Compact67 IO-Link Module

----EtherCAT System Manual

ELCO (Tianjin) Electronics Co., Ltd.
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Preface

1. **Scope of this manual:**

   This manual applies to the ELCO EtherCAT Compact67 series IO-Link module. The information in this manual enables you to run the Compact67 IO-Link module on EtherCAT 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 EtherCAT 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

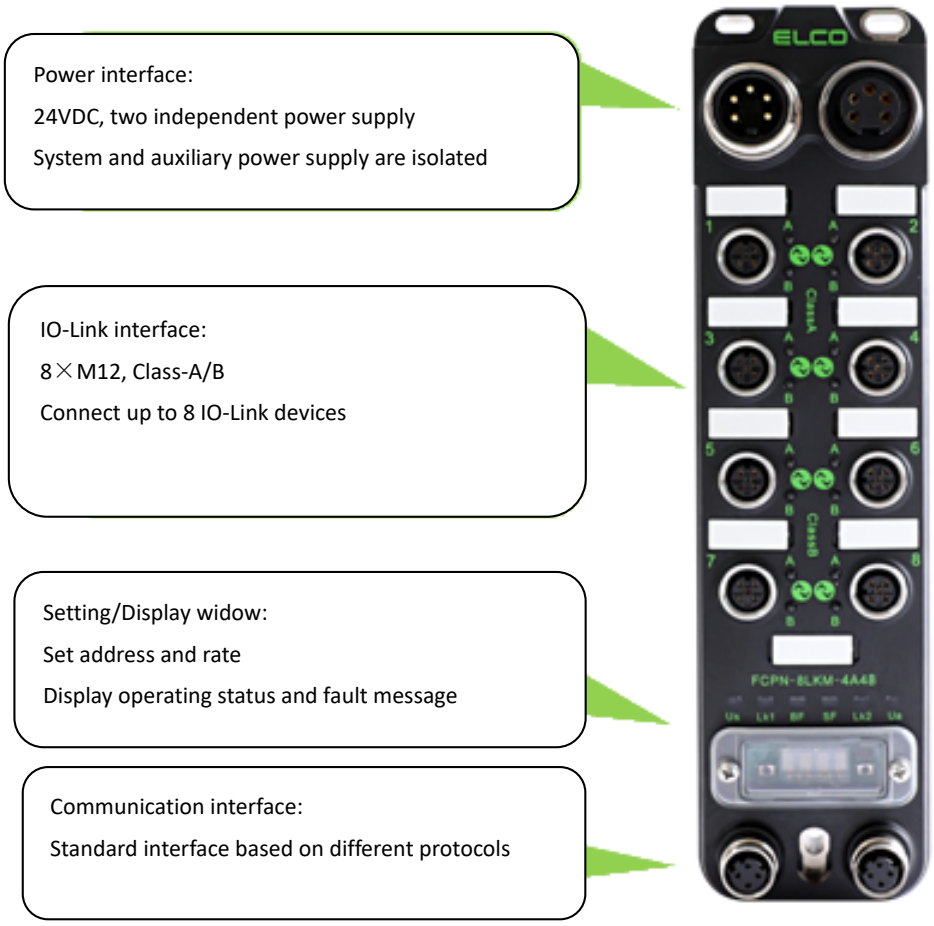
1.4 Type

No.	Type	Description
1	FCEC-8LKM-4A4B	EtherCAT 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	FCEC-8LKM-8A	EtherCAT 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	FCEC-4LKM-4A4S	EtherCAT 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

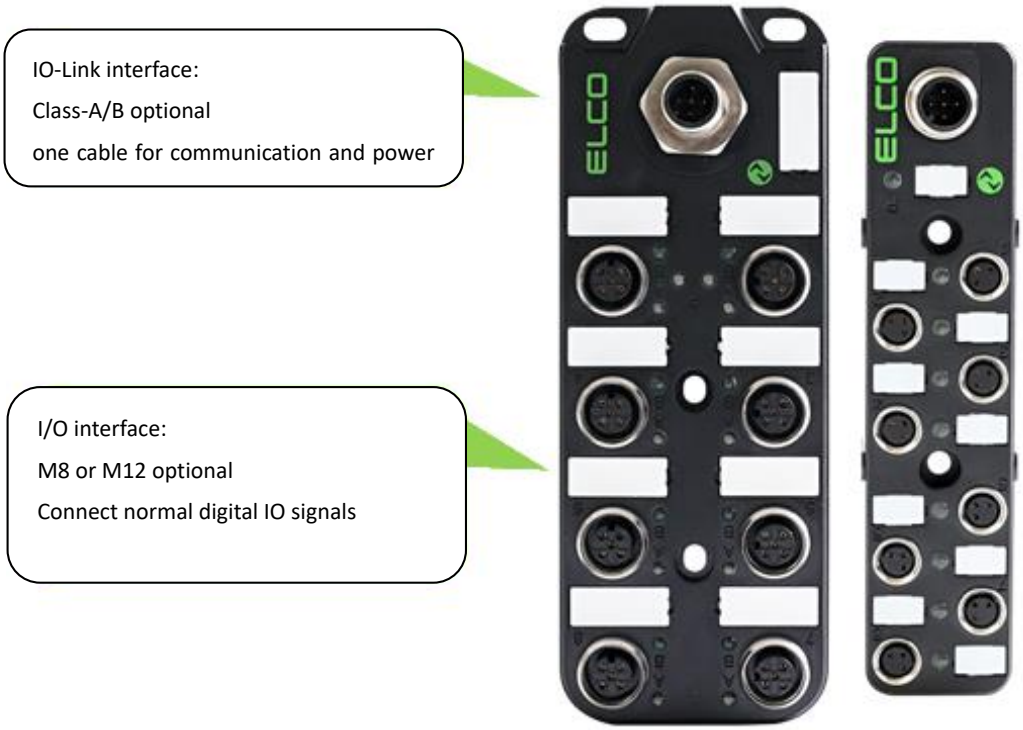


Each Compact67 series IO-Link master module occupies an EtherCAT slave address. Depending on the type, up to 8 IO-Link devices can be connected. Depending on the specific requirements, select the module of Class-A or Class-B interface.

As an EtherCAT slave, the Compact67 module can automatically assign a slave specific address by the PLC according to the network topology. 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	FCEC-8LKM-4A4B	FCEC-8LKM-8A	FCEC-4LKM-4A4S
Description	8 IO-Link ports	8 IO-Link ports	4 IO-Link ports
Communication			
Protocol	EtherCAT		
Operating modes	Auto-negotiation，Auto-MDI/MDI-X		
Transfer rate	10/100 Mbps		
Addressing	System automatic allocation		
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	

