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AS Series Module Manual

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AS Series Module Manual
Revision History

Version	Revision	Date
1st	The first version was published.	2016/11/30
2nd	1. Chapter 1: Added information concerning new models AS08AD-B and AS08AD-C. 2. Chapter 2: Added information concerning new models AS08AD-B andAS08AD-C. 3. Chapter 3: Updated information concerning CR#23-24 and software new screenshots. 4. Chapter 4: Updated information concerning CR#35-54/CR#210-225 and software new screenshots. 5. Chapter 5: Updated information concerning CR#1-4/CR#210-217 and software new screenshots. 6. Chapter 6: Updated information concerning CR#210-217 and software new screenshots. 7. Chapter 7: Updated information concerning theoretical calibration and software new screenshots 8. Chapter 8: Updated information concerning new FW2.0.	2017/07/07
3rd	1. Chapter 1: Added information concerning new models AS06RTD-A and AS08TC-A and installation information updated in section 1.3.1. 2. Chapter 5: Added information concerning new model AS06RTD-A. 3. Chapter 6: Added information concerning new models AS08TC-A.	2018/02/09
4th	1. Chapter 1: Added information concerning ambient air temperature-barometric pressure-altitude. 2. Chapter 2: Added information concerning filter average, cable length and resistance. Updated section 2.2.4 CR#23-38 and section 2.2.5 CR#43-74. 3. Chapter 3: Added information concerning cable length and resistance. Updated section 3.2.1 analog to digital conversion range, output impedance and section 3.2.4 CR17-20 and CR#21-36. 4. Chapter 4: Added information concerning filter average, cable length and resistance. Updated section 4.2.1 analog to digital conversion range, output impedance and 4.2.4 CR#31-21. 5. Chapter 5: Updated section 5.2.1 JPt100 range, section 5.2.4-5.2.5 added notes on CR, updated section 5.2.6 PID information, revised section 5.2.7 control mode. 6. Chapter 6: Section 6.2.1 revised type B range, added a note, section 6.2.4-6.2.5 added notes on CR, revised CR# for the records, updated section 6.2.6 PID information and revised section 6.2.7 control mode. 7. Chapter 7: Section 7.2.4 added notes on CR. 8. Chapter 8: New functions in new FW2.02. 9. Chapter 9: Updated section 9.2.5 output impedance information and added sections 9.2.7.1-9.2.7.9 for new functions added and operational examples.	2018/11/26
5th	1. Chapter 7: Revised contents of CR#0 and #59 in section 7.2.4. 2. Chapter 8: Deleted a note in section 8.6.4.	2019/1/29
6th	1. Chapter 5: Updated wiring information in section 5.2.8.	2019/5/10

Version	Revision	Date
7th	1. Chapter 1: Added model information including AS02PU-A, AS04PU-A, AS02HC-A, AS04SIL-A and AS-FPFN02 2. Chapter 2: Updated section 2.2.1 specification, 2.2.4 and 2.2.5 CR table, and 2.4 adding a new error code. 3. Chapter 3: Updated section 3.2.4 CR table and 3.4 adding a new error code. 4. Chapter 4: Updated section 4.2 specification, 4.2.4 CR table and 4.4 adding a new error code. 5. Chapter 5: Updated section 5.2 specification, 5.2.4 and 5.2.5 CR table, and 5.4 adding a new error code. 6. Chapter 6: Updated section 6.2.4 and 6.2.5 CR table. Added DMPID instruction supporting firmware versions and section 6.4 adding a new error code. 7. Chapter 7: Updated section 7.2.4 and 7.2.5 CR table and 7.5 adding a new error code. 8. Chapter 8: Added a new error code in section 8.7.2.2. 9. Chapter 9: Updated AS-F2AD specifications in sections 9.2.4 and 9.2.5. Deleted SM1110 and SR1540 in section 9.2.7. Added AS-FPFN02 information in sections 9.2.8 and 9.3.5. 10. Chapter 11: New chapter introducing positioning modules AS02PU-A and AS04PU-A.	2019/11/29
8th	1. Chapter 1: Updated section 1.1 to include software information for new AX series PLC, updated AS02HC-A specifications and added AS-FOPC02 information. Added an installation note in section 1.3.4. 2. Chapter 2: New chapter introducing digital input/output modules. 3. Chapter 3 – 7: Added DIADesigner+ and Hardware Configuration information. 4. Chapter 8: Updated CR#120 default value and input values 100 to 105 of CR200 command set in section 8.2.4. 5. Chapter 9: Added AS-FPEN02 and AS04SIL-A information, added LED indicator information of EtherNet/IP in section 9.4.2, and added error LED indicator information of AS00SCM-A in section 9.7.2.2. 6. Chapter 10: Updated software images in section 10.2.7 and 10.2.7.2, updated section 10.2.7.7, added AS-FPFN02 installed on AS00SCM-A information in section 10.2.8, added AS-FOPC02 product information in sections 10.2.9 and 10.3.6, updated LED indicator information of AS-FEN02 in section 10.3.4. 7. Chapter 12: Updated response time and input isolation specifications in section 12.2.1. 8. Chapter 13: New chapter introducing IO link communication module, AS04SIL-A. 9. Chapter 14: New chapter introducing high speed counter modules AS02PU and AS04PU.	4/28/2020

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Chapter 6 Temperature Measurement Module AS04/06RTD

Chapter 8 Load Cell Module AS02LC

Chapter 9 Serial Communication Module AS00SCM

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Chapter 13 I/O Link Communication Modules AS04SIL

Chapter 14 High Speed Counter Moudle AS02/04HC

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Chapter 1 Introduction

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1.1 Overview

This manual introduces the use of special modules. The special modules are the analog input/output modules, temperature measurement modules, load cell modules, and network modules. For software operation, you need to use ISPSoft, if you are using AS Series PLC CPU. Refer to ISPSoft User Manual for more information. The new software DIADesigner+ only supports AX Series PLC CPU and AS Series modules now, refer to DIADesigner+ User Manual for more information on software operation.

The following table shows the module descriptions.

Classification	Model Name	Description
Analog input/output module	AS04AD-A	4-channel analog input module Hardware resolution: 16 bits 0–10 V, 0/1–5 V, -5 to +5 V, -10 to +10 V, 0/4–20 mA, -20 to +20 mA Conversion time: 2 ms/channel
	AS08AD-B	8-channel analog input module Hardware resolution: 16 bits 0–10 V, 0/1–5 V, -5 to +5 V, -10 to +10 V Conversion time: 2 ms/channel
	AS08AD-C	8-channel analog input module Hardware resolution: 16 bits 0/4–20 mA, -20 to +20 mA Conversion time: 2 ms/channel
	AS04DA-A	4-channel analog input module Hardware resolution: 12 bits -10 to +10 V, 0–20 mA, 4–20 mA Conversion time: 2 ms/channel
	AS06XA-A	4-channel analog input module Hardware resolution: 16 bits 0–10 V, 0/1–5 V, -5 to +5 V, -10 to +10 V, 0/4–20 mA, -20 to +20 mA Conversion time: 2 ms/channel 2-channel analog input module Hardware resolution: 12 bits -10 to +10 V, 0–20 mA, 4–20 mA Conversion time: 2 ms/channel

Classification	Model Name	Description
Temperature measurement module	AS04RTD-A	4-channel, 2-wire/3-wire RTD Sensor type: Pt100 / Ni100 / Pt1000 / Ni1000 / JPt100 / LG-Ni1000 / Cu50 / Cu100 / 0–300Ω / 0–3000Ω input impedance Resolution: 0.1°C/0.1°F (16 bits) Conversion time: 200 ms/channel
	AS06RTD-A	6-channel, 2-wire/3-wire RTD Sensor type: Pt100 / Ni100 / Pt1000 / Ni1000 / JPt100 / LG-Ni1000 / Cu50 / Cu100 / 0–300Ω / 0–3000Ω input impedance Resolution: 0.1°C/0.1°F (16 bits) Conversion time: 200 ms/channel
	AS04TC-A	4-channel thermocouple Sensor type: J, K, R, S, T, E, N, B, and -100 to +100 mV Resolution: 0.1°C/0.1°F (24 bits) Conversion time: 200 ms/channel
	AS08TC-A	8-channel thermocouple Sensor type: J, K, R, S, T, E, N, B, and -100 to +100 mV Resolution: 0.1°C/0.1°F (24 bits) Conversion time: 200 ms/channel
Load cell module	AS02LC-A	2-channel, 4-wire/6-wire load cell sensor Eigenvalue applicable to a load cell: 1, 2, 4, 6, 20, 40, 80 mV/V Highest accuracy: 0.04% of full-scale ADC Resolution : 24 bits Conversion time: 2.5–400 ms (nine options to choose from)
Positioning / counter module	AS02PU-A	2-axis positioning control 1 high-speed differential input, 5-24 VDC, maximum at 200 kHz 5 external inputs, 24 VDC, 5 mA, 2-axis high-speed differential outputs, 5 VDC, maximum at 200 kHz
	AS04PU-A	4-axis positioning control 6 inputs, 24 VDC, 5mA, 4-axis high-speed open collector output, 5-30 VDC, 0.1A, maximum at 200 kHz
	AS02HC-A	2-channel high-speed counters Input methods for the 2-channel are pulse-input (max. at 200 kHz) and

Classification	Model Name	Description
		SSI communication interface input (max. at 1.25 MHz) Incrementing / decrementing encoder input 4-point high-speed open collector output, 5-30 VDC, 0.1A, work with high speed differential output
Network module	AS00SCM-A	Serial communication module, 2x communication ports, applicable to communication cards, supporting MODBUS protocols
	AS01DNET-A	DeviceNet communication port, functioning as master or slave
	AS04SIL-A	IO-Link module, built-in with 4 IO-Link communication ports
Remote I/O module	AS00SCM-A + AS-FCOPM	Network module with AS-FCOPM function cards
	AS00SCM-A + AS-FEN02	Network module with AS-FEN02 function cards
	AS01DNET-A (RTU)	DeviceNet remote IO slave, its right side connectswith AS Series extension modules, including digital modules, analog modules, temperature modules, etc.
Function cards	AS-F232	Serial communication port, RS232, functioning as master or slave
	AS-F422	Serial communication port, RS422, functioning as master or slave
	AS-F485	Serial communication port, RS485, functioning as master or slave
	AS-FCOPM	CANopen communication port, supporting DS301, AS series remote modules, and Delta servo systems
	AS-F2AD	2-channel analog input, 0–10 V (12 bits), 4–20 mA (11 bits), Conversion time: 3 ms/channel
	AS-F2DA	2-channel analog input, 0–10 V, 4–20 mA (12 bits), Conversion time: 2 ms/channel
	AS-FEN02	2x Ethernet ports, supporting data exchange, supporting MODBUS TCP, EtherNet/IP Adapter, AS Series remote control, and DLR function
	AS-FPFN02	2x Ethernet ports, supporting data exchange, supporting PROFINET Device (adapter)
	AS-FOPC02	2x Ethernet ports, supporting data exchange, supporting OPC-UA Server and EtherNet/IP Adapter, only available for AS300 Series PLC CPU

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1.2 Specifications

1.2.1 General Specifications

Item	Specifications
Operating temperature	-20 to +60°C
Storage temperature	-40 to +80°C
Operating humidity	5–95% No condensation
Storage humidity	5–95% No condensation
Work environment	No corrosive gas
Installation location	In a control box
Pollution degree	2
Ingress protection **(IP ratings)**	IP20
EMC (electromagnetic compatibility)	Refer to Chapter 7 for more information.
Vibration resistance	Tested with: 5 Hz ≦ f ≦ 8.4 Hz, constant amplitude 3.5 mm 8.4 Hz ≦ f ≦ 150 Hz, constant acceleration 1 g Duration of oscillation: 10 sweep cycles per axis on each direction of the three mutually perpendicular axes International Standard IEC 61131-2 & IEC 60068-2-6 (TEST Fc)
Shock resistance	Tested with: Half-sine wave Strength of shock: 15 g peak value, 11 ms duration Shock direction: The shocks on each direction per axis, of the three mutually perpendicular axes (for a total of 18 shocks) International Standard IEC 61131-2 & IEC 60068-2-27 (TEST Ea)
Safety	Conforms to IEC 61131-2, UL508
Ambient air temperature-barometric pressure-altitude	Operating: 1080 ~ 795hPa (-1000 ~ 2000 m) Storage:1080 ~ 660hPa (-1000 ~ 3500 m)

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1.2.2 EMS Standards

1.2.2.1 EMI

Port	Frequency Range	Level (Normative)	Reference Standard
Enclosure port (radiated) (measured at a distance of 10 meters)	30-230 MHz	40 dB (μV/m) quasi-peak	IEC 61000-6-4
	230-1000 MHz	47 dB (μV/m) quasi-peak	
AC power port (conducted)	0.15-0.5 MHz	79 dB (μV) quasi-peak	
		66 dB (μV) average	
	0.5-30 MHz	73 dB (μV) quasi-peak	
		60 dB (μV) average	

1.2.2.2 EMS

Environmental Phenomenon	Reference Standard	Test		Test Level
Electrostatic Discharge	IEC 61000-4-2	Contact		±4 kV
		Air		±8 kV
Radio Frequency Electromagnetic Field Amplitude Modulated	IEC 61000-4-3	80% AM, 1 kHz sinusoidal	2.0-2.7 GHz	1 V/m
			1.4-2.0 GHz	3 V/m
			80-1000 MHz	10 V/m
Power Frequency Magnetic Field	IEC 61000-4-8	60 Hz		30 A/m
		50 Hz		30 A/m

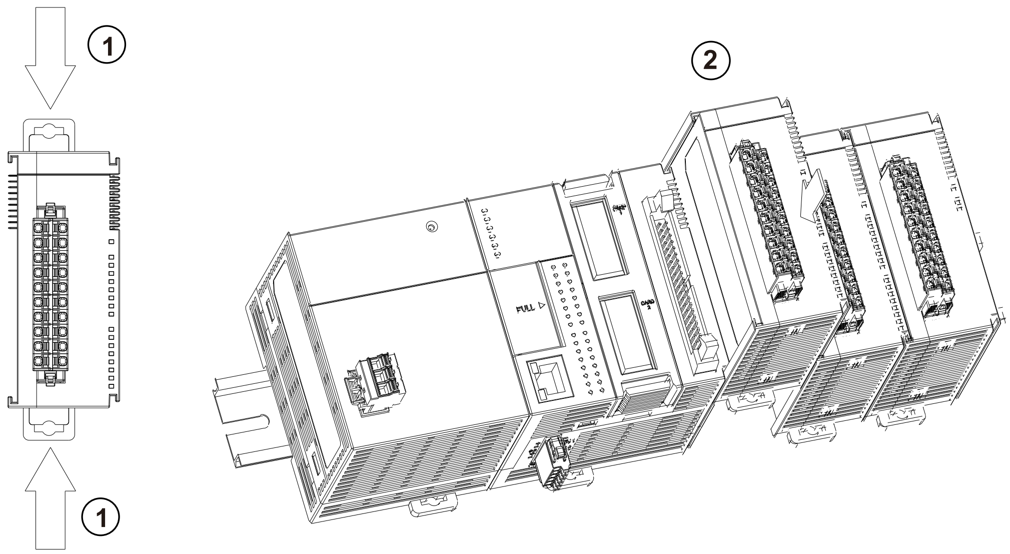
1.2.2.3 Conducted Immunity Test

Environmental Phenomenon		**Fast Transient Burst**	**High Energy Surge**	**Radio Frequency Interference**
Reference Standard		**IEC 61000-4-4**	**IEC 61000-4-5**	**IEC 61000-4-6**
Interface/Port	**Specific Interface/Port**	**Test Level**	**Test Level**	**Test Level**
Data communication	Shielded cable	1 kV	1 kV CM	10 V
	Unshielded cable	1 kV	1 kV CM	10 V
Digital and analog I/O	AC I/O (unshielded)	2 kV	2 kV CM 1 kV DM	10 V
	Analog or DC I/O (unshielded)	1 kV	1 kV CM	10 V
	All shielded lines (earth)	1 kV	1 kV CM	10 V
Equipment power	AC power	2 kV	2 kV CM 1 kV DM	10 V
	DC power	2 kV	0.5 kV CM 0.5 kV DM	10 V
I/O power and auxiliary power output	AC I/O and AC auxiliary power	2 kV	2 kV CM 1 kV DM	10 V
	DC I/O and DC auxiliary power	2 kV	0.5 kV CM 0.5 kV DM	10 V

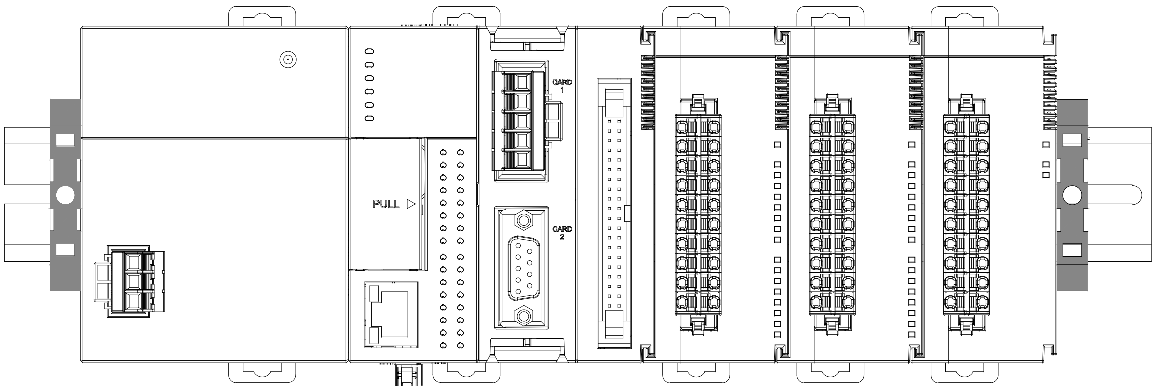
1.3 Installation

1.3.1 Installing a Module

1. Press the clip rings if they are out as the image 1 shown. Push the module to the desire position until you hear a click to finish installation.
2. Link the I/O modules on the right side of the PLC and make sure they are hooked together. Push the modules into the DIN rail until you hear a click.
3. After you installed the module, fasten the screws on the modules to secure the module on the DIN rail.

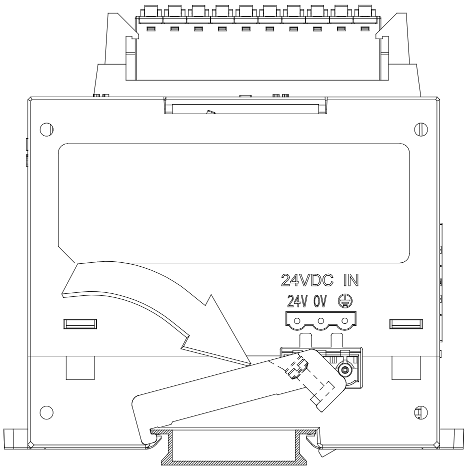


If there is a vibration source near the installation site, install anti-vibration baffles on the sides of the AS Series modules for better stabilization, such as the gray baffles show below.

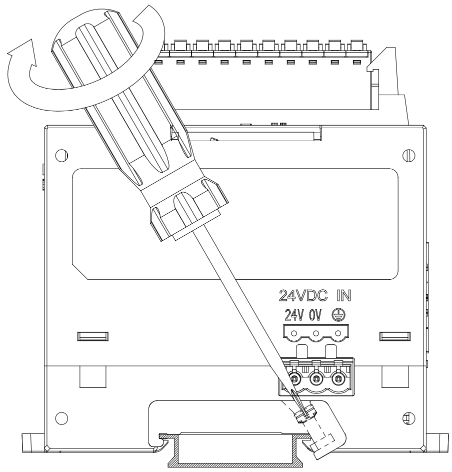


- **Install the baffles:**

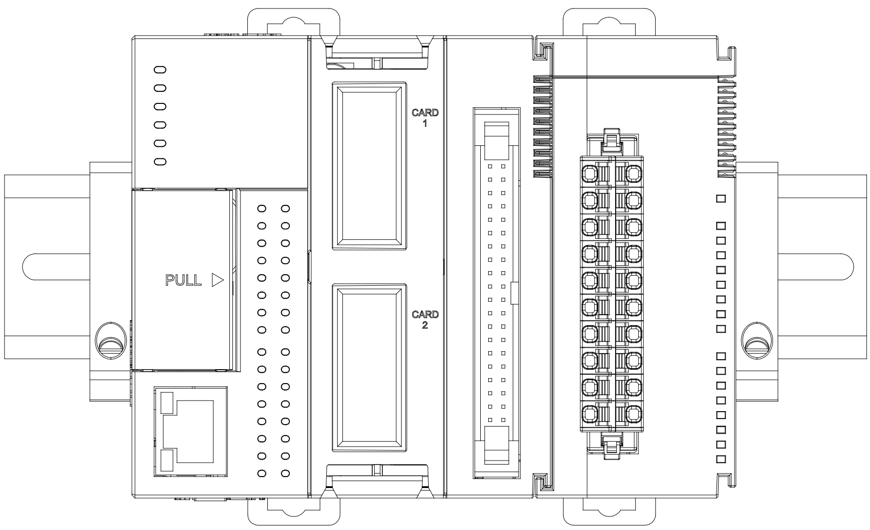
1. Hook the baffle onto the DIN rail and press it down as the directional arrow shows below.



2. Use screws to secure the baffle.



3. The completed baffle installation is shown below.



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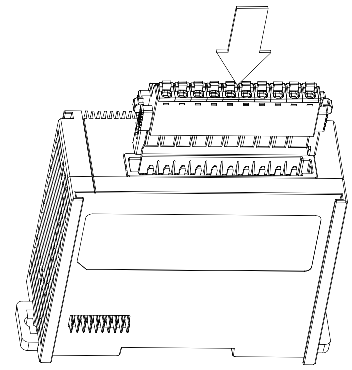
1.3.2 Installing a Removable Terminal Block

Install a removable terminal block on the module as illustrated below.

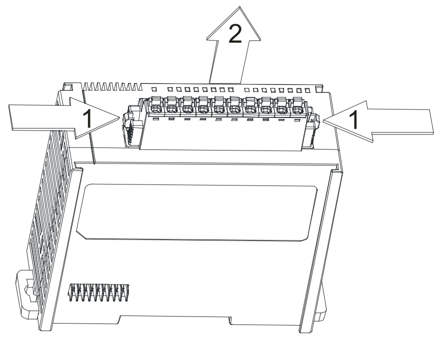
- **Installation**

1. Level the terminal block at the printed circuit board, and press it into the module.



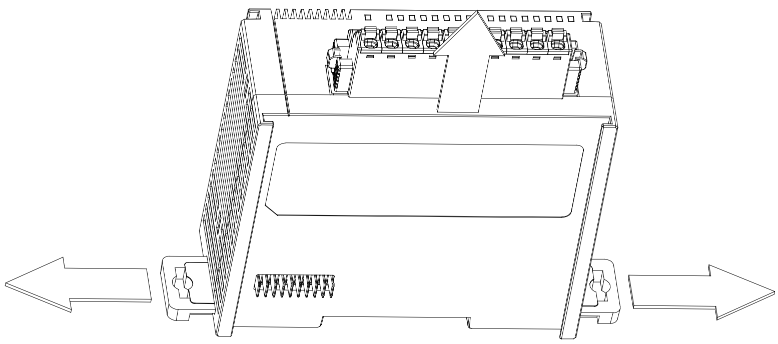
- **Removal**

1. Pull down the clip in the direction indicated by the arrow and then pull the terminal block up as illustrated below.



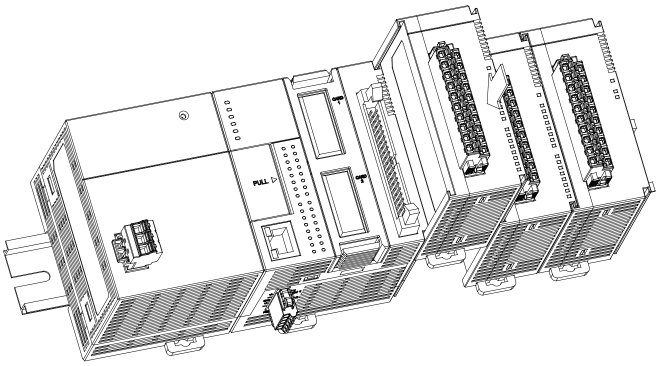
1.3.3 Changing a Module

1. Take the removable terminal block out of the module, and then pull the clip out from the DIN rail as shown below.



2. Remove the module.

3. Slide the new module in as shown below.

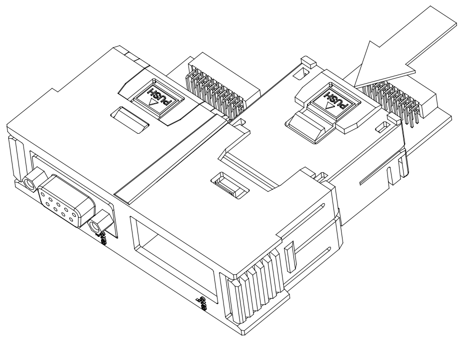


1.3.4 Installing and Removing an Extension Card

- **Installation**

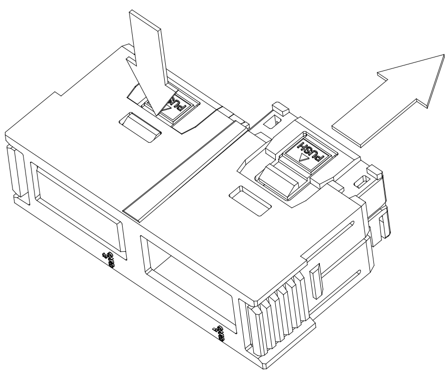
Push the extension card into the extension card slot until you hear a click.

Note: before the installation begin, you need to check if the pin arrangement and appearance are normal. If there is any bent or missing pin, you need to change to a new card. You should also check the PLC card slot to make sure everything is ok.



- **Removal**

Press the tab labeled △PUSH to release the extension card, and then remove the extension card.



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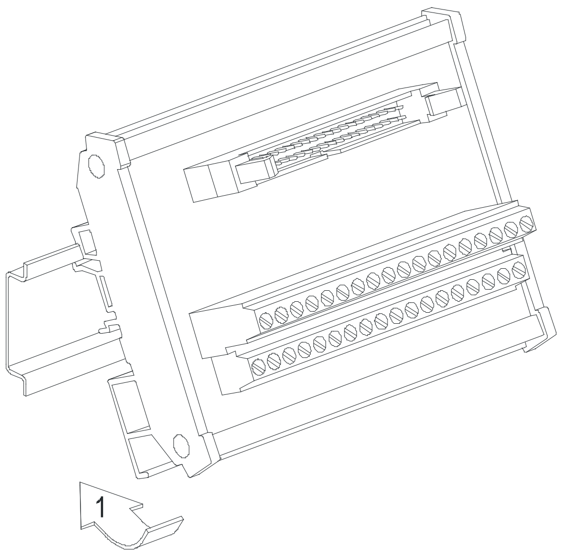
1.3.5 Installing a Wiring Module

Connect a communication cable to the port on a CPU module, and make sure that the connector of the cable is properly seated in the port.

- **Installation**

  1. Firmly seat one side of the wiring module first.

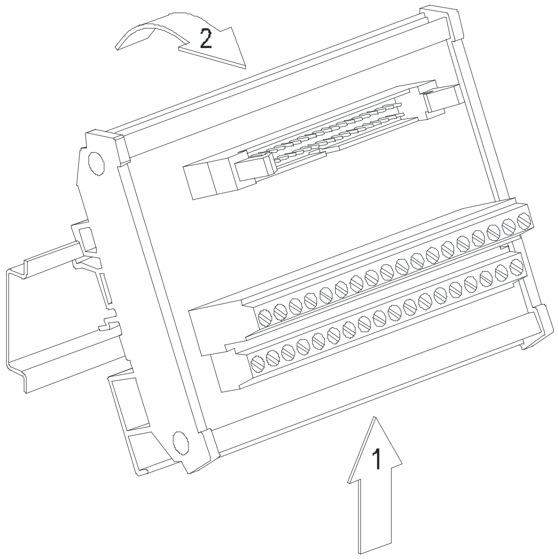
  2. Press the driver board in the direction indicated by arrow 1, and make sure that the groove is attached to the DIN rail.



- **Removal**

  1. Push the wiring module in the direction indicated by arrow 1.

  2. Pull the wiring module in the direction indicated by arrow 2.



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Chapter 2 Digital Input/Output Modules

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2.1 Digital Input/Output Module Specifications

2.1.1 General Specifications

- **Electrical specifications for the inputs on digital input/output modules (The signals passing through the inputs are 24 VDC signals.)**

Module name		08AM10N-A	16AM10N-A	32AM10N-A	64AM10N-A	16AP11R A	16AP11T-A	16AP11P-A
Number of inputs		8	16	32	64	8	8	8
Connector type		Removable terminal block		MIL connector		Removable terminal block		
Input type		Digital input						
Input form		Direct current (sinking or sourcing)						
Input voltage/ current		24 VDC，5 mA			24 VDC 3.2 mA	24 VDC，5 mA		
Input impedance		4.7 k Ω			7.5k Ω	4.7 k Ω		
Action level	OFF→ON	>15 VDC						
	ON→OFF	<5 VDC						
Response time	OFF→ON	< 20 us						
	ON→OFF	< 200 us						
Software filter time		Setting range: 0 ~ 25 ms; default: 10 ms						
Maximum input frequency		Varies according to the filter time; for example when the filter is 1 ms, the maximum input frequency is 500 Hz, when 2 ms, 250 Hz. Note: CPU scan time also affects the maximum input frequency.						
Input signal		Voltage input Sinking: The inputs are NPN transistors whose collectors are open collectors. Sourcing: The inputs are PNP transistors whose collectors are open collectors.						
Input Isolation		500 VDC						
Input display		When the optocoupler is driven, the input LED indicator is ON.						
Weight		100 g	117 g	100 g	140 g	138 g	120 g	120 g

- **Electrical specifications for the outputs on a digital input/output module**

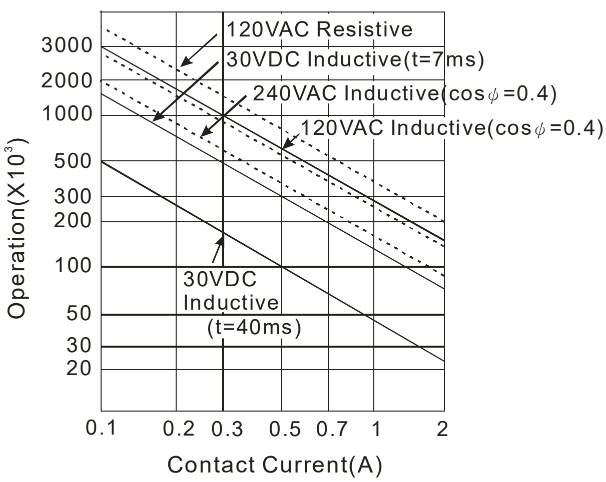
Item \ Model		08AN01 R-A	16AN01 R-A	16AP11 R-A	08AN01 T-A	16AN01 T-A	16AP11 T-A	08AN01 P-A	16AN01 P-A	16AP11 P-A
Number of outputs		8	16	8	8	16	8	8	16	8
Connector type		Removable terminal block								
Output type		Digital output								
Output form		Relay-R			Transistor-T (sinking)			Transistor-P (sourcing)		
Voltage/ current		240 VAC/24 VDC			5–30 VDC *2			5–30 VDC *2		
Leakage current		0uA			<10uA			<250uA (@V1.00A0) <10uA (@V1.00A1)		
Maximum load	Resistance	2A/output, 8A/COM			0.5A/output, 4A/COM			0.5A/output, 4A/COM		
	Inductance	Life cycle curve*2			12 W (24 VDC)			12 W (24 VDC)		
	Bulb	20 W (24 VDC) 100 W (230 VAC)			2 W (24 VDC)			2 W (24 VDC)		
Maximum	Resistance	1 Hz			100 Hz			100 Hz		

Item \ Model		08AN01 R-A	16AN01 R-A	16AP11 R-A	08AN01 T-A	16AN01 T-A	16AP11 T-A	08AN01 P-A	16AN01 P-A	16AP11 P-A
output frequency*1	Inductance	0.5 Hz			0.5 Hz			0.5 Hz		
	Bulb	1 Hz			10 Hz			10 Hz		
	OFF→ON	10 ms			0.5 ms			0.5 ms		
Maximum Response time	ON→OFF	10 ms			0.5 ms			0.5 ms		
Output Isolation		1350 VAC			500 VDC					
Weight		120 g	158 g	138 g	100 g	122 g	120 g	100 g	123 g	120 g

Item \ Model		32AN02T-A	64AN02T-A
Number of outputs		32	64
Connector type		MIL connector	
Output type		Digital output	
Output form		Transistor-T (sinking)	
Output voltage		5–30 VDC	
Leadage current		<10uA	
Maximum load	Resistance	0.1A/output, 3.2A/COM	
	Inductance	N/A	
	Bulb	N/A	
Maximum output frequency*1	Resistance	100 Hz	
	Inductance	N/A	
	Bulb	N/A	
Maximum Response time	OFF→ON	0.5 ms	
	ON→OFF		
Output Isolation		500 VDC	
Weight		100 g	142 g

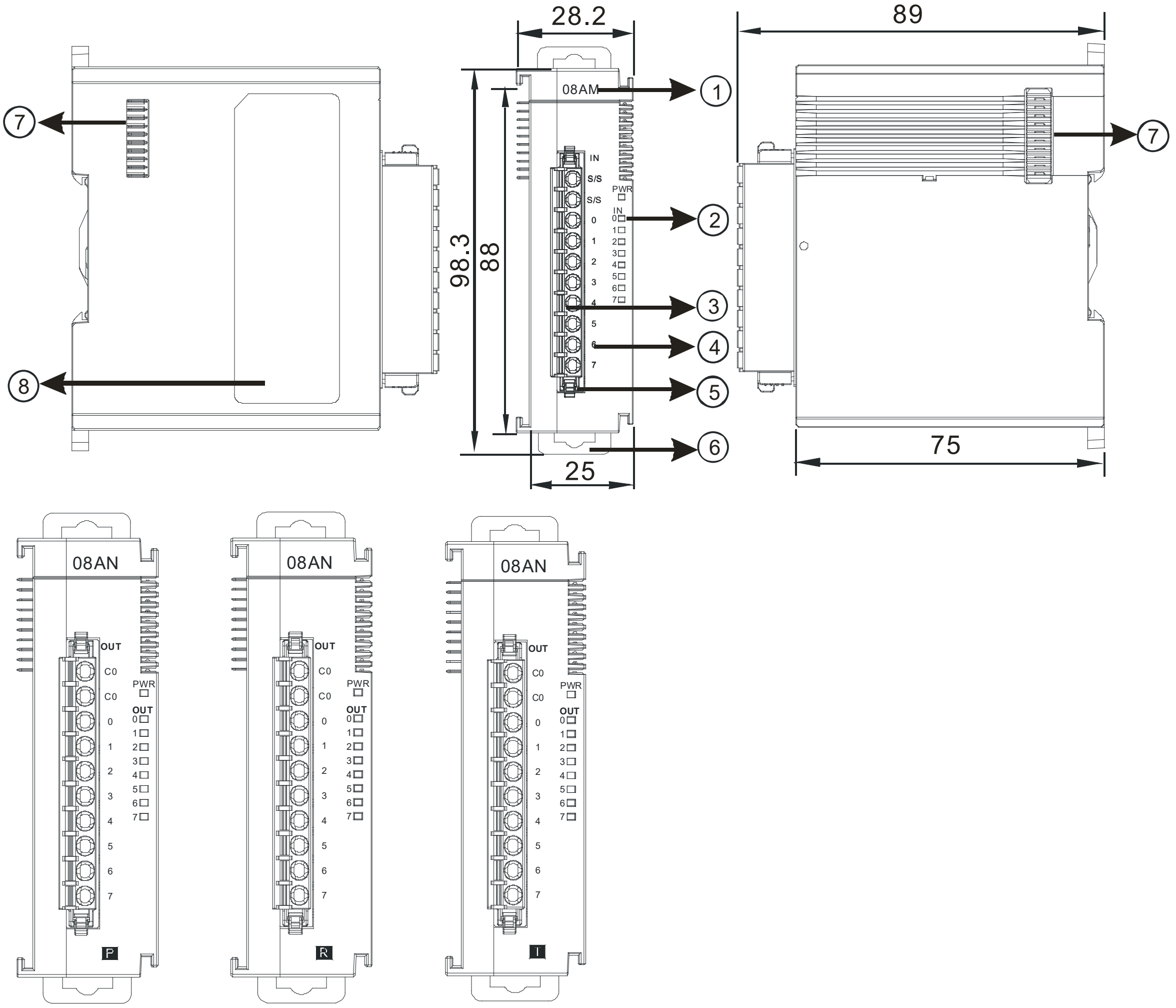
*1: The scan cycle affects the frequency.

*2: The life cycle curve is shown below.



2.1.2 Digital Input/Output Module Profiles

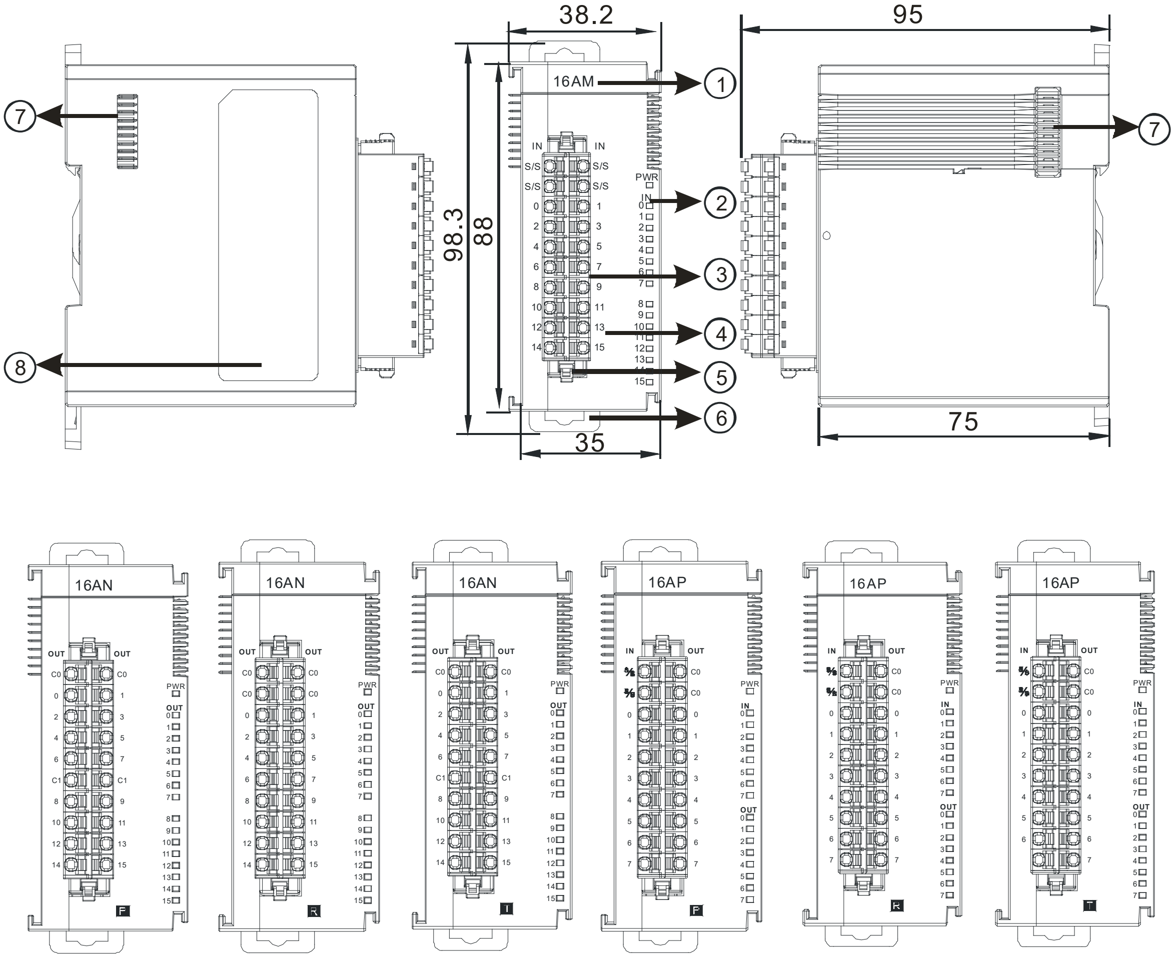
- **AS08AM10N-A/AS08AN01P-A/AS08AN01R-A/AS08AN01T-A**



Unit: mm

Number	Name	Description
1	Model name	Model name of the module
2	Input/output LED indicator	If there is an input signal, the input LED indicator is ON. If there is an output signal, the output LED indicator is ON.
3	Removable terminal block	The inputs are connected to sensors. The outputs are connected to loads to be driven.
4	Arrangement of the input/output terminals	Arrangement of the terminals
5	Terminal block clip	Secures the terminal block
6	DIN rail clip	Secures the DIN rail
7	External module port	Connects the modules
8	Label	Nameplate

- **AS16AM10N-A/AS16AN01P-A/AS16AN01R-A/AS16AN01T-A/AS16AP11P-A/AS16AP11R-A/ AS16AP11T-A**

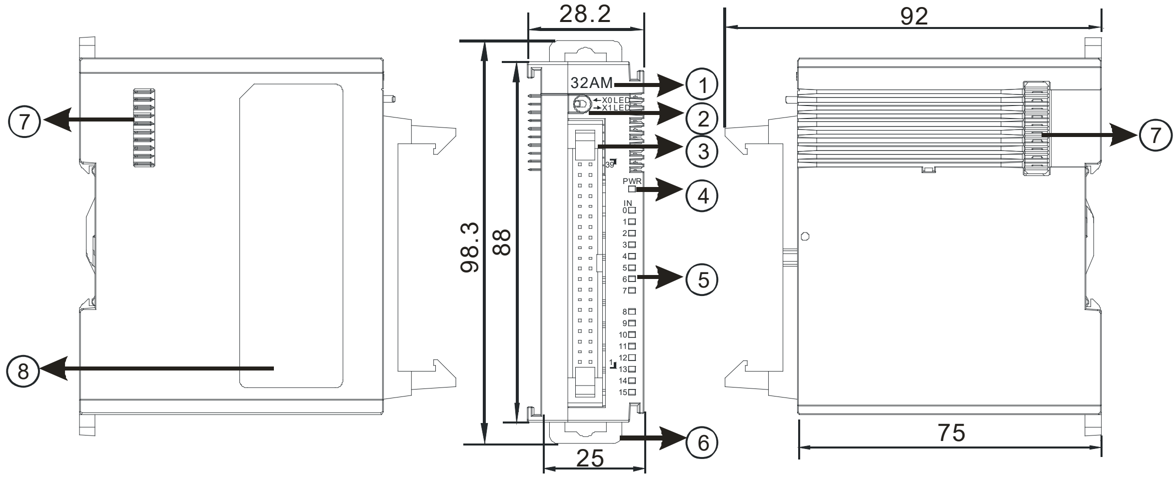


Unit: mm

Number	Name	Description
1	Model name	Model name of the module
2	Input/Output LED indicator	If there is an input signal, the input LED indicator is ON. If there is an output signal, the output LED indicator is ON.
3	Removable terminal block	The inputs are connected to sensors. The outputs are connected to loads to be driven.
4	Arrangement of the input/output terminals	Arrangement of the terminals
5	Terminal block clip	Secures the terminal block
6	DIN rail clip	Secures the DIN rail
7	External module port	Connects the modules
8	Label	Nameplate

2

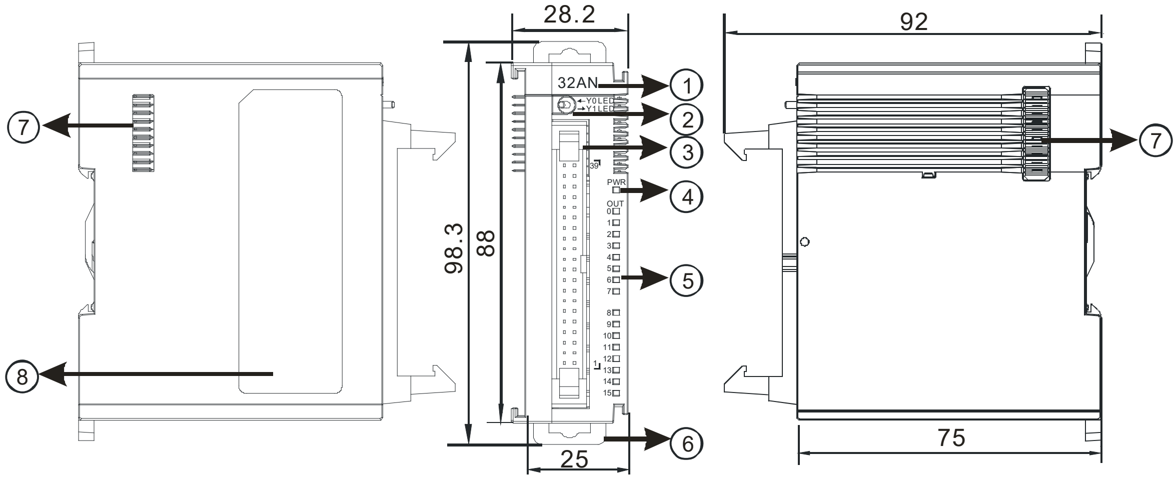
- **AS32AM10N-A**



Unit: mm

Number	Name	Description
1	Model name	Model name of the module
2	X0/X1 LED Indicator switch	Switches the LED indicators to their represented inputs.
3	ML connector	For the external I/O connecting cables UC-ET010-24B, UC-ET020-24B, UC-ET030-24B
4	Power LED indicator	Indicates the power status of the module
5	Input LED indicator	LED indicator is ON during input.
6	DIN rail clip	Secures the DIN rail
7	External module port	Connects the modules
8	Label	Nameplate

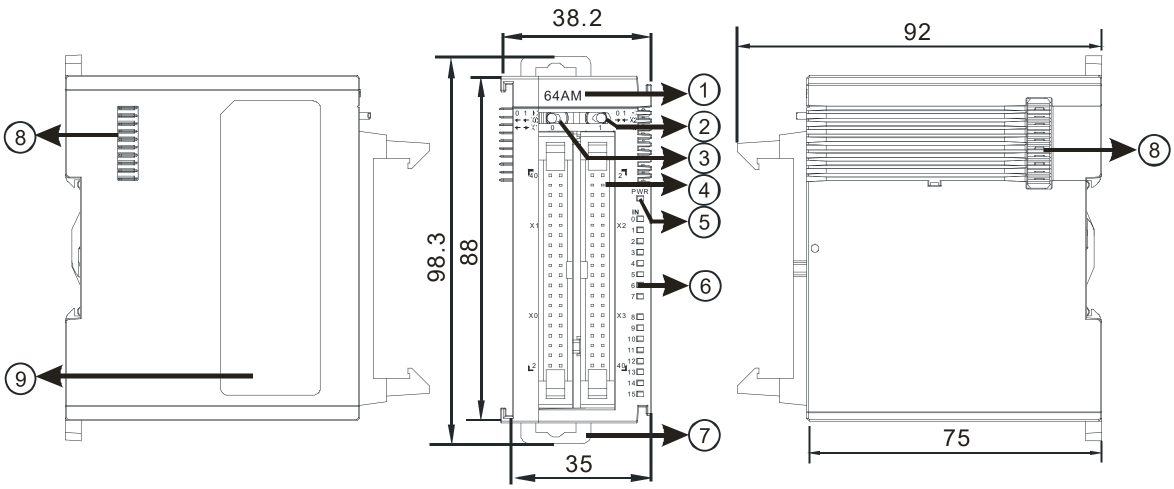
- **AS32AN02T-A**



Unit: mm

Number	Name	Description
1	Model name	Model name of the module
2	Y0/Y1 LED indicator switch	Switches the LED indicators to their represented outputs.
3	ML connector	For the external I/O connecting cables UC-ET010-24D, UC-ET020-24D, UC-ET030-24D
4	Power LED indicator	Indicates the power status of the module
5	Output LED indicator	LED indicator is ON during output.
6	DIN rail clip	Secures the DIN rail
7	External module port	Connects the modules
8	Label	Nameplate

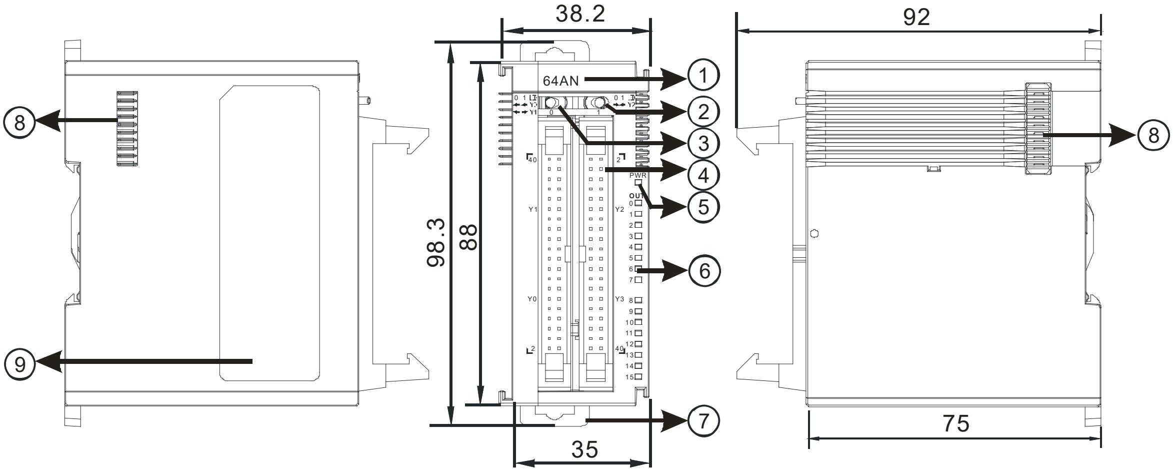
- **AS64AM10N-A**



Unit: mm

Number	Name	Description
1	Model name	Model name of the module
2	LED indicator switch 1	Switches the LED indicators to their represented inputs.
3	LED indicator switch 2	Switches the LED indicators to their represented inputs.
4	ML connector	For the external I/O connecting cables UC-ET010-24B, UC-ET020-24B, UC-ET030-24B
5	Power LED indicator	Indicates the power status of the module
6	Input LED indicator	If there is an input signal, the input LED indicator is ON.
7	DIN rail clip	Secures the DIN rail
8	External module port	Connects the modules
9	Label	Nameplate

- **AS64AN02T-A**

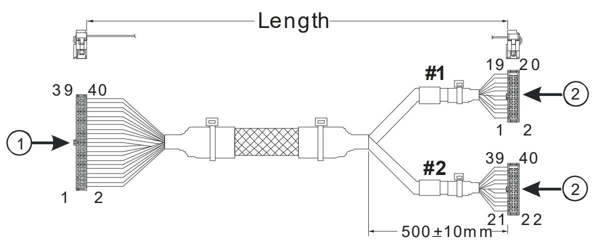


Unit: mm

Number	Name	Description
1	Model name	Model name of the module
2	LED indicator switch 1	Switches the LED indicators to their represented outputs.
3	LED indicator switch 2	Switches the LED indicators to their represented outputs.
4	ML connector	For the external I/O connecting cables UC-ET010-24D, UC-ET020-24D, UC-ET030-24D
5	Power LED indicator	Indicates the power status of the module
6	Output LED indicator	If there is an output signal, the output LED indicator is ON.
7	DIN rail clip	Secures the DIN rail
8	External module port	Connects the modules
9	Label	Nameplate

- **ML connector, extension cable, and wiring modules**

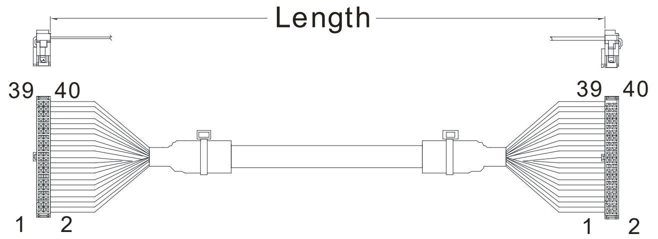
1. Extension Cable UC-ET010-24D (1M) / UC-ET020-24D (2M) / UC-ET030-24D (3M)



Unit: mm

Number	Name	Description
1	IDC 40-pin terminal	Connects a digital input/output module and an external terminal module.
2	IDC 20-pin terminal	Connects the external terminal modules UB-10-ID16A/UB-10-OR16A/UB-10-OR16B

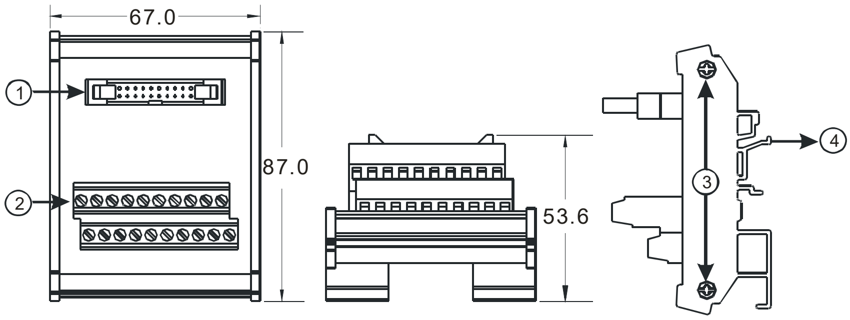
2. I/O connecting cables UC-ET010-24B (1M) / UC-ET020-24B (2M) / UC-ET030-24B (3M)



Number	Name	Description
1	IDC 40-pin terminal	Connects an external terminal module and a wiring module UB-10-ID32A, and UB-10-OT32A

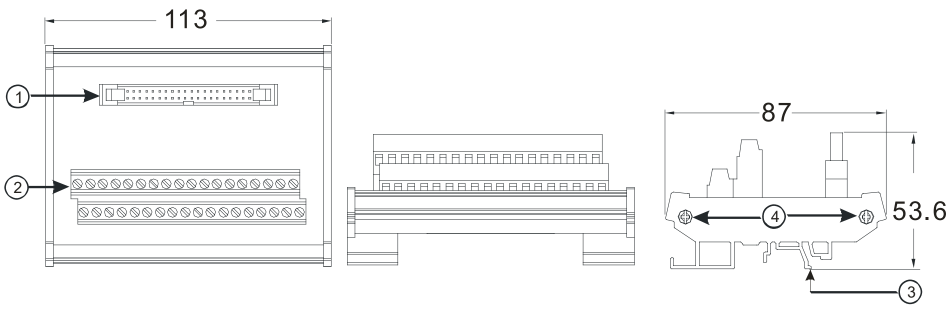
3. AS32AM10N-A/AS64AM10N-A and the external terminal modules UB-10-ID16A, UB-10-ID32A

◆ UB-10-ID16A



Unit: mm

◆ UB-10-ID32A

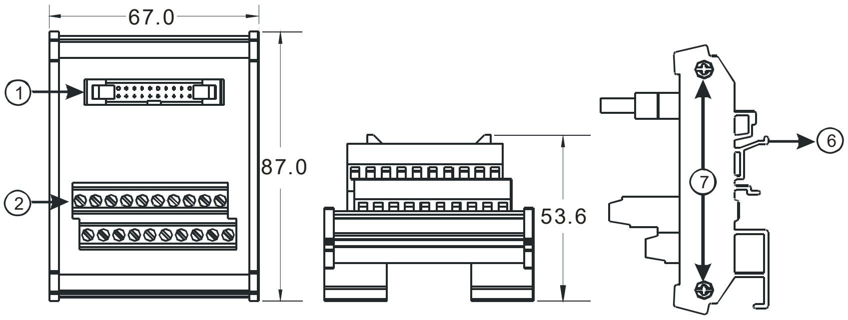


Unit: mm

Number	Name	Description
1	UB-10-ID16A: 20-pin ML connector UB-10-ID32A: 40-pin ML connector	Connects the external terminal module and a wiring module
2	Terminals	Input/Output terminals for wiring
3	Clip	Hangs the external terminal module on a DIN rail
4	Set screw	Fixes the base

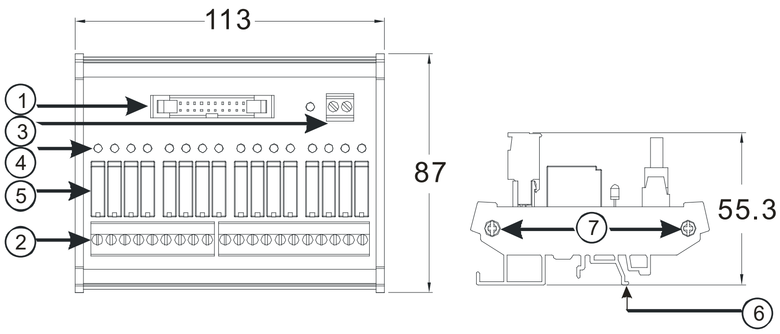
4. AS332T-A/AS64AN02T-A and the external terminal modules UB-10-ID16A, UB-10-OR16A, and UB-10-OT32A.

