



User Guide

MD500-EN1 Communication

Expansion Card

Preface

■ Introduction

MD500 series Ethernet/IP communication card (hereinafter referred to as MD500-EN1 card) is an adapter card for Ethernet/IP fieldbus. It complies with international Ethernet/IP bus standards and features high efficiency, flexible topology, and easy operation.

This user guide describes the specifications, dimensions, installation, wiring, communication protocols, communication-related parameters, and communication examples of the MD500-EN1 expansion card.

■ Revision history

Date	Version	Revision
August 2021	A00	◆ First release

■ Document acquisition

This user guide is not delivered along with the product. You can obtain the PDF version of this document by the following method:

Log in to Inovance's official website (<http://en.inovance.cn/>), choose **Support** > **Download**, search for keywords, and then download the PDF file.

Contents

Preface	1
Safety Instructions	3
Safety Precautions.....	3
Safety Levels and Definitions	3
Safety Instructions.....	3
Safety Signs.....	8
1 Product Information	9
1.1 Applicable AC drive.....	9
1.2 Introduction	9
1.3 Appearance and Dimensions.....	9
1.4 Interface Layout and Description	10
2 Installation and Wiring.....	12
2.1 Installation	12
2.2 Wiring.....	13
2.2.1 Ethernet/IP Topology.....	13
2.2.2 EMC Wiring	14
3 Ethernet/IP Communication Protocol.....	15
3.1 Description of I/O Messages Data	15
3.2 Description of Data Transmitted by the Master.....	15
3.3 Description of Data Responded to by the AC Drive	16
4 Parameters Related to Communication	17
4.1 Communication Card Type Setting	17
4.2 IP Address Setting of MD500-EN1 Card	17
4.3 Parameters of AC Drive Communication Card.....	19
4.4 Parameter Related to Communication Control.....	19
4.5 Parameters Related to Communication Monitoring.....	20
5 Communication Examples	23
5.1 AB L16ER Controller as the Master	23
5.2 Inovance AM600 Controller as the Master.....	36
6 Troubleshooting.....	41

Safety Instructions

Safety Precautions

- 1) Before installing, using, and maintaining this equipment, read the safety information and precautions thoroughly, and comply with them during operations.
- 2) To ensure the safety of humans and equipment, follow the signs on the equipment and all the safety instructions in this user guide.
- 3) "CAUTION", "WARNING", and "DANGER" items in the manual do not indicate all safety precautions that need to be followed; instead, they just supplement the safety precautions.
- 4) Use this equipment according to the designated environment requirements. Damage caused by improper usage is not covered by warranty.
- 5) Inovance shall take no responsibility for any personal injuries or property damage caused by improper usage.

Safety Levels and Definitions



DANGER

indicates that failure to comply with the notice will result in severe personal injuries or even death.



WARNING

indicates that failure to comply with the notice may result in severe personal injuries or even death.



CAUTION

indicates that failure to comply with the notice may result in minor personal injuries or damage to the equipment.

Safety Instructions

Unpacking



CAUTION

- ◆ Check whether the packing is intact and whether there is damage, water seepage, damp, and deformation.
- ◆ Unpack the package by following the package sequence. Do not hit the package with force.
- ◆ Check whether there are damage, rust, or injuries on the surface of the equipment or equipment accessories.
- ◆ Check whether the number of packing materials is consistent with the packing list.



- ◆ Do not install the equipment if you find damage, rust, or indications of use on the equipment or accessories.
- ◆ Do not install the equipment if you find water seepage, component missing or damage upon unpacking.
- ◆ Do not install the equipment if you find the packing list does not conform to the equipment you received.

Storage and Transportation



- ◆ Store and transport this equipment based on the storage and transportation requirements for humidity and temperature.
- ◆ Avoid transporting the equipment in environments such as water splashing, rain, direct sunlight, strong electric field, strong magnetic field, and strong vibration.
- ◆ Avoid storing this equipment for more than three months. Long-term storage requires stricter protection and necessary inspections.
- ◆ Pack the equipment strictly before transportation. Use a sealed box for long-distance transportation.
- ◆ Never transport this equipment with other equipment or materials that may harm or have negative impacts on this equipment.



- ◆ Use professional loading and unloading equipment to carry large-scale or heavy equipment.
- ◆ When carrying this equipment with bare hands, hold the equipment casing firmly with care to prevent parts falling. Failure to comply may result in personal injuries.
- ◆ Handle the equipment with care during transportation and mind your step to prevent personal injuries or equipment damage.
- ◆ Never stand or stay below the equipment when the equipment is lifted by hoisting equipment.

Installation



- ◆ Thoroughly read the safety instructions and user guide before installation.
- ◆ Do not modify this equipment.
- ◆ Do not rotate the equipment components or loosen fixed bolts (especially those marked in red) on equipment components.
- ◆ Do not install this equipment in places with strong electric or magnetic fields.
- ◆ When this equipment is installed in a cabinet or final equipment, protection measures such as a fireproof enclosure, electrical enclosure, or mechanical enclosure must be provided. The IP rating must meet IEC standards and local laws and regulations.

**DANGER**

- ◆ Equipment installation, wiring, maintenance, inspection, or parts replacement must be performed by only professionals.
- ◆ Installation, wiring, maintenance, inspection, or parts replacement must be performed by only experienced personnel who have been trained with necessary electrical information.
- ◆ Installation personnel must be familiar with equipment installation requirements and relevant technical materials.
- ◆ Before installing equipment with strong electromagnetic interference, such as a transformer, install an electromagnetic shielding device for this equipment to prevent malfunctions.

Wiring**DANGER**

- ◆ Equipment installation, wiring, maintenance, inspection, or parts replacement must be performed by only professionals.
- ◆ Never perform wiring at power-on. Failure to comply will result in an electric shock.
- ◆ Before wiring, cut off all equipment power supplies. Wait at least 10 minutes before further operations because residual voltage exists after power-off.
- ◆ Make sure that the equipment is well grounded. Failure to comply will result in an electric shock.
- ◆ During wiring, follow the proper electrostatic discharge (ESD) procedures, and wear an antistatic wrist strap. Failure to comply will result in damage to internal equipment circuits.

**WARNING**

- ◆ Never connect the power cable to output terminals of the equipment. Failure to comply may cause equipment damage or even a fire.
- ◆ When connecting a drive with the motor, make sure that the phase sequences of the drive and motor terminals are consistent to prevent reverse motor rotation.
- ◆ Wiring cables must meet diameter and shielding requirements. The shielding layer of the shielded cable must be reliably grounded at one end.
- ◆ After wiring, make sure that no screws are fallen and cables are exposed in the equipment.

Power-on



DANGER

- ◆ Before power-on, make sure that the equipment is installed properly with reliable wiring and the motor can be restarted.
- ◆ Before power-on, make sure that the power supply meets equipment requirements to prevent equipment damage or even a fire.
- ◆ At power-on, unexpected operations may be triggered on the equipment. Therefore, stay away from the equipment.
- ◆ After power-on, do not open the cabinet door and protective cover of the equipment. Failure to comply will result in an electric shock.
- ◆ Do not touch any wiring terminals at power-on. Failure to comply will result in an electric shock.
- ◆ Do not remove any part of the equipment at power-on. Failure to comply will result in an electric shock.

Operation



DANGER

- ◆ Do not touch any wiring terminals during operation. Failure to comply will result in an electric shock.
- ◆ Do not remove any part of the equipment during operation. Failure to comply will result in an electric shock.
- ◆ Do not touch the equipment shell, fan, or resistor for temperature detection. Failure to comply will result in heat injuries.
- ◆ Signal detection must be performed by only professionals during operation. Failure to comply will result in personal injuries or equipment damage.



WARNING

- ◆ Prevent metal or other objects from falling into the device during operation. Failure to comply may result in equipment damage.
- ◆ Do not start or stop the equipment using the contactor. Failure to comply may result in equipment damage.

Maintenance



DANGER

- ◆ Equipment installation, wiring, maintenance, inspection, or parts replacement must be performed by only professionals.
- ◆ Do not maintain the equipment at power-on. Failure to comply will result in an electric shock.
- ◆ Before maintenance, cut off all equipment power supplies and wait at least 10 minutes.



WARNING

- ◆ Perform daily and periodic inspection and maintenance for the equipment according to maintenance requirements and keep a maintenance record.

Repair



- ◆ Equipment installation, wiring, maintenance, inspection, or parts replacement must be performed by only professionals.
- ◆ Do not repair the equipment at power-on. Failure to comply will result in an electric shock.
- ◆ Before inspection and repair, cut off all equipment power supplies and wait at least 10 minutes.



- ◆ Require for repair services according to the product warranty agreement.
- ◆ When the equipment is faulty or damaged, require professionals to perform troubleshooting and repair by following repair instructions and keep a repair record.
- ◆ Replace quick-wear parts of the equipment according to the replacement guide.
- ◆ Do not operate damaged equipment. Failure to comply may result in worse damage.
- ◆ After the equipment is replaced, perform wiring inspection and parameter settings again.


Disposal



- ◆ Dispose of retired equipment by following local regulations or standards. Failure to comply may result in property damage, personal injuries, or even death.
- ◆ Recycle retired equipment by following industry waste disposal standards to avoid environmental pollution.

