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DELTA_IA-MDS_VFD-ED_UM_EN_20201006

Delta Elevator Drive VFD-ED Series User Manual

# Delta Elevator Drive
# VFD-ED Series User Manual

www.deltaww.com

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Delta reserves the right to make changes to the user manual and the products described in the user manual without prior notice and afterwards.

***PLEASE READ PRIOR TO INSTALLATION FOR SAFETY.***

**DANGER**

- ☑ Disconnect AC input power before connecting any wiring to the AC motor drive.
- ☑ Even if the power has been turned off, a charge may still remain in the DC-link capacitors with hazardous voltages before the POWER LED is OFF. Do NOT touch the internal circuits and components.
- ☑ There are highly sensitive MOS components on the printed circuit boards. These components are especially sensitive to static electricity. Take anti-static measure before touching these components or the circuit boards.
- ☑ Never modify the internal components or wiring.
- ☑ Ground the AC motor drive by using the ground terminal. The grounding method must comply with the laws of the country where the AC motor drive is to be installed.
- ☑ Do NOT install the AC motor drive in a location with high temperature, direct sunlight or inflammable materials or gases.

**CAUTION**

- ☑ Never connect the AC motor drive output terminals U/T1, V/T2 and W/T3 directly to the AC mains circuit power supply.
- ☑ After finishing the wiring of the AC motor drive, check if U/T1, V/T2, and W/T3 are short-circuited to ground with a multimeter. Do NOT power the drive if short circuits occur. Eliminate the short circuits before the drive is powered.
- ☑ The rated voltage for AC motor drive must be ≤ 240V for 230V series (480V for 460V series) and the mains supply current capacity must be ≤ 5000A RMS ( ≤ 10000A RMS for the ≥ 40 HP (30 kW) models).
- ☑ Only qualified persons are allowed to install, wire and maintain the AC motor drives.
- ☑ Even if the three-phase AC motor is stopped, a charge with hazardous voltages may still remain in the main circuit terminals of the AC motor drive.
- ☑ The performance of electrolytic capacitor will degrade if it is not charged for a long time. It is recommended to charge the drive which is stored in no charge condition every 2 years for 3–4 hours to restore the performance of electrolytic capacitor in the motor drive. Note: When power up the motor drive, use adjustable AC power source (e.g. AC autotransformer) to charge the drive at 70%–80% of rated voltage for 30 minutes (do not run the motor drive). Then charge the drive at 100% of rated voltage for an hour (do not run the motor drive). By doing these, restore the performance of electrolytic capacitor before starting to run the motor drive. Do NOT run the motor drive at 100% rated voltage right away.
- ☑ Pay attention to the following precautions when transporting and installing this package (including wooden crate and wood stave)
  1. If you need to deworm the wooden crate, do NOT use fumigation or you will damage the drive. Any damage to the drive caused by using fumigation voids the warranty.
  2. Use other methods, such as heat treatment or any other non-fumigation treatment, to deworm the wood packaging material.
  3. If you use heat treatment to deworm, leave the packaging materials in an environment of over 56°C for a minimum of thirty minutes.
- ☑ Connect the drive to a three-phase three-wire or three-phase four-wire Wye system to comply with UL standards.
- ☑ If the motor drive generates leakage current over AC 3.5 mA or over DC 10 mA on a grounding conductor, compliance with local grounding regulations or IEC61800-5-1 standard is the minimum requirement for grounding.

**NOTE**

The content of this manual may be revised without prior notice. Please consult our distributors or download the latest version at http://www.deltaww.com/iadownload_acmotordrive

# Table of Contents

**Issued Edition: 01**
**Firmware Version: V1.09**
**(Refer to Parameter 00-06 on the product to get the firmware version.)**
**Issued Date: October, 2020**

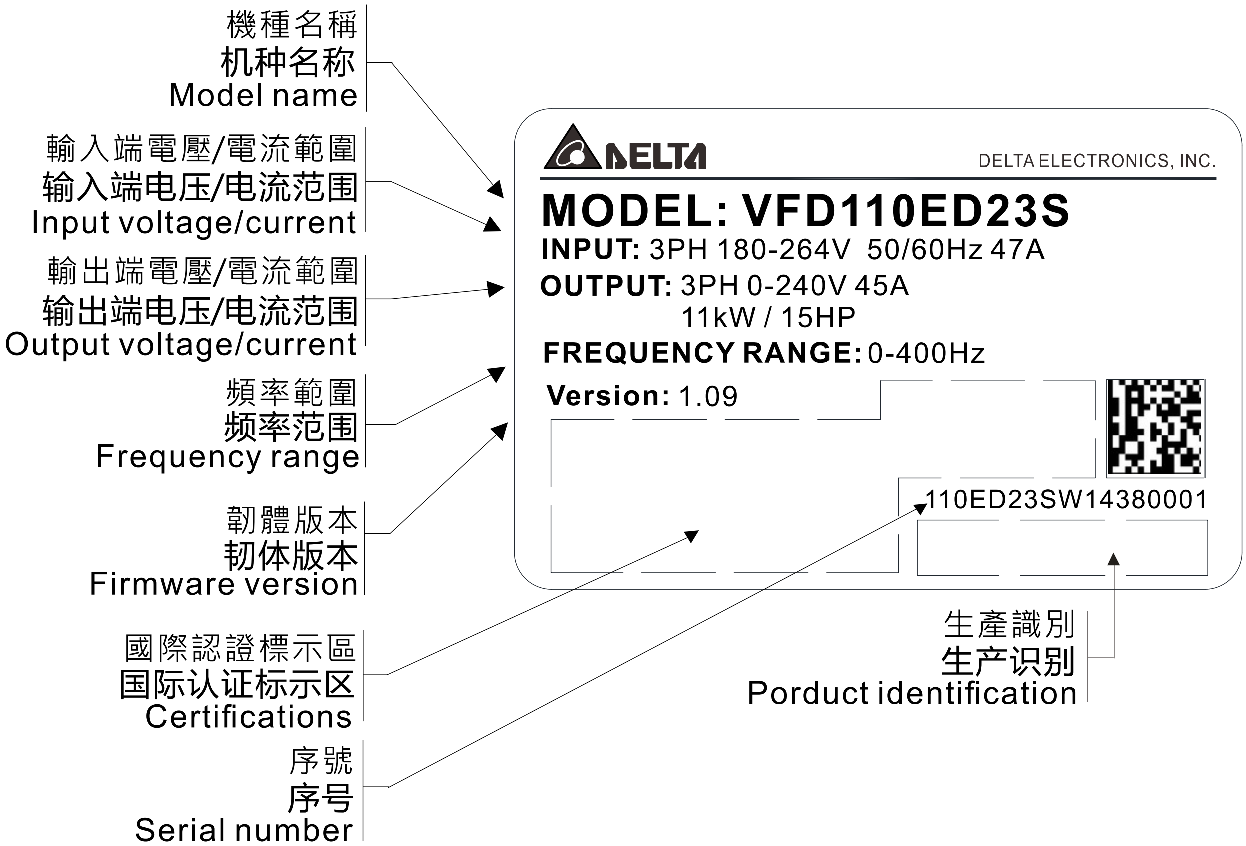
# Chapter 1 Introduction

After you receive the AC motor drive, check the following:

1. Inspect the unit after unpacking to ensure that it was not damaged during shipment. Make sure that the part number printed on the package corresponds with the part number indicated on the nameplate.
2. Make sure that the voltage for the wiring is in the range indicated on the nameplate. Install the AC motor drive according to this manual.
3. Before applying the power, make sure that all the devices, including power, motor, control board and digital keypad are connected correctly.
4. When wiring the AC motor drive, make sure that the wiring for input terminals “R/L1, S/L2, T/L3” and output terminals “U/T1, V/T2, W/T3” is correct to prevent drive damage.
5. When power is applied, select the language and set parameter groups with the digital operation panel (KPED-LE01). When executing a trial run, begin with a low speed and then gradually increase the speed until reaching the desired speed.

## 1-1 Nameplate Information

This example uses the 15 HP/11 kW 230 V, 3-phase motor drive.



## 1-2 Model Name

VFD 110 ED 23 S

- S — Version Type
- 23 — Input Voltage / Phase
  - 23:230V 3-phase
  - 43:460V 3-phase
- ED — ED series
- 110 — Applicable Motor Capacity

| | |
|---|---|
| 022: 3 HP(2.2 kW) | 220: 30 HP(22 kW) |
| 040: 5 HP(4.0 kW) | 300: 40 HP(30 kW) |
| 055: 7.5 HP(5.5 kW) | 370: 50 HP(37 kW) |
| 075: 10 HP(7.5 kW) | 450: 60 HP(45 kW) |
| 110: 15 HP(11 kW) | 550: 75 HP(55 kW) |
| 150: 20 HP(15 kW) | 750: 100 HP(75 kW) |
| 185: 25 HP(18.5 kW) | |

- VFD — Product Name (Variable Frequency Drive)

## 1-3 Serial Number

110ED23S W 14 38 0001

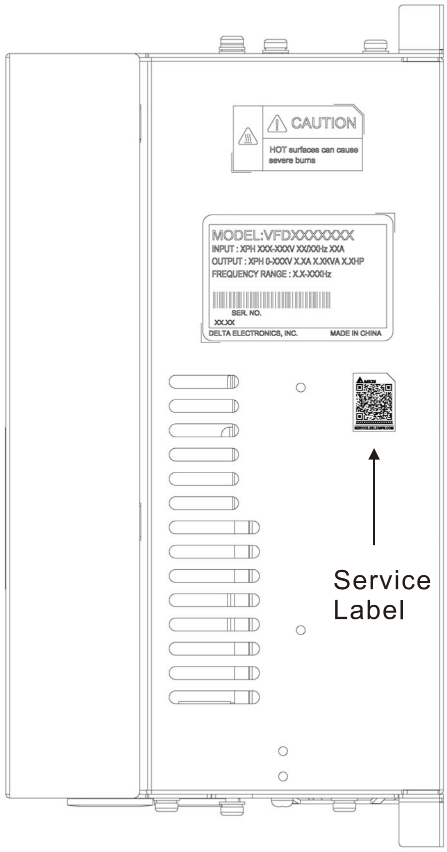
- 0001 — Production number
- 38 — Production week
- 14 — Production year
- W — Production factory (T: Taoyuan W:Wujiang)
- 110ED23S — Model number (230V 3-Phase 15HP(11kW))

# 1-4 Apply After Service by Mobile Device

## 1-4-1 Location of Service Link Label

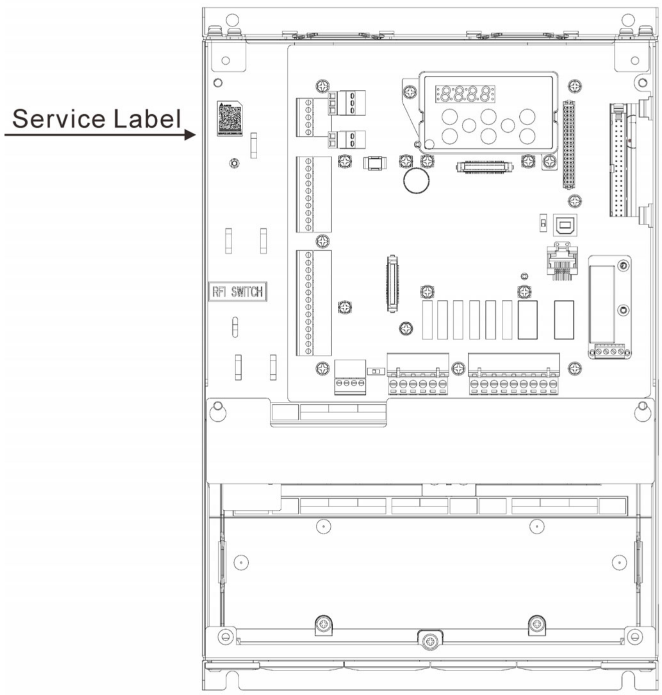
**Frame B**

The image below shows the service link label (service label) that is located on the side of the case.



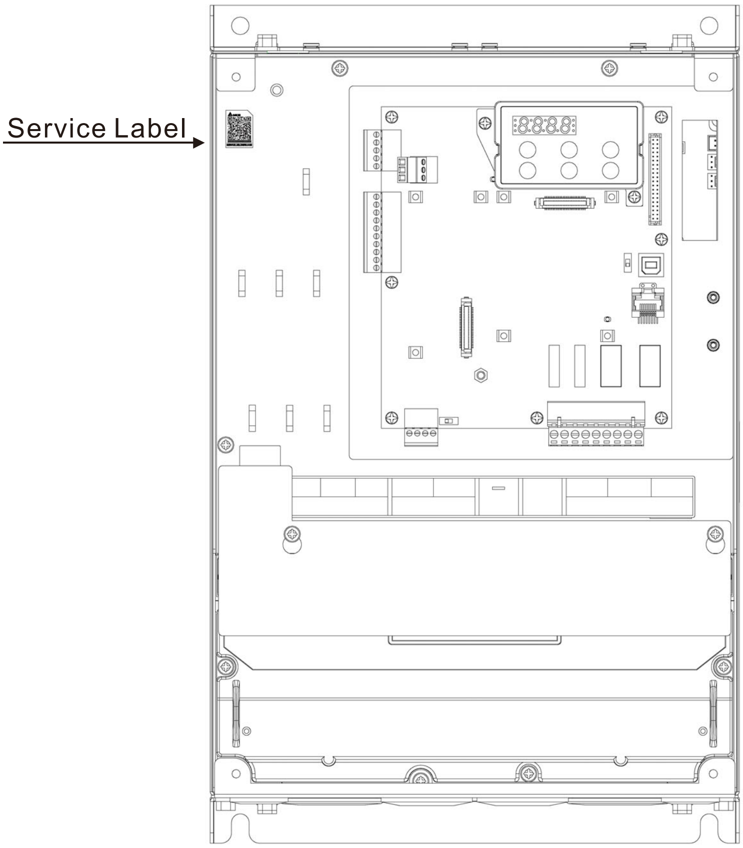

**Frame C**

Remove the front cover of the case to find the service link label (service label) located on the upper left corner as shown in the following image.



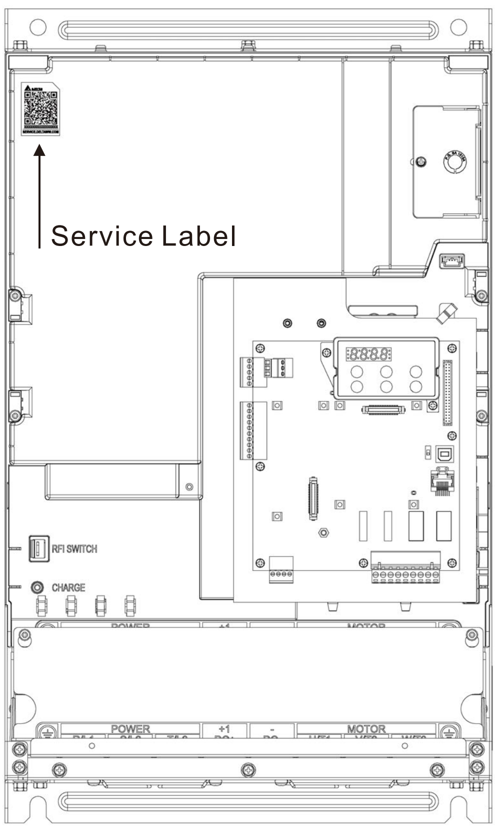
**Frame D**

Remove the front cover of the case to find the service link label (service label) located on the upper left corner as shown in the following image.

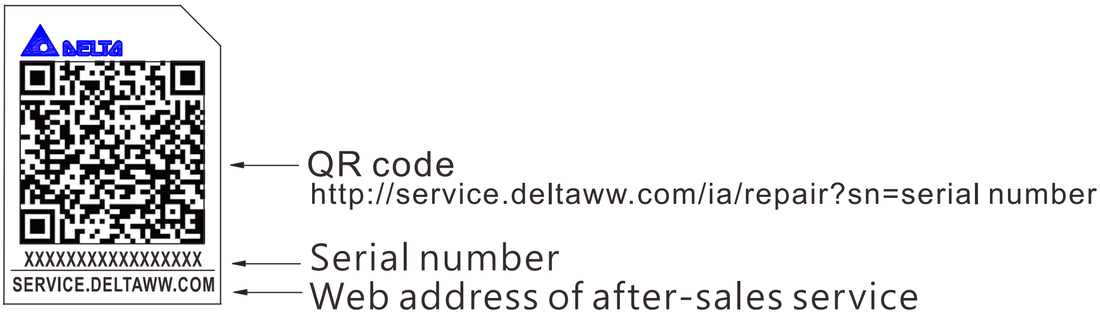



**Frame E**

Remove the front cover of the case to find the service link label (service label) located on the upper left corner as shown in the following image.



## 1-4-2 Service Link Label




Scan QR Code to request service

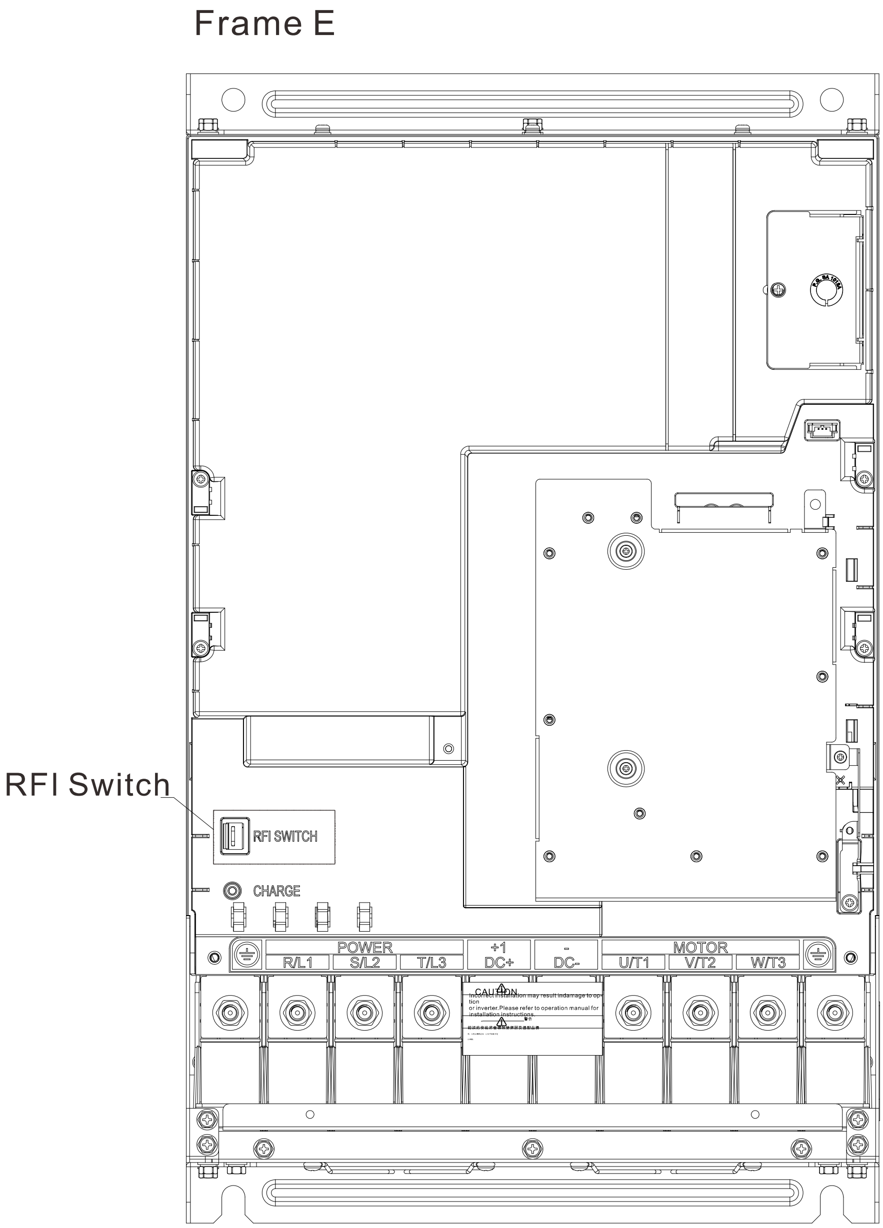
1. Find the QR code sticker (as shown above).
2. Run the QR code reader App on your smartphone.
3. Point your camera at the QR Code. Hold your camera steady until the QR code comes into focus.
4. Access the Delta After-Sales Service website.
5. Fill in the information in the columns marked with an orange star.
6. Enter the CAPTCHA and click **Submit** to complete the request.

Cannot find the QR Code?

1. Open a web browser on your computer or smartphone.
2. Enter https://service.deltaww.com/ia/repair in the browser address bar and press the Enter key.
3. Fill in the information in the columns marked with an orange star.
4. Enter the CAPTCHA and click **Submit** to complete the request.

## 1-5 RFI Switch

The AC motor drive may emit electrical noise. You can use the RFI (Radio Frequency Interference) switch to suppress interference on the power line. The RFI switches on Frames B, C, D, E are at similar locations. Open the drive’s top cover to remove the RFI switch as shown in the following image.




NOTE: The RFI switches on Frames B/C/D/E are at similar locations.

## Isolating main power from ground

When the power distribution system for the motor drive is a floating ground system (IT) or an asymmetric ground system (TN), you must remove the RFI switch. Removing the switch also cuts off the internal RFI capacitor (filter capacitor) between the system's frame and the central circuits to avoid damaging the central circuits and reduces the ground leakage current.

**Important points regarding ground connection**

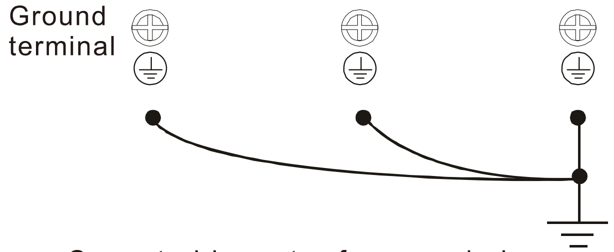
☑ To ensure the safety of personnel, ensure proper operation, and reduce electromagnetic radiation, you must properly ground the motor and drive during installation.

☑ The diameter of the grounding cables must meet the size specified by safety regulations.

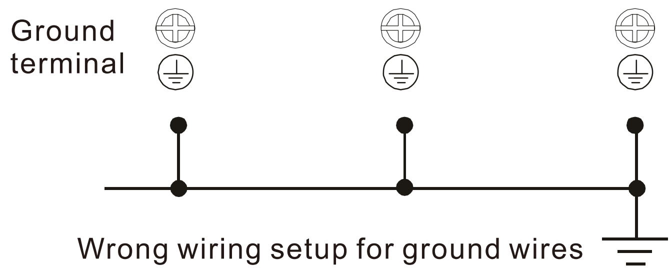
☑ You must connect the shielded cable to the motor drive’s ground to meet safety regulations.

☑ Only use the shielded cable as the ground for equipment when the above points are met.

☑ When installing multiple sets of motor drives, do not connect the motor drives’ grounds in series. See the following image.




Correct wiring setup for ground wires




Wrong wiring setup for ground wires

**Pay particular attention to the following points**

☑ Do not remove the RFI switch while the power is ON.

☑ Make sure the main power is OFF before removing the RFI switch.

☑ Removing the RFI switch also cuts the capacitor conductivity. Gap discharge may occur once the transient voltage exceeds 1000 V.

If you remove the RFI switch, you remove the reliable electrical isolation. In other words, all controlled inputs and outputs become low-voltage terminals with basic electrical isolation. Also, when you remove the internal RFI switch, the motor drive is no longer electromagnetic compatible (EMC).

☑ Do not remove the RFI switch if the main power is a grounded power system.

☑ You must remove the RFI switch when conducting high voltage tests. When conducting a high voltage test for the entire facility, disconnect the main power and the motor if the leakage current is too high.

## Floating Ground System (IT Systems)

A floating ground system is also called an IT system, ungrounded system, or high impedance/resistance (greater than 30 Ω) grounding system.

☑ Disconnect the ground cable from the internal EMC filter.

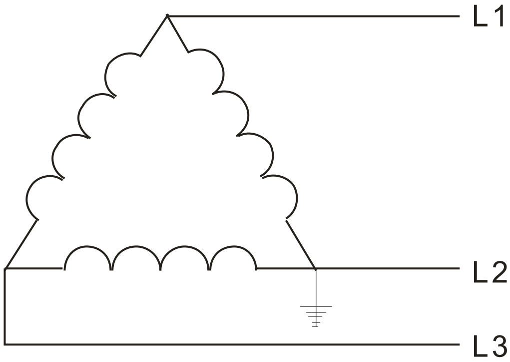
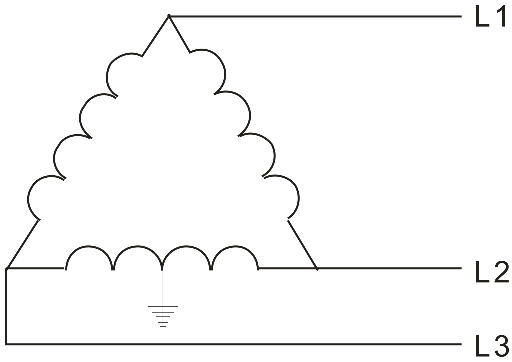
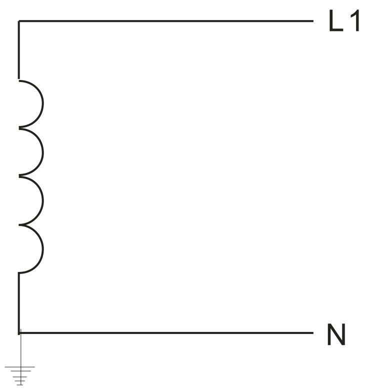
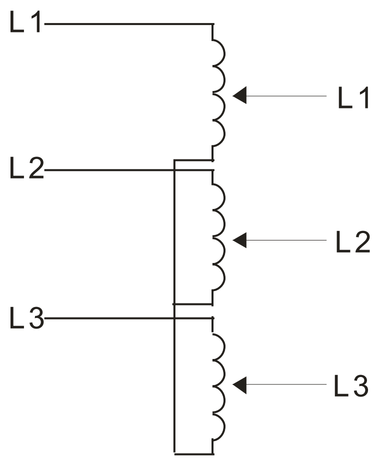
☑ In situations where EMC is required, check for excess electromagnetic radiation affecting nearby low-voltage circuits. In some situations, the adapter and cable naturally provide enough suppression. If in doubt, install an extra electrostatic shielded cable on the power supply side between the main circuit and the control terminals to increase shielding.

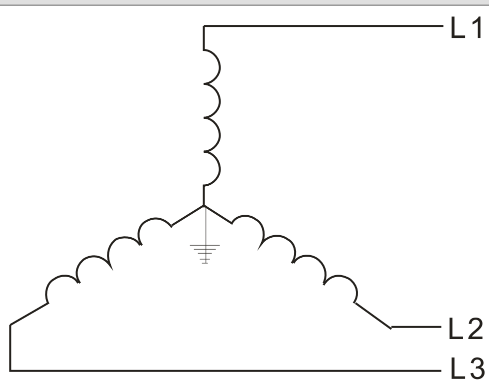
☑ Do not install an external RFI/EMC filter. The external EMC filter passes through a filter capacitor and connects power input to the ground. This is very dangerous and damages the motor drive.

**Asymmetric Ground System (Corner Grounded TN Systems)**

***Caution:*** Do not remove the RFI switch while power to the motor drive input terminal is ON.

In the following four situations, you must remove the RFI switch. This is to prevent the system from grounding through the RFI capacitor and damaging the motor drive.

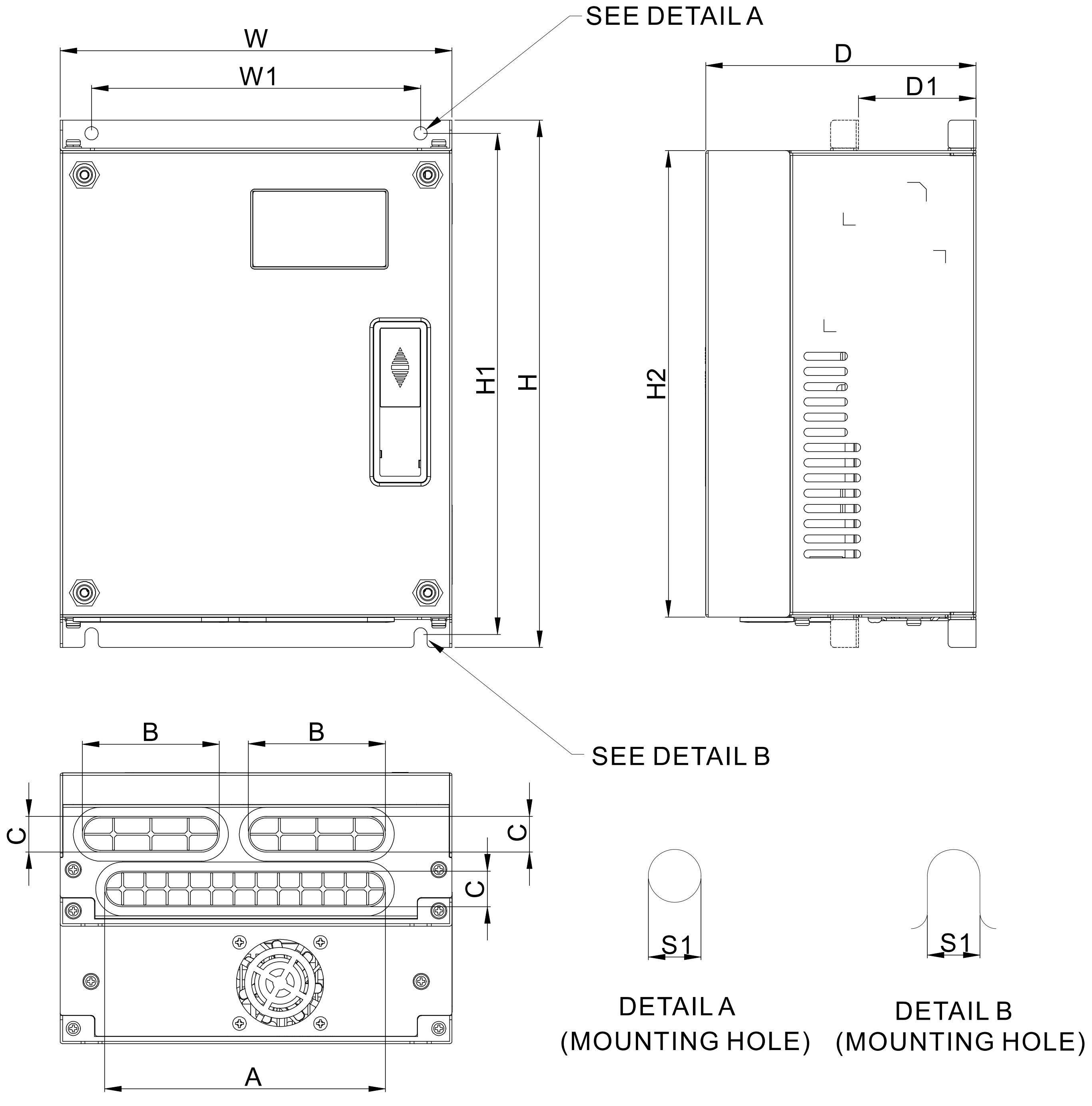
| Conditions for removing the RFI switch | |
|---|---|
| 1. Grounding at a corner in a triangle configuration<br><br> | 2. Grounding at a midpoint in a polygonal configuration<br><br> |
| 3. Grounding at one end in a single-phase configuration<br><br> | 4. No stable neutral grounding in a three-phase autotransformer configuration<br><br> |

| Using the RFI switch | |
|---|---|
| In the situation as the diagram on the right shows, you can use the RFI switch to pass through RFI capacitor to make an internal grounding and reduce electromagnetic radiation. In a situation with higher requirements for electromagnetic compatibility and a symmetrical grounding power system, you can install an EMC filter. For example, the diagram on the right is a symmetrical grounding power system. | <br> |

# 1-6 Dimensions

**Frame B**

VFD022ED21S, VFD037ED21S, VFD040ED23S/43S



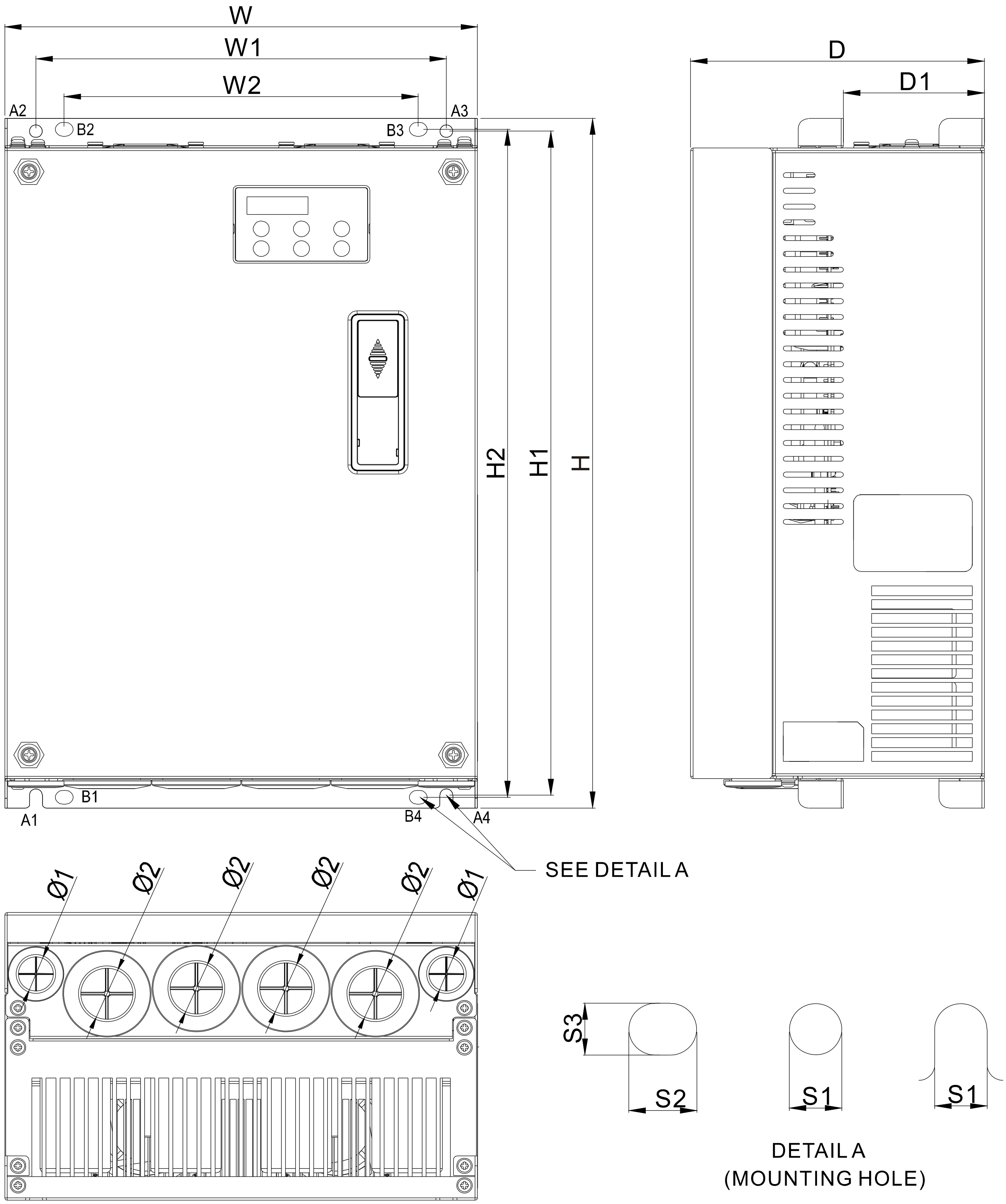

Unit: mm [inch]

| Frame | W | W1 | H | H1 | H2 | D | D1* | S1 | A | B | C |
|---|---|---|---|---|---|---|---|---|---|---|---|
| B | 193.5 [7.60] | 162.5 [6.39] | 260.0 [10.22] | 247.0 [9.71] | 230.0 [9.04] | 133.5 [5.25] | 58.0 [2.28] | 6.5 [0.26] | 138.6 [5.46] | 67.2 [2.66] | 17.6 [0.69] |

*D1: This dimension is for flange mounting application reference.

**Frame C**

VFD055ED23S/43S, VFD075ED23S/43S, VFD110ED23S/43S, VFD150ED43S, VFD185ED43S




Unit: mm [inch]

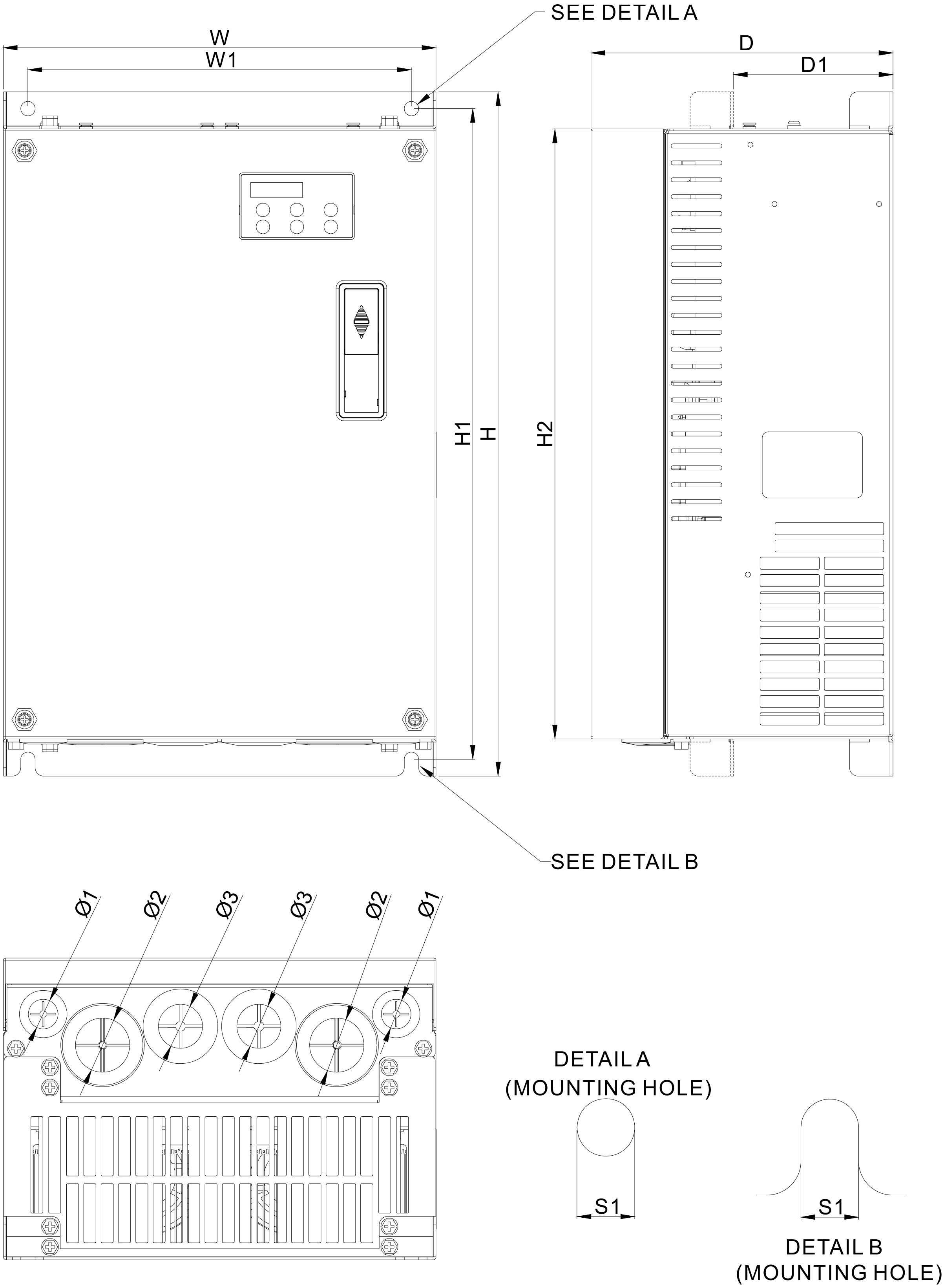
| Frame | W | W1 | W2 | H | H1 | H2 | D | D1* | S1 | S2 | S3 | Ø1 | Ø2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| C | 235.0 [9.25] | 204.0 [8.03] | 176.0 [6.93] | 350.0 [13.78] | 337.0 [13.27] | 320.0 [15.60] | 146.0 [5.75] | 70.0 [2.76] | 6.5 [0.26] | 9.0 [0.35] | 7.0 [0.28] | 19.7 [0.78] | 28.3 [1.11] |

Note: A1–A4 and B1–B4 can be used for screwdriver installation; B1–B4 can also be used for sleeve installation

*D1: This dimension is for flange mounting application reference.

## Frame D

VFD150ED23S, VFD185ED23S, VFD220ED23S/43S, VFD300ED43S



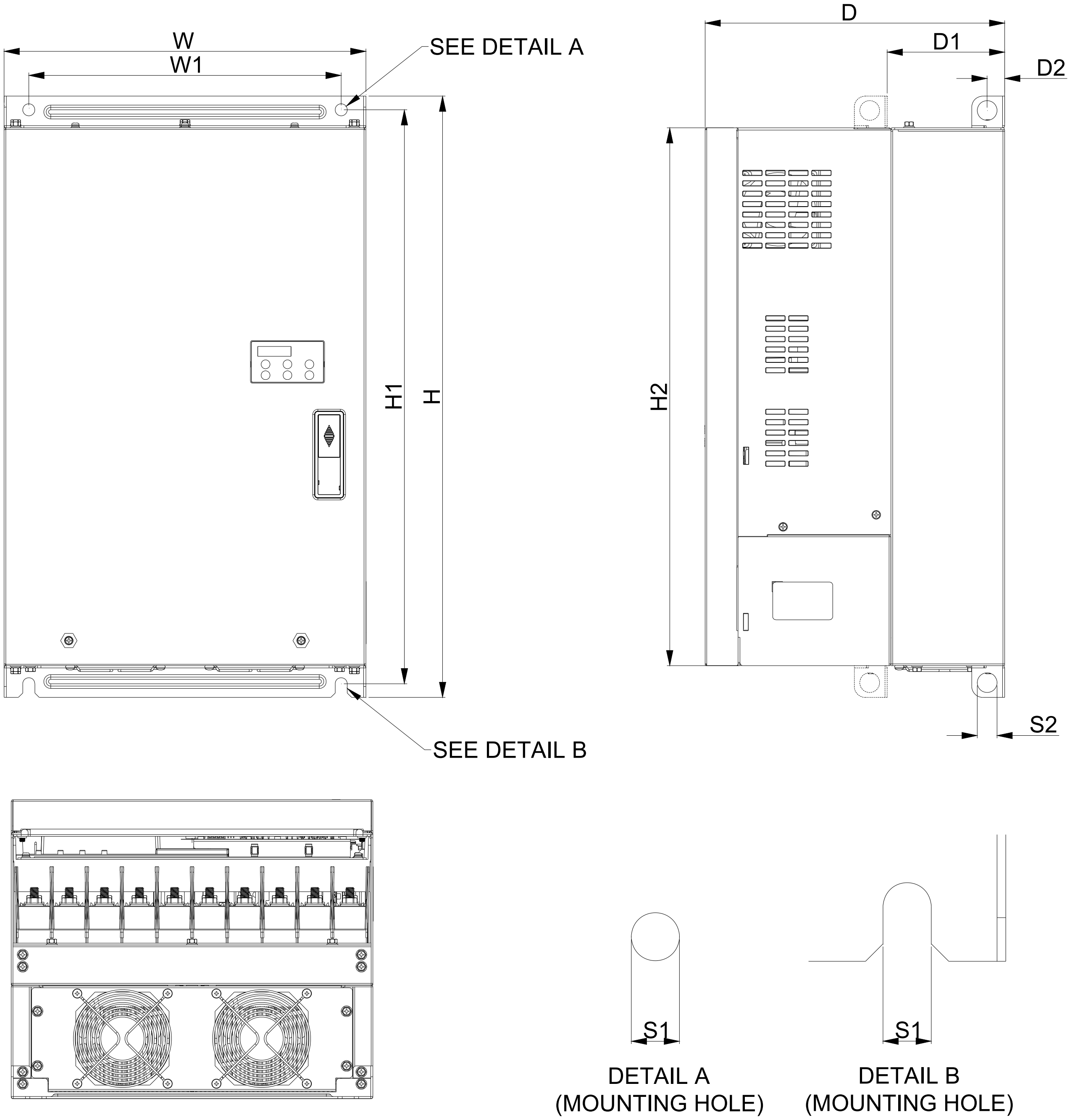

Unit: mm [inch]

| Frame | W | W1 | H | H1 | H2 | D | D1* | S1 | ø1 | ø2 | ø3 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| D | 255.0 [10.04] | 226.0 [8.90] | 403.8 [15.90] | 384.0 [15.12] | 360.0 [14.17] | 178.0 [7.01] | 94.0 [3.70] | 8.5 [0.33] | 17.5 [0.69] | 32.0 [1.26] | 26.0 [1.02] |

*D1: This dimension is for flange mounting application reference.

**Frame E**

VFD300ED23S, VFD370ED23S/43S, VFD450ED43S, VFD550ED43S, VFD750ED43S




Unit: mm [inch]

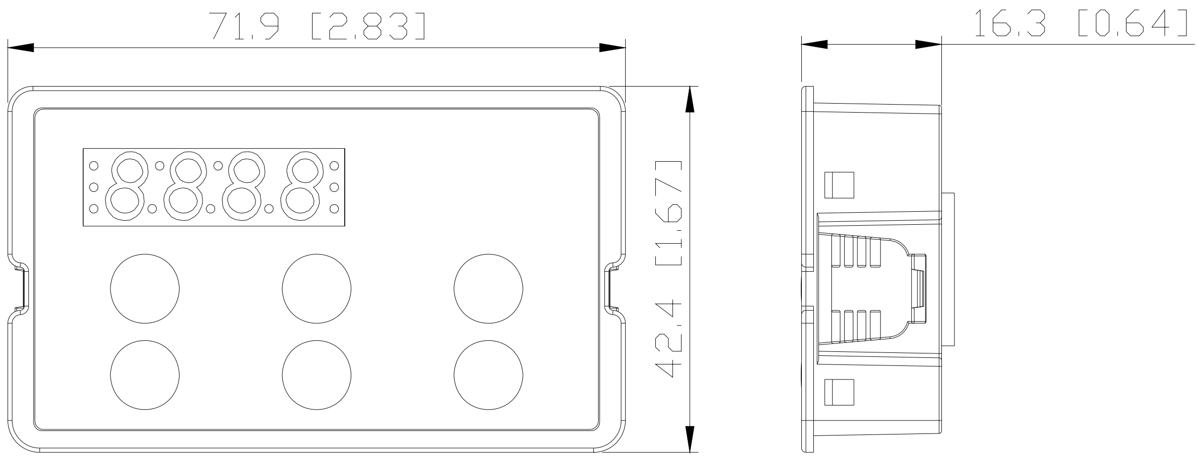
| Frame | W | W1 | H | H1 | H2 | D | D1* | D2 | S1 | S2 |
|---|---|---|---|---|---|---|---|---|---|---|
| E | 330.0 [12.99] | 285.0 [11.22] | 550.0 [21.65] | 525.0 [20.67] | 492.0 [19.37] | 273.4 [10.76] | 107.2 [4.22] | 16.0 [0.63] | 11.0 [0.43] | 18.0 [0.71] |

*D1: This dimension is for flange mounting application reference.

## Built-In Keyboard Panel

KPED-LE01

Unit: mm [inch]



# Chapter 2 Installation

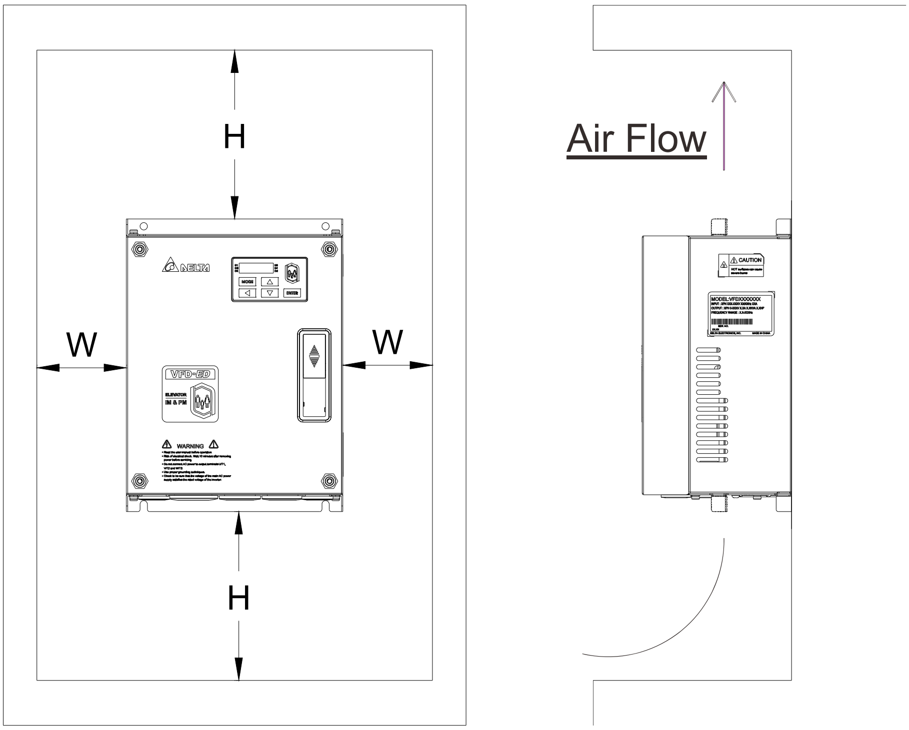
## 2-1 Mounting Clearance

☑ Do not allow material such as fiber particles, scraps of paper, shredded wood, sawdust, and metal particles to adhere to the heat sink.

☑ Install the AC motor drive in a metal cabinet to prevent the risk of fire.

☑ Install the AC motor drive in a Pollution Degree 2 (IEC 60664-1) environment with clean and circulating air. A clean and circulating environment means air without polluting substances and dust.

The motor drives' figures shown below are for reference only. The actual motor drives may look different.




### Minimum Mounting Clearance

| Frame | Capacity | Model No. | W (Width) mm [inch] | H (Height) mm [inch] |
|---|---|---|---|---|
| B | 3.0–5.0 HP (2.2–4 kW) | VFD022ED21S, VFD037ED21S, VFD040ED23S/43S | 50 [2] | 150 [6] |
| C | 7.5–15 HP (5.5–11 kW) | VFD055ED23S/43S,VFD075ED23S/43S, VFD110ED23S/43S, VFD150ED43S, VFD185ED43S | 75 [3] | 175 [7] |
| D | 20–40 HP (15–30 kW) | VFD150ED23S, VFD185ED23S, VFD220ED23S/43S, VFD300ED43S | 75 [3] | 200 [8] |
| E | 40–100 HP (30–75 kW) | VFD300ED23S, VFD370ED23S/43S, VFD450ED43S, VFD550ED43S, VFD750ED43S | 75 [3] | 200 [8] |

NOTE

The minimum mounting clearances stated in the table above apply to AC motor drives frame B, C, D and E. Failure to follow the minimum mounting clearances may cause the motor drive fan to malfunction and cause heat dissipation problems.

## 2-2 Airflow and Power Dissipation

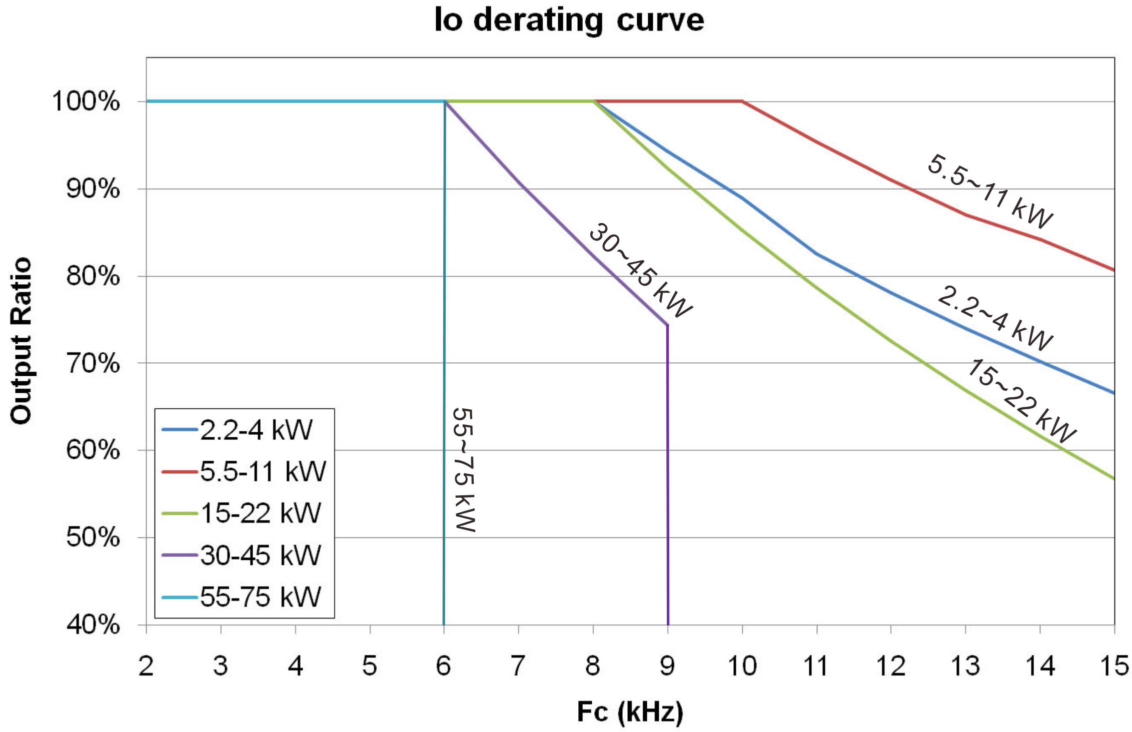
| Model No. | Airflow Rate for Cooling | | | | | | Power Dissipation for AC Motor Drive | | |
|---|---|---|---|---|---|---|---|---|---|
| | Flow Rate [cfm] | | | Flow Rate [m3/hr] | | | Power Dissipation [W] | | |
| | External | Internal | Total | External | Internal | Total | Loss External (Heat Sink) | Internal | Total |
| VFD022ED21S | 13.7 | - | 13.7 | 23.3 | - | 23.3 | 60 | 36 | 96 |
| VFD037ED21S | 23.9 | - | 23.9 | 40.7 | - | 40.7 | 84 | 46 | 130 |
| VFD040ED23S | 23.9 | - | 23.9 | 40.7 | - | 40.7 | 133 | 49 | 182 |
| VFD055ED23S | 48.5 | - | 48.5 | 82.4 | - | 82.4 | 212 | 67 | 279 |
| VFD075ED23S | 48.5 | - | 48.5 | 82.4 | - | 82.4 | 292 | 86 | 379 |
| VFD110ED23S | 47.9 | - | 47.9 | 81.4 | - | 81.4 | 355 | 121 | 476 |
| VFD150ED23S | 64.6 | - | 64.6 | 109.8 | - | 109.8 | 490 | 161 | 651 |
| VFD185ED23S | 102.3 | - | 102.3 | 173.8 | - | 173.8 | 638 | 184 | 822 |
| VFD220ED23S | 102.8 | - | 102.8 | 174.7 | - | 174.7 | 723 | 217 | 939 |
| VFD300ED23S | 179 | 30 | 209 | 304 | 51 | 355 | 932 | 186 | 1118 |
| VFD370ED23S | 179 | 30 | 209 | 304 | 51 | 355 | 1112 | 222 | 1334 |
| VFD040ED43S | 13.7 | - | 13.7 | 23.3 | - | 23.3 | 123 | 42 | 165 |
| VFD055ED43S | 48.5 | - | 48.5 | 82.4 | - | 82.4 | 185 | 55 | 240 |
| VFD075ED43S | 48.5 | - | 48.5 | 82.4 | - | 82.4 | 249 | 71 | 320 |
| VFD110ED43S | 47.9 | - | 47.9 | 81.4 | - | 81.4 | 337 | 94 | 431 |
| VFD150ED43S | 46.1 | - | 46.1 | 78.4 | - | 78.4 | 302 | 123 | 425 |
| VFD185ED43S | 46.1 | - | 46.1 | 78.4 | - | 78.4 | 391 | 139 | 529 |
| VFD220ED43S | 102.8 | - | 102.8 | 174.7 | - | 174.7 | 642 | 141 | 783 |
| VFD300ED43S | 83.7 | - | 83.7 | 142.2 | - | 142.2 | 839 | 180 | 1019 |
| VFD370ED43S | 179 | 30 | 209 | 304 | 51 | 355 | 803 | 252 | 1055 |
| VFD450ED43S | 179 | 30 | 209 | 304 | 51 | 355 | 1014 | 270 | 1284 |
| VFD550ED43S | 179 | 30 | 209 | 304 | 51 | 355 | 1244 | 275 | 1519 |
| VFD750ED43S | 186 | 30 | 216 | 316 | 51 | 367 | 1541 | 338 | 1878 |

# 2-3 Derating Curve for Ambient Temperature, Altitude and Carrier Frequency

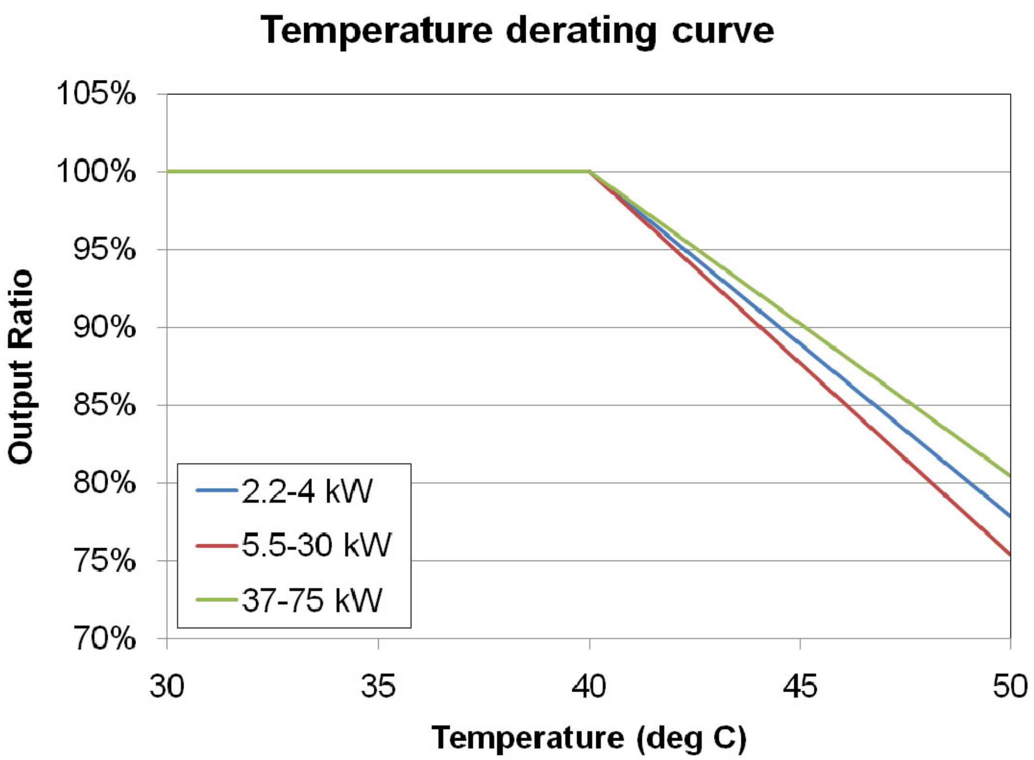
## Carrier Frequency Derating Capacity (Fc)

| Frame | B | C | D | E | E |
|---|---|---|---|---|---|
| Fc (kHz) | 2.2–4 kW | 5.5–11 kW | 15–22 kW | 30–45 kW | 55–75kW |
| 0 | 100% | 100% | 100% | 100% | 100% |
| 1 | 100% | 100% | 100% | 100% | 100% |
| 2 | 100% | 100% | 100% | 100% | 100% |
| 3 | 100% | 100% | 100% | 100% | 100% |
| 4 | 100% | 100% | 100% | 100% | 100% |
| 5 | 100% | 100% | 100% | 100% | 100% |
| 6 | 100% | 100% | 100% | 100% | 100% |
| 7 | 100% | 100% | 100% | 90.73% | - |
| 8 | 100% | 100% | 100% | 82.20% | - |
| 9 | 94.24% | 100% | 92.32% | 74.31% | - |
| 10 | 88.92% | 100% | 85.21% | - | - |
| 11 | 82.54% | 95.35% | 78.63% | - | - |
| 12 | 78.08% | 91.02% | 72.53% | - | - |
| 13 | 73.95% | 86.98% | 66.87% | - | - |
| 14 | 70.14% | 84.14% | 61.62% | - | - |
| 15 | 66.61% | 80.67% | 56.74% | - | - |

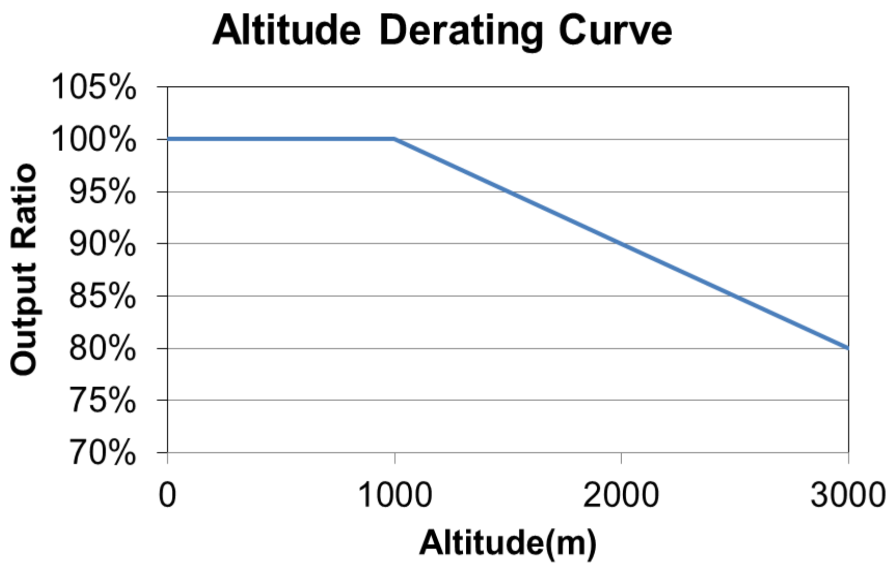
## Carrier Frequency Derating Curve (Fc)



### Ambient Temperature Derating Curve




### Altitude Derating Curve



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# Chapter 3 Wiring

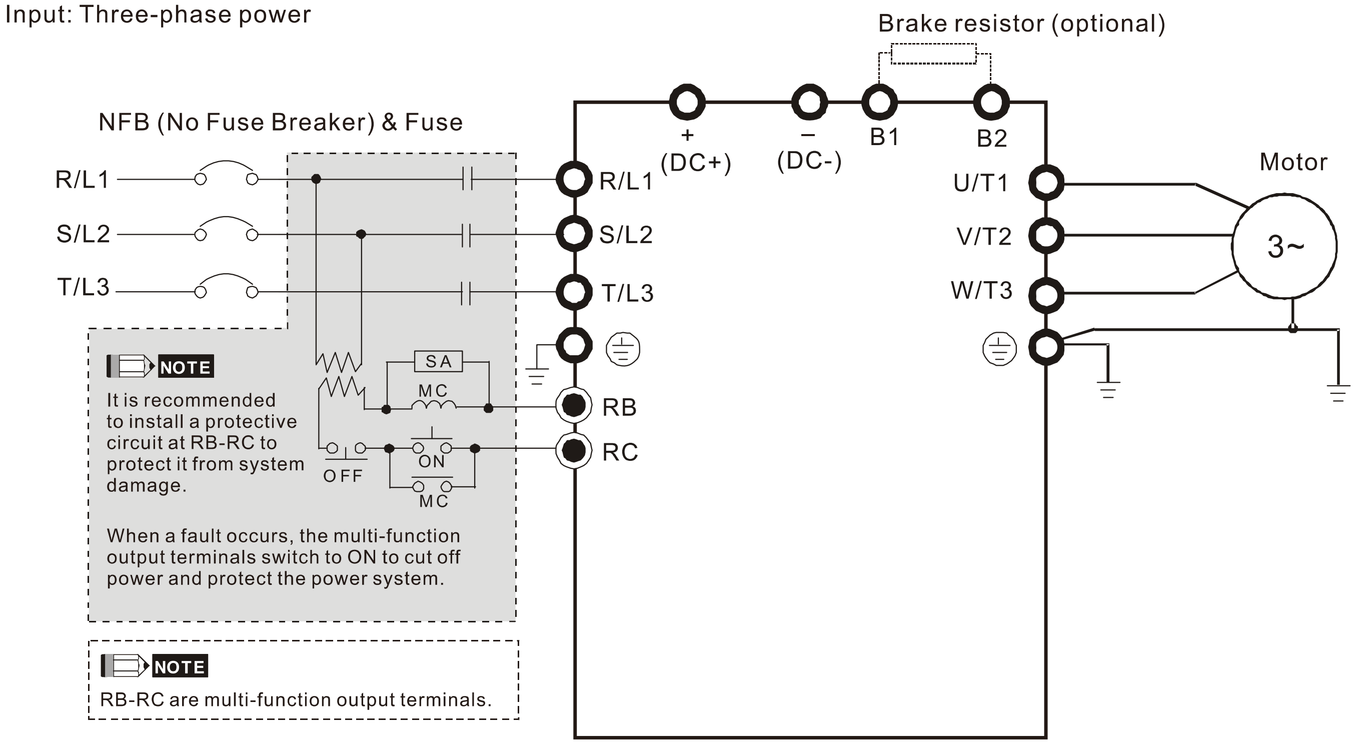
After removing the front cover, verify that the power and control terminals are clear. Be sure to observe the following precautions when wiring.

- ☑ Make sure that power is only applied to the R/L1, S/L2, and T/L3 terminals. Failure to comply may result in damage to the equipment. The voltage and current should be within the range indicated on the AC motor drive nameplate (see Section 1-1 Nameplate Information).
- ☑ All the units must be grounded directly to a common ground terminal to prevent damage from a lightning strike or electric shock.
- ☑ Make sure you correctly tighten the main circuit terminal screws to prevent sparks from screws that have been loosened due to vibration.

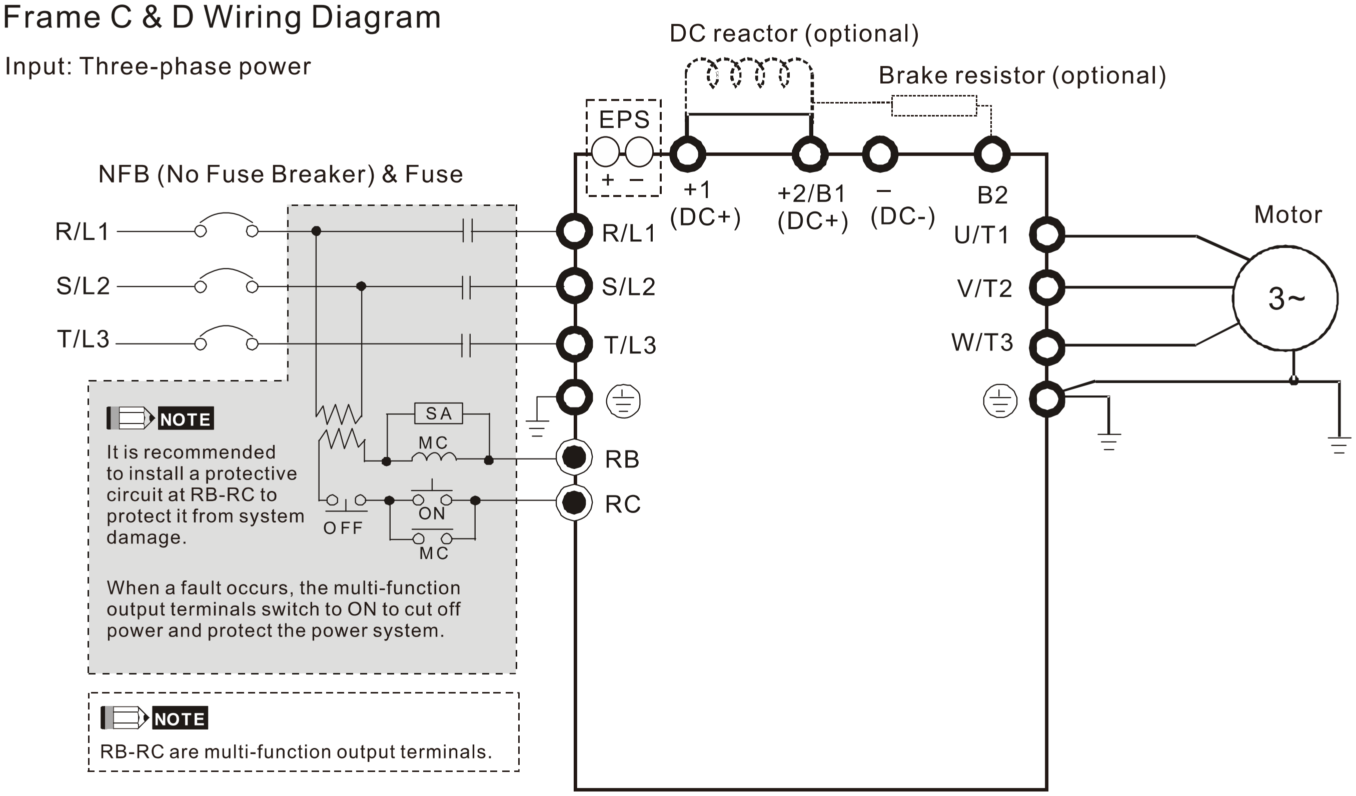
| | |
|---|---|
| DANGER | ☑ Turn off the AC motor drive power before installing any wiring. A hazardous charge may still remain in the DC bus capacitors after the power has been turned off. Measure the remaining voltage before wiring. For your safety, do not perform any wiring before the voltage drops to a safe level < 25 $V_{DC}$. Performing a wiring installation while voltage remains may cause sparks and short circuits.<br>☑ Only qualified personnel familiar with AC motor drives are allowed to perform installation, wiring and commissioning. Make sure the power is turned off before wiring to prevent electric shock. |
| CAUTION | ☑ When wiring, choose wires that comply with local regulations for your safety.<br>☑ Check the following items after finishing the wiring:<br>1. Are all connections correct?<br>2. Are there any loose wires?<br>3. Are there any short circuits between the terminals or to ground? |

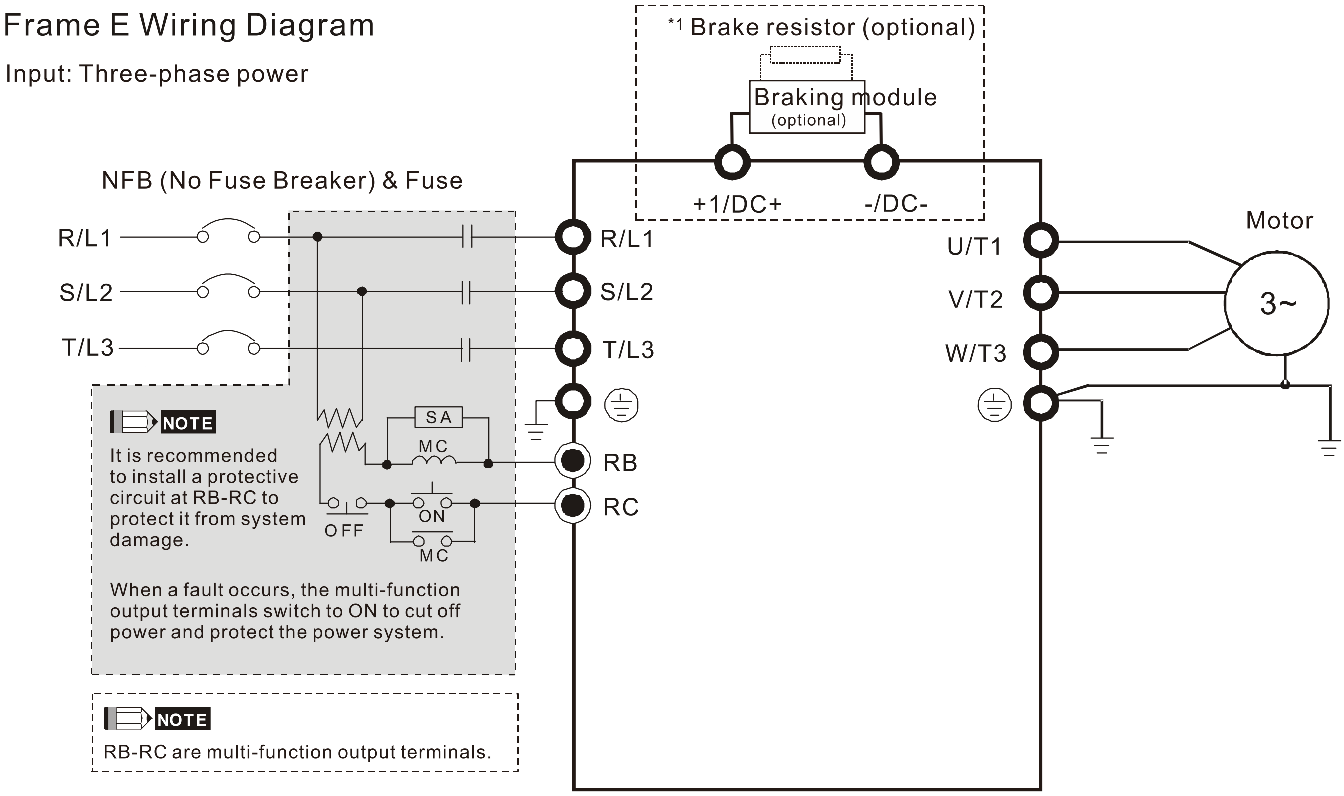
# 3-1 Wiring

## Frame B Wiring Diagram



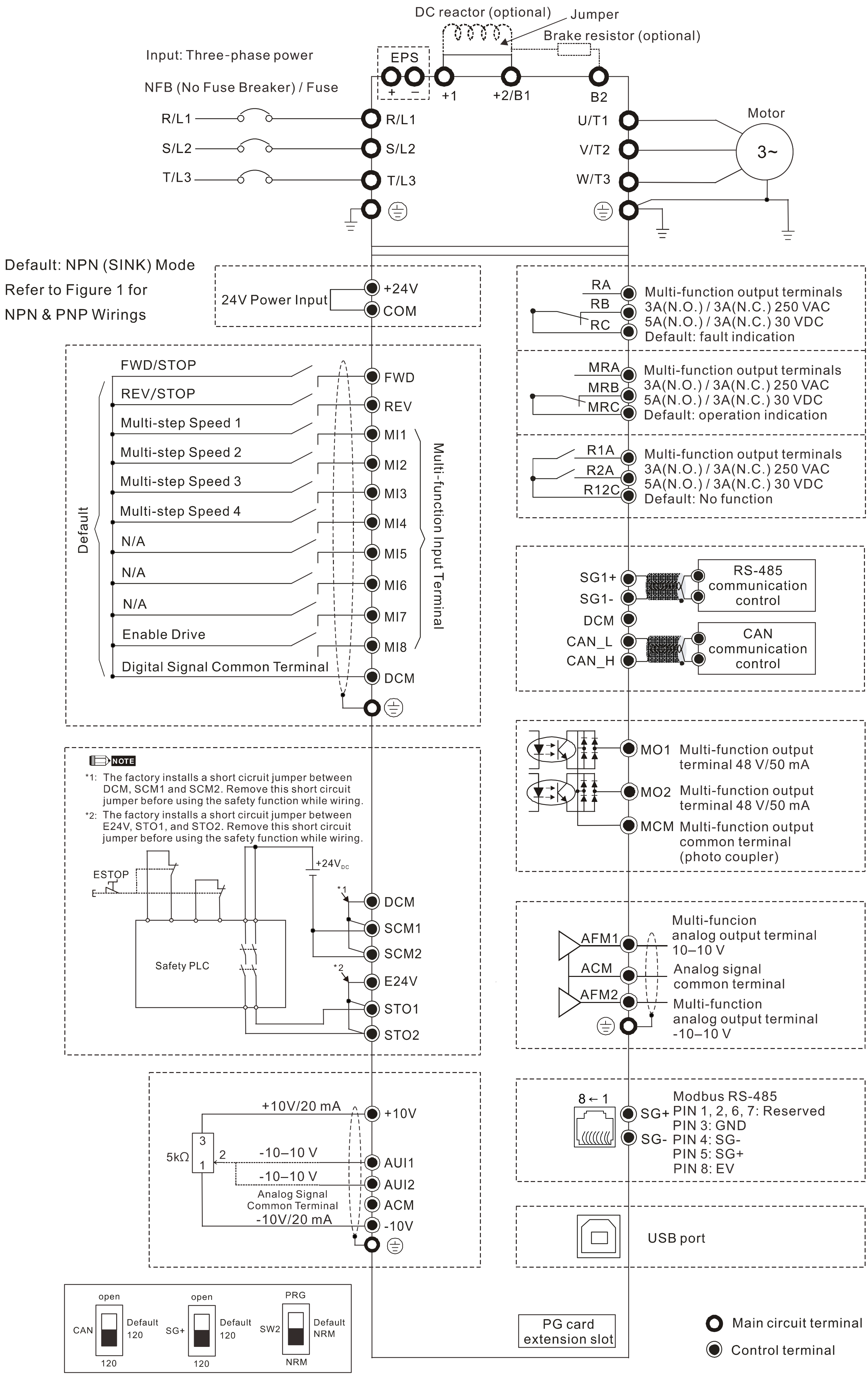

## Frame C & D Wiring Diagram






*See Figure 2 on page 3-6 for the Emergency Power Supply (EPS) system wiring diagrams.

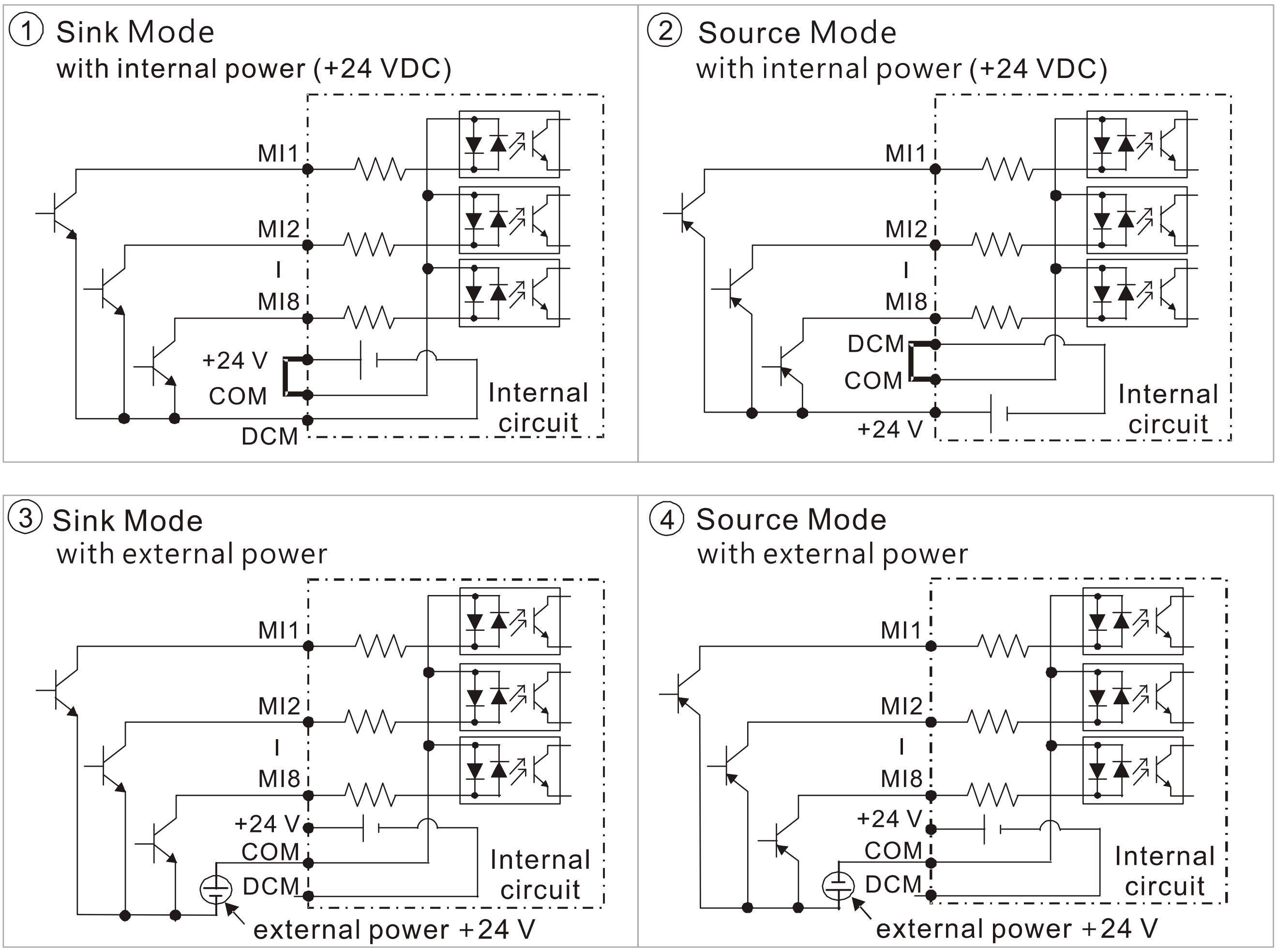
*1 See Section 6-1 Brake Resistors & Brake Units Used in AC Motor Drives for details.



DC reactor (optional)
Jumper
Brake resistor (optional)
Input: Three-phase power
NFB (No Fuse Breaker) / Fuse
EPS
+1
+2/B1
B2
R/L1
S/L2
T/L3
U/T1
V/T2
W/T3
Motor
3~
Default: NPN (SINK) Mode
Refer to Figure 1 for
NPN & PNP Wirings
24V Power Input
+24V
COM
FWD/STOP
REV/STOP
Multi-step Speed 1
Multi-step Speed 2
Multi-step Speed 3
Multi-step Speed 4
N/A
N/A
N/A
Enable Drive
Digital Signal Common Terminal
Default
FWD
REV
MI1
MI2
MI3
MI4
MI5
MI6
MI7
MI8
DCM
Multi-function Input Terminal
RA
RB
RC
Multi-function output terminals
3A(N.O.) / 3A(N.C.) 250 VAC
5A(N.O.) / 3A(N.C.) 30 VDC
Default: fault indication
MRA
MRB
MRC
Multi-function output terminals
3A(N.O.) / 3A(N.C.) 250 VAC
5A(N.O.) / 3A(N.C.) 30 VDC
Default: operation indication
R1A
R2A
R12C
Multi-function output terminals
3A(N.O.) / 3A(N.C.) 250 VAC
5A(N.O.) / 3A(N.C.) 30 VDC
Default: No function
SG1+
SG1-
DCM
CAN_L
CAN_H
RS-485 communication control
CAN communication control
NOTE
*1: The factory installs a short cicrcuit jumper between DCM, SCM1 and SCM2. Remove this short circuit jumper before using the safety function while wiring.
*2: The factory installs a short circuit jumper between E24V, STO1, and STO2. Remove this short circuit jumper before using the safety function while wiring.
ESTOP
Safety PLC
+24V DC
*1
*2
DCM
SCM1
SCM2
E24V
STO1
STO2
MO1
Multi-function output terminal 48 V/50 mA
MO2
Multi-function output terminal 48 V/50 mA
MCM
Multi-function output common terminal (photo coupler)
AFM1
Multi-funcion analog output terminal 10–10 V
ACM
Analog signal common terminal
AFM2
Multi-function analog output terminal -10–10 V
+10V/20 mA
+10V
5kΩ
3
2
1
-10–10 V
AUI1
-10–10 V
AUI2
Analog Signal Common Terminal
ACM
-10V/20 mA
-10V
8 ← 1
SG+
SG-
Modbus RS-485
PIN 1, 2, 6, 7: Reserved
PIN 3: GND
PIN 4: SG-
PIN 5: SG+
PIN 8: EV
USB port
open
CAN
Default 120
120
open
SG+
Default 120
120
PRG
SW2
Default NRM
NRM
PG card extension slot
Main circuit terminal
Control terminal

## Figure 1

**Switching between two modes: SINK (NPN) /SOURCE (PNP)**

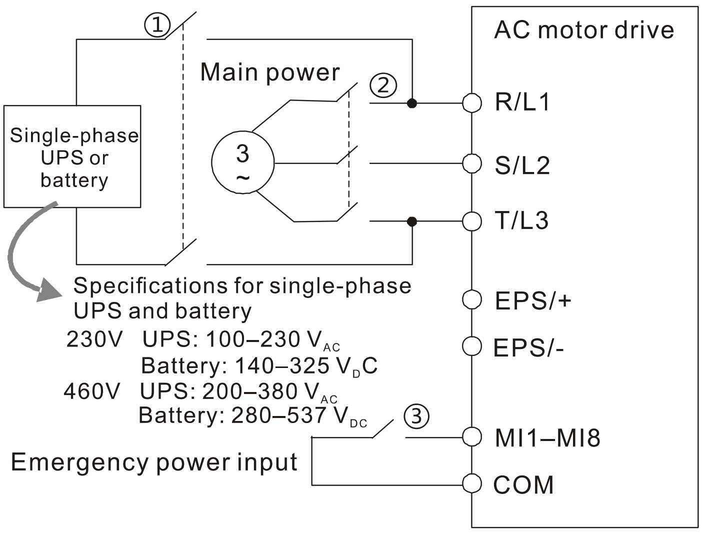



## Figure 2

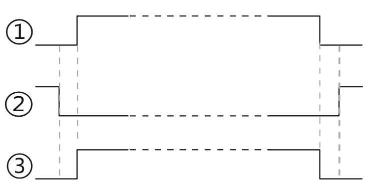
**Emergency Power Supply (EPS) system wiring diagrams**

Frames B, C, D & E

1. Single-phase UPS or battery can only be used on the main power supply side



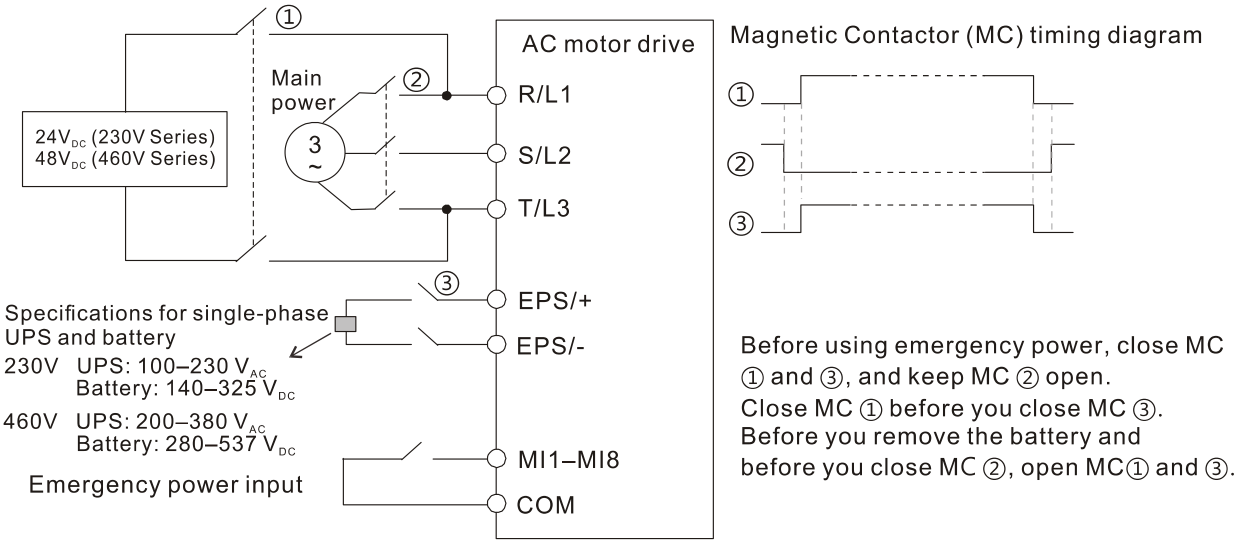

Magnetic Contactor (MC) timing diagram

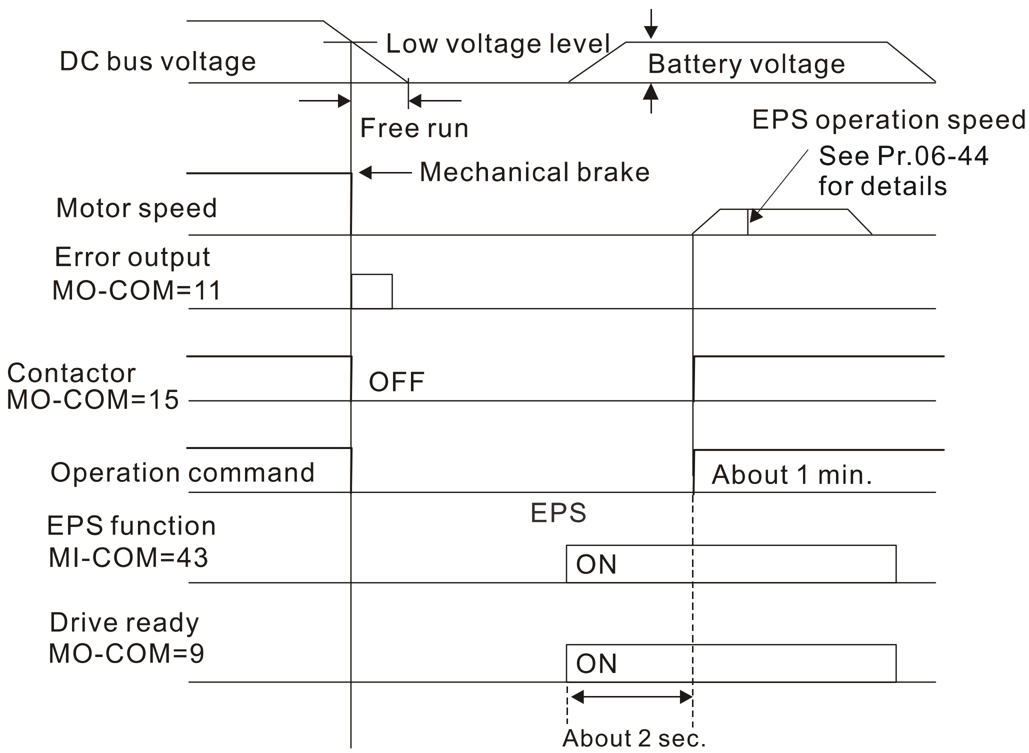



Before using emergency power, close MC ① and ③, and keep MC ② open.
Close MC ① before you close MC ③.
Before you remove the battery and before you close MC ②, open MC① and ③.

Frames C & D

2. When the voltage of the main power supply is lower than 140 $V_{DC}$ (230V series) / 280 $V_{DC}$ (460V series), connect the control power to one-phase UPS or battery.



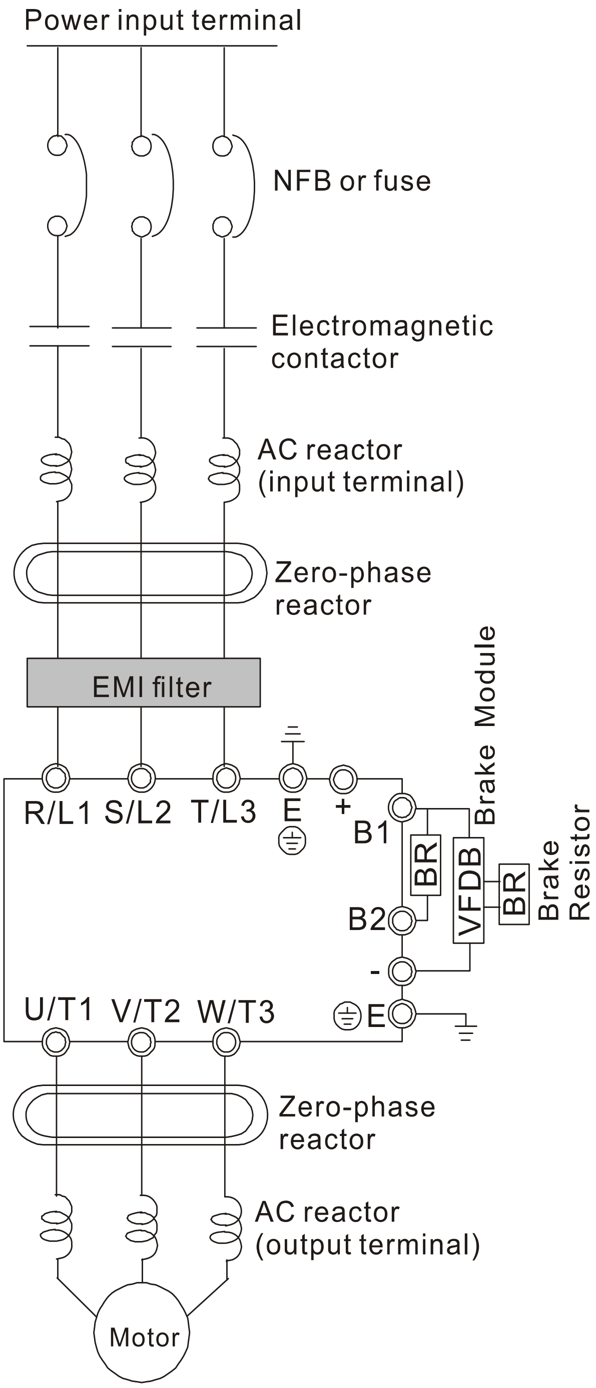




**Notes on Emergency Power Supply (EPS)**

When EPS is enabled (MI=43):

1. Do NOT make the fan run in order to prevent voltage drop during EPS.
2. Parameter settings cannot be saved and will be lost after cycling power.
3. Set the running speed through Pr.06-44.
4. Functions of low voltage and phase loss protection are unavailable.
5. Set the DC bus voltage through Pr.06-29.

## 3-2 System Wiring Diagram




| | |
|---|---|
| Power input terminal | Supply power according to the rated power specifications indicated in the manual (see Chapter 08 Specifications). |
| NFB or fuse | There may be a large inrush current during power on. See Section 6-2 NFB to select a suitable NFB or fuse. |
| Electromagnetic contactor | Switching the power ON/OFF on the primary side of the electromagnetic contactor can turn the integrated elevator device ON/OFF, but frequent switching can cause machine failure. Do not switch ON/OFF more than once an hour. Do not use the electromagnetic contactor as the power switch for the integrated elevator drive; doing so shortens the life of the integrated elevator drive. |
| AC reactor (input terminal) | When the main power supply capacity is greater than 1000 kVA, or when it switches into the phase capacitor, the instantaneous peak voltage and current generated may destroy the internal circuit of the integrated elevator drive. It is recommended that you install an AC reactor at input side in the integrated elevator drive. This also improves the power factor and reduces power harmonics.The wiring distance should be within 10 m. See Chapter 06 Optional Accessoires for details. |
| Zero phase reactor | Use to reduce radiated interference, especially in environments with audio devices, and reduce input and output side interference. The effective range is AM band to 10 MHz. See Chapter 06 Optional Accessoires for details. |
| EMC filter | Use to reduce electromagnetic interference. |
| Brake module & Brake resistor (BR) | Use to shorten the deceleration time of the motor. See Chapter 06 Optional Accessoires for details. |
| AC reactor (output terminal) | The motor cable length affects the size of the reflected wave on the motor end. It is recommended that you install an AC output reactor when the motor wiring length exceeds 20 meters. See Chapter 06 Optional Accessoires for details. |

# *Chapter 4 Main Circuit Terminals*

**CAUTION**

## Main input power terminals

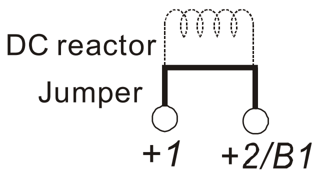
- ☑ Do not connect a three-phase model to one-phase power. R/L1, S/L2 and T/L3 have no phase-sequence requirement and can be connected in any sequence.
- ☑ You must install a NFB between the three-phase power input terminals and the main circuit terminals (R/L1, S/L2, T/L3). Add a magnetic contactor (MC) to the power input wiring to cut off power quickly and reduce malfunctions when the AC motor drive protection function activates. Both ends of the MC should have an R-C surge absorber.
- ☑ Tighten the screws in the main circuit terminal to prevent sparks caused by screws loosened due to vibration.
- ☑ Use voltage and current within the specifications in Chapter 08.
- ☑ When using a general ELB (Earth Leakage Breaker), select a current sensor with sensitivity of 200 mA or above and not less than 0.1 second operation time to avoid nuisance tripping. When choosing an ELB designed for the AC motor drive, choose a current sensor with sensitivity of 30 mA or above.
- ☑ Use shielded wire or conduit for the power wiring and ground the two ends of the shielding or conduit.
- ☑ Do NOT run and stop the AC motor drives by turning the power ON and OFF. Run and stop the AC motor drives by sending the RUN and STOP commands through the control terminals or the keypad. If you still need to run and stop the AC motor drives by turning the power ON and OFF, do so no more often than ONCE per hour.

## Output terminals of the main circuit

- ☑ When it is necessary to install a filter at the output side of the AC motor drive terminals U/T1, V/T2, W/T3, use an inductance filter. Do not use phase-compensation capacitors or L-C (Inductance-Capacitance) or R-C (Resistance-Capacitance) capacitors.
- ☑ DO NOT connect phase-compensation capacitors or surge absorbers at the output terminals of AC motor drives.
- ☑ Use well-insulated motors to prevent any electric leakage from the motors.

## Use terminals [+1, +2] for connecting a DC reactor.
## Use terminals [+1, +2/B1] for connecting a DC bus.

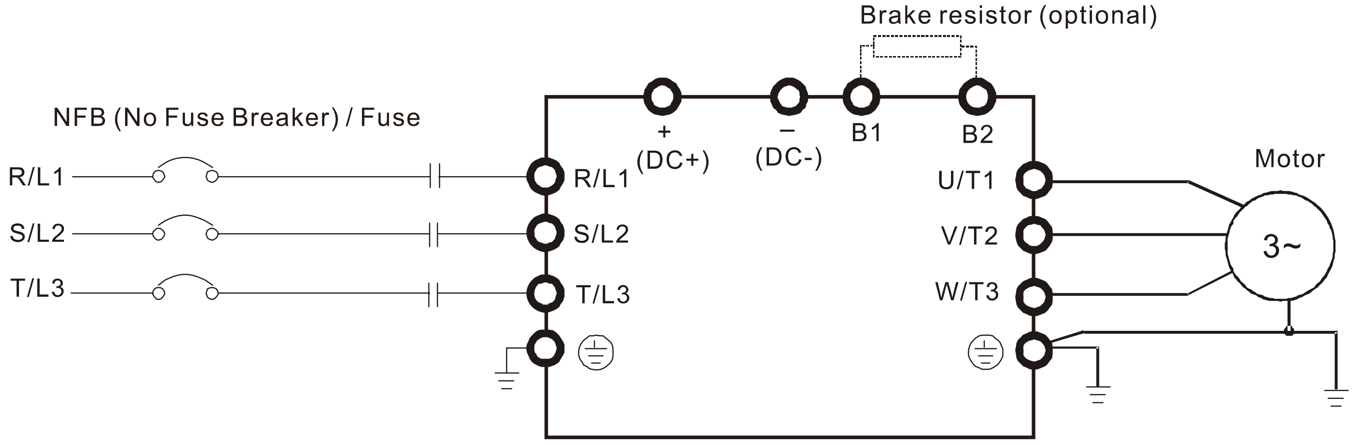
- ☑ Use these terminals to connect a DC reactor to improve the power factor and reduce harmonics. A jumper is connected to these terminals at the factory. Remove that jumper before connecting to a DC reactor.



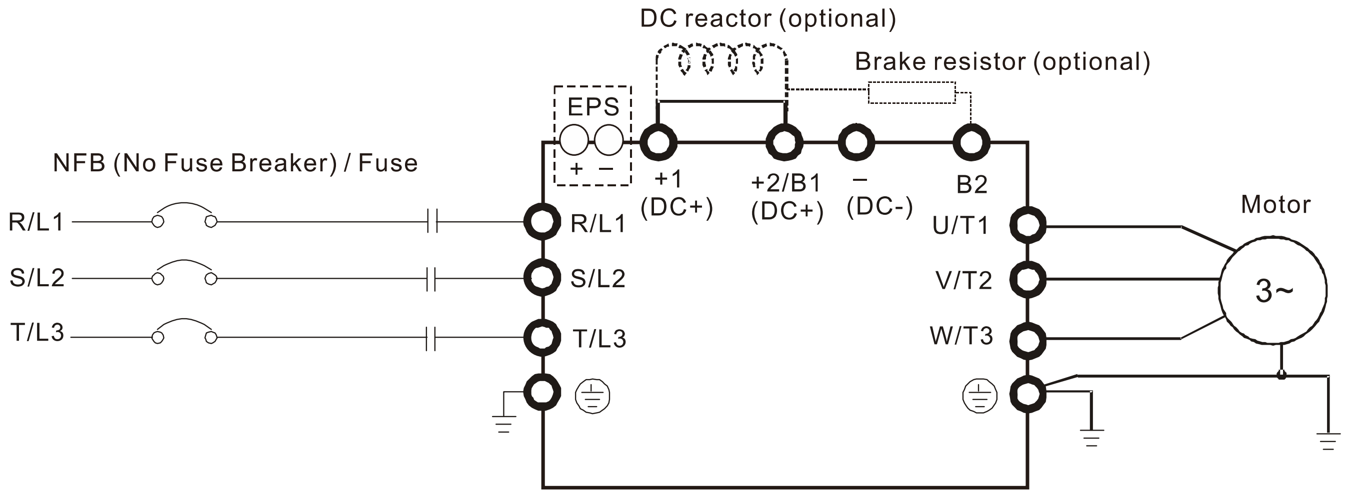

- ☑ Models above 22 kW do not have a built-in brake resistor. To improve resistance braking, connect an optional external brake resistor.
- ☑ When not in use, leave terminals +2/B1, (－) open.
- ☑ Short-circuiting [B2] or [－] to [+2/B1] damages the motor drive. Do NOT short-circuit those terminals.

# 4-1 Main Circuit Diagram

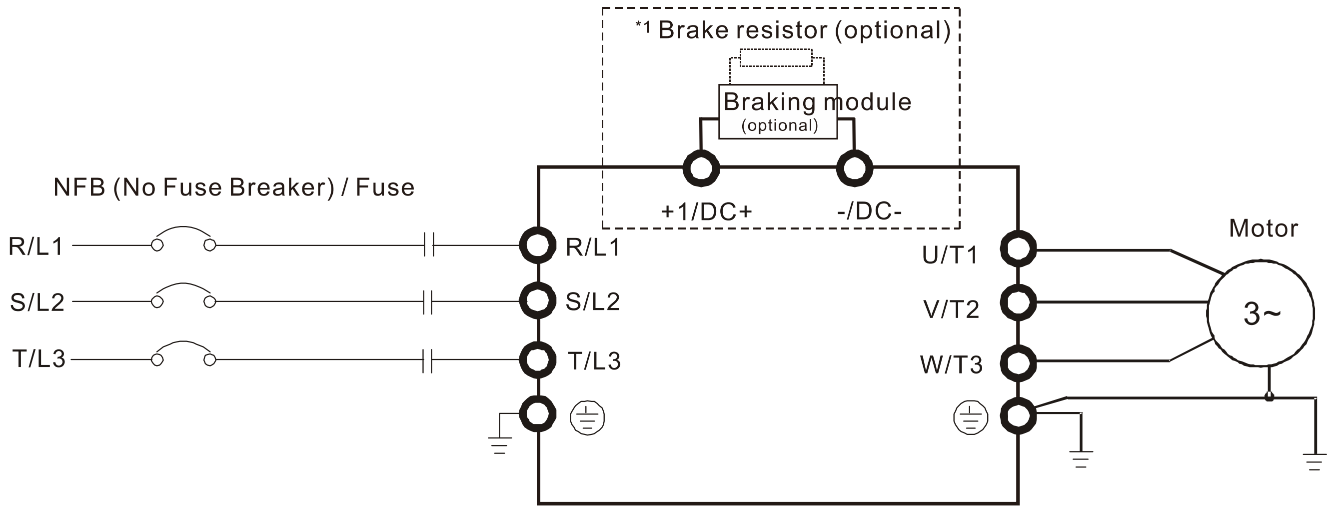
Frame B




Frames C & D



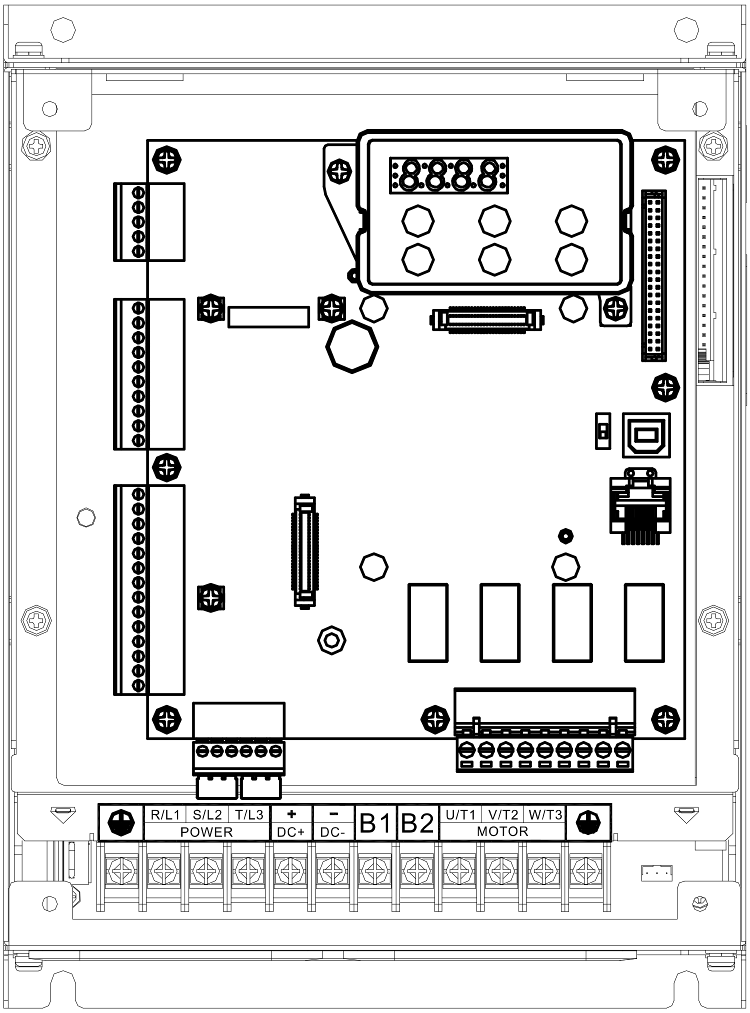

Frame E

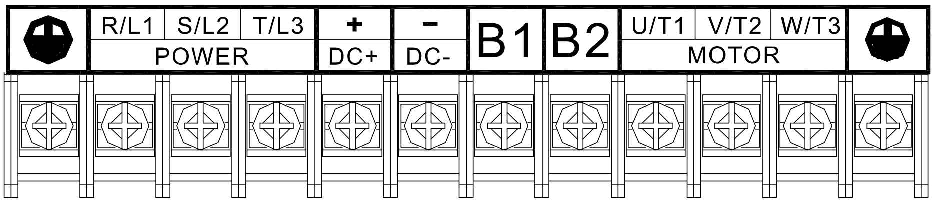


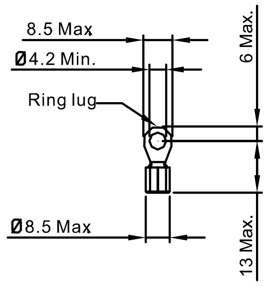
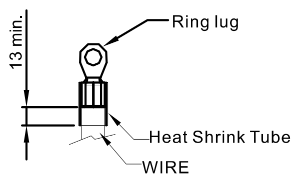
| Terminal Symbol | Description |
|---|---|
| EPS (+, -) | Backup power/ Emergency power connection terminal.<br>Note: EPS (Emergency Power Supply) input terminal supports only frames C & D. |
| R/L1, S/L2, T/L3 | Commercial power input terminal. |
| U/T1, V/T2, W/T3 | AC motor drive output terminals for connecting a three-phase induction motor. |
| +1, +2/B1 | Connections for DC reactor to improve the power factor. Remove the jumper before installing a DC reactor. Frame E has a built-in DC reactor. |
| +2/B1, B2 | Connections for brake resistor (optional). |
| ⏚ | Ground connection; comply with local regulations. |

## 4-2 Main Circuit Terminal Specifications

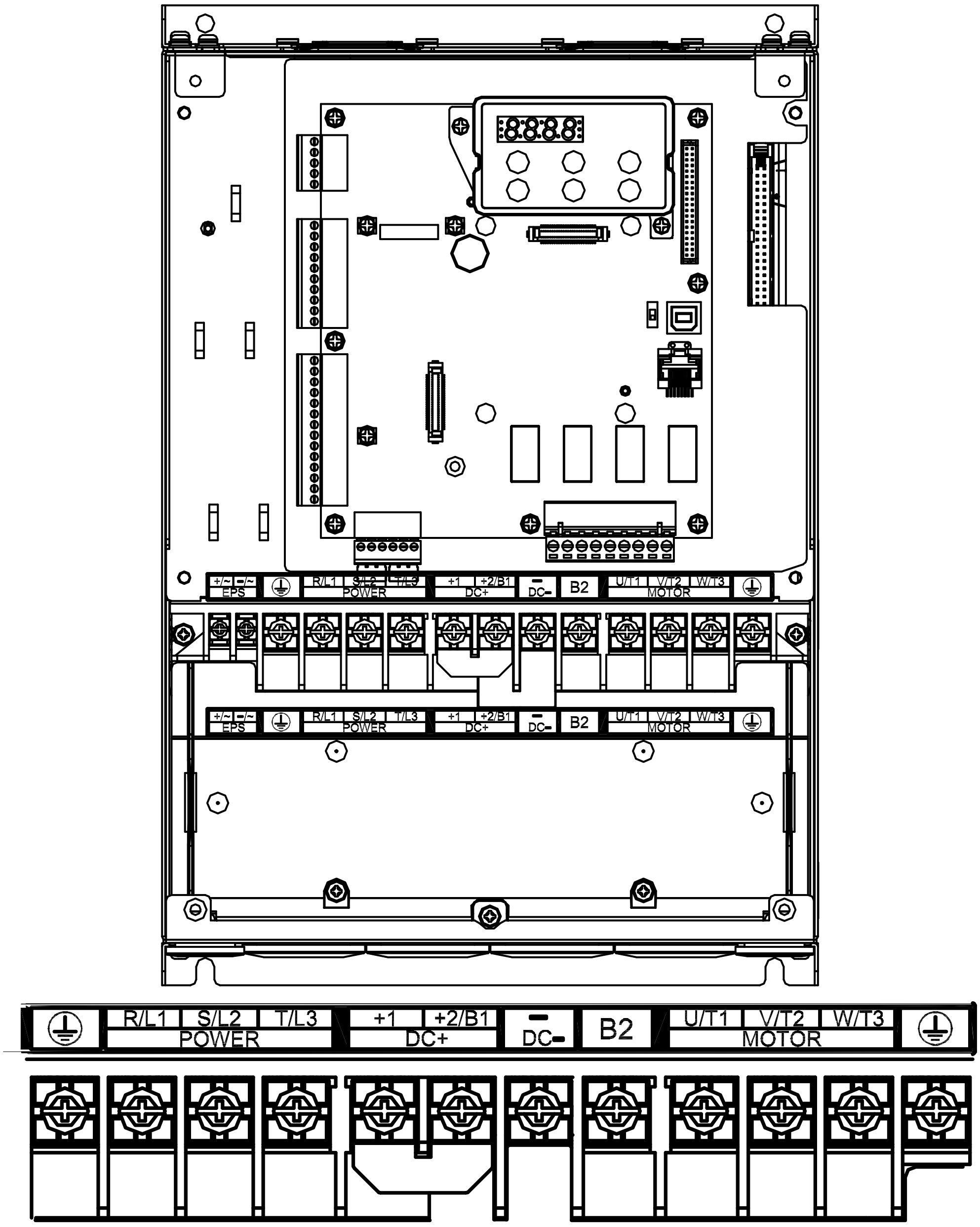
### Frame B




<table>
<tr><td colspan="5">Frame B</td></tr>
<tr><td rowspan="2">Model</td><td colspan="3">Main circuit terminals:<br>R/L1, S/L2, T/L3, U/T1, V/T2, W/T3, +(DC+), -(DC-), B1, B2, ⏚</td><td rowspan="2">NOTE<br>● Use Figure 1 to choose terminal wire size.<br>● As shown in Figure 2, use insulated heat shrink tubing that is resistant to at least 600 V to comply with UL and CSA regulations (600 V, YDPU2).</td></tr>
<tr><td>Maximum Wire Gauge</td><td>Minimum Wire Gauge</td><td>Screw Size Tightening Torque (±10%)</td></tr>
<tr><td>VFD022ED21S</td><td rowspan="4">5.3 mm²<br>[10 AWG]</td><td rowspan="2">2.1 mm²<br>[14 AWG]</td><td rowspan="4">M4<br>18 kg-cm<br>(15.6 lb-in.)<br>(1.7 N-m)</td><td rowspan="5"><br>Figure 1<br><br>Figure 2</td></tr>
<tr><td>VFD040ED43S</td></tr>
<tr><td>VFD037ED21S</td><td rowspan="2">3.3 mm²<br>[12 AWG]</td></tr>
<tr><td>VFD040ED23S</td></tr>
<tr><td colspan="4">For UL installation compliance, select copper wires with voltage rating of 600 V and temperature resistance of 75°C.</td></tr>
</table>

## Frame C




| Frame C | | | |
|---|---|---|---|
| Model | Main circuit terminals: R/L1, S/L2, T/L3, U/T1, V/T2, W/T3, +1, +2/B1, -, B2, ⏚ | | |
| | Maximum Wire Gauge | Minimum Wire Gauge | Screw Size Tightening Torque (±10%) |
| VFD055ED23S | 13.3 mm² [6 AWG] | 3.3 mm² [10 AWG] | M5 30 kg-cm (26 lb-in.) (2.9 N-m) |
| VFD110ED43S | | | |
| VFD055ED43S | | 3.3 mm² [12 AWG] | |
| VFD075ED43S | | | |
| VFD075ED23S | | 8.4 mm² [8 AWG] | |
| VFD150ED43S | | | |
| VFD185ED43S | | | |
| VFD110ED23S | | 13.3 mm² [6 AWG] | |
| For UL installation compliance, select copper wires with voltage rating of 600 V and temperature resistance of 75°C. | | | |

NOTE
- Use Figure 1 to choose terminal wire size.
- As shown in Figure 2, use insulated heat shrink tubing that is resistant to at least 600 V to comply with UL and CSA regulations (600 V, YDPU2).

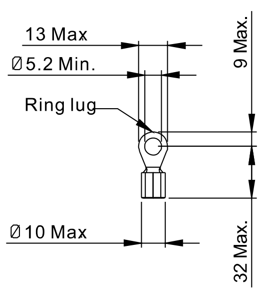



Figure 1

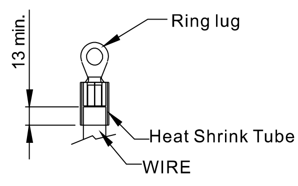
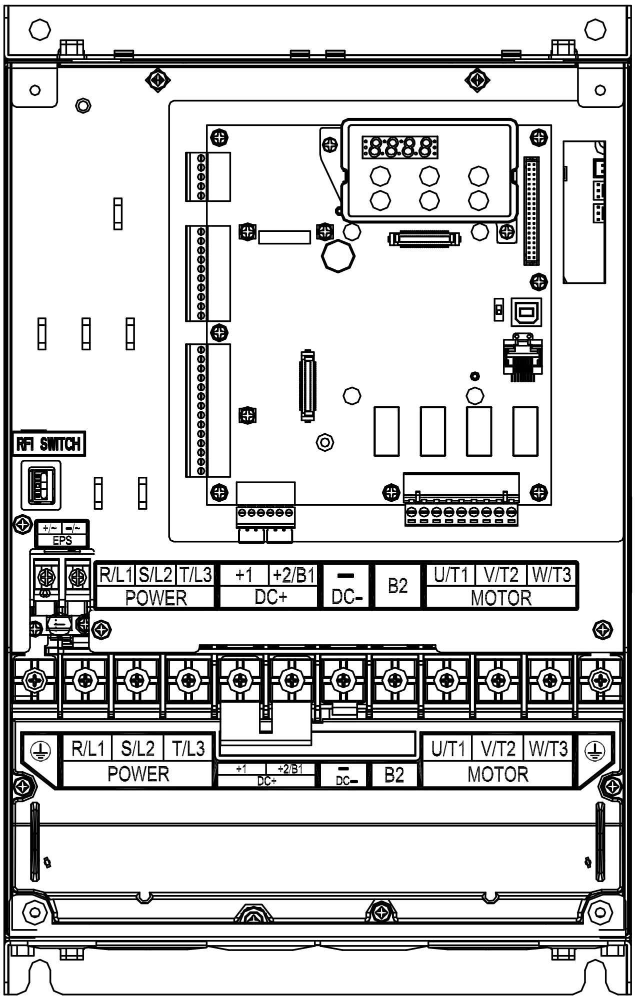
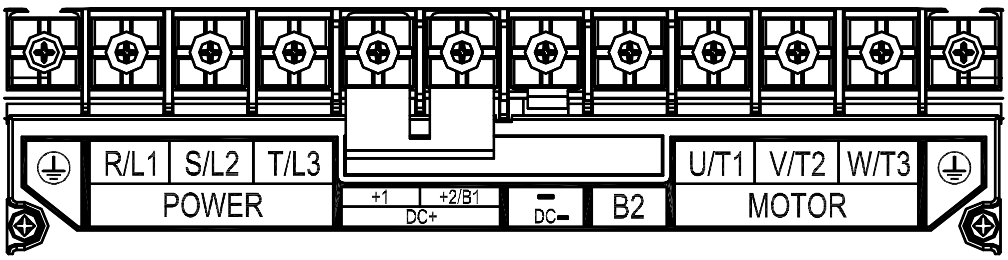



Figure 2

## Frame D




| Frame D | | | |
|---|---|---|---|
| Model | Main circuit terminals: R/L1, S/L2, T/L3, U/T1, V/T2, W/T3, +1, +2/B1, -, B2, ⏚ | | |
| | Maximum Wire Gauge | Minimum Wire Gauge | Screw Size Tightening Torque (±10%) |
| VFD150ED23S | 33.6 mm² [2 AWG] | 21.1 mm² [4 AWG] | M6 50 kg-cm (43.4 lb-in.) (4.9 N-m) |
| VFD300ED43S | | | |
| VFD185ED23S | | 26.7 mm² [3 AWG] | |
| VFD220ED43S | | 13.3 mm² [6 AWG] | |
| VFD220ED23S | | 33.6 mm² [2 AWG] | |
| For UL installation compliance, select copper wires with voltage rating of 600 V and temperature resistance of 75°C. | | | |

NOTE

- Use Figure 1 to choose terminal wire size.
- As shown in Figure 2, use insulated heat shrink tubing that is resistant to at least 600 V to comply with UL and CSA regulations (600 V, YDPU2).

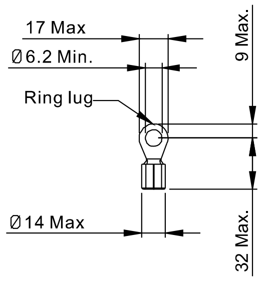



Figure 1

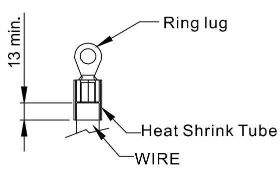
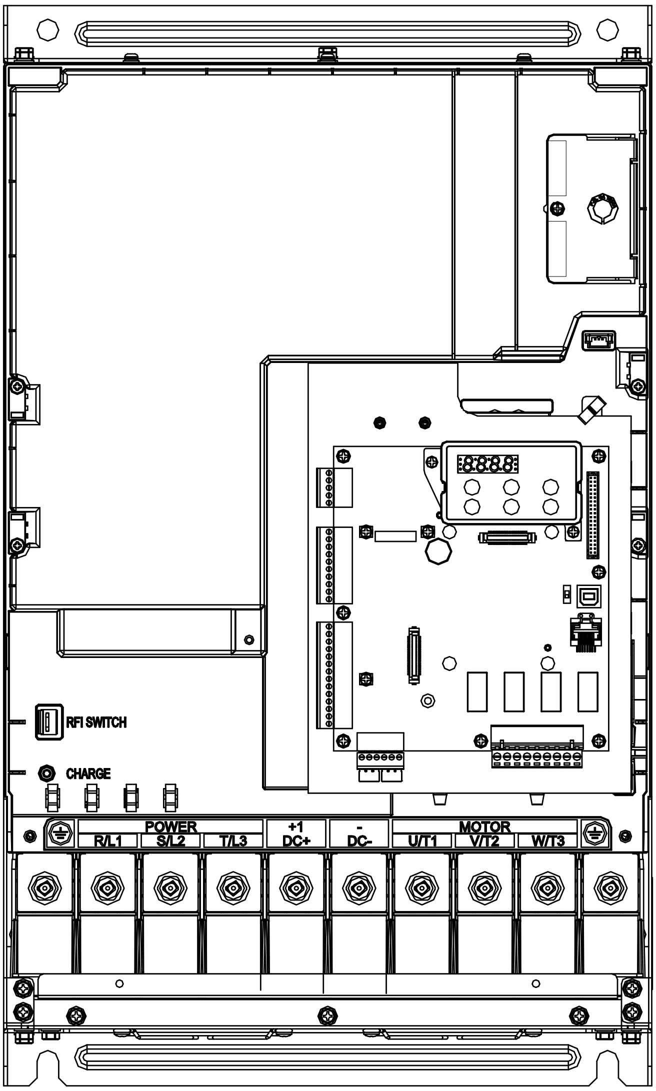
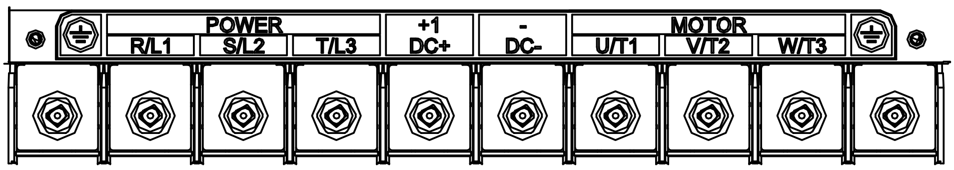
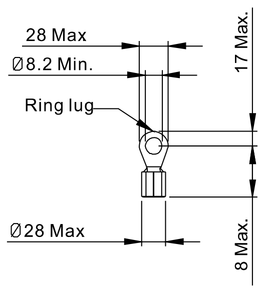
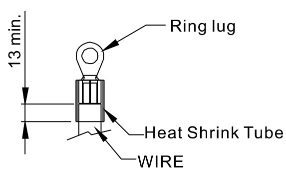



Figure 2

## Frame E




<table>
<tr><td colspan="5">Frame E</td></tr>
<tr><td rowspan="2">Model</td><td colspan="3">Main circuit terminals:<br>R/L1, S/L2, T/L3, U/T1, V/T2, W/T3, +1(DC+), -(DC-), ⏚</td><td>NOTE<br>● Use Figure 1 to choose terminal wire size.<br>● As shown in Figure 2, use insulated heat shrink tubing that is resistant to at least 600 V to comply with UL and CSA regulations (600 V, YDPU2).</td></tr>
<tr><td>Maximum Wire Gauge</td><td>Minimum Wire Gauge</td><td>Screw Size Tightening Torque (±10%)</td><td rowspan="8"><br>Figure 1<br><br>Figure 2</td></tr>
<tr><td>VFD370ED43S</td><td rowspan="6">152 mm²<br>[300 MCM]</td><td>53.5 mm²<br>[1/0 AWG]</td><td rowspan="6">M8<br>200 kg-cm<br>(173 lb-in.)<br>(19.6 N-m)</td></tr>
<tr><td>VFD450ED43S</td><td>67.4 mm²<br>[2/0 AWG]</td></tr>
<tr><td>VFD300ED23S<br>VFD550ED43S</td><td>107 mm²<br>[4/0 AWG]</td></tr>
<tr><td>VFD370ED23S<br>VFD750ED43S</td><td>152 mm²<br>[300 MCM]</td></tr>
<tr><td colspan="4">For UL installation compliance, select copper wires with voltage rating of 600 V and temperature resistance of 75°C.</td></tr>
</table>

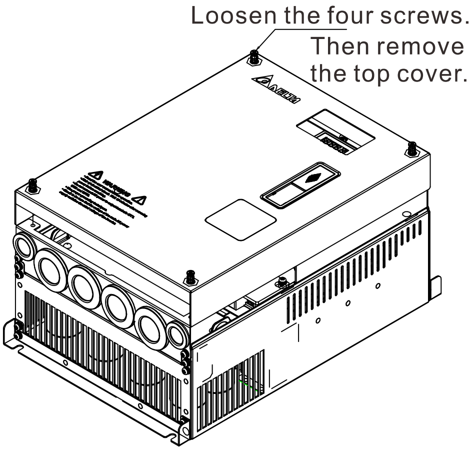
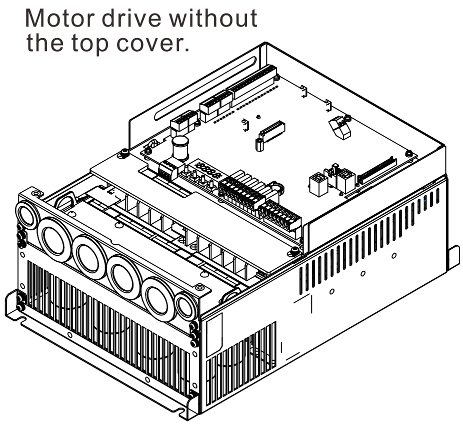
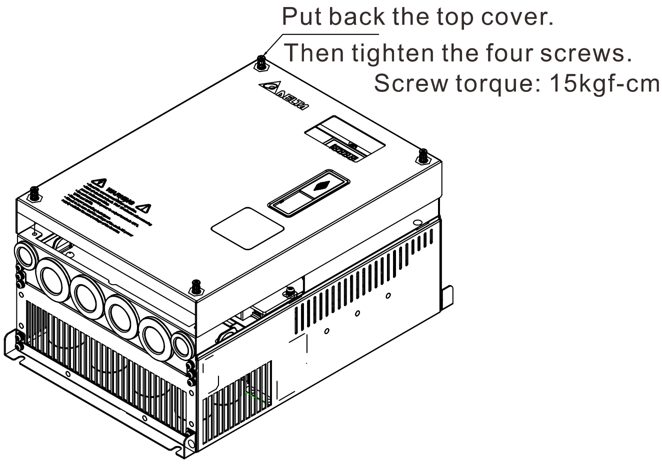
# Chapter 5 Control Terminals

## 5-1 Remove the Cover before Wiring

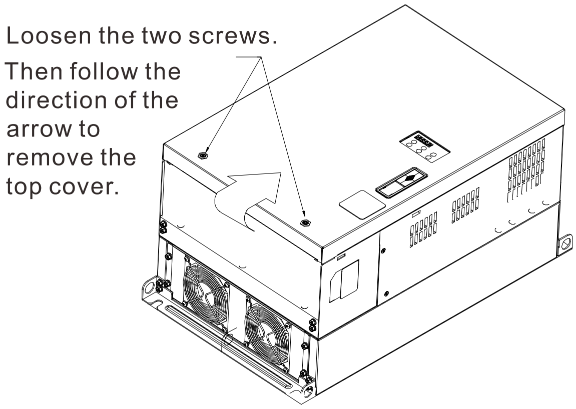
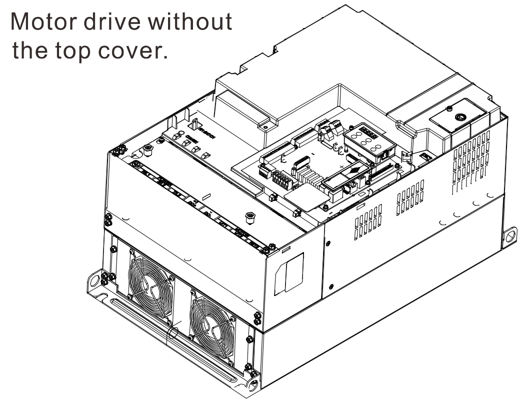
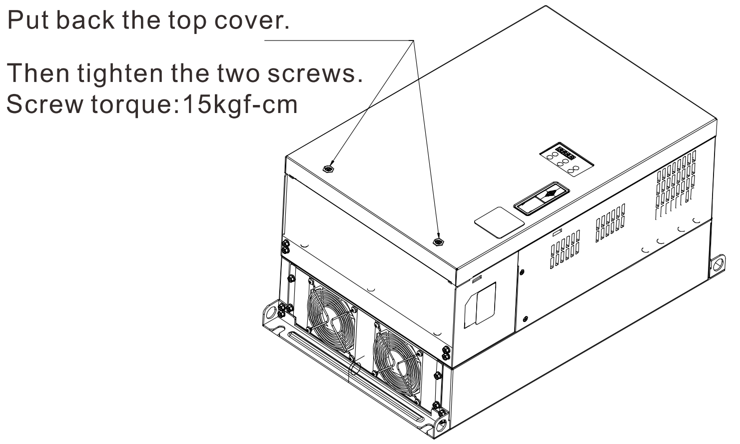
Remove the top cover before wiring the multi-function input and output terminals

NOTE The motor drives' figures shown below are for reference only. The actual motor drives may look different.

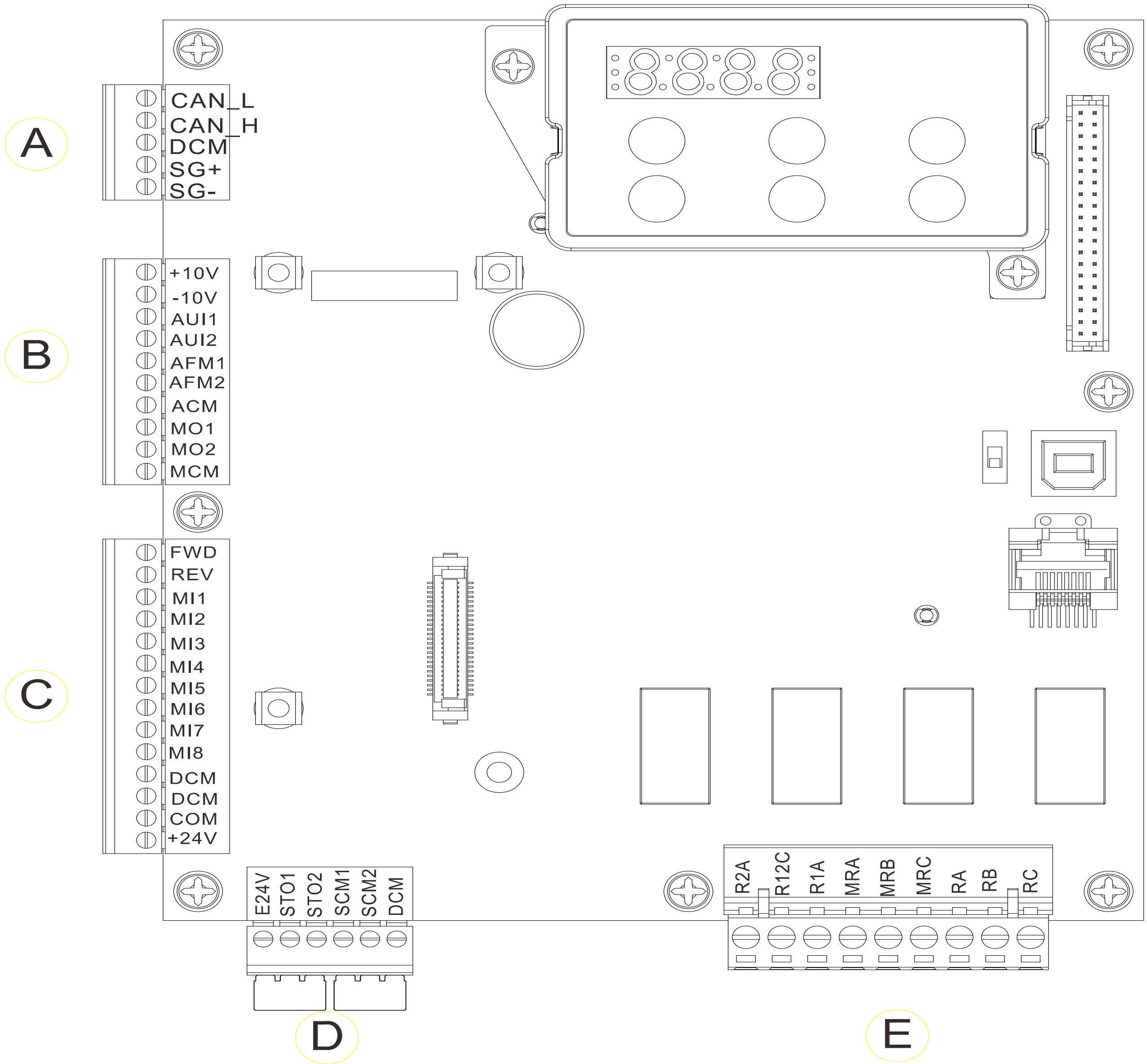
Frames B, C & D

<table>
<tr><th>Step 1</th><th>Step 2</th></tr>
<tr><td>
</td><td>
</td></tr>
<tr><th colspan="2">Step 3</th></tr>
<tr><td colspan="2">
</td></tr>
</table>

Frame E

<table>
<tr><th>Step 1</th><th>Step 2</th></tr>
<tr><td>
</td><td>
</td></tr>
<tr><th colspan="2">Step 3</th></tr>
<tr><td colspan="2">
</td></tr>
</table>

## 5-2 Control Terminal Specifications



## 5-3 Control Circuit Terminals

**Terminal sockets A, B, C**

Torque: 2 kg-cm [1.7 lb-in.] (0.20 Nm)

Wire gauge: 0.08–2.07 mm² [28–14 AWG]

**Terminal socket D**

Torque: 2 kg-cm [1.7 lb-in.] (0.20 Nm)

**Terminal socket E**

Torque: 5.2 kg-cm [4.5 lb-in.] (0.51 Nm)

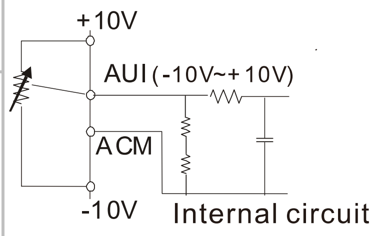
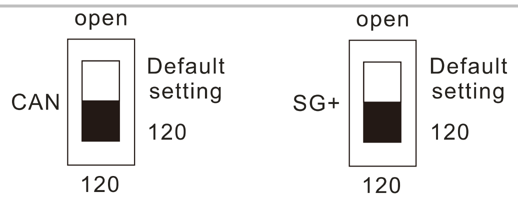
Wire gauge: 0.08–3.33 mm² [28–12 AWG]

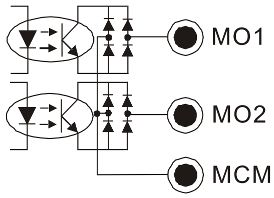
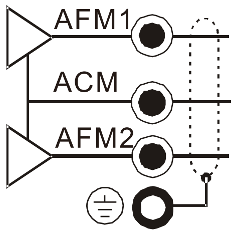
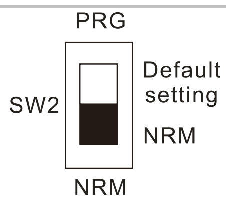
To comply with UL standards, use copper wires in the installation that are able to withstand 600 V, 75ºC environments.

