Compact67 IO-Link Module

----EtherNet/IP System Manual

ELCO (Tianjin) Electronics Co., Ltd.
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Preface

1. **Scope of this manual:**

   This manual applies to the ELCO EtherNet/IP Compact67 series IO-Link module. The information in this manual enables you to run the Compact67 IO-Link 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 describes the hardware of the EtherNet/IP Compact67 series IO-Link module.
   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:
   http://www.elco-holding.com/

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 Compact67 module supporting IO-Link function is a new type of distributed I / O system. The simple and easy to install Fieldbus system Compact67 is especially suitable for applications in rough environments.

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.
ELCO new Compact67 product 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. Optional interface of Class-A or Class-B. 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 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

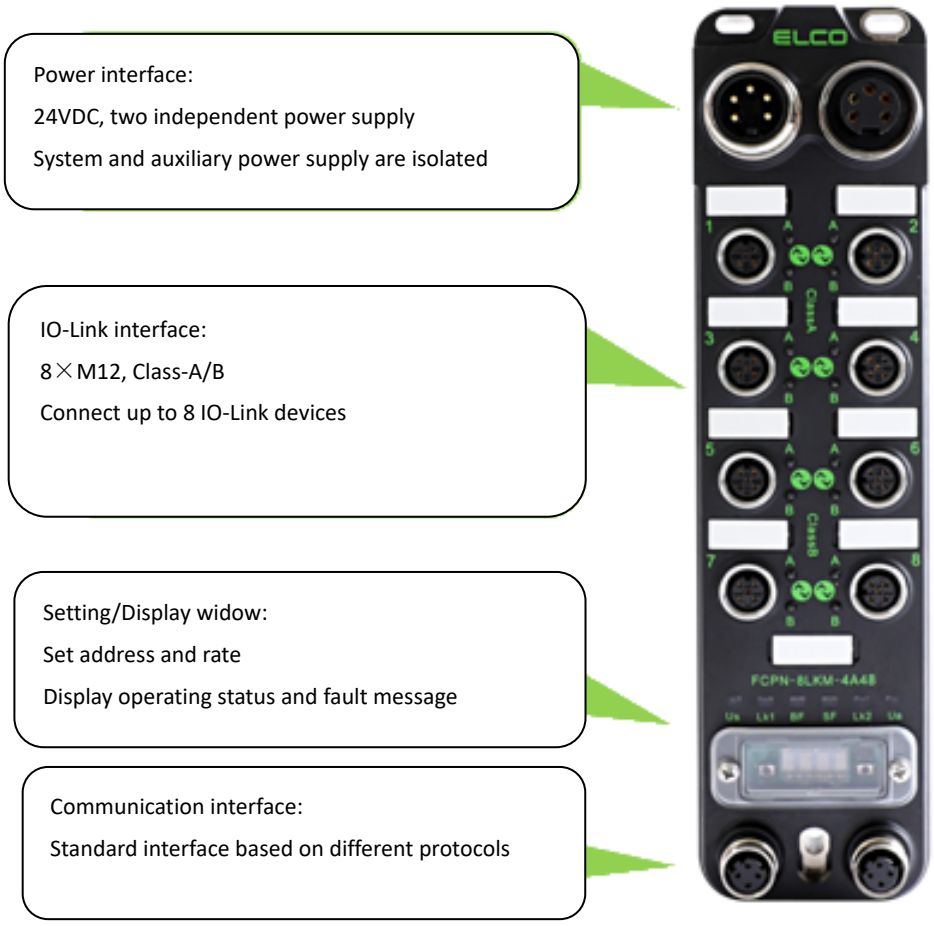
1.4 Type

No.	Type	Description
1	FCEI-8LKM-4A4B	EtherNet/IP IO-Link master module 8 IO-Link interfaces (4*Class-A + 4*Class-B) 2 male+female, 7/8”power supply 2 female, M12 D-Code fieldbus interface
2	FCEI-8LKM-8A	EtherNet/IP IO-Link master module 8 IO-Link interfaces (8*Class-A) 2 male+female, 7/8”power supply 2 female, M12 D-Code fieldbus interface
3	FCEI-4LKM-4A4S	EtherNet/IP IO-Link master module 4 IO-Link interfaces (4*Class-A) 2 male+female, 7/8”power supply 2 female, M12 D-Code fieldbus interface
4	LKHA-1600P-M12	IO-Link sensor hub Class-A (LKHA) interface 16 PNP input signal or dry contact 8 female, M12 A-Code signal interface
5	LKHA-0808P-M12	IO-Link sensor hub Class-A (LKHA) interface 8 PNP input signal or dry contact 8 active output, 0.5A each channel 8 female, M12 A-Code signal interface
6	LKHA-16UP-M12	IO-Link sensor hub Class-A (LKHA) interface 16 PNP input or active output 8 female, M12 A-Code signal interface
7	LKHA-0800P-M8	IO-Link sensor hub Class-A (LKHA) interface 8 PNP input signal or dry contact 8 female, M8-3pin signal interface

8	LKHA-08UP-M8	IO-Link sensor hub Class-A (LKHA) interface 8 PNP input or active output 8 female, M8-3pin signal interface
9	LKHA-0800P-M12	IO-Link sensor hub Class-A (LKHA) interface 8 PNP input signal or dry contact 4 female, M12 A-Code signal interface
10	LKHA-08UP-M12	IO-Link sensor hub Class-A (LKHA) interface 8 PNP input or active output 4 female, M12 A-Code signal interface
11	LKHA-1600N-M12	IO-Link sensor hub Class-A (LKHA) interface 16 NPN input signal or dry contact 8 female, M12 A-Code signal interface
12	LKHA-16UN-M12	IO-Link sensor hub Class-A (LKHA) interface 16 NPN input or active output 8 female, M12 A-Code signal interface

2. Technical characteristics

2.1 IO-Link master

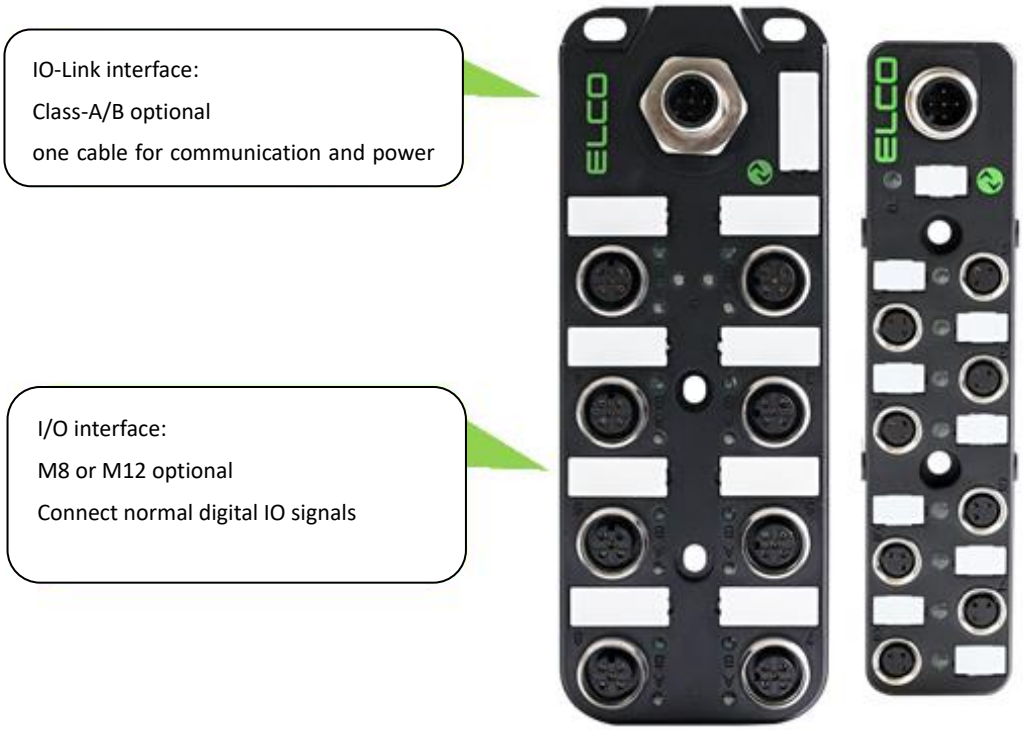


Each Compact67 series IO-Link master module occupies an EtherNet/IP slave address. Depending on the type, up to 8 IO-Link devices can be connected. Depending on the specific requirements, select the module of Class-A or Class-B interface.

As an EtherNet/IP slave, the Compact67 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. Due to there are two IO-Link specifications, Class-A and Class-B, users need to select different types of IO-Link master modules according to their needs and IO-Link device characteristics.

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 and M8.

M12 A-Code, 2 digital or 1 analog are available.

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

2.4.1 IO-Link master

Ordering data			
Product type	FCEI-8LKM-4A4B	FCEI-8LKM-8A	FCEI-4LKM-4A4S
Description	8 IO-Link ports	8 IO-Link ports	4 IO-Link ports
Communication			
Protocol	EtherNet/IP		
Operating modes	Auto-negotiation，Auto-MDI/MDI-X		
Transfer rate	10/100 Mbps		
Addressing	DHCP，BOOTP		
Media Redundancy Protocol	Support		
Power supply			
Supply voltage	24 VDC（18...30 VDC）		
Current consumption	Max. 200mA		
System & Input supply	Us，Max. 8A		
Output supply	Ua，Max. 8A		
Electrical isolation	Us and Ua completely isolated		
Connections			
Power supply	2 x 7/8'' 5pin，Male+Female		
Fieldbus	2 x M12 D-code 4pin，Female		
Signals	8 x M12 A-code 5pin，Female		
Interface			
IO-Link ports	8	8	4
IO-Link type	4*Class-A + 4*Class-B	8*Class-A	4*Class-A
IO-Link version	IO-Link V1.1		
IO-Link communication rates	COM1（4.8kbps）、COM2（38.4kbps）、COM3（230.4kbps）		
Input channels	Max. 12	Max. 16	Max. 16
Input supply current	IO-Link：1.6A per channel，Signal： 200mA per channel		
Auxiliary supply current	2A per channel		
Input type	PNP sensors，mechanical switches，dry contacts，etc..		
Input delay	1.6 ms		

Output channels	Max. 12	Max. 16	Max. 16
Output current	Max. 2A per channel (Pin2) Max. 100mA per channel (Pin4)		
Output type	Lamps，solenoid valve，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			
Protection	IP67		
Temperature	Operating -25...+70 °C，Storage -40...+85 °C		
Dimensions（W*H*D）	60x230x39 mm		

2.4.2 M12-16 signals IO-Link sensor hub

PNP signal type

Ordering data			
Product type	LKHA-1600P-M12	LKHA-0808P-M12	LKHA-16UP-M12
Description	16DI，Class-A，8*M12	8DI+8DO，Class-A，8*M12	16DI/DO，Class-A，8*M12
Connections			
IO-Link	Class-A：1 x M12 A-code 4pin，Male		
Power supply	Included in IO-Link interface		
Signals	8 x M12 A-code 5pin，Female		
Interface			
Input channels	16	8	-
Input supply current	Max. 200mA per channel		
Input type	PNP sensors，mechanical switches，dry contacts，etc..		
Input delay	1.6 ms		
Output channels	-	8	16
Output current	Max. 500mA per channel，2A in total		
Output type	Lamps，solenoid valve，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			
Protection	IP67		
Temperature	Operating -25...+70 °C，Storage -40...+85 °C		
Dimensions（W*H*D）	55x145x29 mm		

NPN signal type

Ordering data			
Product type	LKHA-1600N-M12	LKHA-0808N-M12	LKHA-16UN-M12
Description	16DI，Class-A，8*M12	8DI+8DO，Class-A，8*M12	16DI/DO，Class-A，8*M12
Connections			
IO-Link	Class-A：1 x M12 A-code 4pin，Male		
Power supply	Included in IO-Link interface		
Signals	8 x M12 A-code 5pin，Female		
Interface			
Input channels	16	8	-
Input supply current	Max. 200mA per channel		
Input type	NPN sensors，mechanical switches，dry contacts，etc..		
Input delay	1.6 ms		
Output channels	-	8	16
Output current	Max. 500mA per channel，2A in total		
Output type	Lamps，solenoid valve，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			
Protection	IP67		
Temperature	Operating -25...+70 °C，Storage -40...+85 °C		
Dimensions（W*H*D）	55x145x29 mm		

2.4.3 M8-8 signals IO-Link sensor hub

Ordering data		
Product type	LKHA-0800P-M8	LKHA-08UP-M8
Description	8DI，Class-A，8*M8	8DI/DO，Class-A，8*M8
Connections		
IO-Link	Class-A：1 x M12 A-code 4pin，Male	
Power supply	Included in IO-Link interface	
Signals	8 x M8　3pin，Female	
Interface		
Input channels	8	-
Input supply current	Max. 200mA per channel	
Input type	PNP sensors，mechanical switches，dry contacts，etc..	
Input delay	1.6 ms	
Output channels	-	8
Output current	Max. 500mA per channel，2A in total	
Output type	Lamps，solenoid valve，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		
Protection	IP67	
Temperature	Operating -25...+70 °C，Storage -40...+85 °C	
Dimensions（W*H*D）	55x145x29 mm	

