VFD-MS300/MH300
EtherNet/IP Communication Card

Operation Manual

http://www.delta.com.tw/industrialautomation

⚠ Caution

✓ This operation manual provides information on the specifications, installation instructions, basic operation / configuration, and details related to network communication protocols.

✓ The AC drive is a precision product powered by electricity. For the safety of the operator and to safeguard your mechanical equipment, only qualified electrical engineers should perform the installation / test runs and make parameter adjustments. Please contact your local Delta distributor if you have any questions or concerns. Our professional staff will do their best to assist you.

✓ To prevent damage to the device and to avoid personal injuries, please read this manual carefully and follow the operation instructions closely.

Table of Contents

1 Introduction

1.1 Introduction to EtherNet/IP Communication

EtherNet/IP is an industrial EtherNet protocol managed by ODVA, Inc. (formerly Open DeviceNet Vendors Association, Inc.); here, "IP" is the abbreviation for Industrial Protocol. EtherNet/IP is built on the TCP / IP communication protocol, and it is compatible with ordinary IT networks; it provides a fast and reliable infrastructure for factory automation (FA) , building automation (BA) , and process automation (PA) applications. Delta's EtherNet/IP products cover various control and drive applications, including programmable logic controllers, AC drives, human-machine interfaces, servers, and switches.

Peripheral devices for EtherNet/IP communication supported by our VFD products include the CMM-EIP01 communication card. In addition to supporting the EtherNet/IP protocol, it is also possible to use the DCISoft program to configure and monitor a VFD via a web-based interface. It is also possible to use the program in conjunction with a graphical control software and human-machine interface for remote control and monitoring. In addition, with the automatic detection features of the MDI / MDI-X, it is not necessary to use a jumper cable. In the following sections, we will provide a more detailed description of the CMM-EIP01 communication card.

1.2 Features

● Auto-detects transmission speed: 10 / 100 Mbps
● MDI / MDI-X auto-detection
● Supports EtherNet/IP explicit message
● Supports EtherNet/IP I/O connection (Implicit message)

1.3 Network Functions and Specifications

■ EtherNet specifications

Item	Specifications
Interface	RJ-45 with Auto MDI / MDIX
Number of ports	1 Port
Communication mode	IEEE802.3, IEEE802.3u
Cable	Category 5e shielding 100 M
Transmission speed	10 / 100 Mbps Auto-Defect
Communication protocol	EtherNet/IP
Service support	BOOTP

■ Environment specifications

Item	Specifications
Noise immunity	ESD (IEC 61800-5-1, IEC 6100-4-2)
	EFT (IEC 61800-5-1, IEC 6100-4-4)
	Surge Teat (IEC 61800-5-1, IEC 6100-4-5)
	Conducted Susceptibility Test (IEC 61800-5-1, IEC 6100-4-6)
Operating temperature	-10 °C – 50 °C (temperature), 90 % (humidity)
Storage	-25 °C – 70 °C (temperature), 95 % (humidity)
Vibration / Shock resistant	International standards IEC 61800-5-1,IEC 60068-2-6 / IEC 61800-5-1,IEC 60068-2-27
Standards	CE c(UL)us

■ Electrical specifications

Item	Specifications
Power supply voltage	5 V$_{dc}$
Power consumption	0.8 W
Insulation voltage	500 V$_{dc}$
Weight (g; approx.)	25 (g)

1.4 Glossary / Terms

Abbreviation	Description
ODVA	Open DeviceNet Vendor Association, the organization responsible for managing EtherNet/IP.
EIP	EtherNet/IP, an industrial network protocol that adapts the Industrial Protocol to standard EtherNet. Products from different vendors implementing this protocol enjoy interoperability. IP is short for Industrial Protocol. EIP is the abbreviation used in this manual.
I/O Connection	EtherNet/IP data exchange at regular intervals
Explicit Message	EtherNet/IP non-regular data exchange; data is transmitted via commands one record at a time.
RPI	Requested Packet Interval, IO connection time interval between regular data exchanges.
EDS	Electronic Data Sheets. Used to identify EtherNet/IP-based devices in an EtherNet/IP network.
Data Mapping	Data exchange, equipment and data conversion between devices.
EIP Scanner	EIP master station, designated as the "Scanner" in EtherNet/IP.
DLR	Device Level Ring, for EtherNet/IP cabling redundancy function.
EIP Adapter	EIP slave station; designated as an Adapter in EtherNet/IP.
Cyclic (regular)	The host controller issues commands at regular intervals to the communication card, and each card also issues commands at regular intervals to the VFD.
Non-cyclic (non-regular)	The host controller issues commands to the communication card on demand, and the communication card will also issue commands to the drive based on the actual timing of processing.

1.5 Supports EtherNet/IP Specifications

1.5.1 EtherNet/IP Specifications

Item		Specifications
General	Device category	Adapter
	Topology support	Star
CIP service class_ IO Connection	Max. no. of CIP connections	16 (Clients + Servers)
	Max. no. of TCP connections	8 (Clients + Servers)
	Packet transmission interval	5 ms ~ 1000 ms
	Max. communication capacity	800 pps
	Max. data length	500 bytes
CIP service class_ Explicit Message	Class 3 (Connected Type)	16 (Clients + Servers) , shared with UCMM
	UCMM (Non-Connected Type)	16 (Clients + Servers) , shared with Class 3
	Supports CIP objects	Identity, Message Router, Assembly, Connection Manager, TCP / IP interface, EtherNet link, Vendor specific

1.5.2 Supports services and CIP objects

EtherNet/IP employs "Objects" as the collection of parameters. Each Object defines its own parameters based on the structures of its Class, Instance, and Attribute. In particular, Instance 0 defines the basic information of each Object such as its version number and length. Instances 1 to N represent the parameter values required for each device to establish a connection or obtain status information. User may access product parameters via the service code supported by various Objects. Refer to the diagram below:
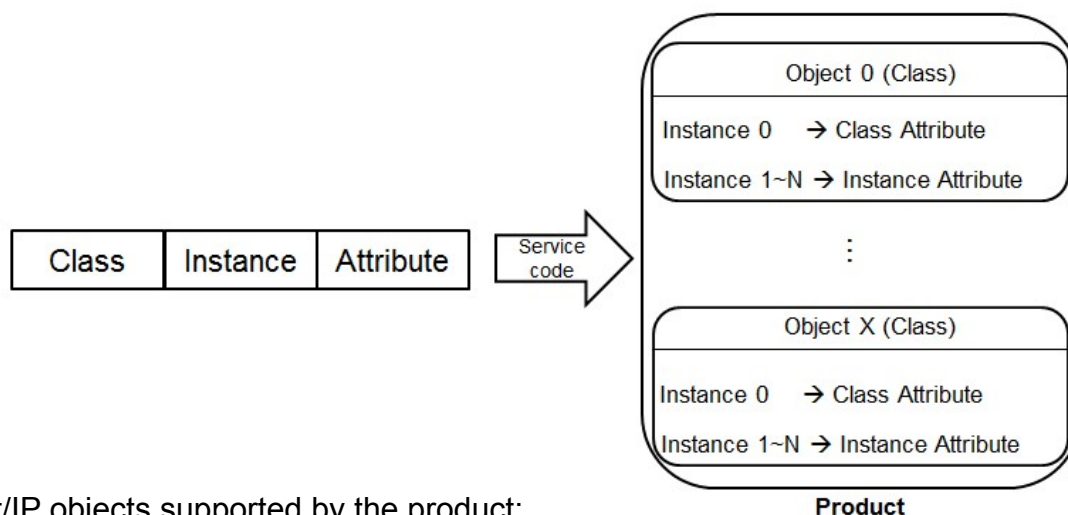
EtherNet/IP objects supported by the product:

Name of element	Class Code	Element description
Identity Object	0x01	Device identification element
Message Router Object	0x02	Message route element
Assembly Object	0x04	Assembly element
Connection Manager Object	0x06	Connection management element
TCP / IP Interface Object	0xF5	For TCP / IP interface
EtherNet Link Object	0xF6	For EtherNet connection
VFD Data Object	0x300	AC drive control element

Refer to Appendix A for the descriptions of object elements.

1.5.3 CIP common status codes

| Status code	Status name	Definition
0x00	Success	Requested service has been successfully executed
0x01	Connection failure	Connected service has failed
0x04	Path segment error	Process node cannot identify the definition or syntax of a path segment. When this error occurs, execution of the path program will be terminated.
0x05	Path destination unknown	The path is related to the category of an object, but the process node does not cover or cannot identify the type or structure of the element. When this error occurs, execution of the path program will be terminated.
0x08	Service not supported	Requested service not supported by this object class, or service not defined.
0x0E	Attribute not settable	Received request to change an unmodifiable attribute
0x13	Not enough data	Unable to execute command due to insufficient data received
0x14	Attribute not supported	Requested attribute not supported

Status code	Status name	Definition
0x15	Too much data	Received data exceeds what is required in executing the command
0x20	Invalid parameter	Illegal parameter requested. The requested parameter is invalid, indicating that the parameter does not fit the definition of the requirement, or the requirement has already been defined in "Application Object Specification".
0x26	Path Size Invalid	The size of a path transmitting requested service is insufficient for transmitting to the object by request, or too much routing data is covered

1.5.4 Error codes for connecting to monitoring service requests

Status code	Extended status code	Definition
0x00	—	Service execution successful
0x01	0x0100	Connection is in progress or the connection is re-opened. The extended status code will be returned when the source is attempting to establish a connection to the target, but the target has already been connected.
0x01	0x0103	Does not support the combination of this transmission type and trigger The target does not support the defined combination of transmission type and trigger. The router will not terminate the connection, only the target is required to return this extended status code.
0x01	0x0106	Conflict of right to control Another connection has taken control and is preventing other connections from being established. When this device connects in an exclusive manner, only one connection will be allowed to control this device.
0x01	0x0107	Unable to locate the corresponding target in order to connect.
0x01	0x0108	Illegal network connection parameter When the target's application program does not support the defined connection mode or connection class, or if there are too many users, this extended status code will be returned. Only the target node has to return this extended status code.
0x01	0x0109	Data exchange zone size settings are invalid This device does not support the setting of the current data exchange zone; the setting may be too large or too small.
0x01	0x0111	RPI setting not supported
0x01	0x0113	The number of connections has exceeded the maximum allowed. The maximum number of connections has been reached; no additional connections are allowed for this device.
0x01	0x0114	Vendor ID does not match the product code The product code or vendor ID marked in the electronic key's logic section does not match the record in the target device.
0x01	0x0115	Product type mismatch The product type marked in the electronic key's logic section does not match the record in the target device.
0x01	0x0116	Version mismatch The primary and secondary revised versions marked in the electronic key's logic section do not match the records in the target device.
0x01	0x0315	Invalid section exists in the connection path The section type or section value in the path is invalid. If the device is unable to interpret the path, it will respond with this extended status code. Causes of this error include unidentifiable path types, unexpected section types, or other problems.

2   Product Appearance and Components

2.1   Exterior Dimensions
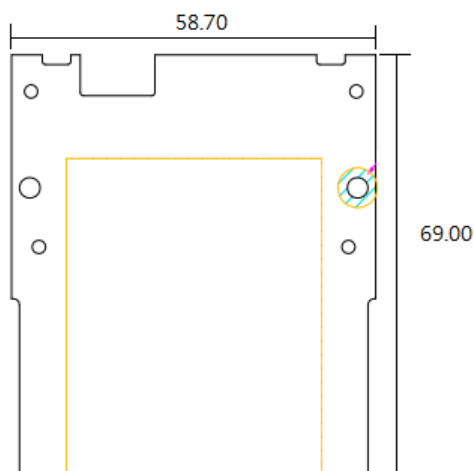
Unit: mm

2.2   Introduction of each Component
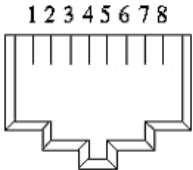
1. Screw fixing hole
2. Positioning hole
3. AC drive connection port
4. Communication port
5. Indicator
6. Ground terminal block
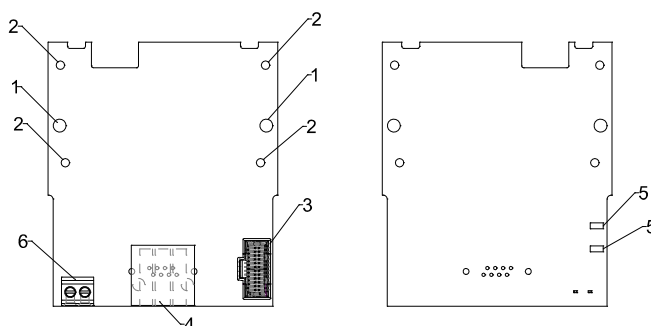
2.3 LED Indicators

Name	Indicator status		Indication
Power indicator	Green / Red LEDs	Flashing red / green alternately	Product status self-testing
		Red LED always on	Device has experienced an unrecoverable error
		Green light always on	Device parameter configuration is complete
		Flashing red light	A recoverable error has occurred
		Flashing green light	Device parameters not configured
		LED is off	No power supply
Link indicator	Green LED	Flashing red / green alternately	Network status self-testing
		Red LED always on	Duplicate IP address
		Green LED always on	Network connection normal
		Flashing red light	Communication time out/disconnected / IP changed
		Flashing green light	Network packets transmitting/receiving
		LED is off	Not connected to a network

2.4 RJ-45 Pin Definitions

RJ-45 Pinout diagram	PIN	Definition	Description
1 2 3 4 5 6 7 8	1	Tx+	Positive pole for data transmission
	2	Tx-	Negative pole for data transmission
	3	Rx+	Positive pole for receiving data
	4	--	N / C
	5	--	N / C
	6	Rx-	Negative pole for receiving data
	7	--	N / C
	8	--	N / C

3   Installation and Wiring

In this section, we illustrate how to connect CMM-EIP01 to VFD-MS300/MH300, as well as connect CMM-EIP01 to the network.

3.1   Installation

How to connect CMM-EIP01 to the VFD-MS300/MH300 series:

3-1-1   Installation (1) (Take MS300 as an example)

1. Switch off the power supply.

2. Open the front cover of the drive.

3. As shown in Fig. 1, aim the two clips at the communication card fixed fitting. Press the fixed fitting to clip the slot.

Communication card
fixed fitting

Clip

Slot

Clip

Slot
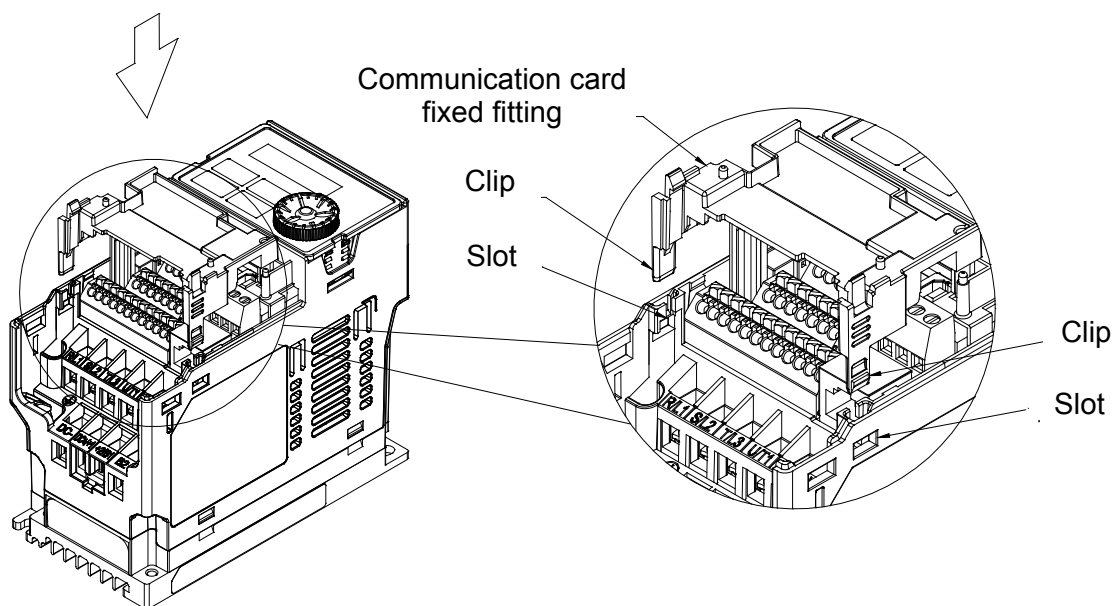
Fig. 1

4. As shown in Fig. 2, aim the three holes at the positioning pin. Press the pin to clip the holes with the communication card.

Position pin

Clip

Clip

Position pin

Position pin
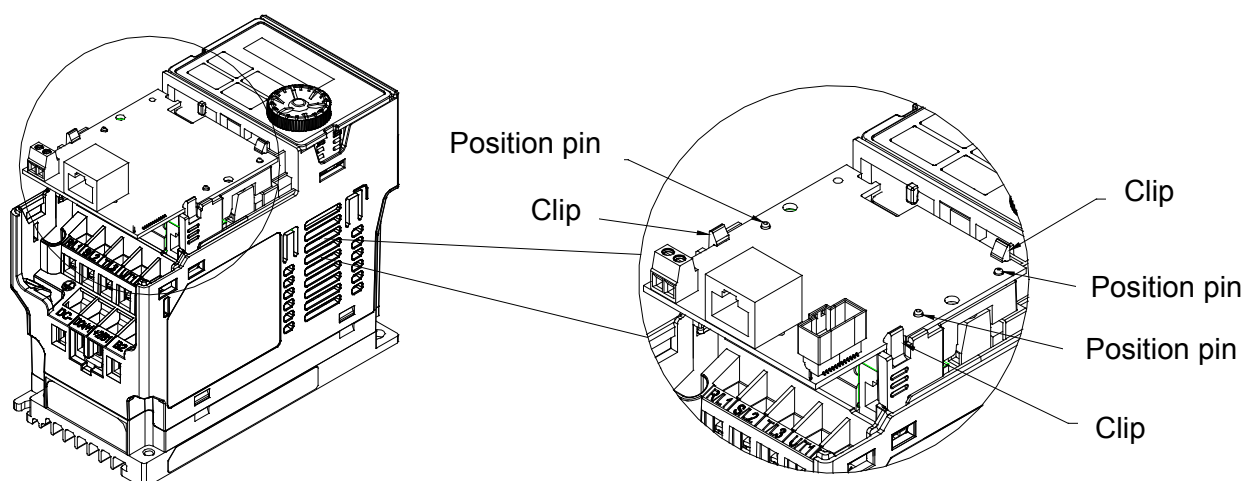
Clip

Fig. 2

5. Wiring after the communication card fixed fitting is clipped with the holes (see ⬛➔ NOTE). Fasten the screw if the communication card maintains front mounting. Torque: 4~6 kg-cm / [3.5~5.2 lb-in.] / [0.39~0.59 Nm], do not close the front cover at this time. (shown in Fig. 3) If close the front cover，please refer to the subsequent steps.

