PRODUCT
USE INSTRUCTIONS

[Technical support]

Ordering code: 007BA1

Part number: FNI MPL-502-105-S

FNI MPL-502-105-S

4xIO-Link,4 DI PNP

IP 67 IO Link Master module user manual

Contents

<u>Security</u>

■ Expected use

This manual describes as decentralized input and output modules for connecting to an industrial network.

■ Installation and start-up

Precautions!

Installation and start-up may only be performed by trained personnel. A qualified individual is one who is familiar with the installation and operation of the product and has the necessary qualifications to perform such operations. Any damage caused by unauthorized operation or illegal and improper use is not covered by the manufacturer's warranty. The equipment operator is responsible for ensuring that appropriate safety and accident prevention regulations are observed.

■ Corrosion resistance

Precautions!

FNI modules generally have good chemical and oil resistance.When used in corrosive media (e.g. high concentrations of chemicals, oils, lubricants, coolants and other material media (i.e. very low water content), these media must be checked before the corresponding application material compatibility.If a module fails or is damaged due to this corrosive medium, a defect claim cannot be made.

■ Dangerous voltage

Precautions!

Disconnect all power before using the device!

■ General security

Debugging and inspection	Fault	Owner/operator obligations	Expected use
Before debugging, read the user manual carefully.	If the defect or equipment failure cannot be corrected, the operation of the equipment must be stopped to avoid damage that may be caused by unauthorized use.	This equipment is an EMC Class A compliant product. This device produces RF noise.	The warranty and limited liability statement provided by the manufacturer does not cover damage caused by: ·Unauthorized tampering ·Improper use operation ·The instructions provided in the user manual explain the use, installation and handling of discrepancies
This system cannot be used in an environment where the safety of personnel depends on the functionality of the equipment.	Only after the housing is fully installed can the intended use be assured.	The owner/operator must take appropriate precautions to use this equipment.	
		This device can only use the power supply that matches this device, and can only connect cables approved for application.	

1.Getting Started Guide

1.1 Module overview
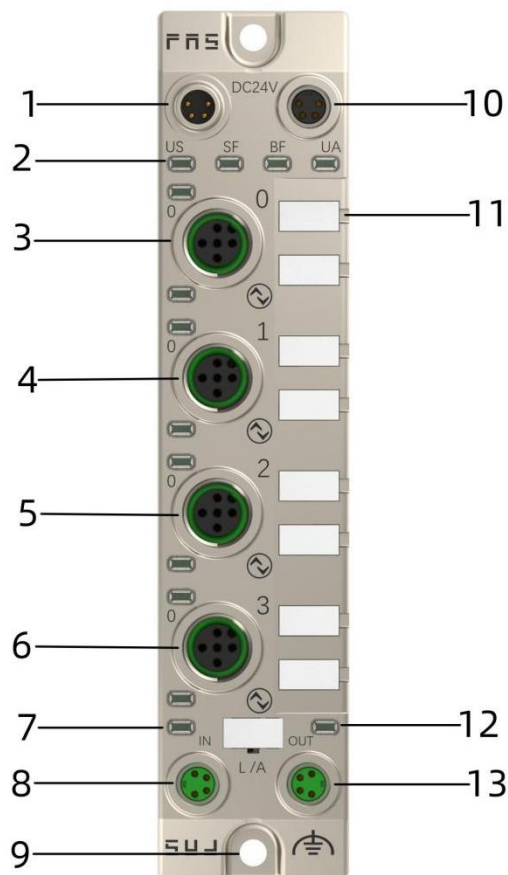
1 Power input port	8 Network input port
2 Module indicator	9 Ground connection
3 Port 0	10 Power output port
4 port 1	11 Port identification board
5 Port 2	12 Network output status indicator light
6 Port 3	13 Network output port
7 Network input status indicator light	

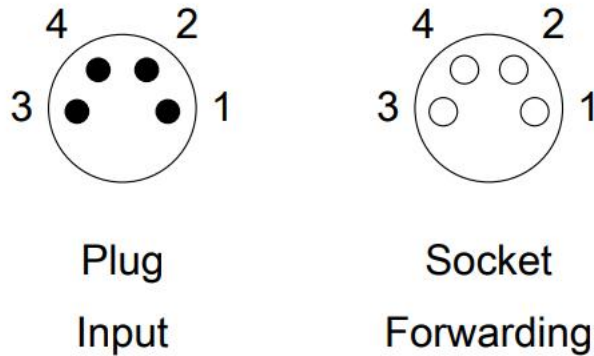## 1.2 Mechanical connection

The modules are connected using 2 M4 bolts and 2 washers.
Isolation pads are available as accessories.

## 1.3 Electrical connection

1.3. 1 Power interface (L-code)

Pin	Function	Description
1	Us+	+24V(Brown)
2	Ua+*	+24V(White)
3	Us-	0V(Blue)
4	Ua-*	0V(Black)

Note:

1. If possible, provide sensor/module power supply and actuator power supply separately.
   Total current <4A. Total current of all modules <4A, even when actuator power supplies are
   daisy chained.
2. The FE connection from the housing to the machine must be low impedance and kept as short
   as possible.
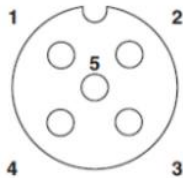
1.3.2 Network interface（M8）
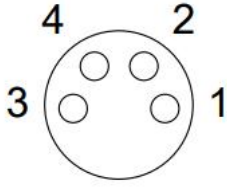
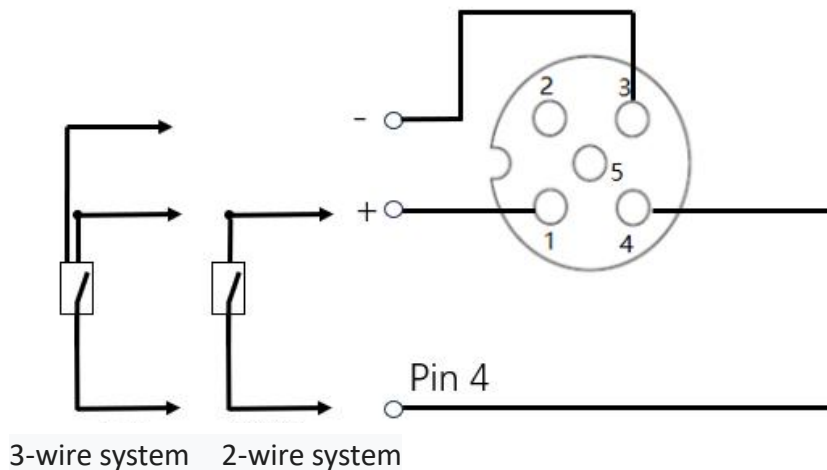| Pin	Function	
1	Tx+	Send data+
2	Rx+	Receive data+
3	Tx-	send data-
4	Rx-	Receive data-

Note:

Unused I/O port sockets must be covered with end caps to meet IP67 protection, etc.

