Unitronics UMI-B7 VFD

Ethernet/IP Communication Guide

UNITRONICS®

No.	Change description	Version	Release date
1	First release	V1.1	May 2024

Safety precautions

The extension card can be installed and operated only by people who have taken part in professional training on electrical operation and safety knowledge, obtained the certification, and been familiar with all steps and requirements for installing, performing commissioning on, operating, maintaining the device, to prevent all kinds of emergencies.

Before installing, removing, or operating the communication card, read the safety precautions described in this manual and the variable-frequency drive (VFD) operation manual carefully to ensure safe operation.

For any physical injuries or damage to the device caused due to your neglect of the safety precautions described in this manual and the VFD operation manual, our company shall not be held liable.

- You need to open the housing of the VFD when installing or removing the communication card. Therefore, you must disconnect all power supplies of the VFD and ensure that the voltage inside the VFD is safe. For details, see the description in the VFD operation manual. Severe physical injuries or even death may be caused if you do not follow the instructions.
- Store the communication card in a place that is dustproof and dampproof without electric shocks or mechanical pressure.
- The communication card is electrostatic sensitive. Take measurements to prevent electrostatic discharge when performing operations involving it.
- Tighten the screws up when installing the communication card. Ensure that it is firmly fixed and properly grounded.

Terminology, abbreviations, and acronyms

CAN	Controller Area Network
COB	Communication object, a transmitted unit on a CAN network. Communication objects (COBs) carry data and can be transmitted through the whole network. A COB is part of a CAN message frame.
EDS	Electronic data sheet (EDS), an ASCII file for node configuration, required when a CANopen network is configured. An EDS file contains general information about nodes and their dictionary objects (parameters).
NMT	Network management, one of the CAN application-layer service elements in the CAN reference model. It is used for the initialization, configuration, and fault handling of a CAN network.
Object dictionary	Stores information about all COBs identified by a device.
PDO	Process data object, a type of COBs, used to transmit process data, such as control command, set values, status values, and actual values.
PDOn Tx	PDO command transmitted by a slave station to the master station, where n refers to 1, 2, 3, 4.
PDOn Rx	PDO command transmitted by the master station and received by a slave station, where n refers to 1, 2, 3, 4.
SDO	Service data object, a type of COB, used to transmit non-time key data, such as parameter values.
RO	Indicates read-only access.
RW	Indicates the read and write access.
SYNC	Indicates synchronous transmission.
Node-ID	Node ID, that is, address of a communication card.
0x	Indicates that a number with this prefix is a hexadecimal value, for example, 0x10 indicates the decimal value 16.

Contents

1 Product Confirmation

Check the following after receiving a communication extension card product:

- Whether the communication card is damaged.
- Whether all the following items are contained in the product package:
  - Communication card
  - Tie
  - M3 screw.
- Obtain the EDS file of the communication card from Unitronics.
- Confirm the environmental requirements for application.

Table 1-1 Environmental requirements

Item	Requirement
Operation temperature	-10–+50°C
Storage temperature	-20–+60°C
Relative humidity	5%–95%
Other weather conditions	No condensation, ice, rain, snow, or hail; solar radiation < 700 W/m^2
Air pressure	70–106 kPa
Vibration and impact	5.9m/s^2 (0.6g) at the sine vibration of 9 Hz to 200 Hz

Ethernet/IP communication card

3.1 Overview

1. This manual describes the function specifications, installation, basic operation and settings, and information about the network protocol. To ensure that you install and operate the product properly, read this manual and the communication protocol section in the VFD operation manual carefully before you use the product.
2. This manual only describes how to operate the Ethernet/IP communication card and the related commands but does not provide details about the Ethernet/IP protocol.
3. This communication card is defined as an Ethernet/IP slave station communication card and is used on a VFD that supports Ethernet/IP communication.
4. The communication card supports star, linear, and ring topologies.
5. The communication card supports 32 inputs/outputs to read and write process data, read status, and read and write function parameters of a VFD.

3.2 Features

1. Functionality

- Supports the Ethernet/IP protocol.
- Two Ethernet/IP ports 10/100M full-duplex / half-duplex operation.
- Support star, linear, and ring topologies (but do not support ring-network monitoring).

2. Protocols

Ethernet/IP adopts the application layer protocol CIP.

CIP uses connectionless UDP and connection-based TCP for information control and transmission over the Ethernet, allowing send of explicit and implicit packets. Implicit packets are time-critical control messages and are transmitted using UDP/IP. Explicit packets are point-to-point messages that are not time-critical and transmitted using TCP/IP. Explicit packets are used for configuration, download, and fault diagnosis, while implicit packets are used for real-time I/O data transmission.

3. Communication ports

Standard RJ45 ports are used in Ethernet/IP communication. The communication card provides two RJ45 ports with no transmission direction defined, and therefore you can insert a cable into the port without regard to its direction. Figure 0-1 shows the ports, and Table 0-1 describes the port pins.

Figure 0-1 Two standard RJ45 ports.

Table 0-1 Standard RJ45 port pins

Pin	Name	Description
1	TX+	Transmit Data+
2	TX-	Transmit Data-
3	RX+	Receive Data+
4	n/c	Not connected
5	n/c	Not connected
6	RX-	Receive Data-
7	n/c	Not connected
8	n/c	Not connected

4. State indicators

The Ethernet/IP communication card provides four LED indicators and four net port indicators to indicate its states. Table 0-2 describes the state indicators.

Table 0-2 State indicators

LED	Color	State	Description
LED1	Green	On	Indicating that the card and VFD identify each other.
		Blinking (1Hz)	Indicating that the card and VFD communicate normally.
		Off	Indicating that the card and VFD communicate improperly.
LED2	Green	On	Indicating that communication between the card and PLC is online and data interchange is allowed.
		Blinking (1Hz)	Indicating IP address conflict between the card and PLC.
		Off	Indicating that communication between the card and PLC is offline.
LED3	Red	On	Failed to set up I/O between the card and PLC.
		Blinking (1Hz)	Incorrect PLC configuration.

LED	Color	State	Description
		Blinking (2Hz)	The card failed to send data to the PLC.
		Blinking (4Hz)	The connection between the card and PLC timed out.
		Off	No fault
LED4	Red	On	3.3V power indicator
Net port indicator	Yellow	On	Link indicator, indicating successful Ethernet connection.
		Off	Link indicator, indicating that Ethernet connection is not established.
Net port indicator	Green	On	ACK indicator, indicating that data interchange is being performed.
		Off	ACK indicator, indicating that data interchange is not being performed.

3.3 Electrical wiring

The Ethernet/IP communication card provides standard RJ45 ports and supports linear, star, and ring topologies. Figure 0-2, Figure 0-3, and Figure 0-4 show the electrical wiring diagrams for different topologies.

Use CAT5, CAT5e, and CAT6 network cables for electrical wiring. When the communication distance is greater than 50 meters, use high-quality network cables that meet the standards.

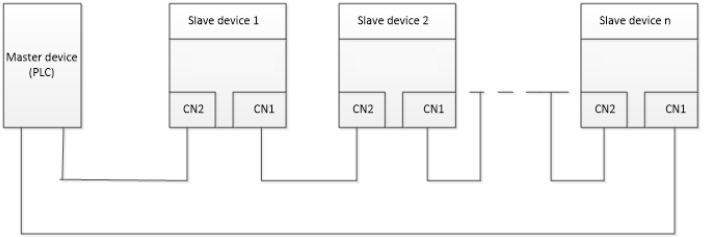


Figure 0-2 Electrical wiring diagram for a linear topology

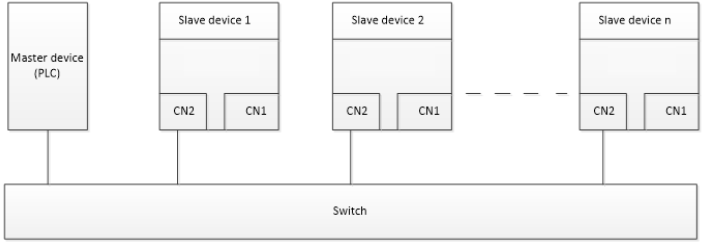


Figure 0-3 Electrical wiring diagram for a star topology

Note: An Ethernet switch must be available when the star topology is used.

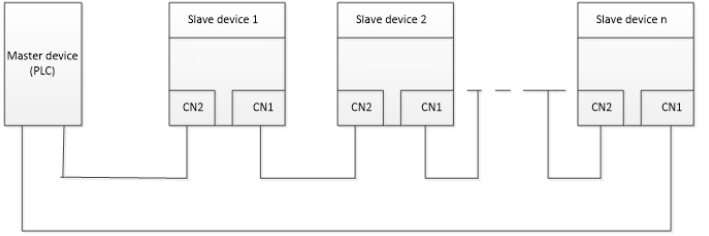


Figure 0-4 Electrical wiring diagram for a ring network

3.4 Communication

3.4.1 Communication settings

The Ethernet/IP communication card can function as only the Ethernet/IP slave station. Before communication, set UMI-B7 function codes, including:

- IP address and subnet mask for the card

The default IP address and subnet mask for each communication card are 192.168.0.20 and 255.255.255.0. You can change them to the address of a network segment.

- Control mode

If you want to control the VFD with the communication card, set the control mode to Ethernet/IP communication control. To be specific, set P00.01=2 (communication as the running command channel) and set P00.02=3 (Ethernet/IP communication channel) to control VFD start and stop.

If you want to set a value through Ethernet/IP communication, change the control way of corresponding function codes to Ethernet/IP communication. Appendix B lists related function codes.

Note: After the setting, the card can communicate normally. If you want to control the VFD with the card, set related function codes to enable Ethernet/IP communication control.

3.4.2 Packet format

Table 0-3 describes the structure of a TCP communication packet.

Table 0-3 Structure of a TCP communication packet

MAC-layer packet header	IP-layer packet header	TCP-layer packet header	Valid data	Packet trailer
14 bytes	20 bytes	20 bytes	0–1488 bytes	4 bytes

Table 0-4 describes the structure of a UDP communication packet.

Table 0-4 Structure of a UDP communication packet

MAC-layer packet header	IP-layer packet header	UDP-layer packet header	Valid data	Packet trailer
14 bytes	20 bytes	20 bytes	0-1488 bytes	4 bytes

3.4.3 Ethernet IP communication

The Ethernet/IP communication card supports 16-word input/output. Figure 0-5 shows the packet format for transmitting data with a VFD.

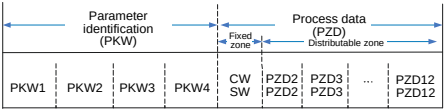


Figure 0-5 Packet structure

By using the 32 inputs/outputs, you can set the reference parameters of the VFD, monitor the status values, transmit control commands, monitor the running state, and read/write the function parameters of the VFD. For specific operations, see the following description.

Parameter zone:

PKW1—Parameter identification

PKW2—Array index number

PKW3—Parameter value 1

PKW4—Parameter value 2

Process data:

CW—Control word (transmitted from the master to a slave. For a description, see Table 0-5.)

SW—Status word (transmitted from a slave to the master. For a description, see Table 0-8.)

PZD—Process data (user defined)

(The process data output from the master to a slave is a reference value, and the process data input from a slave to the master is an actual value.)

PZD zone (process data zone): The PZD zone in a communication packet is designed for controlling and monitoring a VFD. The master and slave stations always process the received PZD with the highest priority. The processing of PZD takes priority over that of PKW, and the master and slave stations always transmit the latest valid data on the interfaces.

CWs and SWs

Using CWs is the basic method of the fieldbus system to control VFDs. A CW is transmitted by the fieldbus master station to a VFD device. In this case, the adapter module functions as a gateway. The VFD device responds to the bit code information of the CW and feeds state information back to the master through an SW.

Reference value: A VFD device may receive control information in multiple channels, including analog and digital input terminals, VFD control panel, and communication modules (such as RS485 and CH-PA01 adapter modules). To enable the control over VFD devices through Ethernet/IP, you need to set the communication module as the controller of the VFD device.

Actual value: An actual value is a 16-bit word that includes information about VFD device operation. The monitoring function is defined through VFD parameters. The conversion scale of an integer transmitted as an actual value from the VFD device to the master depends on the set function. For more description, see the related VFD operation manual.

Note: A VFD device always checks the bytes of a CW and reference value.

Task packet (master station -> VFD)

CW: The first word in a PZD task packet is a VFD CW.

When P15.43=0, Ethernet/IP control words are defined by byte. Table 0-5 describes UMI-B7 series VFD CWs defined by byte.

Table 0-5 UMI-B7 series VFD CWs expressed in decimal format

Bit	Name	Value	Description
0–7	Communication-based control command	1	Forward running
		2	Reverse running
		3	Forward jogging
		4	Reverse jogging
		5	Stop
		6	Coast to stop (emergency stop)
		7	Fault reset
		8	Jogging to stop
		9	Decelerate to stop
8	Enabling writing	1	Enable writing (mainly through PKW1 to PKW4)
9–10	Motor group setting	00	Motor 1
		01	Motor 2
11	Control mode switching	1	Enable torque/speed control switching
		0	Disable switching
12	Resetting power consumption to zero	1	Enable
		0	Disable
13	Pre-excitation	1	Enable
		0	Disable
14	DC braking	1	Enable
		0	Disable
15	Heartbeat reference	1	Enable
		0	Disable

When P16.56=1, Ethernet/IP control words are defined by bit. Table 0-6 describes UMI-B7 series VFD CWs defined by bit.