◆ UB-10-ID16A



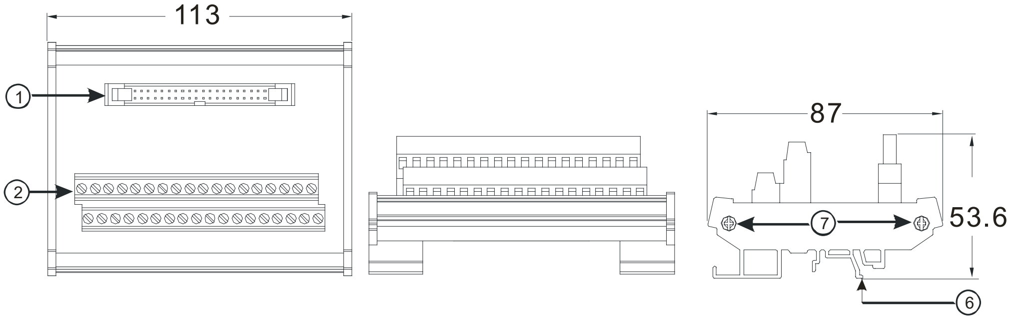
Unit: mm

◆ UB-10-OR16A



Unit: mm

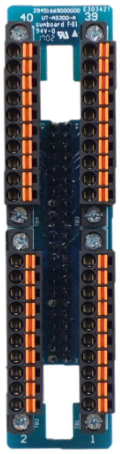
◆ UB-10-OT32A

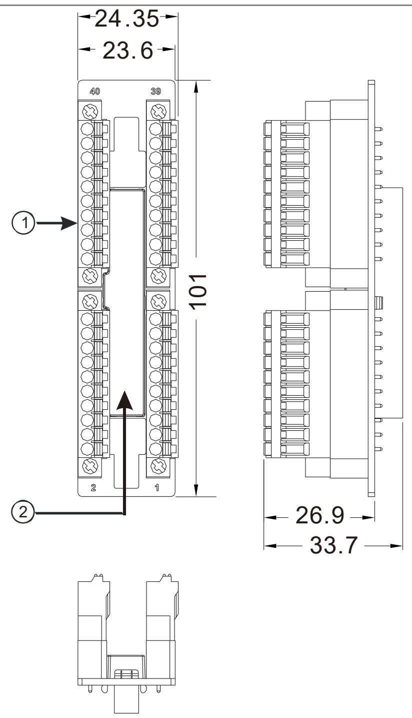


Unit: mm

Number	Name	Description
1	UB-10- ID16A /OR16A: 20-pin ML connector UB-10-OT32A: 40-pin ML connector	Connects the external terminal module and a wiring module
2	Terminals	Input/Output terminals for wiring
3	2-pin power input terminal	Power input terminal for wiring
4	Output LED indicator	LED indicator is ON during output.
5	Relay output	Relay output
6	Clip	Hangs the external terminal module on a DIN rail
7	Set screw	Fixes the base

- **Spring clamp/MIL connector terminal block UB-10-IO32D for AS32AM10N-A/AS32AN02T-A**



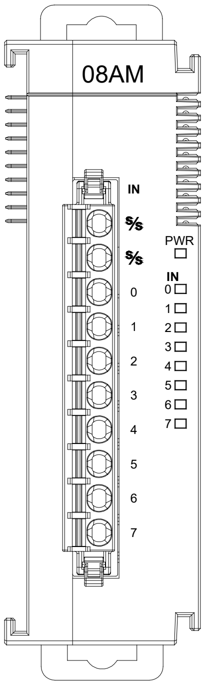
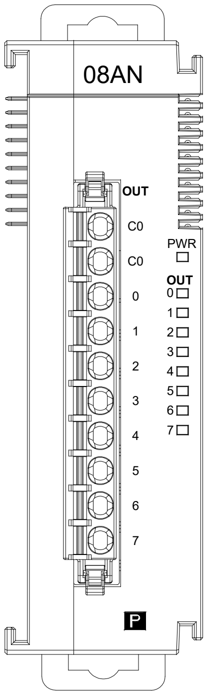
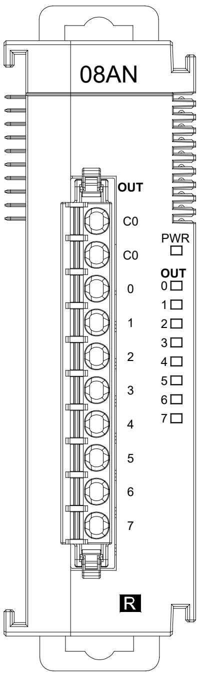
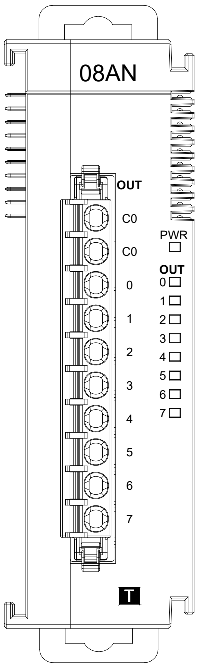


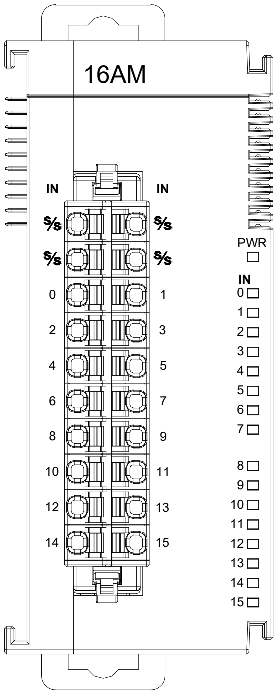
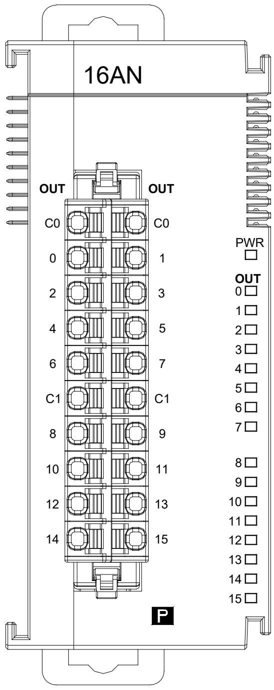
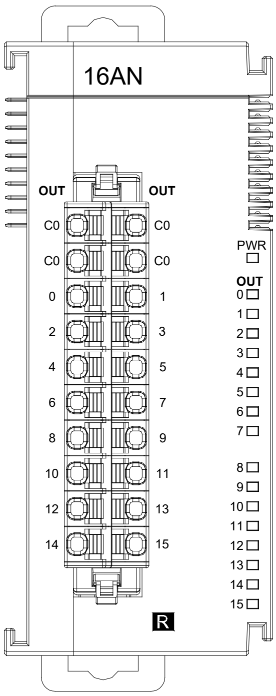
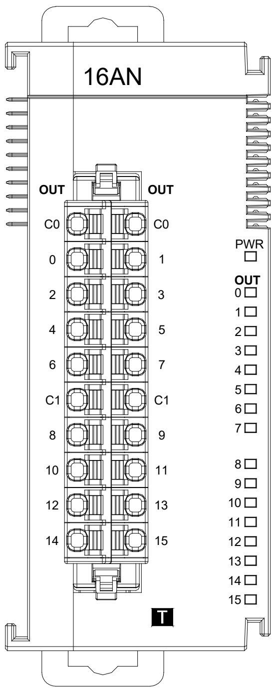
Unit: mm

Number	Name	Description
1	Terminal block for output	Terminal block
2	40-pin MIL connector	Connects the module and the wiring module

2

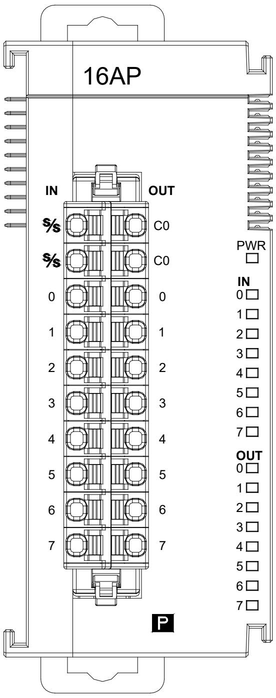
2.1.3 Digital Input/Output Module Terminals

AS08AM10N-A	AS08AN01P-A
	
AS08AN01R-A	**AS08AN01T-A**
	

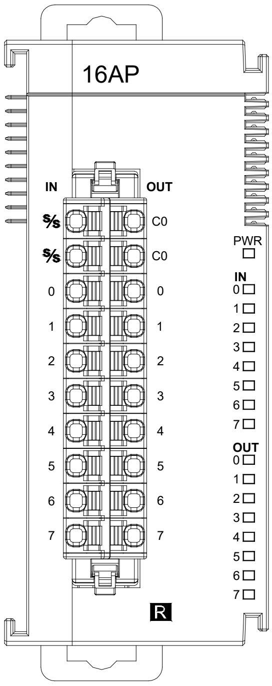
AS16AM10N-A	AS16AN01P-A
	
AS16AN01R-A	**AS16AN01T-A**
	

2

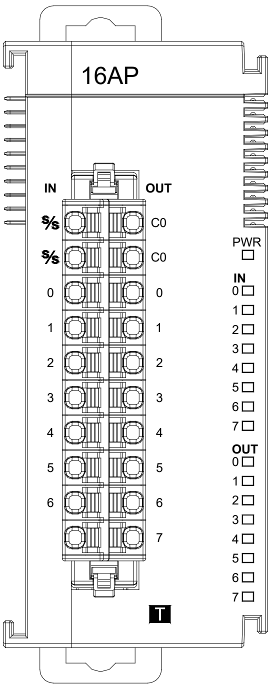
AS16AP11P-A



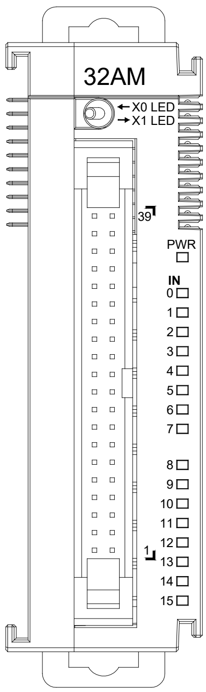
AS16AP11R-A



AS16AP11T-A

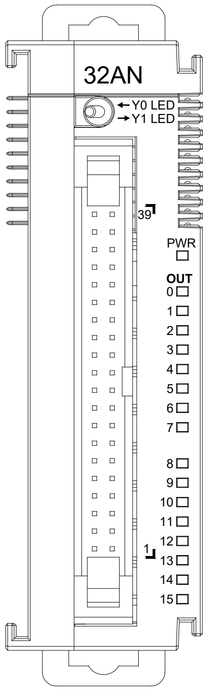


AS32AM10N-A



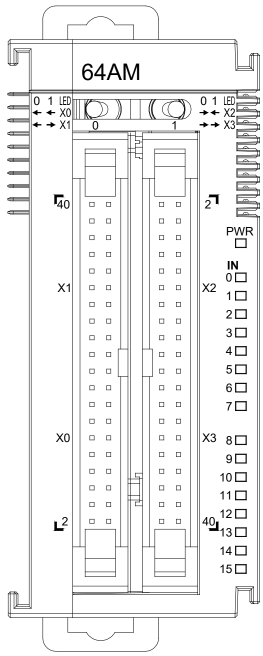
-	-
S/S	S/S
1.15	1.14
1.13	1.12
1.11	1.10
1.9	1.8
1.7	1.6
1.5	1.4
1.3	1.2
1.1	1.0
-	-
S/S	S/S
0.15	0.14
0.13	0.12
0.11	0.10
0.9	0.8
0.7	0.6
0.5	0.4
0.3	0.2
0.1	0.0

AS32AN02T-A



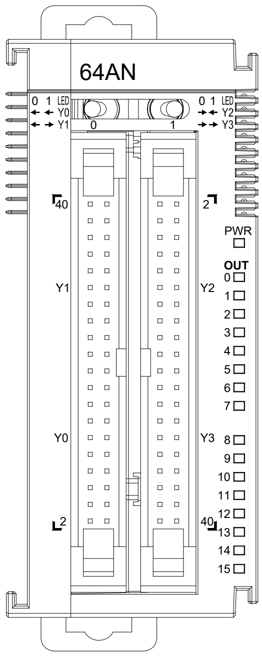
-	-
C0	C0
1.15	1.14
1.13	1.12
1.11	1.10
1.9	1.8
1.7	1.6
1.5	1.4
1.3	1.2
1.1	1.0
-	-
C0	C0
0.15	0.14
0.13	0.12
0.11	0.10
0.9	0.8
0.7	0.6
0.5	0.4
0.3	0.2
0.1	0.0

AS64AM10N-A



-	-	2.0	2.1
S/S0	S/S0	2.2	2.3
1.15	1.14	2.4	2.5
1.13	1.12	2.6	2.7
1.11	1.10	2.8	2.9
1.9	1.8	2.10	2.11
1.7	1.6	2.12	2.13
1.5	1.4	2.14	2.15
1.3	1.2	S/S	S/S
1.1	1.0	-	-
-	-	3.0	3.1
S/S0	S/S0	3.2	3.3
0.15	0.14	3.4	3.5
0.13	0.12	3.6	3.7
0.11	0.10	3.8	3.9
0.9	0.8	3.10	3.11
0.7	0.6	3.12	3.13
0.5	0.4	3.14	3.15
0.3	0.2	S/S1	S/S1
0.1	0.0	-	-

AS64AN02T-A

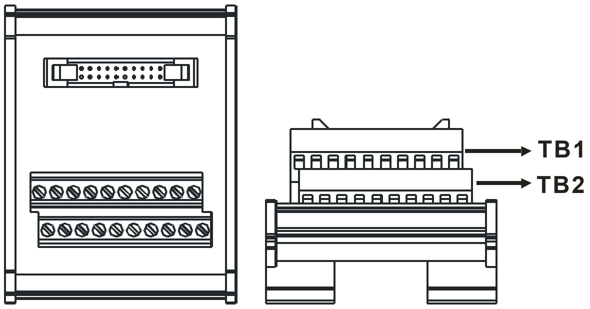


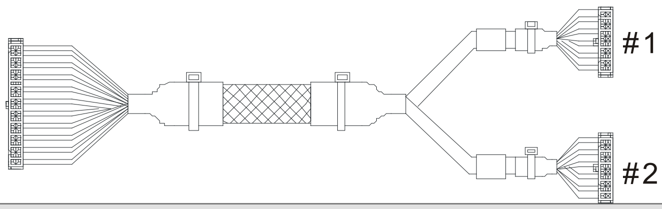
-	-	2.0	2.1
C0	C0	2.2	2.3
1.15	1.14	2.4	2.5
1.13	1.12	2.6	2.7
1.11	1.10	2.8	2.9
1.9	1.8	2.10	2.11
1.7	1.6	2.12	2.13
1.5	1.4	2.14	2.15
1.3	1.2	C1	C1
1.1	1.0	-	-
-	-	3.0	3.1
C0	C0	3.2	3.3
0.15	0.14	3.4	3.5
0.13	0.12	3.6	3.7
0.11	0.10	3.8	3.9
0.9	0.8	3.10	3.11
0.7	0.6	3.12	3.13
0.5	0.4	3.14	3.15
0.3	0.2	C1	C1
0.1	0.0	-	-

- **ML connector and the wiring module**

1. AS32AM10N-A/AS64AM10N-A

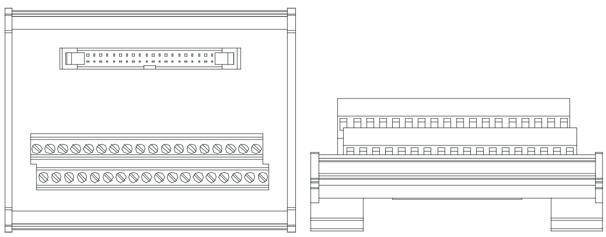
◆ The wiring module: UB-10-ID16A





AS32AM10N-A/ AS64AM10N-A										
#2	TB1	X0.0	X0.2	X0.4	X0.6	X0.8	X0.10	X0.12	X0.14	S/S	-
	TB2	X0.1	X0.3	X0.5	X0.7	X0.9	X0.11	X0.13	X0.15	S/S	-

◆ The wiring module: UB-10-ID32A

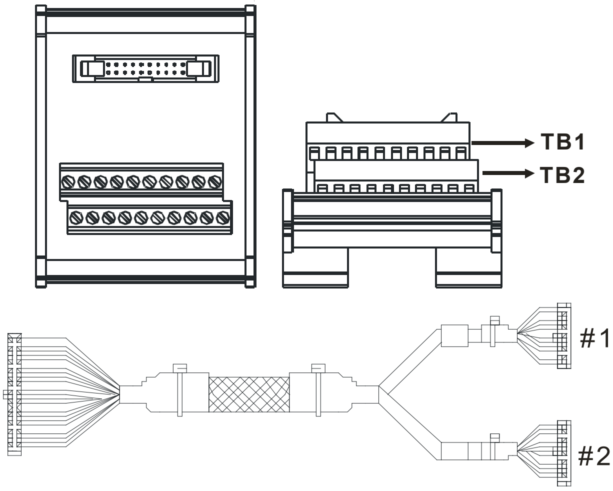


AS series terminals:

Upper row	X0.0	X0.2	X0.4	X0.6	X0.8	X0.10	X0.12	X0.14	X1.0	X1.2	X1.4	X1.6	X1.8	X1.10	X1.12	X1.14	S/S	S/S
Lower row	X0.1	X0.3	X0.5	X0.7	X0.9	X0.11	X0.13	X0.15	X1.1	X1.3	X1.5	X1.7	X1.9	X1.11	X1.13	X1.15	S/S	S/S

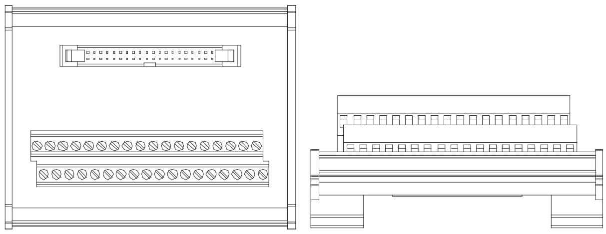
2. AS32AN02T-A/AS64AN02T-A and the wiring modules:

◆ UB-10-ID16A



AS332T-A											
#1	TB1	Y0.0	Y0.2	Y0.4	Y0.6	Y0.8	Y0.10	Y0.12	Y0.14	C0	-
	TB2	Y0.1	Y0.3	Y0.5	Y0.7	Y0.9	Y0.11	Y0.13	Y0.15	C0	-

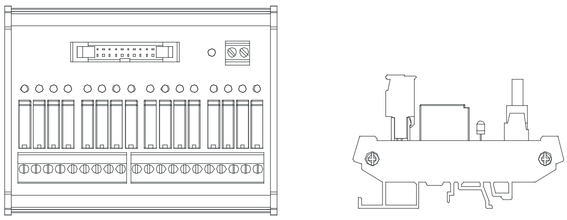
◆ UB-10-OT32A



AS series terminals:

Upper row	Y0.0	Y0.2	Y0.4	Y0.6	Y0.8	Y0.10	Y0.12	Y0.14	Y1.0	Y1.2	Y1.4	Y1.6	Y1.8	Y1.10	Y1.12	Y1.14	•	•
Lower row	Y0.1	Y0.3	Y0.5	Y0.7	Y0.9	Y0.11	Y0.13	Y0.15	Y1.1	Y1.3	Y1.5	Y1.7	Y1.9	Y1.11	Y1.13	Y1.15	C0	C0

◆ UB-10-OR16A



Terminals:

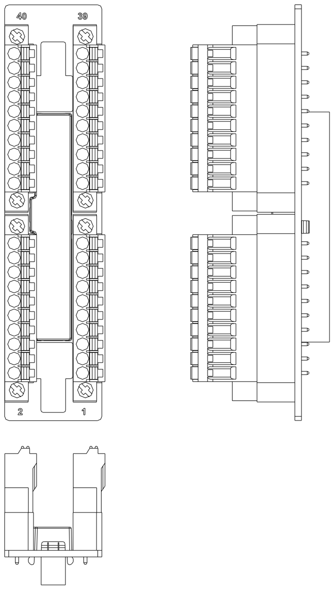
																		GND	+24 V
C0	Y0	Y1	Y2	Y3	C1	Y4	Y5	Y6	Y7	C2	Y10	Y11	Y12	Y13	C3	Y14	Y15	Y16	Y17

AS series terminals:

																		GND	+24V
C0	Y0.0	Y0.1	Y0.2	Y0.3	C1	Y0.4	Y0.5	Y0.6	Y0.7	C2	Y0.8	Y0.9	Y0.10	Y0.11	C3	Y0.12	Y0.13	Y0.14	Y0.15

3. AS32AM10N-A/AS32AN02T-A and the wiring modules:

◆ UB-10-IO32D



3

Chapter 3 Analog Input Module AS04/08AD

Table of Contents

3.1 Overview

This chapter describes the specifications for analog-to-digital modules, their operation, and their programming. In this chapter, “module” refers to the analog-to-digital modules AS04AD-A, AS08AD-B, and AS08AD-C.

3.1.1 Characteristics

(1) **Select a module based on its practical application.**

AS04AD-A: Has four channels. A channel can receive either voltage or current input.

AS08AD-B: Has eight channels. A channel can receive voltage input.

AS08AD-C: Has eight channels. A channel can receive current input.

(2) **High-speed conversion**

Analog signals are converted to digital signals at a rate of 25 ms per channel.

(3) **High accuracy**

Conversion accuracy: The error range for both voltage input and current input is ±0.2% at ambient temperature of 25° C. The number of voltage/current inputs that are averaged is 100.

(4) **Use the utility software to configure the module.**

The HWCONFIG utility software is built into ISPSoft. You can set modes and parameters directly in HWCONFIG without spending time writing programs to set registers to manage functions.

3.2 Specifications and Functions

3.2.1 Specifications

- **Electrical specifications**

Module Name	AS04AD-A	AS08AD-B	AS08AD-C
Number of Inputs	4	8	8
Analog-to-Digital Conversion	Voltage input/Current input	Voltage input	Current input
Supply Voltage	24 VDC (20.4 VDC–28.8 VDC) (-15% to +20%)		
Connector Type	Removable terminal block		
Conversion Time	2ms/channel		
Isolation	An analog circuit is isolated from a digital circuit by a digital integrated circuit/ optocoupler, but the analog channels are not isolated from one another. Isolation between a digital circuit and a ground: 500 VDC Isolation between an analog circuit and a ground: 500 VDC Isolation between an analog circuit and a digital circuit: 500 VDC Isolation between the 24 VDC and a ground: 500 VDC		
Weight	145g		

- **Functional specifications**

Analog-to-Digital Conversion	Voltage Input				
Rated Input Range	-10 V ~ +10 V	0 V ~ 10 V	±5 V	0 V ~ 5 V	1 V ~ 5 V
Rated Conversion Range	K-32000 ~ K32000	K0 ~ K32000	K-32000 ~ K32000	K0 ~ K32000	K0 ~ K32000
Hardware Input Limit*1	-10.12V ~ 10.12V	-0.12V ~ 10.12V	-5.06V ~ 5.06V	-0.06V ~ 5.06V	0.95V ~ 5.05V
Conversion Limit*2	K-32384 ~ K32384	K-384 ~ K32384	K-32384 ~ K32384	K-384 ~ K32384	K-384 ~ K32384
Error Rate	Room Temperature: ±0.2% ; Full Temperature Range: ±0.5%				
Hardware Resolution	16 bits				
Input Impedance	2MΩ				
Absolute Input Range*3	±15 V				

*1: If the input signal exceeds the hardware input limit, the module only shows the maximum value. If the input signal is below the lower limit, it only shows the minimum value.

*2: If the input signal exceeds the hardware input limit, it also exceeds the digital conversion limit and a conversion limit error appears. For example in the voltage input mode (-10 V to +10 V), when the input signal is 10.15 V, exceeding the hardware upper limit, it also exceeds the conversion upper limit. The module uses the upper limit value (32387) as the input signal and a conversion limit error appears.

*3: If an input signal exceeds the absolute range, it might damage the channel.

Analog-to-Digital Conversion	Current Input		
Rated Input Range	±20 mA	0 mA–20 mA	4 mA–20 mA
Rated Conversion Range	K-32000 ~ K+2000	K0 ~ K32000	K0 ~ K32000
Hardware Input Limit*1	-20.24 mA ~ 20.24 mA	-0.24 mA ~ 20.24 mA	3.81 mA ~ 20.19 mA
Conversion Limit*2	K-32384 ~ K32384	K-384 ~ K32384	K-384 ~ K32384
Error Rate	Room Temperature: ±0.2% ; Full Temperature Range: ±0.5%		
Hardware Resolution	16 bits		
Input Impedance	250Ω		
Absolute Input Range*3	±32 mA		

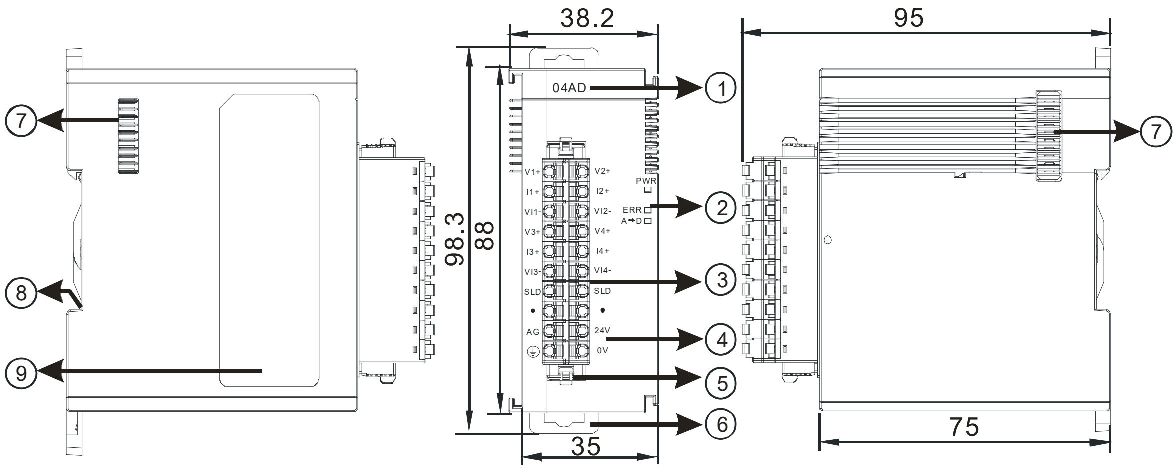
*1: If the input signal exceeds the hardware input limit, the module only shows the maximum value. If the input signal is below the lower limit, it only shows the minimum value.

*2: If the input signal exceeds the hardware input limit, it also exceeds the digital conversion limit and a conversion limit error appears. For example in the voltage input mode (4 mA to 20 mA), when the input signal is 0 mA, exceeding the hardware upper limit, it also exceeds the conversion upper limit. The module uses the upper limit value (-384) as the input signal and a conversion limit error appears.

*3: If an input signal exceeds the absolute range, it might damage the channel.

3.2.2 Profile

- **AS04AD-A**

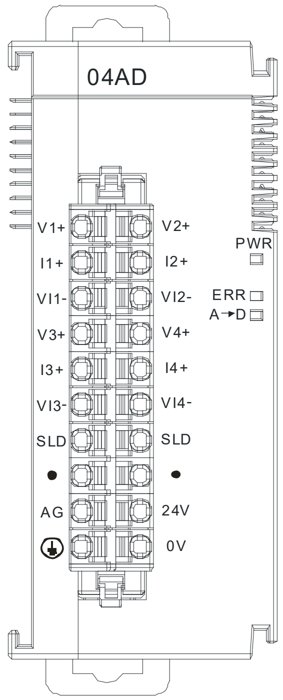


Unit: mm

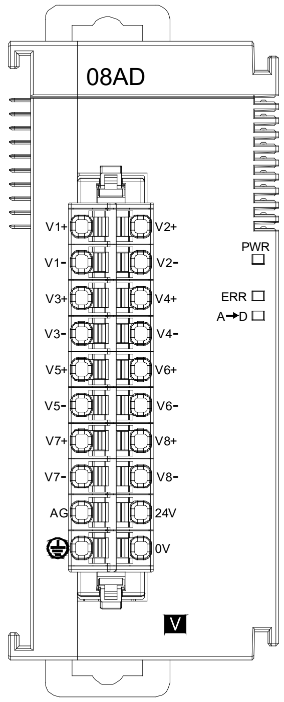
Number	Name	Description
1	Model Name	Model name of the module
2	POWER LED Indicator	Status of the power supply ON: the power is on. OFF: the power is off.
	ERROR LED Indicator	Error status of the module ON: a serious error exists in the module. OFF: the module is operating normally. Blinking: A minor error exists in the module.
	Analog to Digital Conversion Indicator	Analog-to-digital conversion status Blinking: conversion is in process. OFF: conversion has stopped.
3	Removable Terminal Block	Inputs are connected to sensors. Outputs are connected to loads to be driven.
4	Arrangement of the Input/Output Terminals	Arrangement of the terminals
5	Terminal Block Clip	For removing the terminal block
6	DIN Rail Clip	Secures the module onto the DIN rail
7	Module Connecting Set	Connects the modules
8	Ground Clip	
9	Label	Nameplate

3.2.3 Arrangement of Terminals

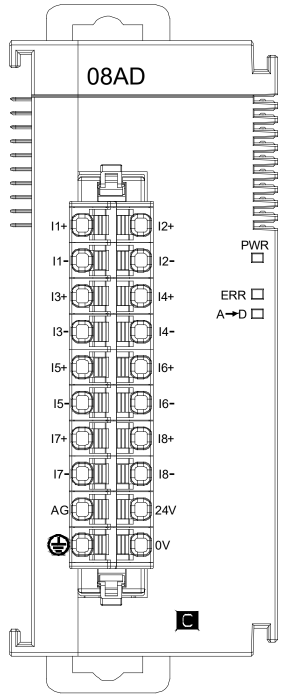
AS04AD-A



AS08AD-B



AS08AD-C



3.2.4 AS04AD Control Register

*If you use HWCONFIG to set values in CRs, once the set value is downloaded, the values can be retained in the module; however if you use TO instruction to write data into CRs, the values CANNOT be retained, after power failure or after transition of the CPU from STOP to RUN.

Note: The attribute of the CR must be W (write) to use TO instruction.

CR#	Name	Description	Atr.	Defaults
0	Format Setup	0: integer format 1: floating point format	R	0
1	Channel 1 mode setup	0: closed 1: -10 V to +10 V 2: 0 V–10 V 3: -5 V to +5 V 4: 0 V–5 V 5: 1 V–5 V 6: 0 mA–20 mA 7: 4 mA–20 mA	R/W	1
2	Channel 2 mode setup			
3	Channel 3 mode setup			
4	Channel 4 mode setup			

CR#	Name	Description	Atr.	Defaults
		8: -20 mA to +20 mA		
5	Channel 1 offset	Range: -32768 to +32767	R/W	0
6	Channel 2 offset			
7	Channel 3 offset			
8	Channel 4 offset			
9	Channel 1 gain	Range: -32768 to +32767	R/W	1000
10	Channel 2 gain			
11	Channel 3 gain			
12	Channel 4 gain			
13	Channel 1 average times	Range: 1–100	R/W	10
14	Channel 2 average times			
15	Channel 3 average times			
16	Channel 4 average times			
17	Channel 1 filter average percentage	Range: 0–3 Unit: ±10% 1: ±10% 2: ±20% 3: ±30%	R/W	1
18	Channel 2 filter average percentage			
19	Channel 3 filter average percentage			
20	Channel 4 filter average percentage			
21	Channel sampling cycle (sampling/integration time)	0: 2 ms 1: 4 ms 2: 10 ms 3: 15 ms 4: 20 ms 5: 30 ms	R/W	0

CR#	Name	Description	Atr.	Defaults
		6: 40 ms 7: 50 ms 8: 60 ms 9: 70 ms 10: 80 ms 11: 90 ms 12: 100 ms		
22	Channel Alarm Setup	0: open channel alarm 1: close channel alarm bit0: channel 1 bit1: channel 2 bit2: channel 3 bit3: channel 4 0: warning 1: alarm bit8: error in the power supply bit9: error in the module hardware bit10: error in calibration	R/W	0
23 24	The minimum scale range for channel 1	When the format is set to integer in HWCONFIG, the scale range is invalid. For analog-digital modules, it is much more convenient if the system can convert digital values to floating-point values for earier understanding. Here you can set the minimum and maximum scale ranges of corresponding floating-point values for channels. For example, if the scale range for an analog to digital input channel is ±10.0 V, it indicates the maximum value is +10.0 V and the minimum value is -10.0 V. If the scale range for an analog to digital input channel is 4 mA ~ 20 mA. It indicates the maximum	R	-10.0
25 26	The minimum scale range for channel 2			-10.0
27 28	The minimum scale range for channel 3			-10.0
29 30	The minimum scale range for channel 4			-10.0
31 32	The maximum scale range for channel 1			10.0
33 34	The maximum scale range for channel 2			10.0
35 36	The maximum scale range for channel 3			10.0

CR#	Name	Description	Atr.	Defaults
37 38	The maximum scale range for channel 4	value is 20 mA and the minimum value is 4 mA. Note: You can use PLC instruction DSCLP (API0217) and set SM685 to ON to use floating-point operations when a conversion range needs to edit.		10.0
201	Instruction Set	Instructions for peak values 16#0101: record the peak value again for channel 1 16#0102: record the peak value again for channel 2 16#0104: record the peak value again for channel 3 16#0108: record the peak value again for channel 4 16#010F: record the peak values again for channels 1–4 16#0201: enable recording for channel 1 16#0202: enable recording for channel 2 16#0204: enable recording for channel 3 16#0208: enable recording for channel 4 16#020F: enable recording for channels 1–4 16#0211: disable recording for channel 1 16#0212: disable recording for channel 2 16#0214: disable recording for channel 3 16#0218: disable recording for channel 4 16#021F: disable recording for channels 1–4 16#0502: restore default settings	W	0
210	The maximum peak value for channel 1	Integer format; the maximum peak value for analog inputs	R	0
211	The maximum peak value for channel 2			0
212	The maximum peak value for channel 3			0
213	The maximum peak			0

3

CR#	Name	Description	Atr.	Defaults
	value for channel 4			
214	The minimum peak value for channel 1	Integer format; the minimum peak value for analog inputs	R	0
215	The minimum peak value for channel 2			0
216	The minimum peak value for channel 3			0
217	The minimum peak value for channel 4			0
222	The time to record for channel 1	Unit: 10 ms Range: 1–100 Time to record the digital value for the channel	R/W	1
223	The time to record for channel 2			1
224	The time to record for channel 3			1
225	The time to record for channel 4			1
240	The number of records for channel 1	Range: 0–500, display the current records	R	0
241	The number of records for channel 2			0
242	The number of records for channel 3			0
243	The number of records for channel 4			0
4000~ 4499	Records for channel 1	500 records for channel 1	R	--
4500~ 4999	Records for channel 2	500 records for channel 2	R	--
5000~ 5499	Records for channel 3	500 records for channel 3	R	--
5500~ 5999	Records for channel 4	500 records for channel 4	R	--

3.2.5 AS08AD Control Registers

*If you use HWCONFIG to set values in CRs, once the set value is downloaded, the values can be retained in the module; however if you use TO instruction to write data into CRs, the values CANNOT be retained, after power failure or after transition of the CPU from STOP to RUN.

Note: The attribute of the CR must be W (write) to use TO instruction.

CR#	Name	Description	Atr.	Defaults
0	Format Setup	0: integer format 1: floating point format	R	0
1	Channel 1 mode setup	AS08AD-B 0: closed 1: -10 V to +10 V 2: 0 V–10 V 3: -5 V to +5 V 4: 0 V–5 V 5: 1 V–5 V AS08AD-C 0: closed 1: -20 mA to +20 mA 2: 0 mA–20 mA 3: 4 mA–20 mA	R/W	1
2	Channel 2 mode setup			
3	Channel 3 mode setup			
4	Channel 4 mode setup			
5	Channel 5 mode setup			
6	Channel 6 mode setup			
7	Channel 7 mode setup			
8	Channel 8 mode setup			
9	Channel 1 offset	Range: -32768 to +32767	R/W	0
10	Channel 2 offset			
11	Channel 3 offset			
12	Channel 4 offset			
13	Channel 5 offset			
14	Channel 6 offset			
15	Channel 7 offset			
16	Channel 8 offset			

CR#	Name	Description	Atr.	Defaults
17	Channel 1 gain	Range: -32768 to +32767	R/W	1000
18	Channel 2 gain			
19	Channel 3 gain			
20	Channel 4 gain			
21	Channel 5 gain			
22	Channel 6 gain			
23	Channel 7 gain			
24	Channel 8 gain			
25	Channel 1 average times	Range: 1–100	R/W	10
26	Channel 2 average times			
27	Channel 3 average times			
28	Channel 4 average times			
29	Channel 5 average times			
30	Channel 6 average times			
31	Channel 7 average times			
32	Channel 8 average times			
33	Channel 1 filter average percentage	Range: 0–3 Unit: ±10% 1: ±10% 2: ±20% 3: ±30%	R/W	1
34	Channel 2 filter average percentage			
35	Channel 3 filter average percentage			
36	Channel 4 filter average percentage			
37	Channel 5 filter average percentage			
38	Channel 6 filter average percentage			
39	Channel 7 filter average percentage			
40	Channel 8 filter average			

CR#	Name	Description	Atr.	Defaults
	percentage			
41	Channel Sampling Cycle (Sampling/Integration Time)	0: 2 ms 1: 4 ms 2: 10 ms 3: 15 ms 4: 20 ms 5: 30 ms 6: 40 ms 7: 50 ms 8: 60 ms 9: 70 ms 10: 80 ms 11: 90 ms 12: 100 ms	R/W	0
42	Channel Alarm Setup	0: open channel alarm 1: close channel alarm bit0: channel 1 bit1: channel 2 bit2: channel 3 bit3: channel 4 bit4: channel 5 bit5: channel 6 bit6: channel 7 bit7: channel 8 0: warning 1: alarm bit8: error in the power supply bit9: error in the module hardware bit10: error in calibration	R/W	0
43 44	The minimum scale range for channel 1	When the format is set to integer in HWCONFIG, the scale range is invalid. For analog-digital modules, it is much more	R	-10.0
45	The minimum scale range			

3

CR#	Name	Description	Atr.	Defaults
46	for channel 2	convenient if the system can convert digital values to floating-point values for earier understanding. Here you can set the minimum and maximum scale ranges of corresponding floating-point values for channels. For example, if the scale range for an analog to digital input channel is ±10.0 V, it indicates the maximum value is +10.0 V and the minimum value is -10.0 V. If the scale range for an analog to digital input channel is 4 mA ~ 20 mA. It indicates the maximum value is 20 mA and the minimum value is 4 mA. Note: You can use PLC instruction DSCLP (API0217) and set SM685 to ON to use floating-point operations when a conversion range needs to edit.		
47	The minimum scale range for channel 3			
48				
49	The minimum scale range for channel 4			
50				
51	The minimum scale range for channel 5			
52				
53	The minimum scale range for channel 6			
54				
55	The minimum scale range for channel 7			
56				
57	The minimum scale range for channel 8			
58				
59	The maximum scale range for channel 1		R	10.0
60				
61	The maximum scale range for channel 2			
62				
63	The maximum scale range for channel 3			
64				
65	The maximum scale range for channel 4			
66				
67	The maximum scale range for channel 5			
68				
69	The maximum scale range for channel 6			
70				
71	The maximum scale range for channel 7			
72				
73	The maximum scale range for channel 8			
74				

CR#	Name	Description	Atr.	Defaults
201	Instruction Set	Instructions for peak values 16#0101: record the peak value again for channel 1 16#0102: record the peak value again for channel 2 16#0104: record the peak value again for channel 3 16#0108: record the peak value again for channel 4 16#010F: record the peak values again for channels 1-4 16#0201: enable recording for channel 1 16#0202: enable recording for channel 2 16#0204: enable recording for channel 3 16#0208: enable recording for channel 4 16#020F: enable recording for channels 1–4 16#0211: disable recording for channel 1 16#0212: disable recording for channel 2 16#0214: disable recording for channel 3 16#0218: disable recording for channel 4 16#021F: disable recording for channels 1–4 16#0502: restore default settings	W	0
210	The maximum peak value for channel 1	Integer format; the maximum peak value for analog inputs	R	0
211	The maximum peak value for channel 2			0
212	The maximum peak value for channel 3			0
213	The maximum peak value for channel 4			0
214	The maximum peak value for channel 5			0
215	The maximum peak value for channel 6			0

CR#	Name	Description	Atr.	Defaults
216	The maximum peak value for channel 7			0
217	The maximum peak value for channel 8			0
218	The minimum peak value for channel 1	Integer format; the minimum peak value for analog inputs	R	0
219	The minimum peak value for channel 2			0
220	The minimum peak value for channel 3			0
221	The minimum peak value for channel 4			0
222	The minimum peak value for channel 5			0
223	The minimum peak value for channel 6			0
224	The minimum peak value for channel 7			0
225	The minimum peak value for channel 8			0
222	The time to record for channel 1	Unit: 10 ms Range: 1–100 Time to record the digital value for the channels	R	1
223	The time to record for channel 2			1
224	The time to record for channel 3			1
225	The time to record for channel 4			1

3.2.6 Functions

Item	Function	Description
1	Enable/Disable a Channel	1. Enable or disable a channel. 2. If a channel is disabled, the total conversion time decreases.
2	Calibration	Calibrate a linear curve.
3	Average	Conversion values are averaged and filtered.
4	Disconnection Detection	Disconnection detection only operates when the analog range is 4 mA–20 mA or 1 V–5 V.
5	Channel Detect and Alarm	If an input signal exceeds the range of inputs that the hardware can receive, the module produces an alarm or a warning. You can disable this function.
6	The Limit Detections for Channels	Save the maximum/minimum values for channels.
7	Records for Channels (Applicable for AS04AD)	Save the analog curves for channels
8	Scale Range	When the format is floating-point, you can set the scale range.

1. Enable/Disable a channel

An analog signal is converted into a digital signal at a rate of 2 ms per channel. The total conversion time is 2 ms X (the number of channels). If a channel is not used, you can disable it to decrease the total conversion time.

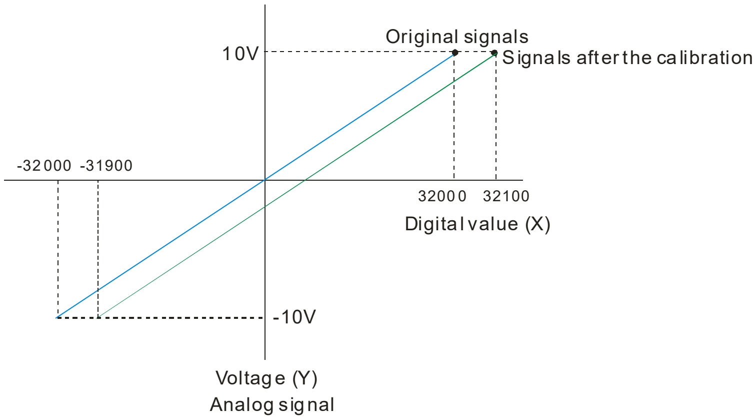
2. Calibration

To make a curve meet specific needs, calibrate the curve by changing the offset and the gain. The calibration range depends on the range of inputs that the hardware can receive. The formula is:

$$Output = \frac{(Input \times Gain)}{1000} + Offset$$

Example:

A channel receives voltage inputs between -10.0 V to +10.0 V. The gain is 1000, and the offset is 0. The corresponding value for the original signal -10.0 V to +10.0 V is -32000 to +32000. If you change the offset to -100, the calibrated value for the original signal -10.0 V to +10.0 V becomes -31900 to +32100.



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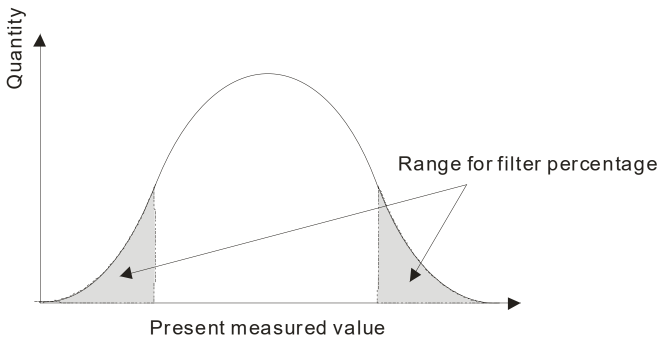
3. Average

You can set the average value between 1–100. It is a steady value obtained from the sum of the recorded values. If the recorded values include an acute pulse due to unavoidable external factors, however, you may observe violent changes in the average value. Use the filtering function to exclude acute pulses from the sum-up and equalization, so that the computed average value is not affected by the acute recorded values. Set the filter percentage to the range 0–3, where the unit is 10%. If you set the filter range to 0, the system sums up all the recorded values and divides them to obtain the average value, but if you set the filter range to 1, for example, the system excludes the bottom 10% and top 10% of the values and averages only the remaining values to obtain the average value. For instantance, set the average value to 100 and set the filter percentage to 3. When there are 100 pieces of data collected, the system arranges the collected data according to their values from large to small and then excludes the bottom 30% and top 30% of the values (60 pieces of data) and averages only the remaining values (40 pieces of data) to obtain the average value.



4. Disconnection detection

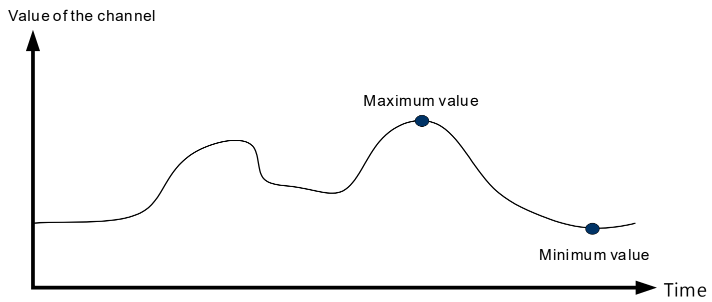
Disconnection detection only operates when the analog range is 4–20 mA or 1–5 V. If a module that can receive inputs between 4–20 mA or from 1–5 V is disconnected, the input signal exceeds the range of allowable inputs, so the module produces an alarm or a warning.

5. Channel detection

If an input signal exceeds the allowable range of inputs, an error message appears. You can disable this function so that the module does not produce an alarm or a warning when the input signal exceeds the input range.

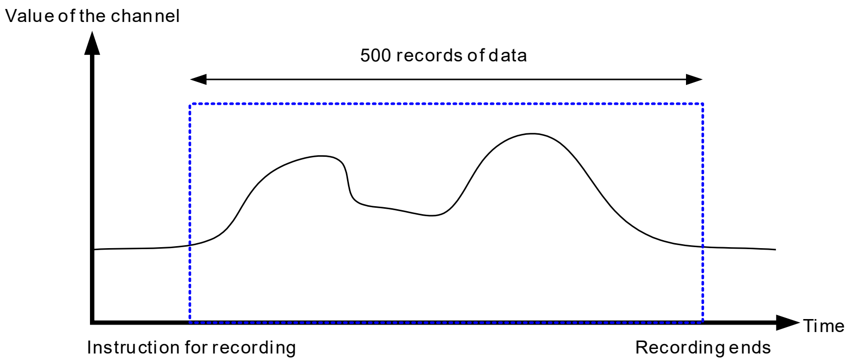
6. Limit detections for channels

This function saves the maximum and minimum values for channels so that you can determine the peak to peak values.