1.3.3 I/O-port (B-code)

Pin	Function	
1 (Brown)	24V Us	Maximum current 1A
2 (White)	24V Ua	
3 (Blue)	0V Us	
4 (Black)	IO-Link	
5 (Gray)	0V Ua	

PNP input

3-wire system   2-wire system
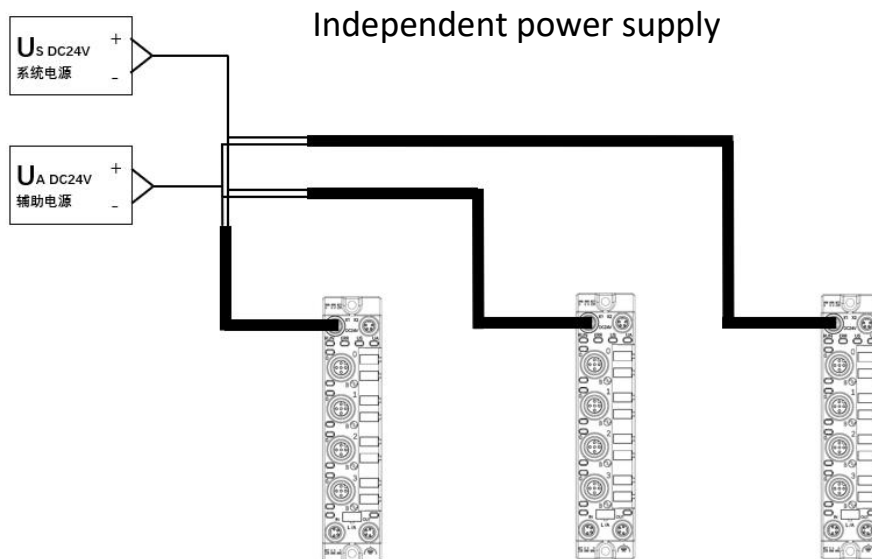
Note:

1. Regarding digital sensor input, please follow the input guidance of EN61131-2, Type 2.

2. The maximum single output current of pins 2 and 4 is 0.5A. The total module current is <4A.

3. Unused I/O port sockets must be covered with end caps to meet IP67 protection level.

1.3.4 Main station module wiring method

Independent power supply

In independent power supply mode, the maximum current of each master station can reach 4A.

String power supply
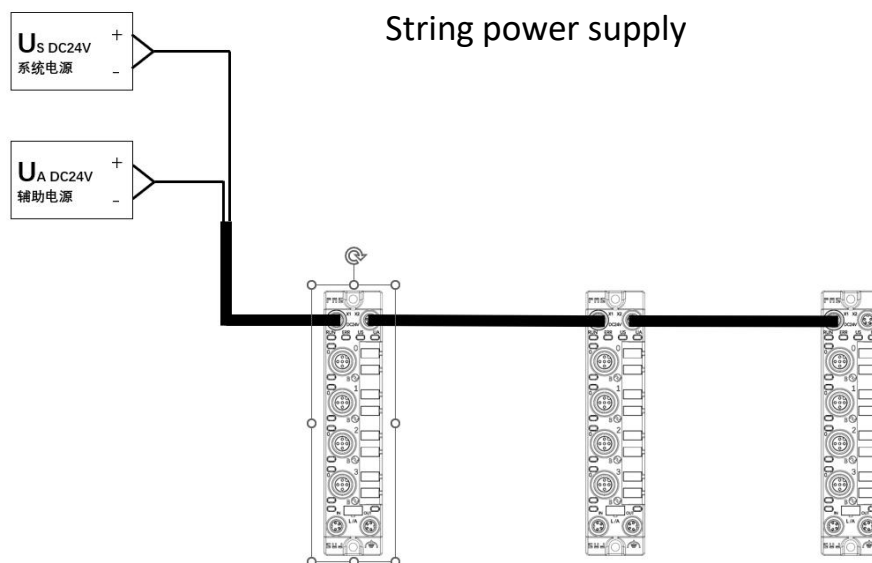
In the serial power supply wiring mode, if the rear module needs to be connected to the front module, the cumulative current must not exceed 4A.