Torque:
4~6 kg-cm
[3.5~5.2 lb-in.]
[0.39~0.59 Nm]

Position pin
Clip
Clip
Position pin
Position pin
Clip
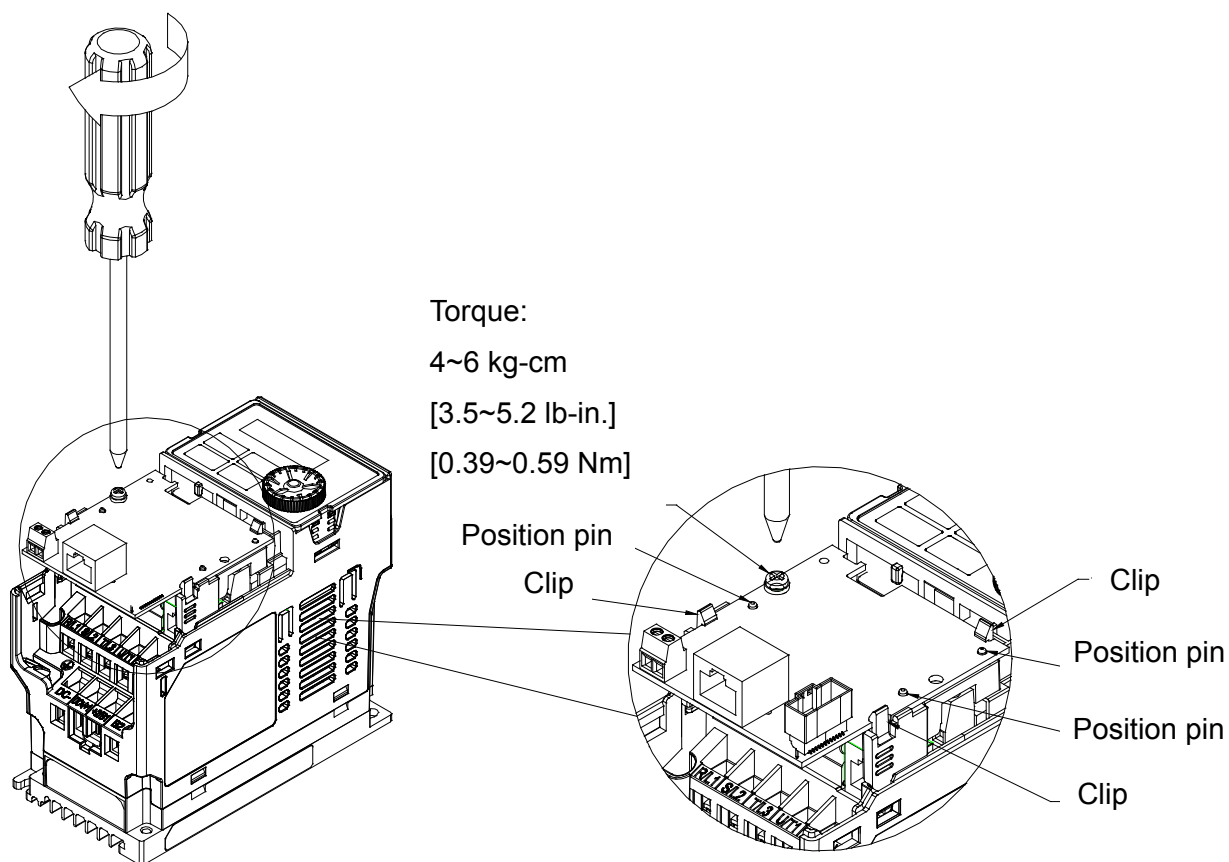
Fig. 3

6. After the wiring is completed, loosen the communication card of the front mounting，and reverse-mounted, aim the three holes at the positioning pin, press the pin to clip the holes with the communication card. (shown in Fig. 4)

Position pin
Clip
Clip
Position pin
Position pin
Clip
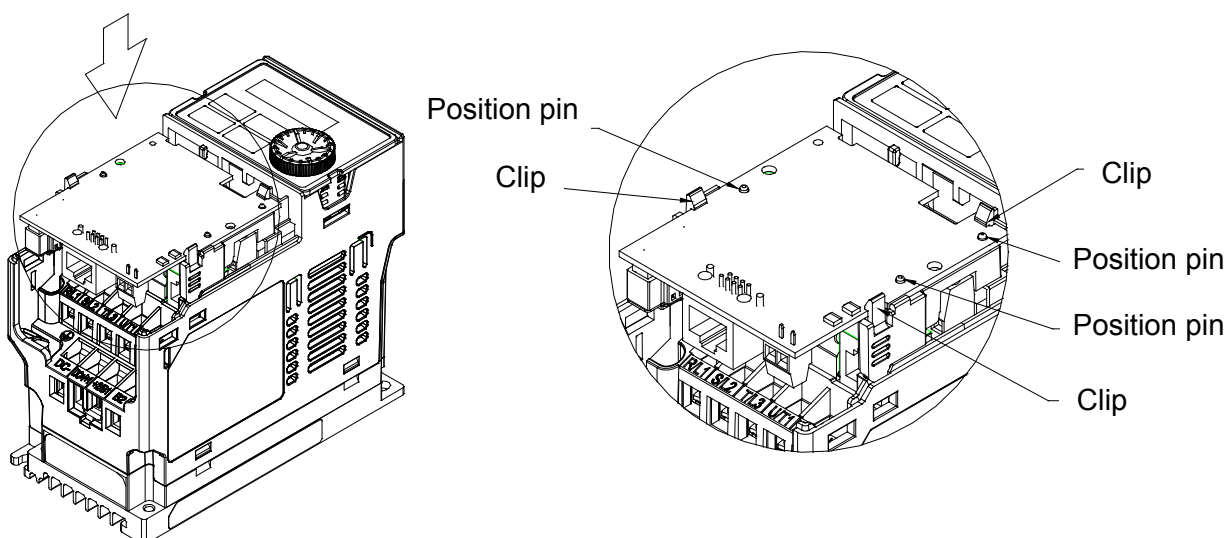
Fig. 4

7. Fasten the screw after the communication card fixed fitting is clipped with the holes. (shown in Fig. 5)

Torque:
4~6 kg-cm
[3.5~5.2 lb-in.]
[0.39~0.59 Nm]

Position pin

Clip

Clip

Position pin

Position pin

Clip
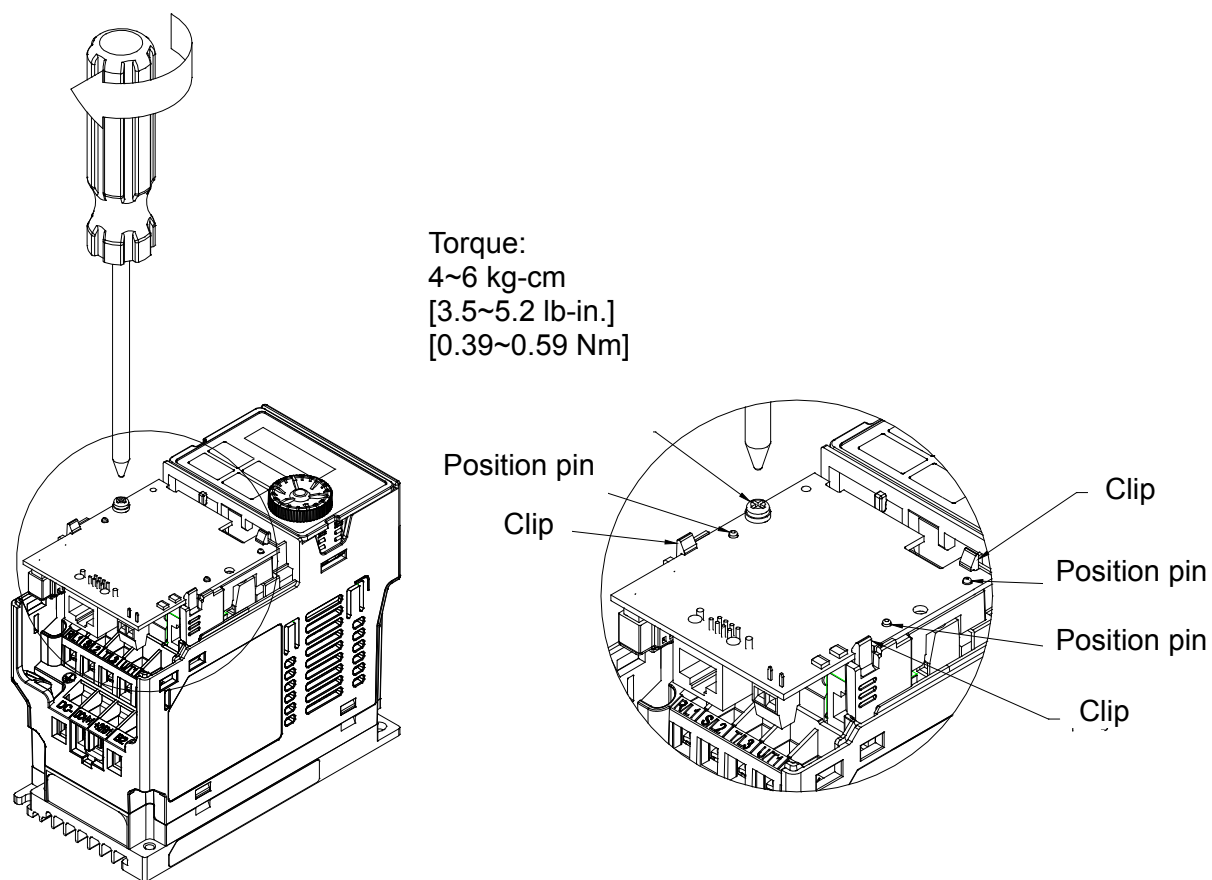
Fig. 5

8. Installation is completed. (shown in Fig. 6) The upper cover can be installed.
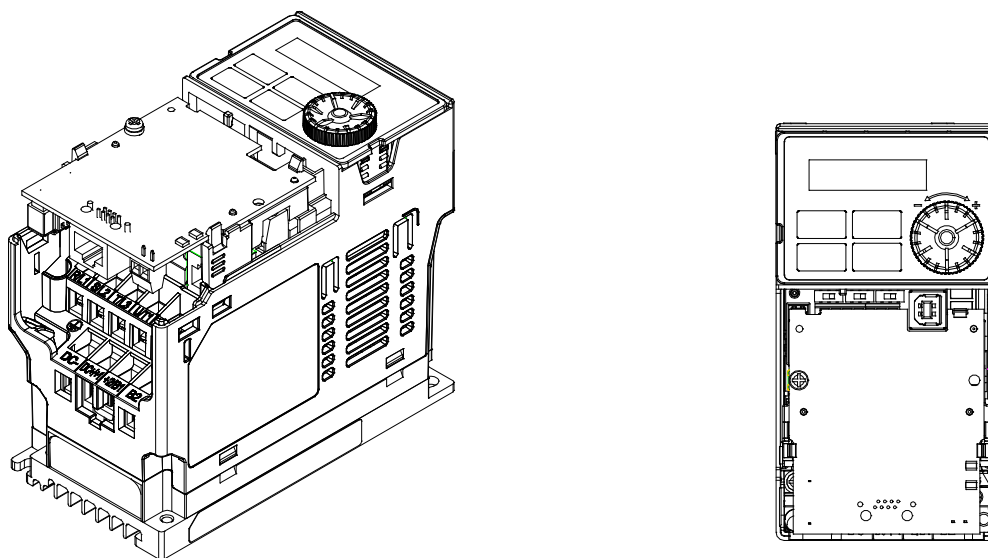
Fig. 6

3-1-2　Installation (2)

This method is only for MH300 series to install a second option card. (see 📖 **NOTE**)

Frame A~D

① ② ③

Clip　　　　Clip

Position
Pin

Position
Pin

Position
Pin

Clip　　　　Clip

④

⑤ ⑥

SCREW:
TORQUE:0.39~0.59 Nm
(4~6 kg-cm)
(3.47~5.21 lb-in.)

⑦,

⑧
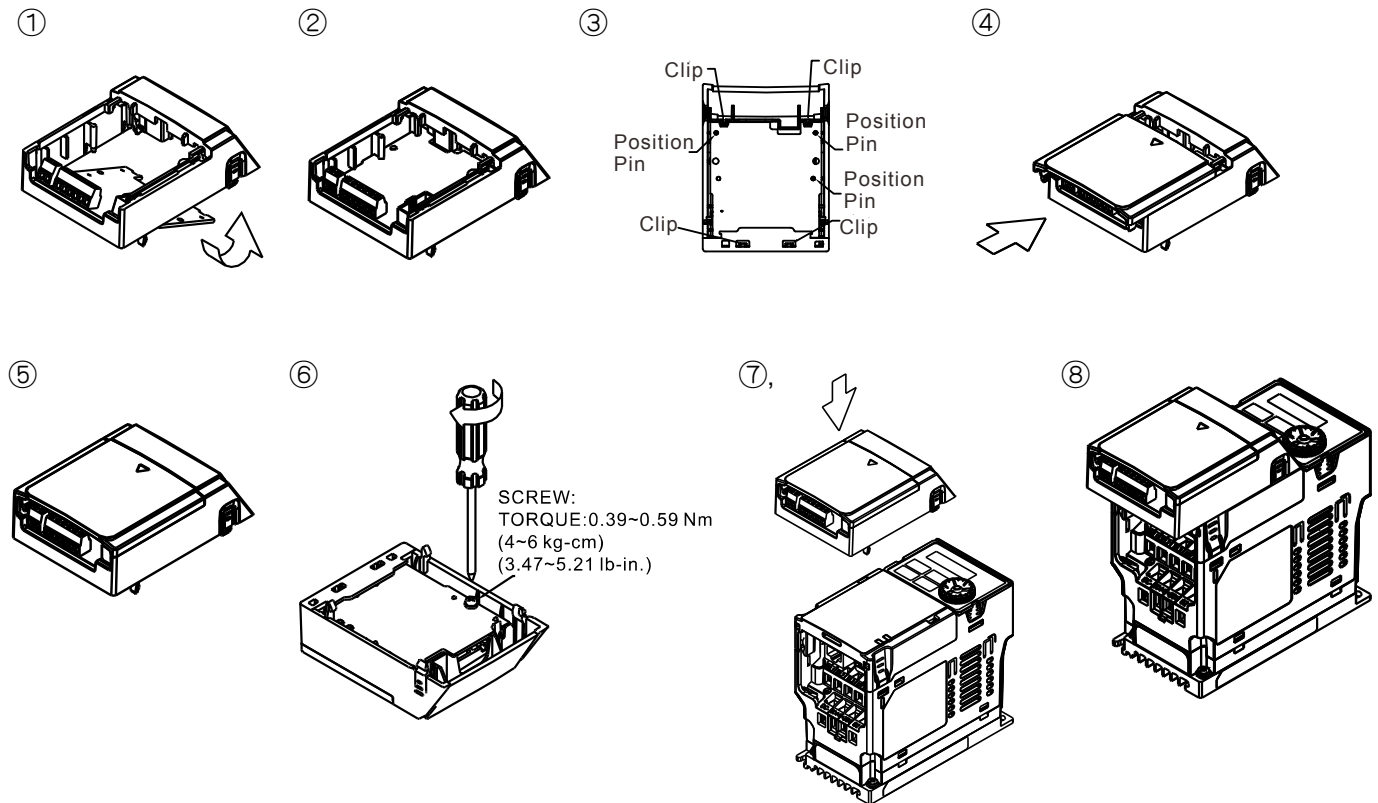
Frame E~F　(Only for IO / RELAY/ PG extension card.)

①

Position Pin

Clip

Clip

Position
Pin

Clip

Clip

Position
Pin

②

Position Pin

Clip

Clip

Clip

Clip

Position Pin

SCREW:
TORQUE:0.39~0.59 Nm
(4~6 kg-cm)
(3.47~5.21 lb-in.)

③
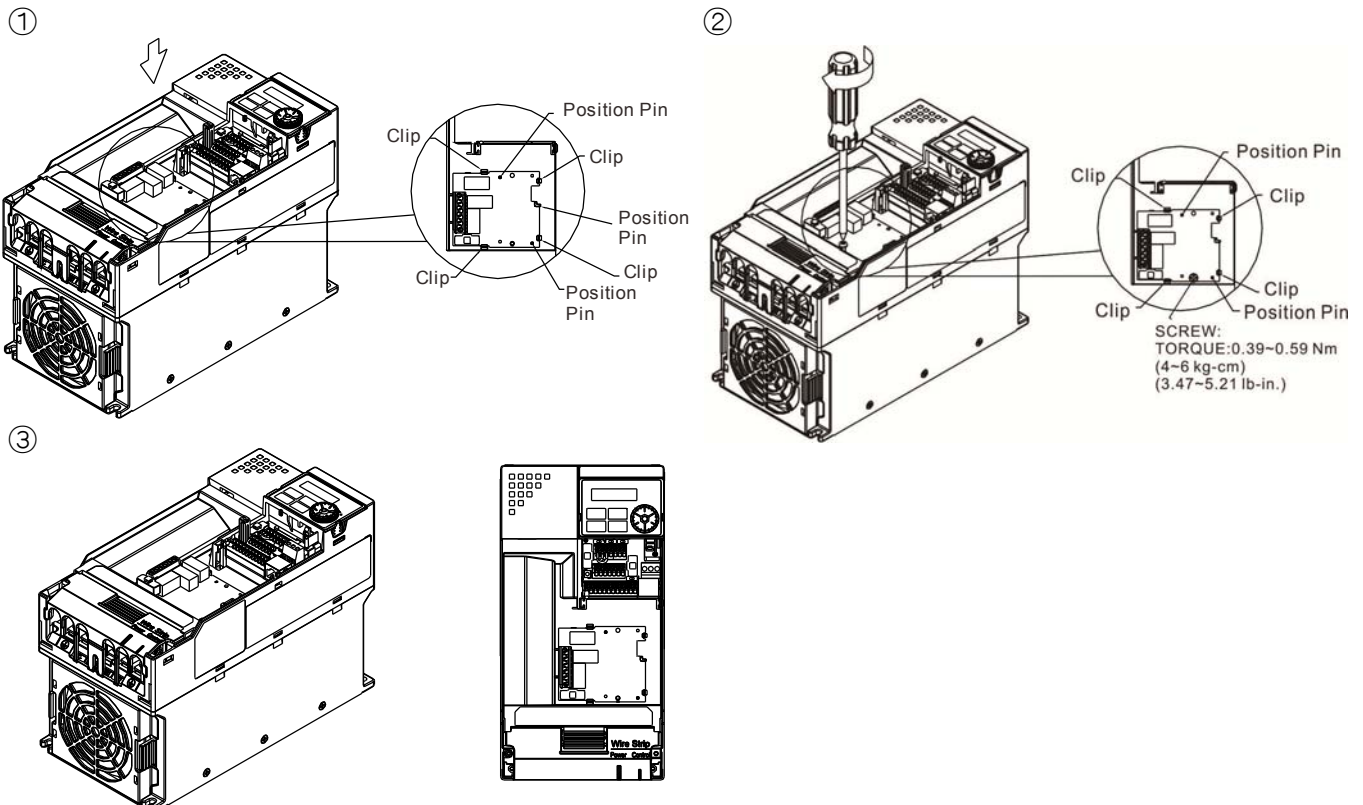
> **NOTE**

- The communication cards listed below must connect to ground when wiring. The ground terminal is enclosed with communication card as shown in Fig. 7.

  1. CMM-MOD01
  2. CMM-PD01
  3. CMM-DN01
  4. CMM-EIP01
  5. EMM-PG01L
  6. EMM-PG01O
  7. EMM-PG01R
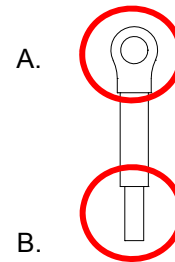
Fig. 7

- Installation of the ground terminal:

  B side of the ground terminal connects to the ground terminal block on communication card as No.6 of CMM-EIP01 shown in Fig. 8, and see each section in Chapter 8 of MS300/MH300 User Manual for ground terminal blocks of other option cards; A side of the ground terminal connects to the PE on the drive as red circles shown in Fig. 9 ~ 11.

Fig. 8

Frame A~C

Fig. 9

Torque (±10%)
Frame A: 9 kg-cm [7.8 lb-in.] [0.88 Nm]
Frame B: 15 kg-cm [13.0 lb-in.] [1.47 Nm]
Frame C: 20 kg-cm [17.4 lb-in.] [1.96 Nm]
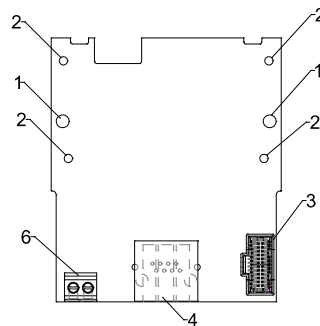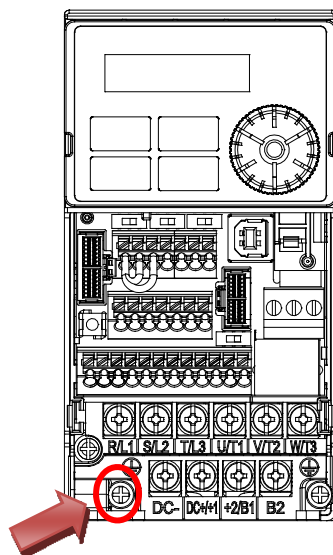
Frame D~E

Fig. 10

Torque (±10%)
Frame D: 20 kg-cm [17.4 lb-in.] [1.96 Nm]
Frame E: 25 kg-cm [21.7 lb-in.] [2.45 Nm]

Frame F
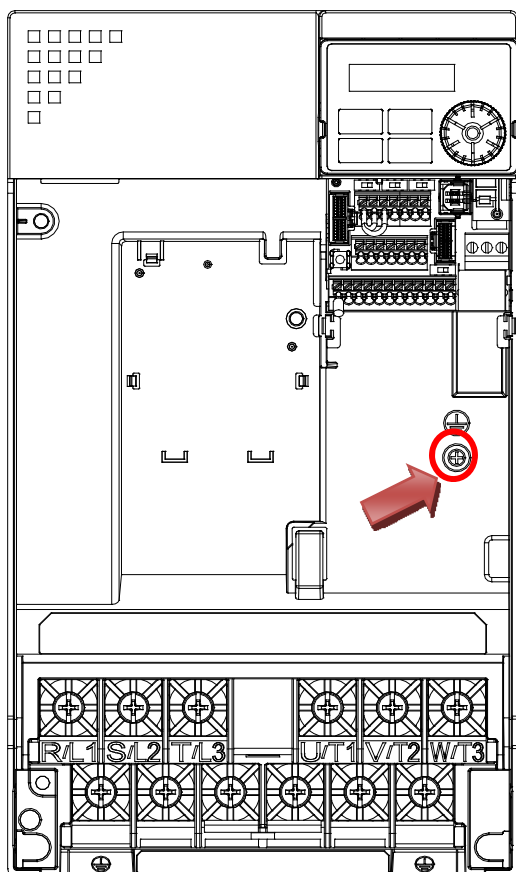
Fig. 11

Torque (±10%)
Frame F: 7 kg-cm [6.1 lb-in.] [0.69 Nm]

3.2 Connecting to the Network

Connect the CMM-EIP01 to the EtherNet hub by using CAT-5e pair twisted cable. Since the CMM-EIP01 has auto MDI / MDIX function, CAT-5e does not require a jumper cable.