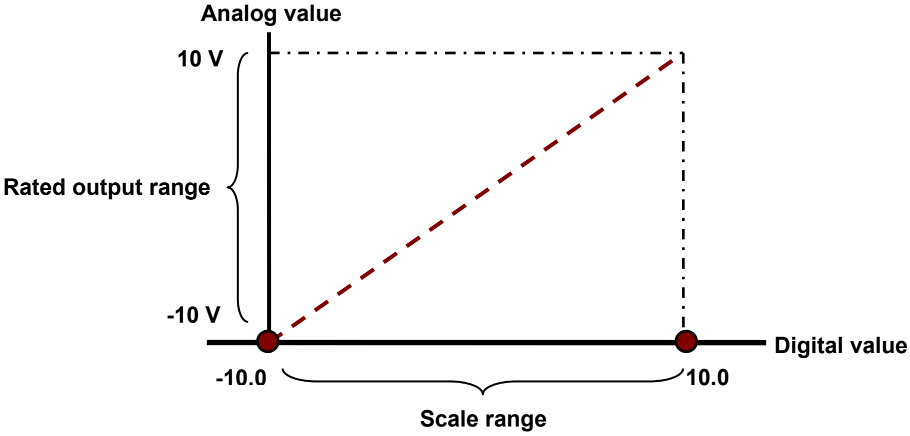
7. Records for channels (applicable for AS04AD)

Record the input values of the cyclic sampling for each channel. The system saves up to 500 data points and the recording time is 10 ms.



8. Scale range

You can set the scale range when the format is floating-point. The analog output mode of a channel has a corresponding digital range. Digital values correspond to analog outputs sent by the module. For example, if the analog range is -10 V to +10 V, the digital range is -10.0 to +10.0, the HSP scale is 10.0, and the LSP scale is -10.0. The digital values -10.0 to +10.0 correspond to the analog values -10 V to +10 V, as the example below shows.



3

3.2.7 Wiring

- **Precautions**

To ensure the analog-to-digital module functions well and reliably, the external wiring must prevent noise. Before you install the cables, follow the precautions below.

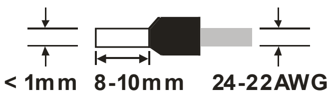
(1) To prevent a surge and induction, the AC cable and the input signal cables that are connected to the module must be separate cables.

(2) Do not install the cable near a main circuit, a high-voltage cable, or a cable connected to a load that is not a PLC. In addition, the cable must not be bound to a main circuit, a high-voltage cable, or a cable connected to a load which is not a PLC.

(3) Ground shielded cables and hermetically sealed cables separately.

(4) Terminals with insulation sleeves cannot be arranged as a terminal block, so you should cover the terminals with insulation tubes.

(5) Use single-core cables or twin-core cables in a diameter of 24 AWG–22 AWG with pin-type connectors smaller than 1 mm. Use only copper conducting wires that can resist temperatures above 60° C-75° C.

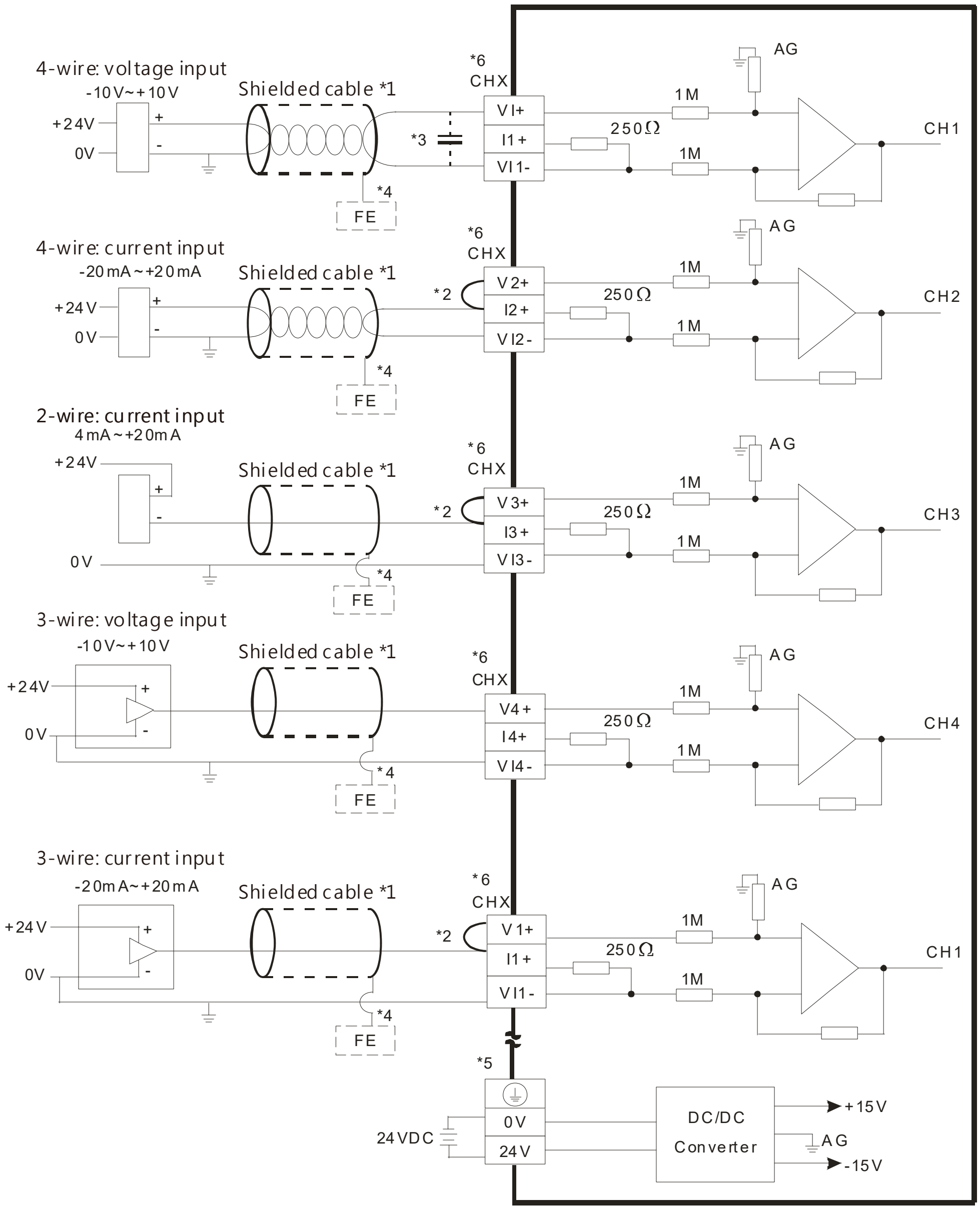


(6) Notes on two-wire, three-wire, and four-wire connections:

- Two-wire connection/three-wire connection (passive transducer): connect the transducer and the analog input module to the same power circuit.
- Four-wire connection (active transducer): the transducer uses an independent power supply so do not connect it to the same power circuit as the analog input module.

(7) Note: use cables with the same length (less than 200 m) and use wire resistance of less than 100 ohm.

- **AS04AD-A External wiring**



*1. Use shielded cables to isolate the analog input signal cable from other power cables.

*2. If the module is connected to a current signal, the terminals Vn and In+ (n=1–4) must be short-circuited.

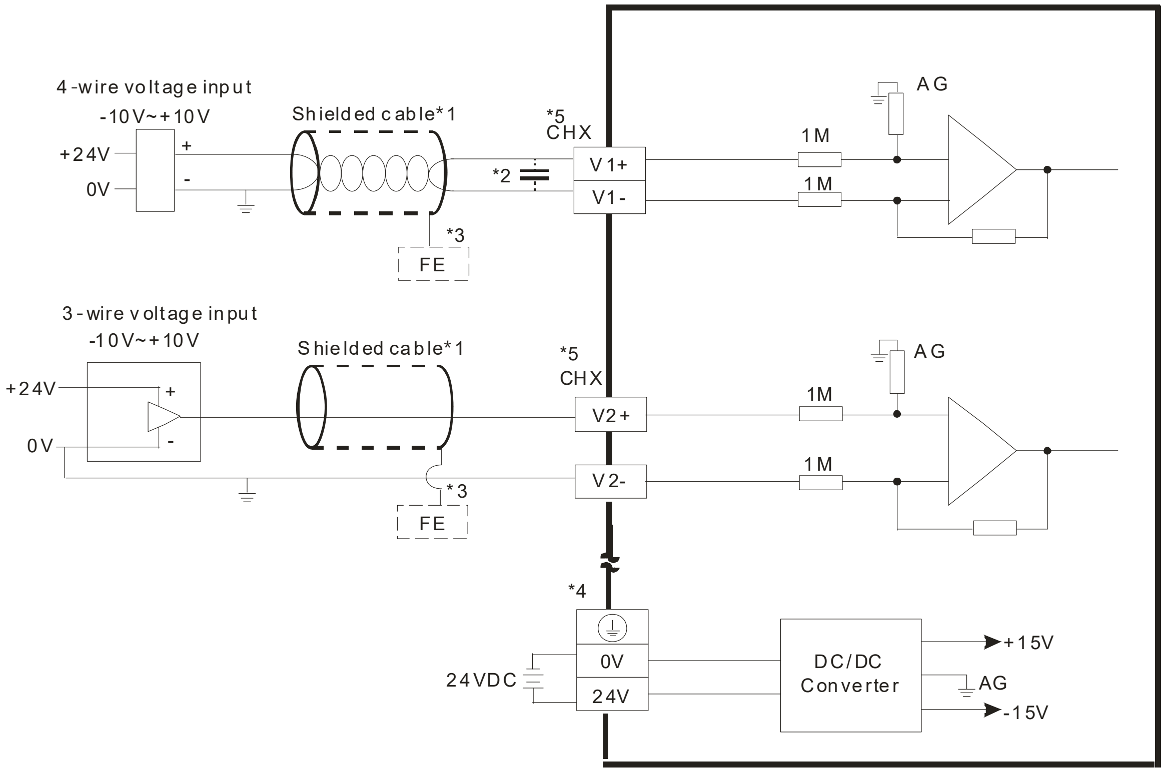
*3. If variability in the input voltage results in interference within the wiring, connect the module to a capacitor with a capacitance between 0.1–0.47 μF and a working voltage of 25 V.

*4. Connect the shielded cable to the terminal FE.

*5. Connect the terminal ⏚ to the ground terminal.

*6. Every channel can operate with the wiring presented above.

- **AS08AD-B External wiring**



*1. Use shielded cables to isolate the analog input signal cable from other power cables.

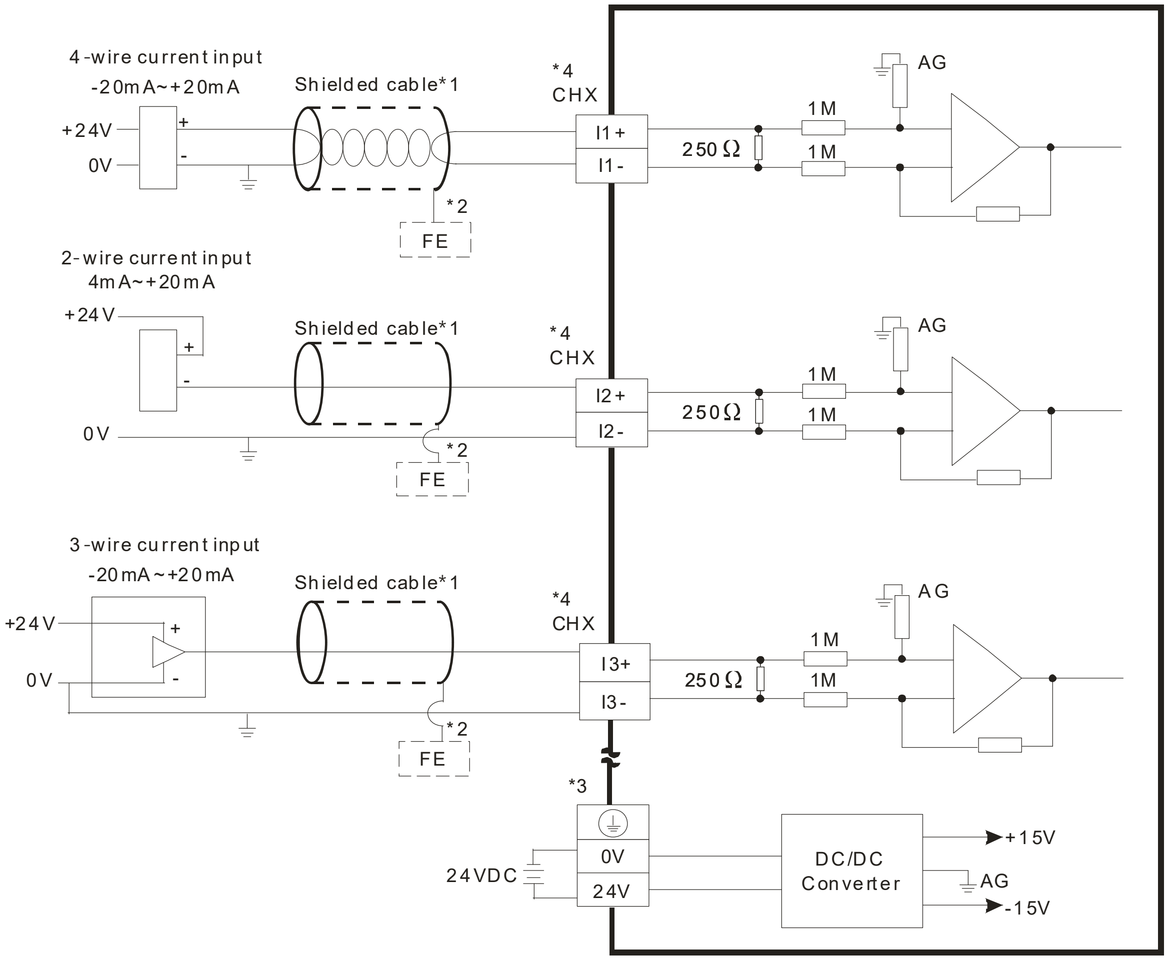
*2. If variability in the input voltage results in interference within the wiring, connect the module to a capacitor with a capacitance between 0.1–0.47 μF and a working voltage of 25 V.

*3. Connect the shielded cable to the terminal FE.

*4. Connect the terminal ⏚ to the ground terminal.

*5. Every channel can operate with the wiring presented above.

- **AS08AD-C External wiring**



*1. Use shielded cables to isolate the analog input signal cable from other power cables.

*2. Connect the shielded cable to the terminal FE.

*3. Connect the terminal ⏚ to the ground terminal.

*4. Every channel can operate with the wiring presented above.

3.2.8 LED Indicators

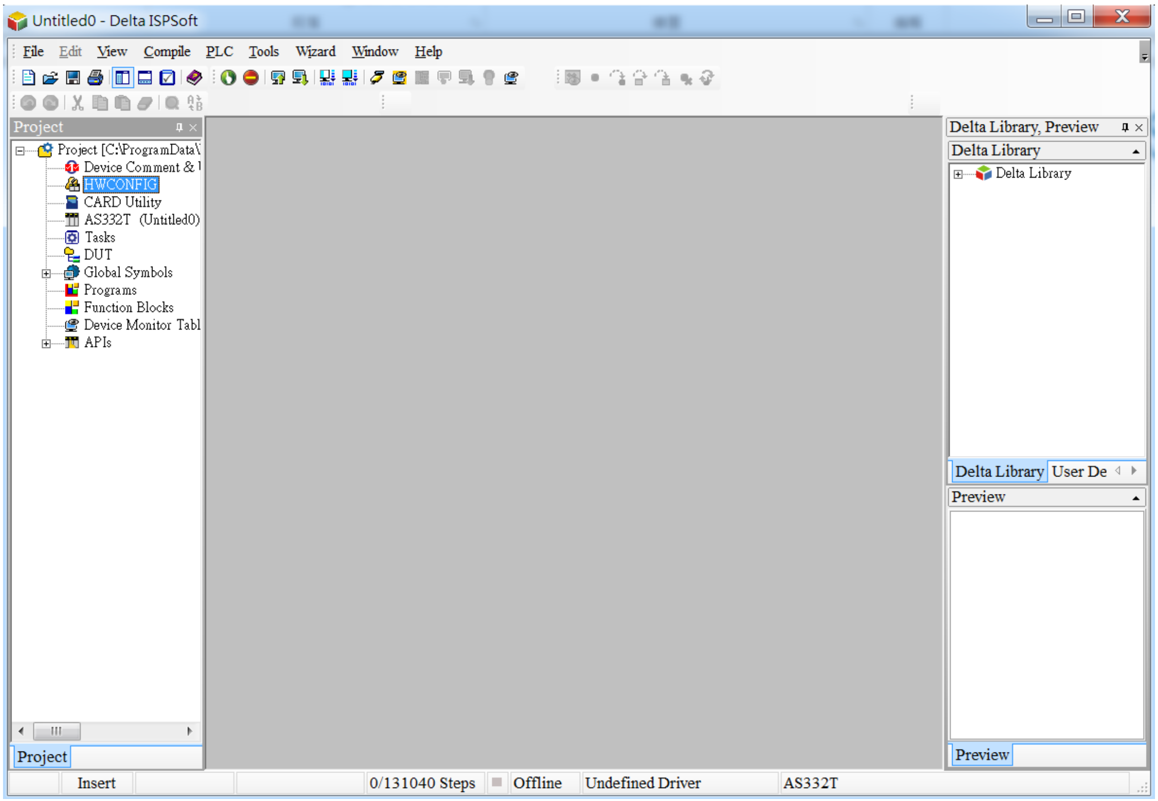
Number	Name	Description
1	RUN LED Indicator	Operating status of the module ON: the module is running. OFF: the module is not running.
2	ERROR LED Indicator	Error status of the module ON: a serious error exists in the module. OFF: the module is operating normally. Blink: a minor error exists in the module.
3	Analog to Digital Conversion Indicator	Analog-to-digital conversion status Blinking: conversion is in process. OFF: conversion has stopped.

3.3 HWCONFIG in ISPSoft

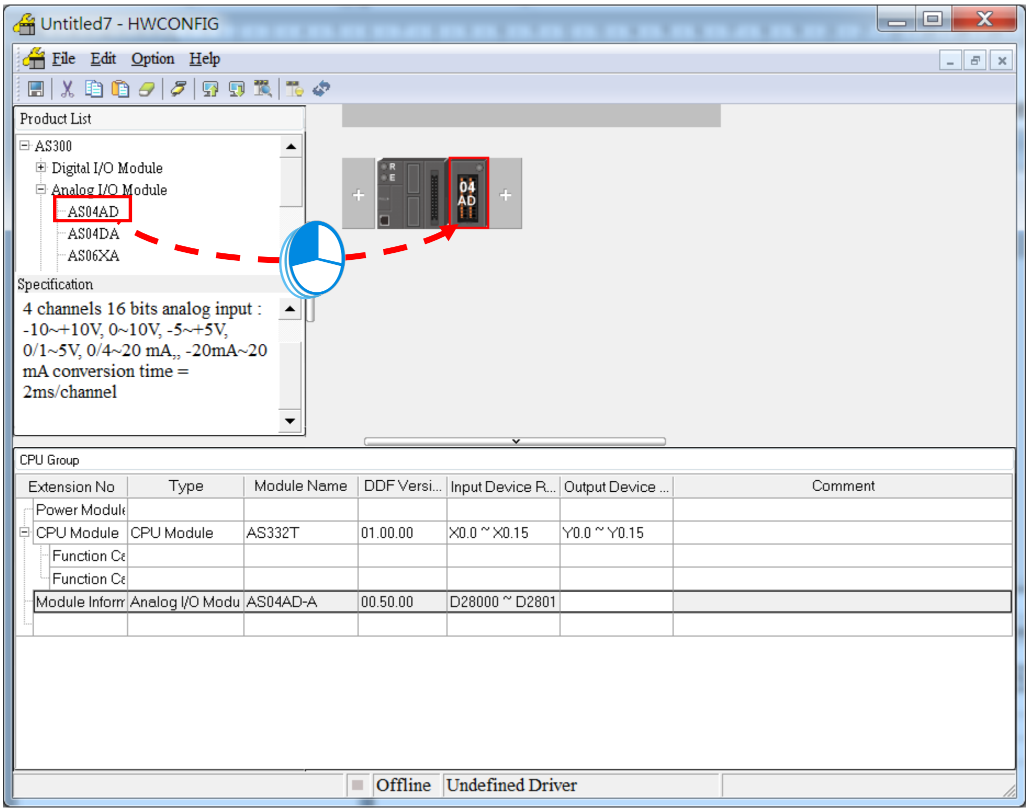
The following example uses the AS04AD-A module.

3.3.1 Initial Setting

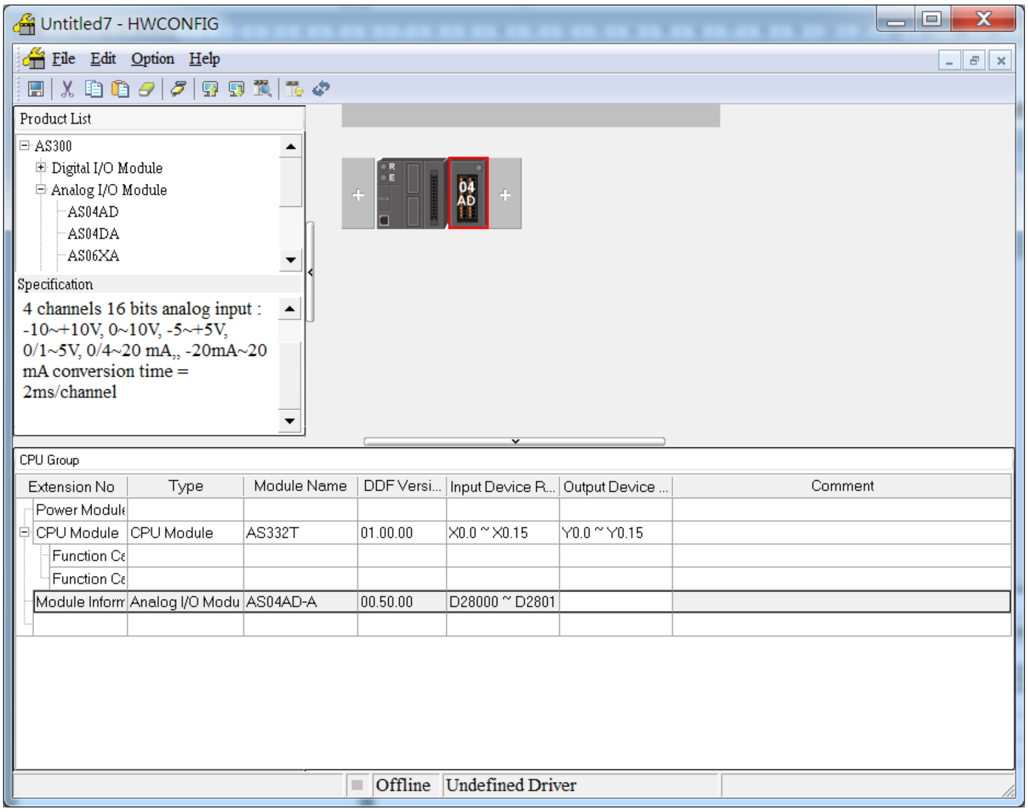
(1) Start ISPSoft and double-click **HWCONFIG**.

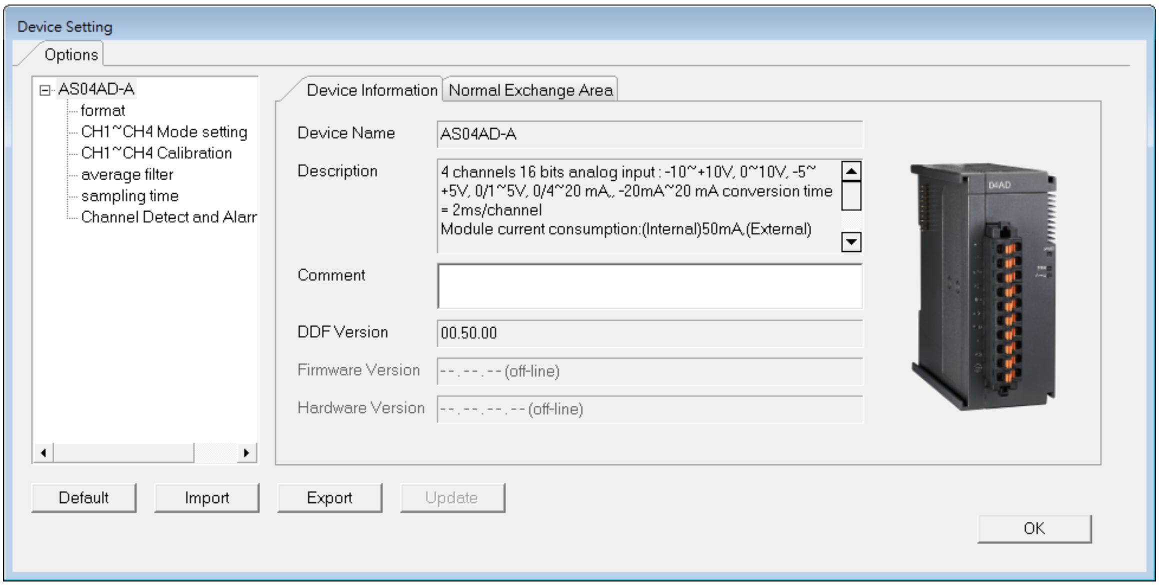


(2) Select a module and drag it to the working area.

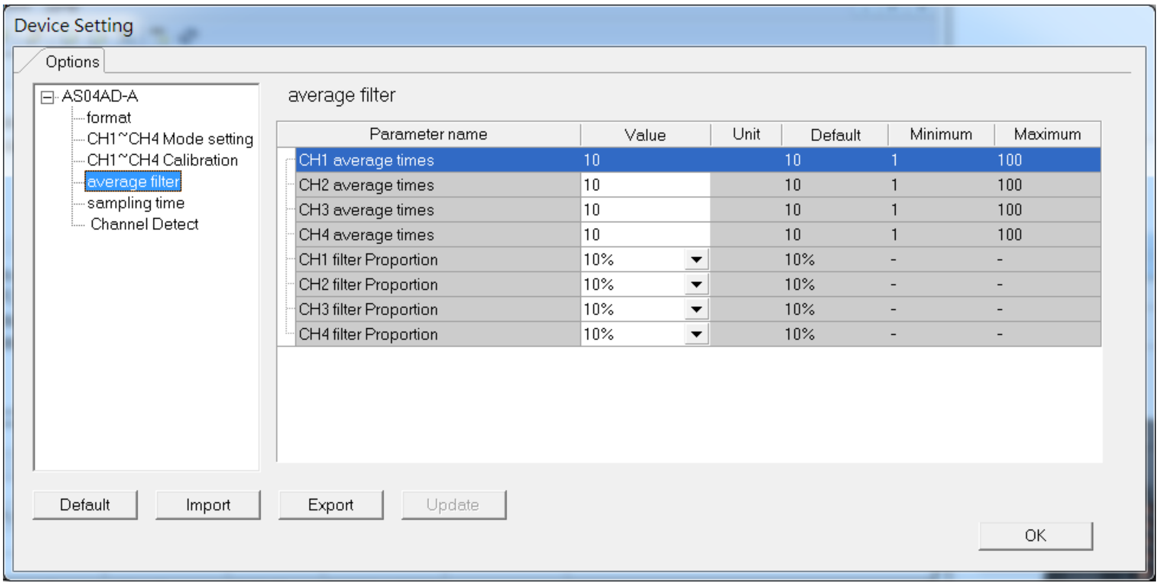


(3) Double-click the module in the working area to open the Device Setting page.

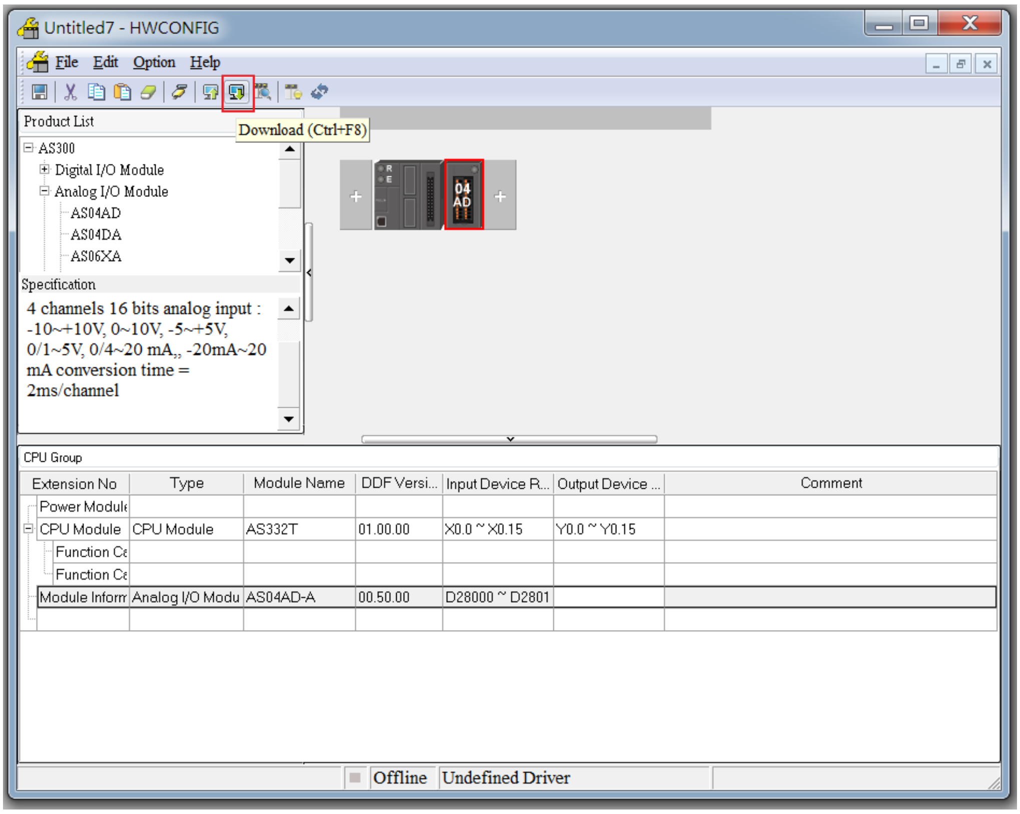




(4) Choose a parameter, set the values, and click **OK**.

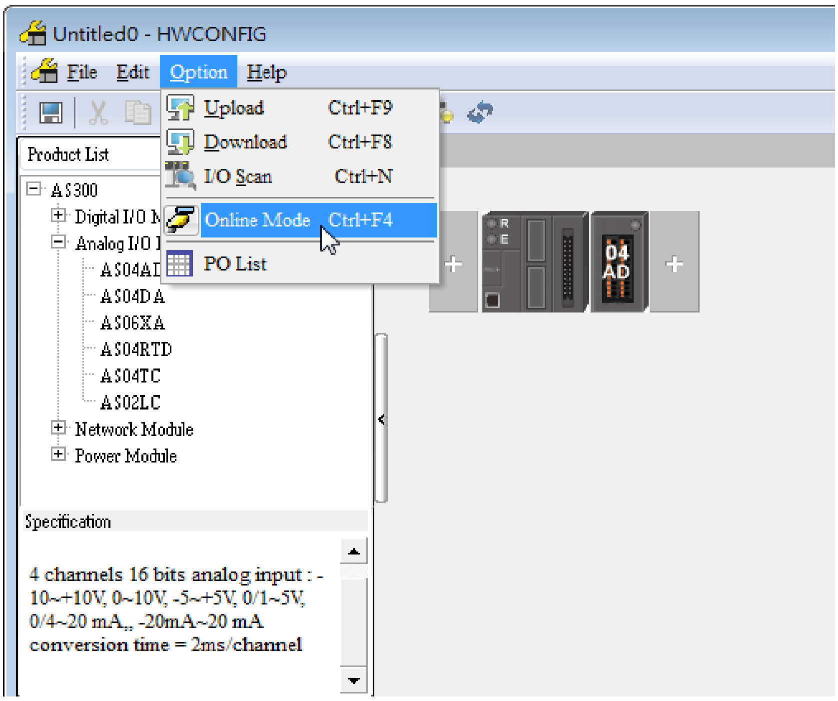


(5) Click **Download** on the toolbar to download the parameters. Note that you cannot download the parameters while the CPU module is running.



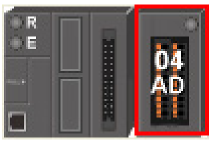
3.3.2 Checking the Version of a Module

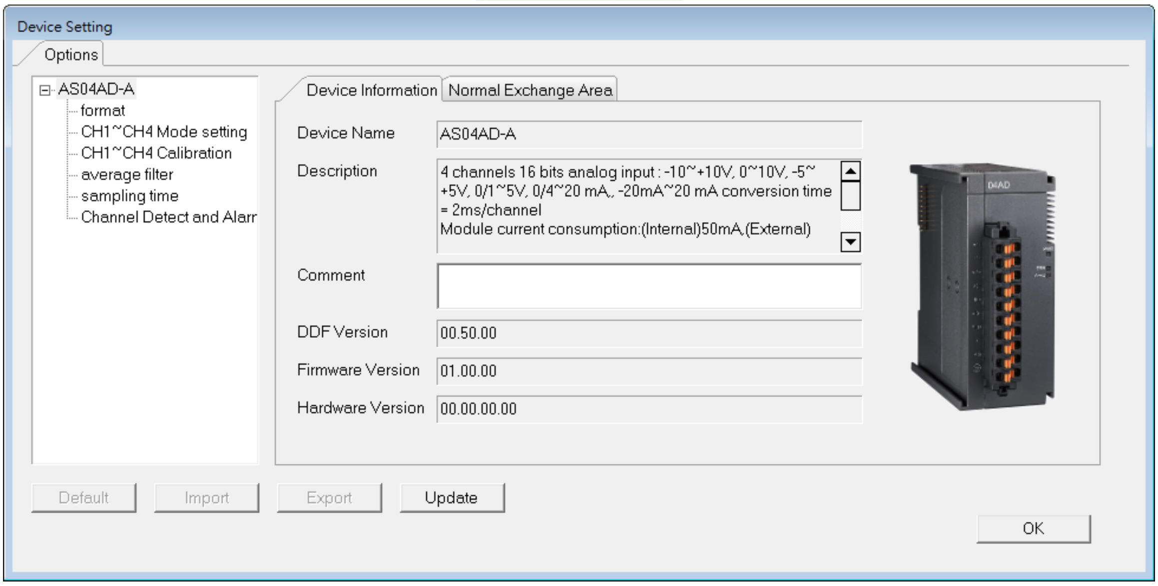
(1) On the **Option** menu, click **Online Mode**.



3

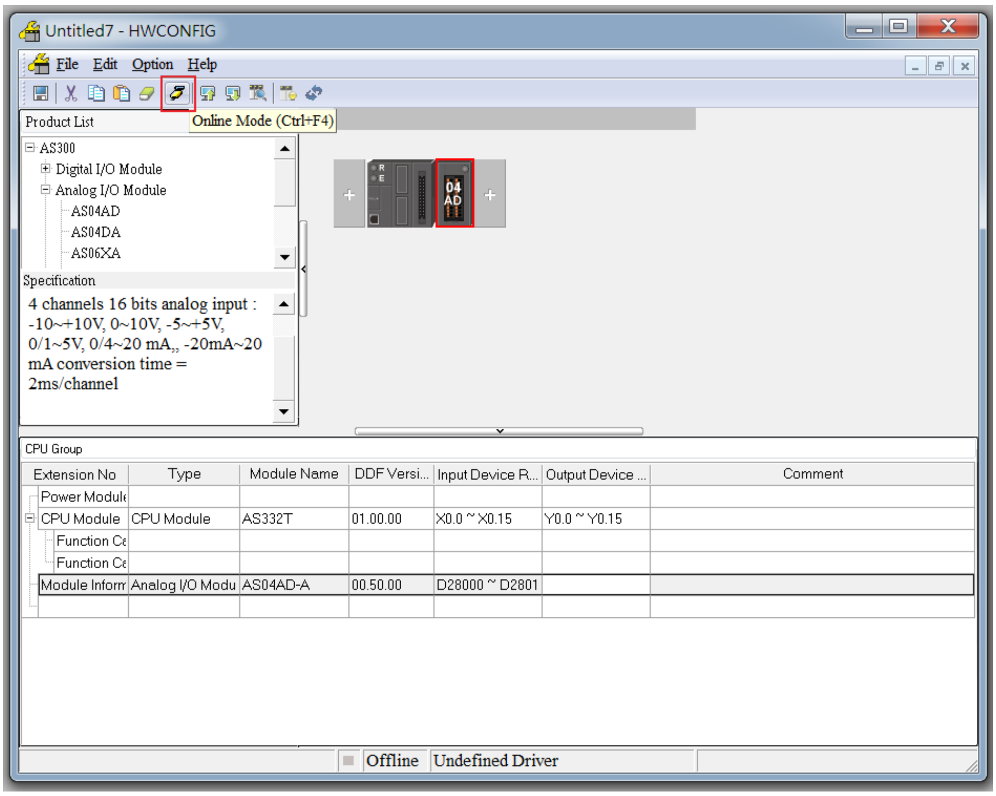
(2) Double-click the module to open the Device Setting page. The versions of both the firmware and the hardware are displayed.



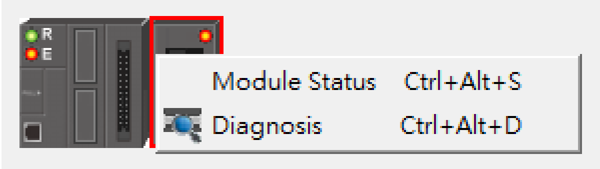


3.3.3 Online Mode

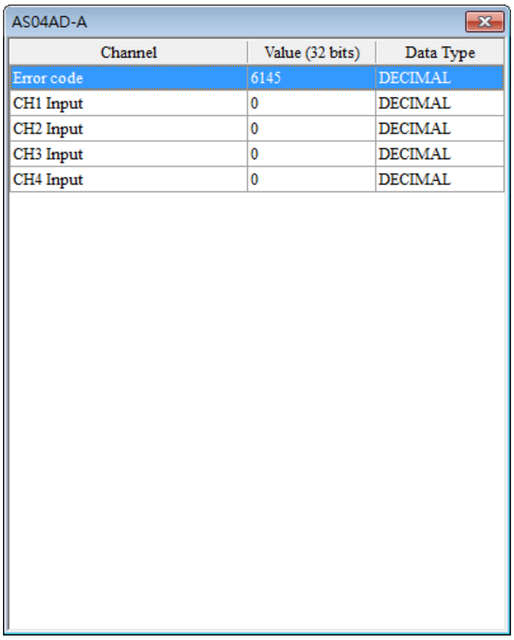
(1) Click **Online Mode** on the toolbar.



(2) Right-click the module and click **Module Status**.

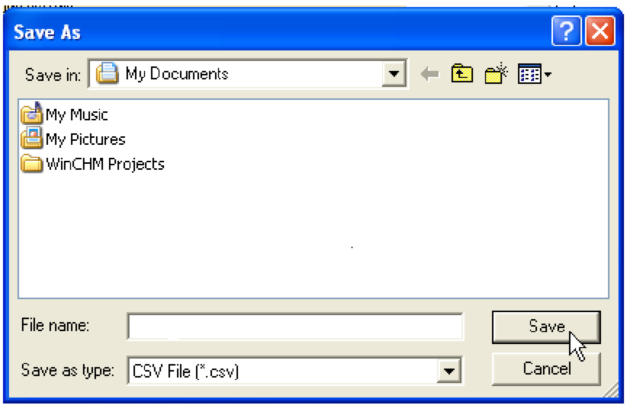


(3) View the module status.

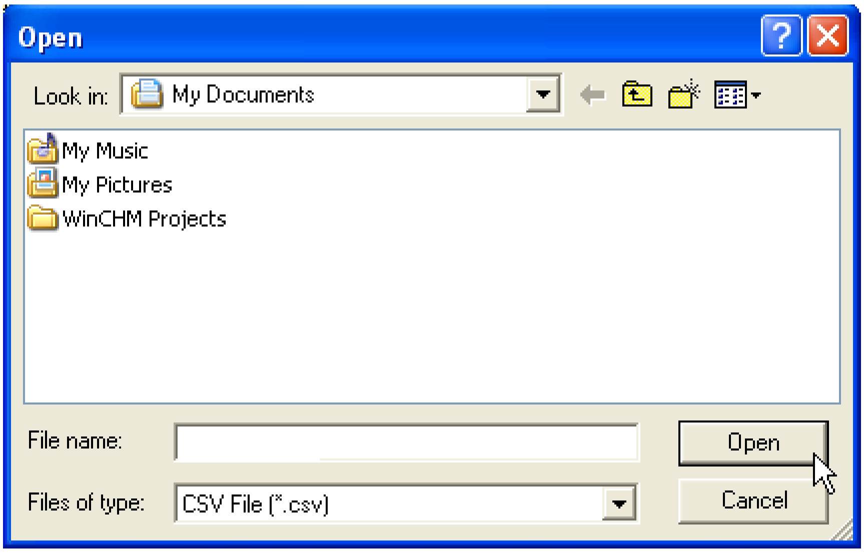


3.3.4 Importing/Exporting a Parameter File

(1) Click **Export** in the Device Settings dialog box to save the current parameters as a CSV file (.csv).

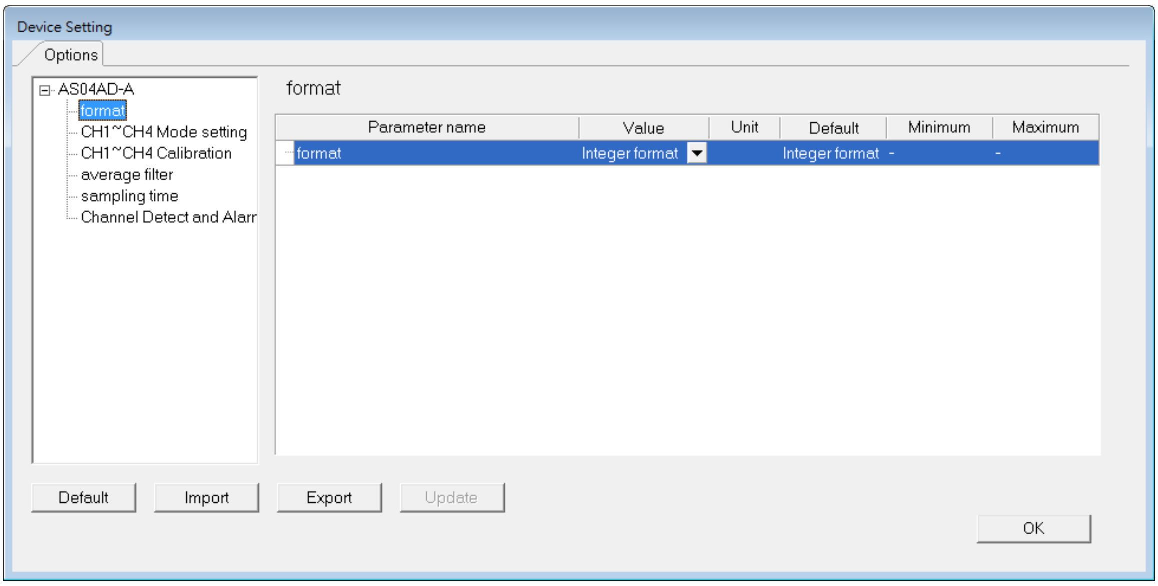


(2) Click **Import** in the Device Settings dialog box and select a CSV file to import saved parameters.

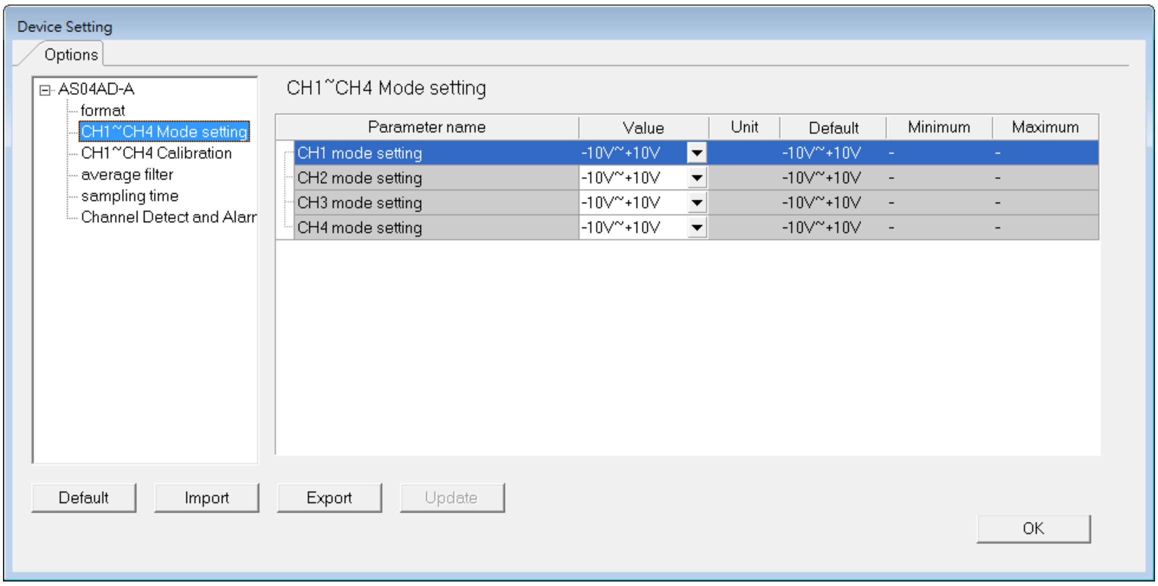


3.3.5 Parameters

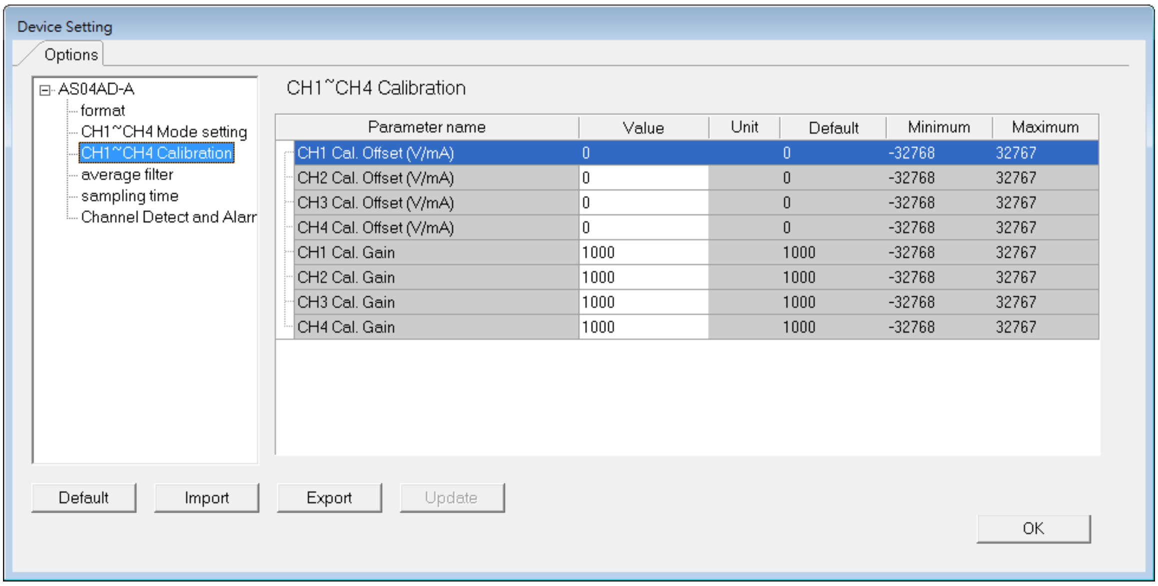
(1) The input formats of the channels



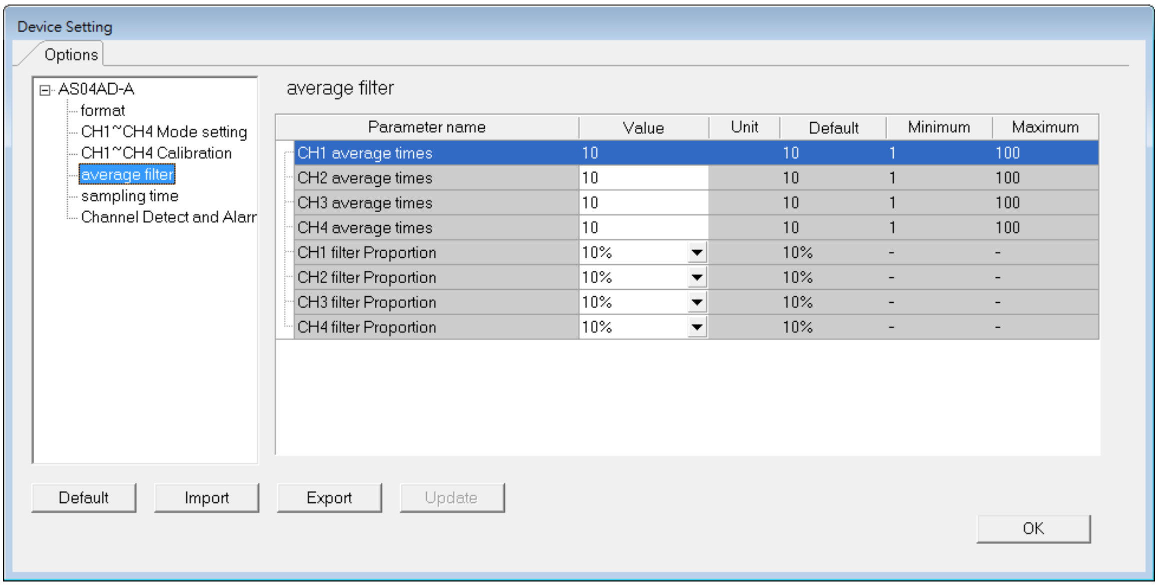
(2) The CH1–CH4 (channel 1–channel 4) mode settings



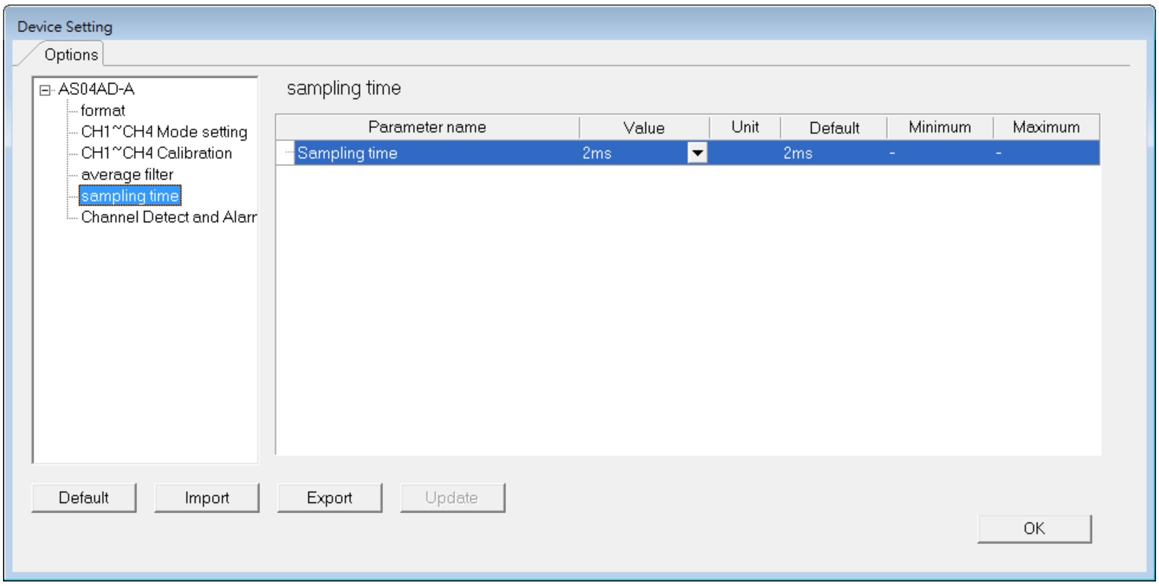
(3) The CH1-CH4 calibration settings



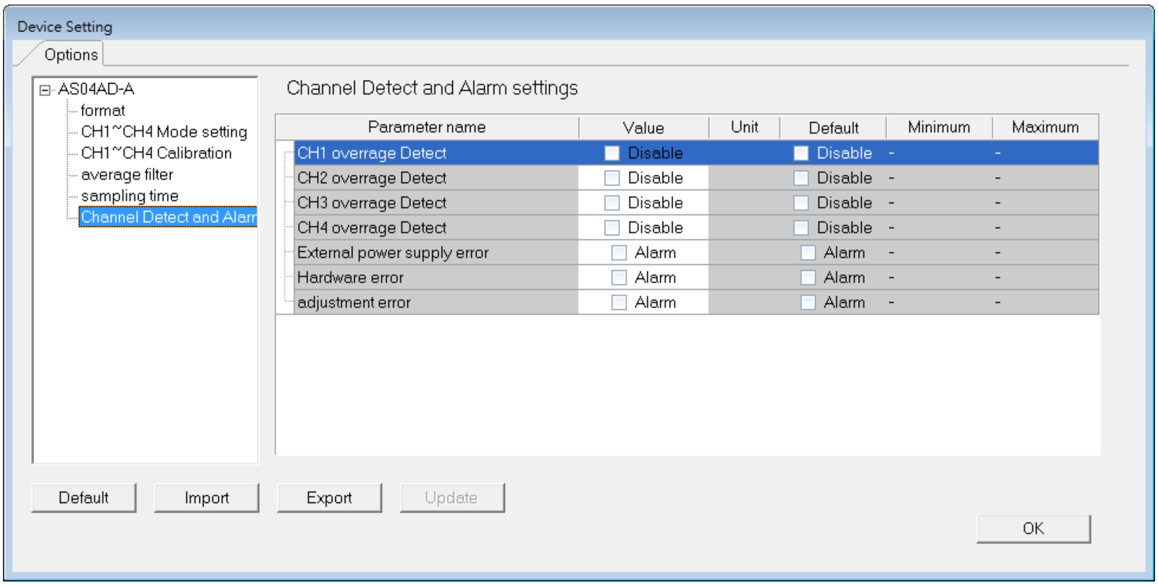
(4) The average filter settings



(5) The sampling time settings



(6) The channel detection settings

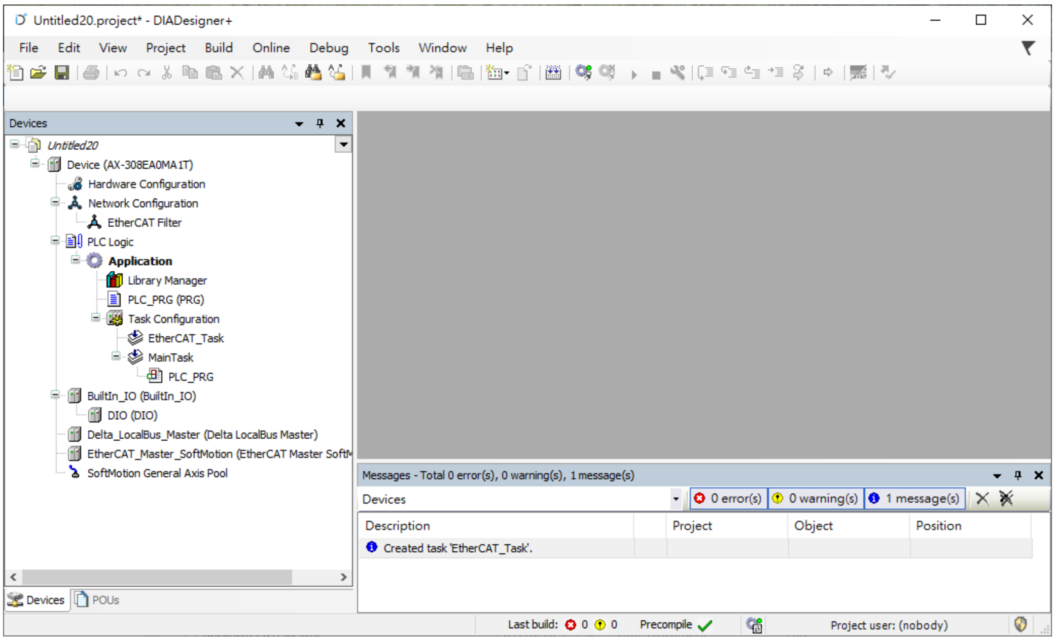


3.4 DIADesigner+ (Hardware Configuration)

The following example uses AS04AD-A.

