





Digitized Automation for a Changing World

Delta Compact Multi-Drive MX300 User Manual



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(Original instructions)

Before Use

READ PRIOR TO INSTALLATION FOR SAFETY.



- ☑ Disconnect AC input power before connecting any wiring to the AC motor drive.
- ☑ Turn OFF the AC motor drive power before doing any wiring. A charge with hazardous voltages may remain in the DC bus capacitors even after the power has been turned off for a short time. Do not touch the internal circuits and components before the POWER LED (behind the digital keypad) is OFF.
- ☑ For your safety, measure the remaining voltage with a DC voltmeter on +1/DC+ and DC- and do not start wiring before the voltage drops to a safe level (less than 25 V_{DC}). Installing wiring with a residual voltage may cause personal injury, sparks and short circuit.
- ☑ There are highly sensitive MOS components on the printed circuit boards. These components are especially sensitive to static electricity. Please do not touch these components or the circuit boards before taking anti-static measures.
- ☑ Never reassemble internal components or wiring.
- ☑ Ground the AC motor drive 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 place subjected to high temperature, direct sunlight and inflammables.



- ☑ Never connect the AC motor drive output terminals U, V and W directly to the AC mains circuit power supply.
- ☑ After finishing the wiring of the AC motor drive, check if R/L1, S/L2 and T/L3 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.
- ☑ Rated voltage of power system to install motor drives is as below, make sure that the installation voltage is within the ranges mentioned below while installing the motor drives:
  1. For 230V models, the range is between 170–264V.
  2. For 460V models, the range is between 323–528V.
- ☑ Refer to the table below for short circuit rating:

Model (Power)	Short circuit rating
230V / 460V	5 kA

- ☑ 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 may still remain in the main circuit terminals of the AC motor drive with hazardous voltages.
- ☑ 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 (ex. AC auto-transformer) 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 produces a leakage current of over 3.5mA AC or over 10mA DC on the Protective Earthing conductor, the minimum specifications required of the Protective Earthing conductor to be installed have to comply with the national, local laws and regulations or follow IEC 61800-5-1 to do grounding.

☑ The MX300 series drives are designed for Industrial application. The non-linear load generates harmonic current, when you use the MX300 series drive in a public low-voltage distribution network (such as power supply in a residential building), install suppression devices (for example, one-to-one transformer or input AC reactor) to suppress the possible interferences caused by the harmonic current. Contact Delta for more information.

NOTE:

1. In the figures in this manual, the cover or safety shield is disassembled only when explaining the details of the product. During operation, install the top cover and wiring correctly according to the provisions. Refer to the operation descriptions in the manual to ensure safety.
2. The figures in this instruction are only for reference and may be slightly different depending on your model, but it will not affect your customer rights.
3. The content of this manual may be revised without prior notice. Consult our distributors or download the latest version at http://www.deltaww.com/iadownload_acmotordrive

Table of Contents

Chapter 1 Overview before Use 1-1
1-1 AC Motor Drive Model Confirm 1-2
1-2 Part Names of the AC Motor Drive 1-6
Chapter 2 Installation and Dimensions 2-1
2-1 Unpacking and the Contents 2-2
2-2 Dimensions 2-4
2-3 Mounting Hole 2-9
2-4 Installation 2-11
2-5 Description of non-IP40 protection areas 2-21
Chapter 3 Electrical Wiring 3-1
3-1 Safety Precautions 3-2
3-2 System Wiring Diagram 3-4
3-3 Main Circuit Terminals 3-5
3-4 Control Terminals 3-9
3-5 RFI Jumper and Leakage Current 3-17
3-6 Harmonic Interference Prevention and Control 3-20
3-7 Long Wiring Application 3-21
3-8 Electromagnetic Interference Prevention 3-23
Chapter 4 Operation Interface 4-1
4-1 Built-in Keypad 4-2
4-2 Built-in Keypad Operation Process 4-5
Chapter 5 Initial operation and adjustment 5-1
5-1 Initial startup steps 5-3
5-2 Operation source setting 5-4
5-3 IMVF Adjustment 5-5
5-4 IMSVC Adjustment 5-8
5-5 PMSVC Adjustment 5-12
Chapter 6 Safe Torque Off 6-1
6-1 Basic Function 6-2
6-2 STO Specification 6-3
6-3 Terminal Function 6-5
6-4 Wiring 6-6
6-5 Parameters and Fault Codes 6-8
6-6 Operating Sequential Diagram 6-9
6-7 STO Offline Test 6-17
Chapter 7 Built-in Network 7-1
7-1 Address Setting 7-2
7-2 Modbus communication 7-4
7-3 CANopen Overview (MX300-C models only) 7-18
7-4 EtherCAT Overview (MX300-E models only) 7-39

7-5 PROFINET Overview (MX300-E models only) 7-71
Chapter 8 Troubleshooting 8-1
8-1 Alarm List 8-2
8-2 Warning Codes and Troubleshooting 8-5
8-3 Fault Codes and Troubleshooting 8-38
Chapter 9 Maintenance and Inspections 9-1
9-1 Maintenance and Inspections 9-3
9-2 Fan Kit 9-6
Chapter 10 Optional Accessories 10-1
10-1 Extension Card EMM-D88A -- Extension for 8-point Digital Input / 8-point Digital Output 10-2
10-2 Delta Standard Fieldbus Cables 10-5
10-3 Brake Resistors 10-6
10-4 Magnetic Contactor / Air Circuit Breaker and Non-fuse Circuit Breaker 10-10
10-5 Fuse 10-11
10-6 AC Reactor 10-12
10-7 Zero phase reactor 10-20
10-8 EMC Filter 10-23
10-9 EMC Shield Plate 10-26
10-10 Capacitive Filter 10-28
10-11 Fan Kit 10-30
10-12 Protective cover 10-31
10-13 Removable terminal 10-32
10-14 Digital Keypad 10-35
Chapter 11 Specifications 11-1
11-1 230V Models 11-2
11-2 460V Models 11-4
11-3 General Specifications 11-6
11-4 Environment for Operation, Storage and Transportation 11-7
11-5 Derating Curve 11-8
11-6 Efficiency curve 11-9
Chapter 12 Summary of Parameter Settings 12-1
12-1 Rectifier Module Parameters 12-2
00 Drive Parameters 12-2
02 Digital Input / Output Parameters 12-4
03 Analog Input / Output Parameters 12-6
05 Motor Parameters 12-7
06 Protection Parameters (1) 12-8
07 Special Parameters 12-10
09 Communication Parameters 12-11
14 Protection Parameters (2) 12-14
12-2 Inverter Module Parameters 12-15
00 Drive Parameters 12-15

01 Basic Parameters 12-21
02 Digital Input / Output Parameters 12-24
03 Analog Input / Output Parameters 12-28
04 Multi-Step Speed Parameters 12-30
05 Motor Parameters 12-31
06 Protection Parameters (1) 12-34
07 Special Parameters 12-41
08 High-function PID Parameters 12-44
09 Communication Parameters 12-47
10 Speed feedback parameters 12-49
11 Advanced Parameters 12-50
13 Macro / User-Defined Macro 12-51
14 Protection Parameters (2) 12-52
Chapter 13 Descriptions of Parameter Settings 13-1
13-1 Rectifier module 13-2
13-2 Inverter module 13-29
Chapter 14 Selection Software - DIASelector 14-1
14-1 Introduction 14-2
14-2 Software Download 14-3
14-3 Project Creation 14-5
14-4 Create a Group 14-6
14-5 Multi Drive Configuration 14-7
Chapter 15 DIADesigner Operation 15-1
15-1 DIADesigner Overview 15-2
15-2 Connection to the Inverter 15-4
15-3 Hardware Configuration 15-7
15-4 Parameter Setting 15-9
15-5 Device and Error Information 15-15
15-6 Adaptation 15-18
Appendix A. Revision History A-1

Issued Edition: 03
Firmware Version: Refer to Pr.00-06 on the product for the firmware version.
- Rectifier Module (MX300-C, MX300-E): V1.03
- Inverter Module (MX300-A, MX300-S): V1.03

Issued Date: 2026/03

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Chapter 1 Overview before Use

1-1 AC Motor Drive Model Confirm

1-2 Part Names of the AC Motor Drive

1-1 AC Motor Drive Model Confirm

After receiving the AC motor drive, check for 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 matches the part number indicated on the nameplate.
2. Make sure that the mains voltage is within the range indicated on the nameplate. Install the AC motor drive according to the instructions in this manual.
3. Before applying power, make sure that all devices, including mains power, motor, control board and digital keypad, are connected correctly.
4. When wiring the AC motor drive, make sure that the wiring of input terminals “R/L1, S/L2, T/L3” and output terminals “U, V, W” are correct to prevent damage to the drive.
5. When power is applied, use the digital keypad to select the language and set parameters. When executing a trial run, begin with a low speed and then gradually increase the speed to the desired speed.

1-1-1 Nameplate Information

Rectifier Module

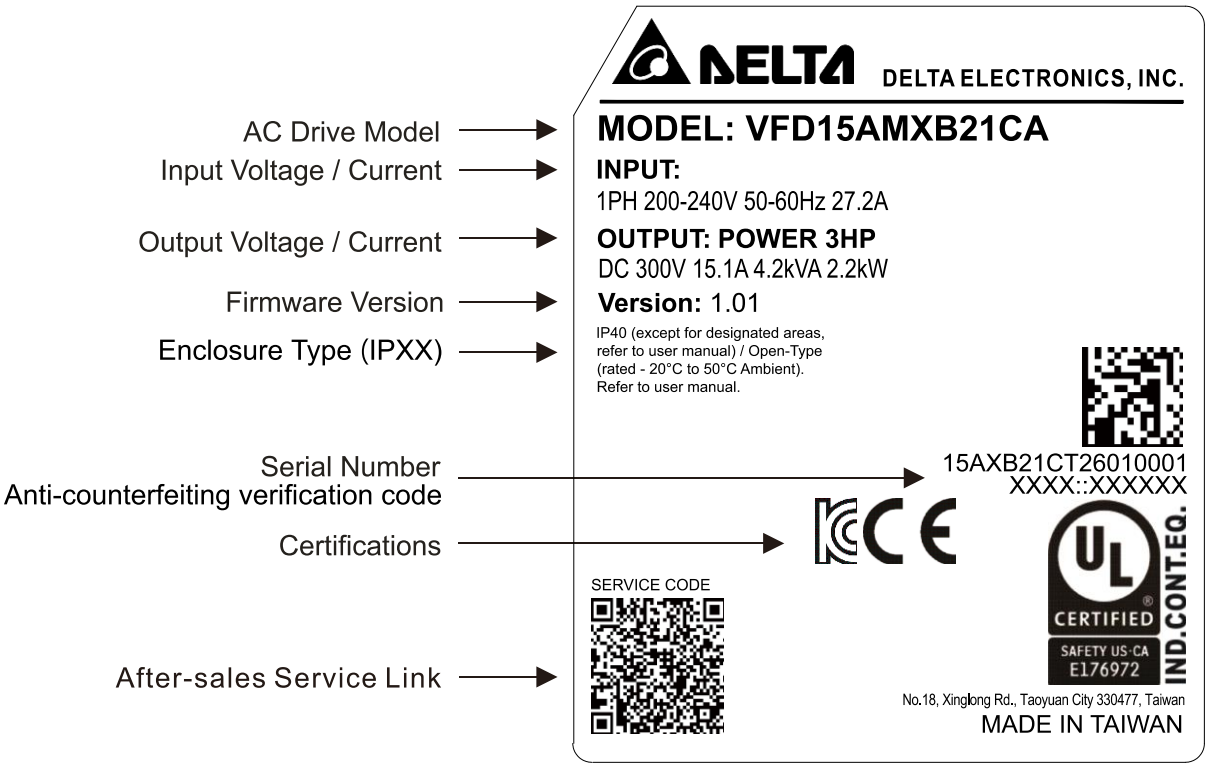


Figure 1-1

Inverter Module

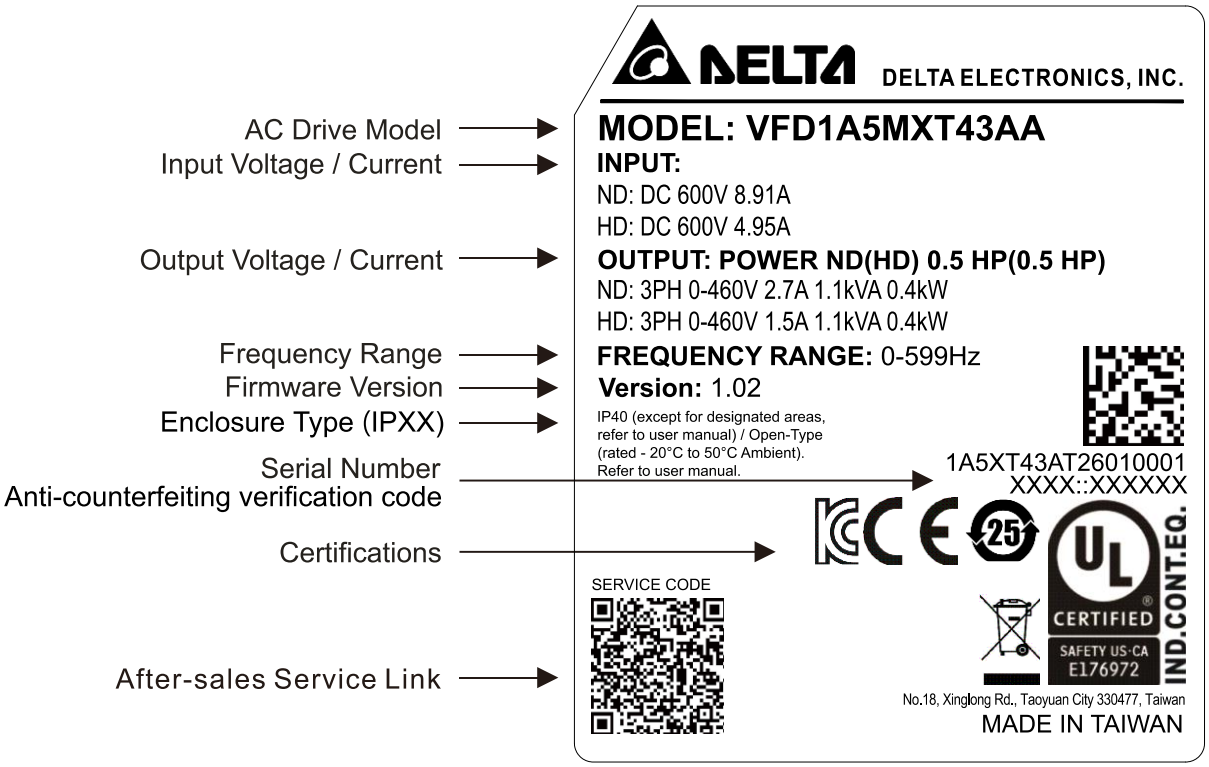


Figure 1-2

After-sales Service Link

Scan QR Code to request service

1. Find the QR code sticker (as shown above).
2. Use a smartphone to run a QR Code reader APP.
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 your information into the column marked with an orange star.
6. Enter the CAPTCHA and click “Submit” to complete the application.

Cannot find the QR Code?

1. Open a web browser on your computer or smartphone.
2. Enter https://service.deltaww.com/us/Repair/Request?type=IA in browser address bar and press the Enter key.
3. Fill your information into the columns marked with an orange star.
4. Enter the CAPTCHA and click “Submit” to complete the application.

1-1-2 Model Name

	[1]	[2]	[3]	[4]	[5]	[6]	[7]
Example	VFD	41A	MX	R	43	C	A

Definition		Description
[1]	Product Name	VFD = Variable Frequency Device (AC Motor Drive)
[2]	Current Specification	Rated output current. Under Heavy duty mode: 150% 60 seconds. (Refer to Chapter 11 Specifications for details.)
[3]	Series	MX = MX300
[4]	Module Name	Rectifier Module: • R = without brake • B = with brake Inverter Module: • S = Single-axis • D = Double-axis • T = Triple-axis
[5]	System Voltage	21 = 230V one-phase 43 = 460V three-phase
[6]	Module	Rectifier Module: • C = CANopen • E = EtherCAT / PROFINET / EtherNet/IP Inverter Module: • A = Standard • S = Built-in STO
[7]	Model Type / Package	A = Single-Module Package T = Multi-Module Package

Table 1-1

1-1-3 Serial Number

	[1]	[2]	[3]	[4]	[5]
Example	41AXB43C	W	24	52	0001

Definition		Description
[1]	Production Model	X: MX300 B: Rectifier Module with brake 43: 460V three-phase
[2]	Production Factory	T: Taoyuan W: Wujiang
[3]	Production Year	2024
[4]	Production Week	Week 52
[5]	Production Number	0001

Table 1-2

1-2 Part Names of the AC Motor Drive

MX300 Product Appearance

MX300-C models:



MX300-E models:



Item	Name	Description
A	Rectifier Module	• MX300-C and MX300-E two types. • Support up to 15 axes and can be installed on the left and right sides of the rectifier module.
B	Single-axis Inverter Module	• MX300-A and MX300-S two types.
C	Double-axis Inverter Module	
D	Triple-axis Inverter Module	

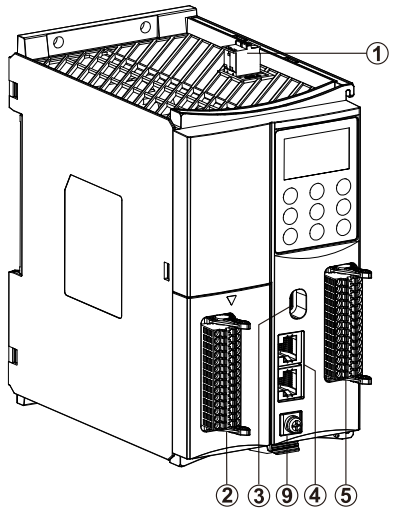
Item	Name	Description
E	Transmission Module	To connect rectifier module and inverter module, support dual or triple inverter modules

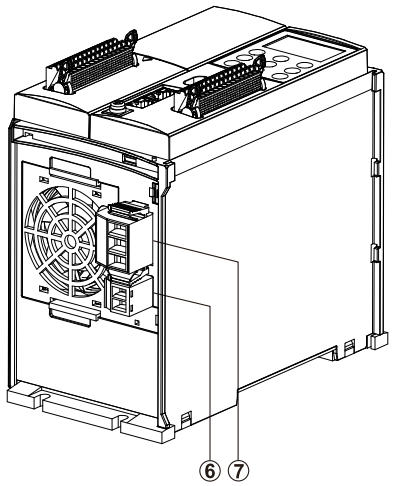
Table 1-3

Parts Description of MX300

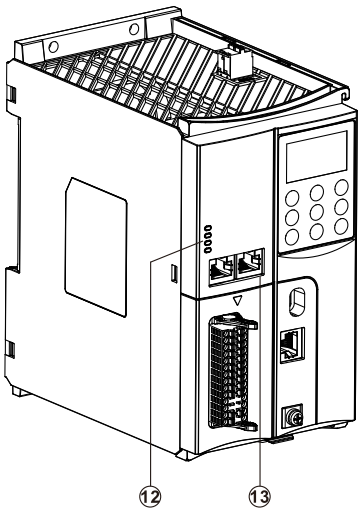
Rectifier module

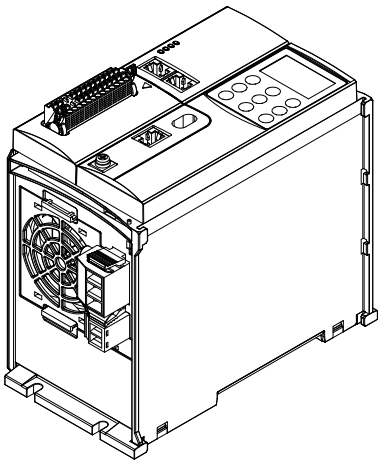
MX300-C models:





MX300-E models:

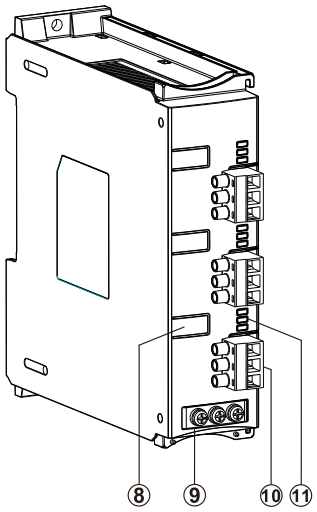




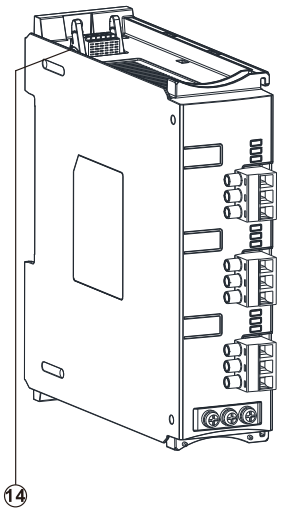
Inverter module

(Take Triple-axis Inverter Module as an example.)

MX300-A models:



MX300-S models:



Item	Name	Description
1	DC 24V Input Power Supply (24V, GND) (CN4)	• Continuous power supply when the main power supply is abnormal to ensure continuous communication.
2	IO Accessory Card (Optional) (CN6)	-
3	Software Operation Interface (CN2)	• Connect to PC software DIADesigner. • The serial communication port is USB type C
4	RS-485 / Canopen Communication Port Connector (CN3)	• MX300-C models support Modbus and CANopen communication control. • MX300-E models support modbus communication control.

<table>
<tr><th>Item</th><th>Name</th><th>Description</th></tr>
<tr><td>5</td><td>I/O Signal Connector (CN1)</td><td>• Digital input: 4 channels
• Digital input / output: 4 channels
• Relay: 1 channel, RA / RB / RC
• Analog input: 2 channels, 0–10 V / 0–20 mA / 4–20 mA</td></tr>
<tr><td>6</td><td>Brake Resistor Interface (B1, B2)</td><td>• The built-in model of the selected brake unit has this interface</td></tr>
<tr><td>7</td><td>Main Circuit Input Power (R, S, T)</td><td>-</td></tr>
<tr><td>8</td><td>Machine Information Paste Place</td><td>-</td></tr>
<tr><td>9</td><td>Ground Terminal</td><td>-</td></tr>
<tr><td>10</td><td>Motor Terminals (U, V, W)</td><td>• Support induction / permanent magnet motor</td></tr>
<tr><td>11</td><td>Inverter Status Indicators
(PWR, RUN, ALM)</td><td>• PWR (Orange): Power indicator light
– On: Power-on state
– Flashing: Digital manipulator / computer operation
– Off: No power state
• RUN (Green): Running indicator light
– On: Running
– Off: Stopping
• ALM (Red): Error indicator ligh
– On: Fault occurs
– Blinking: Warning occurs
– Off: No error and warning</td></tr>
<tr><td>12</td><td>Communication status indicator</td><td><table><tr><th>Communication Type</th><th>Profinet</th><th>EtherCAT</th><th>EtherNet/IP</th></tr><tr><td rowspan="4">Status indicator area</td><td>BF</td><td>ERR</td><td>MS</td></tr><tr><td>RDY/SF</td><td>RUN</td><td>NS</td></tr><tr><td>L/A1</td><td>L/A IN</td><td>-</td></tr><tr><td>L/A2</td><td>L/A OUT</td><td>-</td></tr></table>• Please refer to Chapter 7 Built-in Network Description for detailed indicator light description.</td></tr>
<tr><td>13</td><td>EtherCAT / EtherNet/IP / PROFINET Communication port (CN5)</td><td>• Support EtherCAT, EtherNet/IP anf PROFINET communication control.</td></tr>
<tr><td>14</td><td>STO Thermal (CN7)</td><td>-</td></tr>
</table>

Table 1-4

Chapter 2 Installation and Dimensions

2-1 Unpacking and the Contents

2-2 Dimensions

2-3 Mounting Hole

2-4 Installation

2-5 Description of non-IP40 protection areas

2-1 Unpacking and the Contents

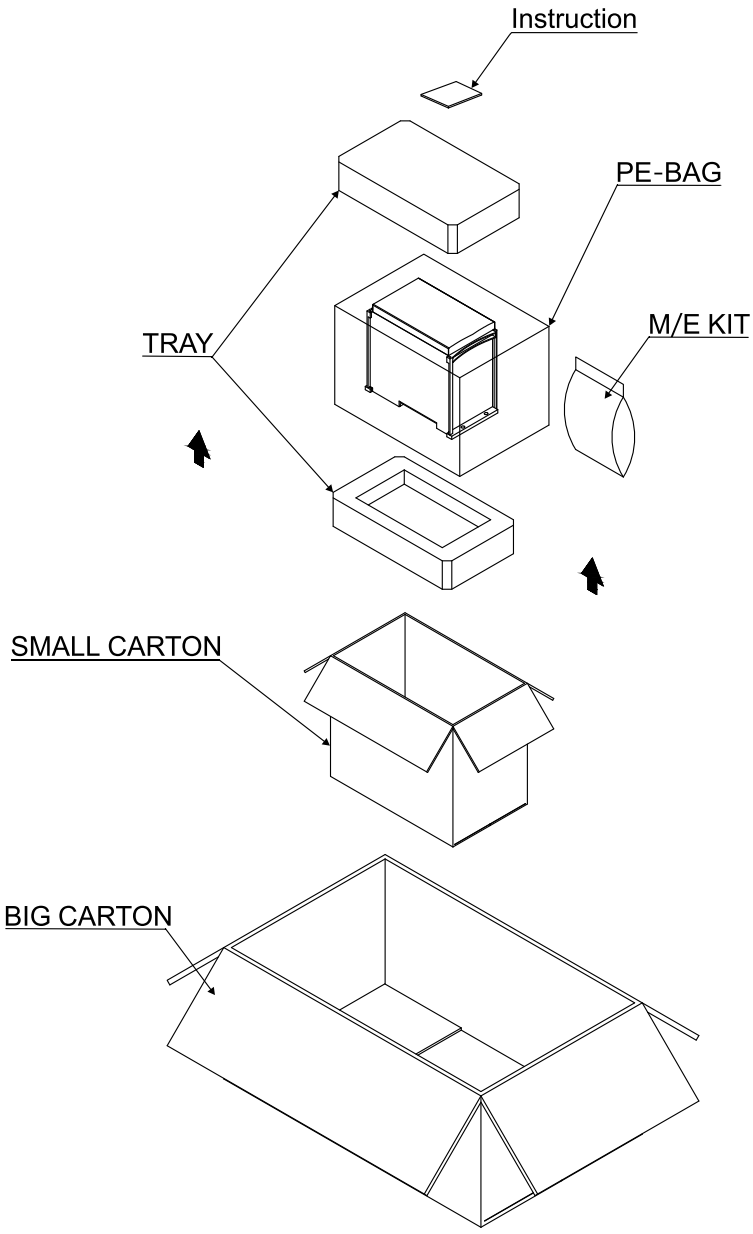
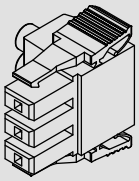
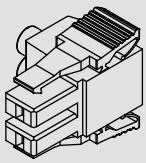
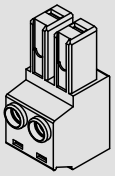
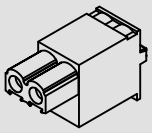
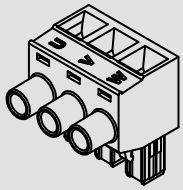
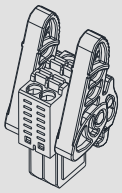
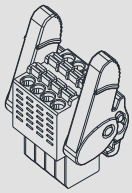
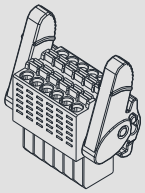


Figure 2-1

Accessories Package

Model	 460V Input Terminal Block (MKM-TBLTRC1)	 230V Input Terminal Block (MKM-TBLTRC2)	 Brake Terminal Block (MKM-TBBKRC)	 24V Terminal Block (MKM-TB24RC)
VFDxxxMXB43Cx	1	0	1	1
VFDxxxMXR43Cx	1	0	0	1
VFDxxxMXB21Cx	0	1	1	1
VFDxxxMXR21Cx	0	1	0	1
VFDxxxMXB43Ex	1	0	1	1
VFDxxxMXR43Ex	1	0	0	1
VFDxxxMXB21Ex	0	1	1	1
VFDxxxMXR21Ex	0	1	0	1

Model	 Output Terminal Block (MKM-TBMTDR)	 Single-axis STO Terminal (MKM-TBSTODR1)	 Double-axis STO Terminal (MKM-TBSTODR2)	 Triple-axis STO Terminal (MKM-TBSTODR3)
VFDxxxMXSxxAx	1	0	0	0
VFDxxxMXDxxAx	2	0	0	0
VFDxxxMXTxxAx	3	0	0	0
VFDxxxMXSxxSx	1	1	0	0
VFDxxxMXDxxSx	2	0	1	0
VFDxxxMXTxxSx	3	0	0	1

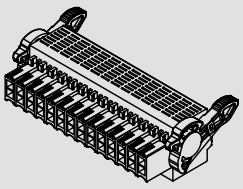
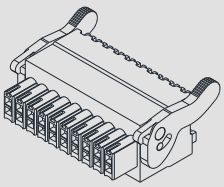
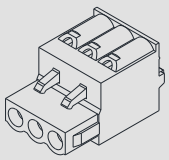
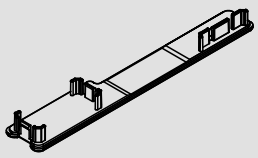
Model	 I/O Terminal Block (MKM-TBIORC)	 I/O Terminal Block (MKM-TBIORC1)	 Relay Terminal Block (MKM-TBRYRC)	 Connector Protection Cover for Rectifier Module (MKM-COVRC)
VFDxxxMXB43Cx	1	1	1	1
VFDxxxMXR43Cx	1	1	1	1
VFDxxxMXB21Cx	1	1	1	1
VFDxxxMXR21Cx	1	1	1	1
VFDxxxMXB43Ex	0	0	0	1
VFDxxxMXR43Ex	0	0	0	1
VFDxxxMXB21Ex	0	0	0	1
VFDxxxMXR21Ex	0	0	0	1

Table 2-1

NOTE:

1. I/O Terminal Block MKM-TBIORC is the version before 2026 Q2 and MKM-TBIORC1 is after 2026 Q2.
2. Relay Terminal Block MKM-TBRYRC is the version after 2026 Q2.

2-2 Dimensions

2-2-1 Rectifier Module (Frame RA)

MX300-C models:

VFD15AMXB21Cx; VFD15AMXR21Cx; VFD25AMXB21Cx; VFD25AMXR21Cx; VFD22AMXB43Cx; VFD22AMXR43Cx; VFD33AMXB43Cx; VFD33AMXR43Cx; VFD41AMXB43Cx; VFD41AMXR43Cx

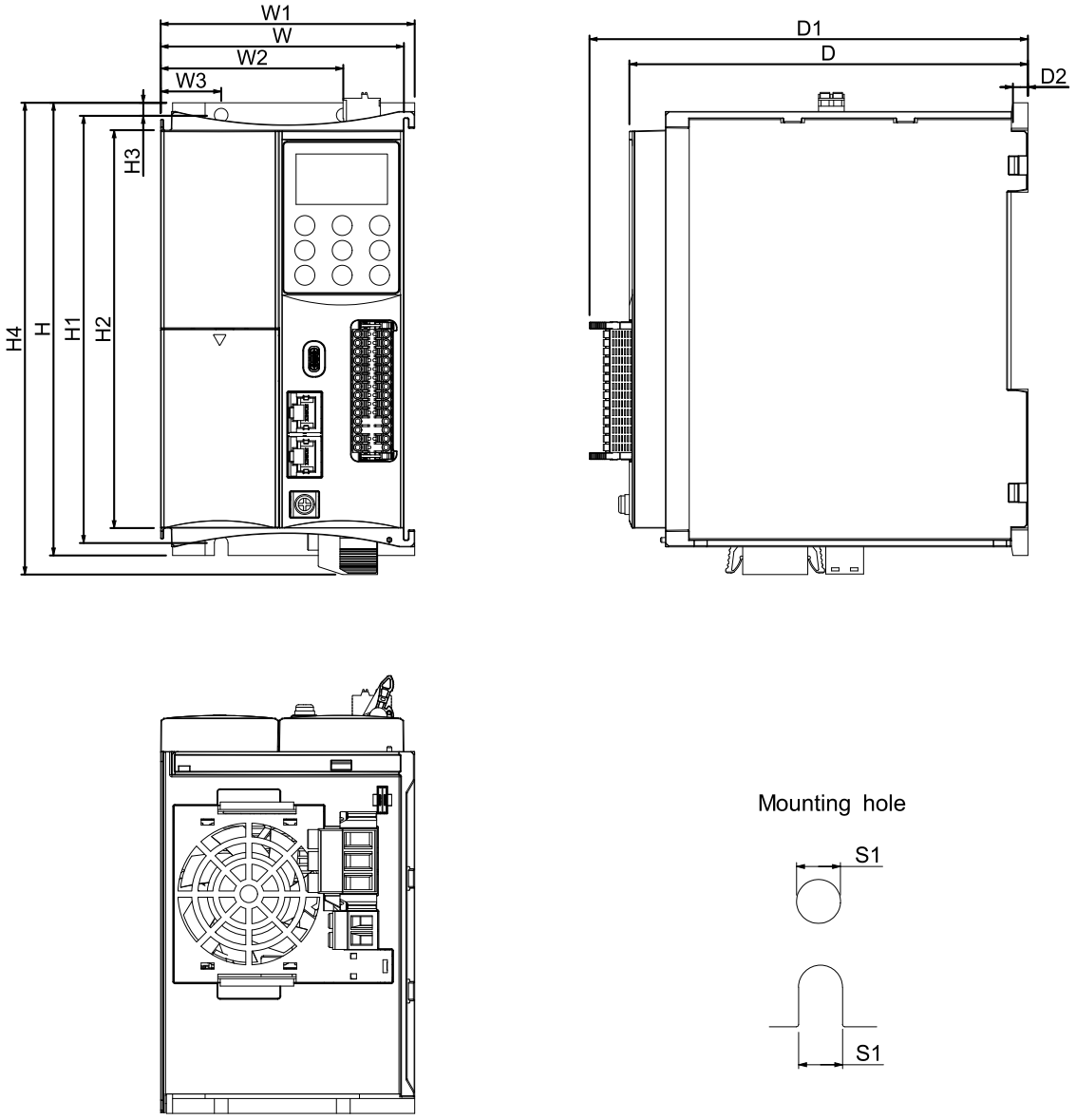


Figure 2-2

Unit: mm (inch)

W	W1	W2	W3	H	H1	H2	H3
97.7 (3.85)	102.0 (4.02)	73.35 (2.89)	24.35 (0.96)	182.0 (7.17)	172.0 (6.77)	160.0 (6.30)	5.0 (0.20)
H4	D	D1	D2	S1			
189.6 (7.46)	160.0 (6.30)	176.0 (6.93)	6.0 (0.24)	5.5 (0.22)			

Table 2-2

MX300-E models:

VFD15AMXB21Ex; VFD15AMXR21Ex; VFD25AMXB21Ex; VFD25AMXR21Ex; VFD22AMXB43Ex; VFD22AMXR43Ex; VFD33AMXB43Ex; VFD33AMXR43Ex; VFD41AMXB43Ex; VFD41AMXR43Ex

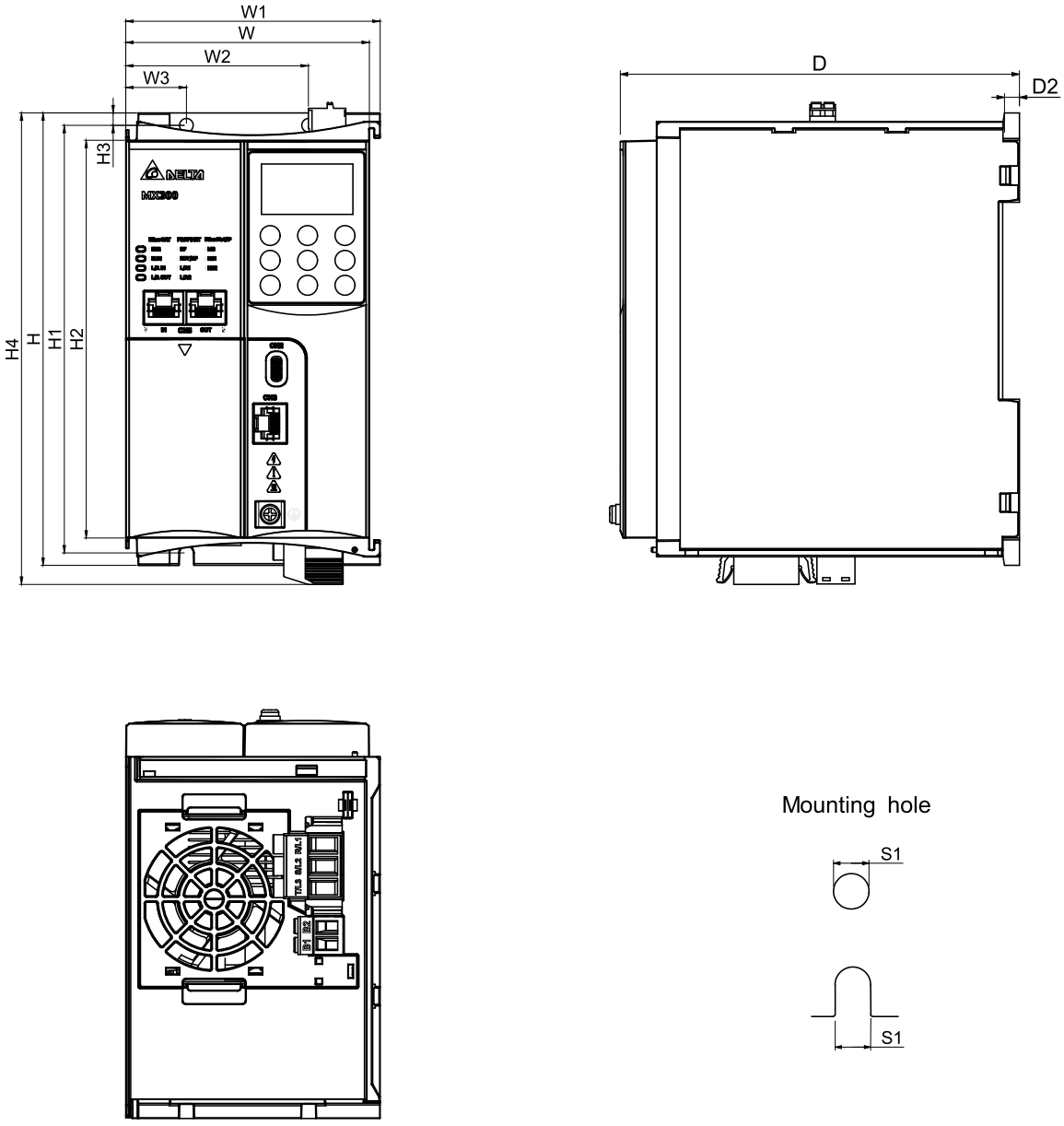


Figure 2-3

Unit: mm (inch)

W	W1	W2	W3	H	H1	H2	H3
97.7 (3.85)	102.0 (4.02)	73.35 (2.89)	24.35 (0.96)	182.0 (7.17)	172.0 (6.77)	160.0 (6.30)	5.0 (0.20)
H4	D	D2	S1				
189.6 (7.46)	160.0 (6.30)	6.0 (0.24)	5.5 (0.22)				

Table 2-3

2-2-2 Inverter Module (Frame IA)

- MX300-A models:
  - Single-axis Inverter Module:
    VFD2A8MXS21Ax; VFD4A8MXS21Ax; VFD7A5MXS21Ax; VFD11AMXS21Ax; VFD1A5MXS43Ax; VFD2A7MXS43Ax; VFD4A2MXS43Ax; VFD5A5MXS43Ax; VFD9A0MXS43Ax; VFD13AMXS43Ax; VFD17AMXS43Ax
  - Double-axis Inverter Module:
    VFD2A8MXD21Ax; VFD4A8MXD21Ax; VFD7A5MXD21Ax; VFD11AMXD21Ax; VFD1A5MXD43Ax; VFD2A7MXD43Ax; VFD4A2MXD43Ax; VFD5A5MXD43Ax; VFD9A0MXD43Ax
  - Triple-axis Inverter Module:
    VFD2A8MXT21Ax; VFD4A8MXT21Ax; VFD7A5MXT21Ax; VFD1A5MXT43Ax; VFD2A7MXT43Ax; VFD4A2MXT43Ax; VFD5A5MXT43Ax

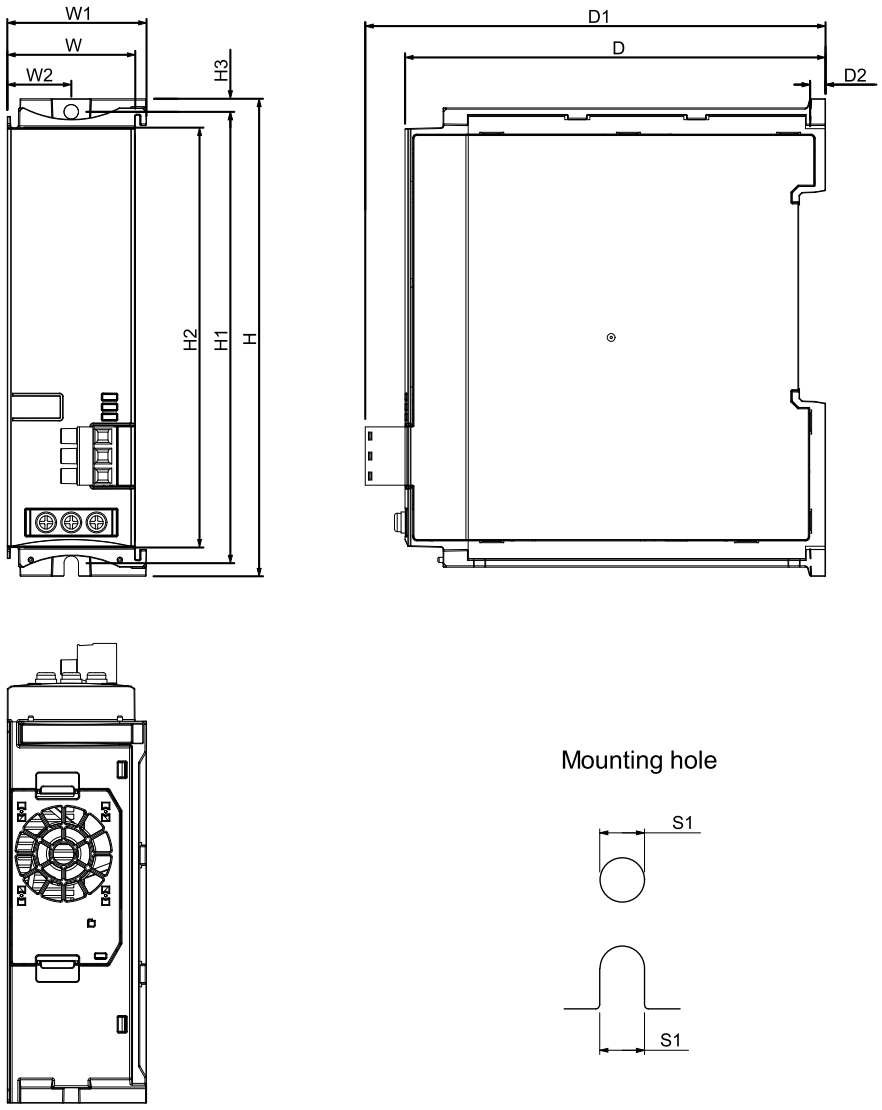


Figure 2-4

Unit: mm (inch)

W	W1	W2	H	H1	H2	H3
48.7 (1.92)	53.0 (2.09)	24.35 (0.96)	182.0 (7.17)	172.0 (6.77)	160.0 (6.30)	5.0 (0.20)
D	D1	D2	S1			
160.0 (6.30)	175.15 (6.90)	6.0 (0.24)	5.5 (0.22)			

Table 2-4

- MX300-S models:
  - Single-axis Inverter Module:
    VFD2A8MXS21SA; VFD4A8MXS21SA; VFD7A5MXS21SA; VFD11AMXS21SA; VFD1A5MXS43SA; VFD2A7MXS43SA; VFD4A2MXS43SA; VFD5A5MXS43SA; VFD9A0MXS43SA; VFD13AMXS43SA; VFD17AMXS43SA
  - Double-axis Inverter Module:
    VFD2A8MXD21SA; VFD4A8MXD21SA; VFD7A5MXD21SA; VFD11AMXD21SA; VFD1A5MXD43SA; VFD2A7MXD43SA; VFD4A2MXD43SA; VFD5A5MXD43SA; VFD9A0MXD43SA
  - Triple-axis Inverter Module:
    VFD2A8MXT21SA; VFD4A8MXT21SA; VFD7A5MXT21SA; VFD1A5MXT43SA; VFD2A7MXT43SA; VFD4A2MXT43SA; VFD5A5MXT43SA

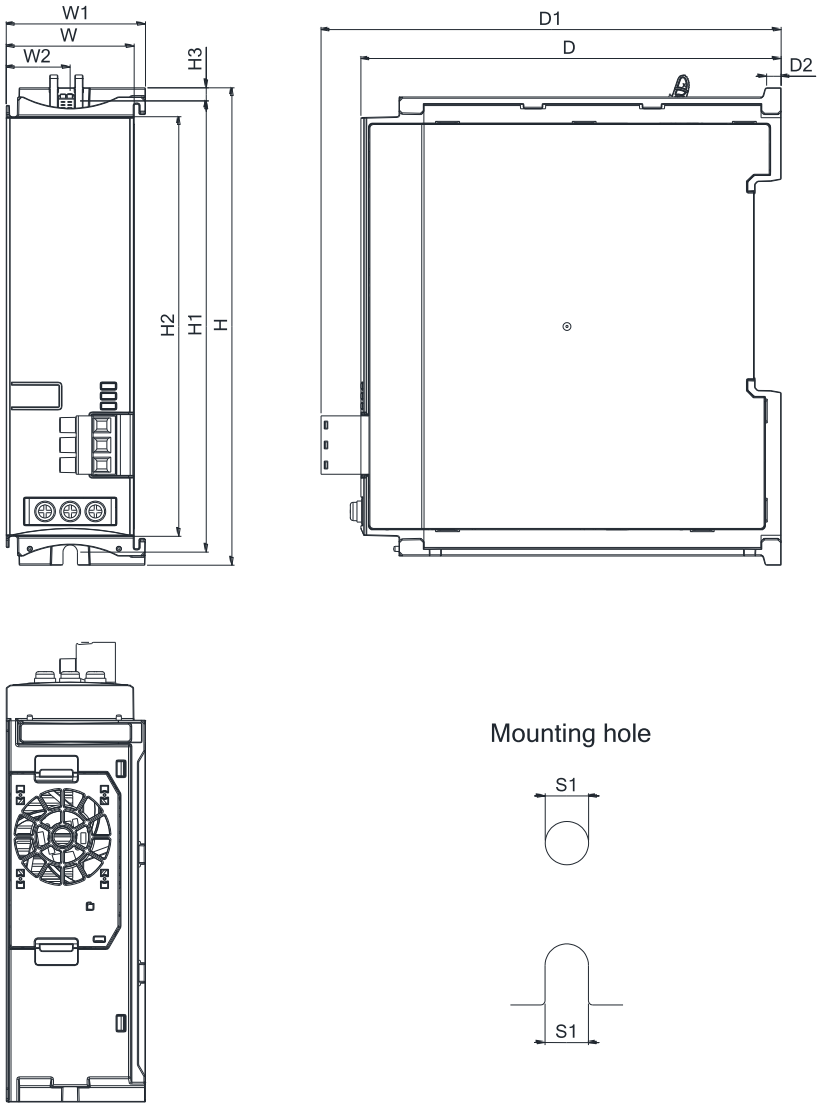


Figure 2-5

Unit: mm (inch)

W	W1	W2	H	H1	H2	H3
48.7 (1.92)	53.0 (2.09)	24.35 (0.96)	182.0 (7.17)	172.0 (6.77)	160.0 (6.30)	5.0 (0.20)
D	D1	D2	S1			
160.0 (6.30)	175.15 (6.90)	6.0 (0.24)	5.5 (0.22)			

Table 2-5

2-2-3 Transmission Module

MKM-DR2M; MKM-DR2MT

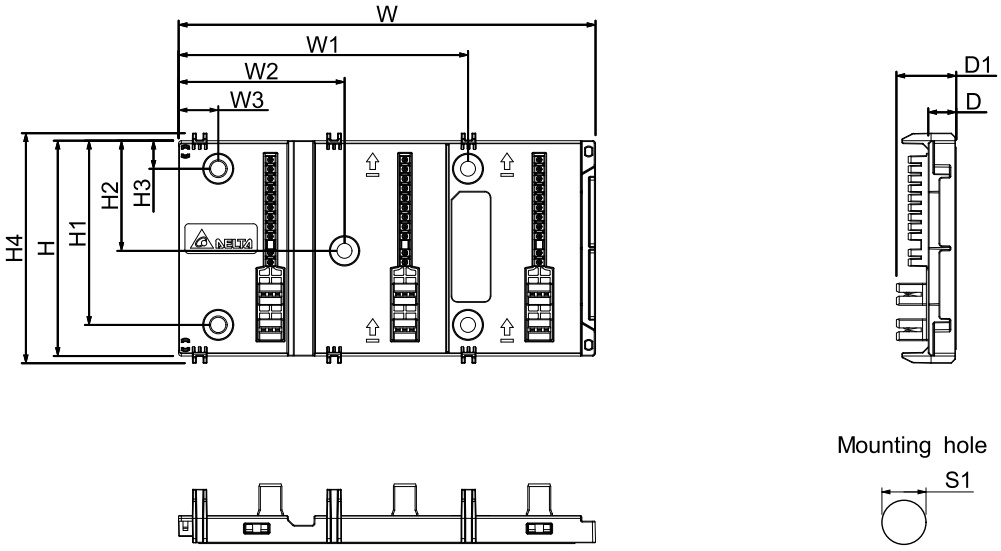


Figure 2-6

Unit: mm (inch)

W	W1	W2	W3	H	H1	H2	H3
151.95 (5.98)	151.95 (5.98)	60.5 (2.38)	14.5 (0.57)	78.6 (3.09)	67.25 (2.65)	40.25 (1.58)	10.25 (0.40)
H4	D	D1	S1				
84.0 (3.31)	10.2 (0.40)	21.8 (0.86)	5.5 (0.22)				

Table 2-6

MKM-DR3M; MKM-DR3MT

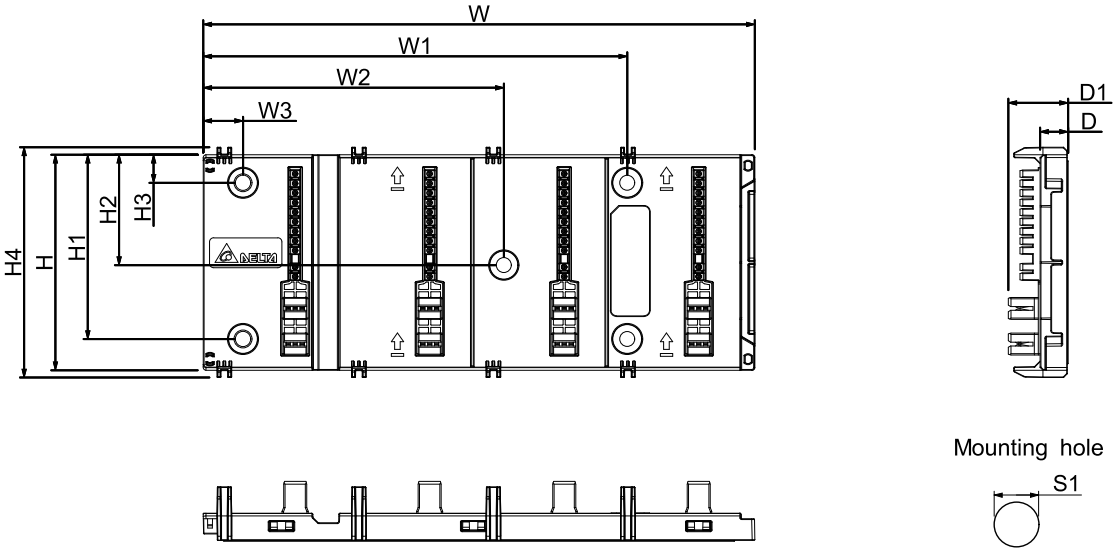


Figure 2-7

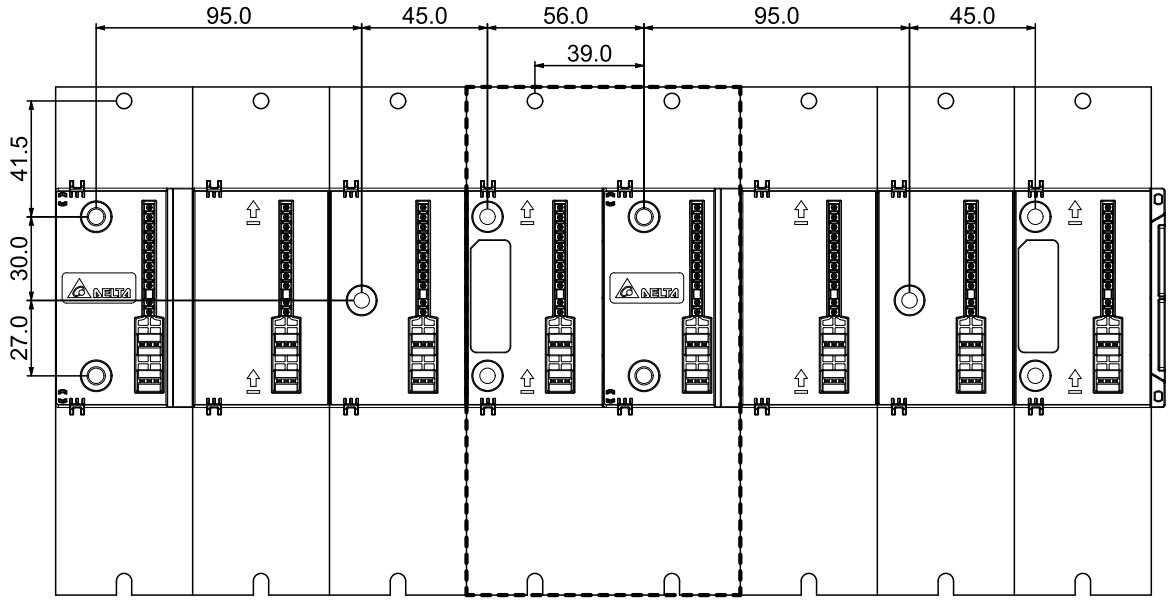
Unit: mm (inch)

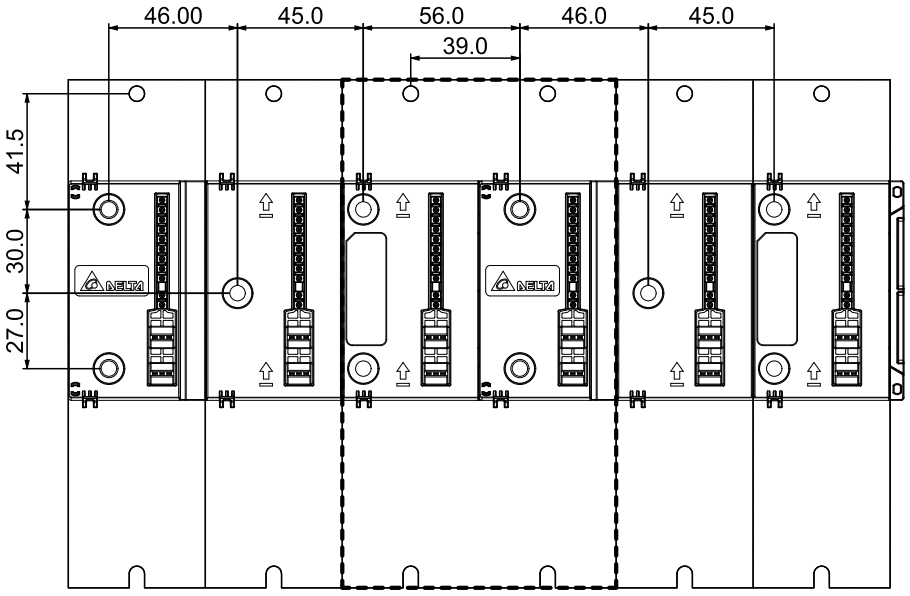
W	W1	W2	W3	H	H1	H2	H3
200.95 (7.91)	154.5 (6.08)	109.5 (4.31)	14.5 (0.57)	78.6 (3.09)	67.25 (2.65)	40.25 (1.58)	10.25 (0.40)
H4	D	D1	S1				
84.0 (3.31)	10.2 (0.40)	21.8 (0.86)	5.5 (0.22)				

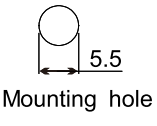
Table 2-7

2-3 Mounting Hole

2-3-1 Transmission Module



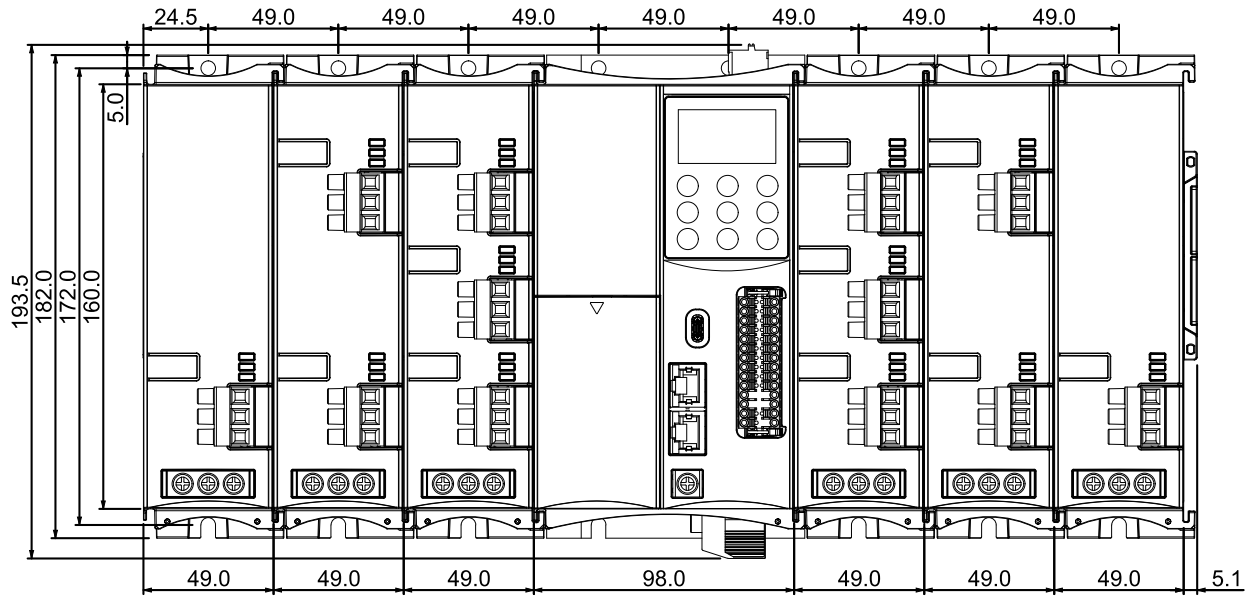


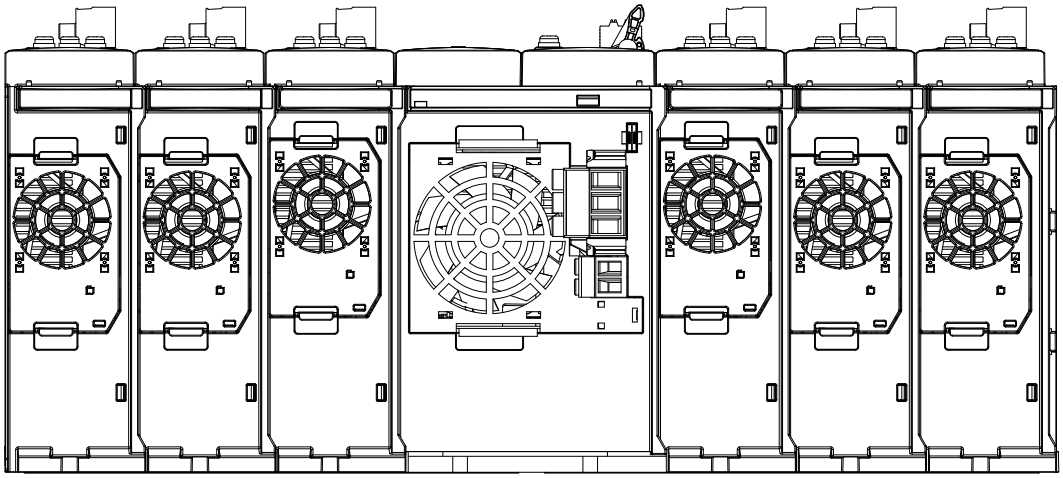


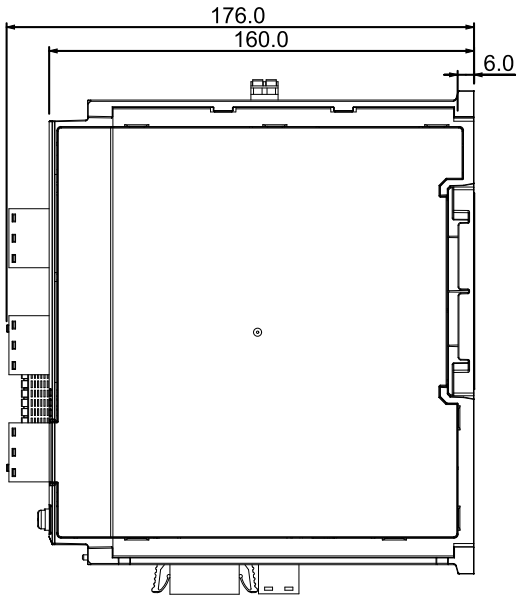
Unit: mm (inch)

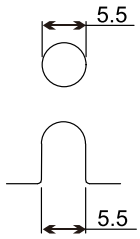
Figure 2-8

2-3-2 power module









Mounting hole

Unit: mm (inch)

Figure 2-9

2-4 Installation

NOTE: Take MX300-C model figures as an example of the rectifier module.

2-4-1 Module Configuration and Axis Number Rules

Module Configuration and Axis Number Rules

☑ A rectifier module can support maximal 6 inverter modules and total 15 axes.

☑ On the right side of the rectifier module:
Maximal 3 inverter modules can be installed on the right side of the rectifier module, and up to a total of 9 axes are supported. The number of axes starts from 1, from top to bottom, from left to right.

☑ On the left side of the rectifier module:
Maximal 3 inverter modules can be installed on the left side of the rectifier module, and up to a total of 6 axes are supported. The number of axes starts from 10, from top to bottom, from right to left.

Correct Configuration Example

Installation	 Figure 2-10
Operation	• On the right side of the rectifier module: 3 triple-axis inverter modules, axis number 1–9. • On the left side of the rectifier module: 2 triple-axis inverter modules, axis number 10–15. • Total 15 axes on the left and right sides of the rectifier module.

Incorrect Configuration Example

Installation	 Figure 2-11
Operation	• The left side of the rectifier module only supports up to 6 axes.

2-4-2 Protection cover

Before installing the module, please install the protection cover on the unused connector ports first to avoid touching or electrical hazards. Refer to the optional accessories MKM-COVBP and MKM-COPRC in Chapter 10 for more information.

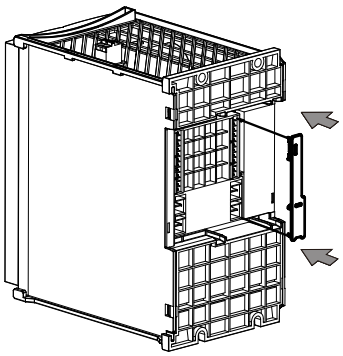


Figure 2-12

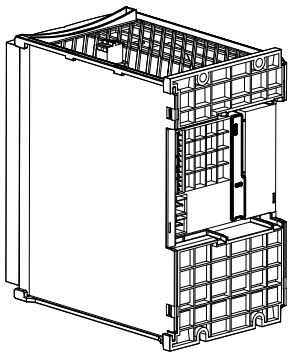


Figure 2-13

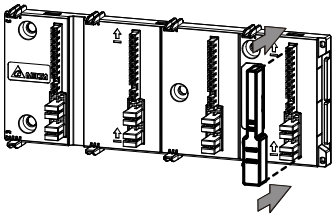


Figure 2-14

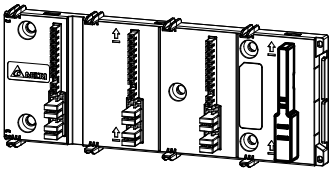


Figure 2-15

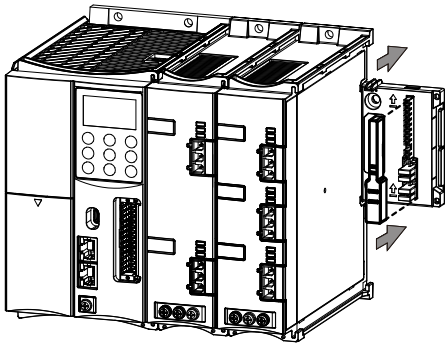


Figure 2-16

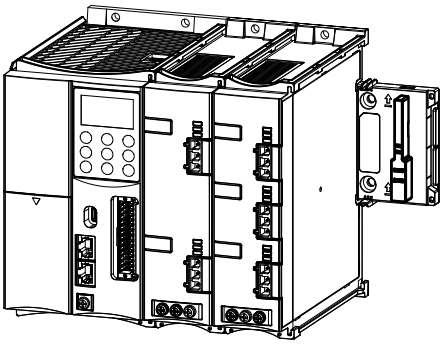


Figure 2-17

2-4-3 Single Side Installation

1. Lock four M5 screws to fix the transmission module according to the corresponding holes.
   Recommended screw torque: 16–20 kg-cm / [13.9–17.3 lb-in.] / [1.56–1.96 Nm]

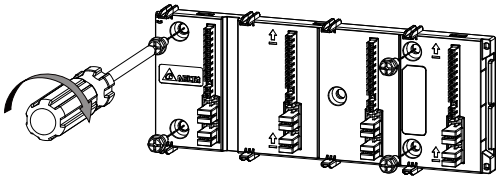


Figure 2-18

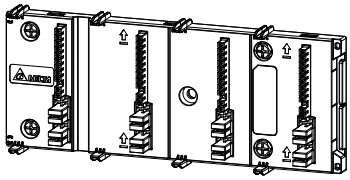


Figure 2-19

2. If you need to increase the overall system grounding effect, lock the middle hole of the transmission module with a M5 screw.
   Recommended screw torque: 16–20 kg-cm / [13.9–17.3 lb-in.] / [1.56–1.96 Nm]

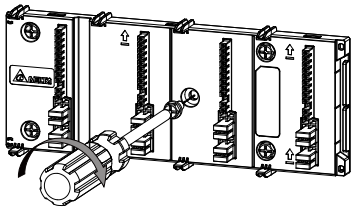


Figure 2-20

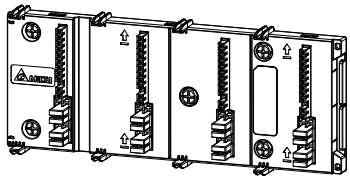


Figure 2-21

3. Install the rectifier module by following the guide rib of the transmission module, and lock four M5 screws.
   Recommended screw torque: 16–20 kg-cm / [13.9–17.3 lb-in.] / [1.56–1.96 Nm]

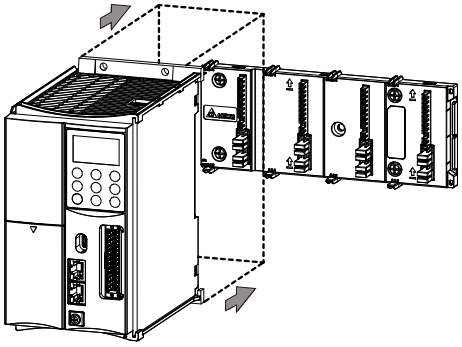


Figure 2-22

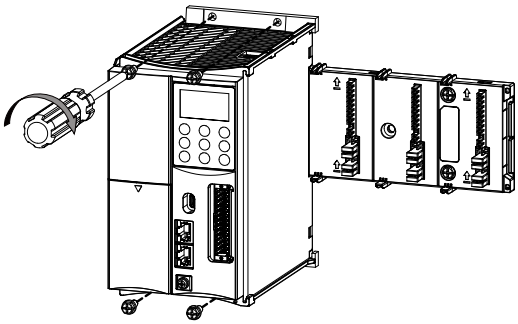


Figure 2-23

4. Insert the inverter module by following the side guide ribs structure and lock two M5 screws.
   Recommended screw torque: 16–20 kg-cm / [13.9–17.3 lb-in.] / [1.56–1.96 Nm]

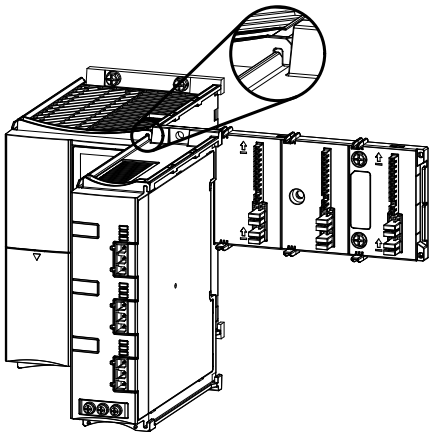


Figure 2-24

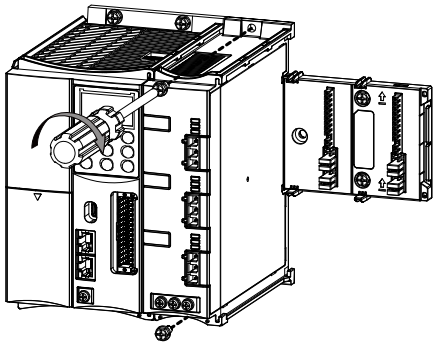


Figure 2-25

5. Insert the inverter modules one by one and fasten all screws. Two positions need to be fix for each inverter module. After that, the single side installation is completed.
   Recommended screw torque: 16–20 kg-cm / [13.9–17.3 lb-in.] / [1.56–1.96 Nm]

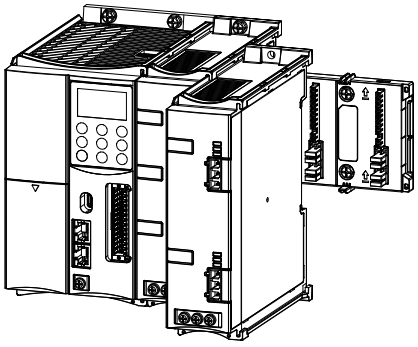


Figure 2-26

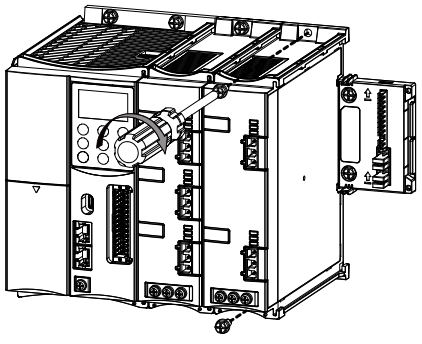


Figure 2-27

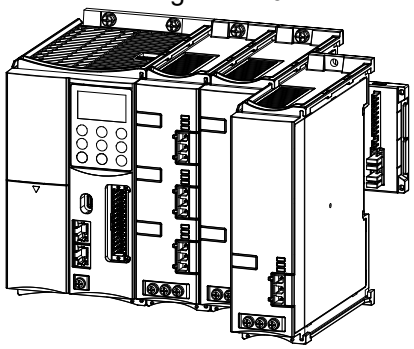


Figure 2-28

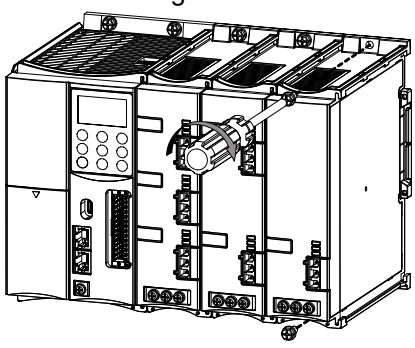


Figure 2-29

2-4-4 Dual Side Installation

1. Lock eight M5 screws to fix two transmission modules according to the corresponding holes on the picture.
   Recommended screw torque: 16–20 kg-cm / [13.9–17.3 lb-in.] / [1.56–1.96 Nm]

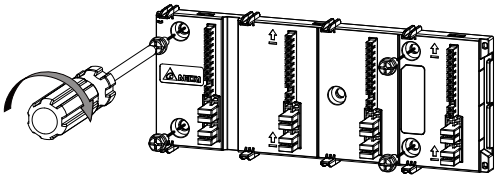


Figure 2-30

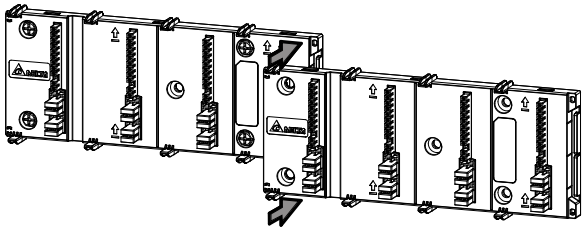


Figure 2-31

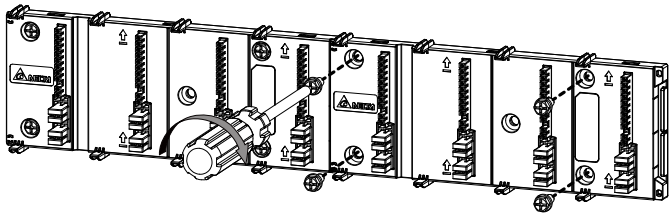


Figure 2-32

2. If you need to increase the overall system grounding effect, lock the middle hole of the transmission module with M5 screw.
   Recommended screw torque: 16–20 kg-cm / [13.9–17.3 lb-in.] / [1.56–1.96 Nm]

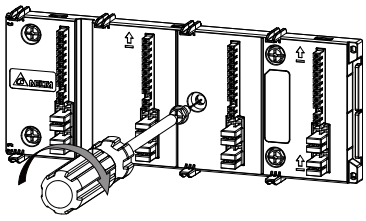


Figure 2-33

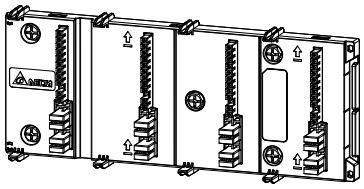


Figure 2-34

3. Install the rectifier module by following the guide rib of the transmission module and lock four M5 screws. The installation position of the rectifier module must be across the middle of the two transmission modules.
   Recommended screw torque: 16–20 kg-cm / [13.9–17.3 lb-in.] / [1.56–1.96 Nm]

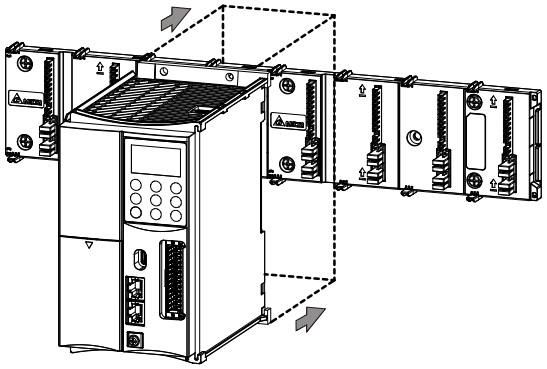


Figure 2-35

4. Insert the inverter module by following the side guide ribs structure and lock two M5 screws.
   Recommended screw torque: 16–20 kg-cm / [13.9–17.3 lb-in.] / [1.56–1.96 Nm]

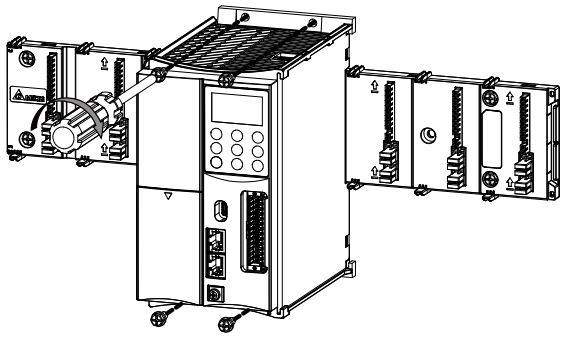


Figure 2-36

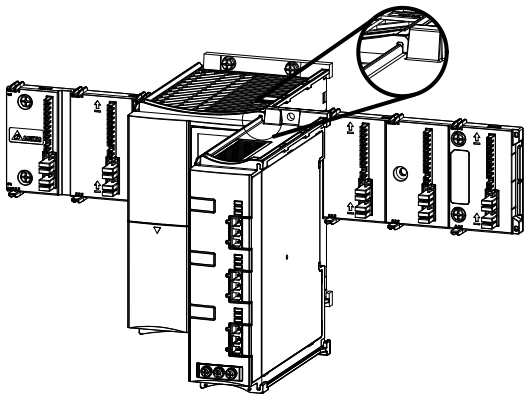


Figure 2-37

5. Insert the inverter modules one by one and fasten all screws. Two positions need to be fix for each inverter module. After that, one side installation is completed.
   Recommended screw torque: 16–20 kg-cm / [13.9–17.3 lb-in.] / [1.56–1.96 Nm]

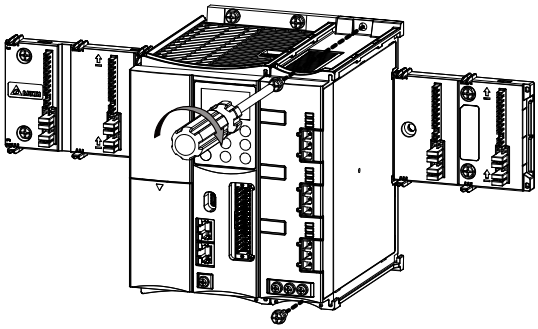


Figure 2-38

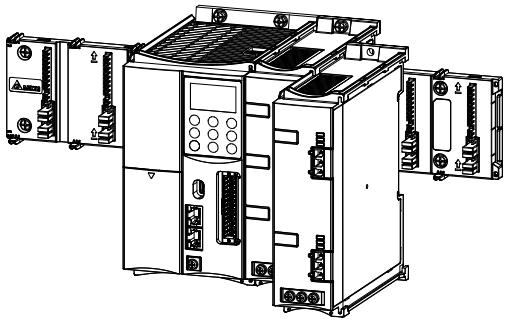


Figure 2-39

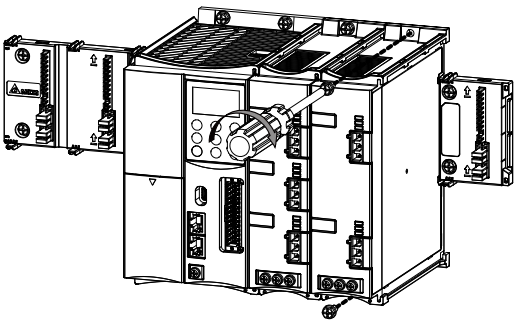


Figure 2-40

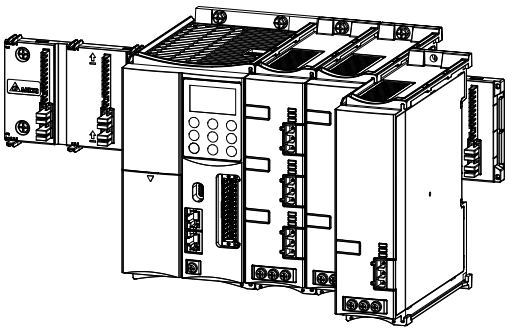


Figure 2-41

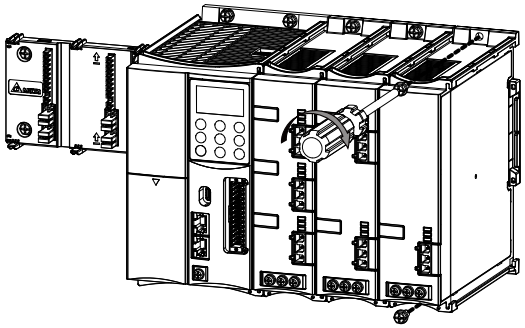


Figure 2-42

6. Insert the inverter module on the other side by following the side guide ribs structure and lock two M5 screws.
   Recommended screw torque: 16–20 kg-cm / [13.9–17.3 lb-in.] / [1.56–1.96 Nm]

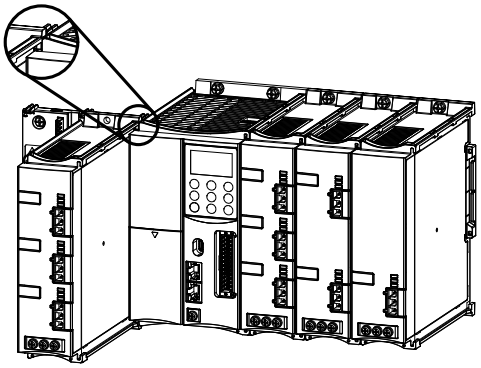


Figure 2-43

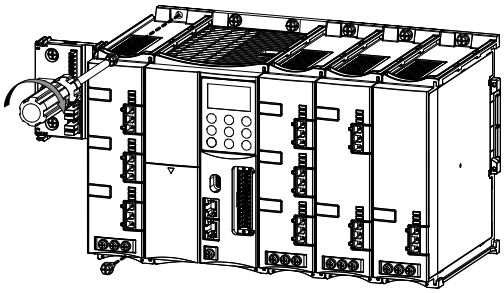


Figure 2-44

7. Insert the inverter module one by one and fasten all screws. Two positions need to be fix for each inverter module. After that, both side installation is completed.
   Recommended screw torque: 16–20 kg-cm / [13.9–17.3 lb-in.] / [1.56–1.96 Nm]

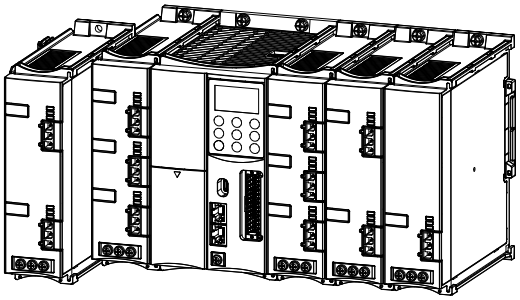


Figure 2-45

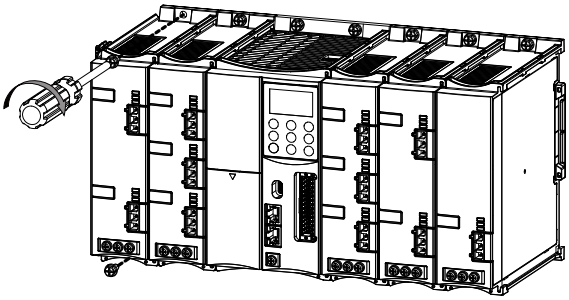


Figure 2-46

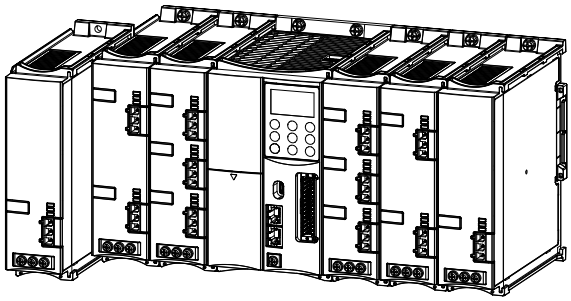


Figure 2-47

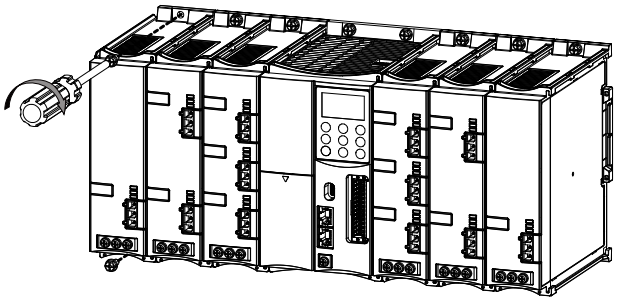


Figure 2-48

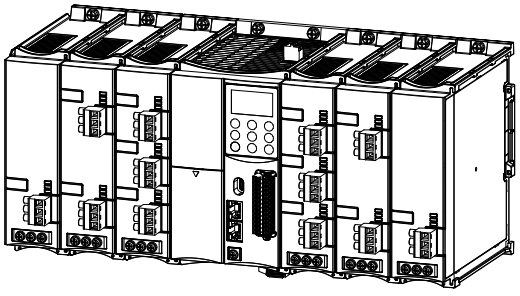


Figure 2-49

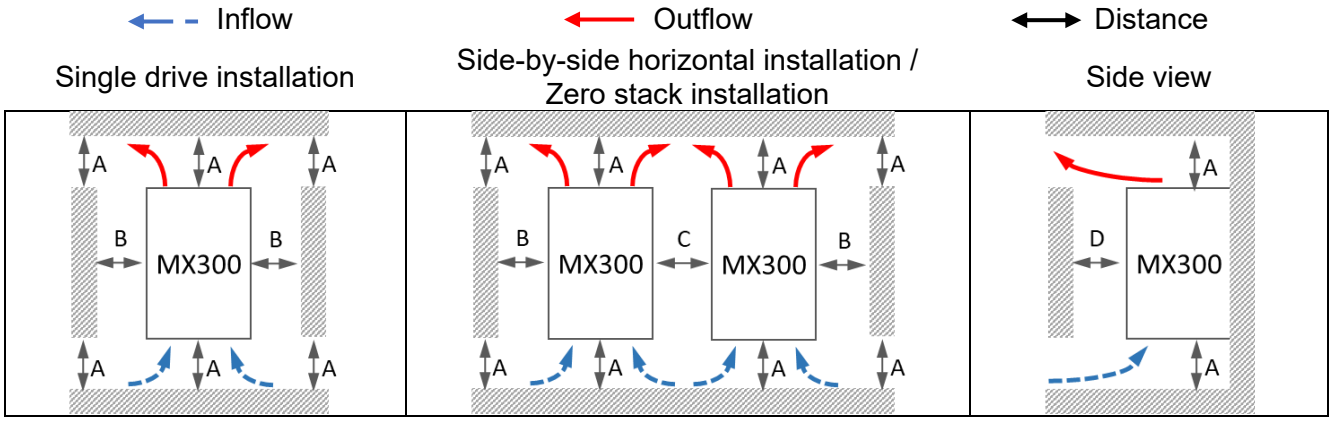
2-4-5 Mounting Clearance

☑ Prevent fiber particles, scraps of paper, shredded wood, sawdust, metal particles, etc. from adhering to the heat sink.

☑ 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 accident.

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

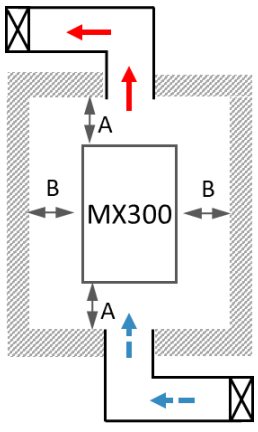
☑ The appearances shown in the following figures are for reference only. The actual motor drives may look different.



Minimum mounting clearance

Installation Method	Distance (mm)					Maximum Ambient Temperature (°C)	
	A	B	C	D	E	Without Derating	With Derating
Single Drive	50	0	-	50	-	50	60
Side-by-side Horizontal			0				

Table 2-8



NOTE:

☑ The minimum mounting clearances A–C stated in the table above apply to AC motor drives installation. Failing to follow the minimum mounting clearances may cause the fan to malfunction and heat dissipation problems.

☑ The mounting clearance stated in the figure is for installing the drive in an open area. To install the drive in a confined space (such as cabinet or electric box), follow the following rules: (1) Keep the minimum mounting clearances. (2) Install a ventilation equipment or an air conditioner to keep surrounding temperature lower than operation temperature.

☑ The table shows the heat dissipation and the required air volume when installing a single drive in a confined space. When installing multiple drives, the required air volume shall be multiplied by the number of the drives.

☑ Refer to the table below (Airflow Rate for Cooling) for ventilation equipment design and selection.

☑ Refer to the table below (Power Dissipation for AC Motor Drive) for air conditioner design and selection.

☑ Refer to Chapter 11 for ambient temperature derating curve and derating curves under different control modes.

Ambient Temperature Derating for Each Installation Method

The ambient temperature derating curve shows the derating status of different protection levels at different temperatures.

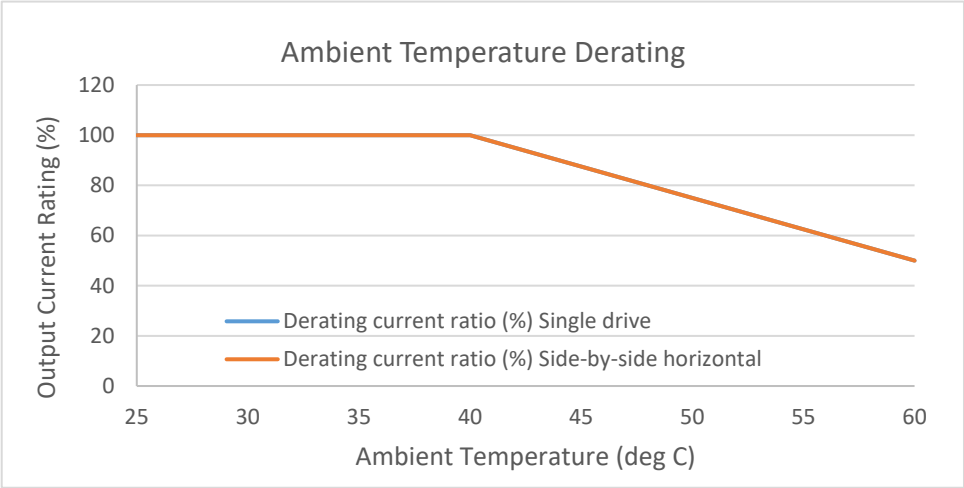


Figure 2-50

NOTE: The ambient temperature derating curves for independent installation and horizontal side-by-side installation are the same.

Ambient Temperature (°C)	Derating Current Ratio (%)	
	Single Drive Installation	Side-by-side Horizontal Installation
25	100	
40		
45		
50		
55	87.5	
60	75	

Table 2-9

2-4-6 Airflow and Power Dissipation

Frame	Airflow Rate for Cooling			Power Dissipation for AC Motor Drive
	Model name	Flow Rate (Unit: cfm)	Flow Rate (Unit: m^3/hr)	Power Loss (Unit: W)
RA	VFD15AMXx21Cx VFD15AMXx21Ex	24.6	41.7	53.6
	VFD25AMXx21Cx VFD25AMXx21Ex	35.2	59.8	96.0
	VFD22AMXx43Cx VFD22AMXx43Ex	24.6	41.7	90.7
	VFD33AMXx43Cx VFD33AMXx43Ex	35.2	59.8	148.3
	VFD41AMXx43Cx VFD14AMXx43Ex			170.7

Table 2-10

Frame	Airflow Rate for Cooling			Power Dissipation for AC Motor Drive	
	Model name	Flow Rate (Unit: cfm)	Flow Rate (Unit: m^3/hr)	Power Loss (HD) (Unit: W)	Power Loss (ND) (Unit: W)
IA	VFD2A8MXS21Ax VFD2A8MXS21SA	0	0	13.5	22.8
	VFD4A8MXS21Ax VFD4A8MXS21SA	7.6	12.9	25.0	40.6
	VFD7A5MXS21Ax VFD7A5MXS21SA	10.9	18.5	39.0	56.3
	VFD11AMXS21Ax VFD11AMXS21SA	16.8	28.5	56.5	88.3
	VFD2A8MXD21Ax VFD2A8MXD21SA	7.6	12.9	28.3	46.8
	VFD4A8MXD21Ax VFD4A8MXD21SA	10.9	18.5	49.3	80.5
	VFD7A5MXD21Ax VFD7A5MXD21SA	12.6	21.4	76.5	111.0
	VFD11AMXD21Ax VFD11AMXD21SA	16.8	28.5	110.2	173.9
	VFD2A8MXT21Ax VFD2A8MXT21SA	10.9	18.5	42.4	70.2
	VFD4A8MXT21Ax VFD4A8MXT21SA	12.6	21.4	73.4	120.2
	VFD7A5MXT21Ax VFD7A5MXT21SA	16.8	28.5	114.4	166.2
	VFD1A5MXS43Ax VFD1A5MXS43SA	0	0	16.0	12.3
	VFD2A7MXS43Ax VFD2A7MXS43SA	7.6	12.9	24.0	24.7
	VFD4A2MXS43Ax VFD4A2MXS43SA			35.9	34.6
	VFD5A5MXS43Ax VFD5A5MXS43SA			43.8	69.0
	VFD9A0MXS43Ax VFD9A0MXS43SA	10.9	18.5	87.3	94.2
	VFD13AMXS43Ax VFD13AMXS43SA	16.8	28.5	139.0	126.7
	VFD17AMXS43Ax VFD17AMXS43SA			160.8	133.7
	VFD1A5MXD43Ax VFD1A5MXD43SA	7.6	12.9	33.3	29.9
	VFD2A7MXD43Ax VFD2A7MXD43SA			46.9	48.2
	VFD4A2MXD43Ax VFD4A2MXD43SA			70.6	67.9
	VFD5A5MXD43Ax VFD5A5MXD43SA	16.8	28.5	88.0	138.4
	VFD9A0MXD43Ax VFD9A0MXD43SA			173.7	187.5

Frame	Airflow Rate for Cooling			Power Dissipation for AC Motor Drive	
	Model name	Flow Rate (Unit: cfm)	Flow Rate (Unit: m^3/hr)	Power Loss (HD) (Unit: W)	Power Loss (ND) (Unit: W)
IA	VFD1A5MXT43Ax VFD1A5MXT43SA	7.6	12.9	49.4	44.2
	VFD2A7MXT43Ax VFD2A7MXT43SA			69.7	71.7
	VFD4A2MXT43Ax VFD4A2MXT43SA	10.9	18.5	105.9	101.8
	VFD5A5MXT43Ax VFD5A5MXT43SA	16.8	28.5	130.6	206.1

Table 2-11

2-5 Description of non-IP40 protection areas

Rectifier Module (Frame RA)

MX300-C models:

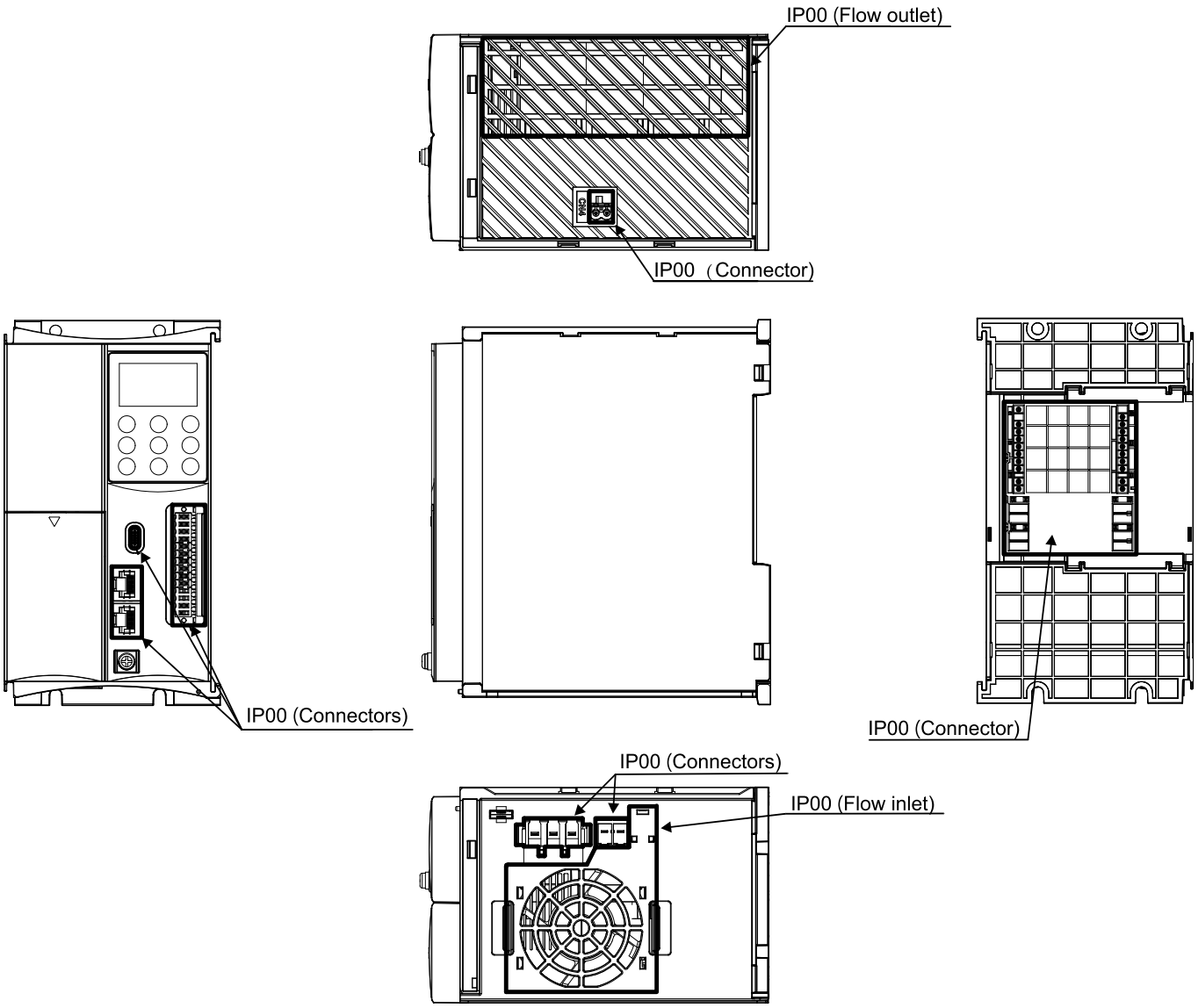


Figure 2-51

MX300-E models:

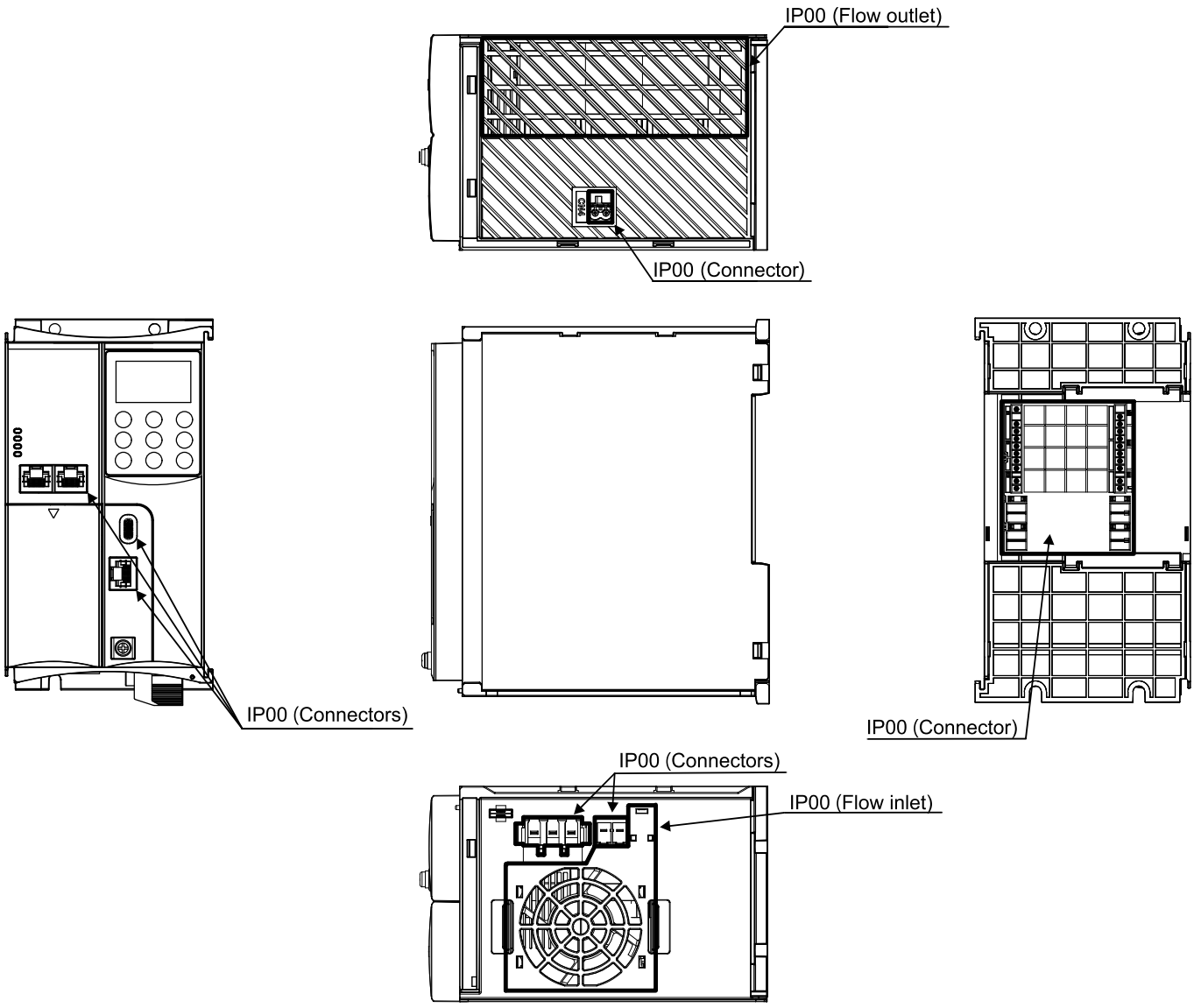


Figure 2-52

Inverter Module (Frame IA)

MX300-A models:

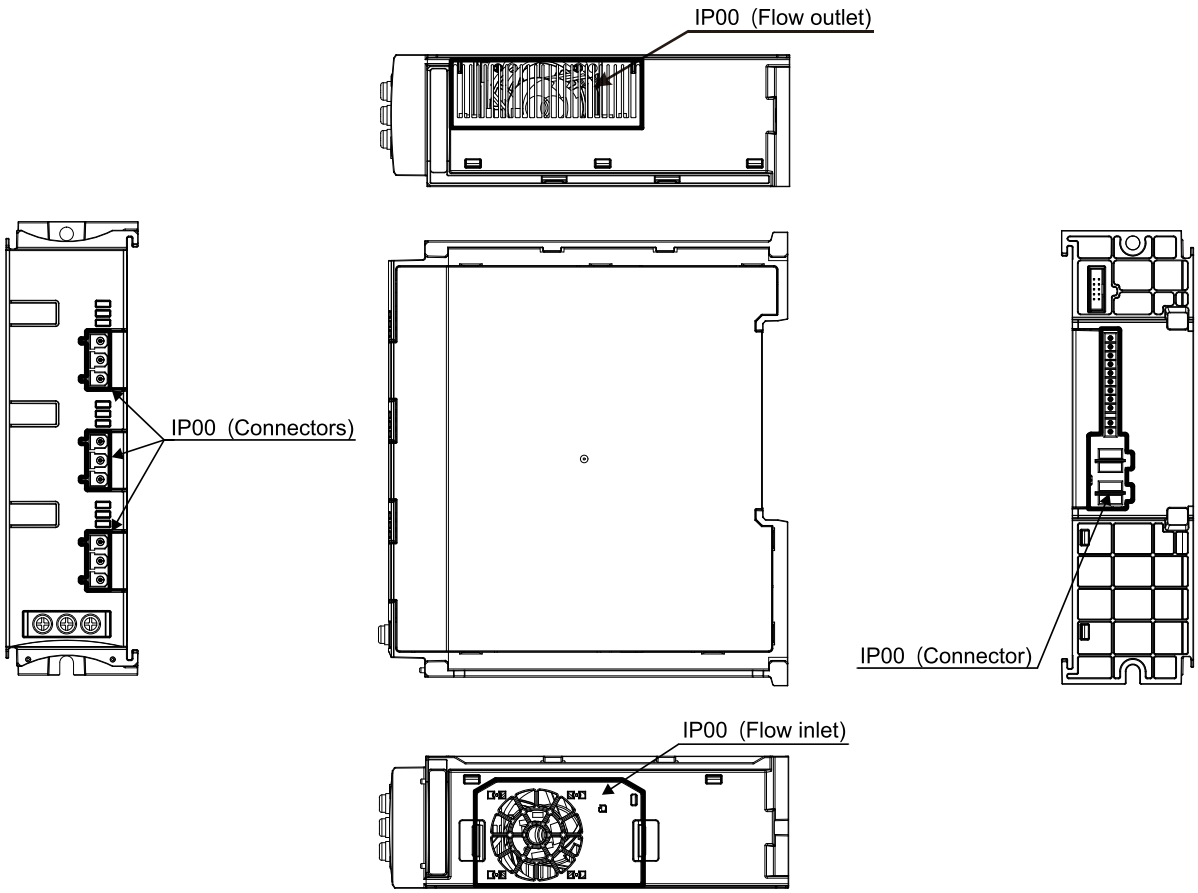
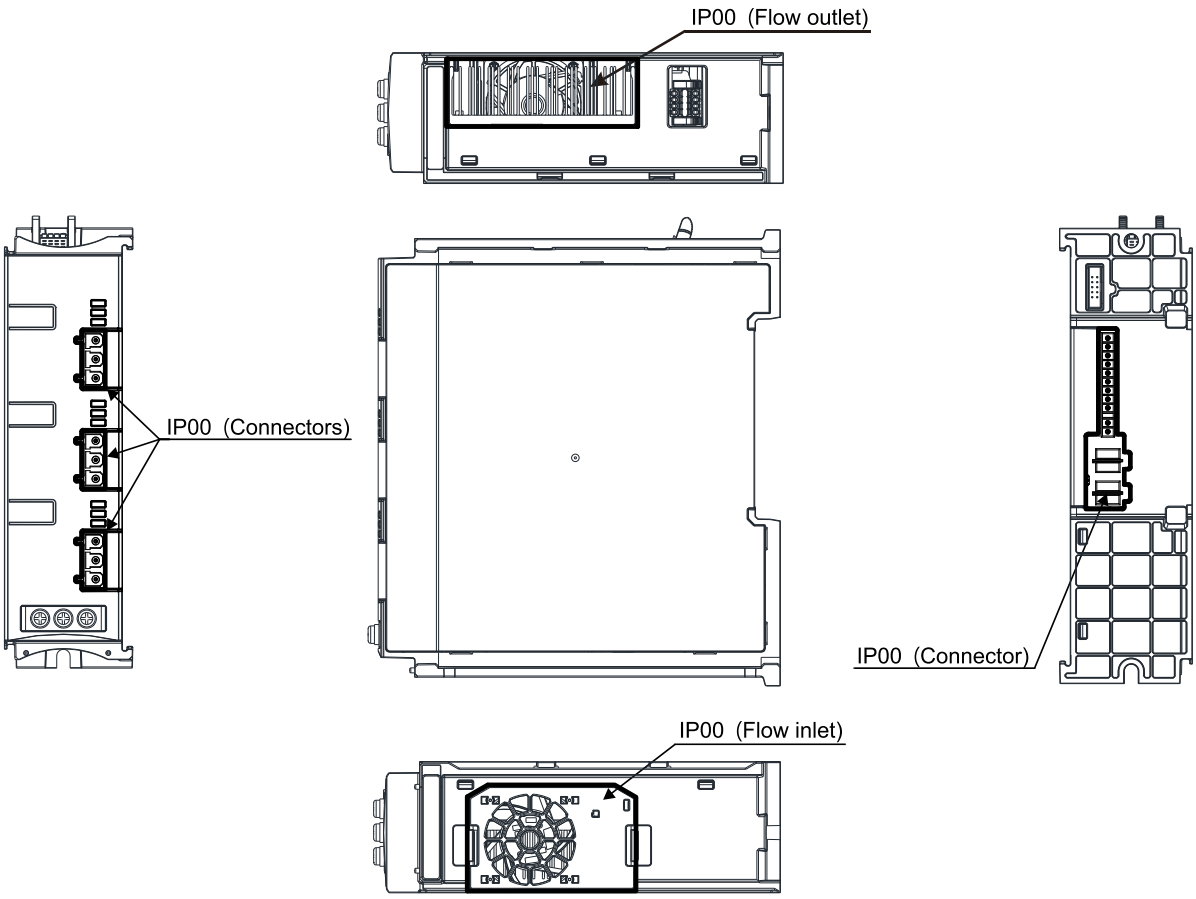


Figure 2-53

MX300-S models:



Chapter 3 Electrical Wiring

3-1 Safety Precautions

3-2 System Wiring Diagram

3-3 Main Circuit Terminals

3-4 Control Terminals

3-5 RFI Jumper and Leakage Current

3-6 Harmonic Interference Prevention and Control

3-7 Long Wiring Application

3-1 Safety Precautions

DANGER

- ☑ Fasten the screws in the main circuit terminal to prevent sparks caused by screws loosened due to vibration.
- ☑ If necessary, use an inductive filter only at the motor output terminals U, V, and W of the AC motor drive. Do NOT use phase-compensation capacitors or L-C (Inductance-Capacitance) or R-C (Resistance-Capacitance), unless approved by Delta.
- ☑ Do NOT connect phase-compensation capacitors or surge absorbers at the output terminals of AC motor drives.
- ☑ Ensure proper insulation of the main circuit wiring in accordance with the relevant safety regulations.

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; It can be connected in any sequence.
- ☑ The connection between the three-phase AC input power supply and the main circuit terminals (R/L1, S/L2, T/L3) must be connected with a non-fuse switch. Add a magnetic contactor (MC) to the power input wiring to cut off power quickly and reduce malfunction when the AC motor drive protection function activates. Both ends of the MC should have an R-C surge absorber.
- ☑ Use voltage and current within the specification. Refer to Chapter 11 Specifications for details.
- ☑ When using a general GFCI (Ground Fault Circuit Interrupter) to avoid nuisance tripping. For 460V models, select a current sensor with sensitivity of 10mA or above and not less than 0.1-second operation time. For 230V models, select a current sensor with sensitivity of 30mA or above and not less than 0.1-second operation time.
- ☑ Use shielded wire or conduit for the power wiring and ground the two ends of the shield wire or conduit.
- ☑ Do NOT run and stop AC motor drives by turning the power ON and OFF Run and stop AC motor drives by sending RUN and STOP command through the control terminals or the keypad. If you still need to run and stop AC motor drives by turning power ON and OFF, do so no more often than ONCE per hour.
- ☑ To comply with UL standards, connect the drive to a three-phase three-wire or three-phase four-wire Wye system of mains power system.

Output Terminals of the Main Circuit

- ☑ Use well-insulated motors to prevent any electric leakage from motors.
- ☑ When the AC drive output terminals U, V, and W are connected to the motor terminals U/T1, V/T2, and W/T3 respectively, the FWD LED indicator on the digital keypad is ON. This means the AC motor drive executes running forward, and the motor rotates counterclockwise (viewed from the shaft end of the motor, as shown in Figure 3-1).

On the contrary, when the REV LED indicator lights, the AC motor drive executes running in reverse, and the motor rotates in an opposite direction to figure below. If the AC motor drive executes running forward but the motor rotates in a reverse direction, exchange any two of the U, V, and W motor leads.

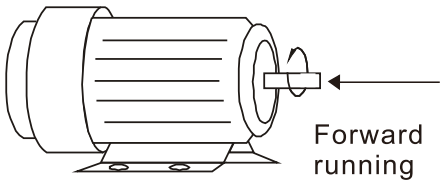


Figure 3-1

Analog Input Terminals (AI1, AI2, ACM)

☑ Analog input signals are easily affected by external noise. Use shielded wiring and keep it as short as possible (less than 20 m) with proper grounding. If the noise is inductive, connecting the shield to the ACM terminal can reduce interference.

☑ Use twisted-pair wire for weak analog signals.

☑ If the analog input signals are affected by noise from the AC motor drive, connect a capacitor and a ferrite core as shown the figure below.

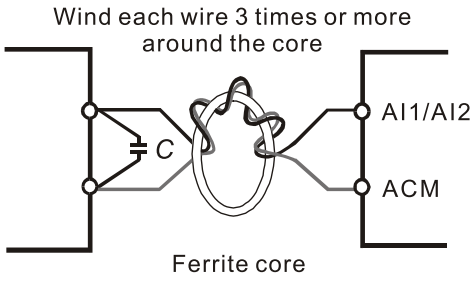


Figure 3-2

Digital Inputs (MI1~MI4, MIO1~MIO4, DCM, +24V, COM)

☑ The “COM” terminal is a common terminal of the photo-coupler in all the wiring methods.

☑ When the photo-coupler uses the internal power supply, the switch connection for Sink and Source modes are as below:

– MI-DCM: Sink mode

– MI-+24V: Source mode

☑ When the photo-coupler uses the external power supply, remove the short-circuit cable between +24V and COM terminals. Connect the +/- terminal of the external power supply to the MI ro COM terminal to determine the Sink or Source mode.

3-2 System Wiring Diagram

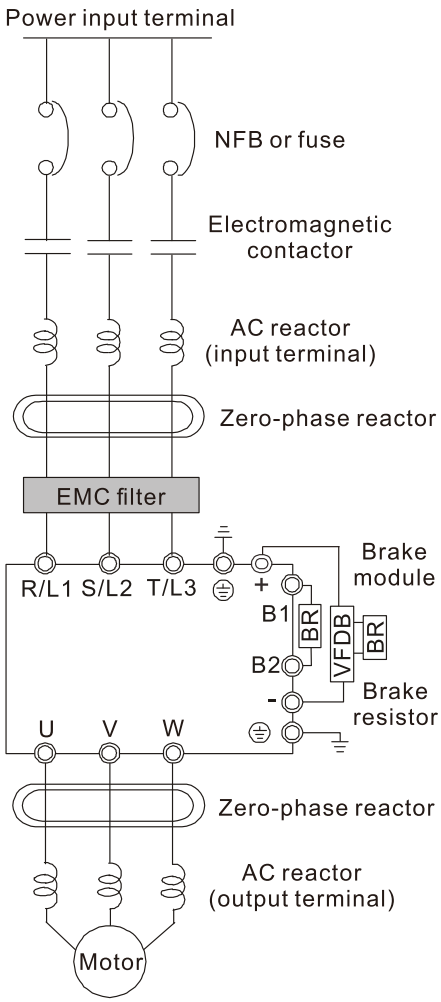


Figure 3-3

Power Input Terminal	Supply power according to the rated power specifications indicated in the manual.
NFB or Fuse	There may be a large inrush current during power on. Refer to Section 10-4 NFB to select a suitable NFB or Section 10-5 Fuse Specification Chart.
Electromagnetic Contactor	Switching the power ON / OFF on the primary side of the electromagnetic contactor can turn the drive 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 drive; doing so shortens the life of the drive.
AC Reactor (Input Terminal)	When the main power supply capacity is greater than 500 kVA, or when it switches into the phase capacitor, the instantaneous peak voltage and current generated may destroy the internal circuit of the drive. It is recommended that you install an input side AC reactor in the drive. This also improves the power factor and reduces power harmonics. The wiring distance should be within 10 m. Refer to Section 10-6 EMC Filter for details.
Zero-phase Reactor	Used 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. Refer to Section 10-7 for details.
Emc Filter	Can be used to reduce electromagnetic interference.
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 20m. Refer to Section 10-6 for details.

Table 3-1

3-3 Main Circuit Terminals

3-3-1 Main Circuit Diagram

Input: one-phase / three-phase power
-Take rectifier module with triple-axis inverter module as an example

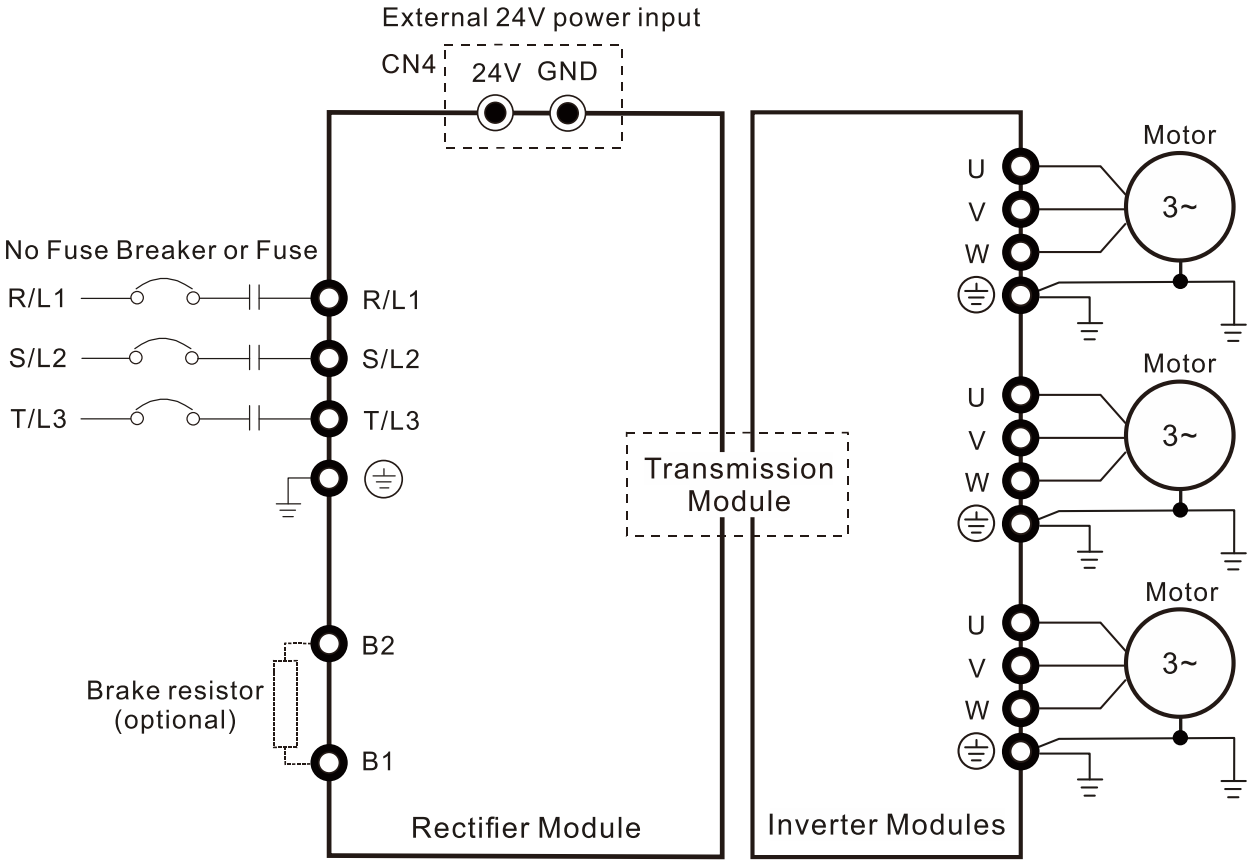


Figure 3-4

3-3-2 Main Circuit Terminal Specifications

- The main circuit terminal uses a screw-type detachable terminal block, and use a Phillips screwdriver to lock the wiring.
- When wiring bare wires, ensure that they are perfectly arranged to go through the wiring holes.
- Main circuit terminals: R/L1, S/L2, T/L3, U, V, W, B1, and B2. There is no T/L3 terminal for one-phase models. The recommended stripping length for each terminal is as shown in the table below.

Terminals	Descriptions	Stripping Length (mm)
R/L1, S/L2	Mains input terminals (one-phase)	11–12
R/L1, S/L2, T/L3	Mains input terminals (three-phase)	
U, V, W	AC motor drive output terminals for connecting three-phase IM and PM motors.	8–9
B1, B2	Connections for brake resistor (optional). Refer to Section 10-3 for details.	7–8

Table 3-2

3-3-3 Grounding Terminals

- Use the specified ring lug for grounding terminal wiring. See Figure 3-5 and Figure 3-6 for ring lug specifications. For other types of wiring, use the wires that comply with the local regulations.
- After crimping the wire to the ring lug (must be UL and CSA approved R/C (YDPU2/8)), install heat shrink tubing rated at a minimum of 600V_{AC} insulation over the live part. Refer to Figure 3-6.

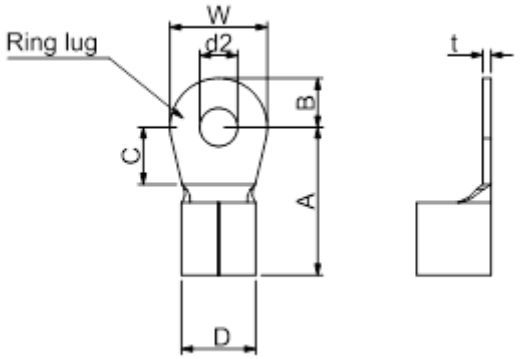


Figure 3-5

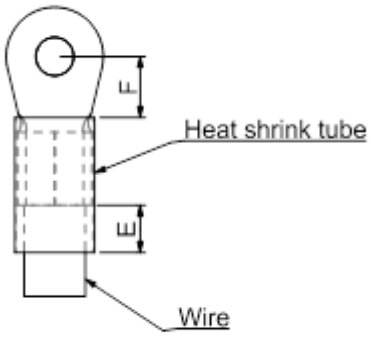


Figure 3-6

- The part # of the ring lugs (produced by K.S. Terminals Inc.) in the table below are for reference only. You can buy other ring lugs of your choice to match with different frame sizes. The main circuit terminals are designed as removable terminal block and are not suitable for ring terminals.

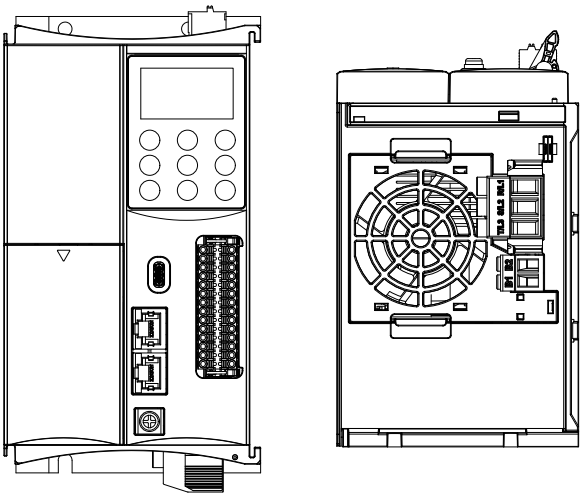
Unit: mm

Frame	*AWG MCM	Kit P/N	A (MAX)	B (MAX)	C (MIN)	D (MAX)	d2 (MIN)	E (MIN)	F (MIN)	W (MAX)	t (MAX)
IA	10	RNBS5-4	12.1	3.6	6.1	5.6	4.3	13	4.5	7.2	1
RA	6	RNB14-5	27.1	6.1	10.5	11.5	5.3	13	6.5	12.6	1.7

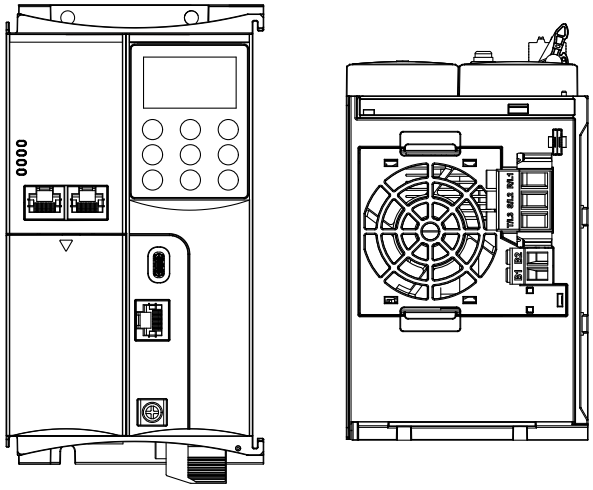
Table 3-3

Frame RA

MX300-C models:



MX300-E models:



- To be UL installation compliant, you must use copper wires when installing. The wire gauge is based on a temperature resistance of 75°C, in accordance with UL requirements and recommendations. Do not reduce the wire gauge when using high-temperature resistant wires.
- If you install at Ta 50°C environment, use copper wires that have a voltage rating of 600 V and are temperature resistant to 75°C or 90°C.
- If you install at Ta 50°C above environment, use copper wires that have a voltage rating of 600 V and are temperature resistant to 90°C or above.
- To be UL installation compliant, you must use copper wires when installing. The wire gauge is based on a temperature resistance of 75°C, in accordance with UL requirements and recommendations. Do not reduce the wire gauge when using high-temperature resistant wires.

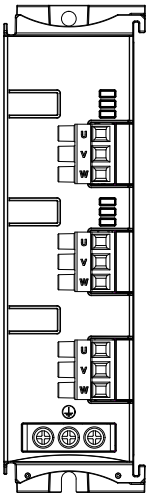
Model	Main Circuit Terminal: R/L1, S/L2, T/L3			Terminals ⏚ with Ring Lug		
	Maximum Wire Gauge	Minimum Wire Gauge	Torque (±10%)	Maximum Wire Gauge	Minimum Wire Gauge	Torque (±10%)
VFD15AMXB21xx VFD15AMXR21xx	16 mm² [6 AWG]	4 mm² [12AWG]	M4 18 Kg-cm [16.0 lb-in.] [1.8 Nm]	16 mm² [6 AWG]	4 mm² [12AWG]	M4 8 Kg-cm [7.0 lb-in.] [0.78 Nm]
VFD25AMXB21xx VFD25AMXR21xx		10 mm² [8AWG]			10 mm² [8AWG]	
VFD22AMXB43xx VFD22AMXR43xx		6 mm² [10 AWG]			6 mm² [10 AWG]	
VFD33AMXB43xx VFD33AMXR43xx		10 mm² [8 AWG]			10 mm² [8 AWG]	
VFD41AMXB43xx VFD41AMXR43xx		16 mm² [6 AWG]			16 mm² [6 AWG]	

Model	Brake Terminal B1, B2		
	Maximum Wire Gauge	Minimum Wire Gauge	Torque (±10%)
VFD15AMXB21xx	10 mm² [8 AWG]	6 mm² [10 AWG]	M3 7 Kg-cm [6.2 lb-in.] [0.7 Nm]
VFD25AMXB21xx			
VFD22AMXB43xx			
VFD33AMXB43xx			
VFD41AMXB43xx			

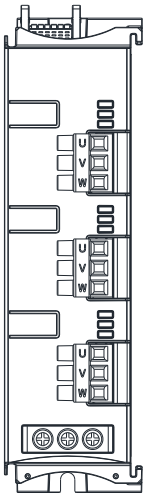
Table 3-4

Frame IA

MX300-A models:



MX300-S models:



- If you install at Ta 50°C environment, use copper wires that have a voltage rating of 600 V and are temperature resistant to 75°C or 90°C.
- If you install at Ta 50°C above environment, use copper wires that have a voltage rating of 600 V and are temperature resistant to 90°C or above.
- To be UL installation compliant, you must use copper wires when installing. The wire gauge is based on a temperature resistance of 75°C, in accordance with UL requirements and recommendations. Do not reduce the wire gauge when using high-temperature resistant wires.

Model	Main Circuit Terminals U, V, W			Terminals ⏚ with Ring Lug		
	Maximum Wire Gauge	Minimum Wire Gauge	Torque (±10%)	Maximum Wire Gauge	Minimum Wire Gauge	Torque (±10%)
VFD2A8MXx21Ax VFD2A8MXx21SA	6 mm^2 [10 AWG]	0.5 mm2 [20AWG]	M3 5.5 Kg-cm [4.8 lb-in.] [0.54 Nm]	6 mm^2 [10 AWG]	2.5 mm^2 [14 AWG]	M4 8 Kg-cm [7.0 lb-in.] [0.78 Nm]
VFD4A8MXx21Ax VFD4A8MXx21SA		0.75 mm^2 [18AWG]				
VFD7A5MXx21Ax VFD7A5MXx21SA		1.5mm^2 [16AWG]				
VFD11AMXx21Ax VFD11AMXx21SA		2.5 mm^2 [14AWG]				
VFD1A5MXx43Ax VFD1A5MXx43SA		0.5 mm2 [20 AWG]				
VFD2A7MXx43Ax VFD2A7MXx43SA						
VFD4A2MXx43Ax VFD4A2MXx43SA		0.75 mm^2 [18 AWG]				
VFD5A5MXx43Ax VFD5A5MXx43SA						
VFD9A0MXx43Ax VFD9A0MXx43SA		2.5 mm^2 [14 AWG]				
VFD13AMXx43Ax VFD13AMXx43SA		4 mm^2 [12 AWG]			4 mm^2 [12 AWG]	
VFD17AMXx43Ax VFD17AMXx43SA		6 mm^2 [10 AWG]			6 mm^2 [10 AWG]	

Table 3-5

3-4 Control Terminals

3-4-1 Wiring

MX300-C models:

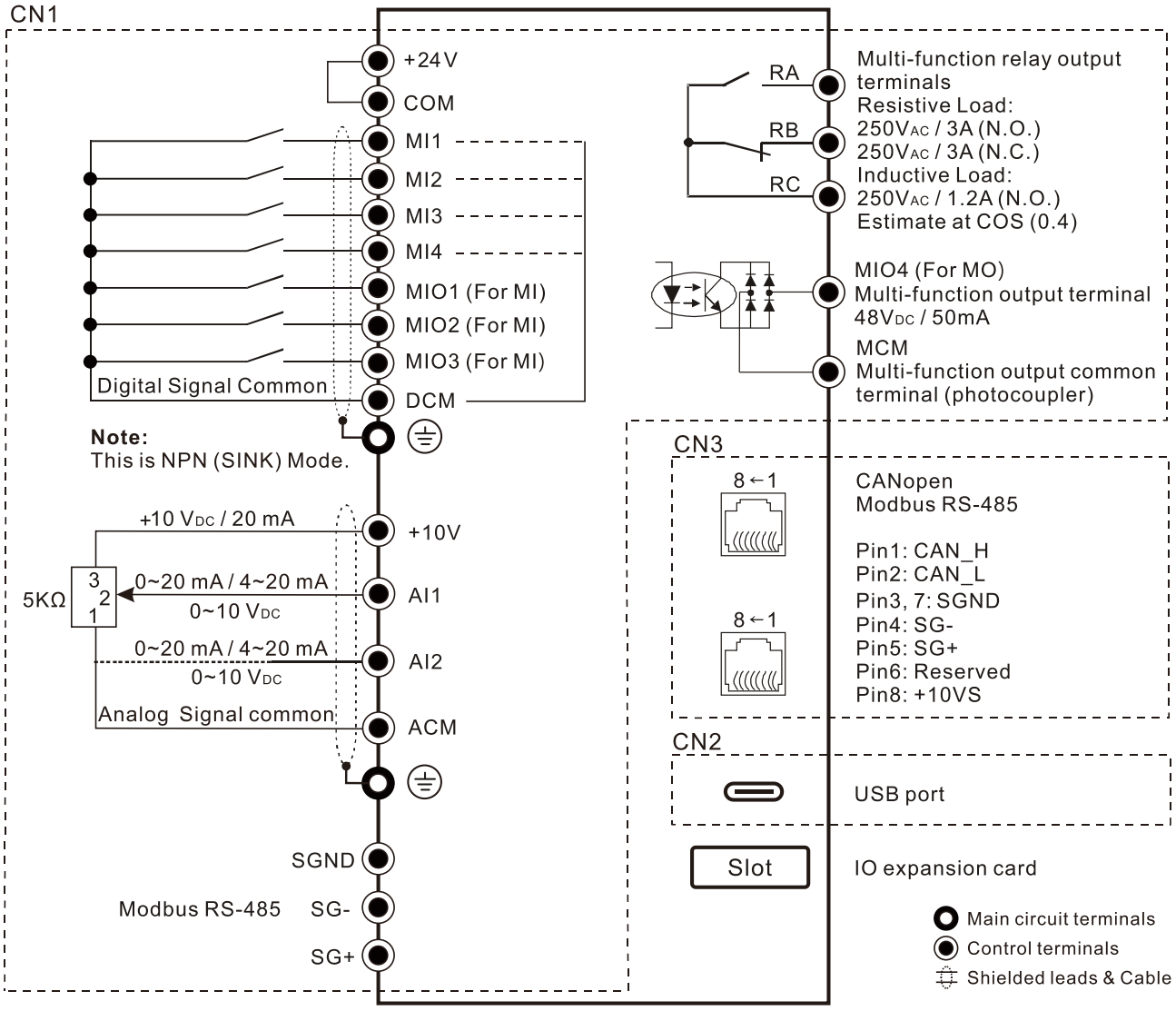


Figure 3-7

MX300-E models:

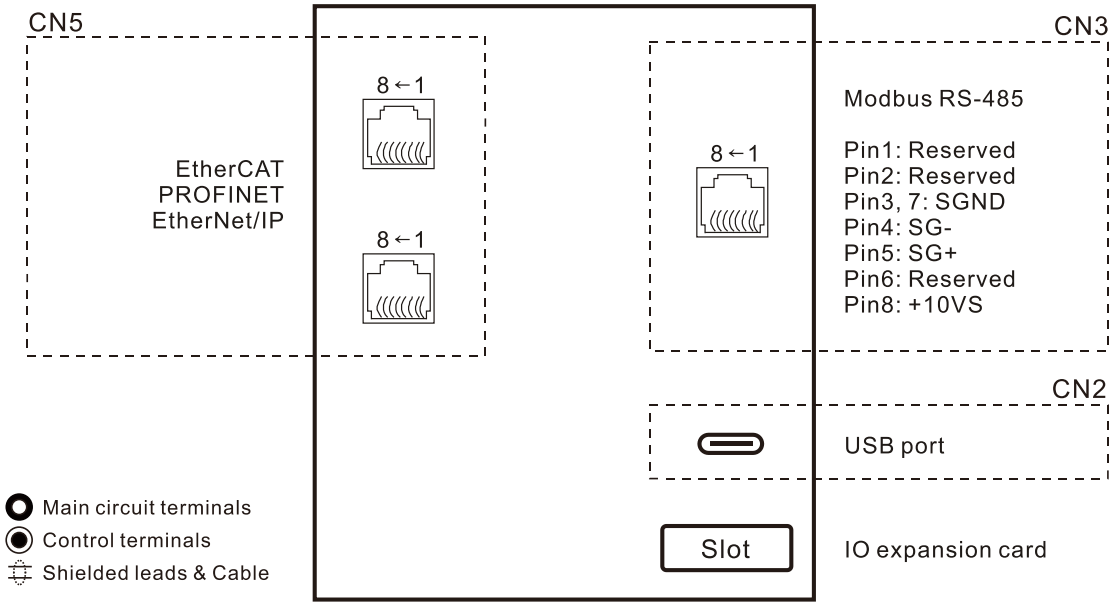


Figure 3-8

MX300-S models:

(Take Triple-axis Built-in STO Inverter Module as an example)

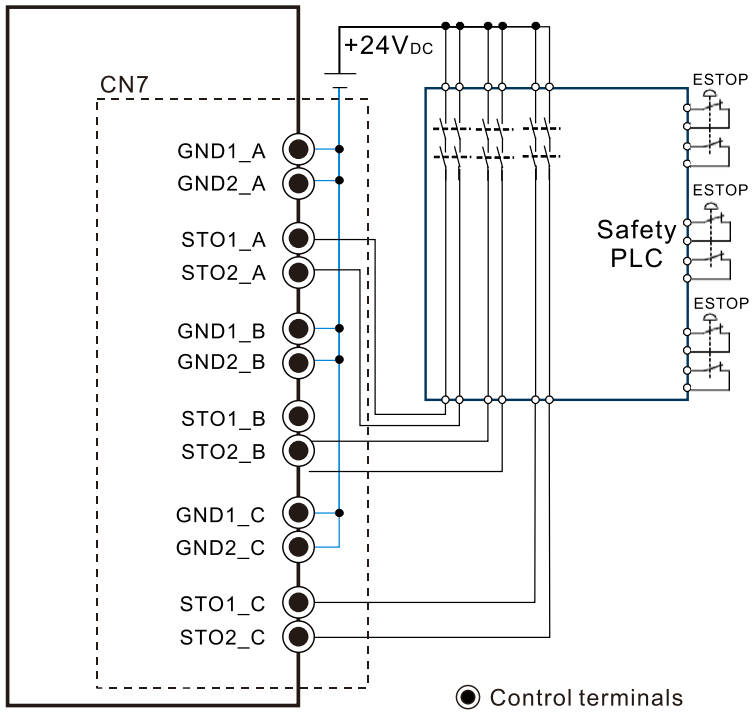
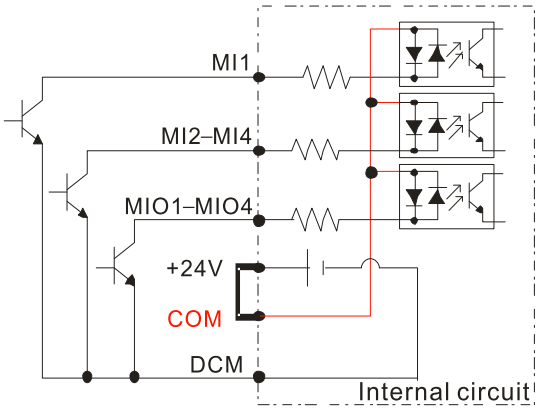


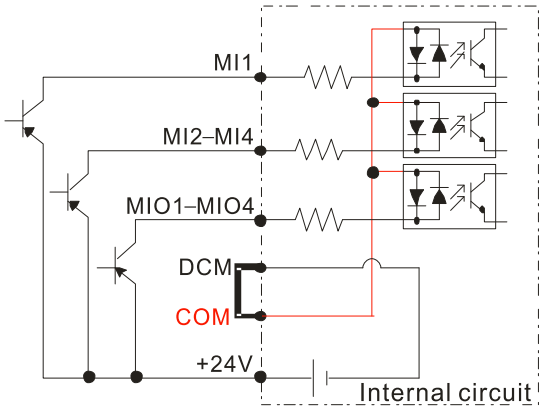
Figure 3-9

3-4-2 SINK (NPN) / SOURCE (PNP) mode

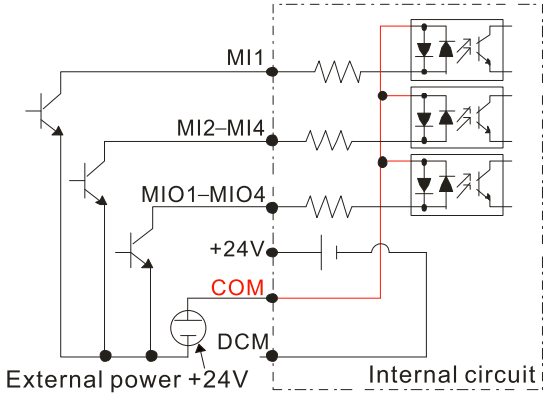
① Sink Mode
with internal power (+24VDC)



② Source Mode
with internal power (+24VDC)



③ Sink Mode
with external power



④ Source Mode
with external power

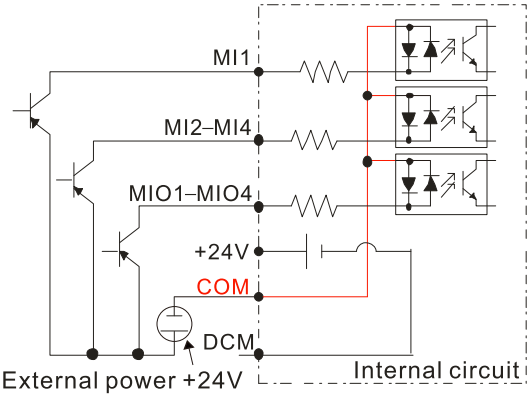


Figure 3-10

3-4-3 Terminal Specifications

Control Terminal Location Diagram

Rectifier Module:

- MX300-C models:

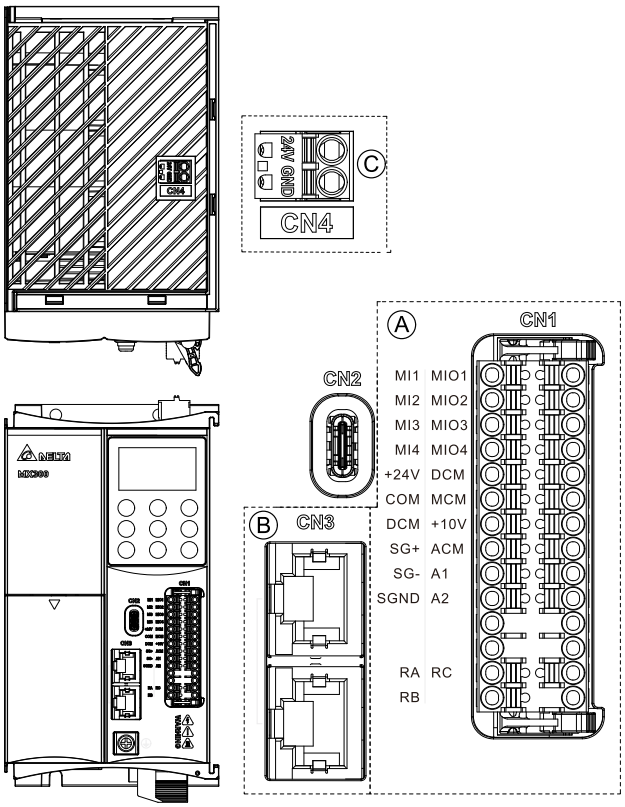


Figure 3-11

- MX300-C models (After 26Q2 version):

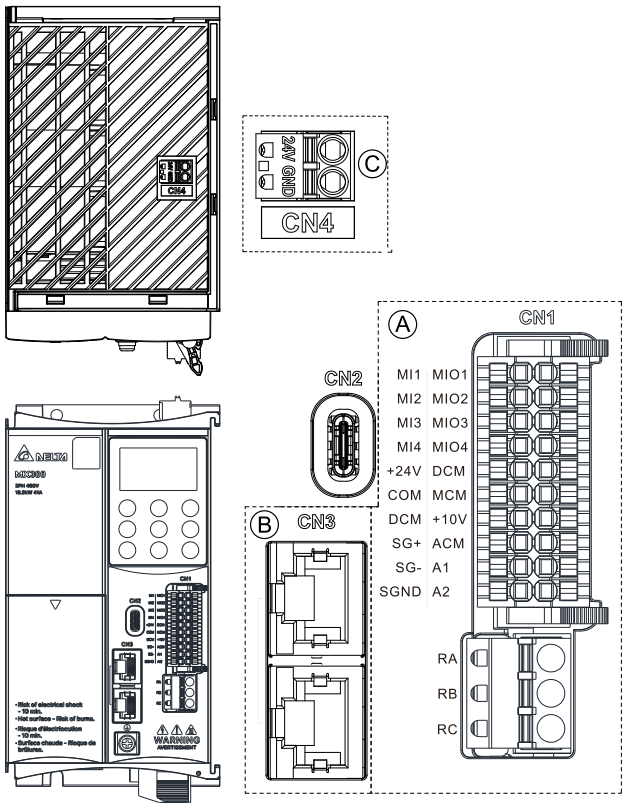


Figure 3-12

Terminal	Area	Wiring type	Stripping Length	Max. Wire Gauge	Min. Wire Gauge
Control Terminals	Ⓐ	Solid wire	8–9 mm	1.5 mm^2 (16 AWG)	0.2 mm^2 (24 AWG)
RELAY Terminals		Stranded wire			
24V Terminals	Ⓒ	Solid wire	10–11 mm	4 mm^2 (12 AWG)	
		Stranded wire			

Table 3-6

Terminal	Area	Description
RJ45	Ⓑ	PIN1: CAN+ PIN2: CAN- PIN3, 7: GND2 PIN4: SG- PIN5: SG+ PIN6: Reserved PIN8: D+10V (provides KPC-CC01 power supply)

Table 3-7

- MX300-E models:

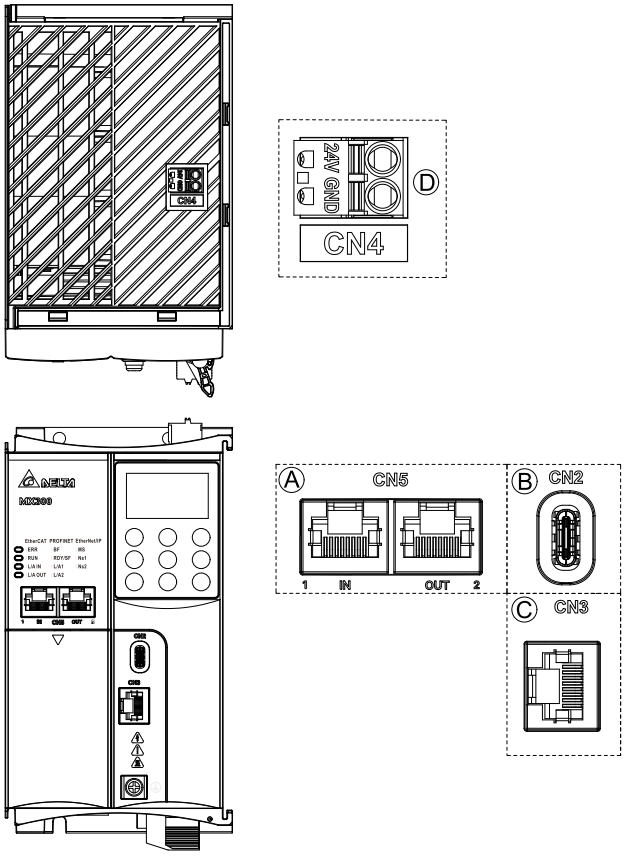


Figure 3-13

Terminal	Area	Wiring Type	Stripping Length	Max. Wire Gauge	Min. Wire Gauge
24V Terminals	Ⓓ	Solid wire	10–11 mm	4 mm^2 (12 AWG)	0.2 mm^2 (24 AWG)
		Stranded wire			

Table 3-8

Terminal	Area	Description			
RJ45	Ⓐ	PIN1: Tx+	PIN2: Tx-	PIN3: Rx+	PIN6: Rx-
		PIN4, 5, 7, 8: Reserved			
	Ⓒ	PIN3, 7: GND2	PIN4: SG-	PIN1, 2, 6: Reserved	
		PIN5: SG+	PIN8: D+10V (provides KPC-CC01 power supply)		

Table 3-9

Inverter Module:

- MX300-S models:

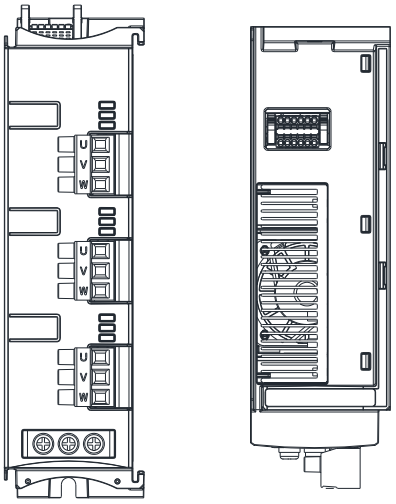


Figure 3-14

Terminal	Wiring Type	Stripping Length	Max. Wire Gauge	Min. Wire Gauge
STO Terminal	Solid wire	7–8	0.5 mm^2 (20 AWG)	0.2 mm^2 (30 AWG)
	Strand wire			

Table 3-10

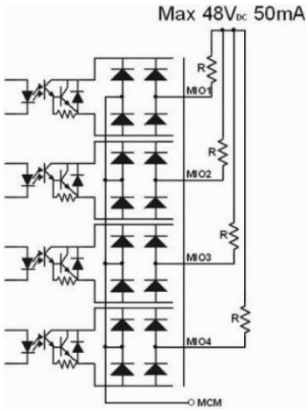
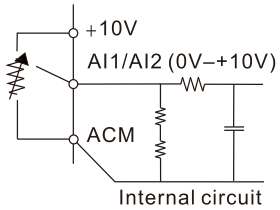
Wiring Precautions:

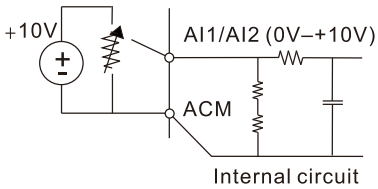
The control terminal uses the push-in spring terminal block (as shown in Area A in the control terminal location diagram):

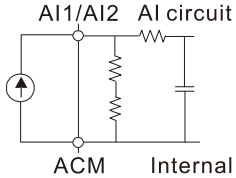
- When removing wires, use the slotted screwdriver to press down the terminal, and the suggested force is 1.5 kgf. Slotted screwdriver: 2.5 mm width and 0.4 mm thickness
- When wiring bare wires, ensure that they are perfectly arranged to go through the wiring holes.

Terminal Function Descriptions

CN1 Terminal		
Terminals	Terminal Function	Description
+24V	Digital Control Signal Common (Source)	+24V ± 10 % 100 mA
COM	Digital Control Signal Common (Sink)	Multi-function input common terminal
MI1–MI4	Multi-Function Input Selection 1–4	Refer to Pr.02-01–02-04 to program the multi-function inputs MI1–MI4. Source Mode ON: activation current is 3.3 mA ≥ 11 V_{DC} OFF: cut-off voltage ≤ 5 V_{DC} Sink Mode ON: activation current is 3.3 mA ≤ 13 V_{DC} OFF: cut-off voltage ≥ 19 V_{DC}
DCM	Digital Signal Common (Sink)	

<table>
<tr><th colspan="3">CN1 Terminal</th></tr>
<tr><th>Terminals</th><th>Terminal Function</th><th>Description</th></tr>
<tr><td>MIO1–MIO4</td><td>Multi-Function Output 1–4 (Photo Coupler)</td><td rowspan="2"><u>MI function</u>
Refer to Pr.02-05–02-08 to program the multi-function inputs MIO1–MIO4. Specifications and wiring are consistent with MI1–MI4.
<u>MO function</u>
The axis number used by MO is specified by Pr.02-65–02-68
Maximum current is 50mA, maximum voltage is 48 V_{DC}.

</td></tr>
<tr><td>MCM</td><td>Multi-Function Output Common (Photo Coupler)</td></tr>
<tr><td>RA</td><td>Multi-Function Relay Output (N.O.) a</td><td rowspan="3"><u>Resistive Load</u>
3 A (N.O.) / 3 A (N.C.) 250 V_{AC}
5 A (N.O.) / 3 A (N.C.) 30 V_{DC}
<u>Inductive Load (COS 0.4)</u>
1.2 A (N.O.) / 1.2 A (N.C.) 250 V_{AC}
2.0 A (N.O.) / 1.2 A (N.C.) 30 V_{DC}
To output different kinds of monitoring signals such as motor drive in operation, frequency reached, and overload indication.
The axis number used by Relay is specified by Pr.02-64.</td></tr>
<tr><td>RB</td><td>Multi-Function Relay Output (N.C.) b</td></tr>
<tr><td>RC</td><td>Multi-Function Relay Common (Relay)</td></tr>
<tr><td>+10 V</td><td>Analog Control Setting Power Supply</td><td>+10.5 ± 0.5 V_{DC} / 20 mA</td></tr>
<tr><td>AI1, AI2</td><td>Analog Input</td><td rowspan="2">The AI1 default is 0–10 V (voltage mode). Set Pr.03-28 to switch to the current mode.
The AI1 default is 0–10 V (current mode). Set Pr.03-29 to switch to the voltage mode.
<u>Voltage mode</u>




• Impedance: 20 kΩ • Resolution : 12 bits
• Range: 0–10 V = 0–Max. Operation Frequency (Pr.01-00)
• Mode switching by setting Pr.03-28, Pr.03-29
<u>Current mode</u>


• Impedance: 250 kΩ • Resolution : 11 bits
• Range: 0–20mA = 0–Max. Operation Frequency (Pr.01-00)
• Mode switching by setting Pr.03-28, Pr.03-29</td></tr>
<tr><td>ACM</td><td>Analog Signal Common</td></tr>
</table>

<table>
<tr><td colspan="3">CN1 Terminal</td></tr>
<tr><td>Terminals</td><td>Terminal Function</td><td>Description</td></tr>
<tr><td>SG+</td><td rowspan="3">Modbus RS-485</td><td rowspan="3">Interoperable with CN3 for simple wiring
(Refer to Chapter 7 Built-in Network for details.)</td></tr>
<tr><td>SG-</td></tr>
<tr><td>SGND</td></tr>
<tr><td colspan="3">CN2 Terminal</td></tr>
<tr><td>Terminal</td><td>Terminal Function</td><td>Description</td></tr>
<tr><td>USB Port</td><td>USB Type-C</td><td>When powered by the drive or 24V external power supply, parameters can be read, written and waveform monitored through the computer.</td></tr>
<tr><td colspan="3">CN3 Terminal</td></tr>
<tr><td>Terminal</td><td>Terminal Function</td><td>Description</td></tr>
<tr><td>RJ45</td><td>Canopen Modbus
RS-485</td><td>PIN 1: CAN_H PIN 2: CAN_L PIN 3, 7: SGND
PIN 4: SG- PIN 5: SG+ PIN 6: Reserved
PIN 8: +10 VS (provides KPC-CC01 power supply)</td></tr>
<tr><td colspan="3">CN4 Terminal</td></tr>
<tr><td>Terminal</td><td>Terminal Function</td><td>Description</td></tr>
<tr><td>24V

GND</td><td>External 24V input terminal</td><td>When the drive uses AC power input to the RST terminal, all functions of the drive work normally. When the above power supply at the input side of the drive is forced to be cut off due to the supply end, the drive is powered off and shut down. Some functions can continue operate through the 24V auxiliary power input, as follows:
1. Parameters can be read, written, and copied through keypad, RS-485, and USB.
2. Keypad is able to display and operate normally.
3. Analog input and Relay output can be read normally.
4. When Digital I/O uses external input, the 24 V_{DC} power supplies normally (refer to external power Sink / Source mode).
5. Rectifier and inverter modules can be programmed.
Input voltage range: 24V ± 5%
Maximum current requirement is greater than 1A (single rectifier module powered by 24V)</td></tr>
<tr><td colspan="3">CN5 Terminal</td></tr>
<tr><td>Terminal</td><td>Terminal Function</td><td>Description</td></tr>
<tr><td>RJ45</td><td>Communication</td><td>For EtherCAT, PROFITNET and EtherNet/IP.</td></tr>
</table>

CN7 Terminal	
Terminal	Description
STO1_A	GND1_A and GND2_A need to be connected to the negative terminal of an external 24V safety power supply to form a power supply circuit. Built-in STO / SIL3 according to EN 61800-5-2, EN 61508 SIL3 / EN ISO 13849-1 PLe STO1_A–GND1_A; STO2_A–GND2_A ON: Voltage ≥ 15 V_{DC} STO1_A–GND1_A; STO2_A–GND2_A OFF: Voltage ≤ 5 V_{DC}
STO2_A	
GND1_A	
GND2_A	
STO1_B	GND1_B and GND2_B need to be connected to the negative terminal of an external 24V safety power supply to form a power supply circuit. Built-in STO / SIL3 according to EN 61800-5-2, EN 61508 SIL3 / EN ISO 13849-1 PLe STO1_B–GND1_B; STO2_B–GND2_B ON: Voltage ≥ 15 V_{DC} STO1_B–GND1_B; STO2_B–GND2_B OFF: Voltage ≤ 5 V_{DC}
STO2_B	
GND1_B	
GND2_B	
STO1_C	GND1_C and GND2_C need to be connected to the negative terminal of an external 24V safety power supply to form a power supply circuit. Built-in STO / SIL3 according to EN 61800-5-2, EN 61508 SIL3 / EN ISO 13849-1 PLe STO1_C–GND1_C; STO2_C–GND2_C ON: Voltage ≥ 15 V_{DC} STO1_C–GND1_C; STO2_C–GND2_C OFF: Voltage ≤ 5 V_{DC}
STO2_C	
GND1_C	
GND2_C	

Table 3-11

NOTE:

1. MX300-E models RJ45 (CN3) termianl PIN1 and 2 are reserved.
2. External 24V input terminal (CN4)
   - When only the single rectifier module powered by 24V, the maximum current requirement is greater than 1A. If multiple inverter modules and IO interface loads are added at the same time, the recommended maximum current requirement is greater than 3A.
   - I/O extension card function cannot work.
3. Analog control signal wiring specification: 0.75 mm^2 [18 AWG] with shielded stranded wire.

3-5 RFI Jumper and Leakage Current

RFI Jumper

The drive contains Varistors / MOVs that are connected from phase to phase and from phase to ground to prevent the drive from unexpected stop or damage caused by mains surges or voltage spikes. Because the Varistors / MOVs from phase to ground are connected to ground with the RFI jumper, removing the RFI jumper disables the protection.

Rectifier Module (Frame RA)

Flip over the product and remove the RFI jumper (as shown below).

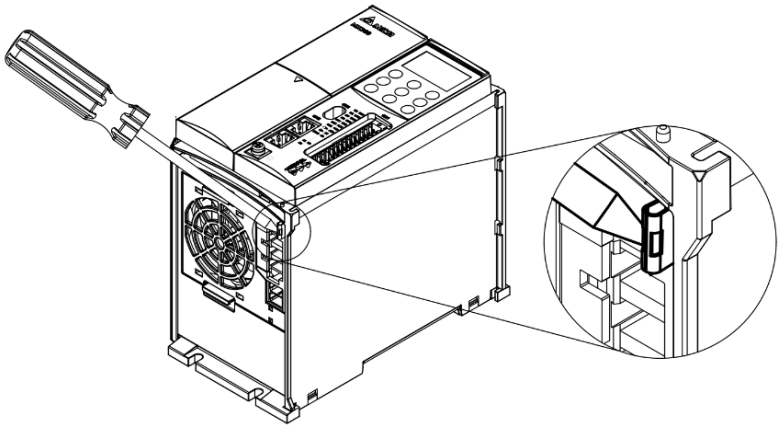


Figure 3-15

Isolating Main Power from Ground

When the power distribution system for the drive is a floating ground system (IT Systems) or an asymmetric ground system (Corner Grounded TN Systems), you must remove the RFI jumper. Removing the RFI jumper disconnects the internal capacitors from ground to avoid damaging the internal circuits and to reduce the ground leakage current.

Important points regarding ground connection

- ☑ To ensure the safety of personnel, proper operation, and to reduce electromagnetic radiation, you must properly ground the motor and drive during installation.
- ☑ The diameter of the grounding cables must comply with the local 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 aforementioned points are met.
- ☑ When installing multiple drives, do not connect the grounds of the drives in series but connect each drive to ground. The following pictures show the correct and wrong ways to connect the grounds.

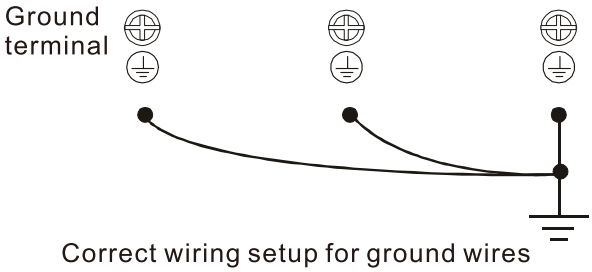


Figure 3-16

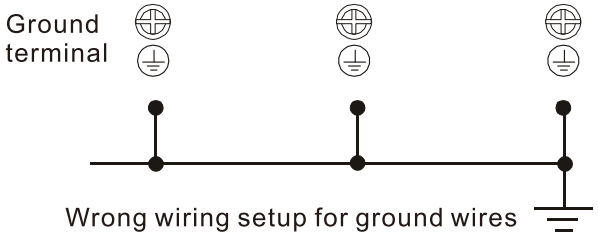


Figure 3-17

Pay particular attention to the following points:

☑ Do not remove the RFI jumper while the power is on.

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

☑ Do not remove the RFI jumper if the mains power is a symmetrical grounded power system in order to maintain the efficiency for EMC circuit.

☑ Remove the RFI jumper when conducting high voltage tests. When conducting a high voltage test to the entire facility, disconnect the mains 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, an ungrounded system, or a high impedance / resistance (greater than 30 Ω) grounded system.

1. 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.
2. Do not install an external ground / EMC filter. The EMC filter may pass through a filter capacitor and cause the input power to be grounded. This situation is very dangerous and may damage the drive easily.

Asymmetric Ground System (Corner Grounded TN Systems)

Caution: Do not remove the RFI jumper while power to the input terminal of the drive is ON.

In the following four situations, you must remove the RFI jumper This is to prevent the system from grounding through the RFI and filter capacitors and damaging the drive.

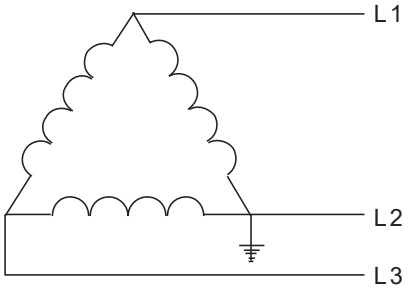
<table>
<tr><th colspan="2">Must remove the RFI jumper</th></tr>
<tr><td>1. Grounding at a corner in a triangle configuration.


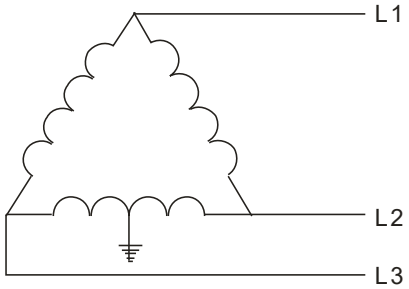
Figure 3-18</td><td>2. Grounding at a midpoint in a polygonal configuration.


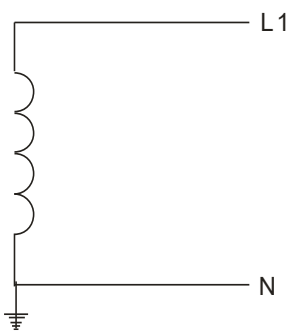
Figure 3-19</td></tr>
<tr><td>3. Grounding at one end in a single-phase configuration.


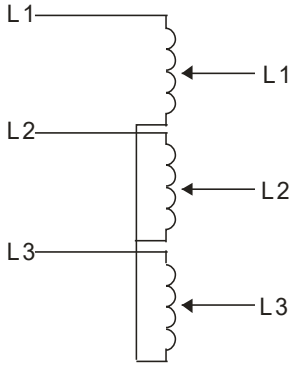
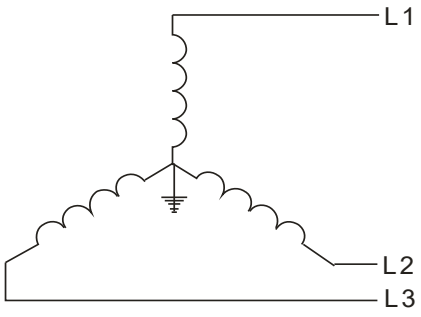
Figure 3-20</td><td>4. No stable neutral grounding in a three-phase autotransformer configuration.


Figure 3-21</td></tr>
</table>

Use the RFI jumper	
An internal ground is formed through a ground capacitor, which reduces electromagnetic radiation. The requirements for electromagnetic compatibility are relatively strict. And EMC filters can be installed in symmetrically grounded power system applications. For example, the diagram on the right is a symmetrical grounding power system.	 Figure 3-22

3-6 Harmonic Interference Prevention and Control

AC Reactor Connection

An AC reactor is required to suppress the rapid changes in current and the high-order harmonic currents. While suppressing the high-order harmonic currents will also improve the power factor on the input side of the drive.

Please connect the AC reactor to the input side (once side) in following cases.

- When suppressing the high-order harmonic currents or improving the power factor on the power supply side.
- When switching the phase advance capacitor.
- When connect the drive to a large power transformer (above 600 kVA).

NOTE: Refer to Section 10-6 for the selection and the installation of AC reactor.

3-7 Long Wiring Application

Motor Cable Length

1. Consequence of leakage current on the motor

   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 one AC motor drive, the total wiring length should be the sum of the wiring length from AC motor drive to each motor. For the 460V models 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.

2. Consequence of the surge voltage on the motor

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

   (1) Use a motor with enhanced insulation.

   (2) Reduce the cable length between the AC motor drive and motor to suggested values.

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

3. Maximum motor cable length allowed by the drive.

   The following table shows the allowable output motor wire length specifications of MX300 inverter module. Please refer to the motor selection and insulation capabilities and the IEC 60034-17 specification to check for installing an AC reactor to protect the motor.

Model		Rated Current for Normal Duty (Arms)	Without an AC Output Reactor	
			Shielded Cable (meter)	Non-shielded Cable (meter)
230V One-phase	VFD2A8MXx21Ax VFD2A8MXx21SA	3.5	50	75
	VFD4A8MXx21Ax VFD4A8MXx21SA	8		
	VFD7A5MXx21Ax VFD7A5MXx21SA	11		
	VFD11AMXx21Ax VFD11AMXx21SA	17.6		
460V Three-phase	VFD1A5MXx43Ax VFD1A5MXx43SA	2.3	50	75
	VFD2A7MXx43Ax VFD2A7MXx43SA	4.2		
	VFD4A2MXx43Ax VFD4A2MXx43SA	5.5		
	VFD5A5MXx43Ax VFD5A5MXx43SA	9		
	VFD9A0MXx43Ax VFD9A0MXx43SA	13	100	150

Model		Rated Current for Normal Duty (Arms)	Without an AC Output Reactor	
			Shielded Cable (meter)	Non-shielded Cable (meter)
460V Three-phase	VFD13AMXx43Ax VFD13AMXx43SA	17	100	150
	VFD17AMXx43Ax VFD17AMXx43SA	21		

Table 3-12

3-8 Electromagnetic Interference Prevention

When using an AC motor drive to drive the equipment, the harmonic noise will be generated on the power input and output sides of the drive and generates EMC interference on the power supply network and the electrical equipment around the AC motor drive. The AC motor drive is usually installed in an industrial environment with high electromagnetic interference. Under these circumstances, the drive may not only be a noise generator, but more possibly a noise receiver.

Delta drives have been optimized for EMC during design and comply with the EMC power system product standard EN 61800-3. Correctly install the drive can reduce the EMC interference. To ensure a long-term normal operation of the power system, the drive must be correct wiring and grounding.
The prevention methods are as follows.

3-8-1 Methods

3-8-1-1 Grounding

When the DC passes through a conductor, it passes through the entire conductor. When the AC passes through a conductor, the current moves increasingly close to the surface of the conductor as the frequency increases, this is so-called the Skin effect that the effective cross-sectional area of the conductor will be smaller, and the resistance value will increase. In conclusion, enlarge the effective cross-sectional area of grounding to increase the current flow at high frequencies may reduce the influence of the skin effect.

For the above circumstances, the grounding wire can be considered to change from a single wire to a braided conductor or a strip conductor.

3-8-1-2 Wire and Cable

The Shielded Twisted Pair (often abbreviated as STP) is a copper wire, which is twisted with several wires and packed in an insulating sleeve. The metal mesh (usually copper) outside the twisted wires can shield the transmission line from external electromagnetic field interference and also serve as a ground.

The outermost layer of the ware and cable is generally rubber or rubber synthetic sleeve, in order to insulate and to protect the cable from damage.
Cables are divided into high-voltage and low-voltage cables, which have significant differences in structure. High-voltage cable have a layer of resin-like filler inside which is the most important part of insulation. Low-voltage cables are wrapped with something like a ribbon inside to fix each core of the cable and fill the gap in the middle.

The two functions for the shielding layer of the power cable are as follows:

1. The current passing through the power cable is relatively large, resulting in a magnetic field around the current. To avoid affecting other components, the shielding layer can shield this electromagnetic field in the cable.
2. To achieve a certain degree of ground protection. If the cable core is damaged, the leaked current flows into the grounding grid along the shielding layer to achieve safety protection.

3-8-1-3 Filter

Electromagnetic interference is divided into ration and conduction according to the energy transmitting methods. For radiated interference, shielding technology can generally achieve the best results; as for conducted interference, the most effective and economical methods is to use magnetic filter components to eliminate and suppress it.

In noise interference, the 150K–300 MHz frequency band is called high-frequency; and 120–3000 Hz frequency band is called low-frequency. The high-frequency noise current has a small amplitude but high frequency, and the low-frequency noise current has a large amplitude but low frequency. Both of them are transmitted to the power supply system through the power line.

The high-frequency interference conducted by the power supply needs to be effectively eliminated and suppressed by using a filter. The filter is composed of an inductance coil and a capacitor. MX300 do not have built-in filters, in which case an external filter must be purchased. Refer to chapter 10-8 EMC Filter for general standard filter wiring diagram.

Since the drive switches the output at high speed, the noise is transmitted from the drive power line, which may cause interference to external equipment (radio, telephone, non-contact switch, pressure sensor or position detector). It is recommended to install an EMC filter on the input side to reduce the noise from the drive to the power line and the reverse noise as well.

NOTE:

1. Use an EMC filter dedicated to the drive.
2. Install the EMC filter as close to the drive as possible.

Connect an EMC filter to the input side of the drive to reduce the radio noise and induction noise. Filter wiring is shown as the figure below.

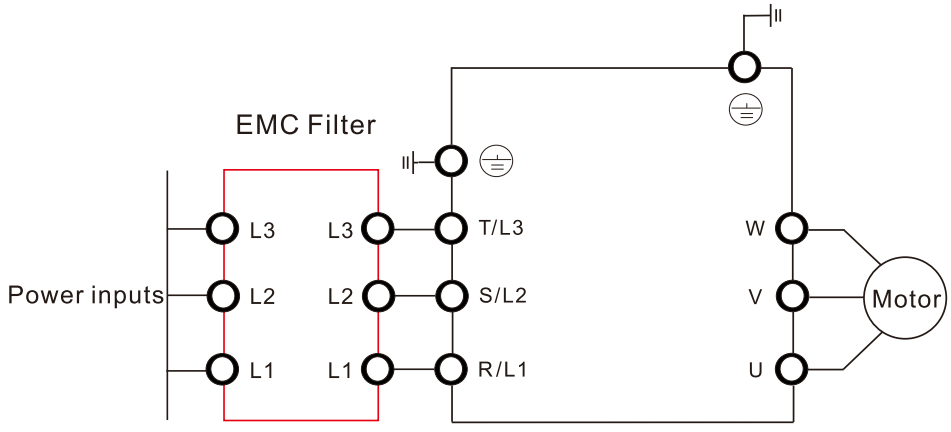


Figure 3-23

NOTE: Do NOT connect phase advanced capacitors and LC/RC filters to the output circuit of the drive. Otherwise, the drive, phase advanced capacitor, EMC filter and earth-leakage circuit-breaker may be damaged.

3-8-1-4 Zero Phase Reactor (Choke)

Install a zero-phase reactor on the input or output side can also reduce the interference. Due to the large current passing through the power input / output line, the large load current on the zero-phase reactor need to be more attention to the saturation of the magnetic core. The ideal material is the composite magnetic powder core which is highly anti-saturated and its resistivity is several times larger than pure metal magnetic material; therefore, it can be applied in a higher frequency band. You can also increase the number of turns to obtain high impedance capability.
Refer to chapter 10-7 Zero Phase Reactor for details.

3-8-2 Installation

All electrical equipment, including AC motor drives, generate high frequency / low frequency noise and interfere with peripheral equipment by radiation or conduction when in operation. You can eliminate most of the interference by install an EMC filter correctly. It is recommended to use DELTA EMC filter to have the best interference elimination performance.

We assure that it can comply with following rules when AC motor drive and EMC filter are installed and wired according to user manual:

1. EN61000-6-4
2. EN61800-3 1996
3. EN55011 (1991) Class A Group 1

3-8-2-1 General Precautions

To ensure EMC filter can maximize the effect of suppressing the interference of AC motor drive, the installation and wiring of AC motor drive should follow the user manual. In addition, be sure to observe the following precautions:

1. All metal parts and components of the control cabinet (side panels, back panel, top, and bottom panel) must be connected to the control cabinet frame, to ensure maximum contact or the maximum number of bolts required by the proper electrical connection.
2. Power cables and signal cables / control cables should be routed in separate wiring ducts and maintained at 30 cm distance to prevent high-voltage or high-current power cables from interfering with signal cables. If a 30 cm distance between power cables and signal cables is not possible, separate them with metal plates.
3. Power and signal cables should be kept as short as possible to avoid antenna effects and interference.
4. Shielded cables are recommended for power or signal cables outside the control panel and grounded at both ends.
   NOTE: Encoders should be grounded at the driver end.

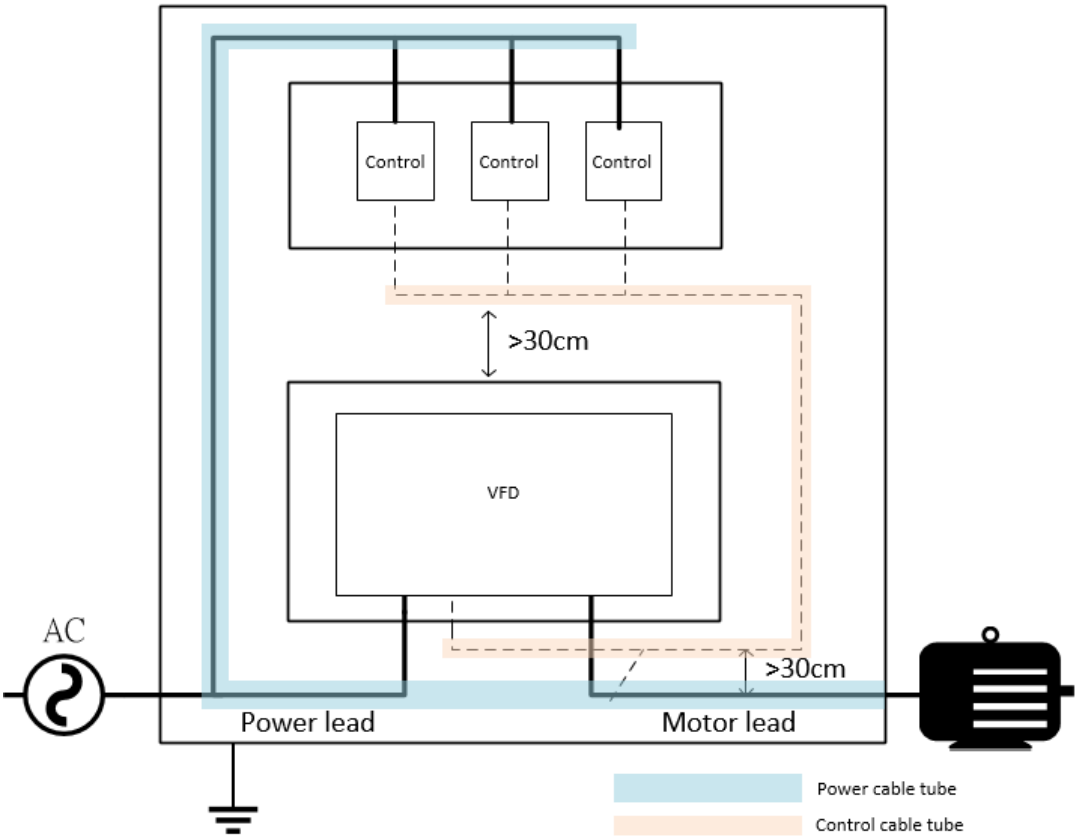


Figure 3-24 Better wiring duct layout

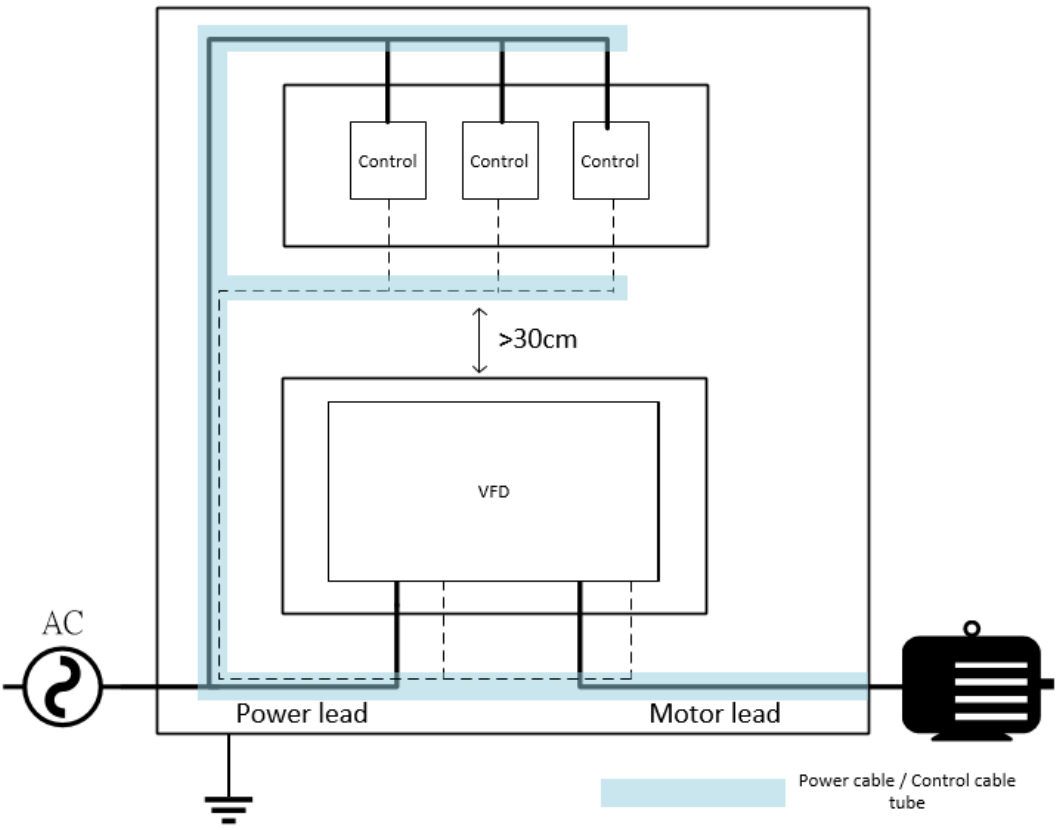


Figure 3-25 Worse wiring duct layout

3-8-2-2 Motor Cable Selection and Precautions

Improper installation and choice of motor cable affect the performance of EMC filter. Be sure to follow the precautions below when selecting motor cable.

1. Use the cable with shielding (double shielding is the best). The shielding on both ends of the motor cable should be grounded with the minimum length and maximum contact area.
2. Remove any paint on metal saddle for good ground contact with the saddle and the metal plate, as shown in Figure 3-26.
3. The connection between the motor cable isolated copper mesh and the metal plate must be correct. The isolated copper mesh at both ends of the motor cable should be fixed to the metal plate with a saddle. Refer to Figure 3-27 for correct connecting method.

