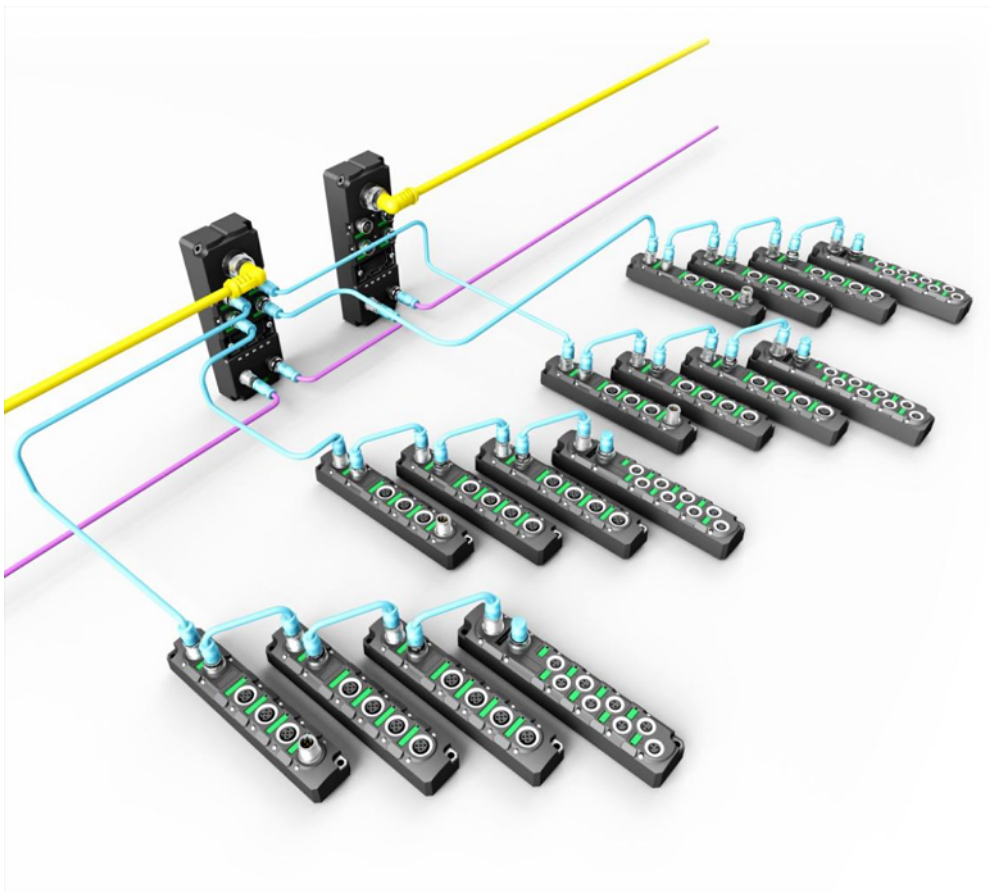# Spider67 I/O Module

----Profibus-DP system Manual

ELCO(Tianjin) Electronics Co., Ltd
04/2019
Version 1.0

Preface

1. Scope of this manual:

This manual applies to the ELCO Profibus-DP Spider67 distributed I/O device. The information in this manual enables you to run the Spider67 module on Profibus-DP in a distributed I/O device

2. Basic knowledge requirements

This manual presumes a general knowledge in the field of automation engineering.
This manual 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 Profibus-DP Spider67 distributed I/O device.
Topics covered in this manual:
- Installation and wiring
- Commissioning and diagnostics
- Components
- Article numbers
- Technical specifications

4. Technical support:

This manual describes the characteristics and the usage of a Spider67 distributed I/O device.
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

Spider67 from ELCO supports modern installation methods with a new and revolutionary expandable I/O system. The simple and easy to install Fieldbus system Spider67 is especially suitable for applications in rough environments.

1.2 Applications

Recently, the wide-range usage of industrial fieldbus I/O products brought deep impact to the automation industry. The traditional centralized control method was replaced by intelligent distribution devices. Besides that, more devices were transferred from cabinets directly to the site. Therefore the reason lies in saving costs, reducing the operation time and shorten the maintenance period. It also optimizes the system procedure.

ELCO Spider67 exactly complies this tendency and represents a revolutionary new generation of I/O solutions. Spider67 is an expandable industrial fieldbus I/O product with protection class IP67. It supports standard industrial bus protocol gateways (such as Profibus-DP, Profinet, EtherCAT, CC-Link) and diversified extended I/O configuration modules and can easily be connected to PLC systems. Compared to the traditional IP67 I/O products, Spider67 expanded modules include digital modules, analog modules and high-speed counting modules etc. Regarding its functions, Spider67 can meet most of the requirements, e.g. processing concentrated / dispersed switch signals, etc. At the same time, this product series offers flexible connection cable and can directly be mounted on a cage lifter or rotational device.

1.3 Features

- IP67 protection class leading to convenient mounting
- Compact design minimizes mounting space requirement
- Standard connection, fast, safe and reliable
- Various input and output signals
- Flexible I/O configuration with a combination of analog, digital, and function modules
- LED status indication, fast function diagnosis
- Can be combined with Spider67 system at random

1.4 Type

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No.	Type	Description
1	SPDP-GW-001	Profibus substation interface module 1-male 7/8"power supply 2*M12 B-Code fieldbus interface (male+female) 4-female, M12 B-Code extended interface
2	SPDB-0800D-001	8 PNP switches or dry contact 4-female,M12 A-Code interface
3	SPDB-0800D-011	8 PNP switches or dry contact 8-female,M8 interface, 3-pin
4	SPDB-0404D-001	4 PNP switches or dry contact 4DI4DO, 0.5A each channel 4-female, M12 A-Code interface
5	SPDB-0404D-011	4 PNP switches or dry contact 4DI4DO, 0.5A each channel 8-female, M8 interface, 3-pin
6	SPDB-08UP-001	8DI+DO, configurable 4-female, M12 A-Code interface
7	SPDB-08UP-011	8DI+DO, configurable 8-female, M8 interface, 3-pin
8	SPDB-0008D-001	8DO, 0.5A each channel 4-female, M12 A-Code interface
9	SPDB-0008D-011	8DO, 0.5A each channel 8-female, M8 interface, 3-pin
10	SPDB-0006D-001	8DO, 2A each channel 1-male, M12 A-Code interface 3-female,M12 A-Code interface
11	SPDB-0300A-001	3AI 0~20mA, 4~20mA, ±20mA optional 3-female, M12 A-Code interface
12	SPDB-0300A-002	3AI 0~10V, ±10V optional 3-female, M12 A-Code interface

13	SPDB-0003A-001	3AO 0~20mA, 4~20mA, ±20mA optional 3-female, M12 A-Code interface
14	SPDB-0003A-002	3AO 0~10V, ±10V optional 3-female, M12 A-Code interface
15	BB6S30P01Dxxx BB6S30P01Mxxx	Pre-wired extensible cable PVC, 5-core shielded, outer diameter 6.5mm Customized length, D=cm，M=dm
16	BB6S30P03Dxxx BB6S30P03Mxxx	Pre-wired extensible cable（drag chain） PUR, 5-core shielded, outer diameter 6.5mm Customized length, D=cm，M=dm
17	BB6S30P09Dxxx BB6S30P09Mxxx	Pre-wired extensible cable（long diatance communication） PUR, 5-core shielded, outer diameter 8mm Customized length, D=cm，M=dm
18	BB6S06	Extension terminal resistance Connecting to the last I/O module

2. Technical characteristics

2.1 Gateway

Power interface:
24VDC, 2 independent power supply
Power supply for system and extensible module

Extension interface
4×M12，6 for each interface

Setting/Display
Set address and rate
Display operating status and fault message

Communication interface
Standard interface based on different protocols

Each Spider67 takes a substation address, extending up to 4-port I/O module connection, max. 6 I/O modules for each port, extension distance up to 100m. Spider67, substation of Profibus-DP, assigns any DP address 1-125 by dial switches, monitor and adapts to transmitting speed of 9.6kbps-12Mbps. Each Spider67 can connect max. 24 I/O modules by extension interface. Modules are allocated to 1-24 in light of extension interface（P0-P1-P2-P3）and the distance to gateway, and are configured by programming software Step7 (see 4.4). If the modules are less than 6, the number will be brought forward automatically. For example, P0 connects 3 modules, the number of 1st module of P1 interface is 4, by analogy, the serial number is the module number that you connected.

2.2 I/O module

Extension interface
In/out, serial
1 cable for communication and power supply

I/O interface:
4×M12
8×M8

I/O modules of Spider67 are serial connected, and are connected to In of 1st module by extension cable, then Out of 1st module to In of 2nd, up to 6 modules. Spider67 I/O modules are designed by the same housing dimensions, including digital, analog, input and output, only 2 different interfaces, 4-M12 and 8-M8. M12 A-Code, 2 digital or 1 analog are available. M8, 3-pin, 1 digital is available.

2.3 Extension cable and terminal resistance

Spider67 extension cable is used between gateways and I/O modules. The overall cable length from the extension interface to the last module is less than 100m . P01, standard extension cable, P09 series long distance communication cable is recommended if the extension distance is over 10m or high load current, P03 series flexible communication cable is especially used for bending lifespan like drag chain (see 1.4).

Terminal resistance is recommended to eliminate reflection and echo, which are used to prevent discontinuous extensible cable resistance or interference caused by long distance communication. As Spider67 is installed terminal resistance, users need to connect a resistance to Out of the last module of each extension interface.

2.4 Hardware

2.4.1 Technical data of gateway

Type	SPDP-GW-001
Extensible channel	4 (P0~P3)
Extensible module/channel	4
Extension distance	Max. 100m
Profinet input	B-Code M12（Male）
Profinet output	B-Code M12（Female）
Extension channel	B-Code M12（Female）
Power input	7/8"（Male,）
U_{MOD}	24VDC (18~30V)
U_{SP}	24VDC (18~30V)
Operation current	<200mA
Max. output current	6A/channel，total for gateway 8A
Operation temperature	-25℃...70℃
Storage temperature	-40℃...85℃
Shock resistance grade	Comply with IEC60068-2-6
EMC	EN 61000-6-2
Protection class	IP67
Operating life	100,000 hours

2.4.2 Digital IO Module

Type	SPDB-0800D001 SPDB-0800D011	SPDB-0404D001 SPDB-0404D011	SPDB-08UP-001 SPDB-08UP-011	SPDB-0008D001 SPDB-0008D011	SPDB-0006D001
Input points	8	4	Max 8	0	0
Output points	0	4	Max 8	8	6
Extension input	B-Code M12（Male）				
Extension output	B-Code M12（Female）				
Input and output Signal	A-Code M12（Female）				
Maximum output current	Each channel 0.5A，module 4A				Each channel 2A, Module 8A
Input response frequency	30Hz				
Output voltage	U_{SP} -0.7V				
Signal type	PNP				
Input point Supply current	Holding current 200mA，Action current 400mA				
Normal input voltage	24VDC (10~30V)				
Operation temperature	-25℃...70℃				
Storage temperature	-40℃...85℃				
Anti-vibration Class	IEC60068-2-6				
Anti-interference EMC	EN 61000-6-2				
Protection class	IP67				
Operating life	100,000 hours				

2.4.3 Analog IO Module

Model	SPDB-0300A-001	SPDB-0300A-002	SPDB-0003A-001	SPDB-0003A-002
Input points	3	3	0	0
Output points	0	0	3	3
Extension input	B-Code M12（Male）			
Extension output	B-Code M12（Female）			
Input and output Signal	A-Code M12（Female）			
Input range	0~20mA 4~20mA -20~20mA	0~5V 0~10V -5~5V -10~10V	Null	Null
Outputrange	Null	Null	0~20mA 4~20mA	0~5V 0~10V -5~5V -10~10V
Internal impedance	<125Ω	<100kΩ	>450Ω	>1kΩ
Resolution	14Bit			
Measurement accuracy	±0.3%			
Input point Supply current	Max. 200mA			
Operation temperature	-25℃...70℃			
Storage temperature	-40℃...85℃			
Anti-vibration Class	IEC60068-2-6			
EMC	EN 61000-6-2			
Protection class	IP67			
Operating life	100,000 hours			

2.4.4 RTD and TC Module

Model	SPDB-0400A-005	SPDB-0400A-006
Input points	4	
Output points	0	
Extension input	B-Code M12（Male）	
Extension output	B-Code M12（Female）	
Input and output Signal	A-Code M12（Female）	
Input range	PT100,PT200,PT500,PT1000 Ni100,Ni1000 0~150/300/600/3000Ω	Type B，E，J，K，N，R，S，T
Output range	Null Null	
Internal impedance	250Ω	1MΩ
Resolution	14Bit	
Measurement accuracy	±0.2%	
Input point Supply current	Max. 200mA	
Operation temperature	-25℃…70℃	
Storage temperature	-40℃…85℃	
Anti-vibration Class	IEC60068-2-6	
EMC	EN 61000-6-2	
Protection class	IP67	
Operating life	100,000 hours	