3.4.1 Initial Setting

(1) Start DIADesigner+, click **New Project**, and then **Project+Device** to create a new project.

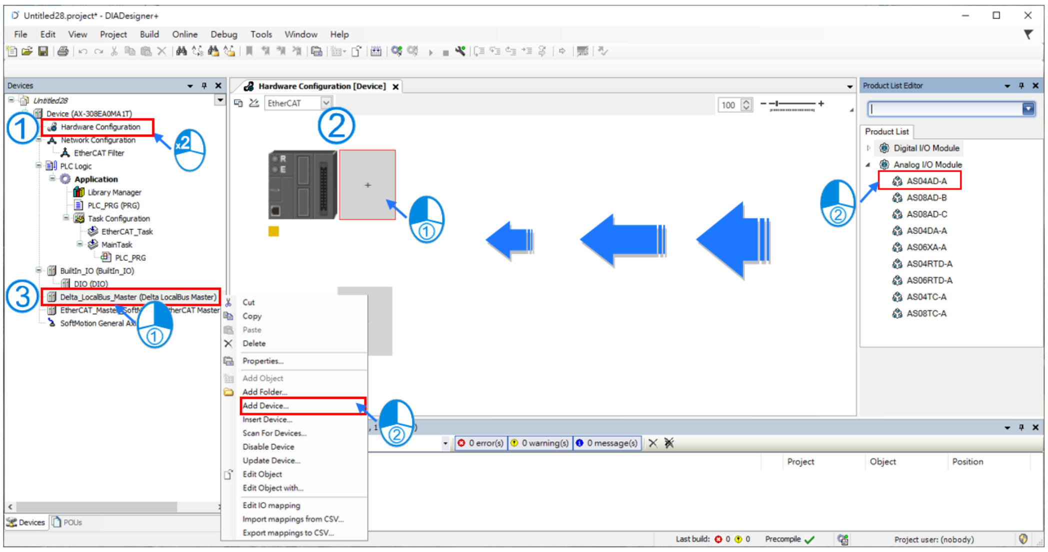


(2) Add modules in:

① Double-click **Hardware Configuration**

② Select the **+ section** and drag and drop the module that you want to add from the Product List to the + section.

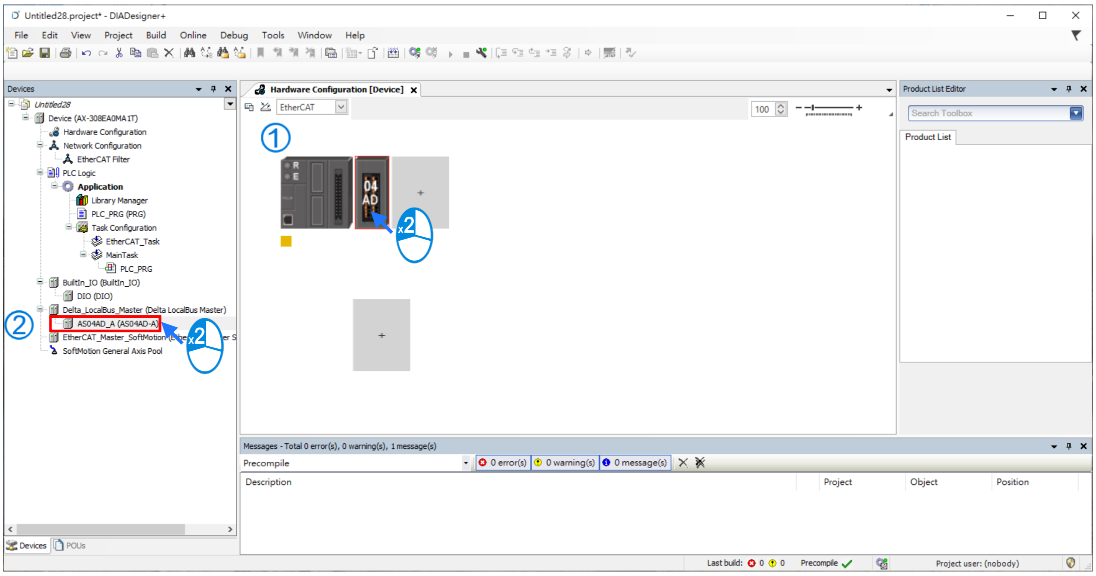
or ③ Right-click **Delta_Localbus Master** to see the context meun and then double-click **Add Device** to add devices manually or double-click **Scan for Devices**.



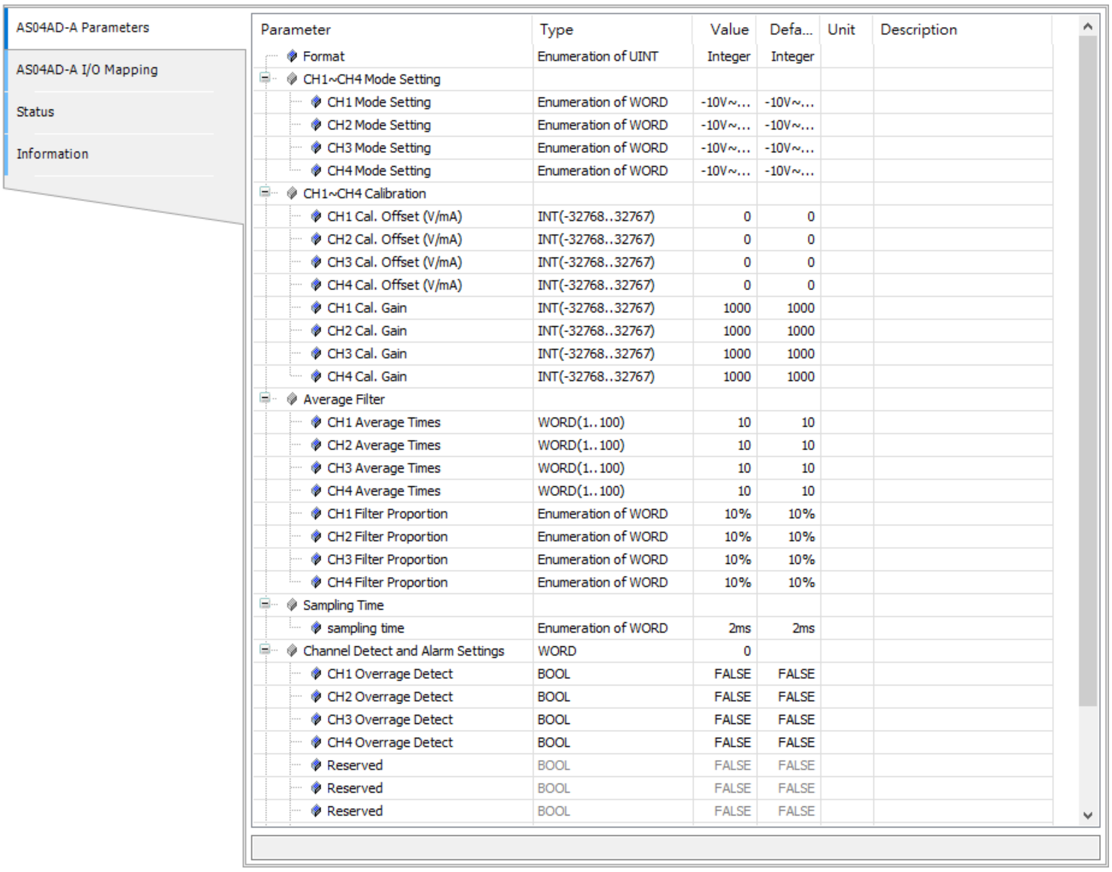
(3) Select modules:

① Double-click the module name in the **Hardware Configuration** area.

or ② Double-click the module name shown in the node.



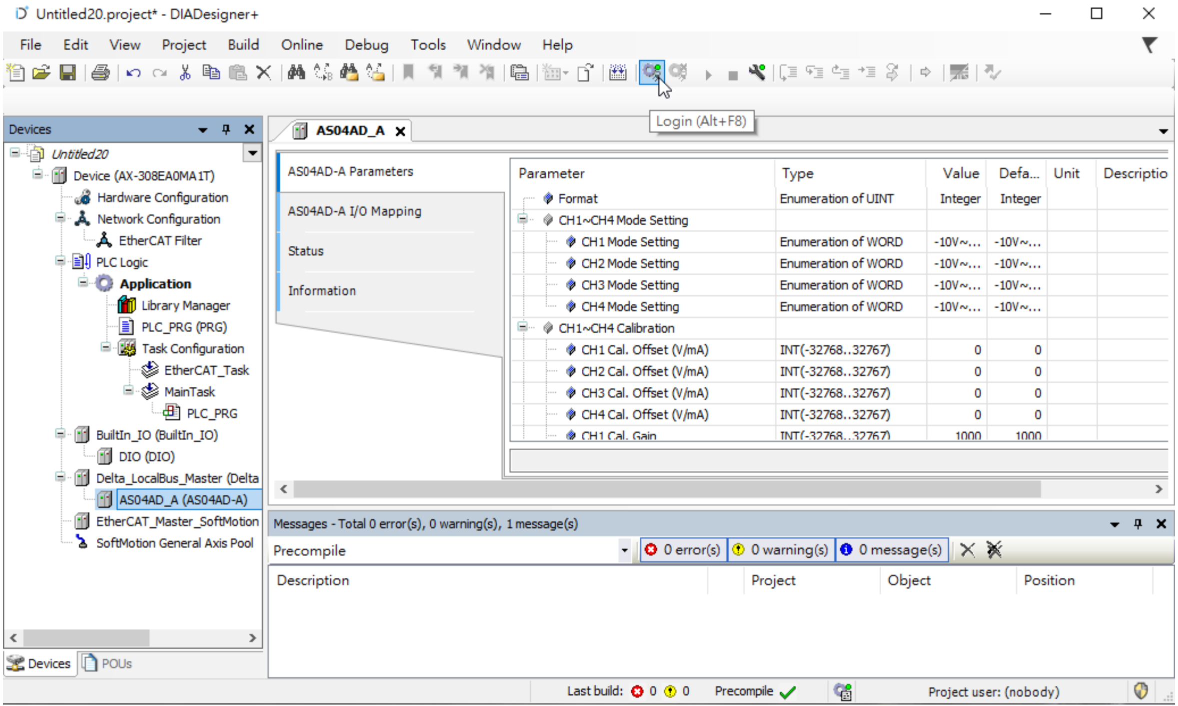
(4) Module parameter setting page:



- AS04AD-A Parameters
- AS04AD-A I/O Mapping
- Status
- Information

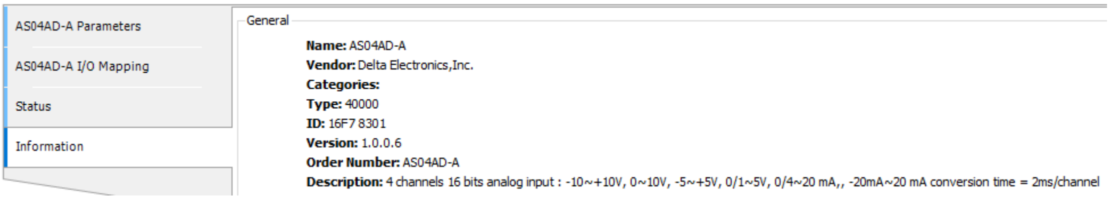
Parameter	Type	Value	Defa...	Unit	Description
Format	Enumeration of UINT	Integer	Integer		
CH1~CH4 Mode Setting					
CH1 Mode Setting	Enumeration of WORD	-10V~...	-10V~...		
CH2 Mode Setting	Enumeration of WORD	-10V~...	-10V~...		
CH3 Mode Setting	Enumeration of WORD	-10V~...	-10V~...		
CH4 Mode Setting	Enumeration of WORD	-10V~...	-10V~...		
CH1~CH4 Calibration					
CH1 Cal. Offset (V/mA)	INT(-32768..32767)	0	0		
CH2 Cal. Offset (V/mA)	INT(-32768..32767)	0	0		
CH3 Cal. Offset (V/mA)	INT(-32768..32767)	0	0		
CH4 Cal. Offset (V/mA)	INT(-32768..32767)	0	0		
CH1 Cal. Gain	INT(-32768..32767)	1000	1000		
CH2 Cal. Gain	INT(-32768..32767)	1000	1000		
CH3 Cal. Gain	INT(-32768..32767)	1000	1000		
CH4 Cal. Gain	INT(-32768..32767)	1000	1000		
Average Filter					
CH1 Average Times	WORD(1..100)	10	10		
CH2 Average Times	WORD(1..100)	10	10		
CH3 Average Times	WORD(1..100)	10	10		
CH4 Average Times	WORD(1..100)	10	10		
CH1 Filter Proportion	Enumeration of WORD	10%	10%		
CH2 Filter Proportion	Enumeration of WORD	10%	10%		
CH3 Filter Proportion	Enumeration of WORD	10%	10%		
CH4 Filter Proportion	Enumeration of WORD	10%	10%		
Sampling Time					
sampling time	Enumeration of WORD	2ms	2ms		
Channel Detect and Alarm Settings	WORD	0			
CH1 Overrage Detect	BOOL	FALSE	FALSE		
CH2 Overrage Detect	BOOL	FALSE	FALSE		
CH3 Overrage Detect	BOOL	FALSE	FALSE		
CH4 Overrage Detect	BOOL	FALSE	FALSE		
Reserved	BOOL	FALSE	FALSE		
Reserved	BOOL	FALSE	FALSE		
Reserved	BOOL	FALSE	FALSE		

(5) After setting is complete, select the module and click **Login** on the tool bar to download the settings to the modules.

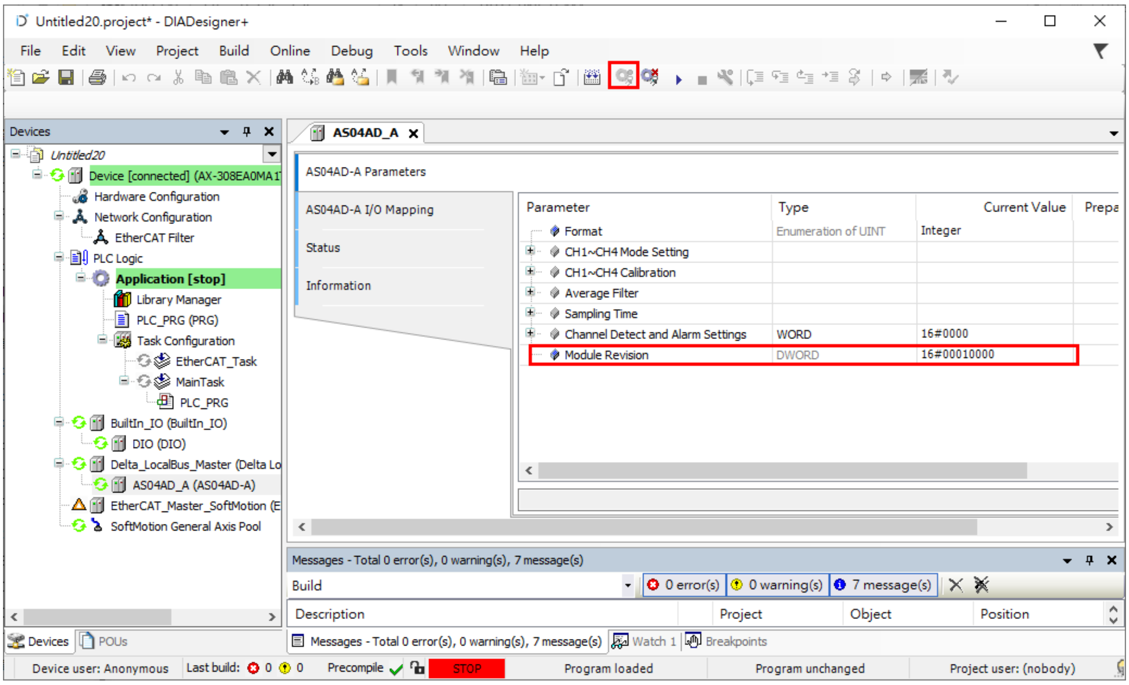


3.4.2 Checking the Version of a Module

(1) Select the module and click the Information tab to see the module information.



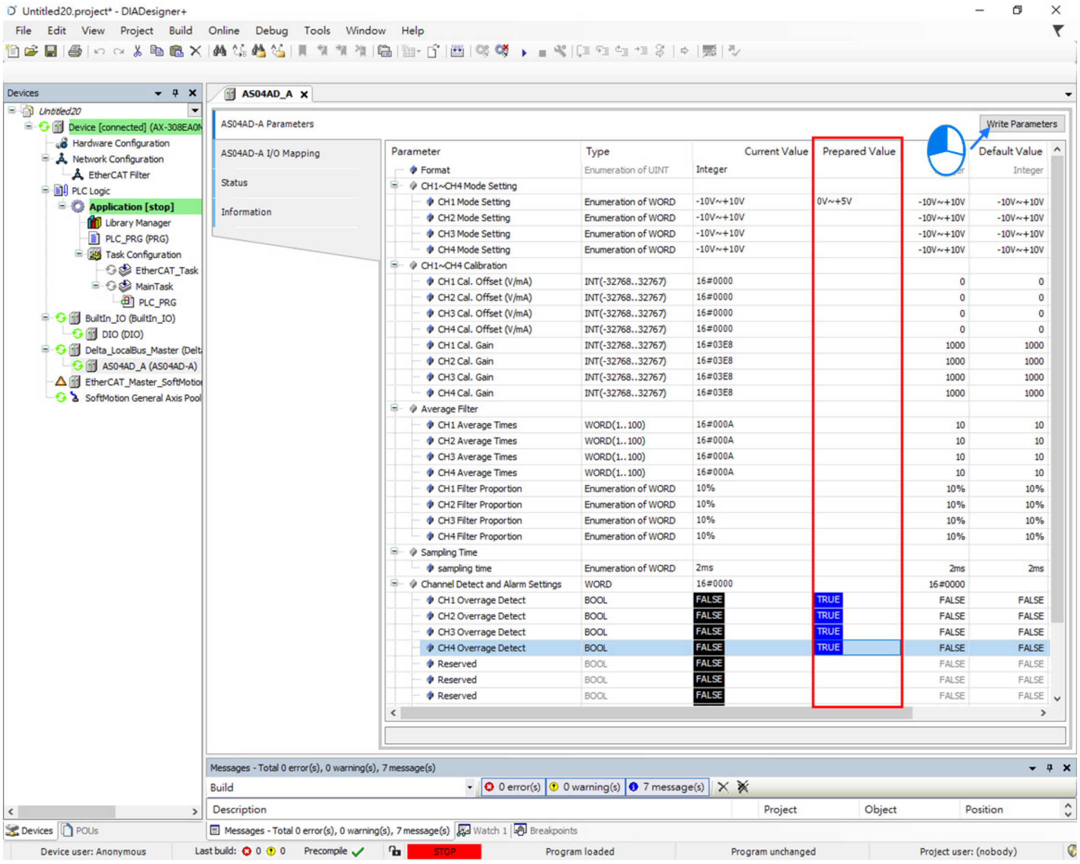
(2) Select the module and click **Login** on the tool bar to go to Online Mode. You can find the Module Revision from the Parameters tab.



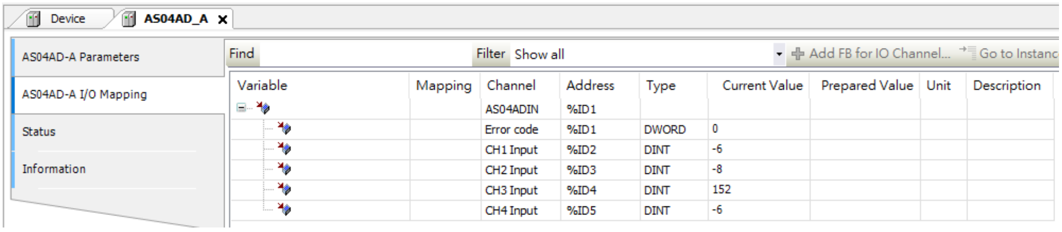
3

3.4.3 Online Mode

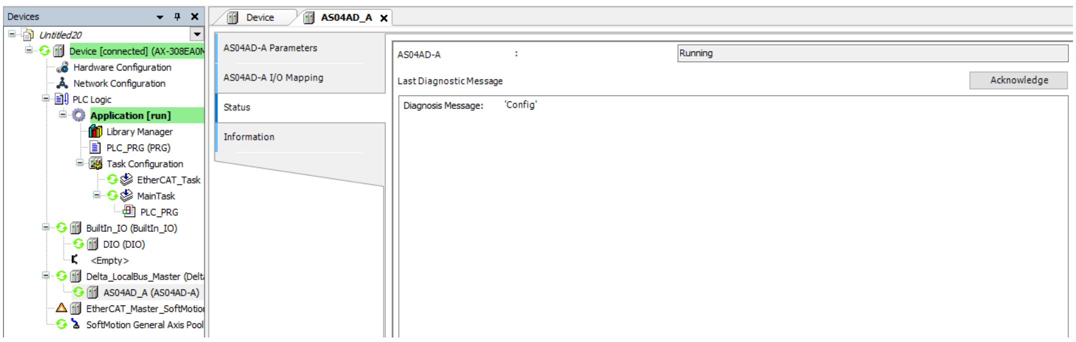
(1) Select the module and click **Login** on the tool bar to go to **Online Mode**. You can monitor all configuration parameters. Vaules in the column of Prepared Value are configurable online. After editing the values in the Prepared Value column, click **Write Parameter** to confirm the change.



(2) You can monitor the values, status, error codes in each channel from the I/O Mapping tab.



(3) You can monitor the current status and error codes from the Status tab.



3.4.4 Parameters

(1) You can set up the value format to **Integer** or **Floating** for Channel 1 to 4.

Parameter	Type	Value	Default Value	Unit	Description
Format	Enumeration of UINT	Integer	Integer		
CH1~CH4 Mode Setting					
CH1 Mode Setting	Enumeration of WORD				
CH2 Mode Setting	Enumeration of WORD				
CH3 Mode Setting	Enumeration of WORD	-10V~+10V	-10V~+10V		
CH4 Mode Setting	Enumeration of WORD	-10V~+10V	-10V~+10V		

Integer
Floating

(2) You can set up the values for Channel 1 to 4.

Parameter	Type	Value	Default Value	Unit	Description
Format	Enumeration of UINT	Integer	Integer		
CH1~CH4 Mode Setting					
CH1 Mode Setting	Enumeration of WORD	-10V~+10V	-10V~+10V		
CH2 Mode Setting	Enumeration of WORD		-10V~+10V		
CH3 Mode Setting	Enumeration of WORD		-10V~+10V		
CH4 Mode Setting	Enumeration of WORD		-10V~+10V		
CH1~CH4 Calibration					
CH1 Cal. Offset (V/mA)	INT(-32768..32767)		0		
CH2 Cal. Offset (V/mA)	INT(-32768..32767)		0		
CH3 Cal. Offset (V/mA)	INT(-32768..32767)		0		

Close
-10V~+10V
0V~+10V
-5V~+5V
0V~+5V
1V~+5V
0mA~20mA
4mA~20mA
-20mA~20mA

(3) You can set up the calibrations for for Channel 1 to 4.

CH1~CH4 Calibration					
CH1 Cal. Offset (V/mA)	INT(-32768..32767)	0	0		
CH2 Cal. Offset (V/mA)	INT(-32768..32767)	0	0		
CH3 Cal. Offset (V/mA)	INT(-32768..32767)	0	0		
CH4 Cal. Offset (V/mA)	INT(-32768..32767)	0	0		
CH1 Cal. Gain	INT(-32768..32767)	1000	1000		
CH2 Cal. Gain	INT(-32768..32767)	1000	1000		
CH3 Cal. Gain	INT(-32768..32767)	1000	1000		
CH4 Cal. Gain	INT(-32768..32767)	1000	1000		

(4) You can set up the average filtering for Channel 1 to 4.

Average Filter					
CH1 Average Times	WORD(1..100)	10	10		
CH2 Average Times	WORD(1..100)	10	10		
CH3 Average Times	WORD(1..100)	10	10		
CH4 Average Times	WORD(1..100)	10	10		
CH1 Filter Proportion	Enumeration of WORD	10%	10%		
CH2 Filter Proportion	Enumeration of WORD	10%	10%		
CH3 Filter Proportion	Enumeration of WORD	10%	10%		
CH4 Filter Proportion	Enumeration of WORD	10%	10%		

(5) You can set up the sampling time.

Sampling Time			
sampling time	Enumeration of WORD	2ms	2ms
Channel Detect and Alarm Settings	WORD	0	
CH1 Overrage Detect	BOOL	FALSE	FALSE
CH2 Overrage Detect	BOOL	FALSE	FALSE
CH3 Overrage Detect	BOOL	FALSE	FALSE
CH4 Overrage Detect	BOOL	FALSE	FALSE
Reserved	BOOL	FALSE	FALSE
Reserved	BOOL	FALSE	FALSE
Reserved	BOOL	FALSE	FALSE

(6) You can set up the channel detect and alarm settings.

Channel Detect and Alarm Settings	WORD	0	
CH1 Overrage Detect	BOOL	FALSE	FALSE
CH2 Overrage Detect	BOOL	FALSE	FALSE
CH3 Overrage Detect	BOOL	FALSE	FALSE
CH4 Overrage Detect	BOOL	FALSE	FALSE
Reserved	BOOL	FALSE	FALSE
Reserved	BOOL	FALSE	FALSE
Reserved	BOOL	FALSE	FALSE
Reserved	BOOL	FALSE	FALSE
External Power Supply Error	BOOL	FALSE	FALSE
Hardware Error	BOOL	FALSE	FALSE
Adjustment Error	BOOL	FALSE	FALSE

3.5 Troubleshooting

3.5.1 Error Codes

Error Code	Description	A → D LED Indicator	ERROR LED Indicator
16#1605	Hardware failure	OFF	ON
16#1607	The external voltage is abnormal.	OFF	ON
16#1608	The factory calibration is abnormal.	OFF	ON
16#1801	The external voltage is abnormal.	OFF	Blinking
16#1802	Hardware failure	OFF	Blinking
16#1804	The factory calibration is abnormal.	OFF	Blinking
16#1808	The signal received by channel 1 exceeds the range of inputs that the hardware can receive.	Run: blinking Stop: OFF	Blinking
16#1809	The signal received by channel 2 exceeds the range of inputs that the hardware can receive.		
16#180A	The signal received by channel 3 exceeds the range of inputs that the hardware can receive.		
16#180B	The signal received by channel 4 exceeds the range of inputs that the hardware can receive.		
16#180C	The signal received by channel 5 exceeds the range of inputs that the hardware can receive.		
16#180D	The signal received by channel 6 exceeds the range of inputs that the hardware can receive.		
16#180E	The signal received by channel 7 exceeds the range of inputs that the hardware can receive.		
16#180F	The signal received by channel 8 exceeds the range of inputs that the hardware can receive.		
-	When power-on, the module is not detected by CPU module.	OFF	Blinking once or twice and after 2 seconds, it blinks repeatedly

3

3.5.2 Troubleshooting Procedure

Description	Procedure
The external voltage is abnormal.	Ensure the external 24 V power supply to the module is functioning normally.
Hardware failure	Return the module to the factory for repair.
Internal error The factory calibration is abnormal.	Contact the factory.
The signal received by channel 1 exceeds the range of inputs that the hardware can receive.	Check the signal received by channel 1
The signal received by channel 2 exceeds the range of inputs that the hardware can receive.	Check the signal received by channel 2.
The signal received by channel 3 exceeds the range of inputs that the hardware can receive.	Check the signal received by channel 3.
The signal received by channel 4 exceeds the range of inputs that the hardware can receive.	Check the signal received by channel 4.
The signal received by channel 5 exceeds the range of inputs that the hardware can receive.	Check the signal received by channel 5.
The signal received by channel 6 exceeds the range of inputs that the hardware can receive.	Check the signal received by channel 6.
The signal received by channel 7 exceeds the range of inputs that the hardware can receive.	Check the signal received by channel 7.
The signal received by channel 8 exceeds the range of inputs that the hardware can receive.	Check the signal received by channel 8.
When power-on, the module is not detected by CPU module.	Check if the connection between module and CPU module is working. If not, connect again.

4

Chapter 4 Analog Output Module AS04DA

Table of Contents

4.1 Overview

An analog output module receives four 12-bit blocks of digital data from a CPU module. The module converts the digital data into analog signals (voltage or current).

4.1.1 Characteristics

(1) **Select a module based on its practical application.**

AS04DA-A: Has four channels. A channel can send either voltage or current output.

(2) **High-speed conversion**

Digital signals are converted to analog signals at a rate of 2 ms per channel.

(3) **High accuracy**

Conversion accuracy: The error range for both voltage output and current output is ±0.2% at ambient temperature of 25° C.

(4) **Use the utility software to configure the module.**

The HWCONFIG utility software is built into ISPSoft. You can set modes and parameters directly in HWCONFIG without spending time writing programs to set registers to manage functions.

4.2 Specifications and Functions

4.2.1 Specifications

- **Electrical specifications**

Module Name	**AS04DA-A**
Number of Outputs	4
Digital-to-Analog Conversion	Voltage input/Current input
Supply Voltage	24 VDC (20.4 VDC–28.8 VDC) (-15% to +20%)
Connector Type	Removable terminal block
Conversion Time	2 ms/channel
Isolation	An analog circuit is isolated from a digital circuit by a digital integrated circuit/ optocoupler, but the analog channels are not isolated from one another. Isolation between a digital circuit and a ground: 500 VDC Isolation between an analog circuit and a ground: 500 VDC Isolation between an analog circuit and a digital circuit: 500 VDC Isolation between the 24 VDC and a ground: 500 VDC
Weight	145 g

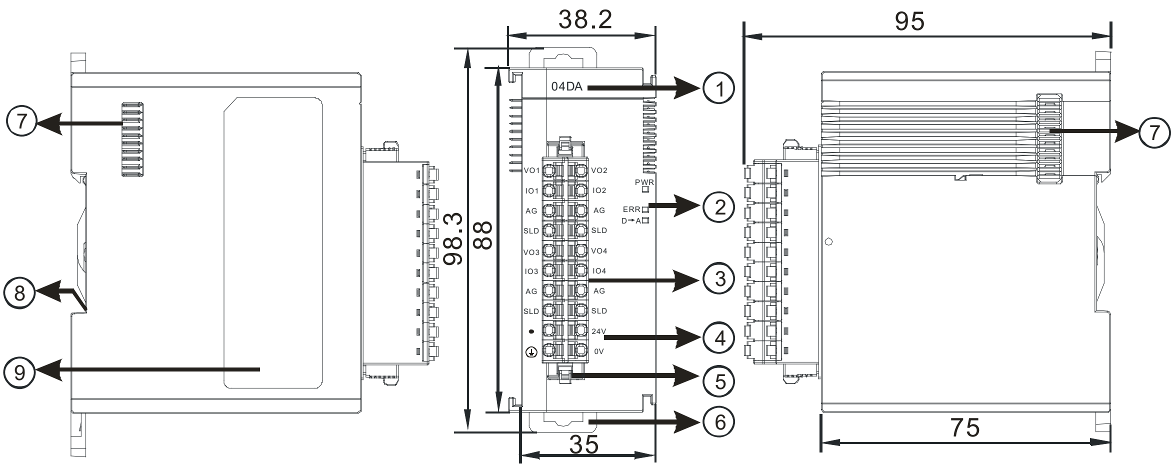
- **Functional specifications**

Digital-to-Analog Conversion	**Voltage Output**				
Rated Output Range	±10 V	0 V~10 V	±5 V	0 V~5 V	1 V~5 V
Conversion Range	K-32000 ~ K32000	K0~K32000	K-32000 ~ K32000	K0 ~ K32000	K0 ~ K32000
Hardware Output Range	-10.1V~10.1V	-0.1V~10.1V	-5.05V~5.05V	-0.05V~5.05V	0.95V~5.05V
Error Rate (Room Temperature)	±0.2%				
Error Rate (Full Temperature Range)	±0. 5%				
Linearity error (Room Temperature)	±0.05%				
Linearity error (Full Temperature Range)	±0.05%				
Hardware Resolution	12 bits				

Digital-to-Analog Conversion	Voltage Output	
Output Impedance	≧1 kΩ	≧500 Ω

Digital-to-Analog Conversion	Current Output	
Rated Output Range	0 mA–20 mA	4 mA–20 mA
Conversion Range	K0 ~ K32000	
Hardware Output Range	-0.2 mA to +20.2 mA	3.8 mA–20.2 mA
Error Rate (Room Temperature)	±0.2%	
Error Rate (Full Temperature Range)	±0.5%	
Linearity Error (Room Temperature)	±0.03%	
Linearity error (Full Temperature Range)	±0.03%	
Hardware Resolution	12 bits	
Output Impedance	≦550 Ω	

4.2.2 Profile

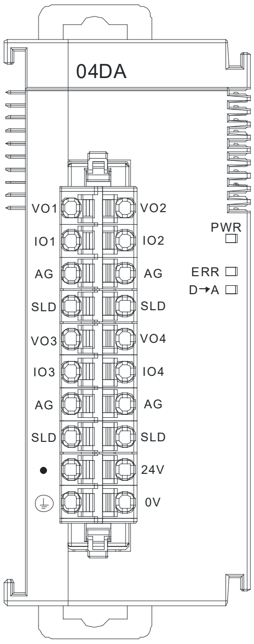


unit: mm

Number	Name	Description
1	Model Name	Model name of the module
2	POWER LED Indicator	Status of the power supply ON: the power is on. OFF: the power is off.
	ERROR LED Indicator	Error status of the module ON: a serious error exists in the module. OFF: the module is operating normally. Blinking: a minor error exists in the module.
	Digital-to-Analog conversion Indicator	Digital-to-Analog conversion status Blinking: conversion is in process. OFF: conversion has stopped.
3	Removable Terminal Block	Outputs are connected to loads to be driven.
4	Arrangement of the Input/Output Terminals	Arrangement of the terminals
5	Terminal Block Clip	For removing the terminal block
6	DIN Rail Clip	Secures the module onto the DIN rail
7	Module Connecting Set	Connects the modules
8	Ground Clip	
9	Label	Nameplate

4.2.3 Arrangement of Terminals

AS04DA-A



4.2.4 Control Registers

*If you use HWCONFIG to set values in CRs, once the set value is downloaded, the values can be retained in the module; however if you use TO instruction to write data into CRs, the values CANNOT be retained, after power failure or after transition of the CPU from STOP to RUN.

Note: The attribute of the CR must be W (write) to use TO instruction.

CR#	Name	Description	Atr.	Defaults
0	Format Setup	0: integer format 1: floating-point format	R	0
1	Channel 1 mode setup	0: closed 1: -10 V to +10 V (default)	R/W	1
2	Channel 2 mode setup	2: 0 V–10 V 3: -5 V to +5 V	R/W	
3	Channel 3 mode setup	4: 0 V–5 V 5: 1 V–5 V	R/W	
4	Channel 4 mode setup	6: 0 mA–20 mA 7: 4 mA–20 mA	R/W	
5	Channel 1 offset	Range: -32768 to +32767	R/W	0

CR#	Name	Description	Atr.	Defaults
6	Channel 2 offset			
7	Channel 3 offset			
8	Channel 4 offset			
9	Channel 1 gain	Range: -32768 to +32767	R/W	1000
10	Channel 2 gain			
11	Channel 3 gain			
12	Channel 4 gain			
13	Retaining an output sent by channel 1	0: when the PLC stops, the value of the analog output is reset to 0. 1: when the PLC stops, the value of the analog output is retained.	R/W	0
14	Retaining an output sent by channel 2			
15	Retaining an output sent by channel 3			
16	Retaining an output sent by channel 4			
17	Refreshing the time for an output sent by channel 1	Range: 10–3200 (100 ms–32000 ms) Unit: 10 ms Any value less than 10 is processed as 0. Any value larger than 3200 is processed as 3200. Set the value to 0 to disable this function.	R/W	0
18	Refreshing the time for an output sent by channel 2			0
19	Refreshing the time for an output sent by channel 3			0
20	Refreshing the time for an output sent by channel 4			0
21	The minimum scale range for channel 1	When the format is set to integer in HWCONFIG, the scale range is invalid. For analog-digital modules, it is much more convenient if the system can convert digital values to floating-point values for earier understanding. Here you can set the minimum and maximum scale ranges of corresponding floating-point values for channels.	R	-10.0
22			R	
23	The minimum scale range for channel 2		R	-10.0
24			R	
25	The minimum scale range for channel 3		R	-10.0
26			R	
27	The minimum scale		R	-10.0

CR#	Name	Description	Atr.	Defaults
28	range for channel 4	For example, if the scale range for an analog to digital input channel is ±10.0 V, it indicates the maximum value is +10.0 V and the minimum value is -10.0 V. If the scale range for an analog to digital input channel is 4 mA ~ 20 mA. It indicates the maximum value is 20 mA and the minimum value is 4 mA. Note: You can use PLC instruction DSCLP (API0217) and set SM685 to ON to use floating-point operations when a conversion range needs to edit.	R	
29	The maximum scale range for channel 1		R	10.0
30			R	
31	The maximum scale range for channel 2		R	10.0
32			R	
33	The maximum scale range for channel 3		R	10.0
34			R	
35	The maximum scale range for channel 4		R	10.0
36			R	
37	Channel alarm setup	0: warning 1: alarm bit0: error in the power supply bit1: error in the module hardware bit2: error in calibration	R/W	0

4.2.5 Functions

Item	Function	Description
1	Enable/Disable a Channel	1. Enable or disable a channel. 2. If a channel is disabled, the total conversion time decreases.
2	Calibration	Calibrate a linear curve.
3	Retain an Output	When a module stops running, the system can retain the signal sent by the module.
4	Refresh Time for an Output	Refresh the analog output value according to the value of the fixed slope.
5	Scale Range	You can set the scale range when the format is floating-point.

1. Enable/Disable a Channel

An analog signal is converted into a digital signal at a rate of 2 ms per channel. The total conversion time is 2 ms X (the number of channels). If a channel is not used, you can disable it to decrease the total conversion time.

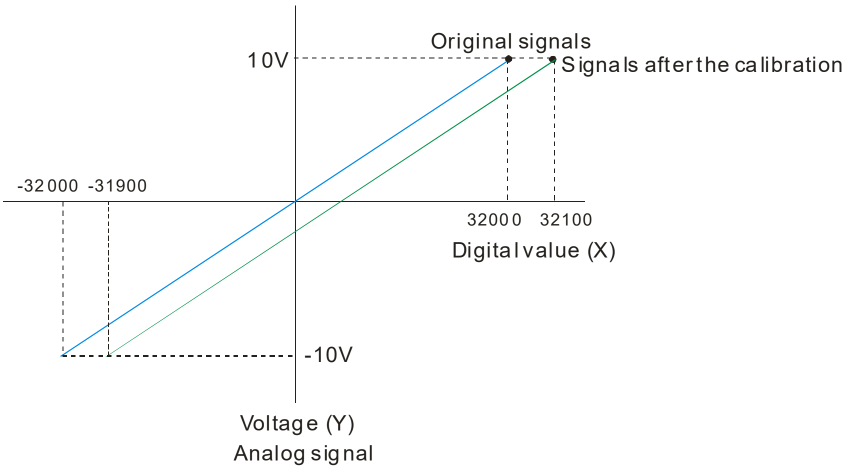
2. Calibration

To make a curve meet specific needs, calibrate the curve by changing the offset and the gain. The calibration range depends on the range of inputs that the hardware can receive. The formula is:

$$Output = \frac{(Input \times Gain)}{1000} + Offset$$

Example:

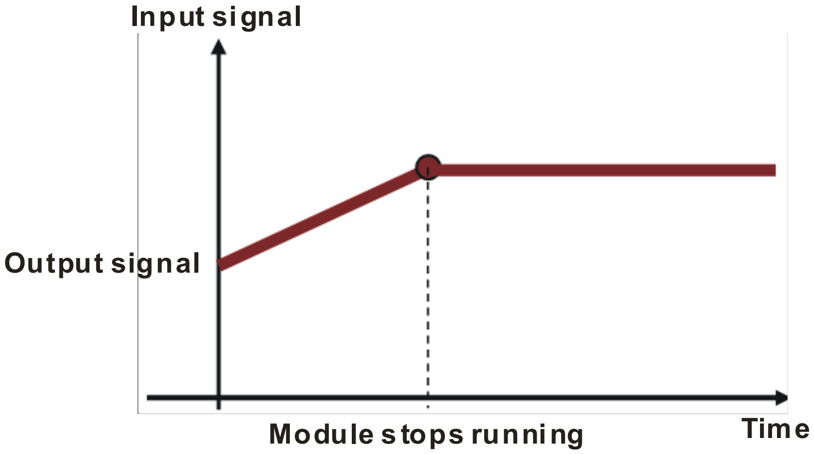
A channel receives voltage inputs between -10.0 V to +10.0 V. The gain is 1000, and the offset is 0. The corresponding value for the original signal -10.0 V to +10.0 V is -32000 to +32000. If you change the offset to -100, the calibrated value for the original signal -10.0 V to +10.0 V becomes -31900 to +32100.



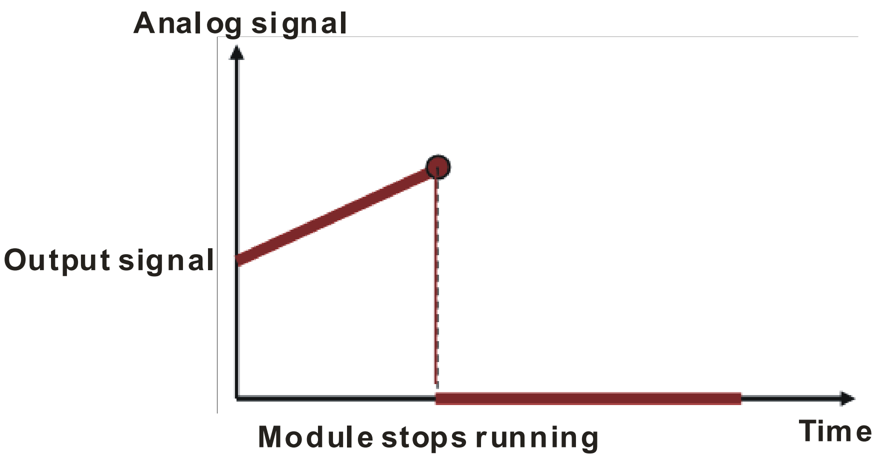
3. Retain an Output

When a module stops running, the system can retain the signal sent by the module.

The output is retained:

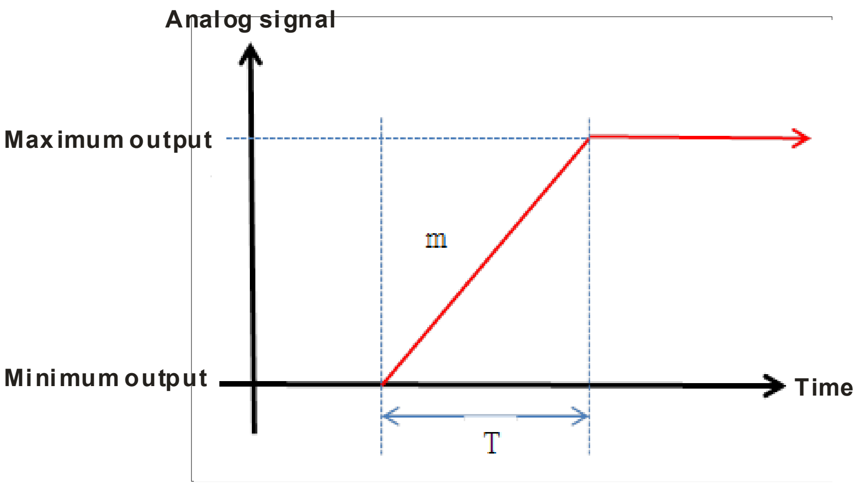


The output is not retained:

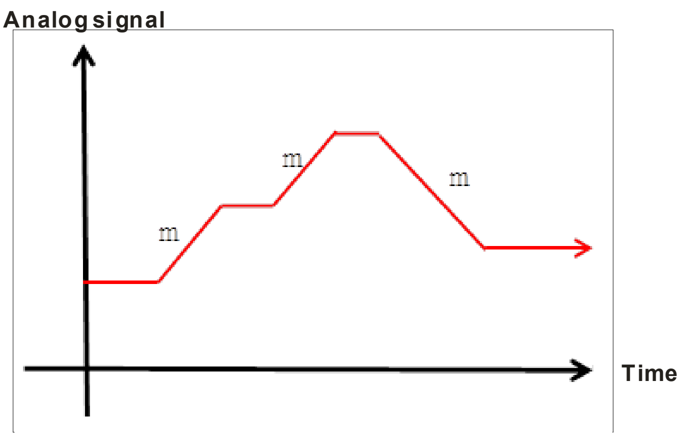


4. Refresh time for an Output

Set the refresh time for an output and the system updates the value of the slope (m) accordingly.

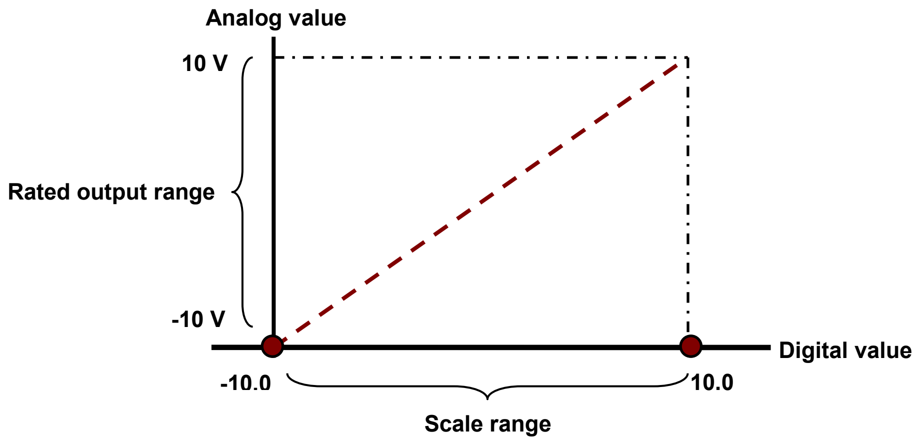


When the analog output signal changes, the system updates the value of the analog output according to the value set in the slope, as shown in the image below.



5. **Scale Range**

You can set the scale range when the format is floating-point. The analog output mode of a channel has a corresponding digital range. Digital values correspond to analog outputs sent by the module. For example, if the analog range is -10 V to +10 V, the digital range is -10.0 to +10.0, the HSP scale is 10.0, and the LSP scale is -10.0. The digital values -10.0 to +10.0 correspond to the analog values -10 V to +10 V, as the example below shows.



4.2.6 Wiring

- **Precautions**

To ensure the digital-to-analog module functions well and reliably, the external wiring must prevent noise.

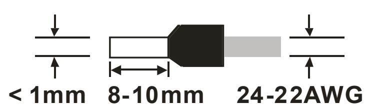
(1) To prevent a surge and induction, the AC cable and the output signal cables that are connected to the AS04DA-A must be separate cables.

(2) Do not install or bound the cable to a main circuit, a high-voltage cable, or a cable connected to a load that is not a PLC.

(3) Ground shielded cables and hermetically sealed cables separately.