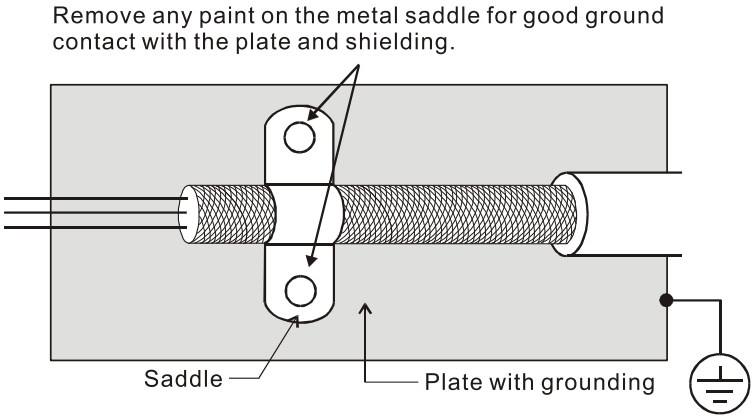


Figure 3-26

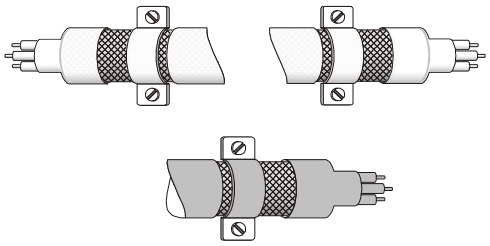


Figure 3-27

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Chapter 4 Operation Interface

4-1 Built-in Keypad

4-2 Built-in Keypad Operation Process

4-1 Built-in Keypad

MX300-C models:



MX300-E models:





Axis Number and Communication Protocol Display Area (Display alternately)
Axis Number:
- 0: Converter module
- 1–9: Right inverter module
- 10–15: Left inverter module

Communication Protocol:
- EC: EtherCAT
- PN: PROFINET
- EI: EtherNet/IP

Axis number replacement
Change operation axis

Stop / Reset Key
Stops the drive and resets after error

Stauts Display Area
STOP: Stop; FWD: Forward; RUN: Run;
PLC: Unsupported; REV: Reverse;
ALM: Error / Warning

Main Display Area
F: Frequency command; H: Frequency output;
U: Multi-function display page; A: Output current;
Frd / rEv: Forward/Reverse command;
JoG: Inching (Up key: Forward / Down key: Reverse);
CoPPr: Parameter copy (whole system and single drive)

Selection Key for Display Screen
Changes the Display Screen mode

Enter Key
1. Enters the setting page
2. Confirms the setting of the parameter

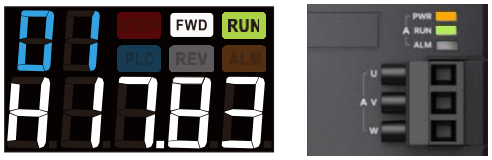
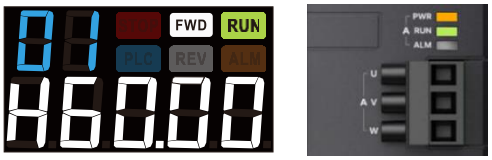
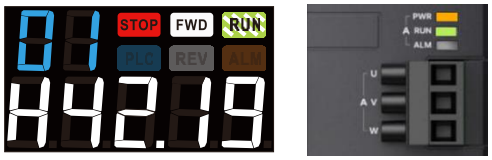
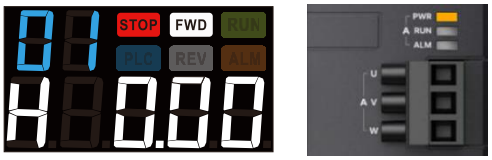
Run Key
Starts the multi-axis

Keypad Function Descriptions

Key	Descriptions
	**Axis Number Replacement** Change operation axis
	**Selection Key for Display Screen** Changes the Display Screen mode
	**Direction: Left / Right / Up / Down** 1. In the numeric value setting mode, moves the cursor and changes the numeric value. 2. In the menu / text selection mode, selects an item.
	**Enter / Confirm** 1. Enters the setting page 2. Confirms the setting of the parameter
	**Stop / Reset** 1. This key has the highest priority when the command is from the keypad. 2. When it receives the STOP command, regardless of whether the AC motor drive is in operation or stop status, the AC motor drive executes the “STOP” command. 3. Use the RESET key to reset the drive after a fault occurs. 4. If you cannot reset after the error: (1) The condition which triggers the fault is not cleared. After you clear the condition, you can then reset the fault. (2) The drive is in fault status when powered on. After you clear the condition, restart and then you can reset the fault.
	**Run Key** Starts the multi-axis

Status indicator

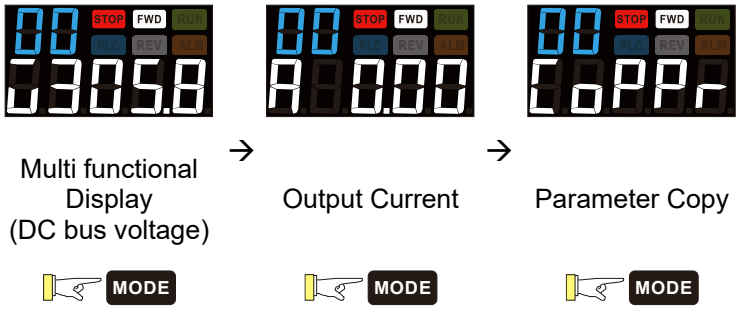
Inverter status indicators (PWR, RUN, ALM)	Descriptions
	• PWR (Orange): power indicator light – On: Power-on state – Flashing: Keypad / computer in operation – Off: No power state • RUN (Green): running indicator light – On: Running – Off: Stopping • ALM (Red): Error indicator ligh – On: Fault occurs – Flashing: Warning occurs – Off: No error and warning

During acceleration	During constant speed operation
• RUN light: Always-on STOP light: Off • RUN light on inverter module: Always-on 	• RUN light: Always-on STOP light: Off • RUN light on inverter module: Always-on 
During deceleration	**STOP**
• RUN light: Flashing STOP light: Always-on • RUN light on inverter module: Always-on 	• RUN light: Off STOP light: Always-on • RUN light on inverter module: Off 

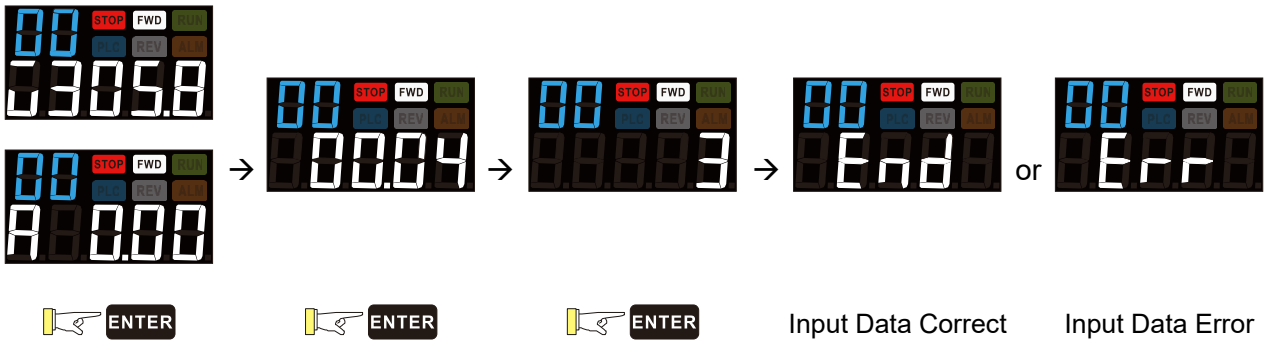
4-2 Built-in Keypad Operation Process

4-2-1 Rectifier module

- Main Page Selection:

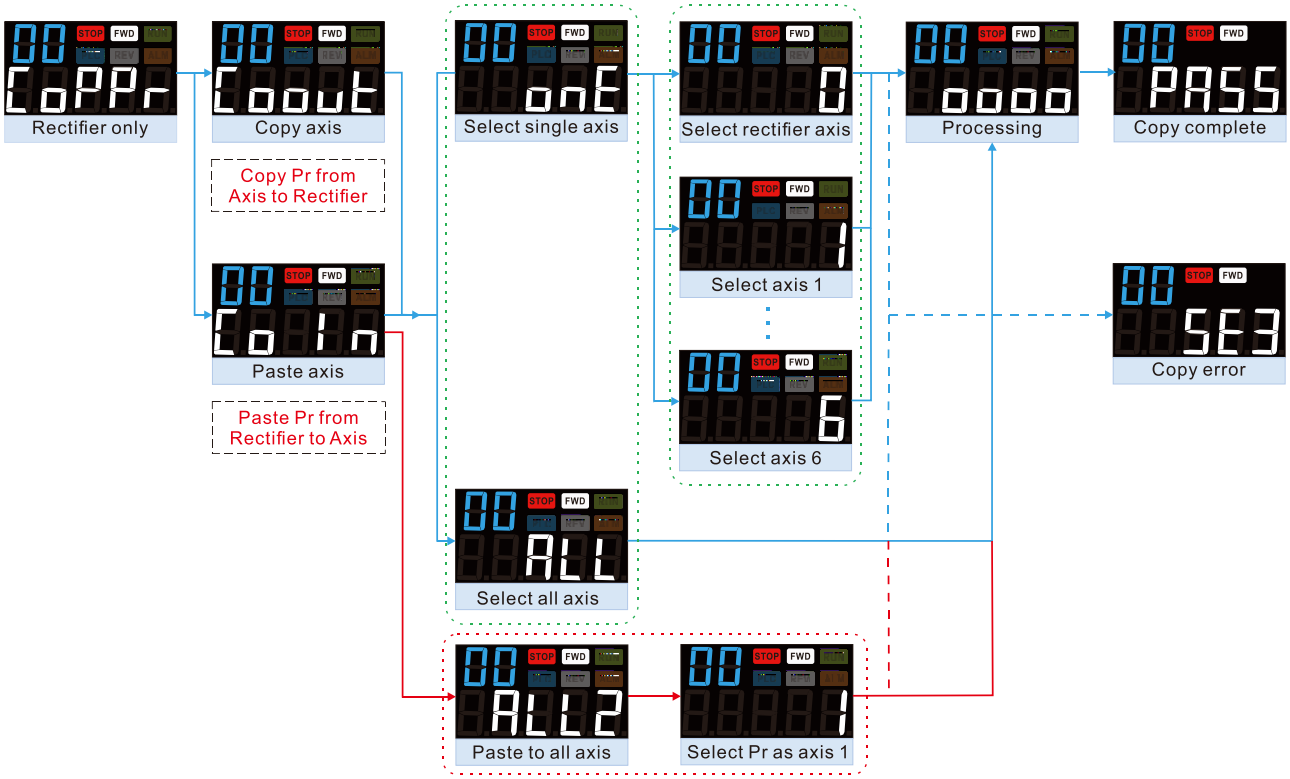


- Parameter Setting:



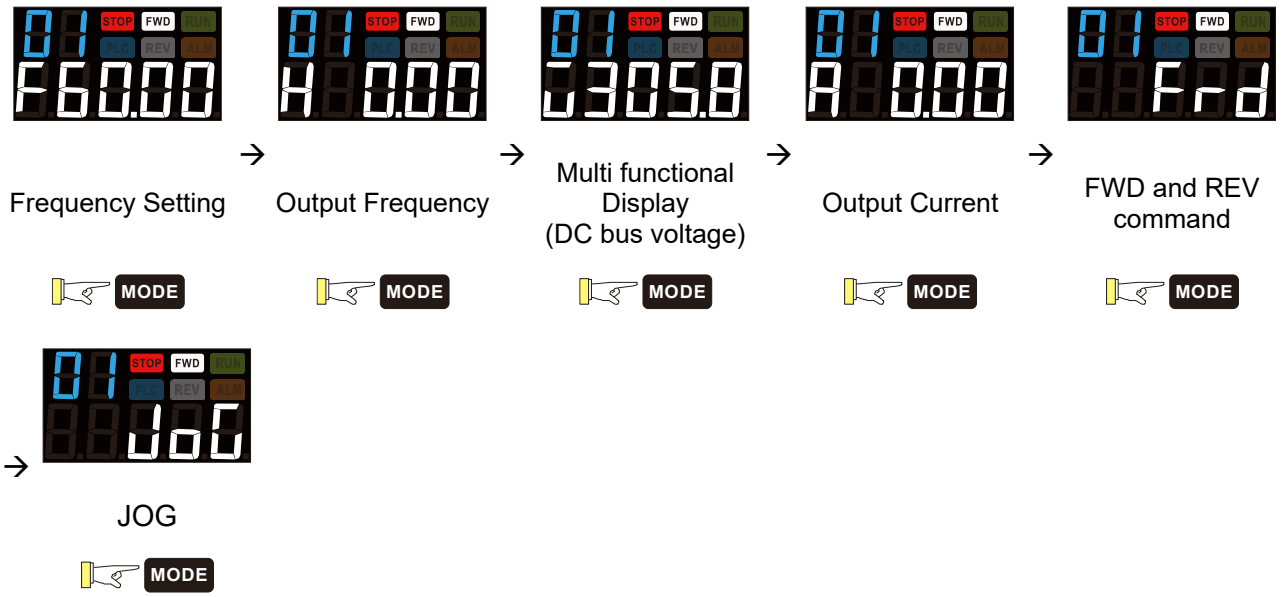
Key points: In the parameter setting mode, MODE can return to the screen selection mode.

- Parameter Copy:

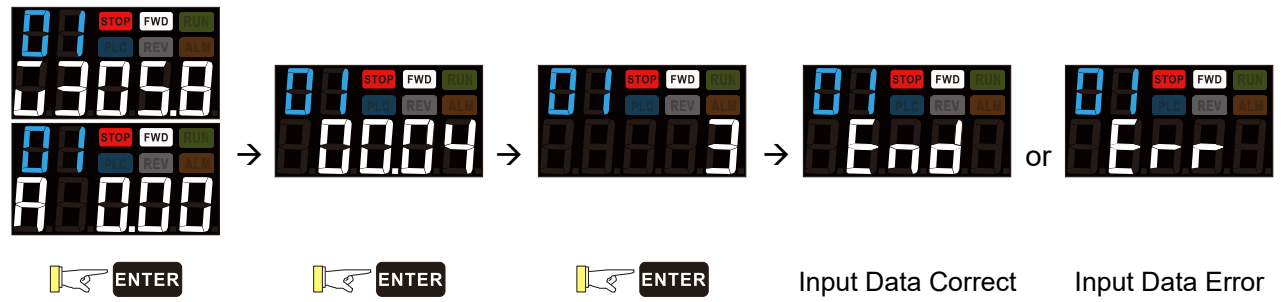


4-2-2 Inverter module

- Main Page Selection:



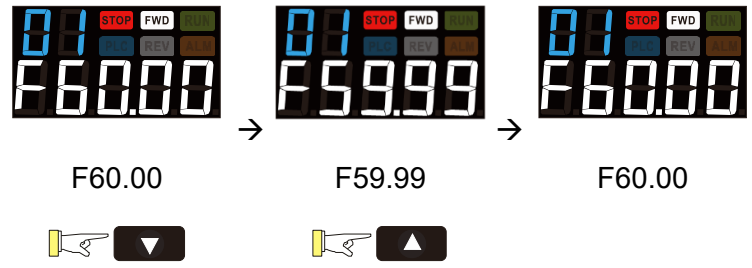
- Parameter Setting:



Key points: In the parameter setting mode, MODE can return to the screen selection mode.

- Data modification:

(When the frequency command source is keypad)



- Steering setting:

(When the operation command source is keypad)



- JOG:



State of rest → FWD operating → FWD deceleration (RUN light flashing) → Stop operating

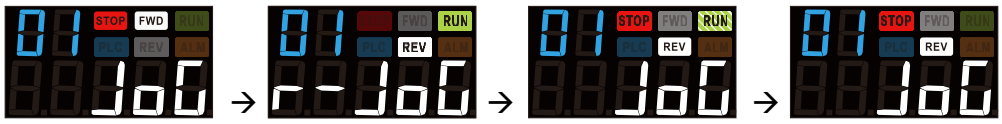


Long Press



Not Press

or



State of rest → REV operating → REV deceleration (RUN light flashing) → Stop operating



Long Press



Not Press

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Chapter 5 Initial operation and adjustment

5-1 Initial startup steps

5-2 Operation source setting

5-3 IMVF Adjustment

5-4 IMSVC Adjustment

5-5 PMSVC Adjustment



- ☑ Turn off the AC motor drive power before doing any wiring. A charge with hazardous voltages may remain in the DC bus capacitors even after the power has been turned off for a short time. Measure the remaining voltage with a DC voltmeter before doing any wiring. For your safety, do not start wiring before the voltage drops to a safe level (less than 25 V_{DC}). Installing wiring with a residual voltage may cause personal injury, sparks and a short circuit
- ☑ 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.
- ☑ 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 must be in the range indicated on the nameplate.
  (Refer to Section 1-1 Nameplate Information for details).
- ☑ All units must be grounded directly to a common ground terminal to prevent damage from a lightning strike or electric shock and reduce noise interference.
- ☑ Tighten the screws of the main circuit terminals to prevent sparks caused by screws loosened due to vibration.



- ☑ For your safety, choose wires that comply with local regulations when wiring.
- ☑ Check the following items after finishing the wiring:
  1. Are all connections correct?
  2. Are there any loose wires?
  3. Are there any short circuits between the terminals or to ground?

5-1 Initial startup steps

Check Items before Power ON:

1. R, S and T are the input terminals of the drive, which are connected to the power supply and there is no voltage between the phase-to-phase or phase-to-ground.
2. U, V and W are the output terminals of the drive, which are connected to the motor and there is no voltage between the phase-to-phase or phase-to-ground.
3. Make sure the resistance of U-V, V-W and W-U are the same.
4. Check whether the input voltage matches the voltage of the drive and motor.
5. Check whether the screws on terminals are tighten well.
6. Check whether the control circuit terminal is short-circuited.
7. Make sure to close the top cover of the drive to avoid accidental touch.
8. Make sure all the power switches of the drive are OFF.

Check Items after Power ON:

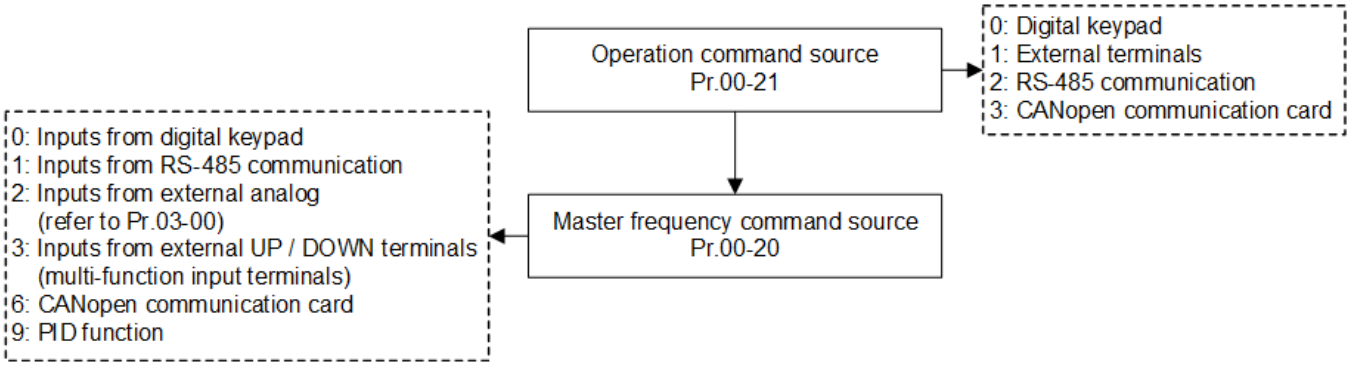
1. Check whether the keypad on the drive displays the initial setting page or main page.
2. If a fault code shows, refer to Chapter 8 Troubleshooting to clear the fault.

5-2 Operation source setting

The following are abbreviations for different types of motors:

- IM: Induction motor
- PM: Permanent magnet synchronous AC motor
- IPM: Interior permanent magnet synchronous AC motor
- SPM: Surface permanent magnet synchronous AC motor

5-2-1 Adjustment Flowchart



5-5-2 Adjustment Steps

1. Set the operation command source.

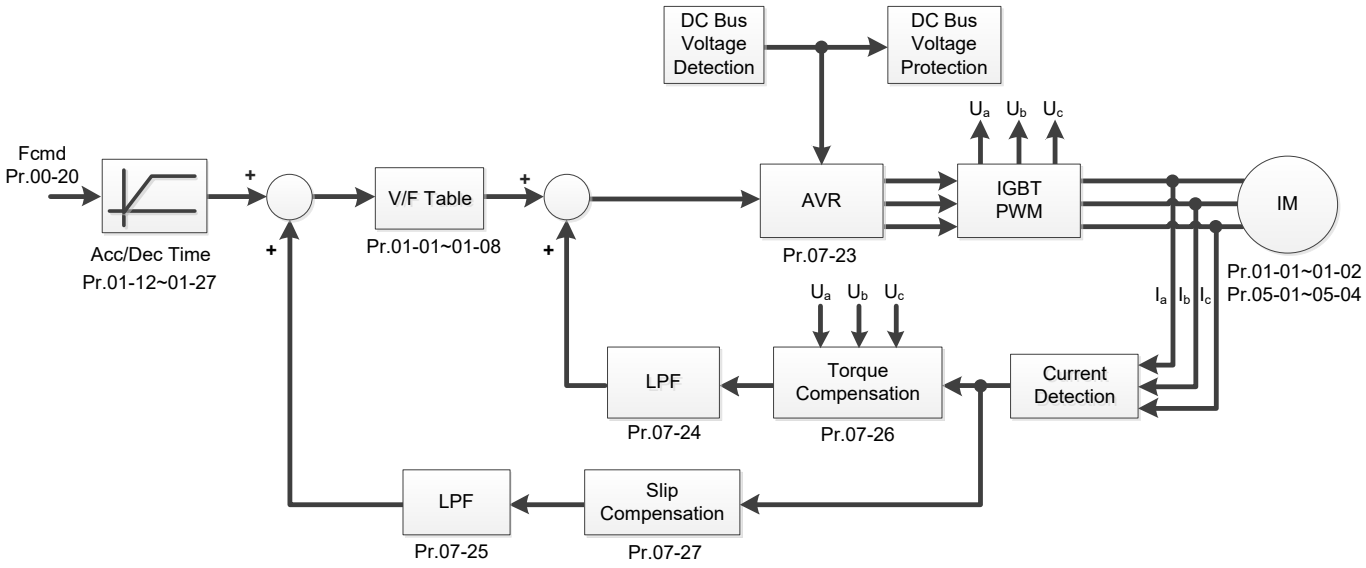
Pr.	Explanation	Settings
00-21	Operation Command Source	0: Digital keypad 1: External terminals 2: RS-485 communication input 3: CANopen communication card

2. Example: Setup source for the master frequency command.

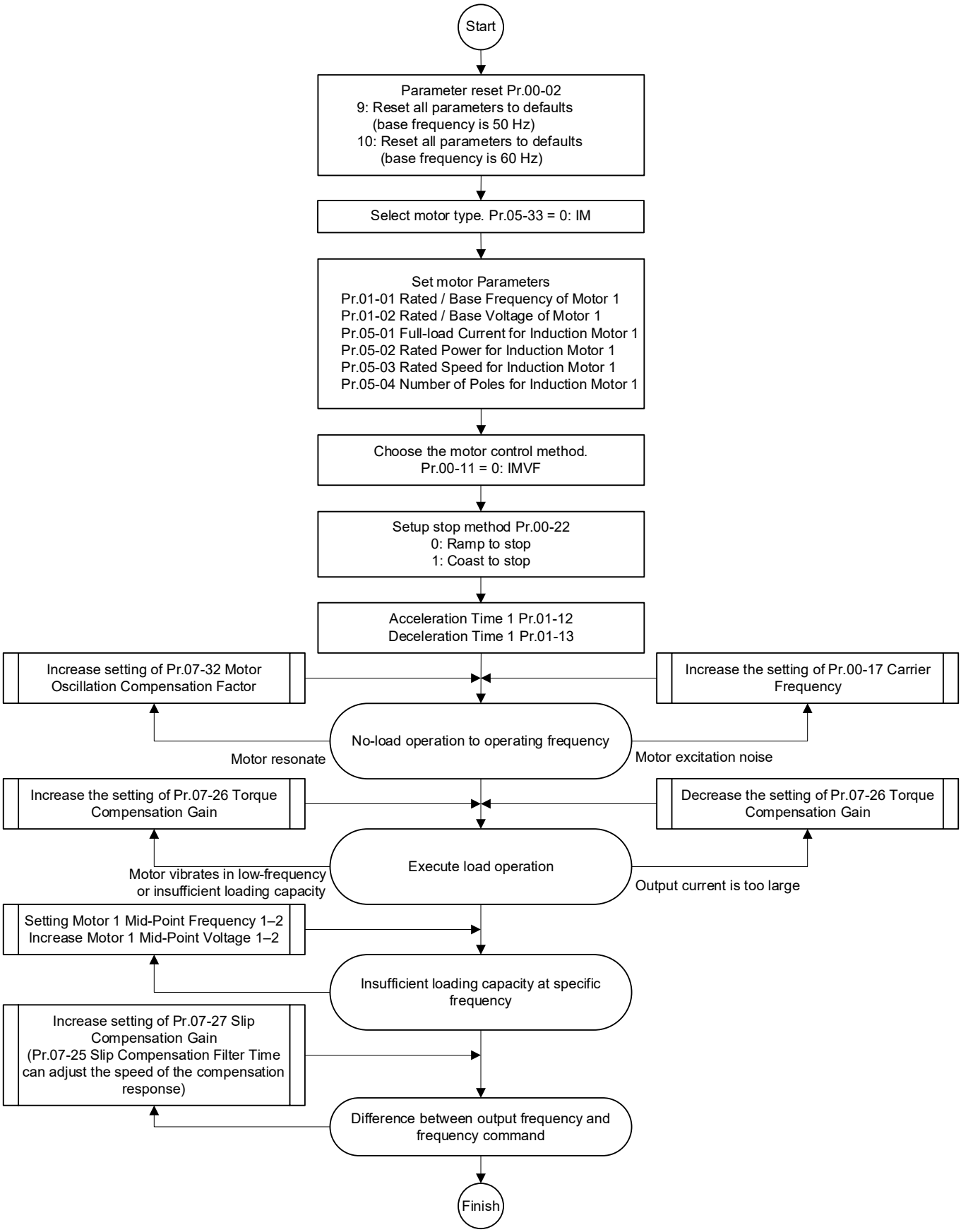
Pr.	Explanation	Settings
00-20	Master frequency command source	0: Digital keypad 1: RS-485 communication input 2: External analog input (Refer to Pr.03-00) 3: External UP / DOWN terminal (multi-function input terminals) 6: CANopen communication card 9: PID

5-3 IMVF Adjustment

5-3-1 Control diagram



5-3-2 Adjustment Flowchart



5-3-3 Adjustment Steps

1. Parameter reset.
   Pr.00-02 = 9, reset to 50 Hz default or Pr.00-02 = 10, reset to 60 Hz default.
2. Select motor type.
   Set Pr.05-33 = 0: IM.
3. Set motor Parameters.

Pr.	Explanation	Pr.	Explanation
01-01	Rated / Base Frequency of Motor 1	05-02	Rated Power for Induction Motor 1
01-02	Rated / Base Voltage of Motor 1	05-03	Rated Speed for Induction Motor 1
05-01	Full-load Current for Induction Motor 1	05-04	Number of Poles for Induction Motor 1

4. Choose the motor control method.
   Set Pr.00-11 = 0: IMVF.
5. Setup stop method.

Pr.	Explanation	Settings
00-22	Stop method	0: Ramp to stop 1: Coast to stop

6. Set the acceleration and deceleration time.

Pr.	Explanation	Pr.	Explanation
01-12	Acceleration Time 1	01-13	Deceleration Time 1

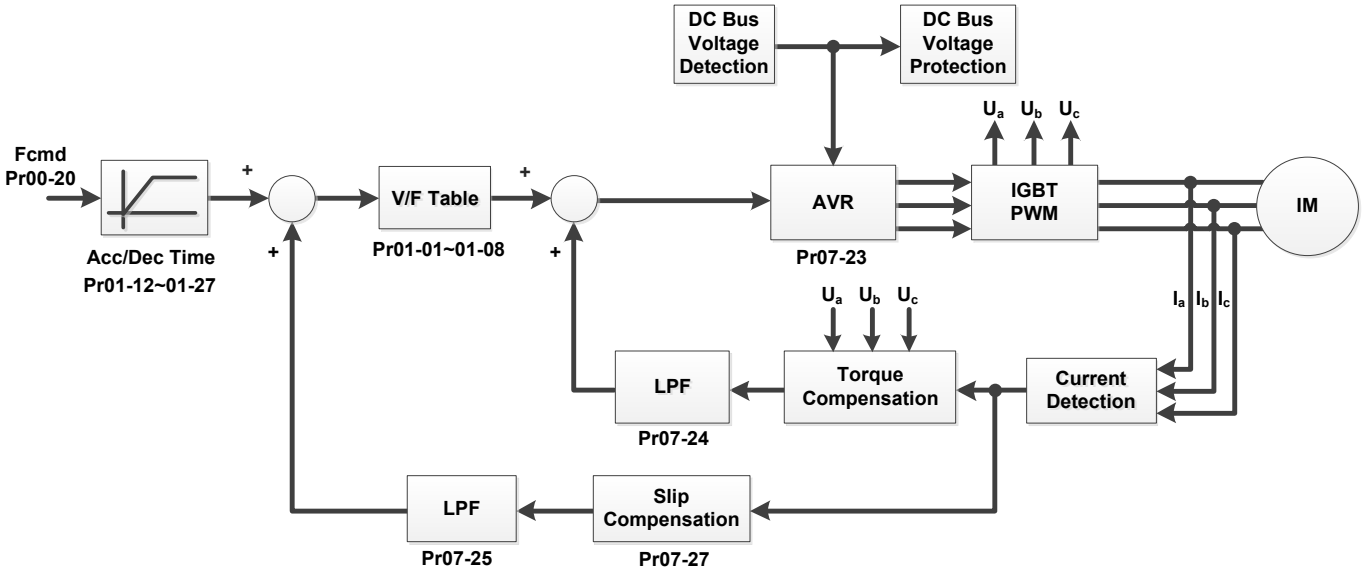
7. No-load operation to operating frequency.
   (1) If the motor resonates, increase setting of Pr.07-32 Motor Oscillation Compensation Factor.
   (2) If there is motor excitation noise, increase the setting of Pr.00-17 Carrier Frequency.
8. Execute load operation.
   (1) If the motor vibrates in low-frequency or has insufficient loading capacity, increase the setting of Pr.07-26 Torque Compensation Gain to enhance the loading capacity for full frequency range; however, it may cause over current if you set this parameter too large.
   (2) If the output current is too large, decrease the setting of Pr.07-26 Torque Compensation Gain or increase setting of Pr.07-24 Torque Command Filter Time, you can also adjust the VF curve if the motor loading capacity at this time is insufficient.
9. If the loading capacity at specific frequency is insufficient, adjust the VF curve manually to increase the output voltage corresponding to the specific frequency.

Pr.	Explanation	Pr.	Explanation
01-03	Motor 1 Mid-Point Frequency 1	01-04	Motor 1 Mid-Point Voltage 1
01-05	Motor 1 Mid-Point Frequency 2	01-06	Motor 1 Mid-Point Voltage 2
01-07	Motor 1 Minimum Output Frequency	01-08	Motor 1 Minimum Output Voltage

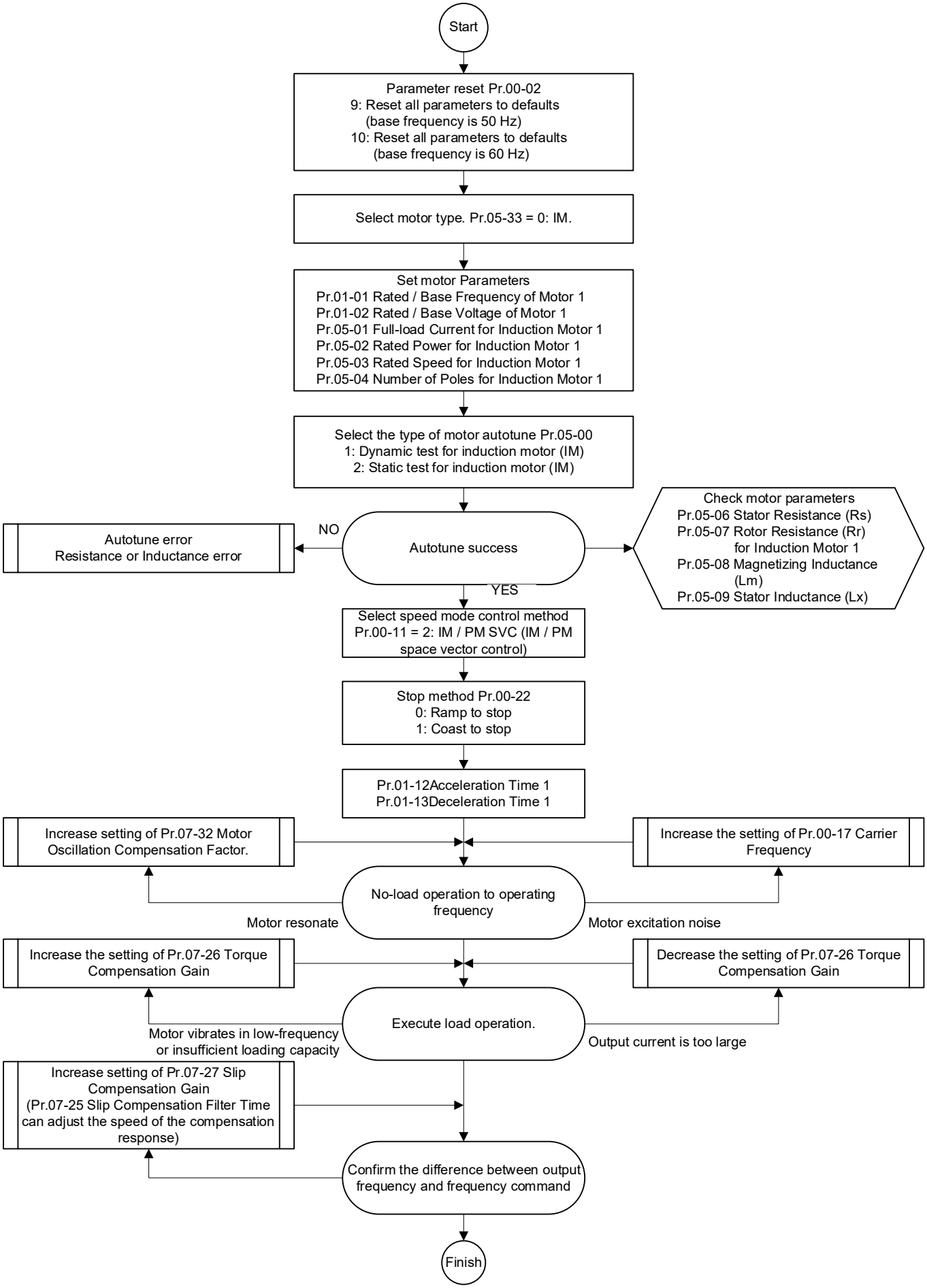
10. Confirm the difference between output frequency and frequency command.
    If the difference between the motor output frequency and the frequency command is too large, increase setting of Pr.07-27 Slip Compensation Gain. And Pr.07-25 Slip Compensation Filter Time can adjust the speed of the compensation response.

5-4 IMSVC Adjustment

5-4-1 Control diagram



5-4-2 Adjustment Flowchart



5-4-3 Adjustment Steps

1. Parameter reset.

   Pr.00-02 = 9, reset to 50 Hz default or Pr.00-02 = 10, reset to 60 Hz default.

2. Select motor type.

   Set Pr.05-33 = 0: IM.

3. Set motor Parameters.

Pr.	Explanation	Pr.	Explanation
01-01	Rated / Base Frequency of Motor 1	05-02	Rated Power for Induction Motor 1
01-02	Rated / Base Voltage of Motor 1	05-03	Rated Speed for Induction Motor 1
05-01	Full-load Current for Induction Motor 1	05-04	Number of Poles for Induction Motor 1

4. Select the type of motor autotune.

   (1) If the motor does not connect to a load and is able to rotate, set Pr.05-00 = 1: Dynamic test for induction motor (IM).

   (2) If the motor is connected to a load or cannot rotate, set Pr.05-00 = 2: Static test for induction motor (IM).

5. Execute autotune.

   (1) Autotune success, check the motor parameters.

Pr.	Explanation	Pr.	Explanation
05-06	Stator Resistance (Rs)	05-08	Magnetizing Inductance (Lm)
05-07	Rotor Resistance (Rr)	05-09	Stator Inductance (Lx)

   (2) Autotune error, refer to the Chapter 9 for fault code information of the drive and keypad.

Fault codes	Description
AUE (40)	Auto-tuning error
AUE1 (142)	No feedback current error when motor parameter automatically detects.
AUE2 (143)	Motor phase loss error when motor parameter automatically detects.
AUE3 (144)	No load current measurement error when the motor parameter automatically detects.

6. Select speed mode control method.

   Set Pr.00-11 = 2: IM / PM SVC (IM / PM space vector control).

7. Setup stop method.

Pr.	Explanation	Settings
00-22	Stop method	0: Ramp to stop 1: Coast to stop

8. Set the acceleration and deceleration time.

Pr.	Explanation	Pr.	Explanation
01-12	Acceleration Time 1	01-13	Deceleration Time 1

9. No-load operation to operating frequency.

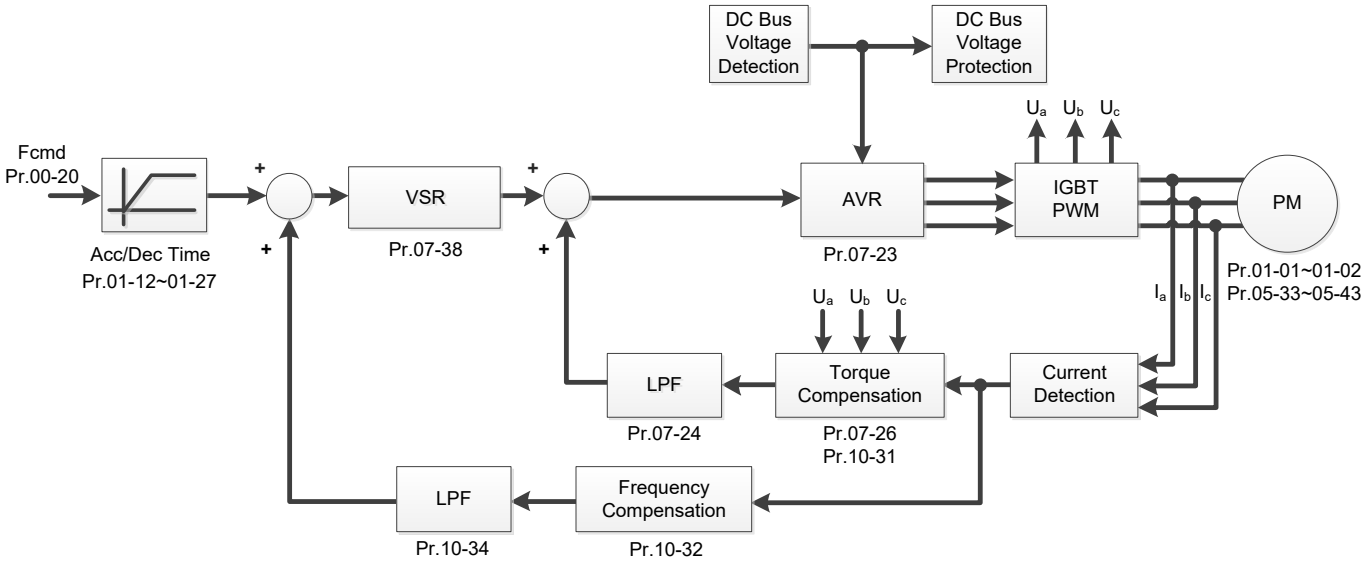
   (1) If the motor resonates, increase setting of Pr.07-32 Motor Oscillation Compensation Factor.

   (2) If there is motor excitation noise, increase the setting of Pr.00-17 Carrier Frequency.

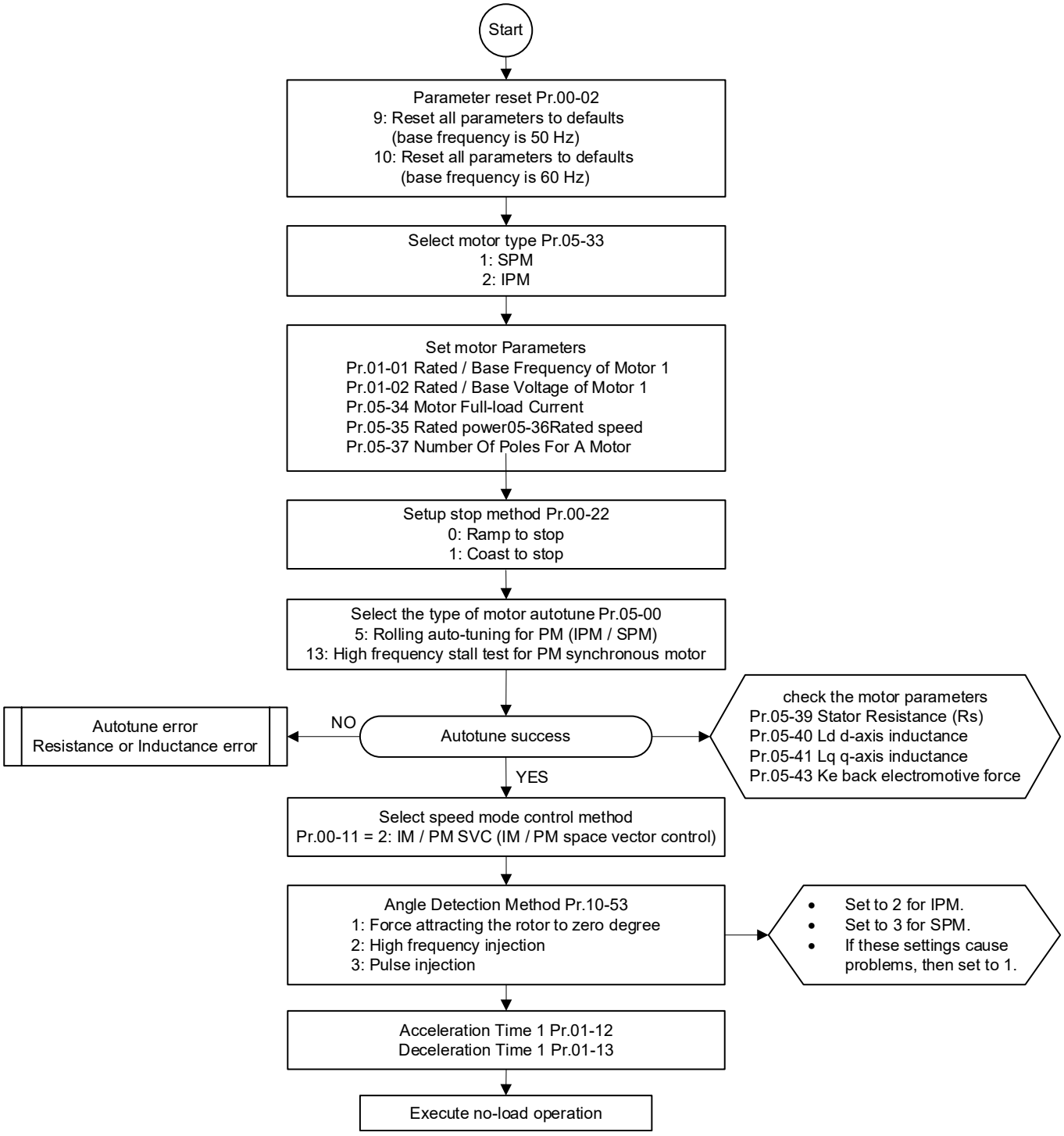
10. Execute load operation.
    (1) If the motor vibrates in low-frequency or has insufficient loading capacity, increase the setting of Pr.07-26 Torque Compensation Gain to enhance the loading capacity for full frequency range; however, it may cause over current if you set this parameter too large.
    (2) If the output current is too large, decrease the setting of Pr.07-26 Torque Compensation Gain or increase setting of Pr.07-24 Torque Command Filter Time.
11. Confirm the difference between output frequency and frequency command.
    If the difference between the motor output frequency and the frequency command is too large, increase setting of Pr.07-27 Slip Compensation Gain. And Pr.07-25 Slip Compensation Filter Time can adjust the speed of the compensation response.

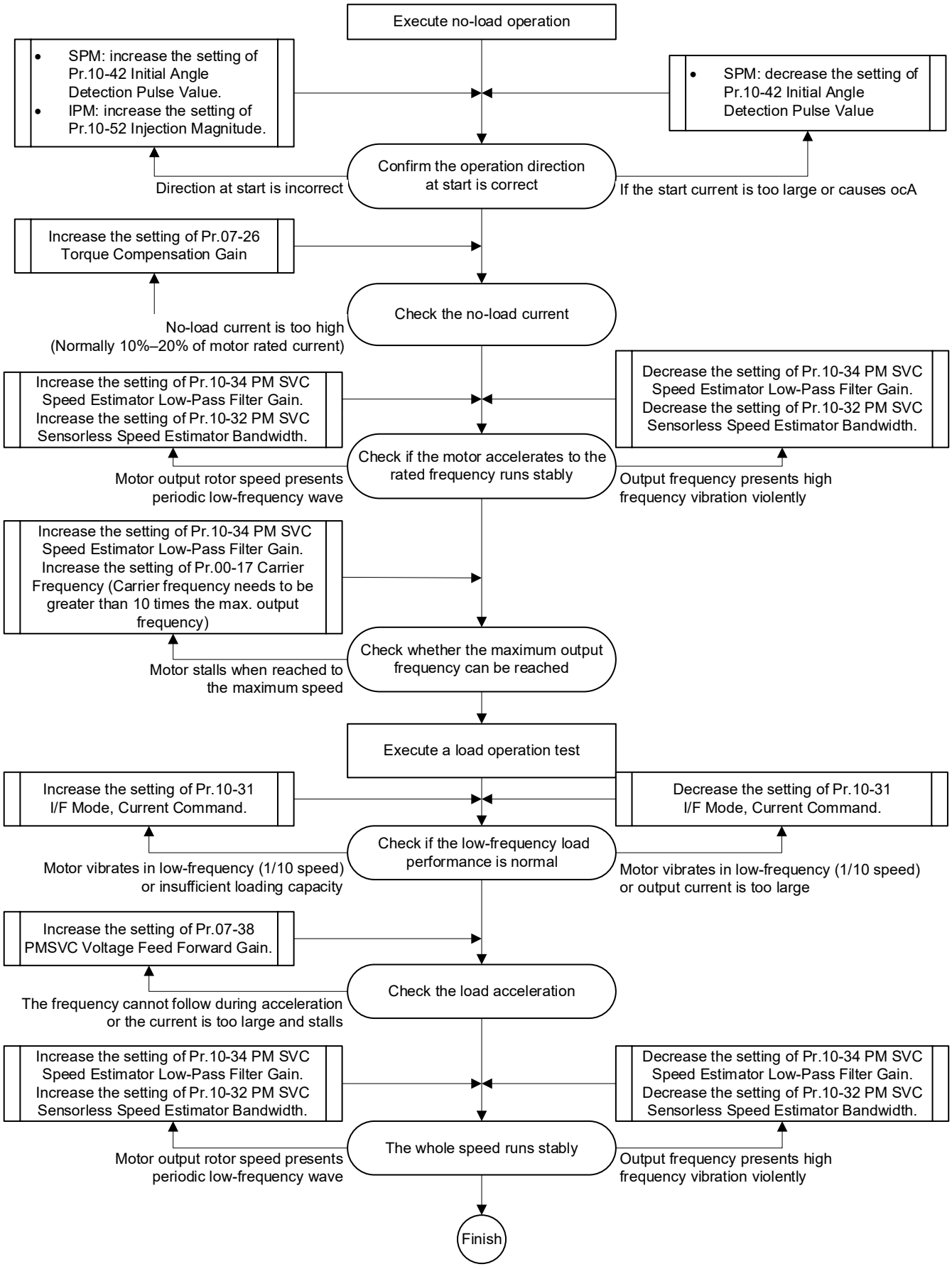
5-5 PMSVC Adjustment

5-5-1 Control diagram



5-5-2 Adjustment Flowchart




Execute no-load operation
SPM: increase the setting of Pr.10-42 Initial Angle Detection Pulse Value.
IPM: increase the setting of Pr.10-52 Injection Magnitude.
SPM: decrease the setting of Pr.10-42 Initial Angle Detection Pulse Value
Confirm the operation direction at start is correct
Direction at start is incorrect
If the start current is too large or causes ocA
Increase the setting of Pr.07-26 Torque Compensation Gain
Check the no-load current
No-load current is too high (Normally 10%–20% of motor rated current)
Increase the setting of Pr.10-34 PM SVC Speed Estimator Low-Pass Filter Gain. Increase the setting of Pr.10-32 PM SVC Sensorless Speed Estimator Bandwidth.
Decrease the setting of Pr.10-34 PM SVC Speed Estimator Low-Pass Filter Gain. Decrease the setting of Pr.10-32 PM SVC Sensorless Speed Estimator Bandwidth.
Check if the motor accelerates to the rated frequency runs stably
Motor output rotor speed presents periodic low-frequency wave
Output frequency presents high frequency vibration violently
Increase the setting of Pr.10-34 PM SVC Speed Estimator Low-Pass Filter Gain. Increase the setting of Pr.00-17 Carrier Frequency (Carrier frequency needs to be greater than 10 times the max. output frequency)
Check whether the maximum output frequency can be reached
Motor stalls when reached to the maximum speed
Execute a load operation test
Increase the setting of Pr.10-31 I/F Mode, Current Command.
Decrease the setting of Pr.10-31 I/F Mode, Current Command.
Check if the low-frequency load performance is normal
Motor vibrates in low-frequency (1/10 speed) or insufficient loading capacity
Motor vibrates in low-frequency (1/10 speed) or output current is too large
Increase the setting of Pr.07-38 PMSVC Voltage Feed Forward Gain.
Check the load acceleration
The frequency cannot follow during acceleration or the current is too large and stalls
Increase the setting of Pr.10-34 PM SVC Speed Estimator Low-Pass Filter Gain. Increase the setting of Pr.10-32 PM SVC Sensorless Speed Estimator Bandwidth.
Decrease the setting of Pr.10-34 PM SVC Speed Estimator Low-Pass Filter Gain. Decrease the setting of Pr.10-32 PM SVC Sensorless Speed Estimator Bandwidth.
The whole speed runs stably
Motor output rotor speed presents periodic low-frequency wave
Output frequency presents high frequency vibration violently
Finish

5-5-3 Adjustment Steps

1. Parameter reset.
   Pr.00-02 = 9, reset to 50 Hz default or Pr.00-02 = 10, reset to 60 Hz default.
2. Select motor type.
   Set Pr.05-33 = 1: SPM, 2: IPM.
3. Set motor Parameters.

Pr.	Explanation	Pr.	Explanation
01-01	Rated / Base Frequency of Motor 1	05-35	Rated power
01-02	Rated / Base Voltage of Motor 1	05-36	Rated speed
05-34	Motor Full-load Current	05-37	Number Of Poles For A Motor

4. Select the type of motor autotune.
   (1) If the motor does not connect to a load and is able to rotate, set Pr.05-00 = 5: Rolling auto-tuning for PM (IPM / SPM).
   (2) If the motor is connected to a load or cannot rotate, set Pr.05-00 = 13: High frequency stall test for PM synchronous motor.
5. Execute autotune.
   (1) Autotune success, check the motor parameters.

Pr.	Explanation	Pr.	Explanation
05-39	Stator Resistance (Rs)	05-41	Lq q-axis inductance
05-40	Ld d-axis inductance	05-43	Ke back electromotive force

   (2) Autotune error, refer to the Chapter 8 for fault code information of the drive and keypad.

Fault codes	Description
AUE (40)	Auto-tuning error
AUE1 (142)	No feedback current error when motor parameter automatically detects.
AUE2 (143)	Motor phase loss error when motor parameter automatically detects.

6. Select speed mode control method.
   Set Pr.00-11 = 2: IM / PM SVC (IM / PM space vector control).
7. Select the SM rotor initial detection method.
   (1) If the mechanism or process allows reversal, set Pr.10-53 = 1: Force attracting.
      - Force attracting the rotor to zero degree.
   (2) If the motor is IPM, PMA and SynRM and the system no reversal allowed, set Pr.10-53 = 2: High frequency injection.
      - If the operation direction at start is incorrect, increase the setting of Pr.10-52 Injection Magnitude; if there is evidence of electromagnetic noise, then decrease the setting of Pr.10-52.
   (3) If the motor is SPM and the system no reversal allowed, set Pr.10-53 = 3: Pulse injection.
      - If the operation direction at start is incorrect, increase the setting of Pr.10-42 Initial Angle Detection Pulse Value; if the start current is too large or causes ocA, then decrease the setting of Pr.10-42.

8. Setup stop method

Pr.	Explanation	Settings
00-22	Stop method	0: Ramp to stop 1: Coast to stop

9. Set the acceleration and deceleration time

Pr.	Explanation	Pr.	Explanation
01-12	Acceleration Time 1	01-13	Deceleration Time 1

10. Execute no-load operation.
11. Confirm the operation direction at start is correct.
    (1) IF IPM operation direction at start is incorrect, increase the setting of Pr.10-52 Injection Magnitude.
    (2) If SPM operation direction at start is incorrect, increase the setting of Pr.10-42 Initial Angle Detection Pulse Value; if the start current is too large, decrease the setting of Pr.10-42.
12. Check the no-load current.
    If the no-load current is too large, increase the setting of Pr.07-26 Torque Compensation Gain.
13. Check if the motor accelerates to the rated frequency runs stably.
    (1) If the motor output rotor speed presents periodic low-frequency wave, increase the setting of Pr.10-34 PM SVC Speed Estimator Low-Pass Filter Gain, or increase the setting of Pr.10-32 PM SVC Sensorless Speed Estimator Bandwidth.
    (2) If the output frequency presents high frequency vibration violently, decrease the setting of Pr.10-34 PM SVC Speed Estimator Low-Pass Filter Gain, or decrease the setting of Pr.10-32 PM SVC Sensorless Speed Estimator Bandwidth.
14. Check whether the maximum output frequency can be reached.
    If the motor stalls when reached to the maximum speed, increase the setting of Pr.10-34 PM SVC Speed Estimator Low-Pass Filter Gain, or increase the setting of Pr.00-17 Carrier Frequency.
15. Execute a load operation test to check if the low-frequency load performance is normal.
    (1) If the motor vibrates in low-frequency or has insufficient loading capacity, increase the setting of Pr.10-31 I/F Mode, Current Command.
    (2) If the output current is too large, decrease the setting of Pr.10-31 I/F Mode, Current Command.
16. Check the load acceleration.
    If the frequency cannot follow during acceleration or the current is too large and stalls, increase the setting of Pr.07-38 PMSVC Voltage Feed Forward Gain.
17. Check if the whole speed runs stably.
    (1) If the motor output rotor speed presents periodic low-frequency wave, increase the setting of Pr.10-34 PM SVC Speed Estimator Low-Pass Filter Gain, or increase the setting of Pr.10-32 PM SVC Sensorless Speed Estimator Bandwidth.
    (2) If the output frequency presents high frequency vibration violently, decrease the setting of Pr.10-34 PM SVC Speed Estimator Low-Pass Filter Gain, or decrease the setting of Pr.10-32 PM SVC Sensorless Speed Estimator Bandwidth.

Chapter 6 Safe Torque Off

6-1 Basic Function

6-2 STO Specification

6-3 Terminal Function

6-4 Wiring

6-5 Parameters and Fault Codes

6-6 Operating Sequential Diagram

6-7 STO Offline Test

6-1 Basic Function

The MX300-S inverter module provides a Safe Torque Off (STO) function, through the dual-channel STO_1 and STO_2 signal input to turn off the IGBT switching, preventing the motor from generating torque, to achieve the purpose of safe stop.

- MX300 STO function comply with the following regulations:
  - EN ISO 13849-1: Category 3 PL e
  - EN 61508 SIL3
  - EN IEC 62061 Maximum SIL 3
  - EN 60204-1 Category 0

- Safety subsystem and ratio:

Subsystem 3 (STO circuit embedded in drive)
SIL claim limit: 3 PL=e 50%

- System achieves SIL3 shall be fulfilled:
  $PFH_{SYS} = PFH_{Sub1} + PFH_{Sub2} + PFH_{Sub3} < 10^{-7}/h$

6-2 STO Specification

Refer to the table below for the safe parameters of STO function:

Item	Definition	Standard	Performance
S.F.F	Safe Failure Fraction	EN 61508	SPS (1oo1): 99.83% STOA (1oo2): 99.11% STOB (1oo2): 99.11% STOC (1oo2): 99.11%
HFT	Hardware Fault Tolerance	EN 61508	SPS (1oo1): 0 STOA / STOB / STOC (1oo2): 1
SIL	Safety Integrity Level	EN 61508	SIL3
		EN IEC 62061	Maximum SIL 3
PFH	Average frequency of dangerous failure [h-1]	EN 61508	STOA: $3.32*10^{-10}$ STOB: $3.32*10^{-10}$ STOC: $3.32*10^{-10}$
PFD_{av}	Probability of Dangerous Failure on Demand	EN 61508	STOA: $1.66*10^{-4}$ STOB: $1.66*10^{-4}$ STOC: $1.66*10^{-4}$
Category	Category	EN ISO 13849-1	Category 3
PL	Performance level	EN ISO 13849-1	e
$MTTF_d$	Mean time to dangerous failure	EN ISO 13849-1	STOA: High (198373) STOB: High (198373) STOC: High (198373)
DC	Diagnostic Coverage	EN ISO 13849-1	Medium
PTI	Proof Test Interval	EN 61508	20 years
Phase deviation	The Max. acceptable phase deviation time between STO1 and STO2	N/A	550 ms
PST	Process Safety Time	EN 61508	6 ms
Demand Mode	Mode of operation	EN 61508	High demand mode
DTI	Diagnostic Test Interval	EN 61508	SPS (1oo1): 6 ms STO (1oo2): 30s
MT	Mission Time	EN ISO 13849-1	> 20 years
MTTR	Mean Time to Restoration	EN ISO 13849-1	0 hours
Tape A/B	Classification of subsystem	EN 61508	Type A
MRT	Mean Repair Time	EN ISO 13849-1	0 hours

Table 6-1

NOTE:

1. Periodic test pulses with the pulse duration (low-level) less than 1 ms and the pulse interval (T) greater than 10 ms will be ignored.
2. If any of the SPS faults occur during the operation, the drive shall stop output current and remain in safe state.

NOTE:

6-3 Terminal Function

Refer to Section 3-4 Control Circuit for description of STO function

The table below is the operation principle and display description after STO1 / STO2 signal input:

Signal	Status			
STO1–GND1	ON	OFF	ON	OFF
STO2–GND2	ON	ON	OFF	OFF
Drive Output Status	Ready to output	STO1 mode Torque output off	STO2 mode Torque output off	STO mode Torque output off
Fault Displays	No fault displays	STO1	STO2	STO
RESET	N.A	Directly reset		

Table 6-2

- STO means that Channel 1 and Channel 2 enable Safe Torque Off at the same time.
- STO1 indicates that the difference between Channel 1 and Channel 2 is too large, and Channel 1 is active. Check the external wiring.
- STO2 indicates that the difference between Channel 1 and Channel 2 is too large, and Channel 2 is active. Check the external wiring.
- STL1 indicates Channel 1 internal circuit detected abnormal. The system executes fault corrective actions to ensure that the drive remains in a safe status.
- STL2 indicates Channel 2 internal circuit detected abnormal. The system executes fault corrective actions to ensure that the drive remains in a safe status.
- STO1–GND1 / STO2–GND2 ON: means STO1–GND1 / STO2–GND2 input voltage > 15 V_{DC} power
- STO1–GND1 / STO2–GND2 OFF: means STO1–GND1 / STO2–GND2 input voltage < 5 V_{DC} power

6-4 Wiring

The following fault exclusion measures in accordance with EN ISO 13849-2:

- Separate multicore cables
- Individually shielded with earth (GND) connection

Internal STO circuit is as the figure below:

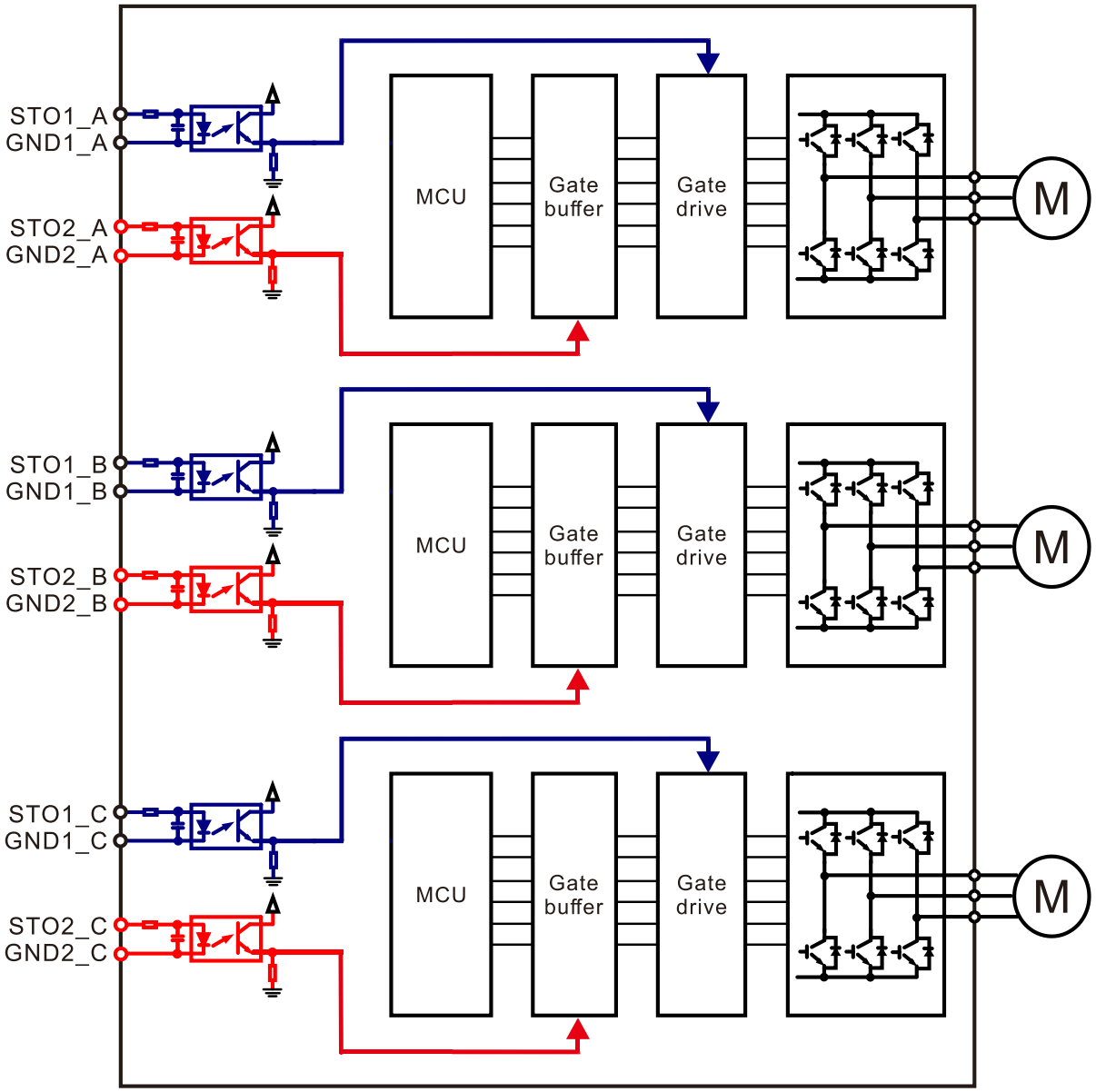


圖 3-42

Control loop wiring

- An external 24V power is needed which is from external SELV/PELV.
- The GND1 and GND2 must be connected to the negative terminal of the external power supply to form a power supply circuit.
- The STO1 and STO2 terminal must be connected to the external individual E-STOP switch. When the E-STOP button is pressed, these two E-STOP switches must be disconnected at the same time.

- As shown in the figures below, the ESTOP switch must be closed in normal situation so the drive can output normally.
- In STO mode, the ESTOP switch is turned ON, the drive stops output, and the keypad displays STO.

1-axis MX300-S inverter module

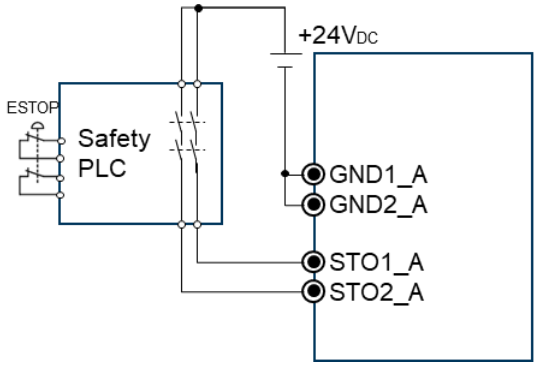


圖 3-43

2-axis MX300-S inverter module

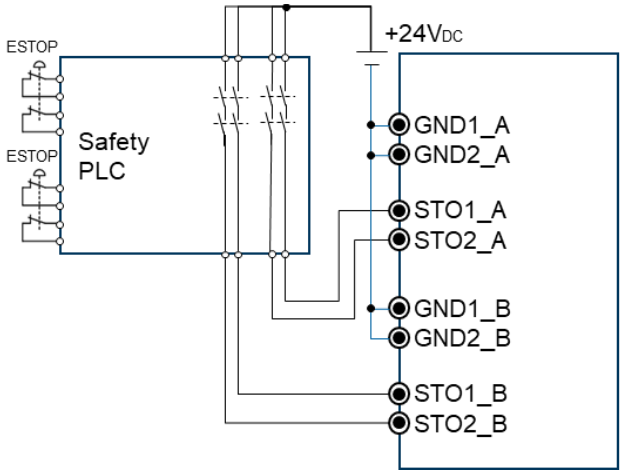


圖 3-44

3-axis MX300-S inverter module

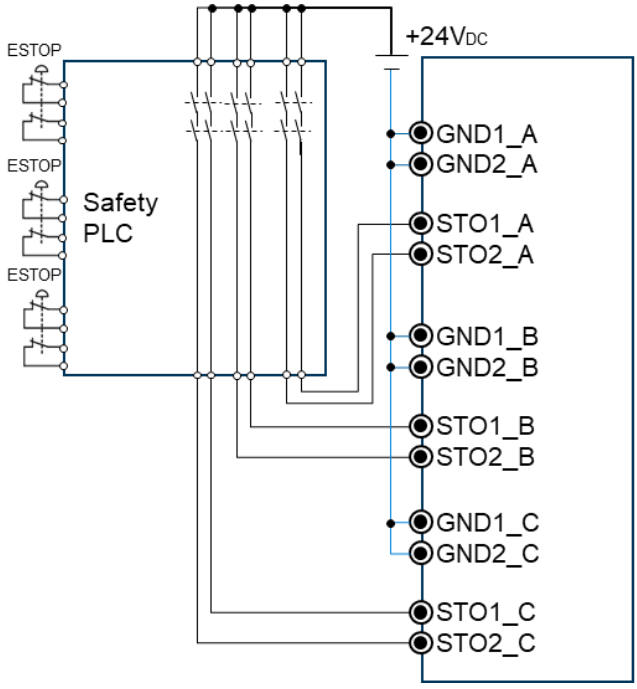


圖 3-45

6-5 Parameters and Fault Codes

Pr.06-44 sets the reset method of STO fault, refer to Chapter 13 for detail.

Refer to Pr.06-17~Pr.06-22 for detailed description of fault records, refer to Chapter 8 for fault treatment.

Pr.	Parameter Name
06-17	Fault Record 1
06-18	Fault Record 2
06-19	Fault Record 3
06-20	Fault Record 4
06-21	Fault Record 5
06-22	Fault Record 6

Table 6-3

6-6 Operating Sequential Diagram

The STO1 and STO2 circuits must be conducted (ON) when the STO function is under general operation, and then the drive can operate normally. If any one of the STO circuits is disconnected (OFF), the drive is unable to run or stop running. The following sequence diagrams describe the signal status under different conditions:

Case 1: STO1 circuit is OFF and STO2 circuit is OFF. The time difference between STO1 OFF and STO2 OFF is less than the Allowable Time. The drive displays STO fault message.

The STO function is triggered after the drive runs, STO1 changes from ON (conducting) to OFF (non-conducting), the drive stops output immediately, and starts counting after the filter time, and then the STO2 is OFF. When the counting time of two circuits of STO are less than then Allowable Difference Time of STO1 / STO2, and the STO Indication Delay Time is reached, the drive displays STO fault message.

Case 1-1 Pr.06-44 bit0 = 0, STO latch

The STO fault message remains after the manual RESET command because the two STO channels are both OFF (non-conductive), and the drive still cannot run after receiving the RUN command.

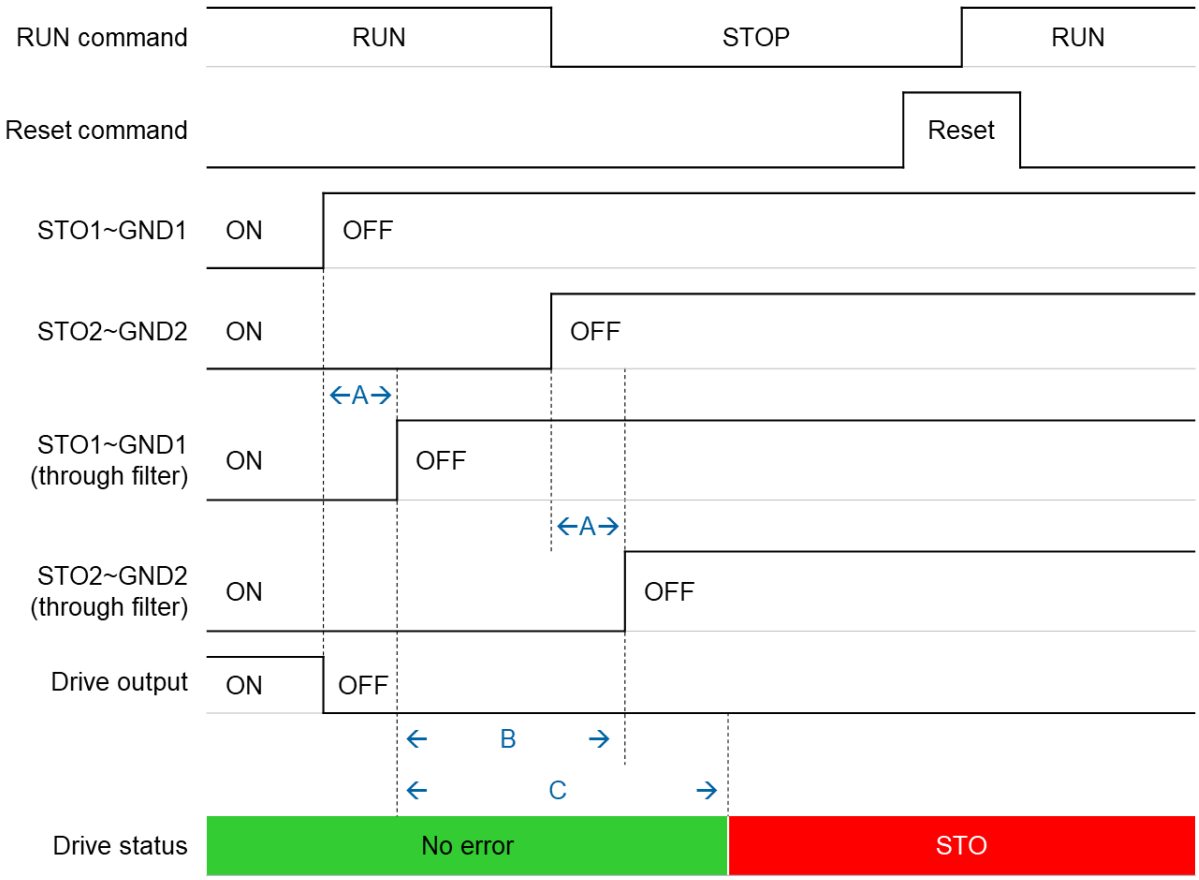


圖 3-46

NOTE:

- A: Filter Time
- B: STO1 / STO2 Allowable Difference Time
- C: STO Indication Delay Time

Case 1-2 Pr.06-44 bit0 = 1, STO no latch

The STO fault message remains when the two STO channels are both OFF (non-conductive), and the drive still cannot run after receiving the RUN command.

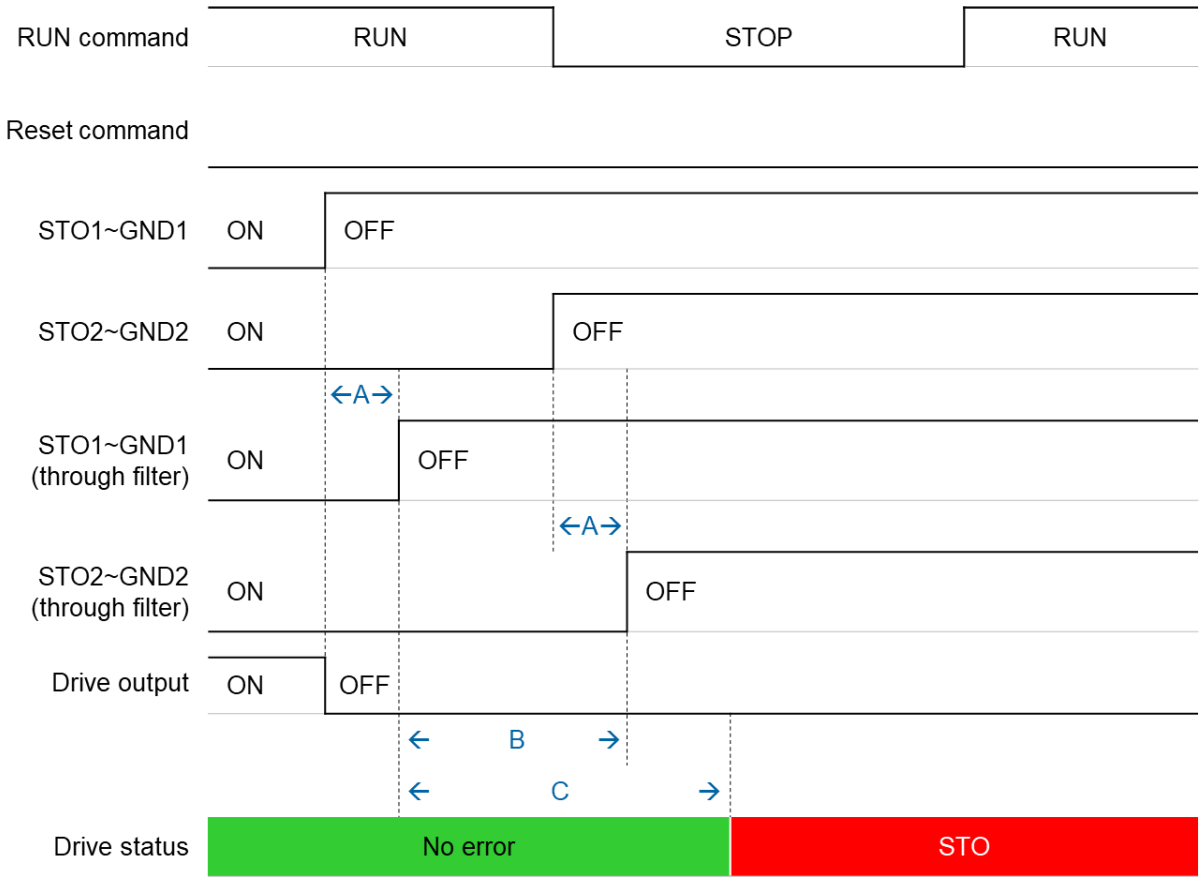


圖 3-47

NOTE:

- A: Filter Time
- B: STO1 / STO2 Allowable Difference Time
- C: STO Indication Delay Time

Case 2: STO1 circuit is OFF and STO2 circuit is OFF. The time difference between STO1 OFF and STO2 OFF is more than the allowable time. The drive displays STO1 fault message.

The STO function is triggered after the drive runs, STO1 changes from ON (conducting) to OFF (non-conducting), the drive stops output immediately, and starts counting after the filter time, and then the STO2 is OFF. When the counting time of two circuits of STO are more than Allowable Difference Time of STO1 / STO2, and the STO Indication Delay Time is reached, the drive displays STO1 fault message.

Case 2-1 Pr.06-44 bit0 = 0, STO latch

The STO1 fault message remains after the manual RESET command because the two STO channels are both OFF (non-conductive), and the drive still cannot run after receiving the RUN command.

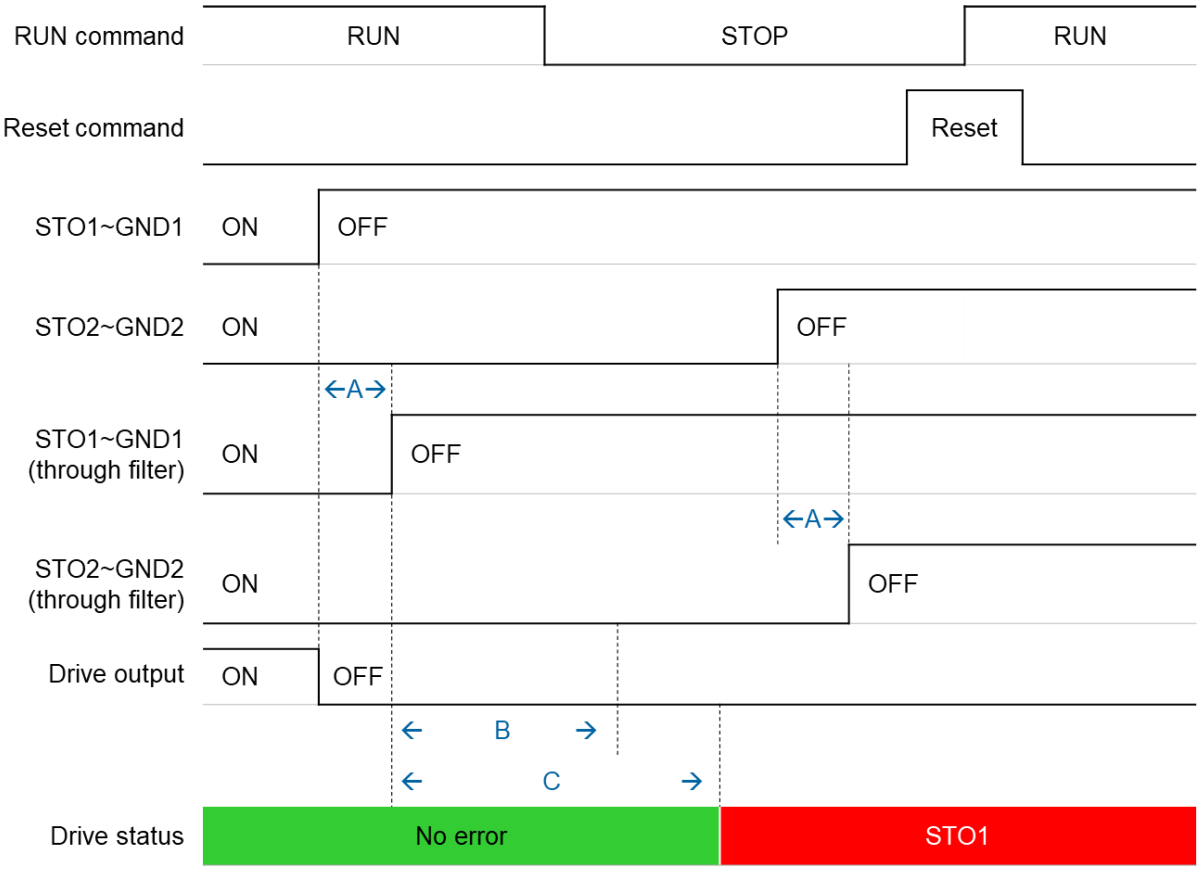


圖 3-48

NOTE:

- A: Filter Time
- B: STO1 / STO2 Allowable Difference Time
- C: STO Indication Delay Time

Case 2-2 Pr.06-44 bit0 = 1, STO no latch

The STO1 fault message remains when the two STO channels are both OFF (non-conductive), and the drive still cannot run after receiving the RUN command.

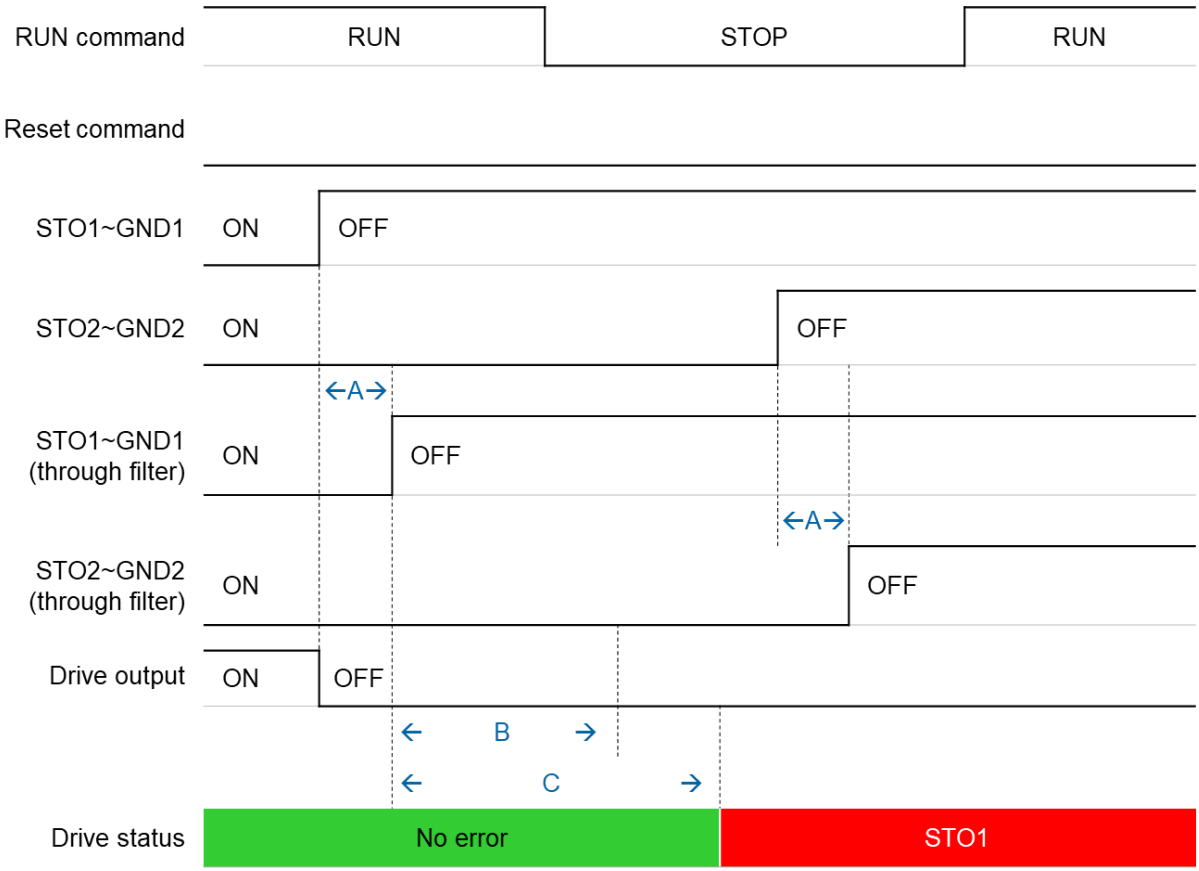


圖 3-49

NOTE:

- A: Filter Time
- B: STO1 / STO2 Allowable Difference Time
- C: STO Indication Delay Time

Case 3: STO1 circuit is OFF and STO2 circuit is ON. The drive displays STO1 fault message.

The STO function is triggered after the drive runs, STO1 changes from ON (conducting) to OFF (non-conducting), the drive stops output immediately and starts counting after the filter time. When the counting time of two circuits of STO Allowable Difference Time is reached, and the STO Indication Delay Time is reached, the drive displays STO1 fault message.

Case 3-1 Pr.06-44 bit0 = 0, STO latch

The STO1 fault message remains after the manual RESET command because the STO1 channel is still OFF (non-conductive), and the drive cannot run after receiving the RUN command.

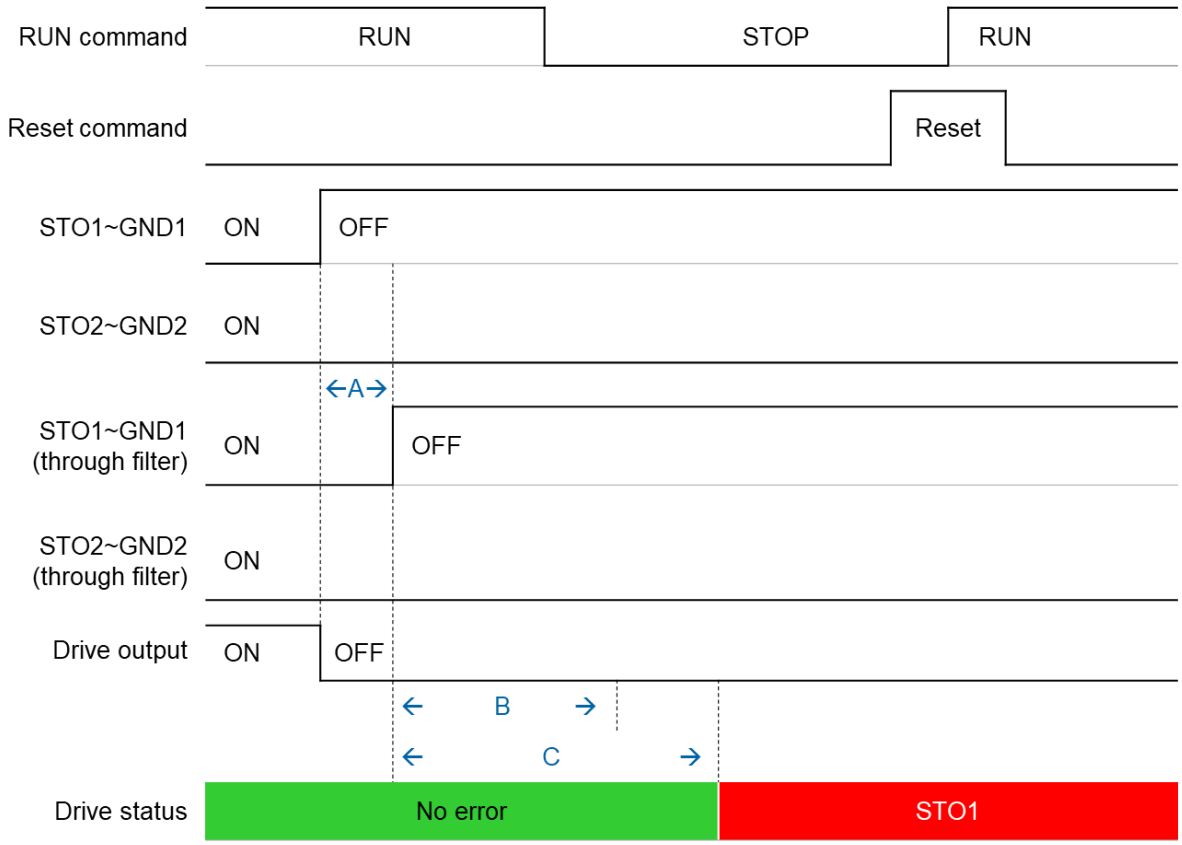


圖 3-50

NOTE:

- A: Filter Time
- B: STO1 / STO2 Allowable Difference Time
- C: STO Indication Delay Time

Case 3-2 Pr.06-44 bit0 = 1, STO no latch

The STO1 fault message remains when the STO1 channel is still OFF (non-conductive), and the drive cannot run after receiving the RUN command.

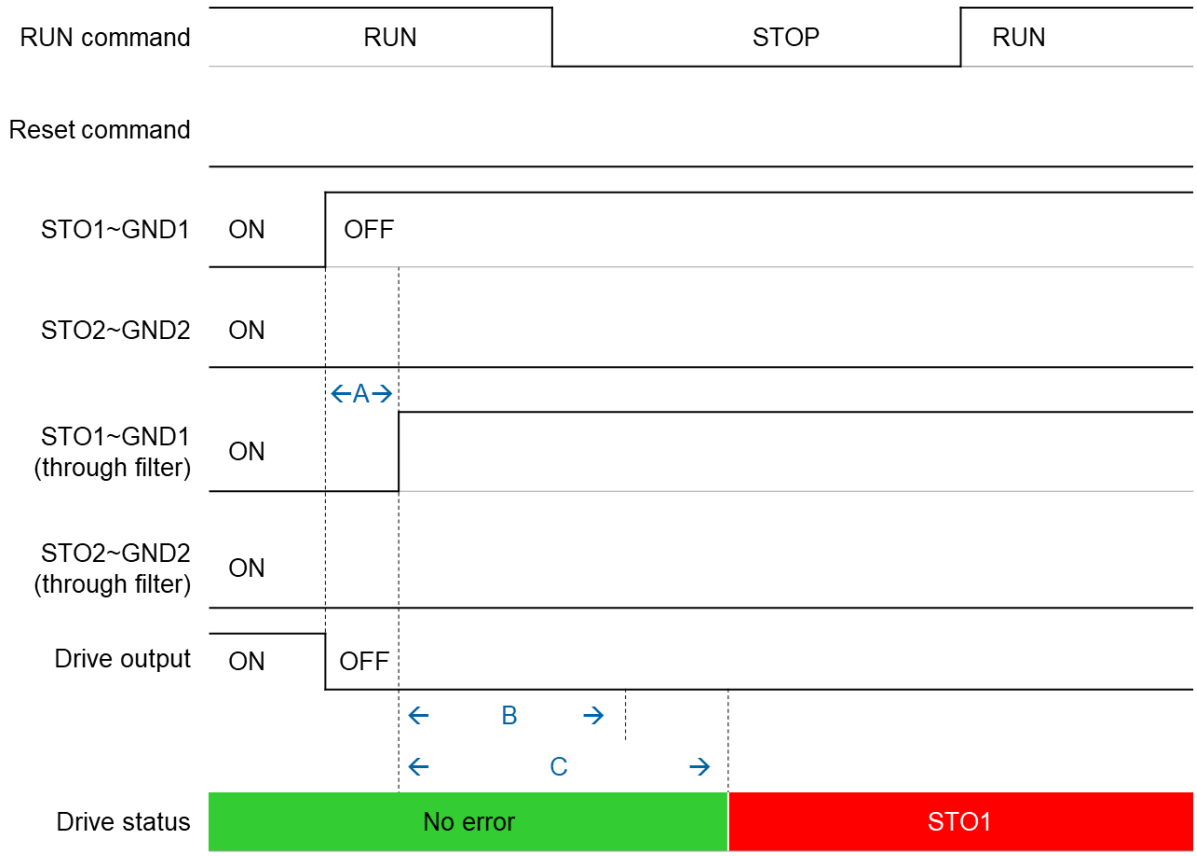


圖 3-51

NOTE:

- A: Filter Time
- B: STO1 / STO2 Allowable Difference Time
- C: STO Indication Delay Time

Case 4: STO1 circuit is OFF only for a brief time and STO2 circuit is ON. The drive displays STO1 fault message.

The STO function is triggered after the drive runs, the original STO1 is OFF (non-conductive) only for a brief time and then turns back to ON (conductive). When it is OFF, the drive stops outputting immediately. When the counting time of two circuits of STO Allowable Difference Time is reached, and the STO Indication Delay Time is reached, the drive displays STO1 fault message.

Case 4-1 Pr.06-44 bit0 = 0, STO latch

The STO1 fault message clear after the manual RESET command because both STO channels are ON (conductive). When the drive receiving the RUN command, it resumes to operate when the reset completed, and the Fault Restart Delay Time is reached.

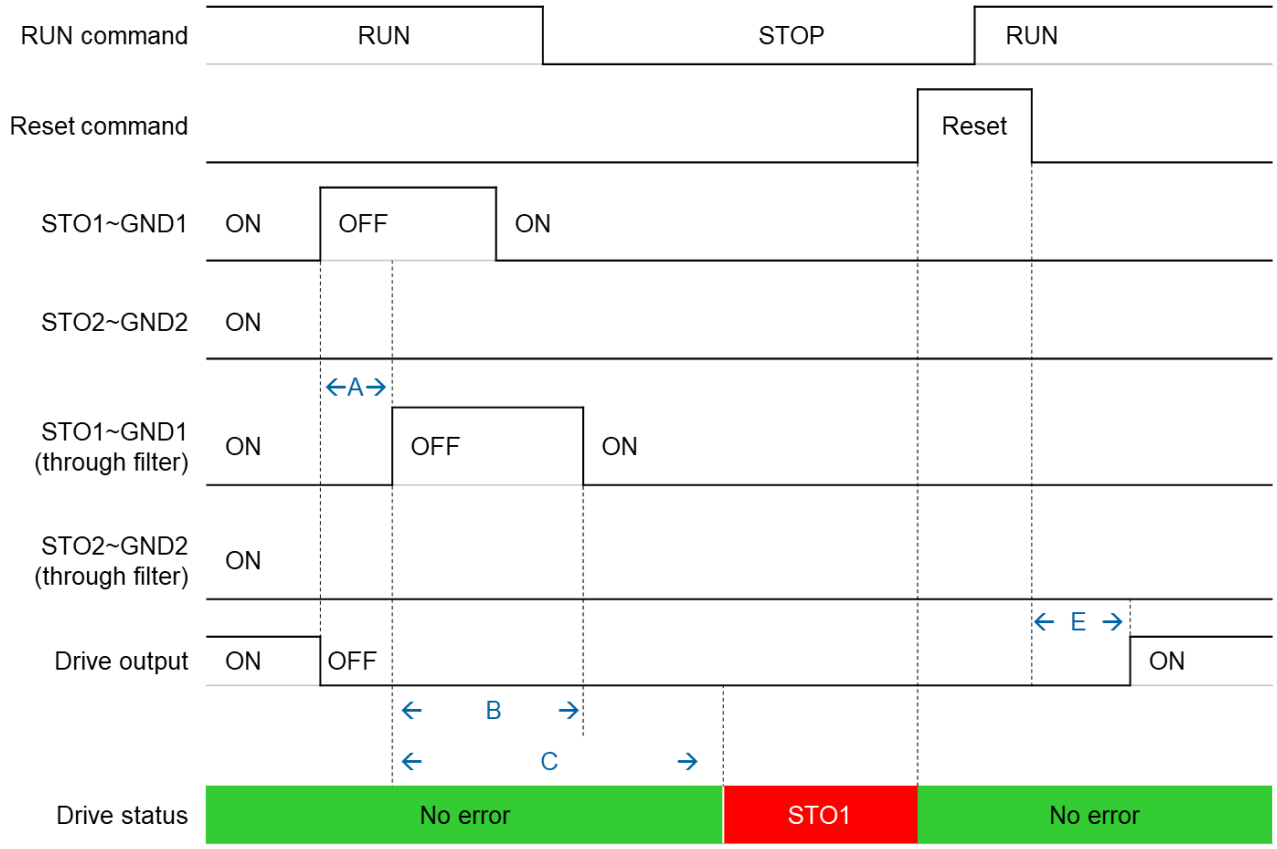


圖 3-52

NOTE:

- A: Filter Time
- B: STO1 / STO2 Allowable Difference Time
- C: STO Indication Delay Time
- E: Fault Restart Delay Time

Case 4-2 Pr.06-44 bit0 = 1, STO no latch

The STO1 fault message is clear automatically after the Fault Auto Reset Delay Time is reached because both STO channels are ON (conductive). After the fault clear and the Fault Restart Delay Time is reached, the drive operates when receiving the RUN command.

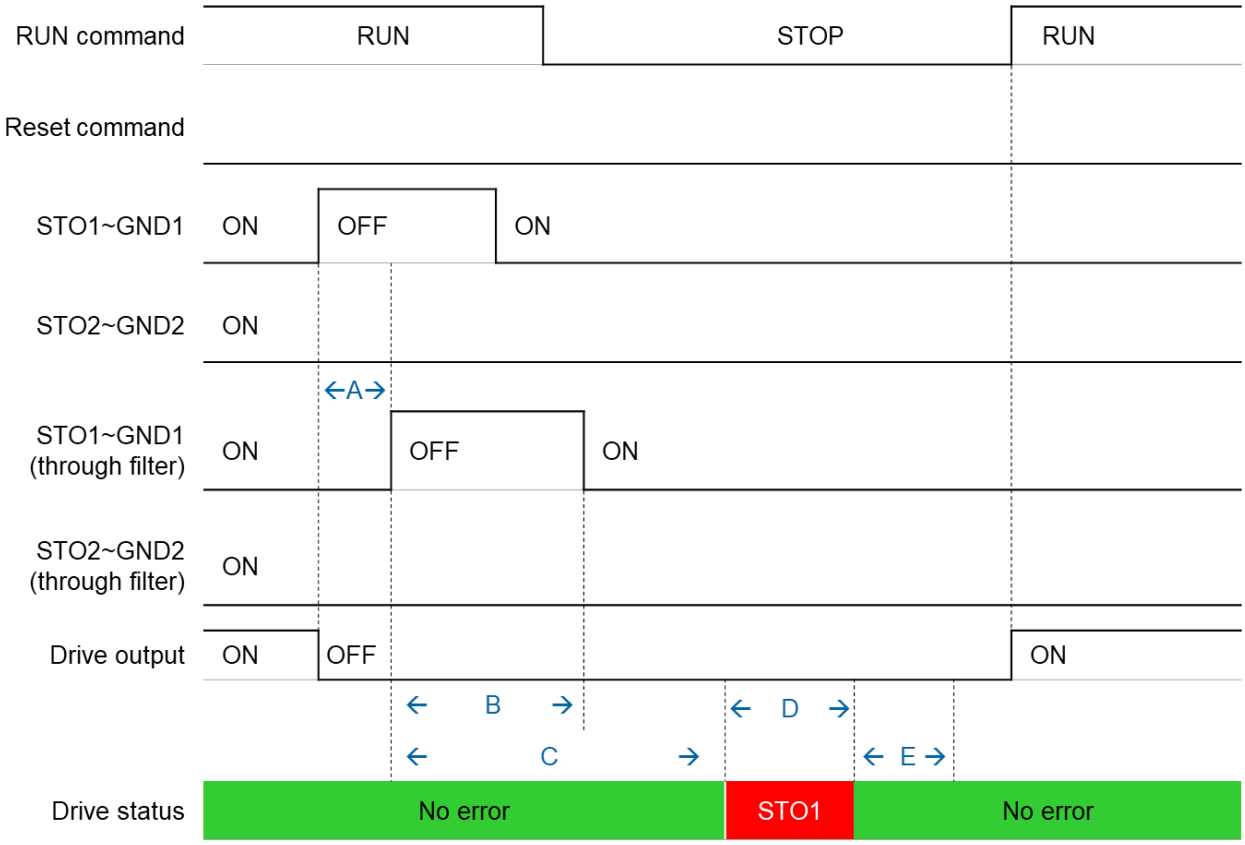


圖 3-53

NOTE:

- A: Filter Time
- B: STO1 / STO2 Allowable Difference Time
- C: STO Indication Delay Time
- D: Fault Auto Restart Delay Time
- E: Fault Restart Delay Time

6-7 STO Offline Test

MX300 is applicable for applications for long-term continuous operation. For safety concern and referring to EN 61800-5-2 Clause 6.2.2.1.4 Note 2, an offline test based on SIL3, PLe/Cat.3 level is required for every three months.

- Test method:

  Connect STO1 and STO2 to GND1 and GND2 simultaneously to check whether the STO function works normally (if the STO safety circuit is connected with an ESTOP switch, you can press the ESTOP switch to fulfill this required condition). If the drive shows STO fault, it means that the STO channels are normal; if anything else pops up, it means that the STO is abnormal and the drive needs to be returned to the factory for repair.

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Chapter 7 Built-in Network

7-1 Address Setting

7-2 Modbus communication

7-3 CANopen Overview (MX300-C models only)

7-4 EtherCAT Overview (MX300-E models only)

7-5 PROFINET Overview (MX300-E models only)

7-1 Address Setting

7-1-1 Modbus Address Setting

- The Modbus address is stored in the Pr.09-00 of the rectifier axis and each inverter axis and can be set by manual-setting or auto-setting through Pr.09-05 of the rectifier axis.
- Manual-setting and Auto-setting

1. Manual-setting
   When the Pr.09-05 of the rectifier axis is set to 0, the auto-setting function off, the address of the rectifier axis and each inverter axis are set by their own Pr.09-00. The user can switch axis and read / write the Modbus address of each axis through the keypad on the rectifier module.
2. Auto-setting
   (1) Set Pr.09-05 of the rectifier axis as 1
   When Pr.09-05 is set to 1, the auto-setting function turns on. The system will reset the Modbus addresses of the rectifier axis and all inverter axes automatically according to the current Modbus address of the rectifier axis.
   (2) Rules of allocating addresses in auto-setting
   The allocation of addresses is in units of 16, and the Modbus address of rectifier axis is fixed to a multiple of 16.
   - When the Modbus address of rectifier axis is any value from 1 to 16, the allocated address of rectifier axis is 16, and the allocated addresses of inverter axes are from 1 to 15 ordered by their axis number.
   - When the Modbus address of rectifier axis is any value from 17 to 32, the allocated address of rectifier axis is 32, and the allocated addresses of inverter axes are from 17 to 31 ordered by their axis number.
   - Continue allocating according to the above rules.
   (3) After auto-setting the addresses, Pr.09-05 changes back to 0 automatically.

- The RS-485 communication baud rate and communication format of MX300 can be set by Pr.09-01 and Pr.09-04 of rectifier axis, separately.

7-1-2 CANopen Address Setting

- The CANopen address is stored in the Pr.09-36 of the rectifier axis and each inverter axis. The user can switch axis and read / write the CANopen address of each axis through the keypad on the rectifier module.

7-1-3 Ethernet Slot Number Setting (MX300-E models only)

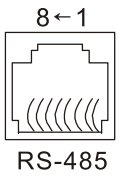
- The Ethernet slot number is stored in Pr.09-57 for each inverter axis. When the system is set to EtherCAT, this function sets the axis number; when the system is set to the PROFINET, this function sets the slot.

- Manual-setting and Auto-setting
  1. Manual-setting: Use the keypad on the rectifier module to switch the axis number and read and write the Ethernet number with the ranges from 1 to 15 and cannot be repeated for each axis. Cycle the power after the setting is completed.
  2. Auto-setting: Set rectifier Pr.09-05 to 3, and the system will set the Ethernet slot number of each inverter axis automatically.

Axis	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Ethernet Slot No.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15

7-2 Modbus communication

- Assists users to monitor the parameters and status of the drive by Modbus communication through the RS-485 serial communication interface.
- When using the communication interface, the diagram below 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. Refer to the RJ45 terminal on Section 3-4-1 Wiring for details of the communication port below.
- Default communication format of the port:
  1. Modbus ASCII mode
  2. 9600 bps transmission speed
  3. 7 data bits
  4. No calibration (NONE)
  5. 2 stop bits



Modbus RS-485
Pin 1: CAN_H
Pin 2: CAN_L
Pin 3, 7: SGND
Pin 4: SG-
Pin 5: SG+
Pin 6: Reserved
Pin 8: +10V

- Modbus ASCII (American Standard Code for Information Interchange): Each byte of data is the combination of two ASCII characters. For example, one byte of data: 64 Hex, shown as '64' in ASCII, consists of '6' (36Hex) and '4' (34Hex).

7-2-1 Code Description

The communication protocol is in hexadecimal, ASCII: "0"…"9", "A"…"F", every hexadecimal value represents an ASCII code. The following table shows some examples.

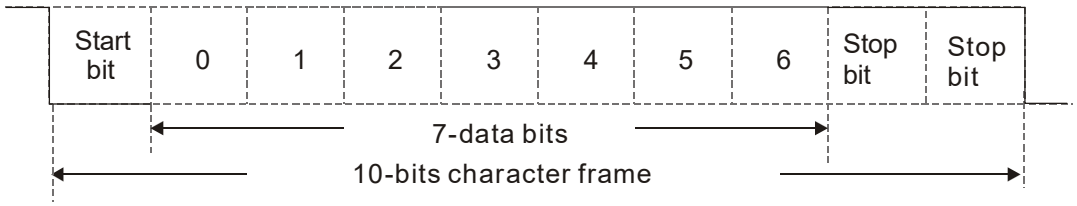
The following table shows some examples.

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

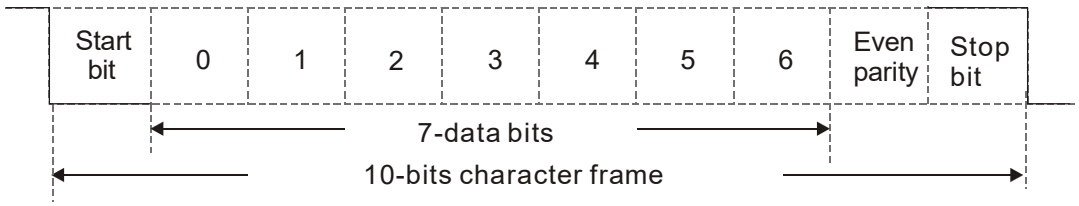
7-2-2 Data Format

1. 10-bit character frame (For ASCII):

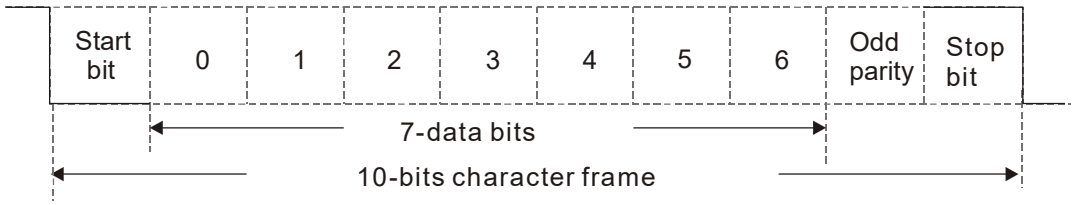
(7, N, 2)



(7, E, 1)

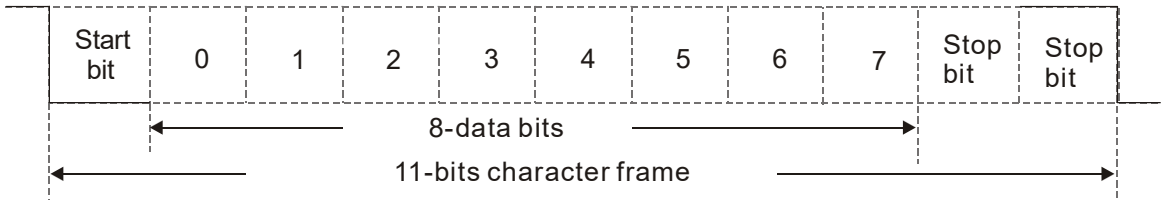


(7, O, 1)

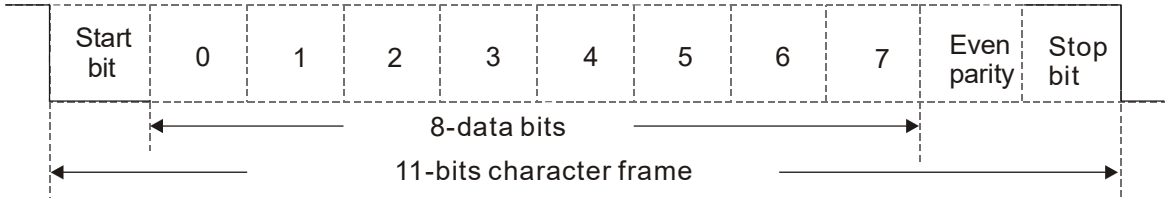


2. 11-bit character frame (For RTU):

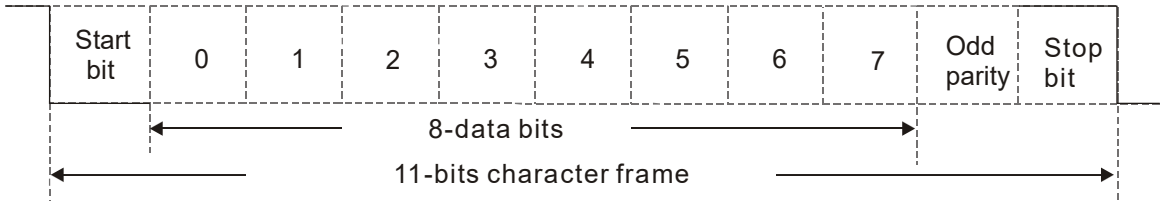
(8, N, 2)



(8, E, 1)



(8, O, 1)



7-2-3 Communication Protocol

1. Communication Data Frame

ASCII mode:

STX	Start character = ‘ : ’ (3AH)
Address High	Communication address:
Address Low	one 8-bit address consists of 2 ASCII codes
Function High	Command code:
Function Low	one 8-bit command consists of 2 ASCII codes
DATA (n-1)	Contents of data:
…….	n x 8-bit data consist of 2n ASCII codes
DATA 0	n ≤ 16, maximum of 32 ASCII codes (20 sets of data)
LRC Check High	LRC checksum:
LRC Check Low	one 8-bit checksum consists of 2 ASCII codes
END High	End characters:
END Low	END Hi = CR (0DH), END Lo = LF (0AH)

RTU mode:

START	Defined by a silent interval of larger than / equal to 3.5 char
Address	Communication address: 8-bit binary address
Function	Command code: 8-bit binary command
DATA (n-1)	Contents of data: N × 8-bit data, n ≤16
…….	
DATA 0	
CRC Check Low	CRC checksum: one 16-bit CRC checksum consists of 2 8-bit binary characters
CRC Check High	
END	Defined by a silent interval of larger than / equal to 3.5 char

2. Communication Address (Address)
   - 00H: Broadcast to all AC motor drives
   - 01H: AC motor drive at address 01
   - 0FH: AC motor drive at address 15
   - 10H: AC motor drive at address 16 and so on up to 254 (FEH)

   NOTE: This Address is the address of Pr.09-00 of each axis. Refer to Section 7-2 Address Setting for details.
3. Function (Function code) and DATA (Data characters)

   03H: Read data from register

   For example: Reading two continuous data from register address 2102H. AMD address is 01H.

   ASCII mode:

Command Message

STX	‘:’
Address	‘0’
	‘1’
Function	‘0’
	‘3’
Starting register	‘2’
	‘1’
	‘0’
	‘2’
Number of register (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 register (count by byte)	‘0’
	‘4’
Content of starting register 2102H	‘1’
	‘7’
	‘7’
	‘0’
Content of register 2103H	‘0’
	‘0’
	‘0’
	‘0’
LRC Check	‘7’
	‘1’
END	CR
	LF

RTU mode:

Command Message		Response Message	
Address	01H	Address	01H
Function	03H	Function	03H
Starting data register	21H	Number of register (count by byte)	04H
	02H		
Number of register (count by word)	00H	Content of register address 2102H	17H
	02H		70H
CRC Check Low	6FH	Content of register address 2103H	00H
CRC Check High	F7H		00H
		CRC Check Low	FEH
		CRC Check High	5CH

4. 06H: Single write, write single data to a register

For 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'
Target register	'0'	Target register	'0'
	'1'		'1'
	'0'		'0'
	'0'		'0'
Register content	'1'	Register 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
Target register	01H	Target register	01H
	00H		00H
Register content	17H	Register content	17H
	70H		70H

Command Message	
CRC Check Low	86H
CRC Check High	22H

Response Message	
CRC Check Low	86H
CRC Check High	22H

5. 10H: Write multiple registers (can write at most 20 sets of data simultaneously).
   For example: Set the multi-step speed of an AC motor drive (address is 01H): Pr.04-00 = 50.00 (1388H), Pr.04-01 = 40.00 (0FA0H).
   ASCII mode:

Command Message	
STX	':'
ADR 1	'0'
ADR 0	'1'
CMD 1	'1'
CMD 0	'0'
Target register	'0'
	'5'
	'0'
	'0'
Number of register (count by word)	'0'
	'0'
	'0'
	'2'
Number of register (count by byte)	'0'
	'4'
The first data content	'1'
	'3'
	'8'
	'8'
The second data content	'0'
	'F'
The second data content	'A'
	'0'
LRC Check	'9'
	'A'
END	CR
	LF

Response Message	
STX	':'
ADR 1	'0'
ADR 0	'1'
CMD 1	'1'
CMD 0	'0'
Target register	'0'
	'5'
	'0'
	'0'
Number of register (count by word)	'0'
	'0'
	'0'
	'2'
LRC Check	'E'
	'8'
END	CR
	LF

   RTU mode:

Command Message	
ADR	01H
CMD	10H
Target register	05H
	00H

Response Message	
ADR	01H
CMD	10H
Target register	05H
	00H

Command Message

Number of register (Count by word)	00H
	02H
Quantity of data (bytes)	04
The first data content	13H
	88H
The second data content	0FH
	A0H
CRC Check Low	'9'
CRC Check High	'A'

Response Message

Number of register (Count by word)	00H
	02H
CRC Check Low	41H
CRC Check High	04H

6. 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: 01H + 03H + 21H + 02H + 00H + 02H = 29H, the 2's-complement negation of 29H is D7H.

   RTU mode (CRC Check):

   CRC (Cyclical Redundancy Check) is calculated by 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 and put 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, fill MSB with zero, then repeat step 3. If the LSB of CRC register is 1, shift the CRC register one bit to the right, fill MSB with zero, Exclusive OR the CRC register with the polynomial value A001H, then repeat step 3.

   Step 5. Repeat step 3 and 4 until you perform eight shifts. This processes a complete 8-bit byte.

   Step 6. Repeat step 2 through 5 for the next 8-bit byte of the command message. Continue doing this until all bytes are 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, that is, the lower order byte is transmitted first.

7. The following is an example of CRC generation using C language.

   Unsigned char* data ← a pointer to the message buffer

   Unsigned char length ← the quantity of bytes in the message buffer

   The function returns the CRC value as a type of unsigned integer.

```
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 CRC
    }
```

7-2-4 Address list

1. ASCII
   (1) Reads one or more parameter values: 3Ah (start bit‘ : ’) + 30h 31h (station address 01) + 30h 33h (function code 03h) + 30h 30h xxh xxh–32h 36h xxh xxh (Modbus address 00xxh–26xxh) + xxh xxh xxh xxh (reading length 1) + LRC (checksum) + CR/LF
   (2) Writes one parameter value: 3Ah (start bit‘ : ’) + 30h 31h (station address 01) + 30h 36h (function code 06h) + 30h 30h xxh xxh–32h 36h xxh xxh (Modbus address 00xxh–26xxh) + xxh xxh xxh xxh (writing value) + LRC (checksum) + CR/LF
   (3) Writes 20 parameter values: 3Ah (start bit‘ : ’) + 30h 31h (station address 01) + 31h 30h (function code 10h) + 30h 30h xxh xxh–32h 36h xxh xxh (Modbus address 00xxh–26xxh) + 30h 30h 31h 34h (word data length) + 30h 30h 32h 38h(byte data length) + xxh xxh xxh xxh (the first writing value) + ... + xxh xxh xxh xxh (the 20th writing value) + LRC (checksum) + CR/LF
2. RTU
   (1) Reads one or more parameter values: 01h (station address 01) + 03h (function code 03h) + 00xxh–26xxh (Modbus address) + xxxxh (reading length) + CRC (checksum)
   (2) Writes one parameter value: 01h (station address 01) + 06h (function code 06h) + 00xxh–26xxh (Modbus address) + xxxxh (writing value) + CRC (checksum)
   (3) Writes 20 parameter values: 01h (station address 01) + 10h (function code 10h) + 00xxh–26xxh (Modbus address) + 0014h (data length, count by word) + 0028h (data length, count by byte) + xxxxh (the first writing value) + ... + xxxxh (the 20th writing value) + CRC (checksum)
3. AC motor drive parameters (GGxx): communication station address is Pr.09-00 setting value

Modbus Address	Attribute (Function Code)	Description
GGnnH	R (03H) / W (06H, 10H)	• GG is the parameter group • nn is the parameter number For example: The Modbus address of Pr.04-10 is 040AH when reading by Delta VFDsoft.

4. Control command (20xx): communication station address is Pr.09-00 setting value

Function Name	Modbus Address	Rectifier Axis Address	Inverter Axis Address
Operation command	2000H	-	V
Frequency command	2001H	-	V
Fault / control command source	2002H	V	V

Function Name	Modbus Address	Attribute (Function Code)	Size	Function		
Operation command	2000H	R (03H) / W (06H, 10H)	U16	bit1–0	00B: No function	1. Remains the status specified by a first command until a second command is received. 2. Valid only when source of the operation command is set to communication RS485 input (Pr.00-21 = 2).
					01B: Stop	
					10B: Run	
					11B: JOG + Run	
				bit5–4	00B: No function	
					01B: FWD	
					10B: REV	
					11B: Change direction	
				bit7–6	00B: 1st accel. / decel.	1. Valid only when 2000h bit12 is set to 1. 2. Obtain the current running speed by reading 2107h.
					01B: 2nd accel. / decel	
					10B: 3rd accel. / decel.	
				bit7–6	11B: 4th accel. / decel.	
				bit11–8	0000B: Master speed	
					0000B: zero step speed	
					0001B: 1st step speed	
					0010B: 2nd step speed	
					0011B: 3rd step speed	
					0100B: 4th step speed	
					0101B: 5th step speed	
					0110B: 6th step speed	
					0111B: 7th step speed	
					1000B: 8th step speed	
					1001B: 9th step speed	
					1010B: 10th step speed	
					1011B: 11th step speed	
					1100B: 12th step speed	
					1101B: 13th step speed	
					1110B: 14th step speed	
				bit12	1: Enable bit 06–11 function	
				bit14–13	00B: No function	
					01B: Operation command by the digital keypad	
					10B: Operation command by Pr.00-21 setting	
					11B: Change the operation source	
Frequency command	2001H			Frequency command (XXX.XX Hz) There are two decimal places for general-purpose drives.		
Fault / control command source	2002H			bit0	1: External Fault (E.F.) ON	To trigger an external fault to the drive to make it stop running. Drive's stop method can be set through drive parameters.
				bit1	1: Reset command	To clear the fault status
				bit2	1: Base Block (B.B) ON	To trigger an external base block to the drive to suspend the operation. When bit = 0 and clear BB situation, the drive returns to the previous operation.

5. Status monitor read only (21xx): communication station address is Pr.09-00 setting value.
   The rectifier address has no operation-related status, including frequency command, output voltage, etc.

Function Name	Modbus Address		Rectifier Axis Address	Inverter Axis Address
Fault status	2100H		V	V
Drive operation status	2101H	bit10–0	-	V
		bit11	V	V
Frequency command	2102H		-	V
Output frequency	2103H		-	V
Output Current	2104H		V	V
DC bus voltage	2105H		V	V
Output voltage	2106H		-	V
Multi-step speed status	2107H		-	V
Counter value	2109H		-	V
Output power factor angle	210AH		-	V
Output torque	210BH		-	V
Motor ~~actual~~ speed	210CH		-	V
Output Power	210FH		-	V
Multi-function display	2116H		V	V
Maximum User-Defined Value	211BH		V	V
Output current digit	211FH		V	V

Function Name	Modbus Address	Attribute (Function Code)	Size	Function		Rectifier	Inverter
Fault status	2100H	R (03H)	U16	bit7–0: Fault code bit15–8: Warning code		V	V
Drive operation status	2101H			bit1–0	Operation status 00B: Stop (RUN indicator is OFF / STOP indicator is ON) 01B: Stopping (RUN indicator flashes / STOP indicator is ON) 10B: Standby (RUN indicator is ON / STOP indicator flashes) 11B: Running (RUN indicator is ON / STOP indicator is OFF)	V	V
				bit2	1: JOG command		
				bit4–3	Operation direction 00B: FWD (REV indicator is OFF / FWD indicator is ON) 01B: from REV to FWD (REV indicator flashes / FWD indicator is ON) 10B: from FWD to REV (REV indicator is ON / FWD indicator flashes) 11B: REV (REV indicator is ON / FWD indicator is OFF)		
				bit8	1: Master frequency controlled by the communication interface		
				bit9	1: Master Frequency command controlled by analog / external signal		
				bit10	1: Operation command controlled by the communication interface		
				bit11	1: Parameter lock		

Function Name	Modbus Address	Attribute (Function Code)	Size	Function	Rectifier	Inverter
Frequency command	2102H	R (03H)	U16	Frequency command (XXX.XX Hz)	-	V
Output frequency	2103H			Drive's output frequency (XXX.XX Hz)	-	V
Output Current	2104H			Output current (XX.XX A). When current is higher than 655.35, it shifts the decimal as (XXX.X A). The decimal can refer to High byte of 211F. Note: The output current read from the rectifier address is the sum of the output currents of all inverter axes.	V	V
DC bus voltage	2105H			DC bus voltage (XXX.X V)	V	V
Output voltage	2106H			Drive's output voltage (XXX.X V)	-	V
Multi-step speed status	2107H			Drive's current running speed step given by multi-step speed command (0 is main speed)	-	V
Counter value	2109H			The present value of MI	-	V
Output power factor angle	210AH			Drive's output power factor angle (XXX.X°) (0.0–180.0°)	-	V
Output torque	210BH			Output torque (XXX.X %)	-	V
Motor speed	210CH			Actual motor speed (XXXXX rpm)	-	V
Output Power	210FH			Drive's output power (XXXX.X kW)	-	V
Multi-function display	2116H			Display the low word value (Pr.00-04) of user-defined items, the value is low 16 bits data.	V	V
Maximum User-Defined Value	211BH			Maximum Operation Frequency (Pr.01-00) or Maximum User-defined Value (Pr.00-26) • When Pr.00-26 is 0, this value is equal to Pr.01-00 setting. • When Pr.00-26 is not 0, and the command source is keypad, this value = Pr.00-24 × Pr.00-26 / Pr.01-00 • When Pr.00-26 is not 0, and the command source is 485, this value = Pr.09-10 × Pr.00-26 / Pr.01-00	V	V
Output current digit	211FH			High byte: Current digit (display)	V	V

6. Status monitor read only (22xx): communication station address is Pr.09-00 setting value.
   The rectifier address has no operation-related status, including frequency command, output voltage, etc.

Function Name	Modbus Address	Rectifier Axis Address	Inverter Axis Address
Output Current	2200H	V	V
Counter value	2201H	-	V
Output frequency	2202H	-	V
DC bus voltage	2203H	V	V
Output voltage	2204H	-	V
Power factor angle	2205H	-	V
Output Power	2206H	-	V
Motor actual speed	2207H	-	V

Function Name	Modbus Address		Rectifier Axis Address	Inverter Axis Address
Output torque	2208H		-	V
PID feedback value	220AH		V	V
AI1 Analog input	220BH		V	V
AI2 Analog input	220CH		V	V
Power components temperature	220EH		V	V
Circuit board ambient temperature	220FH		-	-
Digital input status	2210H		V	V
Digital output status	2211H		V	V
Multi-step speed	2212H		-	V
The corresponding CPU digital input pin status	2213H		V	V
The corresponding CPU digital output pin status	2214H		V	V
DC bus voltage ripples	221BH		V	V
Display of user-defined output	221EH		-	V
Pr.00-05 gain value	221FH		-	V
Control Mode	2223H		-	V
Carrier Frequency	2224H		-	V
Drive status	2226H	bit4–0	-	V
		bit5	-	V
Positive / Negative torque	2227H		-	V
kWh	2229H		-	V
PID reference target	222EH		V	V
PID Compensation	222FH		V	V
PID output frequency	2230H		V	V
Auxiliary frequency	2232H		-	V
Master frequency	2233H		-	V
Frequency value after addition and subtraction of master and auxiliary frequency	2234H		-	V

Function Name	Modbus Address	Attribute (Function Code)	Size	Function	Rectifier	Inverter
Output Current	2200H	R (03H)	U16	Display output current (A). When current is higher than 655.35, it shifts the decimal as (XXX.X A). The decimal can refer to High byte of 211F. **NOTE:** The output current read from the rectifier address is the sum of the output currents of all inverter axes.	V	V
Counter value	2201H			Counter value	-	V
Output frequency	2202H			Drive's output frequency (XXX.XX Hz)	-	V
DC bus voltage	2203H			DC bus voltage (XXX.X V)	V	V
Output voltage	2204H			Output voltage (XXX.X V)	-	V
Power angle	2205H			Drive's power angle (XXX.X deg)	-	V
Output Power	2206H			Display the output power of U, V, W (XXXX.X kW)	-	V
Motor actual speed	2207H			Display the motor speed estimated by the drive or encoder feedback (XXXXX rpm)	-	V
Output torque	2208H			Display positive/negative output torque in %, estimated by the drive (+0.0: positive torque, -0.0: negative torque) (XXX.X %)	-	V

Function Name	Modbus Address	Attribute (Function Code)	Size	Function	Rectifier	Inverter
PID feedback value	220AH	R (03H)	U16	PID feedback value after enabling PID function (XXX.XX %)	V	V
AI2 Analog input	220BH			Display signal of AI1 analog input terminal, 0–10 V corresponds to 0.00–100.00% (1.) (see NOTE 2 in Pr.00-04)	V	V
AI2 Analog input	220CH			Display signal of AI2 analog input terminal, 4–20 mA / 0–10 V corresponds to 0.00–100.00% (2.) (see NOTE 2 in Pr.00-04)	V	V
Power components temperature	220EH			Power components temperature of drive power module (XXX.XºC)	V	V
Circuit board ambient temperature	220FH			Circuit board ambient temperature	-	-
Digital input status	2210H			The status of digital input (ON/OFF), refer to Pr.02-12. (see NOTE 3 in Pr.00-04)	V	V
Digital output status	2211H			The status of digital output (ON/OFF), refer to Pr.02-18. (see NOTE 4 in Pr.00-04)	V	V
Multi-step speed	2212H			The multi-step speed that is executing (S)	-	V
The corresponding CPU digital input pin status	2213H			The corresponding CPU digital input pin status (d.). (see NOTE 3 in Pr.00-04)	V	V
The corresponding CPU digital output pin status	2214H			The corresponding CPU digital output pin status (O.) (see NOTE 4 in Pr.00-04)	V	V
DC bus voltage ripples	221BH			DC bus voltage ripples (XXX.X V)	V	V
Display of user-defined output	221EH			User page displays the value in physical measure	-	V
Pr.00-05 gain value	221FH			Output value of Pr.00-05 (XXX.XX Hz)	-	V
Control Mode	2223H			Control mode of the drive 0: speed mode	-	V
Carrier Frequency	2224H			Carrier frequency of the drive (XX kHz)	-	V
Drive status	2226H			Drive status bit1–0: 00b: No direction; 01b: Forward; 10b: Reverse bit3–2: 01b: Drive ready; 10b: Error bit4: 0b: Motor drive did not output; 1b: Motor drive did outputs bit5: 0b: No warning; 1b: Warning	V	V
Positive / negative torque	2227H			Drive's estimated output torque (positive or negative direction) (XXXX Nt-m)	-	V
kWh	2229H			kWh display (XXXX.X)	-	V
PID target value	222EH			PID reference (XXX.XX%)	V	V

Function Name	Modbus Address	Attribute (Function Code)	Size	Function	Rectifier	Inverter
PID Compensation	222FH	R (03H)	U16	PID offset (XXX.XX%)	V	V
PID output frequency	2230H			PID output frequency (XXX.XX Hz)	V	V
Auxiliary frequency	2232H			Display the auxiliary frequency value	-	V
Master frequency	2233H			Display the master frequency value	-	V
Frequency value after addition and subtraction of master and auxiliary frequency	2234H			Display the frequency value after addition and subtraction of master and auxiliary frequency	-	V

7. Remote IO (26xx): communication station address is the setting of Pr.09-00

Function Name	Modbus Address	Attribute (Function Code)	Size	Function
Digital input terminal MI4–MI1 status	2600H	R (03H)	U16	bit 3–0 corresponds to a different terminal input contact (MX300-C models only)
Digital input terminal MIO4–MIO1 status	2600H			bit 7–4 corresponds to a different terminal input contact (MX300-C models only)
Digital input terminal (Expansion card) MI16–MI9 status				bit 15–8
RY1	2640H	R (03H) / W (06H, 10H)		bit 0 (MX300-C models only)
Digital output terminal MIO4–MIO1 status				bit 4–1 corresponds to a different terminal input contact (MX300-C models only)
Digital output terminal (Expansion card) MO16–MO9 status				bit 15–8
AI1 proportional value	2660H	R (03H)		AVI proportional value (MX300-C models only)
AI2 proportional value	2661H			ACI proportional value (MX300-C models only)

7-2-5 Exception Response

When the drive is using the communication connection, if an error occurs, the drive responds to the error code and sets the highest bit (bit 7) of the command code to 1 (function code AND 80H) then responds to the control system to signal that an error occurred. If the keypad displays “CE-XX” as a warning message, “XX” is the error code at that time. Refer to the table of error codes for communication error for reference. For example:

ASCII mode:

STX	‘:’
Address	‘0’
	‘1’
Function	‘8’
	‘6’

RTU mode:

Address	01H
Function	86H
Exception code	02H
CRC Check Low	C3H
CRC Check High	A1H

ASCII mode:

Exception code	‘0’
	‘2’
LRC Check	‘7’
	‘7’
END	CR
	LF

The explanation of error codes

Fault codes	Explanation
1	Function code is not supported or unrecognized
2	Address is not supported or unrecognized.
3	Data is not correct or unrecognized.
4	Failure to execute this function code

7-3 CANopen Overview (MX300-C models only)

The built-in CANopen function is a kind of remote control. You can control the AC motor drive using the CANopen protocol. CANopen is a CAN-based higher layer protocol that provides standardized communication objects, including real-time data (Process Data Objects, PDO), configuration data (Service Data Objects, SDO), and special functions (Time Stamp, Sync message, and Emergency message). It also has network management data, including Boot-up message, NMT message, and Error Control message. Refer to the CiA website http://www.can-cia.org for related information.

Delta CANopen supported functions:

- CAN2.0A Protocol
- CANopen DS301 V4.02
- CIA402 V2.0

Delta CANopen supported services:

- PDO (Process Data Objects) PDO1–PDO4
- SDO (Service Data Objects)

  Initiate SDO Download / Initiate SDO Upload / Abort SDO; you can use the SDO message to configure the slave node and access the Object Dictionary in every node.
- SOP (Special Object Protocol): Supports default COB-ID in Predefined Master / Slave Connection Set in DS301 V4.02; Supports SYNC service; Supports Emergency service.
- NMT (Network Management): Supports NMT module control; Supports NMT Error control; Supports Boot-up.

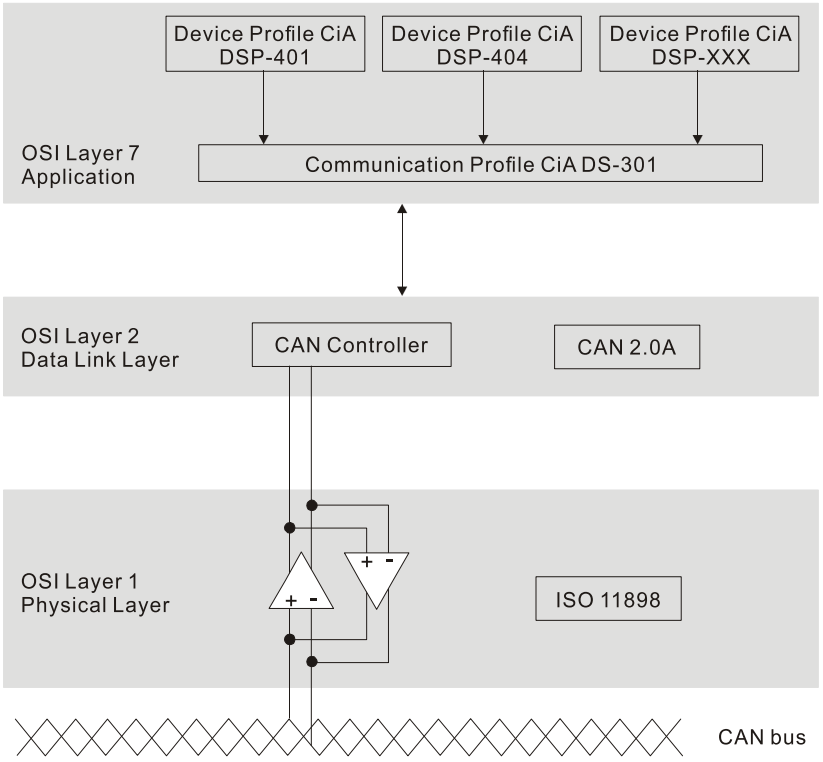
Delta CANopen does not support this service:

- Time Stamp service

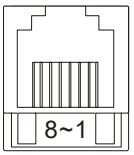
7-3-1 CANopen Overview

CANopen Protocol

CANopen is a CAN-based higher layer protocol, and was designed for motion-oriented machine control networks such as handling systems. Version 4.02 of CANopen (CiA DS301) is standardized as EN50325-4. The CANopen specifications cover the application layer and communication profile (CiA DS301), as well as a framework for programmable devices (CiA DS302), recommendations for cables and connectors (CiA DS303-1) and SI units and prefix representations (CiA DS303-2).



RJ45 Pin Definition



PIN	Signal	Description
1	CAN_H	CAN_H bus line (dominant high)
2	CAN_L	CAN_L bus line (dominant low)
3	CAN_SGND	Ground / 0 V / V-
6	CAN_SGND	Ground / 0 V / V-

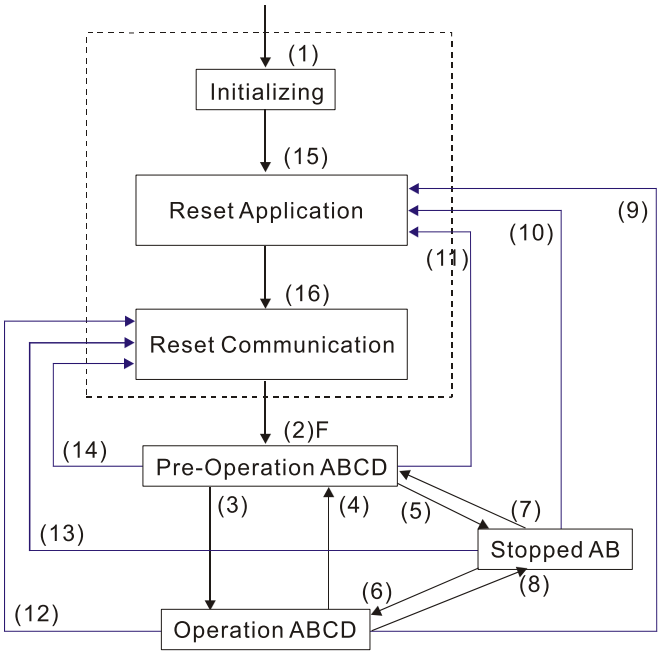
CANopen Communication Protocol

CANopen Communication Protocol contains the following services:

- NMT (Network Management Object)
- SDO (Service Data Objects)
- PDO (Process Data Objects)
- EMCY (Emergency Object)

NMT (Network Management Object)

The Network Management (NMT) follows a Master / Slave structure for executing NMT service. A network has only one NMT master, and the other nodes are slaves. All CANopen nodes have a present NMT state, and the NMT master can control the state of the slave nodes. The following shows the state diagram of a node:



(1) After power is applied, start in the auto-initialization state
(2) Automatically enter the pre-operational state
(3) (6) Start remote node
(4) (7) Enter the pre-operational state
(5) (8) Stop remote node
(9) (10) (11) Reset node
(12) (13) (14) Reset communication
(15) Automatically enter the reset application state
(16) Automatically enter the reset communication state

A: NMT
B: Node Guard
C: SDO
D: Emergency
E: PDO
F: Boot-up

Service	Initializing	Pre-Operational	Operational	Stopped
PDO			○	
SDO		○	○	
SYNC		○	○	
Time Stamp		○	○	
EMCY		○	○	
Boot-up	○			
NMT		○	○	○

SDO (Service Data Objects)

Use SDO to access the Object Dictionary in every CANopen node using the Client/Server model. One SDO has two COB-IDs (request SDO and response SDO) to upload or download data between two nodes. There is no data limit for SDOs to transfer data, but it must transfer data by segment when the data exceeds four bytes with an end signal in the last segment. However, MX300 series does not support transferring data by segment.

The Object Dictionary (OD) is a group of objects in a CANopen node. Every node has an OD in the system, and OD contains all parameters describing the device and its network behavior. The access path in the SOD is the index and sub-index; each object has a unique index in the OD and has a sub-index if necessary.

Type		Data 0								Data 1	Data 2	Data 3	Data 4	Data 5	Data 6	Data 7
		7	6	5	4	3	2	1	0	Index	Index	Index	Data	Data	Data	Data
		command								L	H	Sub	LL	LH	HL	HH
Domain Download	Client	0	0	1	-	N		E	S							
	Server	0	1	1	-	-	-	-	-							
Domain Upload	Client	0	1	0	-	-	-	-	-							
	Server	0	1	0	-	N		E	S							
Abort Domain Transfer	Client	1	0	0	-	-	-	-	-							
	Server	1	0	0	-	-	-	-	-							

N: Bytes not used; E: normal (0) / transferred (1); S: data size

PDO (Process Data Objects)

PDO communication can be described by the producer / consumer model. Each node of the network listens to the messages of the transmission node and distinguishes whether the message has to be processed or not after receiving the message. A PDO can be transmitted from one device to one another device or to many other devices. Every PDO has two PDO services: a TxPDO (transmitting) and an RxPDO (receiving). All transmission types are listed in the following table

Type Number	PDO				
	Cyclic	Acyclic	Synchronous	Asynchronous	RTR only
0		○	○		
1–240	○		○		
241–251	Reserved				
252			○		○
253				○	○
254				○	
255				○	

- Type number 0 indicates acyclic SYNC message between two PDO transmissions.
- Type number 1–240 indicates the number of SYNC message between two PDO transmissions.
- Type number 252 indicates the data is updated (but not sent) immediately after receiving SYNC.
- Type number 253 indicates the data is updated immediately after receiving RTR.
- Type number 254 indicates Delta CANopen does not support this transmission format.
- Type number 255 indicates the data is an asynchronous transmission.

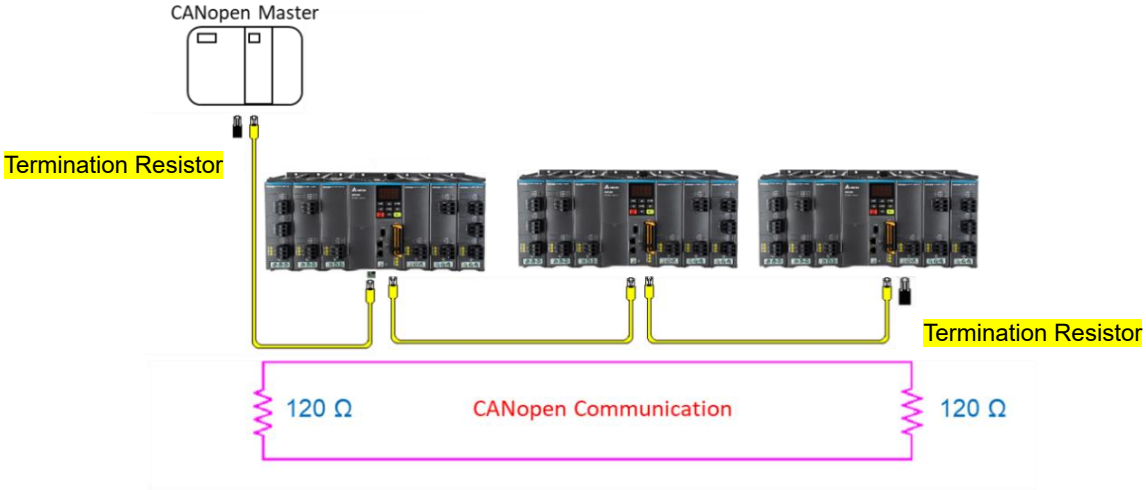
All PDO transmission data must be mapped to the index with Object Dictionary.

EMCY (Emergency Object)

When errors occur inside the hardware, an emergency object is triggered. An emergency object is only sent when an error occurs. As long as there is nothing wrong with the hardware, there is no emergency object warning of an error message.

7-3-2 Wiring for CANopen

MX300 built in dual RJ45 ports which allow multiple devices connection without an external communication splitter box. Termination Resistors of 120 Ω are required at each end of the network topology as shown in the picture below.



CANopen Master can connects to all inverter axes by rectifier module and communicate with each axis through their own CANopen address.

The functions supported by the rectifier axis and the inverter axis are as follows:

Delta CANopen supported functions		Rectifier axis	Inverter axis
Parameter Read / Write		V	V
Error Alarm		V	V
Control Method	CIA402	-	V
	Delta old standard	-	V
	Delta new standard	-	V

7-3-3 CANopen Communication Interface Descriptions

There are two control modes for CANopen: the CIA402 standard (Inverter module Pr.09-40 = 1) is the default, and the Delta's standard setting (Inverter module Pr.09-40 = 0). There are two control modes according to Delta's standard. One is the old control mode (Inverter module Pr.09-30 = 0); which can only control the motor drive under the frequency control. The other mode is a new standard (Inverter module Pr.09-30 = 1); which allows the motor drive to be controlled under all kinds of modes. The MX300 currently supports the speed mode. The following table shows the control mode definitions:

CANopen Control Mode	Speed Control Mode	
	Index	Description
CIA402 Standard Pr.09-40 = 1	6042-00	Target rotating speed (rpm)
	-----	-----
Delta Standard (Old definition) Pr.09-40 = 0, Pr.09-30 = 0	2020-02	Target rotating speed (Hz)
Delta Standard (New definition) Pr.09-40 = 0, Pr.09-30 = 1	2060-03	Target rotating speed (Hz)
	2060-04	Torque limit (%)

CANopen Control Mode	Operation Control	
	Index	Description
CIA402 Standard Pr.09-40 = 1	6040-00	Operation Command
	-----	-----
Delta Standard (Old definition) Pr.09-40 = 0, Pr.09-30 = 0	2020-01	Operation Command
Delta Standard (New definition) Pr.09-40 = 0, Pr.09-30 = 1	2060-01	Operation Command
	-----	-----

CANopen Control Mode	Others	
	Index	Description
CIA402 Standard Pr.09-40 = 1	605A-00	Quick stop processing mode
	605C-00	Disable operation processing mode
Delta Standard (Old definition) Pr.09-40 = 0, Pr.09-30 = 0	-----	-----
Delta Standard (New definition) Pr.09-40 = 0, Pr.09-30 = 1	-----	-----
	-----	-----

You can use some Index in either CIA402 or Delta's standard when:

1. Indices that are defined as RO attributes.
2. The corresponding index of available parameter groups: (2000-00–200E-XX)
3. Acceleration / Deceleration Index: 604F 6050

7-3-3-1 CIA402 Standard Control Mode

CIA402 Standard Control Mode

If you want to use the CIA402 standard to control the motor drive, follow these steps:

1. Wire the hardware (refer to Section 7-3-2 Wiring for CANopen).
2. Set the operation source: set inverter module Pr.00-21 to 3.
   Set the operation command source to CANopen settings (RUN / STOP, forward / reverse running, and so on).
3. Set the frequency source: set inverter module Pr.00-20 to 6.
   Choose the source for the Frequency command from the CANopen setting.
4. Set CIA402 as the control mode: set inverter module Pr.09-40 = 1
5. Set the CANopen station: set inverter module Pr.09-36; the range is between 1–127. When Pr.09-36 = 0, the CANopen slave function is disabled.
6. Set the CANopen baud rate: set rectifier module Pr.09-37 (CANBUS baud rate: 1 Mbps (0), 500 Kbps (1), 250 Kbps (2), 125 Kbps (3), 100 Kbps (4) or 50 Kbps (5)).
7. Set the multiple input functions to Quick Stop. You can also choose to enable or disable; the default setting is disabled. If it is necessary to enable the function, set MI terminal to 53 in one of the following inverter modules: Pr.02-01–02-07 or Pr.02-26–02-28.
   Note that this function is available in CIA402 only.

The status of the motor drive (following the CIA402 standard)

According to the CIA402 definition, the motor drive is divided into 3 blocks and 9 statuses as described below.

3 blocks

- Power Disable: without PWM output

- Power Enable: with PWM output
- Fault: one or more errors have occurred.

9 statuses

- Start: power on
- Not Ready to Switch On: the motor drive is initiating.
- Switch On Disable: occurs when the motor drive finishes initiating.
- Ready to Switch On: warming up before running.
- Switch On: the motor drive has the PWM output, but the reference command is not effective.
- Operation Enable: able to control normally.
- Quick Stop Active: when there is a Quick Stop request, stop running the motor drive.
- Fault Reaction Active: the motor drive detects conditions which might trigger error(s).
- Fault: one or more errors have occurred in the motor drive.

When the motor drive turns on and finishes the initiation, it remains in Ready to Switch On status. To control the operation of the motor drive, change to Operation Enable status. Set the control word's bit0–bit3 and bit7 of the Index 6040H and pair with Index Status Word (Status Word 0x6041).

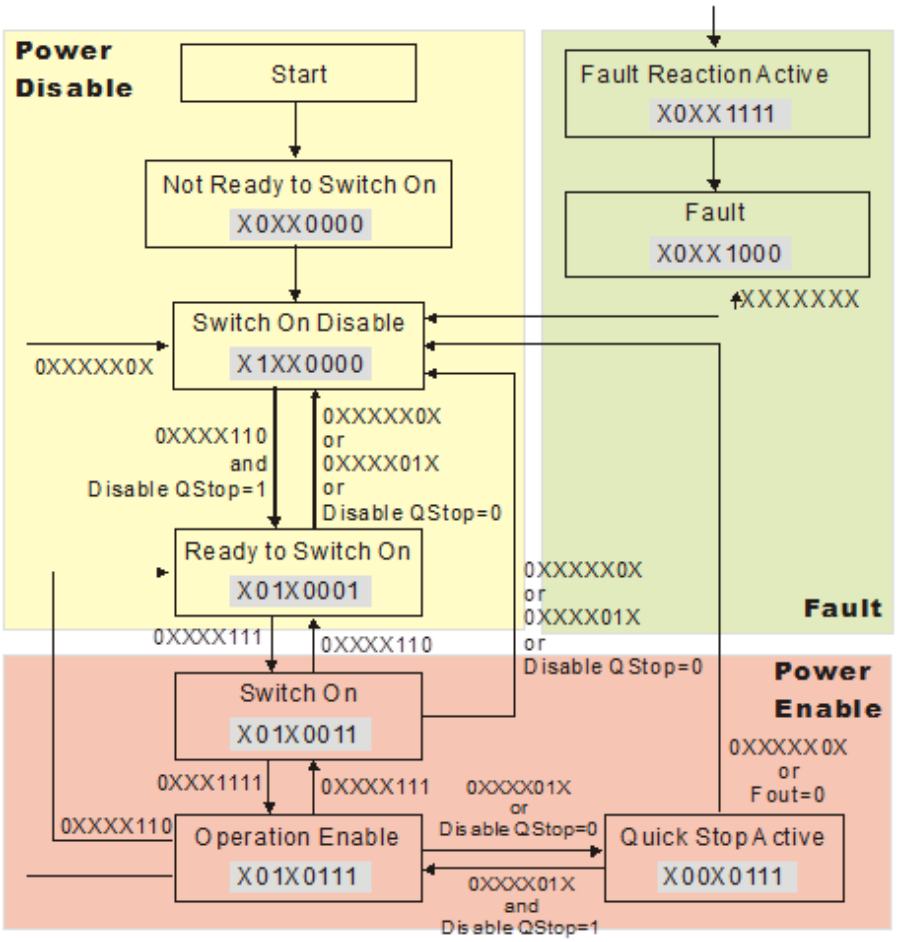
The control steps and index definition are described below.

Index 6040:

15–9	8	7	6–4	3	2	1	0
Reserved	Halt	Fault Reset	Operation	Enable operation	Quick Stop	Enable Voltage	Switch On

Index 6041:

15–14	13–12	11	10	9	8	7	6	5	4	3	2	1	0
Reserved	Operation	Internal limit active	Target reached	Remote	Reserved	Warning	Switch on disabled	Quick stop	Voltage enabled	Fault	Operation enable	Switch on	Ready to switch on



Set command 6040 = 0xE and then set another command 6040 = 0xF. Then you can switch the motor drive to Operation Enable. The Index 605A determines the direction of the lines from Operation Enable when the control mode changes from Quick Stop Active. When the setting value is 5–7, the direction lines are active, but when the setting value of 605A is not 5–7, once the motor drive is switched to Quick Stop Active, it is not able to switch back to Operation Enable.

Index	Sub	Definition	Default	R/W	Size	Unit	PDO Map	Mode	Note
605Ah	0	Quick stop option code	2	RW	S16		No		0: Disable drive function 1: Slow down on slow down ramp 2: Slow down on quick stop ramp 5: Slow down on slow down ramp and stay in Quick Stop 6: Slow down on quick stop ramp and stay in Quick Stop 7: Slow down on the current limit and stay in Quick stop

When the control block switches from Power Enable to Power Disable, use 605C to define the stop method.

Index	Sub	Definition	Default	R/W	Size	Unit	PDO Map	Mode	Note
605Ch	0	Disable operation option code	1	RW	S16		No		0: Disable drive function 1: Slow down with slow down ramp; disable the drive function.

The control method under speed mode (following the CIA402 standard)

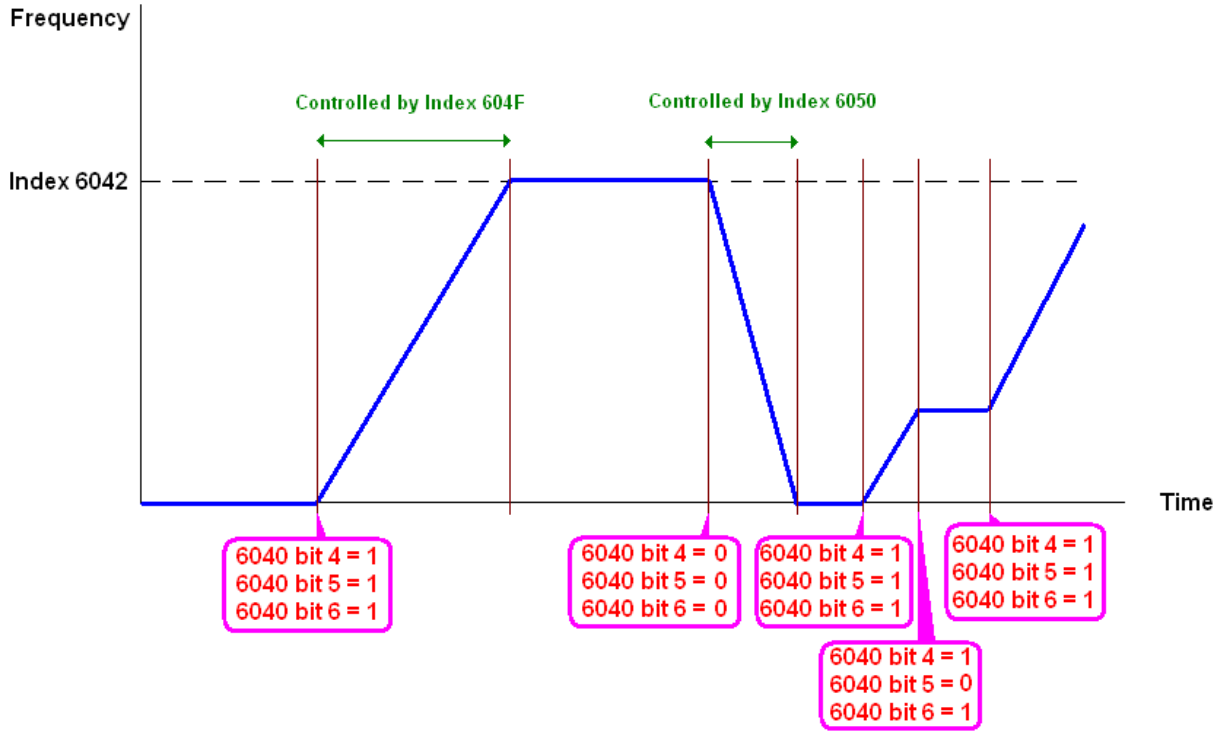
1. Set MX300 to speed control mode: set index 6060 = 2.
2. Switch to Operation Enable mode: set 6040 = 0xE and then set 6040 = 0xF.
3. Set the target frequency: set target frequency for 6042. Since the operation unit of 6042 is rpm, a conversion is required.

   $n = f \times \frac{120}{p}$ n: rotation speed (rpm) (revolutions / minute) f: rotation frequency (Hz)
   P: number of poles of the motor (Pole)

   For example:

   Set 6042H = 1500 (rpm), if the number of poles for the drive is 4 (Pr.05-04, Pr.05-16, Pr.05-67 or Pr.05-73), then the motor drive's operation frequency is 1500 (120/4) = 50 Hz. The 6042 is defined as a signed operation. The plus or minus sign means to rotate clockwise or counterclockwise.
4. To set acceleration and deceleration: use 604F (Acceleration) and 6050 (Deceleration).
5. Trigger an ACK signal: in the speed control mode, control the bit 6–4 of Index 6040 defined below.

	Index 6040			Result
	bit 6	bit 5	bit 4	
Speed Mode (Index 6060=2)	1	0	1	Locked at the current frequency.
	1	1	1	Run to reach the target frequency.
	Others			Decelerating to 0 Hz.



NOTE:

1. Read 6043 to get the current rotation speed (unit: rpm)
2. Read bit 10 of 6041 to check if the rotation speed has reached the targeting value (0: Not reached; 1: Reached).

7-3-3-2 Using the Delta Standard (Old definition)

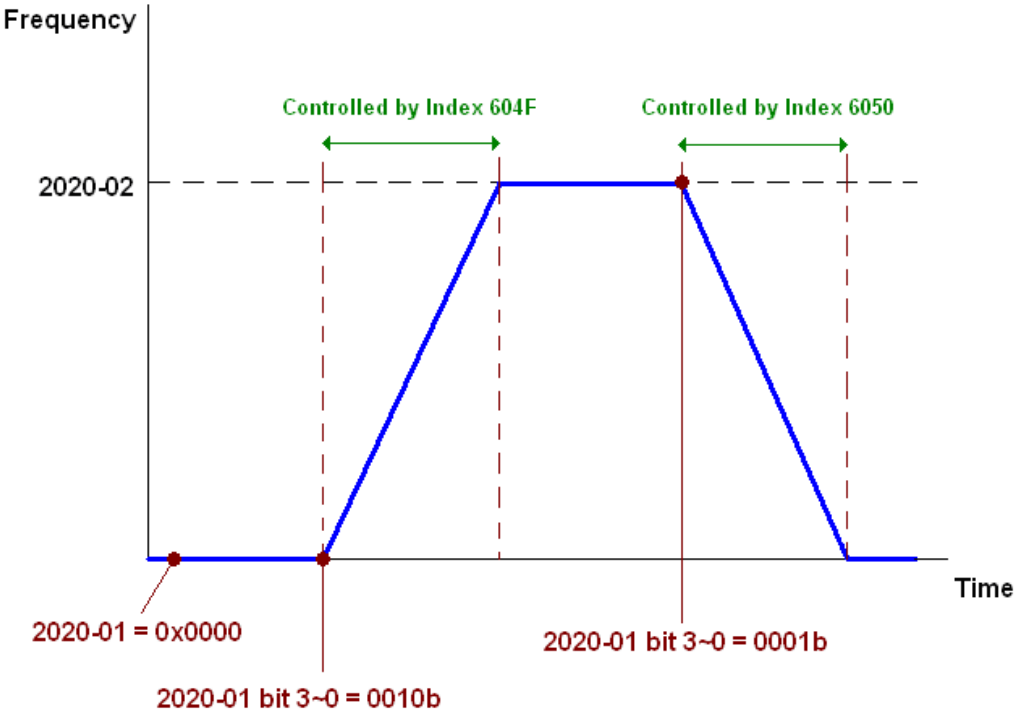
Related settings for an AC motor drive (following the Delta old standard)

If you want to use the Delta old standard to control the motor drive, follow these steps:

1. Wire the hardware (refer to Section 7-3-2 Wiring for CANopen).
2. Set the operation source: set inverter module Pr.00-21 to 3.
   Set the operation command source to CANopen settings (RUN / STOP, forward / reverse running, and so on).
3. Set the frequency source: set inverter module Pr.00-20 to 6.
   Choose the source for the Frequency command from the CANopen setting.
4. Set Delta Standard (Old definition) as the control mode: set inverter module Pr.09-40 = 0 and Pr.09-30 = 0.
5. Set the CANopen station: set inverter module Pr.09-36; the range is between 1–127. When Pr.09-36 = 0, the CANopen slave function is disabled.
6. Set the CANopen baud rate: set rectifier module Pr.09-37 (CANBUS baud rate: 1 Mbps (0), 500 Kbps (1), 250 Kbps (2), 125 Kbps (3), 100 Kbps (4) or 50 Kbps (5)).

The control method under speed mode

1. Set the target frequency: set 2020-02, the unit is Hz, with 2 decimal places. For example, 1000 is 10.00 Hz.
2. Operation control: set 2020-01 = 0002H for running and set 2020-01 = 0001H for stopping.



7-3-3-3 By Using Delta Standard (New Definition)

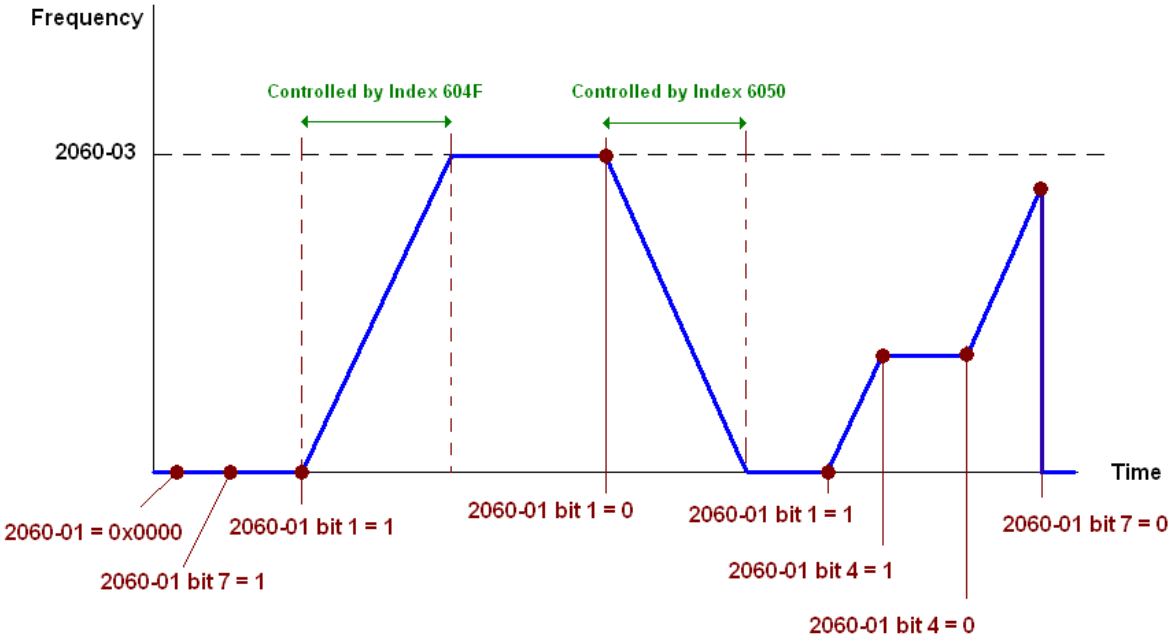
Related settings for an AC motor drive (following the Delta new standard)

If you want to use the Delta new standard to control the motor drive, follow these steps:

1. Wire the hardware (refer to Section 7-3-2 Wiring for CANopen).
2. Set the operation source: set inverter module Pr.00-21 to 3.
   Set the operation command source to CANopen settings (RUN / STOP, forward / reverse running, and so on).
3. Set the frequency source: set inverter module Pr.00-20 to 6.
   Choose the source for the Frequency command from the CANopen setting.
4. Set Delta Standard (New definition) as the control mode: set inverter module Pr.09-40 = 0 and 09-30 = 1.
5. Set the CANopen station: set inverter module Pr.09-36; the range is between 1–127. When Pr.09-36 = 0, the CANopen slave function is disabled.
6. Set the CANopen baud rate: set rectifier module Pr.09-37 (CANBUS baud rate: 1 Mbps (0), 500 Kbps (1), 250 Kbps (2), 125 Kbps (3), 100 Kbps (4) or 50 Kbps (5)).

The control method under speed mode (Delta New Standard)

1. Set MX300 to speed control mode: set index 6060 = 2.
2. Set the target frequency: set 2060-03, unit is Hz, with 2 decimal places. For example, 1000 is 10.00 Hz.
3. Operation control: set 2060-01 = 008H for server on and set 2060-01 = 0081H for running.



7-3-3-4 Control DI / DO / AI through CANopen

To control the DO of the motor drive through CANopen, follow these steps:

1. Define the DO to be controlled by CANopen. For example, set Pr.02-13 = 50 to control RY1.
2. To control DO by using control Index 2026-41. To set RY1 as ON, set bit 0 of Index 2026-41 = 1, then RY1 outputs 1.

The following table shows the mapping of CANopen DI / DO / AI:

DI:

Terminal	Related Parameters	R/W	Mapping Index
MI1	Pr.02-01	RO	2026-01 bit 0
MI2	Pr.02-02	RO	2026-01 bit 1
MI3	Pr.02-03	RO	2026-01 bit 2
MI4	Pr.02-04	RO	2026-01 bit 3
MIO1	Pr.02-05	RO	2026-01 bit 4
MIO2	Pr.02-06	RO	2026-01 bit 5
MIO3	Pr.02-07	RO	2026-01 bit 6
MIO4	Pr.02-08	RO	2026-01 bit 7
MI9 (extension card)	Pr.02-26	RO	2026-01 bit 8
MI10 (extension card)	Pr.02-27	RO	2026-01 bit 9
MI11 (extension card)	Pr.02-28	RO	2026-01 bit 10
MI12 (extension card)	Pr.02-29	RO	2026-01 bit 11
MI13 (extension card)	Pr.02-30	RO	2026-01 bit 12
MI14 (extension card)	Pr.02-31	RO	2026-01 bit 13
MI15 (extension card)	Pr.02-32	RO	2026-01 bit 14
MI16 (extension card)	Pr.02-33	RO	2026-01 bit 15

DO:

Terminal	Related Parameters	R/W	Mapping Index
RY1	Pr.02-13 = 50	RW	2026-41 bit 0
MIO1	Pr.02-05 = 50	RW	2026-41 bit 1
MIO2	Pr.02-06 = 50	RW	2026-41 bit 2
MIO3	Pr.02-07 = 50	RW	2026-41 bit 3
MIO4	Pr.02-08 = 50	RW	2026-41 bit 4
MO9 (extension card)	Pr.02-36 = 50	RW	2026-41 bit 8
MO10 (extension card)	Pr.02-37 = 50	RW	2026-41 bit 9
MO11 (extension card)	Pr.02-38 = 50	RW	2026-41 bit 10
MO12 (extension card)	Pr.02-39 = 50	RW	2026-41 bit 11
MO13 (extension card)	Pr.02-40 = 50	RW	2026-41 bit 12
MO14 (extension card)	Pr.02-41 = 50	RW	2026-41 bit 13
MO15 (extension card)	Pr.02-42 = 50	RW	2026-41 bit 14
MO16 (extension card)	Pr.02-43 = 50	RW	2026-41 bit 15

AI:

Terminal	Related Parameters	R/W	Mapping Index
AI1	==	RO	Value of 2026-61
AI2	==	RO	Value of 2026-62

7-3-4 CANopen Supported Index

MX300 Supported Parameter Index:

The parameter index corresponds as shown in this example:

Index sub-Index

2000H + Group Pr. Number + 1

For example: Pr.10-15 (Encoder Stall and Slip Error Action)

2000H + Group Pr. Number + 1

10(0AH) - 15(0FH)

Index = 2000H + 0AH = 200A

Sub-Index = 0FH + 1H = 10H

MX300 Rectifier Module Supported Control Index:

Delta Standard Mode (Old Definition)

Index	Sub	Definition	Default	R/W	Size	Note	
2020H	3	Fault / control command source	0	RW	U16	bit1	1: Reset command
2021H	0	Number	10	R	U8		
	1	Fault status	0		U16	bit7–0: Fault code bit15–8: Warning code	
	5	Output current (XXX.XX A)	0			When current is higher than 655.35, it shifts the decimal as (XXX.X A). The decimal can refer to High byte of 211F. NOTE: The output current read from the rectifier address is the sum of the output currents of all inverter axes.	

Index	Sub	Definition	Default	R/W	Size	Note
2021H	6	DC bus voltage (XXX.X V)	0	R	U16	
	17	Multi-function display (Pr.00-04)	0			
	20	Output current digit	0			
2022H	0	Reserved	0			
	1	Output current (XX.XX A)	0			When current is higher than 655.35, it shifts the decimal as (XXX.X A). The decimal can refer to High byte of 211F. NOTE: The output current read from the rectifier address is the sum of the output currents of all inverter axes.
	C	AI1 Analog input	0			Display signal of AI1 analog input terminal, 0–10 V corresponds to 0–100.00% (1.) (see NOTE 2 in Pr.00-04)
	D	AI2 Analog input	0			Display signal of AI2 analog input terminal, 4–20 mA / 0–10 V corresponds to 0–100% (2.) (see NOTE 2 in Pr.00-04)
	F	Power components temperature (XXX.X °C)	0			
	11	Digital input status	0			The status of digital input (ON / OFF), refer to Pr.02-12 (see NOTE 3 in Pr.00-04)
	12	Digital output status	0			The status of digital output (ON / OFF), refer to Pr.02-18 (see NOTE 4 in Pr.00-04)
	14	The corresponding CPU digital input pin status	0			The corresponding CPU digital input pin status (d.) (see NOTE 3 in Pr.00-04)
	15	The corresponding CPU digital output pin status	0			The corresponding CPU digital output pin status (O.) (see NOTE 4 in Pr.00-04)
	1C	DC bus voltage ripples ($XXX.X\ V_{DC}$) (r.)	0			

CANopen Remote IO Mapping

Index	Sub	R/W	Description
2026h	01h	R	Each bit corresponds to different input terminals.
	02h	R	Reserved
	03h–40h	R	Reserved
	41h	RW	Each bit corresponds to different output terminals
	42h–60h	R	Reserved
	61h	R	AI1 proportional value
	62h	R	AI2 proportional value
	63h–A4h	R	Reserved

Index 2026-01	bit0	bit1	bit2	bit3	bit4	bit5	bit6	bit7	bit8	bit9	bit10	bit11	bit12	bit13	bit14	bit15
1	MI1	MI2	MI3	MI4	MIO1	MIO2	MIO3	MIO4								
2									MI9	MI10	MI11	MI12	MI13	MI14	MI15	MI16

1: Control board I/O

2: Extension card EMM-D88A I/O

Index 2026-41	bit0	bit1	bit2	bit3	bit4	bit5	bit6	bit7	bit8	bit9	bit10	bit11	bit12	bit13	bit14	bit15
1	RY1	MO1	MO2	MO3	MO4											
2									MI9	MI10	MI11	MI12	MI13	MI14	MI15	MI16

1: Control board I/O

2: Extension card EMM-D88A I/O

MX300 Inverter Module Supported Control Index:

Delta Standard Mode (Old Definition)

Index	Sub	Definition	R/W	Size	Note	
2020H	0	Number	R	U8		
	1	Operation command	RW	U16	bit1–0	00B: No function
						01B: Stop
						10B: Run
						11B: JOG Enable
					bit3–2	Reserved
					bit5–4	00B: No function
						01B: FWD
						10B: REV
						11B: Change direction
					bit7–6	00B: 1st step accel./decel.
						01B: 2nd step accel./decel.
						10B: 3rd step accel./decel.
						11B: 4th step accel./decel.
					bit11–8	0000B: Master speed
						0001B: 1st step speed
						0010B: 2nd step speed
						0011B: 3rd step speed
						0100B: 4th step speed
						0101B: 5th step speed
						0110B: 6th step speed
						0111B: 7th step speed
						1000B: 8th step speed
						1001B: 9th step speed
					bit11–8	1010B: 10th step speed
						1011B: 11th step speed
						1100B: 12th step speed
						1101B: 13th step speed
						1110B: 14th step speed
						1111B: 15th step speed
					bit12	1: Enable the function of bit 06–11
					bit14–13	00B: No function
						01B: Operated command by digital keypad
						10B: Operated command by the setting of Pr.00-21
						11B: Switch the operation command source
					bit15	Reserved
	2	Frequency command (XXX.XX Hz)				
	3	Fault / control command source			bit0	1: External Fault (E.F.) ON
	3	Fault / control command source			bit 1	1: Reset command
					bit 2	1: Base Block (B.B) ON
					bit 15–3:	Reserved
2021H	0	Number	R	U8		
	1	Fault status		U16	bit7–0: Fault code bit 15–8: Warning code	
	2	Drive operation status			bit 1–0	00B: Drive stops
						01B: Drive decelerating
						10B: Drive standby
						11B: Drive operating
					bit 2	1: JOG command
					bit 4–3:	00B: FWD run
						01B: From REV run to FWD run
						10B: REV run
						11B: From FWD run to REV run
					bit 7–5	Reserved
					bit 8	1: Master frequency controlled by the communication interface
					bit 9	1: Master Frequency command controlled by analog / external signal
					bit 10	1: Operation command controlled by the communication interface
					bit 11	1: Parameter lock

Index	Sub	Definition	R/W	Size	Note	
2021H	2	Drive operation status	R	U16	bit 12	1: Enable the digital keypad copy parameter function
					bit 15–13	Reserved
	3	Frequency command (XXX.XX Hz)				
	4	Output frequency (XXX.XX Hz)				
	5	Output current (XXX.XX A)			When current is higher than 655.35, it shifts the decimal as (XXX.X A). The decimal can refer to High byte of 2021-20.	
	6	DC bus voltage (XXX.X V)				
	7	Output voltage (XXX.X V)				
	8	Multi-step speed status				
	A	Counter value (c)				
	B	Power factor angle (XXX.X°)				
	C	Output torque (XXX.X %)				
	D	Motor speed (XXXXX rpm)				
	10	Power output (XX.XXX kW)				
	17	Multi-function display (Pr.00-04)				
	20	Output current digit				
2022H	0	Reserved				
	1	Output current (XX.XX A)			When current is higher than 655.35, it shifts the decimal as (XXX.X A). The decimal can refer to High byte of 211F.	
	2	Counter value				
	3	Output frequency (XXX.XX Hz)				
	4	DC bus voltage (XXX.X V)				
	5	Output voltage (XXX.X V)				
	6	Power angle (XXX.X°)				
	7	Output Power (kW)				
	8	Actual motor speed (XXXXX rpm)			The motor speed estimated by the drive or encoder feedback in rpm	
	9	Output torque (XXX.X %)			Display the positive / negative output torque estimated by the drive (t0.0: positive torque; -0.0: negative torque)	
	B	PID feedback value (XXX.XX%)			Display the PID feedback value after enabling the PID function in %	
	C	AI1 Analog input			Display signal of AI1 analog input terminal, 0–10 V corresponds to 0–100.00% (1.) (see NOTE 2 in Pr.00-04)	
	D	AI2 Analog input			Display signal of AI2 analog input terminal, 4–20 mA / 0–10 V corresponds to 0–100.00% (2.) (see NOTE 2 in Pr.00-04)	
	F	Power components temperature (XXX.X °C)				
	G	Circuit board ambient temperature				
	11	Digital input status			The status of digital input (ON / OFF), refer to Pr.02-12. (see NOTE 3 in Pr.00-04)	
	12	Digital output status			The status of digital output (ON/OFF), refer to Pr.02-18. (see NOTE 4 in Pr.00-04)	
	13	Multi-step speed			Current step for the multi-step speed operation	
	14	The corresponding CPU digital input pin status			The corresponding CPU digital input pin status (d.) (see NOTE 3 in Pr.00-04)	
	15	The corresponding CPU digital output pin status			The corresponding CPU digital output pin status (O.) (see NOTE 4 in Pr.00-04)	
	1C	DC bus voltage ripples (XXX.X V)				
	1F	Display of user-defined output			User page displays the value in physical measure	
	20	Pr.00-05 gain value			Output value of Pr.00-05 (XXX.XX Hz)	
	24	Control Mode			Control mode of the drive 0: speed mode	
	25	Carrier Frequency (XX kHz)			Carrier frequency of the drive	
	27	Motor drive status			bit 1–0	00b: No direction 01b: Forward 10b: Reverse
					bit 3–2	01b: Driver ready 10b: Error
					bit 4	0b: Motor drive does not output 1b: Motor drive outputs
					bit 5	0b: No warning 01b: Warning
	28	Positive or negative torque (XXXX Nt-m)			Output positive / negative torque of motor drive calculation	
	2A	Power consumption kWh (XXXX.X)				

Index	Sub	Definition	R/W	Size	Note
2022H	2F	PID reference (XXX.XX%)	R	U16	
	30	PID offset (XXX.XX%)			
	31	PID output frequency (XXX.XX Hz)			
	32	Auxiliary frequency			
	33	Master frequency			
	34	Frequency value after addition and subtraction of master and auxiliary frequency			

Delta Standard Mode (New Definition)

Index	sub	R/W	Size	Description			Speed Mode
				bit	Definition	Priority	
2060h	00h	R	U8				
	01h	RW	U16	0	Ack	4	0: fcmd = 0 1: fcmd = Fset (Fpid)
				1	Dir	4	0: FWD run command 1: REV run command
				2			
				3	Halt	3	0: Drive runs until target speed is reached 1: Drive stops by deceleration setting
				4	Hold	4	0: Drive runs until target speed is reached 1: Frequency stops at current frequency
				5	JOG	4	0: JOG OFF Pulse 1: JOG RUN
				6	QStop	2	Quick Stop
				7	Power	1	0: Power OFF 1: Power ON
2060h	01h	RW	U16	8	Ext_Cmd2	4	0→1: Absolute position cleared
				14–9			
				15	RST	4	Pulse 1: Fault code cleared
	02h				Mode Cmd		0: Speed mode
	03h						Speed command (unsigned decimal)
2061h	01h	R		0	Arrive		Frequency command reached
				1	Dir		0: Motor FWD run 1: Motor REV run
				2	Warn		Warning occurs
				3	Error		Error detected
				4			
				5	JOG		JOG
				6	QStop		Quick stop
				7	Power On		Switch ON
				15–8			
	02h						
	03h		U16				Actual output frequency
	04h						

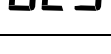
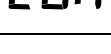
CIA402 part

Index	Sub	Definition	Default	R/W	Size	Unit	PDO Map	Mode	Note
6007h	0	Abort connection option code	2	RW	S16		Yes		0: No action 2: Disable voltage 3: Quick Stop
603Fh		Error code	0	R0	U16				
6040h		Control word		RW					
6041h		Status word		R0					
6042h		vl target velocity		RW	S16	rpm		vl	
6043h		vl velocity demand		RO					
6044h		vl control effort							
604Fh		vl ramp function time	10000	RW	U32	1ms			The minimum unit is 100 ms. In addition, it cannot be set to zero.
6050h		vl slow down time							
6051h		vl quick stop time	1000						
605Ah		Quick stop option code	2		S16		No		0: Disable drive function 1: Slow down on slow down ramp 2: Slow down on quick stop ramp 5: Slow down on slow down ramp and stay in QUICK STOP 6: Slow down on quick stop ramp and stay in QUICK STOP

Index	Sub	Definition	Default	R/W	Size	Unit	PDO Map	Mode	Note
605Ch	0	Disable operation option code	1						0: Disable drive function 1: Slow down with slow down ramp; disable the drive function
6060h		Mode of operation	2		S8		Yes		2: Velocity mode
6061h		Mode of operation display		RO					Same as above

7-3-5 CANopen fault code

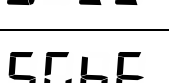
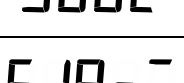
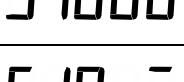
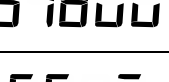
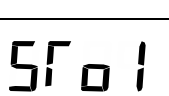
- Refer to settings for Pr.06-17–Pr.06–22 and Pr.14-70–Pr.14-73
- Refer to Chapter 8 Fault Codes for detailed descriptions.

Setting	Display	Fault Codes	Operation	CANopen Fault Register (bit0–7)	CANopen Fault Code
1		0001H	Over-current during acceleration (ocA)	0, 1	2213H
2		0002H	Over-current during deceleration (ocd)	0, 1	2213H
3		0003H	Over-current during steady operation (ocn)	0, 1	2314H
4		0004H	Ground fault (GFF)	0, 1	2240H
6		0006H	Over-current at stop (ocS)	0, 1	2314H
7		0007H	Over-voltage during acceleration (ovA)	0, 2	3210H
8		0008H	Over-voltage during deceleration (ovd)	0, 2	3210H
9		009H	Over-voltage during constant speed (ovn)	0, 2	3210H
10		000AH	Over-voltage at stop (ovS)	0, 2	3210H
11		000BH	Low-voltage during acceleration (LvA)	0, 2	3220H
12		000CH	Low-voltage during deceleration (Lvd)	0, 2	3220H
13		000DH	Low-voltage at constant speed (Lvn)	0, 2	3220H
14		000EH	Low-voltage at stop (LvS)	0, 2	3220H
15		000FH	Phase loss protection (orP)	0, 2	3130H

Setting	Display	Fault Codes	Operation	CANopen Fault Register (bit0–7)	CANopen Fault Code
16	oH1	0010H	IGBT overheating (oH1)	0, 3	4310H
17	oH2	0011H	Circuit board ambient temperature overheats (oH2)	0, 3	4310H
18	tH1o	0012H	IGBT temperature detection failure (tH1o)	0, 3	FF00H
21	oL	0015H	Over load (oL)	0, 1	2310H
22	EoL1	0016H	Electronic thermal relay 1 protection (EoL1)	0, 1	2310H
23	EoL2	0017H	Electronic thermal relay 2 protection (EoL2)	0, 1	2310H
24	oH3	0018H	Motor overheating (oH3)	0, 3	FF20H
26	ot1	001AH	Over torque 1 (ot1)	0, 3	8311H
27	ot2	001BH	Over torque 2 (ot2)	0, 3	8311H
28	uC	001CH	Under current (uC)	0, 1	8321H
31	cF2	001FH	EEPROM read error (cF2)	0, 5	5530H
33	cd1	0021H	U-phase error (cd1)	0, 1	FF04H
34	cd2	0022H	V-phase error (cd2)	0, 1	FF05H
35	cd3	0023H	W-phase error (cd3)	0, 1	FF06H
36	Hd0	0024H	cc hardware error (Hd0)	0, 5	FF07H
37	Hd1	0025H	oc hardware error (Hd1)	0, 5	FF08H
40	AUE	0028H	Auto-tuning error (AUE)	0, 1	FF21H
41	AFE	0029H	PID loss ACI (AFE)	0, 7	FF22H
48	ACE	0030H	ACI loss (ACE)	0, 1	FF25H

Setting	Display	Fault Codes	Operation	CANopen Fault Register (bit0–7)	CANopen Fault Code
49	EF	0031H	External fault (EF)	0, 5	9000H
50	EF1	0032H	Emergency stop (EF1)	0, 5	9000H
51	bb	0033H	External base block (bb)	0, 5	9000H
52	Pcod	0034H	Password is locked (Pcod)	0, 5	FF26H
54	CE1	0036H	Illegal command (CE1)	0, 4	7500H
55	CE2	0037H	Illegal data address (CE2)	0, 4	7500H
56	CE3	0038H	Illegal data value (CE3)	0, 4	7500H
57	CE4	0039H	Data is written to read-only address (CE4)	0, 4	7500H
58	CE10	003AH	Modbus transmission time-out (CE10)	0, 4	7500H
62	dEb	003EH	Deceleration energy backup error (dEb)	0, 2	FF27H
63	oSL	003FH	Over slip warning (oSL)	0, 7	FF28H
72	SrL1	0048H	S1 internal circuit detection error (STL1)	0, 5	FF30H
76	Sro	004CH	STO (STO)	0, 5	FF31H
77	SrL2	004DH	S2 internal circuit detection error (STL2)	0, 5	FF32H
79	Aoc	004FH	U-phase over-current before run (Aoc)	0, 1	FF2BH
80	boc	0050H	V-phase over-current before run (boc)	0, 1	FF2CH
81	coc	0051H	W-phase over-current before run (coc)	0, 1	FF2DH
82	oPL1	0052H	Output phase loss U phase (oPL1)	0, 2	2331H
83	oPL2	0053H	Output phase loss V phase (oPL2)	0, 2	2332H

Setting	Display	Fault Codes	Operation	CANopen Fault Register (bit0–7)	CANopen Fault Code
84	oPL3	0054H	Output phase loss W phase (oPL3)	0, 2	2333H
87	oL3	0057H	Low frequency overload protection (oL3)	0	8A00H
89	roPd	0059H	Rotor position detection error (roPd)	0	8A00H
101	CGdE	0065H	CANopen guarding error (CGdE)	0, 4	8130H
102	CHbE	0066H	CANopen heartbeat error (CHbE)	0, 4	8130H
104	CbFE	0068H	CANopen bus off error (CbFE)	0, 4	8140H
121	CP20	0079H	Internal communication error (CP20)	0, 7	FF36H
123	CP22	007BH	Internal communication error (CP22)	0, 7	FF38H
124	CP30	007CH	Internal communication error (CP30)	0, 7	FF39H
126	CP32	007EH	Internal communication error (CP32)	0, 7	FF3BH
140	Hd6	008CH	oc hardware error (Hd6)	0, 1	2240H
141	b4GFF	008DH	GFF occurs before run (b4GFF)	0, 1	2240H
142	AuE1	008EH	Auto-tuning error (DC test phase) (AuE1)	0, 1	FF3DH
143	AuE2	008FH	Auto-tuning error (High frequency stall phase) (AuE2)	0, 1	FF3EH
144	AuE3	0090H	Auto-tuning error (Eotation test phase) (AuE3)	0, 1	FF3FH
145	MErr	0091H	MErr error (MErr)	0, 1	FF40H
224	SToT	00E0H	STO execution time-out (SToT)	0, 7	FF80H
225	STor	00E1H	STO ROM verifying failure (STor)	0, 7	FF81H
226	SToL	00E2H	STO loss (SToL)	0, 7	FF82H

Setting	Display	Fault Codes	Operation	CANopen Fault Register (bit0–7)	CANopen Fault Code
227		00E3H	STO Channel 1 error (STC1)	0, 7	FF83H
228		00E4H	STO Channel 2 error (STC2)	0, 7	FF84H
229		00E5H	STO Channel 1 time-out (SPC1)	0, 7	FF85H
230		00E6H	STO Channel 2 time-out (SPC2)	0, 7	FF86H
231		00E7H	STO Gate check error (SGbE)	0, 7	FF87H
232		00E8H	STO power 24V over voltage (S18ov)	0, 7	FF88H
233		00E9H	STO power 24V under voltage (S18uv)	0, 7	FF89H
234		00EAH	STO power 6V over voltage (S6ov)	0, 7	FF8AH
235		00EBH	STO power 6V under voltage (S6uv)	0, 7	FF8BH
236		00ECH	STO power 5V over voltage (S5ov)	0, 7	FF8CH
237		00EDH	STO power 5V under voltage (S5uv)	0, 7	FF8DH
238		00EEH	STO Watchdog (SWdG)	0, 7	FF8EH
239		00EFH	STO Sampling failure (SAdE)	0, 7	FF8FH
240		00F0H	STO execution time is too short (SEbL)	0, 7	FF90H
241		00F1H	STO execution time is too high (SEAb)	0, 7	FF91H
242		00F2H	Safe torque off 1 (STo1)	0, 7	FF92H
243		00F3H	Safe torque off 2 (STo2)	0, 7	FF93H

7-4 EtherCAT Overview (MX300-E models only)

7-4-1 EtherCAT Introduction

- Specifications

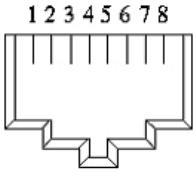
Item	Specification
Interface	RJ45
Port Number	2
Communication Mode	IEEE802.3, IEEE802.3u
Cable	Category 5e shielding 100 M
Transmission Speed	10 / 100 Mbps Auto-Defect
Communication Protocol	EtherCAT
Synchronization Mode	Free Run mode (Asynchronous)
Communication Object	Process Data Object (PDO) Service Data Object (SDO) Emergency Object (EMCY)
Application Layer Specifications	CiA402 Drive Profile
Supported CiA402 Operation Mode	Velocity Mode
Noise Immunity	ESD (EN 61800-5-1, IEC 6100-4-2) EFT (EN 61800-5-1, IEC 6100-4-4) Surge Test (EN 61800-5-1, IEC 6100-4-5) Conducted Susceptibility Test (EN 61800-5-1, IEC 6100-4-6)

NOTE: EtherCAT® is a registered trademark and patented technology, licensed by Beckhoff Automation GmbH, Germany.

- LED Indicators

Name	Indicator Status		Indication
RUN	Green Light	Always ON	Normal operation
		Flashes	Pre-operation (ON / OFF 200 ms)
			Safe mode operation (ON 200 ms / OFF 1000 ms)
		OFF	Initial state
ERROR	Red Light	Flashes	Basic configuration error (ON / OFF 200 ms)
			State switching error (ON 200 ms / OFF 1000 ms)
			Time-out (ON 200 ms twice / OFF 1000 ms)
		OFF	No error
IN LINK	Green Light	Always ON	Internet connection is normal
		Flashes	Network in operation
		OFF	Not connected to the Internet
OUT LINK		Always ON	Internet connection is normal
		Flashes	Network in operation
		OFF	Not connected to the Internet

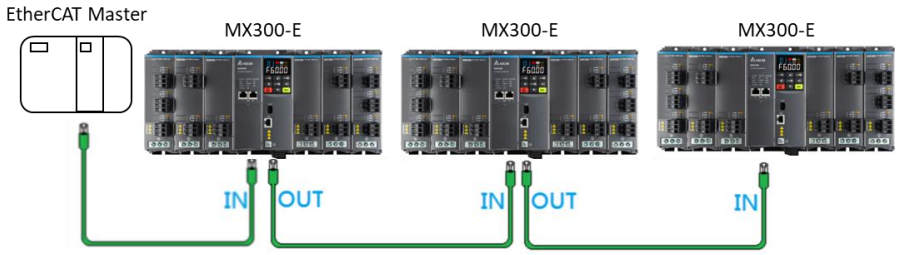
- RJ45 PIN Definition

RJ45 Diagram	PIN No.	Definition	Description
	1	Tx+	Positive pole for data transmission
	2	Tx-	Negative pole for data transmission
	3	Rx+	Positive pole for data reception
	6	Rx-	Negative pole for data reception
	4, 5, 7, 8	--	N / C

7-4-2 EtherCAT Connection

7-4-2-1 Network Connection

The two RJ45 ports (CN5) on the upper left side of MX300-E rectifier module are the EtherCAT ports. Pay attention to the connection method for EtherCAT for its packet delivery is directional from **IN** to **OUT**. The diagram below shows the correct wiring.



