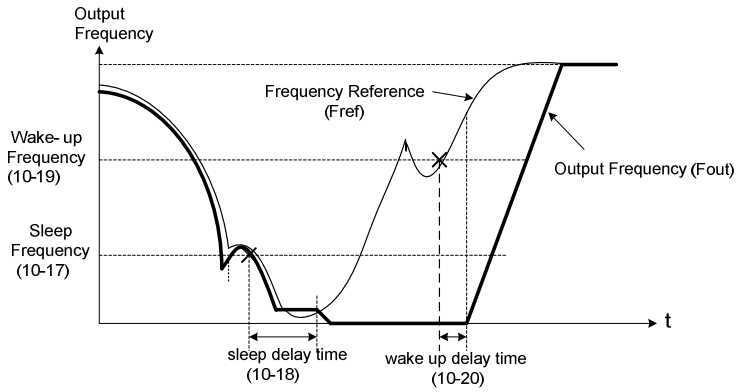


Figure 4.4.74: (b) Timing diagram PID sleep / wakeup

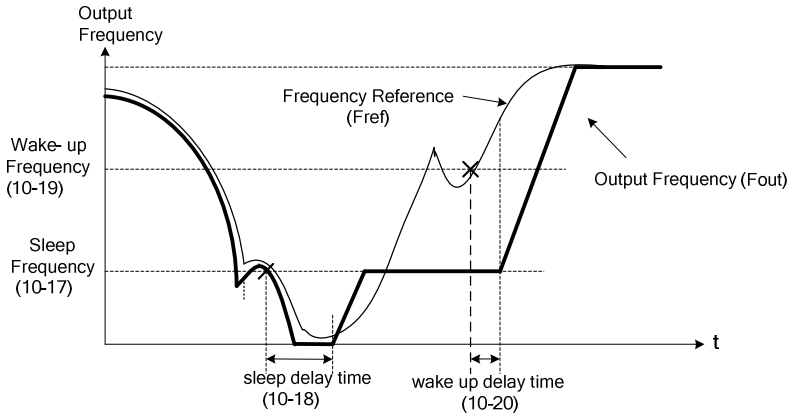


Figure 4.4.74: (c) Timing diagram of PID sleep compensation frequency/ wakeup

Notes:

- Refer to Fig. 4.4.74: (b) for parameter 10-40=0. The PID sleep timer is enabled when the output frequency (Fout) falls below the PID sleep frequency (10-17). When the sleep timer reaches the set PID sleep delay time (10-18) the inverter will decelerate to a stop and enter the sleep mode.
- Refer to Fig.4.4.74: (c) for parameter 10-40=1. The PID sleep timer is enabled when the output frequency (Fout) falls below the PID sleep frequency (10-17). The output frequency changes with the reference frequency (Fref) when the sleep timer reaches the set PID sleep delay time (10-18), the motor will run gradually to PID sleep frequency set by 10-17. (It is applicated in the occasion of fixed frequency.)
- While sleep mode is active and the motor has stopped, the internal PID control is still in operating. When the reference frequency increases and exceeds the wakeup frequency parameter 10-19 for

the time specified in the wakeup delay time parameter 10-20, the inverter will restart and the output frequency will ramp up to the reference frequency.
Ex:
If wakeup frequency < sleep frequency, start upon sleep frequency and the inverter gets into sleep mode by wakeup frequency.
If wakeup frequency > sleep frequency, start upon wakeup frequency and the inverter gets into sleep mode by sleep frequency.
Ex1:
Sleep mode is only allowed in positive direction and if 10-25=1 (Allow Reversal Output), the sleep mode needs to be turned off.

- Parameter 10-00 and 10-01 can not be set in the same source. If they are set in the same value, "SE05" (PID selection error message) will be displayed in the keypad.
- When PID sleep selection is enabled or set by DI (10-29= 1 or 2) and PID reversal output selection (10-25)=1 (allow reversal output), "SE05" (PID selection error message) will be displayed in the keypad.
- When PID sleep selection is enabled ot set by DI (10-29= 1or 2) and PID control mode (10-03) = 1xxxb, "SE05" (PID selection error message) will be displayed in the keypad.

Note: When 23-00=1 (Pump), if PID sleep disable, most pump function will be affected.

10- 33	PID Maximum Feedback Value
Range	【1~10000】

Function of PID maximum feedback value is the 100% corresponding value of 10-02.

10- 34	PID Decimal Width
Range	【0~4】

Function of PID decimal width enables the user to set the decimal point.
For example, if it is set to 1, the keypad displays the first decimal place XXX.X. If it is set to 2, the keypad displays the second decimal place XX.XX.

10- 35	PID Unit (Only display in LCD Keypad)
Range	【0~24】

PID unit enables the user to select the unit for PID target vaule.
When 10-35=0, parameter of 12-38 will be used by the unit of %.

13- 08	Restore Factory Setting
Range	【0】: No Initialization 【1】: Reserved 【2】: 2 Wire Initialization (220/440V, 60Hz) 【3】: 3 Wire Initialization (220/440V, 60Hz) 【4】: 2 Wire Initialization (230/415V, 50Hz) 【5】: 3 Wire Initialization (230/415V, 50Hz) 【6】: 2 Wire Initialization (200/380V, 50Hz) 【7】: 3 Wire Initialization (200/380V, 50Hz) 【8】: PLC Initialization **【9】: 2 Wire Initialization (230V/460V, 60Hz)** **【10】: 3 Wire Initialization (230V/460V, 60Hz)** 【11】: 2 wire Initialization (230V/400V, 60Hz) 【12】: 3 wire Initialization (230V/400V, 60Hz) 【13】: 2 wire Initialization (230V/400V, 50Hz) 【14】: 3 wire Initialization (230V/400V, 50Hz) 【15】: 2 wire Initialization (220V/380V, 50Hz) 【16】: 3 wire Initialization (220V/380V, 50Hz)

	【Others】: Reserved

Note: Main frequency setting is 12-16. The value is equal to frequency setting of speed-stage 0 (05-01)

Use parameter 13-08 to initialize the inverter to factory default. It is recommended to write down the modified parameters before initializing the inverter. After initialization, the value of 13-08 will return to zero automatically.

13-08=9: 2 wire initialization (230V/460V, 60Hz)

Multi-function digital input terminal S1 controls forward operation / stop command, and S2 controls reverse operation / stop command. Refer to Figure 4.4.1. The input voltage (01-14) will be set to 230V (200V class) or 460V (400V class) automatically and when 01-00 (V/F curve) is set to F, the maximum frequency of 01-12 will be set to 60Hz automatically.

13-08=10: 3 wire initialization (230V/460V, 60Hz)

Multi-function digital input terminal S7 controls the forward / reverse direction, and terminals S1 and S2 are set for 3-wire start operation and stop command. Refer to Figure 4.4.2 and Figure 4.4.3 for 3-wire type operation mode. The input voltage (01-14) will be set to 230V (200V class) or 460V (400V class) automatically and when 01-00 (V/F curve) is set to F, the maximum frequency of 01-12 will be set to 60Hz automatically.

Note: Restore factory setting (13-08) will not modify the setting of 01-00 (V/F curve).

Parameter List: parameters that are not affected by default value

No.	**Parameter Name**
00-00	Control Mode Selection
00-04	Language Selection
01-00	V/F Curve Selection
13-00	Inverter Rating Selection
13-03	Cumulative Operation Hours 1
13-04	Cumulative Operation Hours 2
13-05	Selection of Accumulative Operation Time

Chapter 5 Check Motor Rotation and Direction

This test is to be performed solely from the inverter keypad. Apply power to the inverter after all the electrical connections have been made and protective covers have been re-attached.

Important: Motor rotation and direction only applies to standard AC motors with a base frequency of 60Hz. For 50Hz or other frequency AC motors please set the max frequency and base frequency in group 01 accordingly before running the motors.

◆ LED Keypad Display

At this point, **DO NOT RUN THE MOTOR**, the LED keypad should display as shown below in Fig. 5.1 and all LEDs are flashing. Next press the **RUN** key, all LEDs light on. See Fig 5.2. The motor should now be operating at low speed running in forward (clockwise) direction. The value shown in the screen will change from 000.00Hz to 005.00Hz. Next press **STOP** key to stop the motor.

Fig 5.1: LED Keypad (Stopped)

Fig 5.2: LED Keypad (Running)

◆ LCD Keypad Display

At this point, **DO NOT RUN THE MOTOR**, the LCD keypad should display as shown below in Fig. 5.3 and the speed reference 12-16=00**5.00Hz** should be blinking at the parameter code “12-16”. Next press the **RUN** key, see Fig 5.4. The motor should now be operating at low speed running in forward (clockwise) direction. The parameter code 12-17 shown at the bottom left corner of the screen will change from 12-17=000.00Hz to 12-17=005.00Hz. Next press **STOP** key to stop the motor.

Fig 5.3: Keypad (Stopped)

Fig 5.4: Keypad (Running)

Notes:

- **If the motor rotation is incorrect, power down the inverter.**
- **After the power has been turned OFF, wait at least ten minutes until the charge indicator extinguishes completely before touching any wiring, circuit boards or components.**
- **Using Safety precaution, and referring to section 3.8 exchange any two of the three output leads to the motor (U/T1, V/T2 and W/T3). After the wiring change, repeat this step and recheck motor direction.**

Chapter 6 Speed Reference Command Configuration

The inverter offers users several choices to set the speed reference source. The most commonly used methods are described in the next sections.

Frequency reference command is selected with parameter 00-05.

00-05: Main Frequency Command (Frequency Source)

This function sets the frequency command source.

Setting Range: 0 to 5

To set parameter 00-05:
- After power-up press the **DSP**/**FUN** key
- Select **00 Basic Fun**
- Press **READ**/ **ENTER** key
- Select parameter -05 with the **UP**/**DOWN** ▲ and ▼ keys and press the **READ**/ **ENTER** key.

In the parameter list move cursor to 00-05 with the **UP**/**DOWN** keys and press **READ**/ **ENTER** key to select.

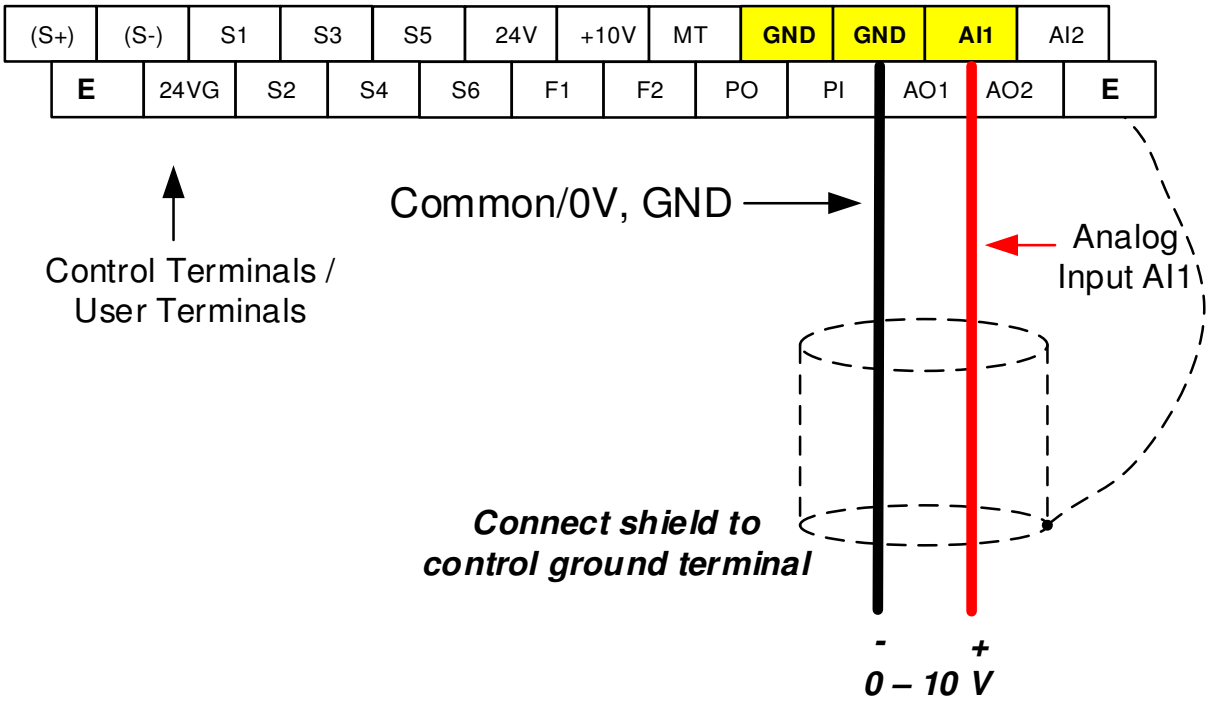
00-05	Main Frequency Command Source Selection
Range	**0:** Keypad **1:** External Terminal (Analog AI1) **2:** Terminal Command UP / DOWN **3:** Communication control (RS-485) **4:** Reserved **5:** Reserved **6:** RTC **7:** AI2 Auxiliary Frequency

6.1 Reference from Keypad

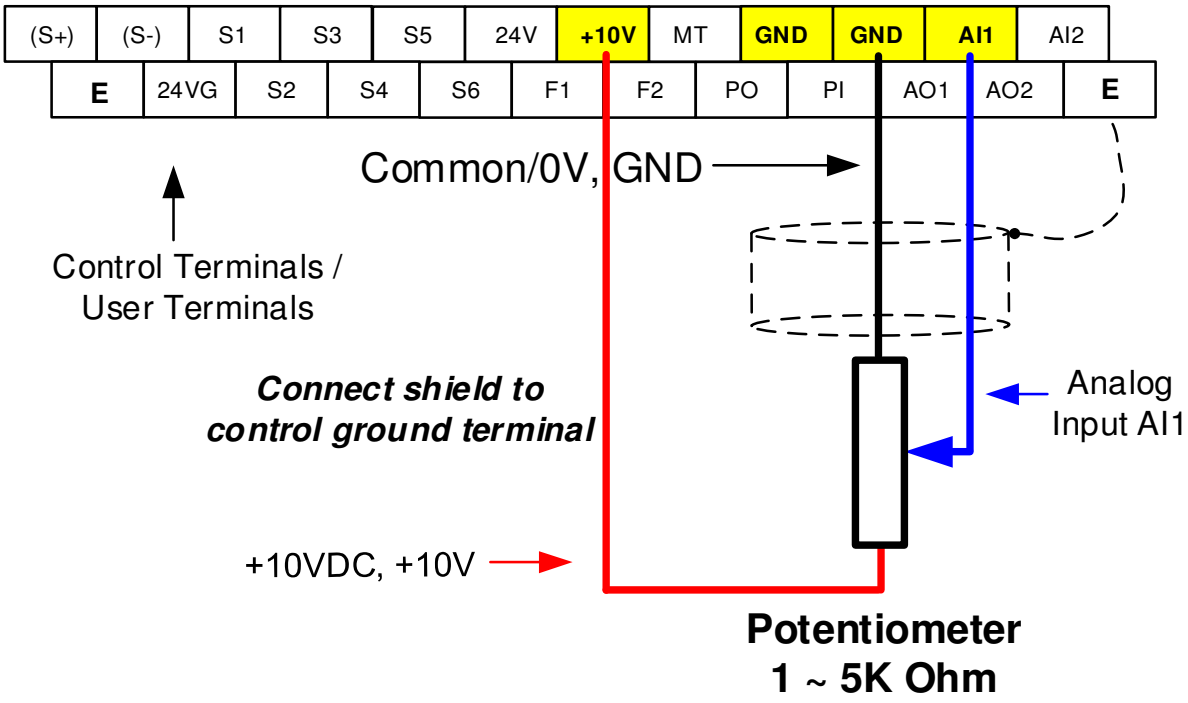
Speed reference from the keypad is the default setting. Press the **READ**/ **ENTER** key first and use the </RESET, ▲ and ▼ keys to change the speed reference.

6.2 Reference from External Analog Signal (0-10V / 4-20mA)

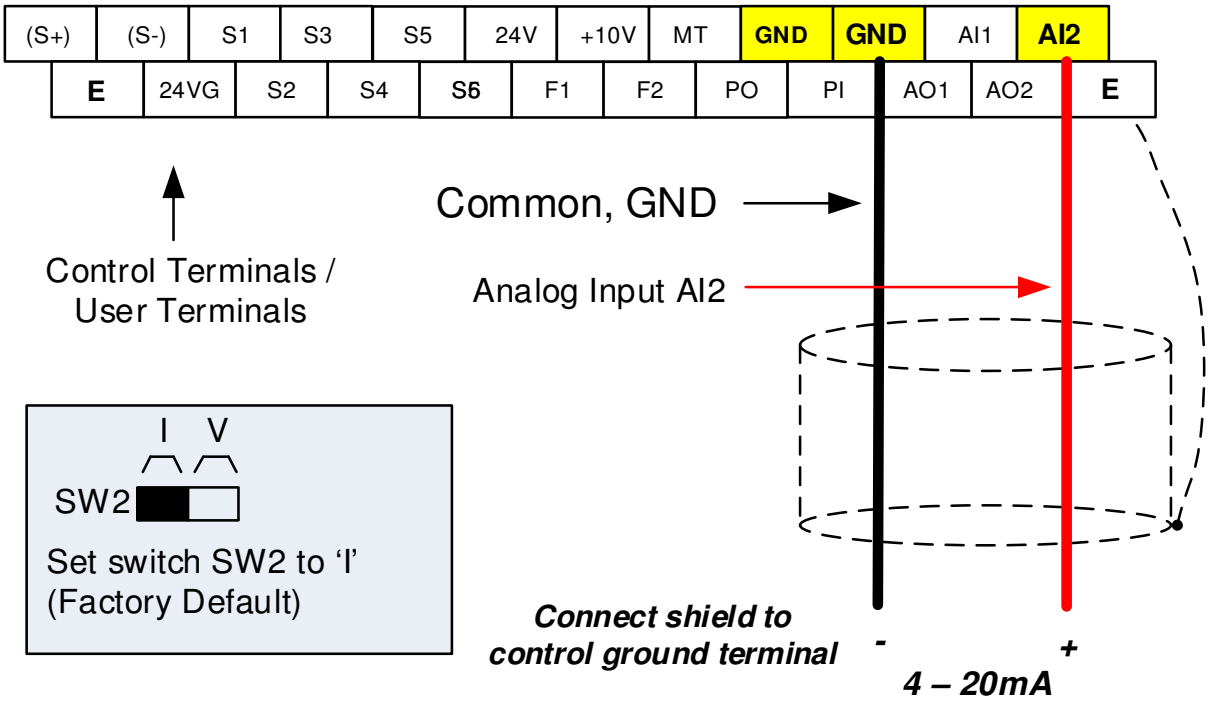
Analog Reference: 0 – 10 V (Setting 00-05 = 1)



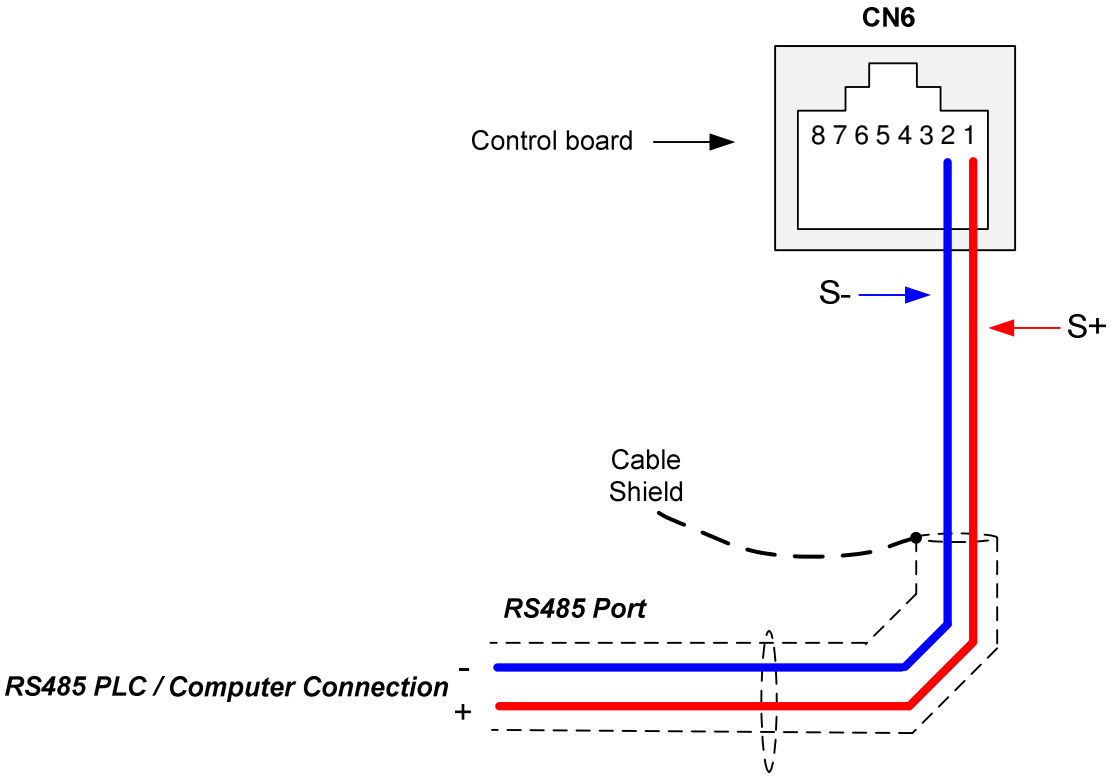
Analog Reference: Potentiometer / Speed Pot (Setting 00-05 = 1)



Analog Reference: 4 – 20mA (Setting 00-05 = 7)



6.3 Reference from Serial Communication RS485 (00-05=3)



To set the speed reference for the inverter via serial communication parameter 00-05 has be set to “3” for frequency command via serial communication.

Default Communication Setting is: Address “1”, 9600 Bits/sec, 1 Start Bit, 1 Stop Bit, and No Parity

The serial communication link function uses RS485 Modbus RTU protocol and allows for:
1) Monitoring (data monitoring, function data check).
2) Frequency setting.
3) Operation command (FWD, REV, and other commands for digital input).
4) Write function data.

Frequency Reference Command Register

Inverter Frequency Reference Register: 2502 (Hexadecimal) - Bit 0 – Bit 15: 0.00 ~ 400.00 Hz

Examples:

Frequency Reference Command: 10.00 Hz (Inverter Node Address: 01)

Command String (hexadecimal): 01 06 25 02 03 E8 23 B8

To set the frequency reference to 10.00, a value of ‘1000’ (03E8h) has to be send to the inverter.

Frequency Reference Command: 30.00 Hz (Inverter Node Address: 01)

Command String (hexadecimal): 01 06 25 02 0B B8 24 44

To set the frequency reference to 30.00, a value of ‘3000’ (0BB8h) has to be send to the inverter.