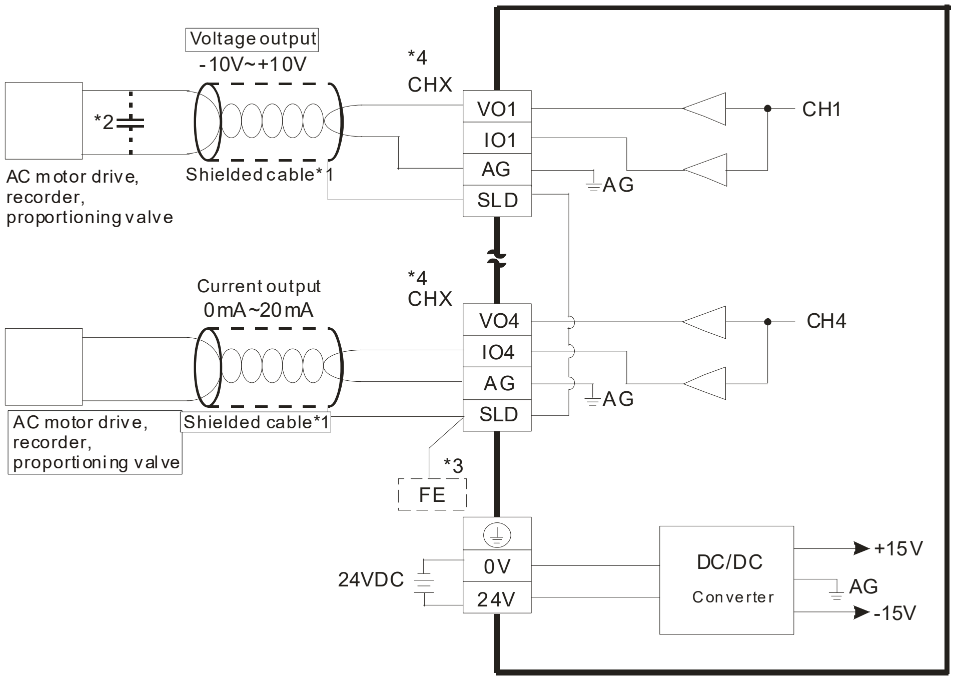
(4) Terminals with insulation sleeves cannot be arranged as a terminal block, so you should cover the terminals with insulation tubes.

(5) Connect 24 to 22 AWG (1 mm) wires to the input/output terminals. The plastic jackets that are removed from the cables should be 8 mm to 10 mm long. The specifications for the terminals and the wiring of the terminals are shown below. Use only copper leads that can resist temperatures above 60° C /75° C.



(6) Note: use cables with the same length (less than 200 m) and use wire resistance of less than 100 ohm.

- **External wiring**



*1. Use shielded cables to isolate the analog input signal cable from other power cables.

*2. If variability in the input voltage results in interference within the wiring, connect the module to a capacitor having a capacitance between 0.1–0.47 µF and a working voltage of 25 V.

*3. Connect the SLD to FE, and connect both the FE and the terminal ⏚ to the ground terminal.

*4. Every channel can operate with the wiring presented above.

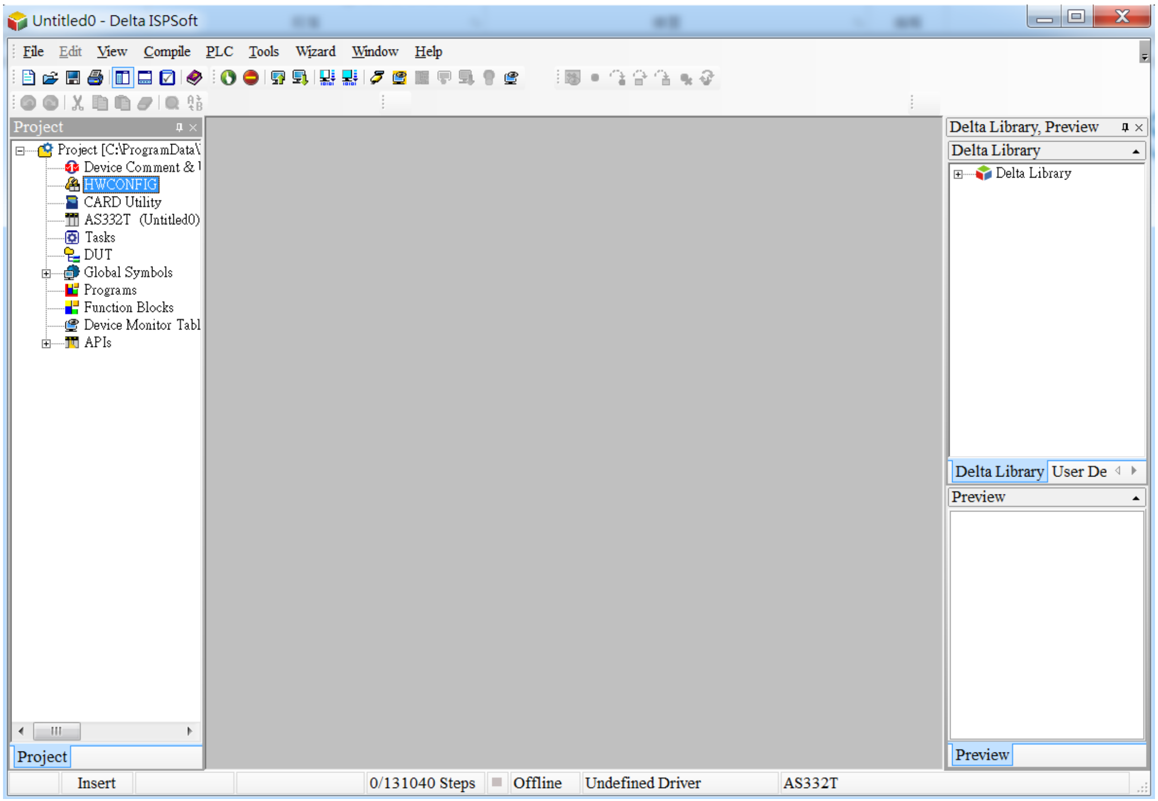
4.2.7 LED Indicators

Number	Name	Description
1	RUN LED Indicator	Operating status of the module ON: the module is running. OFF: the module is not running.
2	ERROR LED Indicator	Error status of the module ON: a serious error exists in the module. OFF: the module is operating normally. Blink: a minor error exists in the module.
3	Digital to Analog Conversion Indicator	Digital-to-analog conversion status Blinking: conversion is in process. OFF: conversion has stopped.

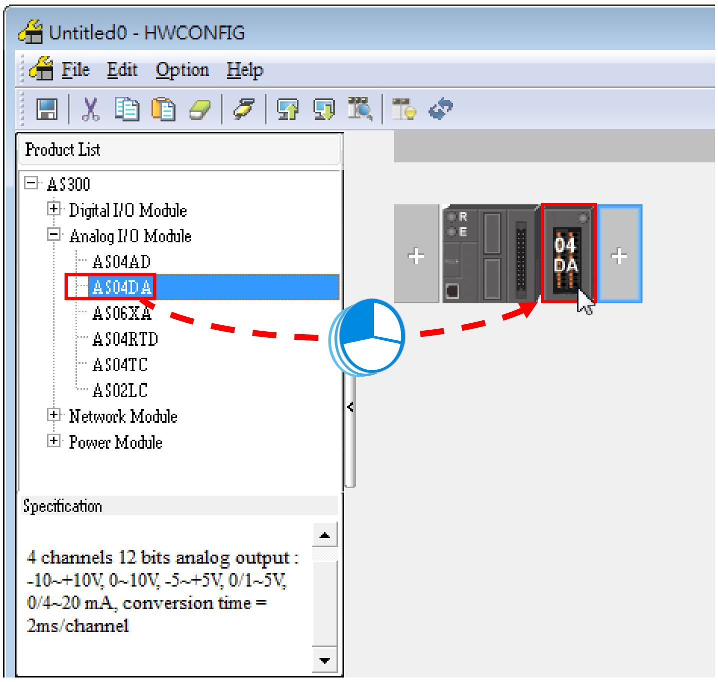
4.3 HWCONFIG in ISPSoft

4.3.1 Initial Setting

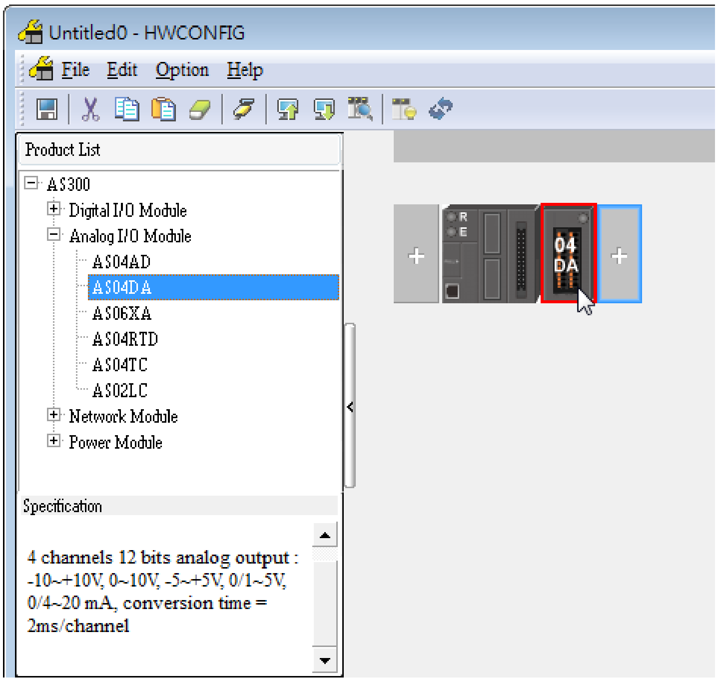
(1) Start ISPSoft and double-click **HWCONFIG**.

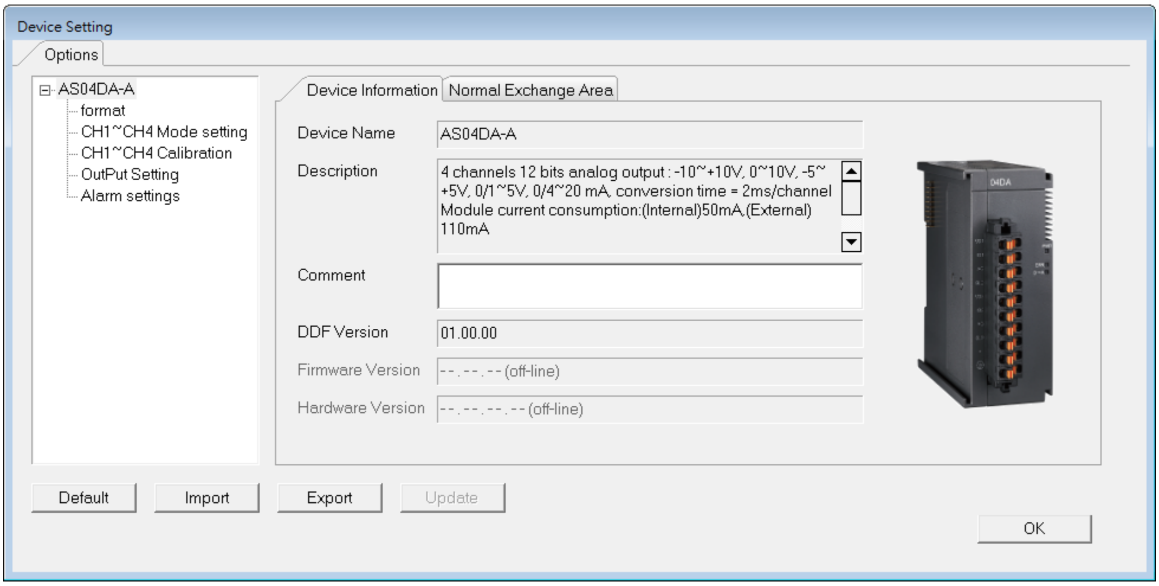


(2) Select a module and drag it to the working area.



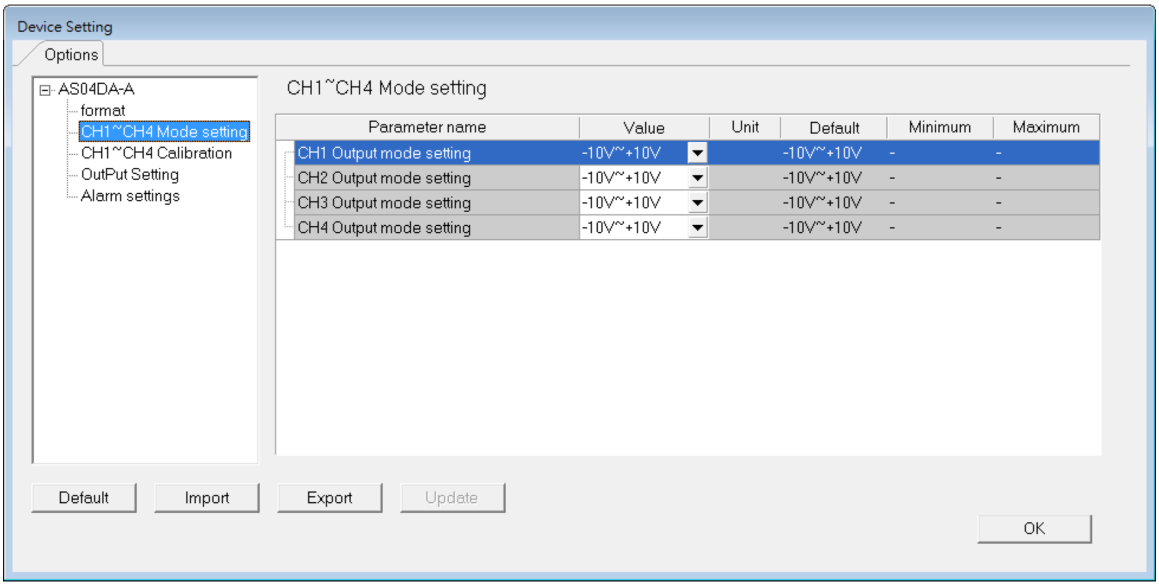
(3) Double-click the module in the working area to open the Device Setting page.



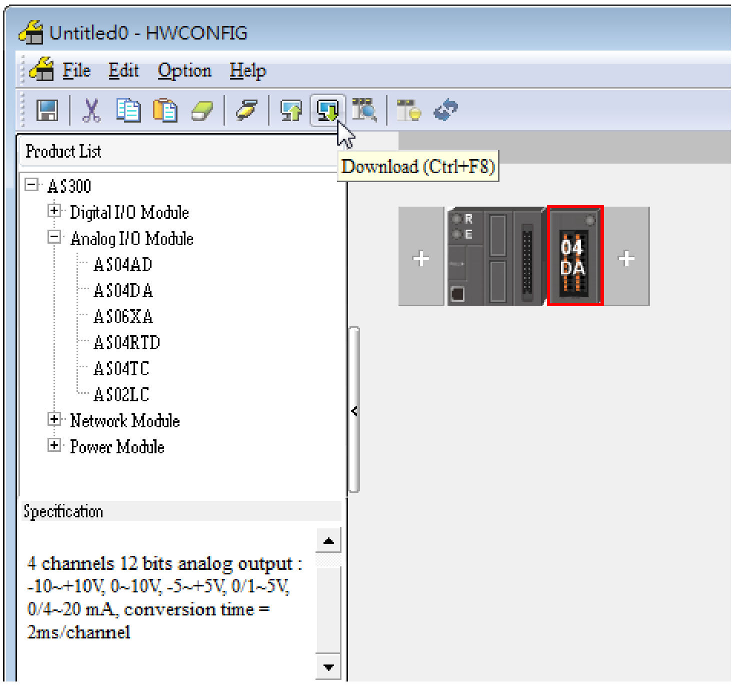


4

(4) Choose a parameter, set the values, and click **OK**.

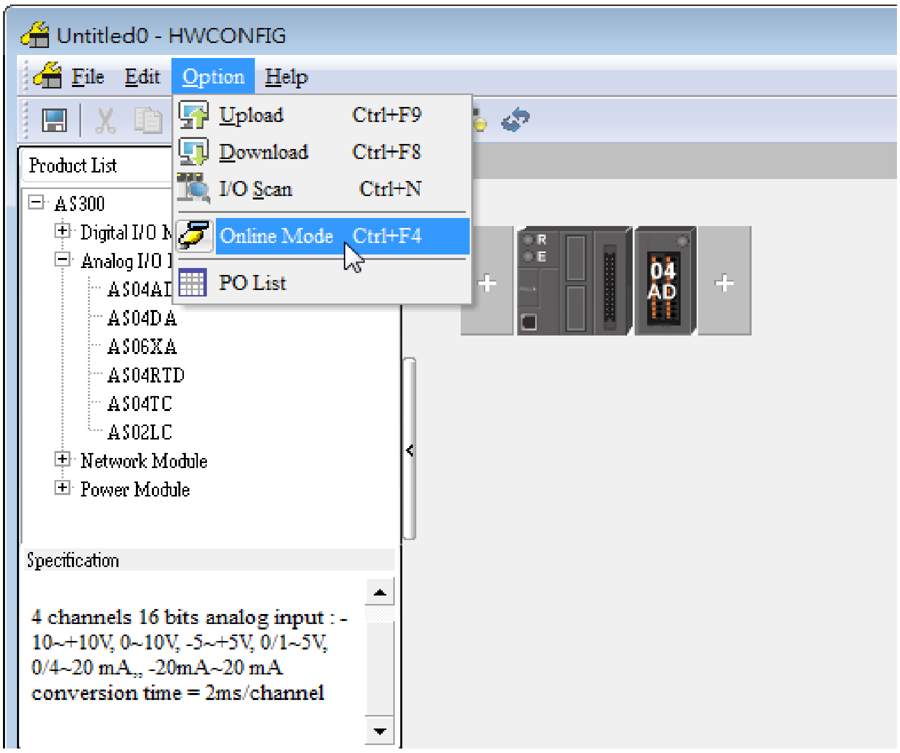


(5) Click **Download** on the toolbar to download the parameters. Note you cannot download the parameters cannot be downloaded.

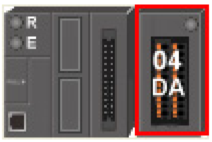


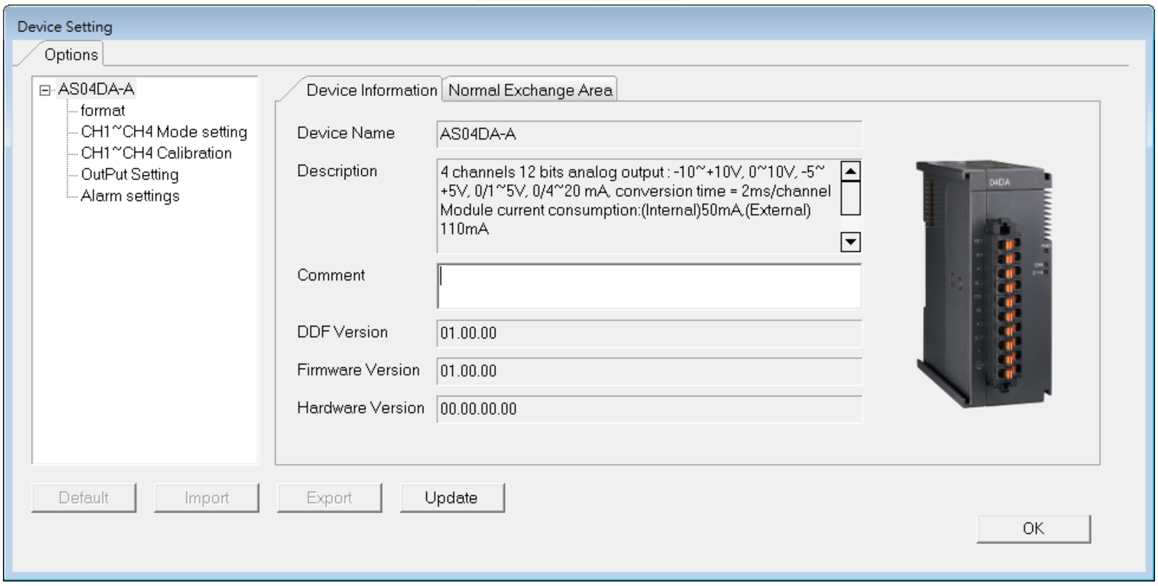
4.3.2 Checking the Version of a Module

(1) On the **Option** menu, click **Online Mode**.



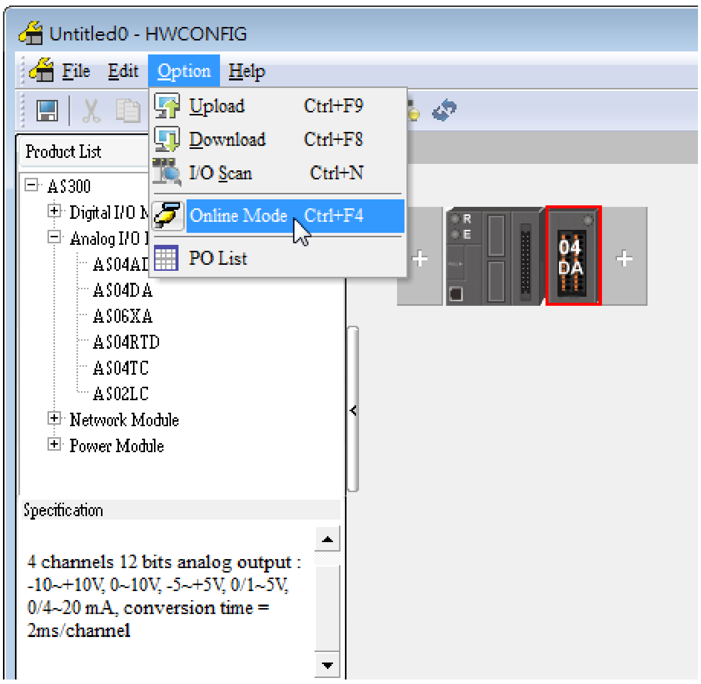
(2) Double-click the module to open the Device Setting page. The versions of both the firmware and the hardware are displayed.



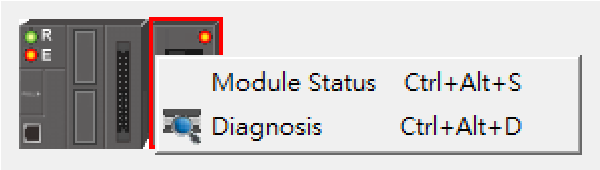


4.3.3 Online Mode

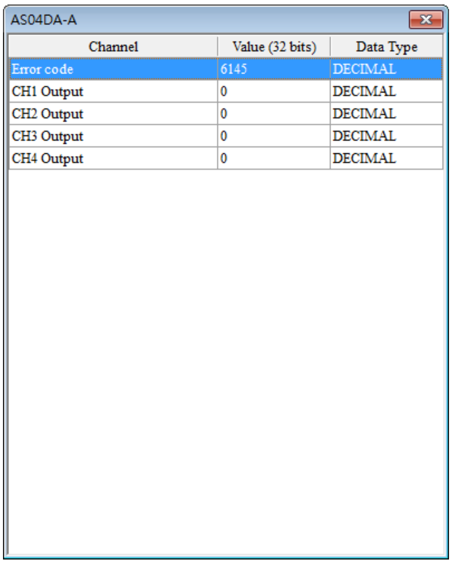
(1) On the **Option** menu, click **Online Mode**.



(2) Right-click the module and click on **Module Status**.



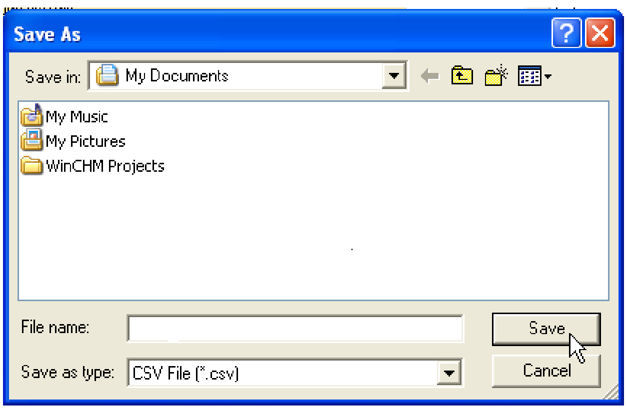
(3) View the module status.


AS04DA-A

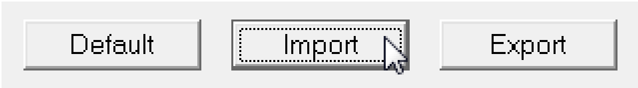
Channel	Value (32 bits)	Data Type
Error code	6145	DECIMAL
CH1 Output	0	DECIMAL
CH2 Output	0	DECIMAL
CH3 Output	0	DECIMAL
CH4 Output	0	DECIMAL

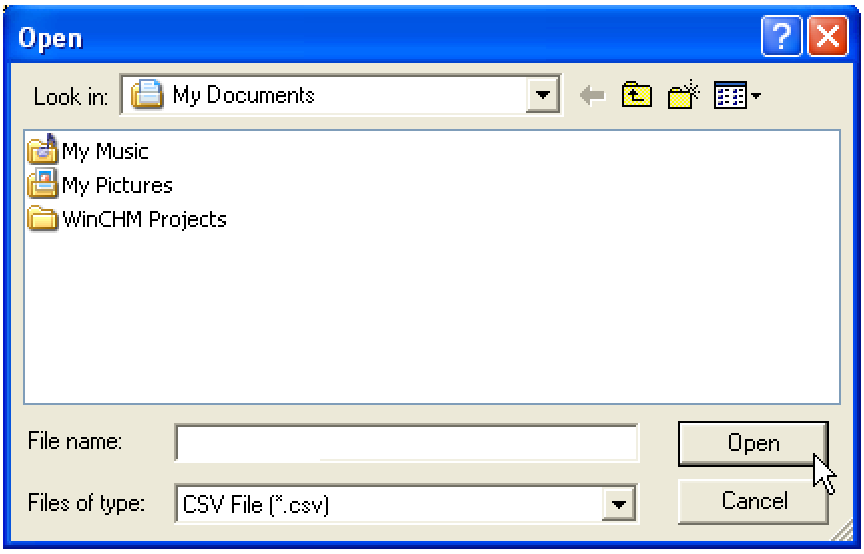
4.3.4 Importing/Exporting a Parameter File

(1) Click **Export** in the Device Settings dialog box to save the current parameters as a CSV file (.csv).



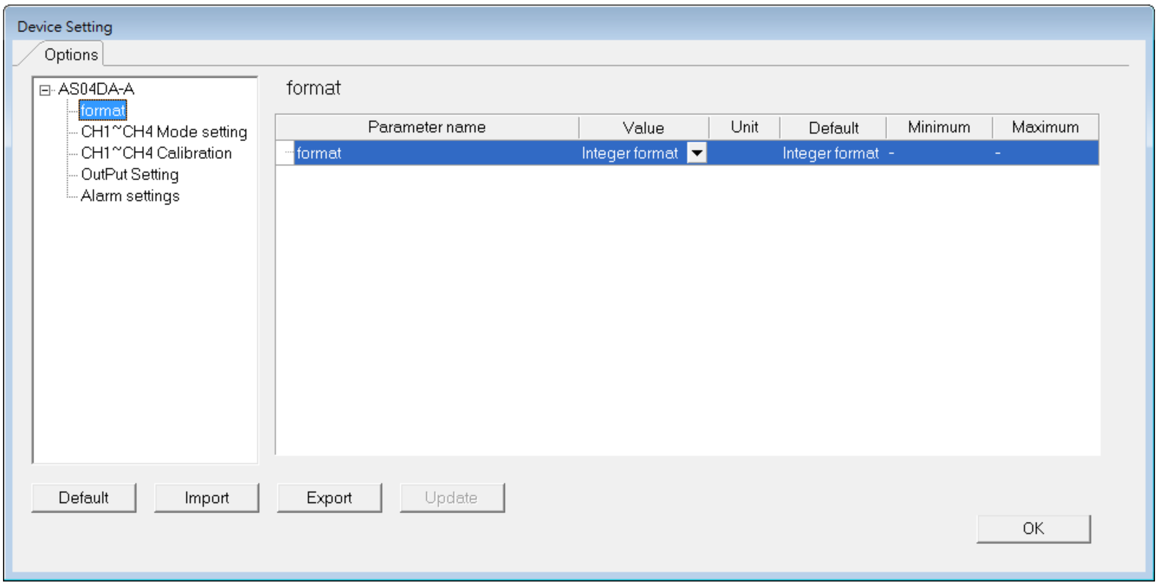
(2) Click **Import** in the Device Settings dialog box and select a CSV file to import save parameters.



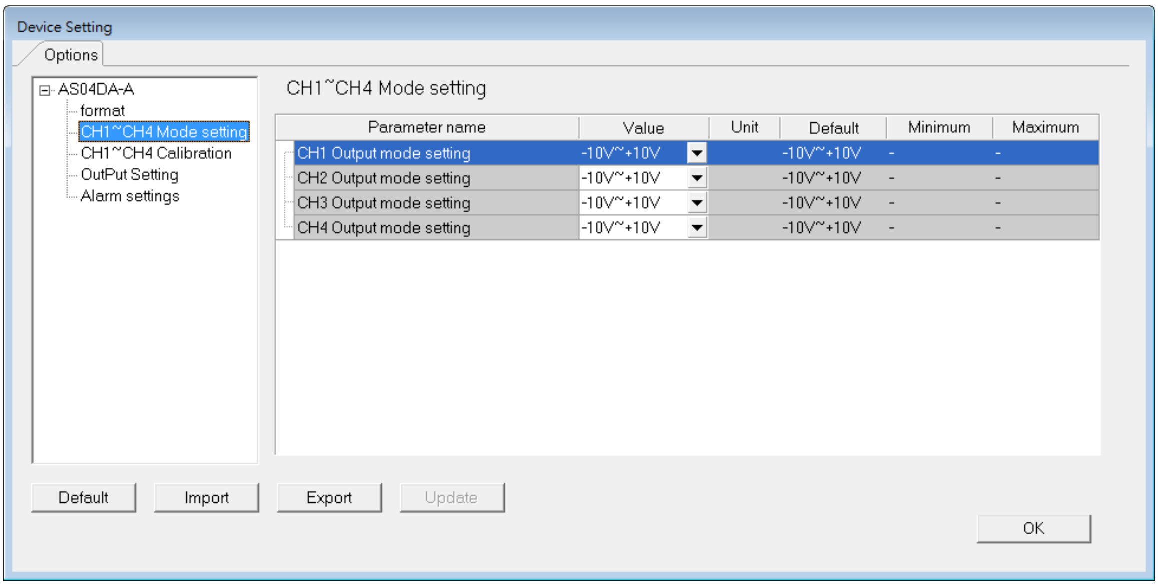


4.3.5 Parameters

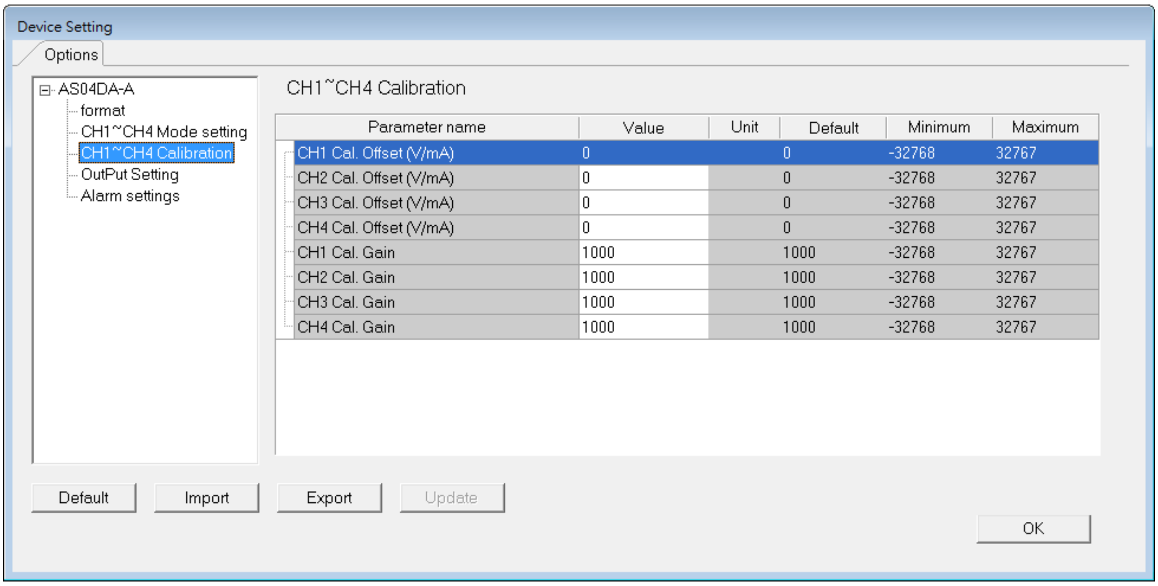
(1) The output formats of the channels



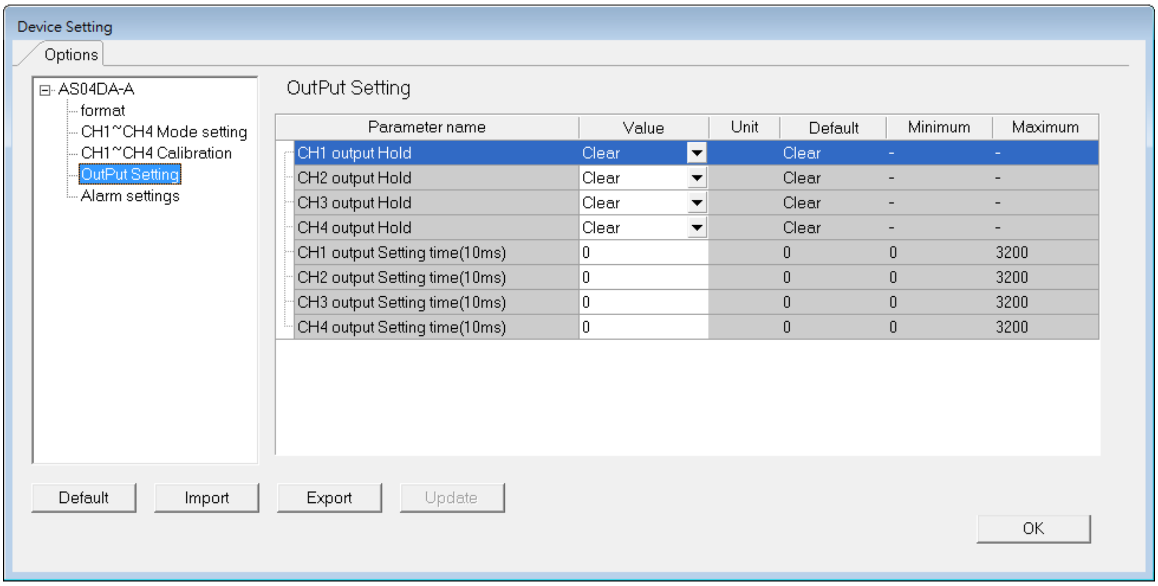
(2) The CH1–CH4 (channel 1–channel 4) mode settings



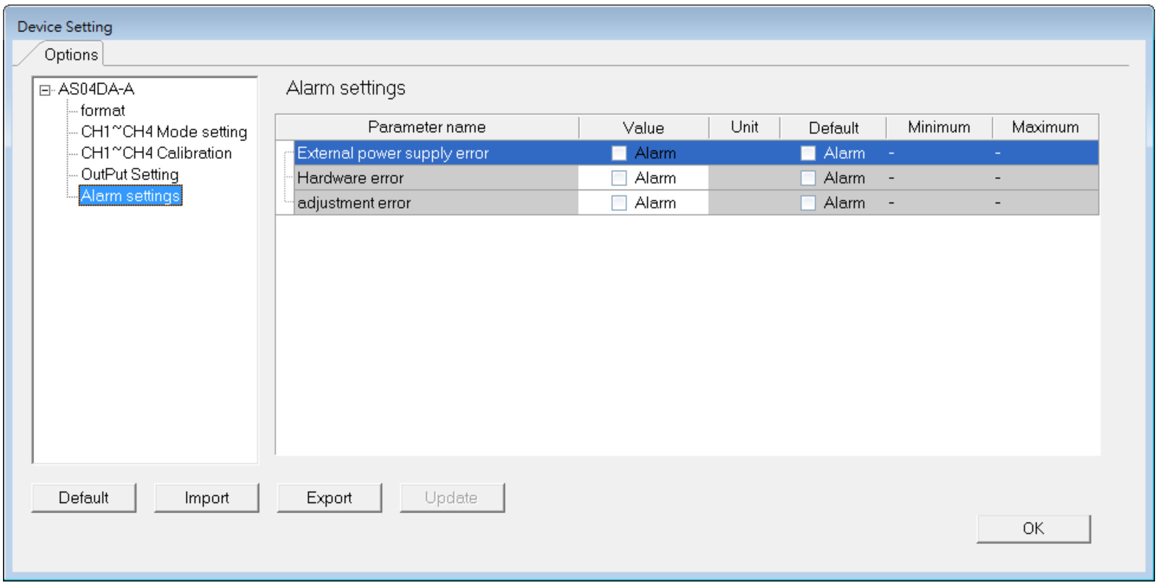
(3) The CH1–CH4 calibration settings



(4) The output settings



(5) The alarm settings

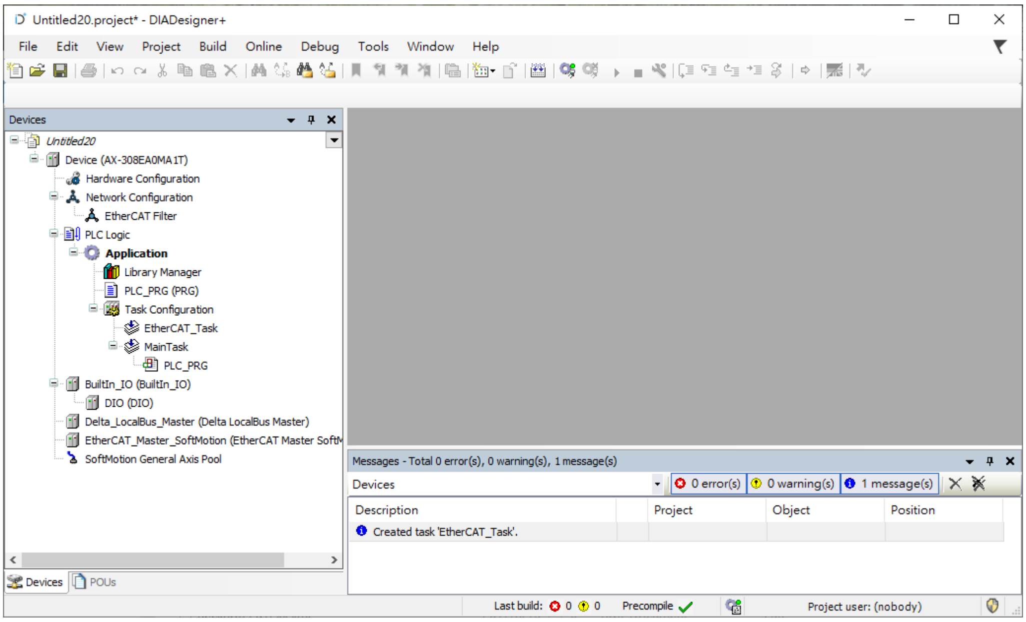


4.4 DIADesigner+ (Hardware Configuration)

The following example uses AS04DA-A.

4.4.1 Initial Setting

(1) Start DIADesigner+, click **New Project**, and then **Project+Device** to create a new project.

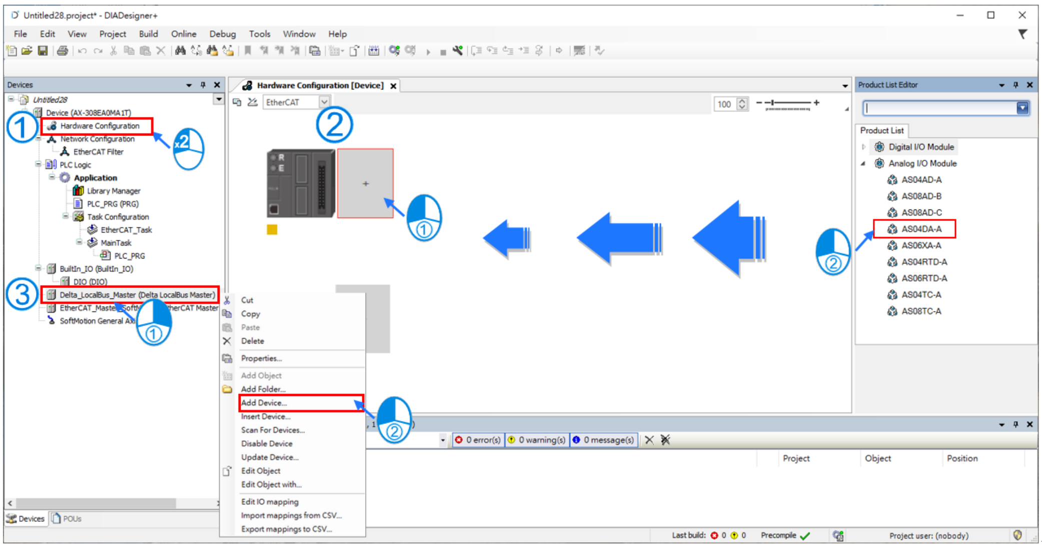


(2) Add modules in:

① Double-click **Hardware Configuration**

② Select the **+ section** and drag and drop the module that you want to add from the Product List to the + section.

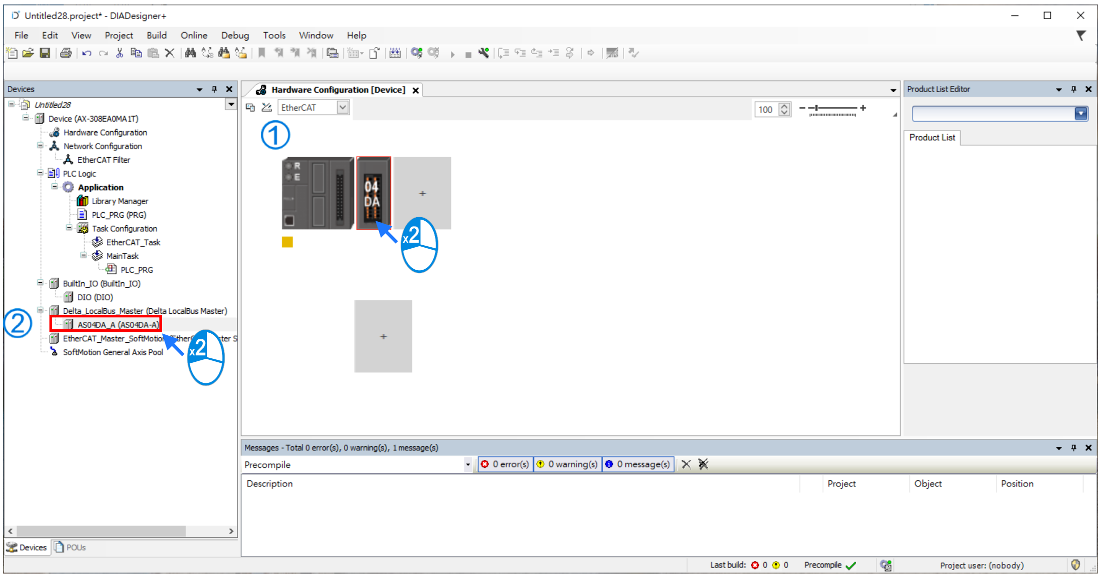
or ③ Right-click **Delta_Localbus Master** to see the context meun and then double-click **Add Device** to add devices manually or double-click **Scan for Devices**.



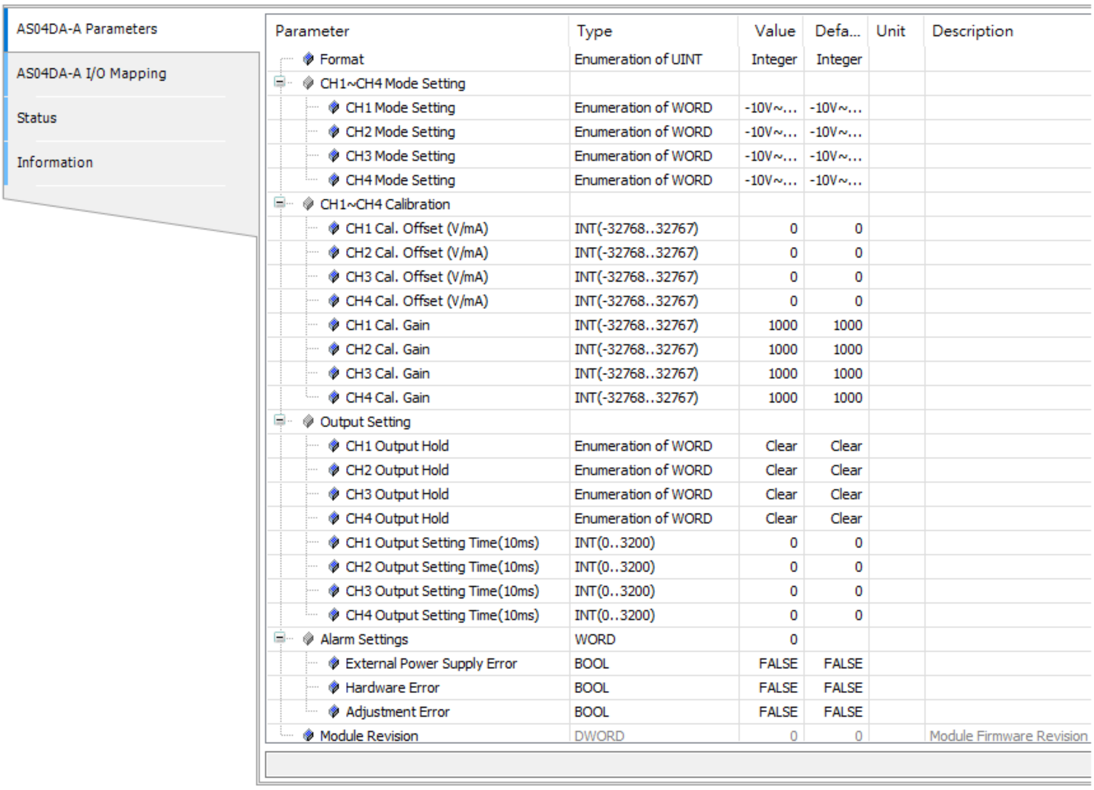
(3) Select modules:

① Double-click the module name in the **Hardware Configuration** area.

or ② Double-click the module name shown in the node.

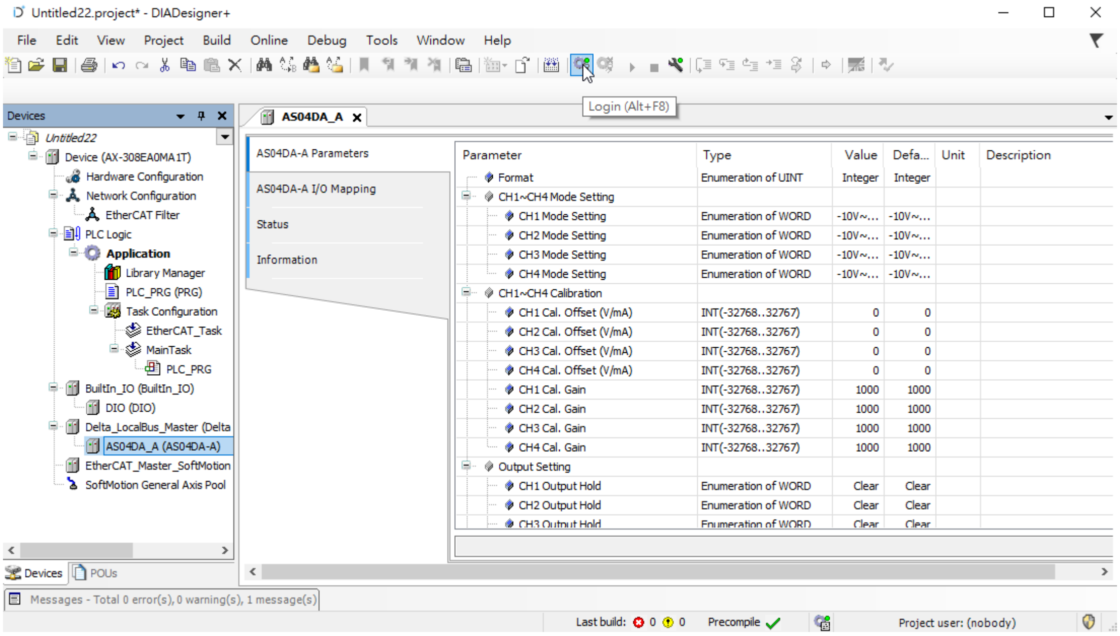


(4) Module parameter setting page:



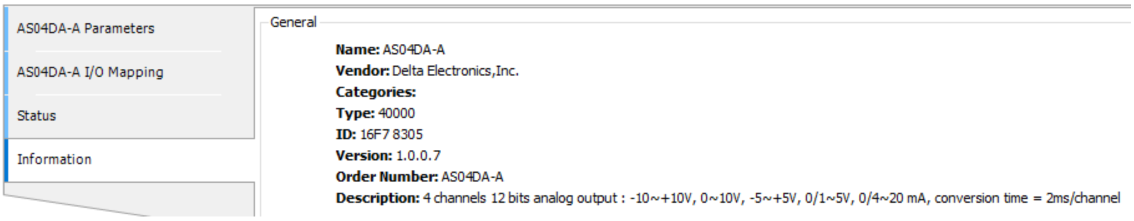
Parameter	Type	Value	Defa...	Unit	Description
Format	Enumeration of UINT	Integer	Integer		
CH1~CH4 Mode Setting					
CH1 Mode Setting	Enumeration of WORD	-10V~...	-10V~...		
CH2 Mode Setting	Enumeration of WORD	-10V~...	-10V~...		
CH3 Mode Setting	Enumeration of WORD	-10V~...	-10V~...		
CH4 Mode Setting	Enumeration of WORD	-10V~...	-10V~...		
CH1~CH4 Calibration					
CH1 Cal. Offset (V/mA)	INT(-32768..32767)	0	0		
CH2 Cal. Offset (V/mA)	INT(-32768..32767)	0	0		
CH3 Cal. Offset (V/mA)	INT(-32768..32767)	0	0		
CH4 Cal. Offset (V/mA)	INT(-32768..32767)	0	0		
CH1 Cal. Gain	INT(-32768..32767)	1000	1000		
CH2 Cal. Gain	INT(-32768..32767)	1000	1000		
CH3 Cal. Gain	INT(-32768..32767)	1000	1000		
CH4 Cal. Gain	INT(-32768..32767)	1000	1000		
Output Setting					
CH1 Output Hold	Enumeration of WORD	Clear	Clear		
CH2 Output Hold	Enumeration of WORD	Clear	Clear		
CH3 Output Hold	Enumeration of WORD	Clear	Clear		
CH4 Output Hold	Enumeration of WORD	Clear	Clear		
CH1 Output Setting Time(10ms)	INT(0..3200)	0	0		
CH2 Output Setting Time(10ms)	INT(0..3200)	0	0		
CH3 Output Setting Time(10ms)	INT(0..3200)	0	0		
CH4 Output Setting Time(10ms)	INT(0..3200)	0	0		
Alarm Settings	WORD	0			
External Power Supply Error	BOOL	FALSE	FALSE		
Hardware Error	BOOL	FALSE	FALSE		
Adjustment Error	BOOL	FALSE	FALSE		
Module Revision	DWORD	0	0		Module Firmware Revision

(5) After setting is complete, select the module and click **Login** on the tool bar to download the settings to the modules.

