FCEN-8LKM-8A-MP4 Module

----EtherNet/IP System Manual

EtherNet/IP™

Preface

1. Scope of this manual:

This manual applies to the FCEN-8LKM-8A-MP4 module of ELCO.

The information in this manual enables you to run the FCEN-8LKM-8A-MP4 module on EtherNet/IP as a distributed I/O device.

2. Basic knowledge requirements

This manual presumes a general knowledge in the field of automation engineering and describes the components based on the data valid at the time of its release.

ELCO reserves the right of including a product information for each new component, and for each component of a later version.

3. Guide:

This manual introduces the hardware and usage of the FCEN-8LKM-8A-MP4 module for the EtherNet/IP protocol.

Covered topics are:

- Installation and wiring
- Commissioning and diagnostics
- Components
- Article numbers
- Technical specifications

4. Technical support:

Please contact your local ELCO representative or dial 400-608-4005 if you have any questions about the products described in this manual.

Additional information about ELCO products is available:

https://www.elcoautomation.com/en-us/

5. Disclaimer of liability:

We have reviewed the contents of this publication to ensure consistency with the hardware and software described. Since variance cannot be precluded entirely, we cannot guarantee full consistency. However, the information in this publication is reviewed regularly and any necessary corrections are included in subsequent editions.

Contents

1. Product overview

1.1 Introduction

The FCEN-8LKM-8A-MP4 module supporting IO-Link function is a new type of distributed I/O system. This series of products adopts a fully sealed design structure and can be directly installed in industrial sites, including harsh working environments where liquids, dust, and vibrations may occur.

1.2 Applications

IO-Link is an IO communication technology from the controller to the lowest level of automation. Through the IO-Link master, information such as sensors and actuators is transmitted to the controller via the fieldbus network so as to improve work efficiency and reduce production costs.
FCEN-8LKM-8A-MP4 module supporting IO-Link communication, as an IO-Link master, does not require a dedicated communication cable, and can achieve efficient communication with IO-Link device through traditional non-shielded industrial cables. Each IO-Link master can support a maximum of 8 IO-Link interfaces. It meets the requirements of IO-Link v1.1 and supports three transmission rate - COM1 (4.8kbps) , COM2 (38.4kbps), COM3 (230.4kbps). It can easily connect IO-Link sensors of various brands and other IO-Link devices, as well as sensors and actuators of ordinary switching signals.
The IO-Link hub launched at the same time, as an IO-Link device, complies with the IO-Link v1.1 and supports COM2 (38.4kbps). It can be connected with the IO-Link master of ELCO or other brands, which is used to collect digital input signals on-site and control digital output signals. Each hub can connect up to 16 digital signals. With ELCO 8-port IO-Link master module, it can transmit up to 128 digital signals.

1.3 Features

- Up to IP67 protection class
- Designed with IO-Link v1.1.3 specification
- The IO-Link master supports three communication rates of COM1, 2 and 3
- Interface type Class-A or Class-B is optional
- Connects various IO-Link standard devices and standard switch signals
- LED status display, channel protection and diagnosis

1.4 Type

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No.	Type	Description
1	FCEN-8LKM-8A-MP4	EtherNet/IP IO-Link master module 8 IO-Link interfaces (8*Class-A) 2 male+female, 7/8” 4-PIN power supply 2 female, M12 D-Code fieldbus interface

2. Technical characteristics

2.1 IO-Link master

Each FCEN-8LKM-8A-MP4 module occupies an EtherNet/IP slave address. Depending on the type, up to 8 IO-Link devices can be connected. As an EtherNet/IP slave, the FCEN-8LKM-8A-MP4 module can specify the device name and the corresponding IP address through the configuration software, or it can automatically assign an IP address by the PLC according to the network topology, thereby realizing the communication of the EtherNet/IP network based on the industrial Ethernet structure. The customer can set the IO-Link interface to the communication mode that meets the requirements of IO-Link v1.1 or the SIO mode used as standard digital input and output in the programming software as required.

The IO-Link interface supports a total of three transmission rate: COM1 (4.8kbps), COM2 (38.4kbps) and COM3 (230.4kbps). The rate will be adaptive according to the characteristics of the IO-Link device.

2.2 IO-Link sensor hub

The Compact67 series IO-Link sensor hub can be used as an IO-Link device to connect with the IO-Link master of ELCO or other brands. It conforms to the IO-Link v1.1 standard and supports COM2 (38.4kbps) transmission rate. Each IO-Link interface of the IO-Link master module can be extended with an IO-Link hub to collect input and output signals. That is, an 8-port IO-Link master plus 8 IO-Link hubs which can connect up to 128 digital signals.

IO-Link sensor hub has different types to choose from, there are products that support Class-A or Class-B standards, and also include two different signal interface - M12 (A-Code, 2 digital or 1 analog are available) and M8 (3-pin, 1 digital is available).

2.3 IO-Link cable

According to the IO-Link protocol, point-to-point transmission is used between the IO-Link master and device. With the ordinary unshielded industrial cables (such as sensor cables), an extended distance of 20 meters can be reached.

According to the IO-Link protocol standard, ordinary 3-core cables can meet transmission requirements, and the 4-core or 5-core cables are used for specific functions. The Compact67 series IO-Link module needs to determine what kind of cable connection to use according to the interface type and IO type of the IO-Link hub.

1) Class-A IO-Link interface, because only three pins are defined, the fourth pin can be used as auxiliary power supply, so input IO-Link hub can use three-core cable, output IO-Link hub requires a four-core cable.

2) Class-B IO-Link interface, because all five pins are defined, when using this IO-Link hub to connect to the IO-Link master, a five-core cable should be used.

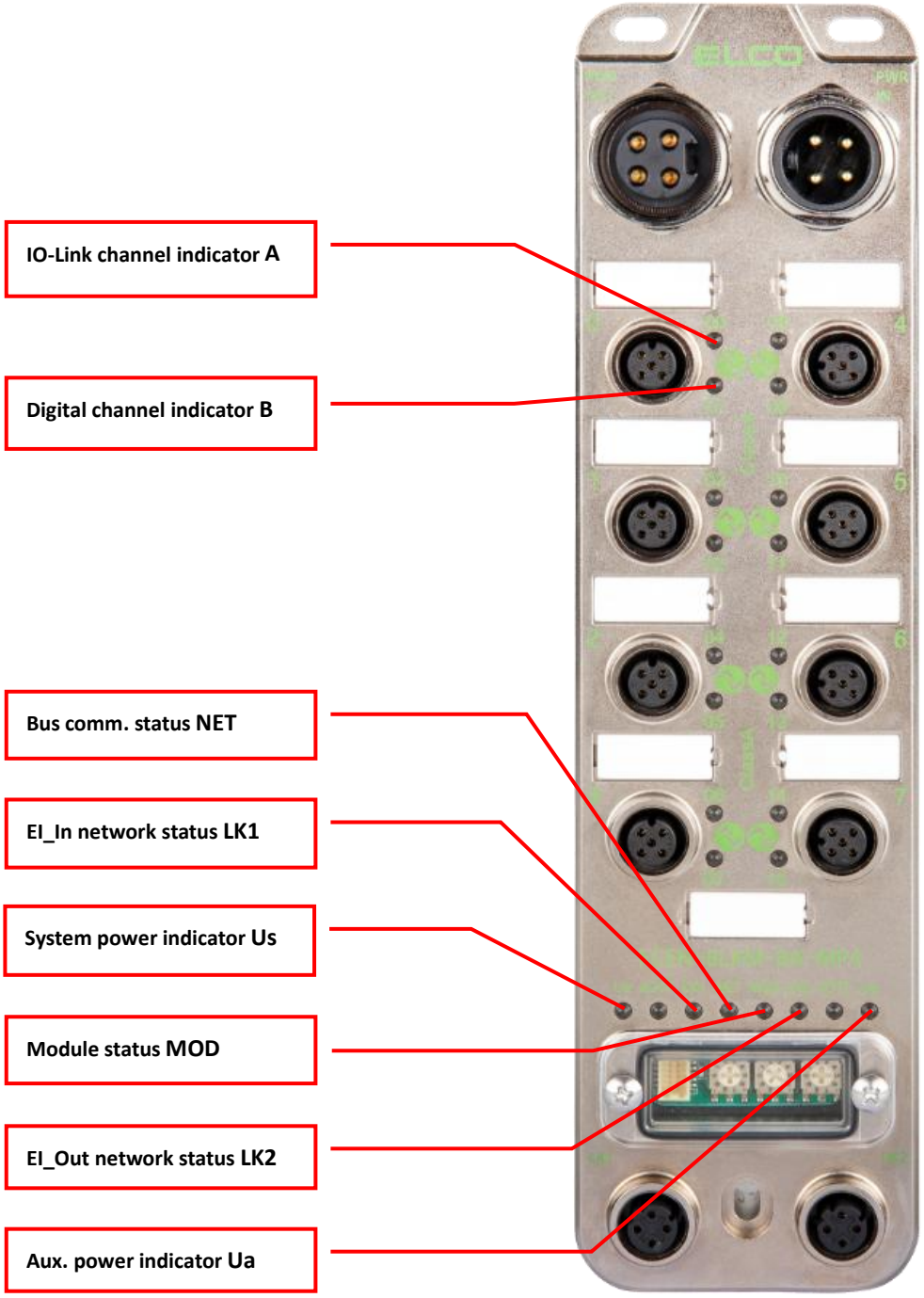
2.4 Hardware

Ordering data	
Product type	FCEN-8LKM-8A-MP4
Description	8 IO-Link ports
Communication	
Protocol	EtherNet/IP , Profinet
Operating modes	Auto-negotiation, Auto-MDI/MDI-X
Transfer rate	10/100 Mbps
Addressing	DHCP, BOOTP
Power supply	
Supply voltage	24 VDC(18...30 VDC)
Self consumption	Max. 200mA
System&Input supply	Us, Max. 8A
Output supply	Ua, Max. 8A
Electrical isolation	Us and Ua: 24V separated, 0V connected
Connections	
Power supply	2 x 7/8" 4pin, Male+Female
Fieldbus	2 x M12 D-code 4pin, Female
Signals	8 x M12 A-code 5pin, Female
Interface	
IO-Link ports	8
IO-Link type	8*Class-A
IO-Link version	IO-Link V1.1.3
IO-Link communication rates	COM1(4.8kbps), COM2(38.4kbps), COM3(230.4kbps)
Input channels	Max. 16 (8*Pin4+8*Pin2)
Input supply current	Pin1&Pin3: 1.6A per channel
Input type	PNP sensors, mechanical switches, dry contacts, etc..
Input delay	1.6 ms
Output channels	Max. 8 (8*Pin2)
Output current	Max. 2A per channel
Output type	Lamps, solenoidvalve, etc..
Output frequency	Resistive load 100Hz, Inductive load 5Hz
Diagnostics	
Communication indication	LED indication, Communication message
Voltage detection	Support, Low voltage alarm
Short-circuit & Overload	Support, LED indication
General data	
Housing material	Casting Zinc Alloy
Protection	IP67
Temperature	Operating -25...+70 °C, Storage -40...+85 °C
Dimensions (W*H*D)	60x230x37.8 mm

2.5 LED indicator

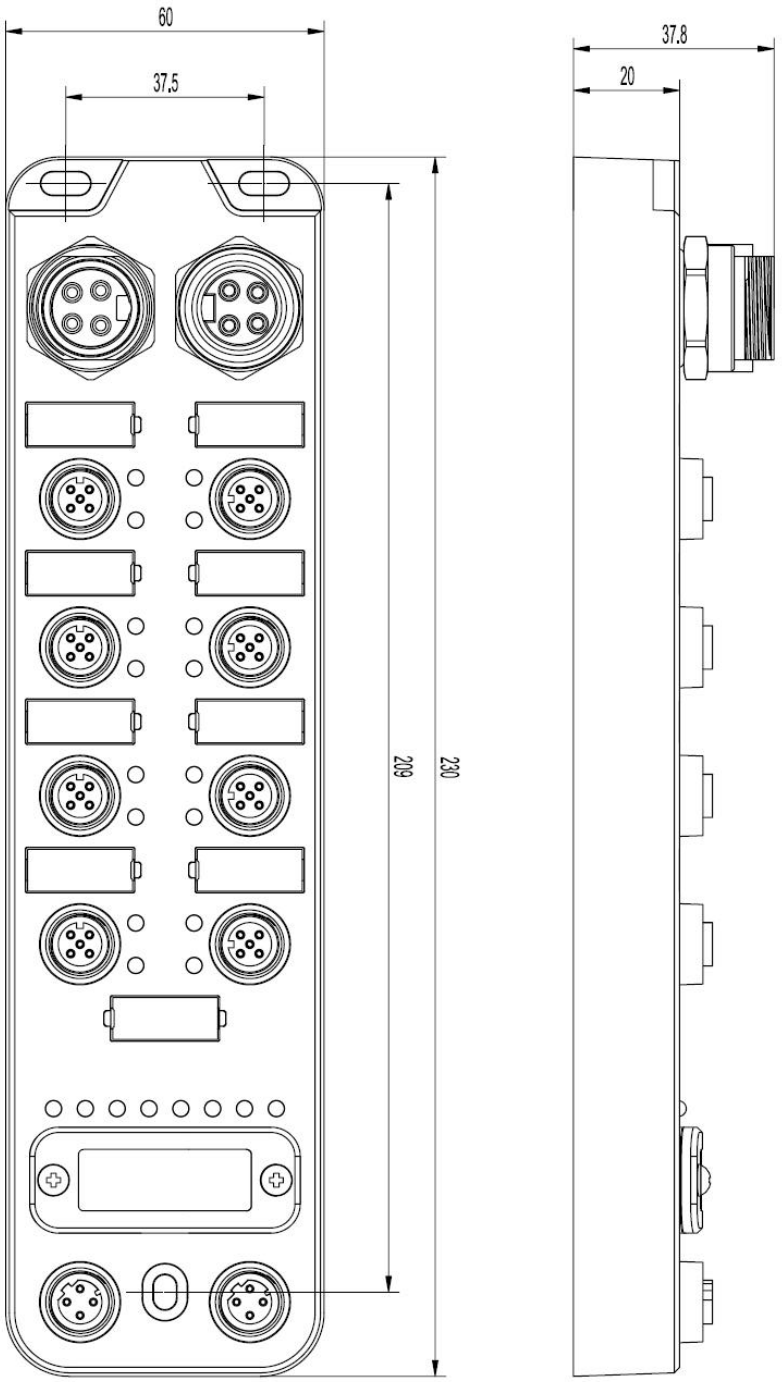
The module's indicator can clearly indicate its operating status. For specific fault indications and solutions, please refer to Section 5.1 “LED Fault Indicator”.

IO-Link master indicator



3. Installation wiring

3.1 Installation dimensions



3.2 Installation position and size

Thanks to IP67 high protection level and excellent resistance to vibration and interference, FCEN-8LKM-8A-MP4 can be installed in almost any location.

FCEN-8LKM-8A-MP4 uses a compact design to minimize installation space. Its IO-Link master module and IO-Link sensor hub use standard dimensions. The following table shows the module installation dimensions:

	FCEN-8LKM-8A-MP4
Installation width	60 mm
Installation height	230 mm
Installation depth	37.8 mm

3.3 Wiring guidance

Please make sure to cut off power supply when wiring to ensure safety.

3.3.1 Connecting module to protective earth (PE)

- Always connect the module to protective earth.
- The module also requires this connection to protective earth in order to discharge any interference currents to ground, and for EMC compatibility.
- Always make sure you have a low-impedance connection to protective earth.

3.3.2 Module power supply

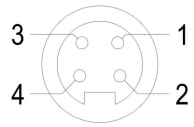
FCEN-8LKM-8A-MP4 module adopts 24VDC power supply, and power IO-Link sensor hub by extensible cable, voltage range 18~30VDC, standard 7/8" 4-PIN connector.

The power supply of IO-Link master is divided into two parts: System and sensor power supply Us (+24V, 0V), and auxiliary power supply Ua (P24, N24). Us is used for module chips and input signal power supply, while Ua is used for output signal power supply.

For FCEN-8LKM-8A-MP4, the two power supply are partially isolated, electrical isolation between Us+ and Ua+, and internally connected between Us- and Ua-.

1) Power in connector (Male)

2) Power out connector (Female)



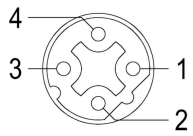
3)Power definition

Terminal	Function	Power supply
1	Output power supply Ua+	24V
2	System and input power supply Us+	24V
3	System and input power supply Us-	0V
4	Output power supply Ua-	0V

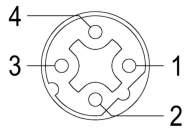
3.3.3 Module BUS connection

FCEN-8LKM-8A-MP4 module, supporting EtherNet/IP protocol, transmits signals by a shielded cable, M12 D-Code connector.

1）BUS-In (Female)



2）BUS-Out (Female)



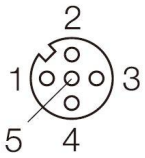
3）Bus definition

Terminal	Function	Cable color
1	Transmit Data (TD+)	Yellow
2	Receive Data (RD+)	White
3	Transmit Data (TD-)	Orange
4	Receive Data (RD-)	Blue

3.3.4 IO-Link master port cable connection

All Compact67 series IO-Link masters are connected through a standard 5-pin M12 connector. Each M12 port can be connected to a maximum of 1 IO-Link signal or 2 switching signals (input or output).

1) IO-Link port connector (Female)



2) IO-Link port pin definition

Terminal	Class-A
1	Power supply 24V+
2	Signal input/output B
3	Power supply GND
4	IO-Link/input/output A
5	Protection Earth PE

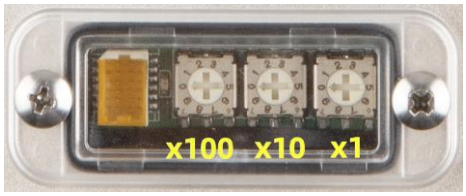
3) The power supply (Pin1 and Pin3) and signal input power supply come from the system power supply Us, and the auxiliary power supply and signal output power supply come from the auxiliary power supply Ua.

