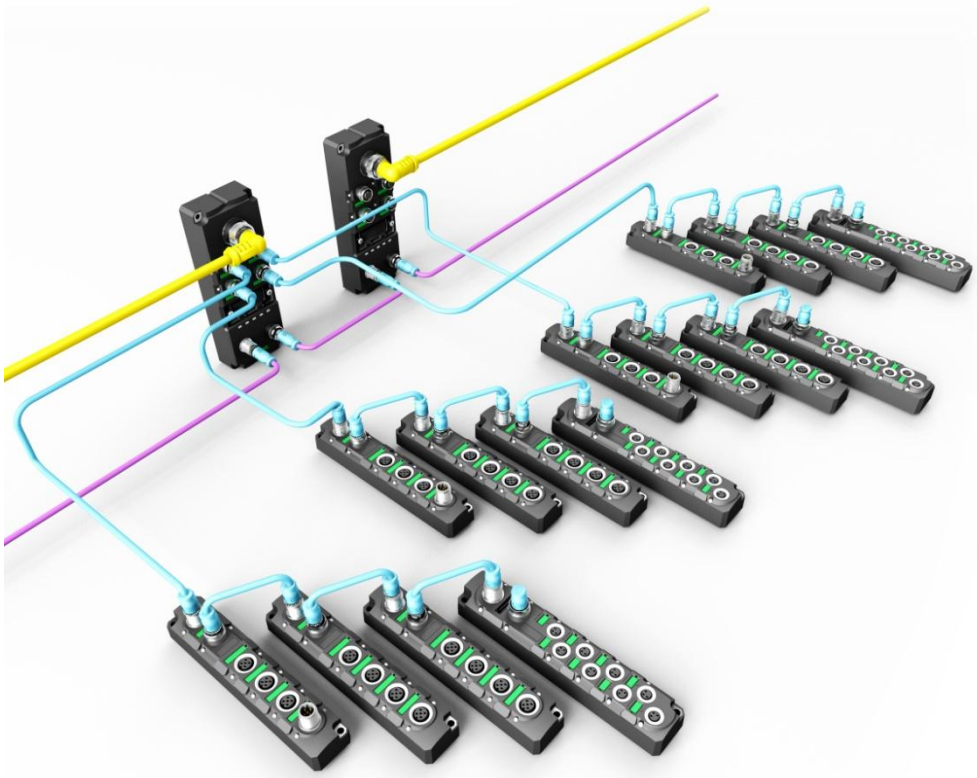
Spider67 I/O Module

----Profinet System Manual



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04/2019

Version 1.5

Preface

1. **Scope of this manual:**

   This manual applies to the ELCO Profinet Spider67 distributed I/O device.
   The information in this manual enables you to run the Spider67 module on Profinet in 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 Profinet Spider67 distributed I/O device.
   Covered topics are:
   - 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.

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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

No.	Type	Description
1	SPPN-GW-001	Profinet substation interface module 1 male 7/8”power supply 2 female, M12 D-Code fieldbus interface 4 female, M12 B-Code extended interface
2	SPDB-0800D-001 SPDB-0800D-003	8 PNP/NPN switches or dry contact 4-female, M12 A-Code interface
3	SPDB-0800D-011 SPDB-0800D-013	8 PNP/NPN switches or dry contact 8-female, M8 interface, 3-pin
4	SPDB-0404D-001 SPDB-0404D-003	4 PNP/NPN switches or dry contact 4DI4DO, 0.5A each channel 4-female, M12 A-Code interface
5	SPDB-0404D-011 SPDB-0404D-013	4 PNP/NPN 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	SPDB-0400A-005	4AI RTD PT100，PT200，PT500，PT1000，Ni100，Ni1000，150/300/600/3000Ω 4-female, M12 A-Code interface
16	SPDB-0400A-006	4AI Thermocouple B，E，J，K，N，R，S，T 4-female, M12 A-Code interface
17	BB6S30P01Dxxx BB6S30P01Mxxx	Pre-wired extensible cable PVC, 5-core shielded, outer diameter 6.5mm Customized length, D=cm，M=dm
18	BB6S30P03Dxxx BB6S30P03Mxxx	Pre-wired extensible cable（drag chain） PUR, 5-core shielded, outer diameter 6.5mm Customized length, D=cm，M=dm
19	BB6S30P09Dxxx BB6S30P09Mxxx	Pre-wired extensible cable（long distance communication） PVC, 5-core shielded, outer diameter 8mm Customized length, D=cm，M=dm
20	BB6S06	Extension terminal resistance Connecting to the last I/O module

2. Technical characteristics

2.1 Gateway

The following picture is the schematic of Spider67 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 gateway occupies one sub-station address, maximum 4 strings, up to 6 I/O modules / string, extending distance up to 100 m.

In order to achieve the PROFINET network communication requirements based on the industrial Ethernet, Spider67 gateway, as the slave station of PROFINET, can assign the device name and the corresponding IP address via the configuration tool, it also can automatically assign IP addresses by PLC according to the network topology. Each Spider67 gateway can connect up to 24 I/O modules via extended port; sort the modules for 1~24 according to the sequence of the connected extension port and the gateway distance from near to far, and configure in programming software Step7(see section 4.4). If the module is connected to the extended port not up to 6, then the number of the following module will be moved

ahead, such as P0 port connect 3 modules, then the serial number of the first module of P1 port is 4, by analogy, the serial number is the module number that you connected.

2.2 I/O module

The picture is the schematic of a Spider67 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

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 series cable is the 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	SPPN-GW-001
Extensible channel	4 (P0~P3)
Extensible module/channel	4
Extension distance	Max. 100m
Profinet input	D-Code M12（Female）
Profinet output	D-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-0800D-001 SPDB-0800D-011 SPDB-0800D-003 SPDB-0800D-013	SPDB-0404D-001 SPDB-0404D-011 SPDB-0404D-003 SPDB-0404D-013	SPDB-08UP-001 SPDB-08UP-011	SPDB-0008D-001 SPDB-0008D-011	SPDB-0006D-001
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/NPN				
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

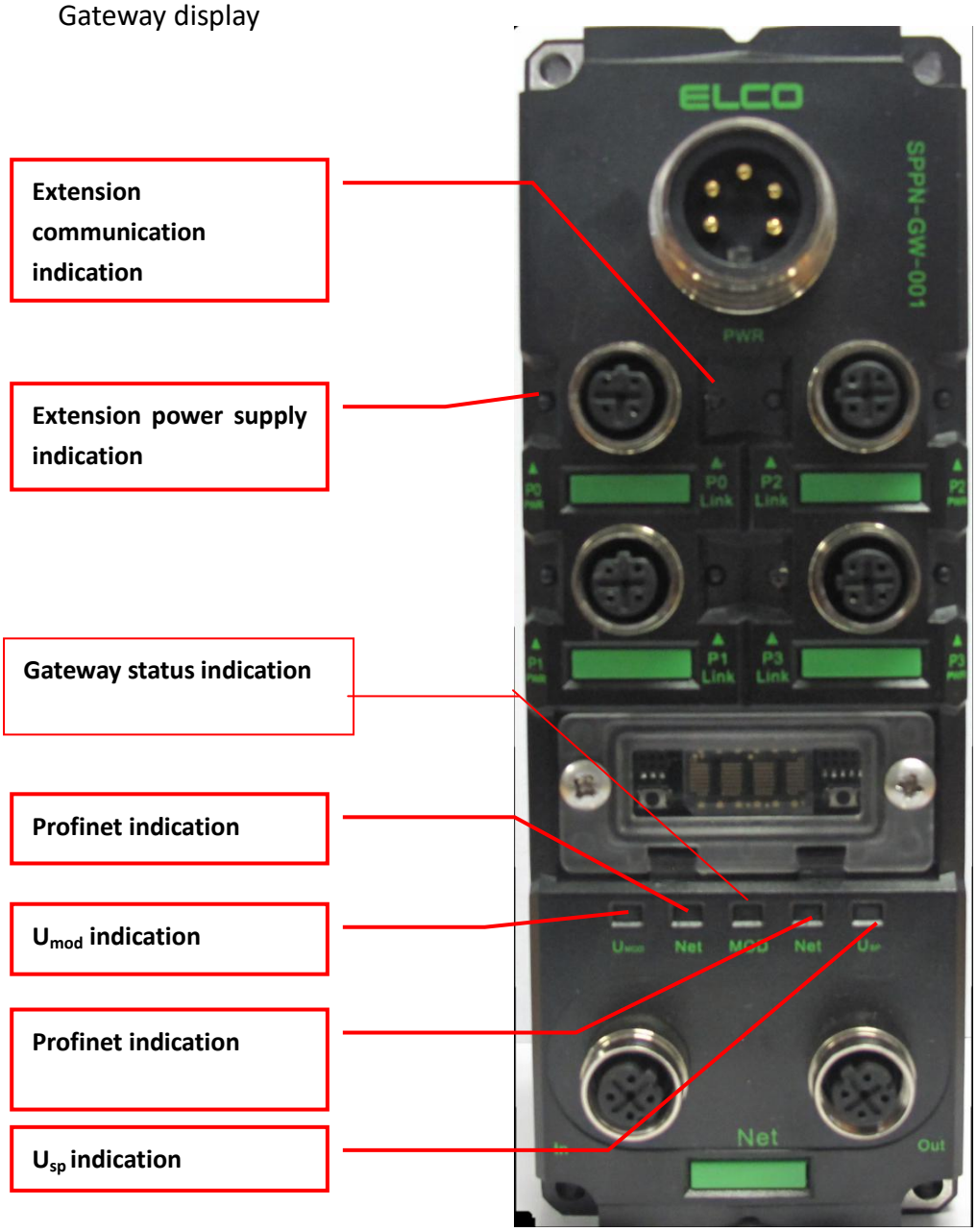
Model	SPDB-0300A-001	SPDB-0300A-002	SPDB-0003A-001	SPDB-0003A-002
Input points	3	3	0	0
Output points	0	0	3	3
Extension input	B-Code M12（Male）			
Extension output	B-Code M12（Female）			
Input and output Signal	A-Code M12（Female）			
Input range	0~20mA 4~20mA -20~20mA	0~5V 0~10V -5~5V -10~10V	Null	Null
Output range	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

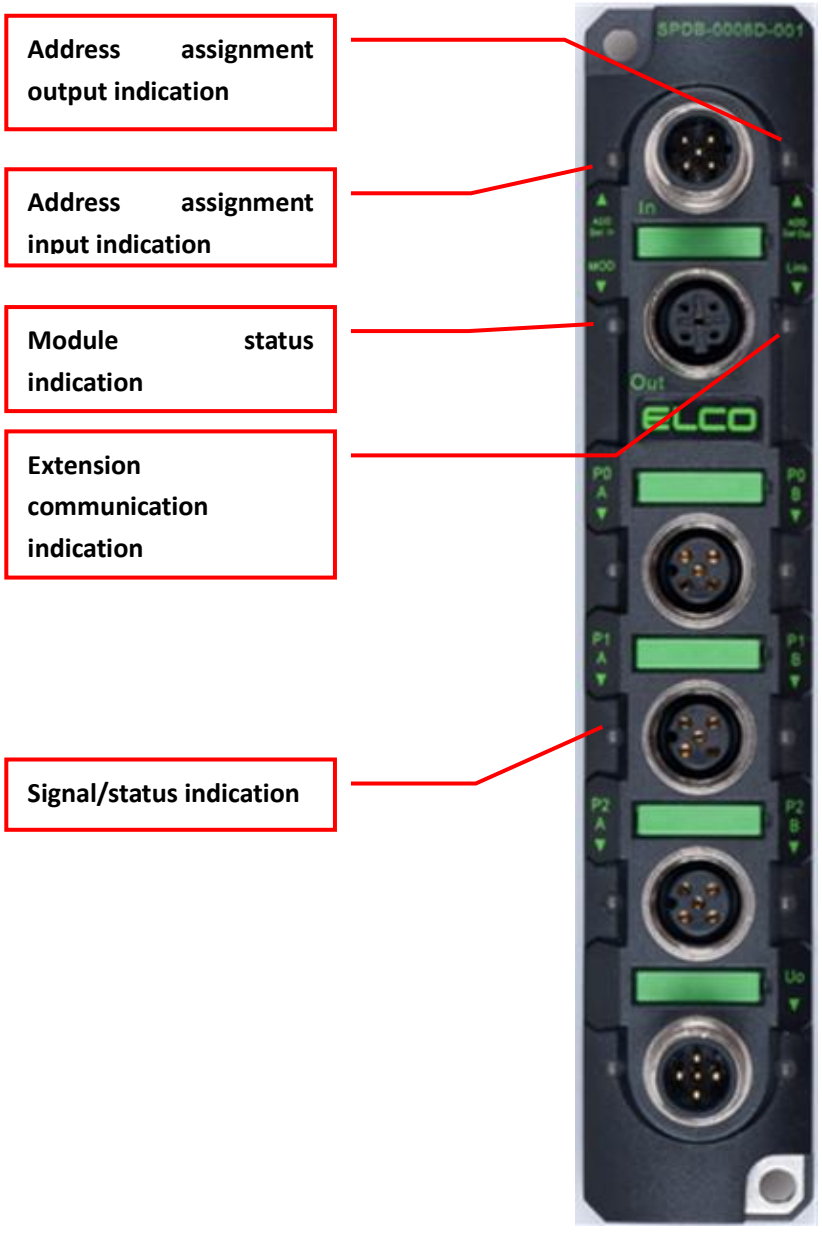
Model	SPDB-0400A-005	SPDB-0400A-006
Input points	4	
Output points	0	
Extension input	B-Code M12（Male）	
Extension output	B-Code M12（Female）	
Input and output Signal	A-Code M12（Female）	
Input range	PT100,PT200,PT500,PT1000 Ni100,Ni1000 0~150/300/600/3000Ω	Type B，E，J，K，N，R，S，T
Output range	Null Null	
Internal 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