Network connection diagram between the PC and CMM-EIP01:
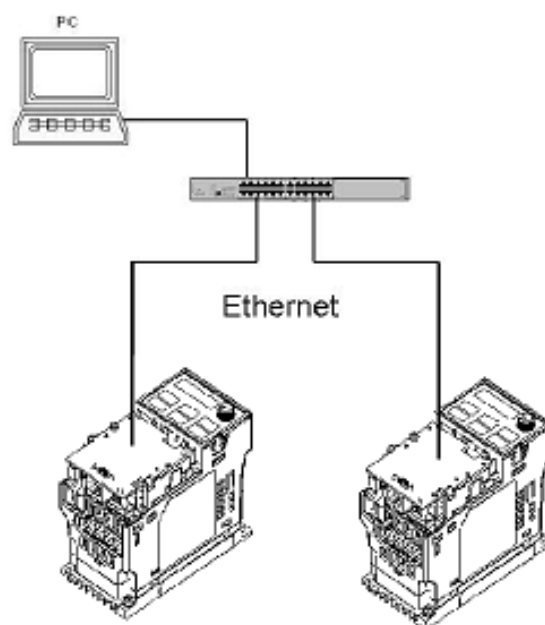
4 VFD-MS300/MH300 drive settings

When operate VFD-MS300/MH300 through CMM-EIP01 over a network, set the control of VFD-MS300/MH300 to the CMM-EIP01 card first. Use the keypad to configure the parameter addresses below to the corresponding values:

Keypad parameter no.	Setting / displayed value	Description of Function
Pr. 00-20	8	Set the source of frequency command to the "CMM-EIP01" communication card
Pr. 00-21	5	Set the control source to CMM-EIP01 communication card
Pr. 09-30	0	0: Use decoding method 1 (20xx) 1: Use decoding method 2 (60xx)
Pr. 09-60	5	Communication card identification: When connected to the CMM-EIP01 communication card, the parameter value displayed is 5 (EtherNet/IP Slave)

Note: When the CMM-EIP01 communication card is connected, the drive will display a warning code ECFE (EtherNet connection error) if the RJ-45 cable is not connected. Refer to Section 8.2 for the description of warning / error codes.

4.1 Control Method Selection

The EtherNet/IP interface supports various modes of control for the VFD. There are two types of control modes defined by Delta. One is the older control mode (Pr. 09-30 = 0), which can be used only under the VFD's frequency control. The other is a new control mode (Pr. 09-30 = 1), which allows the drive to be operated under different modes. Currently the MS300/MH300 supports speed, torque, position, and homing modes.

EtherNet/IP Control method selection	Control method							
	Speed		Torque		Position		Homing Origin	
	Object instance attribute	Description	Index	Description	Index	Description	Index	Description
Delta-defined control mode (Old definition 20xx) Pr. 09-30 = 0	0x300 0x20 0x01	Target speed (Hz)	-----	-----	-----	-----	-----	-----
Delta-defined control mode (New definition 60xx) Pr. 09-30 = 1	0x300 0x60 0x02	Target speed (Hz)	0x300 0x60 0x06	Target torque (%)	-----	-----	-----	-----
	x300 0x60 0x03	Torque limit (%)	0x300 0x60 0x07	Speed limit (Hz)	-----	-----	-----	-----

EtherNet/IP Control method selection	Operation control	
	Object instance attribute	Description
Delta-defined control mode (Old definition 20xx) Pr. 09-30 = 0	0x300 0x20 0x00	Operation command
Delta-defined control mode (New definition 60xx) Pr. 09-30 = 1	0x300 0x60 0x00	Operation command

4.2 Using old Delta Standards (only speed mode is supported)

4.2.1 Basic VFD Configurations

In order to operate the drive via Delta-defined control modes, refer to the following configuration procedure.

1. Wiring (refer to 3.3 EtherNet/IP wiring).
2. Setting source of operation: Drive parameter setting 00-21=5. Selected operational command comes from EtherNet/IP settings. (Run / stop, forward / reverse rotation, etc.)
3. Setting frequency source: Drive parameter setting 00-20=8. Selected frequency command comes from EtherNet/IP settings.
4. Selecting control mode by using old Delta definitions: Drive parameter setting 09-30=0.
5. Setting EtherNet/IP format: Drive parameter 09-75 can be used to set up the IP configuration format (default 0 = static IP; 1 = dynamic IP / DHCP).
6. Setting the IP address of the EtherNet/IP communication card: Drive parameters 09-76, 09-77, 09-78, and 09-79 can be used to configure the IP address (default IP address: 192.168.01.05).
7. Setting EtherNet/IP communication card's netmask: Netmask can be set via drive parameters 09-80, 09-81, 09-82, and 09-83 (default netmask: 255.255.255.0).
8. Setting the gateway for the EtherNet/IP communication card: Gateway can be configured via drive parameters 09-84, 09-85, 09-86, and 09-87 (default gateway: 192.168.01.01).

4.2.2 Using Speed Mode as a Control Method

1. Setting the target frequency: Set (Object, Instance, Attribute) = (300h, 20h, 01h), Unit = Hz, with a decimal precision at the hundredths position. Example: 1000 represents 10.00.
2. Operation: Setting (Object, Instance, Attribute) = (300h, 20h, 00h) = 0002H indicates run, and (Object, Instance, Attribute) = (300h, 20h, 00h) = 0001H indicates stop.
3. Acceleration/deceleration time operations: If the first acceleration / deceleration section is used as the basis, the acceleration time is set to (Object, Instance, Attribute) = (300h, 01h, 12h) and the time is set to (Object, Instance, Attribute) = (300h, 01h, 13h) , with unit = seconds and a decimal precision at the tenths position. Example: 100 represent 10.0 seconds.

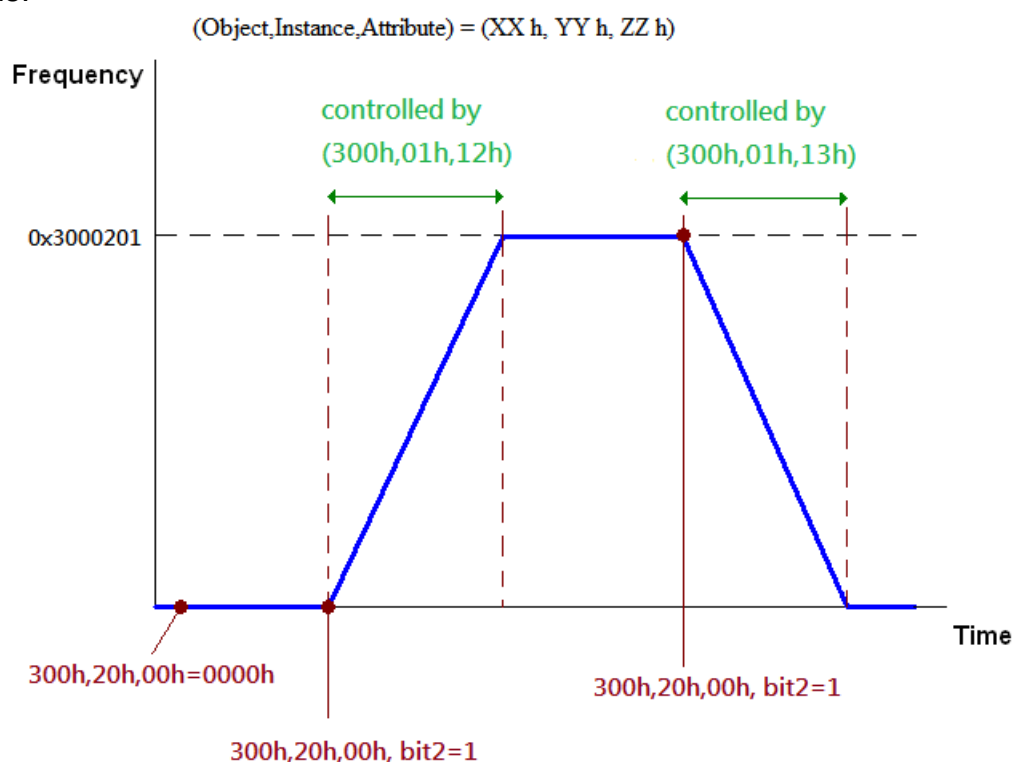## 4.3 Using Delta Standards (new definitions)

4.3.1 VFD Configurations (using new Delta standards)

In order to operate the drive via Delta-defined control modes, refer to the following configuration procedure.

1. Wiring (refer to 3.3 EtherNet/IP wiring).
2. Setting source of operation: Drive parameter setting 00-21=5. Selected operational command comes from EtherNet/IP settings. (Run / stop, forward / reverse rotation, etc.)
3. Setting frequency source: Drive parameter setting 00-20=8. Selected frequency command comes from EtherNet/IP settings.
4. Setting torque source: Drive parameter setting 11-33=3. Selected torque command comes from EtherNet/IP settings.
5. Source of setting position: Drive parameter setting 11-40=3. Selected torque command comes from EtherNet/IP settings.
6. Selecting control mode by using old Delta definitions: Drive parameter setting 09-30=1.
7. Setting EtherNet/IP format: Drive parameter 09-75 can be used to set up the IP configuration format (default 0 = static IP; 1 = dynamic IP / DHCP).
8. Setting the IP address of the EtherNet/IP communication card: Drive parameters 09-76, 09-77, 09-78, and 09-79 can be used to configure the IP address (default IP address: 192.168.01.05).
9. Setting EtherNet/IP communication card's netmask: Netmask can be set via drive parameters 09-80, 09-81, 09-82, and 09-83 (default netmask: 255.255.255.0).
10. Setting the gateway for the EtherNet/IP communication card: Gateway can be configured via drive parameters 09-84, 09-85, 09-86, and 09-87 (default gateway: 192.168.01.01).

4.3.2 Control under Various Modes (using new Delta standards)

Speed mode:

1. Set the control of MS300/MH300 under speed mode: Set (Object, Instance, Attribute) = (300h, 60h, 01h) to 0.
2. Set target frequency: Set (Object, Instance, Attribute) = (300h, 60h, 02h), Unit = Hz, with a decimal precision at the hundredths position.
   Example: 1000 represents 10.00 Hz.
3. Operation: Setting (Object, Instance, Attribute) = (300h, 60h, 00h) = 0080H indicates excitation, and (Object, Instance, Attribute) = (300h, 60h, 00h) = 0081H indicates run.
4. Acceleration/deceleration time operations: If the first acceleration/deceleration section is used as the basis, the acceleration time is set to (Object, Instance, Attribute) = (300h, 01h, 12h) and the deceleration time is set to (Object, Instance, Attribute) = (300h, 01h, 13h) , with unit = seconds and a decimal precision at the tenths position. Example: 100 represent 10.0 seconds.

(Object,Instance,Attribute) = (XX h, YY h, ZZ h)

Frequency

Controller by 300h,01h,12h   Controller by 300h,01h,13h

0x3006003

300h,60h,00h=0000h

300h,60h,00h, bit1=1   300h,60h,00h, bit1=0   300h,60h,00h, bit1=1   300h,60h,00h, bit7=0

300h,60h,00h, bit7=1

300h,60h,00h, bit4=1

300h,60h,00h, bit4=0

Time
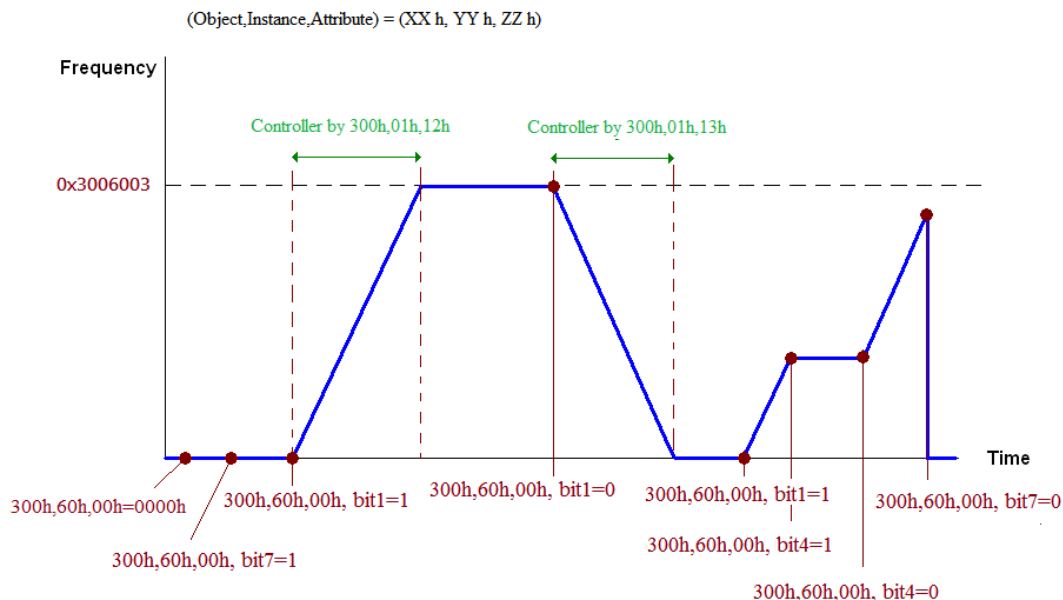
Torque mode:

1. Set the control of MS300/MH300 under the torque mode: Set (Object, Instance, Attribute) = (300h, 60h, 01h) to 2.
2. Set target torque: Set (Object, Instance, Attribute) = (300h, 60h, 06h), unit = % with a decimal precision at the tenths position. Example: 100 represent 10.0%.
3. Operation: Setting (Object, Instance, Attribute) = (300h, 60h, 00h) = 0080H indicates excitation; and the drive will subsequently run until it reaches the target torque.

Torque

300h,60h,06h
(Target Torque)

300h,60h,00h=0080h

Frequency

Fout >= Flimit   Fout < Flimit

300h,60h,07h
(Frequency limit)

Time
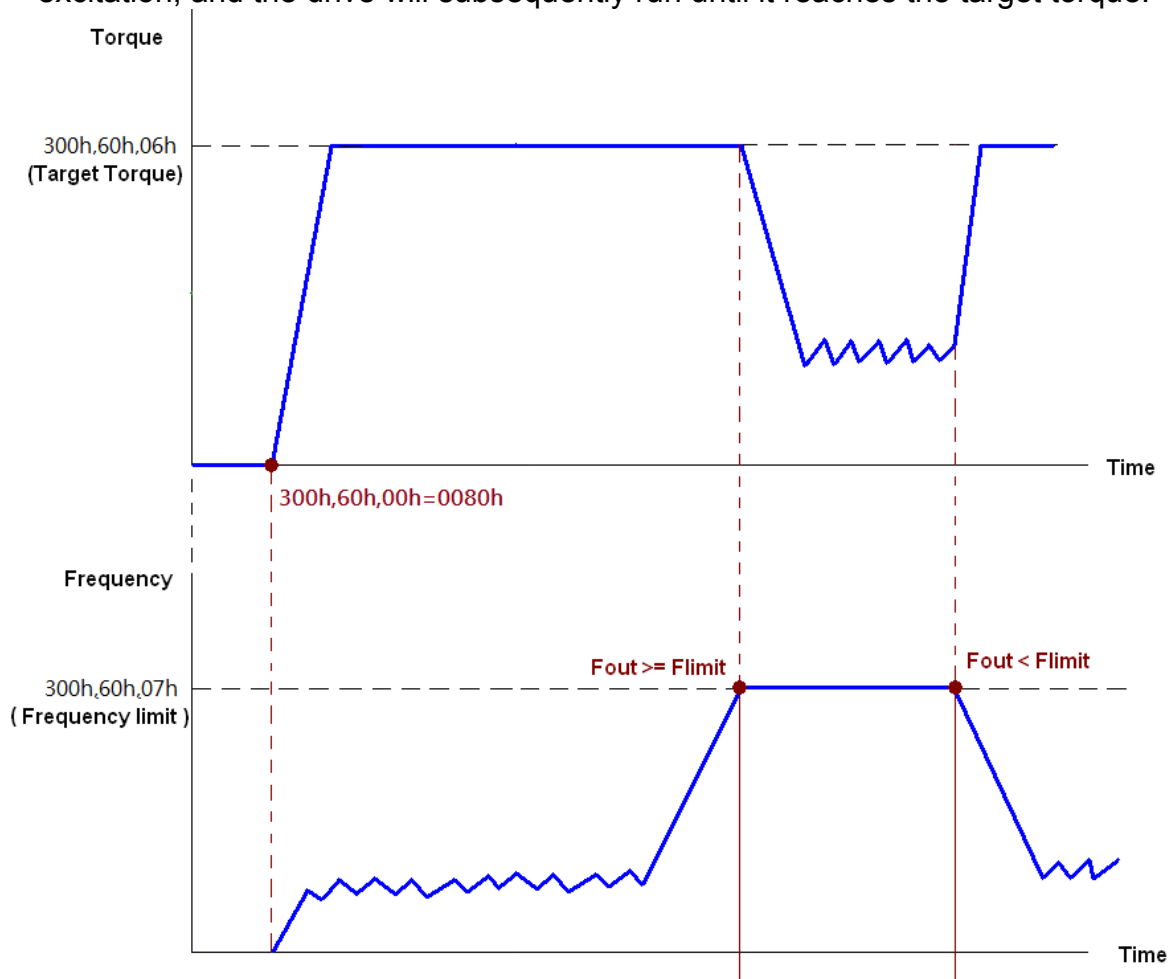
P.S.1 The current torque can be accessed via (Object, Instance, Attribute) = (300h, 61h, 06h). (Unit: 0.1 %)

P.S.2 Whether the torque has reached the target value can be accessed via bit 0 of (Object, Instance, Attribute) = (300h, 61h, 00h). (0: not reached; 1: reached)

Note: When performing torque output, if the drive's speed has reached the speed limit, the output torque will likely decrease to ensure the speed is within the limit.