7-4-2-2 Parameter Setting

EtherCAT station and Ethernet slot numbers (from 1 to 15 and are unique to each axis) can be set separately for the rectifier and inverter axes of MX300. This applies to inverter module firmware v1.02 and above.

EtherCAT supports three control methods: Delta old definition, Delta new definition, and the CANopen standard DiA402 protocol that can be configured by Pr.09-30 and Pr.09-40.

Rectifier Module

Parameter	Explanation	Settings / Displayed Value	Default	Function Description
09-55	Ethernet Communication Protocol	1	1	Choose Ethernet communication protocol 1: EtherCAT
09-56	EtherCAT Alias Address	1–65535	0	Set EtherCAT Alias address Take effect after cycle the power.

Inverter Module

Parameter	Explanation	Settings / Displayed Value	Default	Function Description
00-20	Master Frequency Command Source (AUTO, REMOTE)	6	0	6: CANopen / EtherCAT / PROFINET / EtherNet/IP input
00-21	Operation Command Source (AUTO, REMOTE)	3	0	3: CANopen / EtherCAT / PROFINET / EtherNet/IP input

Parameter	Explanation	Settings / Displayed Value	Default	Function Description
09-30	Delta-defined Communication Decoding Method	0, 1	1	0: Decoding method 1 (20xxh) 1: Decoding method 2 (60xxh)
09-40	Communication Decoding Method	0, 1	1	0: Delta-defined 1: Use CiA402 protocol
09-57	Ethernet Slot	1–15	0	0: Disable 1–15 (1: axis 0, 2: axis 1, and so on) Take effect after cycle the power.

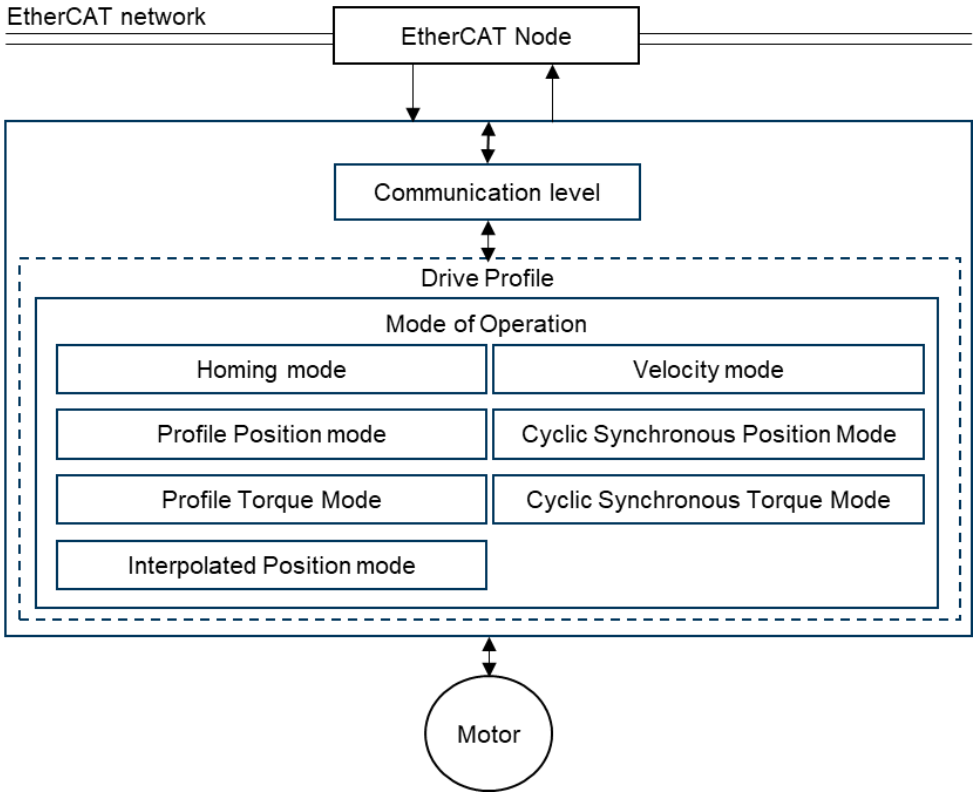
NOTE: Applicable to inverter module firmware v1.02 and above.

7-4-3 Introduction to EtherCAT

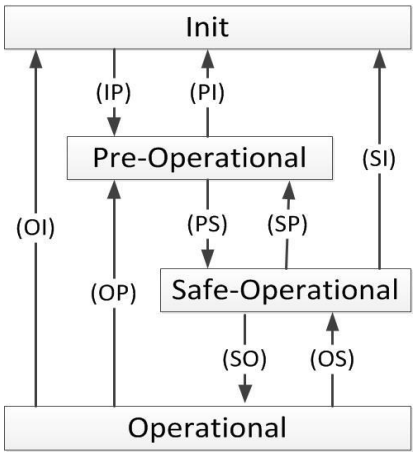
7-4-3-1 Protocol

EtherCAT (Ethernet for Control Automation Technology) - Ethernet network control automation technology was originally developed by Beckhoff Company in Germany based on the Ethernet network communication protocol, and applied to the open real-time field bus (Fieldbus) in the field of automation and industrial control technology. Currently this technology is supported and promoted by the EtherCAT Technology Group (ETG) in the future. EtherCAT architecture of the drive is as follows:

1. Communication layer:
   This protocol covers communication objects (PDO, SDO, Sync, Emergency Object), and related communication object dictionary.
2. DS402 Drives and motion control device profile:
   Defines the behavior of each motion mode and sets the object parameters required for execution.



7-4-3-1 State Machine



State Description:

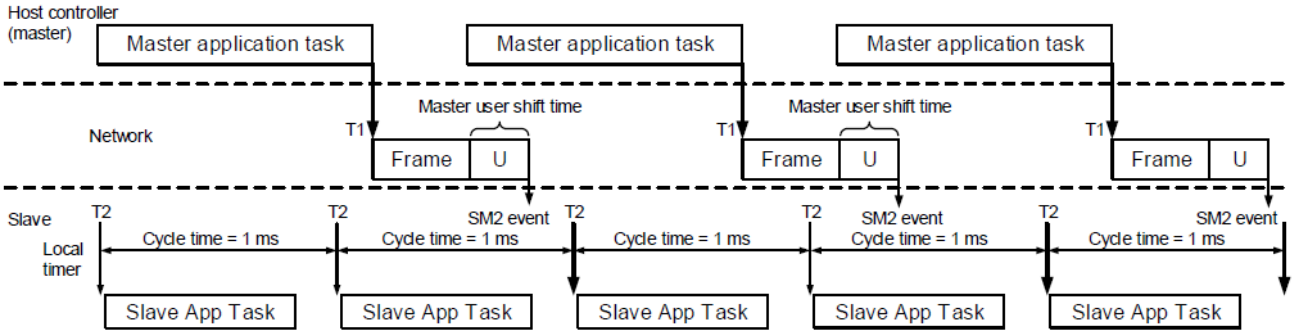
State	Description
Init	Drive has successfully completed initialization after power-up without any errors; there is no communication in the application layer.
Pre-Operational	Mailbox communication can be used at present.
Safe-Operational	PDO input data can be read (TxPDO). PDO output data cannot be received (RxPDO).
Operational	For cyclic I/O communication, PDO output data can be processed (RxPDO).
State Switch Command	Description
IP	Start mailbox communication
PI	Discontinue mailbox communication
PS	Start updating input data (TxPDO)
SP	Terminate updating input data (TxPDO)
SO	Start updating output data (RxPDO)
OS	Terminate updating output data (RxPDO)
OP	Terminate updating input / output data
SI	Terminate updating of input data and mailbox communications
OI	Terminate all input / output data updates and mailbox communications

7-4-4 EtherCAT System Settings

7-4-4-1 Asynchronous Mode

The drive currently supports Free Run Mode only.

There is an asynchronous relationship between master station and the slave station, and both have independent clocks for calculating time, that is, the clocks of the master station and the slave station are not synchronized. The commands transmitted and replied between the master station and the slave station are only sequential command exchanges without precise synchronization. For example, the master sends a PDO at time T1 and the slave receives the PDO at T2 after the SM2 event.



7-4-4-2 PDO Mapping Configuration

1. Default PDO Mapping Configuration

The tables below are the default PDO mapping configurations of EtherCAT drive for data exchange, which is also defined in the XML file of EtherCAT slave. The RxPDO and TxPDO of each group can be worked with each other.

The EtherCAT axis corresponds to the CiA402 specification and differs by one digit from the Ethernet slot parameter. For example, setting the Ethernet slot to 1 corresponds to EtherCAT axis 0.

- RxPDO Mapping:

Inverter axis

RxPDO (0x1600 + 0x0010*n)	Controlword (0x6040 + 0x0800*n)	vl target velocity (0x6042 + 0x0800*n)

n = EtherCAT axis

- TxPDO Mapping:

Rectifier axis

TxPDO (0x1AFF)	Fault status (0x4F21:01h)	Output current (0x4F21:05h)

Inverter axis

TxPDO (0x1A00 + 0x0010*n)			
Statusword (0x6041+ 0x0800*n)	velocity demand (0x6043 + 0x0800*n)	Error code (603Fh + 0x800*n)	Current actual valus (6078h + 0x800*n)

n = EtherCAT axis

The position of each axis

Ethernet Slot Pr.09-57	EtherCAT axis number	RxPDO	TxPDO	Controlword	vl target velocity	Statusword	velocity demand
-	Rectifier	0x16FF	0x1AFF	-	-	-	-
1	0	0x1600	0x1A00	0x6040	0x6042	0x6041	0x6043
2	1	0x1610	0x1A10	0x6840	0x6842	0x6841	0x6843
3	2	0x1620	0x1A20	0x7040	0x7042	0x7041	0x7043
4	3	0x1630	0x1A30	0x7840	0x7842	0x7841	0x7843
5	4	0x1640	0x1A40	0x8040	0x8042	0x8041	0x8043
6	5	0x1650	0x1A50	0x8840	0x8842	0x8841	0x8843

Ethernet Slot Pr.09-57	EtherCAT axis number	RxPDO	TxPDO	Controlword	vl target velocity	Statusword	velocity demand
7	6	0x1660	0x1A60	0x9040	0x9042	0x9041	0x9043
8	7	0x1670	0x1A70	0x9840	0x9842	0x9841	0x9843
9	8	0x1680	0x1A80	0xA040	0xA042	0xA041	0xA043
10	9	0x1690	0x1A90	0xA840	0xA842	0xA841	0xA843
11	10	0x16A0	0x1AA0	0xB040	0xB042	0xB041	0xB043
12	11	0x16B0	0x1AB0	0xB840	0xB842	0xB841	0xB843
13	12	0x16C0	0x1AC0	0xC040	0xC042	0xC041	0xC043
14	13	0x16D0	0x1AD0	0xC840	0xC842	0xC841	0xC843
15	14	0x16E0	0x1AE0	0xD040	0xD042	0xD041	0xD043

NOTE: Applicable to inverter module firmware v1.02 and above.

2. PDO Mapping

Index	Definition	Index	Definition
6007h + 0x800*n	Abort connection option code	6050h+ 0x800*n	vl slow down time
603Fh + 0x800*n	Error code	6051h+ 0x800*n	vl quick stop time
6040h + 0x800*n	Control word	605Ah+ 0x800*n	Quick stop option code
6041h + 0x800*n	Status word	605Ch+ 0x800*n	Disable operation option code
6042h + 0x800*n	vl target velocity	6060h+ 0x800*n	Mode of operation
6043h + 0x800*n	vl velocity demand	6061h+ 0x800*n	Mode of operation display
6044h+ 0x800*n	Velocity Actual Value	6502h+ 0x800*n	Supported drive modes
604Fh+ 0x800*n	vl ramp function time	6078h+ 0x800*n	Current actual values

n = EtherCAT axis

3. PDO Mapping Setting

The steps to set PDO mapping are as follows: (Take EtherCAT axis 0 as example):

(1) Disable PDO configuration:
OD 1C12 sub 0 = 0 (RxPDO), OD 1C13 sub 0 = 0 (TxPDO)

(2) Disable PDO mapping settings:
OD 1600 sub 0 = 0 (RxPDO), OD 1A01 sub 0 = 0 (TxPDO)

(3) Set the content and number of RxPDO mapping objects:
OD 1600–1603 sub 1–sub 8 sets the corresponding OD (RxPDO), OD 1600–1603 sub 0 = the corresponding OD number (RxPDO), the following takes OD 1600 as an example:

RxPDO Mapping Parameter Settings	Data	Description
OD 1600 sub1	6040h	Controlword, 16-bit
OD 1600 sub2	6060h	Modes of operation, 8-bit
OD 1600 sub3	6042h	vl target velocity
OD 1600 sub0	3	Set three RxPDO mappings

(4) Set the content and number of TxPDO mapping objects:
OD 1A00–1A03 sub 1–sub 8 sets the corresponding OD (TxPDO), OD 1A00–1A03 sub 0 = the corresponding OD number (TxPDO), the following takes OD 1A00 as an example:

RxPDO Mapping Parameter Settings	Data	Description
OD 1A00 sub1	6041h	Statusword, 16-bit
OD 1A00 sub2	6061h	Modes of operation display, 8-bit
OD 1A00 sub0	2	Set two RxPDO mappings

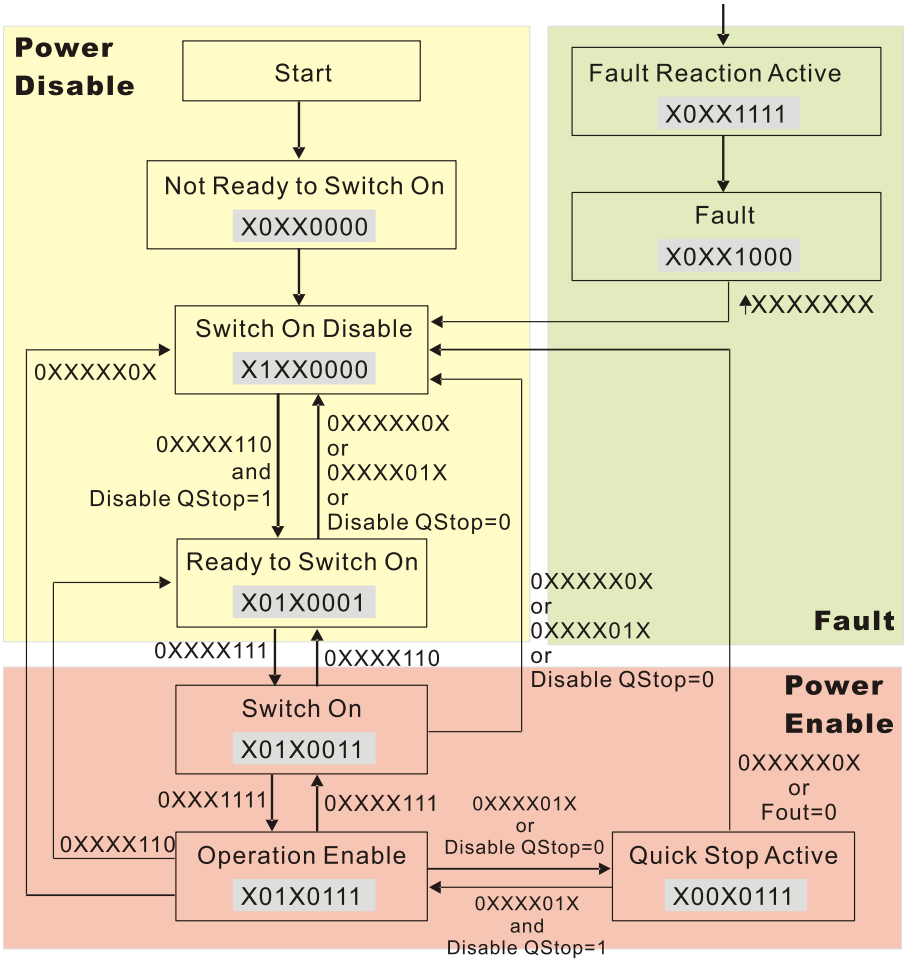
(5) Set the PDO mapping configuration:
OD 1C12 sub 1 = 0x1601 (RxPDO), OD 1C13 sub 1 = 0x1A01 (TxPDO)

(6) Enable PDO configuration:
OD 1C12 sub 0 = 1 (RxPDO), OD 1C13 sub 0 = 1 (TxPDO)

7-4-5 CiA402 Device Specification

This section describes the motion modes defined by the CiA402 specification under the EtherCAT communication protocol, including its basic operations and related object settings. The host computer controls the drive through the control word (controlword, OD 6040h), reads the present drive status by reading the status word (statusword, OD 6041h), and the drive completes the motor motion behavior according to the control instructions of the host computer.

7-4-5-1 CANopen over Ethernet (CoE) State Machine



NOTE: In the figure above, the string next to the arrow is the control word (controlword), and the string in the status box is the status word (statusword).

The state machine is divided into three sections:

Section	Description
Power Disable	Drive has no PWM output
Power Enable	Drive has PWM output
Fault	Error occurred

There are nine states in the three sections:

State	Description
Start	Boot
Not Ready to Switch On	Drive is in the process of initializing
Switch on Disable	Drive initialization is completed
Ready to Switch On	Drive is waiting to enter Switch On, and the motor is not activated
Switch On	Drive has PWM output currently, and reference command is invalid
Operation Enable	Drive is enabled and moves according to the control command
Quick Stop Active	The drive stops according to the setting method
Fault Reaction Active	Drive detects occurrence of an alarm and stops according to the setting mode, and the motor is still in the state of excitation currently
Fault	Motor servo off

Control word (controlword, OD 6040h) bit description

15–9	8	7	6–4	3	2	1	0
Reserved	Halt	Fault reset	Operation mode specific	Enable operation	Quick stop	Enable voltage	Switch on

Status word (statusword, OD 6041h) bit description

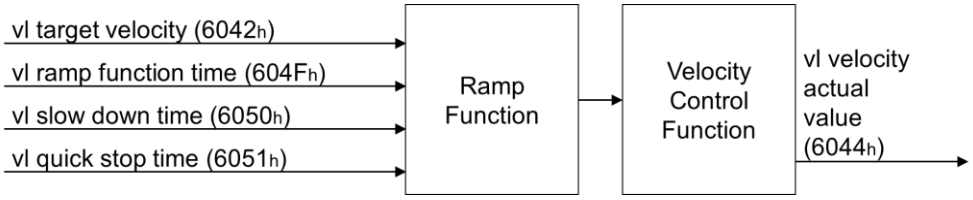
15–14	13–12	11	10	9	8	7
Reserved	Operation mode specific	Reserved	Target reached	Remote	Reserved	Warning

6	5	4	3	2	1	0
Switch on disabled	Quick stop	Voltage enabled	Fault	Operation enable	Switch on	Ready to switch on

7-4-5-2 EtherCAT Operation Mode

Velocity Mode:

The host sends the speed command, acceleration and deceleration and other information to the drive, and the drive executes related speed control behaviors. (Take EtherCAT axis 0 as example.)



- The operation steps are as follows:
  1. Setting mode: OD 6060h = 02h, which is the velocity mode
  2. Set speed command: OD 6042h (Unit: RPM)
  3. Set acceleration time: OD 604Fh (Unit: ms)
  4. Set deceleration time: OD 6050h (Unit: ms)

5. Set the control command: OD 6040h, the control word command makes the drive operate according to the above settings by using the following steps. For the state machine of the drive, refer to OD 6041h.
   (1) OD 6040h = 06h, the drive enters Ready to Switch On state
   (2) OD 6040h = 0Eh, the drive enters Switch On state (Servo On)
   (3) OD 6040h = 0Fh, the drive enters Operation Enable state
   (4) OD 6040h = 7Fh, the drive starts running

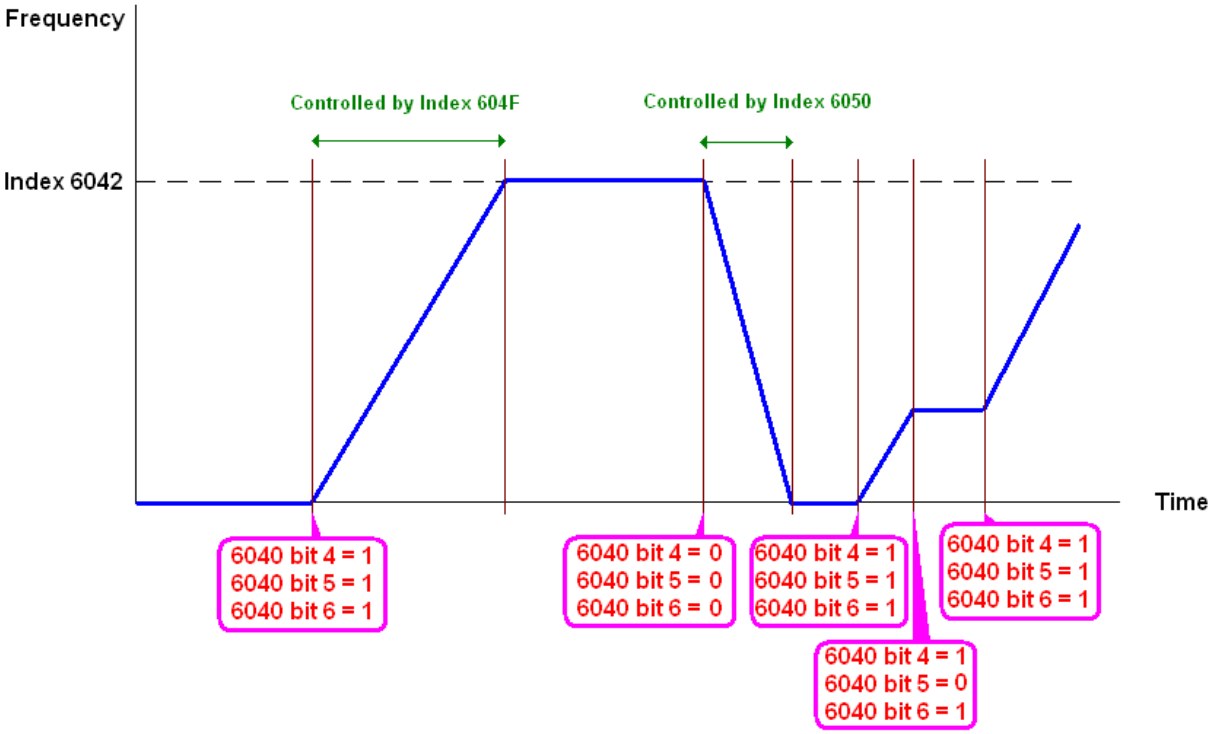
- The corresponding control commands are as follows:

Steps	bit 6	bit 5	bit 4	bit 3	bit 2	bit 1	bit 0	Description
(1)	0	0	0	0	1	1	0	Shutdown (Close)
(2)	0	0	0	0	1	1	1	Switch On (Drive Servo On Ready)
(3)	0	0	0	1	1	1	1	Enable Operation (Drive Servo On)
(4)	1	1	1	1	1	1	1	Run to target speed

- When using the velocity mode (OD 6060h = 02h), the corresponding behavior of controlword operation bit (bit 4–6) is as follows:

OD 6040h			Behavior
bit 6	bit 5	bit 4	
1	0	1	Maintain at present speed
1	1	1	Run to target speed
X	X	X	Decelerate to 0 RPM

- Read drive information
  1. OD 6044h, to observe the motor speed
  2. OD 6041h, status word of the drive, bit 10 target reached
     (0: Target speed is not reached; 1: Target speed is reached)



- Related Object List

Index	Name	Data Type	Attribute
6040h	Controlword	UNSIGNED16	RW

Index	Name	Data Type	Attribute
6041h	Statusword	UNSIGNED16	RO
6060h	Mode of operation	INTEGER8	RW
6061h	Mode of operation display	INTEGER8	RO
6042h	vl target velocity	INTEGER16	RW
6043h	vl velocity demand	INTEGER16	RO
6044h	vl velocity actual value	INTEGER16	RO
604Fh	vl ramp function time	INTEGER16	RW
6050h	vl slow down time	INTEGER16	RW

7-4-6 EtherCAT Warning / Fault Codes

Warning Codes

No.	Warning Code	Warning Name	Description	Corrective Actions
150	Edtn_WARN	Ethernet communication time-out	Communication time-out between rectifier and upper unit	• Check the communication is connected normally. • Check upper unit is connected normally.
152	EACn_WARN	Ethernet slot No. conflict	Any two inverter axes have the same Ethernet slot number in one multi-drive	• Check the Pr.09-57 value of each inverter axis to avoid the Ethernet slot No. duplication.
153	Eitn_WARN	Ethernet Internal communication time-out	Ethernet internal communication error between the rectifier axis and the inverter axis in one multi-drive	• Check the contact between modules.

Fault Codes

No.	Fault Codes	Fault Name	Description	Corrective Actions
215	EdtE_ERR	Ethernet communication time-out	Communication time-out between rectifier and upper unit	• Check the communication is connected normally. • Check upper unit is connected normally.

SDO Abort Code

SDO Abort Code	Description
0x05030000	Bit converting error due to segment transmission
0x05040000	SDO time-out
0x05040001	Client / servo command is invalid or does not exist
0x05040005	Register overflows when executing SDO
0x06010000	Access is not supported
0x06010001	Attempt to read a write-only object
0x06010002	Attempt to write to read-only object
0x06010003	Sub-index cannot be written; sub-index should be 0

SDO Abort Code	Description
0x06020000	Object does not exist in object dictionary
0x06040041	Unable to map object to PDO
0x06040042	The number and length of mapping objects exceed the PDO length
0x06040043	Parameter data format is not compatible
0x06040047	There is a problem about drive compatibility
0x06060000	Access failed due to hardware error (save or restore error)
0x06070010	Data Type does not match; parameter length does not match
0x06070012	Data Type does not match; parameter length is too long
0x06070013	Data Type does not match; parameter length is too short
0x06090011	Sub-index does not exist
0x06090030	Parameter value is out of range
0x06090031	The setting value is too large
0x06090032	The setting value is too small
0x06090033	Detected Module Ident List (0xF030) does not match Configured Module Ident list (0xF050)
0x06090036	The setting value is smaller than the lower limit value
0x08000000	General error
0x08000020	Data cannot be read or written
0x08000021	Data cannot be accessed due to local control
0x08000022	Data cannot be accessed due to present state
0x08000023	Object dictionary does not exist

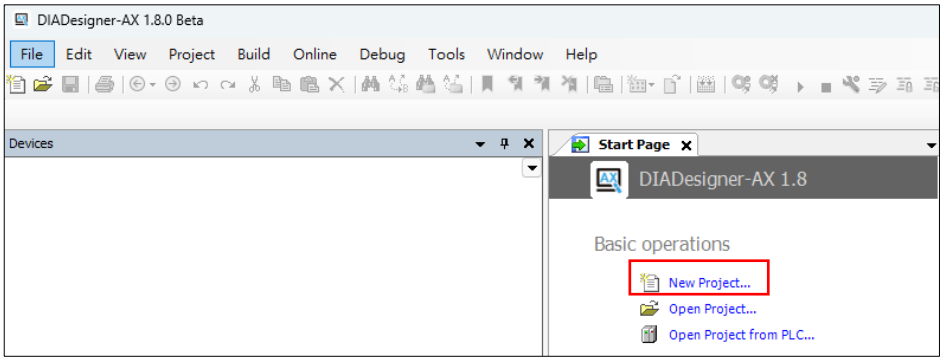
7-4-7 EtherCAT Operation Example

Delta PLC – AX-8 Operation Example (Designer-AX (Codesys base))

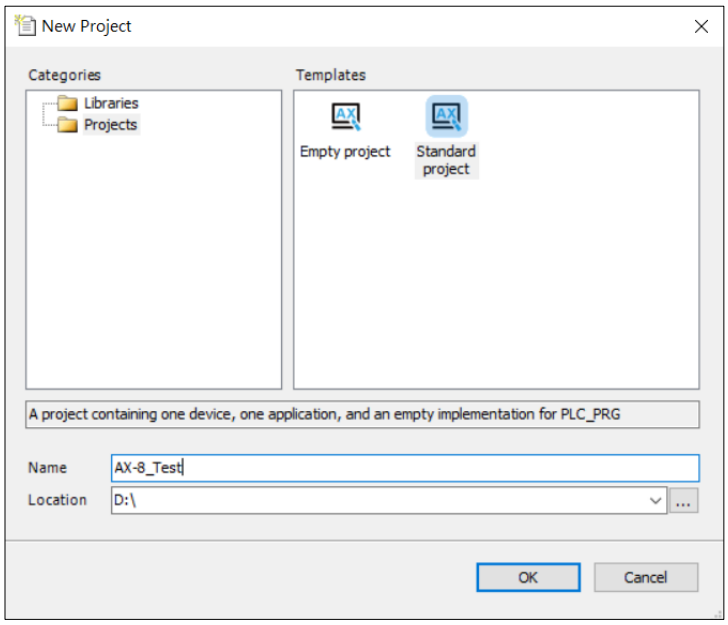
Device	AX-8	GLAN1 IP: 192.168.0.10
	Computer	Network Card IP: 192.168.0.123
	Drive: MX300-E	
Software	DIADesigner-AX	V1.8.0 or above

Steps:

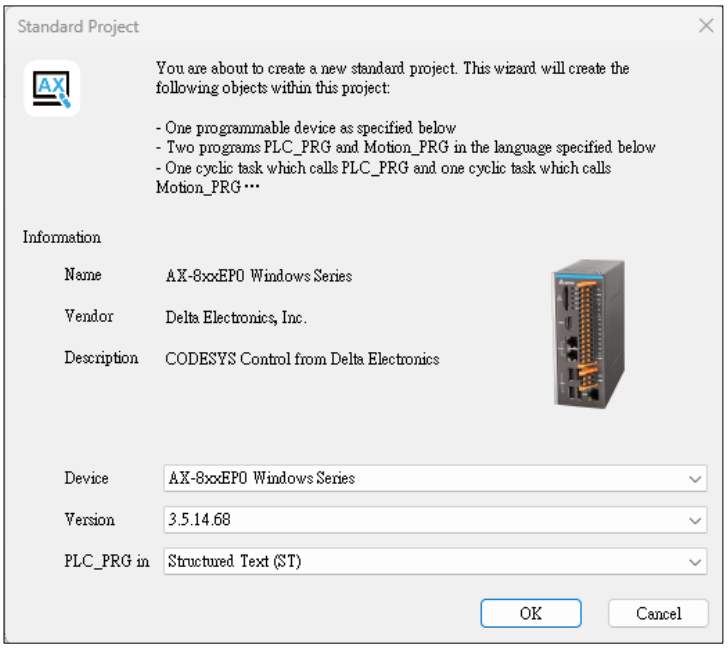
1. Connect MX300-E to AX-8 through the EtherCAT port and connect AX-8 to the computer through the Ethernet port (GLAN1).
2. Open DIADesigner-AX software, and then click **New Project**



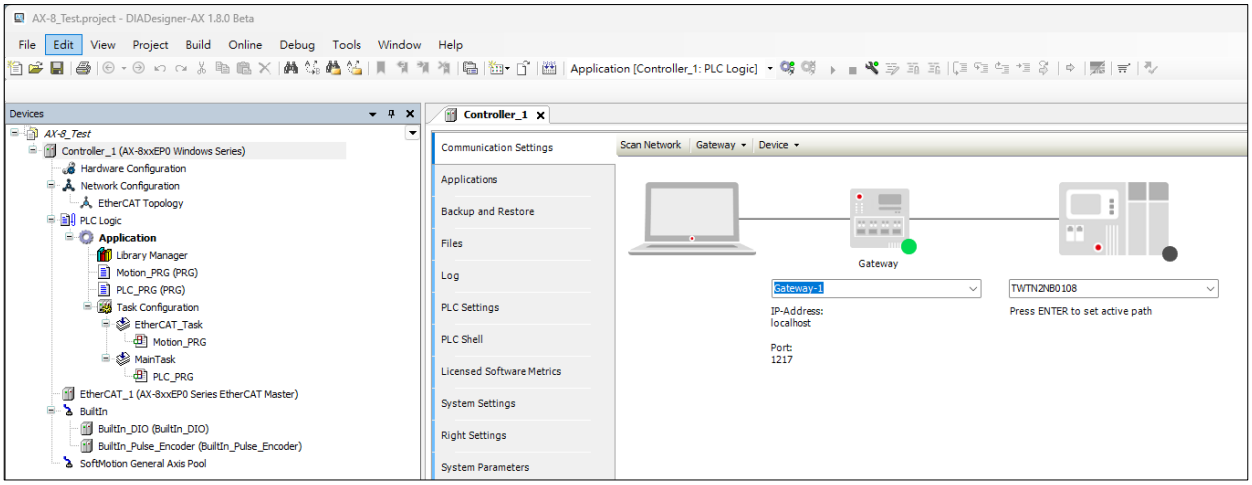
3. Select the **Standard project** in the **New Project** window, then click **OK**.



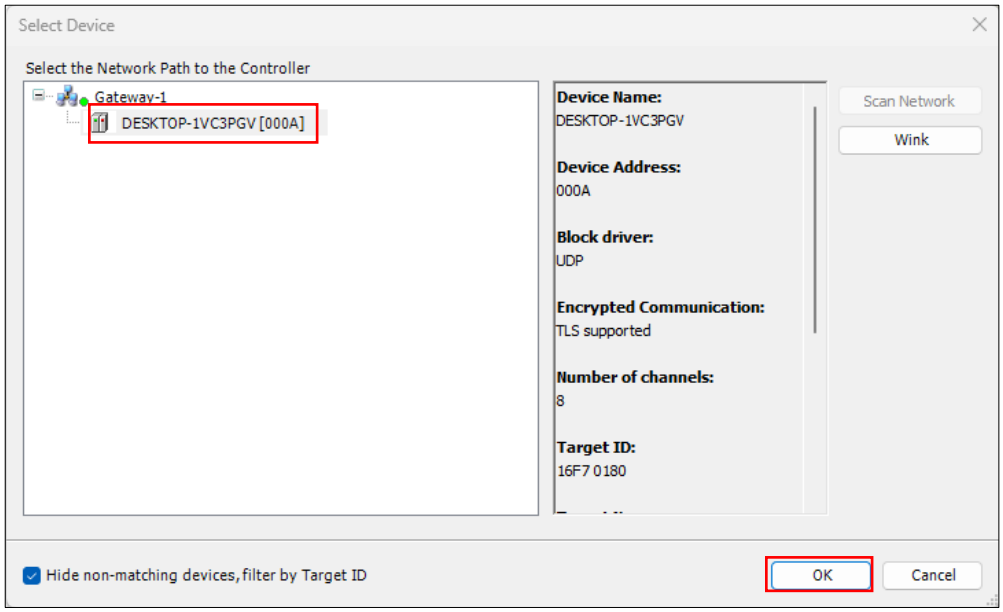
4. In the **Standard Project** window, select the device **AX-8xxEP0 Windows Series, Version, PLC_PGR in** (program type), and then click **OK** to create a new project.

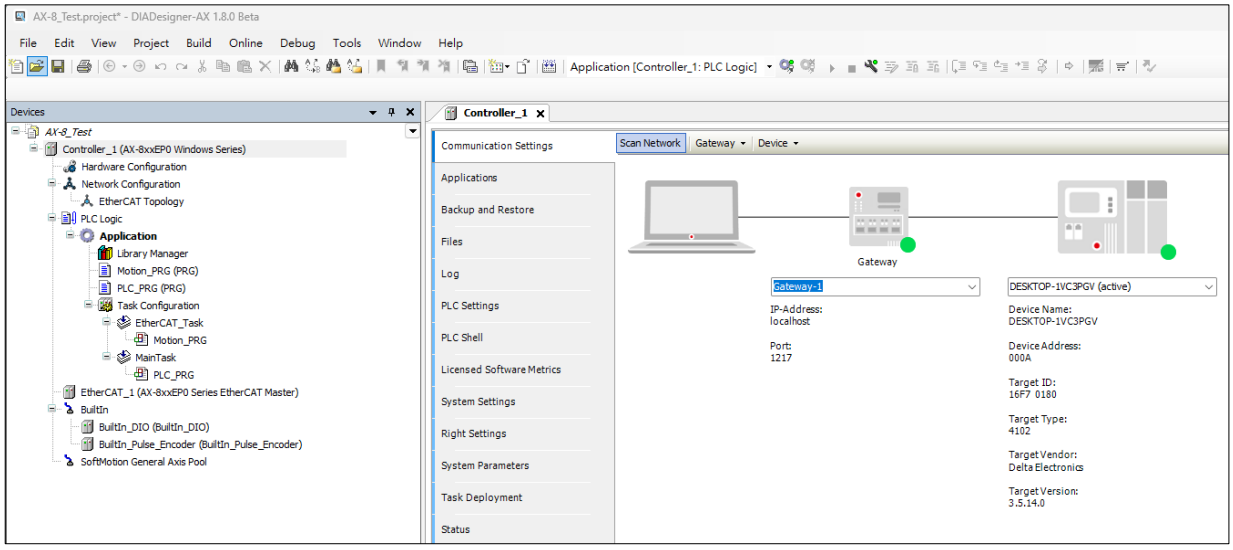


5. Double-click **Controller_1 (AX-8xxEP0 Windows Series)** then click **Scan Network**.

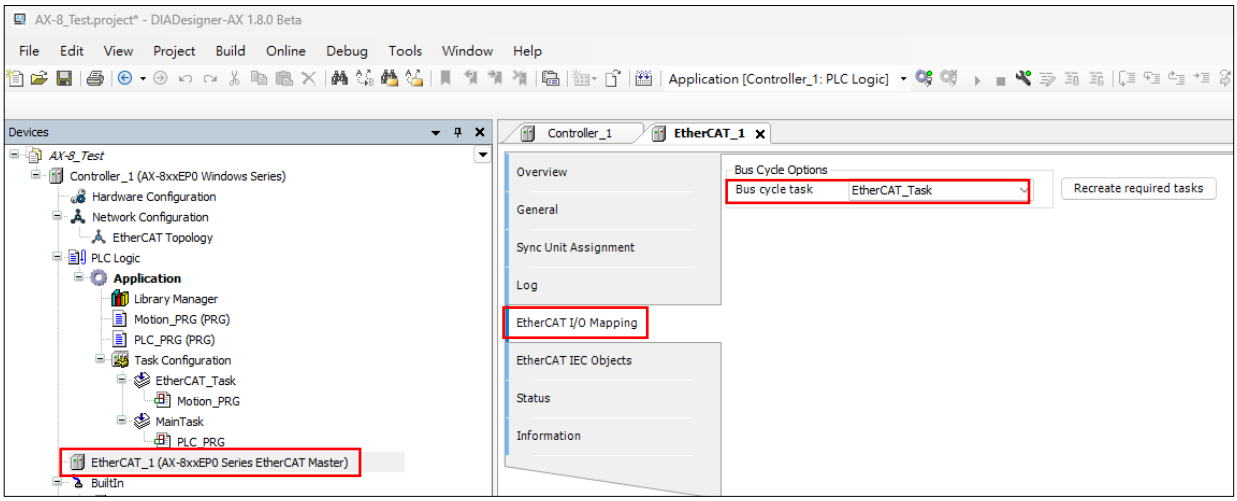


6. If the computer is correctly connected to the AX-8, the serial number of the connected AX-8 will be displayed. Select **the serial number** and click **OK**. Then, a device selection page appears.

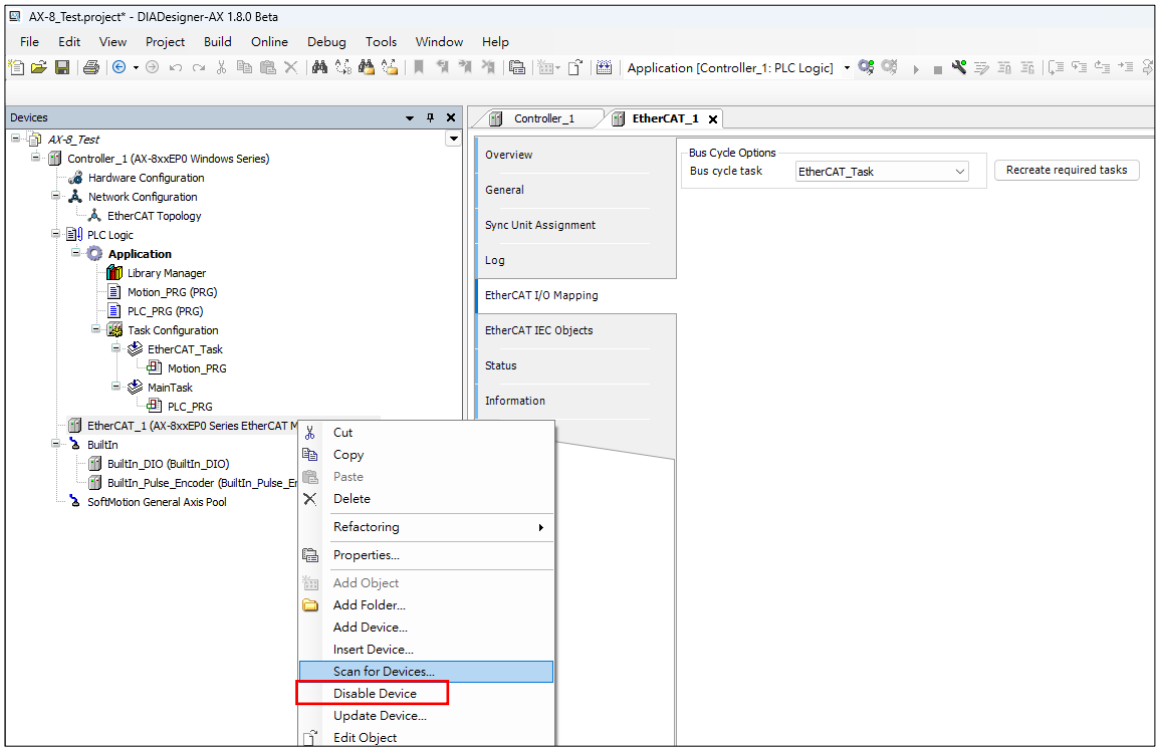




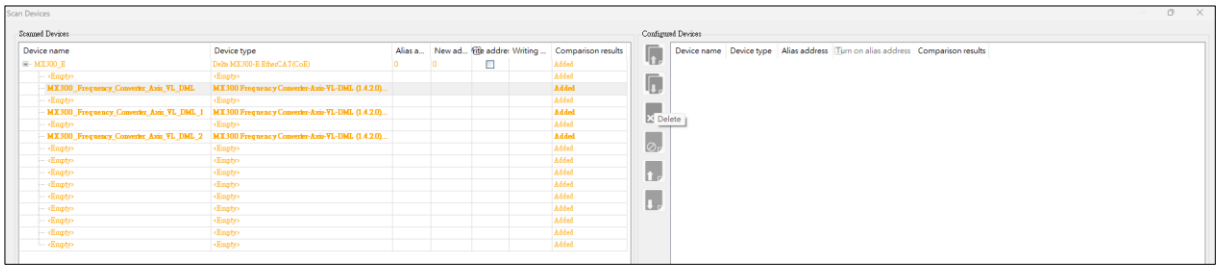
7. In the **Devices** window, click **EtherCAT_Master (AX-8xxEP0 Series EtherCAT Master)**, go to the **EtherCAT I/O Mapping** tab, and verify the **Bus Cycle Options** is set to **EtherCAT_Task**.



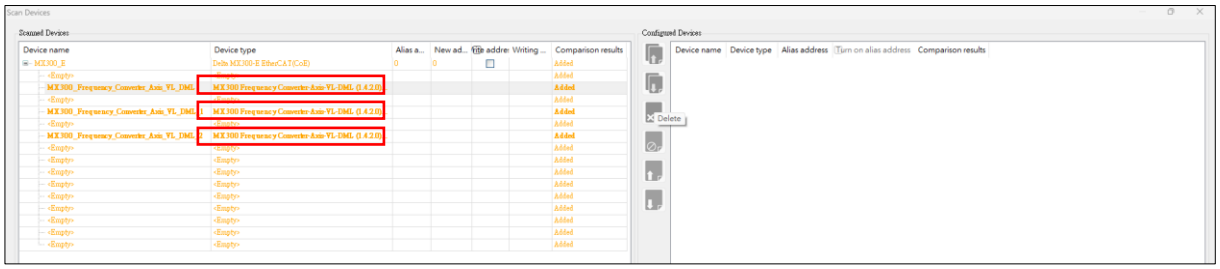
8. In the **Devices** window, right-click on the **EtherCAT_Master (AX-8xxEP0 Series EtherCAT Master)**, and then select **Scan For Devices**

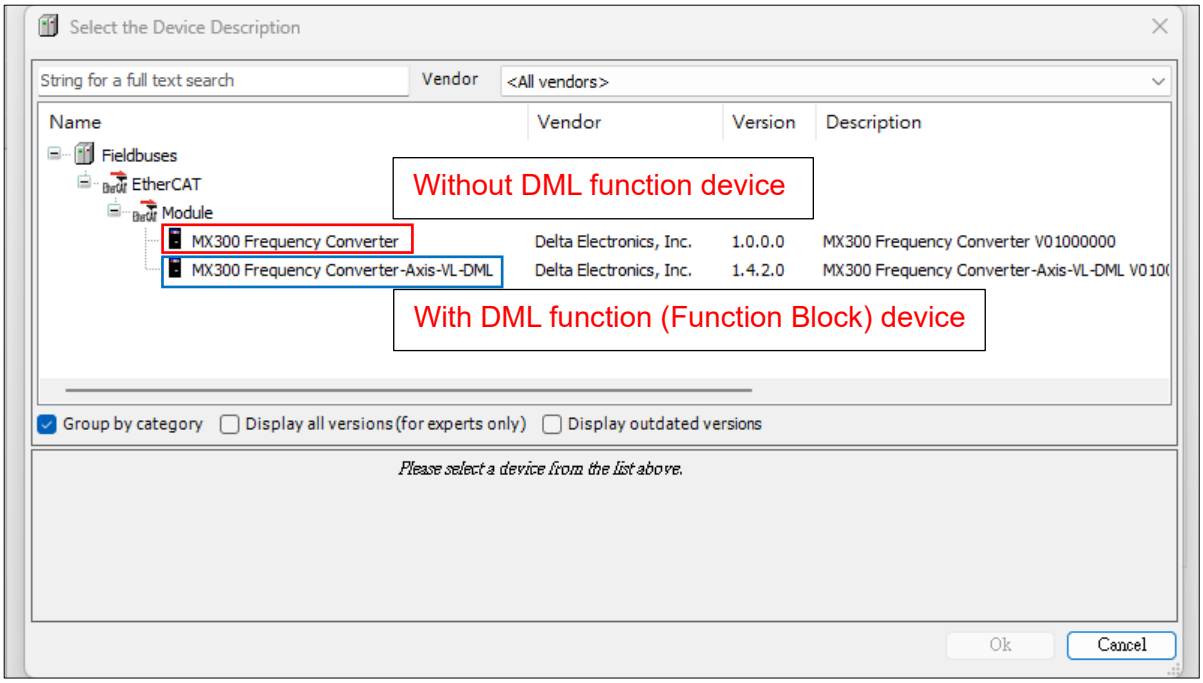


9. The MX300-E model description will appear in the pop-up window. The scanned online inverter axis is as shown below.

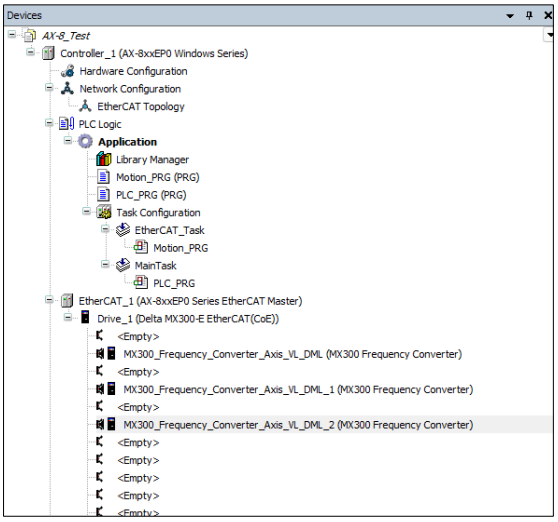


10. In the Scanned Inverter Axis window, double-click the inverter axis in the Device type field to select a device configuration with or without DML functionality (Function Block, requires PLC programming)

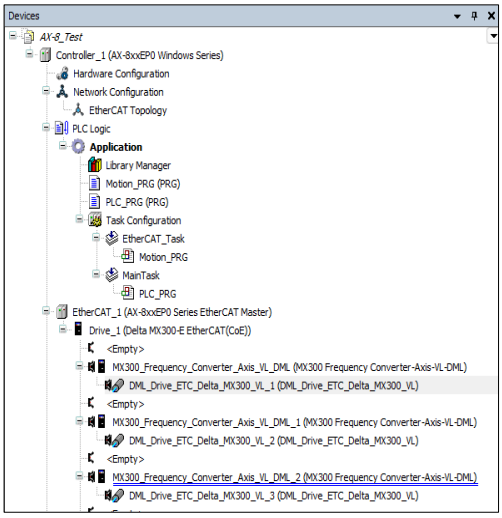




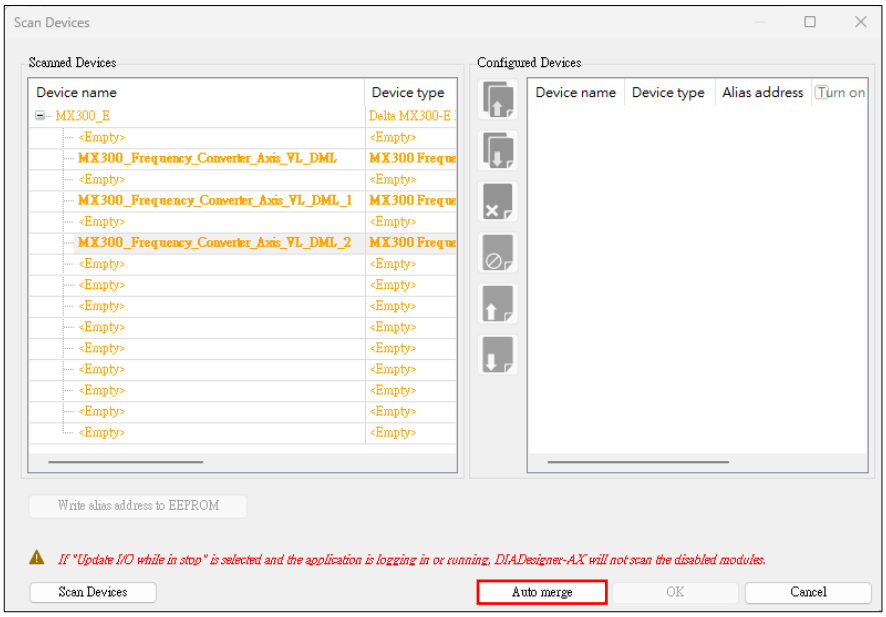
Without DML function device



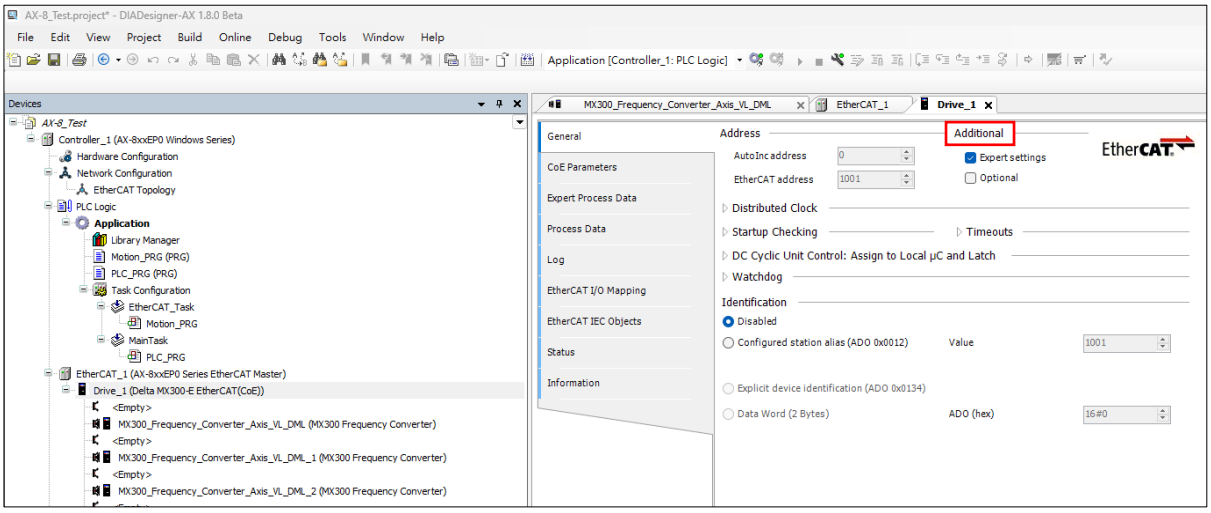
With DML function device



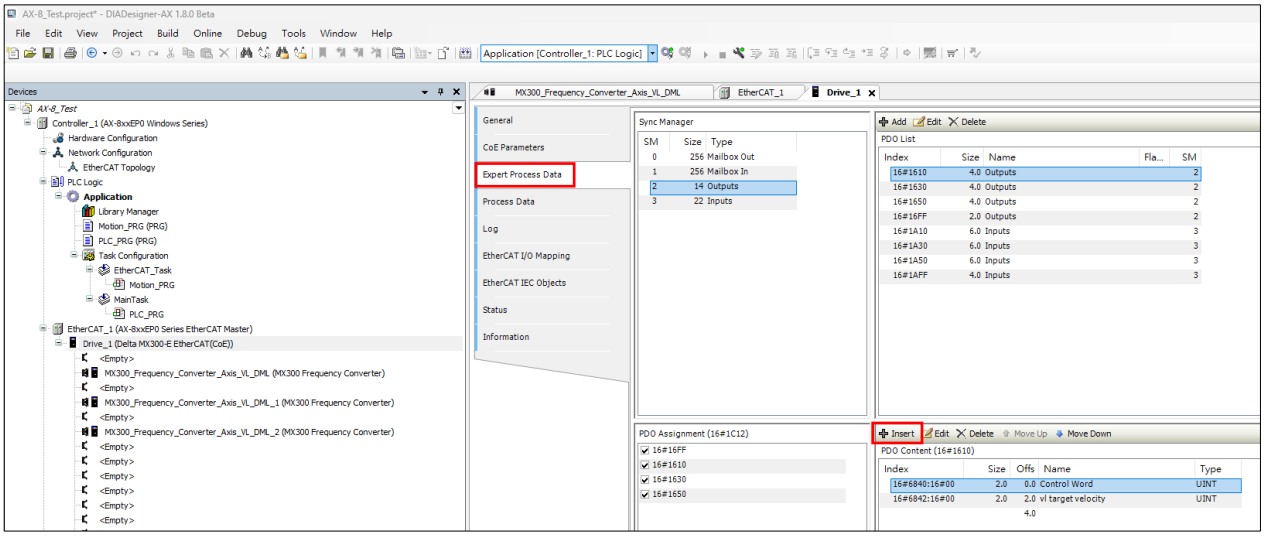
After selecting the above functions, press Auto merge ➔ click **OK**, the setting is completed.



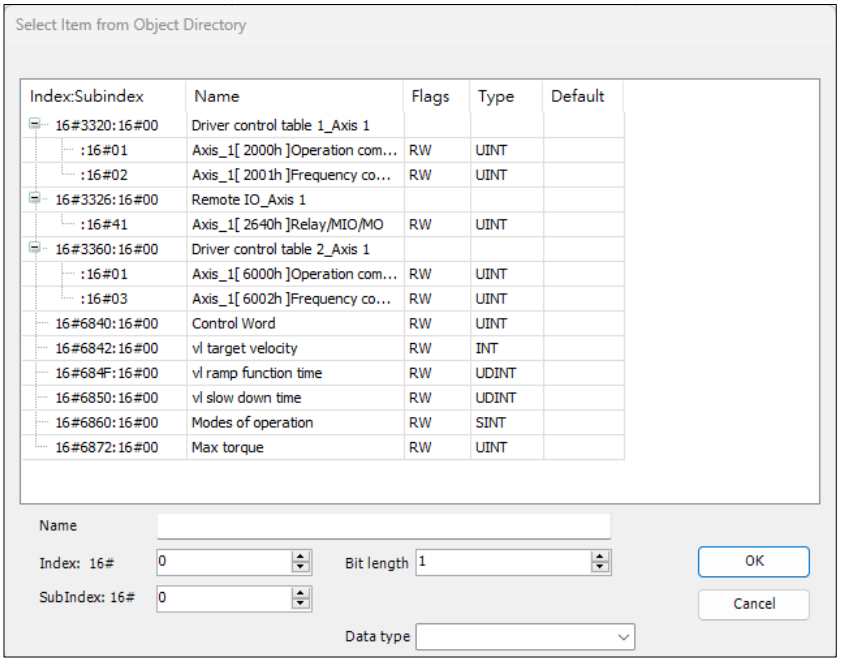
11. In the **Devices** window, double-click **Drive_1 (Delta MX300 EtherCAT(CoE))** to open the tab then check **Expert settings**.



12. Click **Expert Process Data** at the left side of the tab to configure PDO mapping. Then click **Insert** in the lower right-side window of the **Expert Process Data** screen. It's applicable to devices without the DML function.



13. The PDO object mapping window will pop up. Select the PDO object to be mapped.



14. When the steps above are completed, the axis group can be established, and PLC programming can be performed.

7-4-8 EtherCAT Object

7-4-8-1 Object Specifications

Object Type

Object Type	Description
Variable	A single value, such as a UNSIGNED8, Boolean, float, INTEGER16, etc.
Array	Objects with multiple data fields composed of multiple variables of the same data type, such as UNSIGNED16 arrays, etc. Sub-index 0 data type is UNSIGNED8, so it is not arraying data.
Record	An object with multiple data fields consisting of multiple variables of different data types. Sub-index 0 is UNSIGNED8, so it is not RECORD data.

Data Type

Data Type	Size	Range
BOOLEAN	1 bit	0–1
UNSIGNED8	1 byte	0–255
UNSIGNED16	2 bytes	0–65535
UNSIGNED32	4 bytes	0–4294967295
INTEGER8	1 byte	-128–127
INTEGER16	2 bytes	-32768–327671
INTEGER32	4 bytes	-2147483648–2147483647
VISIBLE STRING	-	-

7-4-8-2 Object Dictionary

- OD 1000h Communication Group

Index	Object Type	Name	Data Type	Attribute
1000h	Variable	Device type	UNSIGNED32	RO
1001h	Variable	Error register	UNSIGNED8	RO
1008h	Variable	Device name	STRING	RO
100Ah	Variable	Software version	STRING	RO
1018h	Record	Identity	IDENTITY	RO
0x16FF 1600h + 0x0010*n	Record	Receive PDO mapping	PDOMAPPING	RW
0x1AFF 1A00h + 0x0010*n	Record	Transmit PDO mapping	PDOMAPPING	RW
1C12h	Array	RxPDO assign	UNSIGNED16	RW
1C13h	Array	TxPDO assign	UNSIGNED16	RW

n = EtherCAT axis

- OD 3000h Drive Parameter

  The objects defined here are the related settings of the drive parameters. The setting methods of the related objects are as follows:

  The index value 300Xh corresponds to the Xth group of the drive parameters, and the sub-index values 1–64h (hexadecimal) correspond to the parameters 0–99 in the parameter group.

  Example:

  Set Pr.05-33 (select induction motor or permanent magnet synchronous motor), the index value is 3005h, and the sub-index value is 22h (34).

  Rectifier axis

Index	Name	Index	Name
4E00h	Permanent Group 00	4E07h	Permanent Group 07
4E02h	Permanent Group 02	4E09h	Permanent Group 09
4E05h	Permanent Group 05	4E0Eh	Permanent Group 14
4E06h	Permanent Group 06		

  Inverter axis

Index	Name	Index	Name
3000h+ 0x200*n	Permanent Group 00	3007h + 0x200*n	Permanent Group 07
3001h + 0x200*n	Permanent Group 01	3008h + 0x200*n	Permanent Group 08
3002h + 0x200*n	Permanent Group 02	3009h + 0x200*n	Permanent Group 09
3003h + 0x200*n	Permanent Group 03	300Ah + 0x200*n	Permanent Group 10
3004h + 0x200*n	Permanent Group 04	300Bh + 0x200*n	Permanent Group 11
3005h + 0x200*n	Permanent Group 05	300Dh + 0x200*n	Permanent Group 13
3006h + 0x200*n	Permanent Group 06	300Eh + 0x200*n	Permanent Group 14

  n = EtherCAT axis

- OD 3100h Delta definition

  The objects defined here are the control word and status of the drive. The index values of each axis are as follows:

  Rectifier axis

Index	Sub-index	Name	Data Type	Attribute	PDO Mapping
4F20h	03h	RCT [2002h]	U16	RW	Y
4F21h	01h	RCT [2100h] Fault status		RO	
	05h	RCT [2104h] Output current			
	06h	RCT [2105h] DC bus voltage			
	17h	RCT [2116h] Multi-function display			
	20h	RCT [211Fh] Output current digit			
4F22h	01h	RCT [2100h] Output current			
	0Fh	RCT [210Eh] Power Component Temperature			
	11h	RCT [2110h] Digital input status			
	12h	RCT [2111h] Digital output status			

Index	Sub-index	Name	Data Type	Attribute	PDO Mapping
4F22h	14h	RCT [2113h] The corresponding CPU digital input pin status	U16	RO	Y
	15h	RCT [2114h] The corresponding CPU digital output pin status			
	1Ch	RCT [211Bh] DC bus voltage ripples			
4F26h	01h	RCT [2100h] MI / MIO			
	41h	RCT [2140h] Relay / MIO / MO		RW	

Inverter axis

Index	Sub-index	Name	Data Type	Attribute	PDO Mapping
3120h + 0x200*n	01h	Axis_n [2000h] Operation command	U16	RW	Y
	02h	Axis_n [2001h] Frequency command			
	03h	Axis_n [2002h] Fault / control command source			
3121h + 0x200*n	01h	Axis_n [2100h] Fault status		RO	
	02h	Axis_n [2101h] Drive operation status			
	05h	Axis_n [2104h] Output current			
	06h	Axis_n [2105h] DC bus voltage			
	17h	Axis_n [2116h] Multi-function display			
	20h	Axis_n [2119h] Output current digit			
3122h + 0x200*n	01h	Axis_n [2100h] Output current			
	0Fh	Axis_n [210Eh] Power Component Temperature			
	11h	Axis_n [2110h] Digital input status			
	12h	Axis_n [2111h] Digital output status			
	14h	Axis_n [2113h] The corresponding CPU digital input pin status			
	15h	Axis_n [2114h] The corresponding CPU digital output pin status			
	1Ch	Axis_n [211Bh] DC bus voltage ripples			
3126h + 0x200*n	01h	Axis_n [2100h] MI/MIO			
	41h	Axis_n [2140h] Relay / MIO / MO		RW	
3160h + 0x200*n	01h	Axis_n [6000h] Operation command			
	03h	Axis_n [6002h] Speed command (unsigned decimal)			
3161h + 0x200*n	01h	Axis_n [6100h] Drive operation status		RO	

n = EtherCAT axis

- OD 6000h Communication Object Group

Index	Object Type	Name	Data Type	Attribute	PDO Mapping
6007h+ 0x800*n	Variable	Abort connection option code	INTEGER16	RW	N
603Fh+ 0x800*n		Error code	UNSIGNED16	RO	Y
6040h+ 0x800*n		Controlword		RW	
6041h+ 0x800*n		Statusword		RO	
6042h+ 0x800*n		vl target velocity	INTEGER16	RW	
6043h+ 0x800*n		vl velocity demand		RO	N
6044h+ 0x800*n		vl velocity actual value			Y
604Fh+ 0x800*n		vl ramp function time		RW	N
6050h+ 0x800*n		vl slow down time			
6051h+ 0x800*n		vl quick stop time			
605Ah+ 0x800*n		Quick stop option code			
605Ch+ 0x800*n		Disable operation option code			
6060h+ 0x800*n		Modes of operation	INTEGER8		Y
6061h+ 0x800*n		Modes of operation display		RO	
6078h+ 0x800*n		Current actual valus	INTEGER16		
6502h+ 0x800*n		Supported drive modes	INTEGER32		N

n = EtherCAT axis

7-4-8-3 Object Details

- OD 1000h Communication Group
  - Object 1000h: Device type

Index	1000h
Name	Device type
Object Type	Variable
Data Type	UNSIGNED32
Read / Write Permission	RO
PDO Mapping Setting	No
Setting Range	UNSIGNED32

  - Object 1001h: Error register

Index	1001h
Name	Error register
Object Type	Variable
Data Type	UNSIGNED8
Read / Write Permission	RO
PDO Mapping Setting	No
Setting Range	UNSIGNED8

- Object 1008h: Device name

Index	1008h
Name	Device name
Object Type	Variable
Data Type	STRING
Read / Write Permission	RO
PDO Mapping Setting	No

- Object 100Ah: Software version

Index	100Ah
Name	Software version
Object Type	Variable
Data Type	STRING
Read / Write Permission	RO
PDO Mapping Setting	No

- Object 1018h: Identity

Index	1018h
Name	Identity
Object Type	RECORD
Read / write Permission	RO
PDO Mapping Setting	No

Sub-Index	0
Name	Sub-Index 000
Data Type	UNSIGNED8
Read / Write Permission	RO
PDO Mapping Setting	No
Setting Range	UNSIGNED8

Sub-Index	1
Name	Vendor ID
Data Type	UNSIGNED32
Read / Write Permission	RO
PDO Mapping Setting	No
Setting Range	UNSIGNED32

Sub-Index	2
Name	Product code
Data Type	UNSIGNED32
Read / Write Permission	RO
PDO Mapping Setting	No
Setting Range	UNSIGNED32

Sub-Index	3
Name	Revision
Data Type	UNSIGNED32
Read / Write Permission	RO
PDO Mapping Setting	No
Setting Range	UNSIGNED32

Sub-Index	4
Name	Serial number
Data Type	UNSIGNED32
Read / Write Permission	RO
PDO Mapping Setting	No
Setting Range	UNSIGNED32

- Object 1600h–1603h: Receive PDO Mapping Parameter

Index	16FF 1600h + 0x0010*n / 1601h + 0x0010*n / 1602h + 0x0010*n / 1603h + 0x0010*n
Name	Receive PDO mapping
Object Type	RECORD
Data Type	PDO mapping
Read / Write Permission	RW
PDO Mapping Setting	No
Note	Total length of objects in a PDOs group cannot exceed 64-bit

n = EtherCAT axis

Sub-Index	0
Name	Number of Objects
Data Type	UNSIGNED8
Read / Write Permission	RW
PDO Mapping Setting	No
Setting Range	0: Disabled 1–8: Set the number of PDO mappings and enable the function
Default	0

Sub-Index	1–8
Name	Mapping entry (n)
Data Type	UNSIGNED32
Read / Write Permission	RW
PDO Mapping Setting	No
Setting Range	UNSIGNED32
Default	0

- Object 1A00h–1A03h: Transmit PDO Mapping Parameter

Index	1AFF 1A00h + 0x0010*n / 1A01h + 0x0010*n / 1A02h + 0x0010*n / 1A03h + 0x0010*n
Name	Transmit PDO Mapping Parameter
Object Type	RECORD
Data Type	PDO mapping
Read / Write Permission	RW
Note	The total length of objects in a group of PDOs cannot exceed 64-bit

n = EtherCAT axis

Sub-Index	0
Name	Number of Objects
Data Type	UNSIGNED8
Read / Write Permission	RW
PDO Mapping Setting	No
Setting Range	0: Disabled 1–8: Set the number of PDO mappings and enable the function
Default	0

Sub-Index	1–8
Name	Mapping entry (n)
Data Type	UNSIGNED32
Read / Write Permission	RW
PDO Mapping Setting	No
Setting Range	UNSIGNED32
Default	0

- Object 1C12h: RxPDO assign

Index	1C12h
Name	RxPDO assign
Object Type	ARRAY
Data Type	UNSIGNED16
Read / Write Permission	RW
PDO Mapping Setting	No

Sub-Index	0
Name	Number of assigned RxPDOs
Data Type	UNSIGNED8
Read / Write Permission	RW
PDO Mapping Setting	No
Setting Range	0–1
Default	1

Sub-Index	1
Name	Index of assigned RxPDO
Data Type	UNSIGNED16
Read / Write Permission	RW
PDO Mapping Setting	No
Setting Range	0x1600 / 0x1601 / 0x1602 / 0x1603
Default	0x1600

- Object 1C13h: TxPDO assign

Index	1C13h
Name	TxPDO assign
Object Type	ARRAY
Data Type	UNSIGNED16
Read / Write Permission	RW
PDO Mapping Setting	No

Sub-Index	0
Name	Number of assigned TxPDOs
Data Type	UNSIGNED8
Read / Write Permission	RW
PDO Mapping Setting	No
Setting Range	0–1
Default	1

Sub-Index	1
Name	Index of assigned TxPDO
Data Type	UNSIGNED16
Read / Write Permission	RW
PDO Mapping Setting	No
Setting Range	0x1A00 / 0x1A01 / 0x1A02 / 0x1A03
Default	0x1A00

- OD 3000h Drive Parameter Group

Index	30XXh
Name	Driver parameter
Object Type	Variable
Data Type	UNSIGNED16
Read / Write Permission	RW
PDO Mapping Setting	No
Setting Range	UNSIGNED16
Default	N/A

Access / change drive parameters using this object group, and drive parameters can only be changed through SDO.

The setting method is described as follows:
The index value 300Xh corresponds to the Xth group of the drive parameters, and the sub-index values 1–64h (hexadecimal) correspond to the parameters 0–99 in the parameter group. For example, set Pr.05-33 (select induction motor or permanent magnet synchronous motor), the index value is 3005h, and the sub-index value is 22h (34).

- OD 6000h Communication Object Group
  - Object 6007h: Abort connection option code

Index	6007h + 0x800*n (n = EtherCAT axis)
Name	Abort connection option code
Object Type	Variable
Data Type	INTEGER16
Read/Write Permission	RW
PDO Mapping Setting	No
Setting Range	0: No action 2: Switch on Disable 3: Quick Stop
Default	2

    ☑ Object 6007h = 0: Disconnection error will be ignored, and no warning is displayed, or no action is taken.
    ☑ Object 6007h = 2: When disconnection occurs, CANopen state will be switched to Switch on Disabled, warning code Edtn is displayed, and the drive stops according to the settings of object 605Ah. Once the connection cable is back to normal, the warning code will be automatically cleared.
    ☑ Object 6007h = 3: When disconnection occurs, CANopen state will be switched to Quick Stop, warning code Edtn is displayed, and the drive stops according to the settings of object 605Ch. Once the connection cable is back to normal and communication is successfully connected, the warning code will be automatically cleared.

  - Object 603Fh: Error code

Index	603Fh + 0x800*n (n = EtherCAT axis)
Name	Error code
Object Type	Variable
Data Type	UNSIGNED16
Read / Write Permission	RO
PDO Mapping Setting	Yes
Setting Range	UNSIGNED32
Default	0

  - Object 6040h: Controlword

Index	6040h + 0x800*n (n = EtherCAT axis)
Name	Controlword
Object Type	Variable
Data Type	UNSIGNED16

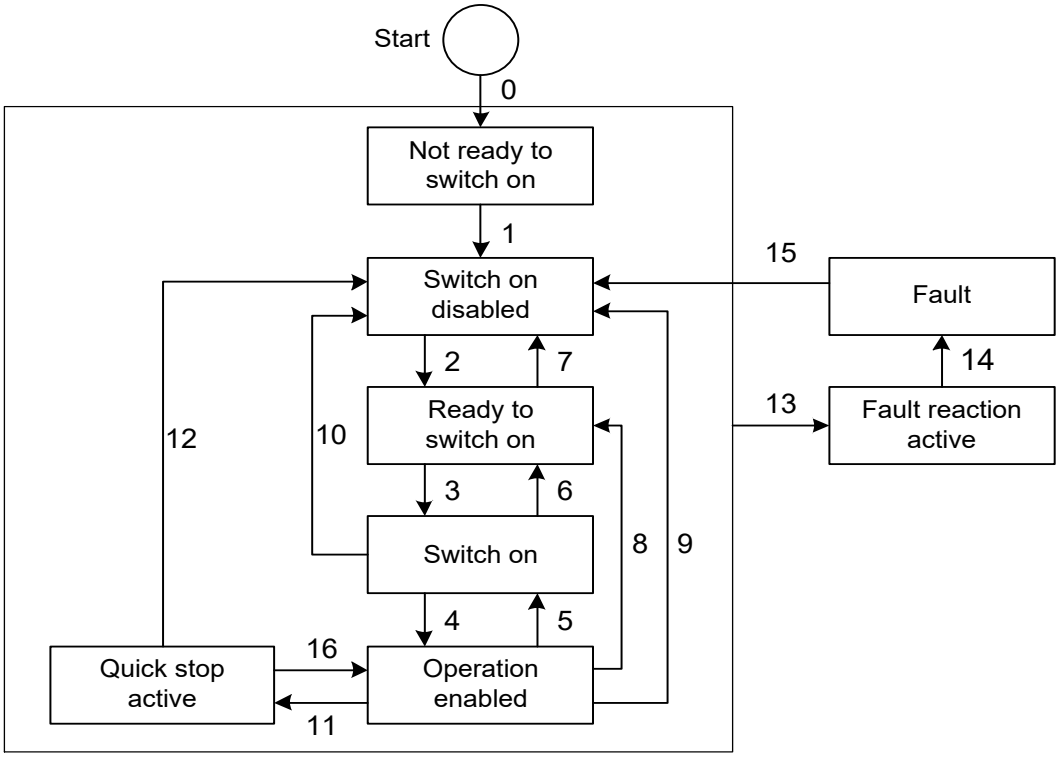
Read / Write Permission	RW
PDO Mapping Setting	Yes
Setting Range	UNSIGNED16
Default	0

- Bit Description

bit	Function	Description
bit 0	Switch on	-
bit 1	Enable voltage	-
bit 2	Quick stop	-
bit 3	Enable operation	-
bit 4–6	Operation mode specific	See the table of Definition of Each Mode below.
bit 7	Fault reset	-
bit 8	Halt	-
bit 9–15	Reserved	-

- Definition of Each Mode

bit	Definition of Each Mode						
	VL	PP	Homing	IP	PT	CSP	CST
bit 4	Enable ramp	-	-	-	-	-	-
bit 5	Unlock ramp	-	-	-	-	-	-
bit 6	Reference ramp	-	-	-	-	-	-
bit 8	Halt	-	-	-	-	-	-



- The state switch is defined in the table below:

State Switch	Event	Action
0, 1	Executes automatically after power-on	Device start-up and initialization
2	Shutdown command	None
3	Switch on command	Drive is ready to serve on
4	Enable operation command	Drive is servo on and executes motion mode
5	Disable operation command	Drive is servo off
6	Shutdown command	None
7	Disable voltage or Quick stop command	None
8	Shutdown command	Drive is servo off
9	Disable voltage command	Drive is servo off
10	Disable voltage or Quick stop command	None
11	Quick stop command	Quick Stop function is enabled
12	Disable voltage command	Drive is servo off
13, 14	Warning / Fault is triggered	Drive is servo off
15	Warning / Fault is cleared	None
16	Enable operation; no alarm command	Motion control behavior is restarted

- The state can be switched using the control command Controlword (6040h). The commands are described as follows:

Command	bit of Controlword (6040h)					State Switch
	bit 7	bit 3	bit 2	bit 1	bit 0	
Shutdown	0	X	1	1	0	2, 6, 8
Switch on	0	0	1	1	1	3
Switch on + Enable operation	0	1	1	1	1	3 + 4
Disable voltage	0	X	X	0	X	7, 9, 10, 12
Quick stop	0	X	0	1	X	7, 10, 11
Disable operation	0	0	1	1	1	5
Enable operation	0	1	1	1	1	4, 16
Fault reset	↑	X	X	X	X	15

NOTE: 0 means the bit is OFF; 1 means the bit is ON; X means the bit is not affected; ↑ is a rising-edge triggered.

- Object 6041h: Statusword

Index	6041h + 0x800*n (n = EtherCAT axis)
Name	Statusword
Object Type	Variable
Data Type	UNSIGNED16
Read / Write Permission	RO
PDO Mapping Setting	Yes
Setting Range	UNSIGNED16
Default	0

- Bit Description

bit	Function	Description
bit 0	Ready to switch on	bit 0 to bit 6: Indicates the present status of the drive, see the table below for details.
bit 1	Switched on	
bit 2	Operation enabled	
bit 3	Fault	
bit 4	Voltage enabled	
bit 5	Quick stop	
bit 6	Switch on disabled	
bit 7	Warning	Warning state, the drive maintains servo on
bit 8	Reserved	-
bit 9	Remote	-
bit 10	Target reached	Target reached
bit 11	Reserved	-
bit 12–13	Operation mode specific	See the table of Definition of Each Mode below.
bit 14	Reserved	-
bit 15	Reserved	-

bit 6	bit 5	bit 4	bit 3	bit 2	bit 1	bit 0	Description
0	-	-	0	0	0	0	Not ready to switch on
1	-	-	0	0	0	0	Switch on disabled
0	1	-	0	0	0	1	Ready to switch on
0	1	-	0	0	1	1	Switch on
0	1	-	0	1	1	1	Operation enabled
0	0	-	0	1	1	1	Quick stop active
0	-	-	1	1	1	1	Fault reaction active
0	-	-	1	0	0	0	Fault

NOTE: 0 means the bit is OFF; 1 means the bit is ON; - means the bit is None

- Object 6042h: vl target velocity

Index	6042h + 0x800*n (n = EtherCAT axis)
Name	vl target velocity
Object Type	Variable
Data Type	INTEGER16
Read / Write Permission	RW
PDO Mapping Setting	Yes
Setting Range	INTEGER16
Default	0
Unit	RPM

This object is the speed command value in Velocity Mode.

- Object 6043h: vl velocity demand

Index	6043h + 0x800*n (n = EtherCAT axis)
Name	vl velocity demand
Object Type	Variable
Data Type	INTEGER16
Read / Write Permission	RO
PDO Mapping Setting	No
Setting Range	INTEGER16
Unit	RPM

This object is the speed command calculated by the drive in Velocity Mode.

- Object 6044h: vl velocity actual value

Index	6044h + 0x800*n (n = EtherCAT axis)
Name	vl velocity actual value
Object Type	Variable
Data Type	INTEGER16
Read / Write Permission	RO
PDO Mapping Setting	Yes
Setting Range	INTEGER16
Unit	RPM

This object is the actual running speed value in Velocity Mode.

- Object 604Fh: vl ramp function time

Index	604Fh + 0x800*n (n = EtherCAT axis)
Name	vl ramp function time
Object Type	Variable
Data Type	UNSIGNED32
Read / Write Permission	RW
PDO Mapping Setting	No
Setting Range	UNSIGNED32
Unit	10000
Index	ms

This object is the time it takes to accelerate from 0 RPM to 6042h in Velocity Mode.

- Object 6050h: vl slow down time

Index	6050h + 0x800*n (n = EtherCAT axis)
Name	vl slow down time
Object Type	Variable
Data Type	UNSIGNED32
Read / Write Permission	RW
PDO Mapping Setting	No
Setting Range	UNSIGNED32

Unit	10000
Index	ms

This object is the time it takes to decelerate from 6042h to 0 RPM in Velocity Mode.

- Object 6051h: vl quick stop time

Index	6051h + 0x800*n (n = EtherCAT axis)
Name	vl quick stop time
Object Type	Variable
Data Type	UNSIGNED32
Read / Write Permission	RW
PDO Mapping Setting	No
Setting Range	Refer to drive Pr.01-45 Pr.01-45=0, Setting Range: 10–600000 Pr.01-45=1, Setting Range: 100–6000000
Default	1000
Unit	ms

This object is the time it takes to decelerate from 6042h to 0 RPM in Quick Stop Active state under Velocity Mode.

- Object 605Ah: Quick stop option code

Index	605Ah + 0x800*n (n = EtherCAT axis)
Name	Quick stop option code
Object Type	Variable
Data Type	INTEGER16
Read / Write Permission	RW
PDO Mapping Setting	No
Setting Range	0: Disable drive function 1: Decelerate to stop using slow down ramp and switch to Switch on Disabled (cannot return to OP) 2: Decelerate to stop using quick stop ramp and switch to Switch on Disabled (cannot return to OP) 5: Decelerate to stop using slow down ramp and maintain in Quick Stop state (returns to OP) 6: Decelerate to stop using quick stop ramp and maintain in Quick Stop state (returns to OP)
Default	2

This object is the action options of 6040h (Controlword) when the Quick Stop bit is triggered.

- Object 605Ch: Disable operation option code

Index	605Ch + 0x800*n (n = EtherCAT axis)
Name	Disable operation option code
Object Type	Variable
Data Type	INTEGER16

Read / Write Permission	RW
PDO Mapping Setting	No
Setting Range	0: Disable drive function 1: Stop using brake deceleration; disable drive function
Default	1

This object is the action options of the drive when the state is switched from Operation Enable to Switched On.

- Object 6060h: Modes of operation

Index	6060h + 0x800*n (n = EtherCAT axis)
Name	Modes of operation
Object Type	Variable
Data Type	INTEGER8
Read / Write Permission	RW
PDO Mapping Setting	Yes
Setting Range	UNSIGNED32
Default	8

This object sets the operation mode. The operation mode is described as follows:

Setting Value	Operation
0, 1, 3–10	Reserved
2	Velocity Mode

- Object 6061h: Modes of operation display

Index	6061h + 0x800*n (n = EtherCAT axis)
Name	Modes of operation display
Object Type	Variable
Data Type	INTEGER8
Read / Write Permission	RO
PDO Mapping Setting	Yes
Setting Range	INTEGER8
Default	0

This object displays the present operation mode.

- Object 6078h: Current actual value

Index	6078h + 0x800*n (n = EtherCAT axis)
Name	Current actual value
Object Type	Variable
Data Type	INTEGER16
Read / Write Permission	RO
PDO Mapping Setting	No
Setting Range	INTEGER16

This object is defined as a percentage of the motor's rated current, presented in per mille (‰). The motor's rated current is set according to parameters 05-01 and 05-13.

- Object 6502h: Supported drive modes

Index	6502h + 0x800*n (n = EtherCAT axis)
Name	Supported drive modes
Object Type	Variable
Data Type	UNSIGNED32
Read / Write Permission	RO
PDO Mapping Setting	No
Setting Range	UNSIGNED32

7-5 PROFINET Overview (MX300-E models only)

7-5-1 PROFINET Introduction

PROFINET (Process Field Net) is an industrial standard based on international Ethernet standards. It's widely used in industrial automation systems, enabling real-time communication between controllers, devices, and machines in factory environments.

Since PROFINET supports the TCP/IP protocol, it offers excellent scalability that can be used in simple small-scale networks as well as extended to large and complex industrial networks. Also, PROFINET is based on the Ethernet standards, any network topology supports Ethernet communication can easily integrate PROFINET devices.

In addition, PROFINET has its own Ethernet type definition which can support high-speed communication under specific configurations as well as the infrequent data exchange communication.

7-5-1-1 Three Types of PROFINET Node

- Device: An independent unit that does not automatically attempt to communicate with other devices. It can send and receive real-time information to controllers and can send alarms to supervisors and controllers.
- Controller: A role for summarizing and setting information of multiple devices, handles real-time data and collects maintenance status from devices, which usually is PLC or HMI.
- Supervisor: It cannot access real-time data from any device and is not part of the daily network operation. The main purpose is to read diagnostic information from the devices, assign IP addresses and DCP station names, and troubleshoot network issues.

7-5-1-2 PROFINET Supports Three Communication Levels:

- Non-Real Time (NRT): Used for non-real-time ordinary data transmission and compatible with TCP/IP functionality. Mainly handles diagnostic information, alarm messages, and Delta-defined read / write messages through read / write record packets.
- Real Time (RT): Used for standard real-time tasks, such as cyclic data exchange.
- Isochronous Real Time (IRT): Used for high-performance synchronous communication, such as motion control.

NOTE: MX300-E only supports non-real-time and real-time communication, for acyclic and cyclic data transmission.

7-5-1-3 PROFINET Electronic Parameter File (GSDML):

The General Station Description in XML Language (GSDML) for PROFINET is typically provided by device manufacturers, which contains necessary information about the device. After importing the GSDML file into the engineering software and users can get necessary information and start to set the device. When corresponding settings are completed, the controller can then control the device and collect data.

In PROFINET engineering software, there are some concepts are used:

- Module: Main functional units provided by a device. In MX300 case, two types of modules are included: rectifier module and inverter module.

- Slot: The space in software where module can be placed. In MX300 case, slot 16 is reserved for the rectifier module, while slots 1–15 are for inverter modules. The slot number must be the same with the number allocated in the inverter module's parameter Pr.09-57(named Ethernet slot number).
- Submodule: Communication functions provided by a module. MX300's module contains two types of submodules: for diagnostic messages and for regular data exchange.
- Subslot: The space in software where submodule can be placed. A slot usually contains several subslots. In MX300 case, subslot 1 is fixed for the submodule which provide module information, and subslot 2 is fixed for the submodule which used to input data to controller, and subslot 3 is fixed for the submodule which for accepting output data from controller.

A device in PROFINET topology should send an alarm message to controller when an error happens. Upon receiving the message, the controller or monitoring system's diagnosis system will display the corresponding information.

7-5-1-4 Relationship between PROFINET and MX300

PROFINET is one of the communication methods used by the MX300 system to connect with the controller / supervisor. Through the communication protocol defined by PROFINET, controller can exchange data with MX300 and command the rectifier module and inverter module of MX300. Meanwhile, the MX300 system also responds accordingly within the PROFINET environment, such as handling connection or disconnection events, and triggering LED indicators.

The overall structure can be roughly divided into three parts: the external environment, the PROFINET protocol definition, and the interaction between the MX300 system and the PROFINET system.

The following sections will introduce the functionalities of PROFINET and simultaneously explain how each function relates to the MX300 system.

7-5-2 PROFINET Hardware and Wiring

7-5-2-1 Network Interface and Environmental Conditions

Item	Specification
Interface	RJ45
Number of Ports	2 Ports
Communication Mode	IEEE802.3, IEEE802.3u, IEEE802.1q
Cable	Category 5e shielding 100 M
Transmission Speed	10 / 100 Mbps Auto-Defect
Noise Immunity	ESD (EN 61800-5-1, IEC 6100-4-2) EFT (EN 61800-5-1, IEC 6100-4-4) Surge Test (EN 61800-5-1, IEC 6100-4-5) Conducted Susceptibility Test (EN 61800-5-1, IEC 6100-4-6)

7-5-2-2 LED Indicators

No.	Name	Indicator Status	Indication
1	BF	Red LED Always on	Disconnected with PROFINET Controller
		Red LED Flashing	Normal connection，but disconnected with PROFINET Controller
		Off	Normal connection with PROFINET Controller
2	RDY / SF	Red LED Always on	PROFINET function error
		Orange LED Always on	PROFINET diagnosis system warning triggered
		Green LED Always on	PROFINET function ready
		Green LED Flashing	PROFINET initialing
		Off	PROFINET function not activated
3	L/A 1	Green LED Always on	L/A1 has network signal.
		Green LED Flashing	L/A1 is data exchanging normally.
		Off	L/A1 doesn't have network signal.
4	L/A 2	Green LED Always on	L/A2 has network signal.
		Green LED Flashing	L/A2 is data exchanging normally.
		Off	L/A2 doesn't have network signal.

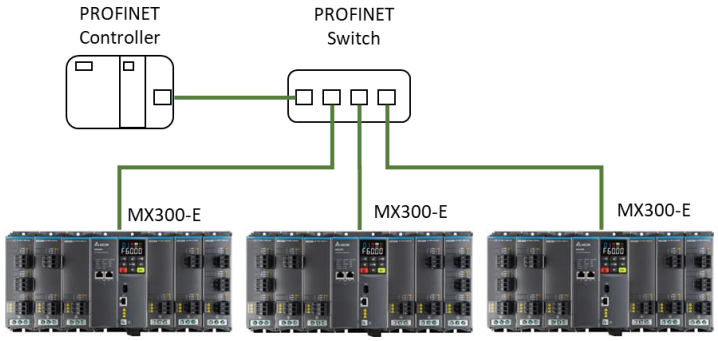
7-5-2-3 Wiring Methods

Users can choose to connect in series or through a switch depending on the system requirements.

1. Series connection



2. Connect via Switch



7-5-3 PROFINET Communication

7-5-3-1 Parameter Settings

Before using PROFINET, please configure the following parameters on the drive:

Item	Module	Parameter Settings
Enable PN and Basic Settings	Rectifier	1. Set Pr.09-55 = 2 (PROFINET Enabled) 2. Set Pr.09-05 = 3 (Auto-assign Ethernet Slot (Pr.09-57))
	Inverter	Confirm Ethernet Slot (Pr.09-57) matches the Slot number configured in the PROFINET engineering software.
Speed Control	Rectifier	Not applicable
	Inverter	1. Set Master Frequency Command Source (Pr.00-20) = 6 2. Set Operation Command Source (Pr.00-21) = 3 3. Set Delta-defined Communication Decoding Method (Pr.09-30) = 0 (20xxh) / 1 (60xxh)
Error Reset	Rectifier	1. Set Operation Command Source (Pr.00-21) = 3 2. Set Delta-defined Communication Decoding Method (Pr.09-30) = 0 (20xxh) / 1 (60xxh)
	Inverter	Same as the speed control method settings
Disconnection Behavior	Rectifier	Not applicable
	Inverter	1. Disconnection between rectifier module and inverter module Set Stop Method (Pr.00-22) 0: Ramp to stop 1: Coast to stop 2. Disconnection between rectifier module and controller (PLC) Set Ethernet Communication Disconnection Treatment (Pr.09-98) 0: Warn and continue operation 1: Fault and ramp to stop 2: Fault and coast to stop 3: No warning and continue operation
Others	Rectifier	Check MAC ID by Pr.09-95–09-97
	Inverter	Not applicable

NOTE:

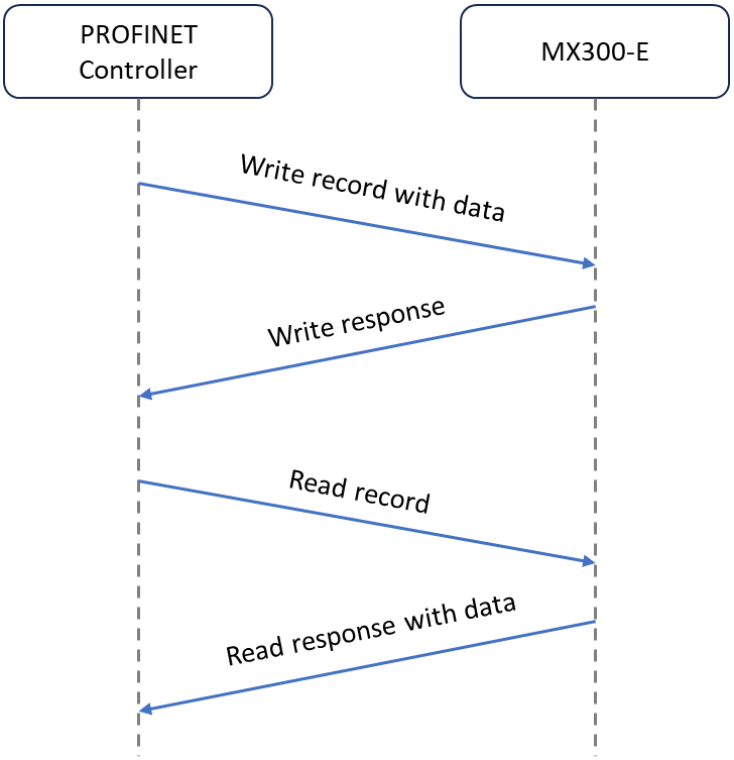
1. Enable PN and Basic Settings: Take effect after cycle the power.
2. Error Reset
   - If Pr.00-22 = 1, disconnection always leads to coast to stop.
   - If Pr.00-22 = 0, rectifier-inverter disconnection leads to ramp to stop, rectifier-controller disconnection behavior depends on Pr.09-98.

7-5-3-2 PROFINET Device setting

The PROFINET controller identifies devices using the DCP station names. Each device must be assigned a unique DCP station name and other basic settings for the controller to recognized and controlled properly. Although the MX300 supports multi-axis inverter modules, all PROFINET configuration and access are managed centrally through the rectifier module.

7-5-3-3 Acyclic (Non-Real-Time, NRT) Data Configuration

NRT communication involves record data exchange and alarm report. A complete record data exchange process contains 4 steps as the follow picture. First, the controller sends a write record, and device response to the write record. And then the controller sends a read record and the device response to the read record.



MX300 has two types of modules: rectifier module and inverter module, each module can perform its own functions and be accessed by a record index, for example, record index 102 is used for reading or writing a parameter.

The MX300 multiple axis structure represent there are several axes in a set. An inverter axis has an Ethernet slot (set by Pr.09-57) which must match with the slot in the engineering software.

For example:

- Slot 2 corresponds to an inverter module with Pr.09-57 = 2
- Slot 16 corresponds to the rectifier module

It should be noted that each record can only read from or write to a slot at a time.

MX300 uses the Modbus over PROFINET method for parameter configuration and supports the following data read / write operations:

– Supports writing writable parameters and Modbus addresses to the rectifier module (Slot 16)
– Supports writing writable parameters and Modbus addresses to inverters module (Slots 1–15)
– Supports reading readable parameters and Modbus addresses from the rectifier module (Slot 16)
– Supports reading readable parameters and Modbus addresses from inverters module (Slots 1–15)

PROFINET uses Record Index to differentiate between various functions. In the MX300, Record Index 102 is used for parameter data read / write, while Record Index 103 is used for system operation demands.

7-5-3-4 Record index 102: Parameter Read / Write

The following table illustrates the method and examples of parameter read / write:

Example 1: The controller writes Pr.04-10 = 258 (102h) and Pr.04-11 = 10 (0Ah)

Record Index 102					
Controller Write		Device Response			
Write Record		Read Record Response (Success)		Read Record Response (Fail)	
(Reserve)	FF	(Reserve)	FF	(Reserve)	FF
Function Code	10	Function Code	10	Function Code	90
Parameter Address	04 (High)	Parameter Address	04 (High)	Exception Code	1: Function code not supported 2: Write quantity exceeds limit 3: Address error 4: Function failure
	0A (Low)		0A (Low)	(Reserve)	--
Write Count	00	Write Count	00		(Remaining data ignored)
	02 (0<and≤10h)		02 (0<and≤10h)		
Byte Count	04 (x2 of above)	Byte Count	04 (x2 of above)		
Write Value 1	01 (High)				
	02 (Low)				
Write Value 2	00				
	0A				
…	(Values exceeding limits will be ignored.)				

Example 2: The controller reads Pr.04-10 and Pr.04-11 and receives the values (102h) and 10 (0Ah).

Record Index 102					
Controller Read		Device Response			
Write Record		Read Record Response (Success)		Read Record Response (Fail)	
(Reserve)	FF	(Reserve)	FF	(Reserve)	FF
Function Code	03	Function Code	03	Function Code	83
Parameter Address	04 (High)	Parameter Address	04	Exception Code	1: Function code not supported 2: Write quantity exceeds limit 3: Address error 4: Function failure
	0A (Low)	Read Value 1	01 (High)	(Reserve)	--
Write Count	00		02 (Low)		(Remaining data ignored)
	02 (0<and≤10h)	Read Value 2	00		
	(Remaining data ignored)		0A		
			(Remaining data ignored)		

7-5-3-5 Record index 103: System command

This section handles system-level functions used in the MX300 PROFINET system.

Record index 103 commands use a structured data format, organized into three layers as shown below:

Record 103 Data				
Command Header	Block 1 Header	Block 1 Data	Block 2 Header	Block 2 Data

The complete list of commands available for Record 103 and the corresponding structure definitions are shown in the table below:

Type	Structure Index Definition	Structure Index H	Structure Index L	Slot	Structural Length	Use Cases
Command Setting	Reconnect command	0	0x01	16	MOSI: 8 MISO: 8	The rectifier and inverter occur disconnection problem such as Ectn and CP21.
	(Reserve)		…			
Information Reading	Response status of each parameter of Record 102	0	0x41	1-16	MOSI: 6 MISO: 8 or 24	To obtain detailed information about the situation when parameter read / write fails.
	(Reserve)		…			

The structure of Command Header, Block Header, and Block Data are as following table.

Command Header		
Byte	Definition	Example (Hex)
1	(Reserve)	FF
2	(Reserve)	00
3	(Reserve)	00
4	Number of structures	01 (only support 1)
Block Header and Block Data		
Byte	Definition	Example (Hex)
5	Structure Index H	00
6	Structure Index L	01
7	(Reserve)	00
8	Structure configuration: bit7: Format Error; bit0: 0 (MOSI), 1 (MISO)	00
9	(Reserve)	00
10	Structure Length (Byte) (refer to the definition of each structure)	02
11	Block Data 1	00
12	Block Data 2	01

The following table shows the success and fails response of device.

- Error description of Command header

Byte	Controller Command		Device response			
	Write Record Request		Read Record Response (Success)		Read Record Response (Fail)	
1	(Reserve)	FF	(Reserve)	FF	(Reserve)	FF
2	(Reserve)	00	Status	00: Success	Status	80: Fail
3	(Reserve)	00	(Reserve)	00	(Reserve)	00
4	Number of structures	01 (only support 1)	Number of structures	01	Error Description	• 0x01: Packet length error • 0x02: Structure number error • 0x03: Structure index error • 0x04: Command slot error
5	Structure Index H	00	Structure Index H	00	(Remaining data ignored)	--
6	Structure Index L	01	Structure Index L	01		
7	Base on each structure	…	Base on each structure	…		
	(Remaining data ignored)	--	(Remaining data ignored)	--		

- Structure 0x01: Reconnect command

Byte	Structure 0x01 Definition	Write Example	Read Example	Error Example
1	Index H	00	00	00
2	Index L	01	01	01
3	(Reserve)	00	00	00
4	Structural Configuration	00 (MOSI)	01 (MISO)	81 (MISO Error)
5	(Reserve)	00	00	00
6	Data Length (Byte)	02	02	02
7	Data H	01: Reconnect rectifier and inverter 02: Read reconnection status Other: Invalid	Reconnection status: 00: Reconnecting in progress 01: Reconnection completed	01: Structural configuration error 02: Data length error 03: Functional error
8	Data L			

NOTE:

1. When the device does not respond, the record sent by the controller will fail to respond at the PROFINET communication level. In this case, the aforementioned data functions and data return will not be available.
2. After the controller issues a write record (A), if the next write record (B) is issued without using a read record (A), the device will directly discard the response data of (A) and begin processing the data of (B).

- Response to read / write info – Structure Index 0x41

Byte	Structure 0x41 Definition	Write Example	Correct format read and return		Formatting error read and return	
1	Index H	00	Index H	00	Index H	00
2	Index L	41	Index L	41	Index L	41
3	(Reserve)	00	(Reserve)	00	(Reserve)	00
4	Structural Configuration	00	Structural Configuration	01	Structural Configuration	81
5	(Reserve)	00	(Reserve)	00	(Reserve)	00
6	Data Length (Byte)	00	Data Length (Byte)	12	Data Length (Byte)	02
7			(Reserve)	00	Data H	01: Structural configuration error 02: Data length error 03: Functional error
8			Check Code	07	Data L	
9			Parameter 01 Read / write status	00: Unread / Written 01: Read / Written Successful Other: Read / Written Failed		
10			Parameter 02 Read / write status			
…			...			
24			Parameter 16 Read / write status			

Example 1: Reconnect Command – The controller commands the MX300 rectifier and inverter to reconnect to resolve communication anomalies.

Record Index 103			
Controller Command		Device response	
Write Record		Read Record Response (Success)	
(Reserve)	FF	(Reserve)	FF
(Reserve)	00	(Reserve)	00
(Reserve)	00	(Reserve)	00
Number of structures	01 (only support 1)	Number of structures	01
Index H	00	Index H	00
Index L	01	Index L	01
(Reserve)	00	(Reserve)	00

Record Index 103			
Controller Command		Device response	
Write Record		Read Record Response (Success)	
Structure configuration	00 (MOSI)	Structure configuration	01 (MISO)
(Reserve)	00	(Reserve)	00
Structure Length (Byte)	02	Structure Length (Byte)	02
Data H	00	Data H	00
Data L	01: Rectifier and inverter reconnect 02: Read reconnection status	Data L	00: Connecting 01: Connection completed

Example 2: If the Read Record 102 read fails, more parameter details can be found through the 0x41 structure.

Record Index 103			
Controller Command		Device response	
Write Record		Read Record Response (Success)	
(Reserve)	FF	(Reserve)	FF
(Reserve)	00	(Reserve)	00
(Reserve)	00	(Reserve)	00
Number of structures	01 (only support 1)	Number of structures	01
Index H	00	Index H	00
Index L	41	Index L	41
(Reserve)	00	(Reserve)	00
Structure configuration	00 (MOSI)	Structure configuration	01 (MISO)
(Reserve)	00	(Reserve)	00
Structure Length (Byte)	00	Structure Length (Byte)	12
		(Reserve)	00
		Checksum	07
		Parameter 01 Read / write status	01: Success
		Parameter 02 Read / write status	02: Failed
		...	…
		Parameter 16 Read / write status	00: No read/write

7-5-3-6 Cyclic (Real Time, RT) Data Configuration

After being configured by the controller, the PROFINET device will perform cyclic data exchange according to the update time defined by the controller. The MX300 supports a minimum update time of 4ms. A single cyclic packet contains both rectified modules and all inverted modules data. The MX300 cyclic packet supports the following data read / write operations (the write function must be enabled by setting parameters first).

– Supports writing Modbus address 2640h to the rectifier module (Slot 16)
– Supports writing writable parameters and Modbus addresses to inverter module (Slots 1–15)
– Supports readable parameters and Modbus addresses from the rectifier module (Slot 16)
– Supports reading readable parameters and Modbus addresses from inverter module (Slots 1–15)

Restrictions on cyclic packets sent by the controller

Cyclic packets sent from the controller must comply with the following two restrictions:

1. Packet length: Must be less than 288 bytes.
   256 (total data bytes) + 32 (number of data exchange submodules) = 288 bytes.
   If the length exceeds this limit, the software will issue a warning.
2. Total data size: Must be less than 256 bytes.
   If the data size exceeds the limit, the device will report a diagnostic alarm.

Configuration of cyclic data in engineering software

When configuring cyclic data in the software, the user must define:

– The memory mapping addresses in the controller

– The corresponding MX300 parameters mapped to those addresses

Example:

If the user wants to cyclically write Modbus parameters 2000h and 2001h to inverters in PROFINET slots 2, 5, and 14, and define the PLC memory mapping address as follows.

– Slot 2 → %QB 0–3 – Slot 5 → %QB 9–12 – Slot 14 → %QB 4–7

The mapping result is shown below:

Address	Definition	Address	Definition
%QB 0	Slot 2 inverter, 2000h (High)	%QB 7	Slot 14 inverter, 2001h (Low)
%QB 1	Slot 2 inverter, 2000h (Low)	%QB 8	Reserved (not assigned)
%QB 2	Slot 2 inverter, 2001h (High)	%QB 9	Slot 5 inverter, 2000h (High)
%QB 3	Slot 2 inverter, 2001h (Low)	%QB 10	Slot 5 inverter, 2000h (Low)
%QB 4	Slot 14 inverter, 2000h (High)	%QB 11	Slot 5 inverter, 2001h (High)
%QB 5	Slot 14 inverter, 2000h (Low)	%QB 12	Slot 5 inverter, 2001h (Low)
%QB 6	Slot 14 inverter, 2001h (High)		

7-5-4 Error Handling under PROFINET Communication

7-5-4-1 Error codes during function activation

The following table lists the error codes that may occur in MX300 rectifier when PROFINET functions encounter abnormalities.

No.	Error Code	Name	Description	Troubleshooting Method
220	PStE	PROFINET Startup Error	Failed to start PROFINET function	• Remove or move away from the noise interference source. • Check the power wiring and cycle the power. • If the above measures do not work, return the device to the factory for repair.
221	PSFE	PROFINET Storage Error	Failed to read PROFINET nonvolatile memory	• Check the power wiring and cycle the power • Remove or move away from the noise interference source. • Cycle the power, if PSFE error still exists, return to the factory for repair.
222	PoPE	PROFINET Operation Error	Abnormality detected during PROFINET operation	• Reduce the periodic communication cycle or the number of parameters read and written. • Reduce the times of non-periodic communication packet settings. • Cycle the power, if PoPE error still exists, return to the factory for repair.
223	PrbE	PROFINET program inspection error	An error is found when loading PROFINET program	• Remove or move away from the noise interference source. • Check the power wiring and cycle the power. • Cycle the power, if PrbE error still exists, return to the factory for repair.

7-5-4-2 Alarm definition and description

When the controller is connected, MX300 will send the warning / error of rectifier and inverter to the controller. After the alarm received, user can check the corresponding slot number, error code, and descriptions through the engineering software. In the PROFINET diagnostic system, alarm codes can be further classified by Channel Error Type and Extend Channel Error Type:

1. Channel Error Type: Represents the first-level alarm. This follows the alarm numbering defined by the official PROFINET specification.
2. Extended Channel Error Type: Represents the second-level alarm, defined by the device under the corresponding first-level alarm. The number definitions used by MX300 are detailed in the table below.

Channel Error Type	Extend Channel Error Type	Description	Error Handling Method
0x0010	0x02	The slot was not found when the controller configured the cyclic data.	Check the network hardware status.
0x0010	0x04	The address configured for cyclic data by the controller is invalid	Verify the cyclic data configuration is valid.
0x0010	0x06	Mismatch occurs between configuration and package number	Ensure the controller has correctly configured the cyclic communication address.
0x0010	0x08	The cyclic data for this slot exceeds the configurable total data limit.	Reduce the total size of configured cyclic communication data.
0x0013	0x02	After the connection of the controller, it detected the slot was disconnected.	Check the network hardware status, issue a record 103 reconnection command to the rectifier, and reconnect the network cable.
0x0013	0x04	The controller failed to establish a connection.	Identify and eliminate any electrical noise in the environment. Confirm MX300 inverter hardware configuration meets expectations.
0x0013	0x06	This slot failed to start due to errors in communication during other slot cycles.	Check and resolve the errors in the other slots.
0x7F00	0x01–0xFF	An MX300 error occurred. (The error code corresponds to the error code in Chapter 8.)	Refer to error handling in Chapter 8 and use parameter 2002h / 6000h to clear the error.
0x7F00	0x100	Other MX300 system errors.	Verify whether any non-compliant operation was performed.
0x7F01	N/A	An MX300 warning occurred.	Refer to error handling in Chapter 8.

7-5-4-3 Error Handling Methods

1. When warning code 0x13-0x02 occurs (Rectifier and Inverter Disconnection), the rectifier will report a warning, and the inverter will act according to the setting of Pr.00-22. At this point, the controller can attempt to issue a Write Record 103 reconnection command to the rectifier (Slot 16) (refer to the Section 7-5-3). All MX300 inverter axes will then stop and restart, and the controller will receive a periodic data invalid warning.

(1) Internal communication errors may be caused by internal hardware issues or external environmental interference. If the error caused by external factors, the inverter may still be able to accept commands from the controller although the warning of controller and rectifier still exist.

(2) To clear the internal communication error, the controller can attempt to issue a Write Record 103 reconnect command to the rectifier (Slot 16) (refer to the Section 7-5-3). In this case, all inverter axes will stop and restart, and the controller will receive a cyclic data invalid warning.

2. When the controller disconnects from the rectifier, both the rectifier and inverter will report an error. The inverter will act according to the settings of Pr.00-22 and Pr.09-98. Once the controller reconnects to the rectifier, MX300 will wait for the controller redo reconnection procedure, allowing the rectifier and inverter to reconfigure cyclic communication.
3. When warning code 0x7F00-0x001 to 0x7F00-0x100 occurs (MX300 Errors), it can be eliminated by attempting the following steps.
   (1) Pr.09-30 = 0: issue 2002h = 2h to the slot with error via cyclic or acyclic communication.
   (2) Pr.09-30 = 1: issue 6000h = 8000h to the slot with error via cyclic or acyclic communication.
   (3) Note 1: After the error is cleared, the inverter will act according to the current command immediately. Otherwise, issue a stop command first and then clear the error, the action will not be immediate.
   (4) Note 2: If cyclic communication is used to clear the error, the execution period should be set between 5–20ms to make sure only the current error is cleared. To avoid frequent system resets on the MX300, which could result in errors being immediately cleared.

7-5-4-4 Other Usage Notes about configuration

1. When configuring cyclic data, pay attention to the following items:
   (1) The slot number should be set by the controller is corresponding to the inverter Pr.09-57 (Ethernet Slot number), not the number of the physical location.
   (2) Do not leave Subslot 2 and Subslot 3 empty during configuration, assign a submodule “empty” instead.
   (3) The configured parameters must be inputted in hexadecimal format as “High Byte, Low Byte.” For example, Pr.11-17 should be inputted as 0B,11.
   (4) A parameter can be set to FF,FF to indicate that this field is not configured.
   (5) If a parameter configuration fails, you can check the diagnostic storage page in the engineering software especially for items with incorrect numbers to identify which parameter failed to configure (refer to section 7-5-5-5 Warning identification).
   (6) If the parameter configuration for one slot is incorrect, the other slots will also fail to operate.
2. When using acyclic command Record 102 to read / write parameters, note the following:
   (1) Always wait for the current Record response before sending the next one. If another Record is sent prematurely, the read / write may fail.
   (2) After using Write Record to write parameters, it is not necessary to use Read Record to confirm the written result.

(3) When using Read Record to read parameter results, if an Exception is returned, you can use Record 103 with structure 0x41 to further check the read / write status of each parameter.

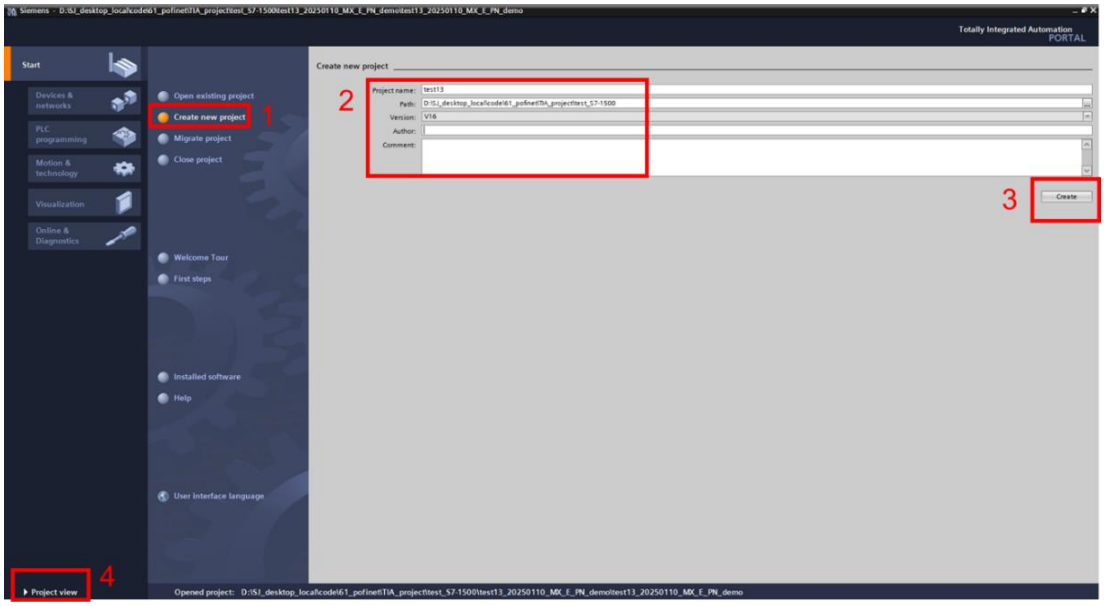
3. When using acyclic command Record 103 for reconnection, note the following:

(1) During reconnection, all inverters will stop simultaneously.

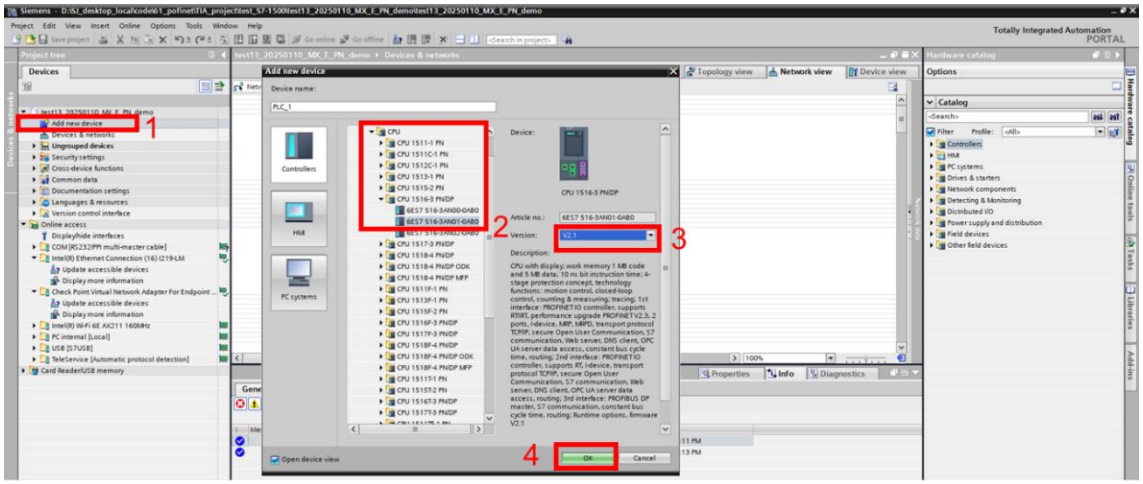
7-5-5 PROFINET Operation Example (Take TIA Portal with S7-1500 as example)

7-5-5-1 Importing GSDML

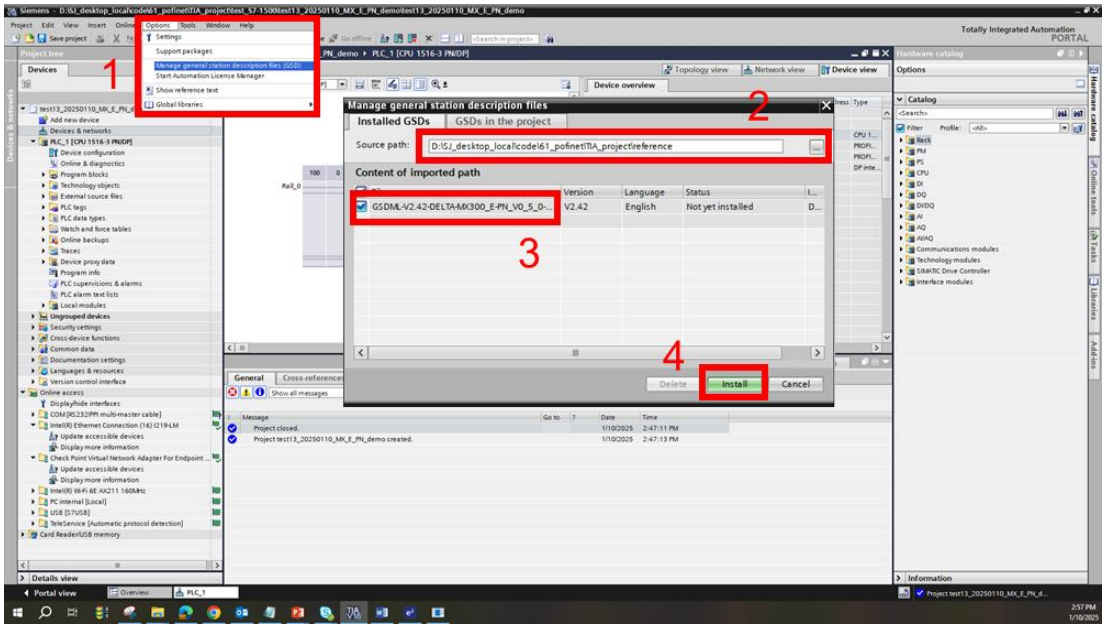
1. Create a Project: Create a new project, then open the Project View.



2. Select the corresponding project based on the type and version of the controller on site (take S7-1500 as example).

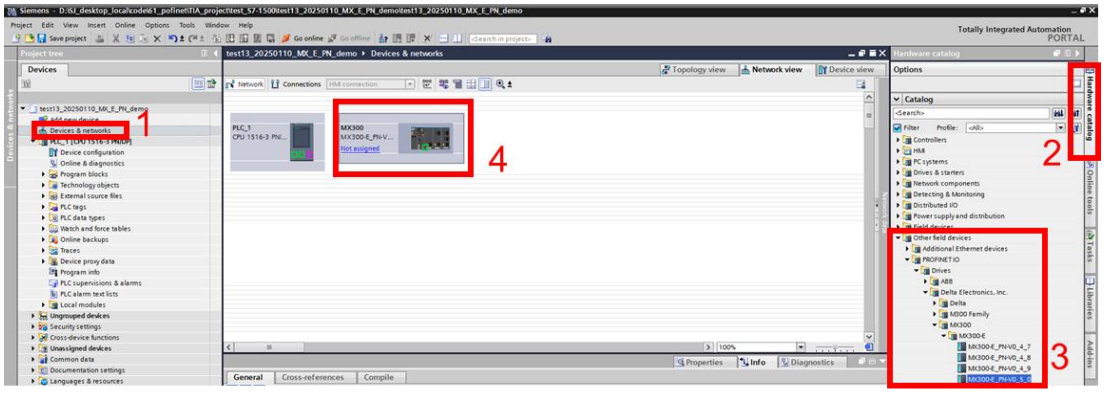


3. Import the GSDML

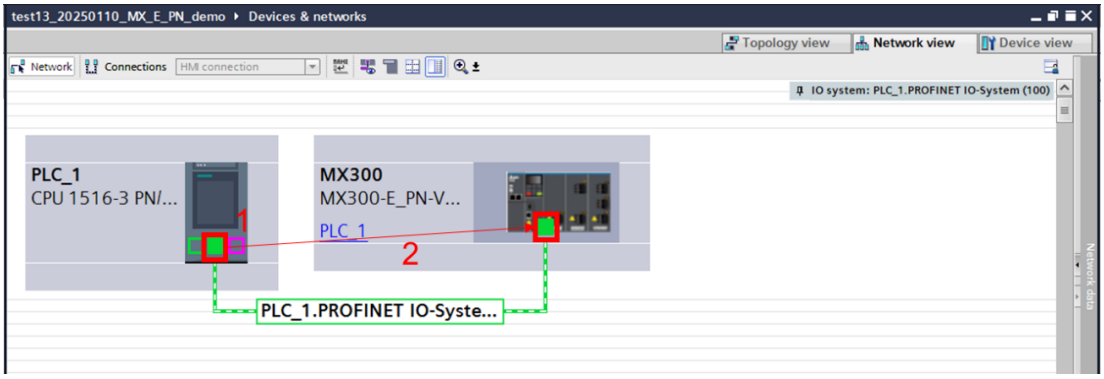


7-5-5-2 Device and Network configuration

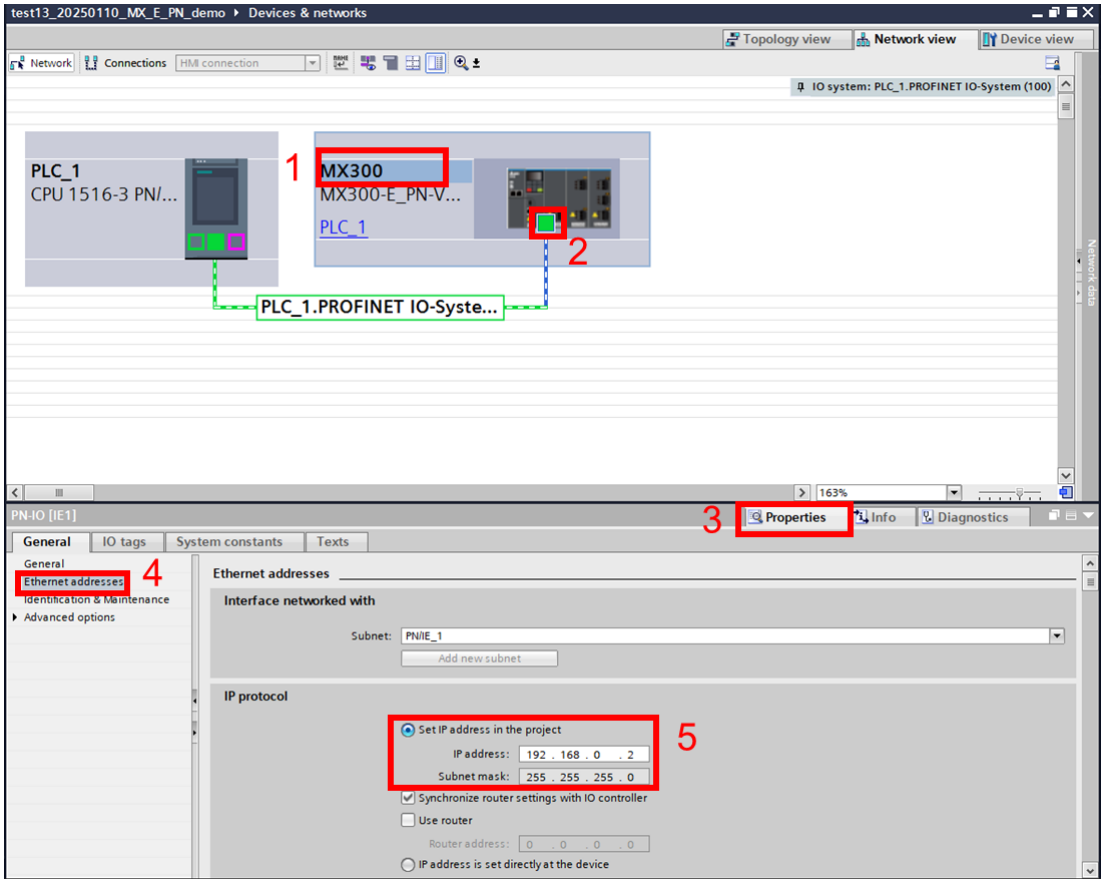
1. Add Device: Double-click the Device & Network page in the Project Tree and import the MX300-E version from the Other field devices section on the right side of the page.



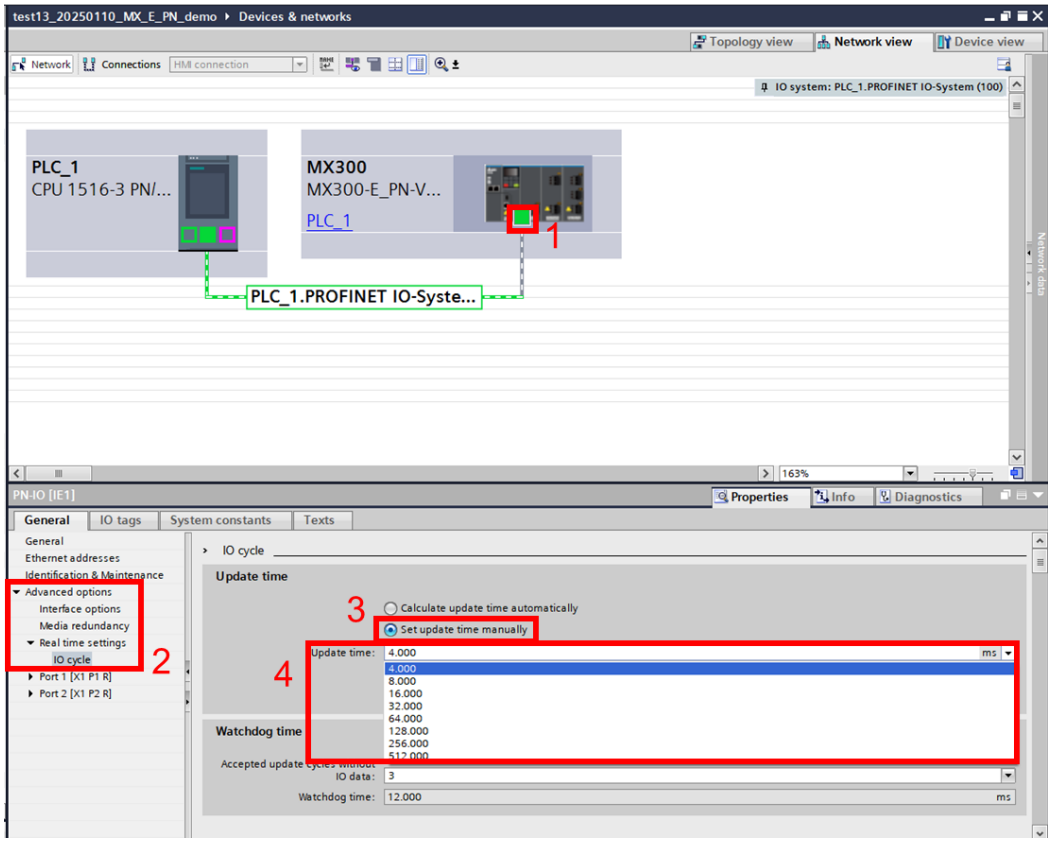
2. Establish connection: In Network view page, left click and drag the green box on the controller to the green box on the MX300.



3. Set Device Name and IP Address: Device names and IP addresses must be different within the same network domain.

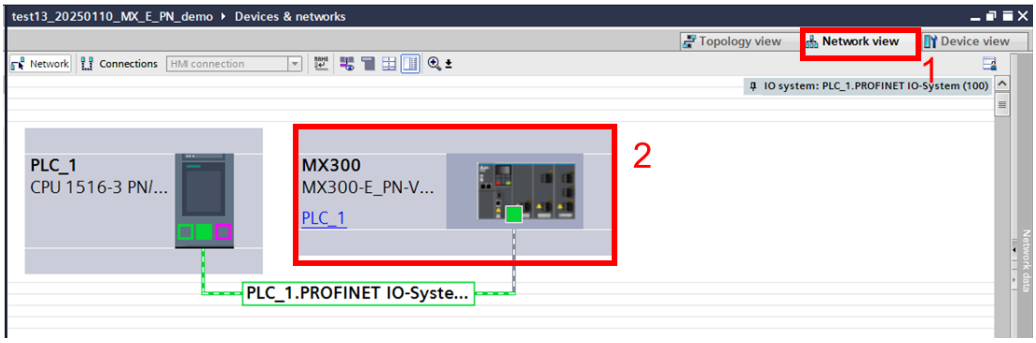


4. Set network cycle: Supports a communication speed of 4ms as the fastest.

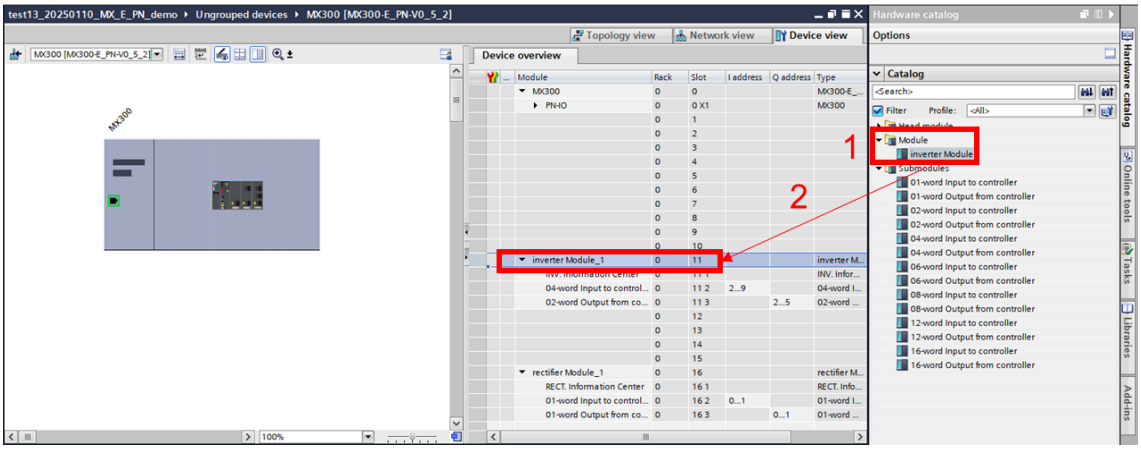


7-5-5-3 Cyclic data configuration (RT)

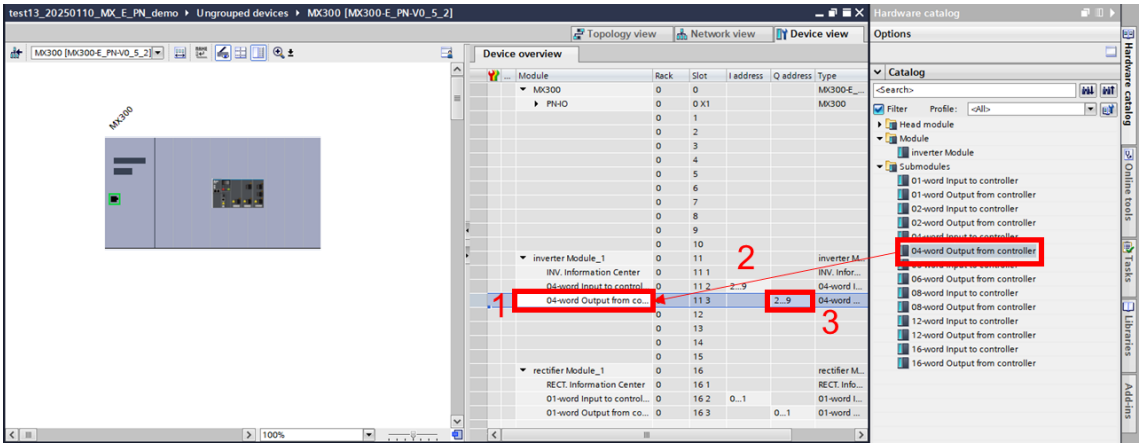
1. Double-click the MX300 icon on the Network view page to access the Device view page.



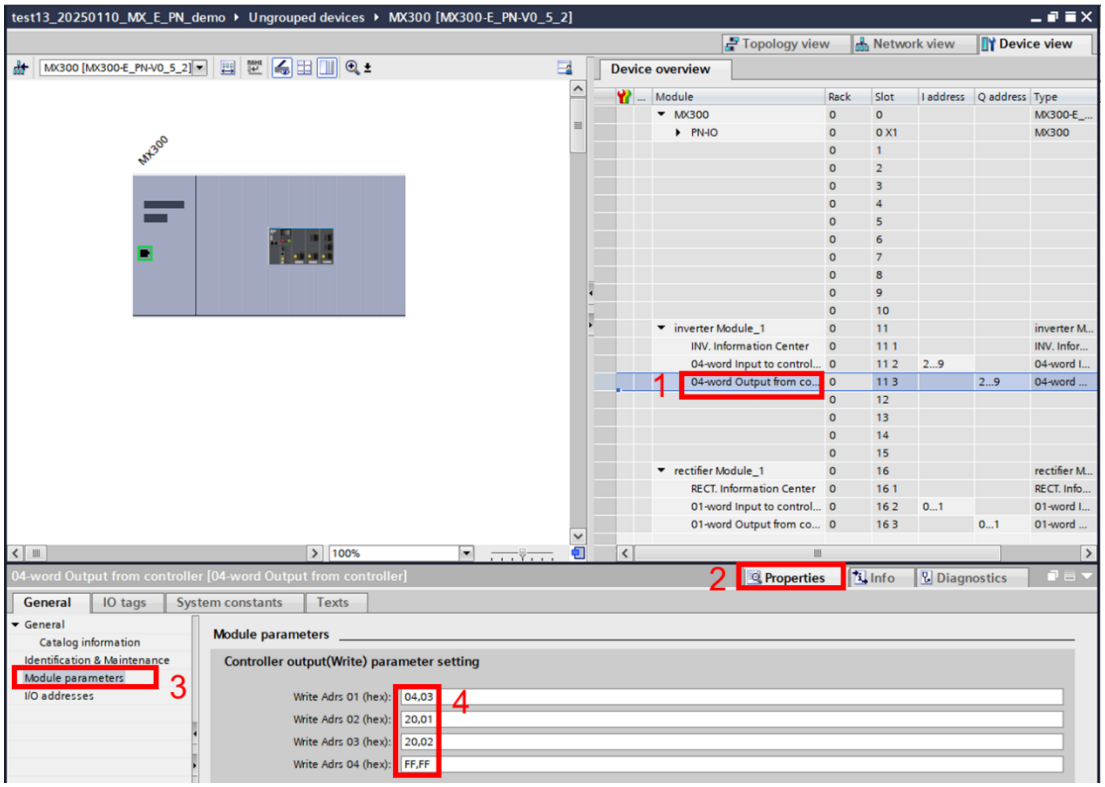
2. Configure Slot: Drag the inverter module to the corresponding slot (must correspond to the inverter Pr.09-57 setting).



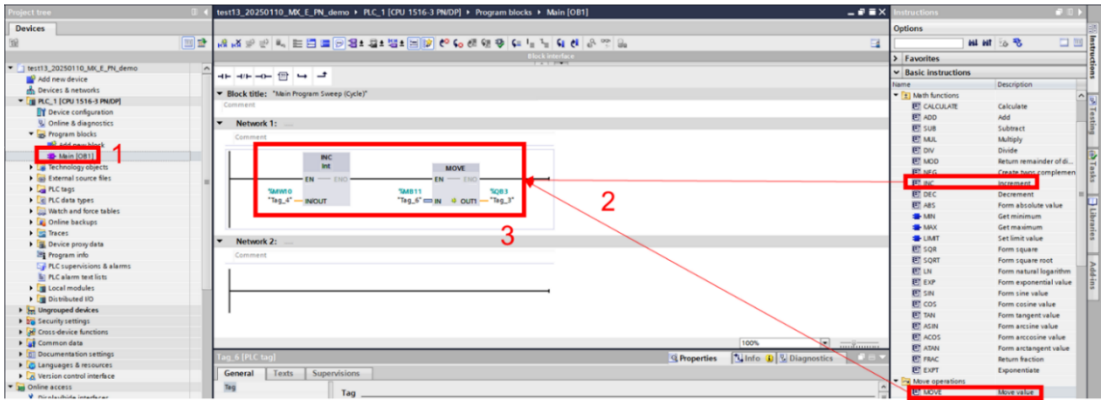
3. Configure Subslot: Choose submodules in hardware catalog and add to subslots which can also be deleted. And double-click the value of IQ address to change the S7-1500 memory mapping address.



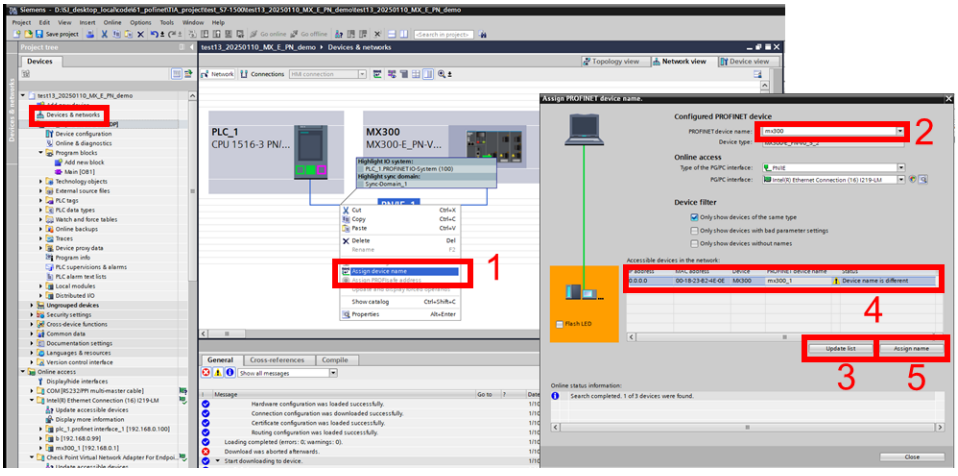
4. Parameter Read / Write Configuration: Input the corresponding Modbus address to set the parameter address corresponding to the IQ memory.
   - Must be in hexadecimal format, separated by a comma (,) between the high byte and low byte. For example, Pr.10-20 should be input as 0A,14
   - In this example, %QB2 corresponds to the high byte of Pr.04-03 in MX300, and %QB3 corresponds to the low byte of Pr.04-03.
   - Input (FF, FF) means this address will be ignored (no error report), and writing values will not be affected.



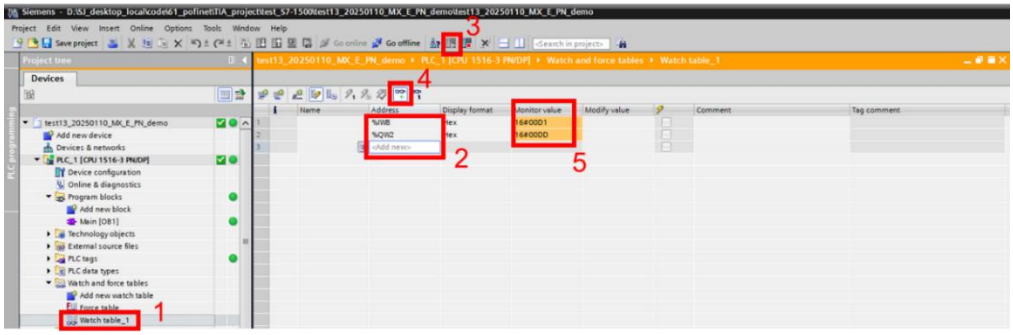
5. Write a program to change the output value. In this example, the internal memory MW10 of the S7-1500 is used for counting, and only the low byte MB11 is set in the output %QB3, which is the low byte of Pr.04-03.



6. After compiling and downloading the program to the S7-1500, confirm the connection between MX300, controller S7-1500 and the PC. Right-click the connection line on the configuration diagram in Device & network view, select assign device name, search for the device, and then named the device.

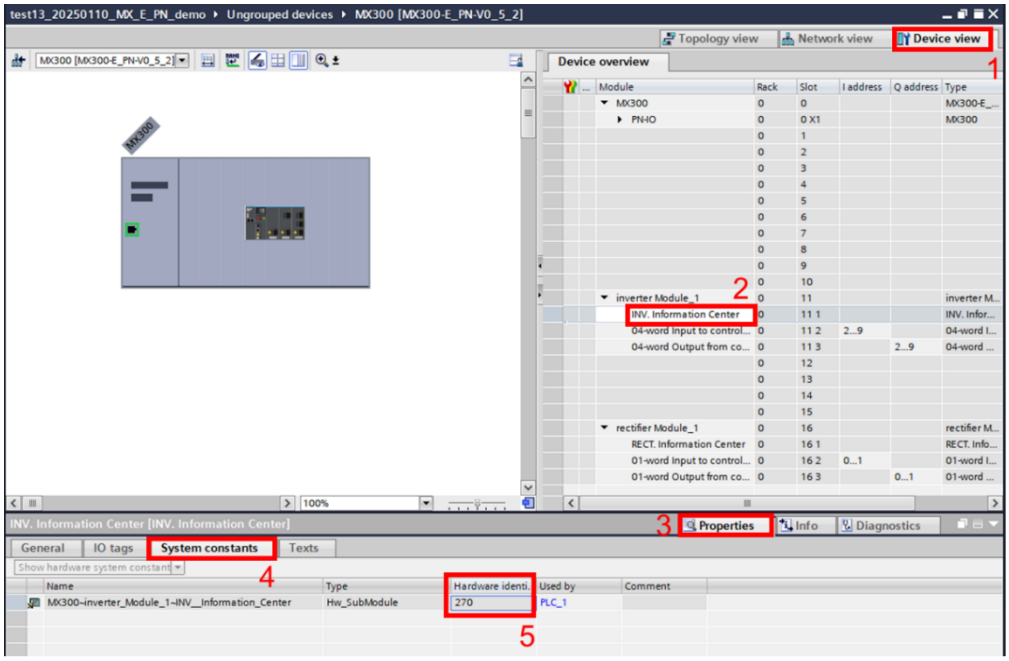


7. Use the Watch Table in the TIA portal to input the corresponding values. Start monitoring these two variables after running the S7-1500. The program count is written to Pr.04-03 and returned accordingly.
   - The fourth parameter of the input module is also set to Pr.04-03. The output count %QB3 can be confirmed by checking %IW8 through the monitoring window.
   - Due to the delay writing and reading, the two values are not equal.

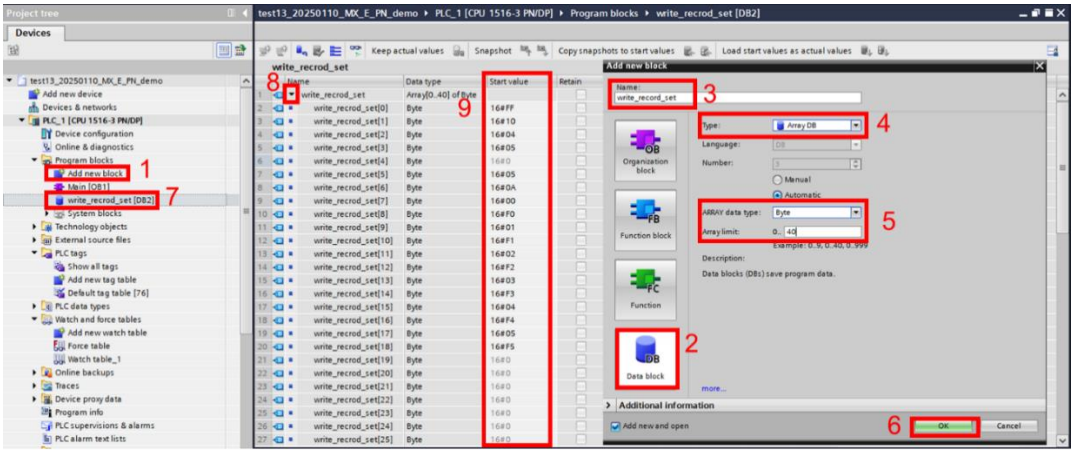


7-5-5-4 Acyclic data configuration (NRT)

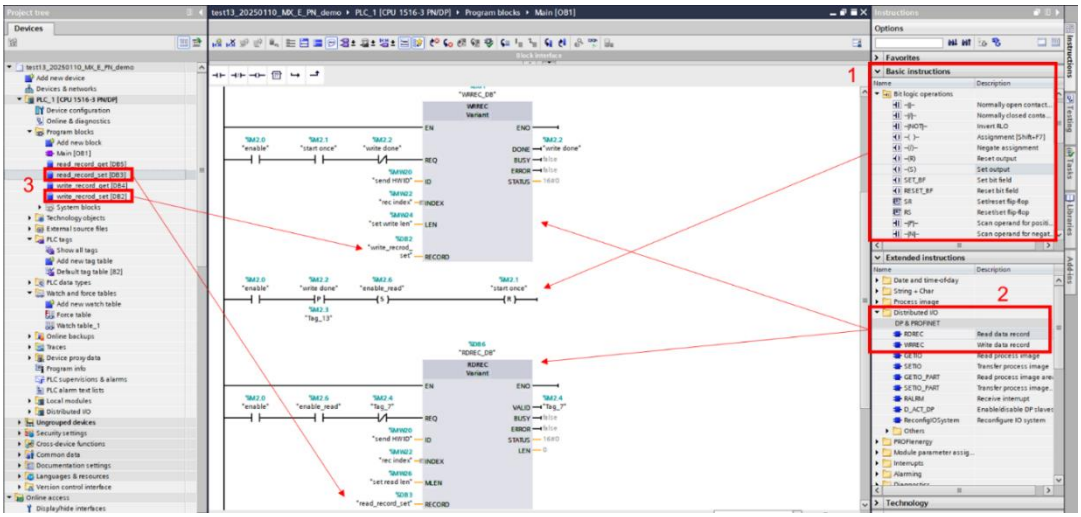
1. Check the Hardware identification code of each module in Device view page.



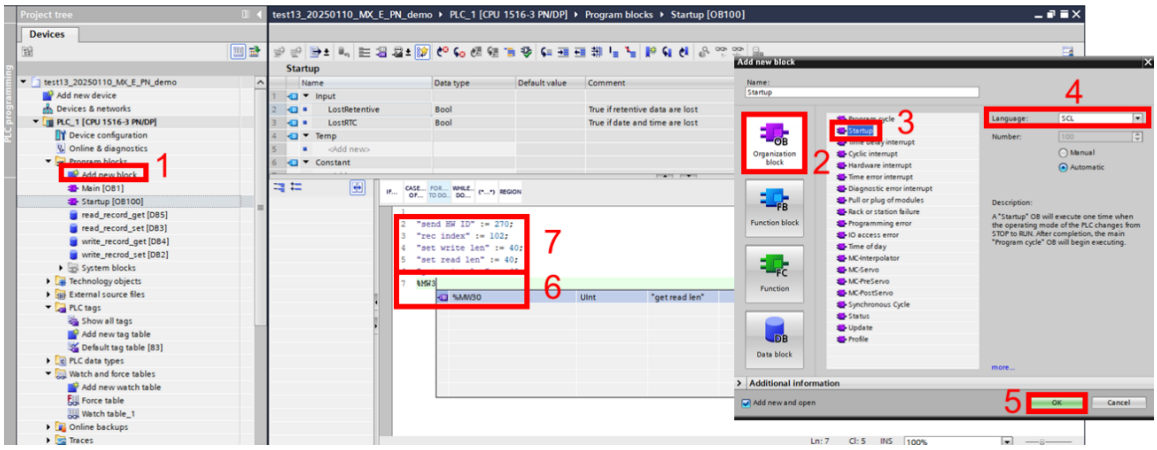
2. Add a new record data array and write preset values. In this example, Pr.04-05 to 04-09 are written.



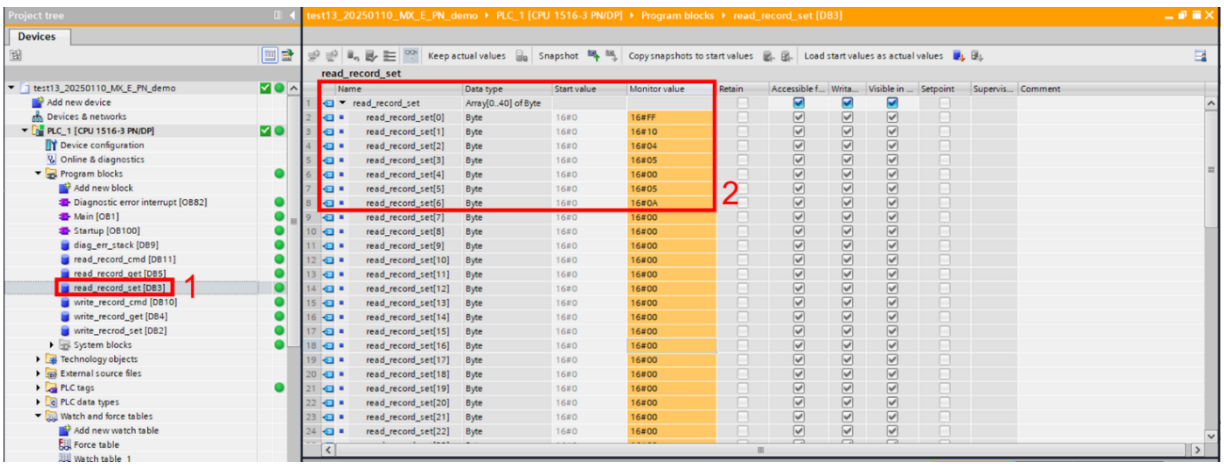
3. In this example, adding record function for writing and reading, the data is written by S7-1500's WRREC and RDREC. Combined with relevant PLC functions and dragging the data array into the record field will create write record and read record packets. Changing the PLC's %M2.1 setting via software triggers the PLC to send a write record packet, and only after the data is returned will a read record packet be sent. The total length of the packet transmitted by record 102 must match the packet length.



4. Add a startup procedure to the program. In this example, TIA PORTAL's SCL language is used to assign initial values to the aforementioned program data.

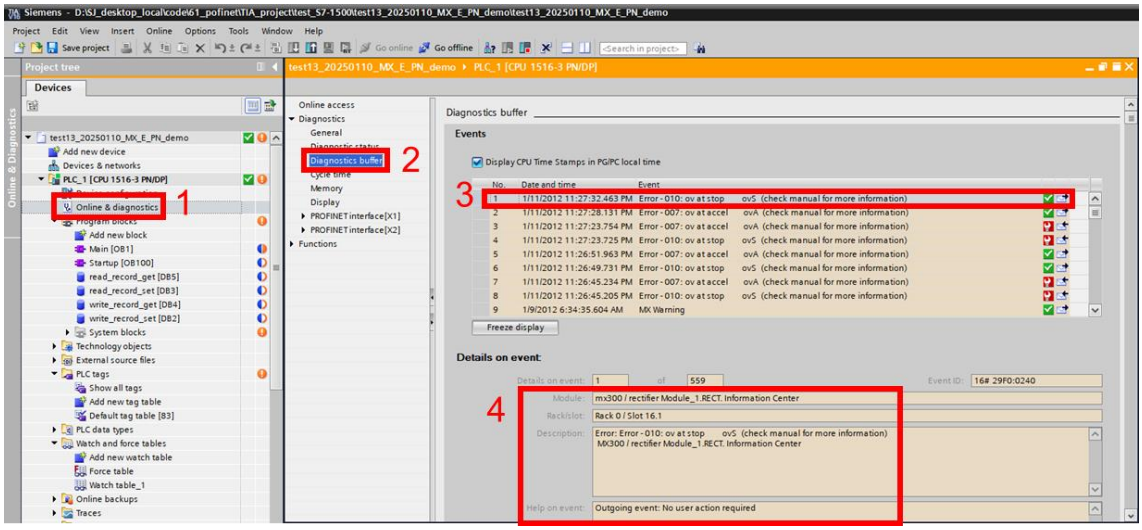


5. After downloading and running this program and sending a record packet through the TIA portal, the data array can be monitored to confirm whether the corresponding values have been obtained.



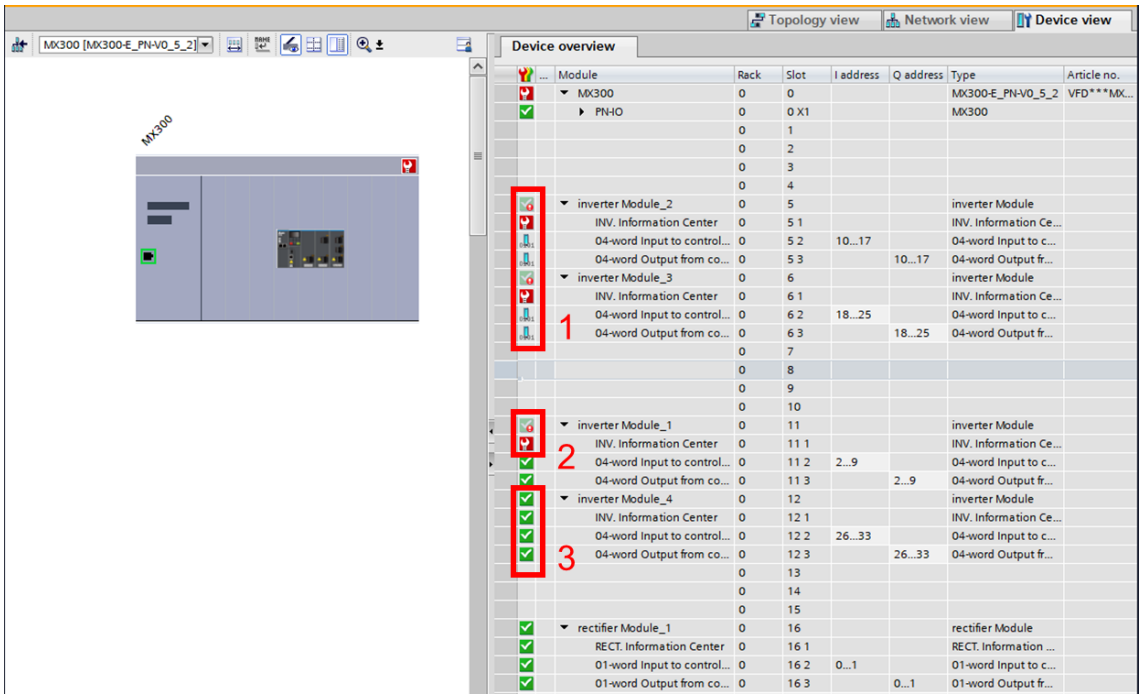
7-5-5-5 Warning identification

In TIA portal, the error of device can be check in online & diagnostics page, the error record will be shown in the Diagnostics buffer. Left click the error will show the slot where the error occurred and the descriptions. Therefore, each slot can be check for errors on the Device view page of MX300.



Take the following figure as an example:

- Area 1: The axis is not actually present in the configuration that data cannot be transmitted, both the input and output columns of this slot have warning labels.
- Area2: The inverter module shows the error, since the error in the inverter will not cause communication problems, there are no warning indicators in the input and output columns of the slot.
- Area 3: Normally operating slots.



Chapter 8 Troubleshooting

8-1 Alarm List

8-2 Warning Codes and Troubleshooting

8-3 Fault Codes and Troubleshooting

8-1 Alarm List

8-1-1 Summary of Warning Codes

No.	Warning Name	No.	Warning Name
0	No record	25	Auto tuning (tUn)
1	Communication error 1 (CE1)	28	Output phase loss (oPHL)
2	Communication error 1 (CE2)	30	Copy model error 3 (SE3)
3	Communication error 3 (CE3)	36	CANopen guarding time-out (CGdn)
4	Communication error 4 (CE4)	37	CANopen heartbeat error (CHbn)
5	Communication error 10 (CE10)	39	CANopen bus off error (CbFn)
7	Save error 1 (SE1)	46	CANopen format error (CPtn)
8	Save error 2 (SE2)	101	Rectifier Module and Inverter Module communication time-out (ictn)
9	Power components overheating warning (oH1)		
10	Circuit board ambient temperature overheats (oH2)	102	Deceleration energy backup error (dEb)
		103	PID feedback fault (dEv)
11	PID feedback error (PID)	104	IO card disconnected (iocb)
12	AI2 analog signal loss (AnL)	127	Hardware positive limit (HPL)
13	Under current (uC)	128	Hardware negative limit (HnL)
19	Phase loss (PHL)	145	Modbus address conflict (bACn)
20	Over-torque 1 (ot1)	150	Ethernet communication time-out (Edtn)
21	Over-torque 1 (ot2)	152	Ethernet number conflict (EACn)
24	Over slip warning (oSL)	153	Ethernet Internal communication time-out (Eitn)

8-1-2 Summary of Fault Codes

No.	Fault Name	No.	Fault Name
0	No record	76	STO (STo)
1	Over-current during acceleration (ocA)	77	S2 internal circuit detection error (STL2)
2	Over-current during deceleration (ocd)	79	U-phase over-current before run (Aoc)
3	Over-current during steady operation (ocn)	80	V-phase over-current before run (boc)
4	Ground fault (GFF)	81	W-phase over-current before run (coc)
6	Over-current at stop (ocS)	82	Output phase loss U phase (oPL1)
7	Over-voltage during acceleration (ovA)	83	Output phase loss V phase (oPL2)
8	Over-voltage during deceleration (ovd)	84	Output phase loss W phase (oPL3)
9	Over-voltage during constant speed (ovn)	87	Low frequency overload protection (oL3)
10	Over-voltage at stop (ovS)	89	Rotor position detection error (roPd)
11	Low-voltage during acceleration (LvA)	101	CANopen guarding error (CGdE)
12	Low-voltage during deceleration (Lvd)	102	CANopen heartbeat error (CHbE)
13	Low-voltage at constant speed (Lvn)	104	CANopen bus off error (CbFE)
14	Low-voltage at stop (LvS)	121	Internal communication error (CP20)
15	Phase loss protection (orP)	122	Internal communication error (CP21)
16	Power components overheating (oH1)	123	Internal communication error (CP22)
17	Circuit board ambient temperature overheats (oH2)	124	Internal communication error (CP30)
		126	Internal communication error (CP32)
18	IGBT temperature detection failure (tH1o)	140	oc hardware error (Hd6)
19	Capacitor hardware error (tH2o)	141	GFF occurs before run (b4GFF)
21	Over load (oL)	142	Auto-tuning error (AuE1)
22	Electronic thermal relay 1 protection (EoL1)	143	Auto-tuning error (AuE2)
23	Electronic thermal relay 2 protection (EoL2)	144	Auto-tuning error (AuE3)
24_1	Motor overheating (oH3) PTC	145	MErr error (MErr)
24_2	Motor overheating (oH3) PT100	215	Ethernet communication time-out (EdtE)
26	Over torque 1 (ot1)	220	PROFINET startup error (PStE)
27	Over torque 2 (ot2)	221	PROFINET storage device error (PSFE)
28	Under current (uC)	222	PROFINET operation error (PoPE)
31	EEPROM read error (cF2)	223	PROFINET program inspection error (PrbE)
33	U-phase error (cd1)	224	STO execution time-out (SToT)
34	V-phase error (cd2)	225	STO ROM verifying failure (STor)
35	W-phase error (cd3)	226	STO loss (SToL)
36	cc hardware error (Hd0)	227	STO Channel 1 error (STC1)
37	oc hardware error (Hd1)	228	STO Channel 2 error (STC2)
38	ov hardware error (Hd2)	229	STO Channel 1 time-out (SPC1)
40	Auto-tuning error (AUE)	230	STO Channel 2 time-out (SPC2)
41	PID off AI2 (AFE)	231	STO Gate buffer check error (SGbE)
48	AI2 loss (ACE)	232	STO power 18V over voltage (S18ov)

No.	Fault Name	No.	Fault Name
49	External fault (EF)	233	STO power 18V under voltage (S18uv)
50	Emergency stop (EF1)	234	STO power 6V over voltage (S6ov)
51	External base block (bb)	235	STO power 6V under voltage (S6uv)
52	Password is locked (Pcod)	236	STO power 5V over voltage (S5ov)
54	Illegal command (CE1)	237	STO power 5V under voltage (S5uv)
55	Illegal data address (CE2)	238	STO Watchdog (SWdG)
56	Illegal data value (CE3)	239	STO ADC Sampling failure (SAdE)
57	Data is written to read-only address (CE4)	240	STO execution time is too short (SEbL)
58	Modbus transmission time-out (CE10)	241	STO execution time is too high (SEAb)
63	Over slip warning (oSL)	242	Safe torque off 1 (STo1)
72	S1 internal circuit detection error (STL1)	243	Safe torque off 2 (STo2)

8-2 Warning Codes and Troubleshooting

No.	Display on LED Keypad	Warning Name	Descriptions
1	CE1	Communication error 1 (CE1)	RS485 Modbus illegal data value
Action and Reset			
Action Condition		When the function code is not 03, 06, 10 and 63.	
Action Time		Immediately	
Warning setting parameter		N/A	
Action and Reset		"Warning" occurs when Pr.09-02=0 and the motor drive keeps running. The drive resets automatically when receiving the correct function code.	
Reset Condition		Immediately reset	
Record		N/A	
Cause		Corrective Actions	
Incorrect communication command from the upper unit		Check if the communication command is correct.	
Malfunction caused by interference		Verify the wiring and grounding of the communication circuit. It is recommended to separate the communication circuit from the main circuit, or wire in 90 degree for effective anti-interference performance.	
Different communication setting from the upper unit		Check if the setting for Pr.09-04 is the same as the setting for the upper unit.	
Disconnection or bad connection of the cable		Check the cable and replace it if necessary.	

No.	Display on LED Keypad	Warning Name	Descriptions
2	CE2	Communication error 2 (CE2)	RS485 Modbus illegal data value
Action and Reset			
Action Condition		When the input data address is incorrect.	
Action Time		Immediately	
Warning setting parameter		N/A	
Action and Reset		"Warning" occurs when Pr.09-02=0 and the motor drive keeps running. The drive resets automatically when receiving the correct data address.	
Reset Condition		Immediately reset	
Record		N/A	
Cause		Corrective Actions	
Incorrect communication command from the upper unit		Check if the communication command is correct.	
Malfunction caused by interference		Verify the wiring and grounding of the communication circuit. It is recommended to separate the communication circuit from the main circuit, or wire in 90 degree for effective anti-interference performance.	
Different communication setting from the upper unit		Check if the setting for Pr.09-04 is the same as the setting for the upper unit.	
Disconnection or bad connection of the cable		Check the cable and replace it if necessary.	

No.	Display on LED Keypad	Warning Name	Descriptions
3	CE3	Communication error 3 (CE3)	RS485 Modbus illegal data value
Action and Reset			
Action Condition		When the length of communication data is too long.	
Action Time		Immediately act	
Warning setting parameter		N/A	
Action and Reset		"Warning" occurs when Pr.09-02 = 0 and the motor drive keeps running. The drive resets automatically when receiving the correct communication data value.	
Reset Condition		Immediately reset	
Record		N/A	
Cause		Corrective Actions	
Incorrect communication command from upper unit.		Check if the communication command is correct.	
Malfunction caused by interference		Verify the wiring and grounding of the communication circuit. It is recommended to separate the communication circuit from the main circuit, or wire in 90 degrees for effective anti-interference performance.	
Different communication setting from the upper unit.		Check if the setting for Pr.09-01, Pr.09-04 are the same as the setting for the upper unit.	
Communication cable is broken or bad connected.		Check the cable and replace it if necessary.	

No.	Display on LED Keypad	Warning Name	Descriptions
4	CE4	Communication error 4 (CE4)	RS485 Modbus data is written to read-only address.
Action and Reset			
Action Condition		When the data is written to read-only address.	
Action Time		Immediately act	
Warning setting parameter		N/A	
Reset Method		“Warning” occurs when Pr.09-02 = 0 and the motor drive keeps running. The drive resets automatically when receiving the correct written address of communication data.	
Reset Condition		Immediately reset	
Record		N/A	
Cause		Corrective Actions	
Incorrect communication command from upper unit.		Check if the communication command is correct.	
Malfunction caused by interference		Verify the wiring and grounding of the communication circuit. It is recommended to separate the communication circuit from the main circuit, or wire in 90 degrees for effective anti-interference performance.	
Different communication setting from the upper unit.		Check if the setting for Pr.09-01, Pr.09-04 are the same as the setting for the upper unit.	
Communication cable is broken or bad connected.		Check the cable and replace it if necessary.	

No.	Display on LCD Keypad	Warning Name	Descriptions
5	CE 10	Communication error 10 (CE10)	RS-485 Modbus transmission time-out
Action and Reset			
Action Condition		When the communication time exceeds the detection time of Pr.09-03 communication time-out	
Action Time		Pr.09-03	
Warning setting parameter		N/A	
Reset Method		“Warning” occurs when Pr.09-02 = 0 and the motor drive keeps running. The drive resets automatically when receiving the next communication packet.	
Reset Condition		Immediately reset	
Record		N/A	
Cause		Corrective Actions	
The upper unit does not transmit the communication command within Pr.09-03 setting time.		Check if the upper unit transmits the communication command within the setting time for Pr.09-03.	
Malfunction caused by interference		Verify the wiring and grounding of the communication circuit. It is recommended to separate the communication circuit from the main circuit, or wire in 90 degrees for effective anti-interference performance.	
Different communication setting from the upper unit.		Check if the setting for Pr.09-01, Pr.09-04 are the same as the setting for the upper unit.	
Communication cable is broken or bad connected.		Check the cable and replace it if necessary.	

No.	Display on LED Keypad	Warning Name	Descriptions
7	SE1	Save error 1 (SE1)	Keypad to Drive COPY error 1: Keypad copy time-out
Action and Reset			
Action Condition		“SE1” warning occurs when the keypad does not transmit the COPY command to the drive, and does not transmit any data to the drive again in 10 ms at the time you copy the parameters to the drive.	
Action Time		10ms	
Warning setting parameter		N/A	
Reset Method		Manual reset	
Reset Condition		Immediately reset	
Record		N/A	
Cause		Corrective Actions	
Communication connection error		SE1: The causes of error are mostly communication problems between the keypad and control board. Potential causes include communication signal interference and the unacceptable communication command to the Slave. It is suggested to check the status of communication and remove the error causes first. Check if the error occurs randomly, or only occurs when copying certain parameters (the error displays on the upper right corner of the copy page). If you cannot clear the error, please contact Delta.	
Digital Keypad error			
Control board error			

No.	Display on LED Keypad	Warning Name	Descriptions
8	SE2	Save error 2 (SE2)	Keypad COPY error 2: parameter writing error
Action and Reset			
Action Condition		“SE2” warning occurs when writing the parameters incorrectly at the time you copy parameters to the drive. For example, you copy the new firmware version with added parameters to the drive with old firmware version.	
Action Time		N/A	
Warning setting parameter		N/A	
Reset Method		Manual reset	
Reset Condition		Immediately reset	
Record		N/A	
Cause		Corrective Actions	
Check if there are new parameters in the new version of firmware.		SE2: In this stage, the copied data has been transmitted to the Slave. The Slave compares and processes the copied data, and then saves the data to the Data ROM. During the process, the data error (should be attribution error) may occur, or the data cannot be saved to EEPROM. At this time, the warning occurs. It is suggested to check the status of Data ROM and remove the error causes first. If you cannot clear the error, please contact Delta.	
Malfunction caused by interference		Verify the wiring and grounding of the main circuit, control circuit and the encoder for effective anti-interference performance.	

No.	Display on LED Keypad	Warning Name	Descriptions
9	oH1	Power components over-heating warning (oH1)	The AC motor drive detects over-heating of power components, and over the protection level of oH1 warning. (When Pr.06-15 is higher than the IGBT over-heating level, the drive shows oH1 error without displaying oH1 warning.)
Action and Reset			
Action Condition		Pr.06-15	
Action Time		"oH1" warning occurs when the temperature of power components are higher than Pr.06-15 setting value.	
Warning setting parameter		N/A	
Reset Method		Auto-reset	
Reset Condition		The drive auto-resets when the temperature of power components are lower than oH1 warning level minus (–) 5°C.	
Record		N/A	
Cause		Corrective Actions	
Check if the ambient temperature or temperature inside the cabinet is too high, or if there is obstruction in the ventilation hole of the control cabinet.		1. Check the ambient temperature. 2. Regularly inspect the ventilation hole of the control cabinet. 3. Change the installed place if there are heating objects, such as brake resistors, in the surroundings. 4. Install / add cooling a fan or air conditioner to lower the temperature inside the cabinet.	
Check if there is any obstruction on the heat sink or if the fan is running.		Remove the obstruction or replace the cooling fan.	
Insufficient ventilation space		Increase ventilation space of the drive.	
Check if the drive matches the corresponded loading.		1. Decrease the load. 2. Decrease the carrier wave. 3. Replace with a drive with larger capacity.	
The drive has run 100% or more than 100% of the rated output for a long time.		Replace with a drive with larger capacity.	

No.	Display on LED Keypad	Warning Name	Descriptions
10	oH2	Circuit board ambient temperature overheats (oH2)	The AC motor drive detects ambient over-heating of Circuit board, and exceeds the protection level.
Action and Reset			
Action Condition		When the circuit board ambient temperature of each model overheat exceeds 95%.	
Action Time		"oH2" warning occurs when circuit board ambient temperature exceeds the protection level continuely for 1 second.	
Warning setting parameter		N/A	
Reset Method		Manual reset	
Reset Condition		The drive can be reset when circuit board ambient temperature is lower than oH2 warning level minus (–) 10°C.	
Record		Yes	
Cause		Corrective Actions	
Check if the ambient temperature or temperature inside the cabinet is too high, or if there is obstruction in the ventilation hole of the control cabinet.		1. Check the ambient temperature. 2. Regularly inspect the ventilation hole of the control cabinet. 3. Change the installed place if there are heating objects, such as brake resistors, in the surroundings. 4. Install / add cooling a fan or air conditioner to lower the temperature inside the cabinet.	
Check if there is any obstruction on the heat sink or if the fan is running.		Remove the obstruction or replace the cooling fan.	
Insufficient ventilation space		Increase ventilation space of the drive.	
Check if the drive matches the corresponded loading.		1. Decrease the load. 2. Decrease the carrier wave. 3. Replace with a drive with larger capacity.	
The drive has run 100% or more than 100% of the rated output for a long time.		Replace with a drive with larger capacity.	
Unstable power source		Installing a reactor	
Frequent load changes		Reduce load variations	

No.	Display on LED Keypad	Warning Name	Descriptions
11	PLd	PID feedback error (PID)	PID feedback loss (A warning for analog feedback signal; it works only when PID enables)
Action and Reset			
Action Condition		When the analog input is lower than 4 mA (only detects analog input 4–20 mA).	
Action Time		Pr.08-08	
Warning setting parameter		Pr.08-09 0: Warn and continue operation 1: Fault and ramp to stop 2: Fault and coast to stop 3: Warn and operate at last frequency	
Reset Method		Auto	"Warning" occurs when Pr.08-09 = 0 or 3. The "Warning" automatically clears when the feedback signal is larger than 4 mA.
		Manual	"Error" occurs when Pr.08-09 = 1 or 2. You must reset manually.
Reset Condition		Immediately reset	
Record		When Pr.06-09 = 1 or 2, PID is a fault, and the fault is recorded. Does not record when Pr.03-09 = 0 or 3 ("Warning").	
Cause		Corrective Actions	
Loose or broken PID feedback wiring		Tighten the terminals again. Replace with a new cable.	
Feedback device malfunction		Replace with a new feedback device.	
Hardware error		If the PID error still occurs after checking all the wiring, return to the factory for repair.	

No.	Display on LED Keypad	Warning Name	Descriptions
12	AnL	AI2 analog signal loss (AnL)	Analog input current loss (including all analog 4–20 mA signals)
Action and Reset			
Action Condition		When the analog input is lower than 4 mA (only detects analog input 4–20 mA).	
Action Time		Immediately act	
Warning setting parameter		Pr.03-19 0: Disabled 1: Continue operation at the last frequency (a warning, keypad displays ”ANL”) 2: Decelerate to 0 Hz (warning, the keypad displays ”ANL”) 3: Stop immediately and display ACE	
Reset Method		Auto	“Warning” occurs when Pr.03-19 = 1 or 2. The “Warning automatically clears when the analog input signal is larger than 4 mA.
		Manual	“Error” occurs when Pr.03-19 = 3. You must reset manually.
Reset Condition		Immediately reset	
Record		When Pr.03-19 = 3, ACE is a “Fault”, and the fault is recorded. Does not record when Pr.03-19 = 1 or 2 (“Warning”).	
Cause		Corrective Actions	
Cable is loose or cut off		Tighten the terminals. Replace with a new cable.	
External device error		Replace with a new device.	
Hardware error		If the AnL error still occurs after checking all the wiring, return to the factory for repair.	

No.	Display on LED Keypad	Warning Name	Descriptions
13	uC	Under current (uC)	Low current detection
Action and Reset			
Action Condition		Pr.06-71	
Action Time		Pr.06-72	
Warning setting parameter		Pr.06-73 0: No function 1: Fault and coast to stop 2: Fault and ramp to stop by the 2nd deceleration time 3: Warn and continue operation	
Reset Method		Auto	"Warning" occurs when Pr.06-73 = 3. The "Warning" automatically clears when the output current is > (Pr.06-71+0.1A).
		Manual	"Error" occurs when Pr.06-73 = 1 and 2. You must reset manually.
Reset Condition		Immediately reset	
Record		When Pr.06-73 = 1 or 2, uC is a "Fault", and the fault is recorded. Does not record when Pr.06-73 = 3 ("Warning").	
Cause		Corrective Actions	
Broken motor cable		Troubleshoot the connection between the motor and the load.	
Improper setting for the low current protection.		Set the proper settings for Pr.06-71, Pr.06-72 and Pr.06-73.	
The load is too low.		Check the loading status. Make sure the loading matches the motor capacity.	

No.	Display on LED Keypad	Warning Name	Descriptions
19	PHL	Phase loss (PHL)	Input phase loss warning
Action and Reset			
Action Condition		One of the phases outputs less than Pr.06-47	
Action Time		Pr.06-46	
Warning setting parameter		Pr.06-45 Output Phase Loss Detection Action (oPHL) =0 0: Warn and continue operation	
Reset Method		“Warning” automatically clears when the drive stops	
Reset Condition		After the drive stops	
Record		N/A	
Cause		Corrective Actions	
Phase loss of the input power		Verify the wiring of the main circuit.	
Single phase power input on a three-phase model		Use the model with voltage that matches the power.	
The power voltage has changed		If the power of main circuit works well, check if the MC of the main circuit is broken. Cycle the power after verifying the power is normal. If PHL still occurs, return to the factory for repair.	
Loose wiring terminal of input power		Tighten the terminal screws with the torque listed in the user manual.	
Check if the input cable of three-phase power is broken		Make sure the wiring is correct. Replace the broken part of the cable.	
Unbalanced three-phase of the input power		Check the status of three-phase power.	

No.	Display on LED Keypad	Warning Name	Descriptions
20	ot1	Over-torque 1 (ot1)	Over-torque 1 warning
Action and Reset			
Action Condition		Pr.06-07	
Action Time		Pr.06-08	
Warning setting parameter		Pr.06-06 Over-torque Detection Selection ot1 = 1 or 3 0: No function 1: Continue operation after over-torque detection during constant speed operation 2: Stop after over-torque detection during constant speed operation 3: Continue operation after over-torque detection during RUN 4: Stop after over-torque detection during RUN	
Reset Method		The warning is automatically cleared when the output current < (Pr.06-07 – 5%).	
Reset Condition		The warning is automatically cleared when the output current < (Pr.06-07 – 5%).	
Record		N/A	
Cause		Corrective Actions	
Incorrect parameter setting		Configure the settings for Pr.06-07 and 06-08 again.	
Mechanical error (e.g. Mechanical lock due to over-torque)		Remove the causes of malfunction.	
The load is too large.		Decrease the load. Replace the motor with a larger capacity model.	
Accel./ Decel. time and working cycle is too short.		Increase the setting values for Pr.01-12–01-19 (accel./ decel. time).	
V/F voltage is too high.		Adjust the settings for Pr.01-01–01-08 (V/F curve) , especially the setting value for the mid-point voltage (if the mid-point voltage is set too small, the load capacity decreases at low-speed).	
The motor capacity is too small.		Replace the motor with a larger capacity model.	
Overload during low-speed operation.		Decrease the load during low-speed operation. Increase the motor capacity.	
The torque compensation is too large.		Readjust the torque compensation value (Pr.07-26 torque compensation gain) till the output current decreases and the motor does not stall.	
Improper parameter settings for the speed tracking function (including restart after momentary power loss and restart after fault)		Correct the parameter settings for speed tracking. Start the speed tracking function. Adjust the maximum current for Pr.07-09 speed tracking.	

No.	Display on LED Keypad	Warning Name	Descriptions
21	ot2	Over-torque 1 (ot2)	Over-torque 2 warning
Action and Reset			
Action Condition		Pr.06-10	
Action Time		Pr.06-11	
Warning setting parameter		Pr.06-09 Over-torque Detection Selection (Motor 2) = 1 or 3 0: No function 1: Continue operation after over-torque detection during constant speed operation 2: Stop after over-torque detection during constant speed operation 3: Continue operation after over-torque detection during RUN 4: Stop after over-torque detection during RUN	
Reset Method		The warning is automatically cleared when the output current < (Pr.06-10 – 5%).	
Reset Condition		The warning is automatically cleared when the output current < (Pr.06-10 – 5%).	
Record		N/A	
Cause		Corrective Actions	
Incorrect parameter setting		Reset Pr.06-10 and Pr.06-11	
Mechanical error (e.g. Mechanical lock due to over-torque)		Remove the causes of malfunction.	
The load is too large.		Decrease the load. Replace the motor with a larger capacity model.	
Accel./ Decel. time and working cycle is too short.		Increase the setting values for Pr.01-12–01-19 (accel./ decel. time).	
V/F voltage is too high.		Adjust the settings for Pr.01-35–01-42 (V/F curve) , especially the setting value for the mid-point voltage (if the mid-point voltage is set too low, the load capacity decreases at low speed).	
The motor capacity is too small.		Replace the motor with a larger capacity model.	
Overload during low-speed operation.		Decrease the load during low-speed operation. Increase the motor capacity.	
The torque compensation is too large.		Readjust the torque compensation value (Pr.07-26 torque compensation gain) till the output current decreases and the motor does not stall.	
Improper parameter settings for the speed tracking function (including restart after momentary power loss and restart after fault)		Correct the parameter settings for speed tracking. Start the speed tracking function. Adjust the maximum current for Pr.07-09 speed tracking.	

No.	Display on LED Keypad	Warning Name	Descriptions
24	oSL	Over slip warning (oSL)	Over slip warning. By using the maximum slip (Pr.10-29) as the base, when the drive outputs at constant speed, and the FV > H or F < H exceeds Pr.07-29 level and Pr.07-30 setting time, 100% Pr.07-29 = Pr.10-29.
Action and Reset			
Action Condition		When the drive outputs at constant speed, and F > H or F < H exceeds the Pr.07-29 level.	
Action Time		Pr.07-30	
Warning setting parameter		Pr.07-31 = 0 Warning 0: Warn and continue operation 1: Fault and ramp to stop 2: Fault and coast to stop 3: No warning	
Reset Method		When Pr.07-31 = 0 and when the drive outputs at constant speed, and F > H or F < H no longer exceeds the Pr.07-29 level, the oSL warning automatically clears.	
Reset Condition		N/A	
Record		N/A	
Cause		Corrective Actions	
Any of the motor parameters in parameter group 05 may be incorrect.		Check the motor parameter.	
The load is too large.		Decrease the load.	
Check if the settings for Pr.07-29, Pr.07-30 and Pr.10-29 are properly set.		Check the parameter settings for oSL protection.	

No.	Display on LED Keypad	Warning Name	Descriptions
25	tUn	Auto tuning (tUn)	Parameter auto-tuning is processing. When running auto-tuning, the keypad displays “tUn”.
Action and Reset			
Action Condition		When running Pr.05-00 motor parameter auto-tuning, the keypad displays “tUn”.	
Action Time		N/A	
Warning setting parameter		N/A	
Reset Method		When auto-tuning is finished and no error occurs, the warning automatically clears.	
Reset Condition		When auto-tuning is finished and no error occurs.	
Record		N/A	
Cause		Corrective Actions	
The motor parameter is running auto-tuning.		When the auto-tuning is finished, the warning automatically clears.	

No.	Display on LED Keypad	Warning Name	Descriptions
28	oPHL	Output phase loss (oPHL)	Output phase loss of the drive
Action and Reset			
Action Condition		Pr.06-47	
Action Time		N/A	
Warning setting parameter		Pr.06-45 0: Warn and continue operation 1: Fault and ramp to stop 2: Fault and coast to stop 3: No warning	
Reset Method		If Pr.06-45 is set to 0, the oPHL warning automatically clears after the drive stops.	
Reset Condition		N/A	
Record		N/A	
Cause		Corrective Actions	
Unbalanced three-phase impedance of the motor		Replace the motor.	
Check if the wiring is incorrect.		Check the cable. Replace the cable.	
Check if the motor is a single-phase motor.		Choose a three-phase motor.	
Check if the current sensor is broken.		Check if the control board cable is loose. If yes, reconnect the cable and run the drive to test. If the error still occurs, send the drive back to the factory for repair. Check if the three-phase current is balanced with a current clamp meter. If the current is balanced and the oPHL error still shows on the display, return to the factory for repair.	
Check if the drive capacity is larger than the motor capacity.		Choose the drive that matches the motor capacity.	

No.	Display on LED Keypad	Warning Name	Descriptions
30	SE3	Copy model error 3 (SE3)	Keypad COPY error 3: copy model error
Action and Reset			
Action Condition		“SE3” warning occurs when different drive identity codes are found during copying parameters.	
Action Time		Immediately displays when the fault is detected	
Warning setting parameter		N/A	
Reset Method		Manual reset	
Reset Condition		N/A	
Record		N/A	
Cause		Corrective Actions	
Parameter copy between different power range drives		It is mainly to prevent parameter copies between different HP/models.	

No.	Display on LCD Keypad	Warning Name	Descriptions
36	CGdn	CANopen guarding time-out (CGdn)	CANopen guarding time-out 1
Action and Reset			
Action Condition		When CANopen Node Guarding detects that one of the slaves does not respond, the CGdn error displays. The upper unit sets the factor and time during configuration.	
Action Time		The time that upper unit sets during configuration	
Warning setting parameter		N/A	
Reset Method		Manual reset	
Reset Condition		The upper unit sends a reset package to clear this fault.	
Record		N/A	
Cause		Corrective Actions	
The guarding time is too short.		Increase guarding time (Index 100C)	
Malfunction caused by interference		1. Verify the wiring and grounding of the communication circuit. It is recommended to separate the communication circuit from the main circuit, or wire in 90 degrees for effective anti-interference performance. 2. Make sure the communication circuit is wired in series. 3. Use CANopen cable or add terminating resistance.	

No.	Display on LCD Keypad	Warning Name	Descriptions
37	CHbn	CANopen heartbeat error (CHbn)	CANopen heartbeat error
Action and Reset			
Action Condition		When CANopen Heartbeat detects that one of the slaves does not respond, the CHbn fault occurs. The upper unit sets the confirming time of producer and consumer during configuration.	
Action Time		The upper unit sets the confirming time of producer and consumer during configuration.	
Warning setting parameter		N/A	
Reset Method		Manual reset	
Reset Condition		The upper unit sends a reset package to clear this fault.	
Record		When Pr.00-21 ≠ 3, CHbn is a “Warning”, and the warning is not recorded.	
Cause		Corrective Actions	
The heartbeat time is too short.		Increase heartbeat time (Index 1016)	
Malfunction caused by interference		1. Verify the wiring and grounding of the communication circuit. It is recommended to separate the communication circuit from the main circuit, or wire in 90 degrees for effective anti-interference performance. 2. Make sure the communication circuit is wired in series. 3. Use CANopen cable or add terminating resistance.	
Communication cable is broken or bad connected.		Check the cable and replace it if necessary.	

No.	Display on LCD Keypad	Warning Name	Descriptions
39	CbFn	CANopen bus off error (CbFn)	CANopen BUS off error
Action and Reset			
Action Condition		Hardware	When CANopen card is not installed, the CbFn warning occurs.
		Software	When the master receives wrong communication package, the CbFn warning occurs. Too much interference on BUS The master receives wrong package when the CAN_H and CAN_L communication cables are short, CbFn warning occurs.
Action Time		Immediately displays when the fault is detected.	
Warning setting parameter		N/A	
Reset Method		Manual reset	
Reset Condition		Cycle the power	
Record		When Pr.00-21 ≠ 3, CbFn is a “Warning”, and the warning is not recorded.	
Cause		Corrective Actions	
Check if the CANopen speed is correct.		Reset CANopen speed (Pr.09-37)	
Malfunction caused by interference		1. Verify the wiring and grounding of the communication circuit. It is recommended to separate the communication circuit from the main circuit, or wire in 90 degrees for effective anti-interference performance. 2. Make sure the communication circuit is wired in series. 3. Use CANopen cable or add terminating resistance.	
Communication cable is broken or bad connected.		Check the cable and replace it if necessary.	

