VFD EtherNet/IP Application Manual

Applicable Products:
CMC-EIPxx (Option Cards for C2000 Family)
CMM-EIPxx (Option Cards for MS300/MH300)

http://www.deltaww.com/

⚠ Caution

CAUTION

✓ This application manual provides information on specifications, installation instructions, basic operations/configurations, and details on network communication protocols.

✓ The AC motor drive is a sophisticated electronic device. For the safety of the operator and your mechanical equipment, only qualified electrical engineers are allowed to perform the installation/trial runs and make parameter adjustments. If you have any question or concern, please contact your local Delta distributor. Our professional staff will be very glad to help you.

✓ Please read this manual carefully and follow the instructions completely to avoid device damage or personal injury.

Application	Drive Firmware Version: C2000 V2.04 / C2000 Plus V3.06 / CH2000 V2.04 / CP2000 V2.04 / CFP2000 V1.04 or later
	Drive Firmware Version: MS300 V1.04 / MH300 V1.00 or later
	CMC-EIP01 Option Card Firmware Version: V 2.04 or later
	CMC-EIP02 Option Card Firmware Version: V 1.00 or later
	CMM-EIP02 Option Card Firmware Version: V 2.04 or later
	CMM-EIP03 Option Card Firmware Version: V 1.00 or later
	DCISoft Communication Software Version: V1.23 or later

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1. Introduction to EtherNet/IP

EtherNet/IP is a communication protocol used in industrial automation, and can be applied for control, security, synchronization, motion control, configuration and information. This industrial Ethernet communication protocol is managed by the ODVA Association (Open DeviceNet Vendors Association). The name "IP" stands for "Industrial Protocol". EtherNet/IP is based on TCP/IP communication protocol so it can easily work with generally-used IT networks and provides high-speed and stable applications for Factory Automation (FA), Building Automation (BA), and Program Automation (PA). Delta's EtherNet/IP products cover a wide range of control and drive products, such as Programmable Logic Controllers (PLC), Variable Frequency Drive (VFD), Human-Machine Interface (HMI), thermostats (DTM), switches (Ethernet Switch), and so on. It can also be connected with other brand EtherNet/IP devices through EDS files. For correct communication, use Delta's products as your first choice for PLC.

Option cards that support EtherNet/IP for M300 and C2000 drive series are CMM-EIP02/03 and CMC-EIP01/02. You can also use DCISoft software to remotely set and monitor through the Internet, or remotely monitor by using CMM-EIP02 that works with drawing control software or HMIs. If you use devices that support auto MDI / MDI-X detection function, you do not need to use crossover cables.

2. Communication Specification

Item		Specification	
		CMM-EIP02 CMC-EIP01	CMM-EIP03 CMC-EIP02
Communication Protocol		ICMP, IP, DHCP, BOOTP, EtherNet/IP Adapter, Modbus TCP	
Transmission Speed		10/100 Mbps Auto-Detection	
Communication Mode		IEEE 802.3, IEEE 802.3u	
Cable		Category 5e shielding 100 M	
Communication Interface		RJ45 with Auto MDI/MDIX	
Ethernet Port Number		1	2
Modbus TCP	Type of Device	Server	
	Topology	Star, Linear bus	Star, Linear bus
	Support Function Code	Depending on the drive's Modbus specification	
	Maximum Number of Connections	16 (differentiated from EtherNet/IP)	
	Maximum Data Length for Single Connection	100 Words	
EtherNet/IP	Type of Device	Adapter	
	Maximum Number of Connections	8 (differentiated from Modbus TCP, all EIP types are calculated altogether)	
	Topology	Star, Linear bus (two ends)	Star, Linear Bus, Ring (DLR Ring Node)
EtherNet/IP Implicit Messaging (I/O Connection)	Requested packet interval (RPI)	5–1000 ms	
	Packets per second	400 pps	
EtherNet/IP Explicit Messaging	Type	Class 3 (Connected Type) UCMM (Unconnected Type)	
	Supported Object	See Appendix A <EtherNet/IP Service and Object> for details	

3. Hardware and Installation

3.1 CMM-EIP02

3.1.1 Product Profile
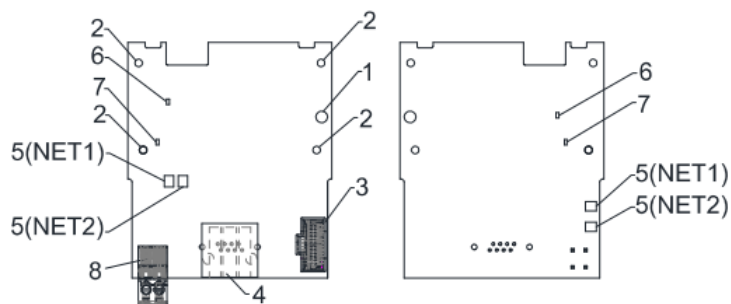
Screw torque: 6–8 kg-cm / (5.21–6.94 lb-in.) / (0.2 Nm)

1. Screw fixing hole
2. Option card positioning hole
3. Drive connection port
4. Communication connection port
5. Indicator NET1 (NS), NET2 (MS)
6. POWER indicator
7. LINK indicator
8. Ground terminal block

3.1.2 Electrical Specifications and Environment

Power Supply Voltage		15 V_{DC}
Insulation Voltage		500 V_{AC}
Power Consumption		0.8 W
Weight		25 g
Noise Immunity		ESD (IEC 61800-5-1, IEC 6100-4-2)
		EFT (IEC 61800-5-1, IEC 6100-4-4)
		Surge Test (IEC 61800-5-1, IEC 6100-4-5)
		Conducted Susceptibility Test (IEC 61800-5-1, IEC 6100-4-6)
Operation and Storage	Operation	-10–50°C (Temperature) 90% (Humidity)
	Storage	-25–70°C (Temperature) 95% (Humidity)
Vibration/Shock Resistance		IEC 61800-5-1, IEC 60068-2-6 / IEC 61800-5-1, IEC 60068-2-27

3.2 CMM-EIP03

3.2.1 Product Profile

Screw torque: 6–8 kg-cm / (5.21–6.94 lb-in.) / (0.2 Nm)

1. Screw fixing hole
2. Option card positioning hole
3. Drive connection port
4. Communication connection port
   P1 (PORT 1), P2 (PORT 2)
5. Indicator NET1 (NS), NET2 (MS)
6. POWER indicator
7. LINK indicator P1 (PORT 1), P2 (PORT 2)
8. Ground terminal block

3.2.2 Electrical Specifications and Environment

Power Supply Voltage		15 V_{DC}
Insulation Voltage		500 V_{AC}
Power Consumption		1.3 W
Weight		30 g
Noise Immunity		ESD (IEC 61800-5-1, IEC 6100-4-2)
		EFT (IEC 61800-5-1, IEC 6100-4-4)
		Surge Test (IEC 61800-5-1, IEC 6100-4-5)
		Conducted Susceptibility Test (IEC 61800-5-1, IEC 6100-4-6)
Operation and Storage	Operation	-10–50°C(Temperature) 90% (Humidity)
	Storage	-25–70°C (Temperature) 95% (Humidity)
Vibration/Shock Resistance		IEC 61800-5-1, IEC 60068-2-6 / IEC 61800-5-1, IEC 60068-2-27

3.3 CMC-EIP01

3.3.1 Product Profile
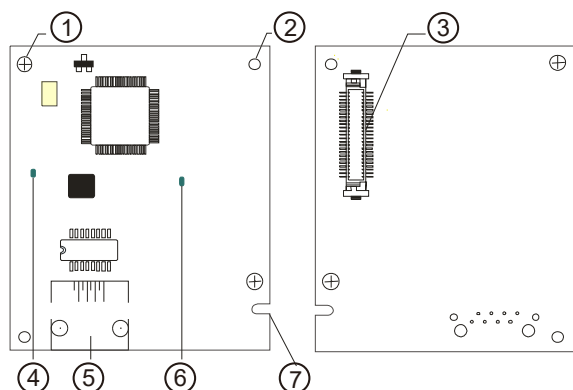
1. Screw fixing hole
2. Option card positioning hole
3. Drive connection port
4. LINK indicator
5. Ethernet communication port (RJ45)
6. POWER indicator
7. Fool-proof groove on option card

Screw torque: 6–8 kg-cm / (5.21–6.94 lb-in.) / (0.2 Nm)

3.3.2 Electrical Specifications and Environment

Power Supply Voltage		5 V_{DC}
Insulation Voltage		500 V_{AC}
Power Consumption		0.8 W
Weight		25 g
Noise Immunity		ESD (IEC 61800-5-1, IEC 6100-4-2)
		EFT (IEC 61800-5-1, IEC 6100-4-4)
		Surge Test (IEC 61800-5-1, IEC 6100-4-5)
		Conducted Susceptibility Test (IEC 61800-5-1, IEC 6100-4-6)
Operation and Storage	Operation	-10–50°C (Temperature) 90% (Humidity)
	Storage	-25–70°C (Temperature) 95% (Humidity)
Vibration/Shock Resistance		IEC 61800-5-1, IEC 60068-2-6 / IEC 61800-5-1, IEC 60068-2-27

3.4 CMC-EIP02

3.4.1 Product Profile
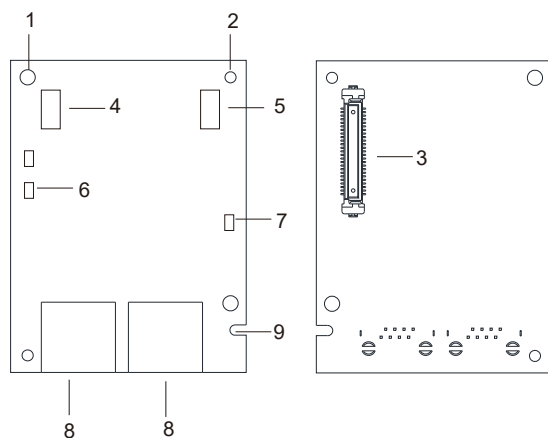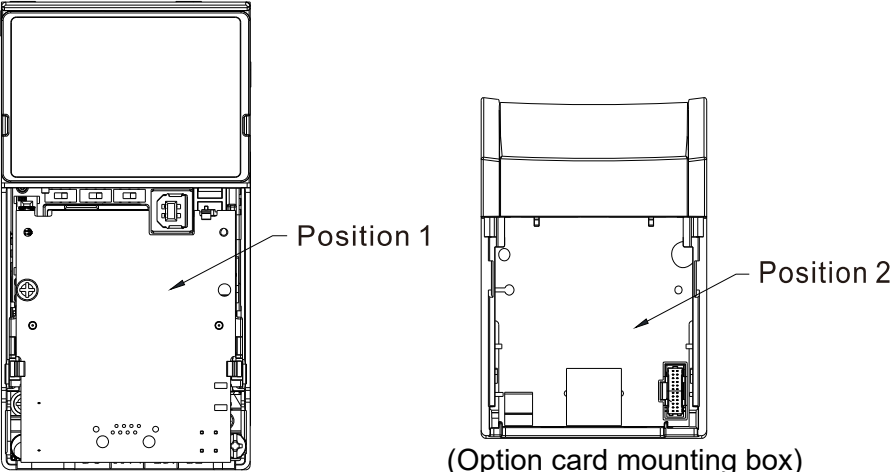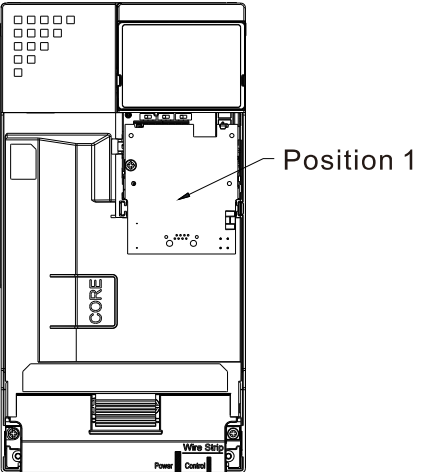
1. Screw fixing hole
2. Option card positioning hole
3. Drive connection port
4. NS indicator
5. MS indicator
6. LINK indicator
7. POWER indicator
8. Ethernet communication port (RJ45)
9. Fool-proof groove on option card

Screw torque: 6–8 kg-cm / (5.21–6.94 lb-in.) / (0.2 Nm)

3.4.2 Electrical Specifications and Environment

Power Supply Voltage		5 V$_{DC}$
Insulation Voltage		500 V$_{AC}$
Power Consumption		1.4 W
Weight		30 g
Noise Immunity		ESD (IEC 61800-5-1, IEC 6100-4-2)
		EFT (IEC 61800-5-1, IEC 6100-4-4)
		Surge Test (IEC 61800-5-1, IEC 6100-4-5)
		Conducted Susceptibility Test (IEC 61800-5-1, IEC 6100-4-6)
Operation and Storage	Operation	-10–50°C (Temperature) 90% (Humidity)
	Storage	-25–70°C (Temperature) 95% (Humidity)
Vibration/Shock Resistance		IEC 61800-5-1, IEC 60068-2-6 / IEC 61800-5-1, IEC 60068-2-27

3.5 Mounting Position of Option Card CMM-EIP

Mounting Position 1 and 2 (Option Card Mounting Box) for Frame A–D	Mounting Position 1 for Frame E and F
Position 1 Position 2 (Option card mounting box)	Position 1
Figure 3-1	Figure 3-2

NOTE: Frame E and F do not support mounting a second option card so there is no position 2 for them.

3.5.1 Option Card Mounting Position 1

Installation method: **Back-mount** the option card

1. Turn off the power of the motor drive, and then remove the front cover, as shown in Figure 3-3.

2. Assemble the connection cable: Connect the connector at one end of the connection cable to the control board connector. See Section 3.6.1 <Connection Cable of Option Cards> for details.

3. Assemble the supported frame of the option card: Aim the two clips at the two slots on the motor drive, and then press downward to have the two clips engage the slots, as shown in Figure 3-4.

4. Assemble the connection cable: Connect the connector at the other end of the connection cable to the connector of the option card.

5. Assemble the option card: Have the terminal block and connector of the option card face downward, aim the two holes of the option card to the positioning pin and press downward so that the three clips engage the option card, as shown in Figure 3-5.

6. Make sure that three clips properly engage the option card and then tighten the screws (suggested torque value: 4–6 kg-cm (3.5–5.2 lb-in.) (0.39–0.59 Nm)), as shown in Figure 3-6.

7. Assembly is completed, as shown in Figure 3-7.

Step1: Remove the front cover	Step 2: Assemble the supported frame
Figure 3-3	Figure 3-4

Step 3: Assemble the option card	Step 4: Tighten the screws	Step 5: Assembly completed
Figure 3-5	Figure 3-6	Figure 3-7
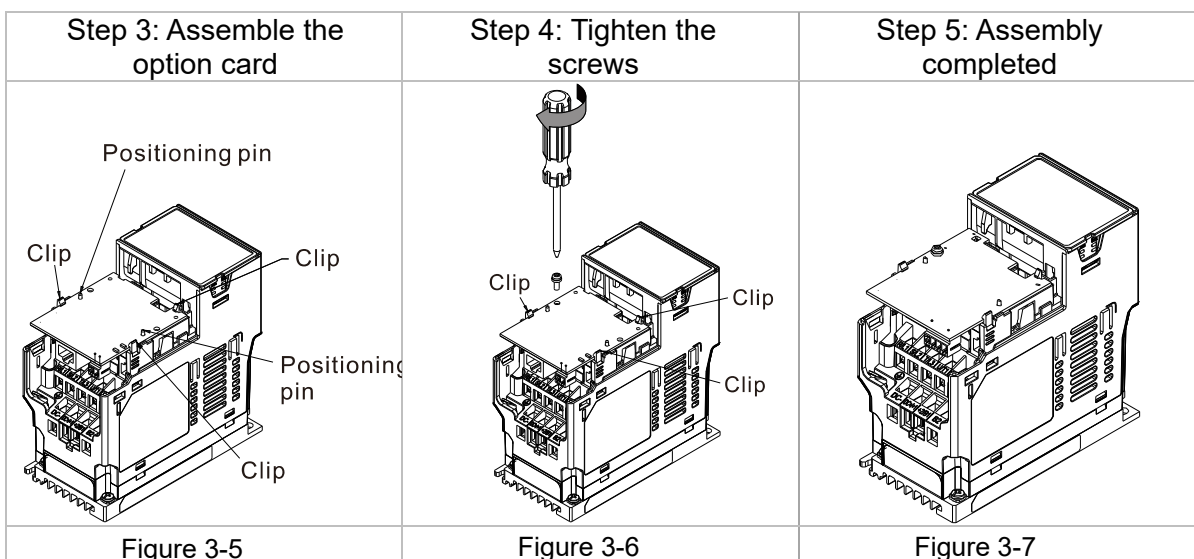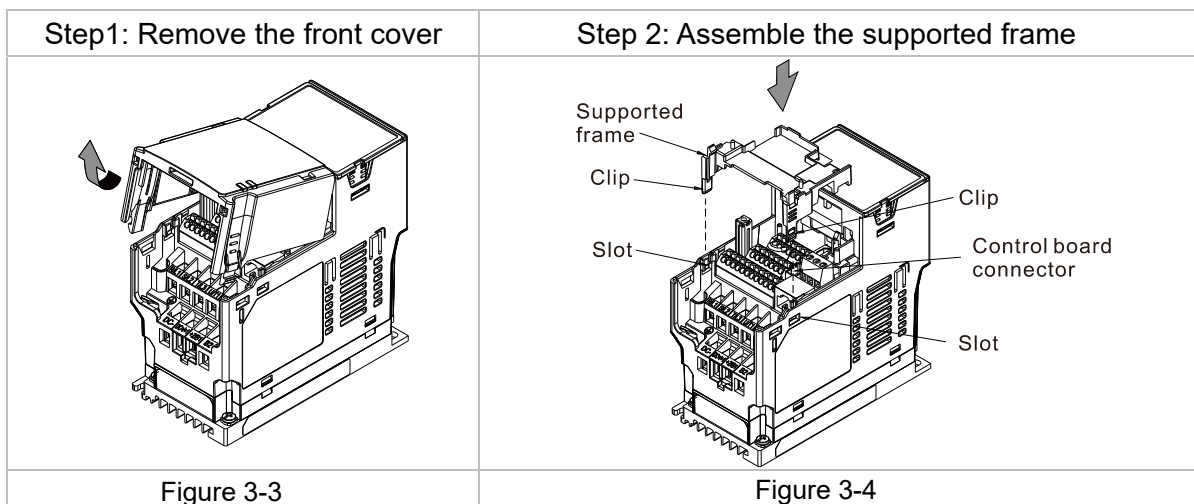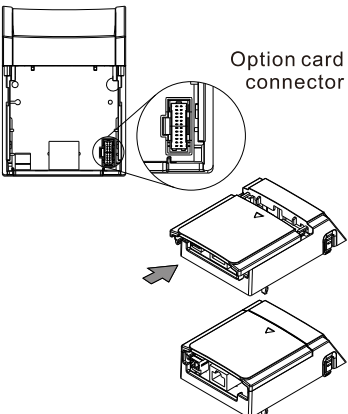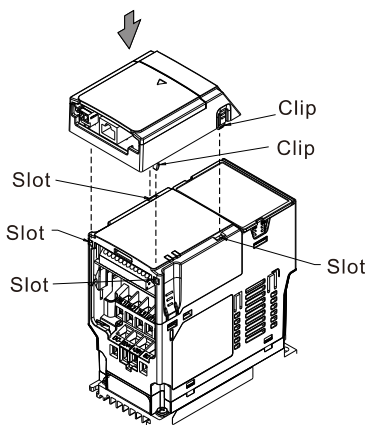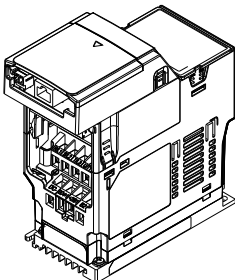
3.5.2 Option Card Mounting Position 2 (Frame A–D)

Installation method: **Front-mount** the option card

1. Turn off the power of the motor drive, and then remove the front cover, as shown in Figure 3-8.
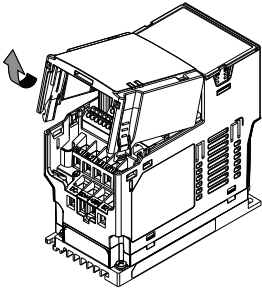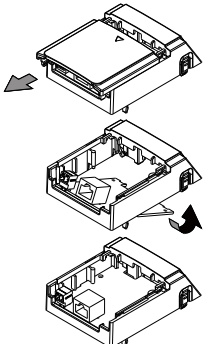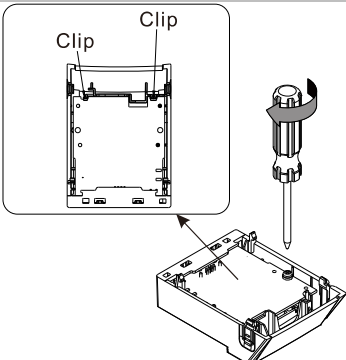2. Assemble the option card: Detach the upper cover of the mounting box for the option card by slipping and make the terminal block and connector of the option card face upward. Fix the front end of the option card to the slots, and then rotate it, as shown in the Figure 3-9.
3. Make sure that two clips properly engage the option card on the backside, and then tighten the screws (suggested torque value: 4–6 kg-cm (3.5–5.2 lb-in.) (0.39–0.59 Nm)), as shown in Figure 3-10.
4. Assemble the connection cable: Connect the connector at one end of the connection cable to the control board connector. See Section 3.6.1 <Connection Cable of Option Cards> for details.
5. Attach the front cover of the drive.
6. Assemble the connection cable: Connect the connector at the other end of the connection cable to the connector of the option card.
7. Attach the upper cover to the mounting box for the option card, as shown in Figure 3-11.
8. Assemble the mounting box for the option card: Aim the four clips of the mounting box for the option card at the slots on the upper cover of the motor drive, and then press downward to have the four clips engage the slots, as shown in the Figure 3-12.
9. Assembly is completed, as shown in Figure 3-13.