5 EtherNet/IP Communication Card Register Settings

The EtherNet/IP interface of VFD-MS300/MH300 supports the drive's various modes of control. The communication protocol provides support for two packet types for data exchange. These are: Explicit Message and Implicit Message; these two types of messages are explained in detail below:

5.1 Explicit Message-based Data Exchange

The host controller directly assigns values to the Inverter. Therefore it is necessary for the EIP01 communication card to allocate a corresponding address for the Object Class. Currently, the address of the Object class occupied by the VFD is 0x300, and supported configuration methods and address list are as follows:

5.1.1 The CMM-EIP01 supports configuration of MS300/MH300 parameters via Explicit Messages:

The regular correspondence between parameter addresses and explicit messages is as follows:

EIP communication data format:

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

For example: If we wish to write a command for parameter Pr. 10-15 (to process encoder rotation difference error), proceed as follows:

Group	Member
10 (0x0A) +	15 (0x0F)

So the Explicit Message format is:

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

5.1.2 List of relevant parameters and addresses for the CMM-EIP01 communication card applicable to VFD-MS300/MH300:

Object	Instance	Attributes	Keypad number	Attributes	Description of Function
0x300	0x09	0x00	09-00	RW	VFD-MS300/MH300 Communication Address
		0x3D	09-61	RW	CMM-EIP01 Firmware Version
		0x3E	09-62	RW	CMM-EIP01 Product Code
		0x3F	09-63	RW	CMM-EIP01 Fault
		0x4B	09-75	RW	IP Configuration 0 – Static 1 – DHCP
		0x4C	09-76	RW	IP Address 1
		0x4D	09-77	RW	IP Address 2
		0x4E	09-78	RW	IP Address 3
		0x4F	09-79	RW	IP Address 4
		0x50	09-80	RW	Net Mask 1
		0x51	09-81	RW	Net Mask 2
		0x52	09-82	RW	Net Mask 3
		0x53	09-83	RW	Net Mask 4
		0x54	09-84	RW	Gateway 1
		0x55	09-85	RW	Gateway 2
		0x56	09-86	RW	Gateway 3
		0x57	09-87	RW	Gateway 4
		0x58	09-88	RW	Password Low (0~255)
		0x59	09-89	RW	Passwrod High (0~255)
		0x5A	09-90	RW	Return to Factory Setting
		0x5B	09-91	RW	CMM-EIP01 Setting Bit 0: Enable IP Filter Bit 1: Internet parameter enable Bit 2: Login password enable
		0x5C	09-92	RW	CMM-EIP01 Status Bit 0: Password enable

5.1.3 List of control explicit messages supported by EtherNet/IP:

Control Explicit Message classes supported by MS300/MH300

Delta-defined portion (old definition 0x20xx)

Object	Instance	Attributes	Definition	Initial value	R/W	Size	Note	
		0x00	Number	3	R	U8		
0x300	0x20	0x01	Control command	0	RW	U16	Bit 1~0	00B: No function
								01B: Stop
								10B: Activate
								11B: JOG activation
							Bit 3~2	Reserved
							Bit 5~4	00B: No function
								01B: Forward command
								10B: Reverse command
								11B: Change direction command
							Bit 7~6	00B: 1st acceleration / deceleration section
								01B: 2nd acceleration / deceleration section
								10B: 3rd acceleration / deceleration section
								11B: 4th acceleration / deceleration section
							Bit 11~8	0000B: Main speed
								0001B: First speed
								0010B: Second speed
								0011B: Third speed
								0100B: Fourth speed
								0101B: Fifth speed
								0110B: Sixth speed
								0111B: Seventh speed
								1000B: Eighth speed
								1001B: Ninth speed
								1010B: Tenth speed
								1011B: Eleventh speed
								1100B: Twelfth speed
								1101B: Thirteenth speed
								1110B: Fourteenth speed
								1111B: Fifteenth speed
							Bit 12	1: Enable Bit 06-11 functions
							Bit 14~13	00B: No function
								01B: Command is operated with the digital keypad
								10B: Command is operated with parameter setting (Pr. 00-21)
								11B: Change the source of operational command
							Bit 15	Reserved

Object	Instance	Attributes	Definition	Initial value	R/W	Size	Note		
0x300	0x20	0x02	Frequency command (XXX.XX Hz)	0	RW	U16			
		0x03	Other trigger	0	RW	U16	Bit 0	1: E.F. ON	
							Bit 1	1: Reset command	
							Bit 2	1: External interruption (B.B) ON	
							Bit 15~3	Reserved	
	0x21	0x00	Number	10	R	U8			
		0x01	Error code	0	R	U16	High byte: Warn code Low byte: Error code		
		0x02	VFD status	0	R	U16	Bit 1~0	00B: VFD has stopped	
								01B: VFD is decelerating	
								10B: VFD is in standby mode	
								11B: VFD is in operation	
							Bit 2	1: JOG command	
							Bit 4~3	00B: Clockwise rotation	
								01B: Counterclockwise to clockwise rotation status	
								10B: Clockwise to counterclockwise rotation status	
								11B: Counterclockwise rotation	
							Bit 7~5	Reserved	
							Bit 8	1: Main frequency source is the communication interface	
							Bit 9	1: Main frequency source is the analog signal input	
							Bit 10	1: Operational command comes from the communication interface	
							Bit 11	1: Locking parameters	
							Bit 12	1: Digital keypad copies the parameter functions	
							Bit 15~13	Reserved	
		0x03	Frequency command (XXX.XX Hz)	0	R	U16			
		0x04	Output frequency (XXX.XX Hz)	0	R	U16			
		0x05	Output current (XX.X A)	0	R	U16			
		0x06	DC bus voltage (XXX.X V)	0	R	U16			
		0x07	Output voltage (XXX.X V)	0	R	U16			

Object	Instance	Attributes	Definition	Initial value	R/W	Size	Note
0x300	0x21	0x08	Current execution speed of the multi-section command	0	R	U16	
		0x09	Reserved	0	R	U16	
		0x0A	Display counter value (c)	0	R	U16	
		0x0B	Output power factor angle (XX.X°)	0	R	U16	
		0x0C	Output torque (XXX.X %)	0	R	U16	
		0x0D	Actual motor rotational speed (rpm)	0	R	U16	
		0x0E	PG feedback pulse count (0–65535)	0	R	U16	
		0x0F	PG2 pulse command count (0–65535)	0	R	U16	
		0x10	Output power (X.XXX kWh)	0	R	U16	
		0x17	Multi-function display (Pr. 00-04)	0	R	U16	
	0x22	0x00	Reserved	0	R	U16	
		0x01	Displays drive's output current	0	R	U16	
		0x02	Counter value	0	R	U16	
		0x03	Actual output frequency	0	R	U16	
		0x04	DC-BUS voltage	0	R	U16	
		0x05	Output voltage	0	R	U16	
		0x06	Power factor angle	0	R	U16	
		0x07	Displays U, V, W power output kW	0	R	U16	
		0x08	Motor speed estimated by the VFD or returned by the encoder; unit: rpm	0	R	U16	
		0x09	Output positive/negative torque of VFD % (t 0.0: positive torque; - 0.0: negative torque)	0	R	U16	
		0x0A	Displays PG feedback (refer to Pr. 00-04 as indicated in Note 1)	0	R	U16	
		0x0B	After the functions of PID has been activated, the PID feedback value will be displayed; unit: %	0	R	U16	
		0x0C	Displays signal values of AVI analog input ports; 0–10V corresponds to 0–100% (refer to parameter 00-04 as indicated in Note 2)	0	R	U16	
		0x0D	Displays signal values of ACI analog input ports; 4–20mA/0–10V corresponds to 0–100% (as indicated in Note 2)	0	R	U16	
		0x0E	Displays signal values of AUI analog input ports; -10V–10V corresponds to -100–100% (as indicated in Note 2)	0	R	U16	
		0x0F	IGBT power module temperature °C	0	R	U16	
		0x10	Temperature of VFD capacitor °C	0	R	U16	
		0x11	On / Off status of digital input; see parameter 02-12 (refer to Note 3 for parameter 00-04)	0	R	U16	
		0x12	On / Off status of digital output; see parameter 02-18 (refer to Note 4 for parameter 00-04)	0	R	U16	
		0x13	Current execution speed of the multi-section command	0	R	U16	

Object	Instance	Attributes	Definition	Initial value	R/W	Size	Note
0x300	0x22	0x14	Digital input's corresponding CPU pin status; (refer to Note 3 for parameter 00-04)	0	R	U16	
		0x15	Digital output's corresponding CPU pin status; (refer to Note 4 for parameter 00-04)	0	R	U16	
		0x16	Motor's actual rotation count (PG card PG1); when the actual rotational direction is changed and the drive is stopped, the display on the digital keypad is reset to zero, and the counter starts at 0. Max. value is 65535	0	R	U16	
		0x17	Pulse input frequency (PG card PG 2)	0	R	U16	
		0x18	Pulse input position (PG card PG 2); max. value is 65535	0	R	U16	
		0x19	Tracking error under full position control	0	R	U16	
		0x1A	Overload count (0.00–100.00 %)	0	R	U16	
		0x1B	GFF's percentage value (%)	0	R	U16	
		0x1C	DC bus voltage ripple current (unit: V_{dc}) (r.)	0	R	U16	
		0x1D	Value of PLC register D1043 (C)	0	R	U16	
		0x1E	Magnetic pole section of a synchronous motor	0	R	U16	
		0x1F	User physical output	0	R	U16	
		0x20	Parameter 00-05's output value	0	R	U16	
		0x21	Motor's rotation count (retained when stopped; reset to zero before running)	0	R	U16	
		0x22	Motor's rotation position (retained when stopped; reset to zero before running)	0	R	U16	
		0x23	Operating speed of VFD cooling fan (%)	0	R	U16	
		0x24	VFD control status 0: Speed mode 1: Torque mode	0	R	U16	
		0x25	VFD operating carrier wave frequency	0	R	U16	
		0x26	Reserved				
		0x27	VFD status				
		0x28	Positive / negative output torque of VFD				
		0x29	Torque command				
		0x2A	KWH display				
		0x2B	PG2pulse input lower byte				
		0x2C	PG2pulse input upper byte				
		0x2D	Motor's actual position: lower byte				
		0x2E	Motor's actual position: upper byte				
		0x2F	PID reference target				
		0x30	PID offset				
		0x31	PID output frequency				

EtherNet/IP Remote Input / Output mapping address

Object	Instance	Attributes	Attributes	Description
0x300	0x26	0x00	R	Each bit corresponds to a different terminal input contact
		0x01	R	Each bit corresponds to a different terminal input contact
		0x02~0x3F	R	Reserved
		0x40	RW	Each bit corresponds to a different terminal output contact
		0x42~0x5F	R	Reserved
		0x60	R	AVI proportion
		0x61	R	ACI proportion
		0x63~0x9F	R	Reserved
		0xA0	RW	AFM1 output proportion

Class 0x300 Instance 0x26 Attribute 0x00	Bit 0	Bit 1	Bit 2	Bit 3	Bit 4	Bit 5	Bit 6	Bit 7	Bit8	Bit9	Bit10	Bit11	Bit12	Bit13	Bit14	Bit15
1	MI1	MI2	MI3	MI4	MI5	MI6	MI7									
2											MI10	MI11	MI12			

1: Control broad I/O (Standard)

2: Add external card, EMM-D33A (only for MH300)

Object x300 instance 0x26 attribute 0x40	Bit 0	Bit 1	Bit 2	Bit 3	Bit 4	Bit 5	Bit 6	Bit 7	Bit8	Bit9	Bit10	Bit11	Bit12	Bit13	Bit14	Bit15
1	RY1			MO1	MO2											
2						MO10	MO11	MO12								
3						RY10	RY11									
4						RY10	RY11	RY12								

1: Control broad I/O (Standard)

2: Add external card, EMM-D33A (only for MH300)

3: Add external card, EMM-R2CA (only for MH300)

4: Add external card, EMM-R3AA (only for MH300)

Delta-defined portion (new definition 0x60xx)

Object	Instance	Attributes	Attributes	Size	bit	Definition	User rights	Speed mode (MS300/MH300)			Torque mode (MH300)
0x300	0x60	0x00	RW	U16	0	Ack	4	0:fcmd =0 1:fcmd= Fset(Fpid)			
					1	Dir	4	0: Clockwise direction command 1: Counterclockwise direction command			
					2						
					3	Halt	3	0: Continue to run until target speed is reached 1: Temporarily stop based on deceleration settings			Regarded as torque by internal decoding; target torque 0, but the display of external target torque remains the value set externally
					4	Hold	4	0: Continue to run until target speed is reached 1: Frequency remains constant at the current level			
					5	JOG	4	0:JOG OFF Pulse 1:JOG RUN			
					6	QStop	2	Quick Stop			Quick Stop
					7	Power	1	0:Power OFF 1:Power ON			0:Power OFF 1:Power ON
					8	Ext_Cmd2	4	0->1: Clear absolute position			0->1: Clear absolute position
					14~8						
					15	RST	4	Pulse 1: Clear error code			Pulse 1: Clear error code
		0x01	RW	U16		Mode md		0: Speed mode			2: Torque mode
		0x02	RW	U16				Speed command (unsigned number)			
		0x03	RW	U16							
		0x04	RW	S32							
		0x05	RW								
		0x06	RW	S16							Torque command (signed number)
		0x07	RW	U16							Speed limit (unsigned number)
	0x61	0x00	R	U16	0	Arrive		Frequency command arrival			Torque command attained
					1	Dir		0: motor in clockwise rotation 1:motor in counterclockwise rotation			0: motor in clockwise rotation 1:motor in counterclockwise rotation
					2	Warn		Alarm raised			Alarm raised
					3	Error		Error occurred			Error occurred
					4						
					5	JOG		JOG			JOG
					6	QStop		Quick stop			Quick stop
					7	Power On		Excitation			Excitation
					15~8						
		0x01	R								
		0x02	R	U16				Actual output frequency			Actual output frequency
		0x03	R								
		0x04	R	S32				Actual position (absolute)			Actual position (absolute)
		0x05	R								
		0x06	R	S16				Actual torque			Actual torque

5.2 Data Exchange via I/O Connection Implicit Message

The host controller is used to designate the configurations of read / write data addresses via the mapped registers of the EIP communication card. The mapped registers are then used to perform a one-time read/write of fixed-sized address data. Currently, the Object Class that supports Implicit Messages has the following address and definitions:

Implicit Message fixed address definitions Name	Function	Object	Instance	Attributes	Size	Description
Connection 1 (v1.06 or above)	Input		0x69	0x03	32 words	Corresponds to data in the input buffer register
				0x04	1 word	Corresponds to the length of input buffer register
	Output		0x68	0x03	32 words	Corresponds to data in the output buffer register
				0x04	1 word	Corresponds to the length of output buffer register
	Configuration		0x80	0x03	128 words	Corresponds to the address and data of setup component
				0x04	1 word	Corresponds to the length of the setup component
Connection 1_ Listen only (v1.06 or above)	Input		0x69	0x03	32 words	Corresponds to the input buffer register
				0x04	1 word	Corresponds to the length of input buffer register
	Output		0xC7	0x03	0 words	
				0x04	0 words	
	Configuration		0x80	0x03	128 words	Corresponds to the address and data of setup component
		0x04		0x04	1 word	Corresponds to the length of the setup component
Connection 2	Input		0x65	0x03	16 words	Corresponds to the input buffer register
				0x04	1 word	Corresponds to the length of input buffer register
	Output		0x64	0x03	3 words	Corresponds to the output buffer register
				0x04	1 word	Corresponds to the length of output buffer register
	Configuration		0x66	0x03	64words	Corresponds to the address and data of setup component
				0x04	1words	Corresponds to the setup component
Connection 2_ Listen only	Input		0x65	0x03	16 words	Corresponds to data in the output buffer register
				0x04	1 word	Corresponds to the length of output buffer register
	Output		0xC7	0x03	0 words	
				0x04	0 words	
	Configuration		0x66	0x03	0 words	
				0x04	0 words	

5.2.1 IN / OUT settings of register's address (refer to the table below)

The 128-word address of the IN / OUT register has the following setting structure:

Object	Instance	Attributes	CMM-EIP01	Word	IN / OUT corresponding address	Description
0x04	0x80	0x03	R	0~24	IN 0 – IN 24's corresponding address	Fixed INPUT address; address data cannot be changed
			R	25~31	IN 25 – IN 31's corresponding address	Non-fixed INPUT address; address data can be changed
			R	32~63	IN 0~IN 31 Initial setting of return value	INPUT initial setting value
			RW	64~79	OUT0–15's corresponding address	Fixed OUTPUT address; address data cannot be changed
			RW	80~95	OUT16-31's corresponding address	Non-fixed OUTPUT address; address data can be changed
			RW	96~127	IN 0~IN31 Initial setting of return value	OUTPUT initial setting value

Detailed settings of the IN/OUT register's 128-word address are listed in the following table:

Object	Instance	Attributes	CMM-EIP01	Word	IN / OUT corresponding address	Description
0x04	0x80	0x03	R	0	IN 0's corresponding address	Fixed 2100h (Warn / Error)
			R	1	IN 1's corresponding address	Fixed 2101h (Status)
			R	2	IN 2's corresponding address	Fixed 2102h (Frequency command)
			R	3	IN 3's corresponding address	Fixed 2103h (Output frequency)
			R	4	IN 4's corresponding address	Fixed 2104h (Output current)
			R	5	IN 5's corresponding address	Fixed 2105h (DC-Bus voltage)
			R	6	IN 6's corresponding address	Fixed 2106h (Output voltage)
			R	7	IN 7's corresponding address	Fixed 2107h (current speed under multispeed settings)
			R	8	IN 8's corresponding address	Fixed 2108h (Reserved)
			R	9	IN 9's corresponding address	Fixed 2109h (Counter value)
			R	10	IN 10's corresponding address	Fixed 210Ah (Output power factor angle)
			R	11	IN 11's corresponding address	Fixed 210Bh (Output torque)
			R	12	IN 12's corresponding address	Fixed 210Ch (actual motor rotational speed)
			R	13	IN 13's corresponding address	Fixed 210Dh (PG feedback pulse count)
			R	14	IN 14's corresponding address	Fixed 210Eh (PG2 pulse command count)
			R	15	IN 15's corresponding address	Fixed 210Fh (output power)

Object	Instance	Attributes	CMM-EIP01	Word	IN / OUT corresponding address	Description
0x04	0x80	0x03	R	16	IN 16's corresponding address	Fixed 6100h (status word)
			R	17	IN 17's corresponding address	Fixed 6101h (current mode)
			R	18	IN 18's corresponding address	Fixed 6102h (current speed)
			R	19	IN 19's corresponding address	Fixed 6103h (Reserved)
			R	20	IN 20's corresponding address	Fixed 6104h (current position L)
			R	21	IN 21's corresponding address	Fixed 6105h (current position H)
			R	22	IN 22's corresponding address	Fixed 6106h (current torque)
			R	23	IN 23's corresponding address	Reserved for fixed use; default value is 0xFFFF
			R	24	IN 24's corresponding address	Reserved for fixed use; default value is 0xFFFF
			R	25	IN 25's corresponding address	Default value is 0xFFFF
			R	26	IN 26's corresponding address	Default value is 0xFFFF
			R	27	IN 27's corresponding address	Default value is 0xFFFF
			R	28	IN 28's corresponding address	Default value is 0xFFFF
			R	29	IN 29's corresponding address	Default value is 0xFFFF
			R	30	IN 30's corresponding address	Default value is 0xFFFF
			R	31	IN 31's corresponding address	Default value is 0xFFFF
			R	32~63	IN 0~IN31 Initial setting of return value	INPUT initial setting value
			RW	64	OUT 0's corresponding address	Fixed 2000H (control word 1, used in speed mode only)
			RW	65	OUT 1's corresponding address	Fixed 2001H (Frequency command)
			RW	66	OUT 2's corresponding address	Fixed 2002H (EXT)
			RW	67	OUT 3's corresponding address	Reserved for fixed use; default value is 0xFFFF
			RW	68	OUT 4's corresponding address	Fixed 6000H (control word 2, can be used under any mode)
			RW	69	OUT 5's corresponding address	Fixed 6001H (Control mode)
			RW	70	OUT 6's corresponding address	Fixed 6002H (Frequency command)
			RW	71	OUT 7's corresponding address	Fixed 6003H (Torque limit)
			RW	72	OUT 8's corresponding address	Fixed 6004H (Position command L)
			RW	73	OUT 9's corresponding address	Fixed 6005H (Position command H)