Table 0-6 UMI-B7 series VFD CWs expressed in binary format

Bit	Name	Description	Priority
0	Forward running	0: Decelerate to stop 1: Forward running	1
1	Reverse running	0: Decelerate to stop 1: Reverse running	2
2	Fault reset	0: Disable 1: Enable	3
3	Coast to stop	0: Disable 1: Enable	4

Bit	Name	Description	Priority
4	Forward jogging	0: Disable 1: Enable	5
5	Reverse jogging	0: Disable 1: Enable	6
6	Jogging to stop	0: Disable 1: Enable	7
7	/	Reserved	
8	Enable reading and writing (PKW1-PKW4)	0: Disable 1: Enable	
9	/	Reserved	
10	Decelerate to stop	0: Disable 1: Enable	0: Top priority
11–15	/	Reserved	

Reference value (REF): The second to twelfth words in a PZD task packet are the main settings. The main frequency settings are provided by the main setting signal source. Table 0-7 describes the settings of UMI-B7 series VFD.

Table 0-7 Settings of UMI-B7 series VFD

Function code	Word	Value Range	Default value
P16.32	Received PZD2	0: Invalid 1: Set frequency (0–Fmax, unit: 0.01 Hz) 2: PID reference (-1000–1000, in which 1000 corresponds to 100.0%) 3: PID feedback (-1000–1000, in which 1000 corresponds to 100.0%) 4: Torque setting (-3000–+3000, in which 1000 corresponds to 100.0% of the rated current of the motor) 5: Setting of the upper limit of forward running frequency (0–Fmax, unit: 0.01 Hz) 6: Setting of the upper limit of reverse running frequency (0–Fmax, unit: 0.01 Hz) 7: Upper limit of the electromotive torque (0–3000, in which 1000 corresponds to 100.0% of the rated current of the motor) 8: Upper limit of the brake torque (0–3000, in which 1000 corresponds to 100.0% of the rated current of the motor) 9: Virtual input terminal command, 0x000–0x3FF (bit9–bit0 correspond to S8/S7/S6/S5/HDIB/HDIA/S4/S3/S2/S1 in sequence) 10: Virtual output terminal command, 0x00–0x0F (bit3–	0
P16.33	Received PZD3		0
P16.34	Received PZD4		0
P16.35	Received PZD5		0
P16.36	Received PZD6		0
P16.37	Received PZD7		0
P16.38	Received PZD8		0
P16.39	Received PZD9		0
P16.40	Received PZD10		0
P16.41	Received PZD11		0
P16.42	Received		0

Function code	Word	Value Range	Default value
	PZD12	bit0 correspond to RO2/RO1/HDO/Y1 in sequence) 11: Voltage setting (for V/F separation) (0–1000, in which 1000 corresponds to 100.0% of the rated voltage of the motor) 12: AO1 output setting 1 (-1000–+1000, in which 1000 corresponds to 100.0%) 13: AO2 output setting 2 (-1000–+1000, in which 1000 corresponds to 100.0%) 14: MSB of position reference (signed number) 15: LSB of position reference (unsigned number) 16: MSB of position feedback (signed number) 17: LSB of position feedback (unsigned number) 18: Position feedback setting flag (position feedback can be set only after this flag is set to 1 and then to 0) 19: Function code mapping (PZD2–PZD12 correspond to P14.49–P14.59 respectively.) 20–31: Reserved	

Response packet (VFD -> master station)

Status word (SW): The first word in a PZD response packet is a VFD status word.

P15.43=0 (SWs are defined in decimal format), and the VFD SWs are defined as follows.

Table 0-8 UMI-B7 series VFD SWs expressed in decimal format

Bit	Name	Value	Description
0–7	Running state	1	Forward running
		2	Reverse running
		3	Stopped
		4	Faulty
		5	POFF
8	Bus voltage established	1	Ready to run
		0	Not ready to run
9–10	Motor group feedback	0	Motor 1
		1	Motor 2
11	Motor type feedback	1	Synchronous motor
		0	Asynchronous motor
12	Overload pre-alarm feedback	1	Overload pre-alarm generated

Bit	Name	Value	Description
		0	No overload pre-alarm generated
13–14	Run/Stop mode	0	Keypad-based control
		1	Terminal-based control
		2	Communication-based control
		3	Reserved
15	Heartbeat feedback	1	Heartbeat feedback
		0	No heartbeat feedback

P15.43=1 (SWs are defined in binary format), and the VFD SWs are defined as follows.

Table 0-9 UMI-B7 series VFD SWs expressed in binary format

Bit	Name	Description	Priority
0	Forward running	0: Disable 1: Enable	1
1	Reverse running	0: Disable 1: Enable	2
2	Stopped	0: Disable 1: Enable	3
3	Fault	0: Disable 1: Enable	4
4	POFF	0: Disable 1: Enable	5
5	Pre-excited	0: Disable 1: Enable	6
6–15	/	Reserved	

Actual value (ACT): The second to twelfth words in a PZD task packet are the main actual values. The main actual frequency values are provided by the main actual value signal source.

Table 0-10 Actual status values of UMI-B7 series VFD

Function code	Word	Value Range	Default value
P16.43	Transmitted PZD2	0: Invalid 1: Running frequency (×100, Hz)	0
P16.44	Transmitted PZD3	2: Set frequency (×100, Hz) 3: Bus voltage (×10, V)	0
P16.45	Transmitted PZD4	4: Output voltage (×1, V) 5: Output current (×10, A)	0
P16.46	Transmitted PZD5	6: Actual output torque (×10, %) 7: Actual output power (×10, %)	0
P16.47	Transmitted PZD6	8: Rotating speed of the running (×1, RPM) 9: Linear speed of the running (×1, m/s)	0
P16.48	Transmitted PZD7	10: Ramp frequency reference 11: Fault code	0

Function code	Word	Value Range	Default value
P16.49	Transmitted PZD8	12: AI1 value (×100, V) 13: AI2 value (×100, V)	0
P16.50	Transmitted PZD9	14: AI3 value (×100, V) 15: HDIA frequency (×1000, kHz)	0
P16.51	Transmitted PZD10	16: Terminal input state 17: Terminal output state	0
P16.52	Transmitted PZD11	18: PID reference (×10, %) 19: PID feedback (×10, %)	0
P16.53	Transmitted PZD12	20: Rated torque of the motor 21: MSB of position reference (signed number) 22: LSB of position reference (unsigned number) 23: MSB of position feedback (signed number) 24: LSB of position feedback (unsigned number) 25: Status word 26: HDIB frequency value (×1000, kHz) 27: MSB of PG card pulse feedback count 28: LSB of PG card pulse feedback count 29: MSB of PG card pulse reference count 30: LSB of PG card pulse reference count 31: Function code mapping (PZD2–PZD12 correspond to P14.60–P14.70 respectively.) 32: Status word 3 33–47: Reserved	0

PKW zone

PKW zone (parameter identification flag PKW1—numerical zone): The PKW zone describes the processing mode of the parameter identification interface. A PKW interface is not a physical interface but a mechanism that defines the transmission mode (such as reading and writing a parameter value) of a parameter between two communication ends.

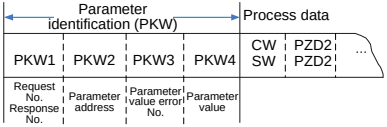


Figure 0-6 Parameter identification zone

In the periodic communication, the PKW zone consists of four 16-bit words. The following table

describes the definition of each word.

First word PKW1 (16 bits)		
Bits 15–00	Task or response identification flag	0 – 7
Second word PKW2 (16 bits)		
Bits 15–00	Basic parameter address	0 – 247
Third word PKW3 (16 bits)		
Bits 15–00	Value (most significant word) of a parameter or error code of the returned value	00
Fourth word PKW4 (16 bits)		
Bits 15–00	Value (least significant word) of a parameter	0 – 65535

Note: If the master station requests the value of a parameter, the values in PKW3 and PKW4 of the packet that the master station transmits to the VFD are no longer valid.

Task request and response: When transmitting data to a slave, the master uses a request number, and the slave uses a response number to accept or reject the request.

Table 0-11 Task identification flag PKW1

Request No. (from the master to a slave)		Response signal	
Request No.	**Function**	**Acceptance**	**Rejection**
0	No task	0	—
1	Requesting the value of a parameter	1, 2	3
2	Modifying a parameter value (one word) [modifying the value only on RAM]	1	3 or 4
3	Modifying a parameter value (two words) [modifying the value only on RAM]	2	3 or 4
4	Modifying a parameter value (one word) [modifying the value on both RAM and EEPROM]	1	3 or 4
5	Modifying a parameter value (two words) [modifying the value on both RAM and EEPROM]	2	3 or 4

Note: The requests #2, #3, and #5 are not supported currently.

Table 0-12 Response identification flag PKW1

Response No. (from a slave to the master)	
Response No.	**Function**
0	No response

Response No. (from a slave to the master)	
Response No.	**Function**
1	Transmitting the value of a parameter (one word)
2	Transmitting the value of a parameter (two words)
3	The task cannot be executed and one of the following error numbers is returned: 1: Invalid command 2: Invalid data address 3: Invalid data value 4: Operation failure 5: Password error 6: Data frame error 7: Parameter read-only 8: The parameter cannot be modified during VFD running 9: Password protection

The standard ODVA protocol specifies the data transmission format and CWs/SWs definitions, and the packet format for data transmission with the VFD is shown in Table 0-13.

Table 0-13 Transmission modes specified in standard ODVA protocol

No.	Input/Output	Data length (bytes)	Format (word)
2	70/20	4	CW1/SW1 + Speed_ref/act
3	71/21	4	CW2/SW2 + Speed_ref/act
4	72/22	6	CW1/SW1 + Speed_ref/act + Torque_ref/act
5	73/23	6	CW2/SW2 + Speed_ref/act + Torque_ref/act

CW1/SW1 and CW2/SW2 are defined as shown in Table 0-14, Table 0-15, Table 0-16 and Table 0-17.

Table 0-14 CW1 specified in standard ODVA protocol

Bit	Name	Value	Description
0	Forward running	0	Disable
		1	Enable
1	Reserved	/	/
2	Fault reset	0	Disable
		1	Enable

Bit	Name	Value	Description
3–15	Reserved	/	/

Table 0-15 SW1 specified in standard ODVA protocol

Bit	Name	Value	Description
0	Fault state	0	No fault
		1	Fault
1	Reserved	/	/
2	Running state	0	Not forward running
		1	Forward running
3–15	Reserved	/	/

Table 0-16 CW2 specified in standard ODVA protocol

Bit	Name	Value	Description
0	Forward running	0	Disable
		1	Enable
1	Reverse running	0	Disable
		1	Enable
2	Fault reset	0	Disable
		1	Enable
3–4	Reserved	/	/
5	Control reference source	0	Local control (keypad)
		1	Remote control (Ethernet/IP communication)
6	Frequency reference source	0	Local reference (keypad)
		1	Remote reference (Ethernet/IP communication)
7–15	Reserved	/	/

Table 0-17 SW2 specified in standard ODVA protocol

Bit	Name	Value	Description
0	Fault	0	No fault
		1	Fault
1	Overload pre-alarm feedback	0	No overload
		1	Overload pre-alarm
2	Running state 1	0	Stopped
		1	Forward running
3	Running state 2	0	Stopped
		1	Reverse running

Bit	Name	Value	Description
4	Bus voltage established	0	Ready to run
		1	Not ready to run
5	Control reference source	0	Local control (keypad)
		1	Remote control (not keypad)
6	Frequency/torque reference source	0	Local control (keypad)
		1	Remote control (not keypad)
7	Reference reached	0	Not reached
		1	Reached
8–15	Reserved	/	/

Based on the ODVA protocol provisions, these four modes are combined with PZD process data defined by Unitronics, and the packet format for data transmission with the VFD is shown in Table 0-18.

Table 0-18 Unitronics extended data model based on the ODVA protocol

No.	Input/Output	Data length (bytes)	Format (word)
6	74/24	24	CW1/SW1 + Speed_ref/act + Null +PZD4–12
7	75/25	24	CW2/SW2 + Speed_ref/act + Null +PZD4–12
8	76/26	24	CW1/SW1 + Speed_ref/act + Torque_ref/act + PZD4–12
9	77/27	24	CW2/SW2 + Speed_ref/act + Torque_ref/act + PZD4–12

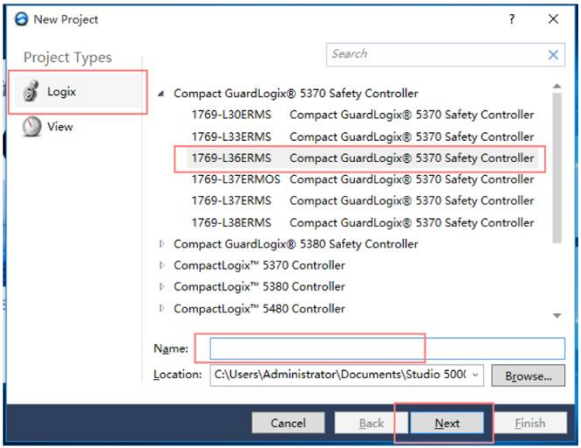
3.5 Example 1 of PLC communication (communicate with Allen-Bradley PLC)

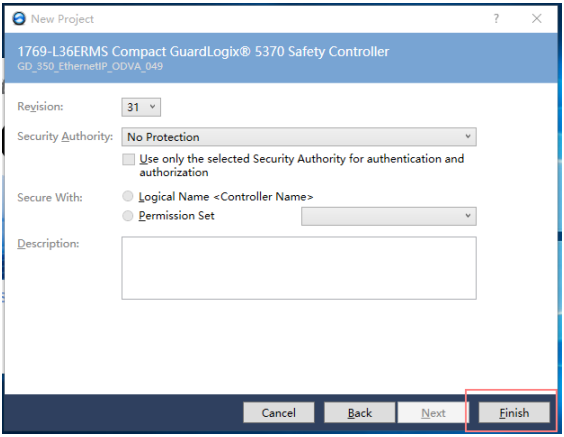
This example shows how to use an Allen-Bradley PLC (model: 1769_L36ERMS) to communicate with an Ethernet/IP adapter module (through using the Studio 5000 software as the configuration tool).