No.	Display on LCD Keypad	Warning Name	Descriptions
46	CPtn	CANopen format error (CPtn)	CANopen protocol format error
Action and Reset			
Action Condition		The slave detects that communication data from the upper unit cannot be recognized, and then CPtn warning occurs.	
Action Time		Immediately displays when the fault is detected	
Warning setting parameter		N/A	
Reset Method		The upper unit sends a reset package to clear the warning.	
Reset Condition		N/A	
Record		N/A	
Cause		Corrective Actions	
The upper unit sends incorrect communication packet.		Make sure the master sends the packet based on CANopen DS301 standard command format.	

No.	Display on LCD Keypad	Warning Name	Descriptions
101	ictn	Rectifier Module and Inverter Module communication time-out (ictn)	Rectifier axis observes the connection status of the inverter axis. If any inverter axis is disconnected, ictn warning occurs.
Action and Reset			
Action Condition		Communication disconnection timeout of the rectifier and inverter axis.	
Action Time		The rectifier is unable to communicate with the inverter for 5 seconds.	
Warning setting parameter		N/A	
Reset Method		The warning will be automatically cleared after the connection is restored.	
Reset Condition		N/A	
Record		N/A	
Cause		Corrective Actions	
Poor contact between backplane and modules		Power off and then power on again. Re-plug the modules.	

No.	Display on LED Keypad	Warning Name	Descriptions
102	dEb	Deceleration energy backup error (dEb)	When Pr.07-13 is not 0, and the power is suddenly off, causing the DC bus voltage lower than the dEb action level, the dEb function acts and the motor ramps to stop. Then dEb displays on the keypad.
Action and Reset			
Action Condition		When Pr.07-13 is not 0, and the DC bus voltage is lower than the level of dEb.	
Action Time		Immediately act	
Fault Treatment Parameter		N/A	
Reset Method		Auto	When Pr.07-13 = 2 (dEb with auto-acceleration / auto-deceleration, the drive outputs the frequency after the power is restored): dEb is automatically cleared.
		Manual	When Pr.07-13 = 1 (dEb with auto-acceleration / auto-deceleration, the drive does not output the frequency after the power is restored): The drive stops when dEb acts and the rotation speed becomes 0Hz, then the drive can be reset manually.
Reset Condition		Auto: The fault is automatically cleared. Manual: When the drive decelerates to 0 Hz.	
Record		Yes	
Cause		Corrective Actions	
Unstable power source or the power is off.		Check the power system.	
There is any other large load operates in the power system.		Replace power system with a larger capacity. Use a different power system from the large load system.	

No.	Display on LED Keypad	Warning Name	Descriptions
103	dEv	PID feedback fault (dEv)	PID feedback fault
Action and Reset			
Action Condition		The feedback deviation is lower than the setting of Pr.08-13.	
Action Time		Pr.08-14	
Fault Treatment Parameter		Pr.08-62	
Reset Method		Manual reset	
Reset Condition		When the feedback returns to the setting range of Pr.08-13, it will be reset automatically.	
Record		Yes	
Cause		Corrective Actions	
PID feedback loss		Check whether the feedback is error or disconnected.	
Pressure sensor error		Check whether the feedback is error or disconnected.	
Insufficient pressure		Check whether the feedback is error or disconnected.	

No.	Display on LED Keypad	Warning Name	Descriptions
104		IO card disconnected (iocb)	IO card disconnected warning
Action and Reset			
Action Condition		IO card disconnected	
Action Time		N/A	
Fault Treatment Parameter		N/A	
Reset Method		Auto reset when IO card is reinstalled correctly	
Reset Condition		Immediate reset	
Record		No	
Cause		Corrective Actions	
IO card is not installed properly		Reinstall IO card.	

No.	Display on LED Keypad	Warning Name	Descriptions
127	HPL	Hardware positive limit (HPL)	When under FOCPG mode, the positive running limit (hardware limit switch) of the MI terminals is activated.
Action and Reset			
Action Condition		When under IMFOCPG / PMFOCPG mode, the motor drive reaches positive running limit.	
Action Time		Immediately acts	
Fault Treatment Parameter		N/A	
Reset Method		Move the motor away from the limit position, the warning automatically clears.	
Reset Condition		Immediately resets	
Record		N/A	
Cause		Corrective Actions	
Error occurs on hardware limit switch		1. Verify if the switch of hardware limit works properly. 2. Verify if the switch of hardware limit is installed at the right position. 3. Verify if the corresponding MI terminals of the positive limit switch is at the right status such as Normal Open and Normal Close.	
Overshoot		1. Verify if the Acceleration/ Deceleration time of the motor drive is right. 2. Verify if the frequency command of the motor drive is right.	
Select the wrong homing method		Verify if the mechanical parts and homing method co-work properly.	

No.	Display on LED Keypad	Warning Name	Descriptions
128	HnL	Hardware negative limit (HnL)	When under FOCPG mode, the negative running limit (hardware limit switch) of the MI terminals is activated.
Action and Reset			
Action Condition		When under IMFOCPG / PMFOCPG mode, the motor drive reaches negative running limit.	
Action Time		Immediately acts	
Fault Treatment Parameter		N/A	
Reset Method		Move the motor away from the limit position, the warning automatically clears.	
Reset Condition		Immediately reset	
Record		N/A	
Cause		Corrective Actions	
Error occurs on hardware limit switch		1. Verify if the switch of hardware limit works properly. 2. Verify if the switch of hardware limit is installed at the right position. 3. Verify if the corresponding MI terminals of the positive limit switch is at the right status such as Normal Open and Normal Close.	
Overshoot		1. Verify if the acceleration/ deceleration time of the motor drive is right. 2. Verify if the frequency command of the motor drive is right	
Select the wrong homing method		Verify if the mechanical parts and homing method co-work properly.	

No.	Display on LED Keypad	Warning Name	Descriptions
145	bACn	Modbus address conflict (bACn)	Any two inverter axes have the same Modbus address in one multi-drive.
Action and Reset			
Action Condition		Any two inverter axes have the same Modbus address in one multi-drive.	
Action Time		Immediately act	
Fault Treatment Parameter		N/A	
Reset Method		Modify the duplicate Modbus address of the inverter axis. After modification, the warning will be cleared automatically.	
Reset Condition		N/A	
Record		No	
Cause		Corrective Actions	
The Modbus address duplication of the inverter axis.		Check the Pr.09-00 value of each inverter axis to avoid the Modbus address duplication	
The inverter module firmware version mismatch.		Upgrade the inverter module firmware version to v1.02 or above	

No.	Display on LED Keypad	Warning Name	Descriptions
150	Edtn	Ethernet communication time-out (Edtn)	Communication time-out between rectifier and PLC
Action and Reset			
Action Condition		The rectifier do not receive the communication packet from the upper unit. When this communication disconnection occurs, the rectifier issues the warning.	
Action Time		100ms (default), can be set by the upper unit	
Fault Treatment Parameter		N/A	
Reset Method		The warning will be automatically cleared after the connection is restored.	
Reset Condition		N/A	
Record		No	
Cause		Corrective Actions	
Cable disconnection or bad connection		Check the cable and replace it if necessary.	
Insufficient performance network card (Example: USB to Ethernet)		Change network card.	

No.	Display on LED Keypad	Warning Name	Descriptions
152	EACn	Ethernet slot conflict (EACn)	Any two inverter axes have the same Ethernet slot No.in one multi-drive.
Action and Reset			
Action Condition		Any two inverter axes have the same Ethernet slot No. in one multi-drive.	
Action Time		Immediately act	
Fault Treatment Parameter		N/A	
Reset Method		Modify the duplicate Ethernet slot No., and cycle the power.	
Reset Condition		N/A	
Record		No	
Cause		Corrective Actions	
The Ethernet slot No.duplication of the inverter axis.		Check the Pr.09-57 value of each inverter axis to avoid the Ethernet slot No. duplication.	
The inverter module firmware version mismatch.		Upgrade the inverter module firmware version to v1.02 or above.	

No.	Display on LED Keypad	Warning Name	Descriptions
153	EitH	Ethernet Internal communication time-out (Eitn)	Ethernet internal communication error between the rectifier axis and the inverter axis in one multi-drive.
Action and Reset			
Action Condition		Rectifier axis detects communication time-out	
Action Time		100ms	
Fault Treatment Parameter		Pr.09-73 Communication abnormal Treat 0: Send fault notification to the upper unit 1: Do not send fault notification to the upper unit	
Reset Method		Automatically reset	
Reset Condition		The error will be automatically cleared after communication restored.	
Record		No	
Cause		Corrective Actions	
Poor connection between modules		Check the installation and reinstall.	
Rectifier or inverter error occurs		Reset error	

8-3 Fault Codes and Troubleshooting

No.	Display on LED Keypad	Fault Name	Descriptions
1	ocA	Over-current during acceleration (ocA)	Output current exceeds 2.5 times of the rated current during acceleration. When ocA occurs, the drive closes the gate of the output immediately, the motor runs freely, and the display shows an ocA error.
Action and Reset			
Action Condition		250% of the rated current (software)	
Action Time		Immediately act	
Fault Treatment Parameter		N/A	
Reset Method		Manual reset	
Reset Condition		Reset in five seconds after the fault is cleared	
Record		Yes	
Cause		Corrective Actions	
Acceleration time setting is too short.		1. Increase the acceleration time 2. Increase the acceleration time of S-curve 3. Set auto-acceleration and auto-deceleration parameter (Pr.01-44) 4. Set over-current stall prevention function (Pr.06-03) 5. Replace the drive with a larger capacity model.	
Short-circuit at motor output due to poor insulation wiring.		Check the motor cable and remove causes of the short circuits, or replace the cable before turning on the power.	
Motor burnout or aging insulation occurred		Check the motor insulation value with megger. Replace the motor if the insulation is poor.	
The load is too large.		Check if the output current during the whole working process exceeds the AC motor drive's rated current. If yes, replace the AC motor drive with a larger capacity model.	
Impulsive change of the load		Reduce the load or increase the capacity of AC motor drive.	
Use special motor or motor with larger capacity than the drive.		Check the motor capacity (the rated current on the motor's nameplate should ≤ the rated current of the drive)	
Use ON / OFF controller of an electromagnetic contactor at the output (U/V/W) of the drive.		Check the action timing of the contactor and make sure it is not turned ON / OFF when the drive outputs the voltage.	
V/F curve setting error		Adjust the V/F curve setting and frequency/voltage. When the fault occurs, and the frequency voltage is too high, reduce the voltage.	
The torque compensation is too large.		Readjust the torque compensation value (Pr.07-26 torque compensation gain) till the output current decreases and the motor does not stall.	
Malfunction caused by interference		Verify the wiring of the control circuit and the wiring/grounding of the main circuit to prevent interference.	
The motor starts when in free run		Enable the speed tracking during start-up of Pr.07-12.	

Improper parameter settings for the speed tracking function (including restart after momentary power loss and restart after fault).	Correct the parameter settings for speed tracking. 1. Start the speed tracking function. 2. Adjust the maximum current for Pr.07-09 speed tracking.
Incorrect combination of control mode and used motor	Check the settings for Pr.00-11 control mode: 1. For IM, Pr.00-11 = 0, 2, Pr.05-33 = 0 2. For PM, Pr.00-11 = 2, Pr.05-33 = 1, 2
The length of motor cable is too long.	Increase the drive capacity. Install AC reactor(s) on the output side (U/V/W).
Hardware failure	The ocA occurs due to the short circuit or ground fault at the output side of the drive. Check for possible short circuits between terminals with the electric meter. If short circuits occur, return to the factory for repair. B1 corresponds to U, V and W; DC- corresponds to U, V and W; ⏚ corresponds to U, V and W.
Check if the setting for stall prevention is correct.	Set the stall prevention to the proper value.

No.	Display on LED Keypad	Fault Name	Descriptions
2	ocd	Over-current during deceleration (ocd)	Output current exceeds 2.5 times of the rated current during deceleration. When ocd occurs, the drive closes the gate of the output immediately, the motor runs freely, and the display shows an ocd error.
Action and Reset			
Action Condition		250% of the rated current	
Action Time		Immediately act	
Fault Treatment Parameter		N/A	
Reset Method		Manual reset	
Reset Condition		Reset in five seconds after the fault is cleared.	
Record		Yes	
Cause		Corrective Actions	
Acceleration time setting is too short.		1. Increase the deceleration time. 2. Increase the deceleration time of S-curve. 3. Set auto-acceleration and auto-deceleration parameter (Pr.01-44). 4. Set over-current stall prevention function (Pr.06-03). 5. Replace the drive with a larger capacity model.	
Check if the mechanical brake of the motor activates too early.		Check the action timing of the mechanical brake.	
Short-circuit at motor output due to poor insulation wiring.		Check the motor cable and remove causes of the short circuits, or replace the cable before turning on the power.	
Motor burnout or aging insulation occurred.		Check the motor insulation value with megger. Replace the motor if the insulation is poor.	
The load is too large		Check if the output current during the whole working process exceeds the AC motor drive's rated current. If yes, replace the AC motor drive with a larger capacity model.	
Impulsive change of the load		Reduce the load or increase the capacity of AC motor drive.	
Use special motor or motor with larger capacity than the drive.		Check the motor capacity (the rated current on the motor's nameplate should ≤ the rated current of the drive)	
Use ON / OFF controller of an electromagnetic contactor at the output (U/V/W) of the drive.		Check the action timing of the contactor and make sure it is not turned ON / OFF when the drive outputs the voltage.	
V/F curve setting error		Adjust the V/F curve setting and frequency / voltage. When the fault occurs, and the frequency voltage is too high, reduce the voltage.	
The torque compensation is too large.		Readjust the torque compensation value (Pr.07-26 torque compensation gain) till the output current decreases and the motor does not stall.	
Malfunction caused by interference		Verify the wiring of the control circuit and the wiring / grounding of the main circuit to prevent interference.	
The length of motor cable is too long.		Increase the drive capacity. Install AC reactor(s) on the output side (U/V/W).	

Hardware error	The ocd occurs due to the short circuit or ground fault at the output side of the drive. Check for possible short circuits between terminals with the electric meter. If short circuits occur, return to the factory for repair. B1 corresponds to U, V and W; DC- corresponds to U, V and W; ⏚ corresponds to U, V and W.
Check if the setting for stall prevention is correct.	Set the stall prevention to the proper value.

No.	Display on LED Keypad	Fault Name	Descriptions
3	ocn	Over-current during steady operation (ocn)	Output current exceeds 2.5 times of the rated current during constant speed. When ocn occurs, the drive closes the gate of the output immediately, the motor runs freely, and the display shows an ocn error.

Action and Reset	
Action Condition	250% of the rated current
Action Time	Immediately act
Fault Treatment Parameter	N/A
Reset Method	Manual reset
Reset Condition	Reset in five seconds after the fault is cleared.
Record	Yes

Cause	Corrective Actions
Short-circuit at motor output due to poor insulation wiring.	Check the motor cable and remove causes of the short circuits, or replace the cable before turning on the power.
Motor burnout or aging insulation occurred.	Troubleshoot the motor shaft lock. Check the motor insulation value with megger. Replace the motor if the insulation is poor.
Impulsive change of the load	Reduce the load or increase the capacity of AC motor drive.
Use special motor or motor with larger capacity than the drive.	Check the motor capacity (the rated current on the motor's nameplate should ≤ the rated current of the drive)
Use ON / OFF controller of an electromagnetic contactor at the output (U/V/W) of the drive.	Check the action timing of the contactor and make sure it is not turned ON / OFF when the drive outputs the voltage.
V/F curve setting error	Adjust the V/F curve setting and frequency / voltage. When the fault occurs, and the frequency voltage is too high, reduce the voltage.
The torque compensation is too large.	Readjust the torque compensation value (Pr.07-26 torque compensation gain) till the output current decreases and the motor does not stall.
Malfunction caused by interference	Verify the wiring of the control circuit and the wiring / grounding of the main circuit to prevent interference.
The length of motor cable is too long.	Increase the drive capacity. Install AC reactor(s) on the output side (U/V/W).
Hardware error	The ocn occurs due to short circuit or ground fault at the output side of the drive. Check for possible short circuits between terminals with the electric meter. If short circuits occur, return to the factory for repair. B1 corresponds to U, V and W; DC- corresponds to U, V and W; ⏚ corresponds to U, V and W.

No.	Display on LED Keypad	Fault Name	Descriptions
4	GFF	Ground fault (GFF)	When the drive detects grounding short circuit on the output terminals (U/V/W), the drive closes the gate of the output immediately, the motor runs freely, and the display shows a GFF error.
Action and Reset			
Action Condition		N/A	
Action Time		N/A	
Fault Treatment Parameter		N/A	
Reset Method		Manual reset	
Reset Condition		Reset in five seconds after the fault is cleared.	
Record		Yes	
Cause		Corrective Actions	
Motor burnout or aging insulation occurred.		Check the motor insulation value with megger. Replace the motor if the insulation is poor.	
Short circuit due to broken cable.		Troubleshoot the short circuit. Replace the cable.	
Larger stray capacitance of the cable and terminal ⏚.		If the motor cable length exceeds 100 m, decrease the setting value for the carrier frequency. Take remedies to reduce stray capacitance.	
Malfunction caused by interference		Verify the grounding and wiring of the communication circuit. It is recommended to separate the communication circuit from the main circuit, or wire in 90 degree for effective anti-interference performance.	
Hardware failure		Cycle the power after checking the status of motor, cable and cable length. If GFF still exists, return to the factory for repair.	
Over-current at constant speed		Refer to the corrective actions for ocn.	
Over-current during acceleration		Refer to the corrective actions for ocA.	
Over-current during deceleration		Refer to the corrective actions for ocd.	

No.	Display on LED Keypad	Fault Name	Descriptions
6	ocS	Over-current at stop (ocS)	Over-current or hardware failure in current detection at stop. Cycle the power after ocS occurs. If the hardware failure occurs, the display shows cd1, cd2 or cd3.
Action and Reset			
Action Condition		240% of the rated current	
Action Time		Immediately act	
Fault Treatment Parameter		N/A	
Reset Method		Manual reset	
Reset Condition		Reset in five seconds after the fault is cleared.	
Record		Yes	
Cause		Corrective Actions	
Malfunction caused by interference		Verify the wiring of the control circuit and the wiring / grounding of the main circuit to prevent interference.	
Hardware error		Check if other error codes such as cd1–cd3 occur after cycling the power. If yes, return to the factory for repair.	

No.	Display on LED Keypad	Fault Name	Descriptions
7	oūA	Over-voltage during acceleration (ovA)	DC bus over-voltage during acceleration. When ovA occurs, the drive closes the gate of the output, the motor runs freely, and the display shows an ovA error.
Action and Reset			
Action Condition		230V models: 410V_{DC} 460V models: 820V_{DC}	
Action Time		Immediately act when the DC bus voltage is higher than the level.	
Fault Treatment Parameter		N/A	
Reset Method		Manual reset	
Reset Condition		Reset only when the DC bus voltage is lower than 90% of the over-voltage level.	
Record		Yes	
Cause		Corrective Actions	
Acceleration is too slow. (e.g. when lifting load decreases acceleration time.)		Decrease the acceleration time. Use a braking unit or DC bus. Replace with a drive with larger capacity model.	
The setting for stall prevention level is smaller than no-load current.		The setting for stall prevention level should be larger than no-load current.	
Power voltage is too high.		Check if the input voltage is within the rated AC motor drive input voltage range, and check for possible voltage spikes.	
ON / OFF switch action of phase-in capacitor in the same power system		If the phase-in capacitor or active power supply unit acts in the same power system, the input voltage may surge abnormally in a short time. In this case, install an AC reactor.	
Regenerative voltage of motor inertia		Use over-voltage stall prevention function (Pr.06-01). Use auto-acceleration and auto-deceleration parameter (Pr.01-44). Use a braking unit or DC bus.	
Acceleration time is too short.		Check if the over-voltage warning occurs after acceleration stops. When the warning occurs, do the following: 1. Increase the acceleration time. 2. Set Pr.06-01 over-voltage stall prevention. 3. Increase the setting value for Pr.01-25 S-curve acceleration arrival time 2.	
Motor ground fault		The ground short circuit current charges the capacitor in the main circuit through the power. Check if there is ground fault on the motor cable, wiring box and its internal terminals. Troubleshoot the ground fault.	
Incorrect wiring of brake resistor or brake unit.		Check the wiring of brake resistor or brake unit.	
Malfunction caused by interference		Verify the wiring of the control circuit and the wiring / grounding of the main circuit to prevent interference.	

No.	Display on LED Keypad	Fault Name	Descriptions
8	oūd	Over-voltage during deceleration (ovd)	DC bus over-voltage during deceleration. When ovd occurs, the drive closes the gate of the output immediately, the motor runs freely, and the display shows an ovd error.
Action and Reset			
Action Condition		230V models: 410V_{DC} 460V models: 820V_{DC}	
Action Time		Immediately act when the DC bus voltage is higher than the level.	
Fault Treatment Parameter		N/A	
Reset Method		Manual reset	
Reset Condition		Reset only when the DC bus voltage is lower than 90% of the over-voltage level.	
Record		Yes	
Cause		Corrective Actions	
Deceleration time is too short, causing too large regenerative energy of the load.		1. Increase the setting value of Pr.01-13, Pr.01-15, Pr.01-17 and Pr.01-19 (deceleration time). 2. Connect the brake resistor, braking unit or DC bus to the drive. 3. Reduce the brake frequency. 4. Replace with a drive with larger capacity. 5. Use S-curve acceleration / deceleration. 6. Use over-voltage stall prevention function (Pr.06-01). 7. Use auto-acceleration and auto-deceleration parameter (Pr.01-44). 8. Adjust braking level (Pr.07-01 or the bolt position of the brake unit).	
The setting for stall prevention level is smaller than no-load current.		The setting for stall prevention level should be larger than no-load current.	
Power voltage is too high.		Check if the input voltage is within the rated AC motor drive input voltage range, and check for possible voltage spikes.	
ON / OFF switch action of phase-in capacitor in the same power system.		If the phase-in capacitor or active power supply unit acts in the same power system, the input voltage may surge abnormally in a short time. In this case, install an AC reactor.	
Motor ground fault		The ground short circuit current charges the capacitor in the main circuit through the power. Check if there is ground fault on the motor cable, wiring box and its internal terminals. Troubleshoot the ground fault.	
Incorrect wiring of brake resistor or brake unit.		Check the wiring of brake resistor or brake unit.	
Malfunction caused by interference		Verify the wiring of the control circuit and the wiring / grounding of the main circuit to prevent interference.	

No.	Display on LED Keypad	Fault Name	Descriptions
9		Over-voltage during constant speed (ovn)	DC bus over-voltage at constant speed. When ovn occurs, the drive closes the gate of the output immediately, the motor runs freely, and the display shows an ovn error.
Action and Reset			
Action Condition		230V models: 410V_{DC} 460V models: 820V_{DC}	
Action Time		Immediately act when the DC bus voltage is higher than the level.	
Fault Treatment Parameter		N/A	
Reset Method		Manual reset	
Reset Condition		Reset only when the DC bus voltage is lower than 90% of the over-voltage level.	
Record		Yes	
Cause		Corrective Actions	
Impulsive change of the load.		1. Connect brake resistor, brake unit or DC bus to the drive. 2. Reduce the load. 3. Replace with a drive with larger capacity. 4. Adjust braking level (Pr.07-01 or the bolt position of the brake unit).	
The setting for stall prevention level is smaller than no-load current.		The setting for stall prevention level should be larger than no-load current.	
Regenerative voltage of motor inertia.		Use over-voltage stall prevention function (Pr.06-01). Use a braking unit or DC bus.	
Power voltage is too high.		Check if the input voltage is within the rated AC motor drive input voltage range, and check for possible voltage spikes.	
ON / OFF switch action of phase-in capacitor in the same power system.		If the phase-in capacitor or active power supply unit acts in the same power system, the input voltage may surge abnormally in a short time. In this case, install an AC reactor.	
Motor ground fault		The ground short circuit current charges the capacitor in the main circuit through the power. Check if there is ground fault on the motor cable, wiring box and its internal terminals. Troubleshoot the ground fault.	
Incorrect wiring of brake resistor or brake unit.		Check the wiring of brake resistor or brake unit.	
Malfunction caused by interference		Verify the wiring of the control circuit and the wiring / grounding of the main circuit to prevent interference.	

No.	Display on LED Keypad	Fault Name	Descriptions
10	oU5	Over-voltage at stop (ovS)	Over-voltage at stop
Action and Reset			
Action Condition		230V models: 410V_{DC} 460V models: 820V_{DC}	
Action Time		Immediately act when the DC bus voltage is higher than the level.	
Fault Treatment Parameter		N/A	
Reset Method		Manual reset	
Reset Condition		Reset only when the DC bus voltage is lower than 90% of the over-voltage level.	
Record		Yes	
Cause		Corrective Actions	
Power voltage is too high.		Check if the input voltage is within the rated AC motor drive input voltage range, and check for possible voltage spikes.	
ON / OFF switch action of phase-in capacitor in the same power system.		If the phase-in capacitor or active power supply unit acts in the same power system, the input voltage may surge abnormally in a short time. In this case, install an AC reactor.	
Incorrect wiring of brake resistor or brake unit.		Check the wiring of brake resistor or brake unit.	
Malfunction caused by interference		Verify the wiring of the control circuit and the wiring / grounding of the main circuit to prevent interference.	
Hardware failure in voltage detection		Check if other error codes such as cd1–cd3 occur after cycling the power. If yes, return to the factory for repair.	
Motor ground fault		The ground short circuit current charges the capacitor in the main circuit through the power. Check if there is ground fault on the motor cable, wiring box and its internal terminals. Troubleshoot the ground fault.	

No.	Display on LED Keypad	Fault Name	Descriptions
11	LvA	Low-voltage during acceleration (LvA)	DC bus voltage is lower than Pr.06-00 setting value during acceleration.
Action and Reset			
Action Condition		Pr.06-00 (Default = depends on the model)	
Action Time		Immediately act when the DC bus voltage is lower than Pr.06-00.	
Fault Treatment Parameter		N/A	
Reset Method		Manual reset	
Reset Condition		Reset when DC bus voltage is higher than Pr.06-00 + 30V (230V series) / + 60V (460V series).	
Record		N/A	
Cause		Corrective Actions	
Power-off		Improve power supply condition.	
Power voltage changes		Adjust voltage to the power range of the drive.	
Start up the motor with large capacity.		Check the power system. Increase the capacity of power equipment.	
The load is too large.		Reduce the load. Increase the drive capacity. Increase the acceleration time.	
DC bus		Install DC reactor(s).	
Check if there is short circuit plate or any DC reactor installed between terminal +1 and +2.		Connect short circuit plate or DC reactor between terminal +1 and +2. If the error still exists, return to the factory for repair.	

No.	Display on LED Keypad	Fault Name	Descriptions
12		Low-voltage during deceleration (Lvd)	DC bus voltage is lower than Pr.06-00 setting value during deceleration.
Action and Reset			
Action Condition		Pr.06-00 (Default = depends on the model)	
Action Time		Immediately act when the DC bus voltage is lower than Pr.06-00.	
Fault Treatment Parameter		N/A	
Reset Method		Manual reset	
Reset Condition		Reset when DC bus voltage is higher than Pr.06-00 + 30V (230V series) / + 60V (460V series).	
Record		N/A	
Cause		Corrective Actions	
Power-off		Improve power supply condition.	
Power voltage changes		Adjust voltage to the power range of the drive.	
Start up the motor with large capacity.		Check the power system. Increase the capacity of power equipment.	
Sudden load		Reduce the load. Increase the drive capacity.	
DC bus		Install DC reactor(s).	

No.	Display on LED Keypad	Fault Name	Descriptions
13	LUn	Low-voltage at constant speed (Lvn)	DC bus voltage is lower than Pr.06-00 setting value at constant speed.
Action and Reset			
Action Condition		Pr.06-00 (Default = depends on the model)	
Action Time		Immediately act when the DC bus voltage is lower than Pr.06-00.	
Fault Treatment Parameter		N/A	
Reset Method		Manual reset	
Reset Condition		Reset when DC bus voltage is higher than Pr.06-00 + 30V (230V series) / + 60V (460V series).	
Record		N/A	
Cause		Corrective Actions	
Power-off		Improve power supply condition.	
Power voltage changes		Adjust voltage to the power range of the drive.	
Start up the motor with large capacity.		Check the power system. Increase the capacity of power equipment.	
Sudden load		Reduce the load. Increase the drive capacity.	
DC bus		Install DC reactor(s).	

No.	Display on LED Keypad	Fault Name	Descriptions
14	LvS	Low-voltage at stop (LvS)	1. DC bus voltage is lower than Pr.06-00 setting value at stop. 2. Hardware failure in voltage detection.
Action and Reset			
Action Condition		Pr.06-00 (Default = depends on the model)	
Action Time		Immediately act when the DC bus voltage is lower than Pr.06-00	
Fault Treatment Parameter		N/A	
Reset Method		Manual / Auto 230V models: Lv level + 30 V_{DC} + 500 ms 460V models: Lv level + 60 V_{DC} + 500 ms	
Reset Condition		500ms	
Record		Yes	
Cause		Corrective Actions	
Power-off		Improve power supply condition.	
Incorrect drive models		Check if the power specification matches the drive.	
Power voltage changes		Adjust voltage to the power range of the drive. Cycle the power after checking the power. If LvS error still exists, return to the factory for repair.	
Start up the motor with large capacity.		Check the power system. Increase the capacity of power equipment.	
DC bus		Install DC reactor(s).	

No.	Display on LED Keypad	Fault Name	Descriptions
15	orP	Phase loss protection (orP)	Phase loss of power input
Action and Reset			
Action Condition		When DC bus ripple is higher than the protection level, and the output current exceeds 50% of the rated current, the drive starts counting. When the counting value reaches the upper limit, an orP error occurs.	
Action Time		N/A	
Fault Treatment Parameter		Pr.06-53	
Reset Method		Manual reset	
Reset Condition		Immediately reset when DC bus is higher than Pr.07-00	
Record		Yes	
Cause		Corrective Actions	
Phase loss of input power		Correctly install the wiring of the main circuit power.	
Single phase power input to three-phase models.		Choose the model whose power matches the voltage.	
Power voltage changes		If the main circuit power works normally, verify the main circuit. Cycle the power after checking the power. If orP error still exists, return to the factory for repair.	
Loose wiring terminal of input power.		Tighten the terminal screws according to the torque described in the user manual.	
The input cable of three-phase power is cut off.		Wire correctly. Replace the cut off cable.	
Unbalanced three-phase of input power.		Check the power three-phase status.	

No.	Display on LED Keypad	Fault Name	Descriptions
16	oH1	Power components overheating (oH1)	Power components temperature exceeds the protection level. (Refer to Pr.06-15)
Action and Reset			
Action Condition		When Pr.06-15 is higher than the power components overheating protection level, the drive shows oH1 error without displaying oH1 warning.	
Action Time		Power components temperature exceeds the protection level for more than 100 ms, oH1 error occurs.	
Fault Treatment Parameter		N/A	
Reset Method		Manual reset	
Reset Condition		Reset only when power components temperature is lower than oH1 error level minus (-) 10°C	
Record		Yes	
Cause		Corrective Actions	
Check if the ambient temperature or temperature inside the cabinet is too high, or if there is obstruction in the ventilation hole of the control cabinet.		Check the ambient temperature. Regularly inspect the ventilation hole of the control cabinet. Change the installed place if there are heating objects, such as brake resistors, in the surroundings. Install / add cooling a fan or air conditioner to lower the temperature inside the cabinet.	
Check if there is any obstruction on the heat sink or if the fan is running.		Remove the obstruction or replace the cooling fan.	
Insufficient ventilation space		Increase ventilation space of the drive.	
Check if the drive matches the corresponded loading.		1. Decrease the load. 2. Decrease the carrier wave. 3. Replace with a drive with larger capacity.	
The drive has run 100% or more than 100% of the rated output for a long time.		Replace with a drive with larger capacity model.	

No.	Display on LED Keypad	Warning Name	Descriptions
17	oH2	Circuit board ambient temperature overheats (oH2)	The AC motor drive detects ambient over-heating of Circuit board, and exceeds the protection level.
Action and Reset			
Action Condition		When the circuit board ambient temperature of each model overheat exceeds 95%.	
Action Time		“oH2” warning occurs when circuit board ambient temperature exceeds the protection level continuely for 1 second.	
Warning setting parameter		N/A	
Reset Method		Manual reset	
Reset Condition		The drive can be reset when circuit board ambient temperature is lower than oH2 warning level minus (–) 10°C.	
Record		Yes	
Cause		Corrective Actions	
Check if the ambient temperature or temperature inside the cabinet is too high, or if there is obstruction in the ventilation hole of the control cabinet.		1. Check the ambient temperature. 2. Regularly inspect the ventilation hole of the control cabinet. 3. Change the installed place if there are heating objects, such as brake resistors, in the surroundings. 4. Install / add cooling a fan or air conditioner to lower the temperature inside the cabinet.	
Check if there is any obstruction on the heat sink or if the fan is running.		Remove the obstruction or replace the cooling fan.	
Insufficient ventilation space		Increase ventilation space of the drive.	
Check if the drive matches the corresponded loading.		1. Decrease the load. 2. Decrease the carrier wave. 3. Replace with a drive with larger capacity.	
The drive has run 100% or more than 100% of the rated output for a long time.		Replace with a drive with larger capacity.	
Unstable power source		Installing a reactor	
Frequent load changes		Reduce load variations	

No.	Display on LED Keypad	Fault Name	Descriptions
18	tH1o	IGBT temperature detection failure (tH1o)	IGBT hardware failure in temperature detection
Action and Reset			
Action Condition		NTC broken or wiring failure	
Action Time		When the IGBT temperature is higher than the protection level, and detection time exceeds 100 ms, the tH1o protection activates.	
Fault Treatment Parameter		N/A	
Reset Method		Manual reset	
Reset Condition		Immediately reset	
Record		Yes	
Cause		Corrective Actions	
Hardware error		Wait for 10 minutes, and then cycle the power. Check if tH1o protection still exists. If yes, return to the factory for repair.	

No.	Display on LED Keypad	Fault Name	Descriptions
19		Capacitor hardware fault (tH2o)	Hardware failure in capacitor temperature detection
Action and Reset			
Action Condition		NTC broken or wiring failure	
Action Time		When higher than the protection level and detection time exceeds 100 ms, the tH2o protection activates.	
Fault Treatment Parameter		N/A	
Reset Method		Manual reset	
Reset Condition		Immediately reset	
Record		Yes	
Cause		Corrective Actions	
Hardware error		Wait for 10 minutes, and then cycle the power. Check if tH2o protection still exists. If yes, return to the factory for repair.	

No.	Display on LED Keypad	Fault Name	Descriptions
21	oL	Over load (oL)	The AC motor drive detects excessive drive output current. • Normal duty: Sustains for one minute when the drive outputs 120% of the drive's rated output current. Sustains for three seconds when the drive outputs 150% of the drive's rated output current. • Heavy duty: Sustains for one minute when the drive outputs 150% of the drive's rated output current. Sustains for three seconds when the drive outputs 200% of the drive's rated output current.
Action and Reset			
Action Condition			Based on overload curve and derating curve (Pr.06-55).
Action Time			When the load is higher than the protection level and exceeds allowable time, the oL protection activates.
Fault Treatment Parameter			N/A
Reset Method			Manual reset
Reset Condition			Reset in five seconds after the fault is cleared
Record			Yes
Cause			Corrective Actions
The load is too large.			Reduce the load.
Accel./ Decel. time and working cycle is too short.			Increase the setting values for Pr.01-12–01-19 (accel./ decel. time).
V/F voltage is too high.			Adjust the settings for Pr.01-01–01-08 (V/F curve), especially the setting value for the mid-point voltage (if the mid-point voltage is set too low, the load capacity decreases at low speed). Refer to the V/F curve selection of Pr.01-43.
The capacity of the drive is too small.			Replace the drive with a larger capacity model.
Overload during low-speed operation..			Decrease the load during low-speed operation. Increase the drive capacity. Decrease the carrier frequency of Pr.00-17.
The torque compensation is too large.			Readjust the torque compensation value (Pr.07-26 torque compensation gain) till the output current decreases and the motor does not stall.
Check if the setting for stall prevention is correct.			Set the stall prevention to the proper value.
Output phase loss			Check the status of three-phase motor. Check if the cable is broken or the screws are loose.

Improper parameter settings for the speed tracking function (including restart after momentary power loss and restart after fault).	Correct the parameter settings for speed tracking. Start the speed tracking function. Adjust the maximum current for Pr.07-09 speed tracking.

No.	Display on LED Keypad	Fault Name	Descriptions
22	EoL 1	Electronic thermal relay 1 protection (EoL1)	Electronic thermal relay 1 protection. The drive coasts to stop once it activates.
Action and Reset			
Action Condition		Start counting when output current > 150% of motor 1 rated current.	
Action Time		Pr.06-14 (if the output current is larger than 105% of motor 1 rated current again within 60 sec., the counting time reduces and is less than Pr.06-14.)	
Fault Treatment Parameter		N/A	
Reset Method		Manual reset	
Reset Condition		Reset in five seconds after the fault is cleared	
Record		Yes	
Cause		Corrective Actions	
The load is too large.		Reduce the load.	
Accel./ Decel. time and working cycle is too short.		Increase the setting values for Pr.01-12–01-19 (accel./ decel. time).	
V/F voltage is too high.		Adjust the settings for Pr.01-01–01-08 (V/F curve) , especially the setting value for the mid-point voltage (if the mid-point voltage is set too low, the load capacity decreases at low speed).	
Overload during low-speed operation. When using a general motor, even it operates below rated current, an overload may still occur during low-speed operation.		Decrease low-speed operation time. Replace the drive with a dedicated to VFD model. Increase the motor capacity.	
When using VFD dedicated motors, Pr.06-13 = 0 (electronic thermal relay selection motor 1 = 0 inverter motor).		Pr.06-13 = 1 electronic thermal relay selection motor 1 = standard motor (motor with fan on the shaft).	
Incorrect value of electronic thermal relay.		Reset to the correct motor rated current.	
The maximum motor frequency is set too low.		Reset to the correct motor rated frequency.	
One drive to multiple motors.		Set Pr.06-13 = 2 electronic thermal relay selection motor 1 = disable, and install thermal relay on each motor.	
Check if the setting for stall prevention is correct.		Set the stall prevention to the proper value.	
The torque compensation is too large.		Readjust the torque compensation value (Pr.07-26 torque compensation gain) till the output current decreases and the motor does not stall.	
Motor fan error		Check the status of the fan, or replace the fan.	
Unbalanced three-phase impedance of the motor		Replace the motor.	

No.	Display on LED Keypad	Fault Name	Descriptions
23	EoL2	Electronic thermal relay 2 protection (EoL2)	Electronic thermal relay 2 protection. The drive coasts to stop once it activates.
Action and Reset			
Action Condition		Start counting when output current > 150% of motor 2 rated current.	
Action Time		Pr.06-28 (if the output current is larger than 105% of motor 1 rated current again within 60 sec., the counting time reduces and is less than Pr.06-28.)	
Fault Treatment Parameter		N/A	
Reset Method		Manual reset	
Reset Condition		Reset in five seconds after the fault is cleared	
Record		Yes	
Cause		Corrective Actions	
The load is too large.		Reduce the load.	
Accel./ Decel. time and working cycle is too short.		Increase the setting values for Pr.01-12–01-19 (accel./ decel. time).	
V/F voltage is too high.		Adjust the settings for Pr.01-01–01-08 (V/F curve), especially the setting value for the mid-point voltage (if the mid-point voltage is set too low, the load capacity decreases at low speed).	
Overload during low-speed operation. When using a general motor, even it operates below rated current, an overload may still occur during low-speed operation.		Decrease low-speed operation time. Replace the drive with a dedicated to VFD model. Increase the motor capacity.	
When using VFD dedicated motors, Pr.06-27 = 0 (electronic thermal relay selection motor 2 = 0 inverter motor).		Pr.06-27 = 1 Electronic thermal relay selection motor 2 = standard motor (motor with fan on the shaft).	
Incorrect value of electronic thermal relay.		Reset to the correct motor rated current.	
The maximum motor frequency is set too low.		Reset to the correct motor rated frequency.	
One drive to multiple motors		Set Pr.06-27 = 2 Electronic thermal relay selection motor 2 = disable, and install thermal relay on each motor.	
Check if the setting for stall prevention is correct.		Set the stall prevention to the proper value.	
The torque compensation is too large.		Readjust the torque compensation value (Pr.07-26 torque compensation gain) till the output current decreases and the motor does not stall.	
Motor fan error		Check the status of the fan, or replace the fan.	
Unbalanced three-phase impedance of the motor.		Replace the motor.	

No.	Display on LED Keypad	Fault Name	Descriptions
24_1	oH3	Motor overheating (oH3) PTC	Motor overheating (PTC) (Pr.03-00–Pr.03-02 = 6 PTC), when PTC input > Pr.06-30, the fault treatment acts according to Pr.06-29.
Action and Reset			
Action Condition		PTC input value > Pr.06-30 setting (Default = 50%)	
Action Time		Immediately act	
Fault Treatment Parameter		Pr.06-29 0: Warn and continue operation 1: Fault and ramp to stop 2: Fault and coast to stop 3: No warning	
Reset Method		When Pr.06-29 = 0, oH3 is a “Warning”. The “Warning” is automatically resets. When Pr.06-29 = 1 or 2, oH3 is a “Fault”. You must reset manually.	
Reset Condition		Immediately reset	
Record		When Pr.06-29 = 1 or 2, oH3 is a “Fault”, and the fault is recorded.	
Cause		Corrective Actions	
Motor locked.		Remove the shaft lock.	
The load is too large.		Reduce the load. Increase the motor capacity.	
Ambient temperature is too high.		Change the installed place if there are heating devices in the surroundings. Install / add cooling a fan or air conditioner to lower the ambient temperature.	
Motor cooling system error		Check the cooling system to make it work normally.	
Motor fan error		Replace the fan.	
Operates at low-speed too long.		Decrease low-speed operation time. Replace the drive with a dedicated to VFD model. Increase the motor capacity.	
Accel./ Decel. time and working cycle is too short.		Increase the setting values for Pr.01-12–01-19 (accel./ decel. time).	
V/F voltage is too high.		Adjust the settings for Pr.01-01–01-08 (V/F curve), especially the setting value for the mid-point voltage (if the mid-point voltage is set too low, the load capacity decreases at low speed).	
Check if the motor rated current matches that on the motor nameplate.		Reset to the correct motor rated current.	
Check if the PTC is properly set and wired.		Check the connection between PTC thermistor and the heat protection.	
Check if the setting for stall prevention is correct.		Set the stall prevention to the proper value.	
Unbalanced three-phase impedance of the motor.		Replace the motor.	
Harmonics are too high.		Use remedies to reduce harmonics.	

No.	Display on LED Keypad	Fault Name	Descriptions
24_2	oH3	Motor overheating (oH3) PT100	Motor overheating (PT100) (Pr.03-00–Pr.03-02 = 11 PT100). When PT100 input > Pr.06-57 (default = 7 V), the fault treatment acts according to Pr.06-29.
Action and Reset			
Action Condition		PT100 input value > Pr.06-57 setting (default = 7 V)	
Action Time		Immediately act	
Fault Treatment Parameter		Pr.06-29 0: Warn and continue operation 1: Fault and ramp to stop 2: Fault and coast to stop 3: No warning	
Reset Method		When Pr.06-29 = 0 and when the temperature is < Pr.06-56 level, the oH3 warning is automatically resets. When Pr.06-29 = 1 or 2, oH3 is a “Fault”. You must reset manually.	
Reset Condition		Immediately reset	
Record		When Pr.06-29 = 1 or 2, oH3 is a “Fault”, and the fault is recorded.	
Cause		Corrective Actions	
Motor locked.		Remove the shaft lock.	
The load is too large.		Reduce the load. Increase the motor capacity.	
Ambient temperature is too high.		Change the installed place if there are heating devices in the surroundings. Install / add cooling a fan or air conditioner to lower the ambient temperature.	
Motor cooling system error		Check the cooling system to make it work normally.	
Motor fan error		Replace the fan.	
Operates at low-speed too long.		Decrease low-speed operation time. Replace the drive with a dedicated to VFD model. Increase the motor capacity.	
Accel./ Decel. time and working cycle is too short.		Increase the setting values for Pr.01-12–01-19 (accel./ decel. time).	
V/F voltage is too high.		Adjust the settings for Pr.01-01–01-08 (V/F curve) , especially the setting value for the mid-point voltage (if the mid-point voltage is set too low, the load capacity decreases at low speed).	
Check if the motor rated current matches that on the motor nameplate.		Reset to the correct motor rated current.	
Check if the PT100 is properly set and wired.		Check connection of PT100 thermistor.	
Check if the setting for stall prevention is correct.		Set the stall prevention to the proper value.	

Unbalanced three-phase impedance of the motor.	Replace the motor.
Harmonics are too high.	Use remedies to reduce harmonics.

No.	Display on LED Keypad	Fault Name	Descriptions
26	ot1	Over torque 1 (ot1)	When output current exceeds the over-torque detection level (Pr.06-07) and exceeds over-torque detection time (Pr.06-08), and when Pr.06-06 or Pr.06-09 is set to 2 or 4, the ot1 error displays.

Action and Reset		
Action Condition	Pr.06-07	
Action Time	Pr.06-08	
Fault Treatment Parameter	Pr.06-06 0: No function 1: Continue operation after over-torque detection during constant speed operation 2: Stop after over-torque detection during constant speed operation 3: Continue operation after over-torque detection during RUN 4: Stop after over-torque detection during RUN	
Reset Method	Auto	"Warning" occurs when Pr.06-06 = 1 or 3. When output current < (Pr.06-07 – 5%), the ot1 warning automatically clears.
	Manual	"Error" occurs when Pr.06-06 = 2 or 4. You must reset manually.
Reset Condition	Immediately reset	
Record	When Pr.06-06 = 2 or 4, ot1 is a fault, and the fault is recorded	

Cause	Corrective Actions
Incorrect parameter setting	Configure the settings for Pr.06-07 and 06-08 again.
Mechanical failure (e.g. over-torque, mechanical lock)	Remove the causes of malfunction.
The load is too large.	Reduce the load. Replace the motor with a larger capacity model.
Accel./ Decel. time and working cycle is too short.	Increase the setting values for Pr.01-12–01-19 (accel./ decel. time).
V/F voltage is too high.	Adjust the settings for Pr.01-01–01-08 (V/F curve) , especially the setting value for the mid-point voltage (if the mid-point voltage is set too low, the load capacity decreases at low speed).
The motor capacity is too small.	Replace the motor with a larger capacity model.
Overload during low-speed operation.	Decrease the load during low-speed operation. Increase the motor capacity.
The torque compensation is too large.	Readjust the torque compensation value (Pr.07-26 torque compensation gain) till the output current decreases and the motor does not stall.
Improper parameter settings for the speed tracking function (including restart after momentary power loss and restart after fault).	Correct the parameter settings for speed tracking. Start the speed tracking function. Adjust the maximum current for Pr.07-09 speed tracking.

No.	Display on LED Keypad	Fault Name	Descriptions
27	ot2	Over torque 2 (ot2)	When the output current exceeds the over-torque detection level (Pr.06-10) and exceeds over-torque detection time (Pr.06-11), and when Pr.06-09 is set to 2 or 4, the ot2 error displays.

Action and Reset		
Action Condition	Pr.06-10	
Action Time	Pr.06-11	
Fault Treatment Parameter	Pr.06-09 0: No function 1: Continue operation after over-torque detection during constant speed operation 2: Stop after over-torque detection during constant speed operation 3: Continue operation after over-torque detection during RUN 4: Stop after over-torque detection during RUN	
Reset Method	Auto	When Pr.06-09 = 1 or 3, ot2 is a “Warning”. The warning is automatically cleared when the output current < (Pr.06-10 – 5%).
	Manual	When Pr.06-09 = 2 or 4, ot2 is a “Fault”. You must reset manually.
Reset Condition	Immediately reset	
Record	When Pr.06-09 = 2 or 4, ot2 is a “Fault”, and the fault is recorded.	

Cause	Corrective Actions
Incorrect parameter setting	Configure the settings for Pr.06-10 and Pr.06-11.
Mechanical error (e.g. Mechanical lock due to over-torque)	Remove the causes of malfunction.
The load is too large.	Reduce the load. Replace the motor with a larger capacity model.
Accel./ Decel. time and working cycle is too short.	Increase the setting values for Pr.01-12–01-19 (accel./ decel. time).
V/F voltage is too high.	Adjust the settings for Pr.01-35–01-42 (V/F curve) , especially the setting value for the mid-point voltage (if the mid-point voltage is set too low, the load capacity decreases at low speed).
The motor capacity is too small	Replace the motor with a larger capacity model.
Overload during low-speed operation.	Decrease the load during low-speed operation. Increase the motor capacity.
The torque compensation is too large.	Readjust the torque compensation value (Pr.07-26 torque compensation gain) till the output current decreases and the motor does not stall.
Improper parameter settings for the speed tracking function (including restart after momentary power loss and restart after fault).	Correct the parameter settings for speed tracking. Start the speed tracking function. Adjust the maximum current for Pr.07-09 speed tracking.

No.	Display on LED Keypad	Fault Name	Descriptions
28	uC	Under current (uC)	Low current detection

Action and Reset		
Action Condition	Pr.06-71	
Action Time	Pr.06-72	
Fault Treatment Parameter	Pr.06-73 0: No function 1: Fault and coast to stop 2: Fault and ramp to stop by the 2nd deceleration time 3: Warn and continue operation	
Reset Method	Auto	When Pr.06-73 = 3, uC is a “Warning”. The “Warning” automatically clears when the output current is > (Pr.06-71+0.1 A).
	Manual	When Pr.06-73 = 1 or 2, uC is a “Fault”. You must reset manually.
Reset Condition	Immediately reset	
Record	When Pr.06-71 = 1 or 2, uC is a fault, and the fault is recorded	

Cause	Corrective Actions
Broken motor cable	Troubleshoot the connection between the motor and the load.
Improper setting for the low current protection.	Reset Pr.06-71, Pr.06-72 and Pr.06-73 to proper settings.
The load is too low.	Check the loading status. Make sure the loading matches the motor capacity.

No.	Display on LED Keypad	Fault Name	Descriptions
31	cF2	EEPROM read error (cF2)	Internal EEPROM cannot be read.
Action and Reset			
Action Condition		Firmware internal detection	
Action Time		cF2 acts immediately when the drive detects the fault	
Fault Treatment Parameter		N/A	
Reset Method		Manual reset	
Reset Condition		Immediately reset	
Record		Yes	
Cause		Corrective Actions	
Internal EEPROM cannot be read.		Press RESET key. If cF2 error still displays on the keypad, return to the factory for repair. Reset the parameter to the default setting. If cF2 error still displays on the keypad, return to the factory for repair. Cycle the power, if cF2 error still exists, return to the factory for repair.	

No.	Display on LED Keypad	Fault Name	Descriptions
33	cd1	U-phase error (cd1)	U-phase current detection error when power is ON
Action and Reset			
Action Condition		Hardware detection	
Action Time		cd1 acts immediately when the drive detects the fault.	
Fault Treatment Parameter		N/A	
Reset Method		Power-off	
Reset Condition		N/A	
Record		Yes	
Cause		Corrective Actions	
Hardware error		Cycle the power. If cd1 still exists, return to the factory for repair.	

No.	Display on LED Keypad	Fault Name	Descriptions
34	cd2	V-phase error (cd2)	V-phase current detection error when power ON.
Action and Reset			
Action Condition		Hardware detection	
Action Time		cd2 acts immediately when the drive detects the fault.	
Fault Treatment Parameter		N/A	
Reset Method		Power-off	
Reset Condition		N/A	
Record		Yes	
Cause		Corrective Actions	
Hardware error		Cycle the power. If cd2 still exists, return to the factory for repair.	

No.	Display on LED Keypad	Fault Name	Descriptions
35	cd3	W-phase error (cd3)	W-phase current detection error when power ON.
Action and Reset			
Action Condition		Hardware detection	
Action Time		cd3 acts immediately when the drive detects the fault.	
Fault Treatment Parameter		N/A	
Reset Method		Power-off	
Reset Condition		N/A	
Record		Yes	
Cause		Corrective Actions	
Hardware error		Cycle the power. If cd3 still exists, return to the factory for repair.	

No.	Display on LED Keypad	Fault Name	Descriptions
36	Hd0	cc hardware error (Hd0)	cc (current clamp) hardware protection error when power is ON.
Action and Reset			
Action Condition		Hardware detection	
Action Time		Hd0 acts immediately when the drive detects the fault.	
Fault Treatment Parameter		N/A	
Reset Method		Power-off	
Reset Condition		N/A	
Record		Yes	
Cause		Corrective Actions	
Hardware error		Cycle the power. If Hd0 still exists, return to the factory for repair.	

No.	Display on LED Keypad	Fault Name	Descriptions
37	Hd1	oc hardware error (Hd1)	oc hardware protection error when power is ON.
Action and Reset			
Action Condition		Hardware detection	
Action Time		Hd1 acts immediately when the drive detects the fault.	
Fault Treatment Parameter		N/A	
Reset Method		Power-off	
Reset Condition		N/A	
Record		Yes	
Cause		Corrective Actions	
Hardware error		Cycle the power. If Hd1 still exists, return to the factory for repair.	

No.	Display on LED Keypad	Fault Name	Descriptions
38	Hd2	ov hardware error (Hd2)	ov hardware protection error when power is ON.
Action and Reset			
Action Condition		Hardware detection	
Action Time		Hd2 acts immediately when the drive detects the fault.	
Fault Treatment Parameter		N/A	
Reset Method		Power-off	
Reset Condition		N/A	
Record		Yes	
Cause		Corrective Actions	
Hardware error		Cycle the power. If Hd2 still exists, return to the factory for repair.	

No.	Display on LED Keypad	Fault Name	Descriptions
40	AUE	Auto-tuning error (AUE)	Motor auto-tuning error
Action and Reset			
Action Condition		Hardware detection	
Action Time		Immediately act	
Fault Treatment Parameter		N/A	
Reset Method		Manual reset	
Reset Condition		Immediately reset	
Record		Yes	
Cause		Corrective Actions	
Press “STOP” key during auto-tuning		Re-execute auto-tuning.	
Incorrect motor capacity (too large or too small) and parameter setting.		Check motor capacity and related parameters. Set the correct parameters, that is Pr.01-01–Pr.01-02. Set Pr.01-00 larger than the motor rated frequency.	
Incorrect motor wiring		Wire the motor correctly.	
Motor shaft lock		Troubleshoot the motor shaft lock.	
The electromagnetic contactor is used as an open state on the output side of the drive (U/V/W).		Check if the electromagnetic valve is closed.	
The load is too large.		Decrease the load. Replace the motor with a larger capacity model.	
Accel. / Decel. time is too short.		Increase the No. for Pr.01-12–01-19 (accel. / decel. time).	

No.	Display on LED Keypad	Fault Name	Descriptions
41	AFE	PID off AI2 (AFE)	PID feedback loss (analog feedback signal is only valid when the PID function is enabled)
Action and Reset			
Action Condition		When the analog input is lower than 4 mA (only detects 4–20 mA analog input).	
Action Time		Pr.08-08	
Fault Treatment Parameter		Pr.08-09 0: Warn and continue operation 1: Fault and ramp to stop 2: Fault and coast to stop 3: Warn and operate at last frequency	
Reset Method		Auto	When Pr.08-09 = 3 or 4, AFE is a “Warning”. The “Warning” automatically clears when the feedback signal is larger than 4 mA.
		Manual	When Pr.08-09 = 1 or 2, AFE is a “Fault”. You must reset manually.
Reset Condition		Immediately reset	
Record		When Pr.08-09 = 1 or 2, AFE is a “Fault”, and the fault is recorded; when Pr.08-09 = 3 or 4, AFE is a “Warning”, and the warning is not recorded.	
Cause		Corrective Actions	
PID feedback cable is loose or cut off.		Tighten the terminals again. Replace with a new cable.	
Feedback device failure		Replace with a new feedback device.	
Hardware error		Check all the wiring. If AFE fault still exists, return to the factory for repair.	

No.	Display on LED Keypad	Fault Name	Descriptions
48	ACE	AI2 loss (ACE)	Analog input current loss (including all analog 4–20 mA signals)
Action and Reset			
Action Condition	When the analog input is lower than 4 mA (only detects analog input 4–20 mA).		
Action Time	Immediately act		
Fault Treatment Parameter	Pr.03-19 0: Disabled 1: Continue operation at the last frequency (warning, the keypad displays ”AnL”) 2: Decelerate to 0 Hz (warning, the keypad displays ”AnL”) 3: Stop immediately and display ACE		
Reset Method	Auto	When Pr.03-19 = 1 or 2, ACE is a “Warning”. When analog input signal is > 4 mA, the warning is automatically cleared.	
	Manual	When Pr.03-19 = 3, ACE is a “Fault”. You must reset manually.	
Reset Condition	Immediately reset		
Record	When Pr.03-19 = 3, ACE is a “Fault”, and the fault is recorded; when Pr.03-19 = 1 or 2, ACE is a “Warning”, and the warning is not recorded.		
Cause	Corrective Actions		
ACE cable is loose or cut off.	Tighten the terminals again. Replace with a new cable.		
External device error	Replace with a new device.		
Hardware error	Check all the wiring. If ACE still exists, return to the factory for repair.		

No.	Display on LED Keypad	Fault Name	Descriptions
49	EF	External fault (EF)	External fault. When the drive decelerates based on the setting of Pr.07-20, the EF fault displays on the keypad.
Action and Reset			
Action Condition		MI = EF and the MI terminal is ON.	
Action Time		Immediately act	
Fault Treatment Parameter		Pr.07-20 0: Coast to stop 1: Stop by the first deceleration time 2: Stop by the second deceleration time 3: Stop by the third deceleration time 4: Stop by the fourth deceleration time 5: System deceleration (according to the original deceleration time setting) 6: Automatic deceleration (Pr.01-46)	
Reset Method		Manual reset	
Reset Condition		Manual reset only after the external fault is cleared (terminal status is recovered).	
Record		Yes	
Cause		Corrective Actions	
External fault		Press RESET key after the fault is cleared.	

No.	Display on LED Keypad	Fault Name	Descriptions
50	EF1	Emergency stop (EF1)	When the contact of MI = EF1 is ON, the output stops immediately and displays EF1 on the keypad. The motor is in free running.
Action and Reset			
Action Condition		MI = EF1 and the MI terminal is ON	
Action Time		Immediately act	
Fault Treatment Parameter		N/A	
Reset Method		Manual reset	
Reset Condition		Manual reset only after the external fault is cleared (terminal status is recovered).	
Record		Yes	
Cause		Corrective Actions	
When MI = EF1 activates		Verify if the system is back to normal condition, and then press RESET key to return to the default.	

No.	Display on LED Keypad	Fault Name	Descriptions
51	bb	External base block (bb)	When the contact of MI = bb is ON, the output stops immediately and displays bb on the keypad. The motor is in free running.
Action and Reset			
Action Condition		MI = bb and the MI terminal is ON.	
Action Time		Immediately act	
Fault Treatment Parameter		N/A	
Reset Method		The display “bb” is automatically cleared after the fault is cleared.	
Reset Condition		N/A	
Record		N/A	
Cause		Corrective Actions	
When MI = bb activates		Verify if the system is back to normal condition, and then press RESET key to return to the default.	

No.	Display on LED Keypad	Fault Name	Descriptions
52	Pcod	Password is locked (Pcod)	Entering the wrong password three consecutive times
Action and Reset			
Action Condition		Entering the wrong password three consecutive times.	
Action Time		Immediately act	
Fault Treatment Parameter		N/A	
Reset Method		Manual reset	
Reset Condition		Power-off	
Record		Yes	
Cause		Corrective Actions	
Incorrect password input through Pr.00-07		1. Input the correct password after rebooting the motor drive. 2. If you forget the password, enter 9999. 3. Press ENTER, and then enter 9999 again. 4. (You must finish pressing ENTER within 10 seconds. If not, you have to repeat the entering). After you successfully unlock the password, the parameter settings return to the default.	

No.	Display on LED Keypad	Fault Name	Descriptions
54	CE1	Illegal command (CE1)	Communication command is illegal
Action and Reset			
Action Condition		When the function code is not 03, 06, 10 and 63.	
Action Time		Immediately act	
Fault Treatment Parameter		N/A	
Reset Method		Manual reset	
Reset Condition		Immediately reset	
Record		N/A	
Cause		Corrective Actions	
Incorrect communication command from upper unit.		Check if the communication command is correct.	
Malfunction caused by interference		Verify the wiring and grounding of the communication circuit. It is recommended to separate the communication circuit from the main circuit, or wire in 90 degrees for effective anti-interference performance.	
Different communication setting from the upper unit.		Check if the setting for Pr.09-01 and Pr.09-04 are the same as the setting for the upper unit.	
Communication cable is broken or bad connected.		Check the cable and replace it if necessary.	

No.	Display on LED Keypad	Fault Name	Descriptions
55	CE2	Illegal data address (CE2)	Data address is illegal
Action and Reset			
Action Condition		When the data address is correct.	
Action Time		Immediately act	
Fault Treatment Parameter		N/A	
Reset Method		Manual reset	
Reset Condition		Immediately reset	
Record		N/A	
Cause		Corrective Actions	
Incorrect communication command from upper unit		Check if the communication command is correct.	
Malfunction caused by interference		Verify the wiring and grounding of the communication circuit. It is recommended to separate the communication circuit from the main circuit, or wire in 90 degrees for effective anti-interference performance.	
Different communication setting from the upper unit		Check if the setting for Pr.09-01 and Pr.09-04 are the same as the setting for the upper unit.	
Communication cable is broken or bad connected		Check the cable and replace it if necessary.	

No.	Display on LED Keypad	Fault Name	Descriptions
56	CE3	Illegal data value (CE3)	Data value is illegal
Action and Reset			
Action Condition		When the data length is too long.	
Action Time		Immediately act	
Fault Treatment Parameter		N/A	
Reset Method		Manual reset	
Reset Condition		Immediately reset	
Record		N/A	
Cause		Corrective Actions	
Incorrect communication command from upper unit.		Check if the communication command is correct.	
Malfunction caused by interference		Verify the wiring and grounding of the communication circuit. It is recommended to separate the communication circuit from the main circuit, or wire in 90 degrees for effective anti-interference performance.	
Different communication setting from the upper unit.		Check if the setting for Pr.09-01 and Pr.09-04 are the same as the setting for the upper unit.	
Communication cable is broken or bad connected.		Check the cable and replace it if necessary.	

No.	Display on LED Keypad	Fault Name	Descriptions
57	CE4	Data is written to read-only address (CE4)	Data is written to read-only address.
Action and Reset			
Action Condition		When the data is written to read-only address.	
Action Time		Immediately act	
Fault Treatment Parameter		N/A	
Reset Method		Manual reset	
Reset Condition		Immediately reset	
Record		N/A	
Cause		Corrective Actions	
Incorrect communication command from upper unit.		Check if the communication command is correct.	
Malfunction caused by interference		Verify the wiring and grounding of the communication circuit. It is recommended to separate the communication circuit from the main circuit, or wire in 90 degrees for effective anti-interference performance.	
Different communication setting from the upper unit.		Check if the setting for Pr.09-01 and Pr.09-04 are the same as the setting for the upper unit.	
Communication cable is broken or bad connected.		Check the cable and replace it if necessary.	

No.	Display on LED Keypad	Fault Name	Descriptions
58	CE10	Modbus transmission time-out (CE10)	Modbus transmission time-out occurs
Action and Reset			
Action Condition		When the communication time exceeds the detection time for Pr.09-03 communication time-out.	
Action Time		Pr.09-03	
Fault Treatment Parameter		Pr.09-02 0: Warn and continue operation 1: Fault and ramp to stop 2: Fault and coast to stop 3: No warning, no fault, and continue operation	
Reset Method		Manual reset	
Reset Condition		Immediately reset	
Record		Yes	
Cause		Corrective Actions	
The upper unit does not transmit the communication command within Pr.09-03 setting time.		Check if the upper unit transmits the communication command within the setting time for Pr.09-03.	
Malfunction caused by interference		Verify the wiring and grounding of the communication circuit. It is recommended to separate the communication circuit from the main circuit, or wire in 90 degrees for effective anti-interference performance.	
Different communication setting from the upper unit.		Check if the setting for Pr.09-01 and Pr.09-04 are the same as the setting for the upper unit.	
Communication cable is broken or bad connected.		Check the cable and replace it if necessary.	

No.	Display on LED Keypad	Fault Name	Descriptions
63	oSL	Over slip warning (oSL)	On the basis of the maximum slip limit set via Pr.10-29, the speed deviation is abnormal. When the motor drive outputs at constant speed, F>H or F<H exceeds the level set via Pr.07-29, and it exceeds the time set via Pr.07-30, oSL shows. oSL occurs in induction motors only.

Action and Reset		
Action Condition	Pr.07-29 (100% of Pr.07-29 = the max. limit of the slip frequency (Pr.10-29))	
Action Time	Pr.07-30	
Fault Treatment Parameter	Pr.07-31 0: Warn and continue operation 1: Fault and ramp to stop 2: Fault and coast to stop 3: No warning	
Reset Method	Auto	Pr.07-31 = 0 is a warning. When the motor drive outputs at constant speed, and F>H or F<H does not exceed the level set via Pr.07-29 anymore, oSL warning will be cleared automatically.
	Manual	When Pr.07-31 = 1 or 2, oSL is an error, and it needs to reset manually.
Reset Condition	Immediately reset	
Record	Pr.07-31 = 1 or 2, oSL is “Fault”, and the fault is recorded.	

Cause	Corrective Actions
Check if the motor parameter is correct.	Check the motor parameters.
The load is too large.	Decrease the load.
Check if the settings for Pr.07-29, Pr.07-30 and Pr.10-29 are properly set.	Check the setting of oSL protection function related parameters.

No.	Display on LED Keypad	Fault Name	Descriptions
72		S1 internal circuit detection error (STL1)	STO1–SCM1 internal loop detection error
Action and Reset			
Action Condition		Hardware detection	
Action Time		Immediately act	
Fault Treatment Parameter		N/A	
Reset Method		Hardware failure, and cannot reset. Cycle the power.	
Reset Condition		N/A	
Record		Yes	
Cause		Corrective Actions	
STO1 and SCM1 short circuit lines are not connected.		Re-connect the short circuit line	
Hardware failure		After you make sure all the wiring is correct, if STL1 fault still exists after cycling the power, return to the factory for repair.	

No.	Display on LED Keypad	Fault Name	Descriptions
76		STO (STo)	Safety Torque Off function active
Action and Reset			
Action Condition		Hardware detection	
Action Time		Immediately act	
Fault Treatment Parameter		Pr.06-44 bit 0: STO locked bit 1: STO error indication shield	
Reset Method		When bit 0 =0 and after STo error is cleared, reset it manually. When bit 0 =1 and after STo error is cleared, it automatically resets.	
Reset Condition		Reset only after STo error is cleared.	
Record		Yes	
Cause		Corrective Actions	
The switch action of STO1 / SCM1, STO2 / SCM2 (OPEN: On).		Check if the wiring and upper unit outputs function are correct.	

No.	Display on LED Keypad	Fault Name	Descriptions
77		S2 internal circuit detection error (STL2)	STO2–SCM2 internal loop detection error
Action and Reset			
Action Condition		Hardware detection	
Action Time		Immediately act	
Fault Treatment Parameter		N/A	
Reset Method		Hardware failure, and cannot reset. Cycle the power.	
Reset Condition		N/A	
Record		Yes	
Cause		Corrective Actions	
STO2 and SCM2 short circuit lines are not connected.		Re-connect the short circuit line	
Hardware failure		After you make sure all the wiring is correct, if STL2 fault still exists after cycling the power, return to the factory for repair.	

No.	Display on LED Keypad	Fault Name	Descriptions
79	Aoc	U-phase over-current before run (Aoc)	U-phase short circuit detected when the output wiring detection is performed before the drive runs.
Action and Reset			
Action Condition		300% of the rated current	
Action Time		Immediately act	
Fault Treatment Parameter		N/A	
Reset Method		Manual reset	
Reset Condition		Reset in five seconds after the fault is cleared.	
Record		Yes	
Cause		Corrective Actions	
Incorrect wiring for the motor.		Check if the motor's internal wiring and the UVW wiring of the drive output terminal are correct.	
Short-circuit at motor output due to poor insulation wiring.		Check the motor cable and remove causes of the short circuits, or replace the cable before turning on the power.	
Check for possible burnout or aging insulation of the motor.		Check the motor insulation value with megger. Replace the motor if the insulation is poor.	
Malfunction caused by interference		Verify the wiring of the control circuit and the wiring / grounding of the main circuit to prevent interference.	
The length of motor cable is too long.		Increase the drive capacity. Install AC reactor(s) on the output side (U/V/W).	
Hardware error		The Aoc occurs due to the short circuit or ground fault at the output side of the drive. Check for possible short circuits between terminals with the electric meter: B1 corresponds to U, V and W; DC- corresponds to U, V and W; ⏚ corresponds to U, V and W. If short circuit occurs, return to the factory for repair.	

No.	Display on LED Keypad	Fault Name	Descriptions
80	boc	V-phase over-current before run (boc)	V-phase short circuit detected when the output wiring detection is performed before the drive runs.
Action and Reset			
Action Condition		300% of the rated current	
Action Time		Immediately act	
Fault Treatment Parameter		N/A	
Reset Method		Manual reset	
Reset Condition		Reset in five seconds after the fault is cleared	
Record		Yes	
Cause		Corrective Actions	
Incorrect wiring for the motor.		Check if the motor's internal wiring and the UVW wiring of the drive output terminal are correct.	
Short-circuit at motor output due to poor insulation wiring.		Check the motor cable and remove causes of the short circuits, or replace the cable before turning on the power.	
Check for possible burnout or aging insulation of the motor.		Check the motor insulation value with megger. Replace the motor if the insulation is poor.	
Malfunction caused by interference		Verify the wiring of the control circuit and the wiring / grounding of the main circuit to prevent interference.	
The length of motor cable is too long.		Increase the drive capacity. Install AC reactor(s) on the output side (U/V/W).	
Hardware error		The boc occurs due to the short circuit or ground fault at the output side of the drive. Check for possible short circuits between terminals with the electric meter: B1 corresponds to U, V and W; DC- corresponds to U, V and W; ⏚ corresponds to U, V and W. If short circuit occurs, return to the factory for repair.	

No.	Display on LED Keypad	Fault Name	Descriptions
81	COC	W-phase over-current before run (coc)	W-phase short circuit detected when the output wiring detection is performed before the drive runs.
Action and Reset			
Action Condition		300% of the rated current	
Action Time		Immediately act	
Fault Treatment Parameter		N/A	
Reset Method		Manual reset	
Reset Condition		Reset in five seconds after the fault is cleared	
Record		Yes	
Cause		Corrective Actions	
Incorrect wiring for the motor.		Check if the motor's internal wiring and the UVW wiring of the drive output terminal are correct.	
Short-circuit at motor output due to poor insulation wiring.		Check the motor cable and remove causes of the short circuits, or replace the cable before turning on the power.	
Check for possible burnout or aging insulation of the motor.		Check the motor insulation value with megger. Replace the motor if the insulation is poor.	
Malfunction caused by interference		Verify the wiring of the control circuit and the wiring / grounding of the main circuit to prevent interference.	
The length of motor cable is too long.		Increase the drive capacity. Install AC reactor(s) on the output side (U/V/W).	
Hardware error		The coc occurs due to the short circuit or ground fault at the output side of the drive. Check for possible short circuits between terminals with the electric meter: B1 corresponds to U, V and W; DC- corresponds to U, V and W; ⏚ corresponds to U, V and W. If short circuit occurs, return to the factory for repair.	

No.	Display on LED Keypad	Fault Name	Descriptions
82	oPL 1	Output phase loss U phase (oPL1)	U phase output phase loss
Action and Reset			
Action Condition		Pr.06-47	
Action Time		Pr.06-46 Pr.06-48: Use the setting value of Pr.06-48 first. If DC braking function activates, use that of Pr.06-46.	
Fault Treatment Parameter		Pr.06-45 0: Warn and continue operation 1: Fault and ramp to stop 2: Fault and coast to stop 3: No warning	
Reset Method		Manual reset	
Reset Condition		Immediately reset	
Record		When Pr.06-45 = 1 or 2, oPL1 is a “Fault”, and the fault is recorded.	
Cause		Corrective Actions	
Unbalanced three-phase impedance of the motor.		Replace the motor.	
Check if the wiring is incorrect.		Check the cable. Replace the cable.	
Check if the motor is a single-phase motor.		Choose a three-phase motor.	
Check if the current sensor is broken.		Check the flat cable of the control board. If yes, reconnect the cable and run the drive to test. If the fault still exists, send the drive back to the factory for repair. Check if the three-phase current is balanced with a current clamp meter. If the current is balanced and the oPL1 error still shows on the display, return to the factory for repair.	
Check if the drive capacity is larger than the motor capacity		Make sure the capacity of the drive and motor match to each other.	

No.	Display on LED Keypad	Fault Name	Descriptions
83	oPL2	Output phase loss V phase (oPL2)	V phase output phase loss
Action and Reset			
Action Condition		Pr.06-47	
Action Time		Pr.06-46 Pr.06-48: Use the setting value of Pr.06-48 first. If DC braking function activates, use that of Pr.06-46.	
Fault Treatment Parameter		Pr.06-45 0: Warn and continue operation 1: Fault and ramp to stop 2: Fault and coast to stop 3: No warning	
Reset Method		Manual reset	
Reset Condition		Immediately reset	
Record		When Pr.06-45 = 1 or 2, oPL2 is a “Fault”, and the fault is recorded.	
Cause		Corrective Actions	
Unbalanced three-phase impedance of the motor.		Replace the motor.	
Check if the wiring is incorrect.		Check the cable. Replace the cable.	
Check if the motor is a single-phase motor.		Choose a three-phase motor.	
Check if the current sensor is broken.		Check the flat cable of the control board. If yes, reconnect the cable and run the drive to test. If the error still occurs, send the drive back to the factory for repair. Check if the three-phase current is balanced with a current clamp meter. If the current is balanced and the oPL2 error still shows on the display, return to the factory for repair.	
Check if the drive capacity is larger than the motor capacity		Choose the drive that matches the motor capacity.	

No.	Display on LED Keypad	Fault Name	Descriptions
84	oPL3	Output phase loss W phase (oPL3)	W phase output phase loss
Action and Reset			
Action Condition		Pr.06-47	
Action Time		Pr.06-46 Pr.06-48: Use the setting value of Pr.06-48 first. If DC braking function activates, use that of Pr.06-46.	
Fault Treatment Parameter		Pr.06-45 0: Warn and continue operation 1: Fault and ramp to stop 2: Fault and coast to stop 3: No warning	
Reset Method		Manual reset	
Reset Condition		Immediately reset	
Record		When Pr.06-45 = 1 or 2, oPL3 is a “Fault”, and the fault is recorded.	
Cause		Corrective Actions	
Unbalanced three-phase impedance of the motor.		Replace the motor.	
Check if the wiring is incorrect.		Check the cable. Replace the cable.	
Check if the motor is a single-phase motor.		Choose a three-phase motor.	
Check if the current sensor is broken.		Check the flat cable of the control board. If yes, reconnect the cable and run the drive to test. If the error still occurs, send the drive back to the factory for repair. Check if the three-phase current is balanced with a current clamp meter. If the current is balanced and the oPL3 error still shows on the display, return to the factory for repair.	
Check if the drive capacity is larger than the motor capacity.		Choose the drive that matches the motor capacity.	

No.	Display on LED Keypad	Fault Name	Descriptions
87	oL3	Power module overload (oL3)	The load almost reaches the upper limit of the power module.
Action and Reset			
Action Condition		Software detection	
Action Time		Immediately act	
Fault Treatment Parameter		N/A	
Reset Method		Manual reset	
Reset Condition		Immediately reset	
Record		Yes	
Cause		Corrective Actions	
The power module overloads		1. Decrease the drive's load. 2. Lower the carrier frequency (Pr.00-17). 3. Lower the drive's operation ambient temperature. 4. Lower the current limit. 5. Choose the drive with a larger power model. 6. Increase the acceleration time. 7. Decrease the output voltage for low-frequency operation in V/F control mode.	

No.	Display on LED Keypad	Fault Name	Descriptions
89	roPd	Rotor position detection error (roPd)	Rotor position detection error protection
Action and Reset			
Action Condition		Software detection	
Action Time		Immediately act	
Fault Treatment Parameter		N/A	
Reset Method		Manual reset	
Reset Condition		Immediately reset	
Record		Yes	
Cause		Corrective Actions	
Check if the motor cable is abnormal or broken.		Check or replace the cable.	
Motor coil error		Replace the motor.	
Hardware error		IGBT broken. Return to the factory for repair.	
Drive's current feedback line error		Cycle the power. If roPd still occurs during operation, return to the factory for repair.	

No.	Display on LCD Keypad	Fault Name	Descriptions
101	CGdE	CANopen guarding error (CGdE)	CANopen guarding error
Action and Reset			
Action Condition		When CANopen Node Guarding detects that one of the slaves does not respond, the CGdE fault occurs. The upper unit sets the factor and time during configuration.	
Action Time		The time that the upper unit sets during configuration	
Fault Treatment Parameter		N/A	
Reset Method		Manual reset	
Reset Condition		The upper unit sends a reset package to clear this fault.	
Record		Yes	
Cause		Corrective Actions	
The guarding time is too short.		Increase guarding time (Index 100C)	
Malfunction caused by interference		1. Verify the wiring and grounding of the communication circuit. It is recommended to separate the communication circuit from the main circuit, or wire in 90 degrees for effective anti-interference performance. 2. Make sure the communication circuit is wired in series. 3. Use CANopen cable or add terminating resistance.	
Communication cable is broken or bad connected.		Check the cable and replace it if necessary.	

No.	Display on LCD Keypad	Fault Name	Descriptions
102	CHbE	CANopen heartbeat error (CHbE)	CANopen heartbeat error
Action and Reset			
Action Condition		When CANopen Heartbeat detects that one of the slaves does not respond, the CHbE fault occurs. The upper unit sets the confirming time of producer and consumer during configuration.	
Action Time		The upper unit sets the confirming time of producer and consumer during configuration.	
Fault Treatment Parameter		N/A	
Reset Method		Manual reset	
Reset Condition		The upper unit sends a reset package to clear this fault.	
Record		Yes	
Cause		Corrective Actions	
The heartbeat time is too short.		Increase heartbeat time (Index 100C)	
Malfunction caused by interference		1. Verify the wiring and grounding of the communication circuit. It is recommended to separate the communication circuit from the main circuit, or wire in 90 degrees for effective anti-interference performance. 2. Make sure the communication circuit is wired in series. 3. Use CANopen cable or add terminating resistance.	
Communication cable is broken or bad connected.		Check the cable and replace it if necessary.	

No.	Display on LCD Keypad	Fault Name	Descriptions
104	CbFE	CANopen bus off error (CbFn)	CANopen bus off error
Action and Reset			
Action Condition		Hardware	When CANopen card is not installed, the CbFE fault occurs.
		Software	When the master receives wrong communication package, the CbFE fault occurs. Too much interference on BUS The master receives wrong package when the CAN_H and CAN_L communication cables are short, CbFE fault occurs.
Action Time		Immediately act	
Fault Treatment Parameter		N/A	
Reset Method		Manual reset	
Reset Condition		Cycle the power	
Record		Yes	
Cause		Corrective Actions	
Check if the CANopen card is installed.		Make sure the CANopen card is installed.	
Check if the CANopen speed is correct.		Reset CANopen speed (Pr.09-37)	
Malfunction caused by interference		1. Verify the wiring and grounding of the communication circuit. It is recommended to separate the communication circuit from the main circuit, or wire in 90 degrees for effective anti-interference performance. 2. Make sure the communication circuit is wired in series. 3. Use CANopen cable or add terminating resistance.	
Communication cable is broken or bad connected.		4. Check the cable and replace it if necessary.	

No.	Display on LCD Keypad	Fault Name	Descriptions
121	CP20	Internal communication error (CP20)	Each inverter axis observes the connection status between itself and the rectifier module. If communication with the rectifier module continues to fail, a CP20 error occurs.
Action and Reset			
Action Condition		Communication disconnection timeout of the rectifier and inverter axis.	
Action Time		The inverter axis is unable to communicate with the rectifier for 5 seconds.	
Fault Treatment Parameter		N/A	
Reset Method		Manual reset	
Reset Condition		The error can be reset when the internal communication restored.	
Record		Yes	
Cause		Corrective Actions	
Poor connection between backplane and modules		Power off and then power on again. Re-plug the modules.	

No.	Display on LCD Keypad	Fault Name	Descriptions
122	CP21	Ethernet Internal communication time-out (CP21)	Ethernet internal communication time-out between the rectifier axis and the inverter axis in one multi-drive.
Action and Reset			
Action Condition		Inverter axis detects communication time-out	
Action Time		100ms	
Fault Treatment Parameter		N/A	
Reset Method		Manual reset	
Reset Condition		The error can be reset when Ethernet internal communication restored.	
Record		Yes	
Cause		Corrective Actions	
Poor connection between modules		Check the installation and reinstall.	
Rectifier error occurs		Reset error	

No.	Display on LCD Keypad	Fault Name	Descriptions
123	CP22	Internal communication error (CP22)	Abnormal internal communication
Action and Reset			
Action Condition		Software detection	
Action Time		Immediately act	
Fault Treatment Parameter		N/A	
Reset Method		N/A	
Record		Yes	
Cause		Corrective Actions	
Internal communication error		Contact local distributor or Delta.	

No.	Display on LCD Keypad	Fault Name	Descriptions
124	CP30	Internal communication error (CP30)	Internal communication time-out
Action and Reset			
Action Condition		Software detection	
Action Time		Immediately act	
Fault Treatment Parameter		N/A	
Reset Method		N/A	
Record		Yes	
Cause		Corrective Actions	
Internal communication error		Contact local distributor or Delta.	

No.	Display on LCD Keypad	Fault Name	Descriptions
126	CP32	Internal communication error (CP32)	Abnormal internal communication
Action and Reset			
Action Condition		Software detection	
Action Time		Immediately act	
Fault Treatment Parameter		N/A	
Reset Method		N/A	
Record		Yes	
Cause		Corrective Actions	
Internal communication error		Contact local distributor or Delta.	

No.	Display on LCD Keypad	Fault Name	Descriptions
140	Hd6	oc hardware error (Hd6)	GFF hardware protection error when power is ON.
Action and Reset			
Action Condition		Hardware detection	
Action Time		Immediately act when the fault is detected.	
Fault Treatment Parameter		N/A	
Reset Method		Power-off	
Reset Condition		N/A	
Record		Yes	
Cause		Corrective Actions	
Hardware error		Cycle the power. If Hd6 still exists, return to the factory for repair.	

No.	Display on LED Keypad	Fault Name	Descriptions
141	b4GFF	GFF occurs before run (b4GFF)	The ground short circuit detected when the output wiring detection is performed before the drive runs.
Action and Reset			
Action Condition		250% of the rated current	
Action Time		Immediately act	
Fault Treatment Parameter		N/A	
Reset Method		Manual reset	
Reset Condition		Reset in five seconds after the fault is cleared.	
Record		Yes	
Cause		Corrective Actions	
Incorrect wiring for the motor		Check if the motor's internal wiring and the UVW wiring of the drive output terminal are correct.	
Short-circuit at motor output due to poor insulation wiring.		Check the motor cable and remove causes of the short circuits, or replace the cable before turning on the power.	
Check for possible burnout or aging insulation of the motor.		Check the motor insulation value with megger. Replace the motor if the insulation is poor.	

No.	Display on LED Keypad	Fault Name	Descriptions
142	AuE1	Auto-tuning error (AuE1)	No feedback current error when motor parameter automatically detects.
Action and Reset			
Action Condition		Software detection	
Action Time		Immediately act	
Fault Treatment Parameter		N/A	
Reset Method		Manual reset	
Reset Condition		Immediately reset	
Record		Yes	
Cause		Corrective Actions	
Motor is not wired.		Wire the motor correctly.	
The electromagnetic contactor is ON at output side (U/V/W) of the drive.		Check if the electromagnetic valve is closed.	

No.	Display on LED Keypad	Fault Name	Descriptions
143	AuE2	Auto-tuning error (AuE2)	Motor phase loss error when motor parameter automatically detects.
Action and Reset			
Action Condition		Software detection	
Action Time		Immediately act	
Fault Treatment Parameter		N/A	
Reset Method		Manual reset	
Reset Condition		Immediately reset	
Record		Yes	
Cause		Corrective Actions	
Incorrect motor wiring		Wire the motor correctly.	
Motor error		Check if the motor works normally.	
The electromagnetic contactor is ON at output side (U/V/W) of the drive.		Verify that the three-phases of the electromagnetic valve are all closed.	
Motor U/V/W wire error		Check if the wires are broken.	

No.	Display on LED Keypad	Fault Name	Descriptions
144	AuE3	Auto-tune error 3 (AuE3)	No load current I_0 measurement error when the motor parameter automatically detects.
Action and Reset			
Action Condition		Software detection	
Action Time		Immediately act	
Fault Treatment Parameter		N/A	
Reset Method		Manual reset	
Reset Condition		Immediately reset	
Record		Yes	
Cause		Corrective Actions	
Incorrect settings for the motor parameter (rated current)		Check the settings for Pr.05-01 / Pr.05-13 / Pr.05-34.	
Motor error		Check if the motor works normally.	

No.	Display on LED Keypad	Fault Name	Descriptions
145		MErr error (MErr)	MErr error.
Action and Reset			
Action Condition		Software detection	
Action Time		Immediately act	
Fault Treatment Parameter		N/A	
Reset Method		N/A	
Reset Condition		N/A	
Record		Yes	
Cause		Corrective Actions	
MErr error		Contact your local distributor or Delta.	

No.	Display on LED Keypad	Fault Name	Descriptions
215	EdtE	Ethernet communication time-out (EdtE)	Communication time-out between rectifier and upper unit
Action and Reset			
Action Condition		The rectifier do not receive the communication packet from the upper unit. When this communication disconnection occurs, the inverter axis issues the error.	
Action Time		100ms (default), can be set by the upper unit	
Fault Treatment Parameter		The reaction of inverter axes please refer to section 7-3-4	
Reset Method		Manual reset / reset by the upper unit command	
Reset Condition		The error can be reset when communication is restored.	
Record		Yes	
Cause		Corrective Actions	
Cable disconnection or bad connection		Check the cable and replace it if necessary	
Insufficient performance network card (Example: USB to Ethernet)		Change network card	

No.	Display on LED Keypad	Fault Name	Descriptions
220	PSEE	PROFINET startup error (PStE)	PROFINET startup failure
Action and Reset			
Action Condition		When Pr.09-55 is set to 2 and cycle the power, the software detects PROFINET initialization failed.	
Action Time		Immediately	
Fault Treatment Parameter		No	
Reset Method		No	
Reset Condition		No (cycle the power)	
Record		Yes	
Cause		Corrective Actions	
Strong environmental noise interference		Remove or move away from the noise interference source. Check the power wiring and cycle the power. If the above measures do not work, return the device to the factory for repair.	
Hardware error		Cycle the power, if PStE error still exists, return to the factory for repair.	

No.	Display on LED Keypad	Fault Name	Descriptions
221	PSFE	PROFINET storage device error (PSFE)	Failed to read PROFINET power-off storage device.
Action and Reset			
Action Condition		When Pr.09-55 is set to 2 and cycle the power, the software detects PROFINET power-off storage checksum is different from the recorded value.	
Action Time		Immediately	
Fault Treatment Parameter		No	
Reset Method		No	
Reset Condition		No (cycle the power)	
Record		Yes	
Cause		Corrective Actions	
Strong environmental noise interference		Check the power wiring and cycle the power. Remove or move away from the noise interference source.	
Storage device error		Cycle the power, if PSFE error still exists, return to the factory for repair.	

No.	Display on LED Keypad	Fault Name	Descriptions
222	PoPE	PROFINET operation error (PoPE)	When running the PROFINET, an operation error detected.
Action and Reset			
Action Condition		When Pr.09-55 is set to 2 and cycle the power, the software detects no PROFINET operation response.	
Action Time		5 sec.	
Fault Treatment Parameter		No	
Reset Method		No	
Reset Condition		No (cycle the power)	
Record		Yes	
Cause		Corrective Actions	
The network is overloaded		Reduce the periodic communication cycle or the number of parameters read and written. Reduce the number of non-periodic communication packet settings. Cycle the power, if PoPE error still exists, return to the factory for repair.	
Network error		Cycle the power, if PoPE error still exists, return to the factory for repair.	

No.	Display on LED Keypad	Fault Name	Descriptions
223	PrbE	PROFINET program inspection error (PrbE)	An error is found when loading PROFINET program.
Action and Reset			
Action Condition		When Pr.09-55 is set to 2 and the power is cycled, the software detects that the loaded PROFINET program is incorrect.	
Action Time		Immediately	
Fault Treatment Parameter		No	
Reset Method		No	
Reset Condition		No	
Record		Yes	
Cause		Corrective Actions	
Strong environmental noise interference		Check the power wiring and cycle the power. Remove or move away from the noise interference source.	
Program inspection error		If the error persists after performing several manual power cycles, return the unit for inspection.	

No.	Display on LED Keypad	Fault Name	Descriptions
224		STO execution time-out (SToT)	The execution time of STO module exceeds the internal counter time.
Action and Reset			
Action Condition		The STO module execution time exceeds the internal counter time	
Action Time		Immediately act	
Fault Treatment Parameter		No	
Reset Method		Hardware error cannot be reset. Cycle the power after power off.	
Reset Condition		No	
Record		Yes	
Cause		Corrective Actions	
Control board error		Replace the control board.	

No.	Display on LED Keypad	Fault Name	Descriptions
225		STO ROM verifying failure (STor)	The STO module ROM read-out error
Action and Reset			
Action Condition		The STO module ROM verifying failure	
Action Time		Immediately act	
Fault Treatment Parameter		No	
Reset Method		Hardware error cannot be reset. Cycle the power after power off.	
Reset Condition		No	
Record		Yes	
Cause		Corrective Actions	
Control board error		Replace the control board.	

No.	Display on LED Keypad	Fault Name	Descriptions
226		STO loss (STOL)	The STO module communication failure
Action and Reset			
Action Condition		The STO module communication failure	
Action Time		Immediately act	
Fault Treatment Parameter		No	
Reset Method		Hardware error cannot be reset. Cycle the power after power off.	
Reset Condition		No	
Record		Yes	
Cause		Corrective Actions	
Control board error		Replace the control board.	

No.	Display on LED Keypad	Fault Name	Descriptions
227		STO Channel 1 error (STC1)	The STO Channel 1 circuit failure
Action and Reset			
Action Condition		The STO Channel 1 circuit failure	
Action Time		Immediately act	
Fault Treatment Parameter		No	
Reset Method		Hardware error cannot be reset. Cycle the power after power off.	
Reset Condition		No	
Record		Yes	
Cause		Corrective Actions	
Control board error		Replace the control board.	

No.	Display on LED Keypad	Fault Name	Descriptions
228		STO Channel 2 error (STC2)	The STO Channel 2 circuit failure
Action and Reset			
Action Condition		The STO Channel 2 circuit failure	
Action Time		Immediately act	
Fault Treatment Parameter		No	
Reset Method		Hardware error cannot be reset. Cycle the power after power off.	
Reset Condition		No	
Record		Yes	
Cause		Corrective Actions	
Control board error		Replace the control board.	

No.	Display on LED Keypad	Fault Name	Descriptions
229	SPC 1	STO Channel 1 time-out (SPC1)	There is an activation time difference (> 500 ms) between STO Channel 1 and Channel 2, and Channel 1 is activated
Action and Reset			
Action Condition		The time difference between two channels are > 500 ms	
Action Time		Immediately act	
Fault Treatment Parameter		No	
Reset Method		Hardware error cannot be reset. Cycle the power after power off.	
Reset Condition		No	
Record		Yes	
Cause		Corrective Actions	
Channel external PLC equipment error		1. Check if Channel 1 and Channel 2 input with external PLC equipment, and if there is time difference between the equipment. Replace the PLC equipment to the ones with the same activation time. 2. Check if the PLC equipment is damaged.	
Control board error		Replace the control board.	

No.	Display on LED Keypad	Fault Name	Descriptions
230	SPC2	STO Channel 2 time-out (SPC2)	There is an activation time difference (> 500 ms) between STO Channel 1 and Channel 2, and Channel 2 is activated
Action and Reset			
Action Condition		The time difference between two channels are > 500 ms	
Action Time		Immediately act	
Fault Treatment Parameter		No	
Reset Method		Hardware error cannot be reset. Cycle the power after power off.	
Reset Condition		No	
Record		Yes	
Cause		Corrective Actions	
Channel external PLC equipment error		1. Check if Channel 1 and Channel 2 input with external PLC equipment, and if there is time difference between the equipment. Replace the PLC equipment to the ones with the same activation time. 2. Check if the PLC equipment is damaged.	
Control board error		Replace the control board.	

No.	Display on LED Keypad	Fault Name	Descriptions
231	SGbE	STO Gate buffer check error (SGbE)	STO Gate buffer circuit error
Action and Reset			
Action Condition		STO Gate buffer check incorrect	
Action Time		Immediately act	
Fault Treatment Parameter		No	
Reset Method		Hardware error cannot be reset. Cycle the power after power off.	
Reset Condition		No	
Record		Yes	
Cause		Corrective Actions	
Control board error		Replace the control board.	

No.	Display on LED Keypad	Fault Name	Descriptions
232		STO power 18V over voltage (S18ov)	STO power 18V over voltage
Action and Reset			
Action Condition		STO power 18V over voltage	
Action Time		Immediately act	
Fault Treatment Parameter		No	
Reset Method		Hardware error cannot be reset. Cycle the power after power off.	
Reset Condition		No	
Record		Yes	
Cause		Corrective Actions	
Control board error		Replace the control board.	

No.	Display on LED Keypad	Fault Name	Descriptions
233		STO power 18V under voltage (S18uv)	STO power 18V under voltage
Action and Reset			
Action Condition		STO power 18V under voltage	
Action Time		Immediately act	
Fault Treatment Parameter		No	
Reset Method		Hardware error cannot be reset. Cycle the power after power off.	
Reset Condition		No	
Record		Yes	
Cause		Corrective Actions	
Control board error		Replace the control board.	

No.	Display on LED Keypad	Fault Name	Descriptions
234	S6oU	STO power 6V over voltage (S6ov)	STO power 6V over voltage
Action and Reset			
Action Condition		STO power 6V over voltage	
Action Time		Immediately act	
Fault Treatment Parameter		No	
Reset Method		Hardware error cannot be reset. Cycle the power after power off.	
Reset Condition		No	
Record		Yes	
Cause		Corrective Actions	
Control board error		Replace the control board.	

No.	Display on LED Keypad	Fault Name	Descriptions
235	S6uu	STO power 6V under voltage (S6uv)	STO power 6V under voltage
Action and Reset			
Action Condition		STO power 6V under voltage	
Action Time		Immediately act	
Fault Treatment Parameter		No	
Reset Method		Hardware error cannot be reset. Cycle the power after power off.	
Reset Condition		No	
Record		Yes	
Cause		Corrective Actions	
Control board error		Replace the control board.	

No.	Display on LED Keypad	Fault Name	Descriptions
236		STO power 5V over voltage (S5ov)	STO power 5V over voltage
Action and Reset			
Action Condition		STO power 5V over voltage	
Action Time		Immediately act	
Fault Treatment Parameter		No	
Reset Method		Hardware error cannot be reset. Cycle the power after power off.	
Reset Condition		No	
Record		Yes	
Cause		Corrective Actions	
Control board error		Replace the control board.	

No.	Display on LED Keypad	Fault Name	Descriptions
237		STO power 5V under voltage (S5uv)	STO power 5V under voltage
Action and Reset			
Action Condition		STO power 5V under voltage	
Action Time		Immediately act	
Fault Treatment Parameter		No	
Reset Method		Hardware error cannot be reset. Cycle the power after power off.	
Reset Condition		No	
Record		Yes	
Cause		Corrective Actions	
Control board error		Replace the control board.	

No.	Display on LED Keypad	Fault Name	Descriptions
238	SUdG	STO Watchdog (SWdG)	STO Watchdog occurs
Action and Reset			
Action Condition		STO module execution has a serious time-out	
Action Time		Immediately act	
Fault Treatment Parameter		No	
Reset Method		Hardware error cannot be reset. Cycle the power after power off.	
Reset Condition		No	
Record		Yes	
Cause		Corrective Actions	
Control board error		Replace the control board.	

No.	Display on LED Keypad	Fault Name	Descriptions
239	SAdE	STO ADC Sampling failure (SAdE)	STO module ADC sampling checking value is abnormal
Action and Reset			
Action Condition		STO module ADC sampling checking value is abnormal	
Action Time		Immediately act	
Fault Treatment Parameter		No	
Reset Method		Hardware error cannot be reset. Cycle the power after power off.	
Reset Condition		No	
Record		Yes	
Cause		Corrective Actions	
The power is ON when the USB is connected		Remove the USB and cycle the power.	

No.	Display on LED Keypad	Fault Name	Descriptions
240	SEbL	STO execution time is too short (SEbL)	STO execution time is lower than the internal limit
Action and Reset			
Action Condition		STO execution time is lower than the internal limit	
Action Time		Immediately act	
Fault Treatment Parameter		No	
Reset Method		Hardware error cannot be reset. Cycle the power after power off.	
Reset Condition		No	
Record		Yes	
Cause		Corrective Actions	
Control board error		Replace the control board.	

No.	Display on LED Keypad	Fault Name	Descriptions
241	SEAb	STO execution time is too high (SEAb)	STO execution time is higher than the internal limit
Action and Reset			
Action Condition		STO execution time is higher than the internal limit	
Action Time		Immediately act	
Fault Treatment Parameter		No	
Reset Method		Hardware error cannot be reset. Cycle the power after power off.	
Reset Condition		No	
Record		Yes	
Cause		Corrective Actions	
Control board error		Replace the control board.	

No.	Display on LED Keypad	Fault Name	Descriptions
242		Safe torque off 1 (STo1)	The action time difference between Channel 1 and Channel 2 are too large and Channel 1 activates.
Action and Reset			
Action Condition		There is action time difference between two channels	
Action Time		20 ms	
Fault Treatment Parameter		Pr.06-44 STO Latch Function bit 0: STO latch bit 1: STO fault indication shield	
Reset Method		Pr.06-44 bit 0 = 0, manual reset Pr.06-44 bit 0 = 1, auto reset	
Reset Condition		Channel 1 and Channel 2 back to no action level	
Record		Yes	
Cause		Corrective Actions	
Channel external appliance problems		1. Check whether Channel 1 and Channel 2 use appliance as input, and whether there is time difference in the appliance action time; replace the appliance with the same action time. 2. Check whether the appliance is broken.	

No.	Display on LED Keypad	Fault Name	Descriptions
243		Safe torque off 2 (STo2)	The action time difference between Channel 1 and Channel 2 are too large and Channel 2 activates.
Action and Reset			
Action Condition		There is action time difference between two channels	
Action Time		20 ms	
Fault Treatment Parameter		Pr.06-44 STO Latch Function bit 0: STO latch bit 1: STO fault indication shield	
Reset Method		Pr.06-44 bit 0 = 0, manual reset Pr.06-44 bit 0 = 1, auto reset	
Reset Condition		Channel 1 and Channel 2 back to no action level	
Record		Yes	
Cause		Corrective Actions	
Channel external appliance problems		3. Check whether Channel 1 and Channel 2 use appliance as input, and whether there is time difference in the appliance action time; replace the appliance with the same action time. 4. Check whether the appliance is broken.	

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Chapter 9 Maintenance and Inspections

9-1 Maintenance and Inspections

9-2 Fan Kit



- ☑ The AC motor drive has various warnings and protections against errors such as over-voltage, low voltage, or over-current. The protections activate once an error occurs, the AC motor drive stops output, activates the error contacts, and the motor coasts to stop.
- ☑ Please refer to Chapter 8 Warning and Fault Codes for the corresponding causes and corrective actions. Wait for five seconds after a fault has been cleared before pressing RESET with the input terminal keypad. The fault record is stored in the AC motor drive internal memory and can be read from the digital keypad or through the communications by accessing the parameters.
- ☑ Cut off the AC motor drive power before regular inspection. Due to a charge may still remain in the main circuit terminals of the AC motor drive with hazardous voltages even after the power has been turned off a short time, the drive must first be switched off for at least five minutes for ≤ 22 kW models, and ten minutes for ≥ 30kW models until the charging indicator turns off.
- ☑ 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.
- ☑ Never modify internal components or wiring.
- ☑ The performance and the surrounding environment should meet the standard specifications. There should be no abnormal noise, vibration, or odor.

9-1 Maintenance and Inspections

Before regular inspections, please be sure to refer to the above precautions to avoid danger.

The AC motor drive includes a large number of electronic components, they will eventually become error-prone if used past their lifespans even under normal circumstances. 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.

Ambient environment

Items to Check	Methods and Criterion	Maintenance Period		
		Daily	Half Year	One Year
The ambient temperature, humidity, and vibration.	Visual inspection and Instrument measurement	○		
Any dust, gas, oil or water drops.	Visual inspection and Instrument measurement	○		
Any dangerous objects	Visual inspection	○		

Voltage

Items to Check	Methods and Criterion	Maintenance Period		
		Daily	Half Year	One Year
If the voltage of main circuit and control circuit are correct.	Multimeter measurement	○		

Digital keypad display

Items to Check	Methods and Criterion	Maintenance Period		
		Daily	Half Year	One Year
If the display is clear	Visual inspection	○		
Any missing characters	Visual inspection	○		

Mechanical parts

Items to Check	Methods and Criterion	Maintenance Period		
		Daily	Half Year	One Year
Any abnormal sound or vibration	Visual and audible inspection		○	
Any loose or missing bolts	Securely tighten		○	
Any deformed or damaged parts	Visual inspection		○	
Any heat discoloration	Visual inspection		○	
Any dust or dirt	Visual inspection		○	

Main circuit

Items to Check	Methods and Criterion	Maintenance Period		
		Daily	Half Year	One Year
Any loose or missing bolts	Securely tighten	○		
Any deformation, crack, damage or heat and aging discoloration of the machine or insulator	Visual inspection		○	
Any dust or dirt	Visual inspection		○	

Main circuit terminals and wiring

Items to Check	Methods and Criterion	Maintenance Period		
		Daily	Half Year	One Year
Any heat discoloration and deformation of the terminal and copper plate	Visual inspection		○	
Any damage or discoloration	Visual inspection		○	

Main circuit terminal block

Items to Check	Methods and Criterion	Maintenance Period		
		Daily	Half Year	One Year
Any damage	Visual inspection	○		

Main circuit filter capacitor

Items to Check	Methods and Criterion	Maintenance Period		
		Daily	Half Year	One Year
Any liquid leaks, discoloration, crack or buckling of the exterior cover	Visual inspection	○		
Any abnormality or obviously expanded of the safety valve	Visual inspection	○		
Measure static capacity as required	Instrument measurement	○		

Main circuit resistor

Items to Check	Methods and Criterion	Maintenance Period		
		Daily	Half Year	One Year
Any hot odor or heat damage	Visual and smell inspection	○		
Any disconnections	Visual inspection	○		
If the connections damaged	Multimeter measurement	○		

Main circuit transformer and reactor

Items to Check	Methods and Criterion	Maintenance Period		
		Daily	Half Year	One Year
Any abnormal vibration or odors	Audible and smell inspection	○		

Main circuit magnetic contactor and relay

Items to Check	Methods and Criterion	Maintenance Period		
		Daily	Half Year	One Year
Any sound of vibration while operating	Audible inspection	○		
If the contact works correctly	Visual inspection	○		

Main circuit PCB and connector

Items to Check	Methods and Criterion	Maintenance Period		
		Daily	Half Year	One Year
Any loose screws and connectors	Securely tighten		○	
Any odors and discoloration	Visual and smell inspection		○	
Any crack, damage, deformation or corrosion	Visual inspection		○	
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
Any abnormal sound or vibration	Audible, visual, and manual inspection (power off before manual operation).		○	
Any loose bolts	Securely tighten		○	
Any heat discoloration	Visual inspection		○	

Cooling system ventilation channel

Items to Check	Methods and Criterion	Maintenance Period		
		Daily	Half Year	One Year
Any obstruction in the heat sink, air intake or air outlet	Visual inspection		○	

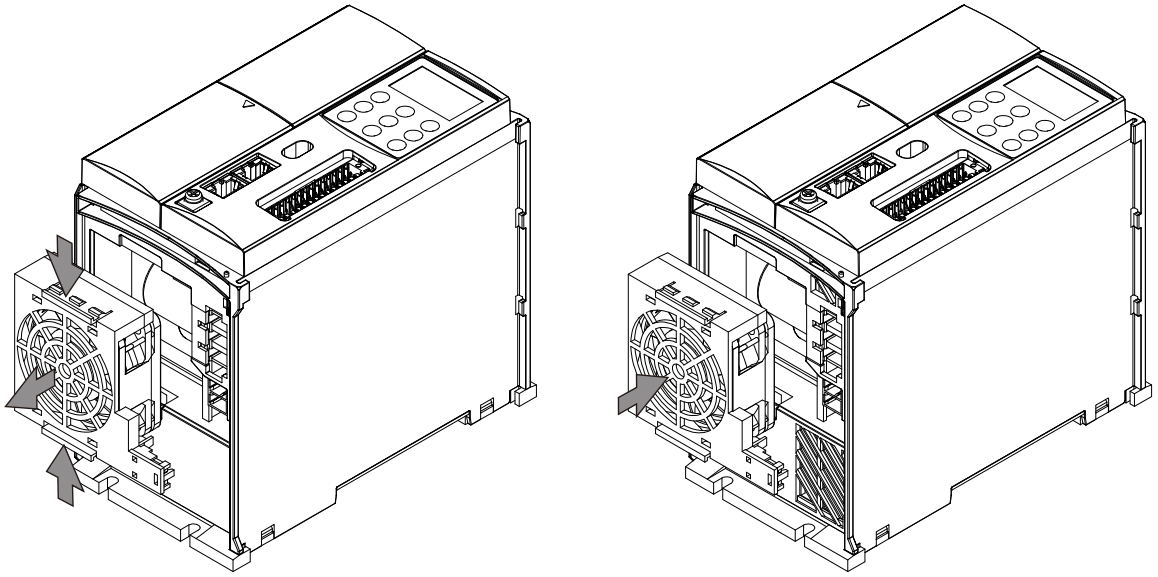
NOTE: Use a chemically neutral cloth to clean and use a dust cleaner to remove dust when necessary.

9-2 Fan Kit

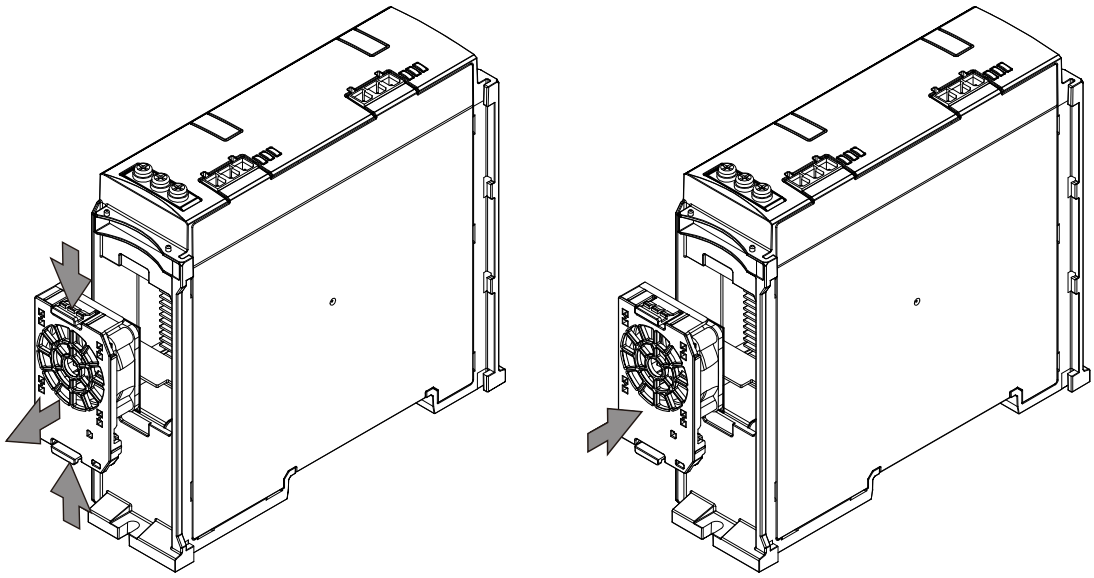
The fan does not support hot-plugging function. Please cut off the AC motor drive power before replacing it.

Rectifier Module (Frame RA) fan model: MKM-FKMRC

NOTE: Take MX300-C model figures as an example of the rectifier module.



Inverter Module (Frame IA) fan model: MKM-FKMDR



Removal steps:

1. Press on both sides of the fan to remove it.
2. Press on both sides of the fan then press inward to assemble it and confirm the hooks are engaged.

Chapter 10 Optional Accessories

10-1 Extension Card EMM-D88A -- Extension for 8-point Digital Input / 8-point Digital Output

10-2 Delta Standard Fieldbus Cables

10-3 Brake Resistors

10-4 Magnetic Contactor / Air Circuit Breaker and Non-fuse Circuit Breaker

10-5 Fuse

10-6 AC Reactor

10-7 Zero phase reactor

10-8 EMC Filter

10-9 EMC Shield Plate

10-10 Capacitive Filter

10-11 Fan Kit

10-12 Protective cover

10-13 Removable terminal

10-14 Digital Keypad

The option cards in this chapter are optional accessories. Select the applicable option cards for your motor drive or contact your local distributor for suggestions. The option cards can significantly improve the efficiency of the motor drive. To prevent damage to the motor drive during installation, remove the digital keypad and the cover before wiring.

10-1 Extension Card EMM-D88A -- Extension for 8-point Digital Input / 8-point Digital Output

10-1-1 Extension Card EMM-D88A

Product Profile



Figure 10-1

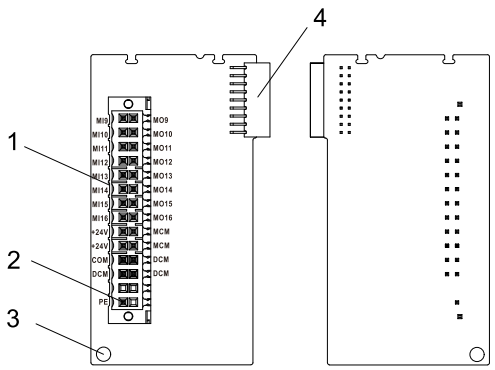


Figure 10-2

1. Terminal block
2. Ground terminal block
3. Screw fixing hole
4. AC motor drive connection port

Wire gauge: 0.25–1.5 mm^2 [24–16 AWG]

Stripping length: 8–9 mm

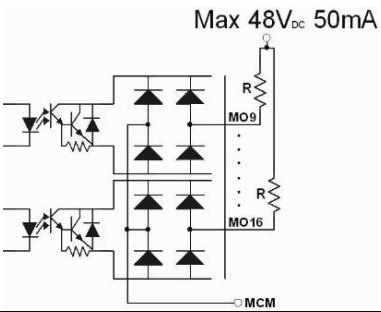
CN6 Terminal	
Terminals	Descriptions
24V, DCM	Output power: +24V (+20V–+30V)
MI9–MI16	Refer to inverter module Pr.02-26–Pr.02-28 input terminal of I/O extension card. Choose SINK (NPN) / SOURCE (PNP) by COM Pin of the Terminal block. COM connects +24 V as the SINK (NPN) and DCM as the SOURCE (PNP) Internal power is supplied by terminal 24 V: +24V (+20V–+30V) If external power is +24 V_{DC}, the max. voltage is 30 V_{DC} and the min. voltage is 19 V_{DC}. • ON: the activation current is 6.5 mA • OFF: leakage current tolerance is 10 μA
MO9–MO16	Refer to inverter module Pr.02-36–Pr.02-38 output terminal of extension card. The AC motor drive outputs various monitoring signals, such as the drive in operation, frequency reached, and overload indication through a transistor. MO output signal: each MO terminal needs a pull-up resistor; the max. external power voltage is 48 V_{DC} / 50 mA. 
MCM	Common for multi-function output terminals MO9–MO16 (photo coupler)
PE	Grounding terminal. To decrease noise, properly ground this terminal.

Table 10-1

10-1-2 Installation Method

Take MX300-C model figures as an example of the rectifier module.

Mounting Position of Extension Cards

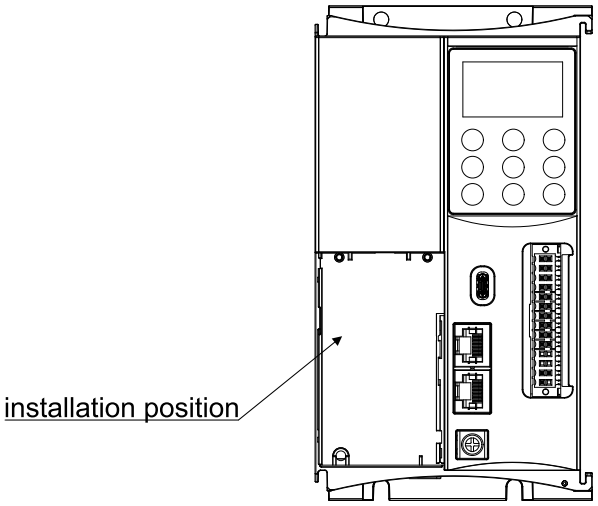


Figure 10-3

Installation Method

1. Turn off the power of the motor drive and then remove the front cover, as shown in Figure 10-4.
2. Insert the slot of the extension card along the cover of the motor drive, as shown in Figure 10-5.
3. Push the extension card sideways and connect the connector of the extension card with the connector on the other end, as shown in Figure 10-6.
4. Use cross screwdriver tighten one M3 screw, the recommended torque is 4-6 kg-cm [3.5-5.2 lb-in] [0.39-0.59 Nm], as shown in Figure 10-7.
5. Install the extension card upper cover back to the drive and have the clips engage the slots, as shown in Figure 10-8.
6. Install the external terminal into the extension card terminal block in the vertical direction, as shown in Figure 10-9.
7. Assembly is completed, as shown in Figure 10-10.

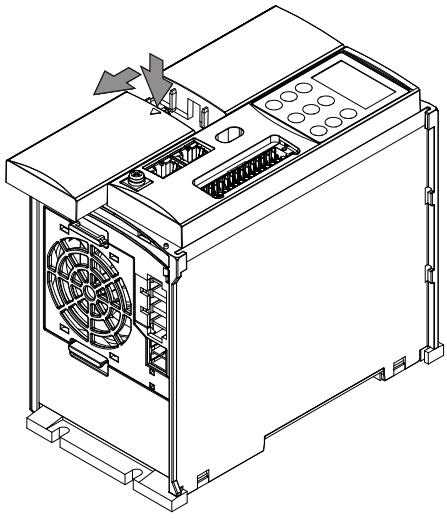


Figure 10-4

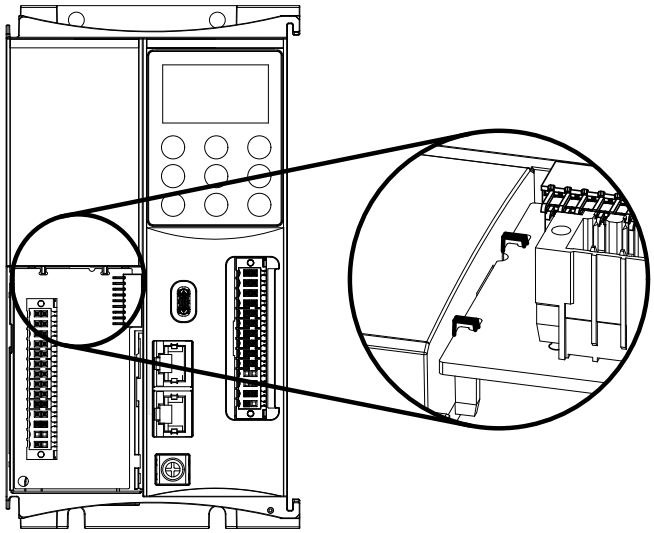


Figure 10-5

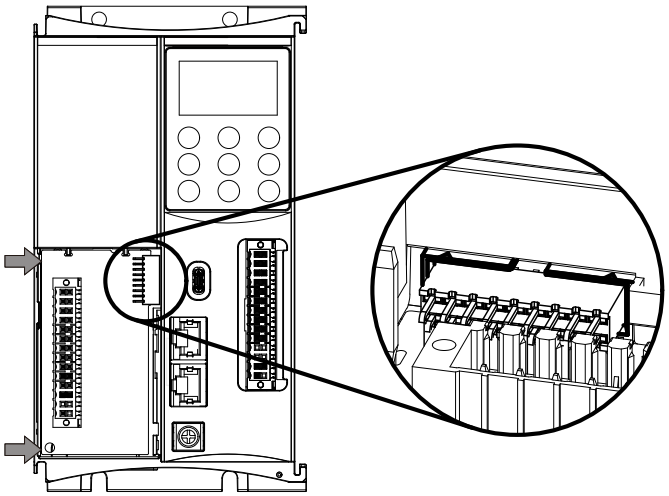


Figure 10-6

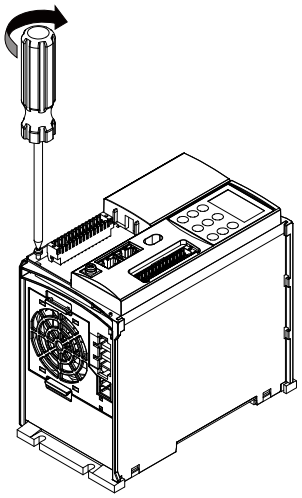


Figure 10-7

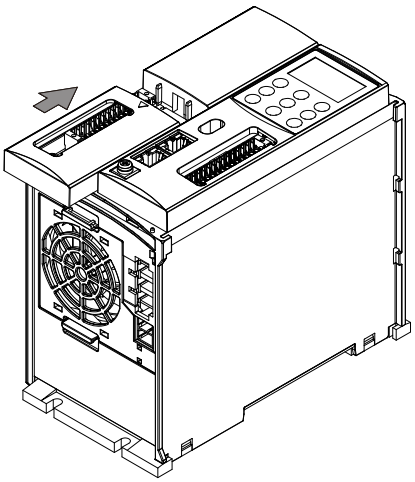


Figure 10-8

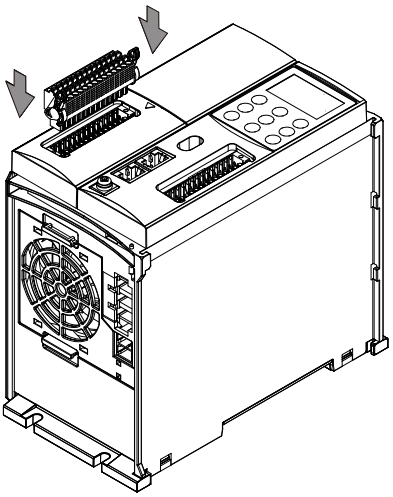


Figure 10-9

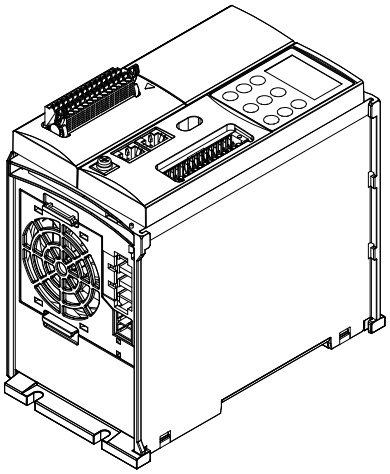


Figure 10-10

Grounded installation

The terminal block grounding pin position of the extension card EMM-D88A is marked “2” in Figure 10-11. The ground terminal connects to the PE on the drive as the circles show in Figure 10-12

- Screw specification: M4; Torque (±10%): 8kg-cm [7.0lb-in] [0.78Nm]

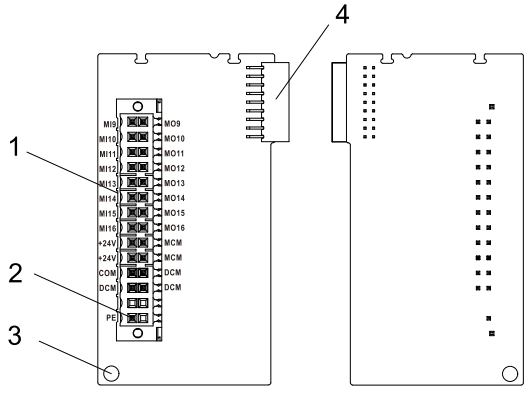


Figure 10-11

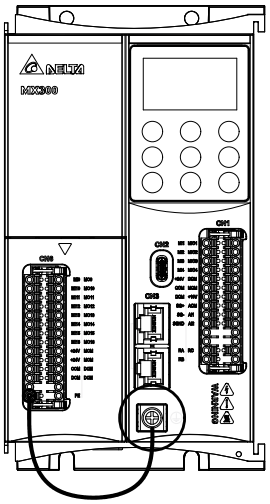


Figure 10-12

10-2 Delta Standard Fieldbus Cables

Delta Standard Fieldbus Cables

Type	Delta Standard Fieldbus Cables	Model	Descriptions	Length
RS-485	Digital Keypad RJ45 Extension Lead	UC-CMC003-01A	CANopen cable, RJ45 connector	0.3 m
		UC-CMC005-01A	CANopen cable, RJ45 connector	0.5 m
		UC-CMC010-01A	CANopen cable, RJ45 connector	1 m
		UC-CMC015-01A	CANopen cable, RJ45 connector	1.5 m
		UC-CMC020-01A	CANopen cable, RJ45 connector	2 m
		UC-CMC030-01A	CANopen cable, RJ45 connector	3 m
		UC-CMC050-01A	CANopen cable, RJ45 connector	5 m
		UC-CMC100-01A	CANopen cable, RJ45 connector	10 m
		UC-CMC200-01A	CANopen cable, RJ45 connector	20 m
EtherNet	EtherNet / EtherCAT Cable	UC-EMC003-02A	Ethernet / EtherCAT cable, Shielding	0.3 m
		UC-EMC005-02A	Ethernet / EtherCAT cable, Shielding	0.5 m
		UC-EMC010-02A	Ethernet / EtherCAT cable, Shielding	1 m
		UC-EMC020-02A	Ethernet / EtherCAT cable, Shielding	2 m
		UC-EMC050-02A	Ethernet / EtherCAT cable, Shielding	5 m
		UC-EMC100-02A	Ethernet / EtherCAT cable, Shielding	10 m
		UC-EMC200-02A	Ethernet / EtherCAT cable, Shielding	20 m

Table 10-2

Delta Fieldbus Cable TAP

Type	Delta Fieldbus Cable TAP	Model	Descriptions	Function
RS-485	CANopen Dimension	TAP-CN01	1 in 2 out, built-in 121 Ω Termination Resistor	1 in 2 out
		TAP-CN02	1 in 4 out, built-in 121 Ω Termination Resistor	1 in 4 out
		TAP-CN03	1 in 4 out, RJ45 connector built-in 121 Ω Termination Resistor	1 in 4 out

Table 10-3

10-3 Brake Resistors

230V one-phase

M0odel	Output Power kW	125% Braking Torque / 10% ED *1							Max. Braking Torque *2		
		Braking Torque *3 (kg-m2)	Equivalent Resistance for each AC motor Drive	Brake Resistor for Each Brake Unit *4			Min. Braking power *5 Pmin. (kW)	Braking Current *6 (A)	Min. Resistor Value (Ω)	Max. Total Braking Current (A)	Max. Peak Power (kW)
				Part No.	Q'ty	Usage					
VFD15AMXx21Cx VFD15AMXx21Ex	2.2	1.5	500W 56Ω	BR500W056	1	-	0.24	6.8	42.2	9	3.4
VFD25AMXx21Cx VFD25AMXx21Ex	3.7	2.5	500W 30Ω	BR500W030			0.41	12.7	27.1	14	5.3

Table 10-4

460V three-phase

M0odel	Output Power kW	125% Braking Torque / 10% ED *1							Max. Braking Torque *2		
		Braking Torque *3 (kg-m2)	Equivalent Resistance for each AC motor Drive	Brake Resistor for Each Brake Unit *4			Min. Braking power *5 Pmin. (kW)	Braking Current *6 (A)	Min. Resistor Value (Ω)	Max. Total Braking Current (A)	Max. Peak Power (kW)
				Part No.	Q'ty	Usage					
VFD22AMXx43Cx VFD22AMXx43Ex	7.5	5.1	1000W 60Ω	BR500W030	2	2 in series	0.8	12.7	50.7	15	11.4
VFD33AMXx43Cx VFD33AMXx43Ex	11	7.4	2000W 50Ω	BR1K0W025			1.2	15.2	38.0	20	15.2
VFD41AMXx43Cx VFD41AMXx43Ex	18.5	12.5	2000W 32Ω	BR1K0W016			2.0	23.8	30.4	25	19.0

Table 10-5

*1. Calculation for 125% brake torque: (kW) × 125% × 0.8; where 0.8 is motor efficiency.
Because of the limited resistor power, the longest operation time for 10% ED is 10 seconds (ON: 10 sec. / OFF: 90 sec.).

*2. Refer to the braking performance curve chart for the working time and ED (%) vs. braking current.

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

*4. For heat dissipation, a resistor of 400 W or lower should be fixed to the frame and maintain the surface temperature below 250°C (482°F). A resistor of 1000 W and above should maintain the surface temperature below 600°C (1112°F). (If the surface temperature is higher than the temperature limit, install extra cooling system or increase the size of the resistor.)

*5. The braking resistor must meet 10% ED and have 10 times overload capability.

*6. This braking current is obtained by using the braking resistor recommended by Delta and the preset braking voltage.

NOTE:

1. Specification and Appearance of Brake Resistors

1.1 Wire wound resistors: For 1000 W and above, refer to the following appearance of wire wound resistor (Figure7-1) and its model and specification comparison table (Table 7-5) for details.

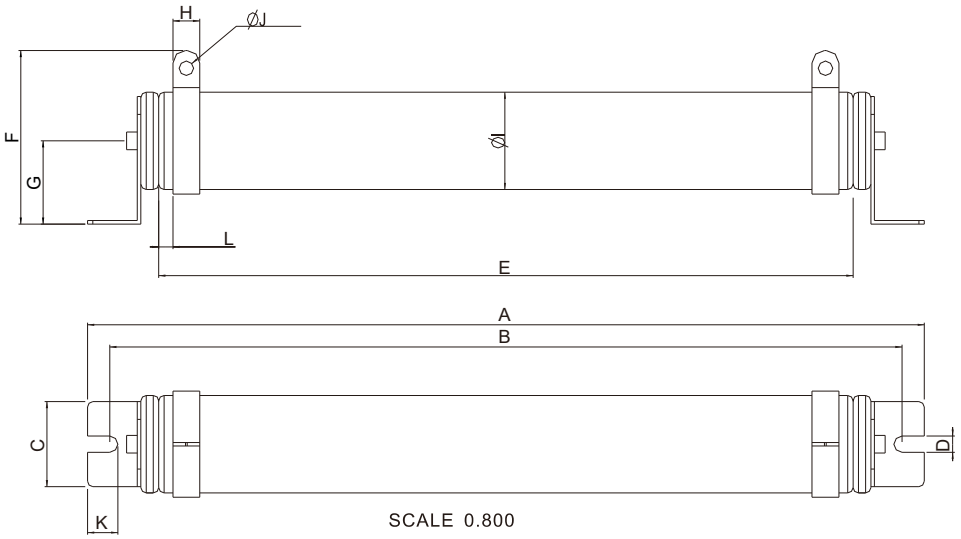


Figure 10-13

Models and Specifications Comparison Table of Wire Wound Resistors: Unit: mm

Models	A	B	C	D	E	F	G	H	Ø	ØJ	K	L
BR1K0W4P3	470±10	445±5	48±0.2	9.1±0.1	390±3	98±5	47±5	15±1	55±5	8.1±0.1	21±0.2	8±1
BR1K0W5P1												
BR1K0W016												
BR1K0W020												
BR1K0W075												
BR1K2W3P9												
BR1K2W015												
BR1K5W3P3												
BR1K5W012												
BR1K5W013												
BR1K5W043												

Table 10-6

1.2 Aluminum housed resistors: For below 1000 W, refer to the following appearance of aluminum-housed resistor (Figure 7-2) and its model and specification comparison table (Table 7-6) for details

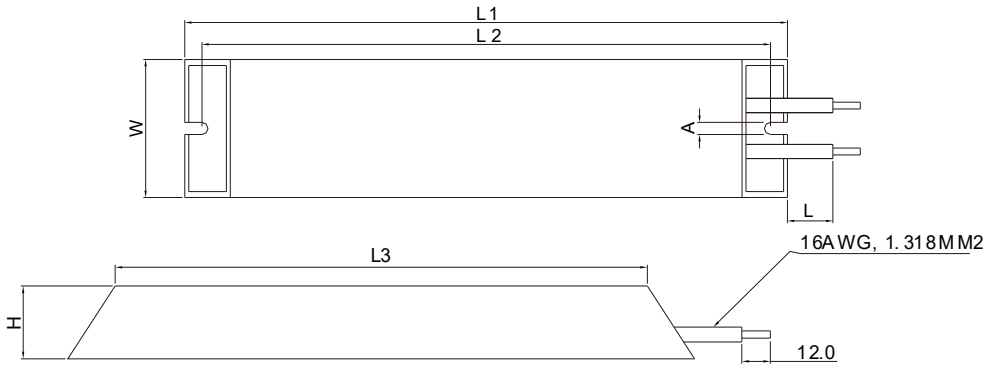


Figure 10-14

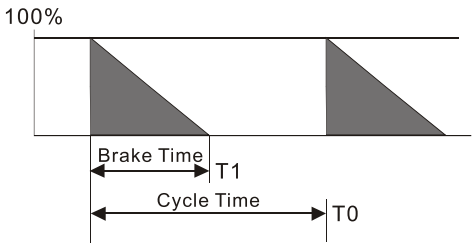
Unit: mm

Models	L1	L2	L3	W	H	A	L
BR080W200	140±2	125±2	100±1	40±0.5	20±0.5	5.3±0.5	200±20
BR080W750							
BR200W091	165±2	150±2	125±1	60±0.5	30±0.5		
BR200W360							
BR300W070	215±2	200±2	175±1				
BR300W250							
BR400W040	265±2	250±2	225±1				
BR400W150							

Table 10-7

2. 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.

Figure 10-15

For safety, install a thermal overload relay (O.L) between the brake unit and the brake resistor in conjunction with the magnetic contactor (MC) before the drive for additional protection. The thermal overload relay protects the brake resistor from damage due to frequent or continuous braking. Under such circumstances, turn off the power to prevent damage to the brake resistor, brake unit and drive.

Notice: Never use it to disconnect the brake resistor.

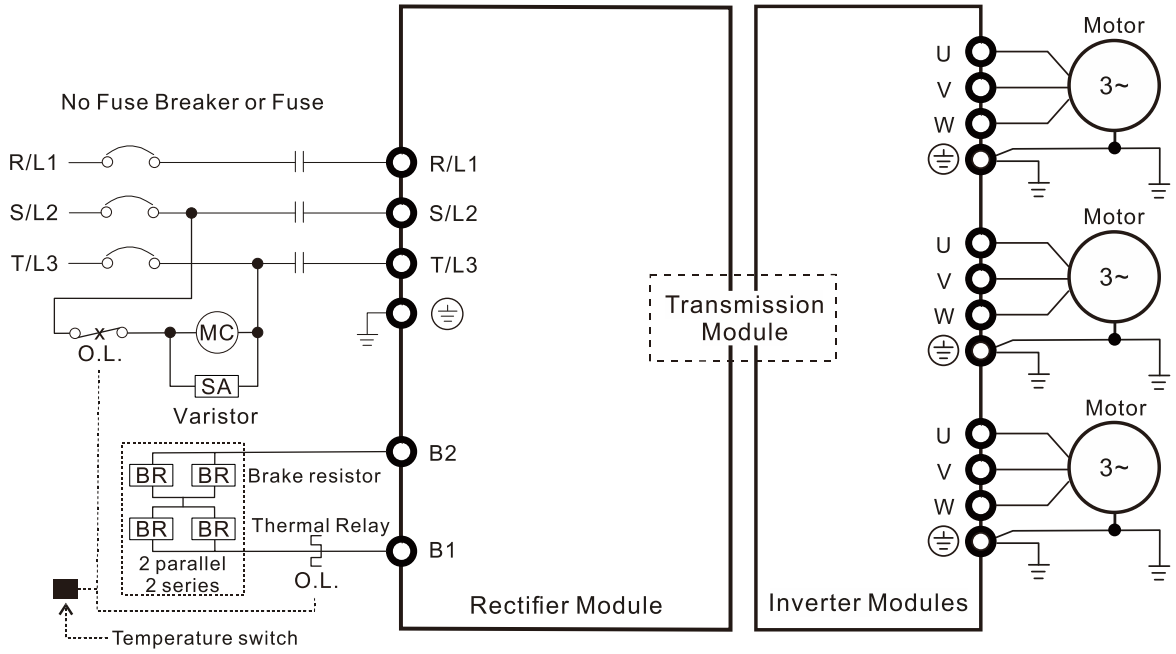


Figure 10-16

3. Any damage to the drive or other equipment caused by using brake resistors and brake modules that are not provided by Delta voids the warranty.
4. Consider environmental safety factors when installing the brake resistors. If you use the minimum resistance value, consult local dealers for the power calculation.
5. When using more than two brake units, the equivalent resistor value of the parallel brake unit cannot be less than the value in the column “Min. Resistor Value (Ω)”. Install the brake unit vertically and leaves appropriate heat dissipation space on the top and the bottom of the brake unit. 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
     https://downloadcenter.deltaww.com/downloadCenterCounter.aspx?DID=47611&DocPath=1&hl=en-US
   - VFDB4110 / 4160 / 4185 Braking Modules Instruction Sheet
     https://downloadcenter.deltaww.com/downloadCenterCounter.aspx?DID=47614&DocPath=1&hl=en-US
   - VFDB6055 / 6110 / 6160 / 6200 Braking Modules Instruction Sheet
     https://downloadcenter.deltaww.com/downloadCenterCounter.aspx?DID=8592&DocPath=1&hl=en-US

6. The selection tables are for normal usage. If the AC motor drive requires frequent braking, increase the Watts by two to three times.
7. Thermal overload relay selection is based on its overload capacity. A standard braking capacity of the MX300 is 10% ED (Tripping time = 10 s). Take 460V / 7.5kW as an example, the braking current is 10.2A. In this case, select a thermal overload relay rated at 5A (5 × 260% = 13A > 10.2A). The property of each thermal relay may vary among different manufacturers. Carefully read the specification before using it.

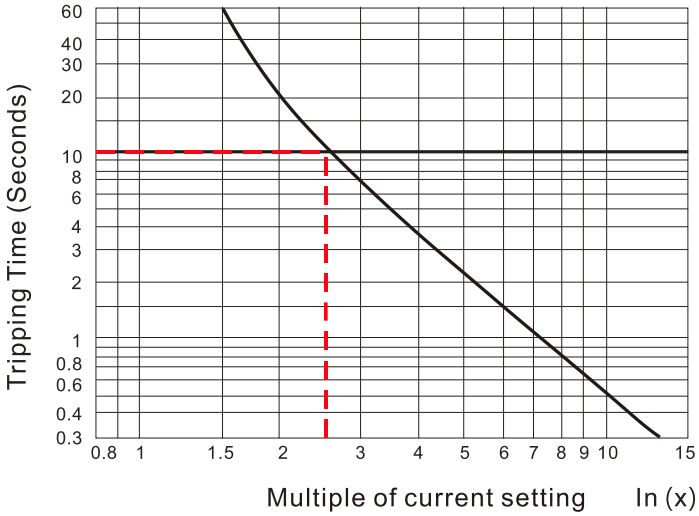


Figure 10-17

10-4 Magnetic Contactor / Air Circuit Breaker and Non-fuse Circuit Breaker

10-4-1 Magnetic Contactor (MC) and Air Circuit Breaker (ACB)

It is recommended the ambient temperature for MC should be ≥ 60°C and that for ACB should be ≥ 50°C. In the meanwhile, consider temperature derating for components with ON / OFF switch in accordance with the ambient temperature of the on-site distribution panel.

Voltage	Model	Heavy Duty Output Current (A)	Heavy Duty Input Current (A)	MC / ACB Selection (A)
230V one-phase	VFD15AMXx21Cx VFD15AMXx21Ex	15.1	27.2	40
	VFD25AMXx21Cx VFD25AMXx21Ex	25	45	63
460V three-phase	VFD22AMXx43Cx VFD22AMXx43Ex	22	24.2	40
	VFD33AMXx43Cx VFD33AMXx43Ex	33	36.3	63
	VFD41AMXx43Cx VFD41AMXx43Ex	41	45	63

Table 10-8

10-4-2 Non-fuse Circuit Breaker

☑ The rated current of the non-fuse circuit breaker should be 1.6–2.6 times the drive's rated input current. The recommended current values are shown in the table below.

☑ Compare the time characteristics of the non-fuse circuit breaker with those of the drive's overheated protection to ensure that there is no tripping.

Voltage	Model	Breaker Rated Input Recommended Current (A) Heavy duty
230V one-phase	VFD15AMXx21Cx VFD15AMXx21Ex	40
	VFD25AMXx21Cx VFD25AMXx21Ex	63
460V three-phase	VFD22AMXx43Cx VFD22AMXx43Ex	40
	VFD33AMXx43Cx VFD33AMXx43Ex	63
	VFD41AMXx43Cx VFD41AMXx43Ex	63

Table 10-9

10-5 Fuse

☑ Fuse specifications lower than the table below are allowed.

☑ UL certified fuses apply to the short-circuit protection at the input side. For installation in the United States, branch circuit protection must be provided in accordance with the National Electrical Code (NEC) and any applicable local codes. Use UL classified fuses to fulfill this requirement.

☑ For the installation in Canada, branch circuit protection must be provided in accordance with Canadian Electrical Code and any applicable provincial codes. Use UL certified fuses to fulfill this requirement.

Voltage	Model		Branch circuit fuses output (A)
230V one-phase	VFD15AMXx21Cx	VFD15AMXx21Ex	40 Class T JJS-40 600 VAC
	VFD25AMXx21Cx	VFD25AMXx21Ex	60 Class T JJS-60 600 VAC
460V three-phase	VFD22AMXx43Cx	VFD22AMXx43Ex	40 Class T JJS-40 600 VAC
	VFD33AMXx43Cx	VFD33AMXx43Ex	60 Class T JJS-60 600 VAC
	VFD41AMXx43Cx	VFD41AMXx43Ex	60 Class T JJS-60 600 VAC

Table 10-10

10-6 AC Reactor

10-6-1 AC Input Reactor

Install an AC reactor at 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 from the mains power, further protecting the drive. For example, when the mains power capacity is higher than 500 kVA, or when using a phase-compensation capacitor, momentary voltage and current spikes may damage the AC motor drive's internal circuit. An AC reactor at the input side of the AC motor drive protects it by suppressing surges.

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

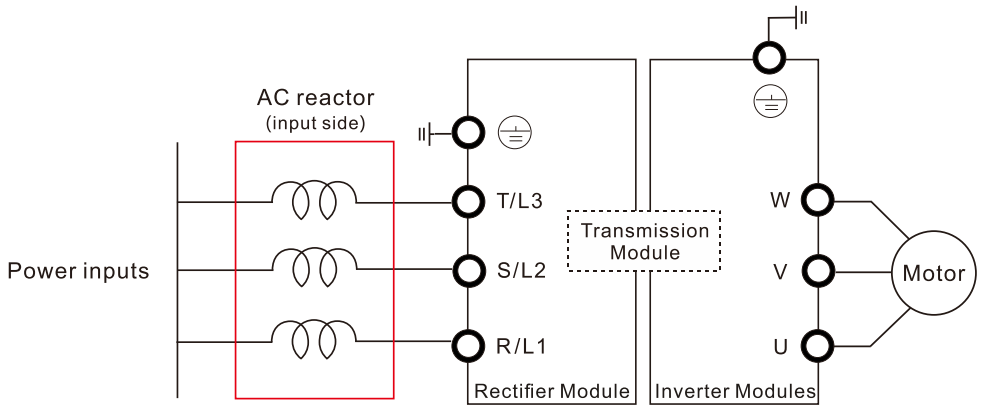


Figure 10-18

10-6-2 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.

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

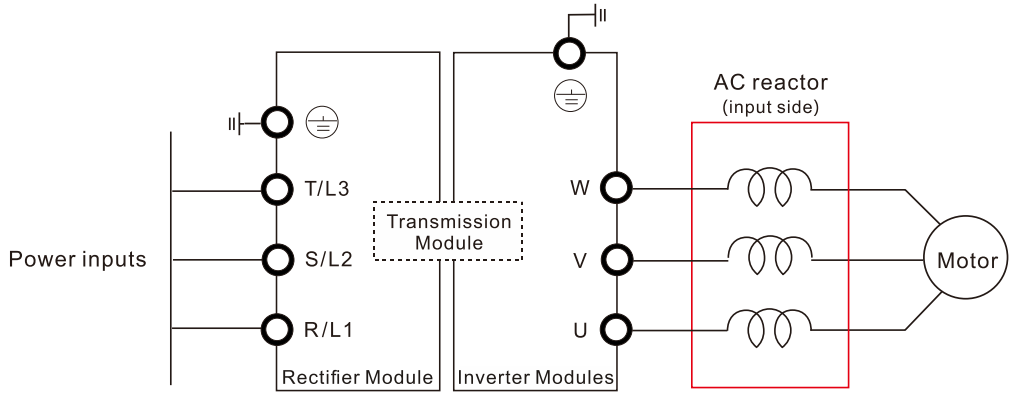


Figure 10-19

10-6-3 Applicable Reactors

Applicable Input Reactors

230V, 50-60 Hz / one-phase

Model		Rated Current [Arms]	Saturation Current [Arms]	AC input reactor	Delta's part no.
VFD15AMXx21Cx	VFD15AMXx21Ex	15	30	1.17	DR018A0117
VFD25AMXx21Cx	VFD25AMXx21Ex	25	50	0.881	DR024AP881

Table 10-11

460V, 50-60 Hz / three-phase

Model		Rated Current [Arms]	Saturation Current [Arms]	AC input reactor	Delta's part no.
VFD22AMXx43Cx	VFD22AMXx43Ex	22	44	0.881	DR024AP881
VFD33AMXx43Cx	VFD33AMXx43Ex	33	66	0.66	DR032AP660
VFD41AMXx43Cx	VFD41AMXx43Ex	41	82	0.541	DR045AP541

Table 10-12

Applicable Output Reactors

230V, 50–60 Hz / One-phase - Normal Duty

Model		Rated Current (Arms)	Saturation Current (Arms)	Output Reactor (mH)	Output Reactor Delta Part #
VFD2A8MXx21Ax	VFD2A8MXx21SA	3.5	7	2.54	DR005L0254
VFD4A8MXx21Ax	VFD4A8MXx21SA	8	16	1.59	DR008L0159
VFD7A5MXx21Ax	VFD7A5MXx21SA	11	22	1.15	DR011L0115
VFD11AMXx21Ax	VFD11AMXx21SA	17.6	35.2	0.746	DR017LP746

Table 10-13

230V, 50–60 Hz / One-phase - Heavy Duty

Model		Rated Current (Arms)	Saturation Current (Arms)	Output Reactor (mH)	Output Reactor Delta Part #
VFD2A8MXx21Ax	VFD2A8MXx21SA	2.8	5.6	2.54	DR005L0254
VFD4A8MXx21Ax	VFD4A8MXx21SA	4.8	9.6	2.54	DR005L0254
VFD7A5MXx21Ax	VFD7A5MXx21SA	7.5	15	1.59	DR008L0159
VFD11AMXx21Ax	VFD11AMXx21SA	11	22	1.15	DR011L0115

Table 10-14

460V, 50–60 Hz / Three-phase - Normal Duty

Model		Rated Current (Arms)	Saturation Current (Arms)	Output Reactor (mH)	Output Reactor Delta Part #
VFD1A5MXx43Ax	VFD1A5MXx43SA	2.3	4.6	8.1	DR003L0810
VFD2A7MXx43Ax	VFD2A7MXx43SA	4.2	8.4	6.07	DR004L0607
VFD4A2MXx43Ax	VFD4A2MXx43SA	5.5	11	4.05	DR006L0405
VFD5A5MXx43Ax	VFD5A5MXx43SA	9	18	2.7	DR009L0270
VFD9A0MXx43Ax	VFD9A0MXx43SA	13	26	2.02	DR012L0202
VFD13AMXx43Ax	VFD13AMXx43SA	17	34	1.17	DR018L0117
VFD17AMXx43Ax	VFD17AMXx43SA	21	42	0.881	DR024LP881

Table 10-15

460V, 50–60 Hz / Three-phase - Heavy Duty

Model		Rated Current (Arms)	Saturation Current (Arms)	Output Reactor (mH)	Output Reactor Delta Part #
VFD1A5MXx43Ax	VFD1A5MXx43SA	1.5	3	8.1	DR003L0810
VFD2A7MXx43Ax	VFD2A7MXx43SA	2.7	5.4	8.1	DR003L0810
VFD4A2MXx43Ax	VFD4A2MXx43SA	4.2	8.4	6.07	DR004L0607
VFD5A5MXx43Ax	VFD5A5MXx43SA	5.5	11	4.05	DR006L0405
VFD9A0MXx43Ax	VFD9A0MXx43SA	9	18	2.7	DR009L0270
VFD13AMXx43Ax	VFD13AMXx43SA	13	26	2.02	DR012L0202
VFD17AMXx43Ax	VFD17AMXx43SA	17	34	1.17	DR018L0117

Table 10-16

The table below shows the THDi specification when using Delta's drives to work with AC / DC reactors.

Drive Spec.	Models without Built-in DC Reactors	
Reactor Spec.	No AC / DC Reactor	3% Input AC Reactor
5th	73.3%	38.5%
7th	52.74%	15.3%
11th	7.28%	7.1%
13th	0.4%	3.75%
THDi	91%	43.6%
The THDi specification listed here assumes that there is 0.8% resistance (mains electricity) before the reactors and may be slightly different from the actual THDi, depending on the installation and environmental conditions (wires, motors).		

Table 10-17

10-6-4 Reactor Dimension and Specifications

The size and the specification of the AC input reactor:

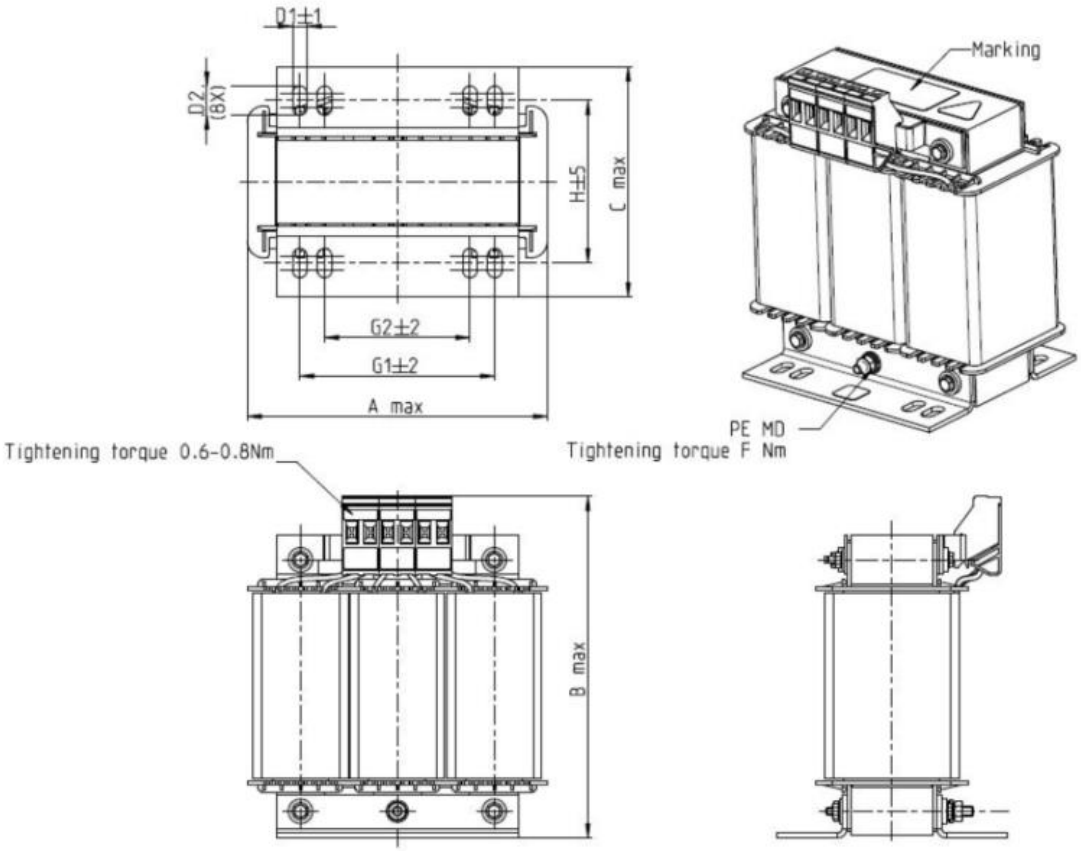


Figure 10-20

Unit: mm

AC Input Reactors Delta Part #	A	B	C	D1*D2	H	G1	G2	PE D
DR018A0117	160	160	115	6*12	90	107	75	M4

Table 10-18

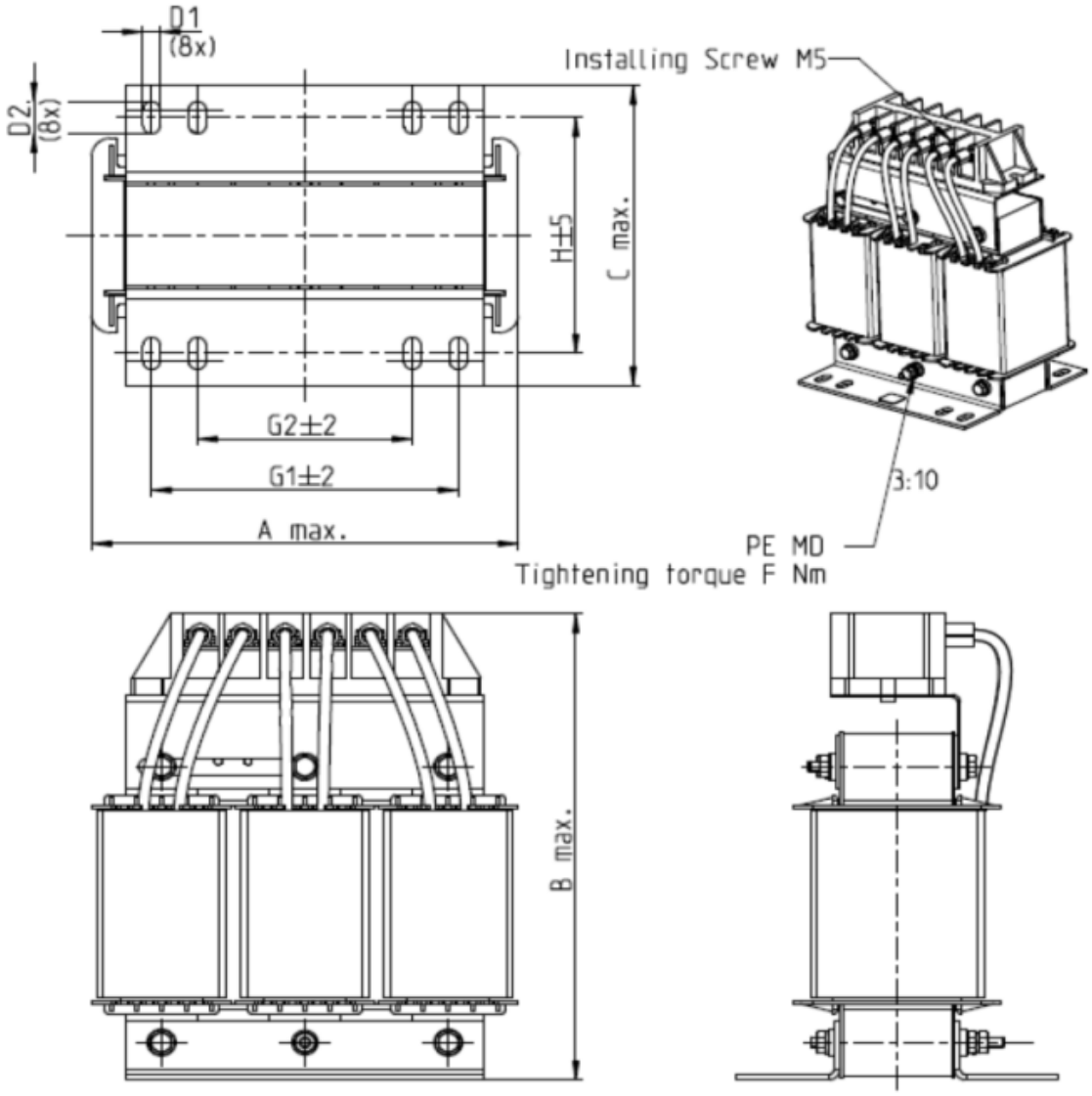


Figure 10-21

Unit: mm

AC Input Reactors Delta Part #	A	B	C	D1*D2	H	G1	G2	PE D
DR024AP881	160	175	115	6*12	90	107	75	M4

Table 10-19

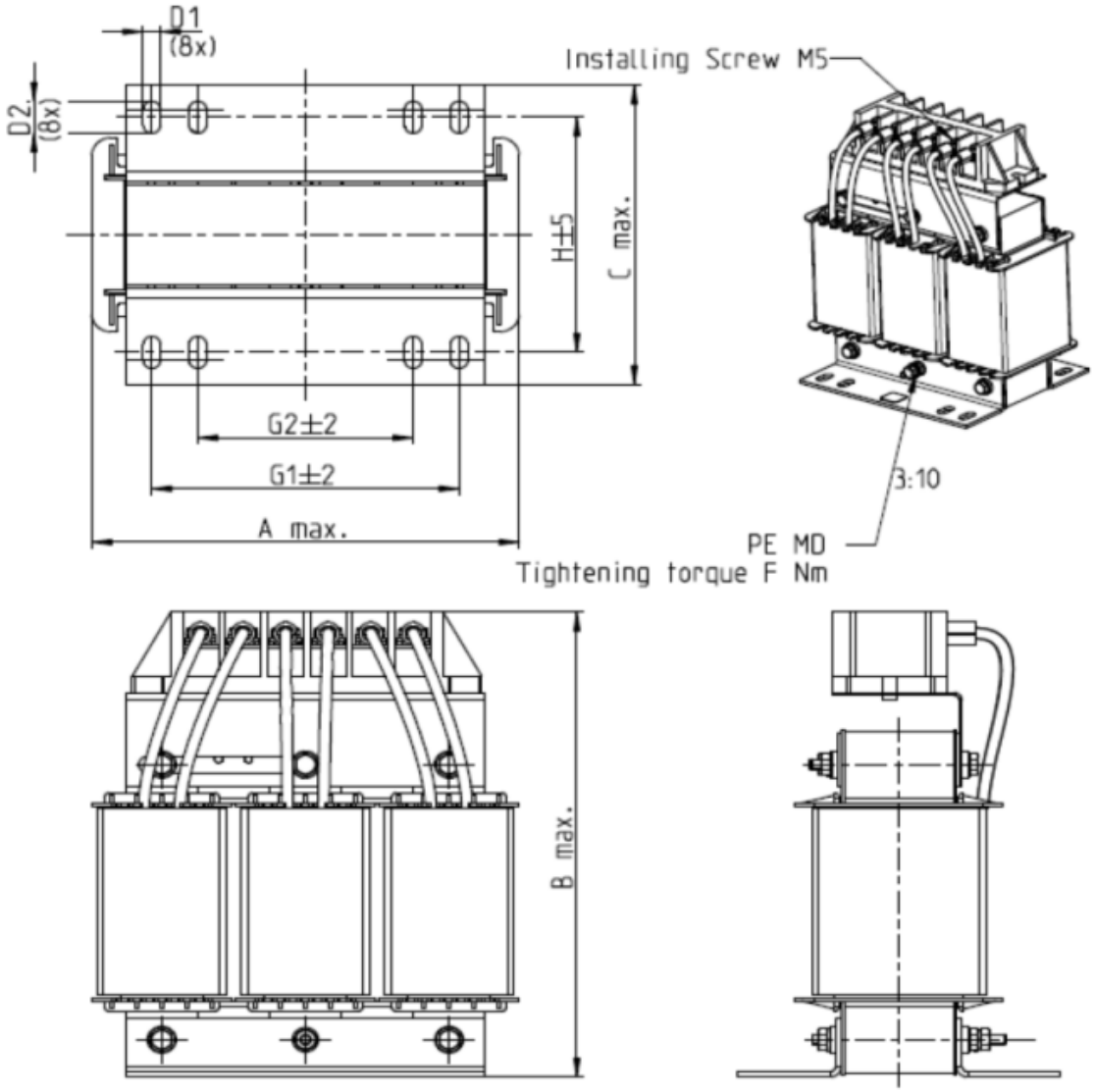


Figure 10-22

Unit: mm

AC Input Reactors Delta Part #	A	B	C	D1*D2	H	G1	G2	PE D
DR032AP660	195	200	145	6*12	115	122	85	M6
DR045AP541	190	200	145	6*12	115	122	85	M6

Table 10-20

The size and the specification of the AC output reactor:

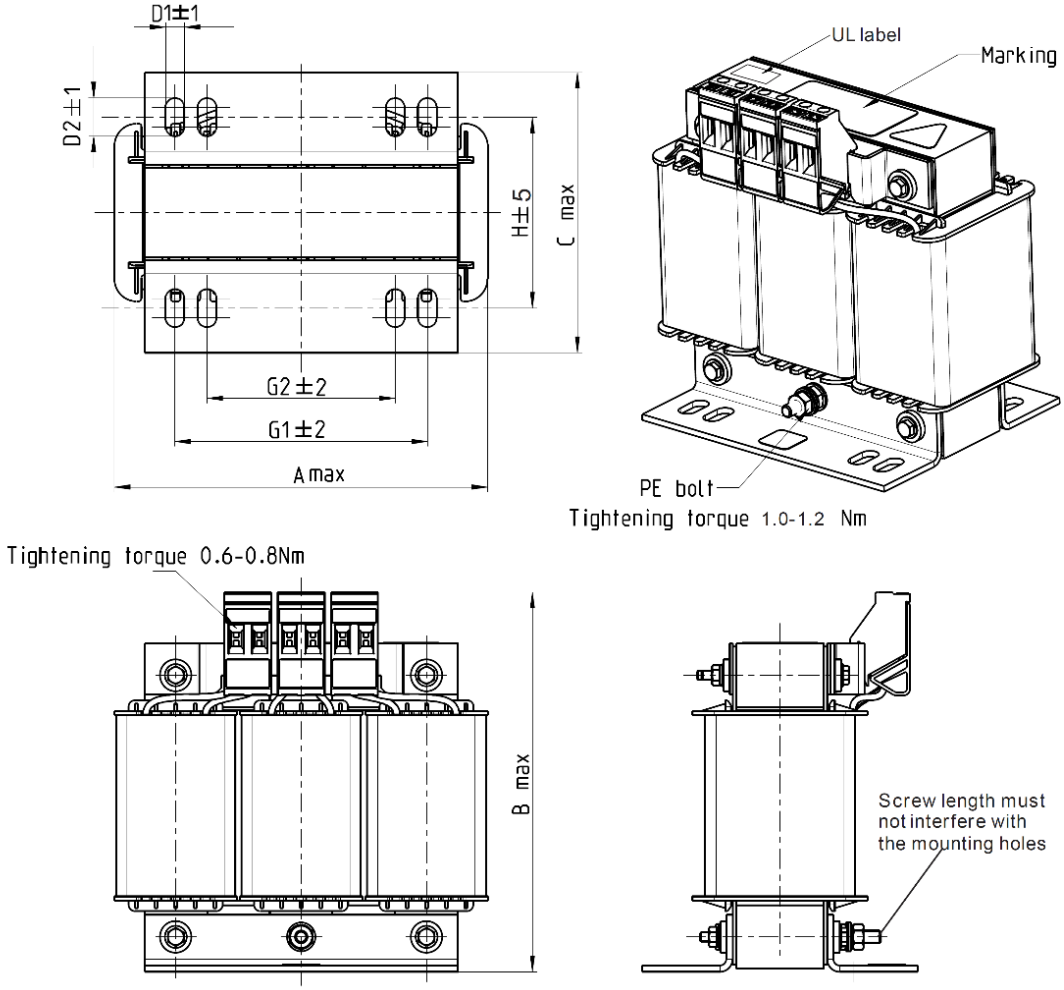


Figure 10-23

Unit: mm

AC 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

Table 10-21

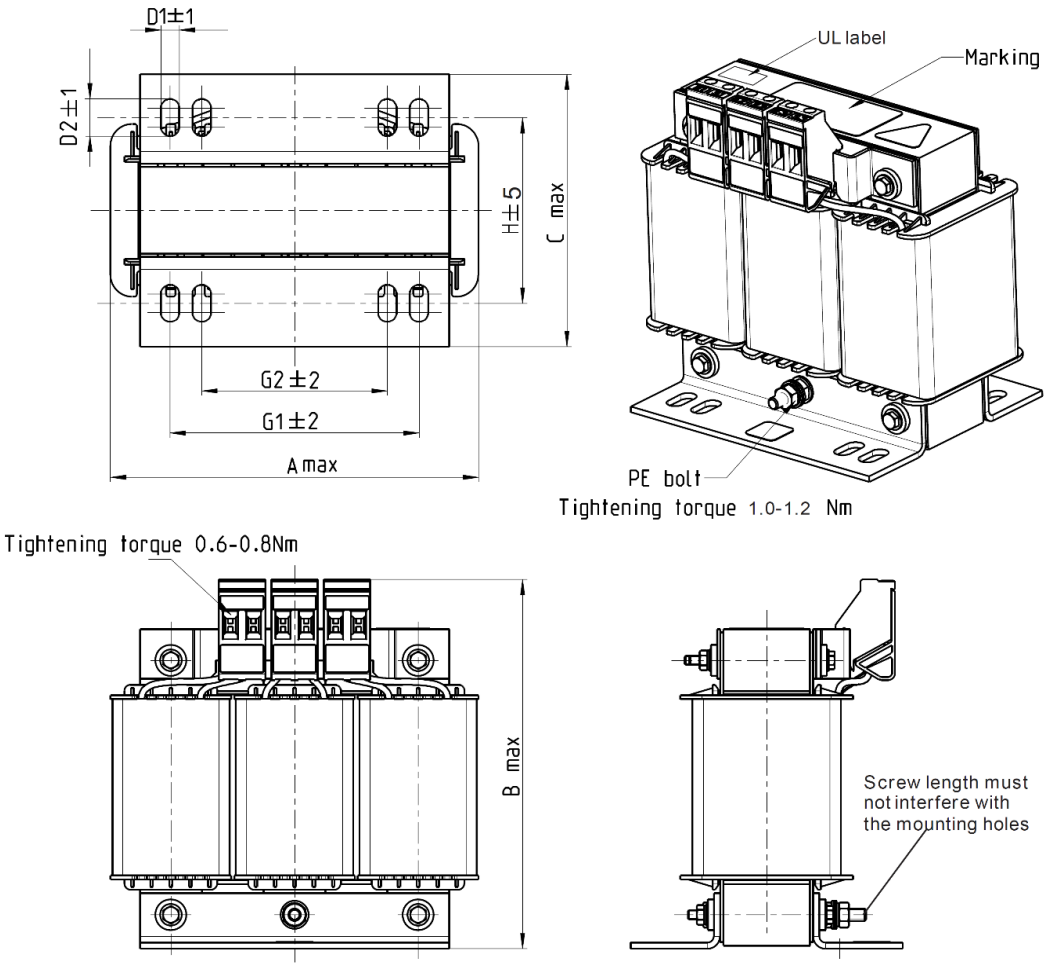


Figure 10-24

Unit: mm

AC 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
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

Table 10-22

10-7 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. Delta provides two types of zero phase reactors to solve interference problems.

1. Casing with mechanical fixed part

   Used for the zero-phase reactor at the main input/motor output. It withstands large current load and is used for high frequencies. You can get higher impedance by increasing the number of turns.

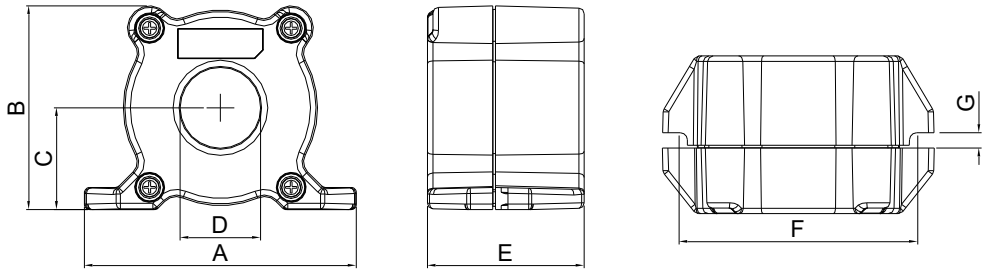


Figure 10-25

Unit: mm

Model	A	B	C	D	E	F	G(Ø)	To use w/
RF008X00A	99	73	36.5	29	56.5	86	5.5	Motor cable

Table 10-23

2. Casing without mechanical fixed part

   Adopts nanocrystalline core developed by VAC, and has high initial 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.

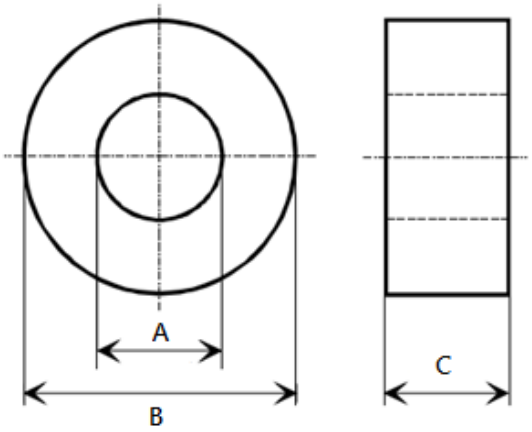


Figure 10-26

Unit: mm

Model	A	B	C	To use w/
RF008X00N	22.5	43.1	18.5	Motor cable
RF026X00N	10.7	17.8	8.0	Signal cable
RF020X00N	17.5	27.3	12.3	

Table 10-24

10-7-1 Installation Method

During installation, pass the cable through at least one zero-phase reactor. Use a suitable cable type (pressure endurance, current endurance, insulation class, and wire gauge) 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 and power cable through the zero-phase reactor. With longer motor cables the zero-phase reactor can effectively reduce interference at the motor output.
Moreover, pay extra attention to the large leakage current due to long cable length. This may cause temperature rise in the zero-phase reactor. Install the zero-phase reactor as close to the output of the drive as possible. The installation diagram for a single turn zero phase reactor is shown below. If the wire diameter allows several turns, can refer to the installation of a multi-turn zero phase reactor. The more turns, the better the noise suppression effect.

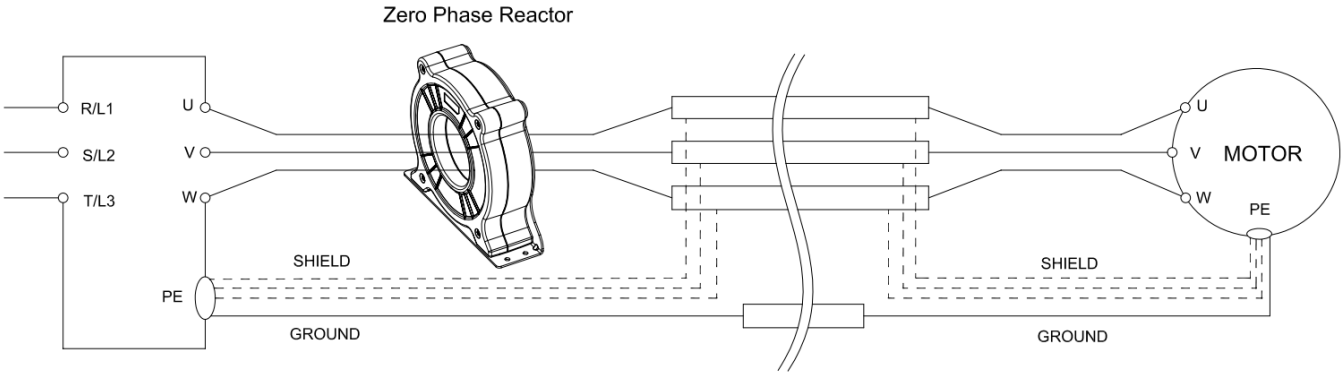


Figure 10-27 Single turn wiring diagram for shielding wire with a zero-phase reactor

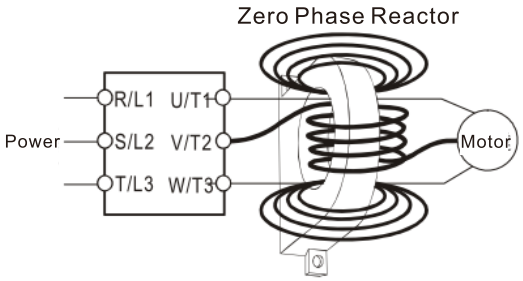


Figure 10-28 Multi-turn zero-phase reactor

10-7-2 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 drive. 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 a zero-phase reactor

Zero Phase Reactor Model No.	Max. Wire Gauge or LUG Width	Max. Wire Gauge AWG (1Cx3)		Max. Wire Gauge AWG (4Cx1)	
		75ºC	90ºC	75ºC	75ºC
RF008X00A	13MM	3AWG	1AWG	3AWG	1AWG
RF008X00N	11MM	9AWG	4AWG	6AWG	6AWG

Table 10-25

Zero Phase Reactor for Signal Cable

To solve interference problems between signal cables and electrical equipment, install a zero-phase reactor on the signal cable. Refer to the table below for models and dimensions. Installing a zero-phase reactor on the signal cable at the source of the interference suppresses the interference and noise between signal cables.

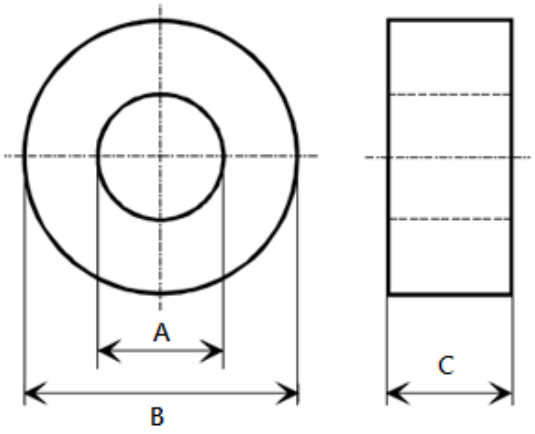


Figure 10-29

Unit: mm

Model name	A	B	C
RF026X00N	10.7	17.8	8.0
RF020X00N	17.5	27.3	12.3

Table 10-26

10-8 EMC Filter

Use EMC filters to enhance the EMC performance for the environment and machines and to comply with EMC regulations, further reducing EMC problems. If you purchase a motor drive without a built-in EMC filter, it is recommended that you select the EMC filters as shown below.

Model: EMF15AM21RA, EMF25AM21RA, EMF22AM43RA, EMF33AM43RA, EMF41AM43RA

Dimensions:

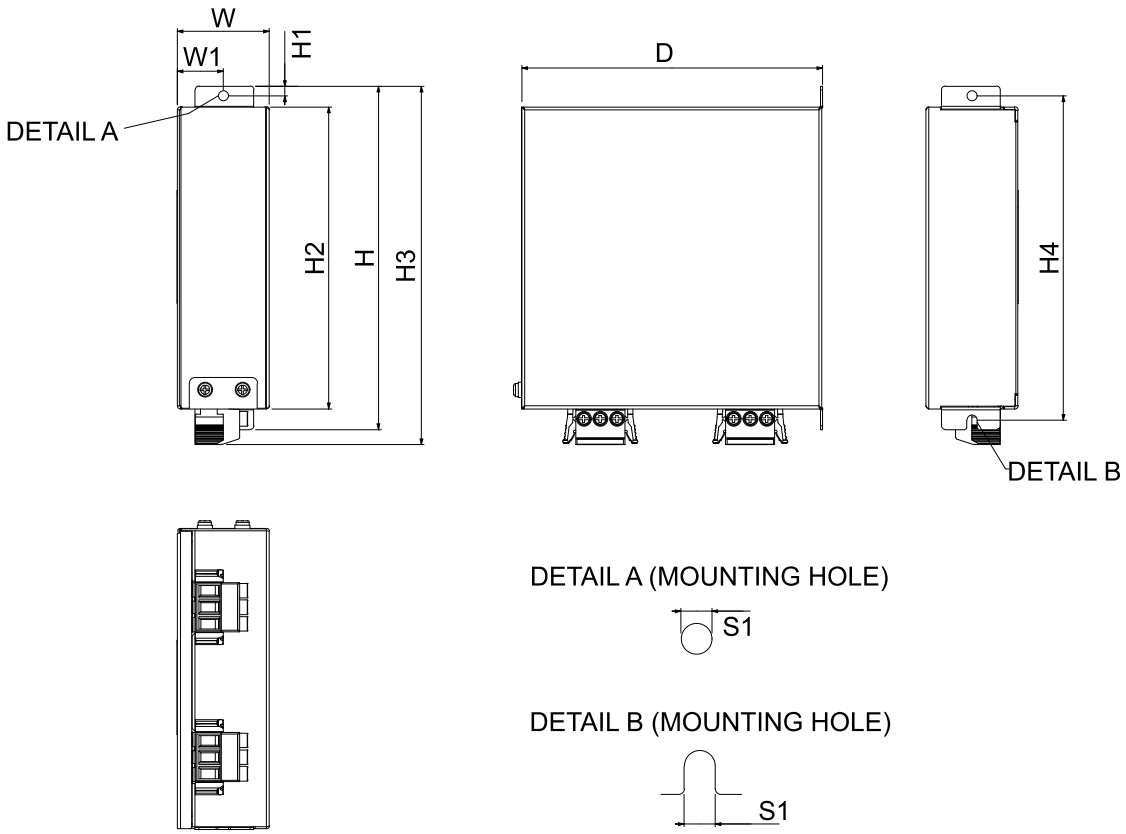


Figure 10-30

W	W1	H	H1	H2	H3	H4	D	S1
48.7 (1.92)	24.35 (0.96)	182.0 (7.17)	5.0 (0.20)	160.0 (6.30)	189.9 (7.48)	172.0 (6.77)	159.5 (6.28)	5.5 (0.22)

Table 10-27

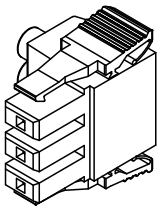
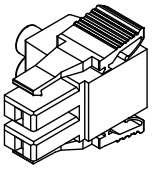
Accessories package Contents and quantity		
EMC Filter Model	 Input Terminal Block (460V R/S/T TBLK)	 Input Terminal Block (230V R/S TBLK)
EMF15AM21RA, EMF25AM21RA	0	2
EMF22AM43RA, EMF33AM43RA, EMF41AM43RA	2	0

Table 10-28

Installation and Wiring:

1. The EMC filters do not need to be installed on transmission module and is compatible with other drives.
2. The recommended distance between the rectifier module and the EMC filter is within 25 cm.
3. The RST/RS terminals on the lower front side are used to connect to the rectifier module, while the RST/RS terminals on the rear side are connected to the input power supply.
4. There are two grounding terminals at the front. Connect one to the rectifier or inverter module ground terminal and the other one to the switchboard ground.

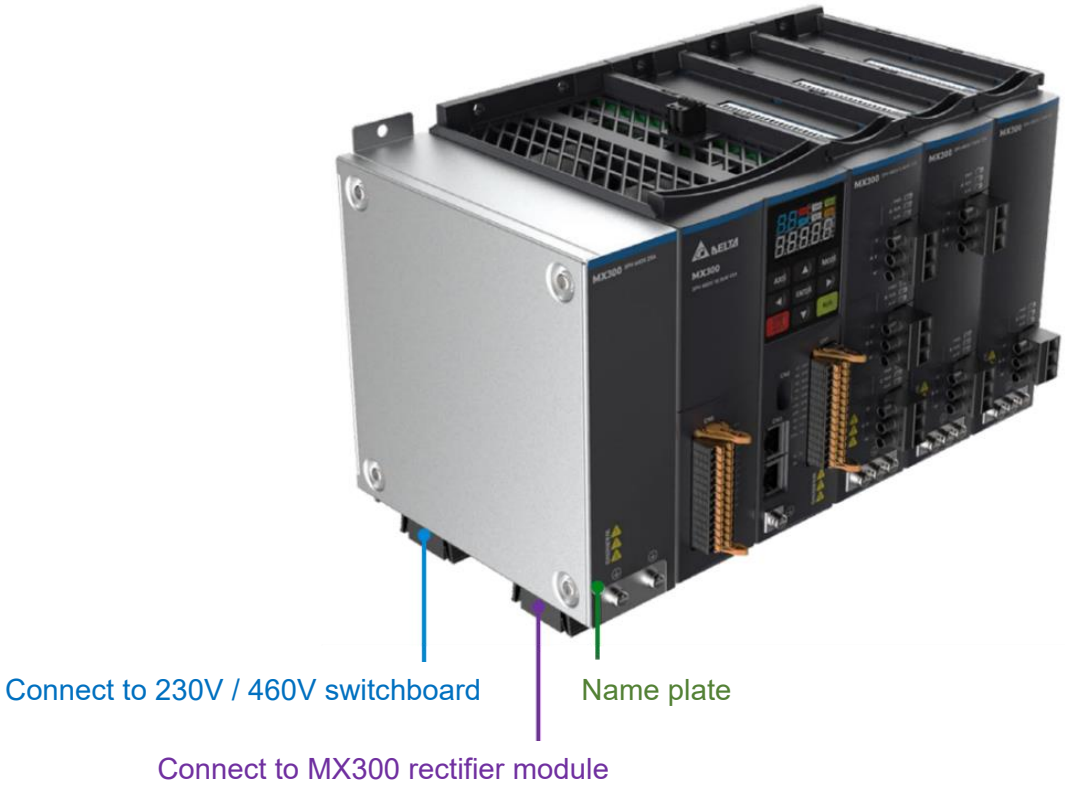


Figure 10-31

For some motor drive models, you need to work with zero-phase reactors to be compliant with EMC regulations. Refer to the table and figure below for the recommended model, setting method, and maximum motor cable length of the EMC filter and zero-phase reactor.

Motor Drive Model	Input Current (A)	Filter Model #	Recommended Model of Zero-phase Reactors	IEC 61800-3					
				Conducted Emission Maximum Motor Cable Length			Radiated Emission Maximum Motor Cable Length		
				C2 100 m					
				Position to install a zero-phase reactor*1					
			DELTA	*1	*2	*3	*1	*2	*3
VFD15AMXx21Cx VFD15AMXx21Ex	27.2	EMF15AM21RA	RF008X00N					✓	✓
VFD25AMXx21Cx VFD25AMXx21Ex	45	EMF25AM21RA	RF008X00N					✓	✓
VFD22AMXx43Cx VFD22AMXx43Ex	24.2	EMF22AM43RA	RF008X00N					✓	✓
VFD33AMXx43Cx VFD33AMXx43Ex	36.3	EMF33AM43RA	RF008X00N					✓	✓
VFD41AMXx43Cx VFD14AMXx43Ex	45	EMF41AM43RA	RF008X00N					✓	✓

Table 10-29

NOTE:

*1. Refer to the figure below for the zero-phase reactor install position.

2. The leakage current of EMF15AM21RA and EMF25AM21RA will exceed 10mA.

Zero-phase reactor installation position:

1. Install at the cable between the power supply and the EMC filter
2. Install at the cable between the EMC filter and the drive
3. Install at the cable between the drive and the motor

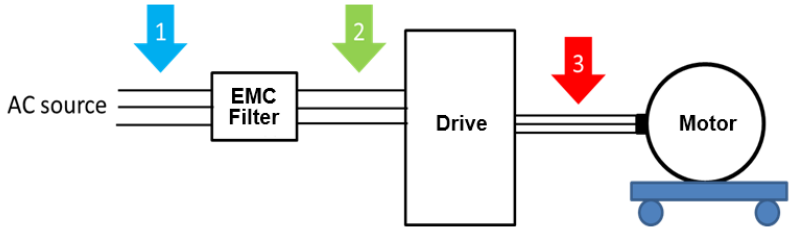
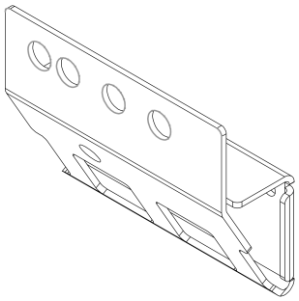
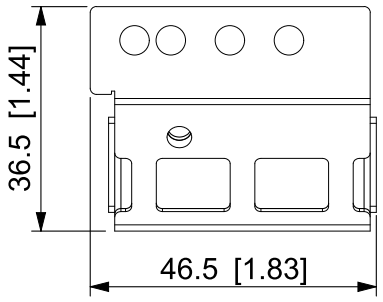


Figure 10-32

10-9 EMC Shield Plate

Take MX300-C model figures as an example of the rectifier module.