Object	Instance	Attributes	CMM-EIP01	Word	IN / OUT corresponding address	Description
0x04	0x80	0x03	RW	74	OUT 10's corresponding address	Fixed 6006H (Torque command)
			RW	75	OUT 11's corresponding address	Fixed 6007H (speed limit)
			RW	76	OUT 12's corresponding address	Reserved for fixed use; default value is 0
			RW	77	OUT 13's corresponding address	Reserved for fixed use; default value is 0
			RW	78	OUT 14's corresponding address	Reserved for fixed use; default value is 0
			RW	79	OUT 15's corresponding address	Reserved for fixed use; default value is 0
			RW	80	OUT 16's corresponding address	Default value is 0xFFFF
			RW	81	OUT 17's corresponding address	Default value is 0xFFFF
			RW	82	OUT 18's corresponding address	Default value is 0xFFFF
			RW	83	OUT 19's corresponding address	Default value is 0xFFFF
			RW	84	OUT 20's corresponding address	Default value is 0xFFFF
			RW	85	OUT 21's corresponding address	Default value is 0xFFFF
			RW	86	OUT 22's corresponding address	Default value is 0xFFFF
			RW	87	OUT 23's corresponding address	Default value is 0xFFFF
			RW	88	OUT 24's corresponding address	Default value is 0xFFFF
			RW	89	OUT 25's corresponding address	Default value is 0xFFFF
			RW	90	OUT 26's corresponding address	Default value is 0xFFFF
			RW	91	OUT 27's corresponding address	Default value is 0xFFFF
			RW	92	OUT 28's corresponding address	Default value is 0xFFFF
			RW	93	OUT 29's corresponding address	Default value is 0xFFFF
			RW	94	OUT 30's corresponding address	Default value is 0xFFFF
			RW	95	OUT 31's corresponding address	Default value is 0xFFFF
			RW	96~127	IN 0–IN31 Initial setting of return value	INPUT initial setting value

5.2.2 IN/OUT buffer address register settings

Currently, 32 sets of IN / OUT buffers are provided for dynamic mapping; the addresses are organized as follows:

32-word IN/OUT registers have the following setting structure:

Object	Instance	Attributes	CMM-EIP01	Word	IN / OUT corresponding address	Description
0x04	0x69	0x03	R	0~24	IN0–IN24's corresponding address	Returns the fixed input address value
			R	16~31	IN16 – IN31's corresponding address	Returns the dynamic input address value
	0x68		RW	0~15	OUT0–15's corresponding address	Returns the fixed output address value
			RW	16~31	OUT16-31's corresponding address	Returns dynamic output address value

Detailed settings of IN / OUT register's 32-word address are listed in the following table:

Object	Instance	Attributes	CMM-EIP01	Corresponding address	Description
0x04	0x69	0x03	R	Return value of IN 0	Fixed 2100h (Warn / Error)
			R	Return value of IN 1	Fixed 2101h (Status)
			R	Return value of IN 2	Fixed 2102h (Frequency command)
			R	Return value of IN 3	Fixed 2103h (Output frequency)
			R	Return value of IN 4	Fixed 2104h (Output current)
			R	Return value of IN 5	Fixed 2105h (DC-Bus voltage)
			R	Return value of IN 6	Fixed 2106h (Output voltage)
			R	Return value of IN 7	Fixed 2107h (current speed under multispeed settings)
			R	Return value of IN 8	Fixed 2108h (Reserved)
			R	Return value of IN 9	Fixed 2109h (Counter value)
			R	Return value of IN 10	Fixed 210Ah (Output power factor angle)
			R	Return value of IN 11	Fixed 210Bh (Output torque)
			R	Return value of IN 12	Fixed 210Ch (actual motor rotational speed)
			R	Return value of IN 13	Fixed 210Dh (PG feedback pulse count)
			R	Return value of IN 14	Fixed 210Eh (PG2 pulse command count)
			R	Return value of IN 15	Fixed 210Fh (output power)
			R	Return value of IN 16	Fixed 6100h (status word)
			R	Return value of IN 17	Fixed 6101h (current mode)
			R	Return value of IN 18	Fixed 6102h (current speed)
			R	Return value of IN 19	Fixed 6103h (Reserved)
			R	Return value of IN 20	Fixed 6104h (current position L)
			R	Return value of IN 21	Fixed 6105h (current position H)
			R	Return value of IN 22	Fixed 6106h (current torque)
			R	Return value of IN 23	(Reserved)
			R	Return value of IN 24	(Reserved)
			R	Return value of IN 25	Returns the value of dynamic corresponding address In 25
			R	Return value of IN 26	Returns the value of dynamic corresponding address In 26

Object	Instance	Attributes	CMM-EIP01	Corresponding address	Description
0x04	0x69		R	Return value of IN 27	Returns the value of dynamic corresponding address In 27
			R	Return value of IN 28	Returns the value of dynamic corresponding address In 28
			R	Return value of IN 29	Returns the value of dynamic corresponding address In 29
			R	Return value of IN 30	Returns the value of dynamic corresponding address In 30
			R	Return value of IN 31	Returns the value of dynamic corresponding address In 31
	0x68	0x03	RW	OUT 0's setting value	Set 2000H (control word) =?
			RW	OUT 1's setting value	Set 2001H (Frequency command) =?
			RW	OUT 2's setting value	Set 2002H (EXT) =?
			RW	OUT 3's setting value	Reserved
			RW	OUT 4's setting value	Set 6000H (control word) =?
			RW	OUT 5's setting value	Set 6001H (Control mode) =?
			RW	OUT 6's setting value	Set 6002H (Frequency command) =?
			RW	OUT 7's setting value	Set 6003H (Torque limit) =?
			RW	OUT 8's setting value	Set 6004H (Position command L) =?
			RW	OUT 9's setting value	Set 6005H (Position command H) =?
			RW	OUT 10's setting value	Set 6006H (Torque command) =?
			RW	OUT 11's setting value	Set 6007H (speed limit) =?
			RW	OUT 12's setting value	Reserved
			RW	OUT 13's setting value	Reserved
			RW	OUT 14's setting value	Reserved
			RW	OUT 15's setting value	Reserved
			RW	OUT 16's setting value	Dynamic corresponding address Out 16= ?
			RW	OUT 17's setting value	Dynamic corresponding address Out 17= ?
			RW	OUT 18's setting value	Dynamic corresponding address Out 18= ?
			RW	OUT 19's setting value	Dynamic corresponding address Out 19= ?
			RW	OUT 20's setting value	Dynamic corresponding address Out 20= ?
			RW	OUT 21's setting value	Dynamic corresponding address Out 21= ?
			RW	OUT 22's setting value	Dynamic corresponding address Out 22= ?
			RW	OUT 23's setting value	Dynamic corresponding address Out 23= ?
			RW	OUT 24's setting value	Dynamic corresponding address Out 24= ?
			RW	OUT 25's setting value	Dynamic corresponding address Out 25= ?
			RW	OUT 26's setting value	Dynamic corresponding address Out 26= ?
			RW	OUT 27's setting value	Dynamic corresponding address Out 27= ?
			RW	OUT 28's setting value	Dynamic corresponding address Out 28= ?
			RW	OUT 29's setting value	Dynamic corresponding address Out 29= ?
			RW	OUT 30's setting value	Dynamic corresponding address Out 30= ?
			RW	OUT 31's setting value	Dynamic corresponding address Out 31= ?

6   DCISoft Software Configuration

This section describes how to set up the CMM-EIP01 with DCISoft, Delta's communication software, and it explains the data fields on each setup page. Before opening the setup pages, it is necessary to select "EtherNet" as the communication mode, after which you can go to the CMM-EIP01 setup page to do a search by broadcast or a specific IP. CMM-EIP01 is accessed via UDP port 20006. It is therefore advisable to be familiar with all relevant firewall settings. In the following section, we provide detailed information on how to open the setup pages as well as describe the function of each data field.

Refer to the following diagram for setting up the connection. The computer can be connected to the VFD-MS300/MH300 equipped with CMM-EIP01 through a cable or a hub.

VFD-M300 + CMM-EIP01
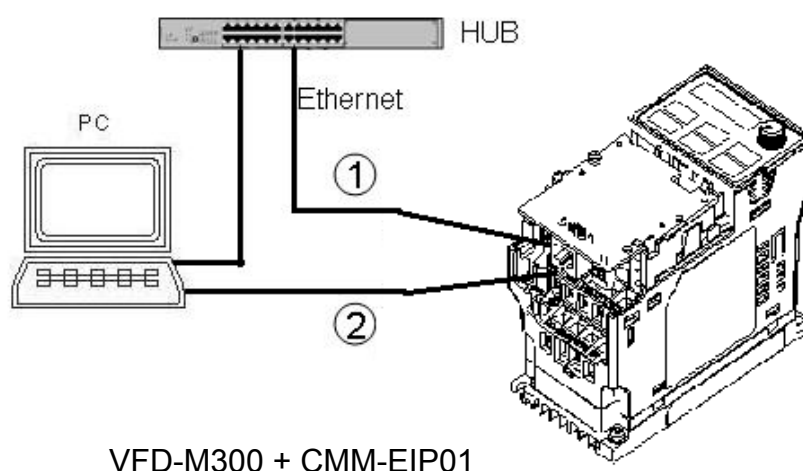
6.1   Communication Settings and Search Modules in DCISoft V1.16

■   Communication Settings

1.   Open DCISoft V1.16 on the PC and select "Tools" => "Communication Settings".
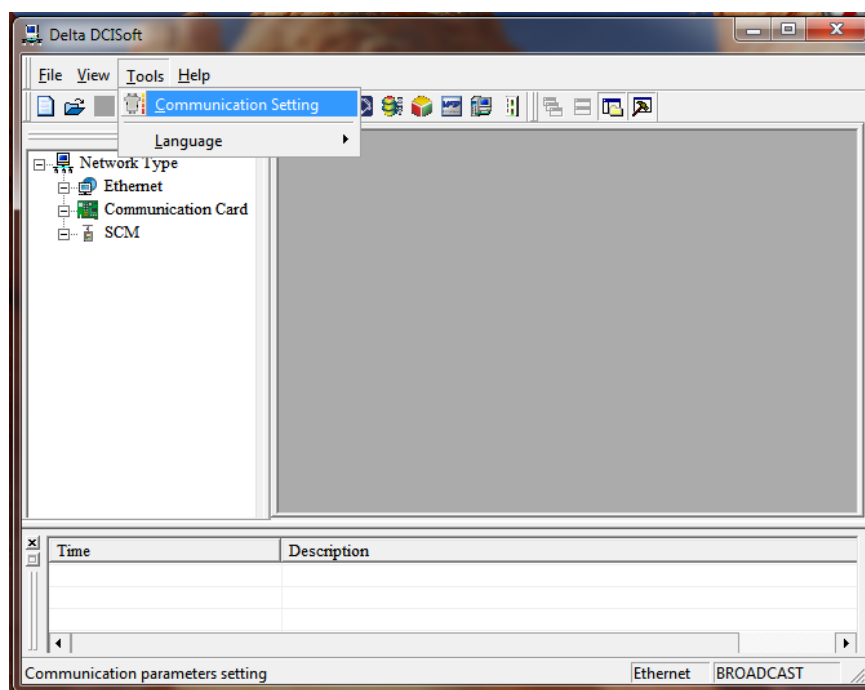
2. Select "EtherNet" as the communication mode.
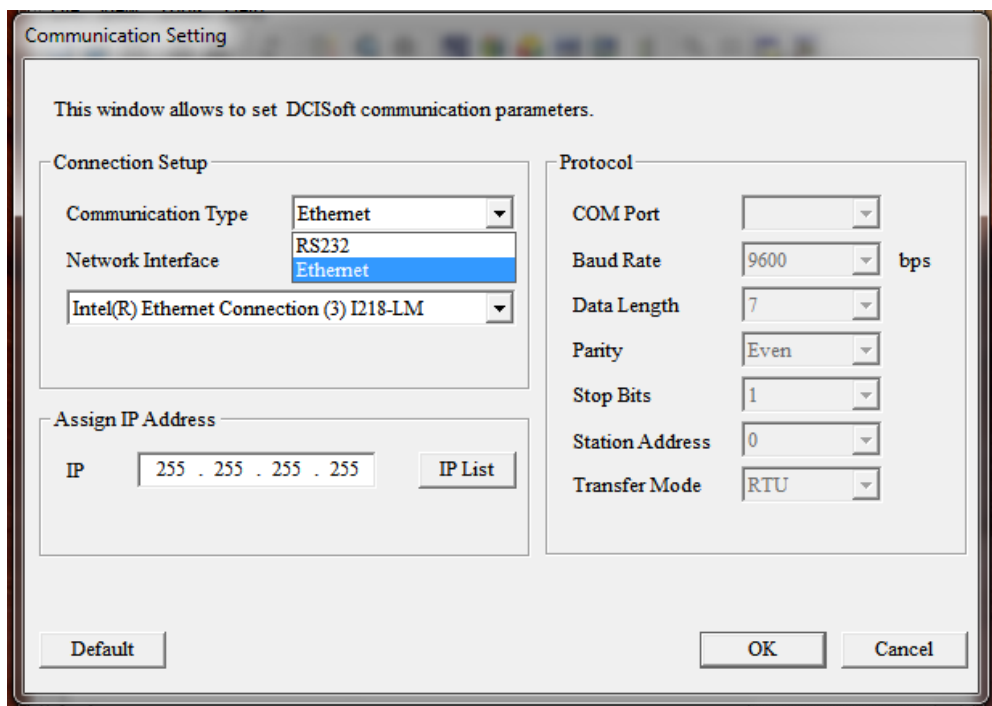
- ■ Broadcast search

1. Click on the "Broadcast Search" icon in DCISoft to search for all Delta devices on the network via the broadcast method. Device categories for products that have been located are displayed in the left panel, and the list of various devices is displayed on the right panel.
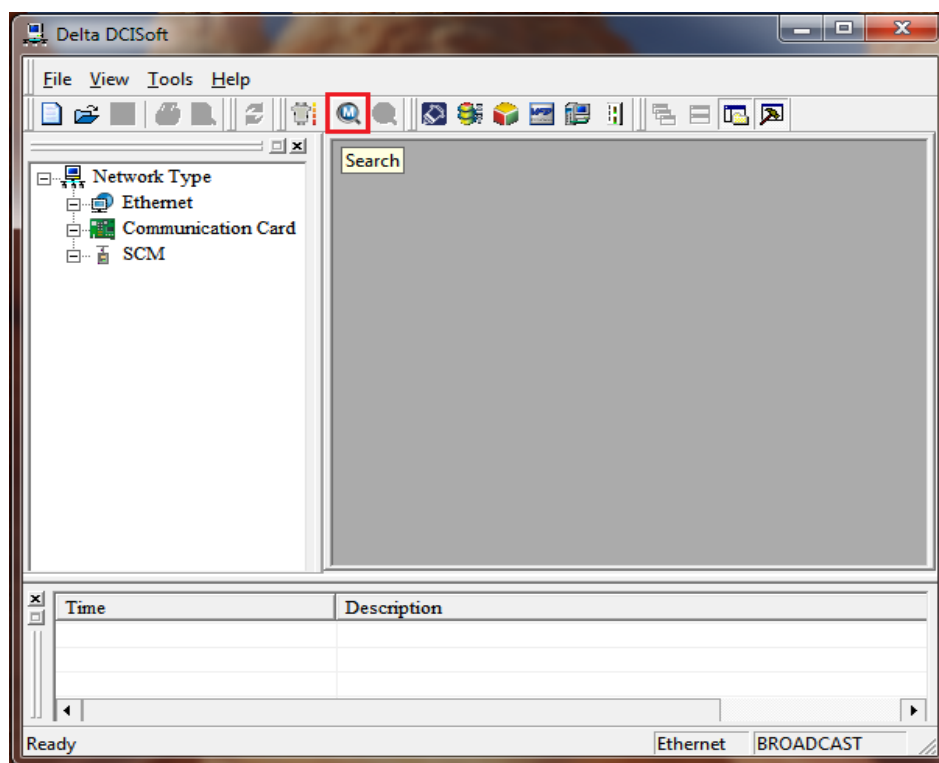
2. Click on the device category on the left panel to display the list of devices under that category on the right panel. On the right panel, double-click on a selected device to launch the setup page for that device.
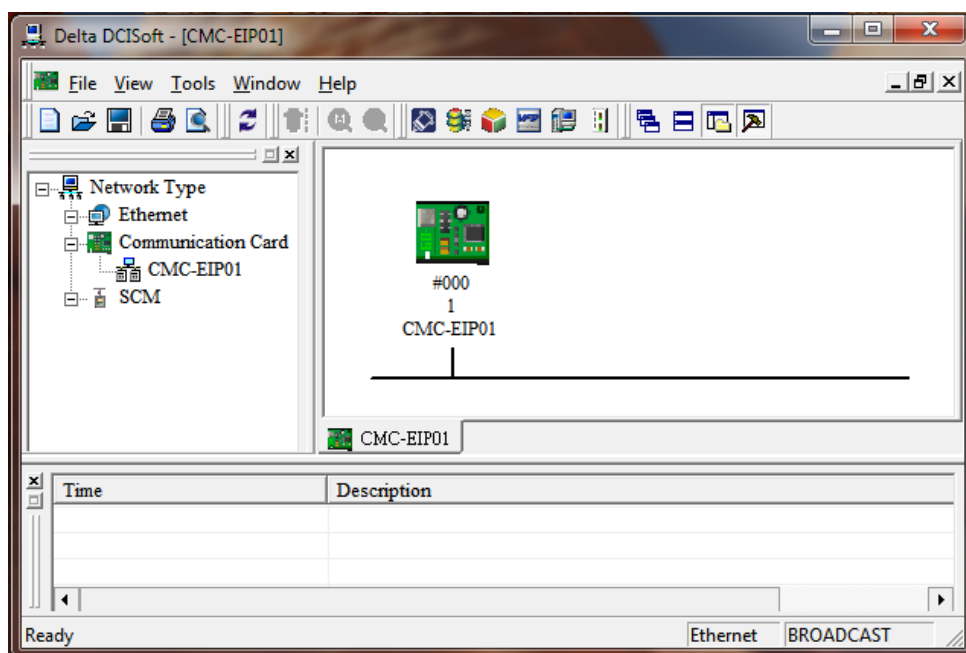
3. The Basic Configuration page is shown below.
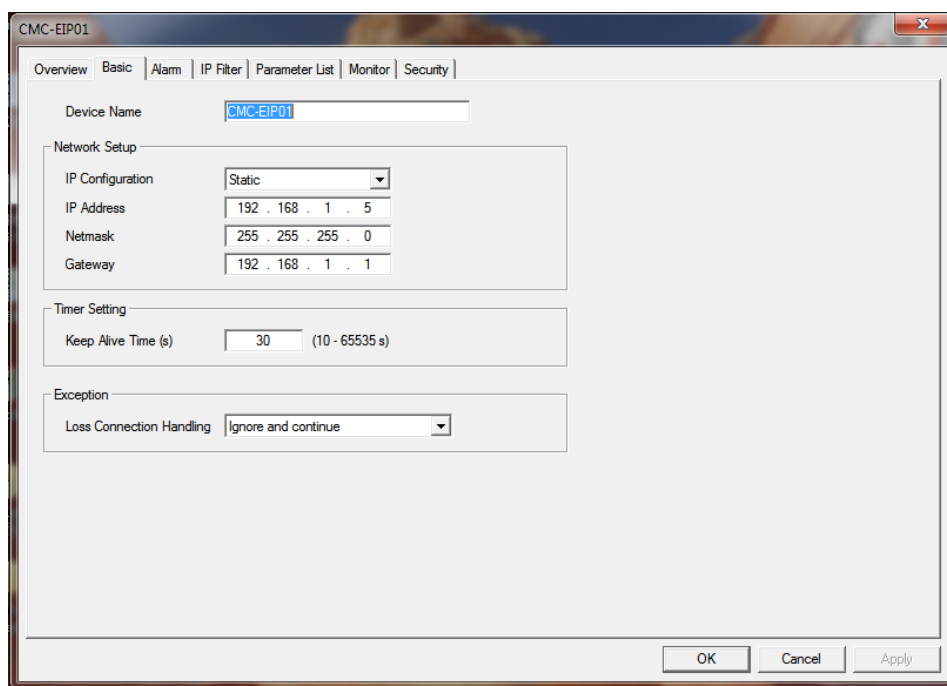
Basic configuration settings include device name, network settings, and timer settings.

1. Device name:

    There may be several CMM-EIP01 devices present on the network. To select the correct equipment, you can assign a name to each device. The devices will then be correctly identified during search.

2. Network Setup:

    (1) IP configuration:
    There are 2 types of IP configurations: Static IP and DHCP.
    Static IP address: Preset or manually modified by the user.
    Dynamic IP address (DHCP): Automatically assigned by the DHCP server.

Option	Description
Static	The user manually enters the IP address, netmask, and gateway.
DHCP	The polled DHCP provides the IP address, netmask, and gateway.