2.5 LED display

Gateway display

Extension communication indication

Extension power supply indication

Profibus indication

Umod indication

Gateway status indication

Usp indication

I/O module display

Address assignment
output indication

Address assignment
input indication
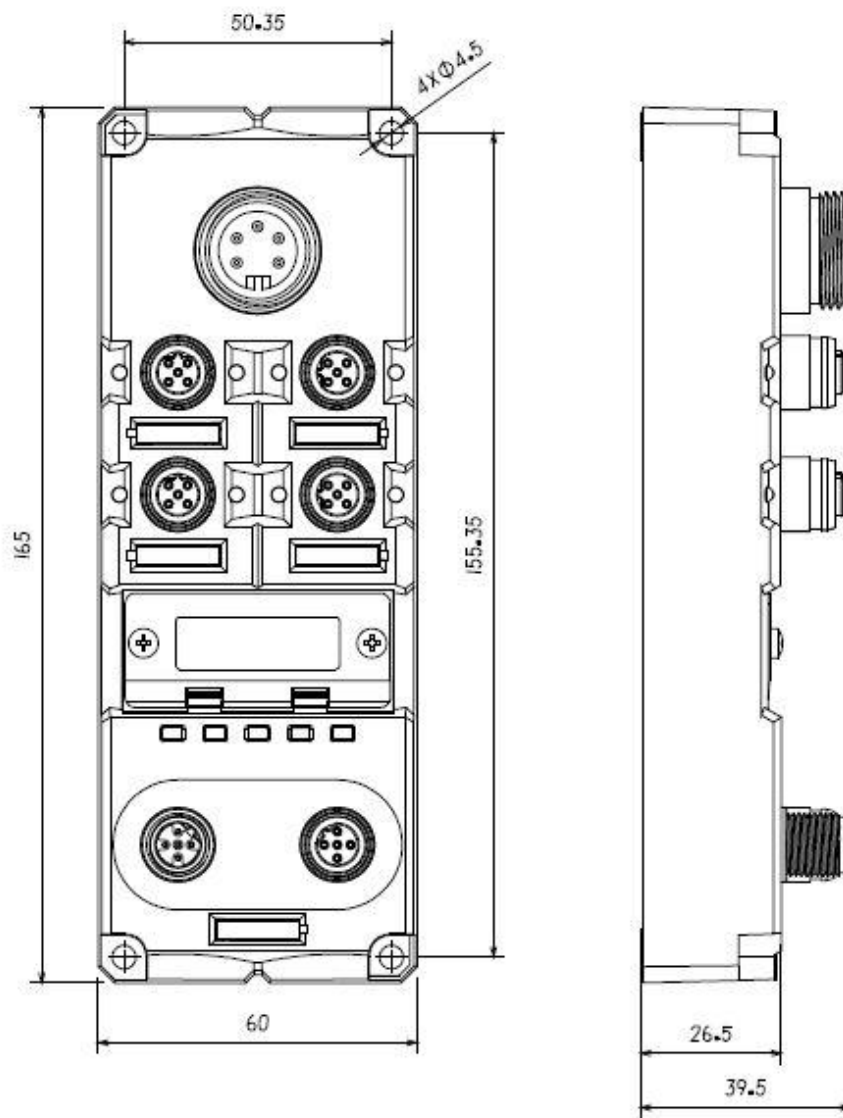
Module status
indication

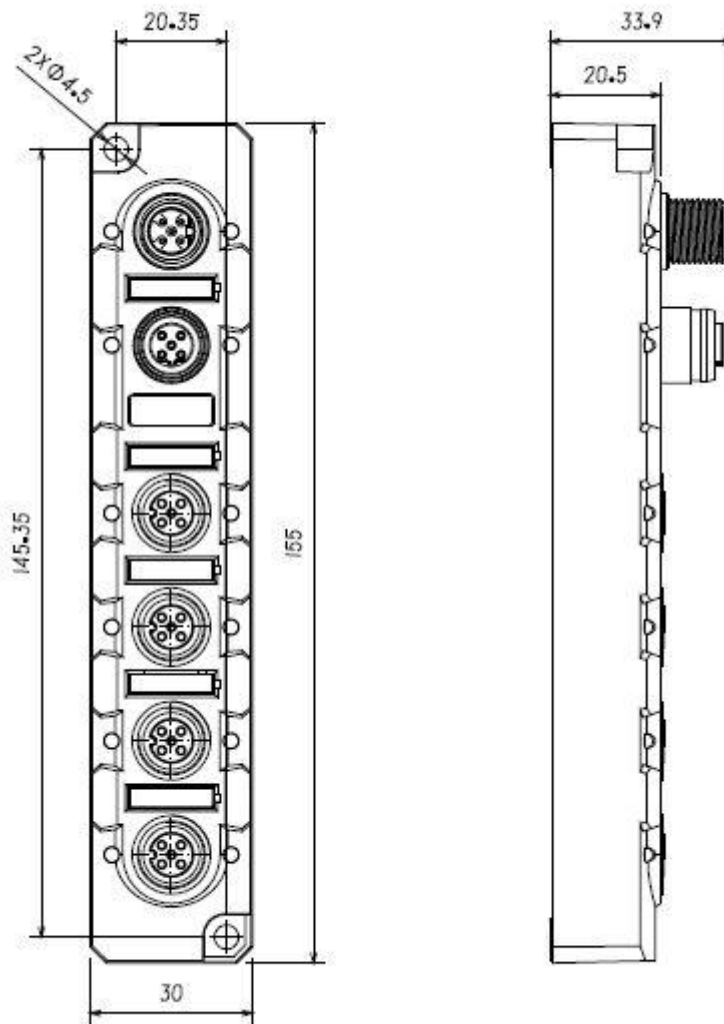Extension
communication
indication

Signal/status indication
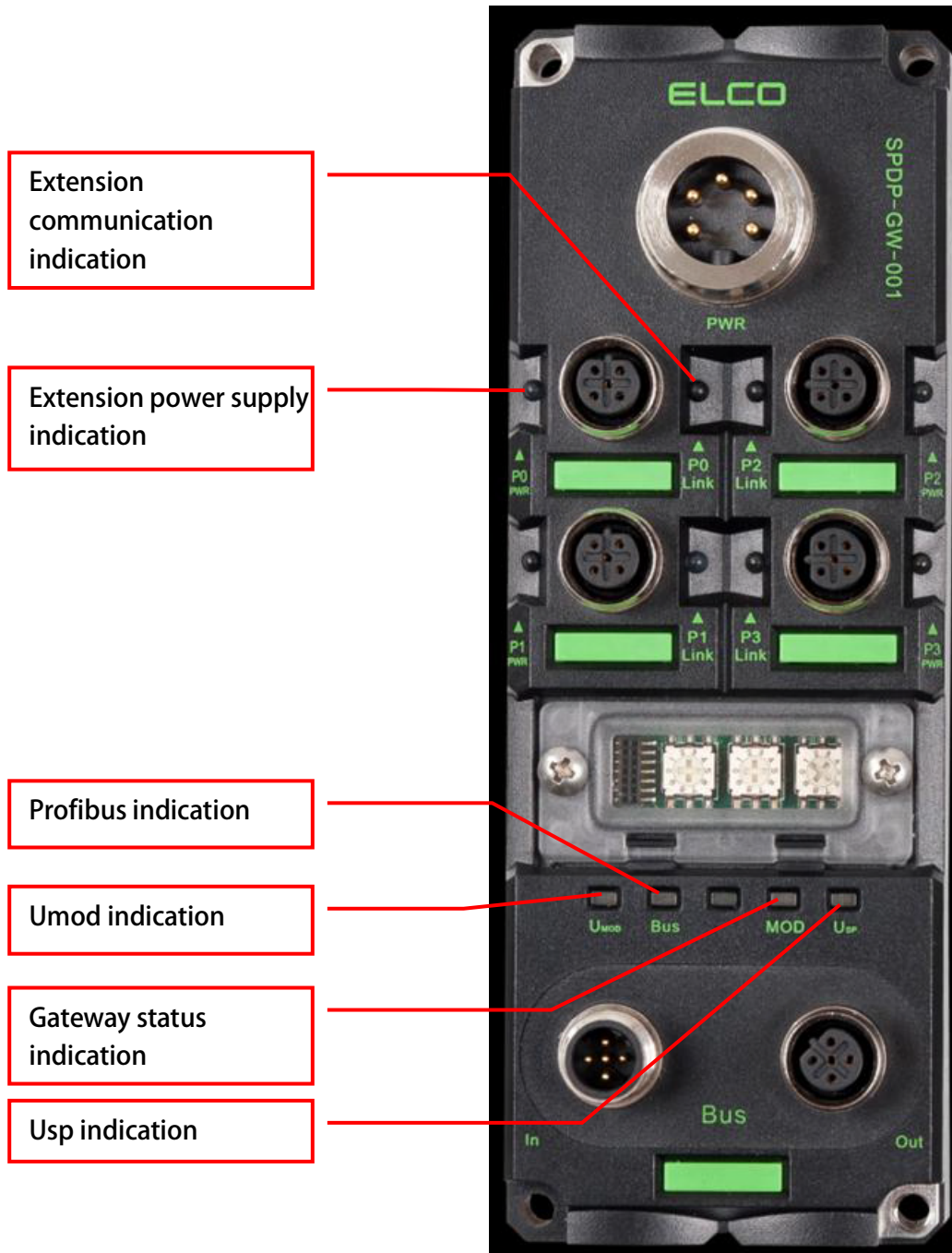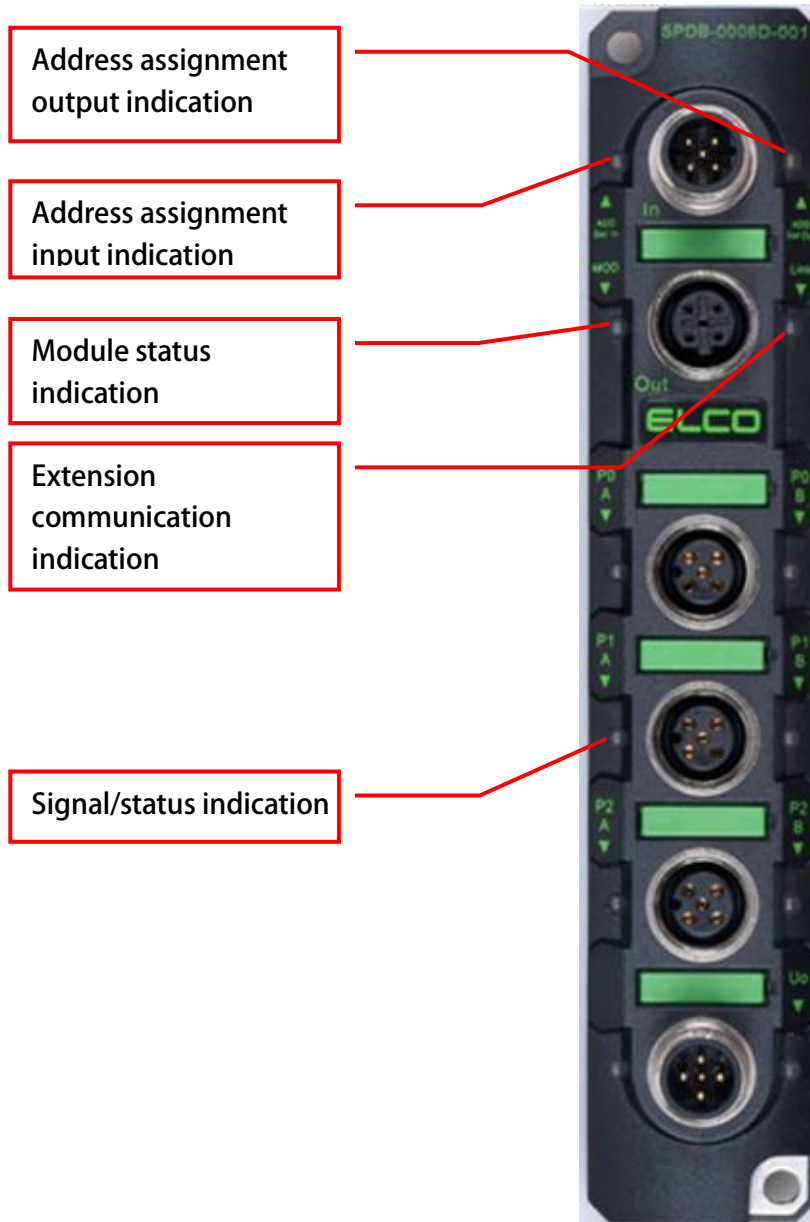
3. Installing

3.1 Mounting dimensions

3.1.1 Gateway dimensions

3.1.2 Module dimensions

3.2 Mounting position and dimensions

Spider67 can be mounted in any position.

The following table shows the mounting dimensions of Spider67 gateway and I/O module.

|	Gateway	I/O module
Mounting width	60mm	30mm
Mounting height	165mm	155mm
Mounting depth	39mm (without connector)	33.5mm (without connector)

3.3 Setting Profibus address

Profibus address assigns Spider67 distributed I/O device address in a Profibus-DP network. Profibus address can be set by opening plastic cover of dial switches:

1) Address is set by rotary encoder, power-off operation
2) Exclusive slave address in the same Profibus network
3) Switch address and module address in configuration is consistent.
4) Address set : 1-125
5) The module can only accept changed Profibus-DP address when power on.

3 rotary switches on the module: ×100, ×10, ×1, indicating current value by arrow

For example, Profibus address is set 55:
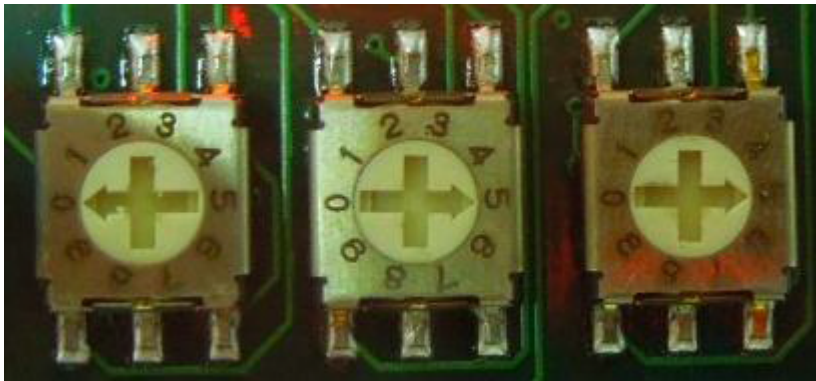
3.4 Wiring Spider67

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

## 3.4.1 Connecting Spider67 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.

3.4.2 Spider67 power supply

Proposal: Spider67 series gateway uses 24VDC power supply, I/O module power supply by extensible cable, voltage range 18~30VDC, standard 7/8" connector.