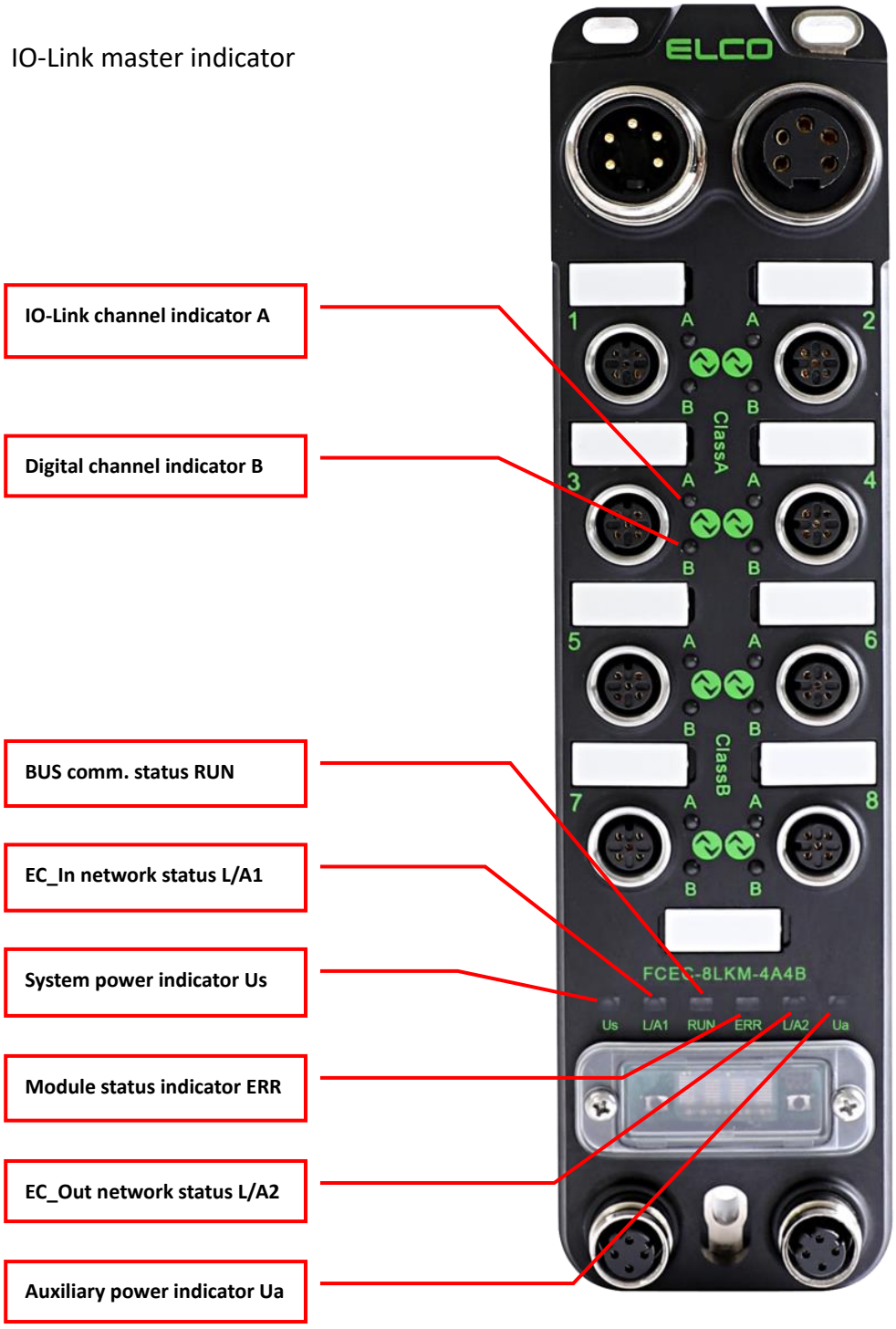
2.4.4 M12-8 signals IO-Link sensor hub

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	

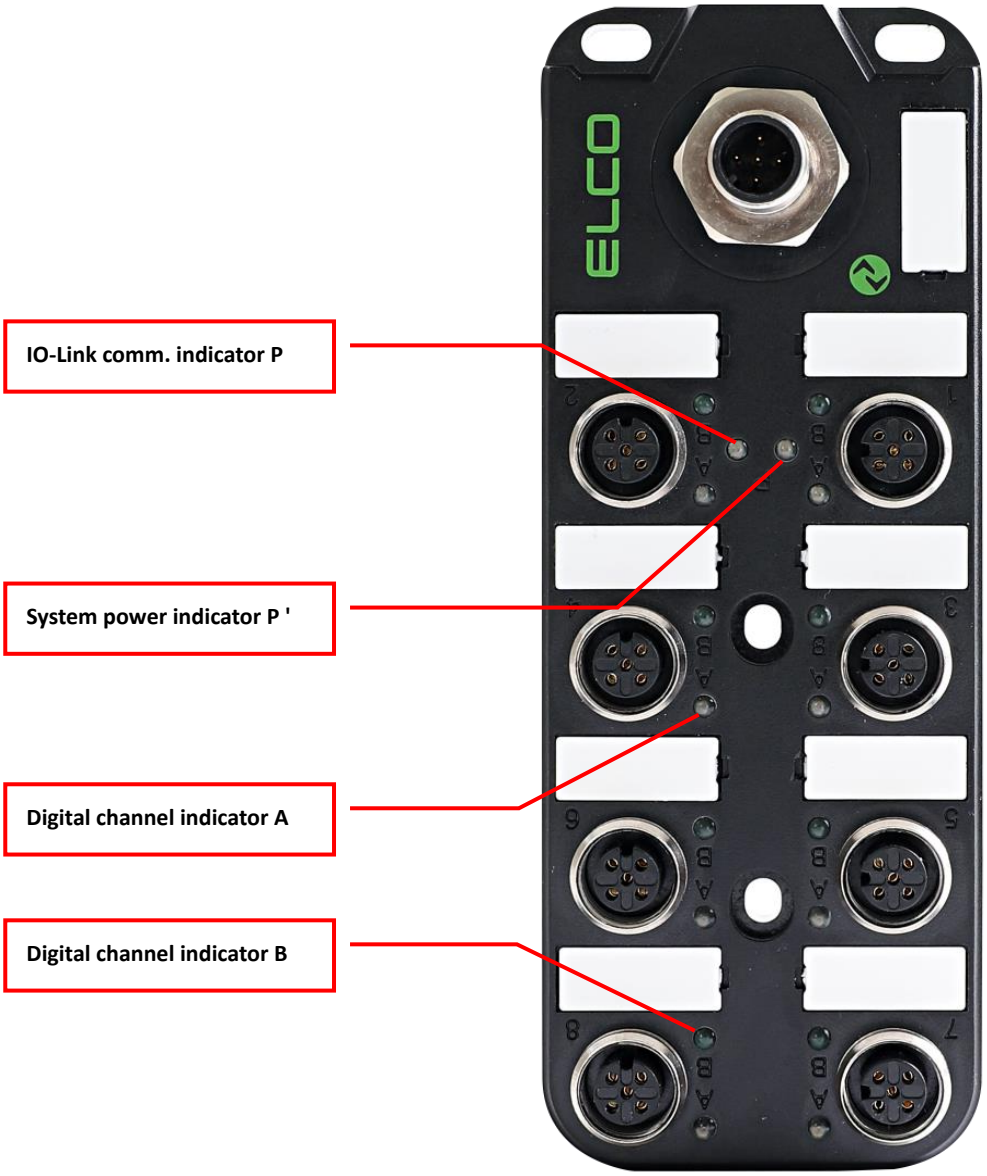
2.5 LED indicator

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

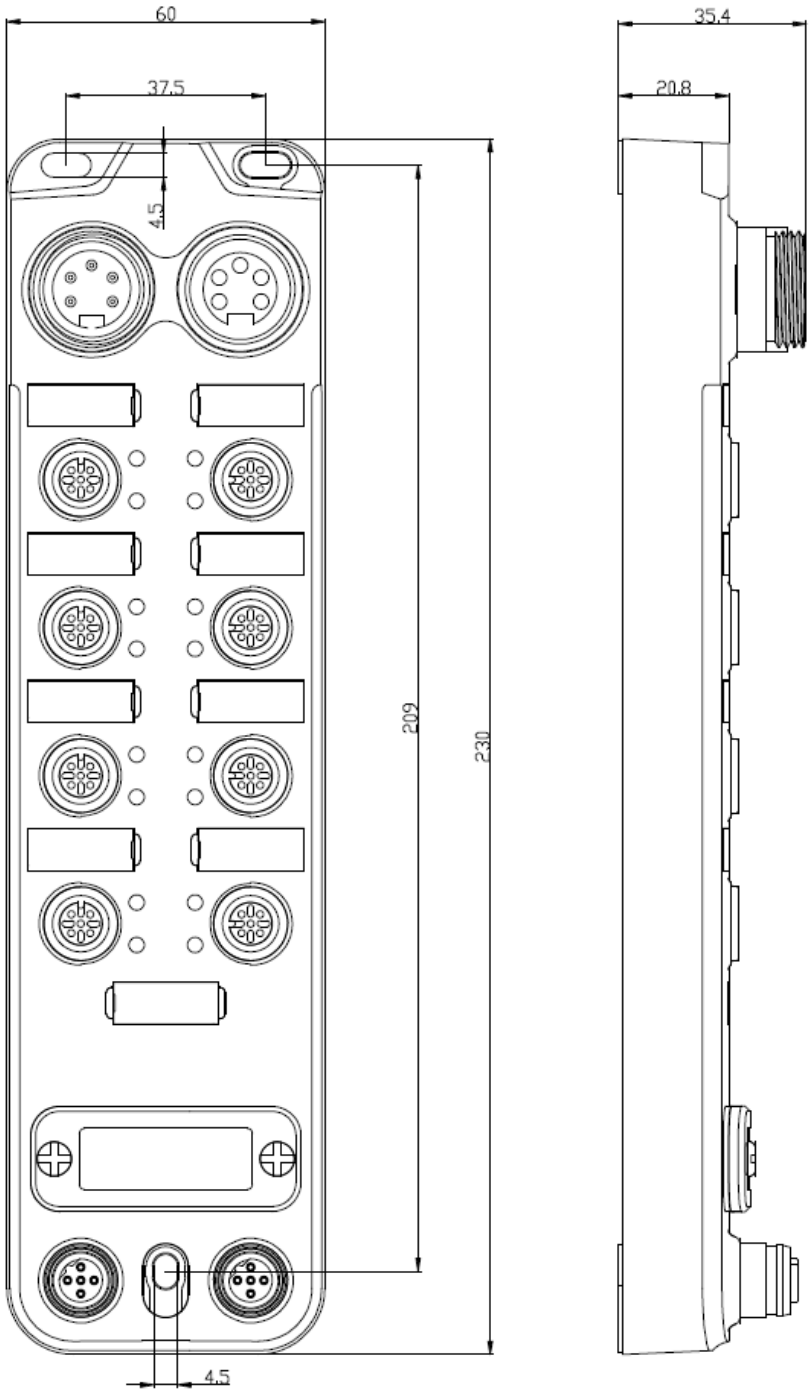


2.6 General system layout

3. Installation wiring

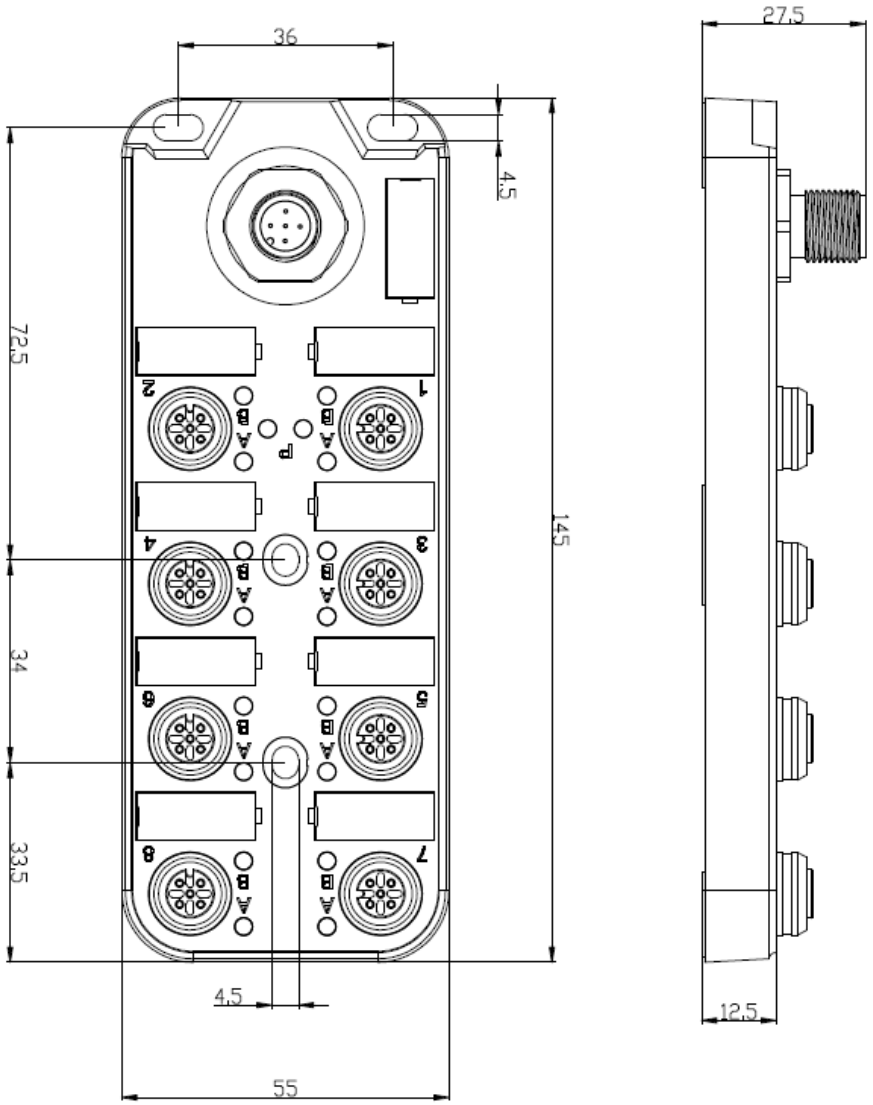
3.1 Installation dimensions

3.1.1 IO-Link master dimensions

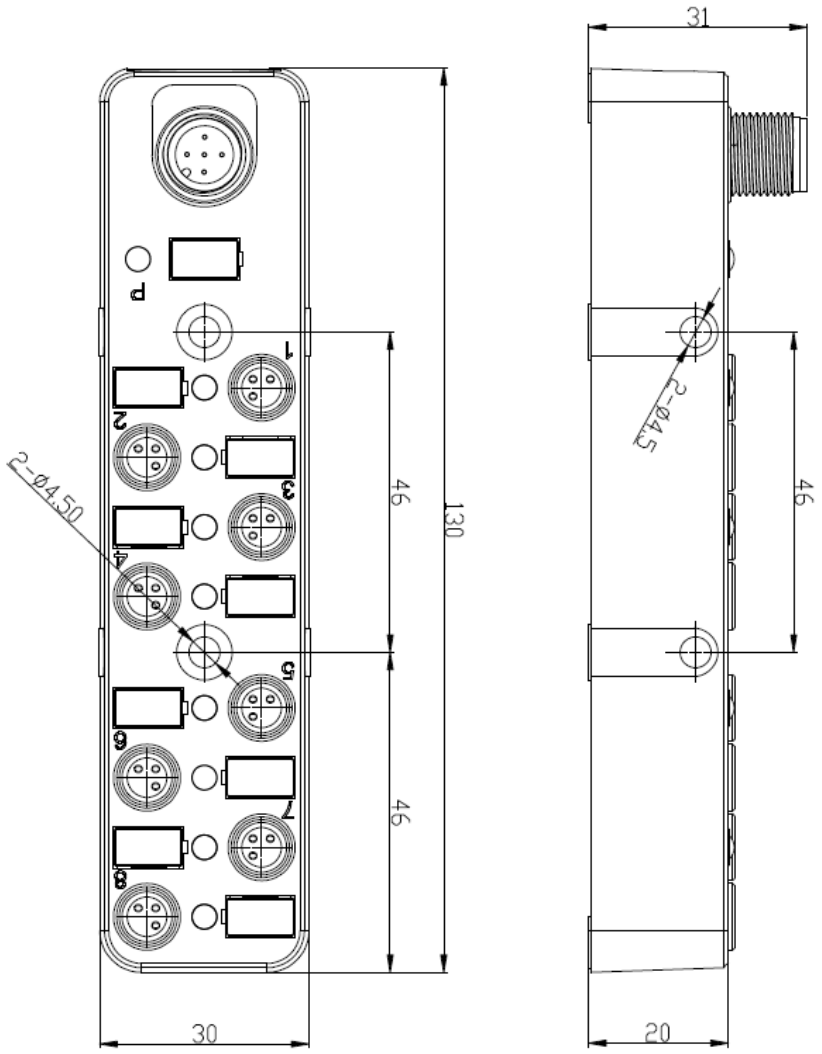


3.1.2 IO-Link sensor hub dimensions

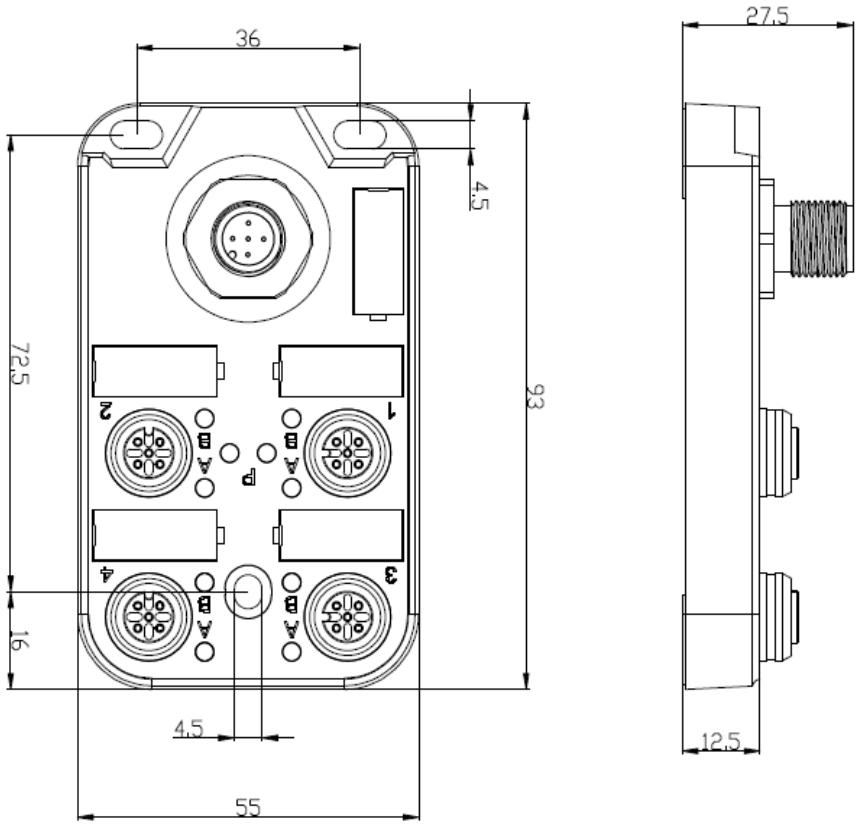
1）16 signals, M12 interface



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 Wiring Compact67