Frequency Reference Command: 60.00 Hz (Inverter Node Address: 01)

Command String (hexadecimal): 01 06 25 02 17 70 2D 12

To set the frequency reference to 60.00, a value of ‘6000’ (1770h) has to be send to the inverter

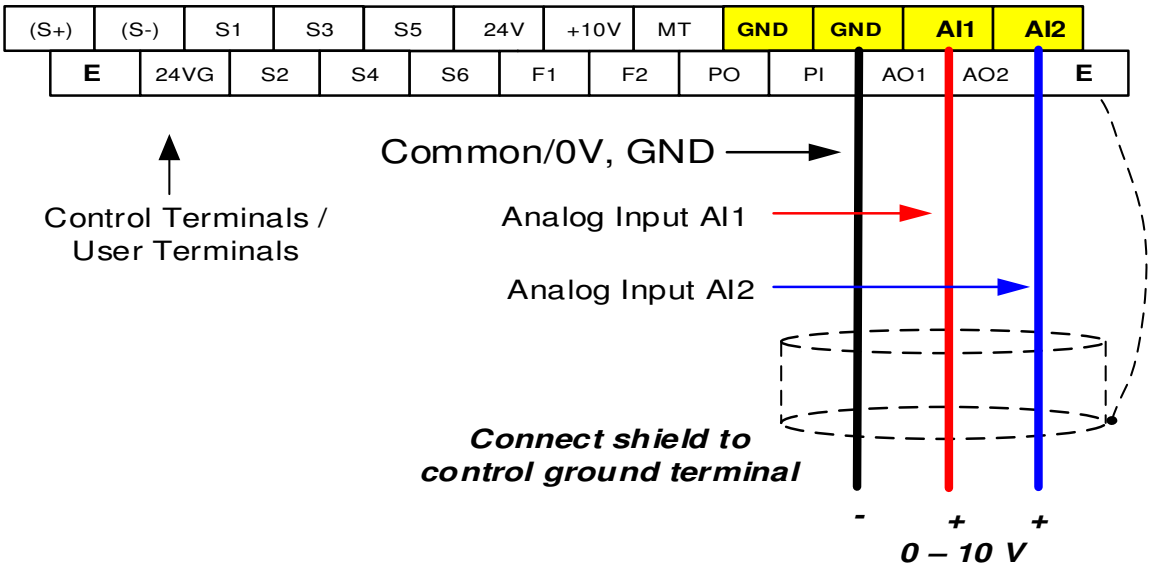
Note: The last 2 bytes of the command strings consist of a CRC16 checksum, please refer to section 4.5 of the instruction manual for additional information.

6.4 Reference from two Analog Inputs

Analog input AI1 is used as master frequency reference and analog input AI2 is used as auxiliary frequency reference.

Analog Reference AI1: 0 – 10 V (Setting 00-05 = 1)
Analog Reference AI2: 0 – 10 V (Setting 00-06 = 1, 04-05 = 1)

AI1 – Analog Input 1	AI2 – Analog Input 2	04-00 Setting (Default = 1)	Dipswitch SW2 (Default 'V')
0 ~ 10V	0 ~ 10V	0	Set to 'V'
0 ~ 10V	4 ~ 20mA	1	Set to 'I'



6.5 Change Frequency Unit from Hz to rpm

Enter the number of motor poles in 16-03 to change the display units from Hz to rpm.

16-03	Display unit
Range	**0:** Display unit is Hz (Resolution is 0.01Hz) **1:** Display unit is % (Resolution is 0.01%) **2:** Rpm display; motor rotation speed is set by the control modes to select IM (02-07)/ PM (22-03) motor poles to calculate **3~39:** Reserved **40~9999:** 100% is XXXX with no decimals (integer only) **10001~19999:** 100% is XXX.X with 1 decimal **20001~29999:** 100% is XX.XX with 2 decimals **30001~39999:** 100% is X.XXX with 3 decimals

Example: Motor poles 4, 02-07 or 22-03 = 4.

Chapter 7 Operation Method Configuration (Run / Stop)

The inverter offers users several choices to run and stop from different sources. The most commonly used methods are described in the next sections.

Operation command is selected with parameter 00-02.

00-02: Run Command Selection

This function sets the frequency command source.

Setting Range: 0 to 3

To set parameter 00-01:
- After power-up press the **DSP**/**FUN** key
- Select **00 Basic Fun**
- Press **READ**/ **ENTER** key
- Select parameter -01 with the **UP**/**DOWN** ▲ and ▼ keys and press the **READ**/ **ENTER** key.

In the parameter list move cursor to 00-01 with the **UP**/**DOWN** keys and press **READ**/ **ENTER** key to select.

00-02	Run Command Selection
Range	**0:** Keypad control **1:** External terminal control **2:** Communication control **3:** PLC **4:** RTC

7.1 Run/Stop from the Keypad (00-02=0) – Default Setting

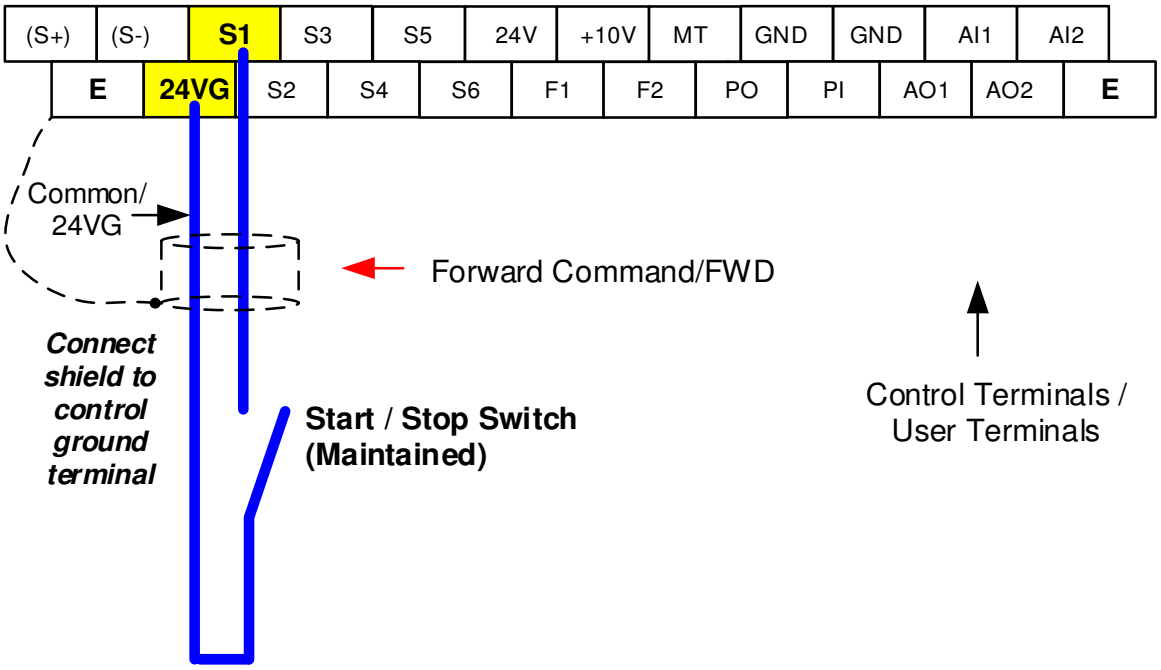
Use the **RUN** key to run the drive in forward direction and the **FWD**/**REV** key to change the motor direction. (Note: to disable reverse direction set parameter 11-01 to 1)

Press **STOP** key to stop the inverter. (Note: Stop method can be set with parameter 07-09, default is **deceleration to stop)**.

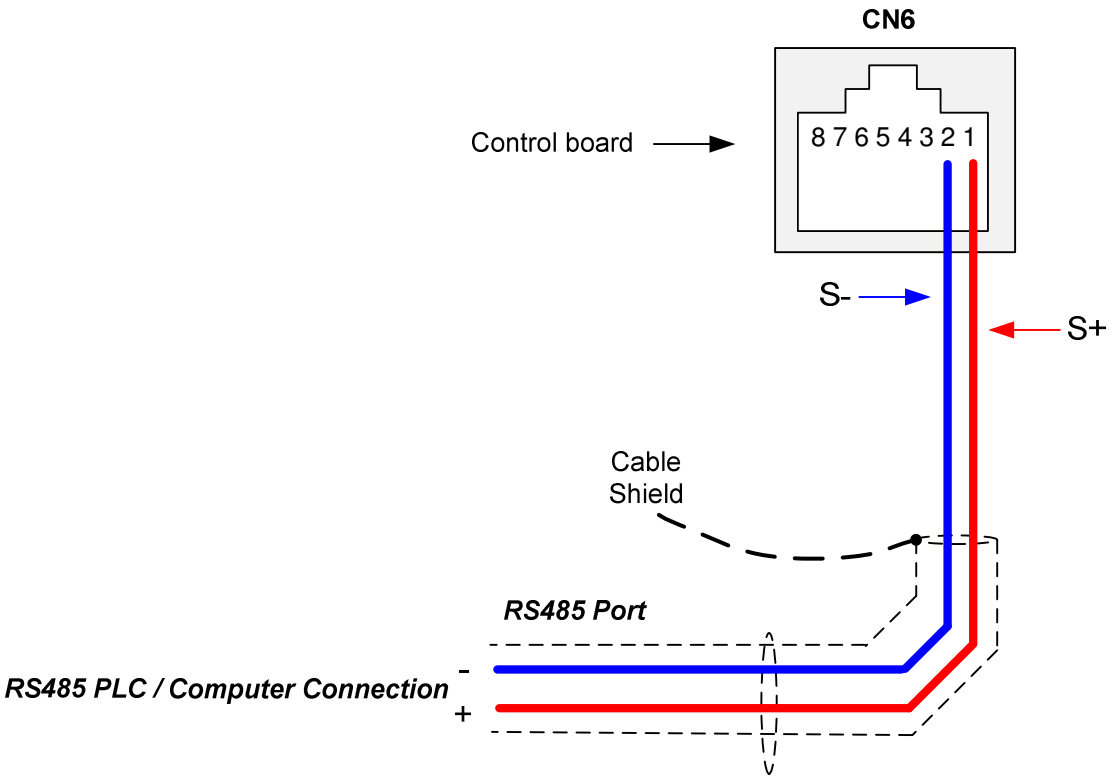
7.2 Run/Stop from External Switch / Contact or Pushbutton (00-02=1)

Use an external contact or switch to Run and Stop the inverter.

Permanent Switch / Contact



7.3 Run/Stop from Serial Communication RS485 (00-02=3)



To control (Run/Stop) the inverter via serial communication parameter 00-02 has be set to either a “3” for communication control.

Default Communication Setting is: Address “1”, 9600 Bits/sec, 1 Start Bit, 1 Stop Bit, and No Parity

The serial communication link function uses RS485 Modbus RTU protocol and allows for:
1) Monitoring (data monitoring, function data check).
2) Frequency setting.
3) Operation command (FWD, REV, and other commands for digital input).
4) Write function data.

Command Register

Inverter Command Register: 2501 (Hexadecimal)

Bit 0: Run Forward
Bit 1: Run Reverse
Bit 2 ~ Bit 15: Refer to the chapter XX of this manual

Examples:

Run Forward Command (Inverter Node Address: 01)

Command String (hexadecimal): 01 06 25 01 00 01 12 C6

Run Reverse Command (Inverter Node Address: 01)

Command String (hexadecimal): 01 06 25 01 00 03 93 07

Stop Command (Inverter Node Address: 01)

Command String (hexadecimal): 01 06 25 01 00 00 D3 06

Note: The last 2 bytes of the command strings consist of a CRC16 checksum, please refer to section 4.5 of the instruction manual for additional information.

Chapter 8 Motor and Application Specific Settings

It is essential that before running the motor, the motor nameplate data matches the motor data in the inverter.

8.1 Set Motor Nameplate Data (02-01, 02-05)

02-05 Rated power of motor 1

The nominal motor rated capacity is set at the factory. Please verify that the motor name plate data matches the motor rated capacity shown in parameter 02-05. The setting should only be changed when driving a motor with a different capacity.

Range: 0.00 to 600.00 kW (1HP = 0.746 kW)

To set parameter 02-05:
- After power-up press the **DSP**/**FUN** key
- Select **02 Motor Parameter**
- Press **READ**/ **ENTER** key
- Select parameter -01 with the **UP**/**DOWN** ▲ and ▼ keys and press the **READ**/ **ENTER** key.

Default values vary based on the inverter model.

02-01 Rated current of motor

The motor rated current is set at the factory based on the inverter model. Enter the motor rated current from the motor nameplate if it does not match the value shown in parameter 02-01.

Setting range: 0.01 to 600.00A

To set parameter 02-01:
- After power-up press the **DSP**/**FUN** key
- Select **02 Motor Parameter**
- Press **READ**/ **ENTER** key
- Select parameter -01 with the **UP**/**DOWN** ▲ and ▼ keys and press the **READ**/ **ENTER** key.

8.2 Acceleration and Deceleration Time (00-14, 00-15)

Acceleration and Deceleration times directly control the system dynamic response. In general, the longer the acceleration and deceleration time, the slower the system response, and the shorter time, the faster the response. An excessive amount of time can result in sluggish system performance while too short of a time may result in system instability.

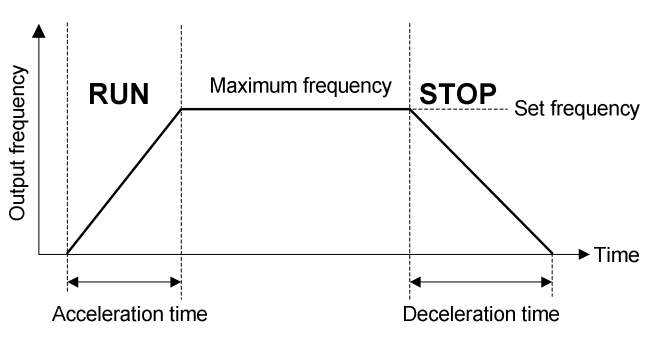
The default values suggested normally result in good system performance for the majority of general purpose applications. If the values need to be adjusted, caution should be exercised, and the changes should be in small increments to avoid system instability.

00-14 Acceleration time 1
00-15 Deceleration time 1

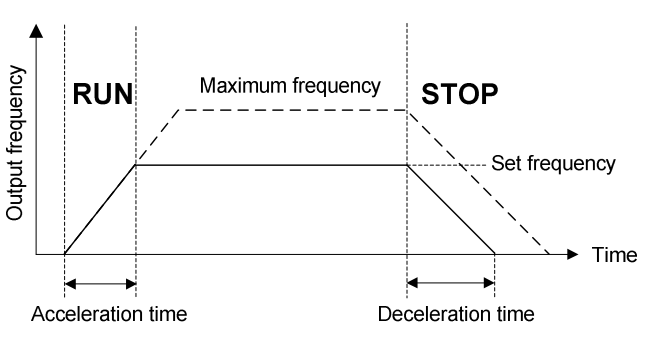
These parameters set the acceleration and deceleration times of the output frequency from 0 to maximum frequency and from maximum frequency to 0.

To set parameter 00-14 or 00-15:
- After power-up press the **DSP**/**FUN** key
- Select **00 Basic Fun**
- Press **READ**/ **ENTER** key
- Select parameter -14 or -15 with the **UP**/**DOWN** ▲ and ▼ keys and press the **READ**/ **ENTER** key.

Acceleration and deceleration times are represented by the three most significant (high order) digits. Set acceleration and deceleration times with respect to maximum frequency. The relationship between the set frequency value and acceleration/deceleration times is as follows:



Set Frequency = Maximum Frequency



Set Frequency < Maximum Frequency

Note: If the set acceleration and deceleration times are set too low, the torque limiting function or stall prevention function can become activated if the load torque and or inertia are relatively high. This will prolong the acceleration and or deceleration times and not allow the set times to be followed. In this case the acceleration and or the deceleration times should be adjusted.

8.3 Torque Compensation Gain (01-10)

This parameter sets the relationship between output frequency and output voltage. Constant torque applications have the same torque requirements at low speed as well as at high speed.

Initial Setup

For Variable Torque / Normal Duty applications set parameter 01-10 to an initial value of 0.5.

For Constant Torque / Heavy Duty applications set parameter 01-10 to an initial value of 1.0.

01-10 Torque compensation gain

This parameter sets the torque boost for motor.

Setting range: 0.0 to 2.0

To set parameter 01-10:
- After power-up press the **DSP**/**FUN** key
- Select **01 V/F Pattern**
- Press **READ**/ **ENTER** key
- Select parameter -10 with the **UP**/**DOWN** ▲ and ▼ keys and press the **READ**/ **ENTER** key.

Increase value when:
- The wiring between the inverter and the motor very too long
- The motor size is smaller than the inverter size

Note: Gradually increase the torque compensation value and make sure the output current does not exceed inverter rated current.

Reduce value when:
- Experiencing motor vibration
- Over Current Fault
- Overload Fault

Important: Confirm that the output current at low speed does not exceed the rated output current of the inverter.

Warning: A larger than required torque compensation gain value creates over-excitation at low speeds, continued operation may cause the motor to overheat. Check the characteristics of the motor for additional information.

8.4 Automatic Energy Savings Function (11-19)

In the V/F control mode the automatic energy saving (AES) function automatically adjusts the output voltage and reduces the output current of the inverter to optimize energy savings based on the load.

The output power changes proportional to the motor load. Energy savings is minimal when the load exceeds 70% of the output power and savings become greater when the load decreases.

The parameter of automatic energy saving function has been set at the factory before shipment. In general, it is no need to adjust. If the motor characteristic has significant difference from TECO standard, please refer to the following commands for adjusting parameters:

Enable Automatic Energy Savings Function

To set parameters 11-19 to 11-24:
- After power-up press the **DSP**/**FUN** key
- Select **11 Auxiliary Function Group**
- Press **READ**/ **ENTER** key
- Select parameter -19 to -24 with the **UP**/**DOWN** ▲ and ▼ keys and press the **READ**/ **ENTER** key.

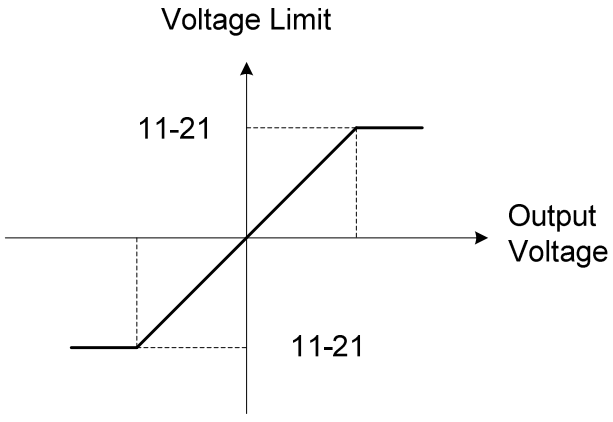
(1) To enable automatic energy saving function set 11-19 to 1.
(2) Filter time of automatic energy saving (11-20)
(3) Commissioning parameter of energy saving (11-21 to 11-22)

In AES mode, the optimum voltage value is calculated based on the load power requirement but is also affected by motor temperature and motor characteristic.

In certain applications the optimum AES voltage needs to be adjusted in order to achieve optimum energy savings. Use the following AES parameters for manual adjustment:

11-21: Voltage limit value of AES commissioning operation

Sets the voltage upper limit during automatic energy saving. 100% corresponds to 230V or 460V depending on the inverter class used.



Voltage limit value of commissioning operation

11-22: Adjustment time of automatic energy saving
Sets sample time constant for measuring output power.
Reduce the value of 11-22 to increase response when the load changes.
Note: If the value of 11-22 is too low and the load is reduced the motor may become unstable.

11-23: Detection level of automatic energy saving
Sets the automatic energy saving output power detection level.

11-24: Coefficient of automatic energy saving
The coefficient is used to tune the automatic energy saving. Adjust the coefficient while running the inverter on light load while monitoring the output power. A lower setting means lower output voltage.

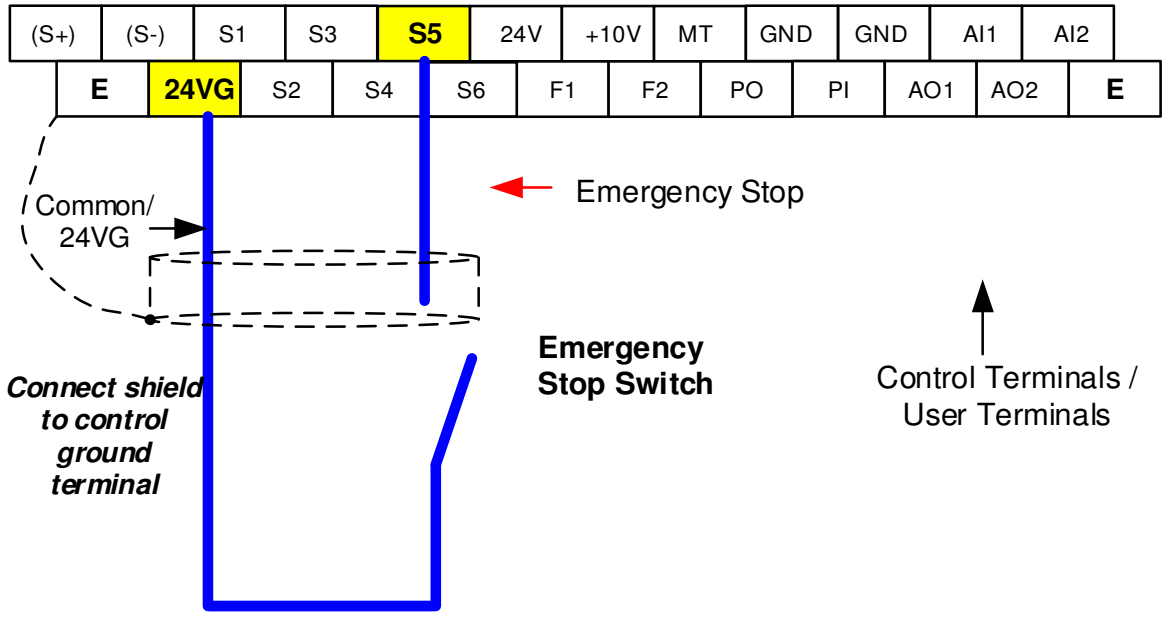
Notes:
- If the coefficient is set to low the motor may stall.
- Coefficient default value is based on the inverter rating. Set parameter 13-00. If the motor power does not match the inverter rating.

8.5 Emergency Stop

The emergency stop time is used in combination with multi-function digital input function #14 (Emergency stop). When emergency stop input is activated the inverter will decelerate to a stop using the Emergency stop time (00-26) and display the [EM STOP] condition on the keypad.

Note: To cancel the emergency stop condition the run command has to be removed and emergency stop input deactivated.

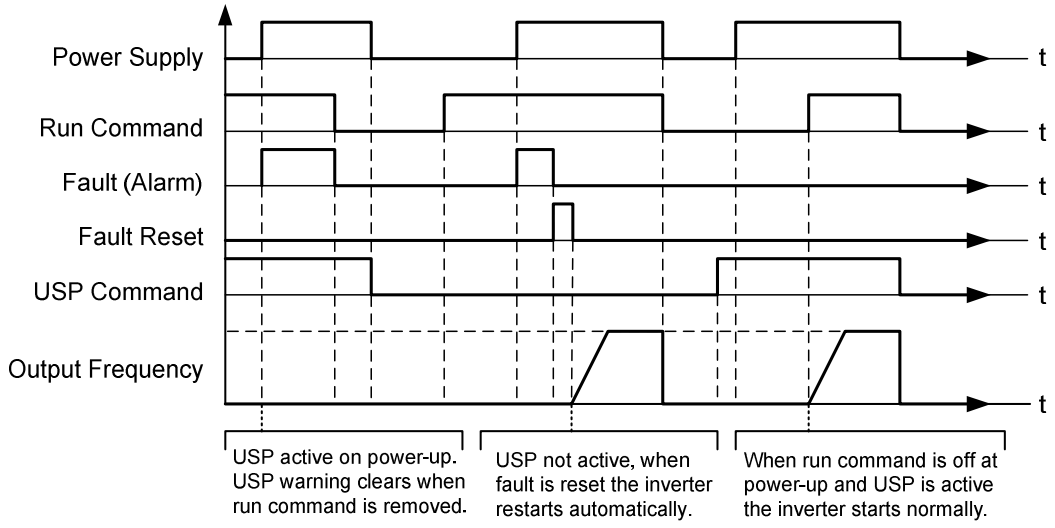
Example: Emergency Stop Switch set for input terminal S5 (03-04 = 14).