Note: When the master station of Class-A interface is used to connect LKHA series slaves, the output of Pin2 (i.e. signal B) can be controlled by program to meet the output power supply of LKHA slaves.

3.4 Setting the IP Address of module

The FCEN-8LKM-8A-MP4 module can set the operation mode of receiving network parameters (such as IP address, subnet mask, etc.) through its built-in rotary code switch. The module will read the status of the switch and update the corresponding network parameter operation mode when re powered on.

Note: Please operate the rotary code switch when the module is powered off, and it will take effect when powered on again.



The following table describes the operating modes represented by the rotary code switch settings:

Rotary code switch	Function
000	Activate DHCP and BOOTP functions. In this mode, IP addresses can be assigned through specialized software such as Rockwell's built-in BOOTP-DHCP server and other tools. Please refer to the example for explanation.
001~254	The last three digits of an IP address. In this mode, network information such as IP addresses can be modified by accessing the Webserver module through a browser. Only the first 9 digits can be set, and the last 3 digits are based on the rotary switch. If the module has already been assigned an IP address through DHCP of 000, it needs to be reset using 999 before the IP address in this mode can take effect.
255~299	Illegal address, invalid setting. The original network parameters of the module will not be changed.
300~998	Multiple protocol switching related functions, please do not select.
999	Module reset. This mode needs to be maintained for more than 5 seconds after power on, and when the module port indicator lights scroll and flash, it indicates a successful reset.

	This operation will clear network parameters such as module IP address and restore to factory settings. Please operate with caution.

The default factory settings for the module are:

IP address: 192.168.250.xxx

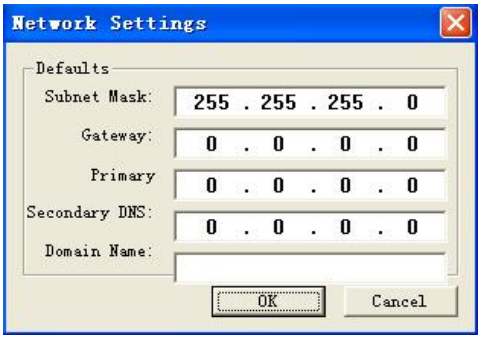
Subnet Mask: 255.255.255.000

You can change the IP address by DHCP (section 3.4.1) or Webserver (section 3.4.2).

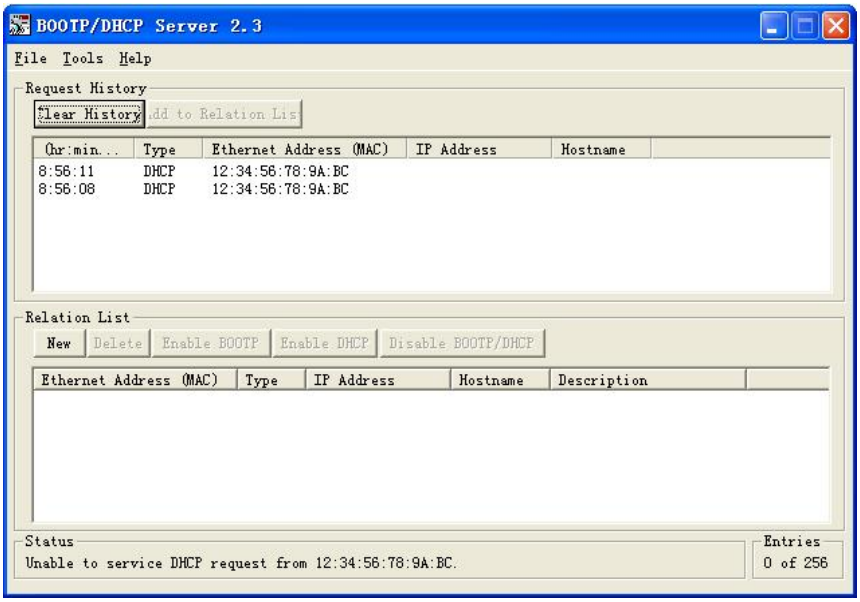
3.4.1 Setting IP through DHCP software (Code: 000)

When the rotary code switch is selected as 000, the FCEN-8LKM-8A-MP4 module allocates network parameters such as IP addresses and subnet masks through DHCP software. This section takes the BOOTP-DCP server tool that comes with Rockwell software as an example to demonstrate how to allocate IP addresses.

First open the BOOP-DHCP server, click on Tools->Network Settings to set the network parameters and fill in the Subnet Mask.

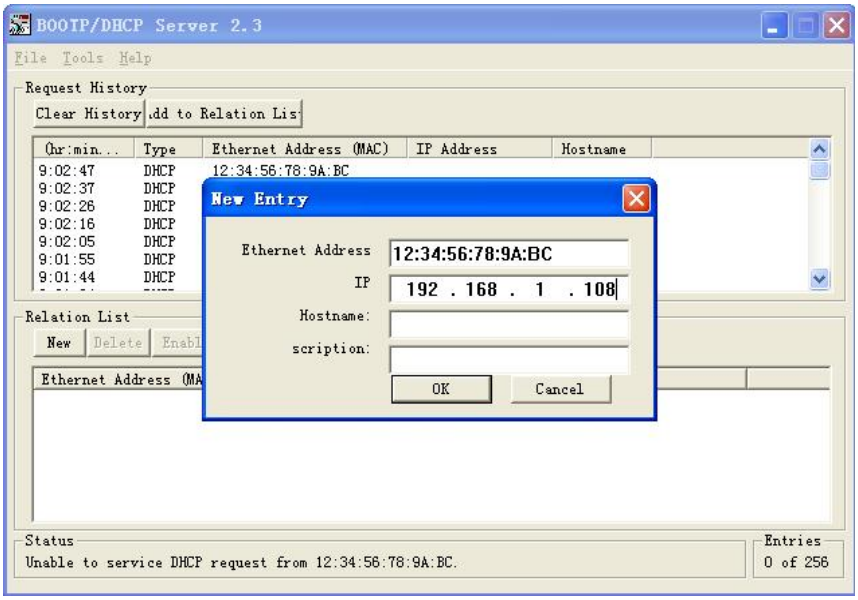


Then the DHCP server will find current gateway that has no IP address assigned on the network, and then click the gateway MAC address that needs to be assigned IP.



Then click Add to Relation List, or double-click MAC address, in the pop-up window, fill in IP address in IP bar, such as 192.168.1.108.

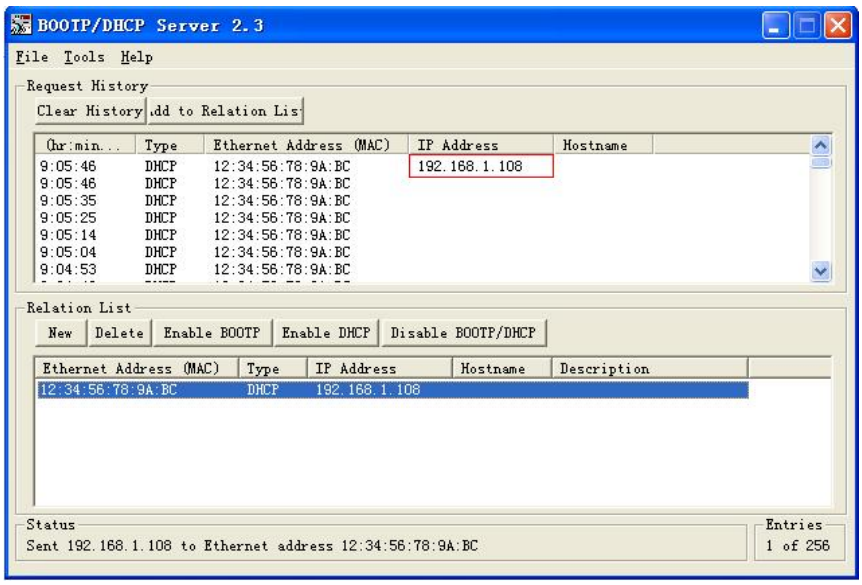
As follows:



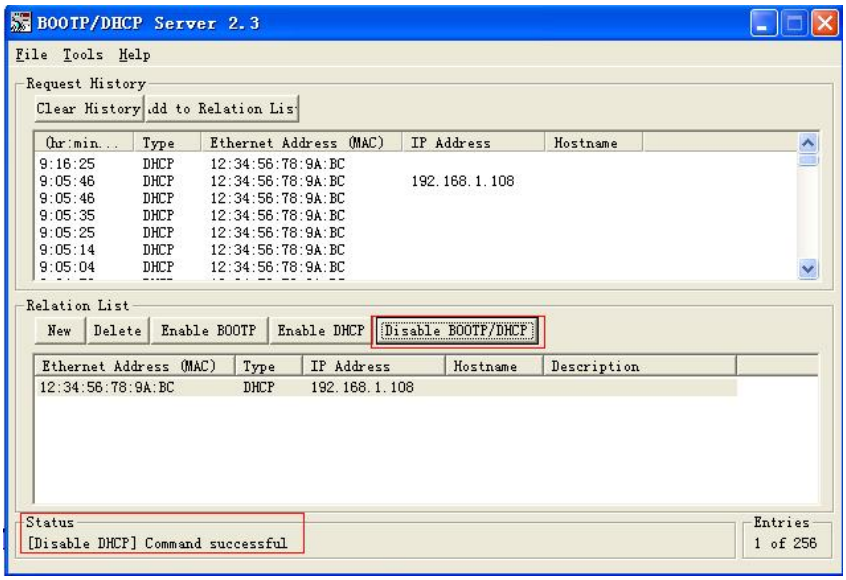
Note: the assigned IP address needs to be in the same IP segment as the local computer.

After the assigned IP address appears in the IP Address column in the list, the IP address of the device is assigned successfully.

As follows:



After the IP address is assigned, the device can work normally on the network. However, if the device is powered off and restarted, the assigned IP address will be lost. Follow the above steps to process IP address allocation. If the IP address to be distributed is solidified to the gateway and its power-off IP address is not lost, you need to click the Disable BOOTP/DHCP button in the following figure. After the Command Successful appears in the Status column, the IP address is successfully solidified. If you click the Status column and there is no success message, you need to click again until the command succeeds. As follows:



Note: If the module has already been assigned an IP address and BOOTP/DHCP is disabled, it will not be able to be automatically searched. There are two ways to reset the IP address.

1) You need to click the "New" button, manually add the MAC and original IP address of the module, and then click the "Enable DHCP" button. Once successful, you can search for this module. Then close the software and power on the module

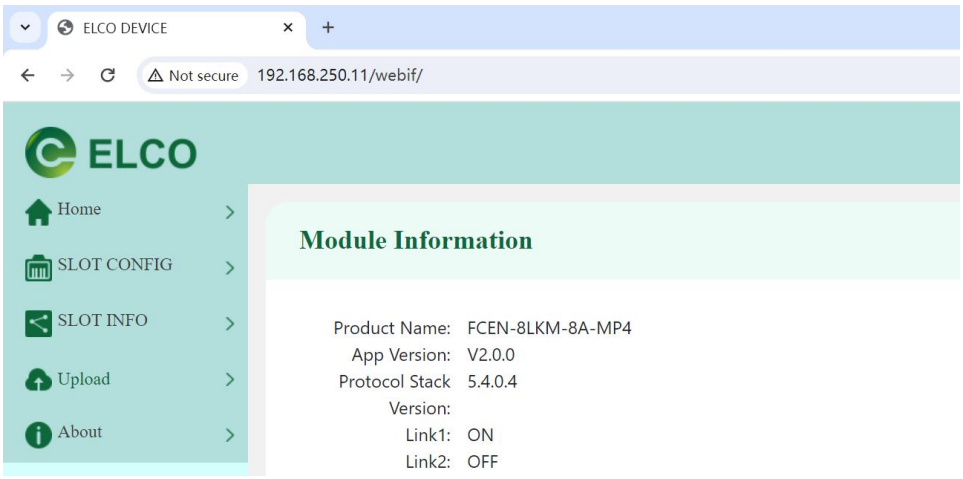
again to assign a new IP.

2) In the event of a power outage, turn the rotary code back to 999 and then power on again for 5 seconds. Wait for the module port indicator light to scroll and flash, then power off again and switch back to 000 to reassign.

3.4.2 Setting IP through Webserver (Code: 001~254)

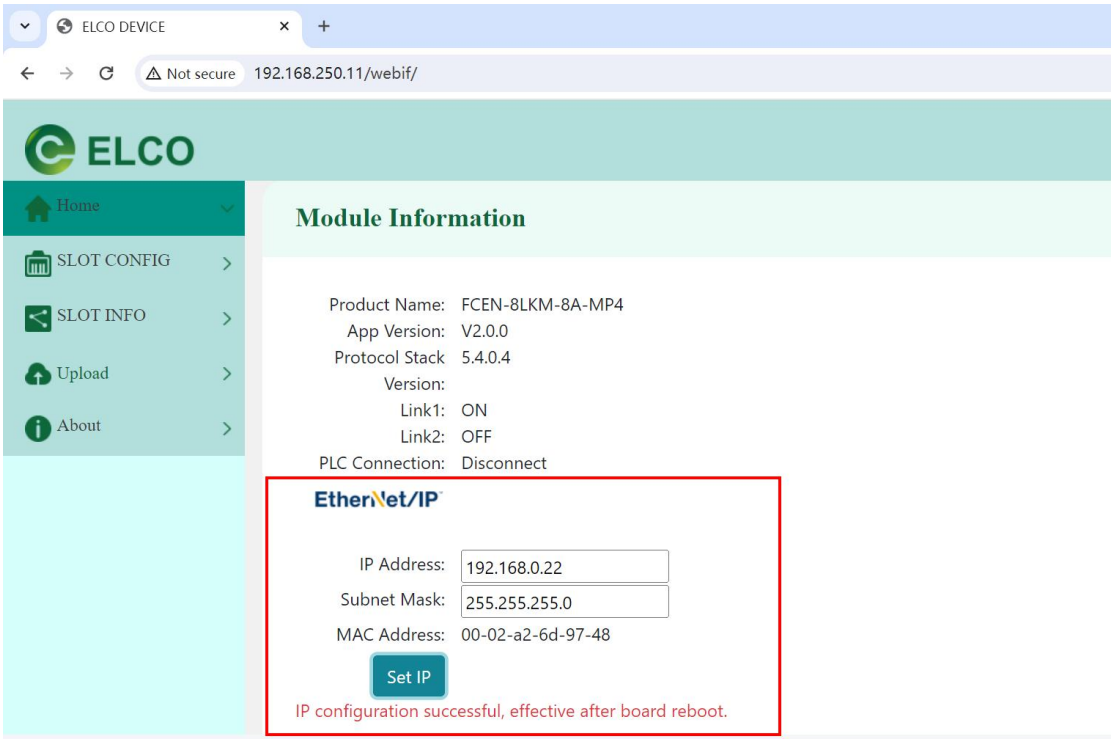
When the rotary code switch is selected from 001 to 254, the FCEN-8LKM-8A-MP4 module accesses the web server through a browser to allocate network parameters such as IP addresses and subnet masks.

The default value of the module or after resetting through code 999, the default IP address is 192.168.250.xxx (depending on the rotary switch value). When the computer and module IP addresses are in the same network segment, you can use a browser to enter http://192.168.250.xxx/webif/ to access the module and modify the first 9 digits of the IP address.



You can see the IP address setting interface on the homepage, modify the values of the IP address and subnet mask, and click the "Set IP" button.

After successful setup, "IP configuration successful" will display under the button, The prompt "effective after board reboot" indicates that the new IP address will take effect after the power reboot.


ELCO DEVICE
Not secure
192.168.250.11/webif/
ELCO
Home
SLOT CONFIG
SLOT INFO
Upload
About
Module Information
Product Name: FCEN-8LKM-8A-MP4
App Version: V2.0.0
Protocol Stack Version: 5.4.0.4
Link1: ON
Link2: OFF
PLC Connection: Disconnect
EtherNet/IP
IP Address: 192.168.0.22
Subnet Mask: 255.255.255.0
MAC Address: 00-02-a2-6d-97-48
Set IP
IP configuration successful, effective after board reboot.

4. Module Address Assignment

This section mainly introduces the signal point arrangement order and address assignment of the FCEN-8LKM-8A-MP4 module, mainly to indicate the clear sequence of signals. Due to the different addressing methods in different PLC systems, this article explains them in Bytes, and systems in Word or DWord units can be arranged in the same order.

4.1 Connection type and address assignment

The FCEN-8LKM-8A-MP4 module supports multiple connection types such as Exclusive owner, Input only, Listen only, etc. By default, the Exclusive owner type that supports input and output signals is used. The data size and instance encoding are shown in the table below:

Data size	Instance ID	Length of data
INPUT	171	394 bytes
OUTPUT	160	260 bytes
CONFIG	102	100 bytes

The default connection name is "Control/Status+IOL32+Status", which includes the input and output signals and status indicators of the IO-Link master, as well as 32 bytes of data input and output and IO-Link status information for each IO-Link port. There will be detailed descriptions in subsequent chapters.

4.2 INPUT data address assignment

The FCEN-8LKM-8A-MP4 module occupies a total of 394 bytes (Bytes 0-393) of input data. The following table lists the mapping of input data occupied by the IO-Link master and IO-Link slave respectively:

Byte	Input data	Description
0...7	Module status	Indicate the status of IO-Link master and IO-Link port.
8...9	Input signal of Master	Process input data for IO-Link Master SIO mode.
10…57	IO-Link Port 0	Process input data for Port 0.
58...105	IO-Link Port 1	Process input data for Port 1.
106…153	IO-Link Port 2	Process input data for Port 2.
154…201	IO-Link Port 3	Process input data for Port 3.
202…249	IO-Link Port 4	Process input data for Port 4.
250…297	IO-Link Port 5	Process input data for Port 5.
298…345	IO-Link Port 6	Process input data for Port 6.
346…393	IO-Link Port 7	Process input data for Port 7.