Safety Signs

For safe equipment operation and maintenance, comply with safety signs on the equipment, and do not damage or remove the safety labels. The following table describes the safety signs.

Safety Sign	Description
	<ul style="list-style-type: none">◆ Read the user guide before installation and operation. Failure to comply will result in an electric shock.◆ Do not remove the cover at power-on or within 10 minutes after power-off.◆ Before maintenance, inspection, and wiring, cut off input and output power, and wait at least 10 minutes until the power indicator is off.

1 Product Information

1.1 Applicable AC drive

Expansion Card	AC drive	Remark
MD500-EN1	MD500-PLUS	-
	MD520	-

1.2 Introduction

MD500 series Ethernet/IP communication card (hereinafter referred to as MD500-EN1 card) is an adapter card for Ethernet/IP fieldbus. It complies with international Ethernet/IP bus standards and features high efficiency, flexible topology, and easy operation. It is installed in the MD series AC drive to increase the communication efficiency and implement the AC drive networking function, which enables the AC drive to be a slave controlled by the field bus master.

The MD500-EN1 card software version required is 1.00 or later (check the software version in U0-67 upon power-on after installing the card). The corresponding EDS file name is **MD500P_EIP_V1.00.eds**. This user guide is applicable only for the MD500-PLUS series AC drive. If you need to use the MD500-EN1 card with other AC drives, contact our technical support for details.

1.3 Appearance and Dimensions



Figure 1-1 2. Appearance of the M500-EN1 card

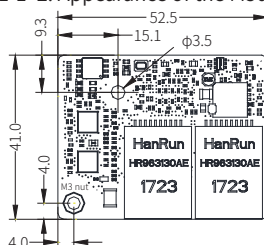


Figure 1-2 Dimensions of the M500-EN1 card

1.4 Interface Layout and Description

"[Figure 1-3 MD500-EN1 interface layout](#)" shows the hardware layout of the MD500-EN1 card. The pin header J7 on the back of the MD500-EN1 card is used to connect the AC drive. The MD500-EN1 card provides two network ports J4 and J6 for communication with Ethernet/IP master (or other slaves). For details about the hardware, see "[Table 1-1 Interface Description](#)".

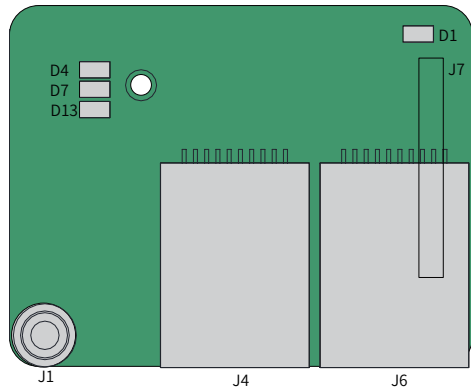


Figure 1-3 MD500-EN1 interface layout

Table 1-1 Interface Description

Symbol	Interface Name	Function Description
J7	Pin header	Used to connect the AC drive.
J4	Network port	Adopts the standard Ethernet RJ45 socket, direction insensitive. Used for MD500-EN1 card to establish communication with Ethernet/IP master station(or other slave stations). Its pin signal definitions are the same as those of the standard Ethernet pins. They can be connected using crossover cables or straight-through cables.
J6		
J1	EMC ground terminal	Used to connect the EMC ground terminal of the AC drive.
D13	Power indicator (green)	Used to indicate the power status. On: normal Off: abnormal (Check whether the installation is correct).

Symbol	Interface Name	Function Description
D1	AC drive communication status indicator (green)	See "Table 1-2 Description of indicators on the MD500-EN1 card" .
D4	Ethernet/IP operation status indicator (green)	
D7	Ethernet/IP fault indicator (red)	

**NOTE**

- ◆ After the MD500-EN1 card is installed, J4 is on the left and J6 is on the right when you face the RJ45 interface. The two interfaces are direction-insensitive. Connect either of them to the PLC.
- ◆ The Cat5e shielded twisted pair (STP) network cable is recommended for operational stability.

Table 1-2 Description of indicators on the MD500-EN1 card

Indicator	State Description	Solution
D1 steady green	Normal	N/A
D1 steady off	Abnormal communication with the AC drive	Check whether FD-00 and FD-01 is set to 9 and 3 respectively.
D4 steady off D7 steady red	System fault	Check the following fault codes and solutions.
D4 steady off D7 flashing red	Waiting for obtaining IP address	The DHCP server assigns an IP address to the device by using BOOTP when the expansion card is in DHCP mode.
D4 flashing green D7 flashing red	Disconnection or timeout	Check whether the network cable is disconnected and the master station is running.
D4 flashing green D7 steady off	Waiting for connecting to the master station	Check whether the network cable connection is normal and the master station is running.
D4 steady green D7 steady off	Normal connection	N/A

2 Installation and Wiring

2.1 Installation

The MD500-EN1 is installed inside the MD500 series AC drive. Before installation, de-energize the AC drive and wait about 10 minutes until the charging indicator on the AC drive becomes off. Then, insert the MD500-EN1 card into the AC drive and fasten the screws to avoid damage caused by external signal cable tension on the signal socket between boards. The installation is shown in "[Figure 2-1 Installation of the MD500-EN1 card](#)".

Note that the ground terminals of both the MD500-EN1 card and AC drive must be connected properly, as shown in "[Figure 2-2 Ground terminal connection between the MD500-EN1 card and the AC drive](#)".

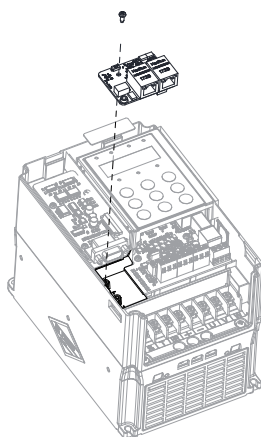


Figure 2-1 Installation of the MD500-EN1 card

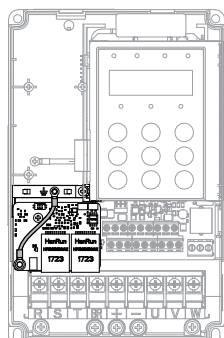


Figure 2-2 Ground terminal connection between the MD500-EN1 card and the AC drive

2.2 Wiring

2.2.1 Ethernet/IP Topology

The topological structures supported by Ethernet/IP include bus, star, and tree topologies. Various networking can be realized by using switches correctly.

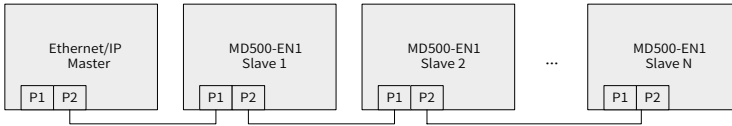


Figure 2-3 Bus topology

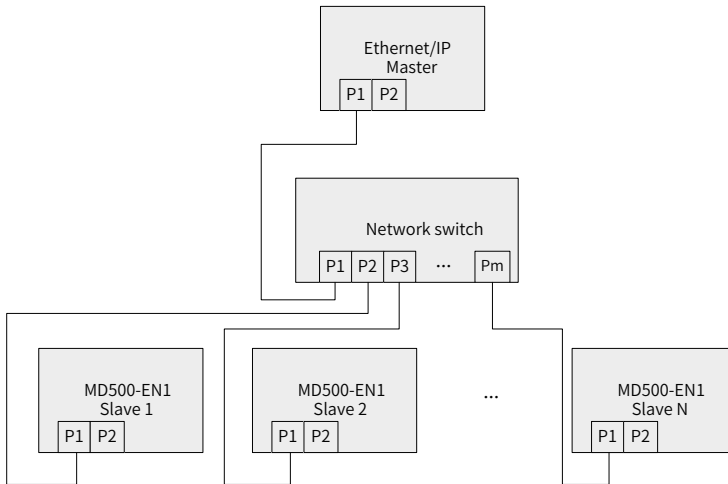


Figure 2-4 Star topology

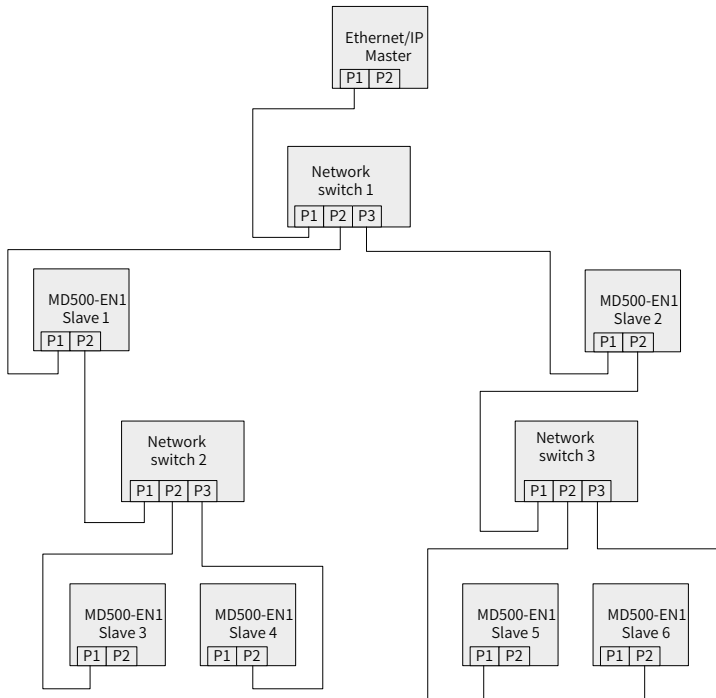


Figure 3-3 Tree topology

2.2.2 EMC Wiring

- During on-site installation and commissioning, the signal cables and power cables must be laid in different ducts. Never bundle the signal cables and power cables together to prevent communication interference.
- Motor enclosure must be connected to PE of the AC drive. Meanwhile, the grounding cable on the motor housing side must be connected properly. Failure to comply will result in poor grounding effect.
- Shielded cables are recommended. Connect the shield to PE of the AC drive.