**Control Board Switch**

NRM = Normal

| Terminals | Terminal Function | Default (NPN mode) |
|---|---|---|
| +24 V / E24 V | Digital control signal common terminal (Source) | +24 V±5% 200 mA |
| COM | Digital control signal common terminal (Sink) | Common terminal for multi-function input terminals |
| FWD | Forward-Stop command | FWD-DCM:<br>ON = run in forward<br>OFF = decelerate to stop |
| REV | Reverse-Stop command | REV-DCM:<br>ON = run in reverse<br>OFF = decelerate to stop |
| MI1 – MI8 | Multi-function input 1–8 | Refer to parameters Pr.02-01–Pr.02-08 to program the multi-function inputs MI1–MI8.<br>Source mode:<br>ON: the activation current is 6.5 mA ≥ 11 $V_{DC}$<br>OFF: allowable leakage current 10 μA ≤ 11 $V_{DC}$ |
| DCM | Digital frequency signal common terminal | |
| SCM1 | The default is short-circuited (E24V/STO1/STO2).<br>The default is short-circuited (SCM1/SCM2/DCM).<br>Power cutoff safety function for EN954-1 and IEC/EN61508.<br>When STO1–SCM1 and STO2–SCM2 are ON, the activation current is 3.3 mA ≥ 11 $V_{DC}$. | |
| SCM2 | | |
| STO1 | | |
| STO2 | | |
| +10 V | Potentiometer power supply | Power supply for analog frequency setting: +10 $V_{DC}$ 20 mA |
| -10 V | Potentiometer power supply | Power supply for analog frequency setting: -10 $V_{DC}$ 20 mA |

| | | |
|---|---|---|
| AUI1 | Analog voltage frequency command<br><br> | Impedance: 20 kΩ<br>Range: -10–10 $V_{DC}$ = 0–Maximum Output Frequency (Pr.01-00) |
| AUI2 | | |
| ACM | Analog signal common terminal control | Analog signal common terminal |
| RA | Multi-function relay output A (N.O.) | 1. User-defined function<br>2. Resistive Load<br>3 A (N.O.) / 3 A (N.C.) 250 $V_{AC}$<br>5 A (N.O.) /3 A (N.C.) 30 $V_{DC}$<br>(minimum 5 $V_{DC}$, 10 mA)<br><br>To output different kinds of monitoring signals such as motor drive in operation, frequency reached, and overload indication. |
| RB | Multi-function relay output A (N.C.) | |
| RC | Multi-function relay output B (Default: error indication) | |
| MRA | Multi-function output terminal (N.O.) | |
| MRB | Multi-function output terminal (N.C.) | |
| MRC | Multi-function output terminal (Default: operating Indication) | |
| R1A | Multi-function output terminal A (N.O.) | |
| R2A | Multi-function output terminal A (N.O.) | |
| R12C | Multi-function output terminal (Default: no function) | |
| SG1+ | Modbus RS-485 | SG1+ switch: terminator 120 ohm (default) / open |
| SG1- | Modbus RS-485 | |
| | | <br> |
| CAN_L | CAN Bus | DIP switch: terminator 120 ohm (default) / open |
| CAN_H | CAN Bus | |
| MO1 | Multi-function output terminal 1 (photo coupler) | The AC motor drive outputs various monitoring signals, such as drive in operation, frequency reached, and overload indication through a transistor (open collector). |

| | | |
|---|---|---|
| MO2 | Multi-function output terminal 2 (photo coupler) |  |
| MCM | Multi-function output common terminal (photo coupler) | Maximum 48 $V_{DC}$ 50 mA |
| AFM1 |  | 0-10 V, max. output current: 2 mA, max. load: 5 kΩ<br>-10–10 V, max. output current: 2 mA, max. load: 5 kΩ<br>Maximum output current: 2 mA<br>Resolution: 0–10 V, corresponds to the maximum operating frequency.<br>Range: 0–10 V→ -10–10 V |
| AFM2 | | |
| RJ45 | PINS 1, 2, 6, 7: Reserved<br>PIN 3: SGND<br>PIN 4: SG-<br>PIN 5: SG+<br>PIN 8: EV | |
| SW2 | Switching USB port | <br>DIP switch: NRM (default) / PRG (use this side of the switch to update firmware). Updating firmware should be done by qualified motor drive service personnel only. Do NOT try to update the firmware by yourself. |

[The page intentionally left blank]

# Chapter 6 Optional Accessories

The optional accessories listed in this chapter are available upon request. Installing additional accessories to your drive can substantially improve the drive's performance. Select accessories according to your needs or contact your local distributor for suggestions.

# 6-1 Brake Resistors and Brake Units Used in AC Motor Drives

## Recommended Model Selection

| Voltage | Delta's Motor Drive Model | IM 10% ED*1 | | | PM 30% ED*2 | | |
|---|---|---|---|---|---|---|---|
| | | Min. Resistor Value*3 (Ω) | Suggested Resistor Value*4 (Ω) | Suggested Braking Power (kW) | Min. Resistor Value*3 (Ω) | Suggested Resistor Value*4 (Ω) | Suggested Braking Power (kW) |
| 230V | VFD022ED21S | 38.0 | 70.0 | 0.3 | 38.0 | 50.0 | 1.0 |
| | VFD037ED21S | 19.0 | 30.0 | 0.5 | 19.0 | 32.0 | 1.5 |
| | VFD040ED23S | 19.0 | 30.0 | 0.5 | 19.0 | 32.0 | 1.5 |
| | VFD055ED23S | 15.6 | 20.0 | 1.0 | 15.6 | 25.0 | 2.0 |
| | VFD075ED23S | 11.5 | 20.0 | 1.0 | 11.5 | 16.7 | 3.0 |
| | VFD110ED23S | 9.5 | 13.0 | 1.5 | 9.5 | 12.5 | 4.0 |
| | VFD150ED23S | 8.3 | 10.0 | 2.0 | 8.3 | 10.0 | 5.0 |
| | VFD185ED23S | 5.8 | 8.0 | 2.0 | 5.8 | 7.8 | 7.5 |
| | VFD220ED23S | 5.8 | 6.6 | 3.0 | 5.8 | 6.5 | 9.0 |
| | VFD300ED23S | 4.8 | 5.1 | 4.0 | 4.8 | 5.0 | 10.0 |
| | VFD370ED23S | 3.2 | 3.9 | 4.8 | 3.2 | 3.6 | 14.0 |
| 460V | VFD040ED43S | 54.3 | 100.0 | 0.5 | 54.3 | 100.0 | 2.0 |
| | VFD055ED43S | 48.4 | 75.0 | 1.0 | 48.4 | 100.0 | 2.0 |
| | VFD075ED43S | 39.4 | 75.0 | 1.0 | 39.4 | 60.0 | 3.0 |
| | VFD110ED43S | 30.8 | 43.0 | 1.5 | 30.8 | 50.0 | 4.0 |
| | VFD150ED43S | 25.0 | 32.0 | 2.0 | 25 | 39.0 | 6.0 |
| | VFD185ED43S | 20.8 | 32.0 | 2.0 | 20.8 | 26.0 | 7.2 |
| | VFD220ED43S | 19.0 | 26.0 | 3.0 | 19.0 | 26.0 | 9.0 |
| | VFD300ED43S | 14.1 | 20.0 | 4.0 | 14.1 | 19.5 | 12.0 |
| | VFD370ED43S | 12.7 | 14.3 | 4.5 | 13.8 | 15.6 | 15.0 |
| | VFD450ED43S | 12.7 | 13.0 | 6.0 | 10.3 | 13.0 | 18.0 |
| | VFD550ED43S | 9.5 | 10.2 | 8.0 | 6.9 | 9.8 | 19.2 |
| | VFD750ED43S | 6.3 | 7.2 | 9.0 | 6.4 | 7.1 | 26.4 |

*1 The brake resistor should be able to endure 10 times the overload capacity.

*2 The brake resistor should be able to endure 3.3 times the overload capacity.

*3 If you choose other brake resistors instead of Delta's, calculate the maximum power and average power of the selected braking power to ensure that they meet the requirements. Maximum power: $Vb^2/R$; average power: $Vb^2/R \times ED\%$. (Vb stands for braking voltage; R stands for brake resistor value.)

*4 The calculation of the brake resistor value and braking power is based on Delta's brake resistor.

## IM Elevator System (Using Delta's Brake Resistor)

| Voltage | Applicable Delta's Motor Drive | | 125% Braking Torque/10% ED*1 | | | | | | | Max. Braking Torque | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | HP | Model | Braking Torque*2 (kg-m) | Brake Unit | | Delta's Brake Resistor*3 | | | Braking Current (A)*4 | Min. Resistor Value (Ω) | Max. Total Braking Current (A) | Peak Power (kW) |
| | | | | VFDB | # | Part No. | # | Configuration | | | | |
| 230V | 3 | VFD022ED21S | 1.5 | | | BR300W070 | 1 | | 5.4 | 38.0 | 10.0 | 3.8 |
| 230V | 5 | VFD037ED21S | 2.5 | | | BR500W030 | 1 | | 12.7 | 19.0 | 20.0 | 7.6 |
| 230V | 5 | VFD040ED23S | 2.5 | | | BR500W030 | 1 | | 12.7 | 19.0 | 20.0 | 7.6 |
| 230V | 7.5 | VFD055ED23S | 3.7 | | | BR1K0W020 | 1 | | 19.0 | 15.6 | 24.4 | 9.3 |
| 230V | 10 | VFD075ED23S | 5.1 | | | BR1K0W020 | 1 | | 19.0 | 11.5 | 33.0 | 12.5 |
| 230V | 15 | VFD110ED23S | 7.5 | | | BR1K5W013 | 1 | | 29.2 | 9.5 | 40.0 | 15.2 |
| 230V | 20 | VFD150ED23S | 10.2 | | | BR1K0W020 | 2 | 2 parallel | 38.0 | 8.3 | 46.0 | 17.5 |
| 230V | 25 | VFD185ED23S | 12.2 | | | BR1K0W016 | 2 | 2 parallel | 47.5 | 5.8 | 66.0 | 25.1 |
| 230V | 30 | VFD220ED23S | 14.9 | | | BR1K5W3P3 | 2 | 2 in series | 57.6 | 5.8 | 66.0 | 25.1 |
| 230V | 40 | VFD300ED23S | 20.3 | 2015 | 2 | BR1K0W5P1 | 4 | 2 in series<br>2 parallel | 74.5 | 4.8 | 80.0 | 30.4 |
| 230V | 50 | VFD370ED23S | 25.1 | 2022 | 2 | BR1K2W3P9 | 4 | 2 in series<br>2 parallel | 97.4 | 3.2 | 120.0 | 45.6 |
| 460V | 5 | VFD040ED43S | 2.7 | | | BR500W100 | 1 | | 7.6 | 54.3 | 14.0 | 10.6 |
| 460V | 7.5 | VFD055ED43S | 3.7 | | | BR1K0W075 | 1 | | 10.1 | 48.4 | 15.7 | 11.9 |
| 460V | 10 | VFD075ED43S | 5.1 | | | BR1K0W075 | 1 | | 10.1 | 39.4 | 19.3 | 14.7 |
| 460V | 15 | VFD110ED43S | 7.5 | | | BR1K5W043 | 1 | | 17.7 | 30.8 | 24.7 | 18.8 |
| 460V | 20 | VFD150ED43S | 10.1 | | | BR1K0W016 | 2 | 2 in series | 23.8 | 25.0 | 30.4 | 23.1 |
| 460V | 25 | VFD185ED43S | 12.5 | | | BR1K0W016 | 2 | 2 in series | 23.8 | 20.8 | 36.5 | 27.7 |
| 460V | 30 | VFD220ED43S | 14.9 | | | BR1K5W013 | 2 | 2 in series | 29.2 | 19.0 | 40.0 | 30.4 |
| 460V | 40 | VFD300ED43S | 20.3 | | | BR1K0W020 | 4 | 2 in series<br>2 parallel | 38.0 | 14.1 | 54.0 | 41.0 |
| 460V | 50 | VFD370ED43S | 25.0 | 4045 | 1 | BR1K5W043 | 3 | 3 parallel | 53.0 | 12.7 | 60.0 | 45.6 |
| 460V | 60 | VFD450ED43S | 30.4 | 4045 | 1 | BR1K5W013 | 4 | 2 in series<br>2 parallel | 58.5 | 12.7 | 60.0 | 45.6 |
| 460V | 75 | VFD550ED43S | 37.2 | 4030 | 2 | BR1K0W5P1 | 8 | 4 in series<br>2 parallel | 74.5 | 9.5 | 80.0 | 60.8 |
| 460V | 100 | VFD750ED43S | 50.7 | 4045 | 2 | BR1K5W043 | 6 | 6 parallel | 106.0 | 6.3 | 120.0 | 91.2 |

*1 Calculation of 125% braking torque: (kW)*125%*0.8; where 0.8 is the motor efficiency.
Since there is a resistor power consumption limit, the longest operation time for 10% ED is 10 seconds (ON: 10 seconds / OFF: 90 seconds).

*2 The calculation of the brake resistor is based on a four-pole motor (1800 rpm).

*3 To dissipate heat, mount a resistors of 400 W or lower to a frame to keep the surface temperature below 250°C (482°F). Fix a resistor of 1000 W or higher to a surface to keep the surface temperature below 600°C (1112°F). (If the resistor temperature is higher than 350°C, install extra cooling. If the resistor temperature is higher than the temperature limit, increase the size of the resistor.)

*4 The calculation of the braking current is based on Delta's brake resistor and default braking voltage ($220V_{AC}$: $380V_{DC}$; $440V_{AC}$: $760V_{DC}$).

## PM Elevator System (Using Delta's Brake Resistor)

| Voltage | Applicable Delta's Motor Drive | | 125% Braking Torque/30% ED*1 | | | | | | Max. Braking Torque | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | HP | Model | Braking Torque*2 (kg-m) | Brake Unit | | Delta's Brake Resistor *3 | | | Braking Current (A)*4 | Min. Resistor Value (Ω) | Max. Total Braking Current (A) | Peak Power (kW) |
| | | | | VFDB | # | Part No. | # | Configuration | | | | |
| 230V | 3 | VFD022ED21S | 1.5 | | | BR1K0W050 | 1 | | 7.6 | 38.0 | 10.0 | 3.8 |
| | 5 | VFD037ED21S | 2.5 | | | BR1K0W016 | 2 | 2 in series | 11.9 | 19.0 | 20.0 | 7.6 |
| | 5 | VFD040ED23S | 2.5 | | | BR1K0W016 | 2 | 2 in series | 11.9 | 19.0 | 20.0 | 7.6 |
| | 7.5 | VFD055ED23S | 3.7 | | | BR1K0W050 | 2 | 2 parallel | 15.2 | 15.6 | 24.4 | 9.3 |
| | 10 | VFD075ED23S | 5.1 | | | BR1K0W050 | 3 | 3 parallel | 22.8 | 11.5 | 33.0 | 12.5 |
| | 15 | VFD110ED23S | 7.5 | | | BR1K0W050 | 4 | 4 parallel | 30.4 | 9.5 | 40.0 | 15.2 |
| | 20 | VFD150ED23S | 10.2 | | | BR1K0W050 | 5 | 5 parallel | 38.0 | 8.3 | 46.0 | 17.5 |
| | 25 | VFD185ED23S | 12.2 | | | BR1K5W039 | 5 | 5 parallel | 48.7 | 5.8 | 66.0 | 25.1 |
| | 30 | VFD220ED23S | 14.9 | | | BR1K5W039 | 6 | 6 parallel | 58.5 | 5.8 | 66.0 | 25.1 |
| | 40 | VFD300ED23S | 20.3 | 2015 | 2 | BR1K0W050 | 10 | 10 parallel | 76.0 | 4.8 | 80.0 | 30.4 |
| | 50 | VFD370ED23S | 25.1 | 2022 | 2 | BR1K0W050 | 14 | 14 parallel | 106.4 | 3.2 | 120.0 | 45.6 |
| 460V | 5 | VFD040ED43S | 2.7 | | | BR1K0W050 | 2 | 2 in series | 7.6 | 54.3 | 14.0 | 10.6 |
| | 7.5 | VFD055ED43S | 3.7 | | | BR1K0W050 | 2 | 2 in series | 7.6 | 48.4 | 15.7 | 11.9 |
| | 10 | VFD075ED43S | 5.1 | | | BR1K0W020 | 3 | 3 in series | 12.7 | 39.4 | 19.3 | 14.7 |
| | 15 | VFD110ED43S | 7.5 | | | BR1K0W050 | 4 | 2 in series 2 parallel | 15.2 | 30.8 | 24.7 | 18.8 |
| | 20 | VFD150ED43S | 10.1 | | | BR1K5W039 | 4 | 2 in series 2 parallel | 19.5 | 25.0 | 30.4 | 23.1 |
| | 25 | VFD185ED43S | 12.5 | | | BR1k2W039 | 6 | 2 in series 3 parallel | 29.2 | 20.8 | 36.5 | 27.7 |
| | 30 | VFD220ED43S | 14.9 | | | BR1K5W039 | 6 | 2 in series 3 parallel | 29.2 | 19.0 | 40.0 | 30.4 |
| | 40 | VFD300ED43S | 20.3 | | | BR1K5W039 | 8 | 2 in series 4 parallel | 39.0 | 14.1 | 54.0 | 41.0 |
| | 50 | VFD370ED43S | 25.0 | 4045 | 1 | BR1K5W039 | 10 | 2 in series 5 parallel | 48.7 | 13.8 | 55.0 | 41.8 |
| | 60 | VFD450ED43S | 30.4 | 4030 | 2 | BR1K5W039 | 12 | 2 in series 6 parallel | 58.5 | 10.3 | 74.0 | 56.2 |
| | 75 | VFD550ED43S | 37.2 | 4045 | 2 | BR1k2W039 | 16 | 2 in series 8 parallel | 77.9 | 6.9 | 110.0 | 83.6 |
| | 100 | VFD750ED43S | 50.7 | 4110 | 1 | BR1k2W039 | 22 | 2 in series 11 parallel | 107.2 | 6.4 | 118.0 | 89.7 |

*1 Calculation of 125% braking torque: (kW)*125%*0.8; where 0.8 is the motor efficiency.
Since there is a resistor power consumption limit, the longest operation time for 30% ED is 30 seconds (ON: 30 seconds / OFF: 70 seconds).

*2 The calculation of the brake resistor is based on a four-pole motor (1800 rpm).

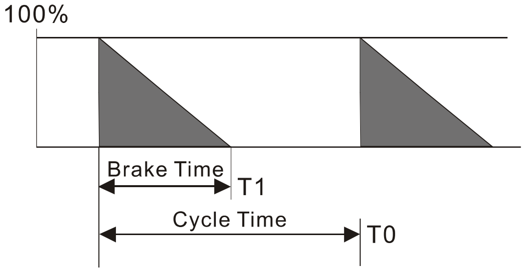
*3 To dissipate heat, mount a resistors of 400 W or lower to a frame to keep the surface temperature below 250°C (482°F). Fix a resistor of 1000 W or higher to a surface to keep the surface temperature below 600°C (1112°F). (If the resistor temperature is higher than 350°C, install extra cooling. If the resistor temperature is higher than the temperature limit, increase the size of the resistor.)

*4 The calculation of the braking current is based on Delta's brake resistor and default braking voltage (220$V_{AC}$: 380$V_{DC}$; 440$V_{AC}$: 760$V_{DC}$).

**NOTE**

1. Select the resistance value, power and brake usage (ED %) according to Delta rules.

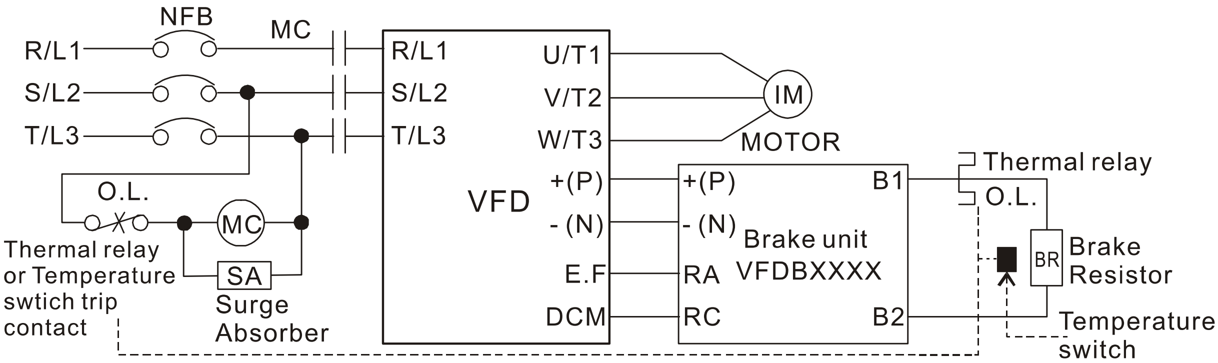
   Definition for Brake Usage ED%




ED% = T1 / T0 x 100(%)

Explanation:
Brake usage ED (%) is the amount of time needed for the brake unit and brake resistor to dissipate heat generated by braking. When the brake resistor heats up, the resistance increases with temperature, and braking torque decreases accordingly.

   For safety, install a thermal overload relay between the brake unit and the brake resistor in conjunction with the magnetic contactor (MC) at the drive mains input for additional protection. The thermal overload relay protects the brake resistor from overheat damage due to frequent or continuous braking. Under such circumstances, turn off the power to prevent damage to the brake resistor and the drive. NOTE: Never use it to disconnect the brake resistor.

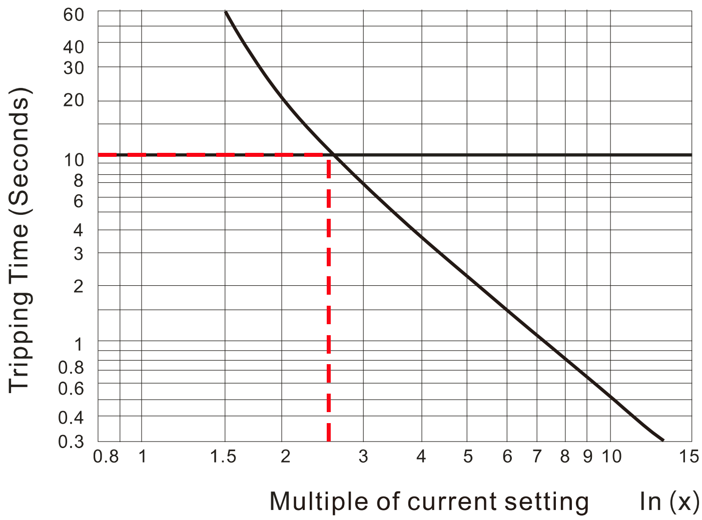



   - When the drive is equipped with a DC reactor, read the user manual for the correct wiring for the brake unit input circuit +(P).
   - DO NOT connect the input circuit -(N) to the neutral point of the power system.

2. Any damage to the drive or other equipment caused by using brake resistors and brake units that are not provided by Delta voids the warranty.
3. Consider environmental safety factors when installing the brake resistors. If you use the minimum resistance value, consult your local dealers for the power calculation.
4. When using more than two brake units, the equivalent resistor value of parallel brake unit cannot be less than the value in the column “Min. Resistor Value (Ω)”. Read the wiring information in the brake unit instruction sheet thoroughly prior to operation. Visit the following links to get the instruction sheets for the wiring in the brake unit:
   - VFDB2015 / 2022 / 4030 / 4045 / 5055 Braking Modules Instruction Sheet
     http://www.deltaww.com/filecenter/Products/download/06/060101/Option/DELTA_IA-MDS_VFDB_I_EN_20070719.pdf
   - VFDB4110 / 4160 / 4185 Braking Modules Instruction Sheet
     http://www.deltaww.com/filecenter/Products/download/06/060101/Option/DELTA_IA-MDS_VFDB4110-4160-4185_I_EN_20101011.pdf
   - VFDB6055 / 6110 / 6160 / 6200 Braking Modules Instruction Sheet
     http://www.deltaww.com/filecenter/Products/download/06/060101/Option/DELTA_IA-MDS_VFDB6055-6110-6160-6200_I_TSE_20121030.pdf

5. The selection tables are for normal use. If the AC motor drive requires frequent braking, increase the Watts by two to three times.
6. Thermal Overload Relay (TOR):

   Thermal overload relay selection is based on its overload capacity. A standard braking capacity of the VFD-ED is 10%ED (Tripping time = 10s). As shown in the graph below, a 460V, 11 kw VFD-ED requires the thermal relay to take 260% overload capacity for 10 seconds (hot starting) and the braking current is 17.7 A. In this case, select a thermal overload relay larger than 17.7 / 2.6 = 6.8 (A). The specification of each thermal relay may vary among different manufacturers. Carefully read the specification before using it.



## 6-2 Non-fuse Circuit Breaker

Comply with the UL standard: Per UL 508, paragraph 45.8.4, part a. The rated current of a breaker shall be two to four times the maximum rated input current of the AC motor drive.

| One-phase/Three-phase | | Three-phase | |
|---|---|---|---|
| Model | Recommended non-fuse breaker (A) | Model | Recommended non-fuse breaker (A) |
| VFD022ED21S* | 50 | VFD040ED43S | 30 |
| VFD037ED21S* | 75 | VFD055ED43S | 35 |
| VFD040ED23S | 40 | VFD075ED43S | 40 |
| VFD055ED23S | 50 | VFD110ED43S | 50 |
| VFD075ED23S | 60 | VFD150ED43S | 60 |
| VFD110ED23S | 100 | VFD185ED43S | 75 |
| VFD150ED23S | 125 | VFD220ED43S | 100 |
| VFD185ED23S | 150 | VFD300ED43S | 125 |
| VFD220ED23S | 175 | VFD370ED43S | 150 |
| VFD300ED23S | 250 | VFD450ED43S | 200 |
| VFD370ED23S | 300 | VFD550ED43S | 250 |
| | | VFD750ED43S | 350 |

* VFD022ED21S and VFD037ED21S are one-phase models.

## 6-3 Fuse Specification Chart

Fuse specifications lower than the table below are allowed.

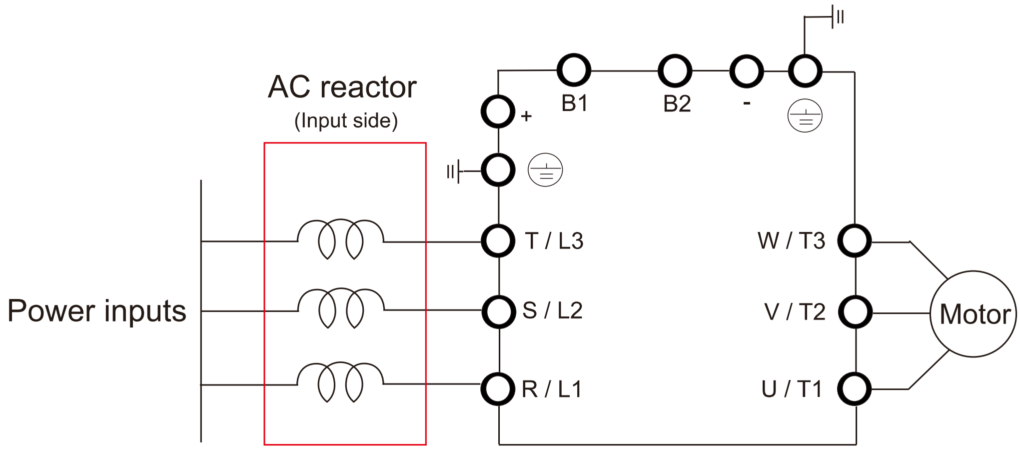
| Model | Input Current (A) | Line Fuse | |
|---|---|---|---|
| | | I (A) | Bussmann P/N |
| VFD022ED21S | 26 | 60 | JJN-60 |
| VFD037ED21S | 37 | 90 | JJN-90 |
| VFD040ED23S | 20 | 50 | JJN-50 |
| VFD055ED23S | 23 | 60 | JJN-60 |
| VFD075ED23S | 30 | 80 | JJN-80 |
| VFD110ED23S | 47 | 125 | JJN-125 |
| VFD150ED23S | 56 | 150 | JJN-150 |
| VFD185ED23S | 73 | 175 | JJN-175 |
| VFD220ED23S | 90 | 225 | JJN-225 |
| VFD300ED23S | 132 | 300 | JJN-300 |
| VFD370ED23S | 161 | 400 | JJN-400 |
| | | | |
| VFD040ED43S | 11.5 | 35 | JJS-35 |
| VFD055ED43S | 14 | 40 | JJS-40 |
| VFD075ED43S | 17 | 45 | JJS-45 |
| VFD110ED43S | 24 | 60 | JJS-60 |
| VFD150ED43S | 30 | 80 | JJS-80 |
| VFD185ED43S | 37 | 90 | JJS-90 |
| VFD220ED43S | 47 | 110 | JJS-110 |
| VFD300ED43S | 58 | 150 | JJS-150 |
| VFD370ED43S | 80 | 200 | JJS-200 |
| VFD450ED43S | 100 | 250 | JJS-250 |
| VFD550ED43S | 128 | 300 | JJS-300 |
| VFD750ED43S | 165 | 400 | JJS-400 |

# 6-4 AC / DC Reactor

## AC Input Reactor

Installing an AC reactor on the input side of an AC motor drive can increase line impedance, improve the power factor, reduce input current, increase system capacity, and reduce interference generated from the motor drive. It also reduces momentary voltage surges or abnormal current spikes. For example, when the main power capacity is higher than 500 kVA, or when using a switching capacitor bank, momentary peak voltage and current spikes may damage the AC motor drive's internal circuit. An AC reactor on the input side of the AC motor drive protects it by suppressing surges.

**Installation**
Install an AC input reactor in series between the main power and the three input phases R S T, as shown in the figure below:

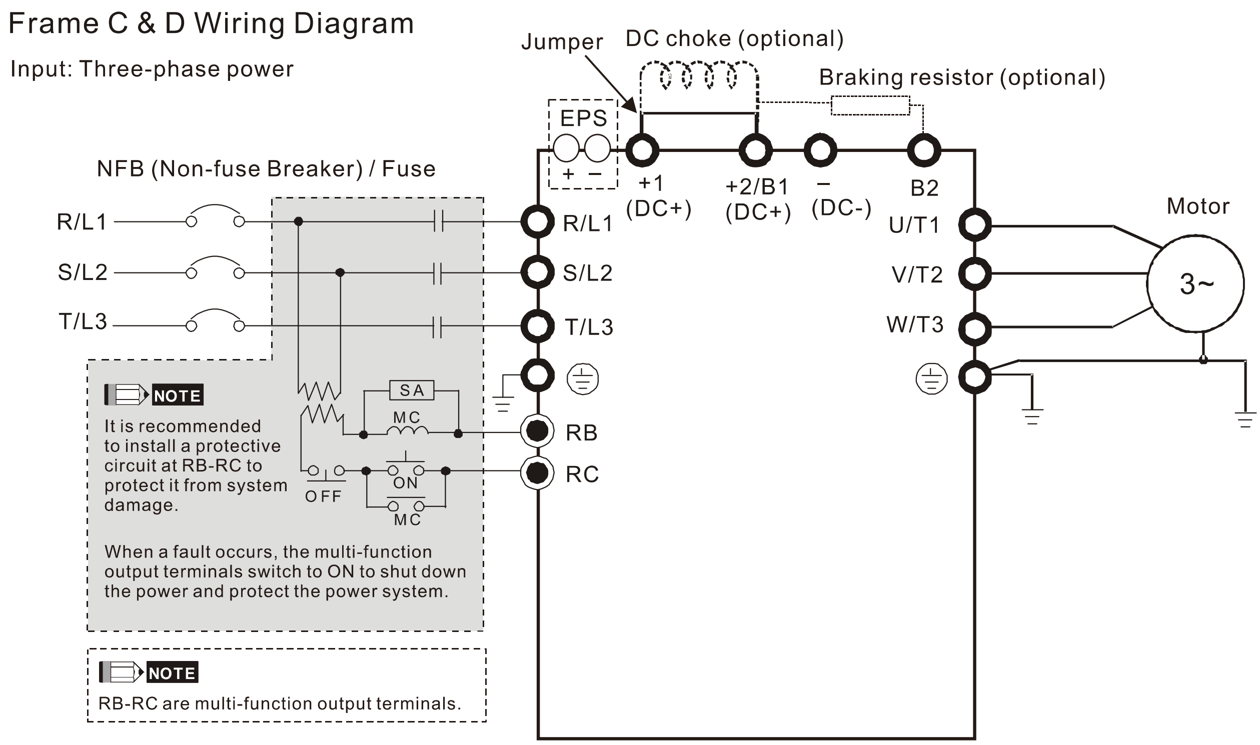



Connecting an AC Input Reactor

## DC Reactor

A DC reactor can also increase line impedance, improve the power factor, reduce input current, increase system power, and reduce interference generated from the motor drive. A DC reactor stabilizes the DC bus voltage. Compared with an AC input reactor, a DC reactor is in smaller size, lower price, and lower voltage drop (lower power dissipation).

**Installation**
Install a DC reactor between terminals +1(DC+) and +2/B1(DC+). Remove the DC reactor jumper, as shown in the figure below, before installing a DC reactor.




Installing a DC reactor

THD (Total Harmonic Distortion)

The table below shows the THDi specification when using Delta's drives (three-phase power models) to work with AC/DC reactors.

| Motor Drive Spec. | Models without AC/DC Reactors | Models without Built-in DC Reactors | | | Models with Built-in DC Reactors | |
|---|---|---|---|---|---|---|
| Reactors in Series Spec. | | 3% Input AC Reactor | 5% Input AC Reactor | 4% DC Reactor | 3% Input AC Reactor | 5% Input AC Reactor |
| 5th | 73.3% | 38.5% | 30.8% | 25.5% | 27.01% | 25.5% |
| 7th | 52.74% | 15.3% | 9.4% | 18.6% | 9.54% | 8.75% |
| 11th | 7.28% | 7.1% | 6.13% | 7.14% | 4.5% | 4.2% |
| 13th | 0.4% | 3.75% | 3.15% | 0.48% | 0.22% | 0.17% |
| THDi | 91% | 43.6% | 34.33% | 38.2% | 30.5% | 28.4% |
| Note | THDi may vary due to different installation conditions and environment (wires, motors). | | | | | |

THDi Specification

Note: For three-phase power models, Delta provides 4% DC reactors and 3% AC reactors. Refer to the following sections to select your applicable reactors.

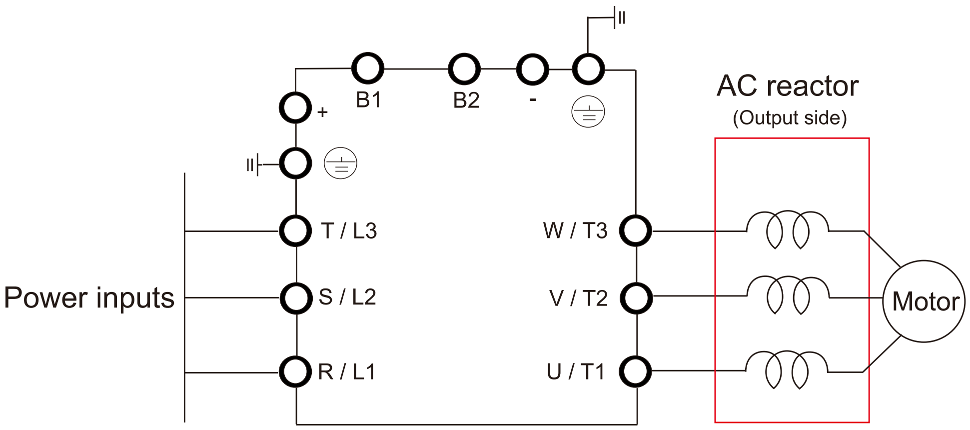
## AC Output Reactor

When using drives in long wiring output application, ground fault (GFF), over-current (OC) and motor over-voltage (OV) often occur. GFF and OC cause errors due to the drive's self-protective mechanism; over-voltage damages motor insulation.

The excessive length of the output wires makes the grounded stray capacitance too large, increase the three-phase output common mode current, and the reflected wave of the long wires makes the motor dv / dt and the motor terminal voltage too high. Thus, installing a reactor on the drive's output side can increases the high-frequency impedance to reduce the dv / dt and terminal voltage to protect the motor.

### Installation

Install an AC output reactor in series between the three output phases U V W and the motor, as shown in the figure below:




Connecting an AC output reactor

## Applicable Reactors

**200V–230V / 50–60 Hz (One-phase power)**

| Model | Rated Current (Arms) | Saturation Current (Arms) | AC Input Reactors (mH) | AC Input Reactors (Delta Part#) | AC Output Reactors (mH) | AC Output Reactors (Delta Part #) |
|---|---|---|---|---|---|---|
| VFD022ED21S | 12 | 24 | 1.172 | DR025D0117 | 2.02 | DR012L0202 |
| VFD037ED21S | 17 | 34 | 0.574 | DR049DP574 | 1.17 | DR018L0117 |

**200V–230V / 50–60 Hz (Three-phase power)**

| Model | Rated Current (Arms) | Saturation Current (Arms) | 3% AC Input / Output Reactors (mH) | 3% AC Input / Output Reactors (Delta Part #) | 4% DC Reactors (mH) | 4% DC Reactors (Delta Part #) |
|---|---|---|---|---|---|---|
| VFD040ED23 | 20 | 40 | 0.507 | DR025AP507<br>DR025LP507 | NA* | NA* |
| VFD055ED23 | 24 | 48 | 0.507 | DR025AP507<br>DR025LP507 | 1.17 | DR025D0117 |
| VFD075ED23 | 30 | 60 | 0.32 | DR033AP320<br>DR033LP320 | 0.851 | DR033DP851 |
| VFD110ED23 | 45 | 90 | 0.215 | DR049AP215<br>DR049LP215 | 0.574 | DR049DP574 |
| VFD150ED23 | 58 | 116 | 0.162 | DR065AP162<br>DR065LP162 | 0.432 | DR065DP432 |

| Model | Rated Current (Arms) | Saturation Current (Arms) | 3% AC Input / Output Reactors (mH) | 3% AC Input / Output Reactors (Delta Part #) | 4% DC Reactors (mH) | 4% DC Reactors (Delta Part #) |
|---|---|---|---|---|---|---|
| VFD185ED23 | 77 | 154 | 0.141 | DR090AP141<br>DR090LP141 | 0.325 | DR090DP325 |
| VFD220ED23 | 87 | 174 | 0.141 | DR090AP141<br>DR090LP141 | 0.325 | DR090DP325 |
| VFD300ED23 | 132 | 264 | 0.087 | DR146AP087<br>DR146LP087 | NA** | NA** |
| VFD370ED23 | 161 | 322 | 0.07 | DR180AP070<br>DR180LP070 | NA** | NA** |

**Note: NA* stands for not being able to install this accessory; NA** stands for built-in accessory.**

**380V–460V / 50–60 Hz (Three-phase power)**

| Model | Rated Current (Arms) | Saturation Current (Arms) | 3% AC Input / Output Reactors (mH) | 3% AC Input / Output Reactors (Delta Part #) | 4% DC Reactors (mH) | 4% DC Reactors (Delta Part #) |
|---|---|---|---|---|---|---|
| VFD040ED43S | 11.5 | 23 | 2.31 | DR010A0231<br>DR010L0231 | NA* | NA* |
| VFD055ED43S | 13 | 26 | 2.02 | DR012A0202<br>DR012L0202 | 4.67 | DR012D0467 |
| VFD075ED43S | 17 | 34 | 1.17 | DR018A0117<br>DR018L0117 | 3.11 | DR018D0311 |
| VFD110ED43S | 23 | 46 | 0.881 | DR024AP881<br>DR024LP881 | 2.33 | DR024D0233 |
| VFD150ED43S | 30 | 60 | 0.66 | DR032AP660<br>DR032LP660 | 1.75 | DR032D0175 |
| VFD185ED43S | 38 | 76 | 0.639 | DR038AP639<br>DR038LP639 | 1.47 | DR038D0147 |
| VFD220ED43S | 45 | 90 | 0.541 | DR045AP541<br>DR045LP541 | 1.24 | DR045D0124 |
| VFD300ED43S | 58 | 116 | 0.405 | DR060AP405<br>DR060LP405 | 0.935 | DR060DP935 |
| VFD370ED43S | 80 | 160 | 0.267 | DR091AP267<br>DR091LP267 | NA** | NA** |
| VFD450ED43S | 100 | 200 | 0.221 | DR110AP221<br>DR110LP221 | NA** | NA** |
| VFD550ED43S | 128 | 256 | 0.162 | DR150AP162<br>DR150LP162 | NA** | NA** |
| VFD750ED43S | 165 | 330 | 0.135 | DR180AP135<br>DR180LP135 | NA** | NA** |

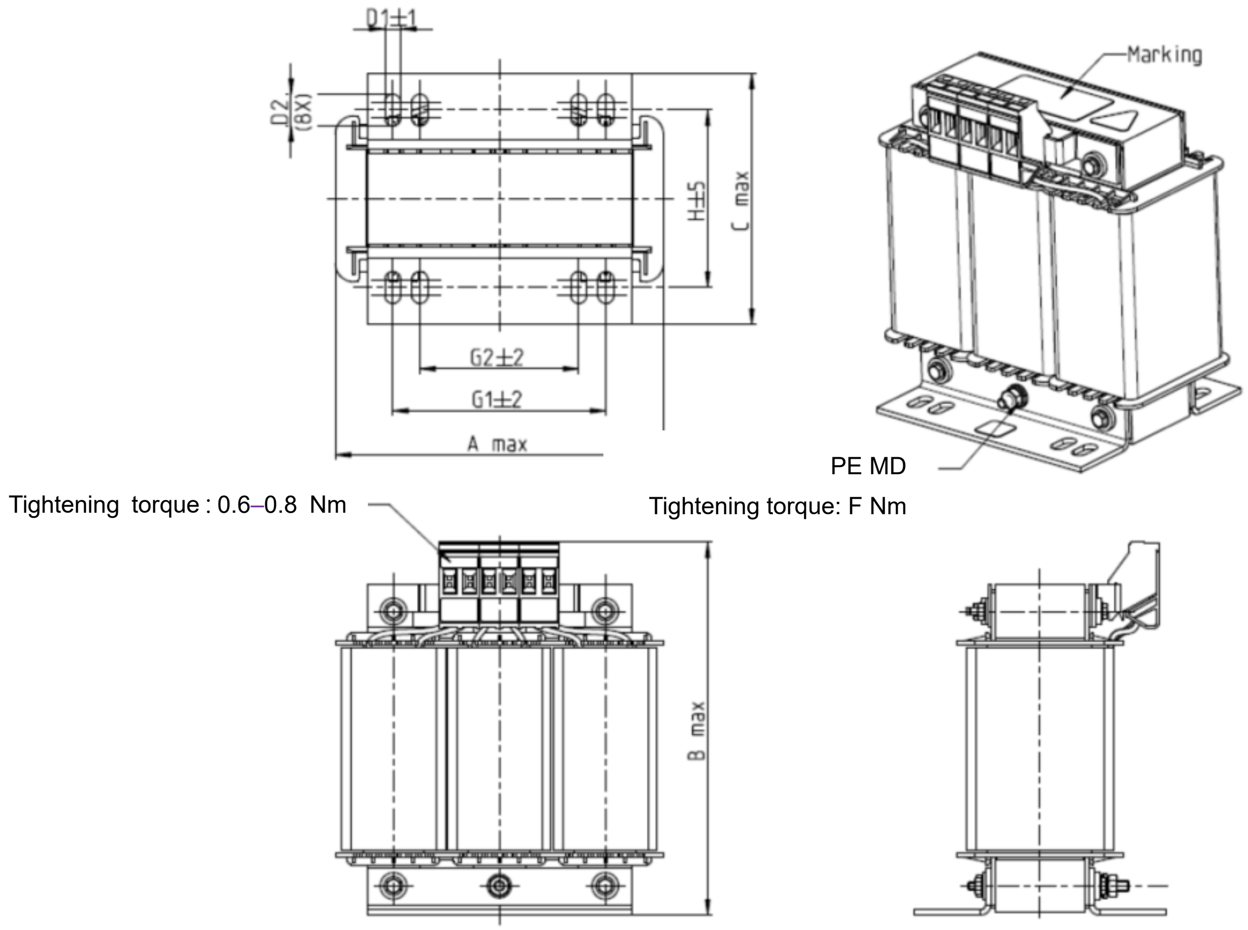
**Note: NA* stands for not being able to install this accessory; NA** stands for built-in accessory.**

NOTE

- Because Delta's three-phase power drive models fulfill the requirement for EN12015:2014 Section 6.6.3 condition a), and in accordance with EN12015:2014 Section 6.7.2 Table 4, use THD <48% to comply with EN12015:2014.

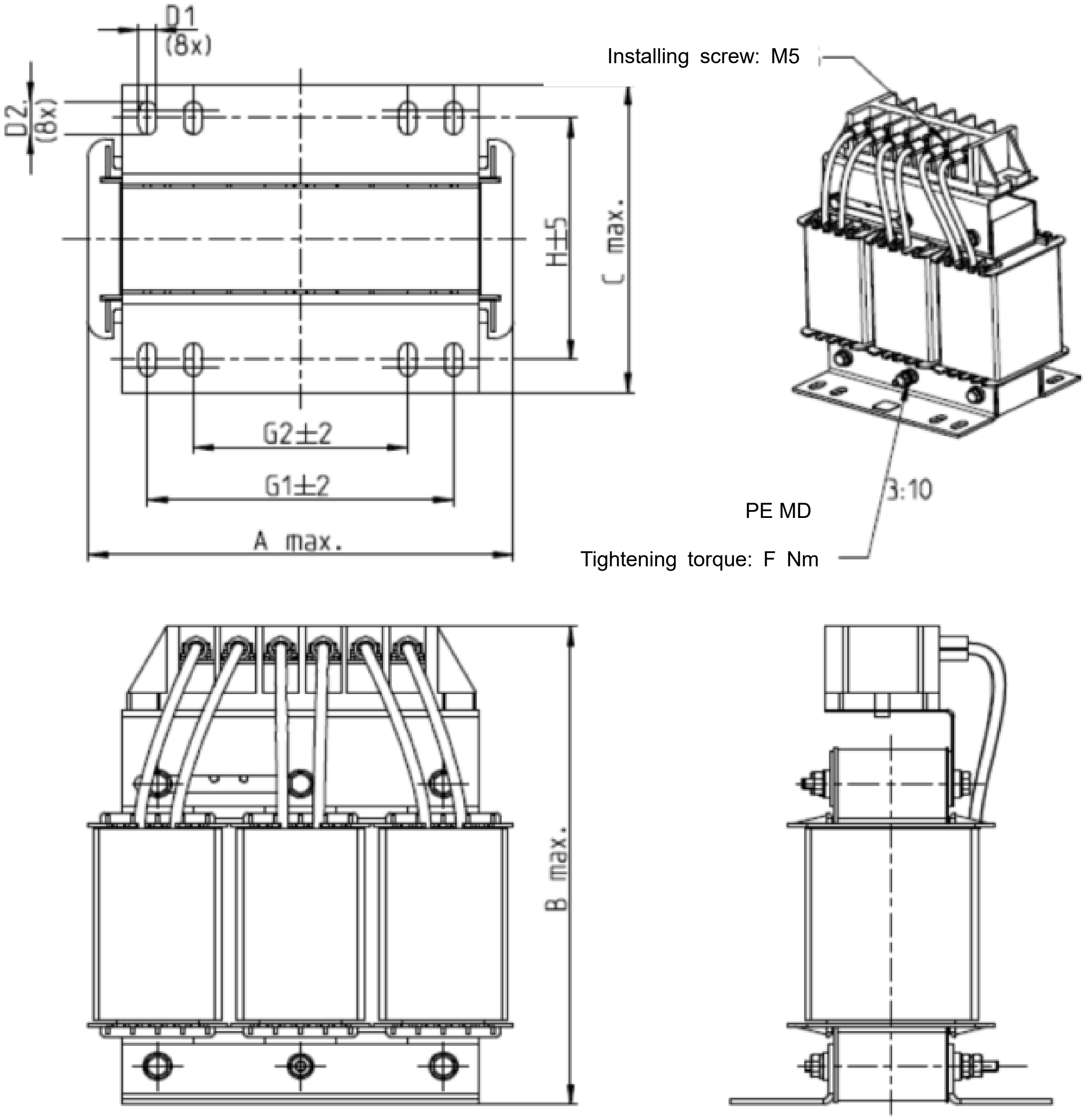
## Reactor Dimensions

AC input reactor dimension and specifications:



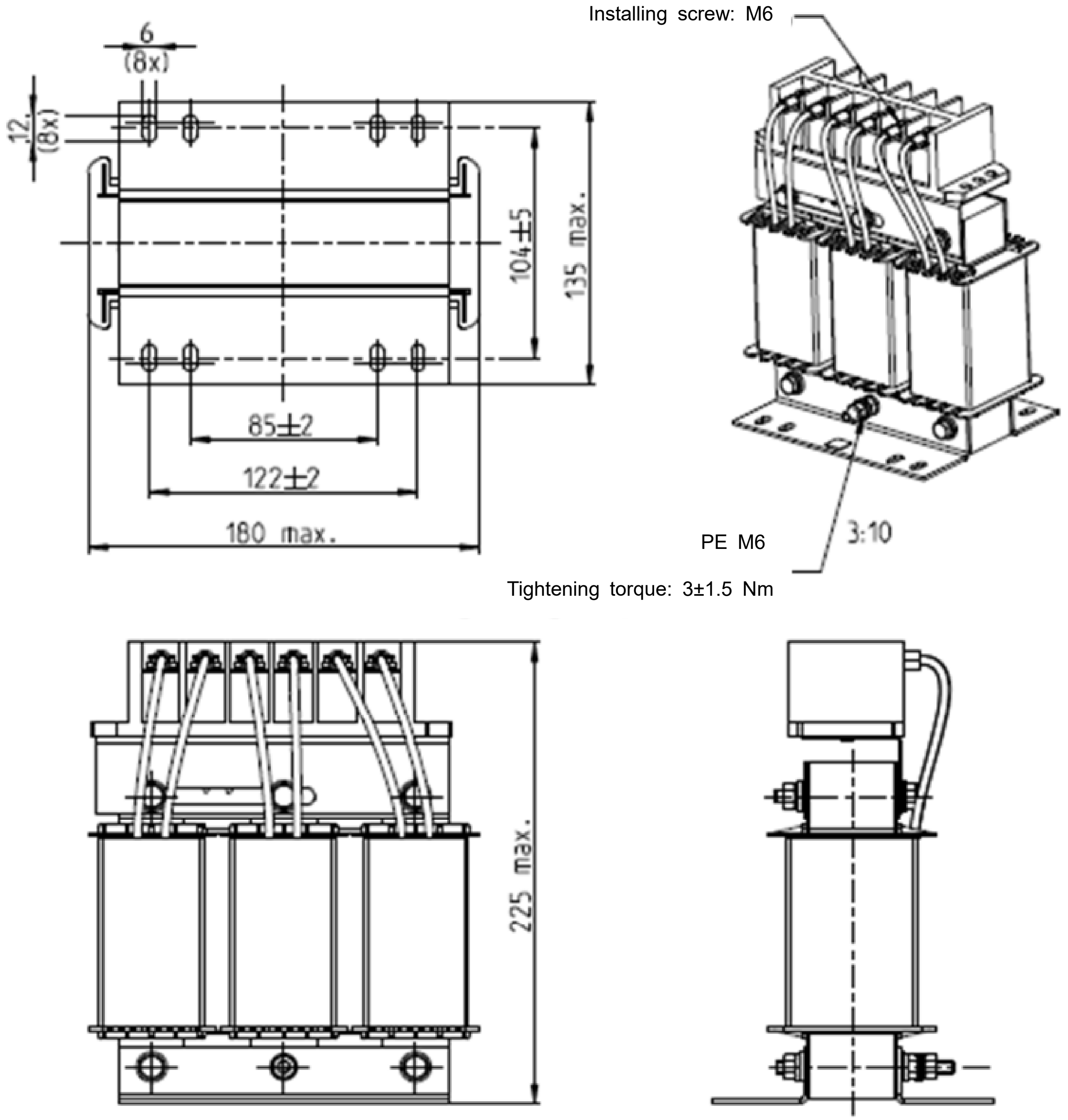

Unit: mm

| Input Reactors Delta Part # | A | B | C | D1*D2 | E | G1 | G2 | PE D |
|---|---|---|---|---|---|---|---|---|
| DR005A0254 | 100 | 115 | 65 | 6*9 | 45 | 60 | 40 | M4 |
| DR008A0159 | 100 | 115 | 65 | 6*9 | 45 | 60 | 40 | M4 |
| DR011A0115 | 130 | 135 | 95 | 6*12 | 60 | 80.5 | 60 | M4 |
| DR017AP746 | 130 | 135 | 100 | 6*12 | 65 | 80.5 | 60 | M4 |



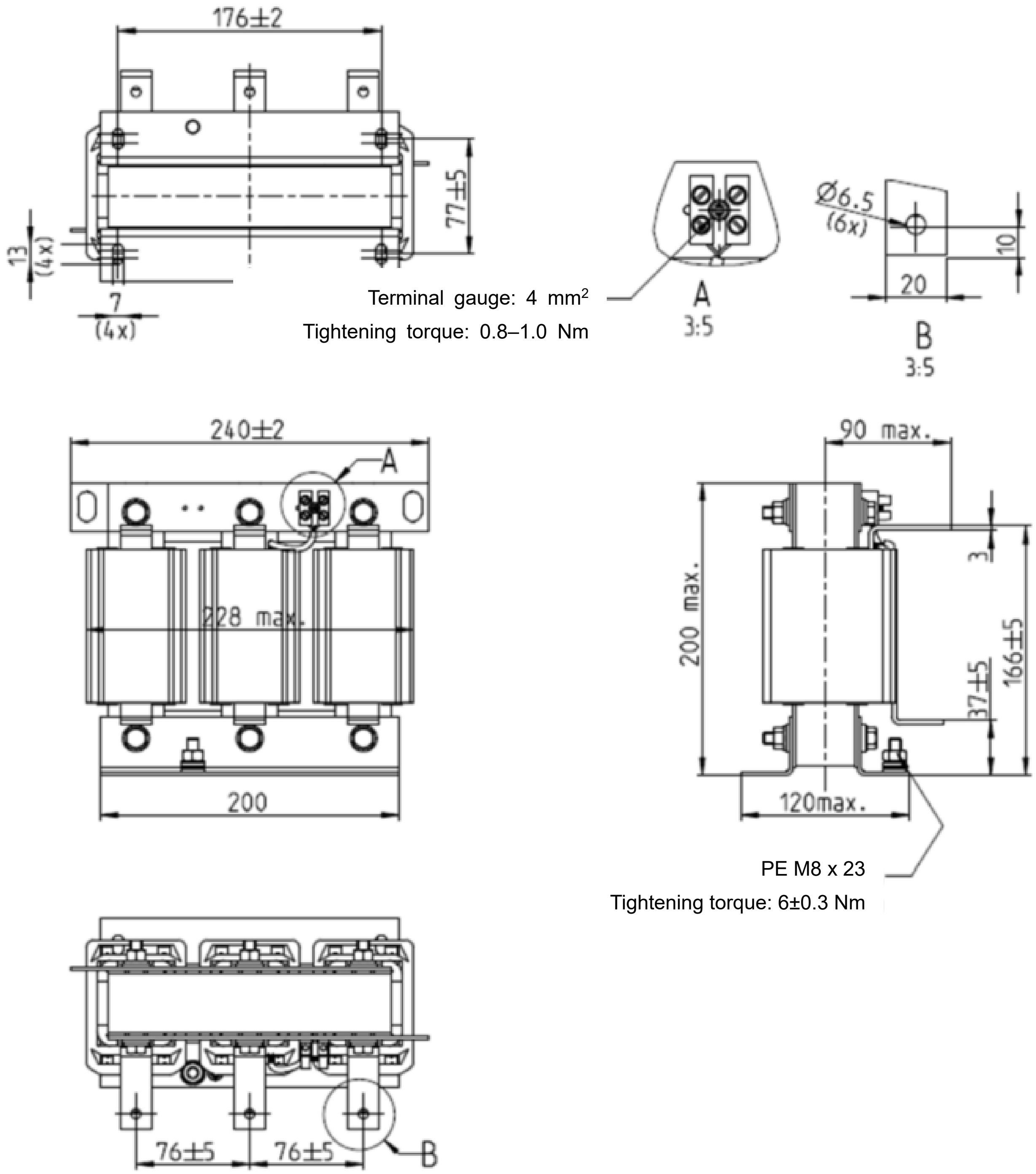

Unit: mm

| Input Reactors Delta Part # | A | B | C | D1*D2 | H | G1 | G2 | PE D |
|---|---|---|---|---|---|---|---|---|
| DR025AP215 | 130 | 195 | 100 | 6*12 | 65 | 80.5 | 60 | M4 |
| DR033AP163 | 130 | 195 | 100 | 6*12 | 65 | 80.5 | 60 | M4 |
| DR049AP163 | 160 | 200 | 125 | 6*12 | 90 | 107 | 75 | M4 |



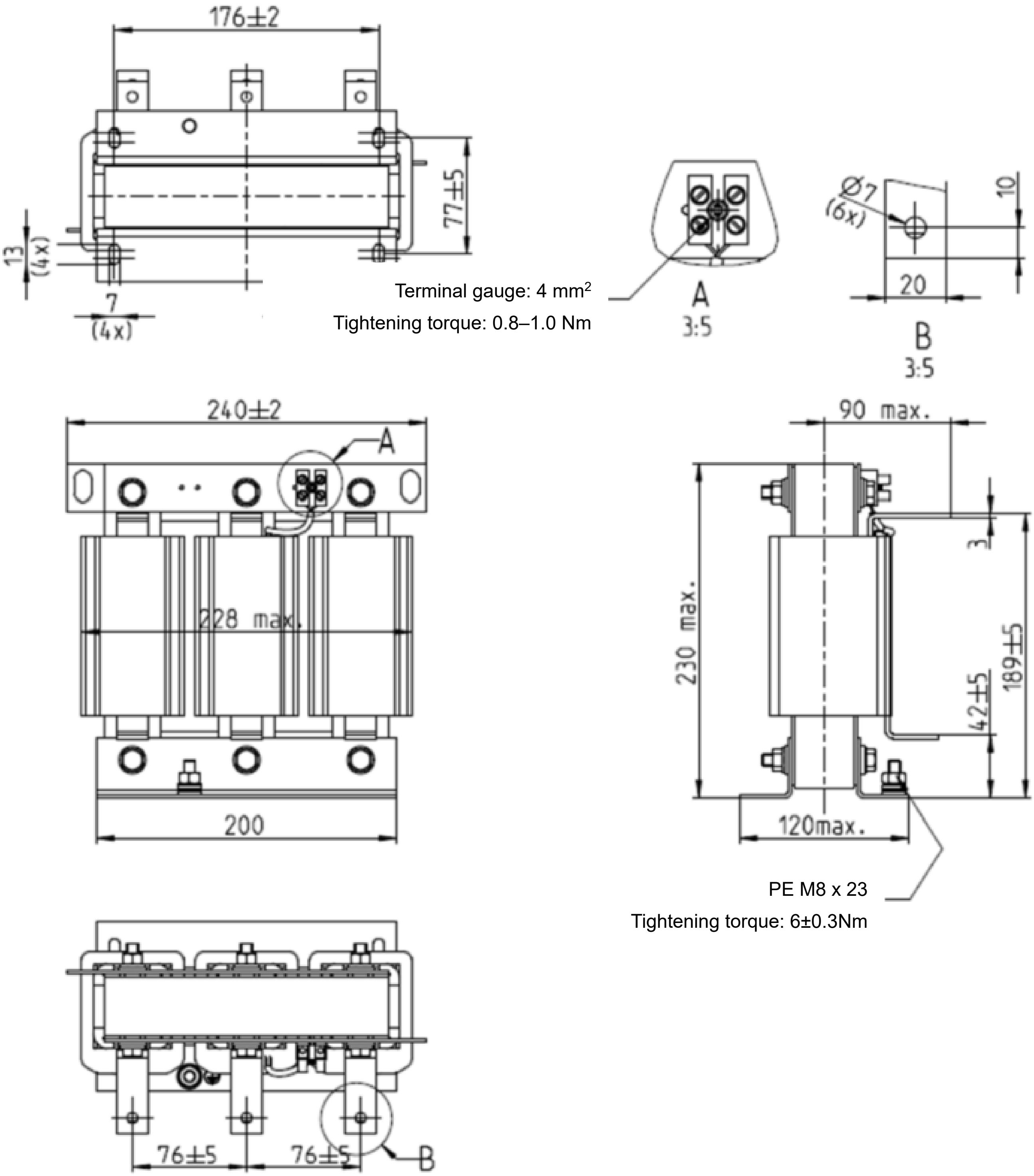

Unit: mm

| Input Reactors Delta Part # | |
|---|---|
| DR065AP162 | See above. |



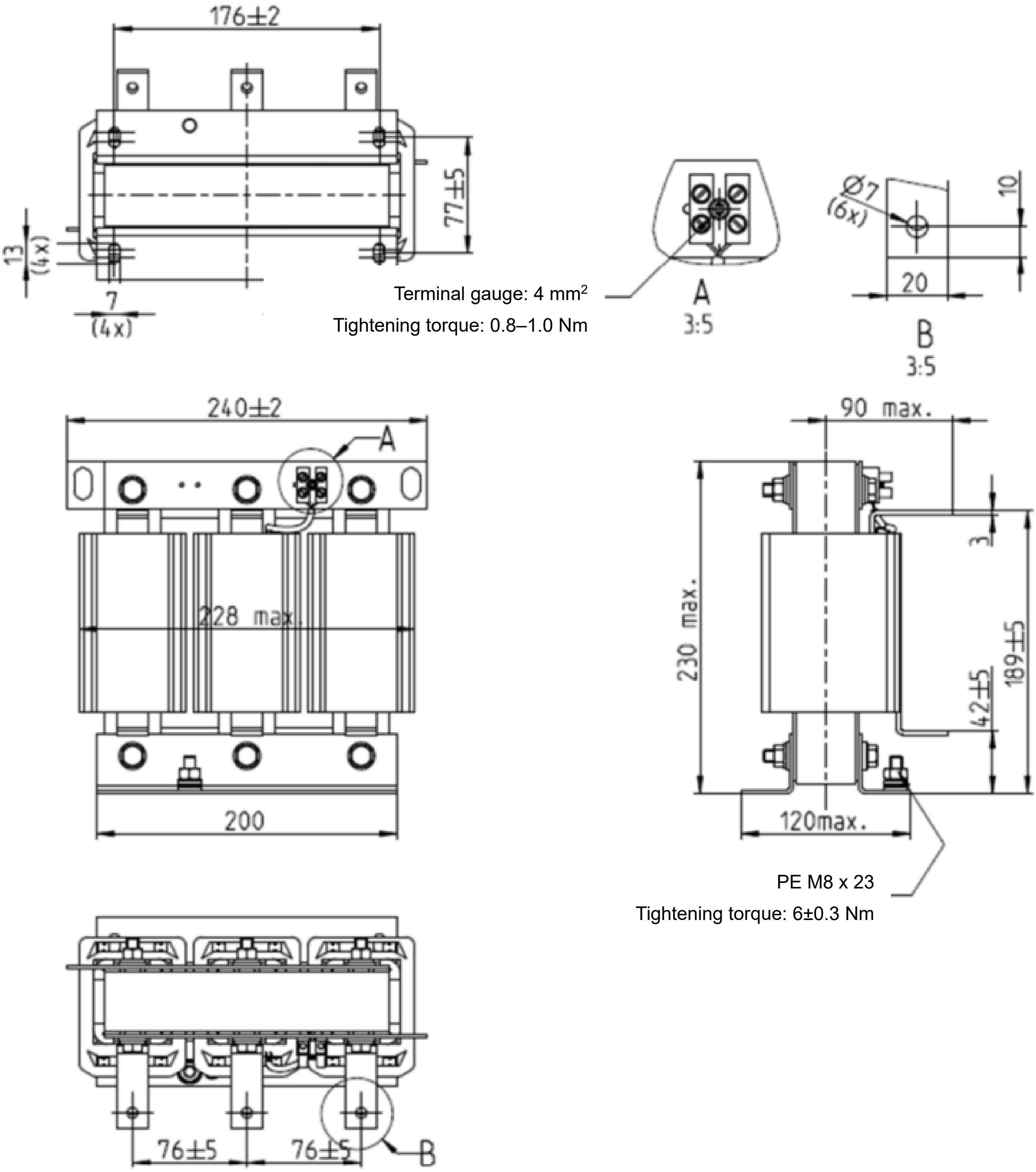

Unit: mm

| Input Reactors Delta Part # | |
|---|---|
| DR075AP170 | See above. |



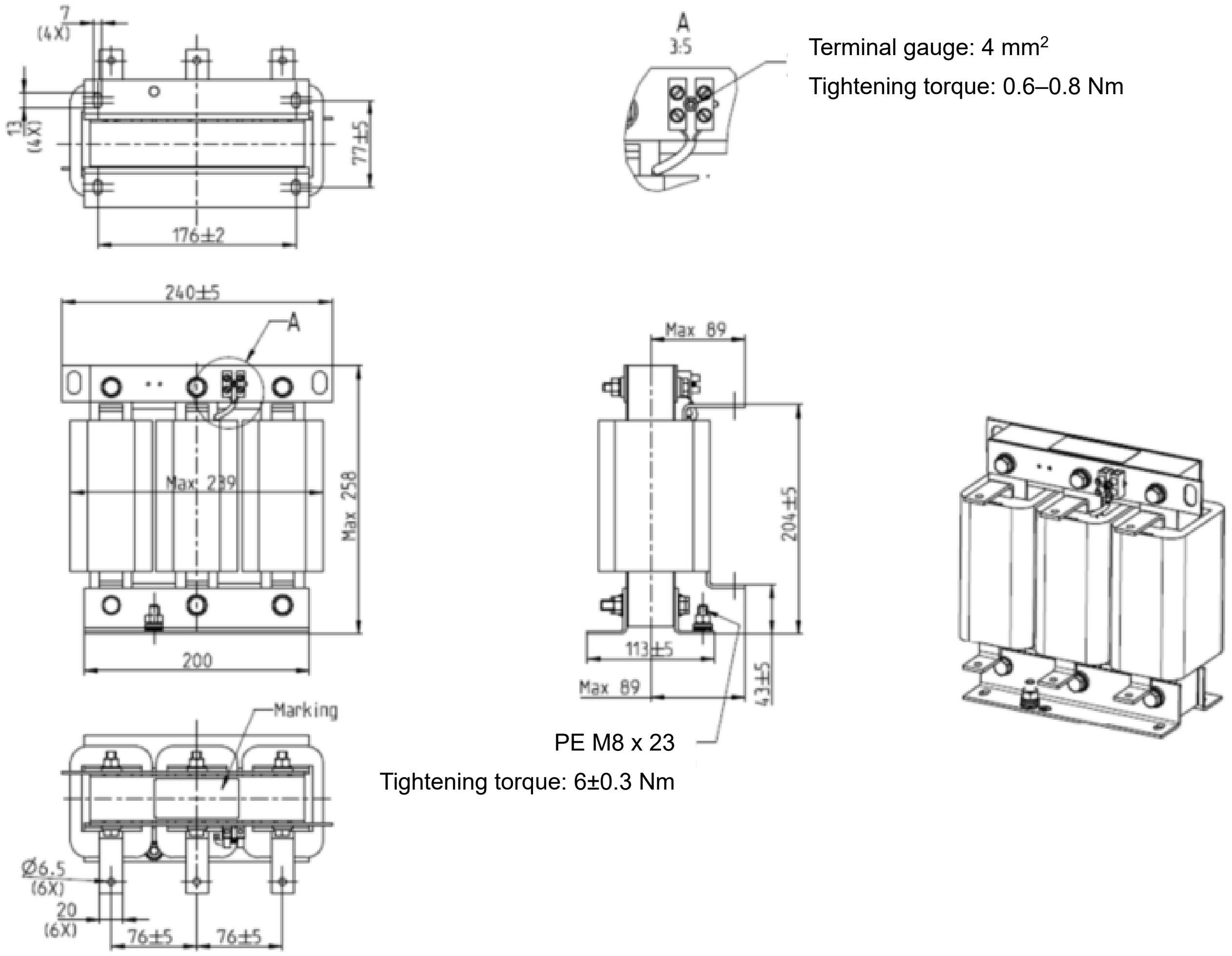

Unit: mm

| Input Reactors Delta Part # | |
|---|---|
| DR090AP141 | See above. |



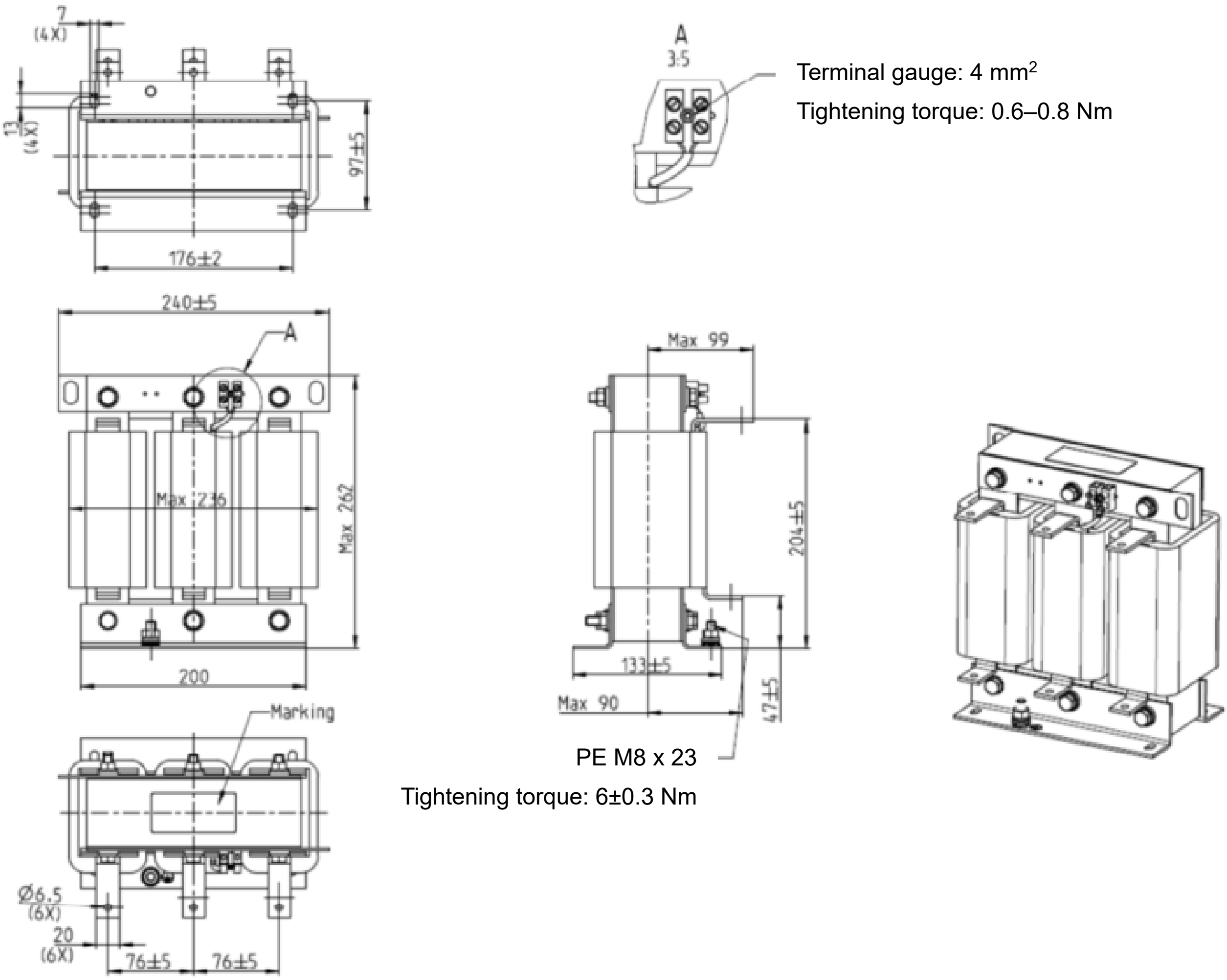

Unit: mm

| Input Reactors Delta Part # | |
|---|---|
| DR105AP106 | See above. |



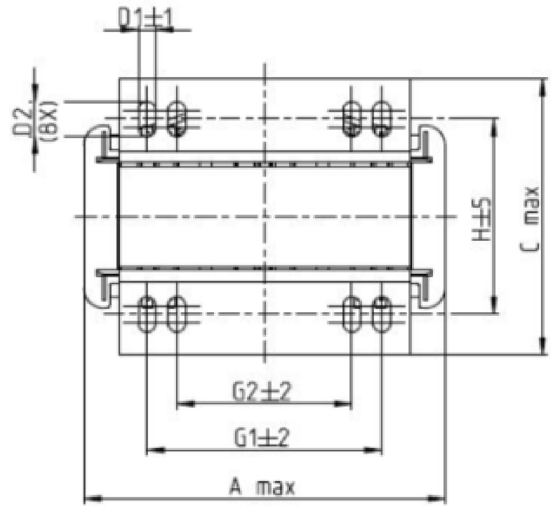

Unit: mm

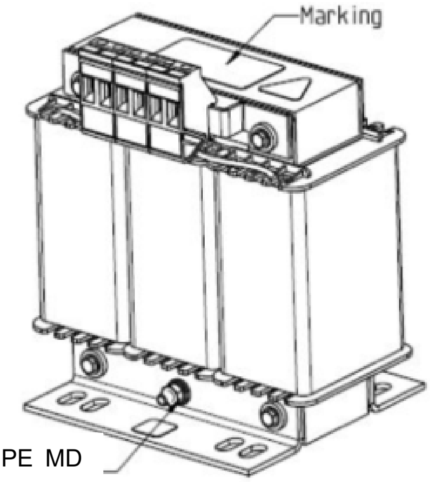
| Input Reactors Delta Part # | |
|---|---|
| DR146AP087 | See above. |




Unit: mm

| Input Reactors Delta Part # | |
|---|---|
| DR180AP070 | See above. |

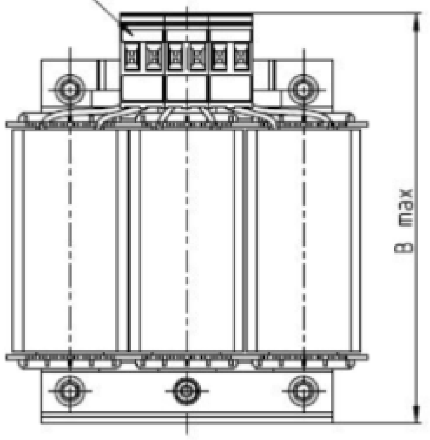


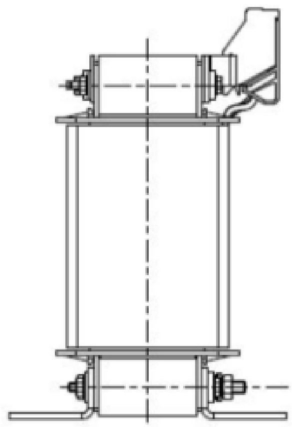




PE MD

Tightening torque: 0.6–0.8 Nm

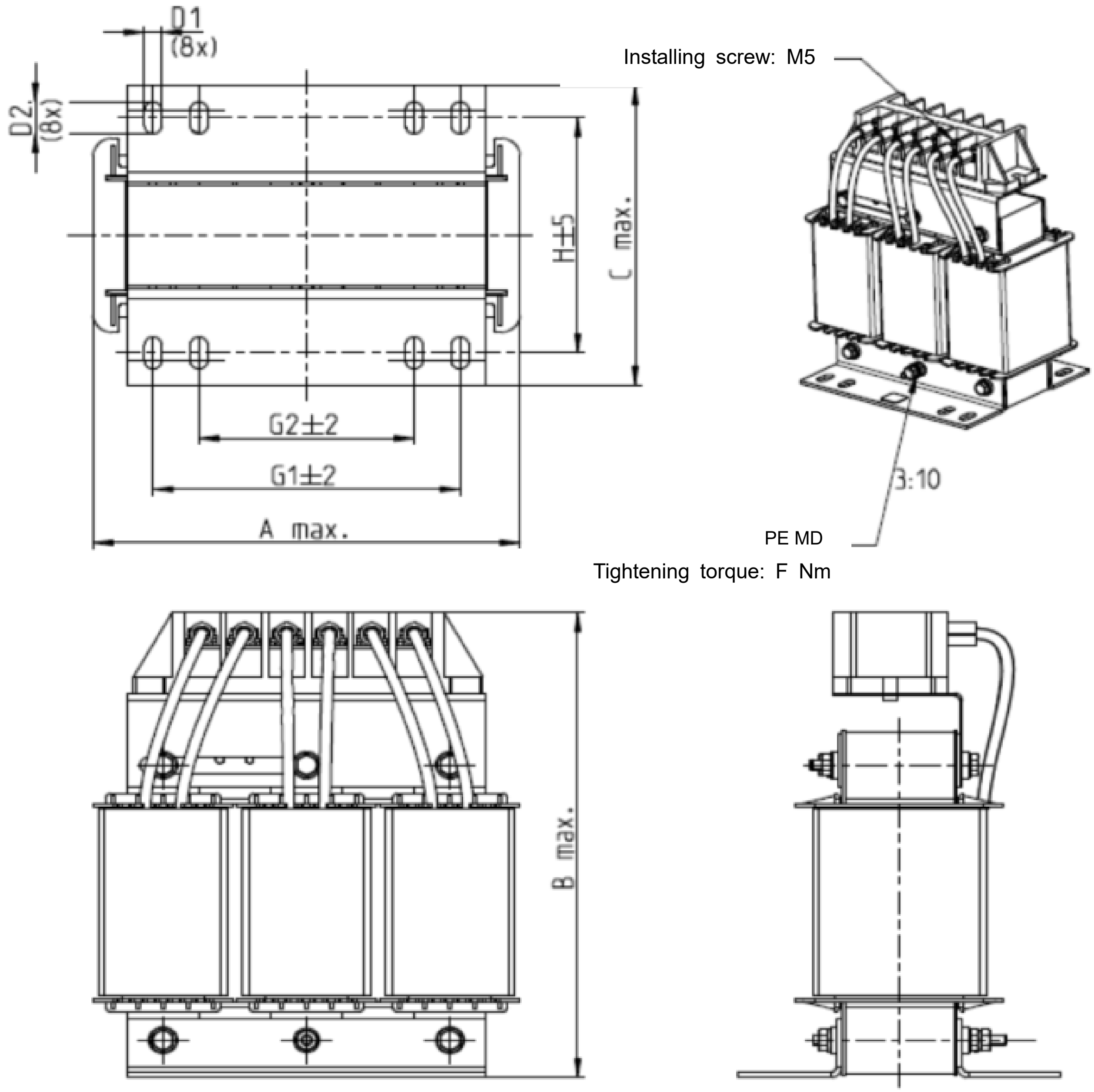
Tightening torque: F Nm



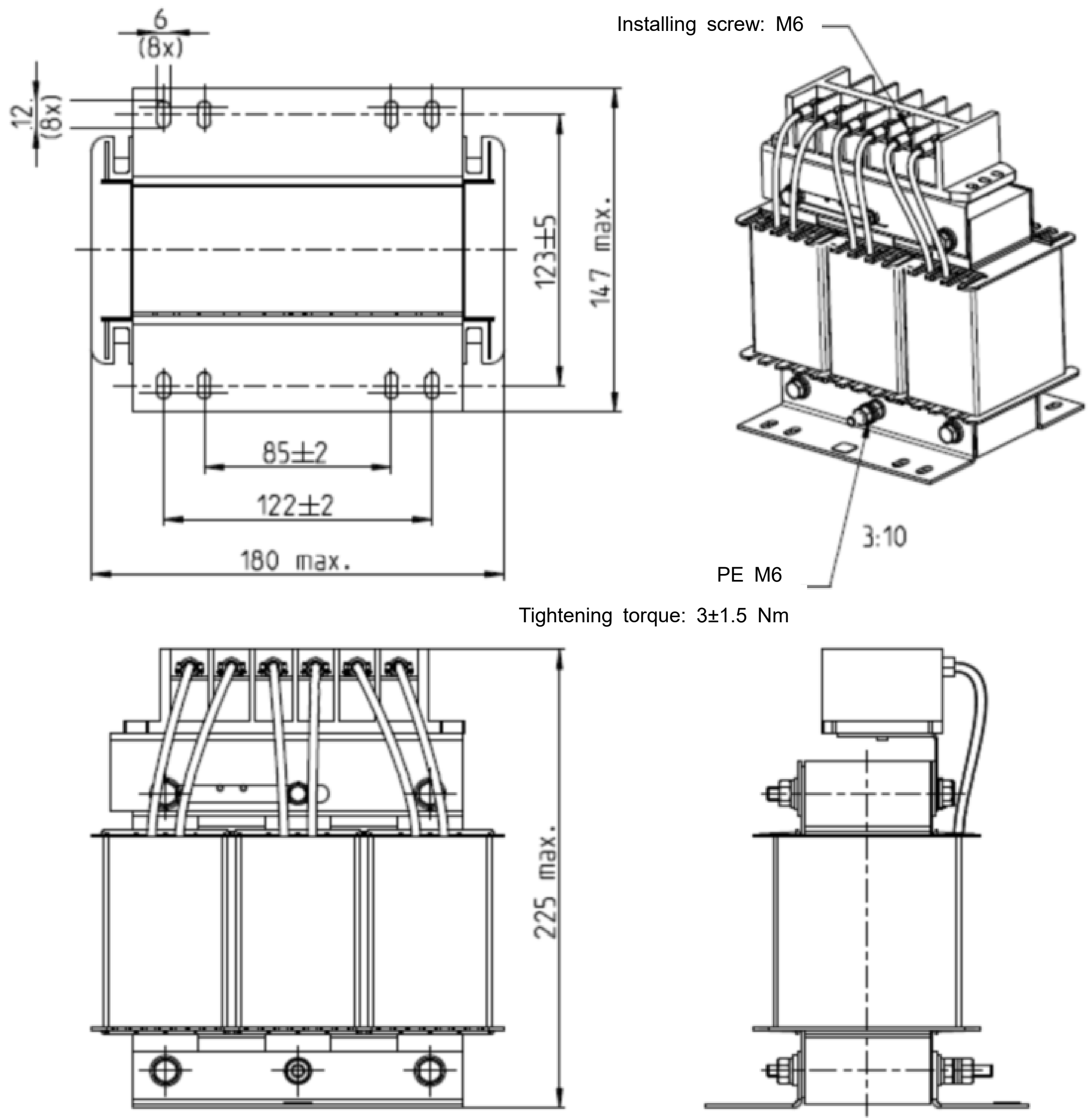
Unit: mm

| Input Reactors Delta Part # | A | B | C | D1*D2 | H | G1 | G2 | PE D |
|---|---|---|---|---|---|---|---|---|
| DR003A0810 | 100 | 125 | 65 | 6*9 | 43 | 60 | 40 | M4 |
| DR004A0607 | 100 | 125 | 65 | 6*9 | 43 | 60 | 40 | M4 |
| DR006A0405 | 130 | 15 | 95 | 6*12 | 60 | 80.5 | 60 | M4 |
| DR009A0270 | 160 | 160 | 105 | 6*12 | 75 | 107 | 75 | M4 |
| DR010A0231 | 160 | 160 | 115 | 6*12 | 90 | 107 | 75 | M4 |
| DR012A0202 | 160 | 160 | 115 | 6*12 | 90 | 107 | 75 | M4 |
| DR018A0117 | 160 | 160 | 115 | 6*12 | 90 | 107 | 75 | M4 |



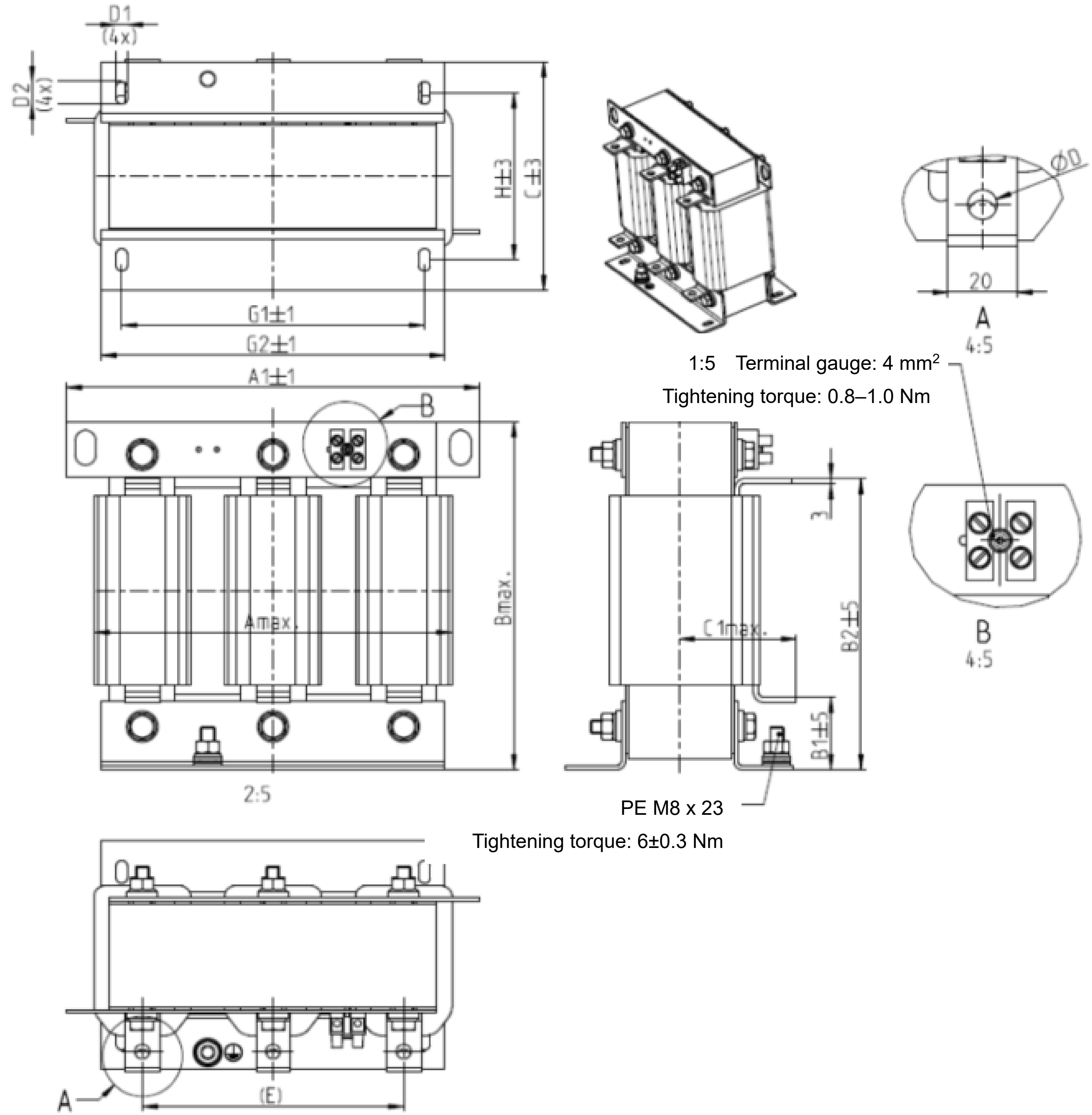

Unit: mm

| Input Reactors Delta Part # | A | B | C | D1*D2 | H | G1 | G2 | PE D |
|---|---|---|---|---|---|---|---|---|
| DR024AP881 | 160 | 175 | 115 | 6*12 | 90 | 107 | 75 | M4 |
| DR032AP660 | 195 | 200 | 145 | 6*12 | 115 | 122 | 85 | M6 |
| DR038AP639 | 190 | 200 | 145 | 6*12 | 115 | 122 | 85 | M6 |
| DR045AP541 | 190 | 200 | 145 | 6*12 | 115 | 122 | 85 | M6 |



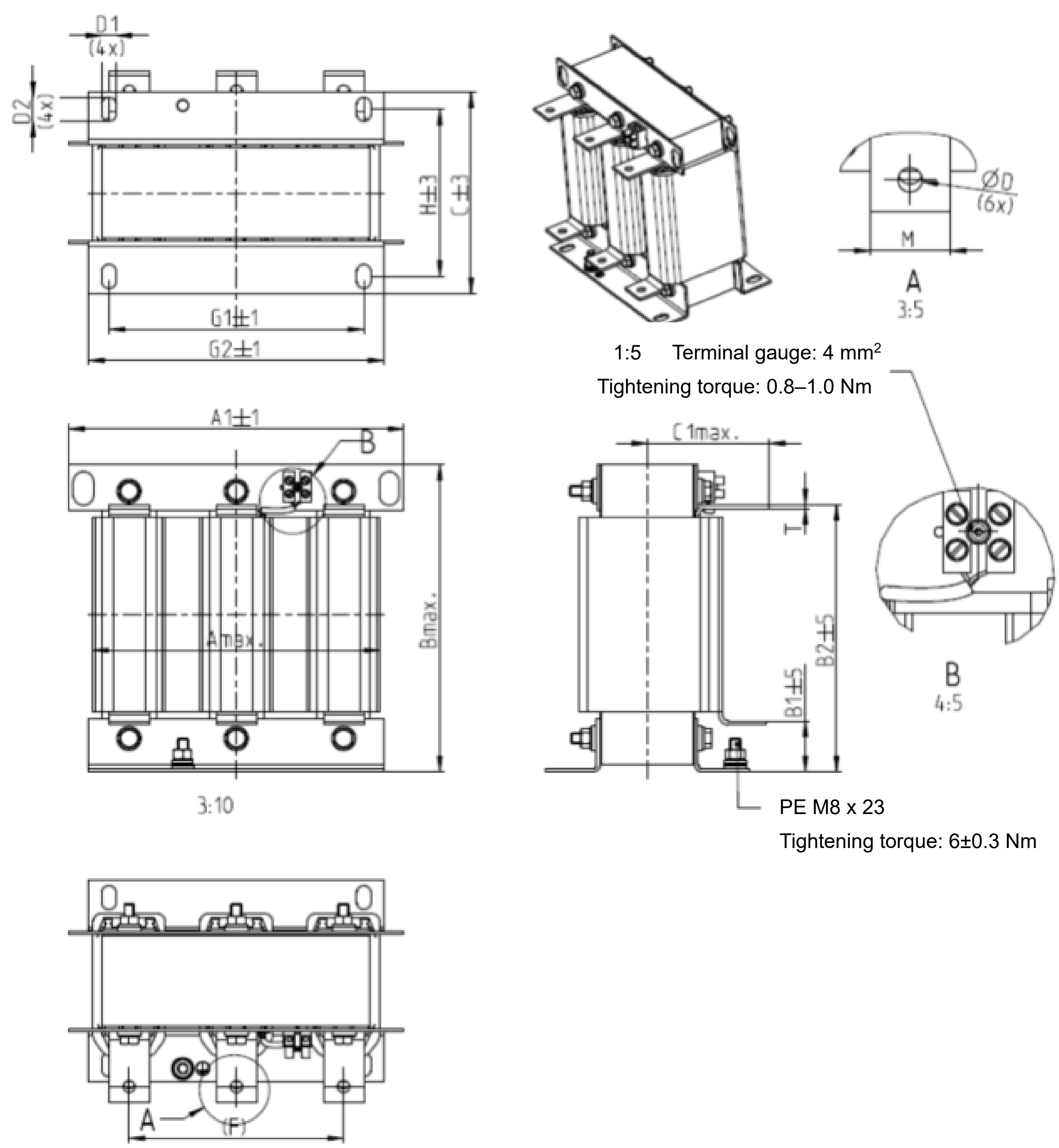

Unit: mm

| Input Reactors Delta Part # | |
|---|---|
| DR060AP405 | See above. |




Unit: mm

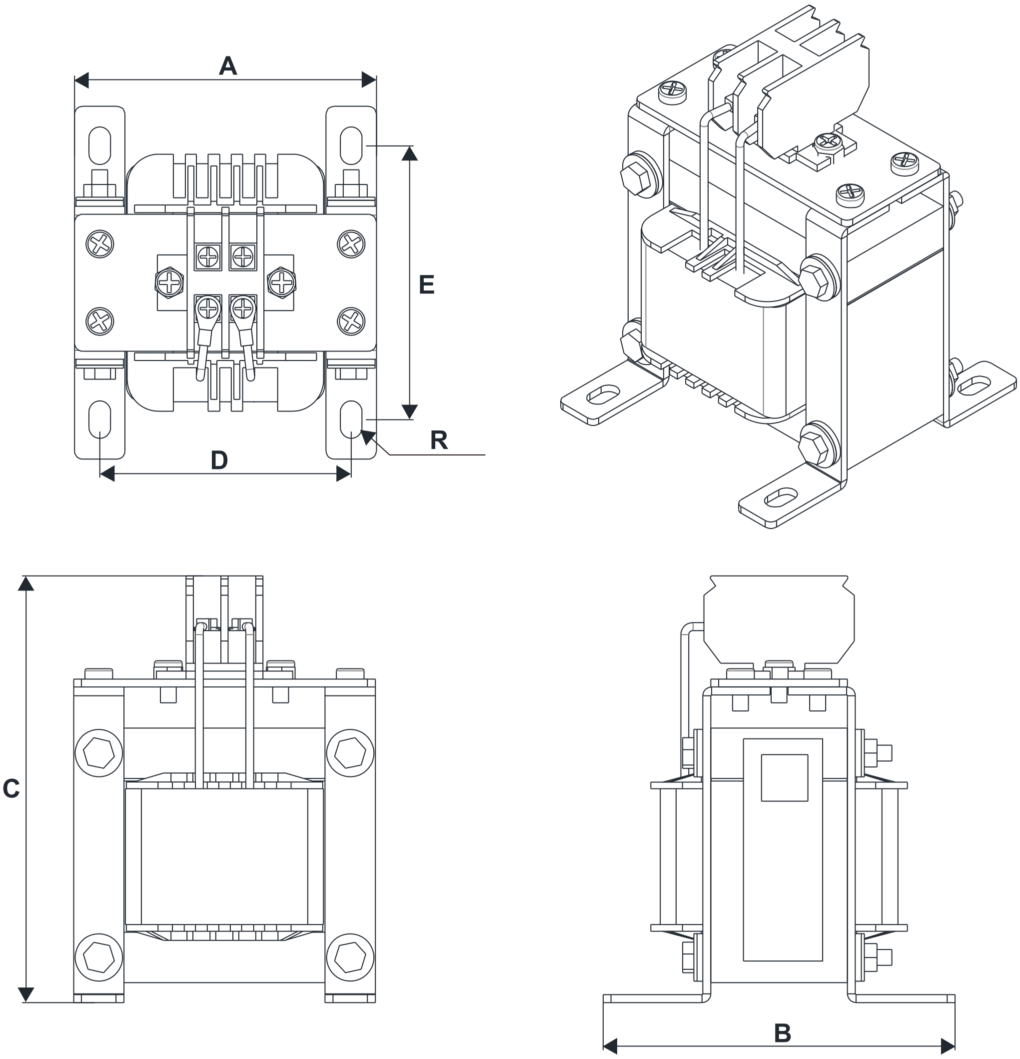
| Input Reactors Delta Part # | A | A1 | B | B1 | B2 | C | D | D1*D2 | E | C1 | G1 | G2 | H |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| DR073AP334 | 228 | 240 | 215 | 40 | 170 | 133 | 8.5 | 7*13 | 152 | 75 | 176 | 200 | 97 |
| DR091AP267 | 228 | 240 | 245 | 40 | 195 | 133 | 8.8 | 7*13 | 152 | 90 | 176 | 200 | 97 |
| DR110AP221 | 228 | 240 | 245 | 40 | 195 | 138 | 8.5 | 7*13 | 152 | 75 | 176 | 200 | 102 |




Unit: mm

| Input Reactors Delta Part # | A | A1 | B | B1 | B2 | C | C1 | D | D1*D2 | F | G1 | G2 | H | M*T |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| DR150AP162 | 240 | 250 | 245 | 40 | 200 | 151 | 105 | 9 | 11*18 | 160 | 190 | 220 | 125 | 20*3 |
| DR180AP135 | 240 | 250 | 245 | 40 | 200 | 151 | 105 | 9 | 11*18 | 160 | 190 | 220 | 125 | 20*3 |
| DR220AP110 | 264 | 270 | 275 | 50 | 230 | 151 | 105 | 9 | 10*18 | 176 | 200 | 230 | 106 | 30*3 |
| DR260AP098 | 264 | 270 | 285 | 50 | 240 | 151 | 105 | 9 | 10*18 | 176 | 200 | 230 | 106 | 30*3 |
| DR310AP078 | 300 | 300 | 345 | 55 | 295 | 153 | 105 | 9 | 10*18 | 200 | 224 | 260 | 113 | 30*3 |
| DR370AP066 | 300 | 300 | 345 | 55 | 295 | 158 | 120 | 9 | 10*18 | 200 | 224 | 260 | 118 | 50*4 |

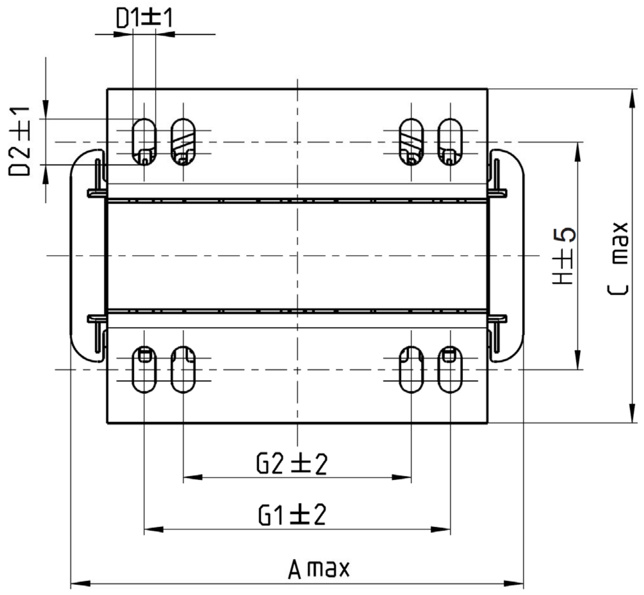
DC reactor dimension and specifications:

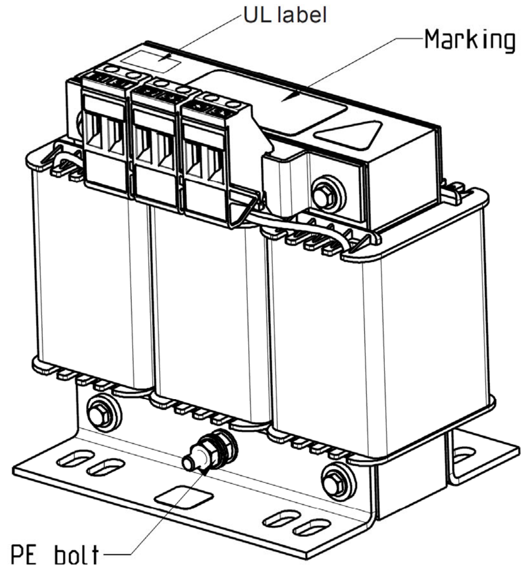



Unit: mm

| DC Reactors Delta Part # | A | B | C | D | E | R |
|---|---|---|---|---|---|---|
| DR005D0585 | 79 | 78 | 112 | 64±2 | 56±2 | 9.5*5.5 |
| DR008D0366 | 79 | 78 | 112 | 64±2 | 56±2 | 9.5*5.5 |
| DR011D0266 | 79 | 92 | 112 | 64±2 | 69.5±2 | 9.5*5.5 |
| DR017D0172 | 79 | 112 | 112 | 64±2 | 89.5±2 | 9.5*5.5 |
| DR025D0117 | 99 | 105 | 128 | 79±2 | 82.5±2 | 9.5*5.5 |
| DR033DP851 | 117 | 110 | 156 | 95±2 | 87±2 | 10*6.5 |
| DR049DP574 | 117 | 120 | 157 | 95±2 | 97±2 | 10*6.5 |
| DR065DP432 | 117 | 140 | 157 | 95±2 | 116.5±2 | 10*6.5 |
| DR075DP391 | 136 | 135 | 178 | 111±2 | 112±2 | 10*6.5 |
| DR090DP325 | 136 | 135 | 179 | 111±2 | 112±2 | 10*6.5 |
| DR003D1870 | 79 | 78 | 112 | 64±2 | 56±2 | 9.5*5.5 |
| DR004D1403 | 79 | 92 | 112 | 64±2 | 69.5±2 | 9.5*5.5 |
| DR006D0935 | 79 | 92 | 112 | 64±2 | 69.5±2 | 9.5*5.5 |
| DR009D0623 | 79 | 112 | 112 | 64±2 | 89.5±2 | 9.5*5.5 |
| DR010D0534 | 99 | 93 | 128 | 79±2 | 70±2 | 9.5*5.5 |
| DR012D0467 | 99 | 105 | 128 | 79±2 | 82.5±2 | 9.5*5.5 |
| DR018D0311 | 117 | 110 | 144 | 95±2 | 87±2 | 10*6.5 |
| DR024D0233 | 117 | 120 | 144 | 95±2 | 97±2 | 10*6.5 |
| DR032D0175 | 117 | 140 | 157 | 95±2 | 116.5±2 | 10*6.5 |
| DR038D0147 | 136 | 135 | 172 | 111±2 | 112±2 | 10*6.5 |
| DR045D0124 | 136 | 135 | 173 | 111±2 | 112±2 | 10*6.5 |
| DR060DP935 | 136 | 150 | 173 | 111±2 | 127±2 | 10*6.5 |

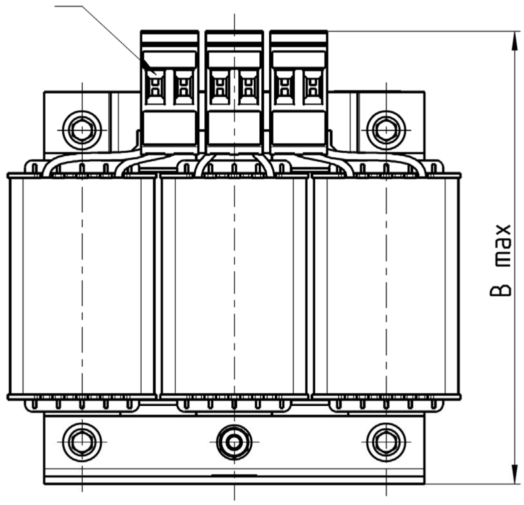
AC output reactor dimension and specifications:

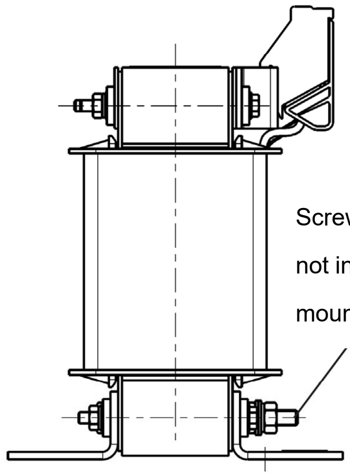



Tightening torque: 0.6–0.8 Nm

Tightening torque: 1.0–1.2 Nm

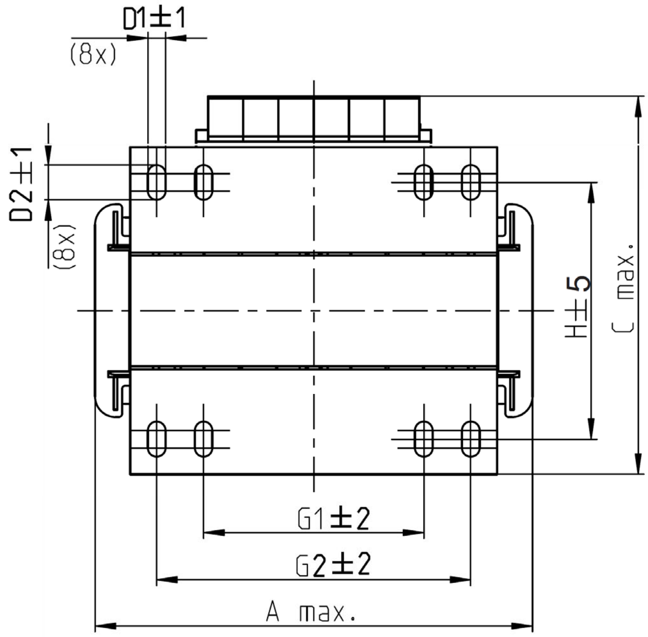


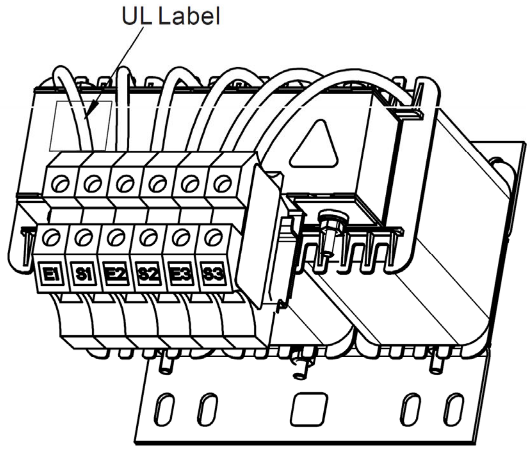



Screw length must not interfere with the mounting holes.

Unit: mm

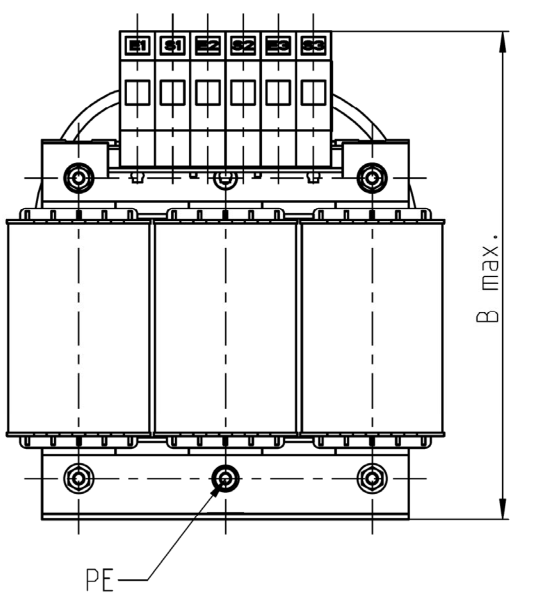
| Output Reactors Delta Part # | A | B | C | D1*D2 | E | G1 | G2 | PE D |
|---|---|---|---|---|---|---|---|---|
| DR005L0254 | 96 | 110 | 70 | 6*9 | 42 | 60 | 40 | M4 |
| DR008L0159 | 120 | 135 | 96 | 6*12 | 60 | 80.5 | 60 | M4 |
| DR011L0115 | 120 | 135 | 96 | 6*12 | 60 | 80.5 | 60 | M4 |
| DR017LP746 | 120 | 135 | 105 | 6*12 | 65 | 80.5 | 60 | M4 |
| DR025LP507 | 150 | 160 | 120 | 6*12 | 88 | 107 | 75 | M4 |
| DR033LP320 | 150 | 160 | 120 | 6*12 | 88 | 107 | 75 | M4 |

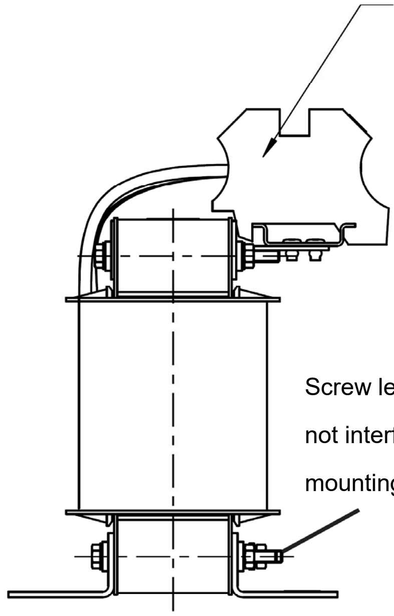



Terminal gauge: 16 mm$^2$

Tightening torque: 1.2–1.4 Nm

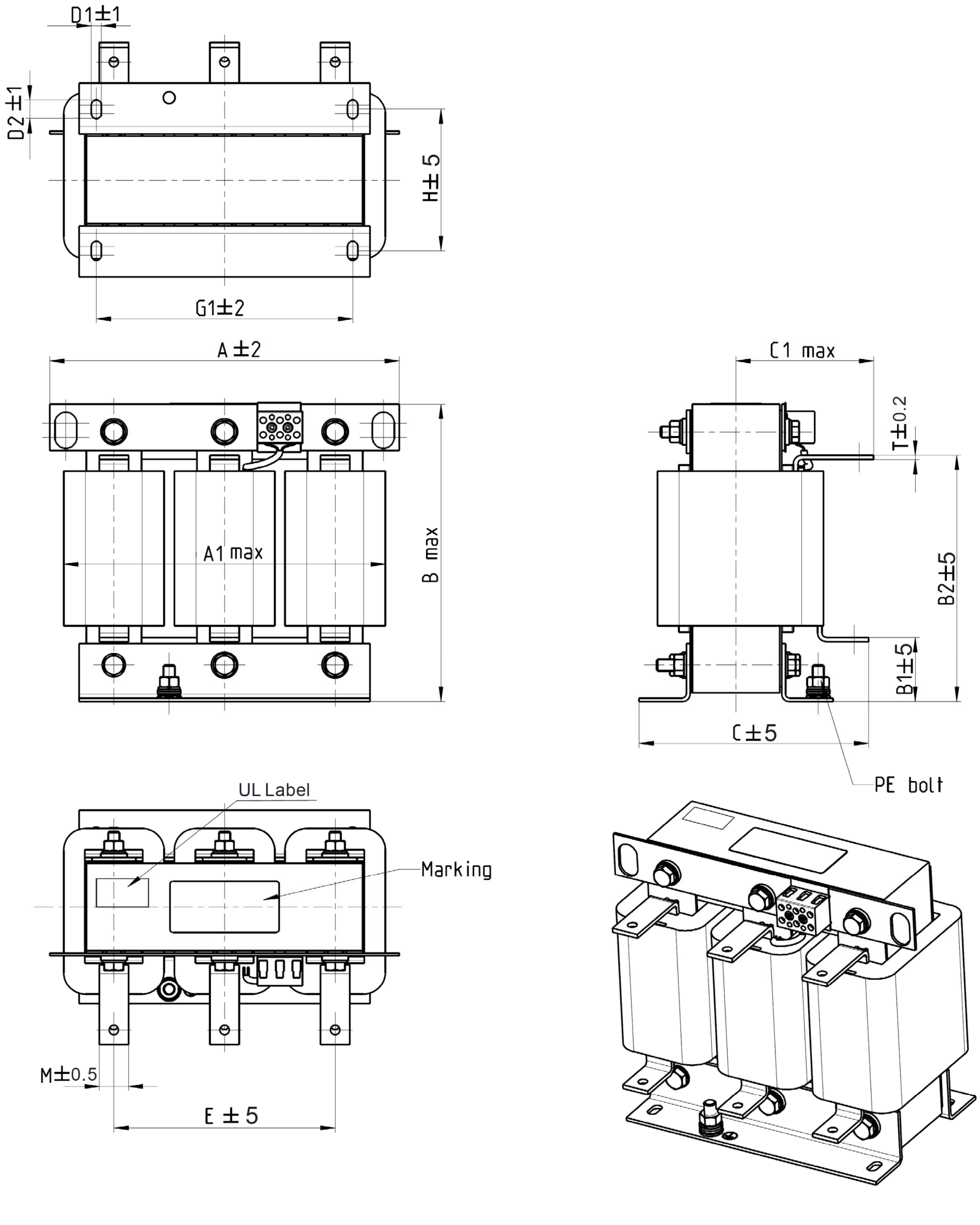


Screw length must not interfere with the mounting holes.

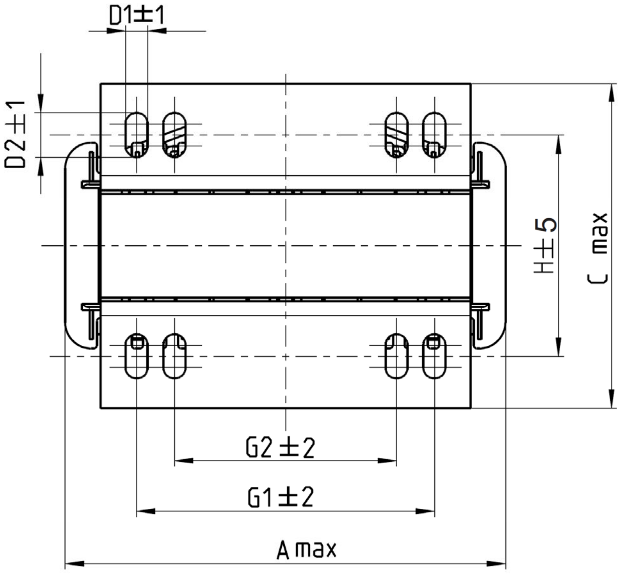
Unit: mm

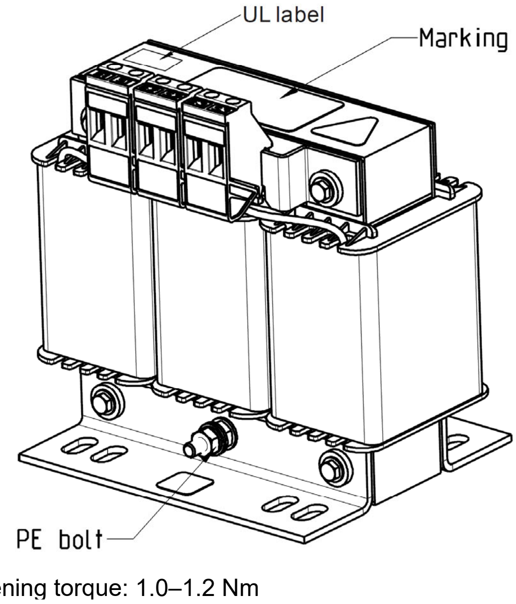
| Output Reactors Delta Part # | A | B | C | D1*D2 | H | G | G1 | Q | M | PE D |
|---|---|---|---|---|---|---|---|---|---|---|
| DR049LP215 | 180 | 205 | 175 | 6*12 | 115 | 85 | 122 | 16 | 1.2-1.4 | M4 |
| DR065LP162 | 180 | 215 | 185 | 6*12 | 115 | 85 | 122 | 35 | 2.5-3.0 | M4 |

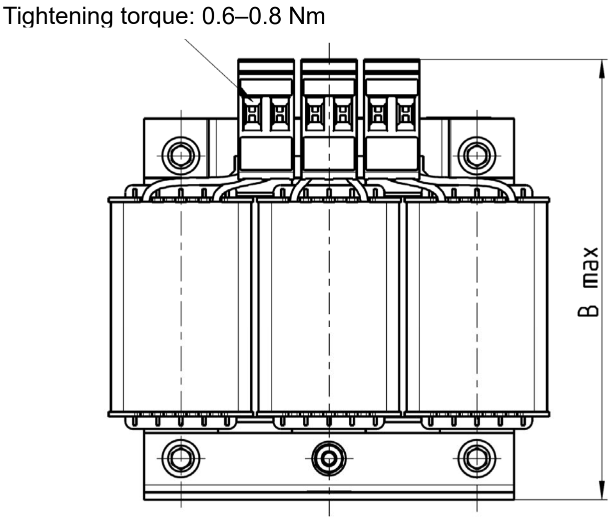


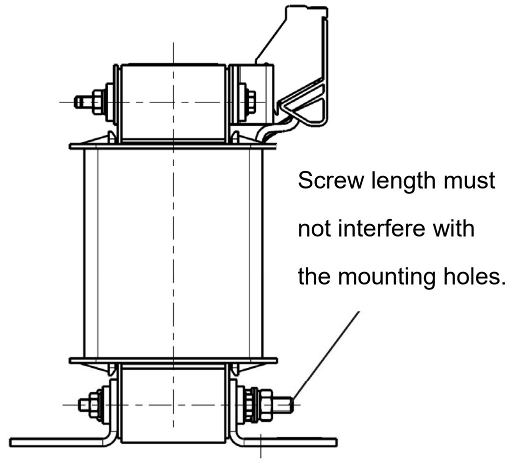

Unit: mm

| Output Reactors Delta Part # | A | A1 | B | B1 | B2 | C | C1 | D1*D2 | E | G1 | H | M*T |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| DR075LP170 | 240 | 228 | 215 | 44 | 170 | 151 | 100 | 7*13 | 152 | 176 | 85 | 20*3 |
| DR090LP141 | 240 | 228 | 215 | 44 | 170 | 151 | 100 | 7*13 | 152 | 176 | 85 | 20*3 |
| DR105LP106 | 240 | 228 | 215 | 44 | 170 | 165 | 110 | 7*13 | 152 | 176 | 97 | 20*3 |
| DR146LP087 | 240 | 228 | 240 | 45 | 202 | 165 | 110 | 7*13 | 152 | 176 | 97 | 30*3 |
| DR180LP070 | 250 | 240 | 250 | 46 | 205 | 175 | 110 | 11*18 | 160 | 190 | 124 | 30*5 |



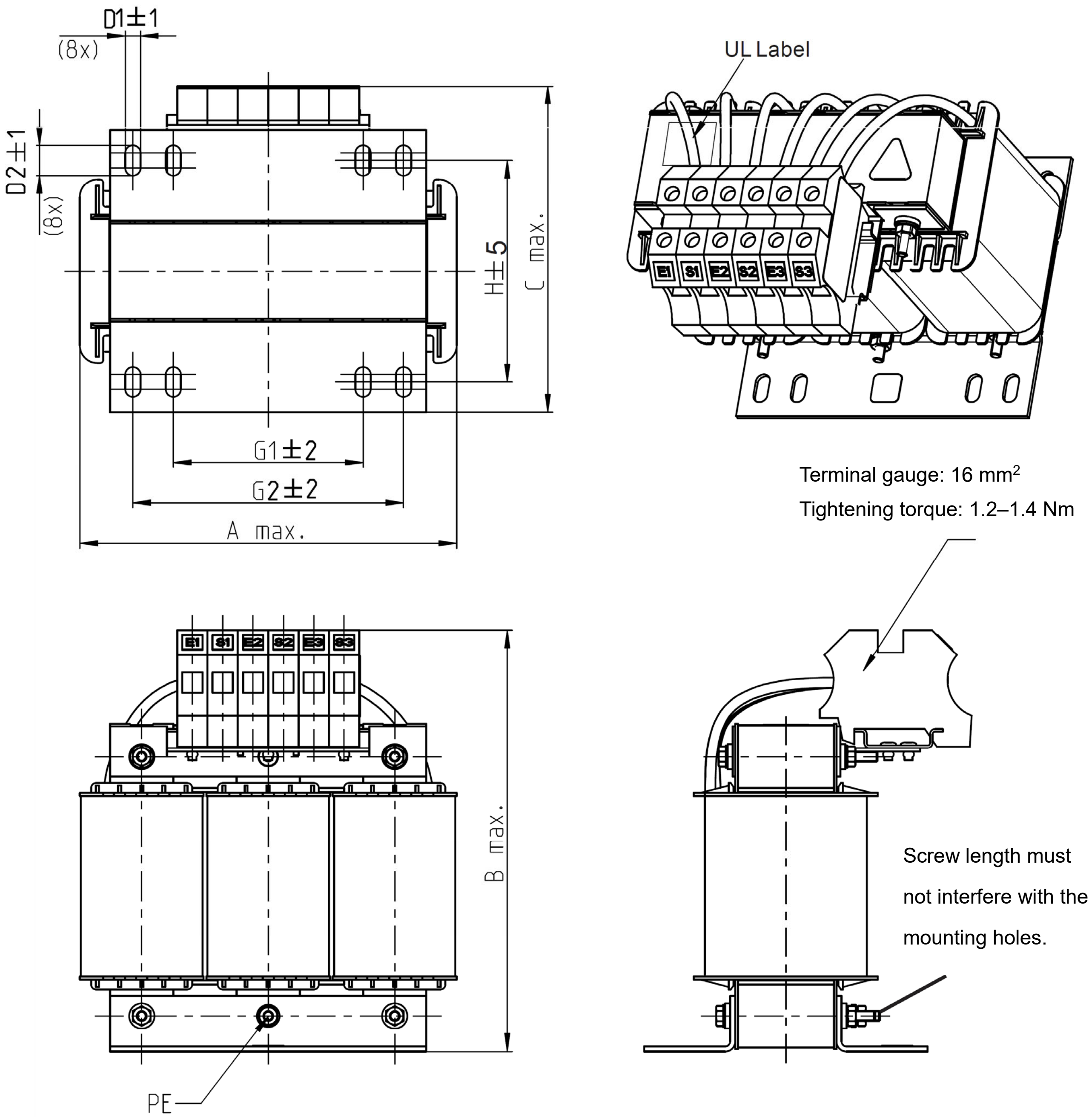



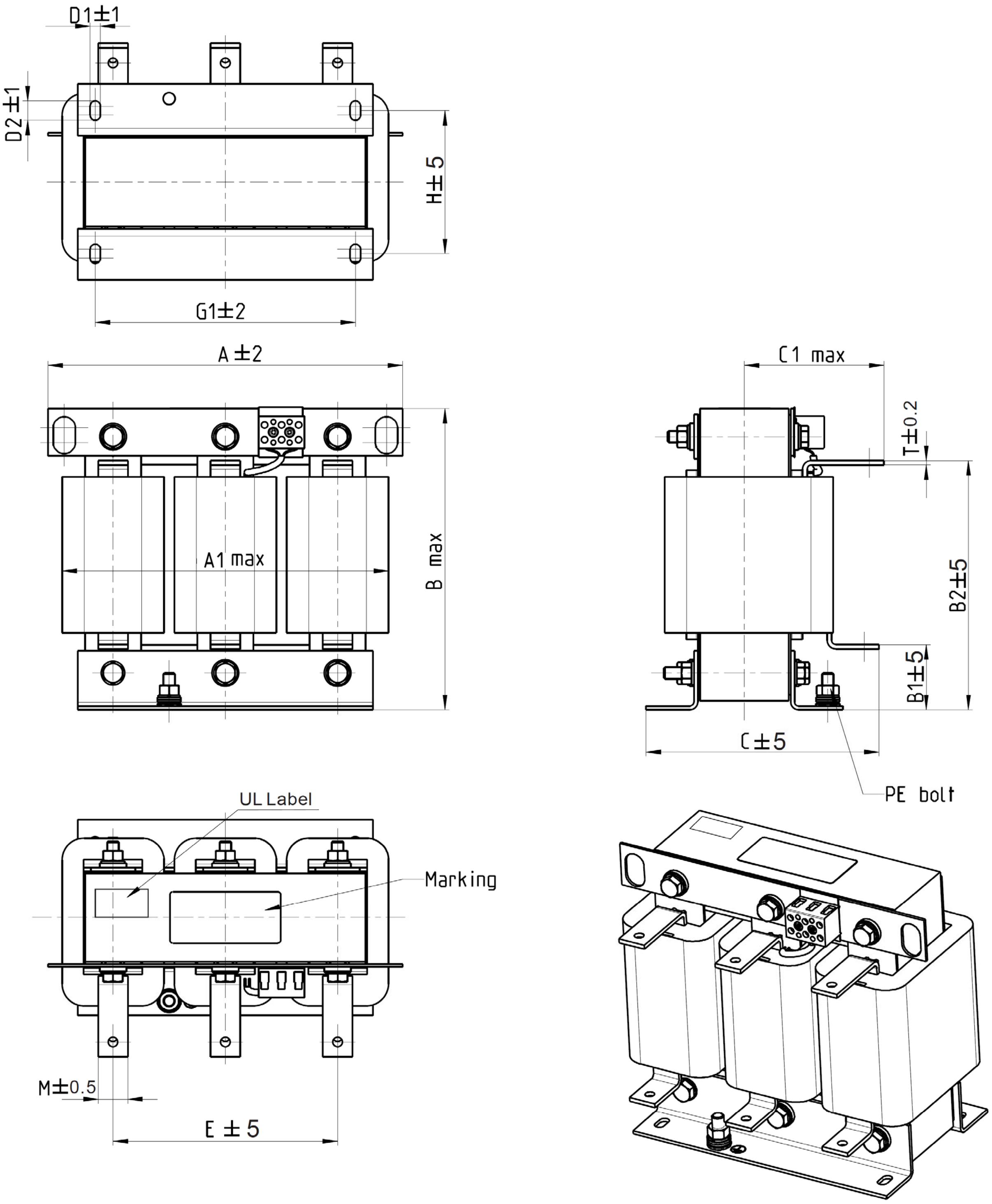

Unit: mm

| Output Reactors Delta Part # | A | B | C | D1*D2 | H | G1 | G2 | PE D |
|---|---|---|---|---|---|---|---|---|
| DR003L0810 | 96 | 115 | 65 | 6*9 | 42 | 60 | 40 | M4 |
| DR004L0607 | 120 | 135 | 95 | 6*12 | 60 | 80.5 | 60 | M4 |
| DR006L0405 | 120 | 135 | 95 | 6*12 | 60 | 80.5 | 60 | M4 |
| DR009L0270 | 150 | 160 | 100 | 6*12 | 74 | 107 | 75 | M4 |
| DR010L0231 | 150 | 160 | 115 | 6*12 | 88 | 107 | 75 | M4 |
| DR012L0202 | 150 | 160 | 115 | 6*12 | 88 | 107 | 75 | M4 |
| DR018L0117 | 150 | 160 | 115 | 6*12 | 88 | 107 | 75 | M4 |
| DR024LP881 | 150 | 160 | 115 | 6*12 | 88 | 107 | 75 | M4 |
| DR032LP660 | 180 | 190 | 145 | 6*12 | 114 | 122 | 85 | M6 |



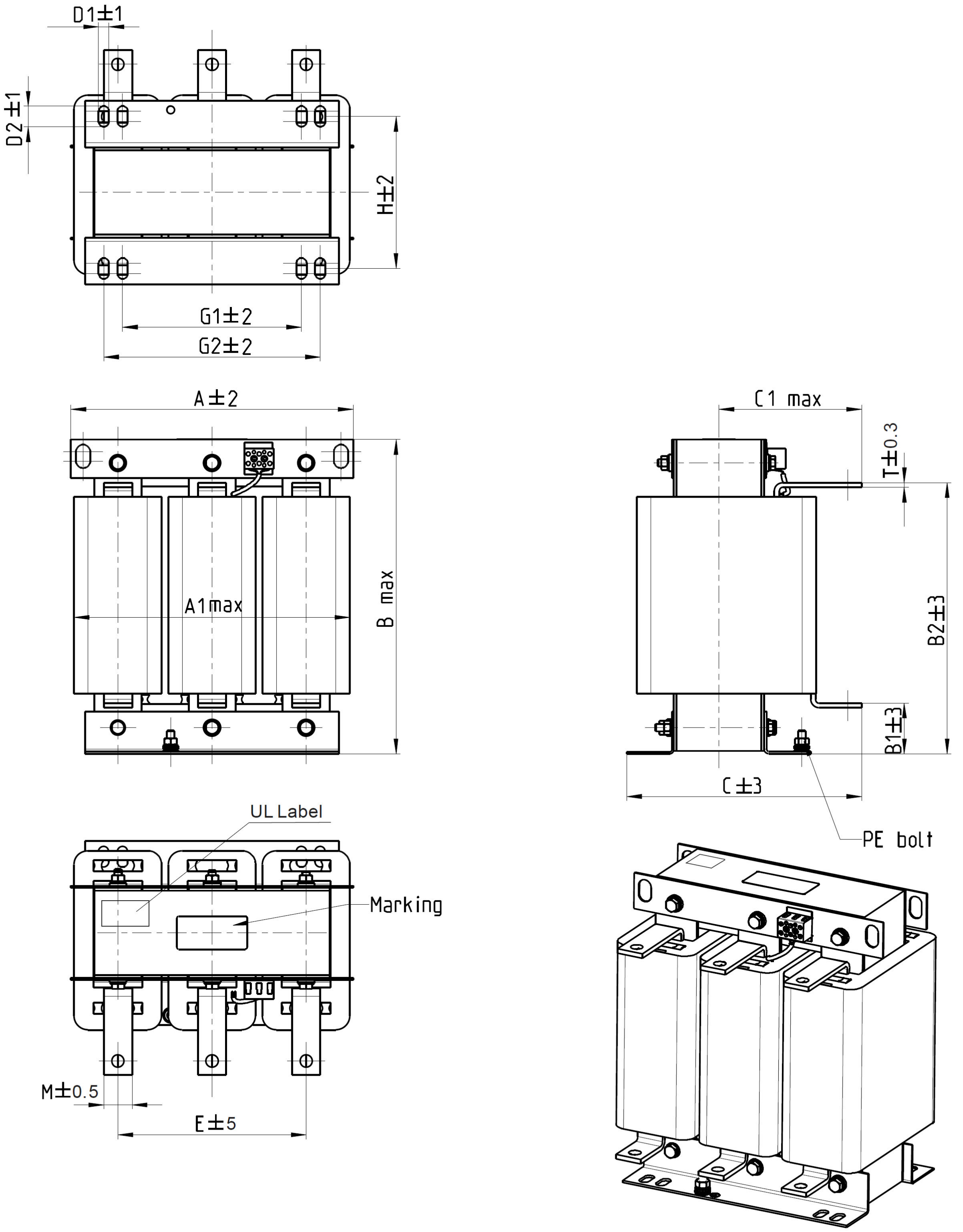

Unit: mm

| Output Reactors Delta Part # | A | B | C | D1*D2 | H | G1 | G2 | PE D |
|---|---|---|---|---|---|---|---|---|
| DR038LP639 | 180 | 205 | 170 | 6*12 | 115 | 85 | 122 | M4 |
| DR045LP541 | 235 | 245 | 155 | 7*13 | 85 | / | 176 | M6 |




Unit: mm

| Output Reactors Delta Part # | A | A1 | B | B1 | B2 | C | C1 | D1*D2 | E | G1 | H | M*T |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| DR060LP405 | 240 | 228 | 215 | 44 | 170 | 163 | 110 | 7*13 | 152 | 176 | 97 | 20*3 |
| DR073LP334 | 250 | 235 | 235 | 44 | 186 | 174 | 115 | 11*18 | 160 | 190 | 124 | 20*3 |
| DR091LP267 | 250 | 240 | 235 | 44 | 186 | 174 | 115 | 11*18 | 160 | 190 | 124 | 20*3 |
| DR110LP221 | 270 | 260 | 245 | 50 | 192 | 175 | 115 | 10*18 | 176 | 200 | 106 | 20*3 |




Unit: mm

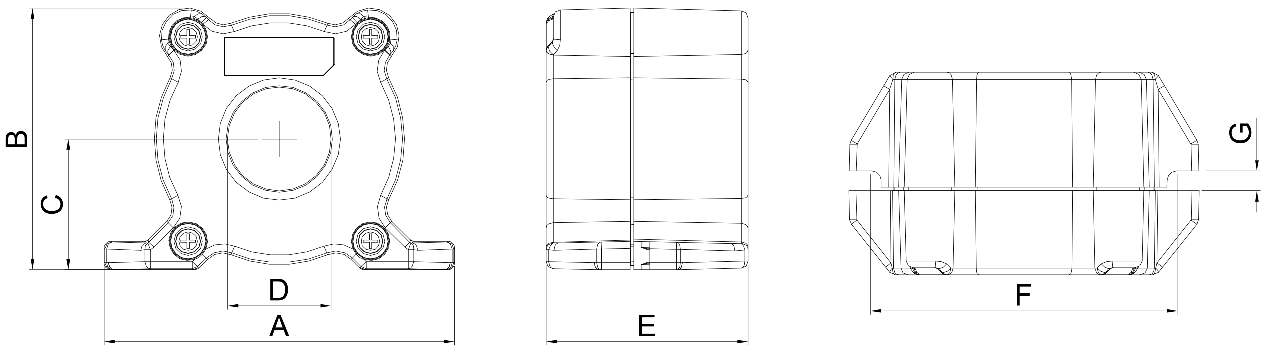
| Output Reactors Delta Part # | A | A1 | B | B1 | B2 | C | C1 | D1*D2 | E | G1 | G2 | H | M*T |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| DR150LP162 | 270 | 264 | 265 | 51 | 208 | 192 | 125 | 10*18 | 176 | 200 | / | 118 | 30*3 |
| DR180LP135 | 300 | 295 | 310 | 55 | 246 | 195 | 125 | 11*22 | 200 | 230 | 190 | 142 | 30*3 |

## 6-5 Zero Phase Reactor

You can also suppress interference by installing a zero phase reactor at the main input or the motor output of the drive, depending on the location of the interference. Due to the large current passed through the main input/motor output side, pay attention to core saturation issue. Delta provides two types of zero phase reactors to solve interference problems.

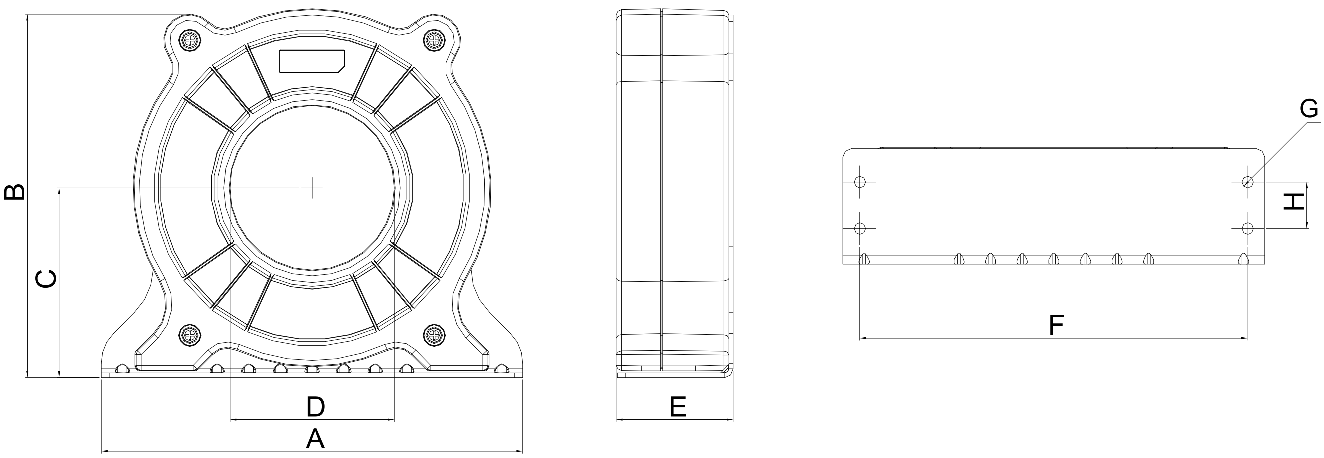
A. Casing with mechanical fixed part

The ideal material for withstanding large current loaded for the zero phase reactor at the main input/motor output is composite core. Core has strong saturation, and its strong resistance are many times of simple metal magnetic materials. Thus it can be used for high frequencies and you can get higher impedance by increasing the number of turns.



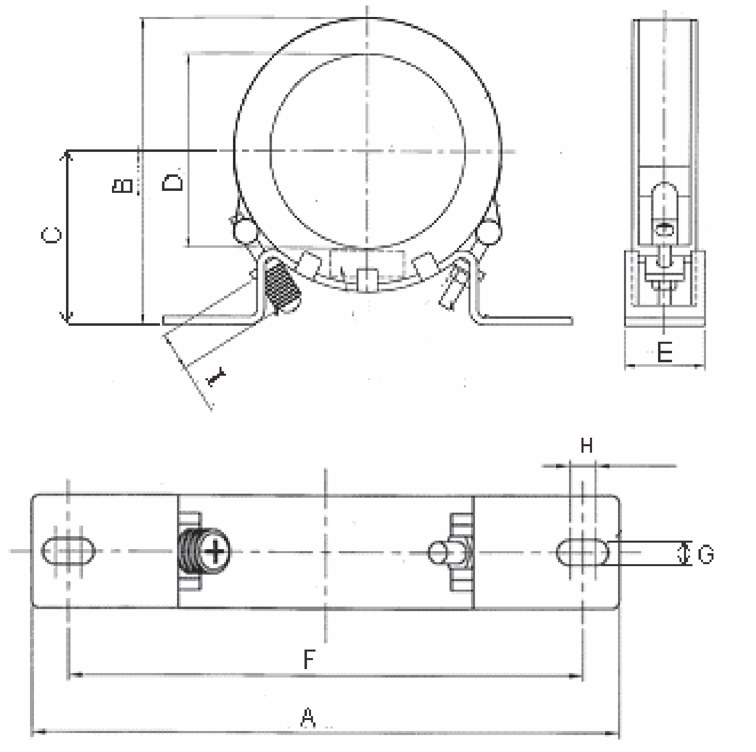

Unit: mm [inch]

| Model | A | B | C | D | E | F | G(Ø) | Torque |
|---|---|---|---|---|---|---|---|---|
| RF008X00A | 98 [3.858] | 73 [2.874] | 36.5 [1.437] | 29 [1.142] | 56.5 [2.224] | 86 [3.386] | 5.5 [0.217] | 8–10 kgf/cm |
| RF004X00A | 110 [4.331] | 87.5 [3.445] | 43.5 [1.713] | 36 [1.417] | 53 [2.087] | 96 [3.780] | 5.5 [0.217] | 8–10 kgf/cm |




Unit: mm [inch]

| Model | A | B | C | D | E | F | G(Ø) | H | Torque |
|---|---|---|---|---|---|---|---|---|---|
| RF002X00A | 200 [7.874] | 172.5 [6.791] | 90 [3.543] | 78 [3.071] | 55.5 [2.185] | 184 [7.244] | 5.5 [0.217] | 22 [0.866] | 40–45 kgf/cm |

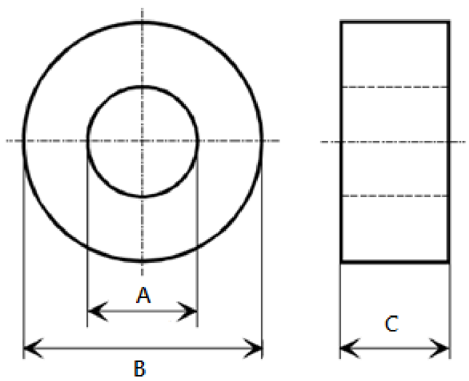



Unit: mm [inch]

| Model | A | B | C | D | E | F | G(Ø) | H | I |
|---|---|---|---|---|---|---|---|---|---|
| RF300X00A | 241<br>[9.488] | 217<br>[8.543] | 114<br>[4.488] | 155<br>[6.102] | 42<br>[1.654] | 220<br>[8.661] | 6.5<br>[0.256] | 7.0<br>[0.276] | 20<br>[0.787] |
| | | | | | | | | **Torque**:<br>40–45 kgf/cm | |

B. Casing without mechanical fixed part

Adopts nanocrystalline core developed by VAC®, and has high initial magnetic permeability, high saturation induction density, low iron loss and perfect temperature characteristic. If the zero phase reactor does not need to be fixed mechanically, use this solution.