Step1: Remove the front cover	Step 2: Assemble the option card	Step 3: Tighten the screws
Figure 3-8	Figure 3-9	Figure 3-10

Step 4: Attach the upper cover to the mounting box	Step 5: Assemble the mounting box for option card	Step 5: Assembly completed
Figure 3-11	Figure 3-12	Figure 3-13

3.5.3 Grounding

● You must ground the following option cards when wiring them. The ground terminal is included in the option card package, as shown in Figure 3-14

- CMM-PD02
- CMM-DN02
- CMM-EIP02
- CMM-COP02
- CMM-EC02
- EMM-BPS02

Terminal A

Terminal B

Figure 3-14
Grounding Wire
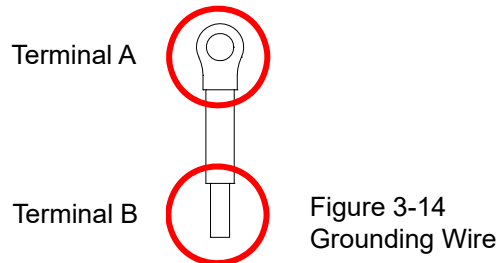
● Installation of the ground terminal:

Connect terminal B of the grounding wire to the grounding terminal block of the option card, as No.8 in Figure 3-15 shows for option card CMM-EIP02. For the connection position of other option cards, see their product profile in Chapter 3 <Hardware and Installation>. Connect Terminal A to the PE of the drive, as the red circles in Figure 3-16 and Figure 3-17 show.

Figure 3-15

Frame A–C

Frame D–F
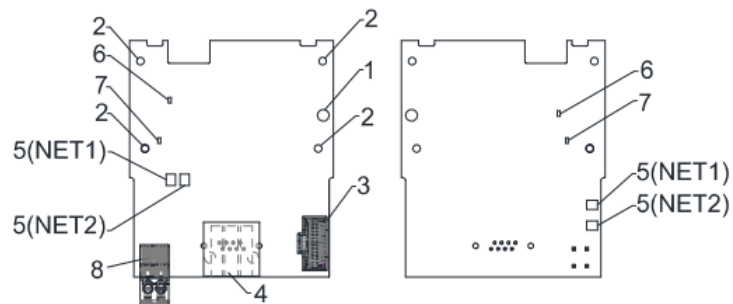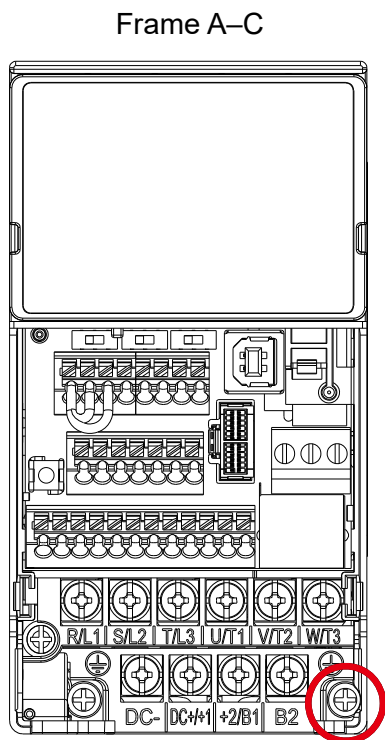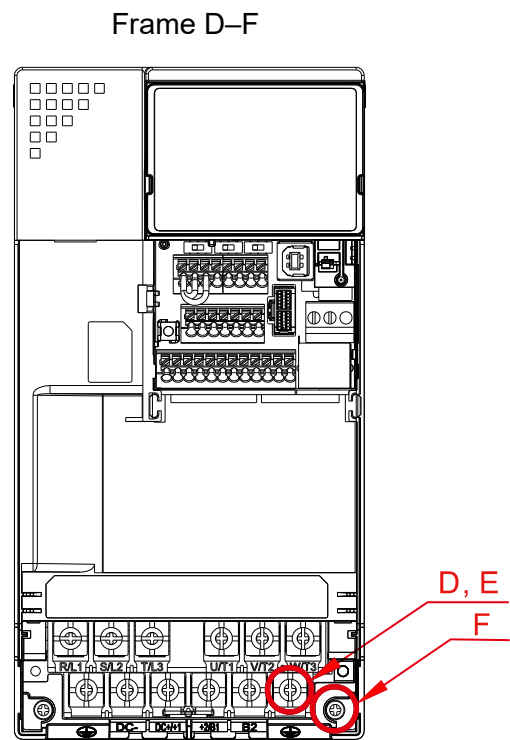
Figure 3-16

Figure 3-17

Frame	Screw Sepc.	Torque (±10%)	Frame	Screw Sepc.	Torque (±10%)
A	M3.5	9 kg-cm (7.8 lb-in.) (0.88 Nm)	D	M4	20 kg-cm (17.4 lb-in.) (1.96 Nm)
B	M4	15 kg-cm (13.0 lb-in.) (1.47 Nm)	E	M5	25 kg-cm (21.7 lb-in.) (2.45 Nm)
C	M4	20 kg-cm (17.4 lb-in.) (1.96 Nm)	F	M4	20 kg-cm (17.4 lb-in.) (1.96 Nm)

3.6   Connections of Option Card CMM-EIP

Control Board Connector
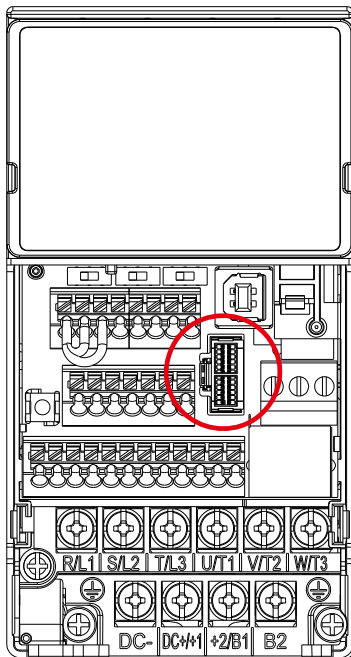
Figure 3-18

Option Card Connector
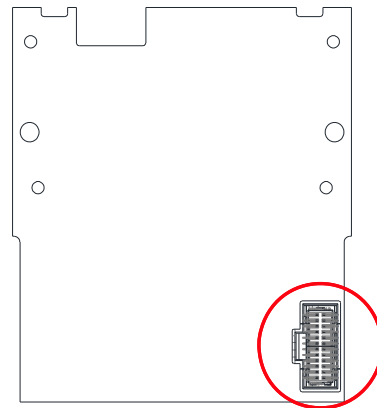
Figure 3-19

NOTE: Do NOT use the connection cable of BPS card for option card. Pay attention to the markings on the connection cable before using.

3.6.1 Connection Cable of Option Cards

You must buy connection cables along with the option card, or you will not be able to use the option card. Ensure your option card model and mounting position before purchasing connection cables. Two different lengths of connection cables are available for your choice. See the table below.

Option Card	CMM-EIP02 CMM-EIP03	
Frame	Mounting Position 1	Mounting Position 2
	Model of Connection Cable	Model of Connection Cable
A	CBM-CL01A	CBM-CC01A
B	CBM-CL01A	CBM-CC02A
C	CBM-CL02A	CBM-CC02A
D	CBM-CL02A	CBM-CC02A
E	CBM-CL02A	N/A
F	CBM-CL02A	N/A

Model	Figures
CBM-CL01A	
CBM-CC01A (mounting box included)	
CBM-CL02A	
CBM-CC02A (mounting box included)	

3.7 Mounting Position of Option Card CMC-EIP

Remove the digital keypad and upper cover before mounting option cards. Be sure to follow the steps below to prevent damage to the drive during installation.

Frame A–C
Screw torque: 8–10 kg-cm / (6.9–8.7 lb-in.) / (0.8–1.0 Nm)

Frame D0
Screw torque: 8–10 kg-cm / (6.9–8.7 lb-in.) / (0.8–1.0 Nm)

Frame D
Screw torque: 8–10 kg-cm / (6.9–8.7 lb-in.) / (0.8–1.0 Nm)
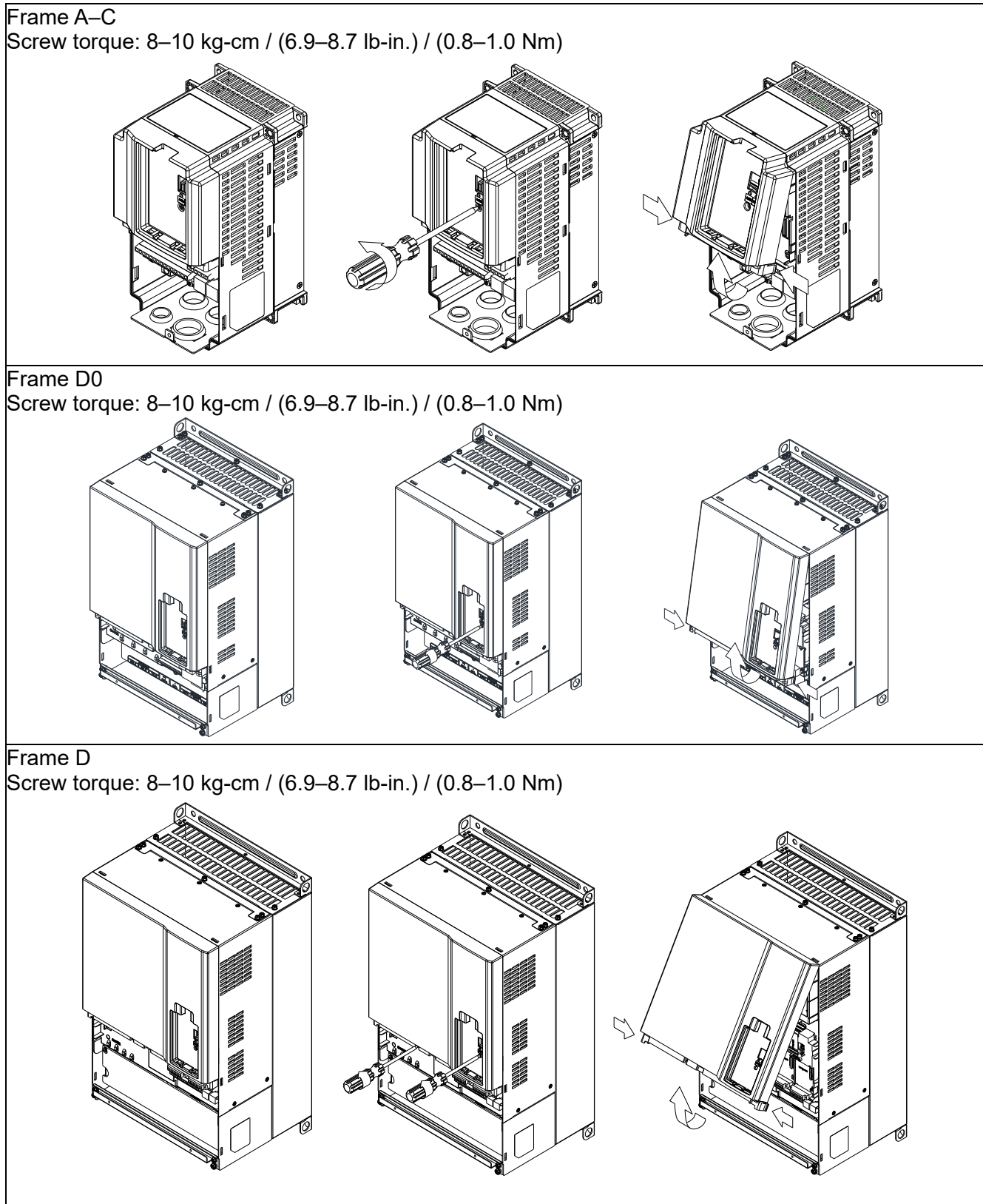
Frame E
Screw torque: 12–15 kg-cm / (10.4–13 lb-in.) / (1.2–1.5 Nm)
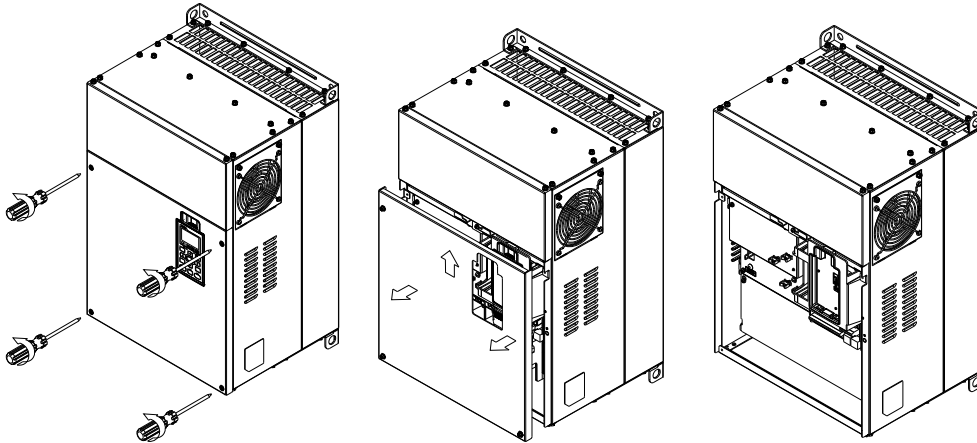
Frame F
Screw torque: 12–15 kg-cm / (10.4–13 lb-in.) / (1.2–1.5 Nm)
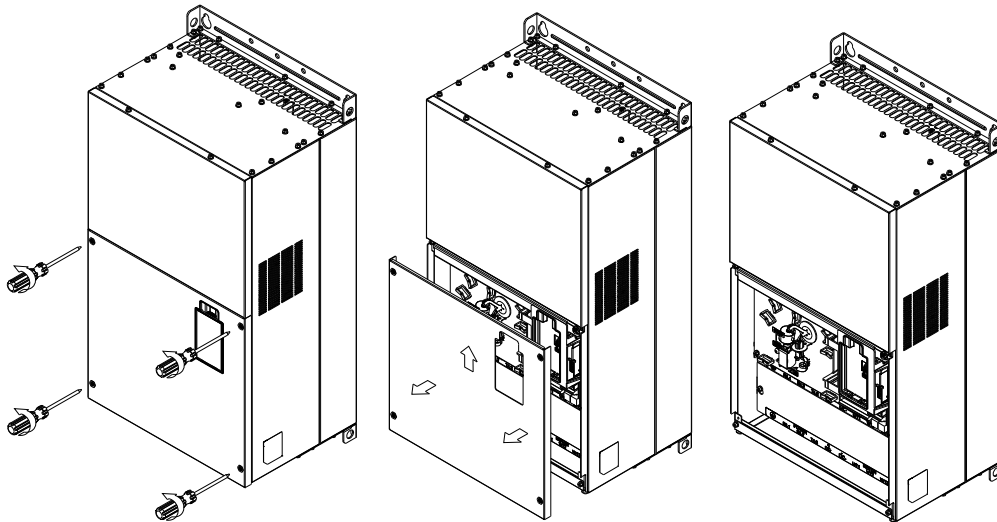
Frame G
Screw torque: 12–15 kg-cm / (10.4–13 lb-in.) / (1.2–1.5 Nm)
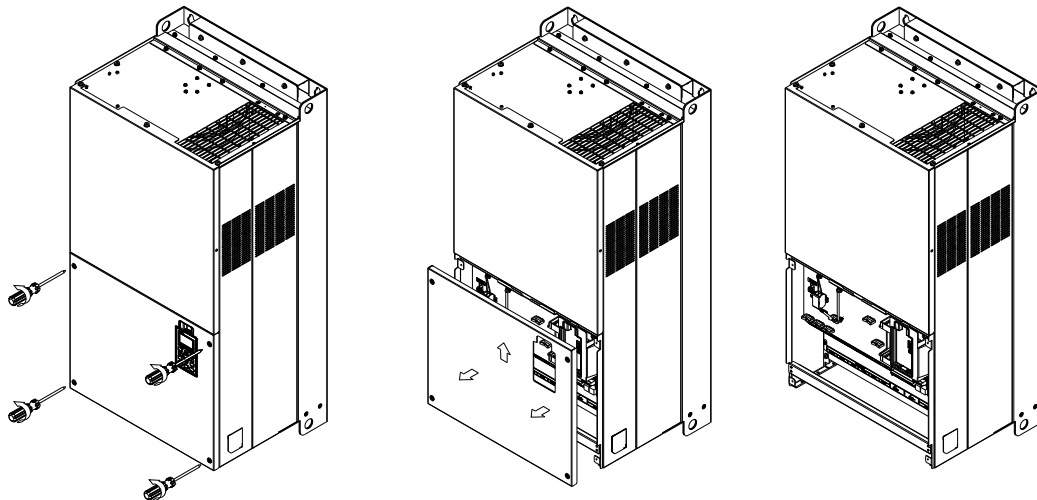
Frame H
Screw torque: 14–16 kg-cm / (12.15–13.89 lb-in.) / (1.4–1.6 Nm)

	1	RJ45 (Socket) for digital keypad KPC-CC01 ☑ See Chapter 10 <Digital Keypad> in M300 and C2000 user manuals for details on using the digital keypad. ☑ You can buy the optional accessory RJ45 extension lead as required. See Chapter 10 <Digital Keypad> in M300 and C2000 user manuals for details.
	2	Communication extension card (Slot 1) CMC-PD01; CMC-DN01; CMC-EIP01; EMC-COP01; CMC-EC01; CMC-PN01
	3	I/O & Relay extension card (Slot 3) EMC-D42A; EMC-D611A; EMC-A22A; EMC-R6AA; EMC-BPS01
	4	PG card (Slot 2) EMC-PG01L; EMC-PG02L; EMC-PG01O; EMC-PG02O; EMC-PG01U; EMC-PG02U; EMC-PG01R; EMC-PG01H

Specifications for Option Card Terminals

EMC-D42A; EMC-D611A; EMC-BPS01	Wire Gauge	0.2–0.5 mm^2 (26–20 AWG)
	Torque	5 kg-cm / (4.4 lb-in.) / (0.5 Nm)
EMC-R6AA	Wire Gauge	0.2–0.5 mm^2 (26–20 AWG)
	Torque	8 kg-cm / (7 lb-in.) / (0.8 Nm)
EMC-A22A	Wire Gauge	0.2–4 mm^2 (24–12 AWG)
	Torque	5 kg-cm / (4.4 lb-in.) / (0.5 Nm)
EMC-PG01L; EMC-PG02L; EMC-PG01O; EMC-PG02O; EMC-PG01U; EMC-PG02U; EMC-PG01R; EMC-PG01H	Wire Gauge	0.2–0.5 mm^2 (26–20 AWG)

3.8 Mounting and Detaching Option Card CMC-EIP

3.8.1 Mounting Option Card

As the figure on the left shows, place the insulation spacer into the positioning pin first. Next, aim the two holes on PCB at the positioning pins, and then press downward to have the two clips engage the PCB.

Model name:
EMC-COP01
CMC-EIP01
CMC-DN01
CMC-PD01
CMC-EC01
CMC-PN01

Clip

Positioning pin

Clip

Positioning pin

Insulation spacer
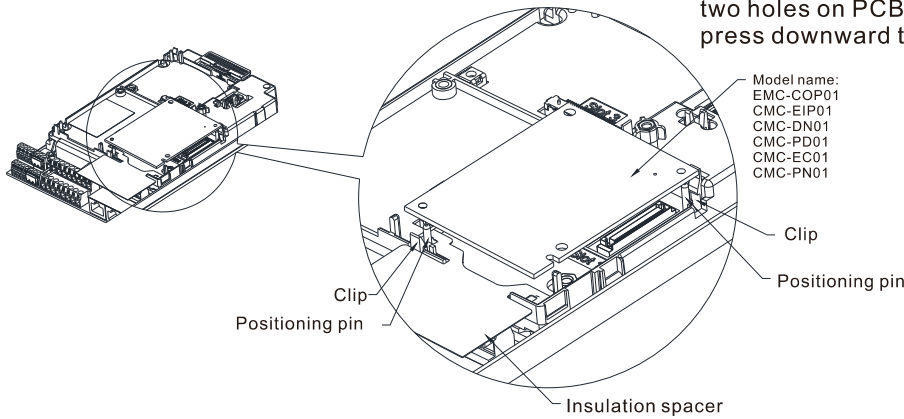
After the clips have engaged the PCB, tighten the screws, as the figure on the left shows.

Clip

Screw torque:
6−8 kg-cm / (5.21−6.94 lb-in.)

Clip

Screw torque:
6−8 kg-cm / (5.21−6.94 lb-in.)

Slot 3

Slot 2

Option connector
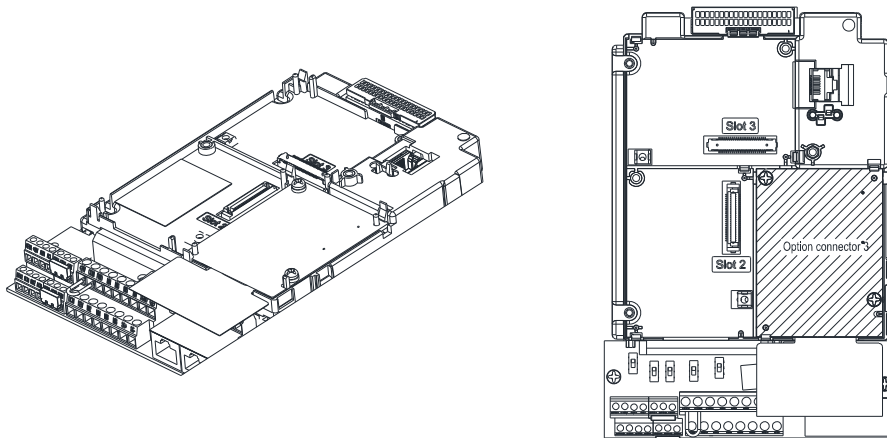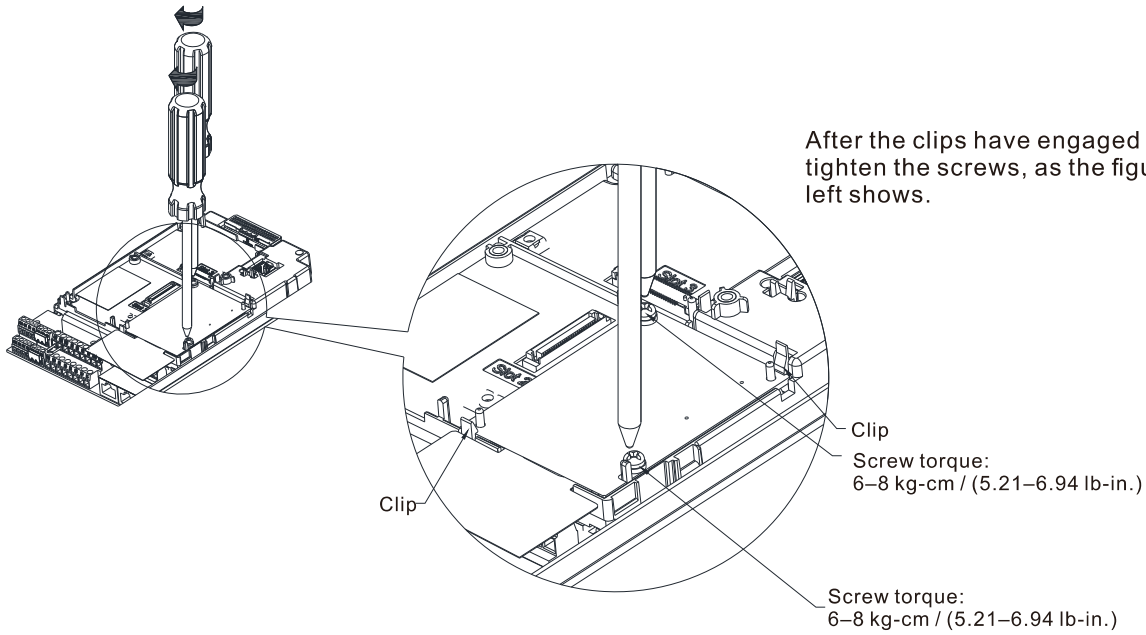
Assembly is completed, as the figure on the left shows.