4.2.1 Status feedback of IO-Link master

This section consists of 8 bytes, used to represent the status and error information related to the IO-Link master.

INPUT	Description
Byte 0	IO-Link Communication Status
Byte 1	IO-Link Device Diagnosis（Short-Circuit & Overload）
Byte 2	IO-Link Port Power Supply Short Circuit（Pin1&Pin3）
Byte 3	Reserved
Byte 4	IO-Link Port Output Overload (Pin4 or Pin2)
Byte 5	Power Supply Diagnosis
Byte 6	IO-Link Device Second Supply Voltage Fault
Byte 7	Reserved

For a detailed description of status feedback, please refer to the following:

Byte 0（IO-Link Communication Status）

When the port is configured in IO-Link mode and has established a connection with the IO-Link device, the corresponding point indicates 1; otherwise, the point indicates 0.

Byte 0	IO-Link Communication Status							
Bit	Bit_7	Bit_6	Bit_5	Bit_4	Bit_3	Bit_2	Bit_1	Bit_0
Port	Port7	Port6	Port5	Port4	Port3	Port2	Port1	Port0

Byte 1（IO-Link Device Diagnosis）

When there is a diagnostic alarm on the IO-Link slave device connected to the port (only supporting short circuit and overload detection of IO-Link slaves), the corresponding point indicates 1, otherwise the point indicates 0.

Byte 1	IO-Link Device Diagnosis							
Bit	Bit_7	Bit_6	Bit_5	Bit_4	Bit_3	Bit_2	Bit_1	Bit_0
Port	Port7	Port6	Port5	Port4	Port3	Port2	Port1	Port0

Byte 2（IO-Link Port Power Supply Short Circuit）

When short circuit occurs between Pin1 and Pin3 of the IO-Link master port, the corresponding point indicates 1, otherwise the point indicates 0.

Byte 2	IO-Link Port Power Supply Short Circuit							
Bit	Bit_7	Bit_6	Bit_5	Bit_4	Bit_3	Bit_2	Bit_1	Bit_0
Port	Port7	Port6	Port5	Port4	Port3	Port2	Port1	Port0

Byte 4（IO-Link Port Output Overload）

When overload occurs between Pin4/Pin2 and Pin3 of the IO-Link master port, the corresponding point indicates 1, otherwise the point indicates 0.

Byte 4	IO-Link Port Output Overload							
Bit	Bit_7	Bit_6	Bit_5	Bit_4	Bit_3	Bit_2	Bit_1	Bit_0
Port	Port7	Port6	Port5	Port4	Port3	Port2	Port1	Port0

Byte 5（Power Supply Diagnosis）

When there is an abnormality in the power supply of the IO-Link master, the corresponding point indication changes to 1, based on the fault status of overvoltage, undervoltage, and disconnection of the voltage.

Otherwise, the point indication is 0.

Byte 5	Power Supply Diagnosis

Bit	Bit_7	Bit_6	Bit_5	Bit_4	Bit_3	Bit_2	Bit_1	Bit_0
Mean	Ua_H High voltage	Ua_L Low voltage	Us_H High voltage	Us_L Low voltage	Ua_S Short circuit	-	-	-

Byte 6（IO-Link Device Second Supply Voltage Fault）

When the IO-Link slave device connected to the port and experiences an auxiliary power loss alarm, the corresponding point indicates 1, otherwise the point indicates 0.

Byte 6	IO-Link Device Second Supply Voltage Fault							
Bit	Bit_7	Bit_6	Bit_5	Bit_4	Bit_3	Bit_2	Bit_1	Bit_0
Port	Port7	Port6	Port5	Port4	Port3	Port2	Port1	Port0

4.2.2 Input signal of IO-Link master

This section consists of 2 bytes, used to represent the status of the IO-Link master port when receiving switch signals.

The default order of port signals is Port base, which means that the mapping addresses are arranged in port order. First, Pin4 of the first port is arranged, then Pin2 of the first port, then Pin4 of the second port, and so on.

Byte 8	Digital input status of port 0~3							
Bit	Bit_7	Bit_6	Bit_5	Bit_4	Bit_3	Bit_2	Bit_1	Bit_0
No.	07	06	05	04	03	02	01	00
Pin	Port3 Pin2	Port3 Pin4	Port2 Pin2	Port2 Pin4	Port1 Pin2	Port1 Pin4	Port0 Pin2	Port0 Pin4
Byte 9	Digital input status of port 4~7							
Bit	Bit_7	Bit_6	Bit_5	Bit_4	Bit_3	Bit_2	Bit_1	Bit_0
No.	15	14	13	12	11	10	09	08
Pin	Port7 Pin2	Port7 Pin4	Port6 Pin2	Port6 Pin4	Port5 Pin2	Port5 Pin4	Port4 Pin2	Port4 Pin4

4.2.3 Input signal and status feedback of IO-Link slave

This section consists of 384 bytes, with each IO-Link port occupying 48 bytes.

The front part of the 48 bytes of each port is the input signal of the IO-Link slave, and the back part is the status, encoding,

events, etc. of the IO-Link slave.

The following table shows the address assignment for 8 IO-Link ports.

Input	Port	Description
Byte 10…41	Port0	Byte 0~31 of IO-Link input signal data
Byte 42…43	Port0	Byte 0~1 of IO-Link status
Byte 44…45	Port0	Byte 0~1 of Vendor_ID from IO-Link device
Byte 46…48	Port0	Byte 0~2 of Device_ID from IO-Link device
Byte 49…57	Port0	Byte 0~8 of IO-Link event
Byte 58…89	Port1	Byte 0~31 of IO-Link input signal data
Byte 90…91	Port1	Byte 0~1 of IO-Link status
Byte 92…93	Port1	Byte 0~1 of Vendor_ID from IO-Link device
Byte 94…96	Port1	Byte 0~2 of Device_ID from IO-Link device
Byte 97…105	Port1	Byte 0~8 of IO-Link event
Byte 106…137	Port2	Byte 0~31 of IO-Link input signal data
Byte 138…139	Port2	Byte 0~1 of IO-Link status
Byte 140…141	Port2	Byte 0~1 of Vendor_ID from IO-Link device
Byte 142…144	Port2	Byte 0~2 of Device_ID from IO-Link device
Byte 145…153	Port2	Byte 0~8 of IO-Link event
Byte 154…185	Port3	Byte 0~31 of IO-Link input signal data
Byte 186…187	Port3	Byte 0~1 of IO-Link status
Byte 188…189	Port3	Byte 0~1 of Vendor_ID from IO-Link device
Byte 190…192	Port3	Byte 0~2 of Device_ID from IO-Link device
Byte 193…201	Port3	Byte 0~8 of IO-Link event
Byte 202…233	Port4	Byte 0~31 of IO-Link input signal data
Byte 234…235	Port4	Byte 0~1 of IO-Link status
Byte 236…237	Port4	Byte 0~1 of Vendor_ID from IO-Link device
Byte 238…240	Port4	Byte 0~2 of Device_ID from IO-Link device
Byte 241…249	Port4	Byte 0~8 of IO-Link event
Byte 250…281	Port5	Byte 0~31 of IO-Link input signal data
Byte 282…283	Port5	Byte 0~1 of IO-Link status
Byte 284…285	Port5	Byte 0~1 of Vendor_ID from IO-Link device
Byte 286…288	Port5	Byte 0~2 of Device_ID from IO-Link device
Byte 289…297	Port5	Byte 0~8 of IO-Link event

Byte 298…329	Port6	Byte 0~31 of IO-Link input signal data
Byte 330…331	Port6	Byte 0~1 of IO-Link status
Byte 332…333	Port6	Byte 0~1 of Vendor_ID from IO-Link device
Byte 334…336	Port6	Byte 0~2 of Device_ID from IO-Link device
Byte 337…345	Port6	Byte 0~8 of IO-Link event
Byte 346…377	Port7	Byte 0~31 of IO-Link input signal data
Byte 378…379	Port7	Byte 0~1 of IO-Link status
Byte 380…381	Port7	Byte 0~1 of Vendor_ID from IO-Link device
Byte 382…384	Port7	Byte 0~2 of Device_ID from IO-Link device
Byte 385…393	Port7	Byte 0~8 of IO-Link event

Taking Port0 port as an example, describe the meanings represented by Byte10~Byte57 in detail. The data definitions for other IO-Link ports can be calculated according to the above table.

Byte 10…41（IO-Link input signal data）

This section is the signal data of the IO-Link slave device, with a total of 32 bytes. According to the IO-Link standard, the maximum data size of a single IO-Link slave is 32 bytes. If the slave data is less than 32 bytes, it is arranged from the lowest byte of the data.

Byte 10…41	IO-Link input signal data
Byte 10	Byte 0 of IO-Link device input signal data
Byte 11	Byte 1 of IO-Link device input signal data
……	Byte 2~30 of IO-Link device input signal data
Byte 41	Byte 31 of IO-Link device input signal data

Byte 42…43（IO-Link status）

This section reflects the status of the IO-Link slave device connected to this IO-Link port. If the status matches the point description, the corresponding point indicates 1; otherwise, the point indicates 0.

DC: Device connected

IOL: Port in IO-Link Mode

VF: Validation failed

SC: IO-Link short-circuit

DF: Data storage validation failed

PDI: Process data invalid

Byte 42	IO-Link Status							
Bit	Bit_7	Bit_6	Bit_5	Bit_4	Bit_3	Bit_2	Bit_1	Bit_0
Mean	-	-	-	-	-	-	DC	IOL
Byte 43	IO-Link Error							
Bit	Bit_7	Bit_6	Bit_5	Bit_4	Bit_3	Bit_2	Bit_1	Bit_0
Mean	SC	-	-	-	-	PDI	DF	VF

Byte 44…45（Vendor_ID from IO-Link device）

This section contains the manufacturer's code for the IO-Link slave device,

totaling 2 bytes.

Byte 44…45	Vendor_ID from IO-Link device
Byte 44	Vendor_ID (High Byte) of device connected
Byte 45	Vendor_ID (Low Byte) of device connected

Byte 46…48（Device_ID from IO-Link device）

This section contains the device's code for the IO-Link slave device,

totaling 3 bytes.

Byte 46…48	Vendor_ID from IO-Link device
Byte 46	Device ID (High Byte) of device connected
Byte 47	Device ID (Mid Byte) of device connected
Byte 48	Device ID (Low Byte) of device connected

Byte 49…57（IO-Link Event）

This section is the status of the IO-Link slave device, which can record the last 3 events, with 3 bytes for each event, for a total of 9 bytes.

Mode: 0-Reserved; 1-Singal event; 2-Event outgoing; 3-Event incoming.

Type: 0-Reserved; 1-Message; 2-Warning; 3-Error.

The meaning represented by each byte is as follows:

	Event_1							
Byte 49	IOL EventQualifier1							
Bit	Bit_7	Bit_6	Bit_5	Bit_4	Bit_3	Bit_2	Bit_1	Bit_0

Mean	Mode		Type		-			
Byte 50	IOL EventCode1 (High Byte)							
Byte 51	IOL EventCode1 (Low Byte)							
	Event_2							
Byte 52	IOL EventQualifier2							
Bit	Bit_7	Bit_6	Bit_5	Bit_4	Bit_3	Bit_2	Bit_1	Bit_0
Mean	Mode		Type		-			
Byte 53	IOL EventCode2 (High Byte)							
Byte 54	IOL EventCode2 (Low Byte)							
	Event_3							
Byte 55	IOL EventQualifier3							
Bit	Bit_7	Bit_6	Bit_5	Bit_4	Bit_3	Bit_2	Bit_1	Bit_0
Mean	Mode		Type		-			
Byte 56	IOL EventCode3 (High Byte)							
Byte 57	IOL EventCode3 (Low Byte)							

4.3 OUTPUT data address assignment

The FCEN-8LKM-8A-MP4 module occupies a total of 260 bytes (Bytes 0-259) of output data. The following table lists the mapping of output data occupied by the IO-Link master and IO-Link slave respectively:

Byte	Output data	Description
0...1	Module Control	Control the function (diagnosis or restart) of IO-Link port.
2...3	Output signal of Master	Process output data for IO-Link Master SIO mode.
4…35	IO-Link Port 0	Process output data for Port 0.
36…67	IO-Link Port 1	Process output data for Port 1.
68…99	IO-Link Port 2	Process output data for Port 2.
100…131	IO-Link Port 3	Process output data for Port 3.
132…163	IO-Link Port 4	Process output data for Port 4.
164…195	IO-Link Port 5	Process output data for Port 5.
196…227	IO-Link Port 6	Process output data for Port 6.
278…259	IO-Link Port 7	Process output data for Port 7.

4.3.1 Control function of IO-Link master

This section consists of 2 bytes, used to control the IO-Link master to disable port diagnosis or restart output, etc.

OUTPUT	Description
Byte 0	Disable IO-Link Port Diagnosis
Byte 1	Reserved

For a detailed description of control function, please refer to the following:

Byte 0（Disable IO-Link Port Diagnosis）

When the port is configured in IO-Link mode and has established a connection with the IO-Link slave, if you want to disable the diagnosis on this port, set the corresponding point to 1; otherwise, set the point to 0.

Byte 0	Disable IO-Link Port Diagnosis

Bit	Bit_7	Bit_6	Bit_5	Bit_4	Bit_3	Bit_2	Bit_1	Bit_0
Port	Port7	Port6	Port5	Port4	Port3	Port2	Port1	Port0

Byte 1（Reserved）

This byte is reserved for related functions and is currently useless.

Byte 1	Reserved							
Bit	Bit_7	Bit_6	Bit_5	Bit_4	Bit_3	Bit_2	Bit_1	Bit_0
Port	Port7	Port6	Port5	Port4	Port3	Port2	Port1	Port0

4.3.2 Output signal of IO-Link master

This section consists of 2 bytes, used to represent the output of the IO-Link master port when controlling switch signals.

The default order of port signals is Port base, which means that the mapping addresses are arranged in port order. First, Pin4 of the first port is arranged, then Pin2 of the first port, then Pin4 of the second port, and so on.

Byte 2	Digital output status of port 0~3							
Bit	Bit_7	Bit_6	Bit_5	Bit_4	Bit_3	Bit_2	Bit_1	Bit_0
No.	07	06	05	04	03	02	01	00
Pin	Port3 Pin2	Port3 Pin4	Port2 Pin2	Port2 Pin4	Port1 Pin2	Port1 Pin4	Port0 Pin2	Port0 Pin4
Byte 3	Digital output status of port 4~7							
Bit	Bit_7	Bit_6	Bit_5	Bit_4	Bit_3	Bit_2	Bit_1	Bit_0
No.	15	14	13	12	11	10	09	08
Pin	Port7 Pin2	Port7 Pin4	Port6 Pin2	Port6 Pin4	Port5 Pin2	Port5 Pin4	Port4 Pin2	Port4 Pin4

4.3.3 Output signal of IO-Link slave

This section consists of 256 bytes, with each IO-Link port occupying 32 bytes. The 32 bytes of each port is the output signal of the IO-Link slave.

The following table shows the address assignment for 8 IO-Link ports.

Output	**Port**	**Description**

Byte 4…35	Port0	Byte 0~31 of IO-Link output signal data
Byte 36…67	Port1	Byte 0~31 of IO-Link output signal data
Byte 68…99	Port2	Byte 0~31 of IO-Link output signal data
Byte 100…131	Port3	Byte 0~31 of IO-Link output signal data
Byte 132…163	Port4	Byte 0~31 of IO-Link output signal data
Byte 164…195	Port5	Byte 0~31 of IO-Link output signal data
Byte 196…227	Port6	Byte 0~31 of IO-Link output signal data
Byte 228…259	Port7	Byte 0~31 of IO-Link output signal data

Taking Port0 port as an example, describe the meanings represented by Byte4~Byte35 in detail. The data definitions for other IO-Link ports can be calculated according to the above table.

Byte 4…35（IO-Link output signal data）

This section is the signal data of the IO-Link slave device, with a total of 32 bytes. According to the IO-Link standard, the maximum data size of a single IO-Link slave is 32 bytes. If the slave data is less than 32 bytes, it is arranged from the lowest byte of the data.

Byte 4…35	IO-Link output signal data
Byte 4	Byte 0 of IO-Link device output signal data
Byte 5	Byte 1 of IO-Link device output signal data
……	Byte 2~30 of IO-Link device output signal data
Byte 35	Byte 31 of IO-Link device output signal data

4.4 CONFIG data address assignment

The FCEN-8LKM-8A-MP4 module occupies a total of 100 bytes (Bytes 0-99) of config data. The following table lists the mapping of config data occupied by the IO-Link master:

Byte	Config data	Description
0…3	Module configuration	General configuration for the overall module.
4…35	Port configuration	Pin type and safe state configuration for ports.
36…43	IO-Link Port 0	Configuration for IO-Link Port 0.
44…51	IO-Link Port 1	Configuration for IO-Link Port 1.
52…59	IO-Link Port 2	Configuration for IO-Link Port 2.
60…67	IO-Link Port 3	Configuration for IO-Link Port 3.
68…75	IO-Link Port 4	Configuration for IO-Link Port 4.
76…83	IO-Link Port 5	Configuration for IO-Link Port 5.
84…91	IO-Link Port 6	Configuration for IO-Link Port 6.
92…99	IO-Link Port 7	Configuration for IO-Link Port 7.