Two parts for power supply: gateway module power supply U_{MOD}(1L+, 1M), signal module power supply (2L+, 2M). Electrical isolation between 1L+ and 2L+, internally connected between common point 1M and 2M.

1）Power in　(Male)
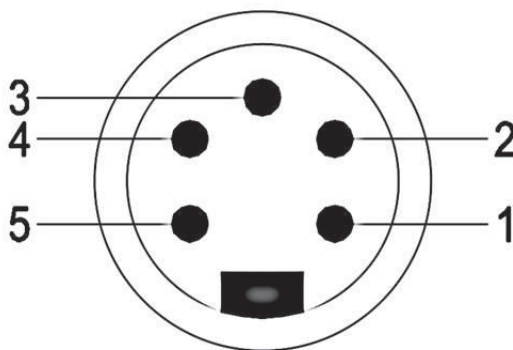
2）Power definition

Terminal	Function	Power supply
1	Signal module power supply 2M	0V
2	Gateway module power supply 1M	0V
3	PE	
4	Gateway module power supply 1L+	24V
5	Signal module power supply 2L+	24V

The six-point output module of Spider67, SPDB-0006D-001 supports auxiliary power supply to the load. The single output point can reach up to 2A, and the whole module can reach up to 8A. This power supply interface also uses standard 24VDC power supply and M12 A-Code standard interface.

1）Auxiliary power supply（Male）
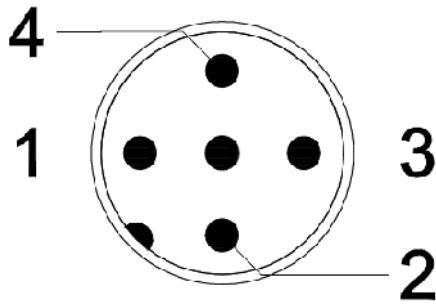
2）Power definition

Terminal	Function	Power supply
1	Auxiliary power supply L+	24V
2	Auxiliary power supply L+	24V
3	Auxiliary power supply M	0V
4	Auxiliary power supply M	0V

Note: In order to improve the power supply capability of the interface, it is recommended that all four pins should be connected with power supply.
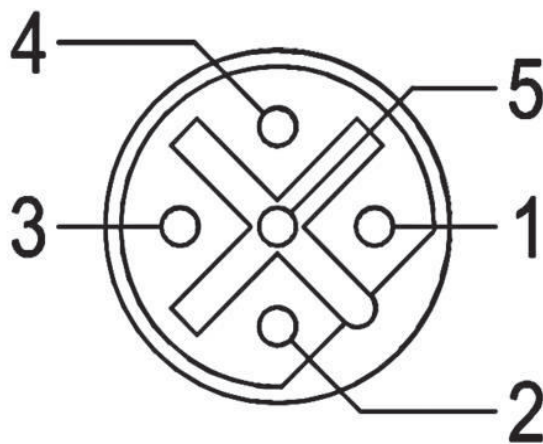In fact,pin1&2 should be connected together and pin 3&4 should be connected together.

3.4.3 Spider67 BUS connection

Spider67 gateway, supporting Profibus-DP protocol, transmits signals by a shielded Profibus cable, B-Code M12 connector.

1）BUS-In (Male)
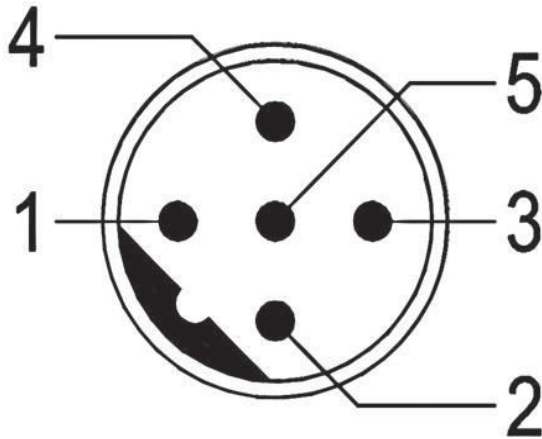
2）BUS-Out (Female)

3）Bus definition

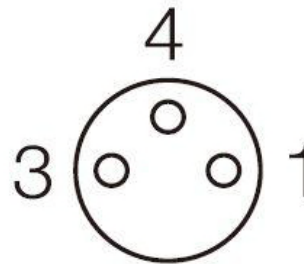| Terminal	Function	Cable color
1	Not used	
2	Bus-A	Green
3	Not used	
4	Bus-B	Red
5	Shield	Shielded

3.4.4 Spider67 digital signal

Spider67 digital I/O modules are connected by standard 5-pin M12 or 3-pin M8 connector, max. 2 signals (input or output) can be connected to M12 interface, 1 signal (input or output) can be connected to M8 interface.

1）Signal receiving (Female)
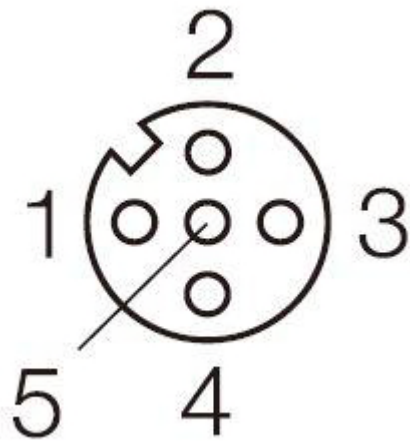
M12 connector   M8 connector

2）Digital signal interface definition

Terminal	M12 connector		M8 connector
1	Power supply 24V+		Power supply 24V+
2	Signal in/out B	2nd signal	None
3	Power supply GND		Power supply GND
4	Signal in/out A	1st signal	Signal in/out
5	PE		None

3） Wiring example

a) Double input signal – 1 connector connects 2 DI, SPDB-0800D-001, SPDB-0404D-001, and SPDB-08UP-001 support this connection.
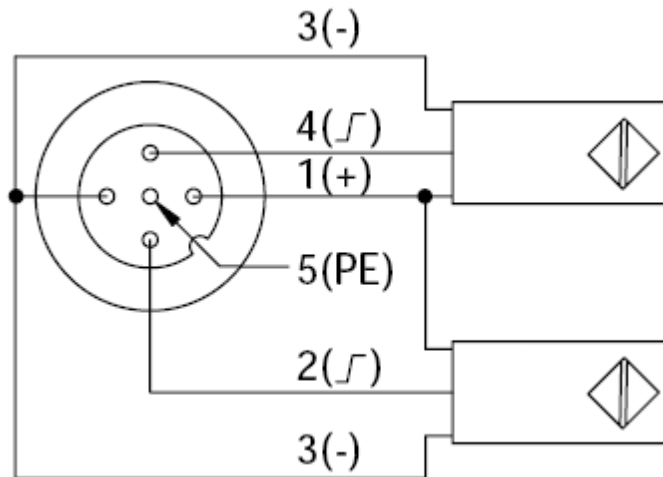
b) Double output signal – 1 connector connects 2 DO, SPDB-0008D-001, SPDB-0404D-001, SPDB-08UP-001, SPDB-0006D-001 support this connection.

c) Input and output signal – 1 connector connects 1 DI and 1 DO,
   SPDB-08UP-001 supports this connection

d) Single input signal – 1 connector connects 1 DI, SPDB-0800D-011,
   SPDB-0404D-011, SPDB-08UP-011 support this connection.

e) Single output signal – 1 connector connects 1 DO, SPDB-0404D-011,
   SPDB-0008D-011, SPDB-08UP-011 support this connection.
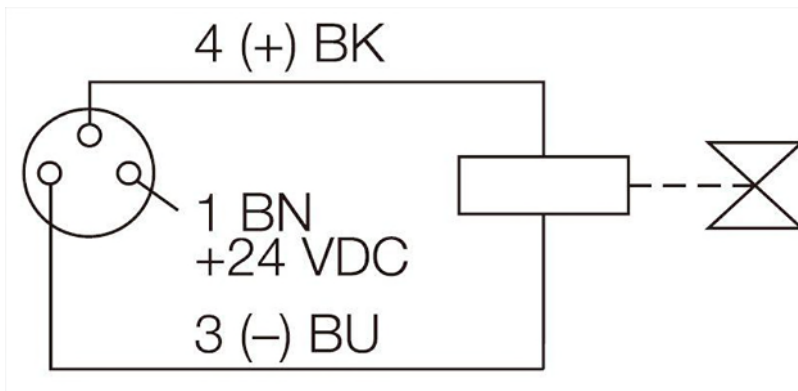
3.4.5 Spider67 analog signal

Spider67 analog I/O modules are connected by standard 5-pin M12, 1 signal (input or output) can be connected to interface.
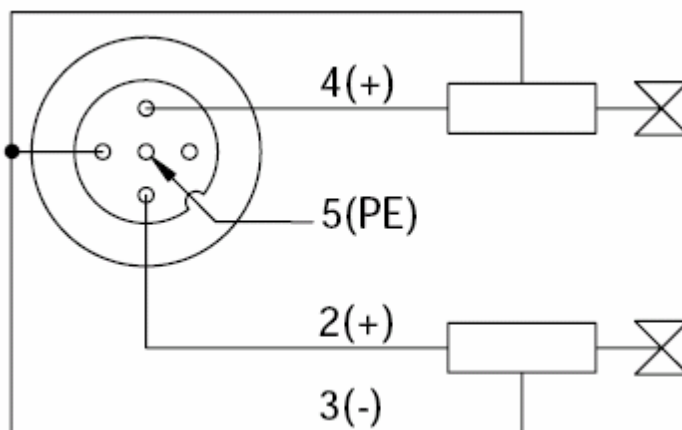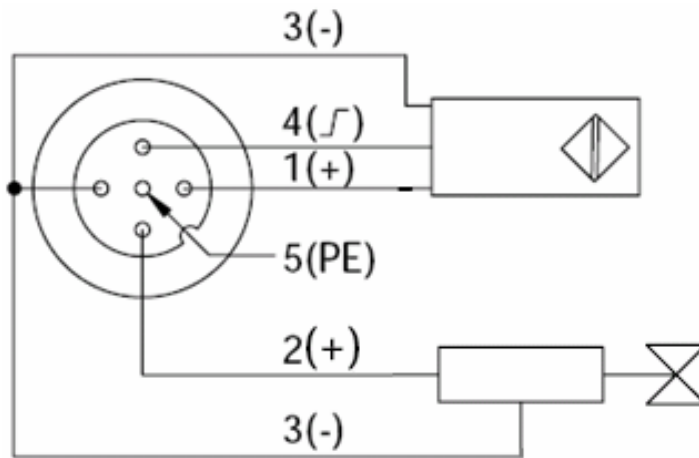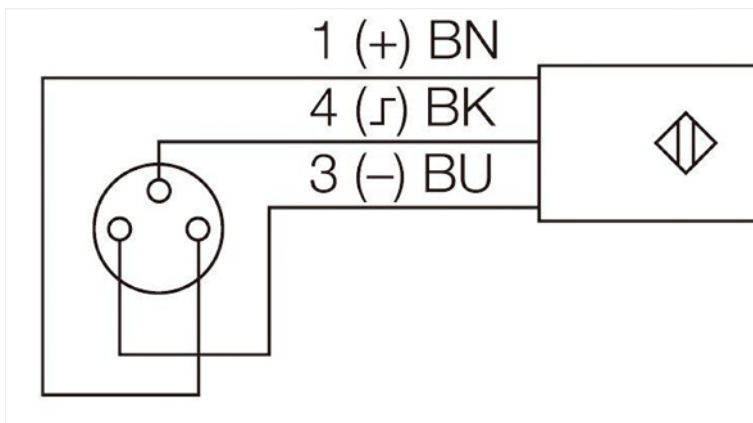
1）Signal receiving (Female)
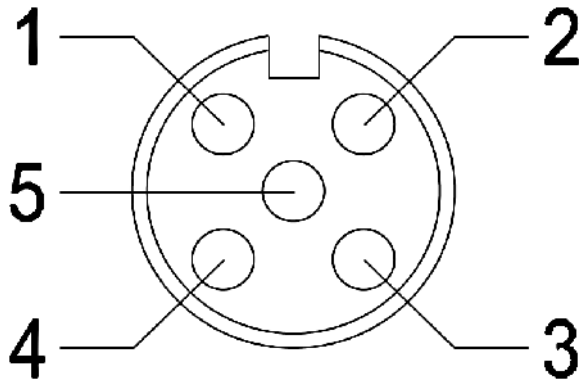
2）Analog signal interface definition

Terminal	Function	Function
1	Power supply 24V+	
2	Signal in/out +	AI/AO +
3	Power supply GND	
4	Signal in/out -	AI/AO -
5	PE	

RTD and TC signal interface definition

Terminal	Function	Function
1	Power supply I+	
2	Signal in M+	RTD/TC +
3	Power supply I-	
4	Signal in M-	RTD/TC -
5	PE	