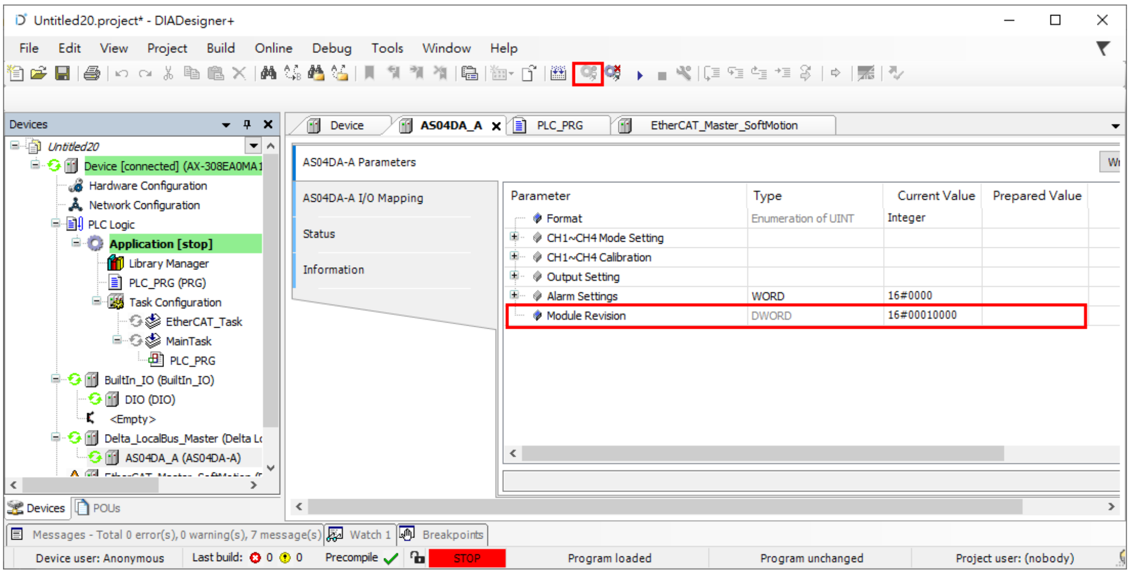


4.4.2 Checking the Version of a Module

(1) Select the module and click the Information tab to see the module information.

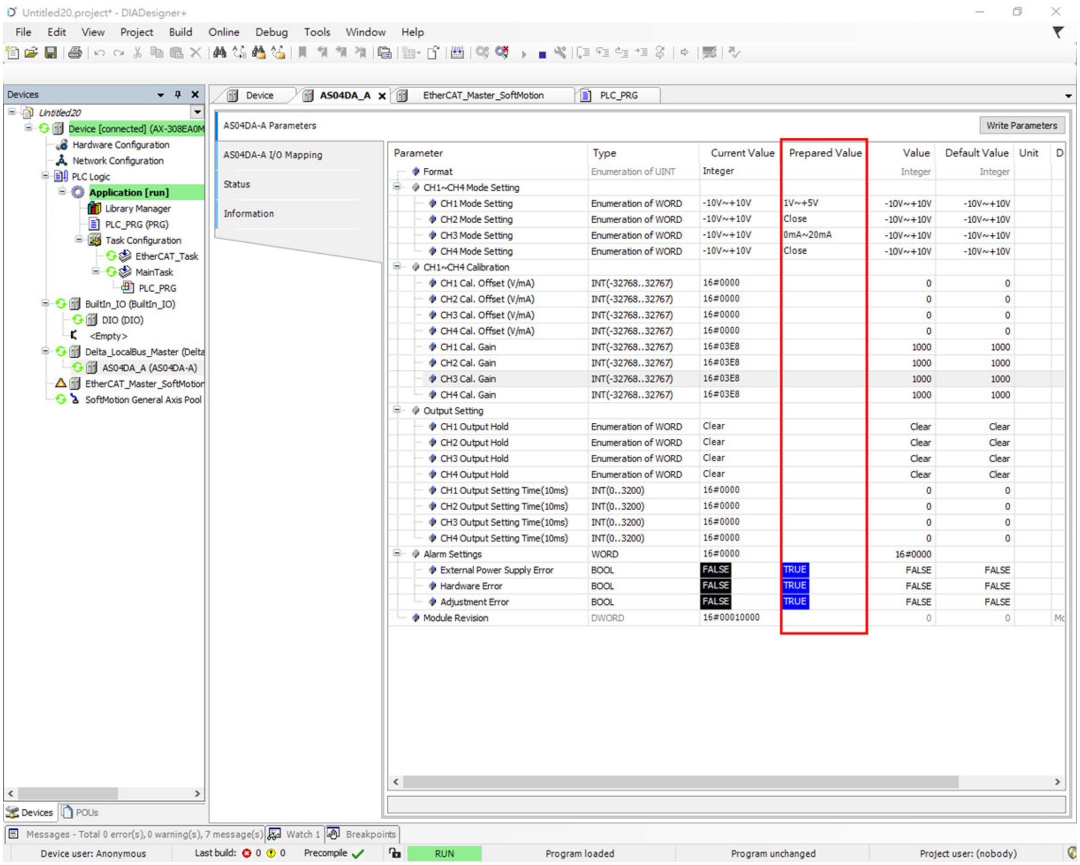


(2) Select the module and click **Login** on the tool bar to go to Online Mode. You can find the Module Revision from the Parameters tab.

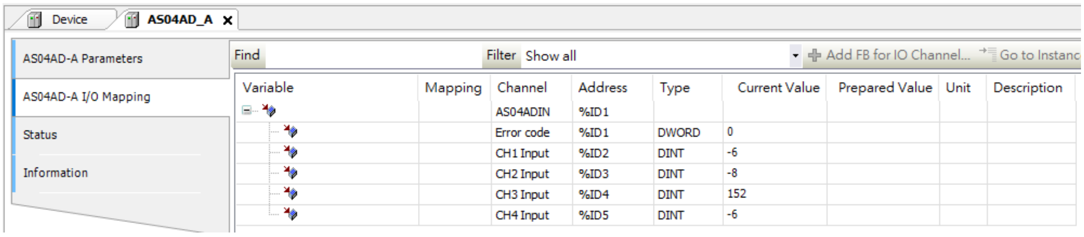


4.4.3 Online Mode

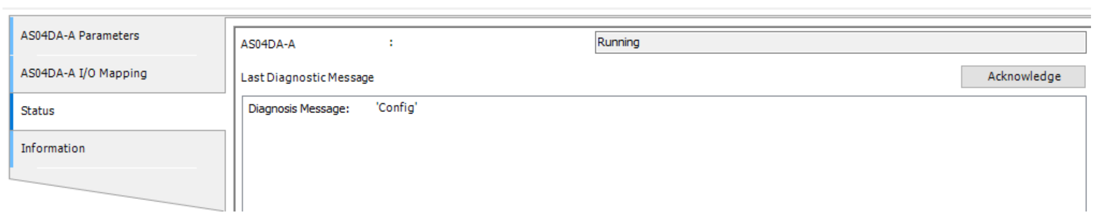
(1) Select the module and click **Login** on the tool bar to go to **Online Mode**. You can monitor all configuration parameters. Vaules in the column of Prepared Value are configurable online. After editing the values in the Prepared Value column, click **Write Parameter** to confirm the change.



(2) You can monitor the values, status, error codes in each channel from the I/O Mapping tab. You can also set a new value in the colum of Prepared Value and press Ctrol+F7 on the keyboard to write the new values in.



(3) You can monitor the current status and error codes from the Status tab.



4.4.4 Parameters

(1) You can set up the value format to **Integer** or **Floating** for Channel 1 to 4.

Parameter	Type	Value	Default Value	Unit	Description
Format	Enumeration of UINT	Integer (Integer / Floating)	Integer		
CH1~CH4 Mode Setting					
CH1 Mode Setting	Enumeration of WORD	-10V~+10V	-10V~+10V		
CH2 Mode Setting	Enumeration of WORD	-10V~+10V	-10V~+10V		
CH3 Mode Setting	Enumeration of WORD	-10V~+10V	-10V~+10V		
CH4 Mode Setting	Enumeration of WORD	-10V~+10V	-10V~+10V		

(2) You can set up the values for Channel 1 to 4.

Parameter	Type	Value	Default Value	Unit	Description
Format	Enumeration of UINT	Integer	Integer		
CH1~CH4 Mode Setting					
CH1 Mode Setting	Enumeration of WORD	-10V~+10V (Close / -10V~+10V / 0V~+10V / -5V~+5V / 0V~+5V / 1V~+5V / 0mA~20mA / 4mA~20mA / -20mA~20mA)	-10V~+10V		
CH2 Mode Setting	Enumeration of WORD		-10V~+10V		
CH3 Mode Setting	Enumeration of WORD		-10V~+10V		
CH4 Mode Setting	Enumeration of WORD		-10V~+10V		
CH1~CH4 Calibration					
CH1 Cal. Offset (V/mA)	INT(-32768..32767)		0		
CH2 Cal. Offset (V/mA)	INT(-32768..32767)		0		
CH3 Cal. Offset (V/mA)	INT(-32768..32767)		0		

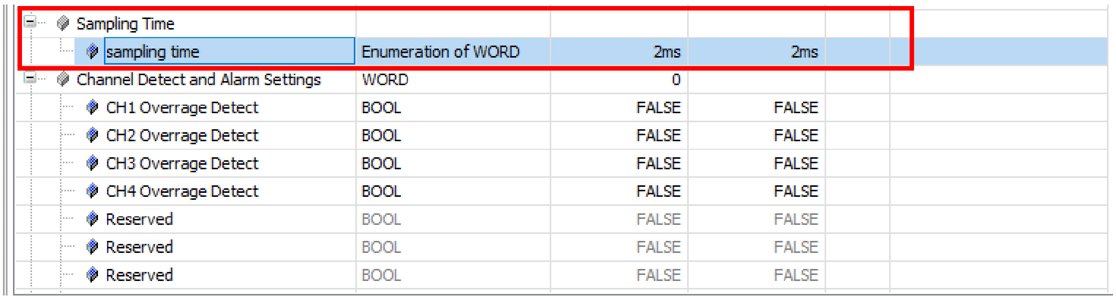
(3) You can set up the calibrations for for Channel 1 to 4.

CH1~CH4 Calibration					
CH1 Cal. Offset (V/mA)	INT(-32768..32767)	0	0		
CH2 Cal. Offset (V/mA)	INT(-32768..32767)	0	0		
CH3 Cal. Offset (V/mA)	INT(-32768..32767)	0	0		
CH4 Cal. Offset (V/mA)	INT(-32768..32767)	0	0		
CH1 Cal. Gain	INT(-32768..32767)	1000	1000		
CH2 Cal. Gain	INT(-32768..32767)	1000	1000		
CH3 Cal. Gain	INT(-32768..32767)	1000	1000		
CH4 Cal. Gain	INT(-32768..32767)	1000	1000		

(4) You can set up the average filtering for Channel 1 to 4.

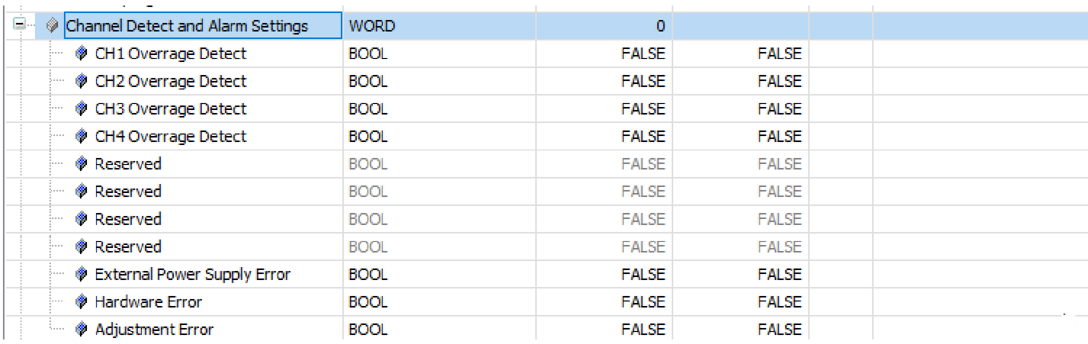
Average Filter					
CH1 Average Times	WORD(1..100)	10	10		
CH2 Average Times	WORD(1..100)	10	10		
CH3 Average Times	WORD(1..100)	10	10		
CH4 Average Times	WORD(1..100)	10	10		
CH1 Filter Proportion	Enumeration of WORD	10%	10%		
CH2 Filter Proportion	Enumeration of WORD	10%	10%		
CH3 Filter Proportion	Enumeration of WORD	10%	10%		
CH4 Filter Proportion	Enumeration of WORD	10%	10%		

(5) You can set up the sampling time.



Sampling Time			
sampling time	Enumeration of WORD	2ms	2ms
Channel Detect and Alarm Settings	WORD	0	
CH1 Overrage Detect	BOOL	FALSE	FALSE
CH2 Overrage Detect	BOOL	FALSE	FALSE
CH3 Overrage Detect	BOOL	FALSE	FALSE
CH4 Overrage Detect	BOOL	FALSE	FALSE
Reserved	BOOL	FALSE	FALSE
Reserved	BOOL	FALSE	FALSE
Reserved	BOOL	FALSE	FALSE

(6) You can set up the channel detect and alarm settings.



Channel Detect and Alarm Settings	WORD	0	
CH1 Overrage Detect	BOOL	FALSE	FALSE
CH2 Overrage Detect	BOOL	FALSE	FALSE
CH3 Overrage Detect	BOOL	FALSE	FALSE
CH4 Overrage Detect	BOOL	FALSE	FALSE
Reserved	BOOL	FALSE	FALSE
Reserved	BOOL	FALSE	FALSE
Reserved	BOOL	FALSE	FALSE
Reserved	BOOL	FALSE	FALSE
External Power Supply Error	BOOL	FALSE	FALSE
Hardware Error	BOOL	FALSE	FALSE
Adjustment Error	BOOL	FALSE	FALSE

4.5 Troubleshooting

4.5.1 Error Codes

Error Code	Description	D → A LED Indicator	ERROR LED Indicator
16#1605	Hardware failure	OFF	ON
16#1607	The external voltage is abnormal.	OFF	ON
16#1608	The factory calibration is abnormal.	OFF	ON
16#1801	The external voltage is abnormal.	OFF	Blinking
16#1802	Hardware failure	OFF	Blinking
16#1804	The factory calibration is abnormal.	OFF	Blinking
-	When power-on, the module is not detected by CPU module.	OFF	Blinking once or twice and after 2 seconds, it blinks repeatedly

4.5.2 Troubleshooting Procedure

Description	Procedure
The external voltage is abnormal.	Ensure the external 24 V power supply to the module is functioning normally.
Hardware failure	Return the module to the factory for repair.
Internal error The factory calibration is abnormal.	Contact the factory.
When power-on, the module is not detected by CPU module.	Check if the connection between module and CPU module is working. If not, connect again.

5

Chapter 5 Analog Input/Output Module AS06XA

Table of Contents

5.1 Overview

This chapter describes the specifications for the analog input/output module, its operation, and its programming. On the analog input/output module, four channels receive analog signals (voltage or current), and converts those signals into 16-bit digital signals. In addition, the analog input/output module receives two blocks of 16-bit digital data from a CPU module, and converts the digital data into analog signals (voltage or current). The analog input/output module sends the analog signals by two channels

5.1.1 Characteristics

(1) **Use the AS06XA-A analog input/output module, based on its practical application.**

CH1–CH4: A channel can receive either voltage or current inputs.

CH5–CH6: A channel can send either voltage or current outputs.

(2) **High-speed conversion**

The conversion rate is 2 ms per channel.

(3) **High accuracy**

Conversion accuracy: At ambient temperature of 25° C.

Input: The error range for both voltage and current input is ±0.2%.

Output: The error range for both voltage and current output is ±0.02%.

(4) **Use the utility software to configure the module.**

The HWCONFIG utility software is built into ISPSoft. You can set modes and parameters directly in HWCONFIG without spending time writing programs to set registers to manage functions.

5.2 Specifications and Functions

5.2.1 Specifications

- **Electrical specifications**

Module Name	AS06XA-A
Number of Analog Inputs/Outputs	4 inputs 2 outputs
Analog-to-Digital Conversion	Voltage input/Current input/Voltage output/Current output
Supply Voltage	24 VDC (20.4–28.8 VDC) (-15% to +20%)
Connector Type	Removable terminal block
Conversion Time	2ms/channel
Isolation	An analog circuit is isolated from a digital circuit by a digital integrated circuit/ optocoupler, but the analog channels are not isolated from one another. Isolation between a digital circuit and the ground: 500 VDC Isolation between an analog circuit and the ground: 500 VDC Isolation between an analog circuit and a digital circuit: 500 VDC Isolation between the 24 VDC and the ground: 500 VDC
Weight	145 g

- **Functional specifications for the analog-to-digital conversion**

Analog-to-Digital Conversion	Voltage Input				
Rated Input Range	-10 V ~ +10 V	0 V ~ 10 V	±5 V	0 V ~ 5 V	1 V ~ 5 V
Rated Conversion Range	K-32000 ~ K32000	K0 ~ K32000	K-32000 ~ K32000	K0 ~ K32000	K0 ~ K32000
Hardware Input Limit*1	-10.12V ~ 10.12V	-0.12V ~ 10.12V	-5.06V ~ 5.06V	-0.06V ~ 5.06V	0.95V ~ 5.05V
Conversion Limit*2	K-32384 ~ K32384	K-384 ~ K32384	K-32384 ~ K32384	K-384 ~ K32384	K-384 ~ K32384
Error Rate	Room Temperature: ±0.2% ; Full Temperature Range: ±0.5%				
Hardware Resolution	16 bits				
Input Impedance	2MΩ				
Absolute Input Range*3	±15 V				

*1: If the input signal exceeds the hardware input limit, the module only shows the maximum value. If the input signal is below the lower limit, it only shows the minimum value.

*2: If the input signal exceeds the hardware input limit, it also exceeds the conversion limit and a conversion limit error appears. For example in the voltage input mode (-10 V to +10 V), when the input signal is 10.15 V, exceeding the hardware upper limit, it also exceeds the conversion upper limit. The module uses the upper limit value (32384) as the input signal and a conversion limit error appears.

*3: If an input signal exceeds the absolute range, it might damage the channel.

Analog-to-Digital Conversion	**Current Input**		
Rated Input Range	±20 mA	0 mA–20 mA	4 mA–20 mA
Rated Conversion Range	K-32000 ~ K+2000	K0 ~ K32000	K0 ~ K32000
Hardware Input Limit*1	-20.24 mA ~ 20.24 mA	-0.24 mA ~ 20.24 mA	3.81 mA ~ 20.19 mA
Conversion Limit*2	K-32384 ~ K32384	K-384 ~ K32384	K-384 ~ K32384
Error Rate	Room Temperature: ±0.2% ; Full Temperature Range: ±0.5%		
Hardware Resolution	16 bits		
Input Impedance	250Ω		
Absolute Input Range*3	±32 mA		

*1: If the input signal exceeds the hardware input limit, the module only shows the maximum value. If the input signal is below the lower limit, it only shows the minimum value.

*2: If the input signal exceeds the hardware input limit, it also exceeds the conversion limit and a conversion limit error appears. For example in the voltage input mode (4 mA to 20 mA), when the input signal is 0 mA, exceeding the hardware upper limit, it also exceeds the conversion upper limit. The module uses the upper limit value (-384) as the input signal and a conversion limit error appears.

*3: If an input signal exceeds the absolute range, it might damage the channel.

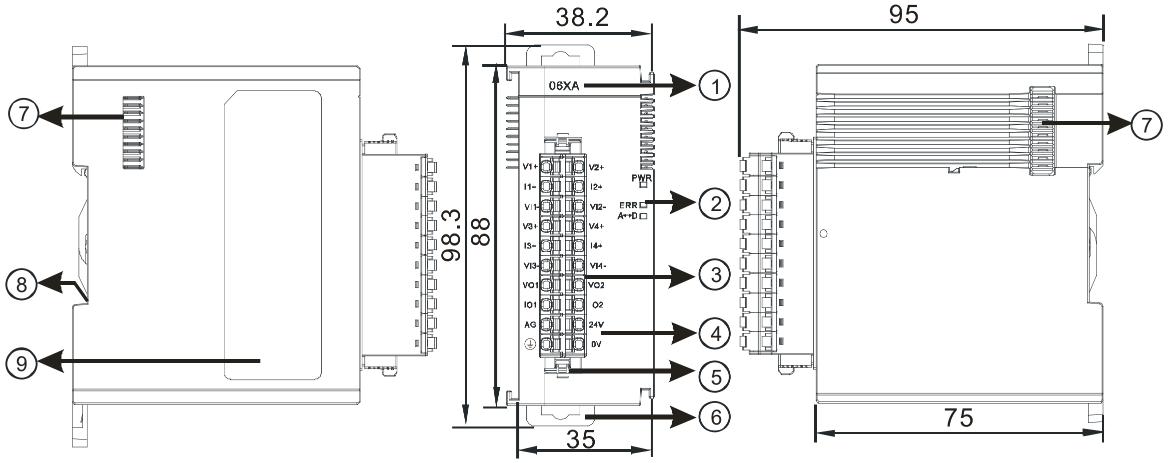
- **Functional specifications for the digital-to-analog conversion**

Digital-to-Analog Conversion	Voltage Output				
Rated Output Range	±10 V	0 ~ 10 V	±5 V	0 ~ 5 V	1 ~ 5 V
Conversion Range	K-32000 ~ K32000	K0 ~ K32000	K-32000 ~ K32000	K0 ~ K32000	K0 ~ K32000
Hardware Output Range	-10.1 V ~ +10.1 V	-0.1 V ~ 10.1 V	-5.05 V ~ +5.05 V	-0.05 V ~ +5.05 V	0.95 ~ 5.05 V
Error Rate (Room Temperature)	±0.2%				
Error Range (Full temperature range)	±0.5%				
Linearity Error (Room Temperature)	±0.05%				
Linearity Error (Full Temperature Range)	±0.05%				
Hardware Resolution	12 bits				
Permissible load impedance	≧1kΩ		≧500Ω		

Digital-to-Analog Conversion	Current Output	
Rated Output Range	0–20 mA	4–20 mA
Conversion Range	K0 ~ K32000	K0 ~ K32000
Hardware Output Range	-0.2 mA to 20.2 mA	3.8–20.2 mA
Error Range (Room Temperature)	±0.2%	
Error Range (Full Temperature Range)	±0.5%	
Linearity Error (Room Temperature)	±0.03%	
Linearity Error	±0.10%	

(Full Temperature Range)	
Hardware Resolution	12 bits
Permissible Load Impedance	≦550 Ω

5.2.2 Profile



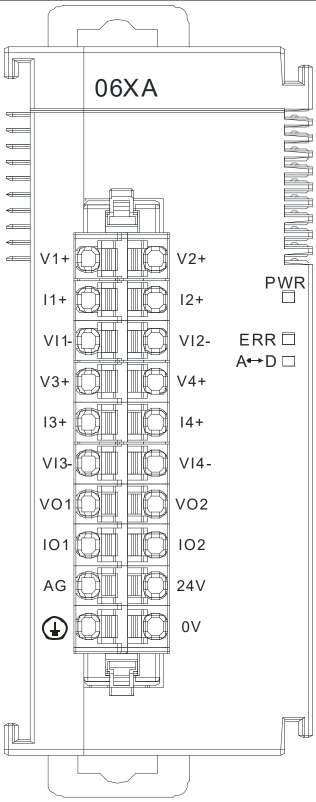
Unit: mm

Number	Name	Description
1	Model Name	Model name of the module
2	RUN LED Indicator	Operating status of the module ON: the module is running. OFF: the module is not running.
	ERROR LED Indicator	Error status of the module ON: a serious error exists in the module. OFF: the module is operating normally. Blink: a minor error exists in the module.
	Analog-to-Digital Conversion Indicator	Conversion status Blinking: conversion is in process. OFF: conversion has stopped.
3	Removable Terminal Block	Inputs are connected to transducers. Outputs are connected to loads to be driven.
4	Arrangement of the Input/Output Terminals	Arrangement of the terminals

Number	Name	Description
5	Clip	For removing the terminal block
6	DIN Rail Clip	Secures the module onto the DIN rail
7	Module Connecting Set	Connects the modules
8	Ground Clip	
9	Label	Nameplate

5.2.3 Arrangement of Terminals

AS06XA-A



5.2.4 Control Registers

*If you use HWCONFIG to set values in CRs, once the set value is downloaded, the values can be retained in the module; however if you use TO instruction to write data into CRs, the values CANNOT be retained, after power failure or after transition of the CPU from STOP to RUN.

Note: The attribute of the CR must be W (write) to use TO instruction.

CR#	Name	Description	Atr.	Defaults
0	Format Setup	0: integer format 1: floating point format	R	0
1	Input channel 1 mode setup	0: closed 1: -10 V to +10 V (default) 2: 0–10 V 3: -5 to +5 V 4: 0–5 V 5: 1–5 V 6: 0–20 mA 7: 4–20 mA 8: -20 mA to +20 mA	R/W	1
2	Input channel 2 mode setup			
3	Input channel 3 mode setup			
4	Input channel 4 mode setup			
5	Input channel 1 offset	Range: -32768 to +32767	R/W	0
6	Input channel 2 offset			
7	Input channel 3 offset			
8	Input channel 4 offset			
9	Input channel 1 gain	Range: -32768 to +32767	R/W	1000
10	Input channel 2 gain			
11	Input channel 3 gain			
12	Input channel 4 gain			
13	Input channel 1 average times	Range: 1–100	R/W	10
14	Input channel 2 average times			
15	Input channel 3 average times			
16	Input channel 4 average times			
17	Input channel 1 filter		R/W	1

CR#	Name	Description	Atr.	Defaults
	average percentage	Range: 0–3 Unit: ±10% 1: ±10% 2: ±20% 3: ±30%		
18	Input channel 2 filter average percentage			
19	Input channel 3 filter average percentage			
20	Input channel 4 filter average percentage			
21	Input channel sampling cycle (sampling/integration time)	0: 2 ms 1: 4 ms 2: 10 ms 3: 15 ms 4: 20 ms 5: 30 ms 6: 40 ms 7: 50 ms 8: 60 ms 9: 70 ms 10: 80 ms 11: 90 ms 12: 100 ms	R/W	0
22	Input channel alarm setup	0: open channel alarm 1: close channel alarm bit0: channel 1 bit1: channel 2 bit2: channel 3 bit3: channel 4 0: warning 1: alarm bit8: error in the power supply bit9: error in the module hardware bit10: error in calibration	R/W	0

5

CR#	Name	Description	Atr.	Defaults
23	Output channel 1 mode setup	0: closed 1: -10 V to +10 V (default) 2: 0–10 V 3: -5 V to +5 V 4: 0–5 V 5: 1–5 V 6: 0–20 mA 7: 4–20 mA	R/W	1
24	Output channel 2 mode setup			
25	Output channel 1 offset	Range: -32768 to +32767	R/W	0
26	Output channel 2 offset			
27	Output channel 1 gain	Range: -32768 to +32767	R/W	1000
28	Output channel 2 gain			
29	Retain the output sent by channel 1	0: When the PLC stops, the value of the analog output is reset to 0. 1: When the PLC stops, the value of the analog output is retained.	R/W	0
30	Retain the output sent by channel 2			
31	Refresh the time for output sent by channel 1	Range: 10–3200 (100 ms–32000 ms) Unit: 10 ms Any value less than 10 is read as 0. Any value larger than 3200 is read as 3200. Set the value to 0 to disable this function.	R/W	0
32	Refreshing the time for an output sent by channel 2		R/W	0
33 34	The minimum scale range for input channel 1	When the format is set to integer in HWCONFIG, the scale range is invalid. For analog-digital modules, it is much more convenient if the system can convert digital values to floating-point values for earier understanding. Here you can set the minimum and maximum scale ranges of corresponding floating-point values for channels. For example, if the scale range for an analog to digital input channel is ±10.0 V, it indicates the maximum value is +10.0 V and the minimum value is -10.0 V.	R	-10.0
35 36	The minimum scale range for input channel 2			-10.0
37 38	The minimum scale range for input channel 3			-10.0
39 40	The minimum scale range for input channel 4			-10.0
41 42	The minimum scale range for output channel 1			-10.0
43 44	The minimum scale range for output channel 2			-10.0

CR#	Name	Description	Atr.	Defaults
45	The maximum scale range for input channel 1	If the scale range for an analog to digital input channel is 4 mA ~ 20 mA. It indicates the maximum value is 20 mA and the minimum value is 4 mA. Note: You can use PLC instruction DSCLP (API0217) and set SM685 to ON to use floating-point operations when a conversion range needs to edit.		10.0
46				
47	The maximum scale range for input channel 2			10.0
48				
49	The maximum scale range for input channel 3			10.0
50				
51	The maximum scale range for input channel 4			10.0
52				
53	The maximum scale range for output channel 1			10.0
54				
55	The maximum scale range for output channel 2			10.0
56				
201	Instruction Set	Instructions for peak values 16#0101: record the peak value again for channel 1 16#0102: record the peak value again for channel 2 16#0104: record the peak value again for channel 3 16#0108: record the peak value again for channel 4 16#010F: record the peak values again for channels 1–4 16#0201: enable recording for channel 1 16#0202: enable recording for channel 2 16#0204: enable recording for channel 3 16#0208: enable recording for channel 4 16#020F: enable recording for channels 1–4 16#0211: disable recording for channel 1 16#0212: disable recording for channel 2 16#0214: disable recording for channel 3 16#0218: disable recording for channel 4 16#021F: disable recording for channels 1–4 16#0502: restore default settings	W	0

5

CR#	Name	Description	Atr.	Defaults
210	The maximum peak value for channel 1	Integer format; the maximum peak value for analog inputs	R	-
211	The maximum peak value for channel 2			
212	The maximum peak value for channel 3			
213	The maximum peak value for channel 4			
214	The minimum peak value for channel 1	Integer format; the minimum peak value for analog inputs	R	-
215	The minimum peak value for channel 2			
216	The minimum peak value for channel 3			
217	The minimum peak value for channel 4			
222	The time to record for channel 1	Unit: 10 ms Range: 1–100 Time to record the digital value for the channels	R/W	1
223	The time to record for channel 2			
224	The time to record for channel 3			
225	The time to record for channel 4			
240	The number of records for channel 1	Range: 0–500, display the current records	R	0
241	The number of records for channel 2			
242	The number of records for channel 3			
243	The number of records for channel 4			
4000 ~4499	Records for channel 1	500 records for channel 1	R	-
4500 ~4999	Records for channel 2	500 records for channel 2		

CR#	Name	Description	Atr.	Defaults
5000 ~5499	Records for channel 3	500 records for channel 3		
5500 ~5999	Records for channel 4	500 records for channel 4		

5.2.5 Functions

Set modes of operation and parameters with HWCONFIG utility software built into ISPSoft.

- **Analog input**

Item	Function	Description
1	Enable/Disable a Channel	1. Enable or disable a channel. 2. If a channel is disabled, the total conversion time decreases.
2	Calibration	Calibrate a linear curve.
3	Average	Conversion values are averaged and filtered.
4	Disconnection Detection	Disconnection detection only operates when the analog range is 4–20 mA or 1–5 V.
5	Channel Detect and Alarm	If an input signal exceeds the range of inputs that the hardware can receive, the module produces an alarm or a warning. You can disable this function.
6	Limit Detections for Channels	Save the maximum/minimum values for channels
7	Records for Channels	Save the analog curves for channels.
8	Scale Range	When the format is floating-point, you can set the scale range.

1. Enable/Disable a Channel

An analog signal is converted into a digital signal at a rate of 2 ms per channel. The total conversion time is 2 ms X (the number of channels). If a channel is not used, you can disable it to decrease the total conversion time.

2. Calibration

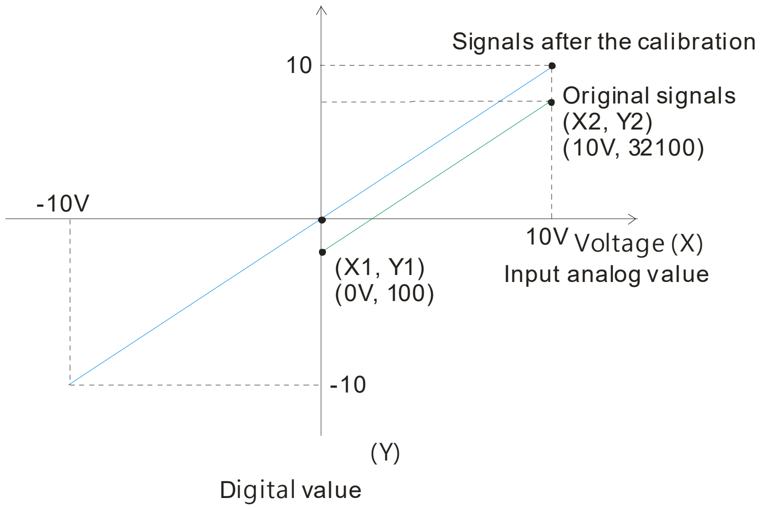
To make a curve meet specific needs, calibrate the curve by changing the offset and the gain. The calibration range depends on the range of inputs which can be received by the hardware. The formula is:

$$Output = \frac{(Input \times Gain)}{1000} + Offset$$

Example:

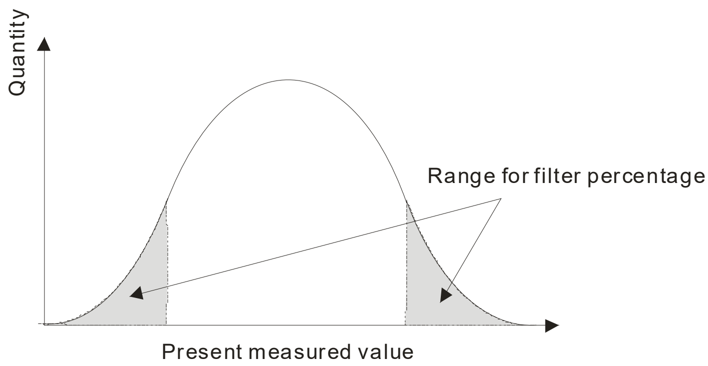
A channel receives voltage inputs between -10.0 V to +10.0 V. The gain is 1000, and the offset is 0. The corresponding value for the original signal -10.0 V to +10.0 V is -32000 to +32000. If you change the offset to -100, the calibrated value for the original signal -10.0 V to +10.0 V becomes -31900 to +32100. When the input voltage is 0 V, the digital value becomes -100. When the input voltage is 10.0 V, the digital value becomes 32100.

Gain = 1000, Offset = -100



3. Average

You can set the average value between 1–100. It is a steady value obtained from the sum of the recorded values. If the recorded values include an acute pulse due to unavoidable external factors, however, you may observe violent changes in the average value. Use the filtering function to exclude acute pulses from the sum-up and equalization, so the computed average value is not affected by the acute recorded values. Set the filter percentage to the range 0–3, where the unit is 10%. If you set the filter range to 0, the system sums up all the recorded values and divides them to obtain the average value, but if you set the filter range to 1, for example, the system excludes the bottom 10% and the top 10% of the values and averages only the remaining values to get the average value. For instantance, set the average value to 100 and set the filter percentage to 3. When there are 100 pieces of data collected, the system arranges the collected data according to their values from large to small and then excludes the bottom 30% and top 30% of the values (60 pieces of data) and averages only the remaining values (40 pieces of data) to obtain the average value.



4. Disconnection detection

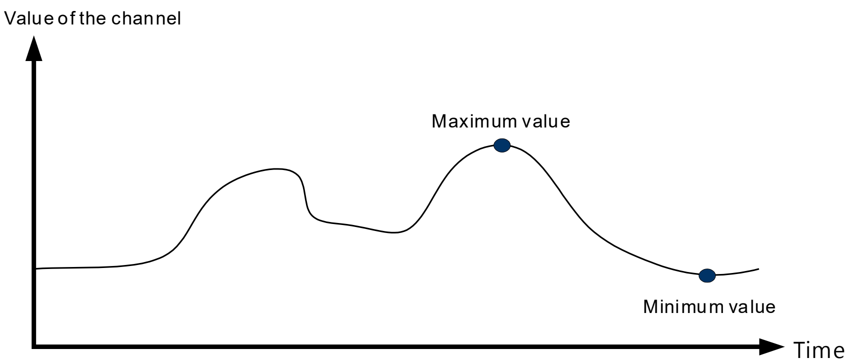
Disconnection detection only operates when the analog range is 4–20 mA or 1–5 V. If a module which can receive inputs between 4–20 mA or between 1–5 V is disconnected, the input signal exceeds the range of allowable inputs, so the module produces an alarm or a warning.

5. Channel Detection

If an input signal exceeds the allowable range of inputs, an error message appears. You can disable this function so that the module does not produce an alarm or a warning when the input signal exceeds the input range.

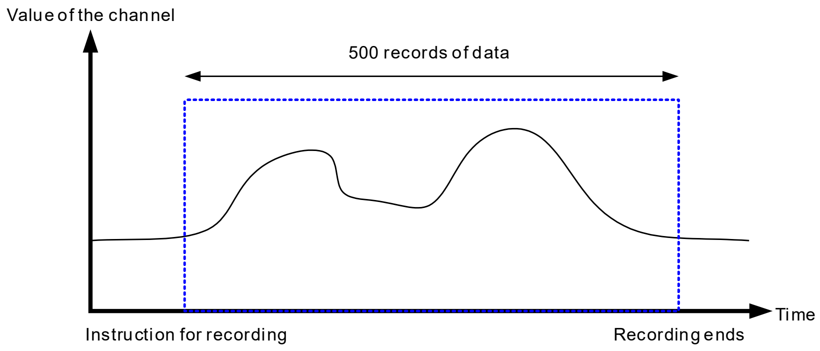
6. Limit detections for channels

This function saves the maximum and minimum values for channels so that you can determine the peak to peak values.



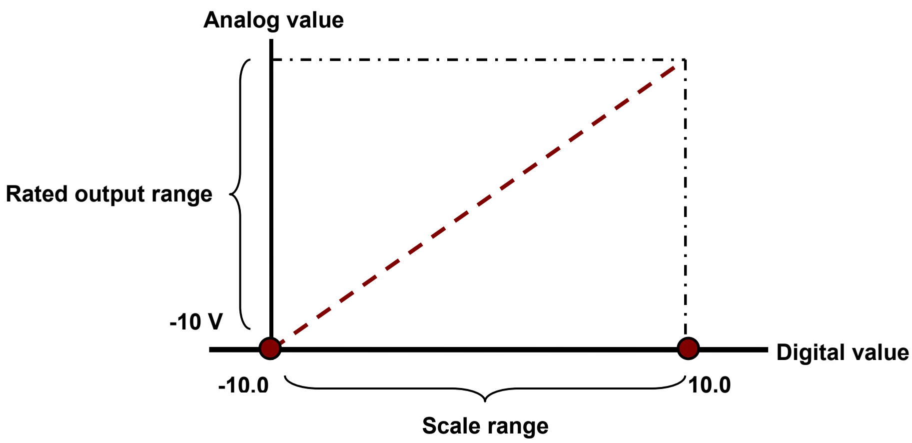
7. Records for Channels

Record the input values of the cyclic sampling for each channel. The system saves up to 500 data points and the recording time is 10 ms.



8. Scale range

When the format is floating-point, you can set the scale range. The analog output mode of a channel has a corresponding digital range. Digital values correspond to analog outputs sent by the module. For example, if the analog range is -10 V to +10 V, the digital range is -10.0 to +10.0, the HSP scale is 10.0, and the LSP scale is -10.0. The digital values -10.0 to +10.0 correspond to the analog values -10 V to +10 V, as the example below shows.



- **Analog Output**

Item	Function	Description
1	Enable/Disable a Channel	1. Enable or disable a channel. 2. If a channel is disabled, the total conversion time decreases.
2	Calibration	Calibrate a linear curve.
3	Retain an Output	When a module stops running, the system retains the signal sent by the module.
4	Refresh Time for an Output	Refresh the analog output value according to the value of the fixed slope.
5	Scale Range	You can set the scale range when the format is floating-point.

1. Enable/Disable a Channel

An analog signal is converted into a digital signal at a rate of 2 ms per channel. The total conversion time is 2 ms X (the number of channels). If a channel is not used, you can disable it to decrease the total conversion time.

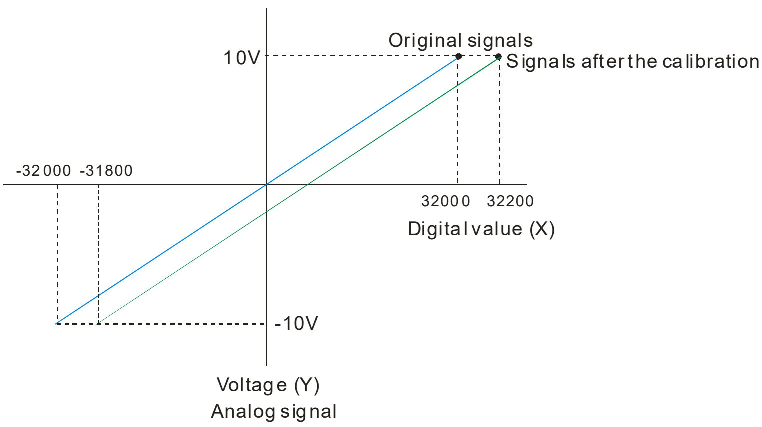
2. Calibration

To make a curve meet specific needs, calibrate the curve by changing the offset and the gain. The calibration range depends on the range of inputs which can be received by the hardware. The formula is:

$$Output = \frac{(Input \times Gain)}{1000} + Offset$$

Example:

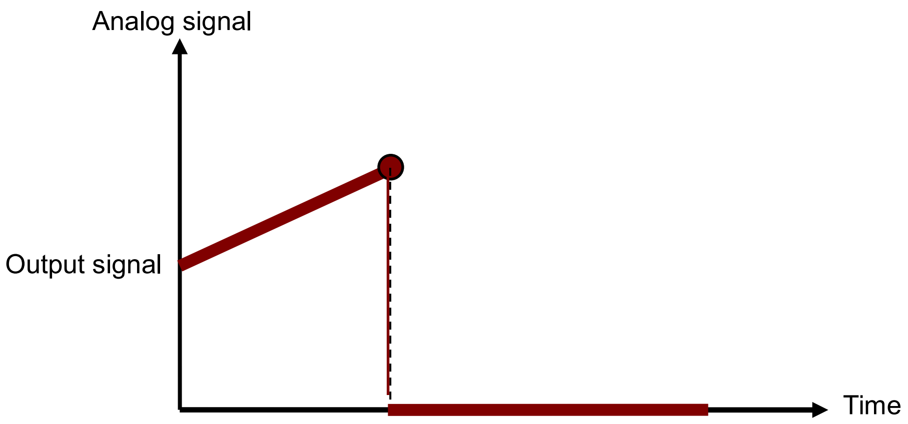
A channel receives voltage inputs between -10.0 V to +10.0 V. The gain is 1000, and the offset is 0. The corresponding value for the original signal -10.0 V to +10.0 V is -32000 to +32000. If you change the offset to 200 and the gain to 1000, the calibrated value for the original signal -10.0 V to +10.0 V is -31800 to +32200.



3. Retain an Output

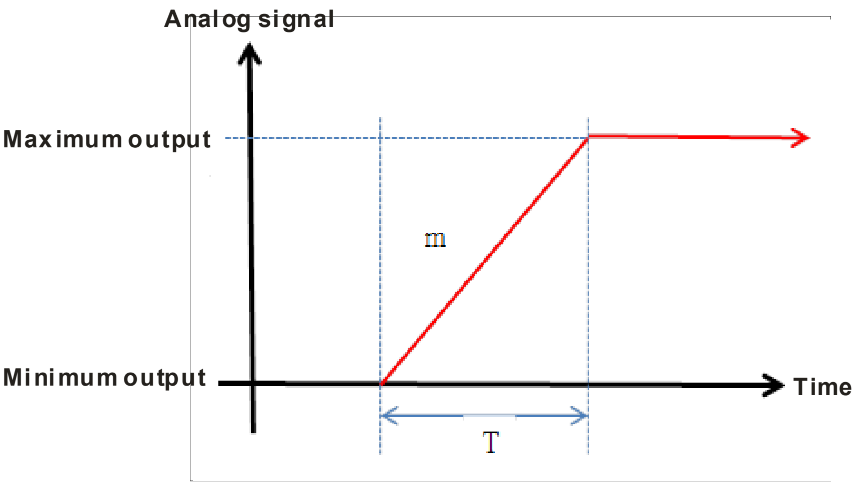
When a module stops running, the system retains the signal sent by the module.

The output is not retained:

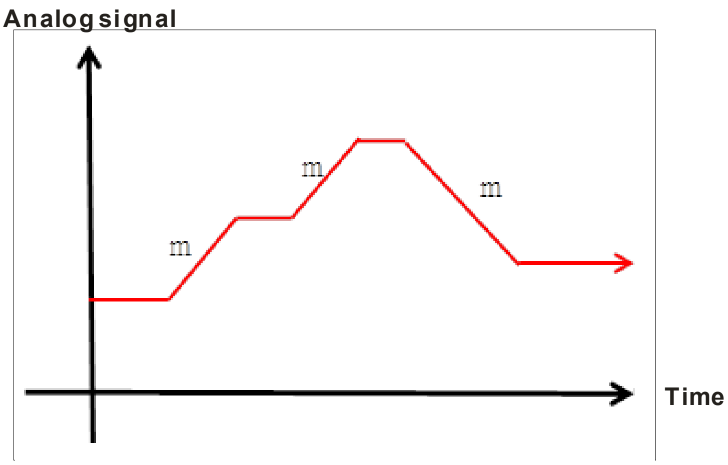


4. Refresh Time for an Output

Set the refresh time for an output and the system updates the value of the slope (m) accordingly.



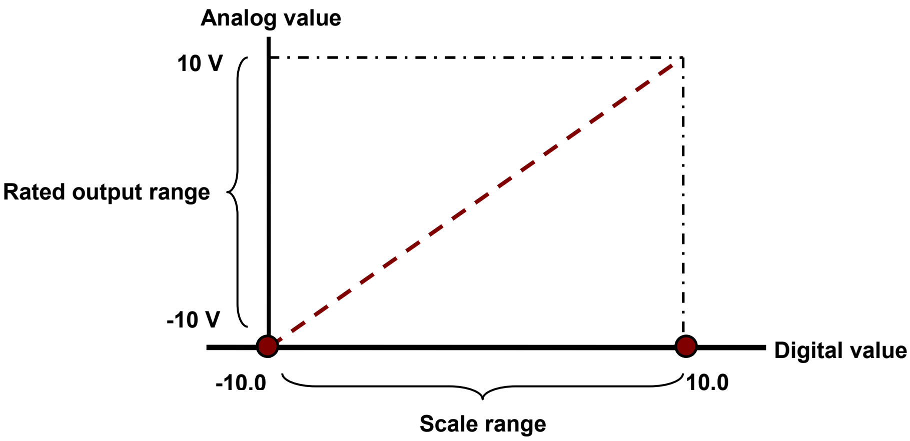
When the analog output signal changes, the system updates the value of the analog output according to the value set in the slope, as shown in the image below.



*The output conversion time and the input channel sampling cycle are the same.

5. Scale Range

You can set the scale range when the format is floating-point. The analog output mode of a channel has a corresponding digital range. Digital values correspond to analog outputs sent by the module. For example, if the analog range is -10 V to +10 V, the digital range is -10.0 to +10.0, the HSP scale is 10.0, and the LSP scale is -10.0. The digital values -10.0 to +10.0 correspond to the analog values -10 V to +10 V, as the example below shows.



5.2.6 Wiring

- **Precautions**

To ensure the analog-to-digital module functions well and reliably, the external wiring must prevent noise. Before you install the cables, follow the precautions below.

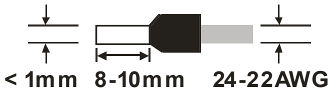
(1) To prevent a surge and induction, the AC cable and the input signal cables that are connected to the AS06XA-A must be separate cables.

(2) Do not install the cable near a main circuit, a high-voltage cable, or a cable connected to a load that is not a PLC. In addition, the cable must not be bound to a main circuit, a high-voltage cable, or a cable connected to a load which is not a PLC.

(3) Ground shielded cables and hermetically sealed cables separately.

(4) Terminals with insulation sleeves cannot be arranged as a terminal block, so you should cover the terminals with insulation tubes.

(5) Use single-core cables or twin-core cables with a diameter of 24–22 AWG and with pin-type connectors smaller than 1 mm. Only use copper conducting wires which can withstand temperatures of 60° C /75° C or higher.



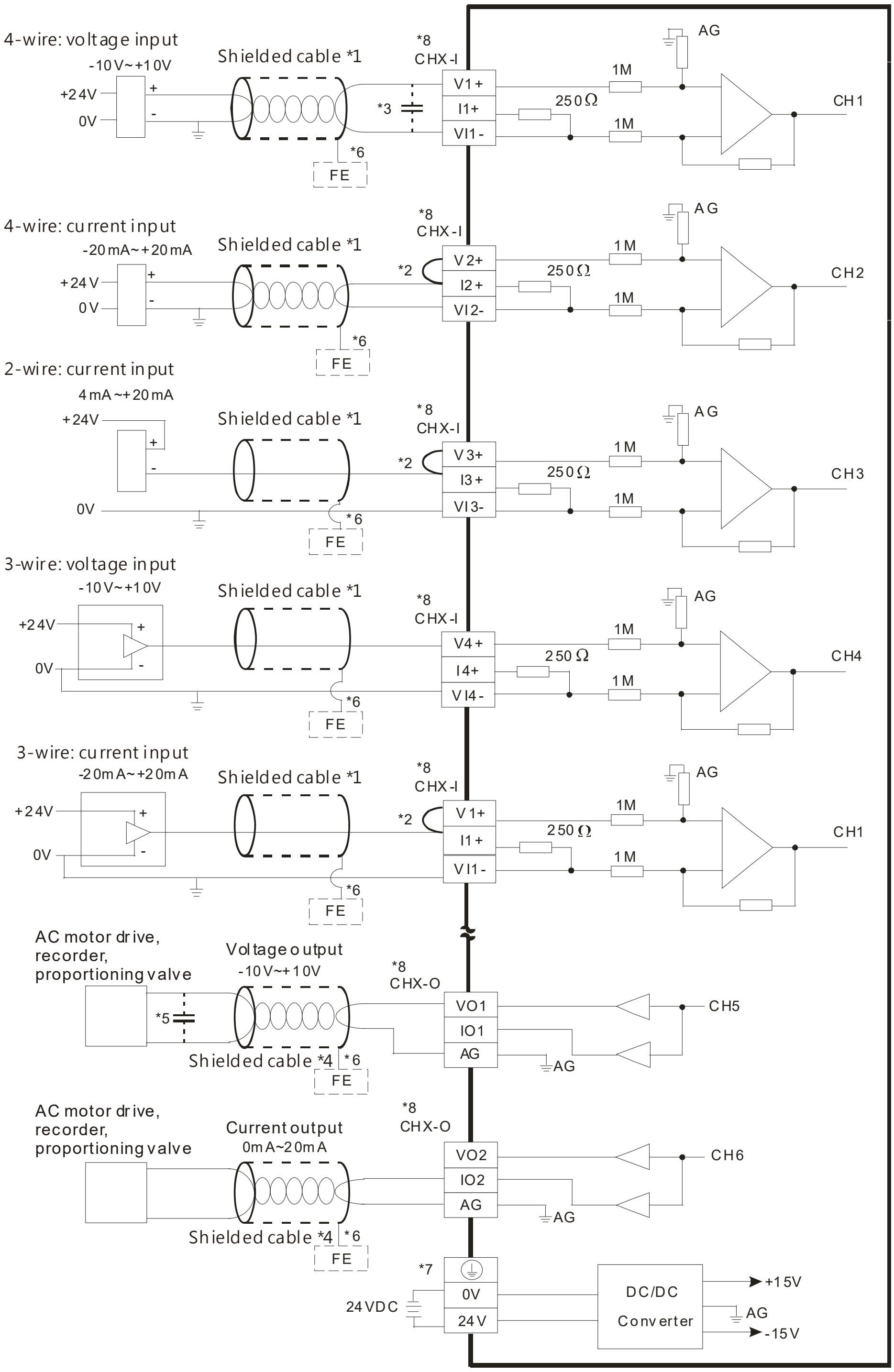
(6) Note: use cables with the same length (less than 200 m) and use wire resistance of less than 100 ohm.

(7) Notes on two-wire, three-wire, and four-wire connections:

- Two-wire connection/three-wire connection (passive transducer): connect the transducer and the analog input module to the same power circuit.
- Four-wire connection (active transducer): the transducer uses an independent power supply, so do not connect it to the same power circuit as the analog input module.

- **External wiring**

(1) AS06XA-A



*1. Use shielded cables to isolate the analog input signal cable from other power cables.

*2. If the module is connected to a current signal, the terminals Vn and In+ (n=1–4) must be short-circuited.

*3. If variability in the input voltage results in interference within the wiring, connect the module to a capacitor having a capacitance between 0.1–0.47 μF and a working voltage of 25 V.

*4. Connect the shielded cable to the terminal FE and to the ground terminal.