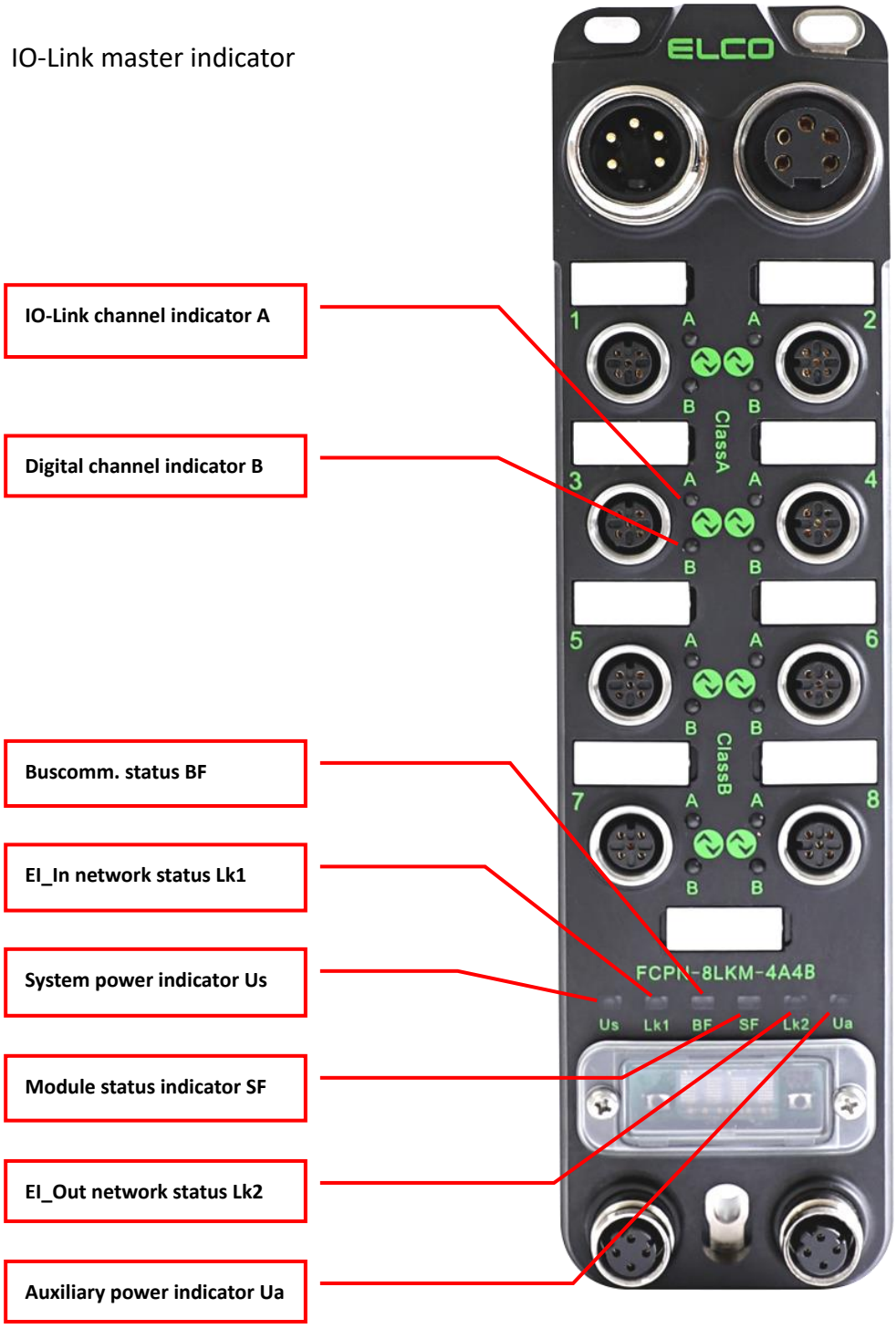
2.4.4 M12-8 signals IO-Link sensor hub

Ordering data		
Product type	LKHA-0800P-M12	LKHA-08UP-M12
Description	8DI，Class-A，4*M12	8DI/DO，Class-A，4*M12
Connections		
IO-Link	Class-A：1 x M12 A-code 4pin，Male	
Power supply	Included in IO-Link interface	
Signals	4 x M12 A-code 5pin，Female	
Interface		
Input channels	8	-
Input supply current	Max. 200mA per channel	
Input type	PNP sensors，mechanical switches，dry contacts，etc..	
Input delay	1.6 ms	
Output channels	-	8
Output current	Max. 500mA per channel，2A in total	
Output type	Lamps，solenoid valve，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		
Protection	IP67	
Temperature	Operating -25...+70 °C，Storage -40...+85 °C	
Dimensions（W*H*D）	55x93x29 mm	