3） Wiring example

    a) 2-wire input - 1 connector connects 1 2-wire input, SPDB-0300A-001
       supports this connection.
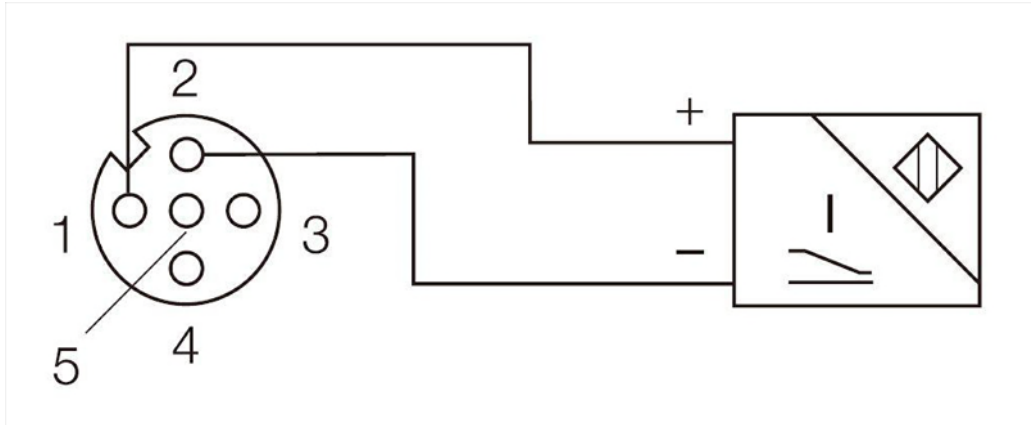
    b) 4-wire input - 1 connector connects 1 4-wire input, SPDB-0300A-001
       supports this connection.
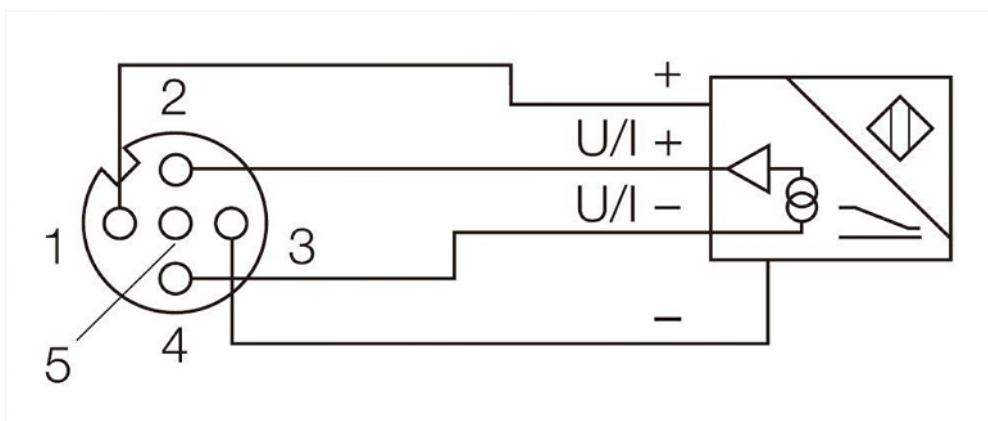
    c) Voltage input- 1 connector connects 1 voltage input, SPDB-0300A-002
       supports this connection.
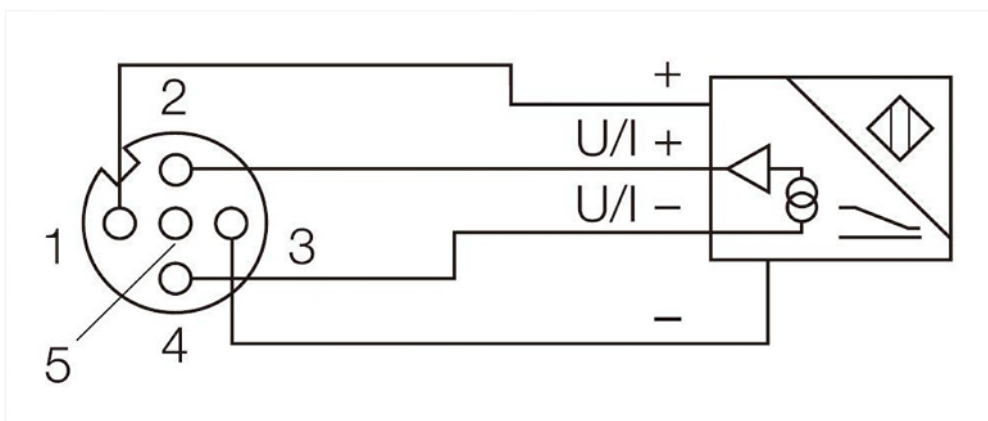
d) Current output- 1 connector connects 1 current output, SPDB-0003A-001 supports this connection.
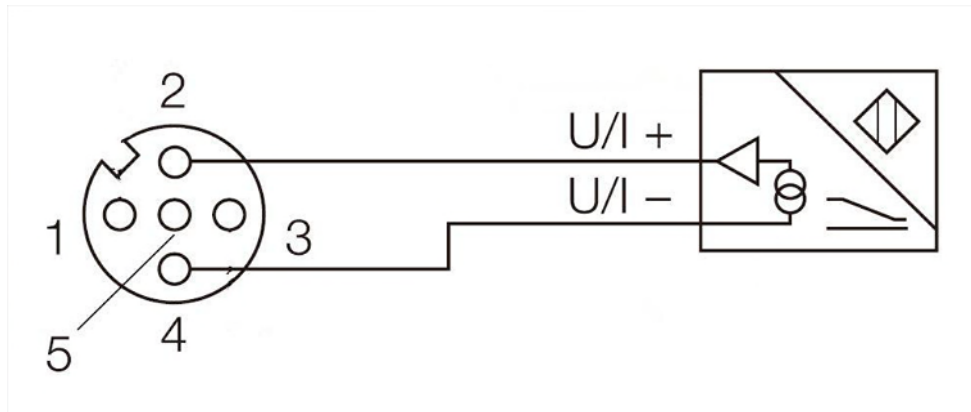
e) Voltage output- 1 connector connects 1 voltage output, SPDB-0003A-002 supports this connection.
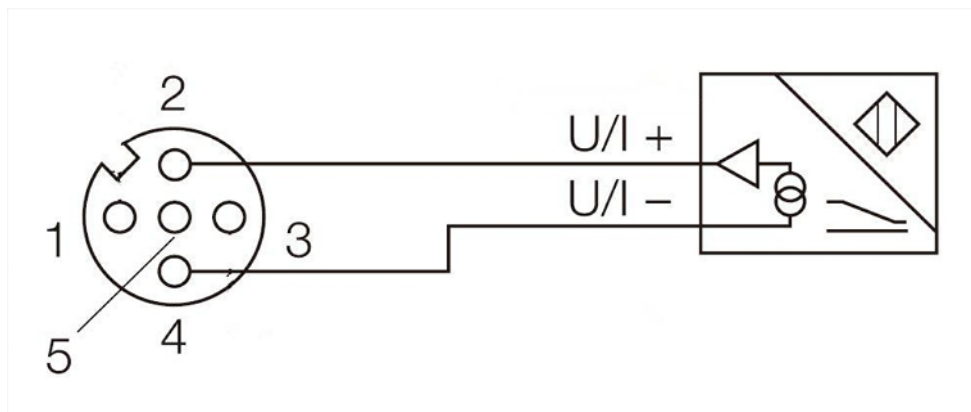
f) Two-wire thermal resistance signal — 1 connector connects 1 two-wire thermal resistance input signal, the model SPDB-0400A-005 of the signal module supports this form of connection.
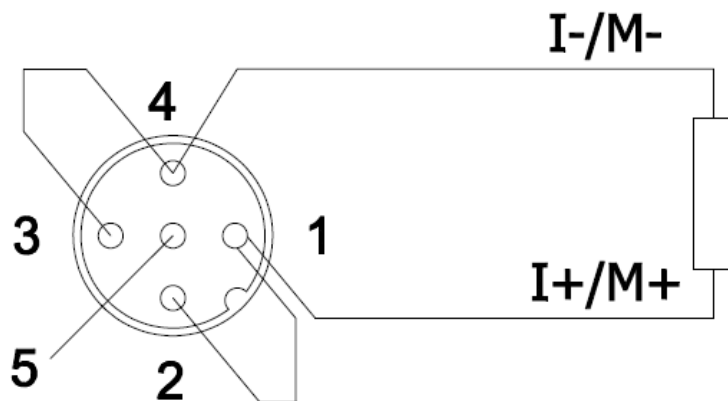
g) Three-wire thermal resistance signal — 1 connector connects 1 three-wire thermal resistance input signal, the model SPDB-0400A-005 of the signal module supports this form of connection.
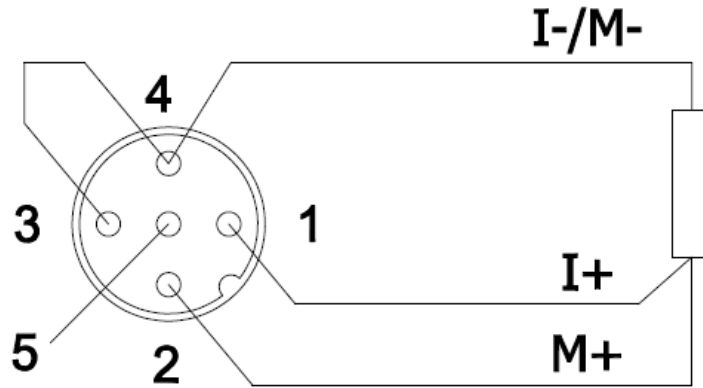
h) Four-wire thermal resistance signal — 1 connector connects 1 four-wire thermal resistance input signal, the model SPDB-0400A-005 of the signal module supports this form of connection.
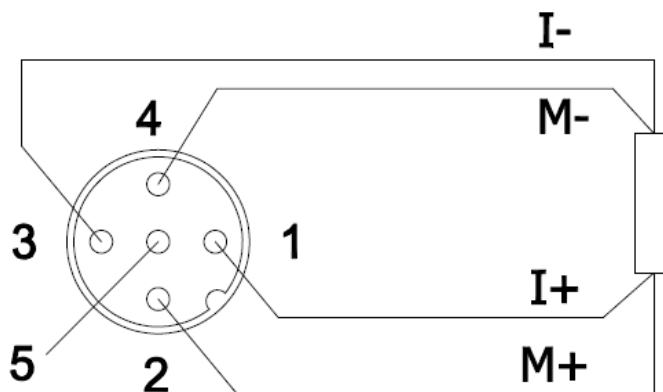
i) Thermocouple signal —1 connector connects 1 thermocouple input signal, the model SPDB-0400A-006 of the signal module supports this form of connection.
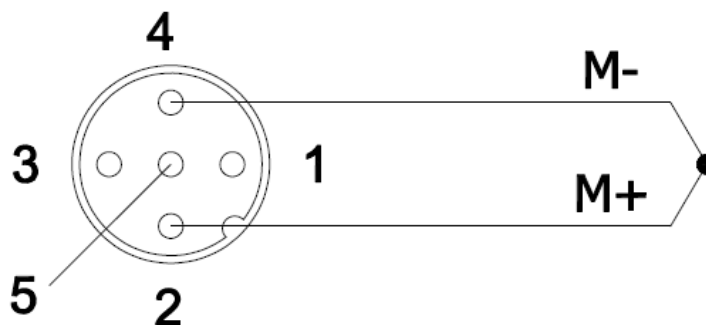
4. Configuration commissioning

4.1 GSD file

You configure Spider67 distributed I/O device using the GSD file. The GSD file is used to integrate Spider67 into your system as standard slave. You can download the GSD file on the internet, at: http://www.elco-holding.com/
The procedure depends on whether you integrate the GSD file into a Profibus system. To integrate the GSD file in your configuration software using Step7:

1) Run Step7, then select "Options>Install New GSD File" in HW Config.
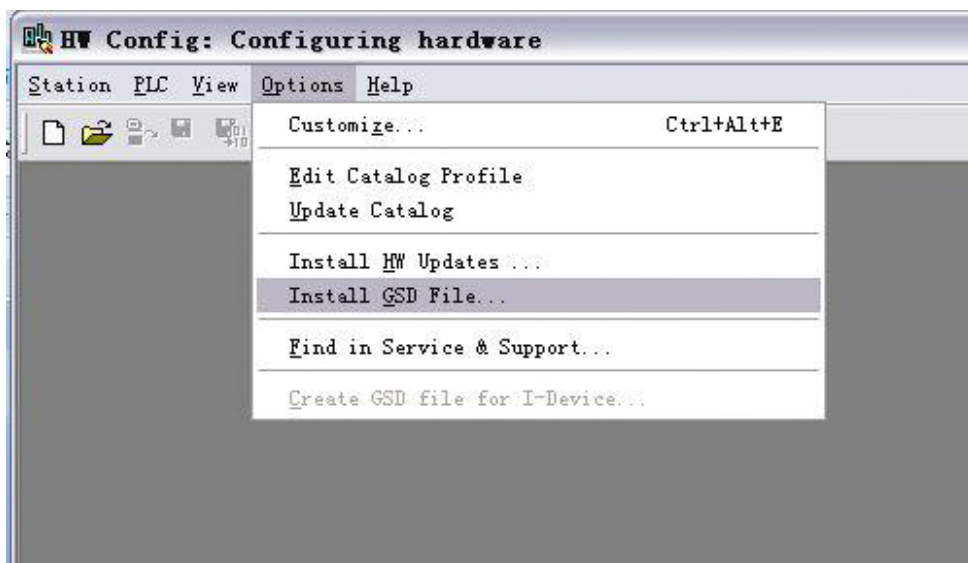
2) On the next dialog box, select the GSD file to install, and confirm with "OK".
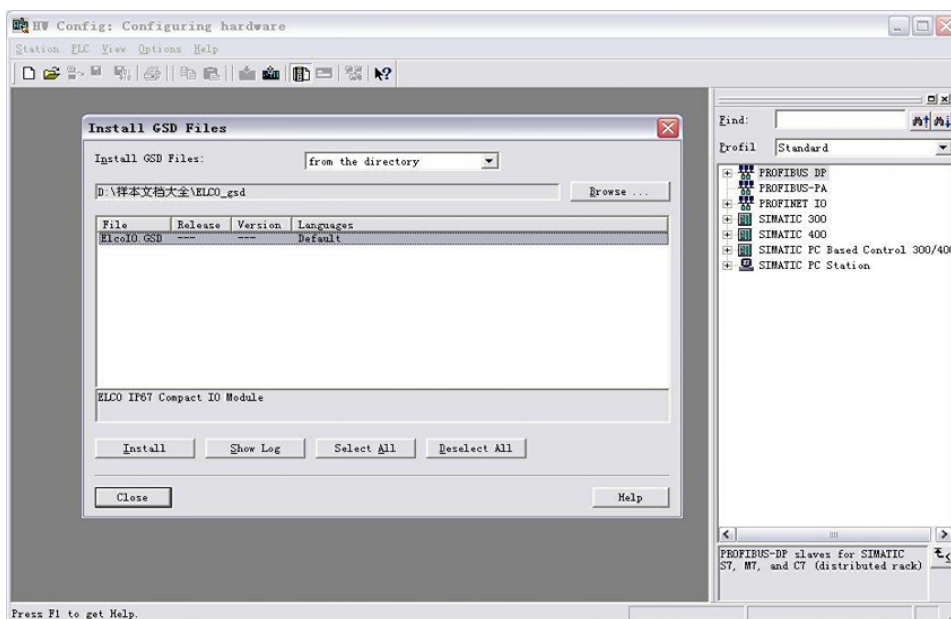
3) The field device appears in the hardware catalog of the "Additional Field Devices>IO>ELCO>IP67" folder.
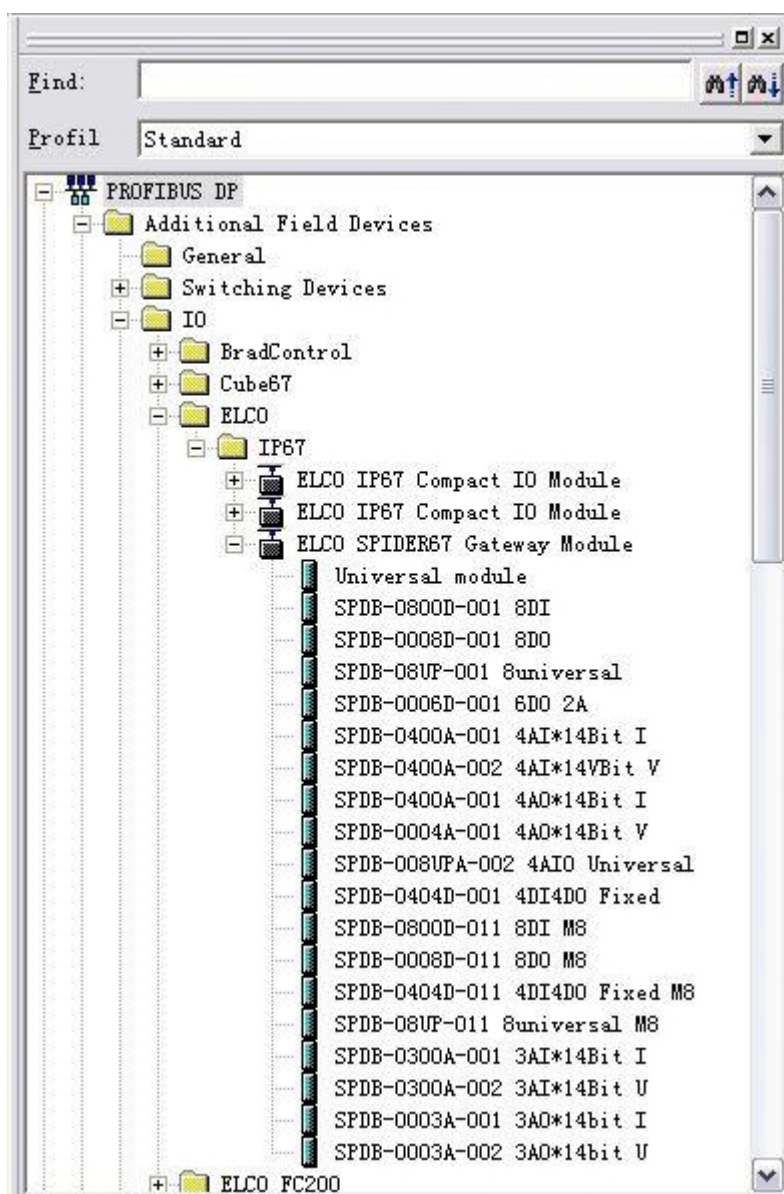
4) Configure Spider67 using Step7.

4.2 Signal assignment

Each Spider67 module connecting M12 has 4 connectors (P0~P3), 5 pins (Pin1~Pin5) for each connector. Each Spider67 module connecting M8 has 8 connectors (P0~P7), 3 pins (Pin1, Pin3, Pin4) for each connector.

1) 8DI: SPDB-0800D-001, SPDB-0800D-011

The module takes up 1 byte input.

Byte	Bit	M12 connector SPDB-0800D-001	M8 connector SPDB-0800D-011	Example
Input Byte 0	Bit 0	P0.Pin4	P0.Pin4	I 0.0
	Bit 1	P0.Pin2	P1.Pin4	I 0.1
	Bit 2	P1.Pin4	P2.Pin4	I 0.2
	Bit 3	P1.Pin2	P3.Pin4	I 0.3
	Bit 4	P2.Pin4	P4.Pin4	I 0.4
	Bit 5	P2.Pin2	P5.Pin4	I 0.5
	Bit 6	P3.Pin4	P6.Pin4	I 0.6
	Bit 7	P3.Pin2	P7.Pin4	I 0.7

2) 4DI4DO: SPDB-0404D-001, SPDB-0404D-011

The module takes up 1 byte input and 1 byte output. As each signal has only 4 DIDO, input takes up I 0.0~I 0.3, I 0.4~I 0.7 is useless, output takes up Q 0.4~Q 0.7, Q 0.0~Q 0.3 is useless.

Byte	Bit	M12 connector SPDB-0404D-001	M8 connector SPDB-0404D-011	Example
Input Byte 0	Bit 0	P0.Pin4	P0.Pin4	I 0.0
	Bit 1	P0.Pin2	P1.Pin4	I 0.1
	Bit 2	P1.Pin4	P2.Pin4	I 0.2
	Bit 3	P1.Pin2	P3.Pin4	I 0.3
Output Byte 0	Bit 4	P2.Pin4	P4.Pin4	Q 0.4
	Bit 5	P2.Pin2	P5.Pin4	Q 0.5
	Bit 6	P3.Pin4	P6.Pin4	Q 0.6
	Bit 7	P3.Pin2	P7.Pin4	Q 0.7

3）8DI8DO: SPDB-08UP-001, SPDB-08UP-011

The module takes up 1 byte input and 1 byte output. Taking up address depends on input or output. For example, 2 signals at 1st interface for input, taking up I0.0 and I0.1, Q0.0 and Q0.1 is useless.

Byte	Bit	M12 connector SPDB-08UP-001	M8 connector SPDB-08UP-011	Example
Input/Output Byte 0	Bit 0	P0.Pin4	P0.Pin4	I 0.0 Q 0.0
	Bit 1	P0.Pin2	P1.Pin4	I 0.1 Q 0.1
	Bit 2	P1.Pin4	P2.Pin4	I 0.2 Q 0.2
	Bit 3	P1.Pin2	P3.Pin4	I 0.3 Q 0.3
	Bit 4	P2.Pin4	P4.Pin4	I 0.4 Q 0.4
	Bit 5	P2.Pin2	P5.Pin4	I 0.5 Q 0.5
	Bit 6	P3.Pin4	P6.Pin4	I 0.6 Q 0.6
	Bit 7	P3.Pin2	P7.Pin4	I 0.7 Q 0.7

4）8DO: SPDB-0008D-001, SPDB-0008D-011

The module takes up 1 byte output.

Byte	Bit	M12 connector SPDB-0008D-001	M8 connector SPDB-0008D-011	Example
Output Byte 0	Bit 0	P0.Pin4	P0.Pin4	Q 0.0
	Bit 1	P0.Pin2	P1.Pin4	Q 0.1
	Bit 2	P1.Pin4	P2.Pin4	Q 0.2
	Bit 3	P1.Pin2	P3.Pin4	Q 0.3
	Bit 4	P2.Pin4	P4.Pin4	Q 0.4
	Bit 5	P2.Pin2	P5.Pin4	Q 0.5
	Bit 6	P3.Pin4	P6.Pin4	Q 0.6
	Bit 7	P3.Pin2	P7.Pin4	Q 0.7

5) 6DO: SPDB-0006D-001

The module takes up 1 byte output.

Byte	Bit	M12 connector SPDB0006D001	Example
Output Byte 0	Bit 0	P0.Pin4	Q 0.0
	Bit 1	P0.Pin2	Q 0.1
	Bit 2	P1.Pin4	Q 0.2
	Bit 3	P1.Pin2	Q 0.3
	Bit 4	P2.Pin4	Q 0.4
	Bit 5	P2.Pin2	Q 0.5
	Bit 6	P3.Pin4	Q 0.6
	Bit 7	P3.Pin2	Q 0.7

6) 3AI: SPDB-0300A-001, PDB-0300A-002

The module takes up 6 byte output.

Byte	Byte	connector	Example
Input Byte 0~5	Byte 0 Byte 1	P0	IW 0
	Byte 2 Byte 3	P1	IW 2
	Byte 4 Byte 5	P2	IW 4

7) 3AO: SPDB-0003A-001, SPDB-0003A-002

The module takes up 6 byte output.

Byte	Byte	connector	Example
Output Byte 0~5	Byte 0 Byte 1	P0	QW 0
	Byte 2 Byte 3	P1	QW 2
	Byte 4 Byte 5	P2	QW 4

4.3 Instruction of Analog Value

PLC controller processes analog values in a binary system; the analog input module transfers analog process signals into digital signals; the analog output module transfers the digital output value into an analog signal.

Digital analog values are suitable to the same rated input and output value; each analog signal occupies 1 word PLC address, i. e. each analog signal corresponds to 16 bit. The symbol of analog is set on bit15: 0 represents '+'; 1 represents '1'. For the analog module with resolution less than 16 bits, the analog value is saved in the format of left justifying; the idle least significant bit is padded with '0'.

Example: analog value18035 can be expressed in binary system as follows:

Resolution	Analog Value															
Bit No.	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
16bit	0	1	0	0	0	1	1	0	0	1	1	1	0	0	1	1
14bit	0	1	0	0	0	1	1	0	0	1	1	1	0	0	0	0

Two types of analog signals: unipolar and bipolar. Current bipolar value ±20mA; voltage bipolar value ±5V and ±10V; current unipolar value 0~20mA and 4~20mA; voltage unipolar value 0~5V and 0~10V.

Note: Analog output only supports rated analog value; overshoot range only represents input module.

● Analog value within bipolar current input/output range:

System Value			Input/Output Range	
	Decimalism	hexadecimal	±20 mA	
118.5149%	32767	7FFF	≥ 23.7 mA	Overflow, lock the maximum
	27649	6C01		Overshoot range
100%	27648	6C00	20 mA	Rated range
75%	20736	5100	15 mA	
0.003617%	1	1	723.4 nA	
0%	0	0	0 mA	
	-1	FFFF	-723.4 nA	
-75%	-20736	AF00	-15 mA	
-100%	-27648	9400	-20 mA	
	-27649	93FF		Overshoot range
-118.519%	-32768	8000	≤ -23.7 mA	Underflow, lock the least value

● Analog value within bipolar voltage input/output range:

System Value			Input/Output Range		
	Decimalism	hexadecimal	± 5V	± 10V	
118.5149%	32767	7FFF	≥ 5.926 V	≥ 11.85 V	Overflow, lock the maximum
	27649	6C01			Overshoot range
100%	27648	6C00	5 V	10 V	Rated range
75%	20736	5100	3.75 V	7.5 V	
0.003617%	1	1	180.8 µV	361.7 µV	
0%	0	0	0 V	0 V	
	-1	FFFF	-180.8 µV	-361.7 µV	
-75%	-20736	AF00	-3.75 V	-7.5 V	
-100%	-27648	9400	-5 V	-10 V	
	-27649	93FF			Overshoot range
-118.519%	-32768	8000	≤ -5.926 V	≤ 11.85 V	Underflow, lock the least value

● Analog value within unipolar current input/output range:

System Value			Input/Output Range		
	Decimalism	hexadecimal	0~20mA	4~20mA	
118.5149%	32767	7FFF	≥ 23.7 mA	≥ 22.96 mA	Overflow, lock the maximum
	27649	6C01			Overshoot range
100%	27648	6C00	20 mA	20 mA	Rated range
75%	20736	5100	15 mA	16 mA	
0.003617%	1	1			
0%	0	0	0 mA	4 mA	
	-1	FFFF			
-75%	-20736	AF00	0 mA	0 mA	Underflow, lock the least value
-100%	-27648	9400			
	-27649	93FF			
-118.519%	-32768	8000	0 mA	0 mA	

● Analog value within unipolar voltage input/output range:

System Value			Input/Output Range		
	Decimalism	hexadecimal	0~5 V	0~10 V	
118.5149%	32767	7FFF	≥ 5.926 V	≥ 11.85 V	Overflow, lock the maximum
	27649	6C01			Overshoot range
100%	27648	6C00	5 V	10 V	Rated range
75%	20736	5100	3.75 V	7.5 V	
0.003617%	1	1			
0%	0	0	0 V	0 V	
	-1	FFFF			
-75%	-20736	AF00	0 V	0 V	Underflow, lock the least value
-100%	-27648	9400			
	-27649	93FF			
-118.519%	-32768	8000	0 V	0 V	

- Analog value within resistance range:

System Value			Input/Output Range				
	Decimalism	hexadecimal	0~ 150Ω	0~ 300Ω	0~ 600Ω	0~ 3000Ω	
118.5149%	32767	7FFF	≥ 176.4 Ω	≥ 352.8 Ω	≥ 705.5 Ω	≥ 3530 Ω	Overflow, lock the maximum
	27649	6C01					Overshoot range
100%	27648	6C00	150 Ω	300 Ω	600 Ω	3000 Ω	Rated range
75%	20736	5100	112.5 Ω	225 Ω	450 Ω	2250 Ω	
0.003617%	1	1	5.43 mΩ	10.85 mΩ	21.7 mΩ	108 mΩ	
0%	0	0	0 Ω	0 Ω	0 Ω	0 Ω	
No resistance is negative							

- Analog value within PT x00 thermal resistance:

System Value			Input/Output Range	
	Decimalism	hexadecimal	-200~+850 ℃	
	32767	7FFF	≥ 850.1 ℃	Overflow, lock the maximum
	8500	2134	850 ℃	Rated range
	6375	18E7	637.5 ℃	
	10	A	1 ℃	
	0	0	0 ℃	
	-10	FFF6	-1 ℃	
	-1500	FA24	-150 ℃	
	-2000	F830	-200 ℃	
	-32768	8000	≤ -200.1 ℃	Underflow, lock the least value

- Analog value within Ni x00 thermal resistance:

System Value			Input/Output Range	
	Decimalism	hexadecimal	-60~+250 ℃	
	32767	7FFF	≥ 250.1 ℃	Overflow, lock the maximum
	2500	9C4	250 ℃	Rated range
	1875	753	187.5 ℃	
	10	A	1 ℃	
	0	0	0 ℃	
	-10	FFF6	-1 ℃	
	-450	FE3E	-45 ℃	
	-600	FDA8	-60 ℃	
	-32768	8000	≤ -60.1 ℃	Underflow, lock the least value

- Analog value within thermocouple:

Type B，E，J，K，N，R，S，T thermocouple determines the rated input and output range according to the temperature range of the scale. Dividing the decimal value of the system by 10, the current temperature can be obtained. The resolution is 0.1 C, and the maximum or minimum value can be locked out beyond the limit.
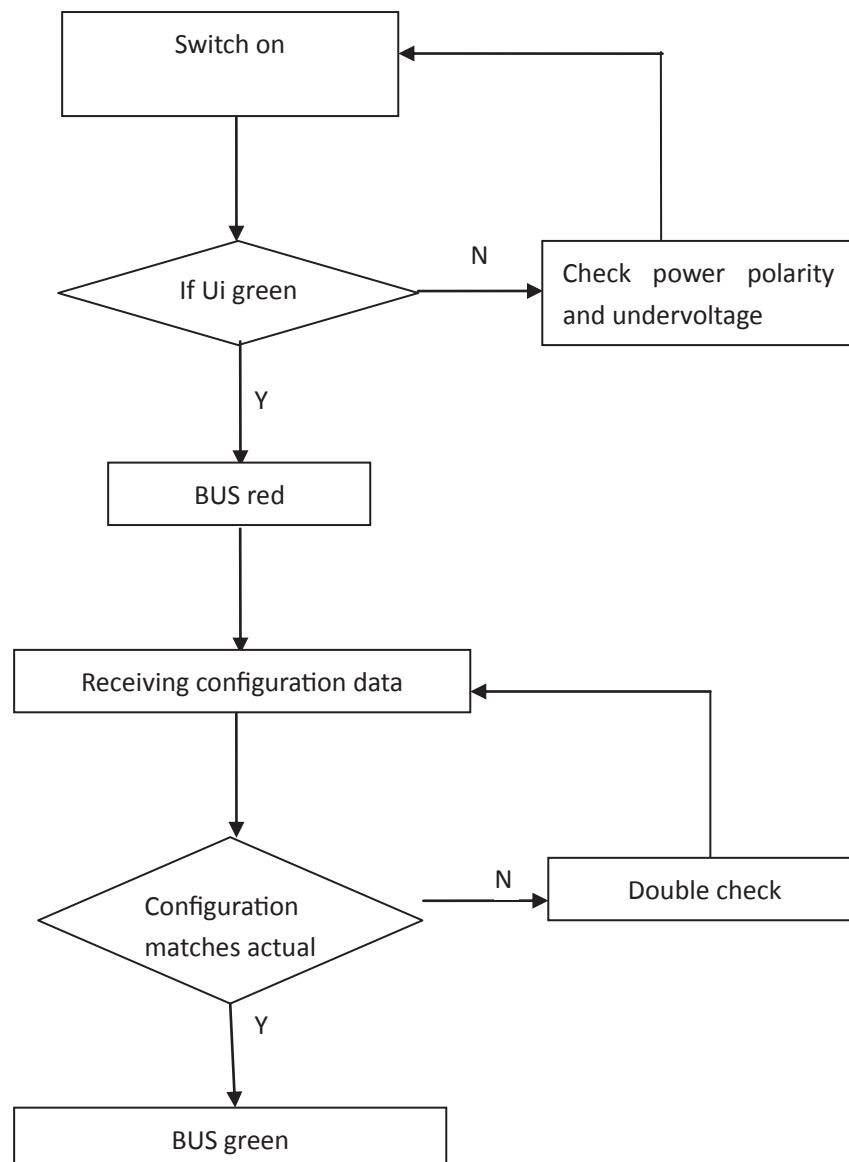
4.4 Module startup process

Check whether the following requirements are met for the startup of the Spider67 distribution I/O module system:

- Spider67 gateway and module are power, bus and signal wired.
- The module address is set by software.
- Spider67 is configured and downloaded into the controller.
- Supply voltage for controller is switched on.

Startup of Spider67:

```
          ┌─────────────────┐
          │    Switch on    │◄──────────────┐
          └────────┬────────┘               │
                   │                        │
                   ▼                        │
              ◇─────────◇      N    ┌──────────────────────┐
            ◇  If Ui green  ◇──────►│ Check  power  polarity│
              ◇─────────◇           │ and undervoltage      │
                   │ Y              └──────────────────────┘
                   ▼
          ┌─────────────────┐
          │     BUS red     │
          └────────┬────────┘
                   │
                   ▼
    ┌──────────────────────────┐◄────────────────┐
    │ Receiving configuration  │                 │
    │ data                     │                 │
    └────────────┬─────────────┘                 │
                 │                                │
                 ▼                                │
          ◇─────────────◇       N      ┌──────────────────┐
        ◇  Configuration  ◇────────────►│   Double check   │
        ◇  matches actual ◇            └──────────────────┘
          ◇─────────────◇
                 │ Y
                 ▼
          ┌─────────────────┐
          │    BUS green    │
          └─────────────────┘
```
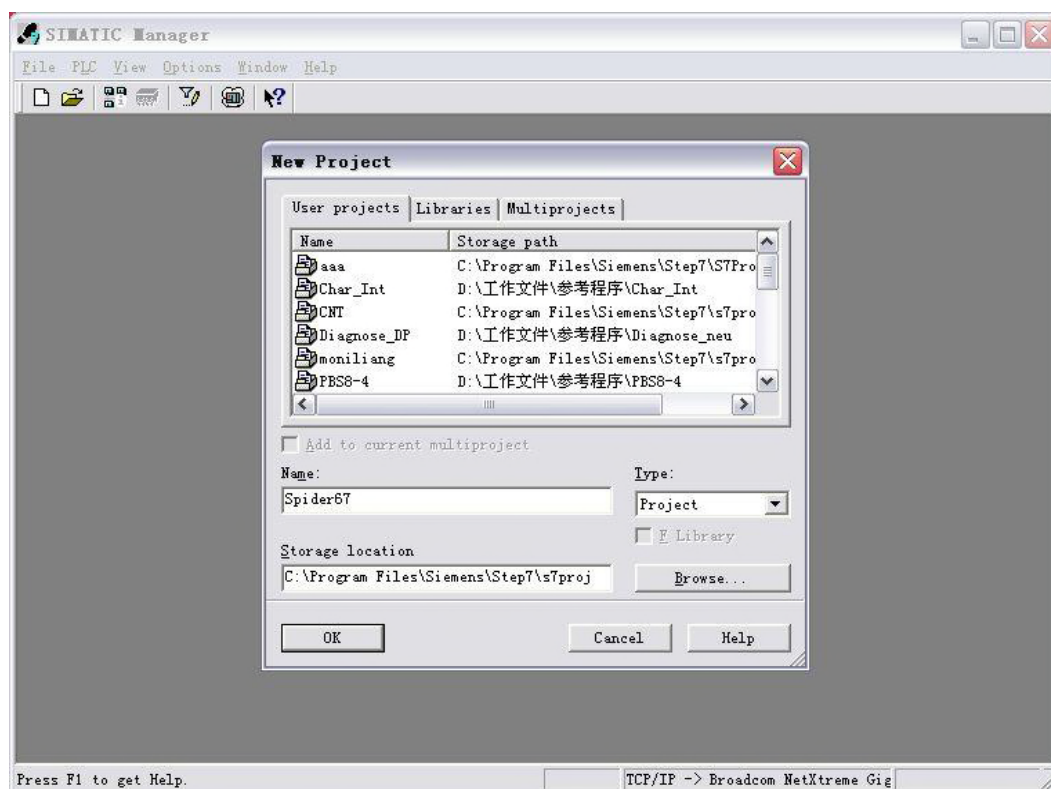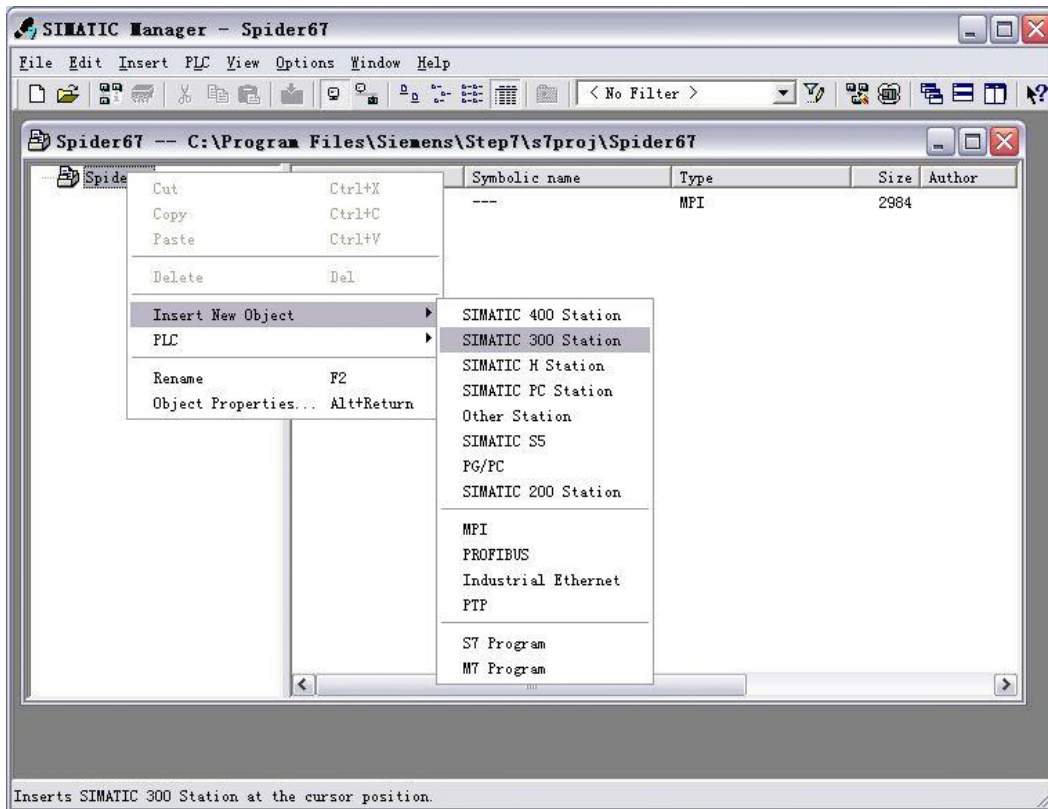
4.5 Module configuration

This chapter makes users realize Spider67 distribution I/O system through configuration operation. In the example, ELCO Spider67, as Profibus-DP slave, connects DP station CPU315-2DP of Siemens. We assume that power and bus are wired, slave address of Spider67 module is set 07 by dial switches.