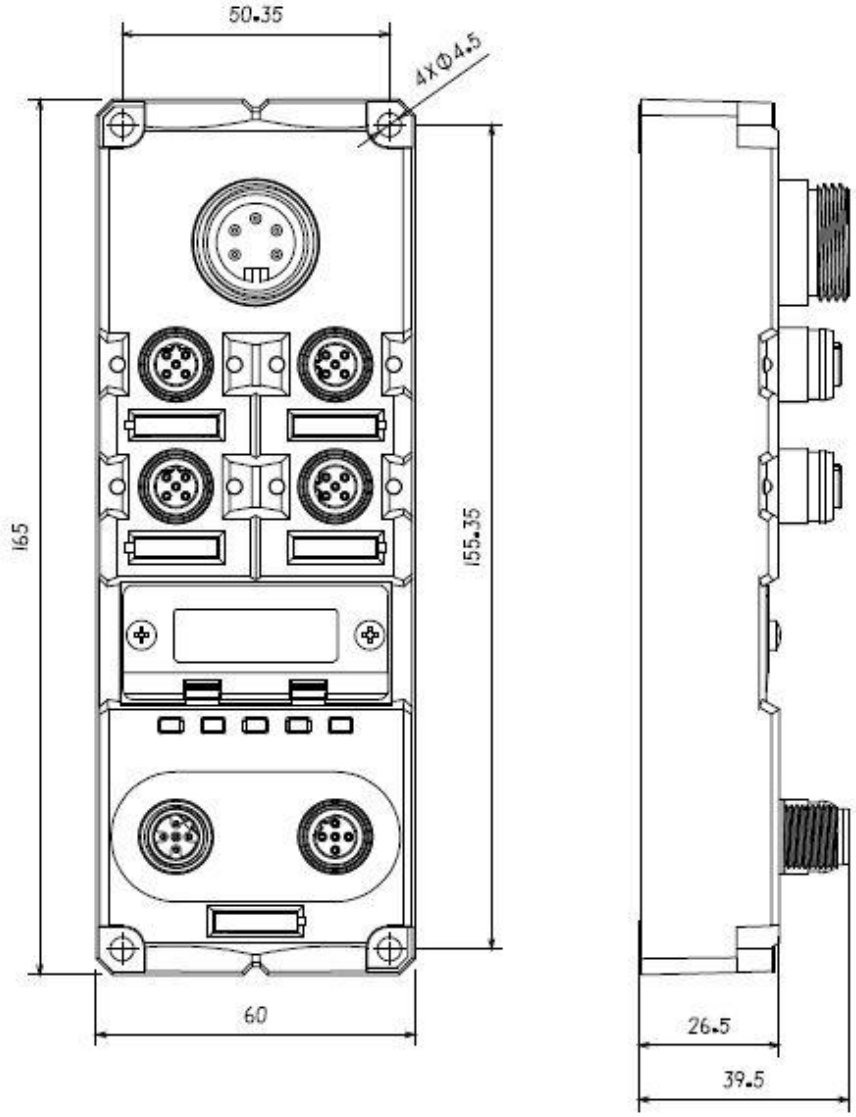
I/O module display



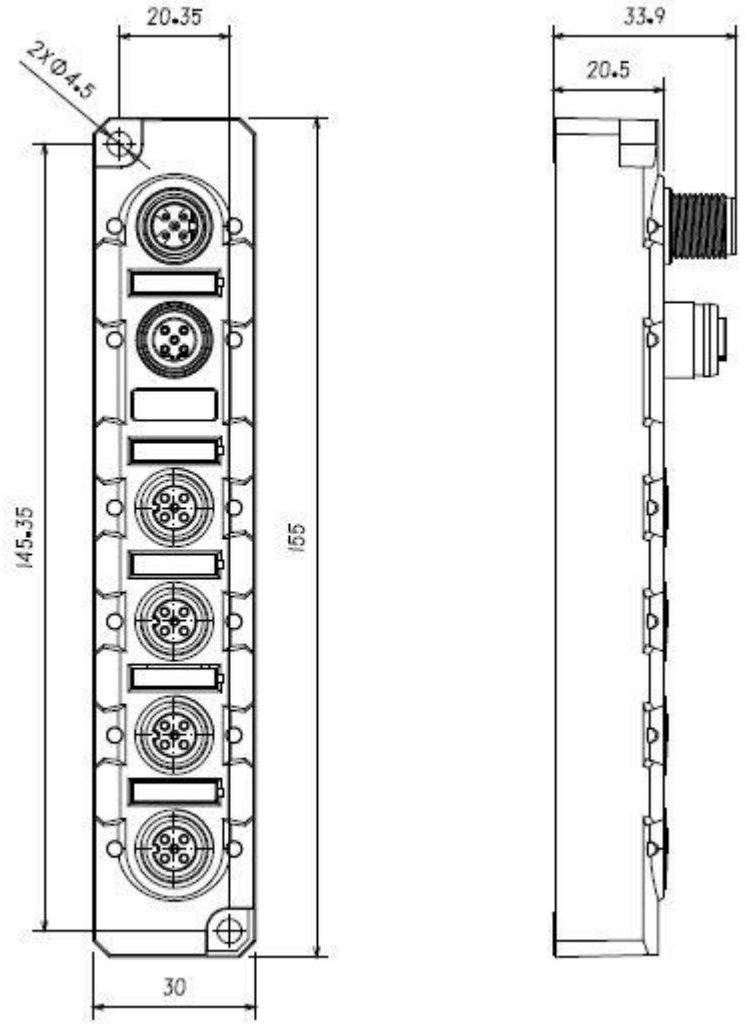
3. Installing

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 Assigning names in PROFINET IO devices

Each Profinet protocol of a Spider67 distributed I/O device is assigned to a unique device ID (i.e. MAC address) at the factory, while the addressing to each Spider67 device is based on the device name during configuration and according to the user program. Therefore, it is necessary to assign names for gateway of each Spider67 I/O devices before the configuration and debugging.

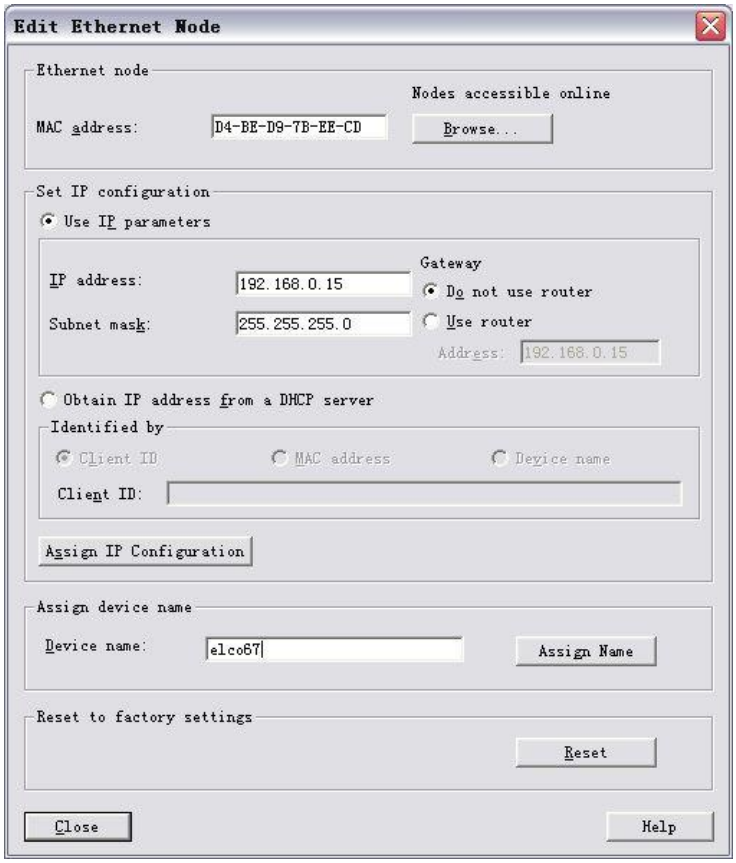
3.3.1 Assigning names by Step7

It is convenient to assign names and IP addresses in PROFINET IO devices through SIEMENS Step7 software, please carry out the following steps:

1) Provide power for the Spider67 gateway and connect it to engineering computer in the same network via a switch or cable connection.

2) In the Step7 software HW-Config, select PLC > Ethernet > Edit Ethernet Node

3) In the pop-up window, click Browse button, select the Spider67 gateway via the MAC address to assign device name and confirm.



4) Assign the device name for Spider67 module by clicking button Assign Name in the dialog "Edit Ethernet Node".

5) Assign the new IP address directly to Spider67 module by clicking the button

"Assign IP Configuration". (IP address assignment can also be carried out during configuration of the I/O Devices)

6) Now, with the new assigned device name as an identifier of the Spider67 module, you can configure and debug in the program.

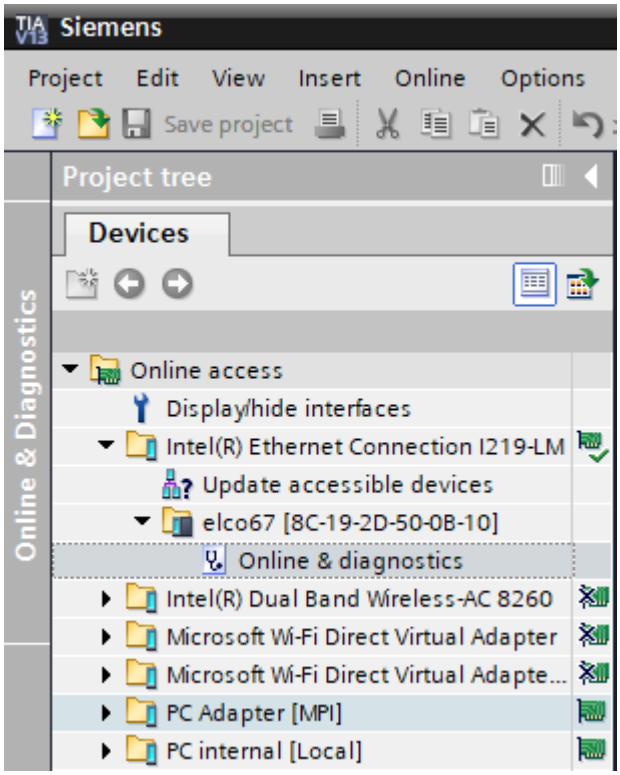
3.3.2 Assigning names by Portal

It is convenient to assign names and IP addresses in PROFINET IO devices through SIEMENS Portal software, please carry out the following steps:

1) Provide power for the Spider67 gateway and connect it to engineering computer in the same network via a switch or cable connection.

2) In “Online Access” of “Project Tree” on the left side of Portal software, select the network card of the computer, update accessible devices.

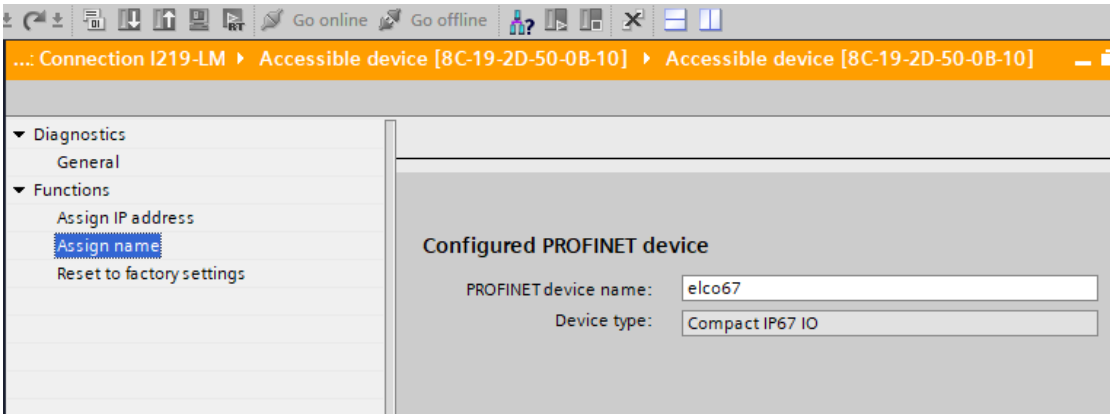
3) You can see all the Profinet devices be connected to the computer. Select Spider67 gateway to assign device name by MAC address.



4) Open the “Online&diagnostics” window, assign the device name to the Spider67 gateway through the “Assign name” option.

5) The IP address can be assigned directly to the Spider67 gateway through the

"Assign IP Address" option. (IP address assignment can also be carried out during configuration of the I/O Devices)



6) Now, with the new assigned device name as an identifier of the Spider67 module, you can configure and debug in the program.

Note: the MAC address of the Spider67gateway in form of laser engraving or label marked on the side of the module, the device name of the Spider67 gateway will be displayed on the scrolling LED screen (normally, the new assigned device name can be correctly displayed after power on again).

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)

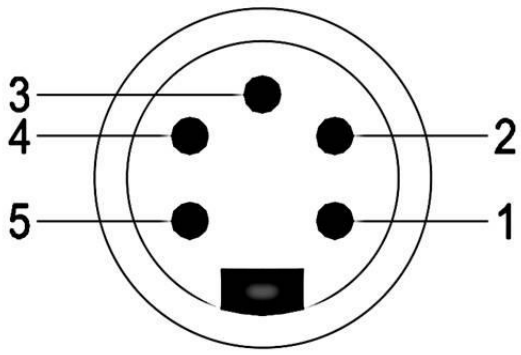
- Always connect the Spider67 to protective earth.
- The module also requires this connection to protective earth in order to discharge any interference currents to ground, and for EMC compatibility.
- Always make sure you have a low-impedance connection to protective earth.

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)

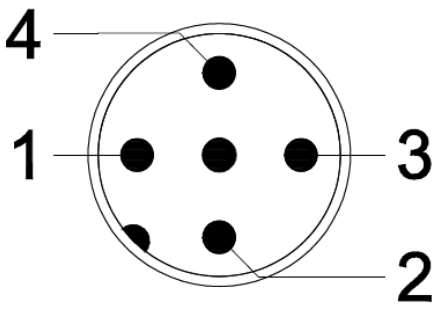


2) Power definition

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 up to 2A, and the whole module can 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

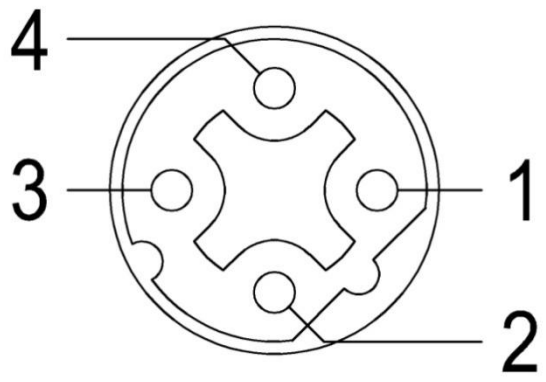
Terminal	Function	Power supply
1	Auxiliary power supply L+	24V
2	Auxiliary power supply L+	24V
3	Auxiliary power supply M	0V
4	Auxiliary power supply M	0V

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.

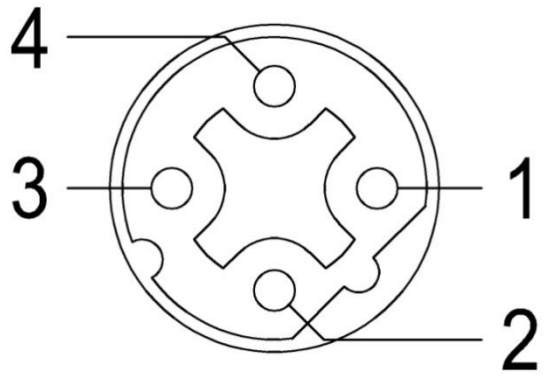
3.4.3 Spider67 BUS connection

Spider67 gateway, supporting Profinet protocol, transmits signals by a shielded cable, D-Code M12 connector.