Unit: mm

| Model | A | B | C | Function |
|---|---|---|---|---|
| T60006L2040W453 | 22.5 | 43.1 | 18.5 | Motor wire |
| T60006L2050W565 | 36.3 | 53.5 | 23.4 | Motor wire |
| T60006L2160V066 | 123.9 | 166.9 | 30.5 | Motor wire |
| T60004L2016W620 | 10.7 | 17.8 | 8.0 | Signal line |
| T60004L2025W622 | 17.5 | 27.3 | 12.3 | Signal line |

| Reactor Model (See Note) | Recommended Wire Size | | Wiring Method | Qty | Applicable Motor Drives |
|---|---|---|---|---|---|
| RF008X00A<br>T60006L2040W453 | ≤ 8 AWG | ≤ 8.37 mm$^2$ | Diagram A<br>Diagram B | 1 | VFD022ED21S VFD037ED21S<br>VFD040ED23S VFD040ED43S |
| RF004X00A<br>T60006L2050W565 | ≤ 4 AWG | ≤ 21.15 mm$^2$ | Diagram A<br>Diagram B | 1 | VFD055ED23S VFD075ED23S<br>VFD110ED23S VFD055ED43S<br>VFD075ED43S VFD110ED43S<br>VFD150ED43S VFD185ED43S |
| RF002X00A<br>T60006L2160V066 | ≤ 2 AWG | ≤ 33.62 mm$^2$ | Diagram A<br>Diagram B | 1 | VFD150ED23S VFD185ED23S<br>VFD220ED23S VFD220ED43S<br>VFD300ED43S |
| RF300X00A<br>T60006L2160V066 | ≤ 300 MCM | ≤ 152 mm$^2$ | Diagram A<br>Diagram B | 1 | VFD300ED23S VFD370ED23S<br>VFD370ED43S VFD450ED43S<br>VFD550ED43S VFD750ED43S |

Note: 600 V insulated cable wire

## Installation

During installation, pass the cable through at least one zero phase reactor. Use a suitable cable type (insulation class and wire section) so that the cable passes easily through the zero phase reactor. Do not pass the grounding cable through the zero phase reactor; only pass the motor wire through the zero phase reactor. With longer motor cables the zero-phase reactor can effectively reduce interference at the motor output. Install the zero-phase reactor as close to the output of the drive as possible. Diagram A shows the installation diagram for a single turn zero phase reactor. If the wire diameter allows several turns, Diagram B shows the installation of a multi-turn zero phase reactor. The more turns, the better the noise suppression effect.

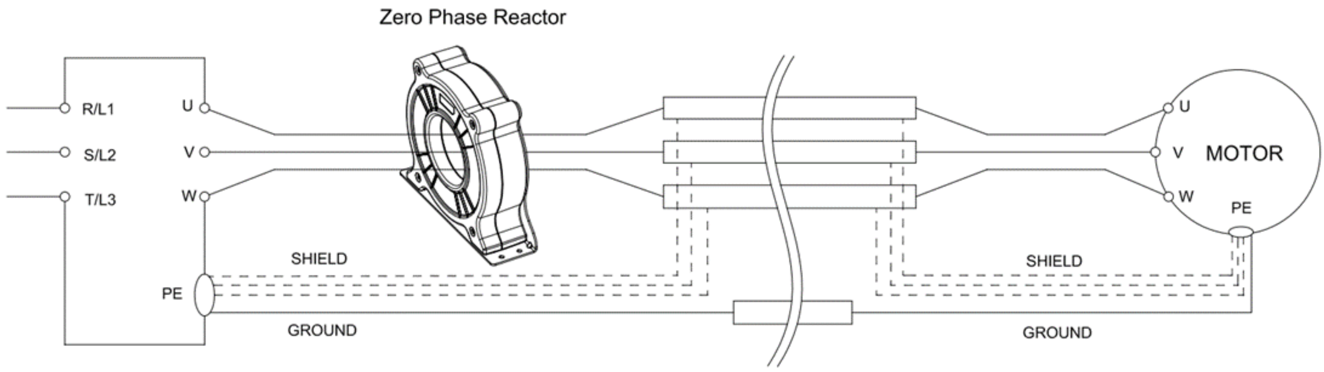



Diagram A. Single turn wiring diagram for shielding wire with a zero phase reactor

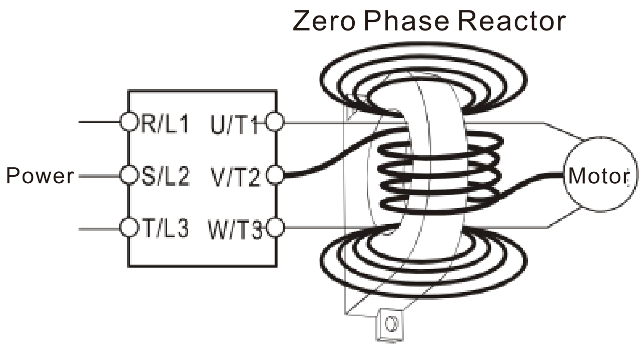



Diagram B. Multi-turn zero phase reactor

## Installation Precaution

Install the zero phase reactor at the drive's output terminal (U/T1, V/T2, W/T3). After the zero phase reactor is installed, it reduces the electromagnetic radiation and load stress emitted by the wiring of the frequency converter. The number of zero phase reactors required for the drive depends on the wiring length and the drive voltage.

The normal operating temperature of the zero phase reactor should be lower than 85°C (176°F). However, when the zero phase reactor is saturated, its temperature may exceed 85°C (176°F). In this case, increase the number of zero phase reactors to avoid saturation. The following are reasons that might cause saturation of the zero phase reactors: the drive wiring is too long; the drive has several sets of loads; the wiring is in parallel; or the drive uses high capacitance wiring. If the temperature of the zero phase reactor exceeds 85°C (176°F) during the operation of the drive, increase the number of zero phase reactors.

Recommended maximum wiring gauge when installing zero phase reactor:

| Zero Phase Reactor Model No. | Max. Wire Gauge or LUG width | Max. Wire Gauge AWG (1 C*3) | | Max. Wire Gauge AWG (4 C*1) | |
|---|---|---|---|---|---|
| | | 75 C | 90 C | 75 C | 90 C |
| RF008X00A | 13 MM | 3 AWG | 1 AWG | 3 AWG | 1 AWG |
| RF004X00A | 16 MM | 1 AWG | 2/0 AWG | 1 AWG | 1/0 AWG |
| RF002X00A | 36 MM | 600 MCM | 600 MCM | 1 AWG | 1/0 AWG |
| RF300X00A | 73 MM | 650 MCM | 650 MCM | 300 MCM | 300 MCM |
| T60006L2040W453 | 11 MM | 9 AWG | 4 AWG | 6 AWG | 6 AWG |
| T60006L2050W565 | 16 MM | 1 AWG | 2/0 AWG | 1 AWG | 1/0 AWG |
| T60006L2160V066 | 57 MM | 600 MCM | 600 MCM | 300 MCM | 300 MCM |

# 6-6 EMC Filter

The table below shows external EMC filter models for each ED-S series motor drive.
Choose corresponding zero phase reactors and applicable shielding cables according to the required noise emission and electromagnetic interference rating for the best configuration and anti-interference performance. If radiation emission (RE) is not a concern on site and you only need conducted emission (CE) to reach EN55011 Class A, you do not need to install a zero phase reactor on the input side to reach the EMC standard.

**220V Models**

| VFD-ED | | | EMC Filter Model # | Zero Phase Reactor | Carrier Frequency | EN12015 | |
|---|---|---|---|---|---|---|---|
| Frame | Motor Drive Model # | Rated Input Current (A) | | Input Side (R/S/T) | | Conducted Emission<br>Length of Output Shielded Cable 50 m | Radiation Emission |
| B | VFD022ED21S | 24 | B84142A0042R122 | RF008X00A or T60006L2040W453 | Carrier frequency by default | CLASS A | CLASS A |
| | VFD037ED21S | 34 | B84142A0042R122 | RF008X00A or T60006L2040W453 | | CLASSA | CLASSA |
| | VFD040ED23S | 20 | EMF035A23A | RF008X00A or T60006L2040W453 | | CLASS A | CLASS A |
| C | VFD055ED23S | 23 | EMF056A23A | RF004X00A or T60006L2050W565 | | CLASS A | CLASS A |
| | VFD075ED23S | 30 | EMF056A23A | RF004X00A or T60006L2050W565 | | CLASS A | CLASS A |
| | VFD110ED23S | 47 | EMF056A23A | RF004X00A or T60006L2050W565 | | CLASS A | CLASS A |
| D | VFD150ED23S | 56 | B84143D0150R127 | RF002X00A or T60006L2160V066 | | CLASS A | CLASS A |
| | VFD185ED23S | 73 | B84143D0150R127 | RF002X00A or T60006L2160V066 | | CLASS A | CLASS A |
| | VFD220ED23S | 90 | B84143D0150R127 | RF002X00A or T60006L2160V066 | | CLASS A | CLASS A |
| E | VFD300ED23S | 132 | B84143D0150R127 | RF002X00A or T60006L2160V066 | | CLASS A | CLASS A |
| | VFD370ED23S | 161 | B84143D0200R127 | RF300X00A or T60006L2160V066 | | CLASS A | CLASS A |

**460V Models**

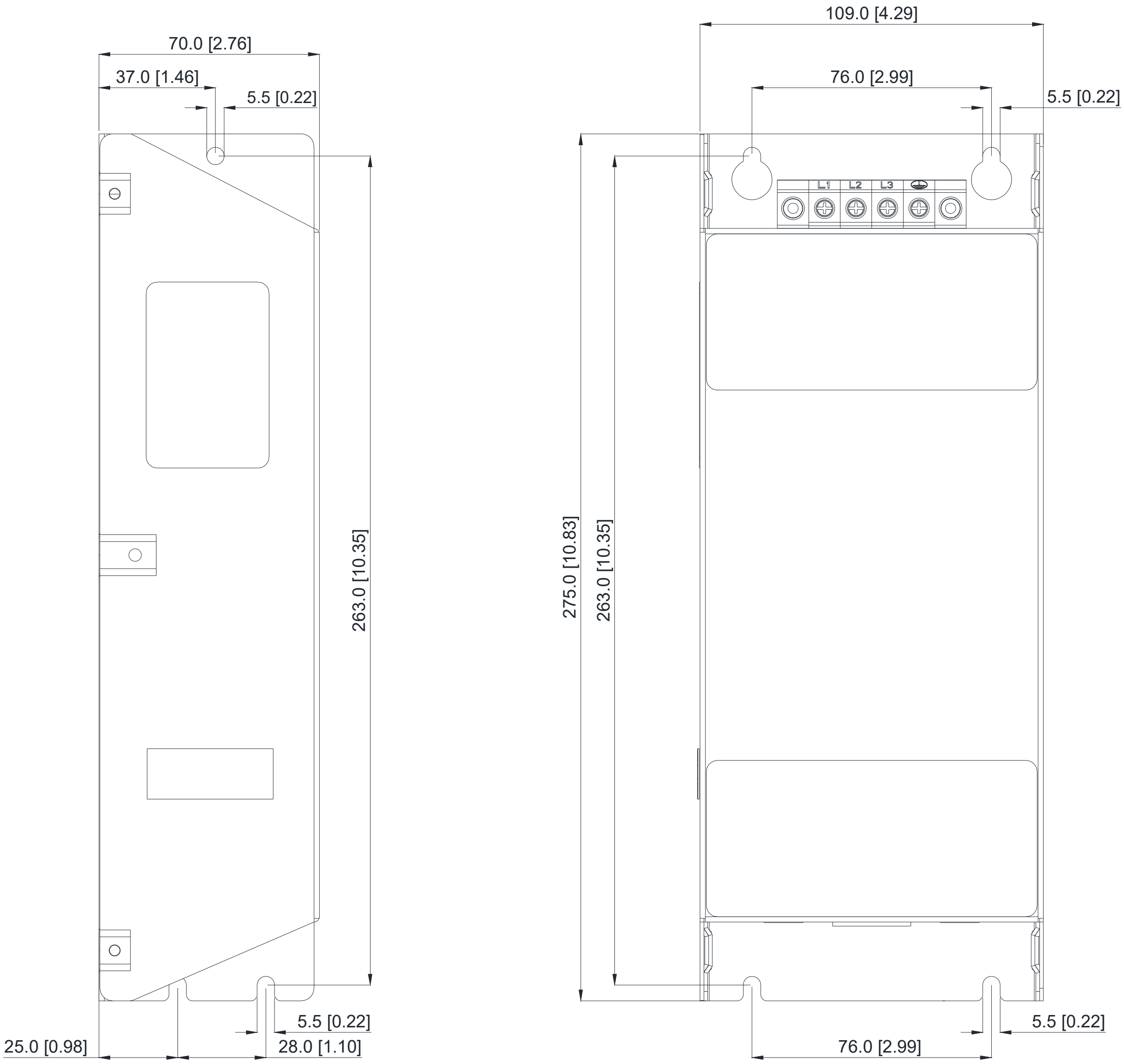
| VFD-ED | | | EMC Filter Model # | Zero Phase Reactor | Carrier Frequency | EN12015 | |
|---|---|---|---|---|---|---|---|
| Frame | Motor Drive Model # | Rated Input Current (A) | | Input Side (R/S/T) | | Conducted Emission<br>Length of Output Shielded Cable 50 m | Radiation Emission |
| B | VFD040ED43S | 11.5 | EMF018A43A | RF008X00A or T60006L2040W453 | Carrier frequency by default | CLASS A | CLASS A |
| C | VFD055ED43S | 14 | EMF033A43A | RF004X00A or T60006L2050W565 | | CLASSA | CLASS A |
| | VFD075ED43S | 17 | EMF033A43A | RF004X00A or T60006L2050W565 | | CLASS A | CLASS A |
| | VFD110ED43S | 24 | EMF033A43A | RF004X00A or T60006L2050W565 | | CLASS A | CLASS A |
| | VFD150ED43S | 30 | B84143D0075R127 | RF004X00A or T60006L2050W565 | | CLASS A | CLASS A |
| | VFD185ED43S | 37 | B84143D0075R127 | RF004X00A or T60006L2050W565 | | CLASS A | CLASS A |
| D | VFD220ED43S | 47 | B84143D0090R127 | RF002X00A or T60006L2160V066 | | CLASS A | CLASS A |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | VFD300ED43S | 58 | B84143D0090R127 | RF002X00A or T60006L2160V066 | | CLASS A | CLASS A |
| E | VFD370ED43S | 80 | B84143D0200R127 | RF300X00A or T60006L2160V066 | | CLASS A | CLASS A |
| | VFD450ED43S | 100 | B84143D0200R127 | RF300X00A or T60006L2160V066 | | CLASS A | CLASS A |
| | VFD550ED43S | 128 | B84143D0200R127 | RF300X00A or T60006L2160V066 | | CLASS A | CLASS A |
| | VFD750ED43S | 165 | B84143D0200R127 | RF300X00A or T60006L2160V066 | | CLASS A | CLASS A |

## EMC Filter Dimension

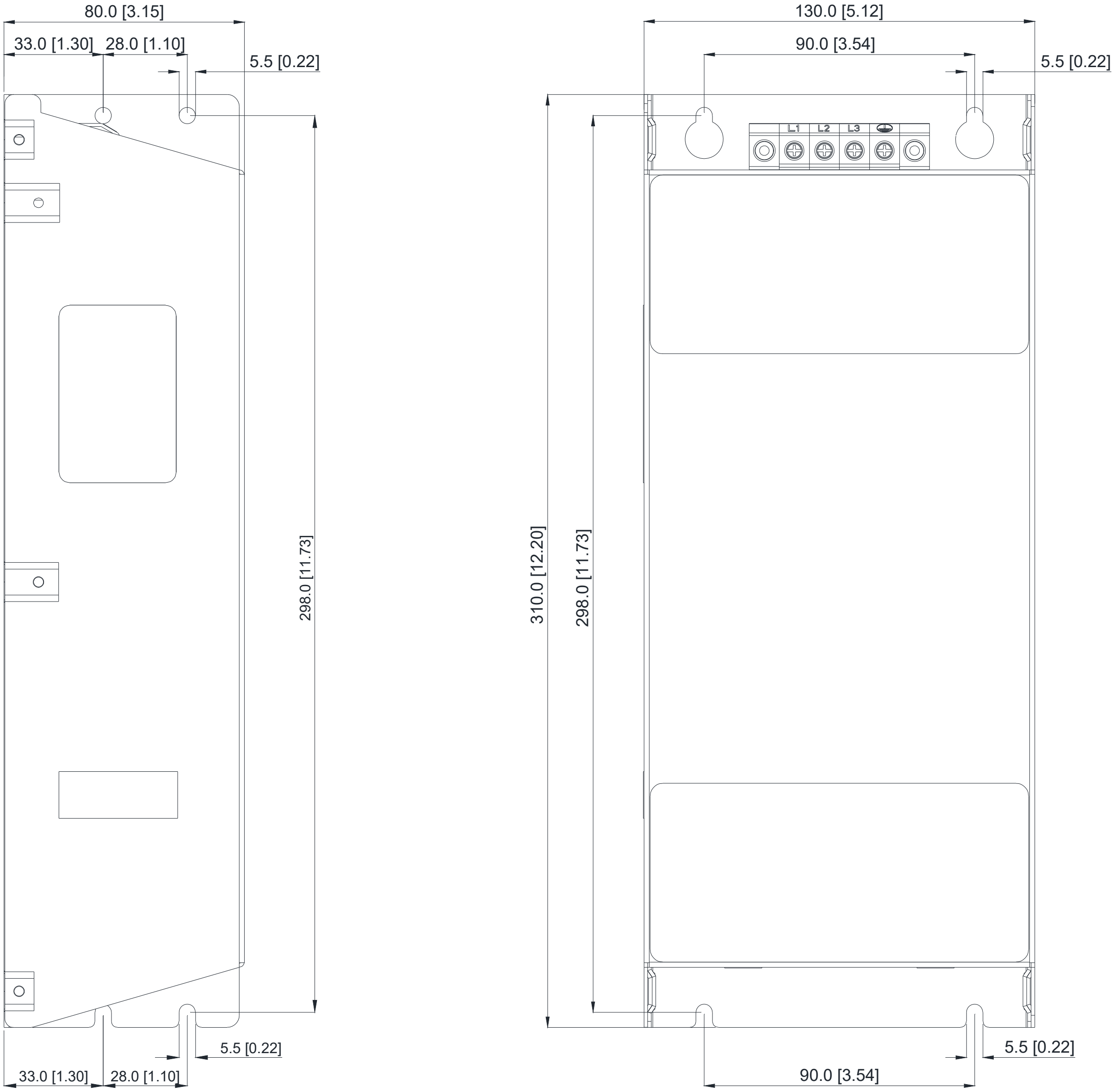
### EMC Filter Model #: EMF018A43A

Unit: mm [inch]



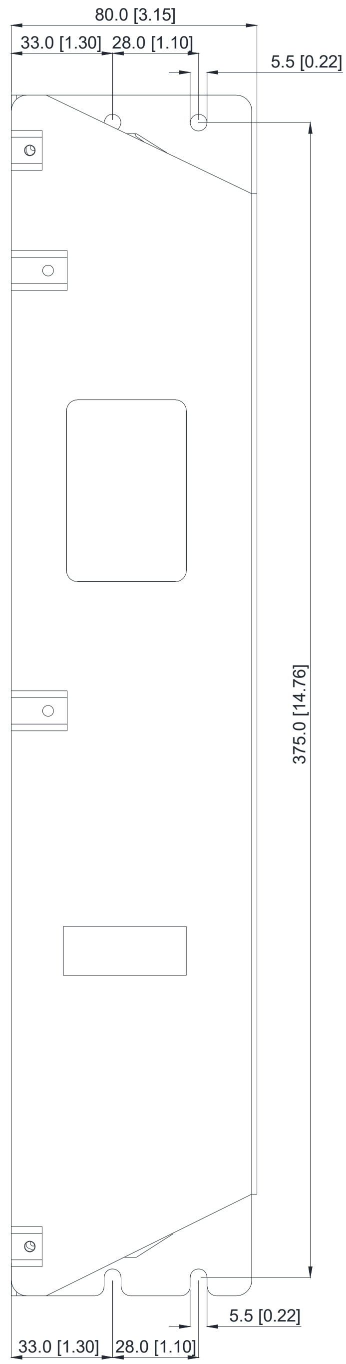
## EMC Filter Model #: EMF035A23A, EMF033A43A

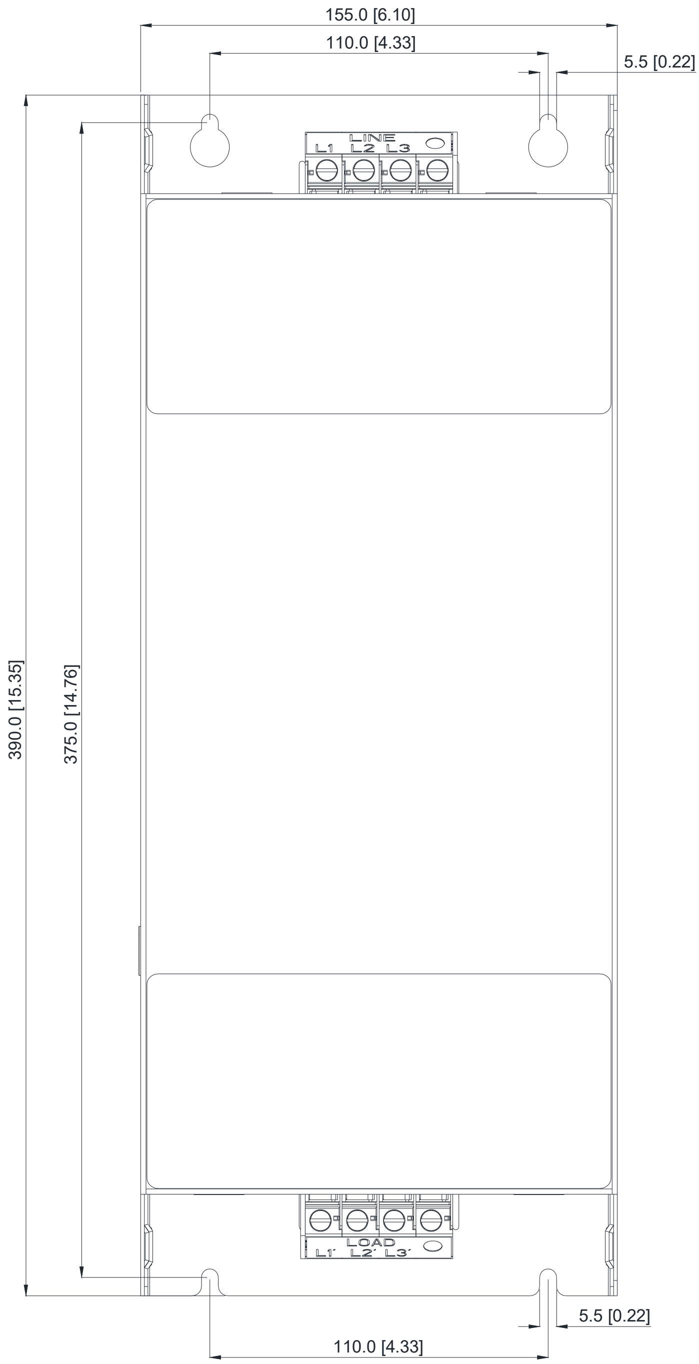
Unit: mm [inch]



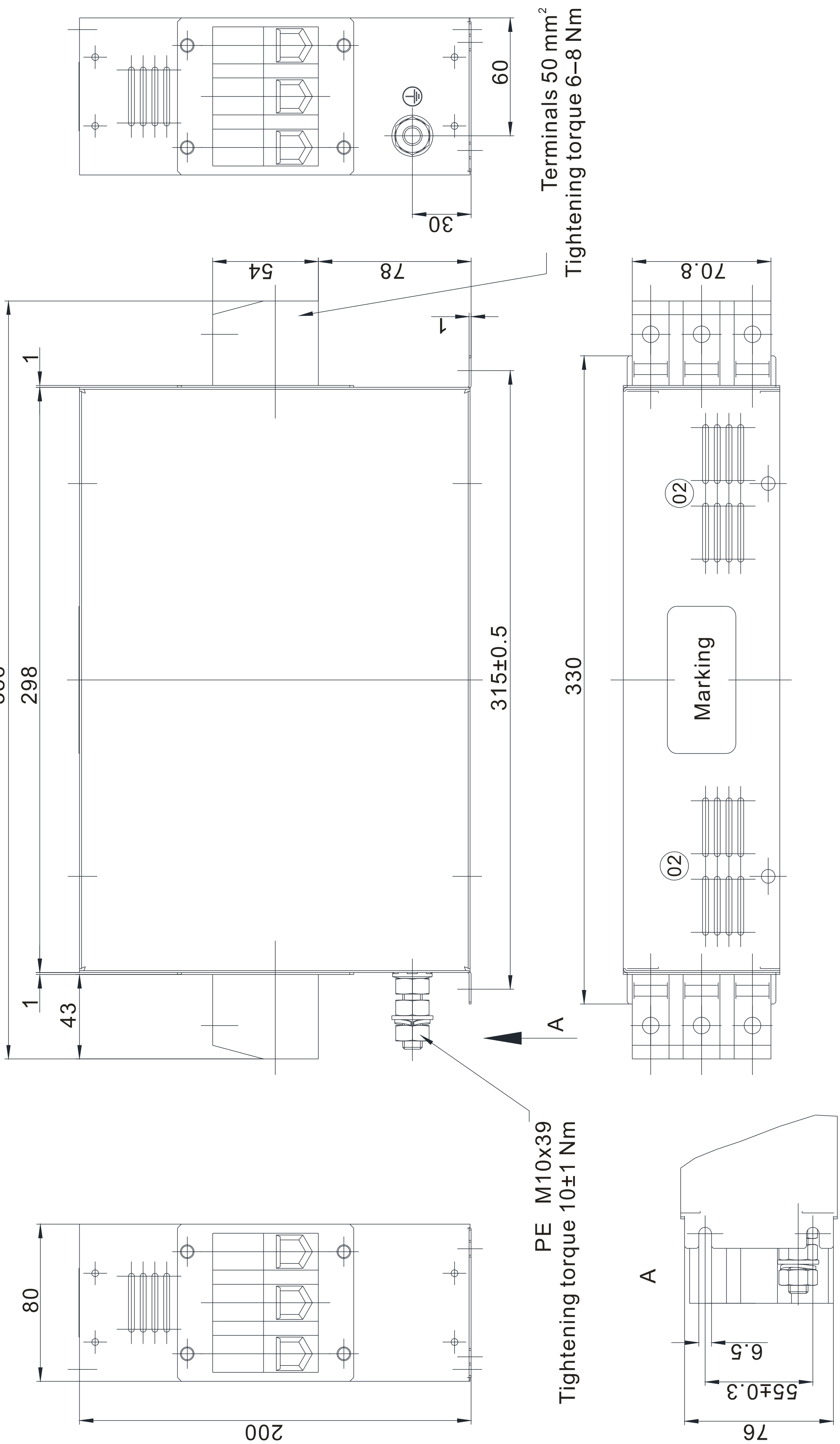
**EMC Filter Model #: EMF056A23A**

Unit: mm [inch]



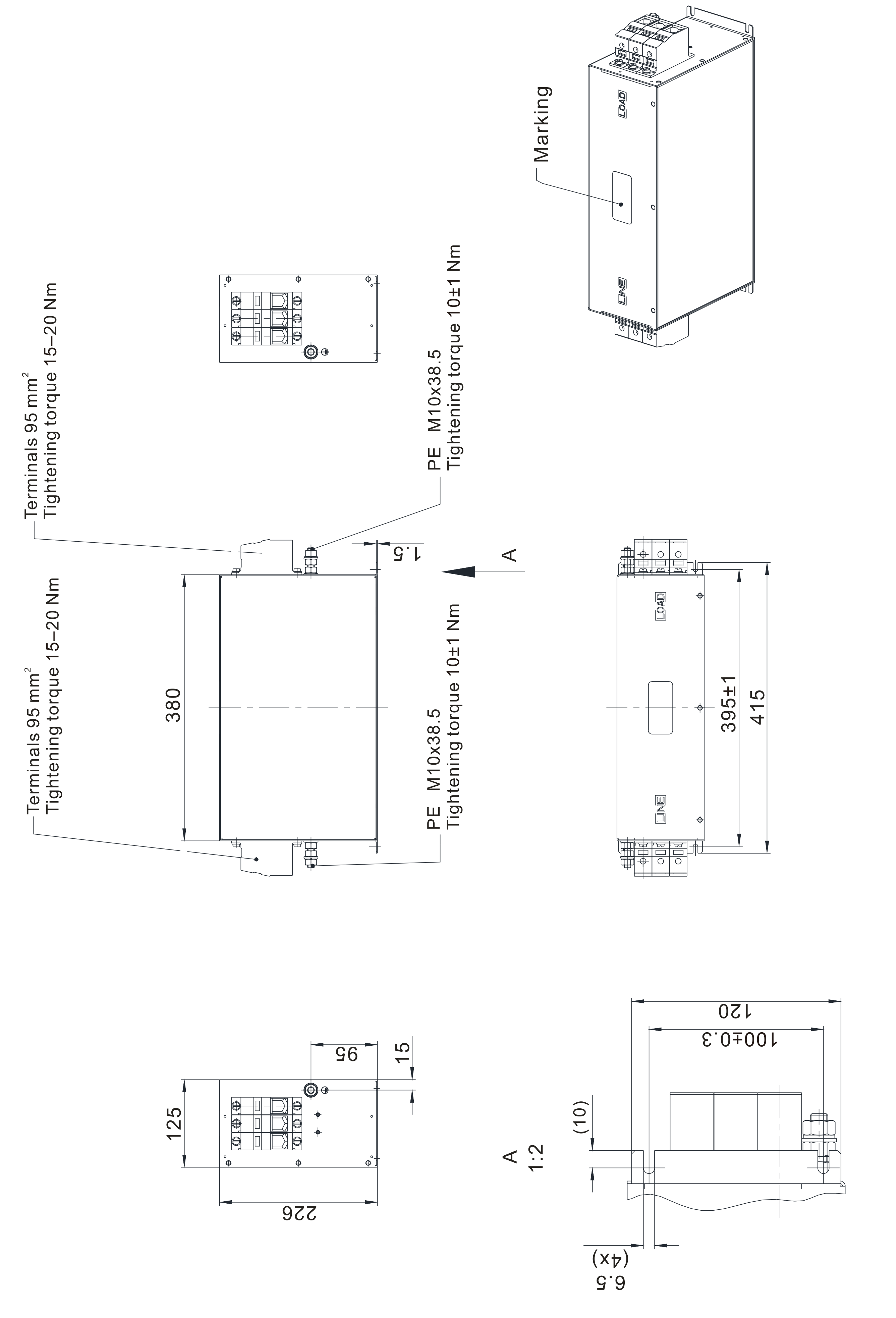



**EMC Filter Model #: B84143D0075R127, B84143D0090R127** Unit: mm [inch]



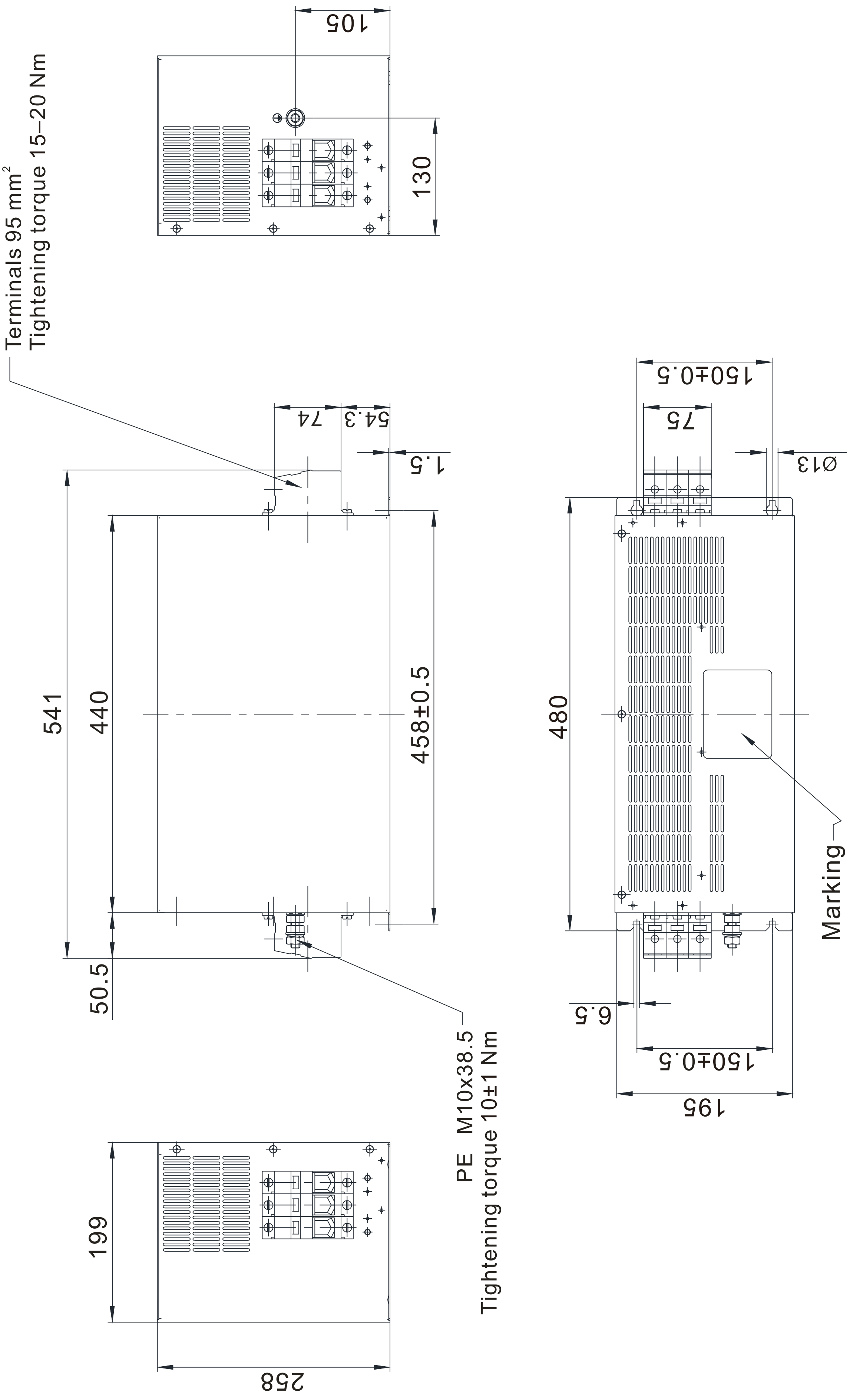
**EMC Filter Model #: B84143D0150R127**

Unit: mm [inch]



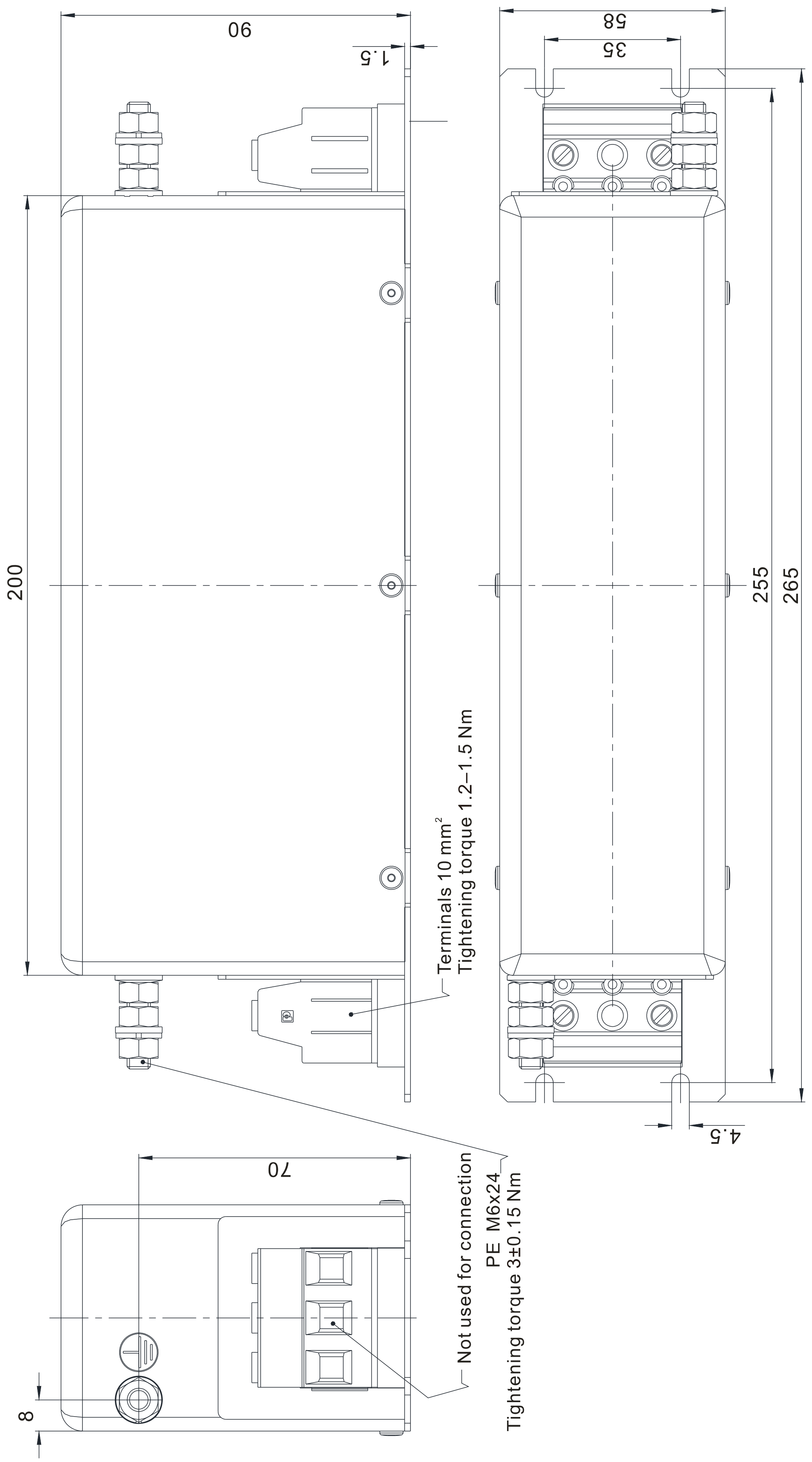
**EMC Filter Model #: B84143D0200R127**

Unit: mm [inch]



**EMC Filter Model #: B84142A0042R122**

Unit: mm [inch]



## EMC Filter Installation

All electrical equipment in operation, including AC motor drives, generates high-frequency and low-frequency noise that interfere with peripheral equipment by radiation or conduction. By correctly installing an EMC filter, you can eliminate much of the interference. Use DELTA EMC filters for the best interference elimination.

The following standards are met when the AC motor drive and EMC filter are installed and wired according to the user manual:

1. EN61000-6-4
2. EN61800-3: 1996
3. EN55011: (1991) Class A Group 1 (1st Environment, restricted distribution)
4. European Standards: EN12015 & EN12016

**General precaution**

To ensure the best anti-interference performance for EMC filter, observe the following precautions in addition to the installation and wiring in the user manual:

☑ Install the EMC filter and AC motor drive on the same metal plate. Install the AC motor drive on the EMC filter footprint or install the EMC filter as close as possible to the AC motor drive.

☑ Use the shortest wire possible. Ground the metal plate. Fix the EMC filter cover and AC motor drive or grounding to the metal plate and make the contact area as large as possible.

**Choose suitable motor cable and precautions**

Improper installation and choice of motor cable affect the performance of EMC filters. Be sure to observe the following precautions when selecting motor cable.

☑ Use shielded cable (double shielding is best). Ground the shielding on both ends of the motor cable with the minimum length and maximum contact area.

☑ Remove any paint on the metal saddle for good ground contact with the plate and shielding (see Figure 1).

☑ The connections between the motor's shielded cable and metal plate must be correct. Use a U-shape metal saddle to fix both ends of the motor cable. See Figure 2 for correct connections.

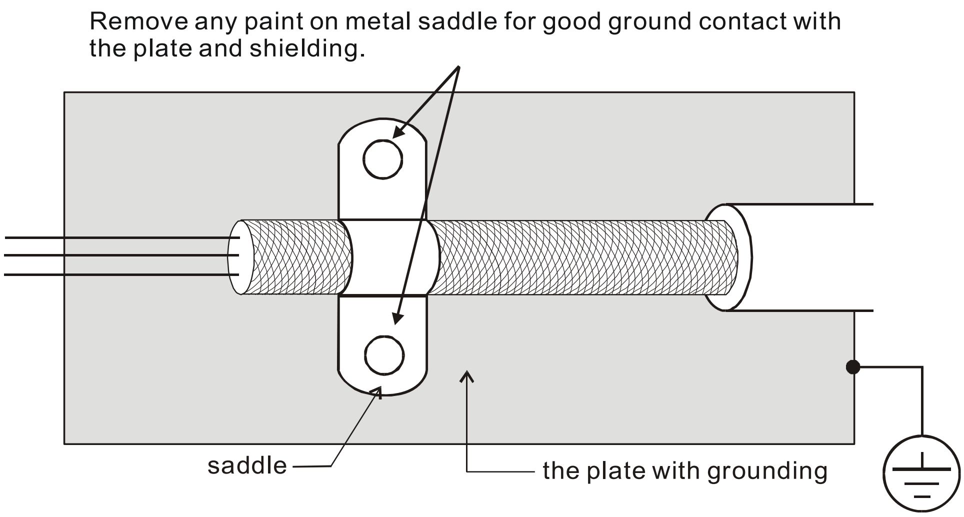



Figure 1

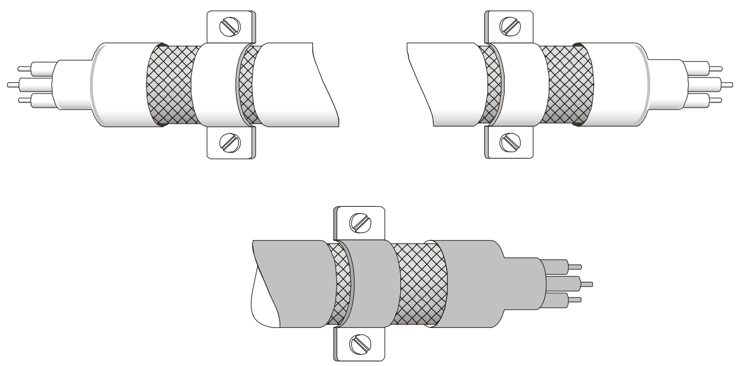


Figure 2

**The motor cable length**

1. Required cable length when the motor drive is at full load.

   a. Non-shielded cable: For 5.5 kW (7.5 HP) and below models, the maximum cable length is 100 m (328 ft). For 7.5 kW (10 HP) and above models, the maximum cable length is 200 m (656 ft)
   b. Shielded cable: For 5.5 kW (7.5 HP) and below models, the maximum cable length is 50 m (165 ft). For 7.5 kW (10 HP) models, the maximum cable length is 100 m (328 ft).
   c. To be compatible with the European Standards EN12015 & EN12016, follow one of the following in addition to the precautions on page 6-44:
      - Use shielded cables
      - The motor cable must be shorter than 2 m (6 ft).

   If the cable length is longer than the recommended lengths above, install an output reactor.

NOTE

- If the cable length is too long, the stray capacitance between cables increases and may cause leakage current. In this case, It activates the over-current protection, increases leakage current, or may affect the current display. The worst case is that it may damage the AC motor drive.
- If more than one motor is connected to the AC motor drive, the total wiring length is the sum of the wiring length from AC motor drive to each motor.
- For the 460V series AC motor drive, when you install an overload thermal relay between the drive and the motor to protect the motor from overheating, the connecting cable must be shorter than 50 m; however, an overload thermal relay malfunction may still occur. To prevent the malfunction, install an output reactor (optional) to the drive or lower the carrier frequency setting (Pr.00-12).

2. Consequence of the surge voltages on the motor

When a motor is driven by a PWM-type AC motor drive, the motor terminals experience surge voltages due to component conversion of AC motor drive and cable capacitance. When the motor cable is very long (especially for the 460V series), surge voltages may damage the insulation. To prevent this, follow these rules:

a. Use a motor with enhanced insulation (refer to the tables below).

b. Reduce the cable length between the AC motor drive and motor to suggested values.

c. Connect an output reactor (optional) to the output terminals of the AC motor drive.

For 7.5 kW (10 HP) and higher models:

| Insulation level of motor | 1000 V | 1300 V | 1600 V |
|---|---|---|---|
| 460 $V_{AC}$ input voltage | 20 m (66 ft) | 100 m (328 ft) | 400 m (1312 ft) |
| 230 $V_{AC}$ input voltage | 400 m (1312 ft) | 400 m (1312 ft) | 400 m (1312 ft) |

For 5.5 kW (7.5 HP) and lower models:

| Insulation level of motor | 1000 V | 1300 V | 1600 V |
|---|---|---|---|
| 460 $V_{AC}$ input voltage | 20 m (66 ft) | 50 m (165 ft) | 50 m (165 ft) |
| 230 $V_{AC}$ input voltage | 100 m (328 ft) | 100 m (328 ft) | 100 m (328 ft) |

# 6-7 Digital Keypad

KPC-CC01


A: LED Display

Display frequency, current, voltage and error etc.

B: Status Indicator

F: Frequency Command
H: Output Frequency
U: User Defined Units
ERR: CAN Error Indicator
RUN: CAN Run Indicator

C: Function

(Refer to the chart follows for detail description)

## Keypad Functions

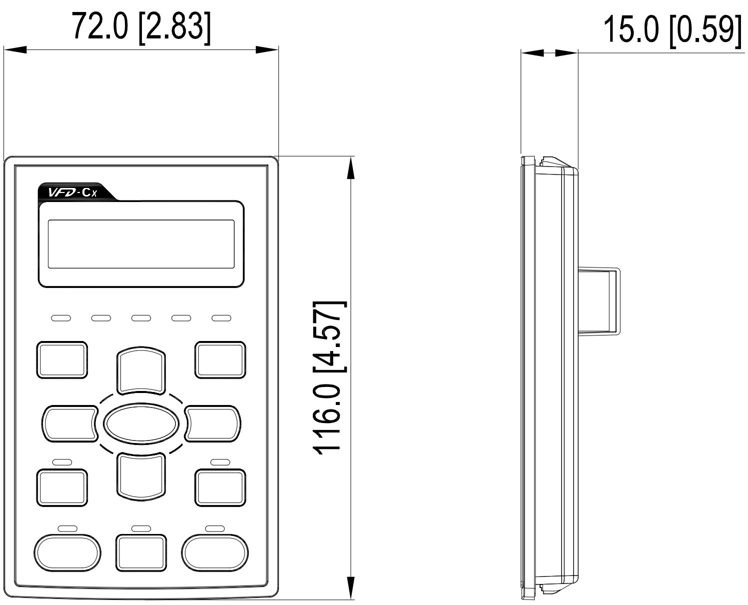
| Key | Description |
|---|---|
| ESC | ESC Key<br>Press the ESC key to return to the previous page, or return to the last category in the sub-menu. |
| MENU | Menu Key<br>Press the MENU key to the main menu.<br>Menu items:<br>1. Parameter Setup<br>2. Copy Parameter<br>3. Keypad Locked<br>4. PLC Function<br>5. Copy PLC<br>6. Fault Record<br>7. Quick Start<br>8. Display Setup<br>9. Time Setup<br>10. Language Setup<br>11. Start-up<br>12. Main Page<br>13. PLC Link<br><br>VFD-ED does not support menu item 4 and 5 (PLC functions) and menu item 7 (Quick Start). |
| ENTER | ENTER Key<br>Press the ENTER key to go to the next menu level. If you are at the last level, then press ENTER to execute the command. |
| HAND | No function |
| AUTO | No function |
| FWD/REV | Operation Direction Key<br>☑ The FWD/REV key controls the operation direction but does NOT activate the drive. FWD: forward, REV: reverse.<br>☑ The drive operates in the direction as shown by the LED. |
| RUN | Start Key<br>☑ This button is functional only when the keypad is the source of the command.<br>☑ This button causes the motor drive to run according to its settings. See “Description of LED Functions” for LED status.<br>☑ Pressing the RUN button repeatedly is allowed while the motor drive is stopping.<br>☑ If HAND mode is ON, the RUN key is valid only when the HAND mode operation source is digital keypad for parameter settings. |
| STOP | Stop Key<br>☑ The STOP key has the highest priority in command.<br>☑ Press the STOP key to stop the drive under any conditions.<br>☑ Press the RESET key to reset the drive when faults occur. If the RESET key does not respond, go to MENU → Fault Records to check the most recent fault. |

## LED Function Description

| LED | Description |
|---|---|
|  | Steady ON: AC motor drive operation indicator, including DC brake, zero speed, standby, restart after fault and speed tracking.<br>Blinking: motor drive is decelerating to stop or in Base Block status.<br>Steady OFF: motor drive does not execute the operation command. |
|  | Steady ON: AC motor drive stop indicator.<br>Blinking: motor drive is in standby status.<br>Steady OFF: motor drive does not execute the STOP command. |
|  | Operation Direction LED<br>1. Green light is on, the drive is running forward.<br>2. Red light is on, the drive is running in reverse.<br>3. Blinking light: the drive is changing direction. |

## Dimension

Unit: mm [inch]




## RJ45 Extension Cables for the Digital Keypad

| Part # | Description |
|---|---|
| CBC-K3FT | 3 feet RJ45 extension lead (approximately 0.9 m) |
| CBC-K5FT | 5 feet RJ45 extension lead (approximately 1.5 m) |
| CBC-K7FT | 7 feet RJ45 extension lead (approximately 2.1 m) |
| CBC-K10FT | 10 feet RJ45 extension lead (approximately 3 m) |
| CBC-K16FT | 16 feet RJ45 extension lead (approximately 4.9 m) |

# 6-8 USB/RS-485 Communication Interface IFD6530

⚠ Warning

✓ *Read this section thoroughly before installing and using the interface.*

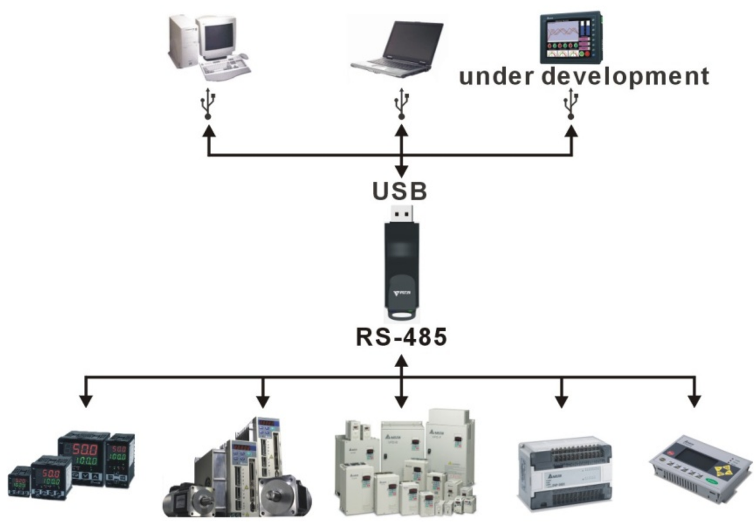
✓ *This section and the driver file may be revised without prior notice. Consult our distributors or download the most updated instruction/driver version at http://www.delta.com.tw/product/em/control/cm/control_cm_main.asp.*

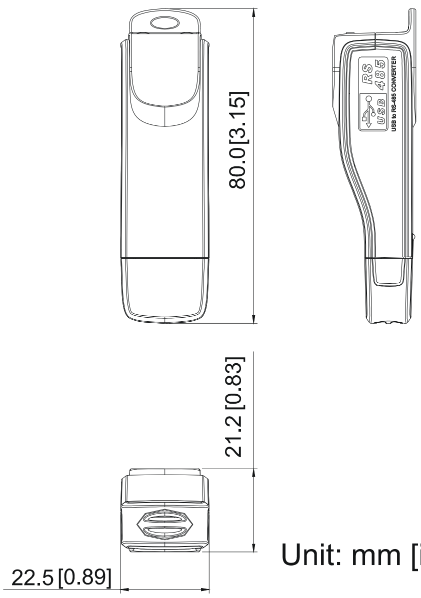
## Introduction

IFD6530 is a convenient RS-485-to-USB converter that does not require an external power supply and a complex setting process. It supports baud rates from 75 to 115.2 kbps and auto-switching of the data transmission direction. In addition, it adopts the RJ45 in RS-485 connector for convenient wiring. Its small size, use of plug-and-play and hot-swappable provide more conveniences for connecting all DELTA IABG products to your PC.

Applicable Models: All DELTA IABG products.

■ Application & Dimension:



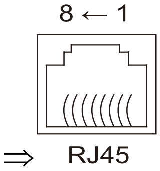




Unit: mm [inch]

## Specifications

| | |
|---|---|
| Power supply | No external power is needed. |
| Power consumption | 1.5 W |
| Isolated voltage | 2,500 $V_{DC}$ |
| Baud rate | 75, 150, 300, 600, 1200, 2400, 4800, 9600, 19200, 38400, 57600, 115200 bps |
| RS-485 connector | RJ45 |
| USB connector | A type (plug) |
| Compatibility | Full compliance with USB V2.0 specification |
| Maximum cable length | RS-485 communication port: 100 m |
| Supports RS-485 half-duplex transmission | |

**RJ45**




| PIN | Description |
|---|---|
| 1 | Reserved |
| 2 | Reserved |
| 3 | GND |
| 4 | SG- |

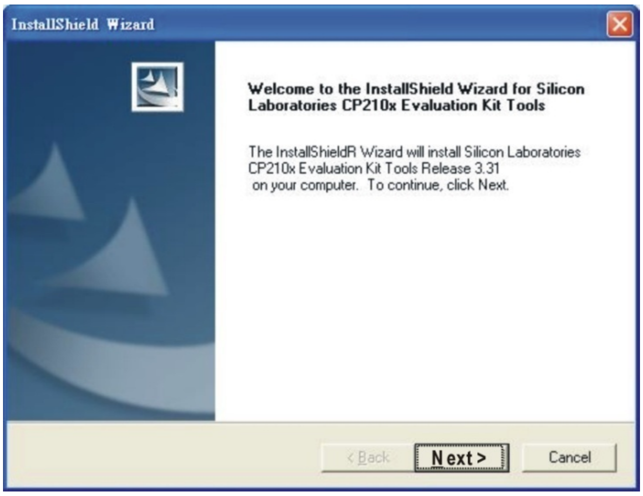
| PIN | Description |
|---|---|
| 5 | SG+ |
| 6 | GND |
| 7 | Reserved |
| 8 | +9V |

## Preparation before Installing Driver

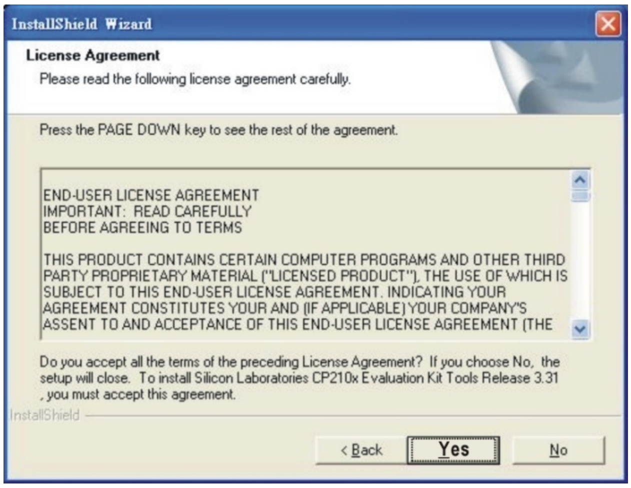
Extract the driver file (IFD6530_Drivers.exe) by following steps. Download the driver file (IFD6530_Drivers.exe) at www.deltaww.com/iadownload_acmotordrive/IFD6530_Drivers.

**Note:** DO NOT connect the IFD6530 to your PC before extracting the driver file.

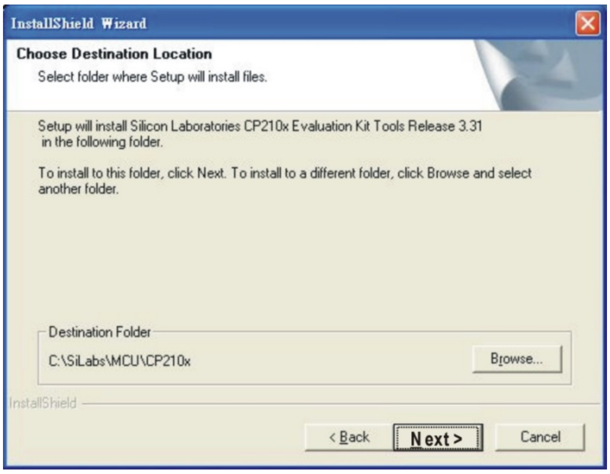
**STEP 1**



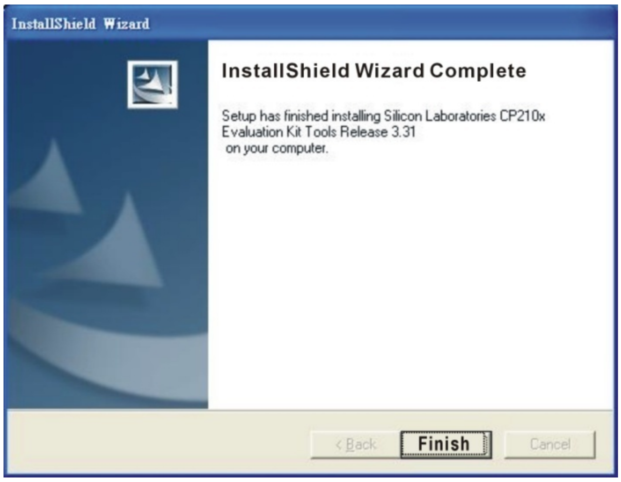

**STEP 2**




**STEP 3**




**STEP 4**



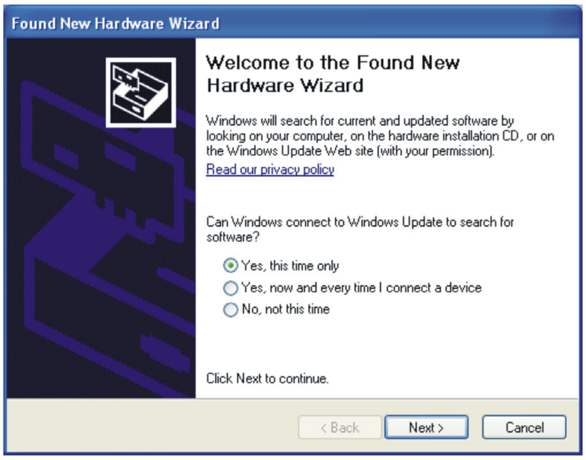

**STEP 5**

At the end of this process, you should have a folder named SiLabs under drive c:\ SiLabs.

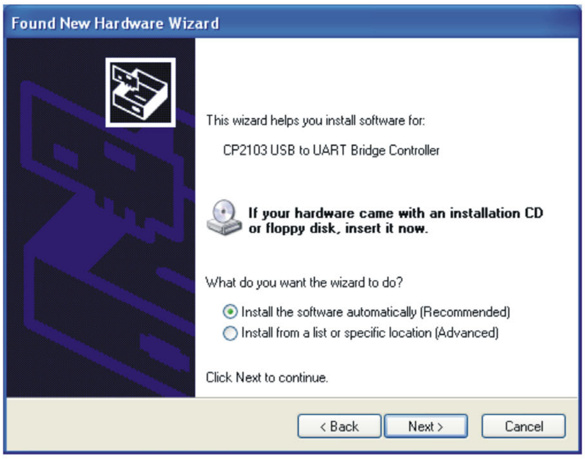
## Installing the Driver

After connecting the IFD6530 to your PC, install the driver using the following steps.

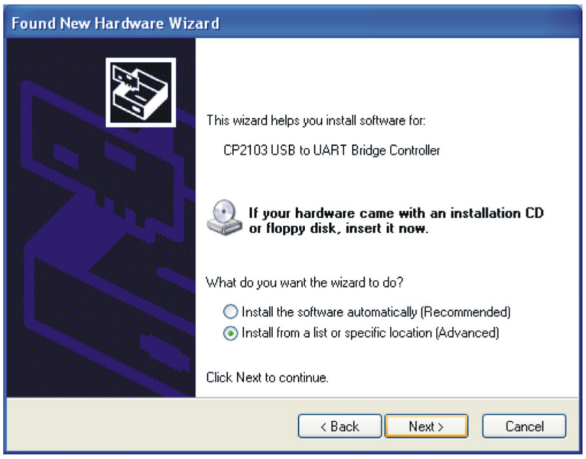
STEP 1

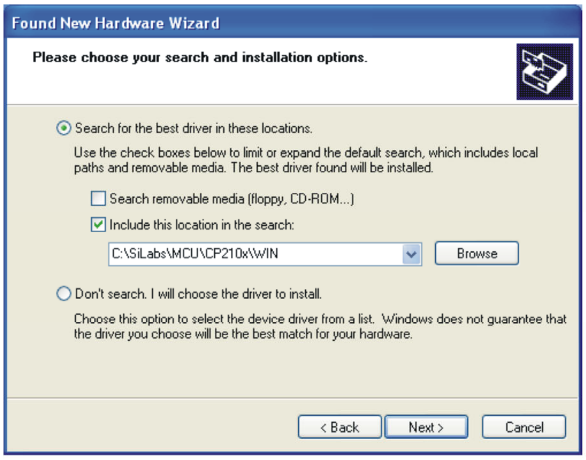



STEP 2



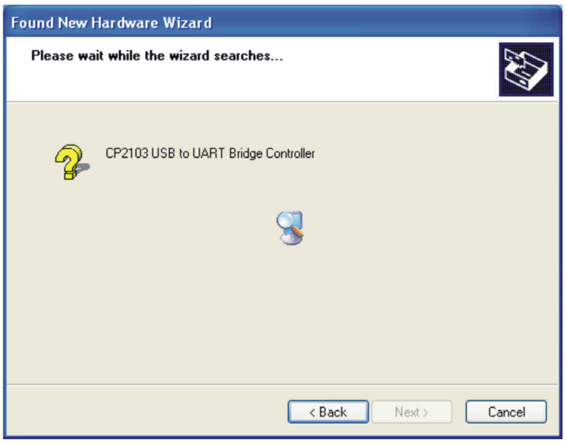

OR



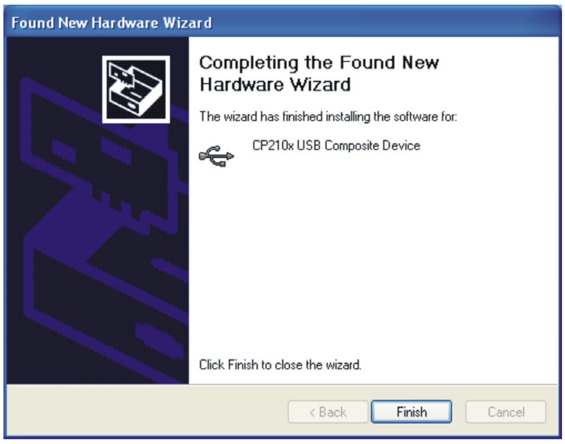




Browse and select directory, or enter C:\SiLabs\MCU\CP210x\WIN

STEP 3




STEP 4




STEP 5
Repeat Step 1 to Step 4 to complete COM PORT setting.

## LED Display

1. Steady green LED ON: power is ON.
2. Blinking orange LED: data is transmitting.

# Chapter 7 Option Cards

Select the applicable option cards for your drive or contact your local distributor for suggestions.
To prevent damage to the motor drive during installation, remove the digital keypad and the cover before wiring. Refer to the following instructions. Note that the option cards do not support hot swapping. Turn off the drive power before installing or removing the option cards.

## Removing the Top Cover

Frames B, C & D    Screw Torque: kg-cm [lb-in.]

<table>
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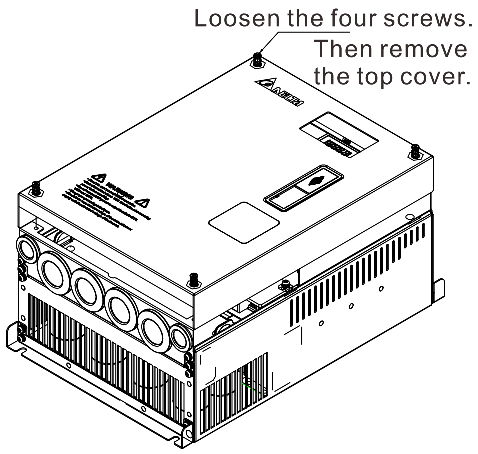
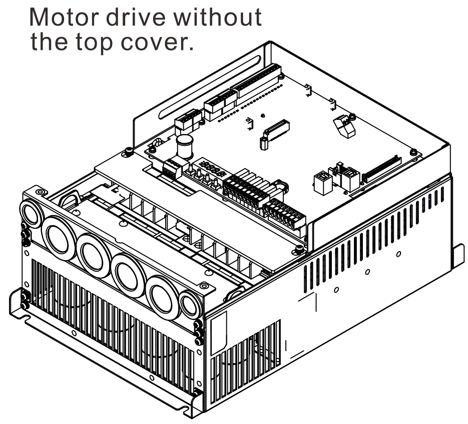
<tr><td>
</td><td>
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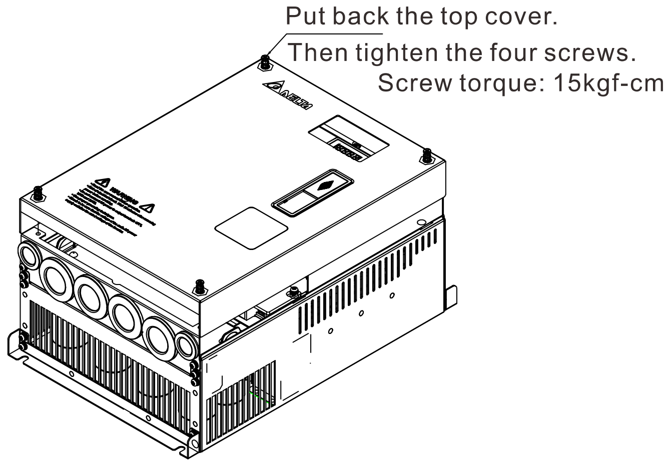
<tr><td colspan="2">Step 3</td></tr>
<tr><td colspan="2">
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Frame E Screw Torque: kg-cm [lb-in.]

<table>
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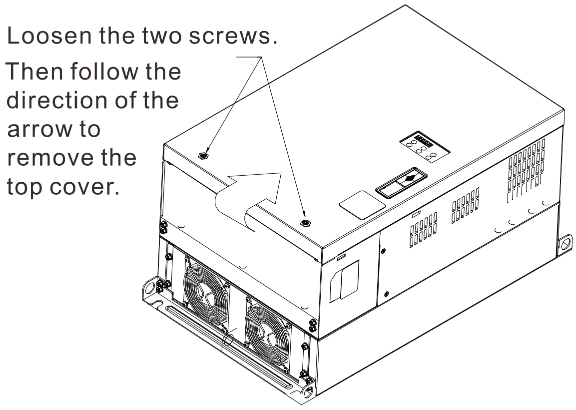

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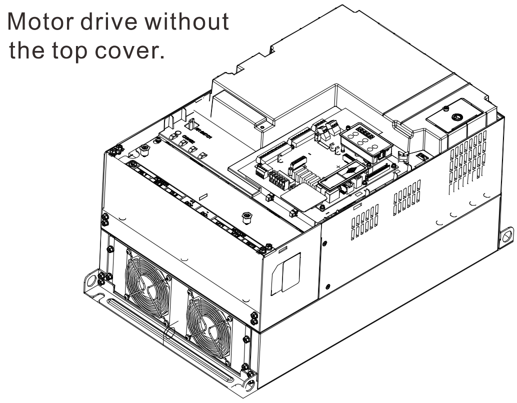

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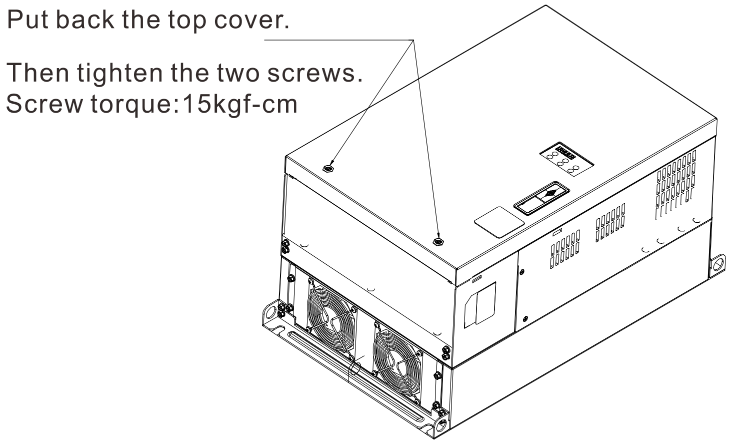

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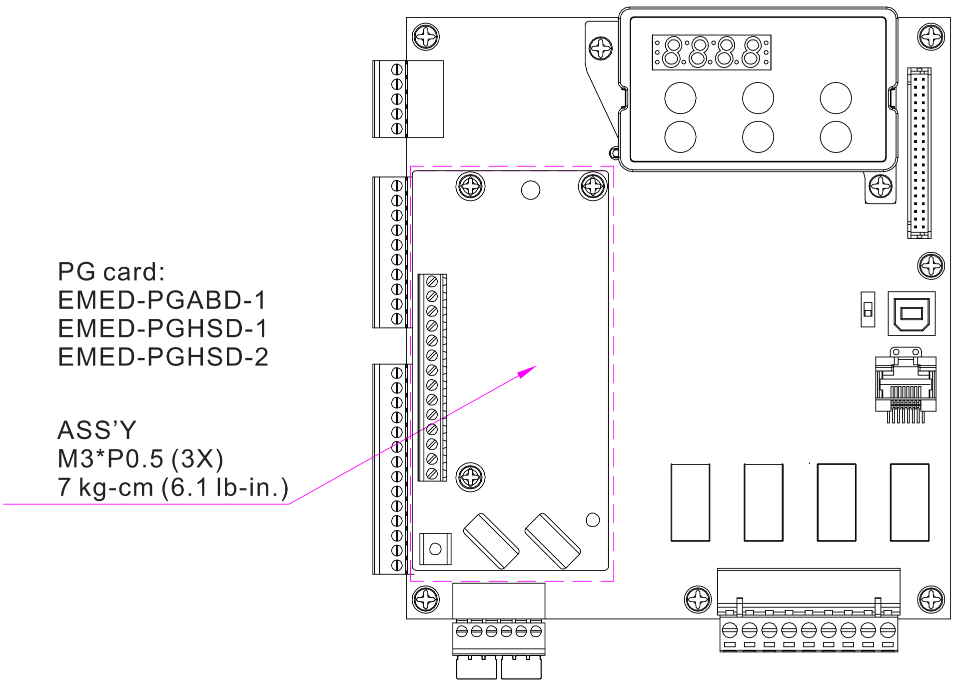
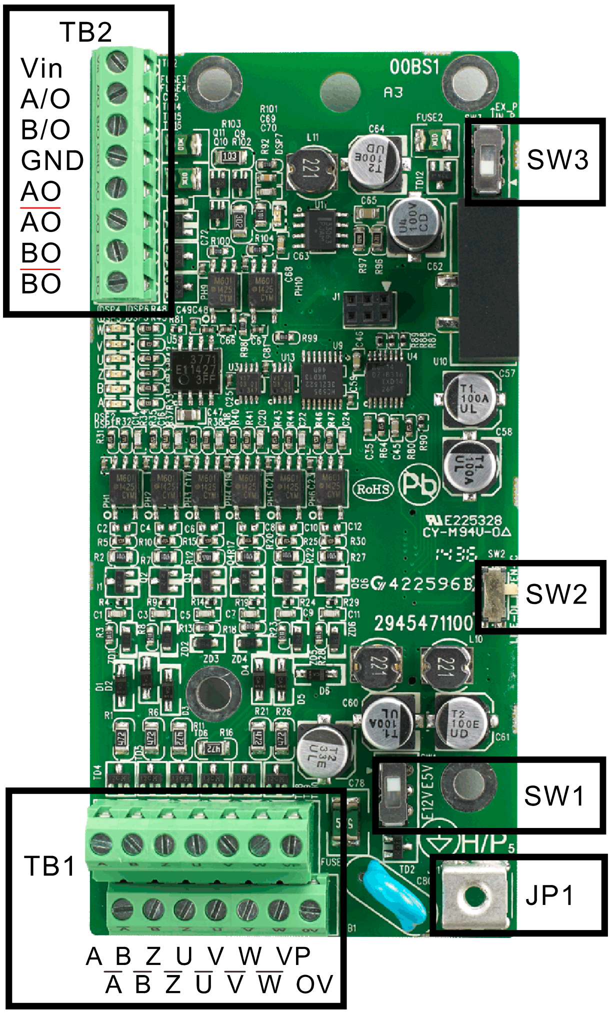
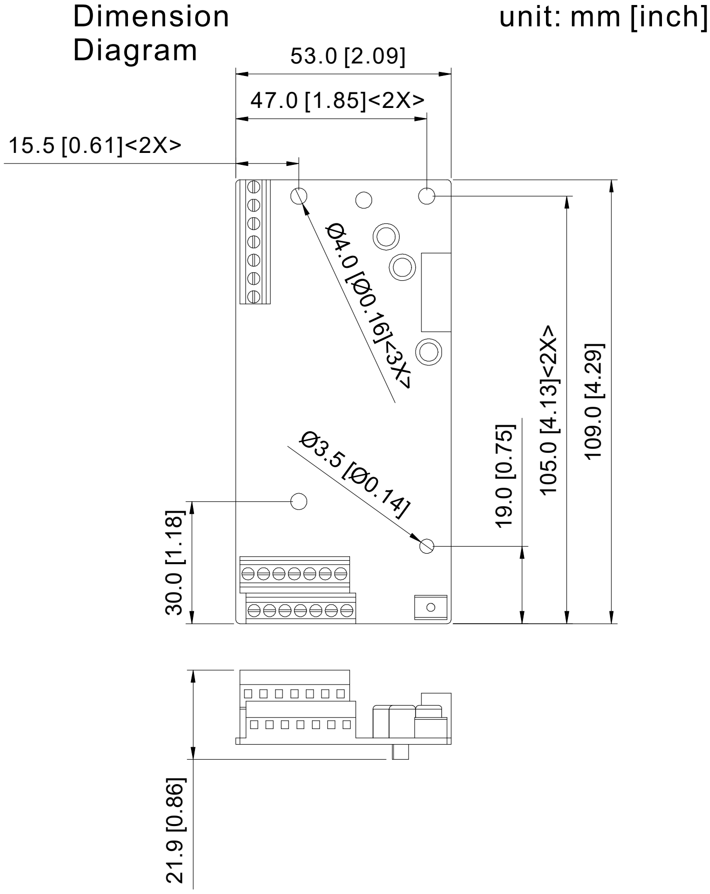
## Vertical View of the Motor Drive & Screw Specifications



## 7-1 EMED-PGABD-1*, EMED-PGABD-2

Applicable encoder: A/B/Z & U/V/W Absolute Encoders




* EMED-PGABD-1 is to be phased out in the first quarter of year 2021, and will be pin-to-pin replaced by EMED-PGABD-2 after EOL.

| Wire Gauge | Torque |
|---|---|
| 30–16 AWG | 1.6 kg-cm [1.4 Ib-in.] |

The following table lists the terminal specifications.

| Terminals | | Descriptions |
|---|---|---|
| TB2 | Vin | Voltage input, to adjust the amplitude of output voltage at terminal A/O and terminal B/O. It also provides a 5 V voltage to support line driver's signal.<br>Vin voltage range: 8–24 V, Max: 24 V. |
| | A/O, B/O | Output signal for the push-pull voltage frequency division.<br>Default: Output amplitude is about +24 V. Use SW3 to disable the internal default power. Required input power through Vin-GND port (i.e. output voltage's amplitude)<br>Vin voltage range: 8–24 V, Max: 24 V.<br>Push-Pull Voltage Output<br>Max. output frequency: 100 kHz<br>Supports frequency division output, the frequency division range: 1–31. |
| | GND | Common ground terminal connecting to the host controller and the motor drive. |
| | AO, /AO, BO, /BO | Output signal for the line driver frequency division.<br>Line Driver RS422 |

| | | |
|---|---|---|
| | | Max. output frequency: 150 kHz<br>Supports frequency division output, the frequency division range: 1–31. |
| TB1 | VP | Power output for encoder<br>**NOTE** *Use SW1 to set output voltage amplitude*<br>Voltage: +5 ± 0.5 V or +12 ± 1 V<br>Current: 200 mA max. |
| | 0 V | Common power terminal for encoder |
| | A, $\overline{A}$, B,<br>$\overline{B}$, Z, $\overline{Z}$ | Incremental-type encoder signal input terminal<br>Types of input signal: line driver, voltage, push-pull, open collector<br>**NOTE** *Different input signals need different wiring methods. See the user manual for wiring diagrams.*<br>Max. input frequency: 150 kHz |
| | U, $\overline{U}$, V<br>$\overline{V}$, W, $\overline{W}$ | Absolute-type encoder signal input terminal<br>Types of input signal: line driver, voltage, push-pull, open collector<br>**NOTE** *Different input signals need different wiring methods. See the user manual for wiring diagrams.*<br>Max. input frequency: 150 kHz |
| JP1 | ⏚ | Ground Terminal<br>Connect the motor drive power supply to ground. Supports PG shielding. |
| SW1 | | Switch between power for the encoder (5 V / 12 V). |
| SW2 | | Offline Detection Switch. Switch to the Line-D side to enable offline detection for the Line-D input signal. Switch to OPEN-C side to disable offline detection function for the OPEN-C input signal. |
| SW3 | | Power supply switch for frequency division. Switch to INP side to provide 24 V power for internal use. Switch to EXP side to provide 24 V power for external use (client). |

Applicable encoders:

1. Open collector output encoder application: Use one pull-up resistor for each set of input current 5–15 mA. If open collector input voltage uses 24V power, connect the encoder power externally. See the PG wiring Figure 2 below.

| | |
|---|---|
| 5 V | Suggested pull-up resistor: above 150–520ohm, 1/2 W |
| 12 V | Suggested pull-up resistor: above 600–2Kohm, 1/2 W |
| 24 V | Suggested pull-up resistor: above 2.2K–4.7Kohm, 1/2 W |

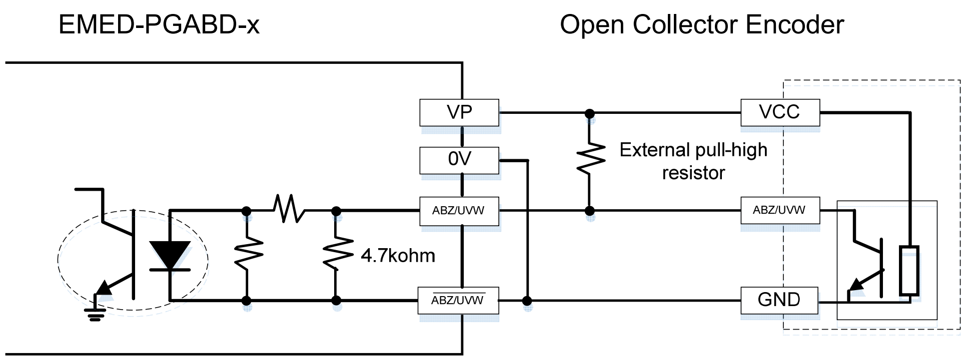



Figure 1

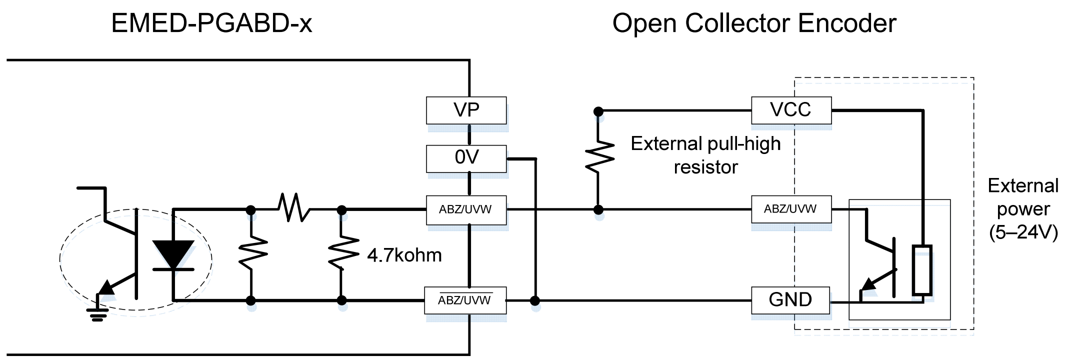



Figure 2

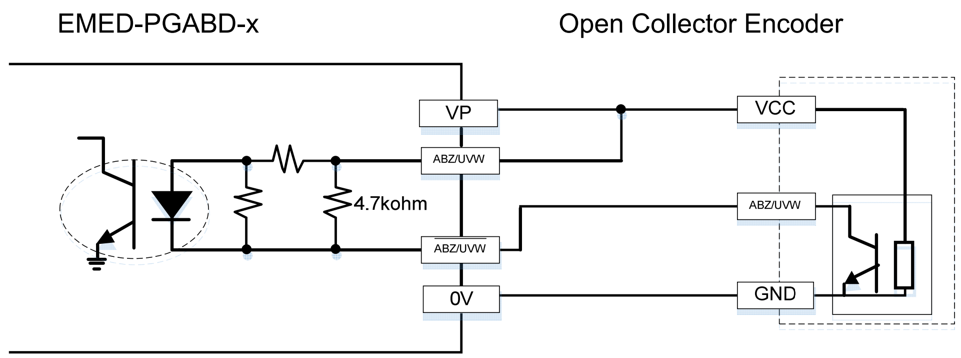



Figure 3

2. Voltage output encoder application: Each set of input current is 5–15 mA. If input voltage uses 24V power, connect the encoder power externally. See the PG wiring Figure 5 below.

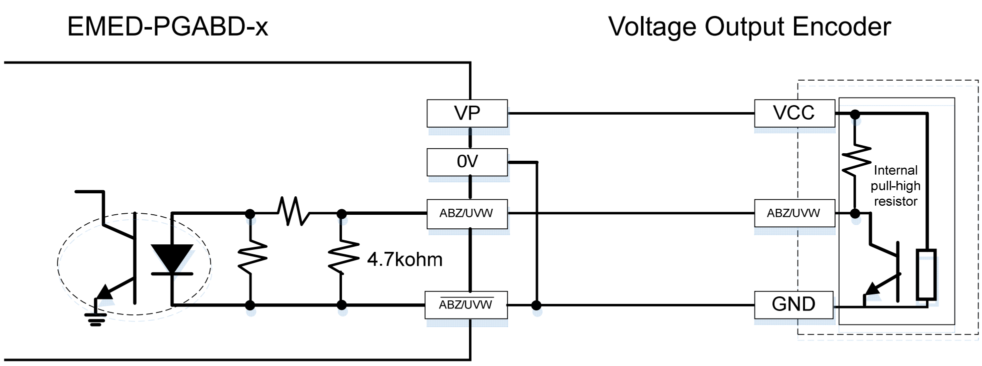



Figure 4

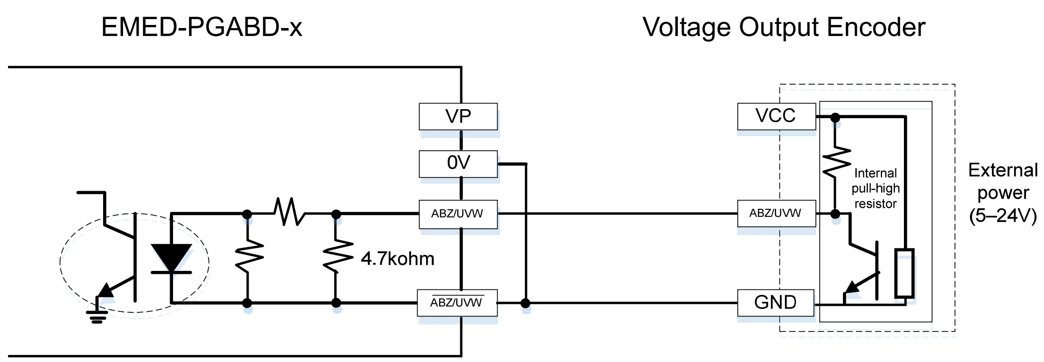



Figure 5

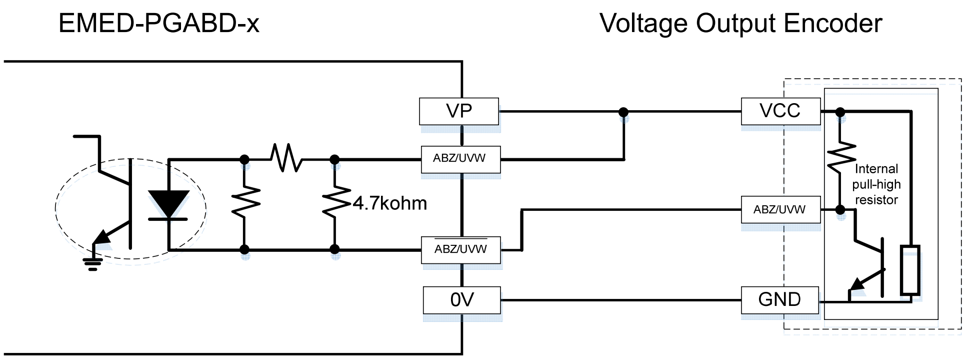



Figure 6

3. Push-pull output encoder application: Each set of input current is 5–15 mA. If input If input voltage uses 24V power, connect the encoder power externally. See the PG wiring Figure 8 below.

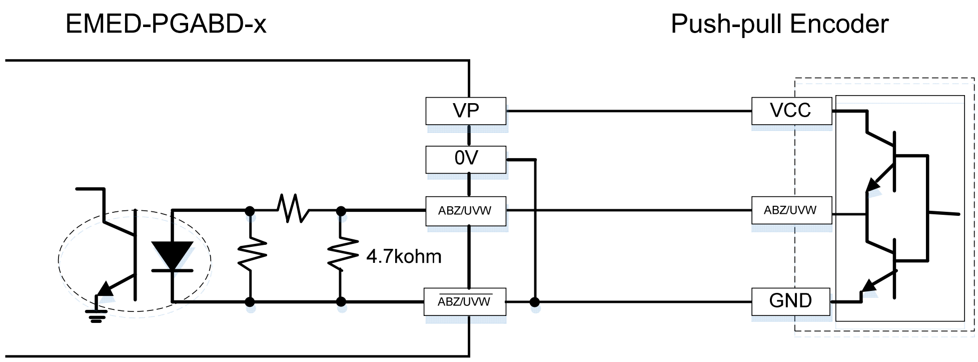



Figure 7

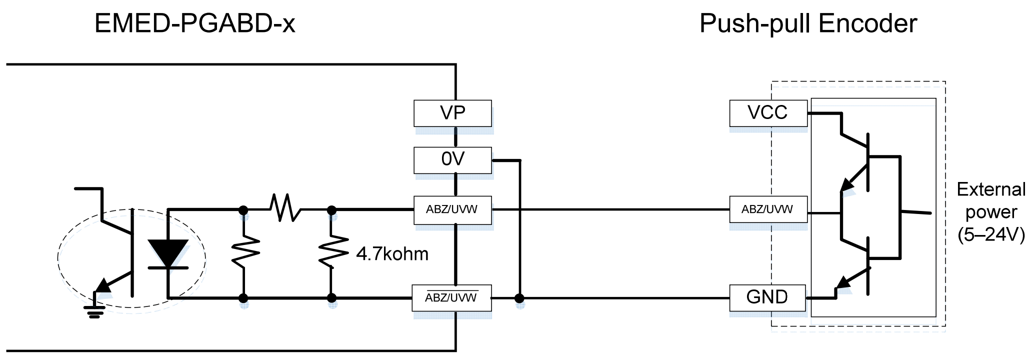



Figure 8

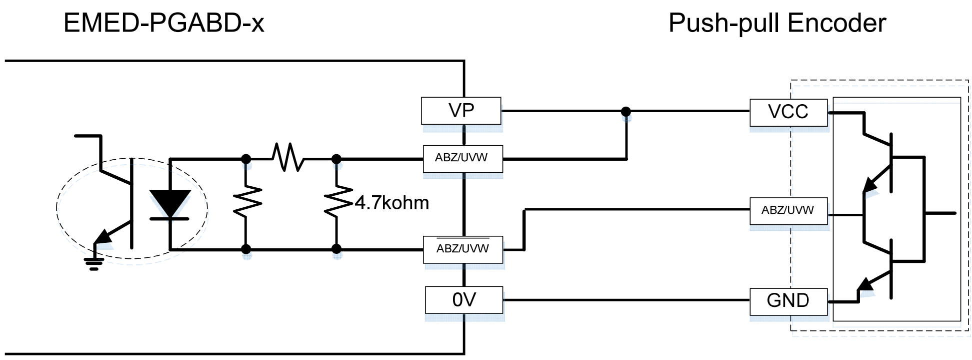



Figure 9

4. Line driver output encoder application: Each set of input current is 5–15 mA. If input voltage uses 24V power, connect the encoder power externally. See the PG wiring Figure 11 below.

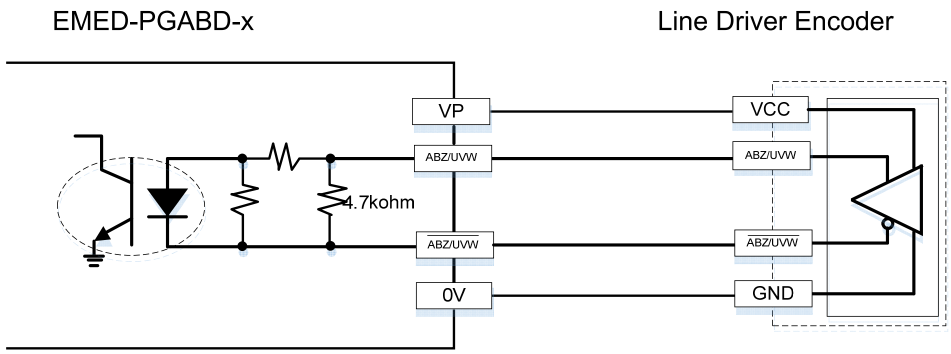



Figure 10

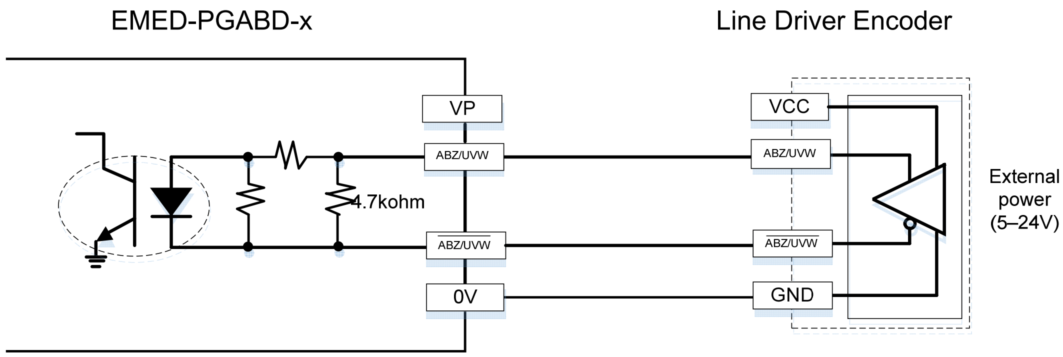
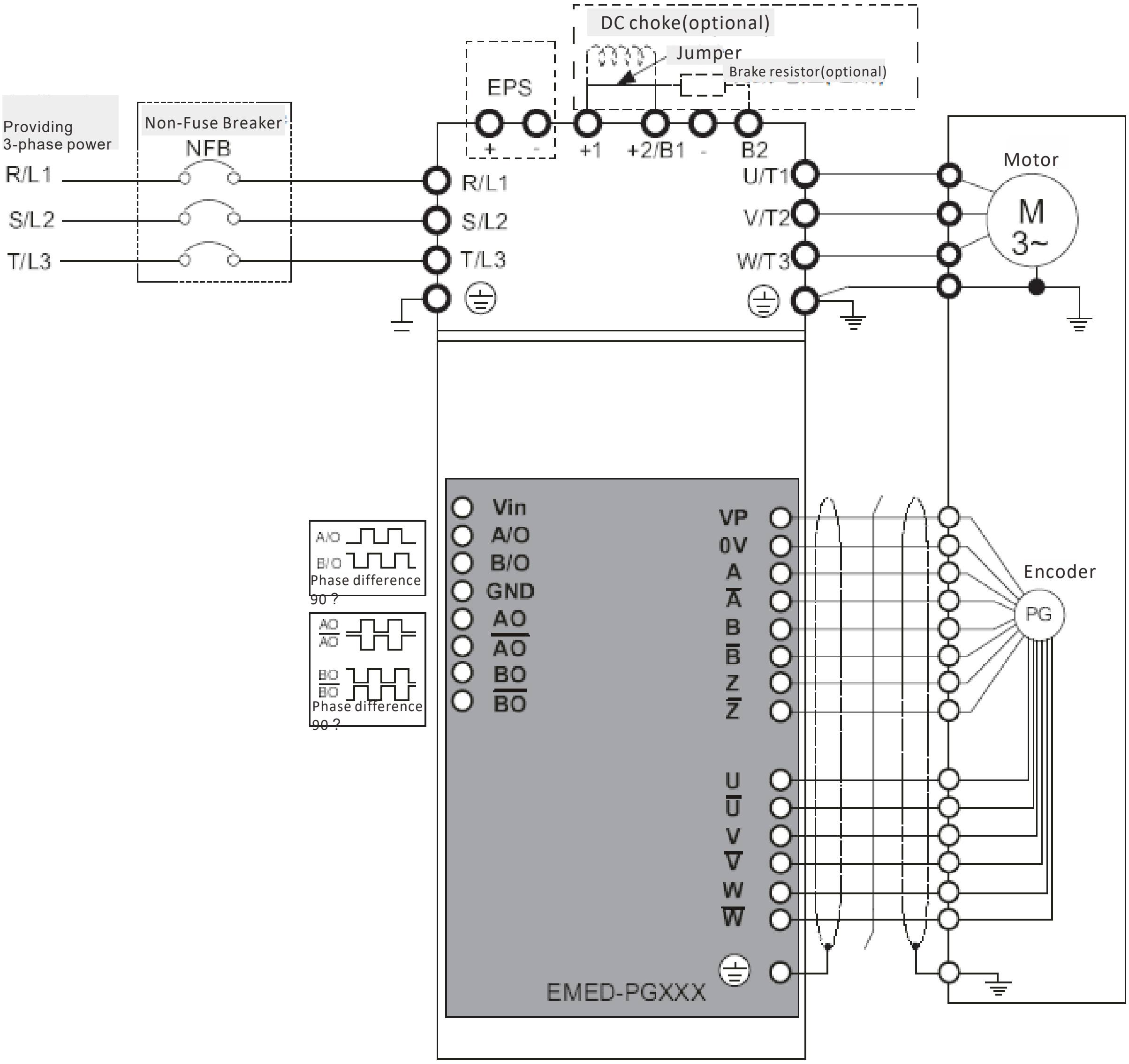



Figure 11

**NOTE**

- Verify that the SW1 is set to the correct output voltage before powering ON.
- Keep the motor drive wiring away from any high voltage lines to avoid interference.
- When using push-pull output and voltage output, short-circuit A, B, Z to 0V.
- When using open collector output, short-circuit A, B, Z to VP.

Wiring Diagram




## Set up the Frequency Division Signal

① After the encoder inputs a PULSE signal, there is an output signal by the division factor “n” Set the value in Pr.10-29 (PG card’s frequency division output).

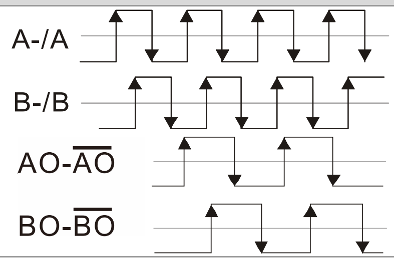
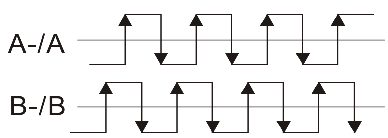
② Set Pr.10-29 (PG card’s frequency division output):
The decimal frequency division output setting; range of the division factor “n”: 1–31.

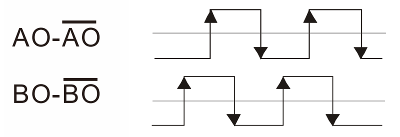
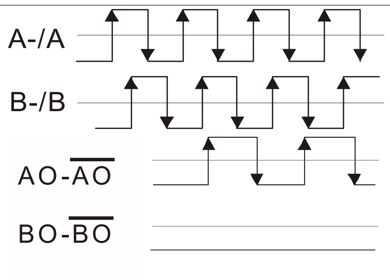
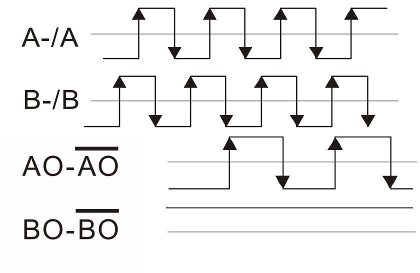
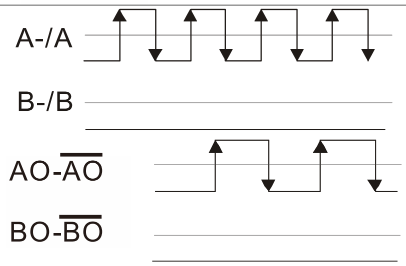
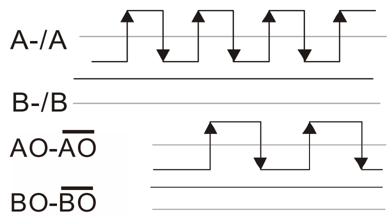
③ Pr.10-30 (PG card’s frequency division output mode)

| Bit3 | Bit2 | Bit1 | Bit0 |
|---|---|---|---|
| X | X | **OUT/M** | **IN/M** |

**OUT/M:** Pulse output mode for frequency division;
**IN/M:** Pulse input mode for frequency division;
“X” is for backup while “0” is a value to write.

The following table lists the Input Mode (IN/M) & Output Mode (OUT/M) setting and description:

| **OUT/M** | **IN/M** | **Division Factor** | |
|---|---|---|---|
| | | A is ahead of B | B is ahead of A |
| 0 | 0 |  |  |

| | | | |
|---|---|---|---|
| | | |   |
| 1 | 0 |   |   |
| X | 1 |   |   |

NOTE

- In the waveform, A-/A, B-/B are the PG card input signals; AO-$\overline{AO}$, BO-$\overline{BO}$ are the differential output frequency division signals. Use a differential probe to measure.
- Division factor "n": Set 15 to divide the input signal by 15.
- When **OUT/M, IN/M** set to 0 and 0, the PG card input signal A-/A, B-/B are square waves while AO-$\overline{AO}$, BO-$\overline{BO}$ are frequency division output.
- When **OUT/M, IN/M** are set to 1 and 0, the PG card input signal A-/A, B-/B are square waves while the BO-$\overline{BO}$ is the A and B phase indicator (for example, when BO-$\overline{BO}$ is LOW, it means A is ahead of B: when BO-$\overline{BO}$ is HIGH, it means B is ahead of A). AO-$\overline{AO}$ is frequency division output.
- When **OUT/M, IN/M** are set to X and 1, B-/B phase has to be the direction indication input signal (for example, when B-/B is LOW, it means A is ahead of B; when B-/B is HIGH, it means B is ahead of A). A-/A is a square wave input, BO-$\overline{BO}$ and B-/B phase are input into synchronous action; AO-$\overline{AO}$ is frequency division output.
- Take Pr.10-29 and Pr.10-30 as examples: When the frequency division value is 15, **OUT/M** =1, **IN/M** = 0. Set Pr.10-29 = 15 and Pr.10-30 = 0002h.

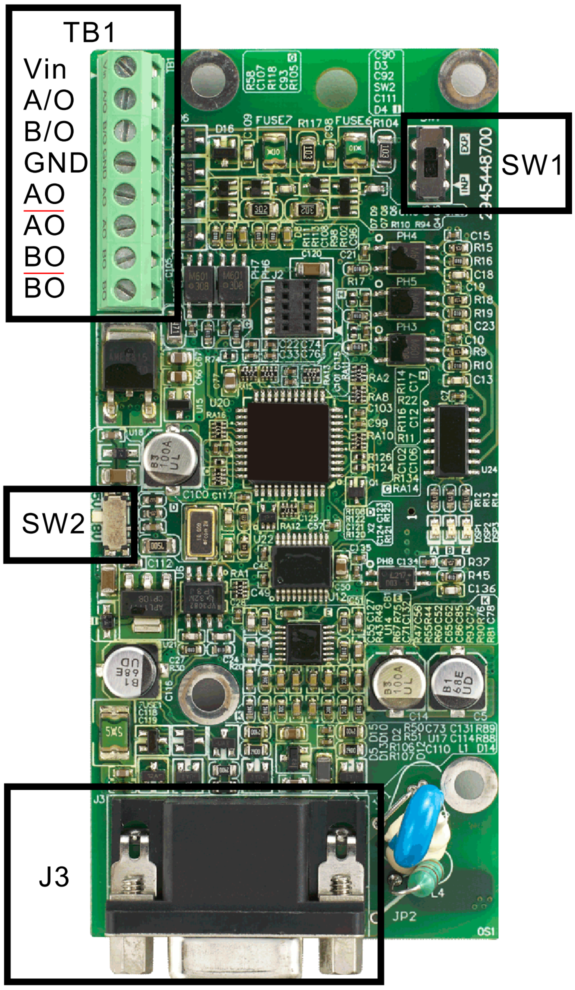
  Set Pr.10-29 =15

  Set Pr.10-30 =0002h

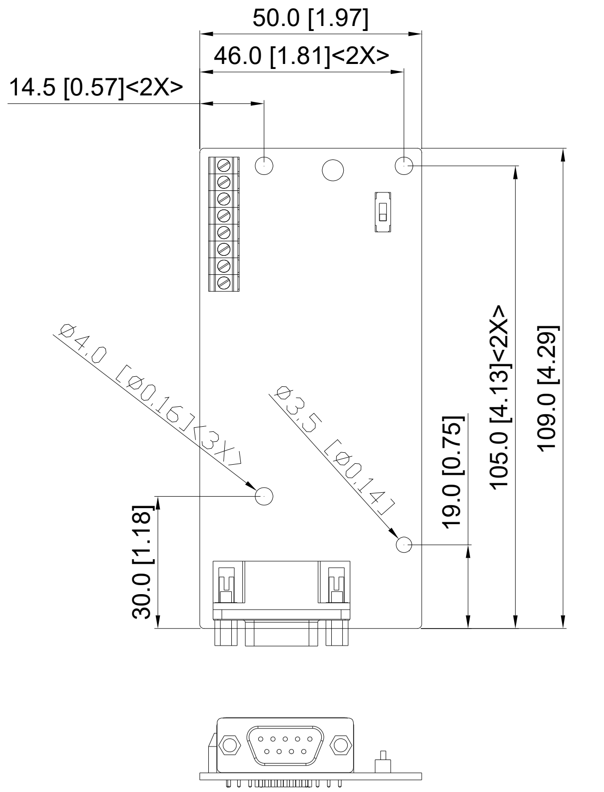
| Bit3 | Bit2 | Bit1 | Bit0 |
|---|---|---|---|
| X | X | **1** | **0** |

## 7-2 EMED-PGHSD-1*, EMED-PGHSD-3

Applicable encoder:
SIN/COS: Heidenhain ERN1387
EnDat2.1/01: Heidenhain ECN413, ECN1313
SICK HIPERFACE: SRS50/60




Dimension Unit: mm [inch]



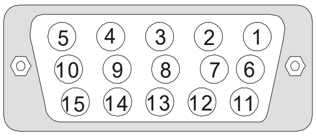

* EMED-PGHSD-1 is to be phased out in the first quarter of year 2021, and will be pin-to-pin replaced by EMED-PGHSD-3 after EOL.

| Wire Gauge | Torque |
|---|---|
| 30–16 AWG | 1.6 kg-cm [1.4 lb-in.] |

※ Supports Heidenhain ERN1387, EnDat2.1, HIPERFACE.

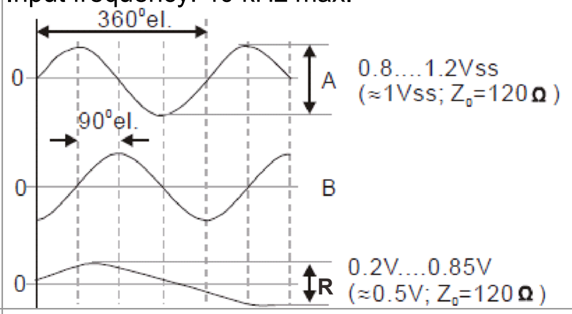
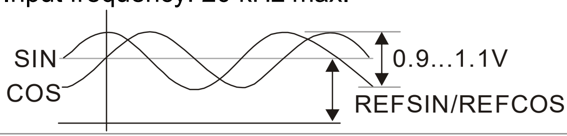
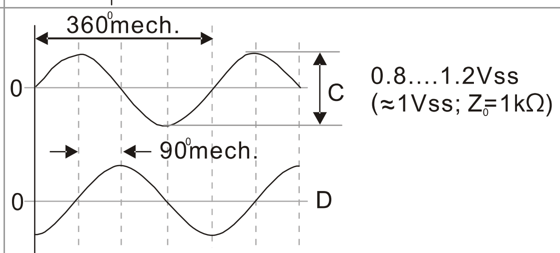
| Terminals | | Descriptions |
|---|---|---|
| TB1 | Vin | Voltage input: (to adjust the output voltage amplitude of the push-pull pulse)<br>Max. input voltage: 24 $V_{DC}$<br>Max. input current: 30 mA |
| | A/O, B/O | Push-pull pulse output signal<br>Max. output frequency: 50 kHz |
| | GND | Common power input/signal output terminal |
| | AO, /AO, BO, /BO | Output signal for the line driver frequency division.<br>Line driver RS422<br>Max. input frequency: 100 kHz |
| J3 (D-SUB female connector) | | Encoder signal input terminal |
| SW1 | | Frequency division output power terminal selection<br>INP: Power supplied by PG card<br>EXP: Power from an external source |
| SW2 | | Encoder's voltage output terminal (Up)<br>NOTE *Modify the terminal output voltage by switching the direction of the SW2 DIP switch on the PG card.*<br>5 V: 5 $V_{DC}$<br>8 V: 8 $V_{DC}$ |

EMED-PGHSD-1 (Terminal J3) pin definitions depend on the encoder type




| Terminal# | Heidenhain ERN1387 | Heidenhain ECN1313 | HIPERFACE® |
|---|---|---|---|
| 1 | B- | B- | REFSIN |
| 2 | - | - | - |
| 3 | R+ | DATA | DATA+ |
| 4 | R- | /DATA | DATA- |
| 5 | A+ | A+ | +COS |
| 6 | A- | A- | REFCOS |
| 7 | 0V | 0V | GND |
| 8 | B+ | B+ | +SIN |
| 9 | Up | Up | Up |
| 10 | C- | - | - |
| 11 | C+ | - | - |
| 12 | D+ | - | - |
| 13 | D- | - | - |
| 14 | - | /CLOCK | - |
| 15 | - | CLOCK | - |

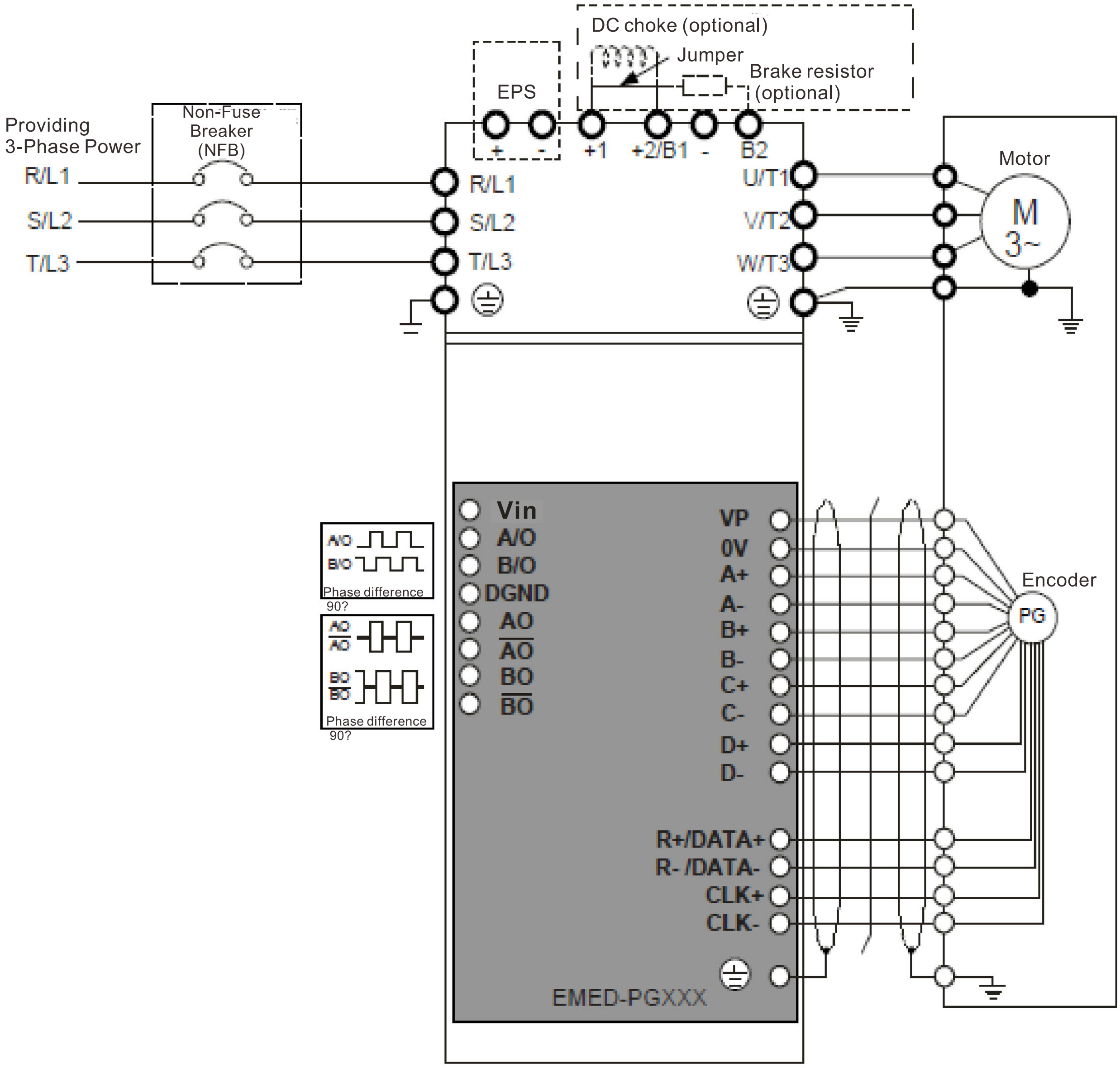
The following table lists the terminal functions.

| Terminals | | Descriptions | Specifications |
|---|---|---|---|
| J3 | Up (VP) | The output voltage for the encoder. Use the SW2 DIP switch to change the output voltage to +5 V or +8 V. | Voltage: +5.1 $V_{DC}$ ± 0.3 V; +8.4 $V_{DC}$ ± 1.5 V<br>Current: 200 mA max. |
| | 0 V | Encoder common power terminal | Reference level for the encoder's power. |
| | A+, A-, B+, B-, R+, R- | Encoder sine wave differential signal input (incremental signal) | Input frequency: 40 kHz max.<br> |
| | +SIN, +COS, REFSIN, REFCOS | Encoder sine wave differential signal input (incremental signal) | Input frequency: 20 kHz max.<br> |
| | C+, C-, D+, D- | Encoder sine wave differential signal input (absolute signal) |  |
| | DATA+(DATA), DATA-(/DATA) | RS-485 communication interface | Terminal resistance is about 130 Ω |
| | CLOCK+, CLOCK- | CLOCK differential output for ENDAT. | Line Driver RS422 level output |

NOTE

- Verify that the SW2 switch is set to the correct output voltage before powering on.
- Keep the motor drive wiring away from any high voltage lines to avoid interference.

### Wiring Diagram




### Set the Frequency Division Signal

① After the encoder inputs a PULSE signal, there is an output signal by the division factor "n." Set the value in Pr.10-29 (PG card's frequency division output).

② Set Pr.10-29 (PG card's frequency division output):

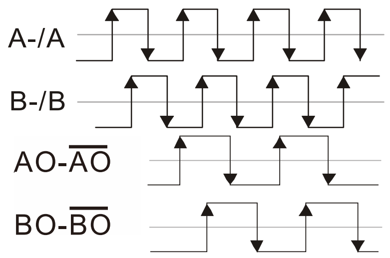
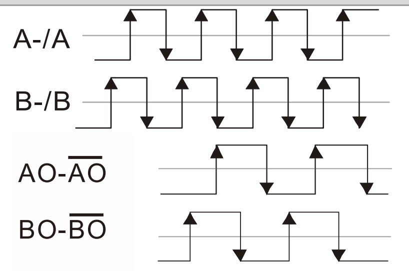
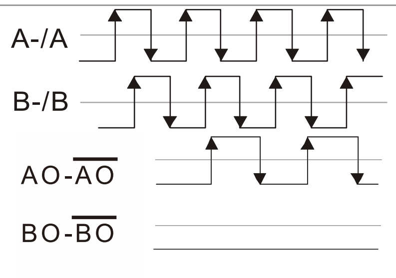
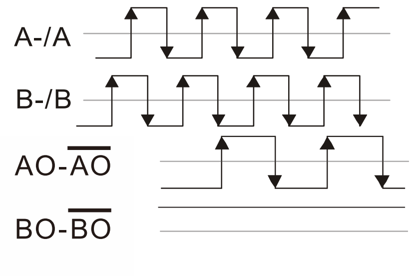
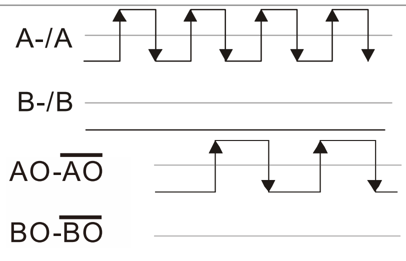
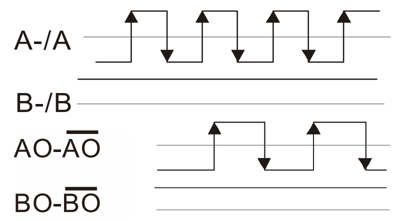
The decimal frequency division output setting; range of the division factor "n": 1–31.

③ Pr.10-30 (PG card's frequency division output mode)

| Bit3 | Bit2 | Bit1 | Bit0 |
|---|---|---|---|
| X | X | **OUT/M** | **IN/M** |

**OUT/M:** Pulse output mode for frequency division;
**IN/M:** Pulse input mode for frequency division;
"X" is for backup while "0" is a value to write.

The following table lists the Input Mode (IN/M) & Output Mode (OUT/M) setting and description:

| OUT/M | IN/M | Division Factor | |
|---|---|---|---|
| | | A is ahead of B | B is ahead of A |
| 0 | 0 |  |  |
| 1 | 0 |  |  |
| X | 1 |  |  |

**NOTE**

- In the waveform, A-/A, B-/B are the PG card input signals; AO-$\overline{AO}$ , BO-$\overline{BO}$ are the differential output frequency division signals. Use a differential probe to measure.
- Division factor "n": Set 15 to divide the input signal by 15.
- When **OUT/M, IN/M** set to 0 and 0, the PG card input signal A-/A, B-/B are square waves while AO-$\overline{AO}$ , BO-$\overline{BO}$ are frequency division output.
- When **OUT/M, IN/M** are set to 1 and 0, the PG card input signal A-/A, B-/B are square waves while the BO-$\overline{BO}$ is the A and B phase indicator (for example, when BO-$\overline{BO}$ is LOW, it means A is ahead of B: when BO-$\overline{BO}$ is HIGH, it means B is ahead of A). AO-$\overline{AO}$ is frequency division output.
- When **OUT/M, IN/M** are set to X and 1, B-/B phase has to be the direction indication input signal (for example, when B-/B is LOW, it means A is ahead of B; when B-/B is HIGH, it means B is ahead of A). A-/A is a square wave input, BO-$\overline{BO}$ and B-/B phase are input into synchronous action; AO-$\overline{AO}$ is frequency division output.
- Take Pr.10-29 and Pr.10-30 as examples: When the frequency division value is 15, **OUT/M** =1, **IN/M** = 0. Set Pr.10-29 = 15 and Pr.10-30 = 0002h.

  Set Pr.10-29 =15

  Set Pr.10-30 =0002h

| Bit3 | Bit2 | Bit1 | Bit0 |
|---|---|---|---|
| X | X | **1** | **0** |

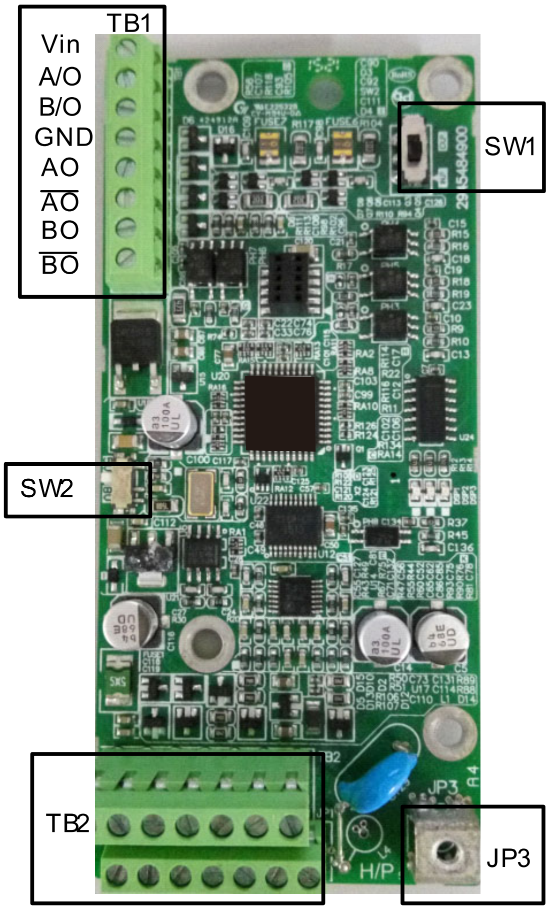
## 7-3 EMED-PGHSD-2*, EMED-PGHSD-4

Applicable encoder:

SIN/COS: Heidenhain ERN1387

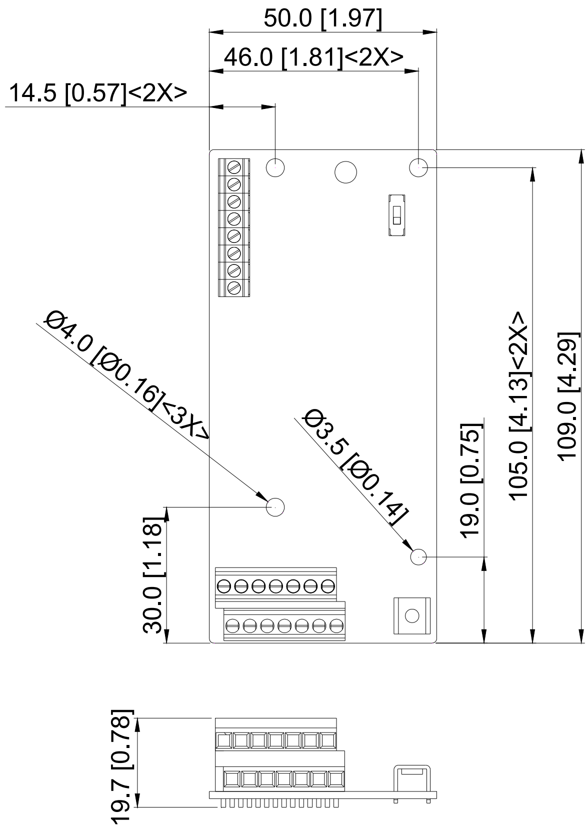
EnDat2.1/01: Heidenhain ECN413, ECN1313

SICK HIPERFACE: SRS50/60




Dimension

Unit: mm [inch]



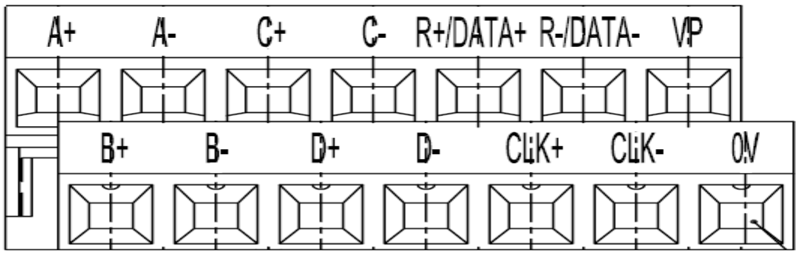

* EMED-PGHSD-2 is to be phased out in the first quarter of year 2021, and will be pin-to pin replaced by EMED-PGHSD-4 after EOL.

| Wire Gauge | Torque |
|---|---|
| 30–16 AWG | 1.6 kg-cm [1.4 lb-in.] |

※ Supports Heidenhain ERN1387, EnDat2.1, HIPERFACE.

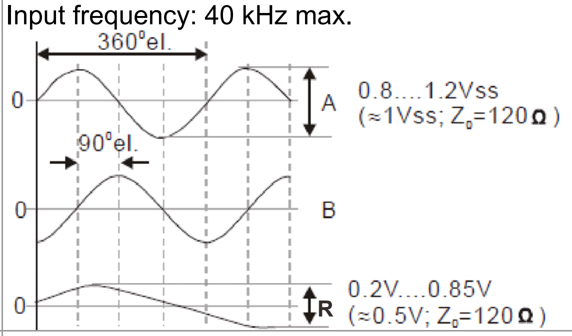
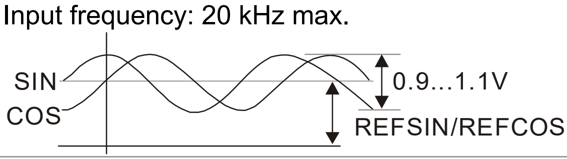
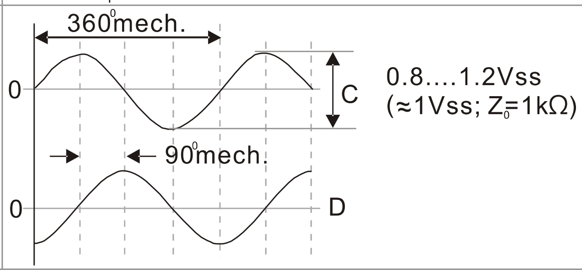
| Terminals | | Descriptions |
|---|---|---|
| TB1 | Vin | Voltage input: (to adjust the output voltage amplitude of the push-pull pulse)<br>Max. input voltage: 24 $V_{DC}$<br>Max. input current: 30 mA |
| | A/O, B/O | Push-pull pulse output signal<br>Max. output frequency: 50 kHz |
| | GND | Common power input/signal output terminal |
| | AO, /AO, BO, /BO | Output signal for the line driver frequency division.<br>Line driver RS422<br>Max. input frequency: 100 kHz |
| TB2 | | Encoder signal input terminal |
| JP3 | ⏚ | Ground Terminal<br>Connect the motor drive power supply to ground. Supports PG shielding. |
| SW1 | | Frequency division output power terminal selection<br>INP: Power supplied by PG card<br>EXP: Power from an external source |
| SW2 | | Encoder's voltage output terminal (Up)<br>**NOTE** *Modify the terminal output voltage by switching the direction of the SW2 DIP switch on the PG card.*<br>5 V: 5 $V_{DC}$<br>8 V: 8 $V_{DC}$ |

EMED-PGHSD-2 (Terminal TB2) pin definitions depend on the encoder type




| Terminals | Heidenhain ERN1387 | | Heidenhain ECN1313 | HIPERFACE® |
|---|---|---|---|---|
| A+ | A+ | | A+ | +COS |
| A- | A- | | A- | REFCOS |
| C+ | C+ | Must set Pr.10-31=1 | - | - |
| C- | C- | | - | - |
| R+/DATA+ | R+ | | DATA | DATA+ |
| R-/DATA- | R- | | /DATA | DATA- |
| VP | Up | | Up | Up |
| B+ | B+ | | B+ | +SIN |
| B- | B- | | B- | REFSIN |
| D+ | D+ | | - | - |
| D- | D- | | - | - |
| CLK+ | - | | CLOCK | - |
| CLK- | - | | /CLOCK | - |
| 0V | 0V | | 0V | GND |

The following table lists the terminal functions.

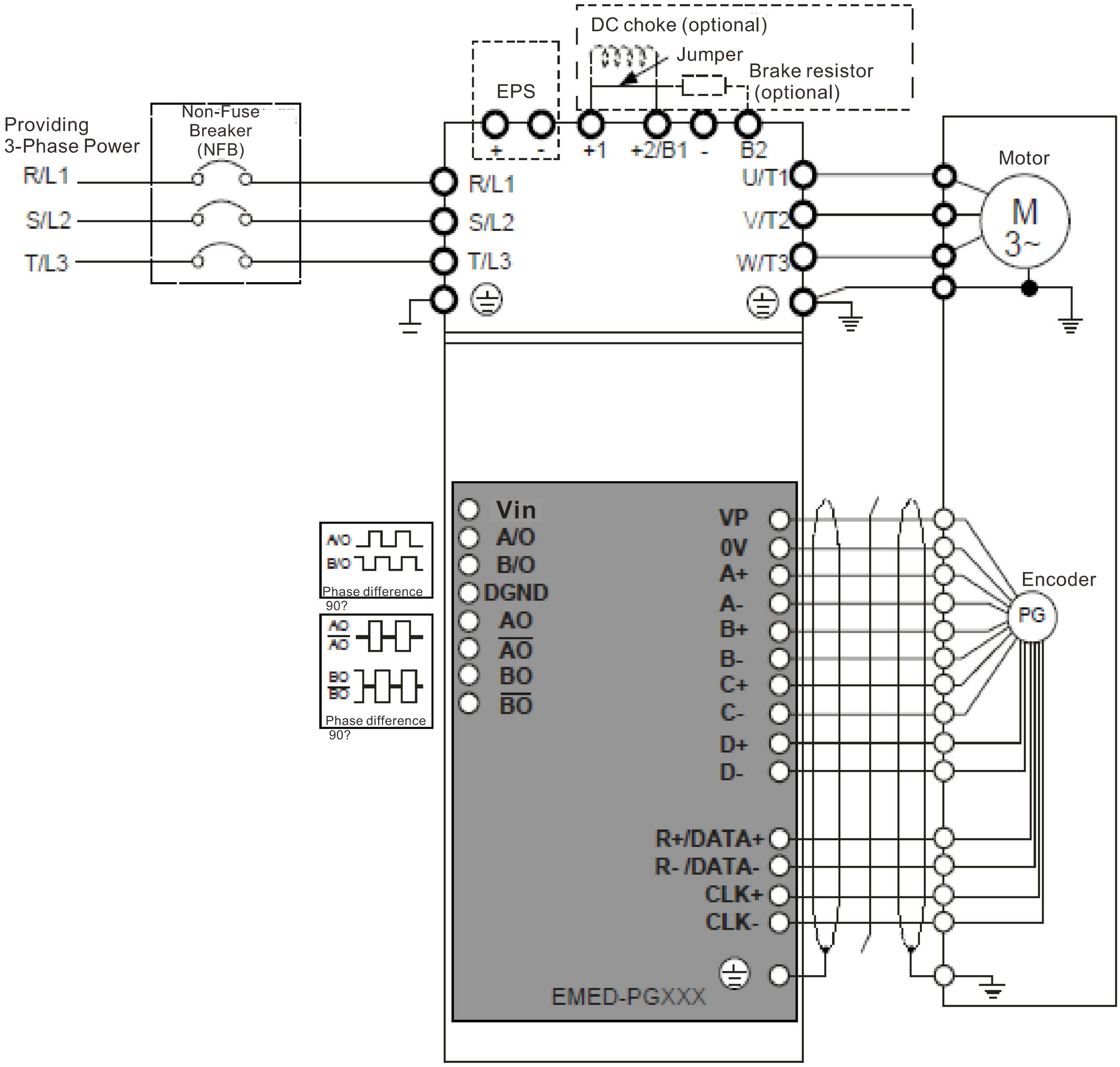
| Terminals | | Descriptions | Specifications |
|---|---|---|---|
| TB2 | Up (VP) | The output voltage for the encoder. Use the SW2 DIP switch to change the output voltage to +5 V or +8 V. | Voltage: +5.1 $V_{DC}$ ± 0.3 V; +8.4 $V_{DC}$ ± 1.5 V<br>Current: 200 mA max. |
| | 0 V | Encoder common power terminal | Reference level for the encoder's power. |
| | A+, A-, B+, B-, R+, R- | Encoder sine wave differential signal input (incremental signal) | Input frequency: 40 kHz max.<br> |
| | +SIN, +COS, REFSIN, REFCOS | Encoder sine wave differential signal input (incremental signal) | Input frequency: 20 kHz max.<br> |
| | C+, C-, D+, D- | Encoder sine wave differential signal input (absolute signal) |  |

| | | | |
|---|---|---|---|
| | DATA+(DATA), DATA-(/DATA) | RS-485 communication interface | Terminal resistance is about 130 Ω. |
| | CLOCK+, CLOCK- | CLOCK differential output for ENDAT | Line driver RS422 level output |

NOTE

- Verify that the SW2 switch is set to the correct output voltage before powering on.
- Keep the motor drive wiring away from any high voltage lines to avoid interference.

### Wiring Diagram




### Set the Frequency Division Signal

① After the encoder inputs a PULSE signal, there is an output signal by the division factor "n." Set the value in Pr.10-29 (PG card's frequency division output).

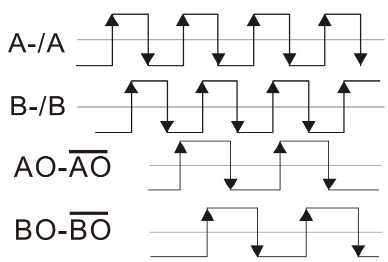
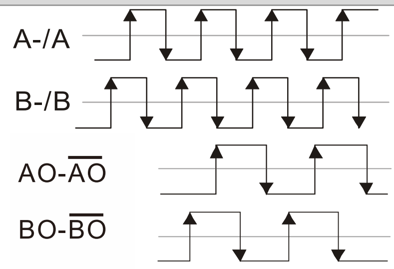
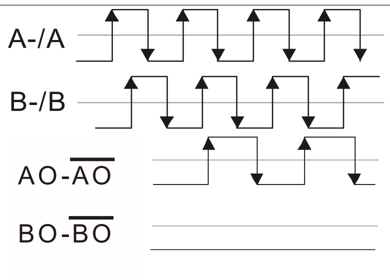
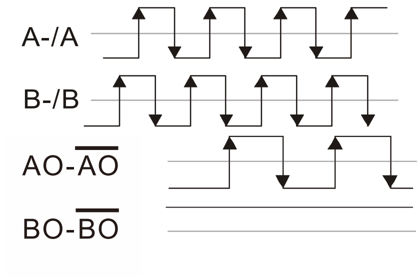
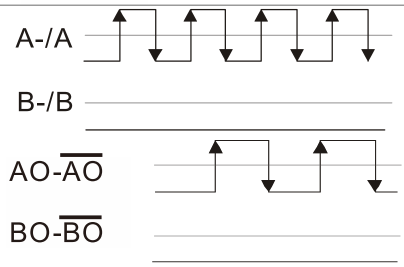
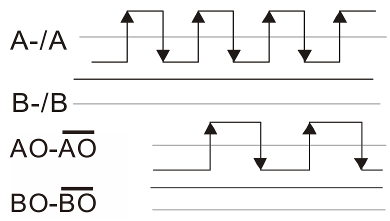
② Set Pr.10-29 (PG card's frequency division output):
The decimal frequency division output setting; range of the division factor "n": 1–31.

③ Pr.10-30 (PG card's frequency division output mode)

| Bit3 | Bit2 | Bit1 | Bit0 |
|---|---|---|---|
| X | X | **OUT/M** | **IN/M** |

**OUT/M:** Pulse output mode for frequency division;
**IN/M:** Pulse input mode for frequency division;
"X" is for backup while "0" is a value to write.

The following table lists the Input Mode (IN/M) & Output Mode (OUT/M) setting and description:

| OUT/M | IN/M | Division Factor | |
|---|---|---|---|
| | | A is ahead of B | B is ahead of A |
| 0 | 0 |  |  |
| 1 | 0 |  |  |
| X | 1 |  |  |

**NOTE**

- In the waveform, A-/A, B-/B are the PG card input signals; AO-$\overline{AO}$, BO-$\overline{BO}$ are the differential output frequency division signals. Use a differential probe to measure.
- Division factor “n”: Set 15 to divide the input signal by 15.
- When **OUT/M, IN/M** set to 0 and 0, the PG card input signal A-/A, B-/B are square waves while AO-$\overline{AO}$, BO-$\overline{BO}$ are frequency division output.
- When **OUT/M, IN/M** are set to 1 and 0, the PG card input signal A-/A, B-/B are square waves while the BO-$\overline{BO}$ is the A and B phase indicator (for example, when BO-$\overline{BO}$ is LOW, it means A is ahead of B: when BO-$\overline{BO}$ is HIGH, it means B is ahead of A). AO-$\overline{AO}$ is frequency division output.
- When **OUT/M, IN/M** are set to X and 1, B-/B phase has to be the direction indication input signal (for example, when B-/B is LOW, it means A is ahead of B; when B-/B is HIGH, it means B is ahead of A). A-/A is a square wave input, BO-$\overline{BO}$ and B-/B phase are input into synchronous action; AO-$\overline{AO}$ is frequency division output.
- Take Pr.10-29 and Pr.10-30 as examples: When the frequency division value is 15, **OUT/M** =1, **IN/M** = 0. Set Pr.10-29 = 15 and Pr.10-30 = 0002h.