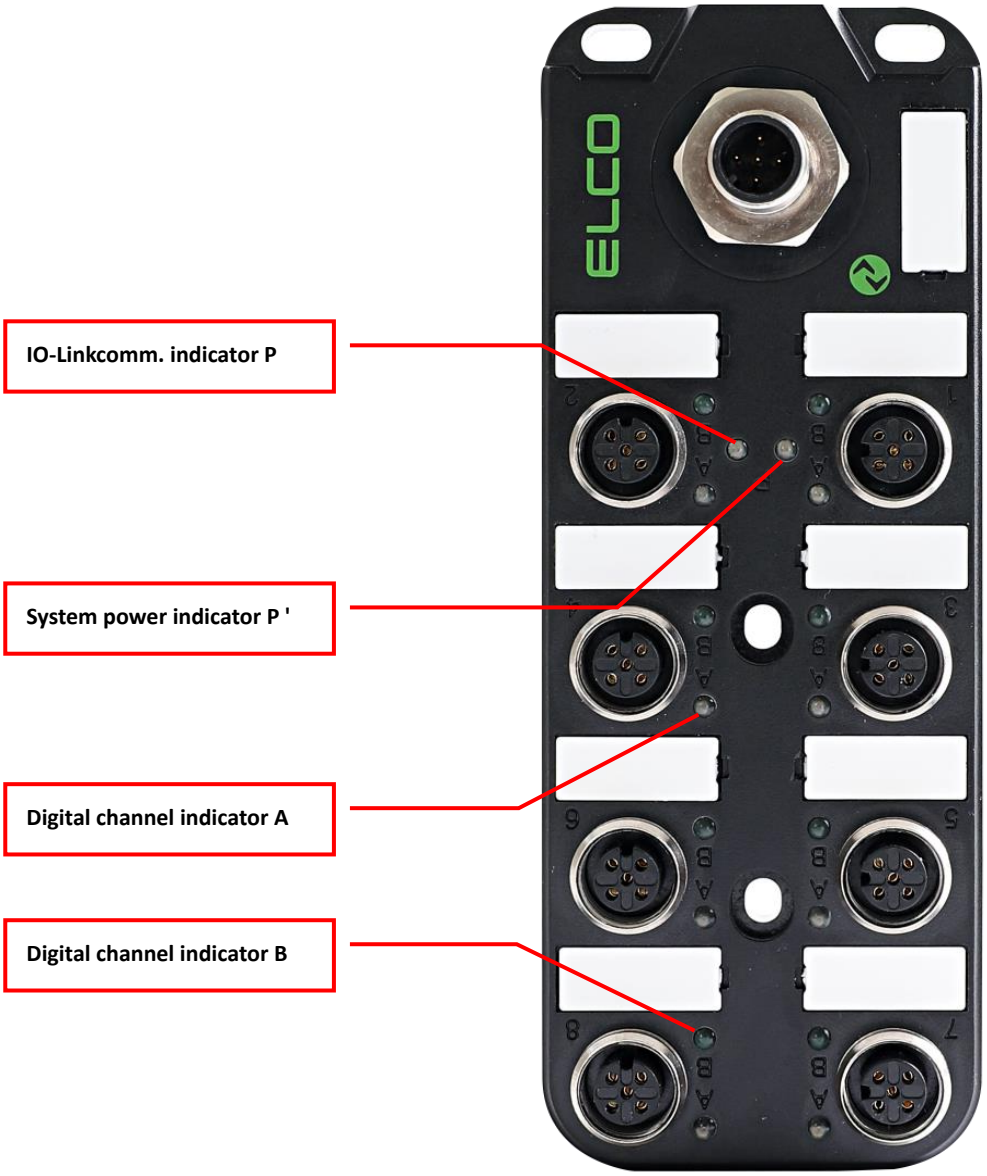
2.5 LED indicator

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



IO-Link sensor hub indicator

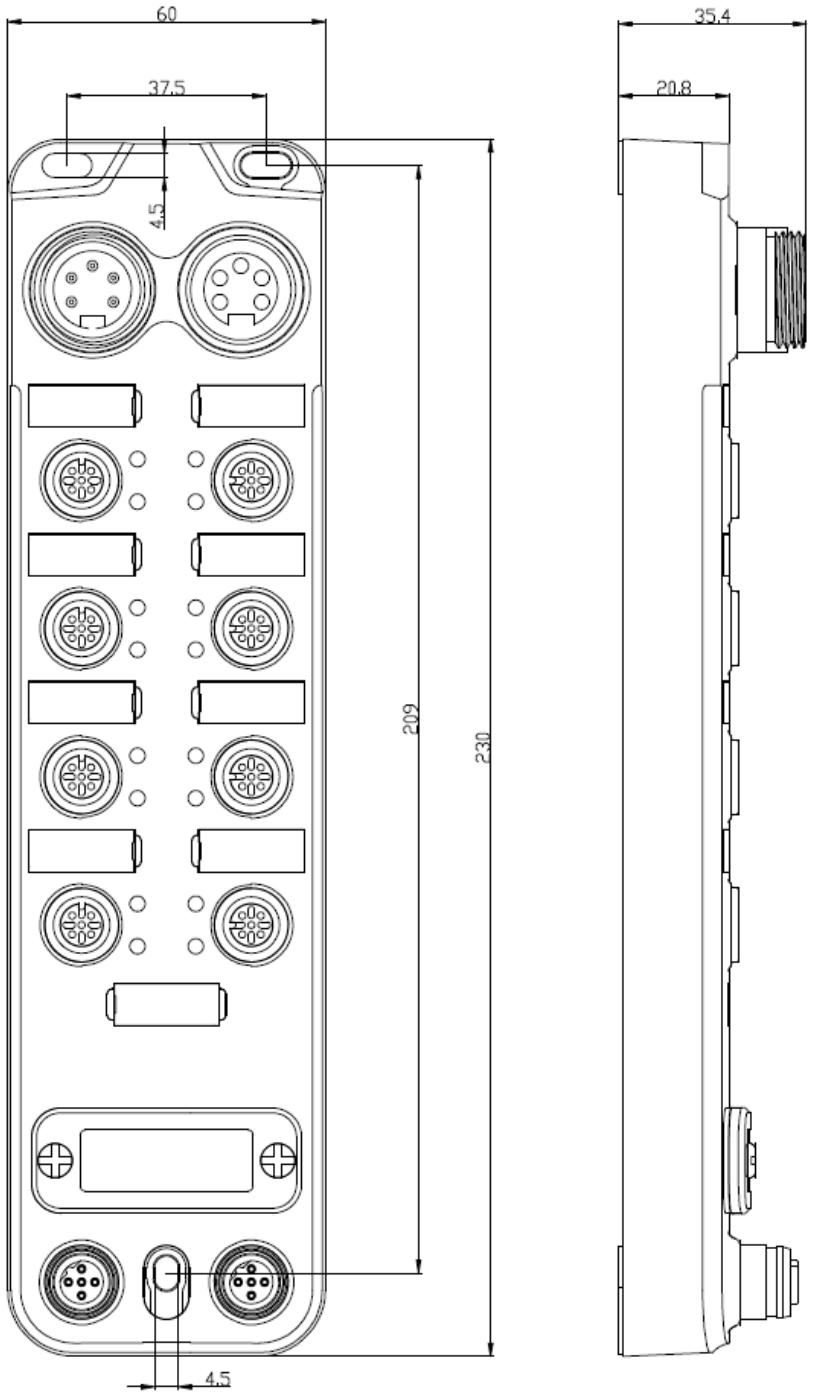


2.6 General system layout

3. Installation wiring

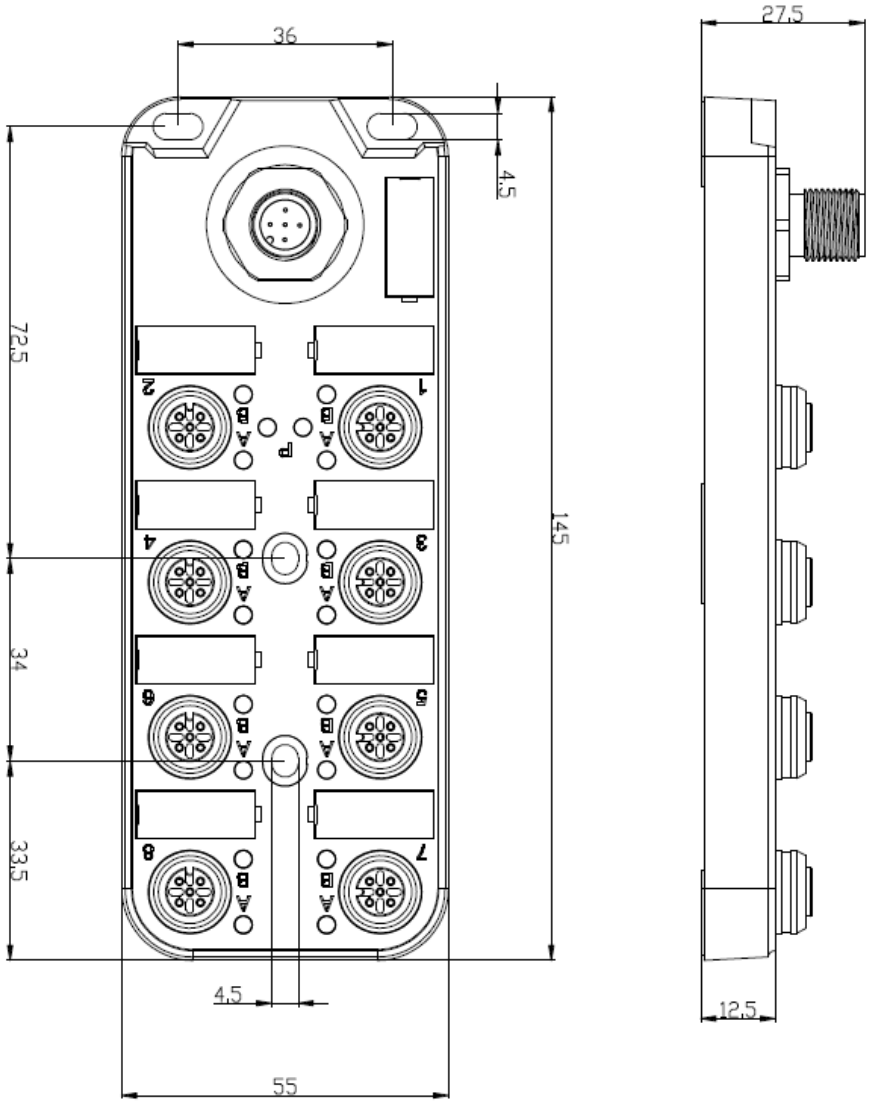
3.1 Installation dimensions

3.1.1 IO-Link master dimensions

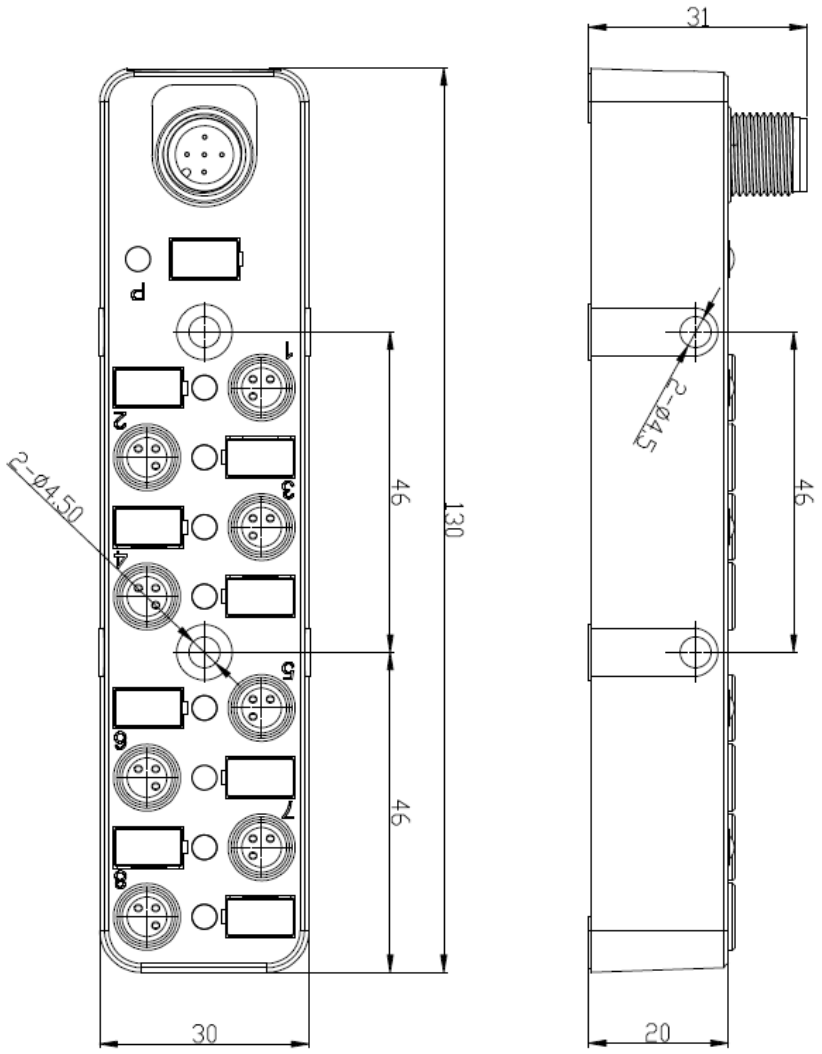


3.1.2 IO-Link sensor hub dimensions

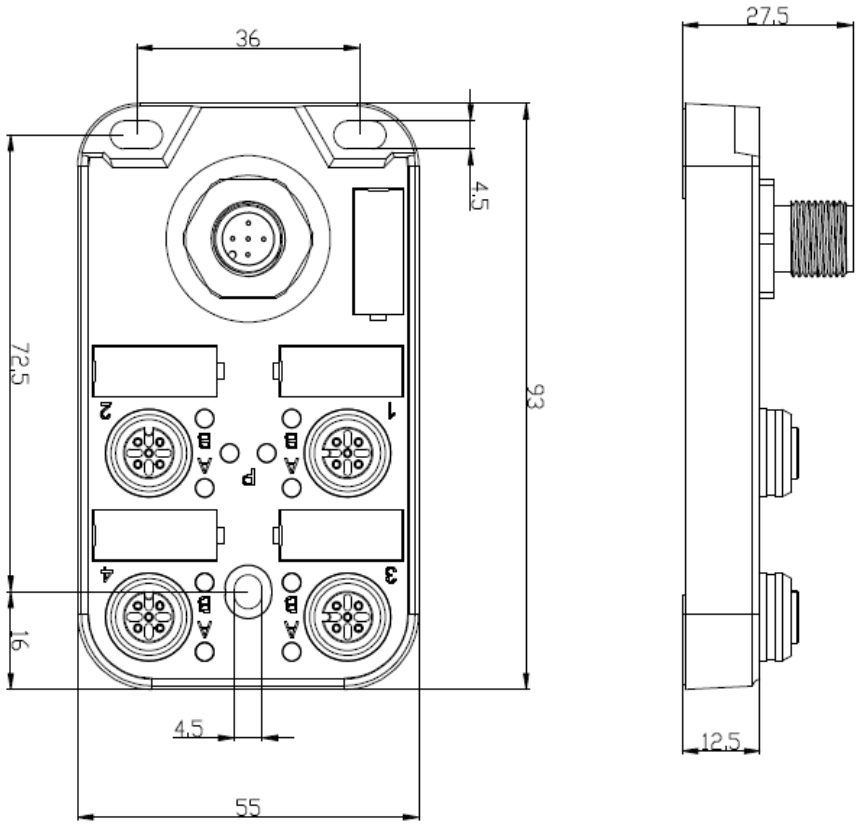
1）16 signals, M12 interface



2）8 signals, M8 interface



3) 8 signals, M12 interface



3.2 Installation position and size

Thanks to IP67 high protection level and excellent resistance to vibration and interference, Compact67 products can be installed in almost any location.

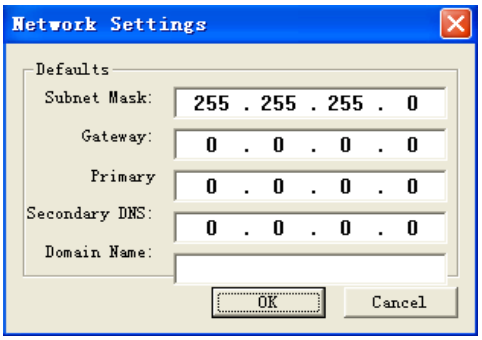
The Compact67 series uses a compact design to minimize installation space. Its IO-Link master module and IO-Link sensor hub use standard dimensions. The following table shows the module installation dimensions:

	Gateway	16 signals M12	8 signals M8	8 signals M12
Installation width	60mm	55mm	30mm	55mm
Installation height	230mm	145mm	130mm	93mm
Installation depth	35mm	29mm	31mm	29mm

3.3 Setting the IP Address of Compact67 module

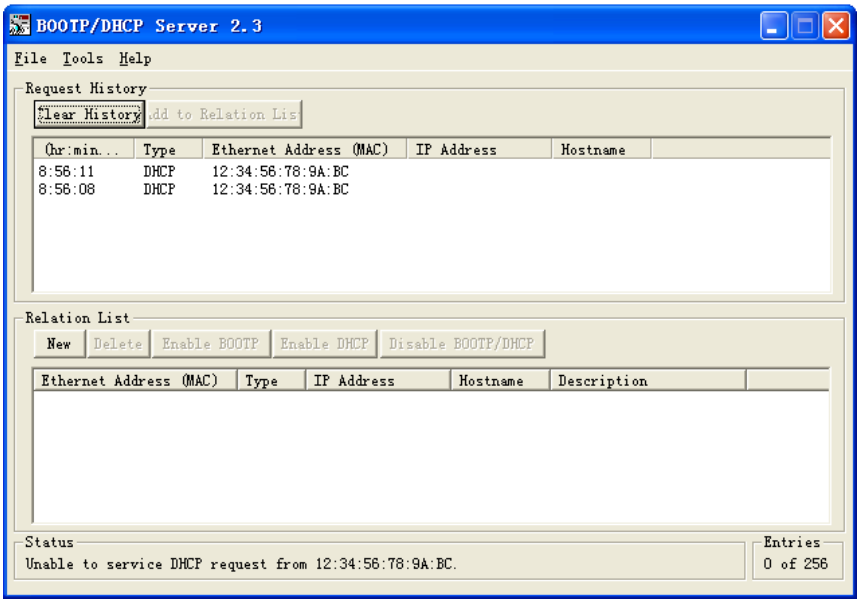
Before using the EtherNet/IP Compact67 module, you need to use the DHCP server of Rockwell software to assign IP addresses.

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



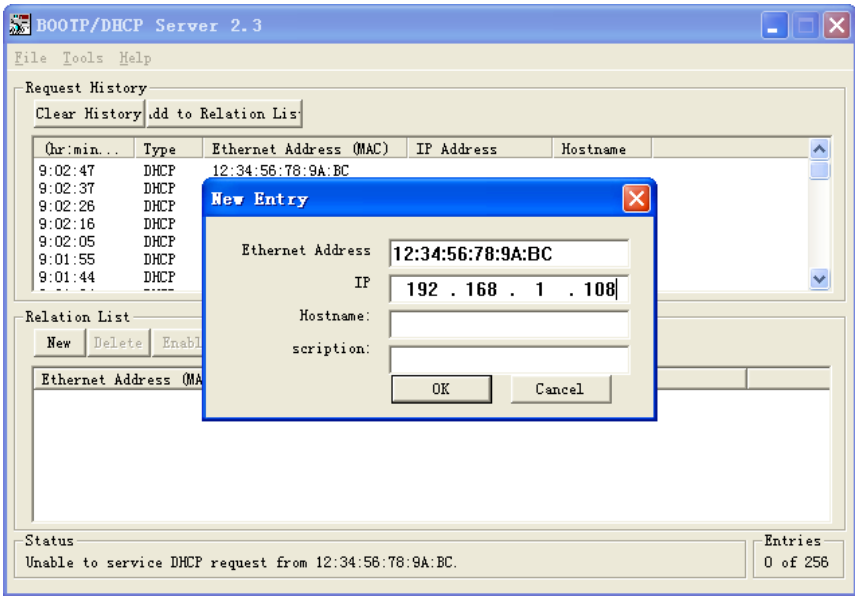
Then the DHCP server will find current gateway that has no IP address assigned on the network, and then click the gateway MAC address that needs to be assigned IP.

If the IP address has been assigned to the moduled and BOOTP/DHCP is disabled, it may not be found automatically. You need to click the 'New' button to manually add the MAC and original IP address of the module, and then click the 'Enable DHCP' button to search it. Then close the software and power on the module again to assign a new IP address.

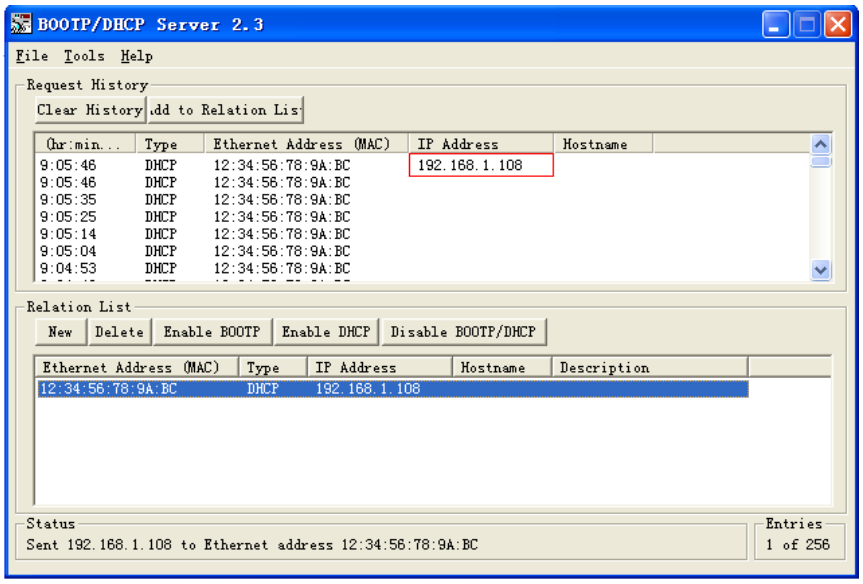


Then click Add to Relation List, or double-click MAC address, in the pop-up window, fill in IP address in IP bar, such as 192.168.1.108.