4.4.1 General settings of IO-Link master

This section consists of 4 bytes, used to disable the diagnosis of IO-Link master and control the order of signal arrangement.

CONFIG	Description
Byte 0	Disable Global Diagnosis
Byte 1	Disable Us Diagnosis
Byte 2	Disable Ua Diagnosis
Byte 3	Process Data Layout

For a detailed description of general settings, please refer to the following:

Byte 0（Disable Global Diagnosis）

This parameter is used to disable all diagnostics of the IO-Link master. When the point is set to 1, diagnosis is disabled, and when set to 0, diagnosis is enabled.

When this setting is disabled, the uploaded diagnostic information and port indicator lights will no longer prompt any errors, but the status transmitted through the input signal is not affected.

Byte 1（Disable Us Diagnosis）

This parameter is used to disable the system power supply diagnosis of the IO-Link master. When the point is set to 1, diagnosis is disabled, and when set to 0, diagnosis is enabled.

When this setting is disabled, the uploaded diagnostic information and port indicator lights will no longer prompt any errors, but the status transmitted through the input signal is not affected.

Byte 2（Disable Ua Diagnosis）

This parameter is used to disable the output power supply diagnosis of the IO-Link master. When the point is set to 1, diagnosis is disabled, and when set to 0, diagnosis is enabled.

When this setting is disabled, the uploaded diagnostic information and port indicator lights will no longer prompt any errors, but the status transmitted through the input signal is not affected.

Byte 3（Process Data Layout）

This parameter is used to set the address mapping order of the IO-Link master switch input and output signals. The default value is 0, which is arranged by port; It can also be set to 1, which is arranged according to the pins.

0-Port based assignment.

Byte offset	bit	PD_IN	PD_OUT
X	0	Port0 Pin4	Not supported.
	1	Port0 Pin2	Port0 Pin2
	……		
	6	Port3 Pin4	
	7	Port3 Pin2	Port3 Pin2
X+1	0	Port4 Pin4	Not supported.
	1	Port4 Pin2	Port4 Pin2
	……		
	6	Port7 Pin4	Not supported.
	7	Port7 Pin2	Port7 Pin2

1-Pin based assignment.

Byte offset	bit	PD_IN	PD_OUT
X	0	Port0 Pin4	No supported.
	1	Port1 Pin4	No supported.
	……		
	6	Port6 Pin4	No supported.
	7	Port7 Pin4	No supported.
X+1	0	Port0 Pin2	Port0 Pin2

	1	Port1 Pin2	Port1 Pin2
	……		
	6	Port6 Pin2	Port6 Pin2
	7	Port7 Pin2	Port7 Pin2

4.4.2 Port settings of IO-Link master

This section consists of 32 bytes, used to set the function of the IO-Link master ports Pin4 and Pin2, and the status of Pin2 output in case of network disconnection or other abnormalities.

CONFIG	Description
Byte 4…19	Pin4 type of Port 0~7
Byte 20…27	Pin2 type of Port 0~7
Byte 28…35	Pin2 safe state of Port 0~7

For a detailed description of port settings, please refer to the following:

Byte 4…19（Pin4 type of Port 0~7）

This section is used to set the properties of Pin4 in each port of the IO-Link master, which can control the IO-Link function of the enabled port.

Each port occupies 2 bytes of data, which is an INT variable. The default is 0, which means empty; Can be set to 1, means Input mode; Can be configured to 32, means IO-Link mode.

Byte 4…19	Pin4 type of Port 0~7
Byte 4…5	Pin4 type of Port 0 (0=empty, 1=DI, 32=IO-Link)
Byte 6…7	Pin4 type of Port 1 (0=empty, 1=DI, 32=IO-Link)
Byte 8…9	Pin4 type of Port 2 (0=empty, 1=DI, 32=IO-Link)
Byte 10…11	Pin4 type of Port 3 (0=empty, 1=DI, 32=IO-Link)
Byte 12…13	Pin4 type of Port 4 (0=empty, 1=DI, 32=IO-Link)
Byte 14…15	Pin4 type of Port 5 (0=empty, 1=DI, 32=IO-Link)
Byte 16…17	Pin4 type of Port 6 (0=empty, 1=DI, 32=IO-Link)
Byte 18…19	Pin4 type of Port 7 (0=empty, 1=DI, 32=IO-Link)

Byte 20…27（Pin2 type of Port 0~7）

This section is used to set the properties of Pin2 in each port of the IO-Link master, which can be set as switch input or switch output.

Each port occupies 1 bytes of data, which is an SINT variable. The default is 0, which means Input mode; Can be set to 1, means Output mode; Can be configured to 3, means Input/Output Universal.

Byte 20…27	Pin2 type of Port 0~7
Byte 20	Pin2 type of Port 0 (0=DI, 1=DO, 3=Universal)
Byte 21	Pin2 type of Port 1 (0=DI, 1=DO, 3=Universal)
Byte 22	Pin2 type of Port 2 (0=DI, 1=DO, 3=Universal)
Byte 23	Pin2 type of Port 3 (0=DI, 1=DO, 3=Universal)
Byte 24	Pin2 type of Port 4 (0=DI, 1=DO, 3=Universal)
Byte 25	Pin2 type of Port 5 (0=DI, 1=DO, 3=Universal)
Byte 26	Pin2 type of Port 6 (0=DI, 1=DO, 3=Universal)
Byte 27	Pin2 type of Port 7 (0=DI, 1=DO, 3=Universal)

Byte 28…35（Pin2 safe state of Port 0~7）

This section is used to set the safety status of Pin2 output in each port of the IO-Link master. When the IO-Link master experiences network disconnection or other abnormalities, the Pin2 output signal will switch to the set value.

Each port occupies 1 bytes of data, which is an SINT variable. The default is 0, which means the output is turned off in case of an exception; Can be set to 1, which means the output is turned on in case of an exception; It can be set to 2, which means the output will maintain the last value in case of an exception.

Byte 28…35	Pin2 safe state of Port 0~7
Byte 28	Pin2 safe state of Port 0 (0=SetTo0, 1=SetTo1, 2=HoldLast)
Byte 29	Pin2 safe state of Port 1 (0=SetTo0, 1=SetTo1, 2=HoldLast)
Byte 30	Pin2 safe state of Port 2 (0=SetTo0, 1=SetTo1, 2=HoldLast)
Byte 31	Pin2 safe state of Port 3 (0=SetTo0, 1=SetTo1, 2=HoldLast)
Byte 32	Pin2 safe state of Port 4 (0=SetTo0, 1=SetTo1, 2=HoldLast)
Byte 33	Pin2 safe state of Port 5 (0=SetTo0, 1=SetTo1, 2=HoldLast)

Byte 34	Pin2 safe state of Port 6 (0=SetTo0, 1=SetTo1, 2=HoldLast)
Byte 35	Pin2 safe state of Port 7 (0=SetTo0, 1=SetTo1, 2=HoldLast)

4.4.3 Parameter settings of IO-Link slave

This section consists of 64 bytes, with each IO-Link port occupying 8 bytes. The 8 bytes of each port include IO-Link cycle time setting, ISDU parameter backup setting, IO-Link slave code setting, etc.

The following table shows the address assignment for 8 IO-Link ports.

CONFIG	Port	Description
Byte 36…37	Port0	IO-Link Port Cycle Time
Byte 38	Port0	IO-Link Port Validation and Backup
Byte 39…40	Port0	Byte 0~1 of Vendor_ID to IO-Link device
Byte 41…43	Port0	Byte 0~2 of Device_ID to IO-Link device
Byte 44…45	Port1	IO-Link Port Cycle Time
Byte 46	Port1	IO-Link Port Validation and Backup
Byte 47…48	Port1	Byte 0~1 of Vendor_ID to IO-Link device
Byte 49…51	Port1	Byte 0~2 of Device_ID to IO-Link device
Byte 52…53	Port2	IO-Link Port Cycle Time
Byte 54	Port2	IO-Link Port Validation and Backup
Byte 55…56	Port2	Byte 0~1 of Vendor_ID to IO-Link device
Byte 57…59	Port2	Byte 0~2 of Device_ID to IO-Link device
Byte 60…61	Port3	IO-Link Port Cycle Time
Byte 62	Port3	IO-Link Port Validation and Backup
Byte 63…64	Port3	Byte 0~1 of Vendor_ID to IO-Link device
Byte 65…67	Port3	Byte 0~2 of Device_ID to IO-Link device
Byte 68…69	Port4	IO-Link Port Cycle Time
Byte 70	Port4	IO-Link Port Validation and Backup
Byte 71…72	Port4	Byte 0~1 of Vendor_ID to IO-Link device

Byte 73…75	Port4	Byte 0~2 of Device_ID to IO-Link device
Byte 76…77	Port5	IO-Link Port Cycle Time
Byte 78	Port5	IO-Link Port Validation and Backup
Byte 79…80	Port5	Byte 0~1 of Vendor_ID to IO-Link device
Byte 81…83	Port5	Byte 0~2 of Device_ID to IO-Link device
Byte 84…85	Port6	IO-Link Port Cycle Time
Byte 86	Port6	IO-Link Port Validation and Backup
Byte 87…88	Port6	Byte 0~1 of Vendor_ID to IO-Link device
Byte 89…91	Port6	Byte 0~2 of Device_ID to IO-Link device
Byte 92…93	Port7	IO-Link Port Cycle Time
Byte 94	Port7	IO-Link Port Validation and Backup
Byte 95…96	Port7	Byte 0~1 of Vendor_ID to IO-Link device
Byte 97…99	Port7	Byte 0~2 of Device_ID to IO-Link device

Taking Port0 port as an example, describe the meanings represented by Byte36~Byte43 in detail. The data definitions for other IO-Link ports can be calculated according to the above table.

Byte 36…37（IO-Link Port Cycle Time）

This section is used to set the cycle time for IO-Link port communication. According to the IO-Link protocol specification, the cycle time is determined by a combination of multiples and time benchmarks.

Each port occupies 2 bytes of data, which is an INT variable. For ease of use, the following table lists the corresponding setting values for different cycle times. Users can directly enter Value in the INT variable to modify the corresponding Cycle time.

Byte 36…37	IO-Link Port Cycle Time (1.6ms~11.2ms)							
Value (INT)	0	16	32	48	64	68	72	76
Cycle time (ms)	Auto	1.6	3.2	4.8	6.4	8.0	9.6	11.2
	IO-Link Port Cycle Time (12.8ms~24ms)							
Value (INT)	80	84	88	92	96	100	104	108
Cycle time (ms)	12.8	14.4	16.0	17.6	19.2	20.8	22.4	24.0
	IO-Link Port Cycle Time (25.6ms~36.8ms)							
Value (INT)	112	116	120	124	128	129	130	131
Cycle time	25.6	27.2	28.8	30.4	32.0	33.6	35.2	36.8

(ms)								
	IO-Link Port Cycle Time (38.4ms~49.6ms)							
Value (INT)	132	133	134	135	136	137	138	139
Cycle time (ms)	38.4	40.0	41.6	43.2	44.8	46.4	48.0	49.6
	IO-Link Port Cycle Time (51.2ms~62.4ms)							
Value (INT)	140	141	142	143	144	145	146	147
Cycle time (ms)	51.2	52.8	54.4	56.0	57.6	59.2	60.8	62.4
	IO-Link Port Cycle Time (64ms~75.2ms)							
Value (INT)	148	149	150	151	152	153	154	155
Cycle time (ms)	64.0	65.6	67.2	68.8	70.4	72.0	736	75.2
	IO-Link Port Cycle Time (76.8ms~88ms)							
Value (INT)	156	157	158	159	160	161	162	163
Cycle time (ms)	76.8	78.4	80.0	81.6	83.2	84.8	86.4	88.0
	IO-Link Port Cycle Time (89.6ms~100.8ms)							
Value (INT)	164	165	166	167	168	169	170	171
Cycle time (ms)	89.6	91.2	92.8	94.4	96.0	97.6	99.2	100.8
	IO-Link Port Cycle Time (102.4ms~113.6ms)							
Value (INT)	172	173	174	175	176	177	178	179
Cycle time (ms)	102.4	104.0	105.6	107.2	108.8	110.4	112.0	113.6
	IO-Link Port Cycle Time (115.2ms~126.4ms)							
Value (INT)	180	181	182	183	184	185	186	187
Cycle time (ms)	115.2	116.8	118.4	120.0	121.6	123.2	124.8	126.4
	IO-Link Port Cycle Time (128ms~132.8ms)							
Value (INT)	188	189	190	191	-	-	-	-
Cycle time (ms)	128.0	129.6	131.2	132.8	-	-	-	-

Byte 38（IO-Link Port Validation and Backup）

This section is used to set the verification and parameter storage function of the port. Depending on the type of setting, the port will verify whether the connected IO-Link slave Vendor_ID and Device_ID are consistent with the set values, and perform backup and recovery of ISDU parameters according to the settings. The default value is 0, which means no checksum storage is performed.

0---No Device check;

1---Type compatible Device V1.0;

2---Type compatible Device V1.1;

3---Type compatible Device V1.1, Backup + Restore;

4---Type compatible Device V1.1, Restore

Byte 39…40（Vendor_ID from IO-Link device）

This section contains the manufacturer's code for the IO-Link slave device,

totaling 2 bytes.

Byte 39…40	Vendor_ID from IO-Link device
Byte 39	Vendor_ID (High Byte) of device connected
Byte 40	Vendor_ID (Low Byte) of device connected

Byte 41…43（Device_ID from IO-Link device）

This section contains the device's code for the IO-Link slave device,

totaling 3 bytes.

Byte 41…43	Vendor_ID from IO-Link device
Byte 41	Device ID (High Byte) of device connected
Byte 42	Device ID (Mid Byte) of device connected
Byte 43	Device ID (Low Byte) of device connected

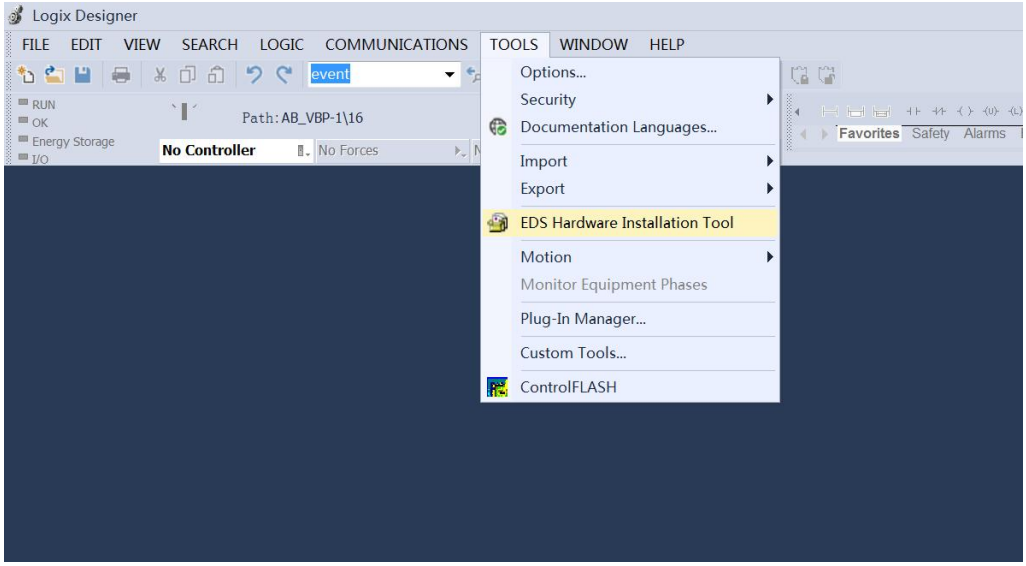
5. Configuration Commissioning (AB PLC)

5.1 Installing EDS files

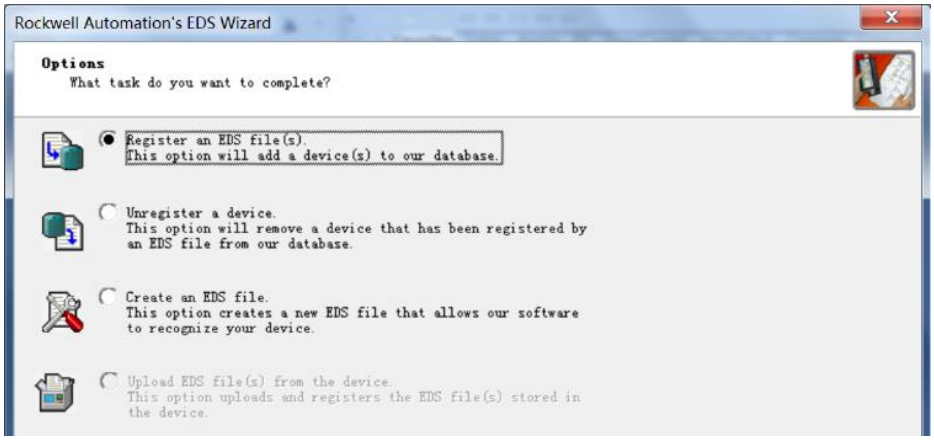
Use EDS files to configure the EtherNet/IP protocol IO-Link module, which is used to integrate the EtherNet/IP protocol module as a standard EtherNet/IP slave into your system. You can visit the ELCO company website to obtain the latest EDS files or call the customer service hotline to contact technical personnel.