3.8.2 Detaching Option Card
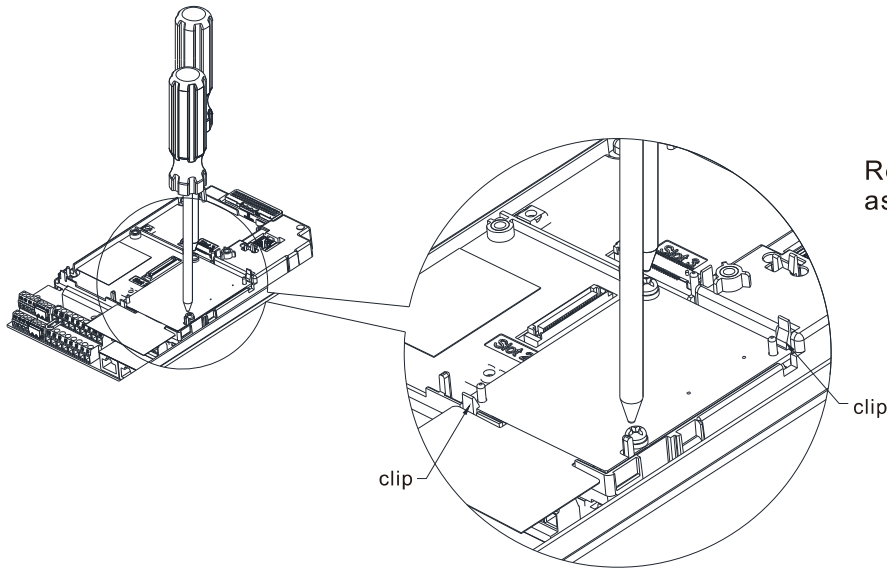
Remove the second screw,
as the figure on the left shows.
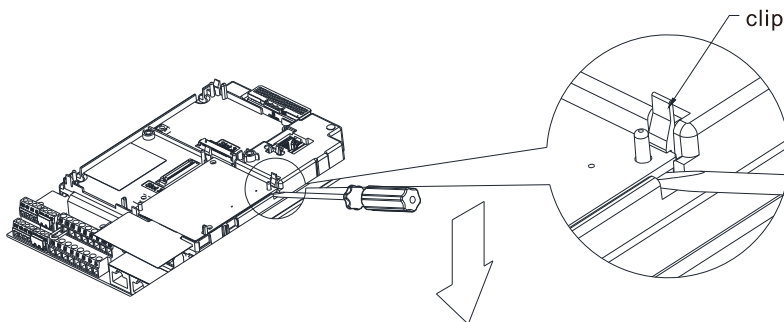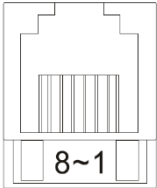
clip

clip

Pull open the clip. Then, use a slotted
screwdriver to prize the PCB off the clip,
as the figure on the left shows.
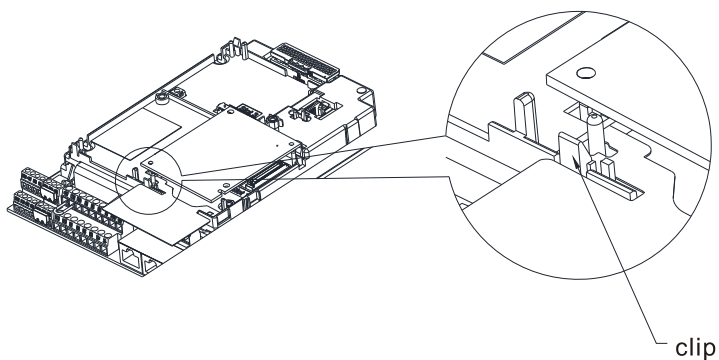
clip

Pull open the other clip to detach the PCB,
as the figure on the left shows.

clip

3.9   Network Installation

Connect CMM-EIP02 to Ethernet hub with CAT-5e twisted-pair cable. CMM-EIP02 supports auto MDI / MDIX function, so you do not need to use crossover cable when using CAT-5e twisted-pair cable.

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

Depending on the number of communication ports for EtherNet/IP, there are two types of network communication port devices: single-port and dual-port.

Drive Series	Option Card	Number of Ports
M300	CMM-EIP02	1
	CMM-EIP03	2
C2000	CMC-EIP01	1
	CMC-EIP02	2

3.9.1 Single-port Communication Device

Single-port communication device can build up a star and linear bus typology, in which both can only be built at two ends and star typology must be created through Ethernet switch. To connect with ring typology, use an EtherNet/IP distribution box (DVS-103I02C-DLR).

【Linear Bus Typology】

● Linear Bus Typology 1
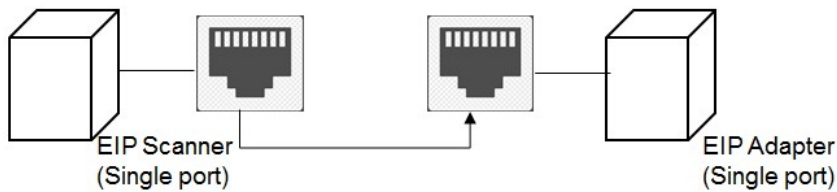
● Linear Bus Typology 2
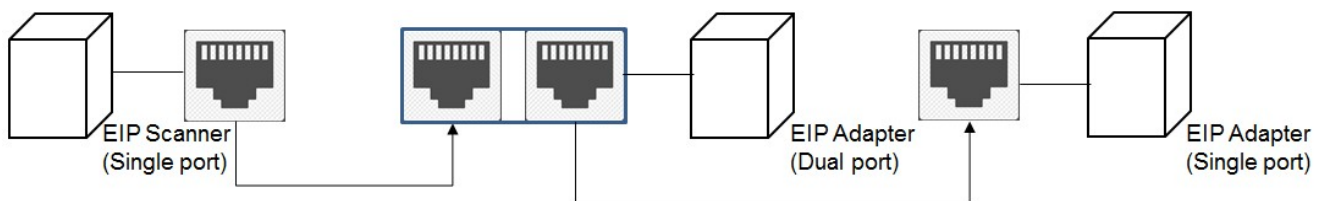
【Star Typology】
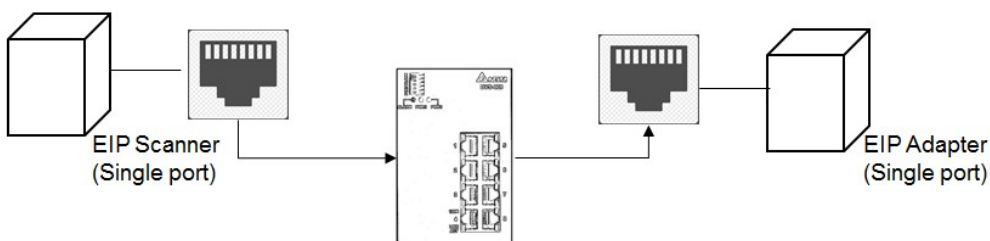
3.9.2 Dual-port Communication Device

Dual-port communication device can build up star, linear bus, and ring typology. A DLR function is required to create for a ring typology.

【Linear Bus Typology】
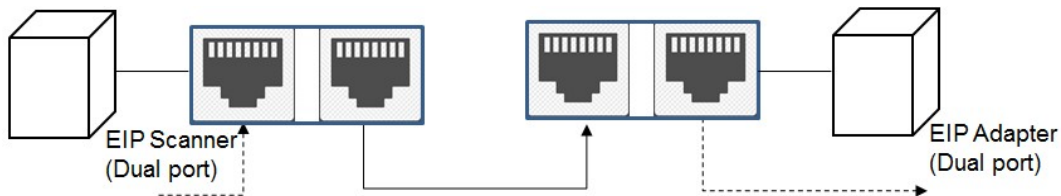
【Star Typology】
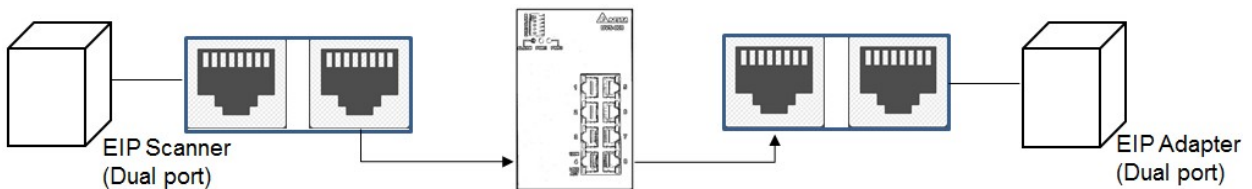
【Ring Typology】

When using ring typology, check if the device supports DLR (Device Level Ring) function. There must be at least one of the devices supports DLR function (Ring Supervisor) in the network. When connecting with a switch in a typology, note that the switch also needs to support DLR function. Any incorrect connection may cause communication errors.
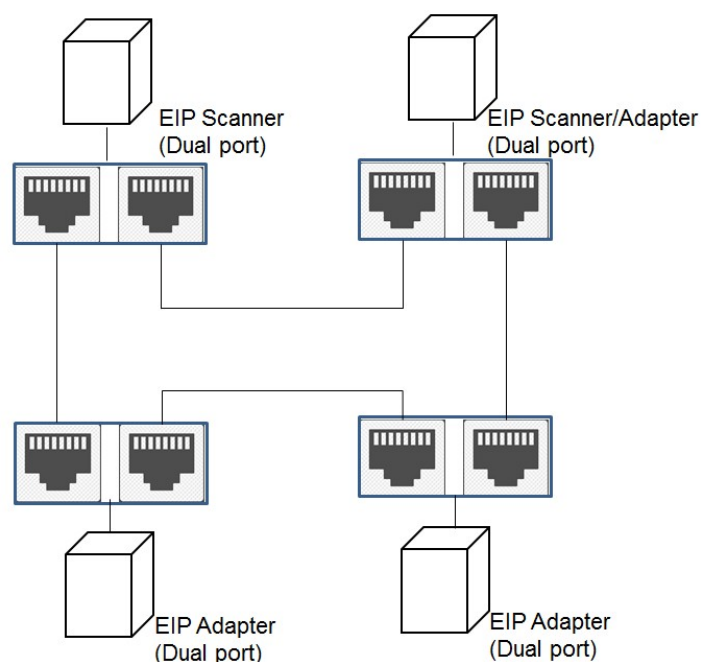
3.9.3 PC Software

As PC does not support ring typology, you can only use star typology or point-to-point connections when using single-port card. For dual-port card, you can use star or linear bus typology, depending on on-site configurations. Below is a star typology network diagram.

4. Settings before Using

4.1 Drive Setting

If you need to operate the drive by using the option card via network, set the drive's control to option cards. Use the digital keypad to finish the setting by following the steps below:

1. After connecting with the option card successfully, check if the value of Pr.09-60 = 5 (EtherNet/IP).
2. Set Pr.09-75 = 0 (Static IP), and then set your own IP address.
3. Set the IP address of the option card (Pr.09-76–Pr.09-79), and its default value is 192.168.1.5. If you have modified the IP parameters manually, make sure that you set Pr.09-91 = 2 to make the parameters valid.
4. Set Pr.00-20 = 8 (set the source of AUTO frequency command to option card)
5. Set Pr.00-21 = 5 (set the source of AUTO control to option card)
6. Set Pr.09-30 = 1 (set decoding method to 60xx or 20xx). For details on the decoding method, see Section 4.2 <EtherNet/IP Control Method Standard>.

4.2 EtherNet/IP Control Method Standard

EtherNet/IP interface supports all control methods of the drive. Delta-defined control methods are categorized into two types: **traditional method standard (Pr.09-30 = 0)** and **new method standard (Pr.09-30 =1)**. The traditional method only supports speed control mode. The new method supports all control modes of the drive, including speed, torque, position and homing.

EtherNet/IP Control Method Selection	Control Method							
	Speed		Torque		Position		Homing	
	Object Instance Attribute	Description	Object Instance Attribute	Description	Object Instance Attribute	Description	Object Instance Attribute	Description
Delta-defined Control (Traditional Method 20xx) Pr.09-30 = 0	0x300 0x20 0x01	Target speed (Hz)	-----	-----	-----	-----	-----	-----
Delta-defined Control (New Method 60xx) Pr.09-30 = 1	0x300 0x60 0x02	Target speed (Hz)	0x300 0x60 0x06	Target torque (%)	0x300 0x60 0x04	Position command L (signed number)	-----	-----
	x300 0x60 0x03	Torque Limit (%)	0x300 0x60 0x07	Speed limit (Hz)	x300 0x60 0x05	Position command H (signed number)	-----	-----

EtherNet/IP Control Method Selection	Operation Control	
	Object Instance Attribute	Description
Delta-defined Control (Traditional Method 20xx) Pr.09-30 = 0	0x300 0x20 0x00	RUN command
Delta-defined Control (New Method 60xx) Pr.09-30 = 1	0x300 0x60 0x00	RUN command

4.2.1   Using Delta-defined Traditional Standard (20xx)

Set the drive according to the steps mentioned in Section 4.1 <Drive Setting>, and then set the drive to delta-defined traditional control method by setting Pr.09-30 = 0. The traditional control method only supports speed mode.

● **Control Method of Speed Mode**

Set the target frequency: Set (Object, Instance, Attribute) = (300h, 20h, 01h). The unit is Hz, and the value is in two decimal places. For example, 1000 stands for 10.00 Hz.

1. RUN operation: Setting (Object, Instance, Attribute) = (300h, 20h, 00h) = 0002H stands for running. Setting (Object, Instance, Attribute) = (300h, 20h, 00h) = 0001H stands for stop.

2. Acceleration and deceleration time operation: Based on the first-step acceleration/deceleration time, set acceleration time setting (Object, Instance, Attribute) = (300h, 01h, 12h), and set the deceleration time setting (Object, Instance, Attribute) = (300h, 01h, 13h). The unit is second, and the value is in one decimal place. For example, 100 stands for 10.0 seconds.
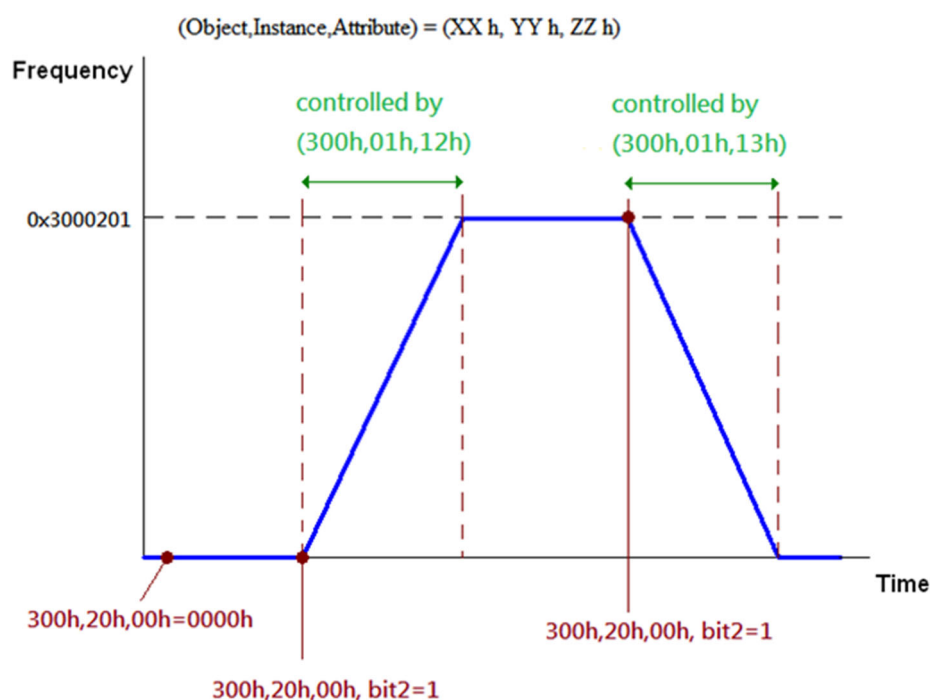
4.2.2 Using Delta-defined New Standard (60xx)

Set the drive according to the steps mentioned in Section 4.1 <Drive Setting>, and then set the drive to delta-defined new control method by setting Pr.09-30 = 1. The new control method supports all control modes of the drive.

● **Speed Mode Control**
1. Control in speed mode: Set (Object, Instance, Attribute) = (300h, 60h, 01h) to 0.
2. Set the target frequency: Set (Object, Instance, Attribute) = (300h, 60h, 02h). The unit is Hz, and the value is in two decimal places. For example, 1000 stands for 10.00 Hz.
3. RUN operation: Setting (Object, Instance, Attribute) = (300h, 60h, 00h) = 0080H stands for excitation. Setting (Object, Instance, Attribute) = (300h, 60h, 00h) = 0081H stands for running.
4. Acceleration and deceleration time operation: Based on the first-step acceleration/deceleration time, set acceleration time setting (Object, Instance, Attribute) = (300h, 01h, 12h), and set the deceleration time setting (Object, Instance, Attribute) = (300h, 01h, 13h). The unit is second, and the value is in one decimal place. For example, 100 stands for 10.0 seconds.
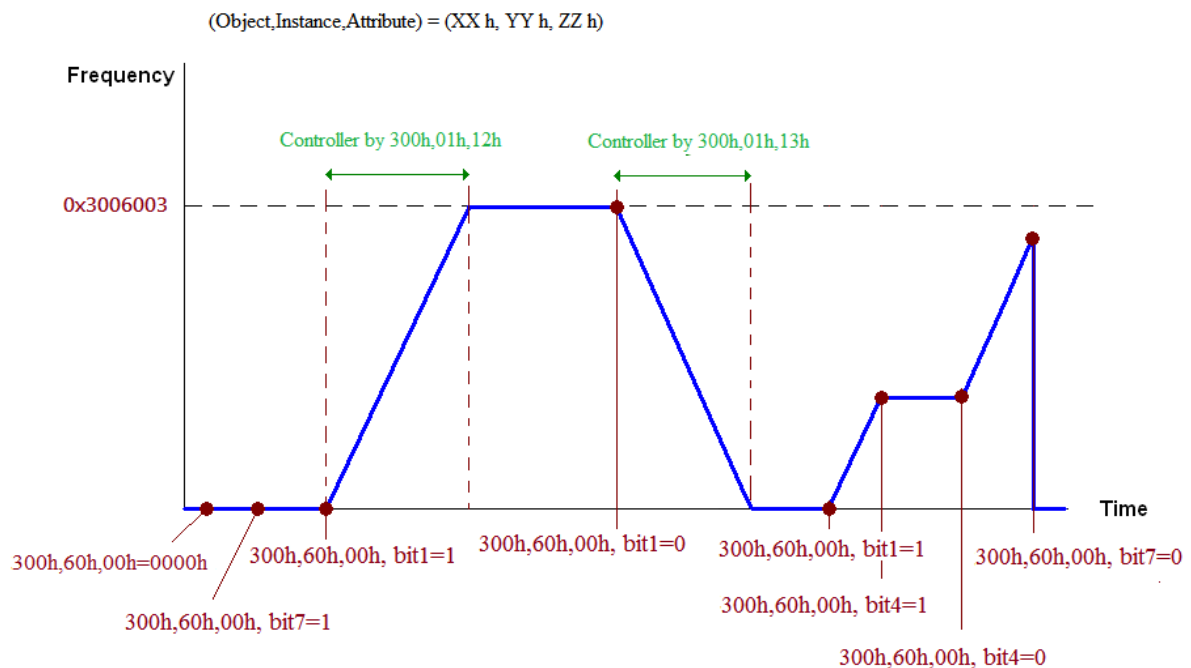
● **Torque Mode Control**

1. Control in torque mode: Set (Object, Instance, Attribute) = (300h, 60h, 01h) to 2.
2. Set the target torque: Set (Object, Instance, Attribute) = (300h, 60h, 06h). The unit is %, and the value is in one decimal place.
3. RUN operation: Setting (Object, Instance, Attribute) = (300h, 60h, 00h) = 0080H stands for excitation. At this time, the drive immediately runs to the target torque.
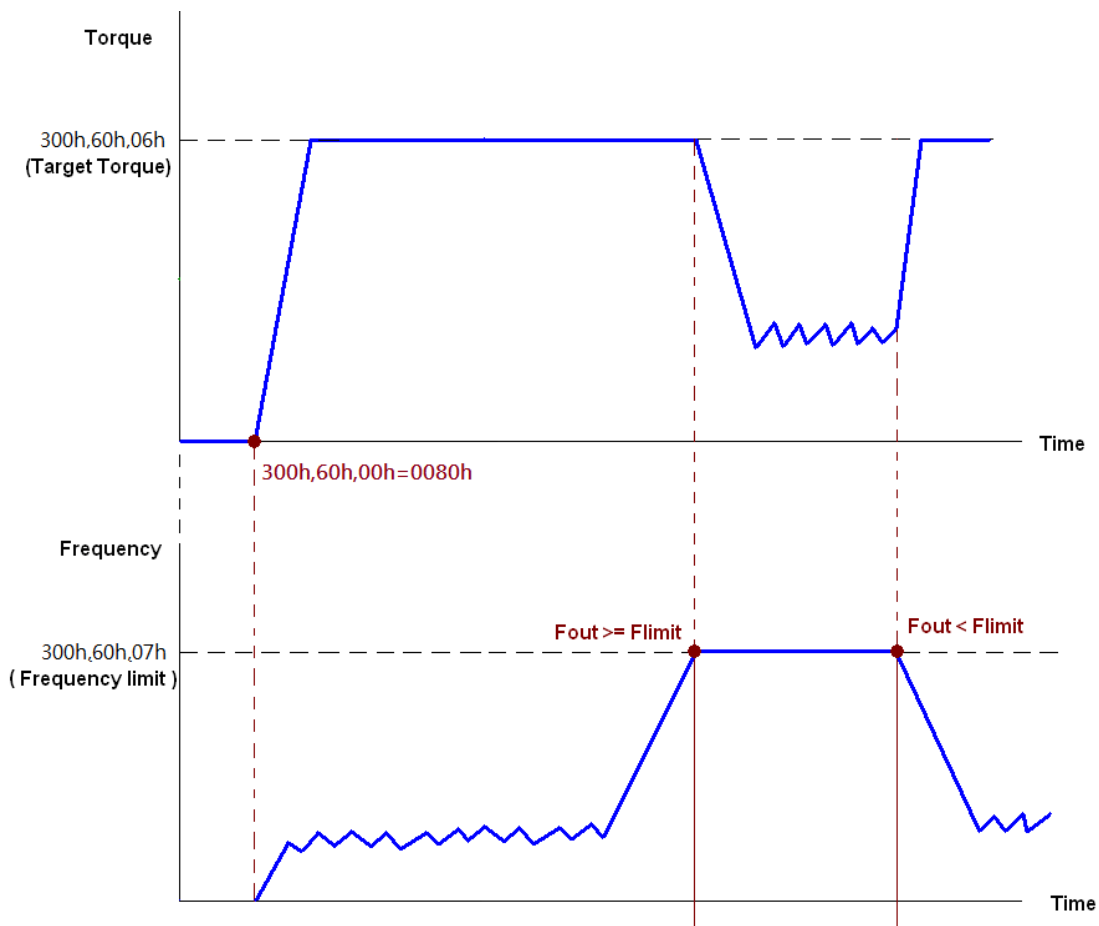
NOTE:

1. If you need to know the current torque, you can read from (Object, Instance, Attribute) = (300h, 61h, 06h) (Unit = 0.1%)
2. Whether the torque has reached the setting value or not is determined by bit 0 of (Object, Instance, Attribute) = (300h, 61h, 00h). (0: not reached / 1: reached.)
3. If drive reaches the speed limit when torque outputs, the outputted torque may reduce in order to ensure the speed is within the limit.