10-9-1 EMC Shield Plate (for use with shielded cable)

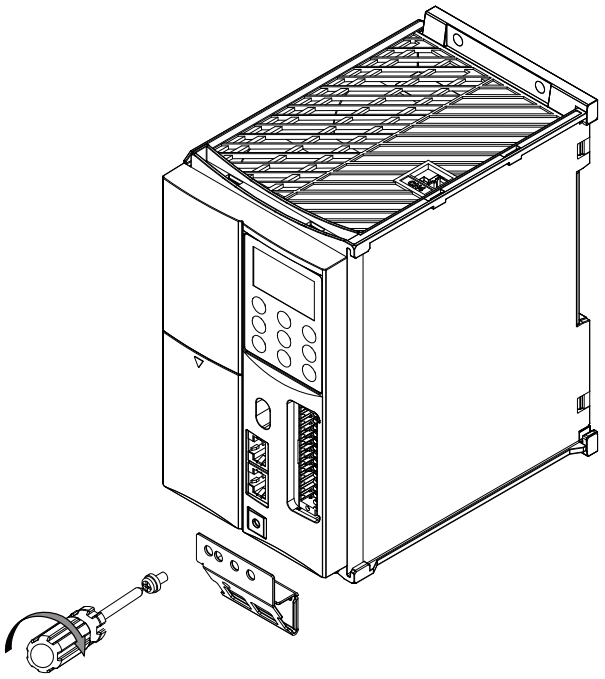
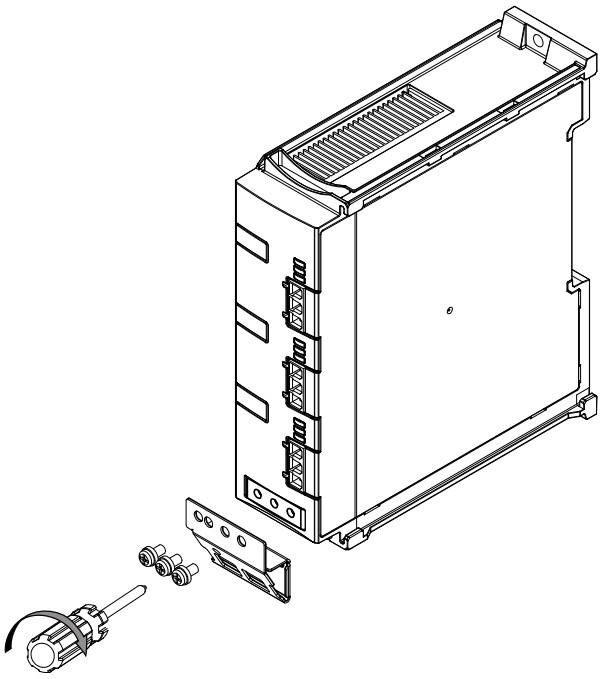
Model	Figure	
MKM-EPRD	 Figure 10-33	 Unit: mm [inch] Figure 10-34

10-9-2 Installation

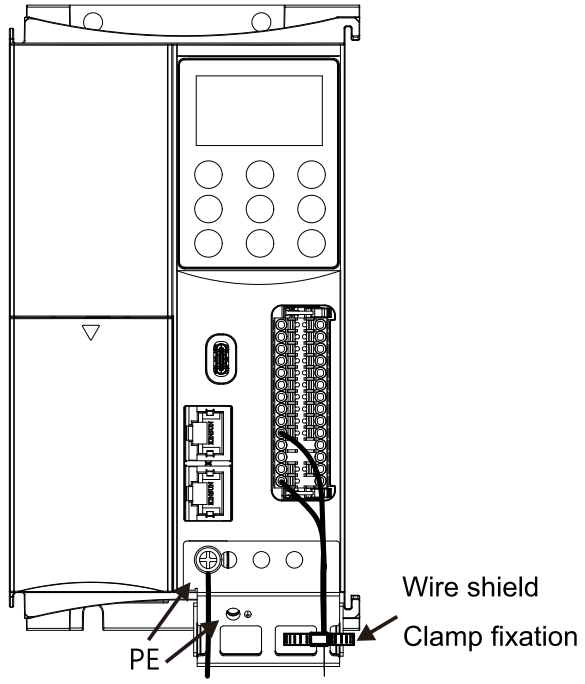
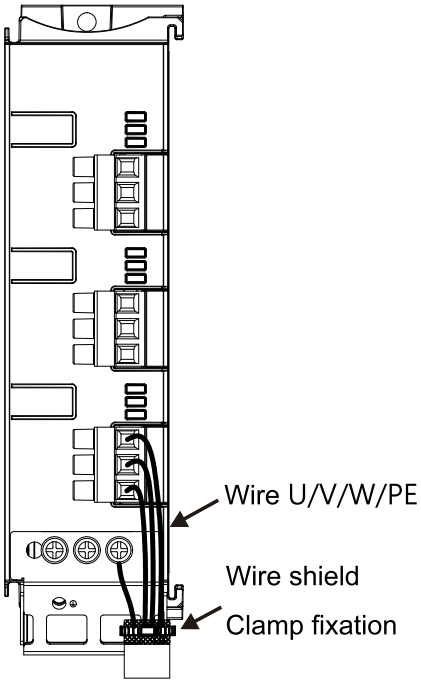
Screw: M4

Screw Torque: 6–8 kg-cm / [5.2–6.9 lb-in.] / [0.59–0.78 Nm]

Installation: Fix the shield plate on the AC motor drive as shown in the figure below.

Rectifier Module (Frame RA)	Inverter Module (Frame IA)
 Figure 10-35	 Figure 10-36

Recommended wiring method

Rectifier Module (Frame RA)	Inverter Module (Frame IA)
 Figure 10-37	 Figure 10-38

10-10 Capacitive Filter

The capacitive filter (CXY101-43A) is a simple filter that supports basic filtering and noise interference reduction.

10-10-1 Installation

Installation diagram:

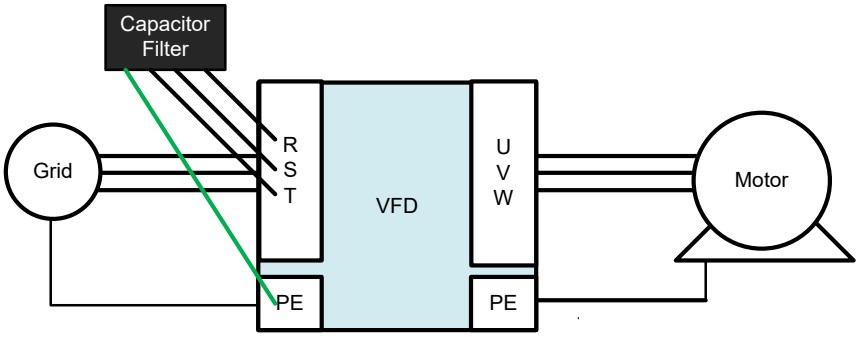


Figure 10-39

Wiring diagram for the capacitive filter and the drive:

(Take MX300-C model figures as an example.)

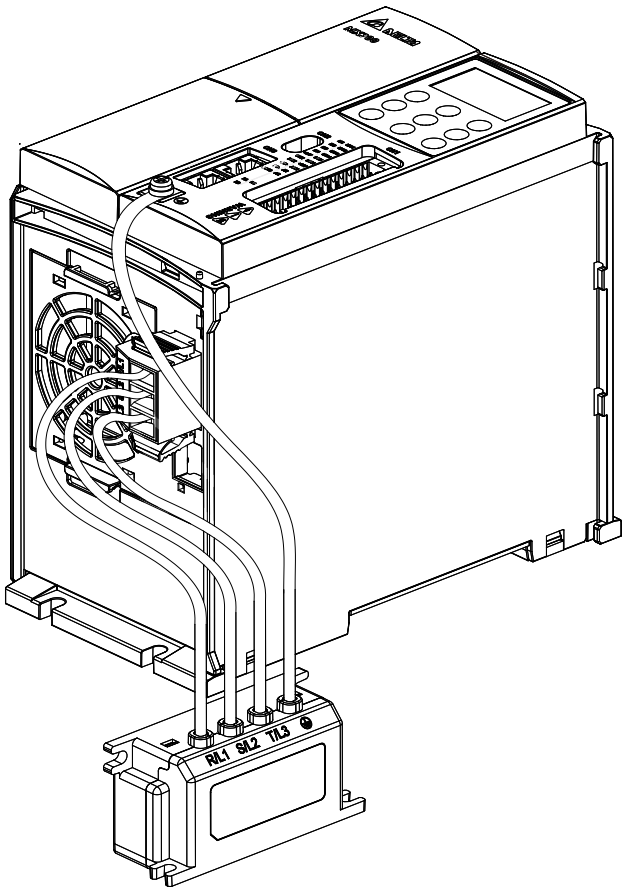


Figure 10-40

Specifications:

Model	Capacitance		Temperature Range
CXY101-43A	Cx: 1 μF ± 20 %	Cy: 1 μF ± 20 %	-40–+85°C

Table 10-30

10-10-2 Dimensions:

Model: CXY101-43A Unit: mm [inch]

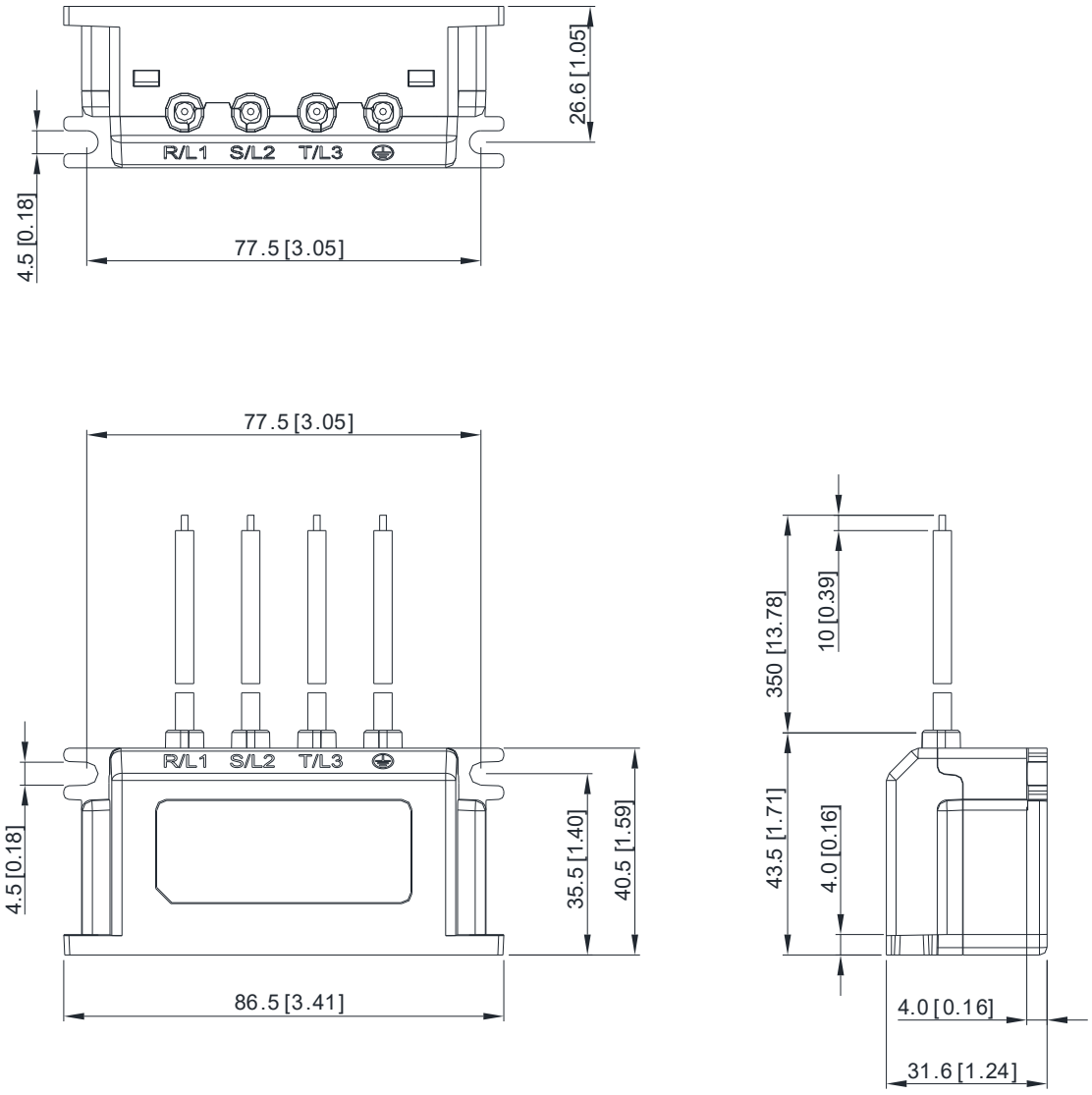
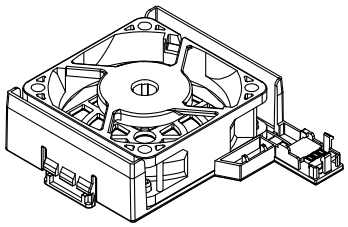
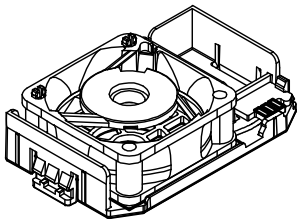


Figure 10-41

10-11 Fan Kit

10-11-1 Fan Kit

Module (Frame)	Rectifier Module (Frame RA)	Inverter Module (Frame IA)
Fan Model	MKM-FKMRC	MKM-FKMDR
Figure	 Figure 10-42	 Figure 10-43

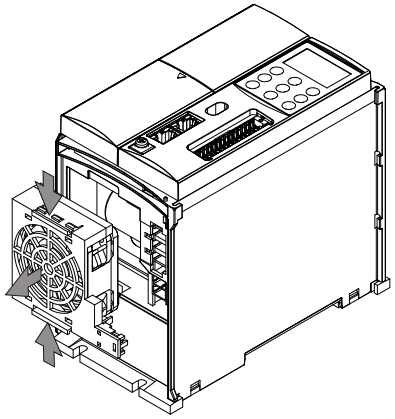
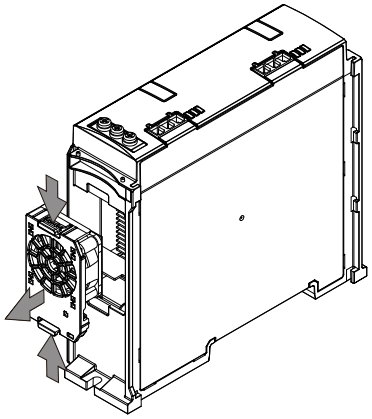
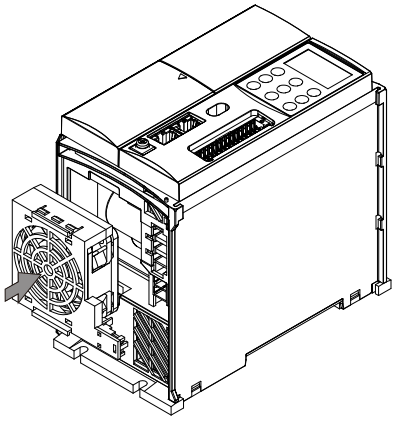
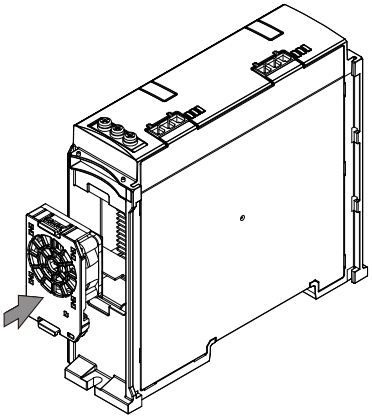
10-11-2 Fan removal / installation

☑ The fan does not support hot-swappable function. Please power off the drive before replacing it.

☑ Take MX300-C model figures as an example of the rectifier module.

Removal steps:

1. Press on both sides of the fan to remove it.
2. Press on both sides of the fan, press inward to assemble it and confirm the hooks on both sides are engaged.

Rectifier Module (Frame RA) fan model: MKM-FKMRC	Inverter Module (Frame IA) fan model: MKM-FKMDR
 Figure 10-44	 Figure 10-45
 Figure 10-46	 Figure 10-47

10-12 Protective cover

10-12-1 Protective cover model and size

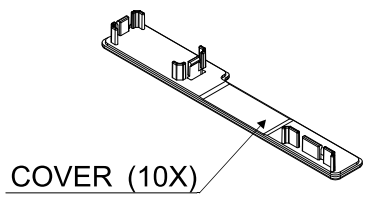
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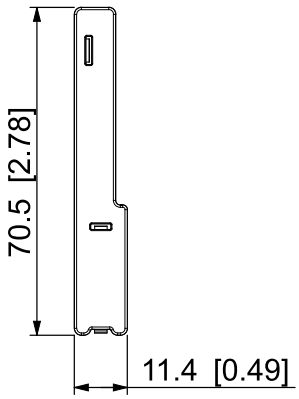
Figure 10-48</td><td>

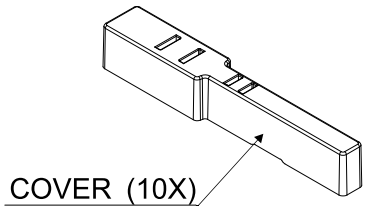
Figure 10-49</td></tr>
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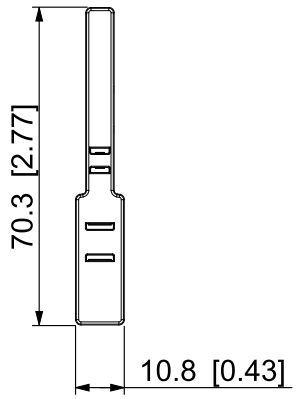
Figure 10-50</td><td>

Figure 10-51</td></tr>
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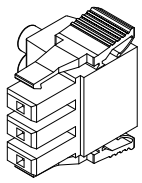
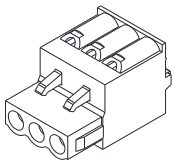
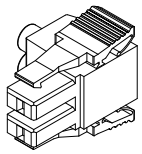
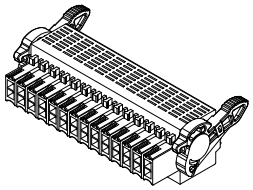
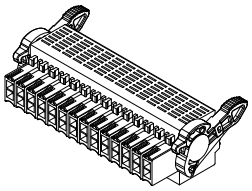
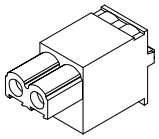
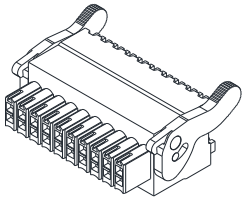
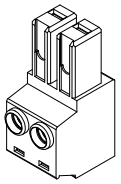
Unit: mm (inch)

NOTE: Please refer to Section 2-4-2 Protective Cover Installation for the protective cover install.

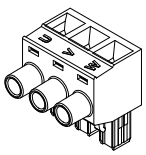
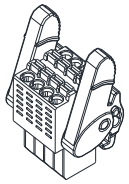
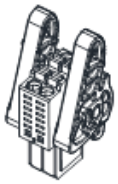
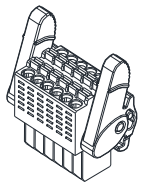
10-13 Removable terminal

10-13-1 Terminal block appearance

Rectifier Module (Frame RA)

Model name	Terminal block	Model name	Terminal block
MKM-TBLTRC1	 Figure 10-52	MKM-TBRYRC	 Figure 10-53
MKM-TBLTRC2	 Figure 10-54	MKM-TBIOAC1	 Figure 10-55
MKM-TBIORC	 Figure 10-56	MKM-TB24RC	 Figure 10-57
MKM-TBIORC1	 Figure 10-58	MKM-TBBKRC	 Figure 10-59

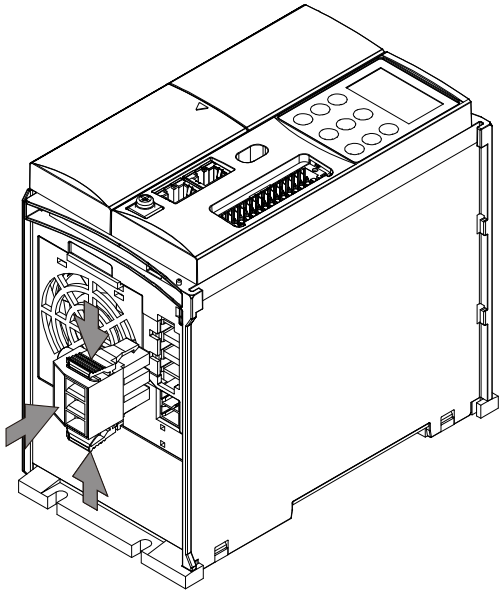
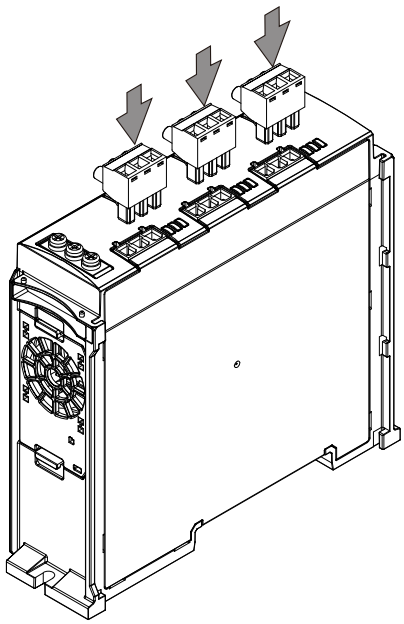
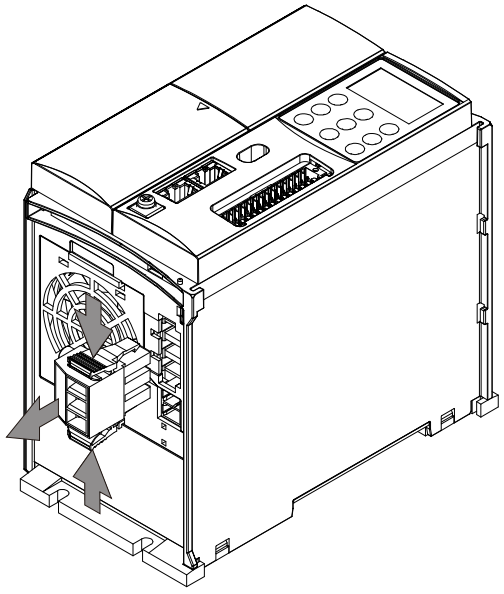
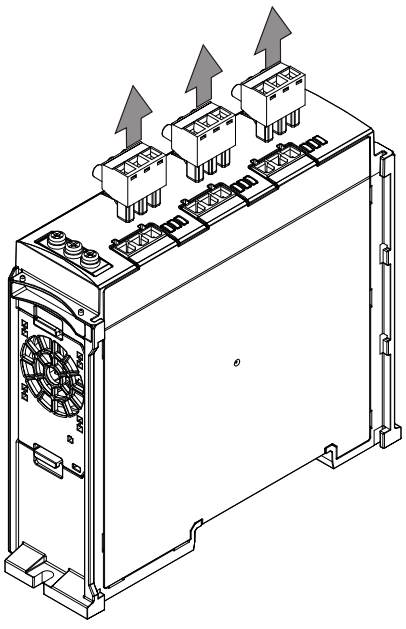
Inverter Module (Frame IA)

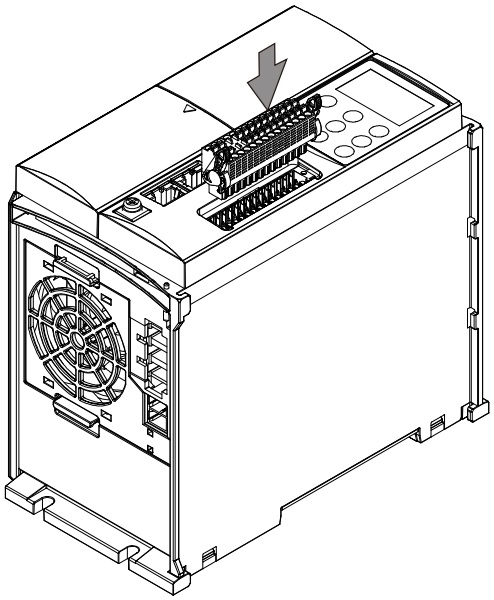
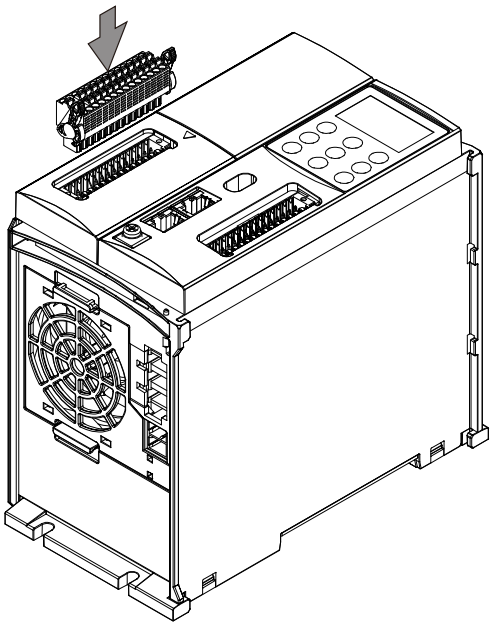
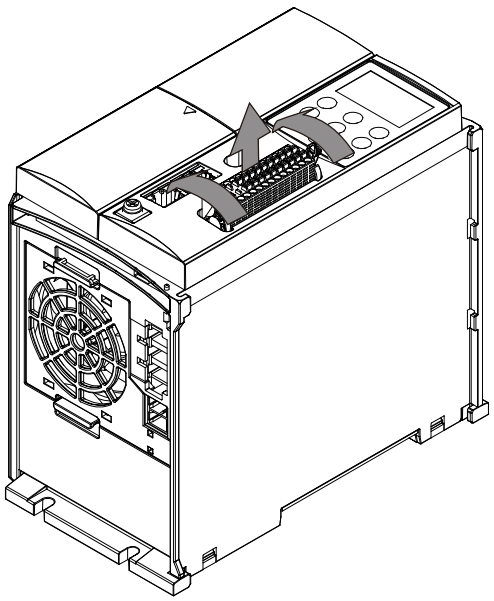
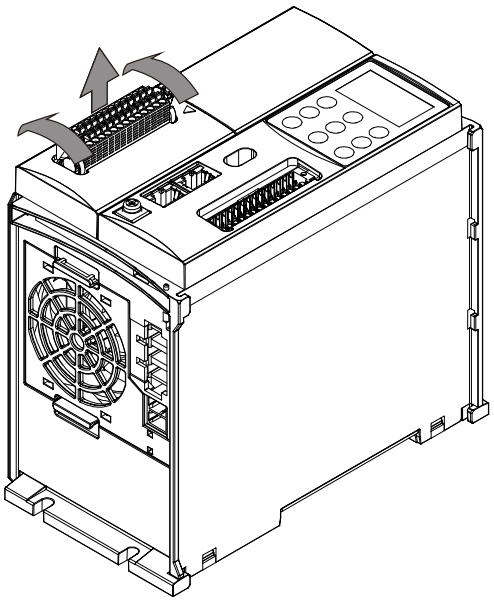
Model name	Terminal block	Model name	Terminal block
MKM-TBMTDR	 Figure 10-60	MKM-TBSTODR2	 Figure 10-61
MKM-TBMTDR	 Figure 10-62	MKM-TBSTODR2	 Figure 10-63

10-13-2 Terminal block installation / removal

☑ The terminal block does not support hot-swappable function. Please power off the drive before replacing it.

☑ Take MX300-C model figures as an example of the rectifier module.

<table>
<tr><th colspan="2">Terminal block model</th></tr>
<tr><td>MKM-TBLTRC1 / MKM-TBLTRC2</td><td>MKM-TBMTDR</td></tr>
<tr><td>Installation:
As shown in the picture below, press both sides of the terminal to insert into the socket and confirm the hooks on both sides are engaged.

Figure 10-64</td><td>Installation:
As shown in the picture below, press the terminal into the socket and confirm the terminal and the socket fit tightly.

Figure 10-65</td></tr>
<tr><td>Remove:
As shown in the figure below, press both sides of the terminal to remove.

Figure 10-66</td><td>Remove:
As shown in the figure below, vertical force can be applied to remove directly.

Figure 10-67</td></tr>
</table>

<table>
<tr><th colspan="2">Terminal block model</th></tr>
<tr><td>MKM-TBIORC</td><td>MKM-TBIOAC1</td></tr>
<tr><td>Installation:
As shown in the picture below, press the terminal and confirm the handle hooks on both sides of the terminal are engaged with the socket.

Figure 10-68</td><td>Installation:
As shown in the picture below, press the terminal and confirm the handle hooks on both sides of the terminal are engaged with the socket.

Figure 10-69</td></tr>
<tr><td>Remove:
As shown in the figure below, rotate the handle hooks on both sides of the terminal away and then remove it.

Figure 10-70</td><td>Remove:
As shown in the figure below, rotate the handle hooks on both sides of the terminal away and then remove it.

Figure 10-71</td></tr>
</table>

10-14 Digital Keypad

10-14-1 Digital Keypad KPC-CC01

KPC-CC01



Communication Interface: RJ45 (socket), RS-485 interface

Communication Protocol: RTU19200, 8, N, 2

Installation Method:

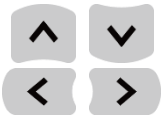
☑ The embedded type can be installed flat on the surface of the control box. The front cover is waterproof.

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

☑ When KPC-CC01 is used with MX300, specific firmware is required. Please contact Delta or agent.

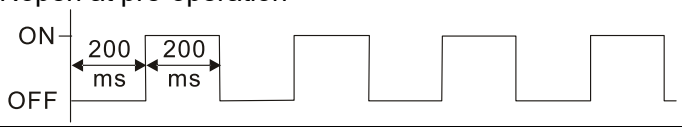
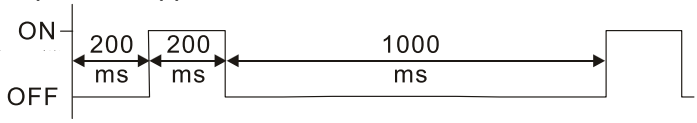
Keypad Function Descriptions

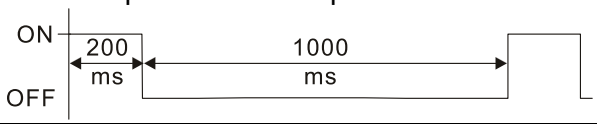
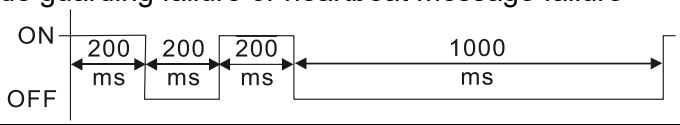
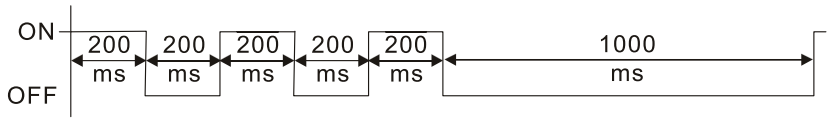
Key	Descriptions
RUN	**Start Operation Key** 1. Only valid when the source of operation command is the keypad. 2. Operates the MX300 by the function setting. The RUN LED will be ON. 3. Can be pressed repeatedly at the stop process.
STOP RESET	**Stop Command Key** 1. This key has the highest priority when the command is from the keypad. 2. When it receives the STOP command, regardless of whether MX300 is in operation or stop status, MX300 executes the “STOP” command. 3. Use the RESET key to reset the drive after a fault occurs. 4. If you cannot reset after the error: a. The condition which triggers the fault is not cleared. After you clear the condition, you can then reset the fault. b. The drive is in fault status when powered on. After you clear the condition, restart and then you can reset the fault.
FWD REV	No Function
ENTER	**ENTER Key** Goes to the next menu level. If at the last level, press ENTER to execute the command.
ESC	**ESC Key** Leaves the current menu and returns to the previous menu; also functions as a return key or cancel key in a sub-menu.
MENU	**Returns to the main menu key** Menu commands: 1. Parameter Setup 6. Parameter Setup 9. Time Setup 3. Application Selection List 7. Fault Record 12. Keypad Locked 5. Axis Parameter Copy 8. Language Setup 13. Display Setup **NOTE:** MX300 does not support the function which not listed in the above MENU list.

Key	Descriptions
	**Direction key: Left / Right / Up / Down** 1. In the numeric value setting mode, moves the cursor and changes the numeric value. 2. In the menu / text selection mode, selects an item.
F4	**Switches axis number key** Axis number display and switch:  **NOTE:** Press MENU to enter the main menu page and the axis number will display on the upper right.

LED Function Descriptions

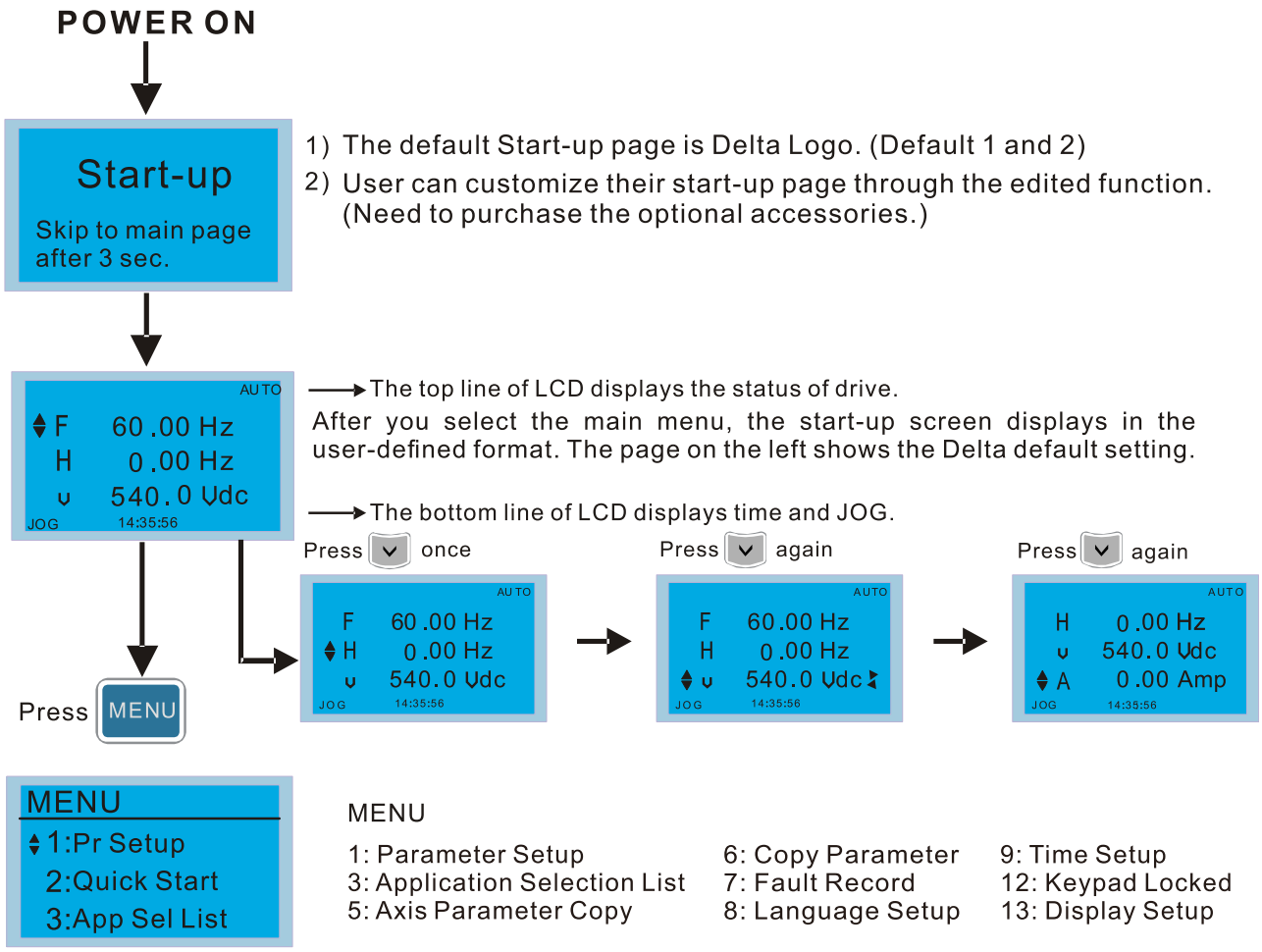
LED	Descriptions
	Steady ON: MX300 stop command. Light on when MX300 is stopped. Flashing: Standby mode. Steady OFF: MX300 does not execute the STOP command.
	Operation Direction Indicator 1. [Green] Steady ON: The motor drive is in forward rotation. 2. [Red] Steady ON: The motor drive is in reverse rotation. 3. Flashing: The motor drive is changing direction. Operation Direction Indicator in Torque Mode 1. [Green] Steady ON: When the torque command ≥ 0, the motor is in forward rotation. 2. [Red] Steady ON: When the torque command < 0, the motor is in reverse rotation. 3. Flashing: When the torque command < 0, the motor is in forward rotation.
CANopen–RUN	RUN LED:

LED Status	Condition / State
OFF	CANopen at initial No LED
Blinking	CANopen at pre-operation 
Single Flash	CANopen at stopped 
ON	CANopen at operation status 

<table>
<tr><th>LED</th><th>Descriptions</th></tr>
<tr><td>CANopen–ERR</td><td>ERR LED:
<table>
<tr><th>LED status</th><th>Condition / State</th></tr>
<tr><td>OFF</td><td>No Error</td></tr>
<tr><td>Single Flash</td><td>At least one packet of CANopen is in failure

</td></tr>
<tr><td>Double Flash</td><td>Node guarding failure or heartbeat message failure

</td></tr>
<tr><td>Triple Flash</td><td>Synchronization failure

</td></tr>
<tr><td>ON</td><td>Bus off

</td></tr>
</table></td></tr>
</table>

10-14-2 Function of Digital Keypad KPC-CC01

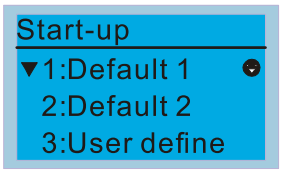


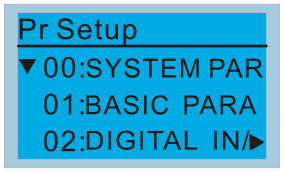
NOTE:

1. Start-up screen can only display pictures, not animation.

2. When powered ON, it displays the start-up screen then the main screen. The main screen displays Delta's default setting F/H/A/U. You can set the display order with Pr.00-03 (Start-up display). When you select the U screen, use the left/right keys to switch between the items, and set the display order for the U screen with Pr.00-04 (User display).

Display Icons





● : present setting

▼ : Scroll down the page for more options

Press ▲ ▼ for more options

▶ : show complete sentence

Press < > for complete information

Display items

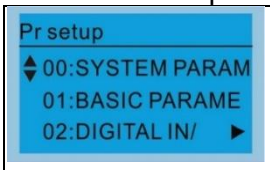


MENU

1: Parameter Setup	6: Copy Parameter	9: Time Setup
3: Application Selection List	7: Fault Record	12: Keypad Locked
5: Axis Parameter Copy	8: Language Setup	13: Display Setup

NOTE: MX300 does not support the function which not listed in the above MENU list.

1. Parameter Setup

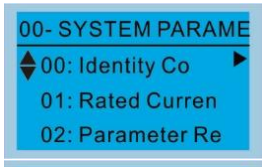


Press ENTER to select.

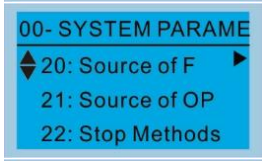
Press the Up / Down keys to select the parameter group.

Once you select a parameter group press ENTER to go into that group.

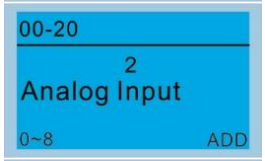
Example: Setup source for the master frequency command.



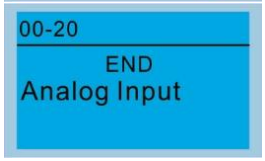
In the Group 00 MX300 Parameter, use the Up / Down keys to select parameter 20: Auto Frequency Command.



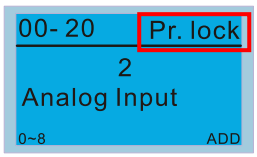
Press ENTER to go to this parameter's setting menu.



Use the Up / Down keys to choose a setting. For example: choose 2 Analog Input, and then press ENTER key.

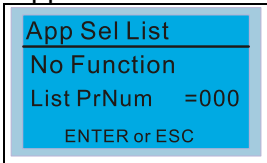


After you press ENTER, END is displayed which means that the parameter setting is done.



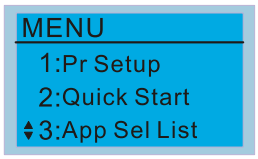
NOTE: When parameter lock / password protection function is enabled, it displays "Pr. lock" on the upper right corner of the keypad. The parameter cannot be written or is protected by the password under this circumstance.

3. Application Selection List

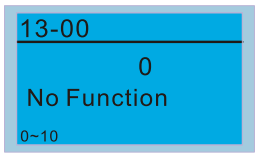


This function enables you to select application and its parameter sets.

Example: In the menu content, select 3: Application Selection List

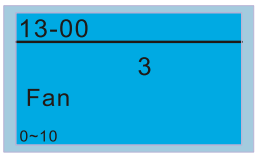


Press ENTER to go into the Application Selection List





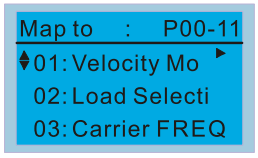
Select Application



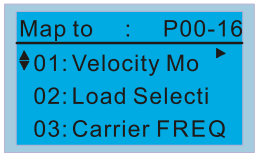
Press ENTER to go to the application selection screen, and the selected application industry is “Fan”.

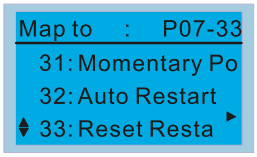


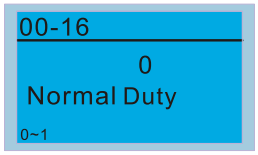
Press ENTER to go to Fan application screen



Press the Up / Down keys to select the parameter for setting.

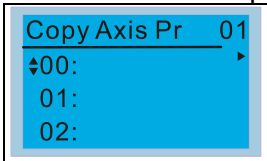






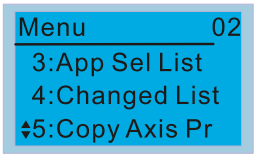
Select 0: Normal duty or 1: Heavy duty according to your needs, and then press ENTER.

5. Axis Parameter Copy

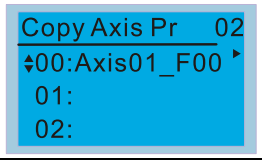


Press ENTER to 001–004 content storage.

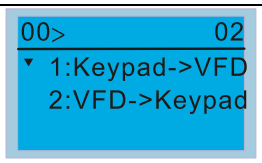
Four groups of parameters are available to copy. The steps are shown in the example below. Example: parameter saved in the motor drive.



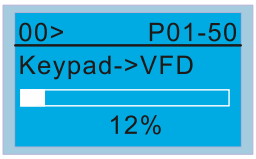
1. Press F4 to select the axis number for rectifier or inverter (00 to 15).
2. Press ENTER to 001–004 content storage.



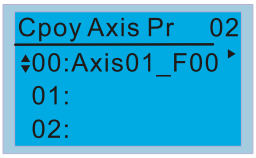
1. Enter into the parameter copying.
2. Select the group you want to copy then press ENTER.



1. Select 1: keypad →VFD
2. Press ENTER to go to the “keypad→VFD” screen.

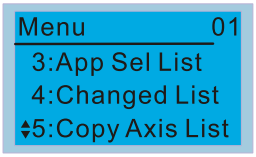


Begin copying parameters until it is done.

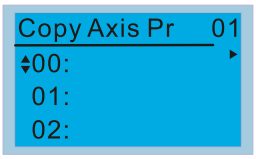


After copying is done, the keypad automatically returns to this screen.

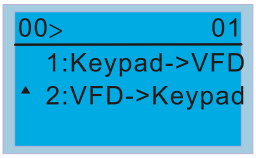
Example: parameter saved in the keypad.



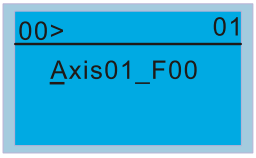
1. Press F4 to select the axis number for rectifier 00.
2. Press ENTER to to 001–004 content storage.



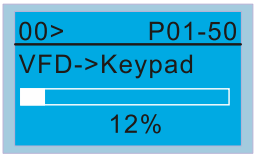
1. Go to Copy parameter
2. Select the parameter group to copy and press ENTER.



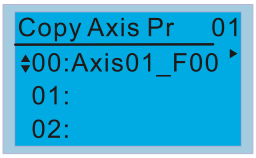
Press ENTER to go to the “VFD→keypad” screen.



Press the Up / Down keys to select a symbol. Press the Left / Right keys to move the cursor to select a file name.

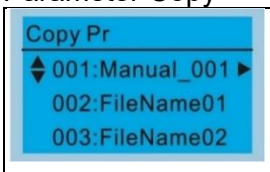


Begin copying parameters until it is done.



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

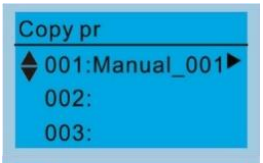
6. Parameter Copy



Press ENTER to 001–004 content storage.

Four groups of parameters are available to copy.

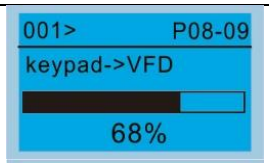
Example: parameter saved in the motor drive.



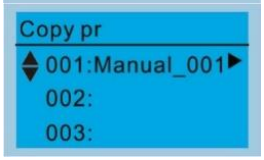
1. Go to Copy Parameter
2. Select the parameter group to copy and press ENTER.



1. Select 1: keypad →VFD.
2. Press ENTER to go to the “keypad→VFD” screen.

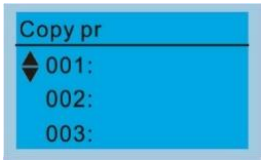


Begin copying parameters until it is done.

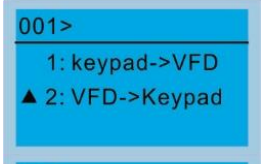


After copying is done, the keypad automatically returns to this screen.

Example: parameter saved in the keypad.



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



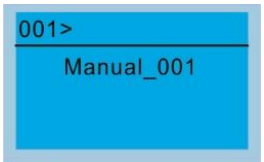
Press ENTER to go to the “VFD→keypad” screen.



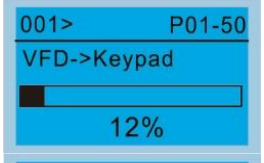
Press the Up / Down keys to select a symbol. Press the Left / Right keys to move the cursor to select a file name.

String & Symbol Table:

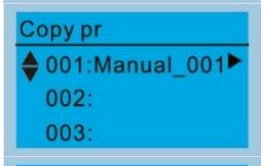
! " # $ % & ' ( ) * + , - . / 0 1 2 3 4 5 6 7 8 9 : ; < = > ? @ A B C D E F G H I J K L M N O P Q R S T U V W X Y Z [\ ] ^ _ ' a b c d f g h i j k l m n o p q r s t u v w x y z { | } ~



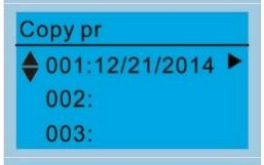
After you confirm the file name, press ENTER.



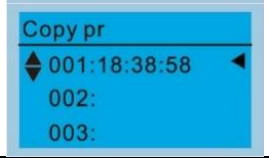
Begin copying parameters until it is done.



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

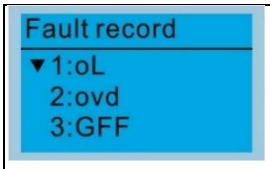
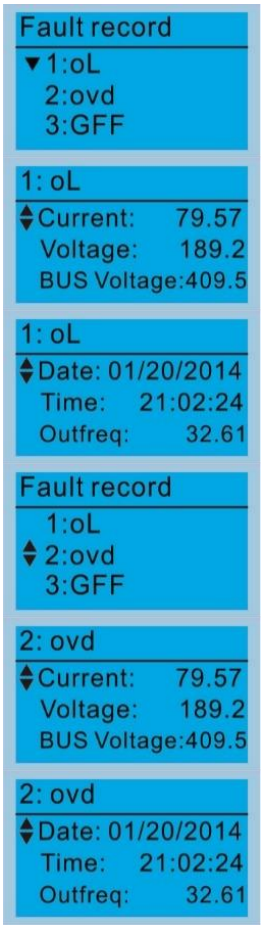


Press the Right key to see the date of the parameters copied.

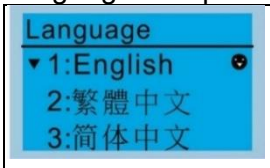


Press the Right key to see the time of the parameters copied.

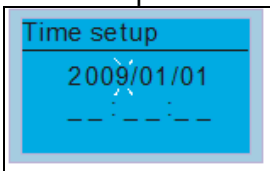
7. Fault Record

 Press ENTER to see an error record's details.	Able to store 6 error codes (Keypad V1.02 and previous versions). Able to store 30 error codes (Keypad V1.20 and later version). 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.  Press the Up / Down keys to select an error record. Press ENTER to see that error record's details. Press the Up / Down keys to scroll through an error record's details such as date, time, frequency, current, voltage, and DC bus voltage. Press ESC to return to the Fault record screen. Press the Up / Down keys to select the next error code. After selecting an error code, press ENTER to see that error record's details. Press the Up / Down keys to see an error record's details such as date, time, frequency, current, voltage, and DC bus voltage. **NOTE:** The fault record of the current MX300 will be recorded and stored in KPC-CC01. When you remove the KPC-CC01 and connect it to another MX300, the previous fault records are not deleted. If the KPC-CC01 digital keypad is replaced from AMX300 to BMX300, the error record is the record of AMX300 and should not be confused with BMX300.

8. Language Setup

 Press the Up / Down keys to select the language, and then press ENTER.	The language setting option is displayed in the language of your choice. Language setting options: 1. English 2. 繁體中文 3. 簡體中文

9. Time Setup



Press the Left / Right keys to select Year, Month, Day, Hour, Minute or Seconds to change.



Press the Up / Down keys to set the Year



Press the Up / Down keys to set the Month



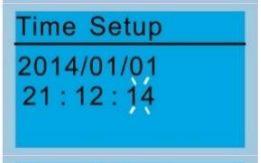
Press the Up / Down keys to set the Day



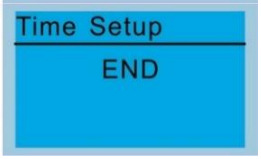
Press the Up / Down keys to set the Hour



Press the Up / Down keys to set the Minute



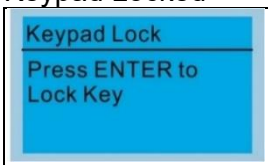
Press the Up / Down keys to set the Second



Press ENTER to confirm the Time Setup.

NOTE: Limitation: The charging process for the keypad super capacitor finishes in about 6 minutes. **When the digital keypad is removed, the time setting is saved for 7 days**. After 7 days, you must reset the time.

12. Keypad Locked



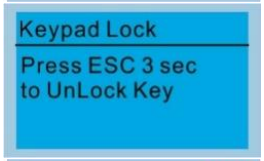
Press ENTER to lock

Lock the keypad.

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 you press any key.



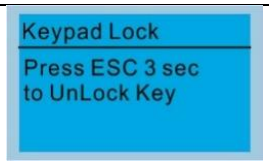
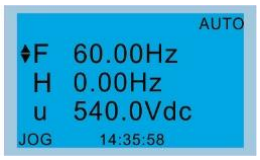
When the keypad is locked, the main screen does not indicate the lock status.



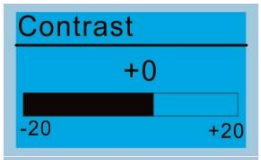
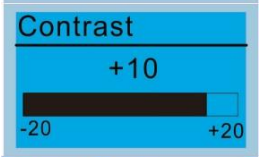
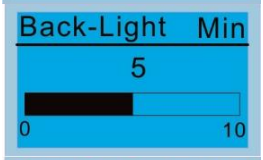
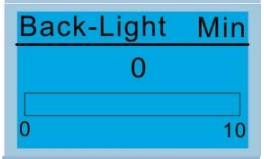
Press any key on the keypad; a message displays as shown on the left.

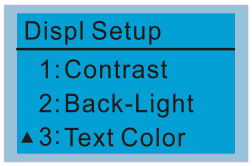
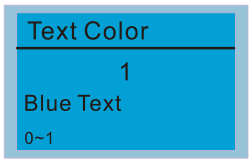


If you do not press the ESC key, the keypad automatically returns to this screen.

	 Press any key on the keypad; a message displays as shown on the left.  Press ESC for 3 seconds to unlock the keypad; the keypad returns to this screen. All keys on the keypad is functional. Turning the power off and on does not lock the keypad.

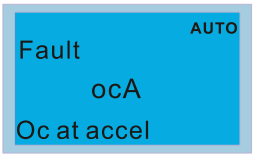
13. Display setup

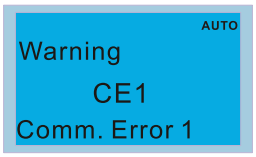
 Press ENTER to go to the setting screen.	1. Contrast  Press the Up / Down keys to adjust the setting value.  For example, increase Contrast to +10.  After you set the value, press ENTER to see the screen display after contrast is adjusted to +10.  Press ENTER and decrease the contrast to -10.  Press ENTER to see screen display after contrast is adjusted to -10. 2. Back-light  Press ENTER to go to the Back-Light Time Setting screen.  Press the Up / Down keys to adjust the setting value.  When the setting value is 0 Min, the backlight remains on.  When the setting value is 10 Min, the backlight turns off in 10 minutes.

	3. Text Color  Press ENTER to go to the Text Color Setting screen.  The default value is White Text.  Press the Up / Down keys to adjust the setting value, and then press ENTER.  The setting value changes to Blue Text.

Other displays

When a fault occurs, the screen display shows the fault or warning:





1. Press the STOP / RESET key to reset the fault code. If there is no response, contact your local distributor or return the unit to the factory. To view the fault DC bus voltage, output current and output voltage, press MENU and then choose 6: Fault Record.
2. After resetting, if the screen returns to the main page and shows no fault after your press ESC, the fault is cleared.
3. When the fault or warning message appears, the LED backlight blinks until you clear the fault or warning.

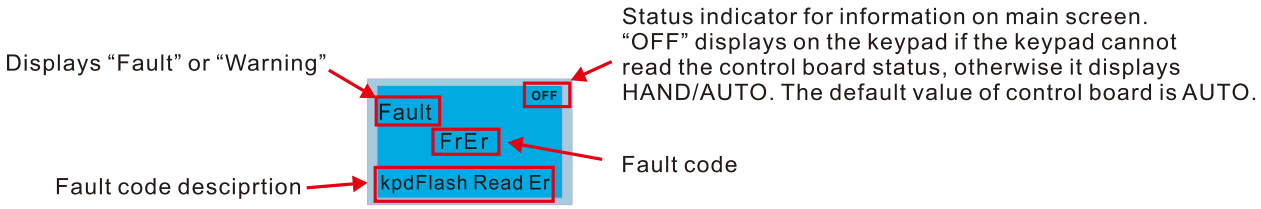
Optional accessory: RJ45 Extension Lead for Digital Keypad

Part No.	Description
CBC-K3FT	RJ45 extension lead, 3 feet (approximately 0.9 m)
CBC-K5FT	RJ45 extension lead, 5 feet (approximately 1.5 m)
CBC-K7FT	RJ45 extension lead, 7 feet (approximately 2.1 m)
CBC-K10FT	RJ45 extension lead, 10 feet (approximately 3 m)
CBC-K16FT	RJ45 extension lead, 16 feet (approximately 4.9 m)

Table 10-31

NOTE: When you need communication cables, buy non-shielded, 24 AWG, four-wire twisted pair, 100 ohms communication cables.

10-14-3 Digital Keypad KPC-CC01 Fault Codes and Descriptions



Fault Codes

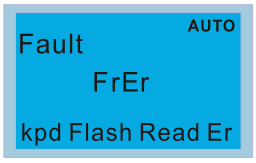
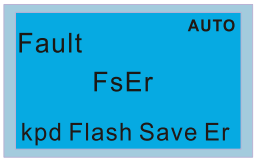
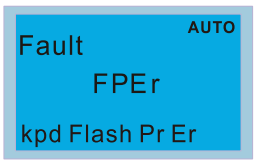
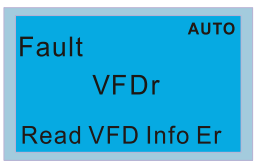
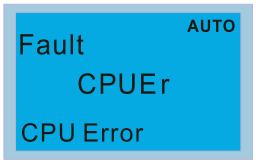
LCD Display	Fault Name	Description	Corrective Actions
	Flash memory read error (FrEr)	Keypad flash memory read error	Error in the keypad’s flash memory. 1. Press RESET to clear the errors. 2. Check for any problem on Flash IC. 3. Shut down the system, wait for ten minutes, and then restart the system.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

Table 10-32

Warning Codes

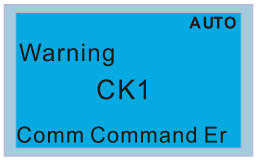
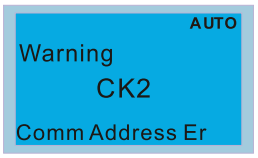
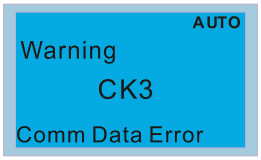
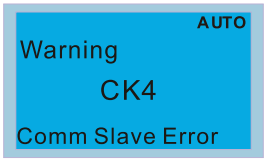
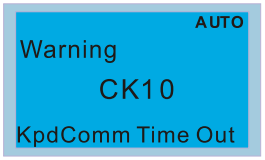
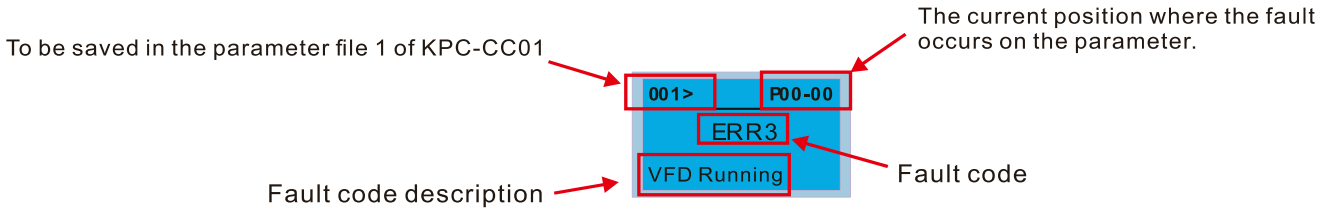
LCD Display	Warning Name	Description	Corrective Actions
	Communication command error 1 (CK1)	Keypad communication data, illegal function code (Keypad auto-detect this error and display it)	Keypad does not accept the motor drive's communication command. 1. Remove the keypad and reconnect it. 2. Verify if the Baud rate = 19200 bps, and the Format = RTU8, N, 2 3. Verify if the keypad is properly connected to the motor drive on the communication contact by a communication cable such as RJ45. If none of the above solution works, contact your local authorized dealer.
	Communication address error (CK2)	Keypad communication data, illegal data address (Keypad auto-detect this error and display it)	Keypad does not accept the motor drive's communication command. 1. Remove the keypad and reconnect it. 2. Verify if the Baud rate = 19200 bps, and the Format = RTU8, N, 2 3. Verify if the keypad is properly connected to the motor drive on the communication contact by a communication cable such as RJ45. If none of the above solution works, contact your local authorized dealer.
	Communication data error (CK3)	Keypad communication data, illegal data value (Keypad auto-detect this error and display it)	Keypad does not accept the motor drive's communication command. 1. Remove the keypad and reconnect it. 2. Verify if the Baud rate = 19200 bps, and the Format = RTU8, N, 2 3. Verify if the keypad is properly connected to the motor drive on the communication contact by a communication cable such as RJ45. If none of the above solution works, contact your local authorized dealer.
	Communication slave error (CK4)	Keypad communication data is written to read-only address (Keypad auto-detect this error and display it)	Keypad does not accept the motor drive's communication command. 1. Remove the keypad and reconnect it. 2. Verify if the Baud rate = 19200 bps, and the Format = RTU8, N, 2 3. Verify if the keypad is properly connected to the motor drive on the communication contact by a communication cable such as RJ45. If none of the above solution works, contact your local authorized dealer.
	Keypad communication time out (CK10)	Keypad communication data, transmission time-out (Keypad auto-detect this error and display it).	Keypad does not accept the motor drive's communication command. 1. Remove the keypad and reconnect it. 2. Verify if the Baud rate = 19200 bps, and the Format = RTU8, N, 2 3. Verify if the keypad is properly connected to the motor drive on the communication contact by a communication cable such as RJ45. If none of the above solution works, contact your local authorized dealer.

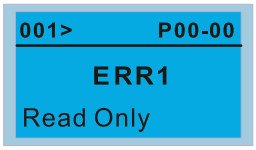
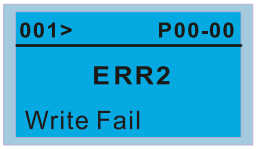
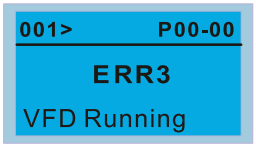
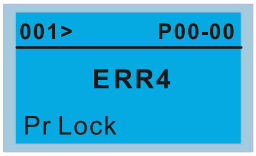
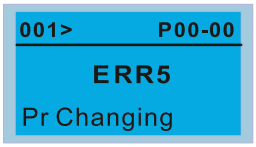
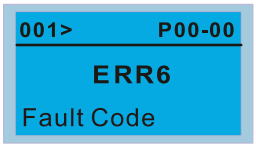
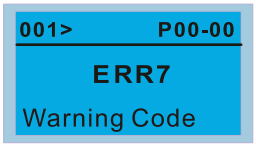
Table 10-33

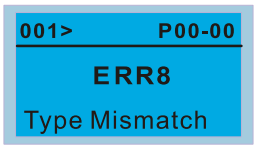
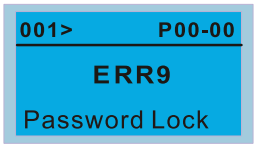
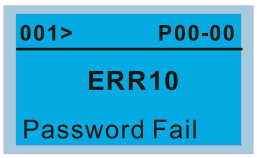
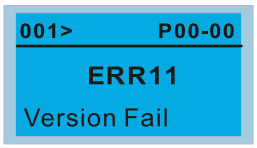
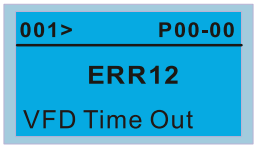
NOTE: The warning code CExx only occurs when the communication problem is between the drive and the keypad. It has nothing to do with the drive and other devices. Note the warning code description to find the cause of the error if CExx appears.

File Copy Setting Fault Description:

These faults occur when KPC-CC01 cannot perform the command after clicking the ENTER key in the copy function.



LCD Display	Fault Name	Description	Corrective Actions
	Read only (ERR1)	Parameter and file are read-only	The parameter / file is read-only and cannot be written to. 1. Verify the specification in the user manual. If this solution does not work, contact your local authorized dealer for assistance.
	Write in error (ERR2)	Fail to write parameter and file	An error occurred while writing to a parameter / file. 1. Check for any problem on Flash IC. 2. Shut down the system, wait for ten minutes, and then restart the system. If this solution does not work, contact your local authorized dealer for assistance.
	Drive operating (ERR3)	AC motor drive is in operating status	A setting cannot be changed while the motor drive is in operation. 1. Verify that the drive is not in operation. If this solution does not work, contact your local authorized dealer for assistance.
	Parameter locked (ERR4)	AC motor drive parameter is locked	A setting cannot be changed because a parameter is locked. 1. Check if the parameter is locked. If it is locked, unlock it and try to set the parameter again. If this solution does not work, contact your local authorized dealer for assistance.
	Parameter changing (ERR5)	AC motor drive parameter is changing	A setting cannot be changed because a parameter is being modified. 1. Check if the parameter is being modified. If it is not being modified, try to change that parameter again. If this solution does not work, contact your local authorized dealer for assistance.
	Fault code (ERR6)	Fault code is not cleared	A setting cannot be changed because an error has occurred in the motor drive. 1. Check if an error occurred in the motor dive. If there is no error, try to change the setting again. If this solution does not work, contact your local authorized dealer for assistance.
	Warning code (ERR7)	Warning code is not cleared	A setting cannot be changed because of a warning message given to the motor drive. 1. Check if there is a warning message given to the motor drive. If this solution does not work, contact your local authorized dealer for assistance.

LCD Display	Fault Name	Description	Corrective Actions
	File type mismatch (ERR8)	File type mismatch	Data to be copied are not the correct type, so the setting cannot be changed. 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. If this solution does not work, contact your authorized dealer for assistance.
	Password locked (ERR9)	File is locked with password	A setting cannot be changed because some data are locked. 1. Check if the data are unlocked or able to be unlocked. If the data are unlocked, try to change the setting again. 2. Shut down the system, wait for ten minutes, and then restart the system. If none of the above solutions works, contact your authorized dealer for assistance.
	Password fail (ERR10)	File password mismatch	A setting cannot be changed because the password is incorrect. 1. Check if the password is correct. If the password is correct, try to change the setting again. 2. Shut down the system, wait for ten minutes, and then restart the system. If none of the above solutions works, contact your authorized dealer for assistance.
	Version fail (ERR11)	File version mismatch	A setting cannot be changed because the version of the data is incorrect. 1. Check if the version of the data matches the motor drive. If it matches, try to change the setting again. If this solution does not work, contact your authorized dealer for assistance.
	VFD Time out (ERR12)	AC motor drive copy function time-out	A setting cannot be changed because the data copying time-out expired. 1. Try copying the data again. 2. Check if copying data is authorized. If it is authorized, try to copy the data again. 3. Shut down the system, wait for ten minutes, and then restart the system. If none of the above solutions works, contact your authorized dealer for assistance.

NOTE: The content in this section only applies to the KPC-CC01 keypad V1.01 and later versions. Table 10-34

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Chapter 11 Specifications

11-1 230V Models

11-2 460V Models

11-3 General Specifications

11-4 Environment for Operation, Storage and Transportation

11-5 Derating Curve

11-6 Efficiency curve

11-1 230V Mode

230V Models – One-phase

Rectifier Module

Model name		Unit	Specifications			
MX300-C models: VFD _ _ _ MX _ 21Cx MX300-E models: VFD _ _ _ MX _ 21Ex		-	15A R	15A B	25A R	25A B
Power (kW)		kW	2.2	2.2	3.7	3.7
Output	Equivalent AC current (sum of inverters)	A	15	15	25	25
Input	Rated Input Current (HD / ND)	A	30	30	50	50
	Rated Voltage / Frequency	-	One-phase AC 200V–240V, 50 / 60 Hz			
	Mains Input Voltage Range	V_{AC}	-15–+10%, Actual range 170–265V			
	Mains Frequency Range	Hz	47–63 Hz			
Brake		-	N/A	Built-in	N/A	Built-in
Power loss		W	53.6	53.6	96.0	96.0
Airflow Rate for Cooling		CFM	24.6	24.6	35.2	35.2
Cooling Method		-	Fan cooling			
Noise		dB	45.2	45.2	52.4	52.4
Weight		kg	2	2	2	2

Table 11-1

Single-axis Inverter Module

Model name		Unit	Specifications			
MX300-A models: VFD _ _ _ MXS21Ax MX300-S models: VFD _ _ _ MXS21SA		-	2A8	4A8	7A5	11A
Output	Heavy duty output current (HD)	A	2.8	4.8	7.5	11
	Normal duty output current (ND)	A	3.5	8	11	17.6
	Applicable Motor Output	kW	0.4	0.75	1.5	2.2
		Hp	0.5	1	2	3
Input	Input voltage	V_{DC}	270–360			
Carrier Frequency		kHz	2–15 (Default: HD 6, ND 2)			
Power loss (HD)		W	13.5	25.0	39.0	56.5
Power loss (ND)		W	22.8	40.6	56.3	88.3
Airflow Rate for Cooling		CFM	0	7.56	10.92	16.8
Cooling Method		-	Convective cooling		Fan cooling	
Motor cable	Shielded	m	50			
	Unshielded	m	75			
Noise		dB	0	29.4	38.2	48.4
Weight		kg	1	1	1	1

Table 11-2

Double-axis Inverter Module

Model name		Unit	Specifications			
MX300-A models: VFD _ _ _ MXD21Ax MX300-S models: VFD _ _ _ MXD21SA		-	2A8	4A8	7A5	11A
Output	Heavy duty output current (HD)	A	2×2.8	2×4.8	2×7.5	2×11
	Normal duty output current (ND)		2×4.8	2×8	2×11	2×17.6
	Applicable Motor Output	kW	2×0.4	2×0.75	2×1.5	2×2.2
		Hp	2×0.5	2×1	2×2	2×3
Input	Input voltage	V_{DC}	270–360			
Carrier Frequency		kHz	2–15 (Default: HD 6, ND 2)			
Power loss (HD)		W	28.3	49.3	76.5	110.2
Power loss (ND)			46.8	80.5	111.0	173.9
Airflow Rate for Cooling		CFM	7.6	10.9	12.6	16.8
Cooling Method		-	Fan cooling			
Motor cable	Shielded	m	50			
	Unshielded		75			
Noise		dB	29.4	38.2	42.1	48.4
Weight		kg	1	1	1	1

Table 11-3

Triple-axis Inverter Module

Model name		Unit	Specifications		
MX300-A models: VFD _ _ _ MXT1Ax MX300-S models: VFD _ _ _ MXT1SA		-	2A8	4A8	7A5
Output	Heavy duty output current (HD)	A	3×2.8	3×4.8	3×7.5
	Normal duty output current (ND)		3×4.8	3×8	3×11
	Applicable Motor Output	kW	3×0.4	3×0.75	3×1.5
		Hp	3×0.5	3×1	3×2
Input	Input voltage	V_{DC}	270–360		
Carrier Frequency		kHz	2–15 (Default: HD 6, ND 2)		
Power loss (HD)		W	42.4	73.4	114.4
Power loss (ND)			70.2	120.2	166.2
Airflow Rate for Cooling		CFM	10.9	12.6	16.8
Cooling Method		-	Fan cooling		
Motor cable	Shielded	m	50		
	Unshielded		75		
Noise		dB	38.2	42.1	48.4
Weight		kg	1	1	1

Table 11-4

NOTE:

1. Default is heavy duty
2. The value of the carrier frequency is a factory default. Decrease the current value if you need to increase the carrier frequency. Refer to Section 11-6 Derating for Ambient Temperature and Altitude for details.

11-2 460V Mode

460V Models - Three-phase

Rectifier Module

Model name		Unit	Specifications					
MX300-C models VFD _ _ _ MX _ 43Cx MX300-E models VFD _ _ _ MX _ 43Ex		-	22A R	22A B	33A R	33A B	41A R	41A B
Power (kW)		kW	7.5	7.5	11	11	18.5	18.5
Output	Equivalent AC current (sum of inverters)	A	22	22	33	33	41	41
Input	Rated Input Current (HD / ND)	A	25	25	38	38	41	41
	Rated Voltage / Frequency	-	Three-phase AC 380V–480V, 50 / 60 Hz					
	Mains Input Voltage Range	V_{AC}	-15–+10%, Actual range 323–528V					
	Mains Frequency Range	Hz	47–63 Hz					
Brake		-	N/A	Built-in	N/A	Built-in	N/A	Built-in
Power loss		W	90.7	90.7	148.3	148.3	170.7	170.7
Airflow Rate for Cooling		CFM	24.6	24.6	35.2	35.2	35.2	35.2
Cooling Method		-	Fan cooling					
Noise		dB	45.2	45.2	53.4	53.4	53.4	53.4
Weight		kg	2	2	2	2	2.1	2.1

Table 11-5

Single-axis Inverter Module

Model name		Unit	Specifications						
MX300-A models: VFD _ _ _ MXS43Ax MX300-S models: VFD _ _ _ MXS43SA		-	1A5	2A7	4A2	5A5	9A0	13A	17A
Output	Heavy duty output current (HD)	A	1.5	2.7	4.2	5.5	9	13	17
	Normal duty output current (ND)	A	2.3	4.2	5.5	9	13	17	18.5
	Applicable Motor Output	kW	0.4	0.75	1.5	2.2	3.7	5.5	7.5
		Hp	0.5	1	2	3	5	7.5	10
Input	Input voltage	V_{DC}	510–720						
Carrier Frequency		kHz	2–15 (Default: HD 6, ND 2)						
Power loss (HD)		W	16.0	24.0	35.9	48.6	95.4	139.0	160.8
Power loss (ND)		W	12.3	24.7	34.6	69.0	102.8	126.7	133.7
Airflow Rate for Cooling		CFM	0	7.6	7.6	7.6	10.9	16.8	16.8
Cooling Method		-	Fan cooling						
Motor cable	Shielded	m	50				100		
	Unshielded	m	100				150		
Noise		dB	0	29.4	29.4	29.4	38.2	48.4	48.4
Weight		kg	1	1	1	1	1	1	1

Table 11-6

Double-axis Inverter Module

Model name		Unit	Specifications				
MX300-A models: VFD _ _ _ MXD43Ax MX300-S models: VFD _ _ _ MXD43SA		-	1A5	2A7	4A2	5A5	9A0
Output	Heavy duty output current (HD)	A	2×1.5	2×2.7	2×4.2	2×5.5	2×9
	Normal duty output current (ND)		2×2.7	2×4.2	2×5.5	2×9	2×13
	Applicable Motor Output	kW	2×0.4	2×0.75	2×1.5	2×2.2	2×3.7
		Hp	2×0.5	2×1	2×2	2×3	2×5
Input	Input voltage	V_{DC}	510–720				
Carrier Frequency		kHz	2–15 (Default: HD 6, ND 2)				
Power loss (HD)		W	33.3	46.9	70.6	97.5	190.0
Power loss (ND)			29.9	48.2	67.9	138.4	204.8
Airflow Rate for Cooling		CFM	7.6	7.6	7.6	16.8	16.8
Cooling Method		-	Fan cooling				
Motor cable	Shielded	m	50				100
	Unshielded		75				150
Noise		dB	29.4	29.4	29.4	48.4	48.4
Weight		kg	1	1	1	1	1

Table 11-7

Triple-axis Inverter Module

Model name		Unit	Specifications			
MX300-A models: VFD _ _ _ MXT43Ax MX300-S models: VFD _ _ _ MXT43SA		-	1A5	2A7	4A2	5A5
Output	Heavy duty output current (HD)	A	3×1.5	3×2.7	3×4.2	3×5.5
	Normal duty output current (ND)		3×2.7	3×4.2	3×5.5	3×9
	Applicable Motor Output	kW	3×0.4	3×0.75	3×1.5	3×2.2
		Hp	3×0.5	3×1	3×2	3×3
Input	Input voltage	V_{DC}	510–720			
Carrier Frequency		kHz	2–15 (Default: HD 6, ND 2)			
Power loss (HD)		W	49.4	69.7	105.9	130.6
Power loss (ND)			44.2	71.7	101.8	206.1
Airflow Rate for Cooling		CFM	7.6	7.6	10.9	16.8
Cooling Method		-	Fan cooling			
Motor cable	Shielded	m	50			
	Unshielded		75			
Noise		dB	29.4	29.4	38.2	54.1
Weight		kg	1	1	1	1

Table 11-8

NOTE:

1. Default is heavy duty
2. The value of the carrier frequency is a factory default. Decrease the current value if you need to increase the carrier frequency. Refer to Section 11-6 Derating for Ambient Temperature and Altitude for details.

11-3 General Specifications

Control Characteristics	Control Method	V/F, SVC
	Applicable Motor	IM (Induction Motor), PM motor control (IPM and SPM)
	Max. Output Frequency	0.00–599.00 Hz
	Starting Torque	200% / 3 Hz (V/F, SVC control for IM) 100% / (motor rated frequency / 20) (SVC control for PM)
	Speed Control Range	1:50 (V/F, SVC control for IM); 1:20 (SVC control for PM)
	Overload Capacity	Normal duty: 110% rated current for 60 seconds and 130% rated current for 3 seconds, if the temperature is above 50°C, decrease 2.5% of the rated current for every 1°C increase in temperature. The maximum allowable temperature is 60°C. Heavy duty: 150% rated current for 60 seconds and 200% rated current for 3 seconds, if the temperature is above 50°C, decrease 2.5% of the rated current for every 1°C increase in temperature. The maximum allowable temperature is 60°C.
	Frequency Setting Signal	0–10V / 4 (0) –20 mA, PWM pulse width input, pulse input (10 KHz)
	Main Functions	Multiple motor switching (a maximum of four independent motor parameter settings), Fast start-up, Deceleration Energy Back (DEB) function, Fast deceleration function, Master and Auxiliary frequency source selectable, Restart after momentary power loss, Speed tracking, Over-torque detection, 16-step speed (including the master speed), Accel. / decel. time switch, S-curve accel. / decel., three-wire operation control, JOG frequency, Frequency upper / lower limit settings, DC brake at start-up and stop, PID control, and Simple positioning function.
	Application Macro	Built-in application parameter groups (selected by industry) and user-defined application parameter groups.
Protection Characteristics	Rectifier Module	Overload, Low-voltage, Over-voltage, Over-heating, Phase loss, Communication failure
	Inverter Module	Overload, Over-current, Overv-oltage, Ground detection protection, Stall prevention
IP Rating (IEC 60529:2013)		Open type: IP40 (MX300 series should be installed in a protective cabinet with an IP54 protection rating or higher.)
Certifications		CE, UL, KC
Safety Function		Safe Torque Off, STO (EN 61800-5-2) TUV Rheinland EN IEC 62061 Maximum SIL 3 / EN 61508 SIL3 EN ISO13849-1, Cat.3/PL e

Table 11-9

NOTE: Control accuracy may vary depending on the environment, application conditions or different motors. Contact Delta or your local distributors for more information.

11-4 Environment for Operation, Storage and Transportation

<table>
<tr><td colspan="4">DO NOT expose the AC motor drive to a poor environment, such as one with dust, direct sunlight, corrosive / 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="13">Environment</td><td>Installation Location</td><td colspan="2">IEC 60364-1/ IEC 60664-1 Pollution degree 2, Indoor use.</td></tr>
<tr><td rowspan="4">Surrounding Temperature</td><td>Operation</td><td>-20–60°C
Normal duty (ND) and Heavy duty (HD): above 50°C with derating</td></tr>
<tr><td>Storage</td><td>-40–85°C</td></tr>
<tr><td>Transportation</td><td>-20–70°C</td></tr>
<tr><td colspan="2">Non-condensing, non-freezing</td></tr>
<tr><td rowspan="3">Rated Humidity</td><td>Operation</td><td>Maximum 90%</td></tr>
<tr><td>Storage / Transportation</td><td>Maximum 95%</td></tr>
<tr><td colspan="2">No water condensation</td></tr>
<tr><td rowspan="2">Air Pressure</td><td>Operation</td><td>86–106 kPa</td></tr>
<tr><td>Storage / Transportation</td><td>70–106 kPa</td></tr>
<tr><td rowspan="4">Pollution Level (IEC60721-3)</td><td>Operation</td><td>Class 3C3; Class 3S3</td></tr>
<tr><td>Storage</td><td>Class 2C2; Class 2S2</td></tr>
<tr><td>Transportation</td><td>Class 1C2; Class 1S2</td></tr>
<tr><td colspan="2">Concentrate prohibited</td></tr>
<tr><td>Altitude</td><td colspan="2"><1000 m (For altitudes > 1000 m, derate to use it.)</td></tr>
<tr><td rowspan="2">Package Drop</td><td>Storage</td><td colspan="2" rowspan="2">ISTA procedure 1A (according to weight) IEC 60068-2-31</td></tr>
<tr><td>Transportation</td></tr>
<tr><td>Vibration</td><td>Operation / Non operation</td><td colspan="2">EN 61800-5-1:
• 10 Hz ≤ f ≤ 58 Hz / Amplitude 0.075 mm
• 58 Hz ≤ f ≤ 150 Hz / 1.0g</td></tr>
<tr><td>Impact</td><td>Operation / Non operation</td><td colspan="2">IEC61800-2 Table 22:
Motion: Waveform: Half sine
Shock amplitude / Time:
1. 50m/s2 (5g) / 30ms
2. 300m/s2 (30g) / 11ms</td></tr>
<tr><td colspan="2">Operating Volume</td><td colspan="2">The operating volume of the rectifier module and inverter module is less than 70dB (EN 61800-5-1)</td></tr>
</table>

Table 11-10

11-5 Derating Curve

Derating Curve for Load and Altitude

Protection Level	Operating Environment
Normal duty Heavy duty	If the AC motor drive operates at the rated current, the ambient temperature needs to be between -20–50°C. If the temperature is above 50ºC, decrease 2.5% of the rated current for every 1ºC increase in temperature. The maximum allowable temperature is 60ºC.
High Altitude	If the AC motor drive is installed at an altitude of 0–1000 m, follow normal operation restrictions. For altitudes of 1000–2000 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 grounded is 2000 m. If installing at an altitude higher than 2000 m is required, contact Delta for more information.

Table 11-11

Altitude Derating Curve

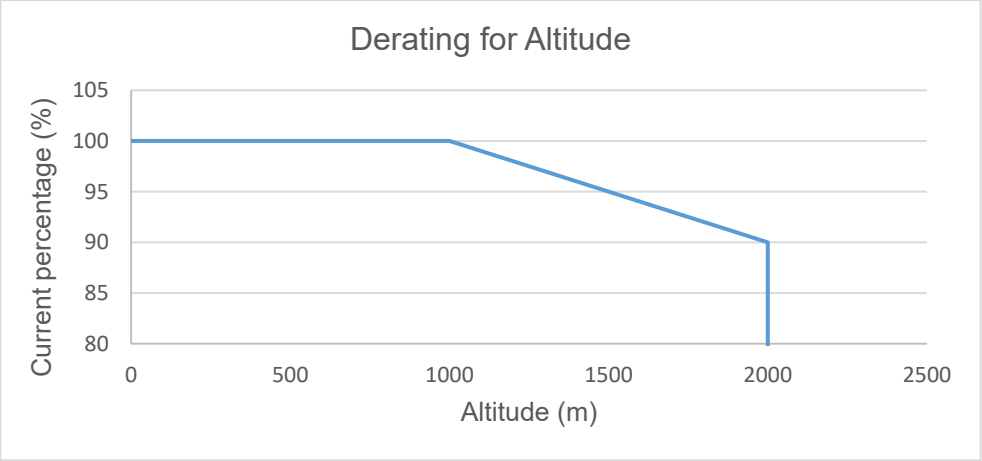


Figure 11-1

Normal duty / Heavy duty

Current derating at ambient temperature				
Ambient temperature		40°C	45°C	50°C
Operating altitude above sea level (m)	0–1000	100%		
	1001–1500	100%		95%
	1501–2000	100%	95%	90%

Table 11-12

11-6 Efficiency curve

Describe the derating curve for different carrier frequency. The relevant parameters are as follows:

Parameter	Description	Settings	Default
00-16	Load selection	0: Normal load 1: Heavy load	1
00-17	Carrier Frequency	2–15 kHz	6
11-41	PWM Mode Selection	0: Two-phase modulation mode 2: Space vector modulation mode	0

Table 11-13

1. The rated output current of DPWM in different carrier frequencies (unit: %)
   - 230V Models:

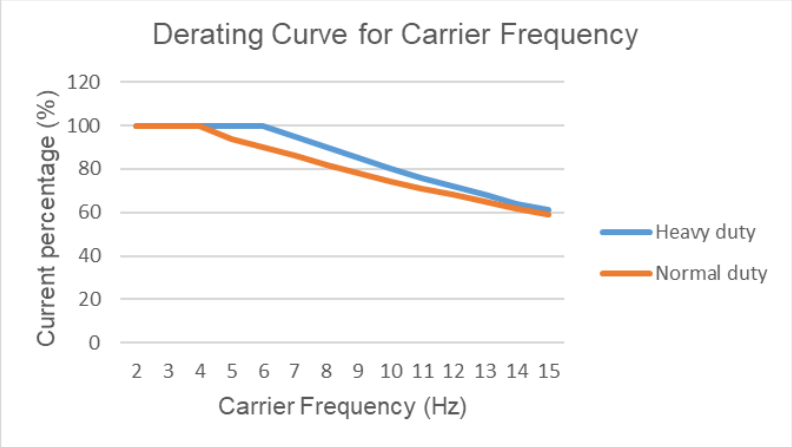


Figure 11-2

Load	Fc (kHz)													
	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Heavy duty	100	100	100	100	100	92	84	78	72	67	63	59	55	52
Normal duty	100	90	82	75	69	64	59	55	51	47	44	41	38	35

Table 11-14

   - 460V Models:

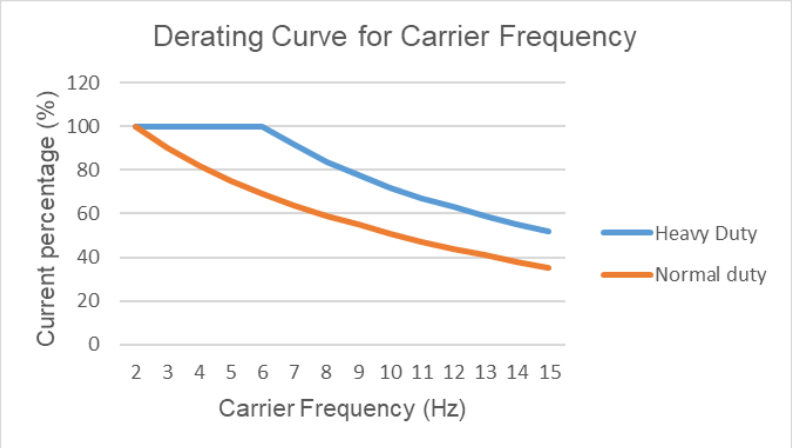


Figure 11-3

Load	Fc (kHz)													
	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Heavy duty	100	100	100	100	100	92	84	78	72	67	63	59	55	52
Normal duty	100	90	82	75	69	64	59	55	51	47	44	41	38	35

Table 11-15

2. The rated output current of SVPWM in different carrier frequencies (unit: %)

- 230V Models:

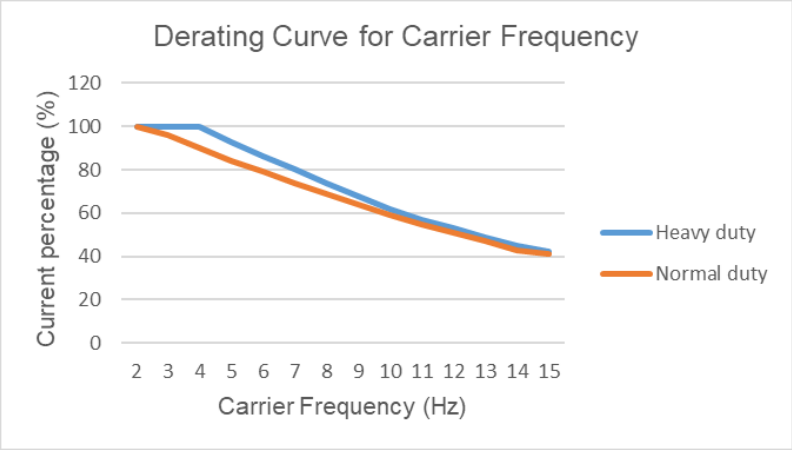


Figure 11-4

Load	Fc (kHz)													
	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Heavy duty	100	100	100	100	100	92	84	78	72	67	63	59	55	52
Normal duty	100	90	82	75	69	64	59	55	51	47	44	41	38	35

Table 11-16

- 460V Models:

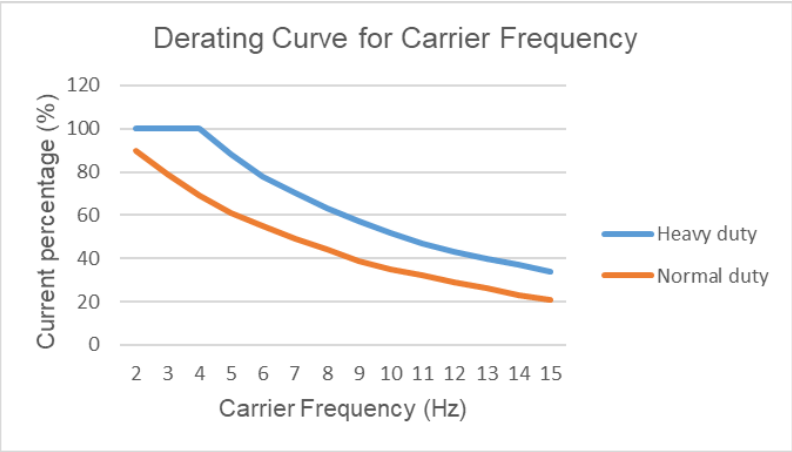


Figure 11-5

Load	Fc (kHz)													
	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Heavy duty	100	100	100	88	78	70	63	57	52	47	43	40	37	34
Normal duty	90	79	69	61	55	49	44	39	35	32	29	26	23	21

Table 11-17

Chapter 12 Summary of Parameter Settings

12-1 Rectifier Module Parameters

12-2 Inverter Module Parameters

This chapter provides a summary of parameters (Pr.) setting ranges and defaults You can set, change, and reset parameters through the digital keypad.

NOTE:

1. ↗ : You can set this parameter during operation.
2. Refer to chapter 13 for the details of parameters.
3. The following are abbreviations for different types of motors:
   - IM: Induction motor
   - PM: Permanent magnet synchronous AC motor
   - IPM: Interior permanent magnet synchronous AC motor
   - SPM: Surface permanent magnet synchronous AC motor

12-1 Rectifier Module Parameters

00 Drive Parameters

	Pr.	Explanation	Settings	Default
	00-00	Rectifier Module Identity Code	306: 230 V, 1 Phase, 3 HP (2.2 kW) 307: 230 V, 1 Phase, 7.5 HP (3.7 kW) 409: 460 V, 3 Phase, 10 HP (7.5 kW) 410: 460 V, 3 Phase, 15 HP (11 kW) 412: 460 V, 3 Phase, 25 HP (18.5 HP)	Read only
	00-01	Rectifier Module Rated Current Display	Display by models	Read only
	00-02	Parameter Reset	0: No function 1: Write protection for parameters 5: Return kWh displays to 0 8: Keypad does not respond 10: Reset all parameters to defaults	0
↗	00-03	Start-up Display	2: U (user-defined) see Pr.00-04 3: A (output current)	2
↗	00-04	Content of Multi-function Display (User-Defined) User-defined Characteristics	0: Display total output current from the rectifier module to the motor (A) (Unit: Amp) 3: Display the rectifier module DC bus voltage (v) (Unit: V_{DC}) 6: Display the rectifier module output power in kW (P) (Unit: kW) 11: Display AI1 analog input terminal signal (1.) (Unit: %) (MX300-C models only) 12: Display AI2 analog input terminal signal (2.) (Unit: %) (MX300-C models only) 13: Power components temperature percentage (C) (Unit: %)	3

	Pr.	Explanation	Settings	Default
			14: Power components temperature (i) (Unit: ºC) 16: The digital input status (ON / OFF) (i) 17: The digital output status (ON / OFF) (o) 19: The corresponding CPU digital input pin status (d) 20: The corresponding CPU digital output pin status (0.) 25: Overload count (0.00–100.00%) (o.) (Unit: %) 27: DC bus voltage ripple (r.) (Unit: V_{DC}) 38: Display the rectifier module status (6.) 41: Total kWh display (J) (Unit: kWh)	
	00-06	Firmware Version	Read only	Read only
✓	00-07	Parameter Protection Password Input	0–65535 0–4: the number of password attempts allowed	0
✓	00-08	Parameter Protection Password Setting	0–65535 0: No password protection or password is entered correctly (Pr.00-07) 1: Password has been set	0
	00-21	Operation Command Source (AUTO, REMOTE)	0: Digital keypad 1: External terminals 2: RS-485 communication input 3: CANopen / EtherCAT / PROFINET / EtherNet/IP input **NOTE:** 1. HOA (Hand-Off-Auto) function is valid only when you use with MO function setting 42 and 56 or with KPC-CC01 (optional) 2. PROFINET periodic communication function needs to be set to 3	0
✓	00-48	Display Filter Time (Current)	0.001–65.535 sec.	0.100
✓	00-49	Display Filter Time (Keypad)	0.001–65.535 sec.	0.100
	00-50	Software Version (Date)	Read only	Read only

02 Digital Input / Output Parameters

	Pr.	Explanation	Settings	Default
	02-01	Multi-function Input Command 1 (MI1)	0: No function 5: Reset 38: Disable writing EEPROM function	0
	02-02	Multi-function Input Command 2 (MI2)		0
	02-03	Multi-function Input Command 3 (MI3)		0
	02-04	Multi-function Input Command 4 (MI4)		0
	02-05	Multi-function Input Command 5 (MIO1)		0
	02-06	Multi-function Input Command 6 (MIO2)		0
	02-07	Multi-function Input Command 7 (MIO3)		0
	02-08	Multi-function Input Command 4 (MIO4)		0
	02-26	Input Terminal of I/O Extension Card (MI9)		0
	02-27	Input Terminal of I/O Extension Card (MI10)		0
	02-28	Input Terminal of I/O Extension Card (MI11)		0
	02-29	Input Terminal of I/O Extension Card (MI12)		0
	02-30	Input Terminal of I/O Extension Card (MI13)		0
	02-31	Input Terminal of I/O Extension Card (MI14)		0
	02-32	Input Terminal of I/O Extension Card (MI15)		0
	02-33	Input Terminal of I/O Extension Card (MI16)		0
✓	02-11	Multi-function Input Response Time	0.000–30.000 sec.	0.005
✓	02-12	Multi-function Input Mode Selection	0–65535	0
✓	02-13	Multi-Function Output 1 RY1	0: No function 10: Low voltage warning (Lv) (Pr.06-00) 11: Malfunction indication 13: Overheat warning (Pr.06-15) 14: Software brake signal indication (Pr.07-00) 20: Warning output 21: Over-voltage 24: Operation source 35: Fault output option 1 (Pr.06-23) 36: Fault output option 2 (Pr.06-24) 37: Fault output option 3 (Pr.06-25) 38: Fault output option 4 (Pr.06-26) 50: Output control for CANopen 51: Analog output control for RS-485 interface 67: Analog input level reached (MX300-C models only)	11
✓	02-14	Multi-function Output 1 (MIO1)		0
✓	02-15	Multi-function Output 2 (MIO2)		0
✓	02-16	Multi-function Output 3 (MIO3)		0
✓	02-17	Multi-function Output 4 (MIO4)		0
✓	02-36	Output Terminal of Extension Card (MO9)		0
✓	02-37	Output Terminal of Extension Card (MO10)		0
✓	02-38	Output Terminal of Extension Card (MO11)		0
✓	02-39	Output Terminal of Extension Card (MO12)		0
✓	02-40	Output Terminal of Extension Card (MO13)		0
✓	02-41	Output Terminal of Extension Card (MO14)		0
✓	02-42	Output Terminal of Extension Card (MO15)		0
✓	02-43	Output Terminal of Extension Card (MO16)		0
✓	02-18	Multi-function Output Direction	0000h–FFFFh (0: N.O.; 1: N.C.)	0000h
	02-50	Display the Status of Multi-function Input Terminal	Monitor the status of the Multi-function Input Terminal	Read only

Pr.	Explanation	Settings	Default
02-51	Display the Status of Multi-function Output Terminal	Monitor the status of the Multi-function Output Terminal	Read only
02-64	The Axis Occupied by Relay	0–15	0
02-65	The Axis Occupied by MIO1 for MO Function		0
02-66	The Axis Occupied by MIO2 for MO Function		0
02-67	The Axis Occupied by MIO3 for MO Function		0
02-68	The Axis Occupied by MIO4 for MO Function		0
02-91	The Axis Occupied by MO9		0
02-92	The Axis Occupied by MO10		0
02-93	The Axis Occupied by MO11		0
02-94	The Axis Occupied by MO12		0
02-95	The Axis Occupied by MO13		0
02-96	The Axis Occupied by MO14		0
02-97	The Axis Occupied by MO15		0
02-98	The Axis Occupied by MO16		0
02-74	Internal / External Multi-Function Input Terminal Selection	0000–FFFFh	0000h
02-75	Internal Multi-Function Input Terminal Selection	0000–FFFFh	0000h

03 Analog Input / Output Parameters

	Pr.	Explanation	Settings	Default
↗	03-28	AI1 Terminal Input Selection (MX300-C models only)	0: 0–10 V 1: 0–20 mA 2: 4–20 mA	0
↗	03-29	AI2 Terminal Input Selection (MX300-C models only)	0: 4–20 mA 1: 0–10 V 2: 0–20 mA	0

05 Motor Parameters

Pr.	Explanation	Settings	Default
05-29	Accumulative Watt-Hour for a Motor in Low Word (kW-hour)	Read only	0.0
05-30	Accumulative Watt-Hour for a Motor in High Word (MW-hour)	Read only	0.0

06 Protection Parameters (1)

	Pr.	Explanation	Settings	Default
✓	06-00	Low Voltage Level	115V / 230V models: 150.0–220.0 V_{DC} 460V models: 300.0–440.0 V_{DC}	180.0 360.0
✓	06-15	Temperature Level Overheat (OH) Warning	0.0: 100.0%	95.0
	06-17	Fault Record 1	0: No fault record 10: Over-voltage at stop (ovS) 14: Low-voltage at stop (LvS) 15: Phase loss protection (orP) 18: IGBT temperature detection failure (tH1o) 21: Rectifier module over load (oL) 24: Motor overheating (PTC / PT100) (oH3) 31: EEPROM read error (cF2) 48: Analog current input loss (ACE) 49: External fault (EF) 50: Emergency stop (EF1) 52: Password is locked (Pcod) 54: Illegal command (CE1) 55: Illegal data address (CE2) 56: Illegal data value (CE3) 57: Data is written to read-only address (CE4) 58: Modbus transmission time-out (CE10) 59: PU board time-out (CP10) (LCD keypad and CC01 keypad) 101: CANopen guarding error (CGdE) 102: CANopen heartbeat error (CHbE) 104: CANopen bus off error (CbFE) 223: PROFINET program inspection error (PrbE)	0
	06-18	Fault Record 2		0
	06-19	Fault Record 3		0
	06-20	Fault Record 4		0
	06-21	Fault Record 5		0
	06-22	Fault Record 6		0
		Fault Record 7 (Pr.14-70)		0
		Fault Record 8 (Pr.14-71)		0
		Fault Record 9 (Pr.14-72)		0
		Fault Record 10 (Pr.14-73)		0
✓	06-23	Fault Output Option 1	0–65535 (refer to bit table for fault code)	0
✓	06-24	Fault Output Option 2	0–65535 (refer to bit table for fault code)	0
✓	06-25	Fault Output Option 3	0–65535 (refer to bit table for fault code)	0
✓	06-26	Fault Output Option 4	0–65535 (refer to bit table for fault code)	0
	06-34	DC bus Voltage at Malfunction	0.0–6553.5 V	Read only
	06-35	Total Output Current at Malfunction	0.00–655.35 Amps	Read only
	06-36	Power Components Temperature at Malfunction	-3276.7–3276.7 °C	Read only
	06-40	Status of the Multi-function Input Terminal at Malfunction	0000h–FFFFh	Read only

Pr.	Explanation	Settings	Default
06-41	Status of the Multi-function Output Terminal at Malfunction	0000h–FFFFh	Read only
06-42	Rectifier Module Status at Malfunction	0000h–FFFFh	Read only
06-53	Input Phase Loss Detection Action (orP)	0: No warning, no fault, and continue operation 1: Fault and ramp to stop	0
06-63	Operation Time of Fault Record 1 (Day)	0–65535 days	Read only
06-64	Operation Time of Fault Record 1 (Min.)	0–1439 min.	Read only
06-65	Operation Time of Fault Record 2 (Day)	0–65535 days	Read only
06-66	Operation Time of Fault Record 2 (Min.)	0–1439 min.	Read only
06-67	Operation Time of Fault Record 3 (Day)	0–65535 days	Read only
06-68	Operation Time of Fault Record 3 (Min.)	0–1439 min.	Read only
06-69	Operation Time of Fault Record 4 (Day)	0–65535 days	Read only
06-70	Operation Time of Fault Record 4 (Min.)	0–1439 min.	Read only
06-90	Operation Time of Fault Record 5 (Day)	0–65535 days	Read only
06-91	Operation Time of Fault Record 5 (Min.)	0–1439 min.	Read only
06-92	Operation Time of Fault Record 6 (Day)	0–65535 days	Read only
06-93	Operation Time of Fault Record 6 (Min.)	0–1439 min.	Read only

07 Special Parameters

	Pr.	Explanation	Settings	Default
↗	07-00	Software Brake Chopper Action Level	230V models: 350.0–450.0 V_{DC} 460V models: 700.0–900.0 V_{DC}	370.0 740.0
↗	07-19	Fan Cooling Control	0: Fan is always ON 3: Fan turns ON when temperature (IGBT) reaches around 60°C	3

09 Communication Parameters

	Pr.	Explanation	Settings	Default
✓	09-00	Modbus Communication Address	1–254	1
✓	09-01	Modbus Transmission Speed	4.8–38.4 Kbps	9.6
✓	09-02	Modbus Transmission Fault Treatment	0: Warn and continue operation 1: Fault and ramp to stop 2: Fault and coast to stop 3: No warning, no fault, and continue operation	3
✓	09-03	Modbus Time-out Detection	0.0–100.0 sec.	0.0
✓	09-04	Modbus Communication Protocol	1: 7, N, 2 (ASCII) 2: 7, E, 1 (ASCII) 3: 7, O, 1 (ASCII) 4: 7, E, 2 (ASCII) 5: 7, O, 2 (ASCII) 6: 8, N, 1 (ASCII) 7: 8, N, 2 (ASCII) 8: 8, E, 1 (ASCII) 9: 8, O, 1 (ASCII) 10: 8, E, 2 (ASCII) 11: 8, O, 2 (ASCII) 12: 8, N, 1 (RTU) 13: 8, N, 2 (RTU) 14: 8, E, 1 (RTU) 15: 8, O, 1 (RTU) 16: 8, E, 2 (RTU) 17: 8, O 2 (RTU)	1
	09-05	Address Setting	0: No function 1: Auto-setting Modbus address (Pr.09-00) 3: Auto-setting Ethernet Slot No.(Pr.09-57) **NOTE:** When the system is configured as EtherCAT, this function configures the axis; when the system is configured as PROFINET, this function configures the Slot.	0
✓	09-09	Communication Response Delay Time	0.0–200.0 ms	2.0
✓	09-11	Block Transfer 1	0–65535	0
✓	09-12	Block Transfer 2	0–65535	0
✓	09-13	Block Transfer 3	0–65535	0
✓	09-14	Block Transfer 4	0–65535	0
✓	09-15	Block Transfer 5	0–65535	0

	Pr.	Explanation	Settings	Default
✓	09-16	Block Transfer 6	0–65535	0
✓	09-17	Block Transfer 7	0–65535	0
✓	09-18	Block Transfer 8	0–65535	0
✓	09-19	Block Transfer 9	0–65535	0
✓	09-20	Block Transfer 10	0–65535	0
✓	09-21	Block Transfer 11	0–65535	0
✓	09-22	Block Transfer 12	0–65535	0
✓	09-23	Block Transfer 13	0–65535	0
✓	09-24	Block Transfer 14	0–65535	0
✓	09-25	Block Transfer 15	0–65535	0
✓	09-26	Block Transfer 16	0–65535	0
	09-30	Delta-defined Communication Decoding Method	0: Decoding method 1 (20xxh) 1: Decoding method 2 (60xxh)	1
	09-36	CANopen Slave Address (MX300-C models only)	0: Disabled 1–127	0
	09-37	CANopen Speed (MX300-C models only)	0: 1 Mbps 1: 500 Kbps 2: 250 Kbps 3: 125 Kbps 4: 100 Kbps 5: 50 Kbps	0
	09-39	CANopen Warning Record (MX300-C models only)	bit 0: CANopen software disconnection 1 (CANopen Guarding Time-out) bit 1: CANopen software disconnection 2 (CANopen Heartbeat Time-out) bit 3: CANopen SDO time-out bit 4: CANopen SDO buffer overflow bit 5: CANopen hardware disconnection warning (CANopen Bus Off) bit 6: CANopen format error warning (Error protocol of CANopen)	Read only
	09-41	CANopen Communication Status (MX300-C models only)	0: Node Reset State 1: Com Reset State 2: Boot up State 3: Pre-operation State 4: Operation State 5: Stop State	Read only

Pr.	Explanation	Settings	Default
09-42	CANopen Control Status (MX300-C models only)	0: Not ready for use state 1: Inhibit start state 2: Ready to switch on state 3: Switched on state 4: Enable operation state 7: Quick stop active state 13: Error reaction activation state 14: Error state	Read only
09-49	CANopen Extended Setting (MX300-C models only)	bit 3: Whether CANopen communication loss CGdE & CHbE and other faults resets automatically • bit3 = 0: When communication is restored, the error will not be reset automatically but needs the communication reset command (NMT Reset) issued through the host computer. • bit3 = 1: When communication is restored, the error is automatically reset without the communication reset command (NMT Reset) issued through the host computer.	0
09-55	Ethernet Communication Protocol (MX300-E models only)	0: Disabled 1: EtherCAT 2: PROFINET 3: EtherNet/IP	1
09-56	EtherCAT Alias Address (MX300-E models only)	1–65535	0
09-73	Communication Abnormal Treat (MX300-E models only)	0: Send fault notification to the upper unit 1: Do not send fault notification to the upper unit	0
09-95	MAC ID_1 (MX300-E models only)	PROFINET MAC ID, read only	Read only
09-96	MAC ID_2 (MX300-E models only)	PROFINET MAC ID, read only	Read only
09-97	MAC ID_3 (MX300-E models only)	PROFINET MAC ID, read only	Read only

14 Protection Parameters (2)

Pr.	Explanation	Settings	Default
14-51	DC bus Voltage at Malfunction 2	0.0–6553.5 V	Read only
14-52	Total Output Current at Malfunction 2	0.00–655.35 Amps	Read only
14-53	Total Power Components Temperature at Fault 2	-3276.7–3276.7	Read only
14-55	DC bus Voltage at Malfunction 3	0.0–6553.5 V	Read only
14-56	Total Output Current at Malfunction 3	0.00–655.35 Amps	Read only
14-57	Total Power Components Temperature at Fault 3	-3276.7–3276.7	Read only
14-59	DC bus Voltage at Malfunction 4	0.0–6553.5 V	Read only
14-60	Total Output Current at Malfunction 4	0.00–655.35 Amps	Read only
14-61	Total Power Components Temperature at Fault 4	-3276.7–3276.7	Read only
14-63	DC bus Voltage at Malfunction 5	0.0–6553.5 V	Read only
14-64	Total Output Current at Malfunction 5	0.00–655.35 Amps	Read only
14-65	Total Power Components Temperature at Fault 5	-3276.7–3276.7	Read only
14-67	DC bus Voltage at Malfunction 6	0.0–6553.5 V	Read only
14-68	Total Output Current at Malfunction 6	0.00–655.35 Amps	Read only
14-69	Total Power Components Temperature at Fault 6	-3276.7–3276.7	Read only
14-70	Fault Record 7	Refer to fault record Pr.06-17–Pr.06-22	0
14-71	Fault Record 8	Refer to fault record Pr.06-17–Pr.06-22	0
14-72	Fault Record 9	Refer to fault record Pr.06-17–Pr.06-22	0
14-73	Fault Record 10	Refer to fault record Pr.06-17–Pr.06-22	0

12-2 Inverter Module Parameters

00 Drive Parameters

Pr.	Explanation	Settings	Default
00-00	Inverter Module Identity Code	203: 230 V, 3 Phase, 0.5 HP (0.4 kW) 204: 230 V, 3 Phase, 1 HP (0.75 kW) 205: 230 V, 3 Phase, 2 HP (1.5 kW) 206: 230 V, 3 Phase, 3 HP (2.2 kW) 403: 460 V, 3 Phase, 0.5 HP (0.4 kW) 404: 460 V, 3 Phase, 1 HP (0.75 kW) 405: 460 V, 3 Phase, 2 HP (1.5 kW) 406: 460 V, 3 Phase, 3 HP (2.2 kW) 407: 460 V, 3 Phase, 5 HP (3.7 kW) 408: 460 V, 3 Phase, 7.5 HP (5.5 kW) 409: 460 V, 3 Phase, 10 HP (7.5 kW)	Read only
00-01	Inverter Module Rated Current Display	Display by models	Read only
00-02	Parameter Reset	0: No function 1: Write protection for parameters 5: Return kWh displays to 0 9: Reset all parameters to defaults (base frequency is 50 Hz) 10: Reset all parameters to defaults (base frequency is 60 Hz) 11: Reset all parameters to defaults with base frequency at 50 Hz (keep the user-defined parameter values Pr.13-01–Pr.13-50) 12: Reset all parameters to defaults with base frequency at 60 Hz (keep the user-defined parameter values Pr.13-01–Pr.13-50)	0
✓ 00-04	Content of Multi-function Display (User-defined)	0: Display output current from the inverter module to the motor (A) (Unit: Amp) 1: Display counter value (c) (Unit: CNT) 2: Display the inverter module actual output frequency (H.) (Unit: Hz) 3: Display the inverter module DC bus voltage (v) (Unit: V_{DC}) 4: Display the inverter module output voltage (E) (Unit: V_{AC}) 5: Display the inverter module output power angle (n) (Unit: deg) 6: Display the inverter module output power in kW (P) (Unit: kW)	3

Pr.	Explanation	Settings	Default
		7: Display the motor speed (r) (Unit: rpm) 8: Display the inverter module estimated output torque, motor's rated torque is 100% (t) (Unit: %) 10: Display PID feedback (b) (Unit: %) 11: Display AI1 analog input terminal signal (1.) (Unit: %) 12: Display AI2 analog input terminal signal (2.) (Unit: %) 13: Power components temperature percentage (C) (Unit: %) 14: Power components temperature (i.) (Unit: °C) 15: Display the circuit board ambient temperature (i.) (Unit: °C) 16: The digital input status (ON / OFF) (i) 17: The digital output status (ON / OFF) (o) 18: Display multi-step speed (S) 25: Overload count (0.00–100.00%) (o.) (Unit: %) 27: DC bus voltage ripple (r.) (Unit: V_{DC}) 30: Display the output of User-defined (U) 31: Display Pr.00-05 user gain (K) 35: Control mode display: 0 = Speed control mode (SPD) 36: Present operating carrier frequency of the inverter module (J.) (Unit: Hz) 38: Display the inverter module status (6.) 39: Display the inverter module estimated output torque, positive and negative, using Nt-m as unit (t 0.0: positive torque; -0.0: negative torque) (C.) 41: kWh display (J) (Unit: kWh) 42: PID target value (h.) (Unit: %) 43: PID compensation (o.) (Unit: %) 44: PID output frequency (b.) (Unit: Hz) 46: Auxiliary frequency value (U.) (Unit: Hz) 47: Master frequency value (A.) (Unit: Hz) 48: Frequency value after addition and subtraction of master and auxiliary frequency (L.) (Unit: Hz) 51: PMSVC torque offset	
✓ 00-05	Coefficient Gain in Actual Output Frequency	0.00–160.00	1.00
00-06	Firmware Version	Read only	Read only

	Pr.	Explanation	Settings	Default
	00-10	Control Mode	0: Speed mode	0
	00-11	Speed Control Mode	0: IMVF (IM V/F control) 2: IM / PM SVC (IM / PM space vector control)	0
	00-16	Load Selection	0: Normal load 1: Heavy load	1
	00-17	Carrier Frequency	2–15 kHz	6
	00-20	Master Frequency Command Source (AUTO, REMOTE)	0: Digital keypad 1: RS-485 communication input 2: External analog input (Refer to Pr.03-00) 3: External UP / DOWN terminal (Multi-function input terminals) 6: CANopen / EtherCAT / PROFINET / EtherNet/IP input 9: PID controller **NOTE**: HOA (Hand-Off-Auto) function is valid only when you use with MO function setting 42 and 56 or with KPC-CC01 (optional).	0
	00-21	Operation Command Source (AUTO, REMOTE)	0: Digital keypad 1: External terminals 2: RS-485 communication input 3: CANopen / EtherCAT / PROFINET / EtherNet/IP input **NOTE**: HOA (Hand-Off-Auto) function is valid only when you use with MO function setting 42 and 56 or with KPC-CC01 (optional).	0
✓	00-22	Stop Method	0: Ramp to stop 1: Coast to stop **NOTE**: In PROFINET, when it is set to 0, it will act by Pr.09-98.	0
✓	00-23	Motor Direction Control	0: Enable forward / reverse 1: Disable reverse 2: Disable forward	0
	00-24	Digital Operator (Keypad) Frequency Command Memory	Read only	Read only
✓	00-25	User-defined Characteristics	bit 0–3: user-defined decimal places 0000h-0000b: no decimal place 0001h-0001b: one decimal place 0002h-0010b: two decimal places 0003h-0011b: three decimal places bit 4–15: user-defined unit	0

Pr.	Explanation	Settings	Default
		000xh: Hz 001xh: rpm 002xh: % 003xh: kg 004xh: m/s 005xh: kW 006xh: HP 007xh: ppm 008xh: 1/m 009xh: kg/s 00Axh: kg/m 00Bxh: kg/h 00Cxh: lb/s 00Dxh: lb/m 00Exh: lb/h 00Fxh: ft/s 010xh: ft/m 011xh: m 012xh: ft 013xh: degC 014xh: degF 015xh: mbar 016xh: bar 017xh: Pa 018xh: kPa 019xh: mWG 01Axh: inWG 01Bxh: ftWG 01Cxh: psi 01Dxh: atm 01Exh: L/s 01Fxh: L/m 020xh: L/h 021xh: m3/s 022xh: m3/h 023xh: GPM 024xh: CFM xxxxh: Hz	

Pr.	Explanation	Settings	Default
00-26	Maximum User-defined Value	0: No function 0–65535 (When Pr.00-25 is set to no decimal place) 0.0–6553.5 (When Pr.00-25 is set to one decimal place) 0.00–655.35 (When Pr.00-25 is set to two decimal places) 0.000–65.535 (When Pr.00-25 is set to three decimal places)	0
00-27	User-defined Value	Read only	Read only
00-29	LOCAL / REMOTE Selection	0: Standard HOA function 1: When switching between local and remote, the drive stops. 2: When switching between local and remote, the drive runs with REMOTE settings for frequency and operating status. 3: When switching between local and remote, the drive runs with LOCAL settings for frequency and operating status. 4: When switching between local and remote, the drive runs with LOCAL settings when switched to Local and runs with REMOTE settings when switched to Remote for frequency and operating status.	0
00-30	Master Frequency Command Source (HAND, LOCAL)	0: Digital keypad 1: RS-485 communication input 2: External analog input (Refer to Pr.03-00) 3: External UP / DOWN terminal (Multi-function input terminals) 6: CANopen / EtherCAT / PROFINET / EtherNet/IP input **NOTE**: HOA (Hand-Off-Auto) function is valid only when you use with MO function setting 41 and 56 or with KPC-CC01 (optional).	0
00-31	Operation Command Source (HAND, LOCAL)	0: Digital keypad 1: External terminals 2: RS-485 communication input 3: CANopen / EtherCAT / PROFINET / EtherNet/IP input **NOTE**: HOA (Hand-Off-Auto) function is valid only when you use with MO function setting 41 and 56 or with KPC-CC01 (optional).	0

	Pr.	Explanation	Settings	Default
↗	00-32	Digital Keypad Stop Function	0: STOP key disabled 1: STOP key enabled	0
	00-33	RPWM Mode Selection	0: No function 1: RPWM mode 1 2: RPWM mode 2 3: RPWM mode 3	0
	00-34	RPWM Range	0.0–4.0 kHz • Pr.00-17 = 4 kHz, 8 kHz: The setting range is 0.0–2.0 kHz • Pr.00-17 = 5 kHz, 6 kHz, 7 kHz: The setting range is 0.0–4.0 kHz	2.0
	00-35	Auxiliary Frequency Source	0: Master and auxiliary frequency function disabled 1: Digital keypad 2: RS-485 communication input 3: Analog input 4: External UP / DOWN (Multi-function input terminals) 6: CANopen / EtherCAT / PROFINET / EtherNet/IP input	0
	00-36	Master and Auxiliary Frequency Command Selection	0: Master + auxiliary frequency 1: Master - auxiliary frequency 2: Auxiliary - master frequency	0
	00-47	Output Phase Order Selection	0: Standard 1: Reverse the operation direction	0
↗	00-48	Display Filter Time (Current)	0.001–65.535 sec.	0.100
↗	00-49	Display Filter Time (Keypad)	0.001–65.535 sec.	0.100
	00-50	Software Version (Date)	Read only	Read only

01 Basic Parameters

	Pr.	Explanation	Settings	Default
	01-00	Maximum Operation Frequency of Motor 1	0.00–599.00 Hz	60.00 / 50.00
	01-01	Rated / Base Frequency of Motor 1	0.00–599.00 Hz	60.00 / 50.00
	01-02	Rated / Base Voltage of Motor 1	230V models: 0.0–255.0 V 460V models: 0.0–510.0 V	220.0 440.0
	01-03	Mid-point Frequency 1 of Motor 1	0.00–599.00 Hz	3.00
✓	01-04	Mid-point Voltage 1 of Motor 1	230V models: 0.0–240.0 V 460V models: 0.0–480.0 V	11.0 22.0
	01-05	Mid-point Frequency 2 of Motor 1	0.00–599.00 Hz	1.50
✓	01-06	Mid-point Voltage 2 of Motor 1	230V models: 0.0–240.0 V 460V models: 0.0–480.0 V	5.0 10.0
	01-07	Minimum Output Frequency of Motor 1	0.00–599.00 Hz	0.50
✓	01-08	Minimum Output Voltage of Motor 1	230V models: 0.0–240.0 V 460V models: 0.0–480.0 V	1.0 2.0
	01-09	Start-up Frequency	0.00–599.00 Hz	0.50
✓	01-10	Output Frequency Upper Limit	0.00–599.00 Hz	599.00
✓	01-11	Output Frequency Lower Limit	0.00–599.00 Hz	0.00
✓	01-12	Acceleration Time 1	Pr.01-45 = 0: 0.00–600.00 sec. Pr.01-45 = 1: 0.0–6000.0 sec.	10.00 10.0
✓	01-13	Deceleration Time 1	Pr.01-45 = 0: 0.00–600.00 sec. Pr.01-45 = 1: 0.0–6000.0 sec.	10.00 10.0
✓	01-14	Acceleration Time 2	Pr.01-45 = 0: 0.00–600.00 sec. Pr.01-45 = 1: 0.0–6000.0 sec.	10.00 10.0
✓	01-15	Deceleration Time 2	Pr.01-45 = 0: 0.00–600.00 sec. Pr.01-45 = 1: 0.0–6000.0 sec.	10.00 10.0
✓	01-16	Acceleration Time 3	Pr.01-45 = 0: 0.00–600.00 sec. Pr.01-45 = 1: 0.0–6000.0 sec.	10.00 10.0
✓	01-17	Deceleration Time 3	Pr.01-45 = 0: 0.00–600.00 sec. Pr.01-45 = 1: 0.0–6000.0 sec.	10.00 10.0
✓	01-18	Acceleration Time 4	Pr.01-45 = 0: 0.00–600.00 sec. Pr.01-45 = 1: 0.0–6000.0 sec.	10.00 10.0
✓	01-19	Deceleration Time 4	Pr.01-45 = 0: 0.00–600.00 sec. Pr.01-45 = 1: 0.0–6000.0 sec.	10.00 10.0

	Pr.	Explanation	Settings	Default
✓	01-20	JOG Acceleration Time	Pr.01-45 = 0: 0.00–600.00 sec. Pr.01-45 = 1: 0.0–6000.0 sec.	10.00 10.0
✓	01-21	JOG Deceleration Time	Pr.01-45 = 0: 0.00–600.00 sec. Pr.01-45 = 1: 0.0–6000.0 sec.	10.00 10.0
✓	01-22	JOG Frequency	0.00–599.00 Hz	6.00
✓	01-23	Switch Frequency Between First and Fourth Accel. / Decel.	0.00–599.00 Hz	0.00
✓	01-24	S-Curve for Acceleration Begin Time 1	Pr.01-45 = 0: 0.00–25.00 sec. Pr.01-45 = 1: 0.0–250.0 sec.	0.20 0.2
✓	01-25	S-Curve for Acceleration Arrival Time 2	Pr.01-45 = 0: 0.00–25.00 sec. Pr.01-45 = 1: 0.0–250.0 sec.	0.20 0.2
✓	01-26	S-Curve for Deceleration Begin Time 1	Pr.01-45 = 0: 0.00–25.00 sec. Pr.01-45 = 1: 0.0–250.0 sec.	0.20 0.2
✓	01-27	S-Curve for Deceleration Arrival Time 2	Pr.01-45 = 0: 0.00–25.00 sec. Pr.01-45 = 1: 0.0–250.0 sec.	0.20 0.2
	01-28	Skip Frequency 1 (Upper Limit)	0.00–599.00 Hz	0.00
	01-29	Skip Frequency 1 (Lower Limit)	0.00–599.00 Hz	0.00
	01-30	Skip Frequency 2 (Upper Limit)	0.00–599.00 Hz	0.00
	01-31	Skip Frequency 2 (Lower Limit)	0.00–599.00 Hz	0.00
	01-32	Skip Frequency 3 (Upper Limit)	0.00–599.00 Hz	0.00
	01-33	Skip Frequency 3 (Lower Limit)	0.00–599.00 Hz	0.00
	01-34	Zero-speed Mode	0: Output waiting 1: Zero-speed operation 2: Fmin (Refer to Pr.01-07, Pr.01-41)	0
	01-35	Rated / Base Frequency of Motor 2	0.00–599.00 Hz	60.00 / 50.00
	01-36	Rated / Base Voltage of Motor 2	230V models: 0.0–255.0 V 460V models: 0.0–510.0 V	220.0 440.0
	01-37	Mid-point Frequency 1 of Motor 2	0.00–599.00 Hz	3.00
✓	01-38	Mid-point Voltage 1 of Motor 2	230V models: 0.0–240.0 V 460V models: 0.0–480.0 V	11.0 22.0
	01-39	Mid-point Frequency 2 of Motor 2	0.00–599.00 Hz	1.50
✓	01-40	Mid-point Voltage 2 of Motor 2	230V models: 0.0–240.0 V 460V models: 0.0–480.0 V	5.0 10.0
	01-41	Minimum Output Frequency of Motor 2	0.00–599.00 Hz	0.50
✓	01-42	Minimum Output Voltage of Motor 2	230V models: 0.0–240.0 V 460V models: 0.0–480.0 V	1.0 2.0

	Pr.	Explanation	Settings	Default
	01-43	V/F Curve Selection	0: V/F curve determined by Pr.01-00–01-08 1: V/F curve to the power of 1.5 2: V/F curve to the power of 2	0
↗	01-44	Auto-acceleration and Auto-deceleration Setting	0: Linear acceleration and deceleration 1: Auto-acceleration and linear deceleration 2: Linear acceleration and auto-deceleration 3: Auto-acceleration and auto-deceleration 4: Stall prevention by auto-acceleration and auto-deceleration (limited by Pr.01-12–01-21)	0
	01-45	Time Unit for Acceleration and Deceleration and S-curve	0: Unit 0.01 sec. 1: Unit 0.1 sec.	0
↗	01-46	CANopen Quick Stop Time	Pr.01-45 = 0: 0.00–600.00 sec. Pr.01-45 = 1: 0.0–6000.0 sec.	1.00 1.0
	01-49	Regenerative Energy Restriction Control Method	0: Disabled 1: Over voltage energy restriction 2: Traction energy control (TEC) 3: Electromagnetic energy traction control	0
	01-52	Maximum Operation Frequency of Motor 2	0.00–599.00 Hz	60.00 / 50.00

02 Digital Input / Output Parameters

Pr.	Explanation	Settings	Default
02-00	Two-wire / Three-wire Operation Control	0: No function 1: Two-wire mode 1, power on for operation control (MIx_d61: FWD / STOP, MIy_d62: REV / STOP) 2: Two-wire mode 2, power on for operation control (MIx_d61: RUN / STOP, MIy_d62: REV / FWD) 3: Three-wire, power on for operation control (MIx_d61: RUN, MIy_d62: REV / FWD, MIz_d63: STOP) 7: One-wire (MIx_d61: RUN / STOP or MIx_d62: REV / STOP)	1
02-01	Multi-function Input Command 1 (MI1)	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 operation [by external control or KPC-CC01 (optional)] 7: Acceleration / deceleration speed inhibit 8: 1st and 2nd acceleration / deceleration time selection 9: 3rd and 4th acceleration / deceleration time selection 10: External Fault (EF) input (Pr.07-20) 11: Base Block (B.B.) input from external 12: Output voltage stop 13: Cancel the setting of auto-acceleration / auto-deceleration time 15: Rotating speed command from AI1 16: Rotating speed command from AI2 18: Force to stop (Pr.07-20) 19: Digital up command 20: Digital down command 21: PID function disabled 22: Clear the counter 24: FWD JOG command 25: REV JOG command	0
02-02	Multi-function Input Command 2 (MI2)		0
02-03	Multi-function Input Command 3 (MI3)		0
02-04	Multi-function Input Command 4 (MI4)		0
02-05	Multi-function Input Command 5 (MIO1)		0
02-06	Multi-function Input Command 6 (MIO2)		0
02-07	Multi-function Input Command 7 (MIO3)		0
02-08	Multi-function Input Command 4 (MIO4)		0
02-26	Input Terminal of I/O Extension Card (MI9)		0
02-27	Input Terminal of I/O Extension Card (MI10)		0
02-28	Input Terminal of I/O Extension Card (MI11)		0
02-29	Input Terminal of I/O Extension Card (MI12)		0
02-30	Input Terminal of I/O Extension Card (MI13)		0
02-31	Input Terminal of I/O Extension Card (MI14)		0
02-32	Input Terminal of I/O Extension Card (MI15)		0
02-33	Input Terminal of I/O Extension Card (MI16)		0

	Pr.	Explanation	Settings	Default
			28: Emergency stop (EF1) 38: Disable writing EEPROM function 40: Force coasting to stop 41: HAND switch 42: AUTO switch 49: Enable drive 50: Slave dEb action to execute 53: Trigger CANopen quick stop 56: Local / Remote selection 61: Multi-wire operation command 1 62: Multi-wire operation command 2 63: Multi-wire operation command 3 70: Force auxiliary frequency return to 0 71: Disable PID function, force PID output return to 0 72: Disable PID function, retain the output value before disabled 73: Force PID integral gain return to 0, disable integral 74: Reverse PID feedback 83: Multi-motor (IM) selection bit 0 98: Simple positioning stop by forward limit 99: Simple positioning stop by reverse limit	
✓	02-09	External Terminals UP / DOWN Key Mode	0: UP / DOWN by the acceleration / deceleration time 1: UP / DOWN constant speed (Pr.02-10) 3: External terminals UP / DOWN key mode	0
✓	02-10	External Terminal Constant Speed, Accel. / Decel. Speed of the UP / DOWN Key	0.001–1.000 Hz / ms	0.001
✓	02-11	Multi-function Input Response Time	0.000–30.000 sec.	0.005
✓	02-12	Multi-function Input Mode Selection	0–65535	0
✓	02-13	Multi-function Output 1 RY1	0: No function 1: Indication during RUN 2: Operation speed reached 3: Desired frequency reached 1 (Pr.02-22) 4: Desired frequency reached 2 (Pr.02-24) 5: Zero speed (Frequency command) 6: Zero speed including STOP (Frequency command)	11
✓	02-14	Multi-function Output 1 (MIO1)		0
✓	02-15	Multi-function Output 2 (MIO2)		0
✓	02-16	Multi-function Output 3 (MIO3)		0
✓	02-17	Multi-function Output 4 (MIO4)		0
✓	02-36	Output Terminal of Extension Card (MO9)		0
✓	02-37	Output Terminal of Extension Card (MO10)		0
✓	02-38	Output Terminal of Extension Card (MO11)		0

	Pr.	Explanation	Settings	Default
✓	02-39	Output Terminal of Extension Card (MO12)	7: Over-torque 1 (Pr.06-06–Pr.06-08)	0
✓	02-40	Output Terminal of Extension Card (MO13)	8: Over-torque 2 (Pr.06-09–Pr.06-11)	0
✓	02-41	Output Terminal of Extension Card (MO14)	9: Drive is ready	0
✓	02-42	Output Terminal of Extension Card (MO15)	10: Low voltage warning (Lv) (Pr.06-00)	0
✓	02-43	Output Terminal of Extension Card (MO16)	11: Malfunction indication	0
			13: Overheat warning (Pr.06-15) 15: PID feedback error (Pr.08-13, Pr.08-14) 16: Slip error (oSL) 17: Count value reached, does not return to 0 (Pr.02-20) 18: Count value reached, return to 0 (Pr.02-19) 19: External interrupt B.B. input (Base Block) 20: Warning output 21: Over-voltage 22: Over-current stall prevention 23: Over-voltage stall prevention 24: Operation source 25: Forward command 26: Reverse command 27: Output when current percentage > Pr.02-46 28: Output when current percentage < Pr.02-46 29: Output when frequency ≥ Pr.02-34 30: Output when frequency < Pr.02-34 33: Zero speed (actual output frequency) 34: Zero speed including STOP (actual output frequency) 35: Error output selection 1 (Pr.06-23) 36: Error output selection 2 (Pr.06-24) 37: Error output selection 3 (Pr.06-25) 38: Error output selection 4 (Pr.06-26) 40: Speed reached (including STOP) 42: Crane function 43: Motor speed detection 44: Low current output (Use with Pr.06-71–Pr.06-73) 45: UVW output electromagnetic valve switch	

	Pr.	Explanation	Settings	Default
			46: Master dEb output 67: Analog input level reached	
✓	02-18	Multi-function Output Direction	0000h–FFFFh (0: N.O.; 1: N.C.)	0000
✓	02-19	Terminal Counting Value Reached (Returns to 0)	0–65500	0
✓	02-20	Preliminary Counting Value Reached (Does Not Return to 0)	0–65500	0
✓	02-22	Desired Frequency Reached 1	0.00–599.00 Hz	60.00 / 50.00
✓	02-23	The Width of the Desired Frequency Reached 1	0.00–599.00 Hz	2.00
✓	02-24	Desired Frequency Reached 2	0.00–599.00 Hz	60.00 / 50.00
✓	02-25	The Width of the Desired Frequency Reached 2	0.00–599.00 Hz	2.00
✓	02-34	Output Frequency Setting for Multi-function Output Terminal	0.00–599.00 Hz (Motor speed when using PG)	0.00
✓	02-35	External Operation Control Selection after Reset and Reboot	0: Disabled 1: Drive runs if the RUN command remains after reset or reboot.	0
	02-46	Output Current Level Setting for Multi-function Output Terminal	0–100%	0
✓	02-47	Motor Zero-Speed Level	0–65535 rpm	0
	02-50	Display the Status of Multi-function Input Terminal	Monitor the status of multi-function input terminals	Read only
	02-51	Display the Status of Multi-function Output Terminal	Monitor the status of multi-function output terminals	Read only
	02-54	Display the Frequency Command Executed by External Terminal	0.00–599.00 Hz (Read only)	Read only
✓	02-58	Multi-function Output Terminal (Function 42): Brake Frequency Check Point	0.00–599.00 Hz	0.00
✓	02-81	EF Active when Terminal Count Value Reached	0: Terminal count value reached, no EF displays (continues to operate) 1: Terminal count value reached, EF activates	0
✓	02-82	Initial Frequency Command (F) Mode after Stop	0: Use current Frequency command 1: Use zero Frequency command 2: Refer to Pr.02-83 to setup	0
✓	02-83	Initial Frequency Command (F) Setting after Stop	0.00–599.00 Hz	60.00

03 Analog Input / Output Parameters

	Pr.	Explanation	Settings	Default
✓	03-00	AI1 Analog Input Selection	0: No function 1: Frequency command 4: PID target value 5: PID feedback signal 6: Thermistor (PTC) input value 11: PT100 thermistor input value 12: Auxiliary frequency input 13: PID compensation value 15: AI is the forward start command 16: AI is the reverse start command	1
✓	03-01	AI2 Analog Input Selection		0
✓	03-03	AI1 Analog Input Bias	-100.0–100.0%	0
✓	03-04	AI2 Analog Input Bias	-100.0–100.0%	0
✓	03-07	AI1 Positive / Negative Bias Mode	0: No bias 1: Lower than or equal to bias 2: Greater than or equal to bias 3: The absolute value of the bias voltage while serving as the center 4: Bias serves as the center	0
✓	03-08	AI2 Positive / Negative Bias Mode		0
✓	03-10	Reverse Setting when Analog Signal Input is Negative Frequency	0: Negative frequency input is not allowed. The digital keypad or external terminal controls the forward and reverse direction. 1: Negative frequency input is allowed. Positive frequency = run in a forward direction; negative frequency = run in a reverse direction. The digital keypad or external terminal control cannot change the running direction.	0
✓	03-11	AI1 Analog Input Gain	-500.0–500.0%	100.0
✓	03-12	AI2 Analog Input Gain	-500.0–500.0%	100.0
✓	03-15	AI1 Analog Input Filter Time	0.00–20.00 sec.	0.01
✓	03-16	AI2 Analog Input Filter Time	0.00–20.00 sec.	0.01
✓	03-18	Analog Input Addition Function	0: Disable (AI1, AI2) 1: Enable (excludes analog extension card)	0
	03-19	Signal Loss Selection for the Analog Input 4–20 mA	0: Disabled 1: Continue operation at the last frequency 2: Decelerate to 0 Hz 3: Stop immediately and display ACE	0
✓	03-44	Multi-function Output (MO) by AI Level Source	0: AI1 1: AI2	0
✓	03-45	AI Upper Level	-100.00–100.00%	50.00

	Pr.	Explanation	Settings	Default
✓	03-46	AI Lower Level	-100.00–100.00%	10.00
✓	03-50	Analog Input Curve Selection	0: Normal curve 1: Three-point curve of AI1 2: Three-point curve of AI2 3: Three-point curve of AI1&AI2	0
✓	03-57	AI2 Lowest Point	Pr.03-29 = 0, 4.00–20.00 mA Pr.03-29 = 1, 0.00–10.00 V Pr.03-29 = 2, 0.00–20.00 mA	4.00 0.00 0.00
✓	03-58	AI2 Proportional Lowest Point	0.00–100.00%	0.00
✓	03-59	AI2 Mid-point	Pr.03-29 = 0, 4.00–20.00 mA Pr.03-29 = 1, 0.00–10.00 V Pr.03-29 = 2, 0.00–20.00 mA	12.00 5.00 10.00
✓	03-60	AI2 Proportional Mid-point	0.00–100.00%	50.00
✓	03-61	AI2 Highest Point	Pr.03-29 = 0, 4.00–20.00 mA Pr.03-29 = 1, 0.00–10.00 V Pr.03-29 = 2, 0.00–20.00 mA	20.00 10.00 20.00
✓	03-62	AI2 Proportional Highest Point	0.00–100.00%	100.00
✓	03-63	AI1 Voltage Lowest Point	Pr.03-28 = 0, 0.00–10.00 V Pr.03-28 = 1, 0.00–20.00 mA Pr.03-28 = 2, 4.00–20.00 mA	0.00 0.00 4.00
✓	03-64	AI1 Proportional Voltage Lowest Point	-100.00–100.00%	0.00
✓	03-65	AI1 Voltage Mid-point	Pr.03-28 = 0, 0.00–10.00 V Pr.03-28 = 1, 0.00–20.00 mA Pr.03-28 = 2, 4.00–20.00 mA	5.00 10.00 12.00
✓	03-66	AI1 Proportional Voltage Mid-point	-100.00–100.00%	50.00
✓	03-67	AI1 Voltage Highest Point	Pr.03-28 = 0, 0.00–10.00 V Pr.03-28 = 1, 0.00–20.00 mA Pr.03-28 = 2, 4.00–20.00 mA	10.00 20.00 20.00
✓	03-68	AI1 Proportional Voltage Highest Point	-100.00–100.00%	100.00

04 Multi-Step Speed Parameters

	Pr.	Explanation	Settings	Default
✓	04-00	1st Step Speed Frequency	0.00–599.00 Hz	0.00
✓	04-01	2nd Step Speed Frequency	0.00–599.00 Hz	0.00
✓	04-02	3rd Step Speed Frequency	0.00–599.00 Hz	0.00
✓	04-03	4th Step Speed Frequency	0.00–599.00 Hz	0.00
✓	04-04	5th Step Speed Frequency	0.00–599.00 Hz	0.00
✓	04-05	6th Step Speed Frequency	0.00–599.00 Hz	0.00
✓	04-06	7th Step Speed Frequency	0.00–599.00 Hz	0.00
✓	04-07	8th Step Speed Frequency	0.00–599.00 Hz	0.00
✓	04-08	9th Step Speed Frequency	0.00–599.00 Hz	0.00
✓	04-09	10th Step Speed Frequency	0.00–599.00 Hz	0.00
✓	04-10	11th Step Speed Frequency	0.00–599.00 Hz	0.00
✓	04-11	12th Step Speed Frequency	0.00–599.00 Hz	0.00
✓	04-12	13th Step Speed Frequency	0.00–599.00 Hz	0.00
✓	04-13	14th Step Speed Frequency	0.00–599.00 Hz	0.00
✓	04-14	15th Step Speed Frequency	0.00–599.00 Hz	0.00

05 Motor Parameters

	Pr.	Explanation	Settings	Default
	05-00	Motor Parameter Auto-tuning	0: No function 1: Dynamic test for induction motor (IM) 2: Static test for induction motor (IM) 5: Rolling auto-tuning for PM (IPM / SPM) 13: High frequency stall test for PM synchronous motor	0
	05-01	Full-load Current for Induction Motor 1 (A)	10–120% of the inverter module rated current	Depend on the model power
✓	05-02	Rated Power for Induction Motor 1 (kW)	0.00–655.35 kW	Depend on the model power
✓	05-03	Rated Speed for Induction Motor 1 (rpm)	0–65535 1710 (60 Hz 4 poles); 1410 (50 Hz 4 poles)	Depend on the motor's number of poles
	05-04	Number of Poles for Induction Motor 1	2–20	4
	05-05	No-load Current for Induction Motor 1 (A)	0.00–Pr.05-01 default	Depend on the model power
	05-06	Stator Resistance (Rs) for Induction Motor 1	0.000–65.535 Ω	Depend on the model power
	05-07	Rotor Resistance (Rr) for Induction Motor 1	0.000–65.535 Ω	0.000
	05-08	Magnetizing Inductance (Lm) for Induction Motor 1	0.0–6553.5 mH	0.0
	05-09	Stator Inductance (Lx) for Induction Motor 1	0.0–6553.5 mH	0.0
	05-13	Full-load Current for Induction Motor 2 (A)	10–120% of the inverter module rated current	Depend on the model power
✓	05-14	Rated Power for Induction Motor 2 (kW)	0.00–655.35 kW	Depend on the model power
✓	05-15	Rated Speed for Induction Motor 2 (rpm)	0–xxxxx (Depend on the motor's number of poles) 1710 (60 Hz 4 poles); 1410 (50 Hz 4 poles)	Depend on the motor's number of poles
	05-16	Number of Poles for Induction Motor 2	2–20	4
	05-17	No-load Current for Induction Motor 2 (A)	0–Pr.05-13 default	Depend on the model power
	05-18	Stator Resistance (Rs) for Induction Motor 2	0.000–65.535 Ω	Depend on the model power

Pr.	Explanation	Settings	Default
05-19	Rotor Resistance (Rr) for Induction Motor 2	0.000–65.535 Ω	0.000
05-20	Magnetizing Inductance (Lm) for Induction Motor 2	0.0–6553.5 mH	0.0
05-21	Stator Inductance (Lx) for Induction Motor 2	0.0–6553.5 mH	0.0
05-22	Multi-motors (Induction) Selection	1: Motor 1 2: Motor 2	1
05-26	Accumulative Watt-second for a Motor in Low Word (W-msec.)	Read only	0.0
05-27	Accumulative Watt-second for a Motor in High Word (W-sec.)	Read only	0.0
05-28	Accumulative Watt-hour for a Motor (W-hour)	Read only	0.0
05-29	Accumulative Watt-hour for a Motor in Low Word (kW-hour)	Read only	0.0
05-30	Accumulative Watt-hour for a Motor in High Word (MW-hour)	Read only	0.0
05-31	Accumulated Motor Operation Time (Minutes)	0–1439	0
05-32	Accumulated Motor Operation Time (Days)	0–65535	0
05-33	Induction Motor (IM) or Permanent Magnet Synchronous AC Motor (PM) Selection	0: Induction motor 1: SPM 2: IPM	0
05-34	Full-load Current for a Permanent Magnet Synchronous AC Motor	0–120 % of the inverter module rated current	Depend on the model power
05-35	Rated Power for a Permanent Magnet Synchronous AC Motor	0.00–655.35 kW	Depending on the model power
05-36	Rated Speed for a Permanent Magnet Synchronous AC Motor	0–65535 rpm	2000

Pr.	Explanation	Settings	Default
05-37	Number of Poles for a Permanent Magnet Synchronous AC Motor	0–65535	10
05-39	Stator Resistance for a Permanent Magnet Synchronous AC Motor	0.000–65.535 Ω	0.000
05-40	Permanent Magnet Synchronous AC Motor Ld	0.00–655.35 mH	0.00
05-41	Permanent Magnet Synchronous AC Motor Lq	0.00–655.35 mH	0.00
05-43	Ke Parameter of a Permanent Magnet Synchronous AC Motor	0–65535 V / krpm	0

06 Protection Parameters (1)

	Pr.	Explanation	Settings	Default
✓	06-00	Low Voltage Level	230V models: 150.0–220.0 V_{DC} 460V models: 300.0–440.0 V_{DC}	180.0 360.0
✓	06-01	Over-voltage Stall Prevention	0: No function 230V models: 0.0–450.0 V_{DC} 460V models: 0.0–900.0 V_{DC}	 380.0 760.0
✓	06-02	Selection for Over-voltage Stall Prevention	0: Traditional over-voltage stall prevention 1: Smart over-voltage stall prevention	0
✓	06-03	Over-current Stall Prevention during Acceleration	Normal duty: 0–150% (100% corresponds to the rated current of the inverter module) Heavy load: 0–200% (100% corresponds to the rated current of the inverter module)	120 180
✓	06-04	Over-current Stall Prevention during Operation	Normal duty: 0–150% (100% corresponds to the rated current of the inverter module) Heavy load: 0–200% (100% corresponds to the rated current of the inverter module)	120 180
✓	06-05	Acceleration / Deceleration Time Selection for Stall Prevention at Constant Speed	0: By current acceleration / deceleration time 1: By the first acceleration / deceleration time 2: By the second acceleration / deceleration time 3: By the third acceleration / deceleration time 4: By the fourth acceleration / deceleration time 5: By auto-acceleration / auto-deceleration	0
✓	06-06	Over-torque Detection Selection (Motor 1)	0: No function 1: Continue operation after over-torque detection during constant speed operation 2: Stop after over-torque detection during constant speed operation 3: Continue operation after over-torque detection during RUN 4: Stop after over-torque detection during RUN	0
✓	06-07	Over-torque Detection Level (Motor 1)	10–250% (100% corresponds to the rated current of the inverter module)	120
✓	06-08	Over-torque Detection Time (Motor 1)	0.0–60.0 sec.	0.1

	Pr.	Explanation	Settings	Default
✓	06-09	Over-torque Detection Selection (Motor 2)	0: No function 1: Continue operation after over-torque detection during constant speed operation 2: Stop after over-torque detection during constant speed operation 3: Continue operation after over-torque detection during RUN 4: Stop after over-torque detection during RUN	0
✓	06-10	Over-torque Detection Level (Motor 2)	10–250% (100% corresponds to the rated current of the inverter module)	120
✓	06-11	Over-torque Detection Time (Motor 2)	0.0–60.0 sec.	0.1
✓	06-13	Electronic Thermal Relay Selection 1 (Motor 1)	0: Inverter motor (with external forced cooling) 1: Standard motor (motor with fan on the shaft) 2: Disabled	2
✓	06-14	Electronic Thermal Relay Action Time 1 (Motor 1)	30.0–600.0 sec.	60.0
✓	06-15	Temperature Level Overheat (OH) Warning	0.0–100.0%	95.0
✓	06-16	Stall Prevention Limit Level	0–100% (Refer to Pr.06-03, Pr.06-04)	100
	06-17	Fault Record 1	0: No fault record 1: Over-current during acceleration (ocA) 2: Over-current during deceleration (ocd) 3: Over-current during steady operation (ocn) 4: Ground fault (GFF) 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 at constant speed (Lvn) 14: Low-voltage at stop (LvS) 16: Power components overheating (oH1) 17: Circuit board ambient temperature overheats (oH2) 18: IGBT temperature detection failure (tH1o) 19: Capacitor hardware error (tH2o)	0
	06-18	Fault Record 2		0
	06-19	Fault Record 3		0
	06-20	Fault Record 4		0
	06-21	Fault Record 5		0
	06-22	Fault Record 6		0
		Fault Record 7 (Pr.14-70)		
		Fault Record 8 (Pr.14-71)		
		Fault Record 9 (Pr.14-72)		
		Fault Record 10 (Pr.14-73)		

Pr.	Explanation	Settings	Default
		21: Over load (oL) 22: Electronics thermal relay 1 protection (EoL1) 23: Electronics thermal relay 2 protection (EoL2) 24: Motor overheating (PTC / PT100) (oH3) 26: Over torque 1 (ot1) 27: Over torque 2 (ot2) 28: Under current (uC) 31: EEPROM read error (cF2) 33: U-phase error (cd1) 34: V-phase error (cd2) 35: W-phase error (cd3) 36: cc hardware error (Hd0) 37: oc hardware error (Hd1) 38: ov hardware error (Hd2) 40: Auto-tuning error (AUE) 41: PID loss AI2 (AFE) 48: AI2 loss (ACE) 49: External fault (EF) 50: Emergency stop (EF1) 51: External base block (bb) 52: Password is locked (Pcod) 54: Illegal command (CE1) 55: Illegal data address (CE2) 56: Illegal data value (CE3) 57: Data is written to read-only address (CE4) 58: Modbus transmission time-out (CE10) 63: Over slip warning (oSL) 72: S1 internal circuit detection error (STL1) 76: STO (STo) 77: S2 internal circuit detection error (STL2) 79: U-phase over-current before run (Aoc) 80: V-phase over-current before run (boc) 81: W-phase over-current before run (coc) 82: U-phase output phase loss (oPL1) 83: V-phase output phase loss (oPL2) 84: W-phase output phase loss (oPL3) 87: Low frequency overload protection (oL3) 89: Rotor position detection error (roPd) 101: CANopen guarding error (CGdE) 102: CANopen heartbeat error (CHbE) 104: CANopen bus off error (CbFE)	

	Pr.	Explanation	Settings	Default
			121: Internal communication error (CP20) 122: Internal communication error (CP21) 123: Internal communication error (CP22) 124: Internal communication error (CP30) 126: Internal communication error (CP32) 140: oc hardware error (Hd6) 141: GFF occurs before run (b4GFF) 142: Auto-tuning error 1 (AuE1) 143: Auto-tuning error 1 (AuE2) 144: Auto-tuning error 1 (AuE3) 145: MErr error (MErr) 215: Ethernet communication time-out (EdtE) 220: PROFINET startup error (PStE) 221: PROFINET storage device error (PSFE) 222: PROFINET operation error (PoPE) 223: PROFINET program inspection error (PrbE) 224: STO execution time-out (SToT) 225: STO ROM verifying failure (STor) 226: STO loss (SToL) 227: STO Channel 1 error (STC1) 228: STO Channel 2 error (STC2) 229: STO Channel 1 time-out (SPC1) 230: STO Channel 2 time-out (SPC2) 231: STO Gate buffer check error (SGbE) 232: STO power 18V over voltage (S18ov) 233: STO power 18V under voltage (S18uv) 234: STO power 6V over voltage (S6ov) 235: STO power 6V under voltage (S6uv) 236: STO power 5V over voltage (S5ov) 237: STO power 5V under voltage (S5uv) 238: STO Watchdog (SWdG) 239: STO ADC Sampling failure (SAdE) 240: STO execution time is too short (SEbL) 241: STO execution time is too high (SEAb) 242: Safe torque off 1 (STo1) 243: Safe torque off 2 (STo2)	
✓	06-23	Fault Output Option 1	0–65535 (refer to bit table for fault code)	0
✓	06-24	Fault Output Option 2	0–65535 (refer to bit table for fault code)	0
✓	06-25	Fault Output Option 3	0–65535 (refer to bit table for fault code)	0
✓	06-26	Fault Output Option 4	0–65535 (refer to bit table for fault code)	0

	Pr.	Explanation	Settings	Default
✓	06-27	Electronic Thermal Relay Selection 2 (Motor 2)	0: Inverter motor (with external forced cooling) 1: Standard motor (motor with fan on the shaft) 2: Disabled	2
✓	06-28	Electronic Thermal Relay Action Time 2 (Motor 2)	30.0–600.0 sec.	60.0
✓	06-29	PTC Detection Selection	0: Warn and continue operation 1: Fault and ramp to stop 2: Fault and coast to stop 3: No warning	0
✓	06-30	PTC Level	0.0–100.0%	50.0
	06-31	Frequency Command at Malfunction	0.00–599.00 Hz	Read only
	06-32	Output Frequency at Malfunction	0.00–599.00 Hz	Read only
	06-33	Output Voltage at Malfunction	0.0–6553.5 V	Read only
	06-34	DC bus Voltage at Malfunction	0.0–6553.5 V	Read only
	06-35	Output Current at Malfunction	0.00–655.35 Amps	Read only
	06-36	Power Components Temperature at Malfunction	-3276.7–3276.7 °C	Read only
	06-37	Circuit Board Ambient Temperature at Malfunction	-3276.7–3276.7 °C	Read only
	06-38	Motor Speed at Malfunction	-32767–32767 rpm	Read only
	06-40	Status of the Multi-function Input Terminal at Malfunction	0000h–FFFFh	Read only
	06-41	Status of the Multi-function Output Terminal at Malfunction	0000h–FFFFh	Read only
	06-42	Inverter Module Status at Malfunction	0000h–FFFFh	Read only
✓	06-44	STO Latch Function (MX300-S models only)	bit 0: STO latch bit 1: STO fault indication shield	0
✓	06-45	Output Phase Loss Detection Action (oPHL)	0: Warn and continue operation 1: Fault and ramp to stop 2: Fault and coast to stop 3: No warning	3
✓	06-46	Detection Time for Output Phase Loss	0.000–65.535 sec.	0.500
✓	06-47	Current Detection Level for Output Phase Loss	0.00–100.00%	1.00
✓	06-48	DC Brake Time for Output Phase Loss	0.000–65.535 sec.	0.000

	Pr.	Explanation	Settings	Default
	06-49	LvX Error Handling Function	bit 0: LvX error auto-restart bit 1: LvX error indicator shield bit 15: LvX error auto-restart shield	0
✓	06-55	Derating Protection	0: Constant rated current and limit carrier frequency by load current and temperature 1: Constant carrier frequency and limit load current by setting carrier frequency 2: Constant rated current (same as setting 0), but close current limit	0
✓	06-56	PT100 Voltage Level 1	0.000–10.000 V	5.000
✓	06-57	PT100 Voltage Level 2	0.000–10.000 V	7.000
✓	06-58	PT100 Level 1 Frequency Protection	0.00–599.00 Hz	0.00
✓	06-59	PT100 Activation Level 1 Protection Frequency Delay Time	0–6000 sec.	60
	06-63	Operation Time of Fault Record 1 (Day)	0–65535 days	Read only
	06-64	Operation Time of Fault Record 1 (Min.)	0–1439 min.	Read only
	06-65	Operation Time of Fault Record 2 (Day)	0–65535 days	Read only
	06-66	Operation Time of Fault Record 2 (Min.)	0–1439 min.	Read only
	06-67	Operation Time of Fault Record 3 (Day)	0–65535 days	Read only
	06-68	Operation Time of Fault Record 3 (Min.)	0–1439 min.	Read only
	06-69	Operation Time of Fault Record 4 (Day)	0–65535 days	Read only
	06-70	Operation Time of Fault Record 4 (Min.)	0–1439 min.	Read only
✓	06-71	Low Current Setting Level	0.0–100.0%	0.0
✓	06-72	Low Current Detection Time	0.00–360.00 sec.	0.00
✓	06-73	Low Current Action	0: No function 1: Fault and coast to stop 2: Fault and ramp to stop by the 2nd deceleration time 3: Warn and continue operation	0

Pr.	Explanation	Settings	Default
06-90	Operation Time of Fault Record 5 (Day)	0–65535 days	Read only
06-91	Operation Time of Fault Record 5 (Min.)	0–1439 min.	Read only
06-92	Operation Time of Fault Record 6 (Day)	0–65535 days	Read only
06-93	Operation Time of Fault Record 6 (Min.)	0–1439 min.	Read only

07 Special Parameters

	Pr.	Explanation	Settings	Default
✓	07-01	DC Brake Current Level	0–100%	0
✓	07-02	DC Brake Time at Start-up	0.0–60.0 sec.	0.0
✓	07-03	DC Brake Time at STOP	0.0–60.0 sec.	0.0
✓	07-04	DC Brake Frequency at STOP	0.00–599.00 Hz	0.00
✓	07-05	Voltage Increasing Gain	1–1000%	100
✓	07-06	Restart after Momentary Power Loss	0: Stop operation 1: Speed tracking by the speed before the power loss 2: Speed tracking by the minimum output frequency	0
✓	07-07	Allowed Power Loss Duration	0.0–20.0 sec.	2.0
✓	07-08	Base Block Time	0.1–5.0 sec.	0.5
✓	07-09	Current Limit of Speed Tracking	20–200%	100
✓	07-10	Restart after Fault Action	0: Stop operation 1: Speed tracking by current speed 2: Speed tracking by the minimum output frequency	0
✓	07-11	Number of Times of Restart after Fault	0–10	0
✓	07-12	Speed Tracking During Start-up	0: No function 1: Speed tracking by the maximum output frequency 2: Speed tracking by the motor frequency at start-up 3: Speed tracking by the minimum output frequency	0
✓	07-13	dEb Function Selection	0: Disabled 1: dEb with auto-acceleration / auto-deceleration, the drive does not output the frequency after the power is restored. 2: dEb with auto-acceleration / auto-deceleration, the drive outputs the frequency after the power is restored.	0
✓	07-15	Dwell Time at Acceleration	0.00–600.00 sec.	0.00
✓	07-16	Dwell Frequency at Acceleration	0.00–599.00 Hz	0.00
✓	07-17	Dwell Time at Deceleration	0.00–600.00 sec.	0.00
✓	07-18	Dwell Frequency at Deceleration	0.00–599.00 Hz	0.00

	Pr.	Explanation	Settings	Default
✓	07-19	Fan Cooling Control	0: Fan is always ON 1: Fan is OFF after the inverter module stops for one minute. 2: Fan turns ON / OFF when the AC motor drive runs / stops. 3: Fan turns ON when temperature (IGBT) reaches around 60°C. 5: Fan turns ON / OFF when the AC motor drive runs / stops and stays in standby mode at zero speed.	3
✓	07-20	Emergency Stop (EF) & Force to Stop Selection	0: Coast to stop 1: Stop by the first deceleration time 2: Stop by the second deceleration time 3: Stop by the third deceleration time 4: Stop by the fourth deceleration time 5: System deceleration 6: Automatic deceleration	0
✓	07-21	Automatic Energy-saving Setting	0: Disabled 1: Enabled	0
✓	07-22	Energy-saving Gain	10–1000%	100
✓	07-23	Automatic Voltage Regulation (AVR) Function	0: Enable AVR 1: Disable AVR 2: Disable AVR during deceleration	0
✓	07-24	Torque Command Filter Time (V/F and SVC Control Mode)	0.001–10.000 sec.	0.050
✓	07-25	Slip Compensation Filter Time (V/F and SVC Control Mode)	0.001–10.000 sec.	0.100
✓	07-26	Torque Compensation Gain	IM: 0–10 (when Pr.05-33=0) PM: 0–5000 (when Pr.05-33=1 or 2)	1
✓	07-27	Slip Compensation Gain	0.00–10.00	0.00 (Default value is 1.00 in SVC mode)
✓	07-29	Slip Deviation Level	0.0–100.0% 0: No detection	0
✓	07-30	Over-slip Deviation Detection Time	0.0–10.0 sec.	1.0
✓	07-31	Over-slip Deviation Treatment	0: Warn and continue operation 1: Fault and ramp to stop 2: Fault and coast to stop 3: No warning	0
✓	07-32	Motor Oscillation Compensation Factor	0–10000	1000

	Pr.	Explanation	Settings	Default
↗	07-33	Auto-restart Interval of Fault	0.0–6000.0 sec.	60.0
	07-38	PMSVC Voltage Feed Forward Gain	0.50–2.00	1.00
	07-49	Fan Control Mode	0: Continuous running by the setting of Pr.07-50 1: Fan runs continuously between 30% to 100% by the speed curve in Figure 1. 2: Fan stops after the drive stops for one minute, runs between 30% to 100% by the speed curve in Figure 1. 3: Fan starts when the temperature reaches 40°C, runs between 30% to 100% by the speed curve in Figure 2. **NOTE:** See the descriptions in section 13-2 for Figure1 and 2)	3
	07-50	Fan Control Duty	0–100 %	60
↗	07-54	Auto-acceleration and Auto-deceleration Gain (Kp)	0–65535	2
↗	07-55	Auto-acceleration and Auto-deceleration Gain (Ki)	0–655.35	4.00
↗	07-62	dEb Gain (Kp)	0–65535	8000
↗	07-63	dEb Gain (Ki)	0–65535	150
↗	07-71	Torque Compensation Gain (Motor 2)	IM: 0–10 (when Pr.05-33=0) PM: 0–5000 (when Pr.05-33=1 or 2)	1
↗	07-72	Slip Compensation Gain (Motor 2)	0.00–10.00	0.00 (Default value is 1.00 in SVC mode)

08 High-function PID Parameters

	Pr.	Explanation	Settings	Default
✓	08-00	Terminal Selection of PID Feedback	0: No function 1: Negative PID feedback: by analog input (Pr.03-00) 4: Positive PID feedback: by analog input (Pr.03-00) 7: Negative PID feedback: by communication protocol 8: Positive PID feedback: by communication protocol	0
✓	08-01	Proportional Gain (P)	0.0–1000.0 (when Pr.08-23 set bit1 = 0) 0.00–100.0 (when Pr.08-23 set bit1 = 1)	1.0 1.00
✓	08-02	Integral Time (I)	0.00–100.00 sec.	1.00
✓	08-03	Differential Time (D)	0.00–1.00 sec.	0.00
✓	08-04	Upper Limit of Integral Control	0.0–100.0%	100.0
✓	08-05	PID Output Command Limit (Positive Limit)	0.0–100.0%	100.0
✓	08-06	PID Feedback Value by Communication Protocol	-200.00–200.00%	0.00
✓	08-07	PID Delay Time	0.0–2.5 sec.	0.0
✓	08-08	Feedback Signal Detection Time	0.0–3600.0 sec.	0.0
✓	08-09	Feedback Signal Fault Treatment	0: Warn and continue operation 1: Fault and ramp to stop 2: Fault and coast to stop 3: Warn and operate at last frequency	0
✓	08-10	Sleep Level	0.00–599.00 Hz / 0.00–200.00 %	0.00
✓	08-11	Wake-up Level	0.00–599.00 Hz / 0.00–200.00 %	0.00
✓	08-12	Sleep Delay Time	0.0–6000.0 sec.	0.0
✓	08-13	PID Feedback Signal Error Deviation Level	1.0–50.0%	10.0
✓	08-14	PID Feedback Signal Error Deviation Detection Time	0.1–300.0 sec.	5.0
✓	08-15	PID Feedback Signal Filter Time	0.1–300.0 sec.	5.0
✓	08-16	PID Compensation Selection	0: Parameter setting 1: Analog input	0
✓	08-17	PID Compensation	-100.0–100.0%	0
	08-18	Sleep Mode Function Setting	0: Refer to PID output command 1: Refer to PID feedback signal	0

	Pr.	Explanation	Settings	Default
✓	08-19	Wake-up Integral Limit	0.0–200.0%	50.0
	08-20	PID Mode Selection	0: Serial connection 1: Parallel connection	0
	08-21	Enable PID to Change the Operation Direction	0: Operation direction cannot be changed 1: Operation direction can be changed	0
✓	08-22	Wake-up Delay Time	0.00–600.00 sec.	0.00
✓	08-23	PID Control Flag	bit 0 = 1, PID running in reverse follows the setting of Pr.00-23. bit 0 = 0, PID running in reverse refers to PID's calculated value. bit 1 = 1, two decimal places for PID Kp bit 1 = 0, one decimal place for PID Kp	2
✓	08-26	PID Output Command Limit (Reverse Limit)	0.0–100.0%	100.0
✓	08-27	Acceleration / Deceleration Time for PID Command	0.00–655.35 sec.	0.00
	08-29	Frequency Base Corresponding to 100.00% PID	0: PID control output 100.00% corresponding to maximum operation frequency (Pr.01-00) 1: PID control output 100.00% corresponding to the input value of the auxiliary frequency	0
✓	08-65	PID Target Value Source	0: Frequency command (Pr.00-20, Pr.00-30) 1: Pr.08-66 setting 2: RS-485 communication input 3: External analog input (Refer to Pr.03-00) 4: CANopen communication card	0
✓	08-66	PID Target Value Setting	-100.00–100.00%	50.00
✓	08-67	Master and Auxiliary Reverse Running Cutoff Frequency	0.0–100.0%	10.0
✓	08-68	PID Deviation Limit	0.00–100.00%	0.00
✓	08-69	Integral Separation Level	0.00–100.00%	0.00
	08-70	Smart Start-up Level	0.00–100.00%	5.00
✓	08-71	Smart Start-up Frequency Command	0.00–599.00 Hz	0.00
✓	08-72	Smart Start-up Acceleration Time	0.00–600.00 sec.	3.00
✓	08-75	PID2 Parameter Switch Condition	0: No switching (refer to Pr.08-01–Pr.08-03) 1: Auto-switch based on the output frequency 2: Auto-switch based on the deviation	0
✓	08-76	PID 2 Parameter Switch Deviation 1	0.00–Pr.08-77%	10.00

	Pr.	Explanation	Settings	Default
↗	08-77	PID 2 Parameter Switch Deviation 2	Pr.08-76–100.00%	40.00
↗	08-78	Allowed Reverse Running Time after Start-up	0.0–6553.5 sec.	0.0

09 Communication Parameters

	Pr.	Explanation	Settings	Default
✓	09-00	Modbus Communication Address	0: Disable 1–247	0
✓	09-02	Modbus Transmission Fault Treatment	0: Warn and continue operation 1: Fault and ramp to stop 2: Fault and coast to stop 3: No warning, no fault, and continue operation	3
✓	09-03	Modbus Time-out Detection	0.0–100.0 sec.	0.0
✓	09-10	Communication Main Frequency	0.00–599.00 Hz	60.00
	09-30	Delta-defined Communication Decoding Method	0: Decoding method 1 (20xxh) 1: Decoding method 2 (60xxh)	1
✓	09-36	CANopen Slave Address	0: Disabled 1–127	0
	09-40	Communication Decoding Method	0: Delta-defined 1: Use CiA402 protocol	1
	09-43	CANopen Reset Index	bit 0: CANopen reset, the internal address 20XX is 0 bit 1: CANopen reset, the internal address 264X is 0 bit 2: CANopen reset, the internal address 26AX is 0 bit 3: CANopen reset, the internal address 60XX is 0	65535
	09-49	Canopen Extended Settings	bit 0: Whether Index 604F and 6050 are updated to the first acceleration and deceleration • bit 0 = 0: Update • bit 0=1: Not update bit 3: Whether CANopen communication loss CGdE & CHbE and other errors resets automatically • bit3 = 0: When communication is restored, the error will not be reset automatically but needs the communication reset command (NMT Reset) issued through the host computer (Default). • bit3 = 1: When communication is restored, the error is automatically reset without the communication reset command (NMT Reset) issued through the host computer.	0
	09-57	Ethernet Slot Number	0: Disable 1–15	0

Pr.	Explanation	Settings	Default
09-94	Ethernet Extended Settings	bit 0: Whether Ethercat and PROFINET recover the connection with upper unit,the disconnection error EdtE will: • 0: Auto-reset • 1: Manual reset	0
09-98	Ethernet Communication Disconnection Treatment	0: Warn and continue operation 1: Fault and ramp to stop 2: Fault and coast to stop 3: No warning and continue operation **NOTE**: PROFINET is valid when Pr. 00-22 = 0 and is invalid when Pr.00-22 = 1.	3

10 Speed feedback parameters

	Pr.	Explanation	Settings	Default
↗	10-29	Upper Limit of Frequency Deviation	0.00–200.00 Hz	20.00
↗	10-31	I/F Mode, Current Command	0–150% rated current of the motor	40
↗	10-32	PM SVC Sensorless Speed Estimator Bandwidth	0.00–600.00 Hz	5.00
↗	10-34	PM SVC Speed Estimator Low-pass Filter Gain	0.00–655.35	1.00
↗	10-39	Frequency Point to Switch from I/F Mode to PM Sensorless Mode	0.00–599.00 Hz	20.00
↗	10-42	Initial Angle Detection Pulse Value	0.0–3.0	1.0
↗	10-49	Zero Voltage Time during Start-up	00.000–60.000 sec.	00.000
↗	10-51	Injection Frequency	0–1200 Hz	500
↗	10-52	Injection Magnitude	230V models: 0.0–100.0 V 460V models: 0.0–200.0 V	15.0 30.0
↗	10-53	Angle Detection Method	0: Disabled 1: Force attracting the rotor to zero degree 2: High frequency injection 3: Pulse injection	0

11 Advanced Parameters

	Pr.	Explanation	Settings	Default
	11-00	System Control	bit 3: Dead time compensation closed bit 7: Save or do not save the frequency	0
	11-41	PWM Mode Selection	0: Two-phase modulation mode 2: Space vector modulation mode	0
↗	11-42	System Control Flag	0000–FFFFh	0000

13 Macro / User-Defined Macro

Pr.	Explanation	Settings	Default
13-00	Application Selection	00: Disabled 01: User Parameter 02: Compressor 03: Fan 05: Conveyor 06: Machine tool 07: Packing 08: Textiles 09: PCB Machine	Read only
13-01 – 13-50	Application Parameters (User-defined)		Read only

14 Protection Parameters (2)

Pr.	Explanation	Settings	Default
14-50	Output Frequency at Malfunction 2	0.00–599.00 Hz	Read only
14-51	DC bus Voltage at Malfunction 2	0.0–6553.5 V	Read only
14-52	Output Current at Malfunction 2	0.00–655.35 Amps	Read only
14-53	Power Components Temperature at Malfunction 2	-3276.7–3276.7 °C	Read only
14-54	Output Frequency at Malfunction 3	0.00–599.00 Hz	Read only
14-55	DC bus Voltage at Malfunction 3	0.0–6553.5 V	Read only
14-56	Output Current at Malfunction 3	0.00–655.35 Amps	Read only
14-57	Power Components Temperature at Malfunction 3	-3276.7–3276.7 °C	Read only
14-58	Output Frequency at Malfunction 4	0.00–599.00 Hz	Read only
14-59	DC bus Voltage at Malfunction 4	0.0–6553.5 V	Read only
14-60	Output Current at Malfunction 4	0.00–655.35 Amps	Read only
14-61	Power Components Temperature at Malfunction 4	-3276.7–3276.7 °C	Read only
14-62	Output Frequency at Malfunction 5	0.00–599.00 Hz	Read only
14-63	DC bus Voltage at Malfunction 5	0.0–6553.5 V	Read only
14-64	Output Current at Malfunction 5	0.00–655.35 Amps	Read only
14-65	Power Components Temperature at Malfunction 5	-3276.7–3276.7 °C	Read only
14-66	Output Frequency at Malfunction 6	0.00–599.00 Hz	Read only
14-67	DC bus Voltage at Malfunction 6	0.0–6553.5 V	Read only
14-68	Output Current at Malfunction 6	0.00–655.35 Amps	Read only
14-69	Power Components Temperature at Malfunction 6	-3276.7–3276.7 °C	Read only
14-70	Fault Record 7	Refer to fault record Pr.06-17–06-22	0
14-71	Fault Record 8	Refer to fault record Pr.06-17–06-22	0
14-72	Fault Record 9	Refer to fault record Pr.06-17–06-22	0
14-73	Fault Record 10	Refer to fault record Pr.06-17–06-22	0

Chapter 13 Descriptions of Parameter Settings

13-1 Rectifier module

13-2 Inverter module

13-1 Rectifier module

13-1-00 Drive Parameters

You can set this parameter during operation.

00-00 Rectifier Module Identity Code

Default: Read only

Settings Read only

00-01 Rectifier Module Rated Current Display

Default: Read only

Settings Display by models

Pr.00-00 displays the AC motor drive identity code. Use the following specification table to check if Pr.00-01 setting is the rated current of the AC motor drive. Pr.00-01 corresponds to the identity code of Pr.00-00.

Setting	230V Models - One-phase		460V Models - Three-phase		
Power (kW)	2.2	3.7	5.5	11	18.5
Power (HP)	3	5	7.5	15	25
Identity Code	306	307	408	410	412
Rated Current for Heavy Duty	15	25	16	33	41

00-02 Parameter Reset

Default: 0

Settings 0: No function
1: Write protection for parameters
5: Return kWh displays to 0
8: Keypad does not respond
10: Reset all parameters to defaults

1: All parameters are read only except Pr.00-02, Pr.00-07, and Pr.00-08. Set Pr.00-02 to 0 before changing other parameter settings.

5: You can return the kWh displayed value to 0 even during drive operation. For example, you can set Pr.05-29 and Pr.05-30 to 0.

8: RUN key on the keypad is invalid; the rest of the keys work normally. Set Pr.02-00 to 0 to unlock the setting.

10: Reset all parameters to defaults.
If you have set a password (Pr.00-08), unlock the password (Pr.00-07) to clear the password you have set before you reset all parameters. Reboot the motor drive after setting is completed.

00-03 Start-up Display

Default: 0

Settings 2: U (user-defined) see Pr.00-04
3: A (output current)

Determines the start-up display page after power is applied to the drive. The user-defined contents display according to the Pr.00-04 settings.

00-04 Content of Multi-function Display (User-defined)

Default: 3

Settings
0: Display total output current from the rectifier module to the motor (A) (Unit: Amp)
3: Display the rectifier module DC bus voltage (v) (Unit: VDC)
6: Display the rectifier module output power in kW (P) (Unit: kW)
11: Display AI1 analog input terminal signal (1.) (Unit: %) (MX300-C models only)
12: Display AI2 analog input terminal signal (2.) (Unit: %) (MX300-C models only)
13: Power components temperature percentage (C) (Unit: %)
14: Power components temperature (i) (Unit: ºC)
16: The digital input status (ON / OFF) (i)
17: The digital output status (ON / OFF) (o)
19: The corresponding CPU digital input pin status (d)
20: The corresponding CPU digital output pin status (0.)
25: Overload count (0.00–100.00%) (o.) (Unit: %)
27: DC bus voltage ripple (r.) (Unit: VDC)
38: Display the rectifier module status (6.)
41: kWh display (J) (Unit: kWh)

Explanation 1

- It can also display negative values when setting analog input bias (Pr.03-03–03-10).
  Example:
  Assume that AI1 input voltage is 0 V, Pr.03-03 is 10.0%, Pr.03-07 is 4 (bias serves as the center).

Explanation 2

- Example:
  If MI1 and MI4 are ON, the following table shows the status of the terminals.
  Normally opened contact (N.O.): (0: OFF, 1: ON)

Terminal	MI4	MI3	MI2	MI1
Status	0	0	0	1

- The value is 0000 0000 0000 1001 in binary and 0009H in HEX. When Pr.00-04 is set to 16 or 19, the u page on the keypad displays 0009h.
- The setting 16 is the ON / OFF status of digital input according to Pr.02-12 setting and the setting 19 is the corresponding CPU pin ON / OFF status of the digital input.
- When MI1 / MI2 default setting is two-wire / three-wire operation control (Pr.02-00 ≠ 0), and MI3 is set to three-wire, it is not affected by Pr.02-12.
- You can set 16 to monitor the digital input ON / OFF status and then set 19 to check if the circuit is normal.

Explanation 3

- Example:
  Assume that RY: Pr.02-13 is set to 11 (Malfunction indication) After an abnormality occurs, the contact is close. The display status is shown below.

Normally open contact (N.O.):

Terminal	MIO1	RY1
Status	0	1

- If Pr.00-04 is set to 17 or 20, it displays in hexadecimal “0001h” with LED u page is ON in the keypad.
- The setting 17 is the ON / OFF status of digital output according to Pr.02-18 setting and the setting 20 is the corresponding CPU pin ON / OFF status of the digital output.
- You can set 17 to monitor the digital output ON / OFF status and then set 20 to check if the circuit is normal.

Explanation 4

- Setting value 25: when displayed value reaches 100.00%, the drive shows “oL” as an overload warning.

Explanation 5

- Setting value 38:

  bit 0: The drive is running forward. bit 3: Errors occurred on the drive.
  bit 1: The drive is running backward. bit 4: The drive is running.
  bit 2: The drive is ready. bit 5: Warnings occurred on the drive.

00-06 Firmware Version

Default: Read only

Settings Read only

00-07 Parameter Protection Password Input

Default: 0

Settings 0–65535

Display 0–4: the number of password attempts

- 🕮 This parameter allows you to enter your password (which is set in Pr.00-08) to unlock the parameter protection and to make changes to the parameter.
- 🕮 To avoid problems in the future, be sure to write down the password after you set this parameter.
- 🕮 Pr.00-07 and Pr.00-08 are used to prevent personnel from setting other parameters by accident.
- 🕮 If you forget the password, clear the password setting by entering 9999 and pressing the ENTER key, then enter 9999 again and press ENTER within 10 seconds. After decoding, all the settings return to default.
- 🕮 When setting is under password protection, all the parameters read 0, except Pr.00-08.

00-08 Parameter Protection Password Setting

Default: 0

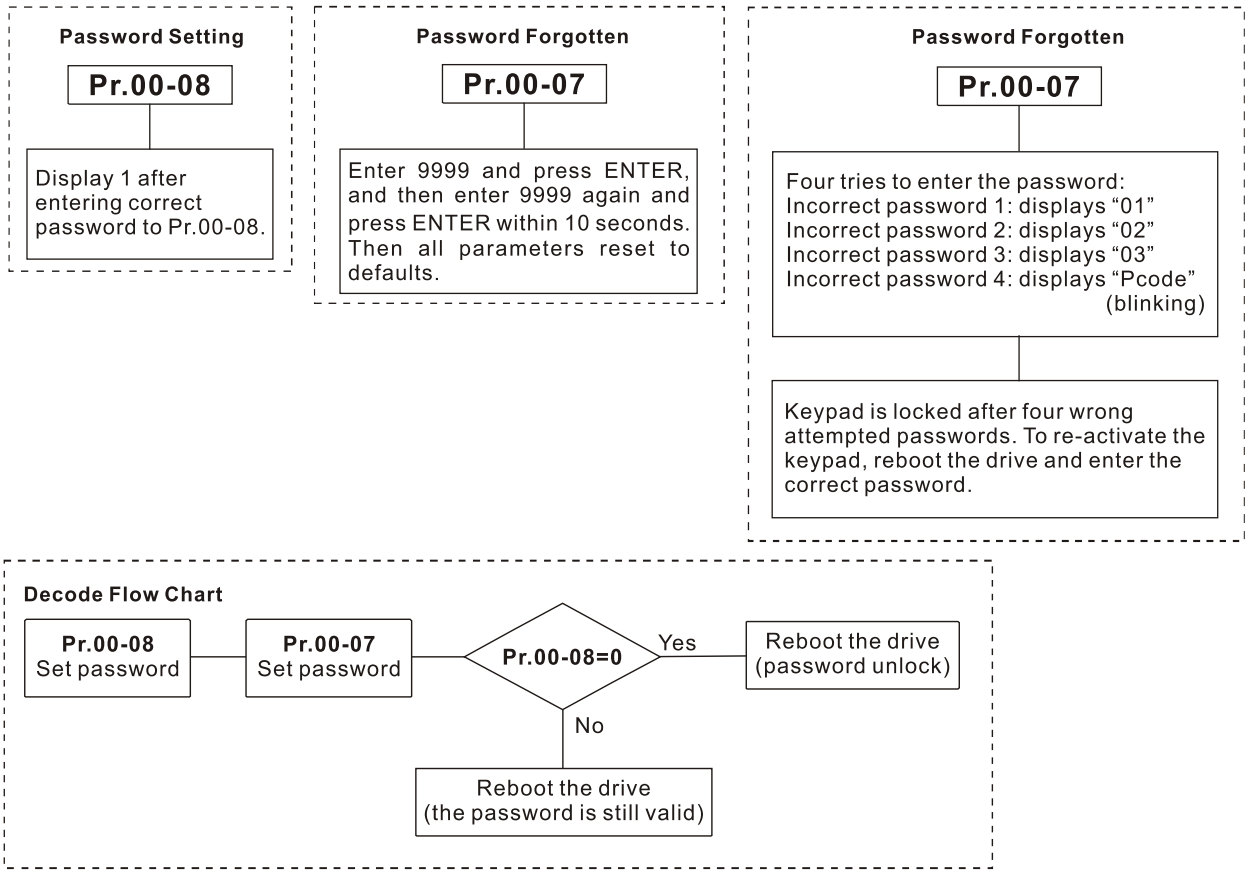
Settings 0–65535

Display 0: No password protection or password is entered correctly (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 1, which means password protection is activated. At this time, if you want to change any of the parameter settings, enter the correct

password in Pr.00-07 to deactivate the password temporarily, then Pr.00-08 would become 0. After finishing the parameters setting, reboot the motor drive and the password is activated again.

- Entering the correct password in Pr.00-07 only temporarily deactivates the password. To permanently deactivate password protection, set Pr.00-08 to 0 manually. Otherwise, password protection is always reactivated after you reboot the motor drive.
- The keypad copy function works only when the password protection is deactivated (temporarily or permanently), and the password set in Pr.00-08 cannot be copied to the keypad. So when copying parameters from the keypad to the motor drive, set the password manually again in the motor drive to activate password protection.



00-21 Operation Command Source (AUTO, REMOTE)

Default: 0

Settings
0: Digital keypad
1: External terminals
2: RS-485 communication input
3: CANopen / EtherCAT / PROFINET / EtherNet/IP input
NOTE: HOA (Hand-Off-Auto) function is valid only when you use with MO function setting 42 and 56 or with KPC-CC01 (optional).

- Determines the operation frequency source in the “AUTO, REMOTE” mode.
- In the HOA mode, if the multi-function input terminal (MI) function setting 41 and 42 are OFF, the drive does not receive any operation command and JOG is invalid.
- PROFINET periodic communication function needs to be set to 3.

00-48 Display Filter Time (Current)

Default: 0.100

Settings 0.001–65.535 sec.

📖 Minimize the current fluctuation displayed by the digital keypad.

00-49 Display Filter Time (Keypad)

Default: 0.100

Settings 0.001–65.535 sec.

📖 Minimize the value fluctuation displayed by the digital keypad.

00-50 Software Version (Date)

Default: Read only

Settings Read only

📖 Display the current drive software version by date.

13-1-02 Digital Input / Output Parameters

You can set this parameter during operation.

02-01	Multi-function Input Command 1 (MI1)
02-02	Multi-function Input Command 2 (MI2)
02-03	Multi-function Input Command 3 (MI3)
02-04	Multi-function Input Command 4 (MI4)
02-05	Multi-function Input Command 5 (MIO1)
02-06	Multi-function Input Command 5 (MIO2)
02-07	Multi-function Input Command 5 (MIO3)
02-08	Multi-function Input Command 5 (MIO4)
02-26	Input Terminal of I/O Extension Card (MI9)
02-27	Input Terminal of I/O Extension Card (MI10)
02-28	Input Terminal of I/O Extension Card (MI11)
02-29	Input Terminal of I/O Extension Card (MI12)
02-30	Input Terminal of I/O Extension Card (MI13)
02-31	Input Terminal of I/O Extension Card (MI14)
02-32	Input Terminal of I/O Extension Card (MI15)
02-33	Input Terminal of I/O Extension Card (MI16)

Default: 0

Settings Refer to the Summary of Function Settings below.

Use this parameter to set the function of multi-function terminals.

Summary of Function Settings (Take the normally open contact (N.O.) for example, ON: contact is closed, OFF: contact is open)

Setting	Function	Descriptions
0	No function	
5	Reset	Use this terminal to reset the drive after clearing a drive fault.
38	Disable writing EEPROM function (parameters memory disable)	ON: writing to EEPROM is disabled. Changed parameters are not saved after powering off.

02-11 Multi-function Input Response Time

Default: 0.005

Settings 0.000–30.000 sec.

Use this parameter to set the response time of the digital input terminals MI1–MI7.

This function is to delay and confirm the digital input terminal signal. The time for delay is also the time for confirmation. The confirmation prevents interference that could cause error in the input to the digital terminals. But in the meanwhile, it delays the response time though confirmation improves accuracy.

02-12 Multi-function Input Mode Selection

Default: 0

Settings 0–65535

- The parameter setting is in decimal.
- This parameter sets the status of the multi-function input signal (0: normally open; 1: normally closed) and it is not affected by the status of SINK / SOURCE.
- bit 0–bit 3 correspond to MI1–MI4, bit 4–bit 7 correspond to MIO1–MIO4.
- You can change the terminal ON / OFF status through communications.

  For example: MI4 is set to 5 (Reset)

  Reset = $1000_2 = 8_{10}$

  As long as Pr.02-12 = 8, there is no need to wire any multi-function terminal to reset the drive.

bit 7	bit 6	bit 5	bit 4	bit 3	bit 2	bit 1	bit 0
MIO4	MIO3	MIO2	MIO1	MI4	MI3	MI2	MI1

02-13 Multi-Function Output 1 RY1

Default: 11

02-14 Multi-function Output 1 (MIO1)
02-15 Multi-function Output 2 (MIO2)
02-16 Multi-function Output 3 (MIO3)
02-17 Multi-function Output 4 (MIO4)
02-36 Output Terminal of Extension Card (MO9)
02-37 Output Terminal of Extension Card (MO10)
02-38 Output Terminal of Extension Card (MO11)
02-39 Output Terminal of Extension Card (MO12)
02-40 Output Terminal of Extension Card (MO13)
02-41 Output Terminal of Extension Card (MO14)
02-42 Output Terminal of Extension Card (MO15)
02-43 Output Terminal of Extension Card (MO16)

Default: 0

Settings Refer to the Summary of Function Settings below.

- Use this parameter to set the function of multi-function terminals.

  Summary of function settings (Take the normally open contact (N.O.) for example, ON: contact is closed, OFF: contact is open)

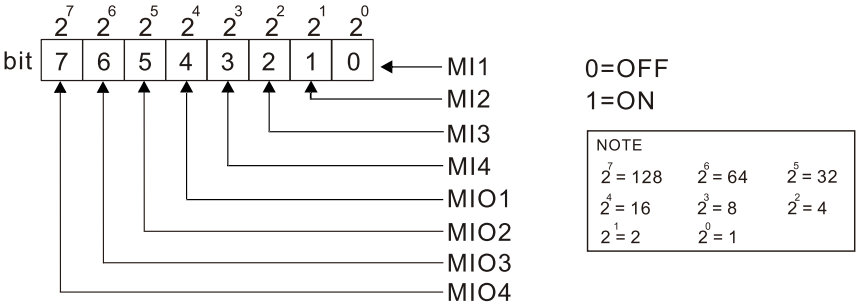
Setting	Function	Descriptions
0	No function	Output terminal with no function
10	Low voltage warning (Lv)	Activates when an extremely low voltage at DC side is detected. (Refer to Pr.06-00 Low Voltage Level.)
11	Malfunction indication	Activates when fault occurs (except Lv stop).
13	Overheat warning	Activates when IGBT or heat sink overheats to prevent the drive from shutting down due to overheating. (Refer to Pr.06-15.)