1） BUS-In (Female)



2） BUS-Out (Female)



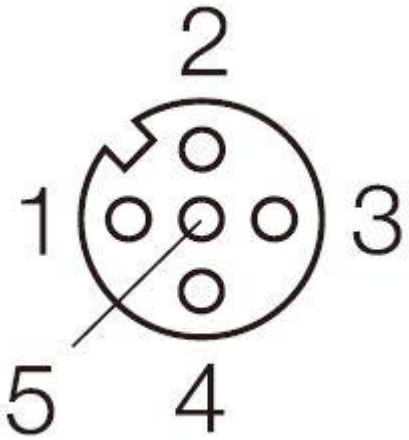
3） Bus definition

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

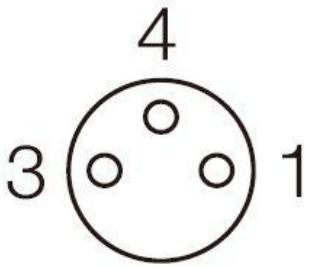
3.4.4 Spider67 digital signal connection

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



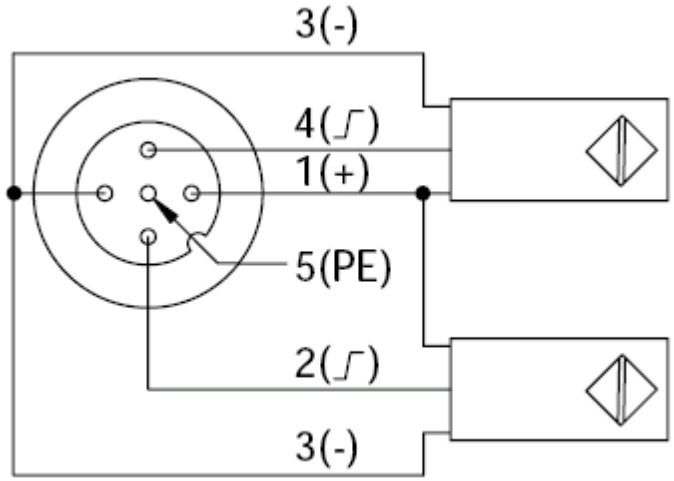
M8 connector

2）Digital signal interface definition

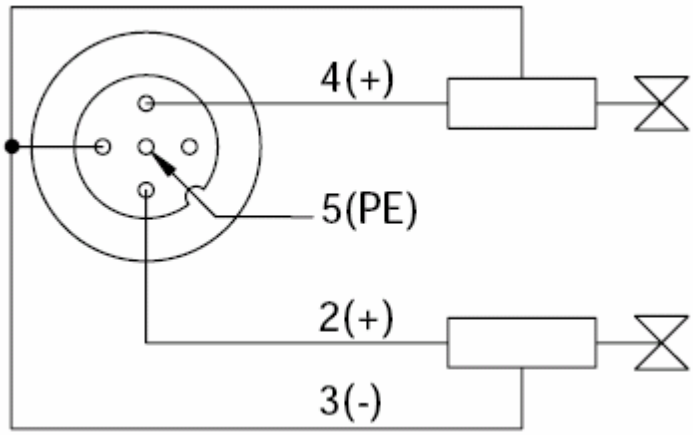
Terminal	**M12 connector**		**M8 connector**
1	Power supply 24V+		Power supply 24V+
2	Signal in/out B	2nd signal	None
3	Power supply GND		Power supply GND
4	Signal in/out A	1st signal	Signal in/out
5	PE		None

3） Wiring example

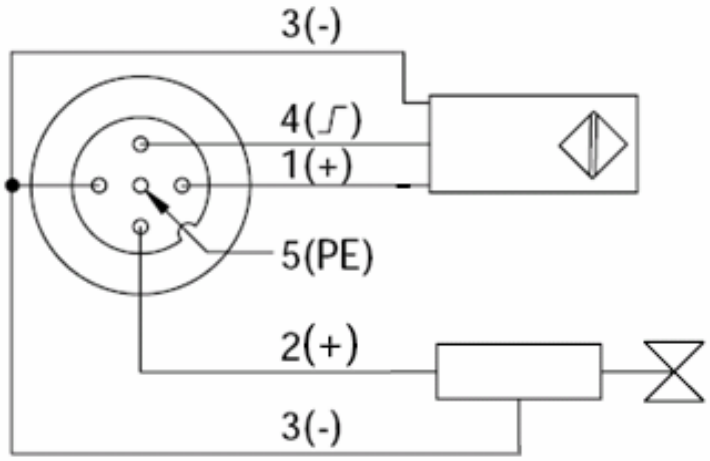
a) Double input signal – 1 connector connects 2 DI, SPDB-0800D-001, SPDB-0404D-001, and SPDB-08UP-001 support this connection.



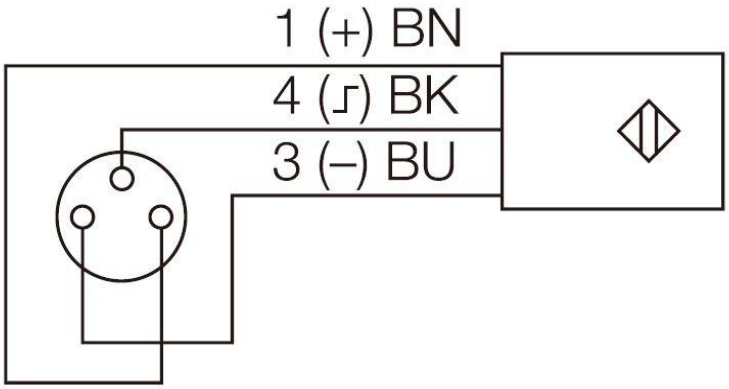
b) Double output signal – 1 connector connects 2 DO, SPDB-0008D-001, SPDB-0404D-001, SPDB-08UP-001, SPDB-0006D-001 support this connection.



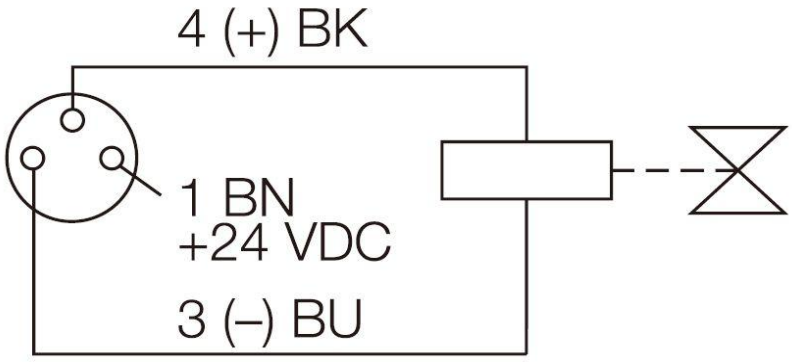
c) Input and output signal – 1 connector connects 1 DI and 1 DO,
SPDB-08UP-001 supports this connection



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



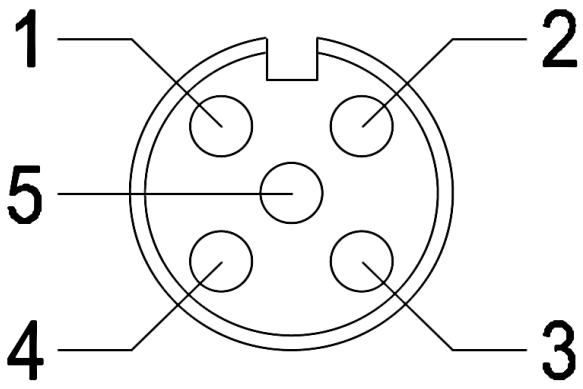
e) Single output signal – 1 connector connects 1 DO, SPDB-0404D-011,
SPDB-0008D-011, SPDB-08UP-011 support this connection.



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

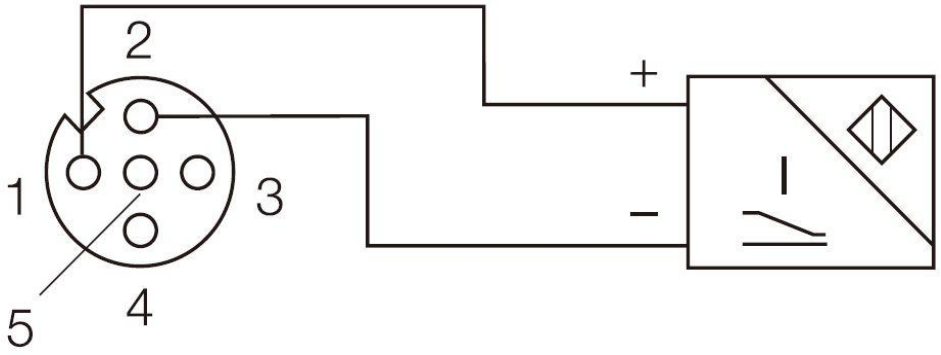
Terminal	Function	Function
1	Power supply 24V+	
2	Signal in/out +	AI/AO +
3	Power supply GND	
4	Signal in/out -	AI/AO -
5	PE	

RTD and TC signal interface definition

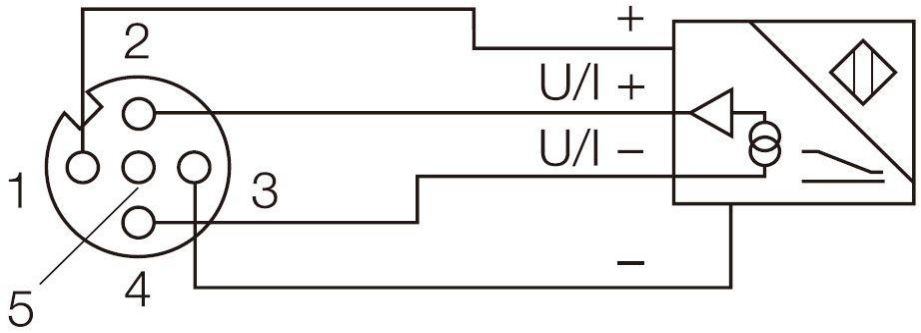
Terminal	Function	Function
1	Power supply I+	
2	Signal in M+	RTD/TC +
3	Power supply I-	
4	Signal in M-	RTD/TC -
5	PE	

3）Wiring example

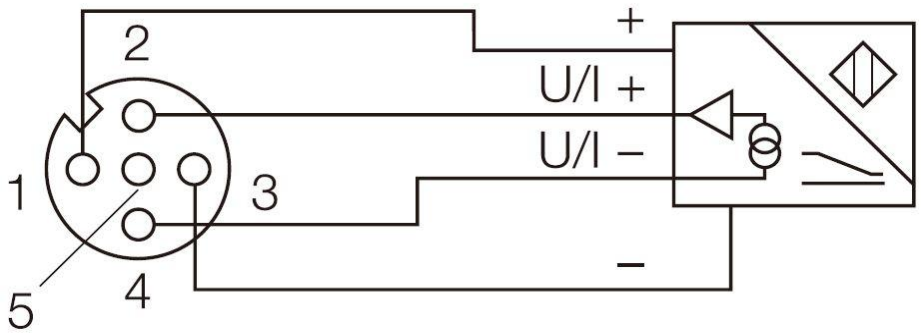
a) 2-wire input - 1 connector connects 1 2-wire input, SPDB-0300A-001 supports this connection.



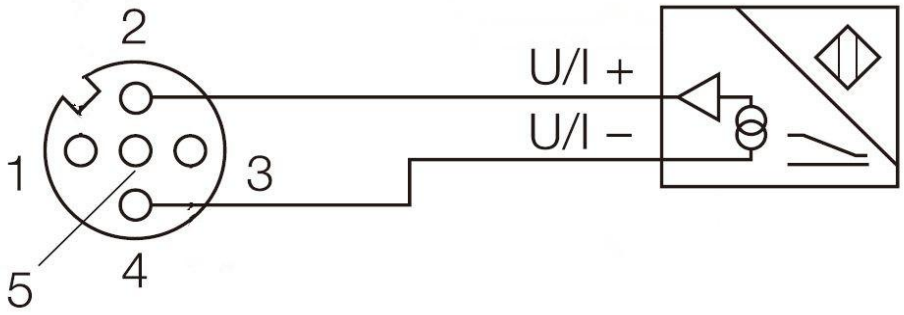
b) 4-wire input - 1 connector connects 1 4-wire input, SPDB-0300A-001 supports this connection.



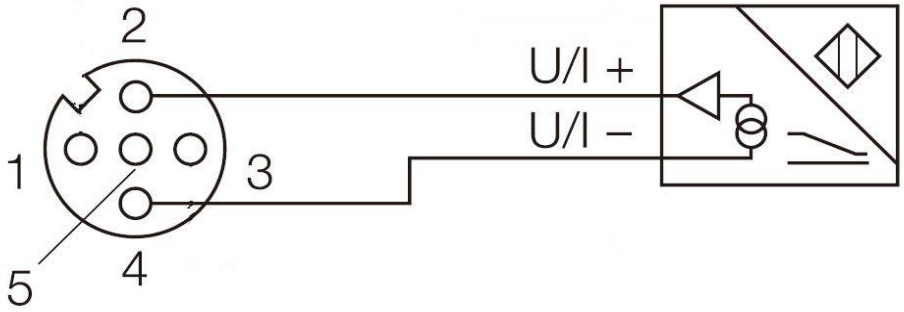
c) Voltage input- 1 connector connects 1 voltage input, SPDB-0300A-002 supports this connection.



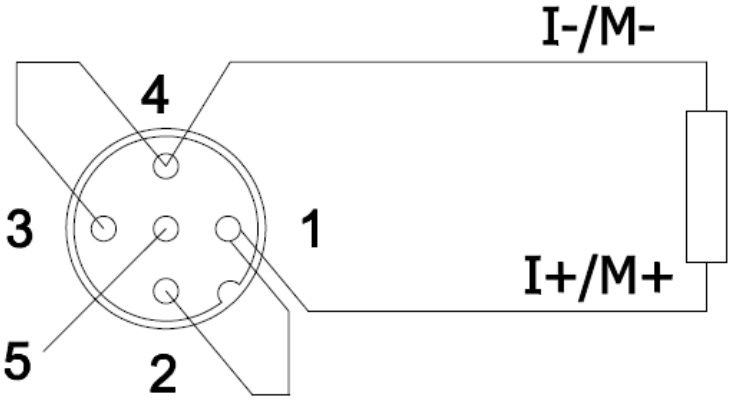
d) Current output- 1 connector connects 1 current output, SPDB-0003A-001 supports this connection.



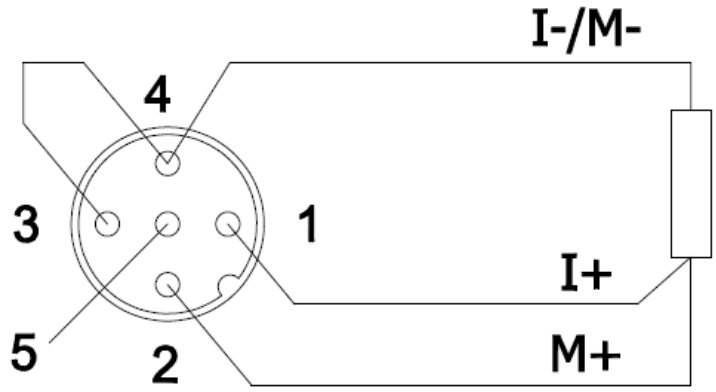
e) Voltage output- 1 connector connects 1 voltage output, SPDB-0003A-002 supports this connection.



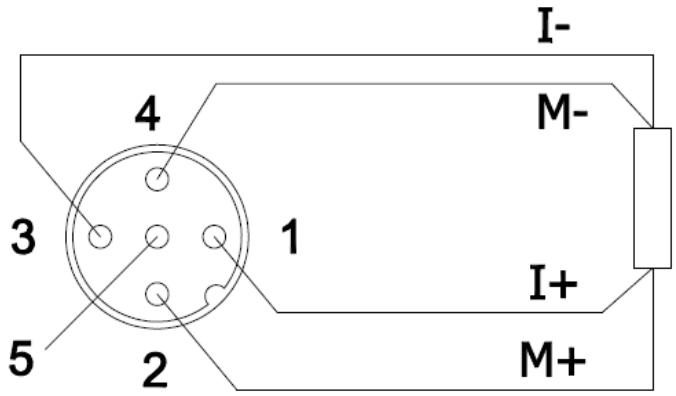
f) Two-wire thermal resistance signal — 1 connector connects 1 two-wire thermal resistance input signal, the model SPDB-0400A-005 of the signal module supports this form of connection.