3.5.1 Create a new project

Connect the PC to the PLC with a printer cable or network cable. Open software, and click "New Project".

Select the correct PLC model, fill in the project name, click "Next", and click "Finish".

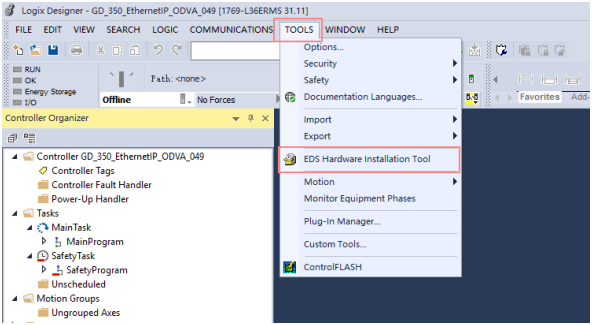




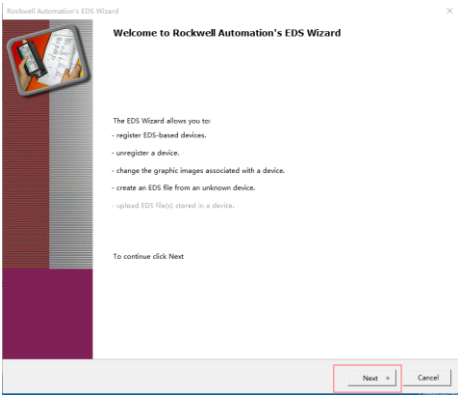
3.5.2 Import an EDS file

The EDS file is used to specify device attributes for Ethernet/IP client. The client identifies the device through product code, device type, and major version attributes.

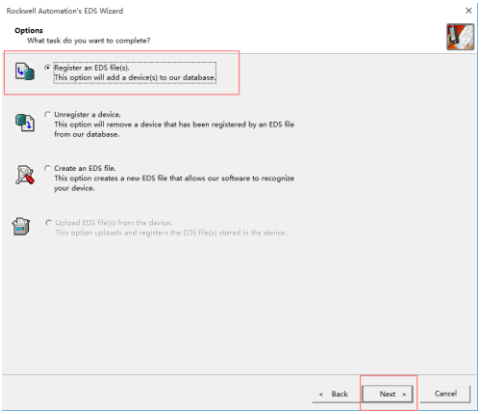
Right click "TOOLS", and select "EDS Hardware Installation Tool".



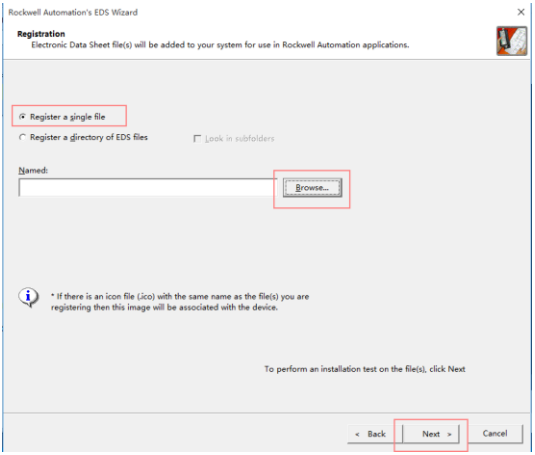
Click "Next".



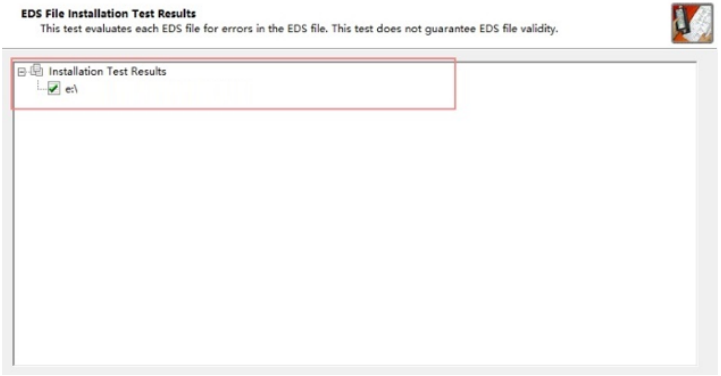
Select the option as shown in the following figure, and click "Next".



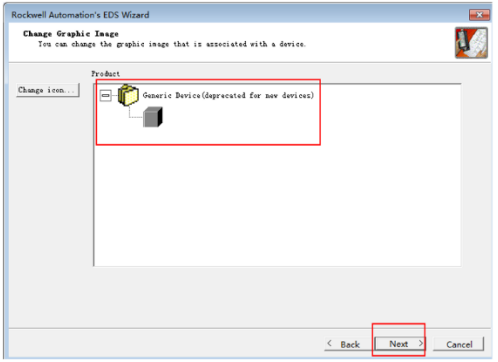
Click "Browse" to select the EDS file that you want to download, and then click "Next".



Continue to click "Next".

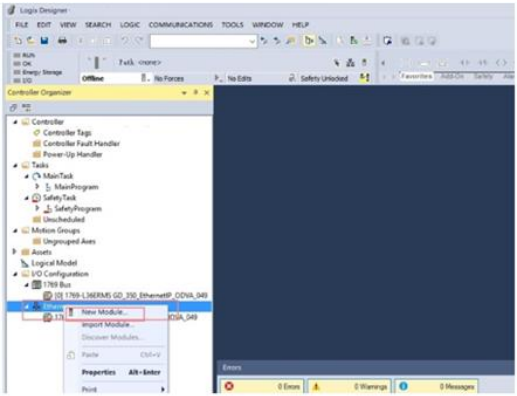


Click "Next" again, and the installation is successful.



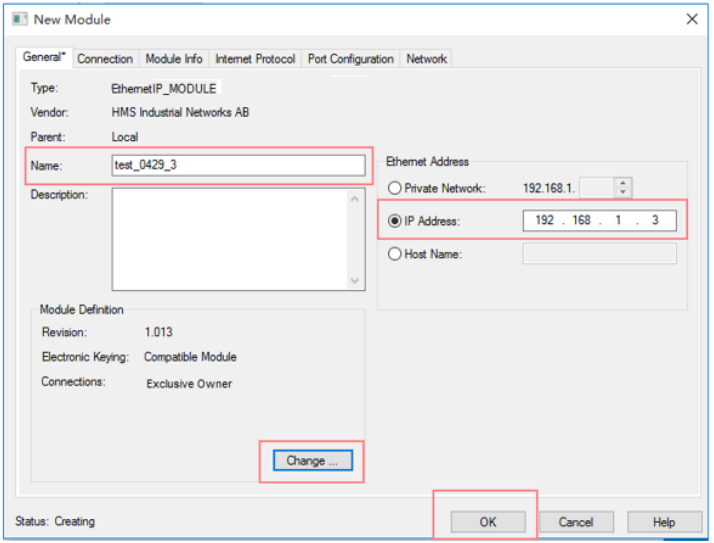
3.5.3 Create a new device object

Select "I/O Configuration"—>"Ethernet item" on the left, and right-click "New Module".

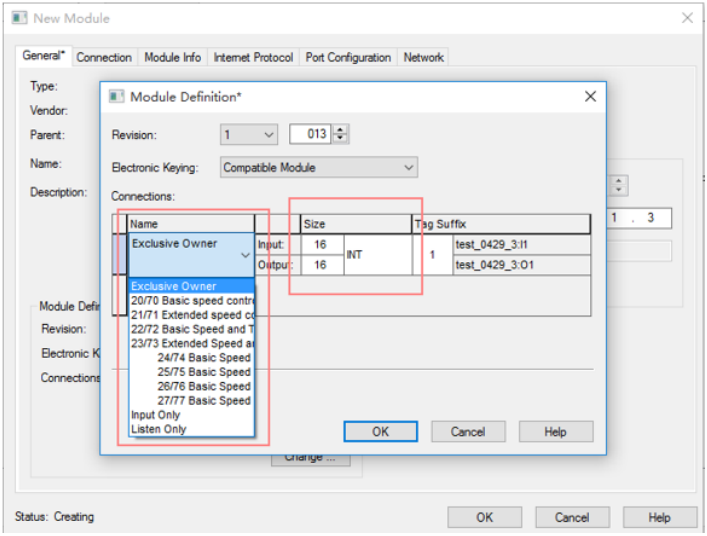


Select the Module, and click "Create".

Fill in the module name, and set the IP address of the module. The IP address must be consistent with P16.58–P16.61 on the UMI-B7 Ethernet/IP communication card, otherwise communication fails.

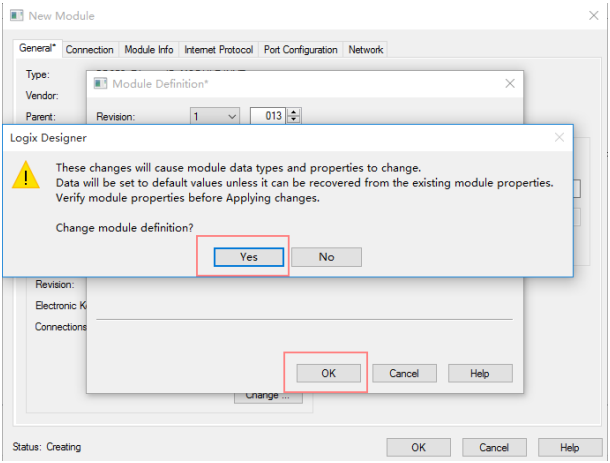


Click the "Change" option to select the protocol type used by the module. Each type differs in IO format, so you need to select the corresponding IO format based on the protocol type, as shown in the following table. Take "Exclusive Owner" as an example.

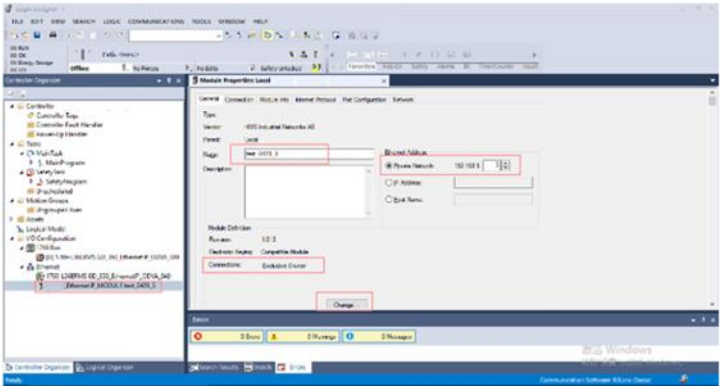


Name	Size	Format
Exclusive Owner	16	INT
20/70 Basic speed control	2	INT
21/71 Extended speed control	2	INT
22/72 Basic Speed and Torque control	3	INT
23/73 Extended Speed and Torque control	3	INT
24/74 Basic Speed Control plus Drive Parameters	12	INT
25/75 Enhanced Speed Control plus Drive Parameters	12	INT
26/76 Basic Speed and torque Control plus Drive Parameters	12	INT
27/77 Enhanced Speed and torque Control plus Drive Parameters	12	INT

Click "OK", "Yes", "OK", "OK", "OK", and "OK" in turn.



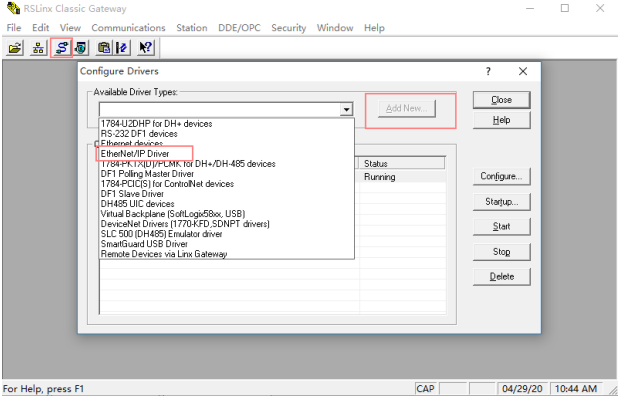
Once the module has been created successfully, you can see it under the "Ethernet" item under "I/O Configuration" on the left, and click it to check the device information.