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

3.3.1 Connecting Compact67 to protective earth (PE)

- Always connect the Spider67 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.

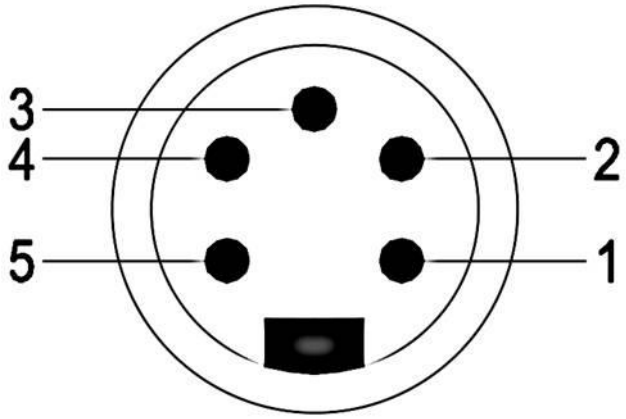
3.3.2 Compact67 power supply

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:

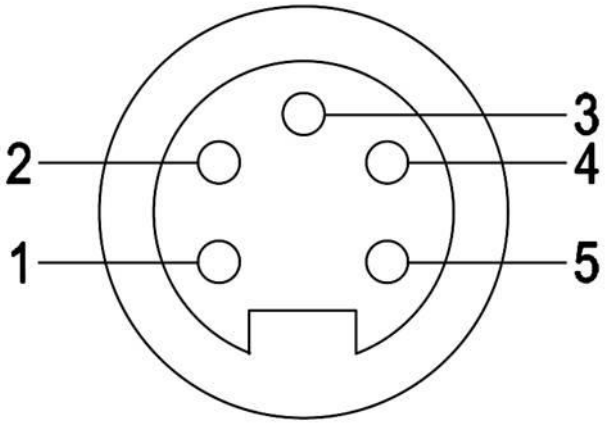
1）FCEC-8LKM-4A4B, the two power supply are completely isolated, that is, electrical isolation between+24V and P24, and electrical isolation between0V and N24.

2）FCEC-8LKM-8A and FCEC-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)



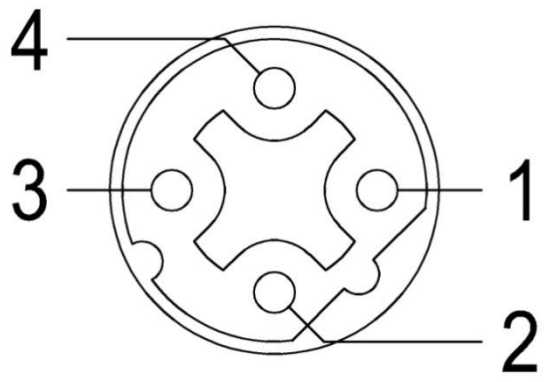