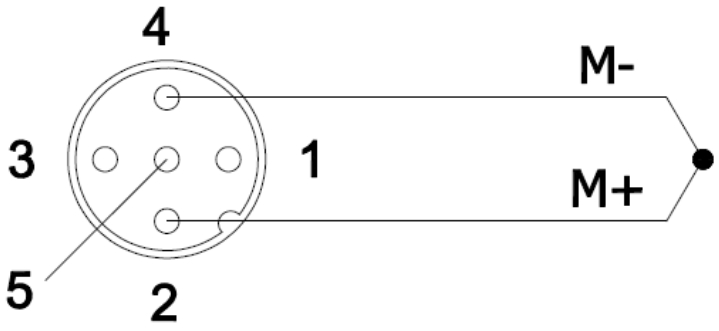
g) Three-wire thermal resistance signal — 1 connector connects 1 three-wire thermal resistance input signal, the model SPDB-0400A-005 of the signal module supports this form of connection.



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.



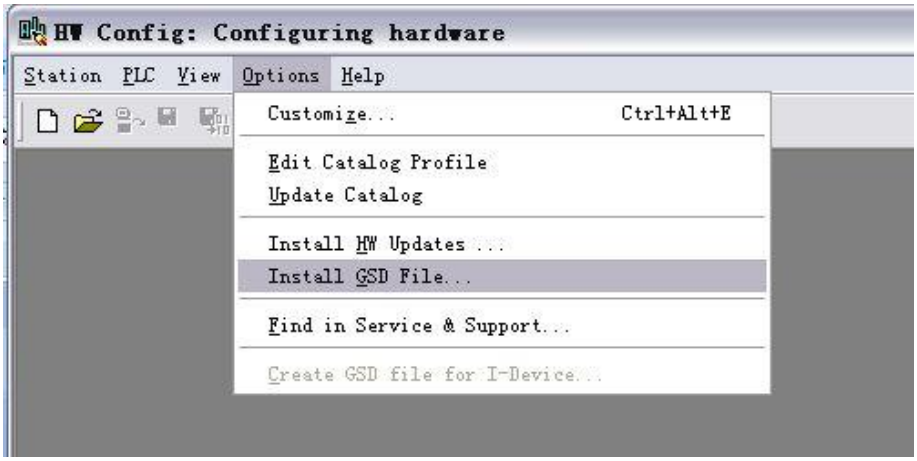
4. Configuration Commissioning

4.1 Installation of configuration files

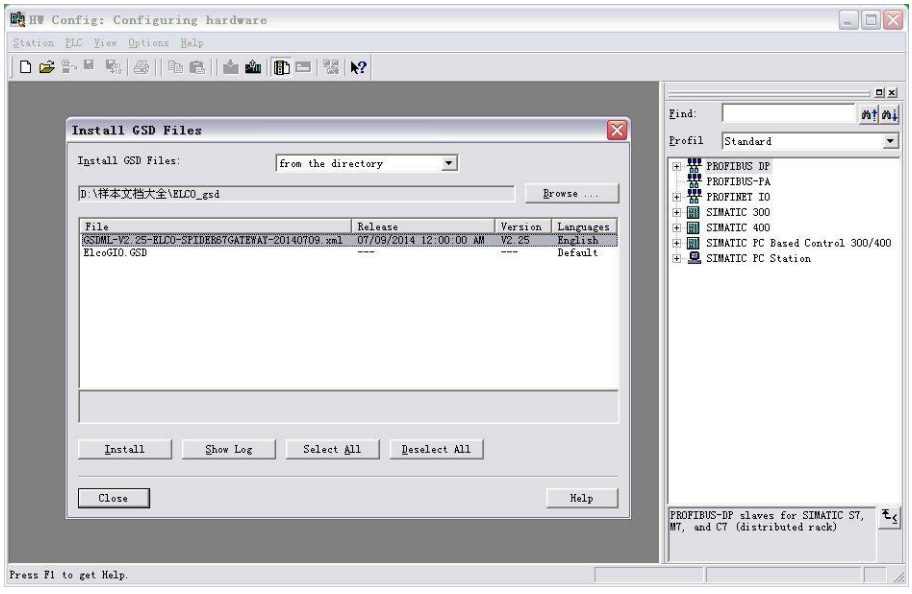
Configuration of the spider67 distributed I/O device via GSD file (XML format) and the standard Profinet IO GSD file for the Spider67 will be integrated into the user's system. You can visit the ELCO website to get the latest GSD file or call the hotline to contact technical support.

How to integrate the GSD file into the system depends on the user's configuration software, usually the Profinet GSD file enables integration with the SIEMENS Step7 in accordance with the following steps:

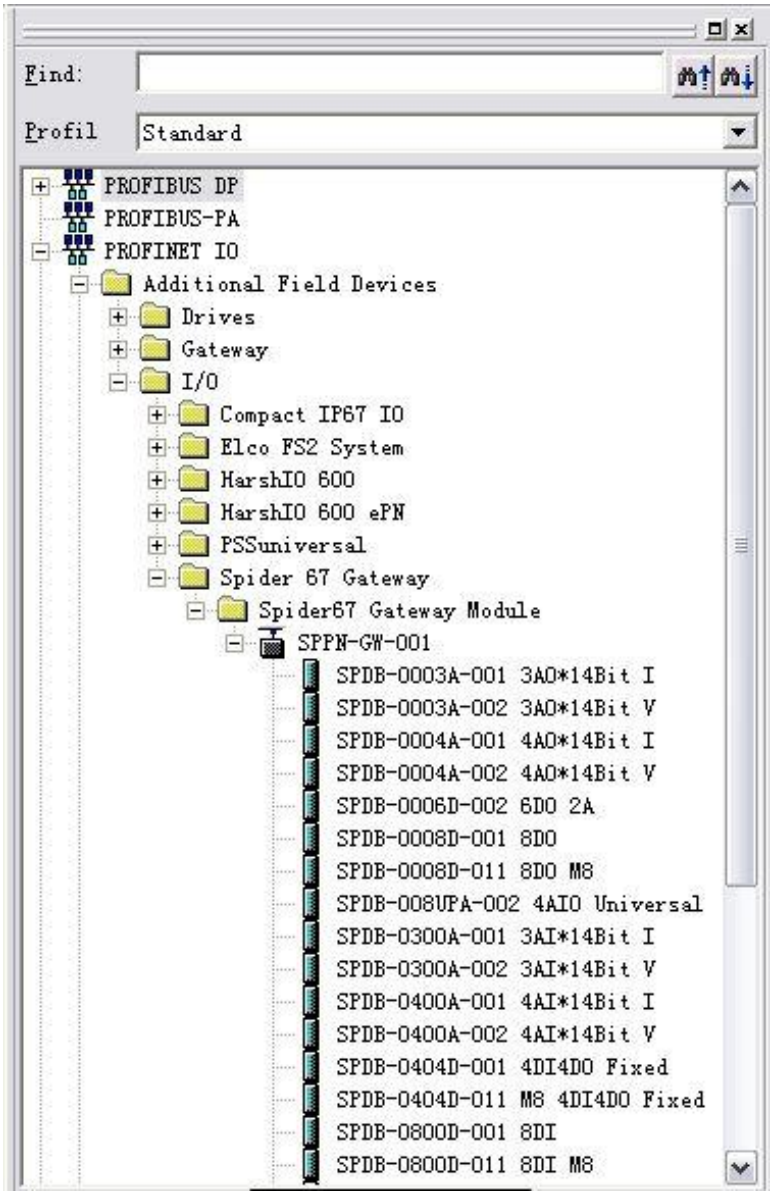
1) Running Step7, and then select menu command " Options>Install New GSD File..."



2) Browse to the file's directory in the next dialog, choose the GSD file and then click "Install".



The new additional Spider67 module is shown in the directory of hardware ”Additional Field Devices>I/O>Spider 67 Gateway>Spider67 Gateway Module”



4) The user can configure the Spider67 module with Step7 according to the actual situation.

4.2 Signal address assignment

Each signal module with M12 interface has 4 connectors (P0~P3) for signal communication; each connector has 5 pins (Pin1~Pin5). Each signal module with M8 interface has 8 connectors (P0~P7) for signal communication; each connector has 3 pins (Pin1, Pin3, Pin4). The following table indicates the matchup between signal status and bytes transmitted of Profinet.

1）8-bit digital input modules SPDB-0800D-001, SPDB-0800D-011

Byte	**Bit**	**M12** **SPDB-0800D-001**	**M8** **SPDB-0800D-011**	**e. g.**
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）4-bit input; 4-bit output digital modules: SPDB-0404D-001, SPDB-0404D-011

The module occupies 8 bits for input and 8 bits for output. Each signal only has 4 bits, so input signal occupies I 0.0~I 0.3, and I 0.4~I 0.7 is useless; output signal occupies Q 0.4~Q 0.7, and Q 0.0~Q 0.3 is useless.

Byte	**Bit**	**M12** **SPDB-0404D-001**	**M8** **SPDB-0404D-011**	**e.g.**
Input 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
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）8-bit digital input/output configurable modules: SPDB-08UP-001, SPDB-08UP-011

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** **SPDB-08UP-001**	**M8** **SPDB-08UP-011**	**e.g.**
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）8-bit digital output modules: SPDB-0008D-001, SPDB-0008D-011

The module occupies 8 bits for output.

Byte	**Bit**	**M12** **SPDB-0008D-001**	**M8** **SPDB-0008D-011**	**e.g.**
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）6-bit digital output modules: SPDB-0006D-001

The module occupies 8 bits for output.

Byte	Bit	M12 SPDB-0006D-001	e.g.
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	-----
	Bit 7	P3.Pin2	-----

6）3-channel analog input modules: SPDB-0300A-001, SPDB-0300A-002

The module occupies 6 bytes for input.

Byte	Byte	Connector	e.g.
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）3-channel analog output modules: SPDB-0003A-001, SPDB-0003A-002

The module occupies 6 bytes for output.

Byte	Byte	Connector	e.g.
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:

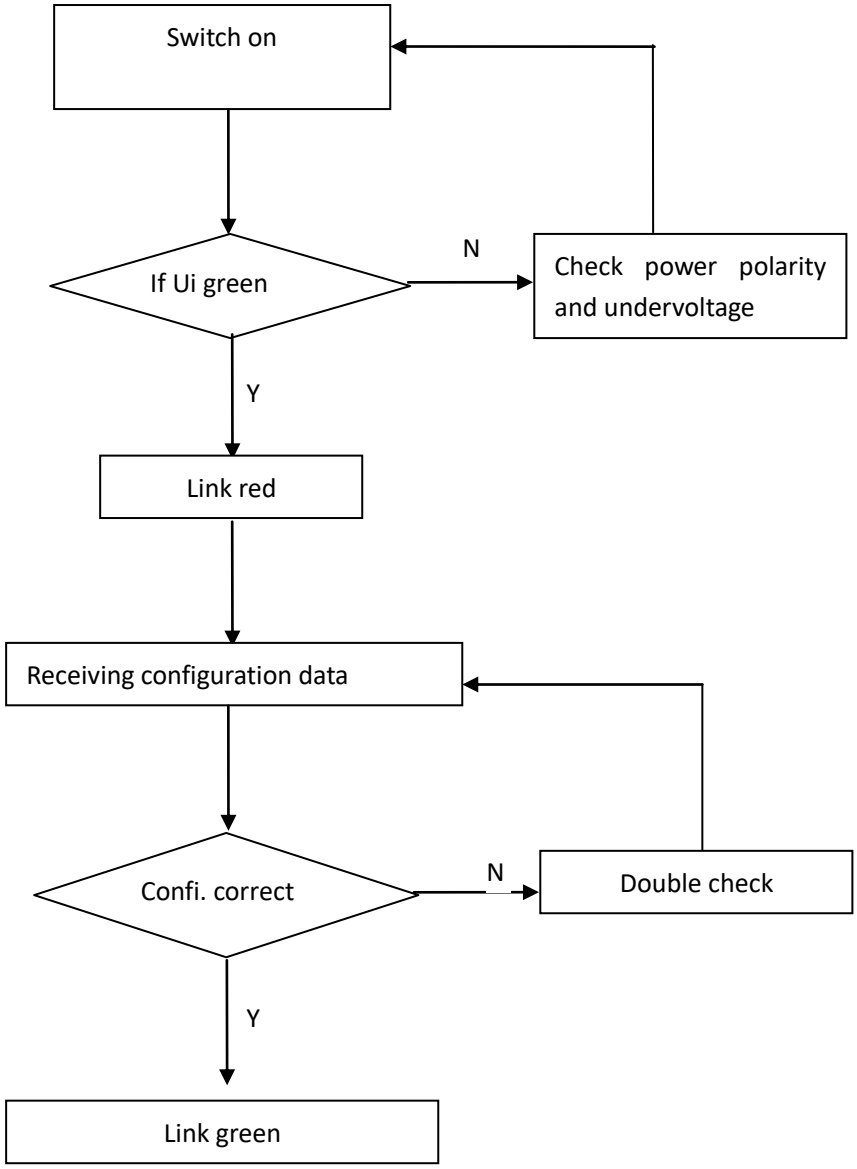
  Type B，E，J，K，N，R，S，T thermocouple determines the rated input and output range according to the temperature range of the scale. Dividing the decimal value of the system by 10, the current temperature can be obtained. The resolution is 0.1 C, and the maximum or minimum value can be locked out beyond the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



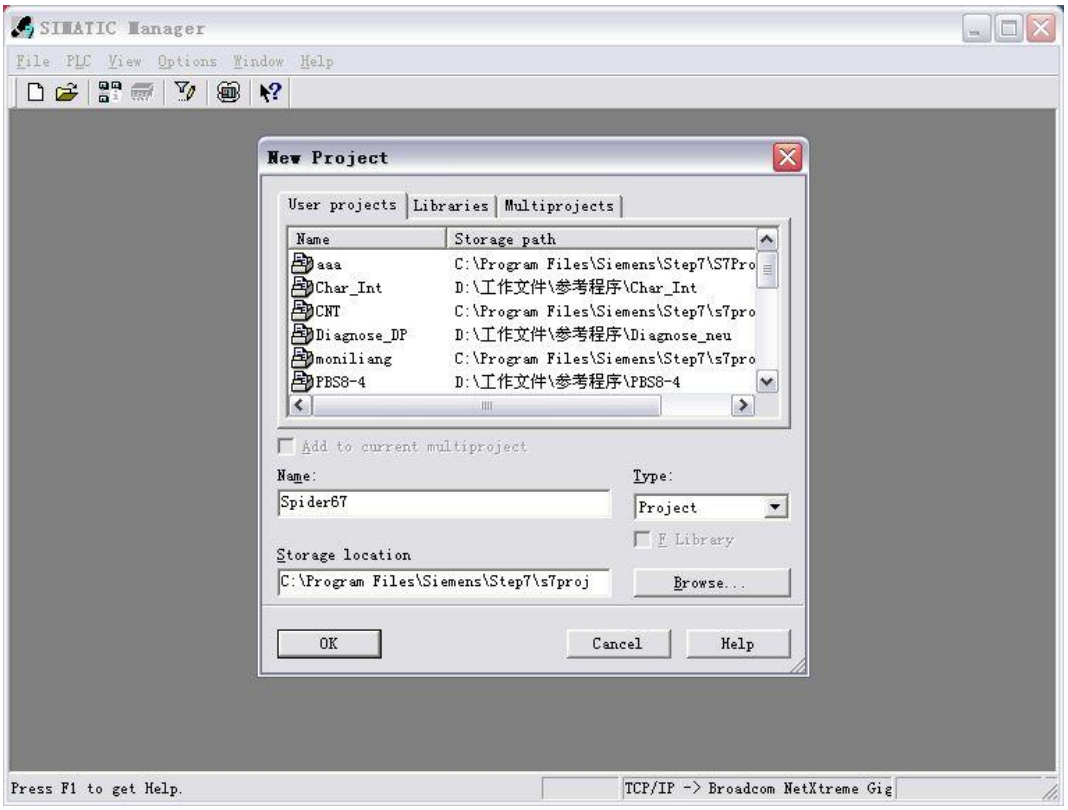
4.5 Module configuration by Step7

This section, through a case of connection configuration in a current operation process, will let the users fully understand how to use the Spider67 distribution I/O system. In this case, using the ELCO spider67 as PROFINET slave station to connect the Siemens PROFINET controller CPU315-2PN/DP under the condition that all power and bus connections have been completed, the device name of Spider67 module is assigned as elco67.