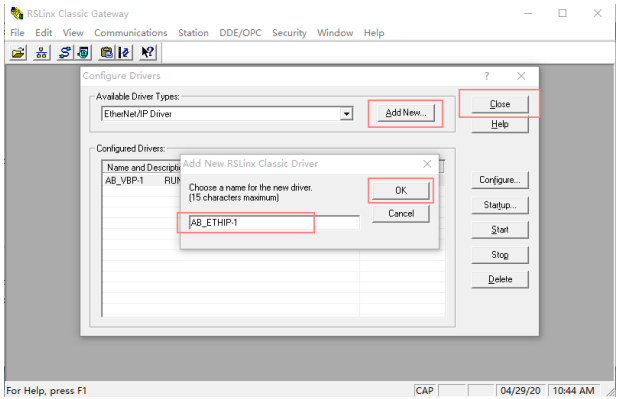


3.5.4 Use of Rslinx Classic

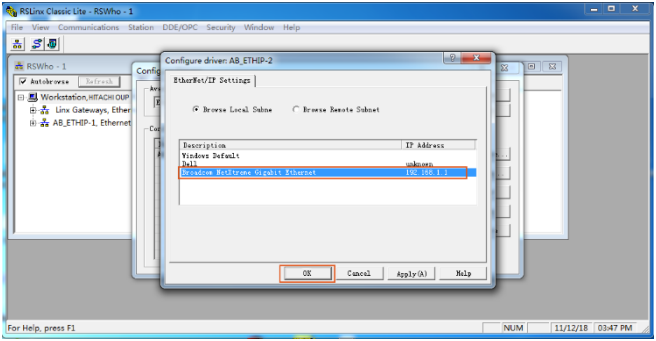
Rslinx Classic is used to connect the PC to the PLC. Open the "Rslinx Classic" software.

Click the "S" icon, and a window of "Configure Drivers" pops up. Select "Ethernet/IP Driver" in the drop-down menu of "Available Driver Types", click "Add New", a window of "Add New RSLinx Classic Driver" pops up, and click "OK".



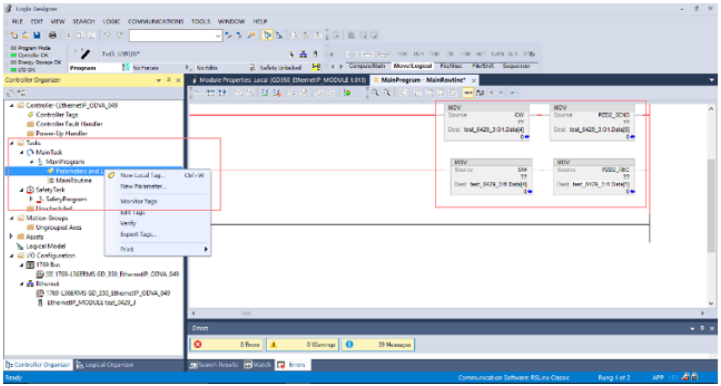


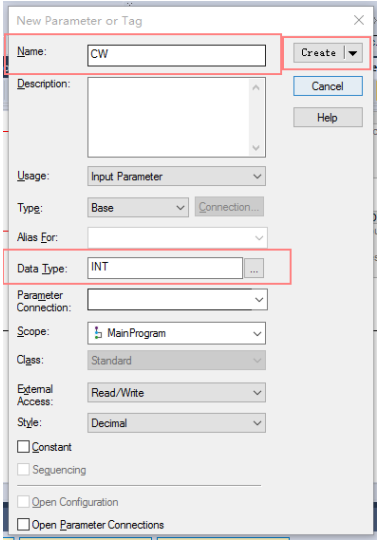
In the "Configure driver" window that pops up, select your computer's network card and click "OK".

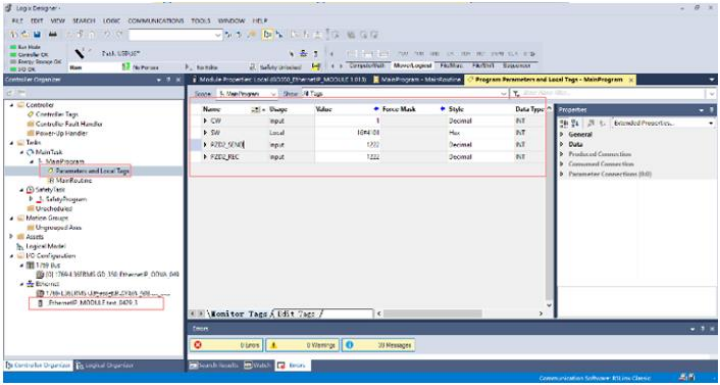


3.5.5 Writing PLC programs

Click on "Tasks"-->"MainTask"-->"MainProgram"--> on the left. Right-click on "MainProgram" and "Parameters and Local Tag" above "MainRoutine" to create global variables. Right-click "Parameters and Local Tag" above "MainProgram" to create global variables.

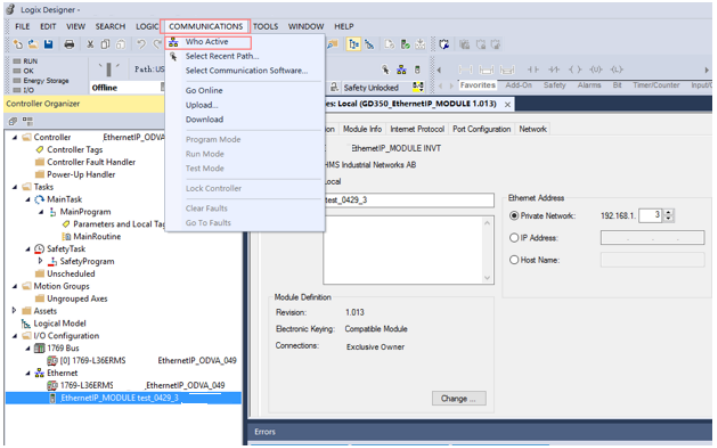


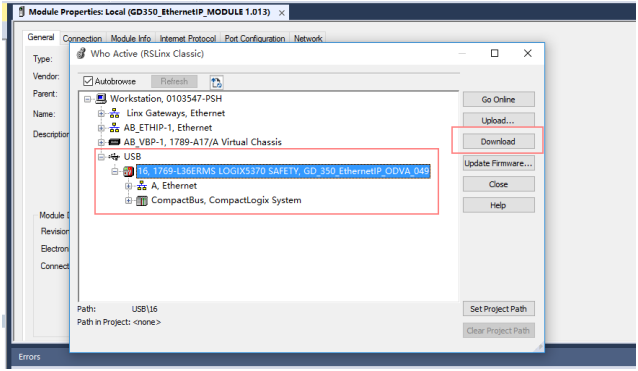

New Parameter or Tag
Name:
CW
Create
Description:
Cancel
Help
Usage:
Input Parameter
Type:
Base
Connection...
Alias For:
Data Type:
INT
Parameter Connection:
Scope:
MainProgram
Class:
Standard
External Access:
Read/Write
Style:
Decimal
Constant
Sequencing
Open Configuration
Open Parameter Connections

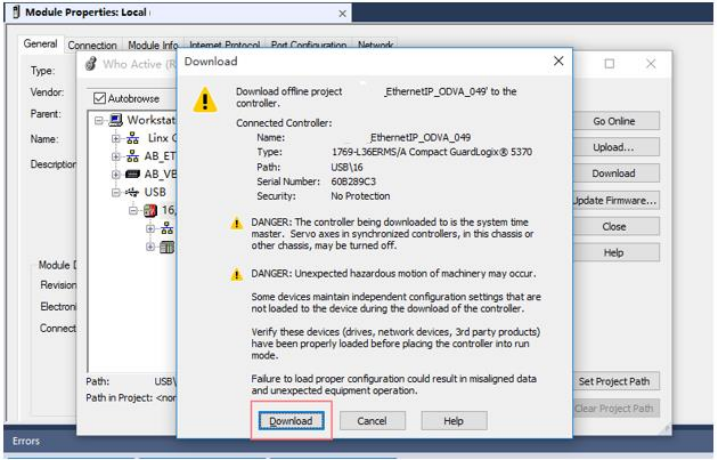


3.5.6 PC connection and program download

Click on "COMMUNICATIONS" under "Who Active", and in the pop-up screen, click on PLC Project under the "USB" option and click "Download". **Note:** The PLC dial code cannot be "RUN" at this time.

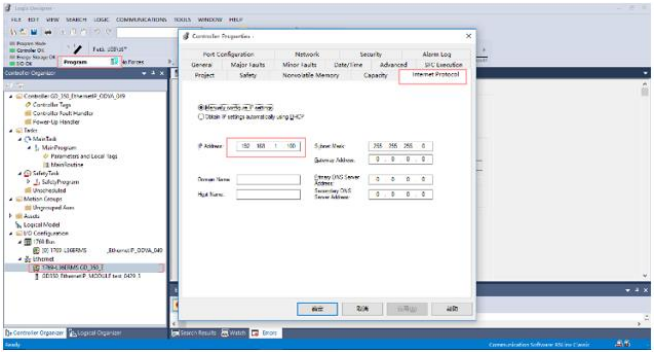






3.5.7 Configuring PLC IP Addresses through the studio5000 V31 software

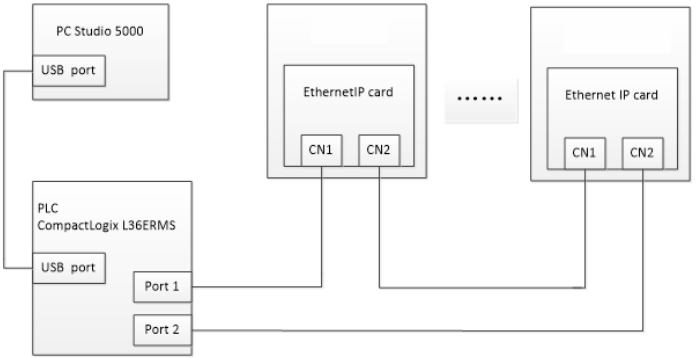
Make sure that the PLC is in REM or PROG mode, click "1769-L36ERMS" at the bottom left to enter the "Controller Properties" interface, and then click "Internet Protocol" to change the IP address of the PLC.



3.5.8 DLR Ring Network Configuration

(1) Using Logix Designer for setup

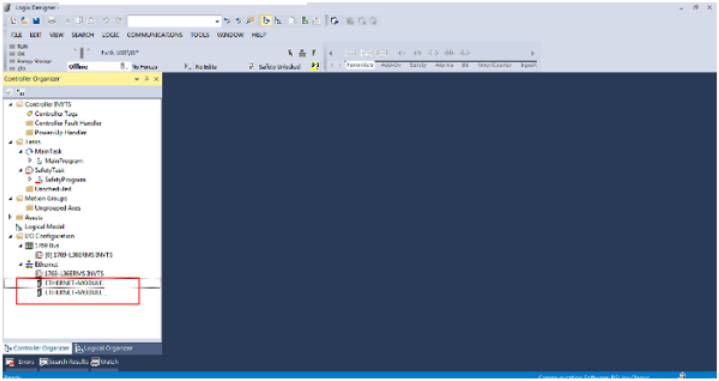
Open the Studio 5000 software and use an Allen-Bradley CompactLogix PLC with ring networking capability, which requires at least two UMI-B7 Ethernet/IP communication cards. More UMI-B7 Ethernet/IP communication cards can be added, but it is recommended that the maximum number of nodes used on the DLR ring network shall not exceed 32. The connection method is shown in the following figure.



Note: An EDS file must be added.

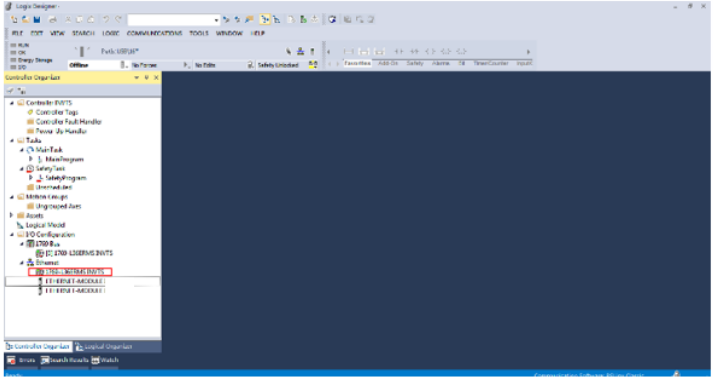
(2) Add an Ethernet/IP communication card to the Studio 5000 software

The method of addition is the same as that of the linear star connection.

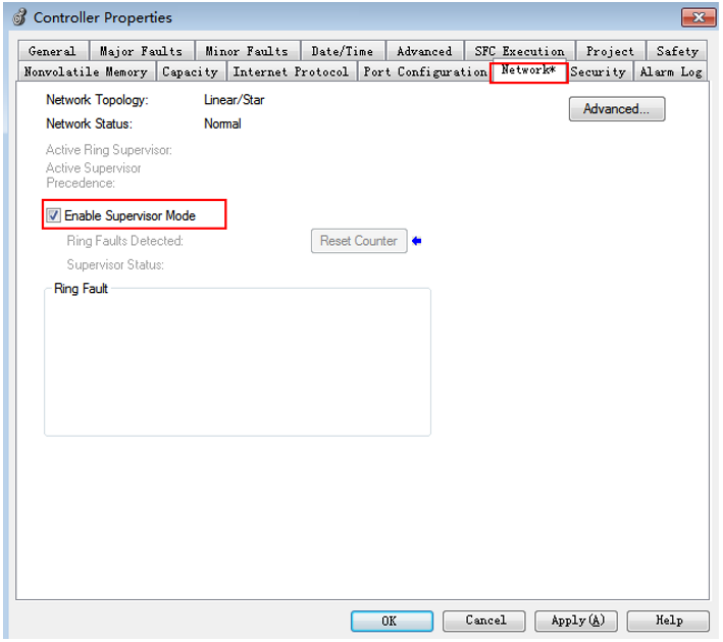


(3) Enabling PLC ring network monitor function

Double click "1769-L36ERMS" under the "I/O Configuration" folder, as shown in the following figure.