*5. Connect the terminal ⏚ to the ground terminal.

*6. The wording “CHX-I” indicates that you can use those five wiring methods for every input channel. The wording “CHX-O” indicates that you can use those two wiring methods for every output channel.

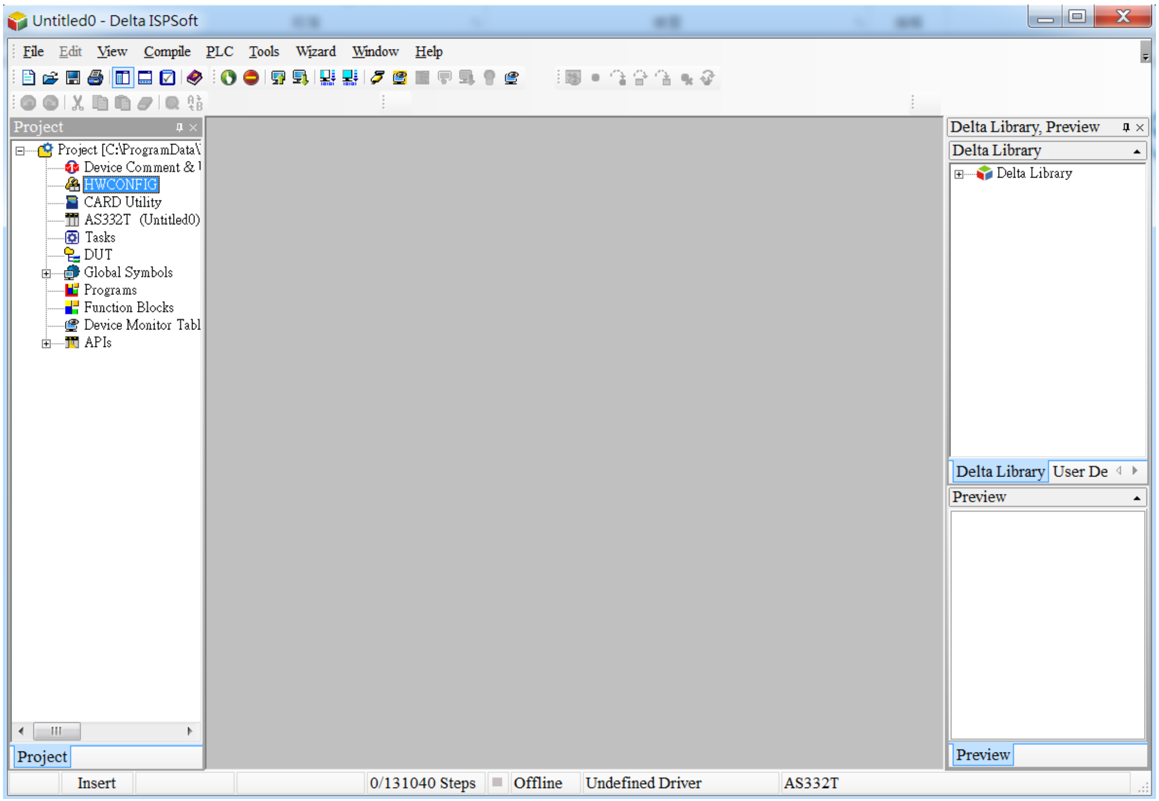
5.2.7 LED Indicators

Number	Name	Description
1	RUN LED Indicator	Operating status of the module ON: the module is running. OFF: the module is not running.
2	ERROR LED Indicator	Error status of the module ON: a serious error exists in the module. OFF: the module is operating normally. Blink: a minor error exists in the module.
3	Analog-to-Digital Conversion Indicator	Conversion status Blinking: conversion is in process. OFF: conversion has stopped.

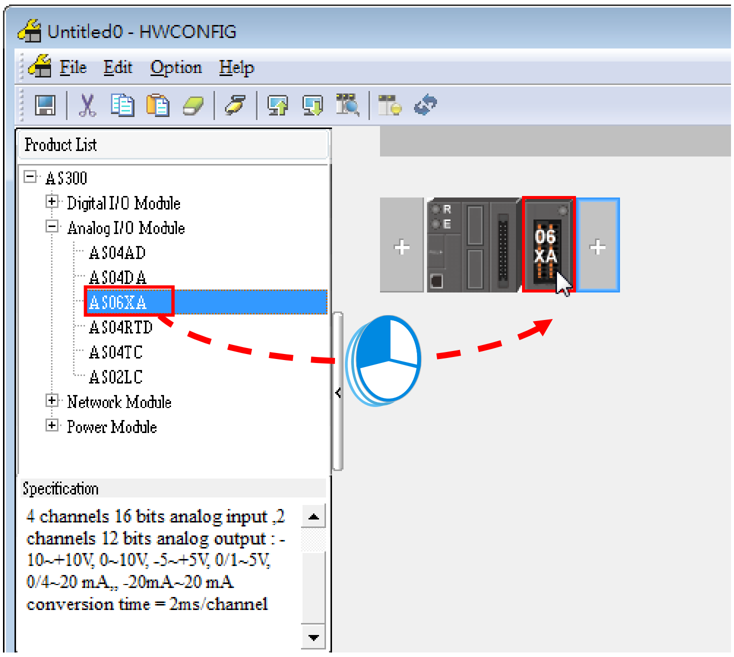
5.3 HWCONFIG in ISPSoft

5.3.1 Initial Setting

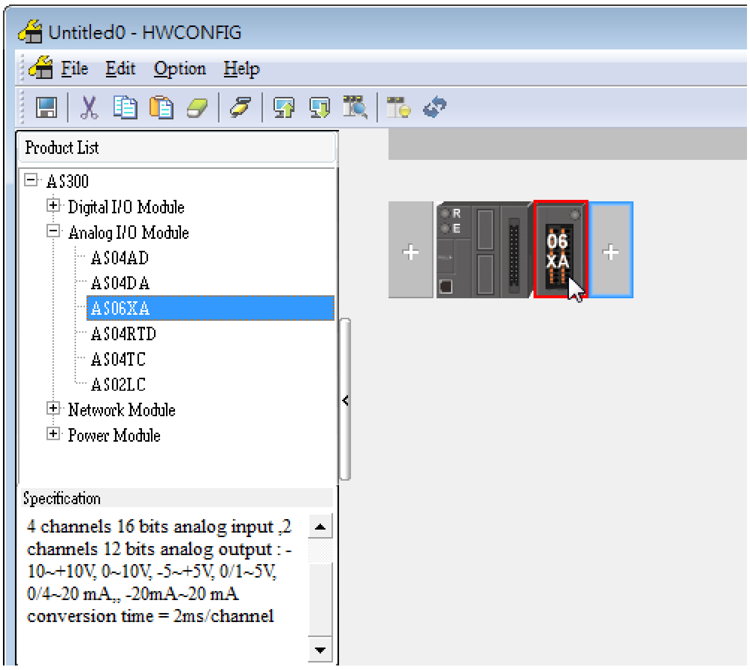
(1) Start ISPSoft and double-click **HWCONFIG**.

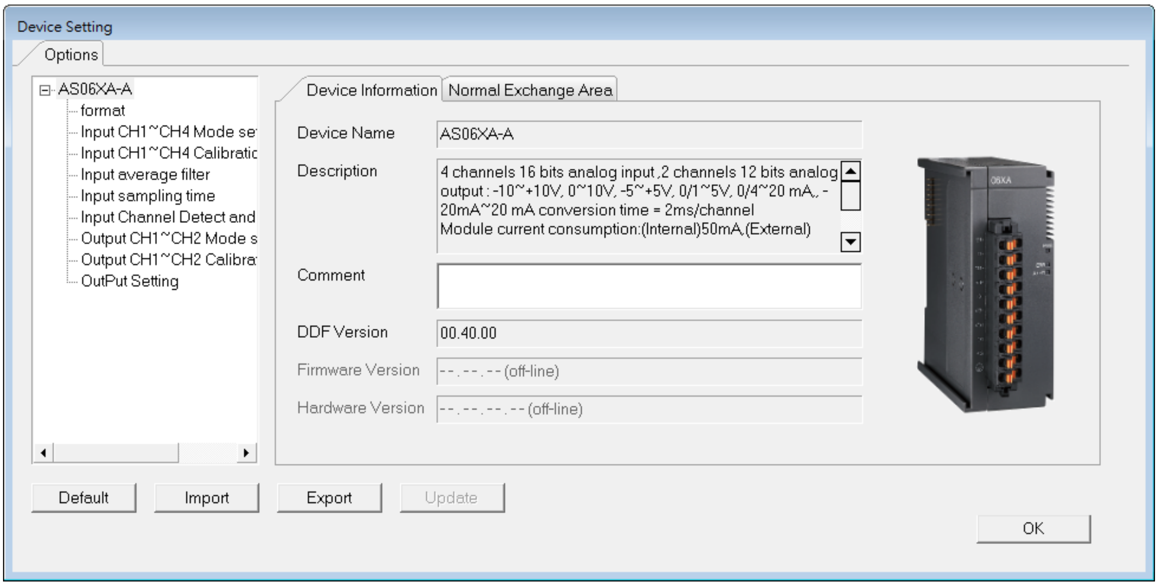


(2) Select a module and drag it to the working area.

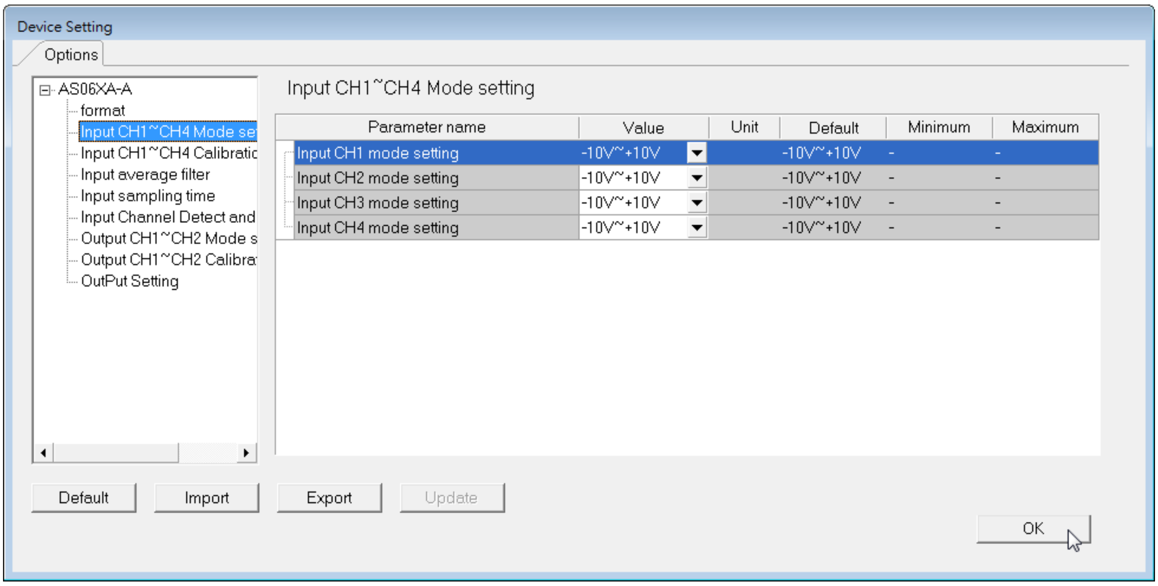


(3) Double-click the module in the working area to open the Device Setting page.

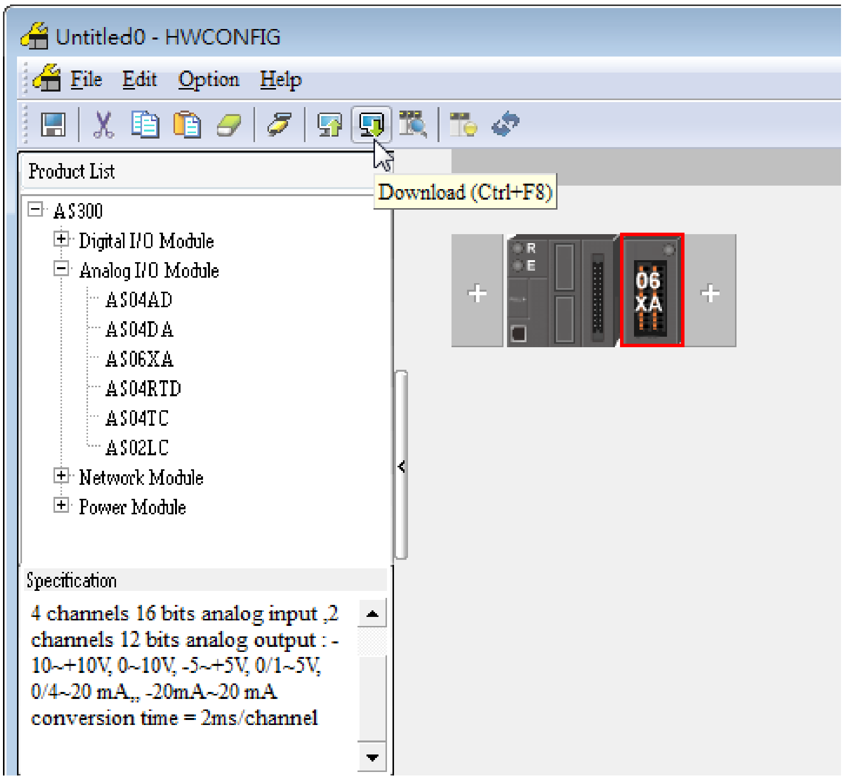




(4) Choose the parameter, set the values, and click **OK**.

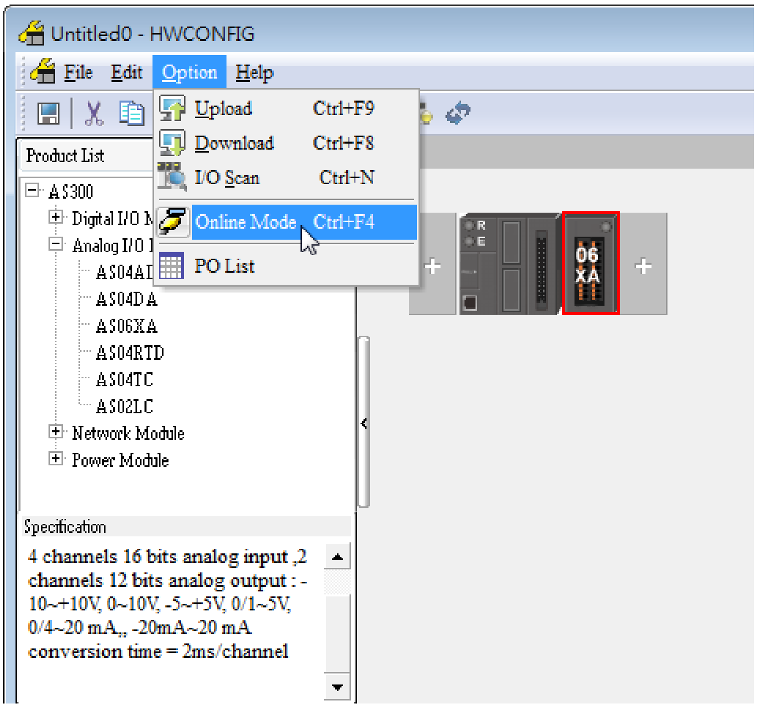


(5) Click **Download** on the toolbar to download the parameters. Note that you cannot download the parameters while the CPU module is running.

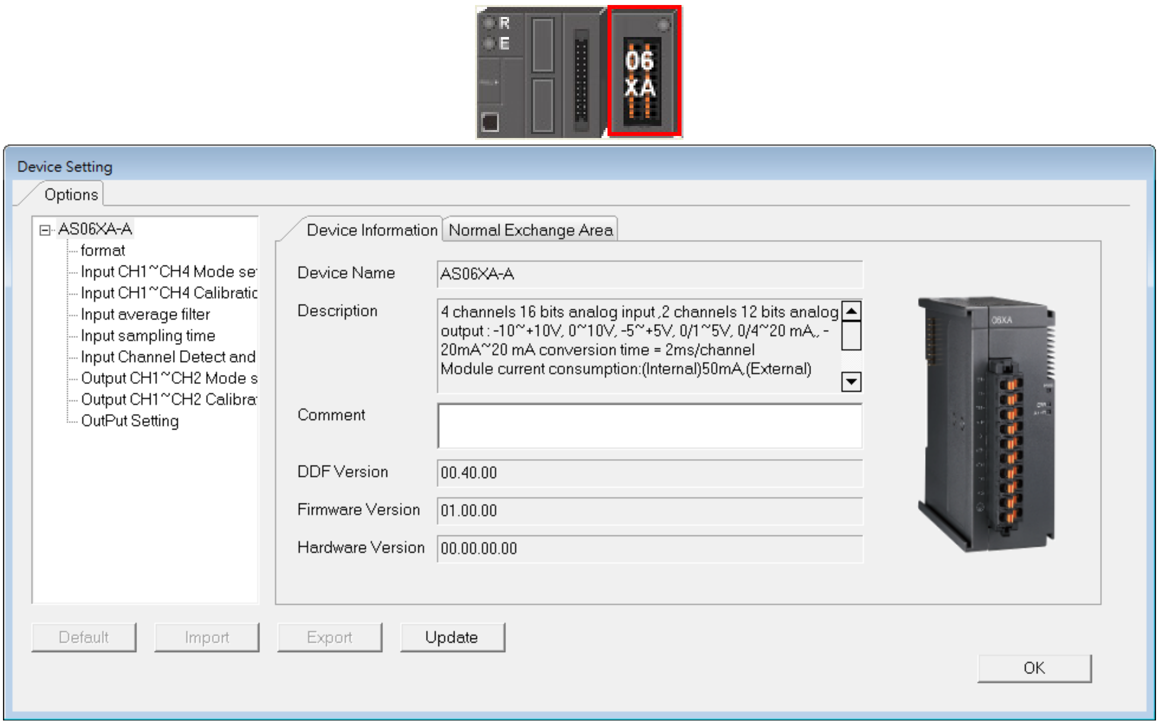


5.3.2 Checking the Version of a Module

(1) On the **Option** menu, click **Online Mode**.

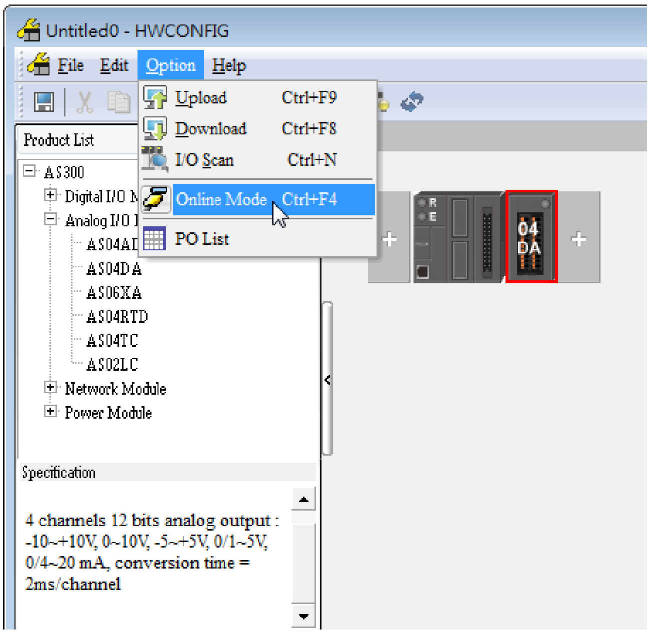


(2) Double-click the module to open the Device Setting page. The versions of both the firmware and the hardware are displayed.

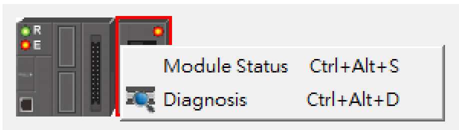


5.3.3 Online Mode

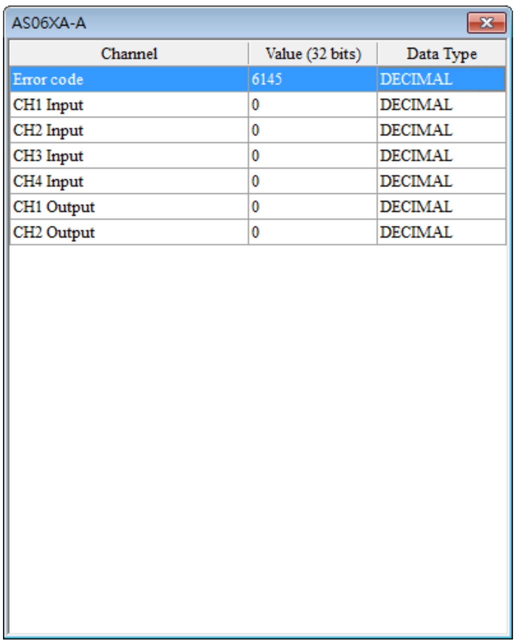
(1) On the **Option** menu, click **Online Mode**.



(2) Right-click the module and click **Module Status**.

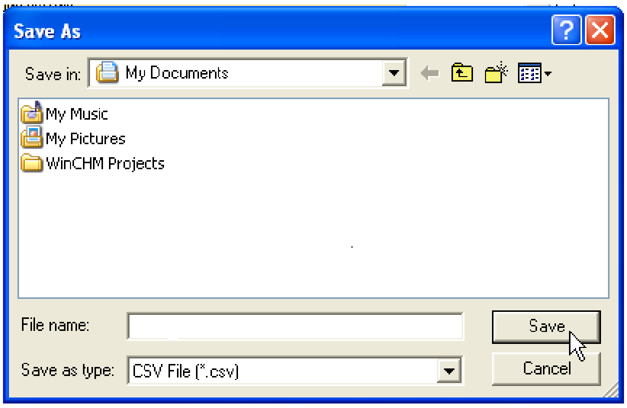


(3) View the module status.

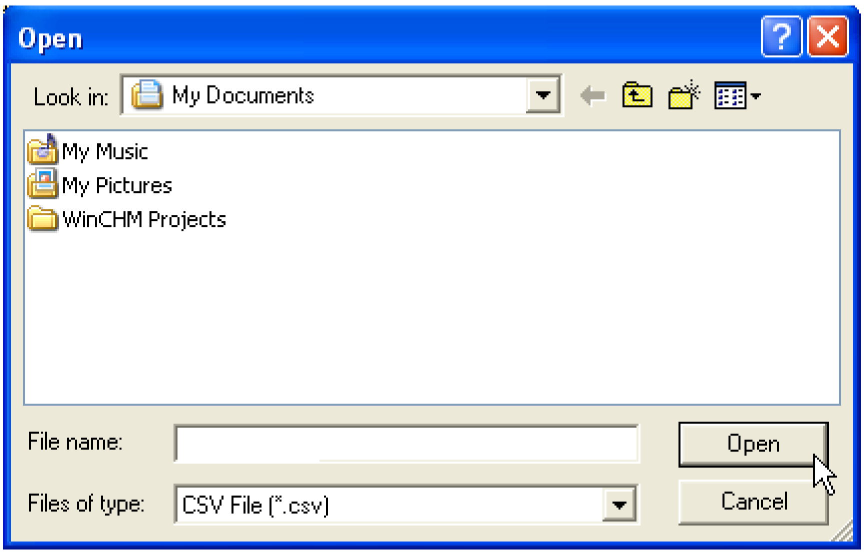


5.3.4 Importing/Exporting a Parameter File

(1) Click **Export** in the Device Settings dialog box to save the current parameters as a CSV file (.csv).

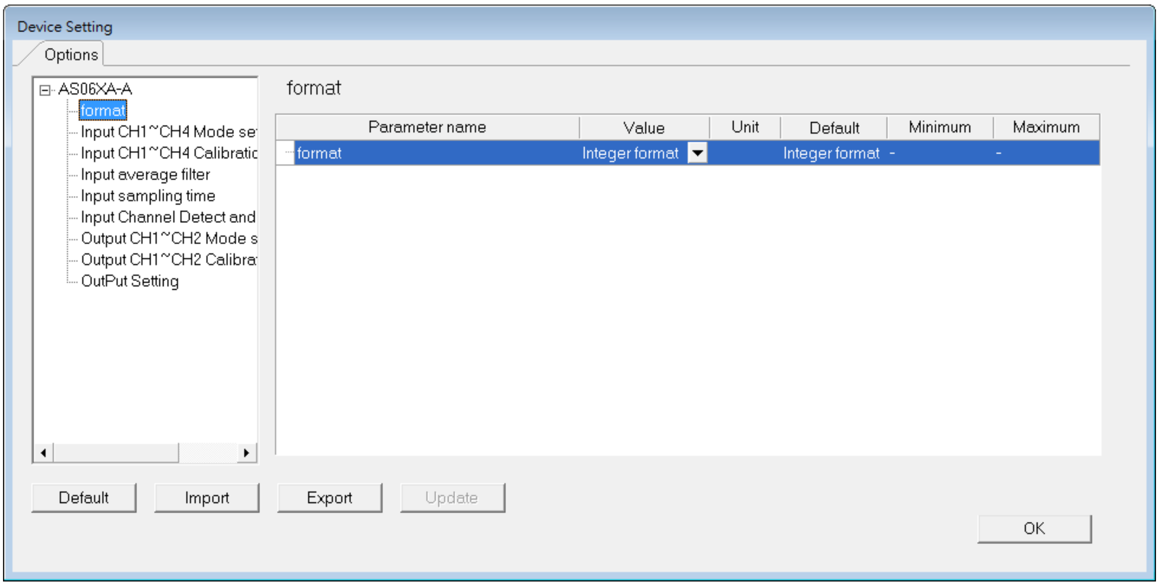


(2) Click **Import** in the Device Settings dialog box and select a CSV file to import saved parameters.

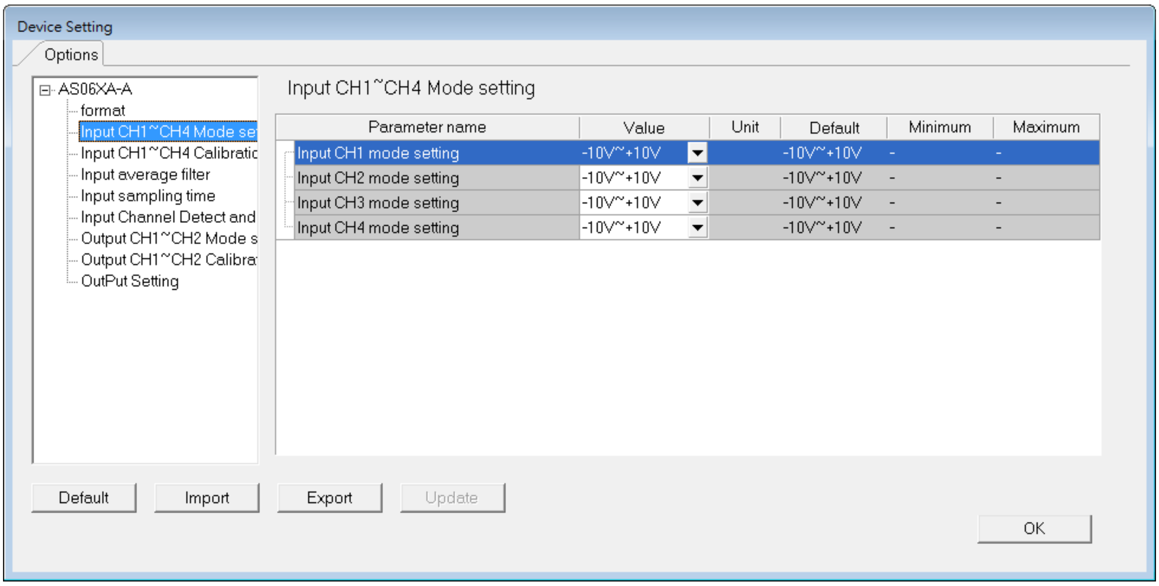


5.3.5 Parameters

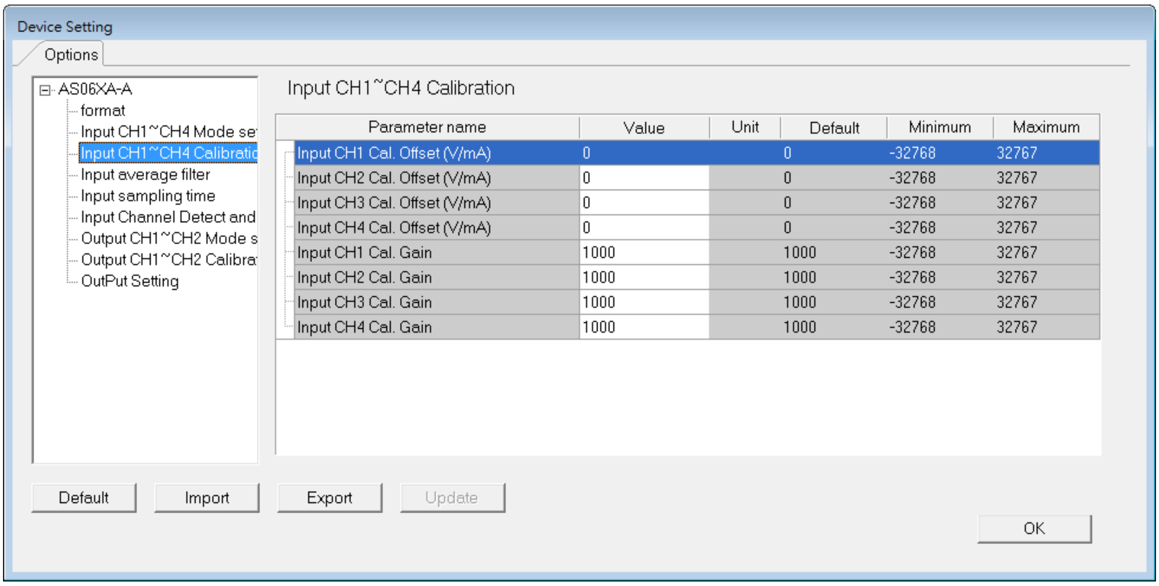
(1) The input modes of the channels



(2) Input CH1–CH4 (channel 1–channel 4) mode settings

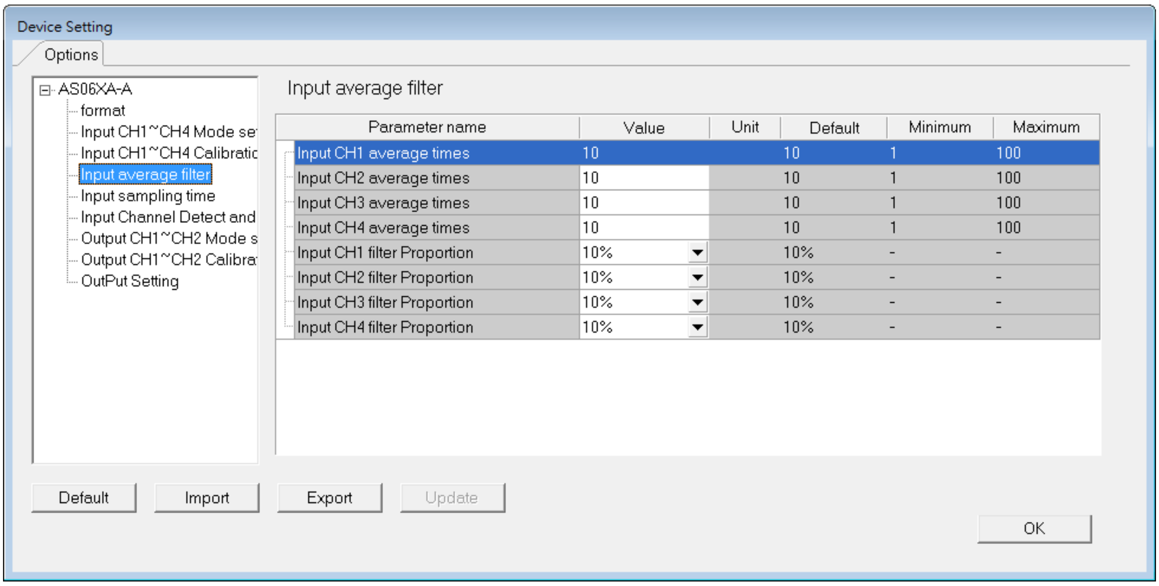


(3) Input CH1–CH4 calibration



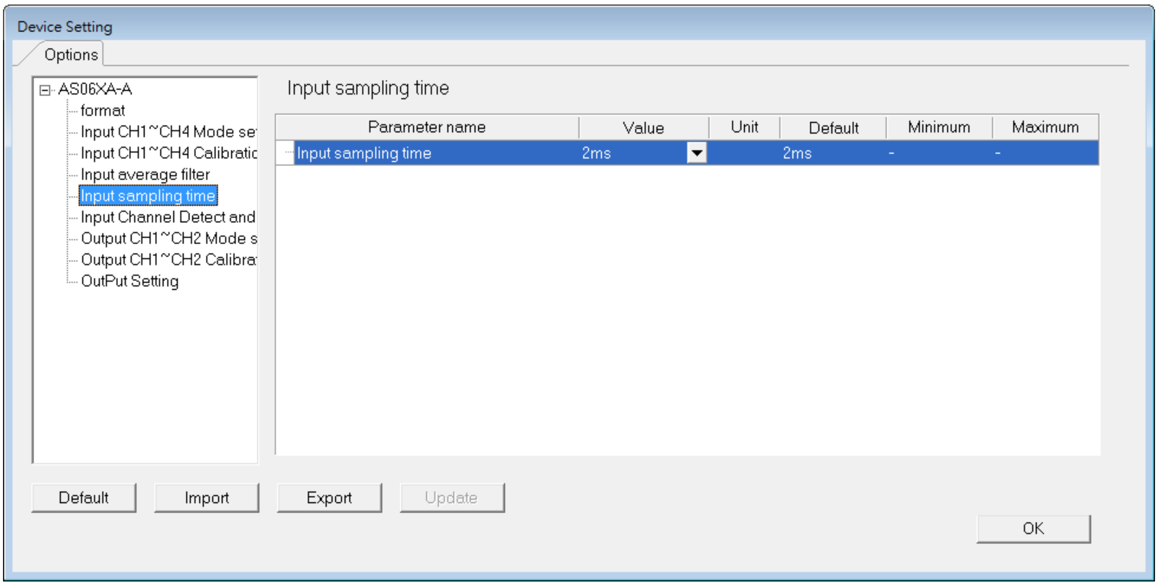
Parameter name	Value	Unit	Default	Minimum	Maximum
Input CH1 Cal. Offset (V/mA)	0		0	-32768	32767
Input CH2 Cal. Offset (V/mA)	0		0	-32768	32767
Input CH3 Cal. Offset (V/mA)	0		0	-32768	32767
Input CH4 Cal. Offset (V/mA)	0		0	-32768	32767
Input CH1 Cal. Gain	1000		1000	-32768	32767
Input CH2 Cal. Gain	1000		1000	-32768	32767
Input CH3 Cal. Gain	1000		1000	-32768	32767
Input CH4 Cal. Gain	1000		1000	-32768	32767

(4) Input average filter

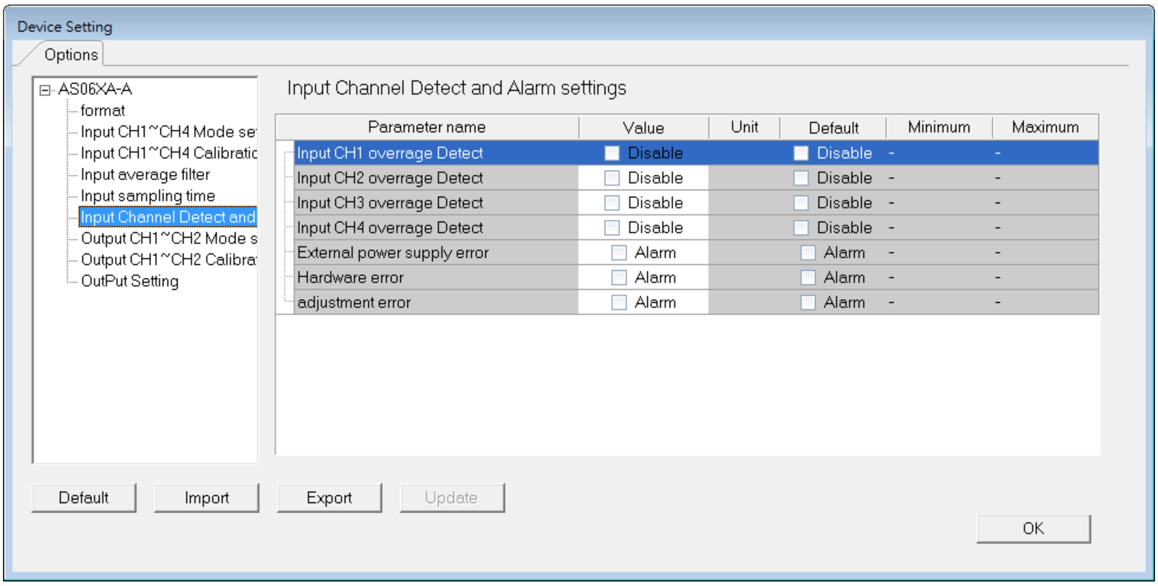


Parameter name	Value	Unit	Default	Minimum	Maximum
Input CH1 average times	10		10	1	100
Input CH2 average times	10		10	1	100
Input CH3 average times	10		10	1	100
Input CH4 average times	10		10	1	100
Input CH1 filter Proportion	10%		10%	-	-
Input CH2 filter Proportion	10%		10%	-	-
Input CH3 filter Proportion	10%		10%	-	-
Input CH4 filter Proportion	10%		10%	-	-

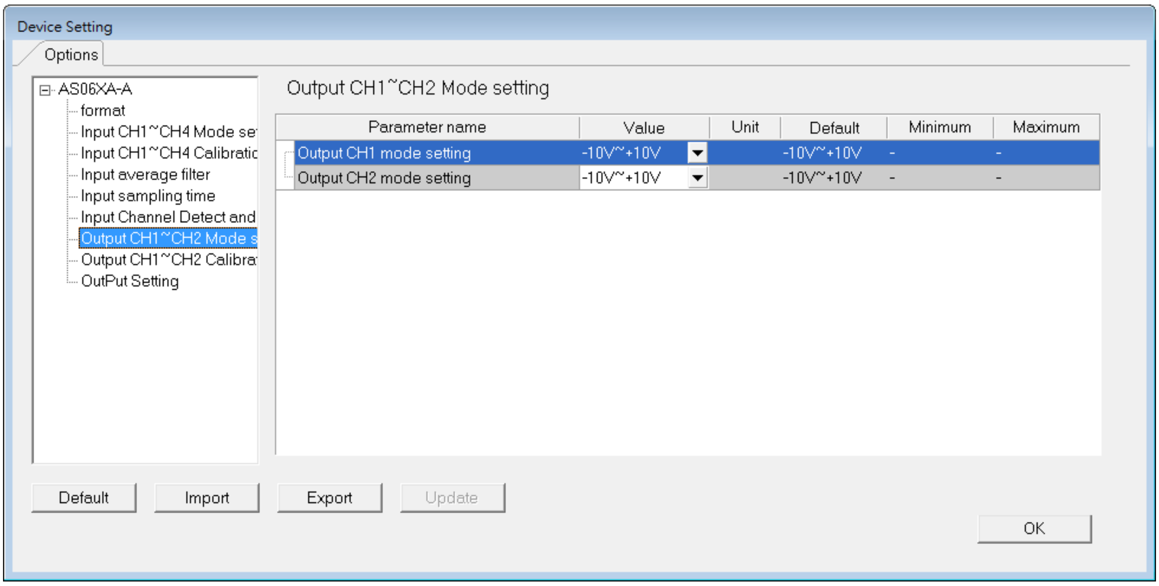
(5) Input sampling time



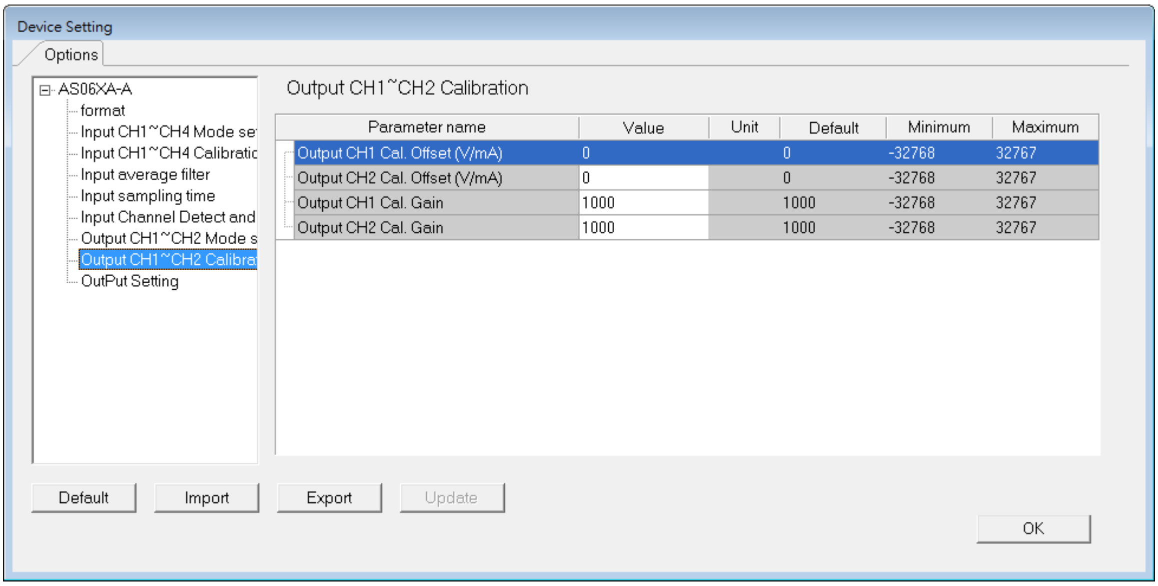
(6) Input channel detection and alarm settings



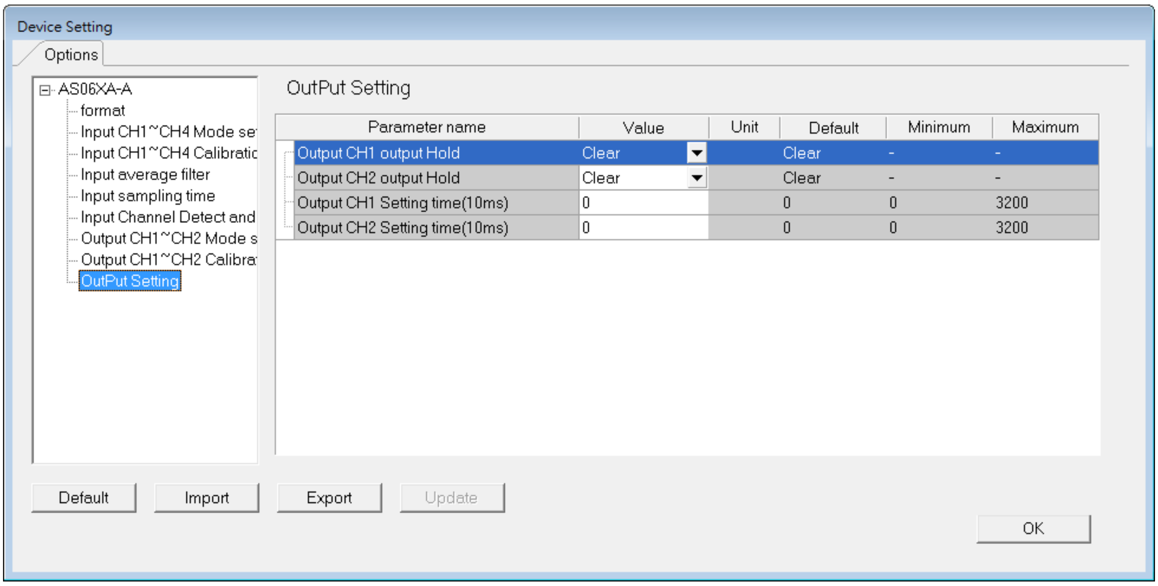
(7) Output CH1-CH2 mode settings



(8) Output CH1-2 calibration



(9) Output Settings

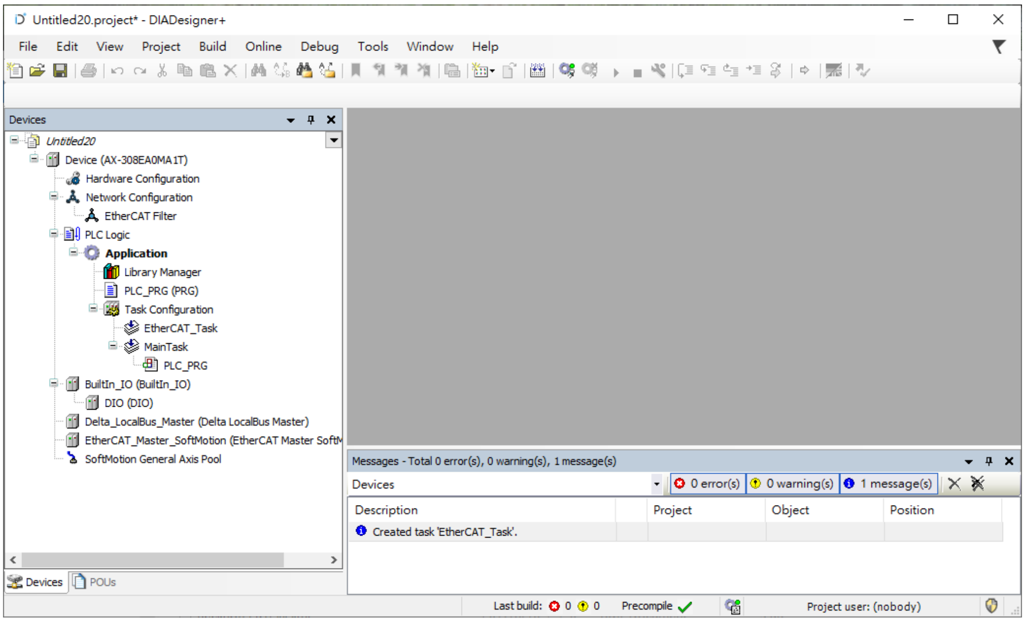


5.4 DIADesigner+ (Hardware Configuration)

The following example uses AS06XA-A.

5.4.1 Initial Setting

(1) Start DIADesigner+, click **New Project**, and then **Project+Device** to create a new project.

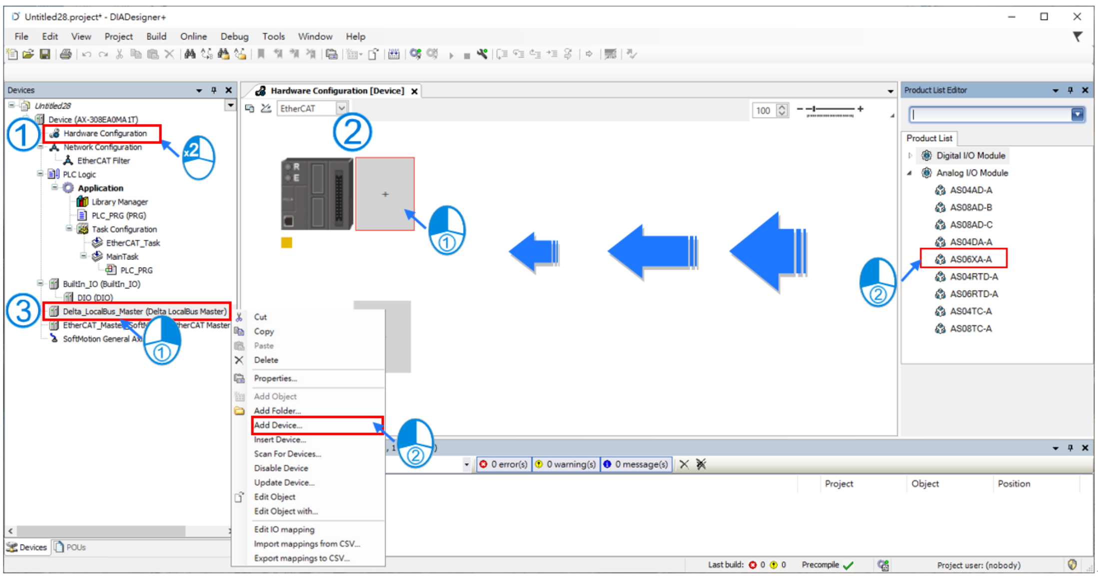


(2) Add modules in:

① Double-click **Hardware Configuration**

② Select the **+ section** and drag and drop the module that you want to add from the Product List to the + section.

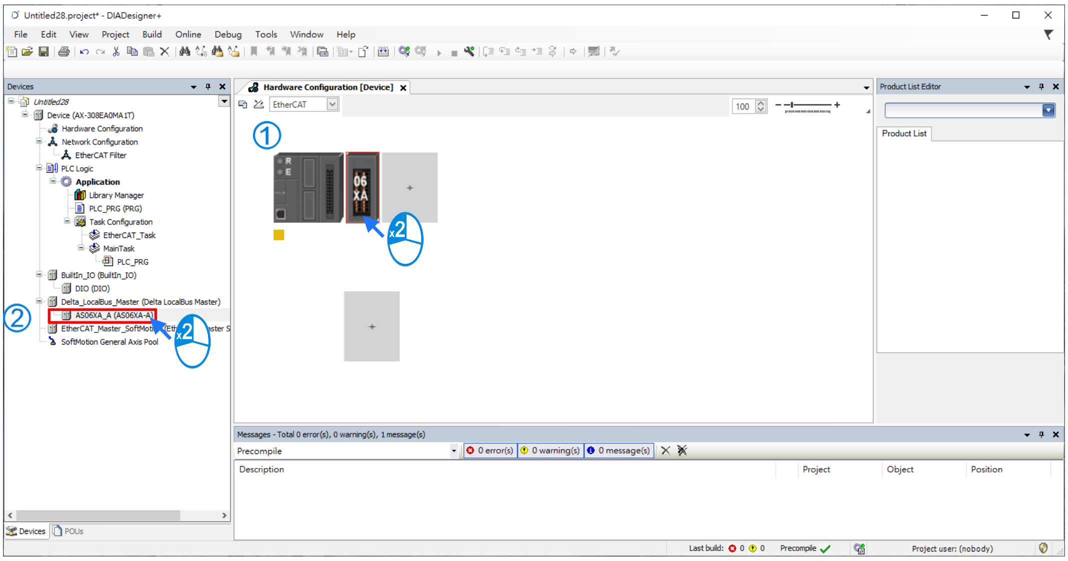
or ③ Right-click **Delta_Localbus Master** to see the context meun and then double-click **Add Device** to add devices manually or double-click **Scan for Devices**.



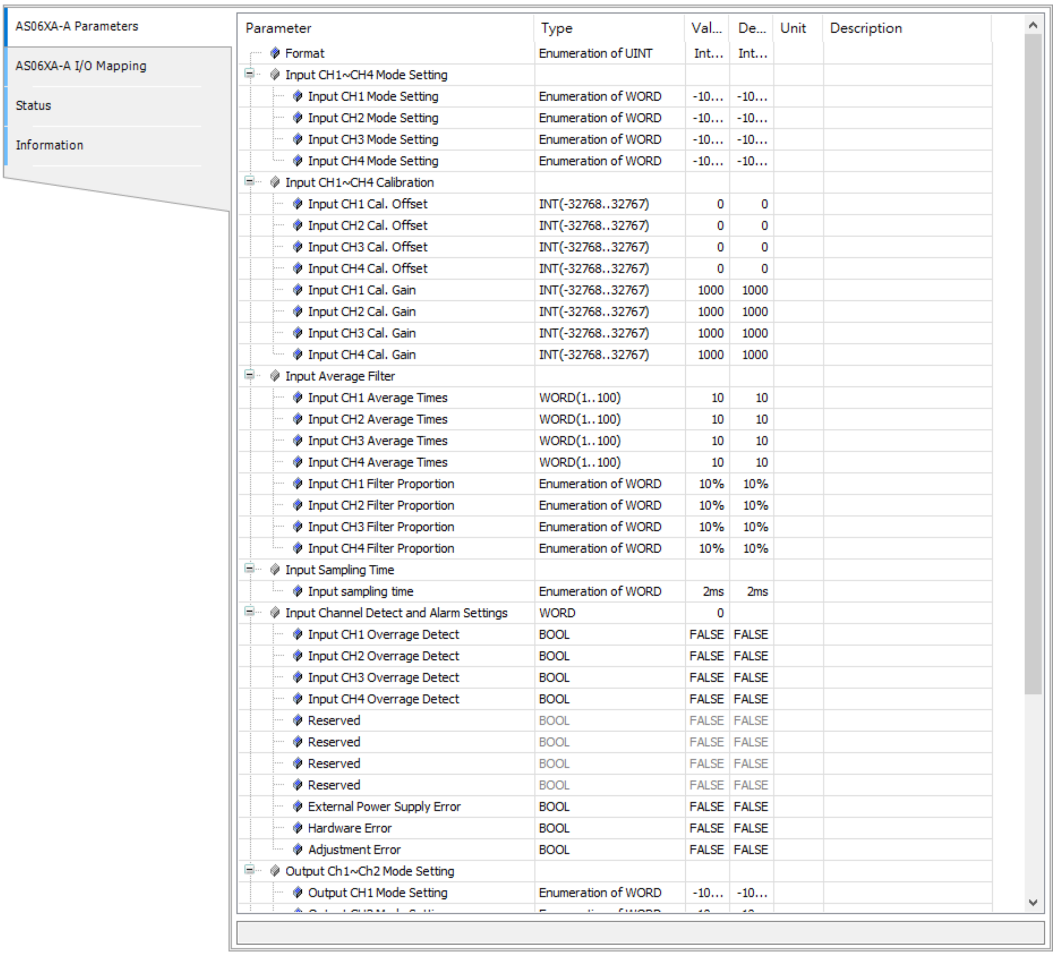
(3) Select modules:

① Double-click the module name in the **Hardware Configuration** area.

or ② Double-click the module name shown in the node.