  Set Pr.10-29 =15

  Set Pr.10-30 =0002h

| Bit3 | Bit2 | Bit1 | Bit0 |
|---|---|---|---|
| X | X | **1** | **0** |

# *Chapter 8 Specifications*

## 8-1 230V Series

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Frame Size | | B | | | C | | | D | | | E | |
| Model VFD-_ _ _ED23/21S | | 022* | 037* | 040 | 055 | 075 | 110 | 150 | 185 | 220 | 300 | 370 |
| Applicable Motor Output (kW) | | 2.2 | 3.7 | 4 | 5.5 | 7.5 | 11 | 15 | 18.5 | 22 | 30 | 37 |
| Applicable Motor Output (HP) | | 3 | 5 | 5 | 7.5 | 10 | 15 | 20 | 25 | 30 | 40 | 50 |
| Output Rating | Rated Output Capacity (kVA) | 4.8 | 6.8 | 7.9 | 9.5 | 12.5 | 19 | 25 | 29 | 34 | 46 | 55 |
| | Rated Output Current (A) | 12 | 17 | 20 | 24 | 30 | 45 | 58 | 77 | 87 | 132 | 161 |
| | Maximum Output Voltage (V) | Three-phase proportional to input voltage | | | | | | | | | | |
| | Output Frequency Range | 0.00–400 Hz | | | | | | | | | | |
| | Carrier Frequency Range | 2–15 kHz | | | | | | | | | 2–9 kHz | |
| | Rated Output Maximum Carrier Frequency | 8 kHz | | | 10 kHz | | | 8 kHz | | | 6 kHz | |
| Input Rating | Input Current (A) | 24 | 34 | 20 | 23 | 30 | 47 | 56 | 73 | 90 | 132 | 161 |
| | Rated Voltage (V) | One-phase | | Three-phase | | | | | | | | |
| | | 200–240 | | | | | | | | | | |
| | Rated Frequency (Hz) | 50/60 | | | | | | | | | | |
| | Voltage Tolerance | ±10% (180–264 V) | | | | | | | | | | |
| | Frequency Tolerance | ±5% (47–63 Hz) | | | | | | | | | | |
| Cooling Method | | Fan cooling | | | | | | | | | | |
| Weight (kg) | | 6 | 6 | 6 | 8 | 10 | 10 | 13 | 13 | 13 | 36 | 36 |

*VFD022ED21S & VFD037ED21S are one-phase input models.

## 8-2 460V Series

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Frame Size | | B | C | | | | | D | | E | | | |
| Model VFD-_ _ _ED43S | | 040 | 055 | 075 | 110 | 150 | 185 | 220 | 300 | 370 | 450 | 550 | 750 |
| Applicable Motor Output (kW) | | 4 | 5.5 | 7.5 | 11 | 15 | 18.5 | 22 | 30 | 37 | 45 | 55 | 75 |
| Applicable Motor Output (HP) | | 5 | 7.5 | 10 | 15 | 20 | 25 | 30 | 40 | 50 | 60 | 75 | 100 |
| Output Rating | Rated Output Capacity (kVA) | 9.2 | 10.4 | 13.5 | 18.3 | 24 | 30.3 | 36 | 46.2 | 63.7 | 80 | 96.4 | 116.3 |
| | Rated Output Current (A) | 11.5 | 13 | 17 | 23 | 30 | 38 | 45 | 58 | 80 | 100 | 128 | 165 |
| | Maximum Output Voltage (V) | Three-phase proportional to input voltage | | | | | | | | | | | |
| | Output Frequency Range | 0.00–400 Hz | | | | | | | | | | | |
| | Carrier Frequency Range | 2–15 kHz | | | | | | | 2–9 kHz | | | 2–6 kHz | |
| | Rated Output Maximum Carrier Frequency | 8 kHz | 10 kHz | | | 8 kHz | | | 6 kHz | | | | |
| Input Rating | Input Current (A) | 11.5 | 14 | 17 | 24 | 30 | 37 | 47 | 58 | 80 | 100 | 128 | 165 |
| | Rated Voltage (V) | Three-phase 380–480 | | | | | | | | | | | |
| | Rated Frequency (Hz) | 50/60 Hz | | | | | | | | | | | |
| | Voltage Tolerance | ±10% (342–528 V) | | | | | | | | | | | |
| | Frequency Tolerance | ±5% (47–63 Hz) | | | | | | | | | | | |
| Cooling Method | | Fan cooling | | | | | | | | | | | |
| Weight (kg) | | 6 | 8 | 10 | 10 | 10 | 10 | 13 | 14.5 | 36 | 36 | 50 | 50 |

*Assumes operation at the rated output current. Input current rating varies depending on the input reactor, transformer, wiring connections and power supply impedance.

# 8-3 General Specifications

| | | |
|---|---|---|
| Control Characteristics | Control Method | V/F, VF+PG, SVC, FOC+PG, FOC+PM |
| | Starting Torque | In V/F mode: 150% at 0.5 Hz.<br>In FOC+PG or FOC+PM mode: 150% at 0 Hz. |
| | Speed Control Range | 1:100 (up to 1:1000 when using PG card) |
| | Speed Control Accuracy | ±0.5% (up to ±0.02% when using PG card) |
| | Speed Response Ability | 5 Hz (Up to 30 Hz for vector control) |
| | Max. Output Frequency | 0.00–400.00 Hz |
| | Output Frequency Accuracy | Digital command 0.005%; analog command 0.5%. |
| | Frequency Setting Resolution | Digital command: 0.01 Hz; analog command: 1/4096 (12 bit) of the maximum output frequency. |
| | Torque Limit | Max. is 200% of the torque current |
| | Torque Accuracy | ±5% |
| | Accel. / Decel. Time | 0.00–600.00 seconds |
| | V/F Curve | Adjustable V/F curve using four independent points. |
| | Frequency Setting Signal | ±10 V |
| | Brake Torque | About 125% while ED is 30% (use optional brake resistor)<br>Note: ED is “Executive Duty” |
| Protection Characteristics | Motor Protection | Electronic thermal relay protection |
| | Over-current Protection | The current is limited by 190% of the drive’s rated current and the limit for over-current protection is 250% of the drive’s rated current. |
| | Ground Leakage Current Protection | More than 50% of the drive’s rated current |
| | Overload Ability | Constant torque: 150% for 60 seconds; variable torque: 180% for 10 seconds. |
| | Voltage Protection | Over-voltage level:<br>[230V model] $V_{DC}$ > 400 V<br>[460V model] $V_{DC}$ > 800 V<br>low-voltage level:<br>[230V model] $V_{DC}$ < 200 V<br>[460V model] $V_{DC}$ < 400 V |
| | Over-voltage Protection for the Input Power | Varistor (MOV) |
| | Overheating Protection | Built-in temperature sensor |
| Certifications | | CE, UL, TUV, EAC, RCM, RoHS, EN81-1+A3, EN81-20: 2014, KC |

# 8-4 Operation, Storage and Transportation Environments

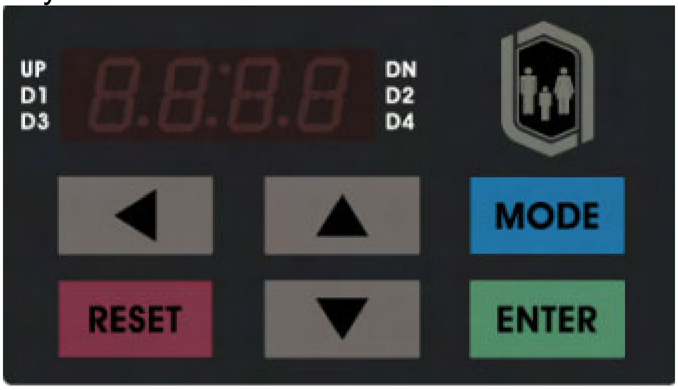
<table>
<tr><td colspan="5">DO NOT expose the AC motor drive to a poor environment, such as one with dust, direct sunlight, corrosive or inflammable gases, humidity, liquids or excessive vibration. The salt in the air must be less than 0.01 $mg/cm^2$ every year.</td></tr>
<tr><td rowspan="12">Environment</td><td>Installation Location</td><td colspan="3">IEC60364-1/IEC60664-1 pollution degree 2. Indoor use only.</td></tr>
<tr><td rowspan="6">Surrounding Temperature</td><td rowspan="4">Operation</td><td colspan="2">Between -10–40°C, up to 50°C with derating for the operation temperature.</td></tr>
<tr><td rowspan="3">Between 40–50°C with Derating</td><td>2.2–4 kW: for every 1°C increase in temperature, decrease the drive’s rated current by 2.2%</td></tr>
<tr><td>5.5–30 kW: for every 1°C increase in temperature, decrease the drive’s rated current by 2.5%</td></tr>
<tr><td>37–75 kW: for every 1°C increase in temperature, decrease the drive’s rated current by 2.0%</td></tr>
<tr><td>Storage/ Transportation</td><td colspan="2">-20–60ºC</td></tr>
<tr><td colspan="3">Non-condensing, non-freezing.</td></tr>
<tr><td rowspan="3">Rated Humidity</td><td>Operation</td><td colspan="2">Max. 90%</td></tr>
<tr><td>Storage/ Transportation</td><td colspan="2">Max. 90%</td></tr>
<tr><td colspan="3">No water condensation</td></tr>
<tr><td>Altitude</td><td>Operation</td><td colspan="2">If the AC motor drive is installed at an altitude of 0–1000 m, follow normal operation restrictions. For altitudes of 1000–3000 m, decrease the drive’s rated current by 1% or lower the temperature by 0.5°C for every 100 m increase in altitude. The maximum altitude for corner grounding is 3000 m. If installing at an altitude higher than 3000 m is required, contact Delta for more information.</td></tr>
<tr><td>Power System</td><td colspan="3">TN system[*1*2]</td></tr>
<tr><td rowspan="2">Package Drop</td><td>Storage</td><td rowspan="2" colspan="3">ISTA procedure 1A (according to weight) IEC60068-2-31</td></tr>
<tr><td>Transportation</td></tr>
<tr><td>Vibration</td><td colspan="4">● 1.0 mm, peak to peak value range from 2–13.2 Hz;<br>● 0.7–1.0 G range from 13.2–55 Hz;<br>● 1.0 G range from 55–512 Hz.<br>Compliance with IEC 60068-2-27.</td></tr>
<tr><td>Impact</td><td colspan="4">Compliance with IEC/EN 60068-2-27</td></tr>
<tr><td>Protection Level</td><td colspan="4">NEMA 1/IP20</td></tr>
<tr><td>EMC Level</td><td colspan="4">IEC 61800-3 and IEC 61000-4</td></tr>
</table>

*1: TN system: The neutral point of the power system connects directly to the ground. The exposed metal components connect to the ground through the protective grounding conductor.
*2: One-phase models use a one-phase three-wire power system.

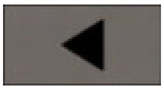
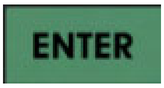
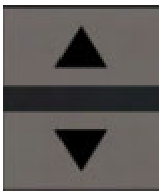
# Chapter 9 Digital Keypad

## 9-1 Description of Keyboard Panel

Keyboard Panel KPED-LE01




### Keypad Functions

| Keys | Description |
|---|---|
|  | **Shift key**<br>Moves the cursor so you can adjust the selected value. |
|  | **Reset key**<br>Resets the motor drive after a fault. |
|  | **Mode key**<br>Changes among the different display modes. |
|  | **ENTER key**<br>Allows you to read or modify the current parameter settings. |
|  | **Up and Down keys**<br>These buttons have two functions:<br>1. Press the Up or Down button to increase or decrease the selected value.<br>2. Press the Up or Down button to select items in a menu and languages. |

### LED Function Description

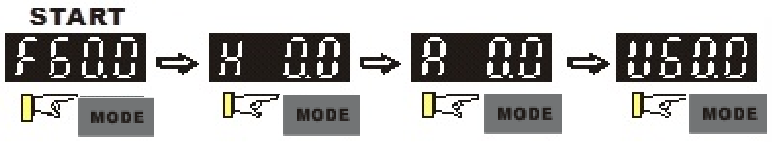
| LED | Description |
|---|---|
|  | **Status Display**<br>UP: Moving up.<br>DN: Moving down<br>D1: MI1 status<br>D2: MI2 status<br>D3: MI3 status<br>D4: MI4 status |
|  | **Main Display Area**<br>Displays frequency, current, voltage, rotation direction, user-defined units, errors and warnings. |

## Description of the Displayed Functions

| Displayed Function | Description |
|---|---|
|   | Displays the VFD-ED frequency setting. |
|   | Displays the actual frequency output from the VFD-ED to the motor. |
|   | Displays the user-defined value in Pr.00-04. |
|   | Displays the current (amperes). |
|   | Displays the selected parameter. |
|   | Displays the value in a parameter. |
|   | Displays the external fault. |
|   | Displays “End” for approximately one second (as shown in the left figure) if the data has been accepted and automatically stored in the register. |
|   | Displays if the setting data is not accepted or data value exceeds the allowed range. |

## 9-2 Keypad Operation Process

Setting Mode




NOTE: In the selected mode, press ENTER to set the parameters.

Setting parameters


NOTE :In the parameter setting mode, you can press MODE to the selected mode.

To change data

## 9-3 Description of the Digital Keypad KPC-CC01

KPC-CC01


Communication Interface
RJ45 (socket), RS-485 interface

Installation methods

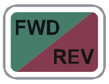
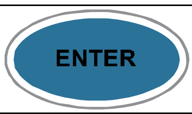
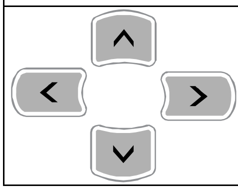
☑ Place the keypad flat on the surface of the control box. The front cover is water proof.

☑ Use a model MKC-KPPK for wall mounting or embedded mounting. Its protection level is IP66.

☑ The maximum RJ45 extension cable is 5 m (16 ft).

☑ This keypad can also be used on Delta's motor drives C2000, CH2000 and CP2000.

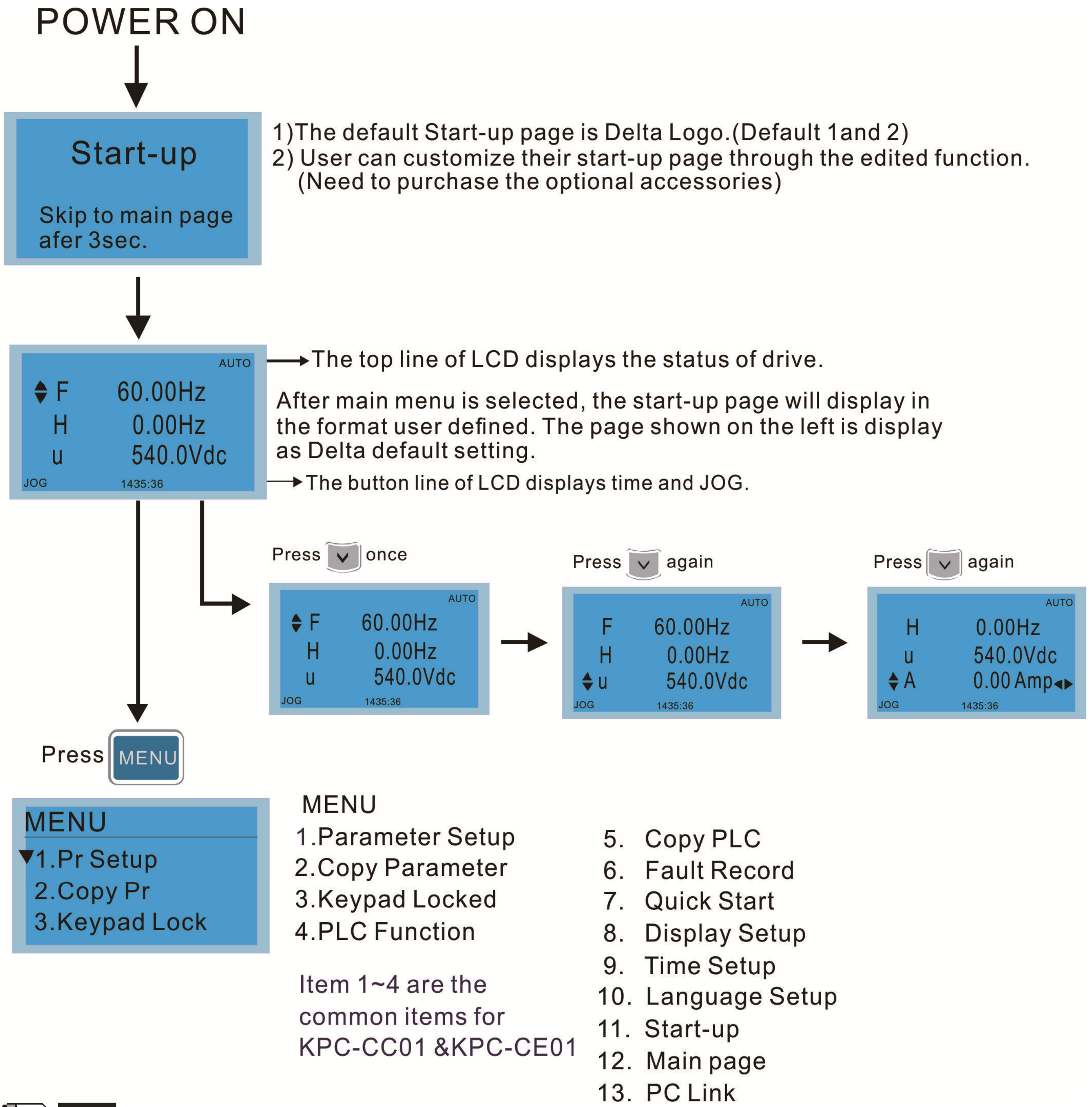
### Keypad Functions

| Key | Description |
|---|---|
|  | Start Key<br>☑ This button is functional only when the keypad is the source of the command.<br>☑ This button causes the motor drive to run according to its settings. See "LED Function Description" for LED status.<br>☑ Pressing the RUN button repeatedly is allowed while the motor drive is stopping. |
|  | Stop Key<br>☑ The STOP key has the highest priority in command.<br>☑ Press the STOP key to stop the drive under any conditions.<br>☑ Press the RESET key to reset the drive when faults occur. If the RESET key does not respond, go to MENU "Fault Records" to check the most recent fault. |
|  | Operation Direction Key<br>☑ The FWD/REV key controls the operation direction but does NOT activate the drive. FWD: forward, REV: reverse.<br>☑ The drive operates in the direction as shown by the LED. |
|  | ENTER Key<br>Press the ENTER key to go to the next menu level. If you are at the last level, then press ENTER to execute the command. |
|  | ESC Key<br>Press the ESC key to return to the previous page, or return to the last category in the sub-menu. |
|  | MENU Key<br>Press the MENU key to return to the main menu.<br>Menu items:<br>1. Parameter Setup 5. Copy PLC 9. Time Setup 13. PLC Link<br>2. Copy Parameter 6. Fault Record 10. Language Setup<br>3. Keypad Locked 7. Quick Start 11. Start-up<br>4. PLC Function 8. Display Setup 12. Main Page<br><br>VFD-ED does not support menu item 4 and 5 (PLC functions) and menu item 7 (Quick Start). |
|  | Direction: Left/Right/Up/Down cursor keys<br>☑ In the numeric value setting mode, press Left and Right to move the cursor; press Up and Down to change the selected value.<br>☑ In the menu/text selection mode, use the cursor keys to select an item. |

## LED Function Descriptions

| LED | Description |
|---|---|
|   | Steady ON: AC motor drive operation indicator, including DC brake, zero speed, standby, restart after fault and speed tracking.<br>Blinking: motor drive is decelerating to stop or in Base Block status.<br>Steady OFF: motor drive does not execute the operation command. |
|   | Steady ON: AC motor drive stop indicator.<br>Blinking: motor drive is in standby status.<br>Steady OFF: motor drive does not execute the STOP command. |
|   | Operation Direction LED<br>1. Green light is on, the drive is running forward.<br>2. Red light is on, the drive is running in reverse.<br>3. Blinking light: the drive is changing direction. |

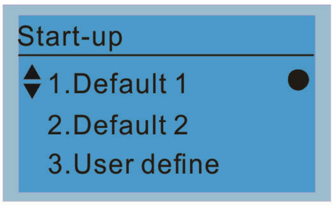
## 9-4 Digital Keypad KPC-CC01 Functions

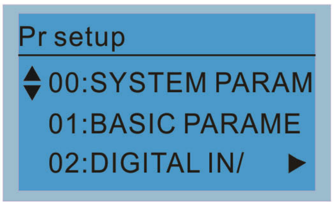



**NOTE**

1. Start-up page can only display pictures, no flash.
2. When power is ON, it displays the start-up page and then the main page. The main page displays Delta's default setting F/H/A/U. Set the displayed order with Pr.00-03 (Start-up Display). When the selected item is U page, use left key and right key to switch between the items. Set the displayed order of U page with Pr.00-04 (Content of Multi-function Display).
3. VFD-ED does not support menu item 4 and 5 (PLC functions) and menu item 7 (Quick Start).

## Display Icon




●: present setting

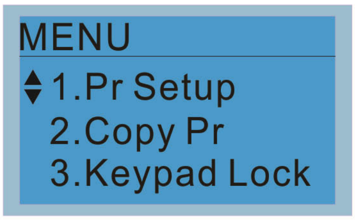
▲▼: roll down the page for more options

Press ▲▼ for more options.

▶ : show complete sentence

Press ◀ ▶ for complete information

## Display Item

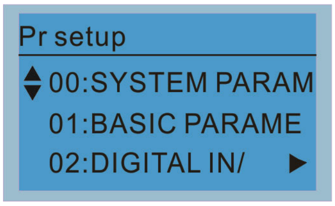



MENU
1.Parameter Setup
2.Copy Parameter
3.Keypad Locked
4.PLC Function

5. Copy PLC
6. Fault Record
7. Quick Start
8. Display Setup
9. Time Setup
10. Language Setup
11. Start-up
12. Main page
13. PC Link

Item 1~4 are the common items for KPC-CC01 &KPC-CE01

1. Parameter Setup

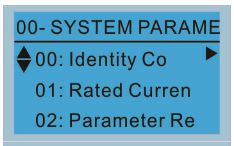



Press ENTER to select.

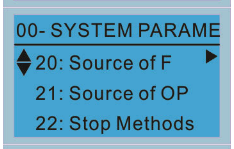
Press ▲▼ to select a parameter group.

Once a parameter group is selected, press ENTER to go into that group.

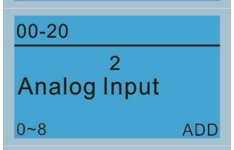
For example: Set the master frequency command source.



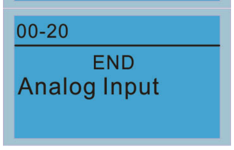

Display the Group 00 Motor Drive Parameter. Use Up and Down to select parameter 20: Auto Frequency Command.




Press ENTER to display the parameter's setting menu.




Use Up and Down to choose a setting.
For example, choose 2 Analogue Input, and then press ENTER.




After you press ENTER, the screen displays "END", indicating that the new parameter value is set.

2. Copy Parameter

```
Copy Pr
001:Manual_001
002:FileName01
003:FileName02
```

Press ENTER to go to 001–004: content storage

Four groups of parameters are available to copy.
The steps are shown in the example below.
Example: Save parameters in the motor drive.

```
Copy pr
001:Manual_001
002:
003:
```

1. Go to Copy Parameter.
2. Select the parameter group to copy, and then press ENTER.

```
001>
1: keypad->VFD
2: VFD->Keypad
```

1. Select 1: keypad->VFD.
2. Press ENTER to go to the "Save in the motor drive" screen.

```
001>          P08-09
keypad->VFD
68%
```

Copy parameters until it is done.

```
Copy pr
001:Manual_001
002:
003:
```

Once copying parameters is done, the keypad automatically returns to this screen.

Example: Save parameters in the keypad.

```
Copy pr
001:
002:
003:
```

1. Go to Copy Parameter.
2. Select the parameter group to copy, and then press ENTER.

```
001>
1: keypad->VFD
2: VFD->Keypad
```

1. Select 2: VFD->Keypad.
2. Press ENTER to go to the "Save in the keypad drive" screen.

```
001>
FileName00
```

Press Up or Down to select a symbol.
Press Left or Right to move the cursor to select a filename.

String & Symbol Table:

! " # $ % & ' ( ) * + · - · / 0 1 2 3 4 5 6 7 8 9 : ; < = > ? @ A B C D E F G H I J K L M N O P Q R S T U V W X Y Z [ \ ] ^ _ ' a b c d f g h i j k l m n o p q r s t u v w x y z { | } ~

```
001>
Manual_001
```

After you confirm the filename, press ENTER.

```
001>          P01-50
VFD->Keypad
12%
```

Copy parameters until it is done.

```
Copy pr
001:Manual_001
002:
003:
```

After copying parameters, the keypad automatically returns to this screen.

```
Copy pr
001:12/21/2014
002:
003:
```

Press Right to see the date the parameters were copied.

| | | |
|---|---|---|
| | Copy pr<br>001:18:38:58<br>002:<br>003: | Press Right again to see the time the parameters were copied. |

3. Keypad Locked

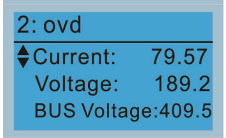
| | | |
|---|---|---|
| Keypad Lock<br>Press ENTER to Lock Key<br><br>Press ENTER to lock | Lock the Keypad<br><br>Use this function to lock the keypad. The main screen does not display "keypad locked" when the keypad is locked; however it displays the message "Press ESC 3 sec to unlock key" when any key is pressed. | |
| | AUTO<br>F 60.00Hz<br>H 0.00Hz<br>u 540.0Vdc<br>JOG 14:35:58 | When the keypad is locked, the main screen does not display the locked status. |
| | Keypad Lock<br>Press ESC 3 sec to UnLock Key | Press any key on the keypad; a message displays as shown on the left. |
| | AUTO<br>F 60.00Hz<br>H 0.00Hz<br>u 540.0Vdc<br>JOG 14:35:58 | If you do not press ESC, the keypad automatically returns to this screen. |
| | Keypad Lock<br>Press ESC 3 sec to UnLock Key | The keypad is still locked. When you press any key, the screen shows the message on the left. |
| | AUTO<br>F 60.00Hz<br>H 0.00Hz<br>u 540.0Vdc<br>JOG 14:35:58 | Press ESC for 3 seconds to unlock the keypad and the keypad returns to this screen. All keys on the keypad are functional. |
| | Once the keypad is unlocked, turning the power off and then back on does not lock the keypad. | |

4.
4.

4. Fault Record

| | | |
|---|---|---|
| Fault record<br>1:oL<br>2:ovd<br>3:GFF<br><br>Press ENTER to select.<br><br>KPC-CE01 does not support this function. | Able to store 6 error codes (Keypad V1.02 and previous versions)<br>Able to store 20 error codes (Keypad V1.03 and later versions)<br>The most recent error record shows as the first record. Choose an error record to see details such as date, time, frequency, current, voltage, and DC bus voltage. | |
| | Fault record<br>1:oL<br>2:ovd<br>3:GFF | Press Up or Down to select a fault record.<br>After selecting a fault code, press ENTER to see that fault record's details. |
| | 1: oL<br>Current: 79.57<br>Voltage: 189.2<br>BUS Voltage:409.5 | Press Up or Down to see the fault record's details such as date, time, frequency, current, voltage, and DC bus voltage. |
| | 1: oL<br>Date: 01/20/2014<br>Time: 21:02:24<br>Outfreq: 32.61 | Press ESC to return to the Fault Record screen. |


Press Up or Down to select the next fault record. After selecting a fault record, press ENTER to see that fault record's details.





Press Up or Down to see the fault record's details such as date, time, frequency, current, voltage, and DC bus voltage.

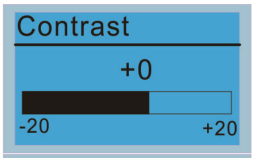
**NOTE**

The AC motor drive fault actions are recorded and saved to the KPC-CC01. When you remove the KPC-CC01 and connect it to another AC motor drive, the previous fault records are not deleted. The new fault records of the new AC motor drive continue to be added to the KPC-CC01.

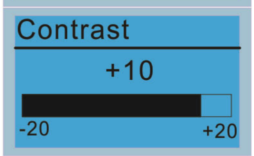
5. Display Setup


Press ENTER to display the Display Setup screen.

1. Contrast

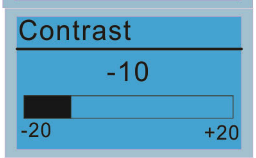



Press Up or Down to adjust the setting value.

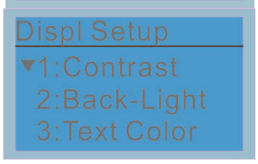



For example, increase the contrast to +10.


After you set the value, press ENTER to see the screen display after increasing the contrast.



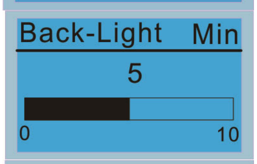

Then press ENTER and decrease the contrast to -10.



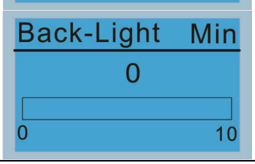

Press ENTER to see the screen display after adjusting the contrast to -10.

2. Back-Light

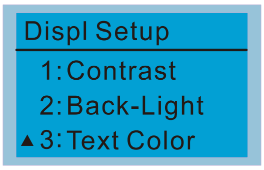
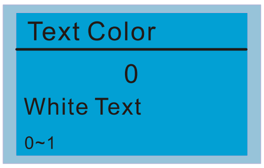
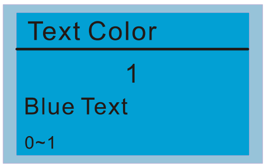

Press ENTER to go to Back-Light time setting screen.



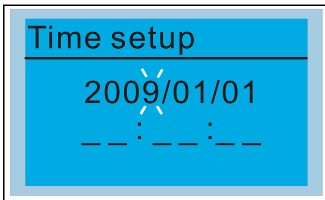
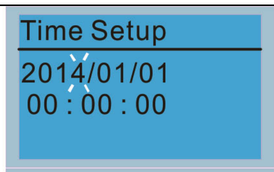
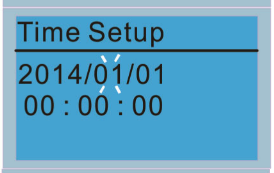
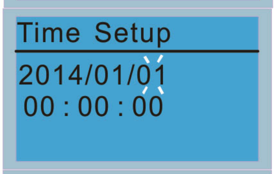
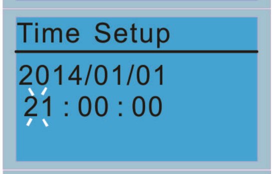
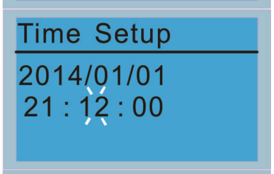
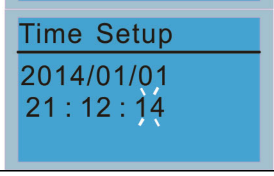

Press Up or Down to adjust the setting value.

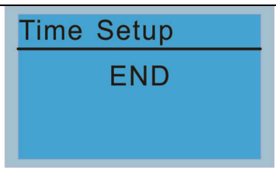



When the setting value is 0 Min, the backlight stays on.

| | | |
|---|---|---|
| |  | When the setting value is 10 Min, the backlight turns off in 10 minutes. |
| | 3. Text Color<br> | Press ENTER to go to the Text Color setting screen. |
| |  | The default value is White Text. |
| |  | Press Up or Down to adjust the setting value, and then press ENTER. |
| |  | The setting value changes to Blue Text. |

6. Time Setup

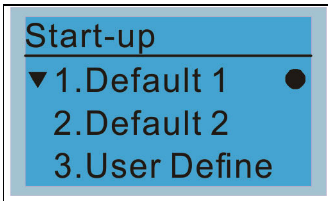
| | | |
|---|---|---|
| <br>Press Left or Right to select Year, Month, Day, Hour, Minute or Second to change. |  | Press Up or Down to set the Year. |
| |  | Press Up or Down to set the Month. |
| |  | Press Up or Down to set the Day. |
| |  | Press Up or Down to set the Hour. |
| |  | Press Up or Down to set the Minute. |
| |  | Press Up or Down to set the Seconds. |

| | |
|---|---|
| | <br><br>Press ENTER to confirm the new date and time setting.<br>NOTE<br>Limitation: The charging process for the keypad super capacitor finishes in about 6 minutes. When you remove the digital keypad from the motor drive, the drive stores the time setting for seven days. After seven days, you must reset the time. |

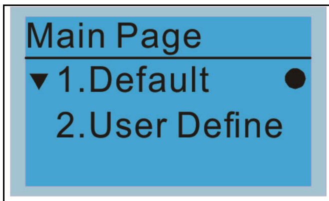
7. Language Setup

| | |
|---|---|
| <br><br>Press Up or Down to select the language, and then press ENTER. | The Language setting option is displayed in the language of your choice.<br>Language setting options:<br>1. English 4. Türkçe<br>2. 繁體中文 5. Русский<br>3. 简体中文<br>NOTE: VFD-ED only supports these five languages currently. |

8. Start-up

| | |
|---|---|
| <br> | 1. Default 1 DELTA LOGO<br><br><br>2. Default 2 DELTA Text<br><br><br>3. User-defined: an optional accessory is required (TPEditor & USB/RS-485 Communication Interface-IFD6530) to design your own start-up page.<br>If the editor accessory is not installed, the User Define option displays a blank screen.<br><br><br>USB/RS-485 Communication Interface-IFD6530<br>Refer to Chapter 06 Optional Accessories for more details.<br>TPEditor<br>Go to Delta's website to download the TPEditor V1.30.6 or later versions.<br>http://www.delta.com.tw/ch/product/em/download/download_main.asp?act=3&pid=1&cid=1&tpid=3<br>Refer to Section 9-6 TPEditor Installation for operation description. |

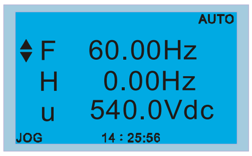
9. Main Page




You can choose the Default picture or the User-defined picture.

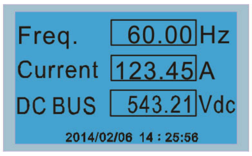
Press ENTER to select.

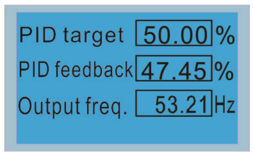
1. Default page




F 600.00 Hz >>> H >>> A >>> U (options rotate)

2. User-defined: an optional accessory is required (TPEditor & USB/RS-485 Communication Interface-IFD6530) to design your own start-up page. If the editor accessory is not installed, the User Define option displays a blank screen.




USB/RS-485 Communication Interface-IFD6530

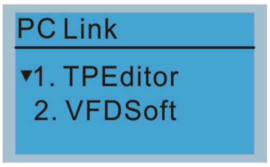
Refer to Chapter 06 Optional Accessories for more details.

TPEditor

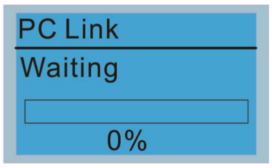
Go to Delta's website to download the TPEditor V1.30.6 or later versions.
http://www.delta.com.tw/ch/product/em/download/download_main.asp?act=3&pid=1&cid=1&tpid=3

Refer to Section 9-6 TPEditor Installation for operation description.

10. PC Link

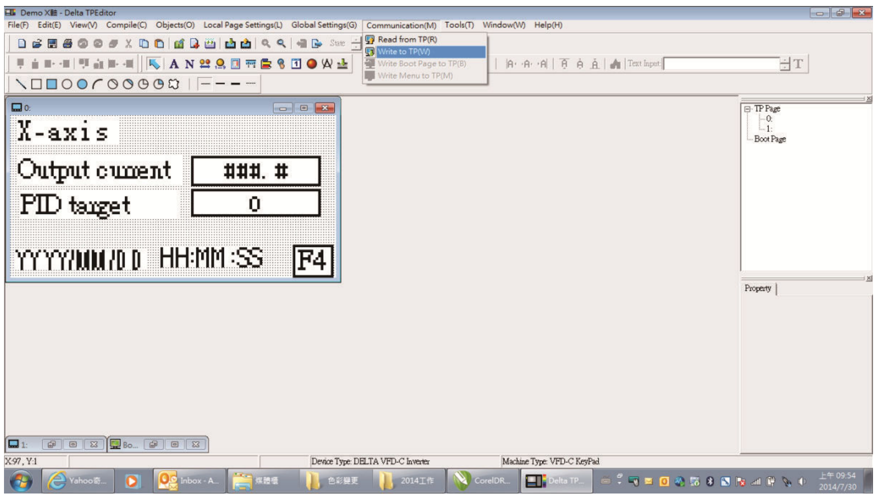



1. TPEditor: This function allows you to connect the keypad to a computer, and then download and edit user-defined pages.

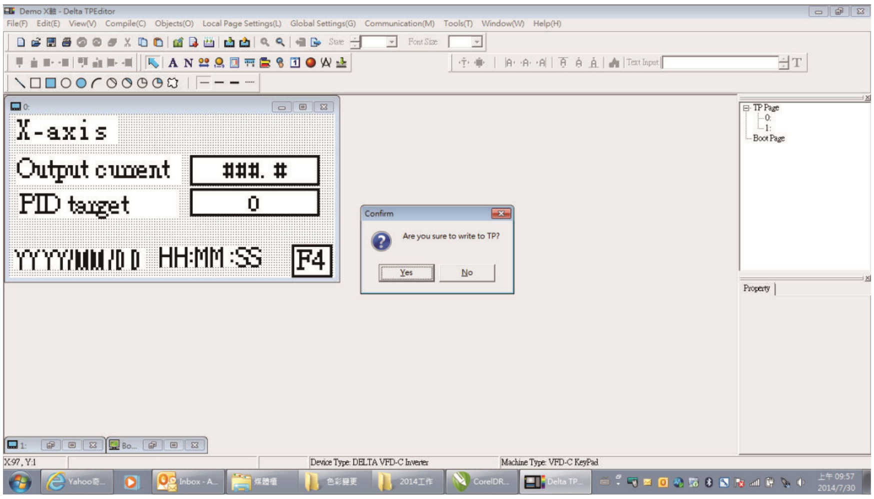


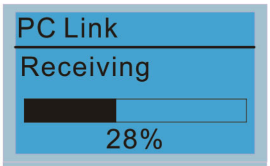

Press ENTER to go to the PC Link Waiting to connect to PC screen.

In TPEditor, from the **Communication** menu, choose **Write to TP**.

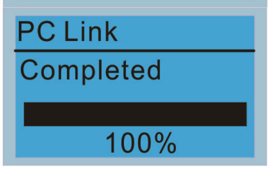


In the **Confirm** message box, click **YES**.



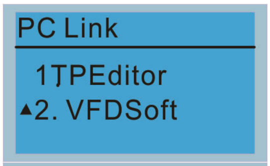

The software starts downloading screens to the KPC-CC01.



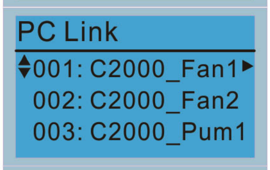

Download completed.

2. VFDSoft: This function links to the software VFDSoft, and then you can upload data that you copied one or more parameter (1–4) from the drive to the KPC-CC01.

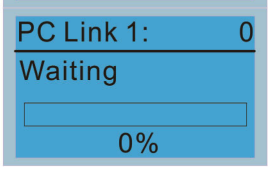
Connect KPC-CCO1 to your computer.




Choose 2. VFDSoft

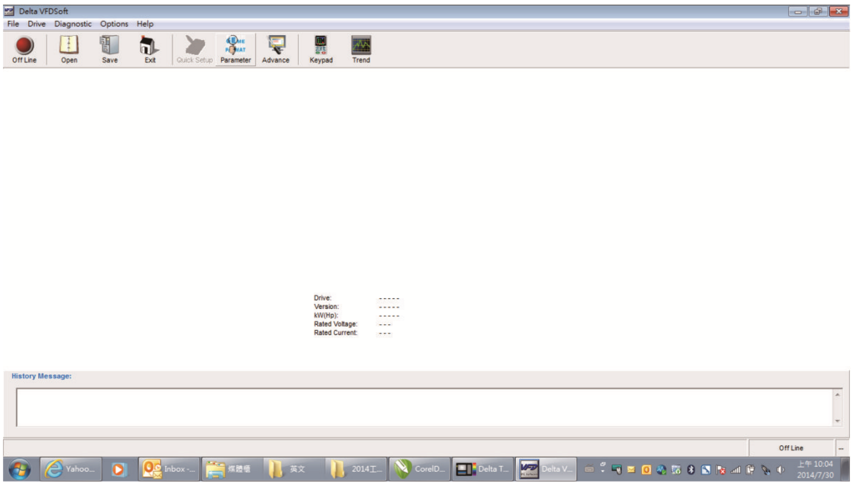



Press Up or Down to select a parameter group to upload to VFDSoft.

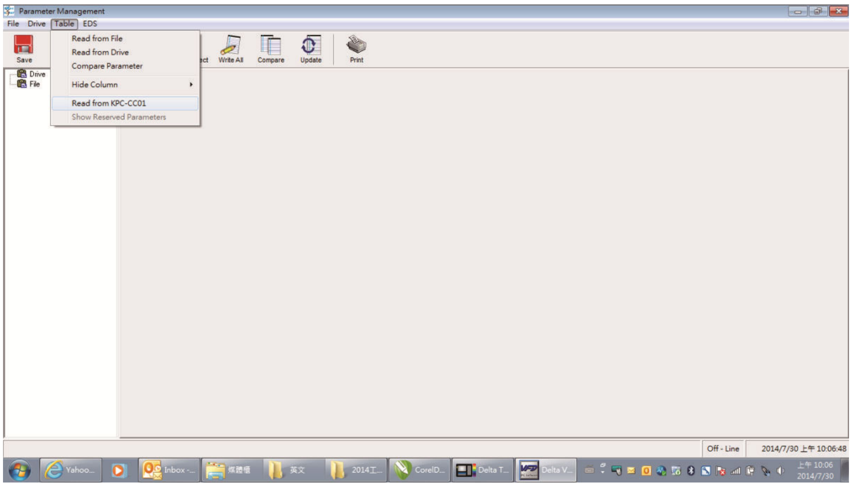



Press ENTER to display the PC Link Waiting to connect to PC screen.

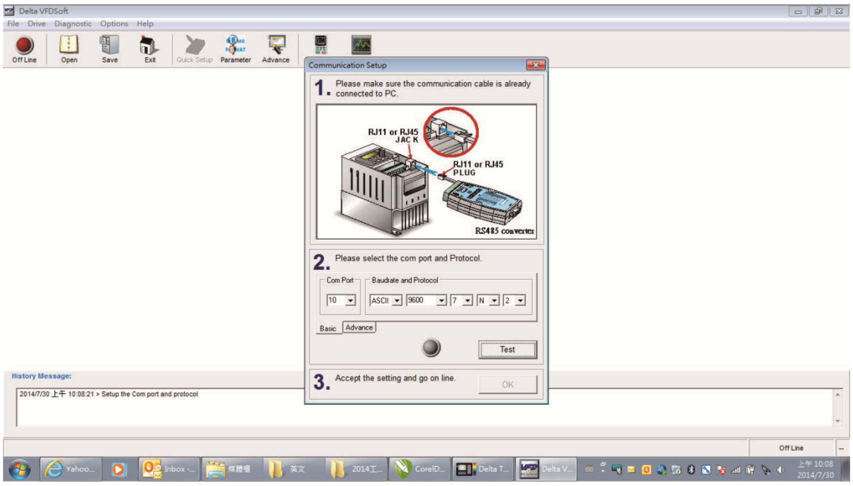
On your computer, open VFDSoft, and click **Parameter** on the toolbar.

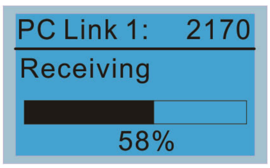


In the Parameter Management, from the **Table** menu, click **Read from KPC-CC01**.

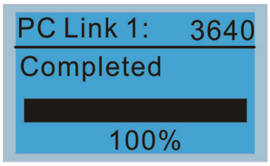



Choose the correct communication port, and then click **OK**.



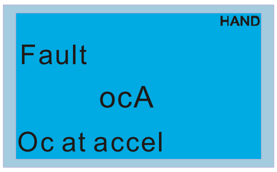



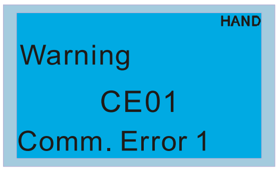

Start to upload parameters to VFDSoft.

| | |
|---|---|
| |   Uploading parameter is completed.<br>Before using the user-defined Start-up screen and user-defined Main screen, you must preset the Start-up screen and the Main screen as user-defined. If you do not download the user-defined screens to the KPC-CC01, the Start-up screen and the Main screen are blank. |

## Other Displays

When a fault or warning occurs, the menu displays the following screens.




1. Press ENTER to RESET. If there is no response, contact your local distributor for instructions to return the equipment to the factory. To view the DC bus fault voltage value, output current and output voltage, press MENU and then choose Fault Record for details (refer to the descriptions in the above #4 Fault Record).
2. Press ENTER again. If the screen returns to Main page, the fault is cleared.

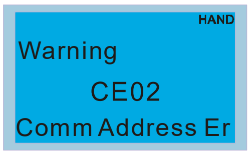
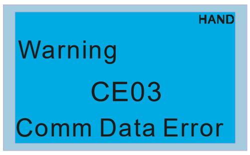
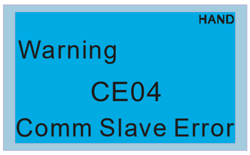
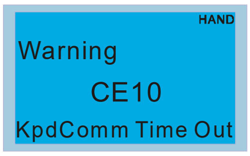
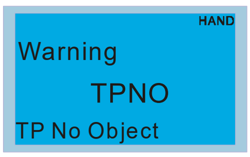
When a fault or warning message appears, the screen backlight blinks until the fault or warning is cleared.

## 9-5 Digital Keypad KPC-CC01 Fault Codes and Descriptions

### Fault Codes

| LCM Display * | Description | Corrective Actions |
|---|---|---|
| HAND<br>Fault<br>FrEr<br>kpdFlash Read Er | Keypad flash memory read error | Error in the keypad's flash memory.<br>1. Press RESET to clear the errors.<br>2. Check for any problem on Flash IC.<br>3. Shut down the system, wait for ten minutes, and then restart the system.<br>If none of the above solutions works, contact your authorized local dealer for assistance. |
| HAND<br>Fault<br>FSEr<br>kpdFlash Save Er | Keypad flash memory save error | Error in the keypad's flash memory.<br>1. Press RESET to clear the errors.<br>2. Check for any problem on Flash IC.<br>3. Shut down the system, wait for ten minutes, and then restart the system.<br>If none of the above solutions works, contact your authorized local dealer for assistance. |
| HAND<br>Fault<br>FPEr<br>kpdFlash Pr Er | Keypad flash memory parameter error | Error in the default parameters.<br>It might be caused by a firmware update.<br>1. Press RESET to clear the errors.<br>2. Check for any problem on Flash IC.<br>3. Shut down the system, wait for ten minutes, and then restart the system.<br>If none of the above solutions works, contact your local authorized dealer for assistance. |
| HAND<br>Fault<br>VFDr<br>Read VFD Info Er | Keypad error when reading AC motor drive data | Keypad cannot read any data sent from the VFD.<br>1. Verify that the keypad is properly connected to the motor drive by a communication cable such as RJ45.<br>2. Press RESET to clear the errors.<br>3. Shut down the system, wait for ten minutes, and then restart the system.<br>If none of the above solutions works, contact your local authorized dealer for assistance. |
| HAND<br>Fault<br>CPUEr<br>CPU Error | Keypad CPU error | A serious error in the keypad's CPU.<br>1. Check for any problem on CPU clock.<br>2. Check for any problem on Flash IC.<br>3. Check for any problem on RTC IC.<br>4. Verify that the communication quality of the RS-485 cable is good.<br>5. Shut down the system, wait for ten minutes, and then restart the system.<br>If none of the above solutions works, contact your local authorized dealer for assistance. |

## Warning Codes

| LCM Display * | Description | Corrective Actions |
|---|---|---|
|  | Modbus function code error | Motor drive does not accept the communication command sent from the keypad.<br>1. Verify that the keypad is properly connected to the motor drive by a communication cable such as RJ45.<br>2. Press RESET to clear the errors.<br>If none of the above solutions works, contact your local authorized dealer for assistance. |
|  | Modbus data address error | Motor drive does not accept the keypad's communication address.<br>1. Verify that the keypad is properly connected to the motor drive by a communication cable such as RJ45.<br>2. Press RESET to clear the errors.<br>If none of the above solutions works, contact your local authorized dealer for assistance. |
|  | Modbus data value error | Motor drive does not accept the communication data sent from the keypad.<br>1. Verify that the keypad is properly connected to the motor drive by a communication cable such as RJ45.<br>2. Press RESET to clear the errors.<br>If none of the above solution works, contact your local authorized dealer for assistance. |
|  | Modbus slave drive error | Motor drive cannot process the communication command sent from the keypad.<br>1. Verify that the keypad is properly connected to the motor drive by a communication cable such as RJ45.<br>2. Press RESET to clear the errors.<br>3. Shut down the system, wait for ten minutes, and then restart the system.<br>If none of the above solutions works, contact your local authorized dealer for assistance. |
|  | Modbus transmission time-out | Motor drive does not respond to the communication command sent from the keypad.<br>1. Verify that the keypad is properly connected to the motor drive by a communication cable such as RJ45.<br>2. Press RESET to clear the errors.<br>3. Shut down the system, wait for ten minutes, and then restart the system.<br>If none of the above solutions works, contact your local authorized dealer for assistance. |
|  | Object not supported by TPEditor | Keypad's TPEditor uses an unsupported object.<br>1. Verify that the TPEditor is not using an unsupported object or setting. Delete unsupported objects and unsupported settings.<br>2. Re-edit the object in the TPEditor, and then download it to the keypad.<br>If none of the above solutions works, contact your local authorized dealer for assistance. |

## File Copy Setting Fault Description

| LCM Display * | Description | Corrective Actions |
|---|---|---|
| HAND<br>File 1<br>Err 1<br>Read Only | Parameter and file are read-only | The parameter/file is read-only and cannot be written to.<br>1. Verify the specification in the user manual.<br>If this solution does not work, contact your local authorized dealer for assistance. |
| HAND<br>File 1<br>Err<br>Write Fail | Fail to write parameter and file | An error occurred while writing to a parameter/file.<br>1. Check for any problem on Flash IC.<br>2. Shut down the system, wait for ten minutes, and then restart the system.<br>If this solution does not work, contact your local authorized dealer for assistance. |
| HAND<br>File 1<br>Err<br>VFD Running | AC motor drive is in operating status | A setting cannot be changed while the motor drive is in operation.<br>1. Verify that the drive is not in operation.<br>If this solution does not work, contact your local authorized dealer for assistance. |
| HAND<br>File 1<br>Err<br>Pr Lock | AC motor drive parameter is locked | A setting cannot be changed because a parameter is locked.<br>1. Check if the parameter is locked. If it is locked, unlock it and try to set the parameter again.<br>If this solution does not work, contact your local authorized dealer for assistance. |
| HAND<br>File 1<br>Err<br>Pr Changing | AC motor drive parameter is changing | A setting cannot be changed because a parameter is being modified.<br>1. Check if the parameter is being modified. If it is not being modified, try to change that parameter again.<br>If this solution does not work, contact your local authorized dealer for assistance. |
| HAND<br>File 1<br>Err<br>Fault Code | Fault code is not cleared | A setting cannot be changed because an error has occurred in the motor drive.<br>1. Check if an error occurred in the motor dive. If there is no error, try to change the setting again.<br>If this solution does not work, contact your local authorized dealer for assistance. |
| HAND<br>File 1<br>Err<br>Warning Code | Warning code is not cleared | A setting cannot be changed because of a warning message given to the motor drive.<br>1. Check if there is a warning message given to the motor drive.<br>If this solution does not work, contact your local authorized dealer for assistance. |
| HAND<br>File 1<br>Err<br>Type Dismatch | File type mismatch | Data to be copied are not the correct type, so the setting cannot be changed.<br>1. Check if the products' serial numbers to be copied are in the same category. If they are in the same category, try to copy the setting again.<br>If this solution does not work, contact your authorized dealer for assistance. |

| LCM Display * | Description | Corrective Actions |
|---|---|---|
| File 1<br>Err<br>Password Lock | File is locked with password | A setting cannot be changed because some data are locked.<br>1. Check if the data are unlocked or able to be unlocked. If the data are unlocked, try to change the setting again.<br>2. Shut down the system, wait for ten minutes, and then restart the system.<br>If none of the above solutions works, contact your authorized dealer for assistance. |
| File 1<br>Err 10<br>Password Fail | File password mismatch | A setting cannot be changed because the password is incorrect.<br>1. Check if the password is correct. If the password is correct, try to change the setting again.<br>2. Shut down the system, wait for ten minutes, and then restart the system.<br>If none of the above solutions works, contact your authorized dealer for assistance. |
| File 1<br>Err<br>Version Fail | File version mismatch | A setting cannot be changed because the version of the data is incorrect.<br>1. Check if the version of the data matches the motor drive. If it matches, try to change the setting again.<br>If this solution does not work, contact your authorized dealer for assistance. |
| File 1<br>Err<br>VFD Time Out | AC motor drive copy function time-out | A setting cannot be changed because the data copying time-out expired.<br>1. Try copying the data again.<br>2. Check if copying data is authorized. If it is authorized, try to copy the data again.<br>3. Shut down the system, wait for ten minutes, and then restart the system.<br>If none of the above solutions works, contact your authorized dealer for assistance. |
| File 1<br>Err<br>Keypad Issue | Other keypad error | This setting cannot be changed due to other keypad issues (Reserved functions).<br>Contact your authorized dealer for assistance. |
| File 1<br>Err<br>VFD Issue | Other AC motor drive error | This setting cannot be changed due to other motor drive issues (Reserved functions).<br>Contact your authorized dealer for assistance. |

※ The content in this section only applies to the KPC-CC01 keypad V1.01 and later versions.

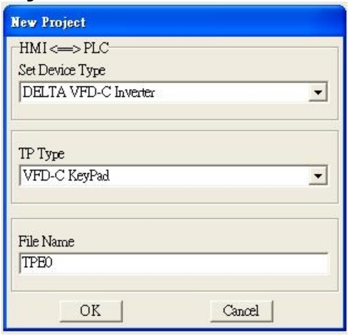
# 9-6 TPEditor Installation

The TPEditor can edit up to 256 HMI (Human-Machine Interface) pages with a total storage capacity of 256 KB. Each page can include 50 normal objects and 10 communication objects.

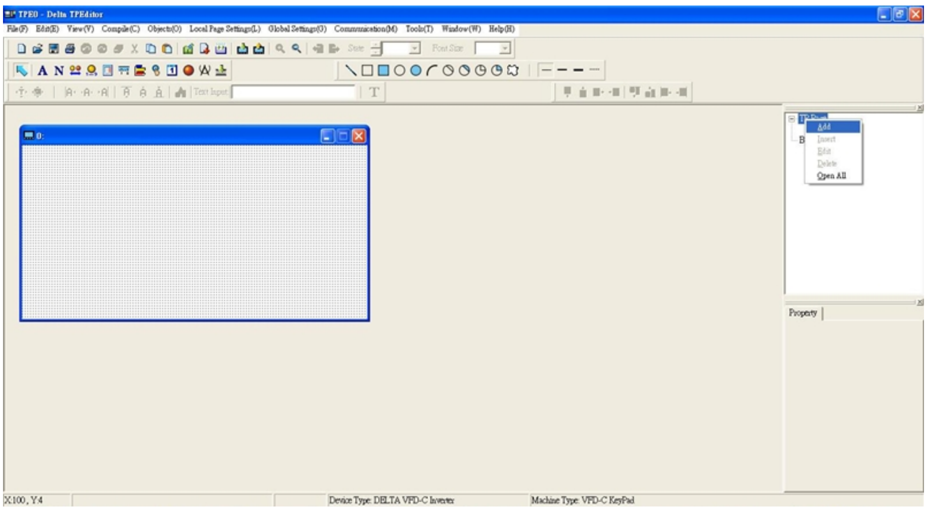
## 1) TPEditor: Setup & Basic Functions

1. Run TPEditor (version 1.60 or later) by double-clicking the program icon.


2. On the **File** menu, click **New**. In the **New Project** window, for **Set Device Type**, select **DELTA VFD-C Inverter**. For **TP Type**, select **VFD-C KeyPad**. For **File Name**, enter TPE0 and then click **OK**.

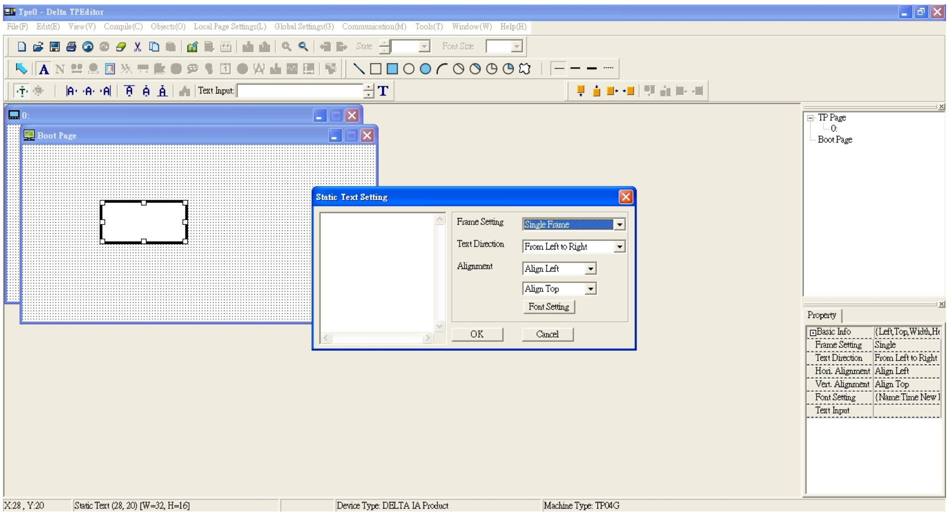



3. The editor displays the Design window. On the **Edit** menu, click **Add a New Page**. You can also right-click on the TP page in the upper right corner of the Design window and click **Add** to add one more pages to edit.

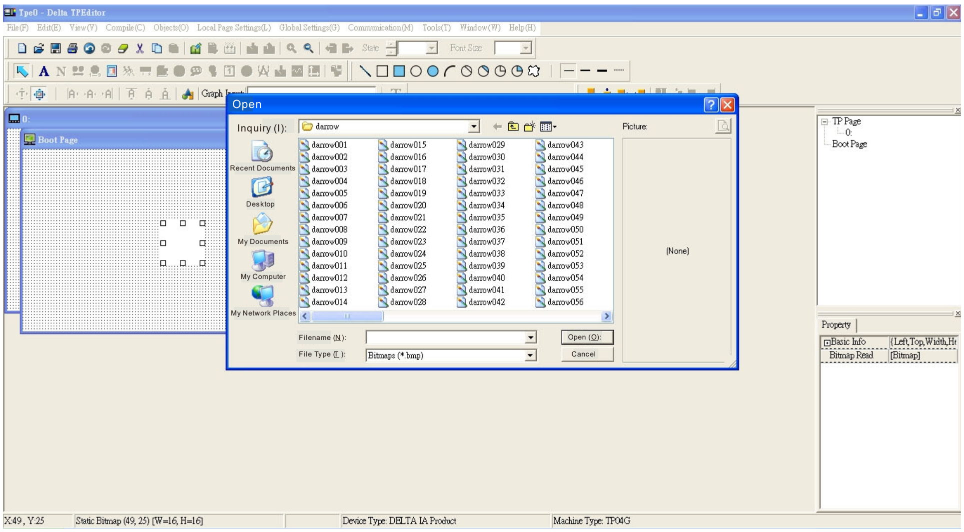


4. Edit the Start-up screen.

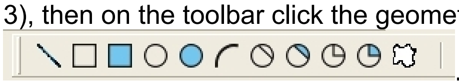
5. Add static text. Open a blank page (step 3), then on the toolbar click . Double-click the blank page to display the **Static Text Setting** dialog box, and then enter the static text.



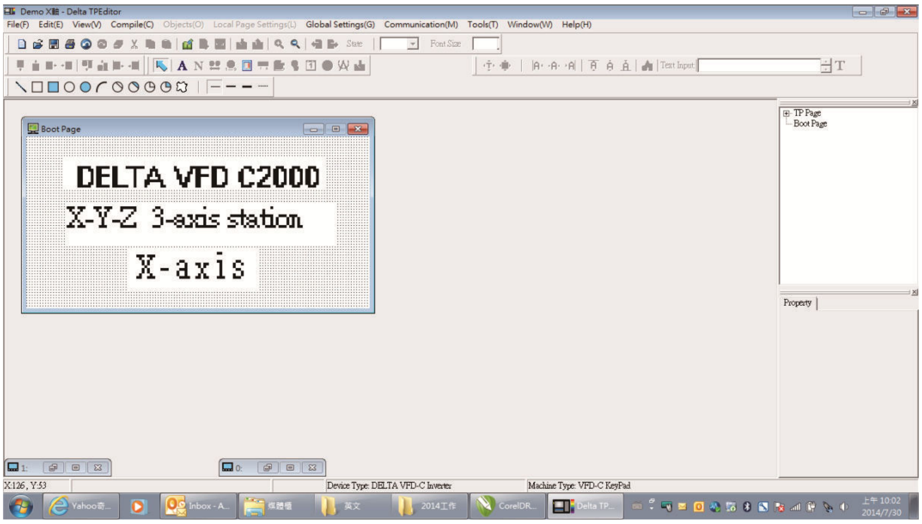

6. Add a static bitmap. Open a blank page (step 3), then on the toolbar, click . Double-click the blank page to display the **Static Bitmap Setting** dialog box where you can choose the bitmap.




You can only use images in the BMP format. Click the image and then click **Open** to show the image in the page.

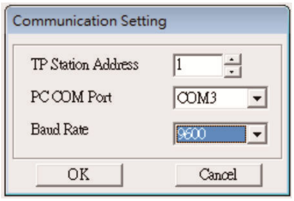
7. Add a geometric bitmap. There are 11 kinds of geometric bitmaps to choose. Open a new blank page (step 3), then on the toolbar click the geometric bitmap icon that you need . In the page, drag the geometric bitmap and enlarge it to the size that you need.

8. When you finish editing the start-up screen, on the **Communication** menu, click **Input User Defined Keypad Starting Screen.**

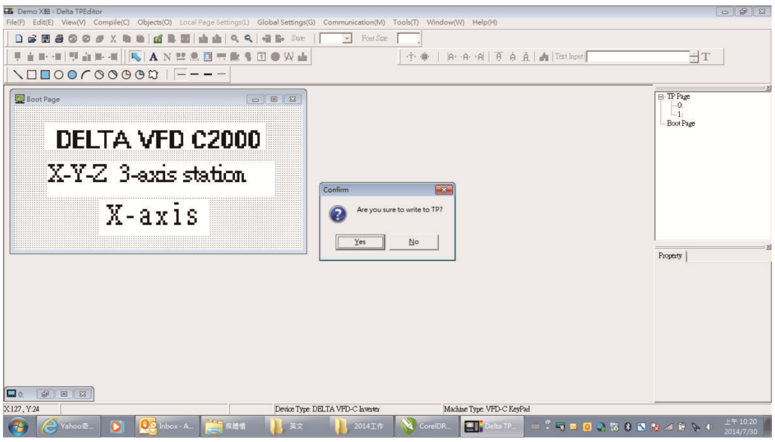


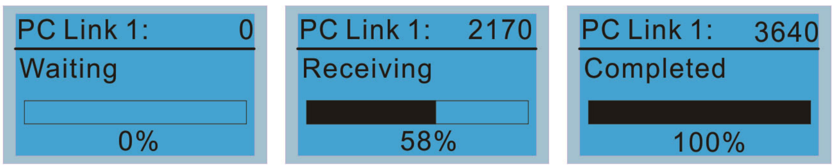

9. Download the new setting: On the **Tool** menu, click **Communication**. Set up the communication port and speed for the IFD6530. There are three speeds available: 9600 bps, 19200 bps, and 38400 bps.

10. On the **Communication** menu, click **Input User Defined Keypad Starting Screen**.



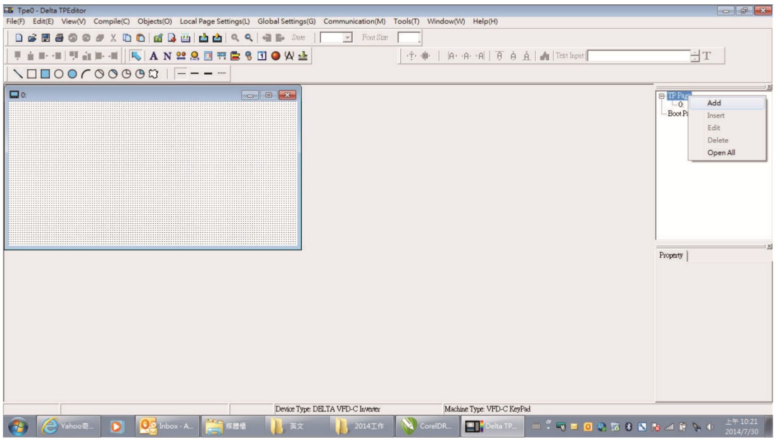

11. The Editor displays a message asking you to confirm the new setting. Before you click **OK**, on the keypad, go to MENU, select PC LINK, press ENTER and then wait for few seconds. Then click **YES** in the confirmation dialog box in the TPEditor to start downloading.



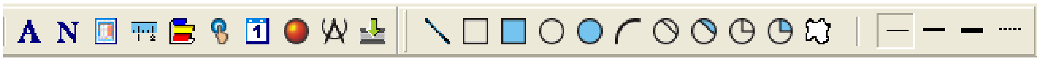



## 2) Edit Main Page and Download to the Keypad

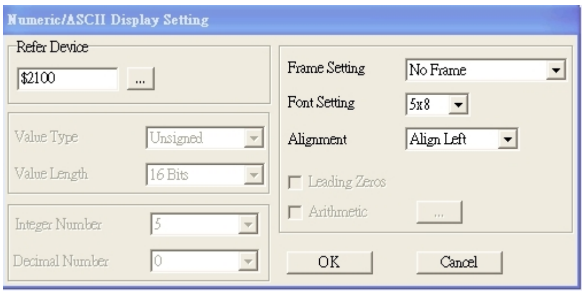
1. In the Editor, add a page to edit. On the **Edit** menu, click **Add a New Page**. You can also right-click on the TP page in the upper right corner of the Design window and click **Add** to add one more pages to edit. This keypad currently support up to 256 pages.



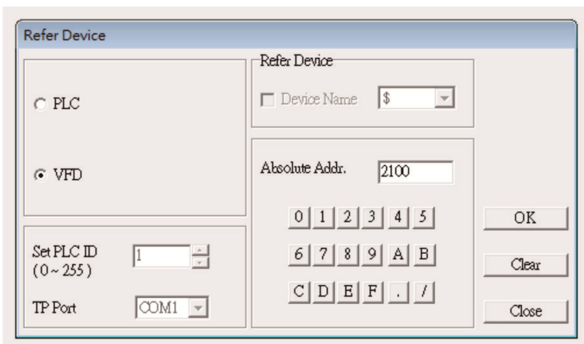
2. In the bottom right-hand corner of the Editor, click the page number to edit, or on the **View** menu, click **HMI Page** to start editing the main page. As shown in the picture above, the following objects are available. From left to right they are: Static Text, ASCII Display, Static Bitmap, Scale, Bar Graph, Button, Clock Display, Multi-state bit map, Units, Numeric Input, the 11 geometric bitmaps, and lines of different widths. Use the same steps to add Static Text, Static Bitmap, and geometric bitmaps as for the start-up page.



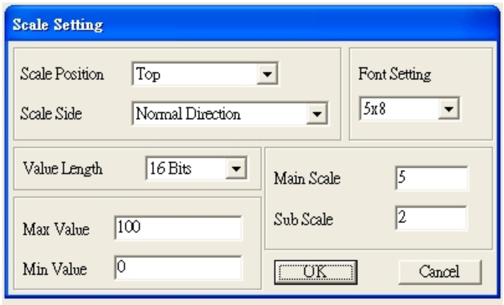
3. Add a numeric/ASCII display. On the toolbar, click the **Numeric/ASCII** button. In the page, double-click the object to specify the **Refer Device**, **Frame Setting**, **Font Setting** and **Alignment**.



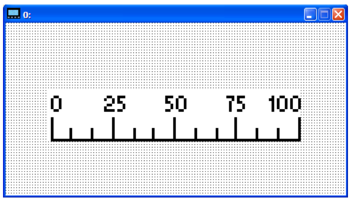

Click **[…]**. In the **Refer Device** dialog box, choose the VFD communication port that you need. If you want to read the output frequency (H), set the **Absolute Addr.** to 2202. For other values, refer to the ACMD Modbus Comm Address List in Pr.09-04 in Chapter 12.



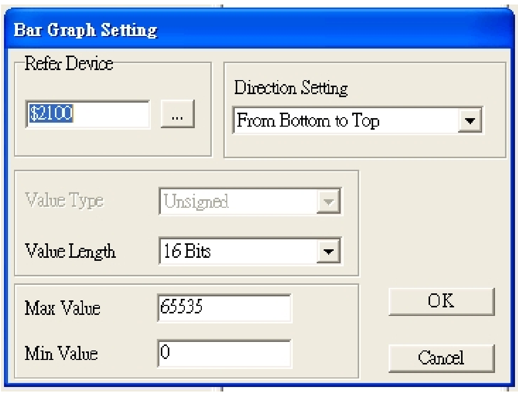
4. Scale Setting : On the toolbar, double-click  to add a scale. You can also edit the Scale Setting in the Property Window on the right-hand side of your computer screen.




a. **Scale Position**: specifies where to place the scale.
b. **Scale Side**: specifies whether the scale is numbered from smaller numbers to larger numbers or from larger to smaller.
c. **Font Setting**: specifies the font.
d. **Value Length**: specifies 16 bits or 32 bits.
e. **Main Scale & Sub-scale**: divides the whole scale into equal parts; enter the numbers for the main scale and sub-scale.
f. **Max Value & Min Value**: specifies the numbers on the two ends of the scale. They can be negative numbers, but the maximum and minimum values are limited by the **Value Length** setting. For example, when **Value Length** is **hexadecimal** (**16 bits**), the maximum and the minimum value cannot be entered as -400000.
Clicking **OK** creates a scale as in the picture below.

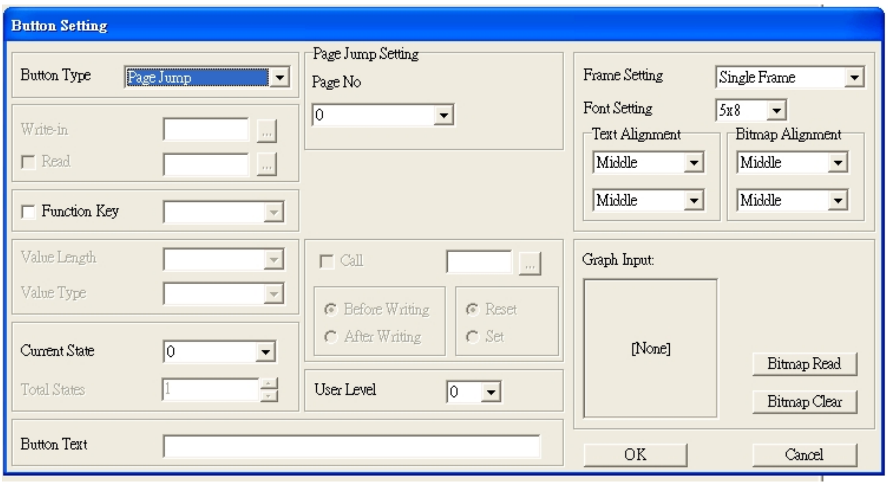



5. Bar Graph setting. On the toolbar, click  to add a bar graph.




a. **Refer Device**: specifies the VFD communication port.
b. **Direction Setting**: specifies the direction: **From Bottom to Top**, **From Top to Bottom**, **From Left to Right** or **From Right to Left**.
c. Value Length: determines the range of the maximum value and minimum value.
d. **Max Value** and **Min Value**: specifies the maximum value and minimum value. A value smaller than or equal to the minimum value causes the bar graph to be blank (0). A value is bigger or equal to the maximum value causes the bar graph is full (100%). A value between the minimum and maximum values causes the bar graph to be filled proportionally.

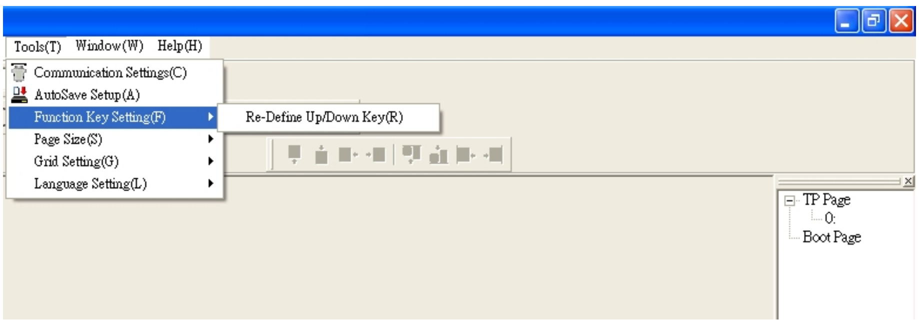
6. Button setting. On the toolbar, click . Currently this function only allows the keypad to switch pages; other functions are not yet available (including text input and insert image). In the blank page, double-click  to open the **Button Setting** window.




**Button Type**: specifies the button's functions. **Page Jump** and **Constant Setting** are the only functions currently supported.

**a. Page Jump Setting**

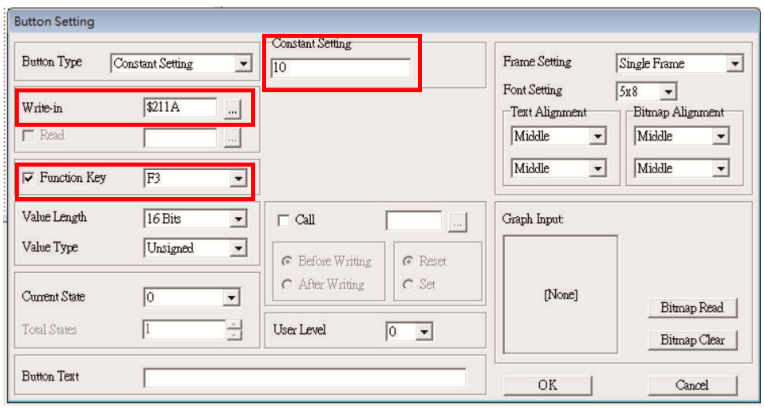
1) **Page Jump Setting**: in the **Button Type** drop-down list, choose **Page Jump** to show the **Page Jump Setting**.
2) **Function Key**: specifies the functions for the following keys on the KPC-CC01 keypad: F1, F2, F3, F4, Up, Down, Left and Right. Note that the Up and Down keys are locked by TPEditor. You cannot program these two keys. If you want to program Up and Down keys, on the **Tool** menu, click **Function Key Settings**, and then click **Re-Define Up/Down Key**.



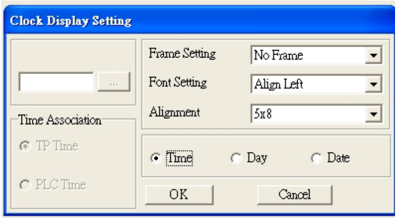

3) **Button Text**: specifies the text that appears on a button. For example, when you enter Next Page for the button text, that text appears on the button.

**b. Constant Setting**

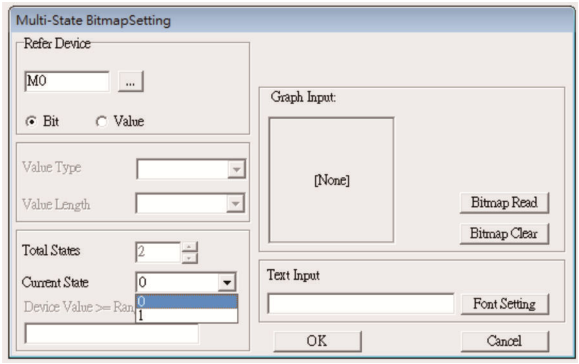
This function specifies the memory address' values for the VFD or PLC. When you press the **Function key**, it writes a value to the memory address specified by the value for **Constant Setting**. You can use this function to initialize a variable.



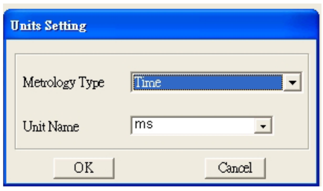
7. Clock Display Setting: on the toolbar, click . You can display the time, day, or date on the keypad. Open a new page and click once in that window to add a clock display.
   Choose to display **Time**, **Day**, or **Date** on the keypad. To adjust time, go to Time Setup on the keypad's menu. You can also specify the **Frame Setting**, **Font Setting**, and **Alignment**.




8. Multi-state bitmap: on the toolbar, click . Open a new page and click once in that window to add a Multi-state bitmap. This object reads a bit's property value from the PLC. It defines the image or text that appears when this bit is 0 or 1. Set the initial status (**Current State**) to be 0 or 1 to define the displayed image or text.

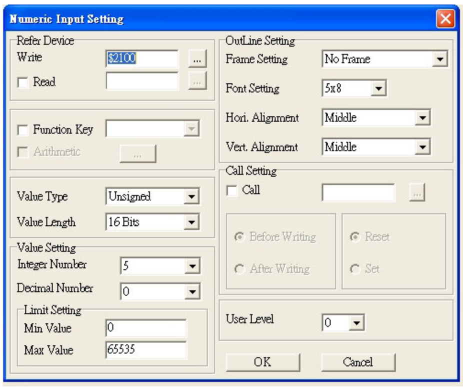



9. Unit Measurement: on the toolbar, click .
   Open a new blank page, and double-click on that window to display the **Units Setting** dialog box.




Choose the **Metrology Type** and the **Unit Name**. For **Metrology**, the choices are Length, Square Measure, Volume/Solid Measure, Weight, Speed, Time, and Temperature. The unit name changes automatically when you change metrology type.

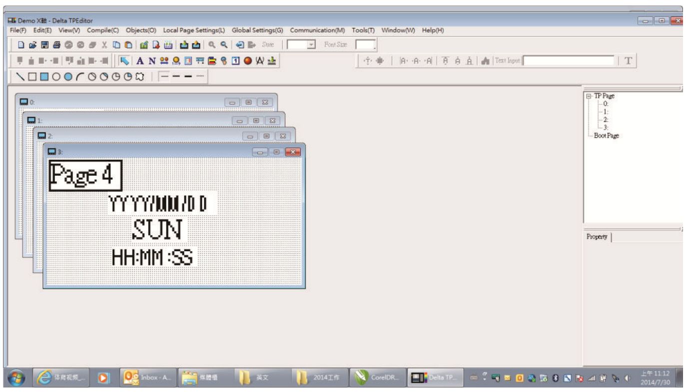
10. Numeric Input Setting: on the toolbar, click .
 This object allows you to provide parameters or communication ports and to input numbers.
 Open a new file and double-click on that window to display the **Numeric Input Setting** dialog box.

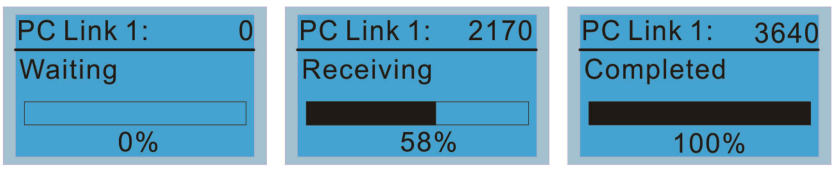



a. **Refer Device**: specifies the **Write** and the **Read** values. Enter the numbers to display and the corresponding parameter and communication port numbers. For example, enter 012C to Read and Write Parameter Pr.01-44.
b. **OutLine Setting**: specifies the **Frame Setting**, **Font Setting**, **Hori. Alignment**, and **Vert. Alignment** for the outline.
c. **Function Key**: specifies the function key to program on the keypad in the **Function Key** box. The corresponding key on the keypad starts to blink. Press ENTER to confirm the setting.
d. **Value Type** and **Value Length**: specify the range of the **Min Value** and **Max Value** for the **Limit Setting**. Note that the corresponding supporting values for VFD-ED must be 16 bits. 32 bit values are not supported.
e. **Value Setting**: automatically set by the keypad itself.
f. **Limit Setting**: specifies the range for the numeric input here.

For example, if you set **Function Key** to **F1**, **Min Value** to 0 and **Max Value** to 4, when you press F1 on the keypad, then you can press Up/Down on the keypad to increase or decrease the value. Press ENTER on the keypad to confirm your setting. You can also view the parameter table for Pr.01-44 to verify if you correctly entered the value.

11. Download the TP Page
 Press Up or Down on the keypad to select "PC Link" in the Menu. Then press ENTER on the keypad. The screen displays "Waiting". In TPEditor, choose a page that you have created, and then on the **Communication** menu click **Write to TP** to start downloading the page to the keypad. Then, the keypad displays "Receiving". When you see "Completed" on the keypad screen, the download is finished. You can then press ESC on the keypad to go back to the menu screen.



# Chapter 10 Auto-tuning Process

## 10-1 Tuning in Easy Steps for IM

1. **Basic Parameter Settings**
   Pr.00-02 Parameter Reset
   Pr.00-14 Master Frequency Command Source
   Pr.00-15 Operation Command Source
   Pr.02-01–Pr.02-08 Multi-function Input Settings
   Pr.02-11–Pr.02-16 Multi-function Output Settings
2. **Encoder Settings**
   Pr.10-00 Selection of Encoder
   Pr.10-01 Encoder PPR
   Pr.10-02 Encoder Input Type Setting
3. **Motor Auto-tuning**
   (1) Motor Settings
      Pr.00-09 Control Mode
      Pr.01-00 Maximum Output Frequency
      Pr.01-01 Motor's Rated Frequency
      Pr.01-02 Motor's Rated Voltage
   (2) Settings for Induction Motor (IM)
      Pr.05-01 Motor Rated Current
      Pr.05-02 Motor Rated Power
      Pr.05-03 Motor Rated Speed
      Pr.05-04 Number of Motor Poles
      Pr.05-00 Motor Auto-tuning
4. **Multi-step Speed Settings**
   Pr.04-00–Pr.04-15 Multi-step Speed Setting
   Pr.01-12–Pr.01-19 Acceleration / Deceleration Time Setting
   Pr.01-24–Pr.01-27. Pr.01-29, Pr.01-30 S-curve for Acceleration and Deceleration Time Settings
5. **Elevator Related Parameters**
   Pr.11-01 Elevator Speed
   Pr.11-02 Traction Sheave Diameter
   Pr.11-03 Gear Ratio
   Pr.11-04 Suspension Ratio
   Pr.11-14 Motor Current at Acceleration
   Pr.11-05 Mechanical Inertial Ratio
6. **Trial Run**
7. **Elevator Performance Fine-tuning**

## 10-2 Tuning in Easy Steps for PM

1. **Basic Parameter Settings**
   Pr.00-02 Parameter Reset
   Pr.00-14 Master Frequency Command Source
   Pr.00-15 Operation Command Source
   Pr.02-01–Pr.02-08 Multi-function Input Settings
   Pr.02-11–Pr.02-16 Multi-function Output Settings
2. **Encoder Settings**
   Pr.10-00 Selection of Encoder
   Pr.10-01 Encoder PPR
   Pr.10-02 Encoder Input Type Setting
3. **Motor Auto-tuning**
   (1) Motor Settings
      Pr.00-09 Control Mode
      Pr.01-00 Maximum Output Frequency
      Pr.01-01 Motor's Rated Frequency
      Pr.01-02 Motor's Rated Voltage
   (2) Settings for Permanent Magnet Synchronous Motor (PM)
      Pr.08-01 Motor Rated Current
      Pr.08-02 Motor Rated Power
      Pr.08-03 Motor Rated Speed
      Pr.08-04 Number of Motor Poles
      Pr.11-00 System Control
      Pr.08-00 Motor Auto-tuning
4. **Multi-step Speed Settings**
   Pr.04-00–Pr.04-15 Multi-step Speed Setting
   Pr.01-12–Pr.01-19 Acceleration / Deceleration Time Setting
   Pr.01-24–Pr.01-27. Pr.01-29, Pr.01-30 S-curve for Acceleration and Deceleration Time Settings
5. **Elevator Related Parameters**
   Pr.11-01 Elevator Speed
   Pr.11-02 Traction Sheave Diameter
   Pr.11-03 Gear Ratio
   Pr.11-04 Suspension Ratio
   Pr.11-14 Motor Current at Acceleration
   Pr.11-05 Mechanical Inertial Ratio
6. **Trial Run**
7. **Elevator Performance Fine-tuning**

# 10-3 Descriptions of Tuning Steps

## 10-3-1 Basic Parameter Settings

Pr.00-02 Parameter Reset

| | | |
|---|---|---|
| Pr Setup<br>00: System Parame<br>01: Basic Parameter<br>02: Digital IN/OUT | Press ENTER | 00-System Parameter<br>02: Parameter Reset<br>03: Start up Display<br>04: User Display |
| | Press ENTER | 00-02<br>10<br>Parameter Reset<br>0–10 ADD |

Set Pr.00-02=9 or 10: Reset all parameters to the default. If the keypad is locked by a password, enter the password to reset to the default. The password is also erased.

Pr.00-14 Master Frequency Command Source

| | | |
|---|---|---|
| Pr Setup<br>00: System Parame<br>01: Basic Parameter<br>02: Digital IN/OUT | Press ENTER | 00-System Parameter<br>14: Souce of Freq.<br>15: Source of Oper.<br>00: Identity Code |
| | Press ENTER | 00-14<br>1<br>Source of Freq.<br>1–5 ADD |

Setting values:

1: RS-485 serial communication or digital keypad (KPC-CC01)
2: External analog input (See Pr.03-00)
3: Digital terminal inputs
4: Direct docking mode only, contact Delta for more information.

Determines the drive’s master frequency source.

Pr.00-15 Operation Command Source

| | | |
|---|---|---|
| Pr Setup<br>00: System Parame<br>01: Basic Parameter<br>02: Digital IN/OUT | Press ENTER | 00-System Parameter<br>15: Souce of Oper.<br>00: Identity Code<br>01: Rated Current |

| | | |
|---|---|---|
| | Press ENTER | 00-15<br>2<br>Source of Oper.<br>1–2 ADD |

📖 Setting values:

1: External terminals (work with controller)

2: RS-485 serial communication or digital keypad (KPC-CC01) (does not work with controller)

Pr.02-01–Pr.02-08 Multi-function Input Settings

| | | |
|---|---|---|
| Pr Setup<br>02: Digital IN/OUT<br>03: Analog IN/OUT<br>04: Multi-speed | Press ENTER | 02-Digital IN/OUT<br>01: Multi-Fun Input1<br>02: Multi-Fun Input2<br>03: Multi-Fun Input3 |
| | Press ENTER | 02-01<br>1<br>Multi-Fun Input1<br>0–56 ADD |

📖 The default value of Pr.02-08 is 40 (Enable Drive). If you do not need this function (does not work with controller), set the setting value to 0.

📖 Setting value:

0: No function
1: Multi-step speed command 1
2: Multi-step speed command 2
3: Multi-step speed command 3
4: Multi-step speed command 4
5: Reset
6: JOG command
7: Acceleration/deceleration speed inhibit
8: First, second acceleration/deceleration time
9: Third, fourth acceleration/deceleration time
10: EF input (Pr.07-28)
11: Reserved
12: Stop output
13–14: Reserved
15: AUI1 operation speed command
16: Reserved
17: AUI2 operation speed command
18: Emergency Stop (Pr.07-28)
19–23: Reserved
24: FWD JOG Command
25: REV JOG Command

26: Reserved
27: ASR1/ASR2 selection
28: Emergency stop (EF1) (motor coasts to stop)
29–30: Reserved
31: High torque bias (according to Pr.07-21)
32: Middle torque bias (according to Pr.07-22)
33: Low torque bias (according to Pr.07-23)
34–37: Reserved
38: Disable writing to EEPROM
39: Torque command direction ( 0 is positive direction)
40: Enable drive function
41: Magnetic contactor detection
42: Mechanical brake 1
43: EPS function (Emergency Power System)
44: Mechanical brake 2
45–51: Direct docking mode only
53: Terminal leveling signal for direct docking
54: Power failure signal
55: Manual emergency deceleration
56: Automatic emergency deceleration

Pr.02-11–Pr.02-16 Multi-function Output Settings

| | | |
|---|---|---|
| Pr Setup<br>02: Digital IN/OUT<br>03: Analog IN/OUT<br>04: Multi-speed | Press ENTER | 02-Digital IN/OUT<br>11: Multi-Fun RLY1<br>12: Multi-Fun RLY2<br>13: Multi-Fun RLY3 |
| | Press ENTER | 02-11<br>0<br>Multi-Fun RLY1<br>0–49 ADD |

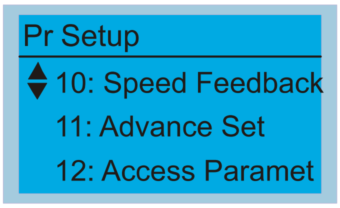
Setting value:
0: No function
1: Indication during operation
2: Operation speed reached
3: Desired frequency 1 reached (Pr.02-25, Pr.02-26)
4: Desired frequency 2 reached (Pr.02-27, Pr.02-28)
5: Zero Speed (Frequency command)
6: Zero speed with stop (Frequency command)
7: Over-torque (OT1) (Pr.06-05–Pr.06-07)
8: Over-torque (OT2) (Pr.06-08–Pr.06-10)
9: Drive is ready
10: User-defined low-voltage detection (LV)
11: Malfunction indication

12: Mechanical brake release (Pr.02-29, Pr.02-30, Pr.02-37)
13: Overheat (Pr.06-14)
14: Brake transistor signal
15: Motor-controlled magnetic contactor output
16: Slip error (oSL)
17: Malfunction indication 1
18: Reserved
19: Brake transistor output error
20: Warning output
21: Over-voltage warning
22: Over-current stall prevention warning
23: Over-voltage stall prevention warning
24: Operation mode indication (Pr.00-15=1)
25: Forward command
26: Reverse command
27: Output when current ≥ Pr.02-33
28: Output when current < Pr.02-33
29: Output when frequency ≥ Pr.02-34
30: Output when frequency < Pr.02-34
31: Power generation direction and status verification
32: Power generation direction
33: Zero speed (actual output frequency)
34: Zero speed with Stop (actual output frequency)
35: Fault output option 1 (Pr.06-22)
36: Fault output option 2 (Pr.06-23)
37: Fault output option 3 (Pr.06-24)
38: Fault output option 4 (Pr.06-25)
39: Reserved
40: Speed reached (including zero speed)
41: Reserved
42: STO Output Error
43–44: Direct Docking Mode only
45: Reserved
46: Retrying after a fault has occurred indication
47: Direct Docking Mode only
48: Control output of MPSCC (Motor Phase Short Circuit Contactor)
49: Emergency power mode action

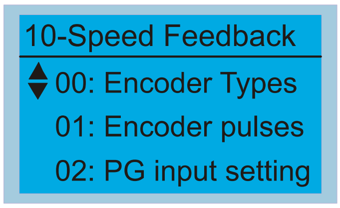
## 10-3-2 Encoder Settings

Speed feedback card selections: See Chapter 07 Speed Feedback Card Selection. Delta provides three types of PG cards, including EMED-PGABD-x (1, 2), EMED-PGHSD-x (1, 3), and EMED-PGHSD-x (2, 4).

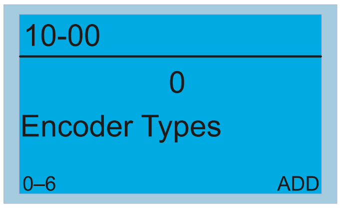
Pr.10-00 Selection of Encoder




Press 


Press 


- When you set Pr.10-02 to 3, 4 or 5, you can set Pr.10-00 only to 0, 1 or 2, and you cannot use 3, 4, 5 and 6.
- When you set Pr.10-00 to 3, the encoder has one sine and one cosine signal for each revolution. The signal must be: 0.75–1.2 Vpp for the amplitude with phase angle 90°±5 elec. (E.g. ERN 1185 ERN 1387)
- When you set Pr.10-00 to 4 or 6, wait for two seconds after applying the power before executing the RUN command.
- When you set Pr.10-00 to 5, you must set Pr.08-09 to 360.
- Detection of the magnetic pole:
  (1) 1 or 5: The AC motor drive outputs a short circuit to detect the position of the magnetic pole. At this moment, the motor generates a little noise.
  (2) 2: The AC motor drive detects the position of the magnetic pole with the UVW encoder signal.
  (3) 3: The AC motor drive detects the position of the magnetic pole with the sine encoder signal.
  (4) 4 or 6: The AC motor drive detects the position of the magnetic pole with the communication encoder signal.
- The table below shows the correspondence among encoder, PG card and auto-tuning

| PG Signal Type Setting | PG Signal Type | Applicable PG Card x=1, 2,… | Pr.08-00=1 | Pr.08-00=3 |
|---|---|---|---|---|
| Pr.10-00=1 | A, B, Z | EMED-PGAB/ABD-x | N/A | N/A |
| Pr.10-00=2 | A, B, Z+U, V, W | EMED-PGABD- x | Rolling test[*1] | Rolling test[*1] |
| Pr.10-00=3 | SIN/COS + Sinusoidal (e.g. ERN1185, ERN1387) | EMED-PGHSD-x | Rolling test[*1] | Pr.11-00 Bit9=0: Rolling test[*1] Pr.11-00 Bit9=1: Static test[*1] |
| Pr.10-00=4 | SIN/COS + Endat 2.1 (e.g. ECN1313, ECN413) | EMED-PGSD-x | Dynamic test[*1] | Static test[*1] |
| Pr.10-00=5 | SIN/COS | EMED-PGHSD-x | N/A | N/A |
| Pr.10-00=6 | SIN/COS + Hiperface (e.g. SRS50/60) | EMED-PGHSD-x | Dynamic test[*1] | Static test[*1] |

[*1] Static: Brake engaged, no motor running. Dynamic: Brake released, motor rotates less than one revolution.
Rolling: Brake released, motor rotates more than one revolution.

Pr.10-01 Encoder PPR

| | | |
|---|---|---|
| Pr Setup<br>10: Speed Feedback<br>11: Advance Set<br>12: Access Paramet | Press ENTER | 10-Speed Feedback<br>01: Encoder pulses<br>02: PG input setting<br>03: PG Err Treat |
| | Press ENTER | 10-01 ppr<br>2048<br>Encoder pulses<br>0–25000 ADD |

Sets the encoder pulses per revolution (PPR).

Pr.10-02 Encoder Input Type Setting

| | | |
|---|---|---|
| Pr Setup<br>10: Speed Feedback<br>11: Advance Set<br>12: Access Paramet | Press ENTER | 10-Speed Feedback<br>02: PG input setting<br>03: PG Err Treat<br>04: PG Err Det. Time |
| | Press ENTER | 10-02<br>0<br>PG input setting<br>0–5 ADD |

- When you set Pr.10-00 to 3, 4, 5 or 6, you can set Pr.10-02 only to 0, 1 or 2, and you cannot use 3, 4 and 5.
- You must enter the correct pulse type for stable control.
- It is suggested that you set Pr.10-02 to 1 first. When fault code PGF1 occurs or the motor does not run, set it to 2.

## 10-3-3 Motor Auto-tuning

## 10-3-3-1 Motor Settings

Pr.00-09 Control Mode

| | | |
|---|---|---|
| Pr Setup<br>00: System Parame<br>01: Basic Parameter<br>02: Digital IN/OUT | Press ENTER | 00-System Parameter<br>09: Control Method<br>10: Speed Unit Sel.<br>11: CHG. Output DIR |
| | Press ENTER | 00-09<br>0<br>Control Method<br>0–8 ADD |

Mode selection:

| Settings | Control Mode | Applicable Motor Type | Speed Feedback | Energy-savings | Tuning Difficulty | Ride Comfort | Speed Control Range | Motor Parameter Tuning | Basic Control | Speed Control |
|---|---|---|---|---|---|---|---|---|---|---|
| 0 | V/F | IM | | Low | Low | Normal | 1:50 | | V/F control | Voltage control |
| 1 | VFPG | IM | ✓ | Medium | Medium | Normal | 1:50 | ✓ | Frequency control | Frequency control |
| 2 | SVC | IM | | Medium | Medium | Normal | 1:50 | ✓ | Voltage control | Voltage control |
| 3 | FOCPG | IM | ✓ | High | High | Good | 1:1000 | ✓ | Vector control | Frequency control |
| 8 | FOCPM | PM | ✓ | High | High | Good | 1:1000 | ✓ | Vector control | Frequency control |

Determines the AC motor drive control method.

0: You can set the V/F ratio as required and control multiple motors simultaneously.

1: You can use a PG card with an Encoder for close-loop speed control.

2: Use auto-tuning for optimal settings of the control parameters.

3: To increase torque and the accuracy of the speed control (1:1000).

8: To increase torque and the accuracy of the speed control (1:1000). This setting is for use only with permanent magnet motors. The other settings are for use with induction motors.

Pr.01-00 Maximum Output Frequency

| | | |
|---|---|---|
| Pr Setup<br>01: Basic Parameter<br>02: Digital IN/OUT<br>03: Analog IN/OUT | Press ENTER | 01-Basic Parameter<br>00: Max Output Freq.<br>01: Motor1 Fbase<br>02: Max Out-Volt 1 |
| | Press ENTER | 01-00 Hz<br>60.00<br>Max Output Freq.<br>5.00–400.00 ADD |

Determines the AC motor drive maximum output frequency, ranging from 5–400 Hz.

Pr.01-01 Motor's Rated Frequency

| | | |
|---|---|---|
| Pr Setup<br>01: Basic Parameter<br>02: Digital IN/OUT<br>03: Analog IN/OUT | Press ENTER | 01-Basic Parameter<br>01: Motor1 Fbase<br>02: Max Out-Volt 1<br>03: Mid Out-Freq.1-1 |
| | Press ENTER | 01-01 Hz<br>60.00<br>Motor1 Fbase<br>0.00–400.00 ADD |
| 📖 Set this parameter according to the rated frequency on the motor nameplate. If the motor is 60 Hz, set this parameter to 60. If the motor is 50 Hz, set it to 50. | | |

Pr.01-02 Motor's Rated Voltage

| | | |
|---|---|---|
| Pr Setup<br>01: Basic Parameter<br>02: Digital IN/OUT<br>03: Analog IN/OUT | Press ENTER | 01-Basic Parameter<br>02: Max Out-Volt 1<br>03: Mid Out-Freq.1-1<br>04: Mid Out-Volt 1-1 |
| | Press ENTER | 01-02 V<br>220.0<br>Max Out-Volt 1<br>0.0–255.0 ADD |
| 📖 Set this parameter according to the rated voltage on the motor nameplate. If the motor is 220 V, set this parameter to 220.0. If the motor is 200 V, set this parameter to 200.0. | | |

## 10-3-3-2 Settings for Induction Motor (IM)

Pr.05-01 Motor Rated Current

| | | |
|---|---|---|
| Pr Setup<br>05: IM Parameter<br>06: Protection<br>07: Special | Press ENTER | 05-IM Parameter<br>01: IM Motor Rated A<br>02: IM Motor Rated P<br>03: IM Motor Rated |
| | Press ENTER | 05-01 Amps<br>16.36<br>IM Motor Rated A<br>0.00–27.27 ADD |
| Set this value according to the rated motor frequency from the motor nameplate. | | |

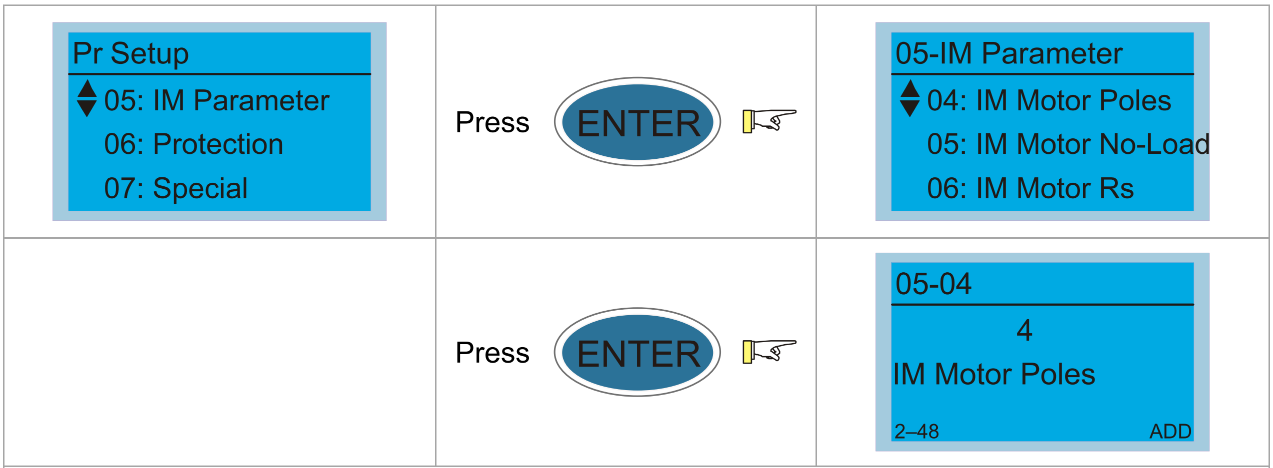
Pr.05-02 Motor Rated Power

| | | |
|---|---|---|
| Pr Setup<br>05: IM Parameter<br>06: Protection<br>07: Special | Press ENTER | 05-IM Parameter<br>02: IM Motor Rated P<br>03: IM Motor Rated<br>04: IM Motor Poles |
| | Press ENTER | 05-02 Kw<br>3.75<br>IM Motor Rated P<br>0.00–655.35 ADD |
| Set the rated power of the motor. The default is the power of the drive. | | |

Pr.05-03 Motor Rated Speed

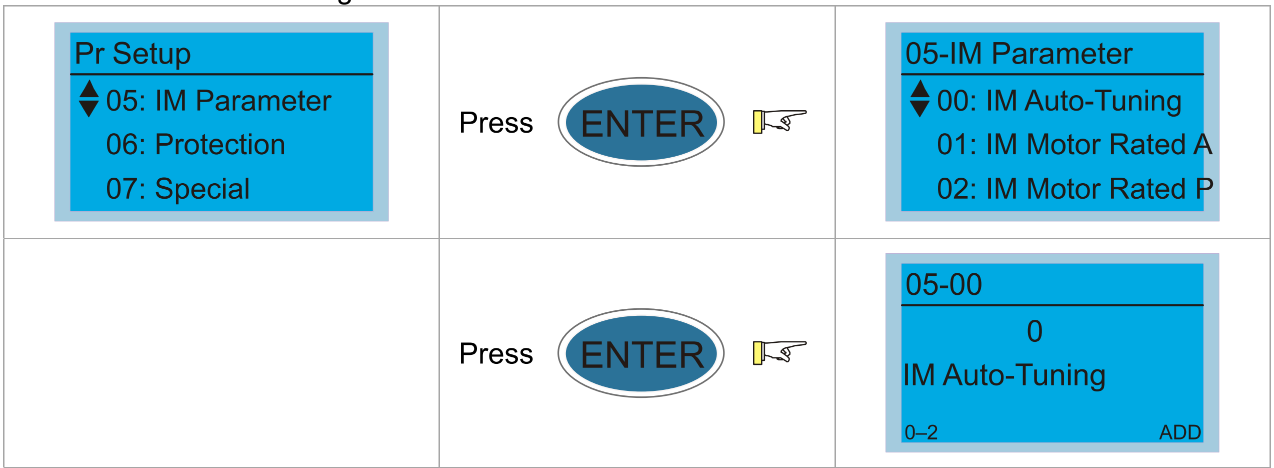
| | | |
|---|---|---|
| Pr Setup<br>05: IM Parameter<br>06: Protection<br>07: Special | Press ENTER | 05-IM Parameter<br>03: IM Motor Rated<br>04: IM Motor Poles<br>05: IM Motor No-Load |
| | Press ENTER | 05-03 RPM<br>1710<br>IM Motor Rated<br>0–65535 ADD |
| Sets the motor rated speed from the value on the motor nameplate. | | |

Pr.05-04 Number of Motor Poles




📖 Sets the number of motor poles (must be an even number).

Pr.05-00 Motor Auto-tuning



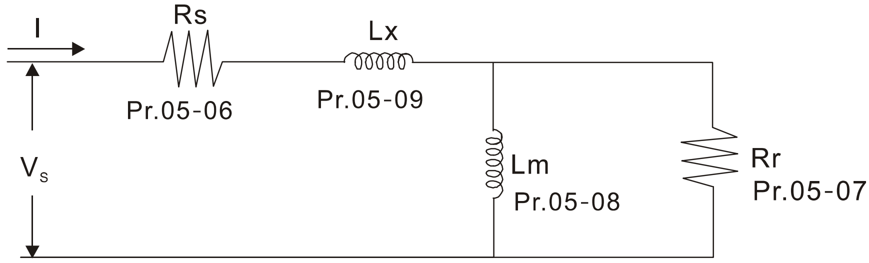

📖 Position the elevator near the middle floors before auto-tuning.

📖 Motor auto-tuning:

Set Pr.05-00 to 1 or 2, and then press the RUN key on the digital keypad KPC-CC01 (Pr.00-15=2) to start auto-tuning. Or when the drive is in manual mode (inspection), run the upward operation or downward operation (Pr.00-15=1) to start auto-tuning immediately. In the process of auto-tuning, an “Auto tuning” warning continuously displays on the digital keypad until it is finished.

📖 Pay attention to the following notes when Pr.05-00=1 (dynamic test):

1. Make sure that all the drive parameters are set to defaults and the motor wiring is correct.
2. Make sure the motor is not loaded before auto-tuning, and that the shaft is not connected to any belt or gear motor. Set this parameter to 2 if you cannot separate the motor from the load.
3. Enter the correct values for Pr.01-01, Pr.01-02, Pr.05-01, Pr.05-02, Pr.05-03 and Pr.05-04. Refer to motor capacity to set the acceleration/deceleration time.
4. After auto-tuning is finished, check if Pr.05-05–Pr.05-09 all have values.
5. Equivalent circuit diagram:




Equivalent circuit for VFD-ED Series

**NOTE**

- ☑ In torque/vector control mode, do not run motors in parallel.
- ☑ Do not use torque/vector control mode if the motor rated power exceeds the rated power for the AC motor drive.
- ☑ The no-load current is usually 20–50% of the rated current.
- ☑ The rated speed cannot be larger or equal to 120 f/p (f: output frequency Pr.01-01, p: Number of Motor Poles Pr.05-04).
- ☑ After auto-tuning is finished, activate the drive again to make it operate when the auto-tuning command source is the external terminal.

### 10-3-3-3 Settings for Permanent Magnet Synchronous Motor (PM)

Pr.08-01 Motor Rated Current

| | | |
|---|---|---|
| Pr Setup<br>08: PM Parameter<br>09: Communication<br>10: Speed Feedback | Press ENTER | 08-PM Parameter<br>01: PM Motor Rated A<br>02: PM Motor Rated P<br>03: PM Motor Rated |
| | Press ENTER | 08-01 Amps<br>16.36<br>PM Motor Rated A<br>0.00–27.27 ADD |
| 🕮 Sets according to the motor rated current as indicated on the motor nameplate. | | |

Pr.08-02 Motor Rated Power

| | | |
|---|---|---|
| Pr Setup<br>08: PM Parameter<br>09: Communication<br>10: Speed Feedback | Press ENTER | 08-PM Parameter<br>02: PM Motor Rated P<br>03: PM Motor Rated<br>04: PM Motor Poles |
| | Press ENTER | 08-02 Kw<br>0.00<br>PM Motor Rated P<br>0.00–655.35 ADD |
| 🕮 Sets the motor rated power. The default is the power of the drive. | | |

Pr.08-03 Motor Rated Speed

| | | |
|---|---|---|
| Pr Setup<br>08: PM Parameter<br>09: Communication<br>10: Speed Feedback | Press ENTER | 08-PM Parameter<br>03: PM Motor Rated<br>04: PM Motor Poles<br>05: PM Motor Rs |
| | Press ENTER | 08-03 RPM<br>1710<br>PM Motor Rated<br>0–65535 ADD |
| 🕮 Sets the motor rated speed according to the motor nameplate. | | |

Pr.08-04 Number of Motor Poles

| | | |
|---|---|---|
| Pr Setup<br>08: PM Parameter<br>09: Communication<br>10: Speed Feedback | Press ENTER | 08-PM Parameter<br>04: PM Motor Poles<br>05: PM Motor Rs<br>06: PM Motor Ld |
| | Press ENTER | 08-04<br>4<br>PM Motor Poles<br>2–96 ADD |

📖 Sets the number of motor poles (must be an even number).

Pr.11-00 System Control

| | | |
|---|---|---|
| Pr Setup<br>11: Advance Set<br>12: Access Paramet<br>13: Display User-Set | Press ENTER | 11-Advance Set<br>00: System Control<br>01: Fmax to Lift Spd<br>02: Traction Sheave |
| | Press ENTER | 11-00 Hex<br>0000h<br>F E D C B A 9 8 7 6 5 4 3 2 1 0<br>0000h–FFFFh ADD |

📖 When Bit 9=1, PGHSD-x with load static PG origin auto-tuning function is enabled. This function is valid only when the mechanical brake is in engaged status.

Pr.08-00 Motor Auto-tuning

| | | |
|---|---|---|
| Pr Setup<br>08: PM Parameter<br>09: Communication<br>10: Speed Feedback | Press ENTER | 08-PM Parameter<br>00: PM Auto-Tuning<br>01: PM Motor Rated A<br>02: PM Motor Rated P |
| | Press ENTER | 08-00<br>0<br>PM Auto-Tuning<br>0–3 ADD |

📖 Position the elevator near the middle floors before auto-tuning.

📖 Auto-tuning process: 2, and then 1 or 3.

📖 Motor auto-tuning:

Set Pr.08-00 to 1 to 3, and then press the RUN key on the digital keypad KPC-CC01 (Pr.00-15=2) to start auto-tuning. Or when the drive is in manual mode (inspection), run the upward operation or downward operation (Pr.00-15=1) to start auto-tuning immediately. In the process of auto-tuning, an "Auto tuning" warning continuously displays on the digital keypad until it is finished.

📖 Pr.08-00=2: Motor auto-tuning is static test:

1. Make sure that all the drive parameters are set to defaults and the motor wiring is correct.
2. Enter the correct values for Pr.01-01, Pr.01-02, Pr.08-01, Pr.08-02, Pr.08-03 and Pr.08-04. Refer to motor capacity to set the acceleration/deceleration time.
3. Note that the motor will run! The shaft needs to be locked by an external force.
4. After auto-tuning is finished, check if Pr.08-05, Pr.08-07, and Pr.08-08 all have values.

📖 Pr.08-00=1: Auto-measures the angle between the magnetic pole and the PG origin. Pay attention to the following notes when measuring: (dynamic test)

1. Unload before auto-tuning.
2. If the drive controls the brake, the drive can auto-tune according to the normal sequence after you complete the wiring and set the brake control parameters.
3. If the host controller controls the brake, make sure that the brake is in release status before auto-tuning.

📖 Pr.08-00=3: Auto-measures the angle between the magnetic pole and the PG origin. Pay attention to the following notes when measuring: (static test)

1. The motor can be loaded or unloaded before auto-tuning.
2. See the reference table for auto-tuning for Pr.10-00 (PG Signal Type).
3. If the drive controls the brake, the drive can auto-tune according to the normal sequence after you complete the wiring and set the brake control parameters.
4. If the host controller controls the brake, make sure that the brake is in release status before auto-tuning.
5. Make sure the setting for Pr.10-02 is correct. Incorrectly setting Pr.10-02 causes incorrect positioning of the magnetic pole and results in the wrong angle between the magnetic pole and PG origin.

**NOTE**

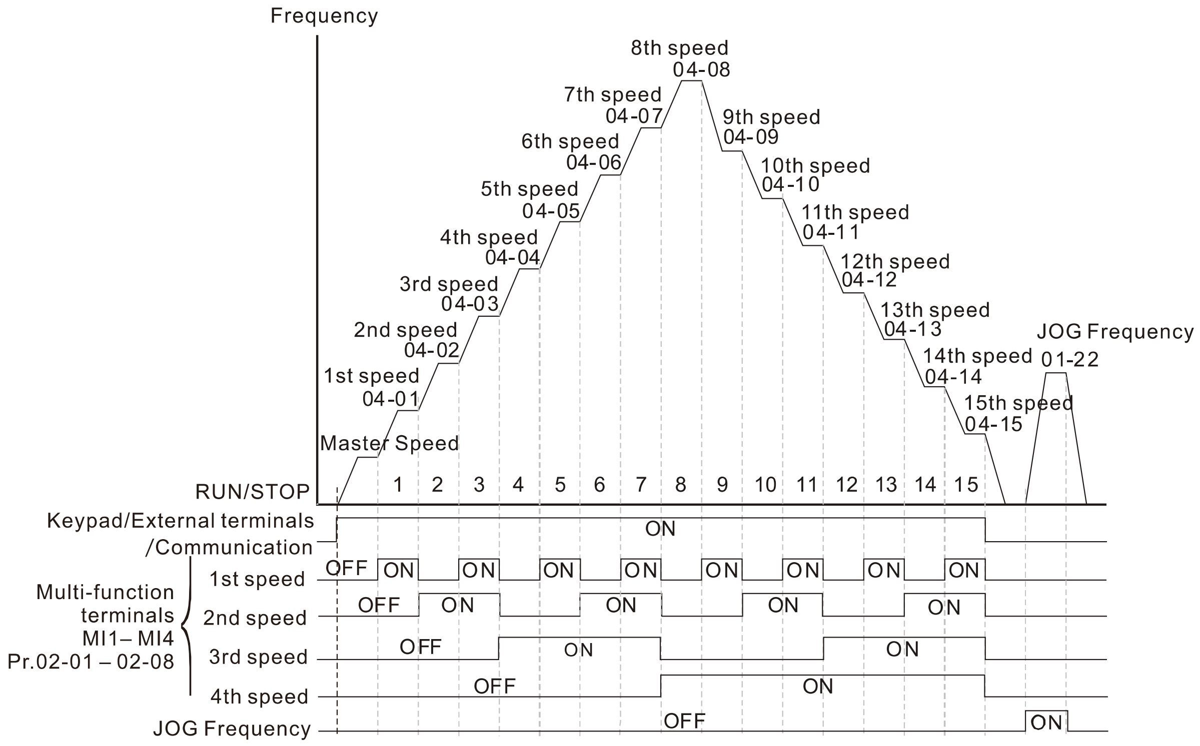
- ☑ The entered rated speed cannot be larger than or equal to 120 f/p.
- ☑ Note that if the contactor and brake are not controlled by the AC motor drive, release it manually.
- ☑ Set Pr.08-00 to 1 (unloaded motor) for accurate calculation. If you need to execute this function with a loaded motor, balance the carriage before execution.
- ☑ If you do not balance the carriage in a measured environment, you can execute this function with a loaded motor by setting Pr.08-00= 3. It will have a difference of 15–30o for different encoder types.
- ☑ "Auto Tuning Err" displays on the digital keypad when stopping due to an AC motor drive fault or human error, which means the detection fails. Check the wiring connections of the AC motor drive If "PG Fbk Error" displays on the digital keypad, change the setting of Pr.10-02 (if set to 1, change it to 2). If "PG Fbk Loss" displays on the digital keypad, check the feedback of Z-phase pulse.

## 10-3-4 Multi-step Speed Settings

Pr.04-00–Pr.04-15 Multi-step Speed Setting

| | | |
|---|---|---|
| Pr Setup<br>04: Multi-Speed<br>05: IM Parameter<br>06: Protection | Press ENTER | 04-Multi-Speed<br>00: Multi-Speed 0<br>01: Multi-Speed 1<br>02: Multi-Speed 2 |
| | Press ENTER | 04-00 Hz<br>0.00<br>Multi-Speed 0<br>0.00–400.00 ADD |

- The multi-function input terminals (refer to Pr.02-01–Pr.02-08) select one of the AC motor drive multi-step speeds (including the master frequency, in total 16 speeds). Pr.04-00–Pr.04-15 determine the speeds (frequencies) as shown above.
- When Pr.00-14 = 1, the master frequency is Pr.01-00.
- When Pr.00-14 = 3, the master frequency is Pr.04-00.

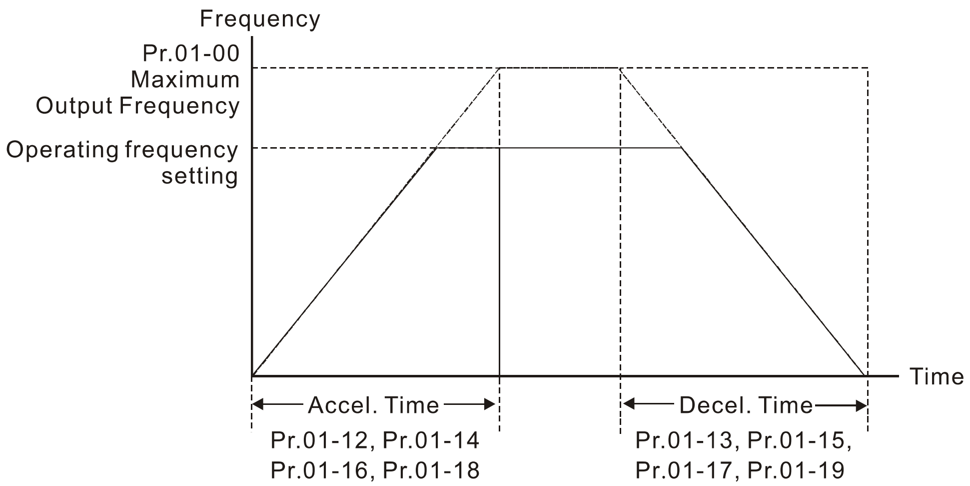



Multi-speed via External Terminals

Pr.01-12–Pr.01-19 Acceleration / Deceleration Time Setting

| | | |
|---|---|---|
| Pr Setup<br>01: Basic Parameter<br>02: Digital IN/OUT<br>03: Analog IN/OUT | Press ENTER | 01-Basic Parameter<br>12: 1st Accel Time<br>13: 1st Decel Time<br>14: 2nd Accel Time |
| | Press ENTER | 01-12 sec<br>3.00<br>1st Accel Time<br>0.00–600.00 ADD |

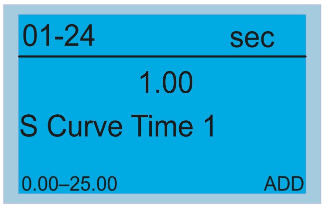
- The Acceleration Time determines the time required for the AC motor drive to ramp from 0.00 Hz to the Maximum Output Frequency (Pr.01-00). The Deceleration Time determines the time required for the AC motor drive to decelerate from the Maximum Output Frequency (Pr.01-00) down to 0.00 Hz.
- Select the Acceleration/Deceleration Time 1, 2, 3, 4 with the multi-function input terminal settings. The defaults are Acceleration Time 1 and Deceleration Time 1.
- When there is a large opposing torque and inertial torque for the load, and the acceleration and deceleration time settings are less than the necessary value, then they enable the torque limit and stall prevention functions. When this happens, the actual acceleration and deceleration time are longer than the settings.

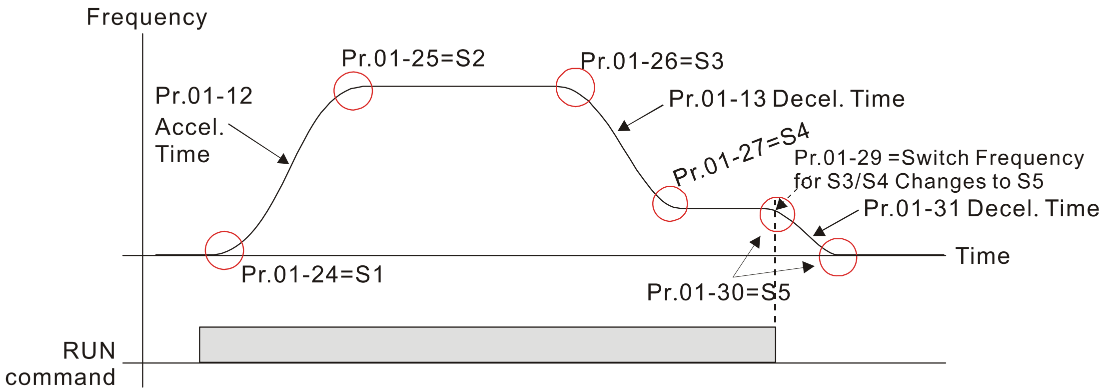



Acceleration & Decelertion Time Setting

Pr.01-24–Pr.01-27. Pr.01-29, Pr.01-30 S-curve for Acceleration and Deceleration Time Settings

| | | |
|---|---|---|
| Pr Setup<br>01: Basic Parameter<br>02: Digital IN/OUT<br>03: Analog IN/OUT | Press ENTER | 01-Basic Parameter<br>24: S Curve Time 1<br>25: S Curve Time 2<br>26: S Curve Time 3 |

<table>
<tr><td></td><td>Press ENTER</td><td>
</td></tr>
<tr><td colspan="3">
📖 Using an S-curve gives the smoothest transition between speed changes. The acceleration and deceleration curve adjusts the acceleration and deceleration S-curve. When enabled, the motor drive produces a different acceleration and deceleration curve according to the acceleration and deceleration time.<br>
📖 The Actual Acceleration Time = selected acceleration Time + (Pr.01-24 + Pr.01-25) ÷ 2.<br>
The Actual Deceleration Time = selected deceleration Time + (Pr.01-26 + Pr.01-27 + Pr.01-30 x 2) ÷ 2.<br>
📖 Use Pr.01-29 to set the switch frequency between S4 and S5 for smooth stopping.<br>
📖 Set Pr.01-29 to the leveling speed of the elevator.
</td></tr>
</table>



### 10-3-5 Elevator Related Parameters

Pr.11-01 Elevator Speed

| | | |
|---|---|---|
| Pr Setup<br>11: Advance Set<br>12: Access Paramet<br>13: Display User-Set | Press ENTER | 11-Advance Set<br>01: Fmax to Lift Spd<br>02: Traction Sheave<br>03: Gear Ratio |
| | Press ENTER | 11-01 m/s<br>1.00<br>Fmax to Lift Spd<br>0.10–4.00 ADD |
| Elevator speed (m/sec. = m/min. / 60) | | |

Pr.11-02 Traction Sheave Diameter

| | | |
|---|---|---|
| Pr Setup<br>11: Advance Set<br>12: Access Paramet<br>13: Display User-Set | Press ENTER | 11-Advance Set<br>02: Traction Sheave<br>03: Gear Ratio<br>04: Suspension Ratio |
| | Press ENTER | 11-02 mm<br>400<br>Traction Sheave Diam<br>100–2000 ADD |

Pr.11-03 Gear Ratio

| | | |
|---|---|---|
| Pr Setup<br>11: Advance Set<br>12: Access Paramet<br>13: Display User-Set | Press ENTER | 11-Advance Set<br>03: Gear Ratio<br>04: Suspension Ratio<br>05: Mech Inertia Ratio |
| | Press ENTER | 11-03<br>1.00<br>Gear Ratio<br>1.00–100.00 ADD |

Pr.11-04 Suspension Ratio

| | | |
|---|---|---|
| Pr Setup<br>11: Advance Set<br>12: Access Paramet<br>13: Display User-Set | Press ENTER | 11-Advance Set<br>04: Suspension Ratio<br>05: Mech Inertia Ratio<br>06: Zero SP Loop BW |
| | Press ENTER | 11-04<br>1<br>Suspension Ratio<br>0–3 ADD |
| Setting value:<br>0 = 1: 1<br>1 = 2: 1<br>2 = 4: 1<br>3 = 8: 1 | | |

Pr.11-14 Motor Current at Acceleration

| | | |
|---|---|---|
| Pr Setup<br>11: Advance Set<br>12: Access Paramet<br>13: Display User-Set | Press ENTER | 11-Advance Set<br>14: Max. ACC Current<br>15: Max Meter per S<br>16: Disp address |
| | Press ENTER | 11-14 %<br>150<br>Max. ACC Current<br>50–200 ADD |
| The maximum motor current measured when the elevator is tuning in automatic mode. | | |

Pr.11-05 Mechanical Inertial Ratio

| | | |
|---|---|---|
| Pr Setup<br>11: Advance Set<br>12: Access Paramet<br>13: Display User-Set | Press ENTER | 11-Advance Set<br>05: Mech Inertia Ratio<br>06: Zero SP Loop BW<br>07: Low SP Loop BW |
| | Press ENTER | 11-05 %<br>40<br>Mech Inertia Ratio<br>1–300 ADD |
| You can calculate the load inertia according to the settings of motor parameters, Pr.11-01 to Pr.11-04 and Pr.11-14 Motor Current at Acceleration and Pr.11-15 Carriage Acceleration. You can use this parameter to adjust the mechanical inertia ratio. | | |

📖 Mechanical inertia reference value (%):

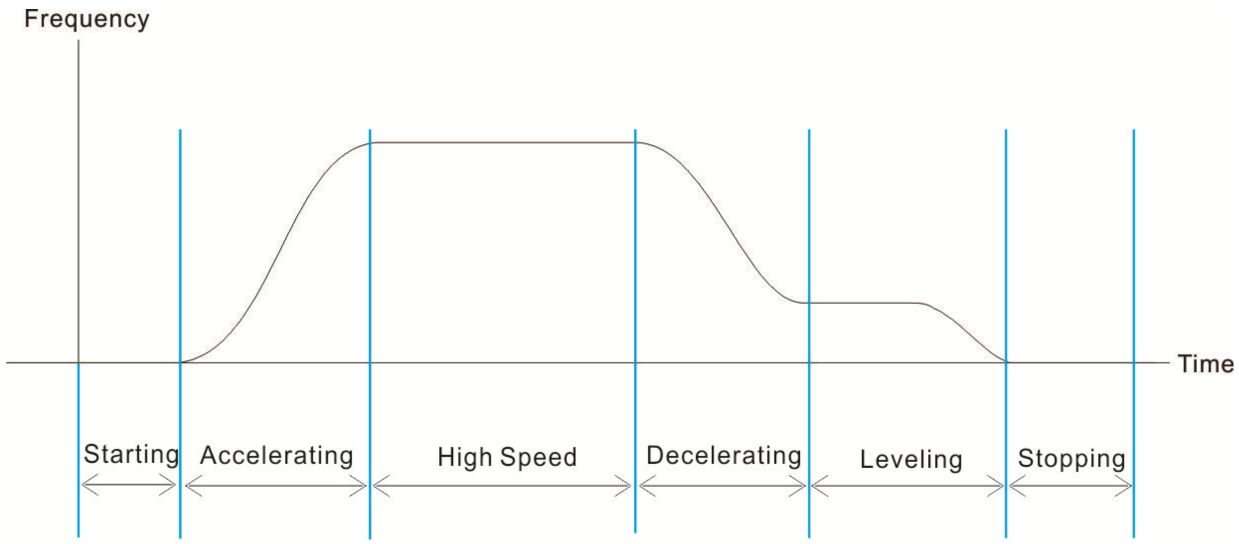
| Load / Motor | IM | PM |
|---|---|---|
| Without load | 40 | 10 |
| With load | 80–120 | 40 |

## 10-3-6 Trial Run

**Test method:**

1. Position the elevator near the middle floors.
2. Enter the correct values for Pr.00-14 and Pr.00-15.
3. Use the upward / downward operation of the inspection mode to execute the trial run.

## 10-4 Elevator Performance Fine-tuning




| Stage | Function | Pr. | Description | Settings | Default |
|---|---|---|---|---|---|
| Starting | Delay Time | 02-31 | Magnetic Contactor Contracting Delay Time between Drive and Motor | 0.010–65.000 sec. | 0.200 |
| | | 02-29 | Brake Release Delay Time when Elevator Starts | 0.000–65.000 sec. | 0.250 |
| | Start-up Adjustment | 01-08 | Fourth Output Voltage Setting (VF, SVC) | 230V series: 0.1–255.0 V<br>460V series: 0.1–510.0 V | 5.0<br>10.0 |
| | Comfort | 11-00 | System Control (FOCPG, FOCPM) | Bit 0 = 1: ASR auto-tuning; PDFF enabled; speed bandwidth control enabled (Pr.11-06–11-08, Pr.11-19)<br>Bit 7 = 1: Zero speed position control is enabled (Pr.10-19, 10-22, 10-24) | 0000h |
| | | 10-19 | Zero Speed Position Control Gain (P) (FOCPM) | 0.00–655.00% | 80.00 |
| | | 10-22 | Zero Speed Position Control Holding Time (FOCPM) | 0.001–65.535 sec. | 0.250 |
| | | 10-24 | Zero Speed Position Control Activation Mode Selection (FOCPM) | 0: After the brake release set in Pr.02-29<br>1: After the brake signal input (Pr.02-01–Pr.02-08 is set to 42) | 0 |
| | | 11-06 | Zero Speed Bandwidth (FOCPG, FOCPM) | 1–40 Hz | 10 |

| Stage | Function | Pr. | Description | Settings | Default |
|---|---|---|---|---|---|
| | Torque Check | 02-33 | External Terminal Output Current Level | 0–100% (motor drive rated current) | 0 |
| | | 02-37 | Torque Check | 0: Disable<br>1: Enable | 0 |
| | DC Brake | 07-02 | DC Brake Current Level at Start-up | 0–100% (motor drive rated current) | 0 |
| | | 07-03 | DC Brake Activation Time | 0.0–60.0 sec. | 0.7 |
| Accelerating | Multi-step Speed | 01-12 | Accel. Time 1 | 0.00–600.00 sec. | 3.00 |
| | | 01-24 | S-curve for Acceleration Begin Time S1 | 0.00–25.00 sec. | 1.00 |
| | | 01-25 | S-curve for Acceleration Arrival Time S2 | 0.00–25.00 sec. | 1.00 |
| | Comfort | 01-04 | Second Output Voltage Setting (VF) | 230V series: 0.1–255.0 V<br>460V series: 0.1–510.0 V | 5.0<br>10.0 |
| | | 01-06 | Third Output Voltage Setting (VF) | 230V series: 0.1–255.0 V<br>460V series: 0.1–510.0 V | 5.0<br>10.0 |
| | | 11-07 | Low Speed Bandwidth (FOCPG, FOCPM) | 1–40 Hz | 10 |
| | | 11-08 | High Speed Bandwidth (FOCPG, FOCPM) | 1–40 Hz | 10 |
| High Speed | Comfort | 11-08 | High Speed Bandwidth (FOCPG, FOCPM) | 1–40 Hz | 10 |
| | | 11-09 | PDFF Gain Value (FOCPG, FOCPM) | 0–200% | 30 |
| Decelerating | Multi-step Speed | 01-13 | Decel. Time 1 | 0.00–600.00 sec. | 2.00 |
| | | 01-26 | S-curve for Deceleration Begin Time S3 | 0.00–25.00 sec. | 1.00 |
| | | 01-27 | S-curve for Deceleration Arrival Time S4 | 0.00–25.00 sec. | 1.00 |
| | Comfort | 01-04 | Second Output Voltage Setting (VF) | 230V series: 0.1–255.0 V<br>460V series: 0.1–510.0 V | 5.0<br>10.0 |
| | | 01-06 | Third Output Voltage Setting (VF) | 230V series: 0.1–255.0 V<br>460V series: 0.1–510.0 V | 5.0<br>10.0 |
| | | 11-07 | Low Speed Bandwidth (FOCPG, FOCPM) | 1–40 Hz | 10 |
| | | 11-08 | High Speed Bandwidth (FOCPG、FOCPM) | 1–40 Hz | 10 |
| Leveling | Comfort | 11-07 | Low Speed Bandwidth (FOCPG, FOCPM) | 1–40 Hz | 10 |
| Stopping | Delay Time | 02-30 | Brake Engage Delay Time | 0.000–65.000 sec. | 0.250 |

| Stage | Function | Pr. | Description | Settings | Default |
|---|---|---|---|---|---|
| | | | when Elevator Stops | | |
| | | 02-32 | Magnetic Contactor Release Delay Time between Drive and Motor | 0.010–65.000 sec. | 0.200 |
| | Elevator Parking | 01-29 | Switch Frequency for S3/S4 Changes to S5 | 0.00–400.00Hz | 0.00 |
| | | 01-30 | S-curve for Deceleration Arrival Time S5 | 0.00–25.00 sec. | 1.00 |
| | | 01-31 | Deceleration Time when Operating without RUN Command | 0.00–600.00 sec. | 2.00 |
| | Comfort | 11-19 | Zero Speed Parking Bandwidth (FOCPG, FOCPM) | 1–40Hz | 10 |
| | Torque Check | 02-33 | External Terminal Output Current Level | 0–100% (motor drive rated current) | 0 |
| | | 02-37 | Torque Check | 0: Disable<br>1: Enable | 0 |
| | DC Brake | 07-30 | DC Brake Current Level at Stop | 0–100% (motor drive rated current) | 0 |
| | | 07-04 | DC Brake Stopping Time | 0.0–60.0 sec. | 0.7 |
| All | Slip Compensation | 05-13 | Slip Compensation Gain (SVC) | 0.00–10.00 | 1.00 |
| | | 05-23 | Slip Compensation Gain % (power generation mode) (VF, SVC) | 0.0–100.0% | 0.0 |
| | | 05-24 | Slip Compensation Gain % (electricity mode) (VF, SVC) | 0.0–100.0% | 0.0 |

# Chapter 11 Summary of Parameter Settings

This chapter provides a summary of parameter settings including the ranges and defaults that help you set the parameters. You can set, change, and reset the parameters with the digital keypad.

NOTE

1) ✐: Indicates a parameter that you can set during operation.
2) For more details on parameters, refer to Chapter 12 Descriptions of Parameter Settings.
3) ◆ indicates that the parameters or the setting values only apply on the Direct Docking Mode. The actual functions of each elevator controller vary from one to another. For more information, please contact Delta.
4) The parameters described in this user manual are designed for multi-step speed mode. The defaults for direct docking mode are different from the defaults described in this user manual. If you need to use the direct docking mode, contact Delta for more information.

## 00 Drive Parameters

✐: You can set this parameter during operation.