3） Power definition

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

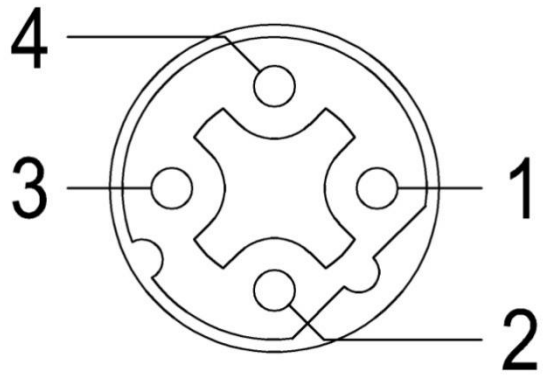
3.3.3 Compact67 BUS connection

Compact67module, supporting EtherCAT protocol, transmits signals by a shielded cable, D-Code M12 connector.

1）BUS-In (Female)



2）BUS-Out (Female)



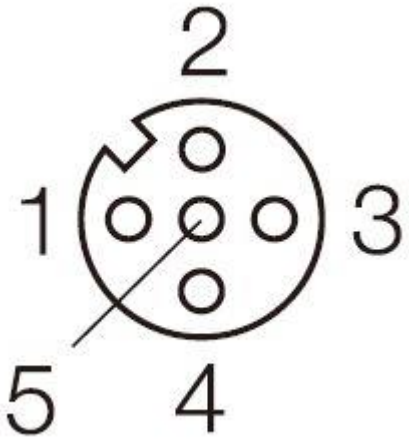
3）Bus definition

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

3.3.4 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)



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 are from the system power supply Us, and the auxiliary power supply and signal output power supply are from the auxiliary power supply Ua.