00-26	Emergency stop time
Range	0.1~6000.0 Sec

8.6 Direct / Unattended Startup

The unattended startup function prevents the inverter from starting automatically when a run command is present at time of power-up. To use USP command set one of the multi-function digital input functions to #50 (USP Startup).



Unattended Startup Protection

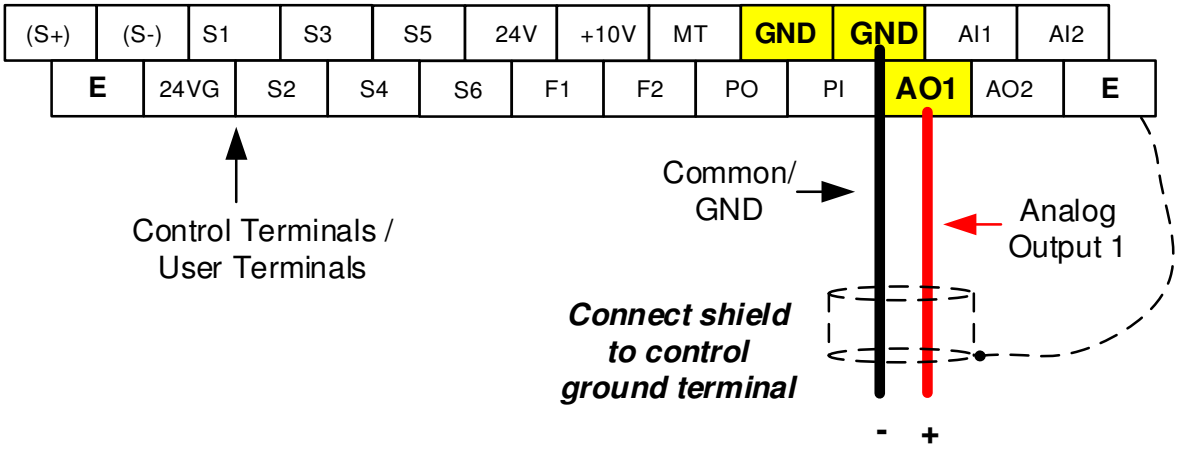
8.7 Analog Output Setup

Signal: Use parameter 04-11 to select the analog output signal for AO1 and parameter 04-16 to select the analog output signal for AO2.

Gain: Use parameter 04-12 to adjust the gain for AO1 and parameter 04-17 to adjust the gain for AO2. Adjust the gain so that the analog output (10V/20mA) matches 100% of the selected analog output signal (04-11 for AO1 and 04-16 for AO2).

Bias: Use parameter 04-13 to adjust the bias for AO1 and parameter 04-18 to adjust the bias for AO2. Adjust the bias so that the analog output (0V/4mA) matches 0% of the selected analog output signal (04-11 for AO1 and 04-16 for AO2).

Example: Analog Output 1 Wiring



04-11	AO1 function Setting	
Range	**0:** Output frequency	**14:** Reserved
	1: Frequency command	**15:** ASR output
	2: Output voltage	**16:** Reserved
	3: DC voltage	**17:** q-axis voltage
	4: Output current	**18:** d-axis voltage
	5: Output power	**19~20:** Reserved
	6: Motor speed	**21:** PID input
	7: Output power factor	**22:** PID output
	8: AI1 input	**23:** PID target value
	9: AI2 input	**24:** PID feedback value
	10: Torque command	**25:** Output frequency of the soft starter
	11: q -axis current	**26~27:** Reserved
	12: d-axis current	**28:** Communication control
	13: Speed deviation	

04-12	AO1 gain value
Range	0.0~1000.0%

04-13	AO1 bias-voltage value
Range	-100.0~100.0%

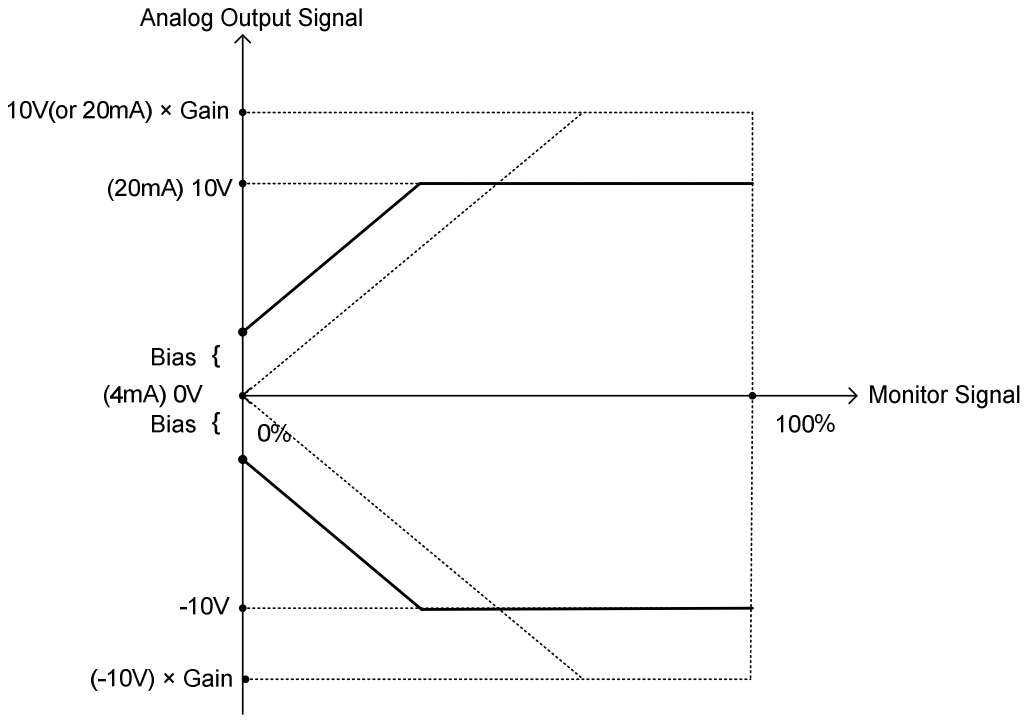
04-16	AO2 function Setting
Range	See parameter 04-11

04-17	AO2 gain value
Range	0.0~1000.0%

04-18	AO2 bias-voltage value
Range	-100.0~100.0%

04-19	AO2 Output Signal Type
Range	0: AO1:0~10V AO2:0~10V 1: AO1:0~10V AO2:4~20mA 2: AO1:4~20mA AO2:0~10V 3: AO1:4~20mA AO2: 4~20mA

04-20	Filter Time of AO Signal Scan
Range	0.00~0.50s



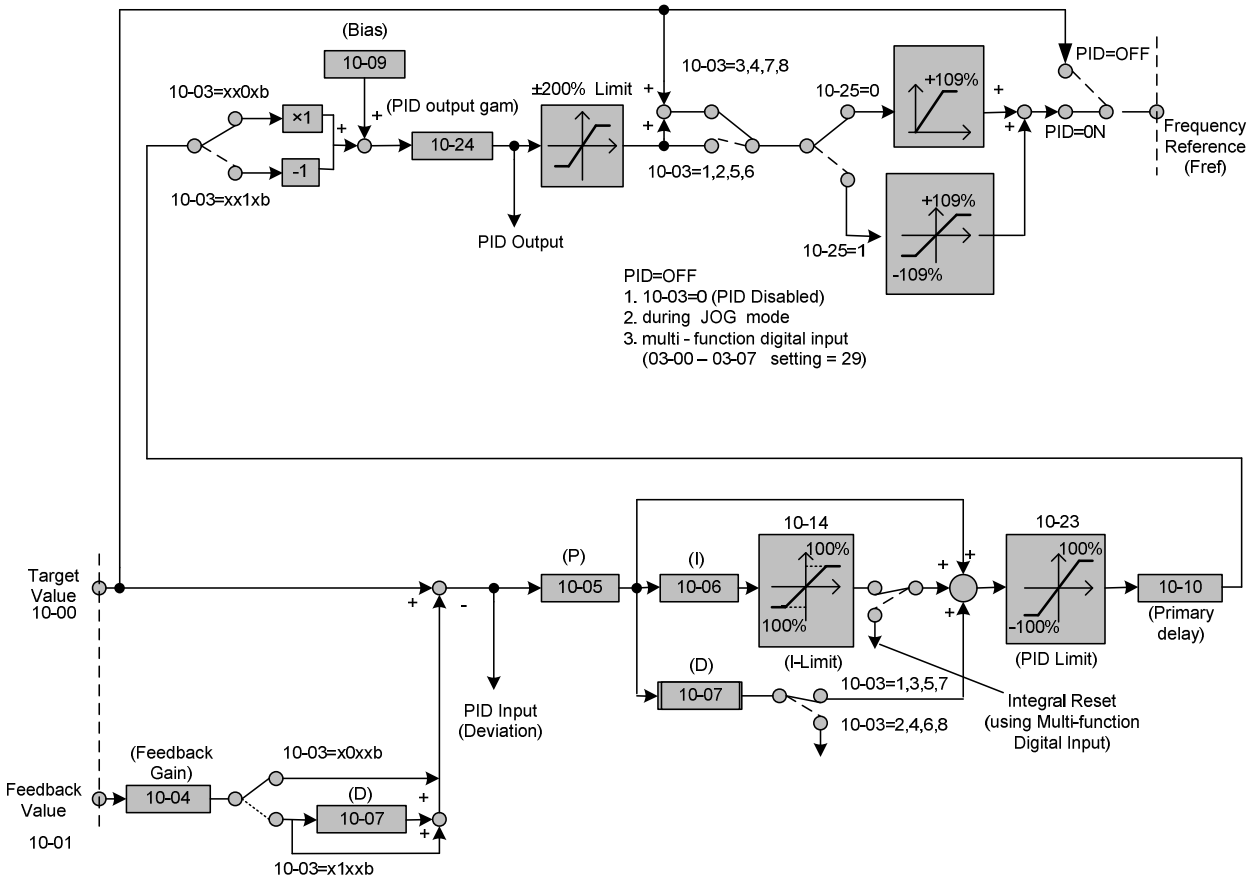
Analog output level adjustment

Chapter 9 Using PID Control for Constant Flow / Pressure Applications

****PID QUICKSTART GUIDE AVALIABLE AT www.tecowetstinghouse.com****

9.1 What is PID Control?

The PID function in the inverter can be used to maintain a constant process variable such as pressure, flow, temperature by regulating the output frequency (motor speed). A feedback device (transducer) signal is used to compare the actual process variable to a specified setpoint. The difference between the set-point and feedback signal is called the error signal.
The PID control tries to minimize this error to maintain a constant process variable by regulating the output frequency (motor speed).



The amplitude of the error can be adjusted with the Proportional Gain parameter 10-05 and is directly related to the output of the PID controller, so the larger gain the larger the output correction.

Example 1:	**Example 2:**
Gain = 1.0	Gain = 2.0
Set-Point = 80%	Set-Point = 80%
Feedback = 78%	Feedback = 78%
Error = Set-point - Feedback = 2%	Error = Set-point - Feedback = 2%
Control Error = Gain x Error = 2%	Control Error = Gain x Error = 4%

Please note that an excessive gain can make the system unstable and oscillation may occur.

The response time of the system can be adjusted with the Integral Gain set by parameter 10-06. Increasing the Integral Time will make the system less responsive and decreasing the Integral Gain Time will increase response but may result in instability of the total system.

Slowing the system down too much may be unsatisfactory for the process. The end result is that these two parameters in conjunction with the acceleration (00-14) and deceleration (00-15) times are adjusted to achieve optimum performance for a particular application.

For typical fan and pump applications a Proportional Gain (10-05) of 2.0 and an Integral Time (10-06) of 5.0 sec is recommended.

10-03 PID control mode

PID control can be enabled by setting parameter 10-03 to ‘xxx1b’

10-03	PID control mode
Range	**xxx0b:** PID disable **xxx1b:** PID enable **xx0xb:** PID positive characteristic **xx1xb:** PID negative characteristic **x0xxb:** PID error value of D control **x1xxb:** PID feedback value of D control **0xxxb:** PID output **1xxxb:** PID output +target value

Commonly used PID control modes

0001b: Forward operation: PID operation enabled, motor speeds increases when feedback signal is smaller than set-point (most fan and pump applications)

0011b: Reverse operation: PID operation enabled, motor slows down when feedback signal is smaller than set-point (e.g. level control applications)

To set parameter 10-03:
- After power-up press the **DSP**/**FUN** key
- Select **10 PID Control**
- Press **READ**/ **ENTER** key
- Select parameter -03 with the **UP**/**DOWN** ▲ and ▼ keys and press the **READ**/ **ENTER** key.

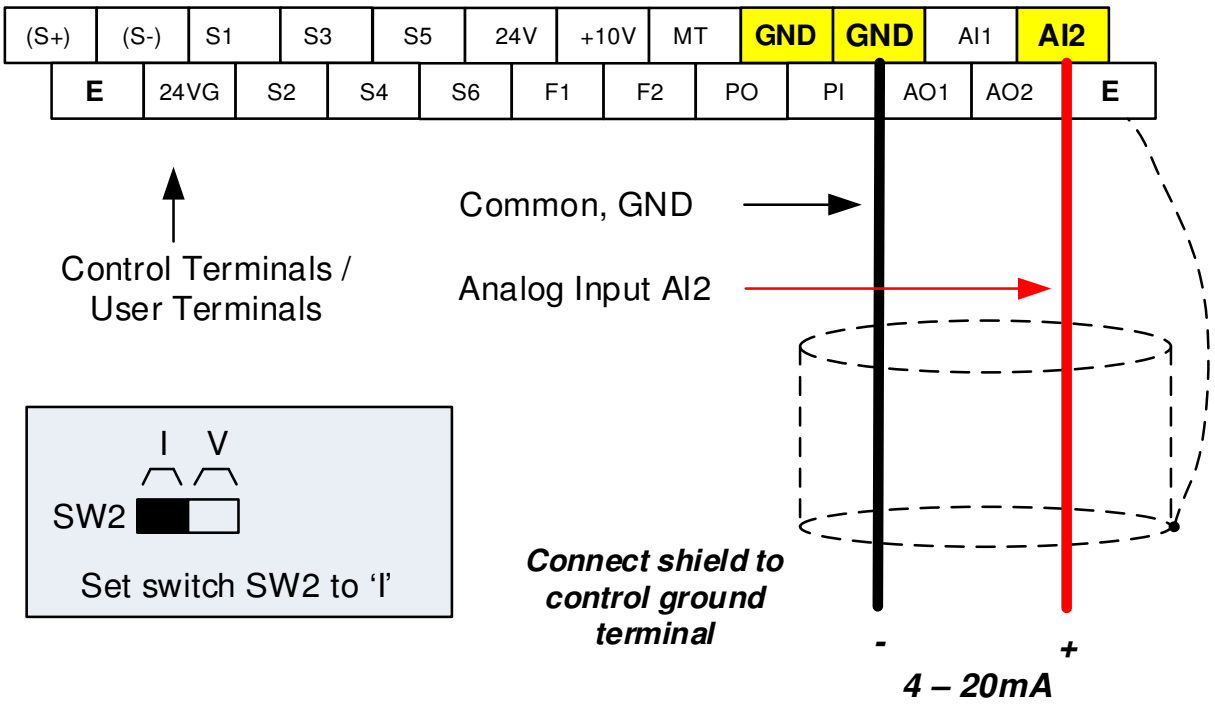
Important: To use the PID function parameter 00-05 (Main Frequency Command Source Selection) has to be set to 5 for PID reference.

9.2 Connect Transducer Feedback Signal (10-01)

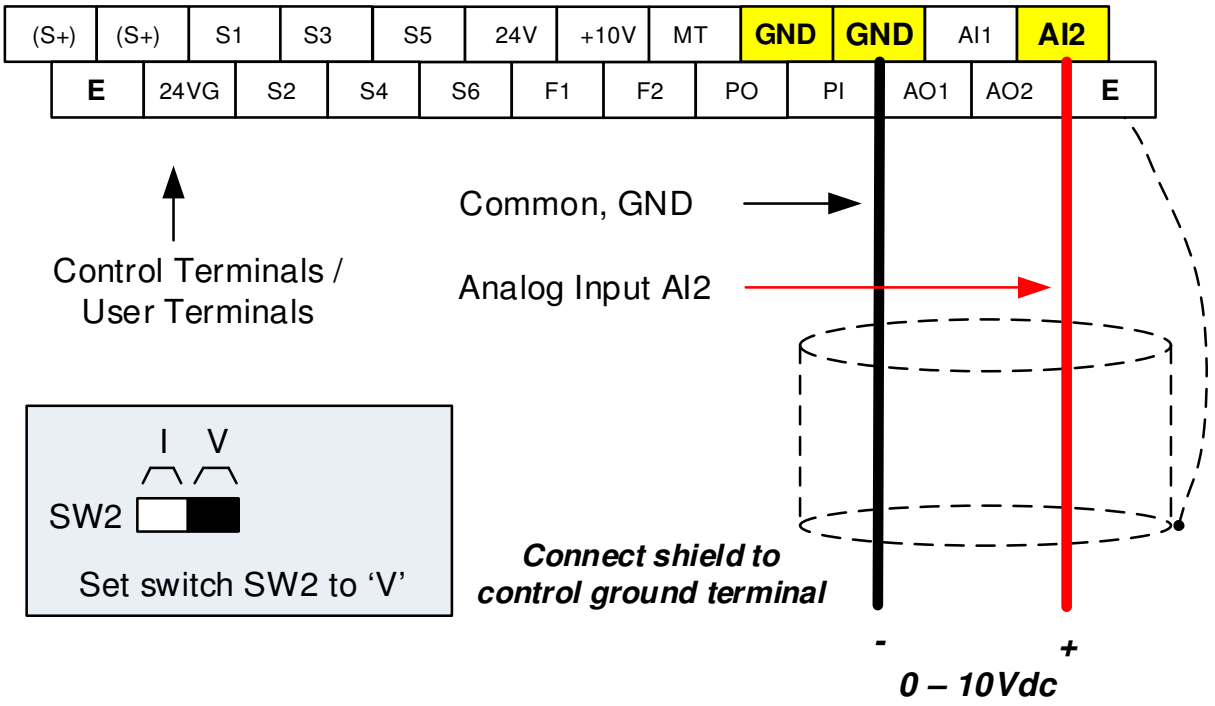
The PID function in the inverter

Depending on the type of feedback transducer used, the inverter can be setup for either 0-10V or a 4-20mA feedback transducer.

Feedback Signal 4 – 20mA (10-01 = 2) – SW2 = I



Feedback Signal 0 – 10V (10-01 = 1) – SW2 = V



9.3 Engineering Units (only for LCD)

The PID setpoint scaling can be selected with parameter 16-03 and 16-04.

Example: 0 – 200.0 PSI Setpoint, set 16-03 to 12000 (1 decimal, range 0 – 200) and 16-04 to 2 (PSI).

9.4 Sleep / Wakeup Function

The PID Sleep function can be used to prevent a system from running at low speeds and is frequently used in pumping application. The PID Sleep function is turned on by parameter 10-29 set to 1. The inverter output turns off when the PID output falls below the PID sleep level (10-17) for the time specified in the PID sleep delay time parameter (10-18).

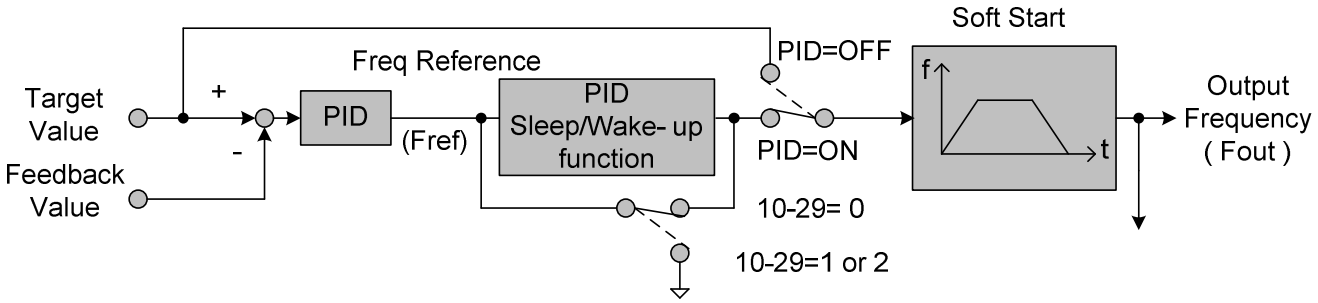
The inverter wakes up from a sleep condition when the PID output (Reference frequency) rises above the PID wake-up frequency (10-19) for the time specified in the PID wake-up delay time (10-20).

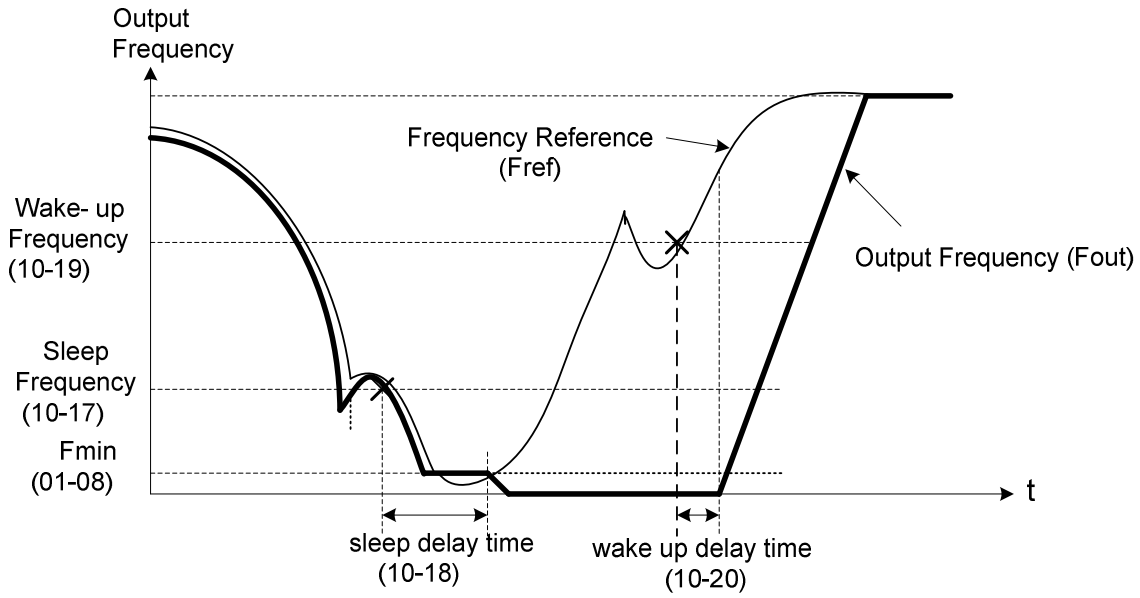
10-29 =0: PID Sleep function is disabled.