3 Ethernet/IP Communication Protocol

3.1 Description of I/O Messages Data

24 I/O Messages are available in the MD500-EN1 expansion card for data transmission, in which 12 I/O messages transmit data from master station to slave station and another 12 I/O messages transmit data from slave station to master station.

The I/O Messages are used by the master station to modify and read AC drive data in real time and perform periodic data exchange. Data communication addresses are directly configured by the AC drive. The specific functions are as follows:

- ◆ Real-time setting of AC drive control command and target frequency
- ◆ Real-time reading of AC drive current state and operating frequency
- ◆ Function parameter and monitoring data real-time exchange between the AC drive and Ethernet/IP master station

The I/O Messages data is used for periodic data exchange between the master station and AC drive, as described in the following table.

I/O Messages (O->T) transmitted by the master		
AC drive command	AC drive target frequency	Modifying function parameters of AC drive in real time
Output I/O Messages[0]	Output I/O Messages[1]	Output I/O Messages[2-11]
I/O Messages (T->O) responded to by the AC Drive		
AC drive state	AC drive operating frequency	Reading function parameters of AC drive in real time
AC drive response I/O Messages (T->O)	Input I/O Messages[1]	Input I/O Messages[2-11]

3.2 Description of Data Transmitted by the Master

For details on the data transmitted by the master, see the following table.

Description of data transmitted by the master		
I/O Messages0	AC drive command word (command source set to "communication")	
	00: Stop as defined by F6-10 (Stop mode) 01: Forward running 02: Reverse running 03: Forward jogging	04: Reverse jogging 05: Coast to stop 06: Stop as defined by F6-10 (Stop mode) 07: Fault reset
I/O Messages1	AC drive target frequency (frequency source set to "communication") in the range of reverse frequency upper limit (negative value) to forward frequency upper limit (decimal places included, for example, 2000 corresponds to 20.00 Hz on the AC drive). When the set target frequency exceeds this range, the AC drive runs at the frequency upper limit.	

Description of data transmitted by the master	
I/O Messages2 to I/O Messages11	Used to change the function parameter values (groups F and A) in real time without writing the values into the EEPROM. FE-02 to FE-11 correspond to I/O Messages2 to I/O Messages11. For details about the configuration, see the I/O Messages data configuration.

3.3 Description of Data Responded to by the AC Drive

For details on the data responded to by the AC drive, see the following table.

Description of data responded to by the AC Drive	
I/O Messages0	Indicates AC drive operating frequency, which is defined by bits as shown below: Bit0: 0: AC drive stop; 1: AC drive running Bit1: 0: Forward running; 1: Reverse running Bit2: 0: No fault; 1: AC drive fault Bit3: 0: Operating frequency not reached; 1: Operating frequency reached Bit4–7: Reserved Bit 8 to Bit 15: AC drive fault code
I/O Messages1	Indicates feedback of the AC drive operating frequency (unit: 0.01 Hz), which is a signed Int16 value.
I/O Messages2 to I/O Messages11	Indicates function parameter values (groups F and A) and monitoring parameter values (group U) read in real time. FE-22 to FE-31 correspond to I/O Messages2 to I/O Messages11. For details about the configuration, see the I/O Messages data configuration.

4 Parameters Related to Communication

4.1 Communication Card Type Setting

After powering on the AC drive, set FD-00 and FD-01 to 9 (baud rate: 115200 bps) and 3 (no check, 8-N-1) respectively to enable communication between the MD500-EN1 card and the AC drive.

Parameter No.	Parameter Name	Setting range	Default	Meaning
FD-00	Baud rate	0:300 bps 1: 600 bps 2:1200 bps 3:2400 bps 4:4800 bps 5:9600 bps 6:19200 bps 7:38400 bps 8:57600 bps 9:115200 bps	9	Used to set the data transmission rate between the communication expansion card and the AC drive.
FD-01	Modbus data format	0: No check (8-N-2) 1: Even parity check (8-E-1) 2: Odd parity check (8-O-1) 3: No check (8-N-1)	3	Used to set the Modbus data format between the communication expansion card and the AC drive.

4.2 IP Address Setting of MD500-EN1 Card

Communication card parameter setting for the AC drive.

Parameter No.	Parameter Name	Setting Range	Description
FD-37	DHCP function selection	0: Disabled 1: Enabled	Used to set the DHCP function of the Ethernet/IP expansion card. Enabling the DHCP function deactivates IP address settings, namely parameters FD-38 to FD-41, FD-42 to FD-45, and FD-46 to FD-49.
FD-38 to FD-41	Expansion card IP address	0-255	Used to set the IP address of Ethernet/IP expansion card.

Parameter No.	Parameter Name	Setting Range	Description
FD-42 to FD-45	Subnet mask of expansion card	0-255	Used to set subnet mask of Ethernet/IP expansion card.
FD-46 to FD-49	Gateway address of expansion card	0-255	Used to set gateway address of Ethernet/IP expansion card.

IP address setting is divided into static IP and DHCP dynamic IP address. Select the IP mode in parameter No. FD-37. Set static IP address in parameter No. FD-37 to FD-49. For example, configure static IP address :192.168.0.6 , subnet mask:255.255.255.0, and gateway address:192.168.0.1, set the following parameters.

Parameter No.	Function	Set Value
FD-37	DHCP function selection	0
FD-38	Most significant byte of the IP address	192
FD-39	Second most significant byte of the IP address	168
FD-40	Third most significant byte of the IP address	0
FD-41	Least significant byte of the IP address	6
FD-42	Most significant byte of the subnet mask	255
FD-43	Second most significant byte of the subnet mask	255
FD-44	Third most significant byte of the subnet mask	255
FD-45	Least significant byte of the subnet mask	0
FD-46	Most significant byte of the gateway	192
FD-47	Second most significant byte of the gateway	168
FD-48	Third most significant byte of the gateway	0
FD-49	Least significant byte of the gateway	1

View MAC address when DHCP/BOOTP function is used. To view the MAC address, read the label attached to the expansion card or check the related parameter (see ["4.3 Parameters of AC Drive Communication Card"](#) for details).

This card supports IP address conflict detection. When other devices in the network share the same IP address with the expansion card, D7 indicator will be steady ON and bit2 of FD-58 will be changed to 1.

The following three cases are present in IP address conflict detection.

No.	Case	Symptom	Solution
1	Both devices support IP address conflict detection. The two devices are powered on one after another.	The device powered on first uses the IP address and continues to operate. The device powered on later enters the conflict mode.	Check device IP address and then modify the repeated one.
2	Both devices support IP address conflict detection. The two devices are powered on at approximately the same time.	The two devices enter the IP address conflict mode simultaneously.	
3	One device supports IP address conflict detection and the second device does not.	Regardless of which device is powered on first, the device that does not support IP address detection uses the IP address. The device that supports IP address conflict detection enters the conflict mode.	

**NOTE**

- ◆ When the DHCP server assigns an IP address to the expansion card, active conflict detection applies. Later, passive detection applies. If the devices are separately assigned with the same dynamic (static) IP address on the same network, both expansion cards do not report IP address conflict.
- ◆ When using the DHCP function to assign IP addresses, the address assignment would fail if IP address conflict occurs.

4.3 Parameters of AC Drive Communication Card

Parameter No.	Parameter Name	Unit	Description
FD-61	The first two bytes of expansion card MAC address	1	Expansion card MAC address
FD-62	The middle two bytes of expansion card MAC address	1	Expansion card MAC address
FD-63	The last two bytes of expansion card MAC address	1	Expansion card MAC address
FD-58	Expansion card error code	1	Expansion card error code

4.4 Parameter Related to Communication Control

Parameter No.	Name	Setting Range	Decimal Address
U3-16	Frequency setting	-Maximum frequency to +Maximum frequency 0.01 Hz	29456

Parameter No.	Name	Setting Range		Decimal Address
U3-17	Control command	0000: Stop as defined by F6-10 (Stop mode) 0001: Forward running 0002: Reverse running 0003: Forward jogging	0004: Reverse jogging 0005: Coast to stop 0006: Decelerate to stop 0007: Fault reset	29457
U3-18	DO control	Bit 0: DO1 control Bit 1: DO2 control Bit 2: RELAY1 control Bit 3: RELAY2 control		29458
U3-19	AO1 control	0 to 7FFF indicate 0% to 100%.		29459
U3-20	AO2 control	0 to 7FFF indicate 0% to 100%.		29460
U3-21	FMP control	0 to 7FFF indicate 0% to 100%.		29461
U3-22	Reserved	Reserved		
U3-23	Speed control	Signed data, 1 rpm		29463

By default, when the MD500-EN1 card is used, the written I/O Messages0 and I/O Messages1 are mapped to U3-17 and U3-16, respectively. If any command or frequency cannot be written to the AC drive correctly but I/O Messages2 to I/O Messages11 can be written and F0-02 and F0-03 are set to 2 and 9 respectively, check whether FE-00 and FE-01 are set to U3-17 and U3-16 respectively. If not, manually correct the values of FE-00 and FE-01.