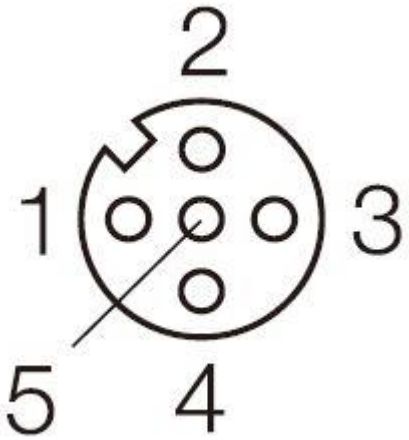
Note: For FCEC-8LKM-4A4B, Pin2 and Pin4 of Class-A interface and Pin4 of Class-B interface are also supplied by system power supply Us.

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.

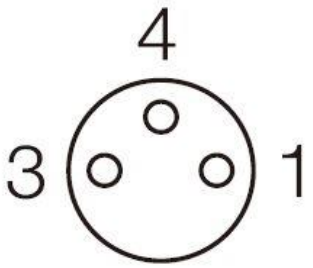
3.3.5 IO-Link hub digital signal cable connection

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



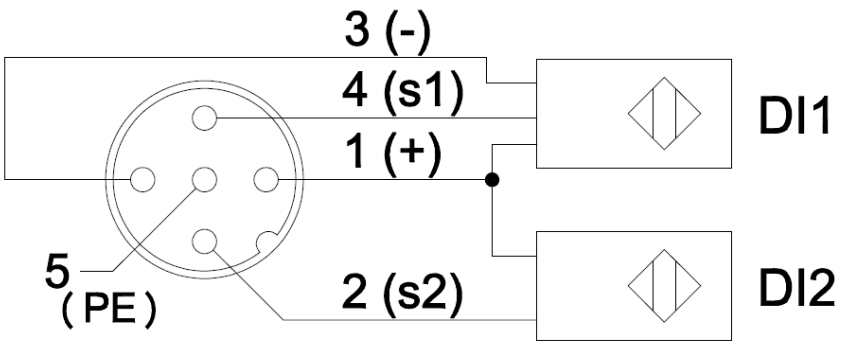
M8 connector

2）Digital signal port definition

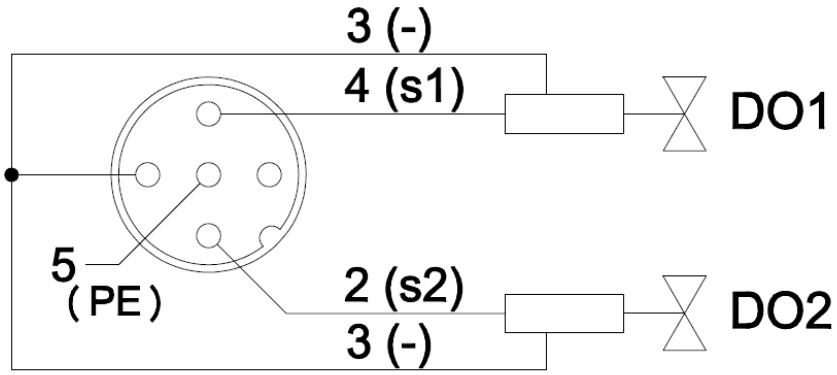
Terminal	M12 connector		M8 connector
1	Power supply 24V+		Power supply 24V +
2	Signal input/output B	2nd signal	-
3	Power supply GND		Power supply GND
4	Signal input/output A	1st signal	Signal input / output
5	Shielded grounding PE		-

3） Wiring example

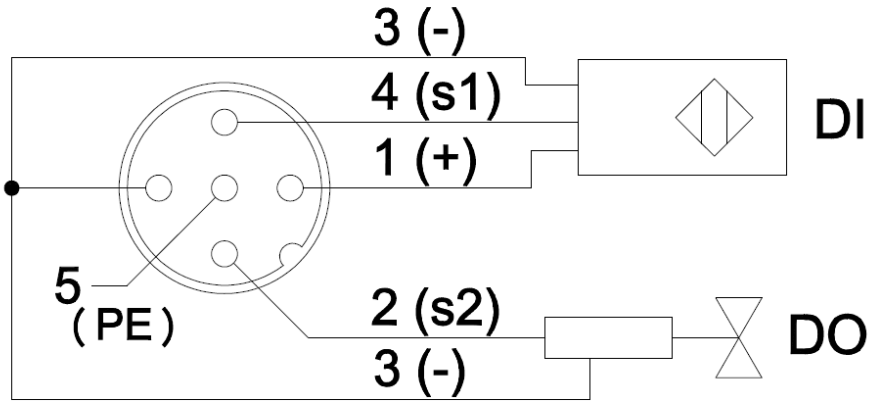
a） Double PNP input signal – 1 connector connects 2 DI, LKHA-1600P-M12, LKHA-0808P-M12, LKHA-16UP-M12, LKHA-0800P-M12, LKHA-08UP-M12 support this connection.



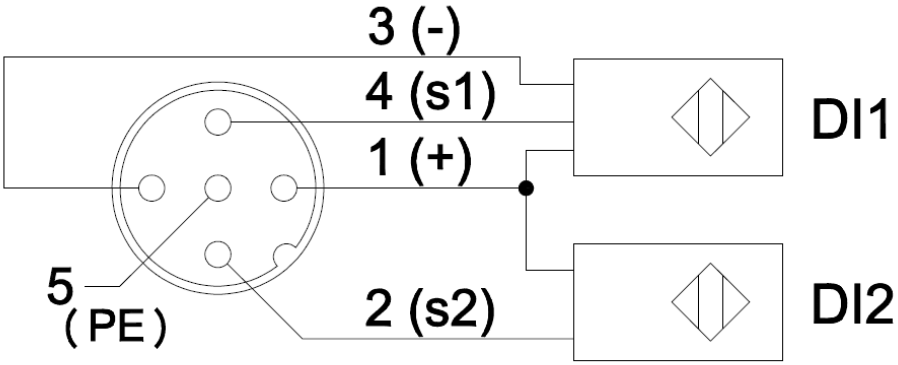
b） Double PNP output signal – 1 connector connects 2 DO, LKHA-0808P-M12, LKHA-16UP-M12, LKHA-08UP-M12 support this connection.



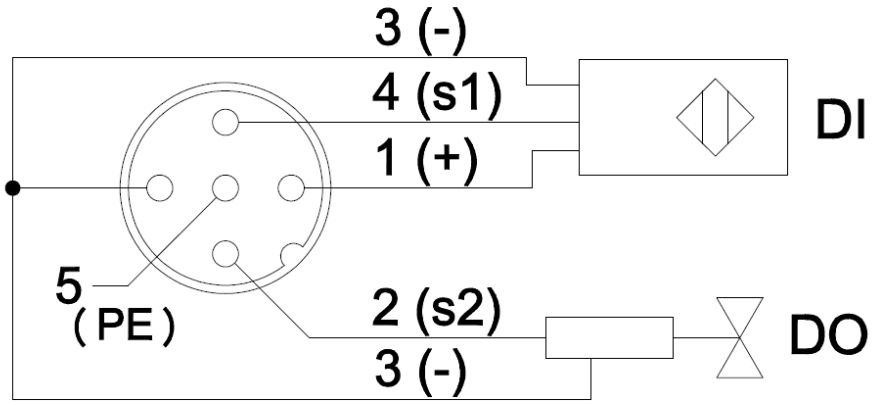
c） PNP Input and output signal – 1 connector connects 1 DI and 1 DO. LKHA-16UP-M12, LKHA-08UP-M12 support this connection.