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

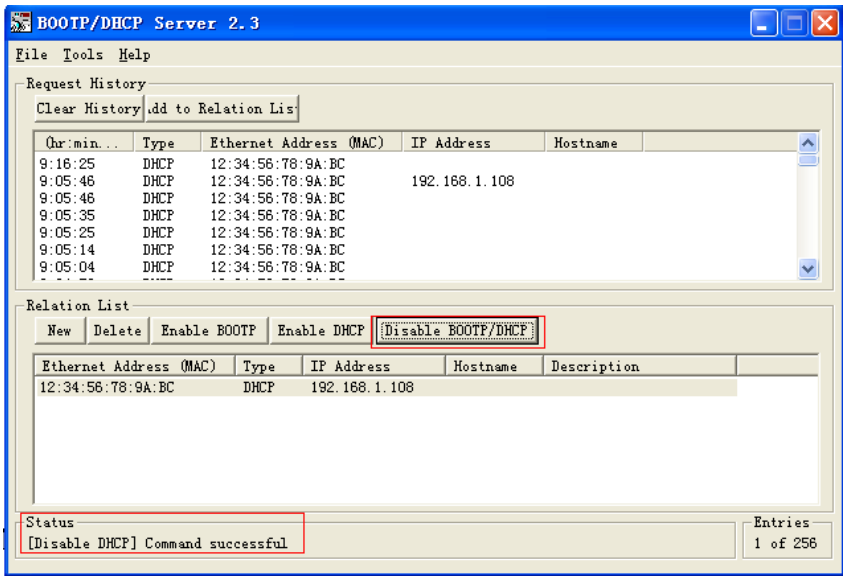


After the assigned IP address appears in the IP Address column in the list, the IP address of the device is assigned successfully. As follows:



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:



3.4 Wiring Compact67

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

3.4.1 Connecting Compact67 to protective earth (PE)

- Always connect the Compact67 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.

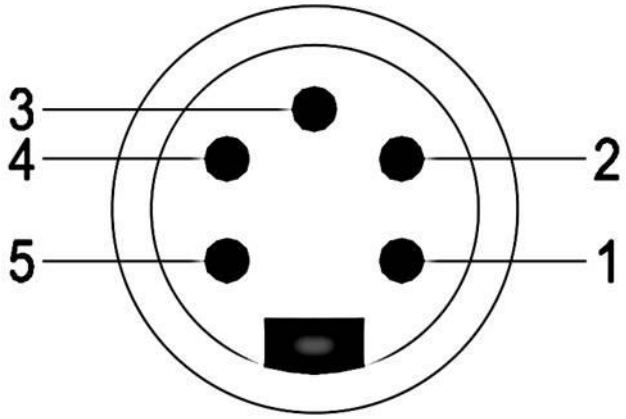
3.4.2 Compact67 power supply

Compact67 series IO-Link module adopts 24VDC power supply, and power IO-Link sensor hub by extensible cable, voltage range 18~30VDC, standard 7/8" connector. System and sensor power supply Us (+24V, 0V), auxiliary power supply Ua (P24, N24). Power supply Us and Ua of different types of modules have different isolation forms:

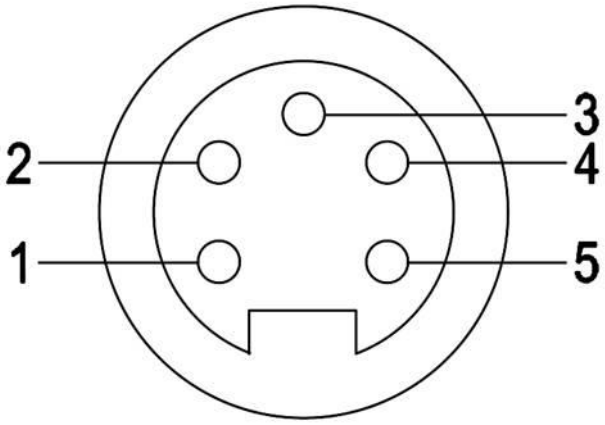
1）FCEI-8LKM-4A4B, the two power supply are completely isolated, that is, electrical isolation between+24V and P24, and electrical isolation between0V and N24.

2）FCEI-8LKM-8A and FCEI-4LKM-4A4S, the two power supply are partially isolated, that is, electrical isolation between+24V and P24, and internally connected between 0V and N24.

1）Power in(Male)



2） Power out (Female)



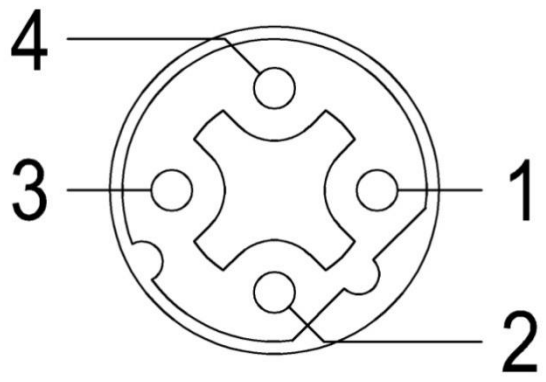
3） Power definition

Terminal	Function	Power supply
1	Auxiliary power supply Ua-	0V
2	System and sensor power supply Us-	0V
3	PE	
4	System and sensor power supply Us+	24V
5	Auxiliary power supply Ua+	24V

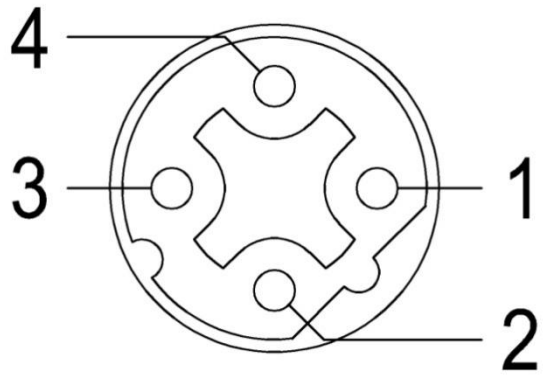
3.4.3 Compact67 BUS connection

Compact67 module, supporting EtherNet/IP protocol, transmits signals by a shielded cable, D-Code M12 connector.

1）BUS-In (Female)



2）BUS-Out (Female)



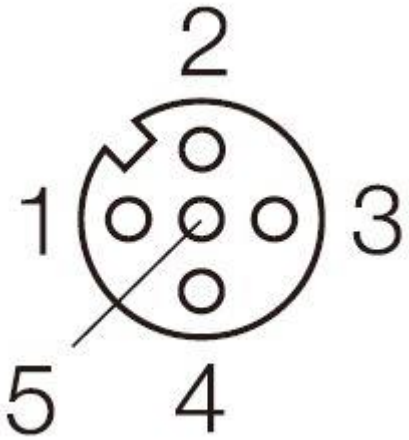
3）Bus definition

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

3.4.4 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)



M12 connector

2）IO-Link port pin definition

Terminal	Class-A	Class-B
1	Power supply 24V+	Power supply 24V+
2	Signal input/output B	Auxiliary power supply P24
3	Power supply GND	Power supply GND
4	IO-Link/input/output A	IO-Link/input/output A
5	-	Auxiliary power N24

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.

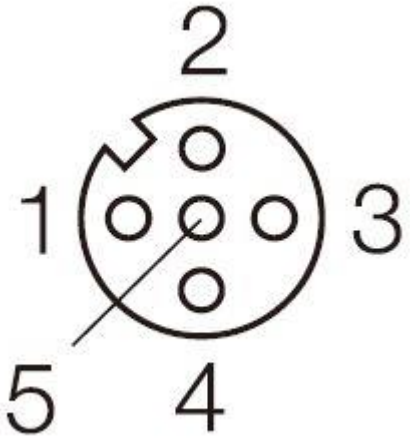
Note: For FCPN-8LKM-4A4B, Pin2 and Pin4 of Class-A interface and Pin4 of Class-B interface are also supplied by system power supply Us.

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.

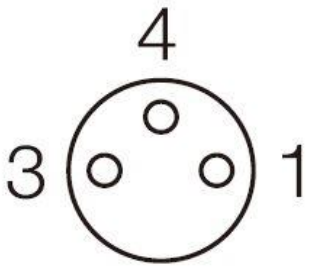
3.4.5 IO-Link hub digital signal cable connection

All Compact67 series IO-Link sensor hubs are connected through standard 5-pin M12 or 3-pin M8 connectors. Each M12 port can connect up to 2 signals (input or output), and each M8 port can connect 1 signal (input or output).

1）Signal I/O connector(Female)



M12 connector



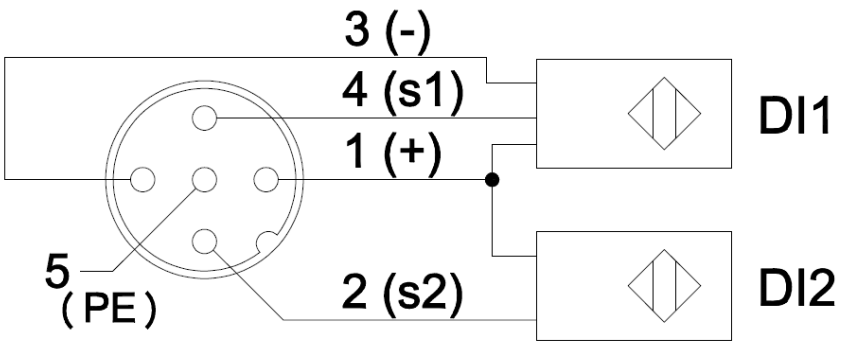
M8 connector

2）Digital signal port definition

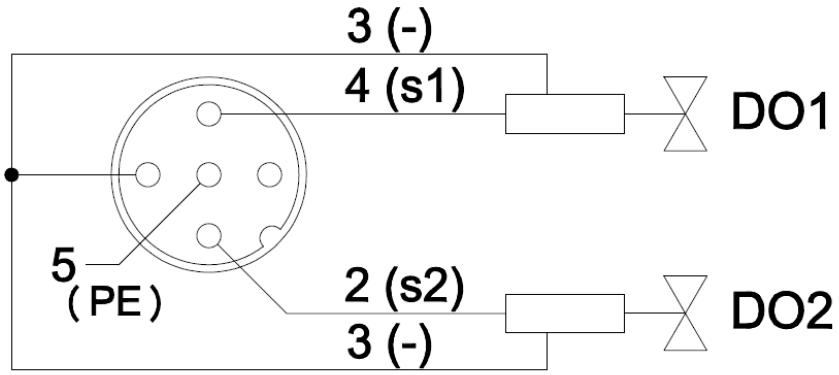
Terminal	M12 connector		M8 connector
1	Power supply 24V+		Power supply 24V +
2	Signal input/output B	2nd signal	-
3	Power supply GND		Power supply GND
4	Signal input/output A	1st signal	Signal input / output
5	Shielded grounding PE		-

3） Wiring example

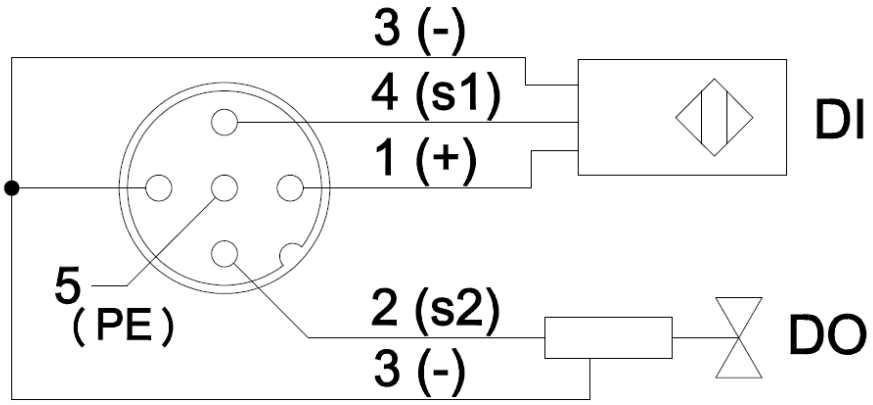
a） Double PNP input signal – 1 connector connects 2 DI, LKHA-1600P-M12, LKHA-0808P-M12, LKHA-16UP-M12, LKHA-0800P-M12, LKHA-08UP-M12 support this connection.



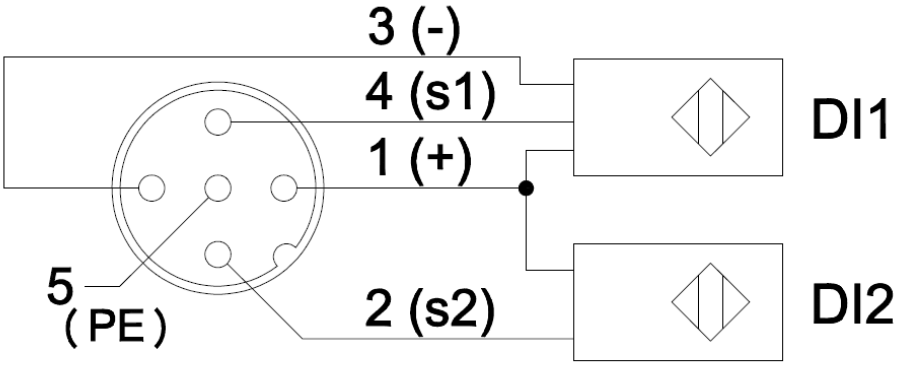
b） Double PNP output signal – 1 connector connects 2 DO, LKHA-0808P-M12, LKHA-16UP-M12, LKHA-08UP-M12 support this connection.