4.5 Parameters Related to Communication Monitoring

Parameter No.	Name	Unit	Decimal Address
U0-00	Operating frequency (Hz)	0.01 Hz	28672
U0-01	Frequency reference (Hz)	0.01 Hz	28673
U0-02	Bus voltage (V)	0.1 V	28674
U0-03	Output voltage (V)	1 V	28675
U0-04	Output current (A)	0.01 A	28676
U0-05	Output power (kW)	0.1 kW	28677
U0-06	Output torque (%)	0.1%	28678
U0-07	DI state	1	28679
U0-08	DO state	1	28680
U0-09	AI1 voltage (V)	0.01 V	28681
U0-10	AI2 voltage (V)	0.01 V	28682
U0-11	AI3 voltage (V)	0.01 V	28683
U0-12	Count value	1	28684

Parameter No.	Name	Unit	Decimal Address
U0-13	Length value	1	28685
U0-14	Load speed display	0.001 Hz	28686
U0-15	PID reference	1	28687
U0-16	PID feedback	1	28688
U0-17	PLC stage	1	28689
U0-18	Pulse input reference (Hz)	0.01 kHz	28690
U0-19	Feedback speed (Hz)	0.01 Hz	28691
U0-20	Remaining operating time	0.1 min	28692
U0-21	AI1 voltage before correction	0.001 V	28693
U0-22	AI2 voltage before correction	0.001 V	28694
U0-23	AI3 voltage before correction	0.001 V	28695
U0-24	Linear speed	1 m/min	28696
U0-25	Current power-on time	1 min	28697
U0-26	Current operating time	0.1 min	28698
U0-27	Pulse input frequency	1 Hz	28699
U0-28	Communication reference	0.01%	28700
U0-29	Encoder feedback speed	0.01 Hz	28701
U0-30	Display of main frequency X	0.01 Hz	28702
U0-31	Display of auxiliary frequency Y	0.01 Hz	28703
U0-32	Check on any memory address	1	28704
U0-33	Synchronous motor rotor position	0.1°	28705
U0-34	Motor temperature	1°C	28706
U0-35	Target torque (%)	0.1%	28707
U0-36	Resolver position	1	28708
U0-37	Power factor angle	0.1°	28709
U0-38	ABZ position	1	28710
U0-39	Target voltage upon V/f separation	1 V	28711
U0-40	Output voltage upon V/f separation	1 V	28712
U0-41	DI state display	1	28713
U0-42	DO state display	1	28714
U0-43	DI state display 1	1	28715
U0-44	DI state display 2	1	28716
U0-45	Fault information	1	28717
U0-58	Z signal counting	1	28730
U0-59	Rated frequency (%)	0.01%	28731
U0-60	Operating frequency (%)	0.01%	28732

4 Parameters Related to Communication

Parameter No.	Name	Unit	Decimal Address
U0-61	AC drive state	1	28733
U0-62	Present fault code	1	28734
U0-63	Operating frequency after droop	0.01 Hz	38375
U0-64	Back EMF	0.1 V	28736
U0-65	Reserved	-	-
U0-66	Expansion card model	100: CANopen 200: PROFIBUS-DP 300: CANlink 400: PROFINET 500: EtherCAT 600: Ethernet/IP	28738
U0-67	Expansion card version	0.01	28739
U0-68	AC drive state	1	28740
U0-69	Operating frequency (Hz)	0.01 Hz	28741
U0-70	Motor speed	1 rpm	28742
U0-71	Output current	0.1 A	28743

By default, when the MD500-EN1 card is used, the I/O Messages0 and I/O Messages1 being read are mapped to U0-68 and U0-69, respectively. If any state or operating frequency cannot be read correctly but I/O Messages2 to I/O Messages11 can be read, check whether FE-20 and FE-21 are set to U0-68 and U0-69 respectively. If not, manually correct the values of FE-20 and FE-21.

5 Communication Examples

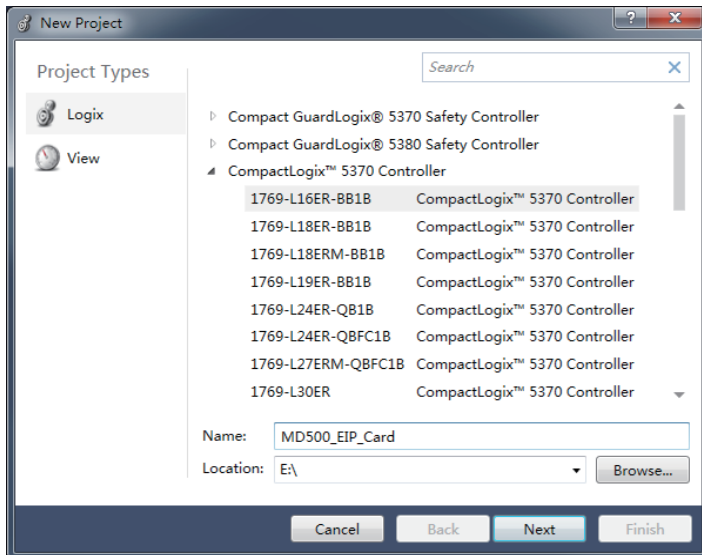
5.1 AB L16ER Controller as the Master

This example uses Studio5000 Logix Designer version 32.00.00 with 1769-L16ER-BB1B being the master. The information such as IP address has been configured according to the user guide. Connect either network port on the expansion card. Set F0-02, F0-03, FD-00, and FD-01 to 2, 9, 9, and 3 respectively before using the expansion card.



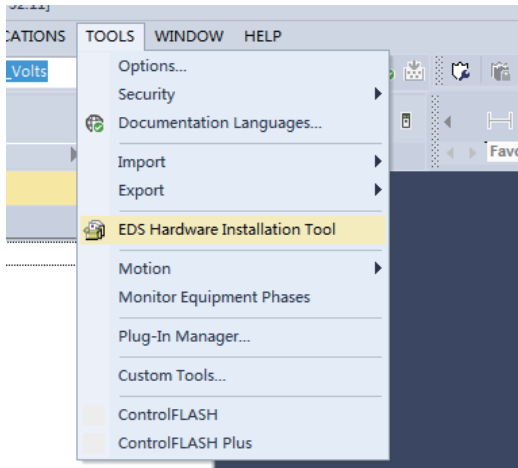
Step 1 : Create a new project.

Open **New project** window from Studio5000 software, select **1769-L16ER-BB1B** in **CompactLogix 5370 Controller**.

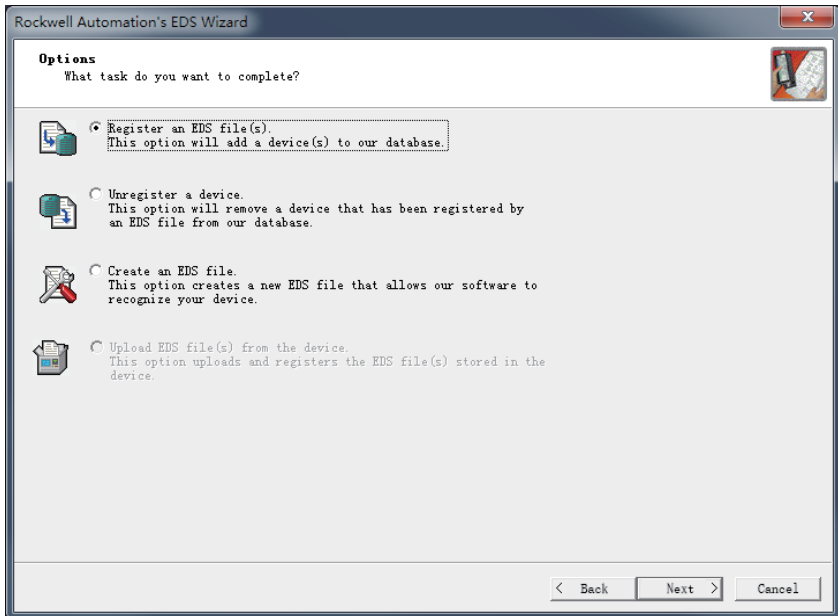


Step 2: Import the EDS file.