    (2) IP address:
    IP address is the location of a device on the network. Each device connected to the network must be assigned an IP address. An incorrectly assigned IP address will result in a device's connection failure. It may also cause other equipment to disconnect from the network. Consult a network administrator on how to set up the IP address. **The default IP address of CMM-EIP01 is 192.168.1.5**.

    (3) Netmask:
    Netmask: Netmask is an important parameter for setting up the subnet. It is used to determine whether the IP address of a target device is located in the same subnet as the local equipment. If it is not in the same network, the device will send its packets to the gateway, and the gateway will send these packets to another subnet. Incorrect settings may cause the target device to be unable to communicate with the CMM-EIP01 properly. To see if your settings are correct, conduct a bitwise AND operation between your IP address and the netmask, and another bitwise AND operation between the IP address of the target device and the netmask. If these two values are the same, both IPs are in the same subnet. **CMM-EIP01's default netmask is 255.255.255.0.**

    (4) Default gateway:
    The gateway is the window of communication between two different subnets; it allows devices on two different subnets to communicate with each other. For example, if a LAN needs to be connected to the WAN, a gateway is necessary to bridge the two communication networks. The IP of the gateway has to be in the same subnet as the CMM-EIP01. **The default gateway of CMM-EIP01 is 192.168.1.1.**

3. Timer Settings:

    This sets up the network keep-alive time (unit: seconds; range: 10 – 65,535; default value is 30 seconds). If the connection idle time exceeds the keep-alive time, CMM-EIP01 will disconnect the idle connection.

4. Exception settings: (detecting disconnection)

    If the communication card detects that the network is disconnected, it can ask the VFD to stop (in accordance with the drive's settings) or ignore the error to maintain the current status (this function is supported by CMM-EIP01 version 1.04 and later).

■ Search by a specific IP address

1. Set the communication mode to "EtherNet" and enter the IP address of the target CMM-EIP01 in the address field. Click "OK" to close the window.
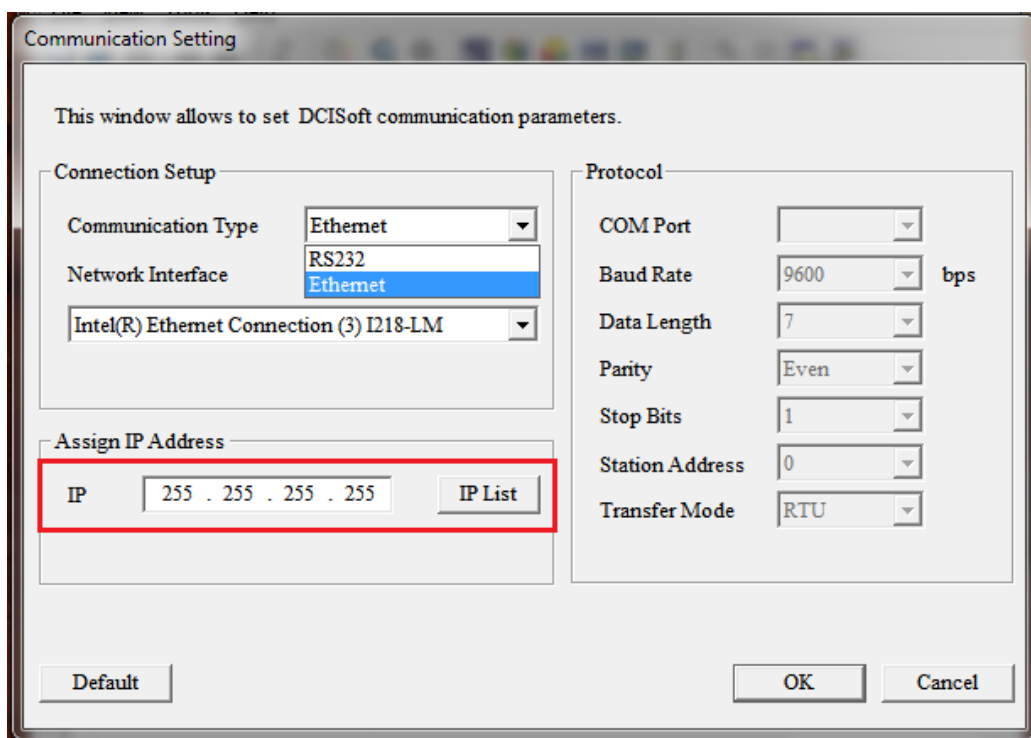
2. Click on the IP search icon [IP] to start searching for the target IP address.
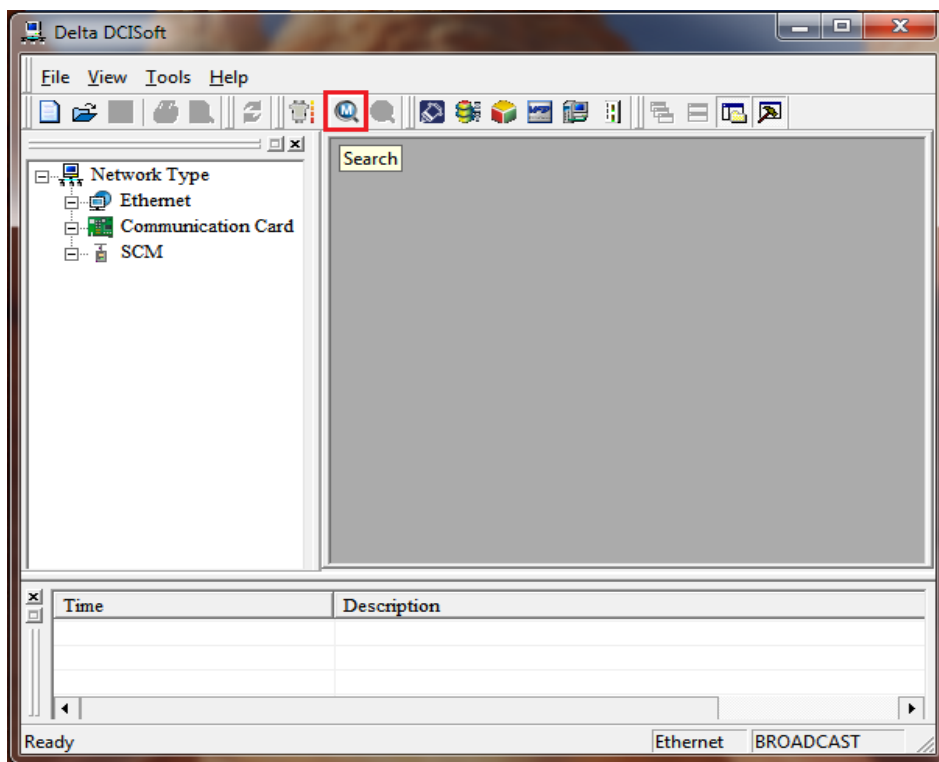
3. The desired CMM-EIP01 that has successfully been located will be displayed in the right panel. Double-click on the device to enter its configuration page.
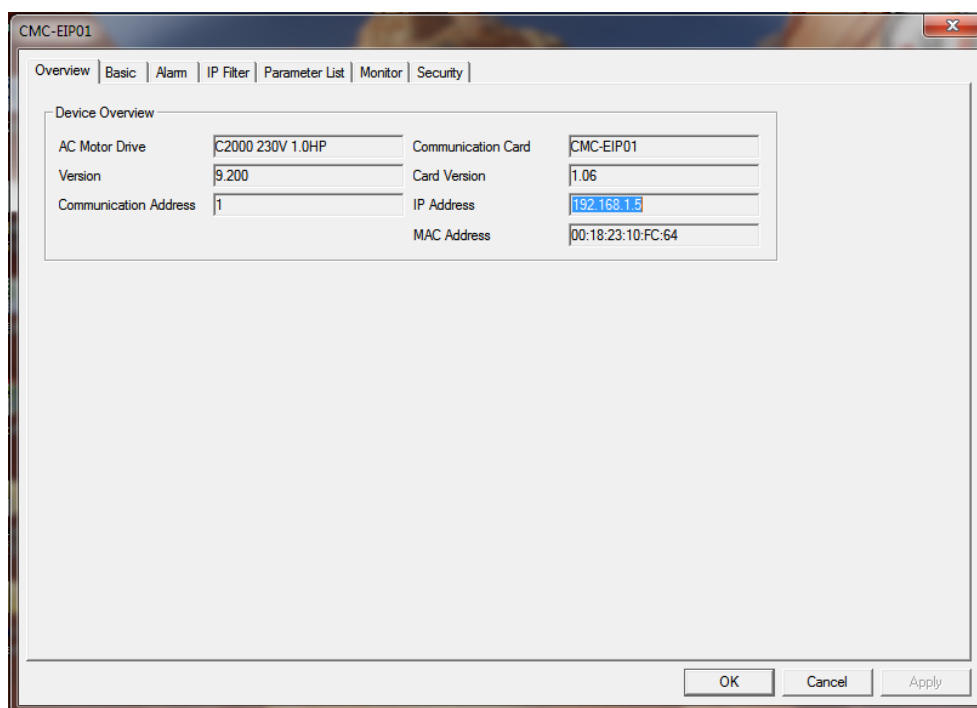
6.2 PC Network Setup

The first step for a network device to be connected to the network is to assign an IP (Internet Protocol) address. The IP address is similar to a serial number and can be used to uniquely identify each piece of equipment on the network.
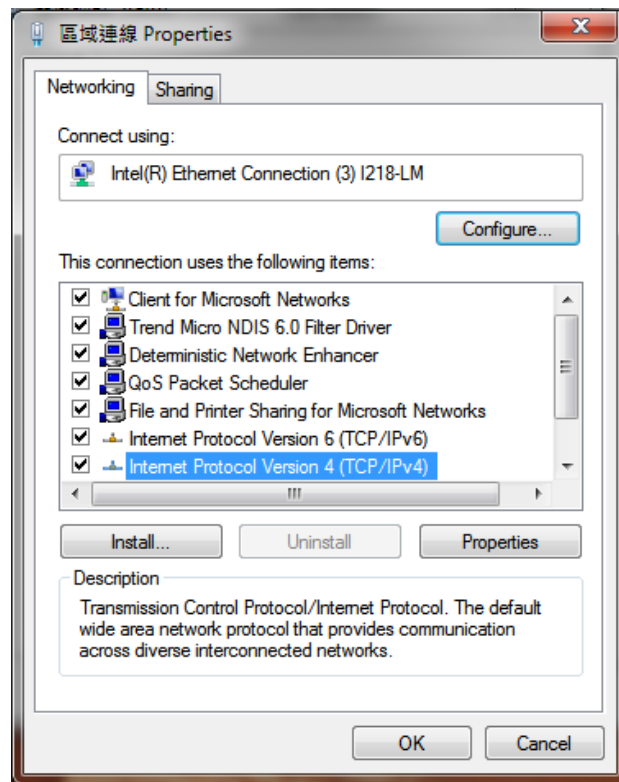
■ Assigning a static IP address to the PC

1. Enter Control Panel → Network and Sharing Center → Click on the local network the PC is connected to.
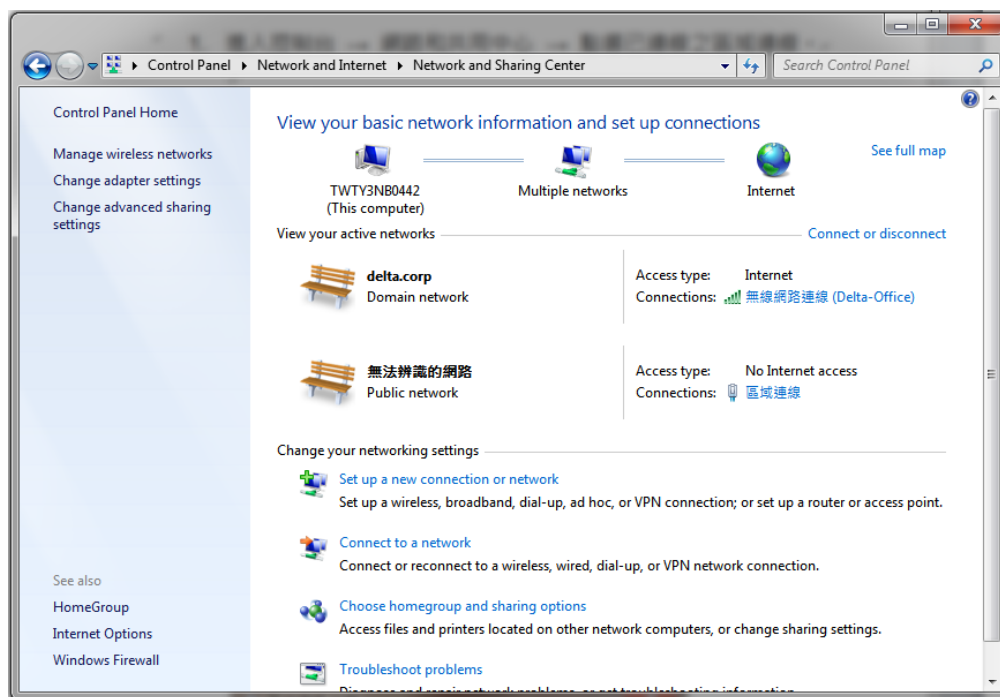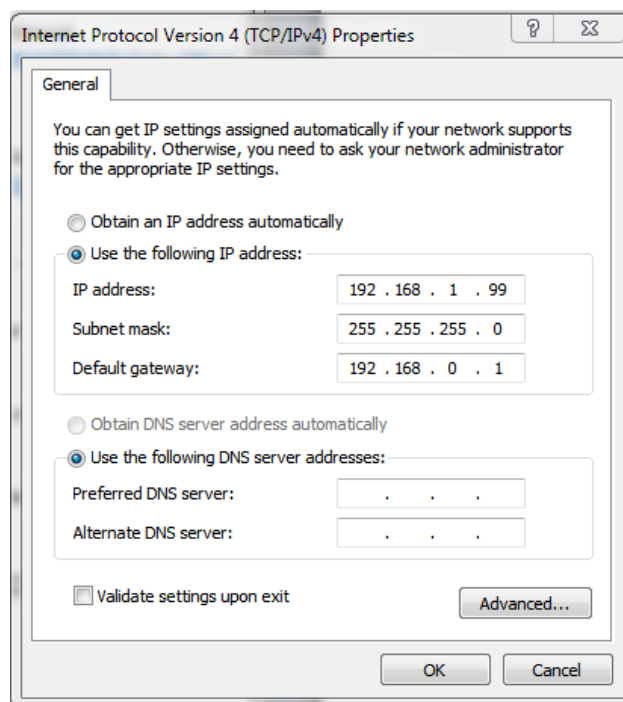

2. Click to enter the "Local Area Connection Status" window as shown in the diagram.
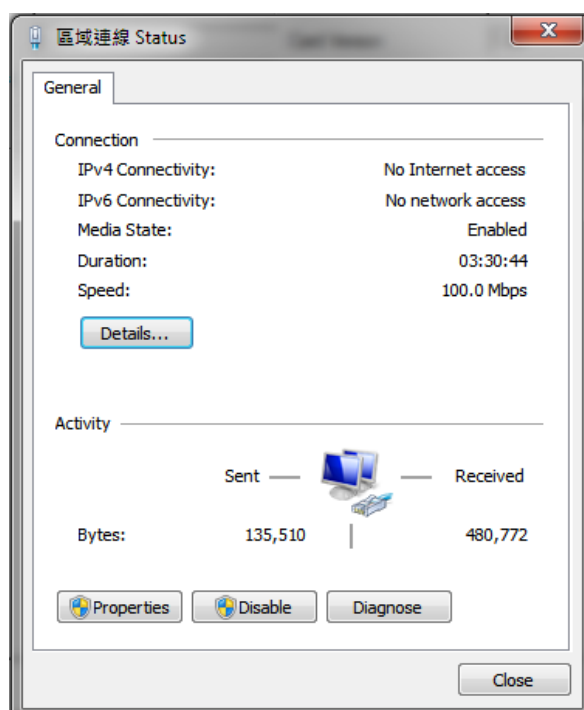
3. Select "Internet Protocol Version 4 (TCP / IPv4)" and click on "Properties" as indicated in the diagram.

4. Enter "192.168.0.1" into the IP address field. Click "OK" to complete the IP address configuration for the PC.

7 Application Scenarios for EIP Operations

In this section, we will introduce how Delta's EtherNet/IP adapter products can be connected and configured with PLC or the web interface via EtherNet/IP by using different application scenarios as examples. **If you require more detailed information on how to configure the PLC Scanner, please visit our official website and download the PLC EtherNet/IP manual. The URL is:**

http://www.deltaww.com/filecenter/Products/download/06/060301/Manual/DELTA_IA-PLC_EtherNet-IP_OP_TC_20160520.pdf

7.1 Monitoring VFD-MS300/MH300 Parameters Online via DCISoft / Web

Function Description	Using DCISoft to monitor MS300/MH300 parameters
Network environment	(1) IP address of the PC is 192.168.1.30 (2) IP address of the CMM-EIP01 communication card on VFD-MS300/MH300 is 192.168.1.20

1. Connectivity diagram
2. Launch DCISoft and use broadcast search to locate CMM-EIP01 (if the device is on a different LAN, search by its designated IP address).
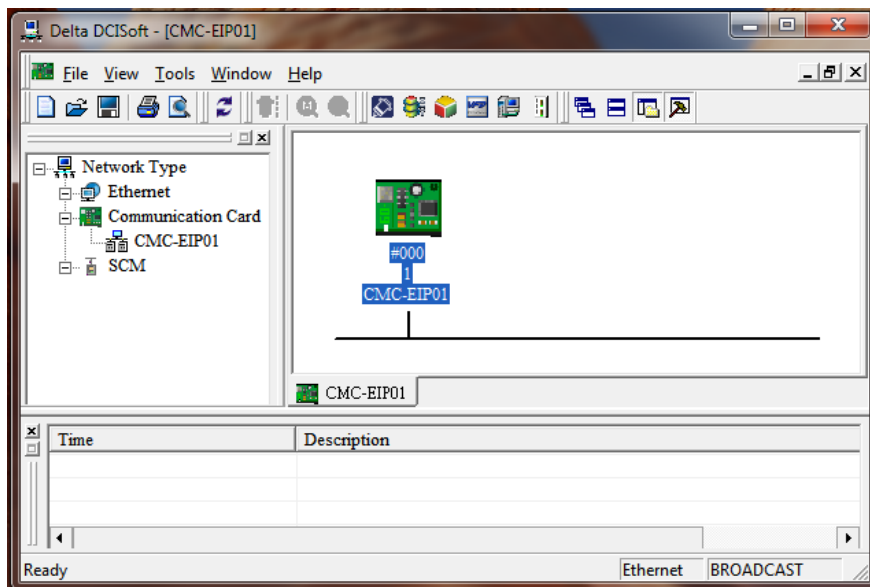

3. Enter the "Parameter List" page and select all VFD-MS300/MH300 parameters that you wish to monitor.
4. For example, if you wish to monitor parameters 00-01, 01-01, 02-01, 03-01, 04-01, 05-01, and 06-01, place a checkmark on them on the parameter list.
5. Switch to the monitor page and all checked items will be displayed on the monitor list.
6. Click "Apply" to automatically execute the monitoring function in DCISoft and the caching function for CMM-EIP01.