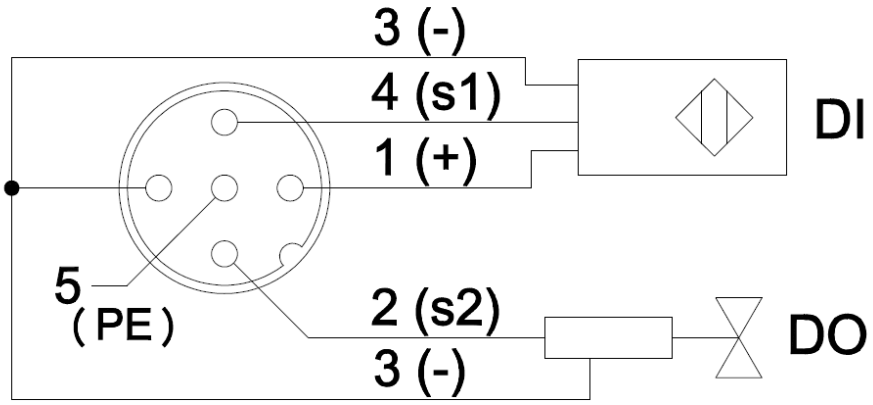
c） PNP Input and output signal – 1 connector connects 1 DI and 1 DO. LKHA-16UP-M12, LKHA-08UP-M12 support this connection.



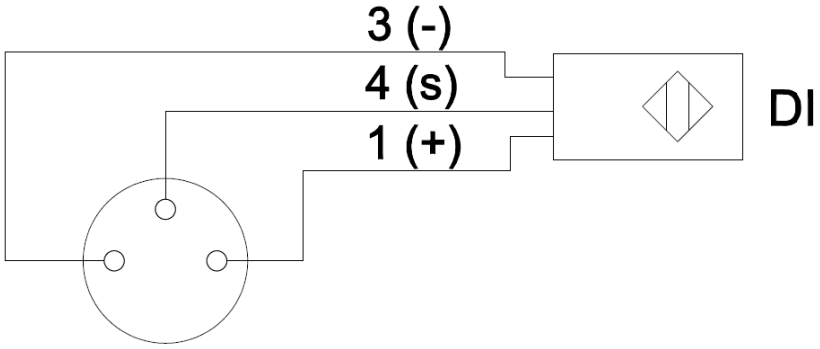
d） Double NPN input signal – 1 connector connects 2 DI, LKHA-1600N-M12, LKHA-16UN-M12 support this connection.



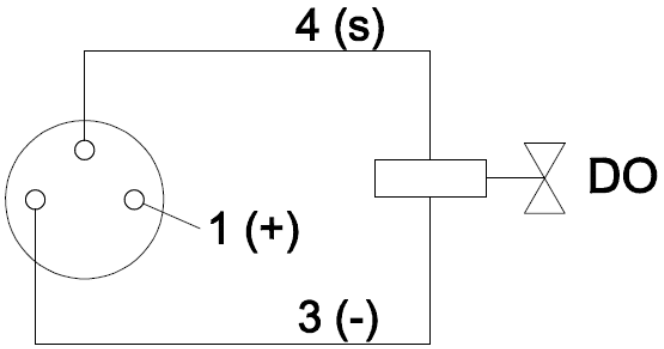
e）NPN Input and output signal – 1 connector connects 1 DI and 1 DO. LKHA-16UN-M12 support this connection.



f）Single PNP input signal – 1 connector connects 1 DI, LKHA-0800P-M8, LKHA-08UP-M8 support this connection.



g）Single PNP output signal – 1 connector connects 1 DO, LKHA-08UP-M8 support this connection.



3.5 Signal address assignment

This part mainly introduces the compact67 module signal point order and address allocation, mainly to show the signal sequence. Due to the different addressing methods in different PLC systems, this paper describes the system in terms of BYTE, and the system in terms of WORD or DWORD can be arranged in the same order.
Each Ethernet / IP IO-link master will occupy 128 bytes input and 128 bytes output, of which the first 8-byte input and the first 2-byte output are used as IO-Link master transfer status, the 9th to 10th byte input and the 3rd to 4th byte output are used as IO-Link master switch signal, the 11th to 128th byte input and the 5th to 128th byte output are used as IO-Link slave station signal address usage.

3.5.1 IO-Link master signal address assignment

Each Compact67 series IO-Link master has 8 M12 ports (Port1 ~ Port8), which are used to expand IO-Link communication or connect digital input and output. Each connector has 5 pins (Pin1 ~ Pin5). At present, the IO-Link master has the following three models, the type and number of channels as follows:

No.	Model	IO-Link channel	Input signal	Output signal
1	FCEI-8LKM-4A4B	4*Class-A + 4*Class-B	Max.12	Max.12
2	FCEI-8LKM-8A	8*Class-A	Max.16	Max.16
3	FCEI-4LKM-4A4S	4*Class-A + 4*SIO	Max.16	Max.16

The IO-Link master interface is configured as a normal digital input and output by default in the program, occupying 2 bytes input and 2 bytes output. Customers can set the corresponding ports to IO-Link communication mode according to their needs. For specific methods, please refer to the descriptions in the following sections.

For the common input and output signals of IO-Link master, 2 input bytes and 2 output bytes indicate the signal status. In order to maintain uniformity, all signal addresses are arranged in order, even unused points will occupy corresponding addresses. Next, the corresponding relationship between the signal status of each connector and the Ethernet/IP bus transmission bytes will be displayed in the model list.

1）4A+4B, 8 ports IO-Link master module FCEI-8LKM-4A4B

Byte	Bit	Connector	e.g.
Input/Output Byte 0	Bit 0	Port1.Pin4	I 0.0 Q 0.0
	Bit 1	Port1.Pin2	I 0.1 Q 0.1
	Bit 2	Port2.Pin4	I 0.2 Q 0.2
	Bit 3	Port2.Pin2	I 0.3 Q 0.3
	Bit 4	Port3.Pin4	I 0.4 Q 0.4
	Bit 5	Port3.Pin2	I 0.5 Q 0.5
	Bit 6	Port4.Pin4	I 0.6 Q 0.6
	Bit 7	Port4.Pin2	I 0.7 Q 0.7
Input/Output Byte 1	Bit 0	Port5.Pin4	I 1.0 Q 1.0
	Bit 1	Port5.Pin2	For auxiliary power supply
	Bit 2	Port6.Pin4	I 1.2 Q 1.2
	Bit 3	Port6.Pin2	For auxiliary power supply
	Bit 4	Port7.Pin4	I 1.4 Q 1.4
	Bit 5	Port7.Pin2	For auxiliary power supply
	Bit 6	Port8.Pin4	I 1.6 Q 1.6
	Bit 7	Port8.Pin2	For auxiliary power supply

2）8A, 8 ports IO-Link master module FCEI-8LKM-8A

Byte	Bit	Connector	e.g.
Input/Output Byte 0	Bit 0	Port1.Pin4	I 0.0 Q 0.0
	Bit 1	Port1.Pin2	I 0.1 Q 0.1
	Bit 2	Port2.Pin4	I 0.2 Q 0.2
	Bit 3	Port2.Pin2	I 0.3 Q 0.3
	Bit 4	Port3.Pin4	I 0.4 Q 0.4
	Bit 5	Port3.Pin2	I 0.5 Q 0.5
	Bit 6	Port4.Pin4	I 0.6 Q 0.6
	Bit 7	Port4.Pin2	I 0.7 Q 0.7
Input/Output Byte 1	Bit 0	Port5.Pin4	I 1.0 Q 1.0
	Bit 1	Port5.Pin2	I 1.1 Q 1.1
	Bit 2	Port6.Pin4	I 1.2 Q 1.2
	Bit 3	Port6.Pin2	I 1.3 Q 1.3
	Bit 4	Port7.Pin4	I 1.4 Q 1.4
	Bit 5	Port7.Pin2	I 1.5 Q 1.5
	Bit 6	Port8.Pin4	I 1.6 Q 1.6
	Bit 7	Port8.Pin2	I 1.7 Q 1.7

3）4A+4S, 4 ports IO-Link master module FCEI-4LKM-4A4S

Byte	Bit	Connector	e.g.
Input/Output Byte 0	Bit 0	Port1.Pin4	I 0.0 Q 0.0
	Bit 1	Port1.Pin2	I 0.1 Q 0.1
	Bit 2	Port2.Pin4	I 0.2 Q 0.2
	Bit 3	Port2.Pin2	I 0.3 Q 0.3
	Bit 4	Port3.Pin4	I 0.4 Q 0.4
	Bit 5	Port3.Pin2	I 0.5 Q 0.5
	Bit 6	Port4.Pin4	I 0.6 Q 0.6
	Bit 7	Port4.Pin2	I 0.7 Q 0.7
Input/Output Byte 1	Bit 0	Port5.Pin4	I 1.0 Q 1.0
	Bit 1	Port5.Pin2	I 1.1 Q 1.1
	Bit 2	Port6.Pin4	I 1.2 Q 1.2
	Bit 3	Port6.Pin2	I 1.3 Q 1.3
	Bit 4	Port7.Pin4	I 1.4 Q 1.4
	Bit 5	Port7.Pin2	I 1.5 Q 1.5
	Bit 6	Port8.Pin4	I 1.6 Q 1.6
	Bit 7	Port8.Pin2	I 1.7 Q 1.7

3.5.2 IO-Link sensor hub signal address assignment

Compact67 series IO-Link hubs have three dimensions: 16 signals_8 M12 ports (Port1 ~ Port8), 8 signals_8 M8 ports (Port1 ~ Port8), 8 signals_4 M12 ports (Port1 ~ Port4). Each M12 port has 5 pins (Pin1 ~ Pin5) and each M8 port has 3 pins (Pin1, Pin3, Pin4). The following table shows the matchup between the signal status of each connector and the EtherNet/IP bus transmission byte.

1）8 DI modules LKHA-0800P-M12, LKHA-0800P-M8

This module takes 1 byte of input.

Byte	Bit	M12 connector LKHA-0800P-M12	M8 connector LKHA-0800P-M8	e. g.
Input Byte 0	Bit 0	P1.Pin4	P1.Pin4	I 0.0
	Bit 1	P1.Pin2	P2.Pin4	I 0.1
	Bit 2	P2.Pin4	P3.Pin4	I 0.2
	Bit 3	P2.Pin2	P4.Pin4	I 0.3
	Bit 4	P3.Pin4	P5.Pin4	I 0.4
	Bit 5	P3.Pin2	P6.Pin4	I 0.5
	Bit 6	P4.Pin4	P7.Pin4	I 0.6
	Bit 7	P4.Pin2	P8.Pin4	I 0.7

2）4 DI 4 DO module LKHA-0404P-M8

This module takes 1 byte of input and 1 byte of output, but since each signal has only 4 pins, the input signal occupies I 0.0 ~ I 0.3, the rest I 0.4 ~ I 0.7 is useless, and the output signal occupies Q 0.4 ~ Q 0.7, the rest Q 0.0 ~ Q 0.3 is useless.

Byte	Bit	M8 connector LKHA-0404P-M8	e. g.
Input Byte 0	Bit 0	P1.Pin4	I 0.0
	Bit 1	P2.Pin4	I 0.1
	Bit 2	P3.Pin4	I 0.2
	Bit 3	P4.Pin4	I 0.3
Output Byte 0	Bit 4	P5.Pin4	Q 0.4
	Bit 5	P6.Pin4	Q 0.5
	Bit 6	P7.Pin4	Q 0.6
	Bit 7	P8.Pin4	Q 0.7

3）8DI/ DO module LKHA-08UP-M12, LKHA-08UP-M8

The module occupies 8 bits for input and 8 bits for output; I-address and Q-address are configurable according to actual application, and the rest addresses are useless. E.g. two signals of first interface are used as input, then I 0.0 and I 0.1 are occupied; Q 0.0 and Q 0.1 are useless.

Byte	Bit	M12 connector LKHA-0800P-M12	M8 connector LKHA-0800P-M8	e. g.
Input/Output Byte 0	Bit 0	P1.Pin4	P1.Pin4	I 0.0 Q 0.0
	Bit 1	P1.Pin2	P2.Pin4	I 0.1 Q 0.1
	Bit 2	P2.Pin4	P3.Pin4	I 0.2 Q 0.2
	Bit 3	P2.Pin2	P4.Pin4	I 0.3 Q 0.3
	Bit 4	P3.Pin4	P5.Pin4	I 0.4 Q 0.4
	Bit 5	P3.Pin2	P6.Pin4	I 0.5 Q 0.5
	Bit 6	P4.Pin4	P7.Pin4	I 0.6 Q 0.6
	Bit 7	P4.Pin2	P8.Pin4	I 0.7 Q 0.7

4）16 DI module LKHA-1600P-M12, LKHA-1600N-M12

This module takes 2 bytes of input.