4.3 DCISoft Software Setting

You can use Delta's software DCISoft to quickly finish the settings of network parameter for the option card. Download the latest DCISoft at Delta's website. Before connecting to the computer, make sure that you have correctly mounted the option card and used the correct typology for network connections according to instructions mentioned in Chapter 3 <Hardware and Installation>.

Before opening DCISoft, make sure that your computer's IP address configuration is in the same subnetwork as the option card. Consult a network administrator before setting the IP address. If you are not sure the IP address, set 192.168.1.x (x=1–254) as IP address. For example, if the IP address of the option card is 192.168.1.5, the computer's IP address must be set to 192.168.1.x (x=1–254, x ≠ 5). Follow the steps to set: Control Panel → Network and Internet → Network Connections → Ethernet Properties → select and double-click **Internet Protocol Version 4 (TCP/IPv4)**.
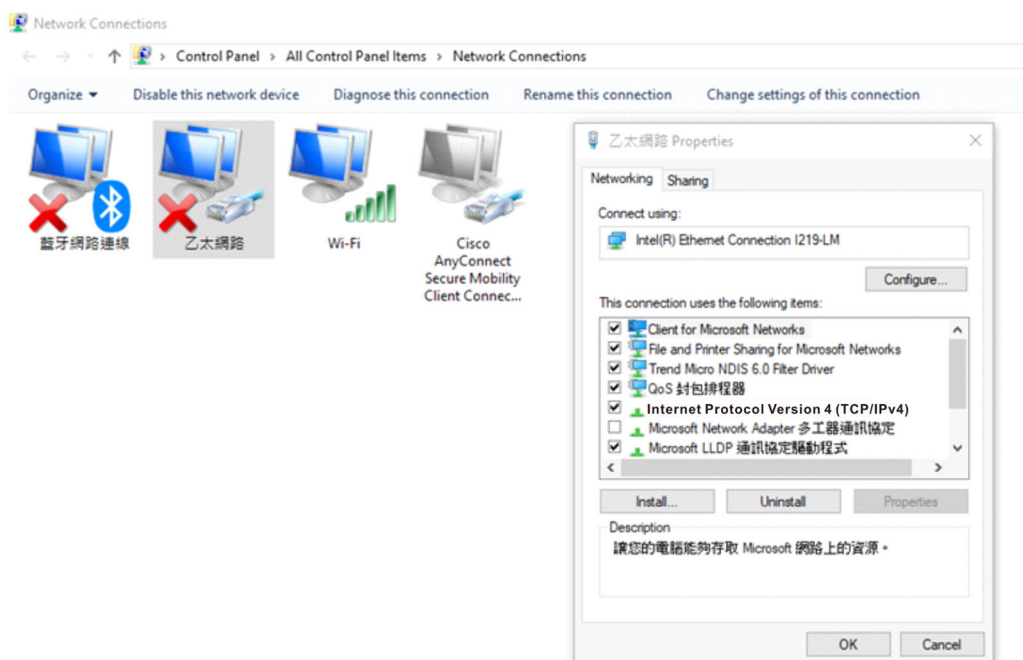
After opening DCISoft, set Ethernet as communication. Then, you can search by broadcast or specify an IP address to locate and open CMM-EIP02 setting page. As CMM-EIP02 uses UDP port: 20006, pay attention to the firewall settings. The following sections describe how to open setting pages and introduces functions for each column.

4.3.1 Network Parameter Setting for Option Card

1. Open DCISoft, select Ethernet as **Communication Type**, and then select the correct Ethernet card.
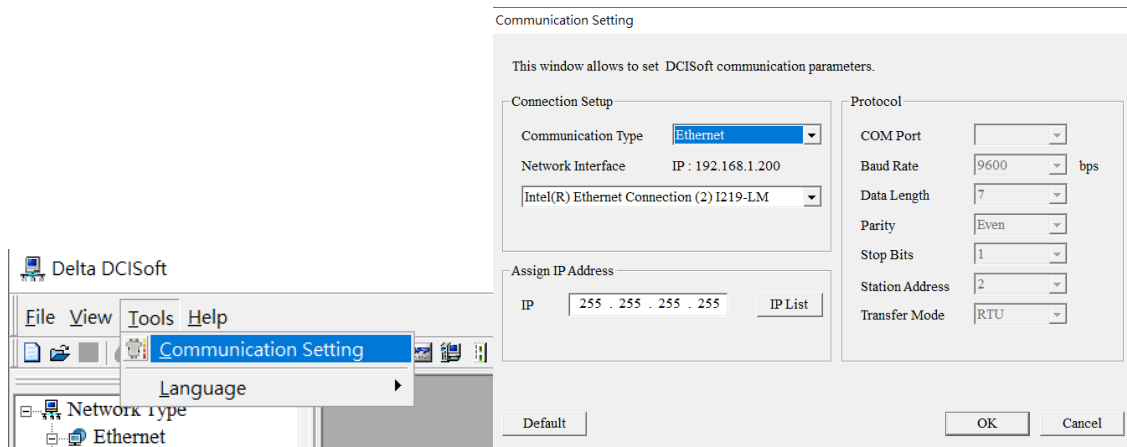
2. Click **Broadcast** icon to search CMM-EIP02. Note that your computer must be in the same subnetwork as the option card.
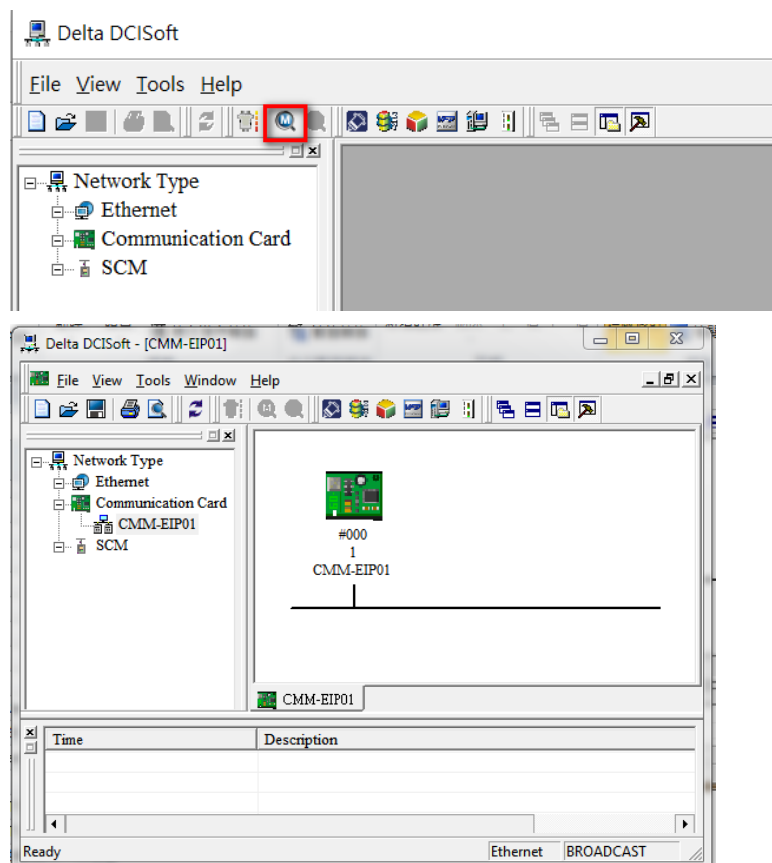
3. You can view the drive station number and device name in **Overview** page. There may be multiple CMM-EIP02 on the network. To quickly locate the control device you need, set the device name in **Basic** page.

4. There are three ways to get the IP address: Static IP, DHCP (Dynamic Host Configuration Protocol) and BOOTP.

- Static IP: IP address is pre-defined or manually modified.
- DHCP: IP address is automatically updated by DHCP server.
- BOOTP: IP address is assigned from BOOTP server.

Item	Description
Static	IP address, netmask and gateway are entered manually.
DHCP	IP address, netmask and gateway are assigned by DHCP server.
BOOTP	Similar to DHCP. The difference is that the IP address assigned by server has no lease time limit.

IP address is the device's address on the network. Each device that connects to network must have an IP address. Ensure that you use a correct IP address to avoid connection failure and prevent other devices from disconnecting. Only a legitimate IP address setting makes valid. For the setting of IP address, consult a network administrator. If you are not sure the IP address, set 192.168.1.x (x=1–254) as IP address, and use default setting values for netmask and gateway.

5. **Timer Setting** sets the connection duration, and starts to count at the last time when the host computer sends commands. When the setting time has reached, the option card is automatically disconnected to prevent idle connection from accumulating.

6. If communication cycle of the host computer is longer, such as once per ten seconds, and will not be connected again when cycle time reaches, then set the connection duration longer than communication cycle of the host computer. By doing so, you can prevent the option card from disconnecting during communication waiting time. Communication of the host computer should be connected again once disconnected.

7. When random communication time-out occurs, check if there are multiple connections to the option card of the host computer. If yes, set the connection duration to the minimum value. If time-out still occurs, reduce the number of connections for the host computer.

4.3.2   Online Monitoring Drive Parameters

1. For communication setting method, see Section 4.3.1 <Network Parameter Setting for Option Card>.

2. Go to **Parameter List** page to select the parameters that you need to monitor.

3. For example, if you need to monitor Pr.00-01, Pr.01-01, Pr.02-01, Pr.03-01, Pr.04-01, Pr.05-01, and Pr.06-01, select these parameter number (Pr. No) in **Parameter List** page.
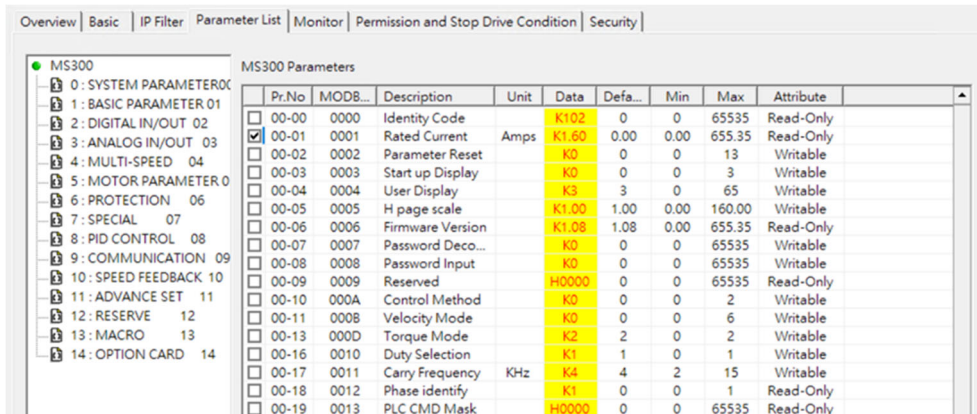
4. Then, the parameters that you selected to monitor display in **Monitor** page. Press **Apply** button to finish the setting, and then DCISoft monitoring and cache functions automatically open.
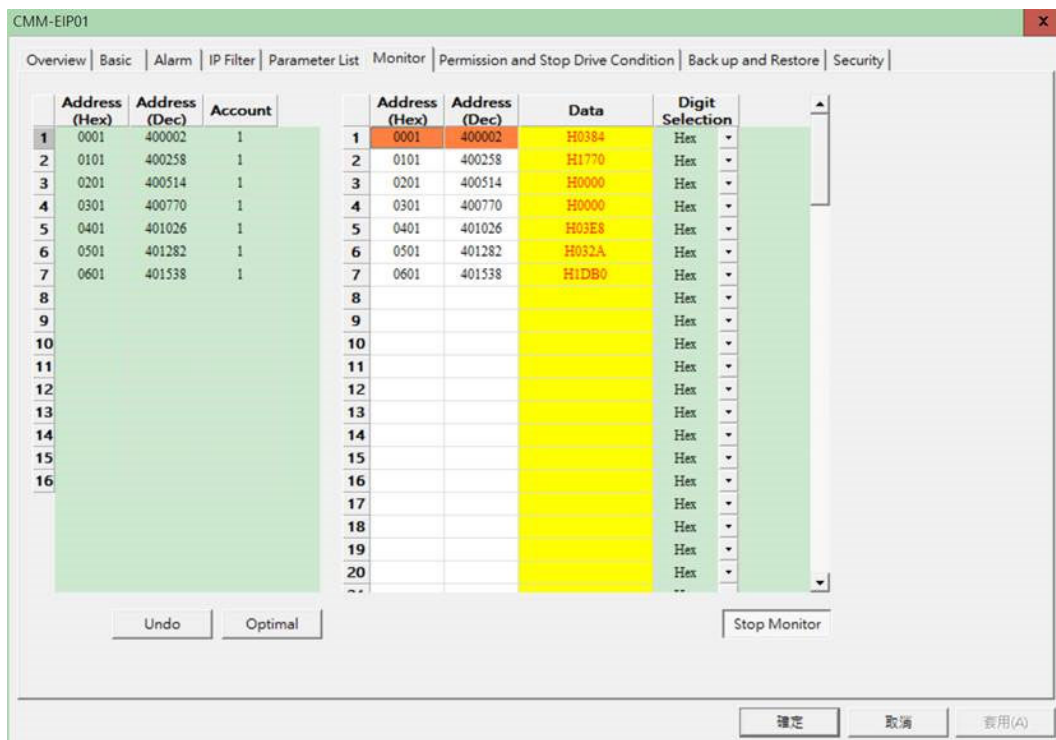
5. You can also enter Modbus address and length directly in **Monitor** page, and then press **Apply** button to start monitoring.

4.3.3 IP Filter Protection

Function Description	IP Filter Protection Setting
Network Environment	(1) The IP address of CMM-EIP02 is 192.168.0.4 (2) Only IP address 192.168.0.7 and 172.16.0.x (x=1–254) are allowed to connect with option card CMM-EIP02.

1. For communication setting method, see Section 4.3.1 <Network Parameter Setting for Option Card>.

2. Open CMM-EIP02 setting page, and then click **IP Filter** page.
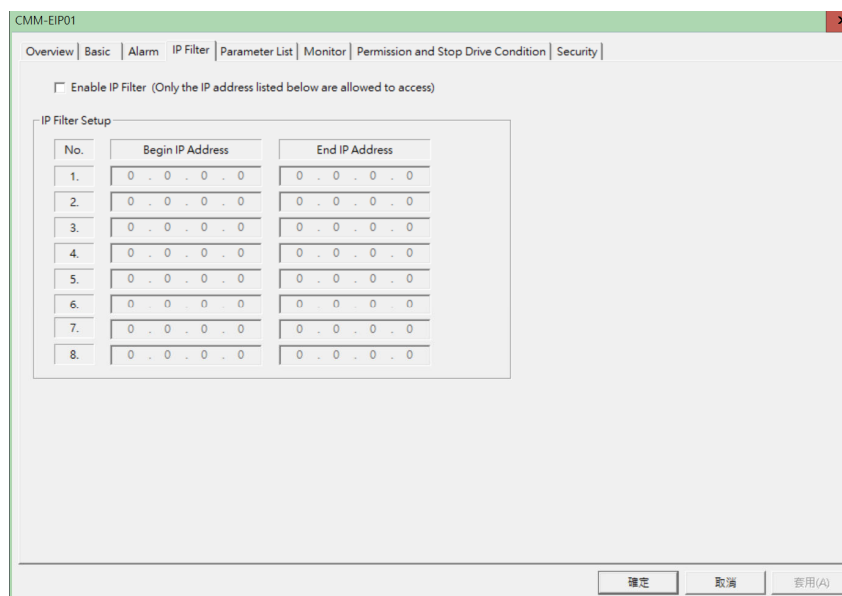
3. Select **Enable IP Filter** checkbox, and then enter 192.168.0.7 into the first setup of **Begin IP Address**, and enter 192.168.0.7 into the first setup of **End IP Address**.
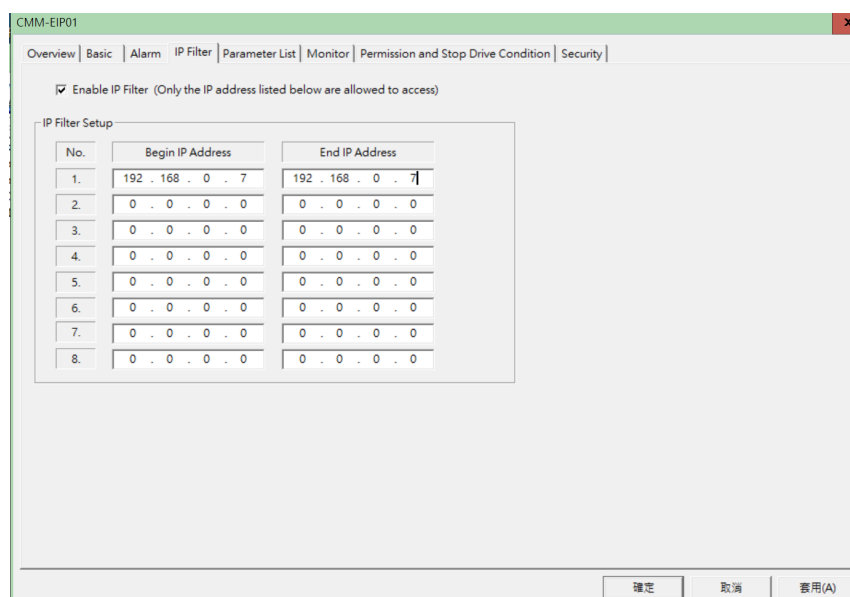
4. Enter 172.16.0.1 into the second setup of **Begin IP Address**, and enter 172.16.0.254 into the second setup of **End IP Address**. Then, press **Apply** button to finish the setting.
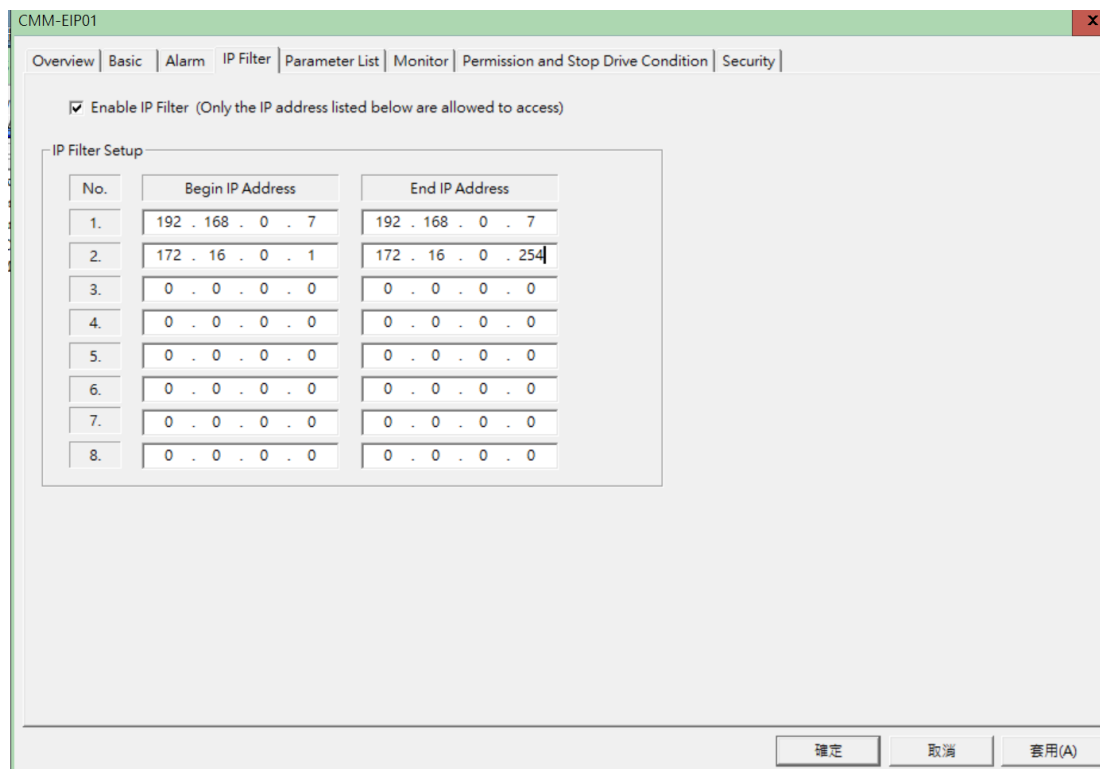
5. When the setting is finished, only devices with allowable IP address can connect with option card CMM-EIP02.