7.2 Password Setup and Clearing

| Function Description	Use DCISoft to set up and clear the password in CMM-EIP01
Network environment	(1) Set up a password in CMM-EIP01 (2) Unlock CMM-EIP01 (3) Clear password in CMM-EIP01

1. Please refer to Section 7.1 for the connection diagram and communication settings.

2. Launch the setup dialog for CMM-EIP01 and click on the "Security settings" tab.
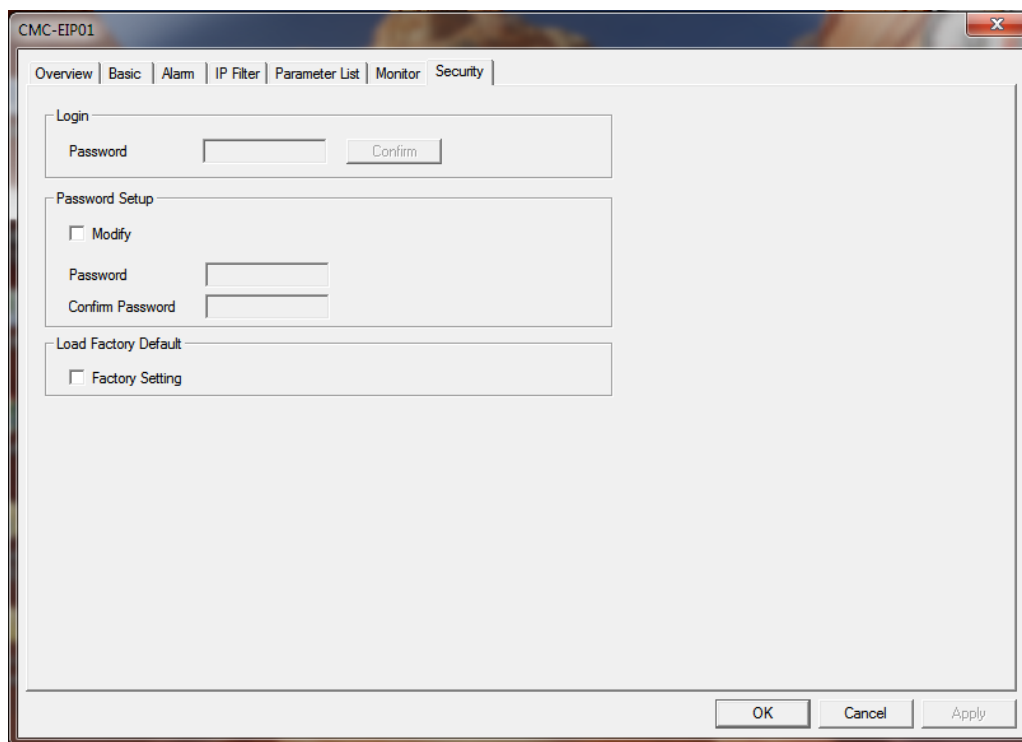
3. Check "Modify" and enter password "1234" into the "Password" and "Confirm Password" text boxes; click on "Apply" to save the password.
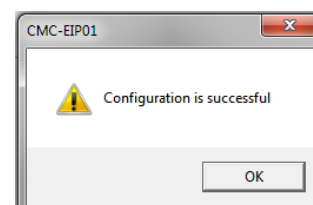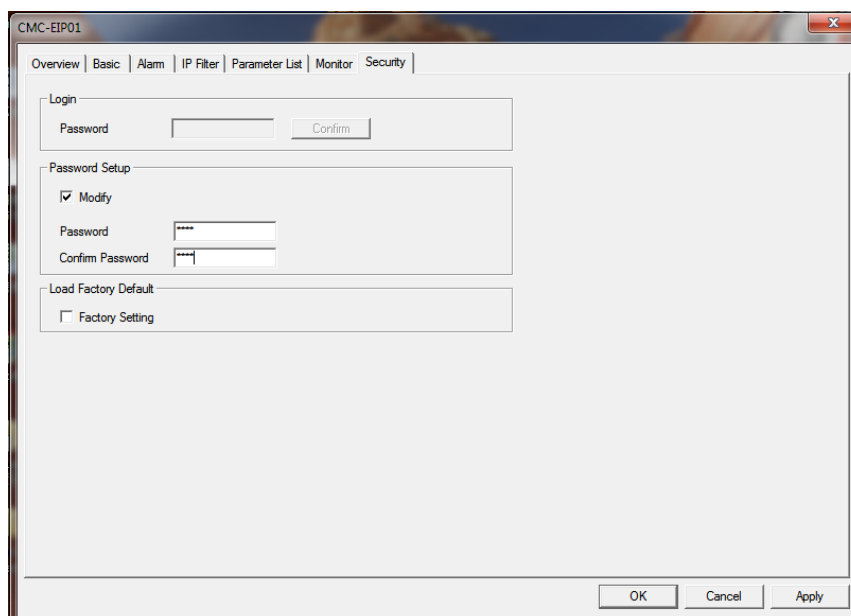
4. Reopen the setup page and you will notice that all of the settings are now password locked and cannot be changed. Enter the password directly into the password box and click "OK".
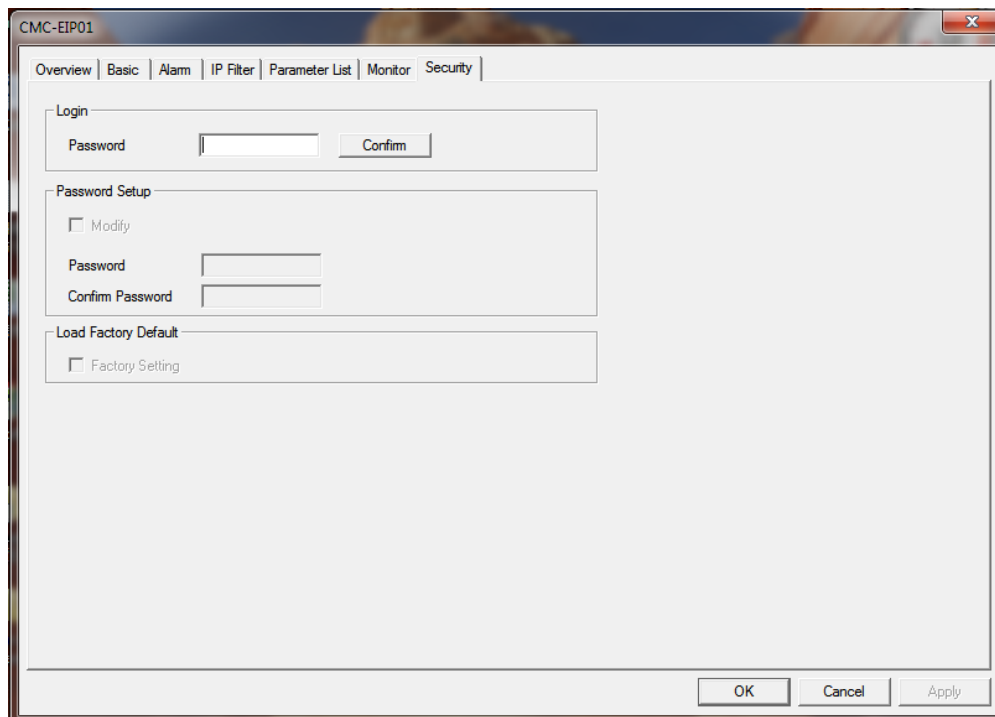
5. Enter the password to temporary unlock the settings and modify parameters. If you close the setup dialog box, settings will be locked once again.
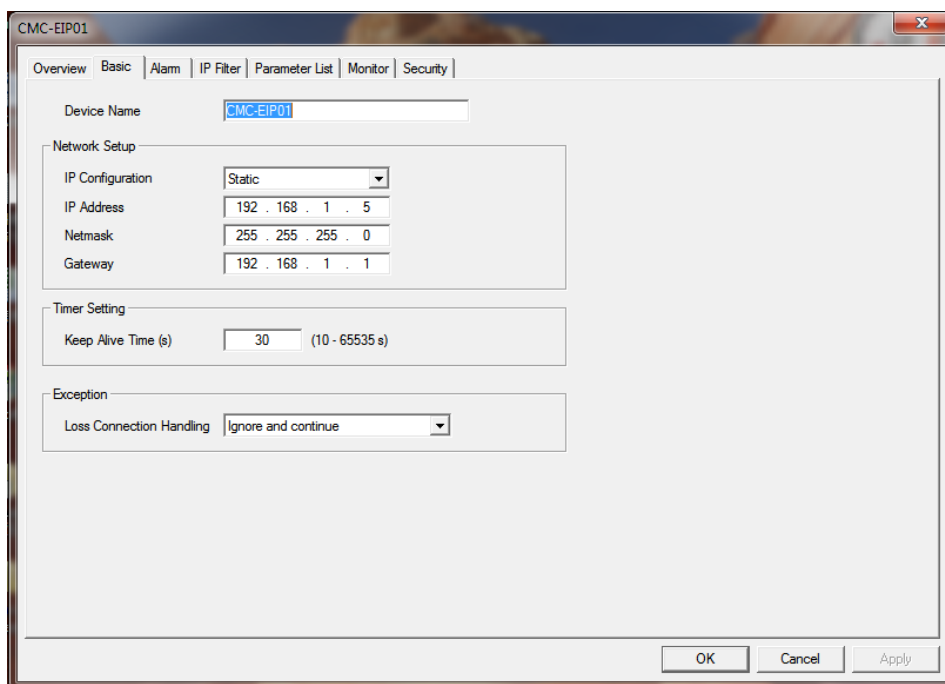
6. To clear the password, click "Modify" on the "Security settings" tab, leave the "Password" and "Confirm Password" boxes blank and then click on the "Apply" button.
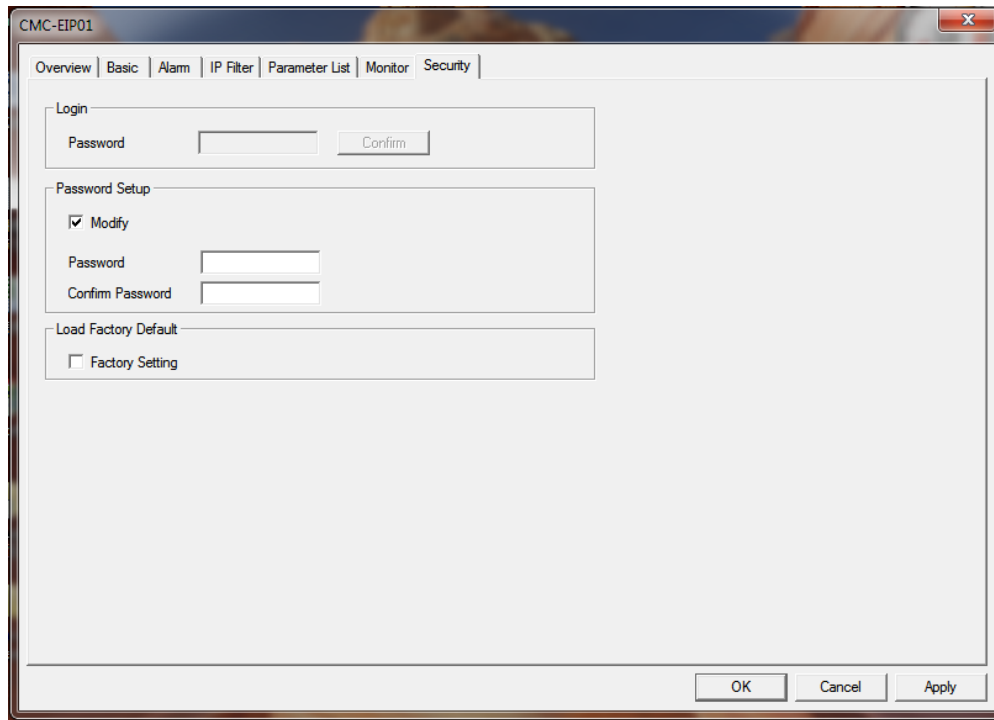
7. After the password is cleared, you may modify any parameters you wish without the need to enter a password.

7.3 IP Filter Protection

Function Description	Setting up IP filter protection
Network environment	(1) IP address of CMM-EIP01 is 192.168.0.4 (2) Allow only devices with IP addresses in the range 192.168.0.7 and 172.16.0.1 – 172.16.0.254 to establish connections with CMM-EIP01

1. Please refer to Section 7.1 for the connection diagram and communication settings.

2. Launch the setup dialog for CMM-EIP01 and click on the "IP Filter" tab.
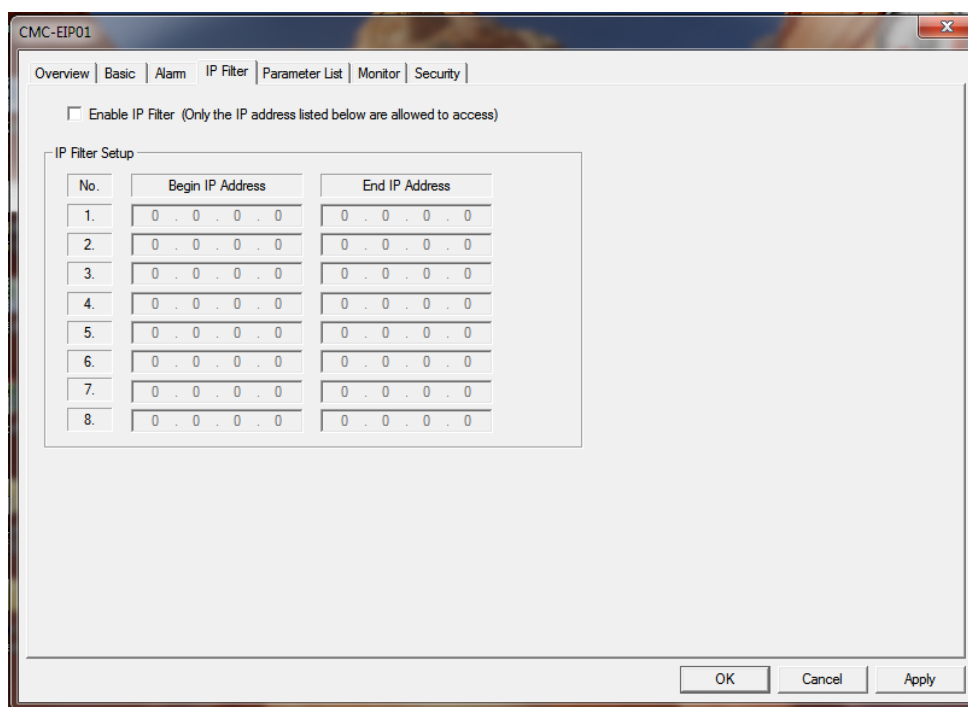
3. Check "Enable IP Filter". Enter "192.168.0.7" into Group 1's "Starting IP address" and "Ending IP address".
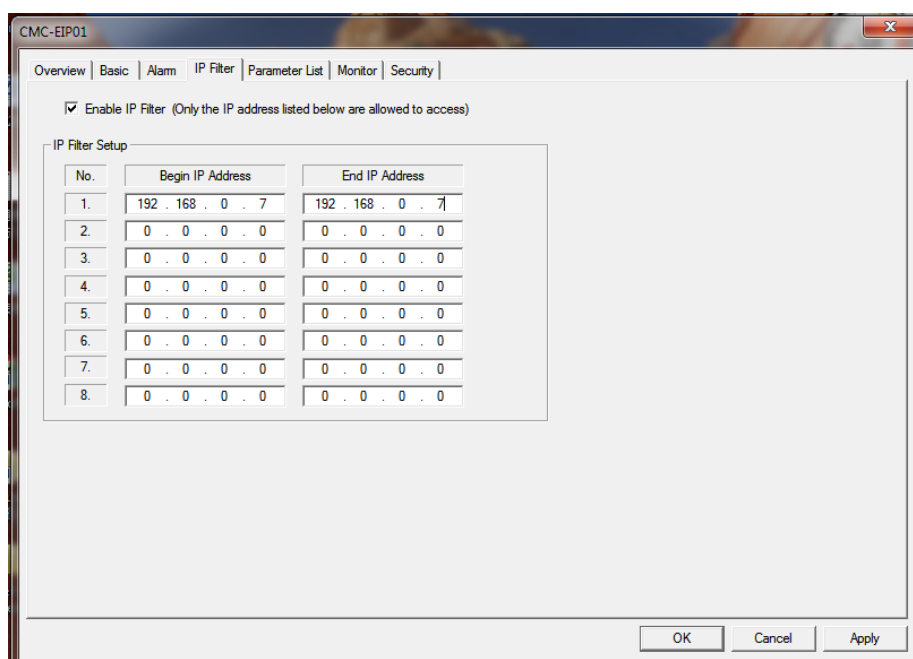
4. Enter "172.16.0.1" and "172.16.0.254" into Group 2's "Starting IP address" and "Ending IP address", respectively. Click "Apply" to complete the configuration.
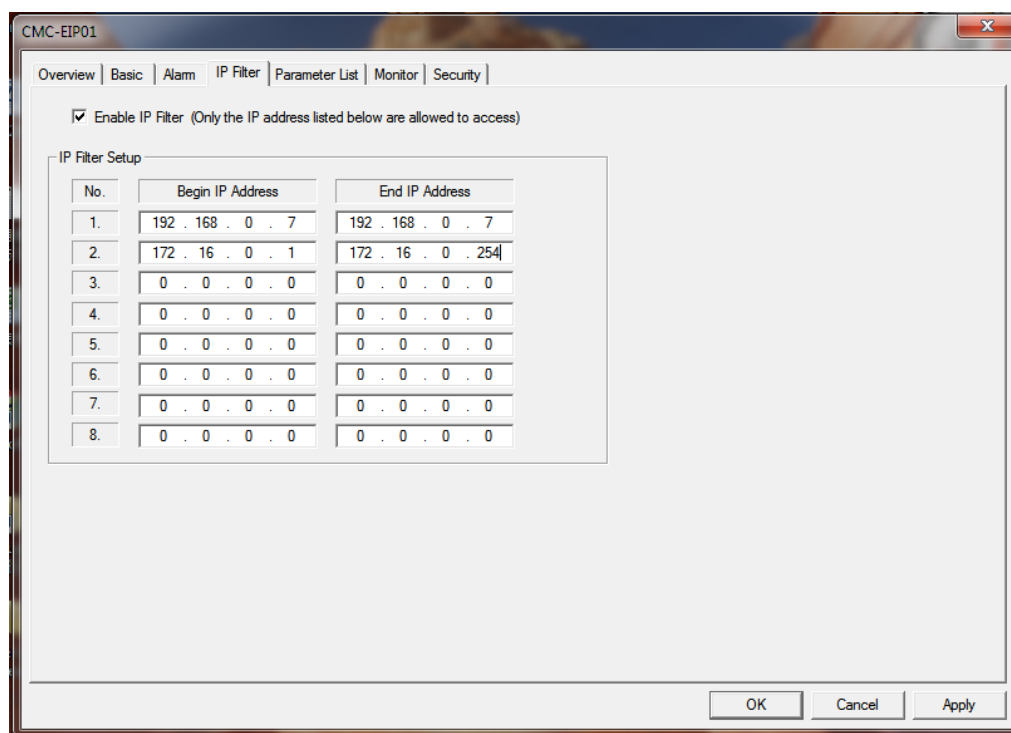
5. Only devices within the permitted range of IP addresses are allowed to be connected to the CMM-EIP01 communication card.