Spider67 system includes 1 gateway module SPDP-GW-001, extension P0 connecting 2 SPDB-08UP-001, extension P1 connecting 1 SPDB-0300A-001, extension P2 connecting 1 SPDB-0300A-002, extension P3 connecting 1 SPDB-0003A-001.
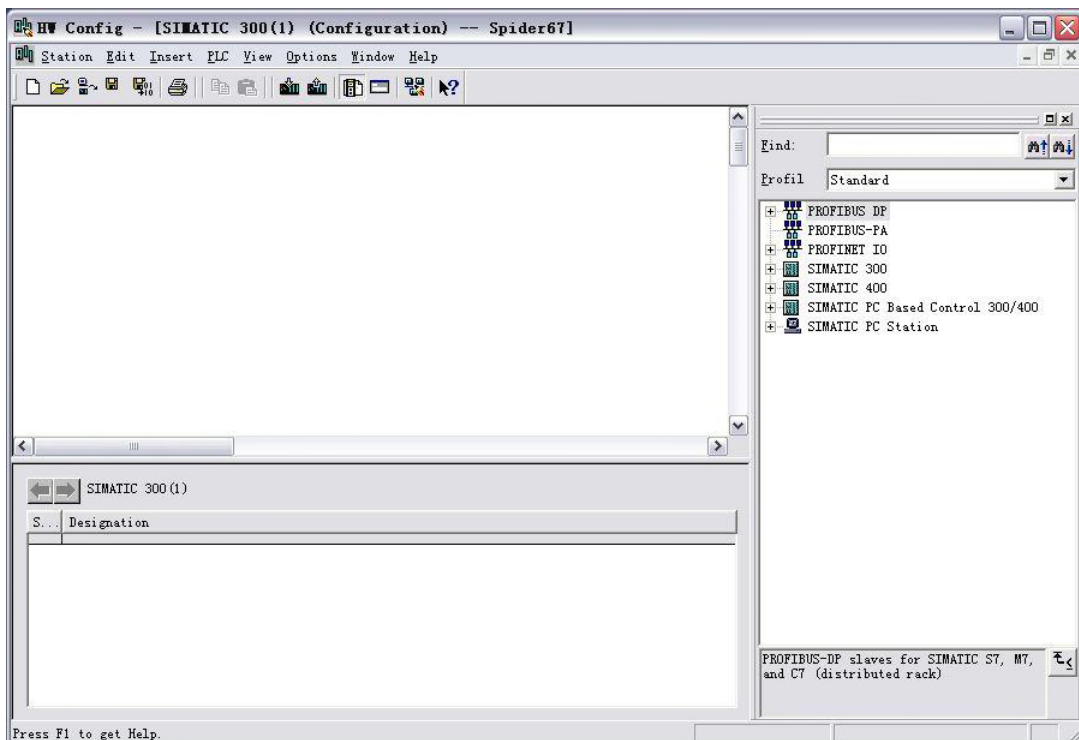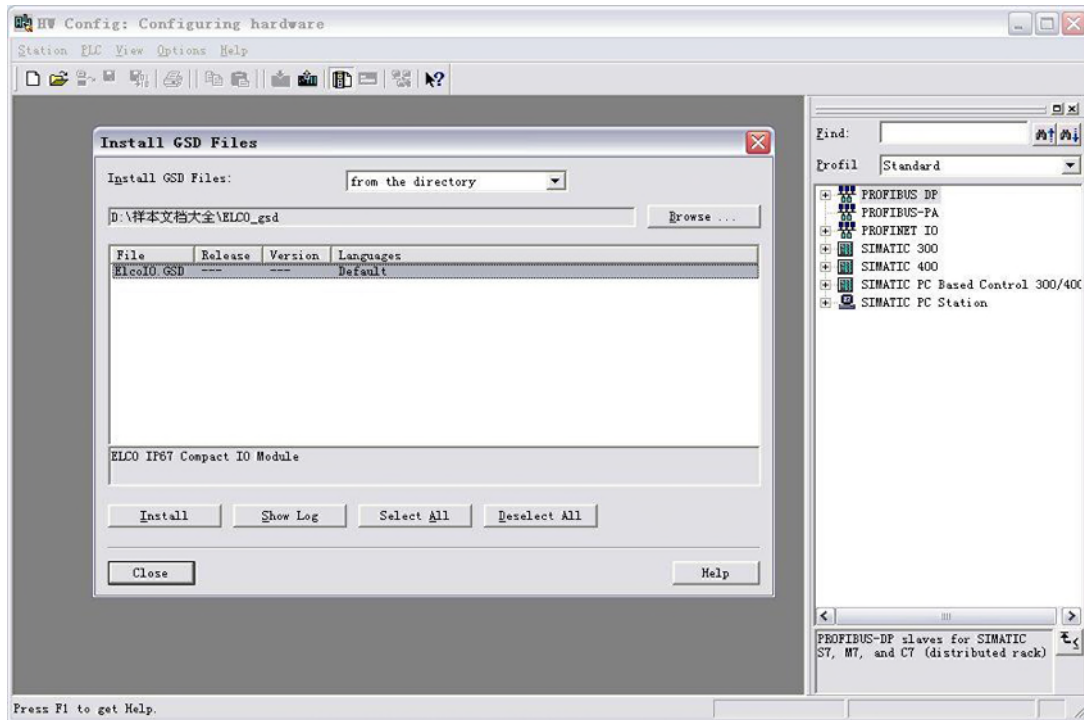
1) Create a new Step7 project.
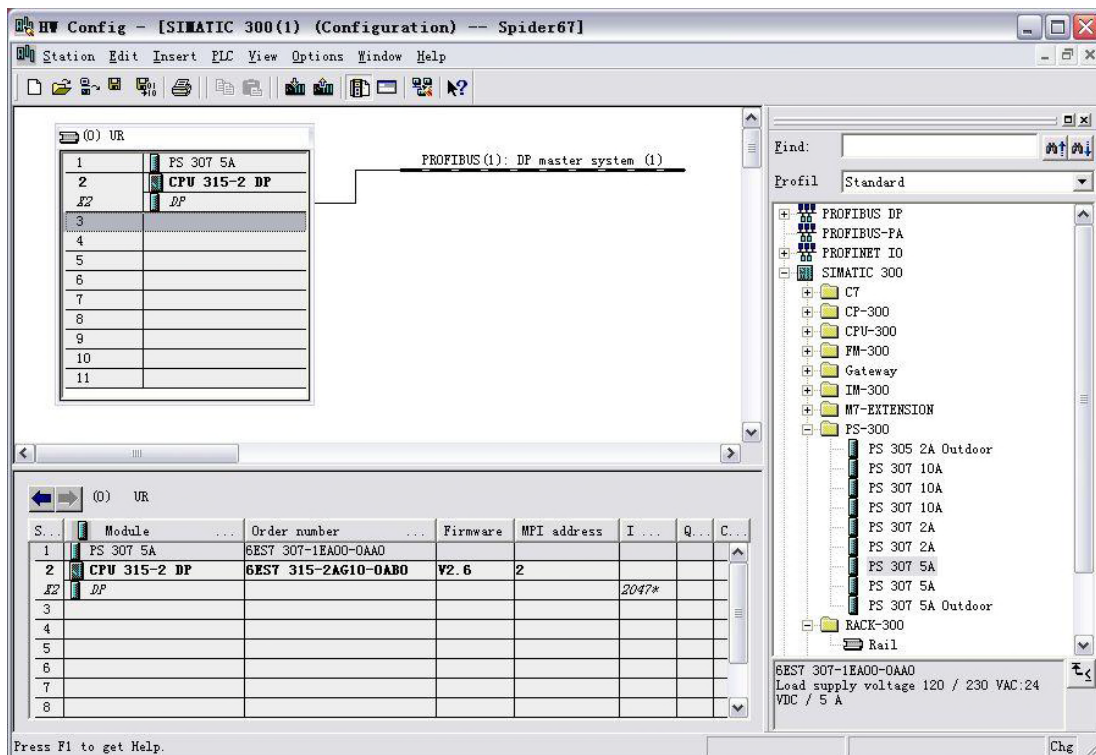
2) Add new Simatic300 station.

3) Double click "Hardware" to startup hardware configuration tool.

4) Refer to 4.1 to install the GSD file.


5) Change the hardware configuration, select the suitable slot, power and CPU in the Catalog dialog box, and set CPU, bus, etc

6) In Catalog box, select ” ELCO SPIDER67 Gateway Module” to add to PROFIBUS network in the directory of ” Profibus DP>Additional Field Devices>IO>ELCO>IP67”. Please note that address set and hardware rotary encoder must share the same: 07.
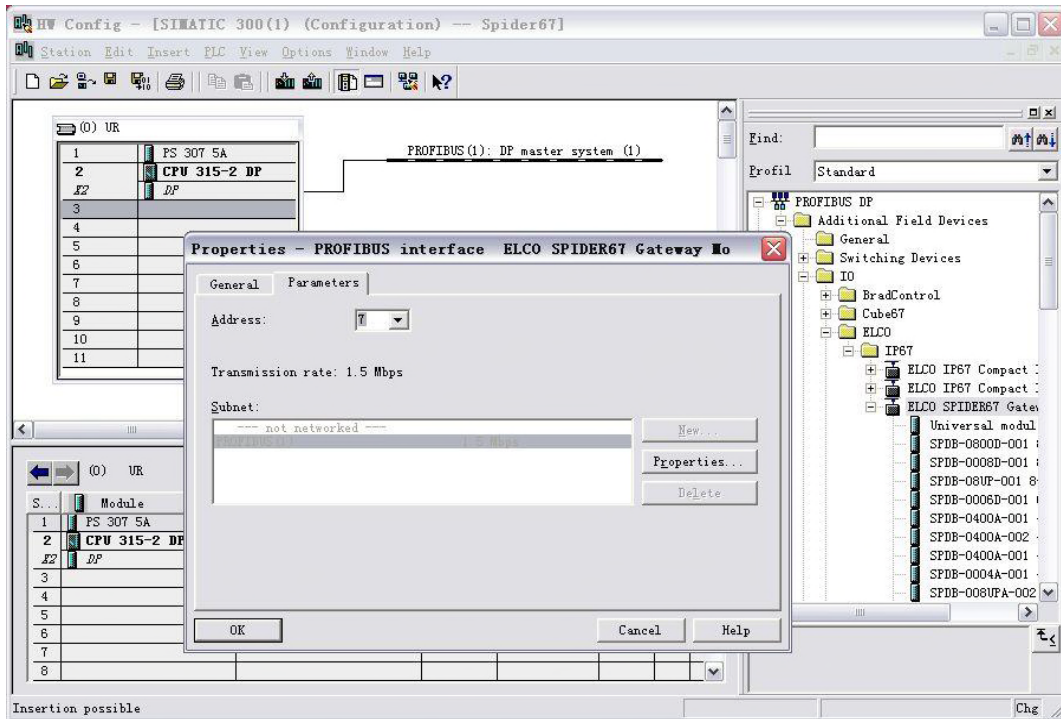
7) According to I/O module configuration in this chapter, add module type and quantity to slot of Spider67 gateway in light of sequence P0-P1-P2-P3 in the directory of "ELCO SPIDER67 Gateway Module".
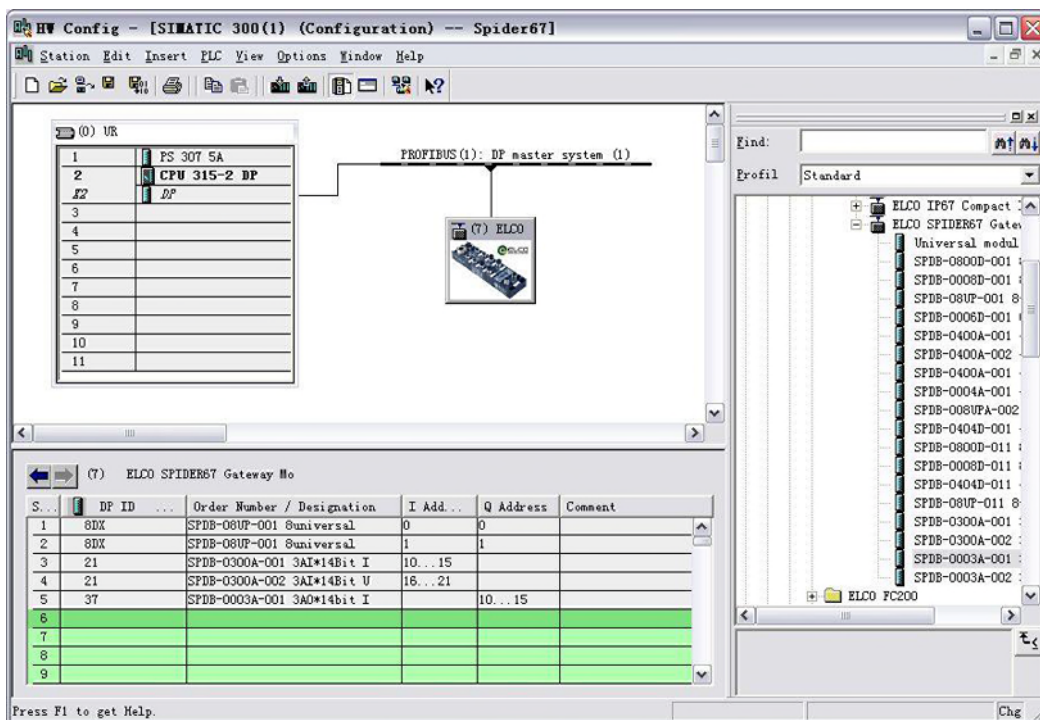
8) Double click the added Spider67 gateway , and select Parameter Assignment to assign numbers of I/O module of extensions. In this example, P0 for 2, P1 for 1, P2 for 1, P3 for 1.
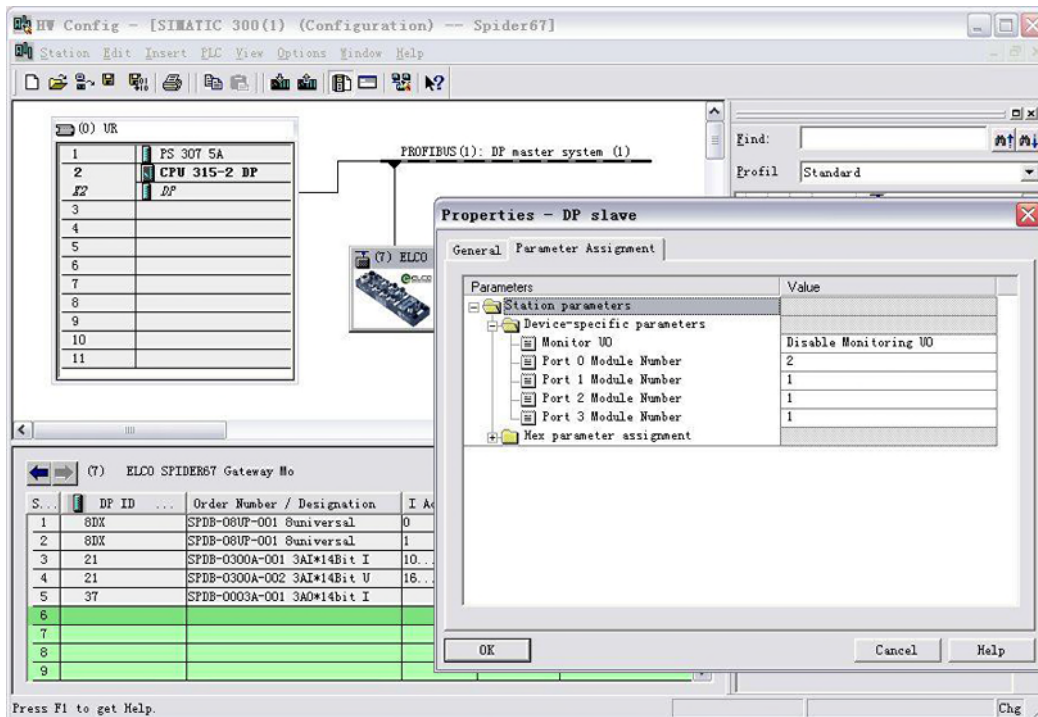
9) Double click the added "SPDB-08UP-001", and select Parameter Assignment to assign module parameters in dialog box "Properties". Users can select "Input" or "Output" of each interface to define input or output. The default "Universal" means interface is input as well as output, which depends on users.
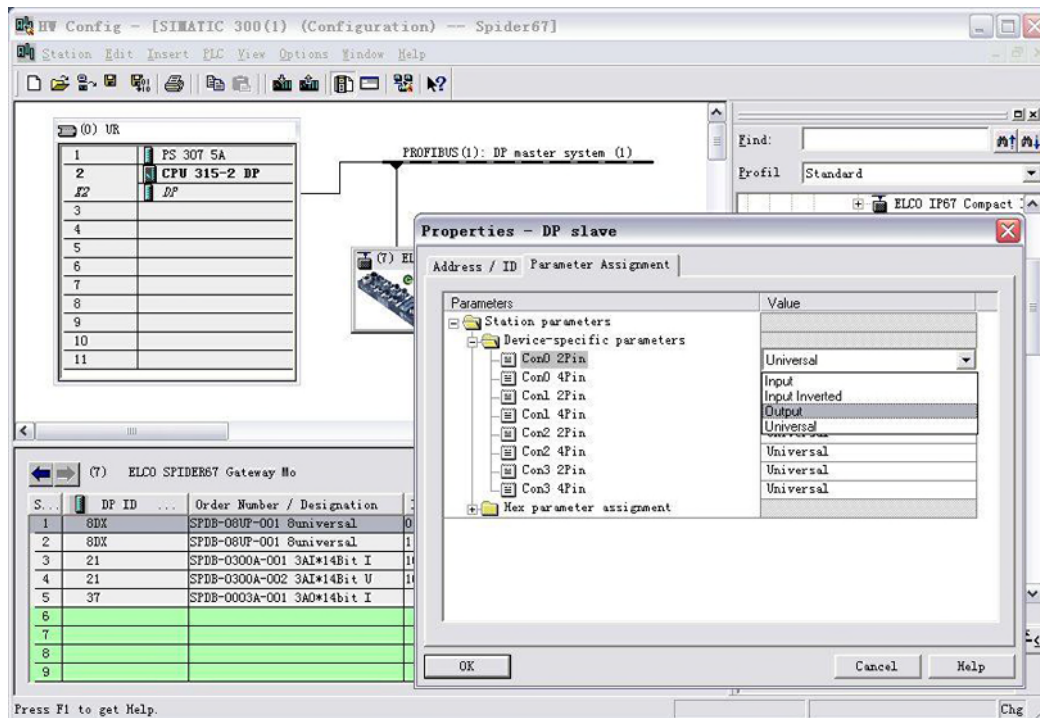
Note：SPDB-08UP-001 is input/output definable module, DIDIO modules of other types can't be changed.