Byte	Bit	M12 connector	e. g.
Input Byte 0	Bit 0	Port1.Pin4	I 0.0
	Bit 1	Port1.Pin2	I 0.1
	Bit 2	Port2.Pin4	I 0.2
	Bit 3	Port2.Pin2	I 0.3
	Bit 4	Port3.Pin4	I 0.4
	Bit 5	Port3.Pin2	I 0.5
	Bit 6	Port4.Pin4	I 0.6
	Bit 7	Port4.Pin2	I 0.7
Input Byte 1	Bit 0	Port5.Pin4	I 1.0
	Bit 1	Port5.Pin2	I 1.1
	Bit 2	Port6.Pin4	I 1.2
	Bit 3	Port6.Pin2	I 1.3
	Bit 4	Port7.Pin4	I 1.4
	Bit 5	Port7.Pin2	I 1.5
	Bit 6	Port8.Pin4	I 1.6
	Bit 7	Port8.Pin2	I 1.7

5）8 DI + 8 DO module LKHA-0808P-M12

This module takes 1 byte of input and 1 byte of output.

Byte	Bit	M12 connector	e. g.
Input Byte 0	Bit 0	Port1.Pin4	I 0.0
	Bit 1	Port1.Pin2	I 0.1
	Bit 2	Port2.Pin4	I 0.2
	Bit 3	Port2.Pin2	I 0.3
	Bit 4	Port3.Pin4	I 0.4
	Bit 5	Port3.Pin2	I 0.5
	Bit 6	Port4.Pin4	I 0.6
	Bit 7	Port4.Pin2	I 0.7
Output Byte 0	Bit 0	Port5.Pin4	Q 0.0
	Bit 1	Port5.Pin2	Q 0.1
	Bit 2	Port6.Pin4	Q 0.2
	Bit 3	Port6.Pin2	Q 0.3
	Bit 4	Port7.Pin4	Q 0.4
	Bit 5	Port7.Pin2	Q 0.5
	Bit 6	Port8.Pin4	Q 0.6
	Bit 7	Port8.Pin2	Q 0.7

6）16 DI/DO module LKHA-16UP-M12, LKHA-16UN-M12

The module occupies 16 bits for input and 16 bits for output; I-address and Q-address are configurable according to actual application, and the rest addresses are useless. E.g. two signals of first interface are used as input, then I 0.0 and I 0.1 are occupied; Q 0.0 and Q 0.1 are useless.

Byte	Bit	M12 connector	e. g.
Input/Output Byte 0	Bit 0	Port1.Pin4	I 0.0 Q 0.0
	Bit 1	Port1.Pin2	I 0.1 Q 0.1
	Bit 2	Port2.Pin4	I 0.2 Q 0.2
	Bit 3	Port2.Pin2	I 0.3 Q 0.3
	Bit 4	Port3.Pin4	I 0.4 Q 0.4
	Bit 5	Port3.Pin2	I 0.5 Q 0.5
	Bit 6	Port4.Pin4	I 0.6 Q 0.6
	Bit 7	Port4.Pin2	I 0.7 Q 0.7
Input/Output Byte 1	Bit 0	Port5.Pin4	I 1.0 Q 1.0
	Bit 1	Port5.Pin2	I 1.1 Q 1.1
	Bit 2	Port6.Pin4	I 1.2 Q 1.2
	Bit 3	Port6.Pin2	I 1.3 Q 1.3
	Bit 4	Port7.Pin4	I 1.4 Q 1.4
	Bit 5	Port7.Pin2	I 1.5 Q 1.5
	Bit 6	Port8.Pin4	I 1.6 Q 1.6
	Bit 7	Port8.Pin2	I 1.7 Q 1.7

4. Configuration Commissioning （Omron PLC)

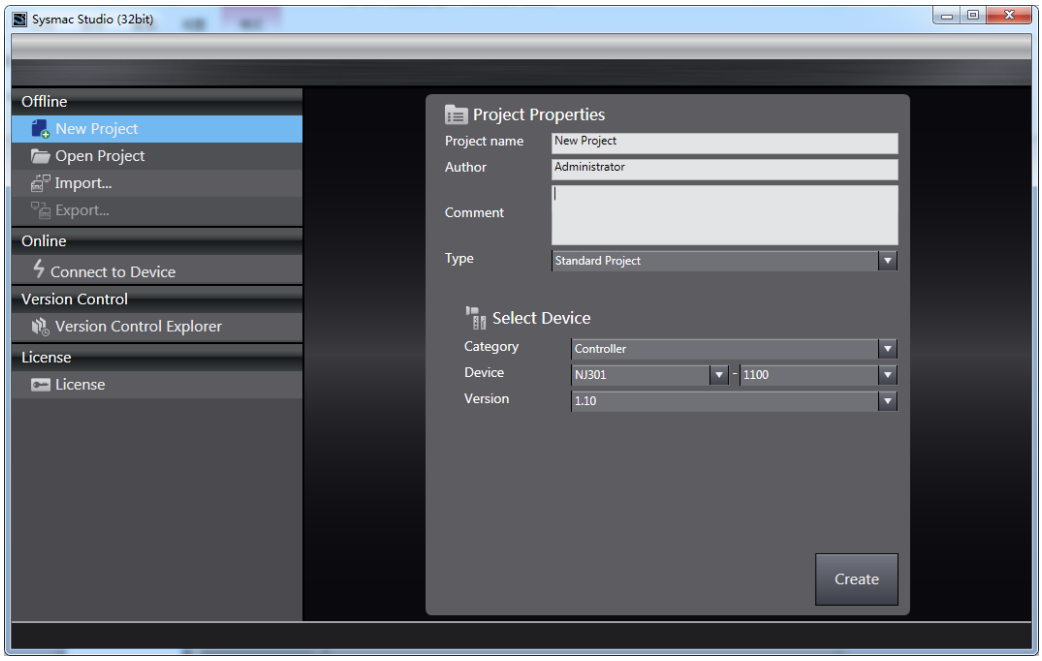
This example uses ELCO IO-Link series Compact67 module as Ethernet/IP slave station to connect Omron's controller NJ301-1100 with Ethernet/IP interface. By default, SYSMAC Studio has been installed and all network card information, power supply and bus connection has been completed. The IP address of Compact67 module is set to 192.168.250.7 (refer to section 3.3 for setting method).

Compact67 system consists of an IO-Link master FCEI-8LKM-8A. Port1 of the master station is connected to IO-Link hub LKHA-16UP-M12, Port2 is connected to IO-Link hub LKHA-0808P-M12, Port6 is connected to IO-Link hub LKHA-0800P-M12, and other port interfaces Pin4 is set to input and Pin2 is set to input/output.

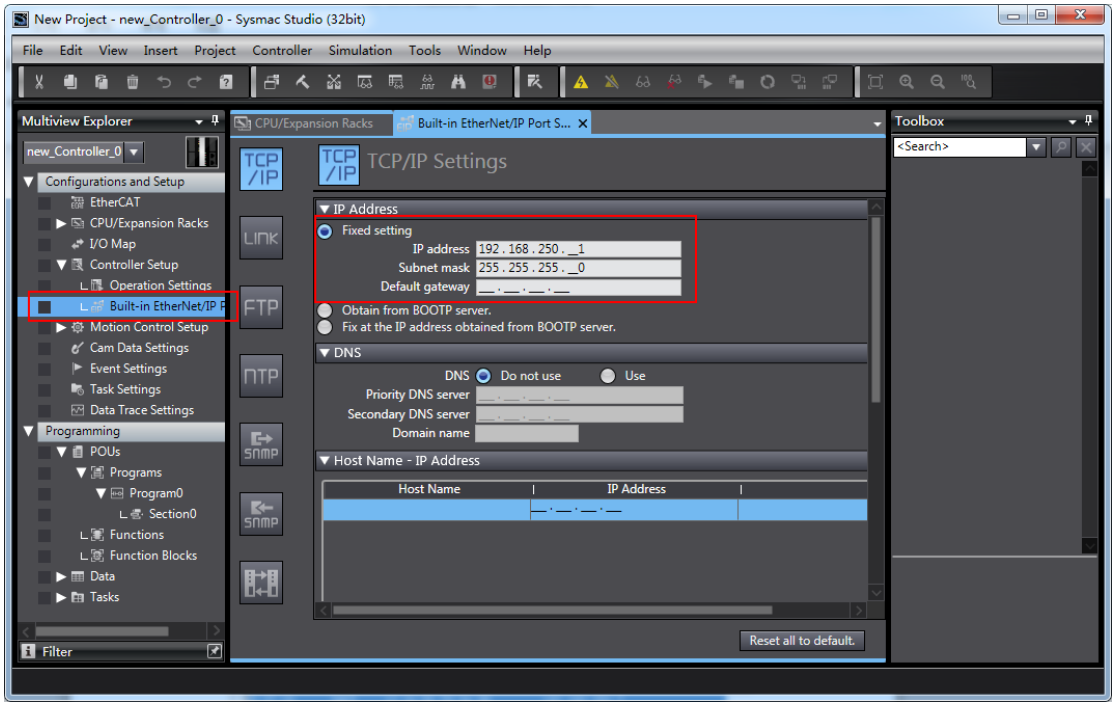
We show the specific software configuration debugging process in the form of pictures.

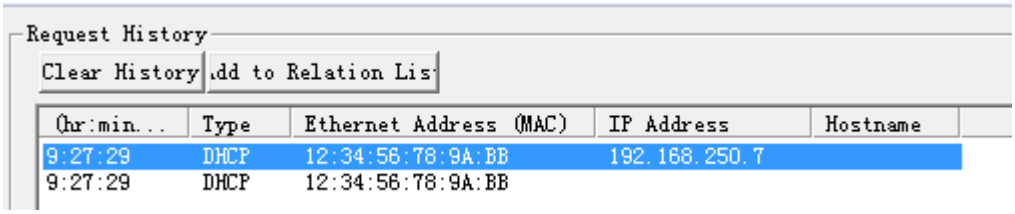
1） Run Sysmac Studio, and then select "New Project".

2） Fill in the corresponding information according to the PLC model and click "create" button.

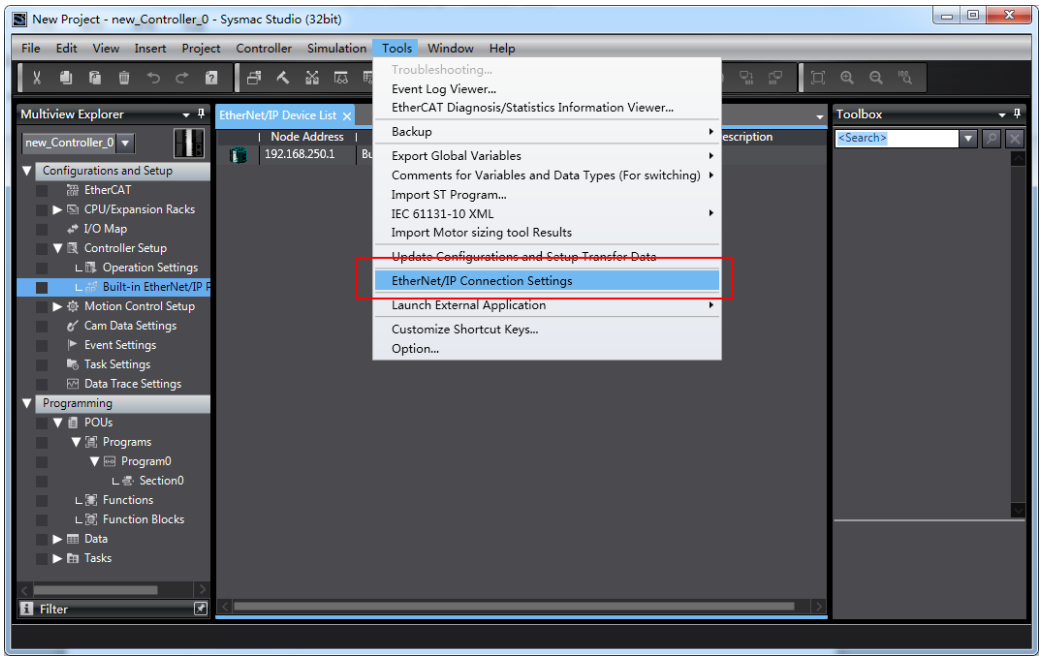


3）In this case, the default IP address of PLC is 192.168.250.1, and the corresponding IP address of compact67 module is 192.168.250.7. Pay attention to set PLC and module to the same network segment. Refer to Section 3.3 for IP setting method of module.