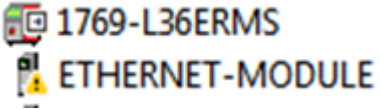


Enter "Network" under the "Controller Properties" option and select "Enable Supervisor Mode".



Note: The ring network monitor function is enabled only when the PLC is in programming mode.

(4) Return to Logix Designer and make sure that none of the communication cards has encountered the following fault.



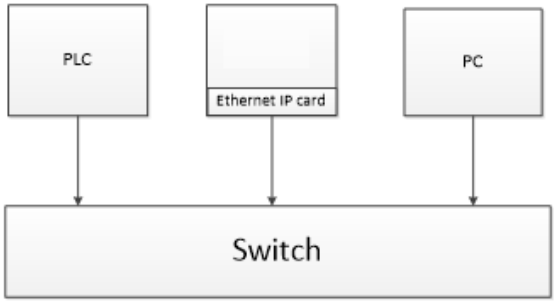
(5) Download the project to the PLC, bring the PLC online, and put it in programming mode.

Example 2 of PLC communication (communicate with ORMON PLC)

This example shows how to use an ORMON PLC (model: NX1P2-9024DT) to communicate with an Ethernet/IP adapter module (through using the Sysmac Studio software as the configuration tool).

3.5.9 Hardware connections

The NX1P2-9024DT is not configured with a USB download port, and communication and download between the PC and PLC is conducted through the built-in Ethernet/IP port. In this case, a switch is needed in the experiment, and the connection method is as follows.



3.5.10 Network Configurator software setting

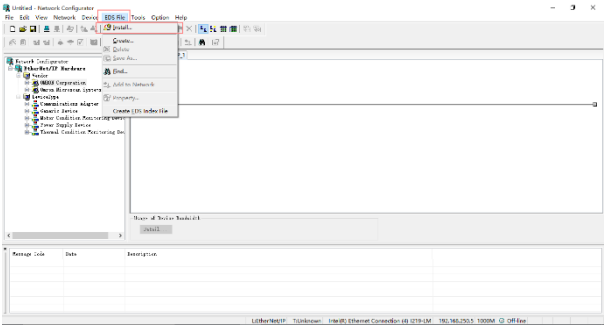
3.6.2.1 Launch Network Configurator software

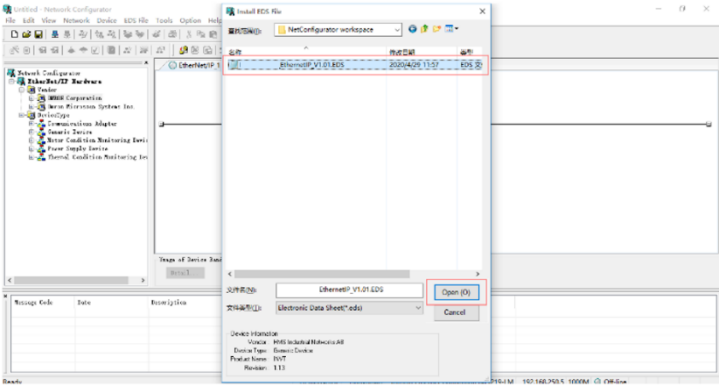
Start the Network Configurator software as an administrator in the following path:

"C:\Program Files (x86)\OMRON\CX-One\NetworkConfigurator\Program\NetConfigurator.exe".

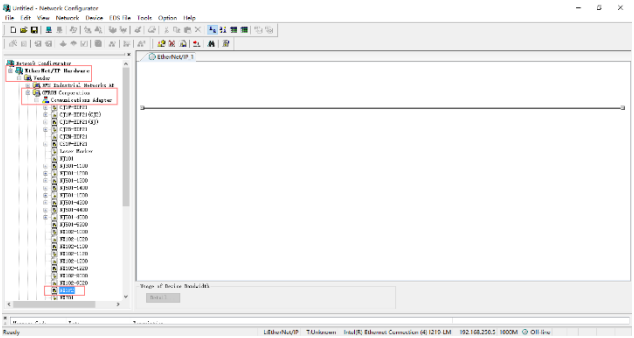
3.6.2.2 Load the EDS file

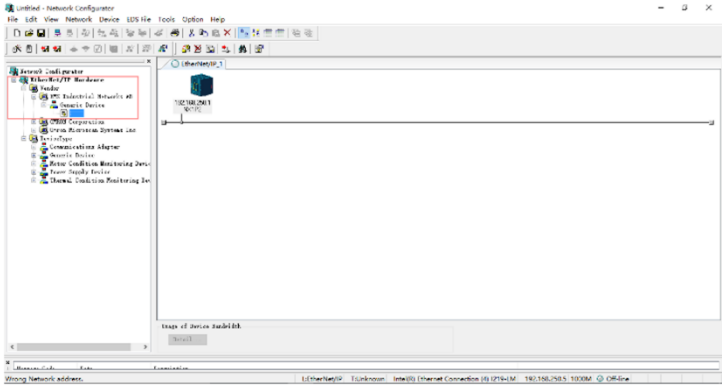
Select "EDS File"->"Install", and add the EDS file. Click "Open", "Yes", and then click "Cancel".





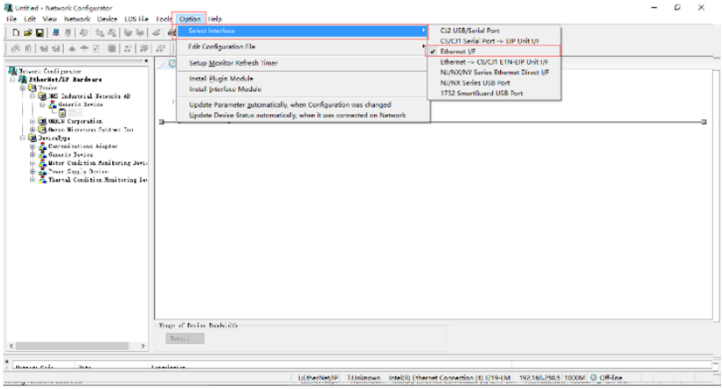
Add "NX1P2" and "UMI-B7" to the Ethernet/IP bus. After these two devices are added successfully, the bus shows two devices. The default IP addresses are "192.168. 250.1" and "192.168.250.2", and UMI-B7 function codes P16.58–P16.61 are changed into 192, 168, 250 and 2 respectively.



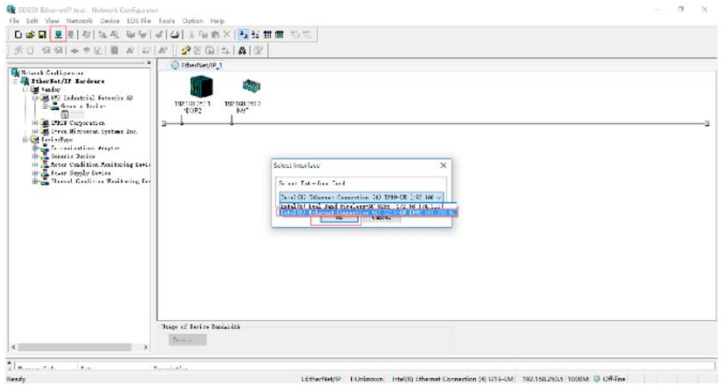


3.6.2.3 Connection setting

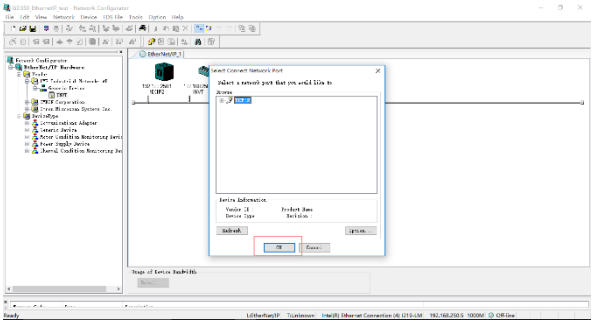
Click "Option" → "Select Interface" and select "Ethernet I/F".



Click the "Connect" icon to select the corresponding network port, and click "OK".

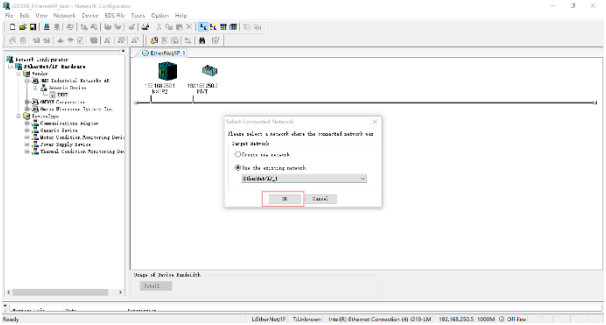


Select "TCP:2", and click "OK".

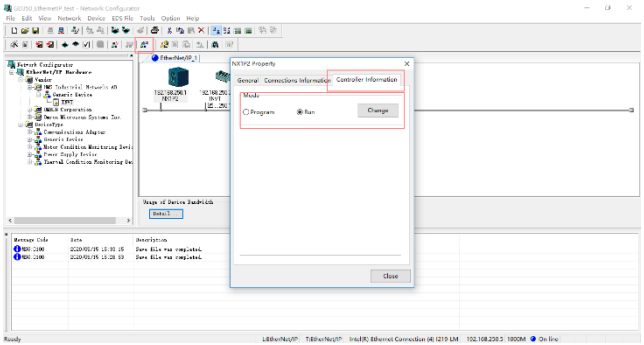


Select "Use the existing network"→"Ethernet/IP_1", click "OK", and the PLC is connected successfully.

After the PLC is connected successfully, the blue indicator above the PLC device icon is on.

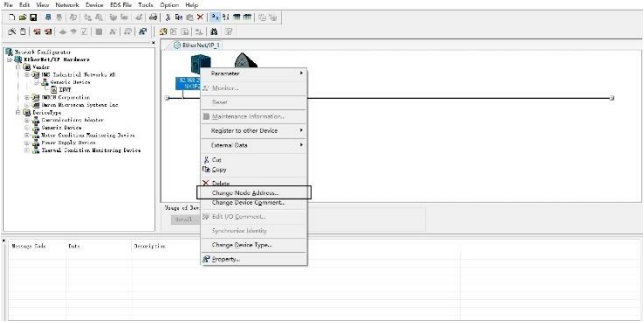


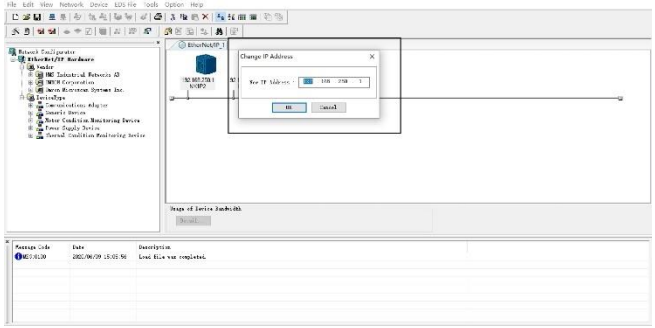
Click the "Device Property" icon, and the "Controller Information" tab pops up. You can switch the PLC status between "Program" and "Run" in the tab.



3.6.2.4 Modify IP address

Right click the device icon and select "Change Node Address" to change the PLC IP address.

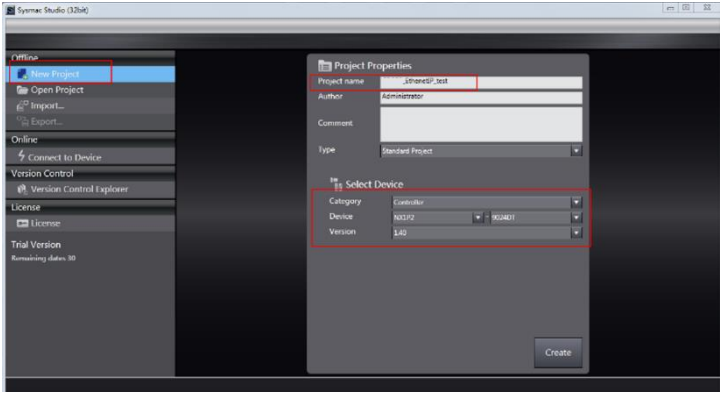




3.5.11 Sysmac Studio software settings

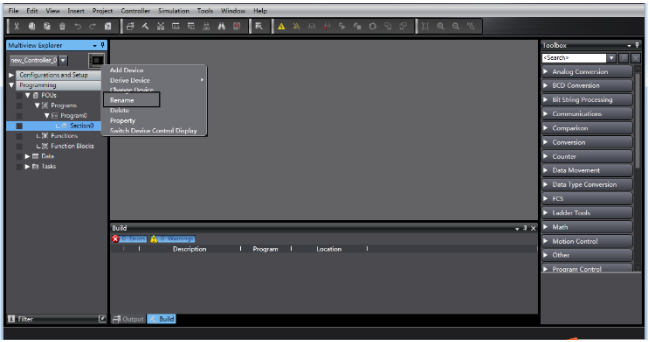
3.6.3.1 Create a new project

Double click the  icon to open the software, select "New Project", enter "Project name", select the device type, and click "Create".