10-29 =1: PID sleep operation is based on parameters of 10-17 and 10-18.

10-29 =2: PID sleep mode is enabled by multi-function digital input

Refer to figure 4.4.74 (a) and (b) for PID sleep / wakeup operation.





PID Sleep Function

Chapter 10 Troubleshooting and Fault Diagnostics

10.1 General

Inverter fault detection and early warning / self-diagnosis function. When the inverter detects a fault, a fault message is displayed on the keypad. The fault contact output energizes and the motor will coast to stop (The stop method can be selected for specific faults).

When the inverter detects a warning / self-diagnostics error, the digital operator will display a warning or self-diagnostic code, the fault output does not energize in this case. Once the warning is removed, the system will automatically return to its original state.

10.2 Fault Detection Function

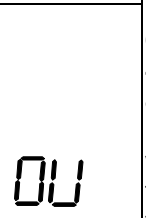
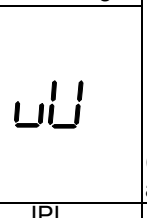
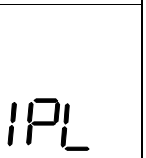
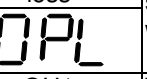
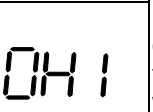
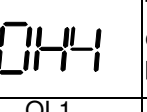
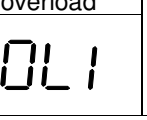
When a fault occurs, please refer to Table 10.2.1 for possible causes and take appropriate measures.

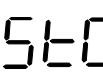
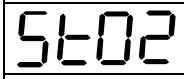
Use one of the following methods to restart:
1. Set one of multi-function digital input terminals (03-00, 03-05) to 17 (Fault reset); activate input
2. Press the reset button on the keypad and clear fault message.
3. Power down inverter wait until keypad goes blank and power-up the inverter again.

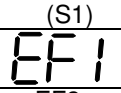
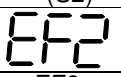
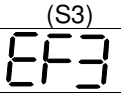
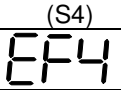
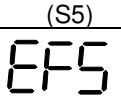
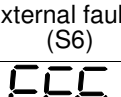
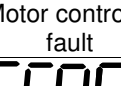
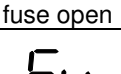
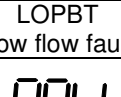
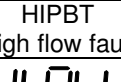
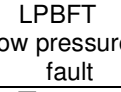
When a fault occurs, the fault message is stored in the fault history (see group 12 parameters).

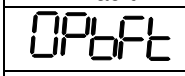
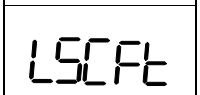
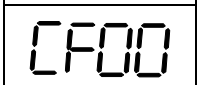
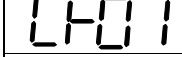
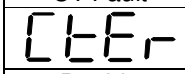
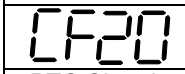
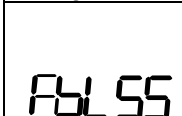
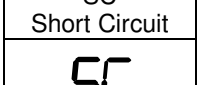
Table 10.2.1 Fault information and possible solutions

LED display	Description	Cause	Possible solutions
OC over current OC	The inverter output current exceeds the overcurrent level (around 200% of the inverter rated current).	• Acceleration time is too short. • Contactor at the inverter output side. • A special motor or applicable capacity is greater than the inverter rated value. • Short circuit or ground fault.	• Extend acceleration time. • Check the motor wiring. • Disconnect motor and try running inverter.
OCA over current OCA	The inverter output current exceeds the overcurrent level in acceleration time	• Acceleration time is too short • Capacity of motor is bigger than inverter • Short circuit between winding and shell of motor • Short circuit between wire and ground of motor • IGBT broken module	• Set the longer acceleration time • Change to bigger capacity of inverter • Examine motor • Check the wire • Replace IGBT module
OCC over current OCC	The inverter output current exceeds the overcurrent level in constant speed	• Instantaneous change of load • Instantaneous change of current	• Change to bigger capacity of inverter • Add reactor to power source
OCD over current OCd	The inverter output current exceeds the overcurrent level in deceleration time	• Deceleration time is too short	• Set the longer acceleration time
GF Ground fault GF	The current to ground exceeds 50% of the inverter rated output current (08-23 = 1, GF function is enabled).	• Motor damaged (insulation). • Wire damage or deterioration. • Inverter DCCT sensors defect.	• Replace motor. • Check the motor wiring. • Disconnect motor and try running inverter. • Check resistance between cables and ground. • Reduce carrier frequency.

LED display	Description	Cause	Possible solutions
OV Over voltage 	DC bus voltage exceeds the OV detection level: 410Vdc: 200V class 820Vdc: 400V class (For 400V class, if input voltage 01-14 is set lower than 400V, the OV detection value will is decreased to 730Vdc).	• Deceleration time set too short, resulting in regenerative energy flowing back from motor to the inverter. • The inverter input voltage is too high. • Use of power factor correction capacitors. • Excessive braking load. • Braking transistor or resistor defective. • Speed search parameters set incorrectly.	• Increase deceleration time • Reduce input voltage to comply with the input voltage requirements or install an AC line reactor to lower the input voltage. • Remove the power factor correction capacitor. • Use dynamic braking unit. • Replace braking transistor or resistor. • Adjust speed search parameters.
UV Under voltage 	DC bus voltage is lower than the UV detection level or the pre-charge contactor is not active while the inverter is running. 190Vdc: 200V class; 380Vdc: 400V class (The detection value can be adjusted by 07-13).	• The input voltage is too low. • Input phase loss. • Input voltage fluctuation. • Pre-charge contactor damaged. • DC bus voltage feedback signal value not incorrect.	• Check the input voltage. • Check input wiring. • Check power source • Replace pre-charge contactor • Replace control board or complete inverter.
IPL input phase loss 	Phase loss at the input side of the inverter or input voltage imbalance, active when 08-09 = 1 (enabled).	• IPL occurs. • Terminal screws of R/L1, S/L2 or T/L3 are loose or lost. • Input voltage fluctuation is too big. • Input Voltage is imbalance per phase • Aging of the capacity on main circuit inside inverter	• Check if the main wiring connection is correct. • Check if the terminal screw gets loose. • Make sure having stable input voltage or turn off IPL detection function. • Replace the circuit board or inverter
OPL output phase loss 	Phase loss at the output side of the inverter, active when 08-10 = 1 (enabled).	• Wiring loose in inverter output terminal. • Motor rated current is less than 10% of the inverter rated current.	• Check output wiring / faster screws. • Check motor & inverter rating.
OH1 Heatsink overheat 	The temperature of the heat sink is too high. **Note:** when OH1 fault occurs three times within five minutes, it is required to wait 10 minutes before resetting the fault.	• Ambient temperature too high. • cooling fan failed • Carrier frequency set too high. • Load too heavy.	• Install fan or AC to cool surroundings. • Replace cooling fan. • Reduce carrier frequency. • Reduce load / Measure output current
OH4 Motor overheating 	Motor overheating : The input of PTC (Positive Temperature Coefficient) exceeds the overheat protection level	• The surrounding temperature of motor is too high. • The input of PTC (Positive Temperature Coefficient) exceeds the overheat protection level.	• Check the surrounding temperature of motor. • Check MT and GND terminal wiring be correct.
OL1 Motor overload 	Internal motor overload protection tripped, active when protection curve 08-05 = xxx1.	• Voltage setting V/F mode too high, resulting in over-excitation of the motor. • Motor rated current (02-01) set incorrectly. • Load too heavy.	• Check V/f curve. • Check motor rated current • Check and reduce motor load, check and operation duty cycle.

LED display	Description	Cause	Possible solutions
OL2 Inverter overload 	Inverter thermal overload protection tripped. If an inverter overload occurs 4 times in five minutes, it is required to wait 4 minutes before resetting the fault.	• Voltage setting V/F mode too high, resulting in over-excitation of the motor. • Inverter rating too small. • Load too heavy.	• Check V/f curve. • Replace inverter with larger rating. • Check and reduce motor load, check and operation duty cycle.
OT Over torque detection 	Inverter output torque is higher than 08-15 (over torque detection level) for the time specified in 08-16. Parameter 08-14 = 0 or 2 to activate.	• Load too heavy.	• Check over torque detection parameters (08-15 / 08-16). • Check and reduce motor load, check and operation duty cycle.
UT Under torque detection 	Inverter output torque is lower than 08-19 (under torque detection level) for the time specified in 08-20. Parameter 08-18 = 0 or 2 to activate.	• Sudden drop in load. • Belt break.	• Check under torque detection parameters (08-19 / 08-20). • Check load / application.
CE communication error 	No Modbus communication received in for the time specified in 09-06 (communication error detection time). Active when 09-07(= 0 to 2).	• Connection lost or wire broken. • Host stopped communicating.	• Check connection • Check host computer / software.
FB PID feedback loss 	PID feedback signal falls below level specified in 10-12 (PID feedback loss detection level) for the time specified in 10-13 (Feedback loss detection time). Active when parameter (10-11 = 2).	• Feedback signal wire broken • Feedback sensor broken.	• Check feedback wiring • Replace feedback sensor.
STO Safety switch  STO2 Safety switch 	Inverter safety switches open.	• Terminal board Input F1 and F2 are not connected (For standard H & C type) • Terminal board Input SF1 / SF2 and SG are not connected (For enhanced E & G type) • 08-30 set to 1,free run to stop, and digital terminal is open, when 03-00~03-07=58	• Check F1 and F2 connection. (For standard H & C type) • Check SF1 / SF2 and SG connection (For enhanced E & G type) • Check if 08-30 =0 and 03-00~03-07=58
SS1 Safety switch 	Inverter safety switches open.	• When 08-30 is set to 0: Deceleration to stop, and digital terminal switch(58) is turned on.	• Check digital terminal(58) is turned on.
EF0 External fault 0 	External fault (Modbus)	Modbus communication 0x2501 bit 2= "1"	• Reset Modbus communication 0x2501 bit 2= "1"

LED display	Description	Cause	Possible solutions
EF1 External fault (S1) 	External fault (Terminal S1) Active when 03-00= 25 or 68, and Inverter external fault selection 08-24=0 or 1.	• Multifunction digital input external fault active.	• Multi-function input function set incorrectly. • Check wiring
EF2 External fault (S2) 	External fault (Terminal S2) Active when 03-01= 25 or 68, and Inverter external fault selection 08-24=0 or 1.		
EF3 External fault (S3) 	External fault (Terminal S3) Active when 03-02= 25 or 68, and Inverter external fault selection 08-24=0 or 1.		
EF4 External fault (S4) 	External fault (Terminal S4) Active when 03-03= 25 or 68, and Inverter external fault selection 08-24=0 or 1.		
EF5 External fault (S5) 	External fault (Terminal S5) Active when 03-04= 25 or 68, and Inverter external fault selection 08-24=0 or 1.		
EF6 External fault (S6) 	External fault (Terminal S6) Active when 03-05= 25 or 68, and Inverter external fault selection 08-24=0 or 1.		
CF07 Motor control fault 	Motor control fault	• SLV mode is unable to run motor.	• Perform rotational or stationary auto-tune • Increase minimum output frequency (01-08)
CF08 Motor control fault 	Motor control fault	• Start or Run fault in PMSLV mode.	• Increase the value of 22-10 properly. • Re auto-tune (22-21) • Check if the load is too heavy to raise torque output limit.
FU fuse open 	DC bus fuse blown DC fuse (Models 230V 50HP and above, 460V 75HP and above) open circuit.	• IGBT damaged. • Short circuit output terminals.	• Check IGBTs • Check for short circuit at inverter output. • Replace inverter.
LOPBT Low flow fault 	Low flow fault	• The feedback signal is not connected. • Due to HVAC feedback value is lower than the limit of minimum flow.	• Check feedback signal is correct and with right connection. • Ensure that the feedback value is higher than the limit of minimum flow (23-51).
HIPBT High flow fault 	High flow fault	• Since HVAC feedback value is higher than the limit of maximum flow.	• Check feedback signal is correct. • Ensure that the feedback value is lower than the limit of maximum flow (23-48).
LPBFT Low pressure fault 	Low pressure fault	• The feedback signal is not connected. • Since feedback value of pump pressure is lower than limit of minimum flow.	• Check feedback signal is correct and with connection. • Check if feedback value of pressure is lower than limit of minimum pressure (23-15).

LED display	Description	Cause	Possible solutions
OPBFT High pressure fault 	High pressure fault	• Since feedback value of pump pressure is lower than limit of maximum flow.	• Check feedback signal is correct. • Check if feedback value of pressure is lower than limit of maximum pressure (23-12).
LSCFT Low suction fault 	Low suction fault	• Insufficient water supply of effluent channel leads to insufficient suction • PID difference is higher than its level or current is lower than output current level	• Check if water of effluent channel is enough, and water supply is regular. • Check PID difference is higher than its level or current is lower than output current level
CF00 Operator Communication Error 	Errors of data transmission occur in keypad	• Keypad and inverter cannot transmit data after power on 5 seconds	• Disconnect the operator and then reconnect. • Replace the control board
CF01 Operator Communication Error 2 	Errors of data transmission occur in keypad	• Keypad and inverter can transmit data but transmission error occurs for more than 2 seconds	• Disconnect the operator and then reconnect. • Replace the control board
CT Fault 	Fault occurs in voltage level of three-phase input	• Abnormal input voltage, too much noise or malfunctioning control board	• Check input voltage signal and the voltage on the control board.
Double Communication Error 	Redundant Profibus and Modbus protocol	• User may use two communication mechanisms simultaneously	• Check only one communication mechanism is used.
PTC Signal Loss 	PTC Signal Loss detecting triggers error message	• PTC connection trips and has lasted for more than 10 seconds	• Check if MT terminal and GND terminal are connected.
OPR Disconnection 	Run command is set to keypad mode (00-02=0). But when the inverter runs, the operator is disconnected. Selection of operator removed (16-09) determines if the inverter stops or displays fault signal.	• The inverter runs at keypad mode (00-02=0), but warning of operator being disconnected/ removed occurs.	• Check if the operator is disconnected or removed.
FBLSS PID Feedback Signal Loss 	When 23-19 > 0, the inverter will display fault signal on the basis of the value of feedback pressure < operation pressure setting (23-02) x detection proportion of loss pressure (23-19) and detection time of loss pressure (23-18) passed, and 23-78=2 in the meanwhile.	• Since proportion of loss pressure (23-19) is enabled and over high, the inverter trips to fault. Thus, feedback sensor cannot operate properly or is not installed correctly.	• Check if the proportion of loss pressure (23-19) is set correctly. • Make sure the feedback sensor is installed correctly and PID feedback signal operates normally.
SC Short Circuit 	The inverter output or load is at short circuit.	• Short circuit or grounding fault (08-23=1) occurs from the damage to motor, insulation deterioration or cable breakage.	• Check if the load is at correct wiring.
PF Protection	OH1 error occurs for 3 times in 5 minutes when	• Run command in multi-function digital input terminals is not	• Remove run command in multi-function digital input

LED display	Description	Cause	Possible solutions
Fault PF	run command in multi-function digital input terminals is not removed.	removed.	terminals.
TOL **External Overload** tOL	External overload (enabled only when firemode activated	• External overload in multi-function digital input terminals. (Ex. Fan overheat)	• Check external overload. • Reset external overload of digital input.

10.3 Warning / Self-diagnosis Detection Function

When the inverter detects a warning, the keypad displays a warning code (flash).

Note: The fault contact output does not energize on a warning and the inverter continues operation. When the warning is no longer active the keypad will return to its original state.

When the inverter detected a programming error (for example two parameters contradict each other of are set to an invalid setting), the keypad displays a self-diagnostics code.

Note: The fault contact output does not energize on a self-diagnostics error. While a self-diagnostics code is active the inverter does not accept a run command until the programming error is corrected.

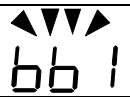
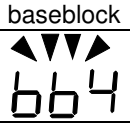
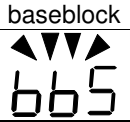
Note: When a warning or self- diagnostic error is active the warning or error code will flash on the keypad.

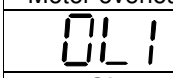
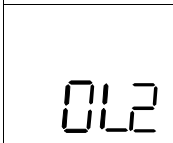
Refer to Table 10.3.1 for and overview, cause and corrective action for inverter warnings and self-diagnostic errors.

Table 10.3.1 Warning / self-diagnosis and corrective actions

LED display	Description	Cause	Possible solutions
OV (flash) Over voltage 	DC bus voltage exceeds the OV detection level: 410Vdc: 200V class 820Vdc: 400V class (for 440V class, if input voltage 01-14 is set lower than 400V, the OV detection value will is decreased to 700Vdc)	• Deceleration time set too short, resulting in regenerative energy flowing back from motor to the inverter. • The inverter input voltage is too high. • Use of power factor correction capacitors. • Excessive braking load. • Braking transistor or resistor defective. • Speed search parameters set incorrectly.	• Increase deceleration time • Reduce input voltage to comply with the input voltage requirements or install an AC line reactor to lower the input voltage. • Remove the power factor correction capacitor. • Use dynamic braking unit. • Replace braking transistor or resistor. • Adjust speed search parameters.
UV (flash) under voltage 	DC bus voltage is lower than the UV detection level or the pre-charge contactor is not active while the inverter is running. 190Vdc: 200V class; 380Vdc: 400V class (the detection value can be adjusted by 07-13)	• The input voltage is too low. • Input phase loss. • Input voltage fluctuation. • Magnetic contactor damaged. • DC bus voltage feedback signal value not incorrect.	• Check the input voltage. • Check input wiring. • Check power source • Replace magnetic contactor • Replace control board or complete inverter.
OH1 Heat sink overheating 	Heat sink is overheating : The temperature of the heat sink is too high. If heat sink overheating fault has occurred with three times in five minutes, it is required to wait for 10 minutes before resetting the fault.	• Ambient temperature is too high. • The cooling fan has stopped. • Carrier frequency setting is too high.	• Check the ambient temperature of the inverter. • Check the fan or dust and dirt in the heat sink. • Check the carrier frequency setting.

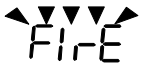
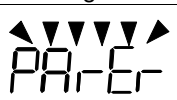
LED display	Description	Cause	Possible solutions

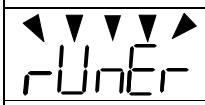
LED display	Description	Cause	Possible solutions
OH2 (flash) Inverter over heating warning 	Inverter overheat warning: Multi-function digital input set to 32. (Terminal S1 ~ S6) Active when 03-00 ~ 03-05 =31).	• Multifunction digital input overheat warning active.	• Multi-function input function set incorrectly. • Check wiring
OT (flash) over torque detection 	Inverter output torque is higher than 08-15 (over torque detection level) for the time specified in 08-16. Parameter 08-14 = 0 to activate.	• Load too heavy.	• Check over torque detection parameters (08-15 / 08-16). • Check and reduce motor load, check and operation duty cycle.
UT (flash) under torque detection 	Inverter output torque is lower than 08-19 (under torque detection level) for the time specified in 08-20. Parameter 08-18 = 0 to activate.	• Sudden drop in load. • Belt break.	• Check under torque detection parameters (08-19 / 08-20). • Check load / application.
bb1 (flash) External baseblock 	External base block (Terminal S1)	• Multifunction digital input external baseblock active.	• Multi-function input function set incorrectly. • Check wiring
bb2 **(flash)** **External baseblock** 	External base block (Terminal S2)		
bb3 (flash) External baseblock 	External base block (Terminal S3)		
bb4 (flash) External baseblock 	External base block (Terminal S4)		
bb5 (flash) External baseblock 	External base block (Terminal S5)		

LED display	Description	Cause	Possible solutions
bb6 (flash) External baseblock 	External base block (Terminal S6)	• Multifunction digital input external baseblock active.	• Multi-function input function set incorrectly. • Check wiring
OL1 Motor overload 	Internal motor overload protection tripped, active when protection curve 08-05 = xxx1.	• Voltage setting V/F mode too high, resulting in over-excitation of the motor. • Motor rated current (02-01) set incorrectly. • Load too heavy. • Voltage setting V/F mode too high, resulting in over-excitation of the motor. • Inverter rating too small. • Load too heavy.	• Check V/f curve. • Check motor rated current • Check and reduce motor load, check and operation duty cycle. • Check V/f curve. • Replace inverter with larger rating. • Check and reduce motor load, check and operation duty cycle
OL2 Inverter overload 	Inverter thermal overload protection tripped. If an inverter overload occurs 4 times in five minutes, it is required to wait 4 minutes before resetting the fault		
CE (flash) communication error 	No Modbus communication received for 2 sec. Active when 09-07=3.	• Connection lost or wire broken. • Host stopped communicating.	• Check connection • Check host computer / software.
CLB over current protection level B 	Inverter current reaches the current protection level B.	• Inverter current too high. • Load too heavy.	• Check load and duty cycle operation.
Retry (flash) retry 	Automatic reset has activated, and it displays before the period of 07-01 automatic reset terminates.	• The period of 07-01 automatic reset≠0. • The times of 07-02 automatic reset≠0.	• It will disappear after the period of automatic reset.
EF1 (flash) External fault (S1) 	External fault (Terminal S1) Active when 03-00= 25 or 68, and Inverter external fault selection 08-24=2.	• Multifunction digital input external fault active and parameter 08-24 = 2 for operation to continue.	• Multi-function input function set incorrectly. • Check wiring • Multi-function input function set incorrectly. • Check wiring
EF2 (flash) External fault (S2) 	External fault (Terminal S2) Active when 03-01= 25 or 68, and Inverter external fault selection 08-24=2.		
EF3 (flash) External fault (S3) 	External fault (Terminal S3) Active when 03-02= 25 or 68, and Inverter external fault selection 08-24=2.		

LED display	Description	Cause	Possible solutions
EF4 (flash) External fault (S4) 	External fault (Terminal S4) Active when 03-03= 25 or 68, and Inverter external fault selection 08-24=2.	• Multifunction digital input external fault active and parameter 08-24 = 2 for operation to continue.	• Multi-function input function set incorrectly. • Check wiring • Multi-function input function set incorrectly. • Check wiring
EF5 (flash) External fault (S5) 	External fault (Terminal S5) Active when 03-04= 25 or 68, and Inverter external fault selection 08-24=2.		
EF6 (flash) External fault (S6) 	External fault (Terminal S6) Active when 03-05= 25 or 68, and Inverter external fault selection 08-24=2.		
EF9 (flash) error of forward/reversal rotation 	Forward run and reverse run are active within 0.5 sec of each other. Stop method set by parameter 07-09.	• Forward run and reverse run active (see 2-wire control).	• Check run command wiring
SE01 Rang setting error 	Parameter setting falls outside the allowed range.	• Some parameter ranges are determined by other inverter parameters which could cause an out of range warning when the dependency parameter is adjusted. For example: 02-00>02-01, 00-12<00-13 or when 00-07 = 1, 00-05 is the same with 00-06 or 20-16 <= 20-15.	• Check parameter setting.
SE02 Digital input terminal error 	Multi-function input setting error.	• Multi-function digital input terminals (03-00 to 03-07) are set to the same function (not including ext. fault and not used.) or ①UP/DOWN commands are not set at the same time(they must be used together). • UP/DOWN commands (08 and 09) and ACC/DEC commands (11) are set at the same time. • Speed search 1(19，maximum frequency) and Speed search 2 (34，from the set frequency）are set at the same time. • 2-wire sequence and 3-wire sequence set at the same time in 03-00~03-07	• Check multi-function input setting.