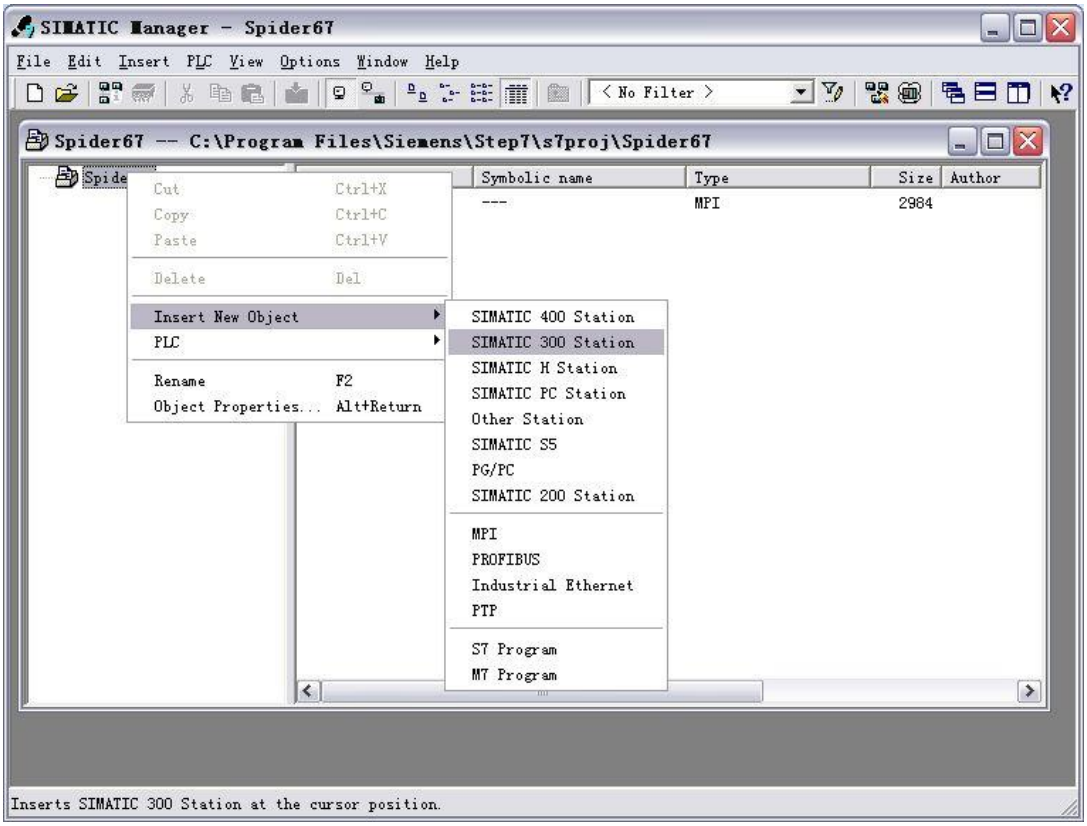
Spider67 system includes a gateway module SPPN-GW-001, gateway extension port P0 connecting two SPDB-08UP-001; extension port P1 connecting one SPDB-0300A-001; extension port P2 connecting one SPDB-0300A-002, extension port P3 connecting one SPDB-0003A-001.

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

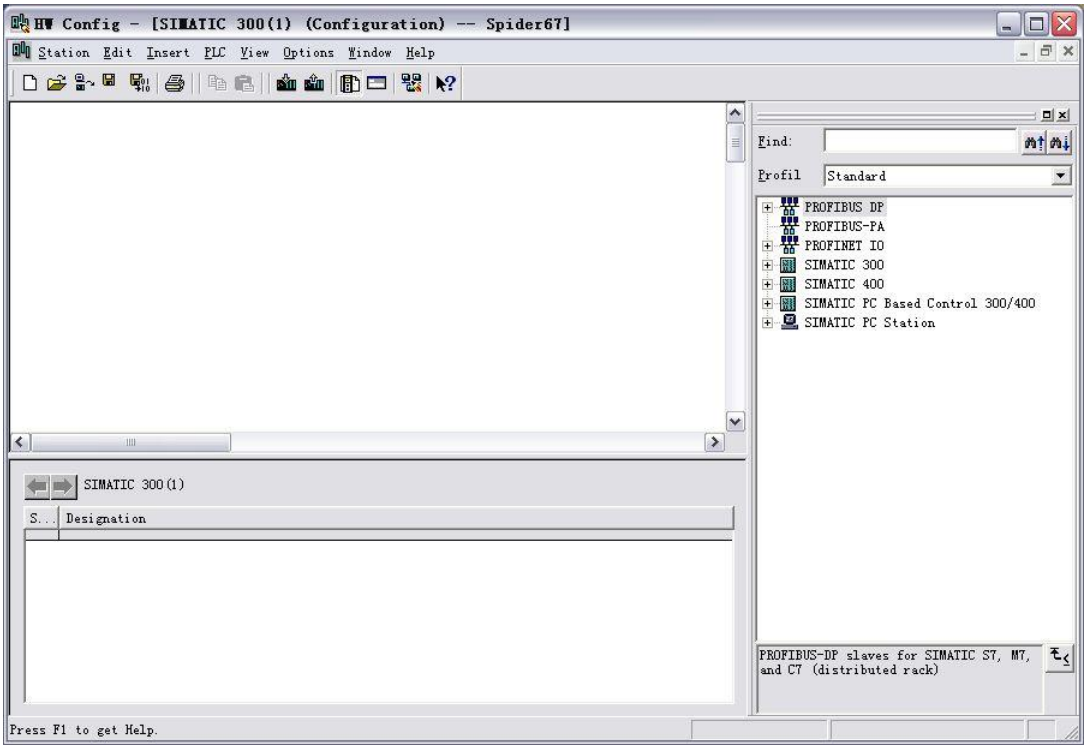
1) Create a new Step7 project



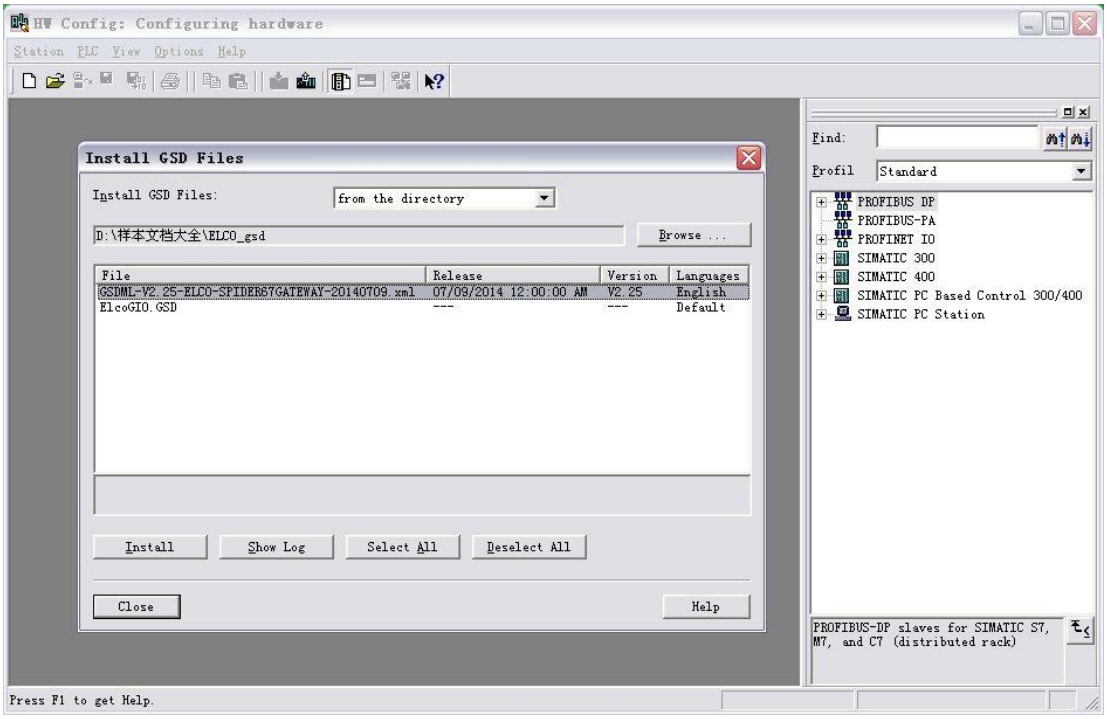
2) Insert a new SIMATIC 300 Station



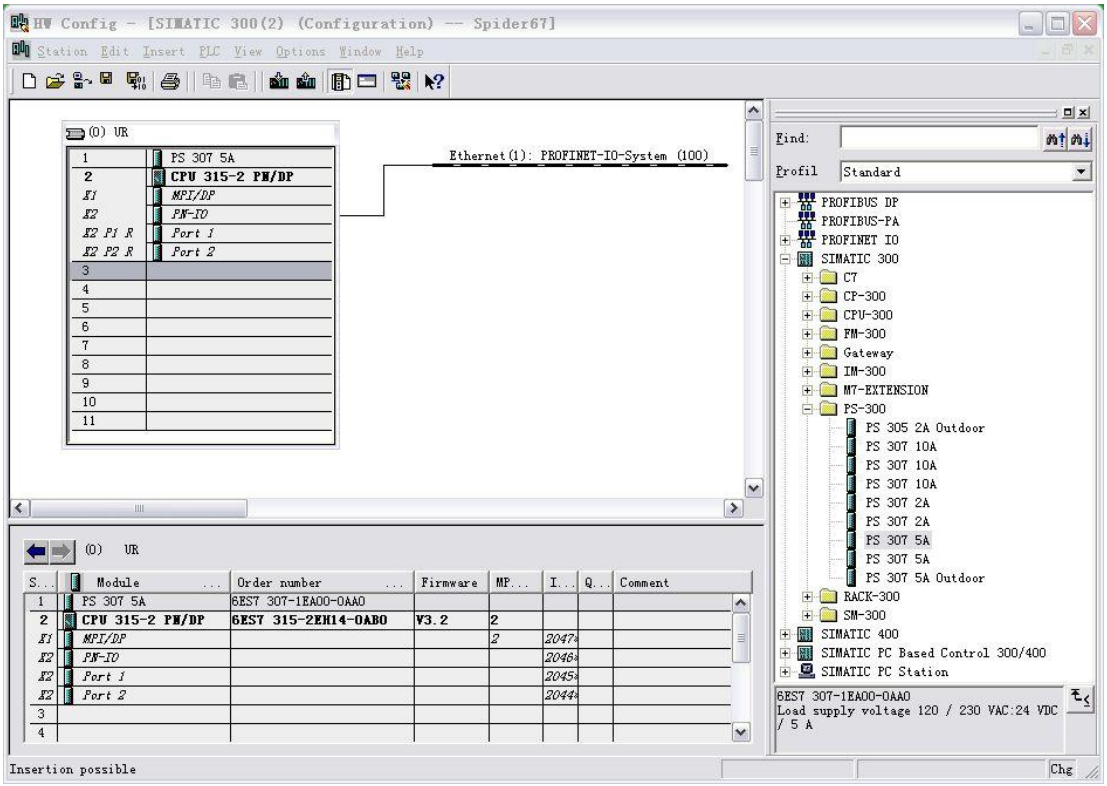
3) Double click "**Hardware"** button to start the hardware configuration tool.



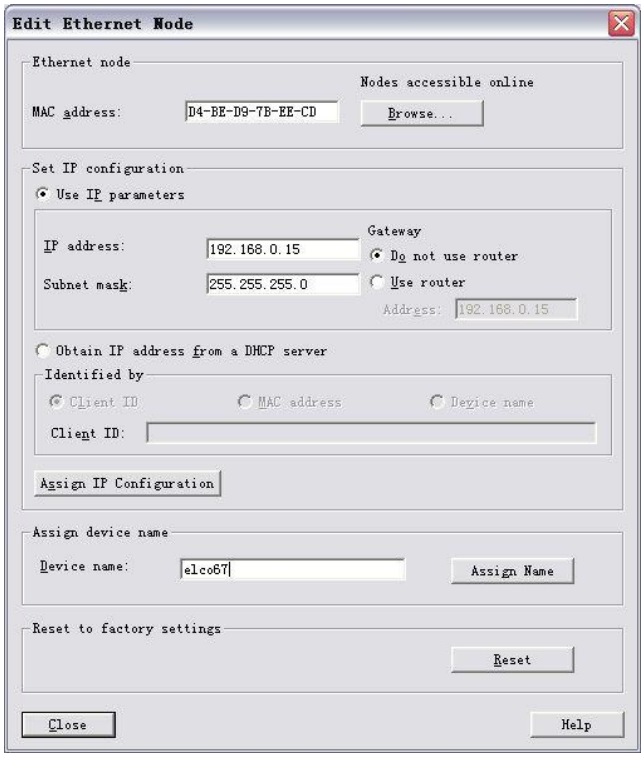
4) Install the GSD file according to section 4.1



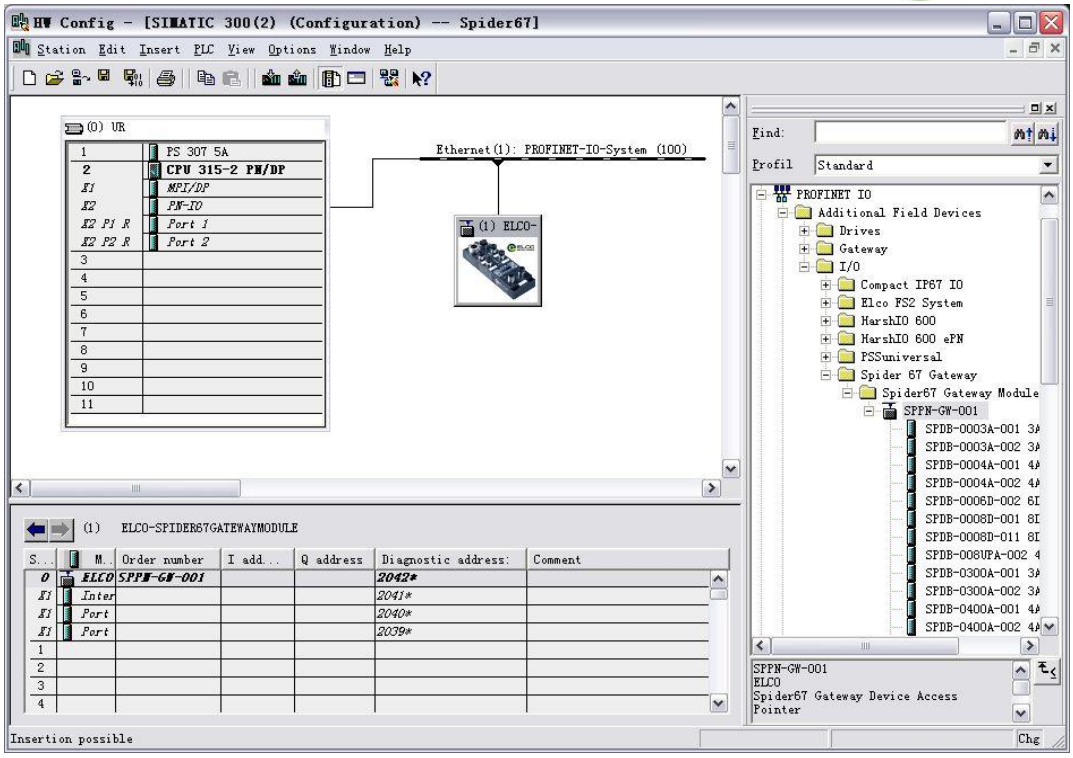
5) Change the hardware configuration, select the appropriate slot, power supply and CPU in the Catalog window, and set the properties of the CPU, bus etc.