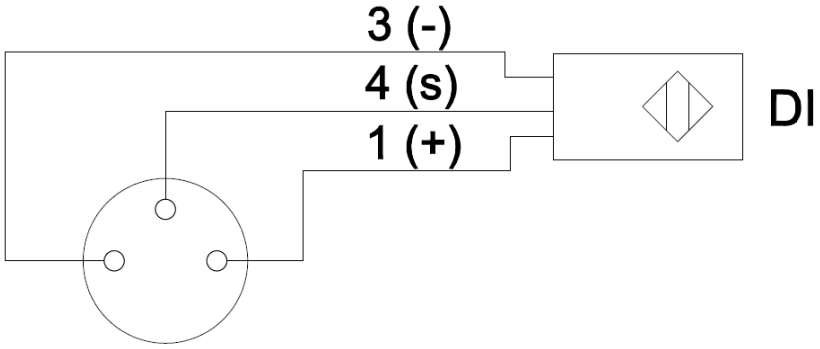
d） Double NPN input signal – 1 connector connects 2 DI, LKHA-1600N-M12, LKHA-16UN-M12 support this connection.



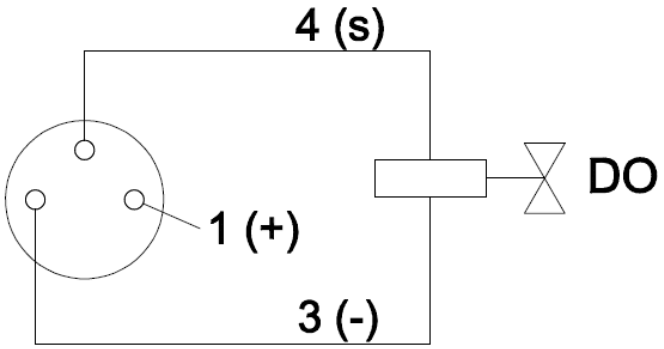
e）NPN Input and output signal – 1 connector connects 1 DI and 1 DO. LKHA-16UN-M12 support this connection.



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.



4. Configuration Commissioning

4.1 Installation of configuration files

Configuration of the Compact67 series I/O module via ESI file (XML format) and the standard EtherCAT IO ESI file for the Compact67 will be integrated into the user's system. You can visit the ELCO website to get the latest GSD file or call the hotline to contact technical support.

How to integrate the ESI file into the system depends on the user's configuration software. Take TwinCAT programming software from Beckoff for EtherCAT system for example, the process of adding ESI file is as follows:

Install TwinCAT, and then copy the ESI file (.xml file) of Compact67 to the following installation directory, for example:

Twincat2: Install to c:\twincat\io\ethercat\

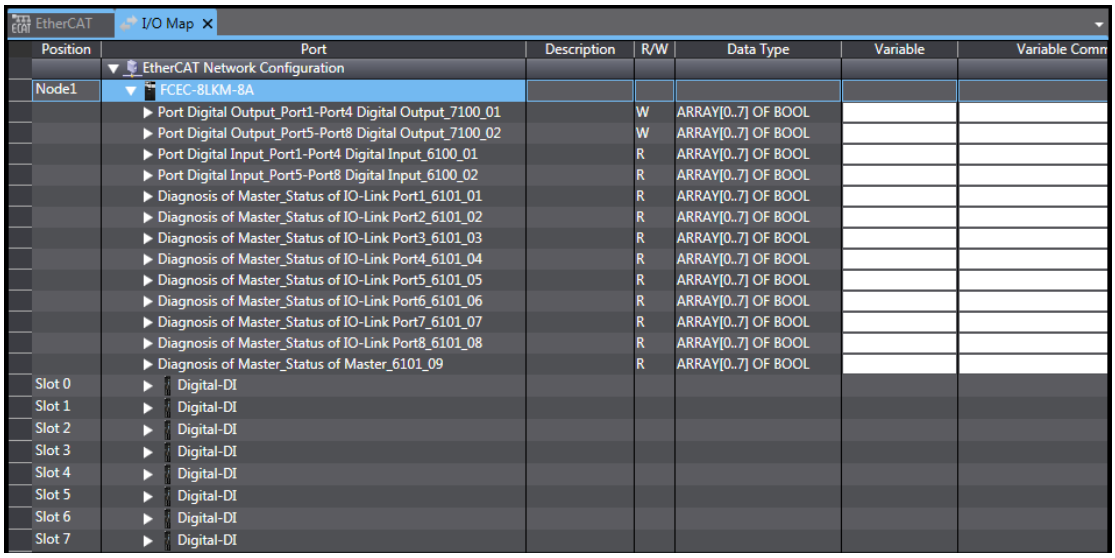
Twincat3: Install to c:\twincat\3.1\config\io\ethercat\

4.2 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 are as follows:

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

Each IO-Link master of EtherCAT protocol will occupy 2 Byte input and 2 Byte output as the switching signal of the IO-Link master, 8 Byte input as the IO-Link port connection status indication, and 1 Byte input to display the power supply status of the master station. The subsequent input and output bytes are determined according to the equipment configured by the IO-Link interface and are used as the signal address of the IO-Link slaves.



IO-Link master interface is configured as normal switching value input and output by default in the program, occupying 2 Byte input and 2 Byte output. The customer can set the corresponding port to the IO-Link communication mode as required. For the specific method, please refer to the description in the subsequent chapters.
The following will display the corresponding relationship between the signal status of each connector and the EtherCAT bus transmission bytes in the sub model list.

1）4A+4B, 8 ports IO-Link master module FCEC-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 FCEC-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 FCEC-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

4.3 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 EtherCAT 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

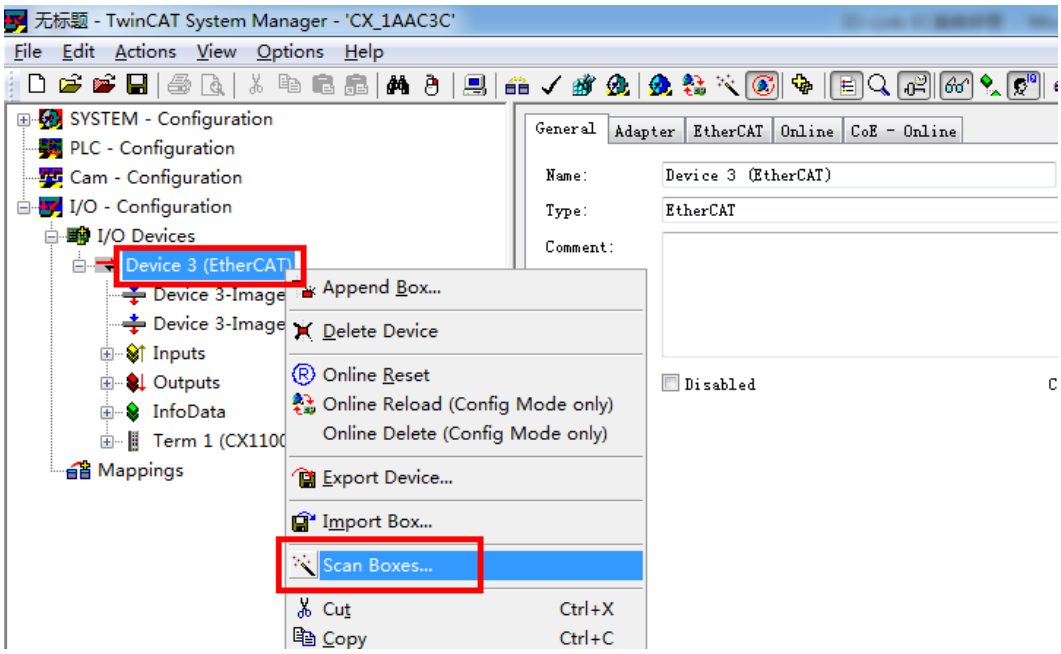
4.4 Module configuration by TwinCAT

This section, through a case of connection configuration in a current operation process, will let the users fully understand how to use the Compact67 series IO-Link module. In this case, using the ELCO Compact67 IO-link master as EtherCAT slave to connect to the Beckhoff controller CX1020 with EtherCAT interface. By default, TwinCAT has been installed, the required network card information has been set, ESI files have been installed, and all power supply and bus connections have been completed. Please refer to TwinCAT operating instructions for the above operating procedures.