Setting	Function	Descriptions
14	Software brake signal indication	Activates when the soft brake function is ON. (Refer to Pr.07-00.)
20	Warning output	Activates when a warning is detected.
21	Over-voltage	Activates when over-voltage is detected. (Refer to Chapter 8 over-voltage related fault description for the action level.)
24	Operation source	Activates when the source of operation command is not controlled by the digital keypad (Pr.00-21 ≠ 0).
35	Fault output option 1 (Pr.06-23)	Activates when the fault output selected by Pr.06-23 is detected.
36	Fault output option 2 (Pr.06-24)	Activates when the fault output selected by Pr.06-24 is detected.
37	Fault output option 3 (Pr.06-25)	Activates when the fault output selected by Pr.06-25 is detected.
38	Fault output option 4 (Pr.06-26)	Activates when the fault output selected by Pr.06-26 is detected.
50	Output control for CANopen	For CANopen communication control output.
51	Analog output control for RS-485 interface	For RS-485 communication control output.
67	Analog input level reached (MX300-C models only)	The multi-function output terminals operate when the analog input level is between the high level and the low level. Pr.03-44: Select one of the analog input channels (AI1, AI2) to be compared. Pr.03-45: The high level for the analog input, default is 50%. Pr.03-46: The low level for the analog input, default is 10%. If analog input > Pr.03-45, the multi-function output terminal operates. If analog input < Pr.03-46, the multi-function output terminal stops outputting.

02-50 Display the Status of Multi-function Input Terminal

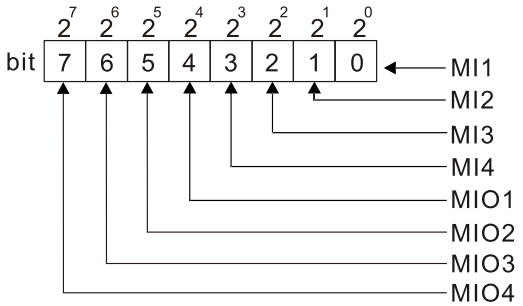
Default: Read only

Settings Monitor the status of the Multi-function Input Terminal



For example:

When Pr.02-50 is 0004h (hex), that is, the value is 20 (decimal), and displays 10100 (binary). It means that MI3 and MIO1 are ON.



0=OFF
1=ON

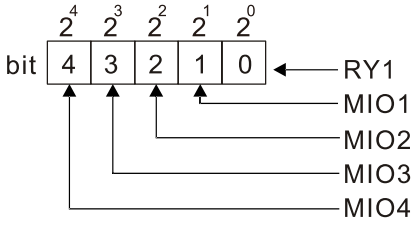
Setting
= bit 5 x 2^5 + bit 4 x 2^4 + bit 2 x 2^2
= 1 x 2^5 + 1 x 2^4 + 1 x 2^2
= 32 + 16 + 4
= 52

NOTE
2^7 = 128 2^6 = 64 2^5 = 32
2^4 = 16 2^3 = 8 2^2 = 4
2^1 = 2 2^0 = 1

02-51 Display the Status of Multi-function Output Terminal

Default: Read only

Settings Monitor the status of the Multi-function Output Terminal

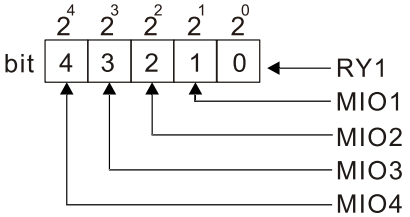


0=OFF
1=ON

NOTE
2^4 = 16 2^3 = 8 2^2 = 4
2^1 = 2 2^0 = 1

For example:

When Pr.02-51 is 0009h (hex), that is, the value is 9 (decimal), and displays 1001 (binary). It means that Relay and MO3 are ON.



0=OFF
1=ON

Setting
= bit 3 x 2^3 + bit 0 x 2^0
= 1 x 2^3 + 1 x 2^0
= 8 + 1
= 9

NOTE
2^4 = 16 2^3 = 8 2^2 = 4
2^1 = 2 2^0 = 1

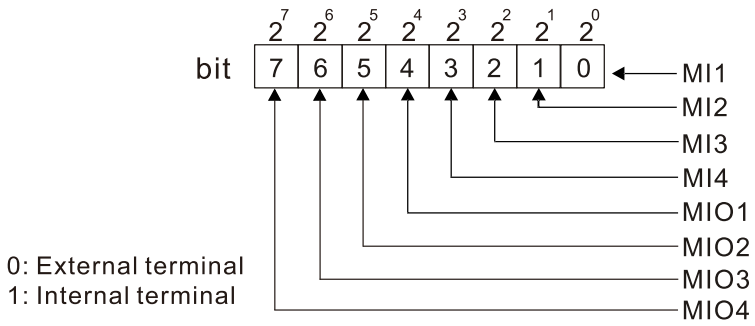
02-74 Internal / External Multi-function Input Terminal Selection

Default: 0000h

Settings 0000–FFFFh

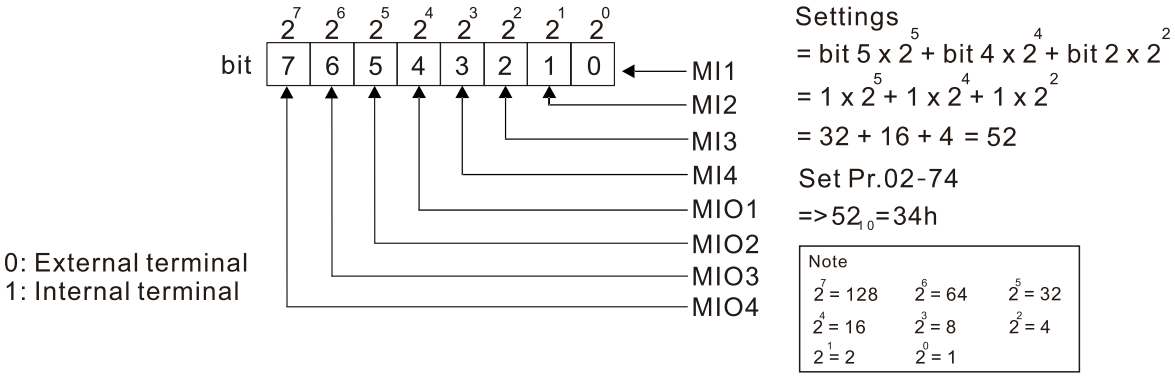
Selects the terminals MI1–MI4 and MIO1–MIO4 to be internal terminals or external terminals. When the MIx is set as internal terminal, the corresponding external terminal function is disabled.

To activate internal terminals via Pr.02-75 setting.



Setting method: convert the binary 12bit number to hexadecimal number for input.

Example: if the MI3, MIO1 and MIO2 are triggered by virtual terminals, then Pr.02-74 = 34h.



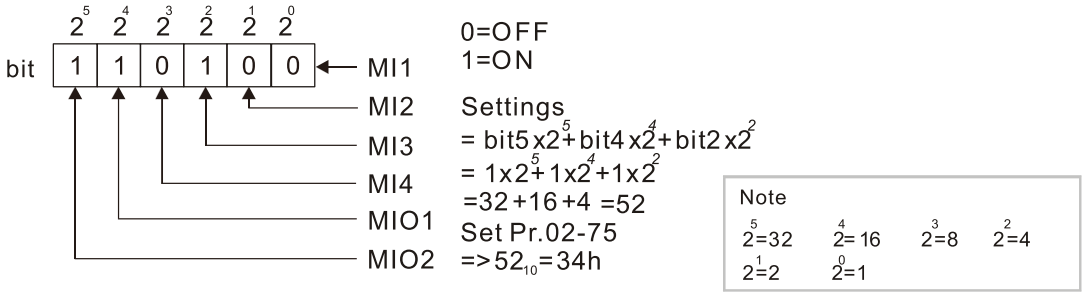
02-75 Internal Multi-function Output Terminal Selection

Default: 0000h

Settings 0000–FFFFh

- Sets the internal terminal action (ON / OFF) through digital keypad, communication or PLC.
- The Local / Remote options on the digital keypad have the lowest priority. When the PLC uses the entity DI, the corresponding function of original DI can still be triggered through virtual terminals.
- Pr.02-74 and Pr.02-75 can both be changed during RUN.
- Pr.02-74 and Pr.02-75 are saved after powering off.
- You can choose N.O. (Pr.02-12 bit = 0) or N.C. (Pr.02-12 bit = 1) through the Pr.02-12 MI mode to trigger the virtual terminals.

Example: Sets Pr.02-75 = 34h to activate MI3, MIO1 and MIO2.



02-64	The Axis Occupied by Relay
02-65	The Axis Occupied by MIO1 for MO Function
02-66	The Axis Occupied by MIO2 for MO Function
02-67	The Axis Occupied by MIO3 for MO Function
02-68	The Axis Occupied by MIO4 for MO Function
02-91	The Axis Occupied by MO9
02-92	The Axis Occupied by MO10
02-93	The Axis Occupied by MO11
02-94	The Axis Occupied by MO12
02-95	The Axis Occupied by MO13
02-96	The Axis Occupied by MO14

02-97 The Axis Occupied by MO15

02-98 The Axis Occupied by MO16

Default: 0

Settings 0–15

📖 When using the Relay or the MIO output function, the parameter must specify which axis the output function is used by.

0 represents the rectifier axis; 1–15 represents the inverter axis.

For example:

When inverter axis 2 uses MIO1 to output "fault indication", rectifier module Pr.02-65 must be set to 2 and the inverter module Pr.02-14 for inverter axis 2 is set to 11: fault indication.

13-1-03 Analog Input / Output Parameters

You can set this parameter during operation.

03-28 AI1 Terminal Input Selection (MX300-C models only)

Default: 0

Settings 0: 0–10 V
1: 0–20 mA
2: 4–20 mA

03-29 AI2 Terminal Input Selection (MX300-C models only)

Default: 0

Settings 0: 4–20 mA
1: 0–10 V
2: 0–20 mA

When you change the setting, proportion to the corresponding AI1 and AI2 will change to default.

13-1-05 Motor Parameters

You can set this parameter during operation.

05-29	Accumulative Watt-hour for a Motor in Low Word (kW-hour)
05-30	Accumulative Watt-hour for a Motor in High Word (MW-hour)

Default: 0.0

Settings Read only

- Pr.05-26–05-30 records the amount of power the motors consume. The accumulation begins when the drive is activated and the record is saved when the drive stops or turns OFF. The amount of consumed watts continues to accumulate when the drive is activated again. To clear the accumulation, set Pr.00-02 to 5 to return the accumulation record to 0.
- The value of rectifier axis Pr.05-29 and Pr.05-30 is the sum of the values of all inverter axis Pr.05-29 and Pr.05-30.
- The accumulated total kilowatts of the motor per hour = Pr.05-30 × 1000000 + Pr.05-28 × 1000 + Pr.05-28 Wh

  For example: When Pr.05-30 = 76 MWh, Pr.05-29 = 150 kWh, Pr.05-28 = 400 Wh (or 0.4 kWh), the motor accumulated watt in every hour = 76 × 1000000 + 150 × 1000 + 400 = 76150400 Wh = 76150.4 kWh

13-1-06 Protection Parameters (1)

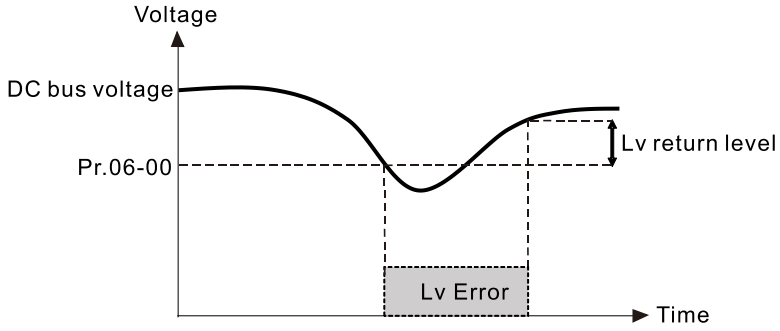
You can set this parameter during operation.

06-00 Low Voltage Level

Default: 180.0 / 360.0

Settings 230V models: 150.0–220.0 V_{DC}
460V models: 300.0–440.0 V_{DC}

- Sets the Low Voltage (LV) level. When the DC bus voltage is lower than Pr.06-00, a LV fault is triggered, and the drive stops output then the motor coasts to a stop.
- If the Lv fault is triggered during operation, the drive stops output and the motor coasts to a stop. There are three Lv faults: LvA (Lv during acceleration), Lvd (Lv during deceleration), and Lvn (Lv in constant speed) that are triggered according to the status of acceleration or deceleration. You must press RESET to clear the Lv fault.
- If the LV fault is triggered when the drive is in STOP status, the drive displays LvS (LV during stop), which is not recorded, and the drive restarts automatically when the input voltage is higher than the LV level of 30 V (230V models) or 60 V (460V models).



06-15 Temperature Level Overheat (OH) Warning

Default: 95.0

Settings 0.0: 100.0%

- Sets the drive's internal overheat warning level. When the temperature is higher than Pr.06-15 setting, the oH1 fault displays and the warning remains but it does not affect the drive operation.
- Use this parameter to check the motor overheat in advance in order to take precautionary measures to decrease the temperature and maintain the motor's normal operation.
- If you set the temperature higher than the maximum setting value for Pr.06-15, overheating occurs and the drive stops. Refer to Chapter 8 oH1 fault descriptions for details.

06-17 Fault Record 1
06-18 Fault Record 2
06-19 Fault Record 3
06-20 Fault Record 4
06-21 Fault Record 5
06-22 Fault Record 6

Default: 0

Display
0: No fault record

10: Over-voltage at stop (ovS)
14: Low-voltage at stop (LvS)
15: Phase loss protection (orP)
18: IGBT temperature detection failure (tH1o)
21: Over load (oL)
24: Motor overheating PTC / PT100 (oH3)
31: EEPROM read error (cF2)
48: AI2 loss (ACE)
49: External fault (EF)
50: Emergency stop (EF1)
52: Password is locked (Pcod)
54: Illegal command (CE1)
55: Illegal data address (CE2)
56: Illegal data value (CE3)
57: Data is written to read-only address (CE4)
58: Modbus transmission time-out (CE10)
59: PU board time-out (CP10) (LCD keypad and CC01 keypad)
101: CANopen guarding error (CGdE)
102: CANopen heartbeat error (CHbE)
104: CANopen bus off error (CbFE)
223: PROFINET program inspection error (PrbE)

🕮 The parameters record when the fault occurs and forces a stop.

🕮 When low-voltage at stop fault (LvS) occurs, the fault is not recorded. When low-voltage during operation faults (LvA, Lvd, Lvn) occur, the faults are recorded.

06-23 Fault Output Option 1
06-24 Fault Output Option 2
06-25 Fault Output Option 3
06-26 Fault Output Option 4

Default: 0

Settings 0–65535 (refer to bit table for fault code)

🕮 Use these parameters with multi-function output terminal (set to 35–38) for the specific requirement. When the fault occurs, the corresponding terminals activate. Convert the binary value to decimal value before you enter the value for Pr.06-23–Pr.06-26.

Fault Code	bit0	bit1	bit2	bit3	bit4	bit5	bit6
	current	Volt.	OL	SYS	FBK	EXI	CE
0: No fault record							
10: Over-voltage at stop (ovS)		●					
14: Low-voltage at stop (LvS)		●					
15: Phase loss protection (orP)		●					
18: IGBT temperature detection failure (tH1o)			●				
21: Over load (oL)			●				

Fault Code	bit0	bit1	bit2	bit3	bit4	bit5	bit6
	current	Volt.	OL	SYS	FBK	EXI	CE
24: Motor overheating PTC / PT100 (oH3)			●				
31: EEPROM read error (cF2)				●			
48: AI2 loss (ACE)					●		
49: External fault (EF)						●	
50: Emergency stop (EF1)						●	
52: Password is locked (Pcod)				●			
54: Illegal command (CE1)							●
55: Illegal data address (CE2)							●
56: Illegal data value (CE3)							●
57: Data is written to read-only address (CE4)							●
58: Modbus transmission time-out (CE10)							●
59: PU board time-out (CP10)							●
101: CANopen guarding error (CGdE)							●
102: CANopen heartbeat error (CHbE)							●
104: CANopen bus off error (CbFE)							●
223: PROFINET program inspection error (PrbE)							●

06-34 DC bus Voltage at Malfunction

Default: Read only

Display 0.0–6553.5 V

📖 When a malfunction occurs, check the current DC bus voltage. If it happens again, it overwrites the previous record.

06-35 Output Current at Malfunction

Default: Read only

Display 0.00–655.35 Amps

📖 When a malfunction occurs, check the current output current. If it happens again, it overwrites the previous record.

06-36 Power Components Temperature at Malfunction

Default: Read only

Display -3276.7–3276.7 ºC

📖 When a malfunction occurs, check the current IGBT temperature. If it happens again, it overwrites the previous record.

06-40 Status of the Multi-function Input Terminal at Malfunction
06-41 Status of the Multi-function Output Terminal at Malfunction

Default: Read only

Settings 0000h–FFFFh

📖 When a malfunction occurs, check the current status of the multi-function input / output terminals. If it happens again, it overwrites the previous record.

06-42 Drive Status at Malfunction

Default: Read only

Display 0000h–FFFFh

📖 When a malfunction occurs, check the current drive status (communication address 2101H). If it happens again, it overwrites the previous record.

06-53 Input Phase Loss Detection Action (OrP)

Default: 0

Settings 0: Fault and ramp to stop

1: Fault and coast to stop

📖 The inverter axis executes the input phase loss protection according to Pr.06-53.

06-63 Operation Time of Fault Record 1 (Day)
06-65 Operation Time of Fault Record 2 (Day)
06-67 Operation Time of Fault Record 3 (Day)
06-69 Operation Time of Fault Record 4 (Day)
06-90 Operation Time of Fault Record 5 (Day)
06-92 Operation Time of Fault Record 6 (Day)

Default: Read only

Display 0–65535 days

06-64 Operation Time of Fault Record 1 (Min.)
06-66 Operation Time of Fault Record 2 (Min.)
06-68 Operation Time of Fault Record 3 (Min.)
06-70 Operation Time of Fault Record 4 (Min.)
06-91 Operation Time of Fault Record 5 (Min.)
06-93 Operation Time of Fault Record 6 (Min.)

Default: Read only

Display 0–1439 min.

📖 If there is any malfunction when the drive operates, Pr.06-17–06-22 records the malfunctions, and Pr.06-63–06-70 records the operation time for four sequential malfunctions. Check if there is any problem with the drive according to the interval of the recorded fault.

For example:

The first error: ocA occurs after motor drive operates for 1000 minutes.

The second error: ocd occurs after another 1000 minutes.

The third error: ocn occurs after another 1000 minutes.

The fourth error: ocA occurs after another 1000 minutes.

The fifth error: ocd occurs after another 1000 minutes.

The sixth error: ocn occurs after another 1000 minutes.

Then Pr.06-17–06-22 and Pr.06-63–06-70 are recorded as follows:

Parameter	1st fault	2nd fault	3rd fault	4th fault	5th fault	6th fault
06-17	ocA	ocd	ocn	ocA	ocd	ocn
06-18	0	ocA	ocd	ocn	ocA	ocd

Parameter	1st fault	2nd fault	3rd fault	4th fault	5th fault	6th fault
06-19	0	0	ocA	ocd	ocn	ocA
06-20	0	0	0	ocA	ocd	ocn
06-21	0	0	0	0	ocA	ocd
06-22	0	0	0	0	0	ocA
06-63	1000	560	120	1120	680	240
06-64	0	1	2	2	3	4
06-65	0	1000	560	120	1120	680
06-66	0	0	1	2	2	3
06-67	0	0	1000	560	120	1120
06-68	0	0	0	1	2	2
06-69	0	0	0	1000	560	120
06-70	0	0	0	0	1	2

NOTE: By examining the time record, you can see that that the last fault (Pr.06-17) happened after the drive ran for four days and 240 minutes.

13-1-07 Special Parameters

You can set this parameter during operation.

07-00 Software Brake Chopper Action Level

Default: 370.0 / 740.0

Settings 230V models: 350.0–450.0 V_{DC}
460V models: 700.0–900.0 V_{DC}

Sets the DC bus voltage at which the brake chopper is activated. Choose a suitable brake resistor to achieve the optimal deceleration performance. Refer to Chapter 10 Optional Accessories for information about brake resistors.

07-19 Fan Cooling Control

Default: 3

Settings 0: Fan is always ON
3: Fan turns ON when the temperature (IGBT) reaches around 60°C

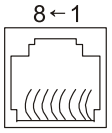
Use this parameter to control the fan.

0: Fan runs immediately when the drive power is turned ON.

3: When the temperature of the IGBT or capacitance is higher than 60ºC, the fan runs. When the temperature of the IGBT and capacitance are lower than 40ºC and the drive stops, the fan stops.

13-1-09 Communication Parameters

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 orIFD6500 as a communication converter.



Modbus RS-485
Pin 1: CAN_H
Pin 2: CAN_L
Pin 3, 7: SGND
Pin 4: SG-
Pin 5: SG+
Pin 6: Reserved
Pin 8: +10V

✎ You can set this parameter during operation.

✎ 09-00 Modbus 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 Modbus Transmission Speed

Default: 9.6

Settings 4.8–38.4 Kbps

🕮 Set the transmission speed between the computer and the AC motor drive.

🕮 Options are 4.8 Kbps, 9.6 Kbps, 19.2 Kbps or 38.4 Kbps; otherwise, the transmission speed is set to the default 9.6 Kbps.

✎ 09-02 Modbus Transmission Fault Treatment

Default: 3

Settings 0: Warn and continue operation
1: Fault and ramp to stop
2: Fault and coast to stop
3: No warning, no fault, and continue operation

🕮 Determines the treatment when an error is detected that the host controller does not continuously transmit data to the AC motor drive during Modbus communication. The detection time is based on the Pr.09-03 setting.

🕮 When a transmission error occurs (for example, the error code CE10 is displayed), the error remains even if the transmission status returns to normal, and does not clear automatically. In this case, set a reset command (Reset) to clear the error.

✎ 09-03 Modbus Time-out Detection

Default: 0.0

Settings 0.0–100 sec.

🕮 Set the communication time-out.

✎ 09-04 Modbus Communication Protocol

Default: 1

Settings 1: 7, N, 2 (ASCII)
2: 7, E, 1 (ASCII)

3: 7, O, 1 (ASCII)
4: 7, E, 2 (ASCII)
5: 7, O, 2 (ASCII)
6: 8, N, 1 (ASCII)
7: 8, N, 2 (ASCII)
8: 8, E, 1 (ASCII)
9: 8, O, 1 (ASCII)
10: 8, E, 2 (ASCII)
11: 8, O, 2 (ASCII)
12: 8, N, 1 (RTU)
13: 8, N, 2 (RTU)
14: 8, E, 1 (RTU)
15: 8, O, 1 (RTU)
16: 8, E, 2 (RTU)
17: 8, O 2 (RTU)

- Control by PC (Computer Link)
  When using the RS-485 serial communication interface, you must specify each drive's communication address in Pr.09-00. The computer then implements control using the drives' individual addresses.
- Modbus ASCII (American Standard Code for Information Interchange):
  Each byte of data is the combination of two ASCII characters. For Example:
  One byte of data: 64 Hex, shown as '64' in ASCII, consists of '6' (36Hex) and '4' (34Hex).

09-05 Station Number Setting

Default: 0

Settings 0: No function
1: Auto-setting Modbus address (Pr.09-00)
3: Auto-setting Ethernet Slot No. (Pr.09-57)

- Set to 0, the auto-setting function OFF, the address of the rectifier axis and each inverter axis are set by their module parameters (Pr.09-00). The user can switch axis and read / write the Modbus address of each axis through the keypad on the rectifier module.
- Set to 1, the auto-setting ON. The system will reset the Pr.09-00 Modbus address of the rectifier axis and inverter axis automatically refer to the current Modbus address of the rectifier axis.
- The automatic station number configuration is in units of 16 and the rectifier axis station number is fixed to a multiple of 16.
  If the current rectifier axis station number is any value from 1 to 16, the reconfigured rectifier axis station number is 16, and the inverter axis station numbers are 1-15 respectively based on the axis number.
  When the rectifier axis station number is any value from 17-32, the reconfigured rectifier axis station number is 32, and the inverter axis station numbers are 17-31 respectively based on the axis number, and so on.
- After the Modbus address are auto-set, rectifier module Pr.09-05 returns to 0 automatically.

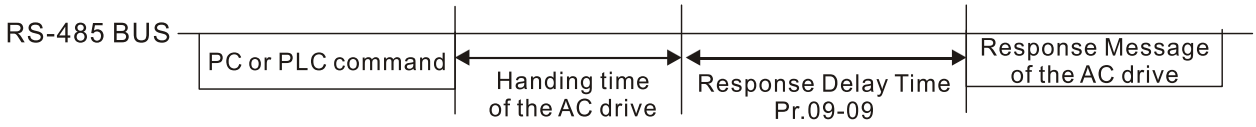
- Set to 3, the system automatically configure the Ethernet Slot (Pr.09-57) of each inverter axis by referring to the number of each axis. The value of Pr.09-57 is the same as the axis number.
- After the Ethernet address are auto-set, rectifier module Pr.09-05 returns to 0 automatically.
- When the system is configured as EtherCAT, this function configures the axis; when the system is configured as PROFINET, this function configures the Slot.

09-09 Communication Response Delay Time

Default: 2.0

Settings 0.0–200.0 ms

- If the host controller 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.



09-11 Block Transfer 1
09-12 Block Transfer 2
09-13 Block Transfer 3
09-14 Block Transfer 4
09-15 Block Transfer 5
09-16 Block Transfer 6
09-17 Block Transfer 7
09-18 Block Transfer 8
09-19 Block Transfer 9
09-20 Block Transfer 10
09-21 Block Transfer 11
09-22 Block Transfer 12
09-23 Block Transfer 13
09-24 Block Transfer 14
09-25 Block Transfer 15
09-26 Block Transfer 16

Default: 0

Settings 0–65535

- There is a group of block transfer parameters available in the AC motor drive (Pr.09-11–09-26). Using communication code 03H, you can store the parameters (Pr.09-11–Pr.09-26) that you want to read.
- For example:
  According to the Address List (as shown in the table below), Pr.01-42 is shown as 012A.
  Set Pr.09-11 to 012Ah (the minimum voltage of Pr.01-42 M2 is 2.0 V), and use Pr.09-11 (communication address 090B) to read the communication parameter, the read value is 2.0.

AC motor drive parameters	GGnnH	GG is the parameter group, nn is the parameter number. For example, the address of Pr.04-10 is 0401H.

📖 Mind if the block transfer parameters are read only. If the data is written to read-only parameters from the upper unit, a communication error may occur.

09-30 Delta-defined Communication Decoding Method

Default: 1

Settings 0: Decoding method 1 (20xxh)
1: Decoding method 2 (60xxh)

Decoding Method		Method 1 & 2
Source of operation control	Digital Keypad	Digital keypad controls the drive action regardless of decoding method 1 or 2.
	External Terminal	External terminal controls the drive action regardless of decoding method 1 or 2.
	RS-485	Refer to address: 2000h–20FFh

09-36 CANopen Slave Address (MX300-C models only)

Default: 0

Settings 0: Disable
1–127

09-37 CANopen Speed (MX300-C models only)

Default: 0

Settings 0: 1 Mbps
1: 500 Kbps
2: 250 Kbps
3: 125 Kbps
4: 100 Kbps (Delta only)
5: 50 Kbps

09-39 CANopen Warning Record (MX300-C models only)

Default: 0

Settings bit 0: CANopen software disconnection 1 (CANopen Guarding Time-out)
bit 1: CANopen software disconnection 2 (CANopen Heartbeat Time-out)
bit 3: CANopen SDO time-out
bit 4: CANopen SDO buffer overflow
bit 5: CANopen hardware disconnection warning (CANopen Bus OFF)
bit 6: CANopen format error warning (Error protocol for CANopen)

09-41 CANopen Communication Status (MX300-C models only)

Default: Read only

Settings 0: Node Reset State
1: Com Reset State
2: Boot up State
3: Pre-operation State
4: Operation State
5: Stop State

09-42 CANopen Control Status (MX300-C models only)

Default: Read only

Settings 0: Not ready for use state
1: Inhibit start state
2: Ready to switch on state
3: Switched on state
4: Enable operation state
7: Quick stop active state
13: Error reaction activation state
14: Error state

09-49 Canopen Extended Settings (MX300-C models only)

Default: 0

Settings bit 3: Whether CANopen communication loss CGdE & CHbE and other errors resets automatically

- bit3 = 0: When communication is restored, the error will not be reset automatically but needs the communication reset command (NMT Reset) issued through the host computer.
- bit3 = 1: When communication is restored, the error is automatically reset without the communication reset command (NMT Reset) issued through the host computer.

📖 bit 3 = 0, when the communication disconnect, the drive will display errors such as CGdE, CHbE, etc. When the connection is restored, the error will still be displayed and needs to be cleared by a communication reset command issued by the host computer.

📖 bit 3 = 1, when the communication disconnect and the error is displayed, the drive will automatically reset once it detects the communication connection is restored.

09-55 Ethernet Communication Protocol (MX300-E models only)

Default: 1

Settings 0: Disabled
1: EtherCAT
2: Profinet
3: EtherNet/IP

📖 This parameter can be used to select the Ethernet communication method for the upper unit.

09-56 EtherCAT Alias Address (MX300-E models only)

Default: 0

Settings 1~65535

📖 This parameter can set the address of the EtherCAT communication.

09-73 Communication Abnormal Treat (MX300-E models only)

Default: 0

Settings 0: Send fault notification to the upper unit

1: Do not send fault notification to the upper unit

📖 For EtherCAT / PROFINET communication, since MX000 is the multi-drive with several axes that the rectifier and inverter periodically exchange internal data. When the rectifier and inverter communication is disconnected, this parameter can be used to report the error to the upper unit.

09-95 MAC ID_1 (MX300-E models only)

Default: Read only

Settings PROFINET MAC ID, read only

09-96 MAC ID_2 (MX300-E models only)

Default: Read only

Settings PROFINET MAC ID, read only

09-97 MAC ID_3 (MX300-E models only)

Default: Read only

Settings PROFINET MAC ID, read only

13-1-14 Protection Parameters (2)

You can set this parameter during operation.

14-51	DC bus Voltage at Malfunction 2
14-55	DC bus Voltage at Malfunction 3
14-59	DC bus Voltage at Malfunction 4
14-63	DC bus Voltage at Malfunction 5
14-67	DC bus Voltage at Malfunction 6

Default: Read only

Display 0.0–6553.5 V

When an error occurs, you can check the DC bus voltage for the malfunction. If the error happens again, this parameter overwrites the previous record.

14-52	Output Current at Malfunction 2
14-56	Output Current at Malfunction 3
14-60	Output Current at Malfunction 4
14-64	Output Current at Malfunction 5
14-68	Output Current at Malfunction 6

Default: Read only

Display 0.00–655.35 Amps

When an error occurs, you can check the output current for the malfunction. If the error happens again, this parameter overwrites the previous record.

14-53	Total Power Components Temperature at Fault 2
14-57	Total Power Components Temperature at Fault 3
14-61	Total Power Components Temperature at Fault 4
14-65	Total Power Components Temperature at Fault 5
14-69	Total Power Components Temperature at Fault 6

Default: Read only

Display -3276.7–3276.7

When an error occurs, you can check the total power components temperature for the malfunction. If the error happens again, this parameter overwrites the previous record.

14-70	Fault Record 7
14-71	Fault Record 8
14-72	Fault Record 9
14-73	Fault Record 10

Default: 0

Display

0: No fault record

10: Over-voltage at stop (ovS)

14: Low-voltage at stop (LvS)

15: Phase loss protection (orP)

18: IGBT temperature detection failure (tH1o)

21: Over load (oL)
24: Motor overheating PTC / PT100 (oH3)
31: EEPROM read error (cF2)
48: ACI loss (ACE)
49: External fault (EF)
50: Emergency stop (EF1)
52: Password is locked (Pcod)
54: Illegal command (CE1)
55: Illegal data address (CE2)
56: Illegal data value (CE3)
57: Data is written to read-only address (CE4)
58: Modbus transmission time-out (CE10)
59: PU board time-out (CP10) (LCD keypad and CC01 keypad)
101: CANopen guarding error (CGdE)
102: CANopen heartbeat error (CHbE)
104: CANopen bus off error (CbFE)
223: PROFINET program inspection error (PrbE)

- 🕮 Refer to fault record Pr.06-17–Pr.06-22.
- 🕮 The parameters record when the fault occurs and forces a stop.
- 🕮 When low-voltage at stop fault (LvS) occurs, the fault is not recorded. When low-voltage during operation faults (LvA, Lvd, Lvn) occur, the faults are recorded.

13-2 Inverter module

13-2-00 Drive Parameters

You can set this parameter during operation.

00-00 Inverter Module Identity Code

Default: Read only

Settings Read only

00-01 Inverter Module Rated Current Display

Default: Read only

Settings Display by models

Pr.00-00 displays the AC motor drive identity code. Use the following specification table to check if Pr.00-01 setting is the rated current of the AC motor drive. Pr.00-01 corresponds to the identity code of Pr.00-00.

Single-axis inverter module

Model	230V Models - One-phase				460V models - Three-phase						
Power (kW)	0.4	0.75	1.5	2.2	0.4	0.75	1.5	2.2	3.7/4	5.5	7.5
Power (HP)	0.5	1	2	3	0.5	1	2	3	5	7.5	10
Identity Code	303	304	305	306	403	404	405	406	407	408	409
Rated Current for Heavy Duty	2.8	4.8	7.5	11	1.5	2.7	4.2	5.5	9	13	17
Rated Current for Normal Duty	3.5	8	11	17.6	2.3	4.2	5.5	9	13	17	18.5

Double-axis inverter Module

Model	230V Models - One-phase				460V models - Three-phase				
Power (kW)	0.4	0.75	1.5	2.2	0.4	0.75	1.5	2.2	3.7/4
Power (HP)	0.5	1	2	3	0.5	1	2	3	5
Identity Code	303	304	305	306	403	404	405	406	407
Rated Current for Heavy Duty	2.8	4.8	7.5	11	1.5	2.7	4.2	5.5	9
Rated Current for Normal Duty	4.8	8	11	17.6	2.7	4.2	5.5	9	13

Triple-axis inverter Module

Model	460V models - Three-phase			
Power (kW)	0.4	0.75	1.5	2.2
Power (HP)	0.5	1	2	3
Identity Code	403	404	405	406
Rated Current for Heavy Duty	1.5	2.7	4.2	5.5
Rated Current for Normal Duty	2.7	4.2	5.5	9

00-02 Parameter Reset

Default: 0

Settings 0: No function
1: Write protection for parameters
5: Return kWh displays to 0
9: Reset all parameters to defaults (base frequency is 50 Hz)
10: Reset all parameters to defaults (base frequency is 60 Hz)
11: Reset all parameters to defaults with base frequency at 50 Hz (keep the user-defined parameter values Pr.13-01–Pr.13-50)
12: Reset all parameters to defaults with base frequency at 60 Hz (keep the user-defined parameter values Pr.13-01–Pr.13-50)

- 1: All parameters are read only except Pr.00-02, Pr.00-07, and Pr.00-08. Set Pr.00-02 to 0 before changing other parameter settings.
- 5: You can return the kWh displayed value to 0 even during drive operation.For example, you can set Pr.05-26–Pr.05-30 to 0.
- 9 or 10: Reset all parameters to defaults. If you have set a password (Pr.00-08), unlock the password (Pr.00-07) to clear the password you have set before you reset all parameters.
- For settings of 9, 1, 0, 10, 11 and 12, you must reboot the motor drive after you finish the setting.

00-04 Content of Multi-function Display (User-defined)

Default: 3

Settings 0: Display output current from the inverter module to the motor (A) (Unit: Amp)
1: Display counter value (c) (Unit: CNT)
2: Display the inverter module actual output frequency (H.) (Unit: Hz)
3: Display the inverter module DC bus voltage (v) (Unit: V_{DC})
4: Display the inverter module output voltage (E) (Unit: V_{AC})
5: Display the inverter module output power angle (n) (Unit: deg)
6: Display the inverter module output power in kW (P) (Unit: kW)
7: Display the motor speed (r) (Unit: rpm)
8: Display the inverter module estimated output torque, motor's rated torque is 100 % (t) (Unit: %)
10: Display PID feedback (b) (Unit: %)
11: Display AI1 analog input terminal signal (1.) (Unit: %)
12: Display AI2 analog input terminal signal (2.) (Unit: %)
13: Power components temperature percentage (C) (Unit: %)
14: Power components temperature (i.) (Unit: °C)
15: Display the circuit board ambient temperature (i.) (Unit: °C)
16: The digital input status (ON / OFF) (i)
17: The digital output status (ON / OFF) (o)
18: Display multi-step speed (S)
25: Overload count (0.00–100.00%) (o.) (Unit: %)
27: DC bus voltage ripple (r.) (Unit: V_{DC})

30: Display the output of User-defined (U)
31: Display Pr.00-05 user gain (K)
35: Control mode display: 0 = Speed control mode (SPD)
36: Present operating carrier frequency of the inverter module (J.) (Unit: Hz)
38: Display the inverter module status (6.)
39: Display the inverter module estimated output torque, positive and negative, using Nt-m as unit (t 0.0: positive torque; -0.0: negative torque) (C.)
41: kWh display (J) (Unit: kWh)
42: PID target value (h.) (Unit: %)
43: PID compensation (o.) (Unit: %)
44: PID output frequency (b.) (Unit: Hz)
46: Auxiliary frequency value (U.) (Unit: Hz)
47: Master frequency value (A.) (Unit: Hz)
48: Frequency value after addition and subtraction of master and auxiliary frequency (L.) (Unit: Hz)
51: PMSVC torque offset

Explanation 1

- It can also display negative values when setting analog input bias (Pr.03-03–03-10). Example: Assume that AVI input voltage is 0 V, Pr.03-03 is 10.0%, Pr.03-07 is 4 (Bias serves as the center).

Explanation 2

If MI1 and MI5 are ON, the following table shows the status of the terminals.

Normally opened contact (N.O.): (0: OFF, 1: ON)

Terminal	MI5	MI4	MI3	MI2	MI1
Status	1	0	0	0	1

- The value is 0000 0000 0000 0001 in binary and 0009H in HEX. When Pr.00-04 is set to 16 or 19, the u page on the keypad displays 0011h.
- When MI1 / MI2 default setting is two-wire / three-wire operation control (Pr.02-00 ≠ 0), and MI3 is set to three-wire, it is not affected by Pr.02-12.

Explanation 3

Example: Assume that RY: Pr.02-13 is set to 9 (Drive is ready). After powering the drive on, if there is no other abnormal status, the contact is close. The display status is shown below.

Normally opened contact (N.O.):

Terminal	MO1	RY1
Status	0	1

Explanation 4

- Setting value 25: when displayed value reaches 100.00%, the drive shows “oL” as an overload warning.

Explanation 5

- Setting value 38:

bit 0: The drive is running forward.
bit 1: The drive is running backward.
bit 2: The drive is ready.
bit 3: Errors occurred on the drive.
bit 4: The drive is running.
bit 5: Warnings occurred on the drive.

00-05 Coefficient Gain in Actual Output Frequency

Default: 1.00

Settings 0.00–160.00

Sets the user-defined unit coefficient gain. Set Pr.00-04 = 31 to display the calculation result on the screen (calculation = output frequency * Pr.00-05).

00-06 Firmware Version

Default: Read only

Settings Read only

00-10 Control Mode

Default: 0

Settings 0: Speed mode

Determines the control mode of the AC motor drive.

00-11 Speed Control Mode

Default: 0

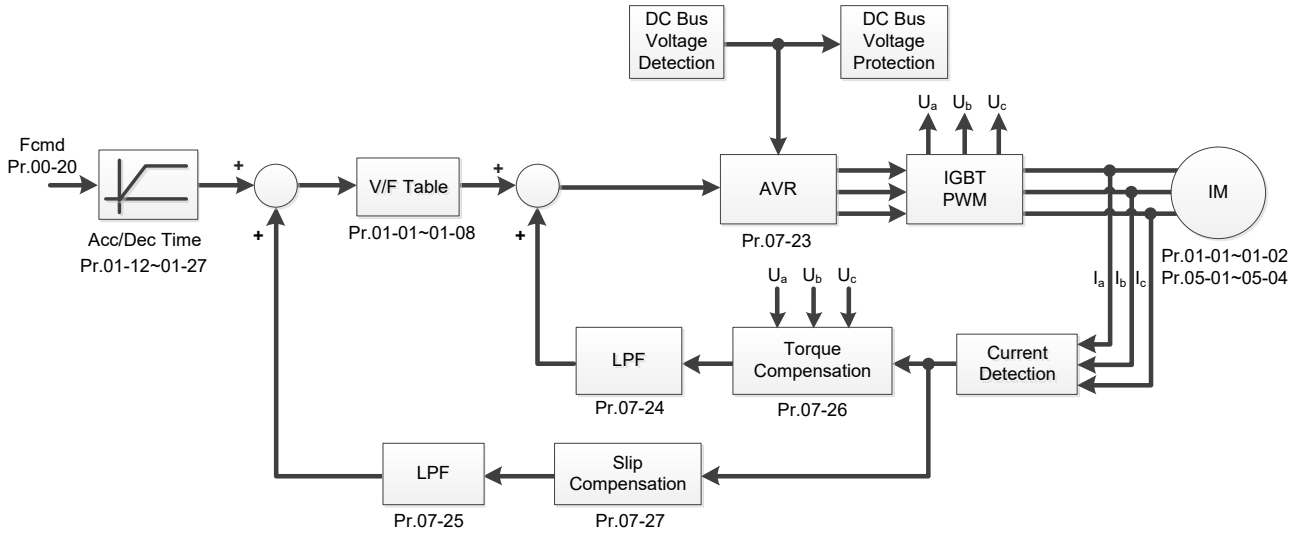
Settings 0: IMVF (IM V/F control)
2: IM/PM SVC (IM / PM Space Vector Control)

Determines the control mode of the AC motor drive.

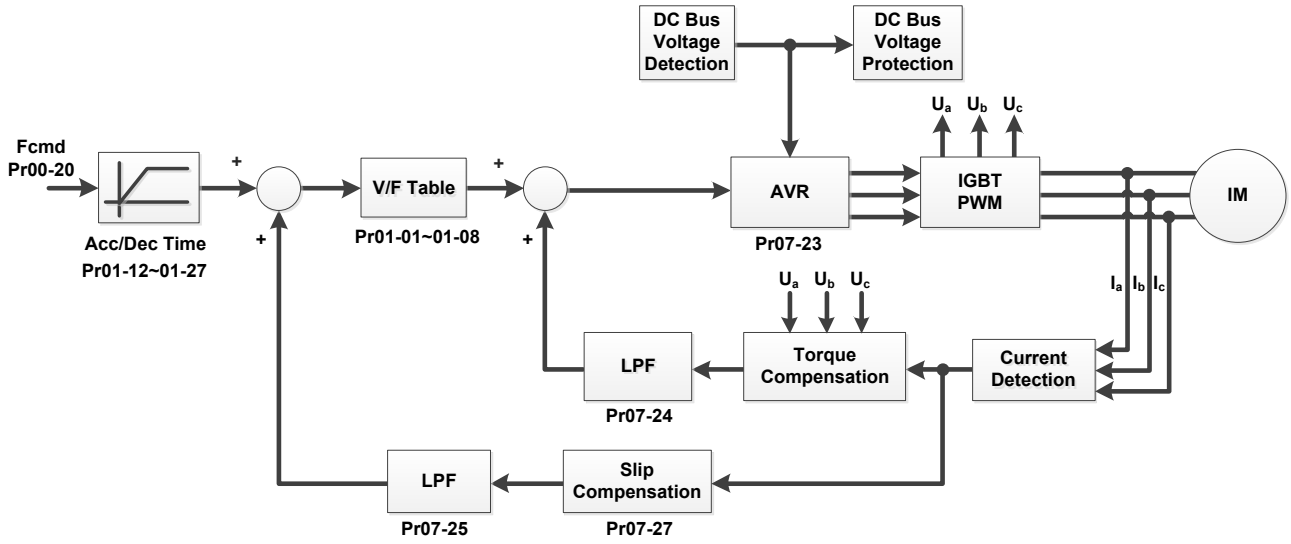
0: IM V/F control, you can set the proportion of V/F as required and control multiple motors simultaneously.

2: IM/PM space vector control: gets the optimal control by auto-tuning the motor parameters.

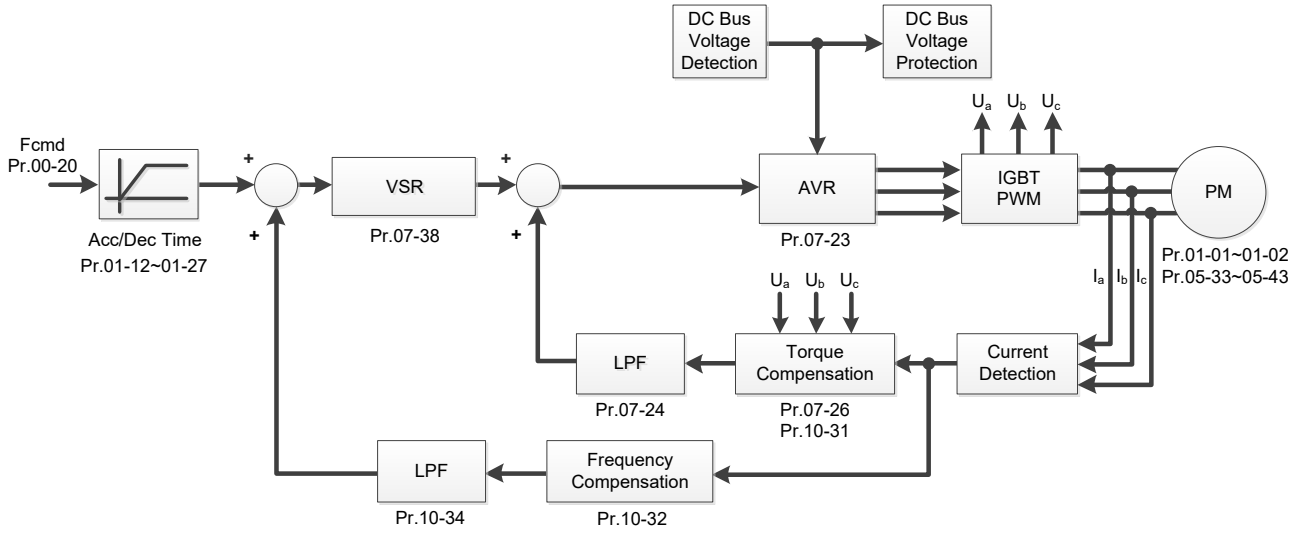
When Pr.00-10 = 0 and you set Pr.00-11 to 0, the V/F control diagram is as follows:



When Pr.00-10 = 0 and you set Pr.00-11 to 2, the sensorless vector control diagram is as follows: IM Space Vector Control (IMSVC):



PM space vector control (PMSVC):



00-16 Load Selection

Default: 1

Settings 0: Normal load

1: Heavy load

- Normal duty: overload rated output current 150% in 3 seconds. (110%, 1 minute).
  Refer to Pr.00-17 for the setting for the carrier frequency.
  Refer to Chapter 11 Specifications or Pr.00-01 for the rated current.
- Heavy duty: overload rated output current 200% in 3 seconds. (150%, 1 minute)
  Refer to Pr.00-17 for the setting for the carrier frequency.
  Refer to Chapter 11 Specifications or Pr.00-01 for the rated current.
- Pr.00-01 varies with the setting value of Pr.00-16. The default value and maximum of Pr.06-03 and Pr.06-04 also vary with the setting value of Pr.00-16.
- In normal duty, the default setting of Pr.06-03 and Pr.06-04 is 120%, and the maximum is 150%.
- In heavy duty, the default setting of Pr.06-03 and Pr.06-04 is 180%, and the maximum is 200%.

00-17 Carrier Frequency

Default: 6

Settings 2–15 kHz

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

Models	230V	460V
Model	0.5–3 HP [0.4–2.2 kW]	0.5–10 HP [0.4–7.5 kW]
Settings	2–15 kHz	
Normal Duty & Heavy Duty Default	6 kHz	

🕮 From the table, you see that the PWM carrier frequency has significant influences on the 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.

🕮 When the carrier frequency is higher than the default, decrease the carrier frequency to protect the drive. Refer to Pr.06-55 for the related setting and details.

00-20 Master Frequency Command Source (AUTO, REMOTE)

Default: 0

Settings 0: Digital keypad
1: RS-485 communication input
2: External analog input (Refer to Pr.03-00)
3: External UP / DOWN terminal (multi-function input terminals)
6: CANopen / EtherCAT / PROFINET / EtherNet/IP input
9: PID (with Pr.08-65 = 1)
NOTE: HOA (Hand-Off-Auto) function is valid only when you use with MO function setting 42 and 56 or with KPC-CC01 (optional).

🕮 Determines the master frequency source in the “AUTO, REMOTE “mode. The default is AUTO mode.

🕮 You can switch the AUTO, REMOTE mode with the keypad KPC-CC01 (optional) or the multi-function input terminal (MI) to set the master frequency source.

🕮 It returns to AUTO or REMOTE mode whenever you cycle the power. If you use a multi-function input terminal to switch between HAND (LOCAL) and AUTO (REMOTE) mode, the highest priority is the multi-function input terminal.

🕮 When Pr.00-20 = 9, Pr.08-65 automatically set as 1 at the same time. Pr.08-65 needs to be set as 0 for changing back to other values.

00-21 Operation Command Source (AUTO, REMOTE)

Default: 0

Settings 0: Digital keypad
1: External terminals
2: RS-485 communication input
3: CANopen / EtherCAT / PROFINET / EtherNet/IP input
NOTE: HOA (Hand-Off-Auto) function is valid only when you use with MO function setting 42 and 56 or with KPC-CC01 (optional).

🕮 Determines the operation frequency source in the “AUTO, REMOTE” mode.

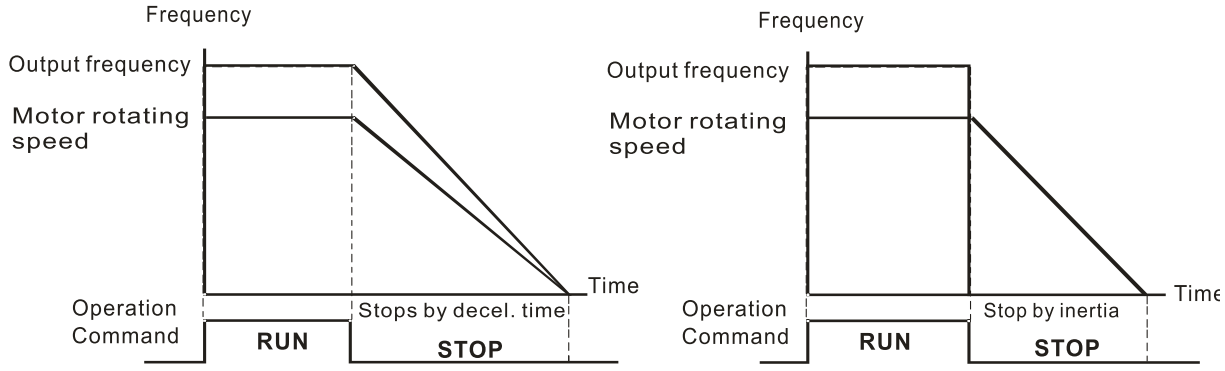
🕮 In the HOA mode, if the multi-function input terminal (MI) function setting 41 and 42 are OFF, the drive does not receive any operation command and JOG is invalid.

00-22 Stop Method

Default: 0

Settings 0: Ramp to stop
1: Coast to stop

🕮 Determines how the motor is stopped when the AC motor drive receives the Stop command.



Ramp to Stop and Coast to Stop

1. Ramp to stop: According to the set deceleration time, the AC motor drive decelerates to 0 Hz or the minimum output frequency (Pr.01-07), and then stop.
2. Coast to stop: According to the load inertia, the AC motor drive stops output immediately, and the motor coasts to stop.
   - Use “ramp to stop” for the safety of personnel or to prevent material from being wasted in applications where the motor must stop immediately after the drive stops. You must set the deceleration time accordingly.
   - If idling is allowed or the load inertia is large, use “coast to stop”.
     For example, blowers, punching machines and pumps.

🕮 In PROFINET, when it is set to 0, it will act by Pr.09-98.

00-23 Motor Direction Control

Default: 0

Settings 0: Enable forward / reverse
1: Disable reverse
2: Disable forward

🕮 Enable the motor to run in the forward and reverse direction. You can use it to prevent a motor from running in a direction that would cause injury or damage to the equipment, especially when only one running direction is allowed for the motor load.

00-24 Digital Operator (Keypad) Frequency Command Memory

Default: Read only

Settings Read only

🕮 If the keypad is the frequency command source, when Lv or fault occurs, this parameter stores the current frequency command.

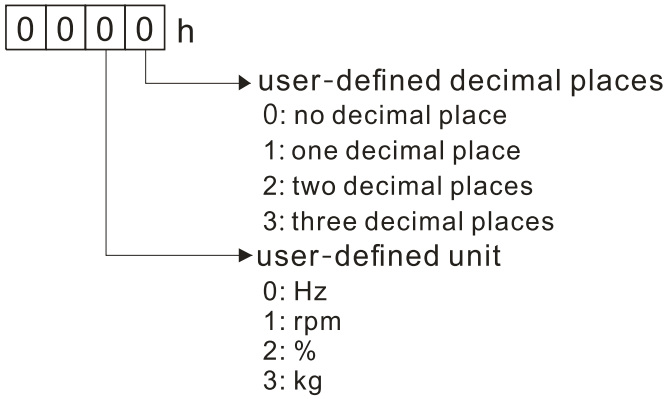
00-25 User-defined Characteristics

Default: 0

Settings bit 0–3: user-defined decimal places
0000h-0000b: no decimal place
0001h-0001b: one decimal place
0002h-0010b: two decimal places
0003h-0011b: three decimal places
bit 4–15: user-defined unit
000xh: Hz
001xh: rpm
002xh: %
003xh: kg
004xh: m/s
005xh: kW
006xh: HP
007xh: ppm
008xh: 1/m
009xh: kg/s
00Axh: kg/m
00Bxh: kg/h
00Cxh: lb/s
00Dxh: lb/m
00Exh: lb/h
00Fxh: ft/s
010xh: ft/m
011xh: m
012xh: ft
013xh: degC
014xh: degF
015xh: mbar
016xh: bar
017xh: Pa

018xh: kPa
01Axh: inWG
01Bxh: ftWG
01Cxh: psi
01Dxh: atm
01Exh: L/s
01Fxh: L/m
020xh: L/h
021xh: m3/s
022xh: m3/h
023xh: GPM
024xh: CFM
xxxxh: Hz

- bit 0–3: The displayed units for the control frequency F page and user-defined (Pr.00-04 = d10, PID feedback), and the displayed number of decimal places for Pr.00-26 (support up to three decimal places).
- bit 4–15: The displayed units for the control frequency F page, user-defined (Pr.00-04 = d10, PID feedback) and Pr.00-26.



- You must convert the setting value to decimal system when using the keypad to set parameters. For example:
  Assume that the user-defined unit is inWG and user-defined decimal place is the third decimal point. According to the information above, the corresponding unit to inWG is 01Axh (x is the set decimal point), and the corresponding unit to the third decimal place is 0003h, then inWG and the third decimal point displayed in hexadecimal is 01A3h, that is 419 in decimal system. Thus, set Pr.00-25 = 419 to complete the setting.

00-26 Maximum User-defined Value

Default: 0

Settings 0: No function
0–65535 (when Pr.00-25 is set to no decimal place)
0.0–6553.5 (when Pr.00-25 is set to one decimal place)
0.00–655.35 (when Pr.00-25 is set to two decimal places)
0.000–65.535 (when Pr.00-25 is set to three decimal places)

When Pr.00-26 is NOT 0, the user-defined value is enabled. After selecting the displayed unit and number of decimal places with Pr.00-25, the setting value of Pr.00-26 corresponds to Pr.01-00 (drive's maximum operating frequency).

For example:

When the frequency set in Pr.01-00 = 60.00 Hz, the maximum user-defined value for Pr.00-26 is 100.0%. This also means that Pr.00-25 is set at 33 (0021h) to select % as the unit.

Note: Set Pr.00-25 before using Pr.00-26. After you finish setting, when Pr.00-26 is not 0, the displayed unit on the keypad shows correctly according to Pr.00-25 settings.

00-27 User-defined Value

Default: Read only

Settings Read only

Pr.00-27 displays the user-defined value when Pr.00-26 is not 0.

00-29 LOCAL / REMOTE Selection

Default: 0

Settings
- 0: Standard HOA function
- 1: When switching between local and remote, the drive stops.
- 2: When switching between local and remote, the drive runs with REMOTE settings for frequency and operating status.
- 3: When switching between local and remote, the drive runs with LOCAL settings for frequency and operating status.
- 4: When switching between local and remote, the drive runs with LOCAL settings when switched to Local and runs with REMOTE settings when switched to Remote for frequency and operating status.

The default for Pr.00-29 is 0, that is, the standard HOA (Hand-Off-Auto) function. Set the AUTO and HAND frequency and operation source with Pr.00-20, 00-21 and Pr.00-30, 00-31. The external terminal function (MI) = 56 for LOC / REM mode selection is disabled when Pr.00-29 is 0.

If Pr.00-29 is not set to 0, the top right corner of digital keypad KPC-CC01 (optional) displays LOC or REM. Set the REMOTE and LOCAL frequency and operation source with Pr.00-20, 00-21 and Pr.00-30, 00-31.

Set the multi-function input terminal (MI) = 56 to set the LOC / REM selection. The AUTO key on the KPC-CC01 (optional) is the REMOTE function; the HAND key is the LOCAL function.

If Pr.00-29 is not set to 0, the AUTO / HAND keys are disabled. In this case, the external terminal (MI) setting = 56 (local / remote selection) has the highest command priority.

00-30 Master Frequency Command Source (HAND, LOCAL)

Default: 0

Settings
0: Digital keypad
1: RS-485 communication input
2: External analog input (Refer to Pr.03-00)
3: External UP / DOWN terminal (multi-function input terminals)
6: CANopen / EtherCAT / PROFINET / EtherNet/IP input
NOTE: HOA (Hand-Off-Auto) function is valid only when you use with MO function setting 41 and 56 or with KPC-CC01 (optional).

- Determine the master frequency source in the "HAND, LOCAL" mode.
- You can switch the HAND, LOCAL mode with the keypad KPC-CC01 (optional) or the multi-function input terminal (MI) to set the master frequency source.
- It returns to AUTO or REMOTE mode whenever you cycle the power. If you use a multi-function input terminal to switch between HAND (LOCAL) and AUTO (REMOTE) mode, the highest priority is the multi-function input terminal.

00-31 Operation Command Source (HAND, LOCAL)

Default: 0

Settings
0: Digital keypad
1: External terminals
2: RS-485 communication input
3: CANopen / EtherCAT / PROFINET / EtherNet/IP input
NOTE: HOA (Hand-Off-Auto) function is valid only when you use with MO function setting 41 and 56 or with KPC-CC01 (optional).

- Determines the operation frequency source in the "HAND, LOCAL" mode.
- In the HOA mode, if the multi-function input terminal (MI) function setting 41 and 42 are OFF, the drive does not receive any operation command and JOG is invalid.

00-32 Digital Keypad STOP Function

Default: 0

Settings
0: STOP key disabled
1: STOP key enabled

- Valid when the operation command source is not the digital keypad (Pr.00-21≠ 0).
  When Pr.00-21 = 0, the STOP key on the digital keypad is not affected by this parameter.

00-33 RPWM Mode Selection

Default: 0

Settings
0: No function
1: RPWM mode 1
2: RPWM mode 2
3: RPWM mode 3

- Control modes applicable to Pr.00-33:

Motor	Induction motor (IM)		Permanent magnet synchronous AC motor (PM)
Control Mode	VF	SVC	SVC
0: RPWM mode 1	✓	✓	✓
1: RPWM mode 2	✓	✓	✓
2: RPWM mode 3	✓	✓	✓

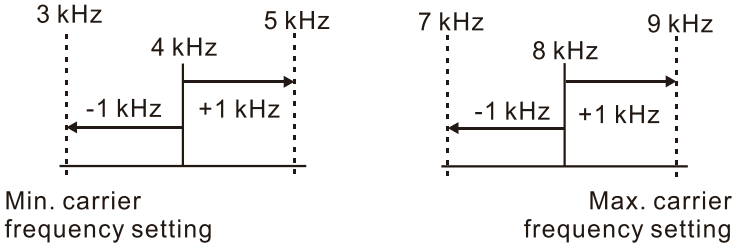
- When activate RPWM function, the carrier wave is randomly distributed according to the carrier frequency (Pr.00-17) which is at the center
- The RPWM function is applicable to all control modes.
- After activating RPWM function, decrease the shrill noise which focuses on a specific high frequency, and change the sound frequency of the motor (usually change the sound from shill to a little deep and low).
- The AC motor drive supports three kinds of RPWM modes for different applications. Each mode has its own frequency distribution, the corresponding electromagnetic noise distribution and the pitch are also different.
- The setting of Pr.00-17 carrier wave will vary depending on the activation / deactivation of RPWM.

00-34 RPWM Carrier Frequency Variation

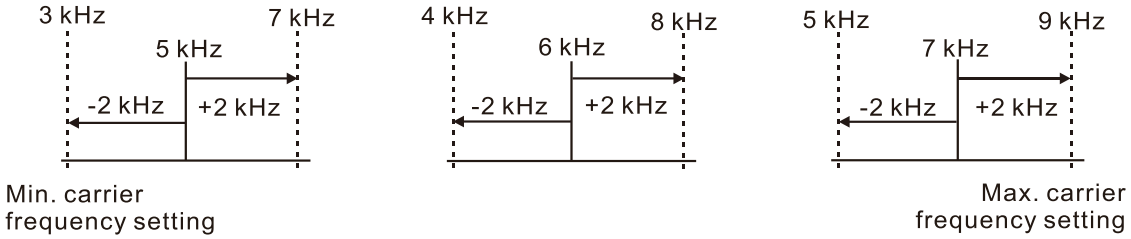
Default: 2 kHz

Settings 0.0–4.0 kHz
Pr.00-17 = 4 kHz, 8 kHz: the setting range is 0.0–2.0 kHz
Pr.00-17 = 5 kHz, 6 kHz, 7 kHz: the setting range is 0.0–4.0 kHz

- When activate RPWM function, the lowest carrier wave can be set in Pr.00-17 is 3 kHz, and the highest is 9 kHz.
- Pr.00-34 is valid only when RPWM function is activating (Pr.00-33 ≠ 0).
- Example:
  When the carrier wave (Pr.00-17) is 4 kHz, activate RPWM function (Pr.00-33 = 1, 2, or 3), and the RPWM range (Pr.00-34) is 2.0 kHz, the output carrier wave is based on 4 kHz, the random frequency range is +/1 kHz, thus the carrier wave changes randomly within 3 kHz to 5 kHz.
- When activate RPWM function, the lowest carrier wave can be set in Pr.00-17 is 3 kHz, and the highest is 9 kHz.
- When Pr.00-17 = 4 or 8 kHz, the maximum setting value of Pr.00-34 can be 2.0 kHz (+/-1 kHz). The carrier wave range to change is as the figure shown below:



- When Pr.00-17 = 5, 6, or 7 kHz, the maximum setting value of Pr.00-34 can be 4.0 kHz (+/-2 kHz). The carrier wave range to change is as the figure shown below:



00-35 Auxiliary Frequency Source

Default: 0

Settings 0: Master and auxiliary frequency function disabled
1: Digital keypad
2: RS-485 communication input
3: Analog input
4: External UP / DOWN (Multi-function input terminals)
6: CANopen / EtherCAT / PROFINET / EtherNet/IP input

00-36 Master and Auxiliary Frequency Command Selection

Default: 0

Settings 0: Master + auxiliary frequency
1: Master - auxiliary frequency
2: Auxiliary - master frequency

- Master and auxiliary frequency command sets the master frequency source according to the Pr.00-20, and sets the auxiliary frequency source according to the Pr.00-35. This parameter determines the addition and subtraction of the master and auxiliary frequency.
- When Pr.00-36 = 0, 1, 2, the control command comes after adding or subtracting the master / auxiliary frequency and the acceleration and deceleration (including S-curve).
- If the value is negative after adding or subtracting the master / auxiliary frequency, Pr.03-10 determines whether to change the running direction.
- If you set the master frequency source (Pr.00-20 = 0) or the auxiliary frequency source (Pr.00-35 = 1) using the keypad, the F page of the keypad displays the setting frequency that you can use to set the master frequency or the auxiliary frequency. If the master frequency source or the auxiliary frequency source is NOT set by the keypad (Pr.00-20 ≠ 0 and Pr.00-35 ≠ 1), the F page of the keypad displays the value after adding or subtracting the master / auxiliary frequency.
- When setting the master frequency source and auxiliary frequency source, Pr.00-35 cannot be set to the same value as Pr.00-20 or Pr.00-30.
- When using the master and auxiliary frequency function, and the value after master and auxiliary frequency are added or subtracted is positive, the output frequency is limited by Pr.01-00 (Max. operation frequency); if the value is negative, the output frequency is limited by Pr.08-67 (Master and auxiliary reverse running cutoff frequency).

00-47 Output Phase Order Selection

Default: 0

Settings 0: Standard
1: Reverse the operation direction

- Without changing the wiring and light indicator, this parameter can be used to change the rotation direction from forward to reverse or from reverse to forward.
- When using this parameter with Pr.00-23 (Motor Direction Control), Pr.00-23 has priority over Pr.00-47.

00-48 Display Filter Time (Current)

Default: 0.100

Settings 0.001–65.535 sec.

- Minimize the current fluctuation displayed by the digital keypad.

00-49 Display Filter Time (Keypad)

Default: 0.100

Settings 0.001–65.535 sec.

- Minimize the value fluctuation displayed by the digital keypad.

00-50 Software Version (Date)

Default: Read only

Settings Read only

- Display the current drive software version by date.

13-2-01 Basic Parameters

You can set this parameter during operation.

01-00 Maximum Operation Frequency of Motor 1
01-52 Maximum Operation Frequency of Motor 2

Default: 60.00 / 50.00

Settings 0.00–599.00 Hz

Determines the AC motor drive's maximum operation frequency.
All the AC motor drive frequency command sources (analog inputs 0–10 V, 4–20 mA, 0–20 mA, ±10 V) are scaled to correspond to the output frequency range.

01-01 Motor 1 Rated / Base Frequency
01-35 Motor 2 Rated / Base Frequency

Default: 60.00 / 50.00

Settings 0.00–599.00 Hz

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

01-02 Motor 1 Rated / Base Voltage
01-36 Motor 2 Rated / Base Voltage

Default: 220.0 / 440.0

Settings 230V models: 0.0–255.0 V
460V models: 0.0–510.0 V

Set this parameter according to the rated voltage on the motor nameplate. If the motor's rated voltage is 220 V, set this parameter to 220.0. If the motor's rated voltage 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 Motor 1 Mid-point Frequency 1

Default: 3.00

Settings 0.00–599.00 Hz

01-04 Motor 1 Mid-Point Voltage 1

Default: 11.0 / 22.0

Settings 230V models: 0.0–255.0 V
460V models: 0.0–480.0 V

01-37 Mid-point Frequency 1 of Motor 2

Default: 3.00

Settings 0.00–599.00 Hz

01-38 Mid-point Voltage 1 of Motor 2

Default: 11.0 / 22.0

Settings 230V models: 0.0–240.0 V
460V models: 0.0–480.0 V

01-05 Motor 1 Mid-point Frequency 2

Default: 1.50

Settings 0.00–599.00 Hz

01-06 Motor 1 Mid-point Voltage 2

Default: 5.0 / 10.0

Settings 230V models: 0.0–240.0 V
460V models: 0.0–480.0 V

01-39 Motor 2 Mid-point Frequency 2

Default: 0.50

Settings 0.00–599.00 Hz

01-40 Motor 2 Mid-point Voltage 2

Default: 5.0 / 10.0

Settings 230V models: 0.0–240.0 V
460V models: 0.0–480.0 V

01-07 Motor 1 Minimum Output Frequency

Default: 0.50

Settings 0.00–599.00 Hz

01-08 Motor 1 Minimum Output Voltage

Default: 1.0 / 2.0

Settings 230V models: 0.0–240.0 V
460V models: 0.0–480.0 V

01-41 Minimum Output Frequency of Motor 2

Default: 0.50

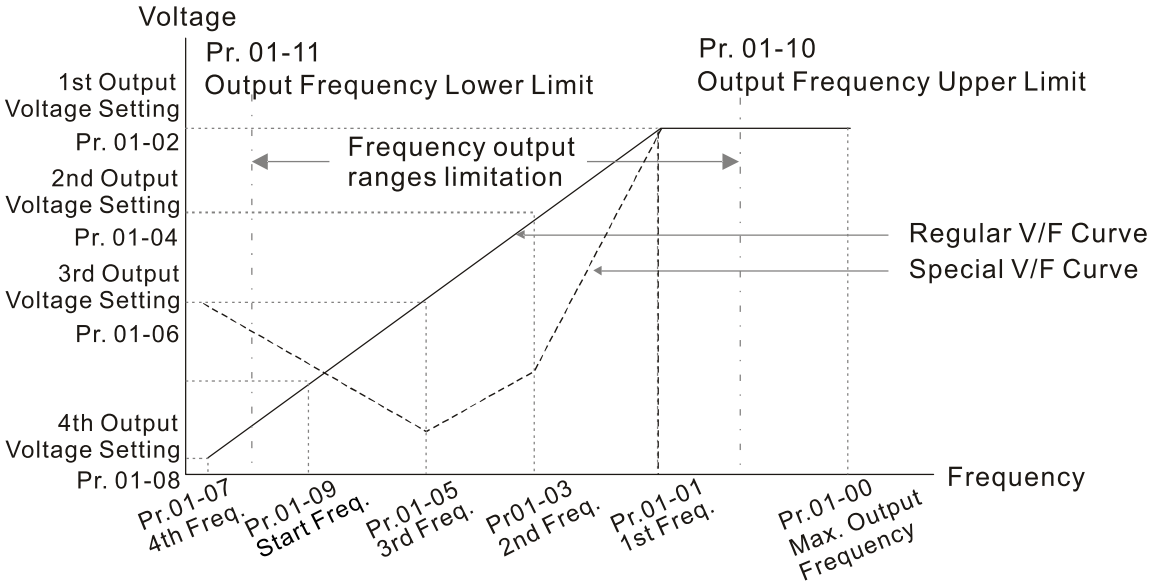
Settings 0.00–599.00 Hz

01-42 Motor 2 Minimum Output Voltage

Default: 1.0 / 2.0

Settings 230V models: 0.0–240.0 V
460V models: 0.0–480.0 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.
- There is no limit for the voltage setting, but a high voltage at a low frequency may cause motor damage, overheating, and trigger the stall prevention or the over-current protection. Therefore, use low voltage at low frequency to prevent motor damage or drive error.
- The diagram below shows the V/F curve for motor 1. You can use the same V/F curve for motor 2. For multi-motor selections, refer to the multi-function input terminal (Pr.02-01–Pr.02-05) settings 83.

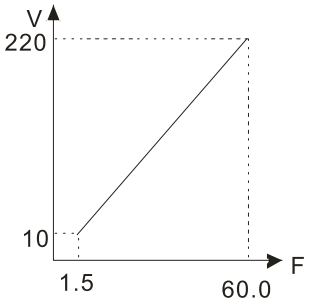


V/F Curve and The Related Parameters

Common settings for the V/F curve

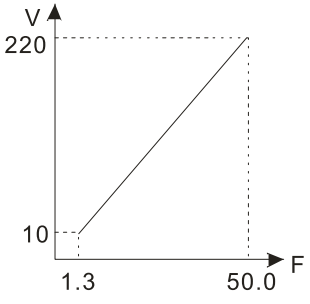
(1) General purpose

Motor spec. 60Hz



Pr.	Setting
01-00	60.0
01-01	60.0
01-02	220.0
01-03 01-05	1.50
01-04 01-06	10.0
01-07	1.50
01-08	10.0

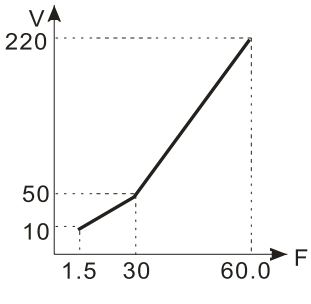
Motor spec. 50Hz



Pr.	Setting
01-00	50.0
01-01	50.0
01-02	220.0
01-03 01-05	1.30
01-04 01-06	10.0
01-07	1.30
01-08	10.0

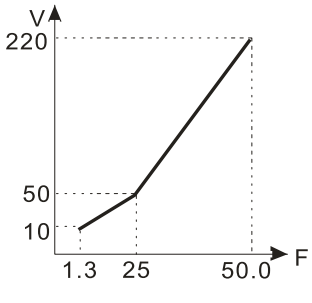
(2) Fan and hydraulic machinery

Motor spec. 60Hz



Pr.	Setting
01-00	60.0
01-01	60.0
01-02	220.0
01-03 01-05	30.0
01-04 01-06	50.0
01-07	1.50
01-08	10.0

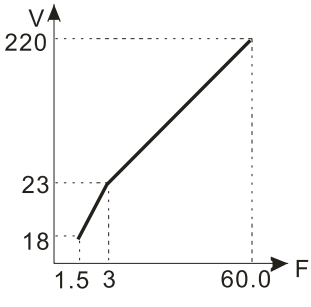
Motor spec. 50Hz



Pr.	Setting
01-00	50.0
01-01	50.0
01-02	220.0
01-03 01-05	25.0
01-04 01-06	50.0
01-07	1.30
01-08	10.0

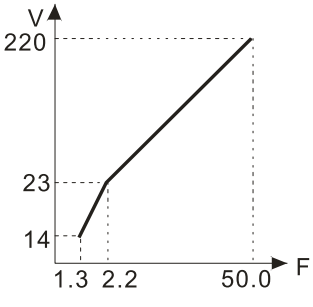
(3) High starting torque

Motor spec. 60Hz



Pr.	Setting
01-00	60.0
01-01	60.0
01-02	220.0
01-03 01-05	3.00
01-04 01-06	23.0
01-07	1.50
01-08	18.0

Motor spec. 50Hz



Pr.	Setting
01-00	50.0
01-01	50.0
01-02	220.0
01-03 01-05	2.20
01-04 01-06	23.0
01-07	1.30
01-08	14.0

01-09 Start-up Frequency

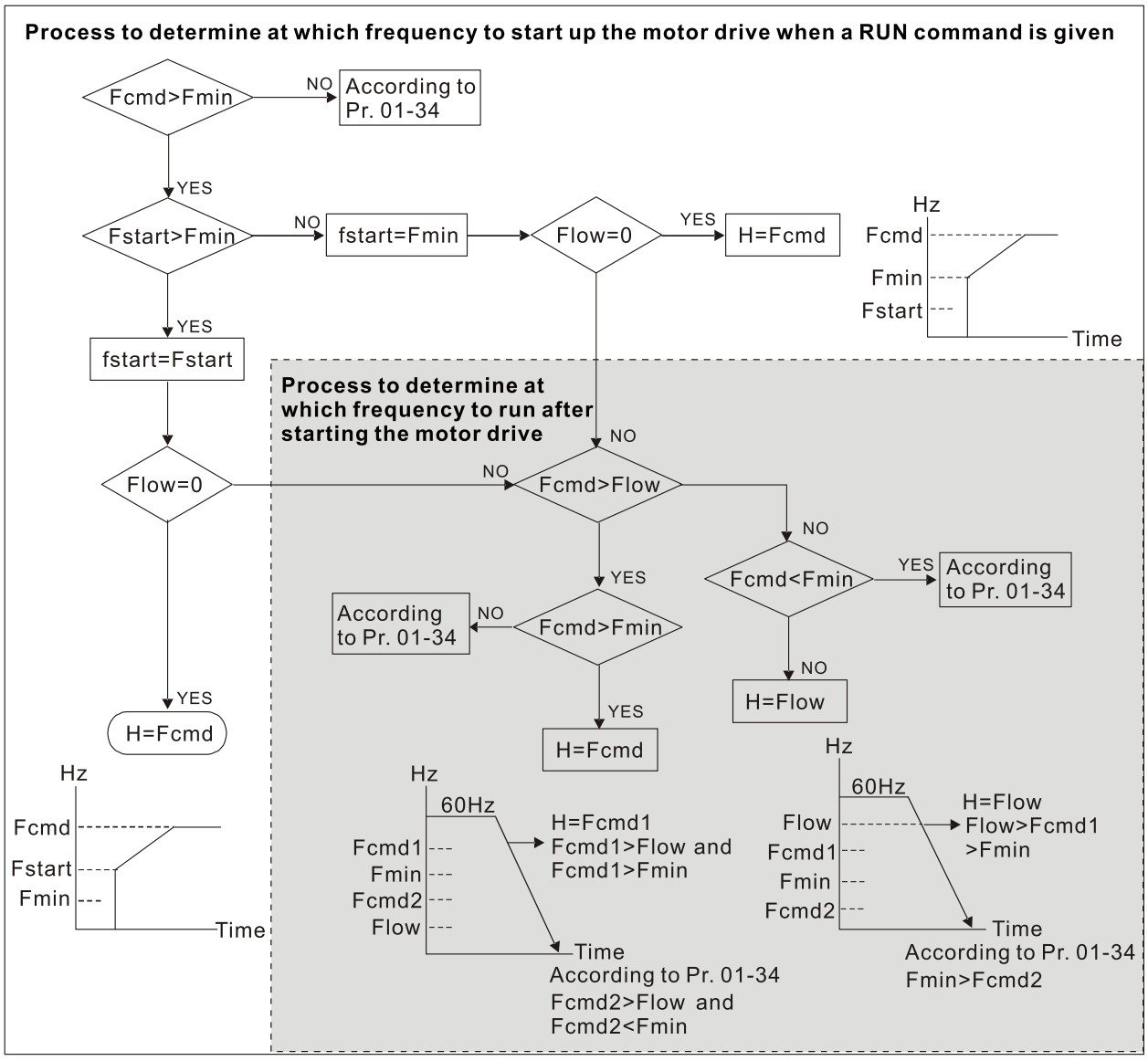
Default: 0.50

Settings 0.00–599.00 Hz

When the starting frequency (Pr.01-09) is larger than the Minimum Output Frequency of Motor 1 (Pr.01-07), the drive's frequency output starts from the starting frequency (Pr.01-09) until reaching the F command.

Refer to the following diagram for details.

- Fcmd = Frequency command
- Fstart = Start-up frequency (Pr.01-09)
- fstart = actual start-up frequency of the drive
- Fmin = 4th output frequency setting (Pr.01-07 / Pr.01-41)
- Flow = output frequency lower limit (Pr.01-11)



When Fcmd > Fmin and Fcmd < Fstart: If Flow < Fcmd, the drive runs directly with Fcmd. If Flow ≥ Fcmd, the drive runs with Fcmd, and then rises to Flow according to acceleration time.

The drive's output frequency goes directly to 0 when decelerating to Fmin.

01-10 Output Frequency Upper Limit

Default: 599.00

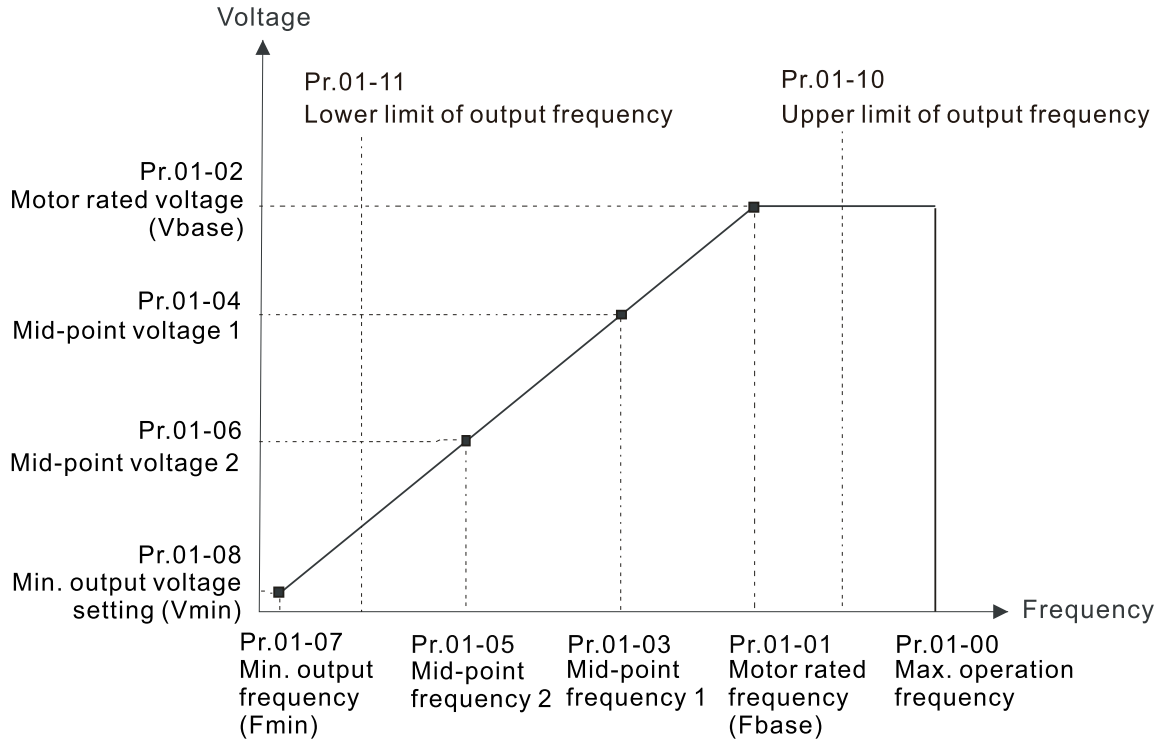
Settings 0.00–599.00 Hz

01-11 Output Frequency Lower Limit

Default: 0.00

Settings 0.0–599.00 Hz

- If the output frequency setting is higher than the upper limit (Pr.01-10), the drive runs with the upper limit frequency. If the output frequency setting is lower than the lower limit (Pr.01-11) but higher than the minimum output frequency (Pr.01-07), the drive runs with the lower limit frequency. Set the upper limit frequency > the lower limit frequency (Pr.01-10 setting value must be > Pr.01-11 setting value).
- If the PID feedback control is enabled for the drive, the drive's output frequency may exceed the frequency command but is still limited by this setting.
- Related parameters: Pr.01-00 Maximum Operation Frequency, Pr.01-11 Output Frequency Lower Limit.



- When the drive starts, it operates according to the V/F curve and accelerates from the minimum output frequency (Pr.01-07) to the setting frequency. It is not limited by the lower output frequency settings.
- Use the output frequency upper and lower limit settings to prevent operator misuse, overheating caused by the motor's operating at a too low frequency, or mechanical wear due to a too high speed.
- If the output frequency upper limit setting is 50 Hz and the frequency setting is 60 Hz, the maximum output frequency is 50 Hz.
- If the output frequency lower limit setting is 10 Hz and the minimum output frequency setting

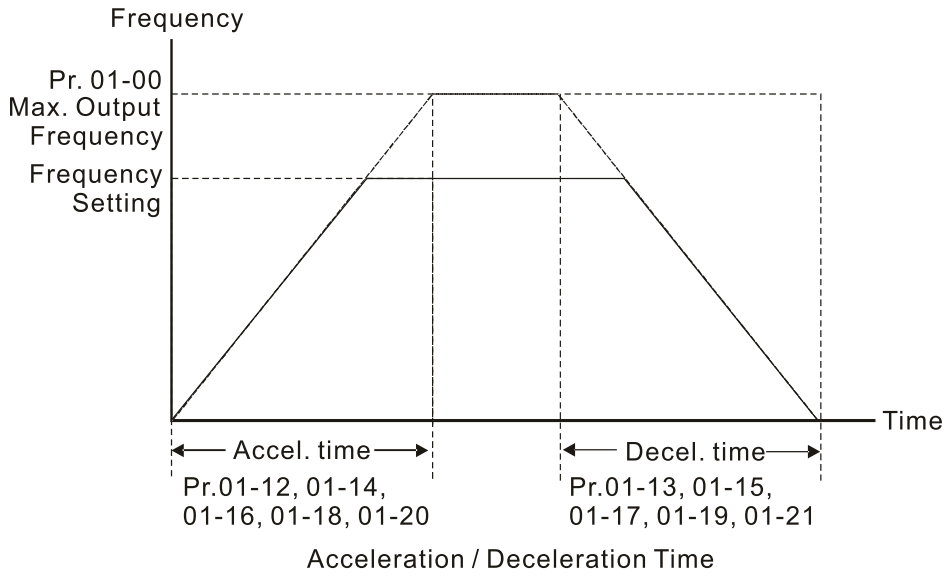
(Pr.01-07) is 1.5 Hz, then the drive operates at 10 Hz when the Frequency command is higher than Pr.01-07 but lower than 10 Hz. If the Frequency command is lower than Pr.01-07, the drive is in ready status without output.

✓	**01-12**	Acceleration Time 1
✓	**01-13**	Deceleration Time 1
✓	**01-14**	Acceleration Time 2
✓	**01-15**	Deceleration Time 2
✓	**01-16**	Acceleration Time 3
✓	**01-17**	Deceleration Time 3
✓	**01-18**	Acceleration Time 4
✓	**01-19**	Deceleration Time 4
✓	**01-20**	JOG Acceleration Time
✓	**01-21**	JOG Deceleration Time

Default: 10.00

Settings Pr.01-45 = 0: 0.00–600.00 sec.
Pr.01-45 = 1: 0.0–6000.0 sec.

- 🕮 The acceleration time determines the time required for the AC motor drive to ramp from 0.00 Hz to the maximum operation frequency (Pr.01-00). The deceleration time determines the time required for the AC motor drive to decelerate from the maximum operation frequency (Pr.01-00) down to 0.00 Hz.
- 🕮 The acceleration and deceleration time are invalid when using Pr.01-44 Auto-acceleration and Auto-deceleration Setting.
- 🕮 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.
- 🕮 With the enabled torque limits and stall prevention functions, the actual acceleration and deceleration time are longer than the above action time.
- 🕮 Note that setting the acceleration and deceleration time too short may trigger the drive's protection function (Pr.06-03 Over-current Stall Prevention during Acceleration or Pr.06-01 Over-voltage Stall Prevention), and the actual acceleration and deceleration time are longer than this setting.
- 🕮 Note that setting the acceleration time too short may cause motor damage or trigger drive protection due to over-current during the drive's acceleration.
- 🕮 Note that setting the deceleration time too short may cause motor damage or trigger drive protection due to over-current during the drive's deceleration or over-voltage.
- 🕮 Use suitable brake resistors (refer to Chapter 10 Optional Accessories) to decelerate in a short time and prevent over-voltage.
- 🕮 When you enable Pr.01-24–Pr.01-27 (S-curve acceleration and deceleration begin and arrival time), the actual acceleration and deceleration time are longer than the setting.



01-22 JOG Frequency

Default: 6.00

Settings 0.00–599.00 Hz

You can use both the external terminal JOG and F1 key on the optional keypad KPC-CC01 (optional) to set the JOG function. When the JOG command is ON, the AC motor drive accelerates from 0 Hz to the JOG frequency (Pr.01-22). When the JOG command is OFF, the AC motor drive decelerates from the JOG frequency to stop. The JOG acceleration and deceleration time (Pr.01-20, Pr.01-21) are the time to accelerate from 0.0 Hz to the JOG frequency (Pr.01-22). You cannot execute the JOG command when the AC motor drive is running. When the JOG command is executing, other operation commands are invalid.

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

Default: 0.00

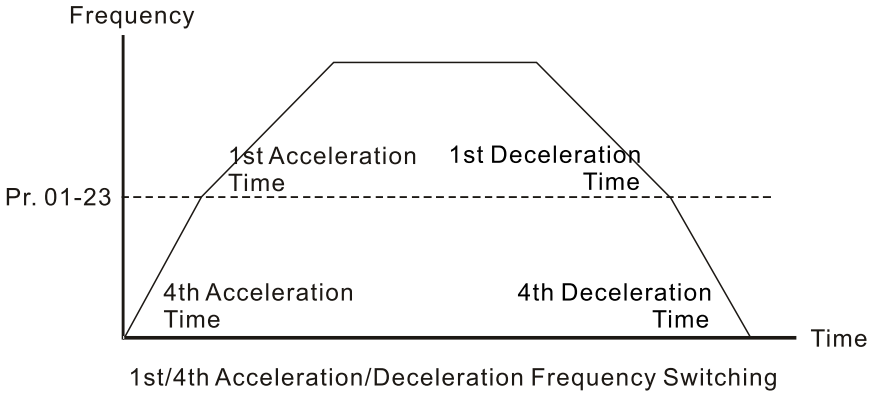
Settings 0.00–599.00 Hz

This function does not require the external terminal switching function; it switches the acceleration and deceleration time automatically according to the Pr.01-23 setting. If you set the external terminal, the external terminal has priority over Pr.01-23.

Use this parameter to set the switch frequency between acceleration and deceleration slope. The First / Fourth Accel. / Decel. slope is calculated by the Max. Operation Frequency (Pr.01-00) / acceleration / deceleration time.

For example: When the Max. Operation Frequency (Pr.01-00) = 80 Hz, and Switch Frequency between First and Fourth Accel. / Decel. (Pr.01-23) = 40 Hz:

- If Acceleration Time 1 (Pr.01-02) = 10 sec., Acceleration Time 4 (Pr.01-18) = 6 sec., then the acceleration time is 3 sec. for 0–40 Hz and 5 sec. for 40–80 Hz.
- If Deceleration Time 1 (Pr.01-13) = 8 sec., Deceleration Time 4 (Pr.01-19) = 2 sec., then the deceleration time is 4 sec. for 80–40 Hz and 1 sec. for 40–0 Hz.



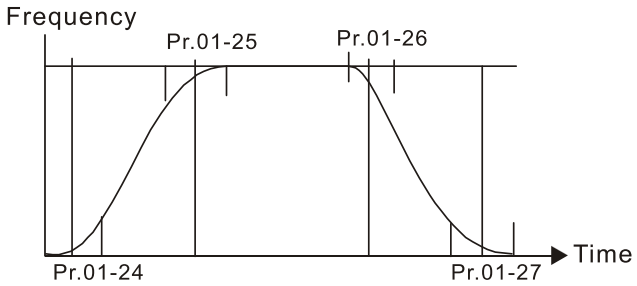
1st/4th Acceleration/Deceleration Frequency Switching

✓	**01-24**	S-curve for Acceleration Begin Time 1
✓	**01-25**	S-curve for Acceleration Arrival Time 2
✓	**01-26**	S-curve for Deceleration Begin Time 1
✓	**01-27**	S-curve for Deceleration Arrival Time 2

Default: 0.20 / 0.2

Settings Pr.01-45 = 0: 0.00–25.00 sec.
Pr.01-45 = 1: 0.0–250.0 sec.

- 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 drive produces a different acceleration and deceleration curve according to the acceleration and deceleration time.
- The S-curve function is invalid when you set the acceleration and deceleration time to 0.
- When Pr.01-12, 01-14, 01-16, 01-18 ≥ Pr.01-24 and Pr.01-25,
  the actual acceleration time = Pr.01-12, 01-14, 01-16, 01-18 + (Pr.01-24 + Pr.01-25) ÷ 2
  When Pr.01-13, 01-15, 01-17, 01-19 ≥ Pr.01-26 and Pr.01-27,
- the actual deceleration time = Pr.01-13, 01-15, 01-17, 01-19 + (Pr.01-26 + Pr.01-27) / 2.

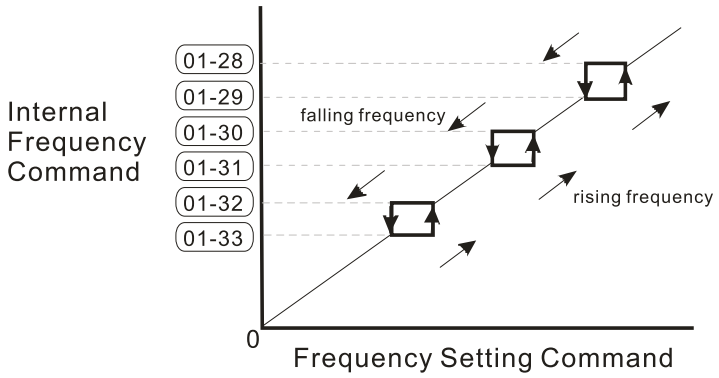


01-28	Skip Frequency 1 (Upper Limit)
01-29	Skip Frequency 1 (Lower Limit)
01-30	Skip Frequency 2 (Upper Limit)
01-31	Skip Frequency 2 (Lower Limit)
01-32	Skip Frequency 3 (Upper Limit)
01-33	Skip Frequency 3 (Lower Limit)

Default: 0.00

Settings 0.00–599.00 Hz

- Sets the AC motor drive's skip frequency. The drive's frequency setting skips these frequency ranges. However, the frequency output is continuous. There are no limits for these six parameters and you can combine them. Pr.01-28 does not need to be greater than Pr.01-29; Pr.01-30 does not need to be greater than Pr.01-31; Pr.01-32 does not need to be greater than Pr.01-33. You can set Pr.01-28–01-33 as you required. There is no size distinction among these six parameters.
- These parameters set the skip frequency ranges for the AC motor drive. You can use this function to avoid frequencies that cause mechanical resonance. The skip frequencies are useful when a motor has resonance vibration at a specific frequency bandwidth. Skipping this frequency avoids the vibration. There are three frequency skip zones available.
- You can set the Frequency command (F) within the range of skip frequencies. Then the output frequency (H) is limited to the lower limit of skip frequency ranges.
- During acceleration and deceleration, the output frequency still passes through the skip frequency ranges.



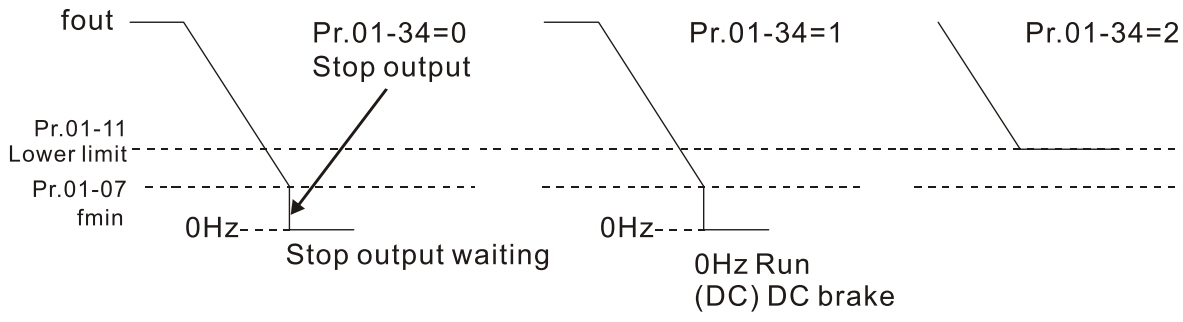
01-34 Zero-speed Mode

Default: 0

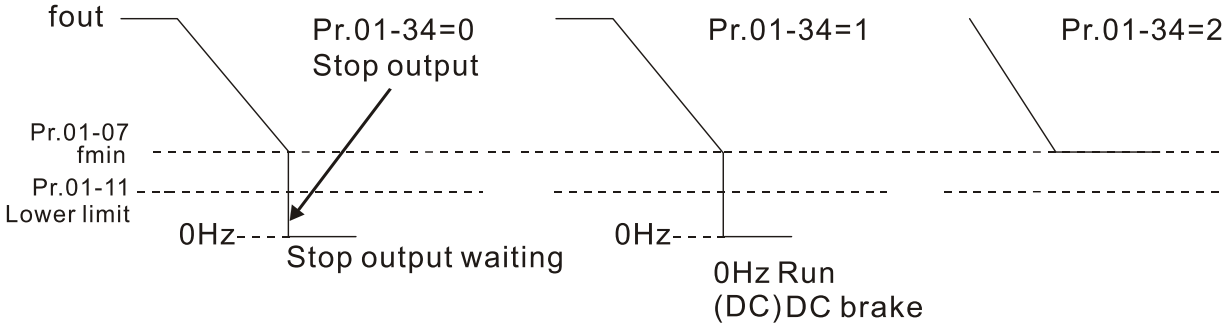
Settings 0: Output waiting
1: Zero-speed operation
2: Fmin (refer to Pr.01-07, Pr.01-41)

- When the drive's Frequency command is lower than Fmin (Pr.01-07 and Pr.01-41), the drive operates according to this parameter.
- 0: the AC motor drive is in waiting mode without voltage output from terminals U, V, W.
- 1: the drive executes the DC brake by Vmin (Pr.01-08 and Pr.01-42) in V/F modes.
- 2: the AC motor drive runs using Fmin (Pr.01-07 and Pr.01-41) and Vmin (Pr.01-08 and Pr.01-42) in V/F and SVC modes.

- Pr.01-11 lower limit > Pr.01-07 Fmin



- Pr.01-00 lower limit < Pr.01-07 Fmin

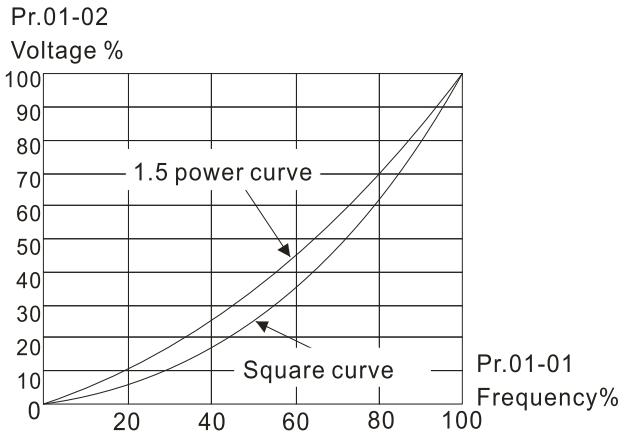


01-43 V/F Curve Selection

Default: 0

Settings 0: Determined by Pr.01-00–01-08
1: V/F curve to the power of 1.5
2: V/F curve to the power of 2

- When setting to 0, refer to Pr.01-01–01-08 for the motor 1 V/F curve. For motor 2, refer to Pr.01-35–01-42.
- When the setting is 1 or 2, the second and third voltage frequency settings are invalid.
- If the load of the motor is a variable torque load (torque is in direct proportion to the rotating speed, such as the load of a fan or a pump), the load torque is low at low rotating speed. You can decrease the input voltage appropriately to make the magnetic field of the input current smaller and reduce flux loss and iron loss for the motor to increase efficiency.
- When you set the V/F curve to high power, it has lower torque at low frequency, and the drive is not suitable for rapid acceleration and deceleration. Do NOT use this parameter for rapid acceleration and deceleration.



01-44 Auto-acceleration and Auto-deceleration Setting

Default: 0

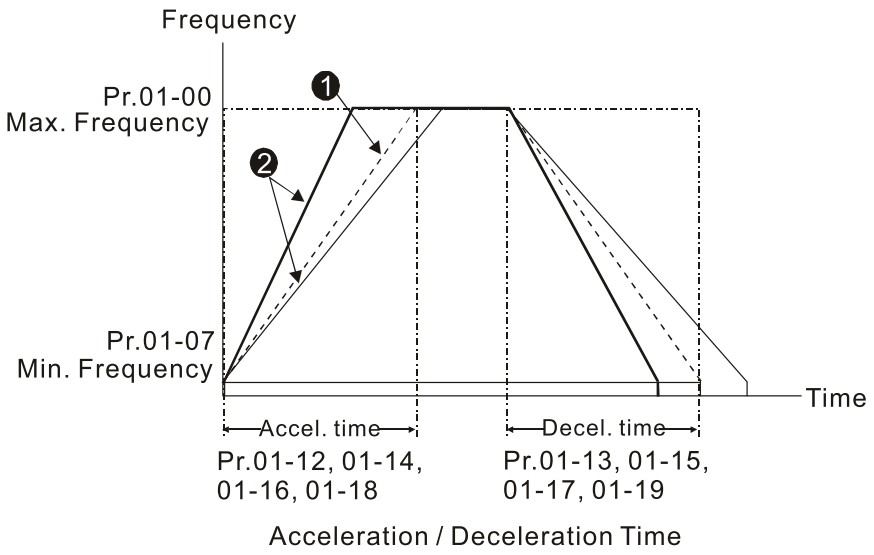
Settings 0: Linear acceleration and deceleration
1: Auto-acceleration and linear deceleration
2: Linear acceleration and auto-deceleration
3: Auto-acceleration and auto-deceleration
4: Stall prevention by auto-acceleration and auto-deceleration (limited by Pr.01-12–Pr.01-21)

0 (Linear acceleration and deceleration):
the drive accelerates and decelerates according to the setting for Pr.01-12–Pr.01-19.

1 or 2 (auto / linear acceleration and auto / linear deceleration):
the drive auto-tunes the acceleration and deceleration to effectively reduce the mechanical vibration during the load start-up and stop and make the auto-tuning process easier. It does not stall during acceleration and does not need a brake resistor during deceleration to stop. It can also improve operation efficiency and save energy.

3 (auto-acceleration and auto-deceleration–decelerating by the actual load): the drive auto-detects the load torque and automatically accelerates from the fastest acceleration time and smoothest start-up current to the setting frequency. During deceleration, the drive automatically determines the loaded regenerative energy to steadily and smoothly stop the motor in the fastest deceleration time.

4 (stall prevention by auto-acceleration and deceleration–reference to the acceleration and deceleration time settings): if the acceleration and deceleration time are within a reasonable range, the actual acceleration and deceleration time refer to the Pr.01-12–Pr.01-19 settings. If the acceleration and deceleration time are too short, the actual acceleration and deceleration time are greater than the acceleration and deceleration time settings.



❶ Optimize the acceleration / deceleration time when Pr.01-44 is set to 0.
❷ Optimize the acceleration / deceleration time which load needs actually when Pr.01-44 is set to 3.

01-45 Time Unit for Acceleration and Deceleration and S-curve

Default: 0

Settings 0: Unit 0.01 sec.
1: Unit 0.1 sec.

01-46 CANopen Quick Stop Time

Default: 1.00

Settings Pr.01-45 = 0: 0.00–600.00 sec.
Pr.01-45 = 1: 0.0–6000.0 sec.

Sets the time required to decelerate from the maximum operation frequency (Pr.01-00) to 0.00 Hz through the CANopen control.

01-49 Regenerative Energy Restriction Control Method

Default: 0

Settings 0: No function
1: Over voltage energy restriction
2: Traction energy control (TEC)
3: Electromagnetic energy traction control

- 0: The drive decelerates or stops based on the original deceleration time settings.
- The actual deceleration time of the motor is longer than the deceleration time setting because of the over-voltage stall prevention.
- 1: During deceleration, the drive controls the motor according to the setting for Pr.06-01 and the recovery voltage of the DC bus. The controller starts when the DC bus voltage reaches 95% of Pr.06-01. When Pr.06-01 is set to 0, the drive controls the motor according to the operating voltage and the recovery voltage of the DC bus. This method decelerates according to the setting for the deceleration time. The fastest actual deceleration time is not less than the deceleration time setting.
- 2: During deceleration, the drive controls the motor according to the setting for Pr.06-01 and the DC bus voltage. The controller starts when the DC bus voltage reaches 95% of Pr.06-01, auto-tunes the output frequency and the output voltage to accelerate the consumption of the regenerative energy according to the drive's capability, and the deceleration time is the result of the drive's auto-tuning. Use this setting when over-voltage occurs due to unexpected deceleration time. Use with Pr.06-02 = 1 to get better deceleration over-voltage suppression effect.
- 3: During operation (acceleration / steady speed / deceleration), the drive adjusts the output voltage according to the amount of regenerative energy and consumes the regenerative energy timely to reduce the risk of over-voltage. The voltage incremental slope can be adjusted through Pr.07-05.

13-2-02 Digital Input / Output Parameters

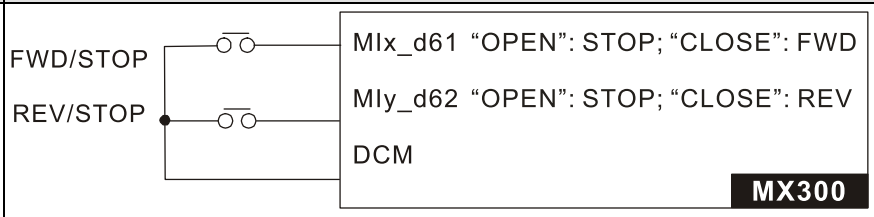
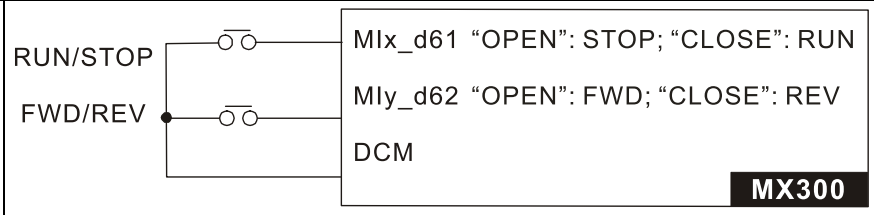
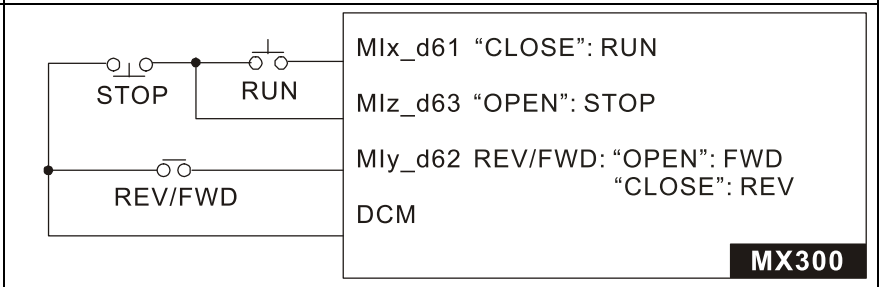
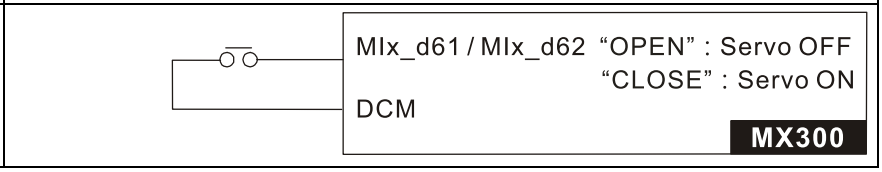
You can set this parameter during operation.

02-00 Two-wire / Three-wire Operation Control

Default: 1

Settings 0: No function
1: Two-wire mode 1, power on for operation control
(MIx_d61: FWD / STOP, MIy_d62: REV / STOP)
2: Two-wire mode 2, power on for operation control
(MIx_d61: RUN / STOP, MIy_d62: REV / FWD)
3: Three-wire, power ON for operation control
(MIx_d61: RUN, MIy_d62: REV / FWD, MIz_d63: STOP)
7: One-wire (MIx_d61: RUN / STOP or MIx_d62: REV / STOP)

This parameter sets the configuration of the external drive operation control and the Quick Start function. There are six different control modes listed in the following table.

Pr.02-00	External Terminal Control Circuits
Setting value: 1 Two-wire operation control FWD / STOP REV / STOP	
Setting value: 2 Two-wire operation control RUN / STOP REV / FWD	
Setting value: 3 Three-wire operation control	
Setting value: 7 Single-wire operation control	

02-01	Multi-function Input Command 1 (MI1)
02-02	Multi-function Input Command 2 (MI2)
02-03	Multi-function Input Command 3 (MI3)
02-04	Multi-function Input Command 4 (MI4)
02-05	Multi-function Input Command 5 (MIO1)
02-06	Multi-function Input Command 6 (MIO2)
02-07	Multi-function Input Command 7 (MIO3)
02-08	Multi-function Input Command 4 (MIO4)
02-26	Input Terminal of I/O Extension Card (MI9)
02-27	Input Terminal of I/O Extension Card (MI10)
02-28	Input Terminal of I/O Extension Card (MI11)
02-29	Input Terminal of I/O Extension Card (MI12)
02-30	Input Terminal of I/O Extension Card (MI13)
02-31	Input Terminal of I/O Extension Card (MI14)
02-32	Input Terminal of I/O Extension Card (MI15)
02-33	Input Terminal of I/O Extension Card (MI16)

Default: 0

Settings Refer to the Summary of Function Settings below.

- Use these parameters to set the function of multi-function terminals.
- When Pr.02-00 = 0, you can set multi-function options with multi-function input terminals MI1, MI2.
- When Pr.02-00 ≠ 0, the multi-function input terminals MI1, MI2 work in accordance with the setting values for Pr.02-00.

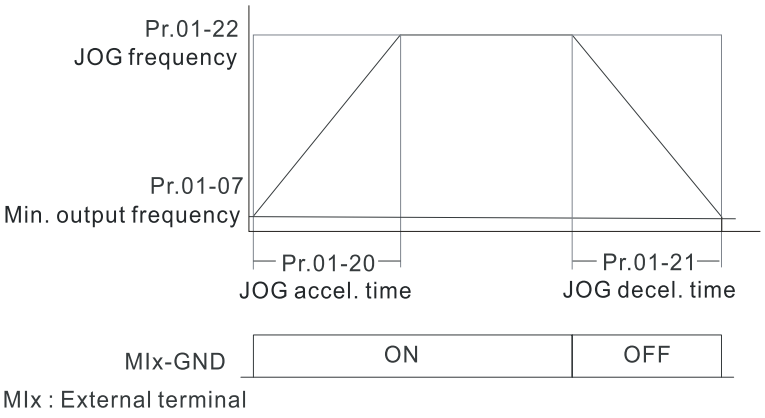
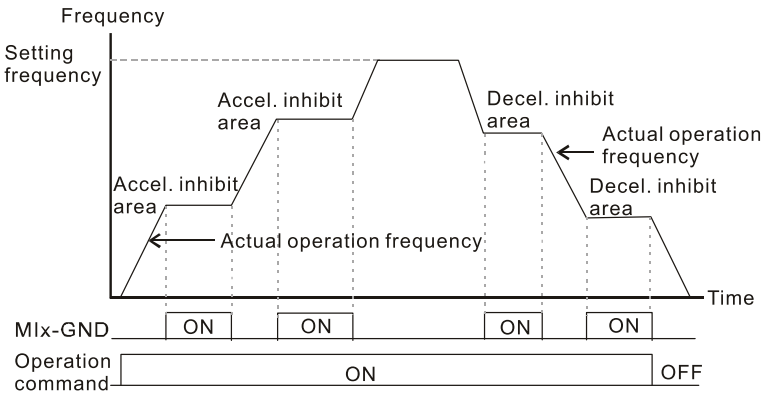
  For example:

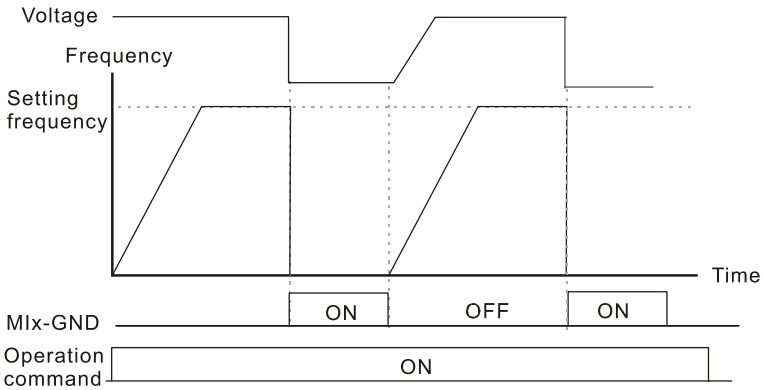
  If Pr.02-00 = 1: multi-function input terminal MI1 = FWD / STOP, MI2 = REV / STOP.

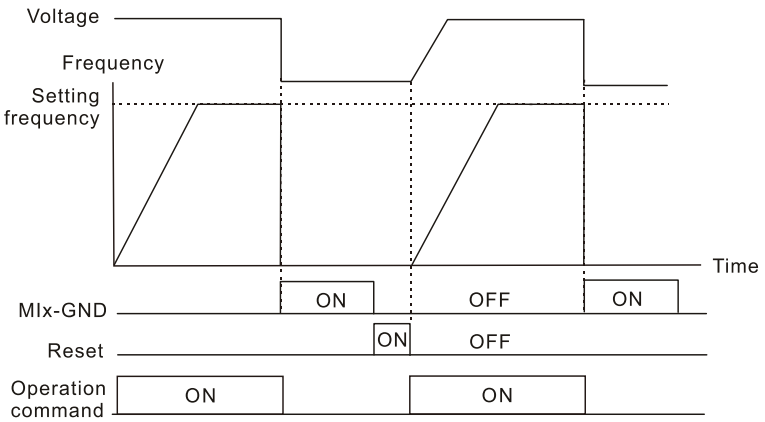
  If Pr.02-00 = 2: multi-function input terminal MI1 = RUN / STOP, MI2 = FWD / REV.
- If Pr.02-00 is set to three-wire operation control, terminal MI3 is for the STOP contact. The function set previously for this terminal is automatically invalid.

Summary of Function Settings (Take the normally open contact (N.O.) for example, ON: contact is closed, OFF: contact is open)

Setting	Function	Descriptions
0	No function	
1	Multi-step speed command 1	You can set 15 steps of speed or 15 positions with the digital status of these four terminals. You can use 16-steps of speed if you include the master speed (refer to Parameter Group 04 Multi-step Speed Parameters).
2	Multi-step speed command 2	
3	Multi-step speed command 3	
4	Multi-step speed command 4	
5	Reset	Use this terminal to reset the drive after clearing a drive fault.

Setting	Function	Descriptions
6	JOG command	This function is valid when the source of the operation command is the external terminals. The JOG operation executes when the drive stops completely. While running, you can still change the operation direction, and the STOP key on the keypad* and the STOP command from communications are valid. Once the external terminal receives the OFF command, the motor stops in the JOG deceleration time. Refer to Pr.01-20–01-22 for details. *: This function is valid when Pr.00-32 is set to 1.  MIx : External terminal
7	Acceleration / deceleration speed inhibit	When you enable this function, the drive stops acceleration or deceleration immediately. After you disable this function, the AC motor drive starts to accelerate or decelerate from the inhibit point. 
8	1st and 2nd acceleration / deceleration time selection	You can select the acceleration and deceleration time of the drive with this function, or from the digital status of the terminals; there are four acceleration and deceleration selections.
9	3rd and 4th acceleration / deceleration time selection	
10	External Fault (EF) input	For external fault input. The drive decelerates according to the Pr.07-20 setting, and the keypad shows “EF” (it shows the fault record when an external fault occurs). The drive keeps running until the fault is cleared (terminal status restored) after RESET.

Setting	Function	Descriptions
11	B.B. inputs from external (B.B.: Base Block)	ON: the output of the drive stops immediately. The motor is in free run and the keypad displays the B.B. signal. Refer to Pr.07-08 for details.
12	Output stop	ON: the output of the drive stops immediately and the motor is in free run status. The drive is in output waiting status until the switch is turned to OFF, and then the drive restarts and runs to the current setting frequency. 
13	Cancel the setting of auto-acceleration / auto-deceleration time	Set Pr.01-44 to one of the 01–04 setting modes before using this function. When this function is enabled, OFF is for auto mode and ON is for linear acceleration / deceleration.
15	Rotating speed command from AI1	ON: force the source of the drive's frequency to be AI1. (If the rotating speed commands are set to AI1 and AI2 at the same time, the priority is AI1 > AI2.)
16	Rotating speed command from AI2	ON: force the source of the drive's frequency to be AI2. (If the rotating speed commands are set to AI1 and AI2 at the same time, the priority is AI1 > AI2.)
18	18: Force to stop (Pr.07-20)	ON: the drive ramps to a stop according to the Pr.07-20 setting.
19	Digital up command	ON: the frequency of the drive increases or decreases by one unit. If this function remains ON continuously, the frequency increases or decreases according to Pr.02-09 / Pr.02-10. The Frequency command returns to zero when the drive stops and the displayed frequency is 0.00 Hz. If you select Pr.11-00, bit 7 = 1, the frequency is not saved.
20	Digital down command	
21	PID function disabled	ON: the PID function is disabled.
22	Clear the counter	ON: the current counter value is cleared and displays 0. The drive counts up when this function is disabled.
24	FWD JOG command	This function is valid when the source of the operation command is the external terminal. ON: the drive executes forward JOG.
25	REV JOG command	This function is valid when the source of the operation command is the external terminal. ON: the drive executes reverse JOG.

<table>
<tr><th>Setting</th><th>Function</th><th>Descriptions</th></tr>
<tr><td>28</td><td>Emergency stop (EF1)</td><td>ON: the output of the drive stops immediately, displays “EF1” on the keypad, and the motor is in free run status. The drive keeps running until the external fault is cleared after you press RESET on the keypad.
(EF: External Fault)

</td></tr>
<tr><td>38</td><td>Disable writing EEPROM function (parameter memory is disabled)</td><td>ON: writing to EEPROM is disabled. Changed parameters are not saved after powering off.</td></tr>
<tr><td>40</td><td>Force coasting to stop</td><td>ON: during operation, the motor coasts to stop.</td></tr>
<tr><td>41</td><td>HAND switch</td><td rowspan="2">● When the MI terminal switches to OFF, it executes a STOP command. Therefore, if the MI terminal switches to OFF during operation, the drive stops.
● Use the optional keypad KPC-CC01 to switch between HAND and AUTO. The drive stops first, and then switches to HAND or AUTO status.
● The optional digital keypad KPC-CC01 displays the current status of the drive (HAND / OFF / AUTO).
<table>
<tr><th></th><th>bit 1</th><th>bit 0</th></tr>
<tr><td>OFF</td><td>0</td><td>0</td></tr>
<tr><td>AUTO</td><td>0</td><td>1</td></tr>
<tr><td>HAND</td><td>1</td><td>0</td></tr>
<tr><td>OFF</td><td>1</td><td>1</td></tr>
</table></td></tr>
<tr><td>42</td><td>AUTO switch</td></tr>
<tr><td>49</td><td>Enable drive</td><td>When the drive is enabled, the RUN command is valid. When the drive is disabled, the RUN command is invalid. When the drive is operating, the motor coasts to stop. This function varies with MO = 45.</td></tr>
<tr><td>50</td><td>Slave dEb action to execute</td><td>Enter the message setting in this parameter when the master triggers dEb. This ensures that the slave also triggers dEb, then the master and slave stop simultaneously.</td></tr>
<tr><td>53</td><td>Trigger CANopen quick stop</td><td>When this function is enabled under CANopen control, it changes to Quick Stop. Refer to Chapter 7 CANopen Salve for more details.</td></tr>
</table>

<table>
<tr><th>Setting</th><th>Function</th><th>Descriptions</th></tr>
<tr><td>56</td><td>Local / Remote selection</td><td>Use Pr.00-29 to select for LOCAL / REMOTE mode (refer to Pr.00-29 for details). When Pr.00-29 is not set to 0, the digital keypad KPC-CC01 displays the LOC / REM status.
<table>
<tr><td></td><td>bit 0</td></tr>
<tr><td>REM</td><td>0</td></tr>
<tr><td>LOC</td><td>1</td></tr>
</table></td></tr>
<tr><td>61</td><td>Multi-wire operation command 1</td><td>When Pr.02-00 is set to 1 or 7, this terminal function is FWD / STOP.
When Pr.02-00 is set to 2, this terminal function is RUN / STOP.
When Pr.02-00 is set to 3, this terminal function is RUN.</td></tr>
<tr><td>62</td><td>Multi-wire operation command 2</td><td>When Pr.02-00 is set to 1 or 7, this terminal function is REV / STOP.
When Pr.02-00 is set to 2 or 3, this terminal function is REV / FWD.</td></tr>
<tr><td>63</td><td>Multi-wire operation command 3</td><td>When Pr.02-00 is set to 3, this terminal function is STOP.</td></tr>
<tr><td>70</td><td>Force auxiliary frequency return to 0</td><td>Forces the auxiliary frequency return to 0 when using this function. PID keeps operating if PID is the master frequency. When Pr.00-35 ≠ 0, the master and auxiliary frequencies are enabled, and then selecting this function with the terminal effectively forces the auxiliary frequency return to 0.</td></tr>
<tr><td>71</td><td>Disable PID function, force PID output return to 0</td><td>When the master and auxiliary frequencies are enabled and when using the PID function, ON: PID does not operate, returns the integral value to 0, and forces the PID output return to 0.</td></tr>
<tr><td>72</td><td>Disable PID function, retain the output value before disabled</td><td>When the master and auxiliary frequencies are enabled, and the PID function is enabled, ON: PID does not operate, and its output value remains the same as the value before it was disabled.</td></tr>
<tr><td>73</td><td>Force PID integral gain return to 0, disable integral</td><td>ON: PID continues to operate, disables the integral control, and returns the integral value to 0.</td></tr>
<tr><td>74</td><td>Reverse PID feedback</td><td>ON: PID negative feedback becomes positive feedback, or PID positive feedback becomes negative feedback.</td></tr>
<tr><td>83</td><td>Multi-motor (IM) selection bit 0</td><td>ON: parameters can be changed. Example: MI1 = 83
<table>
<tr><th rowspan="2">MI1</th><th rowspan="2">Motor Selection</th><th colspan="2">Related Motor Parameter</th></tr>
<tr><th>Max. Operation Frequency</th><th>V/F Curve Parameters</th></tr>
<tr><td>OFF</td><td>Motor 1</td><td>Pr.01-00</td><td>Pr.01-01–01-08</td></tr>
<tr><td>ON</td><td>Motor 2</td><td>Pr.01-52</td><td>Pr.01-35–01-42</td></tr>
</table></td></tr>
<tr><td>98</td><td>Simple positioning FWD stop limit</td><td>When the motor receives this signal while FWD, the motor will stop FWD.</td></tr>
</table>

Setting	Function	Descriptions
99	Simple positioning REV stop limit	When the motor receives this signal while REV, the motor will stop REV.

02-09 External Terminals UP / DOWN Key Mode

Default: 0

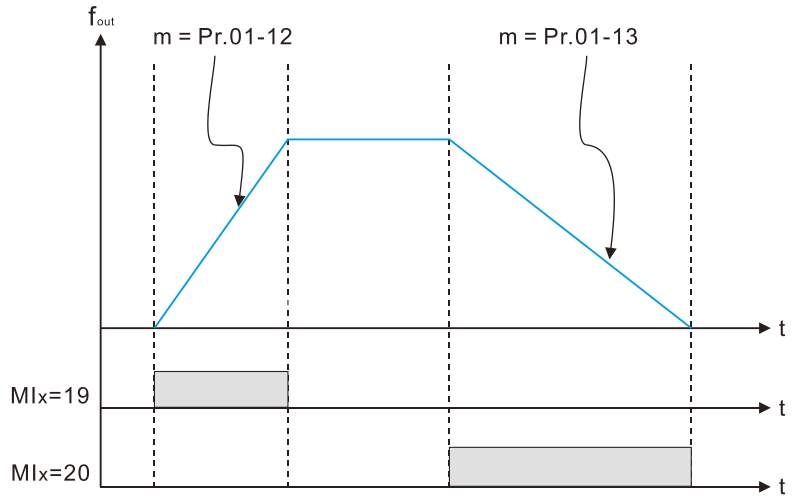
Settings 0: UP / DOWN by the acceleration / deceleration time
1: UP / DOWN constant speed (Pr.02-10)
3: External terminals UP / DOWN key mode

02-10 External Terminal Constant Speed, Accel. / Decel. Speed of the UP / DOWN Key

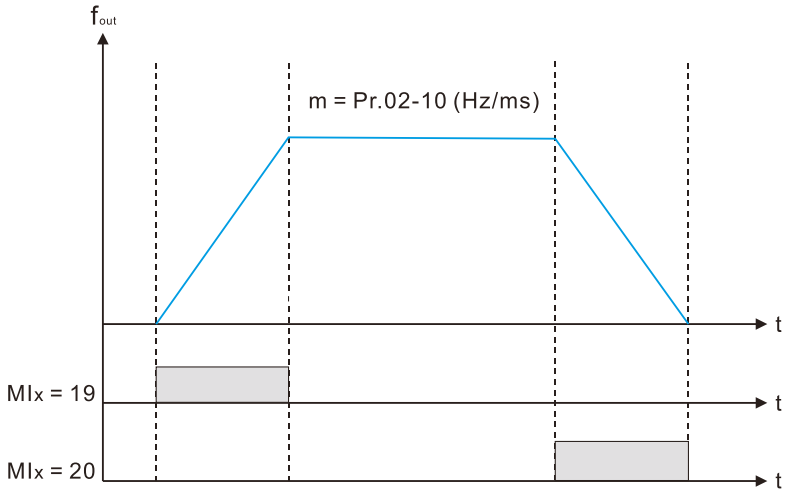
Default: 0.001

Settings 0.001–1.000 Hz / ms

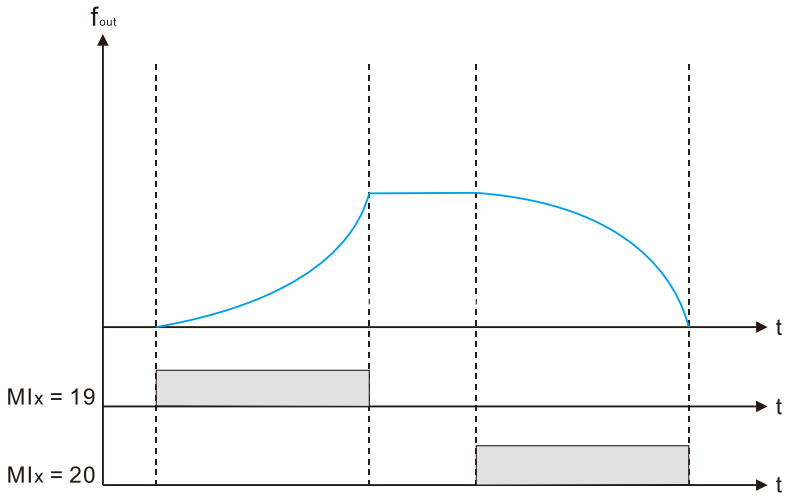
- Use when the multi-function input terminals are set to 19, 20 (Digital UP / DOWN command). The frequency increases or decreases according to Pr.02-09 and Pr.02-10.
- When Pr.11-00 bit 7 = 1, the frequency is not saved. The Frequency command returns to zero when the drive stops, and the displayed frequency is 0.00 Hz. At this time, increasing or decreasing the Frequency command (F) by using the UP or DOWN key is valid only when the drive is running.
- When Pr.02-09 is set to 0: The increasing or decreasing Frequency command (F) operates according to the setting for acceleration or deceleration time (refer to Pr.01-12–01–19).



- When Pr.02-09 is set to 1: The increasing or decreasing Frequency command (F) operates according to the setting of Pr.02-10 (0.01–1.000 Hz/ms).



When Pr.02-09 is set to 3: The increasing or decreasing Frequency command (F) operates according to the exponential curve .



02-11 Multi-function Input Response Time

Default: 0.005

Settings 0.000–30.000 sec.

Use this parameter to set the response time of the digital input terminals MI1–MI5.

This function is to delay and confirm the digital input terminal signal. The time for delay is also the time for confirmation. The confirmation prevents interference that could cause error in the input to the digital terminals. But in the meanwhile, it delays the response time though confirmation improves accuracy.

02-12 Multi-function Input Mode Selection

Default: 0

Settings 0–65535

The parameter setting is in decimal.

This parameter sets the status of the multi-function input signal (0: normally open; 1: normally closed) and it is not affected by the status of SINK / SOURCE.

bit 0–bit 3 correspond to MI1–MI4, bit 4–bit 7 correspond to MIO1–MIO4.

If the MI1 and MI2 are not used as two-wire / three-wire control method, set Pr.02-00 = 0. Then set this parameter according to the functional requirements of terminals MI1 and MI2 (referring to Pr.02-01 and Pr.02-02).

You can change the terminal ON / OFF status through communications.

For example:

MI1 is set to 61 (FWD / STOP) and MI2 is set to 62 (REV / STOP). MI3 is set to 1 (multi-step speed command 1) and MI4 is set to 2 (multi-step speed command 2).

Then the forward + second step speed command = $1001_2 = 9_{10}$.

As long as Pr.02-12 = 9 is set through communications, there is no need to wire any multi-function terminal to run forward with the second step speed.

bit 7	bit 6	bit 5	bit 4	bit 3	bit 2	bit 1	bit 0
MIO4	MIO3	MIO2	MIO1	MI4	MI3	MI2	MI1

📖 Use Pr.11-42 bit 1 to select whether FWD / REV terminal is controlled by Pr.02-12 bit 0 and bit 1.

02-13 Multi-function Output 1 (RY1)

Default: 11

02-14 Multi-function Output 1 (MIO1)
02-15 Multi-function Output 2 (MIO2)
02-16 Multi-function Output 3 (MIO3)
02-17 Multi-function Output 4 (MIO4)
02-36 Output Terminal of Extension Card (MO9)
02-37 Output Terminal of Extension Card (MO10)
02-38 Output Terminal of Extension Card (MO11)
02-39 Output Terminal of Extension Card (MO12)
02-40 Output Terminal of Extension Card (MO13)
02-41 Output Terminal of Extension Card (MO14)
02-42 Output Terminal of Extension Card (MO15)
02-43 Output Terminal of Extension Card (MO16)

Default: 0

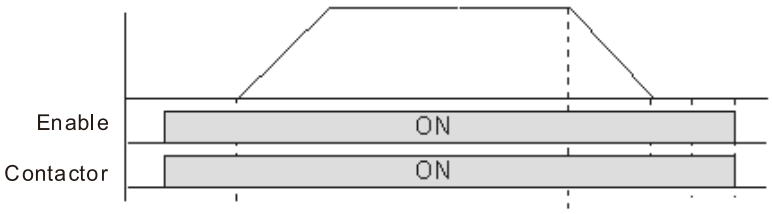
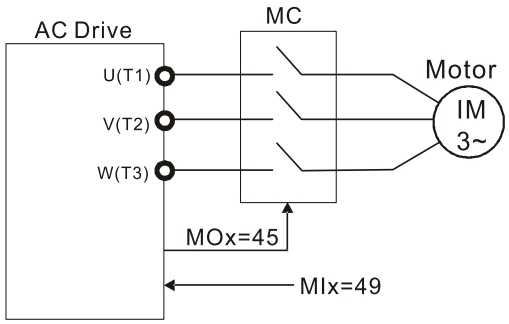
Settings Refer to the Summary of Function Settings below.

📖 Use this parameter to set the function of multi-function terminals.

Summary of function settings (Take the normally open contact (N.O.) for example, ON: contact is closed, OFF: contact is open)

Setting	Function	Descriptions
0	No function	Output terminal with no function
1	Indication during RUN	Activates when the drive is not in STOP.
2	Operation speed reached	Activates when output frequency of drive reaches to the setting frequency.
3	Desired frequency reached 1 (Pr.02-22)	Activates when the desired frequency (Pr.02-22) is reached.
4	Desired frequency reached 2 (Pr.02-24)	Activates when the desired frequency (Pr.02-24) is reached.
5	Zero speed (Frequency command)	Activates when Frequency command = 0 (The drive must be in RUN status).

Setting	Function	Descriptions
6	Zero speed including STOP (Frequency command)	Activates when Frequency command = 0 or stopped.
7	Over torque 1	Activates when the drive detects over-torque. Pr.06-07 sets the over-torque detection level, and Pr.06-08 sets the over-torque detection time. (Refer to Pr.06-06–06-08)
8	Over torque 2	Activates when the drive detects over-torque. Pr.06-10 sets the over-torque detection level, and Pr.06-11 sets the over-torque detection time. (Refer to Pr.06-09–06-11)
9	Drive is ready	Activates when the drive is ON with no error detected.
10	Low voltage warning (Lv)	Activates when an extremely low voltage at DC side is detected (refer to Pr.06-00 Low Voltage Level).
11	Malfunction indication	Activate when fault occurs (except Lv stop).
13	Overheat warning	Activates when IGBT or heat sink overheats to prevent the drive from shutting down due to overheating. (Refer to Pr.06-15)
15	Abnormal PID feedback (Pr.08-13, 08-14)	Activates when the PID feedback signal error is detected.
16	Slip error (oSL)	Activates when the slip error is detected.
17	Count value reached (Pr.02-20)	When the drive executes external counter, this contact activates if the count value is equal to the setting value for Pr.02-20. This contact deactivates when the setting for Pr.02-20 > Pr.02-19.
18	Count value reached (Pr.02-19)	When the drive executes the external counter, this contact activates if the count value is equal to the setting for Pr.02-19.
19	B.B. inputs from external (Base Block)	Activates when external interrupt (B.B.) occurs in the drive and stops outputting .
20	Warning output	Activates when a warning is detected.
21	Over-voltage	Activates when over-voltage is detected. (Refer to Chapter 8 over-voltage related fault description for the action level.)
22	Over-current stall prevention	Activates when the over-current stall prevention is detected.
23	Over-voltage stall prevention	Activates when over-voltage stall prevention is detected.
24	Operation source	Activates when the source of operation command is not controlled by the digital keypad (Pr.00-21 ≠ 0).
25	Forward command	Activates when the operation direction is forward.
26	Reverse command	Activates when the operation direction is reverse.
27	Output when current > Pr.02-46	Activates when current level is > Pr.02-46
28	Output when current < Pr.02-46	Activates when current level is < Pr.02-46

Setting	Function	Descriptions
29	Output when frequency ≥ Pr.02-34	Activates when frequency is < Pr.02-34. (Actual output H ≥ Pr.02-34)
30	Output when frequency < Pr.02-34	Activates when frequency is < Pr.02-34. (Actual output H < Pr.02-34)
33	Zero speed (actual output frequency)	Activates when the actual output frequency is 0. (The drive is in RUN mode)
34	Zero speed including stop (output frequency)	Activates when the actual output frequency is 0 or stopped.
35	Error output selection 1	Activates when Pr.06-23 is ON.
36	Error output selection 2	Activates when Pr.06-24 is ON.
37	Error output selection 3	Activates when Pr.06-25 is ON.
38	Error output selection 4	Activates when Pr.06-26 is ON.
40	Speed reached (including Stop)	Activates when the drive's output frequency reaches the setting frequency or stopped.
42	Crane function	Use this function with Pr.02-34 and Pr.02-58. Refer to Pr.02-34 and 02-58 for details and application examples.
43	Motor speed detection	Activates when the motor speed is less than Pr.02-47.
44	Low current output	Use this function with Pr.06-71–Pr.06-73.
45	UVW output electromagnetic valve switch	Use this function with external terminal input = 49 (drive enabled) and external terminal output = 45 (electromagnetic valve enabled), and then the electromagnetic valve is ON or OFF according to the status of the drive.  
46	Master dEb output	When dEb rises at the master, MO sends a dEb signal to the slave. Output the message when the master triggers dEb. This ensures that the slave also triggers dEb. Then the slave follows the deceleration time of the master to stop simultaneously with the master.

Setting	Function	Descriptions
67	Analog input level reached	The multi-function output terminals operate when the analog input level is between the high level and the low level. Pr.03-44: Select one of the analog input channels (AI1, AI2) to be compared. Pr.03-45: The high level for the analog input, default is 50%. Pr.03-46: The low level for the analog input, default is 10%. If analog input > Pr.03-45, the multi-function output terminal operates. If analog input < Pr.03-46, the multi-function output terminal stops outputting.

02-18 Multi-function Output Direction

Default: 0000h

Settings 0000h–FFFFh (0: N.O.; 1: N.C.)

- The parameter is in hexadecimal.
- This parameter is set by a bit. If the bit is 1, the corresponding multi-function output acts in an opposite way. Example: Assume Pr.02-13 = 1 (indication when the drive is operating). If the output is positive, and the bit is set to 0, then Relay is ON when the drive runs and is OFF when the drive stops. On the contrary, if the output is negative, and the bit is set to 1, then the Relay is OFF when the drive runs and is ON when the drive stops.

bit3	bit2	bit1	bit0
MO1	Reserved	Reserved	RY

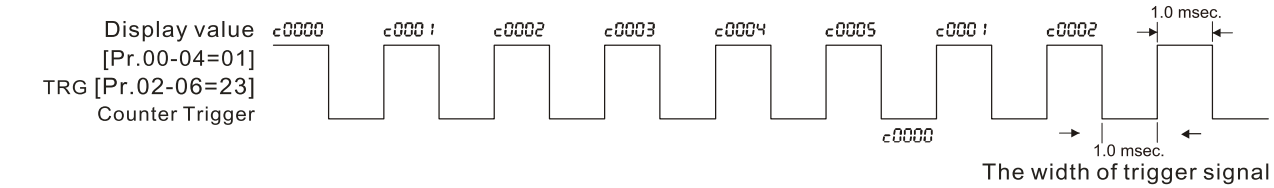
02-19 Terminal Counting Value Reached (Returns to 0)

Default: 0

Settings 0–65500

- The counting function is enabled when Pr.02-19≠0.
- You can set the input point for the counter using the multi-function terminal MI4 as a trigger terminal (set Pr.02-04 to 23). When counting is completed, the specified multi-function output terminal is activated (Pr.02-13 or Pr.02-16 is set to 18).

The timing diagram below shows that when counting to 5, RY1 activates and displays 0.





The timing diagram of
the external counting terminals and the counting value reached

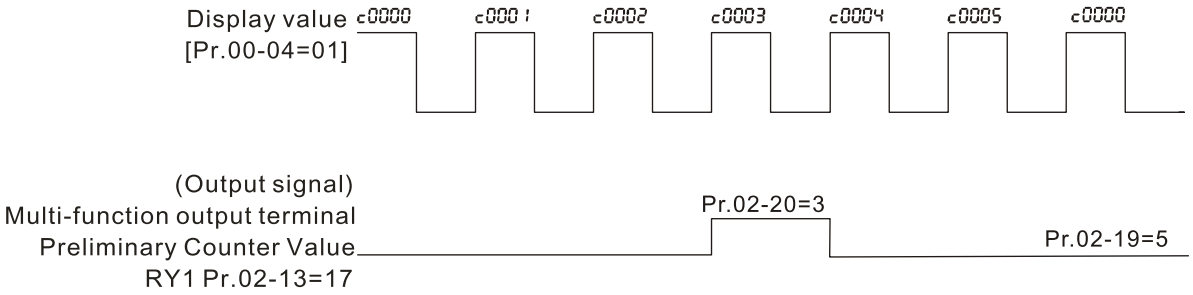
02-20 Preliminary Counting Value Reached (Does not return to 0)

Default: 0

Settings 0–65500

- Use this parameter with Pr.02-19.
- When the count value counts from 1 to reach this value, the corresponding multi-function output terminal is activated (Pr.02-13 and Pr.02-16 are set to 17) and keeps counting to the last count value.
- You can use this parameter as the end of counting to make the drive run from the low speed to stop.

The timing diagram is RY1 activates when the count value is three, and the display returns to zero when counts to five:



The timing diagram of
the external counting terminals and the counting value reached

02-22 Desired Frequency Reached 1
02-24 Desired Frequency Reached 2

Default: 60.00 / 50.00

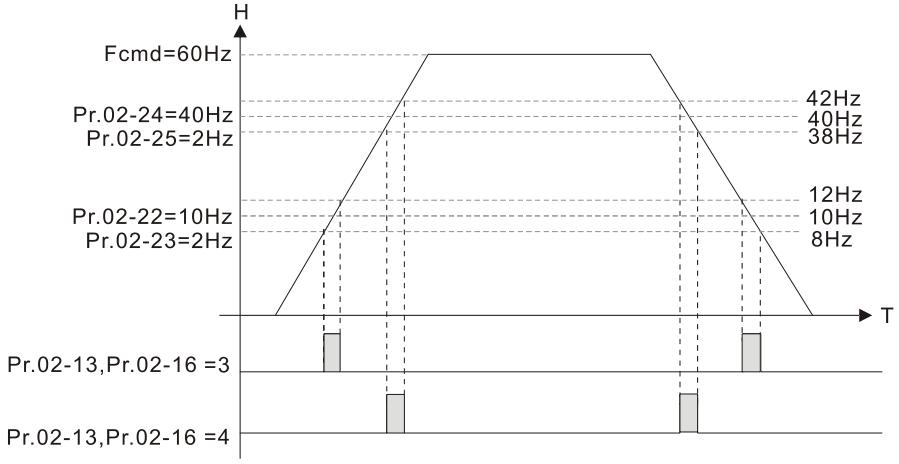
Settings 0.00–599.00 Hz

02-23 The Width of the Desired Frequency Reached 1
02-25 The Width of the Desired Frequency Reached 2

Default: 2.00

Settings 0.00–599.00 Hz

- Once the output speed (frequency) reaches the desired speed (frequency), if the corresponding multi-function output terminal is set to 3 or 4 (Pr.02-13 and Pr.02-16), this multi-function output terminal is “closed”.



02-34 Output Frequency Setting for Multi-function Output Terminal

Default: 0.00

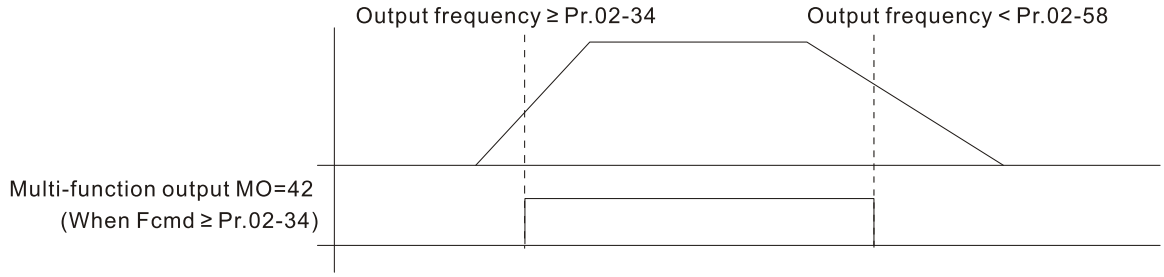
Settings 0.00–599.00 Hz

02-58 Multi-function Output Terminal (Function 42): Brake Frequency Check Point

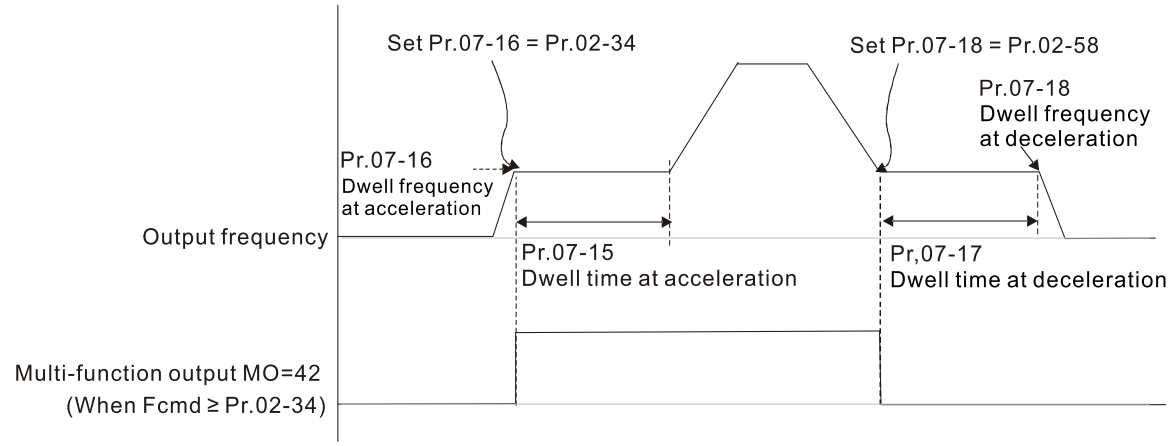
Default: 0.00

Settings 0.00–599.00 Hz

- Pr.02-34 and Pr.02-58 can be applied on setting up cranes. (Choose crane action #42 to set up multi-function output Pr.02-13 and Pr.02-16).
- When the drive outputs frequency is higher than the setting for Pr.02-34 Pivot Point of the Frequency (≥ Pr.02-34), multi-function output are set to 42.
- When the drive output frequency is lower than the setting for Pr.02-58 (< Pr.02-58), disable the setting #42 of the multi-function output.
- Crane application example:



It is recommended that you use this with the Dwell acceleration/deceleration function as shown in the following diagram.



02-35 External Operation Control Selection after Reset and Reboot

Default: 0

Settings 0: Disabled

1: Drive runs if the RUN command remains after reset or reboot.

Setting value as 1: Pay attention that the drive will execute the running command by itself in the following status.

- Situation 1: After the drive is powered on and the external terminal for RUN stays ON, the drive runs.
- Situation 2: After clearing a fault once a fault is detected and the external terminal for RUN stays ON, you can run the drive by pressing the RESET key.

02-46 Output Current Level Setting for Multi-function Output Terminal

Default: 0

Settings 0–100%

When the multi-function output (MO) of Pr.02-13–Pr.02-17 and Pr.02-36–Pr.02-43 is set to 27, and the current output is higher than or equal to the setting level of Pr.02-46, MO output signal.

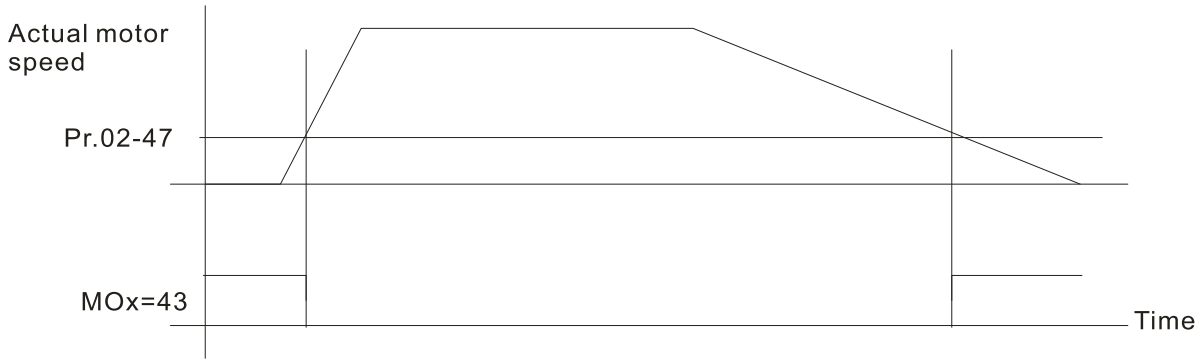
When the multi-function output (MO) of Pr.02-13–Pr.02-17 and Pr.02-36–Pr.02-43 is set to 28, and the current output is lower than the setting level of Pr.02-46, MO output signal.

02-47 Motor Zero-speed Level

Default: 0

Settings 0–65535 rpm

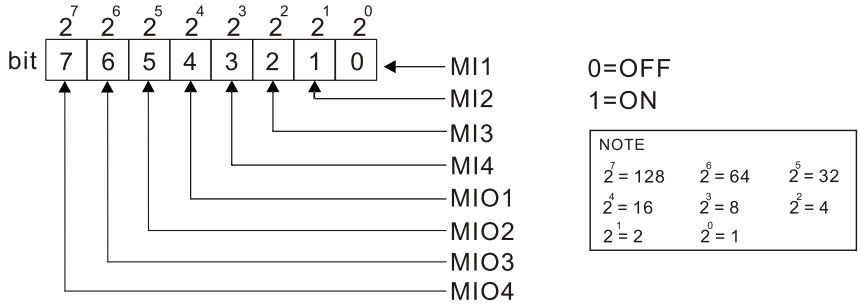
Use this parameter to set the motor's speed level at zero-speed. When the actual speed is lower than this setting, the corresponding multi-function output terminal setting 43 is ON (by default), as shown in the diagram below.



02-50 Display the Status of Multi-function Input Terminal

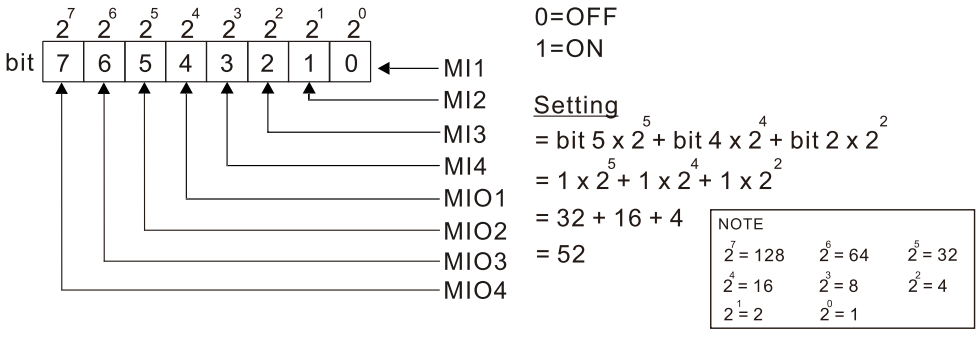
Default: Read only

Settings Monitor the status of the Multi-function Input Terminal



Example:

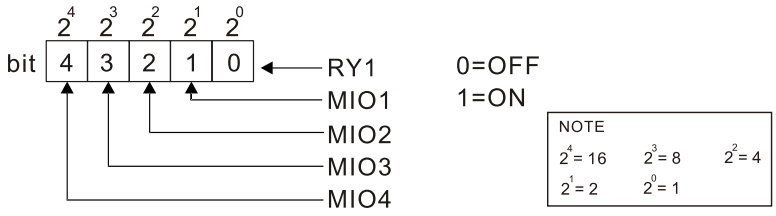
When Pr.02-50 is 0004h (hex), that is, the value is 20 (decimal), and displays 10100 (binary). It means that MI3 and MI5 are ON.



02-51 Display the Status of Multi-function Output Terminal

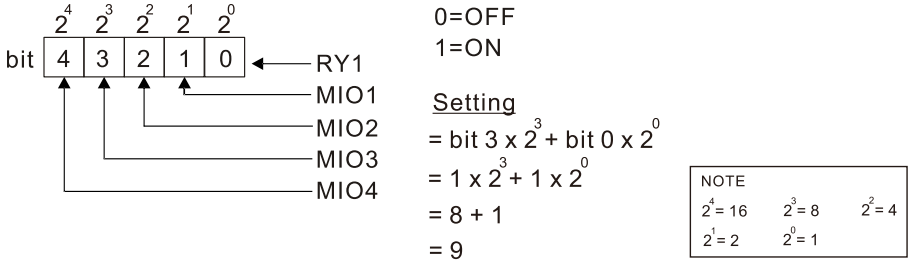
Default: Read only

Settings Monitor the status of the Multi-function Output Terminal



📖 Example:

When Pr.02-51 is 0009h (hex), that is, the value is 9 (decimal), and displays 1001 (binary). It means that Relay and MO1 are ON.



02-54 Display the Frequency Command Executed by External Terminal

Default: Read only

Settings Read only

📖 When you set the source of the Frequency command as the external terminal, if Lv or Fault occurs, the external terminal Frequency command is saved in this parameter.

↗ 02-81 EF Activates when the Terminal Count Value Reached

Default: 0

Settings 0: Terminal count value reached, no EF displays (continues to operate)

1: Terminal count value reached, EF activates

↗ 02-82 Initial Frequency Command (F) Mode after Stop

Default: 0

Settings 0: Use current Frequency command

1: Use zero Frequency command

2: Refer to Pr.02-83 to set up

↗ 02-83 Initial Frequency Command (F) Setting after Stop

Default: 60.00

Settings 0.00–599.00 Hz

13-2-03 Analog Input / Output Parameters

You can set this parameter during operation.

03-00 AI1 Analog Input Selection

Default: 1

03-01 AI2 Analog Input Selection

Default: 0

Settings
0: No function
1: Frequency command
4: PID target value
5: PID feedback signal
6: Thermistor (PTC) input value
11: PT100 thermistor input value
12: Auxiliary frequency input
13: PID compensation value
15: AI is the forward start command
16: AI is the reverse start command

- When you use analog input as the PID reference target input, you must set Pr.00-20 to 2 (external analog input).
  When PID uses frequency as target value, set Pr.03-00 = 1: Frequency command.
  When PID uses pressure, air volume or other targets as target value, set Pr.03-00 = 4: PID target value.
- When you use analog input as the PID compensation value, you must set Pr.08-16 to 1 (source of PID compensation value is analog input). You can see the compensation value with Pr.08-17.
- When using the Frequency command, the corresponding value for 0–10 V / 4–20 mA is 0–max. operation frequency (Pr.01-00).
- When set Pr.03-00 = 15 or 16, AI analog input can be used as a forward start command or a reverse start command.
  Determination conditions:
  - Voltage mode: Start when the voltage value is greater than 80% of 10V, and stop when the voltage value is less than 20% of 10V.
  - Current mode: Start when the current value is greater than 80% of 20mA, and stop when the current value is greater than 20% of 20mA.

03-03 AI1 Analog Input Bias

Default: 0

Settings -100.0–100.0%

- Sets the corresponding AI1 voltage for the external analog input 0.

03-04 AI2 Analog Input Bias

Default: 0

Settings -100.0–100.0%

- Sets the corresponding AI2 voltage for the external analog input 0.

03-07 AI1 Positive / Negative Bias Mode

03-08 AI2 Positive / Negative Bias Mode

Default: 0

Settings
0: No bias
1: Lower than or equal to bias
2: Greater than or equal to bias
3: The absolute value of the bias voltage while serving as the center
4: Bias serves as the center

Using negative bias to set the frequency greatly reduces the noise interference. In a noisy environment, do NOT use signals less than 1 V to set the drive's operation frequency.

03-10 Reverse Setting when Analog Signal Input is Negative Frequency

Default: 0

Settings
0: Negative frequency input is not allowed. The digital keypad or external terminal controls the forward and reverse direction.
1: Negative frequency input is allowed. Positive frequency = run in a forward direction; negative frequency = run in a reverse direction. The digital keypad or external terminal control cannot change the running direction.

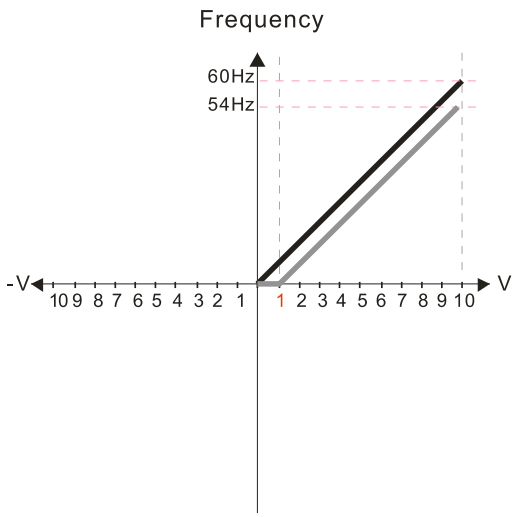
Use this parameter only for AI1 or AI2 analog input.

Requirements for negative frequency (reverse running)

1. Pr.03-10 = 1
2. Bias mode = Bias serves as the center
3. Corresponded analog input gain < 0 (negative); this makes the input frequency negative.

In the diagram below: Black line: Curve with no bias. Gray line: curve with bias

Diagram 01



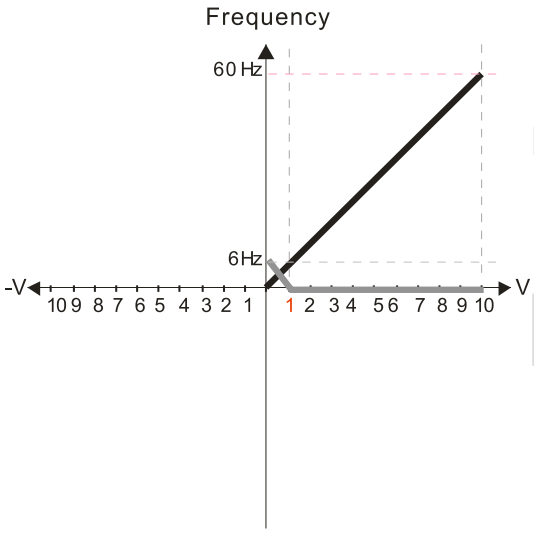
Pr.03-03=10%
Pr.03-07–03-08 (Positive/Negative Bias Mode)

0: No bias
1: Lower than or equal bias
2: Greater than or equal to bias
3: The absolute value of the bias voltage while serving as the center
4: Bias serves as the center

Pr.03-10 (Analog Frequency Command for Reverse Run)
0: Negative frequency is not valid.
Forward and reverse run is controlled by digital keyboard or external terminals.
1: Negative frequency is valid.
Positive frequency = forward run;
negative frequency = reverse run.
Direction can not be switched by digital keypad or external terminal control.

Pr.03-11 Analog input Gain (AI1) = 100%

Diagram 02



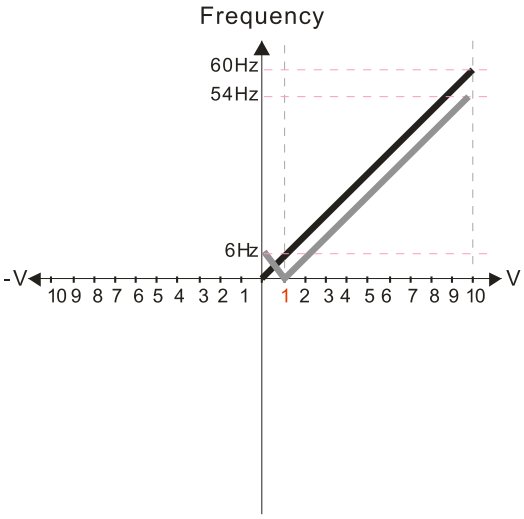
Pr.03-03=10%
Pr.03-07–03-08 (Positive/Negative Bias Mode)

0: No bias
1: Lower than or equal bias
2: Greater than or equal to bias
3: The absolute value of the bias voltage while serving as the center
4: Bias serves as the center

Pr.03-10 (Analog Frequency Command for Reverse Run)
0: Negative frequency is not valid.
Forward and reverse run is controlled by digital keyboard or external terminals.
1: Negative frequency is valid.
Positive frequency = forward run;
negative frequency = reverse run.
Direction can not be switched by digital keypad or external terminal control.

Pr.03-11 Analog input Gain (AI1) = 100%

Diagram 03



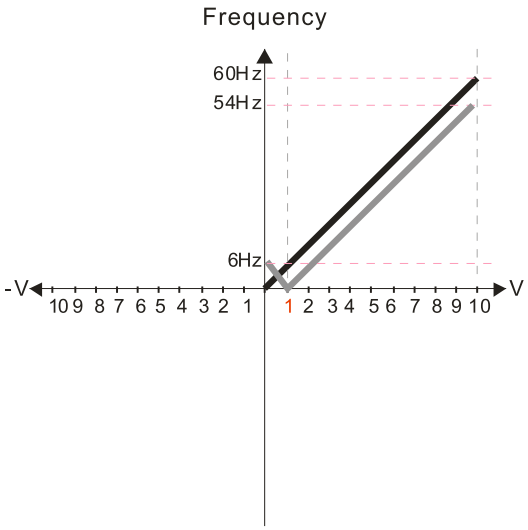
Pr.03-03=10%
Pr.03-07–03-08 (Positive/Negative Bias Mode)

0: No bias
1: Lower than or equal bias
2: Greater than or equal to bias
3: The absolute value of the bias voltage while serving as the center
4: Bias serves as the center

Pr.03-10 (Analog Frequency Command for Reverse Run)
0: Negative frequency is not valid.
Forward and reverse run is controlled by digital keyboard or external terminals.
1: Negative frequency is valid.
Positive frequency = forward run;
negative frequency = reverse run.
Direction can not be switched by digital keypad or external terminal control.

Pr.03-11 Analog input Gain (AI1) = 100%

Diagram 04



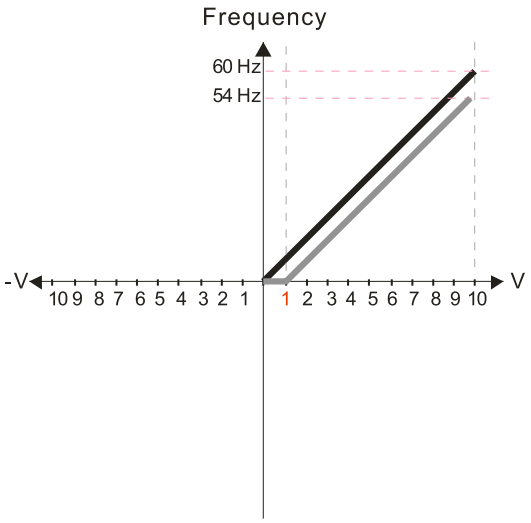
Pr.03-03=10%
Pr.03-07–03-08 (Positive/Negative Bias Mode)

0: No bias
1: Lower than or equal bias
2: Greater than or equal to bias
3: The absolute value of the bias voltage while serving as the center
4: Bias serves as the center

Pr.03-10 (Analog Frequency Command for Reverse Run)
0: Negative frequency is not valid.
Forward and reverse run is controlled by digital keyboard or external terminals.
1: Negative frequency is valid.
Positive frequency = forward run;
negative frequency = reverse run.
Direction can not be switched by digital keypad or external terminal control.

Pr.03-11 Analog input Gain (AI1) = 100%

Diagram 05



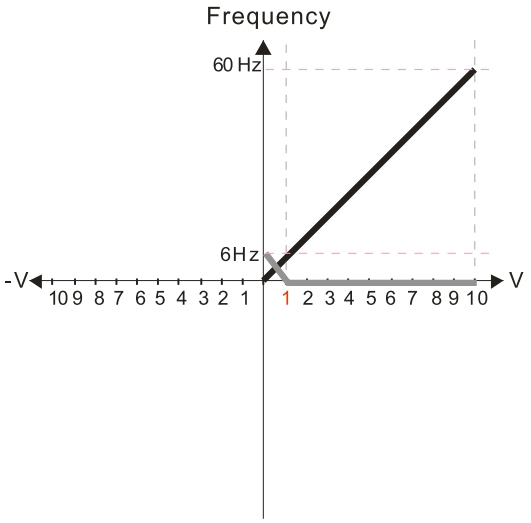
Pr.03-03=10%
Pr.03-07–03-08 (Positive/Negative Bias Mode)

0: No bias
1: Lower than or equal bias
2: Greater than or equal to bias
3: The absolute value of the bias voltage while serving as the center
4: Bias serves as the center

Pr.03-10 (Analog Frequency Command for Reverse Run)
0: Negative frequency is not valid.
Forward and reverse run is controlled by digital keyboard or external terminals.
1: Negative frequency is valid.
Positive frequency = forward run;
negative frequency = reverse run.
Direction can not be switched by digital keypad or external terminal control.

Pr.03-11 Analog input Gain (AI1) = 100%

Diagram 06



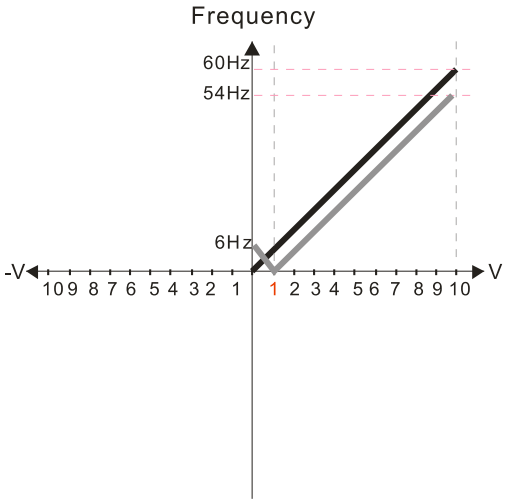
Pr.03-03=10%
Pr.03-07–03-08 (Positive/Negative Bias Mode)

0: No bias
1: Lower than or equal bias
2: Greater than or equal to bias
3: The absolute value of the bias voltage while serving as the center
4: Bias serves as the center

Pr.03-10 (Analog Frequency Command for Reverse Run)
0: Negative frequency is not valid.
Forward and reverse run is controlled by digital keyboard or external terminals.
1: Negative frequency is valid.
Positive frequency = forward run;
negative frequency = reverse run.
Direction can not be switched by digital keypad or external terminal control.

Pr.03-11 Analog input Gain (AI1) = 100%

Diagram 07



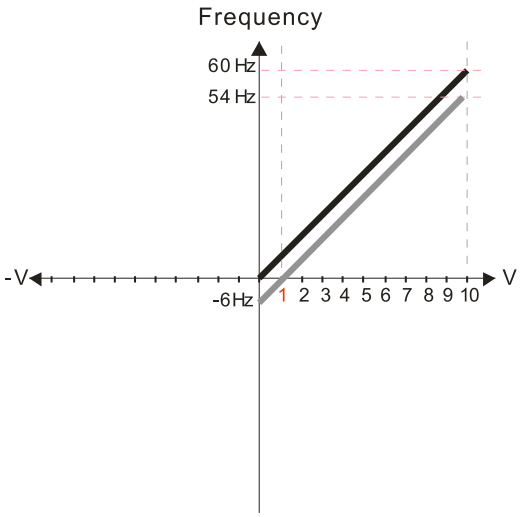
Pr.03-03=10%
Pr.03-07–03-08 (Positive/Negative Bias Mode)

0: No bias
1: Lower than or equal bias
2: Greater than or equal to bias
3: The absolute value of the bias voltage while serving as the center
4: Bias serves as the center

Pr.03-10 (Analog Frequency Command for Reverse Run)
0: Negative frequency is not valid.
Forward and reverse run is controlled by digital keyboard or external terminals.
1: Negative frequency is valid.
Positive frequency = forward run;
negative frequency = reverse run.
Direction can not be switched by digital keypad or external terminal control.

Pr.03-11 Analog input Gain (AI1) = 100%

Diagram 08



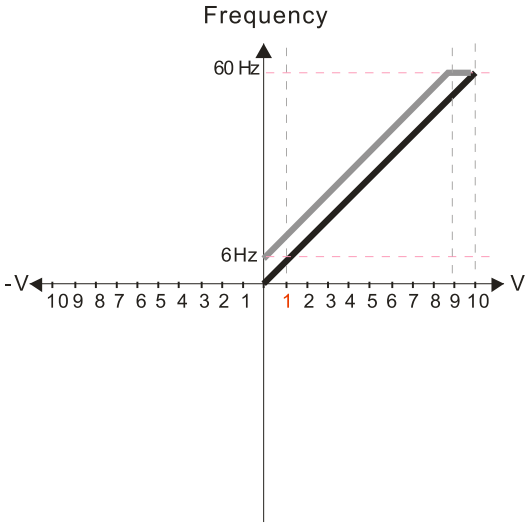
Pr.03-03=10%
Pr.03-07–03-08 (Positive/Negative Bias Mode)

0: No bias
1: Lower than or equal bias
2: Greater than or equal to bias
3: The absolute value of the bias voltage while serving as the center
4: Bias serves as the center

Pr.03-10 (Analog Frequency Command for Reverse Run)
0: Negative frequency is not valid.
Forward and reverse run is controlled by digital keyboard or external terminals.
1: Negative frequency is valid.
Positive frequency = forward run;
negative frequency = reverse run.
Direction can not be switched by digital keypad or external terminal control.

Pr.03-11 Analog input Gain (AI1) = 100%

Diagram 09



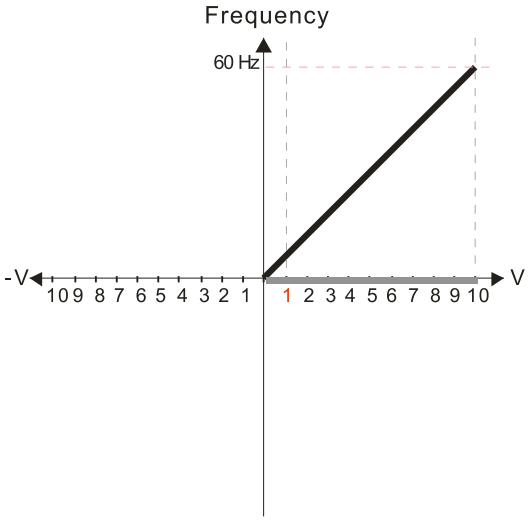
Pr.03-03=10%
Pr.03-07–03-08 (Positive/Negative Bias Mode)

0: No bias
1: Lower than or equal bias
2: Greater than or equal to bias
3: The absolute value of the bias voltage while serving as the center
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0: Negative frequency is not valid.
Forward and reverse run is controlled by digital keyboard or external terminals.
1: Negative frequency is valid.
Positive frequency = forward run;
negative frequency = reverse run.
Direction can not be switched by digital keypad or external terminal control.

Pr.03-11 Analog input Gain (AI1) = 100%

Diagram 10



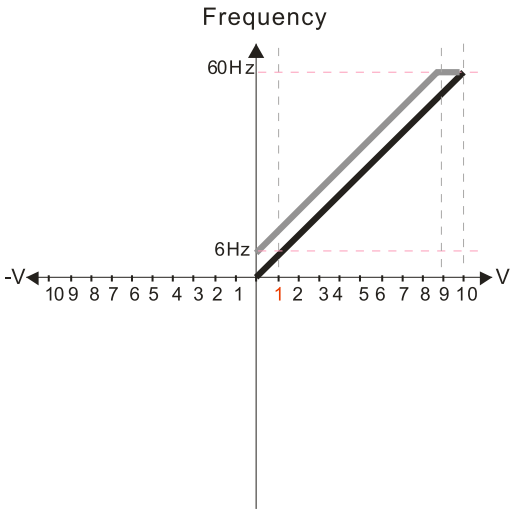
Pr.03-03=10%
Pr.03-07–03-08 (Positive/Negative Bias Mode)

0: No bias
1: Lower than or equal bias
2: Greater than or equal to bias
3: The absolute value of the bias voltage while serving as the center
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Forward and reverse run is controlled by digital keyboard or external terminals.
1: Negative frequency is valid.
Positive frequency = forward run;
negative frequency = reverse run.
Direction can not be switched by digital keypad or external terminal control.

Pr.03-11 Analog input Gain (AI1) = 100%

Diagram 11



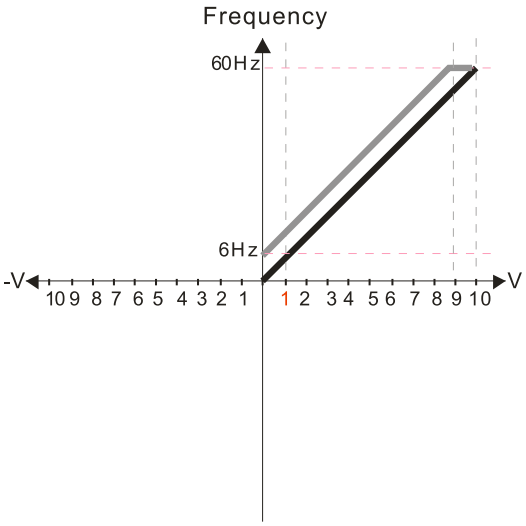
Pr.03-03=10%
Pr.03-07–03-08 (Positive/Negative Bias Mode)

0: No bias
1: Lower than or equal bias
2: Greater than or equal to bias
3: The absolute value of the bias voltage while serving as the center
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negative frequency = reverse run.
Direction can not be switched by digital keypad or external terminal control.

Pr.03-11 Analog input Gain (AI1) = 100%

Diagram 12



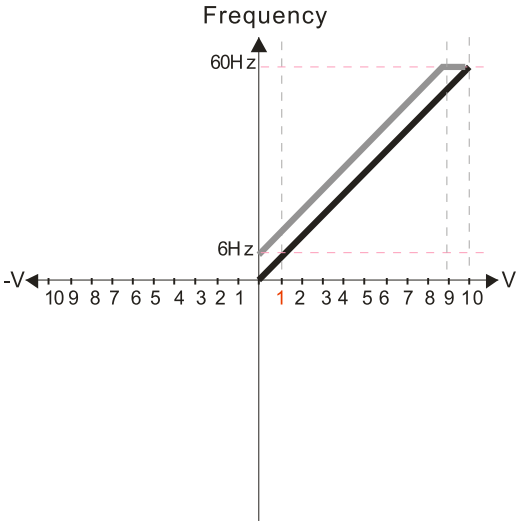
Pr.03-03=10%
Pr.03-07–03-08 (Positive/Negative Bias Mode)

0: No bias
1: Lower than or equal bias
2: Greater than or equal to bias
3: The absolute value of the bias voltage while serving as the center
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Positive frequency = forward run;
negative frequency = reverse run.
Direction can not be switched by digital keypad or external terminal control.

Pr.03-11 Analog input Gain (AI1) = 100%

Diagram 13



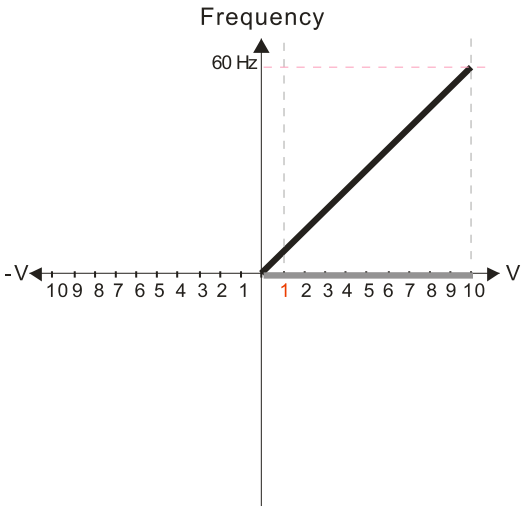
Pr.03-03=10%
Pr.03-07–03-08 (Positive/Negative Bias Mode)

0: No bias
1: Lower than or equal bias
2: Greater than or equal to bias
3: The absolute value of the bias voltage while serving as the center
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negative frequency = reverse run.
Direction can not be switched by digital keypad or external terminal control.

Pr.03-11 Analog input Gain (AI1) = 100%

Diagram 14



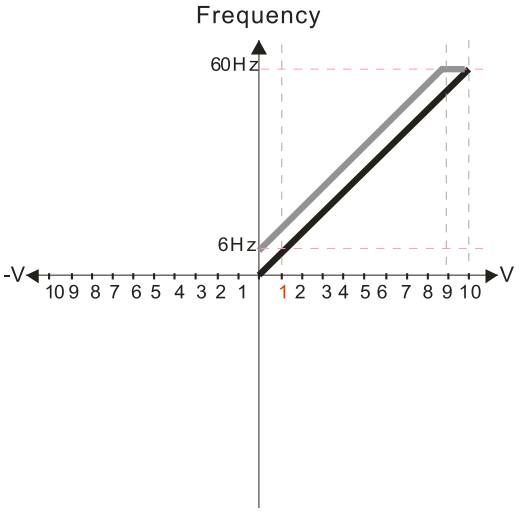
Pr.03-03=10%
Pr.03-07–03-08 (Positive/Negative Bias Mode)

0: No bias
1: Lower than or equal bias
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3: The absolute value of the bias voltage while serving as the center
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1: Negative frequency is valid.
Positive frequency = forward run; negative frequency = reverse run.
Direction can not be switched by digital keypad or external terminal control.

Pr.03-11 Analog input Gain (AI1) = 100%

Diagram 15



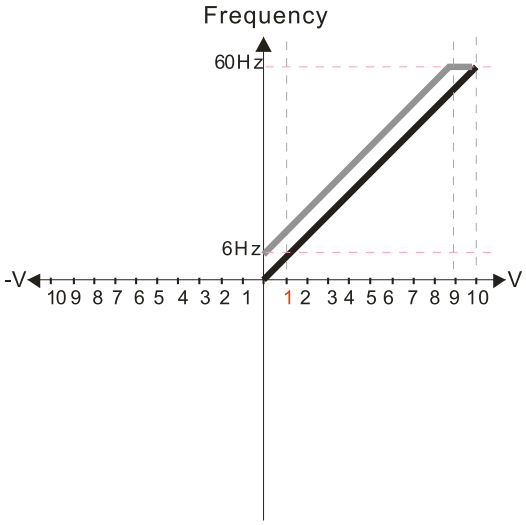
Pr.03-03=10%
Pr.03-07–03-08 (Positive/Negative Bias Mode)

0: No bias
1: Lower than or equal bias
2: Greater than or equal to bias
3: The absolute value of the bias voltage while serving as the center
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0: Negative frequency is not valid.
Forward and reverse run is controlled by digital keyboard or external terminals.
1: Negative frequency is valid.
Positive frequency = forward run; negative frequency = reverse run.
Direction can not be switched by digital keypad or external terminal control.

Pr.03-11 Analog input Gain (AI1) = 100%

Diagram 16



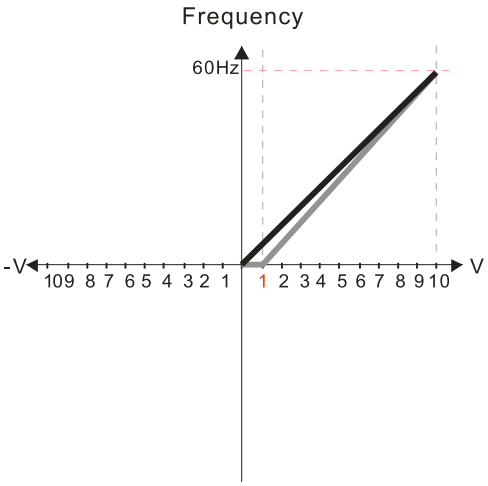
Pr.03-03=10%
Pr.03-07–03-08 (Positive/Negative Bias Mode)

0: No bias
1: Lower than or equal bias
2: Greater than or equal to bias
3: The absolute value of the bias voltage while serving as the center
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Forward and reverse run is controlled by digital keyboard or external terminals.
1: Negative frequency is valid.
Positive frequency = forward run; negative frequency = reverse run.
Direction can not be switched by digital keypad or external terminal control.

Pr.03-11 Analog input Gain (AI1) = 100%

Diagram 17



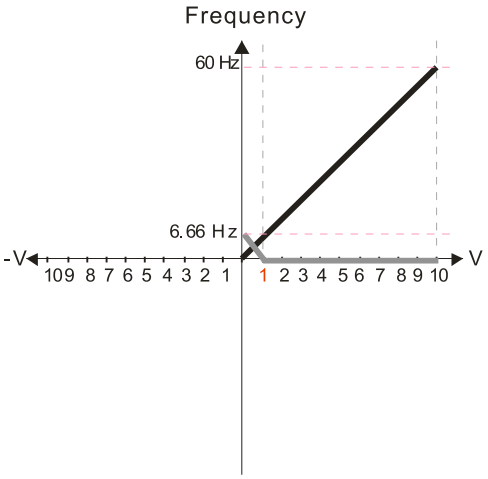
Pr.03-03=10%
Pr.03-07–03-08 (Positive/Negative Bias Mode)

0: No bias
1: Lower than or equal bias
2: Greater than or equal to bias
3: The absolute value of the bias voltage while serving as the center
4: Bias serves as the center

Pr.03-10 (Analog Frequency Command for Reverse Run)
0: Negative frequency is not valid.
Forward and reverse run is controlled by digital keyboard or external terminals.
1: Negative frequency is valid.
Positive frequency = forward run;
negative frequency = reverse run.
Direction can not be switched by digital keypad or external terminal control.

Pr.03-11 Analog input Gain (AI1) = 111.1%
10/9 = 111.1%

Diagram 18



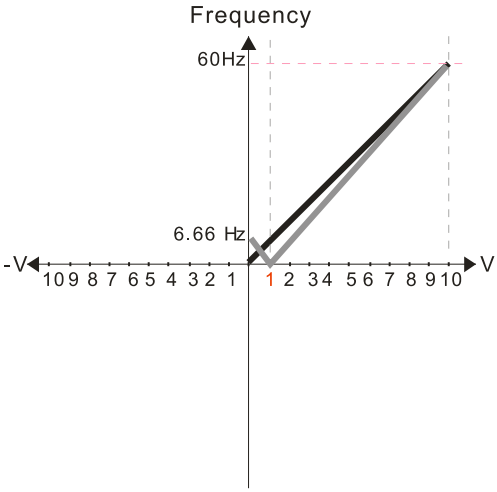
Pr.03-03=10%
Pr.03-07–03-08 (Positive/Negative Bias Mode)

0: No bias
1: Lower than or equal bias
2: Greater than or equal to bias
3: The absolute value of the bias voltage while serving as the center
4: Bias serves as the center

Pr.03-10 (Analog Frequency Command for Reverse Run)
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Forward and reverse run is controlled by digital keyboard or external terminals.
1: Negative frequency is valid.
Positive frequency = forward run;
negative frequency = reverse run.
Direction can not be switched by digital keypad or external terminal control.

Pr.03-11 Analog input Gain (AI1) = 111.1%
10/9 = 111.1%

Diagram 19



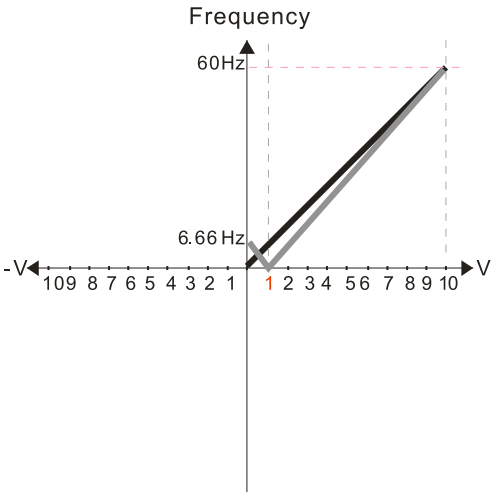
Pr.03-03=10%
Pr.03-07–03-08 (Positive/Negative Bias Mode)

0: No bias
1: Lower than or equal bias
2: Greater than or equal to bias
3: The absolute value of the bias voltage while serving as the center
4: Bias serves as the center

Pr.03-10 (Analog Frequency Command for Reverse Run)
0: Negative frequency is not valid.
Forward and reverse run is controlled by digital keyboard or external terminals.
1: Negative frequency is valid.
Positive frequency = forward run;
negative frequency = reverse run.
Direction can not be switched by digital keypad or external terminal control.

Pr.03-11 Analog input Gain (AI1) = 111.1%
10/9 = 111.1%

Diagram 20



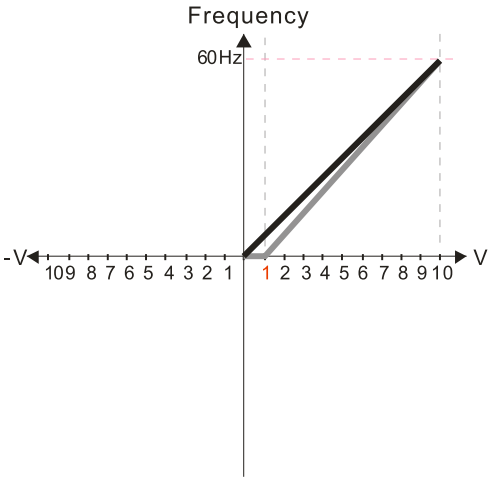
Pr.03-03=10%
Pr.03-07–03-08 (Positive/Negative Bias Mode)

0: No bias
1: Lower than or equal bias
2: Greater than or equal to bias
3: The absolute value of the bias voltage while serving as the center
4: Bias serves as the center

Pr.03-10 (Analog Frequency Command for Reverse Run)
0: Negative frequency is not valid.
Forward and reverse run is controlled by digital keyboard or external terminals.
1: Negative frequency is valid.
Positive frequency = forward run; negative frequency = reverse run.
Direction can not be switched by digital keypad or external terminal control.