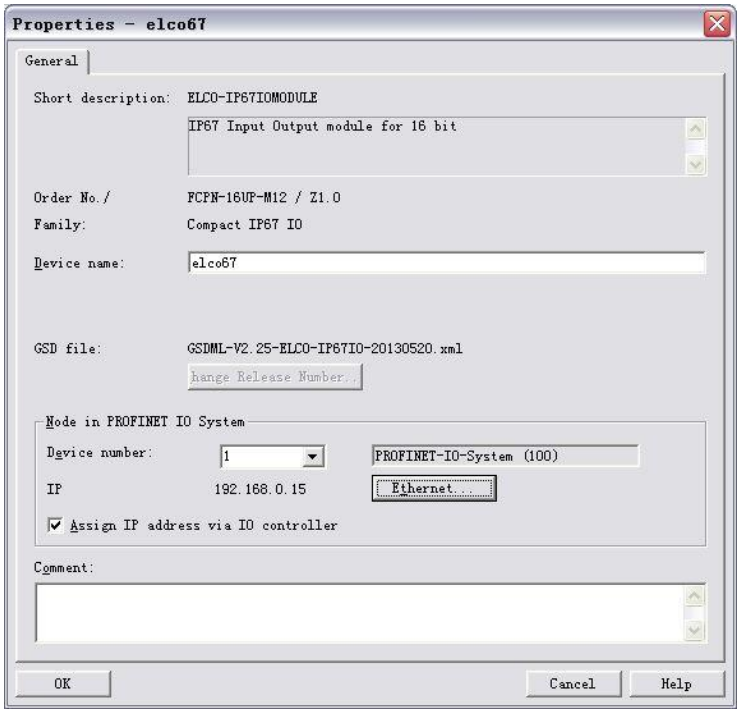
6) According to Section 3.3 user guide, select "PLC Edit Ethernet > Ethernet > Node", assign the Spider67 gateway device the name of elco67 in the pop-up window .



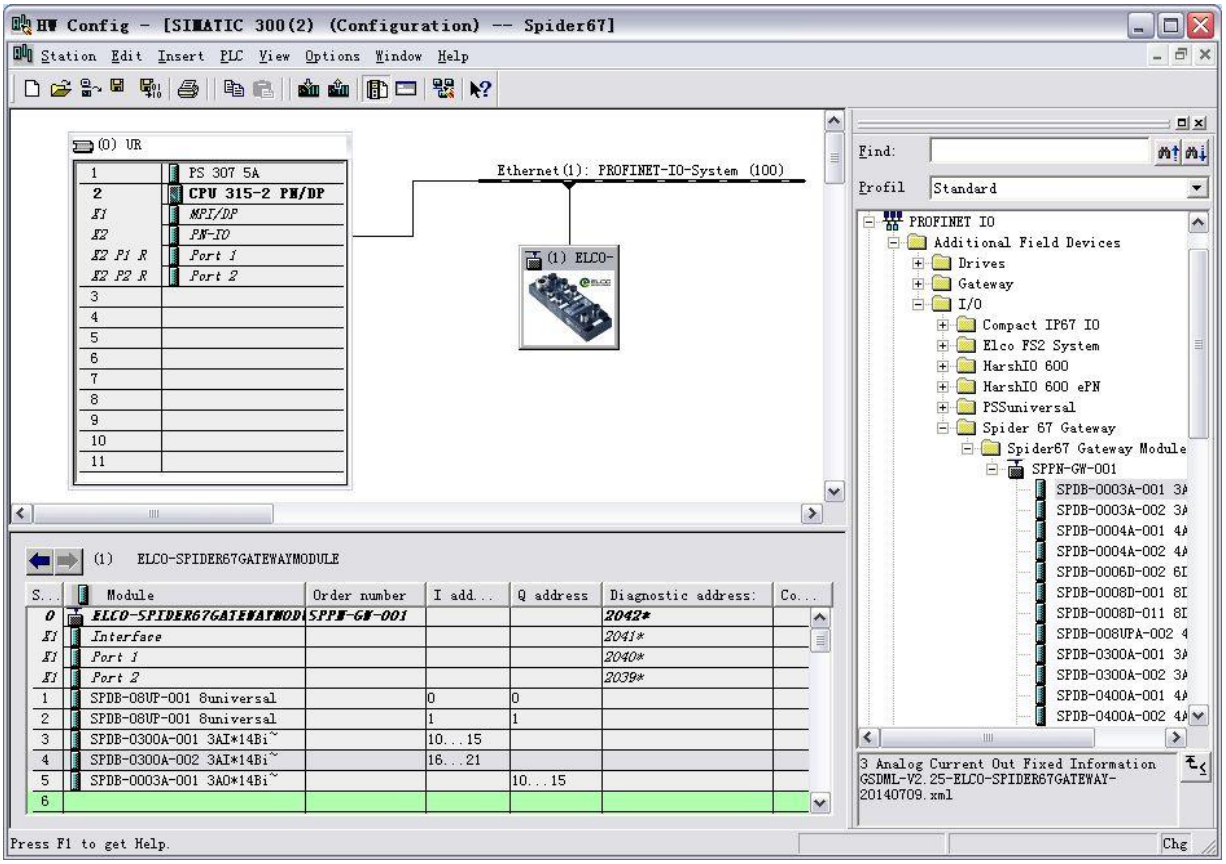
7) In the Catalog window, the catalog of "Profinet IO>Additional Field Devices>I/O>Spider 67 Gateway>Spider67 Gateway Module", select the "SPPN-GW-001"and add it to the PROFINET network.



8) Double click on the newly added Spider67 gateway, fill in the previously setting device name elco67 in the pop-up "**properties**" window, and assign IP address to this module via the "Ethernet.." button: 192.168.0.15. Be sure to click the option "**assign IP via IO controller**" .

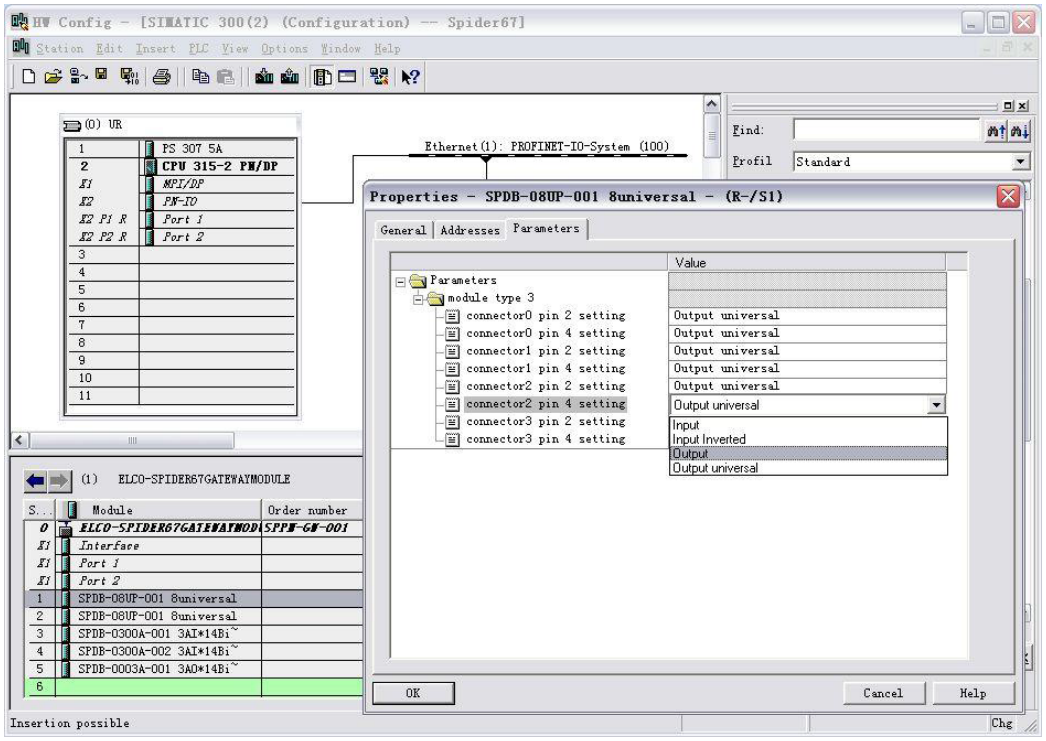


9) Based on the I/O module configuration described in the beginning of this section, we add the module type and quantity to each slot position of Spider67 gateway in the catalog window, from the directory "SPPN-GW-001" according to the sequence of the extension port P0-P1-P2-P3 and assign the input and output address.

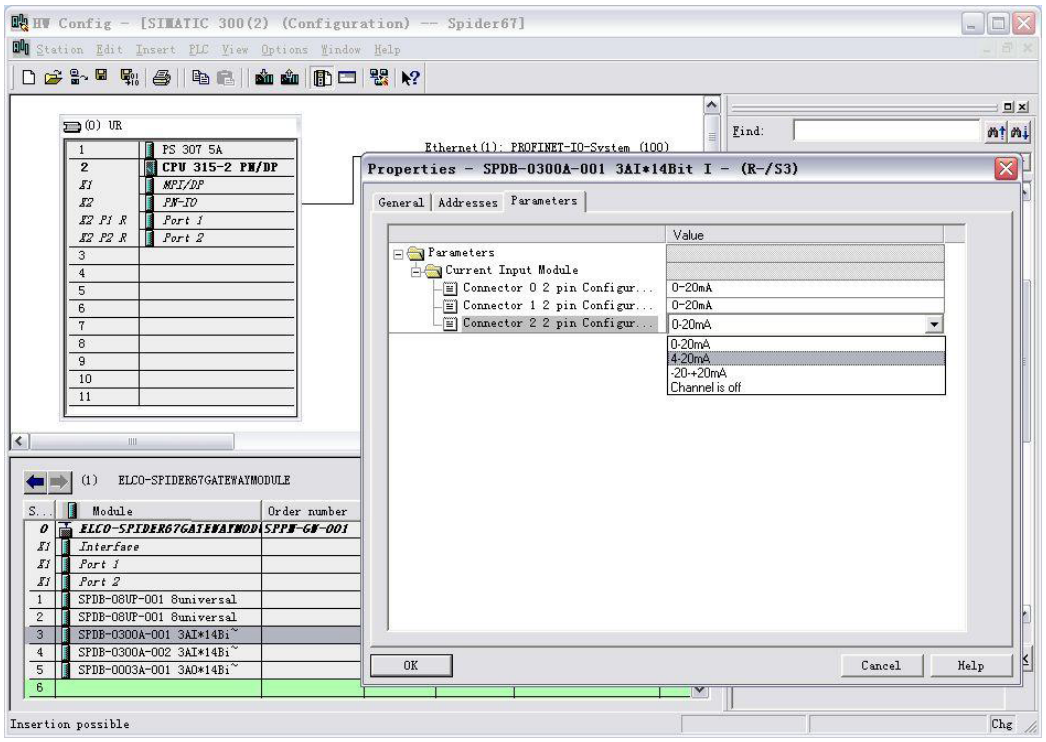


10) Double click the newly added "SPDB-08UP-001" module, select the “Parameters” tab to assign the module parameters in the new pop-up window. Users can select "input" and "output" of each signal port to define that it is used as an input or output, while the default "output universal” indicates that the signal port can be used as input or output, which depends on the customer wiring.

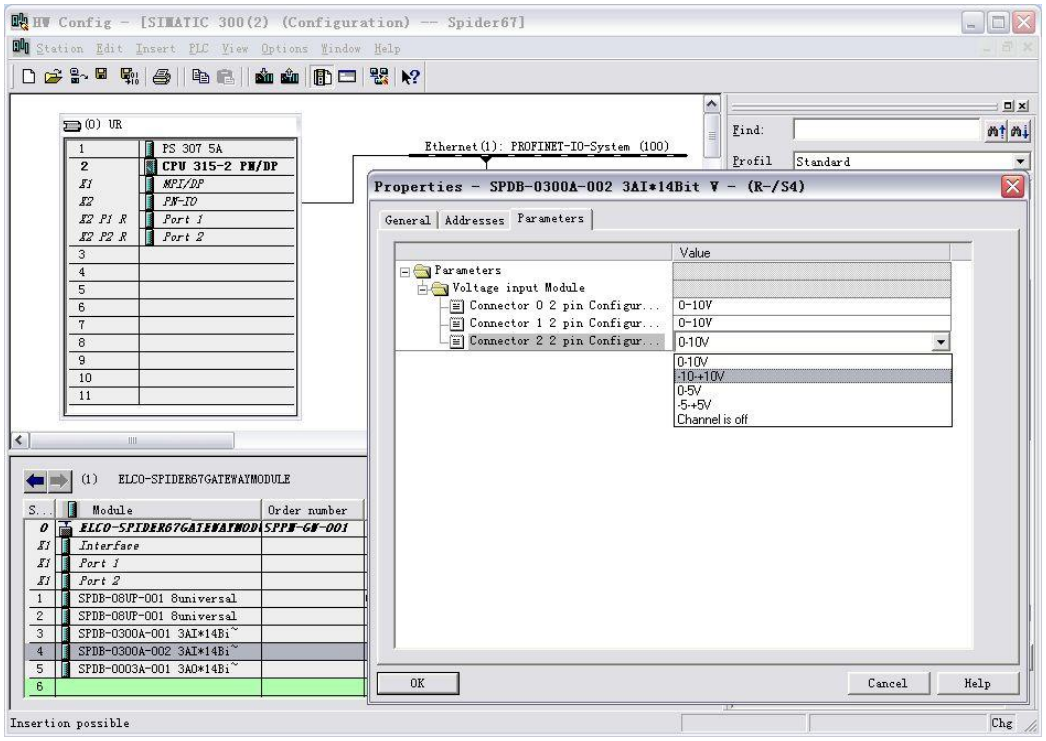
Note: SPDB-08UP-xxx in which the input and output ports can be defined as required in the application. All the other modules are fix.