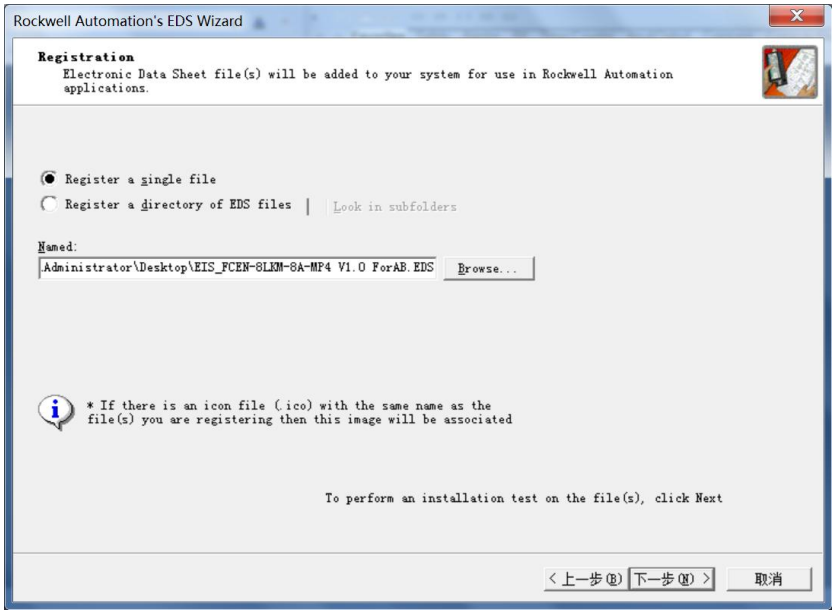
The integration of EDS files into the system depends on the configuration software you are using. Typically, the Rockwell Studio5000 programming software used for the EtherNet/IP protocol integrates EDS files according to the following steps:

1） Run “Logix Designer” software and select “TOOLS>EDS Hardware Installation Tool” in the menu bar.

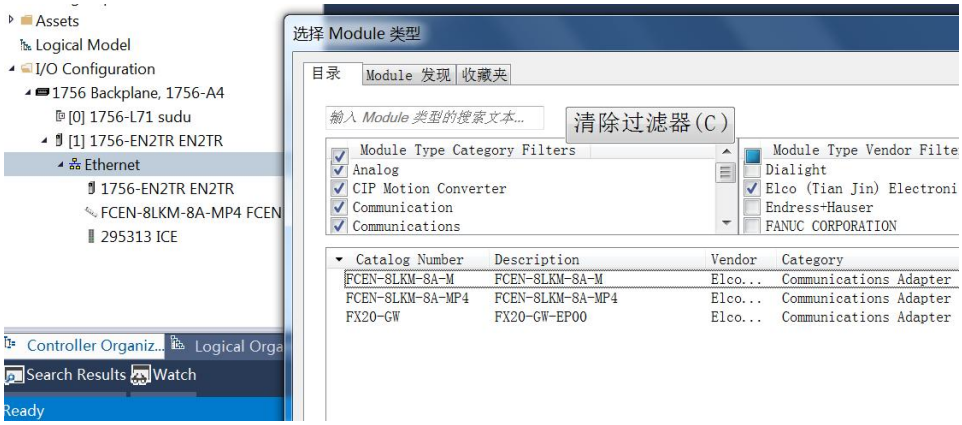


2） In the open dialog box, select "Register an EDS file" to proceed to the next step, select the EDS file to be installed, and then click "Next" to proceed with the installation operation.





3） The newly installed IO-Link master module can be found when adding network devices and is displayed in the "New Module" interface. By filtering the "Module Type Vendor Filter" and selecting "Elco (Tianjin) Electronic", this module can be found and added in the Catalog.



5.2 Configuration example in Logix Designer

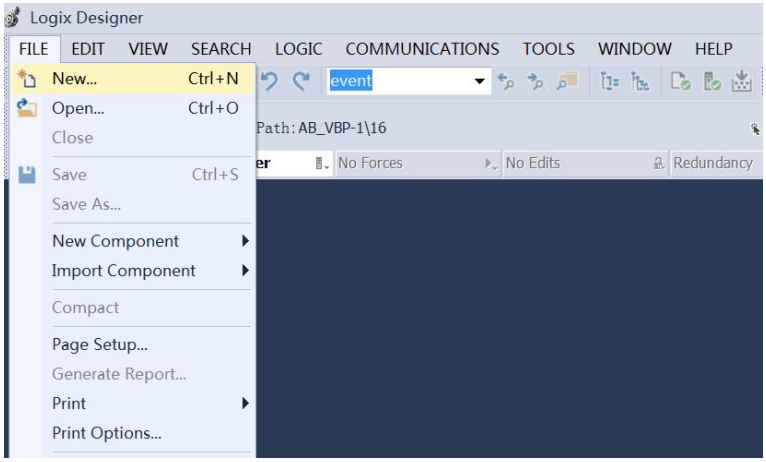
This section provides users with a comprehensive understanding of the actual use of the IO-Link module in the EtherNet/IP protocol through a configuration connection process. This example uses ELCO's FCEN-8LKM-8A-MP4 module as the EtherNet/IP slave to connect Rockwell's 1756-L71 controller and 1756-EN2TR network adapter. By default, all power supply and bus connections have been completed.

The EtherNet/IP protocol IO-Link system includes one IO-Link master module FCEN-8LKM-8A-MP4 (with IP address 192.168.0.11 set in advance), with expansion ports Port0 and Port5 connected to one IO-Link slave hub LKHA-16UP-M12G, and the remaining expansion ports set to the off state

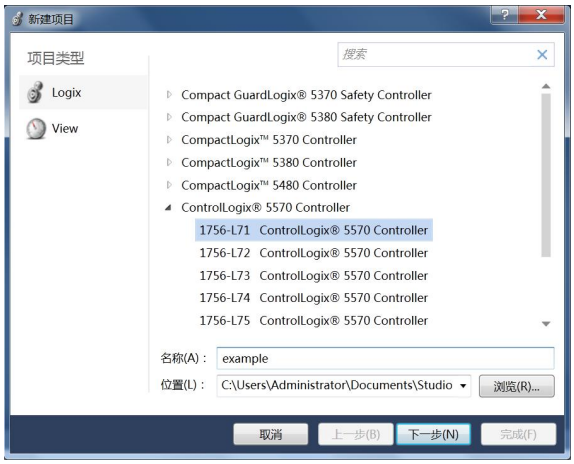
We show the specific software configuration process in the form of pictures:

1）Create a new Studio5000 project.

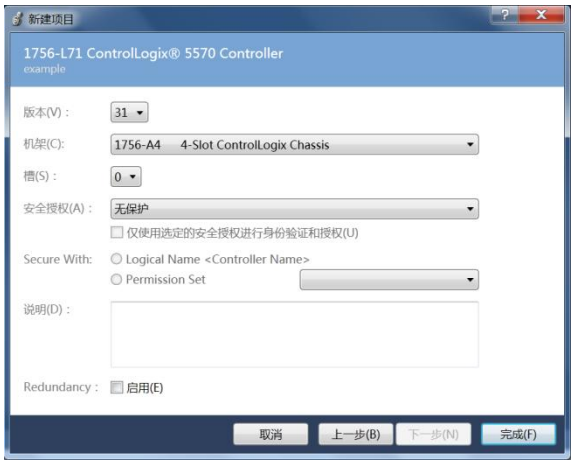
a）Open the “Logix Designer” software and click "File>New...".



b）In the pop-up interface, select the PLC type to use and click "Next".

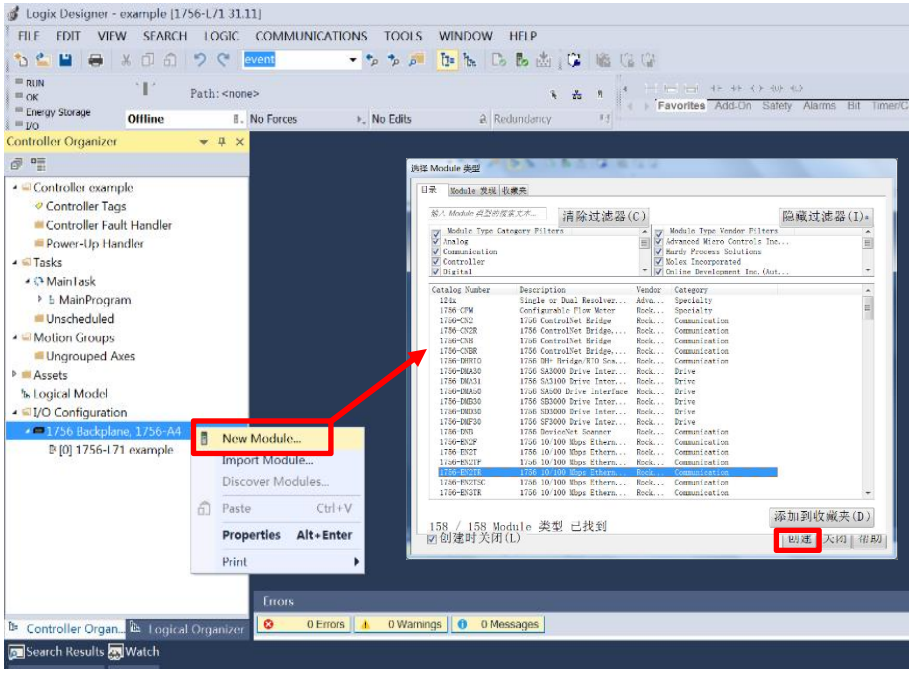


c）Select PLC version, rack, slot number, etc., and click "Finish".

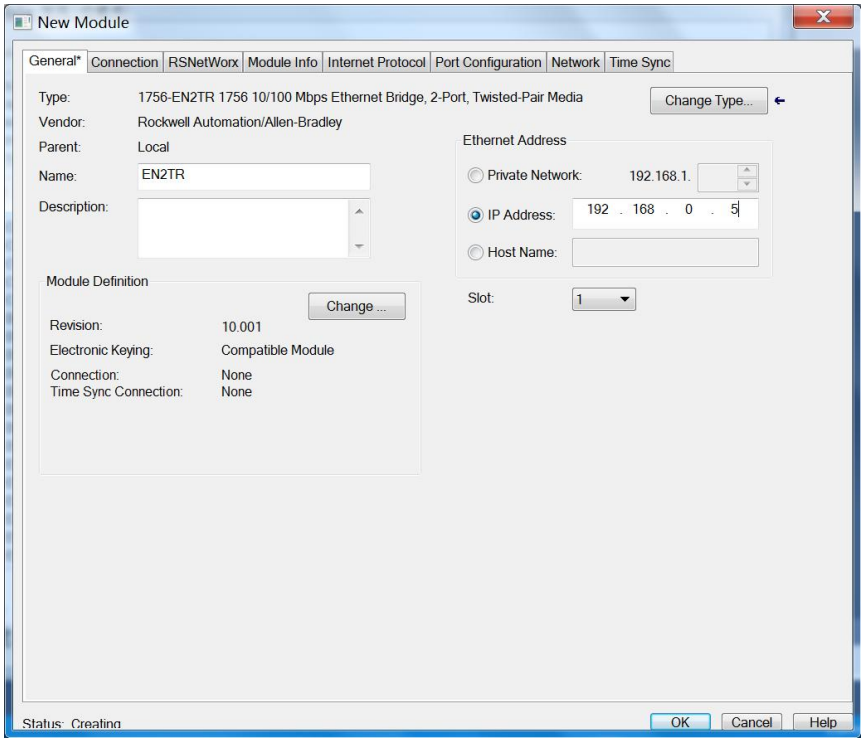


2）Add the 1756-EN2TR network module and set the IP address.

a）In the left Controller Organizer navigation bar, right-click on “1756-A4”, select “New Module...”, select “1756-EN2TR” in the open interface, and click "Create".

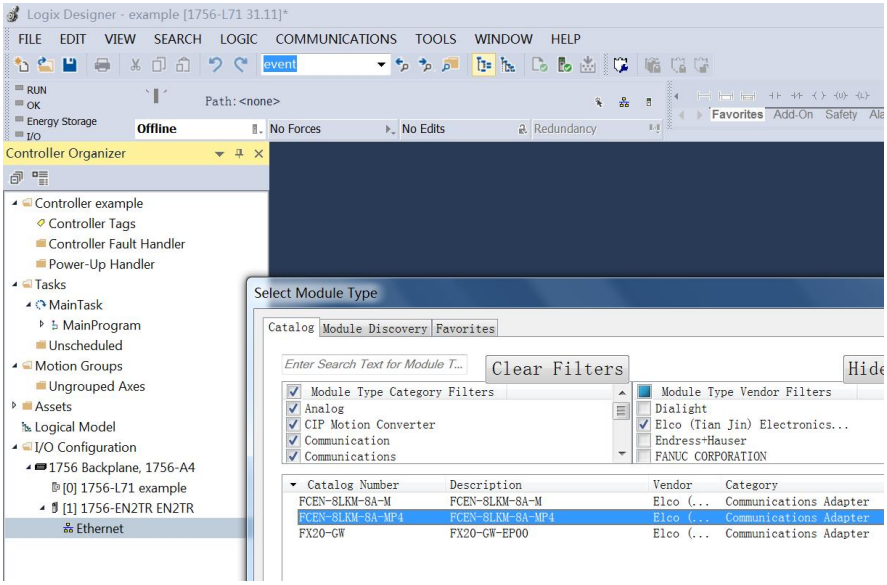


b）In the pop-up interface, fill in the IP address 192.168.0.5 of the module and provide the required name for the module, such as EN2TR. Click "OK" to complete the network adapter configuration.

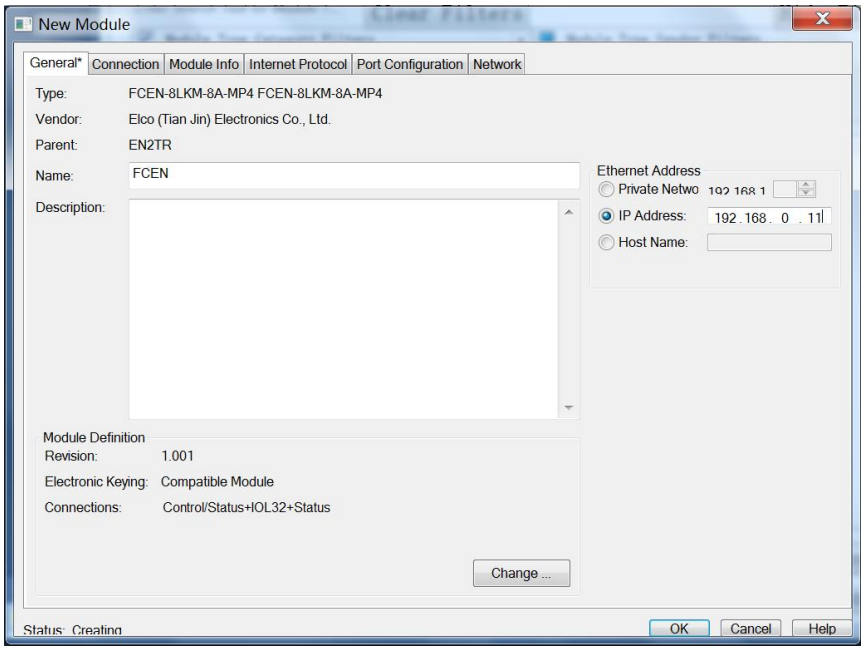


3）Add the FCEN-8LKM-8A-MP4 module and set the IP address.

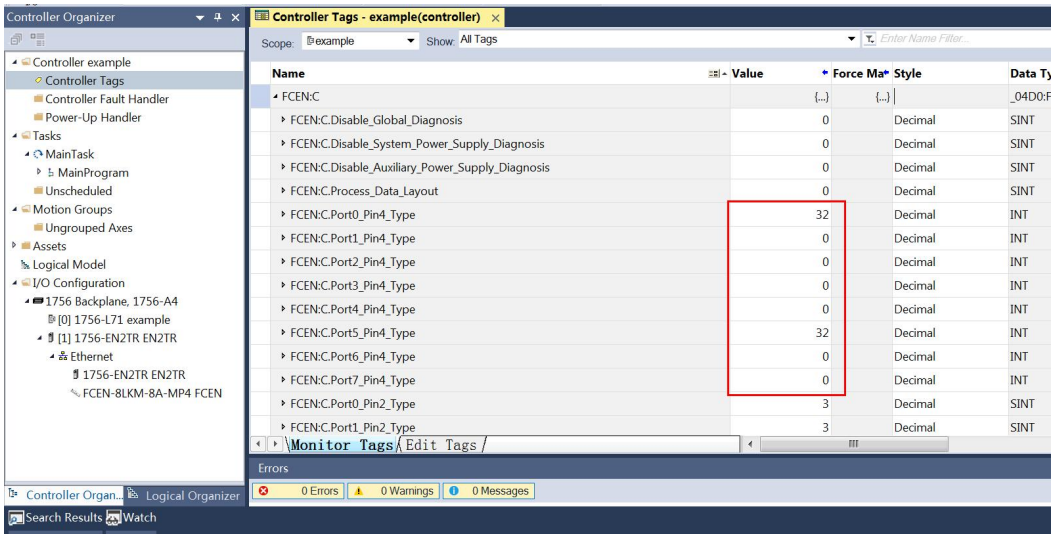
a）In the left Controller Organizer navigation bar, right-click on Ethernet under 1756-EN2TR, select "New Module...", filter ELCO in the open interface, select module model FCEN-8LKM-8A-MP4, and click "Create".



b）In the pop-up interface, fill in the IP address 192.168.0.11 of the module and provide the required name for the module, such as FCEN. Click "OK" to complete the configuration of the IO-Link module.