LED display	Description	Cause	Possible solutions
SE03 V/f curve error 	V/f curve setting error.	• V/F curve setting error. 01-02 > 01-12 > 01-06 (Fmax) (Fbase) (Fmid1) >01-08; (Fmin)	• Check V/F parameters
SE05 PID selection error 	PID selection error.	• 10-00 and 10-01are set to 1 (AI1) or 2 (AI2) simultaneously. • When 23-05=0 and 10-33>= 1000 or 10-34≠1.	• Check the setting value of parameters 10-00 and 10-01. • Check the setting value of 10-33, 10-34 and 23-05.
HPErr Model selection error 	Inverter capacity setting error: Inverter capacity setting 13-00 does not match the rated voltage.	• Inverter capacity setting does not match voltage class (13-00).	• Check inverter capacity setting 13-00.
SE09 PI setting error 	Inverter PI setting error	• Inverter pulse input selection (03-30) selection conflicts with PID source (10-00 and 10-01).	• Check pulse input selection (03-30) and PID source (10-00 and 10-01).
FB (flash) PID feedback breaking 	PID feedback signal falls below level specified in 10-12 (PID feedback loss detection level) for the time specified in 10-13 (Feedback loss detection time). Active when parameter (10-11 = 1).	• Feedback signal wire broken • Feedback sensor broken.	• Check feedback wiring • Replace feedback sensor.
USP (flash) Unattended Start Protection 	Unattended Start Protection (USP) is enabled (enabled at power-up.)	• USP at power-up (activated by multi-function digital input) is enabled. The inverter will not accept a run command. • While the warning is active the inverter does not accept a run command. (See parameter 03-00 - 03-05 = 50).	• Remove run command or reset inverter via multi-function digital input (03-00 to 03-07 = 17) or use the RESET key on the keypad to reset inverter. • Activate USP input and re-apply the power.
LFPB Low flow error 	Low flow error	• The feedback signal is not connected. • Due to HVAC feedback value is lower than limit of minimum flow.	• Check feedback signal is correct and with right connection. • Check if feedback value is lower than limit of minimum flow.
HFPB High flow error 	High flow error	• Due to HVAC feedback value is lower than limit of maximum flow.	• Check feedback signal is correct. • Check if feedback value is lower than limit of maximum flow.

LED display	Description	Cause	Possible solutions
L0PB Low pressure error 	Low pressure error	• The feedback signal is not connected. • Due to feedback value of pump pressure is lower than limit of minimum flow.	• Check feedback signal is correct and with connection. • Check if feedback value of pressure is lower than limit of minimum pressure.
HIPB High pressure error 	High pressure error	• Due to feedback value of pump pressure is lower than limit of maximum flow.	• Check feedback signal is correct. • Check if feedback value of pressure is lower than limit of maximum pressure.
LSCFT Low suction error 	Inadequate suction error	• Insufficient water of supply tank leads to insufficient suction. • PID difference is higher than its level or current is lower than output current level.	• Check if water of supply tank is enough, and water supply is regular. • Check PID difference is higher than its level or current is lower than output current level
FIRE Fire override mode 	Fire override mode	• Fire override mode is active	• None • (Fire override mode is not a kind of warning).
SE10 PUMP/HVAC Setting error 	PUMP/HVAC settings of inverter error	• PUMP selection of inverter (23-02)> (23-03). • HVAC selection of inverter (23-46)< (23-47).	• Check pump selection of inverter (23-02) and (23-03) settings. • Check HVAC selection of inverter (23-46) and (23-47) settings.
COPUP PUMP communication breaking error 	Breaking error of multiple pumps communication	• Communication breaking or disconnection of pump cascade control.	• Check if it has setting issue or is not properly connected.
Parameter Setting Error 	Parameter setting error	• Error of Parameter setting occurs.	• Refer to the instruction manual or this parameter is selected to be disabled.
Warning of Direct Start 	When 07-04 is set to 1, the inverter can not start directly but displays the warning signal.	• Set the digital input terminal (S1~S6) to run and simultaneously set 07-04=1.	• Check the digital input terminal and disconnect it. Then reconnect the DI terminal after the setting delay time (07-05) ends.

LED display	Description	Cause	Possible solutions
External Terminal Stop Error 	External Terminal is main run command source selection (00-02=1) and run command executes but executes stop command from keypad.	• Run command executes from external terminal but executes stop command from keypad.	• Remove the run command from external terminal
ADC Voltage Error 	Abnormal voltage level on the control board	• Abnormal input voltage, too much noise or malfunctioning control board.	• Check the input voltage signal and the voltage on the control board.
EEPROM Archiving Error 	EEPROM Poor archiving	• EEPROM poor peripheral circuit • It occurs in parameters check at inverter boot.	• Reconnect and if the warning signal appears again, replace the circuit board. • Contact TECO for more information.
Control Board Error 	The control board is not correspondent with the program.	• The control board is not correspondent with the program.	• Replace the control board.
Wrong running direction Error 	Only for run in one direction, another direction command is not allowed.	• Run command for another direction on the terminal of control board is active.	• Cancel the run command for another direction on the terminal of control board.
PTC Signal Loss 	PTC Signal Loss detecting triggers error message	• PTC connection trips and has lasted for more than 10 seconds.	• Check if MT terminal and GND terminal are connected.
Parameters Locked 	Parameter password have been locked	• Parameter password function (13-07) starts.	• Correct password input at parameter 13-07
Password Setting Error 	Password input at the second time is different from that at the first time when the password lock function enables.	• Password input at the second time is different from that at the first time when the password lock function enables.	• Password input at the second time is the same as that at the first time when the password lock function enables.
Operator Reading Error **RDE***	Operator cannot read the inverter's information.	• Since signals from the inverter's control board are transmitted error, the inverter cannot normally transmit the data to operator.	• Check if the inverter is normally connected to the operator.

LED display	Description	Cause	Possible solutions
Operator Writing Error **WRE***	Operator cannot write the information into the inverter.	• Data control mode in operator is not consistent with that in the inverter. • Data models in operator are not consistent with that in the inverter. • Data firmware version in operator is not consistent with that in the inverter.	• Check the inverter's firmware version/ control mode/ models
Operator Verifying Error **VRYE***	After operator reads or writes data in the inverter, user can verify it. If the data are not consistent, the inverter displays the signal of verifying error.	• The data in the operator and the inverter is not consistent.	• Check if the inverter is normally connected to the operator.
Repeat Run Command 	The inverter is only allowed unidirectional operation and cannot operate in reverse direction simultaneously.	• Check if the external terminal is given a run command in reverse direction.	• Cancel the run command in reverse direction from the external terminal.
Operator Read Prohibit **RDP***	Selection of allowing reading (16-08) is set to 0 (Do not allow to read inverter parameters and save it to the operator).	• Set parameter 16-08 to 0.	• Set parameter 16-08 to 1 (Allow to read inverter parameters and save it to the operator).
External Emergency Stop 	Function of external emergency stop starts.	• Parameter 03-00~03-08 is set to 14 (Function of emergency stop is enabled.)	• Remove & shutdown the run command of external emergency stop and reset it to multi-function digital input.
Zero Speed Stop Warning 	The operation signal is enabled but frequency command is lower than the minimum output frequency (01-08) and DC brake is disabled.	• The frequency command is not set up.	• Set up the frequency command.
Overload of Air Compressor 	If the inverter's output current reaches OL4 current level (23-69), OL4 Delay Time (23-70) passed. When the count is reached, the inverter will automatically decelerate to stop and displays a warning signal.	• Since the current level (23-69) is set to be over low, the inverter's output current is higher than the standard one or compressor's current is used to be over high.	• Check if the compressor load used is higher than the standard one.
PID feedback signal loss 	When 23-19 > 0, the inverter will according to feedback pressure is less than (pressure transmitter maximum pressure (23-03) x proportion of loss pressure detection (23-19)) value, if the pressure loss detection time (23-18) passed and 23-78 = 1 (loss of pressure detection function) will jump warning signal	• 23-19 proportion of loss pressure detection is too big • Feedback sensor install failure or not work normal.◦	• Check 23-19 setting. • Make sure correct installation and PID feedback signal.

*** RDE、WRE、VRYE、RDP warning signals are only displayed in LCD keypad.**

10.4 Auto-tuning Error

When a fault occurs during auto-tuning of a standard AC motor, the display will show the “AtErr” fault and the motor stops. The fault information is displayed in parameter 17-11.

Note: The fault contact output does not energize with an auto-tuning fault. Refer to Table 10.4.1, for fault information during tuning, cause and corrective action.

Table 10.4.1 Auto-tuning fault and corrective actions

Error	Description	Cause	Corrective action
01	Motor data input error.	• Motor Input data error during auto-tuning. • Inverter output current does not match motor rated current.	• Check the motor tuning data (17-00 to 17-09). • Check inverter capacity
02	Motor lead to lead resistance R1 tuning error.	• Auto-tuning is not completed within the specified time • Auto-tuning results fall outside parameter setting range. • Motor rated current exceeded. • Motor was disconnected.	• Check the motor tuning data (17-00 to 17-09). • Check motor connection. • Disconnect motor load. • Check inverter current detection circuit and DCCTs. • Check motor installation.
03	Motor leakage inductance tuning error.		
04	Motor rotor resistance R2 tuning error.		
05	Motor mutual inductance Lm tuning error.		
07	Deadtime compensation detection error		
08	Motor acceleration error (Rotational type auto-tuning only).	• Motor fails to accelerate in the specified time (00-14= 20sec).	• Increase acceleration time (00-14). • Disconnect motor load.
09	Other auto-tuning errors	• No load current is higher than 70% of the motor rated current. • Torque reference exceeds 100%. • Errors other than ATE01~ATE08.	• Check the motor tuning data (17-00 to 17-09). • Check motor connection.

10.5 PM Motor Auto-tuning Error

When a fault occurs during auto-tuning of a PM motor, the display will show the “IPErr” fault and the motor stops. The fault information is displayed in parameter 22-22.

Note: The fault contact output does not energize with an auto-tuning fault. Refer to Table 10.5.1, for fault information during tuning, cause and corrective action.

Table 10.5.1 Auto-tuning fault and corrective actions for PM motor

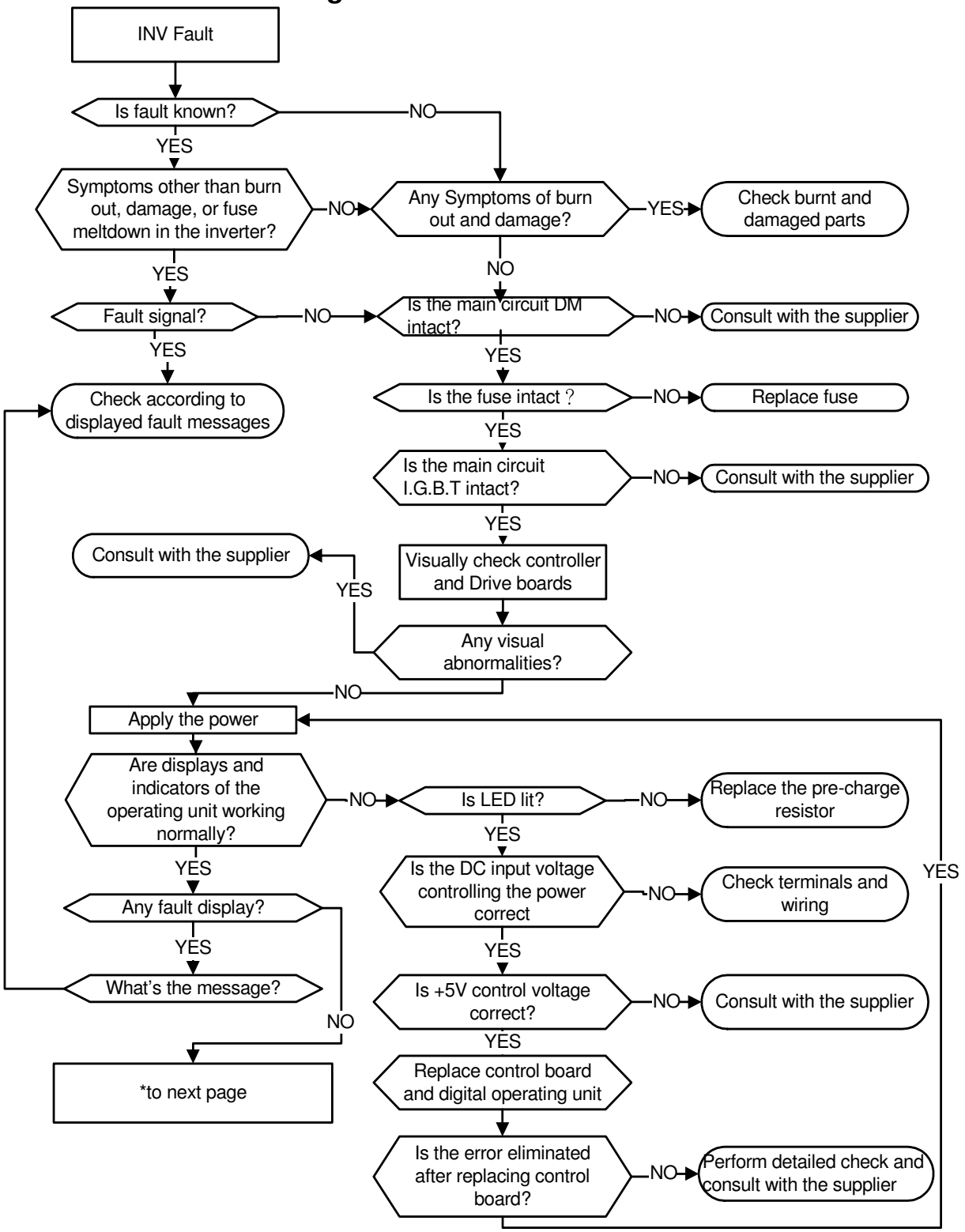
Error	Description	Cause	Corrective action
01	Magnetic pole alignment tuning failure (static).	• Inverter output current does not match motor current.	• Check the motor tuning data (22-02). • Check inverter capacity
02~04	Reserved		
05	Circuit tuning time out.	• System abnormality during circuit tuning.	• Check for active protection functions preventing auto-tuning.
06	Reserved		
07	Other motor tuning errors.	• Other tuning errors.	• Check the motor tuning data (22-02). • Check motor connection.
08	Reserved		
09	Current out of range during circuit tuning.	• Inverter output current does not match motor current.	• Check the motor tuning data (22-02). • Check inverter capacity
10	Reserved		
11	Parameter tuning and detecting time out.	• Error relationship between voltage and current.	• Check if the setting value of parameter 22-11 is too low, but its value cannot exceed 100% of the inverter. • Check motor connection.

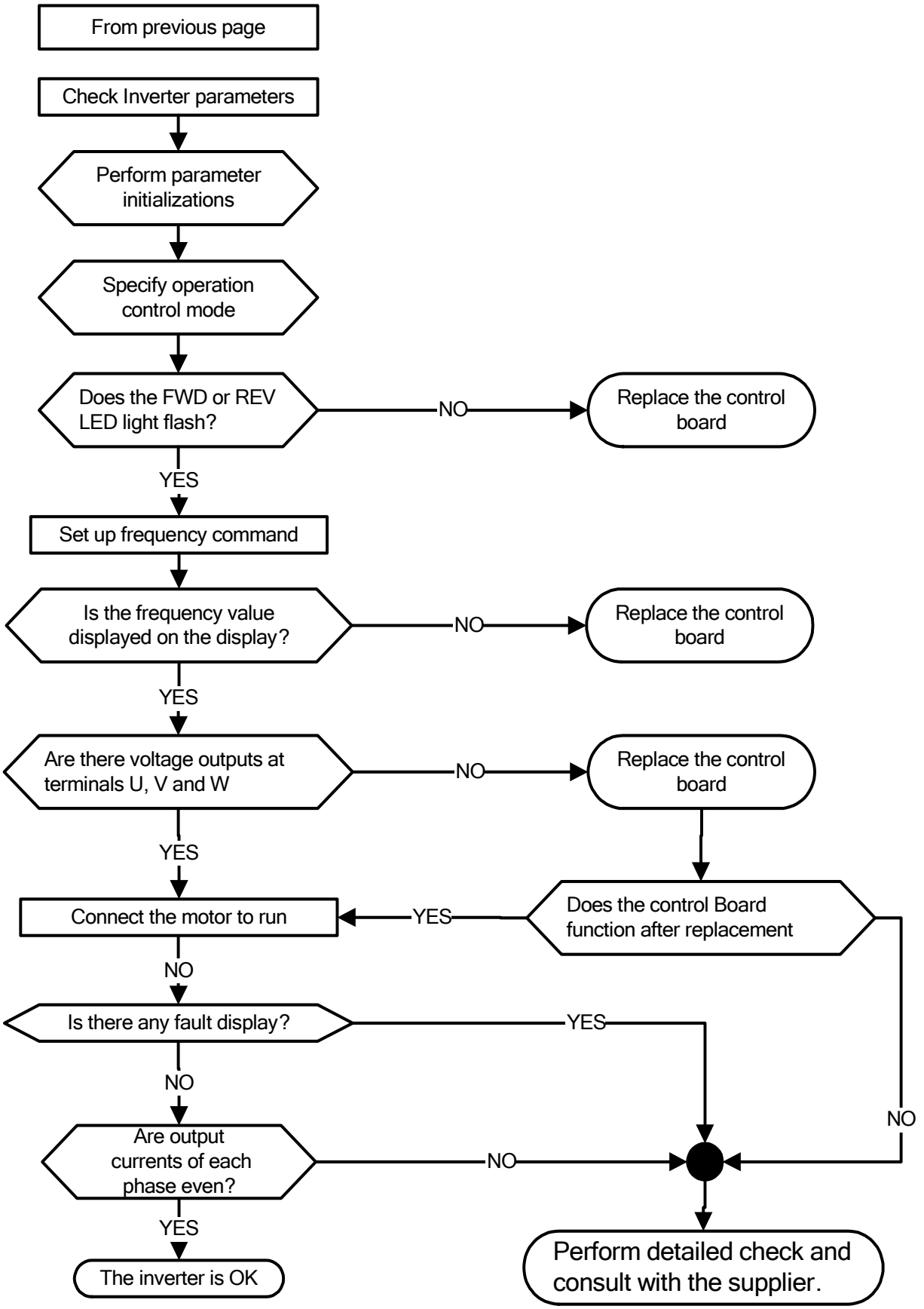
10.6 General troubleshooting

Status	Checking point	Remedy
Motor runs in wrong direction	Is the wiring for the output terminals correct?	Wiring must match U, V, and W terminals of the motor.
	Is the wiring for forward and reverse signals correct?	Check for correct wiring.
The motor speed can not be regulated.	Is the wiring for the analog frequency inputs correct?	Check for correct wiring.
	Is the setting of operation mode correct?	Check the Frequency Source set in parameters 00-05/00-06.
	Is the load too excessive?	Reduce the load.
Motor running speed too high or too low	Check the motor specifications (poles, voltage…) correct?	Confirm the motor specifications.
	Is the gear ratio correct?	Confirm the gear ratio.
	Is the setting of the highest output frequency correct?	Confirm the highest output frequency
Motor speed varies unusually	Is the load too excessive?	Reduce the load.
	Does the load vary excessively?	1.Minimize the variation of the load. 2.Consider increasing the capacities of the inverter and the motor.
	Is the input power unstable or is there a phase loss ?	1.Consider adding an AC reactor at the power input side if using single-phase power.
		2.Check wiring if using three-phase power
Motor can not run	Is the power connected to the correct L1, L2, and L3 terminals? is the charging indicator lit ?	1.Is the power applied? 2.Turn the power OFF and then ON again. 3.Make sure the power voltage is correct. 4.Make sure screws are secured firmly.
	Is there voltage across the output terminals T1, T2, and T3?	Turn the power OFF and then ON again.
	Is overload causing the motor to stall?	Reduce the load so the motor will run.
	Are there any abnormalities in the inverter?	See error descriptions to check wiring and correct if necessary.
	Is there a forward or reverse run command ?	
	Has the analog frequency signal been input?	1.Is analog frequency input signal wiring correct? 2.Is voltage of frequency input correct?
	Is the operation mode setting correct?	Operate through the digital keypad