NOTE IM: Induction Motor; PM: Permanent Magnet Motor

| Pr. | Parameter Name | Setting Range | Default | VF | VFPG | SVC | FOCPG | FOCPM |
|---|---|---|---|---|---|---|---|---|
| 00-00 | AC Motor Drive Identity Code | 108: 220 V, 2.2 kW, 3 HP (single-phase)<br>110: 220 V, 3.7 kW, 5 HP (single-phase)<br>10: 230V, 4.0 kW, 5 HP<br>11: 460V, 4.0 kW, 5 HP<br>12: 230V, 5.5 kW, 7.5 HP<br>13: 460V, 5.5 kW, 7.5 HP<br>14: 230V, 7.5 kW, 10 HP<br>15: 460V, 7.5 kW, 10 HP<br>16: 230V, 11 kW, 15 HP<br>17: 460V, 11 kW, 15 HP<br>18: 230V, 15 kW, 20 HP<br>19: 460V, 15 kW, 20 HP<br>20: 230V, 18.5 kW, 25 HP<br>21: 460V, 18.5 kW, 25 HP<br>22: 230V, 22 kW, 30 HP<br>23: 460V, 22 kW, 30 HP<br>24: 230V, 30 kW, 40 HP<br>25: 460V, 30 kW, 40 HP<br>26: 230V, 37 kW, 50 HP<br>27: 460V, 37 kW, 50 HP<br>29: 460V, 45 kW, 60 HP<br>31: 460V, 55 kW, 75 HP<br>33: 460V, 75 kW, 100 HP | Read Only | ○ | ○ | ○ | ○ | ○ |
| 00-01 | AC Motor Drive Rated Current Display | Display by model | Read only | ○ | ○ | ○ | ○ | ○ |
| 00-02 | Parameter Reset | 0: No function | 0 | ○ | ○ | ○ | ○ | ○ |

| Pr. | Parameter Name | Setting Range | Default | VF | VFPG | SVC | FOCPG | FOCPM |
|---|---|---|---|---|---|---|---|---|
| | | 1: Read only<br>5: Direct docking mode only ◆<br>8: Keypad locked<br>9: Reset all parameters to defaults (base frequency is 50 Hz)<br>10: Reset all parameters to defaults (base frequency is 60 Hz) | | | | | | |
| 00-03 | Start-up Display | 0: Frequency command value<br>1: The actual output frequency<br>2: DC bus voltage<br>3: Output current<br>4: Output voltage<br>5: User-defined (Pr.00-04) | 0 | ○ | ○ | ○ | ○ | ○ |
| 00-04 | Content of Multi-function Display | 0: Display the output current supplied to the motor from the drive (A) (Unit: Amp)<br>1: Reserved<br>2: Display the drive's actual output frequency (H) (Unit: Hz)<br>3: Display the drive's DC bus voltage (v) (Unit: $V_{DC}$)<br>4: Display the terminals U, V, and W output voltage of the drive (E) (Unit: $V_{AC}$)<br>5: Display the terminals U, V, and W output power factor angle to the motor (n) (Unit: deg)<br>6: Display the terminals U, V, and W output power to the motor (P) (Unit: kW)<br>7: Display the actual motor speed in rpm (r) (Unit: rpm)<br>8: Display the drive's estimated output torque in %; the motor's rated torque is 100% (t) (Unit: %)<br>9: Display the PG feedback (G) (See Pr.10-00 and Pr.10-01)<br>10: Display the electrical angle of drive output (d) (Unit: deg)<br>11: Display the AUI1 analog input terminal signal (1.) (Unit: %)<br>12: Reserved<br>13: Display the AUI2 analog input terminal signal (Unit: %)<br>14: Display the drive's heat sink temperature (t) (Unit: °C)<br>15: Display the IGBT temperature (T) (Unit: °C)<br>16: Display digital input status ON/OFF (i)<br>17: Display digital output status ON/OFF (o)<br>18: Display the step speed of multi-step speed that is executing (S)<br>19: The corresponding CPU digital input pin status (i.) | 0 | ○ | ○ | ○ | ○ | ○ |

| | Pr. | Parameter Name | Setting Range | Default | VF | VFPG | SVC | FOCPG | FOCPM |
|---|---|---|---|---|---|---|---|---|---|
| | | | 20: The corresponding CPU digital output pin status (o.)<br>21–23: Reserved<br>24: Output AC voltage when malfunction occurred (E) (Unit: $V_{AC}$)<br>25: Output DC voltage when malfunction occurred (v) (Unit: $V_{DC}$)<br>26: Motor frequency when malfunction occurred (H) (Unit: Hz)<br>27: Output current when malfunction occurred (A) (Unit: Amp)<br>28: Output frequency when malfunction occurred (F) (Unit: Hz)<br>29: Frequency command when malfunction occurred (F) (Unit: Hz)<br>30: Output power when malfunction occurred (P) (Unit: kW)<br>31: Output torque when malfunction occurred (t) (Unit: %)<br>32: Input terminal status when malfunction occurred (i)<br>33: Output terminal status when malfunction occurred (o)<br>34: Drive status when malfunction occurred (s)<br>35: Display MI and MO status on digital keypad<br>36: CAN communication interference index (c) (Unit: %)<br>37: Multi-function display selection (q) (Unit: %) | | | | | | |
| 𝓃 | 00-05 | User-Defined Coefficient K | Digit 4: number of decimal points (0–3)<br>Digit 3–0: 40–9999 | 0 | ○ | ○ | ○ | ○ | ○ |
| | 00-06 | Software Version | READ ONLY | ##.## | ○ | ○ | ○ | ○ | ○ |
| 𝓃 | 00-07 | Password Input | 1–9998, 10000–65535<br>0–2: number of wrong password attempts | 0 | ○ | ○ | ○ | ○ | ○ |
| 𝓃 | 00-08 | Password Set | 1–9998, 10000–65535<br>0: No password set or successful input in Pr.00-07<br>1: Password has been set | 0 | ○ | ○ | ○ | ○ | ○ |
| | 00-09 | Control Method | 0: V/F control (V/F)<br>1: V/F control + Encoder (VFPG)<br>2: Sensorless Vector Control (SVC)<br>3: FOC vector control + Encoder (FOCPG)<br>8: FOC Permanent Motor control (FOCPM) | 0 | ○ | ○ | ○ | ○ | ○ |
| 𝓃 | 00-10 | Speed Unit | 0: Hz<br>1: m/s<br>2: ft/s<br>3: Direct docking mode only ◆ | 0 | ○ | ○ | ○ | ○ | ○ |
| | 00-11 | Output Direction Selection | 0: FWD: counterclockwise, REV: clockwise<br>1: FWD: clockwise, REV: counterclockwise | 0 | ○ | ○ | ○ | ○ | ○ |
| 𝓃 | 00-12 | Carrier Frequency | 2–15 kHz | 12 | ○ | ○ | ○ | ○ | ○ |
| 𝓃 | 00-13 | Automatic Voltage Regulation (AVR) Function | 0: Enable AVR<br>1: Disable AVR<br>2: Disable AVR when deceleration stop | 0 | ○ | ○ | ○ | ○ | ○ |

| | Pr. | Parameter Name | Setting Range | Default | VF | VFPG | SVC | FOCPG | FOCPM |
|---|---|---|---|---|---|---|---|---|---|
| 〆 | 00-14 | Master Frequency Command Source | 1: RS-485 serial communication or digital keypad (KPC-CC01)<br>2: External analog input (Pr.03-00)<br>3: Digital terminal inputs (Pr.04-00–Pr.04-15)<br>4: Direct docking mode only ◆ | 1 | ○ | ○ | ○ | ○ | ○ |
| 〆 | 00-15 | Operation Command Source | 1: External terminals<br>2: RS-485 serial communication or digital keypad (KPC-CC01) | 1 | ○ | ○ | ○ | ○ | ○ |

# 01 Basic Parameters

✓: You can set this parameter during operation.

| | Pr. | Parameter Name | Setting Range | Default | VF | VFPG | SVC | FOCPG | FOCPM |
|---|---|---|---|---|---|---|---|---|---|
| | 01-00 | Maximum Output Frequency | 10.00–400.00 Hz | 60.00/ 50.00 | ○ | ○ | ○ | ○ | ○ |
| | 01-01 | First Output Frequency Setting (base frequency / motor's rated frequency) | 0.00–400.00 Hz | 60.00/ 50.00 | ○ | ○ | ○ | ○ | ○ |
| | 01-02 | First Output Voltage Setting (base voltage/ motor's rated voltage) | 230V series: 0.1–255.0 V<br>460V series: 0.1–510.0 V | 220.0<br>440.0 | ○ | ○ | ○ | ○ | ○ |
| | 01-03 | Second Output Frequency Setting | 0.00–400.00 Hz | 0.50 | ○ | ○ | | | |
| ✓ | 01-04 | Second Output Voltage Setting | 230V series: 0.1–255.0 V<br>460V series: 0.1–510.0 V | 5.0<br>10.0 | ○ | ○ | | | |
| | 01-05 | Third Output Frequency Setting | 0.00–400.00 Hz | 0.50 | ○ | ○ | | | |
| ✓ | 01-06 | Third Output Voltage Setting | 230V series: 0.1–255.0 V<br>460V series: 0.1–510.0 V | 5.0<br>10.0 | ○ | ○ | | | |
| | 01-07 | Fourth Output Frequency Setting | 0.00–400.00 Hz | 0.00 | ○ | ○ | ○ | ○ | |
| ✓ | 01-08 | Fourth Output Voltage Setting | 230V series: 0.1–255.0 V<br>460V series: 0.1–510.0 V | 5.0<br>10.0 | ○ | ○ | | | |
| | 01-09 | Starting Frequency | 0.00–400.00 Hz | 0.50 | ○ | ○ | ○ | ○ | |
| ✓ | 01-10 | Output Frequency Upper Limit | 0.00–400.00 Hz | 400.00 | ○ | ○ | ○ | ○ | ○ |
| ✓ | 01-11 | Output Frequency Lower Limit | 0.00–400.00 Hz | 0.00 | ○ | ○ | ○ | ○ | ○ |
| ✓ | 01-12 | Accel. Time 1 | 0.00–600.00 sec. | 3.00 | ○ | ○ | ○ | ○ | ○ |
| ✓ | 01-13 | Decel. Time 1 | 0.00–600.00 sec. | 2.00 | ○ | ○ | ○ | ○ | ○ |
| ✓ | 01-14 | Accel. Time 2 | 0.00–600.00 sec. | 3.00 | ○ | ○ | ○ | ○ | ○ |
| ✓ | 01-15 | Decel. Time 2 | 0.00–600.00 sec. | 2.00 | ○ | ○ | ○ | ○ | ○ |
| ✓ | 01-16 | Accel. Time 3 | 0.00–600.00 sec. | 3.00 | ○ | ○ | ○ | ○ | ○ |
| ✓ | 01-17 | Decel. Time 3 | 0.00–600.00 sec. | 2.00 | ○ | ○ | ○ | ○ | ○ |
| ✓ | 01-18 | Accel. Time 4 | 0.00–600.00 sec. | 3.00 | ○ | ○ | ○ | ○ | ○ |
| ✓ | 01-19 | Decel. Time 4 | 0.00–600.00 sec. | 2.00 | ○ | ○ | ○ | ○ | ○ |
| ✓ | 01-20 | JOG Acceleration Time | 0.00–600.00 sec. | 1.00 | ○ | ○ | ○ | ○ | ○ |
| ✓ | 01-21 | JOG Deceleration Time | 0.00–600.00 sec. | 1.00 | ○ | ○ | ○ | ○ | ○ |
| ✓ | 01-22 | JOG Frequency | 0.00–400.00 Hz | 6.00 | ○ | ○ | ○ | ○ | ○ |
| ✓ | 01-23 | Switch Frequency between First and Fourth Accel./ Decel. | 0.00–400.00 Hz | 0.00 | ○ | ○ | ○ | ○ | ○ |
| ✓ | 01-24 | S-curve for Acceleration Begin Time S1 | 0.00–25.00 sec. | 1.00 | ○ | ○ | ○ | ○ | ○ |
| ✓ | 01-25 | S-curve for Acceleration Arrival Time S2 | 0.00–25.00 sec. | 1.00 | ○ | ○ | ○ | ○ | ○ |
| ✓ | 01-26 | S-curve for Deceleration Begin Time S3 | 0.00–25.00 sec. | 1.00 | ○ | ○ | ○ | ○ | ○ |
| ✓ | 01-27 | S-curve for Deceleration Arrival Time S4 | 0.00–25.00 sec. | 1.00 | ○ | ○ | ○ | ○ | ○ |
| | 01-28 | Mode Selection when Frequency < Fmin | 0: Output waiting<br>1: Zero-speed operation<br>2: Fmin (fourth output frequency setting) | 1 | ○ | ○ | ○ | | |
| ✓ | 01-29 | Switch Frequency for S3/S4 Changes to S5 | 0.00–400.00 Hz | 0.00 | ○ | ○ | ○ | ○ | ○ |
| ✓ | 01-30 | S-curve for Deceleration Arrival Time S5 | 0.00–25.00 sec. | 1.00 | ○ | ○ | ○ | ○ | ○ |

| Pr. | Parameter Name | Setting Range | Default | VF | VFPG | SVC | FOCPG | FOCPM |
|---|---|---|---|---|---|---|---|---|
| 01-31 | Deceleration Time when Operating without RUN Command | 0.00–600.00 sec. | 2.00 | ○ | ○ | ○ | ○ | ○ |
| 01-32 | Direct docking mode only ◆ | | | | | | | |
| 01-33 | High Speed Time for Short Floor | 0.00–60.00 sec. | 3.00 | ○ | ○ | ○ | ○ | ○ |
| 01-34 | Leveling Time for Short Floor | 0.00–60.00 sec. | 3.00 | ○ | ○ | ○ | ○ | ○ |
| 01-35 | Limit for Direct Docking Terminal | 0.00–10.00 | 2.00 | ○ | ○ | ○ | ○ | ○ |
| 01-36 | Deceleration Distance for Direct Docking Terminal | 0.00–100.00 cm | 30.00 | ○ | ○ | ○ | ○ | ○ |
| 01-37 | Deceleration Distance Reference for Short Floor | 0.00–655.35 m | Read only | ○ | ○ | ○ | ○ | ○ |
| 01-38 | Short Floor/Direct Docking Terminal Enabled | 0000h: Disabled<br>0001h: Short floor enabled<br>0002h: Direct docking terminal enabled<br>0003h: Short floor + direct docking terminal enabled | 0000h | ○ | ○ | ○ | ○ | ○ |
| 01-39 | Automatic Emergency Deceleration Level | 5.00–400.00 Hz | 60.00 | | ○ | | ○ | ○ |
| 01-40 | Deceleration Time for Emergency Deceleration | 0.00–600.00 sec. | 2.00 | | ○ | | ○ | ○ |

# 02 Digital Input / Output Parameters

✎: You can set this parameter during operation.

| Pr. | Parameter Name | Setting Range | Default | VF | VFPG | SVC | FOCPG | FOCPM |
|---|---|---|---|---|---|---|---|---|
| 02-00 | Two-wire/three-wire Operation Control | 0: FWD/STOP, REV/STOP<br>1: FWD/STOP, REV/STOP (Line Start Lockout)<br>2: RUN/STOP, REV/FWD<br>3: RUN/STOP, REV/FWD (Line Start Lockout)<br>4: Three-wire<br>5: Three-wire (Line Start Lockout) | 0 | ○ | ○ | ○ | ○ | ○ |
| 02-01 | Multi-Function Input Command 1 (MI1) (The Stop terminal for three-wire operation) | 0: no function | 1 | ○ | ○ | ○ | ○ | ○ |
| | | 1: multi-step speed command 1 | | ○ | ○ | ○ | ○ | ○ |
| 02-02 | Multi-Function Input Command 2 (MI2) | 2: multi-step speed command 2 | 2 | ○ | ○ | ○ | ○ | ○ |
| 02-03 | Multi-Function Input Command 3 (MI3) | 3: multi-step speed command 3 | 3 | ○ | ○ | ○ | ○ | ○ |
| 02-04 | Multi-Function Input Command 4 (MI4) | 4: multi-step speed command 4 | 4 | ○ | ○ | ○ | ○ | ○ |
| 02-05 | Multi-Function Input Command 5 (MI5) | 5: Reset | 0 | ○ | ○ | ○ | ○ | ○ |
| 02-06 | Multi-Function Input Command 6 (MI6) | 6: JOG command | 0 | ○ | ○ | ○ | ○ | ○ |
| 02-07 | Multi-Function Input Command 7 (MI7) | 7: Acceleration/ deceleration speed inhibit | 0 | ○ | ○ | ○ | ○ | ○ |
| 02-08 | Multi-Function Input Command 8 (MI8) (Enable Drive terminal) | 8: First, second acceleration/deceleration time | 40 | ○ | ○ | ○ | ○ | ○ |
| | | 9: Third, fourth acceleration/deceleration time | | ○ | ○ | ○ | ○ | ○ |
| | | 10: EF input (Pr.07-28) | | ○ | ○ | ○ | ○ | ○ |
| | | 11: Reserved | | | | | | |
| | | 12: Stop output | | ○ | ○ | ○ | ○ | ○ |
| | | 13–14: Reserved | | | | | | |
| | | 15: AUI1 operation speed command | | ○ | ○ | ○ | ○ | ○ |
| | | 16: Reserved | | | | | | |
| | | 17: AUI2 operation speed command | | ○ | ○ | ○ | ○ | ○ |
| | | 18: Emergency Stop (Pr.07-28) | | ○ | ○ | ○ | ○ | ○ |
| | | 19–23: Reserved | | | | | | |
| | | 24: FWD JOG command | | ○ | ○ | ○ | ○ | ○ |
| | | 25: REV JOG command | | ○ | ○ | ○ | ○ | ○ |
| | | 26: Reserved | | | | | | |
| | | 27: ASR1/ASR2 selection | | ○ | ○ | ○ | ○ | ○ |
| | | 28: Emergency stop (EF1) (Motor coasts to stop) | | ○ | ○ | ○ | ○ | ○ |
| | | 29–30: Reserved | | | | | | |
| | | 31: High torque bias (according to Pr.07-21) | | ○ | ○ | ○ | ○ | ○ |
| | | 32: Middle torque bias (according to Pr.07-22) | | ○ | ○ | ○ | ○ | ○ |
| | | 33: Low torque bias (according to Pr.07-23) | | ○ | ○ | ○ | ○ | ○ |
| | | 34–37: Reserved | | | | | | |
| | | 38: Disable writing to EEPROM function | | ○ | ○ | ○ | ○ | ○ |
| | | 39: Torque command direction (0 is positive direction) | | | | | | |

| | Pr. | Parameter Name | Setting Range | Default | VF | VFPG | SVC | FOCPG | FOCPM |
|---|---|---|---|---|---|---|---|---|---|
| | | | 40: Enable drive function | | ○ | ○ | ○ | ○ | ○ |
| | | | 41: Magnetic contactor detection | | ○ | ○ | ○ | ○ | ○ |
| | | | 42: Mechanical brake 1 | | ○ | ○ | ○ | ○ | ○ |
| | | | 43: EPS function (Emergency Power System) | | ○ | ○ | ○ | ○ | ○ |
| | | | 44: Mechanical brake 2 | | | | | | |
| | | | 45–51: Direct docking mode only ◆ | | | | | | |
| | | | 53: Terminal leveling signal for direct docking | | | ○ | | ○ | ○ |
| | | | 54: Power failure signal | | ○ | ○ | ○ | ○ | ○ |
| | | | 55: Manual emergency deceleration | | | ○ | | ○ | ○ |
| | | | 56: Automatic emergency deceleration | | | ○ | | ○ | ○ |
| ↯ | 02-09 | Digital Input Response Time | 0.001–30.000 sec. | 0.005 | ○ | ○ | ○ | ○ | ○ |
| ↯ | 02-10 | Digital Input Operation Direction | 0–65535 | 0 | ○ | ○ | ○ | ○ | ○ |
| ↯ | 02-11 | Multi-function Output 1: RA, RB, RC (Relay1) | 0: No function | 0 | ○ | ○ | ○ | ○ | ○ |
| | | | 1: Operation indication | | ○ | ○ | ○ | ○ | ○ |
| ↯ | 02-12 | Multi-function Output 2: MRA, MRB, MRC (Relay2) | 2: Operation speed reached | 0 | ○ | ○ | ○ | ○ | ○ |
| | | | 3: Desired frequency reached 1 (Pr.02-25, Pr.02-26) | | ○ | ○ | ○ | ○ | ○ |
| ↯ | 02-13 | Multi-function Output 3: R1A, R12C (Relay3) | 4: Desired frequency reached 2 (Pr.02-27, Pr.02-28) | 0 | ○ | ○ | ○ | ○ | ○ |
| ↯ | 02-14 | Multi-function Output 4: R2A, R12C (Relay4) | 5: Zero speed (Frequency command) | 0 | ○ | ○ | ○ | ○ | ○ |
| ↯ | 02-15 | Multi-function Output 5: (MO1) | 6: Zero speed with stop (Frequency command) | 0 | ○ | ○ | ○ | ○ | ○ |
| ↯ | 02-16 | Multi-function Output 6: (MO2) | 7: Over-torque (OT1) (Pr.06-05–06-07) | 0 | ○ | ○ | ○ | ○ | ○ |
| ↯ | 02-17 | Multi-function Output 7: (MO3) | 8: Over-torque (OT2) (Pr.06-08–06-10) | 0 | ○ | ○ | ○ | ○ | ○ |
| ↯ | 02-18 | Multi-function Output 8: (MO4) | 9: Drive ready | 0 | ○ | ○ | ○ | ○ | ○ |
| ↯ | 02-19 | Multi-function Output 9: (MO5) | 10: User-defined low-voltage detection (LV) | 0 | ○ | ○ | ○ | ○ | ○ |
| ↯ | 02-20 | Multi-function Output 10: (MO6) | 11: Malfunction indication | 0 | ○ | ○ | ○ | ○ | ○ |
| | | | 12: Mechanical brake release (Pr.02-29, Pr.02-30, Pr.02-37) | 0 | ○ | ○ | ○ | ○ | ○ |
| | | | 13: Overheat (Pr.06-14) | 0 | ○ | ○ | ○ | ○ | ○ |
| | | | 14: Brake transistor signal | | ○ | ○ | ○ | ○ | ○ |
| | | | 15: Motor-controlled magnetic contactor output | | ○ | ○ | ○ | ○ | ○ |
| | | | 16: Slip error (oSL) | | ○ | ○ | ○ | ○ | ○ |
| | | | 17: Malfunction indication 1 | | ○ | ○ | ○ | ○ | ○ |
| | | | 18: Reserved | | | | | | |
| | | | 19: Brake transistor output error | | ○ | ○ | ○ | ○ | ○ |
| | | | 20: Warning output | | ○ | ○ | ○ | ○ | ○ |
| | | | 21: Over-voltage warning | | ○ | ○ | ○ | ○ | ○ |
| | | | 22: Over-current stall prevention warning | | ○ | ○ | ○ | | |
| | | | 23: Over-voltage stall prevention warning | | ○ | ○ | ○ | ○ | ○ |
| | | | 24: Operation mode indication (Pr.00-15=1) | | ○ | ○ | ○ | ○ | ○ |
| | | | 25: Forward command | | ○ | ○ | ○ | ○ | ○ |
| | | | 26: Reverse command | | ○ | ○ | ○ | ○ | ○ |
| | | | 27: Output when current ≥ Pr.02-33 | | ○ | ○ | ○ | ○ | ○ |

| Pr. | Parameter Name | Setting Range | Default | VF | VFPG | SVC | FOCPG | FOCPM |
|---|---|---|---|---|---|---|---|---|
| | | 28: Output when current < Pr.02-33 | | ○ | ○ | ○ | ○ | ○ |
| | | 29: Output when frequency ≥ Pr.02-34 | | ○ | ○ | ○ | ○ | ○ |
| | | 30: Output when frequency < Pr.02-34 | | ○ | ○ | ○ | ○ | ○ |
| | | 31: Power generation direction and status verification | | ○ | ○ | ○ | ○ | ○ |
| | | 32: Power generation direction | | ○ | ○ | ○ | ○ | ○ |
| | | 33: Zero speed (actual output frequency) | | ○ | ○ | ○ | ○ | ○ |
| | | 34: Zero speed with Stop (actual output frequency) | | ○ | ○ | ○ | ○ | ○ |
| | | 35: Fault output option 1 (Pr.06-22) | | ○ | ○ | ○ | ○ | ○ |
| | | 36: Fault output option 2 (Pr.06-23) | | ○ | ○ | ○ | ○ | ○ |
| | | 37: Fault output option 3 (Pr.06-24) | | ○ | ○ | ○ | ○ | ○ |
| | | 38: Fault output option 4 (Pr.06-25) | | ○ | ○ | ○ | ○ | ○ |
| | | 39: Reserved | | | | | | |
| | | 40: Speed reached (including zero speed) | | ○ | ○ | ○ | ○ | ○ |
| | | 41: Reserved | | | | | | |
| | | 42: STO output error | | ○ | ○ | ○ | ○ | ○ |
| | | 43–44: Direct docking mode only ◆ | | | | | | |
| | | 45: Reserved | | | | | | |
| | | 46: Retrying after a fault has occurred indication | | ○ | ○ | ○ | ○ | ○ |
| | | 47: Direct docking mode only ◆ | | | | | | |
| | | 48: Control output of MPSCC (Motor Phase Short Circuit Contactor) | | ○ | ○ | ○ | ○ | ○ |
| | | 49: Emergency power mode action | | ○ | ○ | ○ | ○ | ○ |
| 02-21–02-22 | | Reserved | | | | | | |
| 02-23 | Multi-output Direction | 0–65535 | 0 | ○ | ○ | ○ | ○ | ○ |
| 02-24 | Serial Start Signal Selection | 0: According to FWD/REV signal<br>1: According to Enable drive function signal | 0 | ○ | ○ | ○ | ○ | ○ |
| 02-25 | Desired Frequency Reached 1 | 0.00–400.00 Hz | 60.00/ 50.00 | ○ | ○ | ○ | ○ | ○ |
| 02-26 | Desired Frequency Reached Width 1 | 0.00–400.00 Hz | 2.00 | ○ | ○ | ○ | ○ | ○ |
| 02-27 | Desired Frequency Reached 2 | 0.00–400.00 Hz | 60.00/ 50.00 | ○ | ○ | ○ | ○ | ○ |
| 02-28 | Desired Frequency Reached Width 2 | 0.00–400.00 Hz | 2.00 | ○ | ○ | ○ | ○ | ○ |
| 02-29 | Brake Release Delay Time when Elevator Starts | 0.000–65.000 sec. | 0.250 | ○ | ○ | ○ | ○ | ○ |
| 02-30 | Brake Engage Delay Time when Elevator Stops | 0.000–65.000 sec. | 0.250 | ○ | ○ | ○ | ○ | ○ |
| 02-31 | Magnetic Contactor Contracting Delay Time between Drive and Motor | 0.010–65.000 sec. | 0.200 | ○ | ○ | ○ | ○ | ○ |
| 02-32 | Magnetic Contactor Release Delay Time between Drive and Motor | 0.010–65.000 sec. | 0.200 | ○ | ○ | ○ | ○ | ○ |
| 02-33 | External Terminal Output Current Level | 0–100% (motor drive rated current) | 0 | ○ | ○ | ○ | ○ | ○ |
| 02-34 | External Terminal Output Speed Limit | 0.00–±400.00 Hz (this is motor speed when using with PG) | 0.00 | ○ | ○ | ○ | ○ | ○ |
| 02-35 | Mechanical Brake | 0.00–10.00 sec. | 0.00 | ○ | ○ | ○ | ○ | ○ |

| | Pr. | Parameter Name | Setting Range | Default | VF | VFPG | SVC | FOCPG | FOCPM |
|---|---|---|---|---|---|---|---|---|---|
| | | Detection Time | | | | | | | |
| ⚡ | 02-36 | Magnetic Contactor Detection Time | 0.00–10.00 sec. | 0.00 | ○ | ○ | ○ | ○ | ○ |
| | 02-37 | Torque Check | 0: Disable<br>1: Enable | 0 | ○ | ○ | ○ | ○ | ○ |
| ⚡ | 02-38 | MPSCC (Motor Phase Short Circuit Contactor) Release Delay Time between Drive and Motor | 0.010~65.000 sec. | 0.200 | ○ | ○ | ○ | ○ | ○ |
| ⚡ | 02-39 | MPSCC (Motor Phase Short Circuit Contactor) Contracting Delay Time between Drive and Motor | 0.010~65.000 sec. | 0.200 | ○ | ○ | ○ | ○ | ○ |

# 03 Analog Input / Output Parameters

✎: You can set this parameter during operation.

| | Pr. | Parameter Name | Setting Range | Default | VF | VFPG | SVC | FOCPG | FOCPM |
|---|---|---|---|---|---|---|---|---|---|
| ✎ | 03-00 | Analog Input 1 (AUI1) | 0: No function | 1 | ○ | ○ | ○ | ○ | ○ |
| | 03-01 | Reserved | 1: Frequency command (speed limit under torque control mode) | | | | | | |
| ✎ | 03-02 | Analog Input 2 (AUI2) | 2: Torque command (torque limit under speed mode) | 0 | | | | | |
| | | | 3: Load compensation | | ○ | ○ | ○ | ○ | ○ |
| | | | 4–5: Reserved | | | | | | |
| | | | 6: P.T.C. thermistor input value | | ○ | ○ | ○ | ○ | ○ |
| | | | 7: Positive torque limit | | | | | ○ | ○ |
| | | | 8: Negative torque limit | | | | | ○ | ○ |
| | | | 9: Regenerative torque limit | | | | | ○ | ○ |
| | | | 10: Positive/negative torque limit | | | | | ○ | ○ |
| ✎ | 03-03 | Analog Input Bias 1 (AUI1) | -100.0–100.0% | 0.0 | ○ | ○ | ○ | ○ | ○ |
| | 03-04 | Reserved | | | | | | | |
| ✎ | 03-05 | Analog Input Bias 1 (AUI2) | -100.0–100.0% | 0.0 | ○ | ○ | ○ | ○ | ○ |
| ✎ | 03-06 | AUI1 Positive/negative Bias Mode | 0: Zero bias<br>1: Lower than or equal to bias | 0 | ○ | ○ | ○ | ○ | ○ |
| | 03-07 | Reserved | 2: Higher than or equal to bias | | | | | | |
| ✎ | 03-08 | AUI2 Positive/negative Bias Mode | 3: Using bias as the base to get the absolute value of bias voltage (unipolar)<br>4: Using bias as the base (unipolar) | 0 | ○ | ○ | ○ | ○ | ○ |
| ✎ | 03-09 | Analog Input Gain 1 (AUI1) | 0.0–500.0% | 100.0 | ○ | ○ | ○ | ○ | ○ |
| | 03-10 | Reserved | | | | | | | |
| ✎ | 03-11 | Analog Input Gain 1 (AUI2) | 0.0–500.0% | 100.0 | ○ | ○ | ○ | ○ | ○ |
| ✎ | 03-12 | Analog Input Filter Time (AUI1) | 0.00–2.00 sec. | 0.01 | ○ | ○ | ○ | ○ | ○ |
| | 03-13 | Reserved | | | | | | | |
| ✎ | 03-14 | Analog Input Filter Time (AUI2) | 0.00–2.00 sec. | 0.01 | ○ | ○ | ○ | ○ | ○ |
| | 03-15 | Load Compensation Auto-tuning | 0: No function<br>1: Auto-tunes with running without load<br>2: Auto-tunes with running with load | 0 | ○ | ○ | ○ | ○ | ○ |
| | 03-15 | Reserved | | | | | | | |
| | 03-16 | Reserved | | | | | | | |
| ✎ | 03-17 | Analog Output Selection 1 | 0: Output frequency (Hz) | 0 | ○ | ○ | ○ | ○ | ○ |
| | | | 1: Frequency command (Hz) | | ○ | ○ | ○ | ○ | ○ |
| | | | 2: Motor speed (RPM) | | ○ | ○ | ○ | ○ | ○ |
| | | | 3: Output current (rms) | | ○ | ○ | ○ | ○ | ○ |
| | | | 4: Output voltage | | ○ | ○ | ○ | ○ | ○ |
| | | | 5: DC bus voltage | | ○ | ○ | ○ | ○ | ○ |
| | | | 6: Power factor angle | | ○ | ○ | ○ | ○ | ○ |
| | | | 7: Power factor | | ○ | ○ | ○ | ○ | ○ |
| | | | 8: Output torque | | ○ | ○ | ○ | ○ | ○ |
| | | | 9: AUI1 | | ○ | ○ | ○ | ○ | ○ |
| | | | 10: Reserved | | | | | | |
| | | | 11: AUI2 | | ○ | ○ | ○ | ○ | ○ |
| | | | 12: q-axis current | | ○ | ○ | ○ | ○ | ○ |
| | | | 13: q-axis feedback value | | ○ | ○ | ○ | ○ | ○ |
| | | | 14: d-axis current | | ○ | ○ | ○ | ○ | ○ |
| | | | 15: d-axis feedback value | | ○ | ○ | ○ | ○ | ○ |

| | Pr. | Parameter Name | Setting Range | Default | VF | VFPG | SVC | FOCPG | FOCPM |
|---|---|---|---|---|---|---|---|---|---|
| | | | 16: q-axis voltage | | ○ | ○ | ○ | ○ | ○ |
| | | | 17: d-axis voltage | | ○ | ○ | ○ | ○ | ○ |
| | | | 18: Torque command | | ○ | ○ | ○ | ○ | ○ |
| | | | 19–20: Reserved | | | | | | |
| | | | 21: Power Output | | ○ | ○ | ○ | ○ | ○ |
| 〆 | 03-18 | Analog Output Gain 1 | 0–200.0% | 100.0 | ○ | ○ | ○ | ○ | ○ |
| 〆 | 03-19 | Analog Output Value in REV Direction 1 | 0: Absolute value in output voltage<br>1: Output 0 V in REV direction<br>2: Enable output voltage in REV direction | 0 | ○ | ○ | ○ | ○ | ○ |
| 〆 | 03-20 | Analog Output Selection 2 | 0: Output frequency (Hz) | 0 | ○ | ○ | ○ | ○ | ○ |
| | | | 1: Frequency command (Hz) | | ○ | ○ | ○ | ○ | ○ |
| | | | 2: Motor speed (RPM) | | ○ | ○ | ○ | ○ | ○ |
| | | | 3: Output current (rms) | | ○ | ○ | ○ | ○ | ○ |
| | | | 4: Output voltage | | ○ | ○ | ○ | ○ | ○ |
| | | | 5: DC bus voltage | | ○ | ○ | ○ | ○ | ○ |
| | | | 6: Power factor angle | | ○ | ○ | ○ | ○ | ○ |
| | | | 7: Power factor | | ○ | ○ | ○ | ○ | ○ |
| | | | 8: Output torque | | ○ | ○ | ○ | ○ | ○ |
| | | | 9: AUI1 | | ○ | ○ | ○ | ○ | ○ |
| | | | 10: Reserved | | | | | | |
| | | | 11: AUI2 | | ○ | ○ | ○ | ○ | ○ |
| | | | 12: q-axis current | | ○ | ○ | ○ | ○ | ○ |
| | | | 13: q-axis feedback value | | ○ | ○ | ○ | ○ | ○ |
| | | | 14: d-axis current | | ○ | ○ | ○ | ○ | ○ |
| | | | 15: d-axis feedback value | | ○ | ○ | ○ | ○ | ○ |
| | | | 16: q-axis voltage | | ○ | ○ | ○ | ○ | ○ |
| | | | 17: d-axis voltage | | ○ | ○ | ○ | ○ | ○ |
| | | | 18: Torque command | | ○ | ○ | ○ | ○ | ○ |
| | | | 19–20: Reserved | | | | | | |
| | | | 21: Power Output | | ○ | ○ | ○ | ○ | ○ |
| 〆 | 03-21 | Analog Output Gain 2 | 0–200.0% | 100.0 | ○ | ○ | ○ | ○ | ○ |
| 〆 | 03-22 | Analog Output Value in REV Direction 2 | 0: Absolute value in output voltage<br>1: Output 0 V in REV direction<br>2: Enable output voltage in REV direction | 0 | ○ | ○ | ○ | ○ | ○ |
| | 03-23 | Analog Input Type (AUI1) | 0: Bipolar (±10 V)<br>1: Unipolar (0–10 V) | 0 | ○ | ○ | ○ | ○ | ○ |
| | 03-24 | Analog Input Type (AUI2) | 0: Bipolar (±10 V)<br>1: Unipolar (0–10 V) | 0 | ○ | ○ | ○ | ○ | ○ |

## 04 Multi-step Speed Parameters

✎: You can set this parameter during operation.

| | Pr. | Parameter Name | Setting Range | Default | VF | VFPG | SVC | FOCPG | FOCPM |
|---|---|---|---|---|---|---|---|---|---|
| ✎ | 04-00 | Zero Step Speed Frequency | 0.00–400.00 Hz | 0.00 | ○ | ○ | ○ | ○ | ○ |
| ✎ | 04-01 | 1st Step Speed Frequency | 0.00–400.00 Hz | 0.00 | ○ | ○ | ○ | ○ | ○ |
| ✎ | 04-02 | 2nd Step Speed Frequency | 0.00–400.00 Hz | 0.00 | ○ | ○ | ○ | ○ | ○ |
| ✎ | 04-03 | 3rd Step Speed Frequency | 0.00–400.00 Hz | 0.00 | ○ | ○ | ○ | ○ | ○ |
| ✎ | 04-04 | 4th Step Speed Frequency | 0.00–400.00 Hz | 0.00 | ○ | ○ | ○ | ○ | ○ |
| ✎ | 04-05 | 5th Step Speed Frequency | 0.00–400.00 Hz | 0.00 | ○ | ○ | ○ | ○ | ○ |
| ✎ | 04-06 | 6th Step Speed Frequency | 0.00–400.00 Hz | 0.00 | ○ | ○ | ○ | ○ | ○ |
| ✎ | 04-07 | 7th Step Speed Frequency | 0.00–400.00 Hz | 0.00 | ○ | ○ | ○ | ○ | ○ |
| ✎ | 04-08 | 8th Step Speed Frequency | 0.00–400.00 Hz | 0.00 | ○ | ○ | ○ | ○ | ○ |
| ✎ | 04-09 | 9th Step Speed Frequency | 0.00–400.00 Hz | 0.00 | ○ | ○ | ○ | ○ | ○ |
| ✎ | 04-10 | 10th Step Speed Frequency | 0.00–400.00 Hz | 0.00 | ○ | ○ | ○ | ○ | ○ |
| ✎ | 04-11 | 11th Step Speed Frequency | 0.00–400.00 Hz | 0.00 | ○ | ○ | ○ | ○ | ○ |
| ✎ | 04-12 | 12th Step Speed Frequency | 0.00–400.00 Hz | 0.00 | ○ | ○ | ○ | ○ | ○ |
| ✎ | 04-13 | 13th Step Speed Frequency | 0.00–400.00 Hz | 0.00 | ○ | ○ | ○ | ○ | ○ |
| ✎ | 04-14 | 14th Step Speed Frequency | 0.00–400.00 Hz | 0.00 | ○ | ○ | ○ | ○ | ○ |
| ✎ | 04-15 | 15th Step Speed Frequency | 0.00–400.00 Hz | 0.00 | ○ | ○ | ○ | ○ | ○ |
| | 04-16 – 04-99 | Direct docking mode only ◆ | | | | | | | |

# 05 IM Parameters

⚡: You can set this parameter during operation.

| | Pr. | Parameter Name | Setting Range | Default | VF | VFPG | SVC | FOCPG | FOCPM |
|---|---|---|---|---|---|---|---|---|---|
| | 05-00 | Motor Auto-tuning | 0: No function<br>1: Dynamic test (Rs, Rr, Lm, Lx, no-load current) (Motor runs)<br>2: Static test (Motor does not run) | 0 | ○ | | | | |
| | 05-01 | Motor Rated Current | (40–120%) * Pr.00-01 Amps | #.## | ○ | ○ | ○ | ○ | |
| | 05-02 | Motor Rated Power | 0.00–655.35 kW | #.## | | | ○ | ○ | |
| | 05-03 | Motor Rated Speed (rpm) | 0–65535 | 1710 | | ○ | ○ | ○ | |
| | 05-04 | Number of Motor Poles | 2–48 | 4 | ○ | ○ | ○ | ○ | |
| | 05-05 | Motor No-load Current | 0–Pr.05-01 <default> | #.## | | ○ | ○ | ○ | |
| | 05-06 | Motor Rs | 0.000–65.535 Ω | 0.000 | | | ○ | ○ | |
| | 05-07 | Motor Rr | 0.000–65.535 Ω | 0.000 | | | ○ | ○ | |
| | 05-08 | Motor Lm | 0.0–6553.5 mH | 0.0 | | | ○ | ○ | |
| | 05-09 | Motor Lx | 0.0–6553.5 mH | 0.0 | | | ○ | ○ | |
| ⚡ | 05-10 | Torque Compensation Low Pass Filter Time | 0.001–10.000 sec. | 0.020 | | | ○ | | |
| ⚡ | 05-11 | Slip Compensation Low Pass Filter Time | 0.001–10.000 sec. | 0.100 | | | ○ | | |
| ⚡ | 05-12 | Torque Compensation Gain | 0–10 | 0 | ○ | ○ | | | |
| ⚡ | 05-13 | Slip Compensation Gain | 0.00–10.00 | 1.00 | | | ○ | | |
| ⚡ | 05-14 | Slip Deviation Level | 0–1000% (0: disable) | 0 | | ○ | ○ | ○ | |
| ⚡ | 05-15 | Slip Deviation Detection Time | 0.0–10.0 sec. | 1.0 | | ○ | ○ | ○ | |
| ⚡ | 05-16 | Over-slip Action | 0: Warn and keep operation<br>1: Fault and ramp to stop<br>2: Fault and coast to stop | 0 | | ○ | ○ | ○ | |
| ⚡ | 05-17 | Hunting Gain | 0–10000 (0: disable) | 2000 | ○ | ○ | ○ | | |
| | 05-18 | Accumulated Motor Operation Time (Min.) | 0–1439 | 0 | ○ | ○ | ○ | ○ | ○ |
| | 05-19 | Accumulated Motor Operation Time (day) | 0–65535 | 0 | ○ | ○ | ○ | ○ | ○ |
| ⚡ | 05-20 | Core Loss Compensation | 0–250% | 10 | | | ○ | | |
| | 05-21 | Accumulated Motor Power-on Time (Min.) | 0–1439 | 0 | ○ | ○ | ○ | ○ | ○ |
| | 05-22 | Accumulated Motor Power-on Time (day) | 0–65535 | 0 | ○ | ○ | ○ | ○ | ○ |
| ⚡ | 05-23 | Slip Compensation Gain % (Power Generation Mode) | 0.0–100.0% | 0.0 | ○ | | ○ | | |
| ⚡ | 05-24 | Slip Compensation Gain % (Electricity Mode) | 0.0–100.0% | 0.0 | ○ | | ○ | | |

# 06 Protection Parameters

〆: You can set this parameter during operation.

| | Pr. | Parameter Name | Setting Range | Default | VF | VFPG | SVC | FOCPG | FOCPM |
|---|---|---|---|---|---|---|---|---|---|
| 〆 | 06-00 | Low Voltage Level | 230V series: 160.0–220.0 V<br>460V series: 320.0–440.0 V | 180.0<br>360.0 | ○ | ○ | ○ | ○ | ○ |
| 〆 | 06-01 | Phase-loss Protection | 0: Warn and keep operation<br>1: Fault and ramp to stop<br>2: Fault and coast to stop | 2 | ○ | ○ | ○ | ○ | ○ |
| 〆 | 06-02 | Over-current Stall Prevention during Acceleration | 0: Disable<br>0–250% (rated current of the motor drive) | 0 | ○ | ○ | ○ | | |
| 〆 | 06-03 | Over-current Stall Prevention during Operation | 0: Disable<br>0–250% (rated current of the motor drive) | 0 | ○ | ○ | ○ | | |
| 〆 | 06-04 | Acceleration/Deceleration Time for Stall Prevention at Constant Speed | 0: Use the current acceleration/deceleration time<br>1: Use the first acceleration/deceleration time<br>2: Use the second acceleration/deceleration time<br>3: Use the third acceleration/deceleration time<br>4: Use the fourth acceleration/deceleration time<br>5: Use the auto-acceleration/ auto-deceleration time | 0 | ○ | ○ | ○ | | |
| 〆 | 06-05 | Over-torque Detection (OT1) | 0: Disable<br>1: Over-torque detection during constant speed operation, continue to operate after detection<br>2: Over-torque detection during constant speed operation, stop operating after detection<br>3: Over-torque detection during operation, continue to operate after detection<br>4: Over-torque detection during operation, stop operating after detection | 0 | ○ | ○ | ○ | ○ | ○ |
| 〆 | 06-06 | Over-torque Detection Level (OT1) | 10–250% (rated current of the motor drive) | 150 | ○ | ○ | ○ | ○ | ○ |
| 〆 | 06-07 | Over-torque Detection Time (OT1) | 0.1–60.0 sec. | 0.1 | ○ | ○ | ○ | ○ | ○ |
| 〆 | 06-08 | Over-torque Detection (OT2) | 0: Disable<br>1: Over-torque detection during constant speed operation, continue to operate after detection<br>2: Over-torque detection during constant speed operation, stop operating after detection<br>3: Over-torque detection during operation, continue to operate after detection<br>4: Over-torque detection during operation, stop operating after detection | 0 | ○ | ○ | ○ | ○ | ○ |
| 〆 | 06-09 | Over-torque Detection Level (OT2) | 10–250% (rated current of the motor drive) | 150 | ○ | ○ | ○ | ○ | ○ |
| 〆 | 06-10 | Over-torque Detection Time (OT2) | 0.1–60.0 sec. | 0.1 | ○ | ○ | ○ | ○ | ○ |

| | Pr. | Parameter Name | Setting Range | Default | VF | VFPG | SVC | FOCPG | FOCPM |
|---|---|---|---|---|---|---|---|---|---|
| ✓ | 06-11 | Current Limit | 0–250% (rated current of the motor drive) | 200 | | | | ○ | ○ |
| | 06-12 | Electronic Thermal Relay | 0: Standard motor<br>1: Inverter motor<br>2: Disabled | 2 | ○ | ○ | ○ | ○ | ○ |
| ✓ | 06-13 | Electronic Thermal Characteristic | 30.0–600.0 sec. | 60.0 | ○ | ○ | ○ | ○ | ○ |
| ✓ | 06-14 | Heat Sink Overheat (OH) Warning | 0.0–110.0°C | 90.0 | ○ | ○ | ○ | ○ | ○ |
| ✓ | 06-15 | Stall Prevention Limit Level | 0–100% (refer to Pr.06-02, Pr.06-03) | 50 | ○ | ○ | ○ | | |
| | 06-16 | Present Fault Record | 0: No fault | 0 | ○ | ○ | ○ | ○ | ○ |
| | 06-17 | Second Most Recent Fault Record | 1: Over-current during acceleration (ocA) | 0 | ○ | ○ | ○ | ○ | ○ |
| | 06-18 | Third Most Recent Fault Record | 2: Over-current during deceleration (ocd) | 0 | ○ | ○ | ○ | ○ | ○ |
| | 06-19 | Fourth Most Recent Fault Record | 3: Over-current during constant speed (ocn) | 0 | ○ | ○ | ○ | ○ | ○ |
| | 06-20 | Fifth Most Recent Fault Record | 4: Ground fault (GFF) | 0 | ○ | ○ | ○ | ○ | ○ |
| | 06-21 | Sixth Most Recent Fault Record | 5: IGBT short-circuit (occ)<br>6: Over-current at stop (ocS)<br>7: Over-voltage during acceleration (ovA)<br>8: Over-voltage during deceleration (ovd)<br>9: Over-voltage during constant speed (ovn)<br>10: Over-voltage at stop (ovS)<br>11: Low voltage during acceleration (LvA)<br>12: Low voltage during deceleration (Lvd)<br>13: Low voltage during constant speed (Lvn)<br>14: Low voltage at stop (LvS)<br>15: Input phase loss (PHL)<br>16: IGBT overheat (oH1)<br>17: Bulk capacitors overheat (oH2)<br>18: Abnormal IGBT temperature detected (tH1o)<br>19: Abnormal bulk capacitor temperature detected (tH2o)<br>20:Unusal cooling fan operation (FAn)<br>21: Overload (oL) (150%; 1 minute, motor drive overloaded)<br>22: Motor overloaded (EoL1)<br>23: Reserved<br>24: Motor PTC overheat (oH3)<br>25: Reserved<br>26: Over-torque 1 (ot1)<br>27: Over-torque 2 (ot2)<br>28: Reserved<br>29: Reserved<br>30: Memory writing error (cF1)<br>31: Memory reading error (cF2)<br>32: Isum current detection error (cd0)<br>33: U-phase current detection error (cd1)<br>34: V-phase current detection error (cd2)<br>35: W-phase current detection error (cd3)<br>36: CC current clamp hardware error (Hd0)<br>37: OC (over-current) hardware error (Hd1)<br>38: ov (over-voltage hardware error (Hd2) | 0 | ○ | ○ | ○ | ○ | ○ |

| Pr. | Parameter Name | Setting Range | Default | VF | VFPG | SVC | FOCPG | FOCPM |
|---|---|---|---|---|---|---|---|---|
| | | 39: GFF(ground fault) hardware error (Hd3)<br>40: Auto-tuning error on motor’s parameter (AUE)<br>41: Reserved<br>42: PG feedback error (PGF1)<br>43: PG feedback loss (PGF2)<br>44: PG feedback stall (PGF3)<br>45: PG slip error (PGF4)<br>46: Reserved<br>47: Reserved<br>48: Reserved<br>49: External fault input (EF)<br>50: Emergency stop from external terminals (EF1)<br>51: Reserved<br>52: Password error after three attempts (Pcod)<br>53: Reserved<br>54: Illegal communication command (cE01)<br>55: Illegal communication address (cE02)<br>56: Communication data length error (cE03)<br>57: Communication attempts to write to a read-only address (cE04)<br>58: Modbus transmission time-out (cE10)<br>59: Keypad transmission time-out (cP10)<br>60: Brake transistor error (BF)<br>61–63: Reserved<br>64: Mechanical brake feedback error (MBF)<br>65: PGF5 hardware error<br>66: Magnetic contactor error (MCF)<br>67: Output phase loss (MPHL)<br>68: CAN BUS disconnected<br>69–71: Reserved<br>72: Safe torque loss (STL1)<br>73: PGcd hardware error<br>74: PG absolute signal error (PGHL)<br>75: PG Z phase signal loss (PGAF)<br>76: Safe torque output stops (STO)<br>77: Safe torque loss 2 (STL2)<br>78: Safe torque loss 3 (STL3)<br>*The definition of codes #69–#71 has been modified in v1.04. See Chapter 14 for more information. | | | | | | |
| 06-22 | Fault Output Option 1 | 0–65535 (refer to bit table for fault code) | 0 | ○ | ○ | ○ | ○ | ○ |
| 06-23 | Fault Output Option 2 | 0–65535 (refer to bit table for fault code) | 0 | ○ | ○ | ○ | ○ | ○ |
| 06-24 | Fault Output Option 3 | 0–65535 (refer to bit table for fault code) | 0 | ○ | ○ | ○ | ○ | ○ |
| 06-25 | Fault Output Option 4 | 0–65535 (refer to bit table for fault code) | 0 | ○ | ○ | ○ | ○ | ○ |
| 06-26 | PTC (Positive Temperature Coefficient) Detection Action | 0: Warn and keep operation<br>1: Fault and ramp to stop | 0 | ○ | ○ | ○ | ○ | ○ |
| 06-27 | PTC Level | 0.0–100.0% | 50.0 | ○ | ○ | ○ | ○ | ○ |
| 06-28 | PTC Detection Filter Time | 0.00–10.00 sec. | 0.20 | ○ | ○ | ○ | ○ | ○ |

| | Pr. | Parameter Name | Setting Range | Default | VF | VFPG | SVC | FOCPG | FOCPM |
|---|---|---|---|---|---|---|---|---|---|
| | 06-29 | Voltage of Emergency Power | 24.0–375.0 $V_{DC}$<br>48.0–750.0 $V_{DC}$ | 24.0<br>48.0 | ○ | ○ | ○ | ○ | ○ |
| 〃 | 06-30 | Fault Output Setting Method | 0: According to Pr.06-22–Pr.06-25<br>1: According to the binary setting | 0 | ○ | ○ | ○ | ○ | ○ |
| | 06-31 | Phase Loss Detection of Drive Output at Start-up (MPHL) | 0: Disable<br>1: Enable | 1 | ○ | ○ | ○ | ○ | ○ |
| | 06-32 | Accumulated Drive Power-on Time at the First Fault (min.) | 0–65535 | Read only | ○ | ○ | ○ | ○ | |
| | 06-33 | Accumulated Drive Power-on Time at the First Fault (day) | 0–65535 | Read only | ○ | ○ | ○ | ○ | |
| | 06-34 | Accumulated Drive Power-on Time at the Second Fault (min.) | 0–65535 | Read only | ○ | ○ | ○ | ○ | |
| | 06-35 | Accumulated Drive Power-on Time at the Second Fault (day) | 0–65535 | Read only | ○ | ○ | ○ | ○ | |
| | 06-36 | Accumulated Drive Power-on Time at the Third Fault (min.) | 0–65535 | Read only | ○ | ○ | ○ | ○ | |
| | 06-37 | Accumulated Drive Power-on Time at the Third Fault (day) | 0–65535 | Read only | ○ | ○ | ○ | ○ | |
| | 06-38 | Accumulated Drive Power-on Time at the Fourth Fault (min.) | 0–65535 | Read only | ○ | ○ | ○ | ○ | |
| | 06-39 | Accumulated Drive Power-on Time at the Fourth Fault (day) | 0–65535 | Read only | ○ | ○ | ○ | ○ | |
| | 06-40 | Accumulated Drive Power-on Time at the Fifth Fault (min.) | 0–65535 | Read only | ○ | ○ | ○ | ○ | |
| | 06-41 | Accumulated Drive Power-on Time at the Fifth Fault (day) | 0–65535 | Read only | ○ | ○ | ○ | ○ | |
| | 06-42 | Accumulated Drive Power-on Time at the Sixth Fault (min.) | 0–65535 | Read only | ○ | ○ | ○ | ○ | |
| | 06-43 | Accumulated Drive Power-on Time at the Sixth Fault (day) | 0–65535 | Read only | ○ | ○ | ○ | ○ | |
| | 06-44 | (EPS) Emergency Power Mode Operation Speed | 0.00–400.00 Hz | Read only | ○ | ○ | ○ | ○ | ○ |
| 〃 | 06-45 | Fault and Warning Actions | Bit0 = 0: Display Lv fault and coast to stop<br>Bit0 = 1: Display Lv warn and coast to stop<br>Bit1 = 0: Fan lock, fault and coast to stop<br>Bit1 = 1: Fan lock, warn and coast to stop<br>Bit2 = 0: software GFF protection enabled<br>Bit2 = 1: software GFF protection disabled | 0 | ○ | ○ | ○ | ○ | ○ |
| 〃 | 06-46 | (EPS) Emergency Power ON Operation Direction | 0: Run according to the current command<br>1: Run according to the operation direction of power generation mode, and execute the power generation | 0 | ○ | ○ | ○ | ○ | ○ |

| | Pr. | Parameter Name | Setting Range | Default | VF | VFPG | SVC | FOCPG | FOCPM |
|---|---|---|---|---|---|---|---|---|---|
| | | | direction detection when in power generation mode.<br>2: After determining the power generation direction, the host controller sends a running direction command. (When at STOP, the direction of power generation mode (MO = 32) confirms and the direction of power generation mode does not remain.) Execute the power generation direction detection every time.<br>3. After determining the power generation direction, the host controller sends a running direction command. (When at STOP, the direction of power generation mode (MO =32) confirms and the direction of power generation mode remains.) Execute the power generation direction detection one time.<br>4. Run according to the operation direction of power generation mode, and execute the power generation direction detection when in normal mode. | | | | | | |
| 𝓜 | 06-47 | Power Generation Direction Search Time | 0.0–5.0 sec. | 1.0 | ○ | ○ | ○ | ○ | ○ |
| | 06-48 | Power Capacity of Emergency Power (EPS) | 0.0–100.0 kVA | 0.0 | ○ | ○ | ○ | ○ | ○ |
| 𝓜 | 06-49 | STO Latch Selection | 0000h: STO fault latched, resending RUN command is required<br>0001h: STO warning latched, resending RUN command is required<br>0002h: STO fault latched<br>0003h: STO warning unlatched | 0000h | ○ | ○ | ○ | ○ | ○ |
| 𝓜 | 06-50 | MO’s Action when Retrying after Fault | 0: Output<br>1: No output | 0 | ○ | ○ | ○ | ○ | ○ |
| 𝓜 | 06-51 | Number of Times to Retry after Fault | 0–10 | 0 | ○ | ○ | ○ | ○ | ○ |
| 𝓜 | 06-52 | Time Interval between Retries | 0.5–600.0 sec. | 10.0 | ○ | ○ | ○ | ○ | ○ |
| | 06-53 | Frequency Command when the Most Recent Fault Occurred | 0.00–655.35 Hz | Read only | ○ | ○ | ○ | ○ | ○ |
| | 06-54 | Output Frequency when the Most Recent Fault Occurred | 0.00–655.35 Hz | Read only | ○ | ○ | ○ | ○ | ○ |
| | 06-55 | Output Current when the Most Recent Fault Occurred | 0.00–655.35 Amps | Read only | ○ | ○ | ○ | ○ | ○ |
| | 06-56 | Motor Frequency when the Most Recent Fault Occurred | 0.00–655.35 Hz | Read only | ○ | ○ | ○ | ○ | ○ |
| | 06-57 | Output Voltage when the Most Recent Fault | 0.0–6553.5 V | Read only | ○ | ○ | ○ | ○ | ○ |

| | Pr. | Parameter Name | Setting Range | Default | VF | VFPG | SVC | FOCPG | FOCPM |
|---|---|---|---|---|---|---|---|---|---|
| | | Occurred | | | | | | | |
| | 06-58 | DC Bus Voltage when the Most Recent Fault Occurred | 0.0–6553.5 V | Read only | ○ | ○ | ○ | ○ | ○ |
| | 06-59 | Output Power when the Most Recent Fault Occurred | 0.0–6553.5 kW | Read only | ○ | ○ | ○ | ○ | ○ |
| | 06-60 | Output Torque when the Most Recent Fault Occurred | 0.00–655.35% | Read only | ○ | ○ | ○ | ○ | ○ |
| | 06-61 | IGBT Temperature when the Most Recent Fault Occurred | -3276.8–3276.7ºC | Read only | ○ | ○ | ○ | ○ | ○ |
| | 06-62 | Multi-input Terminals Status when the Most Recent Fault Occurred | 0000h–FFFFh | Read only | ○ | ○ | ○ | ○ | ○ |
| | 06-63 | Multi-output Terminals status when the Most Recent Fault Occurred | 0000h–FFFFh | Read only | ○ | ○ | ○ | ○ | ○ |
| | 06-64 | Motor Drive Status when the Most Recent Fault Occurred | 0000h–FFFFh | Read only | ○ | ○ | ○ | ○ | ○ |
| 〆 | 06-68 | Power Factor Angle Level for Power Generation Direction | 0.0–150.0° | 70.0 | ○ | ○ | ○ | ○ | ○ |
| | 06-69 | Reference Level for Power Factor Angle during Operation | -200.0–200.0° | Read only | ○ | ○ | ○ | ○ | ○ |
| | 06-70 | Power Generation Direction | 0: FWD<br>1: REV | Read only | ○ | ○ | ○ | ○ | ○ |
| 〆 | 06-71 | UPS Output Delay Time | 0.0–10.0 sec. | 1.0 | ○ | ○ | ○ | ○ | ○ |
| | 06-72 | UPS Stops Output Delay Time | 0.0–60.0 sec. | 3.0 | ○ | ○ | ○ | ○ | ○ |
| | 06-73 | Permanent Operation Direction Count (H) | 0–60000 | Read only | ○ | ○ | ○ | ○ | ○ |
| | 06-74 | Permanent Operation Direction Count (L) | 0–9999 | Read only | ○ | ○ | ○ | ○ | ○ |
| | 06-75 | Single Operation Direction Count (H) | 0–20 | Read only | ○ | ○ | ○ | ○ | ○ |
| | 06-76 | Single Operation Direction Count (L) | 0–9999 | Read only | ○ | ○ | ○ | ○ | ○ |
| | 06-77 | Number of Times for Single Operation Reset | 0–100 | Read only | ○ | ○ | ○ | ○ | ○ |
| | 06-78 | Number of Times for Operation Direction | 0.00–200.00 k | 2.00 | ○ | ○ | ○ | ○ | ○ |
| | 06-79 | Function Selection for Operation Times | 0–2 | 0 | ○ | ○ | ○ | ○ | ○ |
| | 06-80 | Output Frequency when Fault 2 Occurred | 0.00–655.35 Hz | Read only | ○ | ○ | ○ | ○ | ○ |
| | 06-81 | DC Bus Voltage when Fault 2 Occurred | 0.0–6553.5 V | Read only | ○ | ○ | ○ | ○ | ○ |
| | 06-82 | Output Current when Fault 2 Occurred | 0.00–655.35 Amps | Read only | ○ | ○ | ○ | ○ | ○ |
| | 06-83 | IGBT Temperature when Fault 2 Occurred | -3276.8–3276.7 ºC | Read only | ○ | ○ | ○ | ○ | ○ |
| | 06-84 | Output Frequency when Fault 3 Occurred | 0.00–655.35 Hz | Read only | ○ | ○ | ○ | ○ | ○ |

| Pr. | Parameter Name | Setting Range | Default | VF | VFPG | SVC | FOCPG | FOCPM |
|---|---|---|---|---|---|---|---|---|
| 06-85 | DC Bus Voltage when Fault 3 Occurred | 0.0–6553.5 V | Read only | ○ | ○ | ○ | ○ | ○ |
| 06-86 | Output Current when Fault 3 Occurred | 0.00–655.35 Amps | Read only | ○ | ○ | ○ | ○ | ○ |
| 06-87 | IGBT Temperature when Fault 3 Occurred | -3276.8–3276.7 ºC | Read only | ○ | ○ | ○ | ○ | ○ |
| 06-88 | Output Frequency when Fault 4 Occurred | 0.00–655.35 Hz | Read only | ○ | ○ | ○ | ○ | ○ |
| 06-89 | DC Bus Voltage when Fault 4 Occurred | 0.0–6553.5 V | Read only | ○ | ○ | ○ | ○ | ○ |
| 06-90 | Output Current when Fault 4 Occurred | 0.00–655.35 Amps | Read only | ○ | ○ | ○ | ○ | ○ |
| 06-91 | IGBT Temperature when Fault 4 Occurred | -3276.8–3276.7 ºC | Read only | ○ | ○ | ○ | ○ | ○ |
| 06-92 | Output Frequency when Fault 5 Occurred | 0.00–655.35 Hz | Read only | ○ | ○ | ○ | ○ | ○ |
| 06-93 | DC Bus Voltage when Fault 5 Occurred | 0.0–6553.5 V | Read only | ○ | ○ | ○ | ○ | ○ |
| 06-94 | Output Current when Fault 5 Occurred | 0.00–655.35 Amps | Read only | ○ | ○ | ○ | ○ | ○ |
| 06-95 | IGBT Temperature when Fault 5 Occurred | -3276.8–3276.7 ºC | Read only | ○ | ○ | ○ | ○ | ○ |
| 06-96 | Output Frequency when Fault 6 Occurred | 0.00–655.35 Hz | Read only | ○ | ○ | ○ | ○ | ○ |
| 06-97 | DC Bus Voltage when Fault 6 Occurred | 0.0–6553.5 V | Read only | ○ | ○ | ○ | ○ | ○ |
| 06-98 | Output Current when Fault 6 Occurred | 0.00–655.35 Amps | Read only | ○ | ○ | ○ | ○ | ○ |
| 06-99 | IGBT Temperature when Fault 6 Occurred | -3276.8–3276.7 ºC | Read only | ○ | ○ | ○ | ○ | ○ |

# 07 Special Parameters

✎: You can set this parameter during operation.

| | Pr. | Parameter Name | Setting Range | Default | VF | VFPG | SVC | FOCPG | FOCPM |
|---|---|---|---|---|---|---|---|---|---|
| ✎ | 07-00 | Brake Transistor Level | 230V series: 350.0–450.0 $V_{DC}$<br>460V series: 700.0–900.0 $V_{DC}$ | 380.0<br>760.0 | ○ | ○ | ○ | ○ | ○ |
| | 07-01 | Brake Transistor Hysteresis Voltage | 0.0–100.0 V | 0.0 | ○ | ○ | ○ | ○ | ○ |
| ✎ | 07-02 | DC Brake Current Level at Start-up | 0–100% (motor drive rated current) | 0 | ○ | ○ | ○ | | |
| ✎ | 07-03 | DC Brake Activation Time | 0.0–60.0 sec. | 0.7 | ○ | ○ | ○ | ○ | ○ |
| ✎ | 07-04 | DC Brake Stopping Time | 0.0–60.0 sec. | 0.7 | ○ | ○ | ○ | ○ | ○ |
| ✎ | 07-05 | Start-point for DC Brake | 0.00–400.00 Hz | 0.00 | ○ | ○ | ○ | ○ | |
| ✎ | 07-06 | DC Brake Proportional Gain | 1–500 | 50 | ○ | ○ | ○ | | |
| ✎ | 07-07 | Dwell Time at Acceleration | 0.00–600.00 sec. | 0.00 | ○ | ○ | ○ | ○ | ○ |
| ✎ | 07-08 | Dwell Frequency at Acceleration. | 0.00–400.00 Hz | 0.00 | ○ | ○ | ○ | ○ | ○ |
| ✎ | 07-09 | Dwell Time at Deceleration. | 0.00–600.00 sec. | 0.00 | ○ | ○ | ○ | ○ | ○ |
| ✎ | 07-10 | Dwell Frequency at Deceleration. | 0.00–400.00 Hz | 0.00 | ○ | ○ | ○ | ○ | ○ |
| ✎ | 07-11 | Cooling Fan Control | 0: Cooling fan always ON.<br>1: One minute after AC motor drive stops, cooling fan is OFF.<br>2: AC motor drive runs and cooling fan is ON; AC motor drive stops and cooling fan is OFF.<br>3: Cooling fan is ON to run when preliminary IGBT temperature (℃) reached.<br>4: Cooling fan is always OFF. | 2 | ○ | ○ | ○ | ○ | ○ |
| ✎ | 07-12 | Torque command | -150.0–150.0% (Pr.07-14 setting = 100%) | 0.0 | | | | | |
| ✎ | 07-13 | Torque Command Source | 0: Digital keypad (KPC-CC01)<br>1: RS-485 serial communication<br>2: Analog signal (Pr.03-00) | 2 | | | | | |
| ✎ | 07-14 | Maximum Torque Command | 0–300% (motor drive rated torque) | 100 | ○ | ○ | ○ | ○ | ○ |
| ✎ | 07-15 | Torque Command Filter Time | 0.000–1.000 sec. | 0.000 | | | | | |
| | 07-16 | Speed Limit | 0: Settings in Pr.07-17 and Pr.07-18<br>1: Frequency command source (Pr.00-14) | 0 | | | | | |
| ✎ | 07-17 | Torque Mode +Speed Limit | 0–120% | 10 | | | | | |
| ✎ | 07-18 | Torque Mode-Speed Limit | 0–120% | 10 | | | | | |
| ✎ | 07-19 | Torque Offset Source | 0: Disable<br>1: Analog input (Pr.03-00)<br>2: Torque offset setting (Pr.07-20)<br>3: Control through external terminals (by Pr.07-21–Pr.07-23) | 0 | | | ○ | ○ | ○ |
| ✎ | 07-20 | Torque Offset Setting | 0.0–100.0% (motor drive rated torque) | 0.0 | | | ○ | ○ | ○ |
| ✎ | 07-21 | High Torque Offset | 0.0–100.0% (motor drive rated torque) | 30.0 | | | ○ | ○ | ○ |
| ✎ | 07-22 | Middle Torque Offset | 0.0–100.0% (motor drive rated torque) | 20.0 | | | ○ | ○ | ○ |

| | Pr. | Parameter Name | Setting Range | Default | VF | VFPG | SVC | FOCPG | FOCPM |
|---|---|---|---|---|---|---|---|---|---|
| ✓ | 07-23 | Low Torque Offset | 0.0–100.0% (motor drive rated torque) | 10.0 | | | ○ | ○ | ○ |
| ✓ | 07-24 | Forward Motor Torque Limit | 0–300% (motor drive rated torque) | 200 | | | | ○ | ○ |
| ✓ | 07-25 | Forward Regenerative Torque Limit | 0–300% (motor drive rated torque) | 200 | | | | ○ | ○ |
| ✓ | 07-26 | Reverse Motor Torque Limit | 0–300% (motor drive rated torque) | 200 | | | | ○ | ○ |
| ✓ | 07-27 | Reverse Regenerative Torque Limit | 0–300% (motor drive rated torque) | 200 | | | | ○ | ○ |
| ✓ | 07-28 | Emergency Stop (EF) & Forced Stop | 0: Coast to stop<br>1: According to deceleration time 1<br>2: According to deceleration time 2<br>3: According to deceleration time 3<br>4: According to deceleration time 4<br>5: According to Pr.01-31 | 0 | ○ | ○ | ○ | ○ | ○ |
| ✓ | 07-29 | Time for Decreasing Torque at Stop | 0.000–5.000 sec. | 0.000 | | | | ○ | ○ |
| ✓ | 07-30 | DC Brake Current Level at Stop | 0–100% (motor drive rated current) | 0 | ○ | ○ | ○ | | |

# 08 PM Parameters

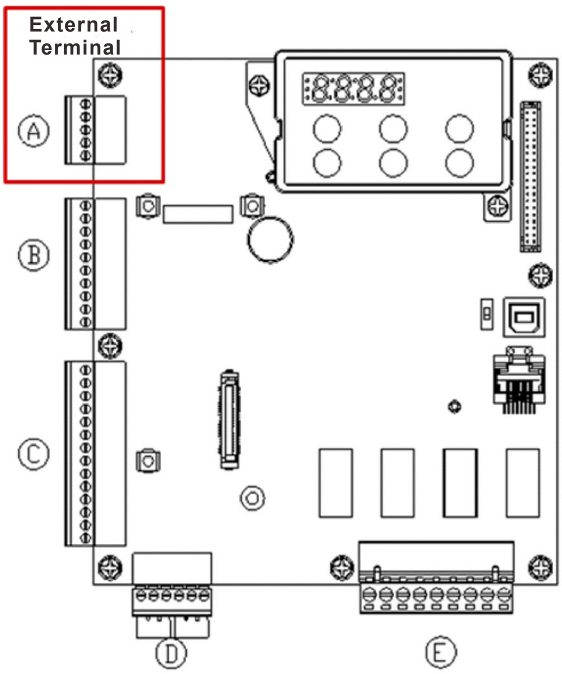
✓: You can set this parameter during operation.

| Pr. | Parameter Name | Setting Range | Default | VF | VFPG | SVC | FOCPG | FOCPM |
|---|---|---|---|---|---|---|---|---|
| 08-00 | Motor Auto-tuning | 0: No function<br>1: Only for an unloaded motor, auto-measures the angle between magnetic pole and PG origin (Pr.08-09)<br>2: For PM parameters (suggested to lock the brake)<br>3: Auto-measures the angle between magnetic pole and PG origin (Pr.08-09) | 0 | | | | | ○ |
| 08-01 | Motor Rated Current | (40–120%) * Pr.00-01 Amps | #.## | | | | | ○ |
| 08-02 | Motor Rated Power | 0.00–655.35 kW | #.## | | | | | ○ |
| 08-03 | Motor Rated Speed (rpm) | 0–65535 rpm | 1710 | | | | | ○ |
| 08-04 | Number of Motor Poles | 2–96 | 4 | | | | | ○ |
| 08-05 | Motor Rs | 0.000–65.535 Ω | 0.000 | | | | | ○ |
| 08-06 | Motor Ld | 0.0–6553.5 mH | 0.0 | | | | | ○ |
| 08-07 | Motor Lq | 0.0–6553.5 mH | 0.0 | | | | | ○ |
| 08-08 | Back Electromotive Force | 0.0–6553.5 V rms | 0.0 | | | | | ○ |
| 08-09 | Angle between Magnetic Pole and PG Origin | 0.0–360.0° | 360.0 | | | | | ○ |
| 08-10 | Magnetic Pole Reorientation | 0: Disable<br>1: Enable | 0 | | | | | ○ |

# 09 Communication Parameters

🗲: You can set this parameter during operation.

| | Pr. | Parameter Name | Setting Range | Default | VF | VFPG | SVC | FOCPG | FOCPM |
|---|---|---|---|---|---|---|---|---|---|
| 🗲 | 09-00 | Communication Address | 1–254 | 1 | | | | | |
| 🗲 | 09-01 | Transmission Speed | 4.8–115.2 kbps | 19.2 | ○ | ○ | ○ | ○ | ○ |
| 🗲 | 09-02 | Transmission Fault Treatment | 0: Warn and keep operation<br>1: Warn and ramp to stop<br>2: Reserved<br>3: No action and no display | 3 | ○ | ○ | ○ | ○ | ○ |
| 🗲 | 09-03 | Time-out Detection | 0.0–100.0 sec.<br>0.0: Disable | 0.0 | ○ | ○ | ○ | ○ | ○ |
| 🗲 | 09-04 | Communication Protocol | 0: 7N1 (ASCII)<br>1: 7N2 (ASCII)<br>2: 7E1 (ASCII)<br>3: 7O1 (ASCII)<br>4: 7E2 (ASCII)<br>5: 7O2 (ASCII)<br>6: 8N1 (ASCII)<br>7: 8N2 (ASCII)<br>8: 8E1 (ASCII)<br>9: 8O1 (ASCII)<br>10: 8E2 (ASCII)<br>11: 8O2 (ASCII)<br>12: 8N1 (RTU)<br>13: 8N2 (RTU)<br>14: 8E1 (RTU)<br>15: 8O1 (RTU)<br>16: 8E2 (RTU)<br>17: 8O2 (RTU) | 13 | ○ | ○ | ○ | ○ | ○ |
| 🗲 | 09-05 | Response Delay Time | 0.0–200.0 ms | 2.0 | ○ | ○ | ○ | ○ | ○ |
| | 09-06 – 09-13 | Direct docking mode only ◆ | | - | | | | | |
| | 09-14 | PDO Transmission Interval | 0–65535 ms | 0 | ○ | ○ | ○ | ○ | ○ |



# 10 Feedback Control Parameters

✎: You can set this parameter during operation.

| Pr. | Parameter Name | Setting Range | Default | VF | VFPG | SVC | FOCPG | FOCPM |
|---|---|---|---|---|---|---|---|---|
| 10-00 | Selection of Encoder | 0: Disable<br>1: ABZ<br>2: ABZ+Hall<br>3: SIN/COS+Sinusoidal<br>4: SIN/COS+Endat<br>5: SIN/COS<br>6: SIN/COS+Hiperface | 0 | | ○ | | ○ | ○ |
| 10-01 | Encoder PPR | 1–25000 | 2048 | | ○ | | ○ | ○ |
| 10-02 | Encoder Input Type Setting | 0: Disable<br>1: Phase A leads in a forward run command and phase B leads in a reverse run command<br>2: Phase B leads in a forward run command and phase A leads in a reverse run command<br>3: Phase A is a pulse input and phase B is a direction input (low input = reverse direction, high input = forward direction)<br>4: Phase A is a pulse input and phase B is a direction input (low input = forward direction, high input = reverse direction)<br>5: Single-phase input | 0 | | ○ | | ○ | ○ |
| ✎ 10-03 | Encoder Feedback Signal Fault Action (PGF1, PGF2) | 0: Warn and keep operation<br>1: Fault and ramp to stop<br>2: Fault and stop operation | 2 | | ○ | | ○ | ○ |
| ✎ 10-04 | Encoder Feedback Signal Fault Detection Time | 0.0–10.0 sec. | 1.0 | | ○ | | ○ | ○ |
| ✎ 10-05 | Encoder Stall Level (PGF3) | 0–120% (0: Disable) | 115 | | ○ | ○ | ○ | ○ |
| ✎ 10-06 | Encoder Stall Detection Time | 0.0–2.0 sec. | 0.1 | | ○ | ○ | ○ | ○ |
| ✎ 10-07 | Encoder Slip Range (PGF4) | 0–50% (0: Disable) | 50 | | ○ | ○ | ○ | ○ |
| ✎ 10-08 | Encoder Slip Detection Time | 0.0–10.0 sec. | 0.5 | | ○ | ○ | ○ | ○ |
| ✎ 10-09 | Encoder Stall and Slip Error Action | 0: Warn and keep operation<br>1: Fault and ramp to stop<br>2: Fault and stop operation | 2 | | ○ | ○ | ○ | ○ |
| 10-10 | Mode Selection for UVW Input | 0: Z signal is at the falling edge of U-phase<br>1: Z signal is at the rising edge of U-phase | 0 | | ○ | | ○ | ○ |
| ✎ 10-11 | ASR (Auto Speed Regulation) Control (P) of Zero Speed | 0.0–1000.0% | 100.0 | ○ | ○ | ○ | ○ | ○ |
| ✎ 10-12 | ASR (Auto Speed Regulation) Control (I) of Zero Speed | 0.000–10.000 sec. | 0.100 | ○ | ○ | ○ | ○ | ○ |
| ✎ 10-13 | ASR (Auto Speed Regulation) Control (P) 1 | 0.0–1000.0% | 100.0 | ○ | ○ | ○ | ○ | ○ |
| ✎ 10-14 | ASR (Auto Speed Regulation) Control (I) 1 | 0.000–10.000 sec. | 0.100 | ○ | ○ | ○ | ○ | ○ |
| ✎ 10-15 | ASR (Auto Speed | 0.0–1000.0% | 100.0 | ○ | ○ | ○ | ○ | ○ |

| | Pr. | Parameter Name | Setting Range | Default | VF | VFPG | SVC | FOCPG | FOCPM |
|---|---|---|---|---|---|---|---|---|---|
| | | Regulation) Control (P) 2 | | | | | | | |
| ✓ | 10-16 | ASR (Auto Speed Regulation) Control (I) 2 | 0.000–10.000 sec. | 0.100 | ○ | ○ | ○ | ○ | ○ |
| ✓ | 10-17 | ASR 1/ ASR2 Switch Frequency | 0.00–400.00 Hz (0: Disable) | 7.00 | ○ | ○ | ○ | ○ | ○ |
| ✓ | 10-18 | ASR Primary Low Pass Filter Gain | 0.001–0.350 sec. | 0.008 | ○ | ○ | ○ | ○ | ○ |
| ✓ | 10-19 | Zero Speed Position Control Gain (P) | 0.00–655.00% | 80.00 | | | | | ○ |
| ✓ | 10-20 | Low Speed ASR Width Adjustment | 0.00–400.00 Hz | 5.00 | | ○ | | ○ | ○ |
| ✓ | 10-21 | High Speed ASR Width Adjustment | 0.00–400.00 Hz | 5.00 | | ○ | | ○ | ○ |
| ✓ | 10-22 | Zero Speed Position Control Holding Time | 0.001–65.535 sec. | 0.250 | | | | | ○ |
| ✓ | 10-23 | Zero Speed Position Control Low Pass Filter Time | 0.001–65.535 sec. | 0.004 | | | | | ○ |
| ✓ | 10-24 | Zero Speed Position Control Activation Mode Selection | 0: After the brake release set in Pr.02-29<br>1: After the brake signal input (Pr.02-01–Pr.02-08 is set to 42) | 0 | | | | | ○ |
| ✓ | 10-25 | Elevator Leveling (Zero Speed Gain P) | 0.0–1000.0% | 100.0 | ○ | ○ | ○ | ○ | ○ |
| ✓ | 10-26 | Elevator Leveling (Zero Speed Integral I) | 0.000–10.000 sec. | 0.100 | ○ | ○ | ○ | ○ | ○ |
| ✓ | 10-27 | Elevator Starting (Zero Speed Gain P) | 0.0–1000.0% | 100.0 | ○ | ○ | ○ | ○ | ○ |
| ✓ | 10-28 | Elevator Starting (Zero Speed Integral I) | 0.000–10.000 sec. | 0.100 | ○ | ○ | ○ | ○ | ○ |
| ✓ | 10-29 | PG Card Frequency Division Output | 0–31 | 0 | | ○ | | ○ | ○ |
| ✓ | 10-30 | PG Card Frequency Division Output Type | 0000h–0008h | 0000h | | ○ | | ○ | ○ |
| | 10-31 | PG Card C+/C- | 0000h–0001h | 0000h | | | | | |
| ✓ | 10-32 | Over-acceleration Level | 0.0–20.0 m/s² | 0.0 | ○ | ○ | ○ | ○ | ○ |
| | 10-33 | Over-acceleration Detection Time | 0.01–5.00 sec. | 0.05 | ○ | ○ | ○ | ○ | ○ |
| | 10-34 | Over-acceleration Detection Selection | 0: Always detect<br>1: Detect during operation | 0 | ○ | ○ | ○ | ○ | ○ |

# 11 Advanced Parameters

〆: You can set this parameter during operation.

| Pr. | Parameter Name | Setting Range | Default | VF | VFPG | SVC | FOCPG | FOCPM |
|---|---|---|---|---|---|---|---|---|
| 11-00 | System Control | Bit 0 = 0: No function<br>Bit 0 = 1: ASR auto-tuning; PDFF enabled; speed bandwidth control enabled<br>Bit 7 = 0: No function<br>Bit 7 = 1: Zero speed position control is enabled<br>Bit 9 = 0: Dynamic PG origin auto-tuning with load (support by PGHSD-1)<br>Bit 9 = 1: Static PG origin auto-tuning with load by enabling PGHSD-1<br>Bit 15 = 0: Detect the position of magnetic pole again when power is applied<br>Bit 15 = 1: Start from the magnetic pole position of the previous power failure when power is applied | 0 | | | | ○ | ○ |
| 〆 11-01 | Elevator Speed | 0.10–4.00 m/s | 1.00 | | | | ○ | ○ |
| 〆 11-02 | Traction Sheave Diameter | 100–2000 mm | 400 | | | | ○ | ○ |
| 〆 11-03 | Gear Ratio | 1.00–100.00 | 1.00 | | | | ○ | ○ |
| 〆 11-04 | Suspension Ratio | 0 = 1:1<br>1 = 2:1<br>2 = 4:1<br>3 = 8:1 | 1 | | | | ○ | ○ |
| 〆 11-05 | Mechanical Inertial Ratio | 1–300% | 40 | | | | ○ | ○ |
| 〆 11-06 | Zero speed Bandwidth | 1–40 Hz | 10 | | | | ○ | ○ |
| 〆 11-07 | Low speed Bandwidth | 1–40 Hz | 10 | | | | ○ | ○ |
| 〆 11-08 | High speed Bandwidth | 1–40 Hz | 10 | | | | ○ | ○ |
| 〆 11-09 | PDFF Gain Value | 0–200% | 30 | | | | ○ | ○ |
| 〆 11-10 | Speed Feed Forward Gain | 0–500 | 0 | | | | ○ | ○ |
| 〆 11-11 | Notch Filter Depth | 0–20 db | 0 | | | | ○ | ○ |
| 〆 11-12 | Notch Filter Frequency | 0.00–200.00 Hz | 0.00 | | | | ○ | ○ |
| 〆 11-13 | Keypad Display for Low Pass Filter Time | 0.001–65.535 sec. | 0.500 | ○ | ○ | ○ | ○ | ○ |
| 〆 11-14 | Motor Current at Acceleration | 50–200% | 150 | | | | | ○ |
| 〆 11-15 | Carriage Acceleration | 0.20–2.00 m/s$^2$ | 0.75 | | | | | ○ |
| 11-16 | Reserved | | | | | | | |
| 11-17 | Reserved | | | | | | | |
| 11-18 | Reserved | | | | | | | |
| 〆 11-19 | Zero Speed Parking Bandwidth | 1–40 Hz | 10 | | | | ○ | ○ |
| 〆 11-20 | PWM Mode | 0: DPWM mode (Digital Pulse-Width Modulation Mode)<br>1: SVPWM mode (Space-Vector Pulse Width Modulation Mode) | 0 | | | | | |

# 12 User-defined Parameters

〆: You can set this parameter during operation.

User-defined Parameters include parameters from Group 00–11.

| | Pr. | Parameter Name | Setting Range | Default | VF | VFPG | SVC | FOCPG | FOCPM |
|---|---|---|---|---|---|---|---|---|---|
| 〆 | 12-00 | User-defined Parameter 1 | 0–9999 | 0616 | ○ | ○ | ○ | ○ | ○ |
| 〆 | 12-01 | User-defined Parameter 2 | 0–9999 | 0632 | ○ | ○ | ○ | ○ | ○ |
| 〆 | 12-02 | User-defined Parameter 3 | 0–9999 | 0633 | ○ | ○ | ○ | ○ | ○ |
| 〆 | 12-03 | User-defined Parameter 4 | 0–9999 | 0653 | ○ | ○ | ○ | ○ | ○ |
| 〆 | 12-04 | User-defined Parameter 5 | 0–9999 | 0654 | ○ | ○ | ○ | ○ | ○ |
| 〆 | 12-05 | User-defined Parameter 6 | 0–9999 | 0655 | ○ | ○ | ○ | ○ | ○ |
| 〆 | 12-06 | User-defined Parameter 7 | 0–9999 | 0656 | ○ | ○ | ○ | ○ | ○ |
| 〆 | 12-07 | User-defined Parameter 8 | 0–9999 | 0657 | ○ | ○ | ○ | ○ | ○ |
| 〆 | 12-08 | User-defined Parameter 9 | 0–9999 | 0658 | ○ | ○ | ○ | ○ | ○ |
| 〆 | 12-09 | User-defined Parameter 10 | 0–9999 | 0659 | ○ | ○ | ○ | ○ | ○ |
| 〆 | 12-10 | User-defined Parameter 11 | 0–9999 | 0660 | ○ | ○ | ○ | ○ | ○ |
| 〆 | 12-11 | User-defined Parameter 12 | 0–9999 | 0661 | ○ | ○ | ○ | ○ | ○ |
| 〆 | 12-12 | User-defined Parameter 13 | 0–9999 | 0662 | ○ | ○ | ○ | ○ | ○ |
| 〆 | 12-13 | User-defined Parameter 14 | 0–9999 | 0663 | ○ | ○ | ○ | ○ | ○ |
| 〆 | 12-14 | User-defined Parameter 15 | 0–9999 | 0664 | ○ | ○ | ○ | ○ | ○ |
| 〆 | 12-15 | User-defined Parameter 16 | 0–9999 | 0617 | ○ | ○ | ○ | ○ | ○ |
| 〆 | 12-16 | User-defined Parameter 17 | 0–9999 | 0634 | ○ | ○ | ○ | ○ | ○ |
| 〆 | 12-17 | User-defined Parameter 18 | 0–9999 | 0635 | ○ | ○ | ○ | ○ | ○ |
| 〆 | 12-18 | User-defined Parameter 19 | 0–9999 | 0618 | ○ | ○ | ○ | ○ | ○ |
| 〆 | 12-19 | User-defined Parameter 20 | 0–9999 | 0636 | ○ | ○ | ○ | ○ | ○ |
| 〆 | 12-20 | User-defined Parameter 21 | 0–9999 | 0637 | ○ | ○ | ○ | ○ | ○ |
| 〆 | 12-21 | User-defined Parameter 22 | 0–9999 | 0619 | ○ | ○ | ○ | ○ | ○ |
| 〆 | 12-22 | User-defined Parameter 23 | 0–9999 | 0638 | ○ | ○ | ○ | ○ | ○ |
| 〆 | 12-23 | User-defined Parameter 24 | 0–9999 | 0639 | ○ | ○ | ○ | ○ | ○ |
| 〆 | 12-24 | User-defined Parameter 25 | 0–9999 | 0620 | ○ | ○ | ○ | ○ | ○ |
| 〆 | 12-25 | User-defined Parameter 26 | 0–9999 | 0640 | ○ | ○ | ○ | ○ | ○ |
| 〆 | 12-26 | User-defined Parameter 27 | 0–9999 | 0641 | ○ | ○ | ○ | ○ | ○ |
| 〆 | 12-27 | User-defined Parameter 28 | 0–9999 | 0621 | ○ | ○ | ○ | ○ | ○ |
| 〆 | 12-28 | User-defined Parameter 29 | 0–9999 | 0642 | ○ | ○ | ○ | ○ | ○ |
| 〆 | 12-29 | User-defined Parameter 30 | 0–9999 | 0643 | ○ | ○ | ○ | ○ | ○ |
| 〆 | 12-30 | User-defined Parameter 31 | 0–9999 | 0 | ○ | ○ | ○ | ○ | ○ |
| 〆 | 12-31 | User-defined Parameter 32 | 0–9999 | 1561 | ○ | ○ | ○ | ○ | ○ |

# 13 View User-defined Parameters

〆: You can set this parameter during operation.

| Pr. | Parameter Name<br>Parameter Group 12 Setting Values | Display Address<br>Pr.00-00–Pr.11-20 | Default | VF | VFPG | SVC | FOCPG | FOCPM |
|---|---|---|---|---|---|---|---|---|
| 13-00 | Present Fault Record | 0616 | - | ○ | ○ | ○ | ○ | ○ |
| 13-01 | Motor Operation at Present Fault Time (min.) | 0632 | - | ○ | ○ | ○ | ○ | ○ |
| 13-02 | Motor Operation at Present Fault Time (day) | 0633 | - | ○ | ○ | ○ | ○ | ○ |
| 13-03 | Frequency Command at Present Fault | 0653 | - | ○ | ○ | ○ | ○ | ○ |
| 13-04 | Output Frequency at Preset Fault | 0654 | - | ○ | ○ | ○ | ○ | ○ |
| 13-05 | Output Current at Present Fault | 0655 | - | ○ | ○ | ○ | ○ | ○ |
| 13-06 | Motor Frequency at Present Fault | 0656 | - | ○ | ○ | ○ | ○ | ○ |
| 13-07 | Output Voltage at Present Fault | 0657 | - | ○ | ○ | ○ | ○ | ○ |
| 13-08 | DC Bus Voltage at Present Fault | 0658 | - | ○ | ○ | ○ | ○ | ○ |
| 13-09 | Output Power at Present Fault | 0659 | - | ○ | ○ | ○ | ○ | ○ |
| 13-10 | Output Torque at Present Fault | 0660 | - | ○ | ○ | ○ | ○ | ○ |
| 13-11 | Power Module IGBT Temperature at Present Fault | 0661 | - | ○ | ○ | ○ | ○ | ○ |
| 13-12 | Multi-function Terminal Input Status at Present Fault | 0662 | - | ○ | ○ | ○ | ○ | ○ |
| 13-13 | Multi-function Terminal Output Status at Present Fault | 0663 | - | ○ | ○ | ○ | ○ | ○ |
| 13-14 | Drive Status at Present Fault | 0664 | - | ○ | ○ | ○ | ○ | ○ |
| 13-15 | Second Most Recent Fault Record | 0617 | - | ○ | ○ | ○ | ○ | ○ |
| 13-16 | Motor Operation at Second Most Recent Fault Time (min.) | 0634 | - | ○ | ○ | ○ | ○ | ○ |
| 13-17 | Motor Operation at Second Most Recent Fault Time (day) | 0635 | - | ○ | ○ | ○ | ○ | ○ |
| 13-18 | Third Most Recent Fault Record | 0618 | - | ○ | ○ | ○ | ○ | ○ |
| 13-19 | Motor Operation at Third Most Recent Fault Time (min.) | 0636 | - | ○ | ○ | ○ | ○ | ○ |
| 13-20 | Motor Operation at Third Most Recent Fault Time (day) | 0637 | - | ○ | ○ | ○ | ○ | ○ |
| 13-21 | Fourth Most Recent Fault Record | 0619 | - | ○ | ○ | ○ | ○ | ○ |
| 13-22 | Motor Operation at Fourth Most Recent Fault Time (min.) | 0638 | - | ○ | ○ | ○ | ○ | ○ |
| 13-23 | Motor Operation at Fourth Most Recent Fault Time (day) | 0639 | - | ○ | ○ | ○ | ○ | ○ |
| 13-24 | Fifth Most Recent Fault Record | 0620 | - | ○ | ○ | ○ | ○ | ○ |
| 13-25 | Motor Operation at Fifth Most Recent Fault Time (min.) | 0640 | - | ○ | ○ | ○ | ○ | ○ |
| 13-26 | Motor Operation at Fifth Most Recent Fault Time (day) | 0641 | - | ○ | ○ | ○ | ○ | ○ |
| 13-27 | Sixth Most Recent Fault Record | 0621 | - | ○ | ○ | ○ | ○ | ○ |
| 13-28 | Motor Operation at Sixth Most Recent Fault Time (min.) | 0642 | - | ○ | ○ | ○ | ○ | ○ |
| 13-29 | Motor Operation at Sixth Most Recent Fault Time (day) | 0643 | - | ○ | ○ | ○ | ○ | ○ |
| 13-30 | AC Motor Drive Identity Code | 0 | - | ○ | ○ | ○ | ○ | ○ |
| 13-31 | Date Code Y.WKD | 1561 | Read only | ○ | ○ | ○ | ○ | ○ |

# Chapter 12 Descriptions of Parameter Settings

## 00 Drive Parameters

✗: You can set this parameter during operation.

**00-00** AC Motor Drive Identity Code

Control Mode **VF** **VFPG** **SVC** **FOCPG** **FOCPM** Default: ##

Settings Read Only

**00-01** AC Motor Drive Rated Current Display

Control Mode **VF** **VFPG** **SVC** **FOCPG** **FOCPM** Default: ##

Settings Read Only (Display by model)

- Pr.00-00 displays the AC motor drive identity code. The capacity, rated current, rated voltage and the maximum carrier frequency relate to the identity code. Use the following table to check how the AC motor drive rated current, rated voltage, and maximum carrier frequency correspond to the identity code.
- Pr.00-01 displays the AC motor drive rated current. By reading this parameter, you can check if the AC motor drive is correct.

| **230V series** | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Power (kW) | 2.2* | 3.7* | 4.0 | 5.5 | 7.5 | 11 | 15 | 18.5 | 22 | 30 | 37 |
| Horsepower (HP) | 3 | 5 | 5 | 7.5 | 10 | 15 | 20 | 25 | 30 | 40 | 50 |
| Motor Drive ID Code (Pr.00-00) | 108 | 110 | 10 | 12 | 14 | 16 | 18 | 20 | 22 | 24 | 26 |
| Rated Output Current for General Purposes (A) | 12.0 | 17.0 | 20 | 24 | 30 | 45 | 58 | 77 | 87 | 132 | 161 |
| Range of the Carrier Frequency | 2–15 kHz | | | | | | | | | 2–9 kHz | |
| Rated Max. Output Carrier Frequency | 8 kHz | | | 10 kHz | | | 8 kHz | | | 6 kHz | |

*VFD022ED21S and VFD037ED21S are single-phase models.

| **460V series** | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Power (kW) | 4.0 | 5.5 | 7.5 | 11 | 15 | 18.5 | 22 | 30 | 37 | 45 | 55 | 75 |
| Horsepower (HP) | 5 | 7.5 | 10 | 15 | 20 | 25 | 30 | 40 | 50 | 60 | 75 | 100 |
| Motor Drive ID Code (Pr.00-00) | 11 | 13 | 15 | 17 | 19 | 21 | 23 | 25 | 27 | 29 | 31 | 33 |
| Rated Output Current for General Purposes (A) | 11.5 | 13 | 17 | 23 | 30 | 38 | 45 | 58 | 80 | 100 | 128 | 165 |
| Range of the Carrier Frequency | 2–15 kHz | | | | | | | 2–9 kHz | | | 2–6 kHz | |
| Rated Max. Output Carrier Frequency | 8 kHz | 10 kHz | | | 8 kHz | | | 6 kHz | | | | |

## 00-02 Parameter Reset

Control Mode **VF** **VFPG** **SVC** **FOCPG** **FOCPM** Default: 0

Settings
0: No Function
1: Read Only
5: Direct docking mode only, contact Delta for more information.
8: Keypad Locked
9: Reset all parameters to defaults (50 Hz )
10: Reset all parameters to defaults (60 Hz)

- 1: Set all parameters to read-only except Pr.00-00–Pr.00-07, and you can use this setting with the password setting for password protection.
- 9 or 10: Reset all parameters to the default. If the keypad is locked by a password, enter the password to reset to the default. The password is also erased.
- 8: Lock the keypad and only Pr.00-02 and Pr.00-07 can be changed.

## 00-03 Start-up Display

Control Mode **VF** **VFPG** **SVC** **FOCPG** **FOCPM** Default: 0

Settings
0: Display the Frequency command value (LED F)
1: Display the actual output frequency (LED H)
2: DC bus voltage (V)
3: Display the output current (A)
4: Output voltage (E)
5: User-defined (see Pr.00-04)

- Determines the start-up display page after power is applied to the drive.

## 00-04 Content of Multi-function Display

Control Mode **VF** **VFPG** **SVC** **FOCPG** **FOCPM** Default: 0

Settings
0: Display the output current supplied to the motor from the drive (A) (Unit: Amp)
1: Reserved
2: Display the drive's actual output frequency (H) (Unit: Hz)
3: Display the drive's DC bus voltage (v) (Unit: $V_{DC}$)
4: Display the terminals U, V, and W output voltage of the drive (E) (Unit: $V_{AC}$)
5: Display the terminals U, V, and W output power factor angle to the motor (n) (Unit: deg)
6: Display the terminals U, V, and W output power to the motor (P) (Unit: kW)
7: Display the actual motor speed in rpm (r) (Unit: rpm)
8: Display the drive's estimated output torque in %; the motor's rated torque is 100% (t) (Unit: %)
9: Display the PG feedback (G) (See Pr.10-00 and Pr.10-01)
10: Display the electrical angle of drive output (d) (Unit: deg)
11: Display the AUI1 analog input terminal signal (1.) (Unit: %)
12: Reserved
13: Display the AUI2 analog input terminal signal (Unit: %)

14: Display the drive’s heat sink temperature (t) (Unit: °C)

15: Display the IGBT temperature (T) (Unit: °C)

16: Display digital input status ON/OFF (i)

17: Display digital output status ON/OFF (o)

18: Display the step speed of multi-step speed that is executing (S)

19: The corresponding CPU digital input pin status (i.)

20: The corresponding CPU digital output pin status (o.)

21–23: Reserved

24: Output AC voltage when malfunction occurred (E) (Unit: $V_{AC}$)

25: Output DC voltage when malfunction occurred (v) (Unit: $V_{DC}$)

26: Motor frequency when malfunction occurred (H) (Unit: Hz)

27: Output current when malfunction occurred (A) (Unit: Amp)

28: Output frequency when malfunction occurred (F) (Unit: Hz)

29: Frequency command when malfunction occurred (F) (Unit: Hz)

30: Output power when malfunction occurred (P) (Unit: kW)

31: Output torque when malfunction occurred (t) (Unit: %)

32: Input terminal status when malfunction occurred (i)

33: Output terminal status when malfunction occurred (o)

34: Drive status when malfunction occurred (s)

35: Display MI and MO status on digital keypad

36: CAN communication interference index (c) (Unit: %)

37: Multi-function display selection (q) (Unit: %)

📖 This parameter displays the content on the digital keypad KPC-CC01 on page U. Use this parameter to get the AC motor drive’s status.

**Example 01**

| Terminal | MI8 | MI7 | MI6 | MI5 | MI4 | MI3 | MI2 | MI1 | REV | FWD |
|---|---|---|---|---|---|---|---|---|---|---|
| Status | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 1 | 0 |

**0: OFF, 1: ON**

MI1: Set Pr.02-01 to 1 (multi-step speed command 1).

MI8: Set Pr.02-08 to 8 (the 1st, 2nd acceleration/deceleration time selection).

If REV, MI1 and MI8 are ON, the value is 0000 0000 1000 01102 in binary and 0086H in HEX. Meanwhile, if you set Pr.00-04 to 16 or 19, the keypad KPC-CC01 displays “0086” and LED U is ON. Pr.00-04=16 is the status of the digital input and Pr.00-04=19 is the corresponding CPU digital input pin status. Set the parameter to 16 to monitor the digital input status and then set to 19 to check if the wire is normal.

**Example 02**

| Terminal | MO8 | MO7 | MO6 | MO5 | MO4 | MO3 | MO2 | MO1 | R2A | R1A | MRA | RA |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Status | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 1 | 0 |

**RA: Set Pr.02-11 to 9 (Drive ready)**

After applying the power to the AC motor drive, if there is no other error, the contact is ON. If you set Pr.00-04 to 17 or 20, the keypad displays 0001 and LED U is ON. Pr.00-04=17 is the status of digital output and Pr.00-04=20 is the corresponding CPU digital output pin status. Set the parameter to 17 to monitor the digital output status and then set to 20 to check if the wire is normal.

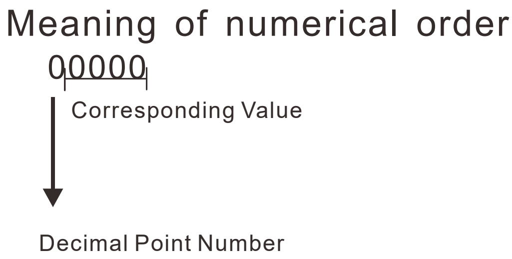
## 00-05 User-defined Coefficient K

| Control Mode | VF | VFPG | SVC | FOCPG | FOCPM | Default: 0 |
|---|---|---|---|---|---|---|

Settings Digit 4: number of decimal points (0–3)

Digit 0–3: 40–9999

- Digital setting method
  Digital 4: number of decimal points (0: no decimal points, 1: one decimal point and so on.)
  Digit 0–3: 40–9999 (the corresponding value for the maximum frequency).




- For example, if you use rpm to display the motor speed, and the corresponding value for the four-pole motor, 60 Hz is 1800. You can set this parameter to 1800 to indicate that the corresponding value for 60 Hz is 1800 rpm. If the unit is rps, set to 10300 to indicate that the corresponding value for 60 Hz is 30.0 (one decimal point).
- The frequency setting only displays as the rpm value. For example, 60 Hz is displayed as 1800 rpm.
- After you set Pr.00-05, the keypad does not display the frequency unit “Hz” after returning to the Main menu.

## 00-06 Software Version

| Control Mode | VF | VFPG | SVC | FOCPG | FOCPM | Default: ##.## |
|---|---|---|---|---|---|---|

Settings Read Only

## 00-07 Password Input

| Control Mode | VF | VFPG | SVC | FOCPG | FOCPM | Default: 0 |
|---|---|---|---|---|---|---|

Settings 1–9998, 10000–65535

Display 0–2 (number of wrong password attempts)

- Inputs the password that is set in Pr.00-08. Enter the correct password here to enable changing parameters. You are limited to a maximum of three attempts. After three consecutive failed attempts, “Password Error” is displayed, and you must restart the AC motor drive before you can try again to enter the correct password.
- If you forget the password, you can decode by setting this parameter to 9999 and press the PROG/DATA button (PROG DATA) twice. Note that this resets the settings to the default.

## 00-08 Password Set

| Control Mode | VF | VFPG | SVC | FOCPG | FOCPM | Default: 0 |
|---|---|---|---|---|---|---|

Settings 1–9998, 10000–65535

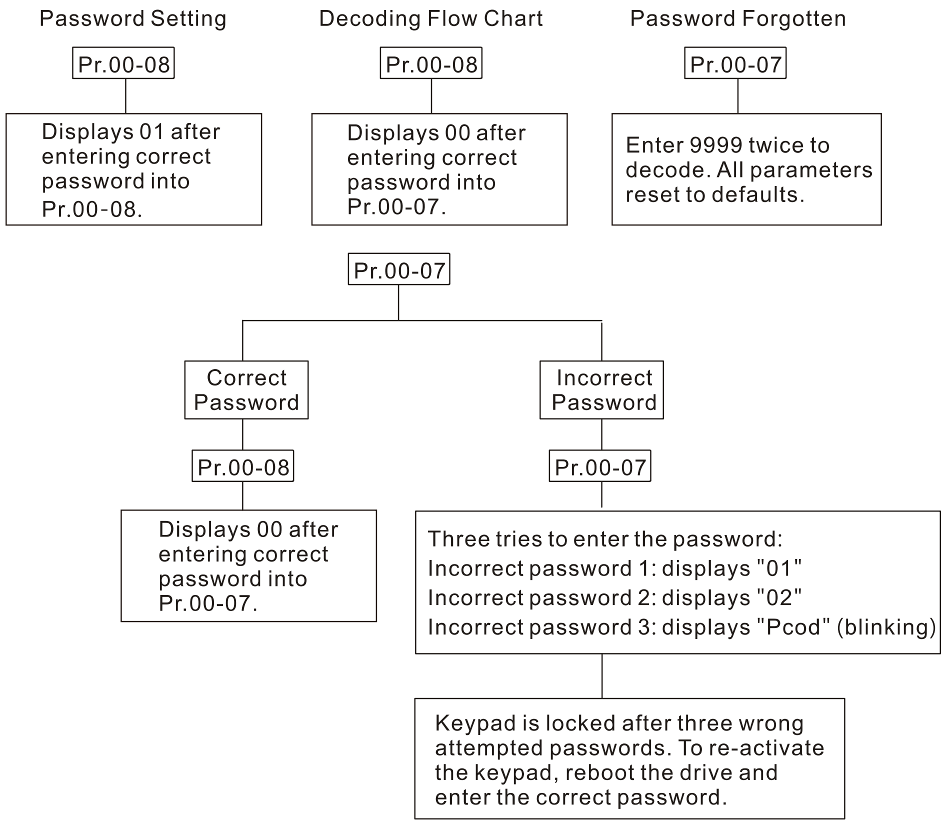
Display 0: No password set or successful input in Pr. 00-07

1: Password has been set

- This parameter is for setting the password protection. Password can be set directly the first time. After you set the password, the value of Pr.00-08 is 01, which means password protection is activated. However, if the value of Pr.00-08 is 00, the password protection is deactivated, which means you can change any of the parameter settings (including resetting the parameter protection password for Pr.00-08). When Pr.00-08 is 01 and if you want to change any of the parameter settings, you must enter the correct password in Pr.00-07 to deactivate the password, and this would make Pr.00-08 become 00. Note that if you set this parameter to 00 again, the password protection function is permanently deactivated. Otherwise, password protection is always reactivated after you reboot the motor drive. If you want to change any of the parameter settings after rebooting the motor drive, enter the correct password in Pr.00-07 to deactivate the password.

📖 How to make the password valid again after decoding by Pr.00-07:
Method 1: Re-enter the original password into Pr.00-08 (or you can enter a new password if you want to use a changed or new one).
Method 2: After rebooting, the password function is restored.
Method 3: Entering a non-password value into Pr.00-07.

Password Decode Flow Chart




## 00-09 Control Mode

Control Mode **VF** **VFPG** **SVC** **FOCPG** **FOCPM** Default: 0

Settings 0: V/F control (V/F)
1: V/F control + Encoder (VFPG)
2: Sensorless Vector Control (SVC)
3: FOC vector control + Encoder (FOCPG)
8: FOC Permanent Motor control (FOCPM)

📖 Mode selection:

| Settings | Control Mode | Applicable Motor Type | Speed Feedback | Energy-savings | Tuning Difficulty | Ride Comfort | Speed Control Range | Motor Parameter Tuning | Basic Control | Speed Control |
|---|---|---|---|---|---|---|---|---|---|---|
| 0 | V/F | IM | | Low | Low | Normal | 1:50 | | V/F control | Voltage control |
| 1 | VFPG | IM | ✓ | Medium | Medium | Normal | 1:50 | ✓ | Frequency control | Frequency control |
| 2 | SVC | IM | | Medium | Medium | Normal | 1:50 | ✓ | Voltage control | Voltage control |
| 3 | FOCPG | IM | ✓ | High | High | Good | 1:1000 | ✓ | Vector control | Frequency control |
| 8 | FOCPM | PM | ✓ | High | High | Good | 1:1000 | ✓ | Vector control | Frequency control |

📖 Determines the AC motor drive control method.
0: You can set the V/F ratio as required and control multiple motors simultaneously.
1: You can use a PG card with an encoder for closed-loop speed control.
2: Use auto-tuning for optimal settings of the control parameters.
3: To increase torque and the accuracy of the speed control (1:1000).
8: To increase torque and the accuracy of the speed control (1:1000). This setting is for use only with permanent magnet motors. The other settings are for use with induction motors.

## ✎ 00-10 Speed Unit

Control Mode **VF** **VFPG** **SVC** **FOCPG** **FOCPM** Default: 0

Settings 0: Hz
1: m/s
2: ft/s
3: Direct docking mode only, contact Delta for more information.

## 00-11 Output Direction Selection

Control Mode **VF** **VFPG** **SVC** **FOCPG** **FOCPM** Default: 0

Settings 0: FWD: counterclockwise, REV: clockwise
1: FWD: clockwise, REV: counterclockwise

## ✎ 00-12 Carrier Frequency

Control Mode **VF** **VFPG** **SVC** **FOCPG** **FOCPM** Default:12

Settings 2–15 kHz

📖 Determines the PWM carrier frequency for the AC motor drive.

| Models | 3–5 HP | 7.5–15 HP | 20–30 HP | 40–60 HP | 75–100 HP |
|---|---|---|---|---|---|
| Settings | 2–15 kHz | 2–15 kHz | 2–15 kHz | 2–9 kHz | 2–6 kHz |
| Default | 8 kHz | 10 kHz | 8 kHz | 6 kHz | 6 kHz |

| Carrier Frequency | Acoustic Noise | Electromagnetic Noise or Leakage Current | Heat Dissipation | Current Wave |
|---|---|---|---|---|
| 2 kHz | Significant ↑ | Minimal ↑ | Minimal ↑ | ↑ |
| 8 kHz | ↕ | ↕ | ↕ | ↕ |
| 15 kHz | Minimal ↓ | Significant ↓ | Significant ↓ | ↓ |

📖 From the table, you see that the PWM carrier frequency has significant influences on the motor's electromagnetic noise, the AC motor drive heat dissipation, and the motor acoustic noise. Therefore, if the surrounding noise is greater than the motor noise, lower the carrier frequency to reduce the temperature rise. Although the motor has quiet operation in the higher carrier frequency, consider the entire wiring and interference.

📖 If you set the carrier frequency higher than the defaults in the table above, the motor drive derates the capacity. See Carrier Frequency Derating Capacity (Fc) in Chapter 02.

## 00-13 Automatic Voltage Regulation (AVR) Function

Control Mode **VF** **VFPG** **SVC** **FOCPG** **FOCPM** Default: 0

Settings 0: Enable AVR

1: Disable AVR

2: Disable AVR when decelerating to stop

- The AVR function automatically regulates the AC motor drive output voltage to the motor's rated voltage when the input power is larger than the motor's rated voltages. For instance, if you set V/F curve to 200 $V_{AC}$/50 Hz and the input voltage is between 200–264 $V_{AC}$, then the output voltage to the motor is automatically regulated to 200 $V_{AC}$/50 Hz. If the input voltage is from 180 to 200 $V_{AC}$, the output voltage to the motor and the input voltage is in direct proportion to the input voltage.
- When the motor stops with deceleration, it shortens the deceleration time with AVR disabled. Setting this parameter to 1 with auto-acceleration/auto-deceleration results in quicker deceleration.

## 00-14 Master Frequency Command Source

Control Mode **VF** **VFPG** **SVC** **FOCPG** **FOCPM** Default:1

Settings 1: RS-485 serial communication or digital keypad (KPC-CC01)

2: External analog input (Pr.03-00)

3: Digital terminal inputs

4: Direct docking mode only, contact Delta for more information.

- Determines the drive's master frequency source.

## 00-15 Operation Command Source

Control Mode **VF** **VFPG** **SVC** **FOCPG** **FOCPM** Default:1

Settings 1: External terminals

2: RS-485 serial communication or digital keypad (KPC-CC01)

- The ED series motor drives are shipped without a digital keypad, but you can use the external terminals or RS-485 to control the operation command.
- When the LED PU is ON, you can control the operation command with the optional digital keypad. (Refer to Chapter 09 for more information about the digital keypad KPC-CC01).

# 01 Basic Parameters

⚡: You can set this parameter during operation.

## 01-00 Maximum Output Frequency

Control Mode **VF** **VFPG** **SVC** **FOCPG** **FOCPM** Default: 60.00/50.00

Settings 10.00–400.00 Hz

📖 Determines the AC motor drive's Maximum Output Frequency. All the AC motor drive frequency command sources (analog inputs -10–10 V) are scaled to correspond to the output frequency range.

## 01-01 1st Output Frequency Setting (base frequency/ motor's rated frequency)

Control Mode **VF** **VFPG** **SVC** **FOCPG** **FOCPM** Default: 60.00/50.00

Settings 0.00–400.00 Hz

📖 Set this parameter according to the rated frequency on the motor nameplate. If the motor is 60 Hz, set this parameter to 60. If the motor is 50 Hz, set it to 50.

## 01-02 1st Output Voltage Setting (base voltage/ motor's rated voltage)

Control Mode **VF** **VFPG** **SVC** **FOCPG** **FOCPM** Default: 220.0/440.0

Settings 230V series 0.1–255.0 V

460V series 0.1–510.0 V

📖 Set this parameter according to the rated voltage on the motor nameplate. If the motor is 220 V, set this parameter to 220.0. If the motor is 200 V, set this parameter to 200.0.

📖 There are many motor types in the market and the power system for each country is also different. The economical and convenient solution is to install an AC motor drive. Then there is no problem using the motor with different voltage and frequency inputs, and the motor drive can improve the original motor characteristics and useful life.

## 01-03 Second Output Frequency Setting

Control Mode **VF** **VFPG** Default: 0.50

Settings 0.00–400.00 Hz

## ⚡ 01-04 Second Output Voltage Setting

Control Mode **VF** **VFPG** Default: 5.0/10.0

Settings 230V series 0.1–255.0 V

460V series 0.1–510.0 V

## 01-05 Third Output Frequency Setting

Control Mode **VF** **VFPG** Default: 0.50

Settings 0.00–400.00 Hz

## ⚡ 01-06 Third Output Voltage Setting

Control Mode **VF** **VFPG** Default: 5.0/10.0

Settings 230V series 0.1–255.0 V

460V series 0.1–510.0 V

## 01-07 Fourth Output Frequency Setting

Control Mode **VF** **VFPG** **SVC** **FOCPG** Default: 0.00

Settings 0.00–400.00 Hz

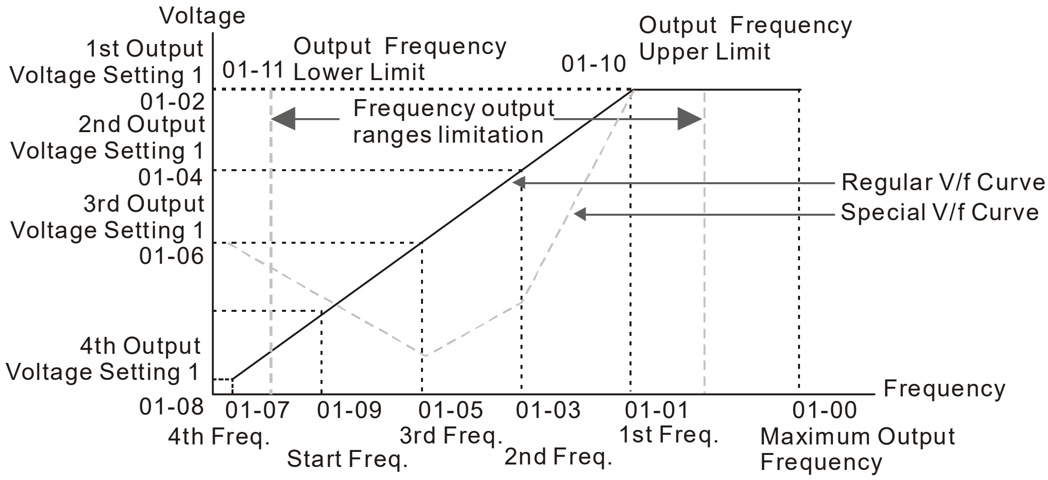
## 01-08 Fourth Output Voltage Setting

Control Mode **VF** **VFPG** Default: 5.0/10.0

Settings 230V series 0.1–255.0 V

460V series 0.1–510.0 V

- You usually set the V/F curve according to the motor's allowable loading characteristics. Pay special attention to the motor's heat dissipation, dynamic balance, and bearing lubrication when the loading characteristics exceed the loading limit of the motor.
- The frequency setting of V/F curve must be set according to this rule: Pr.01-01 ≥ Pr.01-03 ≥ Pr.01-05 ≥ Pr.01-07. There is no limit for the voltage setting, but a high voltage at low frequency may cause motor burnout, overheating, and trigger stall prevention or over-current protection. Use l
- ow voltages at low frequencies to prevent motor damage or drive malfunction.



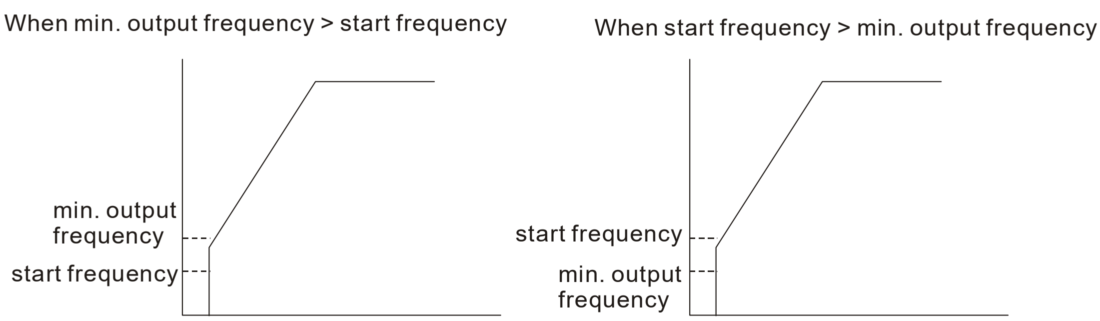

**V/f Curve**

## 01-09 Starting Frequency

Control Mode **VF** **VFPG** **SVC** **FOCPG** Default: 0.50

Settings 0.00–400.00 Hz

- Determines the starting frequency. When the starting frequency (Pr.01-09) is larger than the output frequency (Pr.01-11), the frequency output starts when the starting frequency (Pr.01-09) reaches the F command.




## 01-10 Output Frequency Upper Limit

Control Mode **VF** **VFPG** **SVC** **FOCPG** **FOCPM** Default: 400.00

Settings 0.00–400.00 Hz

## 01-11 Output Frequency Lower Limit

Control Mode **VF** **VFPG** **SVC** **FOCPG** **FOCPM** Default: 0.00

Settings 0.00–400.00 Hz

- Use the upper/lower output frequency settings to limit the actual output frequency. If the frequency setting is lower than the start-up frequency, it runs with zero speed. If the frequency setting is higher than the upper limit, it runs with the upper limit frequency. If the output frequency lower limit is larger than output frequency upper limit, this function is invalid.

### 01-12 Accel. Time 1

Control Mode **VF** **VFPG** **SVC** **FOCPG** **FOCPM** Default: 3.00

Settings 0.00–600.00 sec.

### 01-13 Decel. Time 1

Control Mode **VF** **VFPG** **SVC** **FOCPG** **FOCPM** Default: 2.00

Settings 0.00–600.00 sec.

### 01-14 Accel. Time 2

Control Mode **VF** **VFPG** **SVC** **FOCPG** **FOCPM** Default: 3.00

Settings 0.00–600.00 sec.

### 01-15 Decel. Time 2

Control Mode **VF** **VFPG** **SVC** **FOCPG** **FOCPM** Default: 2.00

Settings 0.00–600.00 sec.

### 01-16 Accel. Time 3

Control Mode **VF** **VFPG** **SVC** **FOCPG** **FOCPM** Default: 3.00

Settings 0.00–600.00 sec.

### 01-17 Decel. Time 3

Control Mode **VF** **VFPG** **SVC** **FOCPG** **FOCPM** Default: 2.00

Settings 0.00–600.00 sec.

### 01-18 Accel. Time 4

Control Mode **VF** **VFPG** **SVC** **FOCPG** **FOCPM** Default: 3.00

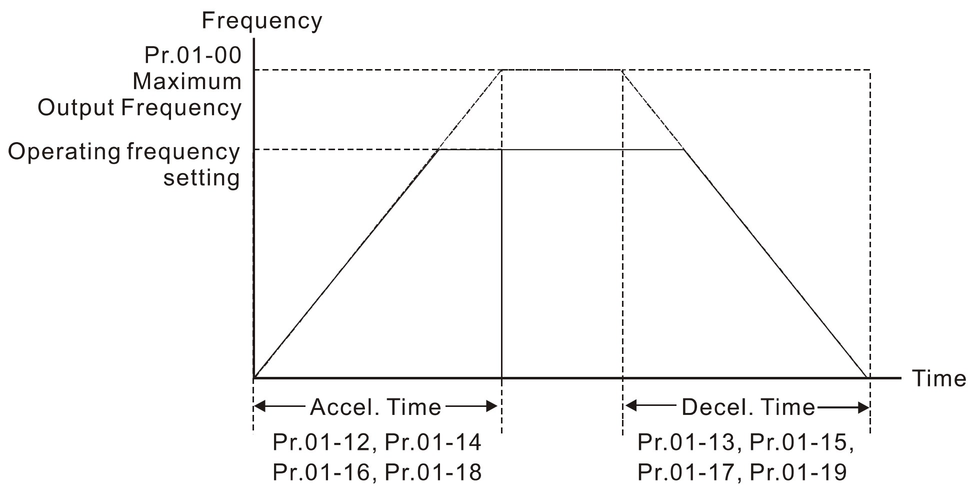
Settings 0.00–600.00 sec.

### 01-19 Decel. Time 4

Control Mode **VF** **VFPG** **SVC** **FOCPG** **FOCPM** Default: 2.00

Settings 0.00–600.00 sec.

- The Acceleration Time determines the time required for the AC motor drive to ramp from 0.00 Hz to the Maximum Output Frequency (Pr.01-00). The Deceleration Time determines the time required for the AC motor drive to decelerate from the Maximum Output Frequency (Pr.01-00) down to 0.00 Hz.
- Select the Acceleration/Deceleration Time 1, 2, 3, 4 with the multi-function input terminal settings. The defaults are Acceleration Time 1 and Deceleration Time 1.
- When there is a large opposing torque and inertial torque for the load, and the acceleration and deceleration time settings are less than the necessary value, then they enable the torque limit and stall prevention functions. When this happens, the actual acceleration and deceleration time are longer than the settings.




Acceleration & Decelertion Time Setting

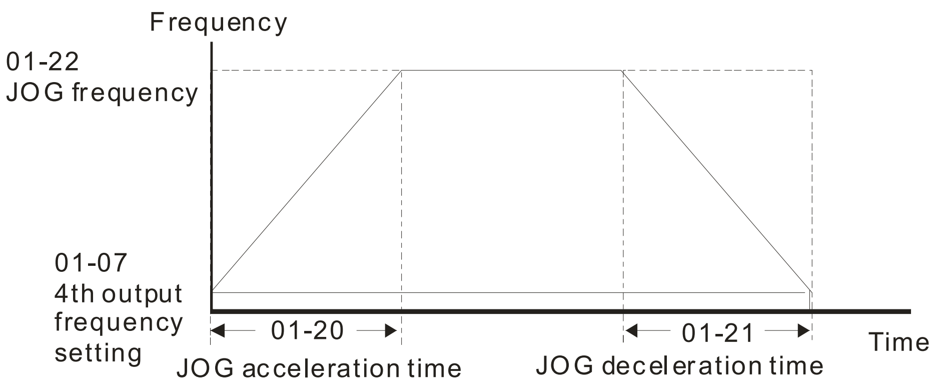
**01-20** JOG Acceleration Time

**01-21** JOG Deceleration Time

Control Mode **VF** **VFPG** **SVC** **FOCPG** **FOCPM** Default: 1.00

Settings 0.00–600.00 sec.

- You can use both the external terminal JOG and the JOG key on the keypad. When the JOG command is ON, the AC motor drive accelerates from the fourth output voltage setting (Pr.01-07) to the JOG frequency (Pr.01-22). When the JOG command is OFF, the AC motor drive decelerates from the JOG frequency to zero. The Acceleration and Deceleration time are set by these parameters (Pr.01-20, Pr.01-21).
- You cannot execute the JOG command when the AC motor drive is running. When the JOG command is running, other operation commands are invalid except the Forward and Reverse commands.




JOG accel./decel. time

**01-22** JOG Frequency

Control Mode **VF** **VFPG** **SVC** **FOCPG** **FOCPM** Default: 6.00

Settings 0.00–400.00 Hz

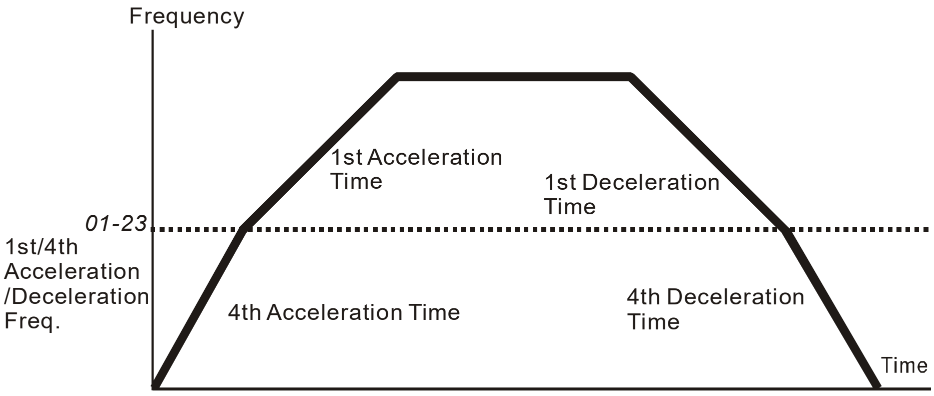
- You can use both the external terminal JOG and the JOG key on PU. When the JOG terminal is disabled, the AC motor drive accelerates from 0 Hz to the JOG frequency (Pr.01-22). When the JOG terminal is enabled, the AC motor drive decelerates from the JOG frequency to zero. The Acceleration and Deceleration time are set by these parameters (Pr.01-20, Pr.01-21). You cannot execute the JOG command when the AC motor drive is running. When the JOG command is running, other operation commands are invalid except the Forward and Reverse commands and the STOP key on the digital keypad.

## 01-23 Switch Frequency between First and Fourth Accel./Decel.

Control Mode **VF VFPG SVC FOCPG FOCPM** Default: 0.00

Settings 0.00–400.00 Hz

- Determines the frequency for the transition from acceleration and deceleration time 1 to acceleration and deceleration time 4. You can also enable the transition from acceleration or deceleration time 1 to acceleration and deceleration time 4 with the external terminals (Pr.02-01–Pr.02-08). The external terminal has priority over Pr.01-23.




1st/4th Acceleration/Deceleration Switching

## 01-24 S-curve for Acceleration Begin Time S1
## 01-25 S-curve for Acceleration Arrival Time S2
## 01-26 S-curve for Deceleration Begin Time S3
## 01-27 S-curve for Deceleration Arrival Time S4
## 01-30 S-curve for Deceleration Arrival Time S5

Control Mode **VF VFPG SVC FOCPG FOCPM** Default: 1.00

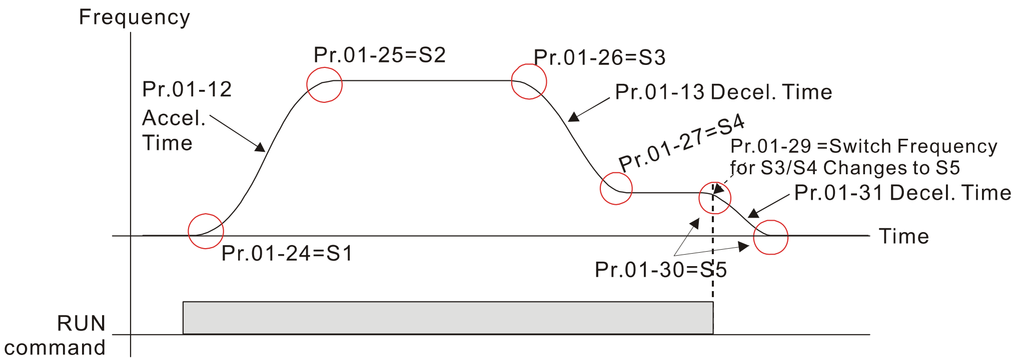
Settings 0.00–25.00 sec.

## 01-29 Switch Frequency for S3/S4 Changes to S5

Control Mode **VF VFPG SVC FOCPG FOCPM** Default: 0.00

Settings 0.00–400.00 Hz

- Using an S-curve gives the smoothest transition between speed changes. The acceleration and deceleration curve adjusts the acceleration and deceleration S-curve. When enabled, the motor drive produces a different acceleration and deceleration curve according to the acceleration and deceleration time.
- The Actual Acceleration Time = selected acceleration Time + (Pr.01-24 + Pr.01-25) ÷ 2.
  The Actual Deceleration Time = selected deceleration Time + (Pr.01-26 + Pr.01-27 + Pr.01-30 x 2) ÷ 2.
- Use Pr.01-29 to set the switch frequency between S4 and S5 for smooth stopping.
- Set Pr.01-29 to the leveling speed of the elevator.



## 01-28 Mode Selection when Frequency < Fmin

Control Mode **VF** **VFPG** **SVC** Default: 1

Settings 0: Output Waiting

1: Zero-speed operation

2: Fmin (Fourth output frequency setting)

- The AC motor drive uses this parameter when it is at 0 Hz.
- 1 or 2: The voltage outputs according to the output voltage command corresponding to Fmin (Pr.01-08).

## ✓ 01-31 Deceleration Time when Operating without RUN Command

Control Mode **VF** **VFPG** **SVC** **FOCPG** **FOCPM** Default: 2.00

Settings 0.00–600.00 sec.

- The AC motor drive stops according to this parameter when cancelling the RUN command. Refer to the figure in the description for Pr.01-29 for details.

## ✓ 01-32 Direct docking mode only

Control Mode Default: -

Settings Contact Delta for more information

## 01-33 High Speed Time for Short Floor

Control Mode **VF** **VFPG** **SVC** **FOCPG** **FOCPM** Default: 3.00

Settings 0.00–60.00 sec.

- Sets the high speed duration during short floor operation.

## 01-34 Leveling Speed Time for Short Floor

Control Mode **VF** **VFPG** **SVC** **FOCPG** **FOCPM** Default: 3.00

Settings 0.00–60.00 sec.

- Sets the leveling speed duration during short floor operation.

## 01-35 Limit for Direct Docking Terminal

Control Mode **VF** **VFPG** **SVC** **FOCPG** **FOCPM** Default: 2.00

Settings 0.00–10.00

- Sets the limit for changing from leveling speed to acceleration when using terminals for direct docking.

## 01-36 Deceleration Distance for Direct Docking Terminal

Control Mode **VF** **VFPG** **SVC** **FOCPG** **FOCPM** Default: 30.00

Settings 0.00–10.00 cm

- Sets the distance between deceleration points.

## 01-37 Deceleration Distance Reference for Short Floor

Control Mode **VF** **VFPG** **SVC** **FOCPG** **FOCPM** Default: Read only

Settings 0.00–655.35 m

- Sets the distance between deceleration points according to short floors (write inhibit).

## 01-38 Short Floor/Direct Docking Terminal Enabled

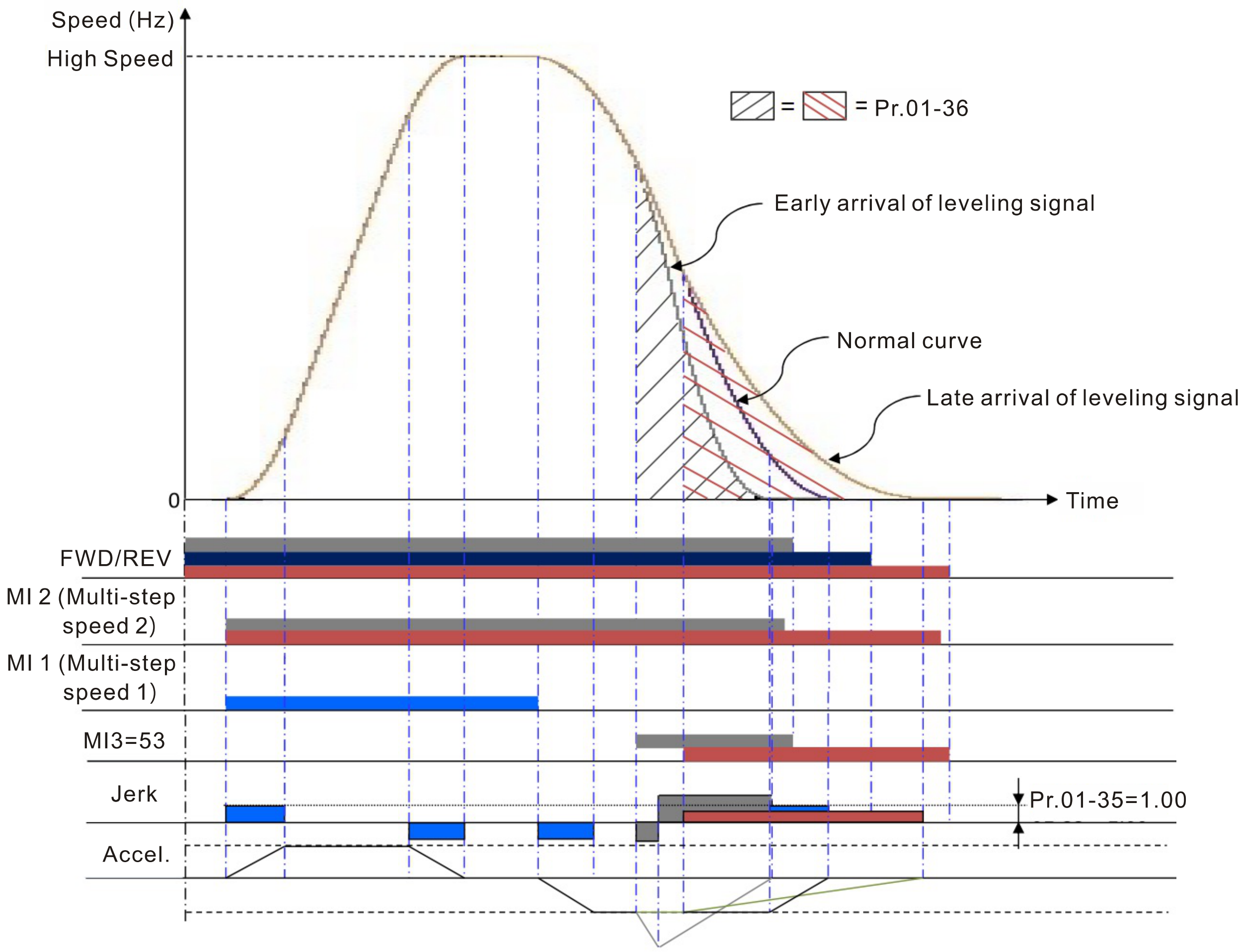
| Control Mode | VF | VFPG | SVC | FOCPG | FOCPM | Default: 0000h |
|---|---|---|---|---|---|---|

Settings
- 0000h: Disabled
- 0001h: Short floor enabled
- 0002h: Direct docking terminal enabled
- 0003h: Short floor + direct docking terminal enabled

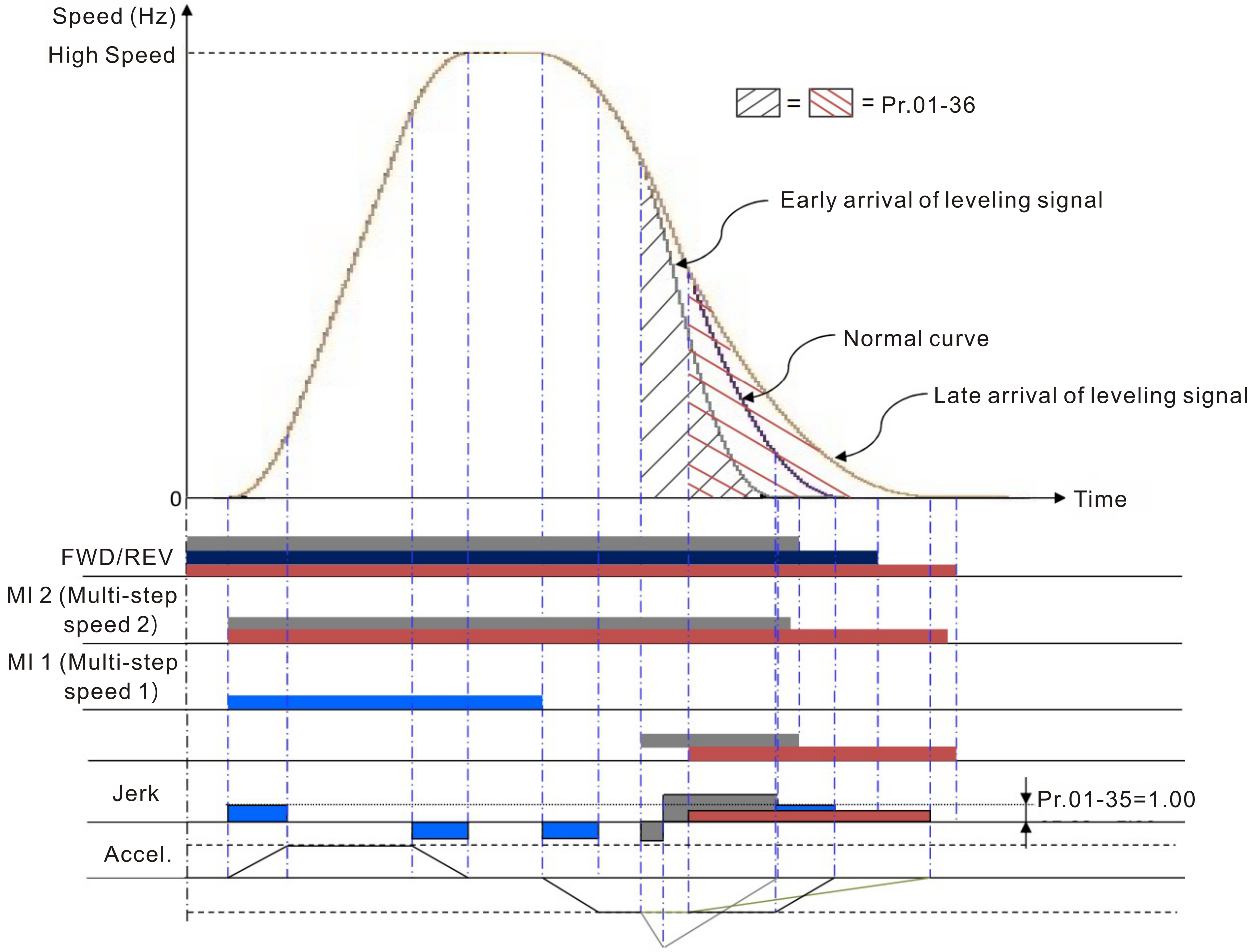
📖 Related parameters: Pr.02-01–02-08 multi-function input terminal (53: terminal leveling signal for direct docking).

📖 Direct docking terminal function:
When the elevator runs to the leveling area, controller sends a leveling signal to the drive to make the drive stop within effective distance (Pr.01-36), as shown in the figure below. If deceleration distance is too short, the drive adjusts the speed according to the limit for acceleration change (Pr.01-35).
There are two methods for sending leveling signals:
1. Using multi-function input terminals
2. Do not use the low speed multi-step speed

When using the first method, set MI setting value to 53.