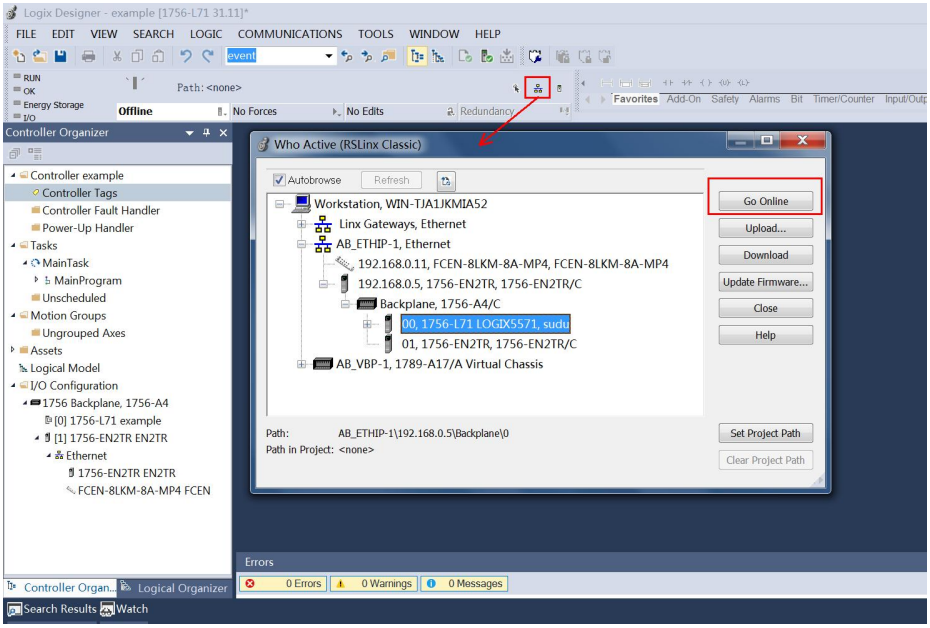


4）After completing the configuration of the hardware module, it is necessary to map the ports and other parameters of the IO-Link module. You can refer to Section 4.4 for the allocation of data addresses. Set the Port0 and Port5 ports to IO-Link mode, and set the values of FCEN:C.Port0_Pin4_Type and FCEN:C.Port5_Pin4_Type to 32. At the same time, in order to provide output power to the IO-Link slave, set the Pin2_Type of FCEN: C.Port0~7 to 3.

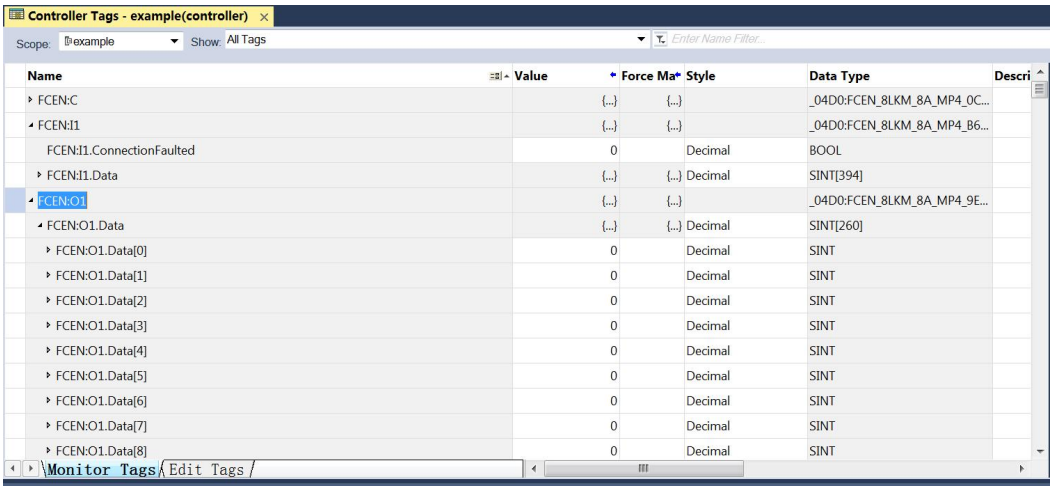


Note: If the value of the CONFIG parameter is modified after network connection, the IO-Link module must be powered on or connected back to the network in order for the newly modified parameters to take effect.

5）Select the already set connection in the RSlinx Classic. In this example, connect through the AB_ETHIP network and select the "Go Online" button to switch the software to online mode. At the same time, a pop-up interface will pop up and select "Download" to download the program to the PLC.

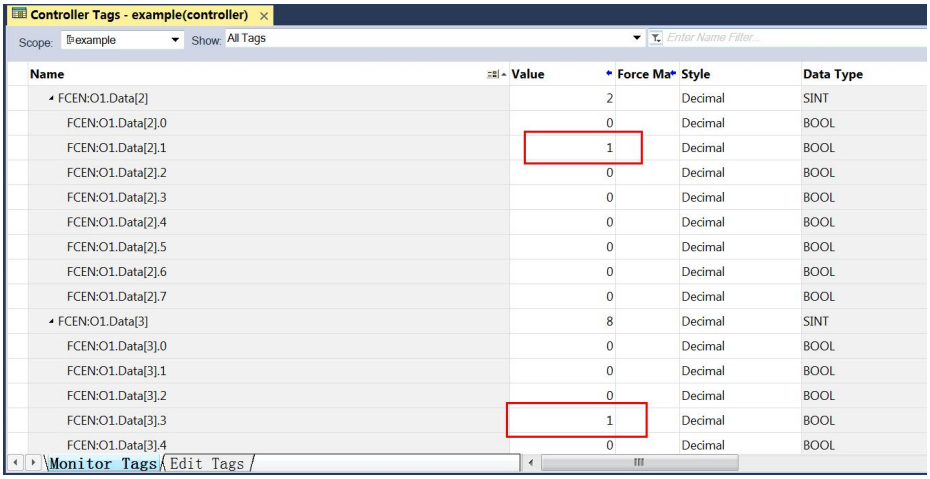


6）After completing the download operation, the NET light of FCEN-8LKM-8A-MP4 module will turn green, indicating that the EtherNet/IP connection between the module and the PLC is successful. The input and output signals of the control module can be read and controlled through the Controller Tags variable table or by programming.



7）Due to the absence of an IO-Link slave output auxiliary power supply signal, the Port0 and Port5 indicator lights of LKHA-16UP-M12G are set to IO-Link mode and connected in red. It is necessary to refer to section 4.3 for module OUTPUT data address assignment, and set FCEN:O1.Data[2].1 and FCEN:O1.Data[3].3 to 1. After a successful assignment,

the light_00 remains yellow and light_01 remains green of Port0; the light_10 remains yellow and light_11 remains green of Port5.



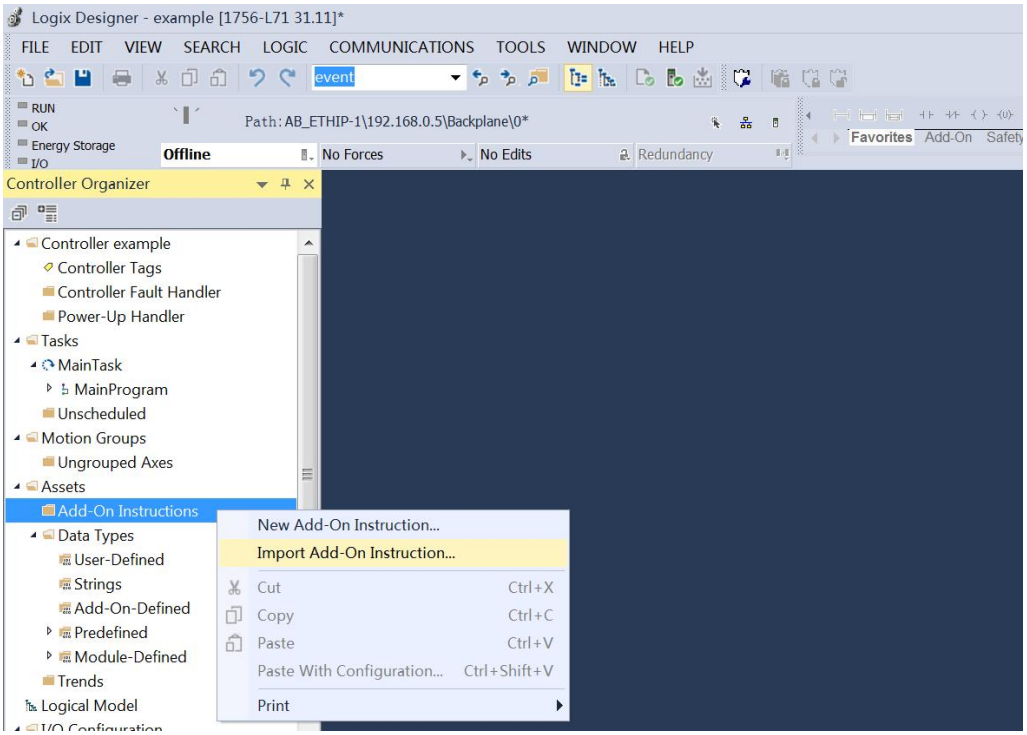
8）All configuration work has been completed and can be used normally.

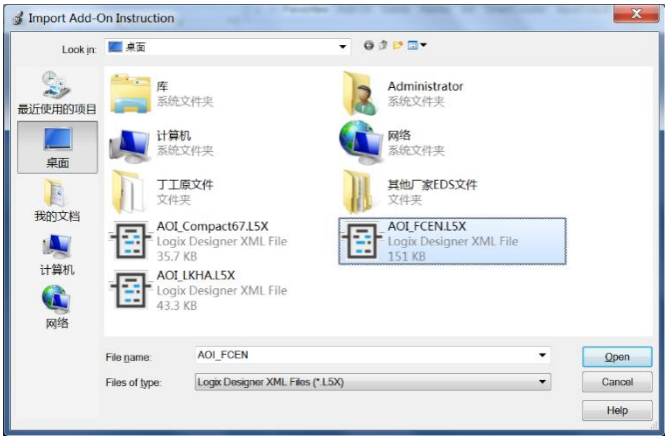
5.3 Import Add-On Instruction

For the convenience of connecting the FCEN-8LKM-8A-MP4 module to AB PLC, ELCO provides an Add-On Instruction specifically designed for Logix Designer software. This program block sorts and annotates the INPUT, OUTPUT, and CONFIG data of the FCEN-8LKM-8A-MP4 module. Users can easily read and control module signals through the AOI program block.

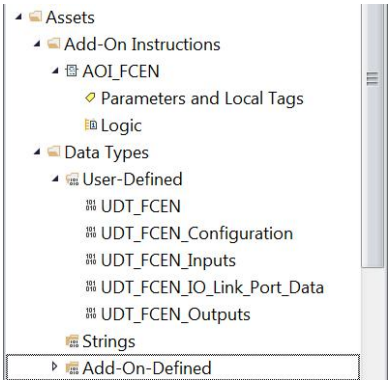
This AOI function block is suitable for RSLogix5000 or Studio5000 software, and the hardware can adapt to various PLCs such as CompactLogix or ControlLogix. The usage steps are as follows:

1)Right click on the “Add-On Instructions” item in Controller Organizer, select "Import Add On Instructions...", and select the AOI-FCEN dedicated to the ELCO FCEN-8LKM-8A-MP4 module from the pop-up menu L5X file, click the "Open" button to import.

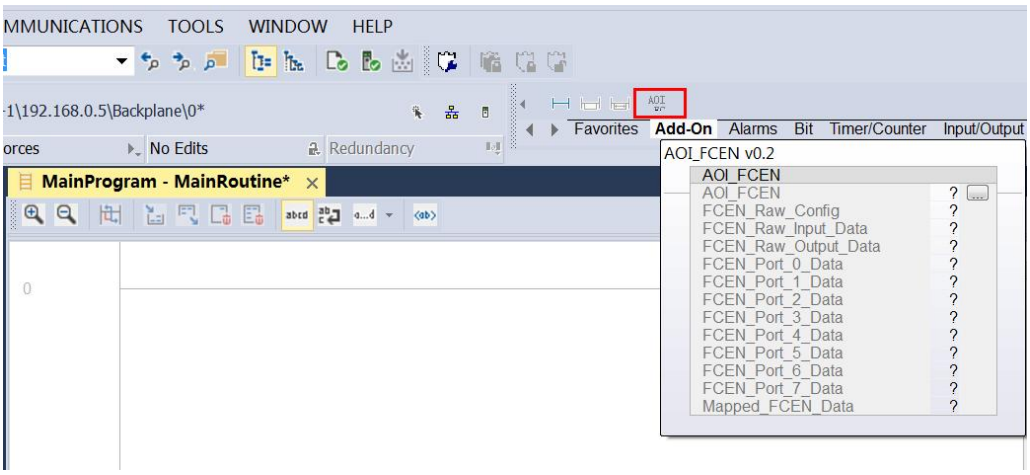




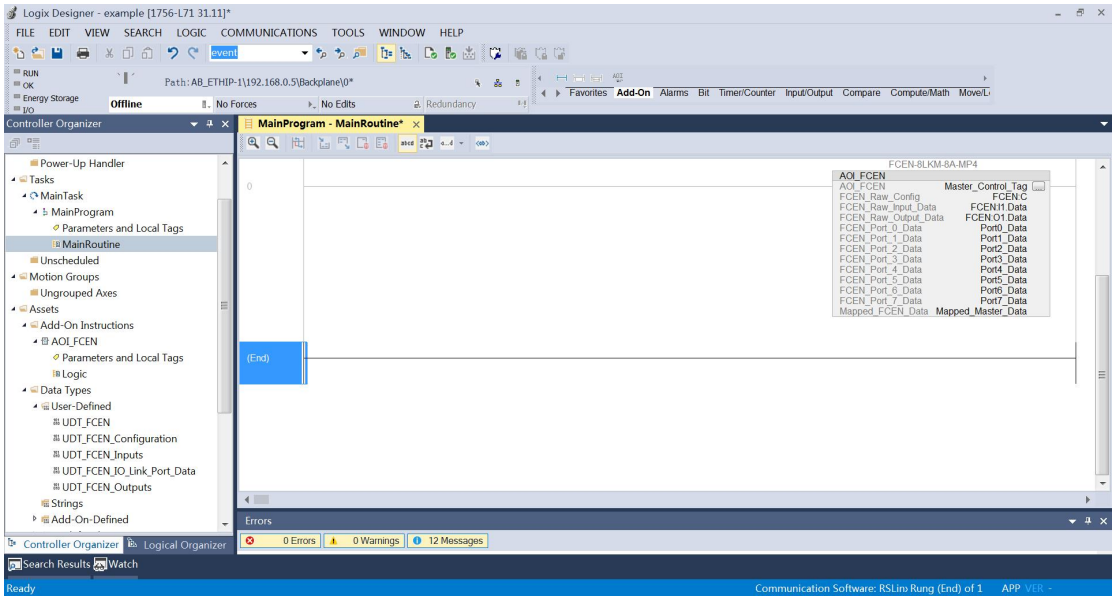
2) After successful import, you can see the newly imported function block under the Add-On Instructions category. At the same time, the Data Types involved in the function block will also be imported together, which can be seen under the User-Defined category.



3) You can see the newly imported blocks in the programming interface.



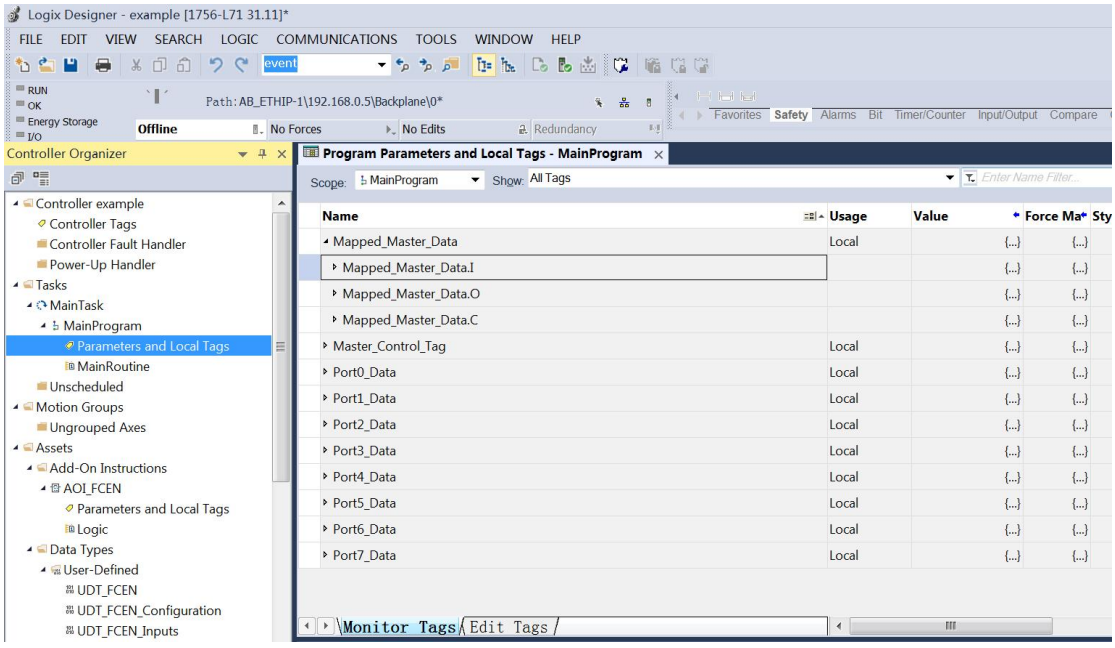
4) Insert the function block into the program by dragging or clicking, and fill in the corresponding variables according to the data type of the Add-On Instruction. Among them, the variables corresponding to the newly inserted FCEN-8LKM-8A-MP4 module need to be selected for FCEN_Raw_Config, FCEN_Raw_Input_Data, and FCEN_Raw_Output_Data. Other projects require users to add variables according to the data type themselves.