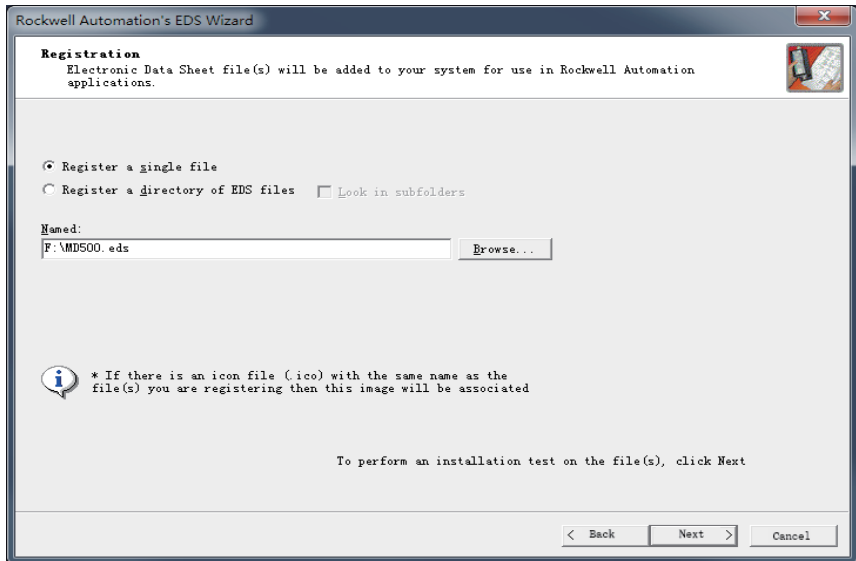
Choose **Tools > EDS Hardware Installation Tool** in the menu bar.



Click **Next** and then select **Register an EDS file(s)**.



Choose EDS file on your computer and then click **Next**.



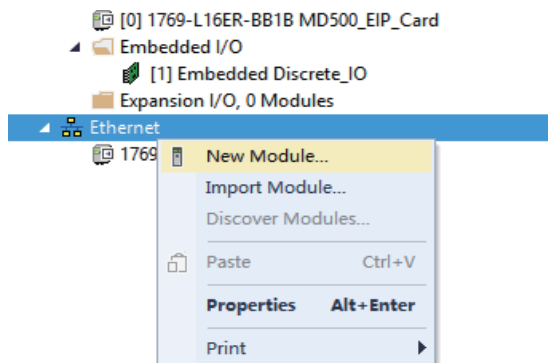
Keep clicking **Next** before the finish button shows and then click **Close**.

Step 3: Set the IP address of the expansion card, herein, take the static IP address as an example.

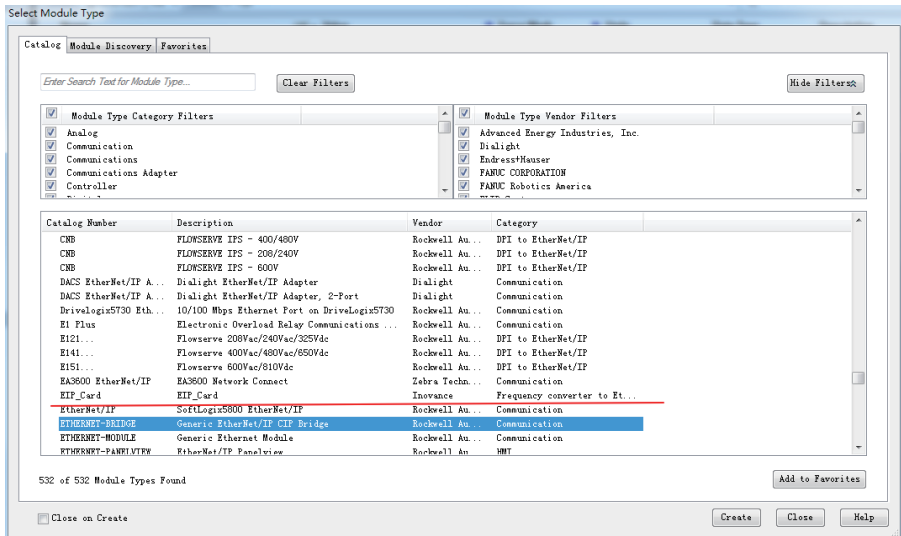
Set FD-37 – FD-49 to 0, 192.168.0.6, 255.255.255.0, and 192.168.0.1 respectively.

Step 4: Configure Studio5000 project.

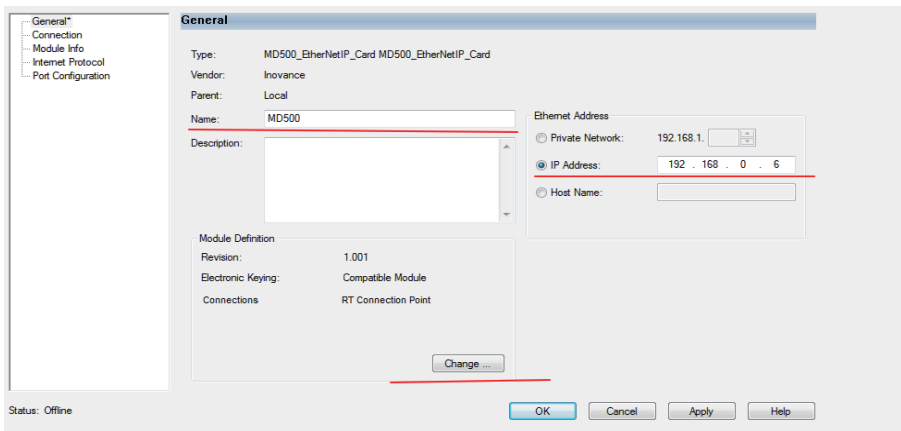
Choose **Ethernet** > **New Module** with left mouse button on the left navigation pane.



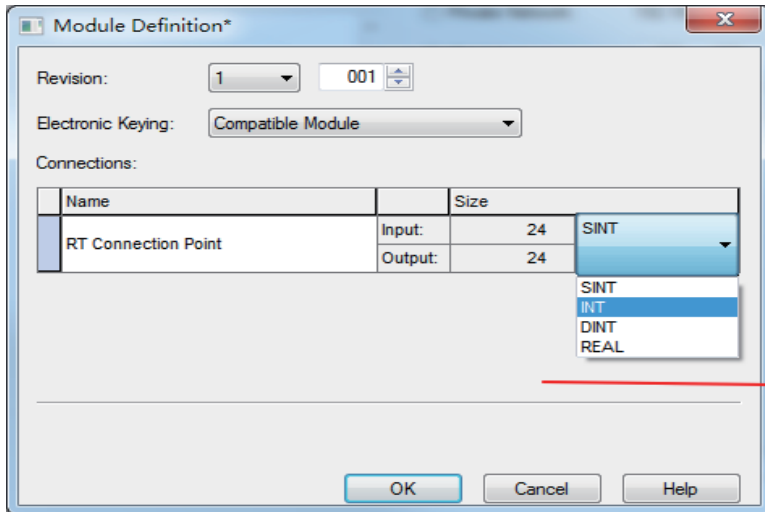
Locate **EIP_Card** on the interface and then click **Create**.



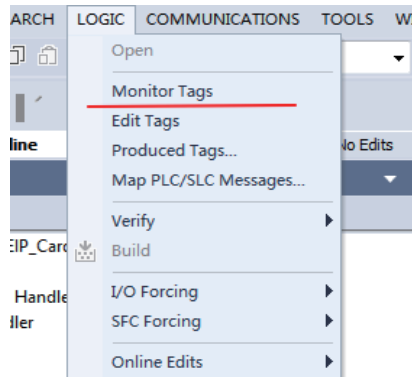
The configuration dialog box appears. Enter the preceding set IP address and type in a name.



Click **Change** in the **General** interface. Locate **SINT** and click to select **INT**. Next, Click **OK** and then **Yes** to proceed when an alert box appears.



Choose **Logic > Monitor Tags** in the menu bar.



Unfold **MD500:C.Data** and click **Style** to convert data type to **Hex**.

Name	Value	Force Mask	Style	Data Type	Description
Local:I:C		[...]	[...]		
Local:I:I		[...]	[...]	AB:Embedded_Discr...	
Local:I:O		[...]	[...]	AB:Embedded_Discr...	
MD500:C		[...]	[...]	3039:MD500_EtherN...	
MD500:C.Data		[...]	Hex	SINT[48]	
MD500:C.Data[0]		16#44	Hex	SINT	
MD500:C.Data[1]		16#70	Hex	SINT	
MD500:C.Data[2]		16#45	Hex	SINT	
MD500:C.Data[3]		16#70	Hex	SINT	
MD500:C.Data[4]		16#00	Hex	SINT	
MD500:C.Data[5]		16#F0	Hex	SINT	
MD500:C.Data[6]		16#00	Hex	SINT	
MD500:C.Data[7]		16#F0	Hex	SINT	
MD500:C.Data[8]		16#00	Hex	SINT	
MD500:C.Data[9]		16#F0	Hex	SINT	
MD500:C.Data[10]		16#00	Hex	SINT	
MD500:C.Data[11]		16#F0	Hex	SINT	
MD500:C.Data[12]		16#00	Hex	SINT	

The following parameters are used to configure PDO mapping. Every two parameters form a group. 0-23 indicates I/O Messages Mapping(T->O) and 24-47 indicates I/O Messages Mapping(O->T). Data[0]=0x44 and Data[1]=0x70 shown in the figure represent that TPDO1 is mapped to U0-68.