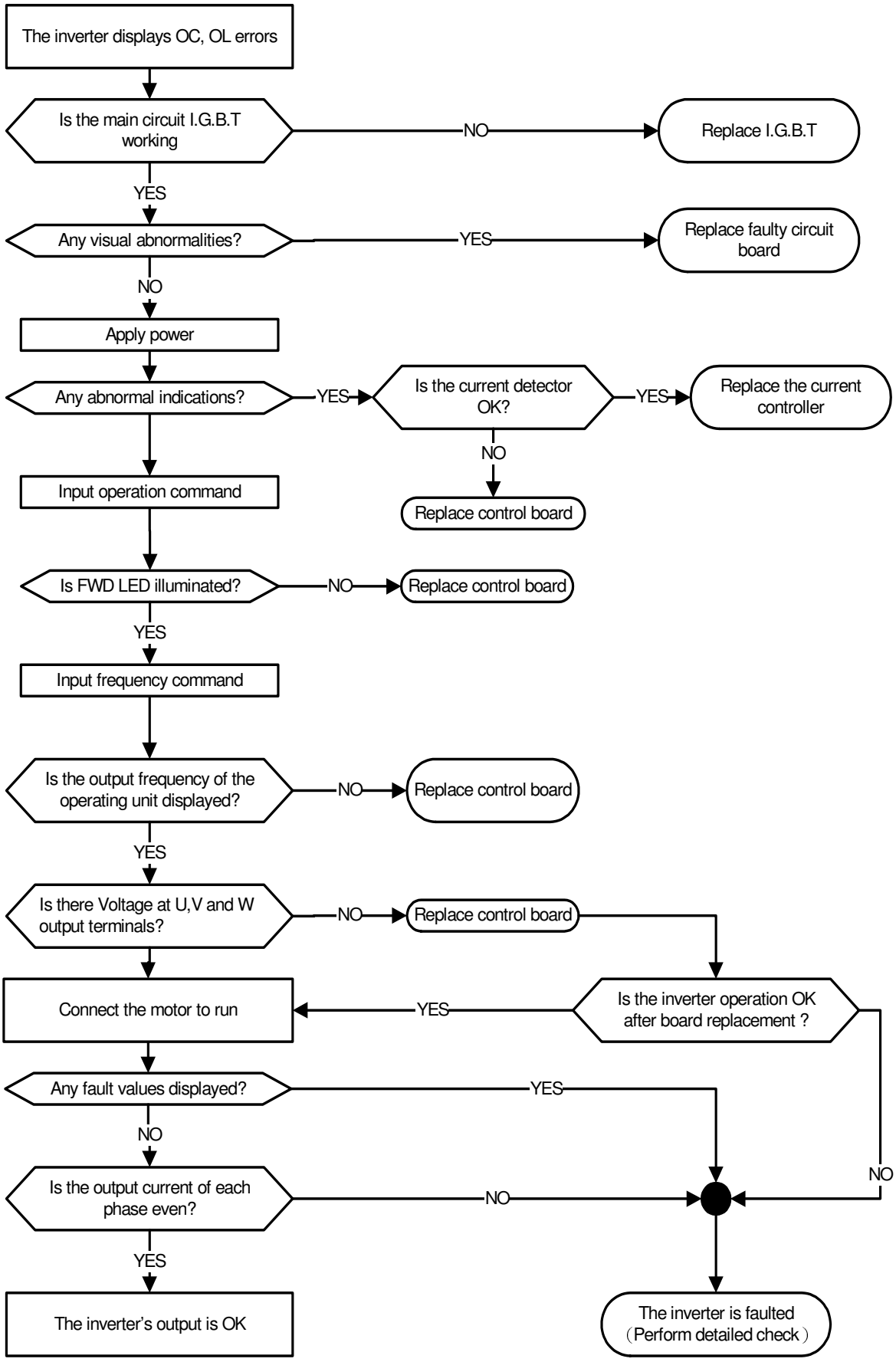
10.7 Troubleshooting of the Inverter

10.7.1 Quick troubleshooting of the Inverter

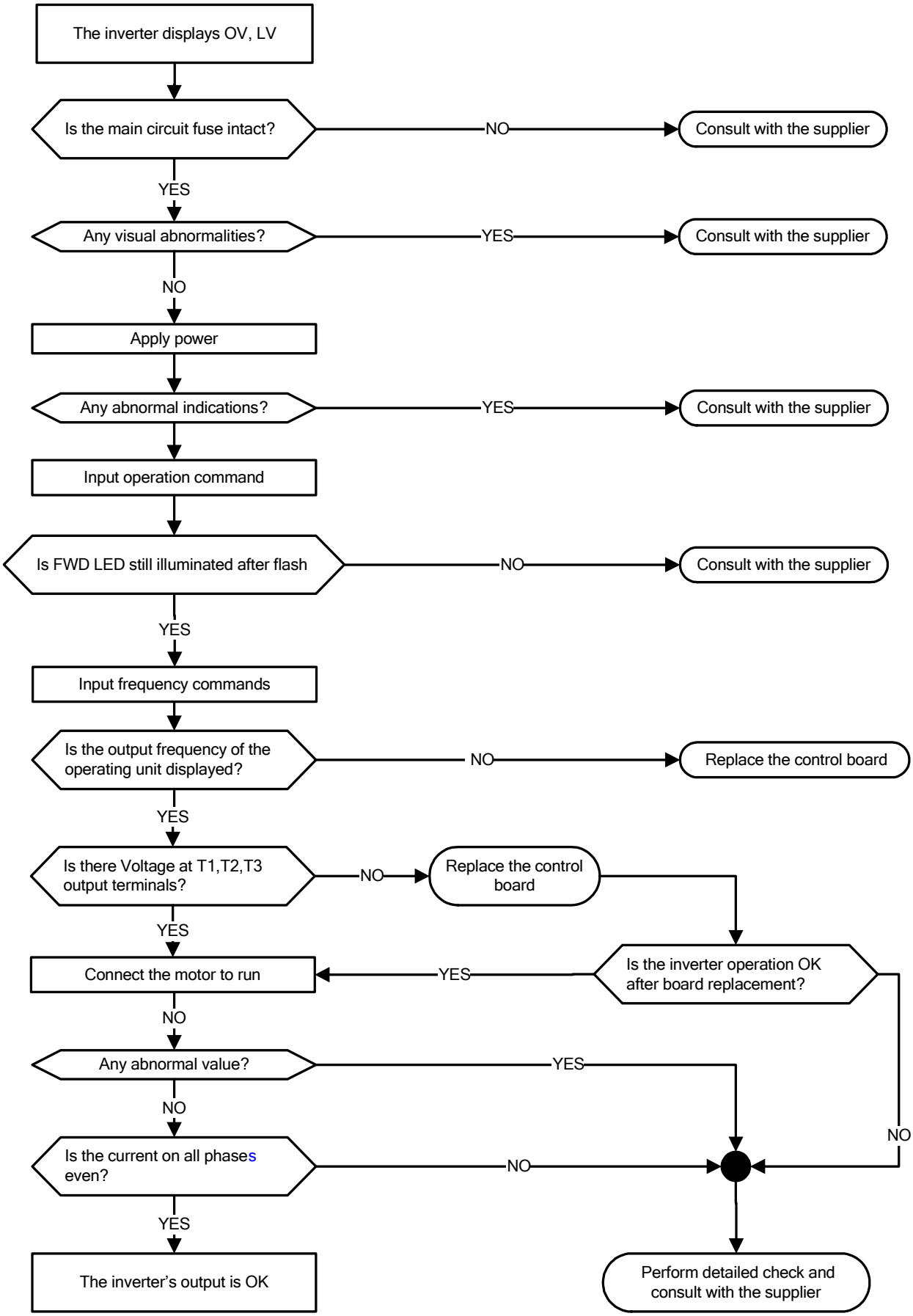



From previous page
Check Inverter parameters
Perform parameter initializations
Specify operation control mode
Does the FWD or REV LED light flash?
NO
Replace the control board
YES
Set up frequency command
Is the frequency value displayed on the display?
NO
Replace the control board
YES
Are there voltage outputs at terminals U, V and W
NO
Replace the control board
YES
Does the control Board function after replacement
YES
Connect the motor to run
NO
Is there any fault display?
YES
NO
Are output currents of each phase even?
NO
YES
The inverter is OK
Perform detailed check and consult with the supplier.

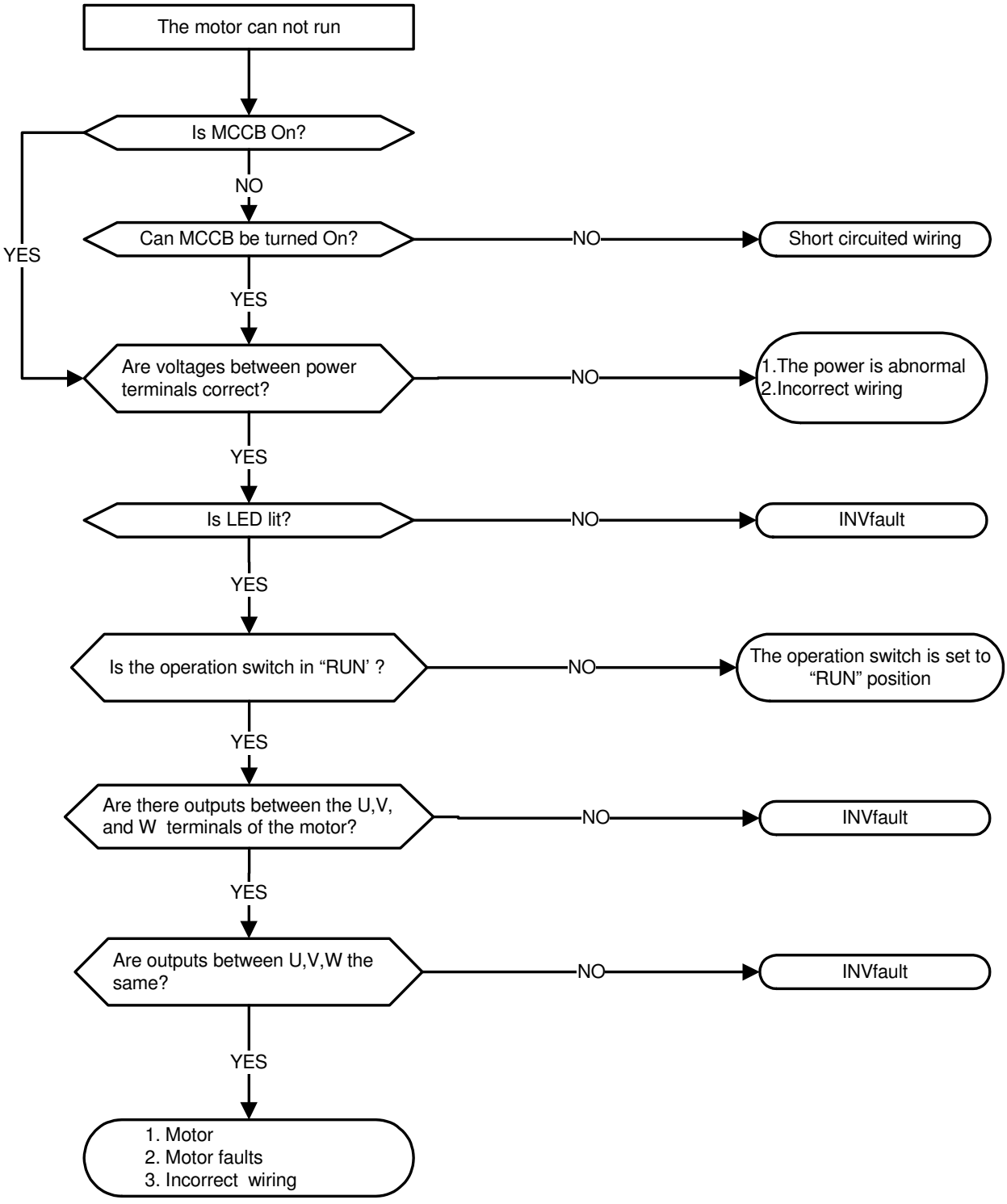
10.7.2 Troubleshooting for OC, OL error displays



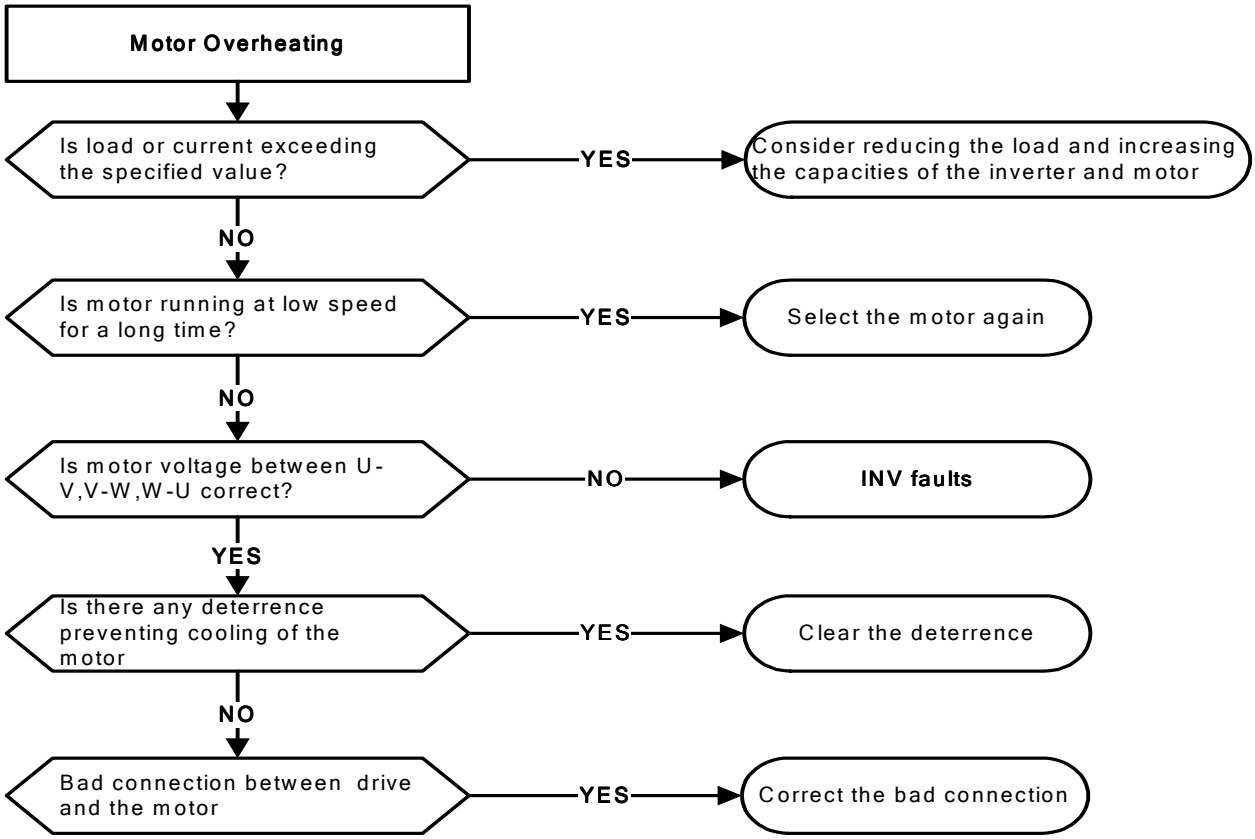
10.7.3 Troubleshooting for OV, LV error



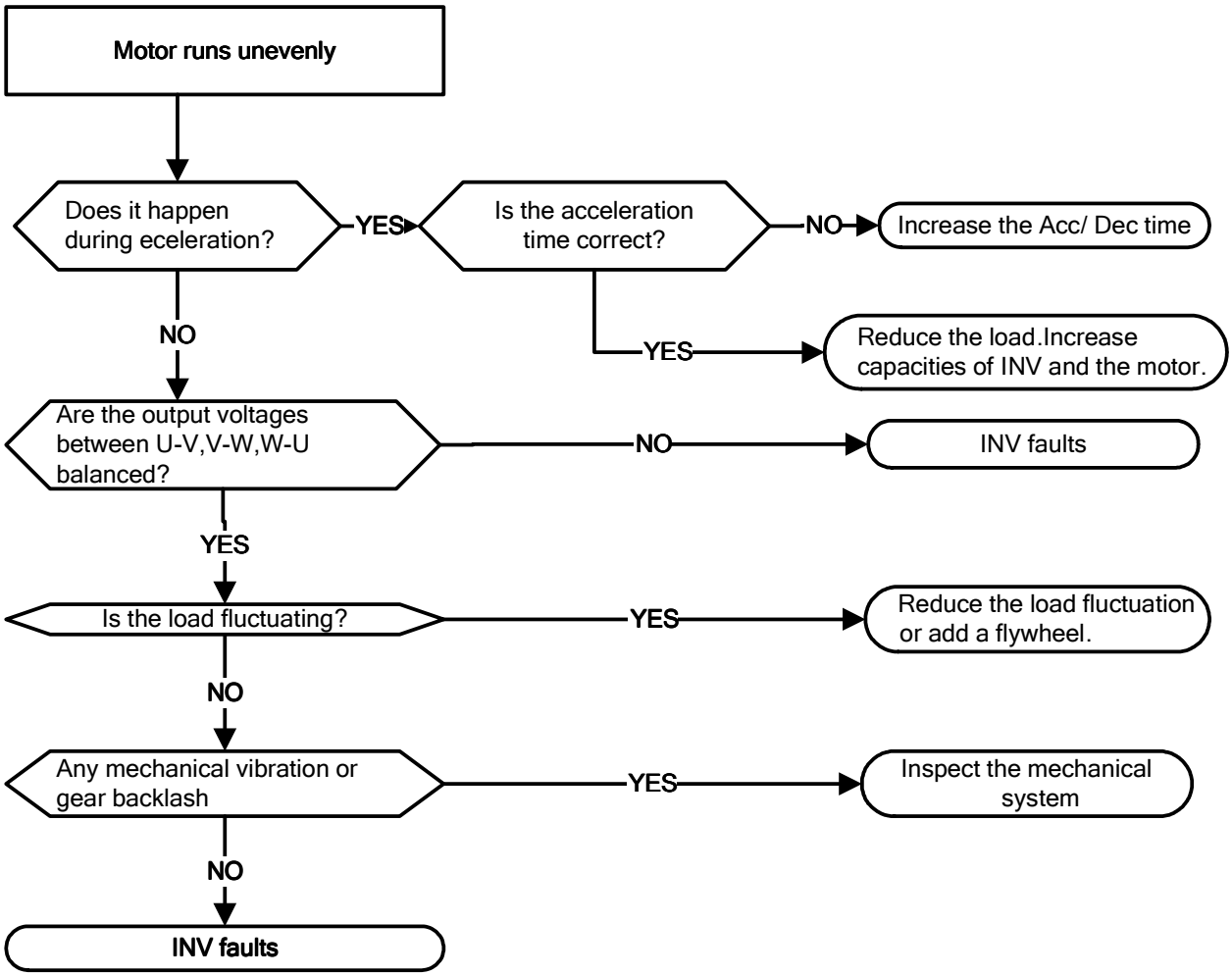
10.7.4 The motor can not run



10.7.5 Motor Overheating



10.7.6 Motor runs unbalanced



10.8 Routine and periodic inspection

To ensure stable and safe operations, check and maintain the inverter at regular intervals.
Use the checklist below to carry out inspection.
Disconnect power after approximately 5 minutes to make sure no voltage is present on the output terminals before any inspection or maintenance.

Items	Details	Checking period		Methods	Criteria	Remedies
		Daily	1Year			
Environment & Ground connection						
Ambient conditions at the installation	Confirm the temperature and humidity at the machine	◎		Measure with thermometer and hygrometer	Temperature: -10 ~40℃/50℃ (14~104℉)/(122℉) Humidity: Below 95%RH	Improve the ambient or relocate the drive to a better area.
Installation Grounding	Is the grounding resistance correct?		◎	Measure the resistance with a multi-tester	200Vclass: below 100Ω	Improve the grounding if needed.
Terminals & Wiring						
Connection terminals	Any loose parts or terminals?		◎	Visual check Check with a screwdriver	Correct installation requirement	Secure terminals and remove rust
	Any damage to the base ?		◎			
	Any corroded Terminals?		◎			
Wiring	Any broken wires?		◎	Visual check	Correct wiring requirement	Rectify as necessary
	Any damage to the wire insulation?		◎			
voltage						
Input power voltage	Is the voltage of the main circuit correct?	◎		Measure the voltage with a multi-tester	Voltage must conform with the spec.	Improve input voltage if necessary.
Circuit boards and components						
Printed circuit board	Any contamination or damage to printed circuit board?		◎	Visual check	Correct component condition	Clean or replace the circuit board
Power component	Any dust or debris		◎			Clean component s
	Check resistance between terminals		◎	Measure with a multi-tester	No short circuit or broken circuit in three phase output	Consult with the supplier
Cooling System						
Cooling fan	Unusual vibration and noise?		◎	Visual and sound check	Correct cooling	Consult with the supplier
	Excessive dust or debris	◎		Visual check		Clean the fan
Heat sink	Excessive dust or debris	◎				Clean up debris or dust
Ventilation Path	Is the ventilation path blocked?	◎				Clear the path

10.9 Maintenance

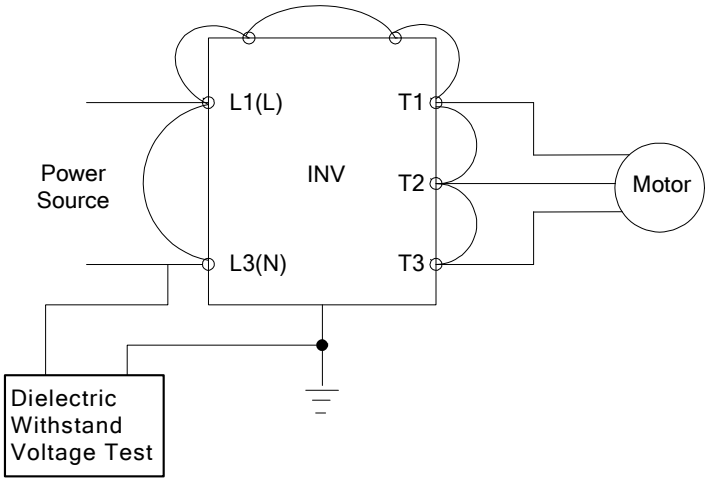
To ensure long-term reliability, follow the instructions below to perform regular inspection. Turn the power off and wait for a minimum of 5 minutes before inspection to avoid potential shock hazard from the charge stored in high-capacity capacitors.

1. Maintenance Check List.

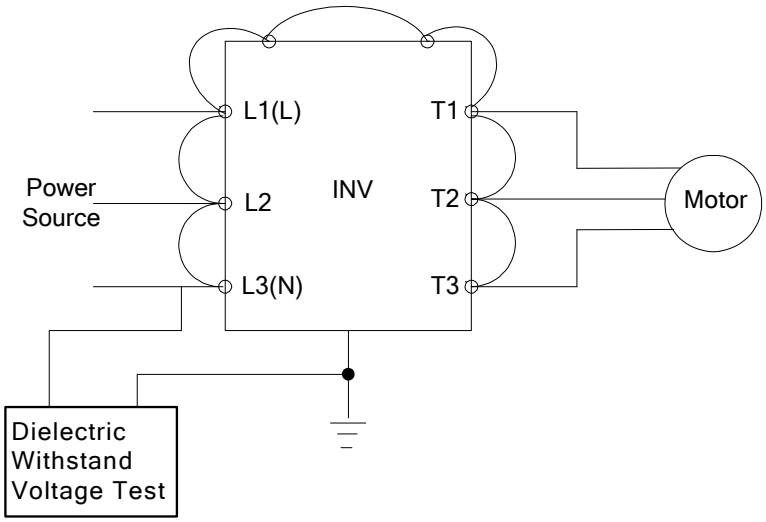
➢ Ensure that temperature and humidity around the inverters is as required in the instruction manual, installed away from any sources of heat and the correct ventilation is provided..
➢ For replacement of a failed or damaged inverter consult with the local supplier.
➢ Ensure that the installation area is free from dust and any other contamination.
➢ Check and ensure that the ground connections are secure and correct.
➢ Terminal screws must be tight, especially on the power input and output of the inverter.
➢ Do not perform any insulation test on the control circuit.

2. Insulation test Method .

Single Phase



Three Phase



Chapter 11 Inverter Peripheral devices and Options

11.1 Braking Resistors and Braking Units

Inverters ratings 200V 1~30HP/400V 1~40HP (IP20) and 400V 1~25HP (IP55) have a built-in braking transistor. For applications requiring a greater braking torque an external braking resistor can be connected to terminals B1 / P and B2 in protection level of IP20; for inverter ratings above 200V 40HP/400V 50HP (IP20) external braking units (connected to ⊕ - ⊖ of the inverter) and braking resistors (connected to two ends of the detection module B-P0) are required.