5) The names and data types of AOI block variables are shown in the table below:

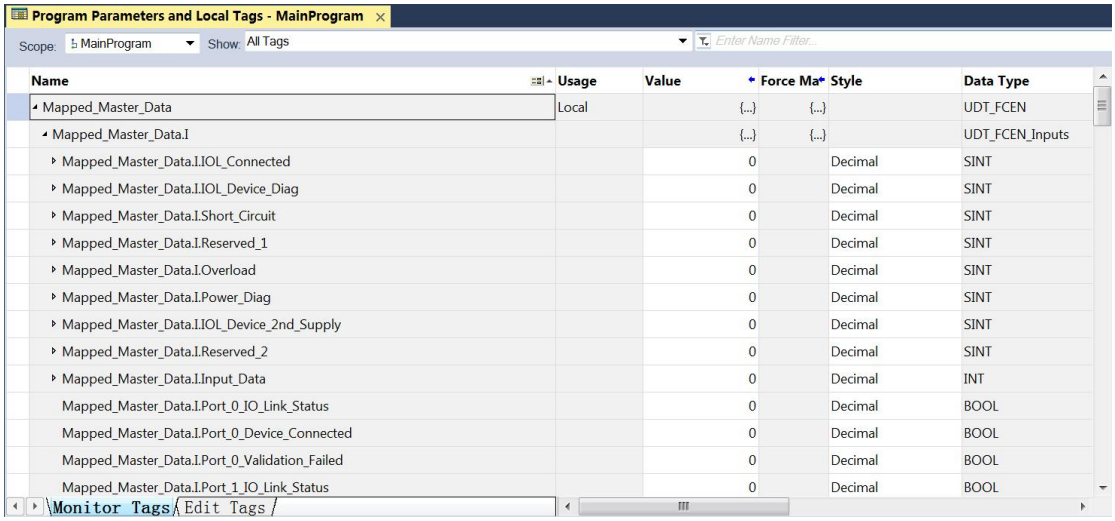
Parameter Name	Description	Data Type	Tag Name (User defined)
AOI_FCEN	Unique Control Tag for AOI Module	AOI_FCEN	Master_Control_Tag
FCEN_Raw_Config	Raw config data from Module Defined Tags	SINT[100]	*Module_Name*:C
FCEN_Raw_Input_Data	Raw input data from Module Defined Tags	SINT[394]	*Module_Name*:I1.Data
FCEN_Raw_Output_Data	Raw output data from Module Defined Tags	SINT[260]	*Module_Name*:O1.Data
FCEN_Port_0_Data	All I/O Data with IO-Link Port 0	UDT_FCEN_ IO_Link_Port_Data	Port0_Data
FCEN_Port_1_Data	All I/O Data with IO-Link Port 1	UDT_FCEN_ IO_Link_Port_Data	Port1_Data
FCEN_Port_2_Data	All I/O Data with IO-Link Port 2	UDT_FCEN_ IO_Link_Port_Data	Port2_Data
FCEN_Port_3_Data	All I/O Data with IO-Link Port 3	UDT_FCEN_ IO_Link_Port_Data	Port3_Data
FCEN_Port_4_Data	All I/O Data with IO-Link Port 4	UDT_FCEN_ IO_Link_Port_Data	Port4_Data
FCEN_Port_5_Data	All I/O Data with IO-Link Port 5	UDT_FCEN_ IO_Link_Port_Data	Port5_Data
FCEN_Port_6_Data	All I/O Data with IO-Link Port 6	UDT_FCEN_ IO_Link_Port_Data	Port6_Data
FCEN_Port_7_Data	All I/O Data with IO-Link Port 7	UDT_FCEN_ IO_Link_Port_Data	Port7_Data
Mapped_FCEN_Data	All Unique data associated with FCEN-8LKM-8A-MP4	UDT_FCEN	Mapped_Master_Data

6) After completing the addition of the AOI block and downloading it to the PLC, the INPUT, OUTPUT and CONFIG variables of the FCEN-8LKM-8A-MP4 module can be read and controlled through the Mapped_Master_Data variable. Due to the addition of this instruction, it is necessary to read and write signal points in the “Parameters and Local Tags”. The values in the Controller Tags cannot be directly modified like in steps 6 and 7 of section 5.2. At the same time, the signal points of the FCEN-8LKM-8A-MP4 module used in programming also need to directly call the values in the Mapped_Master_Data variable.



Note: If the value of the CONFIG parameter is modified after network connection, the IO-Link module must be powered on or connected back to the network in order for the newly modified parameters to take effect.

7) The INPUT, OUTPUT and CONFIG variables of the FCEN-8LKM-8A-MP4 module have been classified and described in the AOI_FCEN program block. For more detailed information, please refer to Chapter 4 “Module Signal Address Assignment”.

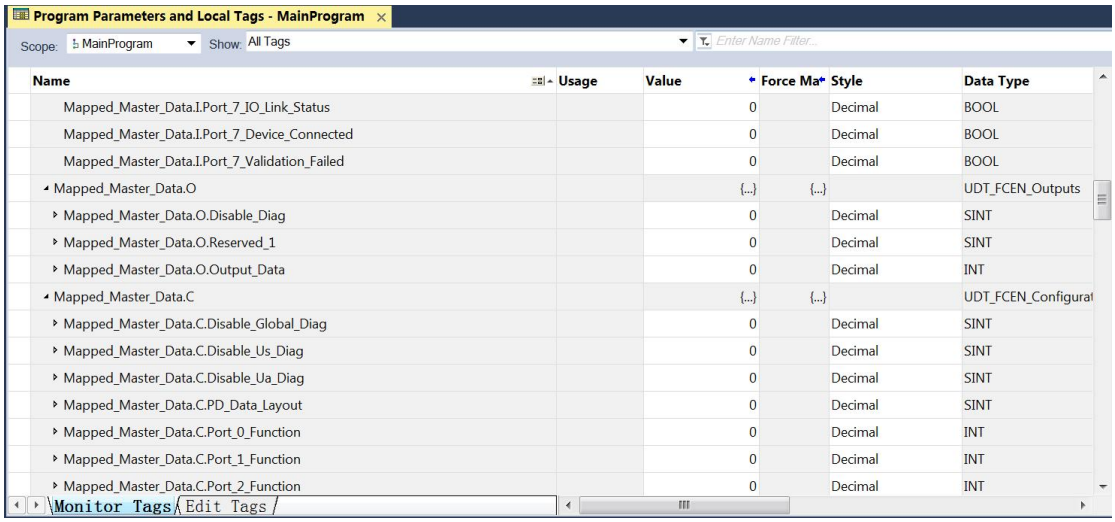


Program Parameters and Local Tags - MainProgram

Scope: MainProgram Show: All Tags Enter Name Filter...

Name	Usage	Value	Force Ma	Style	Data Type
Mapped_Master_Data	Local	{...}	{...}		UDT_FCEN
Mapped_Master_Data.I		{...}	{...}		UDT_FCEN_Inputs
Mapped_Master_Data.I.IOL_Connected		0		Decimal	SINT
Mapped_Master_Data.I.IOL_Device_Diag		0		Decimal	SINT
Mapped_Master_Data.I.Short_Circuit		0		Decimal	SINT
Mapped_Master_Data.I.Reserved_1		0		Decimal	SINT
Mapped_Master_Data.I.Overload		0		Decimal	SINT
Mapped_Master_Data.I.Power_Diag		0		Decimal	SINT
Mapped_Master_Data.I.IOL_Device_2nd_Supply		0		Decimal	SINT
Mapped_Master_Data.I.Reserved_2		0		Decimal	SINT
Mapped_Master_Data.I.Input_Data		0		Decimal	INT
Mapped_Master_Data.I.Port_0_IO_Link_Status		0		Decimal	BOOL
Mapped_Master_Data.I.Port_0_Device_Connected		0		Decimal	BOOL
Mapped_Master_Data.I.Port_0_Validation_Failed		0		Decimal	BOOL
Mapped_Master_Data.I.Port_1_IO_Link_Status		0		Decimal	BOOL

Monitor Tags / Edit Tags /



Program Parameters and Local Tags - MainProgram

Scope: MainProgram Show: All Tags Enter Name Filter...

Name	Usage	Value	Force Ma	Style	Data Type
Mapped_Master_Data.I.Port_7_IO_Link_Status		0		Decimal	BOOL
Mapped_Master_Data.I.Port_7_Device_Connected		0		Decimal	BOOL
Mapped_Master_Data.I.Port_7_Validation_Failed		0		Decimal	BOOL
Mapped_Master_Data.O		{...}	{...}		UDT_FCEN_Outputs
Mapped_Master_Data.O.Disable_Diag		0		Decimal	SINT
Mapped_Master_Data.O.Reserved_1		0		Decimal	SINT
Mapped_Master_Data.O.Output_Data		0		Decimal	INT
Mapped_Master_Data.C		{...}	{...}		UDT_FCEN_Configurat
Mapped_Master_Data.C.Disable_Global_Diag		0		Decimal	SINT
Mapped_Master_Data.C.Disable_Us_Diag		0		Decimal	SINT
Mapped_Master_Data.C.Disable_Ua_Diag		0		Decimal	SINT
Mapped_Master_Data.C.PD_Data_Layout		0		Decimal	SINT
Mapped_Master_Data.C.Port_0_Function		0		Decimal	INT
Mapped_Master_Data.C.Port_1_Function		0		Decimal	INT
Mapped_Master_Data.C.Port_2_Function		0		Decimal	INT

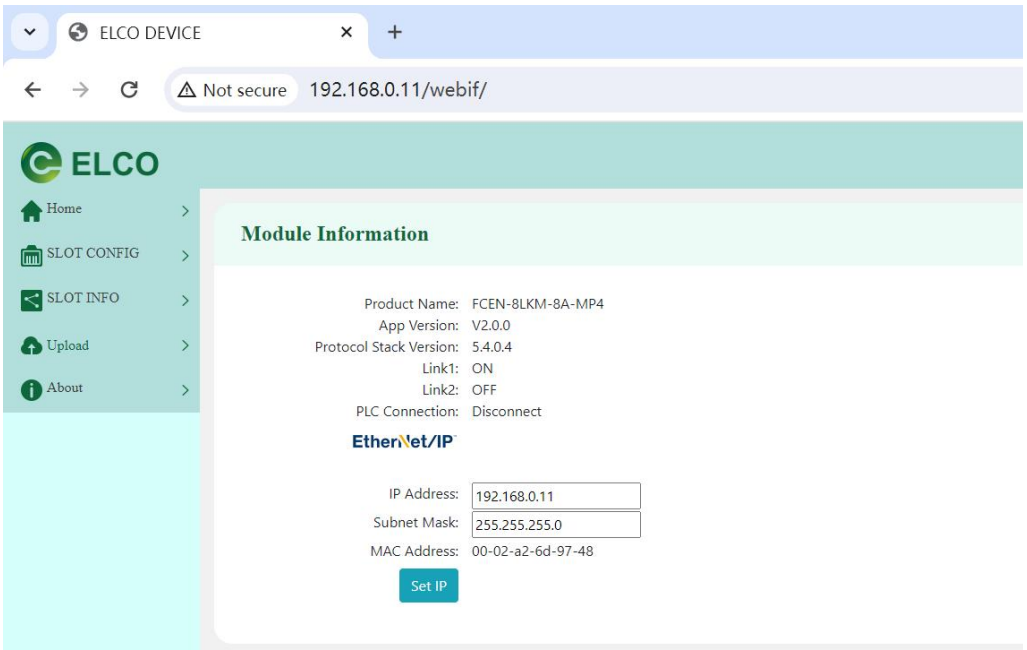
Monitor Tags / Edit Tags /

5.4 Webserver

The FCEN-8LKM-8A-MP4 module integrates Webserver internally. Users can access the Webserver through the IP address, set the parameters of the module, read and write input and output signals, and set the ISDU parameters of the IO-Link device. (When the module is connected to the PLC, only the IO signal status can be read and ISDU of IO-Link device can be set.)
In order to access the Webserver of the module, users need to first assign an IP address to the module. The method of assigning an IP address can be referred to in Section 3.4. Then, using the latest version of Chrome, Edge, or Safari browser, enter http://xxx. xxx. xxx. xxx/webif/ to access the module. (xxx. xxx. xxx. xxx is the IP address assigned by the module)

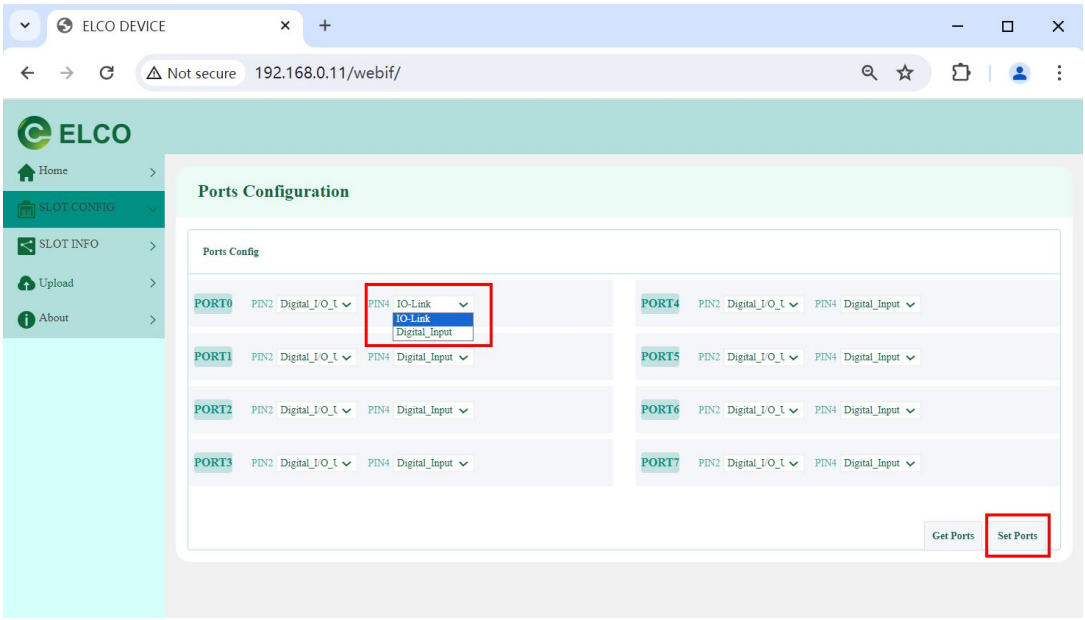
In this example, the IP of FCEN-8LKM-8A-MP4 module has been pre assigned to 192.168.0.11. Without connecting to the PLC, Port0 is connected to the BNI007Z module of Balluff. Show how to enable port IO-Link function and allocate port properties of the Balluff module by importing an IODD file.

1) Set the IP address of the computer to 192.168.0.xxx on the same network segment as the FCEN-8LKM-8A-MP4 module. Then open the browser and enter in the address bar http://192.168.0.11/webif/ . You can see the homepage of the module Webserver.

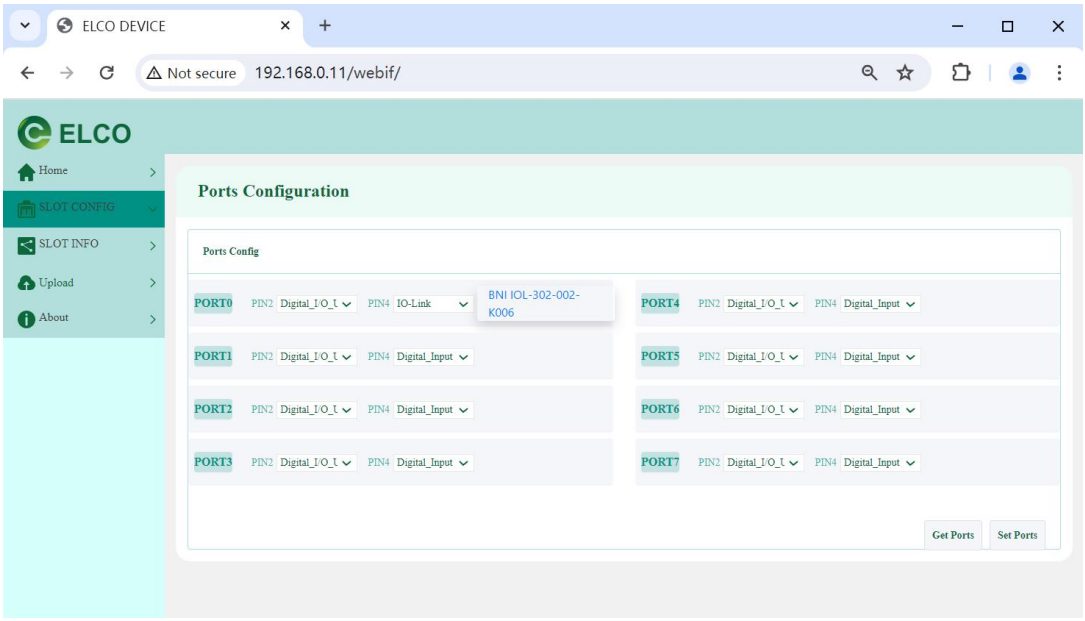


2) Click on the “SLOT CONFIG” item to enter the Ports Configuration interface, where you can read or set the port properties of 8 IO-Link interfaces.

Set PIN4 of PORT0 to IO-Link and click the "Set Ports" button to make the modification effective.