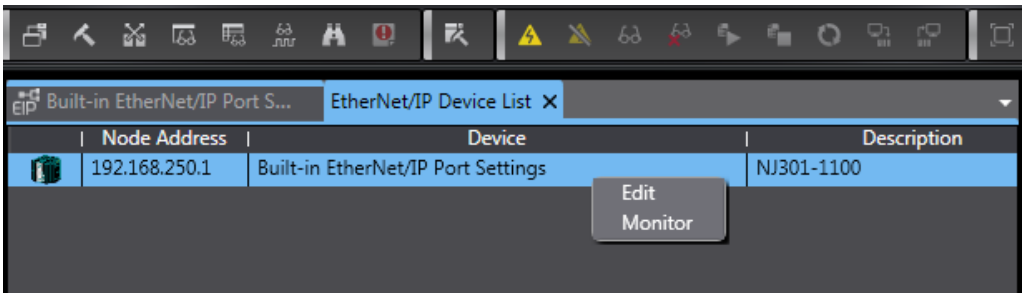

New Project - new_Controller_0 - Sysmac Studio (32bit)
File Edit View Insert Project Controller Simulation Tools Window Help
Multiview Explorer
new_Controller_0
Configurations and Setup
EtherCAT
CPU/Expansion Racks
I/O Map
Controller Setup
Operation Settings
Built-in EtherNet/IP P
Motion Control Setup
Cam Data Settings
Event Settings
Task Settings
Data Trace Settings
Programming
POUs
Programs
Program0
Section0
Functions
Function Blocks
Data
Tasks
Filter
CPU/Expansion Racks
Built-in EtherNet/IP Port S...
TCP/IP Settings
IP Address
Fixed setting
IP address 192 . 168 . 250 . 1
Subnet mask 255 . 255 . 255 . 0
Default gateway
Obtain from BOOTP server.
Fix at the IP address obtained from BOOTP server.
DNS
DNS Do not use Use
Priority DNS server
Secondary DNS server
Domain name
Host Name - IP Address
Host Name
IP Address
Reset all to default.
Toolbox
<Search>


Request History
Clear History
dd to Relation Lis
(hr:min...
Type
Ethernet Address (MAC)
IP Address
Hostname
9:27:29 DHCP 12:34:56:78:9A:BB 192.168.250.7
9:27:29 DHCP 12:34:56:78:9A:BB

4）Start to set the Ethernet/IP network, and select "Tools > Ethernet/IP Connection Settings" in the menu bar.

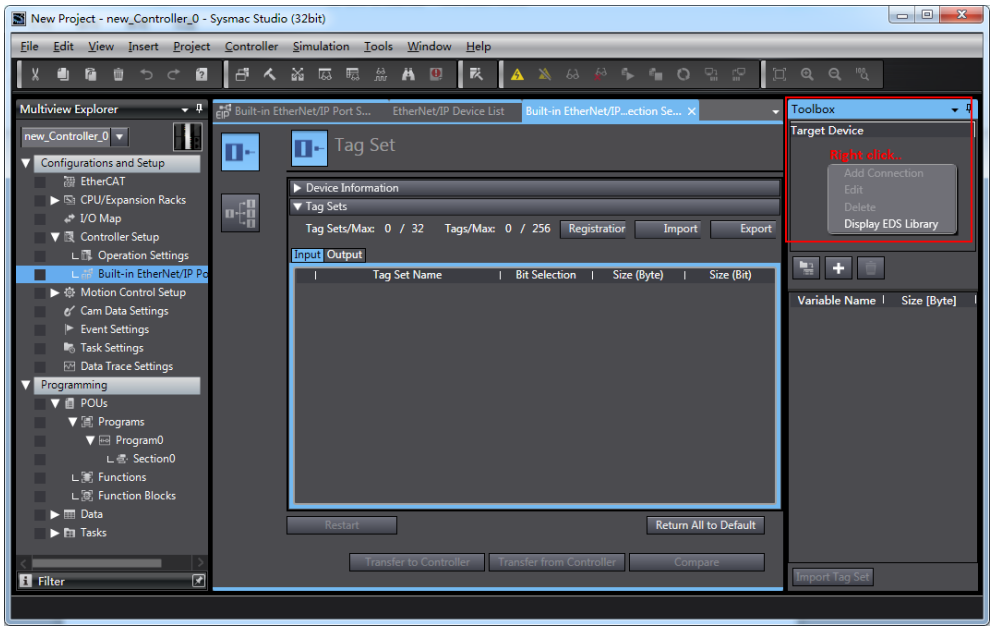


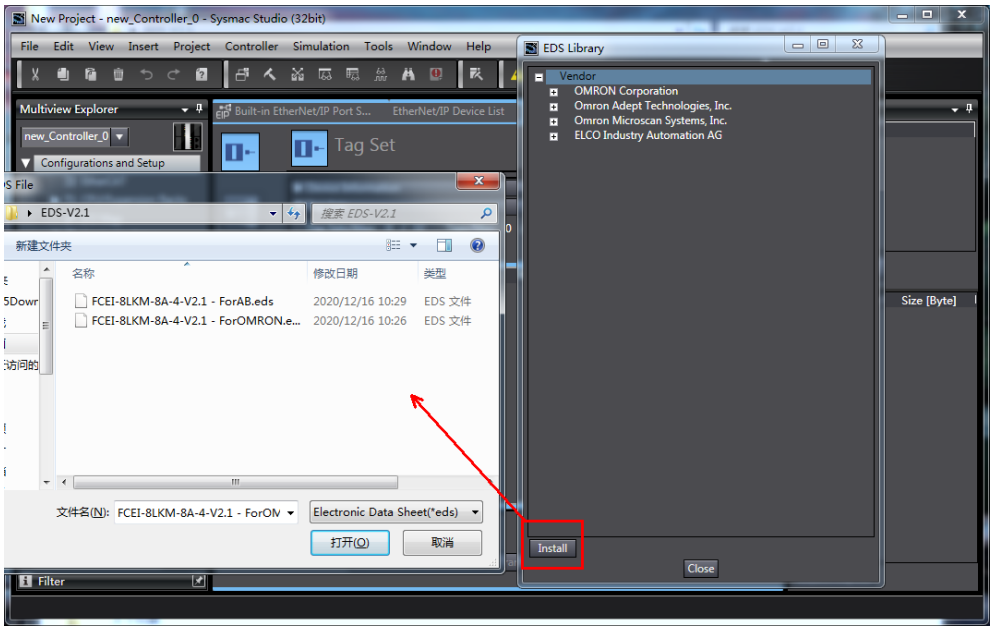
In the newly opened interface, double-click or right-click to edit the built-in Ethernet/IP port setting of PLC to open the connection setting interface.



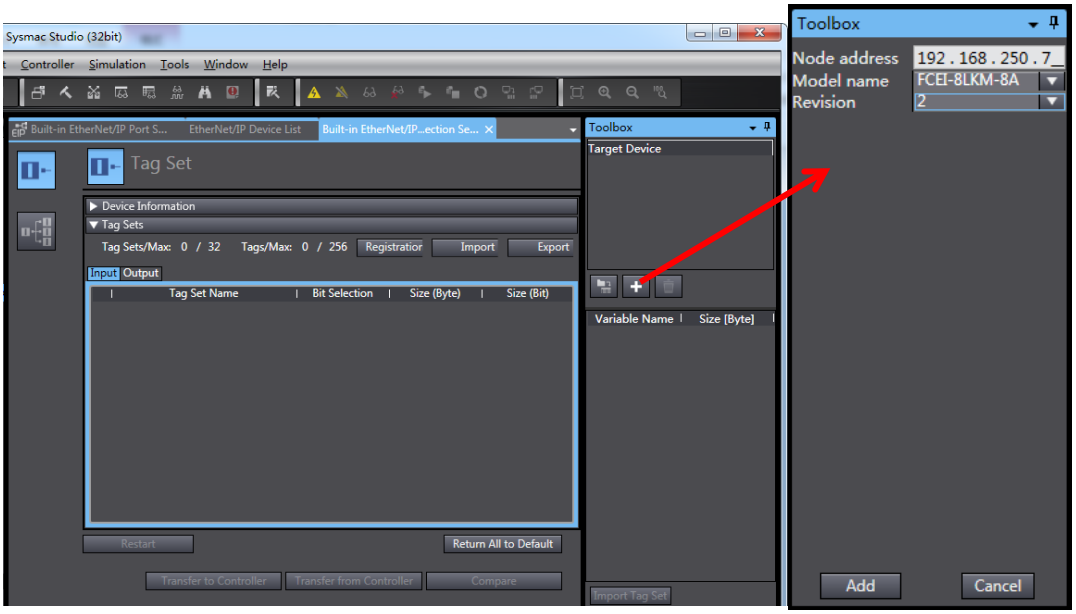
5）Before network configuration, install the EDS file of Compact67 distributed I/O module. This configuration file (.EDS format) is used to integrate Compact67 into your system as a standard Ethernet/IP slave. You can visit ELCO's website to get the latest EDS files or call the customer service hotline to contact the technicians.

Right click in the toolbox on the right side of connection settings and select "display EDS library". In the new pop-up window, click "Install" button to find the path of EDS file, and select "fcei-8lkm-8a. EDS" file to install. Please refer to the following picture for specific steps.

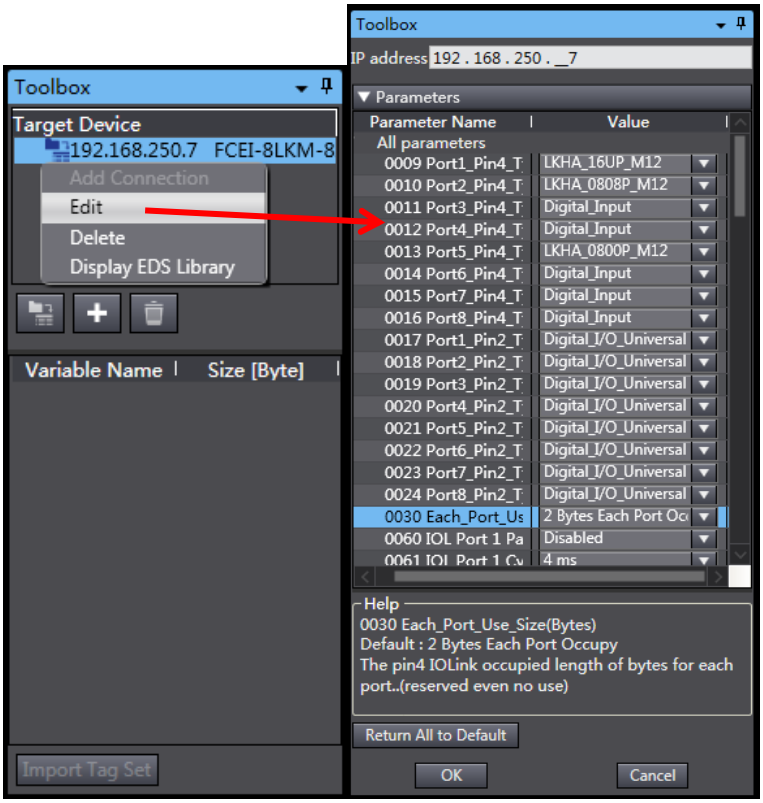




6）Click the "+" button in the toolbox, fill in the IP address of the module to be configured in the pop-up window (192.168.250.7 in this example), select the model FCEI-8LKM-8A of the IO link master station in the model name, select the latest revision version, and then click the "add" button.



7）Right click the newly added "Target Device - > 192.168.250.7 FCEI-8LKM-8A Rev 2", in the pop-up window, according to the situation described at the beginning of this section, select the corresponding interface type and connected IO-Link Sensor Hub, set "RPI range" to the value of PLC network (Omron default is 50ms), and click "OK" to complete the setting.

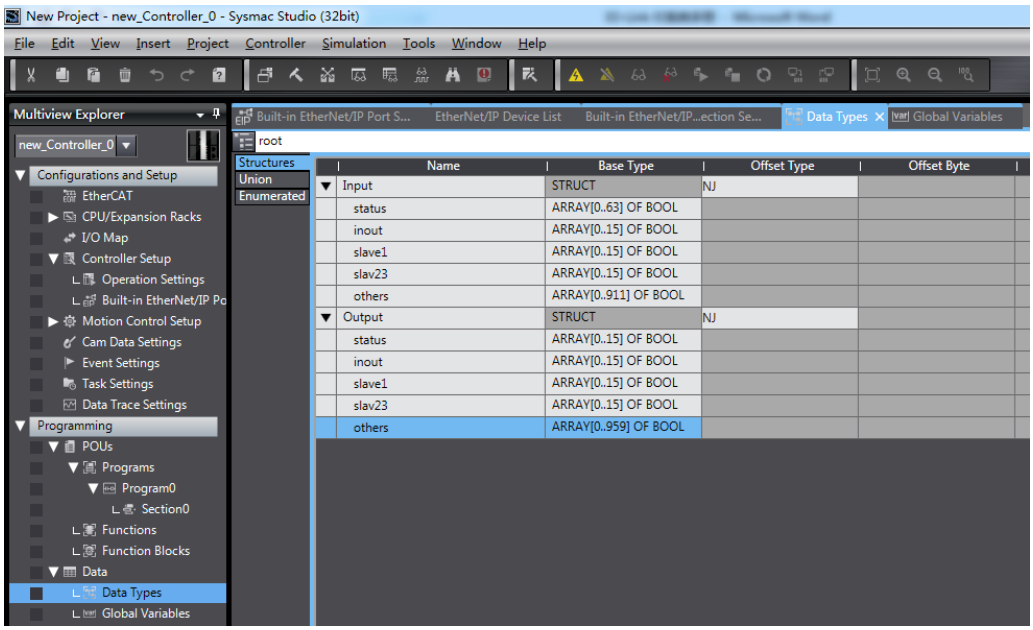


8）Since the data of Ethernet/IP slave station is packaged and sent to PLC, it is recommended to establish data types and global variables to facilitate signal reading. ELCO IO-Link module occupies 128 input bytes and 128 output bytes, the data structure is as follows:

Type	Byte	Description	Data length
Input	0~7	Gateway diagnostic status	64 bit
	8~9	IO-Link Master I/O signals	16 bit
	10~127	IO-Link Slave I/O signals	944 bit
Output	0~1	Gateway control word	16 bit
	2~3	IO-Link Master I/O signals	16 bit
	4~127	IO-Link Slave I/O signals	992 bit

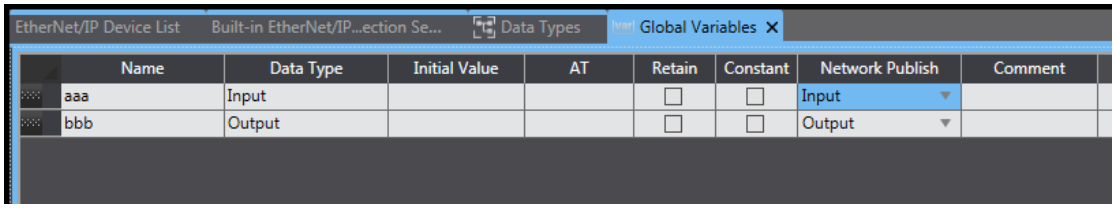
Note: the IO-Link slave I/O signals are arranged according to the connection order, according to the number of bytes occupied by different slave stations, rather than the average allocation of each IO link port.