7.4 E-Mail Applications

Function Description	When the value in a particular address on the VFD-MS300/MH300 matches a specific configured value, CMM-EIP01 will have the drive execute a command and send an e-mail message to notify the administrator.
Network environment	(1) SMTP Server IP: 172.16.144.122 (2) Administrator's e-mail: test@sample.com (3) It is configured that when H2103=60, the command "STOP" is executed and a message is sent to a designated e-mail address

1. Please refer to Section 7.1 for the connection diagram and communication settings.

2. Open the configuration page for CMM-EIP01 and select the "Alarm" tab
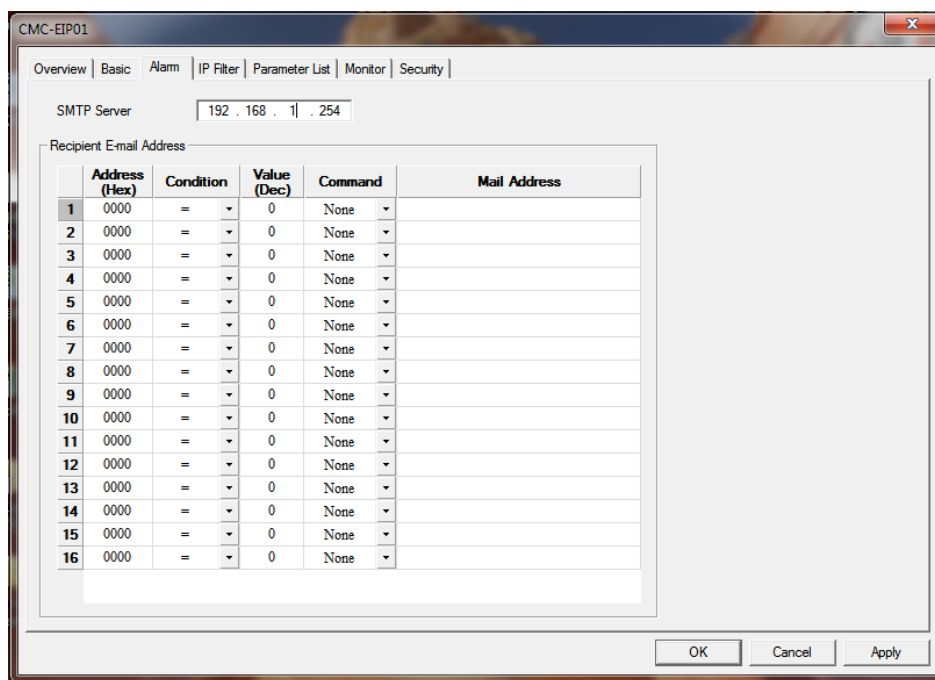
3. Setting up e-mail and trigger events. Enter "172.16.144.122" as the SMTP server. Enter "2103" as the Address (Hex) on the first row, "=" in Condition, "60" in Value (Dec), "Stop" in Command, and "test@sample.com" as the E-mail Address. Click "Apply" to complete the alarm settings.
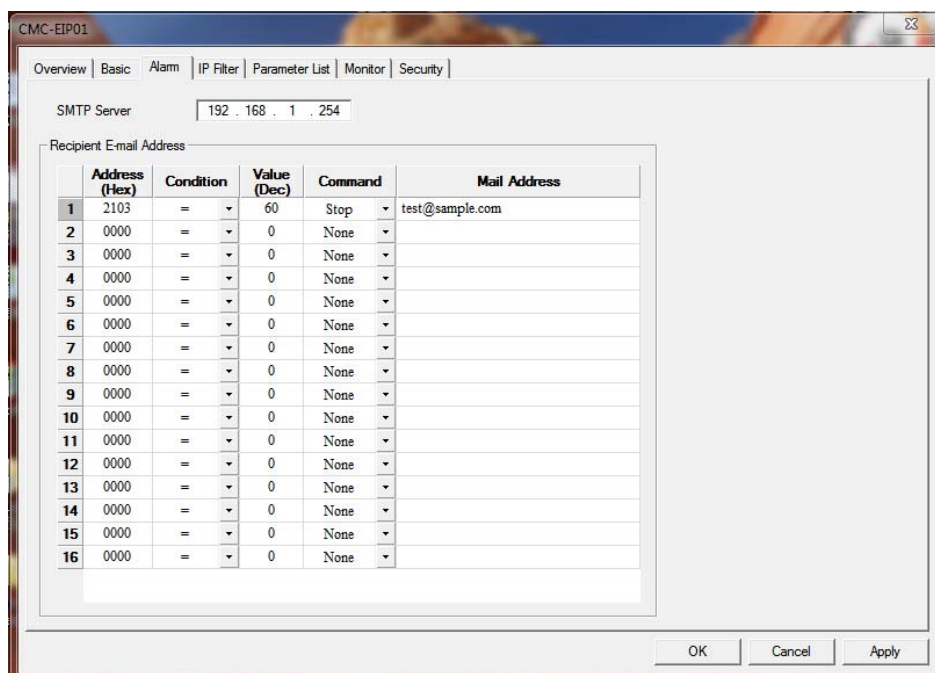
7.5 Keypad Operation (1)

Function Description	Set up network parameters with the keypad
Network environment	(1) Set IP address to "Static": Set the static IP address to "192.168.1.16", netmask to "255.255.255.0", and gateway to "192.168.1.1". (2) Set up IP address via DHCP

- Static

1. Enter the corresponding values into each address with the keypad. Press the "Enter" key on the keypad to complete the setup.

Keypad address	Setting Value	Description of Function
09-75	0	Set IP address to "Static"
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	Net Mask 1
09-81	255	Net Mask 2
09-82	255	Net Mask 3
09-83	0	Net Mask 4
09-84	192	Gateway 1
09-85	168	Gateway 2
09-86	1	Gateway 3
09-87	1	Gateway 4

2. Enter "2" into the address 09-91 with the keypad and press "Enter" on the keypad to complete the setup of network parameters.

- DHCP

1. Enter "1" into the address 09-75 to set the IP via DHCP, and then enter "2" into the address 09-91. Press the "Enter" key on the keypad to complete the setup.

7.6 Keypad Operation (2)

Function Description	Modifying network parameters while under password protection by using the keypad
Network environment	(1) The password for CMM-EIP01 is set to "1234" (2) Set IP address to "Static": Set the static IP address to "192.168.1.16", netmask to "255.255.255.0", and gateway to "192.168.1.1".

1. Refer to Section 7.8 on how to set up the password for CMM-EIP01.

2. Launch the setup dialog box again. At this time, the password status is "locked" and no settings can be modified. In addition, there is no way to revert to factory default settings.
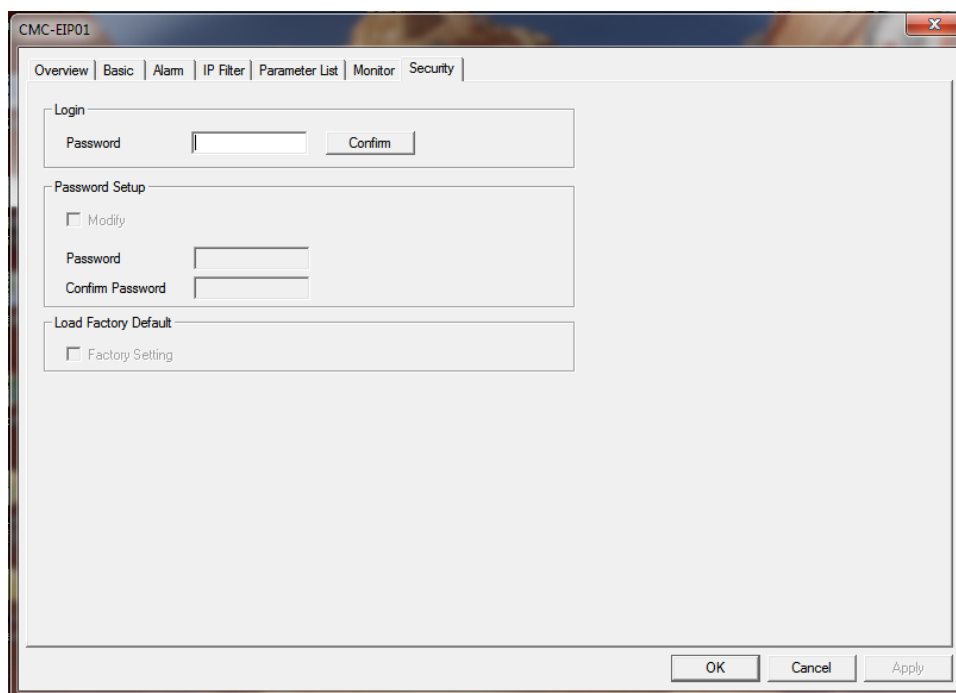
3. Enter the corresponding value in each address with the keypad according to the table below, and then press the "Enter" key on the keypad.

Keypad address	Setting Value	Description of Function
09-75	0	Set IP address to "Static"
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	Passwrod High

4. Enter "6" into the address 09-91 with the keypad and press "Enter" on the keypad to complete the setup of network parameters.

Caution: Password operation on the keypad allows only parameter modification via Login. It is not possible to set/change the password via the keypad.

7.7 Keypad Operation (3)

Function Description	If the password is lost, use the keypad to revert to default factory settings
Network environment	(1) Set up a password in CMM-EIP01 (2) If the password cannot be recovered, revert to default factory settings by using the keypad.

1. Refer to Section 7.8 on how to set up the password for CMM-EIP01.

2. Launch the setup dialog box again. At this time, the password status is "locked" and no settings can be modified. In addition, there is no way to revert to factory default settings.
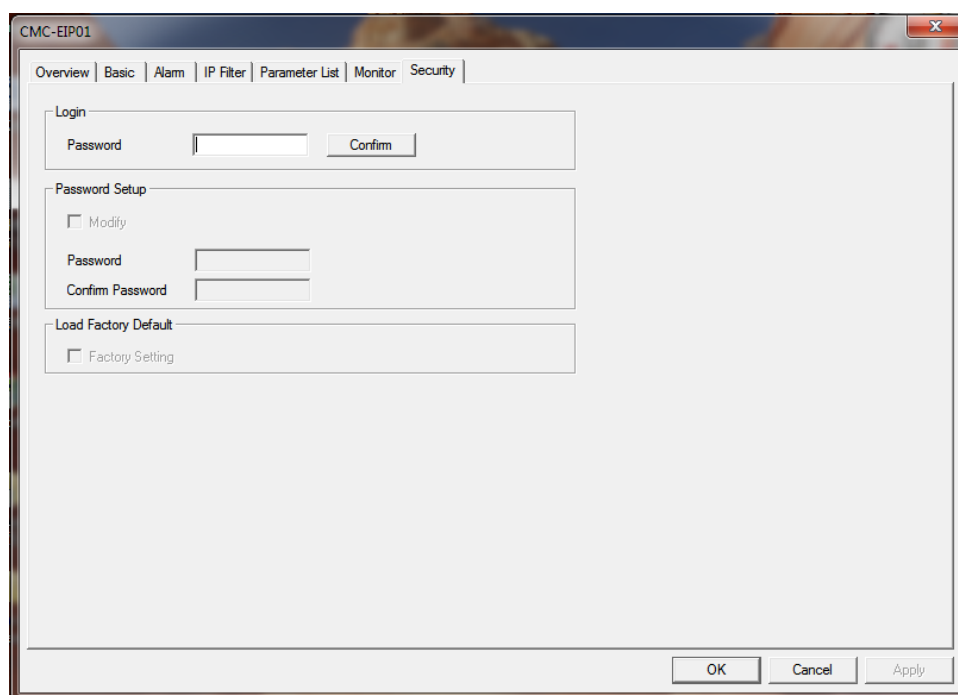
8 Troubleshooting

In this section, we describe the scenario where the CMM-EIP01 communication card is not functioning properly. LED indicators on the CMM-EIP01 will provide information on how to deal with the problem and the meanings of error codes displayed on the drive's panel.

8.1 Explanation of LED Indicators

Name	Indicator status		Indication	Handling method
Power indicator	Green / Red LEDs	Flashing red / green alternately	Product status self-testing	No action required
		Red LED always on	Device has experienced an unrecoverable error	Hardware error; contact the product distributor
		Green light always on	Device parameter configuration is complete	No action required
		Flashing red light	A recoverable error has occurred	Verify if the parameter settings are correct
		Flashing green light	Device parameters not configured	Refer to instructions in the manual to configure parameters
		LED is off	No power supply	Check if the power supply is connected properly
Link indicator	Green LED	Flashing red / green alternately	Network status self-testing	No action required
		Red LED always on	Duplicate IP address	Check if the IP address is correct
		Green LED always on	Network connection normal	No action required
		Flashing red light	Communication time out/disconnected/IP changed	Check if the communication settings are correct
		Flashing green light	Network packets transmitting/receiving	No action required
		LED is off	Not connected to a network	Check if the network cable is connected properly

8.2 Warnings and Error Codes for VFD Indicators

ID	Code	Description
75	ECFF	Manufacturing parameter read error
76	ECiF	Internal parameter configured incorrectly
80	ECEF	EtherNet connection error
81	ECto	Communication timeout between CMM-EIP01 and VFD-MS300/MH300
82	ECCS	Checksum error in the communication between CMM-EIP01 and VFD-MS300/MH300
83	ECrF	The CMM-EIP01 has been restored to its factory default settings
85	ECo1	Exceeds the max. number of connections in EtherNet/IP
86	ECiP	IP error
87	EC3F	Mail alarm

8.3 Troubleshooting

Problem	Cause of the problem	Troubleshooting instructions
Power indicator is off	AC drive is not connected to a power source	Check if the AC drive is powered and whether its power supply is working properly.
	CMM-EIP01 is not connected to the AC drive	Check if the CMM-EIP01 is tightly connected to the AC drive
Link indicator is off	CMM-EIP01 is not connected to a network	Check to see if the network cable is properly connected to the network
	RJ-45 connector is not connected properly	Check if the RJ-45 connector is attached to the EtherNet port correctly
Unable to locate the communication card	CMM-EIP01 is not connected to a network	Check to see if CMM-EIP01 is properly connected to a network
	The computer and CMM-EIP01 are on different networks, blocked by a firewall	Search by using a designated IP address or modify settings with the keypad
Unable to open CMM-EIP01 setup page	CMM-EIP01 is not connected to a network	Check to see if CMM-EIP01 is properly connected to a network
	Incorrect communication settings in DCISoft	Make sure the communication setting in DCISoft is set to EtherNet
	The computer and CMM-EIP01 are on different networks, blocked by a firewall	Conduct setup via the keypad on the AC drive
Can open CMM-EIP01's setup page but cannot use webpage monitoring	Incorrect network settings for CMM-EIP01	Check if the network settings for CMM-EIP01 are correct. Please consult an IT administrator if you are on your company's Intranet. For home networks, refer to the instructions for network settings provided by your internet service provider (ISP).
Unable to send e-mails	Incorrect network settings for CMM-EIP01	Check if the network configurations for CMM-EIP01 are correct
	Incorrect mail server settings	Check SMTP server's IP address

Appendix A: EtherNet/IP Services and Elements

A.1 Elements Supported

Name of element	Class Code	Element description
Identity Object	0x01	Device identification element
Message Router Object	0x02	Message route element
Assembly Object	0x04	Assembly element
Connection Manager Object	0x06	Connection management element
TCP/IP Interface Object	0xF5	For TCP/IP interface
EtherNet Link Object	0xF6	For EtherNet connection
VFD Data Object	0x300	AC drive data element

A.2 Data Types Supported

Data type	Description
BYTE	8-bit string
WORD	16-bit string
DWORD	32-bit string
STRING[n]	String composed of n bytes
SHORT_STRING	String combined from bytes (1 byte length indicator, 1 byte characters)
USINT	8-bit unsigned integer
UINT	16-bit unsigned integer
UDINT	32-bit unsigned integer

A.3 Identity Object (Class Code: 0x01)

A.3.1 Instance Code: 0x01

A.3.2 Instance Attributes

Attribute ID	Access Rule	Name	Data Type	Description of Attribute
0x01	Get	Vendor ID	UINT	799
0x02	Get	Device Type	UINT	Communications Adapter 12
0x03	Get	Product Code	UINT	Model code: 0x0204
0x04	Get	Revision	STRUCT of: USINT, USINT	Firmware version Major Revision Minor Revision
0x05	Get	Status	WORD	Summary status of devices Currently, this value is always 0
0x06	Get	Serial Number	UDINT	32 bit Serial number of device
0x07	Get	Product Name	SHORT_STRING	CMM-EIP01

A.3.3 Common Services:

Service Code	Implemented for		Service Name	Description of Service
	Class	Instance		
0x01		✓	Get_Attribute_All	Returns various attributes of an element
0x05		✓	Reset	Resets device settings
0x0E	✓	✓	Get Attribute Single	Returns the attributes of a designated element

A.4 Message Router Object (Class Code: 0x02)

A.4.1 Instance Code: 0x01

A.4.2 Instance Attributes: None

A.4.3 Common Services

Service Code	Implemented for		Service Name	Description of Service
	Class	Instance		
0x0E		✓	Get Attribute Single	Returns the attributes of a designated element

A.5 Assembly Object (Class Code: 0x04)

A.5.1 Instance Code:

I/O Message Connection				
Name	Function	Instance	Size	Description
Connection 1	Input	0x69	32 words	Corresponds to the input buffer register
	Output	0x68	32 words	Corresponds to the output buffer register
	Configuration	0x80	128 words	Corresponds to the setup component
Connection 1_ Listen only	Input	0x69	32 words	Corresponds to the input buffer register
	Output	0xC7	0 words	
	Configuration	0x80	128 words	Corresponds to the setup component
Connection 2	Input	0x65	16 words	Corresponds to the input buffer register
	Output	0x64	3 words	Corresponds to the output buffer register
	Configuration	0x66	0 words	Corresponds to the setup component
Connection 2_ Listen only	Input	0x65	16 words	Corresponds to the input buffer register
	Output	0xC7	0 words	Corresponds to the output buffer register
	Configuration	0x66	0 words	Corresponds to the setup component

A.5.2 Instance Attributes:

Attribute ID	Access Rule	Name	Data Type	Description of Attribute
0x03	Get / Set	Data	ARRAY of BYTE	Instance Code = 0x64 (Get / Set) Others Get only
0x04	Get	Size	UINT	Instance Code = 0x65 (Get only)

A.5.3 Common Services:

Service Code	Implemented for		Service Name	Description of Service
	Class	Instance		
0x0E	✓	✓	Get Attribute Single	Returns the attributes of a designated element
0x10		✓	Set Attribute Single	Modifies attribute value

A.6 Connection Manager Object (Class Code: 0x06)

A.6.1 Instance Code: 0x01

A.6.2 Instance Attributes: None

A.6.3 Services:

Service Code	Implemented for		Service Name	Description of Service
	Class	Instance		
0x0E	✓	✓	Get_Attribute_Single	Returns the attributes of a designated element
0x4E		✓	Forward Close	Close connection
0x54		✓	Forward Open	Establishes a connection with 511 bytes max.
0x5B		✓	Large_Forward_Open	

A.7 TCP / IP Interface Object (Class Code: 0xF5)

A.7.1 Instance Code: 0x01

A.7.2 Instance Attributes:

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	Path Size, Path	STRUCT of: UINT, Padded EPATH	Path size Path
0x05	Get / Set	Interface Configuration	STRUCT of: UDINT, UDINT, UDINT, UDINT, UDINT, STRING	IP Address Network Mask Gateway Address Name Server Name Server 2 Domain Name
0x06	Get / Set	Host Name	STRING	Host name

■ **Status Instance Attribute**

Bits	Name	Description
0-3	Interface Configuration Status	0 = The Interface Configuration attribute has not been configured. 1 = The Interface Configuration attribute contains valid configuration obtained from BOOTP, DHCP or non-volatile storage. 2 = The IP address member of the Interface Configuration attribute contains valid configuration, obtained from hardware settings (e.g.: pushwheel, thumbwheel, etc.) 3-15 = Reserved for future use.

■ **Configuration Capability Attribute**

Bits	Name	Description
2	DHCP Client	1 (TRUE) shall indicate the device is capable of obtaining its network configuration via DHCP.
4	Configuration Settable	1(TRUE) shall indicate the Interface Configuration attribute is settable.

■ **Configuration Control Attribute**

Bits	Name	Description
0-3	Startup Configuration	0 = The device shall use the interface configuration values previously stored in non-volatile memory. 1 = The device shall obtain its interface configuration values via BOOTP. 2 = The device shall obtain its interface configuration values via DHCP upon start-up. 3-15 = Reserved for future use.

A.7.3 Common Services:

Service Code	Implemented for Class	Implemented for Instance	Service Name	Description of Service
0x0E	✓	✓	Get Attribute Single	Returns the attributes of a designated element
0x10		✓	Set Attribute Single	Modifies attribute value

A.8 EtherNet Link Object (Class Code: 0xF6)

A.8.1 Instance Code: 0x01

A.8.2 Instance Attributes:

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 [6]	MAC address

■ **Interface Flags**

Bits	Name	Description
0	Link Status	0 indicates an inactive link; 1 indicates an active link.
1	Half / Full Duplex	0 indicates the interface is running half duplex; 1 indicates full duplex.
2-4	Negotiation Status	Indicates the status of link auto-negotiation 0 = Auto-negotiation in progress. 1 = Auto-negotiation and speed detection failed. Using default values for speed and duplex. Defaults are 10Mbps and half duplex. 2 = Auto negotiation failed but detected speed. Default is half duplex. 3 = Successfully negotiated speed and duplex. 4 = Auto-negotiation not attempted. Forced speed and duplex.

A.8.3 Services:

Service Code	Implemented for Class	Implemented for Instance	Service Name	Description of Service
0x01		✓	Get_Attribute_All	Returns various attributes of an element
0x0E		✓	Get Attribute Single	Returns the attributes of a designated element

A.9 VFD Data Object (Class Code: 0x300)

A.9.1 Class Attributes & Instance Attributes:

Object class = 0x300
Instance = Parameter Group
Attribute = Parameter Member

Instance & Attributes					
Instance	**Attributes**	**Access Rule**	**Name**	**Data Type**	**Description of Attribute**
0x00~0x0B	0x00~0x63	Get / Set	VFD Parameter.	UDINT, STRING	VFD group parameter data
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 0x40~0x41 0x60~0x62 0xA0~0xA2	Get	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

A.9.2 Services:

Service Code	**Implemented for**		**Service Name**	**Description of Service**
	Class	**Instance**		
0x0E	✓	✓	Get_Attribute_Single	Returns the attributes of a designated element