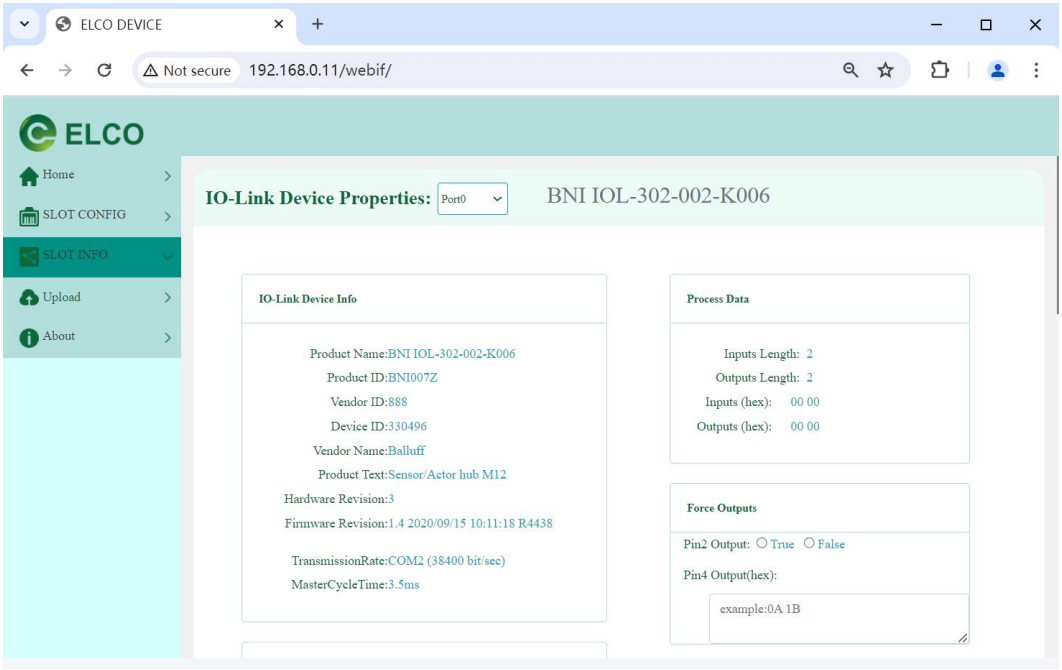


3) After successful modification, it can be seen that Port0 automatically searches for the connected IO-Link device.

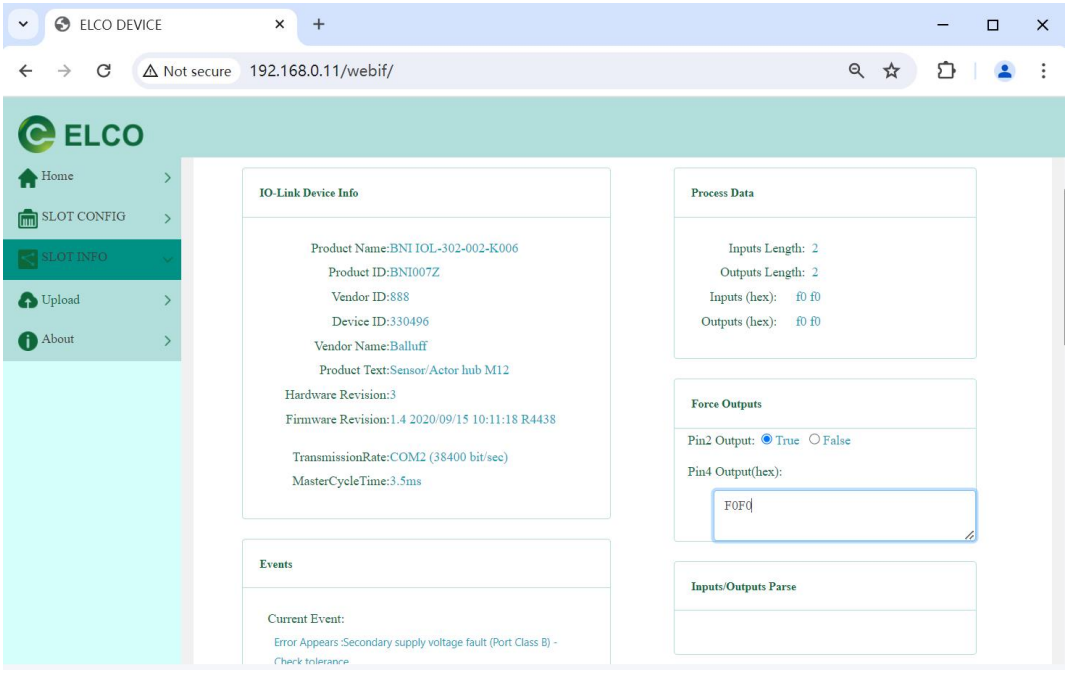


4) You can directly click on the IO-Link device found in the search, or select port Port0 through the “SLOT INFO” item to enter the details page of the IO-Link port. Basic information such as device ID, transmission rate, and process data length of

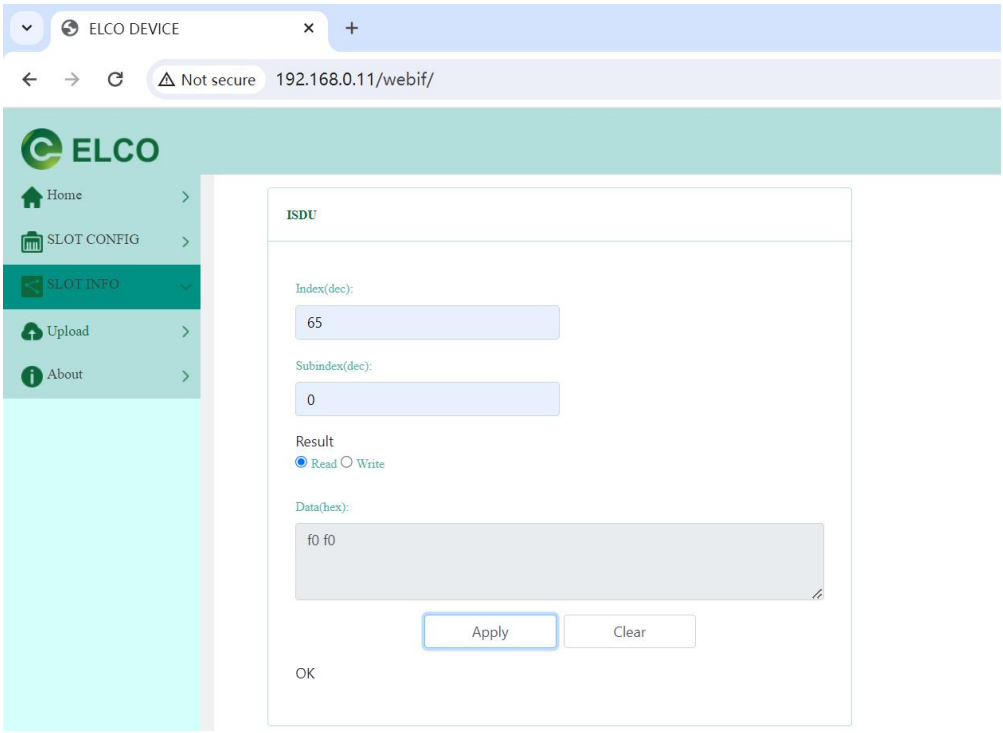
the IO-Link device can be read.



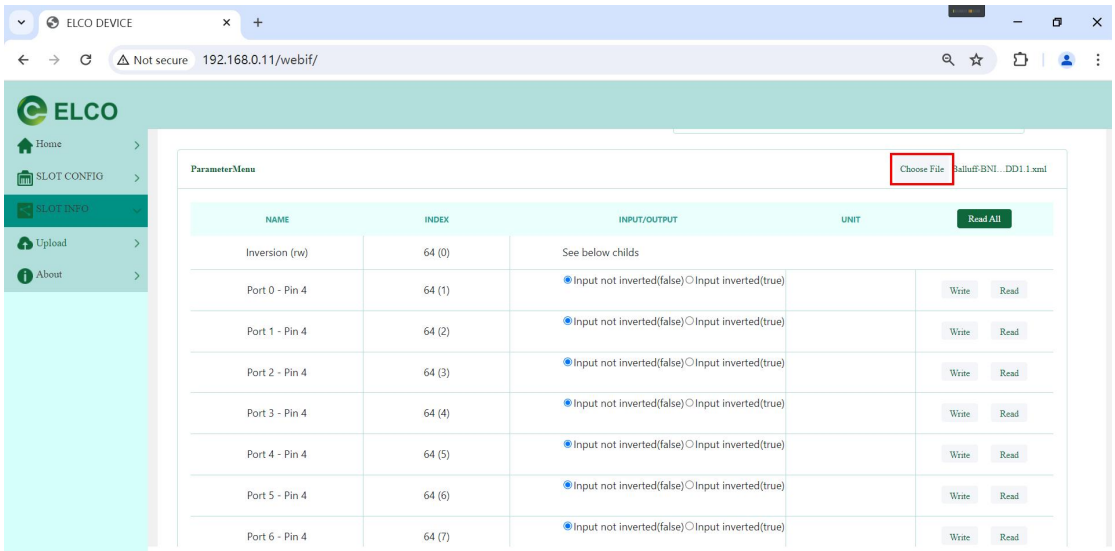
5) "Force Outputs" are used to force Pin2 output to the IO-Link master port, achieving the goal of enabling auxiliary power supply to the IO-Link slave. At the same time, the output value of the IO-Link slave can be written in the "Pin4 Output" interface.



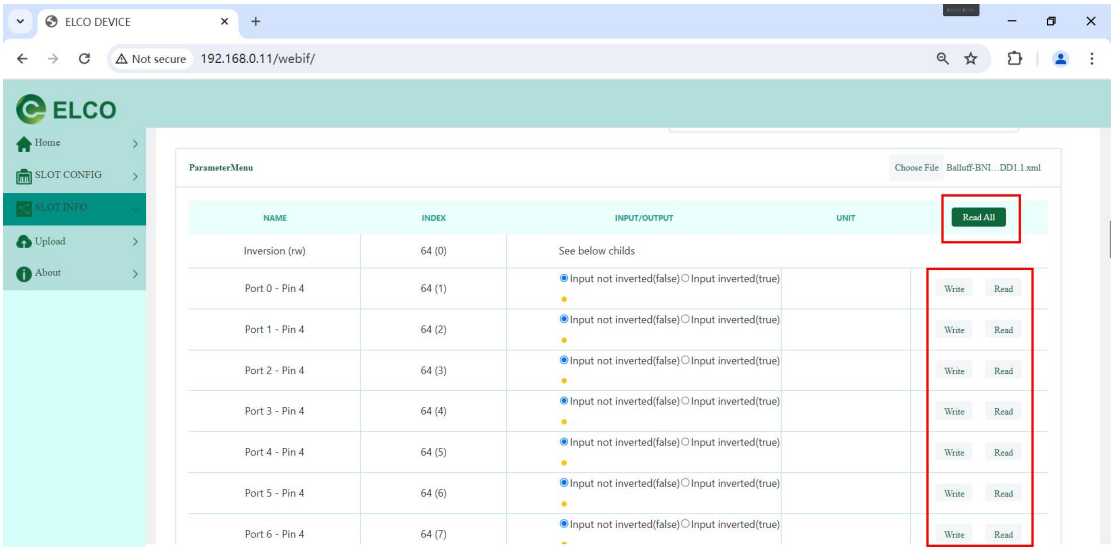
6) Users can directly use the ISDU column on the page to define the parameters of the IO-Link slave to be modified through Index and Subindex, and then read or write values in Data.



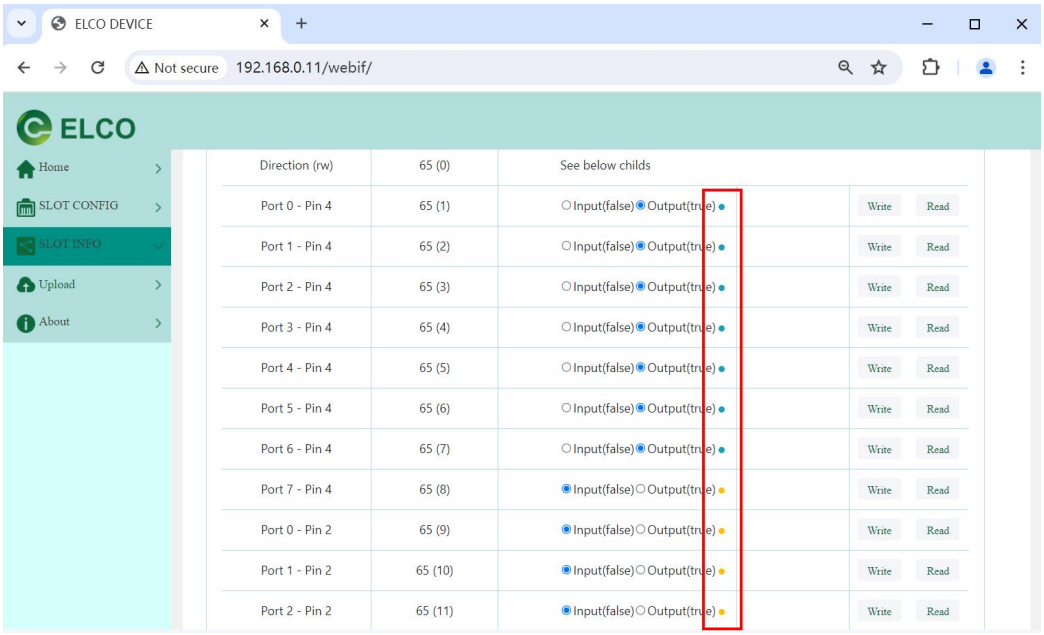
7) Users can also visually edit the ISDU parameters of IO-Link slave by importing IO-Link device IODD files. Click the "Choose File" button to import the prepared IODD file. Once successful, you can see the ISDU parameters of the IO-Link slave.



8) You can obtain all the current ISDU values of IO-Link slave by clicking the "Read All" button, but a large number of parameters can result in a long reading time. It is recommended to read and write the corresponding ISDU parameters through the “Read” or “Write” button corresponding to each parameter.



9) After each parameter, there will be corresponding colored dots to represent the status of this parameter. No dots represent offline values, green dots represent newly written values, and yellow dots represent read values.



Note: The operation of modifying ISDU parameters of the IO-Link slave through Webserver can be carried out with the FCEN-8LKM-8A-MP4 module connected to the PLC normally.

6. Alarm diagnosis

6.1 LED fault indicator

With the LED indicator on the FCEN-8LKM-8A-MP4 module, users can easily and quickly determine the current working status of the module. (For the appearance of the indicator, please refer to Section 2.5 "LED Indication Function")

Name	Status	Meaning	Fault cause
Expansion channel Indicator IO-Link	Yellow	IO-Link connection OK	–
	Green	Ordinary digital signal	–
	Yellow flash	No IO-Link connection	Check the IO-Link cable connection
	Red	1. Short circuit 2. Output signal overload	1. Check the cable connection 2.Module channel is damaged
	Red flash	IO-Link connection incorrect	1. Check the configuration 2.Check IO-Link device status
Gateway status Indicator MOD	Green	Work normally	–
	Red	Working abnormally	1. Power supply is abnormal 2.Channel abnormal (short circuit, overload, etc.) 3. Module is damaged
Comm. status Indicator NET	Green	Communication normal	–
	Red	Communication abnormal	1. Network cable failure 2. Check the configuration 3. Module is damaged
Network status Indicator Lk1, 2	Green	Network Cable connects normal.	–
	Off	Network cable connects error.	1. Network cable failure 2. Module is damaged
Comm. data Indicator ACT1, 2	Yellow flash	Data exchange.	-
	Off	No data exchange.	1. Check the configuration 2. Check the network hardware
Power supply Indicator Us, Ua	Green	Supply voltage normal	–
	Red	Supply voltage abnormal	1. Overvoltage or undervoltage 2. Module is damaged
	Off	No power supply	1.Power supply cable failure 2. Module is damaged

6.2 FCEN Module Address Assignment

The default connection name for the FCEN-8LKM-8A-MP4 module is “Control/Status+IOL32+Status”. This connection contains the input and output signals and status of the IO-Link master, as well as 32 bytes of data input and output and IO-Link slave status information for each IO-Link port.It contains 394 bytes of INPUT, 260 bytes of OUTPUT, and 100 bytes of CONFIG. The table below lists the various data classifications, which can be found in Chapter 4 for details.

Byte	Input data	Description
0...7	Module status	Indicate the status of IO-Link master and IO-Link port.
8...9	Input signal of Master	Process input data for IO-Link Master SIO mode.
10…57	IO-Link Port 0	Process input data for Port 0.
58...105	IO-Link Port 1	Process input data for Port 1.
106...153	IO-Link Port 2	Process input data for Port 2.
154...201	IO-Link Port 3	Process input data for Port 3.
202...249	IO-Link Port 4	Process input data for Port 4.
250...297	IO-Link Port 5	Process input data for Port 5.
298…345	IO-Link Port 6	Process input data for Port 6.
346…393	IO-Link Port 7	Process input data for Port 7.
Byte	**Output data**	**Description**
0...1	Module Control	Control the function (diagnosis or restart) of IO-Link port.
2...3	Output signal of Master	Process output data for IO-Link Master SIO mode.
4…35	IO-Link Port 0	Process output data for Port 0.
36…67	IO-Link Port 1	Process output data for Port 1.
68…99	IO-Link Port 2	Process output data for Port 2.
100…131	IO-Link Port 3	Process output data for Port 3.
132…163	IO-Link Port 4	Process output data for Port 4.
164…195	IO-Link Port 5	Process output data for Port 5.
196…227	IO-Link Port 6	Process output data for Port 6.
278…259	IO-Link Port 7	Process output data for Port 7.
Byte	**Config data**	**Description**

0…3	Module configuration	General configuration for the overall module.
4…35	Port configuration	Pin type and safe state configuration for ports.
36…43	IO-Link Port 0	Configuration for IO-Link Port 0.
44…51	IO-Link Port 1	Configuration for IO-Link Port 1.
52…59	IO-Link Port 2	Configuration for IO-Link Port 2.
60…67	IO-Link Port 3	Configuration for IO-Link Port 3.
68…75	IO-Link Port 4	Configuration for IO-Link Port 4.
76…83	IO-Link Port 5	Configuration for IO-Link Port 5.
84…91	IO-Link Port 6	Configuration for IO-Link Port 6.
92…99	IO-Link Port 7	Configuration for IO-Link Port 7.