2   Technical data
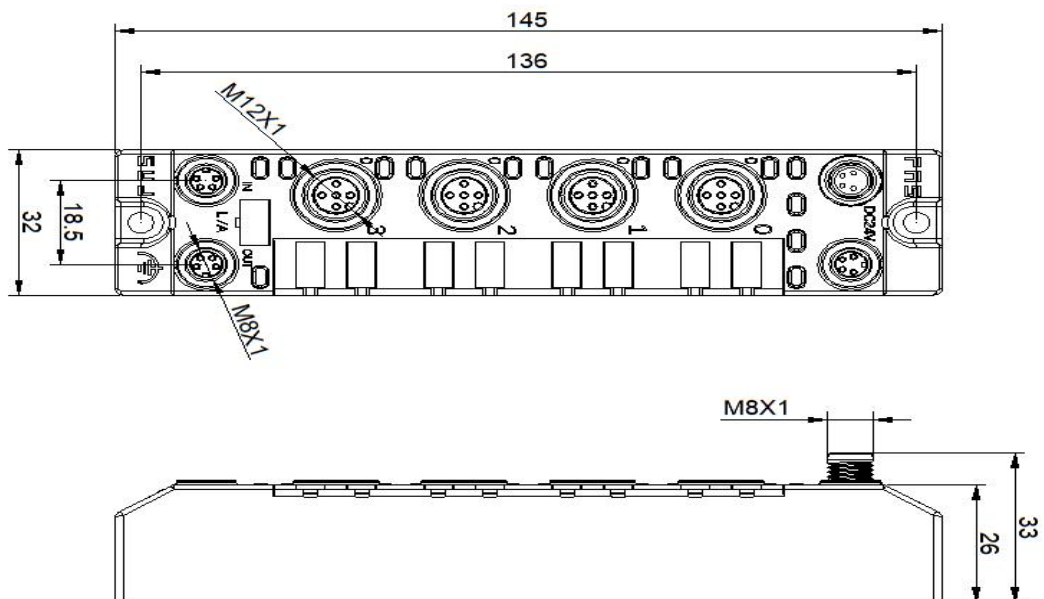
2.1. Size

2.2 Mechanical data

Shell material	Shell material
Housing rating according to IEC 60529	Housing rating according to IEC 60529
Power interface	Power interface
Input port/output port	Input port/output port
Size(W*H*D)	Size(W*H*D)
Installation type	Installation type
Ground bus accessories	Ground bus accessories
Weight	Weight

2.3. Operating conditions

Operating temperature	-5℃ ～ 85℃
Storage temperature	-25℃ ～ 85℃

2.4. Electrical data

Supply voltage	18~30V DC，Symbol EN61131-2
Voltage fluctuation	＜1%
Module operating current when power supply voltage is 24V	<130mA

2.5 Network port

Port	2 x 10Base-/100Base-Tx
Port connection	M8
IEEE 802.3 compliant cable types	Shielded twisted pair, minimum STP CAT 5/STP CAT 5e
Data transfer rate	10/100 M bit/s
Maximum cable length	100m
Flow control	Half working condition/full working condition (IEEE 802.3-PAUSE)

2.6 Function indicator

PN communication protocol module status

LED	Show	Function
L1	Closure	Working fine
	Red flashing 3s1HZ	Bus start
	Red always on	System error
L2	Closure	Working fine
	Flashing red 2HZ	No data exchange
	Red always on	No configuration; or low speed physical link; or no physical link
US	Green	Input voltage is normal
	Flashing red	Input voltage low (< 18 V)
UA	Green	Output voltage is normal
	Flashing red	Output voltage low (< 18 V)
	Red always on	No output voltage present (< 11 V)

EIP communication protocol module status

LED	show	Function
L1	Green light is always on	Working status: The equipment is running normally
	Green light flashes 1HZ	Standby: The device is not configured
	Flashing green, red and green alternately	Self-test: The device is undergoing a power-on test.
	Flashing red 1HZ	Recoverable faults:
	Red light always on	Unrecoverable failure
	closure	US no input voltage
L2	Green light is always on	Connected
	Green light flashes 1HZ	Not connected:
	Flashing green and red alternately	Self-test: The device is undergoing a power-on test.
	Red light flashes 1HZ	Connection timeout
	Red light always on	Duplicate IP:
	closure	USNo input voltage or no IP address
US	green	Input voltage is normal
	Flashing red	Input voltage low (< 18 V)
UA	green	Output voltage is normal
	Flashing red	Output voltage low (< 18 V)
	Red always on	No output voltage present (< 11 V)

CIE communication protocol module status

LED	Show	Function
L1	Green light off	Module not connected
	Green light flashes 2.5HZ	Module has no communication
	Green light flashes 1HZ	Module not configured
	Steady green	Running: The device is running
L2	Closure	Module works fine
	Red light always on	Communication error
US	Green	Input voltage is normal
	Flashing red	Input voltage low (< 18 V)
UA	Green	Output voltage is normal
	Flashing red	Output voltage low (< 18 V)
	Red always on	No output voltage present (< 11 V)

I/O port status
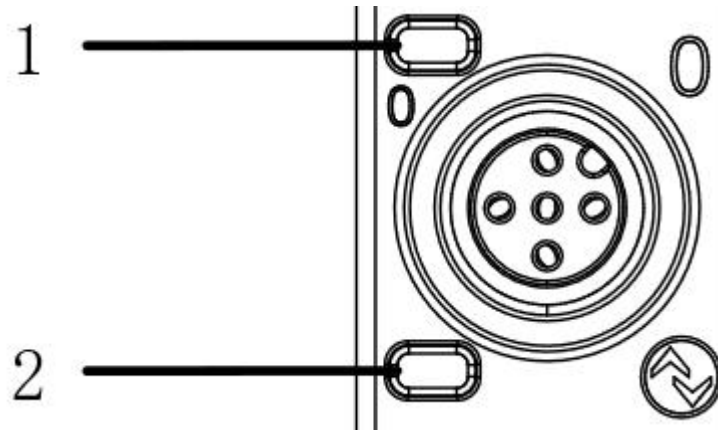
LED	State	Function
1	Closure	The status of Pin4 input is 0
1	Yellow	The status of Pin4 input is 1
1	Red	Pin4 short circuit
1	Flashing red	Pin1 short circuit
2	Closure	The status of Pin2 input is 0
2	Yellow	The status of Pin2 input is 1
2	Red	The UA power supply is cut off or the network is disconnected or Pin2 is short-circuited.
2	Flashing red	Pin1 short circuit

Network port status

LED	State	Function
IN	Flashing green	Data transfer in progress
OUT	Flashing green	Data transfer in progress

3 Integrated

3.1 Data mapping

PROFINET communication protocol module data									
Module	Function description								
	Status description	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
Device Status	Module state				US overv oltage	UA overv oltage	overh eat	US Under voltag e	UA Under voltag e
IO-Link communicati on state	IO communication status					PORT3	PORT2	PORT1	PORT0
IO-Link PD Valid	PD valid bit					PORT3	PORT2	PORT1	PORT0
Actuator shutdown pin 2	Pin2 Port short circuit 0=Normal 1=short circuit					PORT3 PIN2	PORT2 PIN2	PORT1 PIN2	PORT0 PIN2
Input pin 4	Enter pin4					PORT3 PIN4	PORT2 PIN4	PORT1 PIN4	PORT0 PIN4
Data description (binary): 0=no signal 1=signal									