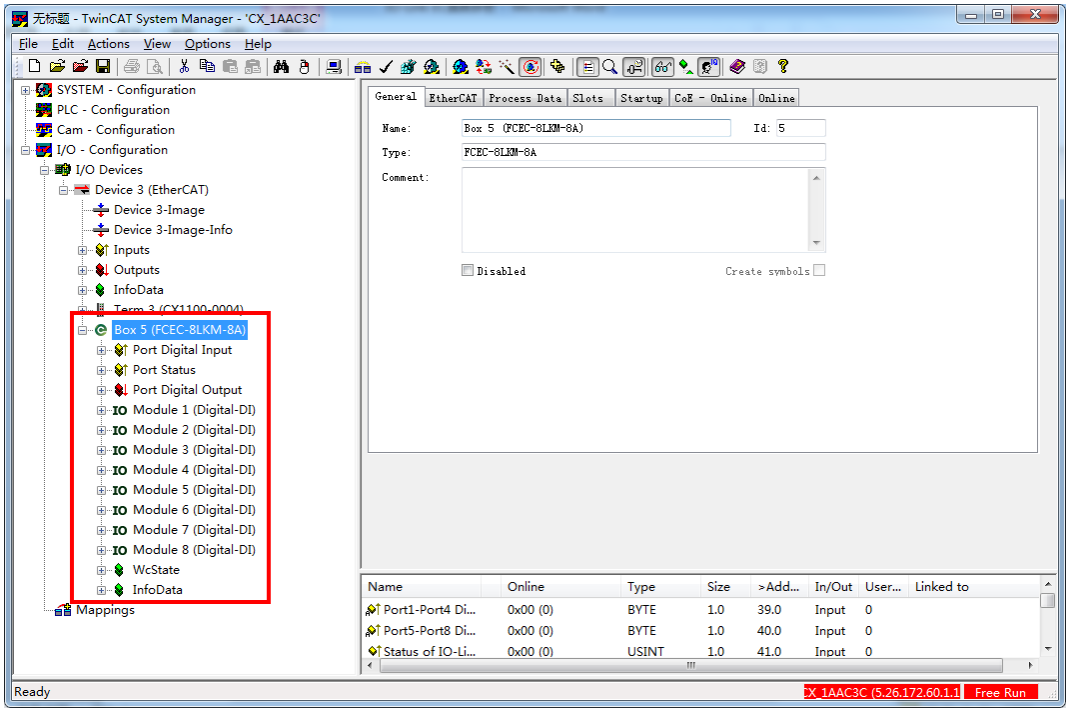
Compact67 IO-link system includes a master module FCEC-8LKM-8A, the master IO-Link port P1 connecting a IO-Link hub LKHA-16UP-M12, IO-Link port P2 connecting a IO-Link hub LKHA-0808P-M12, IO-Link port P6 connecting a IO-Link hub LKHA-0800P-M8. Other port interfaces Pin4 are set to input, and Pin2 is set to input/output.

The following will show the specific process of software configuration and debugging.

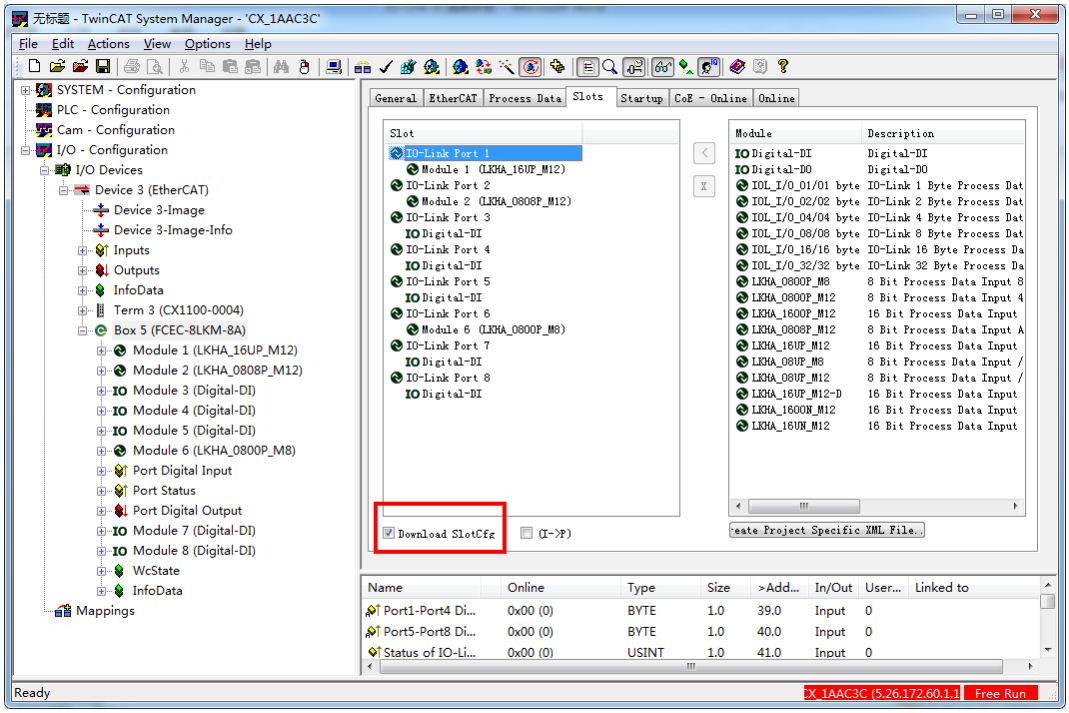
1）Create a new TwinCAT project, connect it to the PLC controller, and switch to 'Config Mode'. Then search the EtherCAT slave: right click the arrow in the figure below > Scan Boxes…