4.3.4   Password Protection: Setting, Unlocking, and Missing

Function Description	CMM-EIP02 password setting and clearing by using DCISoft
Network Environment	(1) Set the password for CMM-EIP02 (2) Unlock the password for CMM-EIP02 (3) Clear the password for CMM-EIP02
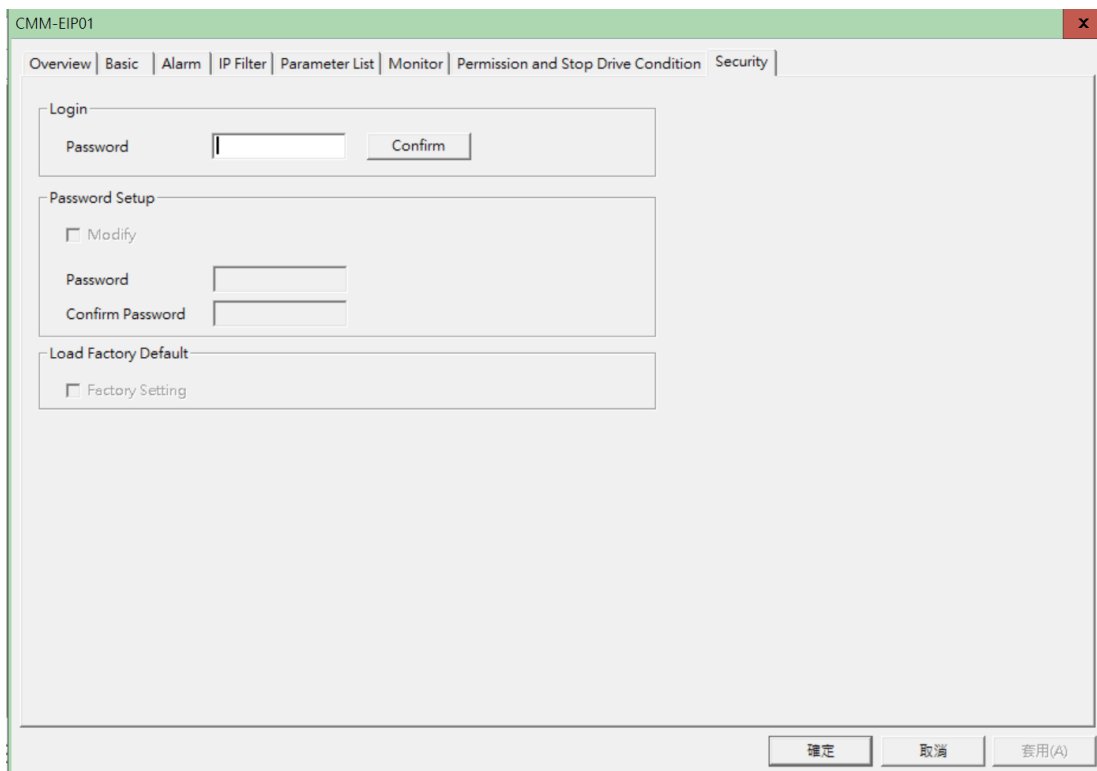
1. Open CMM-EIP02 setting page, and then go to **Security** page.
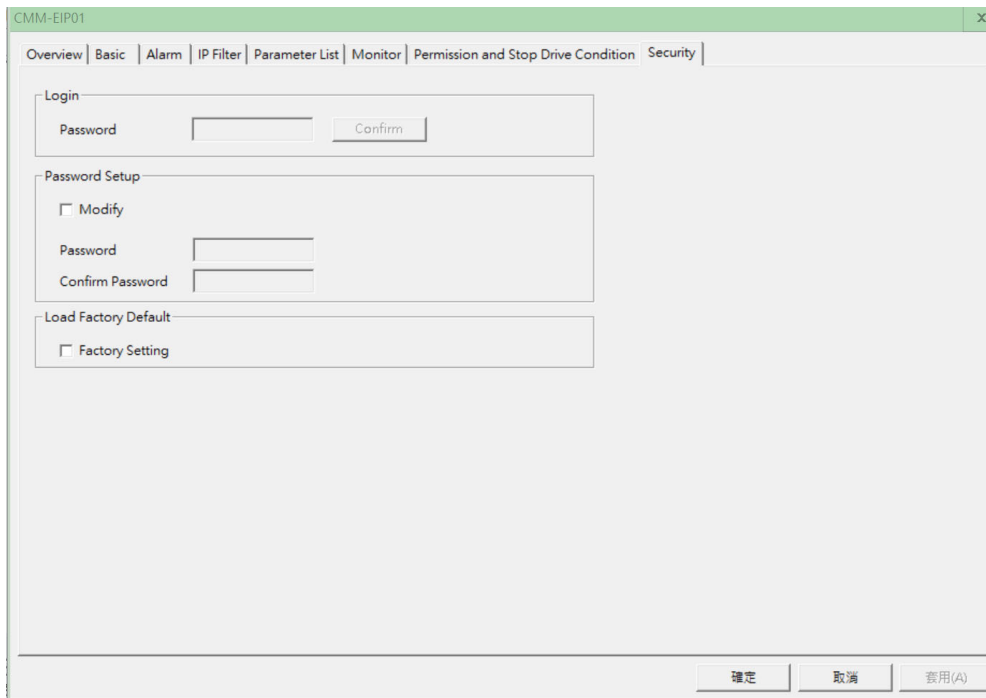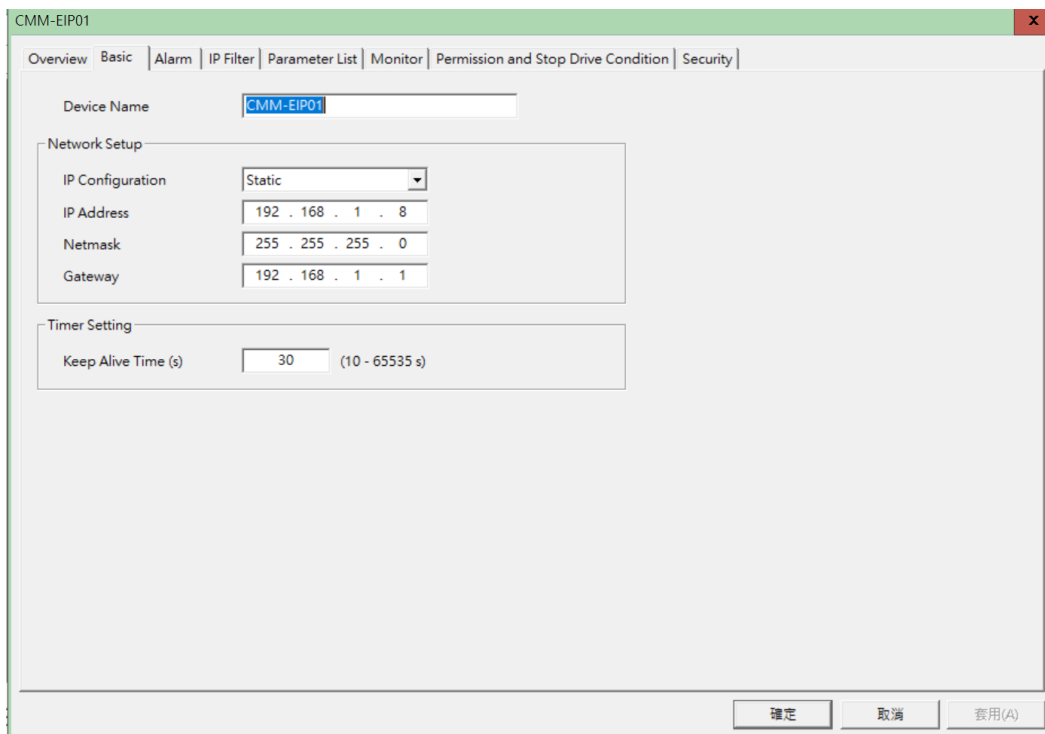
2. Select **Modify** checkbox and enter 1234 in both **Password** and **Confirm Password** columns, and then press **Apply** button to save the password.
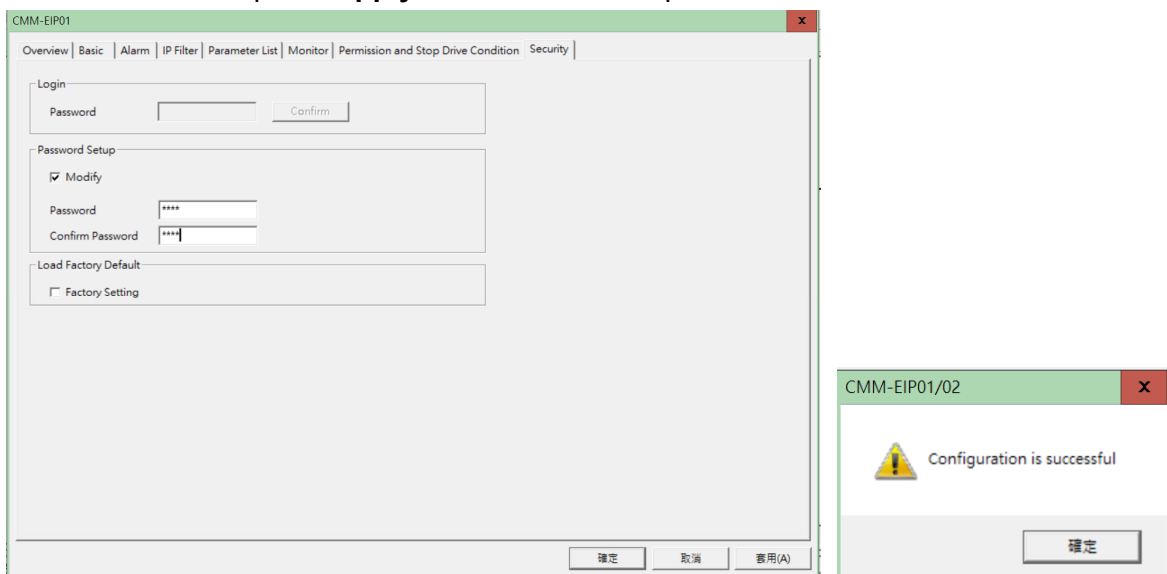
3. Open CMM-EIP02 setting page again. Then, it is locked with password and you cannot modify any settings. At this time, enter the password in **Password** column, and then press **OK** button to unlock.

4. Now, you can modify the parameters. Note that the setting will be automatically locked again once the setting page is closed.

5. To clear the password, select **Modify** in **Security** page. Empty the **Password** and **Password Confirm** columns, and then press **Apply** button to clear the password.

6. After you have cleared the password, you can modify the parameters without entering any password.

● **Password missing:** When DSCISoft setting page opens, the page is locked with password and you cannot change any settings. You are also unable to restore the settings to default values. At this time, use the digital keypad to set Pr.09-90 = 1 to restore the option card to default settings.

● **Change IP address:** You can use the digital keypad to change the network parameters even under password protection.

For example, assume that the password is 1234, if you need to change IP address to 192.168.1.16, set the parameters according to the table below.

Keypad Address	Setting Value	Function Description
09-75	0	Set the IP address is assigned by Static IP.
09-76	192	IP Address 1
09-77	168	IP Address 2
09-78	1	IP Address 3
09-79	16	IP Address 4
09-80	255	Netmask 1
09-81	255	Netmask 2
09-82	255	Netmask 3
09-83	0	Netmask 4
09-84	192	Gateway 1
09-85	168	Gateway 2
09-86	1	Gateway 3
09-87	1	Gateway 4
09-88	34	Password Low
09-89	12	Password High

After you have finished the setting, use the digital keypad to set Pr.09-91 = 6 (log-in and write the parameters), and then press ENTER key on the keypad to finish the network parameter settings. NOTE: You can only use the keypad to change the parameter settings with the password, and you cannot use the keypad to set or change the password.

4.3.5 Permission and Stop Setting

Function Description	Write permission setting and drive stop condition when time-out

Network Environment	(1) Set the option card IP address to 192.168.1.5
	
	(2) Use a computer (192.168.1.100) and an option card that uses Modbus TCP communication
	
	(3) Prepare an AS218TX (192.168.1.10) and an option card that uses EtherNet/IP implicit messaging communication.
	
	(4) Three scenarios:
	
	    a. The drive does not stop regardless of any communication time-out.
	
	    b. The drive stops when PLC communication time-out occurs, and PLC is set as main connection device.
	
	    c. The drive stops when communication time-out occurs both on PLC and remote workstation.

Item	Description
Master Device	After you have set the IP address of master device, only communication comes from this IP address is allowed to modify parameters.
Main Connection Device	Defined by EtherNet/IP communication, each slave (adapter) must and can only have one main connection device. All masters, except the main connection device, are only allowed to read (listen-only).

Open DCISoft setting page, go to **Permission and Stop Drive Condition** page. **Exclusive owner implicit message timeout** checkbox is selected by default. In this case, because no master device is set, drive stops only when implicit messaging communication time-out occurs on EtherNet/IP main connection device once communicated successfully. The following sections describe some commonly seen drive stop scenarios.

Scenario 1

The drive does not stop regardless of any communication time-out.

1. Uncheck **Exclusive owner implicit message timeout**, and then press **Apply** button to finish the setting.
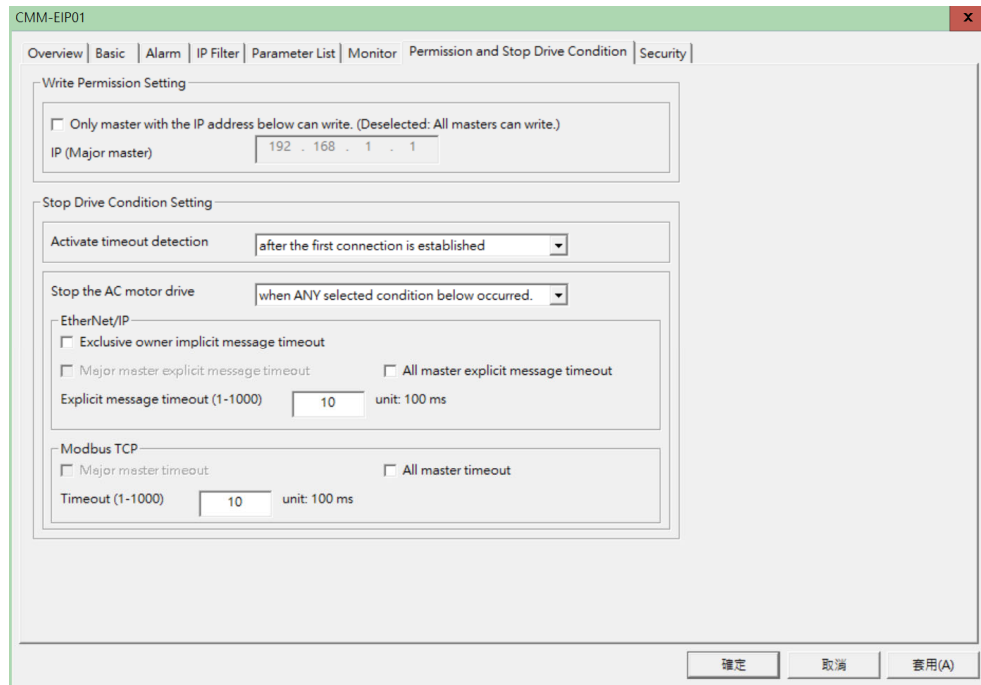
2. When communication time-out occurs on PLC or remote workstation, the drive does not stop.

Scenario 2

Main connection device PLC (192.168.1.10) can read and write, but remote workstation (192.168.1.100) can only read. The drive stops only when communication time-out occurs on main connection device PLC.

1. Select **Only master with the IP address below can write** checkbox, and set PLC as the main connection device (192.168.1.10). Then, press **Apply** button to finish the setting.
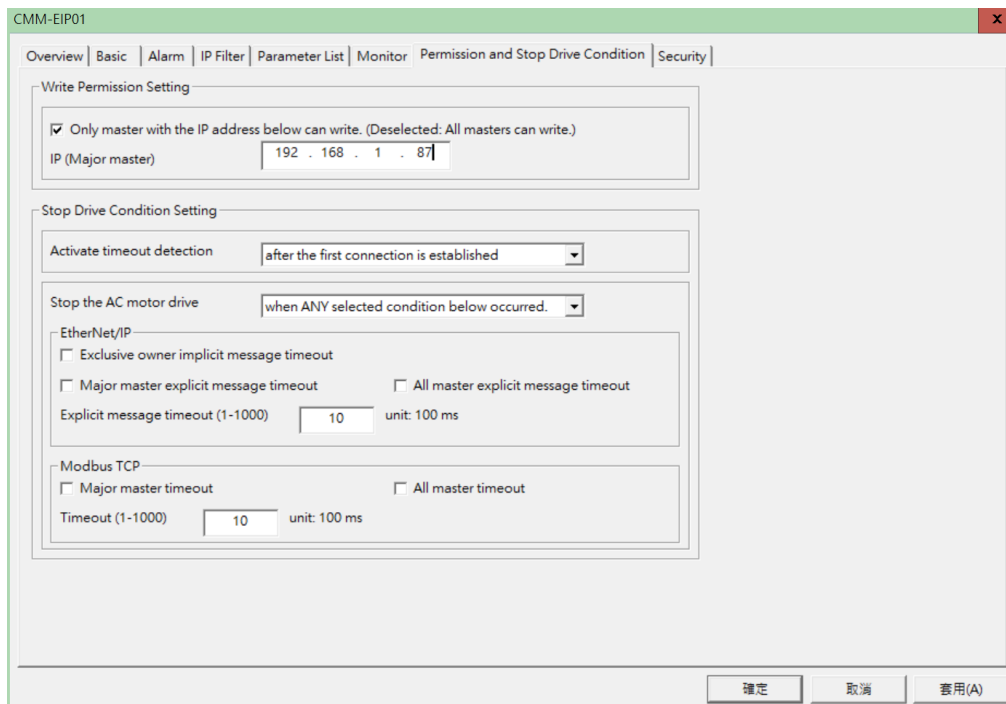
2. When remote workstation sends a Modbus TCP write command, an exception code (0x04) occurs on option card. The drive does not stop when remote workstation time-out occurs.

3. When communication time-out occurs on PLC, the drive stops and "ECto" displays on the keypad. At this time, remote workstation can still send read commands to read parameters of the drive.

Scenario 3

The drive stops when communication time-out occurs both on PLC and remote workstation.

1. In **Modbus TCP**, select **All master timeout** checkbox and set the communication time-out unit, and then select **Stop the AC motor drive when ALL selected conditions below occurred**. Then, press **Apply** button to finish the setting.
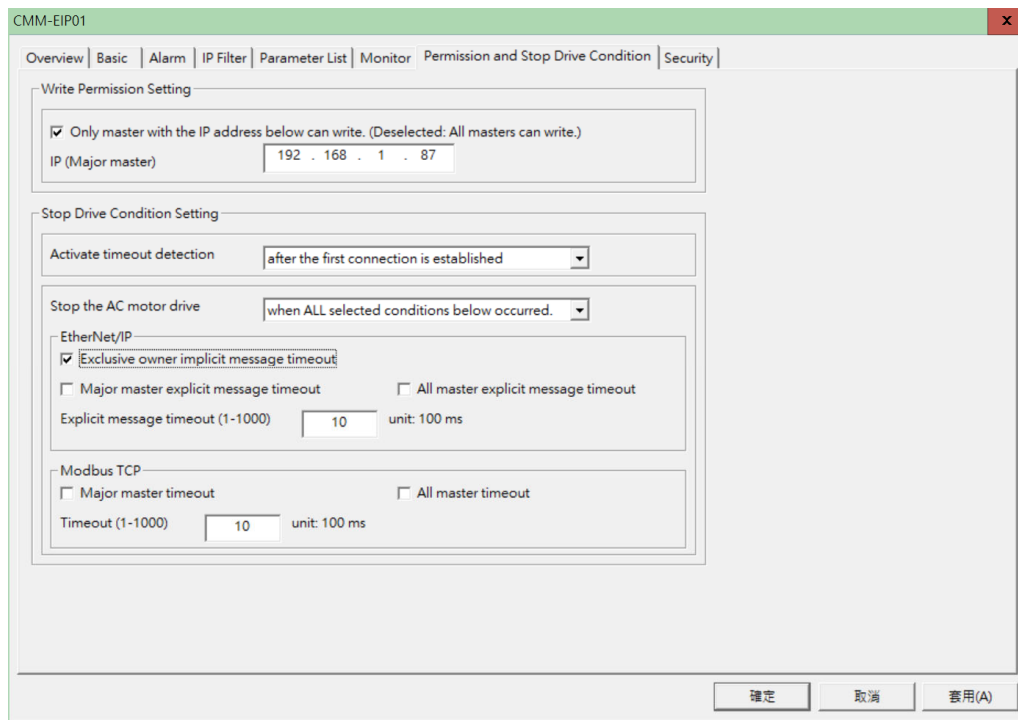
Communication time-out occurs on PLC or remote workstation

Communication time-out occurs on both PLC and remote workstation

2. When communication time-out occurs both on PLC and remote workstation, the drive stops and "ECto" displays on the keypad.

5. Operation Demonstration of Option Card

5.1 EtherNet/IP Implicit Messaging

EthetNet/IP implicit messaging, a cyclic data exchange, assigns read/write data address settings using map register of EtherNet/IP host controller (scanner) on option card, and reads/writes address data value with fixed length at one time using map register.

The scanner identifies the device and establishes connections using EDS files of EtherNet/IP devices. Generally speaking, the EDS file of the device is built-in in the vendor's master operating software. For example, you do not need to import the EDS file of the option card when using Delta EIP Builder. But if you are not using a Delta master, you have to download the EDS file from Delta' website or contact your device supplier.

EtherNet/IP implicit messaging supports user-defined address communication. You can add data into cyclic data exchange table by yourself. But not all device suppliers support this function. To ensure that you can work on this function normally, choose Delta's PLC as your first choice.

5.1.1 Delta's PLC – A Demonstration of AS300

Device	AS332P-A	192.168.1.5
	MS300	192.168.1.105
	CMM-EIP02	
Software	COMMGR	Above V1.11
	DCISoft	Above V1.23
	ISPSoft	Above V3.10
	EIP Builder	Above V1.07

1. Connect your computer, AS332P-A and option card CMM-EIP03 using Ethernet. Then, build up either a star typology or linear typology. For how to create a typology, see Section 3.9.1 <Single-port Communication Device>. If the option card is single port, build up a star typology.

2. Set the IP address of option card and drive parameters according to the instructions in Chapter 4. Then, use DCISoft software to change the IP address of CMM-EIP02 to 192.168.1.105.

3. Open COMMGR software, and click **Add** to select Ethernet as communication type. Select the correct Ethernet card, and then click **Search** to scan all devices. Make sure that AS332P and CMM-EIP02 are listed in the scanned results. Then, press **OK** button to successfully add device channel into COMMGR for ISPSoft connection.