EIP communication protocol process input data									
Byte	Function description								
	Status description	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
0	Standard IO input					PORT 3	PORT 2	PORT 1	PORT 0
1	Reserve								
2	Pin4 short circuit 0=no short circuit 1=There is a short circuit					PORT 3	PORT 2	PORT 1	PORT 0
3	Reserve								
4	IO communication status					PORT 3	PORT 2	PORT 1	PORT 0
5	PD valid bit					PORT 3	PORT 2	PORT 1	PORT 0
6	Module state				US overvoltage	UA overvoltage	overheat	US Undervoltage	UA Undervoltage
8~9	Reserve								
10 ~ 41	Port 0 process input data								
42 ~ 73	Port 1 process input data								
74 ~ 105	Port 2 process input data								
106 ~ 137	Port 3 process input data								
Data description (binary): 0=no signal 1=signal									

EIP communication protocol process output data									
Byte	Function description								
	Status description	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
0~5	Reserve								
6 ~ 37	Port 0 process output data								
38 ~ 69	Port 1 process output data								
70 ~ 101	Port 2 process output data								
102 ~ 133	Port 3 process output data								
Data description (binary): 0=no signal 1=signal									

CIEBS communication protocol process data								
Function description								
Regional function description	Y107	Y106	Y105	Y104	Y103	Y102	Y101	Y100
RY area standard IO output 0=off, 1=on					Route 4	Route 3	Route 2	Route 1
	The remaining points are reserved							
RX area standard IO input 0=off, 1=on	Port 0 process output data (32Byte)							
	Port 1 process output data (32Byte)							
	Port 2 process output data (32Byte)							
	Port 3 process output data (32Byte)							
Regional function description	X107	X106	X105	X104	X103	X102	X101	X100
RX area standard IO input 0=off, 1=on					Route 4	Route 3	Route 2	Route 1
	The remaining points are reserved							
RWR (maximum 128 bytes)	Port 0 process input data (32Byte)							
	Port 1 process input data (32Byte)							
	Port 2 process input data (32Byte)							
	Port 3 process input data (32Byte)							

Modbus TCP communication protocol process output data									
Byte	Function description								
	Function description	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
Word40001	Standard IO output 0=off 1=on	Port7 Pin4	Port6 Pin4	Port5 Pin4	Port4 Pin4	Port3 Pin4	Port2 Pin4	Port1 Pin4	Port0 Pin4
		Bit15	Bit14	Bit13	Bit12	Bit11	Bit10	Bit9	Bit8
		Port7 Pin2	Port6 Pin2	Port5 Pin2	Port4 Pin2	Port3 Pin2	Port2 Pin2	Port1 Pin2	Port0 Pin2
Word40002 - Word40003	Reserve								
Word40004 - Word40019	Port 0 process output data								
Word40020 - Word40035	Port 1 process output data								
Word40036 - Word40051	Port 2 process output data								
Word40052 - Word40067	Port 3 process output data								

Byte	Function description								
	Function description	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
Word30001	Standard IO input 0=no signal 1=There is signal					Port3 Pin4	Port2 Pin4	Port1 Pin4	Port0 Pin4
Word30002	Pin4 short circuit	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
	0=no short circuit 1=There is a short circuit					Port3 Pin4	Port2 Pin4	Port1 Pin4	Port0 Pin4
	Pin2 short circuit	Bit15	Bit14	Bit13	Bit12	Bit11	Bit10	Bit9	Bit8
	0=no short circuit 1=There is a short circuit					Port3 Pin2	Port2 Pin2	Port1 Pin2	Port0 Pin2
Word30003	Short circuit	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
	0=no short circuit 1=There is a short circuit					Port3 Pin1	Port2 Pin1	Port1 Pin1	Port0 Pin1
	IOLink communication status	Bit15	Bit14	Bit13	Bit12	Bit11	Bit10	Bit9	Bit8
	0=not connected 1=Connected					Port3	Port2	Port1	Port0
Word30004	IOLink PD valid 0=disabled 1=enable	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
						Port3	Port2	Port1	Port0
		Bit15	Bit14	Bit13	Bit12	Bit11	Bit10	Bit9	Bit8
	Module status	-	-	-	Us overvoltage	Ua overvoltage	overheat	Us Under voltage	Ua Under voltage
Word30005	Reserve								
Word3000-Word30021	Port 0 process input data								
Word3002-Word30037	Port 1 process input data								
Word3003-Word30053	Port 2 process input data								
Word3005-Word30069	Port 3 process input data								

Modbus TCP communication protocol process input data

Function description

3.2 PLC Integration Tutorial
3.2.1 Siemens S7-1200 Portal Integration (PN)
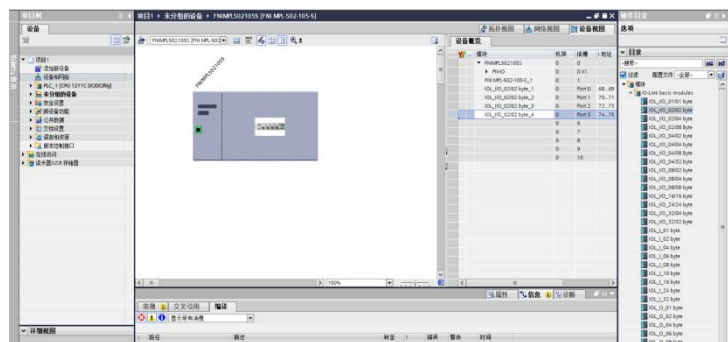
1. Install GSD file