9）The data type is established according to the IO-Link slave connected in this example. Port1 is connected to IO-Link hub LKHA-16UP-M12 (occupying Byte 10~11 input and Byte 4~5 output), Port2 is connected to IO-Link hub LKHA-0808P-M12 (occupying Byte12 input and Byte6 output), and Port6 is connected to IO-Link Hub LKHA-0800P-M12 (occupying Byte13 input). Since Port 3~5 is not connected with IO-Link device, the IO-Link device address of Port6 will be immediately after Port2.

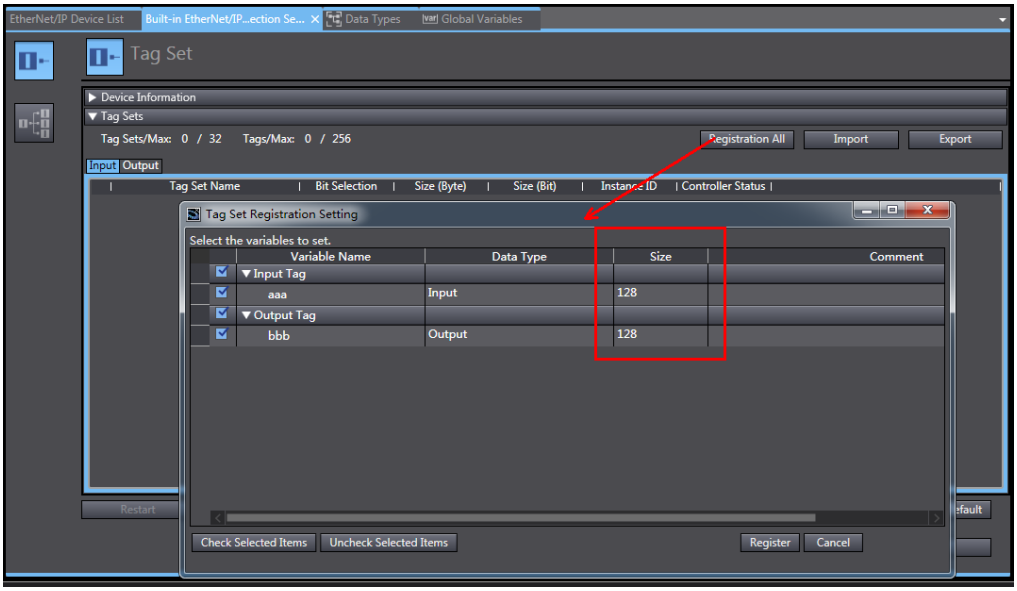


Note: when creating a data type, it should be noted that if the member in each structure is an array, the minimum unit is word (16 bit). Therefore, it is necessary to merge 8-bit slave signals. Here, the second and third slave data are merged together.

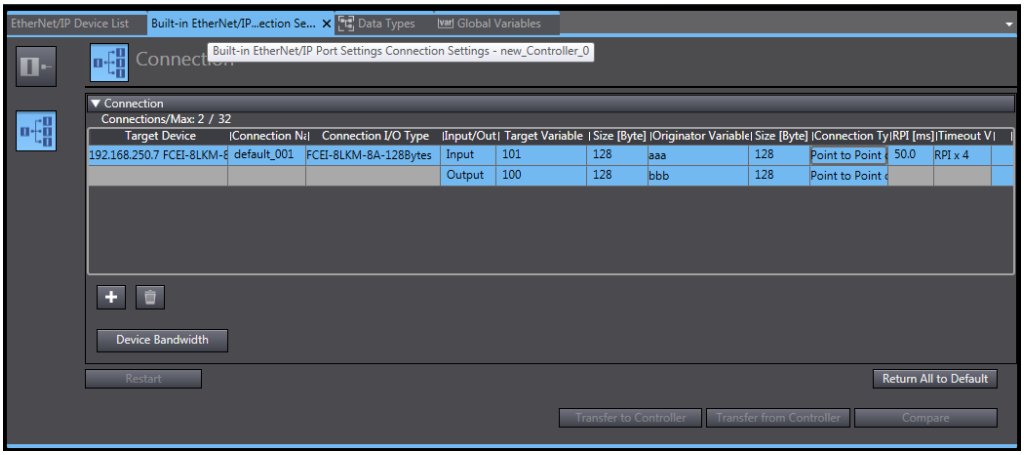
10）Establish the global variables corresponding to IO-Link module, which are divided into input and output. Select the “Data Type” just established, and select the input and output according to the type of “Network Publish”.



11）In the "Built-in Ethernet/IP Port Settings" window, select "Tag Set" and click the "Registration All" button. In the pop-up window, register the newly created global variable. At this time, you can see the size of the new variable. The input and output are 128 bytes. If the size is not 128, there is something wrong with the global variable and data type just established, and it needs to be modified.



12）In the "Built-in Ethernet/IP Port Settings" window, select "Connection" on the left side, click "+" button to add a new connection, "Target Device" selects the IO-Link module we have configured, "Connection I/O Type" selects FCEI-8LKM-8A, "Target Variable" code input is 101, output is 100, "Originator Variable" selects the newly created global variable, "Connection Type" is all Select “point to point connection”.



13）At this time, all the basic settings have been completed, and the program can be downloaded to PLC. Note that the Ethernet/IP port settings need to be downloaded separately. Click "Transfer to Controller" in the figure above. If all kinds of connections are OK, the IO-Link master display screen will scroll "CONN 192.168.250.7", BF and SF will also turn green, and the corresponding points in aaa and bbb can be read and controlled.

5. Alarm diagnosis

5.1 LED fault indicator

With the LED indicator on the Compact67 series IO-Link 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")

IO-Link master indicator

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 SF	Green	Work normally	-
	Red	Working abnormally	1. Power supply is abnormal 2.Channel abnormal (short circuit, overload, etc.) 3. Module is damaged
Network status Indicator BF	Green	Communication normal	-
	Red	Communication abnormal	1. Network cable failure 2. Check the configuration 3. Module is damaged
Ethernet network status Indicator Lk1, 2	Green	Connected to the network	-
	Orange	Not connected to the network	1. Network cable failure 2. Module is damaged
	Orange flash	Network data is exchanging	Check configuration
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

IO-Link sensor hub indicator

Name	Status	Meaning	Fault cause
Module communication Indicator P	Green flash	Receive IO-Link communication	-
	Off	No IO-Link signal received	1.Expansion cable failure 2.Master IO-Link port problem 3.Slave module is damaged
Signal / status Indicator	Red	Abnormal signal	1.Signal overload or short circuit 2.Slave module is damaged
	Green	Have signal	-
	Off	No signal	-

5.2 Process image area of IO-Link Master

The IO-Link master occupies a total of 128_Byte input and 128_Byte output, the IO-Link master itself will occupy 10 bytes input and 4 bytes output for transmission of diagnostic information and communication of built-in I/O signal, and the other inputs and outputs are used for transmission of IO-Link slave signal.

Different types of modules occupy different process image areas of PLC, as follows:

1）8 ports IO-Link interface（4*Class-A + 4*Class-B），FCEI-8LKM-4A4B

IN	Byte	Bit_7	Bit_6	Bit_5	Bit_4	Bit_3	Bit_2	Bit_1	Bit_0
Status	0	IO-Link communication failure							
		Port8	Port7	Port6	Port5	Port4	Port3	Port2	Port1
	1	IO-Link slave short circuit/overload alarm							
		Port8	Port7	Port6	Port5	Port4	Port3	Port2	Port1
	2	IO-Link master Pin1&Pin3 short circuit							
		Port8	Port7	Port6	Port5	Port4	Port3	Port2	Port1
	3	Reserve							
	4	IO-Link master Pin2/Pin4 overload							
		Port8	Port7	Port6	Port5	Port4	Port3	Port2	Port1
	5	-	-	-	Us Over vol.	Ua Over vol.	Us Under vol.	Ua Under vol.	Ua Short cir.
	6	IO-Link slave output undervoltage alarm							
		Port8	Port7	Port6	Port5	Port4	Port3	Port2	Port1
	7	Reserve							
Signals	8	P4.Pin2	P4.Pin4	P3.Pin2	P3.Pin4	P2.Pin2	P2.Pin4	P1.Pin2	P1.Pin4
	9	-	P8.Pin4	-	P7.Pin4	-	P6.Pin4	-	P5.Pin4

OUT	Byte	Bit_7	Bit_6	Bit_5	Bit_4	Bit_3	Bit_2	Bit_1	Bit_0
Status	0	Reserve							
	1	Reserve							
Signals	2	P4.Pin2	P4.Pin4	P3.Pin2	P3.Pin4	P2.Pin2	P2.Pin4	P1.Pin2	P1.Pin4
	3	-	P8.Pin4	-	P7.Pin4	-	P6.Pin4	-	P5.Pin4

2）8 ports IO-Link interface（8*Class-A），FCEI-8LKM-8A

IN	Byte	Bit_7	Bit_6	Bit_5	Bit_4	Bit_3	Bit_2	Bit_1	Bit_0
Status	0	IO-Link communication failure							
		Port8	Port7	Port6	Port5	Port4	Port3	Port2	Port1
	1	IO-Link slave short circuit/overload alarm							
		Port8	Port7	Port6	Port5	Port4	Port3	Port2	Port1
	2	IO-Link master Pin1&Pin3 short circuit							
		Port8	Port7	Port6	Port5	Port4	Port3	Port2	Port1
	3	Reserve							
	4	IO-Link master Pin2/Pin4 overload							
		Port8	Port7	Port6	Port5	Port4	Port3	Port2	Port1
	5	-	-	-	Us Over vol.	Ua Over vol.	Us Under vol.	Ua Under vol.	Ua Short cir.
	6	IO-Link slave output undervoltage alarm							
		Port8	Port7	Port6	Port5	Port4	Port3	Port2	Port1
	7	Reserve							
Signals	8	P4.Pin2	P4.Pin4	P3.Pin2	P3.Pin4	P2.Pin2	P2.Pin4	P1.Pin2	P1.Pin4
	9	P8.Pin2	P8.Pin4	P7.Pin2	P7.Pin4	P6.Pin2	P6.Pin4	P5.Pin2	P5.Pin4
OUT	Byte	Bit_7	Bit_6	Bit_5	Bit_4	Bit_3	Bit_2	Bit_1	Bit_0
Status	0	Reserve							
	1	Reserve							
Signals	2	P4.Pin2	P4.Pin4	P3.Pin2	P3.Pin4	P2.Pin2	P2.Pin4	P1.Pin2	P1.Pin4
	3	P8.Pin2	P8.Pin4	P7.Pin2	P7.Pin4	P6.Pin2	P6.Pin4	P5.Pin2	P5.Pin4

3）4 ports IO-Link interface（4*Class-A），FCEI-4LKM-4A4S

IN	Byte	Bit_7	Bit_6	Bit_5	Bit_4	Bit_3	Bit_2	Bit_1	Bit_0
Status	0	IO-Link communication failure							
		Port8	Port7	Port6	Port5	-	-	-	-
	1	IO-Link slave short circuit/overload alarm							
		Port8	Port7	Port6	Port5	-	-	-	-
	2	IO-Link master Pin1&Pin3 short circuit							
		Port8	Port7	Port6	Port5	Port4	Port3	Port2	Port1
	3	Reserve							
	4	IO-Link master Pin2/Pin4 overload							
		Port8	Port7	Port6	Port5	Port4	Port3	Port2	Port1
	5	-	-	-	Us Over vol.	Ua Over vol.	Us Under vol.	Ua Under vol.	Ua Short cir.
	6	IO-Link slave output undervoltage alarm							
		Port8	Port7	Port6	Port5	Port4	Port3	Port2	Port1
	7	Reserve							
Signals	8	P4.Pin2	P4.Pin4	P3.Pin2	P3.Pin4	P2.Pin2	P2.Pin4	P1.Pin2	P1.Pin4
	9	P8.Pin2	P8.Pin4	P7.Pin2	P7.Pin4	P6.Pin2	P6.Pin4	P5.Pin2	P5.Pin4
OUT	Byte	Bit_7	Bit_6	Bit_5	Bit_4	Bit_3	Bit_2	Bit_1	Bit_0
Status	0	Reserve							
	1	Reserve							
Signals	2	P4.Pin2	P4.Pin4	P3.Pin2	P3.Pin4	P2.Pin2	P2.Pin4	P1.Pin2	P1.Pin4
	3	P8.Pin2	P8.Pin4	P7.Pin2	P7.Pin4	P6.Pin2	P6.Pin4	P5.Pin2	P5.Pin4