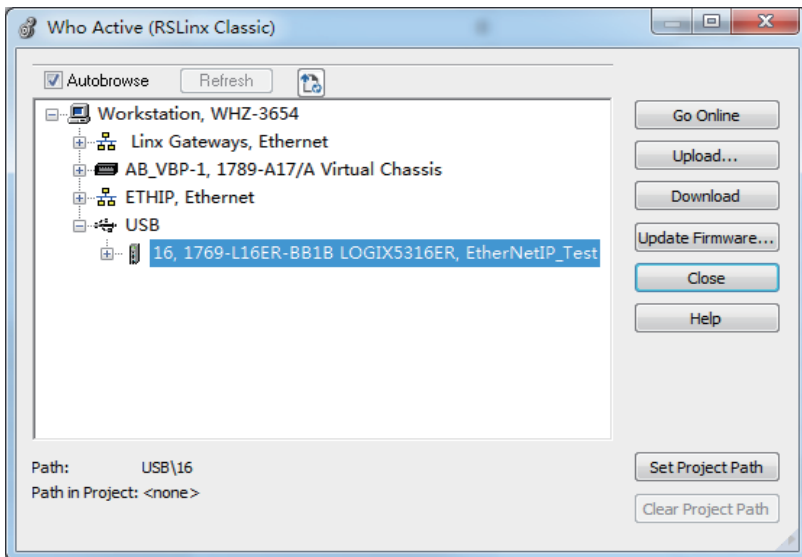
By default, I/O Messages Mapping(T->O)[0] is mapped to U0-68, I/O Messages Mapping(T->O)[1] is mapped to U0-69, I/O Messages Mapping(O->T)[0] is mapped to U3-17, and I/O Messages Mapping(O->T)[1] is mapped to U3-16. These four parameters cannot be changed, otherwise, a fault may occur. Other parameters can be user-defined as required.

MD500:I.Data and MD500:O.Data are IO data during data transmission. The written values in O.Data are written to the parameter corresponding to the mapping that is configured in the preceding process. Configured parameters corresponding to I/O Messages Mapping(T->O)[0] will be uploaded to I.Data regularly.

Click the following button marked in red to search for devices after configuration is finished.

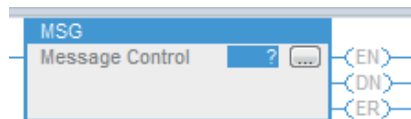


USB is used to connect the device in this example. Select device and then click **Download** to download code to PLC.

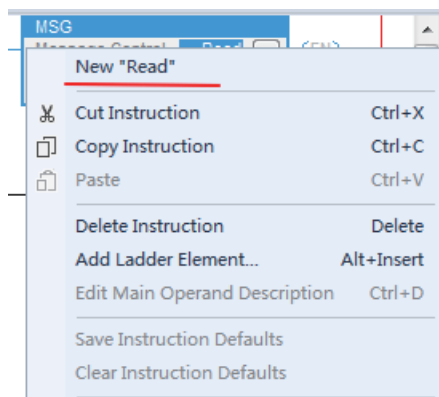


Step 5: Use explicit messaging for data transmission.

Open programming section in PLC, and choose **Input/Output > MSG**.



Enter a name in the field that holds the question mark and right-click **New "Read"**.



Click **Create**.

New Tag

Name: Create ▼

Description:

Usage:

Type: Connection...

Alias For:

Data Type: ...

Parameter Connection:

Scope:

External Access:

Style:

☐ Constant

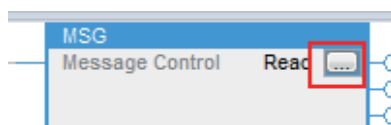
☐ Sequencing

☐ Open MESSAGE Configuration

☐ Open Parameter Connections

Cancel Help

Click the ellipsis on the right side of **MSG**.



Configure according to the following figures.

Message Configuration - Read

Configuration* Communication Tag

Message Type: CIP Generic

Service Type: Get Attribute Single

Service Code: e (Hex) Class: 93 (Hex) Instance: 64781 Attribute: 9 (Hex)

Source Element: Source Length: 0 (Bytes) Destination Element:

New Tag...

☐ Enable
 ☐ Enable Waiting
 ☐ Start
 ☒ Done

☐ Error
 Extended Error
 ☐ Timed Out

Select **Get Attribute Single** to read parameters while select **Set Attribute Single** to write parameters. **Class** and **Attribute** are set to fixed 0x93 and 0x9 respectively. **Instance** converts parameters required to be read to decimal format. FD-13 (FD0D) as shown in the figure is converted to the decimal format, which is **64781**.

Choose the path to saving the parameter by selecting **Destination Element** on the right side of the window. You can use **New Tag** to create a variable.

The screenshot shows a configuration window with the following elements:

- A dropdown menu at the top.
- A "Source Element:" label next to a dropdown menu.
- A "Source Length:" label next to a numeric input field containing "0" and a "(Bytes)" label.
- A "(Hex)" label next to a "Destination Element:" label, which is followed by a dropdown menu containing "EIP_Read".
- A "New Tag..." button located below the Destination Element dropdown.

Click **Communication** to choose the AC drive.

Message Configuration - Read

Configuration* Communication* Tag

☒ Path: MD500 Browse...

MD500

☐ Broadcast: ▼

Communication Method

☒ CIP ☐ DH+ Channel: A* Destination Link: 0

☐ CIP With Source ID Source Link: 0 Destination Node: 0 (Octal)

☐ Connected ☐ Cache Connections ☐ Large Connection

☐ Enable ☐ Enable Waiting ☐ Start ☐ Done Done 0

☐ Error Extended Error ☐ Timed Out

ErrCode:

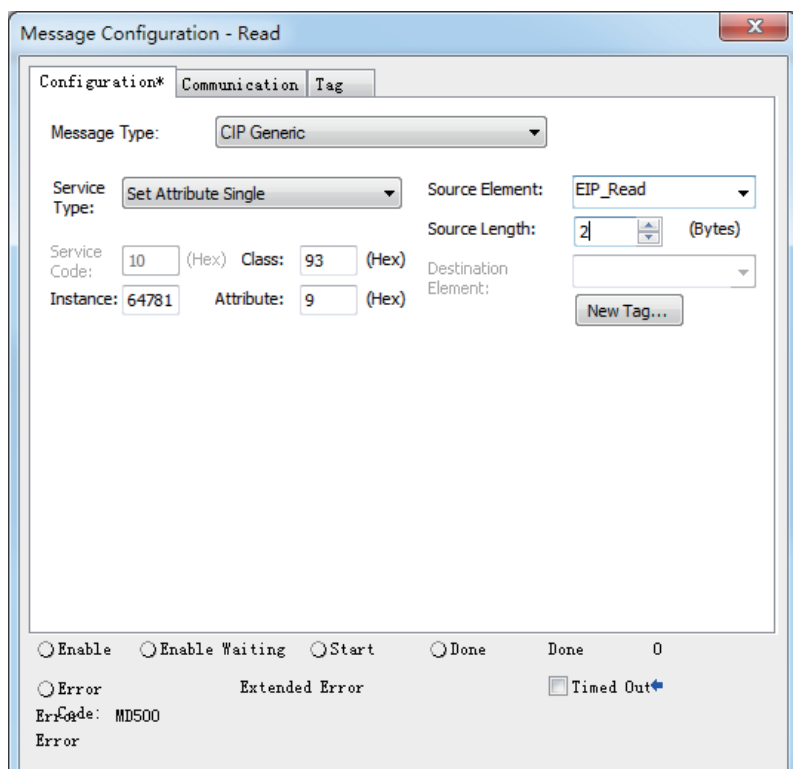
Error

OK Cancel Apply Help

Click **OK**. The master station will read this parameter and store the data into the selected variable. The value of this variable can be viewed in **Logic-Monitor Tags**.

b MD500-I		(...)	(...)	_3039:MD500_EtherN...
b MD500-O		(...)	(...)	_3039:MD500_EtherN...
b Read		(...)	(...)	MESSAGE
b EIP_Read		1	Decimal	DINT
key		0	Decimal	BOOL

Parameters being written are shown in the following figure.

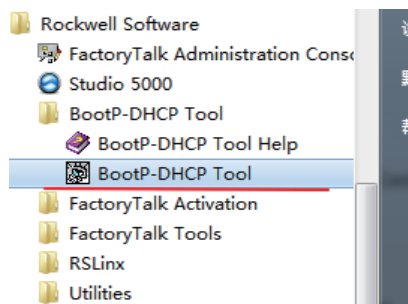


Step 6: Enable DHCP function.

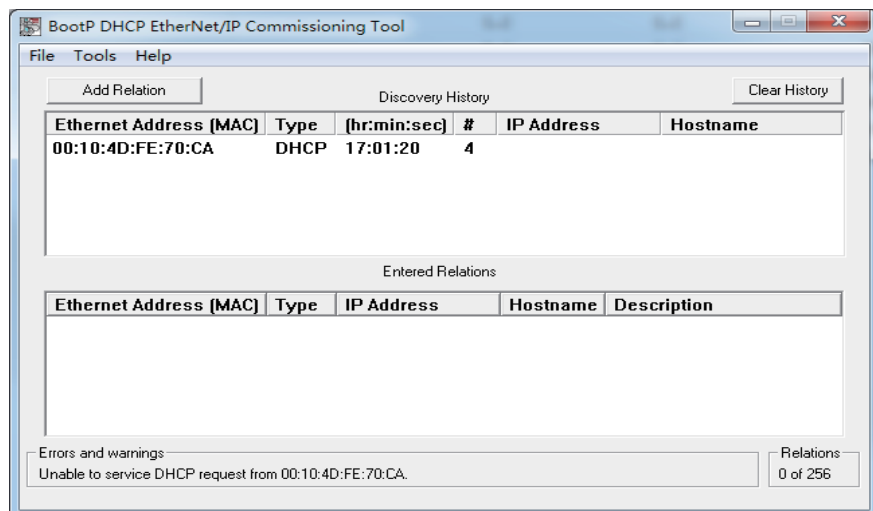
Note: IP address assigned from DHCP server cannot be saved at power-down state.