2. In PLC---Device Configuration---Network View---Hardware Catalog, select the module and drag it in, click "Unassigned", and select the PLC to be connected;
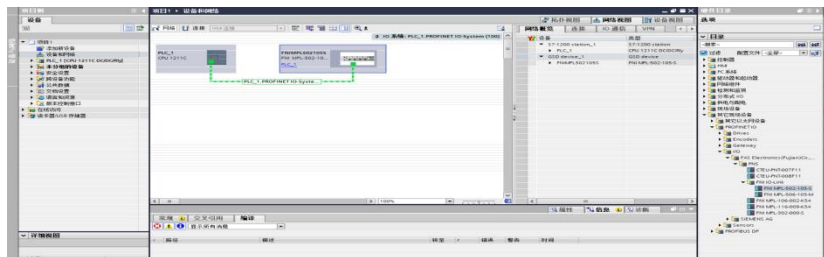

3. Double-click the module to enter the configuration.

(1) Slot function configuration: Select the required data in the hardware catalog--Module and drag it into the slot in the device overview window;


(2) After the configuration is completed, click Download in the configuration view.

4. Assign module PN name: PLC switches to online state, select "Ungrouped Device"---Click the module name----Select Online and Diagnostics---Function-----Assign PROFINET device name----Select the module to be assigned in the list (should be selected according to the physical MAC)---Click "Assign Name" to complete the configuration!
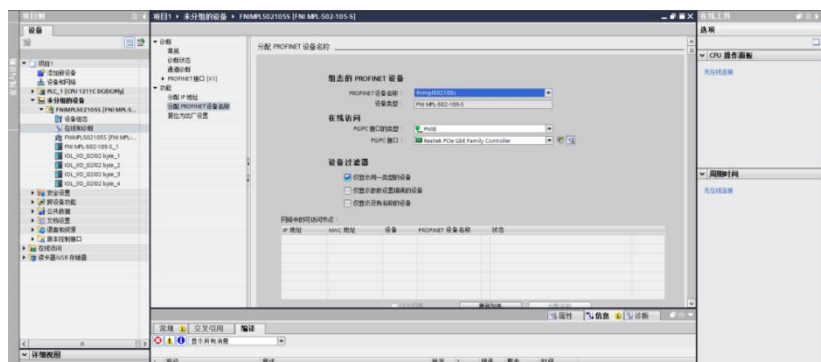
5.3.2 Omron NX1P2 Sysmac Studio Integration (EIP)

1. Install EDS file: Tools---ETHERNET/IP connection settings---double-click PLC in the
   window---right-click the blank space in the toolbox on the right and select "Show EDS library".
   Click "Install" in the pop-up window and select EDS file installation
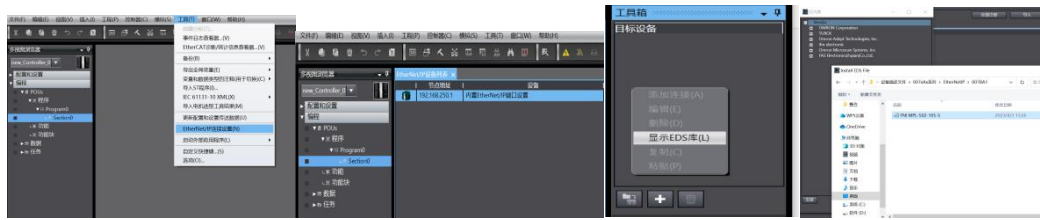
2. Create a module: Click "+" in the toolbox window, fill in the module IP address, model name,
   version, and click "Add" below to complete the module creation;

3. Configure the module: right-click the module--select "Edit"---configure the corresponding
   values in the parameters according to actual needs. Click OK after completion
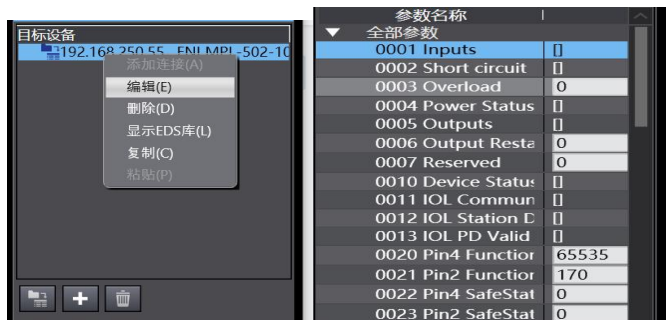
4. Create variable associations:

(1) Programming--Data--Global variables create two arrays, output 138 bytes, input 134 bytes,
    The corresponding input and output should be configured in the network disclosure;
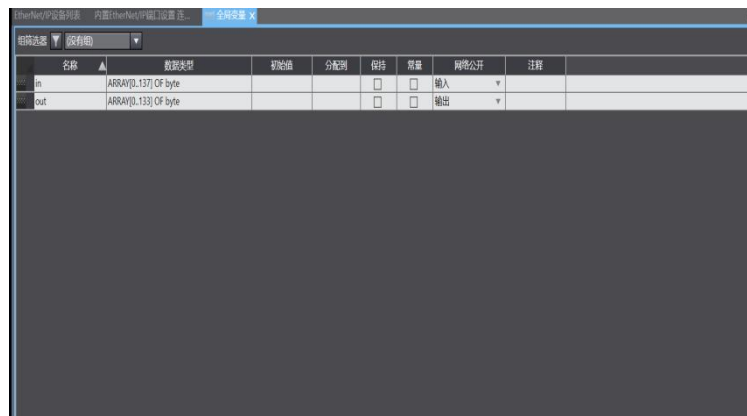
（2）In the built-in ETHERNET/IP port settings window, select the first icon (label) on the left and
   click "Register All".
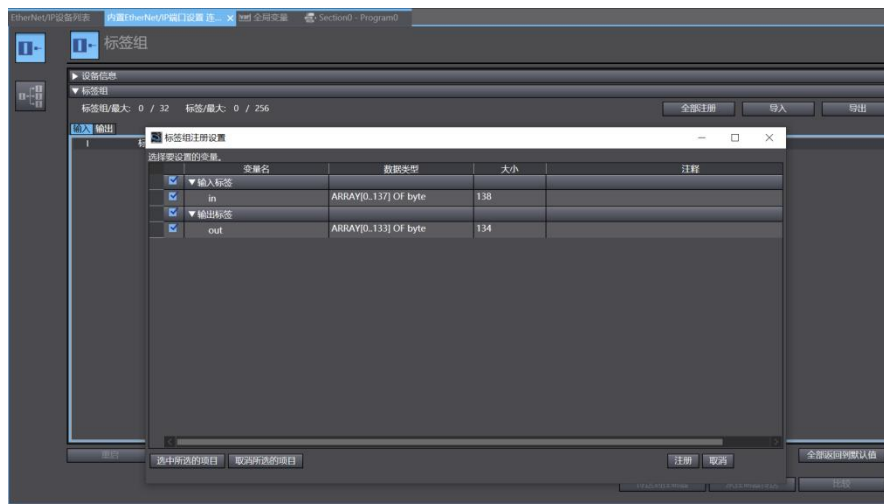
(3) In the built-in ETHERNET/IP port setting window, select the second icon on the left
(connection) and click "+". Select the previously configured module as the target device, select
EXCLUSIVE Owner as the IO type, select the corresponding input and output, and the target
variable must be filled in 101,100; then select the corresponding starting variable, and then go
online. Select "Transfer to controller" and the configuration is complete!
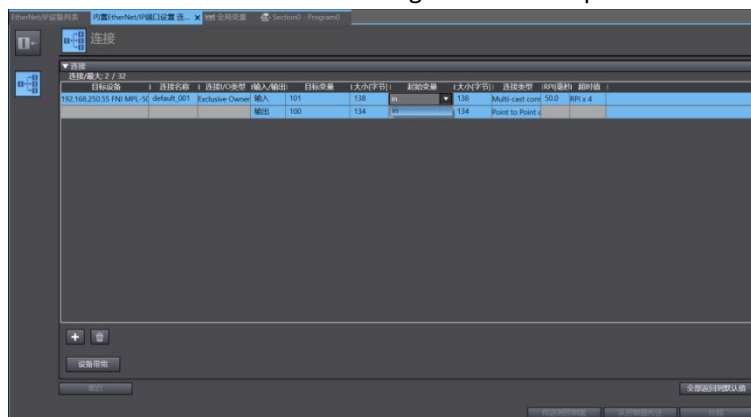
## 3.3.4 Integration in Mitsubishi FX5U Work2 (CIE)

1. Install CCSP file: First open GX WORKS 3-Tools-Configuration File Management-Login-CSPP File (the project must be closed to import the file)
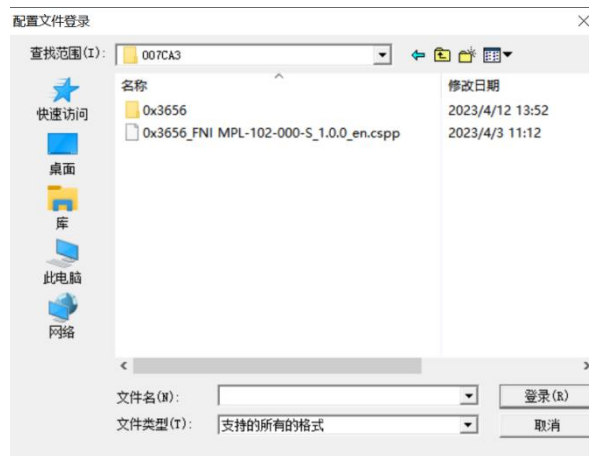
2. Click on the left side Project-Parameters-FX5UCPU-Module Parameters-Ethernet Port, Basic Settings-Self Node Settings. Set the self-node IP
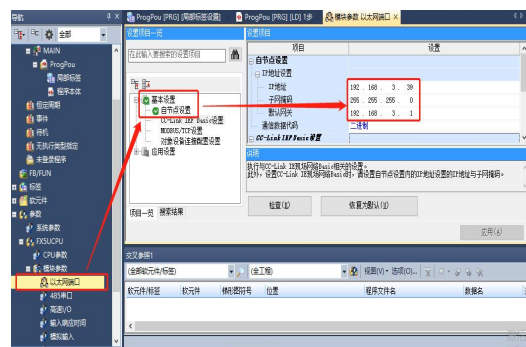
3. Click CC-Link IEF Basic Settings - Select whether to use CC-Link IEF Basic - Click to use
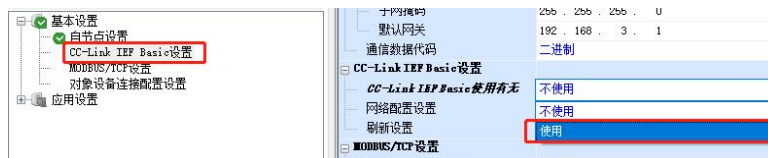
4. Click CC-Link IEF Basic Settings - Select Network Configuration Settings - Detailed Settings;

5. Automatic detection of connected devices - occupies 2 stations, IP address is set using dip switches - reflect settings and close

6. Select the specified soft element for refresh target - soft element name M - assign soft element address - apply, and the configuration is completed!

链接侧					CPU侧				
软元件名	点数	起始	结束		刷新目标	软元件名	点数	起始	结束
RX	128	00000	0007F	⬌	指定软元 ∨	X ∨	128	100	277
RY	128	00000	0007F	⬌	指定软元 ∨	Y ∨	128	100	277
RWr	64	00000	0003F	⬌	指定软元 ∨	D ∨	64	100	163
RWw	64	00000	0003F	⬌	指定软元 ∨	D ∨	64	200	263

3.4 Modbus TCP communication configuration
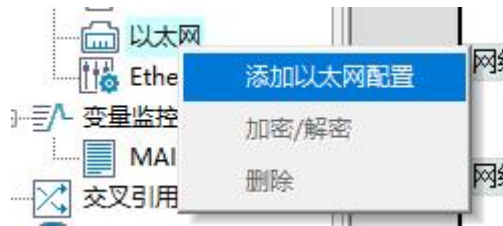
3.4.1 Integration in Inovance Autoshop