Pr.03-11 Analog input Gain (AI1) = 111.1%
10/9 = 111.1%

Diagram 21



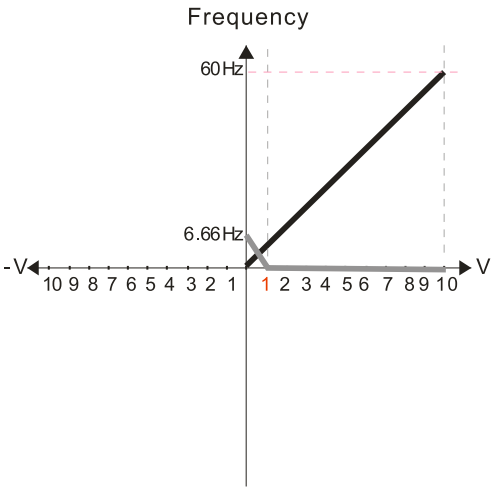
Pr.03-03=10%
Pr.03-07–03-08 (Positive/Negative Bias Mode)

0: No bias
1: Lower than or equal bias
2: Greater than or equal to bias
3: The absolute value of the bias voltage while serving as the center
4: Bias serves as the center

Pr.03-10 (Analog Frequency Command for Reverse Run)
0: Negative frequency is not valid.
Forward and reverse run is controlled by digital keyboard or external terminals.
1: Negative frequency is valid.
Positive frequency = forward run; negative frequency = reverse run.
Direction can not be switched by digital keypad or external terminal control.

Pr.03-11 Analog input Gain (AI1) = 111.1%
10/9 = 111.1%

Diagram 22



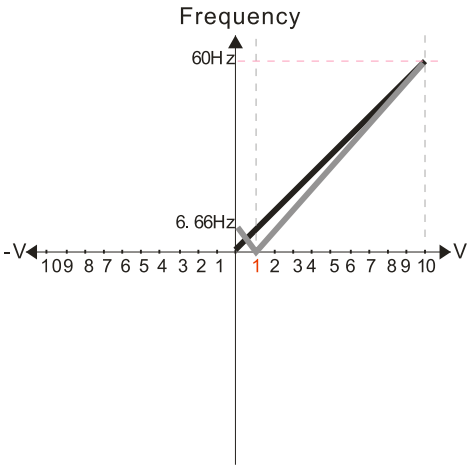
Pr.03-03=10%
Pr.03-07–03-08 (Positive/Negative Bias Mode)

0: No bias
1: Lower than or equal bias
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3: The absolute value of the bias voltage while serving as the center
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0: Negative frequency is not valid.
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Positive frequency = forward run; negative frequency = reverse run.
Direction can not be switched by digital keypad or external terminal control.

Pr.03-11 Analog input Gain (AI1) = 111.1%
10/9 = 111.1%

Diagram 23



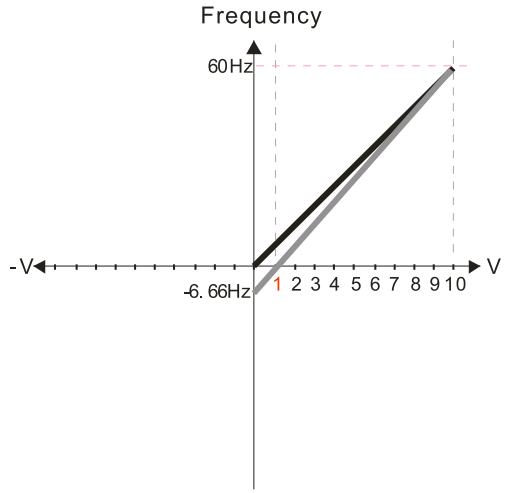
Pr.03-03=10%
Pr.03-07–03-08 (Positive/Negative Bias Mode)

0: No bias
1: Lower than or equal bias
2: Greater than or equal to bias
3: The absolute value of the bias voltage while serving as the center
4: Bias serves as the center

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0: Negative frequency is not valid.
Forward and reverse run is controlled by digital keyboard or external terminals.
1: Negative frequency is valid.
Positive frequency = forward run; negative frequency = reverse run.
Direction can not be switched by digital keypad or external terminal control.

Pr.03-11 Analog input Gain (AI1) = 111.1%
10/9 = 111.1%

Diagram 24



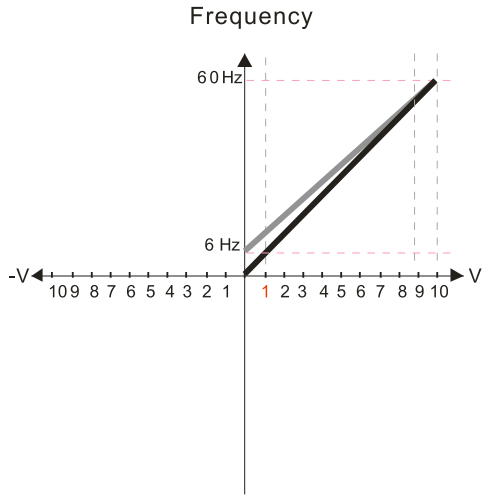
Pr.03-03=10%
Pr.03-07–03-08 (Positive/Negative Bias Mode)

0: No bias
1: Lower than or equal bias
2: Greater than or equal to bias
3: The absolute value of the bias voltage while serving as the center
4: Bias serves as the center

Pr.03-10 (Analog Frequency Command for Reverse Run)
0: Negative frequency is not valid.
Forward and reverse run is controlled by digital keyboard or external terminals.
1: Negative frequency is valid.
Positive frequency = forward run; negative frequency = reverse run.
Direction can not be switched by digital keypad or external terminal control.

Pr.03-11 Analog input Gain (AI1) = 111.1%
10/9 = 111.1%

Diagram 25



Pr.03-07–03-08 (Positive/Negative Bias Mode)

0: No bias
1: Lower than or equal bias
2: Greater than or equal to bias
3: The absolute value of the bias voltage while serving as the center
4: Bias serves as the center

Pr.03-10 (Analog Frequency Command for Reverse Run)

0: Negative frequency is not valid. Forward and reverse run is controlled by digital keyboard or external terminals.
1: Negative frequency is valid. Positive frequency = forward run; negative frequency = reverse run. Direction can not be switched by digital keypad or external terminal control.

Calculate the bias:

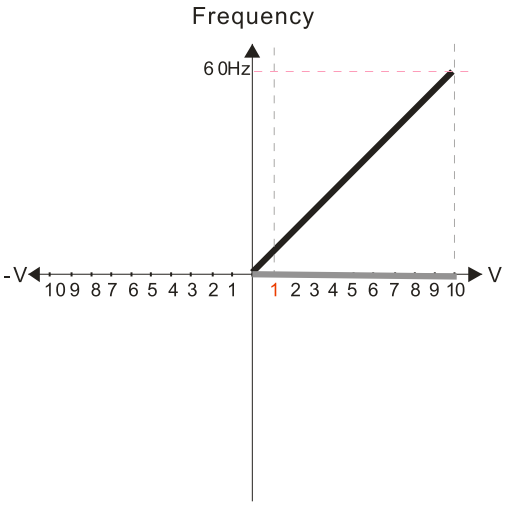
$\frac{60-6Hz}{10V} = \frac{6-0Hz}{(0-X\ V)}$ $XV = \frac{100}{-9} = -1.11V$ $\therefore 03\text{-}03 = \frac{-1.11}{10} \times 100\%$

$= -11.1\%$

Calculate the gain:

$Pr.03\text{-}11 = \frac{10V}{11.1V} \times 100\% = 90.0\%$

Diagram 26



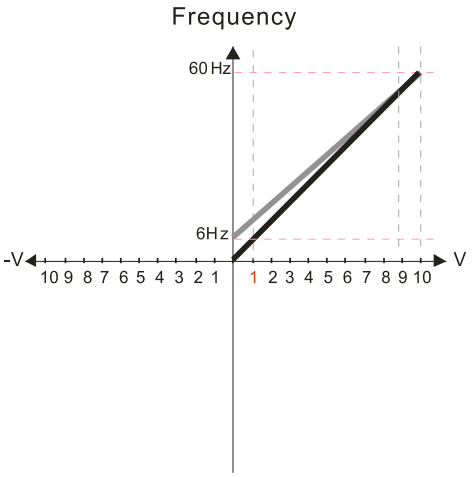
Pr.03-07–03-08 (Positive/Negative Bias Mode)

0: No bias
1: Lower than or equal bias
2: Greater than or equal to bias
3: The absolute value of the bias voltage while serving as the center
4: Bias serves as the center

Pr.03-10 (Analog Frequency Command for Reverse Run)

0: Negative frequency is not valid. Forward and reverse run is controlled by digital keyboard or external terminals.
1: Negative frequency is valid. Positive frequency = forward run; negative frequency = reverse run. Direction can not be switched by digital keypad or external terminal control.

Diagram 27



Pr.03-07–03-08 (Positive/Negative Bias Mode)

0: No bias
1: Lower than or equal bias
2: Greater than or equal to bias
3: The absolute value of the bias voltage while serving as the center
4: Bias serves as the center

Pr.03-10 (Analog Frequency Command for Reverse Run)

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Forward and reverse run is controlled by digital keyboard or external terminals.
1: Negative frequency is valid.
Positive frequency = forward run;
negative frequency = reverse run.
Direction can not be switched by digital keypad or external terminal control.

Calculate the bias:

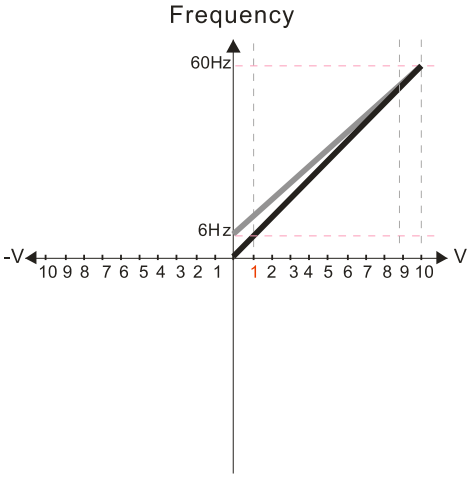
$\frac{60-6Hz}{10V} = \frac{6-0Hz}{(0-XV)}$ $XV = \frac{100}{-9} = -1.11V$ $\therefore 03\text{-}03 = \frac{-1.11}{10} \times 100\%$

$= -11.1\%$

Calculate the gain:

$Pr.03\text{-}11 = \frac{10V}{11.1V} \times 100\% = 90.0\%$

Diagram 28



Pr.03-07–03-08 (Positive/Negative Bias Mode)

0: No bias
1: Lower than or equal bias
2: Greater than or equal to bias
3: The absolute value of the bias voltage while serving as the center
4: Bias serves as the center

Pr.03-10 (Analog Frequency Command for Reverse Run)

0: Negative frequency is not valid.
Forward and reverse run is controlled by digital keyboard or external terminals.
1: Negative frequency is valid.
Positive frequency = forward run;
negative frequency = reverse run.
Direction can not be switched by digital keypad or external terminal control.

Calculate the bias:

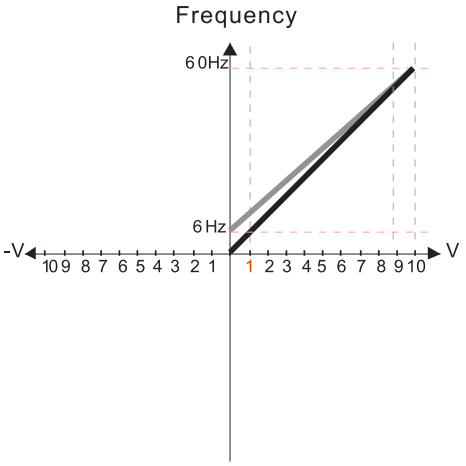
$\frac{60-6Hz}{10V} = \frac{6-0Hz}{(0-XV)}$ $XV = \frac{100}{-9} = -1.11V$ $\therefore 03\text{-}03 = \frac{-1.11}{10} \times 100\%$

$= -11.1\%$

Calculate the gain:

$Pr.03\text{-}11 = \frac{10V}{11.1V} \times 100\% = 90.0\%$

Diagram 29



Pr.03-07–03-08 (Positive/Negative Bias Mode)

0: No bias
1: Lower than or equal bias
2: Greater than or equal to bias
3: The absolute value of the bias voltage while serving as the center
4: Bias serves as the center

Pr.03-10 (Analog Frequency Command for Reverse Run)
0: Negative frequency is not valid.
Forward and reverse run is controlled by digital keyboard or external terminals.
1: Negative frequency is valid.
Positive frequency = forward run;
negative frequency = reverse run.
Direction can not be switched by digital keypad or external terminal control.

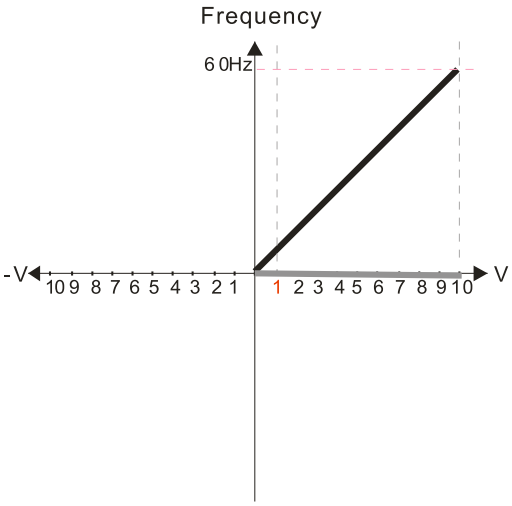
Calculate the bias:

$$\frac{60-6\text{Hz}}{10\text{V}} = \frac{6-0\text{Hz}}{(0-XV)} \quad XV = \frac{100}{-9} = -1.11\text{V} \quad \therefore 03\text{-}03 = \frac{-1.11}{10} \times 100\% = -11.1\,\%$$

Calculate the gain:

$$\text{Pr.03-11} = \frac{10\text{V}}{11.1\text{V}} \times 100\% = 90.0\,\%$$

Diagram 30

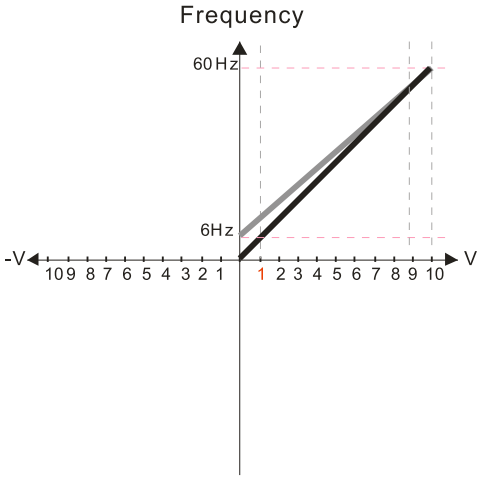


Pr.03-07–03-08 (Positive/Negative Bias Mode)

0: No bias
1: Lower than or equal bias
2: Greater than or equal to bias
3: The absolute value of the bias voltage while serving as the center
4: Bias serves as the center

Pr.03-10 (Analog Frequency Command for Reverse Run)
0: Negative frequency is not valid.
Forward and reverse run is controlled by digital keyboard or external terminals.
1: Negative frequency is valid.
Positive frequency = forward run;
negative frequency = reverse run.
Direction can not be switched by digital keypad or external terminal control.

Diagram 31



Pr.03-07–03-08 (Positive/Negative Bias Mode)

0: No bias
1: Lower than or equal bias
2: Greater than or equal to bias
3: The absolute value of the bias voltage while serving as the center
4: Bias serves as the center

Pr.03-10 (Analog Frequency Command for Reverse Run)
0: Negative frequency is not valid.
Forward and reverse run is controlled by digital keyboard or external terminals.
1: Negative frequency is valid.
Positive frequency = forward run;
negative frequency = reverse run.
Direction can not be switched by digital keypad or external terminal control.

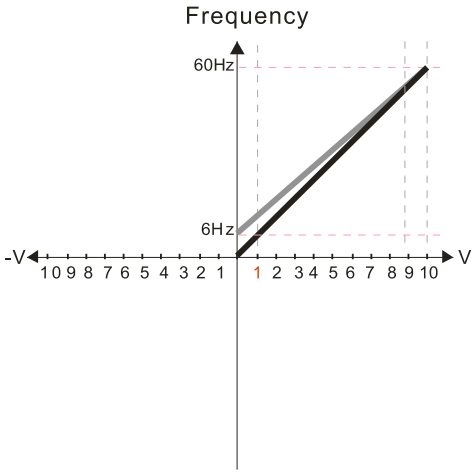
Calculate the bias:

$$\frac{60-6Hz}{10V}=\frac{6-0Hz}{(0-XV)} \quad XV=\frac{100}{-9}=-1.11V \quad \therefore 03\text{-}03=\frac{-1.11}{10}\times 100\% = -11.1\,\%$$

Calculate the gain:

$$Pr.03\text{-}11=\frac{10V}{11.1V}\times 100\%=90.0\,\%$$

Diagram 32



Pr.03-07–03-08 (Positive/Negative Bias Mode)

0: No bias
1: Lower than or equal bias
2: Greater than or equal to bias
3: The absolute value of the bias voltage while serving as the center
4: Bias serves as the center

Pr.03-10 (Analog Frequency Command for Reverse Run)
0: Negative frequency is not valid.
Forward and reverse run is controlled by digital keyboard or external terminals.
1: Negative frequency is valid.
Positive frequency = forward run;
negative frequency = reverse run.
Direction can not be switched by digital keypad or external terminal control.

Calculate the bias:

$$\frac{60-6Hz}{10V}=\frac{6-0Hz}{(0-XV)} \quad XV=\frac{100}{-9}=-1.11V \quad \therefore 03\text{-}03=\frac{-1.11}{10}\times 100\% = -11.1\,\%$$

Calculate the gain:

$$Pr.03\text{-}11=\frac{10V}{11.1V}\times 100\%=90.0\,\%$$

03-11 AI1 Analog Input Gain
03-12 AI2 Analog Input Gain

Default: 100.0

Settings -500.0–500.0%

📖 Pr.03-03–03-12 are used when the Frequency command source is the analog voltage or current signal.

03-15 AI1 Analog Input Filter Time
03-16 AI2 Analog Input Filter Time

Default: 0.01

Settings 0.00–20.00 sec.

📖 Analog signals inputed by the control terminals AI1 and AI2 mostly have noise. Noise affects the stability of the control. Use the Input Noise Filter to create a more stable system.

📖 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.
For optimal setting, adjust the setting based on the control stability or the control response.

03-19 Signal Loss Selection for the Analog Input 4–20 mA

Default: 0

Settings 0: Disabled
1: Continue operation at the last frequency
2: Decelerate to 0 Hz
3: Stop immediately and display ACE

📖 Determines the treatment when the 4–20 mA signal is lost (AI1 (Pr.03-28 = 2 or Pr.03-29 = 0)).

📖 When rectifier module Pr.03-28 ≠ 2, the voltage input to AI1 terminal is 0–10 V or 0–20 mA, and Pr.03-19 is invalid.

📖 When rectifier module Pr.03-29 ≠ 0, the voltage input to AI2 terminal is 0–10 V or 0–20 mA, and Pr.03-19 is invalid.

📖 When the setting is 1 or 2, the keypad displays the warning code “ANL”. It keeps blinking until the AI2 signal is recovered.

📖 When the drive stops, the condition that causes the warning does not exist , so the warning automatically disappears.

03-44 Multi-function Output (MO) by AI Level Source

Default: 0

Settings 0: AI1
1: AI2

03-45 AI Upper Level

Default: 50.00

Settings -100.00–100.00%

03-46 AI Lower Level

Default: 10.00

Settings -100.00–100.00%

- Use this function with the multi-function output setting 67 (analog input level reached). The MO is active when the AI input level is higher than the Pr.03-45. The MO is disabled when the AI input is lower than the Pr.03-46.
- When setting levels, Pr.03-45 AI upper level must be higher than Pr.03-46 AI lower level.

03-50 Analog Input Curve Selection

Default: 0

Settings 0: Normal curve
1: Three-point curve of AI1
2: Three-point curve of AI2
3: Three-point curve of AI1&AI2

03-57 AI2 Lowest Point

Default: 4.00 / 0.00 / 0.00

Settings Pr.03-29 = 0, 4.00–20.00 mA
Pr.03-29 = 1, 0.00–10.00 V
Pr.03-29 = 2, 0.00–20.00 mA

03-58 AI2 Proportional Lowest Point

Default: 0.00

Settings 0.00–100.00%

03-59 AI2 Mid-point

Default: 12.00 / 5.00 / 10.00

Settings Pr.03-29 = 0, 4.00–20.00 mA
Pr.03-29 = 1, 0.00–10.00 V
Pr.03-29 = 2, 0.00–20.00 mA

03-60 AI2 Proportional Mid-point

Default: 50.00

Settings 0.00–100.00%

03-61 AI2 Highest Point

Default: 20.00 / 10.00 / 20.00

Settings Pr.03-29 = 0, 4.00–20.00 mA
Pr.03-29 = 1, 0.00–10.00 V
Pr.03-29 = 2, 0.00–20.00 mA

03-62 AI2 Proportional Highest Point

Default: 100.00

Settings 0.00–100.00%

- When Pr.03-29 = 1, the ACI setting is 0–10 V and the unit is voltage (V). When Pr.03-29 ≠ 1, the ACI setting is 0–20 mA or 4–20 mA and the unit is current (mA).
- When you set the analog input AI2 to the Frequency command, 100% corresponds to Fmax (Pr.01-00 Maximum Operation Frequency).
- The output percentage becomes 0% when the AI2 input value is lower than the lowest point setting.

📖 For example:

Pr.03-57 = 2 mA, Pr.03-58 = 10% The output is 0 % when AI2 input is lower than 2 mA. If the AI2 input swings between 2 mA and 2.1 mA, the drive's output frequency oscillates between 0% and 10%.

03-63 AI1 Voltage Lowest Point

Default: 0.00

Settings 0.00–10.00 V

03-64 AI1 Proportional Lowest Point

Default: 0.00

Settings -100.00–100.00%

03-65 AI1 Voltage Mid-point

Default: 5.00

Settings 0.00–10.00 V

03-66 AI1 Proportional Mid-point

Default: 50.00

Settings -100.00–100.00%

03-67 AI1 Voltage Highest Point

Default: 10.00

Settings 0.00–10.00 V

03-68 AI1 Proportional Highest Point

Default: 100.00

Settings -100.00–100.00%

📖 When you set the positive voltage AI1 to the Frequency command, 100% corresponds to Fmax (Pr.01-00 Maximum Operation Frequency) and the motor runs in the forward direction.

📖 The requirement for these three parameters (Pr.03-63, Pr.03-65 and Pr.03-67) is Pr.03-57 < Pr.03-59 < Pr.03-61. The values for three proportional points (Pr.03-58, Pr.03-60 and Pr.03-62) have no limits. There is a linear calculation between two points.

📖 The output percentage becomes 0% when the positive voltage AI1 input value is lower than the lowest point setting.

For example:

Pr.03-63 = 1V, Pr.03-64 = 10% The output is 0 % when AI1 input is lower than 1V. If the AI1 input swings between 1 V and 1.1 V, the drive's output frequency oscillates between 0% and 10%.

13-2-04 Multi-Step Speed Parameters

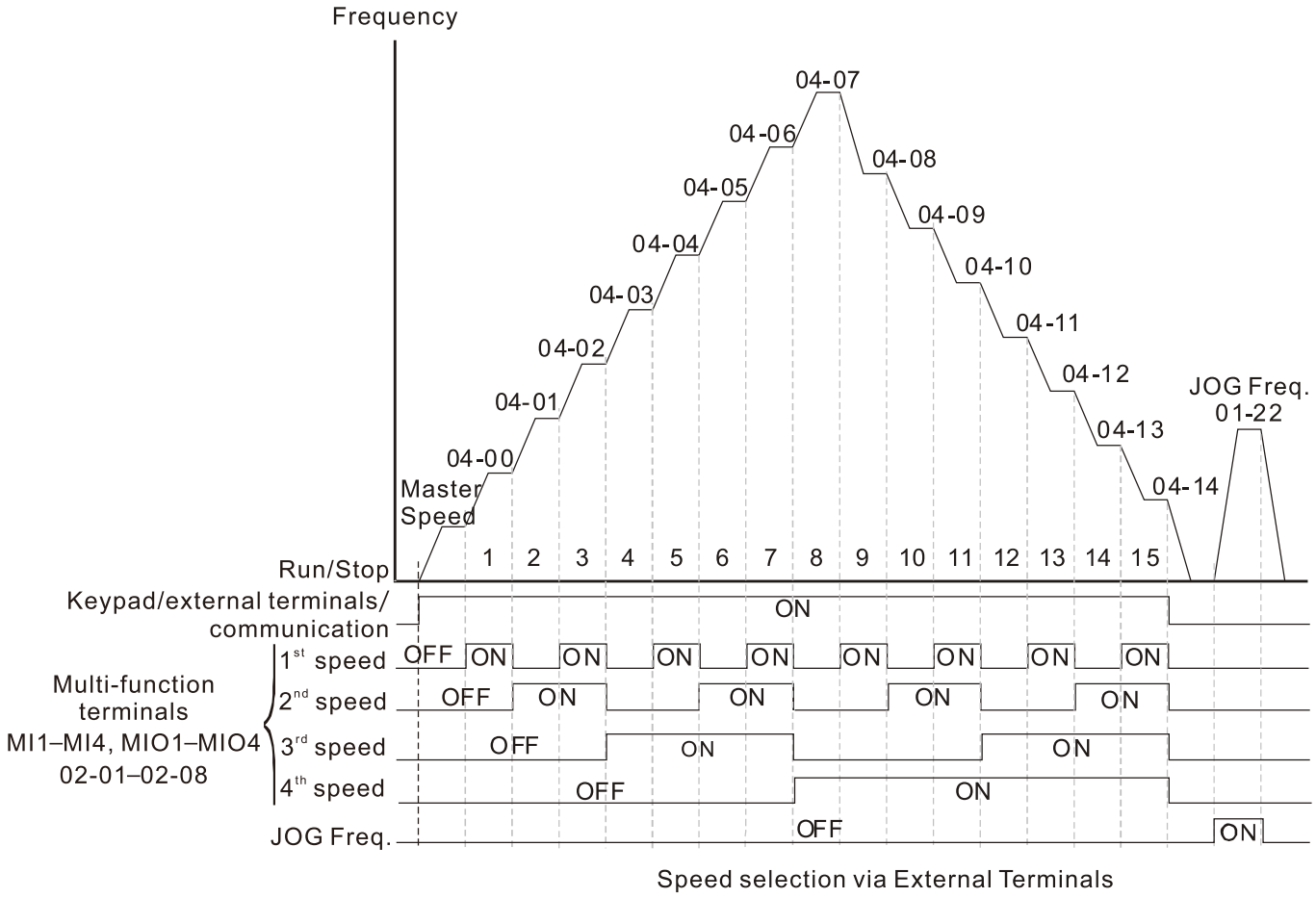
You can set this parameter during operation.

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

Default: 0.00

Settings 0.00–599.00 Hz

- Use the multi-function input terminals (refer to settings 1–4 of Pr.02-01–Pr.02-05) to select the multi-step speed command (the maximum is 15th step speed). Pr.04-00 to Pr.04-14 sets the multi-step speed (frequency) as shown in the following diagram.
- The external terminal / digital keypad / communication controls the RUN and STOP commands with Pr.00-21.
- You can set each multi-step speed (frequency) between 0.00–599.00 Hz during operation.
- Explanation for the timing diagram of the multi-step speed and external terminals:
  The related parameter settings are:
  1. Pr.04-00–Pr.04-14: set the 1st–15th multi-step speed (to set the frequency of each step speed).
  2. Pr.02-01–Pr.02-08: sets the multi-function input terminals (multi-step speed command 1–4).
- Related parameters:
  - Pr.01-22 JOG frequency setting
  - Pr.02-01 multi-function input command 1 (MI1)
  - Pr.02-02 multi-function input command 2 (MI2)
  - Pr.02-03 multi-function input command 3 (MI3)
  - Pr.02-04 multi-function input command 4 (MI4)
  - Pr.02-05 multi-function input command 4 (MIO1)
  - Pr.02-06 multi-function input command 4 (MIO2)
  - Pr.02-07 multi-function input command 4 (MIO3)
  - Pr.02-08 multi-function input command 4 (MIO4)



Speed selection via External Terminals

13-2-05 Motor Parameters

In this parameter group, the following are abbreviations for different types of motors:

- IM: Induction motor
- PM: Permanent magnet synchronous AC motor
- IPM: Interior permanent magnet synchronous AC motor
- SPM: Surface permanent magnet synchronous AC motor

You can set this parameter during operation.

05-00 Motor Parameter Auto-tuning

Default: 0

Settings 0: No function
1: Dynamic test for induction motor (IM)
2: Static test for induction motor (IM)
5: Rolling auto-tuning for PM (IPM / SPM)
13: High frequency stall test for PM synchronous motor

05-01 Full-load Current for Induction Motor 1 (A)

Default: Depend on the model power

Settings 10–120% of the inverter module rated current

Set this value according to the rated current of the motor as indicated on the motor nameplate. The default is 90% of the drive's rated current.

For example:

The rated current for a VFD with 460V 3-ph 7.5 HP (5.5 kW) is 13 A. The default is 13 × 90% = 11.7 A. The setting range is between 1.3–15.6 A. 13 × 10% = 1.3 A, 13 × 120% = 15.6 A

05-02 Rated Power for Induction Motor 1 (kW)

Default: Depend on the model power

Settings 0.00–655.35 kW

Sets the rated power for the motor. The default is the drive's power value.

05-03 Rated Speed for Induction Motor 1 (rpm)

Default: Depend on the motor's number of poles

Settings 0–xxxxx rpm (Depend on the motor's number of poles)
1710 (60 Hz 4 poles); 1410 (50 Hz 4 poles)

Set the rated speed for the motor as indicated on the motor nameplate.

05-04 Number of Poles for Induction Motor 1

Default: 4

Settings 2–20

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

Set up Pr.01-01 and Pr.05-03 before setting up Pr.05-04 to make sure the motor operates normally.

05-05 No-load Current for Induction Motor 1 (A)

Default: Depend on the model power

Settings 0.00–Pr.05-01 default

📖 The default is 40% of motor rated current.

05-06 Stator Resistance (Rs) for Induction Motor 1

Default: Depend on the model power

05-07 Rotor Resistance (Rr) for Induction Motor 1

Default: 0.000

Settings 0.000–65.535 Ω

05-08 Magnetizing Inductance (Lm) for Induction Motor 1

05-09 Stator Inductance (Lx) for Induction Motor 1

Default: 0.0

Settings 0.0–6553.5 mH

05-13 Full-load Current for Induction Motor 2 (A)

Default: Depend on the model power

Settings 10–120% of the inverter module rated current

📖 Set this value according to the rated current of the motor as indicated on the motor nameplate. The default is 90% of the drive's rated current.

For example:

The rated current for a VFD with 460V 3-ph 7.5 HP (5.5 kW) is 13 A. The default is 13 × 90% = 11.7 A. The setting range is between 1.3–15.6 A. 13 × 10% = 1.3 A, 13 × 120% = 15.6 A

05-14 Rated Power for Induction Motor 2 (kW)

Default: Depending on the model power

Settings 0.00–655.35 kW

📖 Sets the rated power for the motor 2. The default is the drive's power value.

05-15 Rated Speed for Induction Motor 2 (rpm)

Default: Depend on the motor's number of poles

Settings 0–xxxxx rpm (Depend on the motor's number of poles)
1710 (60 Hz 4 poles); 1410 (50 Hz 4 poles)

📖 Set the rated speed for the motor as indicated on the motor nameplate.

05-16 Number of Poles for Induction Motor 2

Default: 4

Settings 2–20

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

🕮 Set up Pr.01-35 and Pr.05-15 before setting up Pr.05-16 to make sure the motor operates normally.

05-17 No-load Current for Induction Motor 2 (A)

Default: Depend on the model power

Settings 0.00–Pr.05-13 default

🕮 The default is 40% of motor rated current.

05-18 Stator Resistance (Rs) for Induction Motor 2

Default: Depend on the model power

Settings 0.000–65.535 Ω

05-19 Rotor Resistance (Rr) for Induction Motor 2

Default: 0.000

Settings 0.000–65.535 Ω

05-20 Magnetizing Inductance (Lm) for Induction Motor 2

05-21 Stator Inductance (Lx) for Induction Motor 2

Default: 0.0

Settings 0.0–6553.5 mH

05-22 Multi-motors (Induction) Selection

Default: 1

Settings 1: Motor 1
2: Motor 2

🕮 Sets the motor operated by the AC motor drive. Multi-motor selection only supports single control mode. For example, when you set motor 1 as SVC control mode, the control mode of motors 2 is also set as SVC.

05-26 Accumulative Watt-second for a Motor in Low Word (W-msec.)

05-27 Accumulative Watt-second for a Motor in High Word (W-sec.)

05-28 Accumulative Watt-hour for a Motor (W-hour)

05-29 Accumulative Watt-hour for a Motor in Low Word (kW-hour)

05-30 Accumulative Watt-hour for a Motor in High Word (MW-hour)

Default: 0.0

Settings Read only

🕮 Pr.05-26–05-30 records the amount of power the motors consume. The accumulation begins when the drive is activated and the record is saved when the drive stops or turns OFF. The amount of consumed watts continues to accumulate when the drive is activated again. To clear the accumulation, set Pr.00-02 to 5 to return the accumulation record to 0.

🕮 The accumulated total watts of the motor per second = Pr.05-27 × 65536 + Pr.05-26
For example:
When Pr.05-26 = 2548.1 and Pr.05-27 = 15.2, the accumulated total watts of the motor per second = 15.2 × 65536 + 2548.1 = 996147.2 + 2548.1 = 998695.3 kWh

📖 The accumulated total kilowatts of the motor per hour = Pr.05-30 × 1000000 + Pr.05-28 × 1000 + Pr.05-28 Wh

When Pr.05-30 = 76 MWh, Pr.05-29 = 150 kWh, Pr.05-28 = 400 Wh (or 0.4 kWh), the motor accumulated watt In every hour = 76 × 1000000 + 150 × 1000 + 400 = 76150400 Wh = 76150.4 kWh

05-31 Accumulated Motor Operation Time (minutes)

Default: 0

Settings 0–1439

05-32 Accumulated Motor Operation Time (days)

Default: 0

Settings 0–65535

📖 Use Pr.05-31 and Pr.05-32 to record the motor operation time. Set Pr.05-31 and Pr.05-32 to 00 to clear the operation time. An operation time shorter than 60 seconds is not recorded.

05-33 Induction Motor (IM) or Permanent Magnet Synchronous AC Motor (PM) Selection

Default: 0

Settings 0: IM (Induction motor)
1: SPM (Surface permanent magnet synchronous AC motor)
2: IPM (Interior permanent magnet synchronous AC motor)

05-34 Full-load Current for a Permanent Magnet Synchronous AC Motor

Default: Depend on the model power

Settings 0–120% of the inverter module rated current

05-35 Rated Power for a Permanent Magnet Synchronous AC Motor

Default: Depend on the model power

Settings 0.00–655.35 kW

📖 Sets the rated power for the permanent magnet synchronous AC motor. The default is the drive's power value.

05-36 Rated Speed for a Permanent Magnet Synchronous AC Motor

Default: 2000

Settings 0–65535 rpm

05-37 Number of Poles for a Permanent Magnet Synchronous AC Motor

Default: 10

Settings 0–65535

05-39 Stator Resistance for a Permanent Magnet Synchronous AC Motor

Default: 0.000

Settings 0.000–65.535 Ω

05-40 Permanent Magnet Synchronous AC Motor Ld

Default: 0.00

Settings 0.00–655.35 mH

05-41 Permanent Magnet Synchronous AC Motor Lq

Default: 0.00

Settings 0.00–655.35 mH

05-43 Ke Parameter of a Permanent Magnet Synchronous AC Motor

Default: 0

Settings 0–6553.5 V/krpm

13-2-06 Protection Parameters (1)

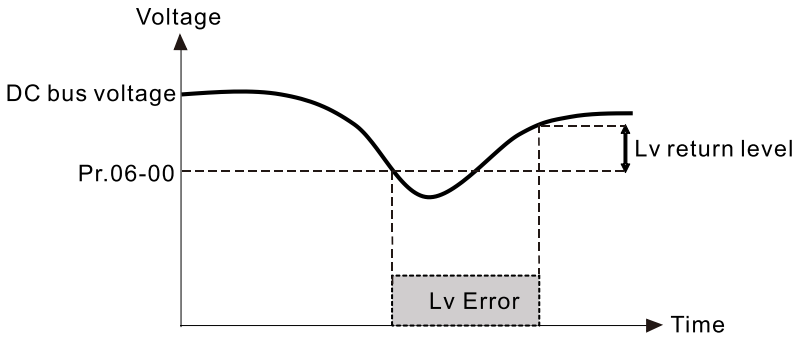
You can set this parameter during operation.

06-00 Low Voltage Level

Default: 180.0 / 360.0

Settings 230V models: 150.0–220.0 V_{DC}
460V models: 300.0–440.0 V_{DC}

- Sets the Low Voltage (LV) level. When the DC bus voltage is lower than Pr.06-00, a LV fault is triggered, and the drive stops output then the motor coasts to a stop.
- If the Lv fault is triggered during operation, the drive stops output and the motor coasts to a stop. There are three Lv faults: LvA (Lv during acceleration), Lvd (Lv during deceleration), and Lvn (Lv in constant speed) that are triggered according to the status of acceleration or deceleration. You must press RESET to clear the Lv fault. The drive automatically restarts if you set to restart after momentary power loss (refer to Pr.07-06 Restart after Momentary Power Loss and Pr.07-07 Allowed Power Loss Duration for details).
- If the LV fault is triggered when the drive is in STOP status, the drive displays LvS (LV during stop), which is not recorded, and the drive restarts automatically when the input voltage is higher than the LV level of 30 V (230V models) or 60 V (460V models).



06-01 Over-voltage Stall Prevention

Default: 380.0 / 760.0

Settings 0: No function
230V models: 0–390.0 V_{DC}
460V models: 0.0–780.0 V_{DC}

- Set Pr.06-01 to 0.0 disables the over-voltage stall prevention function (connected with braking unit or brake resistor). Use this setting when braking units or brake resistors are connected to the drive.
- Setting Pr.06-01 to a value > 0.0 enables the over-voltage stall prevention. This setting refers to the power supply system and loading. If the setting is too low, then over-voltage stall prevention is easily activated, which may increase deceleration time.
- OV stall corresponds to the over-voltage level:

Voltage	OV Stall		OV Level
	Default	Setting	Default (Read Only)
230V Models	380.0 V_{DC}	0.0–390.0 V_{DC}	410.0 V_{DC}
460V Models	760.0 V_{DC}	0.0–780.0 V_{DC}	820.0 V_{DC}

🕮 Related parameters:

- Pr.01-13, Pr.01-15, Pr.01-17, Pr.01-19 Deceleration Time 1–4.
- Pr.02-13 Multi-function Output 1 (Relay 1)
- Pr.02-14–Pr.02-17 Multi-function Output 1–4 (MIO1–MIO4)
- Pr.06-02 Selection for Over-voltage Stall Prevention.

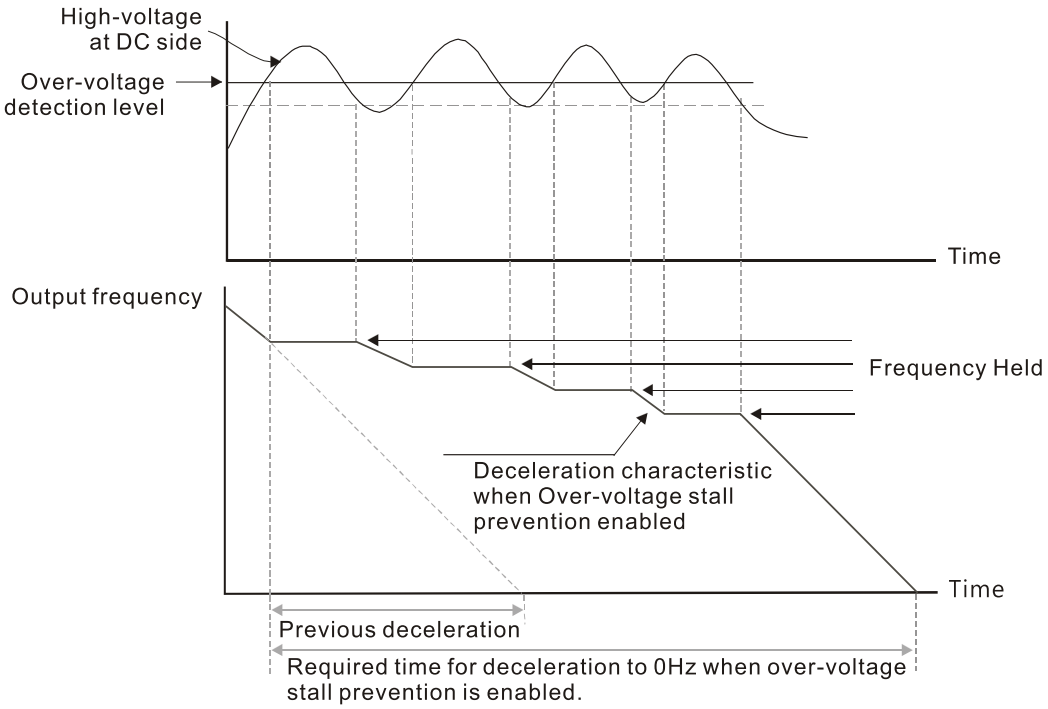
06-02 Selection for Over-voltage Stall Prevention

Default: 0

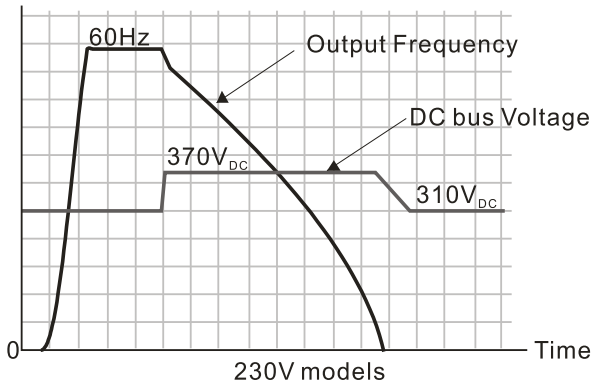
Settings 0: Traditional over-voltage stall prevention
1: Smart over-voltage stall prevention

🕮 Use this function when you are unsure about the load inertia. When stopping under normal load, the over-voltage does not occur during deceleration and meet the deceleration time setting. Sometimes it may not stop due to over-voltage during decelerating to STOP when the load regenerative inertia increases. In this case, the AC motor drive extends the deceleration time automatically until the drive stops.

🕮 When you set Pr.06-02 to 0, during deceleration the motor exceeds the synchronous speed due to load inertia. In this case, the motor becomes an electrical generator. The DC bus voltage may exceed its maximum allowable value due to motor regeneration in some situations, such as motor's loading inertia being too high or drive's deceleration time being set too short. When you enable traditional over-voltage stall prevention and the DC bus voltage detected is too high, the drive stops decelerating (output frequency remains unchanged) until the DC bus voltage drops below the setting value.



🕮 When you set Pr.06-02 to 1 to use smart over-voltage stall prevention during deceleration, the drive maintains the DC bus voltage when decelerating and prevents the drive from OV.



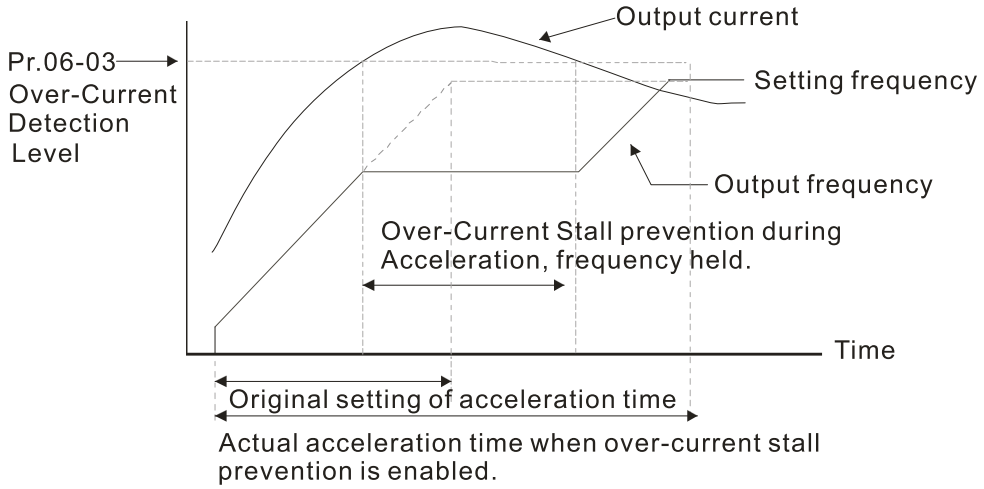
- When you enable the over-voltage stall prevention, the drive's deceleration time is longer than the setting.
- If the deceleration time affects your application, refer to the following guides for troubleshooting.
  - Increase the deceleration time to a proper value.
  - Install a brake resistor (refer to Section 10-3-1 Brake Resistors and Brake Units Used in AC Motor Drives for details) to dissipate the electrical energy that is generated from the motor.
- Related parameters:
  - Pr.01-13, Pr.01-15, Pr.01-17, Pr.01-19 Deceleration Time 1–4
  - Pr.02-13 Multi-Function Output Relay
  - Pr.02-16 Multi-function Output (MO1–MO4)
  - Pr.06-01 Over-voltage Stall Prevention

06-03 Over-current Stall Prevention during Acceleration

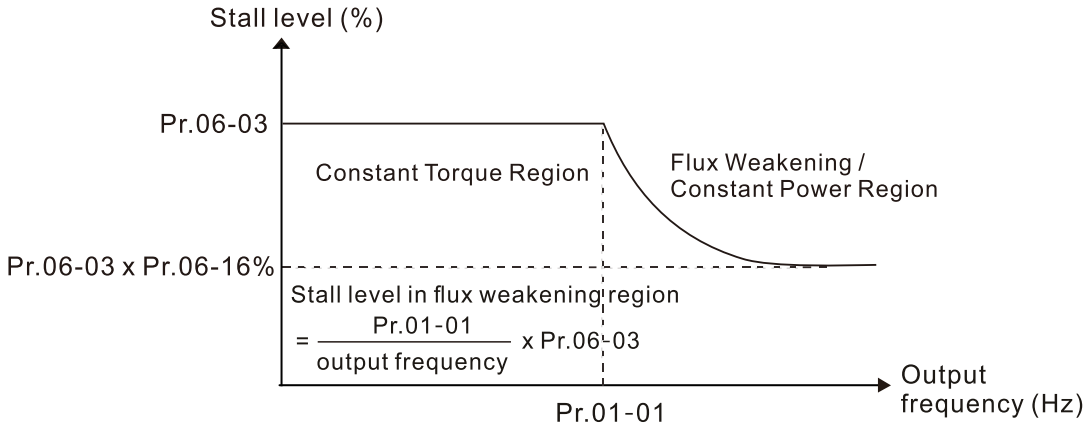
Default: 120 / 180

Settings Normal duty: 0–150% (100 % corresponds to the rated current of the drive)
Heavy load: 0–200% (100% corresponds to the rated current of the inverter module)

- If the motor load is too large or the drive's acceleration time is too short, the output current of the drive may be too high during acceleration, and it may cause motor damage or trigger protection functions (OL or OC). Use this parameter to prevent these situations.
- During acceleration, the output current of the drive may increase abruptly and exceed the setting value of Pr.06-03. In this case, the drive stops accelerating and keeps the output frequency constant, and then continues to accelerate until the output current decreases.



🕮 Refer to Pr.06-16 for more details of stall level in flux weakening region. The protection curve:



🕮 When you enable the over-current stall prevention, the drive's acceleration time is longer than the setting.

🕮 When the over-current stall prevention occurs because the motor capacity is too small or operates in the default, decrease the Pr.06-03 setting value.

🕮 If you encounter any problem with the acceleration time, refer to the following guides for troubleshooting.

- Increase the acceleration time to a proper value.
- Set Pr.01-44 Auto-Acceleration and Auto-Deceleration Setting to 1, 3 or 4.

🕮 Related parameters:

- Pr.01-12, 01-14, 01-16, 01-18 Acceleration Time 1–4
- Pr.01-44 Auto-Acceleration and Auto-Deceleration Setting
- Pr.02-13 Multi-function Output (RY1)
- Pr.02-14–02-17 Multi-function Output 1–4 (MIO1–MIO4)

06-04 Over-current Stall Prevention during Operation

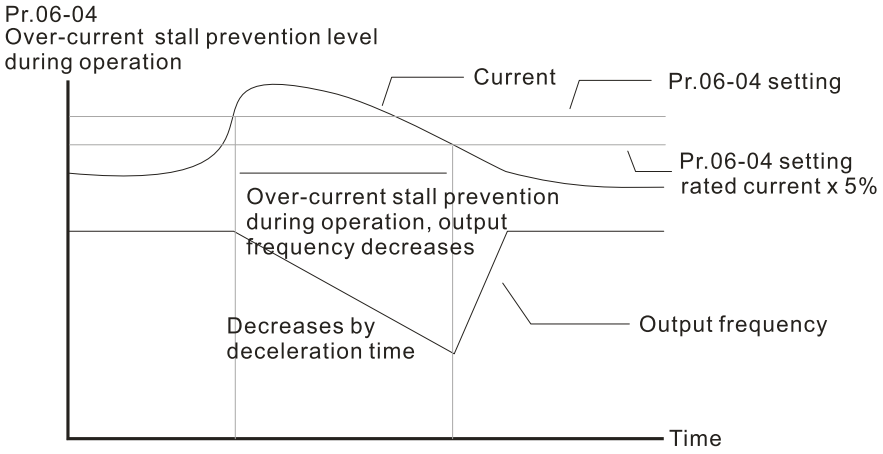
Default: 120 / 180

Settings Normal duty: 0–150%
(100% corresponds to the rated current of the drive)
Heavy load: 0–200%
(100% corresponds to the rated current of the inverter module)

🕮 This is a protection for the drive to decrease output frequency automatically when the motor overloads abruptly during constant motor operation.

🕮 If the output current exceeds the setting value for Pr.06-04 when the drive is operating, the drive decelerates according to the Pr.06-05 setting to prevent the motor from stalling. The lower limit for the over-current stall prevention is determined by the maximum value among 0.5 Hz, Pr.01-07 and Pr.01-11.

🕮 If the output current is lower than the setting value for Pr.06-04, the drive accelerates (according to Pr.06-05) again to the setting frequency.



Over-current stall prevention at constant speed

06-05 Acceleration / Deceleration Time Selection for Stall Prevention at Constant Speed

Default: 0

Settings
0: By current acceleration / deceleration time
1: By the first acceleration / deceleration time
2: By the second acceleration / deceleration time
3: By the third acceleration / deceleration time
4: By the fourth acceleration / deceleration time
5: By auto-acceleration / auto-deceleration

Sets the acceleration / deceleration time selection when stall prevention occurs at constant speed.

06-06 Over-torque Detection Selection (Motor 1)

Default: 0

Settings
0: No function
1: Continue operation after over-torque detection during constant speed operation
2: Stop after over-torque detection during constant speed operation
3: Continue operation after over-torque detection during RUN
4: Stop after over-torque detection during RUN

06-09 Over-torque Detection Selection (Motor 2)

Default: 0

Settings
0: No function
1: Continue operation after over-torque detection during constant speed operation
2: Stop after over-torque detection during constant speed operation
3: Continue operation after over-torque detection during RUN
4: Stop after over-torque detection during RUN

When you set Pr.06-06 and Pr.06-09 to 1 or 3, a warning message displays but there is no error record.

When you set Pr.06-06 and Pr.06-09 to 2 or 4, an error message displays and there is an error record.

06-07 Over-torque Detection Level (Motor 1)

Default: 120

Settings 10–250% (100% corresponds to the rated current of the inverter module)

06-08 Over-torque Detection Time (Motor 1)

Default: 0.1

Settings 0.0–60.0 sec.

06-10 Over-torque Detection Level (Motor 2)

Default: 120

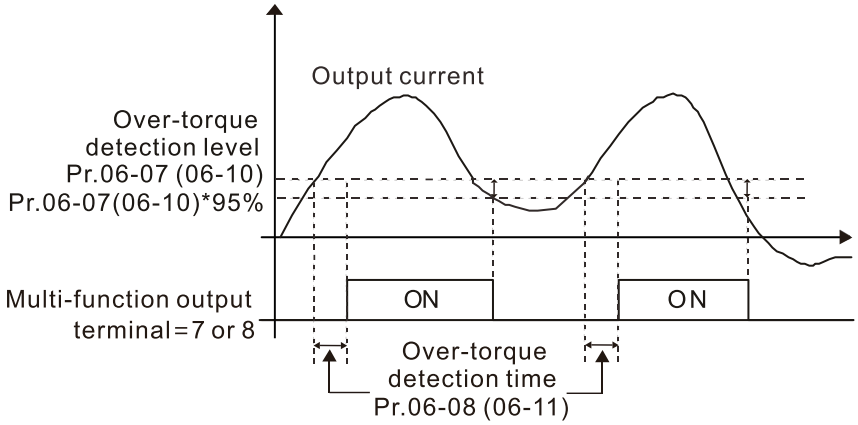
Settings 10–250% (100% corresponds to the rated current of the inverter module)

06-11 Over-torque Detection Time (Motor 2)

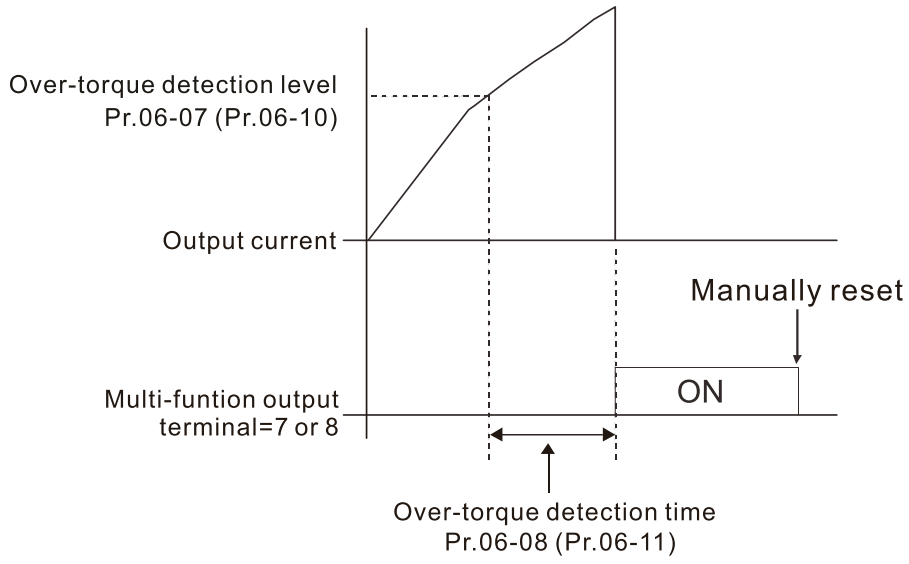
Default: 0.1

Settings 0.0–60.0 sec.

- When the output current exceeds the over-torque detection level (Pr.06-07 or Pr.06-10) and also exceeds the over-torque detection time (Pr.06-08 or Pr.06-11), the over-torque detection follows the setting of Pr.06-06 and Pr.06-09.
- When you set Pr.06-06 or Pr.06-09 to 1 or 3, an ot1 / ot2 warning displays while the drive keeps running after over-torque detection. The warning remains on until the output current is smaller than 5% of the over-torque detection level.



- When you set Pr.06-06 or Pr.06-09 to 2 or 4, an ot1 / ot2 warning displays and the drive stops running after over-torque detection. The drive does not run until you manually reset it.



06-13 Electronic Thermal Relay Selection 1 (Motor 1)
06-27 Electronic Thermal Relay Selection 2 (Motor 2)

Default: 2

Settings 0: Inverter motor (with external forced cooling)
1: Standard motor (motor with fan on the shaft)
2: Disable

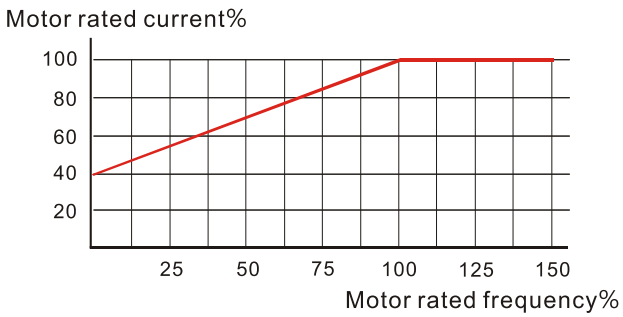
- Prevents self-cooled motor from overheating under low speed. Use an electronic thermal relay to limit the drive's output power.
- Setting the parameter to 0 is suitable for an inverter motor (motor fan using an independent power supply). For this kind of motor, there is no significant correlation between cooling capacity and motor speed. Therefore, the action of electronic thermal relays remains stable in low speed to ensure the load capability of the motor in low speed.
- Setting the parameter to 1 is suitable for standard motor (motor fan is fixed on the rotor shaft). For this kind of motor, the cooling capacity is lower in low speed; therefore, the action of an electronic thermal relay reduces the action time to ensure the life of motor.
- When the power is cycled frequently, if the power is switched OFF, the electronic thermal relay protection is reset; therefore, even setting the parameter to 0 or 1 may not protect the motor well. If there are several motors connected to one drive, install an electronic thermal relay in each motor.

06-14 Electronic Thermal Relay Action Time 1 (Motor 1)
06-28 Electronic Thermal Relay Action Time 2 (Motor 2)

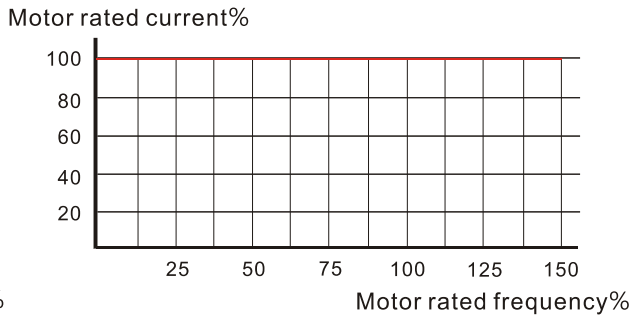
Default: 60.0

Settings 30.0–600.0 sec.

- Set the parameter to 150% of motor rated current and use with the setting of Pr.06-14 and Pr.06-28 to prevent motor damage due to overheating. When it reaches the setting, the drive displays "EoL1 / EoL2", and the motor coasts to stop.
- Use this parameter to set the action time of the electronic thermal relay. It works based on the I2t characteristic curve of electronic thermal relay, the output frequency and current of the drive, and the operation time to prevent the motor from overheating.



Motor cooling curve with shaft-fixed fan



Motor cooling curve with independent fan

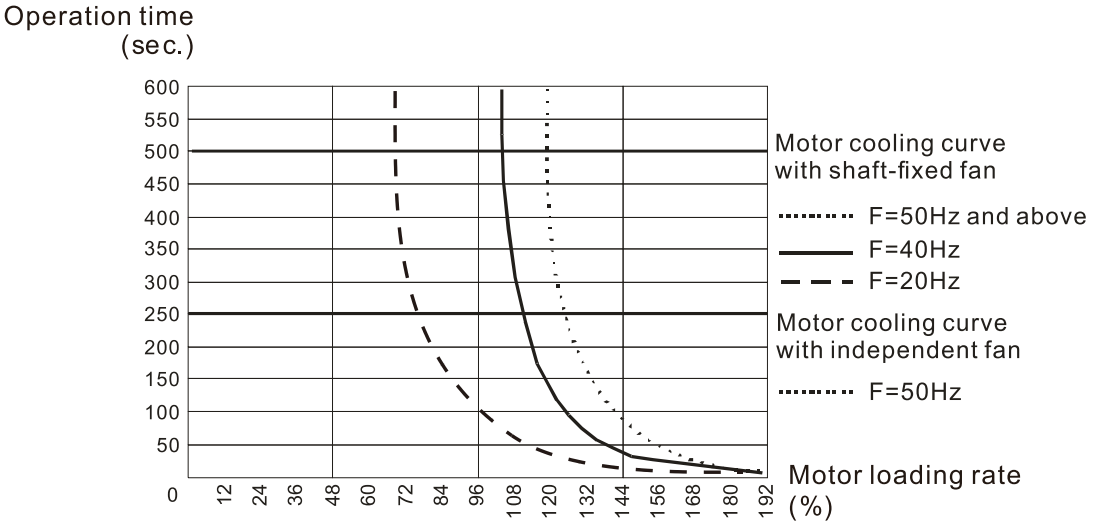
- The action of the electronic thermal relay depends on the settings for Pr.06-13 and Pr.06-27.

  - Pr.06-13 or Pr.06-27 is set to 0 (using inverter motor):
    When the output current of the drive is higher than 150% of the motor rated current (refer to

the motor rated current % corresponded to the motor rated frequency in the motor cooling curve with independent fan), the drive starts to count the time. The electronic thermal relay acts when the accumulated time exceeds Pr.06-14 or Pr.06-28.

- Pr.06-13 or Pr.06-27 is set to 1 (using standard motor):
  When the output current of the drive is higher than 150% of the motor rated current (refer to the motor rated current % corresponded to the motor rated frequency in the motor cooling curve with shaft-fixed fan), the drive starts to count the time. The electronic thermal relay acts when the accumulated time exceeds Pr.06-14 or Pr.06-28.

📖 The actual electronic thermal relay action time adjusts according to the drive output current (shown as the motor loading rate %). The action time is short when the current is high, and the action time is long when the current is low. Refer to the following diagram.
(The motor cooling curve with shaft-fixed / independent fan F=50Hz is the same curve)



06-15 Temperature Level Overheat (OH) Warning

Default: 95.0

Settings 0.0–110.0%

📖 Sets the drive's internal IGBT overheat warning level. When the temperature is higher than Pr.06-15 setting, the oH1 fault displays and the warning remains but it does not affect the drive operation.

📖 Use this parameter to check the motor overheat in advance in order to take precautionary measures to decrease the temperature and maintain the motor's normal operation.

📖 If you set the temperature 5ºC higher than the maximum setting value for Pr.06-15, IGBT overheating occurs and the drive stops. Refer to Chapter 8 oH1 fault descriptions for details.

06-16 Stall Prevention Limit Level (Weak Magnetic Field Current Stall Prevention Level)

Default: 100

Settings 0–100% (Refer to Pr.06-03, Pr.06-04)

📖 This parameter only works in VF and SVC control mode.

📖 Sets the over-current stall prevention level when the motor's operation frequency is larger than Pr.01-01 (base frequency). This parameter only works during acceleration.

📖 For example:

When Pr.06-03 = 150%, Pr.06-04 = 100% and Pr.06-16 = 80%.

When the operation frequency is larger than Pr.01-01 (Base motor frequency), the lowest over-current stall prevention level during acceleration is:

Pr.06-03 × Pr.06-16 = 150 × 80% = 120%. (Refer to Pr.06-03 diagram for the protection curve.)

06-17	Fault Record 1
06-18	Fault Record 2
06-19	Fault Record 3
06-20	Fault Record 4
06-21	Fault Record 5
06-22	Fault Record 6

Default: 0

Display

0: No fault record

1: Over-current during acceleration (ocA)

2: Over-current during deceleration (ocd)

3: Over-current during steady operation (ocn)

4: Ground fault (GFF)

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 at constant speed (Lvn)

14: Low-voltage at stop (LvS)

16: Power components overheating (oH1)

17: Circuit board ambient temperature overheats (oH2)

18: IGBT temperature detection failure (tH1o)

19: Capacitor hardware error (tH2o)

21: Over load (oL)

22: Electronics thermal relay 1 protection (EoL1)

23: Electronics thermal relay 2 protection (EoL2)

24: Motor overheating PTC / PT100 (oH3)

26: Over torque 1 (ot1)

27: Over torque 2 (ot2)

28: Under current (uC)

31: EEPROM read error (cF2)

33: U-phase error (cd1)

34: V-phase error (cd2)

35: W-phase error (cd3)
36: cc hardware error (Hd0)
37: oc hardware error (Hd1)
38: ov hardware error (Hd2)
40: Auto-tuning error (AUE)
41: PID off AI2 (AFE)
48: AI2 loss (ACE)
49: External fault (EF)
50: Emergency stop (EF1)
51: External base block (bb)
52: Password is locked (Pcod)
54: Illegal command (CE1)
55: Illegal data address (CE2)
56: Illegal data value (CE3)
57: Data is written to read-only address (CE4)
58: Modbus transmission time-out (CE10)
63: Over slip warning (oSL)
72: S1 internal circuit detection error (STL1)
76: STO (STo)
77: S2 internal circuit detection error (STL2)
79: U-phase over-current before run (Aoc)
80: V-phase over-current before run (boc)
81: W-phase over-current before run (coc)
82: U-phase output phase loss (oPL1)
83: V-phase output phase loss (oPL2)
84: W-phase output phase loss (oPL3)
87: Low frequency overload protection (oL3)
89: Rotor position detection error (roPd)
101: CANopen guarding error (CGdE)
102: CANopen heartbeat error (CHbE)
104: CANopen bus off error (CbFE)
121: Internal communication error (CP20)
122: Internal communication error (CP21)
123: Internal communication error (CP22)
124: Internal communication error (CP30)
126: Internal communication error (CP32)
140: oc hardware error (Hd6)
141: GFF occurs before run (b4GFF)
142: Auto-tune error 1 (AuE1) (DC test stage)
143: Auto-tune error 2 (AuE2) (high frequency stall stage)
144: Auto-tuning error 1 (AuE3)
145: MErr error (MErr)

215: Ethernet communication time-out (EdtE)
220: PROFINET startup error (PStE)
221: PROFINET storage device error (PSFE)
222: PROFINET operation error (PoPE)
223: PROFINET program inspection error (PrbE)
224: STO execution time-out (SToT)
225: STO ROM verifying failure (STor)
226: STO loss (SToL)
227: STO Channel 1 error (STC1)
228: STO Channel 2 error (STC2)
229: STO Channel 1 time-out (SPC1)
230: STO Channel 2 time-out (SPC2)
231: STO Gate buffer check error (SGbE)
232: STO power 18V over voltage (S18ov)
233: STO power 18V under voltage (S18uv)
234: STO power 6V over voltage (S6ov)
235: STO power 6V under voltage (S6uv)
236: STO power 5V over voltage (S5ov)
237: STO power 5V under voltage (S5uv)
238: STO Watchdog (SWdG)
239: STO ADC Sampling failure (SAdE)
240: STO execution time is too short (SEbL)
241: STO execution time is too high (SEAb)
242: Safe torque off 1 (STo1)
243: Safe torque off 2 (STo2)

- 🕮 The parameters record when the fault occurs and forces a stop.
- 🕮 When low-voltage at stop fault (LvS) occurs, the fault is not recorded. When low-voltage during operation faults (LvA, Lvd, Lvn) occur, the faults are recorded.
- 🕮 When dEb function is valid and enabled, the drive executes dEb and records fault code 62 to Pr.06-17–Pr.06-22 and Pr.14-70–Pr.14-73 simultaneously.

06-23 Fault Output Option 1
06-24 Fault Output Option 2
06-25 Fault Output Option 3
06-26 Fault Output Option 4

Default: 0

Settings 0–65535 (refer to bit table for fault code)

- 🕮 Use these parameters with multi-function output terminal (set Pr.06-23–Pr.06-26 to 35–38) for the specific requirement. When the fault occurs, the corresponding terminals activate. Convert the binary value to decimal value before you enter the value for Pr.06-23–Pr.06-26.

Fault Code	bit0	bit1	bit2	bit3	bit4	bit5	bit6
	current	Volt.	OL	SYS	FBK	EXI	CE
0: No fault record							
1: Over-current during acceleration (ocA)	●						
2: Over-current during deceleration (ocd)	●						
3: Over-current during steady operation (ocn)	●						
4: Ground fault (GFF)	●						
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 at constant speed (Lvn)		●					
14: Low-voltage at stop (LvS)		●					
16: Power components overheating (oH1)			●				
17: Circuit board ambient temperature overheats (oH2)			●				
19: Capacitor hardware error (tH2o)			●				
18: IGBT temperature detection failure (tH1o)			●				
21: Over load (oL)			●				
22: Electronics thermal relay 1 protection (EoL1)			●				
23: Electronics thermal relay 2 protection (EoL2)			●				
24: Motor overheating PTC / PT100 (oH3)			●				
26: Over torque 1 (ot1)			●				
27: Over torque 2 (ot2)			●				
28: Under current (uC)	●						
31: EEPROM read error (cF2)				●			
33: U-phase error (cd1)				●			
34: V-phase error (cd2)				●			
35: W-phase error (cd3)				●			
36: cc hardware error (Hd0)				●			
37: oc hardware error (Hd1)				●			
38: ov hardware error (Hd2)				●			
40: Auto-tuning error (AUE)				●			
41: PID loss AI2 (AFE)					●		
48: AI2 loss (ACE)					●		
49: External fault (EF)						●	
50: Emergency stop (EF1)						●	
51: External base block (bb)						●	

Fault Code	bit0	bit1	bit2	bit3	bit4	bit5	bit6
	current	Volt.	OL	SYS	FBK	EXI	CE
52: Password is locked (Pcod)				●			
54: Illegal command (CE1)							●
55: Illegal data address (CE2)							●
56: Illegal data value (CE3)							●
57: Data is written to read-only address (CE4)							●
58: Modbus transmission time-out (CE10)							●
63: Over slip warning (oSL)						●	
72: S1 internal circuit detection error (STL1)				●			
76: STO (STo)				●			
77: S2 internal circuit detection error (STL2)				●			
79: U-phase over-current before run (Aoc)	●						
80: V-phase over-current before run (boc)	●						
81: W-phase over-current before run (coc)	●						
82: U-phase output phase loss (oPL1)	●						
83: V-phase output phase loss (oPL2)	●						
84: W-phase output phase loss (oPL3)	●						
87: Low frequency overload protection (oL3)			●				
89: Rotor position detection error (roPd)					●		
101: CANopen guarding error (CGdE)							●
102: CANopen heartbeat error (CHbE)							●
104: CANopen bus off error (CbFE)							●
121: Internal communication error (CP20)							●
122: Internal communication error (CP21)							●
123: Internal communication error (CP22)							●
124: Internal communication error (CP30)							●
126: Internal communication error (CP32)							●
140: oc hardware error (Hd6)				●			
141: GFF occurs before run (b4GFF)				●			
142: Auto-tuning error 1 (AUE1) (DC test stage)				●			
143: Auto-tuning error 2 (AUE2) (high frequency stall stage)				●			
144: Auto-tuning error 1 (AuE3)				●			
145: MErr error (MErr)				●			
215: Ethernet communication time-out (EdtE)							●
220: PROFINET startup error (PStE)							●
221: PROFINET storage device error (PSFE)							●
222: PROFINET operation error (PoPE)							●
223: PROFINET program inspection error (PrbE)							●

Fault Code	bit0	bit1	bit2	bit3	bit4	bit5	bit6
	current	Volt.	OL	SYS	FBK	EXI	CE
224: STO execution time-out (SToT)				●			
225: STO ROM verifying failure (STor)				●			
226: STO loss (SToL)				●			
227: STO Channel 1 error (STC1)				●			
228: STO Channel 2 error (STC2)				●			
229: STO Channel 1 time-out (SPC1)				●			
230: STO Channel 2 time-out (SPC2)				●			
231: STO Gate buffer check error (SGbE)				●			
232: STO power 18V over voltage (S18ov)				●			
233: STO power 18V under voltage (S18uv)				●			
234: STO power 6V over voltage (S6ov)				●			
235: STO power 6V under voltage (S6uv)				●			
236: STO power 5V over voltage (S5ov)				●			
237: STO power 5V under voltage (S5uv)				●			
238: STO Watchdog (SWdG)				●			
239: STO ADC Sampling failure (SAdE)				●			
240: STO execution time is too short (SEbL)				●			
241: STO execution time is too high (SEAb)				●			
242: Safe torque off 1 (STo1)				●			
243: Safe torque off 2 (STo2)				●			

06-29 PTC Detection Selection

Default: 0

Settings 0: Warn and continue operation
1: Fault and ramp to stop
2: Fault and coast to stop
3: No warning

- Sets the operation mode of a drive after detecting PTC.
- Running the motor at low frequency for a long time reduces the cooling function of the motor fan. To prevent the motor from damage due to overheating, use a Positive Temperature Coefficient thermistor on the motor, and connect the thermistor output signal to the drive's analog input terminals.

06-30 PTC Level

Default: 50.0

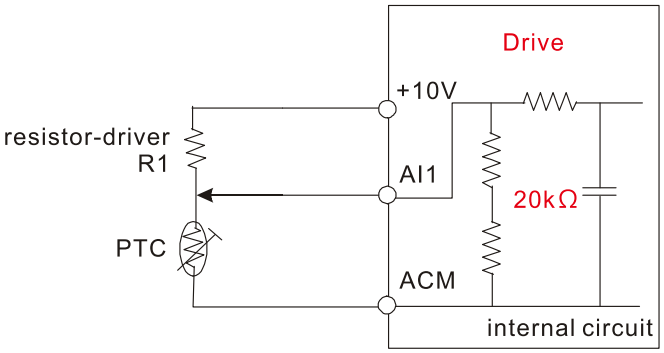
Settings 0.0–100.0%

- Sets AI1 / AI2 analog input function Pr.03-00 to 6 [thermistor (PTC) input value)].
- Use this parameter to set the PTC level; 100% PTC level corresponds to the maximum analog input value.
- When using the AI1 terminal, you must set Pr.03-28 to 0, the input impedance is 20 KΩ.

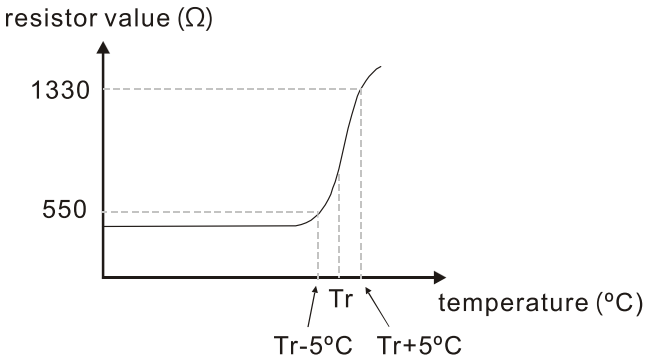
🕮 If the temperature reaches to the set protection level, the motor acts according to the settings for Pr.06-29 and displays warning “oH3” (if Pr.06-29 = 1–3). When the temperature is lower than the set protection level, you can press RESET key to clear the fault.

🕮 The PTC uses the AI1-input and is connected through divider resistance as shown below:

1. The voltage between +10V to ACM: lies within 10–11V.
2. The impedance for AI1 is around 20K Ω. Recommended value for divider resistance is 1K–10K Ω.
3. Please contact your motor dealer for the curve of temperature and resistance value for PTC.
   Protection level (Pr.06-30) = V + 10 × (RPTC//20K) / [R1 + (RPTC//20K)]
   - V+10: voltage between +10V-ACM actual value
   - RPTC: motor PTC overheat protection level;
   - 20K Ω: the AI1 input impedance;
   - R1: divider resistance (recommended value: 1–10k Ω)



Take the standard PTC thermistor as an example: if the protection level is 1330 Ω, the actual voltage between +10V-ACM is 10.5 V and divider resistance R1 is 4.4k Ω.



Refer to the following calculation when Pr.06-30 is set to 23% and motor temperature overheating protection level is 1330 Ω:

1330//20000 = (1330 × 20000) ÷ (1330 + 20000) = 1247.07

10.5 × 1247.07 ÷ (4400 + 1247.07) = 2.32 (V) ≒ 2.3 (V)

Pr.06-30 = 2.3 ÷ 10V × % = 23%

06-31 Frequency Command at Malfunction

Default: Read only

Display	0.00–599.00 Hz

🕮 When a malfunction occurs, check the current Frequency command. If it happens again, it overwrites the previous record.

06-32 Output Frequency at Malfunction

Default: Read only

Display 0.00–599.00 Hz

📖 When a malfunction occurs, check the current output frequency. If it happens again, it overwrites the previous record.

06-33 Output Voltage at Malfunction

Default: Read only

Display 0.0–6553.5 V

📖 When a malfunction occurs, check the current output voltage. If it happens again, it overwrites the previous record.

06-34 DC bus Voltage at Malfunction

Default: Read only

Display 0.0–6553.5 V

📖 When a malfunction occurs, check the current DC bus voltage. If it happens again, it overwrites the previous record.

06-35 Output Current at Malfunction

Default: Read only

Display 0.00–655.35 Amps

📖 When a malfunction occurs, check the current output current. If it happens again, it overwrites the previous record.

06-36 Power Components Temperature at Malfunction

Default: Read only

Display -3276.7–3276.7 ºC

📖 When a malfunction occurs, check the current power components temperature. If it happens again, it overwrites the previous record.

06-37 Circuit Board Ambient Temperature at Malfunction

Default: Read only

Display -3276.7–3276.7 ºC

📖 When a malfunction occurs, check the current circuit board ambient temperature. If it happens again, it overwrites the previous record.

06-38 Motor Speed at Malfunction

Default: Read only

Display -3276.7–3276.7 rpm

📖 When a malfunction occurs, check the current motor speed in rpm. If it happens again, it overwrites the previous record.

06-40 Status of the Multi-function Input Terminal at Malfunction

06-41 Status of the Multi-function Output Terminal at Malfunction

Default: Read only

Display 0000h–FFFFh

📖 When a malfunction occurs, check the current status of the multi-function input / output terminals. If it happens again, it overwrites the previous record.

06-42 Inverter Module Status at Malfunction

Default: Read only

Display 0000h–FFFFh

📖 When a malfunction occurs, check the current drive status (communication address 2101H). If it happens again, it overwrites the previous record.

06-44 STO Latch Function (MX300-S models only)

Default: 0

Settings bit 0: STO latch
bit 1: STO fault indication shield

📖 bit 0 = 0: Manual restart. After the STO error is cleared, restart manually.

📖 bit 0 = 1: Auto-restart. After the STO error is cleared, restart automatically.

📖 bit 1 = 0: Disabled. When the STO occurs, the status will be updated to the relevant indication source, such as: digital output, RS-485 communication, CANopen communication card.

📖 bit 1 = 1: Enabled. When the STO occurs, the status will be shielded to the relevant indication source.

06-45 Output Phase Loss Detection Action (OPHL)

Default: 3

Settings 0: Warn and continue operation
1: Fault and ramp to stop
2: Fault and coast to stop
3: No warning

📖 The OPHL protection is enabled when Pr.06-45 is not set to 3.

06-46 Detection Time for Output Phase Loss

Default: 0.500

Settings 0.000–65.535 sec.

06-47 Current Detection Level for Output Phase Loss

Default: 1.00

Settings 0.00–100.00%

06-48 DC Brake Time for Output Phase Loss

Default: 0.000

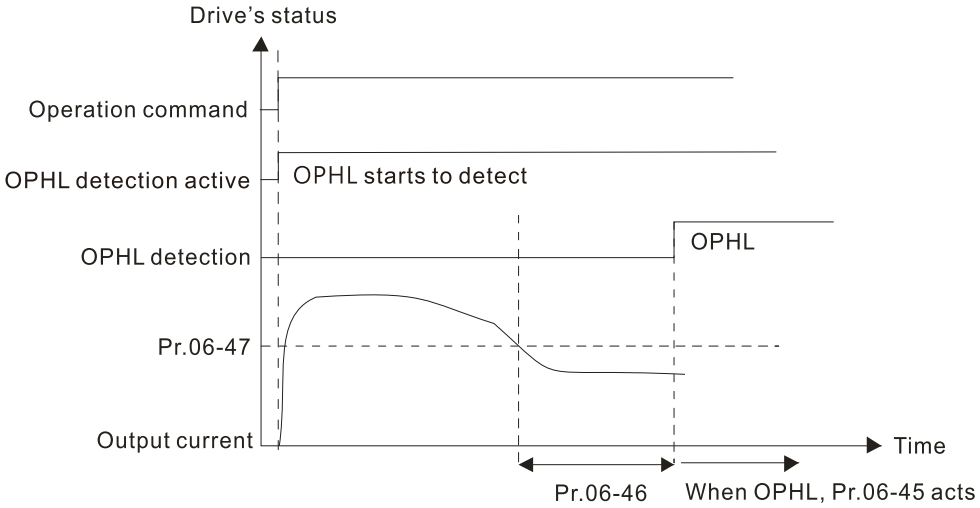
Settings 0.000–65.535 sec.

📖 Setting Pr.06-48 to 0 disables the OPHL detection function before operation.

📖 The status of output phase loss detection are as following:

- Status 1: The drive is in operation

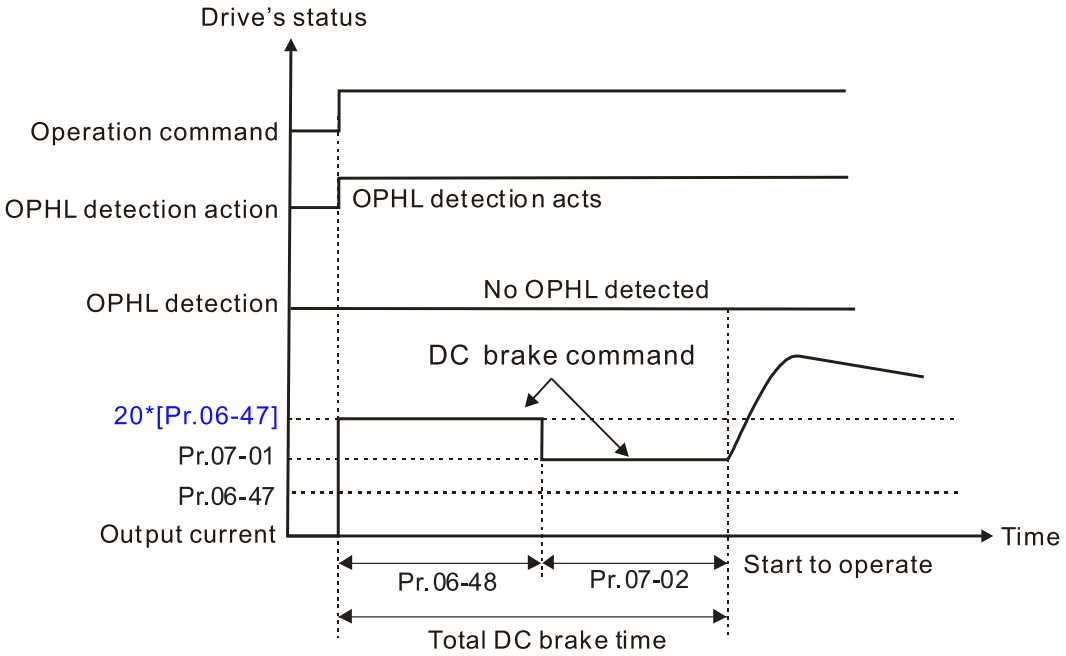
  When any phase is less than the Pr.06-47 setting, and exceeds the Pr.06-46 setting time, the drive executes according to the Pr.06-45 setting.



- Status 2: The drive is in STOP; Pr.06-48 ≠ 0; Pr.07-02 ≠ 0

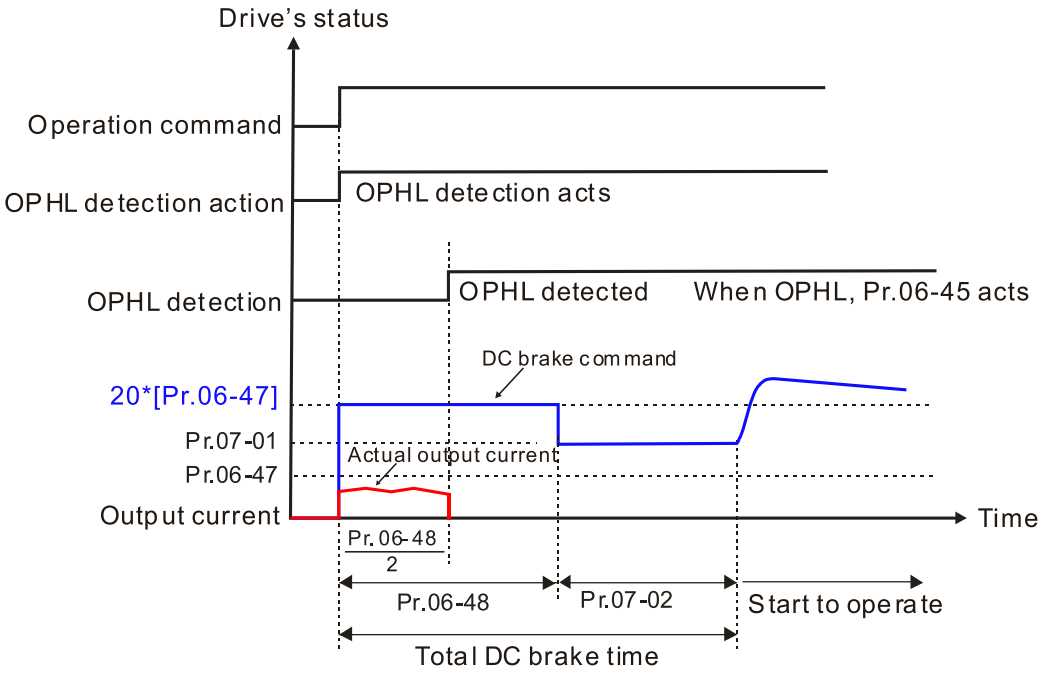
  When the drive starts, it executes Pr.06-48 first, and then executes Pr.07-02 (DC brake). The DC brake current level in this state includes two parts: one is 20 times the Pr.06-47 setting value in Pr.06-48 setting time; the other is the Pr.07-01 setting value in Pr.07-02 setting time. The total DC brake time T = Pr.06-48 + Pr.07-02.

  Status 2-1: Pr.06-48 ≠ 0, Pr.07-02 ≠ 0 (No OPHL detected before the operation)



  Status 2-2: Pr.06-48 ≠ 0, Pr.07-02 ≠ 0 (OPHL detected before the operation)

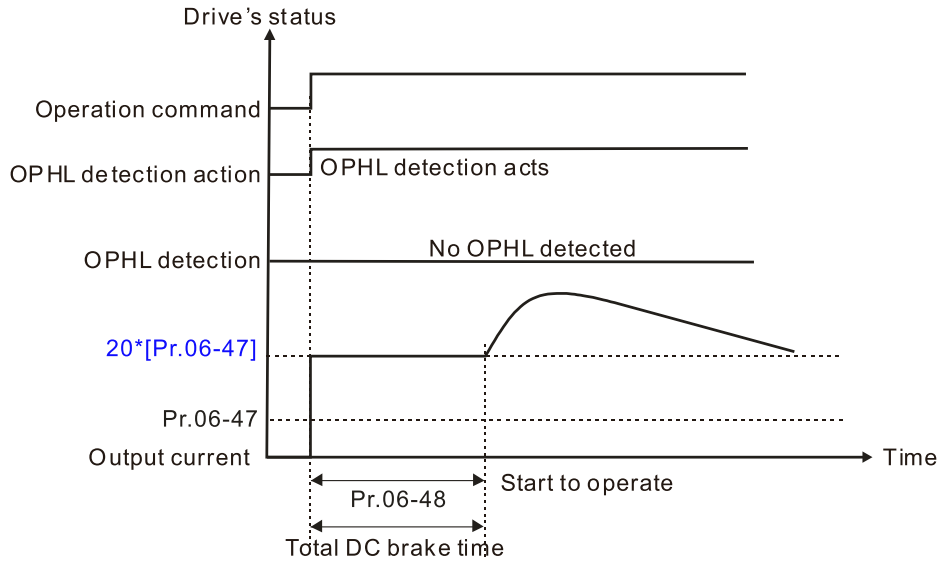
  In this period, if an OPHL happens within the time for Pr.06-48, the drive executes the Pr.06-45 setting after the drive starts counting for half the time of Pr.06-48.



- Status 3: The drive is in STOP; Pr.06-48 ≠ 0; Pr.07-02 = 0

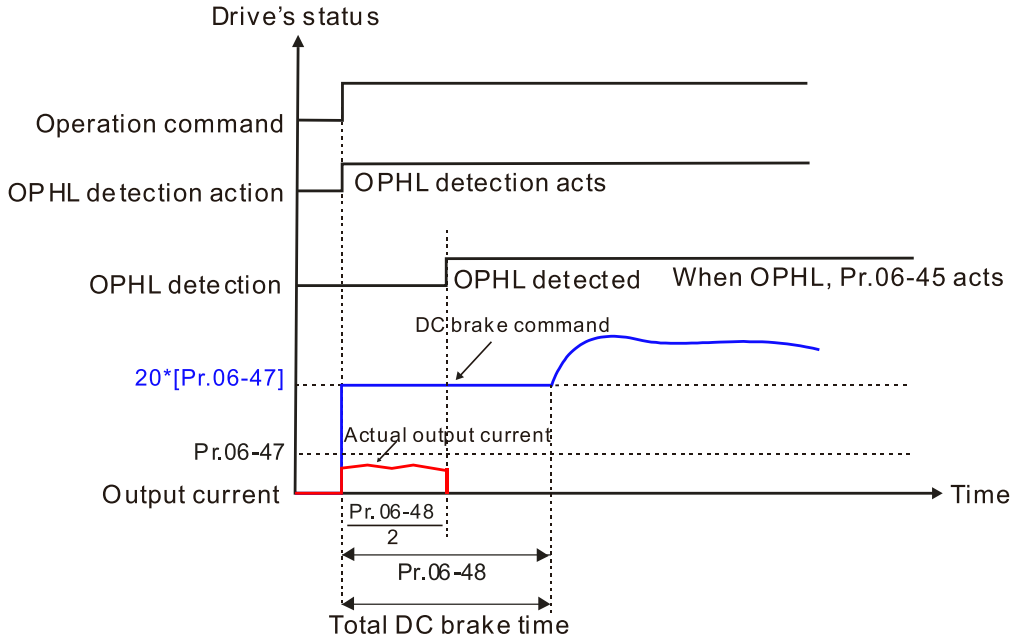
  When the drive starts, it executes Pr.06-48 as the DC brake. The DC brake current level is 20 times the Pr.06-47 setting value.

  Status 3-1: Pr.06-48 ≠ 0, Pr.07-02 = 0 (No OPHL detected before the operation)



  Status 3-2: Pr.06-48 ≠ 0, Pr.07-02 = 0 (OPHL detected before the operation)

  In this period, if an OPHL happens within the time for Pr.06-48, the drive executes the Pr.06-45 setting after the drive starts counting for half the time of Pr.06-48.



06-49 LvX Error Handling Function

Default: 0

Settings bit 0: LvX error auto-restart
bit 1: LvX error indicator shield
bit 15: LvX error auto-restart shield

- bit 0 = 0, LvX (excluding LvS): After the error status is cleared, restart manually.
- bit 0 = 1, LvX (excluding LvS): After the error status is cleared, restart automatically.
- bit 1 = 0, LvX (including LvS): When the error occurs, the status will be updated to the relevant indication source, such as: digital output, RS-485 communication, CANopen communication card.
- bit 1 = 1, LvX (including LvS): When the error occurs, the status will be shielded to the relevant indication source and LvX faults will still be recorded in the fault history
- bit 15 = 0 and bit 0 = 0: After the LvS error status is cleared, restart manually.
- bit 15 = 0 and bit 0 = 1: After the LvS error status is cleared, restart automatically
- bit 15 = 1 and does not refer to Pr.06-49 bit 0: Remains the LvS error and does not restart even Pr.02-35 is setted.

06-55 Derating Protection

Default: 0

Settings 0: Constant rated current and limit carrier frequency by load current and temperature
1: Constant carrier frequency and limit load current by setting carrier frequency
2: Constant rated current (same as setting 0), but close current limit

- Allowable maximum output frequency and the minimum carrier frequency limit in control mode: For VF and SVC modes: When the maximum output frequency is 599 Hz, the minimum carrier frequency is 6 k.

🕮 Setting 0:

- Actual over-current stall prevention level = derating ratio × over-current stall prevention level (Pr.06-03 and 06-04).
- Rated current derating level: derating ratio × rated current (Pr.00-01).
- When the operating point is greater than the derating, derating curve level, and loading curve, the carrier frequency (Fc) output by the drive decreases automatically according to the ambient temperature, overload output current and overload time.
- Application conditions: If overloads are not frequent, and the concern is only about the carrier frequency when the output current is below the rated current most of the time, and accept carrier changes caused by short-term overloading, set to 0.

🕮 Setting 1:

- Actual over-current stall prevention level = derating ratio × over-current stall prevention level (Pr.06-03 and 06-04).
- When the operating point is greater than the derating, derating curve level, the carrier frequency (Fc) output by the drive is fixed to the default value. However, the oH1 fault (IGBT overheating) or oL fault (inverter overload) will be triggered due to the increase in IGBT temperature if the overload continues for a long time, and the machine will eventually shut down.
- Applicable conditions: Select this mode if the operating conditions with high ambient temperature or frequent overload frequency and concern about carrier frequency changes and electromagnetic noise.

🕮 Setting 2:

- Actual over-current stall prevention level = derating ratio × over-current stall prevention level (Pr.06-03 and Pr.06-04).
- Rated current derating level: derating ratio × rated current (Pr.00-01).
- The protection method and action are set to 0.
- It provides a higher starting output current without stalling when the carrier frequency setting is higher than the default. However, the carrier frequency derates easily when it overloads.

🕮 When Pr.06-55 = 0 or 1, over-current stall prevention level = ratio × Pr.06-03.

🕮 When Pr.06-55 = 2, the over-current stall prevention level = Pr.06-03.

🕮 Use this parameter with Pr.00-16 and Pr.00-17.

🕮 The ambient temperature also affects the derating. Refer to Section 11-6 for more details.

06-56 PT100 Voltage Level 1

Default: 5.000

Settings 0.000–10.000 V

06-57 PT100 Voltage Level 2

Default: 7.000

Settings 0.000–10.000 V

🕮 Condition settings: PT100 voltage level Pr.06-57 > Pr.06-56.

06-58 PT100 Level 1 Frequency Protection

Default: 0.00

Settings 0.00–599.00 Hz

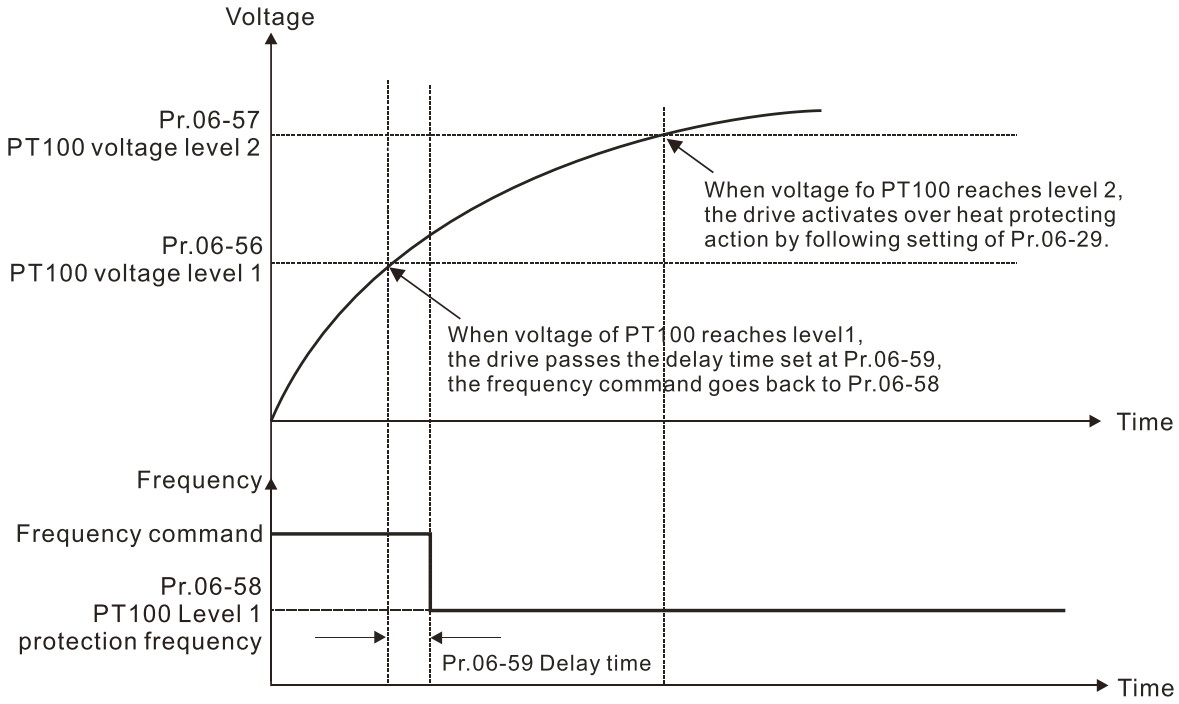
06-59 PT100 Activation Level 1 Protection Frequency Delay Time

Default: 60

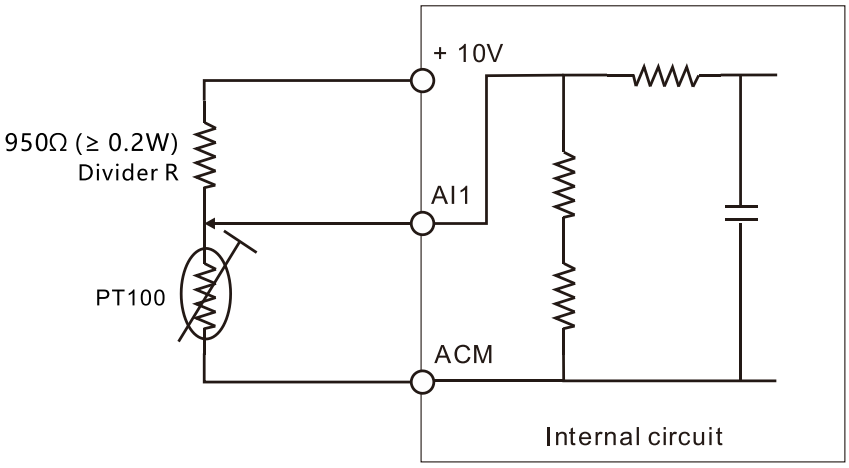
Settings 0–6000 sec.

PT100 operation instructions

1. Use voltage type analog input (voltage 0–10 V) and select PT100 mode.
2. Set Pr.03-00 = 11 and Pr.03-28 = 0
3. Need to connect divider resistance and recommended voltage is 950Ω (≥ 0.2W).
4. There are two types of action levels for PT100. The diagram below shows the PT100 protection action.



PT100 wiring diagram.



📖 For example:

When using PT100, if the motor temperature is higher than 135°C (275°F), the drive starts to count the delay time for auto-deceleration (Pr.06-59). The drive decreases the motor frequency to the setting for Pr.06-58 when it reaches the delay time count value. The drive operates at the frequency set for Pr.06-58 until the motor temperature is lower than 135°C (275°F). If the motor temperature is higher than 150°C (302°F), the drive automatically decelerates to STOP and displays the warning “oH3”.

Set up process:

1. Refer to the PT100 wiring diagram for wiring.
2. Refer to the RTD temperature and resistance comparison table.
   Temperature = 135°C, resistance = 151.71 Ω, input current: 9 mA, voltage: about 1.37 V_{DC}
   Temperature = 150°C, resistance = 157.33 Ω, input current: 9 mA, voltage: about 1.42 V_{DC}
3. When the RTD temperature > 135°C, the drive decelerates to the specified operation frequency automatically.
   Then, Pr.06-56 = 1.37 and Pr.06-58 = 10 Hz. When Pr.06-58 = 0, it disables the specified operation frequency.
4. When RTD temperature > 150°C, the drive outputs a fault, decelerates to STOP, and displays the warning “oH3”.
   Then, Pr.06-57 = 1.42 and Pr.06-29 = 1 (warn and ramp to stop).

06-63	Operation Time of Fault Record 1 (Day)
06-65	Operation Time of Fault Record 2 (Day)
06-67	Operation Time of Fault Record 3 (Day)
06-69	Operation Time of Fault Record 4 (Day)
06-90	Operation Time of Fault Record 5 (Day)
06-92	Operation Time of Fault Record 6 (Day)

Default: Read only

Display 0–65535 days

06-64	Operation Time of Fault Record 1 (Min.)
06-66	Operation Time of Fault Record 2 (Min.)
06-68	Operation Time of Fault Record 3 (Min.)
06-70	Operation Time of Fault Record 4 (Min.)
06-91	Operation Time of Fault Record 5 (Min.)
06-93	Operation Time of Fault Record 6 (Min.)

Default: Read only

Display 0–1439 min.

📖 If there is any malfunction when the drive operates, Pr.06-17–06-22 records the malfunctions, and Pr.06-63–06-70 records the operation time for four sequential malfunctions. Check if there is any problem with the drive according to the interval of the recorded fault.

For example:

The first error: ocA occurs after motor drive operates for 1000 minutes.

The second error: ocd occurs after another 1000 minutes.

The third error: ocn occurs after another 1000 minutes.

The fourth error: ocA occurs after another 1000 minutes.

The fifth error: ocd occurs after another 1000 minutes.

The sixth error: ocn occurs after another 1000 minutes.

Then Pr.06-17–06-22 and Pr.06-63–06-70 are recorded as follows:

Parameter	1st fault	2nd fault	3rd fault	4th fault	5th fault	6th fault
06-17	ocA	ocd	ocn	ocA	ocd	ocn
06-18	0	ocA	ocd	ocn	ocA	ocd
06-19	0	0	ocA	ocd	ocn	ocA
06-20	0	0	0	ocA	ocd	ocn
06-21	0	0	0	0	ocA	ocd
06-22	0	0	0	0	0	ocA
06-63	1000	560	120	1120	680	240
06-64	0	1	2	2	3	4
06-65	0	1000	560	120	1120	680
06-66	0	0	1	2	2	3
06-67	0	0	1000	560	120	1120
06-68	0	0	0	1	2	2
06-69	0	0	0	1000	560	120
06-70	0	0	0	0	1	2

NOTE: By examining the time record, you can see that that the last fault (Pr.06-17) happened after the drive ran for four days and 240 minutes.

06-71 Low Current Setting Level

Default: 0.0

Settings 0.0–100.0%

06-72 Low Current Detection Time

Default: 0.00

Settings 0.00–360.00 sec.

06-73 Low Current Action

Default: 0

Settings 0: No function
1: Fault and coast to stop
2: Fault and ramp to stop by the 2nd deceleration time
3: Warn and continue operation

- The drive operates according to the setting for Pr.06-73 when the output current is lower than the setting for Pr.06-71 and when the time of the low current exceeds the detection time for Pr.06-72. Use this parameter with the external multi-function output terminal 44 (for low current output).
- The low current detection function does not execute when drive is in sleep or standby status.

13-2-07 Special Parameters

You can set this parameter during operation.

07-01 DC Brake Current Level

Default: 0

Settings 0–100%

- Sets the level of the DC brake current output to the motor at start-up and stop. When setting the DC brake current, the rated current (Pr.01-00) 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.

07-02 DC Brake Time at Start-up

Default: 0.0

Settings 0.0–60.0 sec.

- The motor may continue rotating due to external forces or the inertia of the motor itself. If you use the drive with the motor rotating, it may cause motor damage or trigger drive protection due to over-current. This parameter outputs DC current, generating torque to force the motor stop to get a stable start before motor operation. This parameter determines the duration of the DC brake current output to the motor when the drive starts up. Set this parameter to 0.0 to disable the DC brake at start-up.

07-03 DC Brake Time at STOP

Default: 0.0

Settings 0.0–60.0 sec.

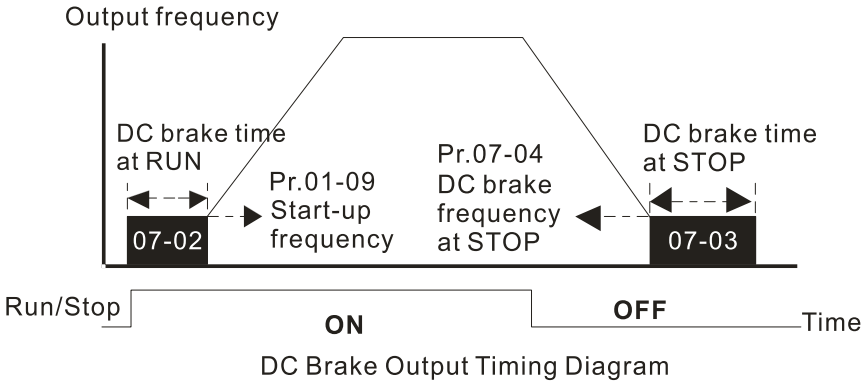
- The motor may continue rotating after the drive stops output due to external forces or the inertia of the motor itself. This parameter outputs DC current, generating torque to force the motor stop after the drive stops output to make sure that the motor stops.
- This parameter determines the duration of the DC Brake current output to the motor when braking. To enable the DC brake at STOP, you must set Pr.00-22 (Stop Method) to 0 (ramp to stop). Set this parameter to 0.0 to disable the DC brake at stop.
- Related parameters: Pr.00-22 Stop Method, Pr.07-04 DC Brake Frequency at STOP.

07-04 DC Brake Frequency at STOP

Default: 0.00

Settings 0.00–599.00 Hz

- Determines the start frequency of the DC brake before the drive ramps to stop. When this setting is less than Pr.01-09 (Start-up Frequency), the start frequency for the DC brake begins at the minimum frequency.



DC Brake Output Timing Diagram

- Use the DC brake before running the motor when the load is movable at stop, such as with fans and pumps. The motor is in free running status and in unknown rotation direction before the drive starts up. Execute the DC brake before you start the motor.
- Use the DC Brake at STOP when you need to brake the motor quickly or to control the positioning. Such as cranes or cutting machines.

07-05 Voltage Increasing Gain

Default: 100

Settings 1–1000%

- When using speed tracking, adjust Pr.07-05 to slow down the increasing voltage gain if there are errors such as oL or oc; however, the speed tracking time will be longer.
- When Pr.01-49 is set to 3, this parameter allows for the adjustment of the voltage increase slope.
- The voltage increase slope is defined as [Pr.07-05] * [1V/1ms].

07-06 Restart after Momentary Power Loss

Default: 0

Settings 0: Stop operation
1: Speed tracking by the speed before the power loss
2: Speed tracking by the minimum output frequency

- Determines the operation mode when the drive restarts from a momentary power loss.
- The power system connected to the drive may power off momentarily for many reasons. This function allows the drive to keep outputting voltages after the drive is re-powered and does not cause the drive to stop.
- 1: Frequency tracking begins before momentary power loss and accelerates to the master Frequency command after the drive output frequency and motor rotator speed are synchronous. Use this setting when there is a lot of inertia with little resistance on the motor load. For example, in equipment with a large inertia flywheel, there is NO need to wait until the flywheel stops completely after a restart to execute the operation command; therefore, it saves time.
- 2: Frequency tracking starts from the minimum output frequency and accelerates to the master Frequency command after the drive output frequency and motor rotator speed are synchronous. Use this setting when there is little inertia and large resistance.

07-07 Allowed Power Loss Duration

Default: 2.0

Settings 0.0–20.0 sec.

- Determines the maximum time of allowable power loss. If the duration of a power loss exceeds this parameter setting, the AC motor drive stops output after the power recovered.
- Pr.07-06 is valid when the maximum allowable power loss time is ≤ 20 seconds and the AC motor drive displays “Lv”. If the AC motor drive is powered off due to overload, even if the maximum allowable power loss time is 20 seconds, the operation mode set in Pr.07-06 does not execute.

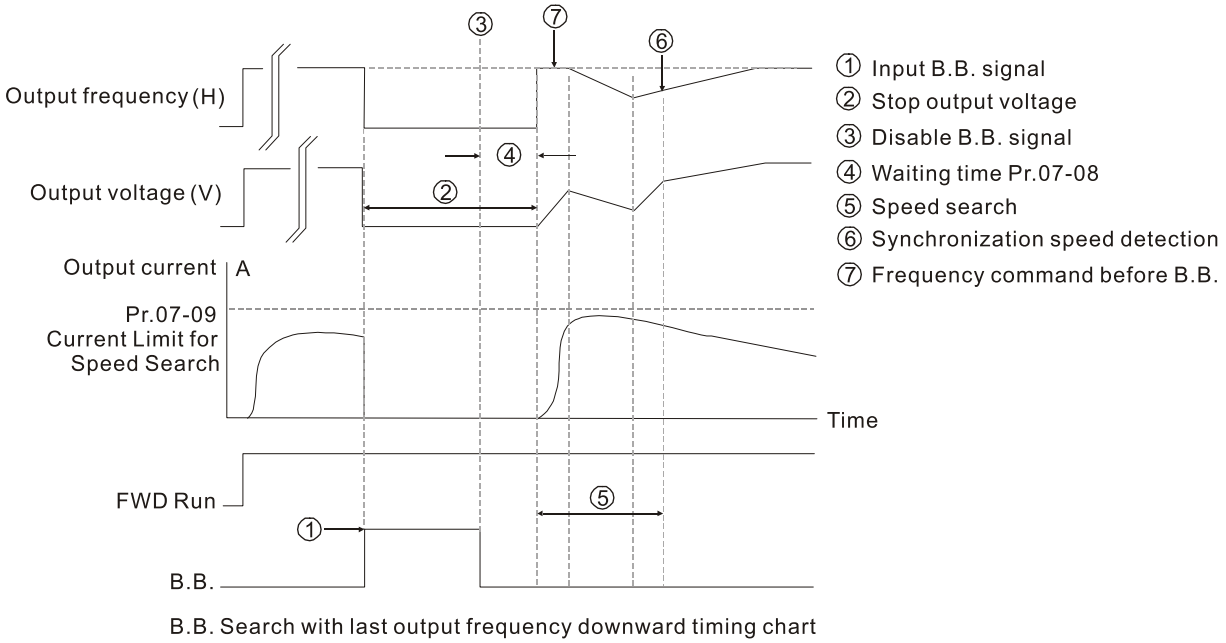
07-08 Base Block Time

Default: 0.5

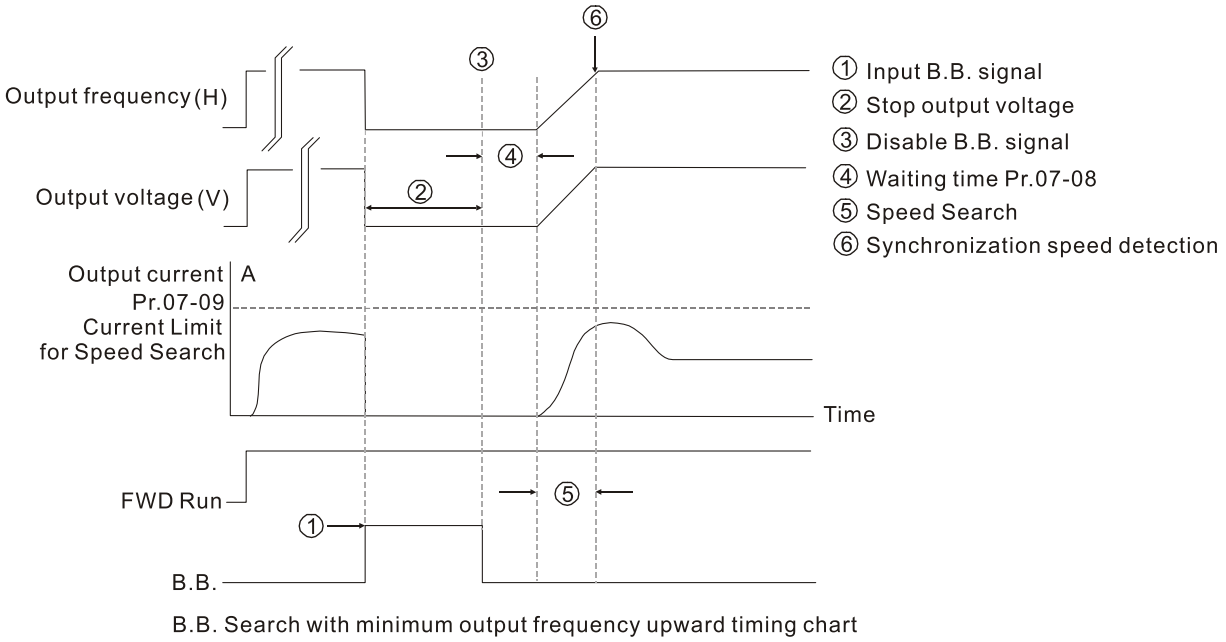
Settings 0.1–5.0 sec.

- When momentary power loss is detected, the AC motor drive blocks its output and then waits for a specified period of time (determined by Pr.07-08, called Base Block Time) before resuming operation. Set this parameter to the time that allows the residual voltage at the output side to decrease to 0 V before activating the drive again.
- This parameter is not only for the B.B. time, but also is the re-start delay time after free run.
- The RUN command during a free run operation is memorized, and runs or stops with the last frequency command after the delay time.
- This delay time is only applicable in “Re-start after coast to stop” status, and does not limit ramp to stop. The coast to stop can be caused by various control command source, or by errors.
- Following table is the recommended setting for re-start delay time of each model power. You must set Pr.07-08 according to this table (the default of each model power is based on this table as well).

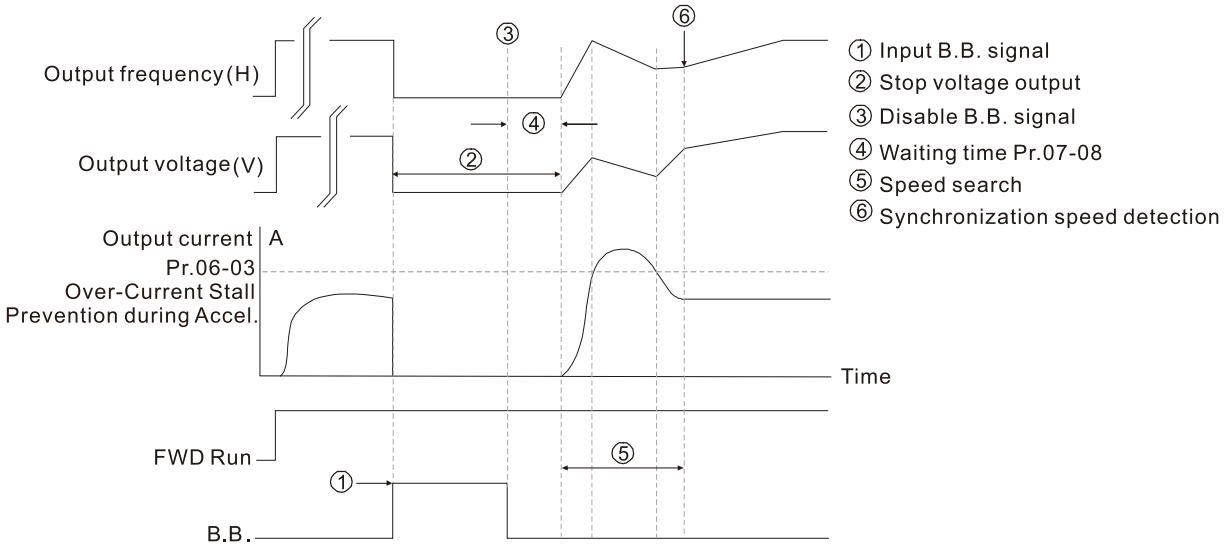
kW	0.75	1.5	2.2	3.7	5.6	7.5	11.0	15.0	18.5	22.0
HP	1	2	3	5	7.5	10	15	20	25	30
Delay time (sec.)	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0	1.1	1.2



B.B. Search with last output frequency downward timing chart



B.B. Search with minimum output frequency upward timing chart



Over-current stall prevention action chart

07-09 Current Limit of Speed Tracking

Default: 100

Settings 20–200%

- The AC motor drive executes speed tracking only when the output current is greater than the value set in Pr.07-09.
- The maximum current for speed tracking affects the synchronous time. The larger the parameter setting, the faster the synchronization occurs. However, if the parameter setting is too large, the overload protection function may be activated.

07-10 Restart after Fault Action

Default: 0

Settings 0: Stop operation
1: Speed tracking by current speed
2: Speed tracking by the minimum output frequency

📖 Faults include: bb, oc, ov, occ. To restart after oc, ov, occ, you can NOT set Pr.07-11 to 0.

07-11 Number of Times of Restart after Fault

Default: 0

Settings 0–10

📖 After fault (allowed fault: oc, ov, occ) occurs, the AC motor drive can reset and restart automatically up to 10 times. If Pr.07-11 is set to 0, the drive does not reset or restart automatically after faults occur. The drive starts according to the Pr.07-10 setting after restarting after fault.

📖 If the number of faults exceeds the Pr.07-11 setting, the drive does not reset and restart until you press “RESET” manually and execute the operation command again.

07-12 Speed Tracking During Start-up

Default: 0

Settings 0: Disable
1: Speed tracking by the maximum output frequency
2: Speed tracking by the motor frequency at start-up
3: Speed tracking by the minimum output frequency

📖 Speed tracking is suitable for punch, fans and other large inertia loads. For example, a mechanical punch usually has a large inertia flywheel, and the general stop method is coast to stop. If it needs to be restarted again, the flywheel may take 2–5 minutes or longer to stop. This parameter setting allows you to start the flywheel operating again without waiting until the flywheel stops completely.

07-13 dEb Function Selection

Default: 0

Settings 0: Disable
1: dEb with auto-acceleration / auto-deceleration, the drive does not output the frequency after the power is restored.
2: dEb with auto-acceleration / auto-deceleration, the drive outputs the frequency after the power is restored.

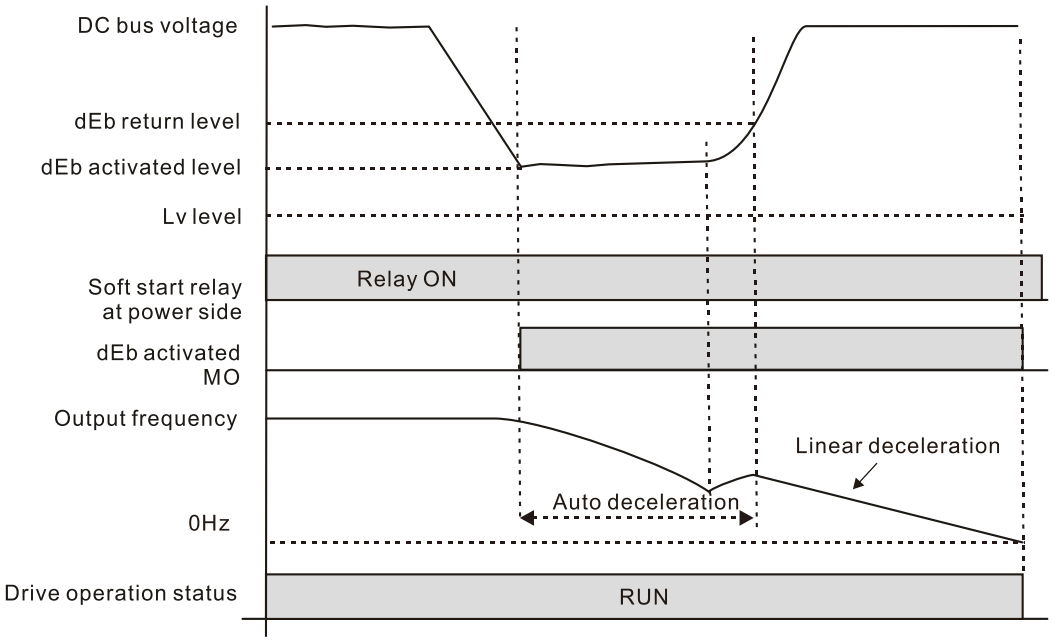
📖 dEb (Deceleration Energy Backup) lets the motor decelerate to stop when momentary power loss occurs. When the power loss is instantaneous, use this function to let the motor decelerate to zero speed. If the power recovers at this time, the drive restarts the motor after the dEb return time.

📖 Lv return level: Pr.06-00 + 60V / 30V (230V models)

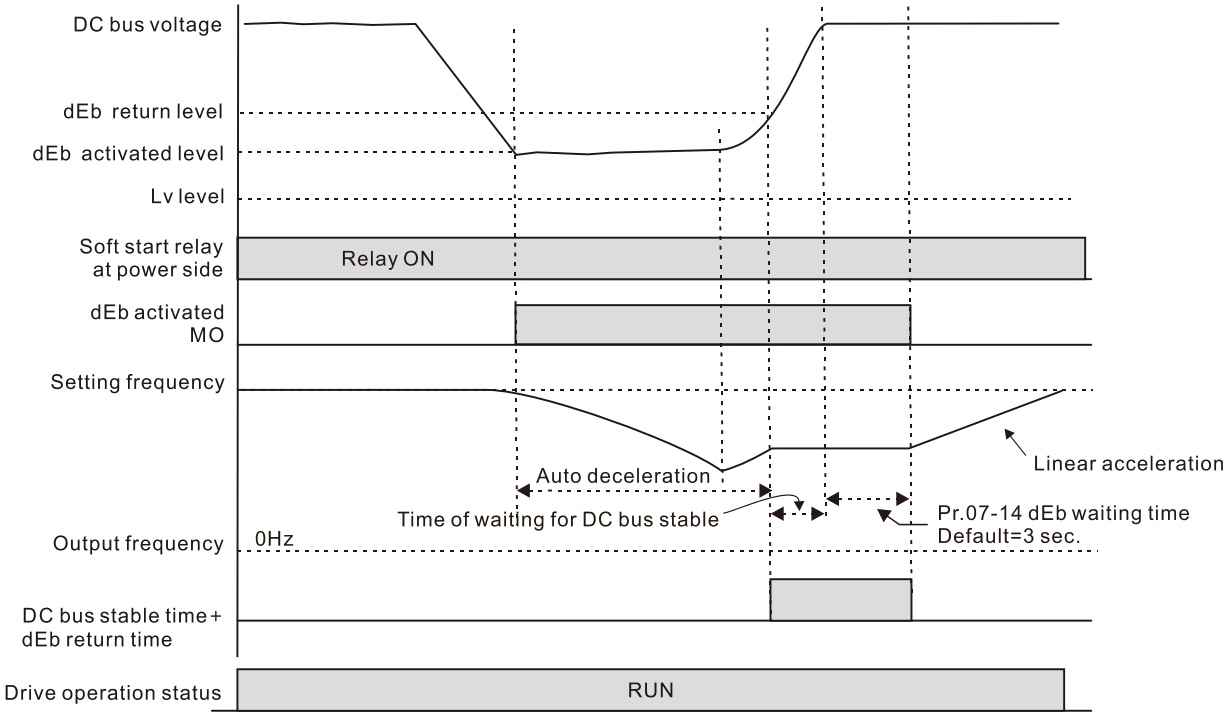
📖 Lv level: Default is Pr.06-00.

📖 During dEb operation, other protection, such as ryF, ov, oc, occ, and EF may interrupt it, and these error codes are recorded.

- The STOP (RESET) command does not work during the dEb auto-deceleration, and the drive continues decelerating to stop. To make the drive coast to stop immediately, use another function (EF) instead.
- The B.B. function does not work when executing dEb. The B.B. function is enabled after the dEb function finishes.
- Even though the Lv warning does not display during dEb operation, if the DC bus voltage is lower than the Lv level, MO = 10 (Low voltage warning) still operates.
- The following explains the dEb action:
  When the DC bus voltage drops below the dEb setting level, the dEb function starts to work (soft start relay remains closed), and the drive executes auto-deceleration.
  - Situation 1: Momentary power loss, or too low and unstable power voltage, or power supply sliding down because of sudden heavy load
    Pr.07-13 = 1 and power recovers
    When the power recovers and DC bus voltage exceeds the dEb return level, the drive linearly decelerates to 0 Hz and stops. The keypad displays the “dEb” warning until you manually reset it, so you can see the reason for the stop.



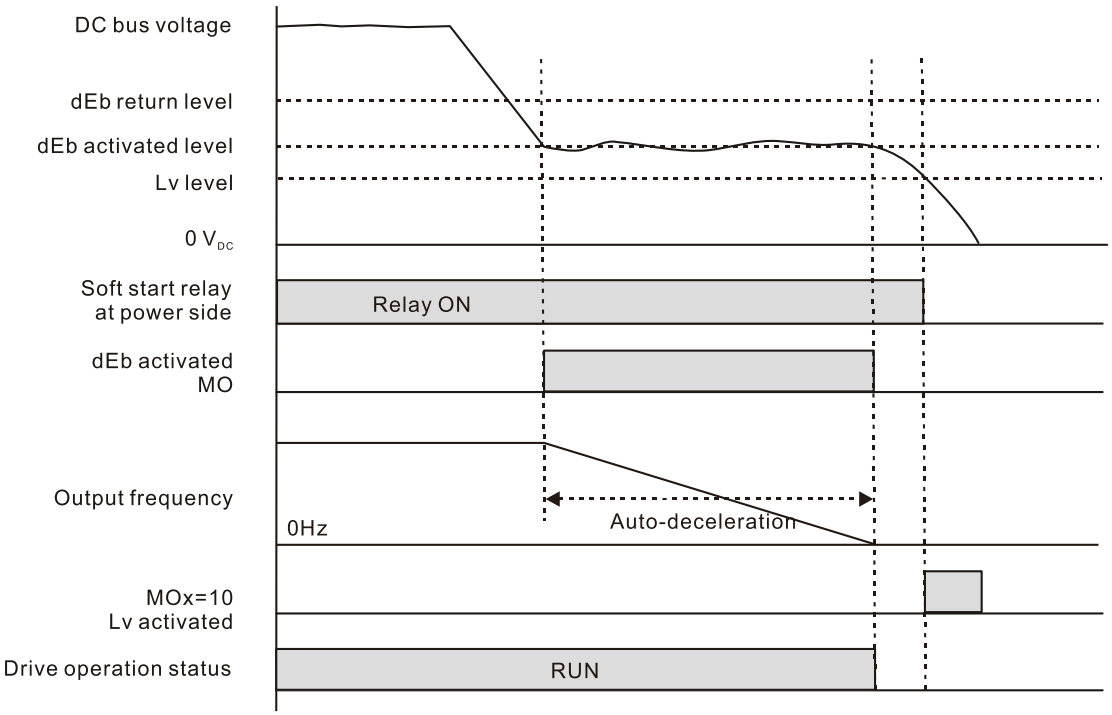
  - Situation 2: Momentary power loss, or too low and unstable power voltage, or power supply sliding down because of sudden heavy load
    Pr.07-13 = 2 and power recovers
    During the dEb deceleration (includes 0 Hz run), if the power recovers to a voltage higher than dEb return level, the drive maintains the frequency for three seconds and then accelerates again. The “dEb” warning on the keypad is automatically cleared.



- Situation 3: Unexpected power shut down or power loss

  Pr.07-13 = 1 and power does not recover

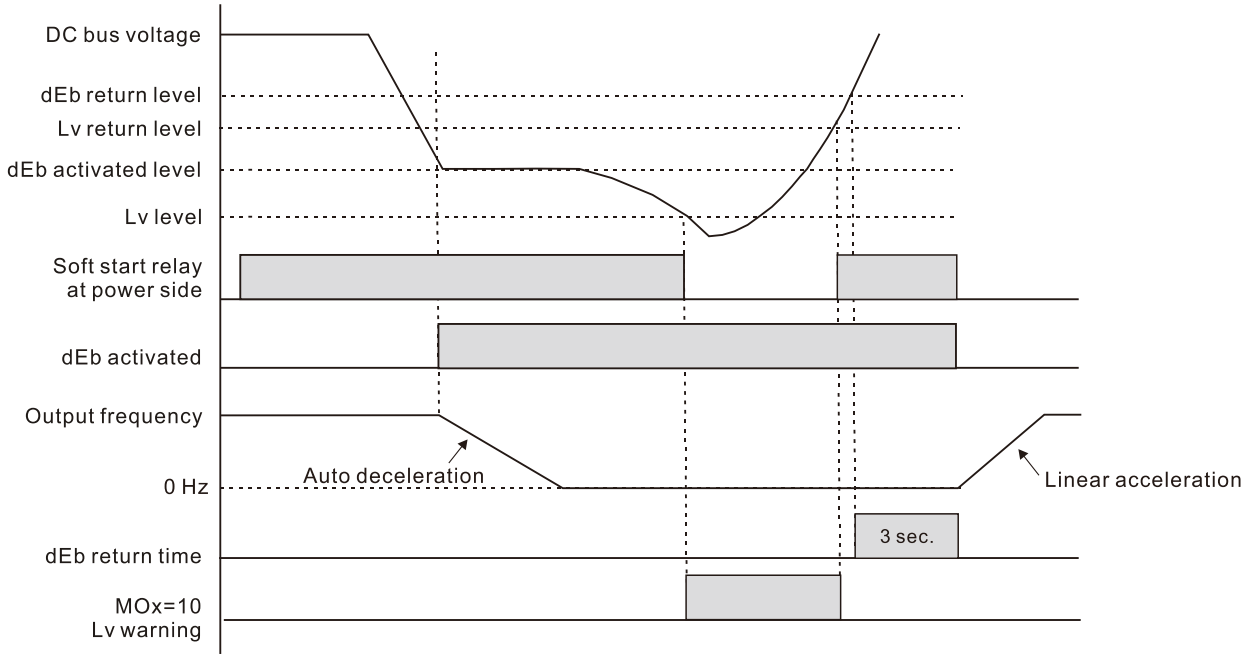
  The keypad displays the “dEb” warning and the drive stops after decelerating to the lowest operating frequency. When the DC bus voltage is lower than the Lv level, the drive disconnects the soft start relay until the power completely runs out.



- Situation 4: Unexpected power shut down or power loss

  Pr.07-13 = 2 and power does not recover the drive decelerates to 0 Hz. The DC bus voltage continues to decrease until the voltage is lower than the Lv level, and then the drive disconnects the soft start relay. The keypad displays “dEb” warning until the drive completely runs out of power.

- Situation 5: Pr.07-13 = 2 and power recovers after the DC bus voltage is lower than the Lv level.
  The drive decelerates to 0 Hz. The DC bus voltage continues to decrease until the voltage is lower than the Lv level, and then the drive disconnects the soft start relay. The soft start relay closes again after the power recovers and the DC bus voltage is higher than the Lv return level. When the DC bus voltage is higher than the dEb return level, the drive maintains the frequency for three seconds and starts to accelerate linearly. The "dEb" warning on the keypad is automatically cleared.



07-15 Dwell Time at Acceleration
07-17 Dwell Time at Deceleration

Default: 0.00

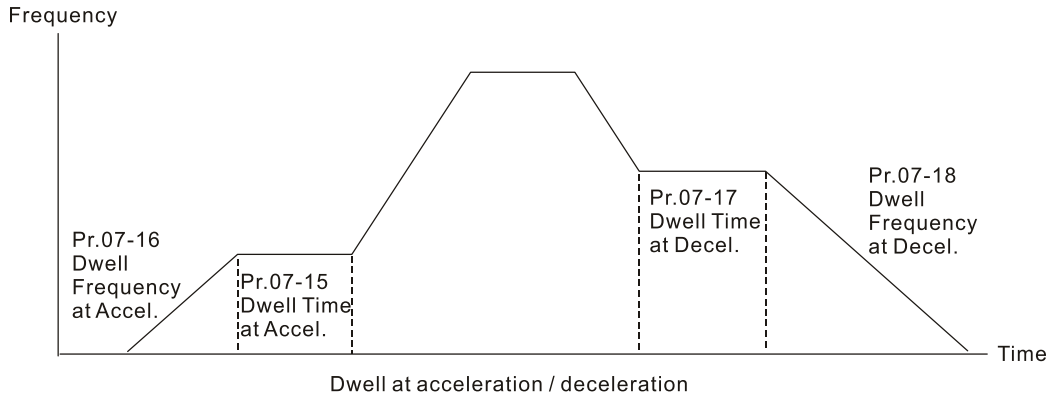
Settings 0.00–600.00 sec.

07-16 Dwell Frequency at Acceleration
07-18 Dwell Frequency at Deceleration

Default: 0.00

Settings 0.00–599.00 Hz

- In heavy load situations, the Dwell temporarily maintains stable output frequency. Use this parameter for cranes, elevators, and so on.
- For heavy load applications, use Pr.07-15–Pr.07-18 to avoid OV or OC protection.



Dwell at acceleration / deceleration

07-19 Fan Cooling Control

Default: 3

Settings
0: Fan is always ON
1: Fan is OFF after the AC motor drive stops for one minute.
2: Fan turns ON / OFF when the AC motor drive runs / stops.
3: Fan turns ON when temperature (IGBT) reaches around 60°C
5: Fan turns ON / OFF when the AC motor drive runs / stops and stays in standby mode at zero speed.

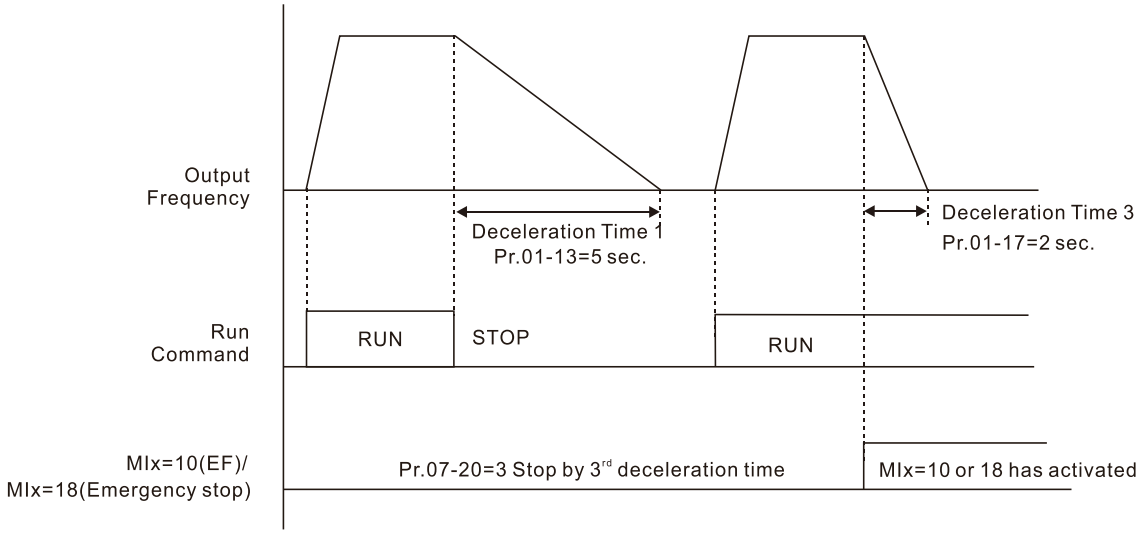
- Use this parameter to control the fan. Applicable to inverter module firmware v1.01 and below. For v1.02 and above, please refer to the description of inverter module Pr.07-49.
- 0: Fan runs immediately when the drive power is turned ON.
- 1: Fan runs when the AC motor drive runs. One minute after the AC motor drive stops, the fan is OFF.
- 2: Fan runs when the AC motor drive runs and stops immediately when the AC motor drive stops.
- 3: When the temperature of the IGBT or capacitance is higher than 60ºC, the fan runs. When the temperature of the IGBT and capacitance are lower than 40ºC and the drive stops, the fan stops.
- 5: Fan runs when the AC motor drive runs and stops immediately when AC motor drive stops. Even if the AC motor drive outputs zero speed, the fan will also stop.

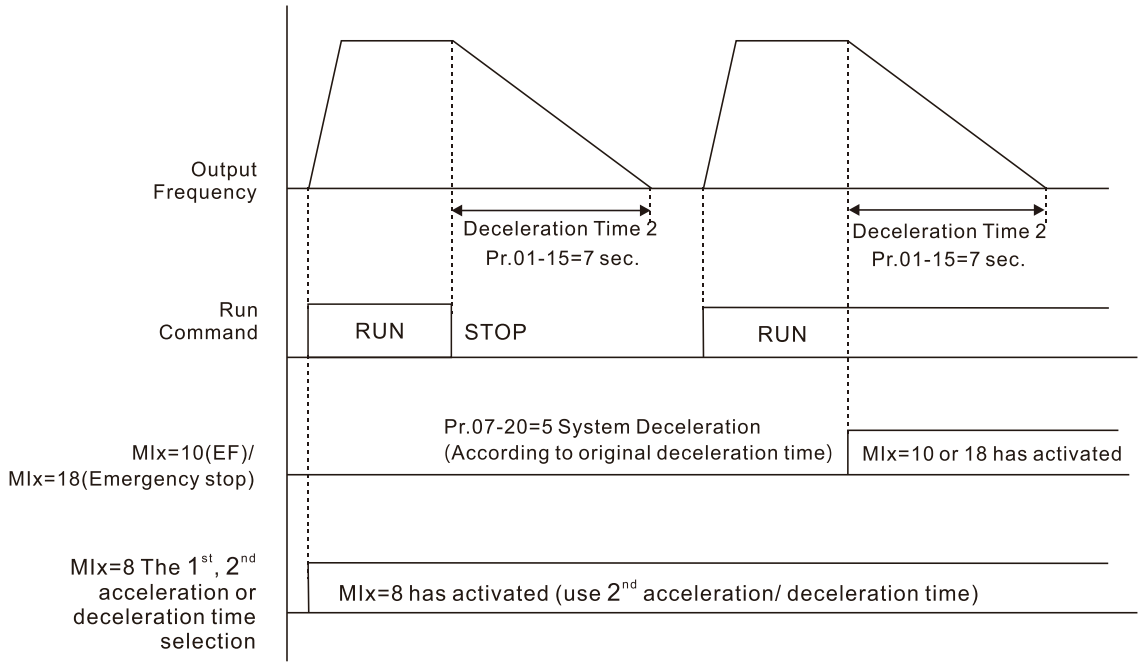
07-20 Emergency Stop (EF) & Force to Stop Selection

Default: 0

Settings
0: Coast to stop
1: Stop by the first deceleration time
2: Stop by the second deceleration time
3: Stop by the third deceleration time
4: Stop by the fourth deceleration time
5: System deceleration
6: Automatic deceleration

- When the multi-function input terminal setting is set to 10 (EF input) or 18 (force to stop) and the terminal contact is ON, the drive stops according to the setting of this parameter.





07-21 Automatic Energy-saving Setting

Default: 0

Settings 0: Disable
1: Enable

- When energy-saving is enabled, the motor acceleration/deceleration operates with full voltage. During constant speed operation, it automatically calculates the best voltage value according to the load power. This function is not suitable for fluctuating loads or loads that are nearly full during operation.
- When the output frequency is constant (that is, constant operation), the output voltage decreases automatically as the load decreases. Therefore, the drive operates with minimum multiplication of voltage and current (electric power) to reach the energy-saving.

07-22 Energy-saving Gain

Default: 100

Settings 10–1000%

- When Pr.07-21 is set to 1, use this parameter to adjust the energy-saving gain. The default is 100%. If the result is not satisfactory, adjust it by decreasing the setting value. If the motor oscillates, then increase the setting value.
- In certain applications such as high-speed spindles, the temperature rise in the motor is a major concern. When the motor is not in working state, reduce the motor current to a lower level. Reduce this parameter setting to meet this requirement.

07-23 Automatic Voltage Regulation (AVR) Function

Default: 0

Settings 0: Enable AVR
1: Disable AVR
2: Disable AVR during deceleration

- The rated voltage of a 220V motor is usually 200 V_{AC}, 60 Hz / 50 Hz, and the input voltage of the AC motor drive may vary from 180–264 V_{AC}, 50 Hz / 60 Hz. Therefore, when the AC motor drive is used without the AVR function, the output voltage is the same as the input voltage. When the motor runs at the voltage exceeding 12–20% of the rated voltage, it causes higher temperatures, damaged insulation, and unstable torque output, which result in losses due to shorter motor lifetime.
- The AVR function automatically regulates the output voltage of the AC motor drive to the motor's rated voltage when the input voltage exceeds the motor's rated voltage. For example, if the V/F curve is set at 200 V_{AC}, 50 Hz and the input voltage is at 200–264 V_{AC}, then the drive automatically reduces the output voltage to the motor to a maximum of 200 V_{AC}, 50 Hz. If the input voltage is at 180–200 V_{AC}, the output voltage to motor is in direct proportion to the input voltage.
- 0: When the AVR function is enabled, the drive calculates the output voltage according to the actual DC bus voltage. The output voltage does NOT change when the DC bus voltage changes.
- 1: When the AVR function is disabled, the drive calculates the output voltage according to the actual DC bus voltage. The output voltage changes with the DC bus voltage, and may cause insufficient current, over-current or oscillation.
- 2: The drive disables the AVR function only during deceleration to stop, and at this time, you can accelerate the braking to achieve the same result.
- When the motor ramps to stop, disable the AVR function to shorten the deceleration time. Then, use with the auto-acceleration and auto-deceleration functions to make the motor's deceleration more stable and quicker.

07-24 Torque Command Filter Time (V/F and SVC control mode)

Default: 0.050

Settings 0.001–10.000 sec.

- IMVF and PMSVC control modes only.
- When the time constant setting is too large, the control is stable but the control response is slow. When the time constant setting is too small, the control response is faster but the control may be unstable. For optimal setting, adjust the setting based on the control stability or the control response.

07-25 Slip Compensation Filter Time (V/F and SVC Control Mode)

Default: 0.100

Settings 0.001–10.000 sec.

- IMSVC control mode only.
- Change the compensation response time with Pr.07-24 and Pr.07-25.
- If you set Pr.07-24 and Pr.07-25 to 10 seconds, the compensation response time is the slowest; however, the system may be unstable if you set the time too short.

07-26 Torque Compensation Gain
07-71 Torque Compensation Gain (Motor 2)

Default: 1

Settings IM: 0–10 (when Pr.05-33=0)
PM: 0–5000 (when Pr.05-33=1 or 2)

- IMVF and PMSVC control modes only.
- With a large motor load, a part of the drive output voltage is absorbed by the stator winding resistor; therefore, the air gap magnetic field is insufficient. This causes insufficient voltage at motor induction and results in excessive output current but insufficient output torque. Auto-torque compensation can automatically adjust the output voltage according to the load and keep the air gap magnetic fields stable to get the optimal operation.
- In the V/F control, the voltage decreases in direct proportion with decreasing frequency. The torque decreases at low speed because of a decreasing AC resistor and an unchanged DC resistor. The auto-torque compensation function increases the output voltage at low frequency to get a higher starting torque.
- When the compensation gain is set too high, it may cause motor over-flux and result in a too large output current of the drive, motor overheating or trigger the drive's protection function.
- This parameter affects the output current when the drive runs. The effect is smaller at the low-speed area.
- Set this parameter higher when the no-load current is too large, but the motor may vibrate if the setting is too high. If the motor vibrates when operating, reduce the setting.

07-27 Slip Compensation Gain
07-72 Slip Compensation Gain (Motor 2)

Default: 0.00
(Default value is 1.00 in SVC mode)

Settings 0.00–10.00

- IMSVC control mode only.
- The induction motor needs constant slip to produce electromagnetic torque. It can be ignored at higher motor speeds, such as rated speed or 2–3% of slip.
- However, during the drive operation, the slip and the synchronous frequency are in reverse proportion to produce the same electromagnetic torque. The slip is larger with the reduction of synchronous frequency. Moreover, the motor may stop when the synchronous frequency decreases to a specific value. Therefore, the slip seriously affects the motor speed accuracy at low speed.
- In another situation, when you use an induction motor with the drive, the slip increases when the load increases. It also affects the motor speed accuracy.
- Use this parameter to set the compensation frequency, and reduce the slip to maintain the synchronous speed when the motor runs at the rated current to improve the accuracy of the drive. When the drive output current is higher than Pr.05-05 (No-load Current for Induction Motor 1 (A)), the drive compensates the frequency according to this parameter.

📖 This parameter is set to 1.00 automatically when Pr.00-11 (Speed Control Mode) is changed from V/F mode to vector mode. Otherwise, it is automatically set to 0.00. Apply the slip compensation after load and acceleration. Increase the compensation value from small to large gradually. Add the output frequency to the [motor rated slip × Pr.07-27 (Slip Compensation Gain)] when the motor is at the rated load. If the actual speed ratio is slower than expected, increase the parameter setting value; otherwise, decrease the setting value.

07-29 Slip Deviation Level

Default: 0

Settings 0.0–100.0%
0: No detection

07-30 Over-slip Deviation Detection Time

Default: 1.0

Settings 0.0–10.0 sec.

07-31 Over-slip Deviation Treatment

Default: 0

Settings 0: Warn and continue operation
1: Fault and ramp to stop
2: Fault and coast to stop
3: No warning

📖 Pr.07-29–Pr.07-31 set the allowable slip level / time and the over-slip treatment when the drive is running.

07-32 Motor Oscillation Compensation Factor

Default: 1000

Settings 0–10000

📖 If the drift current occurs in a specific zone of the motor and causes serious motor vibration. adjust this parameter could greatly improve this situation.

📖 When the current wave motion occurs in low frequency and high power, increase the value for Pr.07-32.

07-33 Auto-restart Interval of Fault

Default: 60.0

Settings 0.0–6000.0 sec.

📖 When a reset / restart occurs after a fault, the drive uses Pr.07-33 as a timer and starts counting the number of faults within this time period. Within this period, if the number of faults does not exceed the setting for Pr.07-11, the counting clears and starts from 0 when the next fault occurs.

07-38 PMSVC Voltage Feed Forward Gain

Default: 1.00

Settings 0.50–2.00

📖 Adjust the PMSVC voltage feedback forward gain, and to meet the demand of rapid feedback application.

📖 Pr.07-38 = 1.00 means forward feedback = Ke × motor rotor speed

🕮 Refer to Chapter 5 PMSVC adjustment process for detail.

07-49 Fan Control Mode

Default: 3

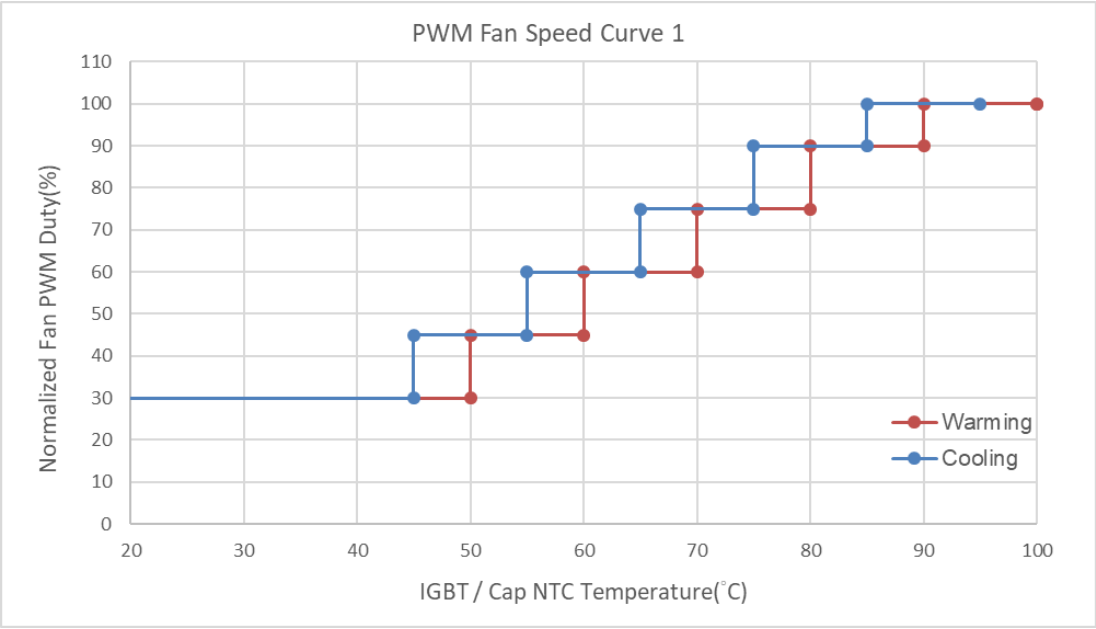
Settings
0: Continuous running by the setting of Pr.07-50
1: Fan runs continuously between 30% to 100% by the speed curve in Figure 1.
2: Fan stops after the drive stops for one minute, runs between 30% to 100% by the speed curve in Figure 1.
3: Fan starts when the temperature reaches 40°C, runs between 30% to 100% by the speed curve in Figure 2.

🕮 Pr.07-49 determines the PWM cooling fan operation mode and is applicable to inverter module firmware v1.02 and above.

🕮 Set to 0, the fan runs continuously according to the Duty of Pr.07-50.

🕮 Set to 1, the fan runs continuously between 30% to 100% by the speed curve in Figure 1 and adjusted by temperature automatically.

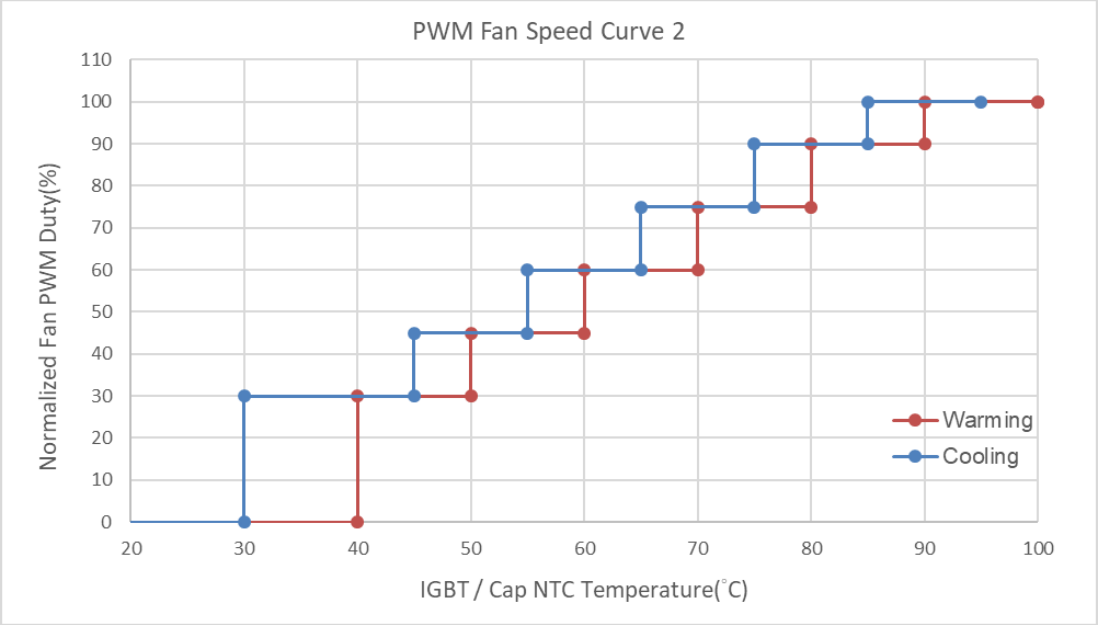
🕮 Set to 2, the fan runs continuously between 30% to 100% by the speed curve in Figure 1 and adjusted by temperature automatically. Fan stops after the drive stops for one minute, but if the temperature drops below 30°C within one minute, it will stop immediately.



🕮 Set to 3:

When IGBT or capacitor temperature > 40ºC, the fan will start running between 30% to 100% by the speed curve in Figure 2.

When IGBT or capacitor temperature > 30ºC, the fan stop.



- Over Temperature Protection: When the temperature reaches the OH warning level, the fan will run at 100% speed to cool the unit, unless Pr.09-49 = 0 and Pr.09-50 = 0.
- Since Pr.07-49 only applies to inverter module firmware v1.02 or above, the fan drives with different combinations of old and new rectifiers and inverters modules.

Refer to the table below for details:

Firmware Version	Inverter Module v1.01 and below	Inverter Module v1.02 and above
Rectifier Module MX300-C v1.00 MX300-E v1.00	● Rectifier module: According to the setting of Pr.07-19. ● Inverter module: According to the setting of Pr.07-19.	● Rectifier module: According to the setting of Pr.07-19. ● Inverter module: According to the setting of Pr.07-49 and 07-50. If the calculated Duty exceeds 30%, run at 100%, or no function.
Rectifier Module MX300-C v1.01	● Rectifier module: According to the setting of Pr.07-19. ● Inverter module: According to the setting of Pr.07-19.	● Rectifier module: According to the setting of Pr.07-19. ● Inverter module: According to the setting of Pr.07-49 and 07-50. Take the max. Duty to run for the same module.

07-50 Fan Control Duty

Default: 60

Settings 0–100 %

- When Pr.07-49 is set to 0, the control speed will be determined by the setting of Pr.07-50.
- When Pr.07-50 is set to 0, no function.
- When Pr.07-50 is set to 1–30, output in 30%.
- When Pr.07-50 is set to 30–100, output by the setting value.

07-54 Auto-acceleration and Auto-deceleration Gain (Kp)

Default: 2

Settings 0–65535

07-55 Auto-acceleration and Auto-deceleration Gain (Ki)

Default: 4.00

Settings 0–655.35

07-62 dEb Gain (Kp)

Default: 8000

Settings 0–65535

07-63 dEb Gain (Ki)

Default: 150

Settings 0–65535

- Sets the PI gain of DC bus voltage controller when the dEb function activates.
- If the DC bus voltage drops too fast, or the speed oscillation occurs during deceleration after the dEb function activates, adjust Pr.07-62 and Pr.07-63. Increase the Kp setting to quicken the control response, but the oscillation may occur if the setting is too large. Use Ki parameter to decrease the steady-state error to zero, and increase the setting to quicken the response speed.

13-2-08 High-function PID Parameters

You can set this parameter during operation.

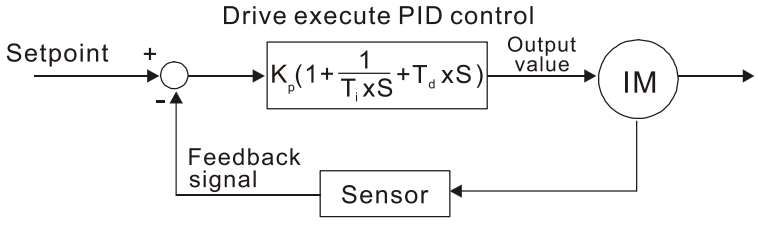
08-00 Terminal Selection of PID Feedback

Default: 0

Settings 0: No function
1: Negative PID feedback: by analog input (Pr.03-00)
4: Positive PID feedback: by analog input (Pr.03-00)
7: Negative PID feedback: by communication protocols
8: Positive PID feedback: by communication protocols

- Negative feedback: Error = Target value (set point) – Feedback. Use negative feedback when the detection value increases if the output frequency increases.
- Positive feedback: Error = - Target value (set point) + Feedback. Use positive feedback when the detection value decreases if the output frequency increases.
- When Pr.08-00 ≠ 7 or ≠ 8, the input value is disabled. The setting value does not remain when the drive is powered off.

1. Common applications for PID control:
   - Flow control: Use a flow sensor to feedback the flow data and perform accurate flow control.
   - Pressure control: Use a pressure sensor to feedback the pressure data and perform precise pressure control.
   - Air volume control: Use an air volume sensor to feedback the air volume data to achieve excellent air volume regulation.
   - Temperature control: Use a thermocouple or thermistor to feedback temperature data for comfortable temperature control.
   - Speed control: Use a speed sensor to feedback motor shaft speed or input another machine speed as a target value for synchronous control.
2. PID control loop:



K_P Proportional Gain (P), T_i Integral Time (I), T_d Differential Time (D), S Calculation

3. Concept of PID control:
   (1) Proportional gain (P):
   The output is proportional to input. With only a proportional gain control, there is always a steady-state error.
   (2) Integral time (I):
   The controller output is proportional to the integral of the controller input. When an automatic control system is in a steady state and a steady-state error occurs, the system is called a System with Steady-state Error. To eliminate the steady-state error, add an “integral part” to the controller. The integral time controls the relation between

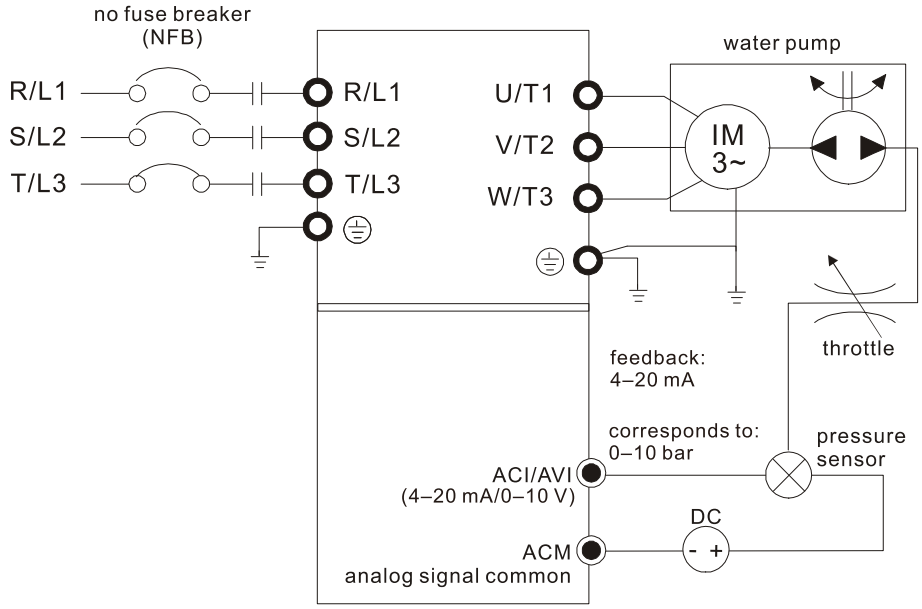
the integral part and the error. The integral part increases over time even if the error is small. It gradually increases the controller output to eliminate the error until it is zero. This stabilizes the system without a steady-state error by using proportional gain control and integral time control.

(3) Differential control (D):

The controller output is proportional to the differential of the controller input. During elimination of the error, oscillation or instability may occur. Use the differential control to suppress these effects by acting before the error. That is, when the error is near 0, the differential control should be 0. Use proportional gain (P) and differential control (D) to improve the system state during PID adjustment.

4. Using PID control in a constant pressure pump feedback application:

Set the application's constant pressure value (bar) to be the set point of PID control. The pressure sensor sends the actual value as the PID feedback value. After comparing the PID set point and PID feedback, an error display. The PID controller calculates the output by using proportional gain (P), integral time (I) and differential time (D) to control the pump. It controls the drive to use a different pump speed and achieves constant pressure control by using a 4–20 mA signal corresponding to 0–10 bar as feedback to the drive.



- Pr.00-04 = 10 (display PID feedback (b) (%))
- Pr.01-12 Acceleration Time is set according to actual conditions.
- Pr.01-13 Deceleration Time is set according to actual conditions.
- Pr.00-21 = 0, operate through the digital keypad
- Pr.00-20 = 0, the digital keypad controls the set point.
- Pr.08-00 = 1 (negative PID feedback from analog input)
- AI1 analog input Pr.03-00 = 5, PID feedback signal.
- Set Pr.08-01–08-03 according to actual conditions.
  If there is no oscillation in the system, increase Pr.08-01 (Proportional Gain (P))
  If there is no oscillation in the system, decrease Pr.08-02 (Integral Time (I))
  If there is no oscillation in the system, increase Pr.08-03 (Differential Time (D))
- Refer to Pr.08-00–08-21 for PID parameter settings.

08-01 Proportional Gain (P)

Default: 1.00

Settings 0.0–1000.0 (when Pr.08-23 setting bit 1 = 0)
0.00–100.00 (when Pr.08-23 setting bit 1 = 1)

- 1.0: Kp gain is 100%; if the setting is 0.5, Kp gain is 50%.
- Sets the proportional gain to determine the deviation response speed. The higher the proportional gain, the faster the response speed, and causes oscillation. The lower the proportional gain, the slower the response speed. Eliminate the system deviation; usually used to decrease the deviation and get faster response speed. If you set the value too high, overshoot occurs and it may cause system oscillation and instability.
- If you set the other two gains (I and D) to zero, proportional control is the only effective parameter.

08-02 Integral Time (I)

Default: 1.00

Settings 0.00–100.00 sec.

- Use the integral controller to eliminate the deviation during stable system operation. The integral control does not stop working until the deviation is zero. The integral is affected by the integral time. The smaller the integral time, the stronger the integral action. It is helpful to reduce overshoot and oscillation for a stable system. Accordingly, the speed to lower the steady-state deviation decreases. The integral control is often used with the other two controls for the PI controller or PID controller.
- Sets the integral time of the I controller. When the integral time is long, there is a small I controller gain, with slower response and slow external control. When the integral time is short, there is a large I controller gain, with faster response and rapid external control.
- When the integral time is too short, it may cause overshoot or oscillation for the output frequency and system.
- Set Integral Time to 0.00 to disable the I controller.

08-03 Differential Time (D)

Default: 0.00

Settings 0.00–1.00 sec.

- Use the differential controller to show the system deviation change, as well as to preview the change in the deviation. You can use the differential controller to eliminate the deviation to improve the system state. Using a suitable differential time can reduce overshoot and shorten adjustment time; however, the differential operation increases noise interference. Note that a too large differential causes more noise interference. In addition, the differential shows the change and the differential output is 0 when there is no change. Note that you cannot use the differential control independently. You must use it with the other two controllers for the PD controller or PID controller.
- Sets the D controller gain to determine the deviation change response. Using a suitable differential time reduces the P and I controllers' overshoot to decrease the oscillation for a stable system. A differential time that is too long may cause system oscillation.

- The differential controller acts on the change in the deviation and cannot reduce the interference. Do not use this function when there is significant interference.

08-04 Upper Limit of Integral Control

Default: 100.0

Settings 0.0–100.0%

- Defines an upper bound for the integral gain (I) and therefore limits the master frequency. The formula is: Integral upper bound = Maximum Operation Frequency (Pr.01-00) x (Pr.08-04%).
- An excessive integral value causes a slow response due to sudden load changes and may cause motor stall or machine damage. If so, decrease it to a proper value.

08-05 PID Output Command Limit (Positive Limit)

Default: 100.0

Settings 0.0–100.0%

- Defines the percentage of the output frequency limit during the PID control. The formula is Output Frequency Limit = Maximum Operation Frequency (Pr.01-00) × Pr.08-05%.

08-06 PID Feedback Value by Communication Protocol

Default: 0.00

Settings -200.00–200.00%

- Use communications to set the PID feedback value when the PID feedback input is set to communications (Pr.08-00 = 7 or 8).

08-07 PID Delay Time

Default: 0.0

Settings 0.0–2.5 sec.

08-20 PID Mode Selection

Default: 0

Settings 0: Serial connection
1: Parallel connection

- 0: Use conventional PID control structure.
  1: The proportional gain, integral gain and differential gain are independent. You can customize the P, I and D value to fit your application.
- This parameter determines the primary low pass filter time when in PID control. Setting a large time constant may slow down the drive's response rate.
- PID control output frequency is filtered with a primary low pass function. This function can filter a mix of frequencies. A long primary low pass time means the filter degree is high and a short primary low pass time means the filter degree is low.
- Inappropriate delay time setting may cause system oscillation.
- PI Control:
  Controlled only by the P action, so the deviation cannot be eliminated. In general, to eliminate residual deviations, use the P + I control. When you use the PI control, it eliminates the deviation caused by the targeted value changes and the constant external interferences. However, if the I action is too powerful, it delays the response when there is rapid variation. You can use the P

action by itself to control the loading system with the integral components.

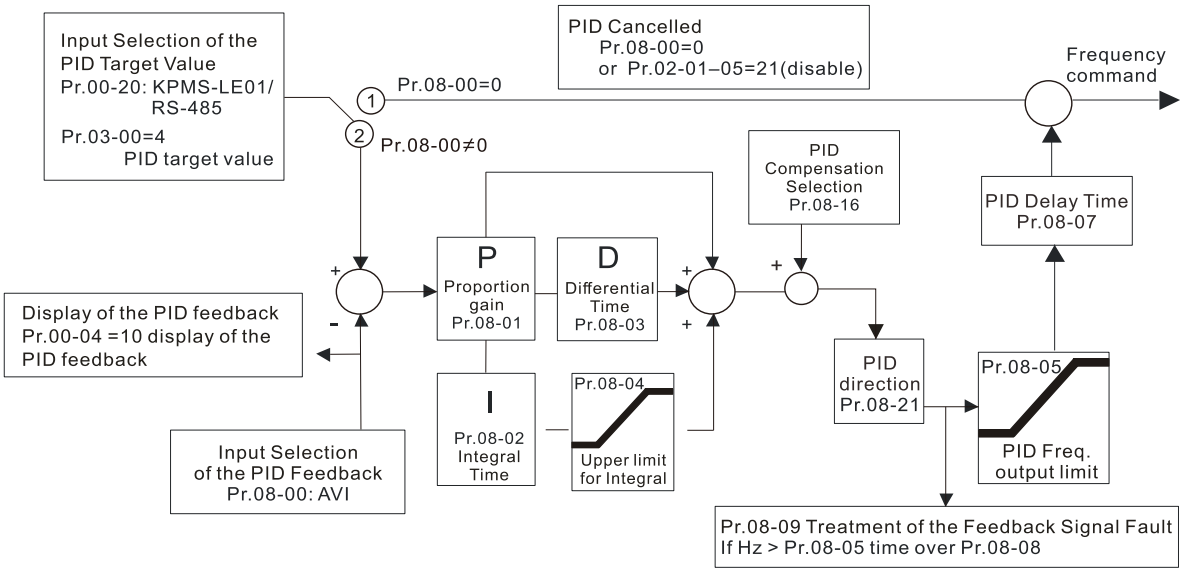
📖 PD Control:

When deviation occurs, the system immediately generates an operation load that is greater than the load generated only by the D action to restrain the deviation increment. If the deviation is small, the effectiveness of the P action decreases as well. The control objects include applications with integral component loads, which are controlled by the P action only. Sometimes, if the integral component is functioning, the whole system may vibrate. In this case, use the PD control to reduce the P action's oscillation and stabilize the system. In other words, this control is useful with no brake function's loading over the processes.

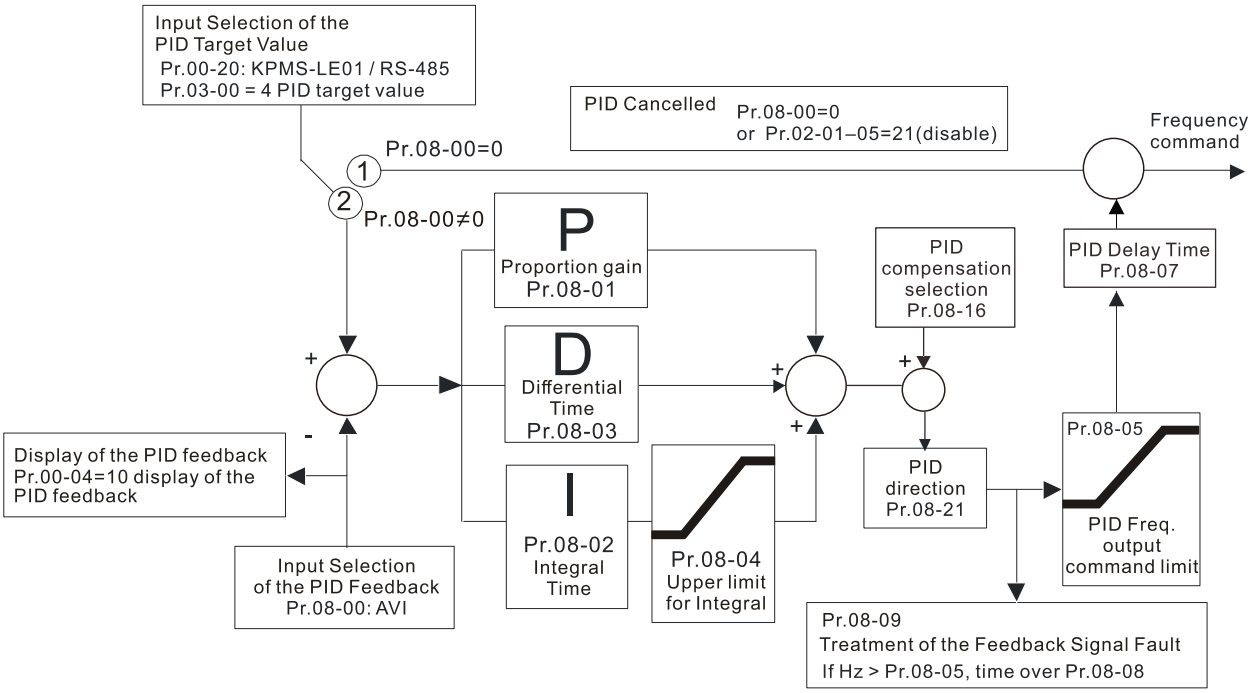
📖 PID Control:

Use the I action to eliminate the deviation and the D action to reduce oscillation; then combine this with the P action for the PID control. Use the PID method for a control process with no deviations, high accuracy, and a stable system.

Serial connection



Parallel connection



08-08 Feedback Signal Detection Time

Default: 0.0

Settings 0.0–3600.0 sec.

- Valid only when the feedback signal is 4–20 mA (Pr.03-28 = 2).
- This parameter sets the detection time for abnormal PID signal feedback. You can also use it when the system feedback signal response is extremely slow. (Setting the detection time to 0.0 disables the detection function.)

08-09 Treatment of Feedback Signal

Default: 0

Settings 0: Warn and continue operation
1: Fault and ramp to stop
2: Fault and coast to stop
3: Warn and operate at last frequency

- Valid only when the feedback signal is 4–20 mA (Pr.03-28 = 2).
- Sets the treatments when the PID feedback signal is abnormal.

08-10 Sleep Level

Default: 0.00

Settings 0.00–599.00 Hz / 0.00–200.00 %

- Determines the sleep frequency, and if the sleep time and the wake-up frequency are enabled or disabled. Pr.08-10 = 0: Disabled; Pr.08-10 ≠ 0: Enabled.

08-11 Wake-up level

Default: 0.00

Settings 0.00–599.00 Hz / 0.00–200.00 %

- Determines the sleep frequency, and if the sleep time and the wake-up frequency are enabled or disabled. Pr.08-10 = 0: Disabled; Pr.08-10 ≠ 0: Enabled.
- When Pr.08-18 = 0, the unit for Pr.08-10 and that for Pr.08-11 switch to frequency. The settings are between 0.00–599.00 Hz.
- When Pr.08-18 = 1, the unit for Pr.08-10 and that for Pr.08-11 switch to percentage. The settings are between 0.00–200.00%.
- The percentage is based on the current command value, not the maximum value.
  For example:
  If the maximum value is 100 kg, and the current command value is 30 kg, then if Pr.08-11 = 40%, the value is 12 kg.

08-12 Sleep Delay Time

Default: 0.0

Settings 0.0–6000.0 sec.

- When the Frequency command is smaller than the sleep frequency and less than the sleep time, the Frequency command is equal to the sleep frequency. However, the Frequency command remains at 0.00 Hz until the Frequency command becomes equal to or larger than the wake-up frequency.

08-13 PID Feedback Signal Error Deviation Level

Default: 10.0

Settings 1.0–50.0%

08-14 PID Feedback Signal Error Deviation Detection Time

Default: 5.0

Settings 0.1–300.0 sec.

08-15 PID Feedback Signal Filter Time

Default: 5.0

Settings 0.1–300.0 sec.

When the PID control function is normal, it should calculate the value within a period that is close to the target value. Refer to the PID control diagram for details. When executing PID feedback control, if |PID reference target value - detection value| > Pr.08-13 PID Feedback Signal Error Deviation Level and time exceeds Pr.08-14 setting, it is regarded as a PID control fault, and the multi-function output terminal setting 15 (PID feedback error) activates.

08-16 PID Compensation Selection

Default: 0

Settings 0: Parameter setting
1: Analog input

0: The setting for Pr.08-17 gives the PID compensation value.

08-17 PID Compensation

Default: 0

Settings -100.0–100.0%

The PID compensation value = maximum PID target value × Pr.08-17.
For example, if the maximum operation frequency Pr.01-00 = 60 Hz, and Pr.08-17 = 10.0%, the PID compensation value increases the output frequency 6.00 Hz. 60.00 Hz × 100.00% × 10.0% = 6.00 Hz

08-18 Sleep Mode Function Setting

Default: 0

Settings 0: Refer to PID output command
1: Refer to PID feedback signal

When Pr.08-18 = 0, the unit for Pr.08-10 and that for Pr.08-11 switch to frequency. The settings are between 0.00–599.00 Hz.

When Pr.08-18 = 1, the unit for Pr.08-10 and that for Pr.08-11 switch to percentage. The settings are between 0.00–200.00%.

08-19 Wake-up Integral Limit

Default: 50.0

Settings 0.0–200.0%

Defines the wake-up integral frequency limit = (Pr.01-00 × Pr.08-19%)

Reduces the reaction time from sleep to wake-up.

08-21 Enable PID to Change the Operation Direction

Default: 0

Settings 0: Operation direction cannot be changed
1: Operation direction can be changed

08-22 Wake-up Delay Time

Default: 0.00

Settings 0.00–600.00 sec.

📖 Refer to Pr.08-18 for more information.

08-23 PID Control Flag

Default: 2

Settings bit 0 = 1, PID running in reverse follows the setting for Pr.00-23.
bit 0 = 0, PID running in reverse refers to PID's calculated value.
bit 1 = 1, two decimal places for PID Kp
bit 1 = 0, one decimal place for PID Kp

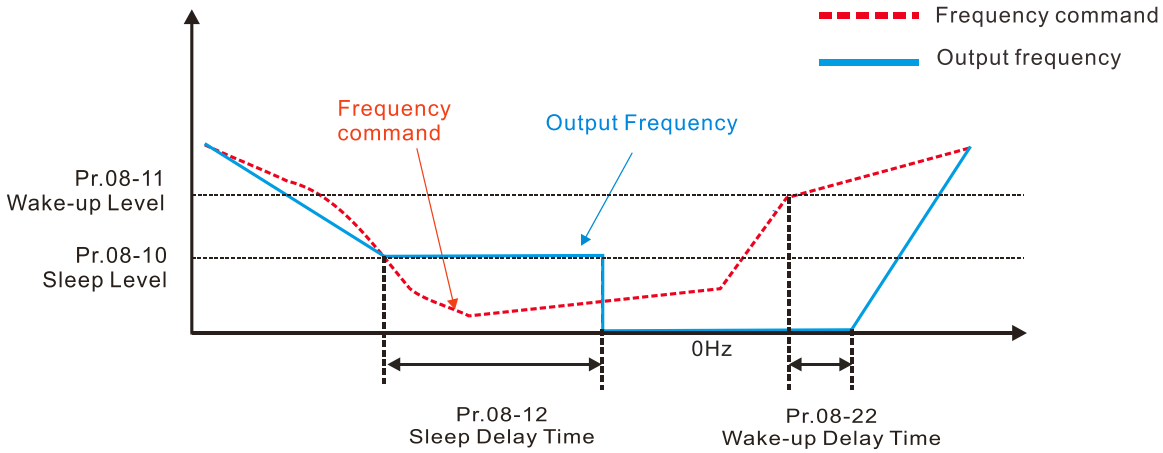
📖 bit 0 = 1: PID running in reverse function is valid only when Pr.08-21 = 1.

📖 bit 0 = 0: If the PID calculated value is positive, the direction is forward. If the PID calculated value is negative, the direction is reverse.

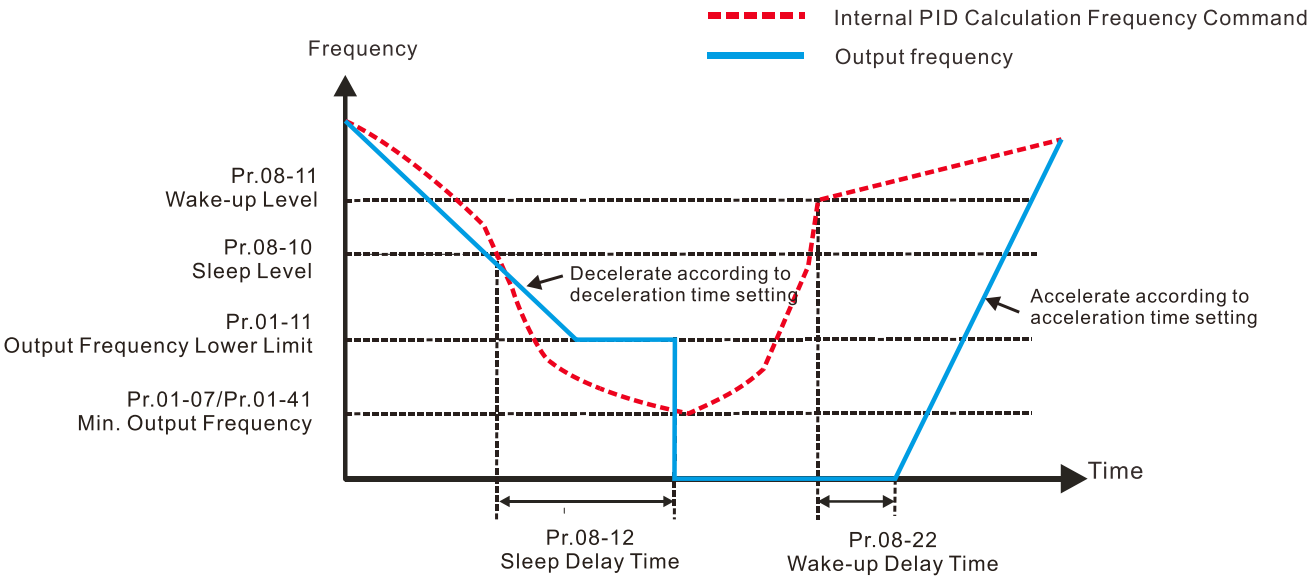
📖 When the bit1 setting changes, the Kp gain does not change.
For example:
Kp = 6. When Pr.08-23 bit1 = 0, Kp = 6.0; when Pr.08-23 bit1 = 1, Kp = 6.00.

📖 There are three scenarios for the sleep and wake-up frequency.

1. Frequency Command (PID is not in use, Pr.08-00 = 0. Works only in VF mode)
When the output frequency reaches the sleep level (Pr.08-10), the drive operates in sleep level and starts to count the sleep delay time (Pr.08-12). When the drive counts exceeding the sleep delay time, the drive is in sleep mode (0 Hz).
When the Frequency command reaches the wake-up level (Pr.08-11), the drive starts to count the wake-up delay time (Pr.08-22). When the drive counts exceeding the wake-up delay time, it starts to catch up to reach the Frequency command value by the acceleration time.



2. Internal PID Calculation Frequency Command (PID is in use, Pr.08-00 ≠ 0 and Pr.08-18 = 0.)
When the PID calculation Frequency command reaches the sleep level (Pr.08-10), the drive starts to count the sleep delay time (Pr.08-12). When the drive counts exceeding the sleep delay time, the drive is in sleep mode (0 Hz). If the drive does not reach preset the sleep delay time, output frequency remains at the lower frequency limit (if not set to zero), or remains at the minimum output frequency set for Pr.01-07 (if the lower limit frequency is set to zero) and waits until it reaches the sleep delay time before going into sleep mode.
When the PID calculated Frequency command reaches the wake-up frequency, the drive starts to count the wake-up delay time (Pr.08-22). Once it exceeds the wake-up delay time, the drive starts to catch up to reach the PID Frequency command value by the acceleration time.



3. PID Feedback Value Percentage (PID is in use, Pr.08-00 ≠ 0 and Pr.08-18 = 1)
When the PID feedback value reaches the sleep level (Pr.08-10), the drive starts to count the sleep delay time (Pr.08-12). If the drive counts exceeding the sleep delay time, the drive is in sleep mode (0 Hz). If the drive does not reach the preset sleep delay time, it remains at the lower frequency limit (if the lower limit is not set to zero), or remains at the minimum output frequency set for Pr.01-07 (if the lower limit frequency is set to zero) and waits until it reaches the sleep delay time before going into sleep mode.
When the PID feedback value reaches the wake-up level (Pr.08-11), the drive starts to count the wake-up delay time (Pr.08-22). Once it reaches the wake-up delay time, the drive starts to catch up to reach the PID Frequency command value by the acceleration time.

Example 01: PID negative feedback

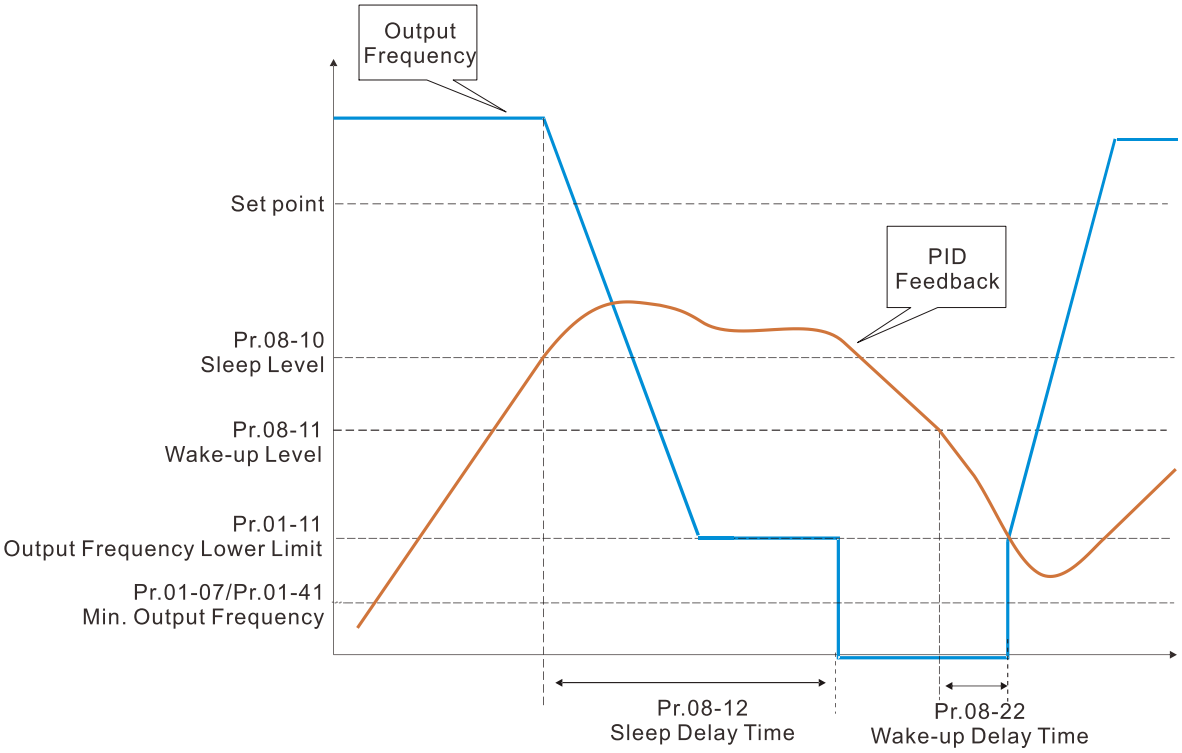
- Pr.08-10 must > Pr.08-11
- 30kg is the reference
- Set the parameter:
  Pr.03-00 = 5 (AI1 is PID feedback)
  Pr.08-00 = 1 (PID negative feedback: AI1 simulation input function select)
  Pr.08-10 = 40% (Sleep reference: 12 kg = 40% × 30 kg)

Pr.08-11 = 20% (Wake-up reference: 6 kg = 20% × 30 kg)

Case 01: If feedback >12kg, frequency decreases.