4. Open ISPSoft software, go to **Communication Settings** menu, and then select **Driver** and **IP Address** of PLC.
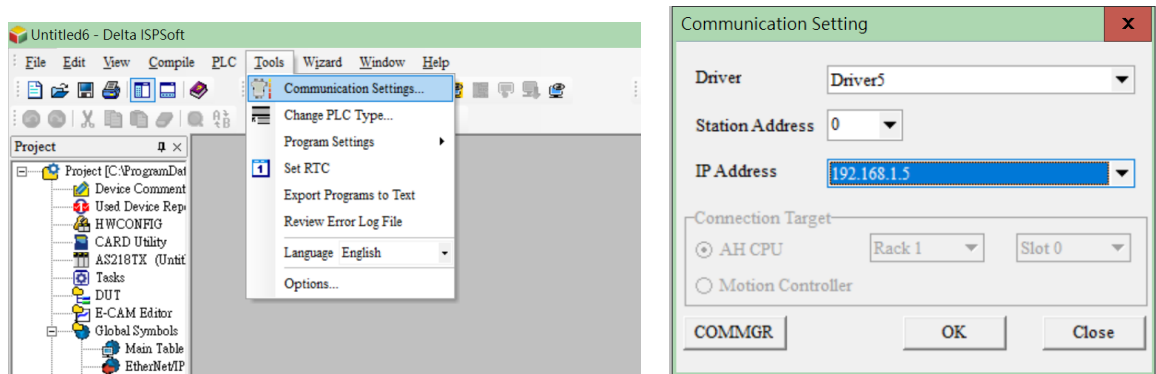
5. If it is not the first time you use PLC, click **Upload from PLC** on the toolbar to proceed on. If it is your first time to use PLC, click **New** on the toolbar to create a new project. In the **Project** panel, right-click **Program** and click **New** to create an empty program. Then, click **Download to PLC** on the toolbar to make PLC run. You can edit PLC programs after the connection is established.
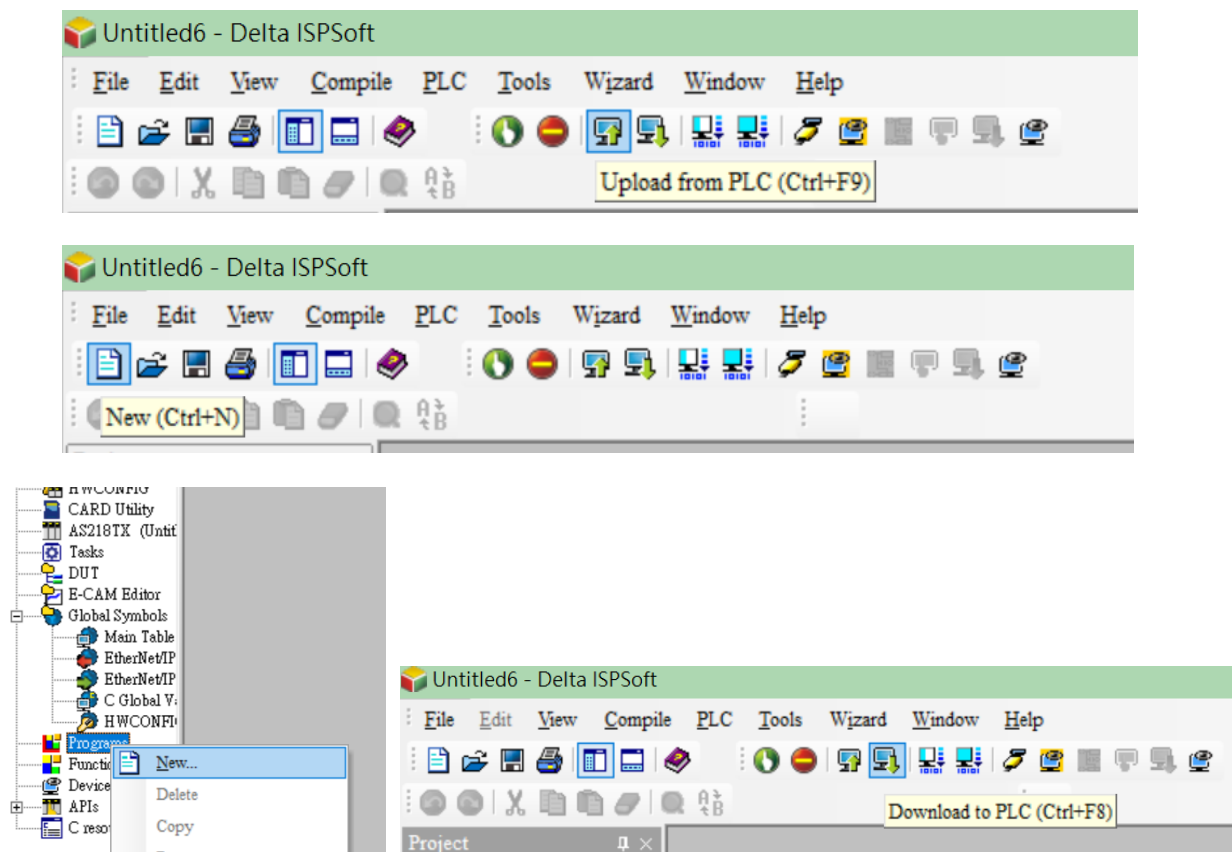
6. In the **Project** panel, open **HWCONFIG**, and then click **Upload** to upload PLC parameters.
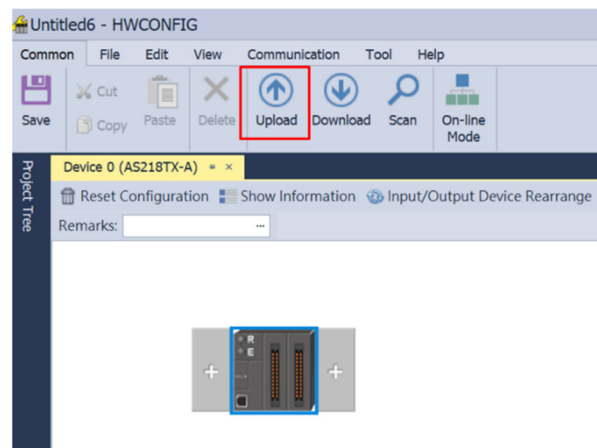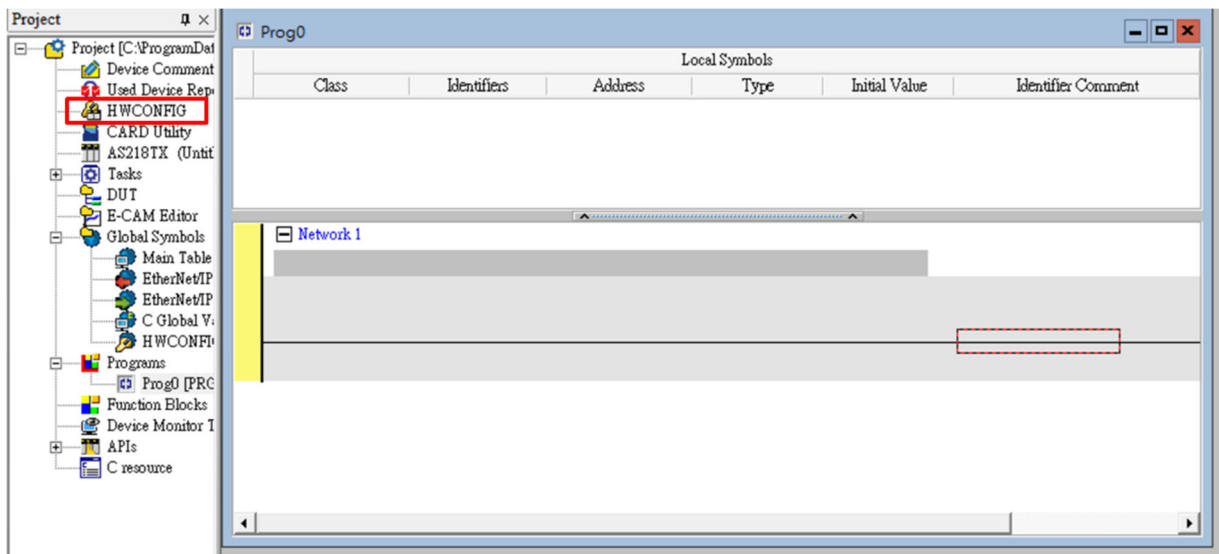
7. After the upload is finished, right-click the device figure, and click **Communication Software**
   → **EIP Builder** to open EIP Builder.
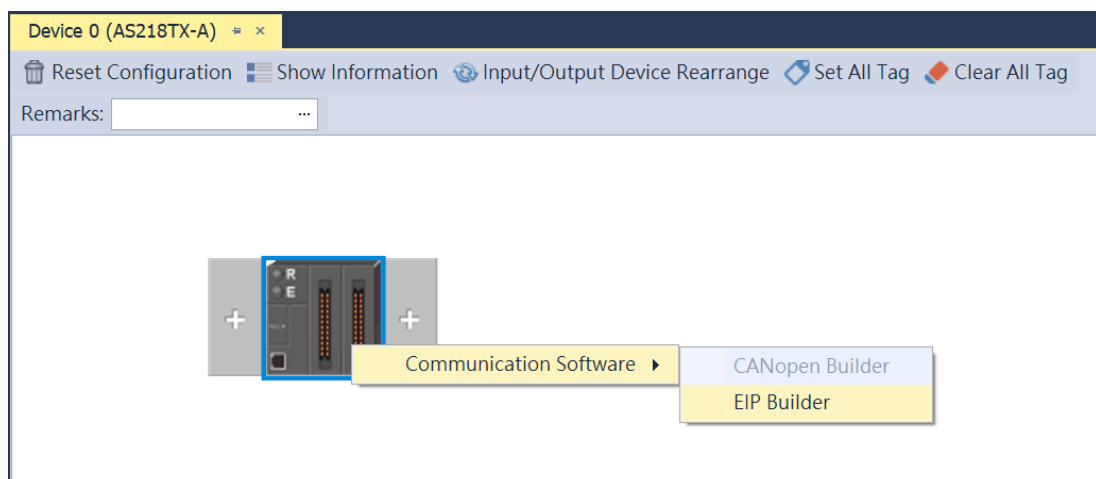
8. Select **Scan Network** on the toolbar to select the device to join the network. You can select multiple devices at one time. If you have any questions about adding devices to the network, contact your device supplier to get the correct EDS file. For how to import the EDS file, see following sections.
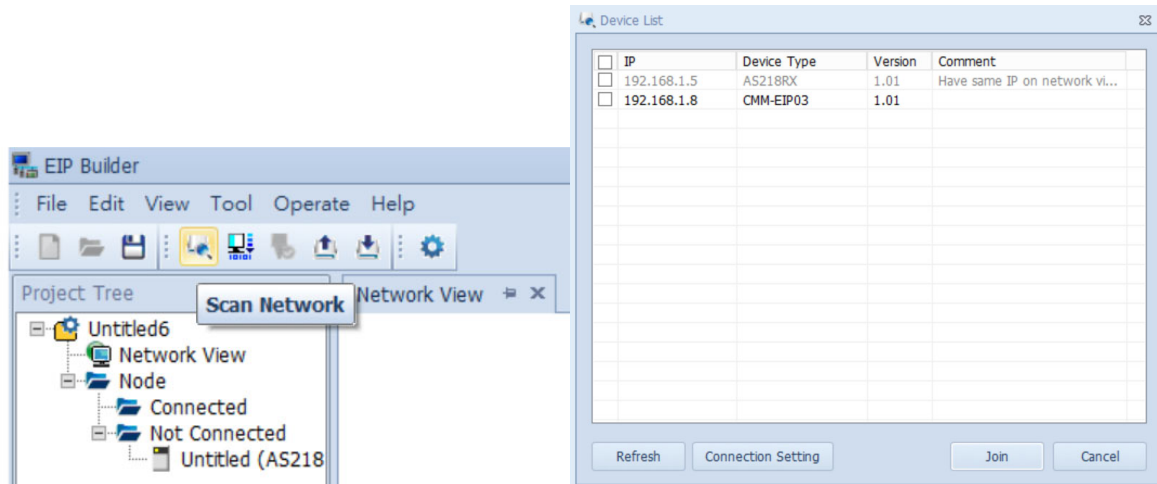
9. Click the red dot on PLC and the drive figure, and then drag them to the same connection line. Or, right-click in an empty space, select **Fast Connect**, select the device, and then add a new connection.
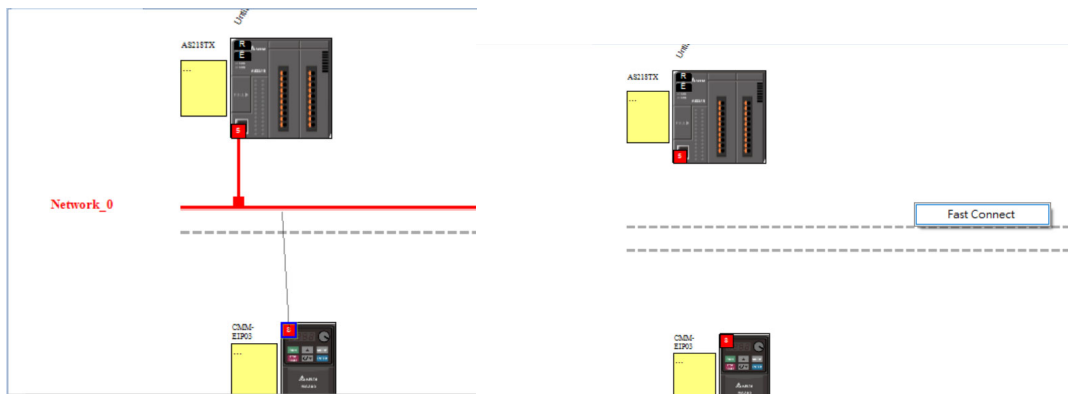
10. After the connection is established, right-click the red dot on PLC figure to open **Data Mapping**. A new page Network_0 automatically opens.
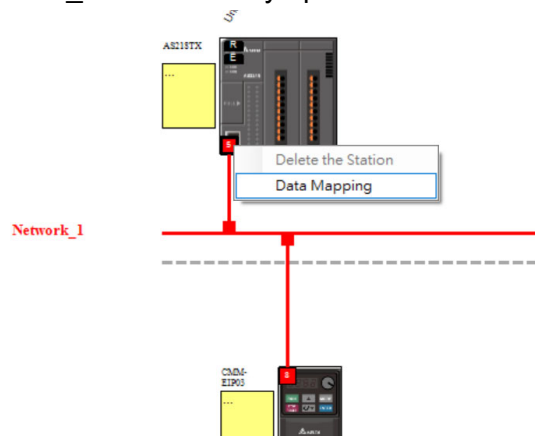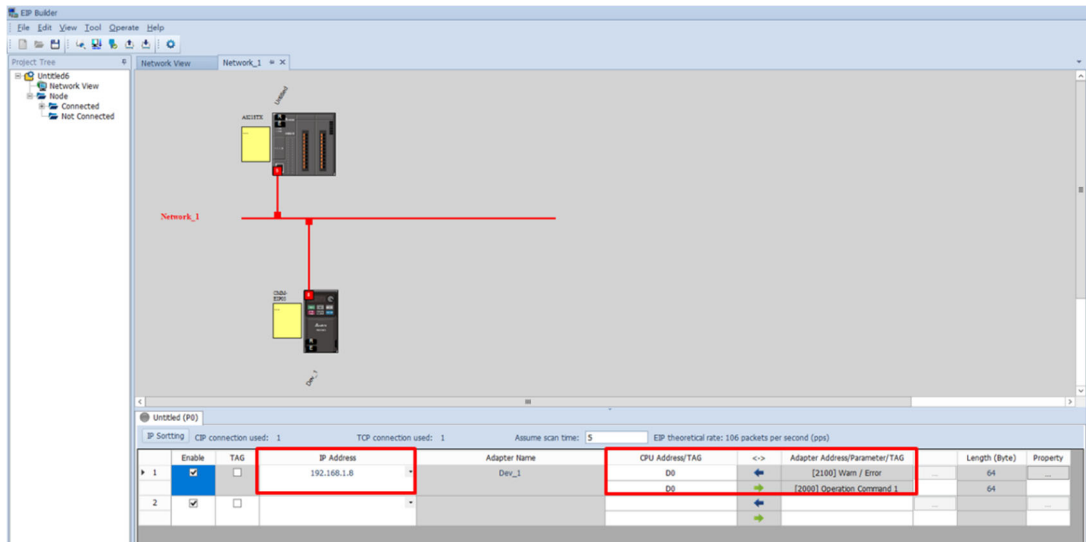
11. Check if the IP address of option card is displayed in the data exchange table below. Check if the default value of Begin IP Address for exchange that PLC uses is D0/D0. If so, change it to a different Begin IP Address first to prevent data from repeating. Click "**…**" at the right to the **Adapter Address/Parameter/TAG** column to open the data exchange table. There are IN (read) and OUT (write) data in the table. When PLC changes the OUT data value, drive's parameters are automatically written, and the mapping parameters of the drive are also automatically retrieved in IN data value in PLC. As the figure below shows, the Begin IP Address for OUT in PLC is D1000, which maps to [2000] VFD Ctrl 1. In a similar way, D1001 maps to [2001] Freq. Cmd 1.
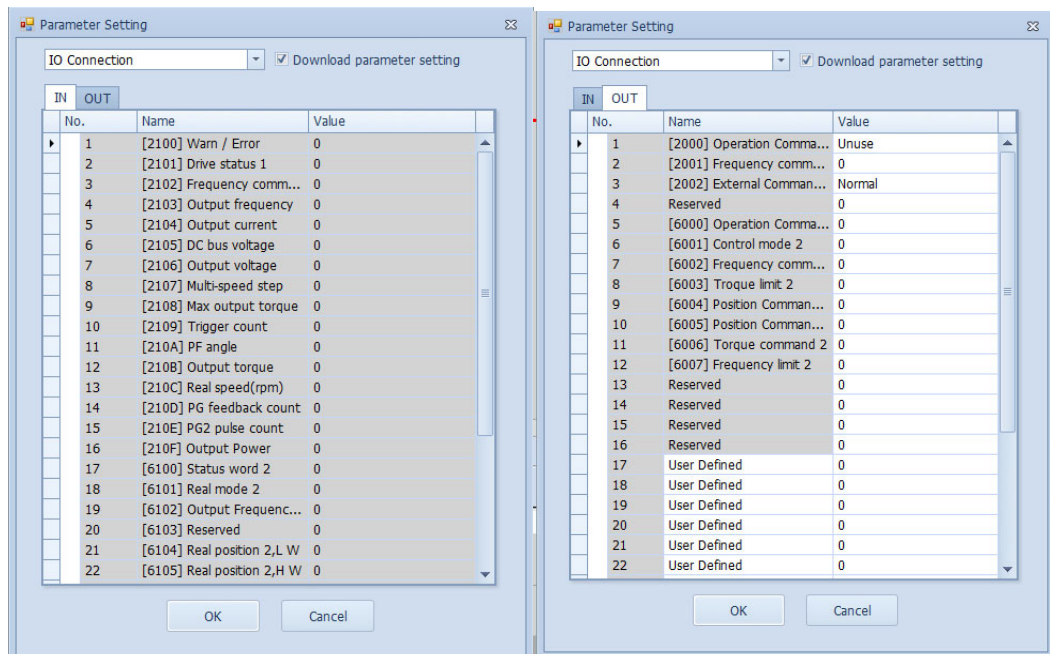
12. IN (read) address No.26 to No.32 and OUT (write) address No.17 to No.32 support user-defined address. Click **User Defined** column, and then select the required parameters in **Address parameter list**. After re-loading the parameters, mapping to the drive is established.
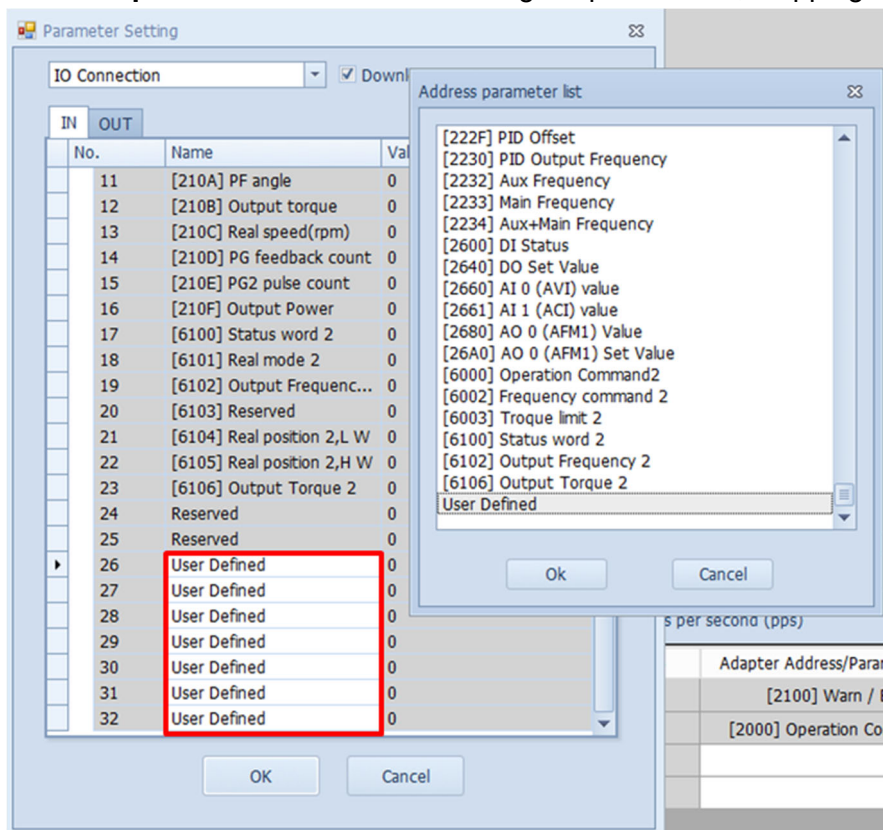
- **How to import EDS files:** As there is no built-in CMC-EIP02 and CMM-EIP03 option card in EIP Builder, contact your device supplier to get the EDS file or download from Delta's website file before importing EDS file into EIP Builder.
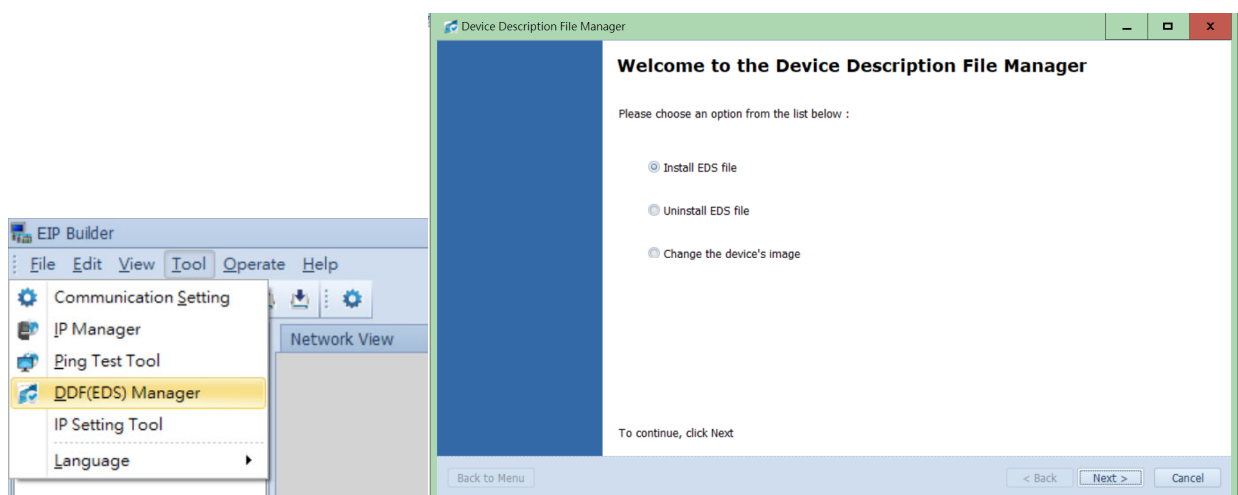
5.1.2   A Demonstration of Rockwell Automation PLC