Set FD-37 to 1 to enter DHCP mode. Re-power on the AC drive and then connect the computer and the AC drive to the same network.

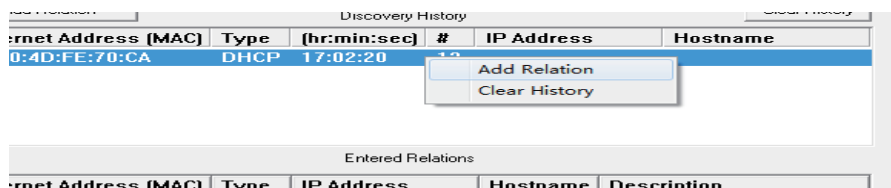
Choose **Start > BootP-DHCP Tool** and select the network adapter.



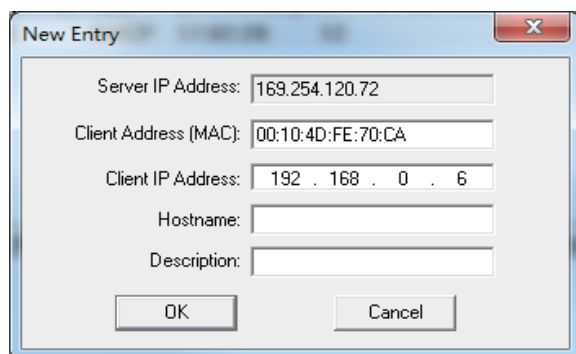
Device request can be seen in the software after power on.



Right-click to select **Add Relation**.



Set the IP address and click **OK**.



The IP address is written to the device.

Delete Relation		Entered Relations		Enable BOOTP/DHCP		Disable BOOTP/DHCP	
Ethernet Address (MAC)	Type	IP Address	Hostname	Description			
00:10:4D:FE:70:CA	DHCP	192.168.0.6					

Errors and warnings
Sent 192.168.0.6 to Ethernet address 00:10:4D:FE:70:CA

Relations
1 of 256

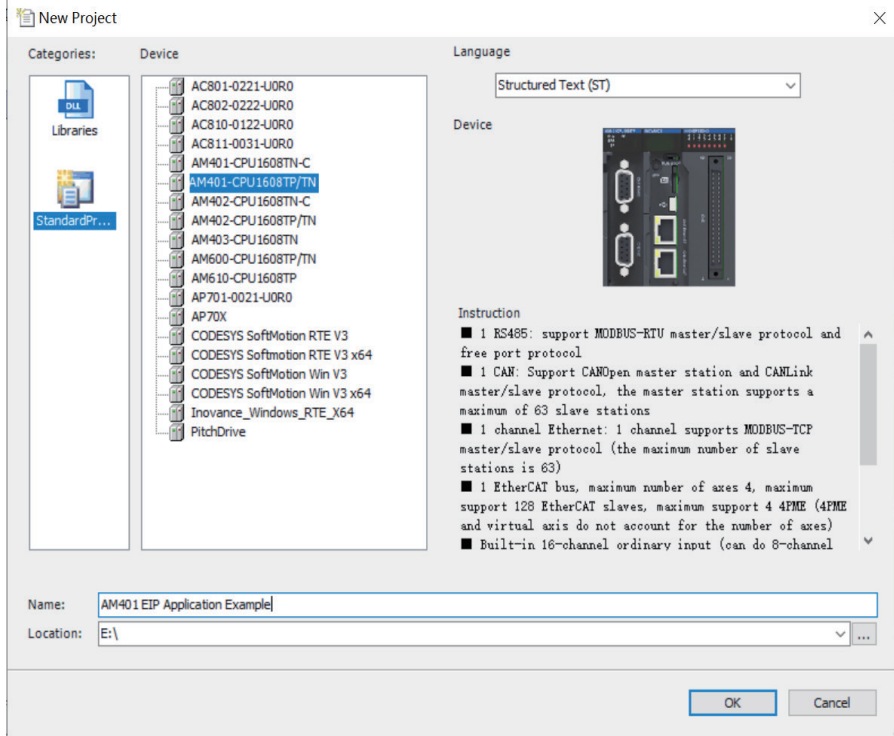
5.2 Inovance AM600 Controller as the Master

This example uses InoProShop version 1.5.2 with AM600 controller. The information such as IP address has been configured according to the user guide. Connect either network port on the left or right of the expansion card. Set F0-02, F0-03, FD-00, and FD-01 to 2, 9, 9, and 3 respectively before using the expansion card.



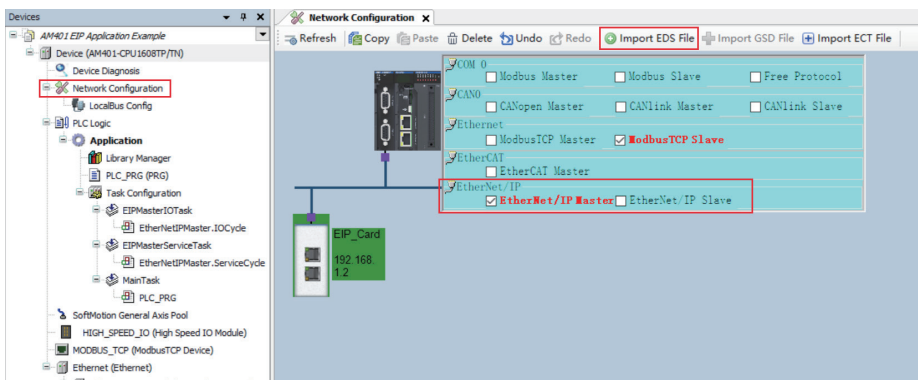
Step 1 : Create a new Project.

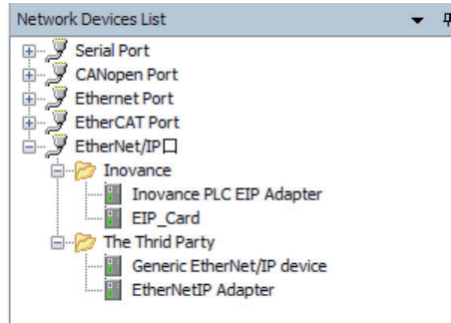
Open InoProShop to create a new project. Select device model: **AM600-CPU1608TP/TN**.



Step 2: Import the ESD file and add a slave station.

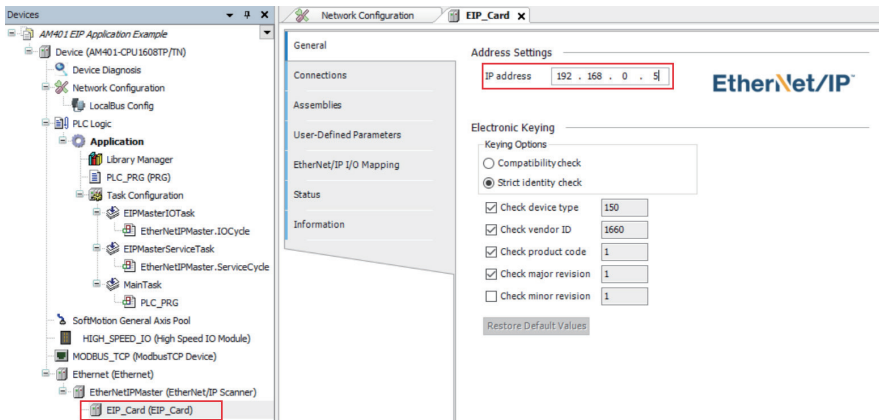
Open network configuration window, click PLC and select **Ethernet/IP master** as current communication protocol. Click **Import EDS file** to import EDS file of EIP card. Import device from **Network Device List** on the right side of the window.





Step 3: Configure the slave parameters.

Set the IP address of the slave station.



Click **Connections** on the left side of window to configure I/O messages mapping. Input I/O Messages Mapping(T->O)[x] indicates that the data is mapped from slave to master station. Output I/O Messages Mapping(O->T)[x] indicates that the data is mapped from master to slave station.