Table 11.1.1 List of braking resistors and braking units (IP20)

Inverter			Braking Unit		Braking resistor					Braking torque (Peak / Continues) 10%ED	Minimum resistance	
V	HP	KW	Model	Qty Req	Part Number	Resistor specification	Qty Req.	Resistor Spec.(W/Ω) & Dimensions (L*W*H)mm	Qty Req.		(Ω)	(W)
1φ/3φ 200V	1	0.75	-	-	JNBR-150W200	150W/200Ω	1	150W/200Ω (251*28*60)	1	119%	17Ω	1000W
	2	1.5	-	-	JNBR-150W100	150W/100Ω	1	150W/100Ω (251*28*60)	1	119%	17Ω	1000W
	3	2.2	-	-	JNBR-260W70	260W/70Ω	1	260W/70Ω (274*40*78)	1	115%	17Ω	1000W
3φ 200V	5	3.7	-	-	JNBR-390W40	390W/40Ω	1	390W/40Ω (395*40*78)	1	119%	25Ω	680W
	7.5	5.5	-	-	JNBR-520W30	520W/30Ω	1	520W/30Ω (400*50*100)	1	108%	21Ω	800W
	10	7.5	-	-	JNBR-780W20	780W/20Ω	1	780W/20Ω (400*50*100)	1	119%	18Ω	900W
	15	11	-	-	JNBR-2R4KW13R6	2400W/13.6Ω	1	1200W/27.2Ω (535*60*110)	2	117%	11Ω	1500W
	20	15	-	-	JNBR-3KW10	3000W/10Ω	1	1500W/20Ω (615*60*110)	2	119%	11Ω	1500W
	25	18.5	-	-	JNBR-4R8KW8	4800W/8Ω	1	1200W/32Ω (535*60*110)	4	119%	7Ω	2400W
	30	22			JNBR-4R8KW6R8	4800W/6.8Ω	1	1200W/27.2Ω (535*60*110)	4	117%	7Ω	2400W
	40	30	JNTBU-230	2	JNBR-3KW10	3000W/10Ω	2	1500W/20Ω (615*60*110)	4	119%	5.5Ω	3000W
	50	37	JNTBU-230	2	JNBR-3KW10	3000W/10Ω	2	1500W/20Ω (615*60*110)	4	99%	5.5Ω	3000W
			JNTBU-260	1	JNBR-4R8KW8	4800W/8Ω	2 In para	1200W/32Ω (535*60*110)	8	113%	3.8Ω	4500W
	60	45	JNTBU-230	2	JNBR-4R8KW6R8	4800W/6.8Ω	2	1200W/27.2Ω (535*60*110)	8	117%	5.5Ω	3000W
			JNTBU-260	1	JNBR-4R8KW8	4800W/8Ω	2 In para	1200W/32Ω (535*60*110)	8	98%	3.8Ω	4500W
	75	55	JNTBU-230	2	JNBR-4R8KW6R8	4800W/6.8Ω	2	1200W/27.2Ω (535*60*110)	8	98%	5.5Ω	3000W
			JNTBU-260	1	JNBR-4R8KW8	4800W/8Ω	2 In para	1200W/32Ω (535*60*110)	8	82.5%	3.8Ω	4500W

Inverter			Braking Unit		Braking resistor					Braking torque (Peak / Continues) 10%ED	Minimum resistance	
V	HP	KW	Model	Qty Req	Part Number	Resistor specification	Qty Req.	Resistor Spec.(W/Ω) & Dimensions (L*W*H)mm	Qty Req.		(Ω)	(W)
	100	75	JNTBU-230	3	JNBR-4R8KW6R8	4800W/6.8Ω	3	1200W/27.2Ω (535*60*110)	12	108%	5.5Ω	3000W
			JNTBU-260	2	JNBR-4R8KW8	4800W/8Ω	2 In para X2	1200W/32Ω (535*60*110)	16	113%	3.8Ω	4500W
	125	90	JNTBU-230	4	JNBR-4R8KW6R8	4800W/6.8Ω	4	1200W/27.2Ω (535*60*110)	16	113%	5.5Ω	3000W
			JNTBU-260	2	JNBR-4R8KW8	4800W/8Ω	2 In para X2	1200W/32Ω (535*60*110)	16	95%	3.8Ω	4500W
	150	110	JNTBU-230	4	JNBR-4R8KW6R8	4800W/6.8Ω	4	1200W/27.2Ω (535*60*110)	16	98%	5.5Ω	3000W
			JNTBU-260	2	JNBR-4R8KW8	4800W/8Ω	2 In para X2	1200W/32Ω (535*60*110)	16	82.5%	3.8Ω	4500W
	175	130	JNTBU-230	5	JNBR-4R8KW6R8	4800W/6.8Ω	5	1200W/27.2Ω (535*60*110)	20	106%	5.5Ω	3000W
			JNTBU-260	3	JNBR-4R8KW8	4800W/8Ω	2 In para X3	1200W/32Ω (535*60*110)	24	100.4%	3.8Ω	4500W
3ϕ 400V	1	0.75	-	-	JNBR-150W750	150W/750Ω	1	150W/750Ω (251*28*60)	1	126%	120Ω	600W
	2	1.5	-	-	JNBR-150W400	150W/400Ω	1	150W/400Ω (251*28*60)	1	119%	120Ω	600W
	3	2.2	-	-	JNBR-260W250	260W/250Ω	1	260W/250Ω (274*40*78)	1	126%	100Ω	680W
	5	3.7	-	-	JNBR-400W150	400W/150Ω	1	400W/150Ω (395*40*78)	1	126%	60Ω	1200W
	7.5	5.5	-	-	JNBR-600W130	600W/130Ω	1	600W/130Ω (470*50*100)	1	102%	60Ω	1200W
	10	7.5	-	-	JNBR-800W100	800W/100Ω	1	800W/100Ω (535*60*110)	1	99%	43Ω	1600W
	15	11	-	-	JNBR-1R6KW50	1600W/50Ω	1	1600W/50Ω (615*60*110)	1	126%	43Ω	1600W
	20	15	-	-	JNBR-1R5KW40	1500W/40Ω	1	1500W/40Ω (615*60*110)	1	119%	39Ω	1600W
	25	18.5	-	-	JNBR-4R8KW32	4800W/32Ω	1	1200W/32Ω (535*60*110)	4	119%	22Ω	3000W
	30	22	-	-	JNBR-4R8KW27R2	4800W/27.2Ω	1	1200W/27.2Ω (535*60*110)	4	117%	14Ω	4800W
	40	30	-	-	JNBR-6KW20	6000W/20Ω	1	1500W/20Ω (615*60*110)	4	119%	14Ω	4800W
	50	37	JNTBU-430	2	JNBR-4R8KW32	4800W/32Ω	2	1200W/32Ω (535*60*110)	8	119%	19.2Ω	3600W
	60	45	JNTBU-430	2	JNBR-4R8KW27R2	4800W/27.2Ω	2	1200W/27.2Ω (535*60*110)	8	117%	19.2Ω	3600W
	75	55	JNTBU-430	2	JNBR-6KW20	6000W/20Ω	2	1500W/20Ω (615*60*110)	8	126%	19.2Ω	3600W
	100	75	JNTBU-430	3	JNBR-6KW20	6000W/20Ω	3	1500W/20Ω (615*60*110)	12	139%	19.2Ω	3600W

Inverter			Braking Unit		Braking resistor					Braking torque (Peak / Continues) 10%ED	Minimum resistance	
V	HP	KW	Model	Qty Req	Part Number	Resistor specification	Qty Req.	Resistor Spec.(W/Ω) & Dimensions (L*W*H)mm	Qty Req.		(Ω)	(W)
			JNTBU-4120	1	JNBR-6KW20	6000W/20Ω	2 In para	1500W/20Ω (615*60*110)	8	99%	7.6Ω	9000W
	125	90	JNTBU-430	3	JNBR-6KW20	6000W/20Ω	3	1500W/20Ω (615*60*110)	12	115%	19.2Ω	3600W
			JNTBU-4120	2	JNBR-6KW20	6000W/20Ω	2 In para X2	1500W/20Ω (615*60*110)	16	146%	7.6Ω	9000W
	150	110	JNTBU-430	4	JNBR-6KW20	6000W/20Ω	4	1500W/20Ω (615*60*110)	16	125%	19.2Ω	3600W
			JNTBU-4120	2	JNBR-6KW20	6000W/20Ω	2 In para X2	1500W/20Ω (615*60*110)	16	125%	7.6Ω	9000W
	175	132	JNTBU-430	4	JNBR-6KW20	6000W/20Ω	4	1500W/20Ω (615*60*110)	16	111%	19.2Ω	3600W
			JNTBU-4120	2	JNBR-6KW20	6000W/20Ω	2 In para X2	1500W/20Ω (615*60*110)	16	110%	7.6Ω	9000W
	215	160	JNTBU-430	5	JNBR-6KW20	6000W/20Ω	5	1500W/20Ω (615*60*110)	20	112%	19.2Ω	3600W
			JNTBU-4120	3	JNBR-6KW20	6000W/20Ω	2 In para X3	1500W/20Ω (615*60*110)	24	130%	7.6Ω	9000W
	250	185	JNTBU-430	5	JNBR-6KW20	6000W/20Ω	5	1500W/20Ω (615*60*110)	20	99%	19.2Ω	3600W
			TBU-4120	3	JNBR-6KW20	6000W/20Ω	2 in para. X 3	1500W/20Ω (615*60*110)	24	114%	7.6Ω	9000W
	300	220	JNTBU-430	6	JNBR-6KW20	6000W/20Ω	6	1500W/20Ω (615*60*110)	24	99%	19.2Ω	3600W
			JNTBU-4120	3	JNBR-6KW20	6000W/20Ω	2 In para X3	1500W/20Ω (615*60*110)	24	99%	7.6Ω	9000W
	375	280	JNTBU-430	8	JNBR-6KW20	6000W/20Ω	8	6000W/20Ω (615*60*110)	32	105%	19.2Ω	3600W
			JNTBU-4120	4	JNBR-6KW20	6000W/20Ω	2 In para X4	1500W/20Ω (615*60*110)	32	104%	7.6Ω	9000W
	425	315	JNTBU-430	9	JNBR-6KW20	6000W/20Ω	9	6000W/20Ω (615*60*110)	36	104%	19.2Ω	3600W
			JNTBU-4120	5	JNBR-6KW20	6000W/20Ω	2 In para X5	1500W/20Ω (615*60*110)	40	113%	7.6Ω	9000W
	535	400	JNTBU-430	10	JNBR-6KW20	6000W/20Ω	10	1500W/20Ω (615*60*110)	40	96%	19.2Ω	3600W
			TBU-4120	6	JNBR-6KW20	6000W/20Ω	2 in para. X 6	1500W/20Ω (615*60*110)	48	108%	7.6Ω	9000W
	670	500	JNTBU-430	11	JNBR-6KW20	6000W/20Ω	11	1500W/20Ω (615*60*110)	44	87%	19.2Ω	3600W
			TBU-4120	7	JNBR-6KW20	6000W/20Ω	2 in para. X 7	1500W/20Ω (615*60*110)	56	102%	7.6Ω	9000W
	800	600	JNTBU-430	13	JNBR-6KW20	6000W/20Ω	13	1500W/20Ω (615*60*110)	52	86%	19.2Ω	3600W
			TBU-4120	8	JNBR-6KW20	6000W/20Ω	2 in para. X 8	1500W/20Ω (615*60*110)	64	99%	7.6Ω	9000W

Note: “2 in parallel” means that need to use 2 set of braking resistor and to be connected in parallel, then connected to braking unit.

For example, 400V class 100HP, it need TBU-4120 for 1 and 6000W/20Ω for 2, the braking resistor need to be connected in parallel, after the connection, the braking resistor is 12000W/10Ω.

Table 11.1.2 List of braking resistors and braking units (IP55)

Inverter			Braking unit		Braking resistor					Braking torque (Peak / Continues)	Minimum resistance	
V	HP	KW	Model	Qty Req	Part Number	Resistor specification	Qty Req.	Resistor Spec. (W/Ω) & Dimensions (L*W*H)mm	Qty Req		(Ω)	(W)
3ϕ 400V	1	0.75	-	-	JNBR-150W750	150W/750Ω	1	150W/750Ω (251*28*60)	1	126%	120Ω	600W
	2	1.5	-	-	JNBR-150W400	150W/400Ω	1	150W/400Ω (251*28*60)	1	119%	120Ω	600W
	3	2.2	-	-	JNBR-260W250	260W/250Ω	1	260W/250Ω (274*40*78)	1	126%	100Ω	680W
	5	3.7	-	-	JNBR-400W150	400W/150Ω	1	400W/150Ω (395*40*78)	1	126%, 10%ED	65Ω	1000W
	7.5	5.5	-	-	JNBR-600W130	600W/130Ω	1	600W/130Ω (470*50*100)	1	102% ,10%ED	65Ω	1000W
	10	7.5	-	-	JNBR-800W100	800W/100Ω	1	800W/100Ω (535*60*110)	1	99% ,10%ED	39Ω	1600W
	15	11	-	-	JNBR-1R6KW50	1600W/50Ω	1	1600W/50Ω (615*60*110)	1	126% ,10%ED	39Ω	1600W
	20	15	-	-	JNBR-1R5KW40	1500W/40Ω	1	1500W/40Ω (615*60*110)	1	119% ,10%ED	20Ω	3000W
	25	18.5	-	-	JNBR-4R8KW32	4800W/32Ω	1	1200W/32Ω (535*60*110)	4	119% ,10%ED	20Ω	3000W
	30	22	JNTBU-430	1	JNBR-4R8KW27R2	4800W/27.2Ω	1	1200W/27.2Ω (535*60*110)	4	117% ,10%ED	19.2Ω	3600W
	40	30	JNTBU-430	1	JNBR-6KW20	6000W/20Ω	1	1500W/20Ω (615*60*110)	4	119% ,10%ED	19.2Ω	3600W
	50	37	JNTBU-430	2	JNBR-4R8KW32	4800W/32Ω	2	1200W/32Ω (535*60*110)	8	119%, 10%ED	19.2Ω	3600W
	60	45	JNTBU-430	2	JNBR-4R8KW27R2	4800W/27.2Ω	2	1200W/27.2Ω (535*60*110)	8	117%, 10%ED	19.2Ω	3600W
	75	55	JNTBU-430	2	JNBR-6KW20	6000W/20Ω	2	1500W/20Ω (615*60*110)	8	126%, 10%ED	19.2Ω	3600W
	100	75	JNTBU-430	3	JNBR-6RKW20	6000W/20Ω	3	1500W/20Ω (615*60*110)	12	139%, 10%ED	19.2Ω	3600W

※Note 1: Keep sufficient space between inverter, braking unit and braking resistor and ensure proper cooling is provided for.

11.2 AC Line Reactors

Contact TECO Westinghouse Motor Company for AC Line Reactor Information

11.3 Input Noise Filters

Contact TECO Westinghouse Motor Company for Input and Output Filter Information.

11.4 Input Current and Fuse Specifications

IP20 200V class

Model	Horse power	KVA	100% of rated output current	Rated input current (3ϕ)	Fuse rating (3ϕ)	Rated input current (1ϕ)
F510-2001-C-UE	1	1.9	5.0	5.4	20	9.4
F510-2002-C-UE	2	2.9	7.5	8.1	30	14.1
F510-2003-C-UE	3	4.0	10.6	11.4	50	19.6
F510-2005-C3-UE	5	5.5	14.5	16	50	X
F510-2008-C3-UE	7.5	8.0	22	22.3	50	X
F510-2010-C3-UE	10	11.4	30	31.6	63	X
F510-2015-C3-UE	15	15	42	41.7	100	X
F510-2020-C3-UE	20	21	56	60.9	120	X
F510-2025-C3-UE	25	26	69	75	150	X
F510-2030-C3-UE	30	30	80	85.9	200	X
F510-2040-C3-UE	40	42	110	119.6	250	X
F510-2050-C3-UE	50	53	138	150	300	X
F510-2060-C3-UE	60	64	169	186	400	X
F510-2075-C3-UE	75	76	200	232	500	X
F510-2100-C3-UE	100	95	250	275	600	X
F510-2125-C3-UE	125	119	312	343	700	X
F510-2150-C3-UE	150	152	400	440	800	X
F510-2175-C3-UE	175	172	450	495	800	X

IP20 400V class

Model	Horse power	KVA	100% of rated output current	Rated input current	Fuse rating
F510-4001-C3-UE	1	2.6	3.4	3.7	10
F510-4002-C3-UE	2	3.1	4.1	4.5	16
F510-4003-C3-UE	3	4.1	5.4	5.9	16
F510-4005-C3-UE	5	7.0	9.2	9.6	16
F510-4008-C3-UE	7.5	8.5	12.1	11.6	25
F510-4010-C3-UE	10	13.3	17.5	18.2	40
F510-4015-C3-UE	15	18	23	24	50
F510-4020-C3-UE	20	24	31	32.3	63
F510-4025-C3-UE	25	29	38	41.3	80
F510-4030-C3-UE	30	34	44	47.8	100
F510-4040-C3-UE	40	41	58	63	120
F510-4050-C3-UE	50	55	73	78.3	150
F510-4060-C3-UE	60	67	88	95.7	200
F510-4075-C3-UE	75	79	103	112	250
F510-4100-C3-UE	100	111	145	159	300
F510-4125-C3-UE	125	126	168	181	400
F510-4150-C3-UE	150	159	208	229	500
F510-4175-C3-UE	175	191	250	275	600
F510-4215-C3-UE	215	226	296	325	700
F510-4250-C3-UE	250	250	328	361	700
F510-4300-C3-UE	300	332	435	478	800
F510-4375-C3-UE	375	393	515	566	800

Model	Horse power	KVA	100% of rated output current	Rated input current	Fuse rating
F510-4425-C3-UE	425	446	585	643	1000
F510-4535-C3-UE	535	526	700	750	1400
F510-4670-C3-UE	670	640	875	913	1800
F510-4800-C3-UE	800	732	960	1044	2200

Fuse type: Choose semiconductor fuse to comply with UL.

Voltage Range:

For 200V class inverter, use 300V class fuse.

For 400V class inverter, use 500V class fuse.

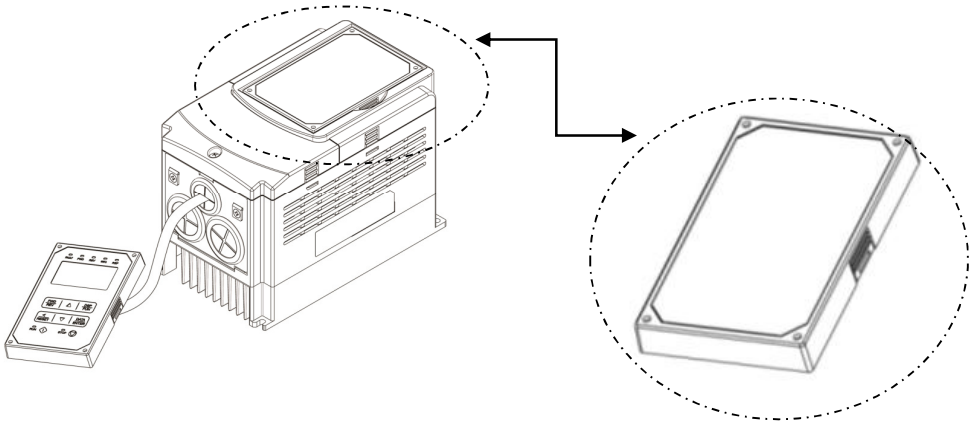
11.5 Other options

A. 4KA41S1139T01 (LCD keypad)

LED keypad is standard for F510 IP20 model and it is optional for LCD keypad. Refer to the following figure.

B. Blank operation box and digital operator wire

- Digital operator can detach inverter itself and users apply digital operator wire for remote operation. Wires have four specifications, inclusive of 1m, 2m, 3m, and 5m.
- For digital operation remote control, separately blank operation box installed in the original position of the operator to prevent the entry of foreign matter.



Remote control installation diagram　　blank operation box

Name	Model	specification
blank operation box	JN5-OP-A03	Black Panel

Name	Model	specification
LED digital operator wire	JN5-CB-01M	**1m**
	JN5-CB-02M	**2m**
	JN5-CB-03M	**3m**
	JN5-CB-05M	**5m**

Name	Model	specification
LED digital operator wire with blank operation box	JN5-CB-01MK	**1m**
	JN5-CB-02MK	**2m**
	JN5-CB-03MK	**3m**
	JN5-CB-05MK	**5m**

Dimensions of LED/LCD keypad (IP20):

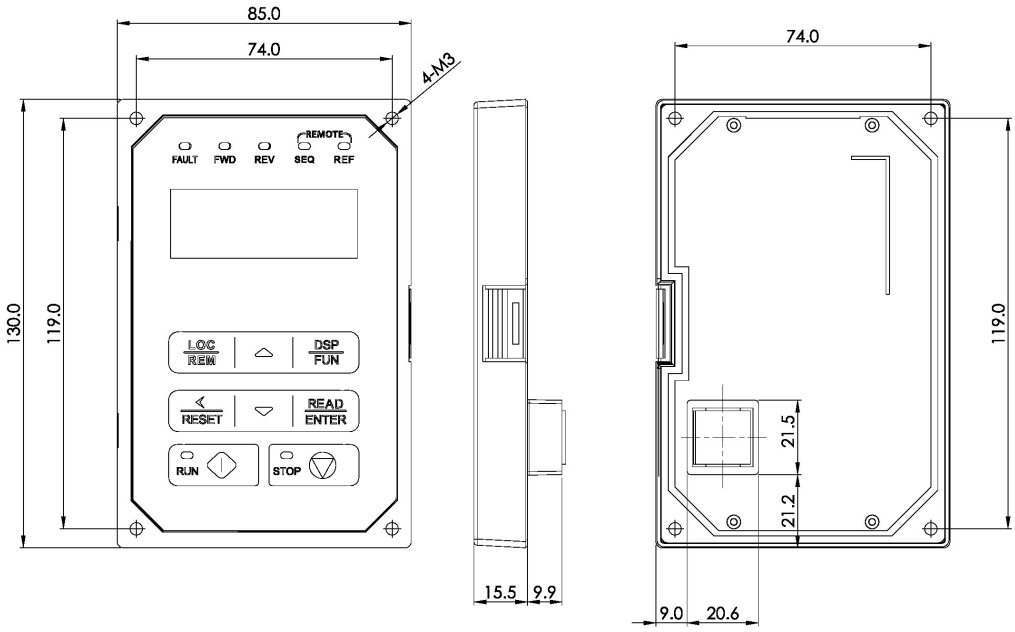


Figure 11.5.2 Dimensions of LED keypad

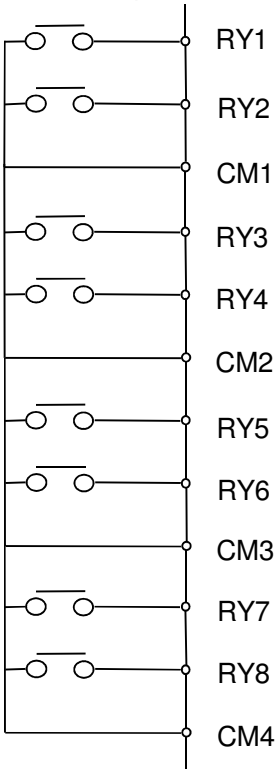
1 to 8 Pump Card

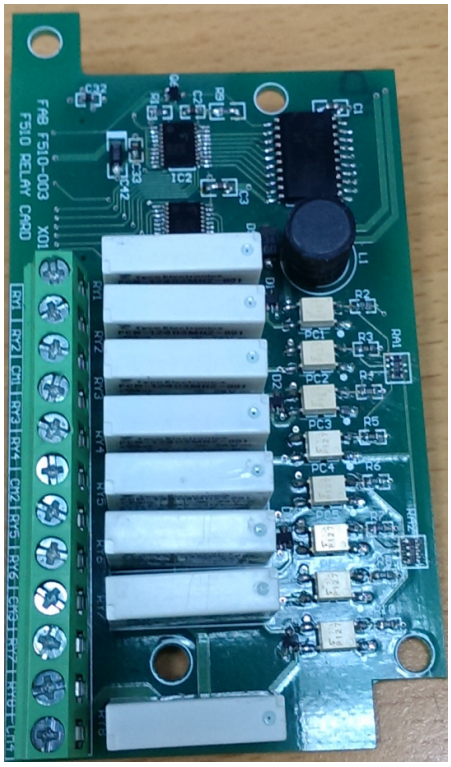
Refer to instruction manual of the option card to install.
JN5-IO-8DO Card: 8 Relay Output Card.