Direct docking terminal function (using MI terminal to input leveling signals)

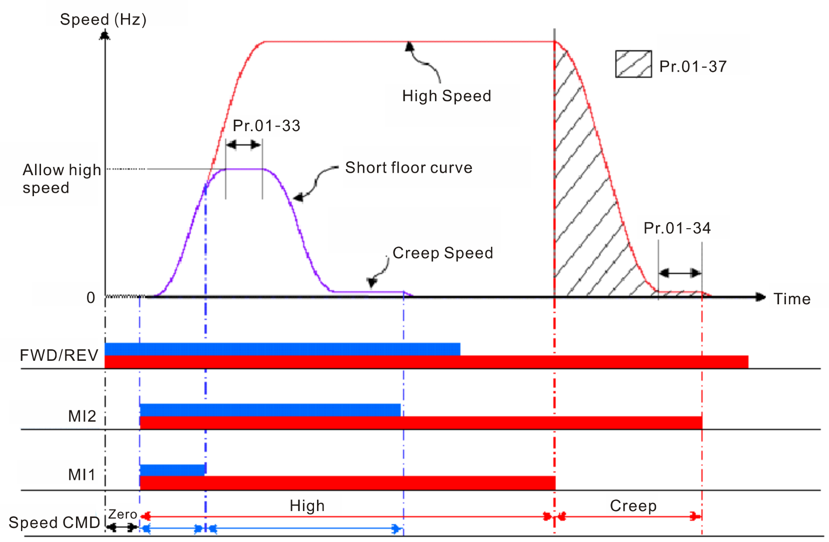



Direct docking terminal function (using multi-step speed change)

📖 Definitions of deceleration distance for short floors:
When the motor runs with the highest speed, the deceleration distance for short floors is calculated according to the first deceleration time (S3 curve time, equivalent deceleration time, S4 curve time) and leveling speed duration, as Pr.01-37 in Case 1_Short floor function diagram illustrated.

The following cases are illustrated by diagrams:
Case 1. Deceleration point (instead of high speed) is given before allowed speed
Case 2. Deceleration point (instead of high speed) is given before allowed speed and high speed time is not zero.
Case 3. Deceleration point (instead of high speed) is given before allowed speed and high speed time is zero.

**Case 1. Deceleration point (instead of high speed) is given before allowed speed**
Regardless of the corresponding speed when the drive gives the deceleration points, the drive issues the speed allowance command to replace leveling speed, executes the corresponded S2 curve before allowed speed, maintains the high speed time set, and gives the leveling speed after high speed duration. Refer to Pr.01-12, 01-24, 01-25 for information on acceleration curves.

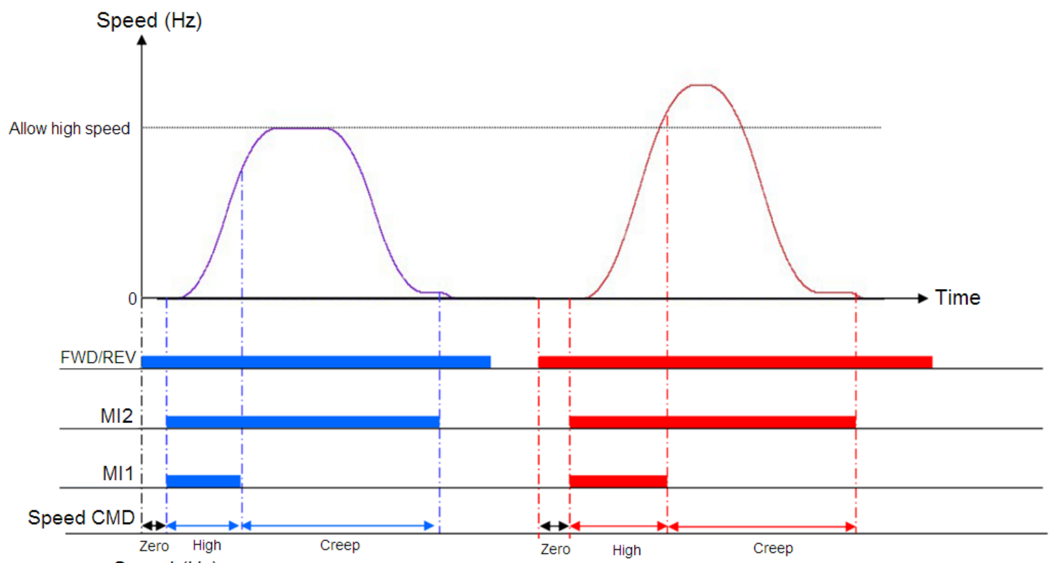


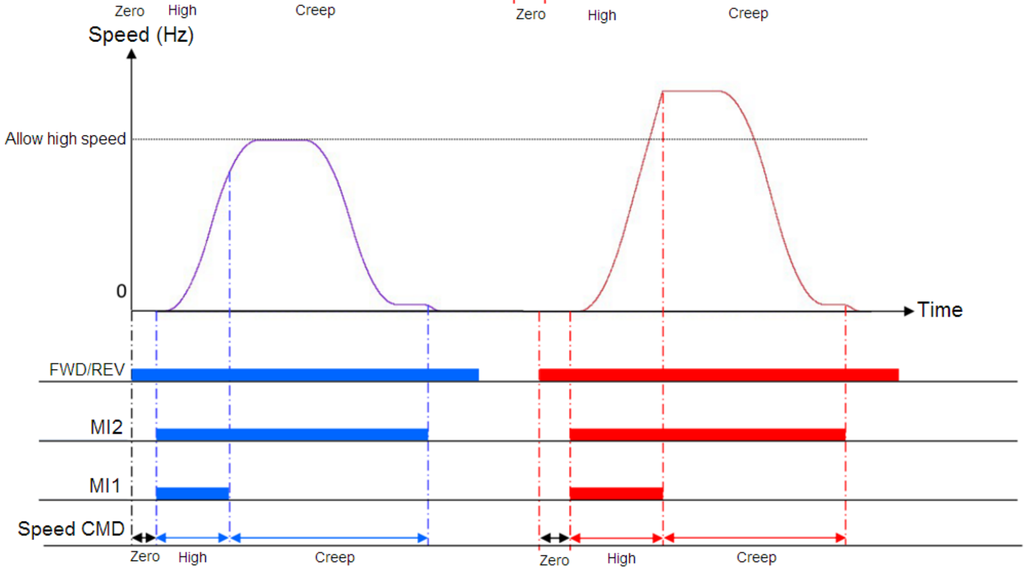

Short floor function diagram

**Case 2. Deceleration point (instead of high speed) is given before allowed speed and high speed time is not zero.**

When high speed is higher than allowed speed, the drive automatically determines the remaining distances and reduces the high speed duration accordingly to increase the running speed.

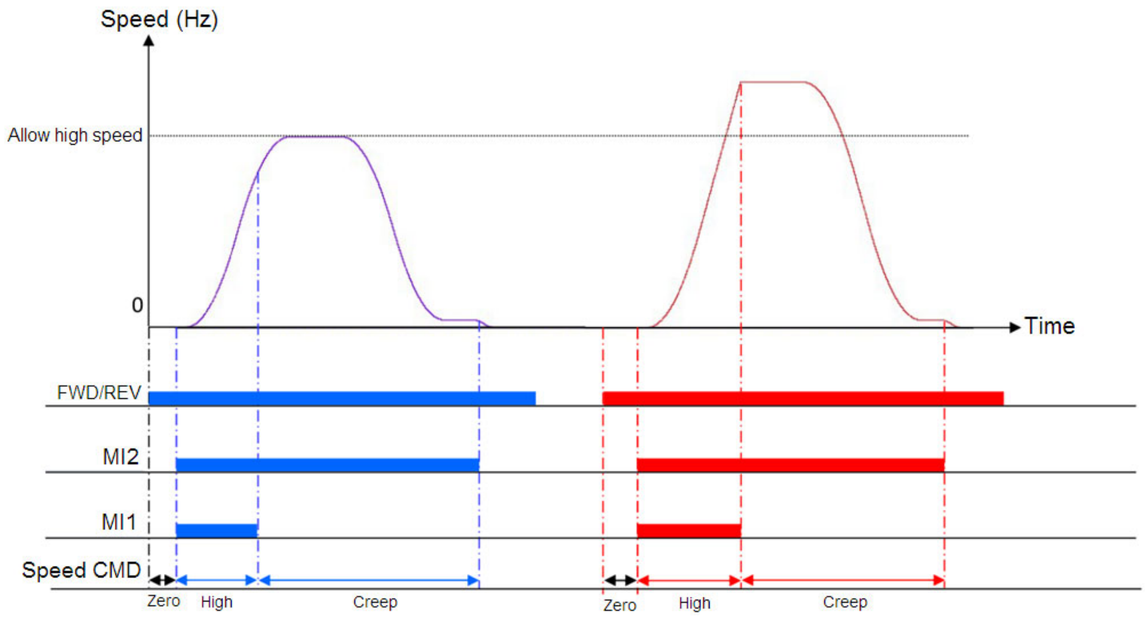
Note that if the high speed duration is reduced to zero or below zero, the system executes the equivalent speed command according to the current speed instead of executing S2, and increases the high speed duration to reduce the leveling time.



**Case 3. Deceleration point (instead of high speed) is given before allowed speed and high speed time is zero**

When high speed is higher than allowed speed, because there is no duration, the drive levels the speed instead of executing S2, adds high speed duration accordingly to reduce the leveling time, which is the same as Case 2 when the high speed duration is reduced to zero or below zero.




## 01-39 Automatic Emergency Deceleration Level

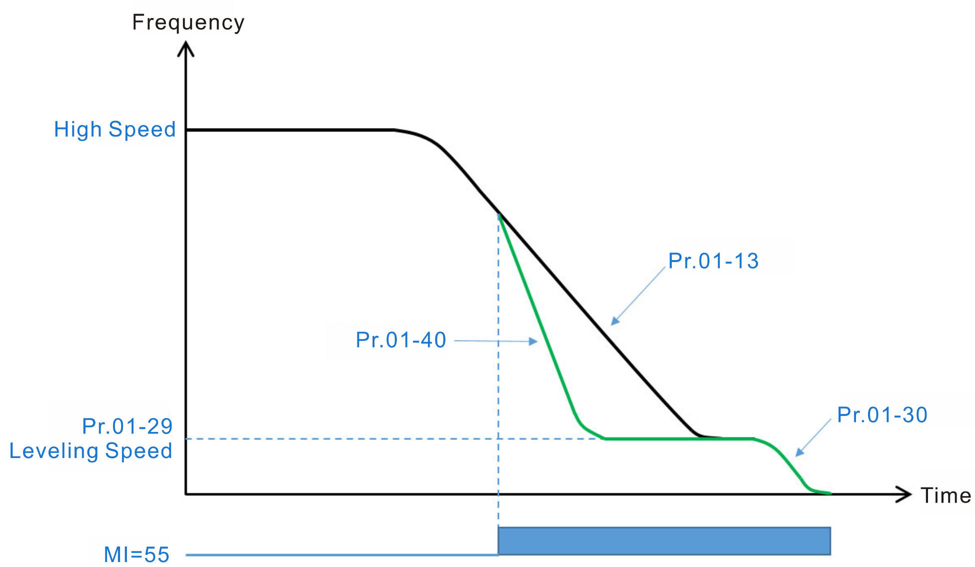
| Control Mode | VFPG | FOCPG | FOCPM | Default: 60.00 |
|---|---|---|---|---|
| | Settings | 5.00–400.00 Hz | | |

📖 When MI is set to 56, the system monitors the current speed. If the speed is higher than Pr.01-39, the drive decelerates to Pr.01-29 speed according to Pr.01-40 deceleration time.

## ✎ 01-40 Deceleration Time for Emergency Deceleration

| Control Mode | VFPG | FOCPG | FOCPM | Default: 2.00 |
|---|---|---|---|---|
| | Settings | 0.00–600.00 sec. | | |

📖 When MI=55 function is triggered, the drive decelerates to Pr.01-29 speed according to Pr.01-40 deceleration time, as shown in the figure below.



# 02 Digital Input / Output Parameters

✎: You can set this parameter during operation.

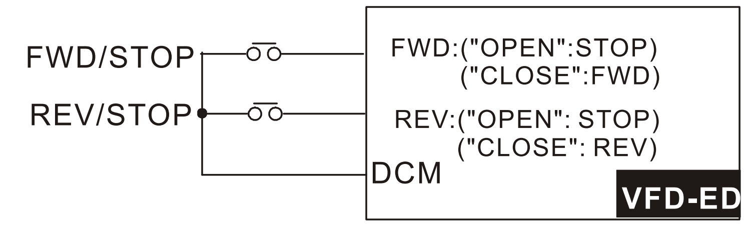
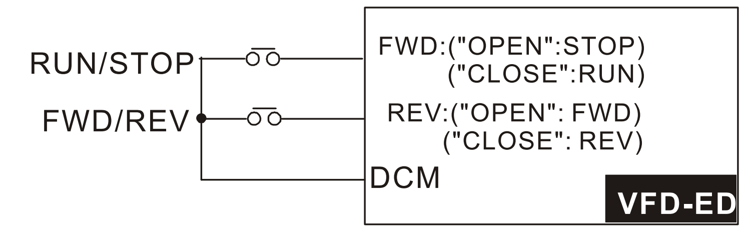
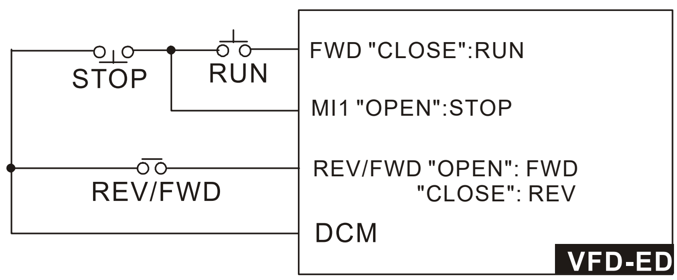
## 02-00 Two-wire//three-wire Operation Control

Control Mode **VF** **VFPG** **SVC** **FOCPG** **FOCPM** Default: 0

Settings
0: FWD/STOP, REV/STOP
1: FWD/STOP, REV/STOP (Line Start Lockout)
2: RUN/STOP, REV/FWD
3: RUN/STOP, REV/FWD (Line Start Lockout)
4: Three-wire
5: Three-wire (Line Start Lockout)

📖 Three of the six modes include a “Line Start Lockout” feature. When line start lockout is enabled, the motor drive does not run when you apply power. The Line Start Lockout feature does not guarantee that the motor never starts under this condition. It is possible the motor may be set in motion by a mechanical vibration or malfunctioning switch.

This parameter controls operation from external terminals. There are three different control modes.

<table>
<tr><th>Pr.02-00</th><th>External Terminal Control Circuits</th></tr>
<tr><td>0, 1<br>Two-wire operation control (1)<br>FWD/STOP<br>REV/STOP</td><td>
</td></tr>
<tr><td>2, 3<br>Two-wire operation control (2)<br>RUN/STOP<br>REV/FWD</td><td>
</td></tr>
<tr><td>4, 5<br>Three-wire operation control</td><td>
</td></tr>
</table>

## 02-01 Multi-function Input Command 1 (MI1) (It is the Stop terminal for three-wire operation)

Default: 1

## 02-02 Multi-function Input Command 2 (MI2)

Default: 2

## 02-03 Multi-function Input Command 3 (MI3)

Default: 3

## 02-04 Multi-function Input Command 4 (MI4)

Default: 4

## 02-05 Multi-function Input Command 5 (MI5)

Default: 0

## 02-06 Multi-function Input Command 6 (MI6)

Default: 0

## 02-07 Multi-function Input Command 7 (MI7)

Default: 0

## 02-08 Multi-function Input Command 8 (MI8) (Enable Drive terminal)

Default:40

| Settings / Control Mode | VF | VFPG | SVC | FOCPG | FOCPM |
|---|---|---|---|---|---|
| 0: No function | ○ | ○ | ○ | ○ | ○ |
| 1: Multi-step speed command 1 | ○ | ○ | ○ | ○ | ○ |
| 2: Multi-step speed command 2 | ○ | ○ | ○ | ○ | ○ |
| 3: Multi-step speed command 3 | ○ | ○ | ○ | ○ | ○ |
| 4: Multi-step speed command 4 | ○ | ○ | ○ | ○ | ○ |
| 5: Reset | ○ | ○ | ○ | ○ | ○ |
| 6: JOG command | ○ | ○ | ○ | ○ | ○ |
| 7: Acceleration/deceleration speed inhibit | ○ | ○ | ○ | ○ | ○ |
| 8: First, second acceleration/deceleration time | ○ | ○ | ○ | ○ | ○ |
| 9: Third, fourth acceleration/deceleration time | ○ | ○ | ○ | ○ | ○ |
| 10: EF input (Pr.07-28) | ○ | ○ | ○ | ○ | ○ |
| 11: Reserved | | | | | |
| 12: Stop output | ○ | ○ | ○ | ○ | ○ |
| 13–14: Reserved | | | | | |
| 15: AUI1 operation speed command | ○ | ○ | ○ | ○ | ○ |
| 16: Reserved | ○ | ○ | ○ | ○ | ○ |
| 17: AUI2 operation speed command | ○ | ○ | ○ | ○ | ○ |
| 18: Emergency Stop (Pr.07-28) | ○ | ○ | ○ | ○ | ○ |
| 19–23: Reserved | | | | | |
| 24: FWD JOG Command | ○ | ○ | ○ | ○ | ○ |
| 25: REV JOG Command | ○ | ○ | ○ | ○ | ○ |
| 26: Reserved | | | | | |
| 27: ASR1/ASR2 selection | ○ | ○ | ○ | ○ | ○ |
| 28: Emergency stop (EF1) (motor coasts to stop) | ○ | ○ | ○ | ○ | ○ |
| 29–30: Reserved | | | | | |
| 31: High torque bias (according to Pr.07-21) | ○ | ○ | ○ | ○ | ○ |
| 32: Middle torque bias (according to Pr.07-22) | ○ | ○ | ○ | ○ | ○ |
| 33: Low torque bias (according to Pr.07-23) | ○ | ○ | ○ | ○ | ○ |
| 34–37: Reserved | | | | | |
| 38: Disable writing to EEPROM | ○ | ○ | ○ | ○ | ○ |
| 39: Torque command direction (0 is positive direction) | | | | | |
| 40: Enable drive function | ○ | ○ | ○ | ○ | ○ |
| 41: Magnetic contactor detection | | ○ | ○ | ○ | ○ |
| 42: Mechanical brake 1 | ○ | ○ | ○ | ○ | ○ |

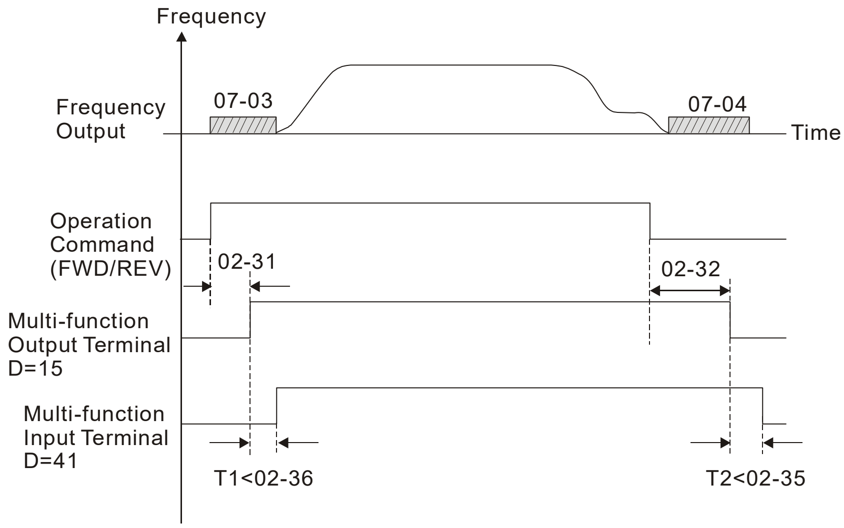
| | | | | | |
|---|---|---|---|---|---|
| 43: EPS function (Emergency Power System) | ○ | ○ | ○ | ○ | ○ |
| 44: Mechanical brake 2 | ○ | ○ | ○ | ○ | ○ |
| 45–51: Direct docking mode only | | | | | |
| 53: Terminal leveling signal for direct docking | | ○ | | ○ | ○ |
| 54: Power failure signal | ○ | ○ | ○ | ○ | ○ |
| 55: Manual emergency deceleration | | ○ | | ○ | ○ |
| 56: Automatic emergency deceleration | | ○ | | ○ | ○ |

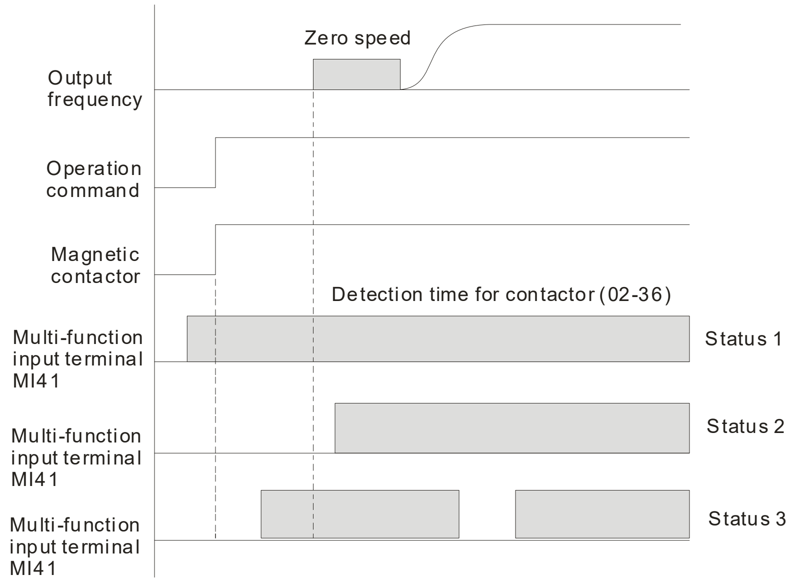
- Selects the functions for each multi-function input terminal.
- If you set Pr.02-00 to three-wire operation control, terminal MI1 is for STOP terminal, and MI1 is not available for any other operation.

<table>
<tr><th>Settings</th><th>Functions</th><th>Descriptions</th></tr>
<tr><td>0</td><td>No Function</td><td></td></tr>
<tr><td>1</td><td>Multi-step speed command 1</td><td rowspan="4">15-step speeds controlled through the four terminals, and 17 in total including the master speed and JOG (refer to Pr. 04-00–Pr.04-14).<br>When using communication to control the multi-step speed, settings 1–4 are invalid.</td></tr>
<tr><td>2</td><td>Multi-step speed command 2</td></tr>
<tr><td>3</td><td>Multi-step speed command 3</td></tr>
<tr><td>4</td><td>Multi-step speed command 4</td></tr>
<tr><td>5</td><td>Reset</td><td>After you eliminate the drive error, use this terminal to reset the drive.</td></tr>
<tr><td>6</td><td>JOG Command</td><td>JOG operation</td></tr>
<tr><td>7</td><td>Acceleration/deceleration Speed Inhibit</td><td>When enabled, acceleration and deceleration are stopped and the AC motor drive starts to accelerate and decelerate from the inhibit point.</td></tr>
<tr><td>8</td><td>The first, second acceleration or deceleration time</td><td rowspan="2">You can select the motor drive’s acceleration and deceleration time through the terminals; there are four acceleration and deceleration speeds in total.<br><table><tr><th>Bit 0</th><th>Bit 1</th><th>Descriptions</th></tr><tr><td>0</td><td>0</td><td>First accel./decel. time<br>When output frequency is less than Pr.01-23 (Switch Frequency between first/fourth Accel./decel.), it outputs the fourth accel./decel. time.</td></tr><tr><td>0</td><td>1</td><td>Second accel./decel. time</td></tr><tr><td>1</td><td>0</td><td>Third accel./decel. time</td></tr><tr><td>1</td><td>1</td><td>Fourth accel./decel. time</td></tr></table>If the drive receives STOP command, it decelerates to stop with Pr.01-31.</td></tr>
<tr><td>9</td><td>The third, fourth acceleration or deceleration time</td></tr>
<tr><td>10</td><td>EF Input</td><td>External fault input terminal, and decelerates according to Pr.07-28 (records EF fault).</td></tr>
<tr><td colspan="3">11: Reserved</td></tr>
<tr><td>12</td><td>Stop output</td><td>When enabled, the motor drive output stops immediately and the motor coasts. When disabled, the motor drive accelerates to the frequency setting.</td></tr>
<tr><td colspan="3">13–14: Reserved</td></tr>
</table>

<table>
<tr><td>15</td><td>AUI1 operation speed command</td><td>When the operation speed command source is AUI1 and AUI2, and two or more terminals are ON, the priority is AUI1 > AUI2.<br>When enabled, the frequency source is AUI1.</td></tr>
<tr><td colspan="3">16: Reserved</td></tr>
<tr><td>17</td><td>AUI2 operation speed command</td><td>When enabled, it forces the frequency source to AUI2.</td></tr>
<tr><td>18</td><td>Emergency Stop</td><td>When enabled, the motor drive ramps to stop according to Pr.07-28.</td></tr>
<tr><td colspan="3">19–23: Reserved</td></tr>
<tr><td>24</td><td>FWD JOG command</td><td>When enabled, the motor drive executes the forward Jog command.</td></tr>
<tr><td>25</td><td>REV JOG command</td><td>When enabled, the motor drive executes the reverse Jog command.</td></tr>
<tr><td colspan="3">26: Reserved</td></tr>
<tr><td>27</td><td>ASR1/ASR2 selection</td><td>ON: Speed is adjusted according to ASR 2.<br>OFF: Speed is adjusted according to ASR 1.</td></tr>
<tr><td>28</td><td>Emergency stop (EF1) (Motor coasts to stop)</td><td>ON: The motor drive executes emergency stop and records the fault code.</td></tr>
<tr><td colspan="3">29–30: Reserved</td></tr>
<tr><td>31</td><td>High torque bias</td><td rowspan="3">When Pr.07-19 is set to 3:<br>Set the high torque bias in Pr.07-21.<br>Set the middle torque bias in Pr.07-22.<br>Set the low torque bias in Pr.07-23.
<table>
<tr><th>31</th><th>32</th><th>33</th><th>Torque Bias</th></tr>
<tr><td>OFF</td><td>OFF</td><td>OFF</td><td>N/A</td></tr>
<tr><td>OFF</td><td>OFF</td><td>ON</td><td>Pr.07-23</td></tr>
<tr><td>OFF</td><td>ON</td><td>OFF</td><td>Pr.07-22</td></tr>
<tr><td>OFF</td><td>ON</td><td>ON</td><td>Pr.07-23+ Pr.07-22</td></tr>
<tr><td>ON</td><td>OFF</td><td>OFF</td><td>Pr.07-21</td></tr>
<tr><td>ON</td><td>OFF</td><td>ON</td><td>Pr.07-21+ Pr.07-23</td></tr>
<tr><td>ON</td><td>ON</td><td>OFF</td><td>Pr.07-21+ Pr.07-22</td></tr>
<tr><td>ON</td><td>ON</td><td>ON</td><td>Pr.07-21+ Pr.07-22+ Pr.07-23</td></tr>
</table></td></tr>
<tr><td>32</td><td>Middle torque bias</td></tr>
<tr><td>33</td><td>Low torque bias</td></tr>
<tr><td colspan="3">34–37: Reserved</td></tr>
<tr><td>38</td><td>Disable writing to EEPROM</td><td>When enabled, you cannot write to EEPROM.</td></tr>
<tr><td>39</td><td>Torque command direction</td><td>When the torque command is AUI, set this function to change the torque command direction. To work with Pr.07-13 = 2, set Pr.03-01 to 2.</td></tr>
<tr><td>40</td><td>Enable drive function</td><td>When enabled, it executes the motor drive function. This function can be used with multi-function output (setting Pr.02-11–Pr.02-14 to 15) and (Pr.02-31 and Pr.02-32).</td></tr>
</table>

| | | |
|---|---|---|
| 41 | Magnetic contactor detection | This terminal is for the magnetic contactor feedback signal ON/OFF.<br>When the motor drive receives a RUN command, it enables the corresponding output terminal (setting 15) after Pr.02-31 time. It checks if this function is enabled in the detection time (Pr.02-36). If NOT, the magnetic contactor error occurs and error code “MCF” displays. |
| 42 | Mechanical brake 1 | When the motor drive receives a RUN command, it enables the corresponding output terminal (setting 12) after Pr.02-29 time. It checks if this function is enabled in the detection time (Pr.02-35). If NOT, the mechanical brake error occurs and error code “MBF” displays. |
| 43 | EPS function (Emergency Power System) | If power is cut during running, the drive stops when the DC bus voltage is less than the low voltage level. After power is cut, the drive runs according to the EPS frequency when EPS is applied and this function is ON. |
| 44 | Mechanical brake 2 | When the motor drive receives a RUN command, it enables the corresponding output terminal (setting 12) after Pr.02-29 time. It checks if this function is enabled in the detection time (Pr.02-35). If NOT, the mechanical brake error occurs and error code “MBF” displays. |
| 45–51 | Direct docking mode only | Contact Delta for more information. |
| 53 | Terminal leveling signal for direct docking | When the elevator runs to the leveling area, controller sends a signal to the drive to make the drive stop within effective distance (Pr.01-36). |
| 54 | Power failure signal | When power failure occurs, the host controller inputs this signal to inform the drive. When the motor drive receives this signal, MO = 49 is disabled after Pr.06-71 time |
| 55 | Manual emergency deceleration | When the motor drive receives this signal, it decelerates to Pr.01-29 speed according to Pr.01-40 deceleration time. |
| 56 | Automatic emergency deceleration | After setting this MI function, the system monitors the current speed. If the speed is higher than Pr.01-39, the drive decelerates to Pr.01-29 speed according to Pr.01-40 deceleration time. |




## 02-09 Digital Input Response Time

Control Mode **VF** **VFPG** **SVC** **FOCPG** **FOCPM** Default: 0.005

Settings 0.001–30.000 sec.

- Defines the digital input terminal signal delay and confirmation. The delay time prevents interference that can cause errors (except for the counter input) in the digital terminal input (FWD, REV and MI1–8). Increasing the setting for this parameter can reduce the errors, but it delays the response time.

## 02-10 Digital Input Operation Direction

Control Mode **VF** **VFPG** **SVC** **FOCPG** **FOCPM** Default: 0

Settings 0–65535

- Sets the input signal level and it is not affected by the SINK/SOURCE status.
- Bit 0 is for FWD terminal, bit 1 is for REV terminal and bits 2–9 are for MI1 to MI8.
- You can change the terminal status between ON and OFF through communications.
  For example, set MI1=1 (multi-step speed command 1) and MI2=2 (multi-step speed command 2). Then the reverse + second step speed command = 1010 (binary) = A (hexadecimal). You only need to set Pr.02-10=A through communications and it can move reverse at the second step speed. In this case, you do not need to wire any multi-function terminals.

| bit9 | bit8 | bit7 | bit6 | bit5 | bit4 | bit3 | bit2 | bit1 | bit0 |
|---|---|---|---|---|---|---|---|---|---|
| MI8 | MI7 | MI6 | MI5 | MI4 | MI3 | MI2 | MI1 | REV | FWD |

| | |
|---|---|
| ✓ 02-11 | Multi-function Output 1: RA, RB, RC (Relay 1) |

Default: 0

| | |
|---|---|
| ✓ 02-12 | Multi-function Output 2: MRA, MRB, MRC (Relay 2) |

Default: 0

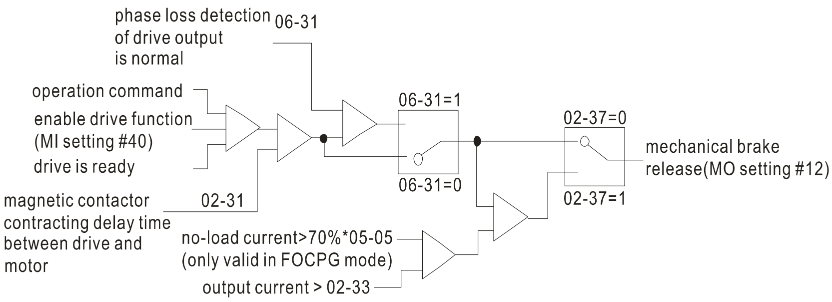
| | |
|---|---|
| ✓ 02-13 | Multi-function Output 3: R1A, R12C (Relay 3) |
| ✓ 02-14 | Multi-function Output 4: R2A, R12C (Relay 4) |
| ✓ 02-15 | Multi-function Output 5: MO1 |
| ✓ 02-16 | Multi-function Output 6: MO2 |
| ✓ 02-17 | Multi-function Output 7: MO3 |
| ✓ 02-18 | Multi-function Output 8: MO4 |
| ✓ 02-19 | Multi-function Output 9: MO5 |
| ✓ 02-20 | Multi-function Output 10: MO6 |
| 02-21 | Reserved |
| 02-22 | Reserved |

Default: 0

| Settings / Control Mode | VF | VFPG | SVC | FOCPG | FOCPM |
|---|---|---|---|---|---|
| 0: No function | ○ | ○ | ○ | ○ | ○ |
| 1: Indication during operation | ○ | ○ | ○ | ○ | ○ |
| 2: Operation speed reached | ○ | ○ | ○ | ○ | ○ |
| 3: Desired frequency 1 reached (Pr.02-25, Pr.02-26) | ○ | ○ | ○ | ○ | ○ |
| 4: Desired frequency 2 reached (Pr.02-27, Pr.02-28) | ○ | ○ | ○ | ○ | ○ |
| 5: Zero Speed (Frequency command) | ○ | ○ | ○ | ○ | ○ |
| 6: Zero speed with stop (Frequency command) | ○ | ○ | ○ | ○ | ○ |
| 7: Over-torque (OT1) (Pr.06-05–06-07) | ○ | ○ | ○ | ○ | ○ |
| 8: Over-torque (OT2) (Pr.06-08–06-10) | ○ | ○ | ○ | ○ | ○ |
| 9: Drive is ready | ○ | ○ | ○ | ○ | ○ |
| 10: User-defined low-voltage detection (LV) | ○ | ○ | ○ | ○ | ○ |
| 11: Malfunction indication | ○ | ○ | ○ | ○ | ○ |
| 12: Mechanical brake release (Pr.02-29, Pr.02-30, Pr.02-37) | ○ | ○ | ○ | ○ | ○ |
| 13: Overheat (Pr.06-14) | ○ | ○ | ○ | ○ | ○ |
| 14: Brake transistor signal | ○ | ○ | ○ | ○ | ○ |
| 15: Motor-controlled magnetic contactor output | ○ | ○ | ○ | ○ | ○ |
| 16: Slip error (oSL) | ○ | ○ | ○ | ○ | ○ |
| 17: Malfunction indication 1 | ○ | ○ | ○ | ○ | ○ |
| 18: Reserved | | | | | |
| 19: Brake transistor output error | ○ | ○ | ○ | ○ | ○ |
| 20: Warning output | ○ | ○ | ○ | ○ | ○ |
| 21: Over-voltage warning | ○ | ○ | ○ | ○ | ○ |
| 22: Over-current stall prevention warning | ○ | ○ | ○ | | |

| | | | | | |
|---|---|---|---|---|---|
| 23: Over-voltage stall prevention warning | ○ | ○ | ○ | ○ | ○ |
| 24: Operation mode indication (Pr.00-15=1) | ○ | ○ | ○ | ○ | ○ |
| 25: Forward command | ○ | ○ | ○ | ○ | ○ |
| 26: Reverse command | ○ | ○ | ○ | ○ | ○ |
| 27: Output when current ≥ Pr.02-33 | ○ | ○ | ○ | ○ | ○ |
| 28: Output when current < Pr.02-33 | ○ | ○ | ○ | ○ | ○ |
| 29: Output when frequency ≥ Pr.02-34 | ○ | ○ | ○ | ○ | ○ |
| 30: Output when frequency < Pr.02-34 | ○ | ○ | ○ | ○ | ○ |
| 31: Power generation direction and status verification | ○ | ○ | ○ | ○ | ○ |
| 32: Power generation direction | ○ | ○ | ○ | ○ | ○ |
| 33: Zero speed (actual output frequency) | ○ | ○ | ○ | ○ | ○ |
| 34: Zero speed with Stop (actual output frequency) | ○ | ○ | ○ | ○ | ○ |
| 35: Fault output option 1 (Pr.06-22) | ○ | ○ | ○ | ○ | ○ |
| 36: Fault output option 2 (Pr.06-23) | ○ | ○ | ○ | ○ | ○ |
| 37: Fault output option 3 (Pr.06-24) | ○ | ○ | ○ | ○ | ○ |
| 38: Fault output option 4 (Pr.06-25) | ○ | ○ | ○ | ○ | ○ |
| 39: Reserved | | | | | |
| 40: Speed reached (including zero speed) | ○ | ○ | ○ | ○ | ○ |
| 41: Reserved | | | | | |
| 42: STO Output Error | ○ | ○ | ○ | ○ | ○ |
| 43–44: Direct Docking Mode only | | | | | |
| 45: Reserved | | | | | |
| 46: Retrying after a fault has occurred indication | ○ | ○ | ○ | ○ | ○ |
| 47: Direct Docking Mode only | | | | | |
| 48: Control output of MPSCC (Motor Phase Short Circuit Contactor) | ○ | ○ | ○ | ○ | ○ |
| 49: Emergency power mode action | ○ | ○ | ○ | ○ | ○ |

| Settings | Functions | Descriptions |
|---|---|---|
| 0 | No function | MO has no function |
| 1 | Indication during operation | Active when there is an output from the drive or RUN command is ON. |
| 2 | Operation speed reached | Active when the AC motor drive reaches the output frequency setting. |
| 3 | Desired frequency 1 reached (Pr.02-25, 02-26) | Active when the desired frequency (Pr.02-25, 02-26) reached. |
| 4 | Desired frequency 2 reached (Pr.02-27, 02-28) | Active when the desired frequency (Pr.02-27, 02-28) reached. |
| 5 | Zero Speed (Frequency command) | Active when the Frequency command = 0. (the drive should be at RUN mode) |
| 6 | Zero Speed with stop (Frequency command) | Active when Frequency command = 0 or Stop. |

| | | |
|---|---|---|
| 7 | Over-torque (OT1) (Pr.06-05–06-07) | Active when detecting over-torque. Refer to Pr.06-05 (over-torque detection-OT1), Pr.06-06 (over-torque detection level-OT1) and Pr.06-07 (over-torque detection time-OT1). |
| 8 | Over-torque (OT2) (Pr.06-08–06-10) | Active when detecting over-torque. Refer to Pr.06-08 (over-torque detection-OT2), Pr.06-09 (over-torque detection level-OT2) and Pr.06-10 (over-torque detection time-OT2). |
| 9 | Drive is ready | Active when the drive is ON and no error detected. |
| 10 | User-defined low-voltage detection | Active when the DC bus voltage is too low (see Pr.06-00 Low voltage level). |
| 11 | Malfunction indication | Active when a fault occurs (except Lv stop). |
| 12 | Mechanical brake release (Pr.02-29, Pr.02-30, Pr.02-37) | When the drive runs according to Pr.02-29, it is ON. Use this function with the DC brake. It is recommended to use contact "b" (N.C).   |
| 13 | Overheat (Pr.06-14) | Active when IGBT or heat sink overheats. To prevent OH, turn off the drive (refer to Pr.06-14). |
| 14 | Brake transistor signal | Activated when the drive needs help braking the load. This function helps achieve a smooth deceleration (refer to Pr.07-00). |
| 15 | Motor-controlled magnetic contactor output | Active when you set MI function to #40 (Enable drive function). |
| 16 | Slip error (oSL) | Active when the slip error is detected (according to Pr.05-14). |
| 17 | Malfunction indication 1 | Activate after 10 ms when a fault occurs (except Lv stop). |
| 18 | Reserved | |
| 19 | Brake transistor output error | Active when a brake transistor error is detected |
| 20 | Warning output | Active when a warning is detected. |
| 21 | Over-voltage warning | Active when an over-voltage is detected. |
| 22 | Over-current stall prevention warning | Active when an over-current stall prevention is detected. |
| 23 | Over-voltage stall prevention warning | Active when an over-voltage stall prevention is detected. |
| 24 | Operation mode indication | Active when the operation command is controlled by an external terminal (Pr.00-15=1). |
| 25 | Forward command | Active when the operation direction is forward. |
| 26 | Reverse command | Active when the operation direction is reverse. |
| 27 | Output when current ≥ Pr.02-33 | Active when current is ≥ Pr.02-33. |

<table>
<tr><td>28</td><td>Output when current < Pr.02-33</td><td>Active when current is < Pr.02-33.</td></tr>
<tr><td>29</td><td>Output when frequency ≥ Pr.02-34</td><td>Active when frequency is ≥ Pr.02-34.</td></tr>
<tr><td>30</td><td>Output when frequency < Pr.02-34</td><td>Active when frequency is < Pr.02-34.</td></tr>
<tr><td>31</td><td>Power generation direction and status verification</td><td>Activate when the power generation direction is verified.</td></tr>
<tr><td>32</td><td>Power generation direction</td><td>Activate when the power generation direction runs forward.</td></tr>
<tr><td>33</td><td>Zero speed (actual output frequency)</td><td>Active when the actual output frequency is 0. The drive should be in RUN mode.</td></tr>
<tr><td>34</td><td>Zero speed with stop (actual output frequency)</td><td>Active when the actual output frequency is 0 or Stop. The drive should be in RUN mode.</td></tr>
<tr><td>35</td><td>Fault output option 1 (Pr.06-22)</td><td>Active when Pr.06-22 is ON.</td></tr>
<tr><td>36</td><td>Fault output option 2 (Pr.06-23)</td><td>Active when Pr.06-23 is ON.</td></tr>
<tr><td>37</td><td>Fault output option 3 (Pr.06-24)</td><td>Active when Pr.06-24 is ON.</td></tr>
<tr><td>38</td><td>Fault output option 4 (Pr.06-25)</td><td>Active when Pr.06-25 is ON.</td></tr>
<tr><td>39</td><td>Reserved</td><td></td></tr>
<tr><td>40</td><td>Speed reached (including zero speed)</td><td>Active when the output frequency reaches the frequency setting.</td></tr>
<tr><td>41</td><td>Reserved</td><td></td></tr>
<tr><td>42</td><td>STO Output Error</td><td><table>
<tr><td rowspan="2">Status of drive</td><td>Status of safety output</td></tr>
<tr><td>Status A (MO=42)</td></tr>
<tr><td>Normal</td><td>Broken circuit (open)</td></tr>
<tr><td>STO</td><td>Short circuit (closed)</td></tr>
<tr><td>STL1–STL3</td><td>Short circuit (closed)</td></tr>
</table>
*Setting of logic output B is on page 16-6.</td></tr>
<tr><td>43–44</td><td>Direct Docking Mode only</td><td>Contact Delta for more information</td></tr>
<tr><td>45</td><td>Reserved</td><td></td></tr>
<tr><td>46</td><td>Retrying after a fault has occurred indication</td><td>Retry multiple outputs after an error has occurred. When the retry period has finished, MO stops.</td></tr>
<tr><td>47</td><td>Direct Docking Mode only</td><td>Contact Delta for more information</td></tr>
<tr><td>48</td><td>Control output of MPSCC (Motor Phase Short Circuit Contactor)</td><td>Active when the drive receives a STOP command.</td></tr>
<tr><td>49</td><td>Emergency power mode action</td><td>Active when the drive receives a signal from the host controller (Pr.02-01–02-08=54) after Pr.06-71 time.</td></tr>
</table>

## 02-23 Multi-function Output Terminal Direction

Control Mode VF VFPG SVC FOCPG FOCPM Default: 0

Settings 0–65535

This parameter uses bit setting. If the bit is 1, the multi-function output terminal acts in the opposite direction. For example, if you set Pr.02-11 to 1 and the forward bit is 0, Relay 1 is ON when the drive is running and OFF when the drive is stopped.

| Bit 11 | Bit 10 | Bit 9 | Bit 8 | Bit 7 | Bit 6 | Bit 5 | Bit 4 | **Bit 3** | **Bit 2** | **Bit 1** | **Bit 0** |
|---|---|---|---|---|---|---|---|---|---|---|---|
| - | - | MO6 | MO5 | MO4 | MO3 | MO2 | MO1 | **R2A** | **R1A** | **MRA** | **RA** |

## 02-24 Serial Start Signal Selection

Control Mode VF VFPG SVC FOCPG FOCPM Default: 0

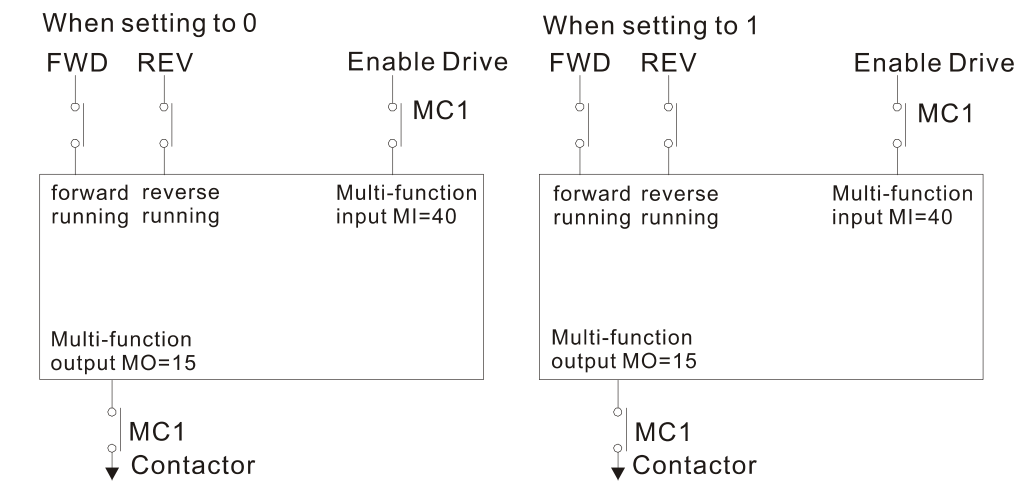
Settings 0: According to FWD/REV signal

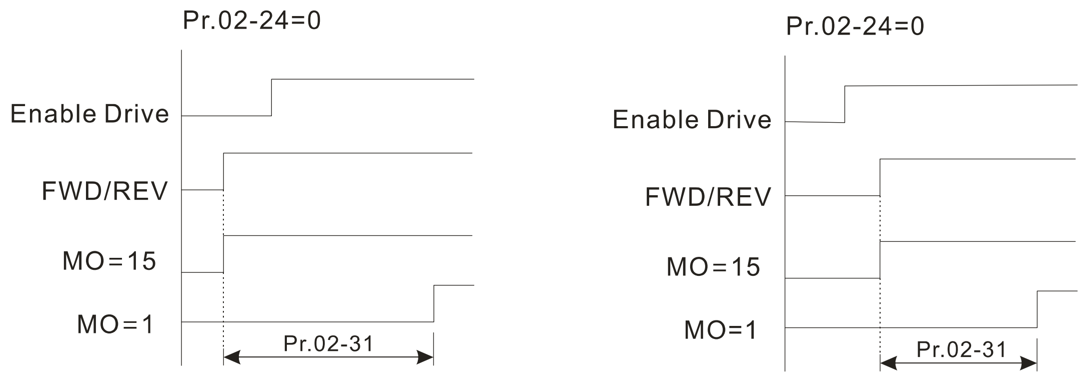
1: According to Enable drive function signal

Selects the contactor serial start method.

0: According to FWD/REV signal, the motor starts to run after the Enable signal MI = 40 is ON.

1: According to Enable signal, the contactor, mechanical brake and DC brake all follow parameters' setting to run after FWD/REV and Enable are ON.

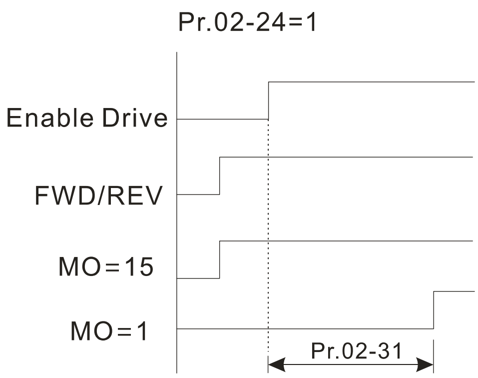


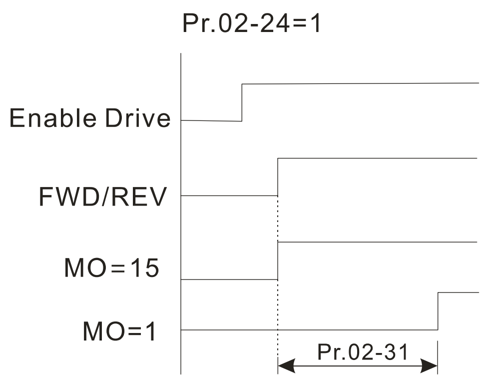




| Pr.02-24=0 | | Enable Drive 0 | Enable Drive 1 |
|---|---|---|---|
| Multi-function output MO= 15 | 0 | False | False |
| | 1 | True | True |

<u>**No matter** if the Enable Drive function signal outputs or not,</u>

<u>the drive starts to count Pr.02-31 after MO15 .outputs.</u>




| Pr.02-24=1 | | Enable Drive | |
|---|---|---|---|
| | | 0 | 1 |
| Multi-function output MO= 15 | 0 | False | False |
| | 1 | False | True |

**After both** Enable Drive function signal and MO15 output, the drive starts to count Pr.02-31.

## 02-25 Desired Frequency Reached 1

Control Mode **VF** **VFPG** **SVC** **FOCPG** **FOCPM** Default: 60.00/50.00

Settings 0.00–400.00 Hz

## 02-26 Desired Frequency Reached Width 1

Control Mode **VF** **VFPG** **SVC** **FOCPG** **FOCPM** Default: 2.00

Settings 0.00–400.00 Hz

## 02-27 Desired Frequency Reached 2

Control Mode **VF** **VFPG** **SVC** **FOCPG** **FOCPM** Default: 60.00/50.00

Settings 0.00–400.00 Hz

## 02-28 Desired Frequency Reached Width 2

Control Mode **VF** **VFPG** **SVC** **FOCPG** **FOCPM** Default: 2.00

Settings 0.00–400.00 Hz

- Once the output frequency reaches the desired frequency and the corresponding multi-function output terminal is set to 3 or 4 (Pr.02-11–Pr.02-22), this multi-function output terminal is ON.

## 02-29 Brake Release Delay Time when Elevator Starts

Control Mode **VF** **VFPG** **SVC** **FOCPG** **FOCPM** Default: 0.250

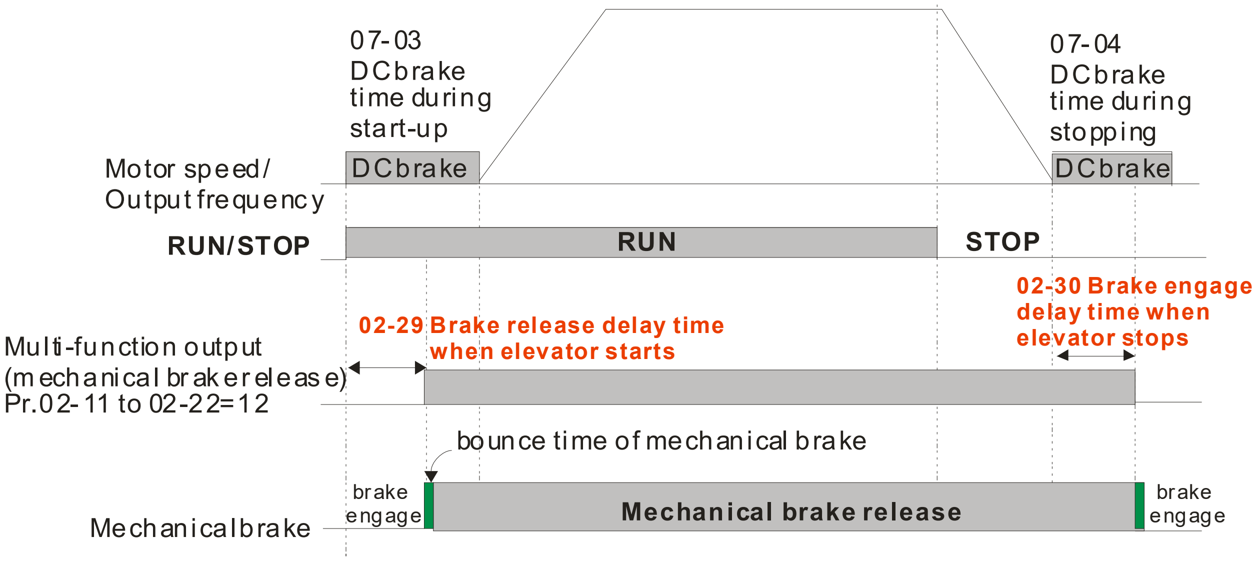
Settings 0.000–65.000 sec.

## 02-30 Brake Engage Delay Time when Elevator Stops

Control Mode **VF** **VFPG** **SVC** **FOCPG** **FOCPM** Default: 0.250

Settings 0.000–65.000 sec.

- When the AC motor drive runs and after the delay time in Pr.02-29, the corresponding multi-function output terminal (12: mechanical brake release) is ON.
- When the AC motor drive stops and after the delay time in Pr.02-30, the corresponding multi-function output terminal (12: mechanical brake release) is OFF.
- Use this function with the DC brake function.




## 02-31 Magnetic Contactor Contracting Delay Time between Drive and Motor
## 02-32 Magnetic Contactor Release Delay Time between Drive and Motor

Control Mode **VF** **VFPG** **SVC** **FOCPG** **FOCPM** Default: 0.200

Settings 0.010–65.000 sec.

After running, use these parameters with multifunction input terminal setting 40 (Enable drive function), and multifunction output terminal setting 15 (motor-controlled magnetic contactor output). When the multifunction output terminals are ON, the drive starts outputting after the delay time in Pr.02-31. When the drive stops outputting, multifunction output terminals release after the delay time in Pr.02-32.

## 02-38 MPSCC (Motor Phase Short Circuit Contactor) Release Delay Time between Drive and Motor

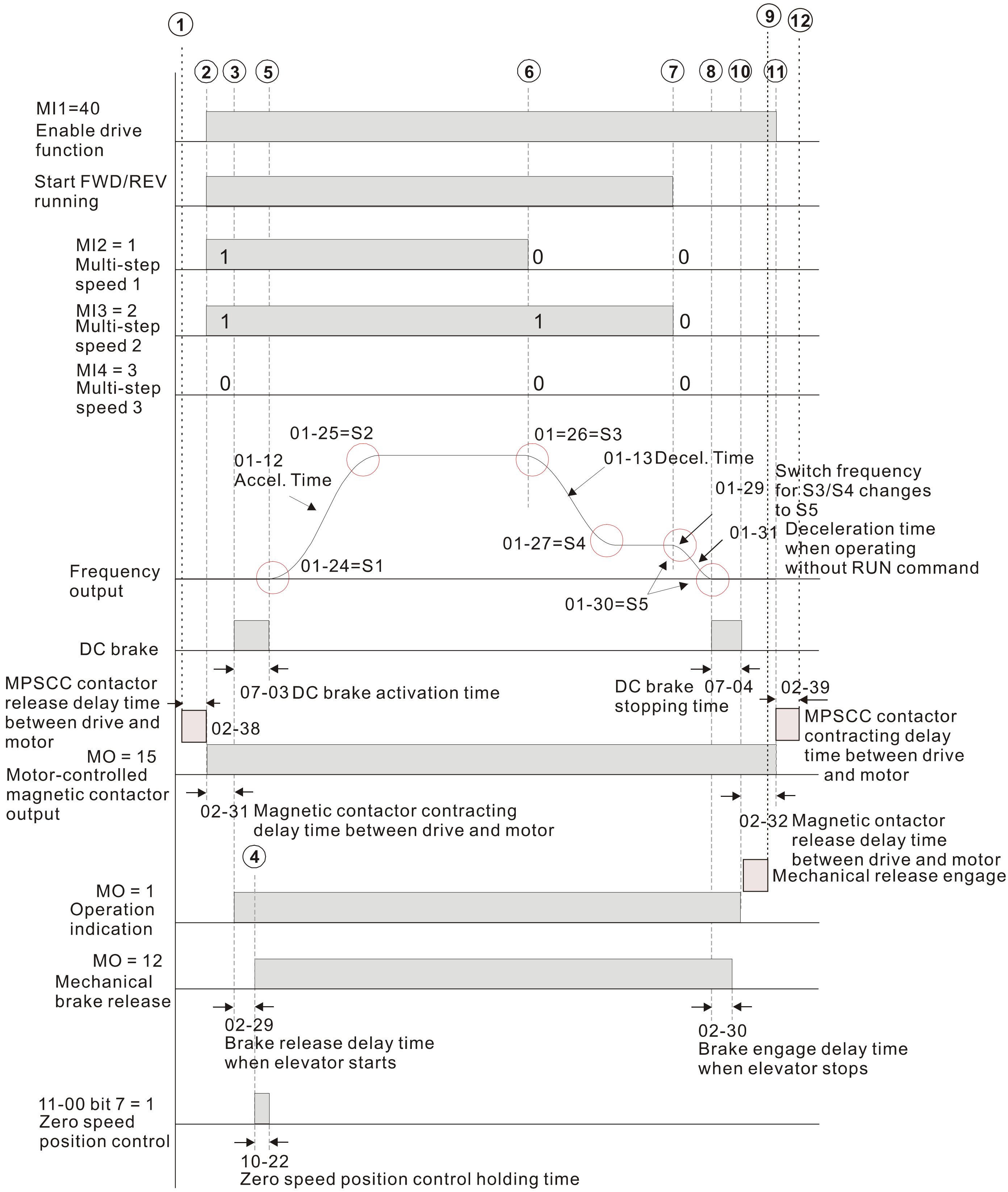
Control Mode **VF** **VFPG** **SVC** **FOCPG** **FOCPM** Default: 0.200

Settings 0.010~65.000 sec.

## 02-39 MPSCC (Motor Phase Short Circuit Contactor) Contracting Delay Time between Drive and Motor

Control Mode **VF** **VFPG** **SVC** **FOCPG** **FOCPM** Default: 0.200

Settings 0.010~65.000 sec.




1 Elevator starts running
2 Star-delta contactor release
3 Magnetic contactor is ON
4 Mechanical brake release
5 End of <DC brake at start-up>
6 Start of deceleration
7 End of creeping
8 Start of <DC brake at stop>
9 Brake release engage
10 End of <DC brake at stop>
11 Magnetic contactor release
12 MPSCC contracting (motor release)

Elevator Timing Diagram

## 02-33 External Terminal Output Current Level

Control Mode **VF** **VFPG** **SVC** **FOCPG** **FOCPM** Default: 0

Settings 0–100%

📖 When output current is ≥ Pr.02-33, it activates the multi-function output terminal (Pr.02-11–Pr.02-22 are set to 27).

📖 When output current is < Pr.02-33, it activates the multi-function output terminal (Pr.02-11–Pr.02-22 are set to 28).

## 02-34 External Terminal Output Speed Limit

Control Mode **VF** **VFPG** **SVC** **FOCPG** **FOCPM** Default: 0.00

Settings 0.00–±400.00 Hz (this is motor speed when using with PG)

📖 When output frequency is ≥ 02-34, it activates the multi-function terminal (Pr.02-11–Pr.02-22 are set to 29).

📖 When output frequency is < 02-34, it activates the multi-function terminal (Pr.02-11–Pr.02-22 are set to 30).

## 02-35 Mechanical Brake Detection Time

Control Mode **VF** **VFPG** **SVC** **FOCPG** **FOCPM** Default: 0.00

Settings 0.00–10.00 sec.

📖 When the mechanical brake function (Pr.02-01–Pr.02-08 are set to 42) is not enabled within this setting time, the drive displays error code 64 (MBF) mechanical brake error.

## 02-36 Magnetic Contactor Detection Time

Control Mode **VF** **VFPG** **SVC** **FOCPG** **FOCPM** Default:0.00

Settings 0.00–10.00 sec.

📖 When the magnetic contactor function (Pr.02-01–02-08 are set to 41) is not enabled within this setting time, the drive displays error code 66 (MCF) magnetic contactor error.

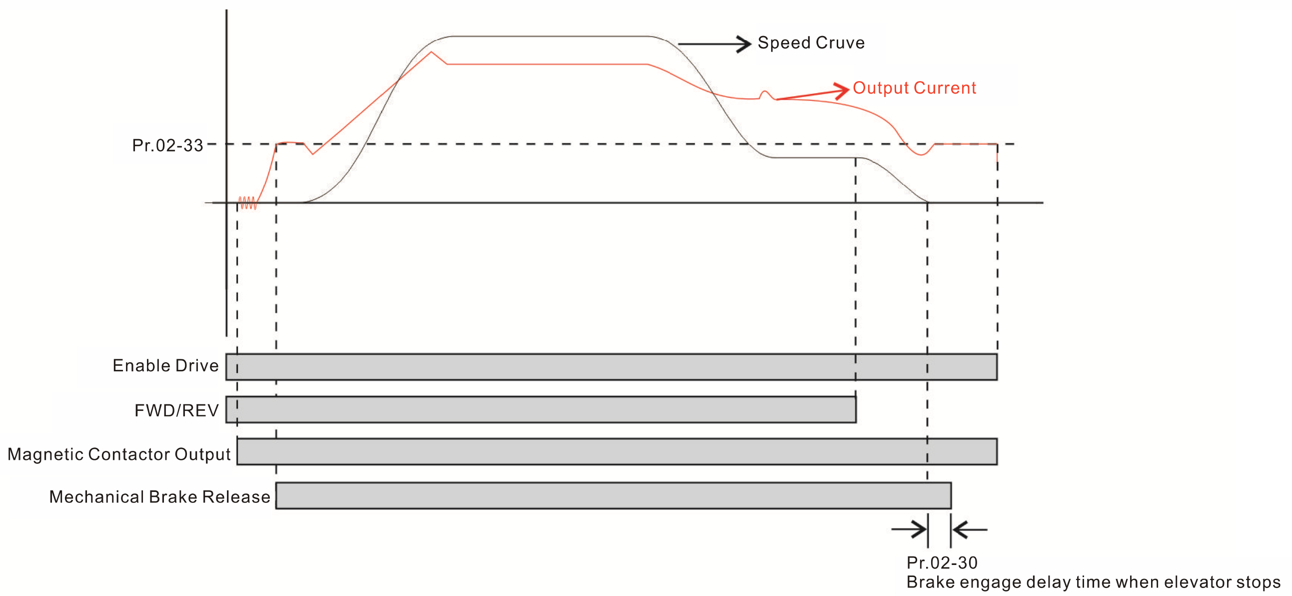
## 02-37 Torque Check

Control Mode **VF** **VFPG** **SVC** **FOCPG** **FOCPM** Default: 0

Settings 0: Disable

1: Enable

📖 When the drive receives the operation signal, the drive checks if there is a torque output. When enabled, the drive releases the mechanical brake after confirming that there is a torque output.



# 03 Analog Input / Output Parameters

✔: You can set this parameter during operation.

## ✔ 03-00 Analog Input 1 (AUI1)

Default:1

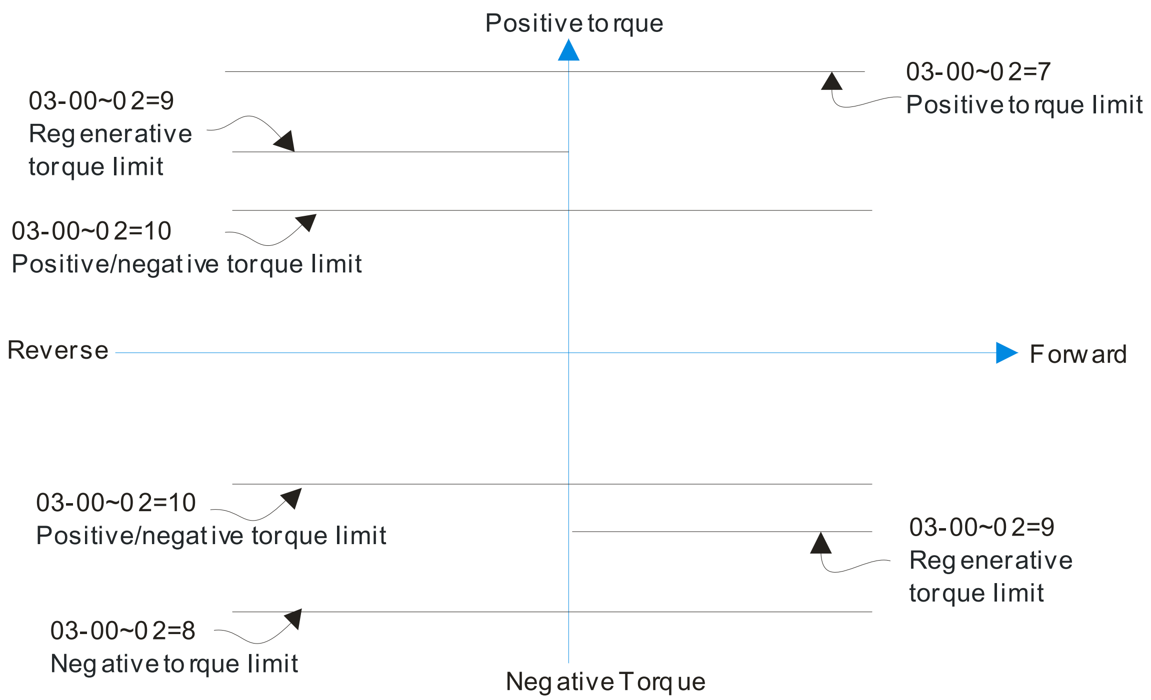
## 03-01 Reserved

## ✔ 03-02 Analog Input 2 (AUI2)

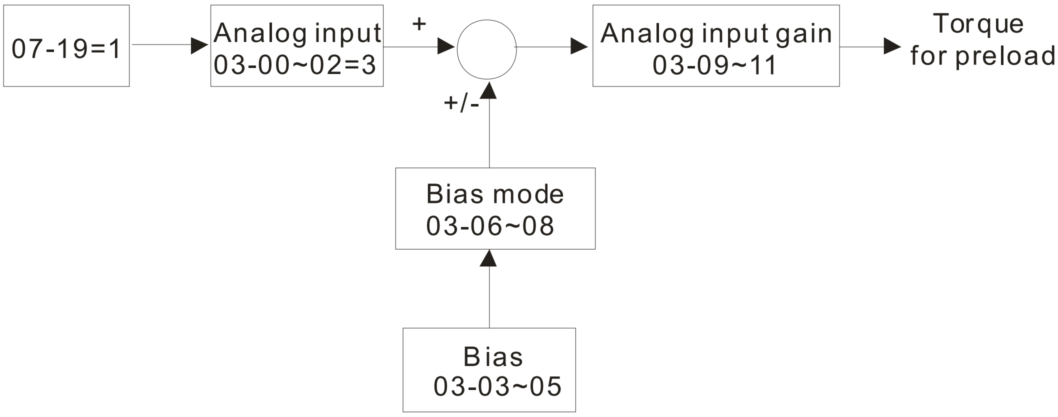
Default: 0

| Settings | Control Mode | VF | VFPG | SVC | FOCPG | FOCPM |
|---|---|---|---|---|---|---|
| 0: No function | | ○ | ○ | ○ | ○ | ○ |
| 1: Frequency command (speed limit under torque control mode) | | ○ | ○ | ○ | ○ | ○ |
| 2: Torque command (torque limit under speed mode) | | | | | | |
| 3: Load compensation | | ○ | ○ | ○ | ○ | ○ |
| 4–5: Reserved | | | | | | |
| 6: P.T.C. thermistor input value | | ○ | ○ | ○ | ○ | ○ |
| 7: Positive torque limit | | | | | ○ | ○ |
| 8: Negative torque limit | | | | | ○ | ○ |
| 9: Regenerative torque limit | | | | | ○ | ○ |
| 10: Positive/negative torque limit | | | | | ○ | ○ |

- When using the Frequency command or speed limit under torque control mode, the corresponding value for 0 to ±10 V or 4–20 mA is 0–maximum output frequency (Pr.01-00).
- When using the Torque command or torque limit, the corresponding value for 0 to ±10 V or 4–20 mA is 0–maximum output torque (Pr.07-14).
- When using torque compensation, the corresponding value for 0 to ±10 V or 4–20 mA is 0–moto's rated torque.



07-19: Source of torque offset
03-00~02: Analog input selections (AUI1/ACI/AUI2)
03-03~05: Analog input bias (AUI1/ACI/AUI2)
03-06~08: AUI1/ACI/AUI2 bias mode




## 03-03 Analog Input Bias 1 (AUI1)

Control Mode **VF** **VFPG** **SVC** **FOCPG** **FOCPM** Default: 0.0

Settings -100.0–100.0%

- Sets the corresponding AUI1 voltage for the external analog input 0.

## 03-04 Reserved

## 03-05 Analog Input Bias 1 (AUI2)

Control Mode **VF** **VFPG** **SVC** **FOCPG** **FOCPM** Default:0.0

Settings -100.0–100.0%

- Sets the corresponding AUI2 voltage for the external analog input 0.
- The relation between external input voltage/current and setting frequency is equal to -10–10 V (4–20 mA) corresponding to 0–60 Hz.

## 03-07 Reserved

## 03-06 AUI1 Positive/negative Bias Mode

Control Mode **VF** **VFPG** **SVC** **FOCPG** **FOCPM** Default: 0

## 03-08 AUI2 Positive/negative Bias Mode

Control Mode **VF** **VFPG** **SVC** **FOCPG** **FOCPM** Default: 0

Settings 0: Zero bias

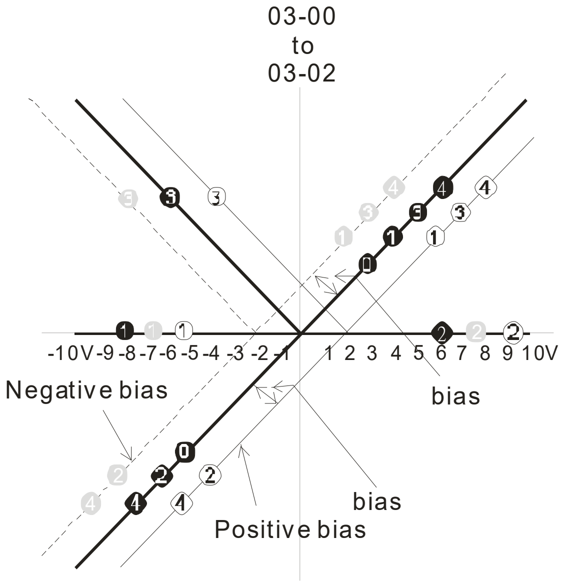
1: Lower than or equal to bias

2: Higher than or equal to bias

3: Use bias as the base to get the absolute value of bias voltage (unipolar)

4: Using bias as the base (unipolar)

- In a noisy environment, you can use a negative bias to provide a noise margin. It is recommended that you NOT use less than 1 V to set the operating frequency.




03-09~03-11 gain is positive

0 Zero bias

1 Serve bias as the center, lower than bias = bias

2 Serve bias as the center, greater than bias=bias

3 The absolute value of the bias voltage while serving as the center (unipolar)

4 Serve bias as the center(unipolar)

## 03-09 Analog Input Gain 1 (AUI1)

Control Mode **VF** **VFPG** **SVC** **FOCPG** **FOCPM** Default: 100.0

Settings 0.0–500.0%

## 03-10 Reserved

## 03-11 Analog Input Gain 1 (AUI2)

Control Mode **VF** **VFPG** **SVC** **FOCPG** **FOCPM** Default: 100.0

Settings 0.0–500.0%

- Pr.03-03–03-11 are used when the Frequency command source is the analog voltage/current signal.

## 03-12 Analog Input Filter Time (AUI1)

Control Mode **VF** **VFPG** **SVC** **FOCPG** **FOCPM** Default: 0.01

Settings 0.00–2.00 sec.

## 03-13 Reserved

## 03-14 Analog Input Filter Time (AUI2)

Control Mode **VF** **VFPG** **SVC** **FOCPG** **FOCPM** Default: 0.01

Settings 0.00–2.00 sec.

- Analog signals, such as those entering AUI1 and AUI2, are commonly affected by interference that affects the stability of the analog control. Use the Input Noise Filter to create a more stable system.
- If Pr.03-14 is large, the control is more stable, but the response to the input is slower. If Pr.03-14 is small, the control may be unstable, but the response to the input is faster.

## 03-15 Load Compensation Auto-tuning

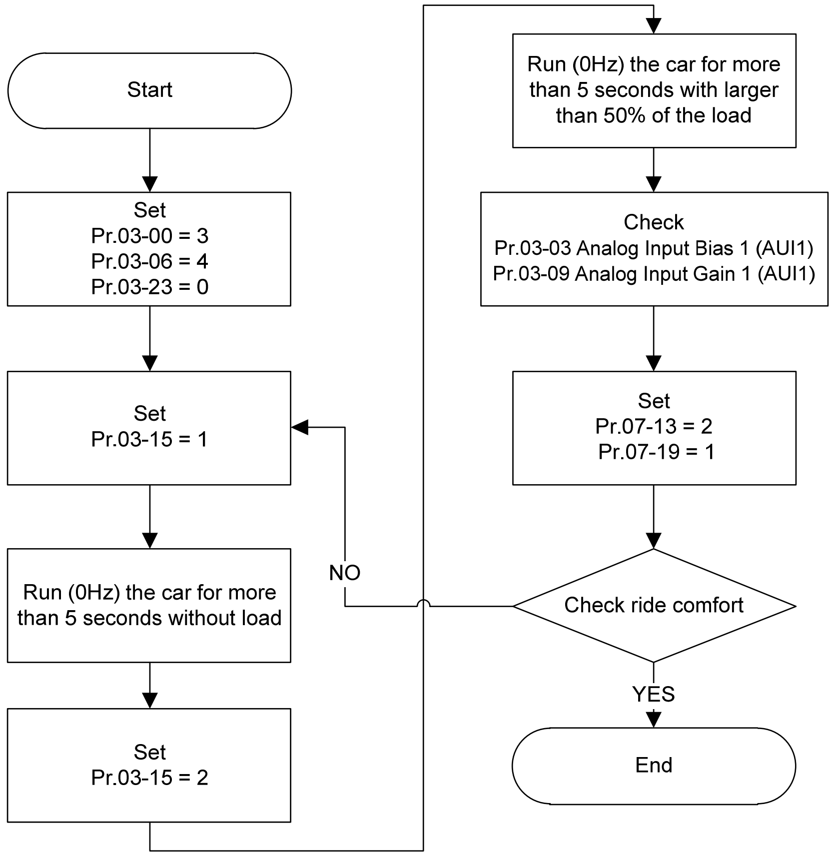
Control Mode **VF** **VFPG** **SVC** **FOCPG** **FOCPM** Default: 0

Settings 0: No function

1: Auto-tunes with running without load

2: Auto-tunes with running with load

- Use torque compensation function to avoid the roll-back generated by using IM to work with spiral gear.
- This function is only valid for AUI1.
- Auto-tuning process:




## 03 - 16 Reserved

## 03 - 17 Analog Output Selection 1
## 03 - 20 Analog Output Selection 2

Control Mode **VF** **VFPG** **SVC** **FOCPG** **FOCPM** Default: 0

Settings 0: Output frequency (Hz)

1: Frequency command (Hz)

2: Motor speed (RPM)

3: Output current (rms)

4: Output voltage

5: DC bus voltage

6: Power factor angle

7: Power factor

8: Output torque

9: AUI1

10: Reserved

11: AUI2

12: q-axis current

13: q-axis feedback value

14: d-axis current

15: d-axis feedback value

16: q-axis voltage

17: d-axis voltage

18: Torque command

19–20: Reserved

21: Power output

📖 When setting to 0, it is output frequency, not ASR output frequency.

## 03-18 Analog Output Gain 1
## 03-21 Analog Output Gain 2

Control Mode **VF VFPG SVC FOCPG FOCPM** Default: 100.0

Settings 0–200.0%

📖 Sets the corresponding voltage for the analog output 0.

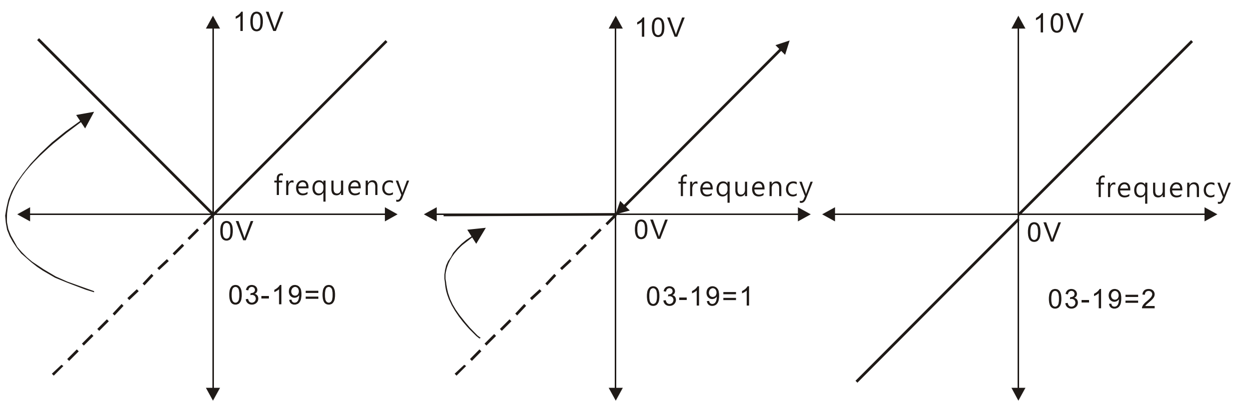
## 03-19 Analog Output Value in REV Direction 1
## 03-22 Analog Output Value in REV Direction 2

Control Mode **VF VFPG SVC FOCPG FOCPM** Default: 0

Settings 0: Absolute value in output voltage

1: Output 0 V in REV direction

2: Enable output voltage in REV direction




Selection for the analog output direction

## 03-23 Analog Input Type (AUI1)
## 03-24 Analog Input Type (AUI2)

Control Mode **VF VFPG SVC FOCPG FOCPM** Default: 0

Settings 0: Bipolar (±10 V)

1: Unipolar (0–10 V)

📖 When this parameter is set to 0 (bipolar), the input function direction is determined by the input signal.

📖 0: And Pr.03-00=1 or 2, AUI decides the operation direction.

📖 1: And Pr.03-00=1, the FWD/REV terminal decides the operation direction.

📖 1: And Pr.03-00=2, setting Pr.02-01–Pr.02-08 to 39 decides the operation direction.

## 04 Multi-step Speed Parameters

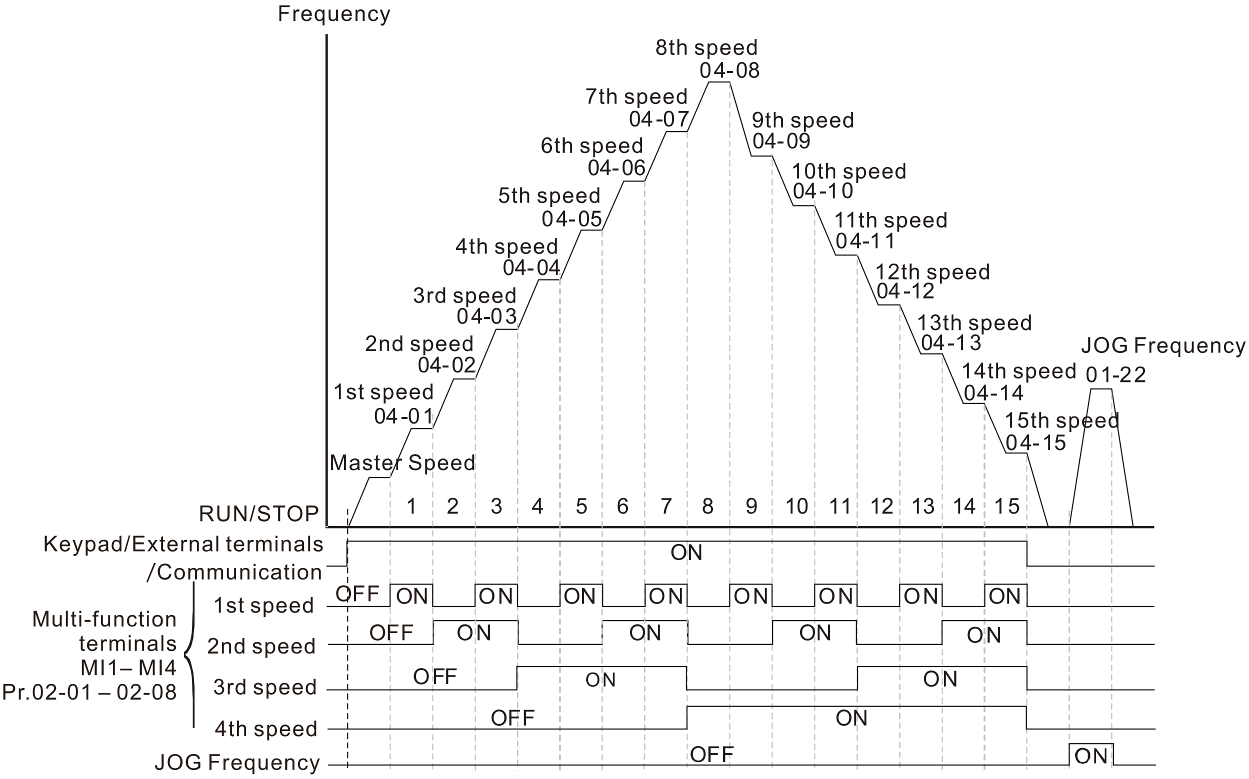
✎: You can set this parameter during operation.

✎ 04-00 Zero Step Speed Frequency
✎ 04-01 1st Step Speed Frequency
✎ 04-02 2nd Step Speed Frequency
✎ 04-03 3rd Step Speed Frequency
✎ 04-04 4th Step Speed Frequency
✎ 04-05 5th Step Speed Frequency
✎ 04-06 6th Step Speed Frequency
✎ 04-07 7th Step Speed Frequency
✎ 04-08 8th Step Speed Frequency
✎ 04-09 9th Step Speed Frequency
✎ 04-10 10th Step Speed Frequency
✎ 04-11 11th Step Speed Frequency
✎ 04-12 12th Step Speed Frequency
✎ 04-13 13th Step Speed Frequency
✎ 04-14 14th Step Speed Frequency
✎ 04-15 15th Step Speed Frequency

Control Mode **VF** **VFPG** **SVC** **FOCPG** **FOCPM** Default: 0.00

Settings 0.00–400.00 Hz

- The multi-function input terminals (refer to Pr.02-01–Pr.02-08) select one of the AC motor drive multi-step speeds (including the master frequency, in total 16 speeds). Pr.04-00–Pr.04-15 determine the speeds (frequencies) as shown above.
- When Pr.00-14 = 1, the master frequency is Pr.01-00.
- When Pr.00-14 = 3, the master frequency is Pr.04-00.




Multi-speed via External Terminals

| 04-16 – 04-99 | Direct docking mode only | | | | | |
|---|---|---|---|---|---|---|
| Control Mode | **VF** | **VFPG** | **SVC** | **FOCPG** | **FOCPM** | Default: - |
| | Settings | Contact Delta for more information | | | | |

# 05 IM Parameters

✎: You can set this parameter during operation.

## 05-00 Motor Auto-tuning

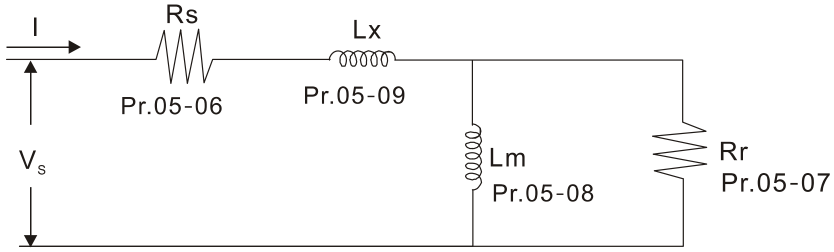
Control Mode **VF** Default: 0

Settings 0: No function

1: Dynamic test (Rs, Rr, Lm, Lx, no-load current) [motor runs]

2: Static Test [motor does not run]

- Position the elevator near the middle floors before auto-tuning.
- Motor auto-tuning:
  Set Pr.05-00 to 1 or 2, and then press the RUN key on the digital keypad KPC-CC01 (Pr.00-15=2) to start auto-tuning. Or when the drive is in manual mode (inspection), run the upward operation or downward operation (Pr.00-15=1) to start auto-tuning immediately. In the process of auto-tuning, an “Auto tuning” warning continuously displays on the digital keypad until it is finished.
- Pay attention to the following notes when Pr.05-00=1 (dynamic test):
  1. Make sure that all the drive parameters are set to defaults and the motor wiring is correct.
  2. Make sure the motor is not loaded before auto-tuning, and that the shaft is not connected to any belt or gear motor. Set this parameter to 2 if you cannot separate the motor from the load.
  3. Enter the correct values for Pr.01-01, Pr.01-02, Pr.05-01, Pr.05-02, Pr.05-03 and Pr.05-04. Refer to motor capacity to set the acceleration/deceleration time.
  4. After auto-tuning is finished, check if Pr.05-05–Pr.05-09 all have values.
  5. Equivalent circuit diagram:




Equivalent circuit for VFD-ED Series

**NOTE**

☑ In torque/vector control mode, do not run motors in parallel.
☑ Do not use torque/vector control mode if the motor rated power exceeds the rated power for the AC motor drive.
☑ The no-load current is usually 20–50% of the rated current.
☑ The rated speed cannot be larger or equal to 120 f/p (f: output frequency Pr.01-01, p: Number of Motor Poles Pr.05-04).
☑ After auto-tuning is finished, activate the drive again to make it operate when the auto-tuning command source is the external terminal.

## 05-01 Motor Rated Current

Control Mode **VF** **VFPG** **SVC** **FOCPG** Unit: Amp

Default: #.##

Settings (40–120%)* Pr.00-01 Amps

- Set this value according to the rated motor frequency from the motor nameplate.
  Example: Suppose the rated current for 7.5 HP (5.5 kW) models is 25 A and the default is 22.5 A. In this way, the current range is from 10 A (25 * 40%) to 30 A (25 * 120%).
- As shown in the table below, the defaults vary according to the different motor drive outputs in HP and in kW.

| | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Motor Drive's Output (HP) | 3* | 5* | 5 | 7.5 | 10 | 15 | 20 | 25 | 30 | 40 | 50 | 60 | 75 | 100 |
| | Motor Drive's Output (kW) | 2.2 | 3.7 | 4 | 5.5 | 7.5 | 11 | 15 | 18.5 | 22 | 30 | 37 | 45 | 55 | 75 |
| 230V | Motor Rated Current (A) Default | 9.82 | 13.91 | 16.36 | 19.64 | 24.54 | 36.82 | 47.46 | 63 | 71.18 | 108 | 131.72 | | | |
| 460V | Motor Rated Current (A) Default | | | 9.41 | 10.64 | 13.91 | 18.82 | 24.54 | 31.1 | 36.82 | 47.46 | 65.46 | 81.82 | 104.72 | 135 |

*: single-phase models.

## 05-02 Motor Rated Power

Control Mode **SVC** **FOCPG** Default: #.##

Settings 0.00–655.35 kW

Sets the rated power of the motor. The default is the power of the drive.

## 05-03 Motor Rated Speed (rpm)

Control Mode **VFPG** **SVC** **FOCPG** Default: 1710

Settings 0–65535

Sets the motor rated speed from the value on the motor nameplate.

## 05-04 Number of Motor Poles

Control Mode **VF** **VFPG** **SVC** **FOCPG** Default: 4

Settings 2–48

Sets the number of motor poles (must be an even number).

## 05-05 Motor No-load Current

Control Mode **VFPG** **SVC** **FOCPG** Unit: Amp

Default: #.##

Settings 0–Pr.05-01 default

As shown in the table below, the defaults vary according to the different motor drive output in HP and in kW.

| | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Motor Drive's Output (HP) | 3* | 5* | 5 | 7.5 | 10 | 15 | 20 | 25 | 30 | 40 | 50 | 60 | 75 | 100 |
| | Motor Drive's Output (kW) | 2.2 | 3.7 | 4 | 5.5 | 7.5 | 11 | 15 | 18.5 | 22 | 30 | 37 | 45 | 55 | 75 |
| 230V | Motor Current w/o Load (A) Default | 3.44 | 4.87 | 5.73 | 6.85 | 8.5 | 12.56 | 15.97 | 20.78 | 23.22 | 33.51 | 39.52 | | | |
| 460V | Motor Current w/o Load (A) Default | | | 3.29 | 3.71 | 4.81 | 6.43 | 8.26 | 10.28 | 11.99 | 15 | 19.64 | 24.55 | 31.42 | 40.5 |

*: single-phase models.

## 05-06 Rs of Motor
## 05-07 Rr of Motor

Control Mode **SVC** **FOCPG** Default: 0.000

Settings 0.000–65.535 Ω

### 05-08 Lm of Motor
### 05-09 Lx of Motor

Control Mode **SVC** **FOCPG** Default: 0.0

Settings 0.0–6553.5 mH

### ✓ 05-10 Torque Compensation Low Pass Filter Time

Control Mode **SVC** Default: 0.020

Settings 0.001–10.000 sec.

### ✓ 05-11 Slip Compensation Low Pass Filter Time

Control Mode **SVC** Default: 0.100

Settings 0.001–10.000 sec.

- Setting Pr.05-10 and Pr.05-11 changes the response time for the compensation.
- When you set Pr.05-10 and Pr.05-11 to 10 seconds, it maximizes the response time for the compensation. If the settings are too low, the system may become unstable.

### ✓ 05-12 Torque Compensation Gain

Control Mode **VF** **VFPG** Default: 0

Settings 0–10

- You can set this parameter so that the AC motor drive increases its voltage output for a higher torque.

### ✓ 05-13 Slip Compensation Gain

Control Mode **SVC** Default: 1.00

Settings 0.00–10.00

- When the motor drive controls an asynchronous motor, the load and slip increase. Use this parameter to correct the frequency and lower the slip to make the motor run near the synchronous speed under the rated current. When the output current is larger than the motor no-load current, the drive compensates the frequency according to the Pr.05-13 setting. If the actual speed is slower than the expected speed, increase the setting and vice versa.
- This is only valid in SVC mode.

### ✓ 05-14 Slip Deviation Level

Control Mode **VFPG** **SVC** **FOCPG** Default: 0

Settings 0–1000%

0: Disable

### ✓ 05-15 Slip Deviation Detection Time

Control Mode **VFPG** **SVC** **FOCPG** Default:1.0

Settings 0.0–10.0 sec.

### ✓ 05-16 Over-slip Action

Control Mode **VFPG** **SVC** **FOCPG** Default: 0

Settings 0: Warn and keep operation

1: Fault and ramp to stop

2: Fault and coast to stop

- Pr.05-14–Pr.05-16 set the allowable slip level and over-slip action when the drive is running.

## 05-17 Hunting Gain

Control Mode **VF** **VFPG** **SVC** Default: 2000

Settings 0–10000

0: Disable

📖 The motor has current wave motion under some specific conditions. You can improve this situation by setting this parameter. You can set it to 0 for current wave motion in the high frequency range or when running with PG. When the current wave motion happens in the low frequency range, increase Pr.05-17.

## 05-18 Accumulated Motor Operation Time (Min.)

Control Mode **VF** **VFPG** **SVC** **FOCPG** **FOCPM** Default: 0

Settings 0–1439 minutes

## 05-19 Accumulated Motor Operation Time (Day)

Control Mode **VF** **VFPG** **SVC** **FOCPG** **FOCPM** Default: 0

Settings 0–65535 days

📖 Pr.05-18 and Pr.05-19 record the motor operation time. You can clear the records by setting the values to 0. Operating time that is less than 60 seconds is not recorded.

## 05-20 Core Loss Compensation

Control Mode **SVC** Default: 10

Settings 0–250%

## 05-21 Accumulated Motor Power-on Time (Min.)

Control Mode **VF** **VFPG** **SVC** **FOCPG** **FOCPM** Default: 0

Settings 0–1439 minutes

## 05-22 Accumulated Motor Power-on Time (day)

Control Mode **VF** **VFPG** **SVC** **FOCPG** **FOCPM** Default: 0

Settings 0–65535 days

## 05-23 Slip Compensation Gain % (power generation mode)

Control Mode **VF** **SVC** Default: 0.0

Settings 0.0–100.0%

## 05-24 Slip Compensation Gain % (electricity mode)

Control Mode **VF** **SVC** Default: 0.0

Settings 0.0–100.0%

📖 When in VF mode, you do NOT have to set Pr.05-13. To satisfy the demand for different compensation gains in power generation mode and electricity mode, set Pr.05-23 and Pr.05-24.

📖 When in SVC mode, set Pr.05-13 first. To satisfy the demand for different compensation gains in power generation mode and electricity mode, set Pr.05-23 and Pr.05-24.

## 06 Protection Parameters

ꟿ: You can set this parameter during operation.

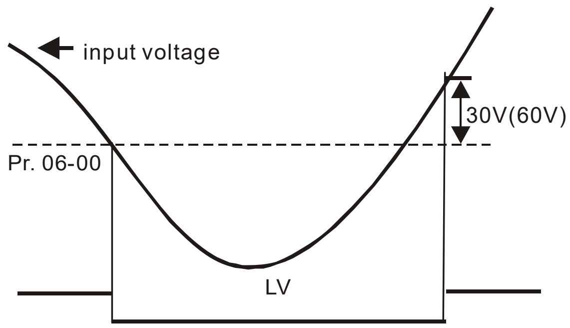
### ꟿ 06-00 Low Voltage Level

Control Mode **VF** **VFPG** **SVC** **FOCPG** **FOCPM** Default: 180.0/360.0

Settings 230V series: 160.0–220.0 V

460V series: 320.0–440.0 V

📖 Sets the Lv level.




### ꟿ 06-01 Phase-loss Protection

Control Mode **VF** **VFPG** **SVC** **FOCPG** **FOCPM** Default: 2

Settings 0: Warn and keep operation

1: Fault and ramp to stop

2: Fault and coast to stop

📖 Sets the phase-loss action. The phase-loss affects the drive's control characteristics and life.

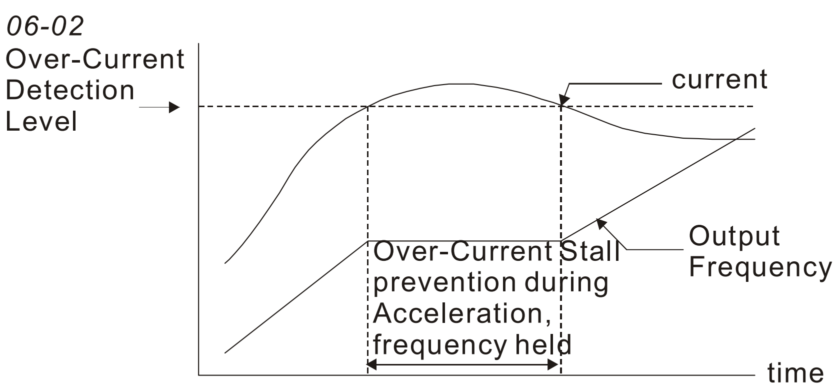
### ꟿ 06-02 Over-current Stall Prevention during Acceleration

Control Mode **VF** **VFPG** **SVC** Default: 0

Settings 0: Disable

0–250% (rated current of the motor drive)

📖 During acceleration, the AC motor drive output current may increase abruptly and exceed the value specified in Pr.06-02 due to rapid acceleration or excessive load on the motor. When you enable this function, the AC motor drive stops accelerating and keeps the output frequency constant until the current drops below the maximum value.




actual acceleration time when over-current stall prevention is enabled

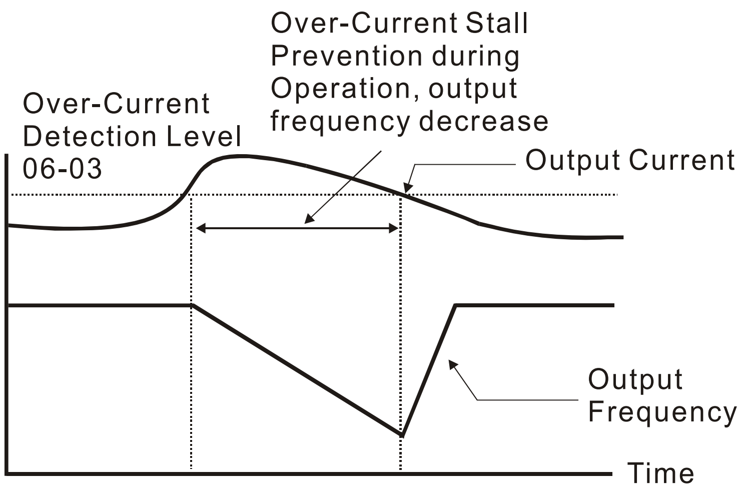
## 06-03 Over-current Stall Prevention during Operation

Control Mode **VF** **VFPG** **SVC** Default: 0

Settings 0: Disable

0–250% (rated current of the motor drive)

- If the output current exceeds the setting specified in Pr.06-03 when the drive is operating, the drive decreases its output frequency according to the Pr.06-04 setting to prevent motor stall. If the output current is lower than the setting in Pr.06-03, the drive accelerates (according to Pr.06-04) again to catch up with the Frequency command value.




**over-current stall prevention during operation**

## 06-04 Acceleration/Deceleration Time for Stall Prevention at Constant Speed

Control Mode **VF** **VFPG** **SVC** Default: 0

Settings 0: Use the current acceleration/deceleration time

1: Use the 1st acceleration/deceleration time

2: Use the 2nd acceleration/deceleration time

3: Use the 3rd acceleration/deceleration time

4: Use the 4th acceleration/deceleration time

5: Use the auto-acceleration/auto-deceleration time

- Sets the acceleration/deceleration time when stall prevention occurs at constant speed.

## 06-05 Over-torque Detection (OT1)

Control Mode **VF** **VFPG** **SVC** **FOCPG** **FOCPM** Default: 0

Settings 0: Over-torque detection disabled

1: Over-torque detection during constant speed operation, continue to operate after detection

2: Over-torque detection during constant speed operation, stop operating after detection

3: Over-torque detection during operation, continue to operate after detection

4: Over-torque detection during operation, stop operating after detection

## 06-06 Over-torque Detection Level (OT1)

Control Mode **VF** **VFPG** **SVC** **FOCPG** **FOCPM** Default: 150

Settings 10–250% (rated current of the motor drive)

## 06-07 Over-torque Detection Time (OT1)

Control Mode VF VFPG SVC FOCPG FOCPM Default: 0.1

Settings 0.1–60.0 sec.

## 06-08 Over-torque Detection (OT2)

Control Mode VF VFPG SVC FOCPG FOCPM Default: 0

Settings
0: Over-torque detection disabled
1: Over-torque detection during constant speed operation, continue to operate after detection
2: Over-torque detection during constant speed operation, stop operating after detection
3: Over-torque detection during operation, continue to operate after detection
4: Over-torque detection during operation, stop operating after detection

## 06-09 Over-torque Detection Level (OT2)

Control Mode VF VFPG SVC FOCPG FOCPM Default: 150

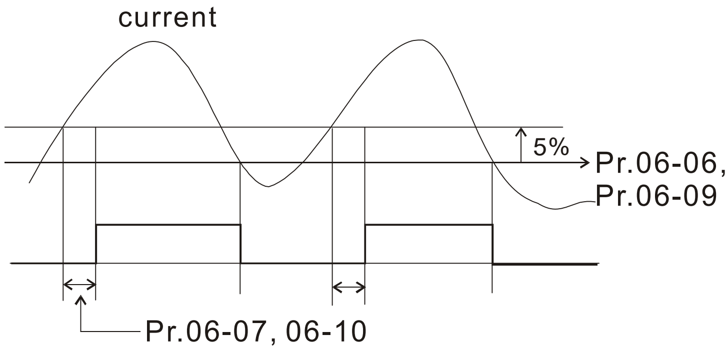
Settings 10–250% (rated current of the motor drive)

## 06-10 Over-torque Detection Time (OT2)

Control Mode VF VFPG SVC FOCPG FOCPM Default: 0.1

Settings 0.1–60.0 sec.

- Pr.06-05 and Pr.06-08 determine the drive's operating mode after over-torque is detected.
- Over-torque is detected according to the following method: if the output current exceeds the over-torque detection level (Pr.06-06, default is 150%) and also exceeds the over-torque detection time (Pr.06-07, default is 0.1 second), the keypad displays the fault code "OT1/OT2". If using a multi-function output terminal for over-torque detection, the output is ON. Refer to Pr.02-11–02-22 for details.




## 06-11 Current Limit

Control Mode FOCPG FOCPM Default: 200

Settings 0–250% (rated current of the motor drive)

- Sets the drive's maximum output current.

## 06-12 Electronic Thermal Relay

Control Mode VF VFPG SVC FOCPG FOCPM Default: 2

Settings
0: Standard motor
1: Inverter motor
2: Disabled

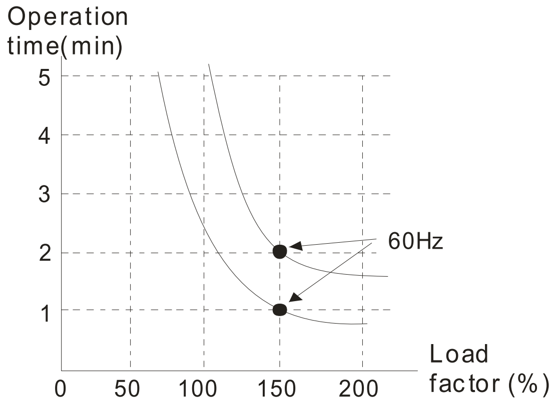
📖 Prevents self-cooled motor from overheating at low speeds. You can use an electrical thermal relay to limit the drive's output power.

## ⚡ 06-13 Electronic Thermal Characteristic

Control Mode **VF** **VFPG** **SVC** **FOCPG** **FOCPM** Default: 60.0

Settings 30.0–600.0 sec.

📖 The parameter is set by the drive's output frequency, current and operation time for activating the $I^2t$ electronic thermal protection function. The function is activated for 150% of the setting current in Pr.06-13.




## ⚡ 06-14 Heat Sink Overheat (OH) Warning

Control Mode **VF** **VFPG** **SVC** **FOCPG** **FOCPM** Default: 90.0

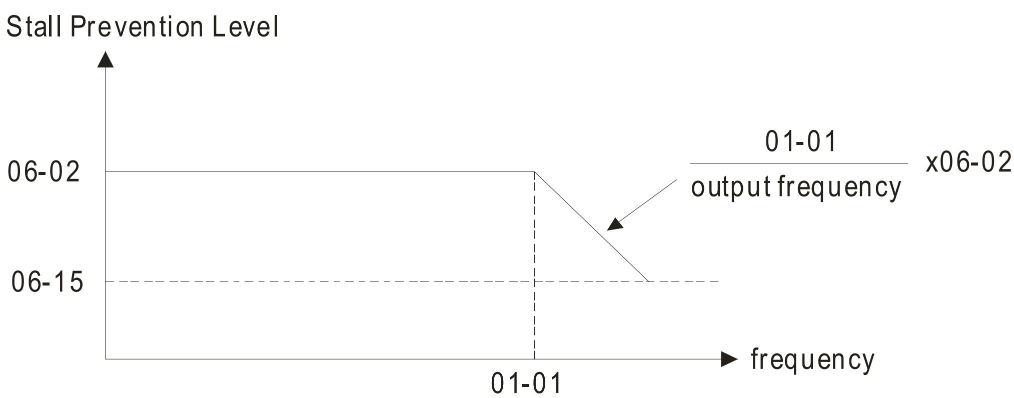
Settings 0.0–110.0°C

## ⚡ 06-15 Stall Prevention Limit Level

Control Mode **VF** **VFPG** **SVC** Default: 50

Settings 0–100% (Refer to Pr.06-02, Pr.06-03)

📖 When the operating frequency is larger than Pr.01-01, Pr.06-02 = 150%, Pr.06-03 = 100% and Pr.06-15 = 80%:
Stall Prevention Level during acceleration = Pr.06-02 x Pr.06-15 = 150% x 80% = 120%.
Stall Prevention Level at constant speed = Pr.06-03 x Pr.06-15 = 100% x 80% = 80%.




## 06-16 Present Fault Record
## 06-17 Second Most Recent Fault Record
## 06-18 Third Most Recent Fault Record
## 06-19 Fourth Recent Fault Record
## 06-20 Fifth Most Recent Fault Record
## 06-21 Sixth Most Recent Fault Record

| Control mode | VF | VFPG | SVC | FOCPG | FOCPM | Default: 0 |
|---|---|---|---|---|---|---|

| | | |
|---|---|---|
| Settings | 0: | No fault |
| | 1: | Over-current during acceleration (ocA) |
| | 2: | Over-current during deceleration (ocd) |
| | 3: | Over-current during constant speed (ocn) |
| | 4: | Ground fault (GFF) |
| | 5: | IGBT short-circuit (occ) |
| | 6: | Over-current at stop (ocS) |
| | 7: | Over-voltage during acceleration (ovA) |
| | 8: | Over-voltage during deceleration (ovd) |
| | 9: | Over-voltage during constant speed (ovn) |
| | 10: | Over-voltage at stop (ovS) |
| | 11: | Low voltage during acceleration (LvA) |
| | 12: | Low voltage during deceleration (Lvd) |
| | 13: | Low voltage during constant speed (Lvn) |
| | 14: | Low voltage at stop (LvS) |
| | 15: | Input phase loss (PHL) |
| | 16: | IGBT overheat (oH1) |
| | 17: | Bulk capacitor overheat (oH2) |
| | 18: | Abnormal IGBT temperature detected (tH1o) |
| | 19: | Abnormal bulk capacitor temperature detected (tH2o) |
| | 20: | Unusual cooling fan operation (FAn) |
| | 21: | Overload (oL) (150%; 1 minute, motor drive overloaded) |
| | 22: | Motor overload (EoL1) |
| | 23: | Reserved |
| | 24: | Motor PTC overheat (oH3) |
| | 25: | Reserved |
| | 26: | Over-torque 1 (ot1) |
| | 27: | Over-torque 2 (ot2) |
| | 28: | Reserved |
| | 29: | Reserved |
| | 30: | Memory writing error (cF1) |
| | 31: | Memory reading error (cF2) |
| | 32: | Isum current detection error (cd0) |
| | 33: | U-phase current detection error (cd1) |
| | 34: | V-phase current detection error (cd2) |
| | 35: | W-phase current detection error (cd3) |
| | 36: | cc current clamp hardware error (Hd0) |
| | 37: | oc (over-current) hardware error (Hd1) |
| | 38: | ov (over-voltage) hardware error (Hd2) |
| | 39: | GFF (ground fault) hardware error (Hd3) |
| | 40: | Auto-tuning error on motor’s parameter (AuE) |
| | 41: | Reserved |
| | 42: | PG feedback error (PGF1) |
| | 43: | PG feedback loss (PGF2) |

44: PG feedback stall (PGF3)
45: PG slip error (PGF4)
46: Reserved
47: Reserved
48: Reserved
49: External fault input (EF)
50: Emergency stop from external terminals (EF1)
51: Reserved
52: Password error after three attempts (Pcod)
53: Reserved
54: Illegal communication command (cE01)
55: Illegal communication address (cE02)
56: Communication data length error (cE03)
57: Communication attempts to write to a read-only address (cE04)
58: Modbus transmission time-out (cE10)
59: Keypad transmission time-out (cP10)
60: Brake transistor error (BF)
61–63: Reserved
64: Mechanical brake feedback error (MBF)
65: PGF5 hardware error
66: Magnetic contactor error (MCF)
67: Output phase loss (MPHL)
68: CAN BUS disconnected
69–71: Reserved
72: Safe torque loss (STL1)
73: PGcd hardware error
74: PG absolute signal error (PGHL)
75: PG Z phase signal loss (PGAF)
76: Safe torque output stops (STO)
77: Safe torque loss 2 (STL2)
78: Safe torque loss 3 (STL3)

📖 The parameters record when the fault occurs and forces a stop. For the Lv, it records when it is operating, or it warns without recording.

## ✓ 06-30 Fault Output Setting Method

Control Mode **VF** **VFPG** **SVC** **FOCPG** **FOCPM** Default: 0

Settings 0: According to settings in Pr.06-22–06-25
1: According to the binary setting

📖 This parameter is used with the settings 35–38 in Pr.02-11–Pr.02-22 (multi-function output). The fault output selections 1–4 correspond to Bit 0–3.

📖 This parameter provides two setting methods for the fault output.
0: Set according to the settings in Pr.06-22–Pr.06-25.
1: Set according to the binary setting. Refer to the following example for details.
Example:
Assume that:

Pr.02-13 (Multi-function output 3 R1A (Relay 3)) is set to 35 Fault output option 1 (Pr.06-22).
Pr.02-14 (Multi-function output 4 R2A (Realy4)) is set to 36 Fault output option 2 (Pr.06-23).
Pr.02-15 (Multi-function output 5 (MO1)) is set to 37 Fault output option 3 (Pr.06-24).
Pr.02-16 (Multi-function output 6 (MO2)) is set to 38 Fault output option 4 (Pr.06-25).
Also assume that external fault outputs with the following signal: R1A = 1, R2A = 1, MO1 = 0 and MO2 = 1.
The corresponding Bit 3–0 is 1011.

| Bit 3 | Bit 2 | Bit 1 | Bit 0 | Fault code |
|---|---|---|---|---|
| - | - | - | - | 0: No fault |
| 0 | 0 | 0 | 1 | 1: Over-current during acceleration (ocA) |
| | | | | 2: Over-current during deceleration (ocd) |
| | | | | 3: Over-current during constant speed (ocn) |
| | | | | 4: Ground fault (GFF) |
| | | | | 5: IGBT short-circuit (occ) |
| | | | | 6: Over-current at stop (ocS) |
| 0 | 0 | 1 | 0 | 7: Over-voltage during acceleration (ovA) |
| | | | | 8: Over-voltage during deceleration (ovd) |
| | | | | 9: Over-voltage during constant speed (ovn) |
| | | | | 10: Over-voltage at stop (ovS) |
| 0 | 0 | 1 | 1 | 11: Low voltage during acceleration (LvA) |
| | | | | 12: Low voltage during deceleration (Lvd) |
| | | | | 13: Low voltage during constant speed (Lvn) |
| | | | | 14: Low voltage at stop (LvS) |
| | | | | 15: Input phase loss (PHL) |
| 0 | 1 | 0 | 0 | 16: IGBT overheat (oH1) |
| | | | | 17: Bulk capacitor overheat (oH2) |
| | | | | 18: Abnormal IGBT temperature detected (tH1o) |
| | | | | 19: Abnormal bulk capacitor temperature detected (tH2o) |
| 1 | 0 | 0 | 0 | 20: Unusual cooling fan operation (FAn) |
| 0 | 1 | 0 | 1 | 21: Overload (oL) (150%; 1 minute, motor drive overloaded) |
| 0 | 1 | 1 | 0 | 22: Motor overload (EoL1) |
| | | | | 24: Motor PTC overheat (oH3) |
| 0 | 1 | 1 | 1 | 26: Over-torque 1 (ot1) |
| | | | | 27: Over-torque 2 (ot2) |
| 1 | 0 | 0 | 0 | 30: Memory writing error (cF1) |
| | | | | 31: Memory reading error (cF2) |
| | | | | 32: Isum current detection error (cd0) |
| | | | | 33: U-phase current detection error (cd1) |
| | | | | 34: V-phase current detection error (cd2) |
| | | | | 35: W-phase current detection error (cd3) |
| | | | | 36: cc (current clamp) hardware error (Hd0) |
| | | | | 37: oc (over-current) hardware error (Hd1) |
| | | | | 38: ov (over-voltage) hardware error (Hd2) |
| | | | | 39: GFF (ground fault) hardware error (Hd3) |
| 1 | 0 | 0 | 1 | 40: Auto-tuning error on motor's parameter (AUE) |
| 1 | 0 | 1 | 0 | 41: Reserved |
| | | | | 42: PG feedback error (PGF1) |
| | | | | 43: PG feedback loss (PGF2) |
| 0 | 1 | 1 | 1 | 44: PG feedback stall (PGF3) |
| 1 | 0 | 1 | 0 | 45: PG slip error (PGF4) |
| | | | | 46: Reserved |
| | | | | 47: Reserved |
| | | | | 48: Reserved |
| 1 | 0 | 1 | 1 | 49: External fault input (EF) |
| | | | | 50: Emergency stop from external terminals (EF1) |
| 1 | 0 | 0 | 1 | 52: Password error after three attempts (Pcod) |
| 1 | 1 | 0 | 0 | 54: Illegal communication command (cE01) |
| | | | | 55: Illegal communication address (cE02) |
| | | | | 56: Communication data length error (cE03) |
| | | | | 57: Communication attempts to write to a read-only address (cE04) |

| Bit 3 | Bit 2 | Bit 1 | Bit 0 | Fault code |
|---|---|---|---|---|
| | | | | 58: Modbus transmission time-out (cE10) |
| | | | | 59: Keypad transmission time-out (cP10) |
| 1 | 0 | 0 | 0 | 60: Brake transistor error (BF) |
| 1 | 0 | 1 | 1 | 61–63: Reserved |
| | | | | 64: Mechanical brake feedback error (MBF) |
| 1 | 0 | 0 | 0 | 65: PGF5 hardware error |
| 1 | 0 | 1 | 1 | 66: Magnetic contactor error (MCF) |
| 1 | 0 | 1 | 1 | 67: Output phase loss (MPHL) |
| 1 | 1 | 0 | 1 | 68: CAN BUS disconnected |
| 1 | 1 | 1 | 0 | 72: Safe torque loss (STL1) |
| 1 | 0 | 0 | 0 | 73: PGcd hardware error |
| 1 | 0 | 0 | 0 | 74: PG absolute signal error (PGHL) |
| 1 | 0 | 0 | 0 | 75: PG Z phase signal loss (PGAF) |
| 1 | 1 | 1 | 0 | 76: Safe torque output stops (STO) |
| 1 | 1 | 1 | 0 | 77: Safe torque loss 2 (STL2) |
| 1 | 1 | 1 | 0 | 78: Safe torque loss 3 (STL3) |

✎ **06-22** Fault Output Option 1

✎ **06-23** Fault Output Option 2

✎ **06-24** Fault Output Option 3

✎ **06-25** Fault Output Option 4

Control Mode **VF** **VFPG** **SVC** **FOCPG** **FOCPM** Default: 0

Settings 0–65535 sec. (refer to bit table for fault code)

📖 You can use these parameters with multi-function output (set Pr.02-11–Pr.02-22 to 35–38) for the specific requirement. When a fault occurs, the corresponding terminals are activated. You must convert binary value to decimal value when setting Pr.06-22–Pr.06-25.

| Fault code | Bit0 | Bit1 | Bit2 | Bit3 | Bit4 | Bit5 | Bit6 |
|---|---|---|---|---|---|---|---|
| | current | Volt. | OL | SYS | FBK | EXI | CE |
| 0: No fault | | | | | | | |
| 1: Over-current during acceleration (ocA) | ● | | | | | | |
| 2: Over-current during deceleration (ocd) | ● | | | | | | |
| 3: Over-current during constant speed (ocn) | ● | | | | | | |
| 4: Ground fault (GFF) | | | | | | ● | |
| 5: IGBT short-circuit (occ) | ● | | | | | | |
| 6: Over-current at stop (ocS) | ● | | | | | | |
| 7: Over-voltage during acceleration (ovA) | | ● | | | | | |
| 8: Over-voltage during deceleration (ovd) | | ● | | | | | |
| 9: Over-voltage during constant speed (ovn) | | ● | | | | | |
| 10: Over-voltage at stop (ovS) | | ● | | | | | |
| 11: Low voltage during acceleration (LvA) | | ● | | | | | |
| 12: Low voltage during deceleration (Lvd) | | ● | | | | | |
| 13: Low voltage during constant speed (Lvn) | | ● | | | | | |
| 14: Low voltage at stop (LvS) | | ● | | | | | |
| 15: Input phase loss (PHL) | | | | | | ● | |
| 16: IGBT overheat (oH1) | | | ● | | | | |
| 17: Bulk capacitor overheat (oH2) | | | ● | | | | |

| Fault code | Bit0 | Bit1 | Bit2 | Bit3 | Bit4 | Bit5 | Bit6 |
|---|---|---|---|---|---|---|---|
| | current | Volt. | OL | SYS | FBK | EXI | CE |
| 18: Abnormal IGBT temperature detected (tH1o) | | | ● | | | | |
| 19: Abnormal bulk capacitor temperature detected (tH2o) | | | ● | | | | |
| 20: Unusual cooling fan operation (FAn) | | | | | | ● | |
| 21: Overload (oL) (150%; 1 minute, motor drive overloaded) | | | ● | | | | |
| 22: Motor overload (EoL1) | | | ● | | | | |
| 23: Reserved | | | | | | | |
| 24: Motor PTC overheat (oH3) | | | ● | | | | |
| 25: Reserved | | | | | | | |
| 26: Over-torque 1 (ot1) | | | ● | | | | |
| 27: Over-torque 2 (ot2) | | | ● | | | | |
| 28: Reserved | | | | | | | |
| 29: Reserved | | | | | | | |
| 30: Memory writing error (cF1) | | | | ● | | | |
| 31: Memory reading error (cF2) | | | | ● | | | |
| 32: Isum current detection error (cd0) | | | | ● | | | |
| 33: U-phase current detection error (cd1) | | | | ● | | | |
| 34: V-phase current detection error (cd2) | | | | ● | | | |
| 35: W-phase current detection error (cd3) | | | | ● | | | |
| 36: cc (current clamp) hardware error (Hd0) | | | | ● | | | |
| 37: oc (over-current) hardware error (Hd1) | | | | ● | | | |
| 38: ov (over-voltage) hardware error (Hd2) | | | | ● | | | |
| 39: GFF (ground fault) hardware error (Hd3) | | | | ● | | | |
| 40: Auto-tuning error on motor's parameter (AUE) | | | | ● | | | |
| 41: Reserved | | | | | ● | | |
| 42: PG feedback error (PGF1) | | | | | ● | | |
| 43: PG feedback loss (PGF2) | | | | | ● | | |
| 44: PG feedback stall (PGF3) | | | | | ● | | |
| 45: PG slip error (PGF4) | | | | | ● | | |
| 46: Reserved | | | | | ● | | |
| 47: Reserved | | | | | | ● | |
| 48: Reserved | | | | | | ● | |
| 49: External fault input (EF) | | | | | | ● | |
| 50: Emergency stop from external terminals (EF1) | | | | | | ● | |

| Fault code | Bit0 | Bit1 | Bit2 | Bit3 | Bit4 | Bit5 | Bit6 |
|---|---|---|---|---|---|---|---|
| | current | Volt. | OL | SYS | FBK | EXI | CE |
| 51: Reserved | | | | | | | |
| 52: Password error after three attempts (Pcod) | | | | ● | | | |
| 53: Reserved | | | | | | | |
| 54: Illegal communication command (cE01) | | | | | | | ● |
| 55: Illegal communication address (cE02) | | | | | | | ● |
| 56: Communication data length error (cE03) | | | | | | | ● |
| 57: Communication attempts to write to a read-only address (cE04) | | | | | | | ● |
| 58: Modbus transmission time-out (cE10) | | | | | | | ● |
| 59: Keypad transmission time-out (cP10) | | | | | | | ● |
| 60: Brake transistor error (BF) | | | | | | ● | |
| 61–62: Reserved | | | | | | | |
| 63: Reserved | | | | ● | | | |
| 64: Mechanical brake feedback error (MBF) | | | | | | ● | |
| 65: PGF5 hardware error | | | | ● | | | |
| 66: Magnetic contactor error (MCF) | | | | | | ● | |
| 67: Output phase loss (MPHL) | | | | | | ● | |
| 68: CAN BUS disconnected (CANF) | | | | | | | ● |
| 72: Safe torque loss (STL1) | | | | ● | | | |
| 73: PGcd hardware error | | | | ● | | | |
| 74: PG absolute signal error (PGHL) | | | | ● | | | |
| 75: PG Z phase signal loss (PGAF) | | | | ● | | | |
| 76: Safe torque output stops (STO) | | | | ● | | | |
| 77: Safe torque loss 2 (STL2) | | | | ● | | | |
| 78: Safe torque loss 3 (STL3) | | | | ● | | | |

## 06-26 PTC (Positive Temperature Coefficient) Detection Action

Control Mode **VF** **VFPG** **SVC** **FOCPG** **FOCPM** Default: 0

Settings 0: Warn and keep operation

1: Fault and ramp to stop

Sets the action after detecting PTC.

## 06-27 PTC Level

Control Mode **VF** **VFPG** **SVC** **FOCPG** **FOCPM** Default: 50.0

Settings 0.0–100.0%

Sets the PTC level. 100% PTC level corresponds to the maximum analog input value.

## 06-28 PTC Detection Filter Time

Control Mode **VF** **VFPG** **SVC** **FOCPG** **FOCPM** Default: 0.20

Settings 0.00–10.00 sec.

See Parameter Group 03 Analog Input/ Output Parameters for details.

## 06-31 Phase Loss Detection of Drive Output at Start-up (MPHL)

Control Mode **VF** **VFPG** **SVC** **FOCPG** **FOCPM** Default: 1

Settings 0: Disable

1: Enable

1: Auto-detect whether the connection between the drive and motor is normal whenever the drive runs. If an error occurs to the connection between the drive and the motor (broken or loose wiring) or there is no output for the drive's any or all of the three phases, the drive displays fault code "67" to indicate motor output phase loss.

## 06-32 Accumulated Drive Power-on Time at the First Fault (min.)
## 06-34 Accumulated Drive Power-on Time at the Second Fault (min.)
## 06-36 Accumulated Drive Power-on Time at the Third Fault (min.)
## 06-38 Accumulated Drive Power-on Time at the Fourth Fault (min.)
## 06-40 Accumulated Drive Power-on Time at the Fifth Fault (min.)
## 06-42 Accumulated Drive Power-on Time at the Sixth Fault (min.)

Control Mode **VF** **VFPG** **SVC** **FOCPG** Default: Read only

Settings 0–65535 min.

## 06-33 Accumulated Drive Power-on Time at the First Fault (day)
## 06-35 Accumulated Drive Power-on Time at the Second Fault (day)
## 06-37 Accumulated Drive Power-on Time at the Third Fault (day)
## 06-39 Accumulated Drive Power-on Time at the Fourth Fault (day)
## 06-41 Accumulated Drive Power-on Time at the Fifth Fault (day)
## 06-43 Accumulated Drive Power-on Time at the Sixth Fault (day)

Control Mode **VF** **VFPG** **SVC** **FOCPG** Default: Read only

Settings 0–65535 day

## 06-45 Fault and Warning Action

Control Mode **VF** **VFPG** **SVC** **FOCPG** **FOCPM** Default: 0

Settings Bit 0 = 0: Display Lv fault and coast to stop

Bit 0 = 1: Display Lv warn and coast to stop

Bit 1= 0 : Fan lock, fault and coast to stop

Bit 1 = 1: Fan lock, warn and coast to stop

Bit 2 = 0: Software GFF protection enabled

Bit 2 = 1: Software GFF protection disabled

## 06-29 Voltage of Emergency Power

Control Mode **VF** **VFPG** **SVC** **FOCPG** **FOCPM** Default: 24.0/48.0

Settings 24.0–375.0 $V_{DC}$

48.0–750.0 $V_{DC}$

- This parameter works with setting 43 (EPS function) for Pr.02-01–Pr.02-08 (multi-function input commands).

## 06-44 Emergency Power (EPS) Mode Operation Speed

Control Mode **VF** **VFPG** **SVC** **FOCPG** **FOCPM** Default: Read only

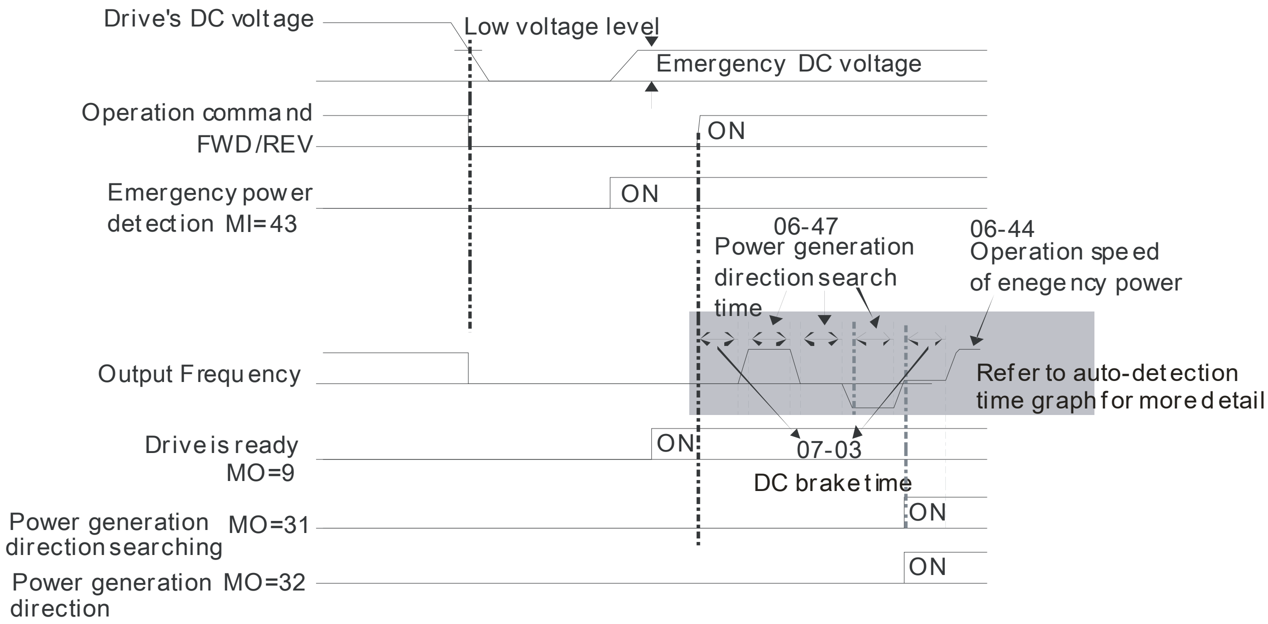
Settings 0.00–400.00 Hz

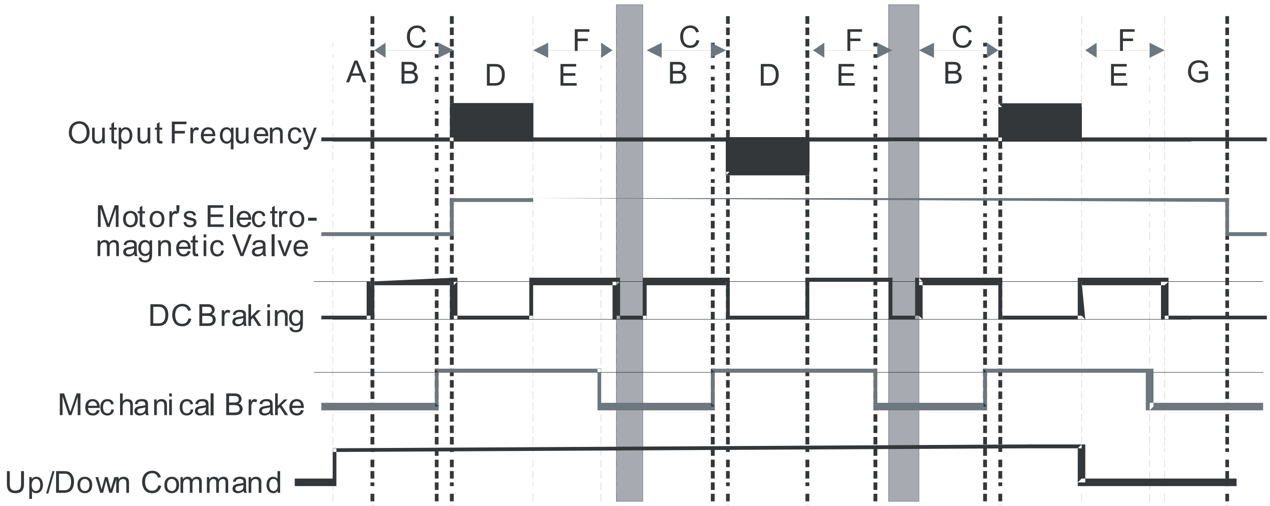
## 06-46 Emergency Power (EPS) ON Operation Direction

Control Mode **VF** **VFPG** **SVC** **FOCPG** **FOCPM** Default: 0

Settings
0: Run according to current command
1: Run according to the operation direction of power generation mode, and execute the power generation direction detection when in power generation mode.
2: After determining the power generation direction, the host controller sends a running direction command. (When at STOP, the direction of power generation mode (MO = 32) confirms and the direction of power generation mode does not remain.) Execute the power generation direction detection every time.
3: After determining the power generation direction, the host controller sends a running direction command. (When at STOP, the direction of power generation mode (MO =32) confirms and the direction of power generation mode remains.) Execute the power generation direction detection one time.
4: Run according to the operation direction of power generation mode, and execute the power generation direction detection when in normal mode.

- Pr.06-46 is enabled when the external terminal detects the emergency power signal EPS (MI=43).
- When you set Pr.06-46 to 1 and a forward/reverse run command is given, the drive checks for the elevator loading and operates in the power regeneration direction (the motor is in power generating status). The drive uses and operates in the direction that was detected as its power regeneration direction. For safety, the drive does not operate in user command direction to prevent emergency power voltage drop (EPS).
- When you set Pr.06-46 to 4 (motor with gear box):
  1. When the normal mode runs to the largest power factor angel, the results are saved in Pr.06-69.
  2. Compare the power factor angle detected by the power generation direction with Pr.06-86 setting value, if the value is larger than Pr.06-68, the current direction is saved in Pr.06-70.
  3. When in emergency power mode, the drive runs according to the Pr.06-70 operation direction.
- VF and SVC control modes: In the time setting in Pr.06-47, the drive detects the elevator loading status by performing forward/reverse run. Then the elevator operates in the power regeneration direction (the motor is in power generating status). Refer to the diagram below for the Auto-Detection Timing Graph.

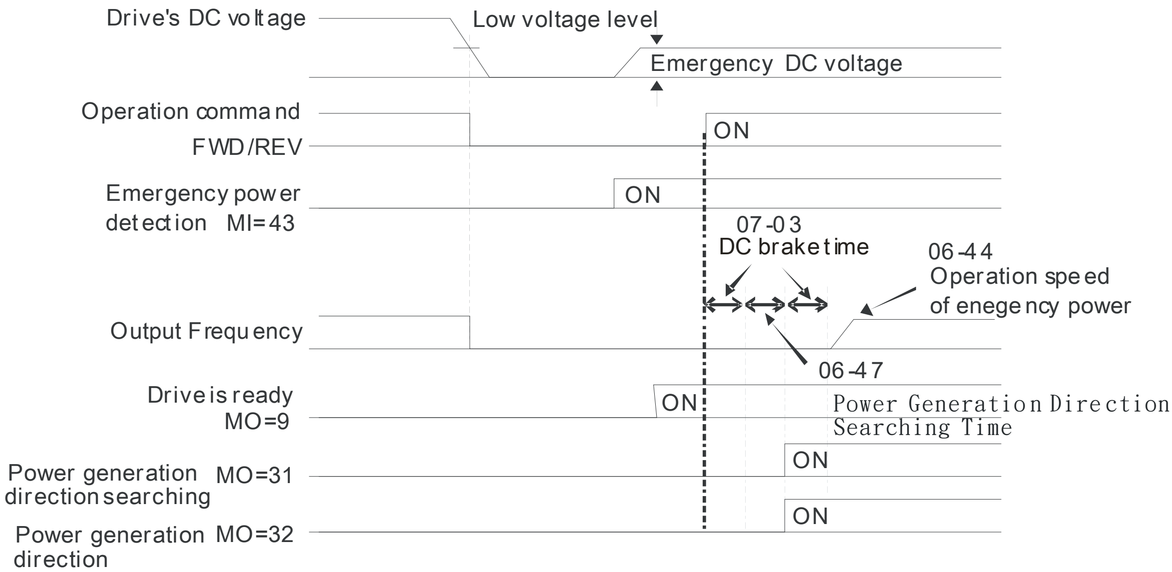



A Pr.02-31: Magnetic Contactor Contracting Delay Time between Drive and Motor
B Pr.02-29: Brake Release Delay Time when Elevator Starts
C Pr.07-03: DC Brake Activation Time
D Pr.06-47: Power Generation Direction Search Time
E Pr.02-30: Brake Engage Delay Time when Elevator Stops
F Pr.07-04: DC Brake Stopping Time
G Pr.02-32: Magnetic Contactor Release Delay Time between Drive and Motor

Auto-detection Timing Diagram

📖 FOCPG/PM Control Mode: In the time setting in Pr.06-47, the drive remains at zero-speed and it is able to determine the elevator loading without performing forward/reverse run. Then the elevator operates in the power regeneration direction (the motor is in power generating status). Refer to the diagram below for the Auto-Detection Timing Graph.




## 06-47 Power Generation Direction Search Time

| Control Mode | VF | VFPG | SVC | FOCPG | FOCPM | Default: 1.0 |
|---|---|---|---|---|---|---|

Settings 0.0–5.0 sec.

## 06-48 Power Capacity of Emergency Power (EPS)

| Control Mode | VF | VFPG | SVC | FOCPG | FOCPM | Default: 0.0 |
|---|---|---|---|---|---|---|

Settings 0.0–100.0 kVA

- When using emergency power (EPS), you must set the parameter to the required power capacity for the emergency power, and then the AC motor drive calculates the acceptable elevator speed (Pr.06-44) with the following equation.
- $I_{motor\_rated} = 05-01$ (Induction Motor)/ $08-01$ (PM Motor)

$$V_{eps\_\max} = \frac{06-48 \times 0.5}{\sqrt{3} \times I_{motor\_rated}}$$

$$f_{eps\_limit} = \frac{V_{eps\_\max}}{01-02} \times 01-01$$

When the Frequency command > $f_{EPS}$, the operation speed of emergency power (EPS) is $f_{EPS}$.
When the Frequency command ≤ $f_{EPS}$, the operation speed of emergency power (EPS) is set according to the current Frequency command.

## 06-68 Power Factor Angle Level for Power Generation Direction

| Control Mode | VF | VFPG | SVC | FOCPG | FOCPM | Default: 70.0 |
|---|---|---|---|---|---|---|

Settings 0.0–150.0°

- During operation, if the largest power factor angle is larger than Pr.06-68 setting value, the power generation direction is the current operation direction.

## 06-69 Reference Level for Power Factor Angle during Operation

| Control Mode | VF | VFPG | SVC | FOCPG | FOCPM | Default: Read only |
|---|---|---|---|---|---|---|

Settings -200.0–200.0°

- The largest power factor angle during operation.

## 06-70 Power Generation Direction

Control Mode **VF** **VFPG** **SVC** **FOCPG** **FOCPM** Default: Read only

Settings 0: FWD

1: REV

## 06-71 UPS Output Delay Time

Control Mode **VF** **VFPG** **SVC** **FOCPG** **FOCPM** Default: 1.0

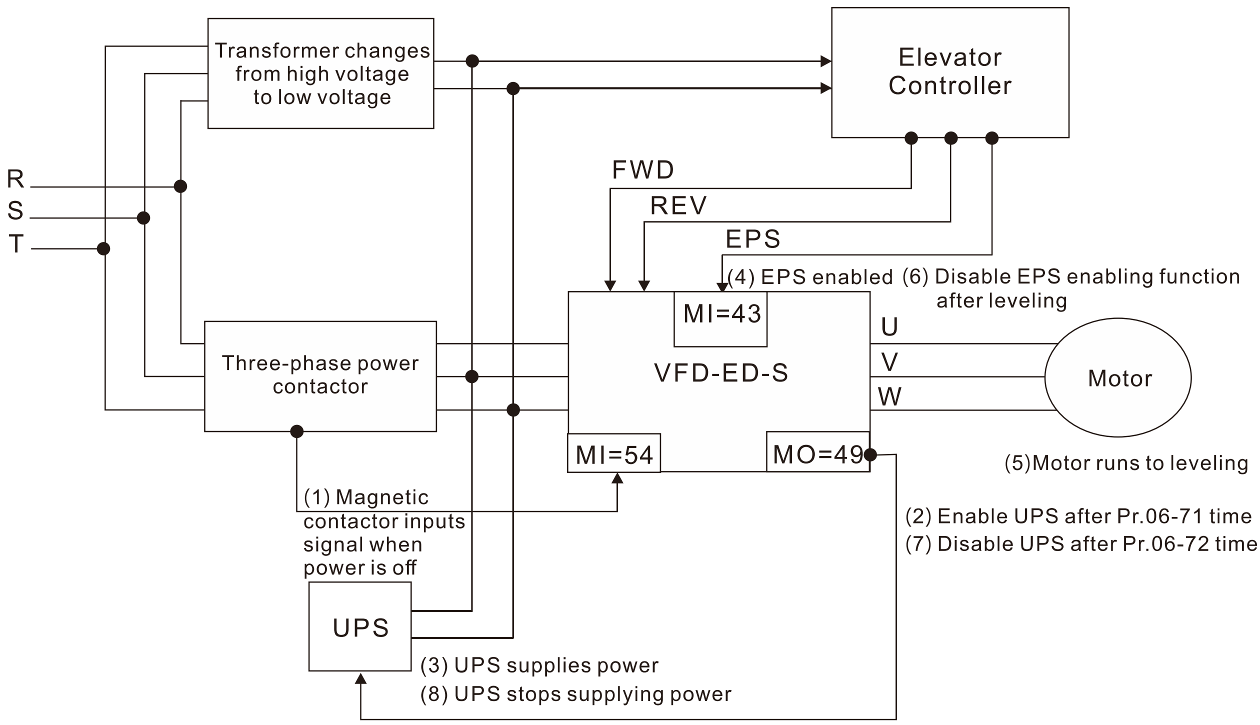
Settings 0.0–10.0 sec.