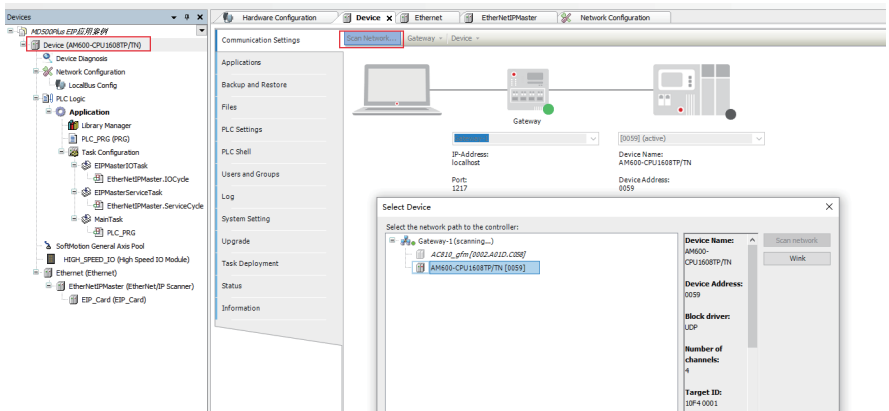
By default, Input I/O Messages Mapping(T->O)[0] is mapped to U0-68 (28740 in decimal). Input I/O Messages Mapping(T->O)[1] is mapped to U0-69 (28741 in decimal). Output I/O Messages Mapping(O->T)[0] is mapped to U3-17(29457 in decimal). Output I/O Messages Mapping(O->T)[1] is mapped to U3-16(29456 in decimal).

These four default mappings can not be changed. Other mappings are configured to F0-00 (61440 in decimal) by default. For the mappings required to be modified, convert the parameter address into decimal format. For example, type in 61452 for F0-12. Keep the default value for the mappings not needed.

Configuration Data							Defaults
<input type="checkbox"/> Raw data values	<input checked="" type="checkbox"/> Show Parameter Groups						
Parameters	Value	Unit	Data Type	Minimum	Maximum	Default	Help String
Exclusive Owner							
Target Config data							
Input I/O Messages Mapping(T->O)[0]	28740	UINT	0	65535	28740	New Help String	
Input I/O Messages Mapping(T->O)[1]	28741	UINT	0	65535	28741	New Help String	
Input I/O Messages Mapping(T->O)[2]	61440	UINT	0	65535	61440	New Help String	
Input I/O Messages Mapping(T->O)[3]	61440	UINT	0	65535	61440	New Help String	
Input I/O Messages Mapping(T->O)[4]	61440	UINT	0	65535	61440	New Help String	
Input I/O Messages Mapping(T->O)[5]	61440	UINT	0	65535	61440	New Help String	
Input I/O Messages Mapping(T->O)[6]	61440	UINT	0	65535	61440	New Help String	
Input I/O Messages Mapping(T->O)[7]	61440	UINT	0	65535	61440	New Help String	
Input I/O Messages Mapping(T->O)[8]	61440	UINT	0	65535	61440	New Help String	
Input I/O Messages Mapping(T->O)[9]	61440	UINT	0	65535	61440	New Help String	
Input I/O Messages Mapping(T->O)[10]	61440	UINT	0	65535	61440	New Help String	
Input I/O Messages Mapping(T->O)[11]	61440	UINT	0	65535	61440	New Help String	
Output I/O Messages Mapping(O->T)[0]	29457	UINT	0	65535	29457	New Help String	
Output I/O Messages Mapping(O->T)[1]	29456	UINT	0	65535	29456	New Help String	
Output I/O Messages Mapping(O->T)[2]	61440	UINT	0	65535	61440	New Help String	

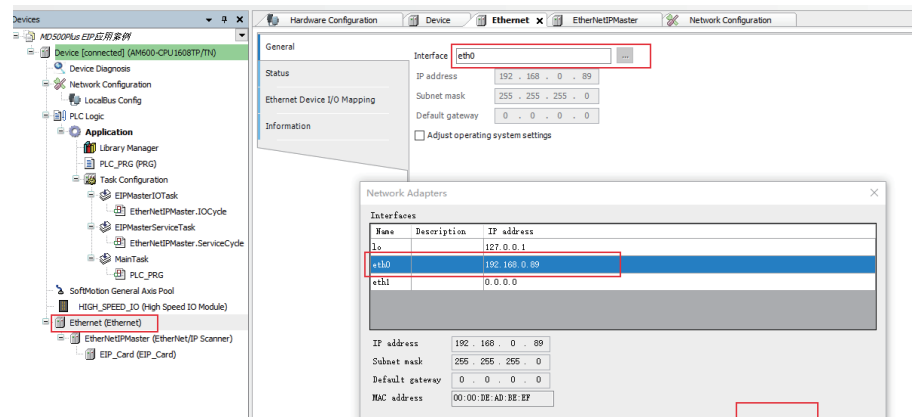
Step 4: Configure the IP address of the master station.

Scan for a network and select the master station to be configured.



Assign an IP address for the master network port.

5 Communication Examples



Download the project to the PLC.



View I/O Messages(O->T) and I/O Messages(T->O) in Ethernet/IP I/O mapping.

Find	Filter	Show all							
Variable	Mapping	Channel	Address	Type	Default Value	Current Value	Prepared Value	Unit	Description
Exclusive Owner		Inverter State	%ZW1	UBNT	0				New Help String
		Output Freq	%ZW2	UBNT	0				New Help String
		Input I/O Messages[2]	%ZW3	UBNT	0				New Help String
		Input I/O Messages[3]	%ZW4	UBNT	0				New Help String
		Input I/O Messages[4]	%ZW5	UBNT	0				New Help String
		Input I/O Messages[5]	%ZW6	UBNT	0				New Help String
		Input I/O Messages[6]	%ZW7	UBNT	0				New Help String
		Input I/O Messages[7]	%ZW8	UBNT	0				New Help String
		Input I/O Messages[8]	%ZW9	UBNT	0				New Help String
		Input I/O Messages[9]	%ZW10	UBNT	0				New Help String
		Input I/O Messages[10]	%ZW11	UBNT	0				New Help String
		Input I/O Messages[11]	%ZW12	UBNT	0				New Help String
		Control Command	%ZW13	UBNT	0				New Help String
		Written Freq	%ZW14	UBNT	0				New Help String
		Output I/O Messages[2]	%ZW15	UBNT	0				New Help String
		Output I/O Messages[3]	%ZW16	UBNT	0				New Help String
		Output I/O Messages[4]	%ZW17	UBNT	0				New Help String
		Output I/O Messages[5]	%ZW18	UBNT	0				New Help String
		Output I/O Messages[6]	%ZW19	UBNT	0				New Help String
		Output I/O Messages[7]	%ZW20	UBNT	0				New Help String
		Output I/O Messages[8]	%ZW21	UBNT	0				New Help String
		Output I/O Messages[9]	%ZW22	UBNT	0				New Help String

6 Troubleshooting

The following table describes the faults that may occur during the use of the MD500-EN1 card and the AC drive.

Table 6-1 Fault causes and solutions

Symptom	Possible Cause	Solution
Communication failure between the MD500-EN1 card and AC drive	<ol style="list-style-type: none"> 1. Ethernet/IP communication is not supported by AC drive. 2. The communication configuration of the MD500-EN1 card is incorrect. 3. The MD500-ECAT card is faulty. 	<ol style="list-style-type: none"> 1. Check whether Ethernet/IP communication is supported by the AC drive. 2. Correctly configure communication parameters of MD500-EN1 card. 3. Replace the MD500-EN1 card.
Err16 (communication error) reported by the AC drive during running	<ol style="list-style-type: none"> 1. The communication data is abnormal. 2. The network cable is damaged or connected incorrectly. 3. The AC drive suffers external interference. 	<ol style="list-style-type: none"> 1. Check whether Ethernet/IP master program is normal. 2. Check whether the network cable is connected correctly. Replace the network cable if required. 3. Use the Cat5e shielded twisted pair (STP) network cable as required. Check that the MD500-EN1 card is grounded correctly. Eliminate the external interference. Contact the agent or Inovance for technical support if necessary.

Fault code is 8-bit binary integer. Every bit represents a specific fault. Fault codes can be obtained through converting parameter values into 8-bit binary values. For example, the read value 3 of FD-58 is converted to binary value 0000 0011, then the fault codes are Bit0 and Bit1. The following table lists the fault description and solutions.

Note: Multiple faults may be present when a fault code appears.

Fault Code	Description	Solution
Bit 7	N/A	N/A
Bit 6	Communication with AC drive failed or AC drive version incorrect	Upgrade the AC drive software to the version that supports EIP.
Bit 5	I/O Messages mapping Error	Check PLC configuration.
Bit 4	Timeout	Check whether the circuit and master station operation is normal.

Fault Code	Description	Solution
Bit 3	LINK loss	Check the wiring.
Bit 2	IP address conflict	Check whether other devices have the same IP address as this device.
Bit 1	MAC address not programmed or lost	Contact Inovance or the agent for technical support.
Bit 0	Ethernet hardware error	Contact Inovance or the agent for technical support.

If the fault code is 0, and indicator D4 is steady off in green and indicator D7 is steady on in red, then the solution is the same as that of Bit 6.

Shenzhen Inovance Technology Co., Ltd.

Add.: Building E, Hongwei Industry Park, Liuxian Road, Baocheng No. 70 Zone, Bao'an District, Shenzhen

Tel: +86-755-2979 9595

Fax: +86-755-2961 9897

<http://www.inovance.com>

Suzhou Inovance Technology Co., Ltd.

Add.: No. 16 Youxiang Road, Yuexi Town, Wuzhong District, Suzhou 215104, P.R. China

Tel: +86-512-6637 6666

Fax: +86-512-6285 6720

<http://www.inovance.com>



19011561A00

Copyright © Shenzhen Inovance Technology Co., Ltd.