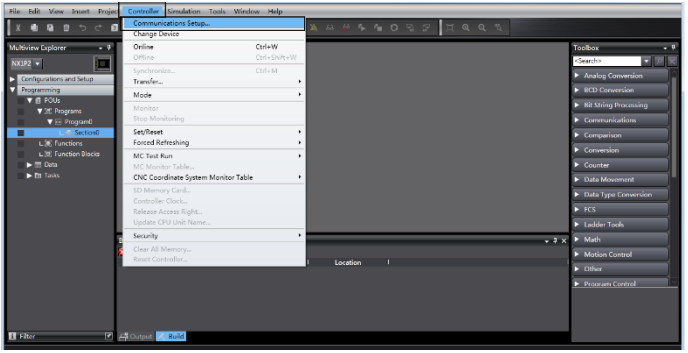
After a new project is created completely, you can enter the following interface. Right click the device icon and select "Rename" to change the device name (you can choose not to change

it).



3.6.3.2 Connection setting

Click "Controller" in the menu bar, and select "Communications setup".

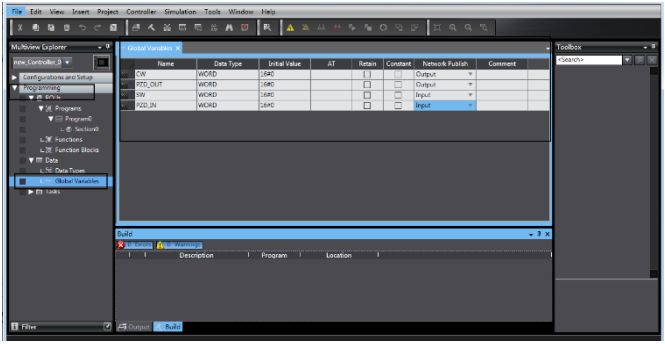


Select "Ethernet-Hub Connection" as the connection method, enter the remote IP address "192.168.250.1", and click "Ethernet communication test". Click "OK" when the status bar shows "Test succeeded".

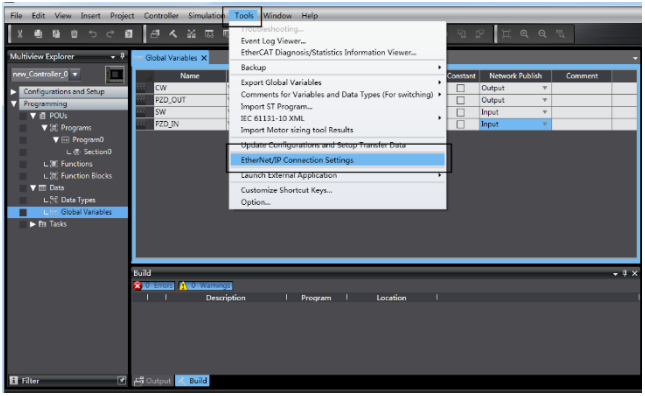
3.6.3.3 Set data labels

Select "Programming" → "Data" → "Global Variables" in the left menu bar, and add global

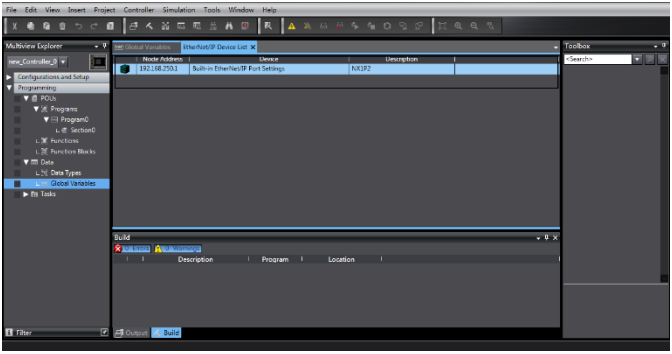
variables as needed. Note that you shall select "WORD" in the "Data Type" column and select "Input/Output" in the "Network Publish" column. Take "ODVA Basic speed control assembly" as an example, and create four global variables.



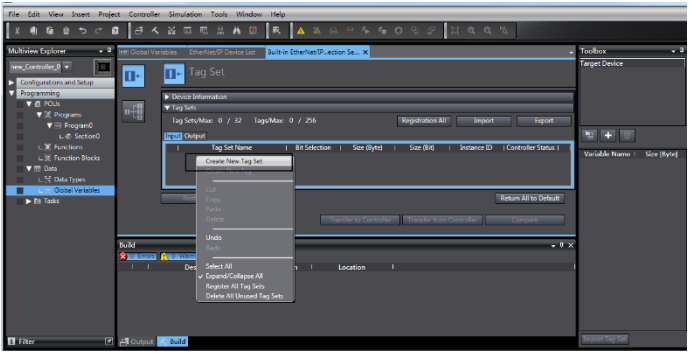
Click "Tools" in the top menu bar, and select "Ethernet/IP Connection Settings".



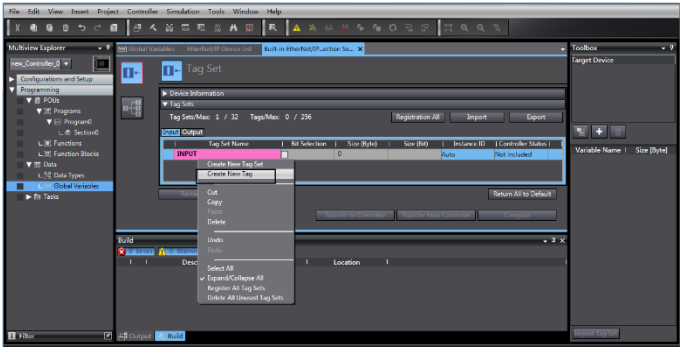
Double click "Built-in Ethernet/IP Port Settings".

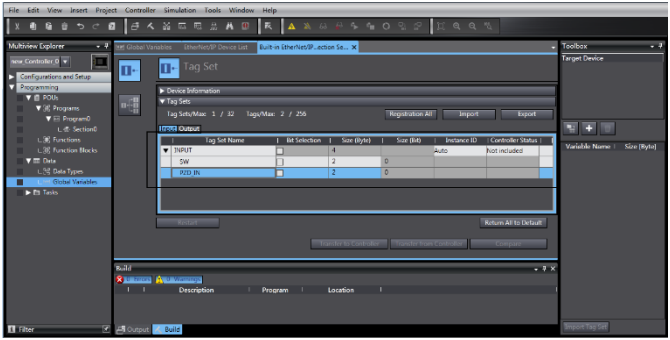


Right-click the blank area under "Tag Set", and select "Create New Tag Set".

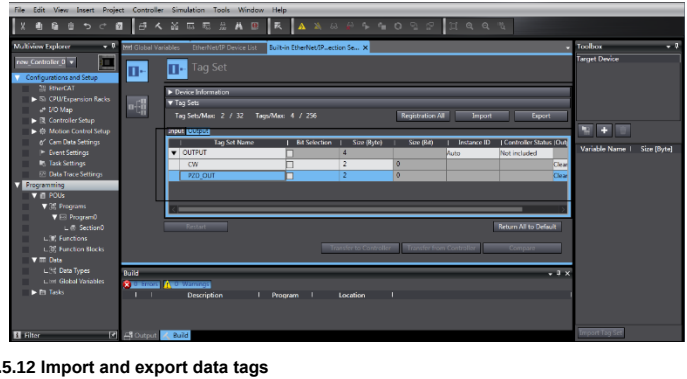


The input tag set is named "INPUT", right-click "INPUT" to select "Create New Tag", and add the input global variables to the "INPUT" tag set. Pay attention to the order of the data sequence.





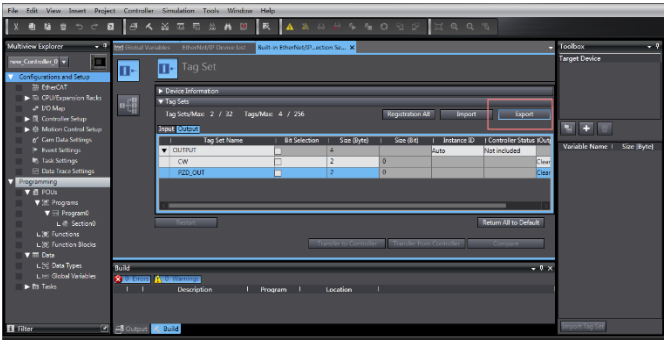
Repeat the above steps for the "OUTPUT" tag set and "OUTPUT" tag.



3.5.12 Import and export data tags

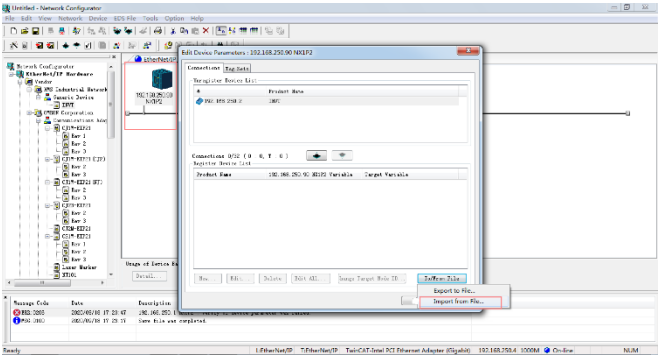
3.6.4.1 Export data tags from Sysmac Studio

After data tags are set completely, click "Export" to export the data tag to a local folder, and save it as "UMI_B7_test.csv" format.



3.6.4.2 Import data tags into Network Configurator

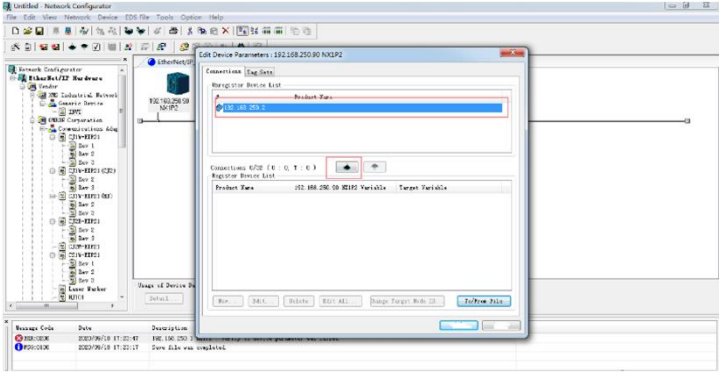
In the "Network Configurator" software, double-click the PLC device icon, click "To/From File" in the lower right corner, and select "Import from File...".



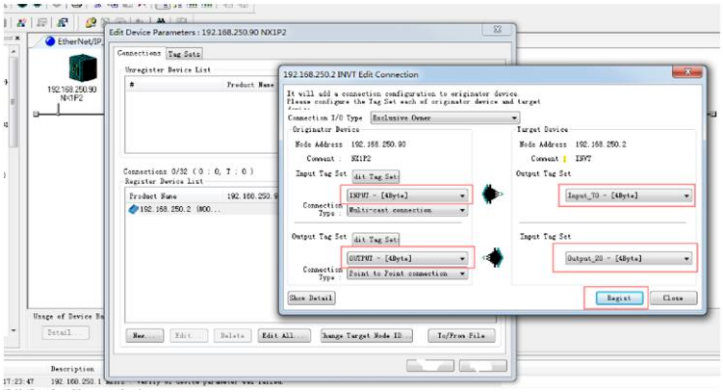
Select the file "UMI_B7_test.csv" exported from Sysmac Studio, and click "Open".

3.6.4.3 Data tag corresponding connection

Select the device "192.168.250.2" under the "Connections" tab, and click the Move Down button.



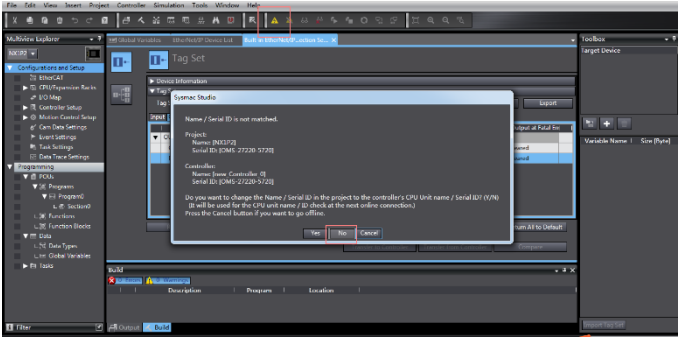
Double click the device "192.168.250.2", set the data input/output tags, and click "Register".