## 06-72 UPS Stops Output Delay Time

Control Mode **VF** **VFPG** **SVC** **FOCPG** **FOCPM** Default: 3.0

Settings 0.0–60.0 sec.

- Pr.06-71: At power failure, the contactor sends a MI signal to inform the drive to activate UPS. Then, the drive sends a MO signal to activate the UPS contactor after Pr.06-71 delay time.
- Pr.06-72: After the controller deactivates the emergency power mode, it stops sending a MO signal to deactivate the UPS power after Pr.06-72 delay time.
- Related parameters: multi-function input commands Pr.02-01–Pr.02-08 function setting 54 (Power failure signal) and multi-function output terminals Pr.02-11–Pr.02-16 function setting 49 (Emergency power mode action).




EPS Flow Chart

## 06-49 STO Latch Selection

Control Mode **VF** **VFPG** **SVC** **FOCPG** **FOCPM** Default: 0000h

Settings 0000h: STO fault latched, resending RUN command is required

0001h: STO warning latched, resending RUN command is required

0002h: STO fault latched

0003h: STO warning unlatched

- 0000h: STO fault latched, resending RUN command is required

If STO is ON in any condition and a fault occurs, it does not reset until STO is back to normal and use a RESET command or power-on again after resending the RUN command.

- 0001h: STO warning latched, resending RUN command is required
  If STO is ON in any condition and a warning occurs, it does not reset until STO is back to normal and resend the RUN command.
- 0002h: STO fault latched
  If STO is ON in any condition and a fault occurs, it does not reset until STO is back to normal and use a RESET command or power-on again.
- 0003h: STO warning unlatched
  If STO is ON in any condition and a warning occurs, it automatically resets when STO is back to normal.
- For more information on the timing diagram, see Section 16-5.
- Make sure there is no risk, which is assessed by the elevator controller, before using the STO warning unlatched function.
- Fault codes STL1 to STL3 are regarded as fault latched (you cannot set Pr.06-49).

## 06-50 MO's Action when Retrying after Fault

Control Mode **VF** **VFPG** **SVC** **FOCPG** **FOCPM** Default: 0

Settings 0: Output
1: No output

- Determines whether to display the fault indication when the following faults occur:
  7: Over-voltage during acceleration (ovA)
  8: Over-voltage during deceleration (ovd)
  9: Over-voltage during constant speed (ovn)
  10: Over-voltage at stop (ovS)
  11: Low voltage during acceleration (LvA)
  12: Low voltage during deceleration (Lvd)
  13: Low voltage during constant speed (Lvn)
  14: Low voltage at stop (LvS)
  15: Input Phase loss (PHL)
- Two MO terminals are affected by this parameter and should be set up as:
  MO = 10: Low voltage waning (LV)
  MO = 11: Fault Indication

## 06-51 Number of Times to Retry after Fault

Control Mode **VF** **VFPG** **SVC** **FOCPG** **FOCPM** Default: 0

Settings 0–10 times

- To determine the number of times to retry when the following faults occur:
  7: Over-voltage during acceleration (ovA)
  8: Over-voltage during deceleration (ovd)
  9: Over-voltage during constant speed (ovn)
  10: Over-voltage at stop (ovS)
  11: Low voltage during acceleration (LvA)
  12: Low voltage during deceleration (Lvd)
  13: Low voltage during constant speed (Lvn)
  14: Low voltage at stop (LvS)
  15: Input Phase loss (PHL)
- After every retry attempt, the number of times to retry is automatically reduced by one as displayed on the keypad.
- The principles for the number of times to reset:
  1. Reset the fault manually.
  2. After running normally for 10 minutes, the motor drive returns to the prior setting.
  3. The motor drive is powered on and powered off again.

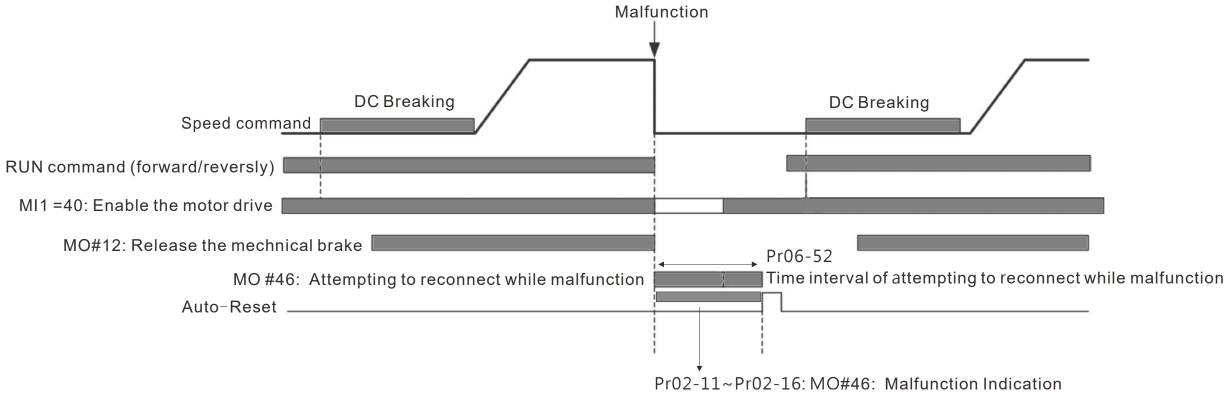
## 06-52 Time Interval between Retries

Control Mode **VF** **VFPG** **SVC** **FOCPG** **FOCPM** Default: 10.0

Settings 0.5–600.0 sec.

Determines the time interval between retries when the following faults occur:

7: Over-voltage during acceleration (ovA)
8: Over-voltage during deceleration (ovd)
9: Over-voltage during constant speed (ovn)
10: Over-voltage at stop (ovS)
11: Low voltage during acceleration (LvA)
12: Low voltage during deceleration (Lvd)
13: Low voltage during constant speed (Lvn)
14: Low voltage at stop (LvS)
15: Input Phase loss (PHL)




## 06-53 Frequency Command when the Most Recent Fault Occurred

Control Mode **VF** **VFPG** **SVC** **FOCPG** **FOCPM** Default: Read only

Settings 0.00–655.35 Hz

## 06-54 Output Frequency when the Most Recent Fault Occurred

Control Mode **VF** **VFPG** **SVC** **FOCPG** **FOCPM** Default: Read only

Settings 0.00–655.35 Hz

## 06-55 Output Current when the Most Recent Fault Occurred

Control Mode **VF** **VFPG** **SVC** **FOCPG** **FOCPM** Default : Read only

Settings 0.00–655.35 Amps

## 06-56 Motor Frequency when the Most Recent Fault Occurred

Control Mode **VF** **VFPG** **SVC** **FOCPG** **FOCPM** Default : Read only

Settings 0.00–655.35 Hz

## 06-57 Output Voltage when the Most Recent Fault Occurred

Control Mode **VF** **VFPG** **SVC** **FOCPG** **FOCPM** Default: Read only

Settings 0.0–6553.5 V

## 06-58 DC Bus Voltage when the Most Recent Fault Occurred

Control Mode **VF** **VFPG** **SVC** **FOCPG** **FOCPM** Default : Read only

Settings 0.0–6553.5 V

## 06-59 Output Power when the Most Recent Fault Occurred

Control Mode **VF** **VFPG** **SVC** **FOCPG** **FOCPM** Default : Read only

Settings 0.0–6553.5 kW

## 06-60 Output Torque when the Most Recent Fault Occurred

Control Mode **VF** **VFPG** **SVC** **FOCPG** **FOCPM** Default: Read only

Settings 0.00–655.35%

## 06-61 IGBT Temperature when the Most Recent Fault Occurred

Control Mode **VF** **VFPG** **SVC** **FOCPG** **FOCPM** Default: Read only

Settings -3276.8–3276.7℃

## 06-62 Multi-input Terminals Status when the Most Recent Fault Occurred

Control Mode **VF** **VFPG** **SVC** **FOCPG** **FOCPM** Default: Read only

Settings 0000h–FFFFh

## 06-63 Multi-output Terminals Status when the Most Recent Fault Occurred

Control Mode **VF** **VFPG** **SVC** **FOCPG** **FOCPM** Default: Read only

Settings 0000h–FFFFh

## 06-64 Motor Drive Status when the Most Recent Fault Occurred

Control Mode **VF** **VFPG** **SVC** **FOCPG** **FOCPM** Default: Read only

Settings 0000h–FFFFh

## 06-73 Permanent Operation Direction Count (H)

Control Mode **VF** **VFPG** **SVC** **FOCPG** **FOCPM** Default: Read only

Settings 0–60000

## 06-74 Permanent Operation Direction Count (L)

Control Mode **VF** **VFPG** **SVC** **FOCPG** **FOCPM** Default: Read only

Settings 0–9999

## 06-75 Single Operation Direction Count (H)

Control Mode **VF** **VFPG** **SVC** **FOCPG** **FOCPM** Default: Read only

Settings 0–20

## 06-76 Single Operation Direction Count (L)

Control Mode **VF** **VFPG** **SVC** **FOCPG** **FOCPM** Default: Read only

Settings 0–9999

## 06-77 Number of Times for Single Operation Reset

Control Mode **VF** **VFPG** **SVC** **FOCPG** **FOCPM** Default: Read only

Settings 0–100

## 06-78 Number of Times for Operation Direction

Control Mode **VF** **VFPG** **SVC** **FOCPG** **FOCPM** Default: 2.00

Settings 0.00–200.00 k

## 06-79 Function Selection for Operation Times

Control Mode **VF** **VFPG** **SVC** **FOCPG** **FOCPM** Default: 0

Settings 0–2

- When you set Pr.06-79 to 0:
  Disable the operation direction count function and clear parameters (Pr.06-75, 06-76, and 06-78), and add one time to the number of time for single operation reset (pr.06-77).
- When you set Pr.06-79 to 1:
  Enable the operation direction count function and add one time to the permanent operation direction count and single operation direction count whenever the operation direction changes. If the single operation direction count is larger than Pr.06-78, it displays a ERV warning and continues operation.
- When you set Pr.06-79 to 2:
  Enable the operation direction count function and add one time to the permanent operation direction count and single operation direction count whenever the operation direction changes. If the single operation direction count is larger than Pr.06-78, it displays a SERV warning and decelerates to stop.

**06-80** Output Frequency when Fault 2 Occurred

Control Mode **VF** **VFPG** **SVC** **FOCPG** **FOCPM** Default: Read only

Settings 0.00–655.35 Hz

**06-81** DC Bus Voltage when Fault 2 Occurred

Control Mode **VF** **VFPG** **SVC** **FOCPG** **FOCPM** Default: Read only

Settings 0.0–6553.5 V

**06-82** Output Current when Fault 2 Occurred

Control Mode **VF** **VFPG** **SVC** **FOCPG** **FOCPM** Default: Read only

Settings 0.00–655.35 Amps

**06-83** IGBT Temperature when Fault 2 Occurred

Control Mode **VF** **VFPG** **SVC** **FOCPG** **FOCPM** Default: Read only

Settings -3276.8–3276.7ºC

**06-84** Output Frequency when Fault 3 Occurred

Control Mode **VF** **VFPG** **SVC** **FOCPG** **FOCPM** Default: Read only

Settings 0.00–655.35 Hz

**06-85** DC Bus Voltage when Fault 3 Occurred

Control Mode **VF** **VFPG** **SVC** **FOCPG** **FOCPM** Default: Read only

Settings 0.0–6553.5 V

**06-86** Output Current when Fault 3 Occurred

Control Mode **VF** **VFPG** **SVC** **FOCPG** **FOCPM** Default: Read only

Settings 0.00–655.35 Amps

**06-87** IGBT Temperature when Fault 3 Occurred

Control Mode **VF** **VFPG** **SVC** **FOCPG** **FOCPM** Default: Read only

Settings -3276.8–3276.7ºC

**06-88** Output Frequency when Fault 4 Occurred

Control Mode **VF** **VFPG** **SVC** **FOCPG** **FOCPM** Default: Read only

Settings 0.00–655.35 Hz

**06-89** DC Bus Voltage when Fault 4 Occurred

Control Mode **VF** **VFPG** **SVC** **FOCPG** **FOCPM** Default: Read only

Settings 0.0–6553.5 V

**06-90** Output Current when Fault 4 Occurred

Control Mode **VF** **VFPG** **SVC** **FOCPG** **FOCPM** Default: Read only

Settings 0.00–655.35 Amps

### 06-91 IGBT Temperature when Fault 4 Occurred

Control Mode **VF** **VFPG** **SVC** **FOCPG** **FOCPM** Default: Read only

Settings -3276.8–3276.7ºC

### 06-92 Output Frequency when Fault 5 Occurred

Control Mode **VF** **VFPG** **SVC** **FOCPG** **FOCPM** Default: Read only

Settings 0.00–655.35 Hz

### 06-93 DC Bus Voltage when Fault 5 Occurred

Control Mode **VF** **VFPG** **SVC** **FOCPG** **FOCPM** Default: Read only

Settings 0.0–6553.5 V

### 06-94 Output Current when Fault 5 Occurred

Control Mode **VF** **VFPG** **SVC** **FOCPG** **FOCPM** Default: Read only

Settings 0.00–655.35 Amps

### 06-95 IGBT Temperature when Fault 5 Occurred

Control Mode **VF** **VFPG** **SVC** **FOCPG** **FOCPM** Default: Read only

Settings -3276.8–3276.7ºC

### 06-96 Output Frequency when Fault 6 Occurred

Control Mode **VF** **VFPG** **SVC** **FOCPG** **FOCPM** Default: Read only

Settings 0.00–655.35 Hz

### 06-97 DC Bus Voltage when Fault 6 Occurred

Control Mode **VF** **VFPG** **SVC** **FOCPG** **FOCPM** Default: Read only

Settings 0.0–6553.5 V

### 06-98 Output Current when Fault 6 Occurred

Control Mode **VF** **VFPG** **SVC** **FOCPG** **FOCPM** Default: Read only

Settings 0.00–655.35 Amps

### 06-99 IGBT Temperature when Fault 6 Occurred

Control Mode **VF** **VFPG** **SVC** **FOCPG** **FOCPM** Default: Read only

Settings -3276.8–3276.7ºC

## 07 Special Parameters

✔: You can set this parameter during operation.

### ✔ 07-00 Brake Transistor Level

Control Mode **VF** **VFPG** **SVC** **FOCPG** **FOCPM** Default: 380.0/760.0

Settings 230V series: 350.0–450.0 $V_{DC}$

460V series: 700.0–900.0 $V_{DC}$

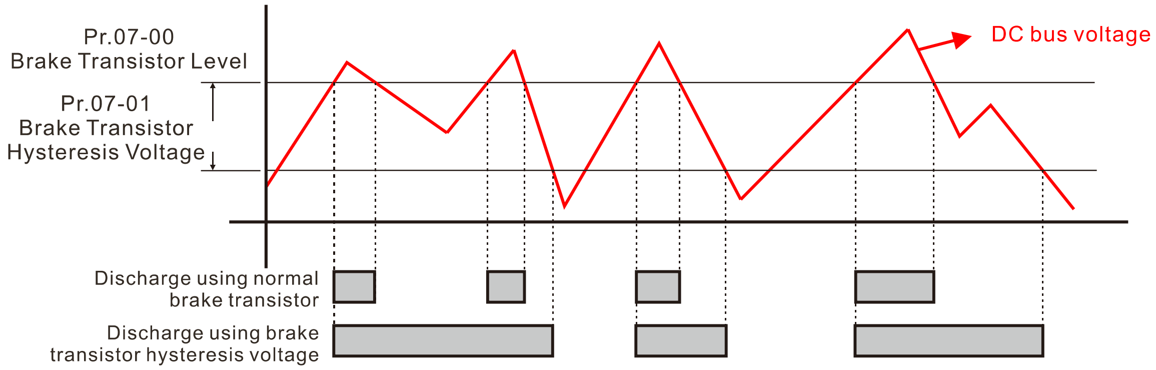
📖 Sets the DC bus voltage at which the brake transistor is activated.

### 07-01 Brake Transistor Hysteresis Voltage

Control Mode **VF** **VFPG** **SVC** **FOCPG** **FOCPM** Default: 0.0

Settings 0.0–100.0 V

📖 Used with Pr.07-00 to make the activated voltage level within range in order to prevent the brake resistor from overheating due to frequent ON/OFF of the brake transistor caused by fluctuated DC bus voltage.




### ✔ 07-02 DC Brake Current Level at Start-up

Control Mode **VF** **VFPG** **SVC** Default: 0

Settings 0–100% of the rated current of the motor drive

📖 Sets the level of the DC brake current output to the motor at start-up. When setting the DC brake current, the rated current (Pr.00-01) is 100%. It is recommended that you start with a low DC brake current level and then increase until you reach the proper holding torque. However, the DC brake current cannot exceed the motor's rated current to prevent the motor from burnout. Therefore, DO NOT use the DC brake for mechanical retention, otherwise injury or accident may occur.

📖 When in FOCPG/FOCPM mode, you can enable the DC brake function without setting up this parameter.

### ✔ 07-03 DC Brake Activation Time

Control Mode **VF** **VFPG** **SVC** **FOCPG** **FOCPM** Default: 0.7

Settings 0.0–60.0 sec.

📖 Sets the length of time that the DC brake current is supplied to motor when activating the drive.

### ✔ 07-04 DC Brake Stopping Time

Control Mode **VF** **VFPG** **SVC** **FOCPG** **FOCPM** Default: 0.7

Settings 0.0–60.0 sec.

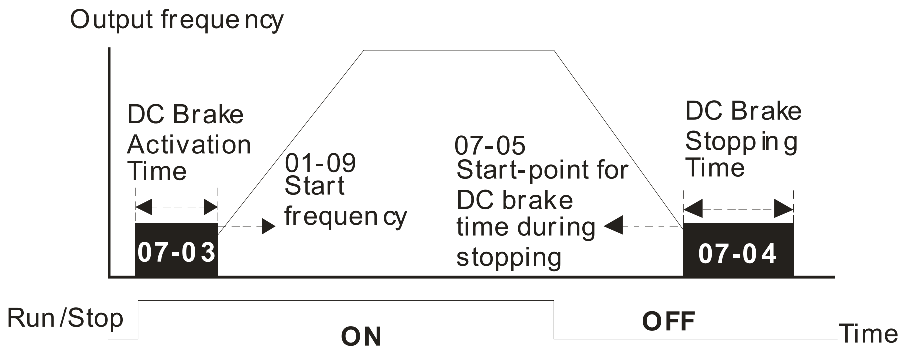
📖 Sets the length of time that the DC brake current is supplied to motor when stopping the drive.

## 07-05 Start-point for DC Brake

Control Mode **VF** **VFPG** **SVC** **FOCPG** Default: 0.00

Settings 0.00–400.00 Hz

📖 Determines the frequency at which the DC brake begins during deceleration. When the setting is less than the start frequency (Pr.01-09), the start-point for the DC brake begins at the minimum frequency.




DC Brake Time

## 07-06 DC Brake Proportional Gain

Control Mode **VF** **VFPG** **SVC** Default: 50

Settings 1–500

📖 Sets the output voltage gain when DC braking.

## 07-07 Dwell Time at Acceleration

Control Mode **VF** **VFPG** **SVC** **FOCPG** **FOCPM** Default: 0.00

Settings 0.00–600.00 sec.

## 07-09 Dwell Time at Deceleration

Control Mode **VF** **VFPG** **SVC** **FOCPG** **FOCPM** Default: 0.00

Settings 0.00–600.00 sec.

## 07-08 Dwell Frequency at Acceleration

Control Mode **VF** **VFPG** **SVC** **FOCPG** **FOCPM** Default: 0.00

Settings 0.00–400.00 Hz

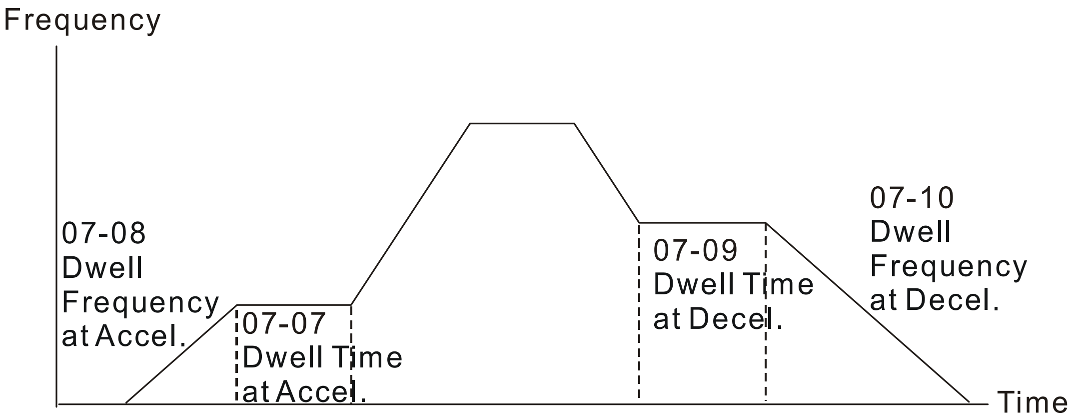
## 07-10 Dwell Frequency at Deceleration

Control Mode **VF** **VFPG** **SVC** **FOCPG** **FOCPM** Default: 0.00

Settings 0.00–400.00 Hz

📖 In a heavy load situation, dwelling can temporarily stabilize the output frequency.

📖 Use Pr.07-07–Pr.07-10 with heavy load to prevent over-voltage or over-current.




Dwell at accel./decel.

## 07-11 Cooling Fan Control

Control Mode **VF** **VFPG** **SVC** **FOCPG** **FOCPM** Default: 2

Settings
0: Cooling fan is always ON.
1: One minute after AC motor drive stops, cooling fan is OFF.
2: AC motor drive runs and cooling fan is ON; AC motor drive stops and cooling fan is OFF.
3: Cooling fan is ON to run when preliminary IGBT temperature (℃) reached.
4: Cooling fan is always OFF.

- Use this parameter for the fan control.
- When set to 3, the fan starts to run until the heat sink temperature is less than 40°C if temperature exceeds 40°C.

## 07-12 Torque Command

Control Mode Default: 0.0

Settings -150.0–150.0% (Pr.07-14 setting = 100%)

- This parameter sets the Torque command. When Pr.07-14 is 250% and Pr.07-12 is 100%, the actual Torque command = 250x100% =250% of the motor rated torque.

## 07-13 Torque Command Source

Control Mode Default: 2

Settings
0: Use the KPC-CC01 digital keypad
1: Use the RS-485 serial communication
2: Use the analog signal (Pr.03-00)

- Specifies the Torque command source (Torque command is in Pr.07-12).

## 07-14 Maximum Torque Command

Control Mode **VF** **VFPG** **SVC** **FOCPG** **FOCPM** Default: 100

Settings 0–300% of the rated motor drive torque

- Sets the maximum Torque command value (the motor rated torque is 100%).

## 07-15 Torque Command Filter Time

Control Mode Default: 0.000

Settings 0.000–1.000 sec.

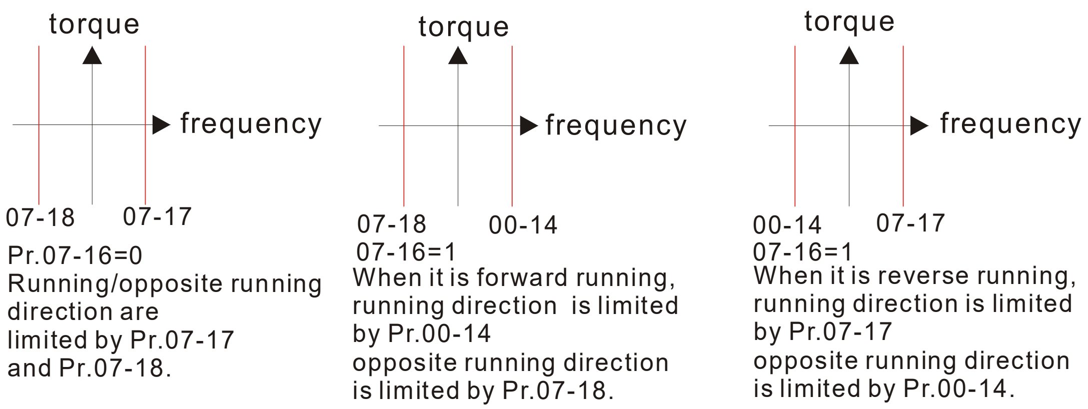
📖 When the setting is too long, the control is stable but the control response is delayed. When the setting is too short, the response is quick but the control may be unstable. Adjust the setting according to your control and response situation.

## 07-16 Speed Limit

Control Mode Default: 0

Settings 0: Use the settings in Pr.07-17 and Pr.07-18

1: Use the Frequency command source (Pr.00-14)




## ✓ 07-17 Torque Mode + Speed Limit

Control Mode Default: 10

Settings 0–120%

## ✓ 07-18 Torque Mode - Speed Limit

Control Mode Default: 10

Settings 0–120%

📖 Limits the speed for forward and reverse running in torque mode (Pr.01-00 Maximum Output Frequency = 100%).

## ✓ 07-19 Torque Offset Source

Control Mode **SVC** **FOCPG** **FOCPM** Default: 0

Settings 0: Disable

1: Use the analog input (Pr.03-00)

2: Use the torque offset setting (Pr.07-20)

3: Use the external terminals (by Pr.07-21–Pr.07-23)

📖 Specifies the torque offset source.

📖 When set to 3, the torque offset sources are Pr.07-21, Pr.07-22 and Pr.07-23 according to the multi-function input terminal settings (31, 32 or 33).

| Pr.02-01–Pr.02-08 is set to 31 | Pr.02-01–Pr.02-08 is set to 32 | Pr.02-01–Pr.02-08 is set to 33 | Torque offset |
|---|---|---|---|
| OFF | OFF | OFF | N/A |
| OFF | OFF | ON | 07-23 |
| OFF | ON | OFF | 07-22 |
| OFF | ON | ON | 07-23+07-22 |
| ON | OFF | OFF | 07-21 |
| ON | OFF | ON | 07-21+07-23 |
| ON | ON | OFF | 07-21+07-22 |
| ON | ON | ON | 07-21+07-22+07-23 |

## 07-20 Torque Offset Setting

Control Mode SVC FOCPG FOCPM Default: 0.0

Settings 0.0–100.0% (motor drive rated torque)

Sets the torque offset. The motor rated torque is 100%.

## 07-21 High Torque Offset

Control Mode SVC FOCPG FOCPM Default: 30.0

Settings 0.0–100.0% (motor drive rated torque)

## 07-22 Middle Torque Offset

Control Mode SVC FOCPG FOCPM Default: 20.0

Settings 0.0–100.0% (motor drive rated torque)

## 07-23 Low Torque Offset

Control Mode SVC FOCPG FOCPM Default: 10.0

Settings 0.0–100.0% (motor drive rated torque)

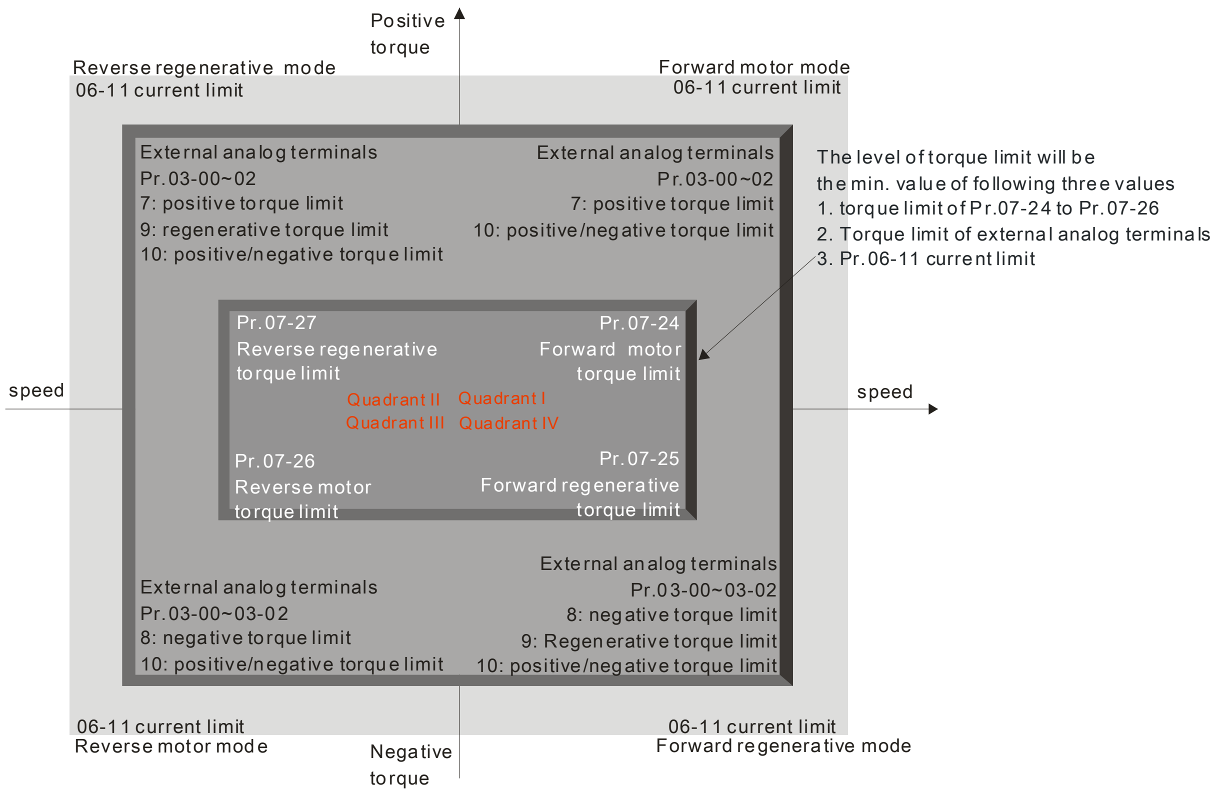
When set to 3, the torque offset sources are Pr.07-21, Pr.07-22 and Pr.07-23 according to the multi-function input terminal settings (31, 32 or 33). The motor rated torque is 100%.

## 07-24 Forward Motor Torque Limit
## 07-25 Forward Regenerative Torque Limit
## 07-26 Reverse Motor Torque Limit
## 07-27 Reverse Regenerative Torque Limit

Control Mode FOCPG FOCPM Default: 200

Settings 0–300% (rated torque of the motor drive)

The motor rated torque is 100%. The settings for Pr.07-24–Pr.07-27 compare with Pr.03-00=5, 6, 7, 8. The minimum of the comparison result is torque limit. The diagram below illustrates the torque limit.



## 07-28 Emergency Stop (EF) & Forced Stop

Control Mode **VF** **VFPG** **SVC** **FOCPG** **FOCPM** Default: 0

Settings 0: Coast to stop
1: According to deceleration Time 1
2: According to deceleration Time 2
3: According to deceleration Time 3
4: According to deceleration Time 4
5: According to Pr.01-31

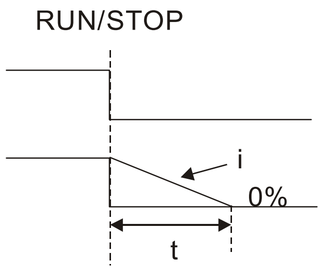
- When the multi-function input terminal is set to 10 or 18 and is ON, the drive operates according to this parameter setting.

## 07-29 Time for Decreasing Torque at Stop

Control Mode **FOCPG** **FOCPM** Default: 0.000

Settings 0.000–5.000 sec.

- When the elevator is stopped and the mechanical brake is engaged, the drive stops output. At the same time, it produces noise from the reacting force between the motor and the mechanical brake. Use this parameter to decrease this reacting force and lower the noise.
- Sets the time when torque decreases from 300% to 0%.




$$\frac{i}{00\text{-}01} \times \frac{100\%}{300\%} \times (07\text{-}29) = t$$

## 07-30 DC Brake Current Level at Stop

Control Mode **VF** **VFPG** **SVC** Default: 0

Settings 0–100% of the rated current of the motor drive

- Sets the level of the DC brake current output to the motor at stop. When setting the DC brake current, the rated current (Pr.00-01) is 100%. It is recommended that you start with a low DC brake current level and then increase until you reach the proper holding torque. However, the DC brake current cannot exceed the motor’s rated current to prevent the motor from burnout. Therefore, DO NOT use the DC brake for mechanical retention, otherwise injury or accident may occur.
- When in FOCPG/FOCPM control mode, you can enable the DC brake without setting up Pr.07-30.

# 08 PM Parameters

✔: You can set this parameter during operation.

## 08-00 Motor Auto-tuning

Control Mode **FOCPM** Default: 0

Settings 0: No function

1: Only for an unloaded motor; auto-measures the angle between magnetic pole and PG origin (Pr.08-09)

2: Auto-tuning PM parameters (suggested to lock the brake)

3: Auto-measures the angle between magnetic pole and PG origin (Pr.08-09)

- Position the elevator near the middle floors before auto-tuning.
- Auto-tuning process: 2, and then 1 or 3.
- Motor auto-tuning:
  Set Pr.08-00 to 1 to 3, and then press the RUN key on the digital keypad KPC-CC01 (Pr.00-15=2) to start auto-tuning. Or when the drive is in manual mode (inspection), run the upward operation or downward operation (Pr.00-15=1) to start auto-tuning immediately. In the process of auto-tuning, an "Auto tuning" warning continuously displays on the digital keypad until it is finished.
- Pr.08-00=2: Motor auto-tuning is static test:
  1. Make sure that all the drive parameters are set to defaults and the motor wiring is correct.
  2. Enter the correct values for Pr.01-01, Pr.01-02, Pr.08-01, Pr.08-02, Pr.08-03 and Pr.08-04. Refer to motor capacity to set the acceleration/deceleration time.
  3. Note that the motor will run! The shaft needs to be locked by an external force.
  4. After auto-tuning is finished, check if Pr.08-05, Pr.08-07, and Pr.08-08 all have values.
- Pr.08-00=1: Auto-measures the angle between the magnetic pole and the PG origin. Pay attention to the following notes when measuring: (dynamic test)
  1. Unload before auto-tuning.
  2. If the drive controls the brake, the drive can auto-tune according to the normal sequence after you complete the wiring and set the brake control parameters.
  3. If the host controller controls the brake, make sure that the brake is in release status before auto-tuning.
- Pr.08-00=3: Auto-measures the angle between the magnetic pole and the PG origin. Pay attention to the following notes when measuring: (static test)
  1. The motor can be loaded or unloaded before auto-tuning.
  2. See the reference table for auto-tuning for Pr.10-00 (PG Signal Type).
  3. If the drive controls the brake, the drive can auto-tune according to the normal sequence after you complete the wiring and set the brake control parameters.
  4. If the host controller controls the brake, make sure that the brake is in release status before auto-tuning.
  5. Make sure the setting for Pr.10-02 is correct. Incorrectly setting Pr.10-02 causes incorrect positioning of the magnetic pole and results in the wrong angle between the magnetic pole and PG origin.

**NOTE**

- ☑ The entered rated speed cannot be larger than or equal to 120 f/p.
- ☑ Note that if the contactor and brake are not controlled by the AC motor drive, release it manually.
- ☑ Set Pr.08-00 to 1 (unloaded motor) for accurate calculation. If you need to execute this function with a loaded motor, balance the carriage before execution.
- ☑ If you do not balance the carriage in a measured environment, you can execute this function with a loaded motor by setting Pr.08-00= 3. It will have a difference of 15–30$^{o}$ for different encoder types.
- ☑ "Auto Tuning Err" displays on the digital keypad when stopping due to an AC motor drive fault or human error, which means the detection fails. Check the wiring connections of the AC motor drive If "PG Fbk Error" displays on the digital keypad, change the setting of Pr.10-02 (if set to 1, change it to 2). If "PG Fbk Loss" displays on the digital keypad, check the feedback of Z-phase pulse.

## 08-01 Motor Rated Current

Control Mode FOCPM Unit: Amp

Default: #.##

Settings (40–120%) * Pr.00-01 Amps

- Sets according to the motor rated current as indicated on the motor nameplate. The default is 90% of the rated current.
- Example: Suppose the rated current for 7.5 HP (5.5 kW) models is 25 A and the default is 22.5 A. In this case, the current range is from 10 A (25 * 40%) to 30 A (25 * 120%).

## ✓ 08-02 Motor Rated Power

Control Mode FOCPM Default: #.##

Settings 0.00–655.35 kW

- Sets the motor rated power. The default is the power of the drive.

## ✓ 08-03 Motor Rated Speed (rpm)

Control Mode FOCPM Default: 1710

Settings 0–65535 rpm

- Sets the motor rated speed according to the motor nameplate.

## 08-04 Number of Motor Poles

Control Mode FOCPM Default: 4

Settings 2–96

- Sets the number of motor poles (must be an even number).

## 08-05 Motor Rs

Control Mode FOCPM Default: 0.000

Settings 0.000–65.535 Ω

## 08-06 Motor Ld
## 08-07 Motor Lq

Control Mode FOCPM Default: 0.0

Settings 0.0–6553.5 mH

## 08-08 Back Electromotive Force

Control Mode FOCPM Default: 0.0

Settings 0.0–6553.5 Vrms

- Sets the back electromotive force (phase-phase RMS value) when the motor is operated at the rated speed.
- You can get the RMS value by setting Pr.08-00 = 2 (Motor Auto-tuning).

## 08-09 Offset Angle between Magnetic Pole and PG Origin

Control Mode FOCPM Default: 360.0

Settings 0.0–360.0°

- The offset angle between the magnetic pole and PG origin (measured by auto-tuning).

## 08-10 Magnetic Pole Re-orientation

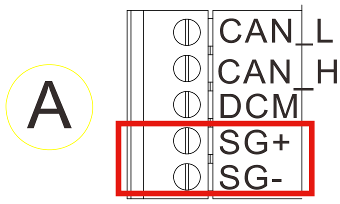
| Control Mode | | **FOCPM** | Default: 0 |
|---|---|---|---|
| | Settings | 0: Disable | |
| | | 1: Enable | |

- Use with Pr.11-00 bit15 = 1.
- Use this function to search for the magnetic pole position only for permanent magnet motors.
- When there is no origin-adjustment for the encoder (Pr.08-09 is 360.0), it only ensures that the motor operation efficiency can be up to 86% of the best efficiency. In this situation, if you need to improve the operation efficiency, cycle the power or set Pr.08-10 to 1 to measure the magnetic pole orientation again.

# 09 Communication Parameters

⚡: You can set this parameter during operation.

When using the communication interface, the diagram on the right shows the communication port pin definitions. We recommend that you connect the AC motor drive to your PC by using Delta IFD6530 or IFD6500 as a communication converter.




## ⚡ 09-00 Communication Address

Default: 1

Settings 1–254

📖 Sets the communication address for the drive if the AC motor drive is controlled through RS-485 serial communication. The communication address for each AC motor drive must be unique.

## ⚡ 09-01 Transmission Speed

Control Mode **VF** **VFPG** **SVC** **FOCPG** **FOCPM** Default: 19.2

Settings 4.8–115.2 kbps

📖 Sets the transmission speed between the RS-485 master (PLC, PC, etc.) and the AC motor drive.

## ⚡ 09-02 Transmission Fault Treatment

Control Mode **VF** **VFPG** **SVC** **FOCPG** **FOCPM** Default: 3

Settings
0: Warn and keep operation
1: Warn and ramp to stop
2: Reserved
3: No action and no display

📖 Determines the treatment if a transmission time-out error (such as disconnection) occurs during communication.

## ⚡ 09-03 Time-out Detection

Control Mode **VF** **VFPG** **SVC** **FOCPG** **FOCPM** Default: 0.0

Settings
0.0–100.0 sec.
0.0: Disable

📖 Sets the communication time-out value.

## ⚡ 09-04 Communication Protocol

Control Mode **VF** **VFPG** **SVC** **FOCPG** **FOCPM** Default:13

Settings
0: 7, N, 1 for ASCII
1: 7, N, 2 for ASCII
2: 7, E, 1 for ASCII
3: 7, O, 1 for ASCII
4: 7, E, 2 for ASCII
5: 7, O, 2 for ASCII

6: 8, N, 1 for ASCII
7: 8, N, 2 for ASCII
8: 8, E, 1 for ASCII
9: 8, O, 1 for ASCII
10: 8, E, 2 for ASCII
11: 8, O, 2 for ASCII
12: 8, N, 1 for RTU
13: 8, N, 2 for RTU
14: 8, E, 1 for RTU
15: 8, O, 1 for RTU
16: 8, E, 2 for RTU
17: 8, O, 2 for RTU

- Control by PC or PLC (Computer Link):
  Selects the desired mode along with the RS-485 serial port communication protocol in Pr.09-00.
- Modbus ASCII (American Standard Code for Information Interchange): Each data byte is the combination of two ASCII characters; for example, a 1-byte data: 64 Hex, is shown as ‘64’ in ASCII, and consists of ‘6’ (36 Hex) and ‘4’ (34 Hex).

**1. Code Description**

The communication protocol is in hexadecimal, ASCII: “0”, “9”, “A”, “F”, every 16 hexadecimal represents an ASCII code. For example:

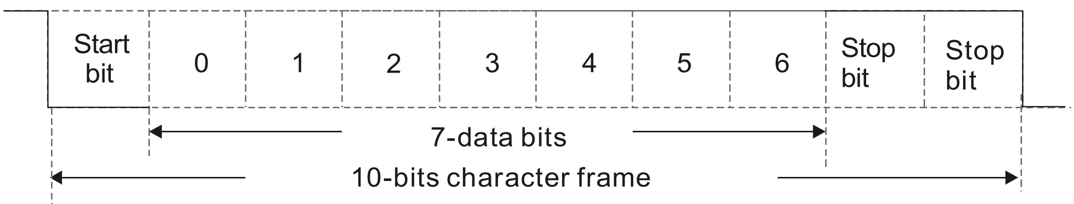
| Character | ‘0’ | ‘1’ | ‘2’ | ‘3’ | ‘4’ | ‘5’ | ‘6’ | ‘7’ |
|---|---|---|---|---|---|---|---|---|
| ASCII code | 30H | 31H | 32H | 33H | 34H | 35H | 36H | 37H |

| Character | ‘8’ | ‘9’ | ‘A’ | ‘B’ | ‘C’ | ‘D’ | ‘E’ | ‘F’ |
|---|---|---|---|---|---|---|---|---|
| ASCII code | 38H | 39H | 41H | 42H | 43H | 44H | 45H | 46H |

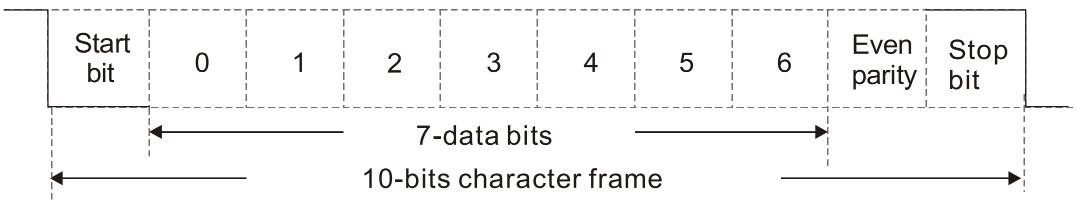
**2. Data Format**

10-bit character frame (For ASCII):

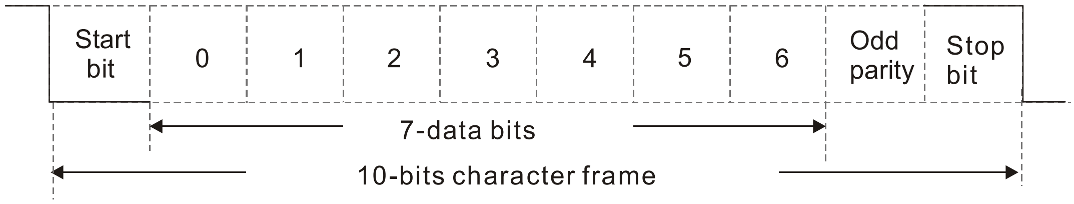
(Format: 7, N, 2)




(Format: 7, E, 1)

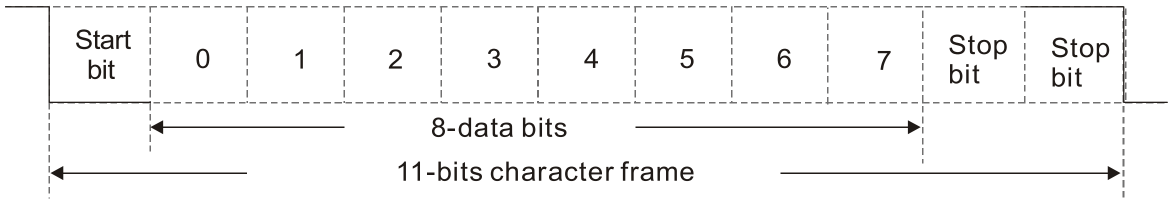


(Format: 7, O, 1)

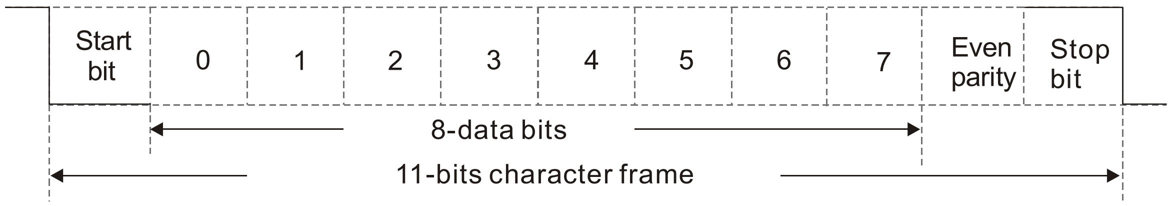



11-bit character frame (For RTU)

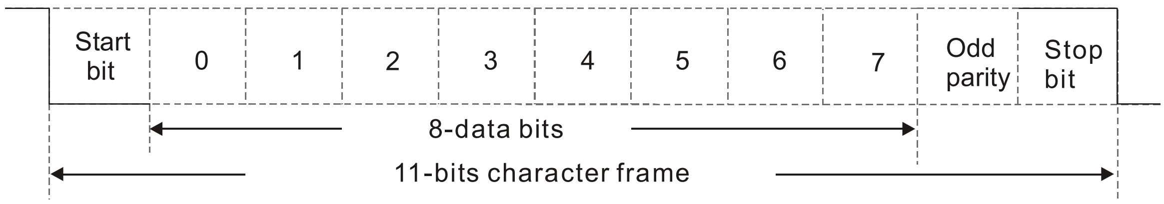
(Format: 8, N, 2)




(Format: 8, E, 1)




(Format 8, O, 1)




## 3. Communication Protocol

### 3.1 Communication Data Frame

**ASCII mode:**

| | |
|---|---|
| STX | Start character ':' (3AH) |
| Address Hi<br>Address Lo | Communication address:<br>8-bit address consists of 2 ASCII codes |
| Function Hi<br>Function Lo | Command code:<br>8-bit command code consists of 2 ASCII codes |
| DATA (n-1)<br>to<br>DATA 0 | Contents of data:<br>Nx8-bit data consists of 2n ASCII codes<br>n<=16, maximum of 32 ASCII codes (20 sets of data) |
| LRC CHK Hi<br>LRC CHK Lo | LRC checksum:<br>8-bit checksum consists of 2 ASCII codes |
| END Hi<br>END Lo | End characters:<br>END1= CR (0DH), END0 = LF(0AH) |

**RTU mode:**

| | |
|---|---|
| START | A silent interval of larger than/equal to 10 ms |
| Address | Communication address: 8-bit binary address |
| Function | Command code: 8-bit binary command |
| DATA (n-1)<br>to<br>DATA 0 | Contents of data:<br>n×8-bit data, n<=16 |
| CRC CHK Low | CRC checksum:<br>16-bit CRC checksum consists of 2 8-bit binary characters |
| CRC CHK High | |
| END | A silent interval of larger than/equal to 10 ms |

### 3.2 Address (Communication Address)

00H: Broadcast to all AC motor drives

01H: AC motor drive of address 01

0FH: AC motor drive of address 15

10H: AC motor drive of address 16

:

FEH: AC motor drive of address 254

### 3.3 Function (Function code) and DATA (data characters)

**(1) 03H: Read data from register**

Example: reading continuous 2-data from register address 2102H, AMD address is 01H.

**ASCII mode:**

Command Message

| | |
|---|---|
| STX | ‘:’ |
| Address | ‘0’ |
| | ‘1’ |
| Function | ‘0’ |
| | ‘3’ |
| Starting address | ‘2’ |
| | ‘1’ |
| | ‘0’ |
| | ‘2’ |
| Number of data<br>(count by word) | ‘0’ |
| | ‘0’ |
| | ‘0’ |
| | ‘2’ |
| LRC Check | ‘D’ |
| | ‘7’ |
| END | CR |
| | LF |

Response Message

| | |
|---|---|
| STX | ‘:’ |
| Address | ‘0’ |
| | ‘1’ |
| Function | ‘0’ |
| | ‘3’ |
| Number of data<br>(count by byte) | ‘0’ |
| | ‘4’ |
| Content of starting address 2102H | ‘1’ |
| | ‘7’ |
| | ‘7’ |
| | ‘0’ |
| Content of address 2103H | ‘0’ |
| | ‘0’ |
| | ‘0’ |
| | ‘0’ |
| LRC Check | ‘7’ |
| | ‘1’ |
| END | CR |
| | LF |

**RTU mode:**

Command Message

| | |
|---|---|
| Address | 01H |
| Function | 03H |
| Starting data address | 21H |
| | 02H |
| Number of data<br>(count by world) | 00H |
| | 02H |
| CRC CHK Low | 6FH |
| CRC CHK High | F7H |

Response Message

| | |
|---|---|
| Address | 01H |
| Function | 03H |
| Number of data<br>(count by byte) | 04H |
| Content of data<br>address 2102H | 17H |
| | 70H |
| Content of data<br>address 2103H | 00H |
| | 00H |
| CRC CHK Low | FEH |
| CRC CHK High | 5CH |

**(2) 06H: Single write, write single data to register**

06H: Single write, write single data to register (can write at most 20 sets of data simultaneously).

Example: writing data 6000 (1770H) to register 0100H. AMD address is 01H.

**ASCII mode:**

| Command Message | | Response Message | |
|---|---|---|---|
| STX | ':' | STX | ':' |
| Address | '0' | Address | '0' |
| | '1' | | '1' |
| Function | '0' | Function | '0' |
| | '6' | | '6' |
| Data address | '0' | Data address | '0' |
| | '1' | | '1' |
| | '0' | | '0' |
| | '0' | | '0' |
| Data content | '1' | Data content | '1' |
| | '7' | | '7' |
| | '7' | | '7' |
| | '0' | | '0' |
| LRC Check | '7' | LRC Check | '7' |
| | '1' | | '1' |
| END | CR | END | CR |
| | LF | | LF |

**RTU mode:**

| Command Message | | Response Message | |
|---|---|---|---|
| Address | 01H | Address | 01H |
| Function | 06H | Function | 06H |
| Data address | 01H | Data address | 01H |
| | 00H | | 00H |
| Data content | 17H | Data content | 17H |
| | 70H | | 70H |
| CRC CHK Low | 86H | CRC CHK Low | 86H |
| CRC CHK High | 22H | CRC CHK High | 22H |

**(3) 10H: Write multiple registers (write multiple data to registers)**

Example: Set the multi-step speed,

Pr.04-00 = 50.00 (1388H), Pr.04-01 = 40.00 (0FA0H). AC motor drive address is 01H.

**ASCII mode:**

| Command Message | | Response Message | |
|---|---|---|---|
| STX | ':' | STX | ':' |
| ADR 1 | '0' | ADR 1 | '0' |
| ADR 0 | '1' | ADR 0 | '1' |
| CMD 1 | '1' | CMD 1 | '1' |
| CMD 0 | '0' | CMD 0 | '0' |
| Target Register | '0' | Target Register | '0' |
| | '5' | | '5' |
| | '0' | | '0' |
| | '0' | | '0' |
| Number of Register (Count by word) | '0' | Number of Register (Count by word) | '0' |
| | '0' | | '0' |
| | '0' | | '0' |
| | '2' | | '2' |
| Number of Register (Count by byte) | '0' | LRC Check | 'E' |
| | '4' | | '8' |
| The first data content | '1' | END | CR |
| | '3' | | LF |
| | '8' | | |

| | |
|---|---|
| | '8' |
| The second data content | '0' |
| | 'F' |
| | 'A' |
| | '0' |
| LRC Check | '9' |
| | 'A' |
| END | CR |
| | LF |

**RTU mode:**

Command Message

| | |
|---|---|
| ADR | 01H |
| CMD | 10H |
| Target Register | 05H |
| | 00H |
| Number of Register (Count by word) | 00H |
| | 02H |
| Number of Register(Byte) | 04 |
| The first Data content | 13H |
| | 88H |
| The second Data content | 0FH |
| | A0H |
| CRC Check Low | '9' |
| CRC Check High | 'A' |

Response

| | |
|---|---|
| ADR | 01H |
| CMD 1 | 10H |
| Target Register | 05H |
| | 00H |
| Number of Register (Count by word) | 00H |
| | 02H |
| CRC Check Low | 41H |
| CRC Check High | 04H |

### 3.4 Checksum

**ASCII mode (LRC Check)**

LRC (Longitudinal Redundancy Check) is calculated by summing up the values of the bytes from ADR1 to the last data character then calculating the hexadecimal representation of the 2's-complement negation of the sum.

For example, as shown in the above Section 3.3.1,

01H + 03H + 21H + 02H + 00H + 02H = 29H, the 2's-complement negation of 29H is **D7**H.

**RTU mode (CRC check)**

CRC (Cyclical Redundancy Check) is calculated with the following steps:

**Step 1:** Load a 16-bit register (called CRC register) with FFFFH.

**Step 2:** Exclusive OR the first 8-bit byte of the command message with the low order byte of the 16-bit CRC register, putting the result in the CRC register.

**Step 3:** Examine the LSB of CRC register.

**Step 4:** If the LSB of CRC register is 0, shift the CRC register one bit to the right with MSB zero filling, then repeat step 3. If the LSB of CRC register is 1, shift the CRC register one bit to the right with MSB zero filling, Exclusive OR the CRC register with the polynomial value A001H, then repeat step 3.

**Step 5:** Repeat step 3 and 4 until eight shifts have been performed. When this is done, a complete 8-bit byte will have been processed.

**Step 6:** Repeat step 2 to 5 for the next 8-bit byte of the command message. Continue doing this until all bytes have been processed. The final contents of the CRC register are the CRC value. When transmitting the CRC value in the message, the upper and lower bytes of the CRC value must be swapped, i.e. the lower order byte is transmitted first.

The following is an example of CRC generation using C language. The function takes two arguments:

```
unsigned char* data      ← // a pointer to the message buffer
unsigned char length    ← // the quantity of bytes in the message buffer
unsigned int crc_chk(unsigned char* data, unsigned char length)
  {
  int j;
  unsigned int reg_crc=0Xffff;
  while(length--){
    reg_crc ^= *data++;
    for(j=0;j<8;j++){
    if(reg_crc & 0x01){   /* LSB(b0)=1 */
      reg_crc=(reg_crc>>1) ^ 0Xa001;
    }else{
      reg_crc=reg_crc >>1;
    }
  }
}
return reg_crc;                         // return register to CRC
```

## 4. ACMD Modbus Communication Address List

The following table shows the contents of available addresses.

<table>
<tr><th>Content</th><th>Address</th><th colspan="2">Function</th></tr>
<tr><td>AC motor drive Parameters</td><td>GGnnH</td><td colspan="2">GG means parameter group, nn means parameter number, for example, the address of Pr.04-01 is 0401H.</td></tr>
<tr><td rowspan="8">Command Write only</td><td rowspan="8">2000H</td><td>Bit 0–3</td><td>0: No function<br>1: Stop<br>2: Run<br>3: Jog + Run</td></tr>
<tr><td>Bit 4–5</td><td>00B: No function<br>01B: FWD<br>10B: REV<br>11B: Change direction</td></tr>
<tr><td>Bit 6–7</td><td>00B: First acceleration/deceleration<br>01B: Second acceleration/deceleration<br>10B: Third acceleration/deceleration<br>11B: Fourth acceleration/deceleration</td></tr>
<tr><td>Bit 8–11</td><td>0000B: master speed<br>0001B: 1st step speed<br>0010B: 2nd step speed<br>0011B: 3rd step speed<br>0100B: 4th step speed<br>0101B: 5th step speed<br>0110B: 6th step speed<br>0111B: 7th step speed<br>1000B: 8th step speed<br>1001B: 9th step speed<br>1010B: 10th step speed<br>1011B: 11th step speed<br>1100B: 12th step speed<br>1101B: 13th step speed<br>1110B: 14th step speed<br>1111B: 15th step speed</td></tr>
<tr><td>Bit 12</td><td>1: Enable bit 06–11</td></tr>
<tr><td>Bit 13–14</td><td>00B: No function<br>01B: Operated by digital keypad<br>10B: Operated by Pr.00-15 setting<br>11B: Change operation source</td></tr>
<tr><td>Bit 15</td><td>Reserved</td></tr>
<tr><td></td><td></td></tr>
<tr><td rowspan="18">Status monitor Read only</td><td>2001H</td><td colspan="2">Frequency command</td></tr>
<tr><td rowspan="4">2002H</td><td>Bit 0</td><td>1: EF (external fault) ON</td></tr>
<tr><td>Bit 1</td><td>1: Reset</td></tr>
<tr><td>Bit 2</td><td>1: B.B. ON</td></tr>
<tr><td>Bit 3–15</td><td>Reserved</td></tr>
<tr><td>2100H</td><td colspan="2">Fault code: refer to Pr.06-16–Pr.06-21</td></tr>
<tr><td rowspan="12">2119H</td><td rowspan="4">Bit 0–1</td><td>00: Stop</td></tr>
<tr><td>01: Deceleration</td></tr>
<tr><td>10: Ready for operation</td></tr>
<tr><td>11: Operation</td></tr>
<tr><td>Bit 2</td><td>1: JOG command</td></tr>
<tr><td rowspan="4">Bit 3–4</td><td>00: FWD command, FWD output</td></tr>
<tr><td>01: FWD command, REV output</td></tr>
<tr><td>10: REV command, FWD output</td></tr>
<tr><td>11: Reserved</td></tr>
<tr><td>Bit 5–7</td><td>Reserved</td></tr>
<tr><td>Bit 8</td><td>1: Master frequency controlled by communication interface</td></tr>
<tr><td>Bit 9</td><td>1: Master frequency controlled by analog/external terminal signals (EXT)</td></tr>
<tr><td></td><td></td><td>Bit 10</td><td>1: Operation command controlled by communication interface (PU)</td></tr>
<tr><td></td><td></td><td>Bit 11</td><td>1: Parameters locked</td></tr>
</table>

| Content | Address | Function | |
|---|---|---|---|
| | | Bit 12 | 1: Enable copy parameter from keypad |
| | | Bit 13–15 | Reserved |
| | 2102H | Frequency command (F) | |
| | 2103H | Output frequency (H) | |
| | 2104H | Output current (AXXX.X) | |
| | 2105H | DC bus voltage (UXXX.X) | |
| | 2106H | Output voltage (EXXX.X) | |
| | 2107H | Current step number of multi-step speed operation | |
| | 2116H | Multi-function displays (Pr.00-04) | |
| | 2201H | Pr.00-05 user-defined setting | |
| | 2203H | AUI1 analog input (XXX.XX %) | |
| | 2204H | AUI2 analog input (XXX.XX %) | |
| | 2205H | Reserved | |
| | 2206H | Display temperature of IGBT (°C) | |
| | 2207H | Display temperature of heat sink (°C) (only for model 40 HP and above) | |
| | 2208H | Digital input state | |
| | 2209H | Digital output state | |

**5. Exception Response**

The AC motor drive is expected to return a normal response after receiving command messages from the master device. The following describes the conditions when no normal response is sent to the master device.

The AC motor drive does not receive the messages due to a communication error; thus, the AC motor drive gives no response. The master device eventually processes a time-out condition.

The AC motor drive receives the messages without a communication error, but cannot handle them. It returns an exception response to the master device and displays an error message “CExx” on the AC motor drive keypad. The xx of “CExx” is a decimal code equal to the exception code (described below).

In the exception response, the most significant bit (bit7) of the original command code is set to 1 (function code and 80H), and it returns an exception code that explains the condition that caused the exception.

Example:

ASCII mode

| | |
|---|---|
| STX | ‘:’ |
| Address | ‘0’ |
| | ‘1’ |
| Function | ‘8’ |
| | ‘6’ |
| Exception code | ‘0’ |
| | ‘2’ |
| LRC CHK | ‘7’ |
| | ‘7’ |
| END | CR |
| | LF |

RTU mode

| | |
|---|---|
| Address | 01H |
| Function | 86H |
| Exception code | 02H |
| CRC CHK Low | C3H |
| CRC CHK High | A1H |

The following table describes the exception codes.

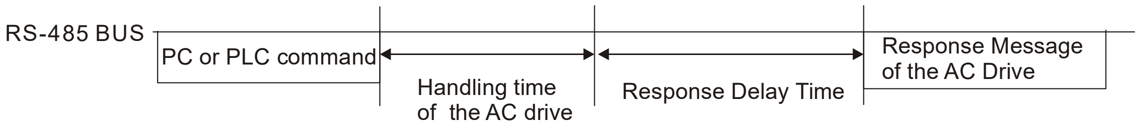
| Exception Code | Description |
|---|---|
| 1 | Incorrect data contents: the contents of data are too large, and not recognized by the motor drive. |
| 2 | Incorrect parameter address: The parameter addresses are not recognized by the motor drive. |
| 3 | Password locked: parameters cannot be changed. |
| 4 | Parameters cannot be changed during operation. |
| 10 | Transmission time-out |

## 09-05 Response Delay Time

Control Mode **VF** **VFPG** **SVC** **FOCPG** **FOCPM** Default: 2.0

Settings 0.0–200.0 ms

If the host computer does not finish the transmitting/receiving process, you can use this parameter to set the response delay time after the AC motor drive receives communication command as shown in the following picture.




## 09-06 – 09-13 Direct docking mode only

Control Mode **VF** **VFPG** **SVC** **FOCPG** **FOCPM** Default: -

Settings Contact Delta for more information

## 09-14 PDO Transmission Interval

Control Mode **VF** **VFPG** **SVC** **FOCPG** **FOCPM** Default: 0

Settings 0–65535 ms

# 10 Feedback Control Parameters

✎: You can set this parameter during operation.

In this parameter group, ASR is the abbreviation for Adjust Speed Regulator and PG is the abbreviation for Pulse Generator.

## 10-00 Selection of Encoder

Control Mode **VFPG** **FOCPG** **FOCPM** Default: 0

Settings
0: No function
1: ABZ
2: ABZ+Hall
3: SIN/COS + Sinusoidal
4: SIN/COS + Endat
5: SIN/COS
6: SIN/COS + Hiperface

📖 When you set Pr.10-02 to 3, 4 or 5, you can set Pr.10-00 only to 0, 1 or 2, and you cannot use 3, 4, 5 and 6.

📖 When you set Pr.10-00 to 3, the encoder has one sine and one cosine signal for each revolution. The signal must be: 0.75–1.2 Vpp for the amplitude with phase angle 90°±5 elec. (E.g. ERN 1185 ERN 1387)

📖 When you set Pr.10-00 to 4 or 6, wait for two seconds after applying the power before executing the RUN command.

📖 When you set Pr.10-00 to 5, you must set Pr.08-09 to 360.

📖 Detection of the magnetic pole:
(1) 1 or 5: The AC motor drive outputs a short circuit to detect the position of the magnetic pole. At this moment, the motor generates a little noise.
(2) 2: The AC motor drive detects the position of the magnetic pole with the UVW encoder signal.
(3) 3: The AC motor drive detects the position of the magnetic pole with the sine encoder signal.
(4) 4 or 6: The AC motor drive detects the position of the magnetic pole with the communication encoder signal.

📖 The table below shows the correspondence among encoder, PG card and auto-tuning

| PG Signal Type Setting | PG Signal Type | Applicable PG Card x=1, 2,… | Pr.08-00=1 | Pr.08-00=3 |
|---|---|---|---|---|
| Pr.10-00=1 | A, B, Z | EMED-PGAB/ABD-x | N/A | N/A |
| Pr.10-00=2 | A, B, Z+U, V, W | EMED-PGABD- x | Rolling test[*1] | Rolling test[*1] |
| Pr.10-00=3 | SIN/COS + Sinusoidal (e.g. ERN1185, ERN1387) | EMED-PGHSD-x | Rolling test[*1] | Pr.11-00 Bit9=0: Rolling test[*1] Pr.11-00 Bit9=1: Static test[*1] |
| Pr.10-00=4 | SIN/COS + Endat 2.1 (e.g. ECN1313, ECN413) | EMED-PGSD-x | Dynamic test[*1] | Static test[*1] |
| Pr.10-00=5 | SIN/COS | EMED-PGHSD-x | N/A | N/A |
| Pr.10-00=6 | SIN/COS + Hiperface (e.g. SRS50/60) | EMED-PGHSD-x | Dynamic test[*1] | Static test[*1] |

[*1] Static: Brake engaged, no motor running. Dynamic: Brake released, motor rotates less than one revolution.
Rolling: Brake released, motor rotates more than one revolution.

## 10-01 Encoder PPR

Control Mode **VFPG** **FOCPG** **FOCPM** Default: 2048

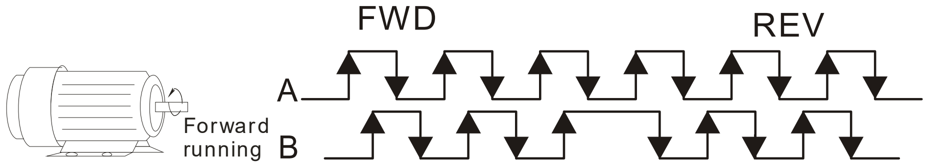
Settings 1–25000

📖 Sets the encoder pulses per revolution (PPR).

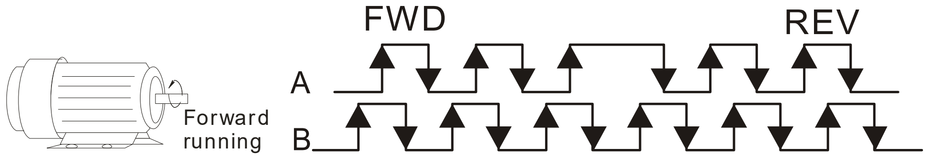
## 10-02 Encoder Input Type Setting

Control Mode **VFPG** **FOCPG** **FOCPM** Default: 0

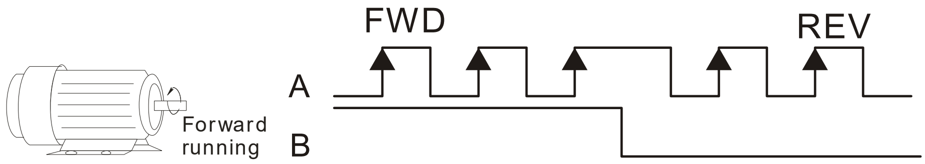
Settings
0: Disable
1: Phase A leads in a forward run command and phase B leads in a reverse run command



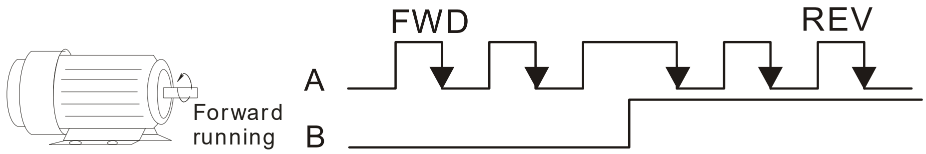

2: Phase B leads in a forward run command and phase A leads in a reverse run command



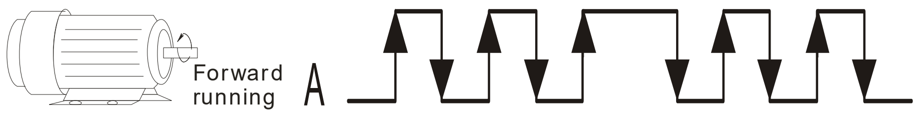

3: Phase A is a pulse input and phase B is a direction input. (low input=reverse direction, high input=forward direction)




4: Phase A is a pulse input and phase B is a direction input. (low input=forward direction, high input=reverse direction)




5: Single-phase input




- When you set Pr.10-00 to 3, 4, 5 or 6, you can set Pr.10-02 only to 0, 1 or 2, and you cannot use 3, 4 and 5.
- You must enter the correct pulse type for stable control.

## 10-03 Encoder Feedback Signal Fault Action (PGF1, PGF2)

Control Mode **VFPG** **FOCPG** **FOCPM** Default: 2

Settings
0: Warn and keep operation
1: Fault and ramp to stop
2: Fault and stop operation

## 10-04 Encoder Feedback Signal Fault Detection Time

Control Mode **VFPG** **FOCPG** **FOCPM** Default: 1.0

Settings 0.0–10.0 sec.

- When there is a PG loss, encoder signal error, pulse signal setting error or signal error, if time exceeds the setting for this parameter (Pr.10-04), the PG signal error occurs. Refer to Pr.10-03 for the encoder feedback signal fault action.

## 10-05 Encoder Stall Level (PGF3)

Control Mode **VFPG** **SVC** **FOCPG** **FOCPM** Default: 115

Settings 0–120%

0: Disable

Determines the maximum encoder feedback signal allowed before a fault occurs. (The maximum output frequency Pr.01-00 = 100%.)

## 10-06 Encoder Stall Detection Time (maximum output frequency Pr.01-00 = 100%)

Control Mode **VFPG** **SVC** **FOCPG** **FOCPM** Default: 0.1

Settings 0.0–2.0 sec.

## 10-07 Encoder Slip Range (PGF4) (maximum output frequency Pr.01-00 = 100%)

Control Mode **VFPG** **SVC** **FOCPG** **FOCPM** Default: 50

Settings 0–50%

0: Disable

## 10-08 Encoder Slip Detection Time (maximum output frequency Pr.01-00=100%)

Control Mode **VFPG** **SVC** **FOCPG** **FOCPM** Default: 0.5

Settings 0.0–10.0 sec.

## 10-09 Encoder Stall and Slip Error Action (maximum output frequency Pr.01-00 = 100%)

Control Mode **VFPG** **SVC** **FOCPG** **FOCPM** Default: 2

Settings 0: Warn and keep operation

1: Fault and ramp to stop

2: Fault and stop operation

When the difference of (rotation speed－motor frequency) exceeds the Pr.10-07 setting, and the detection time exceeds Pr.10-08 or the motor frequency exceeds Pr.10-05 setting, the drive starts to count time. If the detection time exceeds Pr.10-06, the encoder feedback signal error occurs. Refer to Pr.10-09 encoder stall and slip error action.

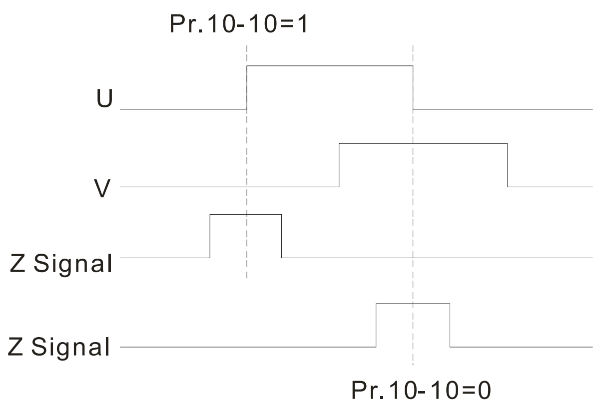
## 10-10 Mode Selection for UVW Input

Control Mode **VFPG** **FOCPG** **FOCPM** Default: 0

Settings 0: Z signal is at the falling edge of U-phase

1: Z signal is at the rising edge of U-phase

0: The operation is U->V->W, Z signal is at the falling edge of U-phase.
1: The operation is U->V->W, Z signal is at the rising edge of U-phase.



## 10-11 ASR (Auto Speed Regulation) Control (P) of Zero Speed

Control Mode **VF** **VFPG** **SVC** **FOCPG** **FOCPM** Default: 100.0

Settings 0.0–1000.0%

## 10-12 ASR (Auto Speed Regulation) Control (I) of Zero Speed

Control Mode **VF** **VFPG** **SVC** **FOCPG** **FOCPM** Default: 0.100

Settings 0.000–10.000 sec.

## 10-13 ASR (Auto Speed Regulation) Control (P) 1

Control Mode **VF** **VFPG** **SVC** **FOCPG** **FOCPM** Default: 100.0

Settings 0.0–1000.0%

## 10-14 ASR (Auto Speed Regulation) Control (I) 1

Control Mode **VF** **VFPG** **SVC** **FOCPG** **FOCPM** Default: 0.100

Settings 0.000–10.000 sec.

## 10-15 ASR (Auto Speed Regulation) Control (P) 2

Control Mode **VF** **VFPG** **SVC** **FOCPG** **FOCPM** Default: 100.0

Settings 0.0–1000.0%

## 10-16 ASR (Auto Speed Regulation) Control (I) 2

Control Mode **VF** **VFPG** **SVC** **FOCPG** **FOCPM** Default: 0.100

Settings 0.000–10.000 sec.

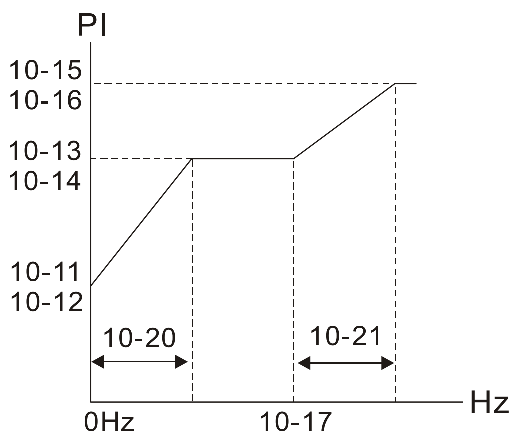
## 10-17 ASR 1/ASR2 Switch Frequency

Control Mode **VF** **VFPG** **SVC** **FOCPG** **FOCPM** Default: 7.00

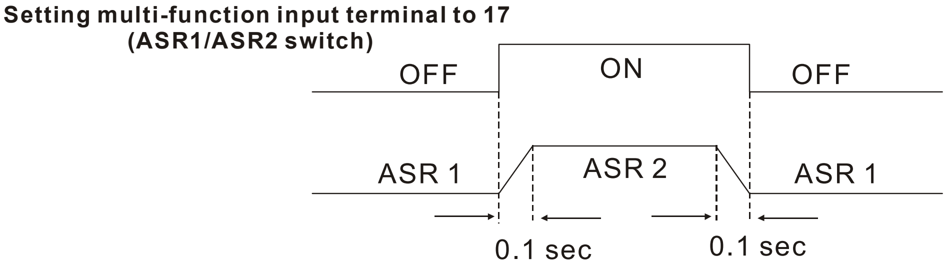
Settings 0.00–400.00 Hz

0: Disable

- ASR P determines the proportional control and associated gain (P). ASR I determines the integral control and associated gain (I).
- When you set the integral time to 0, it is disabled. Pr.10-17 defines the switch frequency for the ASR1 (Pr.10-13, Pr.10-14) and ASR2 (Pr.10-15, Pr.10-16).



📖 When using multi-function input terminals to switch ASR1/ASR2, the following diagram shows the operation.




## 10-18 ASR Primary Low Pass Filter Gain

Control Mode VF VFPG SVC FOCPG FOCPM Default: 0.008

Settings 0.001–0.350 sec.

📖 Defines the ASR command filter time.

📖 When Pr.11-00 is set to 1 ASR auto-tuning, Pr.10-18 is invalid.

## 10-19 Zero Speed Position Control Gain (P)

Control Mode FOCPM Default: 80.00

Settings 0.00–655.00%

📖 When Pr.11-00 is set to bit 7=1, Pr.10-19 is valid

## 10-20 Low Speed ASR Width Adjustment

Control Mode VFPG FOCPG FOCPM Default: 5.00

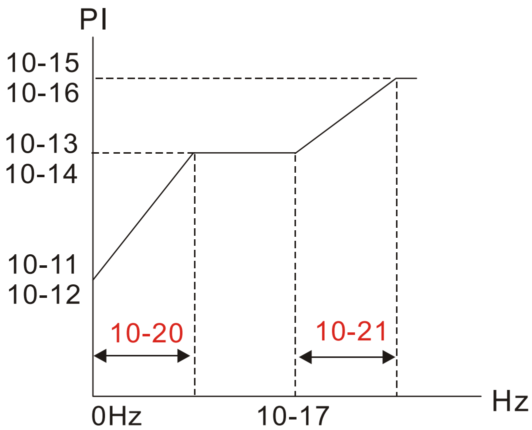
Settings 0.00–400.00 Hz

## 10-21 High Speed ASR Width Adjustment

Control Mode VFPG FOCPG FOCPM Default: 5.00

Settings 0.00–400.00 Hz

📖 These two parameters set the width of the slope of the ASR command during zero speed to low speed or Pr.10-17 to high speed.




## 10-22 Zero Speed Position Control Holding Time

Control Mode FOCPM Default: 0.250

Settings 0.001–65.535 sec.

📖 When Pr.11-00 is set to bit 7=1, Pr.10-22 is valid.

📖 Sets this parameter when elevator jerk at start-up or carriage inversion occurs. In principle, the holding time cannot exceed the time when frequency starts output.

## 10-23 Zero Speed Position Control Low Pass Filter Time

Control Mode **FOCPM** Default: 0.004

Settings 0.001–65.535 sec.

## 10-24 Zero Speed Position Control Activation Mode Selection

Control Mode **FOCPM** Default: 0

Settings 0: After the brake release set in Pr.02-29

1: After the brake signal input (Pr.02-01–02-08 is set to 42)

When Pr.10-24 = 0, use the zero speed control with Pr.02-29 (refer to the explanations in Pr.02-32).

## 10-25 Elevator Leveling (Zero Speed Gain P)

Control Mode **VF VFPG SVC FOCPG FOCPM** Default: 100.0

Settings 0.0–1000.0%

## 10-26 Elevator Leveling (Zero Speed Integral I)

Control Mode **VF VFPG SVC FOCPG FOCPM** Default: 0.100

Settings 0.000–10.000 sec.

## 10-27 Elevator Starting (Zero Speed Gain P)

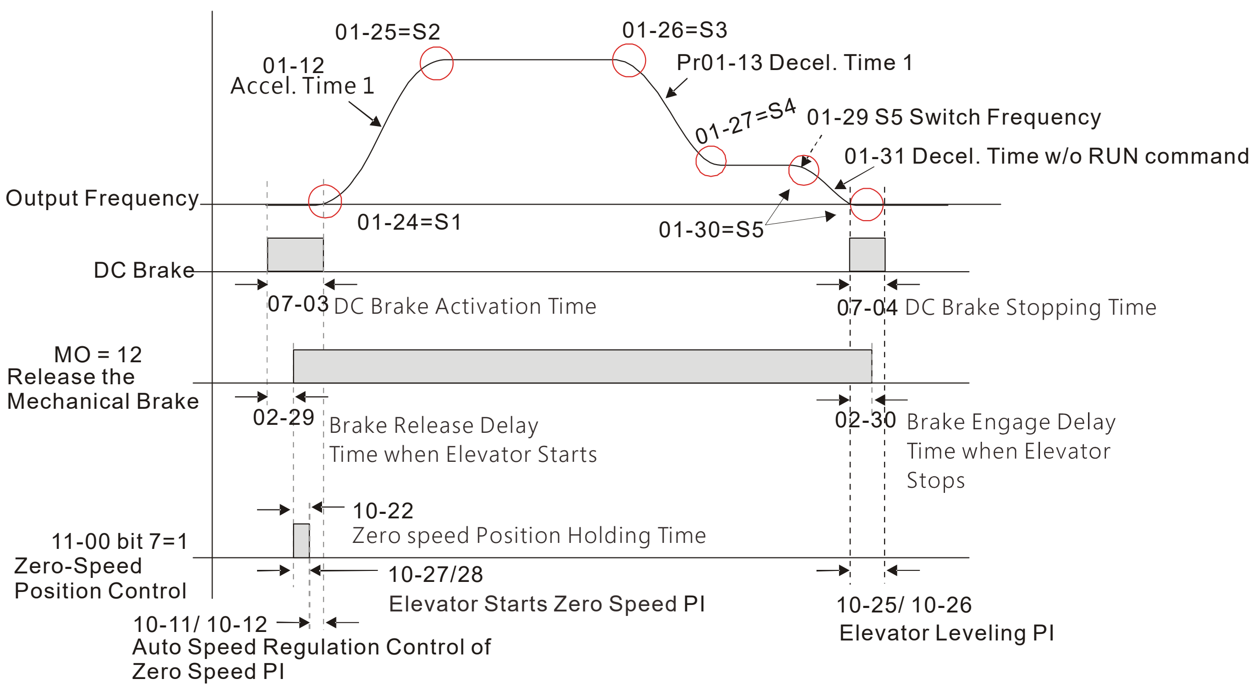
Control Mode **VF VFPG SVC FOCPG FOCPM** Default: 100.0

Settings 0.0–1000.0%

## 10-28 Elevator Starting (Zero Speed Integral I)

Control Mode **VF VFPG SVC FOCPG FOCPM** Default: 0.100

Settings 0.000–10.000 sec.



## 10-29 PG Card Frequency Division Output

| Control Mode | VFPG | FOCPG | FOCPM | Default: 0 |
|---|---|---|---|---|

Settings 0–31

- Setting to 0 is the same as setting to 1:
  0: No frequency division
  1: Frequency division by 1 (remains the same as the original frequency)

## 10-30 PG Card Frequency Division Output Type

| Control Mode | VFPG | FOCPG | FOCPM | Default: 0000h |
|---|---|---|---|---|

Settings 0000h–0008h

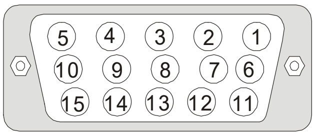
- See Chapter 7 for more information about PG cards.

## 10-31 PG Card C+/C-

| Control Mode | VFPG | FOCPG | FOCPM | Default: 0000h |
|---|---|---|---|---|

Settings 0000h–0001h

- When using a Heidenhain ERN1387 encoder, use Pr.10-31 to adjust the definition of the Delta PG card EMED-PGHSD-1's terminal 10 and terminal 11 (see the table below). Refer to p.7-8 for detailed terminal descriptions.
- Delta PG card: EMED-PGHSD-1 (D-sub Terminal #)




| | Heidenhain ERN1387 | |
|---|---|---|
| Terminal # | **Pr.10-31=0000h** | **Pr.10-31=0001h** |
| 10 | C- | C+ |
| 11 | C+ | C- |

- After connecting Delta PG card EMED-PGHSD-2 according to the descriptions in Section 7-3, **you must set Pr.10-31=0001h**.

## 10-32 Over-acceleration Level

| Control Mode | VF | VFPG | SVC | FOCPG | FOCPM | Default: 0.0 |
|---|---|---|---|---|---|---|

Settings 0.0–20.0 m/s²

## 10-33 Over-acceleration Detection Time

| Control Mode | VF | VFPG | SVC | FOCPG | FOCPM | Default: 0.05 |
|---|---|---|---|---|---|---|

Settings 0.01–5.00 sec.

## 10-34 Over-acceleration Detection Selection

| Control Mode | VF | VFPG | SVC | FOCPG | FOCPM | Default: 0 |
|---|---|---|---|---|---|---|

Settings 0: Always detect
1: Detect during operation

# 11 Advanced Parameters

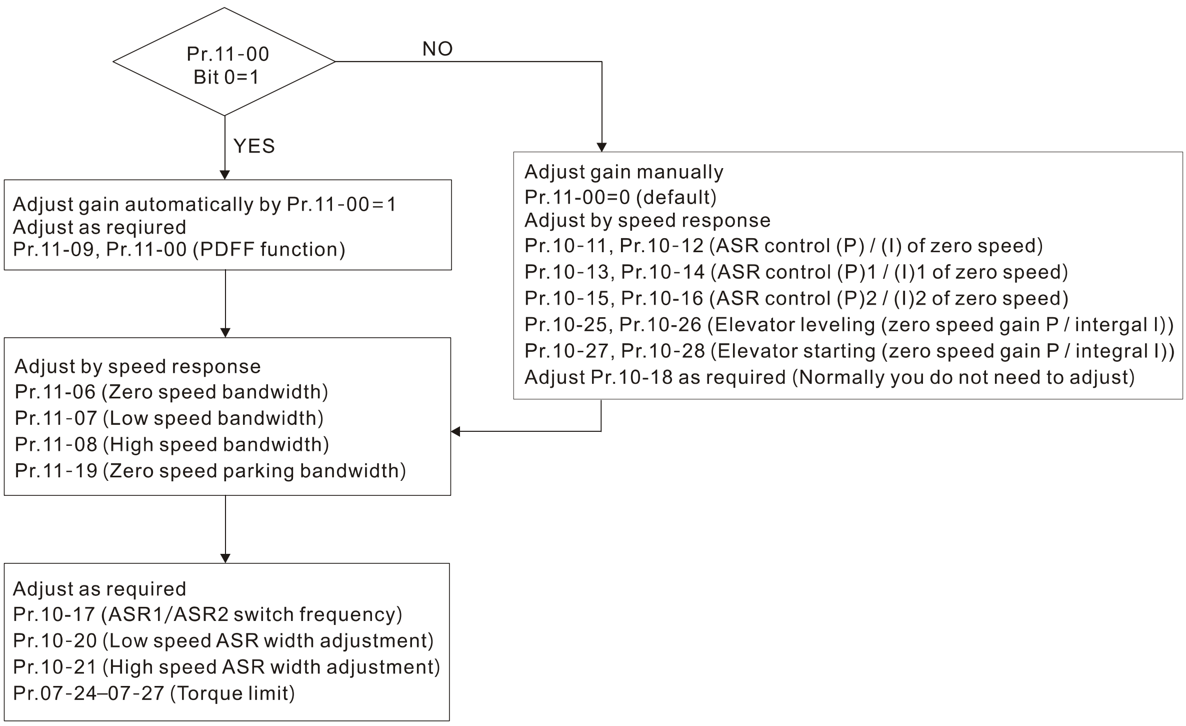
✎: You can set this parameter during operation.

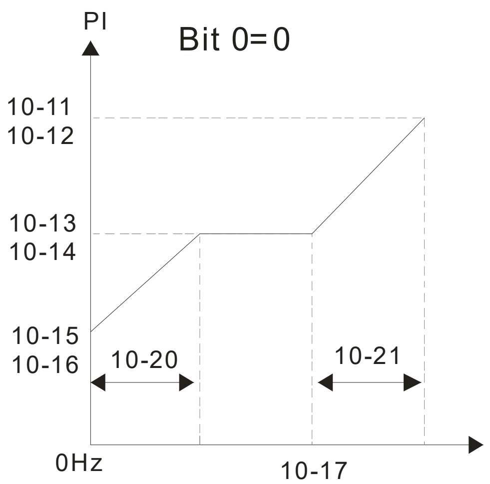
## 11-00 System Control

Control Mode **FOCPG** **FOCPM** Default: 0000h

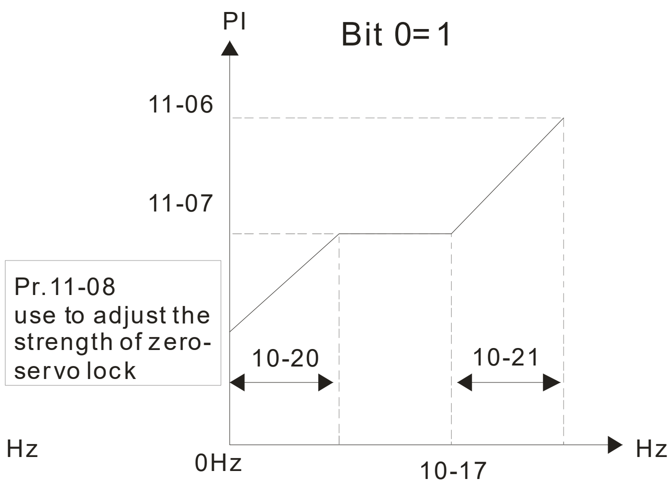
Settings
- Bit 0 = 0: No function
- Bit 0 = 1: ASR auto-tuning; PDFF enabled; speed bandwidth control enabled
- Bit 7 = 0: No function
- Bit 7 = 1: Zero speed position control is enabled
- Bit 9 = 0: Dynamic PG origin auto-tuning with load (support by PGHSD-1)
- Bit 9 = 1: Static PG origin auto-tuning with load by enabling PGHSD-1
- Bit 15 = 0: When power is applied, detect the position of the magnetic pole again
- Bit 15 = 1: When power is applied, start from the magnetic pole position of the previous power failure

📖 Bit 0 = 1: Enable the PDFF function and the system generates an ASR setting. At this time, Pr.10-11–Pr.10-16 are invalid and Pr.11-09–Pr.11-10 are valid.




PI adjustment-manual gain




PI adjustment-auto gain

- When Bit 7 = 1, zero speed position control is enabled (refer to Chapter 12 Parameter Group 02 Elevator Timing Diagram). Pr.10-22 is valid only when bit 7 is set to 1, and this function only supports PM motors.
- When Bit 9 = 1, valid only when Pr.10-00 is set to 3, and the mechanical brake must be in engaged status.

## 11-01 Elevator Speed

Control Mode **FOCPG** **FOCPM** Default: 1.00

Settings 0.10–4.00 m/s

## 11-02 Traction Sheave Diameter

Control Mode **FOCPG** **FOCPM** Default: 400

Settings 100–2000 mm

## 11-03 Gear Ratio

Control Mode **FOCPG** **FOCPM** Default: 1.00

Settings 1.00–100.00

## 11-04 Suspension Ratio

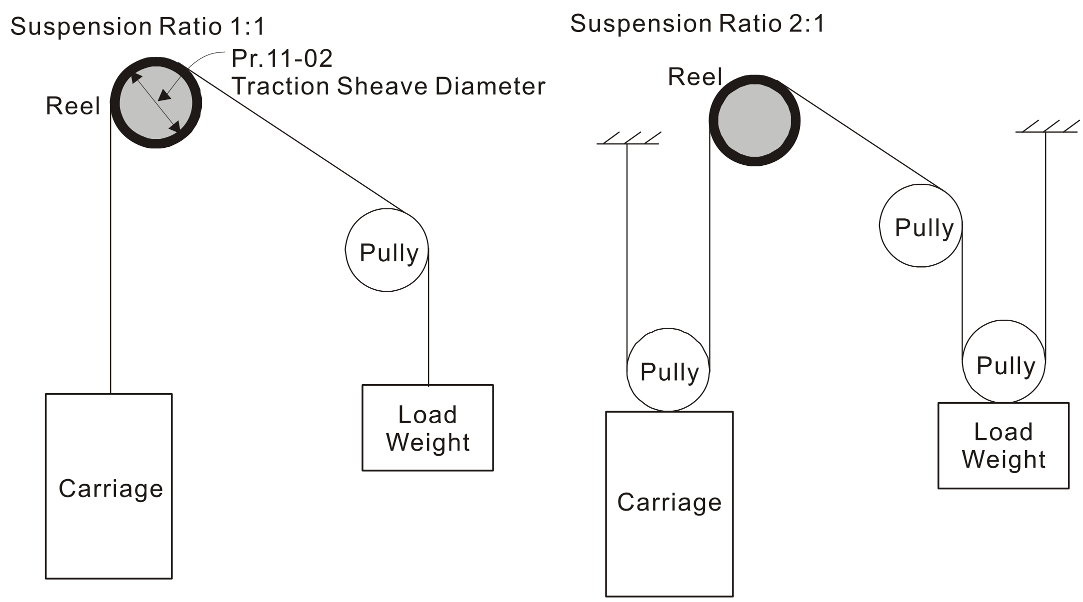
Control Mode **FOCPG** **FOCPM** Default: 1

Settings 0 = 1: 1

1 = 2: 1

2 = 4:1

3 = 8:1




## 11-05 Mechanical Inertial Ratio

Control Mode **FOCPG** **FOCPM** Default: 40

Settings 1–300%

- You can calculate the load inertia according to the settings of motor parameters, Pr.11-02 Traction Sheave Diameter, Pr.11-14 Motor Current at Acceleration and Pr.11-15 Carriage Acceleration. You can use this parameter to adjust the mechanical inertia ratio.

Mechanical inertia reference value (%):

| Load / Motor | IM | PM |
|---|---|---|
| Without load | 40 | 10 |
| With load | 80–120 | 40 |

## 11-06 Zero speed Bandwidth

Control Mode FOCPG FOCPM Default: 10

Settings 1–40 Hz

## 11-07 Low speed Bandwidth

Control Mode FOCPG FOCPM Default: 10

Settings 1–40 Hz

## 11-08 High speed Bandwidth

Control Mode FOCPG FOCPM Default: 10

Settings 1–40 Hz

After estimating the inertia and setting Pr.11-00 =1 (auto-tuning), you can adjust parameters Pr.11-06, Pr.11-07 and Pr.11-08 separately by speed response. The larger the value, the faster the response. Pr.10-17 is the switch frequency between the low speed and high speed bandwidth.

## 11-09 PDFF Gain Value

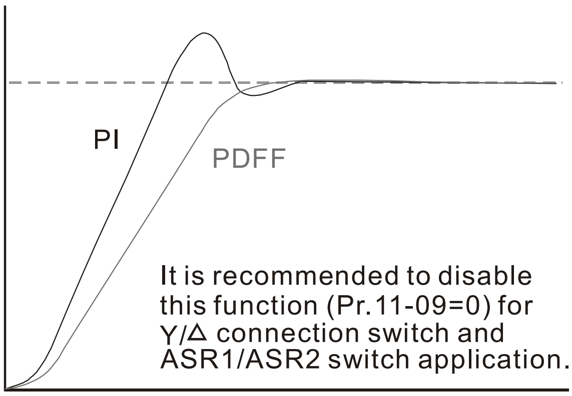
Control Mode FOCPG FOCPM Default: 30

Settings 0–200%

After you estimate and set Pr.11-00=1 (auto-tuning), use Pr.11-09/11-10 to reduce overshoot. Adjust the PDFF gain value according to the actual situation.

In addition to traditional PI control, it also provides the PDFF function to reduce overshoot for speed control.

1. Get system inertia
2. Set Pr.11-00 to 1
3. Adjust Pr.11-09 and Pr.11-10 (a larger value suppresses overshoot better). Adjust according to the actual condition.




## 11-10 Speed Feed Forward Gain

Control Mode FOCPG FOCPM Default: 0

Settings 0–500

Pr.11-09 and Pr.11-10 are enabled when Pr.11-00 is set to Bit 0 = 1.

## 11-11 Notch Filter Depth

Control Mode FOCPG FOCPM Default: 0

Settings 0–20 db

## 11-12 Notch Filter Frequency

| Control Mode | | | | FOCPG | FOCPM | Default: 0.00 |
|---|---|---|---|---|---|---|
| Settings | 0.00–200.00 Hz | | | | | |

- Sets the resonance frequency of the mechanical system. Adjust it to a smaller value to suppress the mechanical system resonance.
- A larger value improves resonance suppression function.
- The notch filter frequency is the mechanical frequency resonance.

## 11-13 Keypad Display for Low Pass Filter Time

| Control Mode | VF | VFPG | SVC | FOCPG | FOCPM | Default: 0.500 |
|---|---|---|---|---|---|---|
| Settings | 0.001–65.535 sec. | | | | | |

- Lowers the blinking frequency of the LCD display.

## 11-14 Motor Current at Acceleration

| Control Mode | | | | | FOCPM | Default: 150 |
|---|---|---|---|---|---|---|
| Settings | 50–200% | | | | | |

## 11-15 Carriage Acceleration

| Control Mode | | | | | FOCPM | Default: 0.75 |
|---|---|---|---|---|---|---|
| Settings | 0.20–2.00 $m/s^2$ | | | | | |

## 11-16 Reserved
## 11-17 Reserved
## 11-18 Reserved

## 11-19 Zero Speed Parking Bandwidth

| Control Mode | | | | FOCPG | FOCPM | Default: 10 |
|---|---|---|---|---|---|---|
| Settings | 1–40 Hz | | | | | |

## 11-20 PWM Mode (Pulse-Width Modulation Mode)

| Control Mode | | Default: 0 |
|---|---|---|
| Settings | 0: DPWM Mode (Digital Pulse-Width Modulation Mode) | |
| | 1: SVPWM mode (Space-Vector Pulse Width Modulation Mode) | |

## 12 User-defined Parameters

✓: You can set this parameter during operation.

✓ **12-00** User-defined Parameter 1

Control Mode **VF** **VFPG** **SVC** **FOCPG** **FOCPM** Default: 0616

Settings 0–9999

✓ **12-01** User-defined Parameter 2

Control Mode **VF** **VFPG** **SVC** **FOCPG** **FOCPM** Default: 0632

Settings 0–9999

✓ **12-02** User-defined Parameter 3

Control Mode **VF** **VFPG** **SVC** **FOCPG** **FOCPM** Default: 0633

Settings 0–9999

✓ **12-03** User-defined Parameter 4

Control Mode **VF** **VFPG** **SVC** **FOCPG** **FOCPM** Default: 0653

Settings 0–9999

✓ **12-04** User-defined Parameter 5

Control Mode **VF** **VFPG** **SVC** **FOCPG** **FOCPM** Default: 0654

Settings 0–9999

✓ **12-05** User-defined Parameter 6

Control Mode **VF** **VFPG** **SVC** **FOCPG** **FOCPM** Default: 0655

Settings 0–9999

✓ **12-06** User-defined Parameter 7

Control Mode **VF** **VFPG** **SVC** **FOCPG** **FOCPM** Default: 0656

Settings 0–9999

✓ **12-07** User-defined Parameter 8

Control Mode **VF** **VFPG** **SVC** **FOCPG** **FOCPM** Default: 0657

Settings 0–9999

✓ **12-08** User-defined Parameter 9

Control Mode **VF** **VFPG** **SVC** **FOCPG** **FOCPM** Default: 0658

Settings 0–9999

✓ **12-09** User-defined Parameter 10

Control Mode **VF** **VFPG** **SVC** **FOCPG** **FOCPM** Default: 0659

Settings 0–9999

✓ **12-10** User-defined Parameter 11

Control Mode **VF** **VFPG** **SVC** **FOCPG** **FOCPM** Default: 0660

Settings 0–9999

12-11 User-defined Parameter 12

Control Mode **VF** **VFPG** **SVC** **FOCPG** **FOCPM** Default: 0661

Settings 0–9999

12-12 User-defined Parameter 13

Control Mode **VF** **VFPG** **SVC** **FOCPG** **FOCPM** Default: 0662

Settings 0–9999

12-13 User-defined Parameter 14

Control Mode **VF** **VFPG** **SVC** **FOCPG** **FOCPM** Default: 0663

Settings 0–9999

12-14 User-defined Parameter 15

Control Mode **VF** **VFPG** **SVC** **FOCPG** **FOCPM** Default: 0664

Settings 0–9999

12-15 User-defined Parameter 16

Control Mode **VF** **VFPG** **SVC** **FOCPG** **FOCPM** Default: 0617

Settings 0–9999

12-16 User-defined Parameter 17

Control Mode **VF** **VFPG** **SVC** **FOCPG** **FOCPM** Default: 0634

Settings 0–9999

12-17 User-defined Parameter 18

Control Mode **VF** **VFPG** **SVC** **FOCPG** **FOCPM** Default: 0635

Settings 0–9999

12-18 User-defined Parameter 19

Control Mode **VF** **VFPG** **SVC** **FOCPG** **FOCPM** Default: 0618

Settings 0–9999

12-19 User-defined Parameter 20

Control Mode **VF** **VFPG** **SVC** **FOCPG** **FOCPM** Default: 0636

Settings 0–9999

12-20 User-defined Parameter 21

Control Mode **VF** **VFPG** **SVC** **FOCPG** **FOCPM** Default: 0637

Settings 0–9999

12-21 User-defined Parameter 22

Control Mode **VF** **VFPG** **SVC** **FOCPG** **FOCPM** Default: 0619

Settings 0–9999

### 12-22 User-defined Parameter 23

Control Mode **VF** **VFPG** **SVC** **FOCPG** **FOCPM** Default: 0638

Settings 0–9999

### 12-23 User-defined Parameter 24

Control Mode **VF** **VFPG** **SVC** **FOCPG** **FOCPM** Default: 0639

Settings 0–9999

### 12-24 User-defined Parameter 25

Control Mode **VF** **VFPG** **SVC** **FOCPG** **FOCPM** Default: 0620

Settings 0–9999

### 12-25 User-defined Parameter 26

Control Mode **VF** **VFPG** **SVC** **FOCPG** **FOCPM** Default: 0640

Settings 0–9999

### 12-26 User-defined Parameter 27

Control Mode **VF** **VFPG** **SVC** **FOCPG** **FOCPM** Default: 0641

Settings 0–9999

### 12-27 User-defined Parameter 28

Control Mode **VF** **VFPG** **SVC** **FOCPG** **FOCPM** Default: 0621

Settings 0–9999

### 12-28 User-defined Parameter 29

Control Mode **VF** **VFPG** **SVC** **FOCPG** **FOCPM** Default: 0642

Settings 0–9999

### 12-29 User-defined Parameter 30

Control Mode **VF** **VFPG** **SVC** **FOCPG** **FOCPM** Default: 0643

Settings 0–9999

### 12-30 User-defined Parameter 31

Control Mode **VF** **VFPG** **SVC** **FOCPG** **FOCPM** Default: 0

Settings 0–9999

### 12-31 User-defined Parameter 32

Control Mode **VF** **VFPG** **SVC** **FOCPG** **FOCPM** Default: 1561

Settings 0–9999

- You can define commonly used parameters in parameter group 12.
- You can enter the parameters from group 00 to group 11 into group 12 (it can save up to 32 parameters).
- The saved values can also be the parameter addresses (but you must convert the hexadecimal value to a decimal value).
- Examples of user-defined parameters

Example 1:

If you want to enter Pr.08-03 into Pr.12-00, enter 0803 into Pr.12-00. Then, the keypad displays the setting for Pr.08-03 in Pr.13-00.

Example 2:

If you need to enter parameter addresses 2102H and 211BH with the digital keypad, convert 211BH to a decimal value before entering (see below for details).

The setting method for 211BH:

Convert 211BH (hexadecimal) to a decimal value:

$2\ 1\ \underline{1}\ \underline{B}$

$\underline{1}\text{x}16^{1}+\underline{11}\text{x}16^{0}=16+11=27$ input 2127

# 13 View User-defined Parameters

✎: You can set this parameter during operation.

**13-00 – 13-31** View User-defined Parameters

Control Mode **VF VFPG SVC FOCPG FOCPM** Default: -

Settings Pr.00-00–Pr.11-20

---

**13-00** Present Fault Record

Control Mode **VF VFPG SVC FOCPG FOCPM** Default: -

Display Address 0616 (Same as Pr.06-16)

---

**13-01** Motor Operation at Present Fault Time (min.)

Control Mode **VF VFPG SVC FOCPG FOCPM** Default: -

Display Address 0632 (Same as Pr.06-32)

---

**13-02** Motor Operation at Present Fault Time (day)

Control Mode **VF VFPG SVC FOCPG FOCPM** Default: -

Display Address 0633 (Same as Pr.06-33)

---

**13-03** Frequency Command at Present Fault

Control Mode **VF VFPG SVC FOCPG FOCPM** Default: -

Display Address 0653 (Same as Pr.06-53)

---

**13-04** Output Frequency at Preset Fault

Control Mode **VF VFPG SVC FOCPG FOCPM** Default: -

Display Address 0654 (Same as Pr.06-54)

---

**13-05** Output Current at Present Fault

Control Mode **VF VFPG SVC FOCPG FOCPM** Default: -

Display Address 0655 (Same as Pr.06-55)

---

**13-06** Motor Frequency at Present Fault

Control Mode **VF VFPG SVC FOCPG FOCPM** Default: -

Display Address 0656 (Same as Pr.06-56)

## 13-07 Output Voltage at Present Fault

Control Mode **VF** **VFPG** **SVC** **FOCPG** **FOCPM** Default: -

Display Address 0657 (Same as Pr.06-57)

## 13-08 DC Bus Voltage at Present Fault

Control Mode **VF** **VFPG** **SVC** **FOCPG** **FOCPM** Default: -

Display Address 0658 (Same as Pr.06-58)

## 13-09 Output Power at Present Fault

Control Mode **VF** **VFPG** **SVC** **FOCPG** **FOCPM** Default: -

Display Address 0659 (Same as Pr.06-59)

## 13-10 Output Torque at Present Fault

Control Mode **VF** **VFPG** **SVC** **FOCPG** **FOCPM** Default: -

Display Address 0660 (Same as Pr.06-60)

## 13-11 Power Module IGBT Temperature at Present Fault

Control Mode **VF** **VFPG** **SVC** **FOCPG** **FOCPM** Default: -

Display Address 0661 (Same as Pr.06-61)

## 13-12 Multi-function Terminal Input Status at Present Fault

Control Mode **VF** **VFPG** **SVC** **FOCPG** **FOCPM** Default: -

Display Address 0662 (Same as Pr.06-62)

## 13-13 Multi-function Terminal Output Status at Present Fault

Control Mode **VF** **VFPG** **SVC** **FOCPG** **FOCPM** Default: -

Display Address 0663 (Same as Pr.06-63)

## 13-14 Drive Status at Present Fault

Control Mode **VF** **VFPG** **SVC** **FOCPG** **FOCPM** Default: -

Display Address 0664 (Same as Pr.06-64)

## 13-15 Second Most Recent Fault Record

Control Mode **VF** **VFPG** **SVC** **FOCPG** **FOCPM** Default: -

Display Address 0617 (Same as Pr.06-17)

## 13-16 Motor Operation at Second Most Recent Fault Time (min.)

Control Mode **VF** **VFPG** **SVC** **FOCPG** **FOCPM** Default: -

Display Address 0634 (Same as Pr.06-34)

## 13-17 Motor Operation at Second Most Recent Fault Time (day)

Control Mode **VF** **VFPG** **SVC** **FOCPG** **FOCPM** Default: -

Display Address 0635 (Same as Pr.06-35)

## 13-18 Third Most Recent Fault Record

Control Mode **VF** **VFPG** **SVC** **FOCPG** **FOCPM** Default: -

Display Address 0618 (Same as Pr.06-18)

## 13-19 Motor Operation at Third Most Recent Fault Time (min.)

Control Mode **VF** **VFPG** **SVC** **FOCPG** **FOCPM** Default: -

Display Address 0636 (Same as Pr.06-36)

## 13-20 Motor Operation at Third Most Recent Fault Time (day)

Control Mode **VF** **VFPG** **SVC** **FOCPG** **FOCPM** Default: -

Display Address 0637 (Same as Pr.06-37)

## 13-21 Fourth Most Recent Fault Record

Control Mode **VF** **VFPG** **SVC** **FOCPG** **FOCPM** Default: -

Display Address 0619 (Same as Pr.06-19)

## 13-22 Motor Operation at Fourth Most Recent Fault Time (min.)

Control Mode **VF** **VFPG** **SVC** **FOCPG** **FOCPM** Default: -

Display Address 0638 (Same as Pr.06-38)

## 13-23 Motor Operation at Fourth Most Recent Fault Time (day)

Control Mode **VF** **VFPG** **SVC** **FOCPG** **FOCPM** Default: -

Display Address 0639 (Same as Pr.06-39)

## 13-24 Fifth Most Recent Fault Record

Control Mode **VF** **VFPG** **SVC** **FOCPG** **FOCPM** Default: -

Display Address 0620 (Same as Pr.06-20)

## 13-25 Motor Operation at Fifth Most Recent Fault Time (min.)

Control Mode **VF** **VFPG** **SVC** **FOCPG** **FOCPM** Default: -

Display Address 0640 (Same as Pr.06-40)

## 13-26 Motor Operation at Fifth Most Recent Fault Time (day)

Control Mode **VF** **VFPG** **SVC** **FOCPG** **FOCPM** Default: -

Display Address 0641 (Same as Pr.06-41)

## 13-27 Sixth Most Recent Fault Record

Control Mode **VF** **VFPG** **SVC** **FOCPG** **FOCPM** Default: -

Display Address 0621 (Same as Pr.06-21)

## 13-28 Motor Operation at Sixth Most Recent Fault Time (min.)

Control Mode **VF** **VFPG** **SVC** **FOCPG** **FOCPM** Default: -

Display Address 0642 (Same as Pr.06-42)

## 13-29 Motor Operation at Sixth Most Recent Fault Time (day)

Control Mode **VF** **VFPG** **SVC** **FOCPG** **FOCPM** Default: -

Display Address 0643 (Same as Pr.06-43)

## 13-30 AC Motor Drive Identity Code

Control Mode **VF** **VFPG** **SVC** **FOCPG** **FOCPM** Default: -

Display Address 0 (Same as Pr.00-00)

## 13-31 Date Code Y.WKD

Control Mode **VF** **VFPG** **SVC** **FOCPG** **FOCPM** Default: Read only

Display Address 1561 (Same as Pr.15-61)

📖 Displays the year / week / day that the program of this firmware version is completed. For example, 20.321 indicates that the program is completed on the first day of the 32th week in year 2020.

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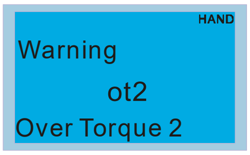
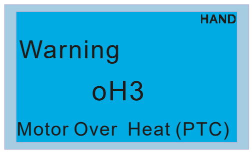
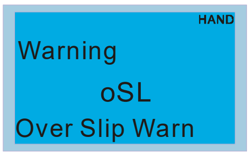
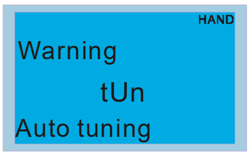
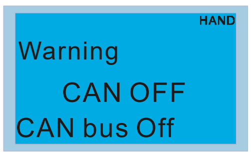
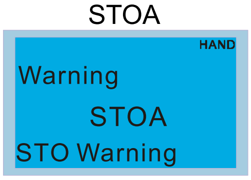
# Chapter 13 Warning Codes

| | |
|---|---|
| ① Warning | ① Display error signal |
| ② CE01 | ② Abbreviated error code.<br>The code is displayed as shown on KPC-CE01. |
| ③ Comm. Cmd. Error | ③ Display error description |

HAND

| ID No. | Display on KPED-LE01 | Display on LCM Keypad | Descriptions |
|---|---|---|---|
| 1 | CE01 | CE01<br>HAND<br>Warning<br>CE01<br>Comm. Cmd. Err | Illegal communication command<br><br>Cause<br>Communication command error |
| 2 | CE02 | CE02<br>HAND<br>Warning<br>CE02<br>Data Adrr. Err | Illegal data address<br><br>Cause<br>Data address error |
| 3 | CE03 | CE03<br>HAND<br>Warning<br>CE03<br>Data Length Err | Communication data length error<br><br>Cause<br>Communication data length exceeds 1–20 characters |
| 4 | CE04 | CE04<br>HAND<br>Warning<br>CE04<br>Wrong Writing | Attempt to write to a read-only address.<br><br>Cause<br>Communication error occurred when attempting to write values into 0x21xx, 0x22xx read-only address. |
| 5 | CE10 | CE10<br>HAND<br>Warning<br>CE10<br>Comm. Time Out | Modbus transmission time-out<br><br>Cause<br>Communication cable error |
| 6 | CP10 | CP10<br>HAND<br>Warning<br>CP10<br>Keypad time out | Digital keypad KPC-CC01 transmission time-out<br><br>Cause<br>Communication cable or digital keypad error |
| 7 | SE1 | SE1<br>HAND<br>Warning<br>SE1<br>Keypad Copy Err | Keypad copy parameter error<br><br>Cause<br>Keypad copy errors, including communication delays, communication error (keypad received error FF86) and parameter value error. |

| ID No. | Display on KPED-LE01 | Display on LCM Keypad | Descriptions |
|---|---|---|---|
| 8 | SE2 | SE2<br>HAND<br>Warning<br>SE2<br>Keypad Copy Fail | Keypad copy parameter failure<br><br>Cause<br>Keypad copy done but parameter writing error |
| 9 | oH1 | oH1<br>HAND<br>Warning<br>oH1<br>IGBT Over Heat | IGBT overheat warning<br><br>Cause<br>IGBT temperature is over the default 90˚C (Pr.06-14). |
| 10 | oH2 | oH2<br>HAND<br>Warning<br>oH2<br>Capacitance oH | Capacitor overheat warning<br><br>Cause<br>The temperature of the capacitor is over 65˚C. |
| 15 | PGF1 | PGF1<br>HAND<br>Warning<br>PGF1<br>PGFBK warn | PG feedback error<br><br>Cause<br>When Pr.10-03 = 0 (default = 2), a warning message displays instead of a fault message when an error occurs. |
| 16 | PGF2 | PGF2<br>HAND<br>Warning<br>PGF2<br>PGFBK Loss | PG feedback loss warning<br><br>Cause<br>Pr.10-03 = 0 (default = 2), a warning message displays instead of a fault message when an error occurs. |
| 17 | PGF3 | PGF3<br>HAND<br>Warning<br>PGF3<br>PGFBK Stall | PG feedback stall warning<br><br>Cause<br>Pr.10-09 = 0 (default = 2), a warning message displays instead of a fault message when an error occurs. |
| 18 | PGF4 | PGF4<br>HAND<br>Warning<br>PGF4<br>PG Slip Err | PG slip error warning<br><br>Cause<br>Pr.10-09 = 0 (default = 2), a warning message displays instead of a fault message when an error occurs. |
| 19 | PHL | PHL<br>HAND<br>Warning<br>PHL<br>Phase Loss | Phase loss<br><br>Cause<br>When Pr.06-01 =0 (default = 2), a warning message displays instead of a fault message when a phase loss occurs. |
| 20 | ot1 | ot1<br>HAND<br>Warning<br>ot1<br>Over Torque 1 | Over-torque 1<br><br>Cause<br>When Pr.06-05 =1 or 3 (default = 0), a warning message displays instead of a fault message when there is an over-torque detection. |

| ID No. | Display on KPED-LE01 | Display on LCM Keypad | Descriptions |
|---|---|---|---|
| 21 |  | ot2<br> | Over-torque 2<br><br>Cause<br>When Pr.06-05 =1 or 3 (default = 0), a warning message displays instead of a fault message when there is an over-torque detection. |
| 22 |  | oH3<br> | Motor overheat (PTC)<br><br>Cause<br>When Pr.06-26 = 0 (default = 0), a warning message displays when there is a PTC detection. |
| 24 |  | oSL<br> | Over-slip error<br><br>Cause<br>When Pr.05-16 = 0 (default = 0), a warning message displays when the slip deviation level is over the setting in Pr.05-14 and the slip deviation detection time is longer than the setting in Pr.05-15. |
| 25 |  | tUn<br> | Auto-tuning in process |
| 26 |  | FAn<br> | Fan error warning<br><br>Cause<br>When Pr.06-45 bit 1 = 1, a warning message displays when the cooling fan is locked (when bit1 = 1, there is an output error). |
| 27 |  | dCAn<br> | CAN Bus off<br><br>Cause<br>CAN Bus disconnection or PDO communication time-out |
| 28 |  | STOA<br> | Safe Torque Off alarm<br><br>Cause<br>Safe torque output function is off and Pr.06-49 = 0001h or 0003h. |

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# Chapter 14 Fault Codes

| | |
|---|---|
| ① Fault | HAND |
| ② ocA | |
| ③ oc at Accel | |

① Display fault (error) signal

② Abbreviated fault (error) code.
The code is displayed as shown on KPC-CE01.

③ Display fault (error) description

*In accordance with the settings of Pr.06-16 to Pr.06-21.

| ID* | Display on KPED-LE01 | LCM Panel Display | Descriptions |
|---|---|---|---|
| 1 | ocA | HAND<br>Fault<br>ocA<br>oc at Accel | Over-current during acceleration<br>(output current exceeds three times the drive's rated current during acceleration).<br><br>corrective action<br>1. Short-circuit at motor output: Check for possible poor insulation at the output.<br>2. Acceleration Time is too short: Increase the Acceleration Time.<br>3. AC motor drive output power is too small: Replace the AC motor drive with a higher power model. |
| 2 | ocd | HAND<br>Fault<br>ocd<br>oc at Decel | Over-current during deceleration<br>(output current exceeds three times the drive's rated current during deceleration).<br><br>corrective action<br>1. Short-circuit at motor output: Check for possible poor insulation at the output.<br>2. Deceleration Time is too short: Increase the Deceleration Time.<br>3. AC motor drive output power is too small: Replace the AC motor drive with a higher power model. |
| 3 | ocn | HAND<br>Fault<br>ocn<br>oc at Normal SPD | Over-current during steady operation<br>(output current exceeds three times the drive's rated current during constant speed).<br><br>corrective action<br>1. Short-circuit at motor output: Check for possible poor insulation at the output.<br>2. Sudden increase in motor load: Check for possible motor stall.<br>3. AC motor drive output power is too small: Replace the AC motor drive with a higher power model. |
| 4 | GFF | HAND<br>Fault<br>GFF<br>Ground Fault | Ground fault<br>When one or more of the output terminals is (are) grounded, and the short circuit current is more than 60% of the AC motor drive rated current, the AC motor drive power module may be damaged.<br>**NOTE:** The short circuit protection is to protect the AC motor drive, not to protect you.<br><br>corrective action<br>1. Check the wiring connections between the AC motor drive and motor for possible short circuits, also check connection to ground.<br>2. Check whether the IGBT power module is damaged.<br>3. Check for possible poor insulation at the output. |

| | | | |
|---|---|---|---|
| 5 | occ | HAND<br>Fault<br>occ<br>Short Circuit | Short circuit is detected between the IGBT module upper bridge and lower bridge.<br><br>corrective action<br>Contact the dealer or manufacturer to return the motor drive to the factory for repair. |
| 6 | ocS | HAND<br>Fault<br>ocS<br>oc at Stop | Over-current at stop<br>Hardware failure in over-current detection<br><br>corrective action<br>Contact the dealer or manufacturer to return the motor drive to the factory for repair. |
| 7 | ovA | HAND<br>Fault<br>ovA<br>ov at Accel | DC bus over-voltage during acceleration<br>230V: 405 $V_{DC}$; 460V: 810 $V_{DC}$<br><br>corrective action<br>1. Check if the input voltage falls in the rated AC motor drive input voltage range.<br>2. Check for possible voltage transients.<br>3. If DC bus over-voltage is due to regenerative voltage, increase the Acceleration Time or add an optional brake resistor. |
| 8 | ovd | HAND<br>Fault<br>ovd<br>ov at Decel | DC bus over-voltage during deceleration<br>230V: 405 $V_{DC}$; 460V: 810 $V_{DC}$<br><br>corrective action<br>1. Check if the input voltage falls in the rated AC motor drive input voltage range.<br>2. Check for possible voltage transients.<br>3. If DC bus over-voltage due to regenerative voltage, increase the Deceleration Time or add an optional brake resistor. |
| 9 | ovn | HAND<br>Fault<br>ovn<br>ov at Normal SPD | DC bus over-voltage at constant speed<br>230V: 405 $V_{DC}$; 460V: 810 $V_{DC}$<br><br>corrective action<br>1. Check if the input voltage falls in the rated AC motor drive input voltage range.<br>2. Check for possible voltage transients.<br>3. If DC bus over-voltage due to regenerative voltage, increase the Deceleration Time or add an optional brake resistor. |
| 10 | ovS | HAND<br>Fault<br>ovS<br>ov at Stop | Over-voltage at stop<br>Hardware failure in voltage detection.<br><br>corrective action<br>1. Check if the input voltage falls in the rated AC motor drive input voltage range.<br>2. Check for possible voltage transients. |
| 11 | LvA | HAND<br>Fault<br>LvA<br>Lv at Accel | DC bus voltage during acceleration is less than the setting in Pr.06-00.<br><br>corrective action<br>1. Check if the input voltage is normal.<br>2. Check for possible sudden load change. |

| | | | |
|---|---|---|---|
| 12 | Lud | Fault<br>Lvd<br>Lv at Decel | DC bus voltage during deceleration is less than the setting in Pr.06-00.<br><br>corrective action<br>1. Check if the input voltage is normal.<br>2. Check for possible sudden load change. |
| 13 | Lun | Fault<br>Lvn<br>Lv at Normal SPD | DC bus voltage at constant speed is less than the setting in Pr.06-00<br><br>corrective action<br>1. Check if the input voltage is normal.<br>2. Check for possible sudden load change. |
| 14 | LuS | Fault<br>LvS<br>Lv at Stop | Low voltage at stop<br><br>corrective action<br>1. Check if the input voltage is normal.<br>2. Check for possible sudden load change. |
| 15 | PHL | Fault<br>PHL<br>Phase Loss | Phase Loss<br><br>corrective action<br>Check power source input to make sure all three input phases are connected correctly. |
| 16 | oH1 | Fault<br>oH1<br>IGBT Over Heat | IGBT overheating<br>IGBT temperature exceeds protection level<br>3–5 HP, 50–60 HP: 105ºC<br>7.5–30 HP: 95ºC<br>40–100 HP: 110ºC<br><br>corrective action<br>1. Ensure that the ambient temperature falls in the specified temperature range.<br>2. Make sure heat sink is not obstructed. Check if the fan is operating<br>3. Check if there is enough ventilation clearance for the AC motor drive. |
| 17 | oH2 | Fault<br>oH2<br>Capacitance oH | Capacitor overheating<br>Capacitor's temperature exceeds the protection level.<br>3–100 HP: 65ºC<br><br>corrective action<br>1. Ensure that the ambient temperature falls in the specified temperature range.<br>2. Make sure heat sink is not obstructed. Check if the fan is operating<br>3. Check if there is enough ventilation clearance for the AC motor drive. |

| | | | |
|---|---|---|---|
| 18 | tH1o | HAND<br>Fault<br>tH1o<br>Thermo 1 Open | IGBT overheating protection fault<br><br>corrective action<br>Contact the dealer or manufacturer to return the motor drive to the factory for repair. |
| 19 | tH2o | HAND<br>Fault<br>tH2o<br>Thermo 2 Open | Capacitor module overheating fault<br><br>corrective action<br>Contact the dealer or manufacturer to return the motor drive to the factory for repair. |
| 20 | FAn | HAND<br>Fault<br>FAn<br>Fan Locked | Cooling fan does not run properly.<br><br>corrective action<br>Check if the cooling fan is covered by dust and needs to be cleaned. Contact the dealer or manufacturer to return the motor drive to the factory for repair if necessary. |
| 21 | oL | HAND<br>Fault<br>oL<br>Over Load | The output current causes the motor drive to be overload. If the output current is 150% higher than the drive's rated current, the motor drive can sustain the output for a maximum of 60 seconds.<br><br>corrective action<br>1. Check if the motor is overloaded.<br>2. Increase the output capacity of the motor drive. |
| 22 | EoL1 | HAND<br>Fault<br>EoL1<br>Thermal Relay 1 | The output current causes the motor to be overload. If the output current is 150% higher than the drive's rated current, the motor can sustain the output for a maximum of 60 seconds.<br><br>corrective action<br>1. Check the setting for motor full-load current (Pr.05-01).<br>2. Check if motor is overloaded and change to a higher power motor. |
| 24 | oH3 | HAND<br>Fault<br>oH3<br>Motor Over Heat | Motor overheating<br>The AC motor drive internal temperature exceeds the setting in Pr.06-27 (PTC level).<br><br>corrective action<br>1. Make sure that the motor is not obstructed.<br>2. Ensure that the ambient temperature falls in the specified temperature range.<br>3. Change to a higher power motor. |

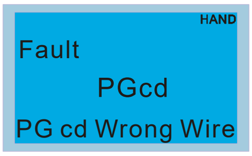
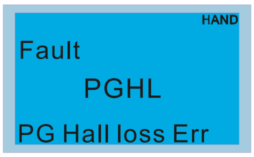
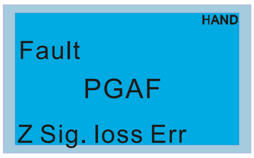
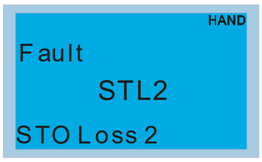
| | | | |
|---|---|---|---|
| 26 | ot1 | HAND<br>Fault<br>ot1<br>Over Torque 1 | The ot1 and ot2 fault codes appear when the following conditions occur:<br>- The output current exceeds the setting in Pr.06-06 (Over-torque Detection Level (OT1)> and Pr.06-09 (Over-torque Protection Level (OT2).<br>- The output current lasts longer than the time setting in Pr.06-07 and Pr.06-10.<br>- You set Pr.06-05 or Pr.06-08 to 2 or 4.<br><br>corrective action<br>1. Check if the motor is overloaded.<br>2. Check if the setting in Pr.05-01 IM (Motor Full-load Current) and Pr.08-01 PM (Motor Full-load Current) are appropriate.<br>3. If necessary, increase the motor output capacity. |
| 27 | ot2 | HAND<br>Fault<br>ot2<br>Over Torque 2 | |
| 30 | cF1 | HAND<br>Fault<br>cF1<br>EEPROM Write Err | Cannot program internal EEPROM.<br><br>corrective action<br>1. Press RESET key to reset to the default.<br>2. Contact the dealer or manufacturer to return the motor drive to the factory for repair. |
| 31 | cF2 | HAND<br>Fault<br>cF2<br>EEPROM Read Err | Cannot read internal EEPROM.<br><br>corrective action<br>1. Press RESET key to reset to the default.<br>2. Contact the dealer or manufacturer to return the motor drive to the factory for repair. |
| 32 | cd0 | HAND<br>Fault<br>cd0<br>Isum Sensor Err | Hardware failure in current detection<br><br>corrective action<br>Reboot the motor drive. If fault code continues to display on the keypad, contact the dealer or manufacturer to return the motor drive to the factory for repair. |
| 33 | cd1 | HAND<br>Fault<br>cd1<br>Ias Sensor Err | U-phase current detection error<br><br>corrective action<br>Reboot the motor drive. If fault code continues to display on the keypad, contact the dealer or manufacturer to return the motor drive to the factory for repair. |
| 34 | cd2 | HAND<br>Fault<br>cd2<br>Ibs Sensor Err | V-phase current detection error<br><br>corrective action<br>Reboot the motor drive. If fault code continues to display on the keypad, contact the dealer or manufacturer to return the motor drive to the factory for repair. |

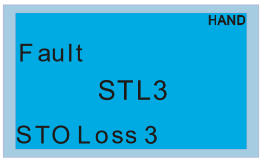
| | | | |
|---|---|---|---|
| 35 | cd3 | HAND<br>Fault<br>cd3<br>Ics Sensor Err | W-phase current detection error<br><br>corrective action<br>Reboot the motor drive. If fault code continues to display on the keypad, contact the dealer or manufacturer to return the motor drive to the factory for repair. |
| 36 | Hd0 | HAND<br>Fault<br>Hd0<br>cc HW Error | CC (current clamp) hardware error<br><br>corrective action<br>Reboot the motor drive. If fault code continues to display on the keypad, contact the dealer or manufacturer to return the motor drive to the factory for repair. |
| 37 | Hd1 | HAND<br>Fault<br>Hd1<br>oc HW Error | OC hardware error<br><br>corrective action<br>Reboot the motor drive. If fault code continues to display on the keypad, contact the dealer or manufacturer to return the motor drive to the factory for repair. |
| 38 | Hd2 | HAND<br>Fault<br>Hd2<br>ov HW Error | OV hardware error<br><br>corrective action<br>Reboot the motor drive. If fault code continues to display on the keypad, contact the dealer or manufacturer to return the motor drive to the factory for repair. |
| 39 | Hd3 | HAND<br>Fault<br>Hd3<br>GFF HW Error | GFF hardware error<br><br>corrective action<br>Reboot the motor drive. If fault code continues to display on the keypad, contact the dealer or manufacturer to return the motor drive to the factory for repair. |
| 40 | AUE | HAND<br>Fault<br>AUE<br>Auto Tuning Err | Auto-tuning error<br><br>corrective action<br>1. Check the cabling between drive and motor.<br>2. Check if the motor capacity and the parameter settings are appropriate and try again. |
| 42 | PGF1 | HAND<br>Fault<br>PGF1<br>PG Fbk Error | PG feedback error (command direction is different from the feedback direction)<br><br>corrective action<br>When PG feedback control is enabled, check if Pr.10-01 (Encoder PPR) is set to 0. |

| | | | |
|---|---|---|---|
| 43 | PGF2 | HAND<br>Fault<br>PGF2<br>PG Fbk Loss | PG feedback loss<br><br>corrective action<br>Check the PG feedback wiring. |
| 44 | PGF3 | HAND<br>Fault<br>PGF3<br>PG Fbk Over SPD | PG feedback stall<br><br>corrective action<br>1. Check the PG feedback wiring.<br>2. Check if the settings for PI gain and acceleration/deceleration are appropriate (Pr.10-05, Pr.10-06).<br>3. Contact the dealer or manufacturer to return the motor drive to the factory for repair. |
| 45 | PGF4 | HAND<br>Fault<br>PGF4<br>PG Fbk Deviate | PG slip error<br><br>corrective action<br>1. Check the PG feedback wiring.<br>2. Check if the settings for PI gain and acceleration/deceleration are appropriate (Pr.10-07, Pr.10-08).<br>3. Contact the dealer or manufacturer to return the motor drive to the factory for repair. |
| 49 | EF | HAND<br>Fault<br>EF<br>External Fault | External Fault<br>When you set the Multi-Function Input command (MI1–MI8) to #10 EF input (Pr.07-28) and when multi-function input terminals are triggered to close, the motor drive stops running.<br><br>corrective action<br>Press RESET after you clear the fault. |
| 50 | EF1 | HAND<br>Fault<br>EF1<br>Emergency Stop | Emergency Stop<br>When you set the Multi-Function Input command (MI1–MI8) to #28 Emergency stop (EF1) (Motor coasts to stop), the motor drive stops running.<br><br>corrective action<br>Press RESET after you clear the fault. |
| 52 | Pcod | HAND<br>Fault<br>Pcod<br>Password Error | Password error<br>After entering the wrong password three consecutive times, the keypad is locked.<br><br>corrective action<br>Refer to Pr.00-07 and Pr.00-08 settings for more information. Cycle the power for the motor drive to clear the lock and enter the correct password. |
| 54 | cE01 | HAND<br>Fault<br>cE01<br>Comm Cmd Err | Illegal function code<br><br>corrective action<br>Check if the function code is correct (function code must be 03, 06, 10, 63). |

| | | | |
|---|---|---|---|
| 55 | cE02 | HAND<br>Fault<br>cE02<br>Data Addr Err | Illegal data address (00H to 254H)<br>The data address for 0X2XX is between 0X2000–0X2005. Any address out of this range is a fault.<br><br>corrective action<br>Check if the communication data address is correct. |
| 56 | cE03 | HAND<br>Fault<br>cE03<br>Data length Err | Illegal data length<br>The data length must be between 1 to 20 digits. Any length out of this range is a fault.<br><br>corrective action<br>Check if the data length is smaller than the minimum value or larger than the maximum value. |
| 57 | cE04 | HAND<br>Fault<br>cE04<br>Wrong Writing | Attempt to write value to read-only communication address<br>Communication addresses such as 0X21XX, 0X22XX are read-only. Any command sent to these addresses causes a fault.<br><br>corrective action<br>Check if the communication address is correct. |
| 58 | cE 10 | HAND<br>Fault<br>cE10<br>Comm Time Out | Modbus communication time-out (Pr.09-02–Pr.09-03)<br><br>corrective action<br>Check if the communication wiring is correct. |
| 59 | cP 10 | HAND<br>Fault<br>cP10<br>Keypad Time Out | Keypad KPC-CC01 transmission time-out<br><br>corrective action<br>1. Check if the communication wiring is correct<br>2. Check if there is anything wrong with the keypad |
| 60 | bF | HAND<br>Fault<br>BF<br>Braking Fault | Brake transistor fault<br><br>corrective action<br>If the fault code continues to display on the keypad after you press RESET key, contact the dealer or manufacturer to return the motor drive to the factory for repair. |
| 64 | mbF | HAND<br>Fault<br>MBF<br>Mech. Brake Fail | Mechanical brake failure<br>The feedback signal and the release signal are not consistent.<br><br>corrective action<br>1. Check if the mechanical brake signal is correct.<br>2. Check if the mechanical brake detection time setting (Pr.02-35) is correct. |

| | | | |
|---|---|---|---|
| 65 | PGF5 | HAND<br>Fault<br>PGF5<br>PG HW Error | PG card hardware error<br><br>corrective action<br>1. Check if the PG feedback wiring is correct.<br>2. If fault code continues to display on the keypad, contact the dealer or manufacturer to return the motor drive to the factory for repair. |
| 66 | MCF | HAND<br>Fault<br>MCF<br>Contactor Fail | Magnetic contactor error<br>The feedback signal and the release signal are not consistent.<br><br>corrective action<br>1. Check if the magnetic contactor signal is correct.<br>2. Check if the magnetic contactor detection time setting (Pr.02-36) is correct. |
| 67 | MPHL | HAND<br>Fault<br>MPHL<br>Motor Phase Loss | Motor phase loss.<br><br>corrective action<br>1. Check the cabling between drive and motor.<br>2. Check if there is any output from the motor drive.<br>3. Contact the dealer or manufacturer to return the motor drive to the factory for repair. |
| 68 | CAnF | HAND<br>Fault<br>CANF<br>CAN Bus Off | CAN Bus off<br><br>corrective action<br>1. Check that the CAN Bus is wired correctly.<br>2. Verify that there is no PDO communication time-out. |
| 69 | Reserved | | |
| 70 | Reserved | | |
| 71 | Reserved | | |
| 72 | StL 1 | HAND<br>Fault<br>STL1<br>STO Loss 1 | STO1–SCM1 internal hardware error.<br><br>corrective action<br>1. Check the STO1/SCM1 wiring.<br>2. Reset the emergency switch (ON) and reboot the motor drive.<br>3. Check the voltage at least > 11 V.<br>4. Check the wiring between STO1 and E24V, and the wiring between SCM1 and DCM.<br>5. After checking all the wiring, reboot the motor drive. If STL1 still appears, contact the local dealer or manufacturer. |

| | | | |
|---|---|---|---|
| 73 | PGcd |  | PG card wiring error<br><br>corrective action<br>Incorrect wiring for pin C+, C-, D+, D-. Verify if the wiring matches the descriptions in Section 7-2 (EMED-PGHSD-1, EMED-PGHSD-3) and Section 7-3 (EMED-PGHSD-2, EMED-PGHSD-4). |
| 74 | PGHL |  | PG absolute signal error<br><br>corrective action<br>1. Check if the encoder absolute positions (C+/C- and D+/D-) and PG card are properly wired.<br>2. If the cables are properly wired but the fault code still displays on the keypad, contact the dealer or manufacturer to return the motor drive to the factory for repair. |
| 75 | PGAF |  | PG Z-phase signal loss<br><br>corrective action<br>1. Check if the encoder's Z-phase signal and PG card are properly wired.<br>2. If the cables are properly wired but the fault code still displays on the keypad, contact the dealer or manufacturer to return the motor drive to the factory for repair. |
| 76 | StO |  | Safe Torque Off function is enabled.<br><br>corrective action<br>1. Check the wiring for STO1/SCM1 and STO2/SCM2.<br>2. Reset the emergency switch (ON) and reboot the motor drive.<br>3. Check the voltage at least > 11 V.<br>4. Check the wiring between STO1/STO2 and E24V, and the wiring between SCM1/SCM2 and DCM.<br>5. After checking all the wiring, reboot the motor drive. If STO still appears, contact the local dealer or manufacturer. |
| 77 | StL2 |  | STO2–SCM2 internal hardware error.<br><br>corrective action<br>1. Check the STO2/SCM2 wiring.<br>2. Reset the emergency switch (ON) and reboot the motor drive.<br>3. Check the voltage at least > 11 V.<br>4. Check the wiring between STO2 and E24V, and the wiring between SCM2 and DCM.<br>5. After checking all the wiring, reboot the motor drive. If STL2 still appears, contact the local dealer or manufacturer. |

| | | | |
|---|---|---|---|
| 78 | StL3 |  | Internal hardware error.<br><br>corrective action<br>After checking all the wiring, reboot the motor drive. If STL3 still appears, contact the local dealer or manufacturer. |

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# *Chapter 15 Suggestions and Error Corrections for Standard AC Motor Drives*

The AC motor drive has various warnings and protections against errors such as over-voltage, low voltage, or over-current. Once an error occurs, the protections activate, the AC motor drive stops output, activates the error contacts, and the motor coasts to stop. Please refer to the error display from the AC motor drive and look up the corresponding causes and solutions. The fault record is stored in the AC motor drive internal memory and can store the six most recent error messages. You can read it from the digital keypad or through the communications by accessing the parameters.