11) Double click the newly added "SPDB-0300A-001" module, select the Parameters tab to assign parameters in the new pop-up window. The user can select the current input type of each signal port: "0~20mA", "4~20mA", "-20~+20mA", you can also close the port to improve the sample scanning speed of this module.



12) Double click the newly added "SPDB-0300A-002" module, select the **Parameters** tab to assign parameters in the new pop-up window. The user can select the voltage input type of each signal port: "0~10V", "-10~+10V", "0~5V", "-5~+5V", you can also close the port to improve the sample scanning speed of this module.



13) Save the compilation and download configuration to the PLC, until now the configuration is completed.

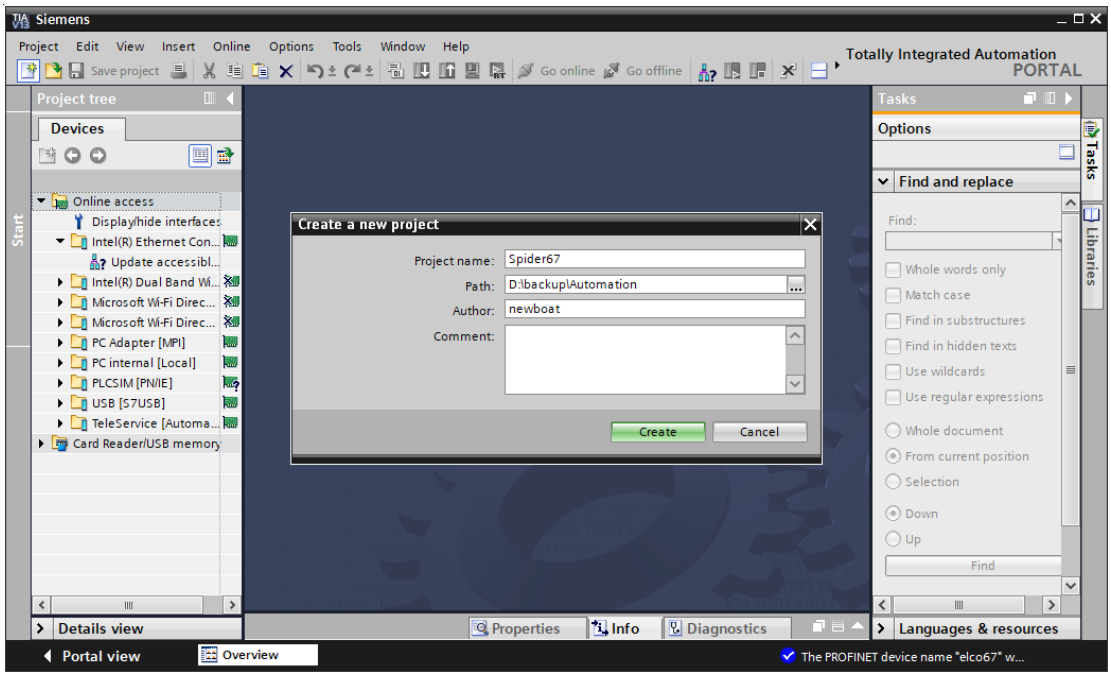
4.6 Module configuration by Portal

This section, through a case of connection configuration in a current operation process, will let the users fully understand how to use the Spider67 distribution I/O system. In this case, using the ELCO spider67 as PROFINET slave station to connect the Siemens PROFINET controller CPU1211C under the condition that all power and bus connections have been completed, the device name of Spider67 module is assigned as elco67.

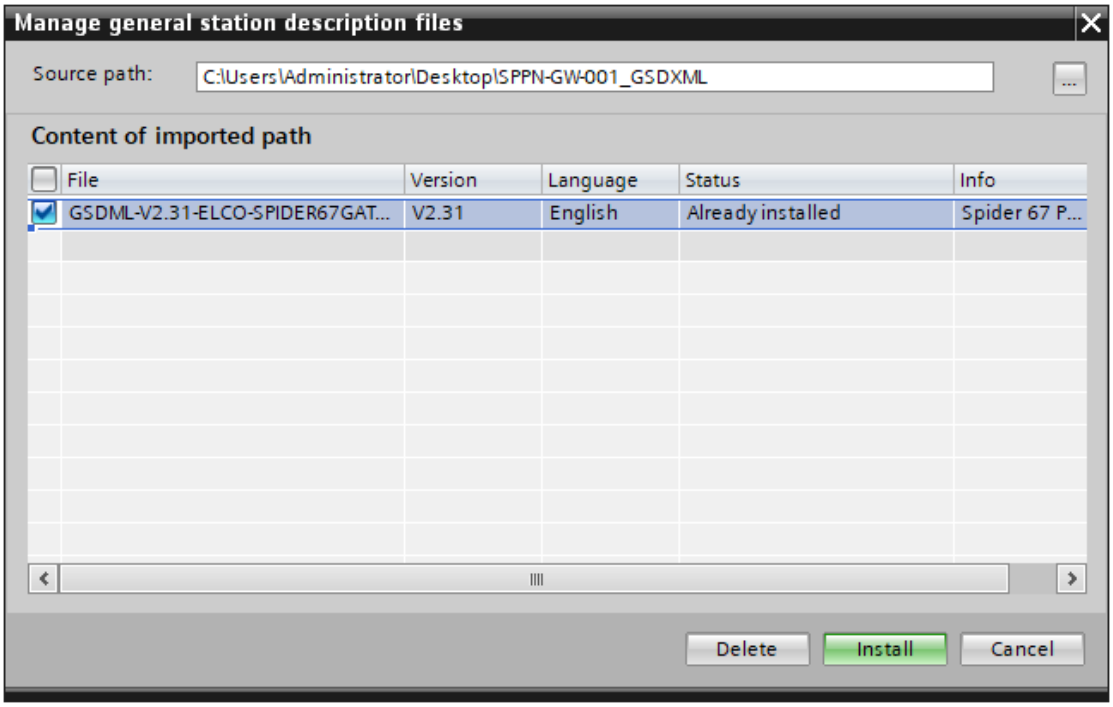
Spider67 system includes a gateway module SPPN-GW-001, gateway extension port P0 connecting two SPDB-08UP-001; extension port P1 connecting one SPDB-0300A-001; extension port P2 connecting one SPDB-0300A-002, extension port P3 connecting one SPDB-0003A-001.

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

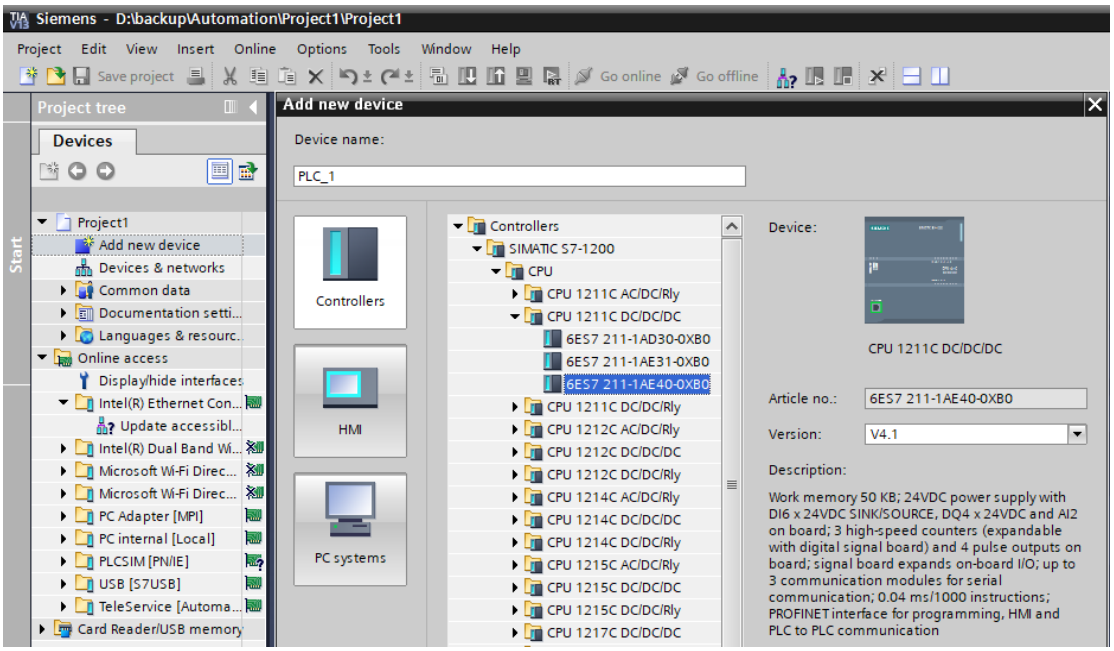
1) Create a new Portal project



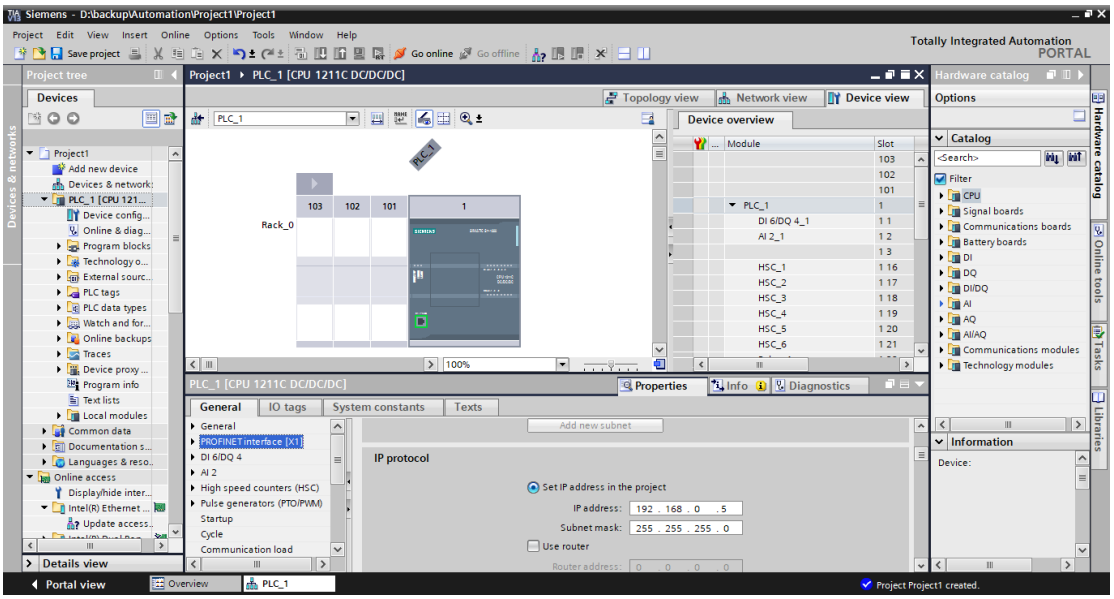
2) Install the GSD files of ELCO Spider67



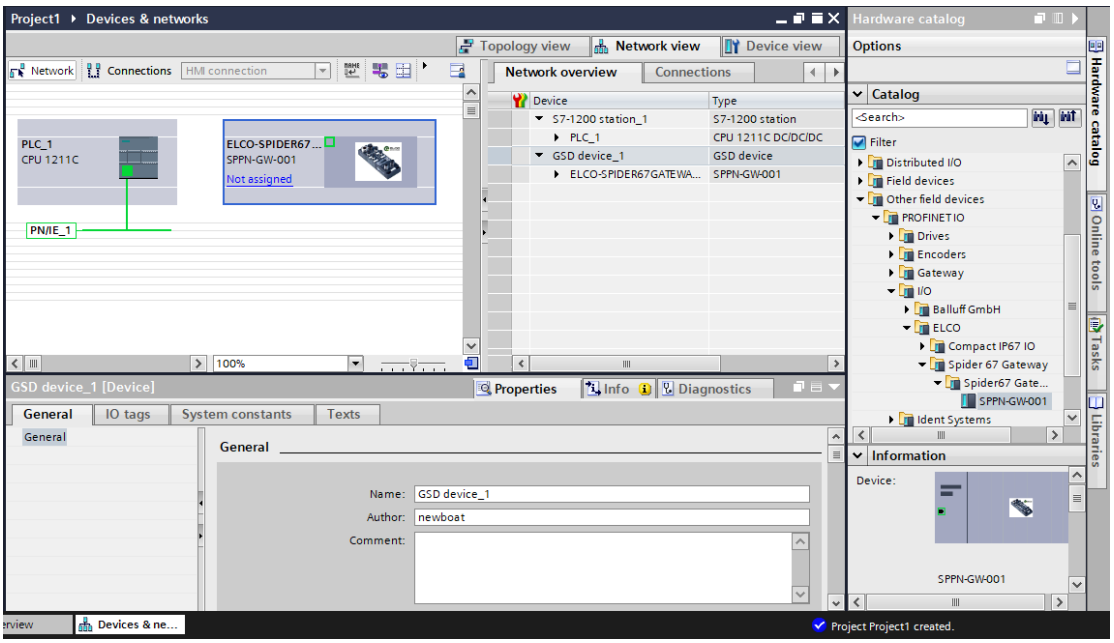
3) Double-click “Add New Device” and select the PLC type.



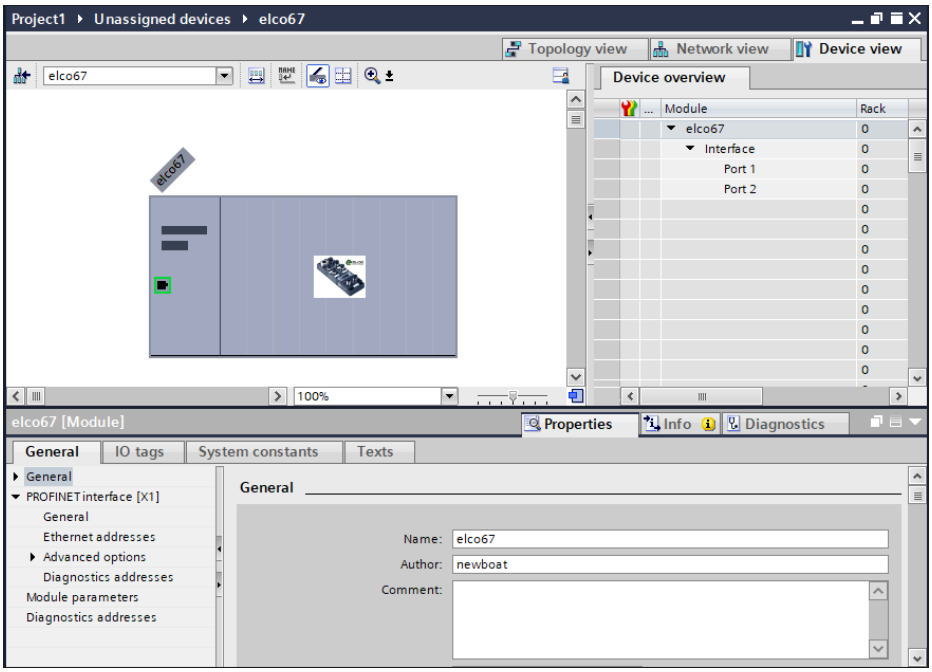
4) In the "Device View" tab of the "Device Configuration" window, set the relevant properties of PLC, click the "Add New Subnet" button to add Profinet network, and set the IP address of PLC.