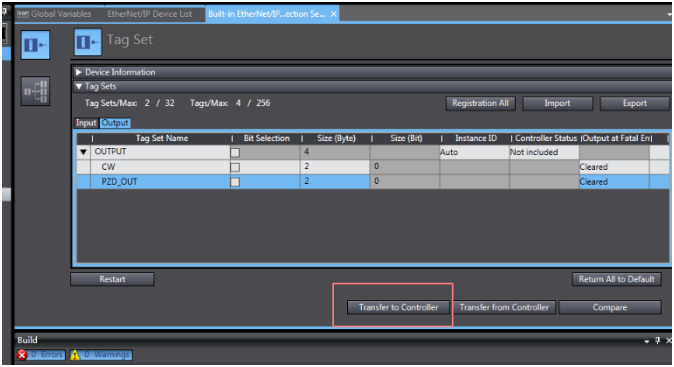
3.5.13 PLC program downloading and online monitoring

3.6.5.1 Sysamc Studio downloading

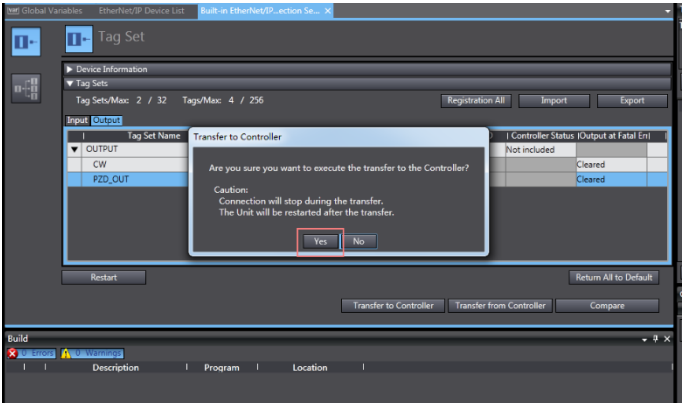
Click the Online button (If the device name has been changed, the following interface will pop up, and you can click "No").



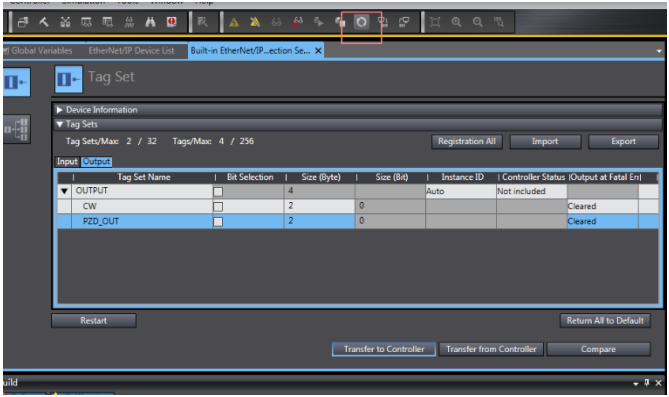
Click "Transfer to Controller" under the "Built-in Ethernet/IP Port Settings" tab.



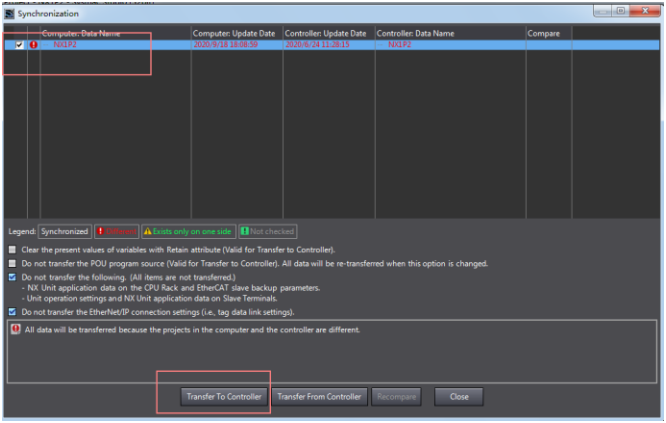
Click "Yes".



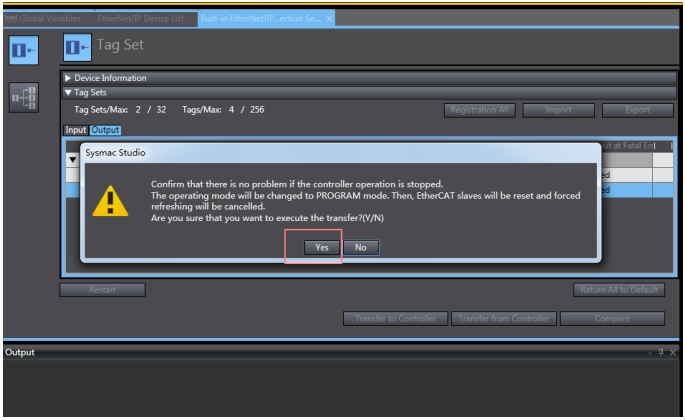
Click the "Sync" function button.



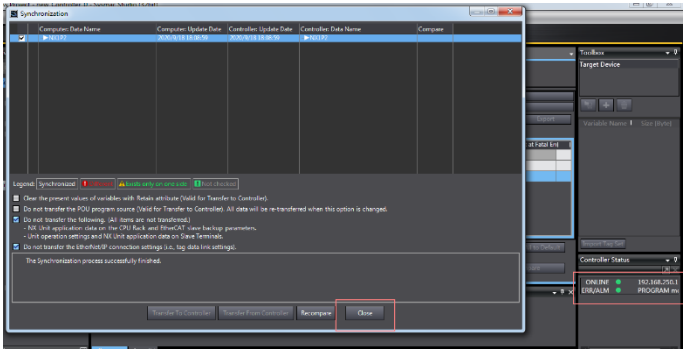
Select the device "NX1P2", and click "Transfer To Controller".



Click "Yes".

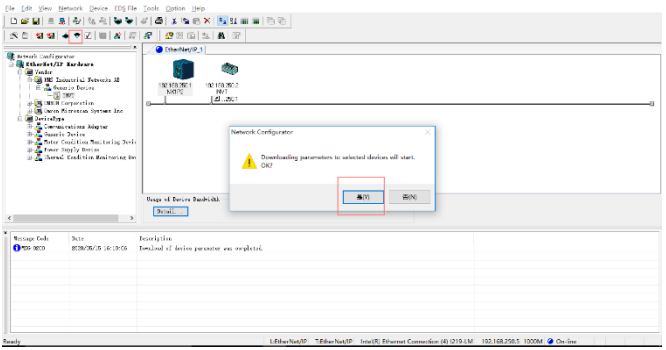


Click "Close" when the "Controller" status in the lower right corner is two green lights.

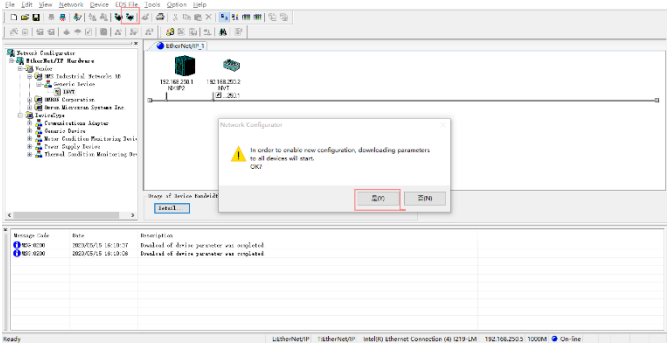


3.6.5.2 Network Configurator downloading

Click the icon of "Download to Device", and click "Yes".

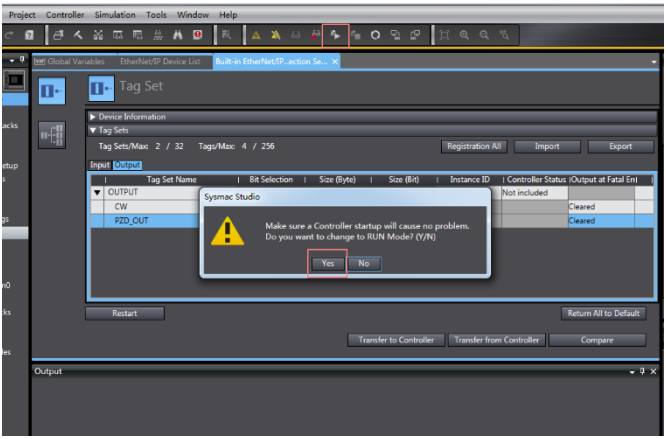


Click the icon of "Download to Network", and click "Yes".

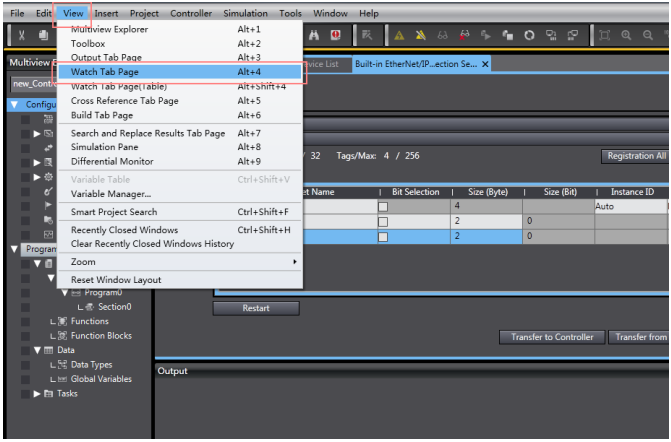


3.6.5.3 Sysmac Studio online monitoring

Click the "Run" icon, turn the PLC to "Run Mode", and click "Yes".

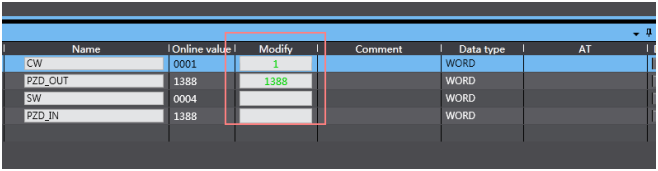


Click "View" on the top menu bar, and select "Watch Tab Page".



Enter the variable name in the "Watch Tab Page" to monitor the value of the variable, and

change the value in real-time in the "Modify" box.



Appendix A Related function codes

Function code	Name	Parameter description	Setting range	Default value
P00.01	Channel of running commands	0: Keypad 1: Terminal 2: Communication	0–2	0
P00.02	Communication channel of running commands	3: Ethernet/IP communication	0–6	0
P00.06	Frequency A command setting mode	13: Ethernet/IP communication	0–15	0
P00.07	Frequency B command setting mode		0–15	15
P03.11	Torque setting mode	11: Ethernet/IP communication	0–12	0
P03.14	Setting mode of upper frequency limit of forward running in torque control	10: Ethernet/IP communication	0–12	0
P03.15	Setting mode of upper frequency limit of reverse running in torque control	10: Ethernet/IP communication	0–12	0
P03.18	Setting mode of upper limit of electromotive torque	9: Ethernet/IP communication	0–11	0
P03.19	Setting mode of upper limit of brake torque	9: Ethernet/IP communication	0–11	0
P04.27	Voltage setting channel	11: Ethernet/IP communication	0–13	0
P06.01	Y1 output		0–63	0

Function code	Name	Parameter description	Setting range	Default value
P06.02	HDO output	34: Ethernet/IP communication	0–63	0
P06.03	Relay output RO1		0–63	1
P06.04	Relay output RO2		0–63	5
P06.14	Analog output AO1	27: Ethernet/IP communication	0–63	0
P06.16	HDO high-speed pulse output		0–63	0
P07.27	Type of current fault	60: Card identification failure in slot 1 (F1-Er) 61: Card identification failure in slot 2 (F2-Er) 62: Card identification failure in slot 3 (F3-Er) 63: Card communication failure in slot 1 (C1-Er) 64: Card communication failure in slot 2 (C2-Er) 65: Card communication failure in slot 3 (C3-Er) 72: Ethernet/IP communication timeout (E-EIP)	/	/
P07.28	Type of last fault		/	/
P07.29	Type of 2nd-last fault		/	/
P07.30	Type of 3rd-last fault		/	/
P07.31	Type of 4th-last fault		/	/
P07.32	Type of 5th-last fault		/	/
P08.31	Motor 1 and motor 2 switching channel	0x00–0x14 LED ones place: Switching channel 4: Ethernet/IP communication LED tens place: Switching in running 0: Disabled 1: Enabled	00–14	0x00
P09.00	PID reference source	10: Ethernet/IP communication	0–12	0
P09.02	PID feedback source	8: Ethernet/IP communication	0–10	0
P15.01	Module address	0–127	0–127	2
P15.02	Received PZD2	0: Invalid 1: Set frequency (0–Fmax, unit: 0.01 Hz) 2: PID reference (-1000–1000, in which	0–31	0
P15.03	Received PZD3		0–31	0
P15.04	Received PZD4		0–31	0
P15.05	Received PZD5		0–31	0

Function code	Name	Parameter description	Setting range	Default value
P15.06	Received PZD6	1000 corresponds to 100.0%)	0–31	0
P15.07	Received PZD7	3: PID feedback (-1000–1000, in which	0–31	0
P15.08	Received PZD8	1000 corresponds to 100.0%)	0–31	0
P15.09	Received PZD9	4: Torque setting (-3000–+3000, in	0–31	0
P15.10	Received PZD10	which 1000 corresponds to 100.0% of	0–31	0
P15.11	Received PZD11	the rated current of the motor)	0–31	0
P15.12	Received PZD12	5: Setting of the upper limit of forward running frequency (0–Fmax, unit: 0.01 Hz) 6: Setting of the upper limit of reverse running frequency (0–Fmax, unit: 0.01 Hz) 7: Upper limit of the electromotive torque (0–3000, in which 1000 corresponds to 100.0% of the rated current of the motor) 8: Upper limit of the brake torque (0–3000, in which 1000 corresponds to 100.0% of the rated current of the motor) 9: Virtual input terminal command, 0x000–0x3FF (corresponding to S8, S7, S6, S5, HDIB, HDIA, S4, S3, S2, and S1 in sequence) 10: Virtual output terminal command, 0x00–0x0F (corresponding to RO2, RO1, HDO, and Y1 in sequence) 11: Voltage setting (for V/F separation) (0–1000, in which 1000 corresponds to 100.0% of the rated voltage of the motor) 12: AO1 output setting 1 (-1000–+1000, in which 1000 corresponds to 100.0%) 13: AO2 output setting 2 (-1000–+1000, in which 1000 corresponds to 100.0%) 14: MSB of position reference (signed number)	0–31	0