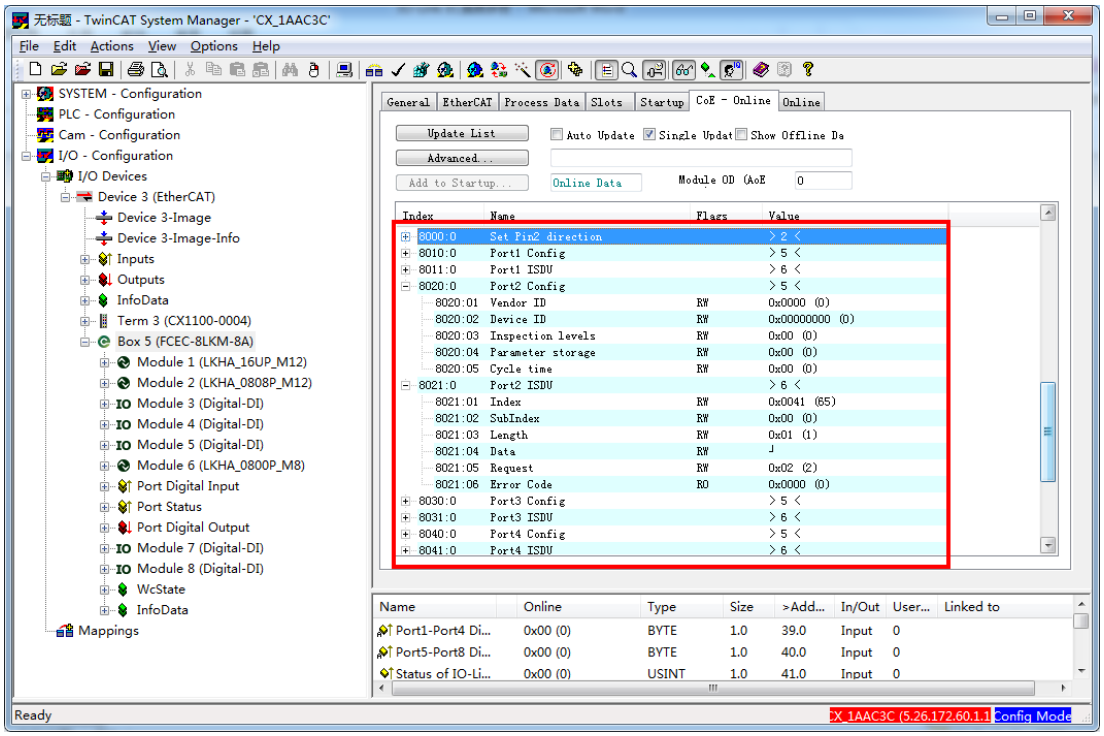
2）If the IO-Link master and PLC are normally connected, the system can automatically search for the Compact67 module, but cannot see the IO-Link slave specifically connected. As shown below:



3）Configure the slave module according to the actual connection. In order to distribute the specific module configuration to the PLC to ensure that the subsequent power on can be used normally, you need to check the "Download Slot Configuration" option in the slots tab.



4）For IO-Link hubs or other IO-Link devices that need to be configured, customers can modify them in the COE online tab. The index label 8000 represents the channel parameter setting, and 8010~8081 sets the ISDU parameters of the IO-Link slave.



5）After all settings are completed, click the "reload i/o devices" button to download all information to the PLC. At this time, the module should be in the connected state, and the RUN indicator turn green.

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
BUS status Indicator RUN	Green	Communication normal OP Mode	–
	Green fast flash	Pre-OP Mode	
	Green slow flash	Safe-OP Mode	
	Off	Communication abnormal	1. Network cable failure 2. Check the configuration 3. Module is damaged
Gateway status Indicator ERR	Green	Work normally	–
	Red	Working abnormally	1. Power supply is abnormal 2.Channel abnormal (short circuit, overload, etc.) 3. Module is damaged
EtherCAT network status Indicator L/A_1, 2	Green flash	Connected to the network	–
	Orange	Not connected to the network	1. Network cable failure 2. Module is damaged

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

Each IO-Link master of EtherCAT protocol will occupy 2 Byte input and 2 Byte output as the switching signal of the IO-Link master, 8 Byte input as the IO-Link port connection status indication, and 1 Byte input to display the power supply status of the master station. The subsequent input and output bytes are determined according to the equipment configured by the IO-Link interface and are used as the signal address of the IO-Link slaves.

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） , FCEC-8LKM-4A4B

IN	Byte	Bit_7	Bit_6	Bit_5	Bit_4	Bit_3	Bit_2	Bit_1	Bit_0
Signals	1	P4.Pin2	P4.Pin4	P3.Pin2	P3.Pin4	P2.Pin2	P2.Pin4	P1.Pin2	P1.Pin4
	2	-	P8.Pin4	-	P7.Pin4	-	P6.Pin4	-	P5.Pin4
Status1		Slave Power supply Error	Slave signal short circuit overload	IO-Link Wrong type	IO-Link Not connected	Reserved	Pin2_3 Overload	Pin4_3 Overload	Pin1_3 Short circuit
	1	IO-Link Port1 status							
	2	IO-Link Port2 status							
	3	IO-Link Port3 status							
	4	IO-Link Port4 status							
	5	IO-Link Port5 status							
	6	IO-Link Port6 status							
	7	IO-Link Port7 status							
	8	IO-Link Port8 status							
Status2	9	Ua Overvoltage	Ua Undervoltage	Us Overvoltage	Us Undervoltage	Ua Short circuit	-	Connect OK	Module Not sent
OUT	Byte	Bit_7	Bit_6	Bit_5	Bit_4	Bit_3	Bit_2	Bit_1	Bit_0
Signals	1	P4.Pin2	P4.Pin4	P3.Pin2	P3.Pin4	P2.Pin2	P2.Pin4	P1.Pin2	P1.Pin4
	2	-	P8.Pin4	-	P7.Pin4	-	P6.Pin4	-	P5.Pin4

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

IN	Byte	Bit_7	Bit_6	Bit_5	Bit_4	Bit_3	Bit_2	Bit_1	Bit_0
Signals	1	P4.Pin2	P4.Pin4	P3.Pin2	P3.Pin4	P2.Pin2	P2.Pin4	P1.Pin2	P1.Pin4
	2	P8.Pin2	P8.Pin4	P7.Pin2	P7.Pin4	P6.Pin2	P6.Pin4	P5.Pin2	P5.Pin4
Status1		Slave Power supply Error	Slave signal short circuit overload	IO-Link Wrong type	IO-Link Not connected	Reserved	Pin2_3 Overload	Pin4_3 Overload	Pin1_3 Short circuit
	1	IO-Link Port1 status							
	2	IO-Link Port2 status							
	3	IO-Link Port3 status							
	4	IO-Link Port4 status							
	5	IO-Link Port5 status							
	6	IO-Link Port6 status							
	7	IO-Link Port7 status							
	8	IO-Link Port8 status							
Status2	9	Ua Overvoltage	Ua Undervoltage	Us Overvoltage	Us Undervoltage	Ua Short circuit	-	Connect OK	Module Not sent
OUT	Byte	Bit_7	Bit_6	Bit_5	Bit_4	Bit_3	Bit_2	Bit_1	Bit_0
Signals	1	P4.Pin2	P4.Pin4	P3.Pin2	P3.Pin4	P2.Pin2	P2.Pin4	P1.Pin2	P1.Pin4
	2	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），FCEC-4LKM-4A4S

IN	Byte	Bit_7	Bit_6	Bit_5	Bit_4	Bit_3	Bit_2	Bit_1	Bit_0
Signals	1	P4.Pin2	P4.Pin4	P3.Pin2	P3.Pin4	P2.Pin2	P2.Pin4	P1.Pin2	P1.Pin4
	2	P8.Pin2	P8.Pin4	P7.Pin2	P7.Pin4	P6.Pin2	P6.Pin4	P5.Pin2	P5.Pin4
Status1		Slave Power supply Error	Slave signal short circuit overload	IO-Link Wrong type	IO-Link Not connected	Reserved	Pin2_3 Overload	Pin4_3 Overload	Pin1_3 Short circuit
	1	Signal Port1 status							
	2	Signal Port2 status							
	3	Signal Port3 status							
	4	Signal Port4 status							
	5	IO-Link Port5 status							
	6	IO-Link Port6 status							
	7	IO-Link Port7 status							
	8	IO-Link Port8 status							
Status2	9	Ua Overvoltage	Ua Undervoltage	Us Overvoltage	Us Undervoltage	Ua Short circuit	-	Connect OK	Module Not sent
OUT	Byte	Bit_7	Bit_6	Bit_5	Bit_4	Bit_3	Bit_2	Bit_1	Bit_0
Signals	1	P4.Pin2	P4.Pin4	P3.Pin2	P3.Pin4	P2.Pin2	P2.Pin4	P1.Pin2	P1.Pin4
	2	P8.Pin2	P8.Pin4	P7.Pin2	P7.Pin4	P6.Pin2	P6.Pin4	P5.Pin2	P5.Pin4