Terminals of JN5-IO-8DO:

Terminal	Description
RY1~RY8	Relay1~Relay8 A terminal output
CM1~CM4	Common terminal output

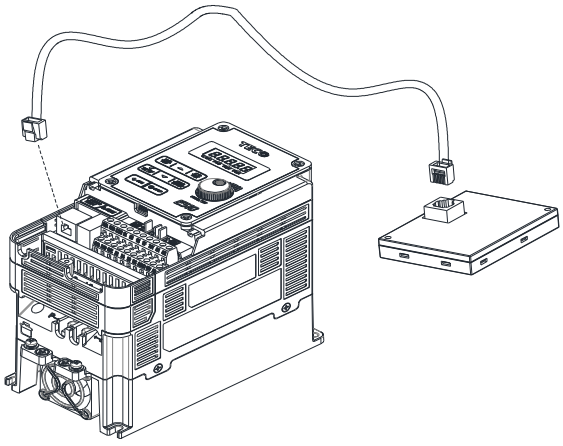
Wiring of JN5-IO-8DO (Example):





Copy Unit (JN5-CU) *NOTE STANDARD LCD KEYPAD IS ALSO A COPY UNIT*

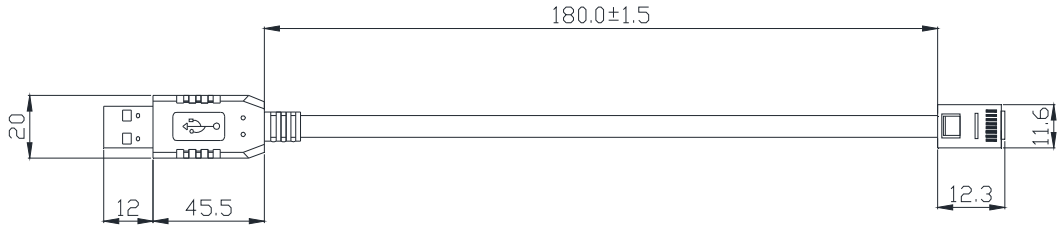
The copy unit is used to copy an inverter parameter setup to another inverter.



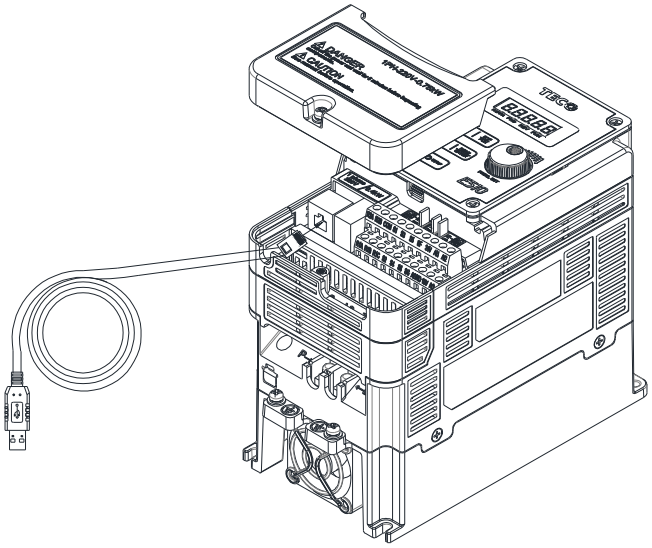
C. RJ45 to USB connecting Cable (1.8m)

JN5-CM-USB has the function of converting USB communication format to RS485 to achieve the inverter communication control being similar with PC or other control equipment with USB port.

- Exterior:



- Connecting:

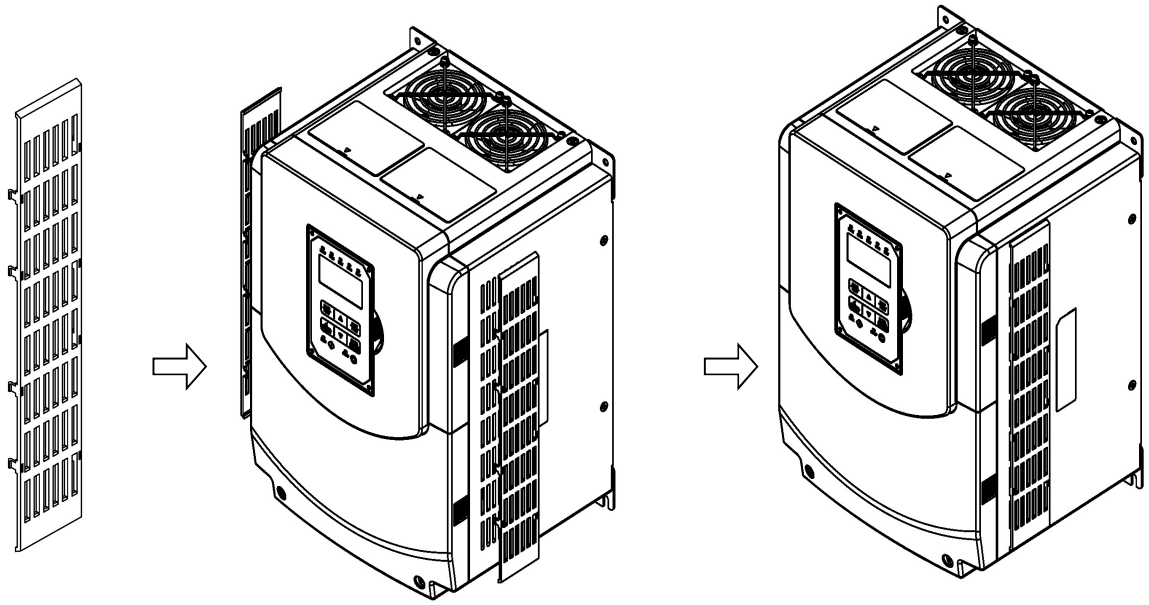


11.6 Others Options

A. Protective Cover *Not Standard for US Market*

If inverter is around the environment of dust or metal shavings, it is recommended to purchase the protective covers positioned on both sides of the inverter to prevent unknown objects from invading.

Frame	Model
1	JN5-CR-A01
2	JN5-CR-A02
4	JN5-CR-A04



Protective Cover **Installation of Protective Cover** **Inverter with Protective Cover**

B. High-speed communication expansion card & I/O expansion card & Middle layer case

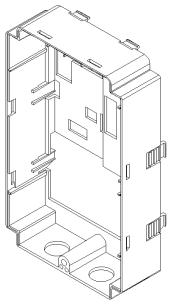
If frame 1~4 of the inverter need to install high-speed communication expansion card or I/O expansion card, middle layer case is necessary, which is option, to install between the top cover and the bottom case, for adding extra space to install the expansion card.

Table 1. Expansion card model number

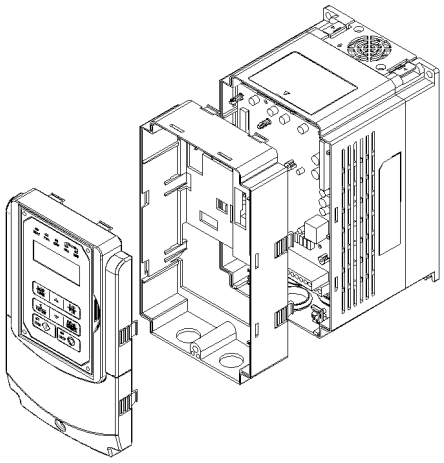
Expansion card type	Model number	Reference chapter
PROFIBUS high-speed comm.	JN5-CMHI-PDP	6.9
CANopen high-speed comm.	JN5-CMHI-CAN	6.10
EtherCAT high-speed comm.	JN5-CMHI-ECAT	6.11
I/O expansion	JN5-IO-2DO1AI	6.12

Table 2. Middle layer case model number

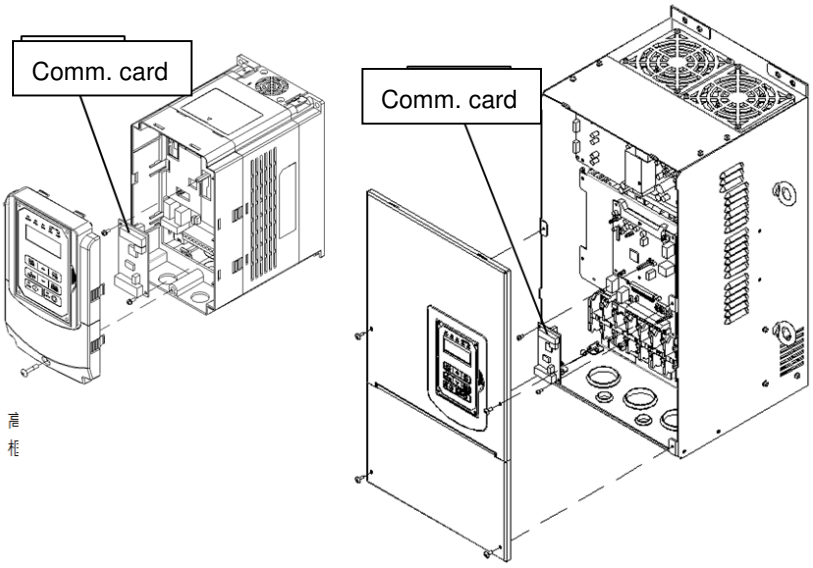
Frame	Middle layer case model number
1	JN5-MD-A01
2	JN5-MD-A02
3	JN5-MD-A03
4	JN5-MD-A04



Middle layer case outline



Middle layer case installation diagram



Communication card installation diagram

11.7 NEMA1 Kit

If NEMA1 or IP20 protective level is necessary to upgrade, it is recommended to purchase the NEMA1 kit positioned on top and bottom sides of the inverter. The drawings installed in the inverter, please refer to chapter 3.7.

Frame	Model
6	JN5-NK-A06
7	JN5-NK-A07
8	JN5-NK-A08
9	JN5-NK-A09

Appendix-A Instructions for UL

◆ Safety Precautions

⚠ DANGER

Electrical Shock Hazard

Do not connect or disconnect wiring while the power is on.

Failure to comply will result in death or serious injury.

⚠ WARNING

Electrical Shock Hazard

Do not operate equipment with covers removed.

Failure to comply could result in death or serious injury.

The diagrams in this section may show drives without covers or safety shields to show details. Be sure to reinstall covers or shields before operating the drives and run the drives according to the instructions described in this manual.

Always ground the motor-side grounding terminal.

Improper equipment grounding could result in death or serious injury by contacting the motor case.

Do not touch any terminals before the capacitors have fully discharged.

Failure to comply could result in death or serious injury.

Before wiring terminals, disconnect all power to the equipment. The internal capacitor remains charged even after the power supply is turned off. After shutting off the power, wait for at least the amount of time specified on the drive before touching any components.

Do not allow unqualified personnel to perform work on the drive.

Failure to comply could result in death or serious injury.

Installation, maintenance, inspection, and servicing must be performed only by authorized personnel familiar with installation, adjustment, and maintenance of AC drives.

Do not perform work on the drive while wearing loose clothing, jewelry, or lack of eye protection.

Failure to comply could result in death or serious injury.

Remove all metal objects such as watches and rings, secure loose clothing, and wear eye protection before beginning work on the drive.

Do not remove covers or touch circuit boards while the power is on.

Failure to comply could result in death or serious injury.

Fire Hazard

Tighten all terminal screws to the specified tightening torque.

Loose electrical connections could result in death or serious injury by fire due to overheating of electrical connections.

Do not use an improper voltage source.

Failure to comply could result in death or serious injury by fire.

Verify that the rated voltage of the drive matches the voltage of the incoming power supply before applying power.

Do not use improper combustible materials.

Failure to comply could result in death or serious injury by fire.

Attach the drive to metal or other noncombustible material.

NOTICE

Observe proper electrostatic discharge procedures (ESD) when handling the drive and circuit boards.

Failure to comply may result in ESD damage to the drive circuitry.

Never connect or disconnect the motor from the drive while the drive is outputting voltage.

Improper equipment sequencing could result in damage to the drive.

Do not use unshielded cable for control wiring.

Failure to comply may cause electrical interference resulting in poor system performance. Use shielded twisted-pair wires and ground the shield to the ground terminal of the drive.

NOTICE

Do not modify the drive circuitry.

Failure to comply could result in damage to the drive and will void warranty.

Teco is not responsible for any modification of the product made by the user. This product must not be modified.

Check all the wiring to ensure that all connections are correct after installing the drive and connecting any other devices.

Failure to comply could result in damage to the drive.

◆ UL Standards

The UL/cUL mark applies to products in the United States and Canada and it means that UL has performed product testing and evaluation and determined that their stringent standards for product safety have been met. For a product to receive UL certification, all components inside that product must also receive UL certification.

UL/cUL Mark

◆ UL Standards Compliance

This drive is tested in accordance with UL standard UL508C and complies with UL requirements. To ensure continued compliance when using this drive in combination with other equipment, meet the following conditions:

■ Installation Area

Do not install the drive to an area greater than pollution severity 2 (UL standard).

■ Main Circuit Terminal Wiring

UL approval requires crimp terminals when wiring the drive's main circuit terminals. Use crimping tools as specified by the crimp terminal manufacturer. Teco recommends crimp terminals made by NICHIFU for the insulation cap.

The table below matches drives models with crimp terminals and insulation caps. Orders can be placed with a Teco representative or directly with the Teco sales department.

Closed-Loop Crimp Terminal Size

Drive Model	Wire Gauge mm², (AWG)		Terminal	Crimp Terminal	Tool	Insulation Cap
F510	R/L1 · S/L2 · T/L3	U/T1 · V/T2 · W/T3	Screws	Model No.	Machine No.	Model No.
2003	2 (14)		M4	R2-4	Nichifu NH 1 / 9	TIC 2
	3.5 (12)			R5.5-4		TIC 3.5
	5.5 (10)					TIC 5.5
2008	5.5 (10)		M4	R5.5-4	Nichifu NH 1 / 9	TIC 5.5
2015	14 (6)		M4	R14-6	Nichifu NOP 60	TIC 8
2030	38 (2)		M6	R38-6	Nichifu NOP 60 / 150H	TIC 22
2050	80 (3/0)		M8	R80-8	Nichifu NOP 60 / 150H	TIC 60
2075	150 (4/0)		M8	R150-8	Nichifu NOP 150H	TIC 80
2125	300 (4/0)*2		M10	R150-10	Nichifu NOP 150H	TIC 100
4003	2 (14)		M4	R2-4	Nichifu NH 1 / 9	TIC 2
	3.5 (12)			R5.5-4		TIC 3.5
	5.5 (10)					TIC 5.5
4010	5.5 (10)		M4	R5.5-4	Nichifu NH 1 / 9	TIC 5.5
4020	8 (8)		M6	R8-6	Nichifu NOP 60	TIC 8
4040	22 (6)		M6	R22-6	Nichifu NOP 60 / 150H	TIC 14
4075	60 (2)		M8	R60-8	Nichifu NOP 60 / 150H	TIC 38
4125	150 (3/0)		M8	R150-8	Nichifu NOP 150H	TIC 80
4250	300 (4/0)*2		M10	R150-10	Nichifu NOP 150H	TIC 100

◆Type 1

During installation, all conduit hole plugs shall be removed, and all conduit holes shall be used.
PS : About 2175 and 4300~4425, please see additional data page.

Recommended Input Fuse Selection

Drive Model F510	Fuse Type	
	Manufacturer: Bussmann / FERRAZ SHAWMUT	
	Model	Fuse Ampere Rating (A)
200 V Class Three-Phase Drives		
2001	Bussmann 20CT	690V 20A
2002	Bussmann 20CT	690V 20A
2003	Bussmann 30FE	690V 30A
2005	Bussmann 50FE	690V 50A
2008	Bussmann 50FE	690V 50A
2010	Bussmann 63FE	690V 63A
2015	FERRAZ SHAWMUT A50QS100-4	500V 100A
2020	Bussmann 120FEE / FERRAZ A50QS150-4	690V 120A / 500V 150A
2025	FERRAZ SHAWMUT A50QS150-4	500V 150A
2030	FERRAZ SHAWMUT A50QS200-4	500V 200A
2040	FERRAZ SHAWMUT A50QS250-4	500V 250A
2050	FERRAZ SHAWMUT A50QS300-4	500V 300A
2060	FERRAZ SHAWMUT A50QS400-4	500V 400A
2075	FERRAZ SHAWMUT A50QS500-4	500V 500A
2100	FERRAZ SHAWMUT A50QS600-4	500V 600A
2125	FERRAZ SHAWMUT A50QS700-4	500V 700A

Drive Model F510	Fuse Type	
	Manufacturer: Bussmann / FERRAZ SHAWMUT	
	Model	Fuse Ampere Rating (A)
	400 V Class Three-Phase Drives	
4001	Bussmann 10CT	690V 10A
4002	Bussmann 10CT	690V 10A
4003	Bussmann 16CT	690V 16A
4005	Bussmann 16CT	690V 16A
4008	Bussmann 25ET	690V 25A
4010	Bussmann 40FE	690V 40A
4015	Bussmann 50FE	690V 50A
4020	Bussmann 63FE	690V 63A
4025	Bussmann 80FE	690V 80A
4030	Bussmann 100FE / FERRAZ A50QS100-4	690V 100A / 500V 100A
4040	Bussmann 120FEE	690V 120A
4050	FERRAZ SHAWMUT A50QS150-4	500V 150A
4060	FERRAZ SHAWMUT A50QS200-4	500V 200A
4075	FERRAZ SHAWMUT A50QS250-4	500V 250A
4100	FERRAZ SHAWMUT A50QS300-4	500V 300A
4125	FERRAZ SHAWMUT A50QS400-4	500V 400A
4150	FERRAZ SHAWMUT A50QS500-4	500V 500A
4175	FERRAZ SHAWMUT A50QS600-4	500V 600A
4215	FERRAZ SHAWMUT A50QS700-4	500V 700A
4250	FERRAZ SHAWMUT A50QS700-4	500V 700A

◆ Motor Overtemperature Protection

Motor overtemperature protection shall be provided in the end use application.

■ Field Wiring Terminals

All input and output field wiring terminals not located within the motor circuit shall be marked to indicate the proper connections that are to be made to each terminal and indicate that copper conductors, rated 75℃ are to be used.

■ Drive Short-Circuit Rating

This drive has undergone the UL short-circuit test, which certifies that during a short circuit in the power supply the current flow will not rise above value. Please see electrical ratings for maximum voltage and table below for current.

- The MCCB and breaker protection and fuse ratings (refer to the preceding table) shall be equal to or greater than the short-circuit tolerance of the power supply being used.
- Suitable for use on a circuit capable of delivering not more than (A) RMS symmetrical amperes for (Hp) Hp in 240 / 480 V class drives motor overload protection.

Horse Power (Hp)	Current (A)	Voltage (V)
1 - 50	5,000	240 / 480
51 - 200	10,000	240 / 480
201 - 400	18,000	240 / 480
401 - 600	30,000	240 / 480

◆ Drive Motor Overload Protection

Set parameter 02-01 (motor rated current) to the appropriate value to enable motor overload protection. The internal motor overload protection is UL listed and in accordance with the NEC and CEC.

■ 02-01 Motor Rated Current

Setting Range: Model Dependent
Factory Default: Model Dependent

The motor rated current parameter (02-01) protects the motor and allows for proper vector control when using open loop vector or flux vector control methods (00-00 = 2 or 3). The motor protection parameter 08-05 is set as factory default. Set 02-01 to the full load amps (FLA) stamped on the nameplate of the motor.

The operator must enter the rated current of the motor (17-02) in the menu during auto-tuning. If the auto-tuning operation completes successfully (17-00 = 0), the value entered into 17-02 will automatically write into 02-01.

■ 08-05 Motor Overload Protection Selection

The drive has an electronic overload protection function (OL1) based on time, output current, and output frequency, which protects the motor from overheating. The electronic thermal overload function is UL-recognized, so it does not require an external thermal overload relay for single motor operation.

This parameter selects the motor overload curve used according to the type of motor applied.

Overload Protection Settings

Setting	Description
---0B	Motor Overload Protection is disabled
---1B	Motor Overload Protection is enabled
--0-B	Cold Start of Motor Overload
--1-B	Hot Start of Motor Overload
-0--B	Standard Motor
-1--B	Special motor

Sets the motor overload protection function in 08-05 according to the applicable motor.

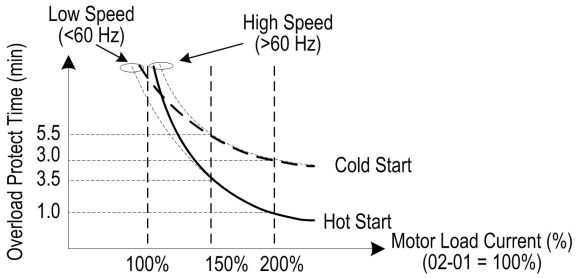
Setting 08-05 = ---0B. Disables the motor overload protection function when two or more motors are connected to a single inverter. Use an alternative method to provide separate overload protection for each motor such as connecting a thermal overload relay to the power line of each motor.

Setting 08-05 = --1-B. The motor overload protection function should be set to hot start protection characteristic curve when the power supply is turned on and off frequently, because the thermal values are reset each time when the power is turned off.

Setting 08-05 = -0--B. For motors without a forced cooling fan (general purpose standard motor), the heat dissipation capability is lower when in low speed operation.

Setting 08-05 = -1--B. For motors with a forced cooling fan (inverter duty or V/F motor), the heat dissipation capability is not dependent upon the rotating speed.

To protect the motor from overload by using electronic overload protection, be sure to set parameter 02-01 according to the rated current value shown on the motor nameplate.
Refer to the following "Motor Overload Protection Time" for the standard motor overload protection curve example : Setting 08-05 = -0--B.



Motor Overload Protection Time

■ 08-06 Start-up mode of overload protection operation

Setting	Description
0	Stop Output after Overload Protection
1	Continuous Operation after Overload Protection

08-06=0: When the inverter detects a motor overload the inverter output is turned off and the OL1 fault message will flash on the keypad. Press RESET button on the keypad or activate the reset function through the multi-function inputs to reset the OL1 fault.

08-06=1: When the inverter detects a motor overload the inverter will continue running and the OL1 alarm message will flash on the keypad until the motor current falls within the normal operating range.

Motor overtemperature protection shall be provided in the end use application.

Closed-Loop Crimp Terminal Size

Drive Model F510	Wire Gauge mm², (AWG)		Terminal	Crimp Terminal	Tool	Insulation Cap
	R/L1 □ S/L2 □ T/L3	U/T1 □ V/T2 □ W/T3	Screws	Model No.	Machine No.	Model No.
2175	152 (300)*2		M12	R150-12*2	Nichifu NOP 150H	TIC 150
4300	203 (400)*2		M12	R200-12S*2	Nichifu NOH 300K	TIC 200
4375	253 (500)*2		M12	R325-12S*2	Nichifu NOH 300K	TIC 325
4425	253 (500)*2		M12	R325-12S*2	Nichifu NOH 300K	TIC 325

◆Type 1

During installation, all conduit hole plugs shall be removed, and all conduit holes shall be used.

Recommended Input Fuse Selection

Drive Model F510	Fuse Type	
	Manufacturer: Bussmann / FERRAZ SHAWMUT	
	Model	Fuse Ampere Rating (A)
200 V Class Three-Phase Drives		
2150	Bussmann 170M5464	690V 800A
2175	Bussmann 170M5464	690V 800A

Drive Model A510	Fuse Type	
	Manufacturer: Bussmann / FERRAZ SHAWMUT	
	Model	Fuse Ampere Rating (A)
400 V Class Three-Phase Drives		
4300	Bussmann 170M5464	690V 800A
4375	Bussmann 170M5464	690V 800A
4425	Bussmann 170M5466	690V 1000A

TECO Westinghouse

INVERTER

F510

Distributor

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