1. Create a new project, fill in the required project name, PLC model and programming method, and then confirm:
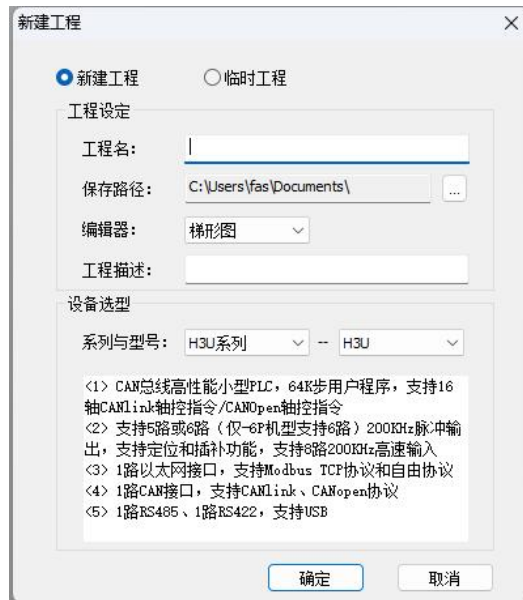
2. Modify the IP so that the PLC and the module are in the same network segment:

3. Add Modbus TCP configuration:
   Select the Ethernet option in the left column and right-click to add Ethernet configuration:

After entering the menu, fill in the module's IP address and port number and click OK:

After clicking OK, a Modbus TCP connection device will be added:

Right-click the device and select Open to pop up the Modbus TCP configuration page. Click Add in the page to display the configuration options shown below. Change the function code, quantity, and mapping address to the values   you need.

The addresses of the mapped input and output correspond to the addresses of the read and write registers in the module. After configuration, click OK:

4. Download the program and test:

Click this button to download the program to the PLC and then switch the PLC to online monitoring mode

During online monitoring, right-click in the information output window, select batch add and click:

After clicking Enter, select D as the software element type and fill in the start address and end address as the mapping address added previously on the Modbus TCP configuration page and click OK:
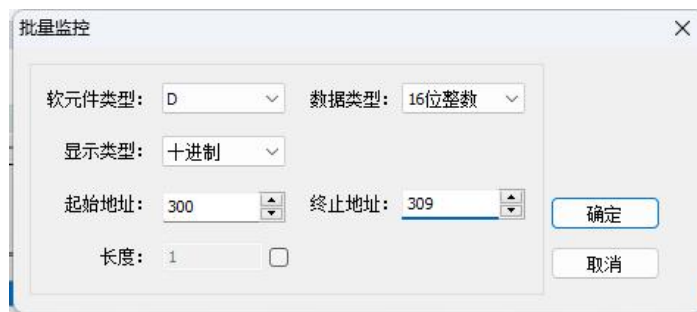
After adding the address, you can now test it. The following example uses the read register and write register to test. At this time, D300 and D200 in the figure correspond to the 0th bit of the module:

|		元件名称	数据类型	显示格式	当前值
1	...	D300	INT	十进制	0
2	...	D200	INT	十进制	0

At this time, D300 is the write register and D200 is the read register. The write register is written to 1. At this time, the read register value is also fed back to a coil of valve island 1 to connect. At this time, the Modbus TCP configuration is completed:

		元件名称	数据类型	显示格式	当前值
1	...	D300	INT	十进制	1
2	...	D200	INT	十进制	1

3.4.2 Integration in Siemens Portal

1. Create a new project

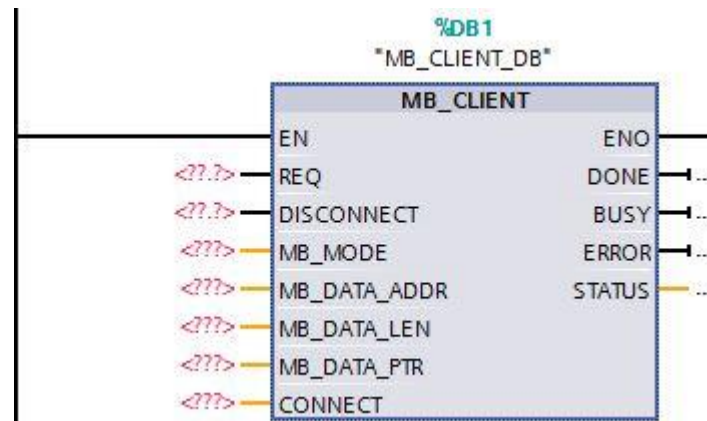Create a new project-Enter the project name-Create
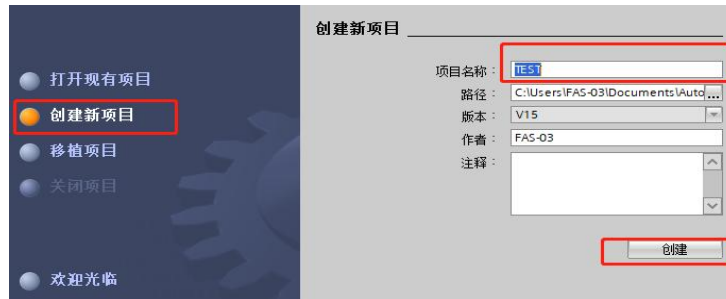
Devices and Networks - Add New Devices - Select the appropriate PLC and CPU models - Add

2. Create MUDBUS program

1. Call MB_CLIENT

Call the MB_CLIENT instruction block in the program segment in "Program Block > OB1". The background DB will be automatically generated when calling. Click OK:

The first step is to create a new global data block DB2:

In the second step, double-click to open DB2, define the variable name as "aa", the data type as "TCON_IP_v4" (you can copy TCON_IP_v4 to this dialog box), and then click the "Enter" button. The data type structure is created:

数据块_1

Definition of each parameter:

Parameter	Description
InterfaceId	Network port hardware identifier, for the main network port is 64, that is, 16#40.
ID	Connection ID, value range 1~4095
Connection Type	Connection type. TCP connection default is: 16#0B
ActiveEstablished	Establish connection. Active is 1 (client), passive is 0 (server).
ADDR	Server side IP address
RemotePort	Remote port number
LocalPort	Local port number