Device	ControlLogix 1756-L71 1756-EN2TR	192.168.1.20
	C2000 CMC-EIP01	192.168.1.106
Software	Logix Designer	V31.00.00

1. For details on setting the IP address of option card and drive parameters, see Chapter 4.

2. Open Logix Designer software to install the EDS file. Download the latest EDS file from Delta's website.
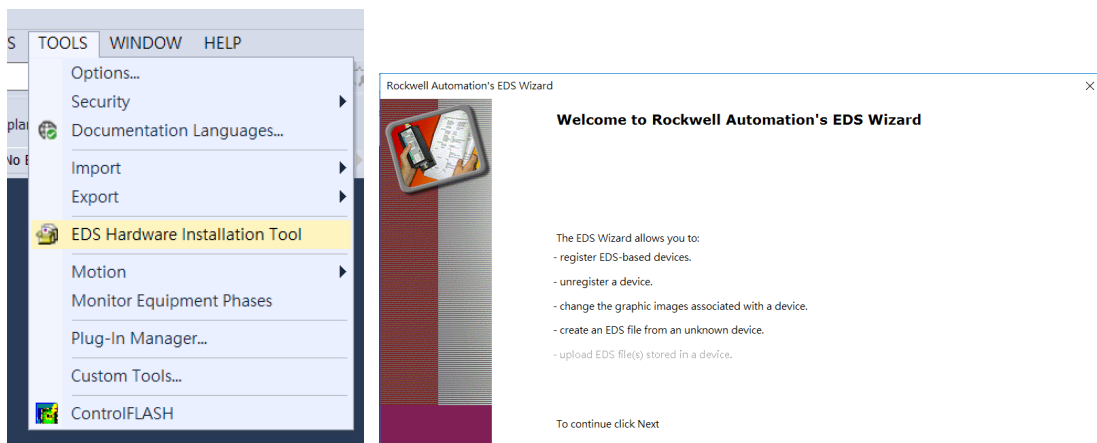
3. After the installation is finished, in **Controller Organizer → I/O Configuration** panel, right-click **Ethernet**, and then click **New Module** to add device.
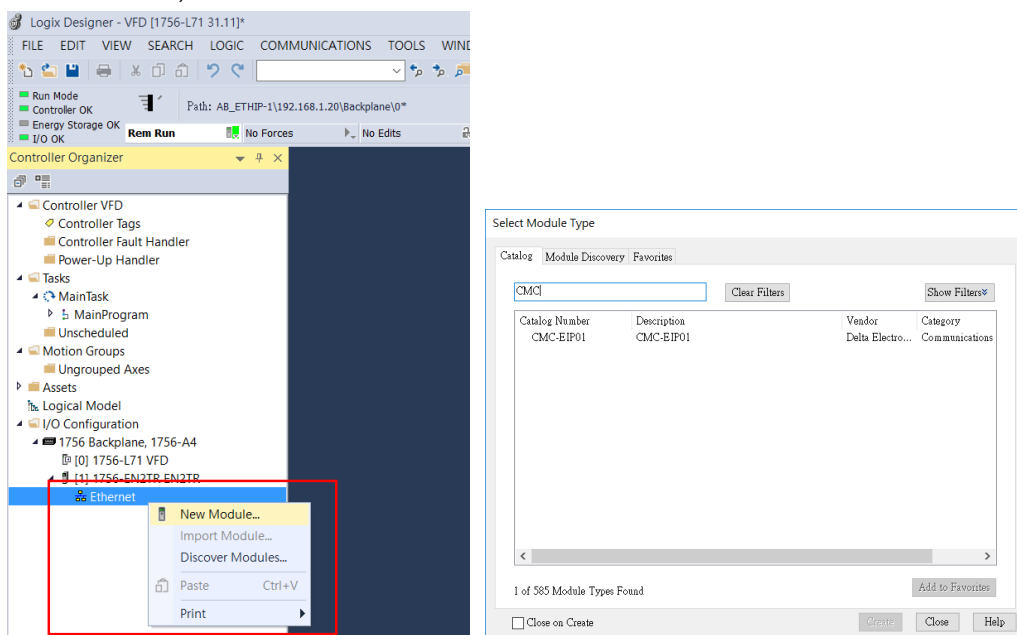
4. Enter the IP adress of the device and device name.
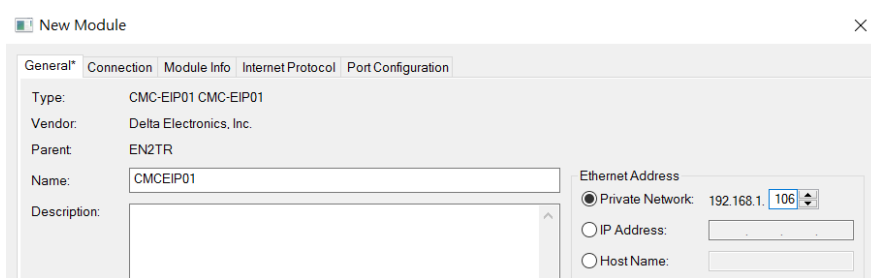
5. Click **Change** to change data format to INT, and then press **OK** button to finish adding. CMC-EIP01 icon displays under **Ethernet** in **Controller Organizer → I/O Configuration** panel.
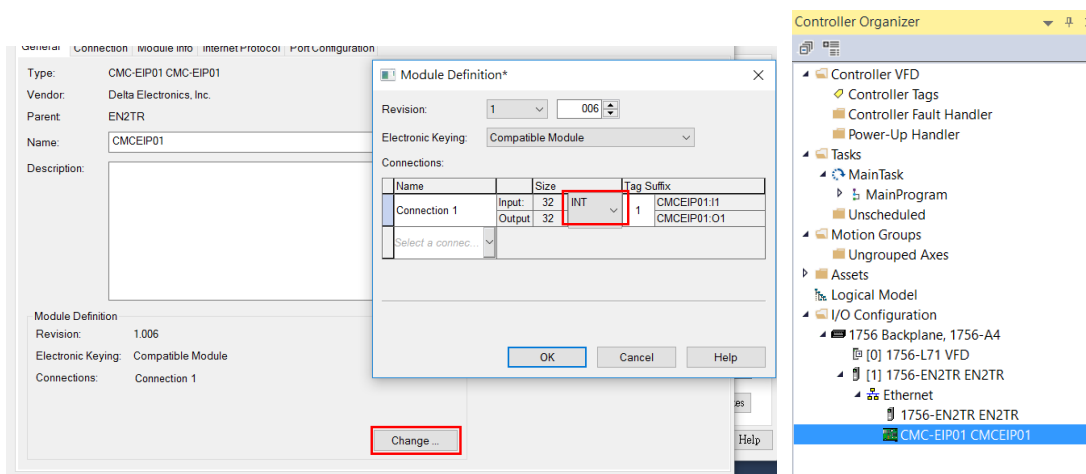
6. Data mapping of the drive will be automatically added in **Controller Tags**. "C" stands for "Configuration", "I" and "O" respectively stands for "INPUT" and "OUTPUT". The functions are mapped in sequence. For example, CMCEIP01:**O1.Data[0]** maps to **N 0**. As Logix Designer cannot display the notes of drives' IP address, see following tables for detailed descriptions of the IP address.
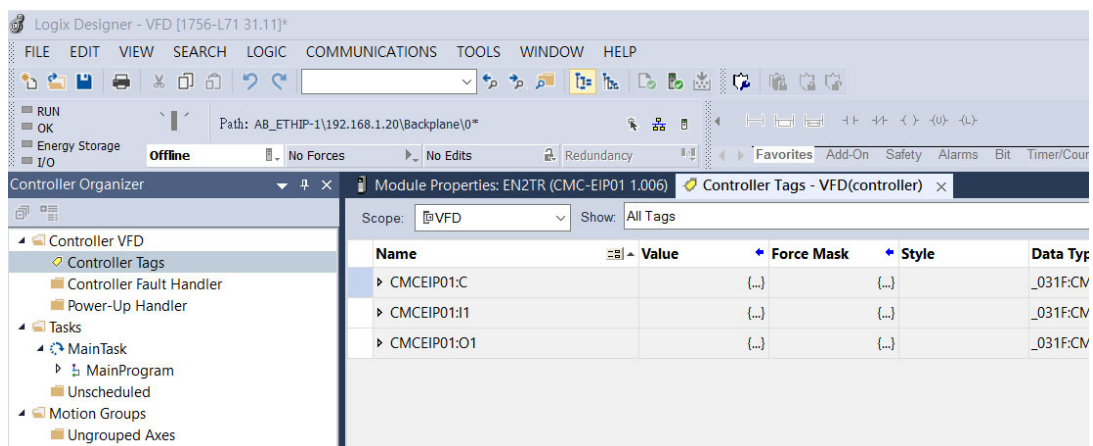
5.1.3 Implicit Messaging Communication Address

● The IP address that implicit messaging currently supports and their definitions are shown in the table below:

Implicit Messaging Fixed Address Definition	Function	Size (word)	Description
I/O Connection	Input	32	Mapping to input buffer register data
		1	Mapping to input buffer register length
	Output	32	Mapping to output buffer register data
		1	Mapping to output buffer register length
	Configuration	128	Mapping to setting object address
		1	Mapping to setting object length
I/O Connection Listen only	Input	32	Mapping to input buffer register data (the same as I/O Connection)
		1	Mapping to input buffer register length (the same as I/O Connection)
	Output	0	
		0	
	Configuration	0	
		0	

● The functions of 32 addresses in IN / OUT register are described in sequence in the table below. Dynamic mapping address can be set through configuration data.

	IN			OUT	
Attribute	Mapping Address	Description	Attribute	Mapping Address	Description
R	IN 0 return value	Fixed 2100H (warn / fault)	RW	OUT 0 setting value	Set 2000H (control word)
R	IN 1 return value	Fixed 2101H (status)	RW	OUT 1 setting value	Set 2001H (frequency command)
R	IN 2 return value	Fixed 2102H (frequency command)	RW	OUT 2 setting value	Set 2002H (EXT)
R	IN 3 return value	Fixed 2103H (output frequency)	RW	OUT 3 setting value	Reserved
R	IN 4 return value	Fixed 2104H (output current)	RW	OUT 4 setting value	Set 6000H (control word)
R	IN 5 return value	Fixed 2105H (DC bus voltage)	RW	OUT 5 setting value	Set 6001H (control mode)
R	IN 6 return value	Fixed 2106H (output voltage)	RW	OUT 6 setting value	Set 6002H (frequency command)
R	IN 7 return value	Fixed 2107H (current speed of multi-step speed)	RW	OUT 7 setting value	Set 6003H (torque limit)
R	IN 8 return value	Fixed 2108H (reserved)	RW	OUT 8 setting value	Set 6004H (position command L)
R	IN 9 return value	Fixed 2109H (count value)	RW	OUT 9 setting value	Set 6005H (position command H)
R	IN 10 return value	Fixed 210AH (output power factor angle)	RW	OUT 10 setting value	Set 6006H (torque command)
R	IN 11 return value	Fixed 210BH (output torque)	RW	OUT 11 setting value	Set 6007H (speed limit)
R	IN 12 return value	Fixed 210CH (motor actual speed)	RW	OUT 12 setting value	Reserved
R	IN 13 return value	Fixed 210DH (PG feedback pulse number)	RW	OUT 13 setting value	Reserved
R	IN 14 return value	Fixed 210EH (PG2 pulse command number)	RW	OUT 14 setting value	Reserved
R	IN 15 return value	Fixed 210FH (output power)	RW	OUT 15 setting value	Reserved
R	IN 16 return value	Fixed 6100H (status word)	RW	OUT 16 setting value	Dynamical mapping address Out 16
R	IN 17 return value	Fixed 6101H (current mode)	RW	OUT 17 setting value	Dynamical mapping address Out 17

IN			OUT		
Attribute	Mapping Address	Description	Attribute	Mapping Address	Description
R	IN 18 return value	Fixed 6102H (current speed)	RW	OUT 18setting value	Dynamical mapping address Out 18
R	IN 19 return value	Fixed 定 6103H (reserved)	RW	OUT 19 setting value	Dynamical mapping address Out 19
R	IN 20 return value	Fixed 6104H (current position L)	RW	OUT 20 setting value	Dynamical mapping address Out 20
R	IN 21 return value	Fixed 6105H (current position H)	RW	OUT 21 setting value	Dynamical mapping address Out 21
R	IN 22 return value	Fixed 6106H (current torque)	RW	OUT 22 setting value	Dynamical mapping address Out 22
R	IN 23 return value	(Reserved)	RW	OUT 23 setting value	Dynamical mapping address Out 23
R	IN 24 return value	(Reserved)	RW	OUT 24 setting value	Dynamical mapping address Out 24
R	IN 25 return value	Returns content value of dynamic mapping address In 25	RW	OUT 25 setting value	Dynamical mapping address Out 25
R	IN 26 return value	Returns content value of dynamic mapping address In 26	RW	OUT 26 setting value	Dynamical mapping address Out 26
R	IN 27 return value	Returns content value of dynamic mapping address In 27	RW	OUT 27 setting value	Dynamical mapping address Out 27
R	IN 28 return value	Returns content value of dynamic mapping address In 28	RW	OUT 28 setting value	Dynamical mapping address Out 28
R	IN 29 return value	Returns content value of dynamic mapping address In 29	RW	OUT 29 setting value	Dynamical mapping address Out 29
R	IN 30 return value	Returns content value of dynamic mapping address In 30	RW	OUT 30 setting value	Dynamical mapping address Out 30
R	IN 31 return value	Returns content value of dynamic mapping address In 31	RW	OUT 31 setting value	Dynamical mapping address Out 31

● Configuration register controls 128 addresses. For detailed setting values, see the table below.

Index	Attribute	Description	Index	Attribute	Description
0	R	IN 0 mapping address Fixed 2100H (warn / fault)	64	R	OUT 0 mapping address Fixed 2000H (control word 1, only used in speed mode)
1	R	IN 1 mapping address Fixed 2101H (status)	65	R	OUT 1 mapping address Fixed 2001H (frequency command 1)
2	R	IN 2 mapping address Fixed 2102H (frequency command)	66	R	OUT 2 mapping address Fixed 2002H (EXT)
3	R	IN 3 mapping address Fixed 2103H (output frequency)	67	R	OUT 3 mapping address Reserved for the fixed, default is 0xFFFF
4	R	IN 4 mapping address Fixed 2104H (output current)	68	R	OUT 4 mapping address Fixed 6000H (control word 2, can be used for any control modes)
5	R	IN 5 mapping address Fixed 2105H (DC bus voltage)	69	R	OUT 5 mapping address Fixed 6001H (control mode)
6	R	IN 6 mapping address Fixed 2106H (output voltage)	70	R	OUT 6 mapping address Fixed 6002H (frequency command 2)
7	R	IN 7 mapping address Fixed 2107H (current speed of multi-step speed)	71	R	OUT 7 mapping address Fixed 6003H (torque limit)
8	R	IN 8 mapping address Fixed 2108H (reserved)	72	R	OUT 8 mapping address Fixed 6004H (position command L)
9	R	IN 9 mapping address Fixed 2109H (count value)	73	R	OUT 9 mapping address Fixed 6005H (position command H)
10	R	IN 10 mapping address Fixed 210AH (output power factor angle)	74	R	OUT 10 mapping address Fixed 6006H (torque command)
11	R	IN 11 mapping address Fixed 210BH (output torque)	75	R	OUT 11 mapping address Fixed 6007H (speed limit)
12	R	IN 12 mapping address Fixed 210CH (motor actual speed)	76	R	OUT 12 mapping address Reserved for the fixed, default is 0
13	R	IN 13 mapping address Fixed 210DH (PG feedback pulse number)	77	R	OUT 13 mapping address Reserved for the fixed, default is 0
14	R	IN 14 mapping address Fixed 210EH (PG2 pulse command number)	78	R	OUT 14 mapping address Reserved for the fixed, default is 0

Index	Attribute	Description	Index	Attribute	Description
15	R	IN 15 mapping address Fixed 210FH (output power)	79	R	OUT 15 mapping address Reserved for the fixed, default is 0
16	R	IN 16 mapping address Fixed 6100H (status word)	80	RW	OUT 16 mapping address Can be modified, default is 0xFFFF
17	R	IN 17 mapping address Fixed 6101H (current mode)	81	RW	OUT 17 mapping address Can be modified, default is 0xFFFF
18	R	IN 18 mapping address Fixed 6102H (current speed)	82	RW	OUT 18 mapping address Can be modified, default is 0xFFFF
19	R	IN 19 mapping address Fixed 6103H (reserved)	83	RW	OUT 19 mapping address Can be modified, default is 0xFFFF
20	R	IN 20 mapping address Fixed 6104H (current position L)	84	RW	OUT 20 mapping address Can be modified, default is 0xFFFF
21	R	IN 21 mapping address Fixed 6105H (current position H)	85	RW	OUT 21 mapping address Can be modified, default is 0xFFFF
22	R	IN 22 mapping address Fixed 6106H (current torque)	86	RW	OUT 22 mapping address Can be modified, default is 0xFFFF
23	R	IN 23 mapping address Reserved for the fixed, default is 0xFFFF	87	RW	OUT 23 mapping address Can be modified, default is 0xFFFF
24	R	IN 24 mapping address Reserved for the fixed, default is 0xFFFF	88	RW	OUT 24 mapping address Can be modified, default is 0xFFFF
25	RW	IN 25 mapping address Can be modified, default is 0xFFFF	89	RW	OUT 25 mapping address Can be modified, default is 0xFFFF
26	RW	IN 26 mapping address Can be modified, default is 0xFFFF	90	RW	OUT 26 mapping address Can be modified, default is 0xFFFF
27	RW	IN 27 mapping address Can be modified, default is 0xFFFF	91	RW	OUT 27 mapping address Can be modified, default is 0xFFFF
28	RW	IN 28 mapping address Can be modified, default is 0xFFFF	92	RW	OUT 28 mapping address Can be modified, default is 0xFFFF
29	RW	IN 29 mapping address Can be modified, default is 0xFFFF	93	RW	OUT 29 mapping address Can be modified, default is 0xFFFF
30	RW	IN 30 mapping address Can be modified, default is 0xFFFF	94	RW	OUT 30 mapping address Can be modified, default is 0xFFFF
31	RW	IN 31 mapping address Can be modified, default is 0xFFFF	95	RW	OUT 31 mapping address Can be modified, default is 0xFFFF
32–63	R	IN 0–IN 31 initial setting value	96–127	RW	OUT 0–OUT 31 initial setting value

- **Example of Configuration Modification:**

  Take IN 25 as an example. The mapping address of IN 25 can be modified in configuration address, which maps to Configuration 25. The data format of Configuration is SINT (byte, and cannot be modified), so it consists of C.Data[50] and C.Data[51], which the former is high byte, the latter is low byte. To map to address 2001H (frequency command 1), set C.Data[50] = 16#01 and C.Data[51] = 16#20, as the figure below shows. After the setting is finished, download the program again to make it valid.

Addresses that support dynamic mapping are as follows:

IN	OUT
All parameter groups	All parameter groups
Modbus address: 264xH	Modbus address: 21xxH
Modbus address: 26AxH	Modbus address: 22xxH
-	Modbus address: 26xxH
-	Modbus address: 20xxH (determined by drive's firmware)
-	Modbus address: 60xxH (determined by drive's firmware)
-	Modbus address: 61xxH (determined by drive's firmware)

5.2 EtherNet/IP Explicit Messaging

Before using this function, see Appendix A<EtherNet/IP Service and Object> to check the objects that the option card supports and make sure that you have understood the read and write methods of explicit messaging. The host controller can directly map to the drive's setting value using mapping address of object class. The object class code of the drive is 0x300, and the explicit messaging formula of parameter address is as follows:

EIP Communication Data Type:

Object class		Instance		Attribute
0x300	+	Pr. Group	+	Pr. Number

● Example:
To write commands into Pr.10-15 (Encoder Slip Error Treatment), use the following method:

Pr. Group = 10 (0x0A)
Pr. Number = 15 (0x0F)

The explicit messaging would be displayed as:

Object class   +   Instance   +   Attribute   =   0x300 + 0x0A + 0x0F

NOTE: For detailed descriptions of parameters, see the user manual of the drive. For details on the objects of EtherNet/IP communication parameters, see Appendix A<EtherNet/IP Service and Object>.

5.3 Ring-based Network Functions

DLR (Device Level Ring) is an EtherNet/IP protocol in a ring-based network. It provides single network backup in a ring-bas network (only one physical layer network failure at a maximum is allowed), and a means to detect, manage, and recover in a ring-based network.
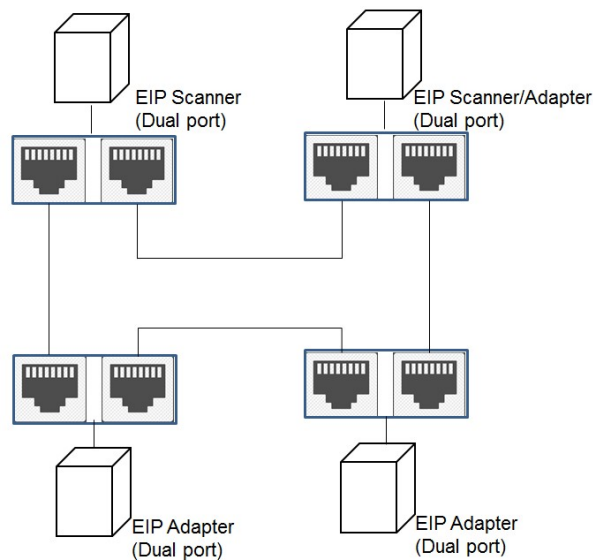
A DLR network includes three types of ring nodes: Ring Supervisor, Ring Participants / Ring Node, and DLR Switch. Dual-port option card only supports Ring Participants. You must enable the Ring Supervisor function in a network before connecting a ring-based network, or network failure may occur. See the table below for descriptions of each node.