Function code	Name	Parameter description	Setting range	Default value
		15: LSB of position reference (unsigned number) 16: MSB of position feedback (signed number) 17: LSB of position feedback (unsigned number) 18: Position feedback setting flag (position feedback can be set only after this flag is set to 1 and then to 0) 19: Function code mapping (PZD2–PZD12 correspond to P14.49–P14.59 respectively.) 20–31: Reserved		
P15.13	Transmitted PZD2	0: Invalid 1: Running frequency (×100, Hz) 2: Set frequency (×100, Hz) 3: Bus voltage (×10, V) 4: Output voltage (×1, V) 5: Output current (×10, A) 6: Actual output torque (×10, %) 7: Actual output power (×10, %) 8: Rotating speed of the running (×1, RPM) 9: Linear speed of the running (×1, m/s) 10: Ramp frequency reference 11: Fault code 12: AI1 value (×100, V) 13: AI2 value (×100, V) 14: AI3 value (×100, V) 15: HDIA frequency (×1000, kHz) 16: Terminal input state 17: Terminal output state 18: PID reference (×10, %) 19: PID feedback (×10, %) 20: Rated torque of the motor 21: MSB of position reference (signed number) 22: LSB of position reference (unsigned	0–47	0
P15.14	Transmitted PZD3		0–47	0
P15.15	Transmitted PZD4		0–47	0
P15.16	Transmitted PZD5		0–47	0
P15.17	Transmitted PZD6		0–47	0
P15.18	Transmitted PZD7		0–47	0
P15.19	Transmitted PZD8		0–47	0
P15.20	Transmitted PZD9		0–47	0
P15.21	Transmitted PZD10		0–47	0
P15.22	Transmitted PZD11		0–47	0
P15.23	Transmitted PZD12		0–47	0

Function code	Name	Parameter description	Setting range	Default value
		number) 23: MSB of position feedback (signed number) 24: LSB of position feedback (unsigned number) 25: Status word 26: HDIB frequency value (×1000, kHz) 27: MSB of PG card pulse feedback count 28: LSB of PG card pulse feedback count 29: MSB of PG card pulse reference count 30: LSB of PG card pulse reference count 31: Function code mapping (PZD2–PZD12 correspond to P14.60–P14.70 respectively.) 32: Status word 3 33–47: Reserved		
P15.32	Displayed node baud rate	0	0	0
P15.33	Enable polling	0–1	0–1	1
P15.34	Output instance in polling	19: Self-defined output 20: ODVA basic speed control output 21: ODVA extended speed control output 22: ODVA speed and torque control output 23: ODVA extended speed and torque control output 24: Basic speed control output 25: Extended speed control output 26: Speed and torque control output 27: Extended speed and torque control output	19–27	19
P15.35	Input instance in polling	69: Self-defined input 70: ODVA basic speed control input	69–77	69

Function code	Name	Parameter description	Setting range	Default value
		71: ODVA extended speed control input 72: ODVA speed and torque control input 73: ODVA extended speed and torque control input 74: Basic speed control input 75: Extended speed control input 76: Speed and torque control input 77: Extended speed and torque control input		
P15.36	Enable state change/period	0–1	0–1	0
P15.37	Output instance in state change/period	19: Self-defined output 20: ODVA basic speed control output 21: ODVA extended speed control output 22: ODVA speed and torque control output 23: ODVA extended speed and torque control output 24: Basic speed control output 25: Extended speed control output 26: Speed and torque control output 27: Extended speed and torque control output	19–27	19
P15.38	Input instance in state change/period	69: Self-defined input 70: ODVA basic speed control input 71: ODVA extended speed control input 72: ODVA speed and torque control input 73: ODVA extended speed and torque control input 74: Basic speed control input 75: Extended speed control input 76: Speed and torque control input 77: Extended speed and torque control input	69–77	69
P15.39	Output length of	8–32	8–32	32

Function code	Name	Parameter description	Setting range	Default value
	component 19			
P15.40	Input length of component 69	8–32	8–32	32
P15.43	Communication control word expression method	0: In decimal format 1: In binary format	0–1	0
P15.44	Communication control word/status word display selection	0: Display the currently identified card (only one) 4: Ethernet/IP card	0–6	0
P15.45–P15.69	Reserved			
P16.14	Ethernet card monitoring variable address 1	0x0000–0xFFFF	0000–FFFF	0x0000
P16.15	Ethernet card monitoring variable address 2	0x0000–0xFFFF	0000–FFFF	0x0000
P16.16	Ethernet card monitoring variable address 3	0x0000–0xFFFF	0000–FFFF	0x0000
P16.17	Ethernet card monitoring variable address 4	0x0000–0xFFFF	0000–FFFF	0x0000
P16.24	Extension card identification time of slot 1	0.0–600.0s When this parameter is set to 0.0, disconnection fault detection is not performed.	0.0–600.0s	0.0s
P16.25	Extension card identification time of slot 2	0.0–600.0s When this parameter is set to 0.0, disconnection fault detection is not performed.	0.0–600.0s	0.0s

Function code	Name	Parameter description	Setting range	Default value
P16.26	Extension card identification time of slot 3	0.0–600.0s When this parameter is set to 0.0, disconnection fault detection is not performed.	0.0–600.0s	0.0s
P16.27	Extension card communication timeout time of slot 1	0.0–600.0s When this parameter is set to 0.0, disconnection fault detection is not performed.	0.0–600.0s	0.0s
P16.28	Extension card communication timeout time of slot 2	0.0–600.0s When this parameter is set to 0.0, disconnection fault detection is not performed.	0.0–600.0s	0.0s
P16.29	Extension card communication timeout time of slot 3	0.0–600.0s When this parameter is set to 0.0, disconnection fault detection is not performed.	0.0–600.0s	0.0s
P16.31	PROFINET communication timeout time	0.0 (invalid)–60.0s	0.0–60.0s	5.0s
P16.32	Received PZD2	0: Invalid 1: Set frequency (0–Fmax, unit: 0.01 Hz) 2: PID reference (-1000–1000, in which 1000 corresponds to 100.0%) 3: PID feedback (-1000–1000, in which 1000 corresponds to 100.0%) 4: Torque setting (-3000–+3000, in which 1000 corresponds to 100.0% of the rated current of the motor) 5: Setting of the upper limit of forward running frequency (0–Fmax, unit: 0.01 Hz) 6: Setting of the upper limit of reverse running frequency (0–Fmax, unit: 0.01 Hz) 7: Upper limit of the electromotive torque (0–3000, in which 1000 corresponds to 100.0% of the rated	0–31	0
P16.33	Received PZD3		0–31	0
P16.34	Received PZD4		0–31	0
P16.35	Received PZD5		0–31	0
P16.36	Received PZD6		0–31	0
P16.37	Received PZD7		0–31	0
P16.38	Received PZD8		0–31	0
P16.39	Received PZD9		0–31	0
P16.40	Received PZD10		0–31	0
P16.41	Received PZD11		0–31	0
P16.42	Received PZD12		0–31	0

Function code	Name	Parameter description	Setting range	Default value
		current of the motor) 8: Upper limit of the brake torque (0–3000, in which 1000 corresponds to 100.0% of the rated current of the motor) 9: Virtual input terminal command, 0x000–0x3FF (bit9–bit0 correspond to S8/S7/S6/S5/HDIB/HDIA/S4/S3/S2/S1 in sequence) 10: Virtual output terminal command, 0x00–0x0F (bit3–bit0 correspond to RO2/RO1/HDO/Y1 in sequence) 11: Voltage setting (for V/F separation) (0–1000, in which 1000 corresponds to 100.0% of the rated voltage of the motor) 12: AO1 output setting 1 (-1000–+1000, in which 1000 corresponds to 100.0%) 13: AO2 output setting 2 (-1000–+1000, in which 1000 corresponds to 100.0%) 14: MSB of position reference (signed number) 15: LSB of position reference (unsigned number) 16: MSB of position feedback (signed number) 17: LSB of position feedback (unsigned number) 18: Position feedback setting flag (position feedback can be set only after this flag is set to 1 and then to 0) 19: Function code mapping (PZD2–PZD12 correspond to P14.49–P14.59 respectively.) 20–31: Reserved		
P16.43	Transmitted PZD2	0: Invalid 1: Running frequency (×100, Hz)	0–47	0
P16.44	Transmitted	2: Set frequency (×100, Hz)	0–47	0

Function code	Name	Parameter description	Setting range	Default value
	PZD3	3: Bus voltage (×10, V)		
P16.45	Transmitted PZD4	4: Output voltage (×1, V) 5: Output current (×10, A)	0–47	0
P16.46	Transmitted PZD5	6: Actual output torque (×10, %) 7: Actual output power (×10, %)	0–47	0
P16.47	Transmitted PZD6	8: Rotating speed of the running (×1, RPM)	0–47	0
P16.48	Transmitted PZD7	9: Linear speed of the running (×1, m/s) 10: Ramp frequency reference	0–47	0
P16.49	Transmitted PZD8	11: Fault code 12: AI1 value (×100, V)	0–47	0
P16.50	Transmitted PZD9	13: AI2 value (×100, V) 14: AI3 value (×100, V)	0–47	0
P16.51	Transmitted PZD10	15: HDIA frequency (×1000, kHz) 16: Terminal input state	0–47	0
P16.52	Transmitted PZD11	17: Terminal output state 18: PID reference (×10, %)	0–47	0
P16.53	Transmitted PZD12	19: PID feedback (×10, %) 20: Rated torque of the motor 21: MSB of position reference (signed number) 22: LSB of position reference (unsigned number) 23: MSB of position feedback (signed number) 24: LSB of position feedback (unsigned number) 25: Status word 26: HDIB frequency value (×1000, kHz) 27: MSB of PG card pulse feedback count 28: LSB of PG card pulse feedback count 29: MSB of PG card pulse reference count 30: LSB of PG card pulse reference count 31: Function code mapping (PZD2–	0–47	0

Function code	Name	Parameter description	Setting range	Default value
		PZD12 correspond to P14.60–P14.70) 32: Status word 3 33–47: Reserved		
P16.54	Ethernet IP communication timeout time	0.0–60.0s	0.0–60.0s	5.0s
P16.55	Ethernet IP communication rate setting	0: Self-adaption 1: 100M full duplex 2: 100M half duplex 3: 10M full duplex 4: 10M half duplex	0–4	0
P16.58	Industrial Ethernet communication card IP address 1	0–255	0–255	192
P16.59	Industrial Ethernet communication card IP address 2	0–255	0–255	168
P16.60	Industrial Ethernet communication card IP address 3	0–255	0–255	0
P16.61	Industrial Ethernet communication card IP address 4	0–255	0–255	20
P16.62	Industrial Ethernet communication card subnet mask 1	0–255	0–255	255
P16.63	Industrial Ethernet communication card subnet mask 2	0–255	0–255	255
P16.64	Industrial Ethernet	0–255	0–255	255

Function code	Name	Parameter description	Setting range	Default value
	communication card subnet mask 3			
P16.65	Industrial Ethernet communication card subnet mask 4	0–255	0–255	0
P16.66	Industrial Ethernet communication card gateway 1	0–255	0–255	192
P16.67	Industrial Ethernet communication card gateway 2	0–255	0–255	168
P16.68	Industrial Ethernet communication card gateway 3	0–255	0–255	0
P16.69	Industrial Ethernet communication card gateway 4	0–255	0–255	1
P16.70	Save EtherCAT written function codes	0: No 1: Yes	0–1	0
P16.72	EtherCAT input unit selection	0: PRM as the input rotation speed unit 1: plus/s as the input rotation speed unit	0–1	0
P16.73	EtherCAT slave address	0x0000–0xffff	0x0000–0xffff	0xffff
P16.74	EtherCAT-DC synchronization period selection	0: Reserved 1: Reserved 2: 1ms 3: 2ms 4: Reserved 5: Reserved	0–5	0

Function code	Name	Parameter description	Setting range	Default value
P16.75	EtherCAT communication timeout time	0.0–60.0(s)	0.0–60.0	5.0s
P16.76	EtherCAT supported PLC type	0: Beckhoff 1: AX70 2: OMRON 3: Trio 4: LNC 5–8: Reserved	0–8	0
P16.77	EtherCAT run mode	0: Free-run mode 1: SM mode (synchronized in data input and output) 2: DC mode (synchronized in distributed clocks)	0–2	0
P19.00	State of extension card at slot 1	0: No card 1: PLC programmable card 2: I/O card 3: Incremental PG card 4: Incremental PG card with UVW 5: Ethernet communication card	0–65535	0
P19.01	State of extension card at slot 2		0–65535	0

Function code	Name	Parameter description	Setting range	Default value
P19.02	State of extension card at slot 3	7: Bluetooth card 8: Resolver PG card 9: CANopen communication card 11: PROFINET communication card 12: Sine-cosine PG card without CD signals 13: Sine-cosine PG card with CD signals 14: Absolute encoder PG card 16: Modbus TCP communication card 17: EtherCAT communication card 20: PT100/PT1000 temperature detection card 21: Ethernet/IP communication card 24–31: Reserved 32: SSI-PG card 33–65535: Reserved	0–65535	0