The IP address of the remote server in this article is 192.168.0.4, and the remote port number is set to 502. Therefore, the values   of the data structure on the client side are as shown in the figure:

数据块_1

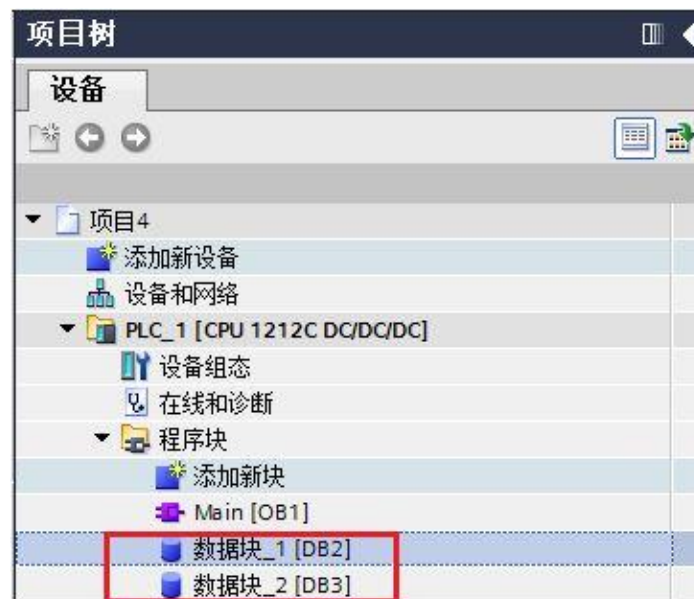|	名称			数据类型	启动值
	▼ Static				
■	▼ aa			TCON_IP_v4	
	■		InterfaceId	HW_ANY	16#40
	■		ID	CONN_OUC	16#1
	■		ConnectionType	Byte	16#0B
	■		ActiveEstablished	Bool	1
	■	▼ RemoteAddress		IP_V4	
		■	▼ ADDR	Array[1..4] of Byte	
			■ ADDR[1]	Byte	16#c0
			■ ADDR[2]	Byte	16#A8
			■ ADDR[3]	Byte	16#0
			■ ADDR[4]	Byte	16#04
	■		RemotePort	UInt	502
	■		LocalPort	UInt	0

The CONNECT pin needs to be filled in with symbolic addressing.

TCON_IP_v4 is a system data type, not created in the PLC data type.

LocalPort generally uses the default value 0, which means that a random port is used locally.

3. Create MB_DATA_PTR data buffer

The first step is to create a global data block DB3, which is located in the CPU program block together with DB2 created in the previous step, as shown in the figure:

The second step is to create a Word array data type to store data during communication, as shown in the figure.

The data buffer specified by MB_DATA_PTR can be in the DB block or M storage area address. The DB block can be an optimized data block or a standard data block structure.

If it is an optimized data block structure, it must be an array of basic data types, such as Int, Real, Bool arrays, and the pin needs to be filled in by symbolic addressing during programming;

If it is a standard data block structure (you can right-click the DB block and uncheck "Optimized Block Access" in "Properties", as shown in Figure 9), you can fill in the pin in the form of a pointer.

The data buffer specified by MB_DATA_PTR must be large enough, at least MB_DATA_LEN bits (when accessing input bits, output bits) or words (when accessing holding registers, input words).

This article takes the standard data block (default) as an example for programming.
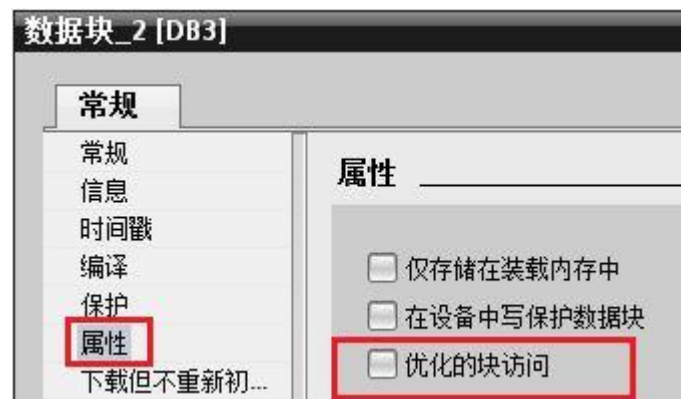
4.The client side completes the instruction block programming and calls the MB_CLIENT instruction block. It uses function code 03 to read the values   of two holding registers from the server. Refer to Table 4, so MB_MODE = 0, MB_DATA_ADDR = 40001, MB_DATA_LEN = 2, as shown in the figure:
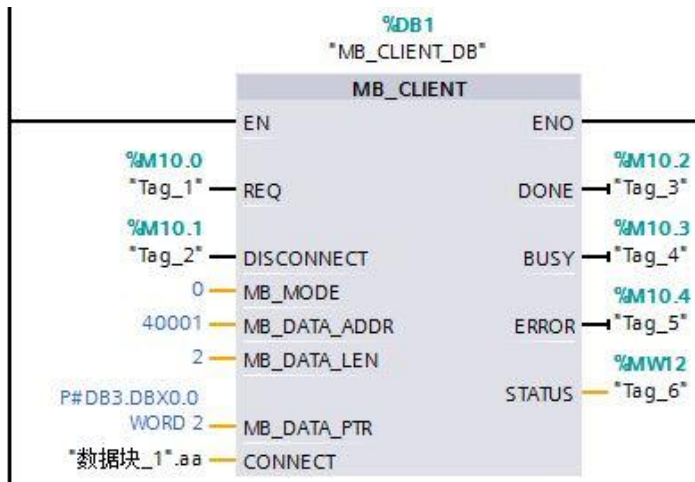
5. Download the entire project to S7-1200
When the server is ready, trigger a rising edge on the REQ pin of the instruction block and put the read data into the DB block variable specified by the MB_DATA_PTR pin.

4 Appendix

4.1 Ordering Information

Product Order Code	Ordering code
FNI MPL-502-105-S	007BA1

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