Case 02: If feedback < 6kg, frequency increases.

Area	PID Physical Quantity
Sleep area	> 12 kg, the drive goes into sleep, the motor goes into sleep
Excessive area	between 6 kg and 12 kg, the drive remains in current state
Wake-up area	< 6 kg, the drive wakes-up, the motor wakes-up



Example 02: PID positive feedback

- Pr.08-10 must < Pr.08-11
- 30kg is the reference
- Set the parameter:

  Pr.03-00 = 5 (AI1 is PID feedback)

  Pr.08-00 = 4 (PID positive feedback: AI1 simulation input function select)

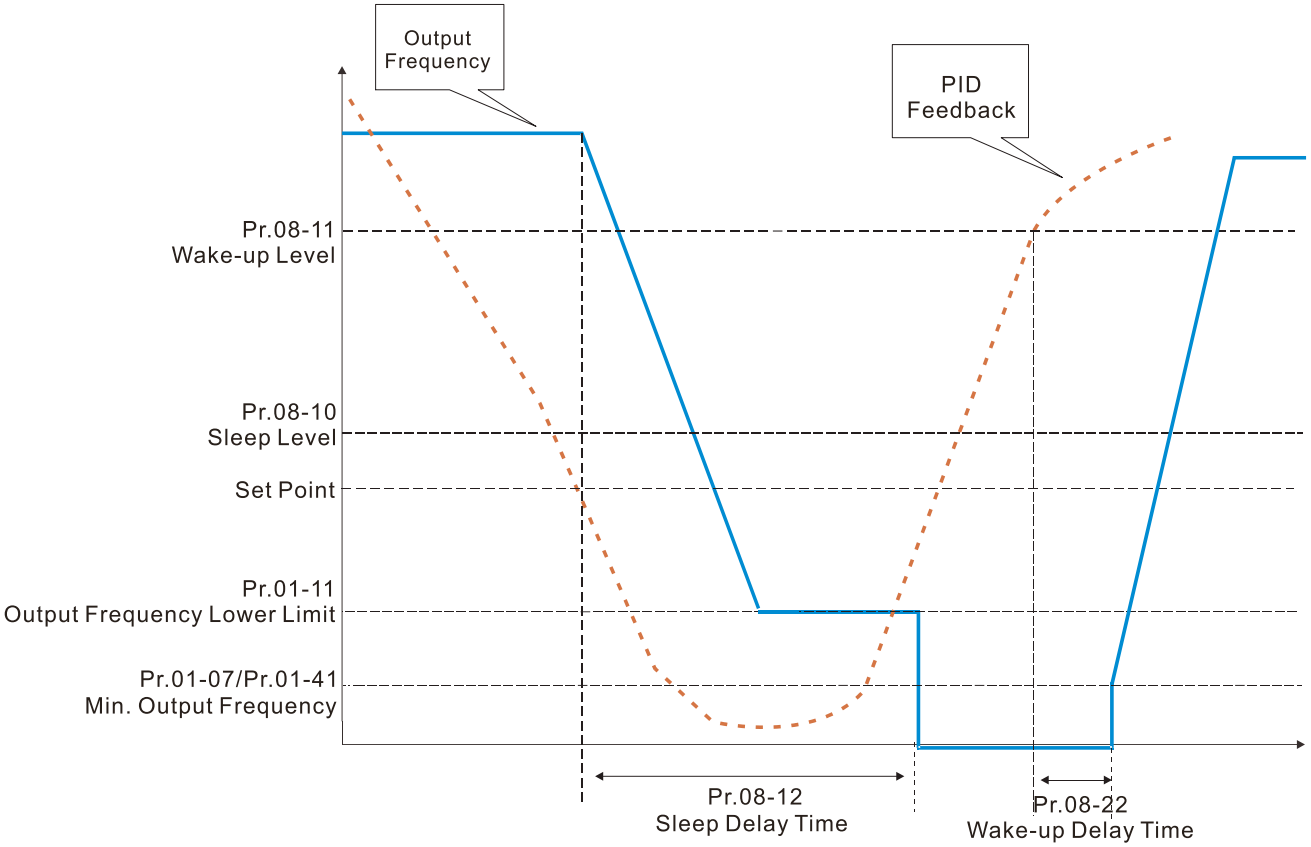
  Pr.08-10 = 110% (Sleep reference: 33 kg = 110% × 30 kg)

  Pr.08-11 = 120% (Wake-up reference: 36 kg = 120% × 30 kg)

  Case 01: If feedback < 33kg, frequency decreases.

  Case 02: If feedback > 36kg, frequency increases.

Area	PID Physical Quantity
Sleep area	> 36 kg, the drive goes into sleep, the motor goes into sleep
Excessive area	between 33 kg and 36 kg, the drive remains in the current state
Wake-up area	< 33 kg, the drive wakes-up



08-26 PID Output Command Limit (Reverse Limit)

Default: 100.0

Settings 0.0–100.0%

When PID enables the reverse direction, the PID output is a negative value, and the PID output value is limited by the setting for Pr.08-26. Use this function with Pr.08-21.

08-27 Acceleration / Deceleration Time for PID Command

Default: 0.00

Settings 0.00–655.35 sec.

0.00 seconds: Disables the PID acceleration/deceleration command, and the target value is equal to the PID command. When this parameter is not set to 0.00 seconds: Enables the PID acceleration/deceleration command. For PID acceleration and deceleration, when the PID target value changes, the command value increment/decrement is executed according to this parameter.

For example:

If we set this parameter to 10.00 seconds, when PID target value changes from 0% to 100%, it takes 10 seconds for the PID command to change from 0% to 100%. In a similar way, when PID target value changes from 100% to 0%, it takes 10 seconds for the PID command to change from 100% to 0%.

08-29 Frequency Base Corresponding to 100.00% PID

Default: 0

Settings 0: PID control output 100.00% corresponding to maximum operation frequency (Pr.01-00)

1: PID control output 100.00% corresponding to the input value of the auxiliary frequency

08-65 PID Target Value Source

Default: 0

Settings 0: Frequency command (Pr.00-20, Pr.00-30)

1: Pr.08-66 setting

2: RS-485 communication input

3: External analog input (Refer to Pr.03-00)

4: CANopen communication card

Selects the target value source for the PID controller.

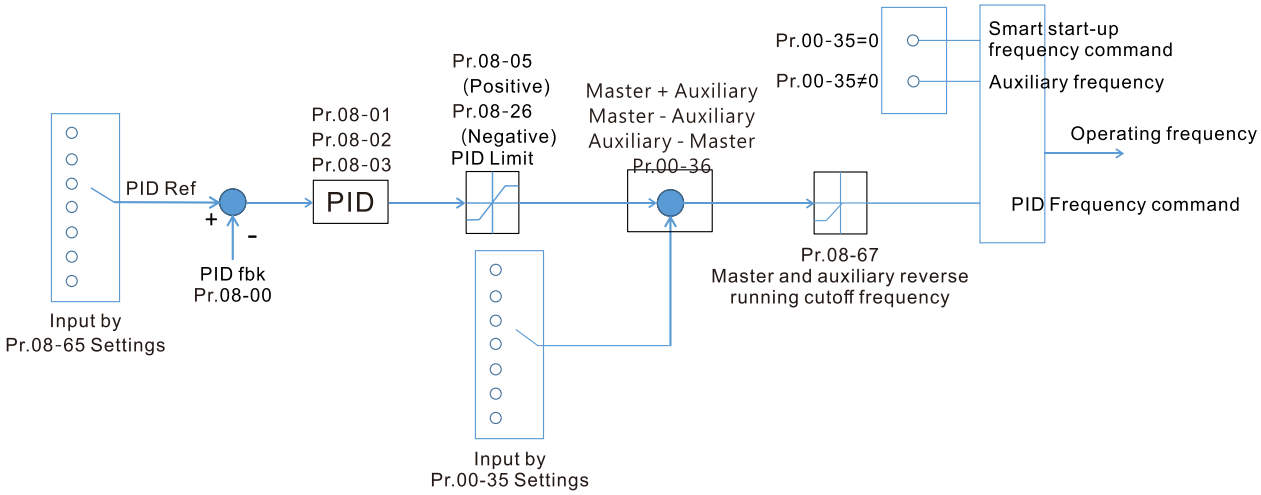
When Pr.08-65 = 0, the maximum operating frequency Pr.01-00 is 60 Hz, the error is 100%, and Pr.08-01 = 1.00, then the output frequency is "1" times the Pr.01-00 maximum operating frequency. Therefore, the output frequency = 60 × 100% × 1 = 60 Hz.

Calculation formula: Output frequency = Fmax (Pr.01-00) × error% ((PID reference value (Pr.00-20 / Pr.00-30) – PID feedback (Pr.08-00)) × Pr.08-01.

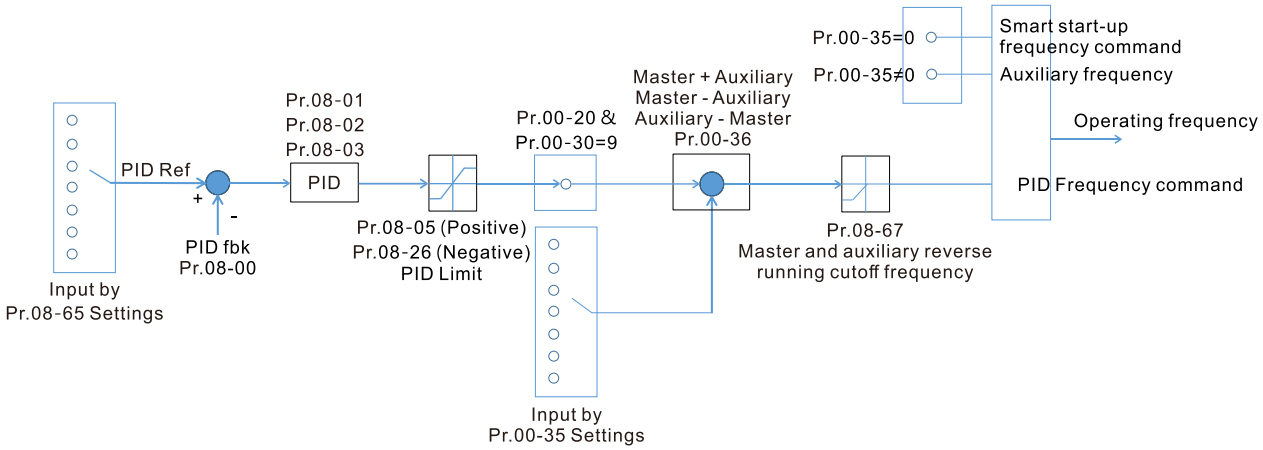
When Pr.08-65 ≠ 0, the internal calculation of the proportional gain reduces by 100 times, that is, when Pr.01-00 Fmax = 60 Hz, error = 100%, Pr.08-01 = 1.00, then the output frequency is "0.01" times the Pr.01-00 Fmax. Therefore, the output frequency = 60 × 100% × 0.01 = 0.6 Hz.

Calculation formula: Output frequency = Fmax (Pr.01-00) × error% ((PID reference value (Pr.08-66) – PID feedback value (Pr.08-00)) × Pr.08-01 × 0.01.

When Pr.08-65 = 0, the PID controller architecture shows as the diagram below:



When Pr.08-65 = 0, the PID controller architecture shows as the diagram below:



- When Pr.08-65 is not set to 0, Pr.00-20 is automatically set to 9.
- When Pr.08-65 is set to 1, set the PID command through Pr.08-66; when Pr.08-65 is not set to 1, Pr.08-66 displays the PID command.
- When Pr.08-65 is set to 2 and 4, the corresponding communication address is 2003H.

08-66 PID Target Value Setting

Default: 50.00

Settings -100.00–100.00%

- The target value setting of the PID controller (Pr.08-66) is a relative value.

08-67 Master and Auxiliary Reverse Running Cutoff Frequency

Default: 10.0

Settings 0.0–100.0%

- 100% corresponds to Pr.01-00 the maximum operation frequency
- In some cases, it is only possible for the PID to control the set point and the feedback to the same status when the PID output frequency is negative (the motor runs in reverse). However, an excessively high reverse frequency is not allowed in some cases, and Pr.08-67 is used to determine the upper limit of the reverse frequency.

08-68 PID Deviation Limit

Default: 0.00

Settings 0.00–100.00%

- When Pr.08-68 is not set to 0, the PID deviation limit function is enabled.
- When PID deviation ≤ PID deviation limit, PID stops adjusting, which means the PID output frequency maintains the value at last status. This function is effective for some closed-loop control applications.

08-69 Integral Separation Level

Default: 0.00

Settings 0.00–100.00%

- Reduces overshoot when overshoot occurs in the PID feedback at start-up.
- When Pr.08-69 is not set to 0, the integral separation function is enabled.
- The benchmark for the integral separation level is the PID error%.
- The integral separation function activates only once at start-up.

When PID deviation ≥ Pr.08-69, the integral effect is cancelled to avoid the increasing system overshoot due to the integral effect. When PID deviation is smaller than Pr.08-69, the integral effect is activated to eliminate the steady-state error.

08-70 Smart Start-up Level

Default: 5.00

Settings 0.00–100.00%

08-71 Smart Start-up Frequency Command

Default: 0.00

Settings 0.00–599.00 Hz

08-72 Smart Start-up Acceleration Time

Default: 3.00

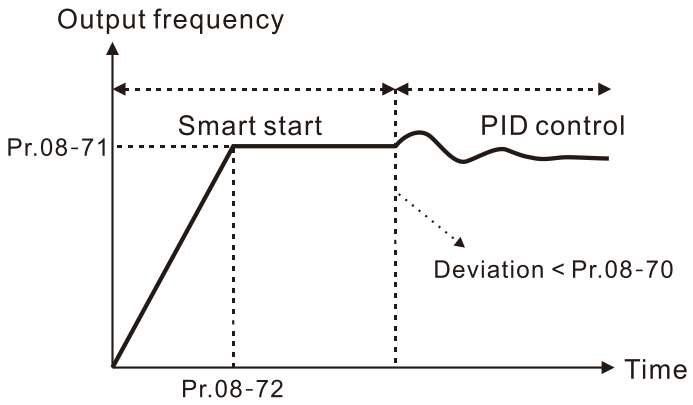
Settings 0.00–600.00 sec.

When Pr.08-71 is not set to 0, the smart start-up function is enabled.

The benchmark for the smart start-up level is the percentage of PID deviation.

Use the smart start-up function to reduce overshoot when overshoot occurs in the PID feedback at start-up. The smart start-up activates only once at start-up.

When the smart start-up function is enabled, it starts with the Pr.08-71 frequency and Pr.08-72 acceleration time (Pr.08-72 acceleration time is the time that it accelerates to Pr.08-71). When the PID deviation is smaller than Pr.08-70, it switches to the normal PID control (the smart start-up frequency is filled into the PID integral when switching to PID control to avoid discontinuous frequency).



08-75 PID2 Parameter Switch Condition

Default: 0

Settings 0: No switching (refer to Pr.08-01–Pr.08-03)
1: Auto-switch based on the output frequency
2: Auto-switch based on the deviation

08-76 PID 2 Parameter Switch Deviation 1

Default: 10.00

Settings 0.00–Pr.08-77%

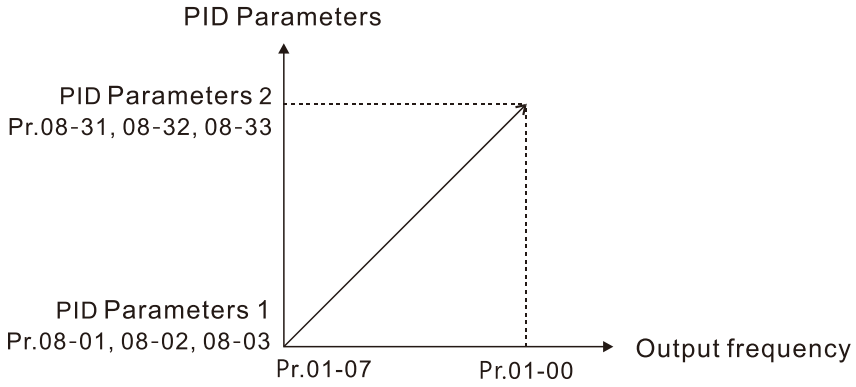
08-77 PID 2 Parameter Switch Deviation 2

Default: 40.00

Settings Pr.08-76–100.00%

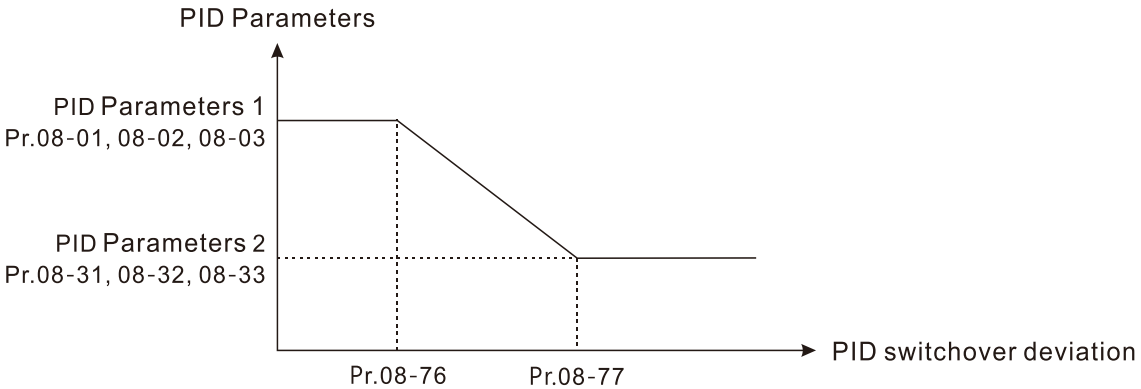
- A set of PID parameters cannot meet the requirements of the entire running process in some applications. Use Pr.08-75 to switch to the second set of PID parameters Pr.08-31–08-33. The setting method for Pr.08-31–08-33 is the same as that for Pr.08-01–08-03.
- The two sets of PID parameters switch automatically according to the frequency and deviation. Switch according to the output frequency:

  - When the output frequency is between Pr.01-07 and Pr.01-00, the PID parameter is the linear interpolation value between the two PID parameter groups.



- Switch according to the deviation:

  - When the deviation absolute value between the set point and feedback is smaller than Pr.08-76 (PID2 Parameter Switch Deviation 1), the first group PID parameters are used.
  - When the deviation absolute value between the set point and feedback is larger than Pr.08-77 (PID2 Parameter Switch Deviation 2), the second group PID parameters are used.
  - When the deviation absolute value between the set point and feedback is between Pr.08-76 and Pr.08-77, the PID parameter is the linear interpolation value between the two PID parameter groups.



08-78 Allowed Reverse Running Time after Start-up

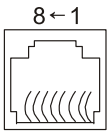
Default: 0.0

Settings 0.0–6553.5 sec.

- When Pr.08-78 is not set to 0, the allowed reverse running time after start-up is enabled.
- When it is set to 1 second, the PID control is not allowed to change the running direction within 0–1 seconds of starting time (Pr.08-21 = 0), and can change after 1 second of starting time (Pr.08-21 = 1).

13-2-09 Communication Parameters

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 orIFD6500 as a communication converter.



Modbus RS-485
Pin 1: CAN_H
Pin 2: CAN_L
Pin 3, 7: SGND
Pin 4: SG-
Pin 5: SG+
Pin 6: Reserved
Pin 8: +10V

✓ You can set this parameter during operation.

✓ 09-00 Modbus Communication Address

Default: 0

Settings 0: Disable
1–247

📖 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.

✓ 09-02 Modbus Transmission Fault Treatment

Default: 3

Settings 0: Warn and continue operation
1: Fault and ramp to stop
2: Fault and coast to stop
3: No warning, no fault, and continue operation

📖 Determines the treatment when an error is detected that the upper unit does not continuously transmit data to the AC motor drive during Modbus communication. The detection time is based on the Pr.09-03 setting.

📖 When a transmission error occurs (for example, the fault code CE10 is displayed), the error remains even if the transmission status returns to normal, and does not clear automatically. In this case, set a reset command (Reset) to clear the error.

✓ 09-03 Modbus Time-out Detection

Default: 0.0

Settings 0.0–100 sec.

📖 Set the communication time-out.

09-10 Communication Main Frequency

Default: 60.00

Settings 0.00–599.00 Hz

📖 When you set Pr.00-20 to 1 (RS-485 communication input), the AC motor drive saves the last Frequency command into Pr.09-10 when there is abnormal power off or momentary power loss. After the drive reboots when power is restored, it checks the frequency in Pr.09-10 if no new Frequency command is input. When power is restored, the AC motor drive operates with the frequency in Pr.09-10 if there is no new Frequency command input. When a Frequency command of 485 changes (the Frequency command source must be set as Modbus), this parameter also changes.

09-30 Delta-defined Communication Decoding Method

Default: 1

Settings 0: Decoding method 1 (20xxh)
1: Decoding method 2 (60xxh)

📖 EtherCAT card only supports decoding method 2.

Decoding Method		Method 1	Method 2
Source of operation control	Digital Keypad	Digital keypad controls the drive action regardless of decoding method 1 or 2.	
	External Terminal	External terminal controls the drive action regardless of decoding method 1 or 2.	
	RS-485	Refer to address: 2000h–20FFh	Refer to address: 6000h–60FFh

09-36 CANopen Slave Address

Default: 0

Settings 0: Disabled
1–127

09-40 Communication CANopen Decoding Method

Default: 1

Settings 0: Use Delta-defined decoding method
1: Use CiA402 protocol

09-43 CANopen Reset Index

Default: 65535

Settings bit 0: CANopen reset, the internal address 20XX is 0
bit 1: CANopen reset, the internal address 264X is 0
bit 2: CANopen reset, the internal address 26AX is 0
bit 3: CANopen reset, the internal address 60XX is 0

09-49 Canopen Extended Settings

Default: 0

Settings bit 0: Whether Index 604F and 6050 are updated to the first acceleration and deceleration
- bit 0 = 0: Update
- bit 0 = 1: Not update

bit 3: Whether CANopen communication loss CGdE & CHbE and other errors resets automatically
- bit3 = 0: When the communication is restored, the error will not be reset automatically but needs the communication reset command (NMT Reset) issued through the upper unit (Default).
- bit3 = 1: When the communication is restored, the error reset automatically without the communication reset command (NMT Reset) issued through the upper unit.

- bit 0 = 0, control the acceleration time 1 (Pr.01-12) and the deceleration time 1 (Pr.01-13) through CANopen.
- bit 3 = 0, when the communication disconnect, the drive will display fault codes such as CGdE, CHbE, etc. When the connection is restored, the error will still be displayed and needs to be cleared by a communication reset command issued by the upper unit.
- bit 3 = 1, when the communication disconnect and the error is displayed, the drive will reset automatically once it detects the communication connection is restored.

09-57 Ethernet Slot Number

Default: 0

Settings 0: Disable
1–15

09-94 Ethernet Extended Settings

Default: 0

Settings bit 0: Whether Ethercat and PROFINET recover the connection with upper unit,the disconnection error EdtE will:
- bit 0 = 0: Auto-reset
- bit 0 = 1: Manual reset

- When using EtherCAT or PROFINET communication with Pr.09-40 Delta-defined communication decoding method, following behavior happened while the communication between the rectifier module and the upper unit disconnected, the rectifier module alarm Edtn, and set the inverter module according to Pr.00-22 and Pr.09-98.

Parameter Setting	Inverter Module Alarm	Stop Method
Pr.00-22 = 1	EdtE fault	Coast to stop
Pr.00-22 = 0 & Pr.09-98 = 0	Edtn warning	No stop
Pr.00-22 = 0 & Pr.09-98 = 1	EdtE fault	Ramp to stop
Pr.00-22 = 0 & Pr.09-98 = 2	EdtE fault	Coast to stop
Pr.00-22 = 0 & Pr.09-98 = 3	No warning and fault	No stop

- When the rectifier module and the upper unit reconnected the communication
  bit 0 = 0: Auto-reset. The error reset automatically and the inverter module remains the state before the disconnection.
  bit 0 = 1: Manual reset. The error remains until the upper unit clear it and reissue the operation command.

09-98 Ethernet Communication Disconnection Treatment

Default: 3

Settings 0: Warn and continue operation
1: Fault and ramp to stop
2: Fault and coast to stop
3: No warning and continue operation

- PROFINET is valid when Pr.00-22 = 0 and is invalid when Pr.00-22 = 1.
- Pr.09-40 must be considered for EtherCAT and CANopen.

- When Pr.09-40 = 0:
  When Pr.00-22 = 0, Pr.09-98 is valid; when Pr.00-22 = 1, Pr.09-98 is invalid.
- When Pr.09-40 = 1:
  When Pr.00-22 = 0, it is determined by CiA402 (must determined index objects such as 6007, 605A, and 605C); when Pr.00-22 = 1, Pr.09-98 is invalid.

13-2-10 Speed feedback parameters

You can set this parameter during operation.

10-29 Upper Limit of Frequency Deviation

Default: 20.00

Settings 0.00–200.00 Hz

- Limit the maximum frequency deviation.
- If you set this parameter too high, an abnormal feedback malfunction will occurs.

10-31 I/F Mode, Current Command

Default: 40

Settings 0–150% rated current of the motor

- Sets the current command for the drive in low speed area. When the motor stalls on heavy duty start-up or forward / reverse with load, increase the parameter value. If the inrush current is too high and causes oc stall, then decrease the parameter value.

10-32 PM SVC Sensorless Speed Estimator Bandwidth

Default: 5.00

Settings 0.00–600.00 Hz

- Set the speed estimator bandwidth. Adjust the parameter to influence the stability and the accuracy of the motor speed.
- If there is low frequency vibration (the waveform is similar to a sine wave) during the process, then increase the bandwidth. If there is high frequency vibration (the waveform shows extreme vibration and is like a spur), then decrease the bandwidth.

10-34 PM SVC Speed Estimator Low-pass Filter Gain

Default: 1.00

Settings 0.00–655.35

- Influences the response speed of the speed estimator.
- If there is low frequency vibration (the waveform is similar to a sine wave) during the process, then increase the gain.
- If there is high frequency vibration (the waveform shows extreme vibration and is like a spur), then decrease the gain.

10-39 Frequency Point to Switch from I/F Mode to PM Sensorless Mode

Default: 20.00

Settings 0.00–599.00 Hz

- Sets the frequency for the switch point from low frequency to high frequency.
- Due to the weak back-EMF in the low frequency area, PM sensorless mode cannot estimate the accurate speed and position of the rotor. Thus, using I/F mode control is more suitable. In the medium-to-high frequency area, PM sensorless can accurately estimate the back-EMF, stabilizes and controls the motor with lower current.
- If the switch point is too low and PM sensorless mode operates at a too low frequency, the motor does not generate enough back-EMF to let the speed estimator measure the right position and speed of the rotor, and causes stall and oc when running at the switch point frequency.

- If the switch point is too high, the drive easily runs in the frequency area of the I/F mode for a long time, which generates a larger current and cannot save energy. (If the current value for Pr.10-31 is too high, the high switch frequency makes the drive continue to output with Pr.10-31 setting value.)

10-42 Initial Angle Detection Pulse Value

Default: 1.0

Settings 0.0–3.0

- The angle detection is fixed to 3: Use the pulse injection method to start. The parameter influences the value of the pulse during the angle detection. The larger the pulse, the higher the accuracy of rotor's position. A larger pulse might cause oc.
- Increase the parameter when the running direction and the command are opposite during start-up. If oc occurs at start-up, then decrease the parameter.
- Refer to Section 5 Adjustment & Application for detailed motor adjustment procedure.

10-49 Zero Voltage Time During Start-up

Default: 00.000

Settings 00.000–60.000 sec.

- This parameter is valid only when the setting of Pr.07-12 (Speed Tracking during Start-up) = 0.
- When the motor is in static state at start-up, this increases the accuracy when estimating angles. In order to put the motor in static state, set the three-phase of the drive output to the motor to 0 V. The Pr.10-49 setting time is the length of time for three-phase output at 0 V.
- It is possible that even when you apply this parameter, the motor cannot go in to the static state because of inertia or some external force. If the motor does not go into a complete static state in 0.2 seconds, increase this setting value appropriately.
- If Pr.10-49 is set too high, the start-up time is longer. If it is too low, then the braking performance is weak.

10-51 Injection Frequency

Default: 500

Settings 0–1200 Hz

- This parameter is a high frequency injection command in PM SVC control mode, and usually no adjustment is required. But if a motor's rated frequency (for example, 400 Hz) is too close to the frequency setting for this parameter (that is, the default of 500 Hz), it affects the accuracy of the angle detection. Refer to the setting for Pr.01-01 before you adjust this parameter.
- If the setting value for Pr.00-17 is lower than Pr.10-51 × 10, then increase the frequency of the carrier frequency.
- Pr.10-51 is valid only when Pr.10-53 = 2.

10-52 Injection Magnitude

Default: 15.0 / 30.0

Settings 230V models: 0.0–100.0 V
460V models: 0.0–200.0 V
Note: The setting range varies depending on the voltage.

- The parameter is the magnitude command for the high frequency injection signal in PM SVC control mode.
- Increasing the parameter can increase the accuracy of the angle estimation, but the electromagnetic noise might be louder if the setting value is too high.
- The system uses this parameter when the motor's parameter is "Auto". This parameter influences the angle estimation accuracy.
- When the ratio of the salient pole (Lq / Ld) is lower, increase Pr.10-52 to make the angle detection accurate.
- Pr.10-52 is valid only when Pr.10-53 = 2.

10-53 Angle Detection Method

Default: 0

Settings 0: Disable
1: Force attracting the rotor to zero degree
2: High frequency injection
3: Pulse injection

- Set to 2 for IPM; set to 3 for SPM. If these settings cause problems, then set the parameter to 1.

13-2-11 Advanced Parameters

You can set this parameter during operation.

11-00 System Control

Default: 0

Settings bit 7: Save or do not save the frequency

bit 7 = 0: Save the frequency before power is OFF. When power is ON again, the saved frequency is displayed.

bit 7 = 1: Do not save the frequency before power is OFF. When power is ON again, 0.00 Hz is the displayed frequency.

11-41 PWM Mode Selection

Default: 0

Settings 0: Two-phase modulation mode

2: Space vector modulation mode

Two-phase modulation mode: effectively reduces the drive power component losses and provides better performance in long wiring applications.

Space vector modulation mode: effectively reduces the power loss and electromagnetic noise of the motor.

11-42 System Control Flag

Default: 0000

Settings 0000–FFFFh

bit No.	Function	Description
0	Reserved	
1	FWD / REV action control	0: FWD / REV cannot be controlled by Pr.02-12 bit 0 & 1 1: FWD / REV can be controlled by Pr.02-12 bit 0 & 1

13-2-13 Macro / User-Defined Macro

You can set this parameter during operation.

13-00 Macro Selection

Default: 00

Settings
00: Disabled
01: User-defined
02: Compressor
03: Fan
05: Conveyor
06: Machine tool
07: Packing
08: Textiles
09: PCB Machine

NOTE: After you select the macro, some of the default values adjust automatically according to the application selection.

Setting 02: Compressor

The following table lists the relevant compressor setting application parameters.

Pr.	Parameter Name	Settings
00-11	Speed Control Mode	0 (IM V/F control mode)
00-17	Carrier Frequency	Default setting
00-20	Master Frequency Command Source (AUTO, REMOTE)	2 (External analog input)
00-21	Operation Command Source (AUTO, REMOTE)	1 (External terminals)
00-22	Stop Method	0 (Ramp to stop)
00-23	Motor Direction Control	1 (Disable reverse)
01-00	Motor 1 Maximum Operation Frequency	Default setting
01-01	Rated / Base Frequency of Motor 1	Default setting
01-02	Rated / Base Voltage of Motor 1	Default setting
01-03	Motor 1 Mid-point Frequency 1	Default setting
01-04	Motor 1 Mid-point Voltage 1	Default setting
01-05	Motor 1 Mid-point Frequency 2	Default setting
01-06	Motor 1 Mid-point Voltage 2	Default setting
01-07	Motor 1 Minimum Output Frequency	Default setting
01-08	Motor 1 Minimum Output Voltage	Default setting
01-11	Output Frequency Lower Limit	20 (Hz)
01-12	Acceleration Time 1	20 (sec.)
01-13	Deceleration Time 1	20 (sec.)
03-00	AI1 Analog Input Selection	0 (No function)
03-01	AI2 Analog Input Selection	1 (Frequency command)
05-01	Full-load Current for Induction Motor 1 (A)	Default setting

Pr.	Parameter Name	Settings
05-03	Rated Speed for Induction Motor 1 (rpm)	Default setting
05-04	Number of Poles for Induction Motor 1	Default setting

📖 Setting 03: Fan

The following table lists the relevant fan setting application parameters.

Pr.	Parameter Name	Settings
00-11	Speed Control Mode	0 (IM V/F)
00-17	Carrier Frequency	Default setting
00-20	Master Frequency Command Source (AUTO, REMOTE)	2 (External analog input)
00-21	Operation Command Source (AUTO, REMOTE)	1 (External terminals)
00-22	Stop Method	1 (Coast to stop)
00-23	Motor Direction Control	1 (Disable reverse)
00-30	Master Frequency Command Source (HAND, LOCAL)	0 (Digital keypad)
00-31	Operation Command Source (HAND, LOCAL)	0 (Digital keypad)
01-00	Motor 1 Maximum Operation Frequency	Default setting
01-01	Rated / Base Frequency of Motor 1	Default setting
01-02	Rated / Base Voltage of Motor 1	Default setting
01-03	Motor 1 Mid-point Frequency 1	Default setting
01-04	Motor 1 Mid-point Voltage 1	Default setting
01-05	Motor 1 Mid-point Frequency 2	Default setting
01-06	Motor 1 Mid-point Voltage 2	Default setting
01-07	Motor 1 Minimum Output Frequency	Default setting
01-08	Motor 1 Minimum Output Voltage	Default setting
01-10	Output Frequency Upper Limit	50.00 (Hz)
01-11	Output Frequency Lower Limit	35.00 (Hz)
01-12	Acceleration Time 1	15.00 (sec.)
01-13	Deceleration Time 1	15.00 (sec.)
01-43	V/F Curve Selection	2 (V/F curve to the power of 2)
02-05	Multi-function Input Command 5 (MIO1)	15 (Rotating speed command from AI1)
02-13	Multi-function Output 1 (RY1)	11 (Malfunction indication)
03-00	AI1 Analog Input Selection	1 (Frequency command)
Rectifier module 03-28	AI1 Terminal Input Selection	0 (0–10 V)
03-50	Analog Input Curve Selection	1 (three-point curve of AI1 & AI2)
07-06	Restart After Momentary Power Loss	2 (Speed tracking by the minimum output frequency)

Pr.	Parameter Name	Settings
07-11	Number of Times of Restart after Fault	5 (times)
07-33	Auto-restart Interval of Fault	60.0 (sec.)

📖 Setting 05: Conveyor

The following table lists the relevant conveyor setting application parameters.

Pr.	Parameter Name	Settings
00-11	Speed Control Mode	0 (IM V/F)
00-20	Master Frequency Command Source (AUTO, REMOTE)	2 (External analog input)
00-21	Operation Command Source (AUTO, REMOTE)	1 (External terminals)
01-00	Motor 1 Maximum Operation Frequency	Default setting
01-01	Rated / Base Frequency of Motor 1	Default setting
01-02	Rated / Base Voltage of Motor 1	Default setting
01-03	Motor 1 Mid-point Frequency 1	Default setting
01-04	Motor 1 Mid-point Voltage 1	Default setting
01-05	Motor 1 Mid-point Frequency 2	Default setting
01-06	Motor 1 Mid-point Voltage 2	Default setting
01-07	Motor 1 Minimum Output Frequency	Default setting
01-08	Motor 1 Minimum Output Voltage	Default setting
01-12	Acceleration Time 1	10.00 (sec.)
01-13	Deceleration Time 1	10.00 (sec.)

📖 Setting 06: Machine tool

The following table lists the relevant machine tool setting application parameters.

Pr.	Parameter Name	Settings
00-11	Speed Control Mode	0 (IM V/F)
00-17	Carrier Frequency	Default setting
00-20	Master Frequency Command Source (AUTO, REMOTE)	2 (External analog input)
00-21	Operation Command Source (AUTO, REMOTE)	1 (External terminals)
01-00	Motor 1 Maximum Operation Frequency	Default setting
01-01	Rated / Base Frequency of Motor 1	Default setting
01-02	Rated / Base Voltage of Motor 1	Default setting
01-03	Motor 1 Mid-point Frequency 1	0
01-04	Motor 1 Mid-point Voltage 1	0
01-05	Motor 1 Mid-point Frequency 2	0
01-06	Motor 1 Mid-point Voltage 2	0
01-07	Motor 1 Minimum Output Frequency	Default setting
01-08	Motor 1 Minimum Output Voltage	Default setting

Pr.	Parameter Name	Settings
01-12	Acceleration Time 1	5 (sec.)
01-13	Deceleration Time 1	5 (sec.)
01-24	S-curve for Acceleration Begin Time 1	0
01-25	S-curve for Acceleration Arrival Time 2	0
01-26	S-curve for Deceleration Begin Time 1	0
01-27	S-curve for Deceleration Arrival Time 2	0
02-03	Multi-function Input Command 3 (MI3)	1 (Multi-step speed command 1)
02-04	Multi-function Input Command 4 (MI4)	2 (Multi-step speed command 2)
02-13	Multi-function Output 1 (RY1)	11 (Malfunction indication)
02-16	Multi-function Output 2 (MIO3)	1 (Indication during RUN)
02-17	Multi-function Output 3 (MIO4)	2 (Operation speed reached)
03-00	AI1 Analog Input Selection	1 (Frequency command)
06-01	Over-voltage Stall Prevention	0 (No function)
06-03	Over-current Stall Prevention during Acceleration	0 (No function)
06-04	Over-current Stall Prevention during Operation	0 (No function)
06-05	Acceleration / Deceleration Time Selection for Stall Prevention at Constant Speed	0 (By current acceleration / deceleration time)
07-01	DC Brake Current Level	20 (%)
07-03	DC Brake Time at STOP	0.3 (sec.)
07-04	DC Brake Frequency at STOP	0 (Hz)
07-23	Automatic Voltage Regulation (AVR) Function	1 (Disable AVR)

📖 Setting 07: Packing

The following table lists the relevant packing setting application parameters.

Pr.	Parameter Name	Settings
00-11	Speed Control Mode	0 (IM V/F)
00-20	Master Frequency Command Source (AUTO, REMOTE)	0 (Digital keypad)
00-21	Operation Command Source (AUTO, REMOTE)	2 (RS-485 communication input)
01-00	Motor 1 Maximum Operation Frequency	Default setting
01-01	Rated / Base Frequency of Motor 1	Default setting
01-02	Rated / Base Voltage of Motor 1	Default setting
01-03	Motor 1 Mid-point Frequency 1	Default setting
01-04	Motor 1 Mid-point Voltage 1	Default setting
01-05	Motor 1 Mid-point Frequency 2	Default setting
01-06	Motor 1 Mid-point Voltage 2	Default setting

Pr.	Parameter Name	Settings
01-07	Motor 1 Minimum Output Frequency	Default setting
01-08	Motor 1 Minimum Output Voltage	Default setting
01-12	Acceleration Time 1	10.00 (sec.)
01-13	Deceleration Time 1	10.00 (sec.)
01-24	S-curve for Acceleration Begin Time 1	Default setting
01-25	S-curve for Acceleration Arrival Time 2	Default setting
01-26	S-curve for Deceleration Begin Time 1	Default setting
01-27	S-curve for Deceleration Arrival Time 2	Default setting
02-00	Two-wire / Three-wire Operation Control	1 (Two-wire mode 1, power on for operation control (MIx_d61: FWD / STOP, MIy_d62: REV / STOP))
03-00	AI1 Analog Input Selection	1 (Frequency command)
Rectifier module 03-28	AI1 Terminal Input Selection	Default setting

🕮 Setting 08: Textiles

The following table lists the relevant textile setting application parameters.

Pr.	Parameter Name	Settings
00-11	Speed Control Mode	0 (IM V/F)
00-20	Master Frequency Command Source (AUTO, REMOTE)	1 (RS-485 communication input)
00-21	Operation Command Source (AUTO, REMOTE)	1 (External terminals)
01-00	Motor 1 Maximum Operation Frequency	Default setting
01-01	Rated / Base Frequency of Motor 1	Default setting
01-02	Rated / Base Voltage of Motor 1	Default setting
01-03	Motor 1 Mid-point Frequency 1	Default setting
01-04	Motor 1 Mid-point Voltage 1	Default setting
01-05	Motor 1 Mid-point Frequency 2	Default setting
01-06	Motor 1 Mid-point Voltage 2	Default setting
01-07	Motor 1 Minimum Output Frequency	Default setting
01-08	Motor 1 Minimum Output Voltage	Default setting
01-12	Acceleration Time 1	10 (sec.)
01-13	Deceleration Time 1	10 (sec.)
01-24	S-curve for Acceleration Begin Time 1	0.2 (sec.)
01-25	S-curve for Acceleration Arrival Time 2	0.2 (sec.)
01-26	S-curve for Deceleration Begin Time 1	0.2 (sec.)
01-27	S-curve for Deceleration Arrival Time 2	0.2 (sec.)
06-03	Over-current Stall Prevention during Acceleration	180 (%)

Pr.	Parameter Name	Settings
06-04	Over-current Stall Prevention during Operation	180 (%)
06-07	Over-torque detection Level (Motor 1)	200 (%)
07-19	Fan Cooling Control	2 (Fan turns ON / OFF when the AC motor drive runs / stops)

📖 Setting 09: PCB Machine

The following table lists the relevant PCB machine setting application parameters.

Pr.	Parameter Name	Settings
00-11	Speed Control Mode	0 (IM V/F)
00-20	Master Frequency Command Source (AUTO)	2 (External analog input)
00-21	Operation Command Source (AUTO)	1 (External terminals)
00-23	Motor Direction Control	1 (Disable reverse)
01-00	Maximum Operation Frequency of Motor 1	1500.0 (Hz)
01-01	Rated / Base Frequency of Motor 1	800.0 (Hz)
01-02	Rated / Base Voltage of Motor 1	380.0 (V)
01-03	Mid-point Frequency 1 of Motor 1	20.0 (Hz)
01-04	Mid-point Voltage 1 of Motor 1	22.0 (V)
01-05	Mid-point Frequency 2 of Motor 1	5.0 (Hz)
01-06	Mid-point Voltage 2 of Motor 1	4.0 (V)
01-07	Minimum Output Frequency of Motor 1	0 (Hz)
01-08	Minimum Output Voltage of Motor 1	0 (Hz)
01-12	Acceleration Time 1	4 (sec.)
01-13	Deceleration Time 1	3 (sec.)
02-13	Multi-function Output 1 RY1	11 (Malfunction indication)
02-16	Multi-function Output 3 (MIO3)	1 (Indication during RUN)
02-17	Multi-function Output 4 (MIO4)	2 (Operation speed reached)
03-00	AI1 Analog Input Selection	1 (Frequency command)
06-01	Over-voltage Stall Prevention	0 (No function)
06-03	Over-current Stall Prevention during Acceleration	0 (No function)
06-04	Over-current Stall Prevention during Operation	0 (No function)
06-05	Acceleration / Deceleration Time Selection for Stall Prevention at Constant Speed	0 (By current acceleration / deceleration time)
06-06	Over-torque Detection Selection (Motor 1)	2 (Stop after over-torque detection during constant speed operation)
06-07	Over-torque Detection Level (Motor 1)	Default setting
06-08	Over-torque Detection Time (Motor 1)	Default setting

Pr.	Parameter Name	Settings
06-45	Output Phase Loss Detection Action (OPHL)	1 (Fault and ramp to stop)
07-01	DC Brake Current Level	20 (%)
07-03	DC Brake Time at STOP	0.3 (sec.)
07-04	DC Brake Frequency at STOP	0 (Hz)
07-23	Automatic Voltage Regulation (AVR) Function	1 (Disable AVR)

13-00 – 13-50 Application Parameters (User-defined)

13-2-14 Protection Parameters (2)

You can set this parameter during operation.

14-50	Output Frequency at Malfunction 2
14-54	Output Frequency at Malfunction 3
14-58	Output Frequency at Malfunction 4
14-62	Output Frequency at Malfunction 5
14-66	Output Frequency at Malfunction 6

Default: Read only

Settings 0.00–599.00 Hz

When an error occurs, you can check the output frequency for the malfunction. If the error happens again, this parameter overwrites the previous record.

14-51	DC bus Voltage at Malfunction 2
14-55	DC bus Voltage at Malfunction 3
14-59	DC bus Voltage at Malfunction 4
14-63	DC bus Voltage at Malfunction 5
14-67	DC bus Voltage at Malfunction 6

Default: Read only

Display 0.0–6553.5 V

When an error occurs, you can check the DC bus voltage for the malfunction. If the error happens again, this parameter overwrites the previous record.

14-52	Output Current at Malfunction 2
14-56	Output Current at Malfunction 3
14-60	Output Current at Malfunction 4
14-64	Output Current at Malfunction 5
14-68	Output Current at Malfunction 6

Default: Read only

Display 0.00–655.35 Amps

When an error occurs, you can check the output current for the malfunction. If the error happens again, this parameter overwrites the previous record.

14-53	Power Components Temperature at Malfunction 2
14-57	Power Components Temperature at Malfunction 3
14-61	Power Components Temperature at Malfunction 4
14-65	Power Components Temperature at Malfunction 5
14-69	Power Components Temperature at Malfunction 6

Default: Read only

Display -3276.7–3276.7 °C

When an error occurs, you can check the IGBT temperature for the malfunction. If the error happens again, this parameter overwrites the previous record.

14-70	Fault Record 7
14-71	Fault Record 8
14-72	Fault Record 9
14-73	Fault Record 10

Default: 0

Display

0: No fault record

1: Over-current during acceleration (ocA)

2: Over-current during deceleration (ocd)

3: Over-current during steady operation (ocn)

4: Ground fault (GFF)

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 at constant speed (Lvn)

14: Low-voltage at stop (LvS)

15: Phase loss protection (orP)

16: Power components overheating (oH1)

17: Circuit board ambient temperature overheats (oH2)

18: IGBT temperature detection failure (tH1o)

19: Capacitor hardware error (tH2o)

21: Over load (oL)

22: Electronics thermal relay 1 protection (EoL1)

23: Electronics thermal relay 2 protection (EoL2)

Motor overheating PTC / PT100 (oH3)

26: Over torque 1 (ot1)

27: Over torque 2 (ot2)

28: Under current (uC)

31: EEPROM read error (cF2)

33: U-phase error (cd1)

34: V-phase error (cd2)

35: W-phase error (cd3)

36: cc hardware error (Hd0)

37: oc hardware error (Hd1)

38: ov hardware error (Hd2)

40: Auto-tuning error (AUE)

41: PID off AI2 (AFE)

48: AI2 loss (ACE)
49: External fault (EF)
50: Emergency stop (EF1)
51: External base block (bb)
52: Password is locked (Pcod)
54: Illegal command (CE1)
55: Illegal data address (CE2)
56: Illegal data value (CE3)
57: Data is written to read-only address (CE4)
58: Modbus transmission time-out (CE10)
63: Over slip warning (oSL)
72: S1 internal circuit detection error (STL1)
76: STO (STo)
77: S2 internal circuit detection error (STL2)
79: U-phase over-current before run (Aoc)
80: V-phase over-current before run (boc)
81: W-phase over-current before run (coc)
82: U-phase output phase loss (oPL1)
83: V-phase output phase loss (oPL2)
84: W-phase output phase loss (oPL3)
87: Low frequency overload protection (oL3)
89: Rotor position detection error (roPd)
101: CANopen guarding error (CGdE)
102: CANopen heartbeat error (CHbE)
104: CANopen bus off error (CbFE)
121: Internal communication error (CP20)
122: Internal communication error (CP21)
123: Internal communication error (CP22)
124: Internal communication error (CP30)
126: Internal communication error (CP32)
140: oc hardware error (Hd6)
141: GFF occurs before run (b4GFF)
142: Auto-tune error 1 (AuE1) (DC test stage)
143: Auto-tune error 2 (AuE2) (high frequency stall stage)
144: Auto-tuning error 1 (AuE3)
145: MErr error (MErr)
215: Ethernet communication time-out (EdtE)
220: PROFINET startup error (PStE)
221: PROFINET storage device error (PSFE)
222: PROFINET operation error (PoPE)
223: PROFINET program inspection error (PrbE)
224: STO execution time-out (SToT)

225: STO ROM verifying failure (STor)
226: STO loss (SToL)
227: STO Channel 1 error (STC1)
228: STO Channel 2 error (STC2)
229: STO Channel 1 time-out (SPC1)
230: STO Channel 2 time-out (SPC2)
231: STO Gate buffer check error (SGbE)
232: STO power 18V over voltage (S18ov)
233: STO power 18V under voltage (S18uv)
234: STO power 6V over voltage (S6ov)
235: STO power 6V under voltage (S6uv)
236: STO power 5V over voltage (S5ov)
237: STO power 5V under voltage (S5uv)
238: STO Watchdog (SWdG)
239: STO ADC Sampling failure (SAdE)
240: STO execution time is too short (SEbL)
241: STO execution time is too high (SEAb)
242: Safe torque off 1 (STo1)
243: Safe torque off 2 (STo2)

- 🕮 The parameters record when the fault occurs and forces a stop.
- 🕮 When low-voltage at stop fault (LvS) occurs, the fault is not recorded. When low-voltage during operation faults (LvA, Lvd, Lvn) occur, the faults are recorded.
- 🕮 When dEb function is valid and enabled, the drive executes dEb and records fault code 62 to Pr.06-17–Pr.06-22 and Pr.14-70–Pr.14-73 simultaneously.

Chapter 14 Selection Software - DIASelector

14-1 Introduction

14-2 Software Download

14-3 Project Creation

14-4 Create a Group

14-5 Multi Drive Configuration

14-1 Introduction

The DIASelector (Delta Industrial Automation Selector) application assists you to select Delta's Industrial Automation products based on associated technical requirements.

You can compare the products based on properties and specifications, configure products to create a complete system and export the result in the form of BOM.

- The project file created with DIASelector can be exported to EPLAN for cabinet designing.
- DIASelector application is part of DIAStudio suite and is available in multiple variants as follows:
  - Stand-alone windows desktop application
  - Mobile application (Android and iOS)
  - Web browser: Microsoft Edge, Google Chrome
- Key Features:
  - Product selection
  - Product filter
  - Product comparison
  - Search product by Part number, Description and Part number pattern
  - Compatible accessories recommendation
  - Configure PLC, AC Motor Drives and AC Servo Drives
  - View product properties, product images, descriptions and so on
  - Generate BOM for added products and export it in MS-Word / Excel file format (BOM can also be sent via email)
  - Open / Save project on local hard disk or from / to Delta Cloud (DIAStudio-Web)
  - Download and view the product catalogs
  - Share project with other registered DIAStudio users
  - Supported languages - English, Traditional Chinese and Simplified Chinese

NOTE: The above content is excerpted from Chapter 1.2 of the DIASelector software user manual. Please refer to the manual for more details.

14-2 Software Download

- DIAInstaller

  A resident program to manage all Delta IA software for download, install and update. User can registe and log in from https://diastudio.deltaww.com/home/downloads?sec=download#catalog.

  The DIAInstaller main window is shown as below for DIASelector download.

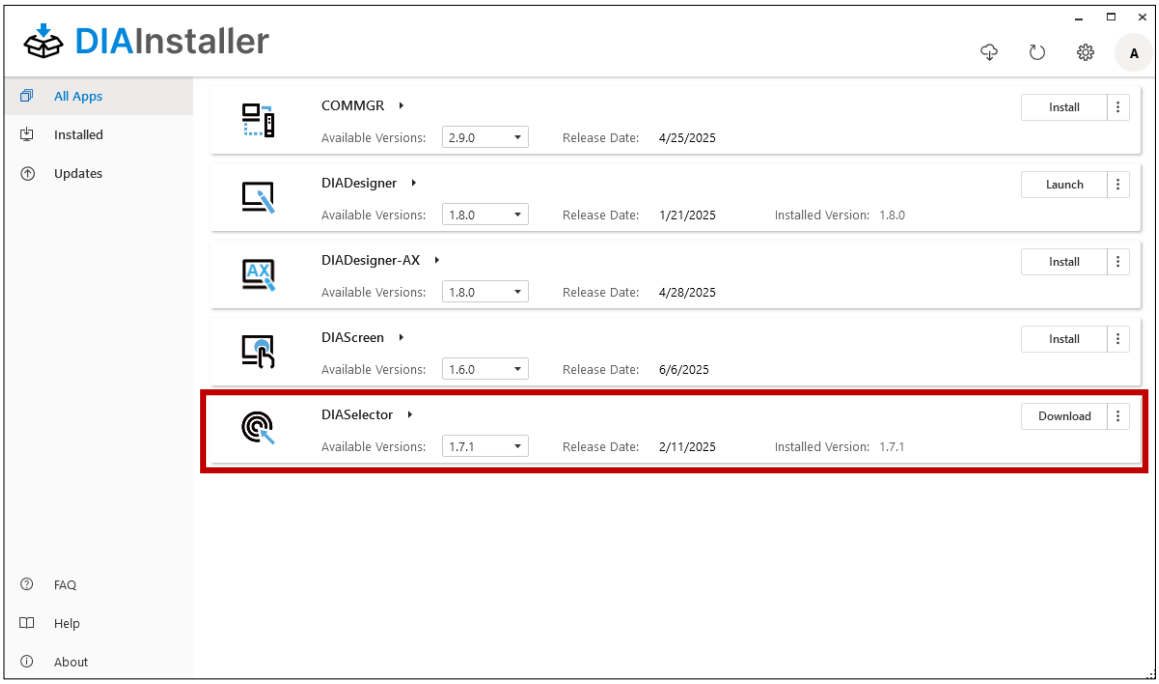


Figure 14-1

- DIASelector

  The DIAInstaller main screen is shown as below which provides product selection and functional options related to specific device configurations.

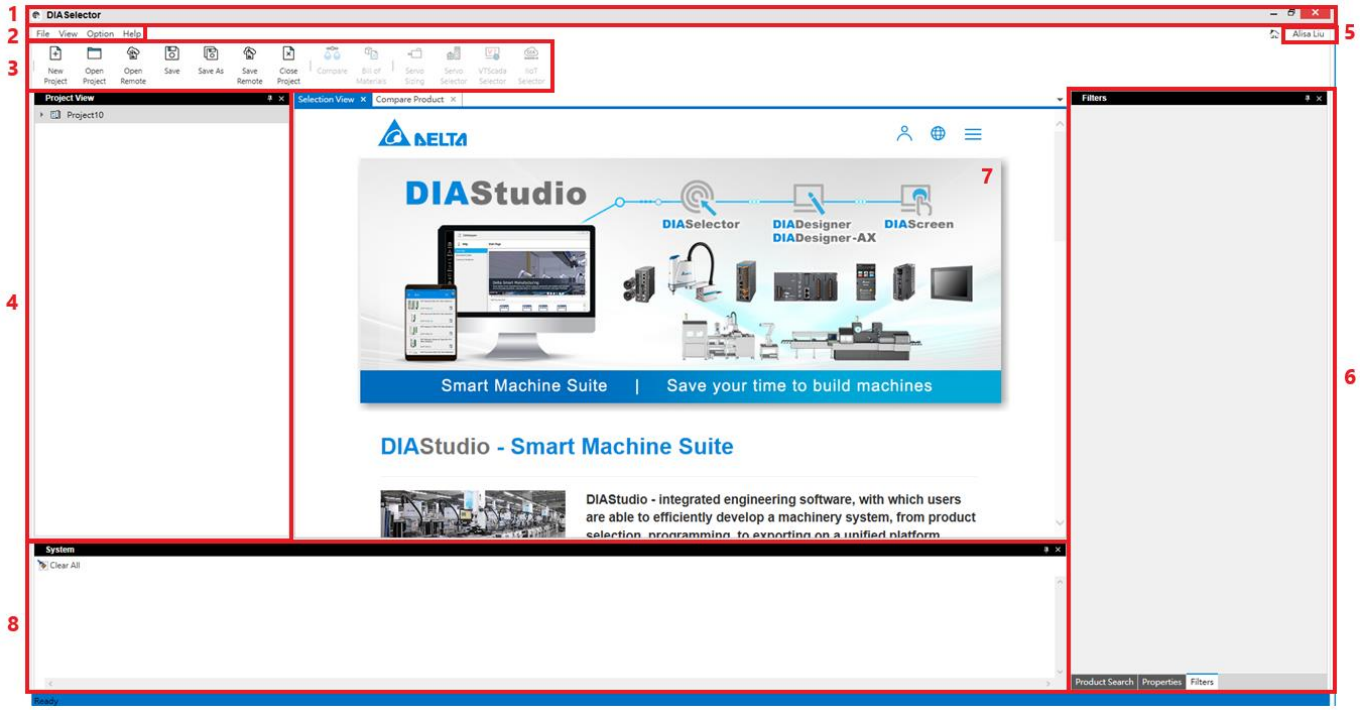


Figure 14-2

The functions of the DIASelector main window are as follows:

Legend	Name	Legend	Name
1	Application window title bar	5	Sign In / Account Name
2	Menu bar	6	Product Search, Properties, Filters
3	Quick access toolbar	7	Selection View
4	Project View	8	System

Table 14-1

14-3 Project Creation

Follow the steps to create a project.

Step 1. In the **File** Menu, click **File** → **New Project**. Or click  icon in the Quick access toolbar to create a new project which is shown as below.

Step 2. Enter a project name.

Step 3. Browse a location to save the project.

Step 4. Select a region. This allows you to access products available to a particular region.

Step 5. Enter description (optional) and click **OK**.

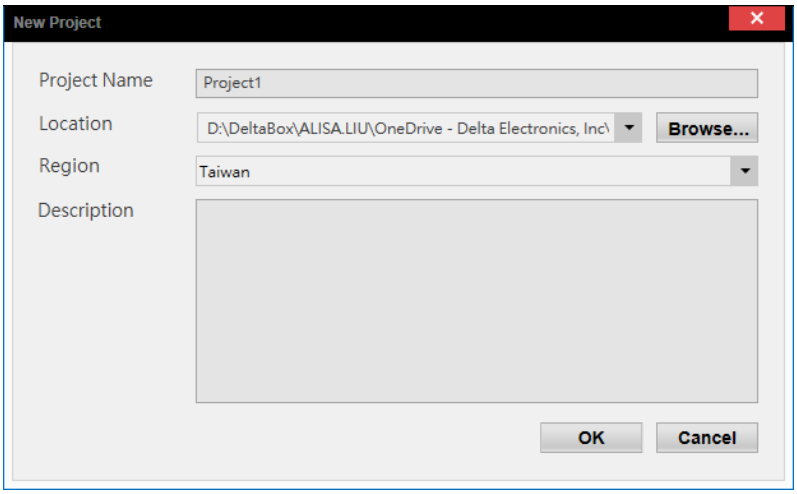


Figure 14-3

Result

Displays the **Project View** which is shown as below.

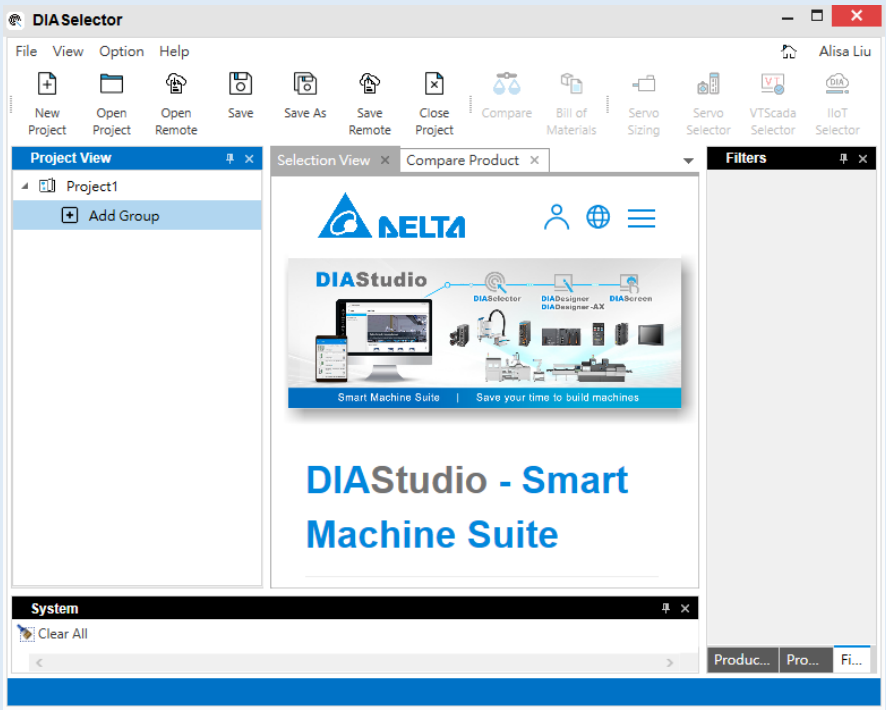


Figure 14-4

14-4 Create a Group

In DIASelector, based on the application type, user can create different Groups:

- **General Application**: Select a product manually from the **Selection View**
- **Motion Control Application**: Select Motion Control Products from the **Selection View**.
- **Custom Generated Application**: Enter required specifications to get suitable PLC / AC Motor Drives.

Follow the steps to create a group.

Step 1. Click icon in the Project View.

Step 2. Enter a group name.

Step 3. Select an application profile. To configure the MX300 multi-drive, please select a customized application which is shown as below.

Step 4. Click **OK**.

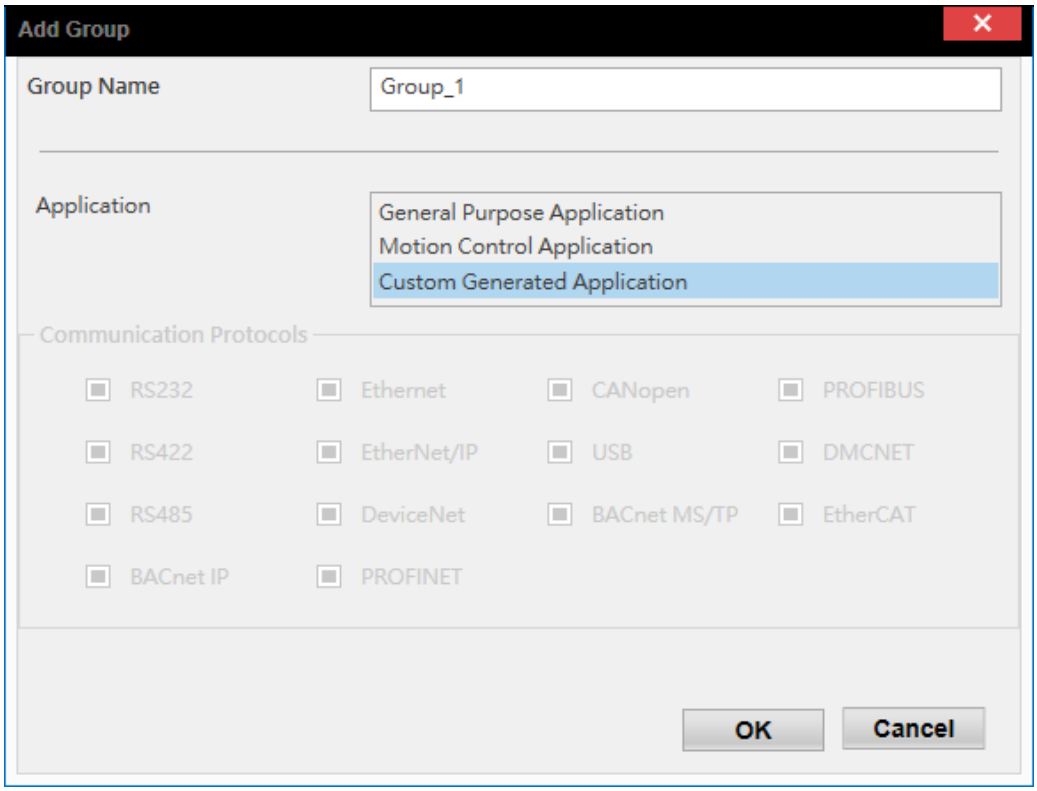


Figure 14-5

14-5 Multi Drive Configuration

The following are the steps for Multi Drive Configuration selection:

Step 1: Select the Multi Drive option in the Drive Type drop-down list and click **Configure**, which is shown as below.

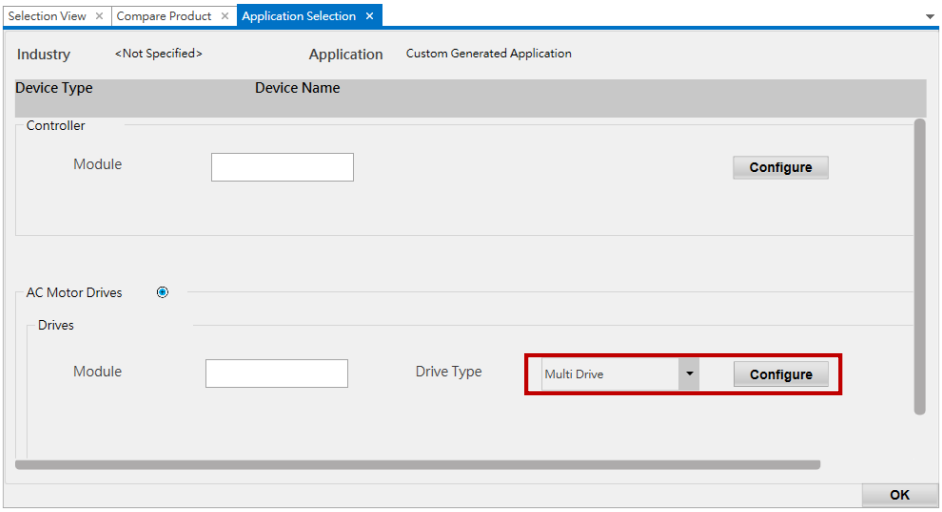


Figure 14-6 Application Selection - AC Motor Drives - Multi Drive - Configuration

Result

The Multi Drive Configuration window appears which is shown as below.

There are four tabs:

- System Selection
- Equipment / Inverter Module Specification
- Rectifier / Inverter Module Selection
- Multi Drive Configuration

Step 2: System Selection tab is the default window for MX300 Selection. Select system voltage and the drive as required.

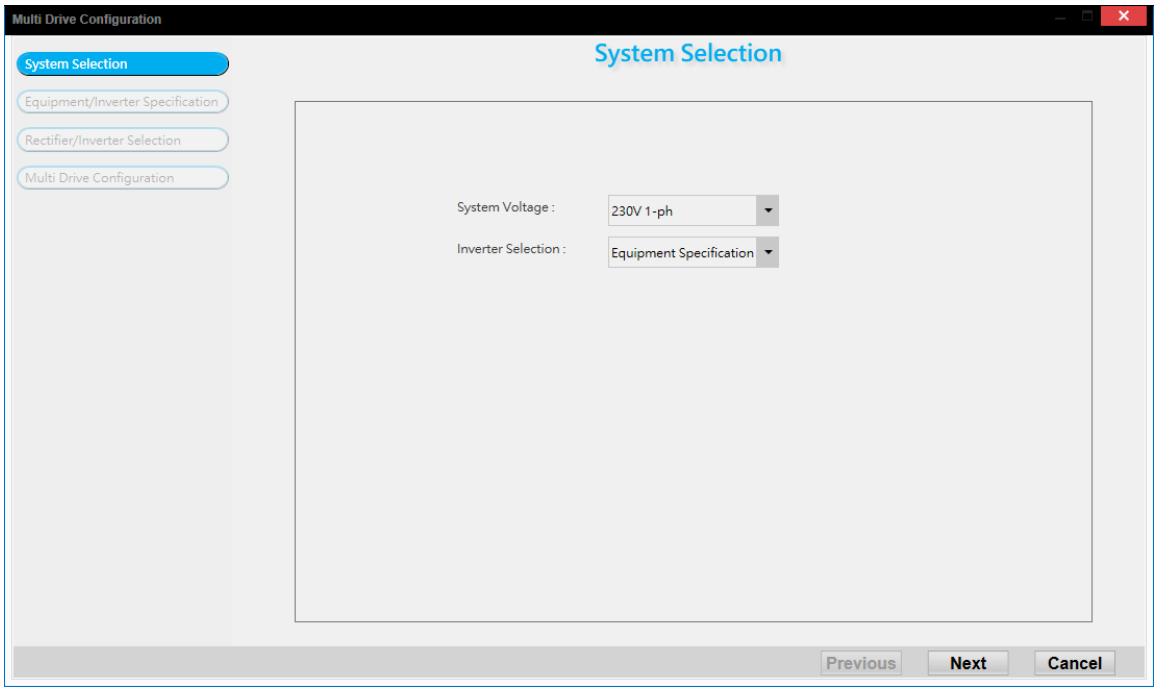


Figure 14-7 Multi Drive Configuration - Select System Voltage and Inverter Selection

Please select the drive as follows:

- Select by Equipment Specification - User can select the drive based on the input motor load details and also the preferred number of the inverter module axes.
- Select by Inverter Module Specification - User can select the inverter module based on the selected system voltage and the number of inverter module axes.

Step 3: Click **Next** to proceed to Equipment / Inverter Module Specification tab.

Result

The Equipment / Inverter Module Specification tab displays the specification based on the Inverter module selection standards which selected in the System Selection tab.

1. Drive Selection: Select by Equipment Specification
   When the Drive is selected by the Equipment Specification, the Equipment / Inverter Module Specification tab is shown as below.

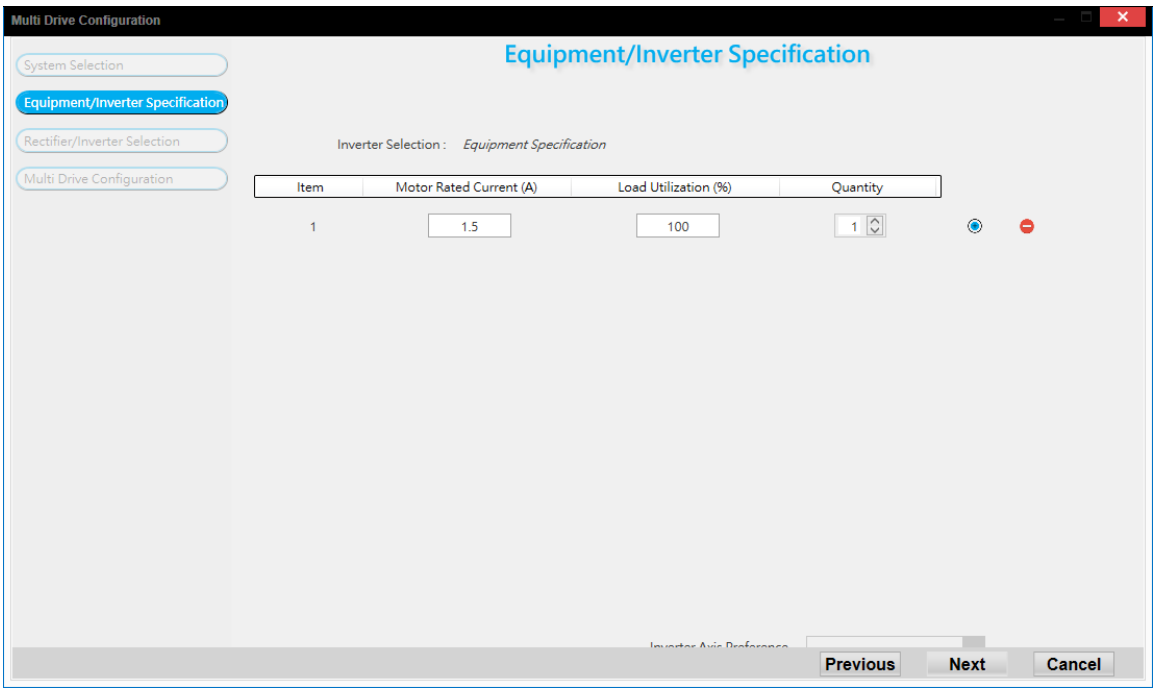


Figure 14-8 Select by Equipment Specification

Step 4: Enter the Motor Rated Current (A)and Load Utilization (%), and select required Quantity.
Click icon to add more motor load detail rows and click icon to delete a motor load detail row.

When the Drive is selected by the Equipment Specification, an example of the motor load details column in the Equipment / Inverter Module Specifications tab is shown as below.

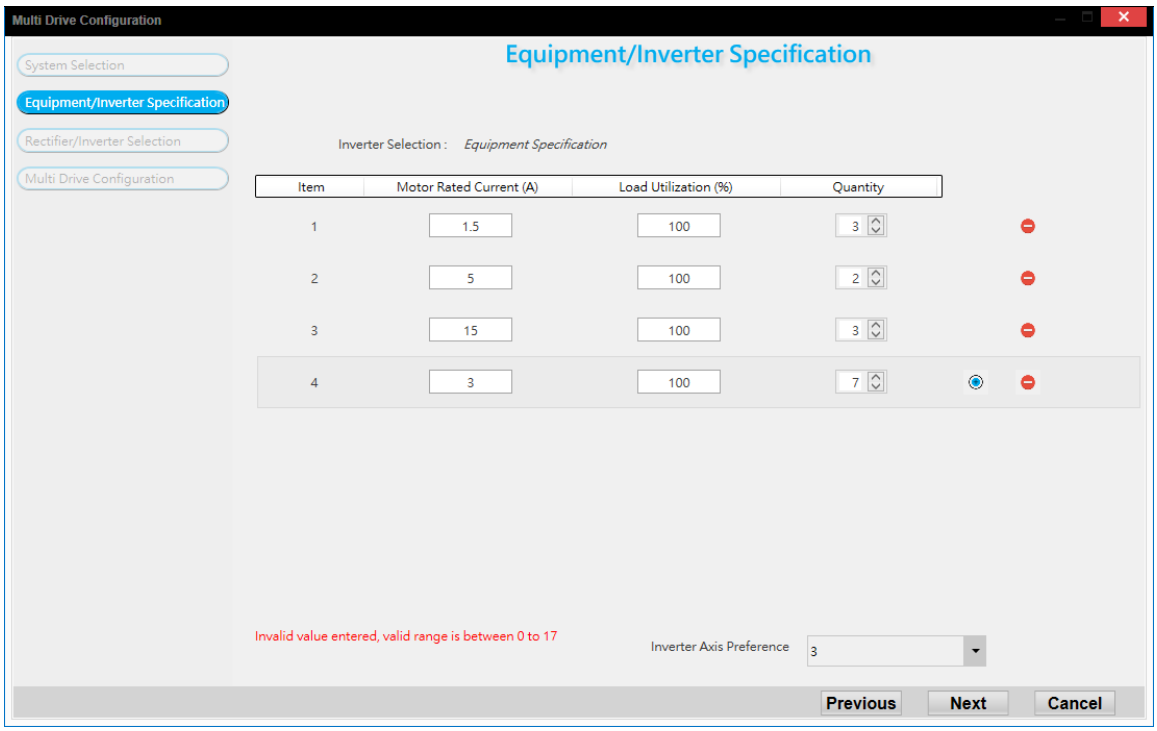


Figure 14-9 Select by Equipment Specification – Example

NOTE: When the Drive is selected by the Equipment Specification, the Equipment / Inverter Module Specifications tab can support up to 99 columns of motor load details.

2. Drive Selection: Select by Inverter Module Specification
   When the Drive is selected by the Inverter Module Specification, the Equipment / Inverter Module Specification tab is shown as below.

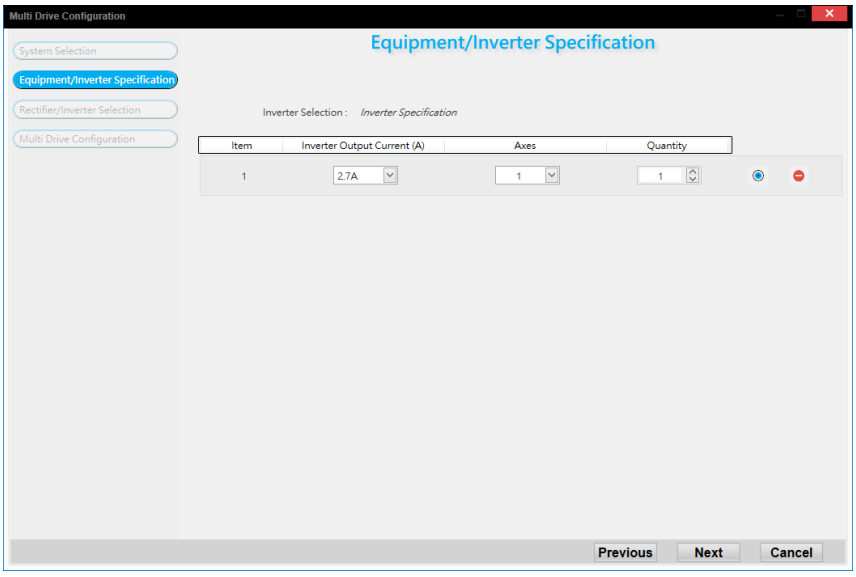


Figure 14-10 Select by Inverter Module Specification

Step 5: Select the inverter module output current (A) and the number of axes from the corresponding drop-down menu, and select the number of drive as required. Click  icon to add more motor load detail rows and click  icon to delete a motor load detail row.
When the Drive is selected by the Inverter Module Specification, an example of the drive details column in the Equipment / Inverter Module Specifications tab is shown as below.

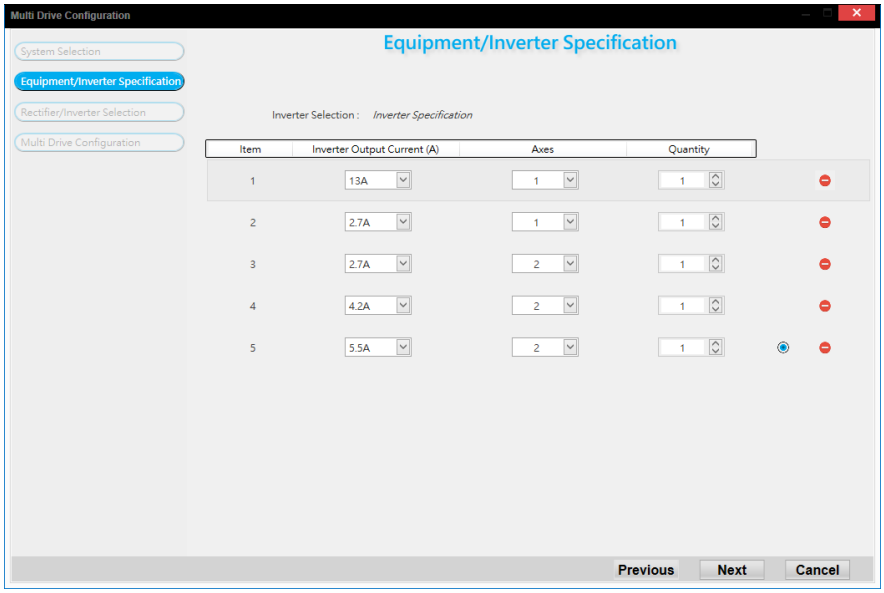


Figure 14-11 Select by Inverter Module Specification – Example

Step 6: Click **Next** to proceed to Rectifier / Inverter Module Selection tab.

Step 7: Select the Rectifier Module requirements based on the Braking Chopper and Communication properties. Rectifier / Inverter Module Selection tab is shown as below.

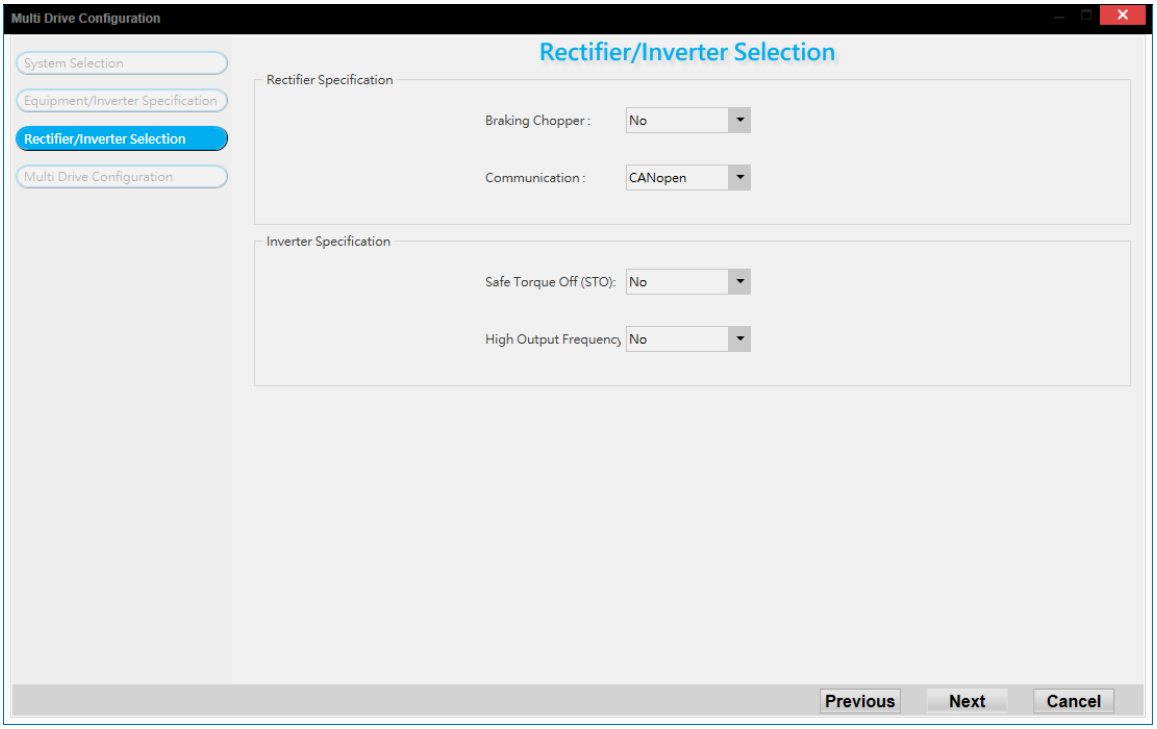


Figure 14-12 Multi Drive Configuration – Rectifier / Inverter Module Selection

NOTE: Select the specifications for Braking Chopper and Communication Mode as required.

Step 8: Click **Next** to proceed to Multi-Drive Selection tab.

Step 9: The Multi Drive Configuration tab shows Rectifier Module , Inverter Module , Transmission Module and other Accessories. Select extra accessories as required. An example of Multi Drive Configuration tab is shown as below.

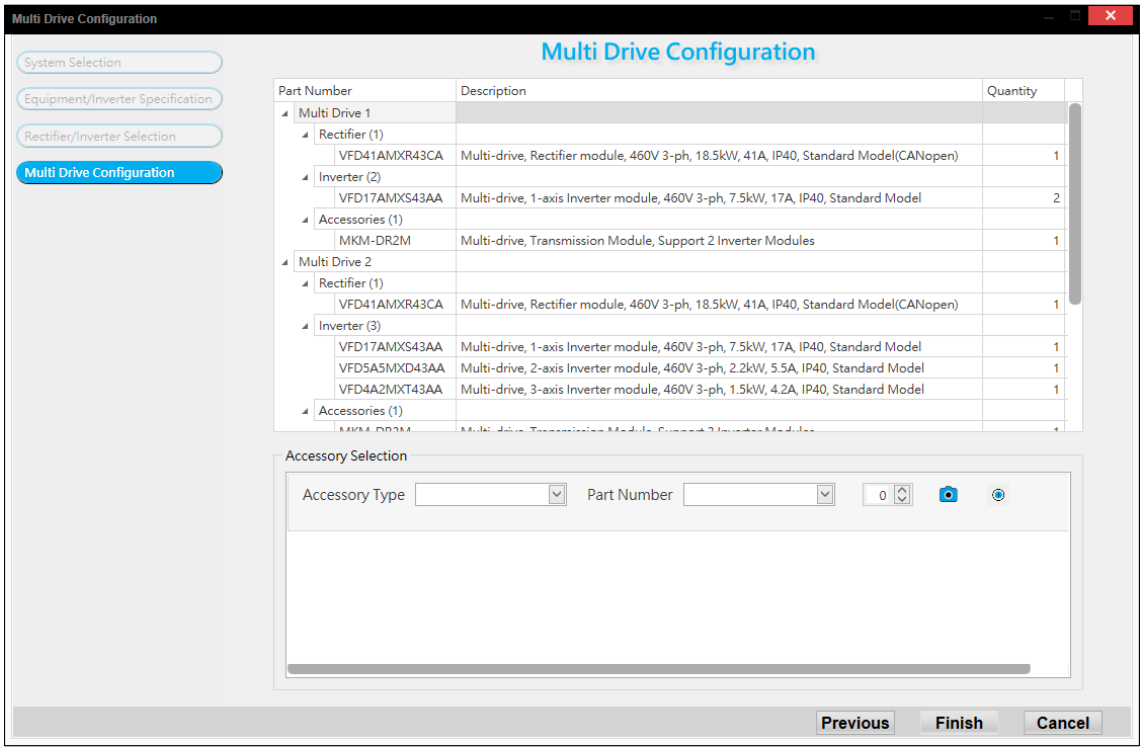


Figure 14-13 Multi Drive Configuration - Multi Drive Configuration tab

NOTE: Select the accessory from the drop-down list in the respective multi-drive set.

Step 10: Click **Finish** in the Multi Drive Configuration tab of Multi Drive Configuration window to add the Rectifier(s) Modules , Inverters Modules , Transmission Modules and other Accessories to the Application Selection window.

Result

The Module is added in the AC Motor Drives of Application Selection window which is shown as below.

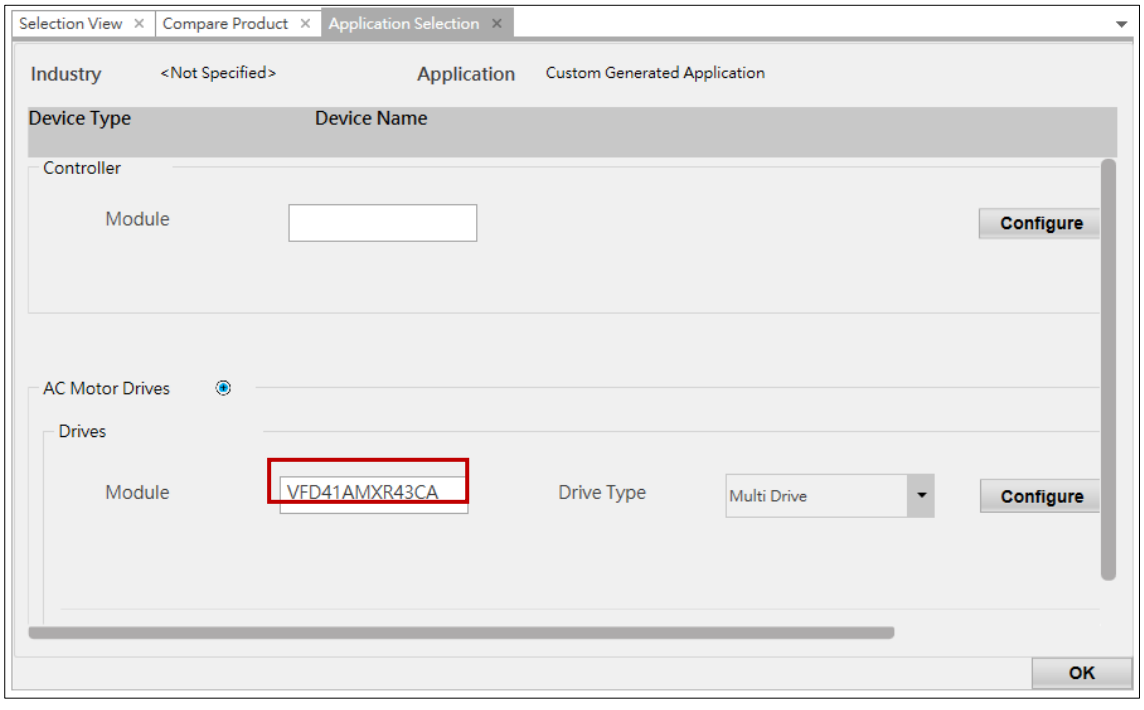


Figure 14-14 Module is added to the AC Motor Drives

Step 11: Click **OK** in the Application Selection window.

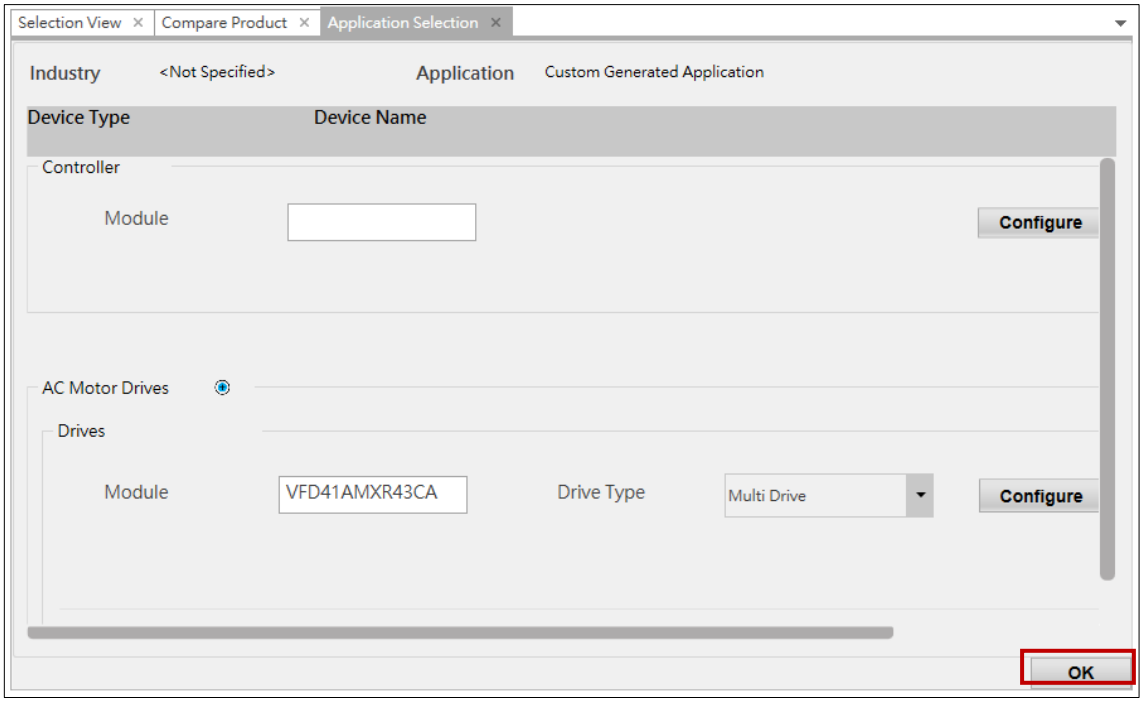


Figure 14-15 Select OK in Application Selection window

Result

The part numbers are added to the **Project View Group** suggested by **Multi Drive Configuration** which is shown as below.

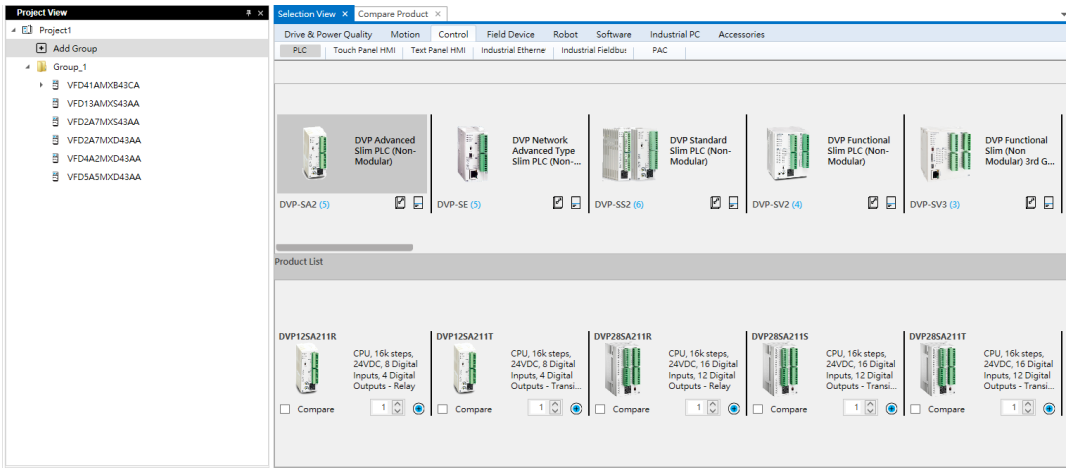


Figure 14-16 Part Number added to Project View

NOTE: The above content is excerpted from Chapter 6.3 of the DIASelector software user manual. Please refer to the manual for more details.

Chapter 15 DIADesigner Operation

15-1 DIADesigner Overview

15-2 Connection to the Inverter

15-3 Hardware Configuration

15-4 Parameter Setting

15-5 Device and Error Information

15-6 Adaptation

15-1 DIADesigner Overview

DIADesigner is a member of the DIAStudio integrated software suite, which develops software for Delta's new generation of automation products. It provides you with Delta's full range of Industrial Automation products for program editing, network and hardware configuration, parameter settings and other functions, to complete various tasks with a consistent user interface and operating experience. In addition, it also provides many auxiliary tools and multi-language systems, providing you with a convenient and efficient development environment.

DIADesigner features are as follows:

- Integration Function
  - DIADesigner integrates the software of all Delta products so that you do not need to switch between multiple software operations. One project can support multiple Delta products for systematic project creation.
  - Provides Basic View and Advanced View design interfaces for a consistent, friendly, and intuitive experience.
  - Legacy ISPSoft software projects are compatible with DIADesigner and can be reused.
- **Program Editing Function**
  - Adopts the international standard IEC 61131-3 programming architecture and has a rich built-in application instruction set.
  - Supports multiple languages, including ladder diagram (LD), sequential function diagram (SFC), structured language (ST) and C language (C).
- **Configuration Function**
  - Hardware Planning Tool: Used for configuration and parameter management of the hardware architecture of the controller.
  - Network Planning Tool: Used to manage and configure network architecture and data exchange mechanism of the controller.
- **Convenient Function**
  - Instant keyword filtering function helps you to confirm the correctness when setting commands or parameters.
  - Supports import / export functions of multiple objects, and can be exported / imported into txt, csv and other text formats for further use.

    NOTE: The import / export function can be compatible with the files exported by the legacy software. For example, the parameter file exported by ASDASoft can be imported into the parameter table of DIADesigner.
  - Provides Online and Offline modes for different operating functions for online / offline devices.
  - Provides a search and replacement function.
  - Support multilingual such as Traditional Chinese, Simplified Chinese, English, and other languages.
  - Project management uses a clear and easy-to-use Windows-level tree-like interface.

System Requirement of DIADesigner:

Item	System Requirement
Operating System	Windows 11 (64-bit)
CPU	Intel Core i5 M520 2.4 GHz (min.)
Memory	Recommend to use 16 GB or above
Hard Disk Drive	15 GB free for DIADesigner
Monitor	Resolution: 1024×768 Pixels, 1920×1080 Pixels
Keyboard / Mouse	General keyboard mouse or Windows-compatible device
USB	Used in connection with the device
Ethernet	Used in connection with the device
Software	Need to install Microsoft.Net Framework 4.7.2

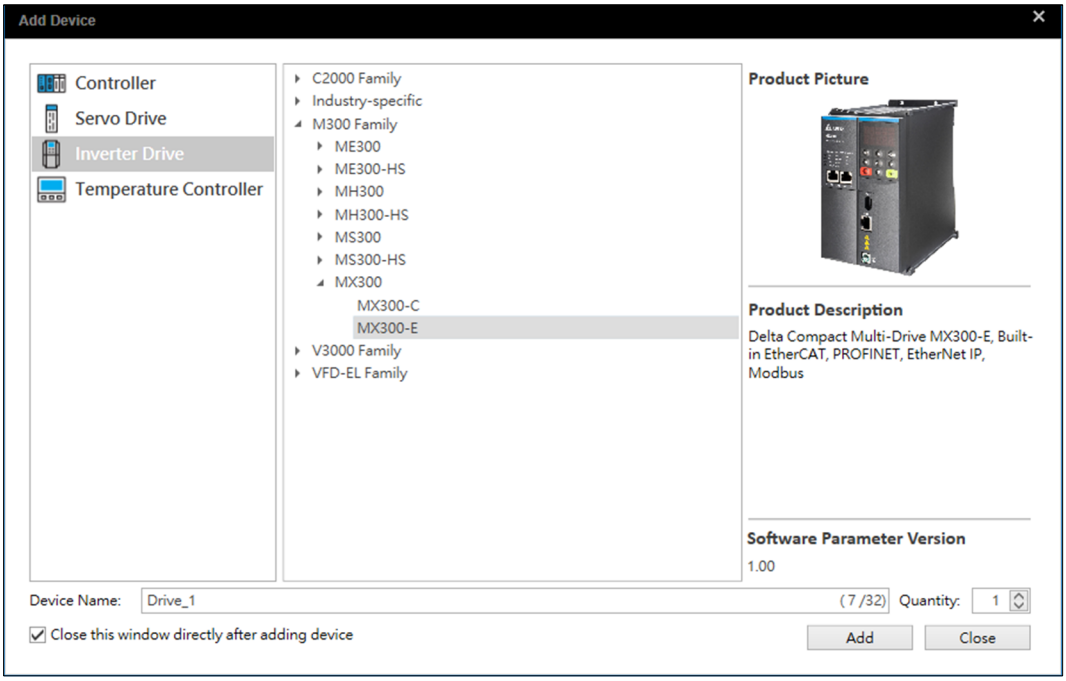
Table 15-1

15-2 Connection to the Inverter

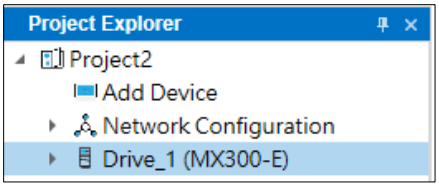
15-2-1 Add Device

You can add devices to the project by following steps

1. Click  on the development toolbar.
   Or click **Operation** → **Add Device** from the **menu** bar. Or click  in **Project Explorer**.
2. Choose MX300 from M300 Family of Inverter Drive.



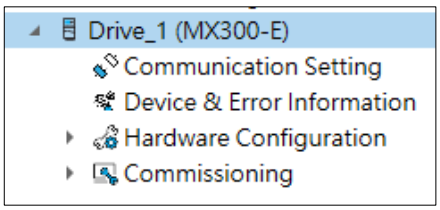
3. Click **Add Device**, then the device shows in the **Project Explorer**.

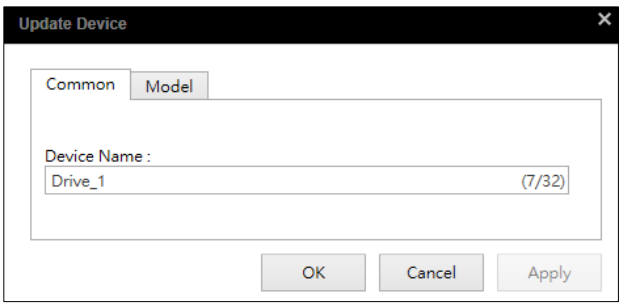


15-2-2 Device Name

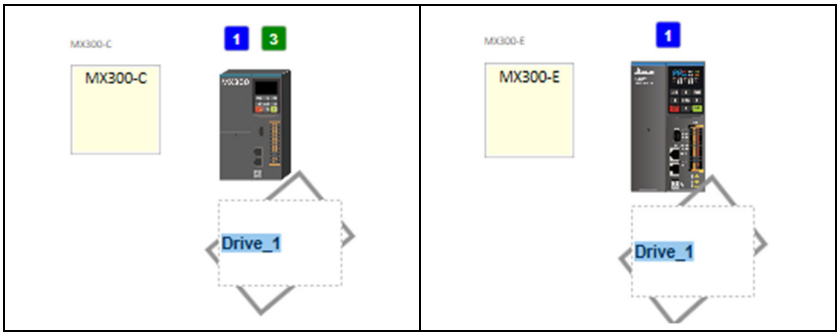
To modify the device name, do one of the following:

1. Right-click the device in **Project Explorer** and select **Update Device**. Then you can modify the device name.





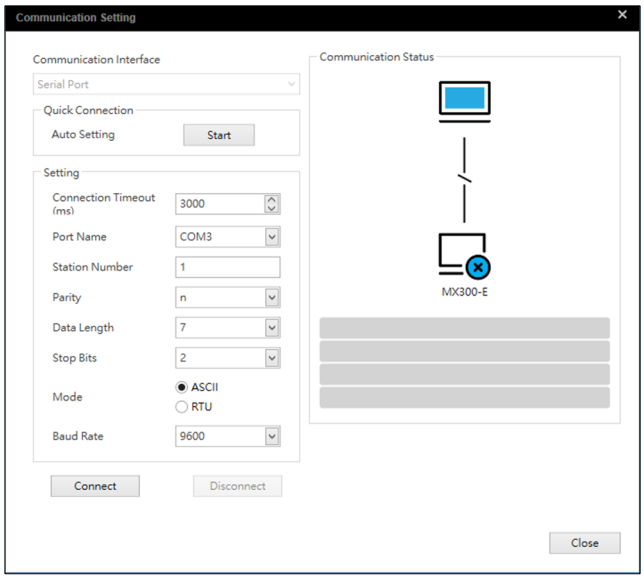
2. Click the device in **Project Explorer** directly.
3. Choose the device in **Project Explorer**, and then press **F2**.
4. Double-click **Network View** → **Network View**, then double-click the device name above the device or press **F2.**



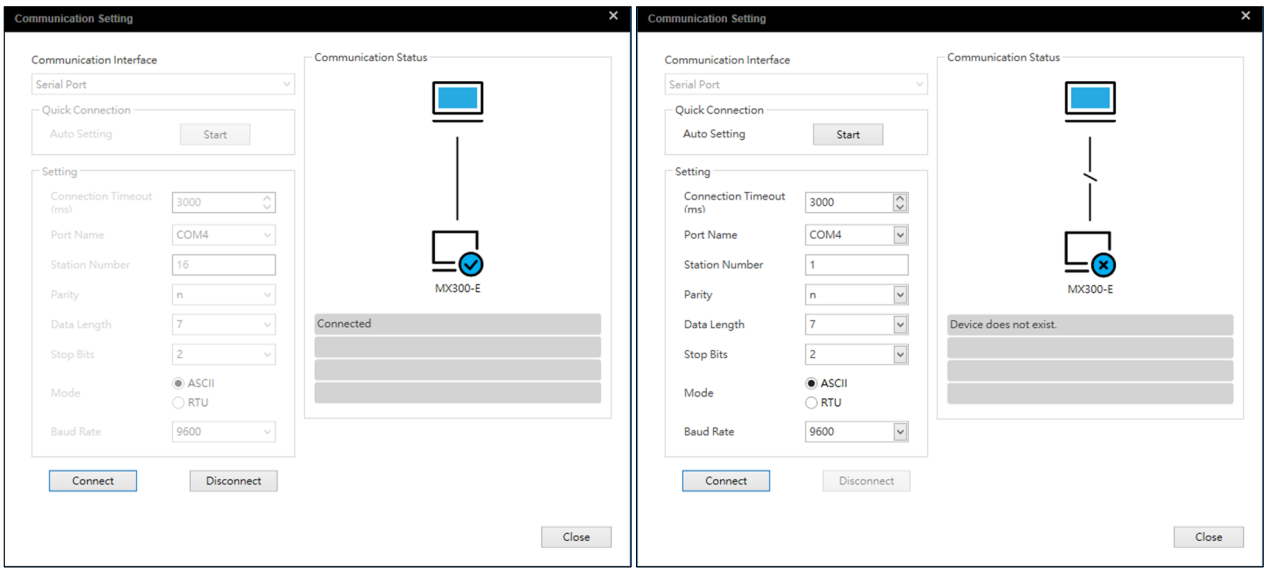
15-2-3 Communication Setting

To establish a connection with the inverter by following steps in Communication Setting dialog

1. In **Project Explorer**, double-click **Device → Communication Setting**.
2. Filled the option in setting dialog, click **Connect.**
   - Station Number: Modbus Communication address (Pr.09-00)
   - Parity, Data Length, Stop Bits, and Mode: Modbus Communication Protocol (Pr.09-04)
   - Baud Rate: Transmission Speed (Pr.09-01)

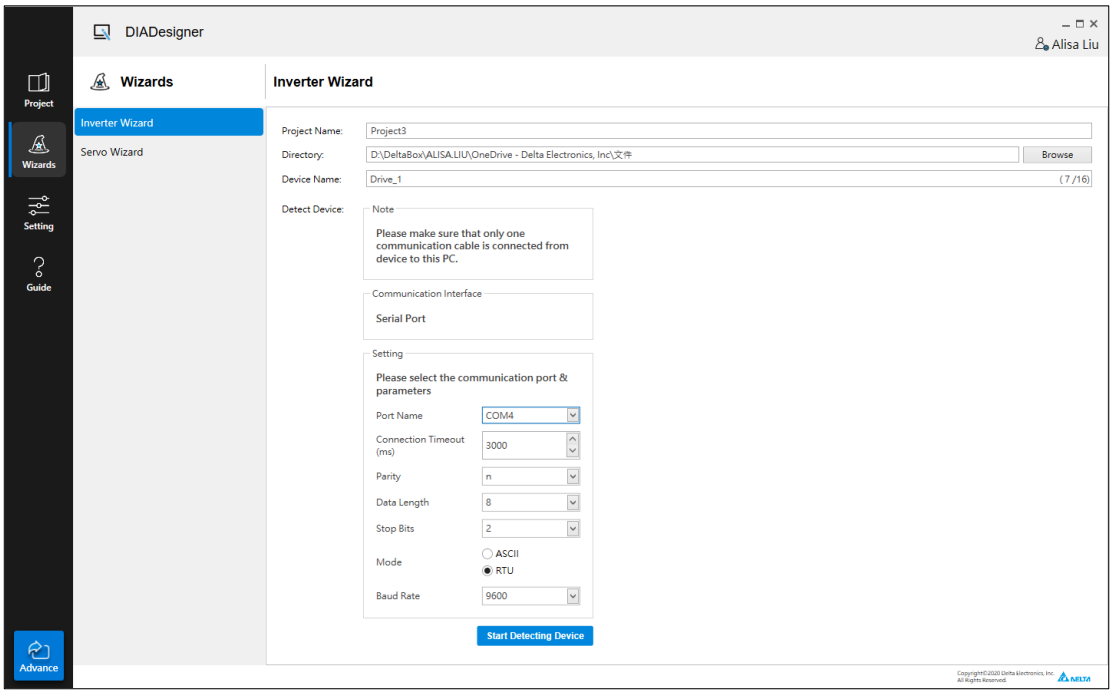


3. Displays **Connected** or **Device does not exist**.



15-2-4 Inverter Wizard

In the **Inverter Wizard** pane, you can add the inverter devices to the project and connect the inverter.

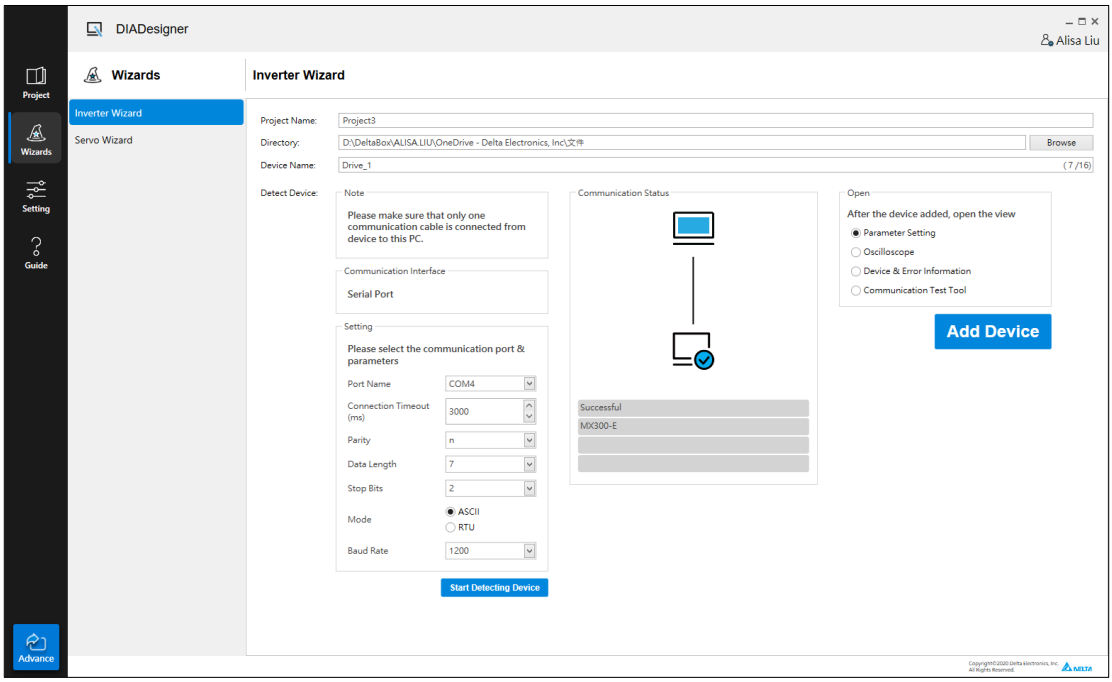


The following table lists the functions in the **Inverter Wizard** pane and their descriptions.

Function	Description
Project Name	Enter a name for the project.
Directory	Displays the project path. By default, this field displays the path selected from the **Browse** function. You can also enter the path.
Device Name	Enter a name for the inverter.
Detection	Set the communication to connect to the inverter or click **Start Detecting Device** to auto-detect the inverter. To stop detection, click **Stop Detecting Device**.

Table 15-2

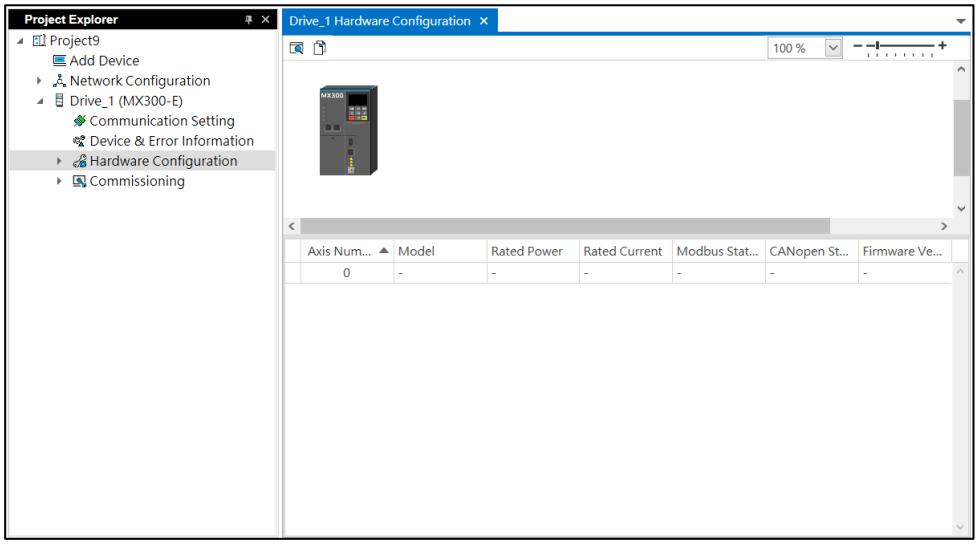
Click **Add Device** after the connection, it will jump to Hardware Configuration dialog.



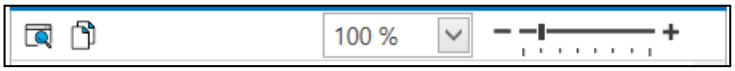
15-3 Hardware Configuration

The multi- drive inverter includes rectifier and inverter modules. After adding the rectifier module in Creating Project and Device, add the relevant inverter module in **hardware Configuration**. The following is an example of MX300-E. Follow these steps to enable **Configuration**.

1. In **Project Explorer**, navigate inverter device → **VFD Function** → **Hardware Configuration** → **Configuration**.
2. Double-click **Configuration** to open Hardware Configuration dialog. Upper pane displays hardware view and bottom pane displays Configuration Table as shown in the following figure.



The following figure shows **Hardware Configuration** toolbar.



The following table describes the functions in Hardware Configuration.

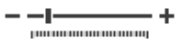
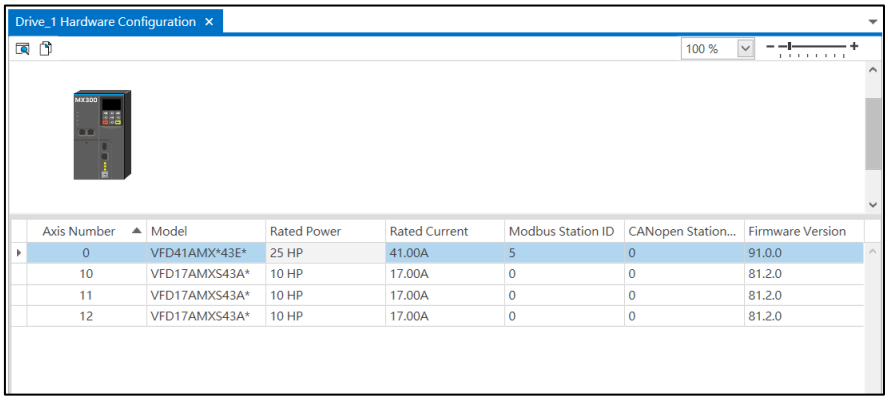
Function / Icon	Description	Function / Icon	Description
	Click to perform I/O scan.		Click to perform I/O match.
	Enter or select value to zoom-in or zoom-out.		Click and drag to zoom-in and zoom-out.

Table 15-3

3. Adding inverter module

   The multi-drive inverter hardware configuration only supports the configuration returned by the actual connected device after online scanning. It does not support offline configuration. First confirm that the device has completed communication settings and connection. Click **I/O Scan** on the toolbar, and DIADesigner displays the current configuration in the configuration table below, as shown in the following figure.



Axis Number	Model	Rated Power	Rated Current	Modbus Station ID	CANopen Station...	Firmware Version
0	VFD41AMX*43E*	25 HP	41.00A	5	0	91.0.0
10	VFD17AMXS43A*	10 HP	17.00A	0	0	81.2.0
11	VFD17AMXS43A*	10 HP	17.00A	0	0	81.2.0
12	VFD17AMXS43A*	10 HP	17.00A	0	0	81.2.0

4. After completing the scan, click **Save Project** to save the module configuration in the project. If the actual module configuration changes in the future, repeat the above I/O scan and update it to the current module configuration.

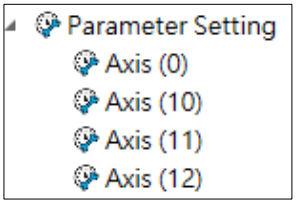
Match Module Configuration

When the previously scanned inverter module configuration has been saved in the project, press the **I/O Match** button on the toolbar to confirm whether DIADesigner matches the currently connected device. If it does not match, decide whether to re-perform the **I/O scan** or change the actual hardware installation to match DIADesigner.

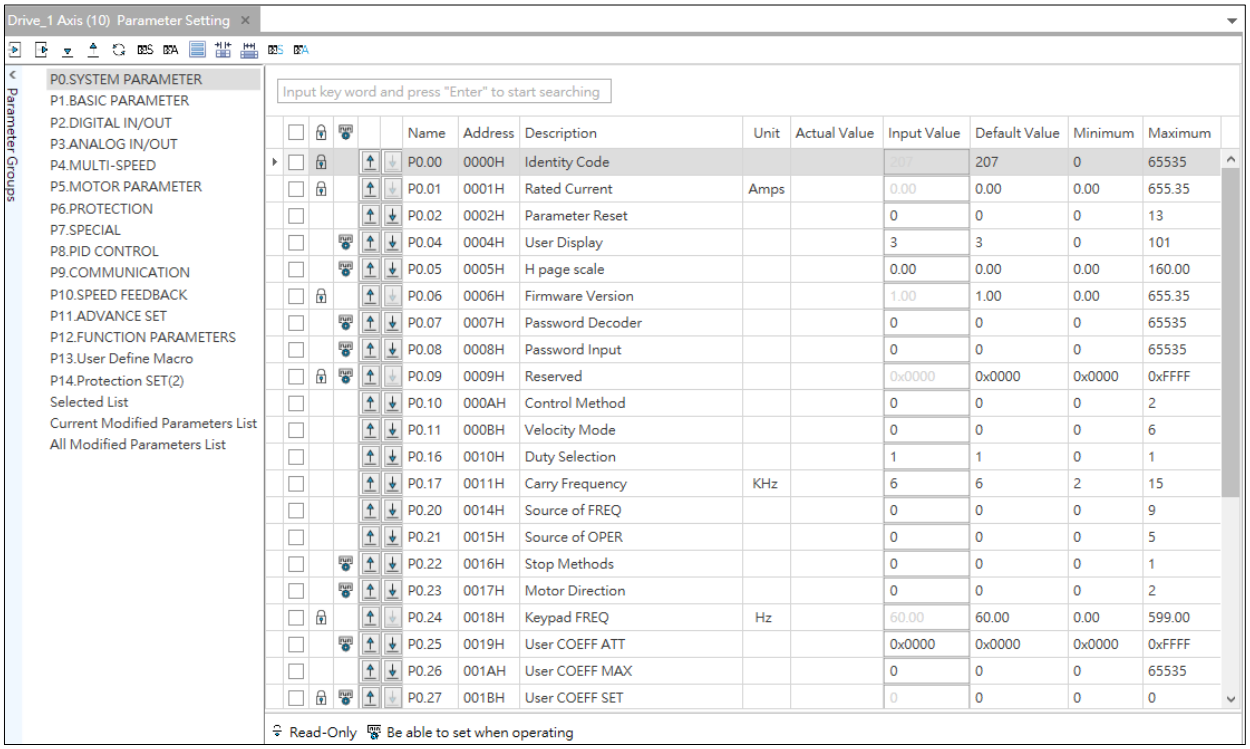
15-4 Parameter Setting

15-4-1 Open Parameter Setting Page

1. In **Project Explorer**, double-click **VFD Function** of the drive device → **Hardware Configuration** → **Parameter Setting**.
2. For multi-drive, after completing the module scan configuration, the parameter editor entry for each axis will be automatically listed in the lower layer of **Parameter Setting**



3. Double-click the axis to be set to open **Parameter Setting** dialog.



The following figure shows the toolbar of drive **Parameter Setting** dialog.



The following table describes the functions in toolbar of Parameter Setting dialog.

Function / Icon	Description
	Click to import the parameters. Upon click, **Open** dialog appears to select the parameter file.
	Parameter export function. After clicking, the **Save New File As** dialog appears to select the storage location where the parameter file is expected to be exported.
	Click to download the parameters. Upon click, **Download View** dialog appears to select the parameters you want to download.
	Click to upload the parameters. Upon click, **Upload View** dialog appears to select the parameters you want to upload.

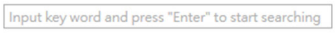
Function / Icon	Description
	Click to continuously update the parameters one-by-one for the display group.
	After clicking, the selected parameter input value will be replaced with the default value.
	After clicking, all parameter input values will be replaced with preset values.
	The fields are reduced to parameter number, name, actual value and input value.
	Users can select the fields they want to display.
	Click to restore the default field settings.
	After clicking, the default parameter input value will be replaced with the actual value.
	After clicking, all parameter input values will be replaced with actual values.
	Parameter comparison function of the same model CPU host. After clicking, the **Parameter Compare** dialog appears.
	Keyword search function. After entering a keyword, the words associated with the keyword will be marked with yellow background.

Table 15-4

Parameters are classified into fifteen groups in the drive **Parameter Setting** dialog. The following table describes the columns in each group.

Function / Icon	Description
	Indicate that this parameter is a read-only parameter.
	Indicate that this parameter can be set during operation.
	Provide this parameter independent single parameter upload / download function.
Name	Display the parameter number.
Address	Display the memory address of parameter.
Description	Display parameter description.
Unit	Display parameter unit.
Actual Value	Display the actual value of the parameter after successful upload / download.
Input Value	Set parameter value.
Default Value	Display the default value of the parameter.

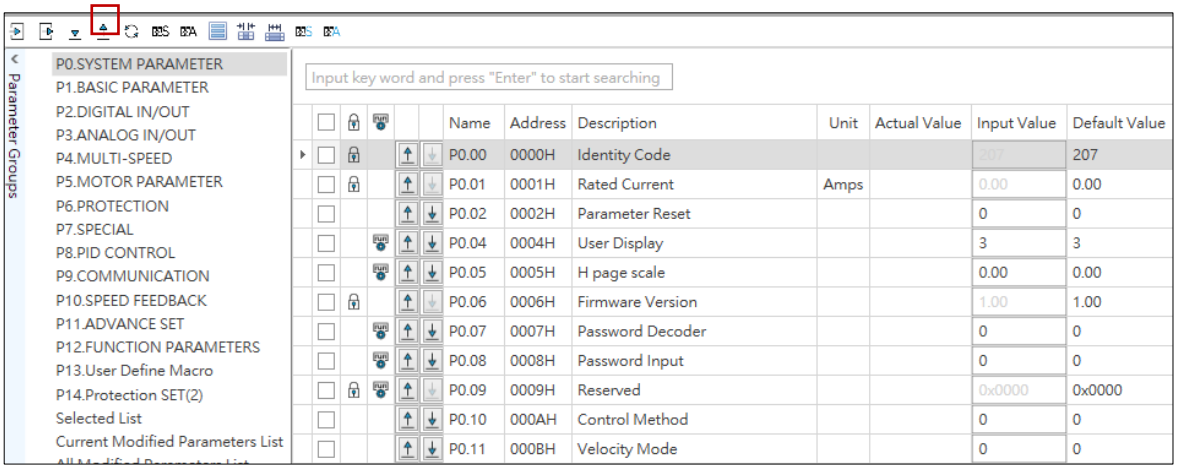
Table 15-5

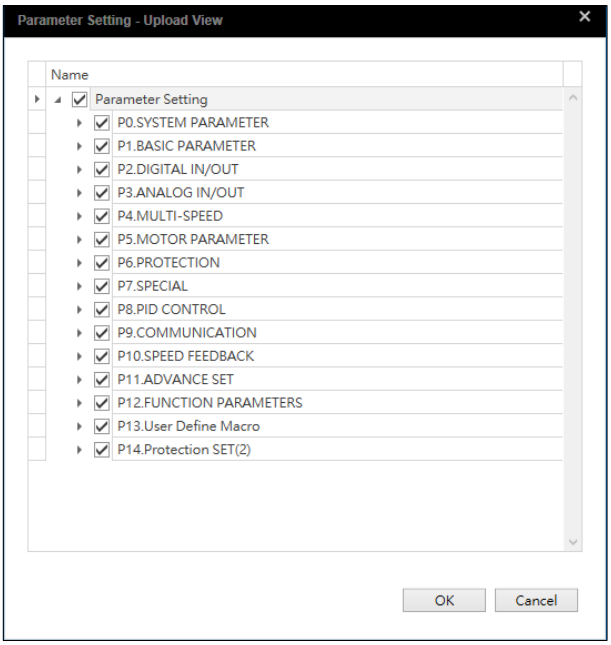
15-4-2 Upload Parameters

Parameter Setting provides the **Actual Value** and **Input Value** fields and the purpose is to separate the current device values and the values set by uses. Actual value and Input value can be synchronized through the following methods.

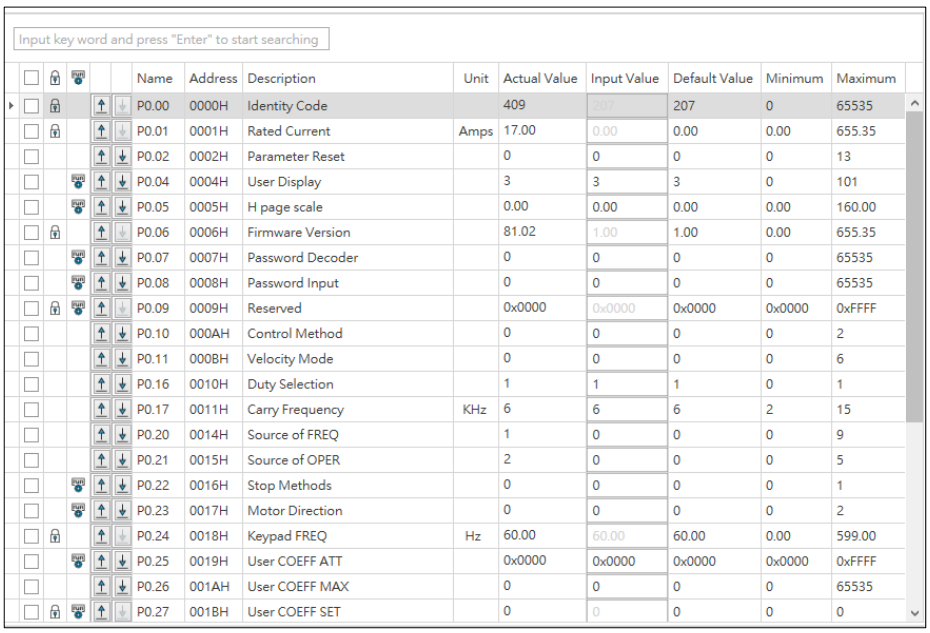
After communication is established, you can read the parameter **actual values** by upload function of Parameter Setting.

1. Click  in the toolbar of drive **Parameter Setting** dialog (Device → PC)
2. Select the parameter group you want to upload and click **OK**.

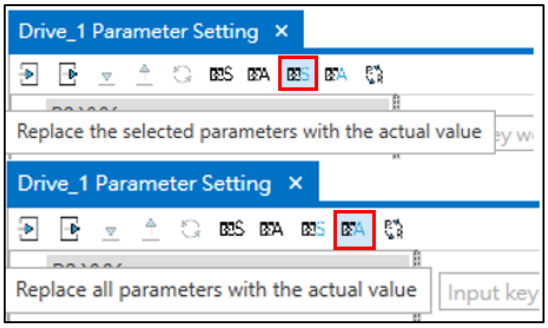




3. Once the upload is complete, the readback parameter values are shown in the **Actual Value** column, as shown in the following figure.



4. If you want to export the parameters or edit the parameters, then download to the device, click the **Replace the selected parameters with the actual value** or **Replace all parameters with the actual value** button. The actual values will be written to input values for subsequent editing.



Input key word and press "Enter" to start searching

Name	Address	Description	Unit	Actual Value	Input Value	Default Value	Minimum	Maximum
P4.00	0400H	Multi-Speed 1	Hz	0.00	0.00	0.00	0.00	599.00
P4.01	0401H	Multi-Speed 2	Hz	0.00	0.00	0.00	0.00	599.00
P4.02	0402H	Multi-Speed 3	Hz	91.51	91.51	0.00	0.00	599.00
P4.03	0403H	Multi-Speed 4	Hz	0.00	0.00	0.00	0.00	599.00
P4.04	0404H	Multi-Speed 5	Hz	0.00	0.00	0.00	0.00	599.00
P4.05	0405H	Multi-Speed 6	Hz	0.00	0.00	0.00	0.00	599.00
P4.06	0406H	Multi-Speed 7	Hz	0.00	0.00	0.00	0.00	599.00
P4.07	0407H	Multi-Speed 8	Hz	0.00	0.00	0.00	0.00	599.00
P4.08	0408H	Multi-Speed 9	Hz	0.00	0.00	0.00	0.00	599.00
P4.09	0409H	Multi-Speed 10	Hz	0.00	0.00	0.00	0.00	599.00
P4.10	040AH	Multi-Speed 11	Hz	0.00	0.00	0.00	0.00	599.00
P4.11	040BH	Multi-Speed 12	Hz	0.00	0.00	0.00	0.00	599.00
P4.12	040CH	Multi-Speed 13	Hz	0.00	0.00	0.00	0.00	599.00
P4.13	040DH	Multi-Speed 14	Hz	0.00	0.00	0.00	0.00	599.00
P4.14	040EH	Multi-Speed 15	Hz	0.00	0.00	0.00	0.00	599.00
P4.68	0444H	Reserved		0	0	0	0	65535
P4.69	0445H	Reserved		0	0	0	0	65535

15-4-3 Edit Parameters

The parameters can be edited by following steps.

1. Enter the parameter value in the Input Value field.
2. Click (PC → Device) Write to the inverter.
3. When the input value is different from the default value after editing, the default value field will be marked in green.

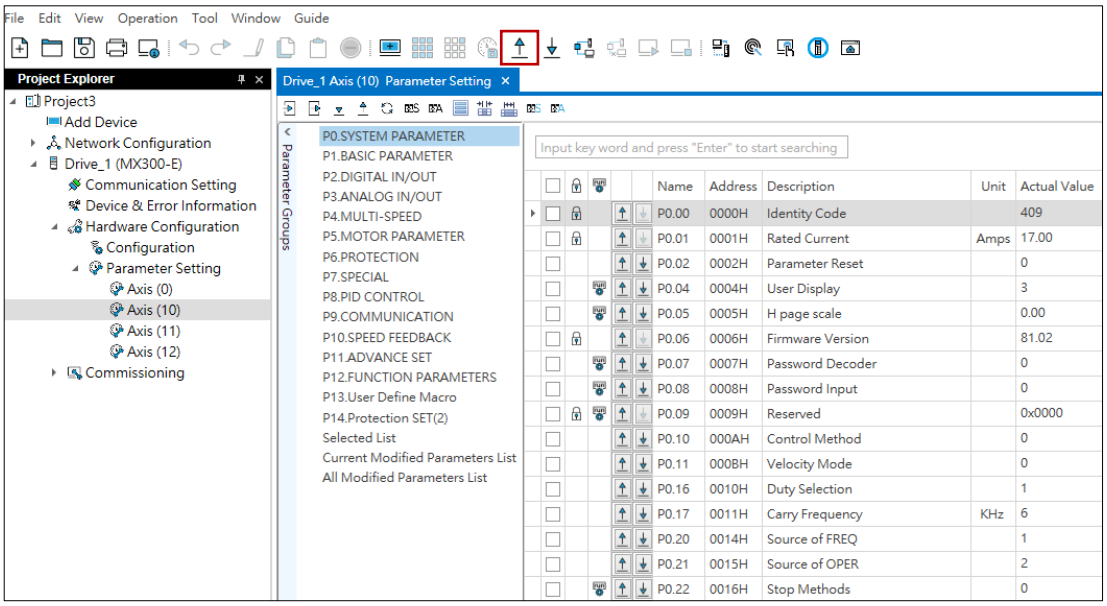
Input key word and press "Enter" to start searching

Name	Address	Description	Unit	Actual Value	Input Value	Default Value	Minimum	Maximum
P4.00	0400H	Multi-Speed 1	Hz	0.00	0.00	0.00	0.00	599.00
P4.01	0401H	Multi-Speed 2	Hz	0.00	0.00	0.00	0.00	599.00
P4.02	0402H	Multi-Speed 3	Hz	91.51	91.51	0.00	0.00	599.00
P4.03	0403H	Multi-Speed 4	Hz	0.00	60.00	0.00	0.00	599.00
P4.04	0404H	Multi-Speed 5	Hz	0.00	50.00	0.00	0.00	599.00
P4.05	0405H	Multi-Speed 6	Hz	0.00	0.00	0.00	0.00	599.00
P4.06	0406H	Multi-Speed 7	Hz	0.00	0.00	0.00	0.00	599.00
P4.07	0407H	Multi-Speed 8	Hz	0.00	0.00	0.00	0.00	599.00
P4.08	0408H	Multi-Speed 9	Hz	0.00	0.00	0.00	0.00	599.00
P4.09	0409H	Multi-Speed 10	Hz	0.00	0.00	0.00	0.00	599.00
P4.10	040AH	Multi-Speed 11	Hz	0.00	0.00	0.00	0.00	599.00

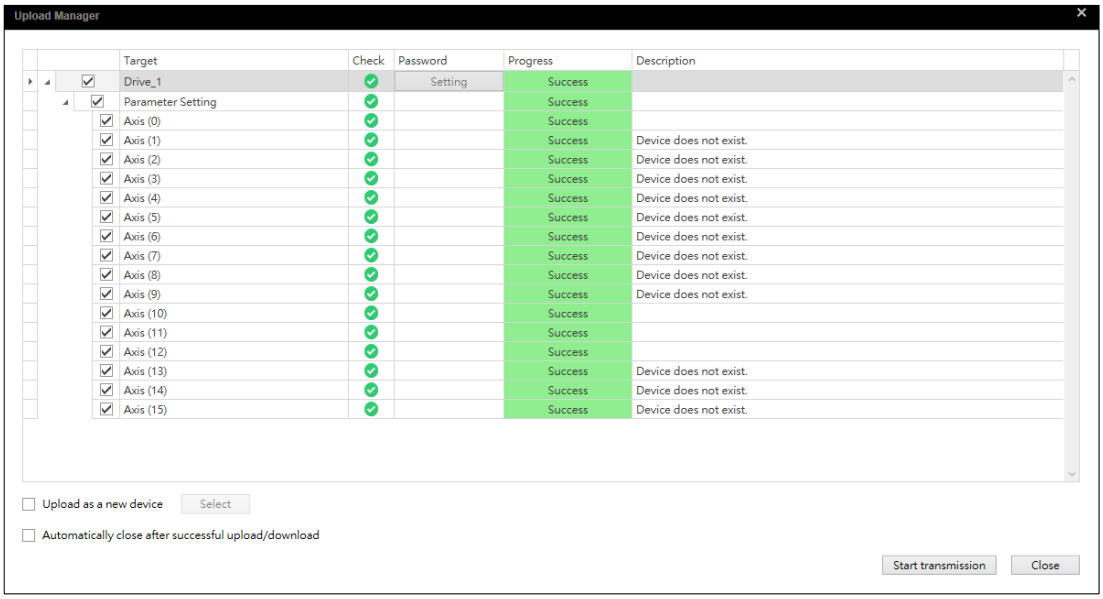
15-4-4 Upload and download all axis parameters

To upload all the parameters to the PC, follow the following steps.

1. Click **Project Upload** in the toolbar.

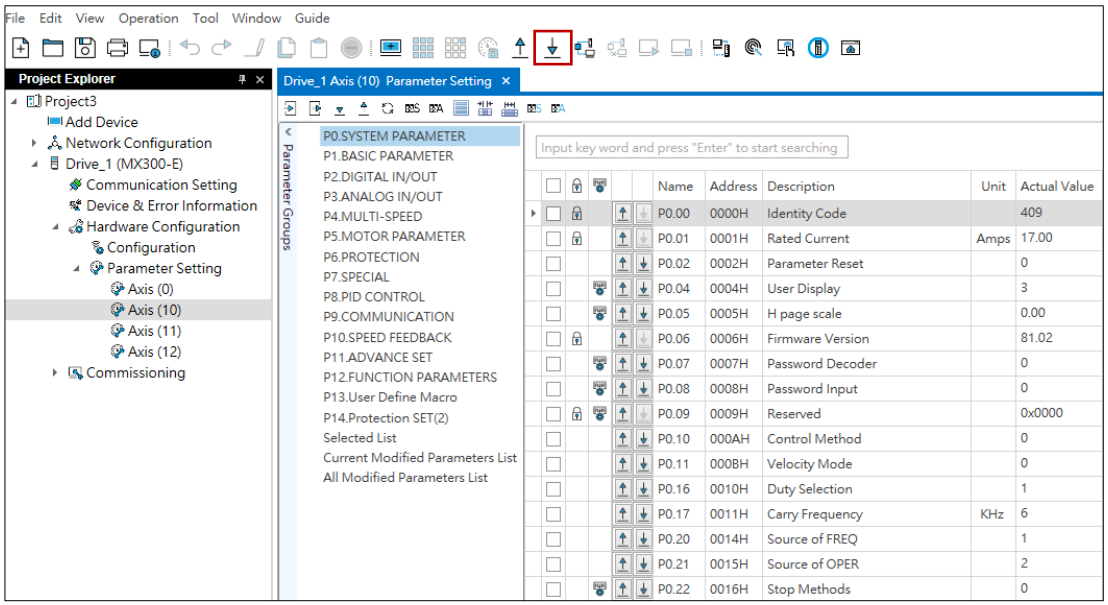


2. Choose **Not** to close the current project.
3. Select the axis to be uploaded and click OK.
4. After the transfer is complete, the results will be displayed in the **Progress** and **Description** columns. If the selected axis does not exist in the actual configuration, it will display "Success & Device does not exist".

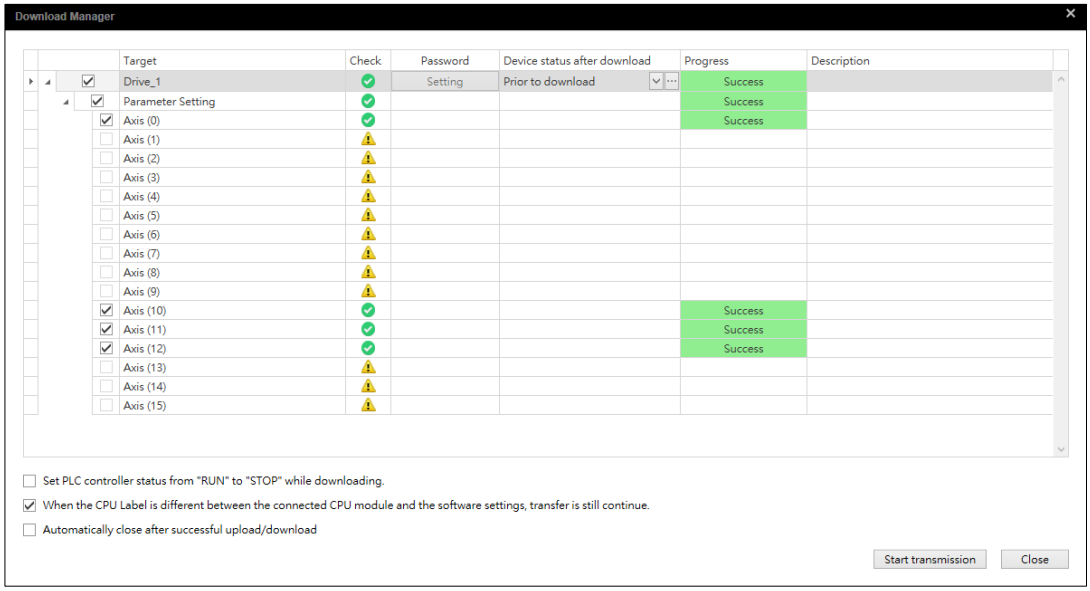


To download all the parameters to the inverter, follow the following steps.

1. Click **Project Download** in the toolbar.



2. Select the axis to be downloaded and click OK.
3. After the transfer is complete, the results will be displayed in the **Progress** and **Description** columns. If the selected axis does not exist in the actual configuration, it will display exclamation mark.

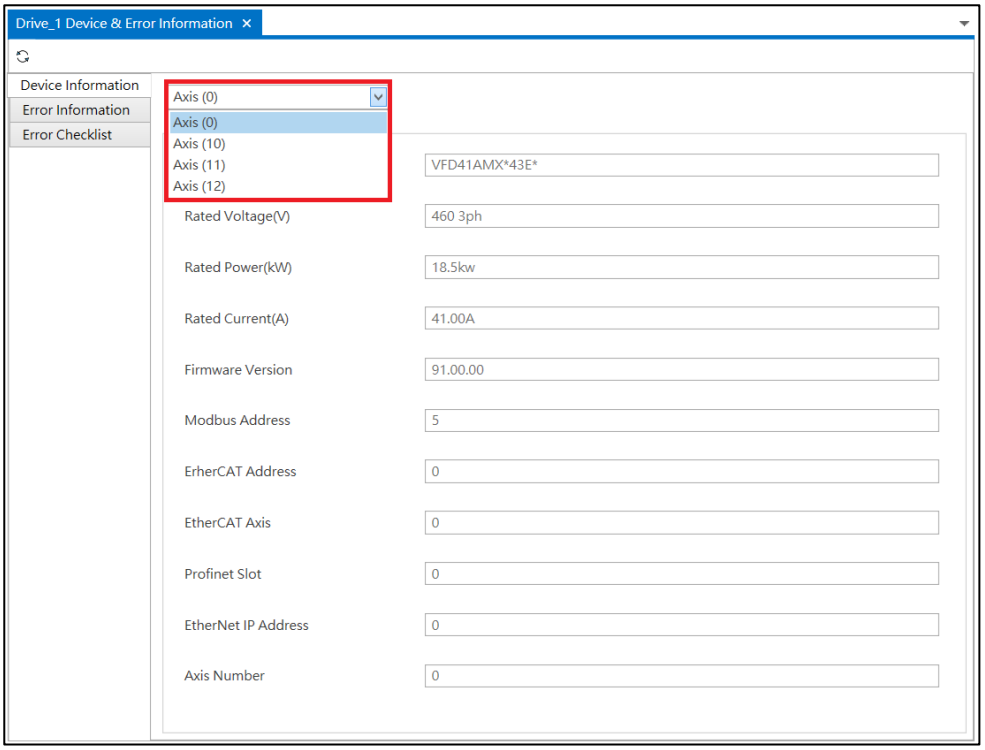


15-5 Device and Error Information

If DIADesigner is connected to a device, the system retrieves the Hardware Configuration. If it does not match the actual configuration, you will need to scan the device on the **Hardware Configuration** dialog.

15-5-1 Device Information

Select the axis number you want to view from the drop-down menu at the top of the screen and the corresponding axis information appears.



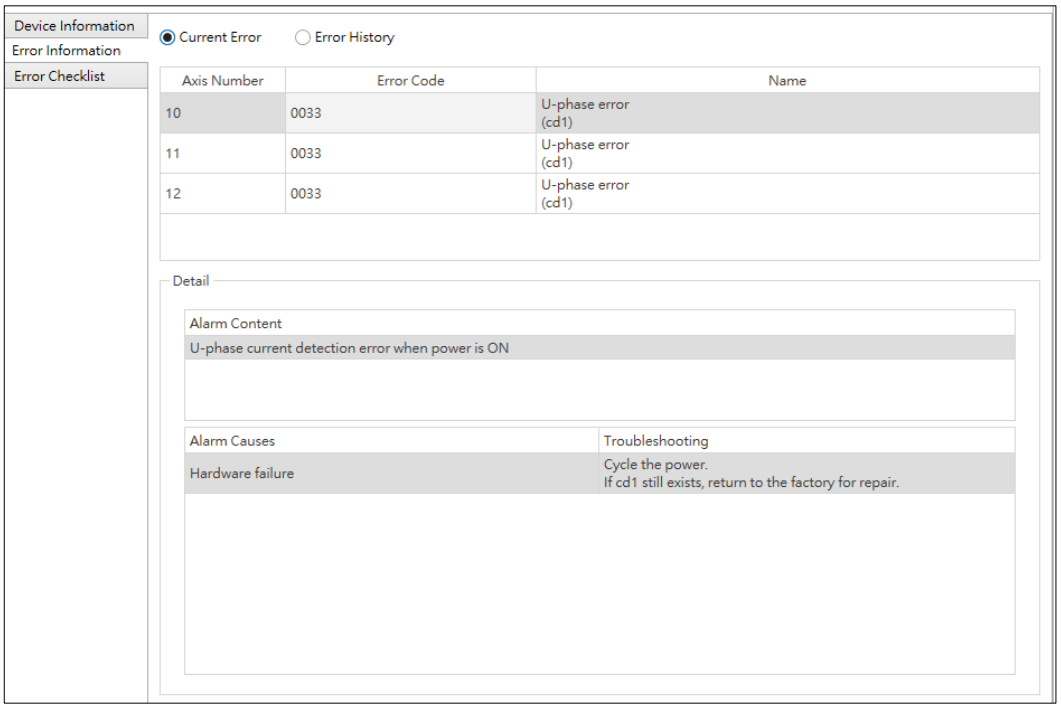
Function	Description
Modbus address	The axis Modbus address which is set in Pr.09-00. • Applicable modules: MX300-C rectifier, MX300-E rectifier, and inverter modules.
CANopen address	The axis CANopen address which is set in Pr.09-36. • Applicable modules: MX300-C rectifier and inverter modules.
EtherCAT address	When using EtherCAT communication, the EtherCAT address alias corresponding to the upper unit which is set in Pr.09-56. • Applicable modules: MX300-E rectifier.
Ethernet Slot	When using Ethernet communication, set the communication number of each axis in Pr.09-57 according to the one-station multi-axis architecture. • Applicable modules: Inverter modules.
Axis	Displays the number of each axis which is configured by the system. The fixed number of the rectifier axis is 0.

Table 15-6

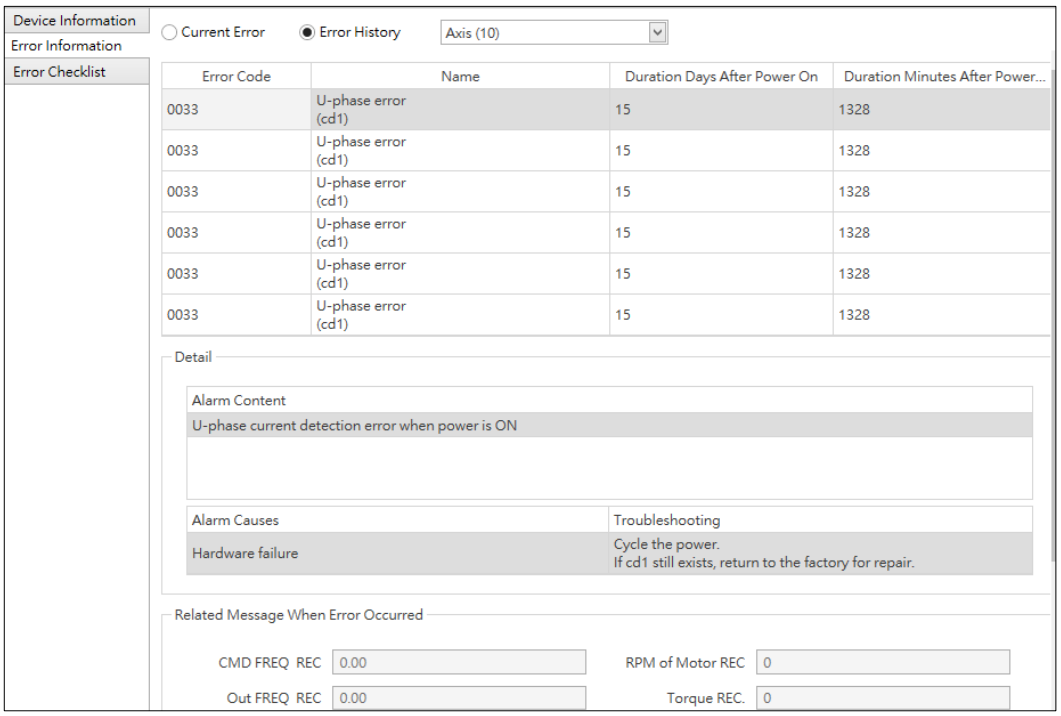
15-5-2 Error Information

The **Error Information** tab displays the **Current Error** and **Error History**.

Current Error: Display all error codes and error names of each axis

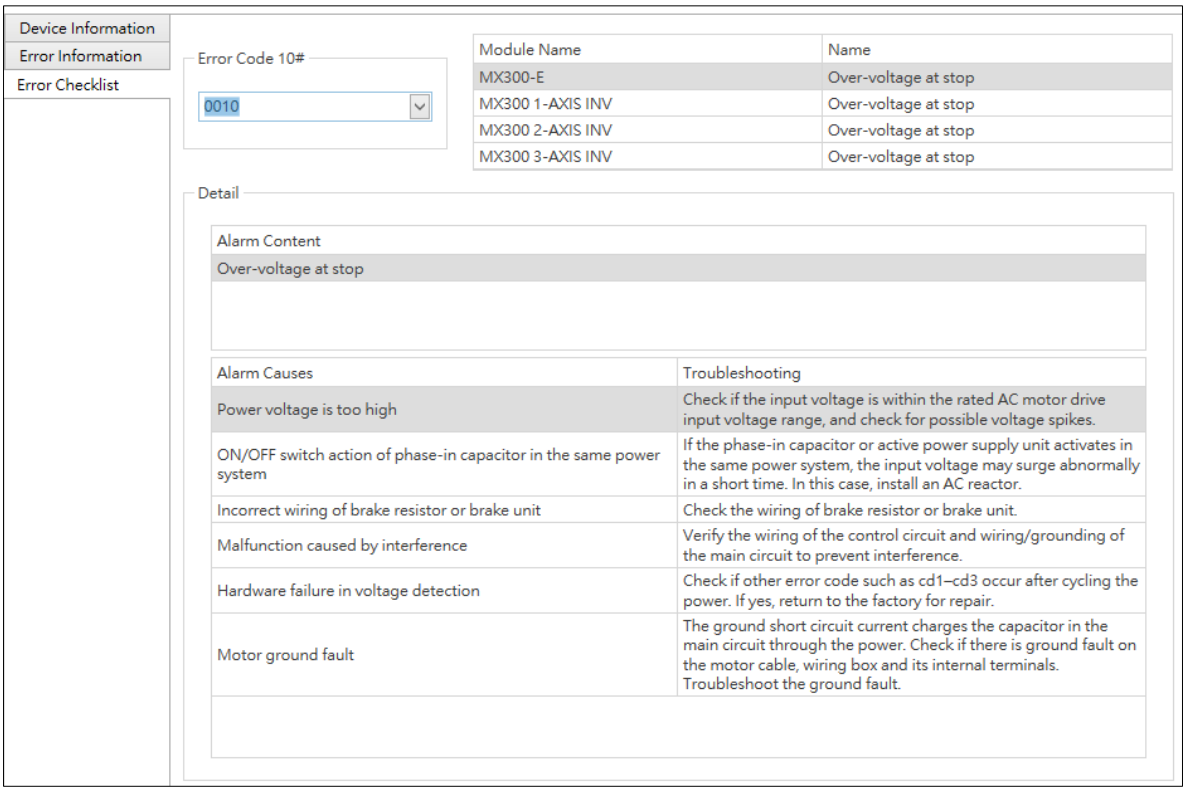


Error History: Select the axis from the drop-down menu to view the latest 6 error records. Click the error to check the information and related data when it occurred.



15-5-3 Error Checklist

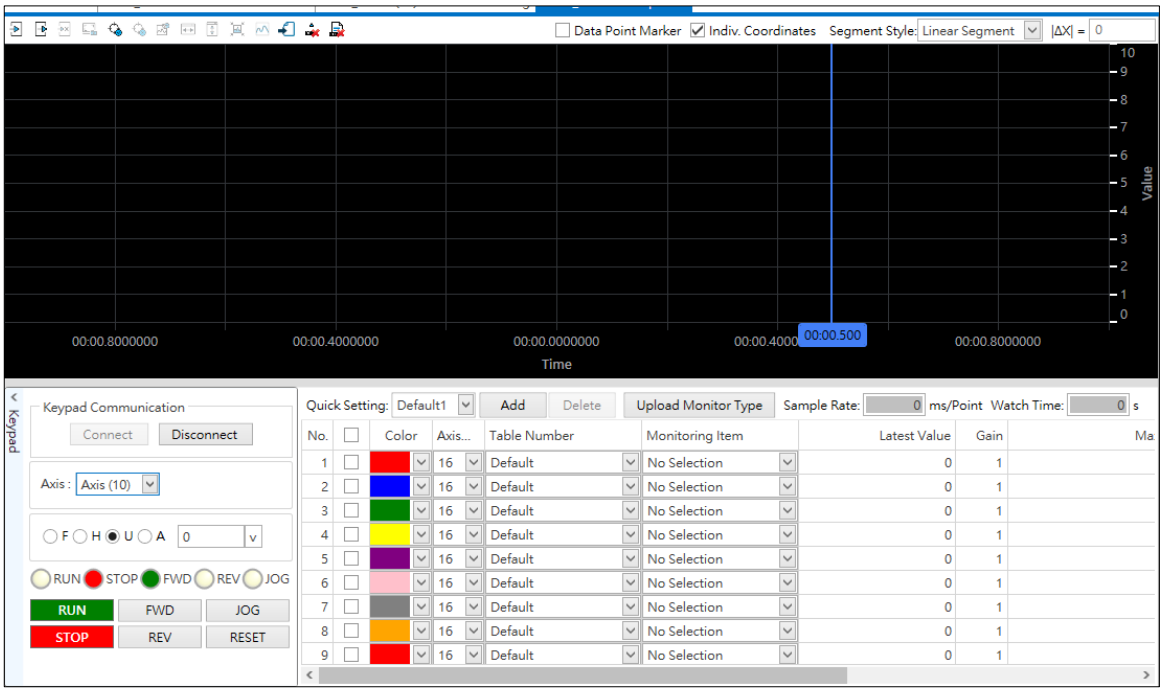
Check the description of the errors and error codes offline **Error Checklist** tab displays all the error codes, names, description, alarm causes, and troubleshooting.



15-6 Adaptation

15-6-1 Oscilloscope

- Purpose: Monitor the inverter device status in real-time through the oscilloscope. For MX300 series, high-speed sampling of less than 1 ms is supported.
- Path: Click **Inverter** → **VFD Function** → **Commissioning** → **Oscilloscope**.



15-6-1-1 Toolbar

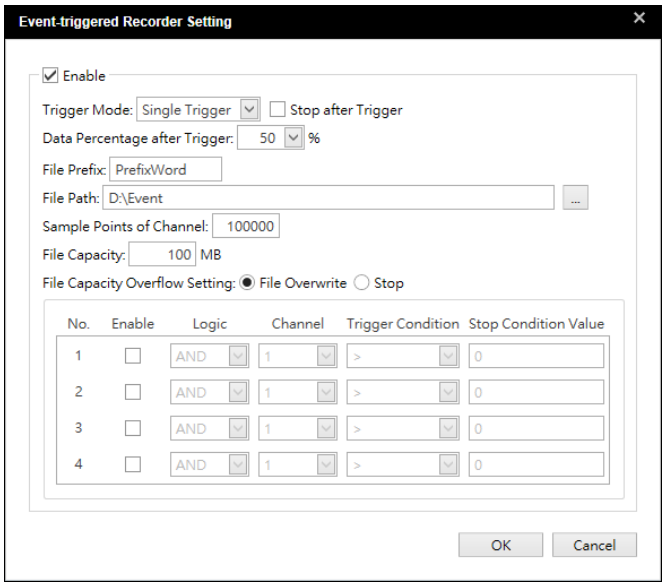
The following table describes the functions on the toolbar in the oscilloscope.



Icon	Description
	Click to open sampling setting and points.
	Click to save sampling setting and points in *.vfdscp file format.
	Click to export points in *.csv file format.
	Click to take a screenshot of the display area. (*.png, *.jpg & *.bmp).
	Click to start monitoring.
	Click to stop monitoring.
	Click to clear screen.
	Click to display two vertical lines to measure the distance between waveforms.
	Click to display two horizontal lines to measure the distance between waveforms.
	Click to zoom fit, same as double-click the trend display area.
	Click to open the **FFT Analysis** dialog.
	Click to open the **Event-triggered Recorder Setting** dialog.
	Click to open the **Recorder Setting** dialog.

Table 15-7

The following table describes the functions of the **Event-triggered Recorder Setting** dialog.



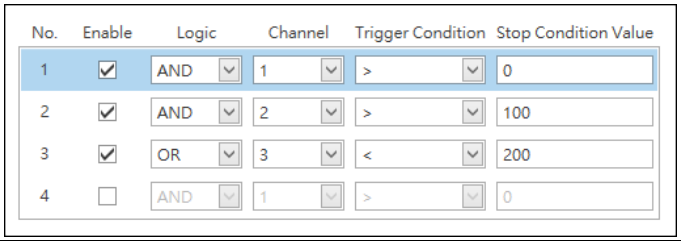
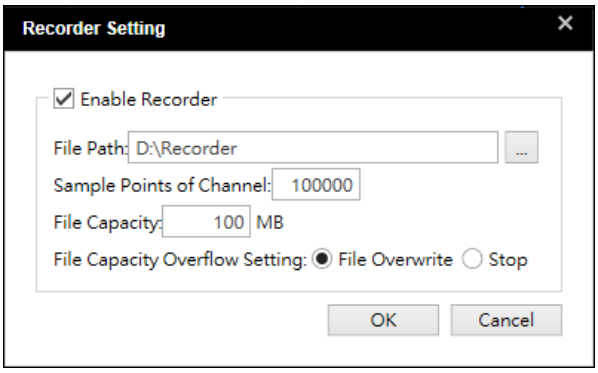
Function	Description
Enable	Click to enable the event-triggered recorder function.
Trigger Mode	Select the trigger mode. The default is **Single Trigger**. If **Single Trigger** is selected, the **Stop after Trigger** checkbox is available.
Data Percentage after Trigger	Set how much data before and after the condition will be recorded when meeting the trigger condition. For example, if select 20, the data of 20% after triggering and data of 80% before triggering will be recorded.
File Prefix	Set the default prefix to be added before the filename when saving the file.
File Path	Select the file path.
Sample Points of Channel	Set the sample points of single channel. The default value is 100000.
File Capacity	Set the file capacity the file path can save. The default value is 100.
File Capacity Overflow Setting	Set to overwrite the oldest file or stop recording when the file capacity exceeds the limit value.
Condition Setting	Set the trigger condition. For example: Tigger the recorder when channel 1 value > 0 and channel 2 value > 100, or channel 3 value < 200. 

Table 15-8

The following table describes the functions of the **Recorder Setting** dialog.

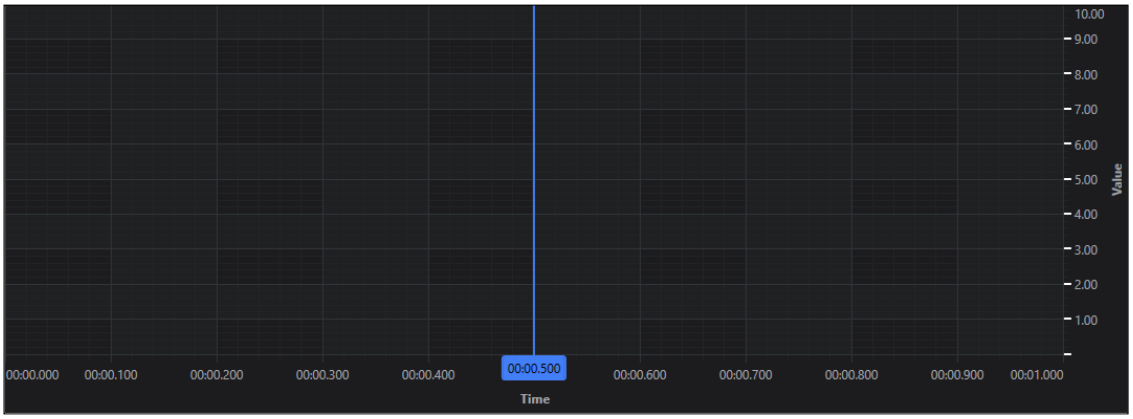


Function	Description
Enable Recorder	Check to enable the function.
File Path	Select file saving path.
Sample Points of Channel	Set sampling points of every channel.
File Capacity	Set total file capacity limit of file path.
File Capacity Overflow Setting	Select overwrite of stop when the file capacity is overflow.

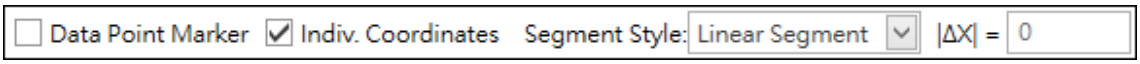
Table 15-9

15-6-1-2 Display Area

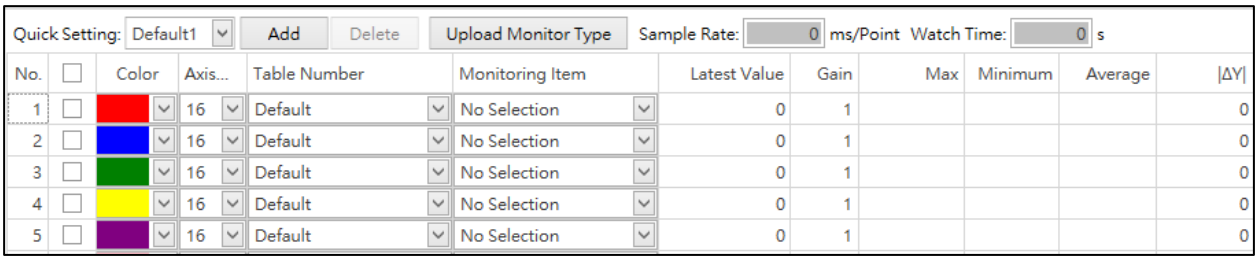
Display the selected monitoring channel in real-time. You can hold down the right button of the mouse and drag display area presentation position, and use the mouse wheel to zoom in and out of the presentation range.



- The X axis represents time. The unit is sec.
- The Y axis represents the data, which corresponds to the selected channels. By default, each channel shares a Y axis, which is suitable for monitoring items with the same unit. However, if the unit of monitoring items are different, it is recommended to select **Indiv. Coordinates** checkbox on display area settings bar. After clicking a variable below, use the left mouse button to drag Y-axis coordinate axis to arbitrarily scale or adjust the up and down position of the variable sampling waveform. In this way, the relative position of each waveform on the screen can be adjusted.



The following table describes the functions in the channel setting area.



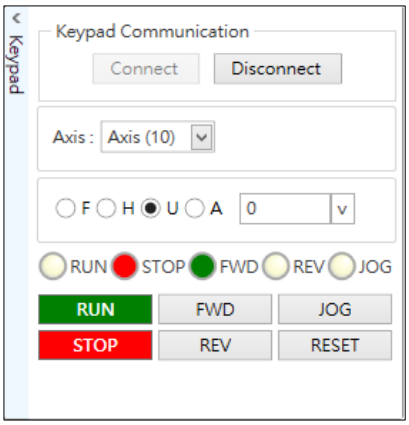
Function	Description
Enable	Select to display a channel.
Color	Select the channel color.
Axis Number	Select the axis number of the multi-drive inverter.
Table Number	Select the table number of the parameter group.
Monitoring Item	Select the built-in monitoring items.
Latest Value	Display the latest value of a channel.
Unit	Change the corresponding unit according to monitoring items.
Gain	Move the waveform position according to gain.
Max	Display the maximum value of the waveform.
|ΔY|	Display the spacing between Y axis and measuring lines. On the toolbar, click to enable this setting.

Table 15-10

15-6-1-3 Keypad

Control inverter, adjust speed, monitor status, and read / write parameters through keypad.

1. Set frequency command source and operation command source parameters to be controlled by communication. And set Pr.00-20 and 00-21 as 1 and 2 respectively.
2. Click Connect.
3. Select the axis number you want to control



The following table describes the functions in the Keypad setting area.

Function	Description
F	Display command frequency. Enter command frequency in the text field.
H	Display output frequency.
U	User-defined. Display DC bus voltage by default.

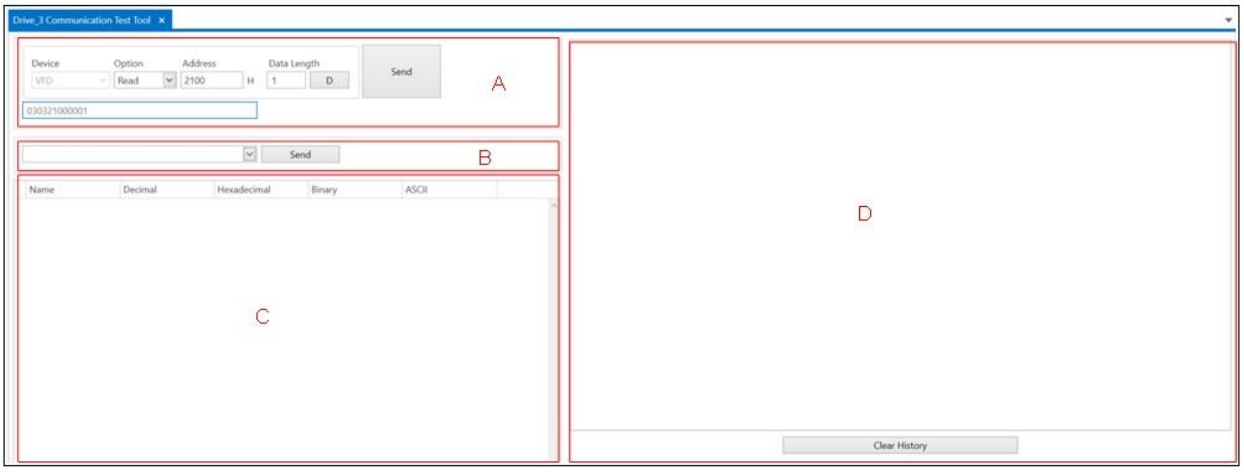
Function	Description
A	Display output current.
RUN / STOP	Click to run or stop the inverter.
FWD / REV	Click to forward or reverse the operation of inverter.
JOG	Click to perform the jog.
REST	Click to clear the error code.

Table 15-11

15-6-2 Communication Test Tools

- Purpose: A command transceiver is based on Modbus communication. During testing and commissioning, it can quickly read / write the related data of inverter (or the built-in PLC) through Modbus communication.
- Path: In **Project Explorer**, double-click **Inverter Device** → **VFD function** → **Commissioning** → **Communication Test Tool**.

The following figure shows **Communication Test Tool** tab.



The view of **Communication Test Tool** includes the following area.

A. Communication format setting (form)
B. Communication format setting (input box)
C. Data reading result
D. Delivering history

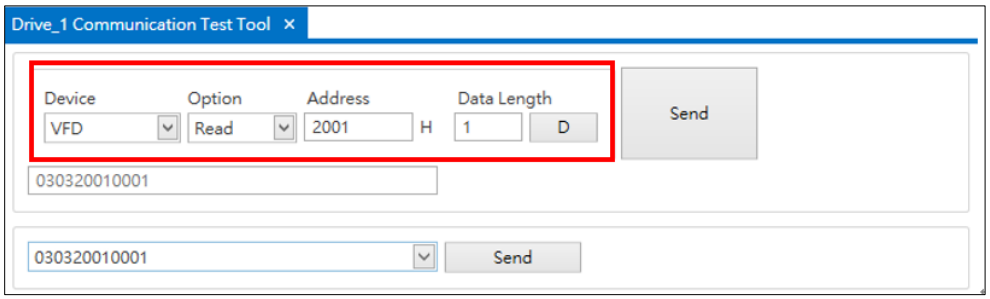
The following table describes the functions of the **Communication Test Tool** area.

Function	Description
Device	No built-in PLC in MX300, this field is fixed to the Inverter (VFD)
Axis	Select the axis number of the multi-drive, the drop-down list will only display the online axis
Option	Choose a command to the device ● Read ● Write
Address	Hex. address of read / write Modbus
Data Length	When selecting “read the address data”, assign the data length.
Data (Text box)	When selecting “write the address data”, assign the data content.

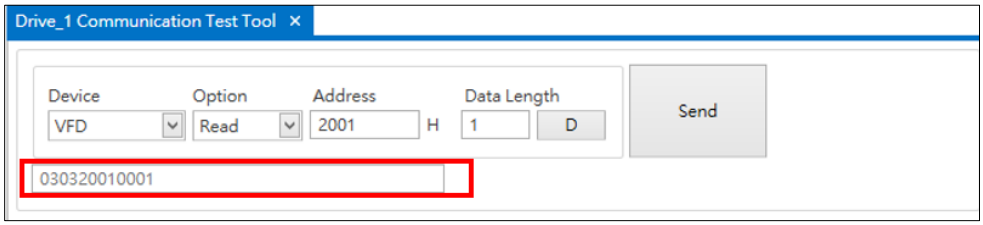
Table 15-12

Example 1: Read the VFD Modbus address

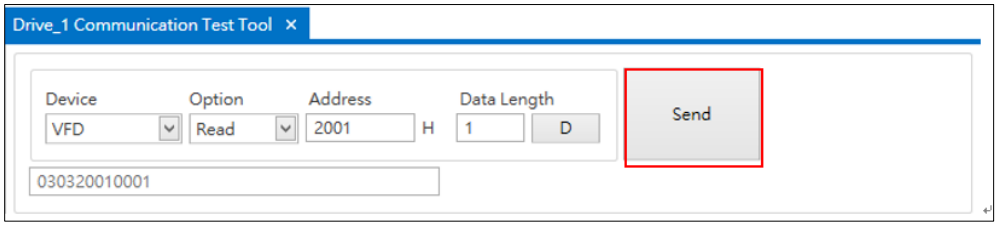
1. Device: VFD
   Option: Read
   Address: 2001
   Data Length: 1



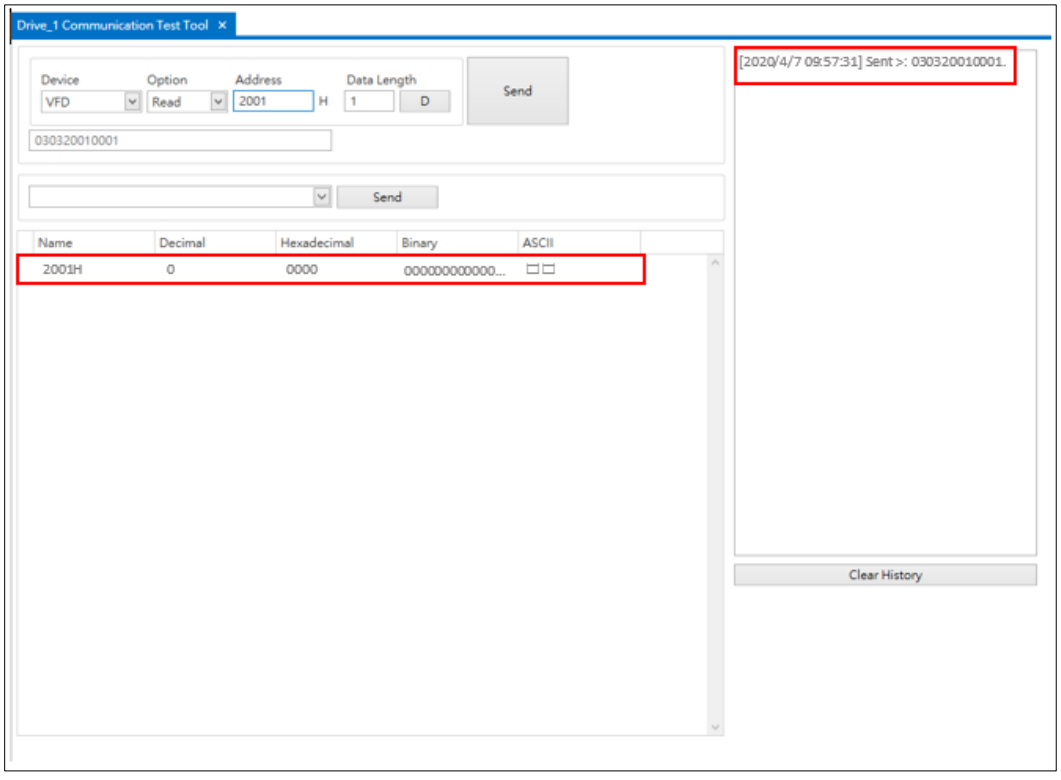
2. After filling in the columns, you can see the Modbus command value in the text box.



3. Confirm the value and click **Send.**



4. Data reading result **shows** the 2001H address content value (currently 0) in different ways. On the right, the delivering history block shows the delivery record.



Example 2: Write the VFD Modbus address

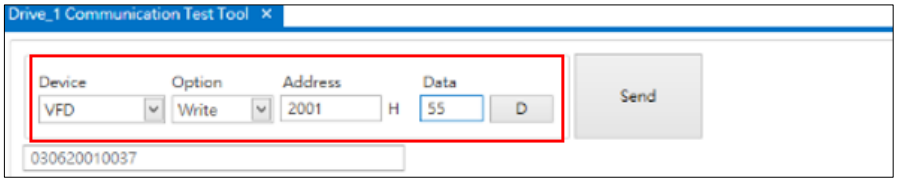
1. Device: VFD

   Axis: 10

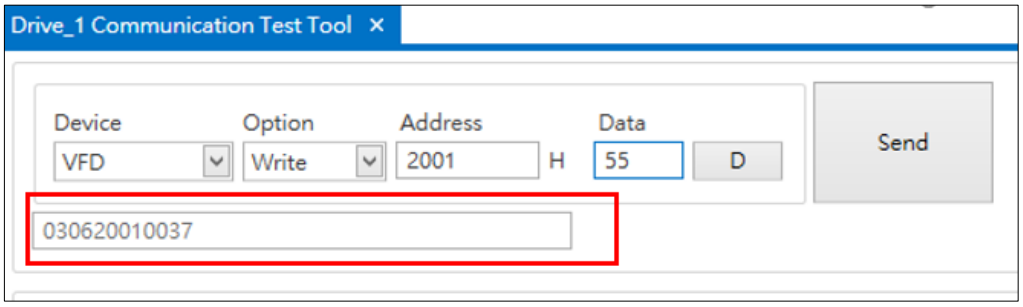
   Option: Write

   Address: 2001

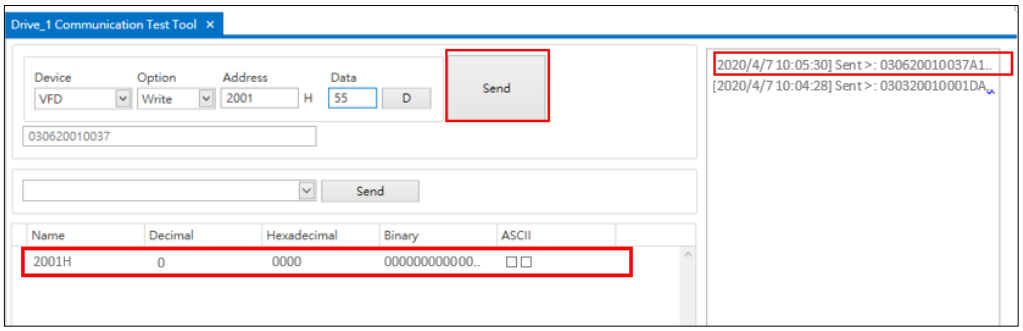
   Data Length: 55 (D: decimal) or 37 (H: hex)



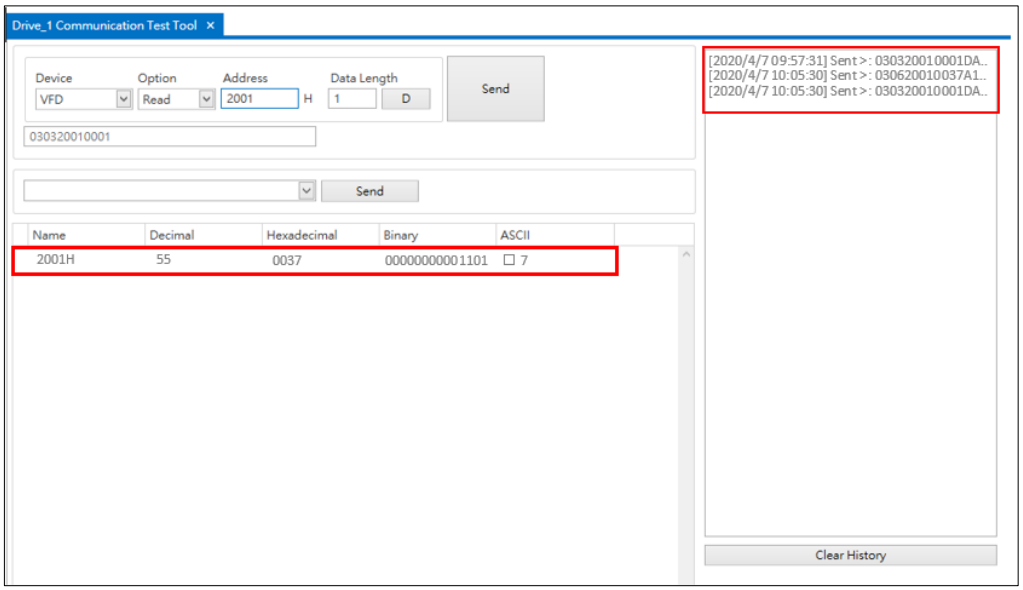
2. After filling in the columns, you can see the Modbus command value in the text box.



3. Confirm the value and click **Send**. A new delivering record will be added on the right.



4. Refer to example 1, if the current 2001H content value is 55, which represents successful write.



Appendix A. Revision History

New Information	
Description	Related Part
Added STO inverter module (MX3000-S) and related STO information. The standard inverter model is defined as MX3000-A. Simplified the presentation of model names, the variable digits in the model code have been replaced with lowercase “x”.	All
Added after-sales service link and information	Chapter 1
Updated wire gauge value	Chapter 3
Added the parameter copying process description; the description of the KPC-CC01 digital keypad has been moved to Chapter 10.	Chapter 4
Added a new chapter Safe Torque Off.	Chapter 6
Updated the CANopen error codes, EtherCAT wiring connection network and parameter setting instructions, EtherCAT object descriptions, PROFINET hardware and wiring indicator descriptions, and PROFINET fault codes.	Chapter 7
Modified the value of 17A normal duty output current. Add safety function specifications and update safety certifications.	Chapter 11
New parameters Rectifier module: ● Parameter group 06: 06-17–06-22 (item 223) ● Parameter group 09: 09-94 Inverter module: ● Parameter group 02: 02-13–02-17, 02-36–02-43 (item 27, 28), 02-46 ● Parameter group 06: 06-17–06-22 (item 19, 38, 72, 76, 77, 145, 224–243), 06-44 ● Parameter group 09: 09-44 ● Parameter group 14: 14-70–14-73 (item 19, 38, 72, 76, 77, 145, 224–243)	Chapter 12, 13
Updated parameter settings and instructions Rectifier module: ● Parameter group 00: 00-01, 00-21, 00-30 ● Parameter group 05: 05-01, 05-13 Inverter module: ● Parameter group 00: 00-17	
Deleted parameter settings and instructions Inverter module: ● Parameter group 06: 06-17–06-22 (item 62)	
Updated according to the DIA Designer user manual	Chapter 15

Smarter. Greener. Together.

Industrial Automation Headquarters

Delta Electronics, Inc.
Taoyuan Technology Center
No.18, Xinglong Rd., Taoyuan District,
Taoyuan City 330477, Taiwan
TEL: +886-3-362-6301 / FAX: +886-3-371-6301

Asia

Delta Electronics (Shanghai) Co., Ltd.
No.182 Minyu Rd., Pudong Shanghai, P.R.C.
Post code : 201209
TEL: +86-21-6872-3988 / FAX: +86-21-6872-3996
Customer Service: 400-820-9595

Delta Electronics (Japan), Inc.
Industrial Automation Sales Department
4-11-25, Shibaura, Minato-ku, Tokyo 108-0023, Japan
TEL: +81-3-6811-5470 / FAX: +81-3-6811-5802

Delta Electronics (Korea), Inc.
1511, 219, Gasan Digital 1-Ro., Geumcheon-gu,
Seoul, 08501 South Korea
TEL: +82-2-515-5305 / FAX: +82-2-515-5302

Delta Energy Systems (Singapore) Pte Ltd.
4 Kaki Bukit Avenue 1, #05-04, Singapore 417939
TEL: +65-6747-5155 / FAX: +65-6744-9228

Delta Electronics (India) Pvt. Ltd.
Plot No.43, Sector 35, HSIIDC Gurgaon,
PIN 122001, Haryana, India
TEL: +91-124-4874900 / FAX: +91-124-4874945

Delta Electronics (Thailand) PCL.
909 Soi 9, Moo 4, Bangpoo Industrial Estate (E.P.Z),
Pattana 1 Rd., T.Phraksa, A.Muang,
Samutprakarn 10280, Thailand
TEL: +66-2709-2800 / FAX: +66-2709-2827

Delta Electronics (Australia) Pty Ltd.
Unit 2, Building A, 18-24 Ricketts Road,
Mount Waverley, Victoria 3149 Australia
Mail: IA.au@deltaww.com
TEL: +61-1300-335-823 / +61-3-9543-3720

Americas

Delta Electronics (Americas) Ltd.
5101 Davis Drive, Research Triangle Park, NC 27709, U.S.A.
TEL: +1-919-767-3813

Delta Electronics Brazil Ltd.
Estrada Velha Rio-São Paulo, 5300 Eugênio de
Melo - São José dos Campos CEP: 12247-004 - SP - Brazil
TEL: +55-12-3932-2300 / FAX: +55-12-3932-237

Delta Electronics International Mexico S.A. de C.V.
Gustavo Baz No. 309 Edificio E PB 103
Colonia La Loma, CP 54060
Tlalnepantla, Estado de México
TEL: +52-55-3603-9200

EMEA

Delta Electronics (Netherlands) B.V.
Sales: Sales.IA.EMEA@deltaww.com
Marketing: Marketing.IA.EMEA@deltaww.com
Technical Support: iatechnicalsupport@deltaww.com
Customer Support: Customer-Support@deltaww.com
Service: Service.IA.emea@deltaww.com
TEL: +31(0)40 800 3900

Delta Electronics (Netherlands) B.V.
Automotive Campus 260, 5708 JZ Helmond, The Netherlands
Mail: Sales.IA.Benelux@deltaww.com
TEL: +31(0)40 800 3900

Delta Electronics (Netherlands) B.V.
Coesterweg 45,D-59494 Soest,Germany
Mail: Sales.IA.DACH@deltaww.com
TEL: +49 2921 987 238

Delta Electronics (France) S.A.
ZI du bois Challand 2,15 rue des Pyrénées,
Lisses, 91090 Evry Cedex, France
Mail: Sales.IA.FR@deltaww.com
TEL: +33(0)1 69 77 82 60

Delta Electronics Solutions (Spain) S.L.U
Ctra. De Villaverde a Vallecas, 265 1º Dcha Ed.
Hormigueras – P.I. de Vallecas 28031 Madrid
TEL: +34(0)91 223 74 20

Carrer Llacuna 166, 08018 Barcelona, Spain
Mail: Sales.IA.Iberia@deltaww.com

Delta Electronics (Italy) S.r.l.
Via Meda 2–22060 Novedrate(CO)
Piazza Grazioli 18 00186 Roma Italy
Mail: Sales.IA.Italy@deltaww.com
TEL: +39 039 8900365

Delta Greentech Elektronik San. Ltd. Sti. (Turkey)
Şerifali Mah. Hendem Cad. Kule Sok. No:16-A
34775 Ümraniye – İstanbul
Mail: Sales.IA.Turkey@deltaww.com
TEL: + 90 216 499 9910

Eltek Dubai (Eltek MEA DMCC)
OFFICE 2504, 25th Floor, Saba Tower 1,
Jumeirah Lakes Towers, Dubai, UAE
Mail: Sales.IA.MEA@deltaww.com
TEL: +971(0)4 2690148

*We reserve the right to change the information in this manual without prior notice.

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