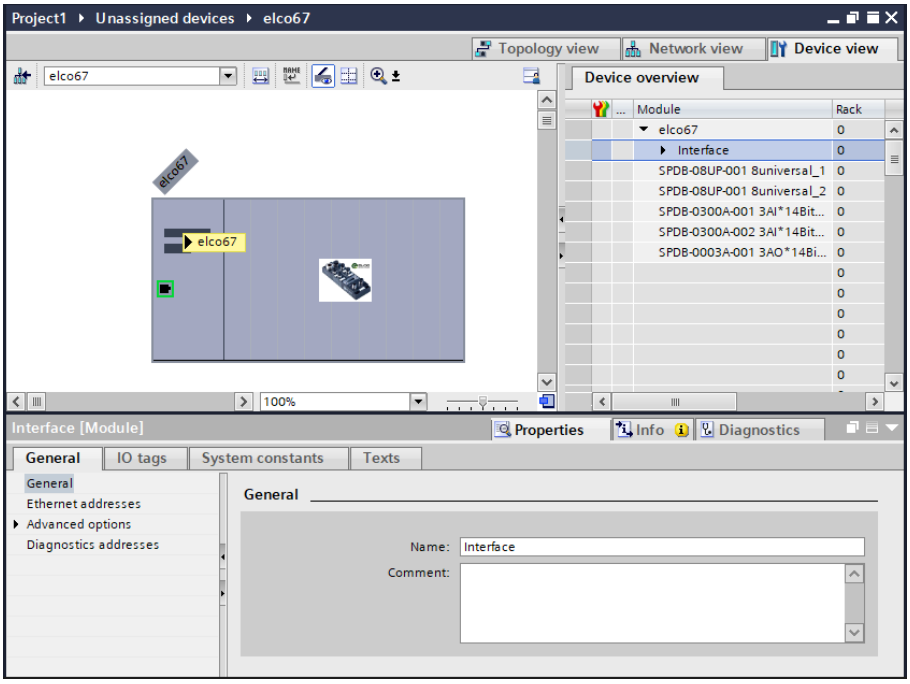
5) On the “Network View” tab, select the SPPN-GW-001 gateway of ELCO from the Hardware Directory on the right to add to the network.



6) According to the instructions in Section 3.3, double-click the Spider67 gateway, enter the device view of SPPN-GW-001, set the device name “elco67” of Spider67 gateway in the window, and set the IP address.

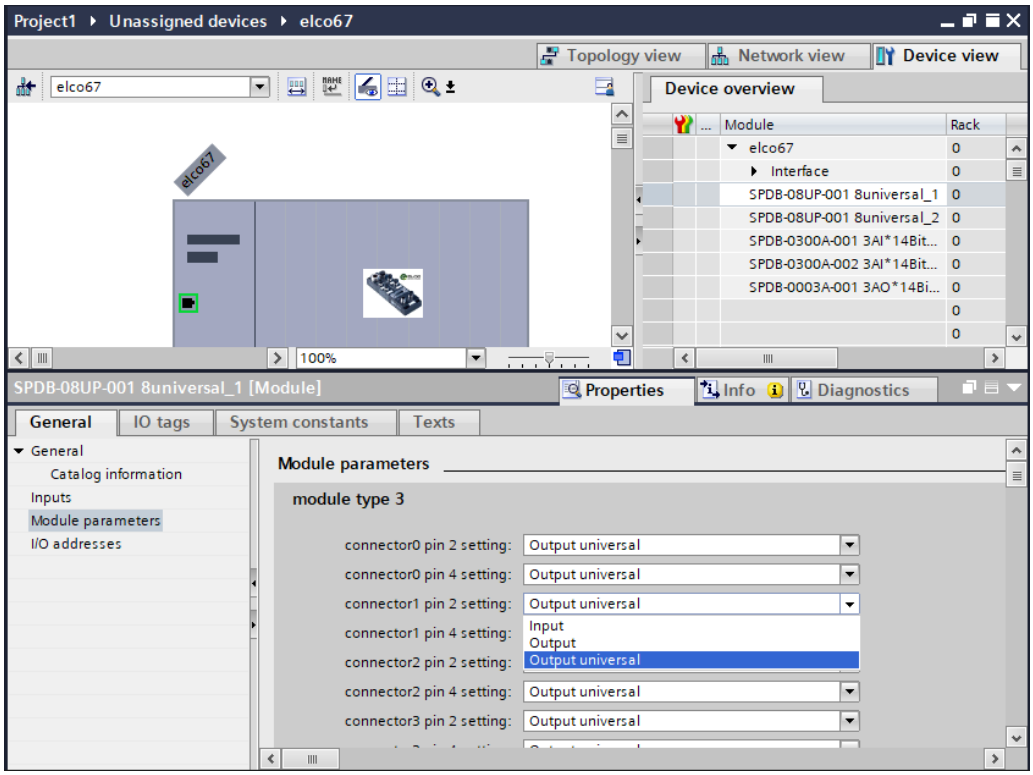


7) Based on the I/O module configuration described in the beginning of this section, we add the module type and quantity to each slot position of Spider67 gateway in the catalog window, from the directory "SPPN-GW-001" according to the sequence of the extension port P0-P1-P2-P3 and assign the input and output address.

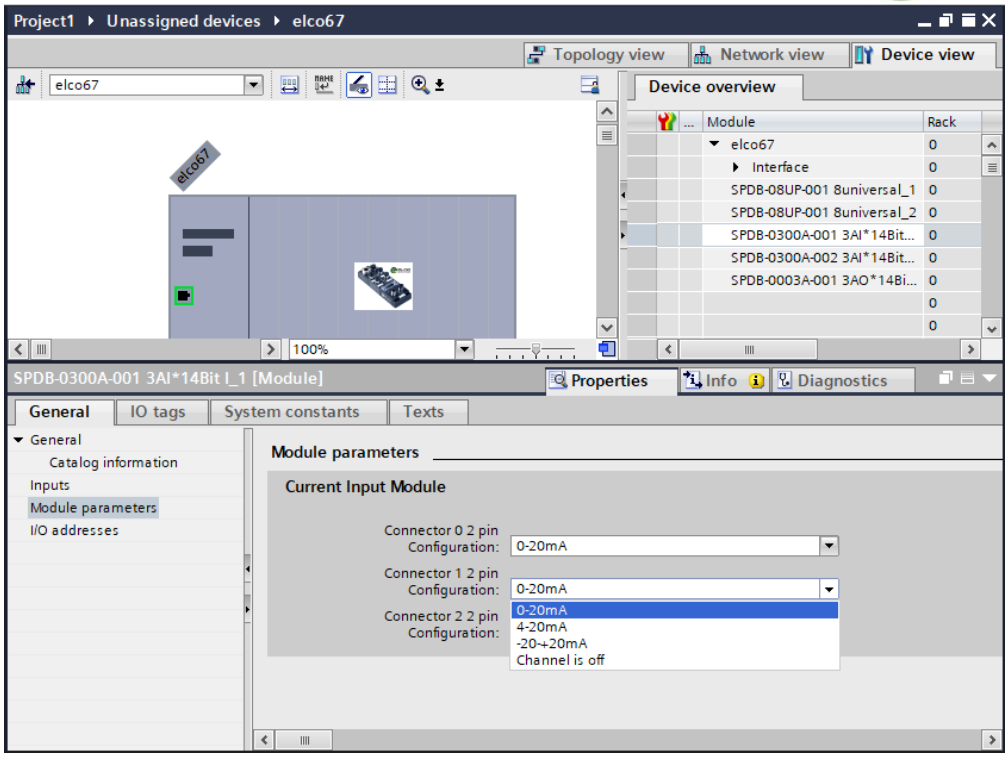


8) Double click the newly added "SPDB-08UP-001" module, select the “Parameters” tab to assign the module parameters in the new pop-up window. Users can select "input" and "output" of each signal port to define that it is used as an input or output, while the default "output universal” indicates that the signal port can be used as input or output, which depends on the customer wiring.

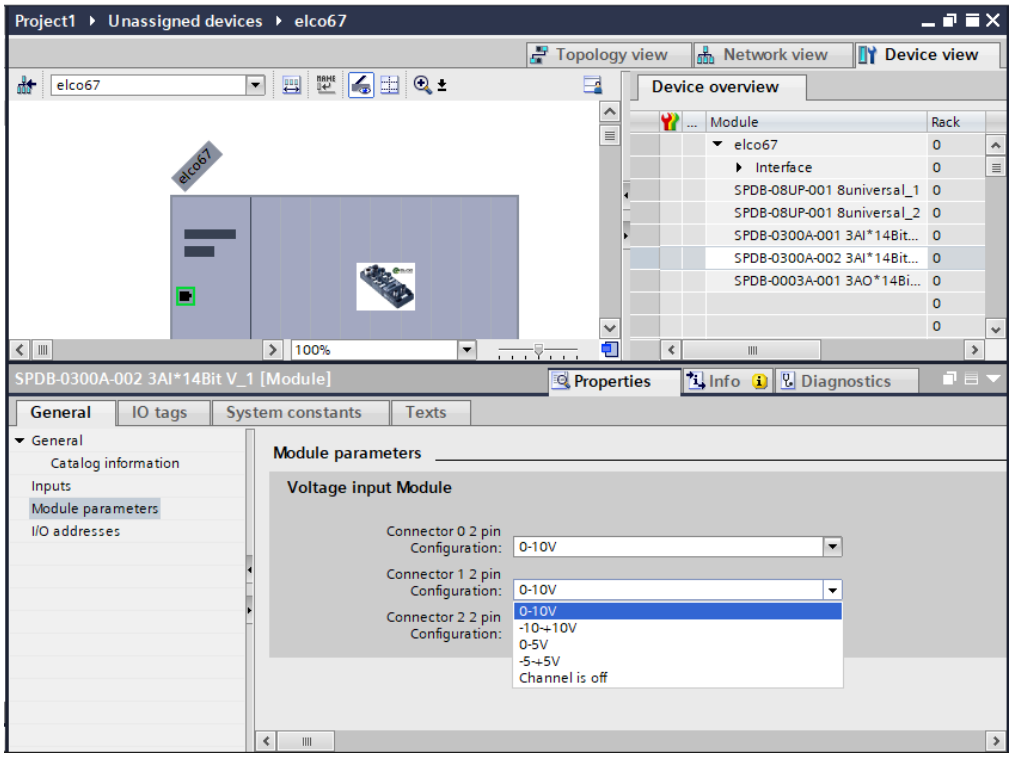
Note: SPDB-08UP-xxx in which the input and output ports can be defined as required in the application. All the other modules are fix.



9) Double click the newly added "SPDB-0300A-001" module, select the Parameters tab to assign parametersin the new pop-up window. The user can select the current input type of each signal port: "0~20mA", "4~20mA", "-20~+20mA", you can also close the port to improve the sample scanning speed of this module.



10) Double click the newly added "SPDB-0300A-002" module, select the Parameters tab to assign parameters in the new pop-up window. The user can select the voltage input type of each signal port: "0~10V", "-10~+10V", "0~5V", "-5~+5V", you can also close the port to improve the sample scanning speed of this module.



11) Save the compilation and download configuration to the PLC, until now the configuration is completed.

5. Alarm diagnosis

5.1 LED fault indicator

With the built-in LED on Spider67 distributed I/O module, users can quickly and easily diagnose the working status of module. (Please see Section 2.5 "LED function")

Gateway LED

Name	**status**	**Meaning**	**Possible causes**
Communication LED	Green	Normal	N/A
	Red	Abnormal	1.Not connected with the expansion module 2.Expansion cable fault 3.Expansion module damage
Power LED PWR	Green	Normal	N/A
	Red	Abnormal	1.Usp power fault 2.Gateway damage
Gateway status MOD	Green	Normal	N/A
	Red	Abnormal	1.Umod Power fault 2.Usp Power fault 3.Communication channelfault(short circuit,over voltage etc.) 4.The configuration does not match the actual connection status 5.Gateway damage
Profinet Network status NET	Green	Access to the network	N/A
	Orange	Not access to the network	1.Network cable fault 2.Gateway damage
	Orange flash	Exchanging data	Date connecting
Power supply status Umod、Usp	Green	Voltage normal	N/A
	Red	Voltage abnormal	1.Over-voltage or under-voltage 2.Gateway damage
	OFF	No power	1.Power cable fault 2.Gateway damage

I/O module LED

Name	status	Meaning	Possible causes
Address configuration Input LED Set_In	Green	Configured	N/A
	Red	No configuration	1.Expansion cable fault 2.Expansion cable damage
Address configuration Output LED Set_Out	Green	Configured next module	N/A
	Red	No configured next module	1.Expansion cable fault 2.Expansion cable damage
Module status LED MOD	Green	Normal	N/A
	Red	Abnormal	1.Single channel abnormal 2.Expansion module damage
Link expansion module Communication Link	Green	Normal	N/A
	Red	Abnormal	1.Expansion cable fault 2.Gateway damage 3.Expansion module damage
Signal/Status LED	Red	Signal abnormal	1 The actual output signal does not match with the configuration 2 Signal power supply short circuit 3.Expansion module damage 4 Beyond range (analog module)
	Green	Signal	N/A
	OFF	No signal	N/A

5.2 Diagnostic information

Profinet supports integrated diagnosis concept, each individual error occurred at the same time or some errors are transferred from IO devices to the IO controller. The following steps can be carried out for the diagnosis: response to the error (for interrupt event-driven diagnosis and evaluation), check the current status of automation system (status-driven diagnosis). Users can access to SFB/SFC in Step7 to evaluate the diagnostic information:

1) Diagnosis with the SFB52 in the OB1

The diagnostic data record in the system offers a diagnostic capability with additional detailed information, and the system function block SFB52 ("RDREC") is used for reading these data records.

When called, the system function block addresses the station to be diagnosed and indicates the data record to be read as the INDEX parameters. If there is no diagnostic information, the system function block is executed without output.

Since SFB 52 “RDREC” is an SFB that works asynchronously, i.e., the execution spans several SFB calls, the block can only be used in cyclic operation. A use of the block in an interrupt OB or a timed interrupt OB is not advisable. Aside from the exact position of the error, the diagnostic data record of SFB 52 also includes information on the occurred error type. This information can be evaluated for further analysis purposes.

You define the maximum number of bytes to read by setting the MLEN variable, so you should select a RECORD target range of at least the same length as defined in MLEN. Output parameter VALID = TRUE indicates the successful transfer of the record to the target area RECORD. Output parameter LEN contains the length in [bytes] of the read data. Output parameter ERROR reports any errors detected during record transfer. ERROR =TRUE and the error information is written to output parameter STATUS when an error is detected.

2) Diagnosis with the SFB54 in the OB82

SFB54 "RALARM" evaluates received interrupt data and all corresponding information from peripheral modules or Profinet devices, and then the information is provided to the output parameters.

The information with additional detailed information includes both the information of the starting interrupt OB and the information of the interrupt source. Call "RALRM" only within the interrupt OB started by the CPU operating system as a

result of the peripheral device interrupt that is to be examined. The call of SFB 54 “RALARM” outside an interrupt OB is not advisable since important information on the interrupt status are not included here.
In the TINFO and AINFO cache data, you can quickly get the information such as station number, slot number, channel and occurred error type and other information.