The AC motor drive includes a large number of electronic components, including ICs, resistors, capacitors, transistors, cooling fans and relays. These components do not last forever. Even under normal circumstances, they will eventually become error-prone if used past their lifespans. Therefore, you must perform periodic preventive maintenance to identify defective and worn out parts, and eliminate the causes of malfunctions in the AC motor drive at an early stage. At the same time, parts that have exceeded their product life should be replaced whenever possible to ensure safe operation.

Visual checks should be done regularly to monitor the AC motor drive's operation, and to make sure nothing unusual happens. Check the situations listed in the following table.

| | |
|---|---|
| CAUTION | ☑ Wait five seconds after a fault has been cleared before pressing RESET with the input terminal keypad.<br>☑ The Hybrid Servo Controller must first be switched off for at least five minutes for ≤ 22 kW models, and 10 minutes for ≥ 30kW models until the charging indicator turns off, and the voltage between terminals ⊕–⊖ must be lower than 25 $V_{DC}$ before it is safe to open the cover to begin maintenance operations.<br>☑ Only qualified personnel can work on maintenance or replace parts. (Remove metal items such as watch, rings, and other metal items before operation, and use only insulated tools.)<br>☑ Never modify internal components or wiring.<br>☑ The performance and the surrounding environment should meet the standard specifications. There should be no abnormal noise, vibration, or odor. |

## 15-1 Maintenance and Inspections

For regular maintenance, first stop operation, then turn off the power, and then take off the outer cover. Even after turning off the power supply, charging voltages remaining in the filter capacitor require some time to discharge. To avoid danger, operation must not start until the charging indicator goes off, and you confirm the voltage with a voltmeter to be below the safety value (≤ 25 $V_{DC}$).

**Ambient environment**

| Items to Check | Methods and Criterion | Maintenance Period | | |
|---|---|---|---|---|
| | | Daily | Half Year | One Year |
| Check the ambient temperature, humidity, and vibration and check for any dust, gas, oil or water drops. | Visual inspection and measurement with equipment with standard specification | ○ | | |
| Check for any dangerous objects | Visual inspection | ○ | | |

**Voltage**

| Items to Check | Methods and Criterion | Maintenance Period | | |
|---|---|---|---|---|
| | | Daily | Half Year | One Year |
| Check that the voltage of main circuit and control circuit are correct. | Measure with multimeter with standard specifications. | ○ | | |

**Digital keypad display**

| Items to Check | Methods and Criterion | Maintenance Period | | |
|---|---|---|---|---|
| | | Daily | Half Year | One Year |
| Check that the display is clear for reading | Visual inspection | ○ | | |
| Check for any missing characters | Visual inspection | ○ | | |

**Mechanical parts**

| Items to Check | Methods and Criterion | Maintenance Period | | |
|---|---|---|---|---|
| | | Daily | Half Year | One Year |
| Check for any abnormal sound or vibration | Visual and audible inspection | | ○ | |
| Check for any loose bolts | Securely tighten | | ○ | |
| Check for any deformed or damaged parts | Visual inspection | | ○ | |
| Check for any color change caused by overheating | Visual inspection | | ○ | |
| Check for any dust or dirt | Visual inspection | | ○ | |

**Main circuit**

| Items to Check | Methods and Criterion | Maintenance Period | | |
|---|---|---|---|---|
| | | Daily | Half Year | One Year |
| Check for any loose or missing bolts | Securely tighten | ○ | | |
| Check for machine or insulator deformation, crack, damage or color change due to overheating or ageing | Visual inspection | | ○ | |
| Check for any dust or dirt | Visual inspection | | ○ | |

**Main circuit terminals and wiring**

| Items to Check | Methods and Criterion | Maintenance Period | | |
|---|---|---|---|---|
| | | Daily | Half Year | One Year |
| Check the terminal and copper plate for color change or deformation due to overheating | Visual inspection | | ○ | |
| Check for damage to the wiring insulation or color change | Visual inspection | | ○ | |

**Main circuit terminal block**

| Items to Check | Methods and Criterion | Maintenance Period | | |
|---|---|---|---|---|
| | | Daily | Half Year | One Year |
| Check for any damage | Visual inspection | ○ | | |

**Main circuit filter capacitor**

| Items to Check | Methods and Criterion | Maintenance Period | | |
|---|---|---|---|---|
| | | Daily | Half Year | One Year |
| Check for any liquid leaks, color change, crack or buckling of the exterior cover | Visual inspection | ○ | | |
| Check if the safety valve is not removed or if the valve is obviously expanded | Visual inspection | ○ | | |
| Measure static capacity when required | | ○ | | |

**Main circuit resistor**

| Items to Check | Methods and Criterion | Maintenance Period | | |
|---|---|---|---|---|
| | | Daily | Half Year | One Year |
| Check for any odors or insulation cracks due to overheating | Visual inspection, smell | ○ | | |
| Check for any disconnections | Visual inspection | ○ | | |
| Check for damaged connections | Measure with multimeter with standard specifications | ○ | | |

**Main circuit transformer and reactor**

| Items to Check | Methods and Criterion | Maintenance Period | | |
|---|---|---|---|---|
| | | Daily | Half Year | One Year |
| Check for any abnormal vibration or odors | Visual, audible inspection and smell | ○ | | |

**Main circuit electromagnetic contactor and relay**

| Items to Check | Methods and Criterion | Maintenance Period | | |
|---|---|---|---|---|
| | | Daily | Half Year | One Year |
| Check for any sound of vibration while running | Audible inspection | ○ | | |
| Check that the contact works correctly | Visual inspection | ○ | | |

**Main circuit printed circuit board and connector**

| Items to Check | Methods and Criterion | Maintenance Period | | |
|---|---|---|---|---|
| | | Daily | Half Year | One Year |
| Check for any loose screws and connectors | Tighten the screws and press the connectors firmly in place. | | ○ | |
| Check for any odors and color change | Visual and smell inspection | | ○ | |
| Check for any crack, damage, deformation or corrosion | Visual inspection | | ○ | |
| Check for any liquid leaks or deformation in capacity | Visual inspection | | ○ | |

**Cooling system cooling fan**

| Items to Check | Methods and Criterion | Maintenance Period | | |
|---|---|---|---|---|
| | | Daily | Half Year | One Year |
| Check for any abnormal sound or vibration | Visual, audible inspection, and turn the fan by hand (turn off the power before operation) to see if it rotates smoothly. | | ○ | |
| Check for any loose bolts | Securely tighten | | ○ | |
| Check for any color change due to overheating | Visual inspection | | ○ | |

**Cooling system ventilation channel**

| Items to Check | Methods and Criterion | Maintenance Period | | |
|---|---|---|---|---|
| | | Daily | Half Year | One Year |
| Check for any obstruction in the heat sink, air intake or air outlet | Visual inspection | | ○ | |

**NOTE**

Use a chemically neutral cloth to clean and use a dust cleaner to remove dust when necessary.

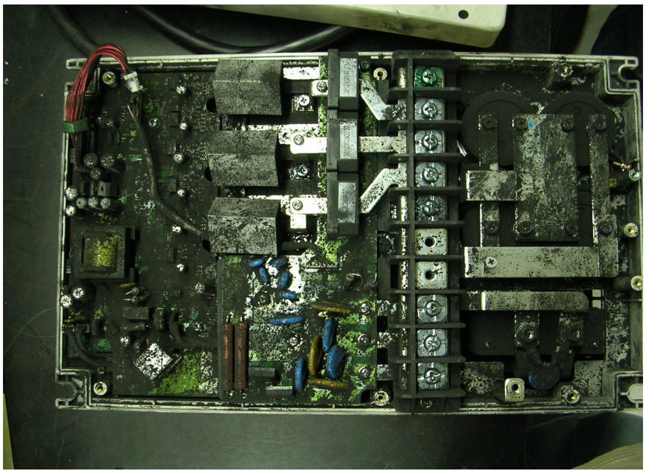
## 15-2 Greasy Dirt Problems

Serious greasy dirt problems generally occur in processing industries such as machine tools, punching machines and so on. Please be aware of the possible damages that greasy oil may cause to your drive.

1. Electronic components that silt up with greasy oil may cause the drive to burn out or even explode.
2. Most greasy dirt contains corrosive substances that may damage the drive.

**Solution**

Install the AC motor drive in a standard cabinet to keep it away from greasy dirt. Clean and remove greasy dirt regularly to prevent damage to the drive.



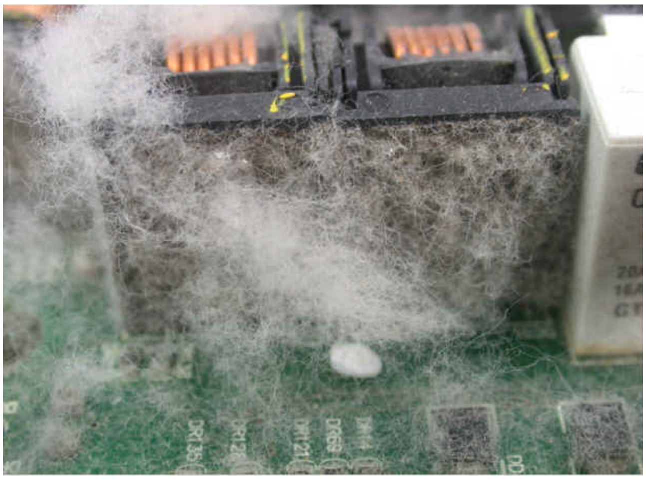
## 15-3 Fiber Dust Problems

Serious fiber dust problems generally occur in the textile industry. Please be aware of the possible damages that fiber may cause to your drives.

1. Fiber that accumulates or adheres to the fans leads to poor ventilation and causes overheating problems.
2. Plant environments in the textile industry have higher degrees of humidity that may cause the drive to burn out, become damaged or explode due to wet fiber dust adhering to the devices.

**Solution**

Install the AC motor drive in a standard cabinet to keep it away from fiber dust. Clean and remove fiber dust regularly to prevent damage to the drive.



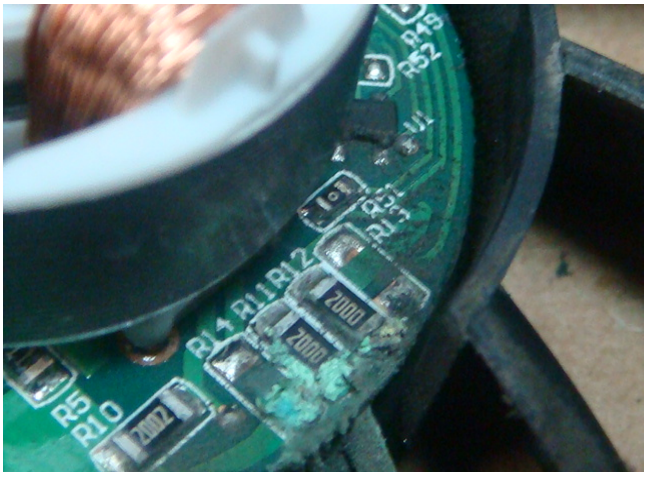
## 15-4 Corrosion Problems

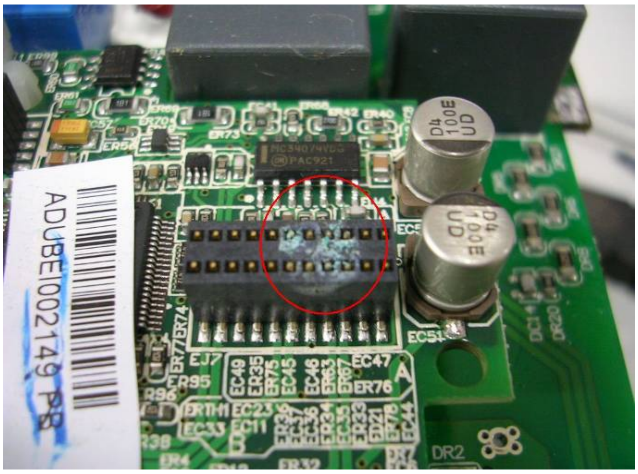
Corrosion problems may occur if any fluids flow into the drives. Please be aware of the possible damages that corrosion may cause to your drive.

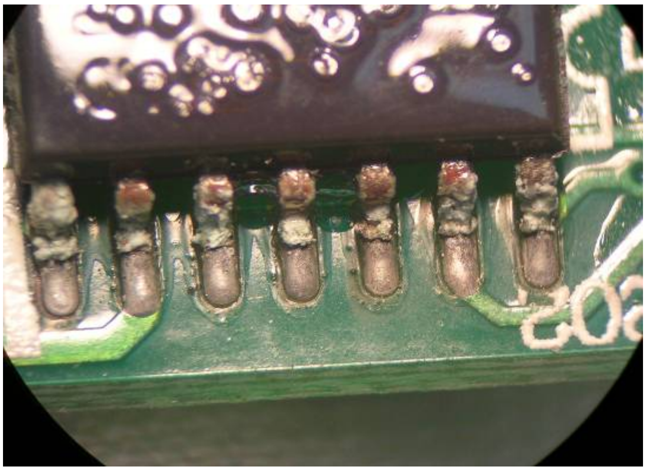
1. Corrosion of internal components may cause the drive to malfunction and possibility to explode.

**Solution**

Install the AC motor drive in a standard cabinet to keep it away from fluids. Clean the drive regularly to prevent corrosion.







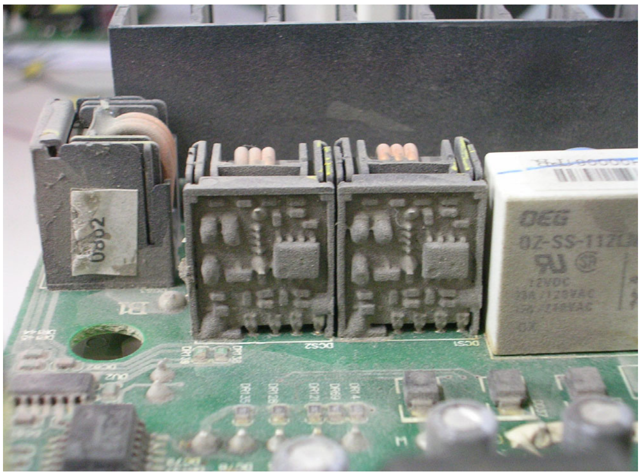
## 15-5 Industrial Dust Problems

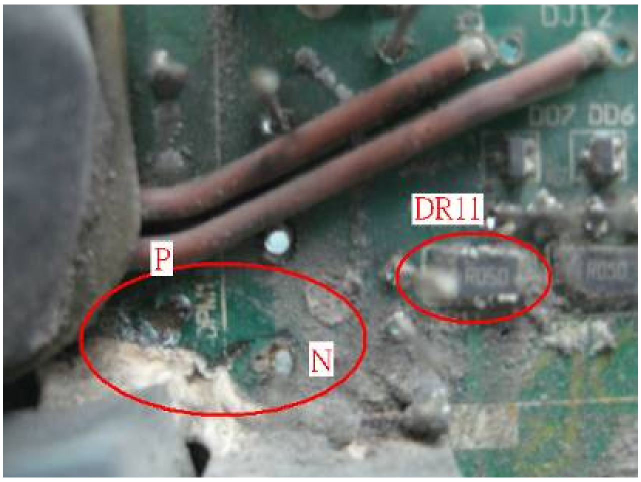
Serious industrial dust pollution frequently occur in environments such as stone processing plants, flour mills, cement plants, and so on. Please be aware of the possible damages that industrial dust may cause to your drives.

1. Dust accumulating on electronic components may cause overheating problem and shorten the service life of the drive.
2. Conductive dust may damage the circuit board and may even cause the drive to explode.

**Solution**

Install the AC motor drive in a standard cabinet and cover the drive with a dust cover. Clean the cabinet and ventilation holes regularly for good ventilation.





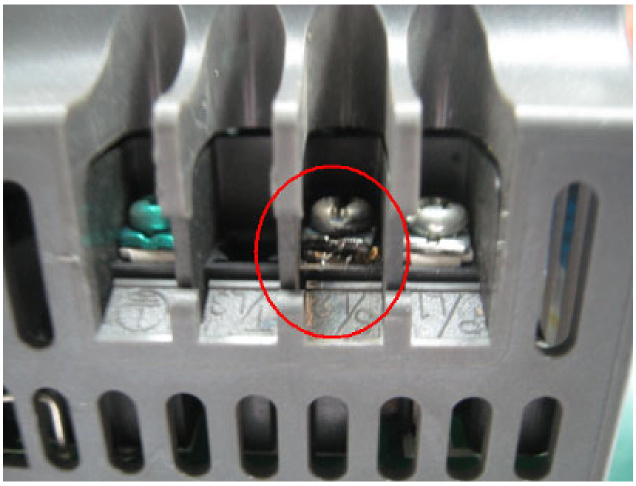
## 15-6 Installation and Wiring Problems

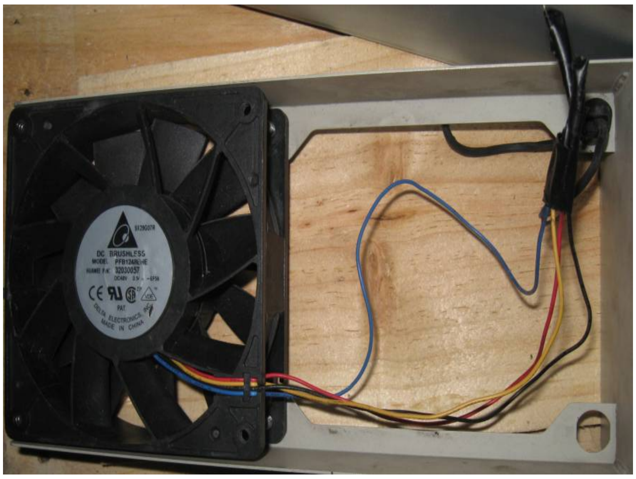
When wiring the drive, the most common problem is incorrect wire installation or poor wiring. Please be aware of the possible damages that poor wiring may cause to your drives.

1. If screws are not fully tightened, then sparking may occur as impedance increases.
2. If you have opened the drive and modified the internal circuit board, the internal components may have been damaged.

**Solution**

Ensure that all screws are tightened when installing the AC motor drive. If the AC motor drive functions abnormally, send it back to Delta for repair. DO NOT try to modify or repair the internal components or wiring.





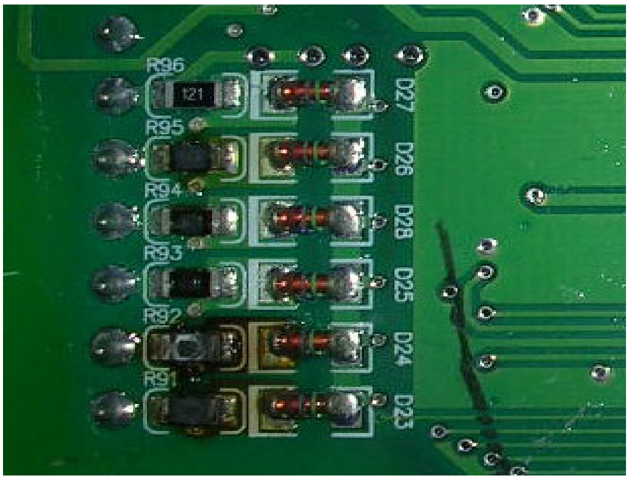
## 15-7 Multi-function Input / Output Terminal Application Problems

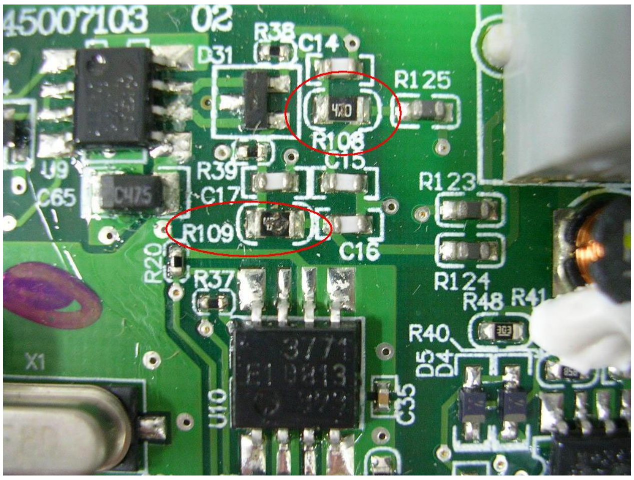
Multi-function input/output terminal errors are generally caused by over-usage of the terminals and not following the specifications. Please be aware of the possible damages that multi-function input/output terminal errors may cause to your drives.

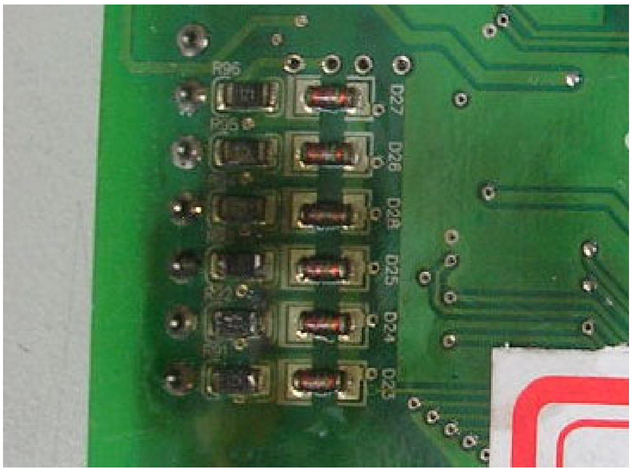
1. Input/output circuit may burn out when the terminal usage exceeds the specified limit.

**Solution**

Refer to the user manual for multi-function input output terminals usage and follow the specified voltage and current. DO NOT exceed the specification limits.



# Chapter 16 Safe Torque Off Function

## 16-1 Failure Rate of the Drive's Safety Function

| Item | Definition | Standard | Performance |
|---|---|---|---|
| SFF | Safe Failure Fraction | IEC61508 | Channel 1: 80.08%<br>Channel 2: 68.91% |
| HFT (Type A subsystem) | Hardware Fault Tolerance | IEC61508 | 1 |
| SIL | Safety Integrity Level | IEC61508 | SIL 2 |
| | | IEC62061 | SILCL 2 |
| PFH | Average frequency of dangerous failure [h-1] | IEC61508 | $9.56\times10^{-10}$ |
| $PFD_{av}$ | Probability of Dangerous Failure on Demand | IEC61508 | $4.18\times10^{-6}$ |
| Category | Category | ISO13849-1 | Category 3 |
| PL | Performance level | ISO13849-1 | d |
| $MTTF_d$ | Mean time to dangerous failure | ISO13849-1 | High |
| DC | Diagnostic coverage | ISO13849-1 | Low |

## 16-2 Description of STO's Functions

The STO (Safe Torque Off) function is to cut off the motor's power supply to prevent the motor from producing torque force. The STO function is run by two independent hardware circuits to control the drive signals emitted by the motor's current, and then to cut off motor drive's power module output in order to safely stop the motor drive.

The following table describes the terminal functions.

Table 1: Terminal Function Descriptions

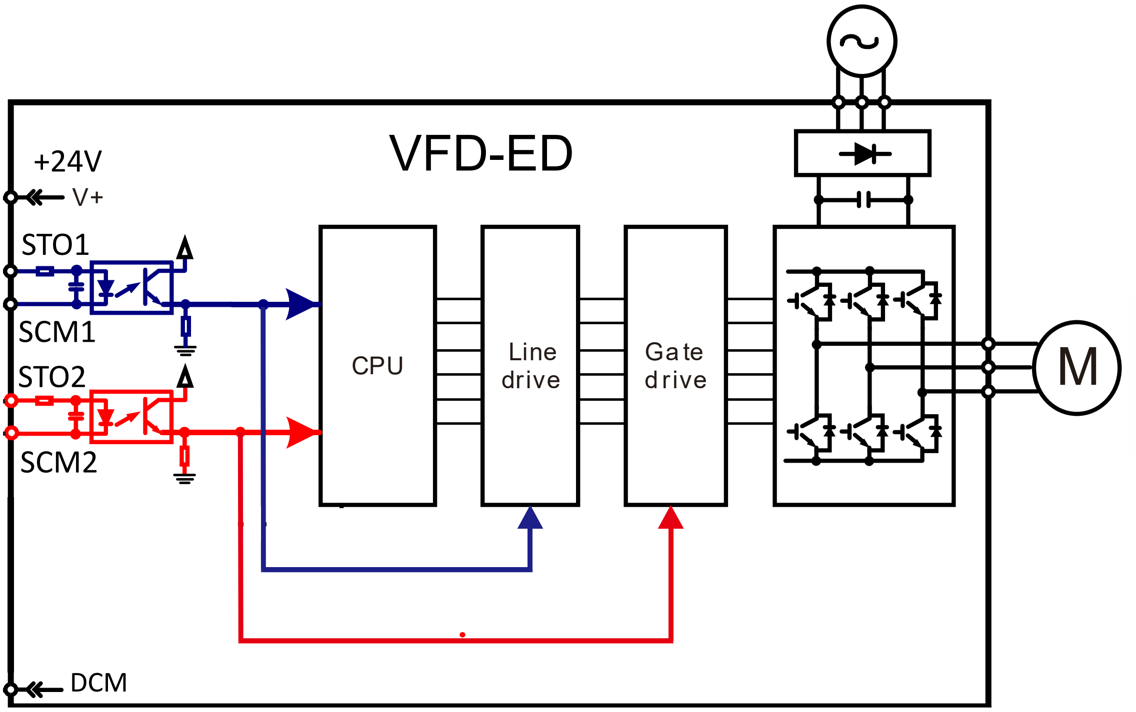
<table>
<tr><th>Signal</th><th>Channel</th><th colspan="4">Status of Photo Coupler</th></tr>
<tr><td rowspan="2">STO Signal</td><td>STO1–SCM1</td><td>ON (High)</td><td>ON (High)</td><td>OFF (Low)</td><td>OFF (Low)</td></tr>
<tr><td>STO2–SCM2</td><td>ON (High)</td><td>OFF (Low)</td><td>ON (High)</td><td>OFF (Low)</td></tr>
<tr><td colspan="2">Drive Output Status</td><td>Ready</td><td>STL2 mode<br>(Torque output off)</td><td>STL1 mode<br>(Torque output off)</td><td>STO mode<br>(Torque output Off)</td></tr>
</table>

- 🕮 STO is Safe Torque Off
- 🕮 STL1–STL3 means an STO internal hardware error.
- 🕮 STL3 means STO1–SCM1 and STO2–SCM2 has an internal circuit error.
- 🕮 STO1–SCM1 ON (High): means STO1–SCM1 has connection to a +24 $V_{DC}$ power supply.
- 🕮 STO2–SCM2 ON (High): means STO2–SCM2 has connection to a +24 $V_{DC}$ power supply.
- 🕮 STO1–SCM1 OFF (Low): means STO1–SCM1 has no connection to a +24 $V_{DC}$ power supply.
- 🕮 STO2–SCM2 OFF (Low): means STO2–SCM2 has no connection to a +24 $V_{DC}$ power supply.

# 16-3 Wiring Diagram

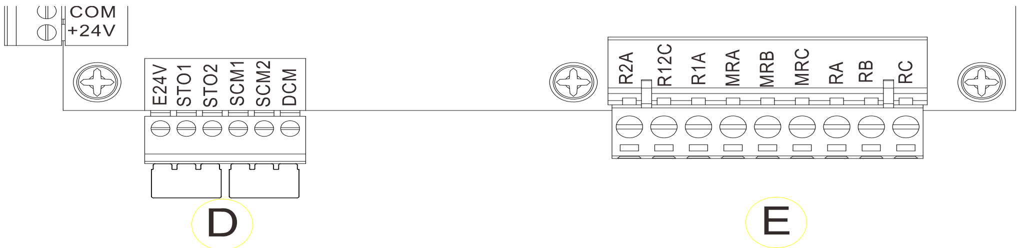
## 16-3-1 Internal Safety Circuit

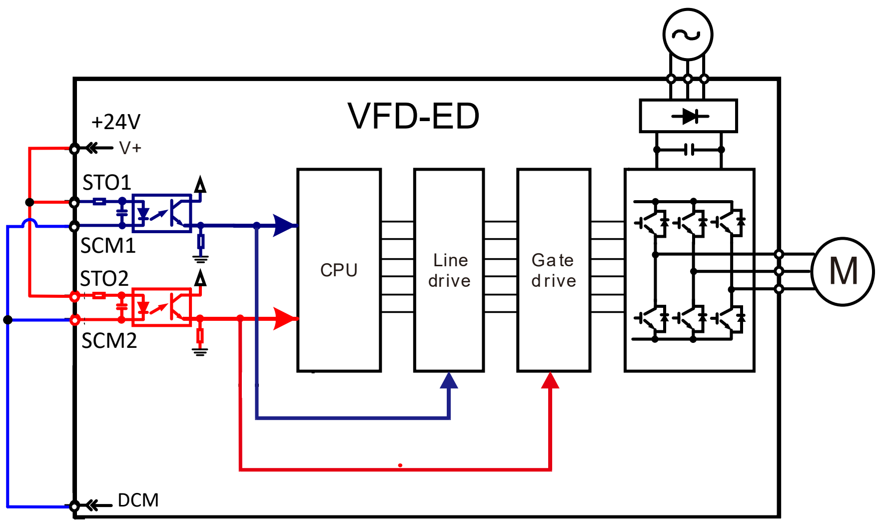
The following diagram shows the drive's Internal Safety Circuit.




## 16-3-2 Internal Safety Circuit Terminals

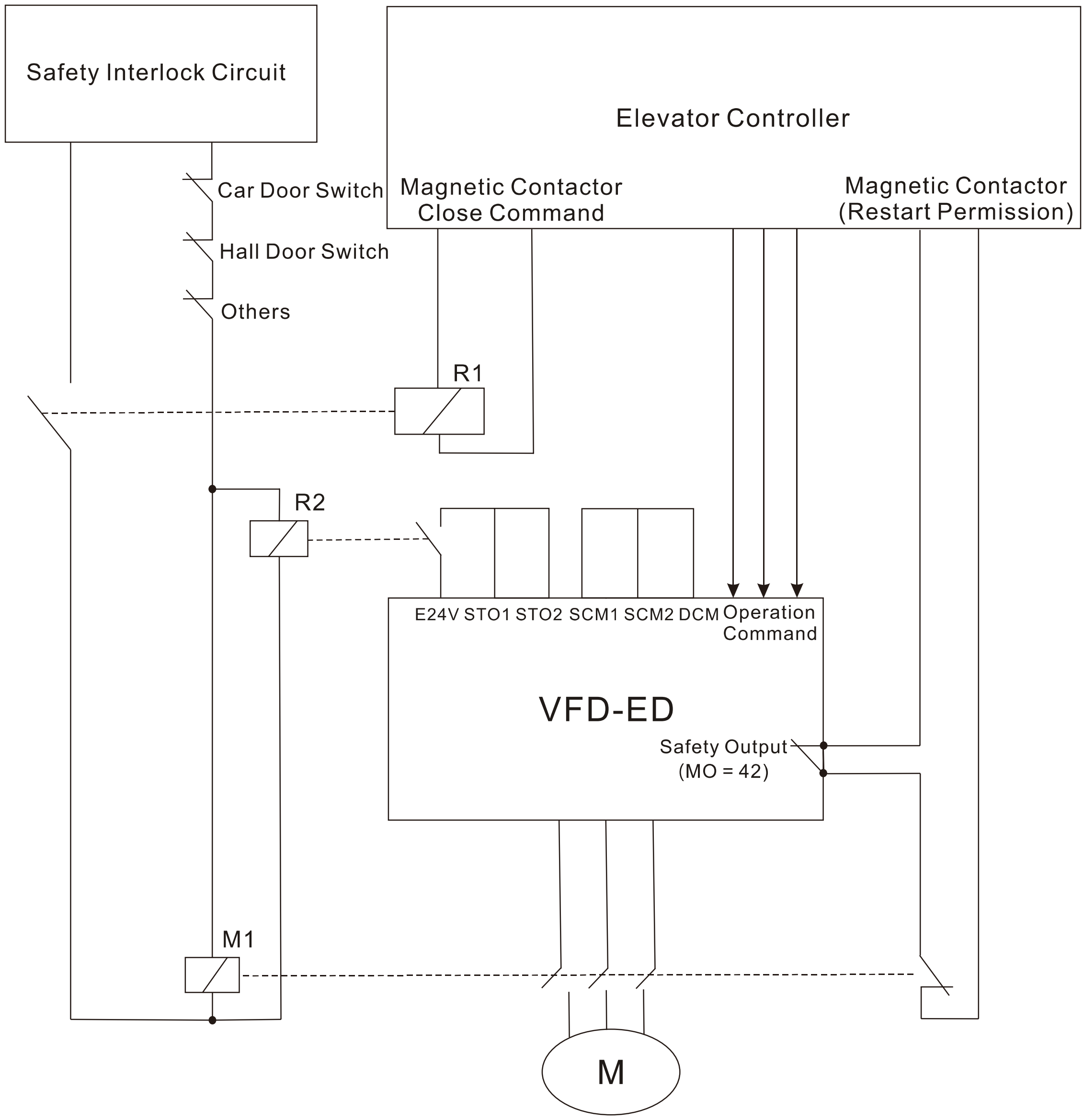
The part D in the diagram below shows the default for terminals +24V-STO1-STO2 and terminals SCM1-SCM2-DCM in the drive's Internal Safety Circuit, which are short-circuited when they are delivered from the factory.



### 16-3-3 Drive's Control Circuit Wiring Diagram

1. Remove the E24V-STO1-STO2 short circuit.
2. The following diagram shows the wiring. The contract for safety interlock circuit must be closed during the normal situation so that the motor drive can run.
3. In STO mode, if you switch on the safety interlock circuit, the motor drive stops outputting and the keypad displays STO.
4. If the restart permission signal is OFF before the elevator controller issues the command to start the elevator, it means that the STO function is currently malfunctioned or M1 magnetic contactor error has occurred, and then the elevator is unable to start (R1 cannot be ON).




Note: "R" in R1/R2 stands for Relay; "M" in M1 stands for MC (Magnetic Contactor)

## 16-4 Related Parameters

### 06-49 STO Latch Selection

Default: 0000h

| Settings | 0000h: STO fault latched, resending RUN command is required |
|---|---|
| | 0001h: STO warning latched, resending RUN command is required |
| | 0002h: STO fault latched |
| | 0003h: STO warning unlatched |

### 02-11 Multi-function Output 1: RA, RB, RC (Relay 1)

Default: 0

### 02-12 Multi-function Output 2: MRA, MRB, MRC (Relay 2)

Default: 0

### 02-13 Multi-function Output 3: R1A, R12C (Relay 3)
### 02-14 Multi-function Output 4: R2A, R12C (Relay 4)
### 02-15 Multi-function Output 5: MO1
### 02-16 Multi-function Output 6: MO2
### 02-17 Multi-function Output 7: MO3
### 02-18 Multi-function Output 8: MO4
### 02-19 Multi-function Output 9: MO5
### 02-20 Multi-function Output 10: MO6

Default: 0

| Settings | 0: No function |
|---|---|
| | 1: Operation indication |
| | 11: Malfunction indication |
| | 42: STO Output Error |

### 02-23 Multi-output Direction

Default: 0

This parameter uses bit setting. If the bit is 1, the multi-function output terminal acts in the opposite direction.

| Bit 11 | Bit 10 | Bit 9 | Bit 8 | Bit 7 | Bit 6 | Bit 5 | Bit 4 | **Bit 3** | **Bit 2** | **Bit 1** | **Bit 0** |
|---|---|---|---|---|---|---|---|---|---|---|---|
| - | - | MO6 | MO5 | MO4 | MO3 | MO2 | MO1 | **R2A** | **R1A** | **MRA** | **RA** |

STO output default: Pr.02-15 (MO1 =42 Logic Output A). You can also set Pr.02-23 (Multi-output direction) to choose Logic Output B.

| Motor Drive Status | Output Safety Status | |
|---|---|---|
| | Logic Output A (Pr.02-15 = 42) | Logic Output B (Pr.02-15 = 42) (Pr.02-23 = 16) |
| Normal | Broken circuit (Open) | Short circuit (Closed) |
| STO | Short circuit (Closed) | Broken circuit (Open) |
| STL1–STL3 | Short circuit (Closed) | Broken circuit (Open) |

# 16-5 Timing Diagram Description

## 16-5-1 Normal Operation Status

As shown in Figure 1, when the STO1–SCM1 and STO2–SCM2 are ON (safety function is not required), the motor drive executes “Operating” or “Output Stop” according to the RUN/STOP command.

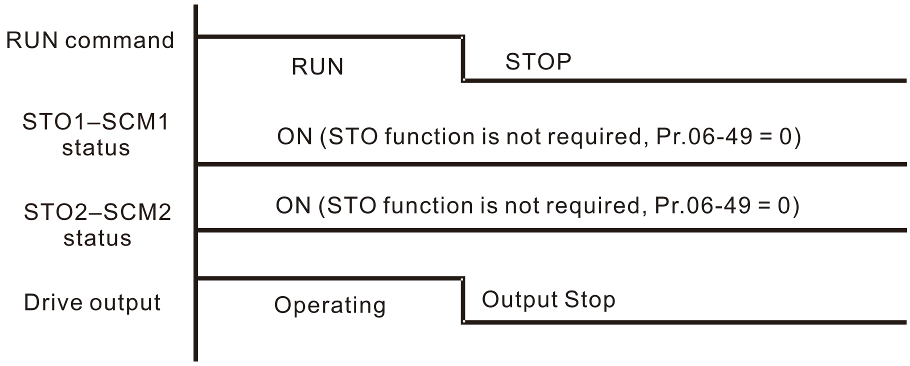



Figure 1

## 16-5-2 Pr.06-49 = 0000h, STO fault latched, resending RUN command is required

If STO is ON in any condition and a fault occurs, it does not reset until STO is back to normal and use a RESET command or power-on again after resending the RUN command.

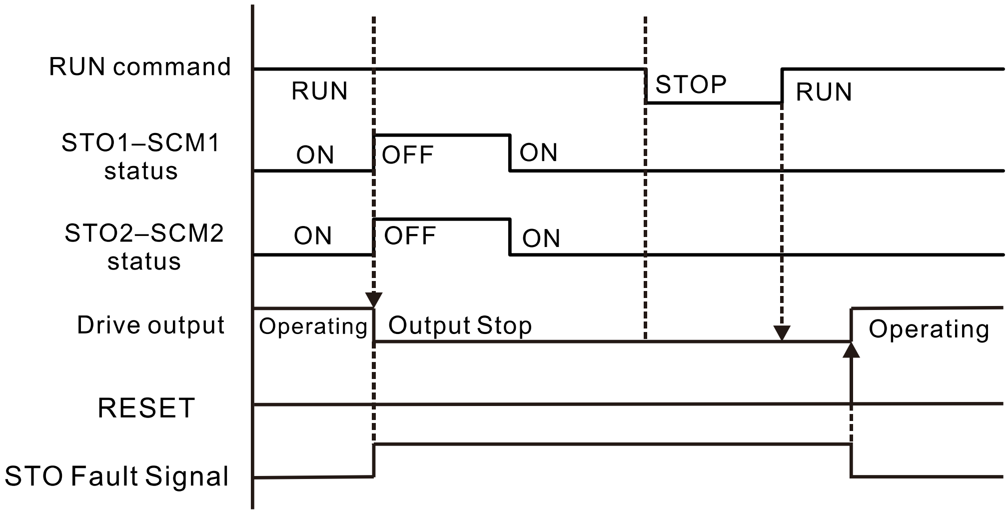



Figure 2

## 16-5-3 Pr.06-49 = 0001h, STO warning latched, resending RUN command is required

If STO is ON in any condition and a warning occurs, it does not reset until STO is back to normal and resend the RUN command.

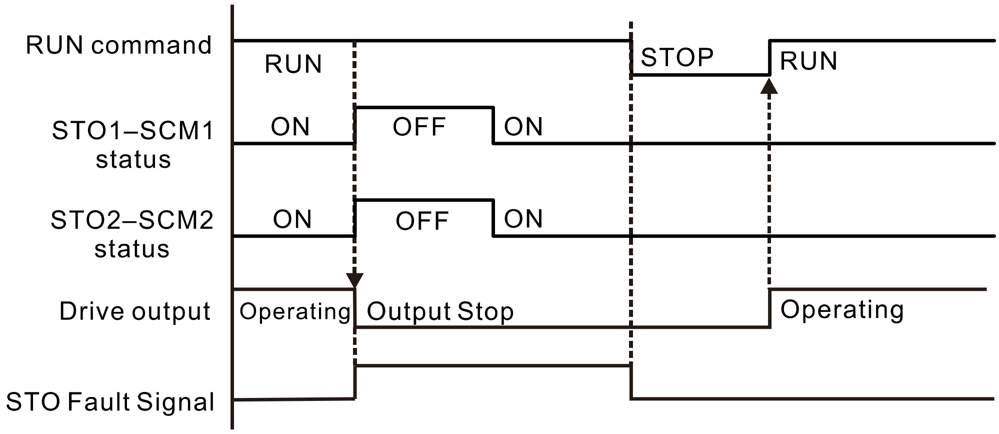



Figure 3

### 16-5-4 Pr.06-49 = 0002h, STO fault latched

If STO is ON in any condition and a fault occurs, it does not reset until STO is back to normal and use a RESET command or power-on again.

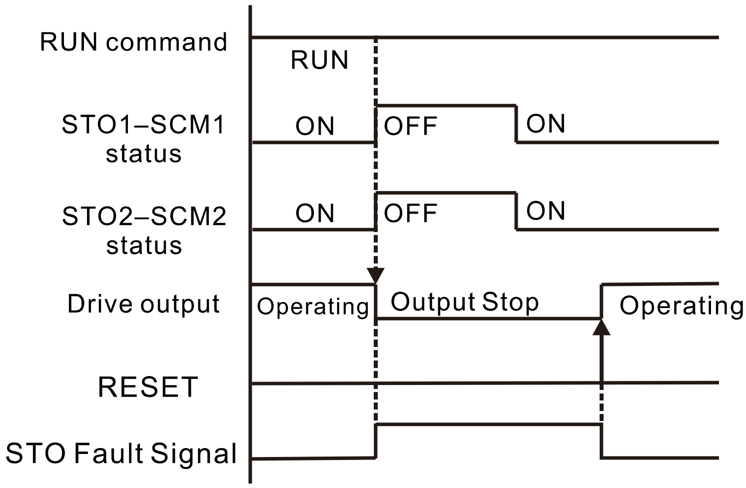



Figure 4

### 16-5-5 Pr.06-49 = 0003h, STO warning unlatched

If STO is ON in any condition and a warning occurs, it automatically resets when STO is back to normal.

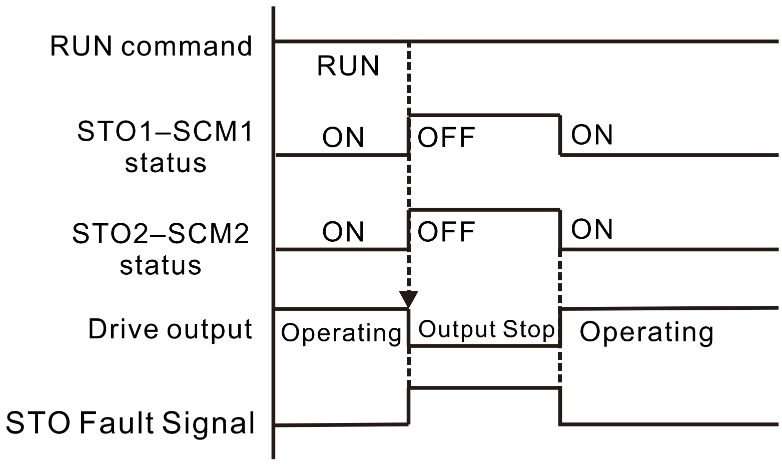



Figure 5

### 16-5-6 STL1

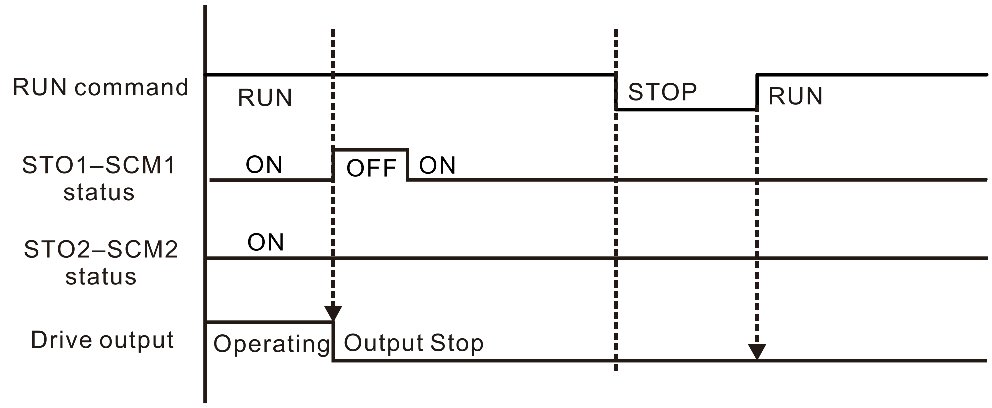



Figure 6

### 16-5-7 STL2

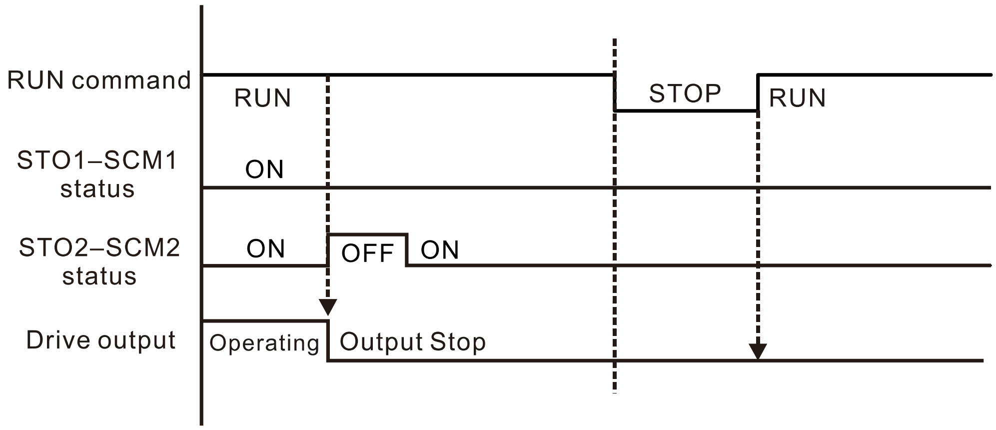



Figure 7

## 16-6 Fault Codes Related to STO

**06 - 16** Present Fault Record
**06 - 17** Second Most Recent Fault Record
**06 - 18** Third Most Recent Fault Record
**06 - 19** Fourth Recent Fault Record
**06 - 20** Fifth Most Recent Fault Record
**06 - 21** Sixth Most Recent Fault Record

Settings

72: Safe torque loss (STL1)

76: Safe torque output stops (STO)

77: Safe torque loss 2 (STL2)

78: Safe torque loss 3 (STL3)

| Fault Code | Reading | Description |
|---|---|---|
| 72 (STL1) | Safe torque loss (STL1) | STO1–SCM1 internal circuit error. |
| 76 (STO) | Safe torque output stops (STO) | Safe Torque Off function is enabled while Pr.06-49 is set to 0000h or 0002h. |
| 77 (STL2) | Safe torque loss 2 (STL2) | STO2–SCM2 internal circuit error. |
| 78 (STL3) | Safe torque loss 3 (STL3) | STO1–SCM1 and STO2–SCM2 internal circuit error. |

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# Appendix A.

# AC Motor Drives
# EMC Standard Installation Guide

EMC Compliance Practice

# Preface

When an AC motor drive is installed in a noisy environment, radiated and/or conducted noise via signal and power cables can interfere with the correct functioning, cause errors or even damage to the drive. To prevent this, some AC motor drives have an enhanced noise resistance but the results are limited and it is not economical. Therefore, an effective method would be finding the cause of the noise and use the right solution to achieve “no emission, no transmission and no reception of noise”. All three solutions should be applied.

## Finding the Noise

- Ascertain whether the error is caused by noise.
- Find the source of the noise and its transmission path.
- Confirm the signal and the source of noise

## Solutions

- Grounding
- Shielding
- Filtering

# Table of Contents

# *Introduction*

## 1.1 What is EMC?

Electromagnetic Compatibility (EMC) is the ability of an electrical device to function properly in electromagnetic environments. It does not emit electromagnetic noise to surrounding equipment and is immune to interference from surrounding equipment. The goal is to achieve high immunity and low emission; these two properties define the quality of EMC. In general, electrical devices react to high and low frequency phenomena. High frequency phenomena are electrostatic discharge (ESD); pulse interference; radiated electromagnetic field; and conducted high frequency electrical surge. Low frequency phenomena refer to mains power harmonics and imbalance.

The standard emission and immunity levels for compliance depend on the installation location of the drive. A Power Drive System (PDS) is installed in an industrial or domestic environment. A PDS in a domestic environment must have lower emission levels and is allowed to have lower immunity levels. A PDS in an industrial environment is allowed to have higher emission levels but must have more severe immunity levels.

## 1.2 EMC for AC Motor Drive

When an AC motor drive is put into operation, harmonic signal will occur at the AC drive's power input and output side. It creates a certain level of electromagnetic interference to the surrounding electrical devices and the mains power network. An AC motor dive is usually applied in industrial environments with a strong electromagnetic interference. Under such conditions, an AC drive could disturb or be disturbed.

Delta's AC motor drives are designed for EMC and comply with EMC standard EN61800-3 2004. Installing the AC motor drive accurately will decrease EMI influences and ensure long-term stability of the electricity system. It is strongly suggested to follow Delta's user manual for wiring and grounding. If any difficulties or problems arise, please follow the instructions and measures as indicated in this EMC Standard Installation Guide.

# How to prevent EMI

## 2.1 Types of EMI: Common-mode and differential-mode noise

The electromagnetic noise of an AC motor drive can be distinguished into common-mode and differential-mode noise. Differential-mode noise is caused by the stray capacitance between the conducting wires and common-mode noise is caused by the common-mode coupling current path created by the stray capacitance between the conducting wires and ground.

Basically, differential-mode noise has a greater impact to the AC motor drive and common-mode noise has a greater impact to high-sensitivity electronic devices. An excessive amount of differential-mode noise may trigger the circuit protection system of the AC motor drive. Common-mode noise affects peripheral electronic devices via the common ground connection.

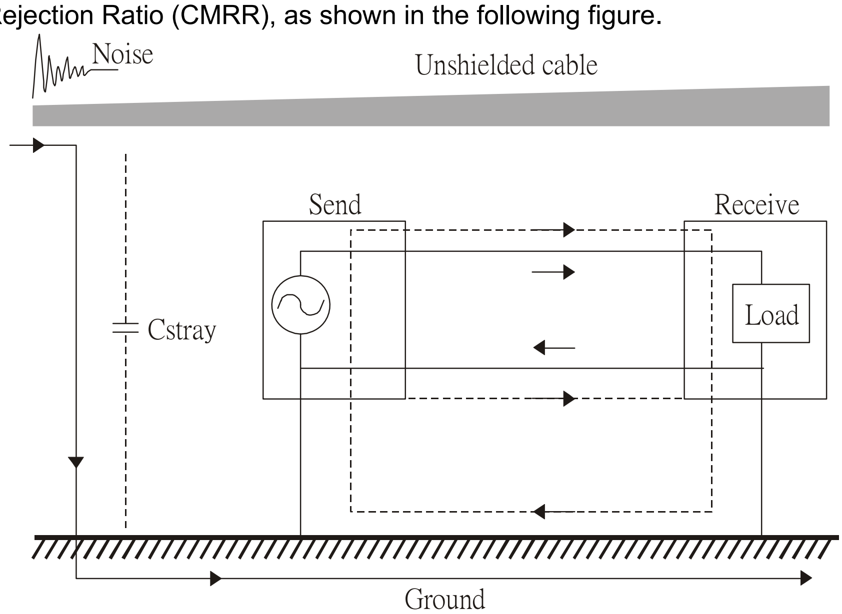
EMC problems can be more serious when the following conditions apply:

- When a large horsepower AC motor drive is connected to a large horsepower motor.
- The AC motor drive's operation voltage increases.
- Fast switching of the IGBTs.
- When a long cable is used to connect the motor to the AC motor drive.

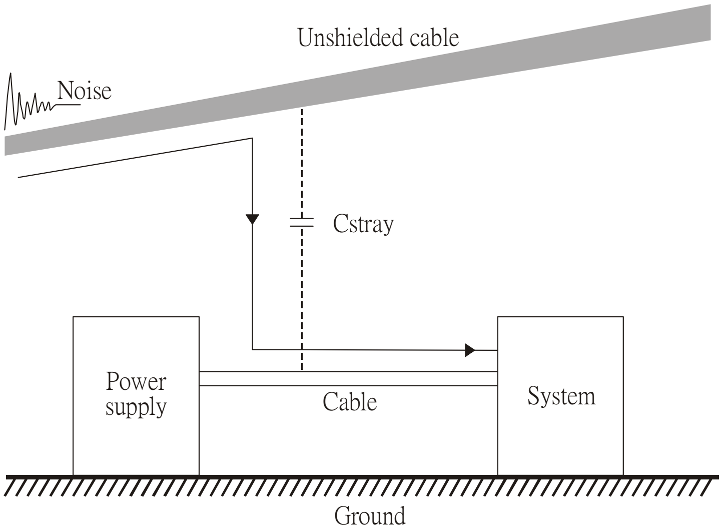
## 2.2 How does EMI transmit? (Noise transmission path)

Noise disturbs peripheral high-sensitivity electrical devices/systems via conduction and radiation, their transmission paths are shown hereafter:

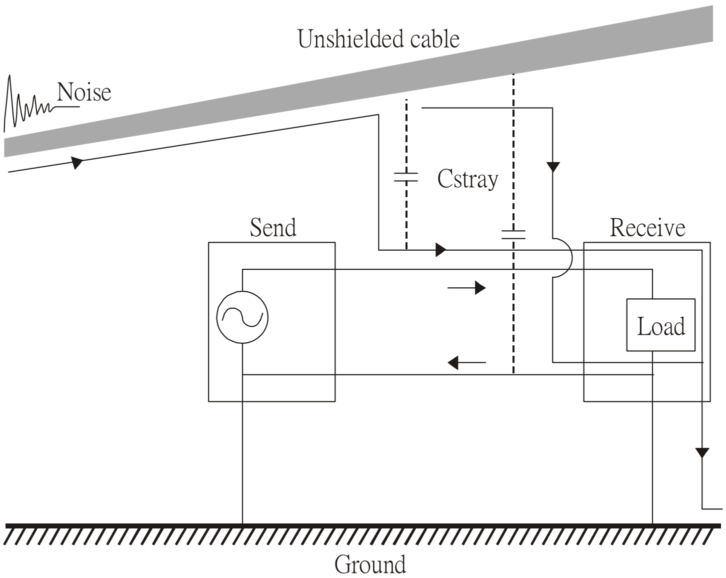
1. Noise current in the unshielded power cable is conducted to ground via stray capacitances into a common-mode voltage. Whether or not other modules are capable to resist this common-mode noise depends on their Common-Mode Rejection Ratio (CMRR), as shown in the following figure.



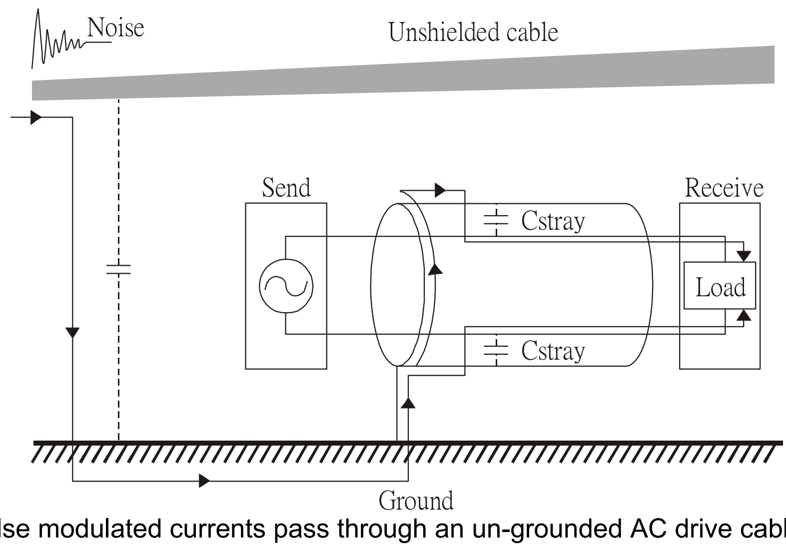

2. Common-mode noise in the power cable is transmitted through the stray capacitance and coupled into the adjacent signal cable, as shown in Figure 2. Several methods can be applied to reduce the effect of this common-mode noise; for example, shield the power cable and/or the signal cables, separate the power and signal cables, take the input and output side of the signal cable and twist them together to balance out the stray capacitance, let power cables and signal cables cross at 90°, etc.




3. Common-mode noise is coupled via the power cable to other power systems then the cable of such a power system is coupled to the transmission system, as shown in Figure 3.




4. The common-mode noise of an unshielded power cable is transmitted to the ground via the stray capacitance. Since both shielded wire and unshielded wire are connected to a common ground, other systems can be interfered with by the common-mode noise that is transmitted from the ground back to the system via the shield. See Figure 4.




5. When excessive pulse modulated currents pass through an un-grounded AC drive cable, it acts as an antenna and creates radiated interference.

# Solution to EMI: Grounding

The leakage current of an electronic equipment is conducted to ground via the grounding wire and the ground electrode. According to Ohm's law, potential differences may arise when the electrode's ground and the ground's ground resistance are different.

According to Ohm's law, the earth resistance for electrode and the ground are different; in this case, potential differences may arise.

## 3.1 Protective Grounding & Functional Grounding

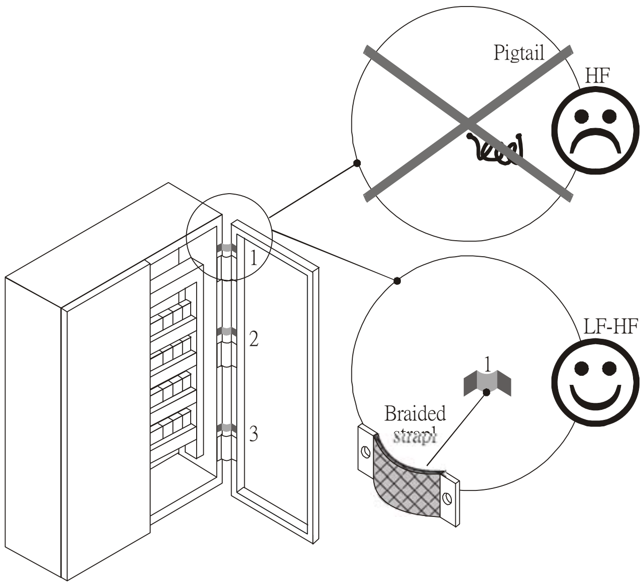
Please carefully read the following instruction if two types of grounding are applied at the same time.

Protective grounding is applied outside buildings and must have low resistance. On the other hand, functional grounding can be applied inside buildings and must have low impedance.

The goal of EMC is to avoid any interference effects. Grounding for EMC can be distinguished by frequency. For frequencies lower than 10 kHz, a *single-point ground* system should be used and for frequencies higher than 10 kHz, a *multiple point ground* system should be used.

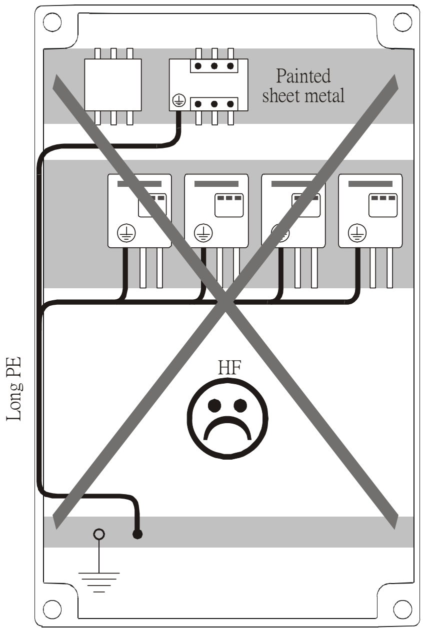
- *Single Point Grounding*: all signal grounds of all IT equipment are connected in series to form a single reference point. This point can be grounded directly to earth; to the designated grounding point or to the safety point that is already grounded.
- *Multiple Point Grounding:* all signals of all IT equipment are grounded independently.
- *Hybrid Grounding:* this type of grounding behaves differently for low and high frequencies. When two pieces of IT equipment (A and B) are connected via a shielded cable, one end is connected directly to ground while the other end is connected to ground via a capacitor. This type of grounding system fulfils the criteria for high and low frequency grounding.
- *Floating grounding:* the signals of all IT equipment are isolated from each other and are not grounded.

DC current flows evenly throughout the conductor section. But AC current flows towards the conductor's surface as frequency increases; this is called the "skin effect". It causes the effective cross-section area to be reduced with increasing frequency. Therefore, it is suggested to increase the effective ground cross-section area for high frequencies by replacing pigtail grounding by braided conductors or strip conductors. Refer to the following figure.




This is why a thick short ground wire must be implemented for connecting to the common grounding path or the ground busbar. Especially when a controller (e.g. PLC) is connected to an AC motor drive, it must be grounded by a short and thick conducting wire. It is suggested to use a flat braided conductor (ex: metal mesh) with a lower impedance at high frequencies.

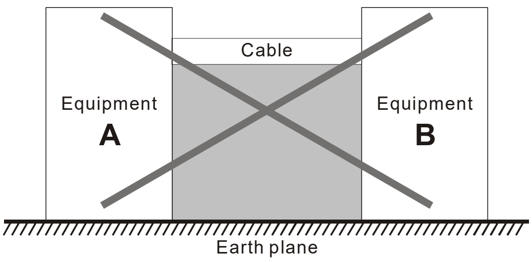
If the grounding wire is too long, its inductance may interfere structure of the building or the control cabinet and form mutual inductance and stray capacitance. As shown in the following figure, a long grounding wire could become a vertical antenna and turn into a source of noise.

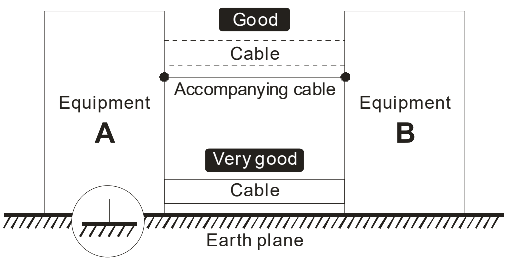



## 3.2 Ground Loops

A *ground loop* occurs when the pieces of equipment are connected to more than one grounding path. In this case, the ground current may return to the grounding electrode via more than one path. There are three methods to prevent ground loops

1. Use a common power circuit
2. Single point grounding
3. Isolate signals, e.g. by photocouplers




In order to avoid "Common Mode Noise", please use parallel wires or twisted pair wiring. Follow this rule and also avoid long wires, it is suggested to place the two wires as close to each other as possible.

## 3.3 Earthing Systems

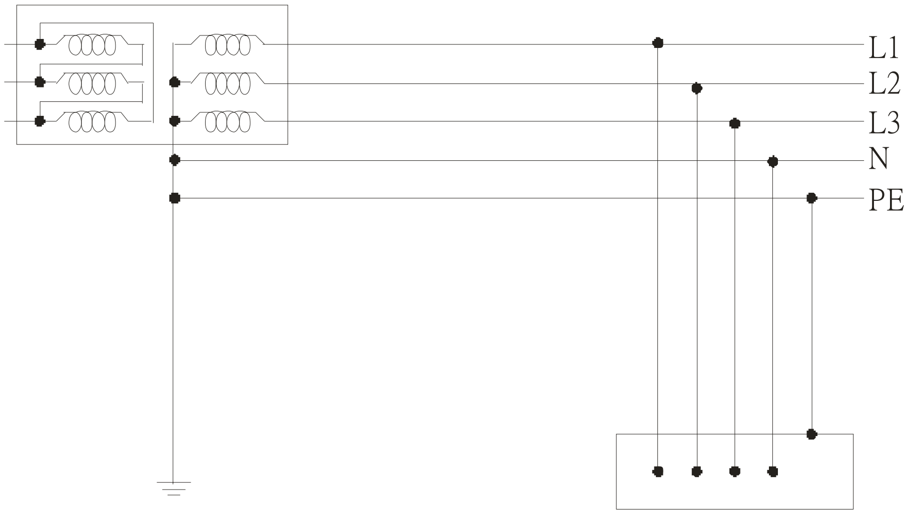
The international standard IEC60364 distinguishes three different earthing system categories, using the two-letter codes TN, TT, IT.

- The ***first letter*** indicates the type of earthing for the power supply equipment (generator or transformer).
  **T**: One or more points of the power supply equipment are connected directly to the same earthing point.
  **I**: Either no point is connected to earth (isolated) or it is connected to earth via high impedance.
- The ***second letter*** indicates the connection between earth and the power supply equipment.
  **T**: Connected directly to earth (This earthing point is separate from other earthing points in the power supply system.)
  **N**: Connected to earth via the conductor that is provided by the power supply system
- The ***third and forth letter*** indicate the location of the earth conductor.
  **S**: Neutral and earth conductors are separate
  **C**: Neutral and earth are combined into a single conductor

## TN system

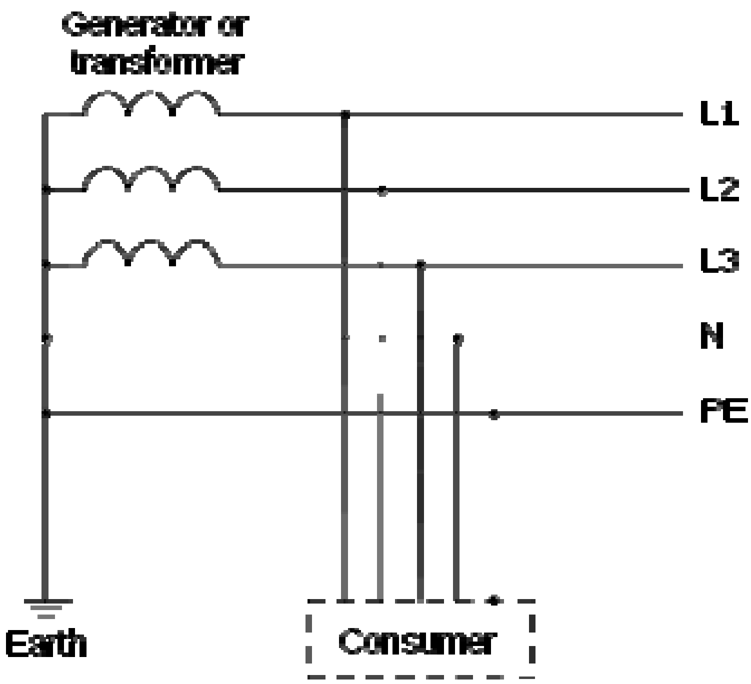
**TN***:* The neutral point of the low voltage transformer or generator is earthed, usually the star point in a three-phase system. The body of the electrical device is connected to earth via this earth connection at the transformer.

*Protective earth* (*PE*): The conductor that connects the exposed metallic parts of the consumer.
*Neutral* (*N*): The conductor that connects to the start point in a three-phase system or that carries the return current in a single phase system.



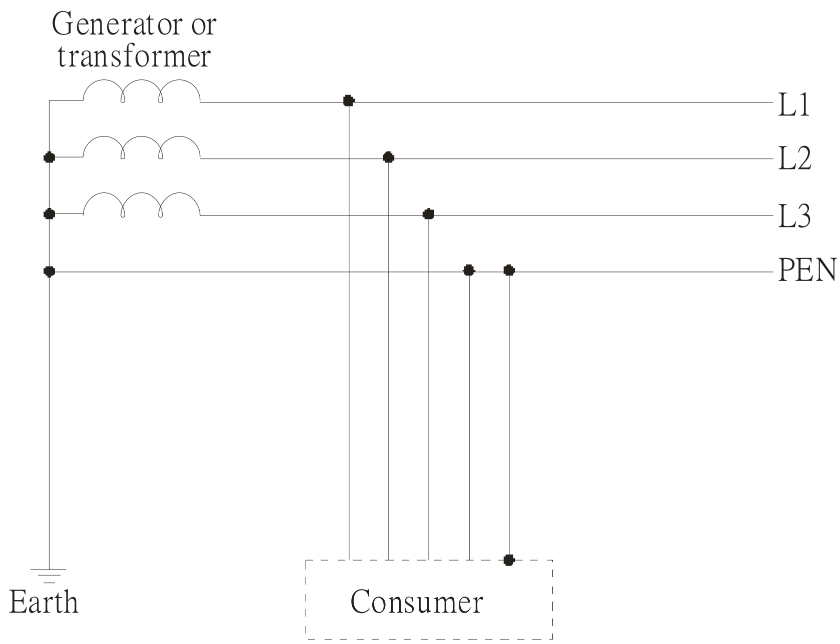

## TN-S system

**TN**-**S**: PE and N are two separate conductors that are combined together only near the power source (transformer or generator). It is the same as a three-phase five-wire system.



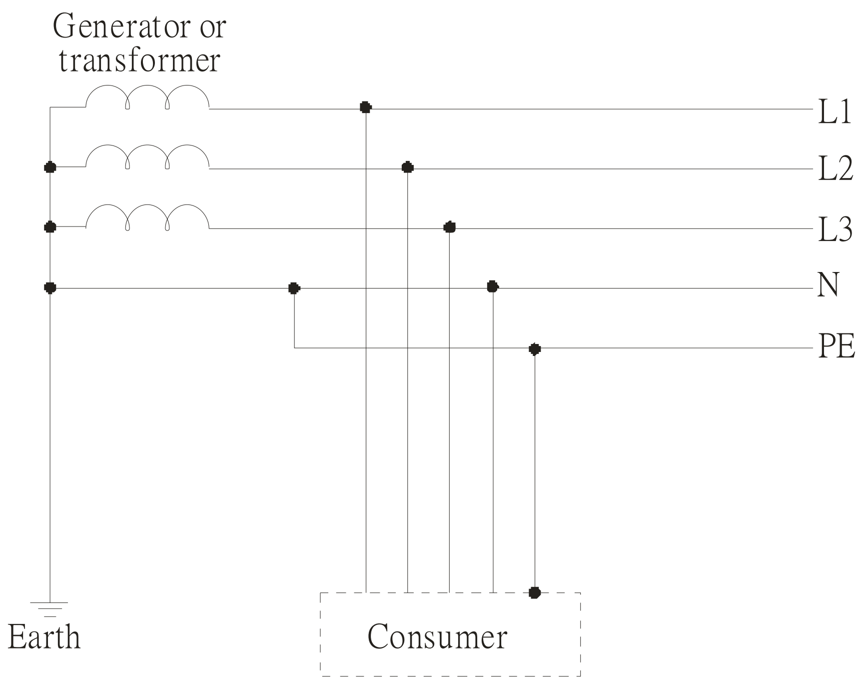
## TN-C system

**TN-C**: PE and N are two separate conductors in an electrical installation similar to a three-phase five-wire system, but near the power side, PE and N are combined into a PEN conductor similar to a three-phase four-wire system.



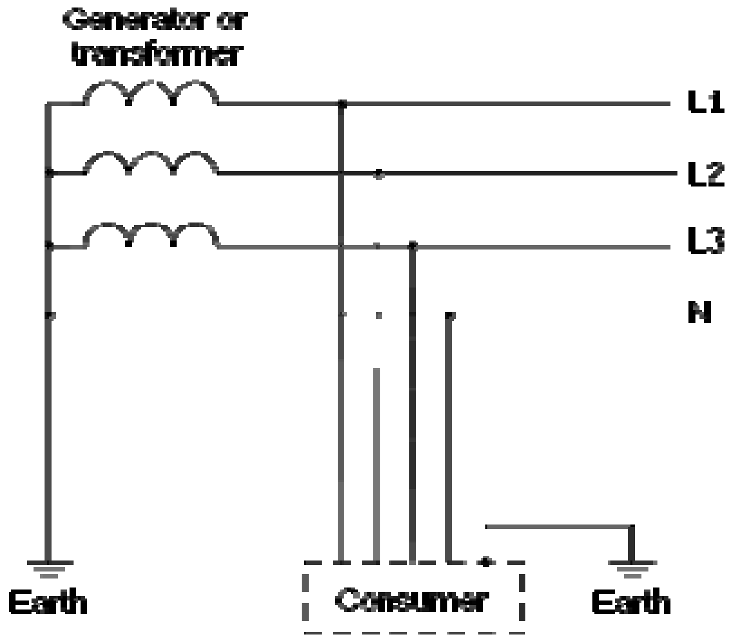

## TN-C-S system

**TN-C-S**: A combined earth and neutral system (PEN conductor) is used in certain systems but eventually split up into two separate conductors PE and N. A typical application of combined PEN conductor is from the substation to the building but within the building PEN is separated into the PE and N conductors. Direct connection of PE and N conductors to many earthing points at different locations in the field will reduce the risk of broken neutrals. Therefore, this application is also known as *protective multiple earthing (PME)* in the UK or as *multiple earthed neutral (MEN) in* Australia



## TT system

**TT**: The neutral point (N) of the low voltage transformer and the equipment frames (PE) are connected to a separate earthing point. The Neutral (N) of the transformer and electrical equipment are connected.

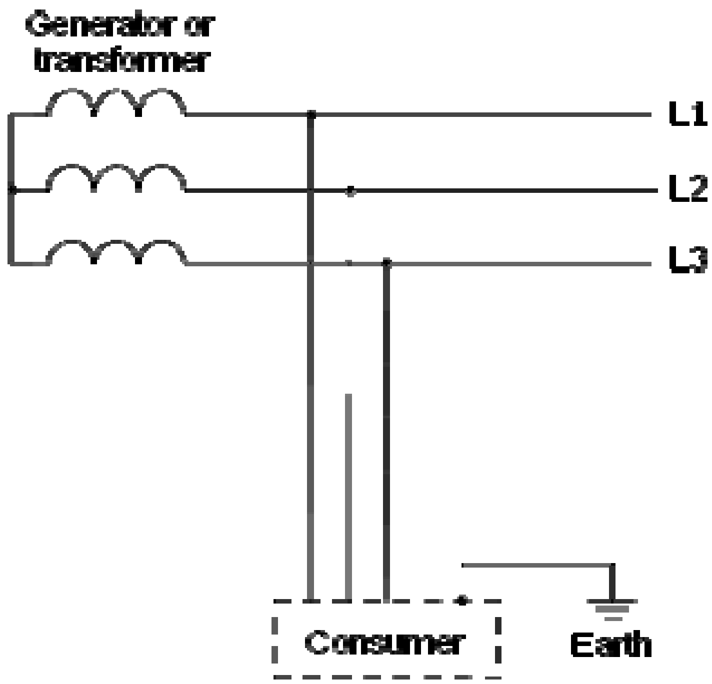



## IT system

**IT**: The neutral point of the transformer and electrical equipment are not earthed, only the equipment frames PE are earthed.

In the IT network, the power distribution system Neutral is either not connected to earth or is earthed via high impedance. In such a system, an insulated monitoring device is used for impedance monitoring.

A built-in filter should be disconnected by the RFI-jumper and an external filter should not be installed when the AC motor drive or the AC servo motor drive is connected to an IT system.



## Criteria for Earthing System and EMC

| | TN-S | TN-C | TT | IT |
|---|---|---|---|---|
| Safety of Personnel | Good<br><br>Continuity of the PE conductor must be ensured throughout the installation | Good<br><br>Continuity of the PE conductor must be ensured throughout the installation | Good<br><br>RCD is mandatory | Good<br><br>Continuity of the PE conductor must be ensured throughout the installation |
| Safety of Property | Poor<br><br>High fault current (around 1kA) | Poor<br><br>High fault current (around 1kA) | Good<br><br>Medium fault current (< a few dozen amperes) | Good<br><br>Low current at the first fault (< a few dozen mA) but high current at the second fault |
| Availability of Energy | Good | Good | Good | Excellent |
| EMC Behavior | Excellent<br><br>Few equipotential<br><br>Problems:<br>- Need to handle the high leaking currents problem of the device<br><br>- High fault current (transient disturbances) | Poor (prohibited)<br><br>- Neutral and PE are the same<br><br>- Circulation of disturbance currents in exposed conductive parts (high magnetic-field radiation)<br><br>- High fault currents (transient disturbances) | Good<br><br>- Over-voltage risk<br>- Equipotential<br><br>Problems:<br>- Need to handle the high leaking currents problem of the device<br><br>- RCD (Residual-current device) | Poor (should be avoided)<br><br>- Over-voltage risk<br><br>- Common–mode filters and surge arrestors must handle the phase-to-phase voltage.<br><br>- RCDs subject to nuisance tripping when common-mode capacitors are present<br><br>- Equivalent to TN system for second fault |

# Solution to EMI: Shielding

## 4.1 What is Shielding?

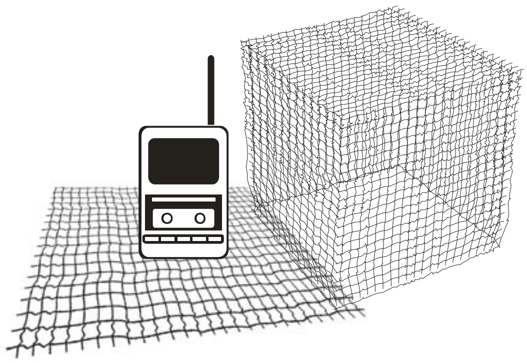
*Electrostatic shielding* is used to isolate equipment so that it will not create electromagnetic field interference or be influenced by an external electromagnetic field. A conductive material is used for electrostatic shielding to achieve this isolation.

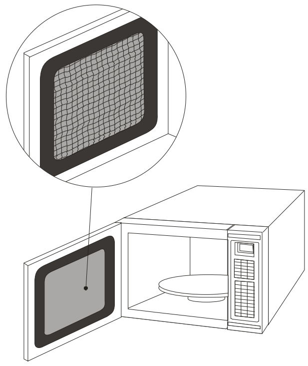
A *Faraday cage* can be made from a mesh of metal or a conductive material.
One characteristic of metal is that it is highly conductive and not electrostatic, which offers shielding and prevents interference by external electrical fields. Metal with its high conductivity protects the internal devices from high voltages—no voltage will enter the cage even when the cage is experiencing a high current. In addition, electromagnetic fields can also pass through the Faraday cage without causing any disturbance.

Electromagnetic shielding is applied to some electrical devices and measurement equipment for the purpose of blocking interference. Examples of shielding include:

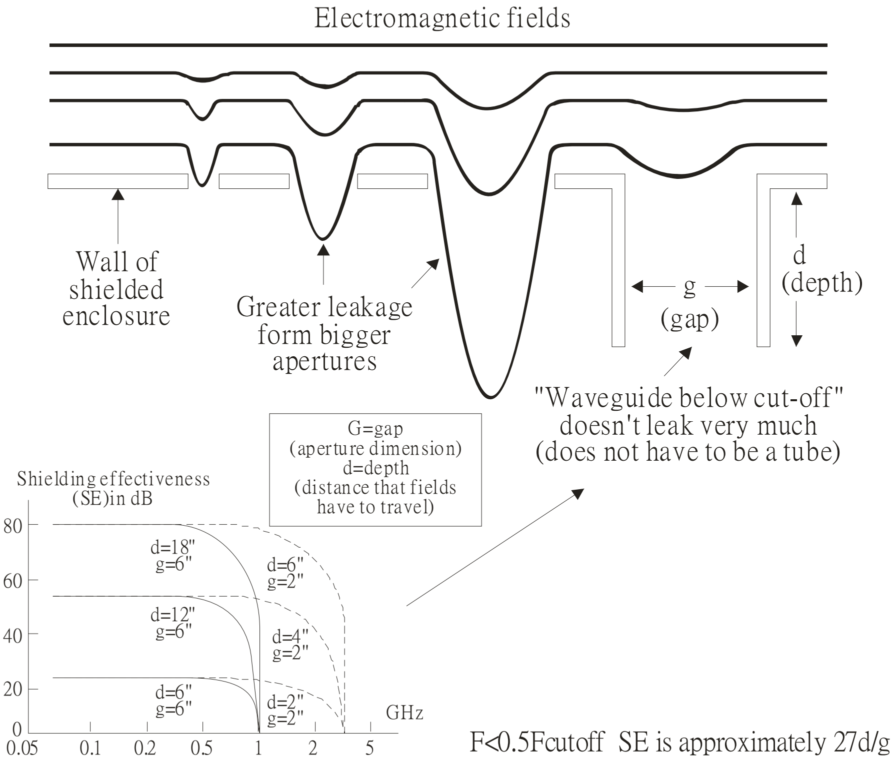
- earth high-voltage indoor equipment using a metal frame or a high-density metal mesh
- shielding a power transformer is achieved by wrapping a metal sheet between the primary and secondary windings or by adding an enamel wire to the winding wire which is then earthed.
- a shielding coating, which is made of metal mesh or conductive fibers to provide effective protection for the workers who work in a high-voltage environment.

In the picture below, the radio appears to be not fully covered by metal but if the conductivity of the metal is high, radio waves are completely blocked and the radio will not receive any signal.





Mobile phone connections are also established through the transmission of radio waves. This is why the mobile phone reception is often cut off when we walk into an elevator. The metal walls of the elevator create the same shielding effect just as if we had entered a metal cage. Another example is a microwave oven. The microwave door may seem transparent in visible light, but the density of the metal mesh in the microwave door blocks the electromagnetic waves. A higher density of the metal mesh offers better shielding.




## 4.2 How to reduce EMI by Shielding?

Iron and other metals are high conductivity materials that provide effective shielding at extremely low frequencies. But conductivity will decrease as:

1. High frequency signals are applied to the conductor.
2. Equipment is located in a strong magnetic field
3. The shielding frame is forced into a specific form by machines.

It is difficult to select a suitable high-conductivity material for shielding without the help from a shielding material supplier or a related EMI institution.

## Metallic Shielding Effectiveness

Shielding Effectiveness (SE) is used to assess the applicability of the shielding shell. The formula is:

SEdB=A+R+B (Measures in dB) where A= Absorption loss (dB)
R= Reflection loss (dB)
B= Correction factor (dB) (for multiple reflections in thin shields)

The absorption loss refers to the amount of energy loss as the electromagnetic wave travels through the shield. The formula is:

AdB=1.314(fσμ) 1/2t where f= frequency (MHz)
μ= permeability relative to copper
σ= conductivity relative to copper
t= thickness of the shield in centimeters

The reflection loss depends on the source of the electromagnetic wave and the distance from that source. For a rod or straight wire antenna, the wave impedance increases as it moves closer to the source and decreases as it moves away from the source until it reaches the plane wave impedance (377) and shows no change. If the wave source is a small wire loop, the magnetic field is dominant and the wave impedance decreases as it moves closer to the source and increases as it moves away from the source; but it levels out at 377 when the distance exceeds one-sixth of the wavelength.

## Electrical Cabinet Design

In a high frequency electric field, shielding can be achieved by painting a thin layer of conductive metal on the enclosure or on the internal lining material. However, the coating must be thorough and all parts should be properly covered without any seams or gaps (just like a Faraday cage). That is only the ideal. Making a seamless shielding shell is practically impossible since the cage is composed of metal parts. In some conditions, it is necessary to drill holes in the shielding enclosure for installation of accessories (like optional cards and other devices).

1. If the metallic components are properly welded using sophisticated welding technology to form an electrical cabinet, deformation during usage is unlikely to occur. But if the electrical cabinet is assembled with screws, the protective insulating layer under the screw must be properly removed before assembly to achieve the greatest conductivity and best shielding.
2. Drilling holes for the installation of wires in the electrical cabinet lowers the shielding effectiveness and increases the chance of electric waves leaking through the openings and emitting interference. We recommend that the drilled holes are as narrow as possible. When the wiring holes are not used, properly cover the holes with metal plates or metal covers. The paint or the coating of the metal plate and metal cover should be thoroughly removed to ensure a metal-to-metal contact or a conductive gasket should be installed.
3. Install industrial conductive gaskets to completely seal the electrical cabinet and the cabinet door without gaps. If conductive gaskets are too costly, please screw the cabinet door to the electrical cabinet with a short distance between the screws.
4. Reserve a grounding terminal on the electrical cabinet door. This grounding terminal shall not be painted. If the paint already exists, please remove the paint before grounding.

## Electrical wires and cables

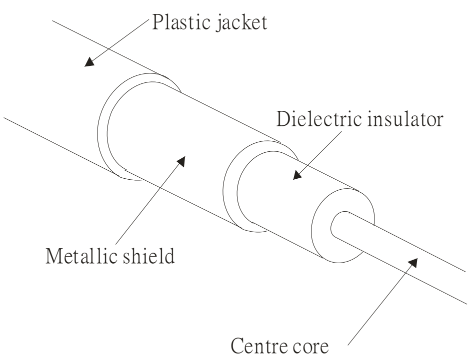
Shielded Twisted Pair (STP) is a type of cable where two insulated copper wires are twisted together with a metal mesh surrounding the twisted pair that forms the electromagnetic shielding and can also be used for grounding.

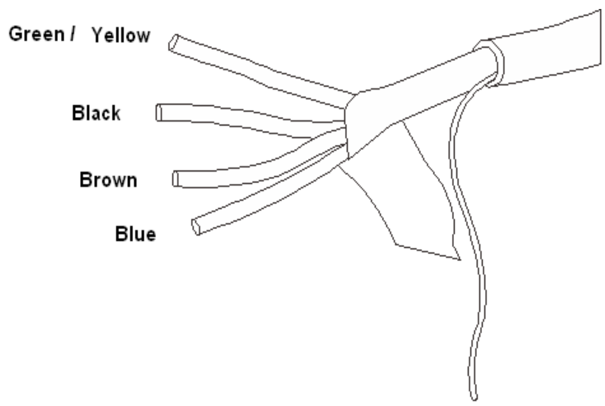
The individual electrical wires and complete cable are surrounded by (synthetic) rubber that provides insulation and also protects against damage.

There are two types of electrical cables: high voltage and low voltage. The high voltage cable differs from the low voltage cable in that it has an additional insulation layer called the dielectric insulator within the plastic sleeve. The dielectric insulator is the most important component in insulation. The low voltage cable is usually only filled with a soft polymer material for keeping the internal copper wire in place.

The shield has two functions.

1. To shield the electrical wire and cable.
   A. Electric currents increase as power flows through the power cable and generate an electrical field. Such interference can be suppressed inside the cable by shielding the power cables or the electrical wires.
   B. To form a protective earthing. When the cable core is damaged, the leakage current will flow via the shield to ground
2. To protect the cable. A power cable used for the computer control purpose generates only relatively low amount of current inside the cable. Such power cable will not become the source of interferences but has great possibility to be interfered by the surrounding electrical devices.



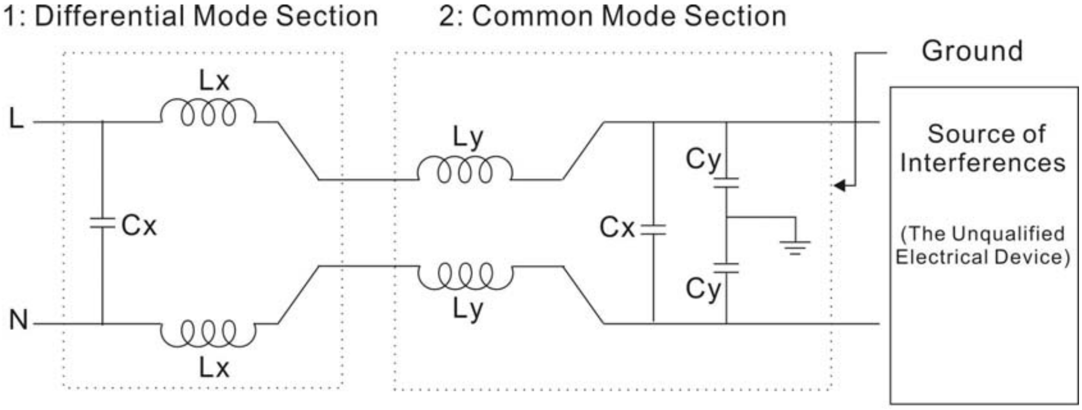
# Solution to EMI: Filter

## 5.1 Filter

Electromagnetic interference is transmitted in two ways, by radiation and by conduction. The most effective and economical method of reducing radiated interference is to use shielding and of reducing conducted interference is to use an electromagnetic filter.

Noise interference can be divided into two categories: high frequency (150 kHz–300 MHz) and low frequency (100–3000 Hz). High-frequency noise fades more over distance and has a shorter wave-length, while low-frequency noise fades less over distance and has a longer wave-length. Both types of interference are transmitted through power cables and power leads, affecting the power supply side.

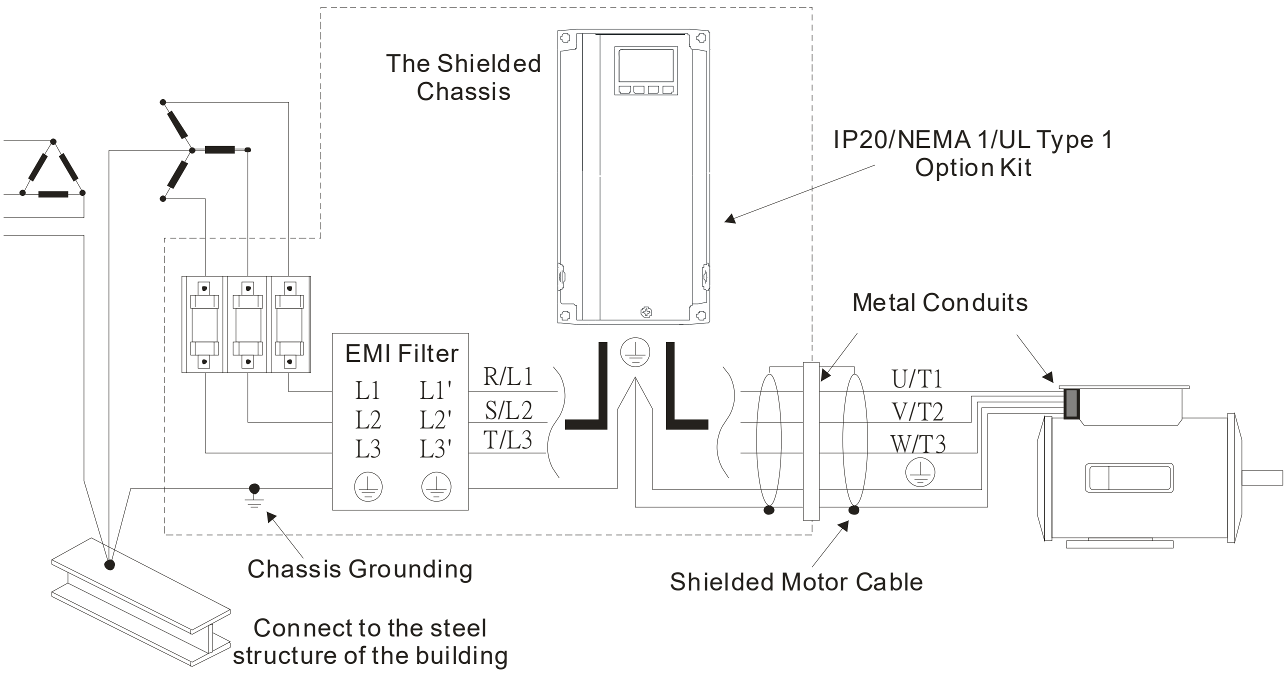
High-frequency interference at the power side can be eliminated or attenuated by mounting a filter. The filter consists of coils and capacitors. Some drives do not have a built-in filter, in which case the installation of an external option filter is required. The drawing below shows a standard filter diagram:




A filter is composed of a Differential Mode section (to eliminate noise below 150 kHz) and a Common Mode section (to eliminate noise above 150 kHz). For high-frequency noise, the inductor acts as a high impedance to form an open circuit and the capacitor acts as a low impedance to form a short circuit. Proper design and dimensioning of inductors and capacitors give a resonant circuit to absorb harmonic currents. Capacitor Cy is earthed to lead the harmonic currents to the ground.

### External Filter

The filter and the AC drive should be installed in the control cabinet or on the mounting plate that is earthed to ground. The motor cable must be shielded and as short as possible. Please use the filters recommended by Delta to ensure compliance with EMC standards.

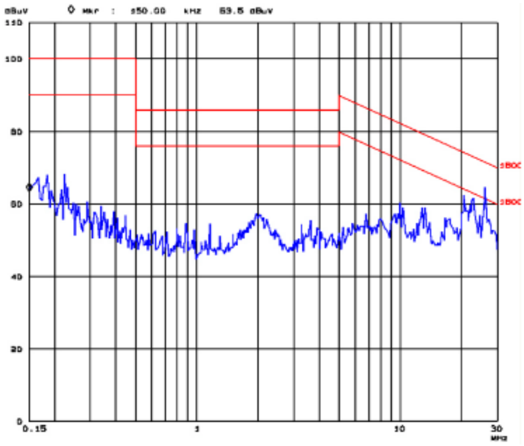


## AC Motor Drives with Built-in Filter

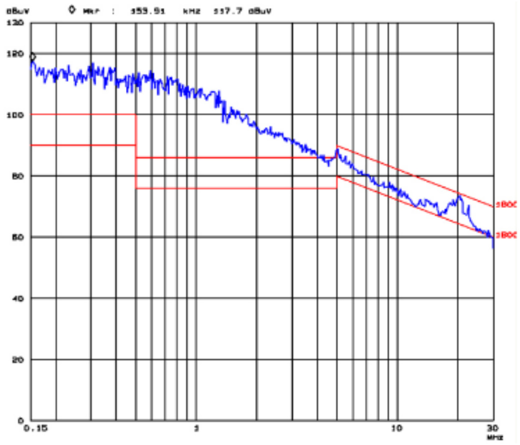
**1.** Since interferences are suppressed by installing an earthed capacitor in the filter, the amount of current to ground (leakage current) could result in electric shocks to personnel or the power system. Please be aware of this problem.

**2.** Since the leakage current to ground can be high, it is crucial to implement protective earthing to prevent electrical shocks.

## Filter Installation (With and Without)



<15m@60Hz with EMI Filter>



<15m@60Hz without EMI Filter>

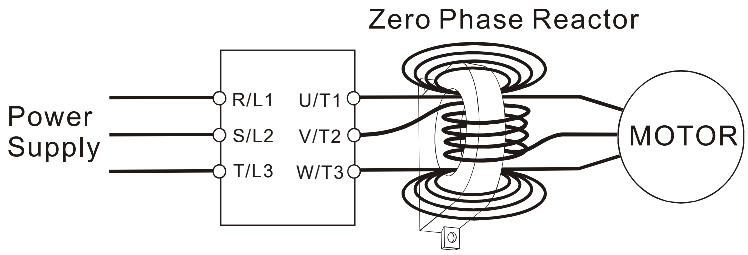
## Zero Phase Reactor (Choke)

Interferences can also be suppressed by installing a zero phase reactor at the power supply side and/or the AC Motor Drive's output, depending on where the interference is. Since currents are large at the power input and the AC Motor Drive's output, please carefully select the magnetic core with suitable current handling capability. An ideal magnetic material for large currents is compound magnetic powder. It has a higher current handling capability and higher impedance compared to pure metallic magnetic cores. It is therefore suitable to implement in a high frequency environment. The impedance can also be enhanced by increasing the turn ratio.

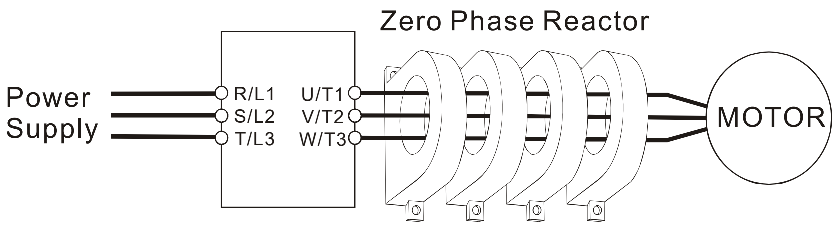
## Zero Phase Reactor Installation

There are two installation methods, depending on the size of the zero phase reactor and the motor cable length.

1. Wind the motor cable through the middle of a zero-phase reactor four times. Place the reactor and the AC Motor Drive as close to each other as possible.



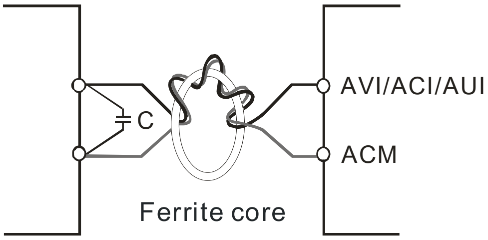

2. Place all wires through the middle of four zero-phase reactors without winding.



## Analog Input Signals

If the analog input signals are affected by noise from the AC motor drive, please connect a capacitor and a ferrite core as indicated in the following diagram.

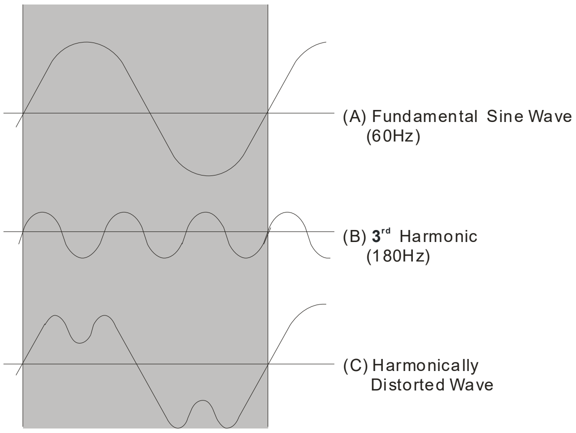
Wind the wires around the core in same direction for 3 times or more.

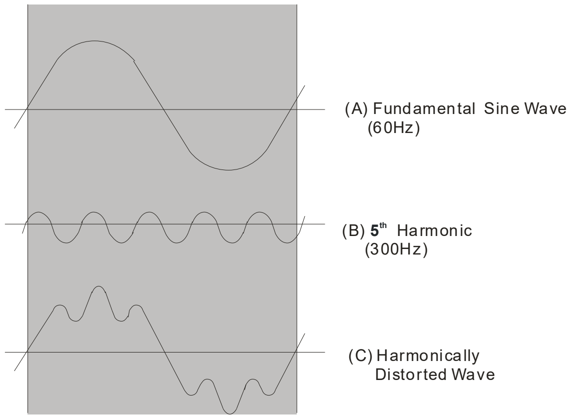



# 5.2 Harmonic Interference

The AC motor drive's input current is non-linear, the input rectifier generates harmonics. Harmonics must be limited to within a certain range to avoid impact the mains power and to avoid current distortion to ensure surrounding devices are not influenced. An AC Motor Drive with built-in DC reactor suppresses harmonic currents (Total Harmonic Current Distortion THID) effectively and therefore reduces the harmonic voltage peaks (Total Harmonic Voltage Distortion).

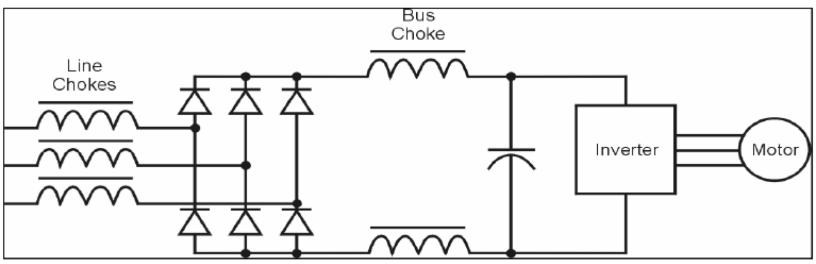
## Harmonic Current at the Power Supply Side




## Suppression of Harmonic Currents

When a large portion of lower order harmonic currents (5th, 7th, 11th, etc.) occur at the power input, surrounding devices will be disturbed and the power factor will be low as a result of reactive power. Installing a reactor at the AC Motor Drive's input effectively suppresses lower order harmonic currents.




## AC Reactor

Installed in series with the power supply and is effective in reducing low order current harmonics.
Features of an AC reactor include:

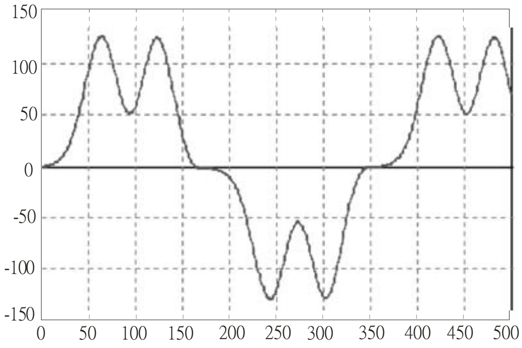
1. Reduces the harmonic currents to the AC Motor Drive and increases the impedance of the power supply.
2. Absorbs interferences generated by surrounding devices (such as surge voltages, currents, and mains surge voltages) and reduce their effect on the AC Motor Drive.
3. Increases the power factor.

## DC Reactor

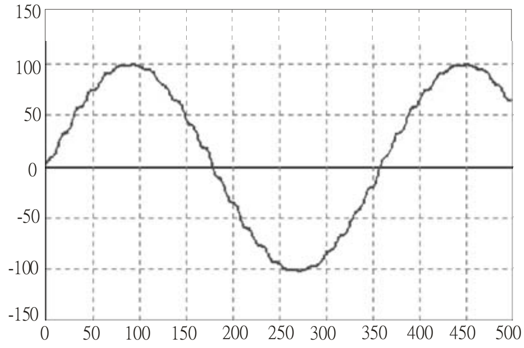
A DC-Reactor is installed between the rectifier and the DC-bus capacitor to suppress harmonic currents and to achieve a higher power factor.

## Current Wave Diagrams

Without Reactor




With Reactor



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# Appendix B. Revision History

Firmware Version: V1.07
Issued Edition: V01
Issued Date: April 2019
Revision History

<table>
<tr><th colspan="2">Newly Added</th></tr>
<tr><th>Description</th><th>Chapter</th></tr>
<tr><td>Copyright notice and limitation of liability added</td><td>Preface</td></tr>
<tr><td>EC 60664-1 for pollution degree 2 added</td><td>Chapter 2</td></tr>
<tr><td>● ”HP” and “Min. Braking Power” columns are added for 6-1 Brake Resistors and Brake Units Used in AC Motor Drives, and notes for 6 and 7 under the tables are also added.<br>● One-phase models for Section 6-2 non-fuse circuit breaker added<br>● Installation precaution for Section 6-5 Zero Phase Reactor added<br>● Recommended maximum wiring gauge reference table for Section 6-5 added</td><td>Chapter 6</td></tr>
<tr><td>● Notes for terminal function table and descriptions for the third item (and hereinafter) for setting the frequency division signal for EMED-PGHSD-1 added<br>● Descriptions for the third item (and hereinafter) for setting the frequency division signal for EMED-PGHSD-2 added</td><td>Chapter 7</td></tr>
<tr><td>Operation, Storage and Transportation Environments\EMC level added</td><td>Chapter 8</td></tr>
<tr><td>● The descriptions for text color under menu item “5. Display Setup” for Section 9-4 Digital Keypad KPC-CC01 Functions added</td><td>Chapter 9</td></tr>
<tr><td>● The curve and descriptions for elevator performance fine-tuning added<br>● Explanations for the auto-tuning steps added:<br>Step 5: Inertia reference value (%)<br>Step 7: (1) Enable slip compensation (VF, SVC), (2) Comfort adjustment for normal operation (FOCPG, FOCPM), and (4) DC brake adjustment.</td><td>Chapter 10</td></tr>
<tr><td>Parameter settings and detailed descriptions added:<br>● Parameter Group 01: 01-33–01-40<br>● Parameter Group 02: 02-11–02-22 function setting #49<br>● Parameter Group 04: 04-15<br>● Parameter Group 06: 06-68–06-72, 06-73–06-99</td><td>Chapter 11<br>Chapter 12</td></tr>
</table>

| **Major Changes** | |
|---|---|
| Description | Chapter |
| Vdc is corrected to $V_{DC}$；Vac is corrected to $V_{AC}$. | All sections |
| “Before Using” updated | Preface |
| ● For Section 1-5 RFI Switch, all “cut off RFI short circuit cable” is corrected to “remove RFI switch”, "according to IEC 61800-3" is deleted, one “RFI capacitor” is corrected to “RFI switch” for particular attention under Isolating Main Power from Ground.<br>● Figure, dimension, and notes for Frame C are updated in Section 1-6 Dimensions. | Chapter 1 |
| Models’ information about horsepower and capacity are combined into one table for Section 2-2 Minimum Mounting Clearance. | Chapter 2 |
| Frame E wring diagram (braking resistor added) updated | Chapter 3 |
| Main circuit diagram for frame E updated (braking resistor added) | Chapter 4 |
| ● Figures for control board switch are respectively placed into the Default (NPN mode) column for SG1+ and SG1- terminals and SW2 terminal.<br>● The figure for AUI and AUI2 analog voltage frequency updated<br>● Descriptions for AFM1 and AFM2 Default (NPN mode) are combined into one column. | Chapter 5 |
| ● Table for brake resistors and brake units used in AC motor drives updated: table is changed from one to two (10% ED and 30% ED), “Braking Resistor Value Spec. for Each AC Motor Drive” column is deleted, “Braking Resistor Value Spec. for Each AC Motor Drive” column is corrected to “Delta’s Part No.”, values in the tables are all updated, note 1 under the tables are updated.<br>● Section 6-4 AC/DC Reactor all updated<br>● Zero phase reactors are changed into two types: casing with mechanical fixed part and casing without mechanical fixed part<br>● Diagrams for installing zero phase reactors are changed into two methods: single turn and multi-turn.<br>● Zero phase reactor models for input side (R/S/T) of 220V and 460V models updated. Zero phase reactor models for output side (U/V/W) of 220V and 460V models deleted.<br>● Figures for EMC filters updated<br>● Menu items under MENU key for KPC-CC01 keypad functions are corrected to 13 items and unsupported item 4, 5 and 7 are noted.<br>● HAND and AUTO keys for KPC-CC01 keypad functions are corrected to “no function”<br>● LED function descriptions updated<br>● The method for downloading the driver file (IFD6530_Drivers.exe) is changed from CD to URL address. | Chapter 6 |

| Major Changes | |
|---|---|
| Description | Chapter |
| ● The table for screw specification for optional card terminal is deleted and screw specifications are respectively placed into the right bottom corner for each PG card figure.<br>● The number of PG cards for Vertical View of the Motor Drive & Screw Specifications are corrected from two to three: EMED-PGABD-1, EMED-PGHSD-1 and EMED-PGHSD-2.<br>● Applicable encoders for EMED-PGHSD-1 and EMED-PGHSD-2 updated<br>● EMED-PGABD-1\Terminal TB2\Terminals A/O and B/O\ SW2 is corrected to SW3 in Descriptions column<br>● EMED-PGHSD-2 (Terminal TB2) pin definitions depend on the encoder type \Terminals\ Change terminal order in the terminal table to match that in the terminal figure, and information of the second row is deleted. "Must set Pr.10-31=1" to terminals C+ and C- for Heidenhain ERN1387 is added.<br>● Terminal UP is corrected into Up.<br>● Terminal Vp is corrected into VP.<br>● Terminal DVin is corrected into Vin. | Chapter 7 |
| ● General Specifications\brake torque updated<br>● General Specifications\certifications updated<br>● Operation temperature updated | Chapter 8 |
| ● Menu items under MENU key for KPC-CC01 keypad functions are corrected to 13 items and unsupported item 4, 5 and 7 are noted.<br>● Unsupported menu items under Section 9-4 Digital Keypad KPC-CC01 Functions are corrected from two items (4 and 5) to three items (4, 5 and 7).<br>● Language selections for Language Setup are corrected to three languages: English, Traditional Chinese and Simplified Chinese and that only these three languages are currently supported are noted.<br>● Subsection 3) Edit Main Page is deleted because the contents are the same as those in subsection 2) Edit Main Page & Example of Download under Section 9-6 TPEditor Installation. | Chapter 9 |
| ● Flow chart for the auto-tuning process updated<br>● Explanations for the auto-tuning steps updated:<br>Step 1: Pr.00-02, Pr.00-14, Pr.00-15, Pr.02-01–02-08, Pr.02-15–02-16 settings<br>Step 2: Encoder Settings<br>Step 3: Pr.00-09 and Pr.01-02 settings,【PM Motor】\Motor Auto-tuning\ Pr.08-00 NOTE1 descriptions, and Pr.08-00 NOTE2 descriptions under Measure the Angle between the Magnetic Pole and the PG Origin.<br>Step 4: Pr.01-12–01-19 NOTE description, and analog setting<br>Step 7: Pr.11-00, Pr.11-06–11-08 settings, (3) Start-up adjustment (FOCPM), | Chapter 10 |

| Major Changes | |
|---|---|
| Description | Chapter |
| Pr.11-00, Pr.10-19, Pr.10-22, Pr.03-00, Pr.07-19, Pr.03-06, Pr.03-09 settings, and (5) Set drive stop. | |
| Parameter settings and detailed descriptions updated:<br>● Parameter Group 00: 00-01, 00-02, 00-09, 00-11, 00-14, 00-15<br>● Parameter Group 01: 01-21, 01-29<br>● Parameter Group 02: 02-01–02-08, 02-10, 02-11–02-22, 02-34, 02-37, 02-38, 02-39, 02-44<br>● Parameter Group 03: 03-00–03-02, 03-17 & 03-20, 03-23 & 03-24<br>● Parameter Group 05: 05-01, 05-05, 05-18, 05-19, 05-21, 05-22<br>● Parameter Group 06: 06-02, 06-03, 06-10, 06-11, 06-16–06-21, 06-28, 06-32–06-43, 06-46, 06-49–06-64<br>● Parameter Group 07: 07-03, 07-11, 07-23, 07-28, 07-29<br>● Parameter Group 08: 08-00<br>● Parameter Group 09: 09-02, 09-04<br>● Parameter Group 10: 10-00, 10-06–10-09, 10-19, 10-24, 10-29, 10-30, 10-31<br>● Parameter Group 11: 11-03, 11-04, 11-05, 11-16–11-18, 11-20<br>● Parameter Group 12: 12-00–12-31<br>● Parameter Group 13: 13-00–13-31 | Chapter 11<br>Chapter 12 |
| Descriptions for warning codes CE01, CE02, CE03, CE04, CE10, CP10, PGF1, PGF4, ot1, ot2, oH3, oSL, FAn, dCAn updated | Chapter 13 |
| Descriptions for fault codes ocA, ocd, ocn, GFF, occ, ocS, ovS, LvA, Lvd, Lvn, LvS, PHL, oH1, tH1o, tH2o, FAn, oL, EoL1, oH3, ot1&ot2, cF1, cF2, cd0, cd1, cd2, cd3, Hd0, Hd1, Hd2, Hd3, PGF1, PGF3, PGF4, EF, EF1, Pcod, cE02, BF, MBF, PGF5, MCF, MPHL, CANF, STL1, PGcd, PGHL, PGAF, PGcd, STO, STL2, STL3 updated | Chapter 14 |
| Descriptions for Suggestions and Error Corrections for Standard AC Motor Drives updated | Chapter 15 |
| ● The descriptions and contents for Table 1 Terminal Function Descriptions updated:<br>The status of photo coupler between channel STO2–SCM2 and STL1 mode (Torque output off) is corrected from ON(Low) to ON(High)<br>● Descriptions and the figure for Section 16-3-3 Control Circuit Wiring Diagram updated (change from ESTOP to Safety Interlock Circuit)<br>● Descriptions for Fault Codes related to STO updated | Chapter 16 |

Firmware Version: V1.07
Issued Edition: V02
Issued Date: January 2020
Revision History

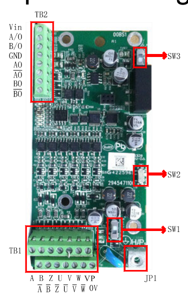
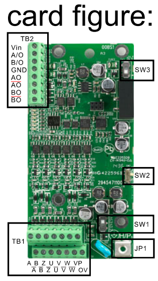
| Section | Subject | Revision/ Addition | Previous Revision | Latest Change |
|---|---|---|---|---|
| 3-1 Wiring | Frame B–E Wiring Diagram MI8 terminal name | Revision | Safety Circuit Feedback | Enable Drive |
| 3-1 Wiring | Figure 2 Emergency Power Supply (EPS) system wiring diagrams Frames C & D | Revision | 48VDC (230V Series)<br>96VDC (460V Series) | 24VDC (230V Series)<br>48VDC (460V Series) |
| 6-1 Brake Resistors and Brake Units Used in AC Motor Drives | Recommended model selection table | Addition | None | Recommended model selection table added |
| | 1. Two model selection tables<br>2. The notes under the tables | 1. Revision<br>2. Revision | 1. Two model selection tables and the notes under the tables<br>2. 7 notes | 1. Two model section tables are divided into two elevator systems: IM and PM (Using Delta's Brake Resistor)<br>2. 5 notes |
| | The diagram and description for NOTE1 Brake Usage ED% | 1. Revision<br>2. Revision<br>3. Addition | 1. …the magnetic contactor (MC) before the drive for additional protection.<br>2. …turn off the power to prevent damage to the brake resistor.<br>3. None | 1. …the magnetic contactor (MC) at the drive mains input for additional protection.<br>2. …turn off the power to prevent damage to the brake resistor and the drive<br>3. NOTE: Never use it to disconnect the brake resistor. |
| | The description for NOTE 4 Brake Units | Addition | None | Download links for braking modules instruction sheet added |
| | The diagram and description for NOTE 6 Thermal Overload Relay | Revision | · Diagram<br>· Description | · Diagram revised<br>· Description revised |
| 6-4 AC / DC Reactor | Applicable Reactors | 1. Revision<br>2. Addition | 1. Three-phase power\titles of AC Input / Output Reactors and DC Reactors<br>2. None | 1. "3%" is added to the title of AC Input / Output Reactors and "4%" is added to the title of DC Reactors<br>2. A note is added under the table: Because Delta's three-phase power drive models fulfill the requirement for EN12015:2014 |

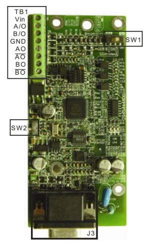
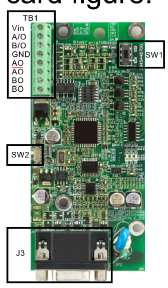
| Section | Subject | Revision/ Addition | Previous Revision | Latest Change |
|---|---|---|---|---|
| | | | | Section 6.6.3 condition a), and in accordance with EN12015:2014 Section 6.7.2 Table 4, use THD <48% to comply with EN12015:2014. |
| 6-5 Zero Phase Reactor | B. Casing without mechanical fixed part\model selection table | Revision | T60006L2160V066<br>Model A diameter: 166.9 mm<br>Model B diameter: 123.9 mm | T60006L2160V066<br>Model A diameter: 123.9 mm<br>Model B diameter: 166.9 mm |
| 7-2 EMED-PGHSD-1 | Terminal name in the specification diagram | Revision | C+, D+ | C, D |
| 7-2 EMED-PGHSD-2 | Terminal name in the specification diagram | Revision | C+, D+ | C, D |
| 10-2 Explanations for the Auto-tuning Steps<br>10-3 Elevator Performance Fine-tuning | 1. Step 7\(3) Start-up adjustment (FOCPM)<br>2. Table for elevator performance fine-tuning | Revision | Information related to Pr.10-23 | Information related to Pr.10-23 deleted |
| 10-3 Elevator Performance Fine-tuning | 3. (See right) | 1. Delete Pr.01-04 and Pr.01-06<br>2. Only Pr.01-08 corresponds to the “start-up adjustment” function<br>3. Delete Pr.10-23 and add Pr.11-06 to make Pr.11-00–Pr.11-06 correspond to the “comfort” function. The functions and settings for Pr.11-00 are revised.<br>4. The “comfort” function is added to the “accelerating” stage (Pr.01-04, Pr.01-06, Pr.11-07, and Pr.11-08)<br>5. The “comfort” function is added to the “high speed” stage (Pr.11-08 and Pr.11-09)<br>6. The “comfort” function is added to the “decelerating” stage (Pr.01-04, Pr.01-06, Pr.11-07, and Pr.11-08)<br>7. The “comfort” function is added to the “leveling” stage (Pr.11-07).<br>8. Move the “elevator parking” function in the “leveling” stage to the “stopping” stage and divide its parameters into “elevator parking” (Pr.01-29, Pr.01-30, and Pr.01-31) function and “comfort” (Pr.11-19) function.<br>9. Change the settings for Pr.11-00 “bit0=1: ASR auto-tuning, enable PDFF” to：<br>"bit0=1：ASR auto-tuning; PDFF enabled; speed bandwidth control enabled" | | |
| Ch12-G02 Digital Input / Output Parameters | The description for Pr.02-10 Digital Input Operation Direction | Revision | For example, set MI1=1 (multi-step speed command 1) and MI2=2 (multi-step speed command 2). Then the | For example, set MI1=1 (multi-step speed command 1) and MI2=2 (multi-step speed command 2). Then the |

| Section | Subject | Revision/ Addition | Previous Revision | Latest Change |
|---|---|---|---|---|
| | | | forward + second step speed command = 1001 (binary) = 9 (Decimal). Pr.02-10=9 through communications and it can move forward at the second step speed. In this case, you do not need to wire any multi-function terminals. | reverse + second step speed command = 1010 (binary) = A (hexadecimal). You only need to set Pr.02-10=A through communications and it can move reverse at the second step speed. In this case, you do not need to wire any multi-function terminals. |
| Ch12-G05 IM Parameters | Pr.05-13 Slip Compensation Gain | Revision | Control Mode: VF/VFPG/SVC | Control Mode: SVC |
| Ch12-G06 Protection Parameters | Pr.06-12 Electronic Thermal Relay | Revision | Settings<br>0: Inverter motor<br>1: Standard motor<br>2: Disabled | Exchange the setting value 0 and 1：<br>Settings<br>0: Standard motor<br>1: Inverter motor<br>2: Disabled |
| Ch12-G09 Communication Parameters | Diagram for PIN definition | Revision | Modbus RS-485 communication port pin definitions | Change to the diagram that matches the terminal block diagram A in Chapter 5 and mark SG+ and SG- with red frames. |
| Ch12-G10 Feedback Control Parameters | Pr.10-00 The corresponding table for the encoder and PG card | Revision | 1. The PG signal type name for setting value 3, 4, 5, and 6.<br>2. Title “Applicable PG Card”<br>3. Rolling test*[1] (Pr.08-00=3 corresponding Pr.10-00=3) | 1. Revise the PG signal type name for the setting value 3, 4, 5, and 6<br>2. Change the title to “Applicable PG Card x=1, 2,…”<br>3. Change the rolling test*[1] to:<br>Pr.11-00 Bit9=0: Rolling test*[1]<br>Pr.11-00 Bit9=1: Static test*[1] |
| Ch12-G11 Advanced Parameters | Pr.11-00 setting bit 0=1 | Revision | bit0=1: ASR auto-tuning, enable PDFF | bit0=1：ASR auto-tuning; PDFF enabled; speed bandwidth control enabled |
| Ch12-G11 Advanced Parameters | The flow chart when Pr.11-00 Bit 0=1 and Bit 0 ≠1 | Revision | The flow chart | Revise the flow chart |
| 1. Pr.02-38 & Pr.02-39 parameter name and<br>2. Pr.02-11– | 1. Star-delta Contactor<br>2. Control output of “star-delta | Revision | Star-delta Contactor | MPSCC (Motor Phase Short Circuit Contactor) |

| Section | Subject | Revision/ Addition | Previous Revision | Latest Change |
|---|---|---|---|---|
| Pr.02-16 MO setting #48 name | contactor" in Chapter 10, 11, and 12. | | | |
| 1. Pr.06-16–Pr.06-21 Fault Record<br>2. Pr.06-30 Fault Output Setting Method<br>3. Pr.06-22–Pr.06-25 Fault Output Option\ fault code description<br>4. Chapter 14 fault code ID60 BF fault | Fault cod ID60 "brake chopper" & "brake resistor" | Revision | p.11-16<br>60: Brake chopper error (BF)<br><br>p.12-49<br>60: Brake chopper error (BF)<br><br>p.12-51<br>60: Brake chopper error (BF)<br><br>p.12-53<br>60: Brake chopper error (BF)<br><br>p.14-8 ID60<br>Brake resistor fault | p.11-16<br>60: Brake transistor error (BF)<br><br>p.12-49<br>60: Brake transistor error (BF)<br><br>p.12-51<br>60: Brake transistor error (BF)<br><br>p.12-53<br>60: Brake transistor error (BF)<br><br>p.14-8 ID60<br>Brake transistor fault |
| 1. Pr.02-11–Pr.02-16<br>2. Pr.07-00 | 1. MO setting #14 and MO setting #19<br>2. Pr.07-00 "brake chopper" | Revision | MO#14, M#O19<br>14: Brake chopper signal<br><br>19: Brake chopper output error<br><br>Pr.07-00<br>Brake Chopper Level | MO#14, MO#19 (p.11-8, p.12-24, p.12-26)<br>14: Brake transistor signal<br><br>19: Brake transistor output error<br><br>Pr.07-00 (p.11-21 & p.12-64)<br>Brake Transistor Level |

Firmware Version: V1.09
Issued Edition: V01
Issued Date: October 2020
Revision History

| Section | Subject | Revision / Addition / Deletion | Previous Revision | Latest Change |
|---|---|---|---|---|
| 02 Installation | Add four derating diagrams as Section 2-3 | Addition | Four derating diagrams | 2-3 Derating Curve for Ambient Temperature, Altitude and Carrier Frequency |
| 2-1 Mounting Clearance | No installation of one drive below another one for VFD-ED. So revise the description at top of Section 2-1. | Revision | Install the AC motor drive in a metal cabinet. When installing one drive below another one, use a metal separator between the AC motor drives to prevent mutual heating and to prevent the risk of fire. | Install the AC motor drive in a metal cabinet to prevent the risk of fire. |
| 3-1 Wiring | Frame B–E Wiring Diagram | 1. Addition<br>2. Deletion<br>3. Addition | 1. None<br>2. “I/O card expansion slot”<br>3. None | 1. Power input and motor output diagram added<br>2. “I/O card expansion slot” deleted<br>3. Symbols of “main circuit terminal” and “control terminal” at the right bottom corner of the wiring diagram are added |
| 07 Option Cards | Add a description that option cards do not support hot swapping to top of Chapter 07. | Addition | None | Note that the option cards do not support hot swapping. Turn off the drive power before installing or removing the option cards. |
| 7-1 EMED-PGABD-1 | 1. Add EOL information below the option card figure<br>2. Add option card “EMED-PGABD-2” to the title of Section 7-1<br>3. Update option card figure | 1. Addition<br>2. Addition<br>3. Revision | 1. None<br>2. EMED-PGABD-1<br>3. Option card figure:<br> | 1. * EMED-PGABD-1 is to be phased out in the first quarter of year 2021, and will be pin-to-pin replaced by EMED-PGABD-2 after EOL.<br>2. EMED-PGABD-1, EMED-PGABD-2<br>3. Updated option card figure:<br> |

| Section | Subject | Revision / Addition / Deletion | Previous Revision | Latest Change |
|---|---|---|---|---|
| 7-1 EMED-PGABD-1 | 1. Revise the section of “Different Types of Encoder Output”<br>2. Add two notes | 1. Revision<br>2. Addition | 1. Four diagrams of output applications<br>2. NOTE item 1 and 2:<br>· Verify that the SW1 is set to the correct output voltage before powering ON.<br>· Keep the motor drive wiring away from any high voltage lines to avoid interference. | 1. Descriptions of four output applications and 11 diagrams<br>2. Add item 3 and 4 to NOTE:<br>· When using push-pull output and voltage output, short-circuit A, B, Z to 0V.<br>· When using open collector output, short-circuit A, B, Z to VP. |
| 7-2 EMED-PGHSD-1 | 1. Add EOL information below the option card figure<br>2. Add option card “EMED-PGHSD-3” to the title of Section 7-2<br>3. Update option card figure | 1. Addition<br>2. Addition<br>3. Revision | 1. None<br>2. EMED-PGHSD-1<br>3. Option card figure:<br> | 1. * EMED-PGHSD-1 is to be phased out in the first quarter of year 2021, and will be pin-to-pin replaced by EMED-PGHSD-3 after EOL.<br>2. EMED-PGHSD-1, EMED-PGHSD-3<br>3. Updated option card figure:<br> |
| 7-3 EMED-PGHSD-2 | 1. Add EOL information below the option card figure<br>2. Add option card “EMED-PGHSD-4” to the title of Section 7-3 | Addition | 1. None<br>2. EMED-PGHSD-2 | 1. * EMED-PGHSD-2 is to be phased out in the first quarter of year 2021, and will be pin-to-pin replaced by EMED-PGHSD-4 after EOL.<br>2. EMED-PGHSD-2, EMED-PGHSD-4 |

| Section | Subject | Revision / Addition / Deletion | Previous Revision | Latest Change |
|---|---|---|---|---|
| 8-1 230V Series<br>8-2 460V Series | Make the numbers integral | Revision | 4.0<br>12.0<br>20.0<br>24.0<br>30.0<br>45.0<br>58.0<br>77.0<br>87.0<br>132.0<br>161.0 | 4<br>12<br>20<br>24<br>30<br>45<br>58<br>77<br>87<br>132<br>161 |
| 08 Specifications\ General Specifications\ Brake Torque | Revise the description of brake torque | Revision | About 20% (while using optional braking resistor, about 125%, 30% ED) | About 125% while ED is 30% (use optional brake resistor)<br>Note: ED is “Executive Duty |
| 08 Specifications\ General Specifications\ Certifications | Add new certification “KC” | Addition | CE, UL, TUV, EAC, RCM, RoHS, EN81-1+A3, EN81-20: 2014 | CE, UL, TUV, EAC, RCM, RoHS, EN81-1+A3, EN81-20: 2014, **KC** |
| 08 Specifications\ General Specifications | Add title “General Specifications” as Section 8-3 | Addition | General Specifications | **8-3** General Specifications |
| 9-4 Digital Keypad KPC-CC01 Functions\ 7. Language Setup | Add Turkish and Russian | Addition | 1. English<br>2. 繁體中文<br>3. 简体中文<br>NOTE: VFD-ED only supports these three languages currently. | 1. English<br>2. 繁體中文<br>3. 简体中文<br>4. Türkçe<br>5. Русский<br>NOTE: VFD-ED only supports these five languages currently. |
| 10 Auto-tuning Process | Update all contents for Chapter 10 | Revision | See manual for details:<br>FW Version: V1.07<br>Issued Edition: V02 | See manual for details:<br>FW Version: V1.09<br>Issued Edition: V01 |
| 11 Summary of Parameter Pr.00-00 | Delete setting value 8 because there is no such power | Deletion | 8: 230V, 3HP | Delete “8: 230V, 3HP” |
| 11 Summary of Parameter Pr.00-00 | Add kW information to each setting value | Addition | 108: 220 V, 3 HP (single-phase)<br>110: 220 V, 5 HP (single-phase)<br>10: 230V, 5 HP<br>11: 460V, 5 HP (4.0 kW)<br>12: 230V, 7.5 HP<br>13: 460V, 7.5 HP<br>14: 230V, 10 HP<br>15: 460V, 10 HP<br>16: 230V, 15 HP<br>17: 460V, 15 HP<br>18: 230V, 20 HP<br>19: 460V, 20 HP | 108: 220 V, 2.2 kW, 3 HP (single-phase)<br>110: 220 V, 3.7 kW, 5 HP (single-phase)<br>10: 230V, 4.0 kW, 5 HP<br>11: 460V, 4.0 kW, 5 HP<br>12: 230V, 5.5 kW, 7.5 HP<br>13: 460V, 5.5 kW, 7.5 HP<br>14: 230V, 7.5 kW, 10 HP |

| Section | Subject | Revision / Addition / Deletion | Previous Revision | Latest Change |
|---|---|---|---|---|
| | | | 20: 230V, 25 HP<br>21: 460V, 25 HP<br>22: 230V, 30 HP<br>23: 460V, 30 HP<br>24: 230V, 40 HP<br>25: 460V, 40 HP<br>26: 230V, 50 HP<br>27: 460V, 50 HP<br>29: 460V, 60 HP<br>31: 460V, 75 HP<br>33: 460V, 100 HP | 15: 460V, 7.5 kW, 10 HP<br>16: 230V, 11 kW, 15 HP<br>17: 460V, 11 kW, 15 HP<br>18: 230V, 15 kW, 20 HP<br>19: 460V, 15 kW, 20 HP<br>20: 230V, 18.5 kW, 25 HP<br>21: 460V, 18.5 kW, 25 HP<br>22: 230V, 22 kW, 30 HP<br>23: 460V, 22 kW, 30 HP<br>24: 230V, 30 kW, 40 HP<br>25: 460V, 30 kW, 40 HP<br>26: 230V, 37 kW, 50 HP<br>27: 460V, 37 kW, 50 HP<br>29: 460V, 45 kW, 60 HP<br>31: 460V, 55 kW, 75 HP<br>33: 460V, 75 kW, 100 HP |
| 11 &12 Pr.00-04 Content of Multi-function Display | 1. Revise all descriptions for each setting value<br>2. Add abbreviation and unit for each setting value<br>(except those "reserved" and setting value 35) | 1. Revision<br>2. Addition | See manual for details:<br>FW Version: V1.07<br>Issued Edition: V02 | See manual for details:<br>FW Version: V1.09<br>Issued Edition: V01 |
| 11 &12 Pr.00-06 Software Version | Revise the default setting value | Revision | #.## | ##.## |
| 12 Pr.00-08 Password Set | Revise description to make the password set flow clearer | Revision | Sets a password to protect your parameter settings.<br>If the display shows 0, no password is set or the password in Pr.00-07 is not correct.<br>When the display shows 0, you can change all parameters, including Pr.00-08.<br>The first time you can set a password directly. After you successfully set the password, the display shows 1.<br>Be sure to record the password for later use. | This parameter is for setting the password protection. Password can be set directly the first time. After you set the password, the value of Pr.00-08 is 01, which means password protection is activated. However, if the value of Pr.00-08 is 00, the password protection is deactivated, which means you can change any of the parameter settings (including resetting the parameter protection password for |

| Section | Subject | Revision / Addition / Deletion | Previous Revision | Latest Change |
|---|---|---|---|---|
| | | | To cancel the parameter lock, set this parameter to 0 after setting correct password in Pr.00-07. The password consists of 2–5 digits. | Pr.00-08). When Pr.00-08 is 01 and if you want to change any of the parameter settings, you must enter the correct password in Pr.00-07 to deactivate the password, and this would make Pr.00-08 become 00. Note that if you set this parameter to 00 again, the password protection function is permanently deactivated. Otherwise, password protection is always reactivated after you reboot the motor drive. If you want to change any of the parameter settings after rebooting the motor drive, enter the correct password in Pr.00-07 to deactivate the password. |
| 12 Pr.00-08 Password Decode Flow Chart | Incorrect fault code after three wrong attempts | Revision | P code | Pcod |
| 11 & 12 Pr.01-10 Output Frequency Upper Limit | Revise the default setting value | Revision | 120.00 | 400.00 |
| 11 & 12 & 16-4 Pr.02-11 Multi-function Output 1: RA, RB, RC (Relay 1) | Revise the default setting value | Revision | 11 | 0 |
| 11 & 12 & 16-4 Pr.02-12 Multi-function Output 2: MRA, MRB, MRC (Relay 2) | Revise the default setting value | Revision | 1 | 0 |
| 11 & 12 & 16-4 Pr.02-17 | New parameter | Addition | Reserved | Multi-function Output 7: MO3 |
| 11 & 12 & 16-4 Pr.02-18 | New parameter | Addition | Reserved | Multi-function Output 8: MO4 |
| 11 & 12 & 16-4 Pr.02-19 | New parameter | Addition | Reserved | Multi-function Output 9: MO5 |
| 11 & 12 & 16-4 Pr.02-20 | New parameter | Addition | Reserved | Multi-function Output 10: MO6 |
| 12 & 16-4 | Revise bit setting | Addition | MO is none from bit6 to | MOs are MO3 to MO6 |

| Section | Subject | Revision / Addition / Deletion | Previous Revision | Latest Change |
|---|---|---|---|---|
| Pr.02-23 | table due to the change of Pr.02-17–Pr.02-20 | | bit9 | from bit6 to bit9 |
| 11 & 12 Pr.03-15 | New parameter | Addition | Reserved | Load Compensation Auto-tuning (See manual for details) |
| 12 Pr.05-00 Motor Auto-tuning | Update parameter descriptions | Revision | See manual for details: FW Version: V1.07 Issued Edition: V02 | See manual for details: FW Version: V1.09 Issued Edition: V01 |
| 11 & 12 Pr.05-01 | Revise the parameter name and its description | Revision | Motor Full-load Current (See manual for details) | Motor Rated Current (See manual for details) |
| 11 & 12 Pr.05-10 | Revise the parameter name | Revision | Torque Compensation Time Constant | Torque Compensation Low Pass Filter Time |
| 11 & 12 Pr.05-11 | Revise the parameter name | Revision | Slip Compensation Time Constant | Slip Compensation Low Pass Filter Time |
| 11 & 12 Pr.06-31 | Revise the default setting value | Revision | 0 | 1 |
| 11 & 12 Control modes | Delete all “TQCPG” control mode | Deletion | TQCPG control mode | Delete “TQCPG” control mode |
| 11 & 12 Pr.06-44 | Revise the default setting value | Revision | 0.00 | Read only |
| 12 Pr.06-48 | Revise the formula in the parameter description | Revision | $f_{eps\_limit} = \frac{V_{eps\_max}}{01-02} \times 01-01 \times 0.5$ | $f_{eps\_limit} = \frac{V_{eps\_max}}{01-02} \times 01-01$ |
| 11 & 12 & 16-4 Pr.06-49 | Revise:<br>1. Default setting value and setting range (Ch11+Ch12)<br>2. Parameter description (Ch12) | Revision | See manual for details: FW Version: V1.07 Issued Edition: V02 | See manual for details: FW Version: V1.09 Issued Edition: V01 |
| 11 & 12 Pr.07-01 | New parameter | Addition | Reserved | Brake Transistor Hysteresis Voltage (See manual for details) |
| 12 Pr.08-00 Motor Auto-tuning | Update parameter descriptions | Revision | See manual for details: FW Version: V1.07 Issued Edition: V02 | See manual for details: FW Version: V1.09 Issued Edition: V01 |
| 11 & 12 Pr.08-01 | Revise the parameter name and its description | Revision | Motor Full-load Current (See manual for details) | Motor Rated Current (See manual for details) |
| 11 & 12 Pr.10-01 | Revise the parameter name | Revision | Encoder Pulse | Encoder PPR |
| 11 & 12 Pr.11-02 | Revise the parameter name | Revision | Sheave Diameter | Traction Sheave Diameter |
| 11 & 12 Pr.11-03 | Revise the parameter name | Revision | Mechanical Gear Ratio | Gear Ratio |
| 11 & 12 Pr.11-05 | Revise the parameter name | Revision | Inertial Ratio | Mechanical Inertial Ratio |
| 11 & 12 Pr.12-31 | Revise the default setting value | Revision | 0 | 1561 |
| 11 & 12 | Revise the | Revision | 1. Pr.13-30 No Default | 1. Pr.13-00 AC Motor |

| Section | Subject | Revision / Addition / Deletion | Previous Revision | Latest Change |
|---|---|---|---|---|
| Pr.13-30<br>Pr.13-31 | parameter name, setting value and parameter description | | 2. Pr.13-31 No Default | Drive Identity Code<br>2. Pr.13-31 Date Code Y.WKD |
| 12 | Word usage correction | Revision | electromagnetic valve | contactor |
| 13 Warning Codes | Revise due to the change of Pr.06-49 | Revision | Safe Torque Off alarm Cause<br>Safe torque output function is off and Pr.06-49 = 1 or 3. | Safe Torque Off alarm Cause<br>Safe torque output function is off and Pr.06-49 = 0001h or 0003h. |
| 16-5 Timing Diagram Description<br>16-5-2~16-5-5<br>16-5-6~16-5-7 | 1. Revise due to the change of Pr.06-49<br>2. Add two sub-sections: 16-5-6–16-5-7 (originally 16-5-4~ 16-5-5) | 1. Revision<br>2. Addition | See manual for details:<br>FW Version: V1.07<br>Issued Edition: V02 | See manual for details:<br>FW Version: V1.09<br>Issued Edition: V01 |
| 16-6 Fault Codes Related to STO | Revise due to the change of Pr.06-49 | Revision | Safe Torque Off function is enabled while Pr.06-49 is set to 0 or 2. | Safe Torque Off function is enabled while Pr.06-49 is set to 0000h or 0002h. |

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