Node	Description	Delta's Models
Ring Supervisor	1. Manages a ring-based network and collects data, including status and error information. Every DLR must have at least one ring supervisor. 2. This function is normally disabled. **You must enable this function before connecting a ring-based network**, or network failure may occur. 3. Set priorities if there are multiple ring supervisors.	AHCPU560-EN2 AHRTU-ETHN-5A DVS-103I02C-DLR
Ring Participants / Ring Node	1. A basic function of DLR. In a DLR network, if you install a device that does not support Ring Participant, it may cause the device malfunctioned. 2. Reports fault network information to Ring Supervisor, automatically adjusts communication methods when fault occurs, and continues communicating on typology (linear bus) after fault occurs.	AHCPU560-EN2 AHRTU-ETHN-5A AH10EN-5A DVS-103I02C-DLR CMC-EIP02 CMM-EIP03
DLR Switch	1. Via network socket, you can add ring-based network to non-ring based network, or add devices that do not support ring-based network (including computer, SCADA) to ring-based network. 2. DLR Switch is enabled with Ring Supervisor function.	DVS-103I02C-DLR

6. Troubleshooting

This section introduces descriptions of LED indicator for option card and fault codes on drive panel when communication error occurs on option card or drive.

6.1 LED Indicators

Indicator	Indicator Status	Indication	Fault Treatment
NET1 (NS)	Red and green light alternately blink	Network status self-test	No action required
	Green light steady ON	CIP connection established	No action required
	Green light blinks	No CIP connection established after power-on	No action required
	Red light steady ON	Repeated IP	Check if the IP setting is correct
	Red light blinks	Communication time-out / disconnection / IP modification	Check if communication setting is correct
	OFF	Network not connected	Check if the connection cable is correctly connected
NET2 (MS)	Red and green light alternately blink	Drive status self-test	No action required
	Green light steady ON	Drive parameter setting finished	No action required
	Green light blinks	Drive parameter is not set	Set according to the user manual
	Red light steady ON	Unrecoverable error occurs on the drive	Hardware failure. Contact your distributors.
	Red light blinks	Recoverable error occurs on the drive	Check if the parameter setting is correct
	OFF	No power supply	Check if power is ON
POWER	Steady ON	Power supply is normal	No action required
	OFF	No power supply	Check if power is ON
LINK	Steady ON	Network packet is transmitting / receiving	No action required
	OFF	Network not connected	Check if the connection cable is correctly connected

6.2 Drive Warning / Fault Code

ID	Code	Description	Corrective Action
75	ECFF	Parameter read error	Reset the drive and option card to default settings. If the code still exists, contact your drive supplier.
76	ECiF	Incorrect internal parameter setting	1. Mount the option card again or verify the wiring of the control circuit and wiring / grounding of the main circuit to prevent interference. 2. Reset the drive and option card to default settings. If the code still exists, contact your drive supplier.
80	ECEF	Incorrect Ethernet connection	Check if Ethernet connection cable is firmly installed.
81	ECto	Drive executes time-out stop	Ensure communication of the host controller is normal. Check the time-out drive stop settings (see Section 4.3.5). By default, EtherNet/IP executes time-out drive stop once master is disconnected.
82	ECCS	Communication checksum error occurs on option card and drive	Mount the option card again or verify the wiring of the control circuit and wiring / grounding of the main circuit to prevent interference.
83	ECrF	Option card returns to default settings	No action required
84	ECo0	Number of connections exceeds limit for Modbus TCP	Decrease number of connections for Modbus TCP host controller
85	ECo1	Number of connections exceeds limit for EtherNet/IP TCP	Decrease number of connections for EtherNet/IP host controller
86	ECiP	Incorrect IP setting	1. Verify there is no IP conflict on-site. 2. Set IP again or check if DHCP/BOOTP Server works normally.
89	ECCb	Communication time-out occurs on option card and drive	1. Mount the option card again or verify the wiring of the control circuit and wiring/grounding of the main circuit to prevent interference. 2. Verify if the station number of Modbus TCP command is different from Pr.09-00 communication address setting value.

NOTE: When error occurs, fault code ID can be read from Pr.09-63.

6.3 Fault Clearing

Fault	Cause	Corrective Action
POWER indicator OFF	Drive is not powered on	Check if the drive is powered on and the power supply of the drive is normal.
	CMM-EIP02 is not connected to the drive	Check if CMM-EIP02 is tightly connected to the drive.
LINK indicator OFF	Network is not connected	Check if connection cable is correctly connected to the network.
	Poor contact of RJ45 connector	Check if RJ45 connector is correctly connected to Ethernet communication port.
Option card cannot be found	CMM-EIP02 is not connected to network	Check if CMM-EIP02 is correctly connected to network.
	Computer and CMM-EIP02 are not in the same network and are blocked by network firewall	Use the assigned IP to locate or keypad to set.
CMM-EIP02 Setting page cannot be opened	CMM-EIP02 is not connected to network	Check if CMM-EIP02 is correctly connected to network.
	Incorrect DCISoft communication setting	Check if the communication of DCISoft is set to Ethernet.
	Computer and CMM-EIP02 are not in the same network and are blocked by network firewall	Use drive's keypad to set
CMM-EIP02 setting page can be opened, but **Monitor** page cannot be used	Incorrect CMM-EIP02 network setting	Check if the network setting of CMM-EIP02 is correct. If it is an Intranet, contact IT personnel. If it is a home networking, check the internet settings provided by Internet Service Provider (ISP).
E-Mail cannot be sent	Incorrect CMM-EIP02 network setting	Check if the network setting of CMM-EIP02 is correct.
	Incorrect mail server setting	Check the IP address of SMTP Server.

Appendix A. EtherNet/IP Service and Object

A.1 Object

EtherNet/IP uses Object as a set of parameters. Each Object defines parameters according to Class, Instance and Attribute. Instance 0 defines basic information of each Object, such as version and length. Instance 1 to Instance N are parameters that are required to establish connections or status. You can use Service Code that each object supports to read/write drive's parameters and specifications. See the diagram below.
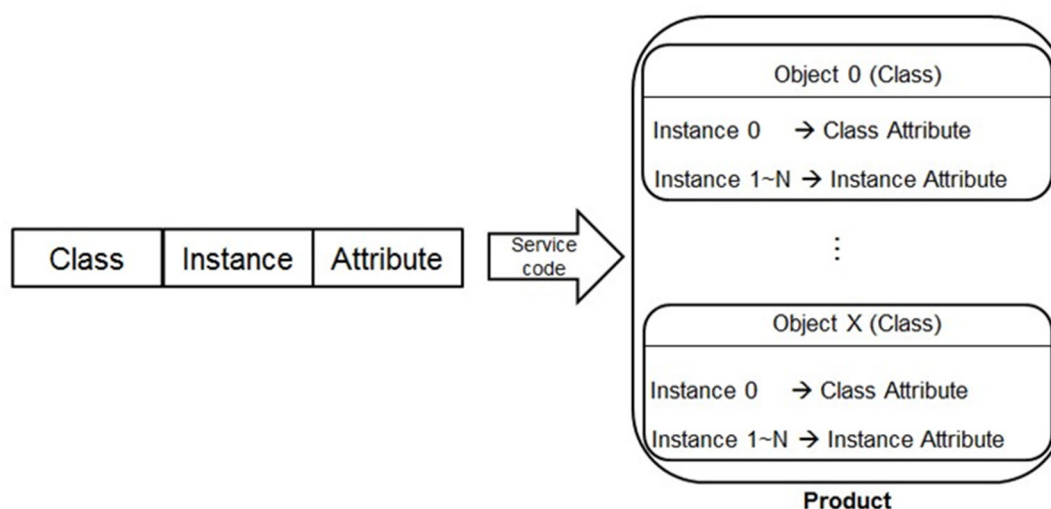
NOTE:

For details on the EtherNet/IP Object that the drive supports, see following sections. For the setting method, see Section 5.2 <EtherNet/IP Explicit Messaging>.

A.2 Supported Object

Object Name	Class Code	Description	Supported Models
Identity Object	0x01	Describes device information, including manufacturer, device type and version.	All models
Message Router Object	0x02	Provides connection status and supported number of connections.	All models
Assembly Object	0x04	Aggregates data for input and output data associated with I/O connections	All models
Connection Manager Object	0x06	Establishes CIP connection	All models
Device Level Ring Object	0x47	Enables with DLR function setting and connection status	Two-port option card
QoS Object	0x48	Distinguishes priorities by packet. When device support DLR function, DLR packet has priority over normal packet (in consideration of system recovering time).	Two-port option card
TCP/IP Interface Object	0xF5	Displays IP setting method and IP setting interface	All models
Ethernet Link Object	0xF6	Displays connection status for each Ethernet port on the device.	All models
VFD Data Object	0x300	Reads/writes drive's data object	All models
VFD Data Object	0x301	Reads/writes drive's data object	All models

A.3 Supported Data Type

Data Type	Description
BYTE	8-bit string
WORD	16-bit string
DWORD	32-bit string
STRING[n]	String consists of n characters
SHORT_STRING	String consists of characters
USINT	8-bit unsigned integers
UINT	16-bit unsigned integers
UDINT	32-bit unsigned integers

A.4 Identity Object (Class Code: 0x01)

A.4.1   Service Code

Service Code	Implemented for		Service Name	Description of Service
	Class	Instance		
0x01		✓	Get_Attribute_All	Read the attribute content of multiple objects
0x05		✓	Reset	Device settings reset
0x0E	✓	✓	Get Attribute Single	Read the attribute content of specified object

A.4.2   Instance Code: 0x00

Class Attribute ID	Access Rule	Name	Data Type	Description of Attribute
0x01	Get	Revision	UINT	Object version 1
0x02	Get	Max Instance	UINT	Maximum Instance number is 1
0x03	Get	Number of Instance	UINT	Number of Instances defined in Object is 1

A.4.3   Instance Code: 0x01

Instance Attribute ID	Access Rule	Name	Data Type	Description of Attribute
0x01	Get	Vendor ID	UINT	Vendor ID: 799 Delta Electronics, Inc.
0x02	Get	Device Type	UINT	Device Type: 12 Communications Adapter
0x03	Get	Product Code	UINT	Product Code
0x04	Get	Revision	STRUCT	Device EIP version
		Major Revision	USINT	Major version
		Minor Revision	USINT	Minor version
0x05	Get	Status	WORD	Summary status of devices
0x06	Get	Serial Number	UDINT	Serial Number: MAC Last four codes of address
0x07	Get	Product Name	SHORT_STRING	Product Name

A.5 Message Router Object (Class Code: 0x02)

A.5.1   Service Code

Service Code	Implemented for		Service Name	Description of Service
	Class	Instance		
0x0E	✓	✓	Get Attribute Single	Read the attribute content of the specified object

A.5.2   Instance Code: 0x00

Class Attribute ID	Access Rule	Name	Data Type	Description of Attribute
0x01	Get	Revision	UINT	Object version 1

A.5.3   Instance Code: 0x01

Instance Attribute ID	Access Rule	Name	Data Type	Description of Attribute
0x02	Get	Number Available	UINT	Maximum established number of connections
0x03	Get	Number Active	UINT	Currently number of established connections

A.6 Assembly Object (Class Code: 0x04)

A.6.1   Service Code

Service Code	Implemented for		Service Name	Description of Service
	Class	Instance		
0x0E	✓	✓	Get Attribute Single	Read the attribute content of the specified object
0x10		✓	Set Attribute Single	Modify attribute value

A.6.2   Instance Code: 0x00

Class Attribute ID	Access Rule	Name	Data Type	Description of Attribute
0x01	Get	Revision	UINT	Object version 2
0x02	Get	Max Instance	UINT	Maximum Instance number is 199 (0xC7)

A.6.3   Instance Code: 0x69, 0x68, 0x80, 0xC7

Instance Attribute ID	Access Rule	Name	Data Type	Description of Attribute
0x03	Get / Set	Data	ARRAY of BYTE	I/O connection data context
0x04	Get	Size	UINT	Instance attribute 0x03 data length

I/O Message Connection				
Name	Function	Instance	Size	Description
I/O Connection	Input	0x69	32 words	Corresponding input buffer register
	Output	0x68	32 words	Corresponding output buffer register
	Configuration	0x80	128 words	Corresponding setting element
I/O Connection Listen only	Input	0x69	32 words	Corresponding input buffer register
	Output	0xC7	0 words	

A.7 Connection Manager Object (Class Code: 0x06)

A.7.1   Service Code

Service Code	Implemented for		Service Name	Description of Service
	Class	Instance		
0x0E	✓	✓	Get_Attribute_Single	Read attribute content of specified object
0x4E		✓	Forward Close	Close CIP connection
0x54		✓	Forward Open	Establish CIP connection, maximum data volume is 511 bytes
0x5B		✓	Large_Forward_Open	Establish CIP connection, maximum data volume is 65535 bytes

A.7.2   Instance Code: 0x00

Class Attribute ID	Access Rule	Name	Data Type	Description of Attribute
0x01	Get	Revision	UINT	Object version 1
0x02	Get	Max Instance	UINT	Maximum Instance number is 1

A.7.3   Instance Code: 0x01

Instance Attribute ID	Access Rule	Name	Data Type	Description of Attribute
0x01	Get	Open Requests	UINT	Number of Forward Open service received
0x02	Get	Open Format Rejects	UINT	Forward Open rejected number of service requests due to format error
0x03	Get	Open Resource Rejects	UINT	Forward Open rejected number of service requests due to lack of resources
0x04	Get	Open Other Rejects	UINT	Forward Open rejected number of service requests due to other reasons
0x05	Get	Close Requests	UINT	Received Forward Close service number
0x06	Get	Close Format Rejects	UINT	Forward Open rejected number of service requests due to format error
0x07	Get	Close Other Reject	UINT	Forward Open rejected number of service requests due to other reasons
0x08	Get	Connection Timeouts	UINT	Timeout times of all connections of the device

A.8 Device Level Ring Object (Class Code: 0x47)

A.8.1 Service Code

Service Code	Implemented for		Service Name	Description of Service
	Class	Instance		
0x01		✓	Get_Attributes_All	Read attribute content of multiple objects
0x0E	✓	✓	Get_Attribute_Single	Read the attribute content of specified object
0x10		✓	Set_Attribute_Single	Modify attribute value
0x4B		✓	Verify_Fault_Location	Send Locate_Fault command to get the start and end addresses
0x4C		✓	Clear_Rapid_Faults	Send the Rapid Fault/Restore Cycle Detected command to make the supervisor return to normal operation
0x4D		✓	Restart_Sign_On	Send Sign On to refresh the DLR device list

A.8.2 Instance Code: 0x00

Class Attribute ID	Access Rule	Name	Data Type	Description of Attribute
0x01	Get	Revision	UINT	Object version 3

A.8.3 Instance Code: 0x01

Instance Attribute ID	Access Rule	Name	Data Type	Description of Attribute
0x01	Get	Network Topology	USINT	Current network topology 0: "Linear bus" ; 1: "Ring"
0x02	Get	Network Status	USINT	Current network condition
0x03	Get	Ring Supervisor	USINT	Ring Supervisor triggered status flag
0x0A	Get	Active Supervisor Address	STRUCT	Ring supervisor IP and MAC address
		Supervisor IP Address	UDINT	Supervisor device IP address
		Supervisor MAC Address	ARRAY of 6 USINTs	Supervisor device MAC address
0x0B	Get	Active Supervisor Precedence	USINT	Ring supervisor Precedence value
0x0C	Get	Capability Flags	DWORD	

A.9 Qos Object (Class Code: 0x48)

A.9.1   Service Code

Service Code	Implemented for		Service Name	Description of Service
	Class	Instance		
0x0E	✓	✓	Get_Attribute_Single	Read attribute content of specified object
0x10		✓	Set_Attribute_Single	Modify attribute value

A.9.2   Instance Code: 0x00

Class Attribute ID	Access Rule	Name	Data Type	Description of Attribute
0x01	Get	Revision	UINT	Object version 1

A.9.3   Instance Code: 0x01

Instance Attribute ID	Access Rule	Name	Data Type	Description of Attribute
0x01	Get/Set	802.1Q Tag Enable	USINT	Enable 802.1Q packet transmission 0: disable (Default); 1: enable
0x04	Get/Set	DSCP Urgent	USINT	
0x05	Get/Set	DSCP Scheduled	USINT	
0x06	Get/Set	DSCP High	USINT	
0x07	Get/Set	DSCP Low	USINT	
0x08	Get/Set	DSCP Explicit	USINT	

A.10   TCP / IP Interface Object (Class Code: 0xF5)

A.10.1   Service Code

Service Code	Implemented for		Service Name	Description of Service
	Class	Instance		
0x01		✓	Get_Attribute_All	Read attribute content of multiple objects
0x0E	✓	✓	Get Attribute Single	Read attribute content of the specified object
0x10		✓	Set Attribute Single	Modify attribute value

A.10.2   Instance Code: 0x00

Class Attribute ID	Access Rule	Name	Data Type	Description of Attribute
0x01	Get	Revision	UINT	Object version 4

A.10.3   Instance Code: 0x01

Instance Attribute ID	Access Rule	Name	Data Type	Description of Attribute
0x01	Get	Status	DWORD	Interface status
0x02	Get	Configuration Capability	DWORD	Interface capability flags
0x03	Get / Set	Configuration Control	DWORD	Interface control flags
0x04	Get	Physical Link	STRUCT	
		Path Size	UINT	0x0002
		Path	Padded EPATH	[20] [F6] [24] [01]
0x05	Get / Set	Interface Configuration	STRUCT	
		IP Address	UDINT	192.168.1.5
		Network Mask	UDINT	255.255.255.0
		Gateway Address	UDINT	192.168.1.1
		Name Server	UDINT	Primary name server
		Name Server 2	UDINT	Secondary name server
		Domain Name	STRING	Default domain name
0x06	Get / Set	Host Name	STRING	Host name

A.11   EtherNet Link Object (Class Code: 0xF6)

A.11.1   Service Code

Service Code	Implemented for		Service Name	Description of Service
	Class	Instance		
0x01		✓	Get_Attribute_All	Read attribute content of multiple objects
0x0E	✓	✓	Get Attribute Single	Read attribute content of the specified object

A.11.2   Instance Code: 0x00

Class Attribute ID	Access Rule	Name	Data Type	Description of Attribute
0x01	Get	Revision	UINT	Object version 4
0x02	Get	Max Instance	UINT	Max Instance number
0x03	Get	Number of Instance	UINT	The number of instances defined in Object

A.11.3   Instance Code: 0xN (Ethernet Port Number)

Instance Attribute ID	Access Rule	Name	Data Type	Description of Attribute
0x01	Get	Interface Speed	UDINT	Interface speed currently in use Speed in Mbps (e.g. 0, 10, 100, 1000, etc.)
0x02	Get	Interface Flags	DWORD	Interface status flags
0x03	Get	Physical Address	USINT	MAC address
0x07	Get	Interface Type	USINT	Type of interface: twisted pair, fiber, internal, etc. 2-Port option card only
0x08	Get	Interface Sate	USINT	Current state of the interface: operational, disabled, etc. 2-Port option card only
0x0A	Get	Interface Label	SHORT_STRING	Human readable identification
0x0B	Get	Interface Capability	STRUCT	
		Capability Bits	DWORD	Bit map
		Speed/Duplex Options	STRUCT	
		Speed/Duplex Array Count	USINT	Number of elements
		Speed/Duplex Array	ARRAY of STRUCT	
		Interface Speed	UINT	Semantics are the same as the Forced Interface Speed in the Interface Control attribute: speed in Mbps
		Interface Duplex Mode	UINT	0=half duplex 1=full duplex 2-255=Reserved

A.12   VFD Data Object (Class Code: 0x300)

A.12.1   Service Code

Service Code	Implemented for		Service Name	Description of Service
	Class	Instance		
0x0E		✓	Get_Attribute_Single	Read attribute content of the specified object
0x10		✓	Set_Attribute_Single	Modify attribute value

A.12.2   Instance Attributes

Instance & Attributes					
Instance	Attributes	Access Rule	Name	Data Type	Description of Attribute
0x00–0x0E	0x00–0x63	Get / Set*	VFD Parameter	UDINT, STRING	VFD parameter data Instance: Parameter Group Attribute: Parameter Number
0x20	0x00–0x02	Get / Set	VFD Command	UDINT, STRING	VFD command Data
0x21	0x00–0x1F	Get	VFD Status	UDINT, STRING	VFD status Data
0x22	0x00–0x31	Get	VFD Status	UDINT, STRING	VFD status Data
0x26	0x00–0x01 0x60–0x62	Get	VFD Command	UDINT, STRING	VFD command Data
	0x40–0x41 0xA0–0xA2	Get / Set	VFD Command	UDINT, STRING	VFD command Data
0x60	0x00–0x07	Get / Set	VFD Command	UDINT, STRING	VFD command Data
0x61	0x00–0x06	Get	VFD Status	UDINT, STRING	VFD status Data

*NOTE: See the user manual of the drive to check if the parameters are read-only. It they are read-only, it is suggested not change the attribute value.

A.13 VFD Data Object (Class Code: 0x301)

A.13.1 Service Code

Service Code	Implemented for		Service Name	Description of Service
	Class	Instance		
0x0E		✓	Get_Attribute_Single	Read attribute content of the specified object
0x10		✓	Set_Attribute_Single	Modify attribute value

A.13.2 Instance Code: 0x01

Attribute = Parameter Modbus Address (Decimal) + 1

Instance & Attributes					
Modbus Address	Attributes	Access Rule	Name	Data Type	Description of Attribute
0x0000–0x0E63	1–3684	Get / Set*	VFD Parameter.	UDINT, STRING	VFD parameter data
0x2000–0x2002	8193–8195	Get / Set	VFD Command	UDINT, STRING	VFD command Data
0x2100–0x211F	8449–8480	Get	VFD Status	UDINT, STRING	VFD status Data
0x2200–0x2231	8705–8754	Get	VFD Status	UDINT, STRING	VFD status Data
0x2600–0x2601 0x2660–0x2662	9729–9730 9825–9827	Get	VFD Command	UDINT, STRING	VFD command Data
0x2640–0x2641 0x26A0–0x26A2	9793–9794 9889–9891	Get / Set	VFD Command	UDINT, STRING	VFD command Data
0x6000–0x6007	24577–24584	Get / Set	VFD Command	UDINT, STRING	VFD command Data
0x6100–0x6106	24833–24839	Get	VFD Status	UDINT, STRING	VFD status Data

*NOTE: See the user manual of the drive to check if the parameters are read-only. It they are read-only, it is suggested not change the attribute value.