10）Double click the added "SPDB-0300A-001", and select Parameter Assignment to assign module parameters in dialog box "Properties". Users can select current input of each interface: "0~20mA", "4~20mA", "-20~+20mA", and can also close the interface to increase scanning speed of module.
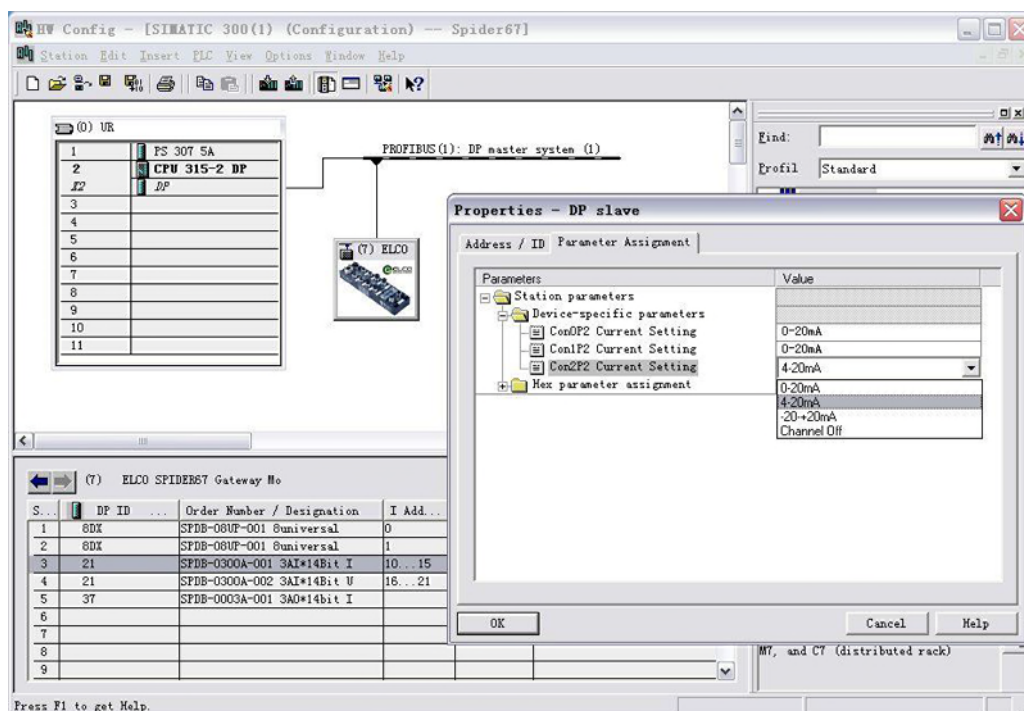
11) Double check the added "SPDB-0300A-002", and select Parameter Assignment to   assign module parameters in dialog box "Properties". Users can select voltage input of each interface: " 0~10V", " -10~+10V", " 0~5V", "-5~+5V", and can also close the interface to increase scanning speed of module.
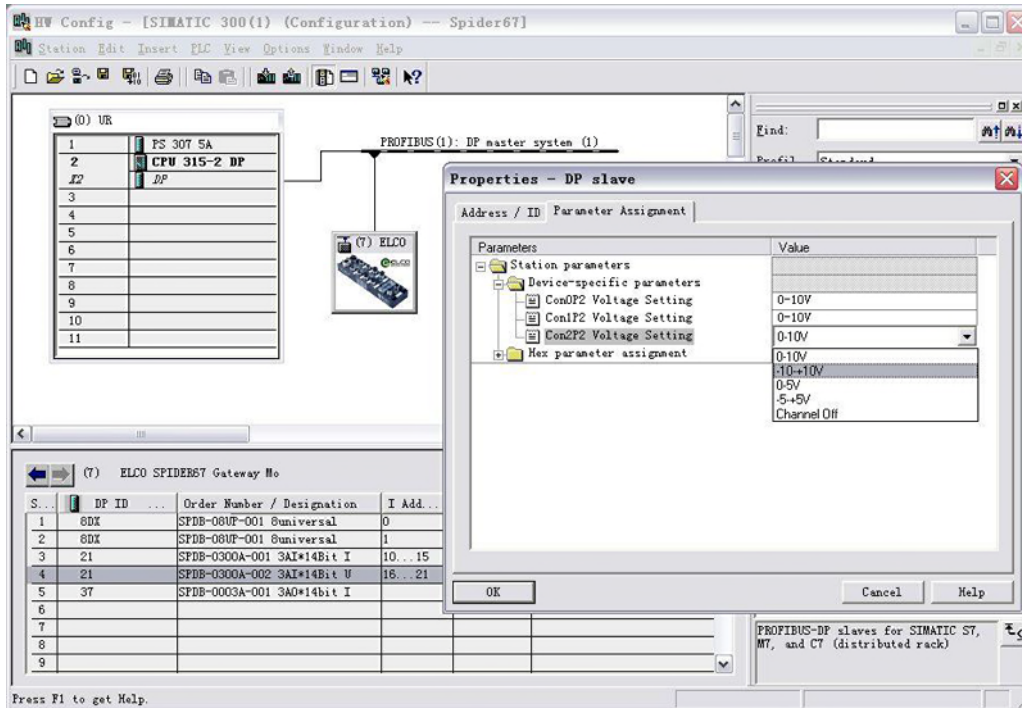
12) Download configuration to PLC after saving.

5. Alarm

5.1 LED display

Users can realize the status of module by LED display of Spider67 distributed I/O. (Refer to 2.5 "LED display" for LED appearance.)

GatewayLED indication				Meaning	Remedy
U_{MOD}	U_{SP}	Bus	MOD		
Red	-	-	-	Power supply of gateway module low than 18V	Check module power supply
-	Red	-	-	Power supply of module load low than 18V	Check **auxiliary**power supply
-	-	-	Red	I/O short-circuit or overload	Check sensor or load
				The actual setting of extension module is different from the configuration	Check configuration
				Other module failure	Contact technical supports
Green	Green	Red	-	Normal module and auxiliary power supply, but fail to communicate with profibus master	Check Profibus DP cable
					Check Profibus DP address set
					Check slave configuration
Green	Green	Green	Green	Module ready	-

ModuleLED indication				Meaning	Remedy
ADD$_n$	ADD$_{Out}$	Link	MOD		
Red	Red	-	-	Wrong address assignment of extension module	Re-power supply for gateway
-	-	Red	-	Wrong extension module connection	Check extensible cable connection
				Extension module is communicating with gateway configuration	Waiting for recovery
-	-	-	Red	I I/O short-circuit or overload	Check sensor or load
				The actual setting of module is different from the configuration	Check configuration
				Other module failure	Contact technical supports
Green	Green	Green	Green	Module ready	-

5.2 Diagnostics

Spider67 distributed I/O diagnostics function is compliant with Profibus slave, and see IEC61784-1:2002 ED1 CP3/1 for definition. The diagnostics data of all Spider67 can be read out from Profibus master using SFC13.

The diagnostics data consist of 3 parts: 1st part standard diagnosis block, including 6 bytes, 2nd part Module status block, 3rd part Channel diagnosis block.

1) Standard diagnosis block:

Byte	Bit	Description
Byte 0	Bit7	Diag.Master_Lock: (1) = Slave has been parameterized by another master. This bit to be set by the master itself.
	Bit6	Diag.Prm_Fault: (1) = Slave got wrong parameterization.
	Bit5	Diag.Invalid_Slave_Response: (0) = Set by slave. Diag.Invalid_Slave_Response: (1) = Set by master in case of fault.
	Bit4	Diag.Not_Supported: (1) = Slave doesn't support the required function.
	Bit3	Diag.Ext_Diag: (0) = Slave sends standard diagnosis data only (6 bytes). Optionally with extended diagnosis without faults. Diag.Ext_Diag: (1) = Slave indicates serious faults, usually with extended diagnosis data.
	Bit2	Diag.Cfg_Fault: (1) = Slave has mismatching configuration data
	Bit1	Diag.Station_Not_Ready: (1) = Slave not ready for data exchange
	Bit0	Diag.Station_Non_Existent: (1) = Slave doesn't exist. This bit to be set by the master itself.
Byte 1	Bit7	Diag.Deactivated: (1) = Diagnosis deactivated. This bit to be set by the master itself.
	Bit6	Reserved
	Bit5	Diag.Sync_Mode: (1) = Slave is in SYNC mode.
	Bit4	Diag.Freeze_Mode: (1) = Slave is in FREEZE mode.
	Bit3	Diag.WD_On: (1) = Slave reports exceeded watchdog time.
	Bit2	DP: (1) = shall always be set
	Bit1	Diag.Stat_Diag: (1) = Slave not able to provide valid diagnosis data. Master repeats diagnosis requests while in Data Exchange mode until this bit is set (0).
	Bit0	Diag.Prm_Req: (1) = Slave requests parameterization.

		There upon the master starts a new run-up for that slave.
Byte 2	Bit7	Diag.Ext_Diag_Overflow: (1) = Slave has more diagnosis data than fit into the buffer.
	Bit6 …. Bit0	Reserved
Byte 3		Diag_Master_Add: (0 –125) =Address of the master that has parameterized the slave. Diag_Master_Add: (255) = The slave has not yet been parameterized.
Byte 4 Byte 5		IdentNumber: High and low byte of the slave's identnumber that is to be provided by the PROFIBUS business office.

2）Module status block:

Byte	Bit	Description
Byte 6	Bit7=0 Bit6=0	Selection: (0) = Device Related Diagnosis
	Bit5 Bit0	Block_Length: Number of bytes of the following Extended Diagnosis block including this header byte the length of block is 5
Byte 7	Bit7=1	Identifier: (1) = Status
	Bit6=0 Bit5=0 Bit4=0 Bit3=0 Bit2=0 Bit1=1 Bit0=0	Status_Type: (2) Modul_Stat
Byte 8	0	Slot_Number: Data type: Unsigned8; Range: (0)
Byte 9	Bit7=0 Bit6=0 Bit5=0 Bit4=0 Bit3=0 Bit2=0	status_Specifier: (0) no further differentiation Extended

Byte	Bit	Description
	Bit1=0 Bit0=0	Reserved: (0) Shall be set
Byte 10	0	Module status ok

3） Channel diagnosis block:

Byte	Bit	Description
Byte 10+n*3	Bit7=1 Bit6=0	Diagnosis HeaderSelection: (2) = Channel Related Diagnosis
	Bit5-bit0	Identifier_Number: Range (0-63); (Identifier corresponds to module),
Byte 11+n*3	Bit7 Bit6	ChannelInputOutputSelection: (0) reserved(1) Input(2) Output(3)
	Bit5-bit0	10Channel_Number: Range (0-63)
Byte 12+n*3	Bit7 Bit6 Bit5	DiagnosisChannelType: (0) unspecific, may be used for any type (1) bit (2) 2 bit (3) 4 bit (4) byte (5) word (6) 2 words (7) reserved
	Bit4 Bit3 Bit2 Bit1 Bit0	20Error_Type: Range (0-31) Short circuit(1) Undervoltage of Module power supply (2)Undervoltage of auxiliary power supply (18) (Definition via GSD entries)

Note: The diagnostics of each channel is consisted of 3 byte, n means alarm channel.