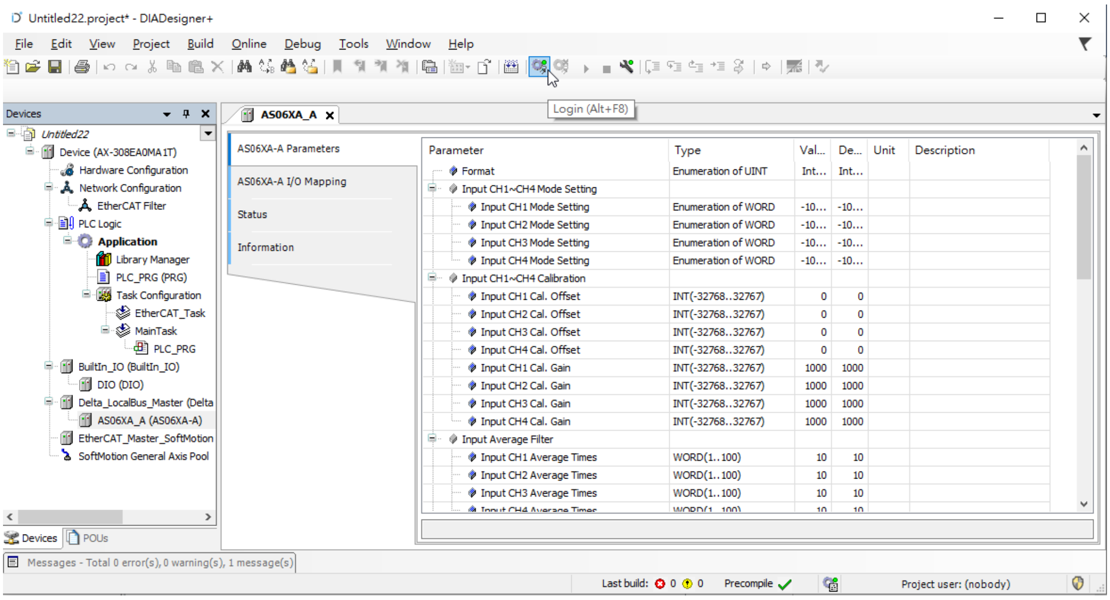


(4) Module parameter setting page:



Parameter	Type	Val...	De...	Unit	Description
Format	Enumeration of UINT	Int...	Int...		
Input CH1~CH4 Mode Setting					
Input CH1 Mode Setting	Enumeration of WORD	-10...	-10...		
Input CH2 Mode Setting	Enumeration of WORD	-10...	-10...		
Input CH3 Mode Setting	Enumeration of WORD	-10...	-10...		
Input CH4 Mode Setting	Enumeration of WORD	-10...	-10...		
Input CH1~CH4 Calibration					
Input CH1 Cal. Offset	INT(-32768..32767)	0	0		
Input CH2 Cal. Offset	INT(-32768..32767)	0	0		
Input CH3 Cal. Offset	INT(-32768..32767)	0	0		
Input CH4 Cal. Offset	INT(-32768..32767)	0	0		
Input CH1 Cal. Gain	INT(-32768..32767)	1000	1000		
Input CH2 Cal. Gain	INT(-32768..32767)	1000	1000		
Input CH3 Cal. Gain	INT(-32768..32767)	1000	1000		
Input CH4 Cal. Gain	INT(-32768..32767)	1000	1000		
Input Average Filter					
Input CH1 Average Times	WORD(1..100)	10	10		
Input CH2 Average Times	WORD(1..100)	10	10		
Input CH3 Average Times	WORD(1..100)	10	10		
Input CH4 Average Times	WORD(1..100)	10	10		
Input CH1 Filter Proportion	Enumeration of WORD	10%	10%		
Input CH2 Filter Proportion	Enumeration of WORD	10%	10%		
Input CH3 Filter Proportion	Enumeration of WORD	10%	10%		
Input CH4 Filter Proportion	Enumeration of WORD	10%	10%		
Input Sampling Time					
Input sampling time	Enumeration of WORD	2ms	2ms		
Input Channel Detect and Alarm Settings	WORD	0			
Input CH1 Overrage Detect	BOOL	FALSE	FALSE		
Input CH2 Overrage Detect	BOOL	FALSE	FALSE		
Input CH3 Overrage Detect	BOOL	FALSE	FALSE		
Input CH4 Overrage Detect	BOOL	FALSE	FALSE		
Reserved	BOOL	FALSE	FALSE		
Reserved	BOOL	FALSE	FALSE		
Reserved	BOOL	FALSE	FALSE		
Reserved	BOOL	FALSE	FALSE		
External Power Supply Error	BOOL	FALSE	FALSE		
Hardware Error	BOOL	FALSE	FALSE		
Adjustment Error	BOOL	FALSE	FALSE		
Output Ch1~Ch2 Mode Setting					
Output CH1 Mode Setting	Enumeration of WORD	-10...	-10...		

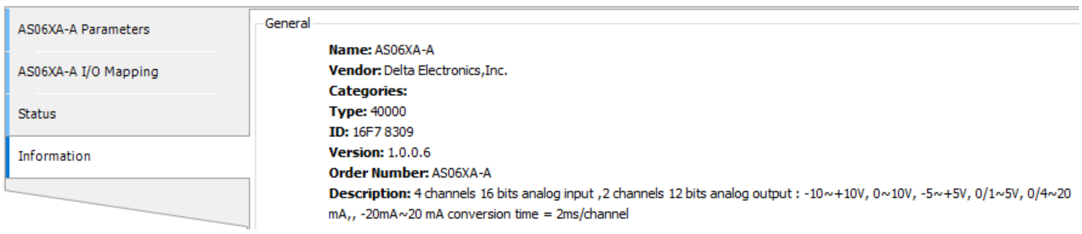
(5) After setting is complete, select the module and click **Login** on the tool bar to download the settings to the modules.



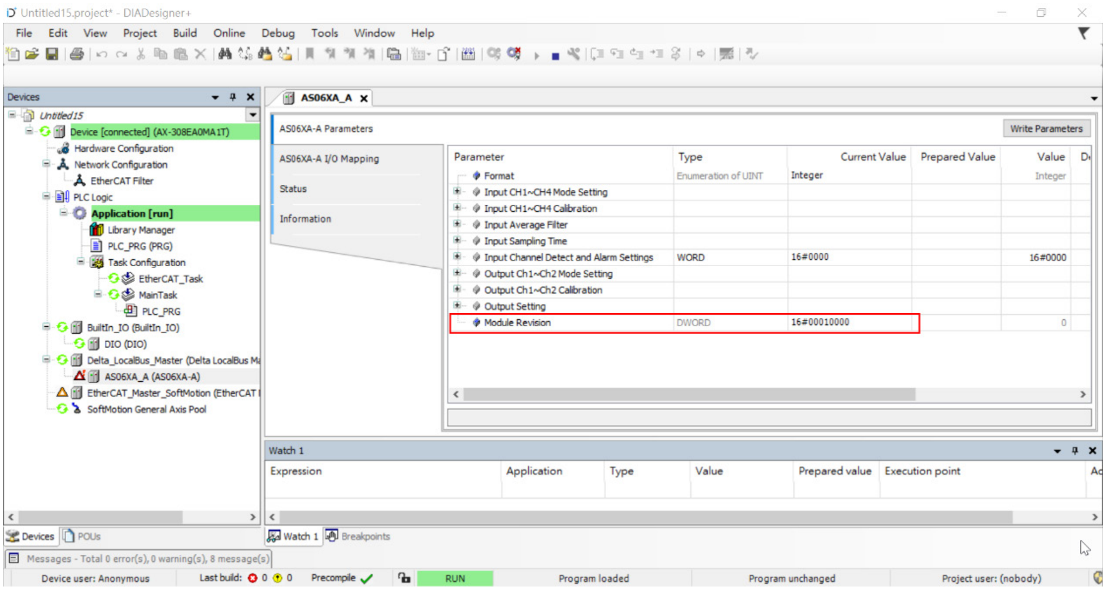
5

5.4.2 Checking the Version of a Module

(1) Select the module and click the Information tab to see the module information.

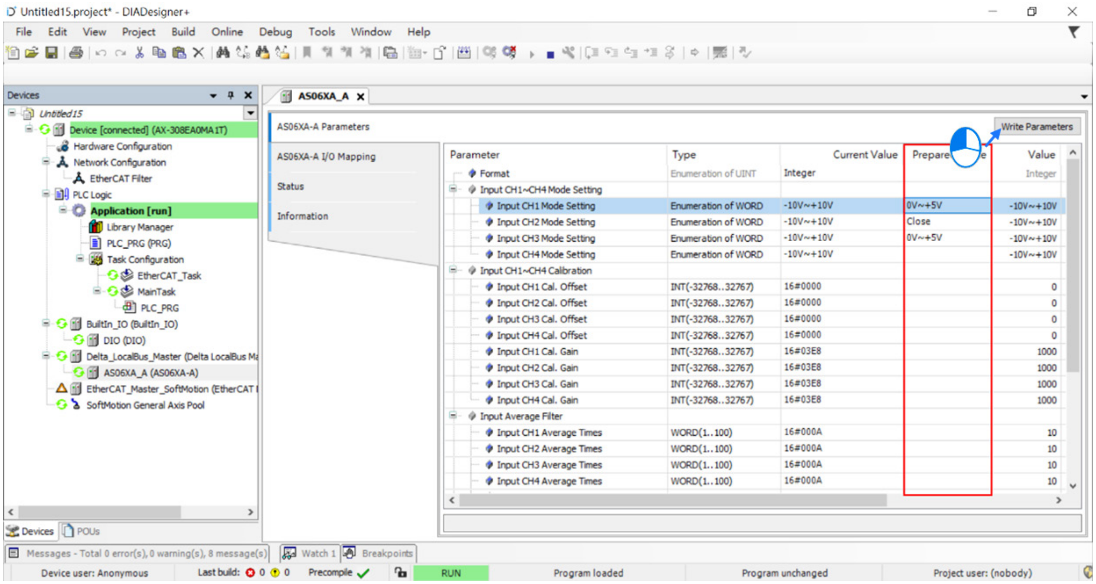


(2) Select the module and click **Login** on the tool bar to go to Online Mode. You can find the Module Revision from the Parameters tab.

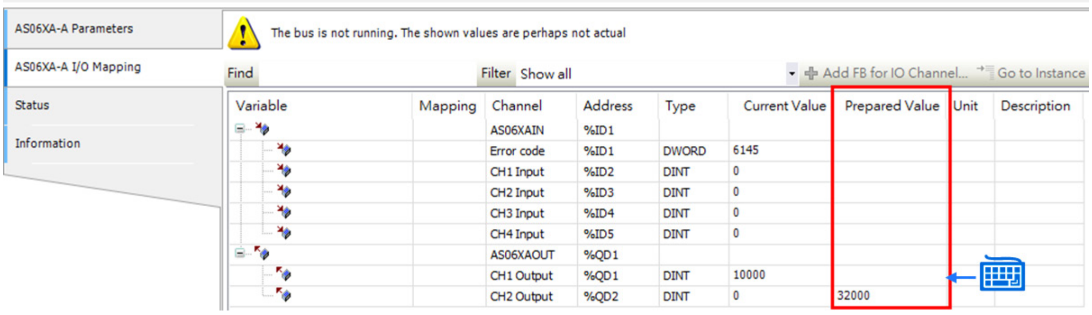


5.4.3 Online Mode

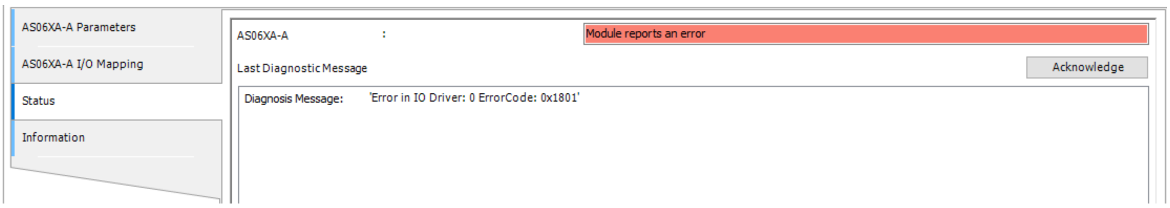
(1) Select the module and click **Login** on the tool bar to go to **Online Mode**. You can monitor all configuration parameters. Vaules in the column of Prepared Value are configurable online. After editing the values in the Prepared Value column, click **Write Parameter** to confirm the change.



(2) You can monitor the values, status, error codes in each channel from the I/O Mapping tab. You can also set a new value in the colum of Prepared Value and press Ctrol+F7 on the keyboard to write the new values in.



(3) You can monitor the current status and error codes from the Status tab.



5.4.4 Parameters

(1) You can set up the value format to **Integer** or **Floating** for Channel 1 to 4.

Parameter	Type	Value	Default Value	Unit	Description
Format	Enumeration of UINT	Integer	Integer		
CH1~CH4 Mode Setting					
CH1 Mode Setting	Enumeration of WORD	-10V~+10V	-10V~+10V		
CH2 Mode Setting	Enumeration of WORD	-10V~+10V	-10V~+10V		
CH3 Mode Setting	Enumeration of WORD	-10V~+10V	-10V~+10V		
CH4 Mode Setting	Enumeration of WORD	-10V~+10V	-10V~+10V		

(2) You can set up the values for Channel 1 to 4.

Parameter	Type	Value	Default Value	Unit	Description
Format	Enumeration of UINT	Integer	Integer		
CH1~CH4 Mode Setting					
CH1 Mode Setting	Enumeration of WORD	-10V~+10V	-10V~+10V		
CH2 Mode Setting	Enumeration of WORD		-10V~+10V		
CH3 Mode Setting	Enumeration of WORD		-10V~+10V		
CH4 Mode Setting	Enumeration of WORD		-10V~+10V		
CH1~CH4 Calibration					
CH1 Cal. Offset (V/mA)	INT(-32768..32767)		0		
CH2 Cal. Offset (V/mA)	INT(-32768..32767)		0		
CH3 Cal. Offset (V/mA)	INT(-32768..32767)		0		

Close
-10V~+10V
0V~+10V
-5V~+5V
0V~+5V
1V~+5V
0mA~20mA
4mA~20mA
-20mA~20mA

(3) You can set up the calibrations for for Channel 1 to 4.

CH1~CH4 Calibration					
CH1 Cal. Offset (V/mA)	INT(-32768..32767)	0	0		
CH2 Cal. Offset (V/mA)	INT(-32768..32767)	0	0		
CH3 Cal. Offset (V/mA)	INT(-32768..32767)	0	0		
CH4 Cal. Offset (V/mA)	INT(-32768..32767)	0	0		
CH1 Cal. Gain	INT(-32768..32767)	1000	1000		
CH2 Cal. Gain	INT(-32768..32767)	1000	1000		
CH3 Cal. Gain	INT(-32768..32767)	1000	1000		
CH4 Cal. Gain	INT(-32768..32767)	1000	1000		

(4) You can set up the average filtering for Channel 1 to 4.

Average Filter					
CH1 Average Times	WORD(1..100)	10	10		
CH2 Average Times	WORD(1..100)	10	10		
CH3 Average Times	WORD(1..100)	10	10		
CH4 Average Times	WORD(1..100)	10	10		
CH1 Filter Proportion	Enumeration of WORD	10%	10%		
CH2 Filter Proportion	Enumeration of WORD	10%	10%		
CH3 Filter Proportion	Enumeration of WORD	10%	10%		
CH4 Filter Proportion	Enumeration of WORD	10%	10%		

(5) You can set up the sampling time.

Sampling Time			
sampling time	Enumeration of WORD	2ms	2ms
Channel Detect and Alarm Settings	WORD	0	
CH1 Overrage Detect	BOOL	FALSE	FALSE
CH2 Overrage Detect	BOOL	FALSE	FALSE
CH3 Overrage Detect	BOOL	FALSE	FALSE
CH4 Overrage Detect	BOOL	FALSE	FALSE
Reserved	BOOL	FALSE	FALSE
Reserved	BOOL	FALSE	FALSE
Reserved	BOOL	FALSE	FALSE

(6) You can set up the channel detect and alarm settings.

Channel Detect and Alarm Settings	WORD	0	
CH1 Overrage Detect	BOOL	FALSE	FALSE
CH2 Overrage Detect	BOOL	FALSE	FALSE
CH3 Overrage Detect	BOOL	FALSE	FALSE
CH4 Overrage Detect	BOOL	FALSE	FALSE
Reserved	BOOL	FALSE	FALSE
Reserved	BOOL	FALSE	FALSE
Reserved	BOOL	FALSE	FALSE
Reserved	BOOL	FALSE	FALSE
External Power Supply Error	BOOL	FALSE	FALSE
Hardware Error	BOOL	FALSE	FALSE
Adjustment Error	BOOL	FALSE	FALSE

5

(7) You can set up the output channel mode for Channel 1 and 2.

Output Ch1~Ch2 Mode Setting			
Output CH1 Mode Setting	Enumeration of WORD	-10V~+10V	-10V~+10V
Output CH2 Mode Setting	Enumeration of WORD	-10V~+10V	-10V~+10V

(8) You can set up the calibrations for output Channel 1 and 2.

Output Ch1~Ch2 Calibration			
Output CH1 Cal. Offset	INT(-32768..32767)	0	0
Output CH2 Cal. Offset	INT(-32768..32767)	0	0
Output CH1 Cal. Gain	INT(-32768..32767)	1000	1000
Output CH2 Cal. Gain	INT(-32768..32767)	1000	1000

(9) You can set up the output settings for output Channel 1 and 2.

Output Setting			
Output CH1 Output Hold	Enumeration of WORD	Clear	Clear
Output CH2 Output Hold	Enumeration of WORD	Clear	Clear
Output CH1 Setting Time(10ms)	INT(0..3200)	0	0
Output CH2 Setting Time(10ms)	INT(0..3200)	0	0

5.5 Troubleshooting

5.5.1 Error Codes

Error Code	Description	A↔D LED indicator	ERROR LED indicator
16#1605	Hardware failure	OFF	ON
16#1607	The external voltage is abnormal.	OFF	ON
16#1608	The factory calibration is abnormal.	OFF	ON
16#1801	The external voltage is abnormal.	OFF	Blinking
16#1802	Hardware failure	OFF	Blinking
16#1804	The factory calibration is abnormal.	OFF	Blinking
16#1808	The signal received by channel 1 exceeds the range of inputs that the hardware can receive.	Run: blinking Stop: OFF	Blinking
16#1809	The signal received by channel 2 exceeds the range of inputs that the hardware can receive.		
16#180A	The signal received by channel 3 exceeds the range of inputs that the hardware can receive.		
16#180B	The signal received by channel 4 exceeds the range of inputs that the hardware can receive.		
-	When power-on, the module is not detected by CPU module.	OFF	Blinking once or twice and after 2 seconds, it blinks repeatedly

5.5.2 Troubleshooting Procedure

Description	Procedure
The external voltage is abnormal.	Ensure the external 24 V power supply to the module is functioning normally.
Hardware failure	Return the module to the factory for repair.
Internal error The factory calibration is abnormal.	Contact the factory.

Description	Procedure
The signal received by channel 1 exceeds the range of inputs that the hardware can receive.	Check the signal received by channel 1
The signal received by channel 2 exceeds the range of inputs that the hardware can receive.	Check the signal received by channel 2.
The signal received by channel 3 exceeds the range of inputs that the hardware can receive.	Check the signal received by channel 3.
The signal received by channel 4 exceeds the range of inputs that the hardware can receive.	Check the signal received by channel 4.
When power-on, the module is not detected by CPU module.	Check if the connection between module and CPU module is working. If not, connect again.

6

Chapter 6 Temperature Measurement Module AS04/06RTD

Table of Contents

6.1 Overview

6.1.1 Characteristics

This section describes the specifications for temperature measurement modules, their operation, and their programming. The AS04/06RTD is a temperature measurement module that converts the temperatures received from four/six thermocouples into digital signals. You can select either Celsius or Fahrenheit as the unit of measurement.

6.1.2 Characteristics

(1) **Select a sensor based on its practical application.**

Pt100/Ni100/Pt1000/Ni1000/JPt100/LG-Ni1000/Cu50/Cu100/0–300 Ω/0–3000 Ω sensor

(2) **High-speed conversion**

Two-wire/Three-wire configuration: 200 ms/channel

(3) **High accuracy**

Conversion accuracy: The error range of the input is ±0.1% at ambient temperature of 25° ±5° C.)

(4) **Disconnection detection**

When a sensor is disconnected, the AS04RTD produces an alarm or a warning.

(5) **PID control**

An object’s temperature can be maintained through PID control actions.

(6) **Use the utility software to configure the module.**

The HWCONFIG utility software is built into ISPSoft. You can set modes and parameters directly in HWCONFIG without spending time writing programs to set registers to manage functions.

6.2 Specifications and Functions

6.2.1 Specifications

- **Electrical specifications**

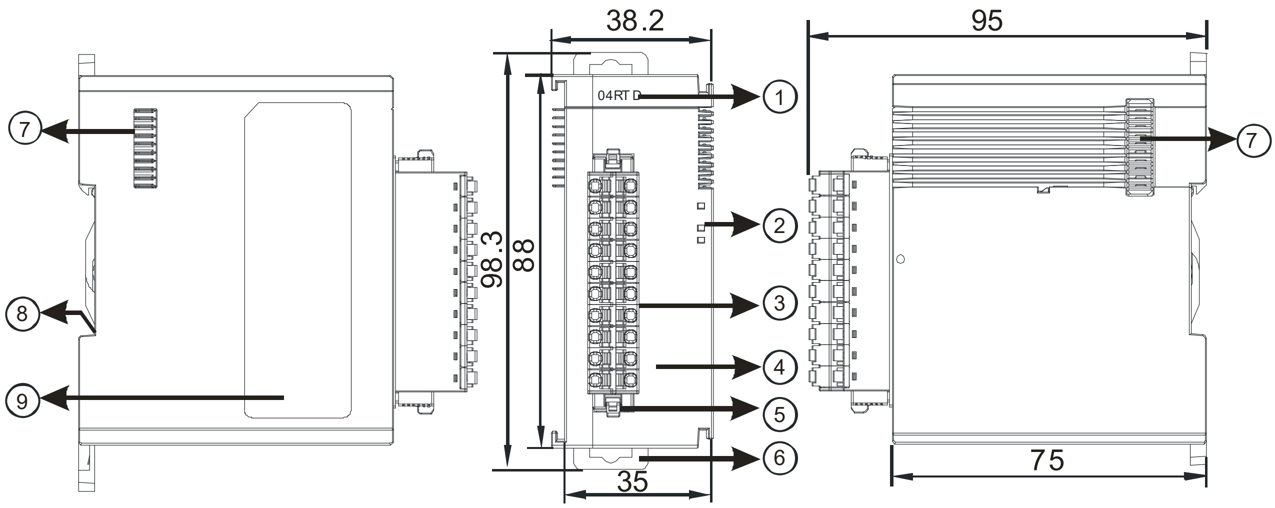
<table>
<tr><th>Module</th><th>AS04RTD-A</th><th>AS06RTD-A</th></tr>
<tr><td>Number of Analog Inputs</td><td>4</td><td>6</td></tr>
<tr><td>Applicable Sensor</td><td colspan="2">2-Wire & 3-Wire Pt100/Ni100/Pt1000/Ni1000/JPt100/LG-Ni1000/Cu50/Cu100/0–300 Ω/0–3000 Ω
Pt100: DIN 43760-1980 JIS C1604-1989; 100 Ω 3850 PPM/°C
Pt1000: DIN EN60751; 1 kΩ 3850 PPM/°C
Ni100/Ni1000: DIN 43760
JPt100：JIS C1604-1989
LG-Ni1000
Cu50/Cu100</td></tr>
<tr><td>Supply Voltage</td><td colspan="2">24 VDC (20.4–28.8 VDC) (-15% to +20%)</td></tr>
<tr><td>Connector Type</td><td colspan="2">Removable terminal block</td></tr>
<tr><td rowspan="4">Overall Accuracy</td><td colspan="2">Pt100/Ni100/Pt1000/Ni1000/JPt100
25° C/77° F: The allowed error range is ±0.1% of full scale.
-20° C to 60° C/-4° F to 140° F: The allowed error range is ±0.5% of full scale.</td></tr>
<tr><td colspan="2">LG-Ni1000; 25° C/77° F: The allowed error range is ±0.1% of full scale.</td></tr>
<tr><td colspan="2">Cu50; 25° C/77° F: The allowed error range is ±4% of full scale.</td></tr>
<tr><td colspan="2">Cu100; 25° C/77° F: The allowed error range is ±2% of full scale.</td></tr>
<tr><td>Conversion Time</td><td colspan="2">Two-wire/Three-wire configuration: 200 ms/channel</td></tr>
<tr><td>Isolation</td><td colspan="2">An analog circuit is isolated from a digital circuit by a digital integrated circuit/ optocoupler, and the analog channels are isolated from one another by optocouplers.
Isolation between a digital circuit and the ground: 500 VDC
Isolation between an analog circuit and the ground: 500 VDC
Isolation between an analog circuit and the digital circuit: 500 VDC
Isolation between the 24 VDC and the ground: 500 VDC</td></tr>
<tr><td>Weight</td><td>115 g</td><td>125 g</td></tr>
</table>

- **Functional specifications**

Analog-to-Digital Conversion	Centigrade (°C)	Fahrenheit (°F)	Input Impedance
Rated Input Range[*1]	Pt100 : -180° C to +800° C Ni100 : -80° C to +170° C Pt1000 : -180° C to +800° C Ni1000 : -80° C to +170° C JPt100 : -180° C to +500° C LG-Ni1000 : -50° C to +180° C Cu50 : -50° C to +150° C Cu100 : -50° C to +150° C	Pt100 : -292° F to +1,472° F Ni100 : -112° F to +338° F Pt1000 : -292° F to +1,472° F Ni1000 : -112° F to +338° F JPt100 : -292° F to +932° F LG-Ni1000 : -58° F to +356° F Cu50 : -58° F to +302° F Cu100 : -58° F to +302° F	0–300 Ω 0–3000 Ω
Average function	Range: 1-100		
Self-diagnosis	Disconnection detection		

*1 If the measured temperature exceeds the upper limit, it only shows the maximum value. If the measured temperature is below the lower limit, it only shows the minimum value.

6.2.2 Profile

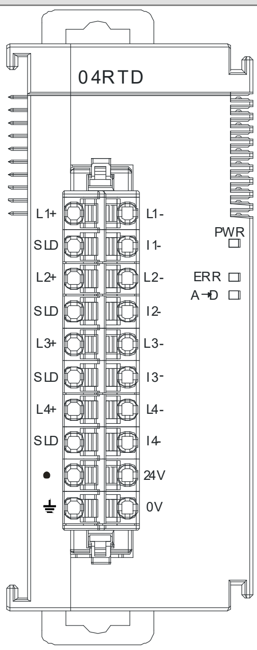
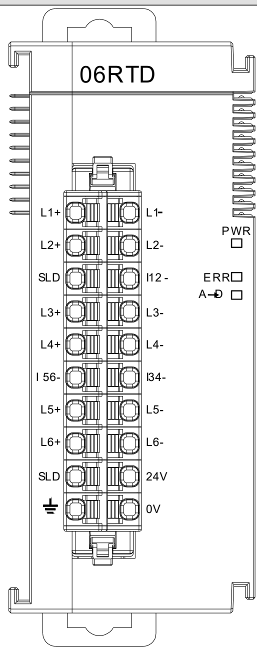


Unit: mm

Number	Name	Description
1	Model Name	Model name of the module
2	RUN LED Indicator	Operating status of the module ON: the module is running. OFF: the module is not running.
	ERROR LED Indicator	Error status of the module ON: a serious error exists in the module.

Number	Name	Description
		OFF: the module is operating normally. Blink: a minor error exists in the module.
	Analog-to-Digital Conversion Indicator	Conversion status Blinking: conversion is in process. OFF: conversion has stopped.
3	Removable Terminal Block	The inputs are connected to transducers. The outputs are connected to loads to be driven.
4	Arrangement of the Input/Output Yerminals	Arrangement of the terminals
5	Clip	For removing the terminal block
6	DIN Rail Clip	Secures the module onto the DIN rail
7	Module Connecting Set	Connects the modules
8	Ground Clip	

6.2.3 Arrangement of Terminals

AS04RTD-A	AS06RTD-A
	

6.2.4 AS04RTD Control Registers

*If you use HWCONFIG to set values in CRs, once the set value is downloaded, the values can be retained in the module; however if you use TO instruction to write data into CRs, the values CANNOT be retained, after power failure or after transition of the CPU from STOP to RUN.

Note: The attribute of the CR must be W (write) to use TO instruction.

CR#	Name	Description	Atr.	Defaults
0	Format Setup	0: integer format 1: floating point format	R	0
1	Channel 1 mode setup	0: closed 1：0–300 Ω (default) 2：0–3000 Ω 3：Pt100 4：JPt100 5：Pt1000 6：Ni100 7：Ni1000 8：LG-Ni1000 9：Cu50 10：Cu100	R/W	1
2	Channel 2 mode setup			
3	Channel 3 mode setup			
4	Channel 4 mode setup			
5	Channel 1 offset	Range: -32768 to +32767	R/W	0
6	Channel 2 offset			
7	Channel 3 offset			
8	Channel 4 offset			
9	Channel 1 gain	Range: -32768 to +32767	R/W	1000
10	Channel 2 gain			
11	Channel 3 gain			
12	Channel 4 gain			
13	Channel 1 average times	Range: 1–100	R/W	10
14	Channel 2 average times			
15	Channel 3 average times			
16	Channel 4 average times			
17	Channel 1 filter average percentage	Range: 0–3 Unit: ±10%	R/W	1
18	Channel 2 filter average percentage			

CR#	Name	Description	Atr.	Defaults
19	Channel 3 filter average percentage			
20	Channel 4 filter average percentage			
21	Units of temperature	0: Fahrenheit 1: Celsius	R/W	0
22	Channel alarm setup	0: open channel alarm 1: close channel alarm bit0: channel 1 bit1: channel 2 bit2: channel 3 bit3: channel 4 0: warning 1: alarm bit8: error in the power supply bit9: error in the module hardware bit10: error in calibration	R/W	0
201	Instruction set	16#0101: record the peak value again for channel 1 16#0102: record the peak value again for channel 2 16#0104: record the peak value again for channel 3 16#0108: record the peak value again for channel 4 16#010F: record the peak values again for channels 1–4 16#0201: enable recording for channel 1 16#0202: enable recording for channel 2 16#0204: enable recording for channel 3 16#0208: enable recording for	W	0

6

CR#	Name	Description	Atr.	Defaults
		channel 4 16#020F: enable recording for channels 1–4 16#0211: disable recording for channel 1 16#0212: disable recording for channel 2 16#0214: disable recording for channel 3 16#0218: disable recording for channel 4 16#021F: disable recording for channels 1–4 16#0502: restore default settings		
210	The maximum peak value for channel 1	Integer format; the maximum peak value for analog inputs	R	-
211	The maximum peak value for channel 2			-
212	The maximum peak value for channel 3			-
213	The maximum peak value for channel 4			-
214	The minimum peak value for channel 1	Integer format; the minimum peak value for analog inputs	R	-
215	The minimum peak value for channel 2			-
216	The minimum peak value for channel 3			-
217	The minimum peak value for channel 4			-
222	The time to record for channel 1	Unit: 10 ms Range: 1–100 The time to record the digital value for the channels	R/W	1
223	The time to record for channel 2			1
224	The time to record for channel 3			1
225	The time to record for channel 4			1
240	The number of records for channel 1	Range: 0–500, display the current records	R	0
241	The number of records for channel 2			0
242	The number of records for channel 3			0
243	The number of records for channel 4			0
4000-4499	Records for channel 1	500 records for channel 1	R	--
4500-	Records for channel 2	500 records for channel 2	R	--

6

CR#	Name	Description	Atr.	Defaults
4999				
5000- 5499	Records for channel 3	500 records for channel 3	R	--
5500- 5999	Records for channel 4	500 records for channel 4	R	--

6.2.5 AS06RTD Control Registers

*If you use HWCONFIG to set values in CRs, once the set value is downloaded, the values can be retained in the module; however if you use TO instruction to write data into CRs, the values CANNOT be retained, after power failure or after transition of the CPU from STOP to RUN.

Note: The attribute of the CR must be W (write) to use TO instruction.

CR#	Name	Description	Atr.	Defaults
0	Format Setup	0: integer format 1: floating point format	R	0
1	Channel 1 mode setup	0: closed 1：0–300 Ω (default) 2：0–3000 Ω 3：Pt100 4：JPt100 5：Pt1000 6：Ni100 7：Ni1000 8：LG-Ni1000 9：Cu50 10：Cu100	R/W	1
2	Channel 2 mode setup			
3	Channel 3 mode setup			
4	Channel 4 mode setup			
5	Channel 5 mode setup			
6	Channel 6 mode setup			
7	Channel 1 offset	Range: -32768 to +32767	R/W	0
8	Channel 2 offset			
9	Channel 3 offset			
10	Channel 4 offset			
11	Channel 5 offset			
12	Channel 6 offset			
13	Channel 1 gain	Range: -32768 to +32767	R/W	1000
14	Channel 2 gain			
15	Channel 3 gain			
16	Channel 4 gain			
17	Channel 5gain			
18	Channel 6 gain			
19	Channel 1 average times	Range: 1–100	R/W	10
20	Channel 2 average times			

CR#	Name	Description	Atr.	Defaults
21	Channel 3 average times			
22	Channel 4 average times			
23	Channel 5 average times			
24	Channel 6 average times			
25	Channel 1 filter average percentage	Range: 0–3 Unit: ±10%	R/W	1
26	Channel 2 filter average percentage			
27	Channel 3 filter average percentage			
28	Channel 4 filter average percentage			
29	Channel 5 filter average percentage			
30	Channel 6 filter average percentage			
31	Units of temperature	0: Fahrenheit 1: Celsius	R/W	0
32	Channel alarm setup	0: open channel alarm 1: close channel alarm bit0: channel 1 bit1: channel 2 bit2: channel 3 bit3: channel 4 bit4: channel 5 bit5: channel 6 0: warning 1: alarm bit8: error in the power supply bit9: error in the module hardware bit10: error in calibration	R/W	0

6

CR#	Name	Description	Atr.	Defaults
201	Instruction set	16#0101: record the peak value again for channel 1 16#0102: record the peak value again for channel 2 16#0104: record the peak value again for channel 3 16#0108: record the peak value again for channel 4 16#110: record the peak values again for channels 5 16#120: record the peak values again for channels 6 16#013: record the peak values again for channels 1-6 16#0201: enable recording for channel 1 16#0202: enable recording for channel 2 16#0204: enable recording for channel 3 16#0208: enable recording for channel 4 16#0210: enable recording for channels 5 16#0220: enable recording for channels 6 16#023F: enable recording for channels 1-6 16#0301: disable recording for channel 1 16#0302: disable recording for channel 2 16#0304: disable recording for channel 3 16#0308: disable recording for channel 4 16#0310: disable recording for channel 5 16#0320: disable recording for channel 6 16#033F: disable recording for channel1-6 16#0501: restore default settings, clear setting values in the Flash 16#0502: restore default settings, do not clear setting values in the Flash	W	0

CR#	Name	Description	Atr.	Defaults
210	The maximum peak value for channel 1	Integer format; the maximum peak value for analog inputs	R	-
211	The maximum peak value for channel 2			-
212	The maximum peak value for channel 3			-
213	The maximum peak value for channel 4			-
214	The maximum peak value for channel 5			-
215	The maximum peak value for channel 6			-
216	The minimum peak value for channel 1	Integer format; the minimum peak value for analog inputs	R	-
217	The minimum peak value for channel 2			-
218	The minimum peak value for channel 3			-
219	The minimum peak value for channel 4			-
220	The minimum peak value for channel 5			-
221	The minimum peak value for channel 6			-
222	The time to record for channel 1	Unit: 100 ms Range: 1–100 The time to record the digital value for the channels	R/W	1
223	The time to record for channel 2			1
224	The time to record for channel 3			1
225	The time to record for channel 4			1
226	The time to record for channel 5			1
227	The time to record for channel 6			1
240	The number of records for channel 1	Range: 0–200, display the current records	R	0
241	The number of records for channel 2			0

6

CR#	Name	Description	Atr.	Defaults
242	The number of records for channel 3			0
243	The number of records for channel 4			0
244	The number of records for channel 5			0
245	The number of records for channel 6			0
4000 - 4199	Records for channel 1	200 records for channel 1	R	-
4500 - 4699	Records for channel 2	200 records for channel 2	R	-
5000 - 5199	Records for channel 3	200 records for channel 3	R	-
5500 - 5699	Records for channel 4	200 records for channel 4	R	-
6000 - 6199	Records for channel 4	200 records for channel 5	R	-
6500 - 6699	Records for channel 4	200 records for channel 6	R	-

6.2.6 Functions

Use the HWCONFIG utility software built into ISPSoft to set modes of operation and parameters.

- **Analog input**

Item	Function	Description
1	Enable/Disable a Channel	1. Enable or disable a channel. 2. If a channel is disabled, the total conversion time decreases.
2	Unit of Measurement	Select the unit of measurement: Fahrenheit or Celsius.
3	Calibration	Calibrate a linear curve.
4	Average	Conversion values are averaged and filtered.
5	Disconnection Detection	If the channel is open, the module can detect when it is disconnected. If the input is open-circuited, the module produces an alarm or a warning.
6	Channel Detection and Alarm	If an input signal exceeds the range of inputs that the hardware can receive, the module produces an alarm or a warning. You can disable this function.
7	Limit Detections for Channels	Save the maximum/minimum values for channels.
8	Records for Channels	Save the analog curves for channels.
9	PID Algorithm	PID control modes

1. Enable/Disable a Channel

An analog signal is converted into a digital signal at a rate of 200 ms per channel. If a channel is not used, you can disable it to decrease the total conversion time.

2. Unit of Measurement

Select the unit of measurement, Fahrenheit or Celsius, according to your needs.

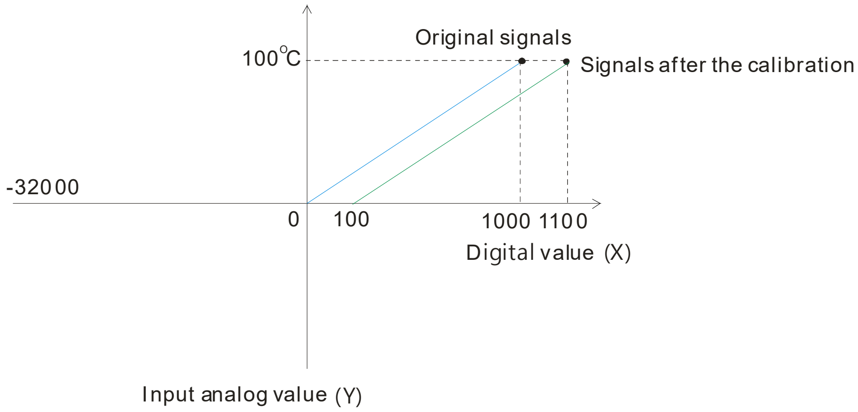
3. Calibration

- To make a curve meet specific needs, calibrate the curve by changing the offset and the gain. The calibration range depends on the range of inputs that the hardware can receive. The formula is:

$$Output = \frac{(Input \times Gain)}{1000} + Offset$$

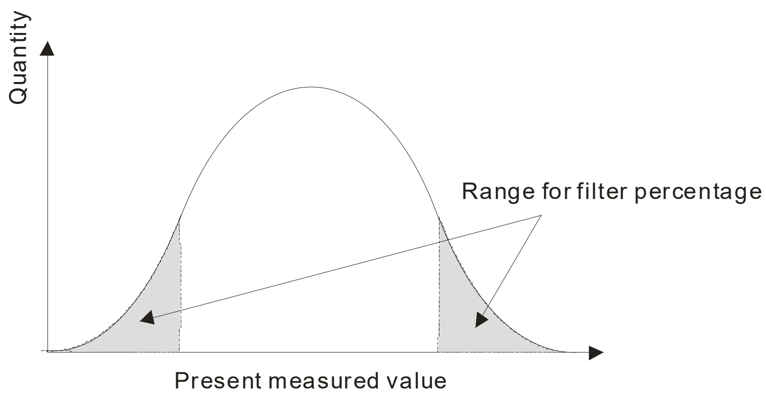
Example:

If the gain is 1000 and the offset is 0, the corresponding value for the original signal 0° C to 100° C is 0–1000. If you change the offset to 100, the calibrated value for the original signal 0° C to 100° C becomes 100–1100.



4. Average

You can set the average value between 1–100. It is a steady value obtained from the sum of the recorded values. If the recorded values include an acute pulse due to unavoidable external factors, however, you may observe violent changes in the average value. Use the filtering function to exclude the acute pulses from the sum-up and equalization, so the computed average value is not affected by the acute recorded values. Set the filter percentage to the range 0–3, where the unit is 10%. If you set the filter range to 0, the system sums up all the recorded values and divides them to obtain the average value, but if you set the filter range to 1, for example, the system excludes the bottom 10% and the top 10% of the values and averages only the remaining values to obtain the average value.



5. Disconnection Detection

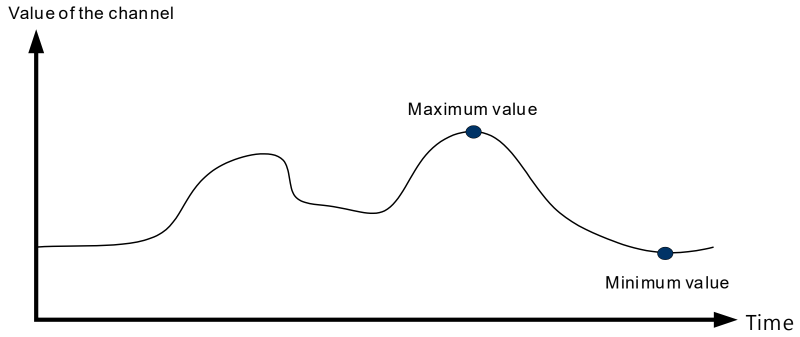
If the channel is open, the module can detect when it is disconnected. If the input is open-circuited, the module produces an alarm or a warning.

6. Channel Detection

If an input signal exceeds the allowable range of inputs, an error message appears. You can disable this function so that the module does not produce an alarm or a warning when the input signal exceeds the input range.

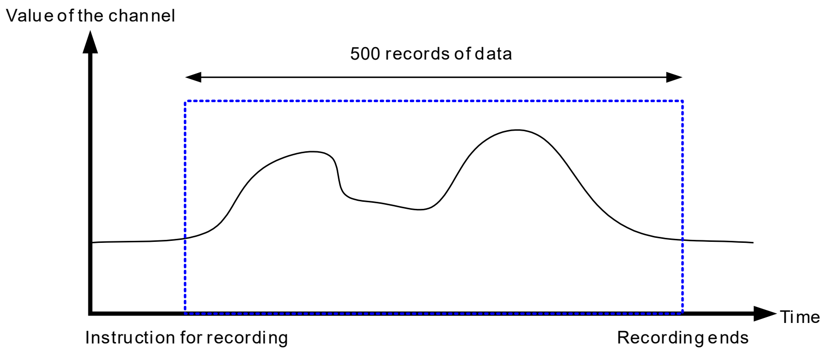
7. Limit Detections for Channels

This function saves the maximum and minimum values for channels so that you can determine the peak to peak values.



8. Records for Channels

Record the input values of the cyclic sampling for each channel. The system saves up to 500 data points for AS04RTD-A and up to 200 data points for AS06RTD-A and the recording time is 100 ms. The following uses AS04RTD-A as an example to demonstrate.



9. PID control

PID algorithm is available for every channel. With its auto tuning function, parameters such as Kp, Ki, Kd and more can be calculated and therefore temperature control can be achieved. You can also use DMPID instruction to calculate relative parameters by entering the parameters in the endpoints of corresponding instruction image and you can then obtain the output values from the output endpoints. Note: DMPID instruction is availbe for AS04RTD-A (V1.04 or later), AS06RTD-A (V1.00 or later), AS Series PLC (V1.06 or later) and AS-SCM (V2.04 or later).

6.2.7 Control Mode

1. Refer to section 7.2.7 for more details on how to use DMPID instruction.

2. When using PID parameters to set up control registers: PID control registers of AS04RTD-A are retainable; however PID control registers of AS06RTD-A are not retainable.

6.2.8 Wiring

- **Precautions**

  To ensure the analog-to-digital module functions well and reliably, the external wiring must prevent noise. Before you install the cables, follow the precautions below.

  (1) To prevent a surge and induction, the AC cable and the input signal cables that are connected to the ASRTD Series must be separate cables.

  (2) Do not install the cable near a main circuit, a high-voltage cable, or a cable connected to a load which is not a PLC. In addition, the cable must not be bound to a main circuit, a high-voltage cable, or a cable connected to a load which is not a PLC.

  (3) Ground shielded cables and hermetically sealed cables separately.

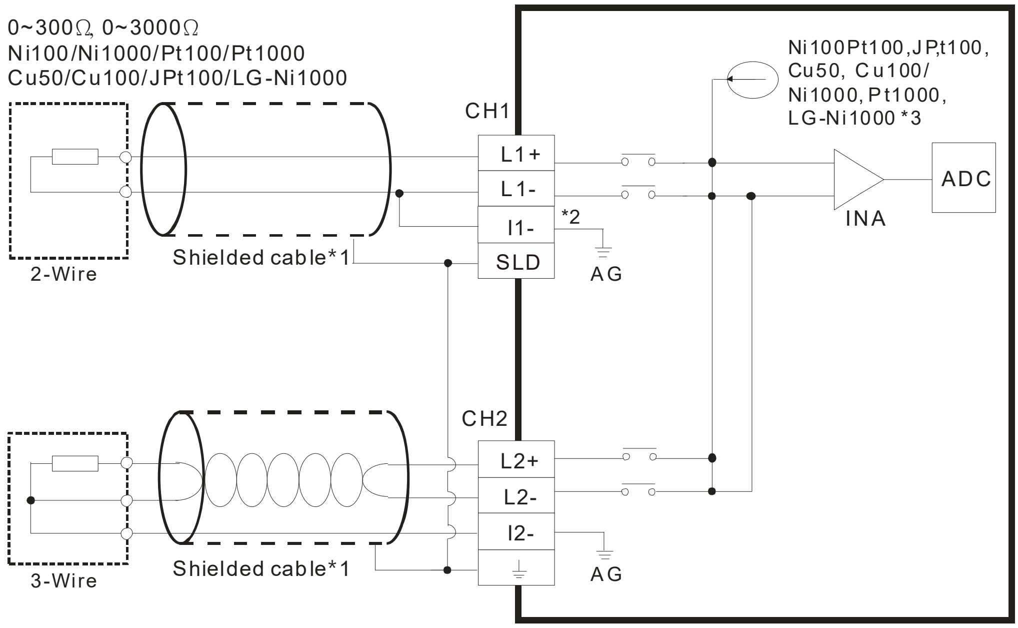
  (4) Terminals with insulation sleeves cannot be arranged as a terminal block, so you should cover the terminals with insulation tubes.

  (5) Note: use cables with the same length (less than 200 m) and use wire resistance of less than 20 ohm.

6

- **External wiring**

  (1) AS04RTD-A



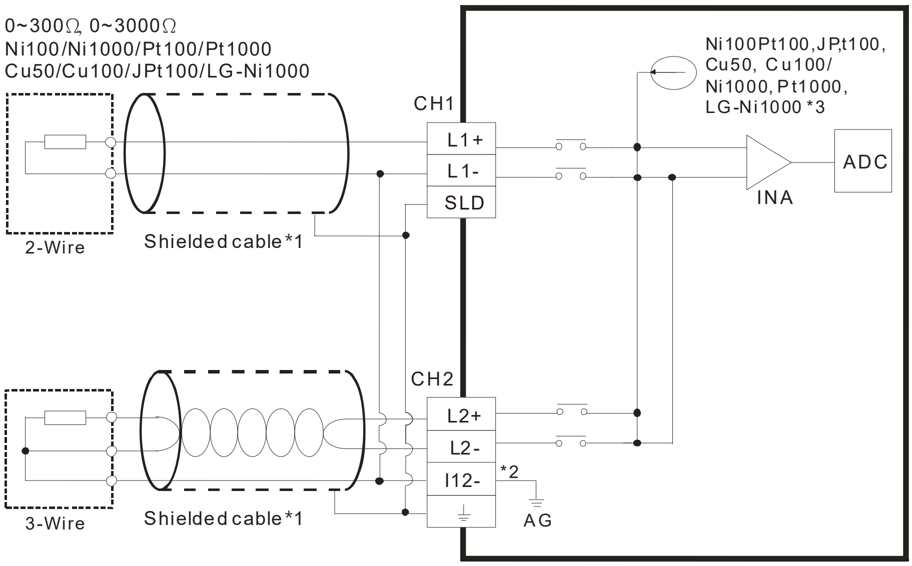
*1. Use shielded twisted pair cables for temperature sensors, and keep them away from power cables and other cables that generate noise.

*2. If using two-wire temperature sensors, L**n**- and I**n**- must be short-circuited (where **n** is between 1–4).

*3. There are two different internal excitation currents. If you are using a Ni100 temperature sensor, a Pt100 sensor, a JPt100, a Cu50/Cu100, or a 0~300 Ω resistance sensor, the internal excitation current is 1.5 mA. If you are using a Ni1000 temperature sensor, a Pt1000 temperature sensor, a LG-Ni1000 sensor, or a 0~3000 Ω resistance sensor, the internal excitation current is 0.2 mA.

Note: When using a three-wire temperature sensor, the cables should be the same length (less than 200 meter) and with a resistor less than 20 ohm.

(2) AS06RTD-A



*1. Use shielded twisted pair cables for temperature sensors and keep them away from power cables and other cables that generate noise.

*2. Terminal “I12-“ indicates “ I1- & I2-“, terminal “I34-“ indicates “ I3- & I4-“, and terminal “I56-“ indicates “ I5- & I6-“. If you use two-wire temperature sensors, Ln- and In- must be short-circuited (where n is between 1–6).

*3. There are two different internal excitation currents. If you are using a Ni100 temperature sensor, a Pt100 sensor, a JPt100, a Cu50/Cu100, or a 0~300 Ω resistance sensor, the internal excitation current is 1.0 mA. If you are using a Ni1000 temperature sensor, a Pt1000 temperature sensor, a LG-Ni1000 sensor, or a 0~3000 Ω resistance sensor, the internal excitation current is 0.2 mA.

Note: When using a three-wire temperature sensor, the cables should be the same length (less than 200 meter) and with a resistor less than 20 ohm.

6.2.9 LED Indicators

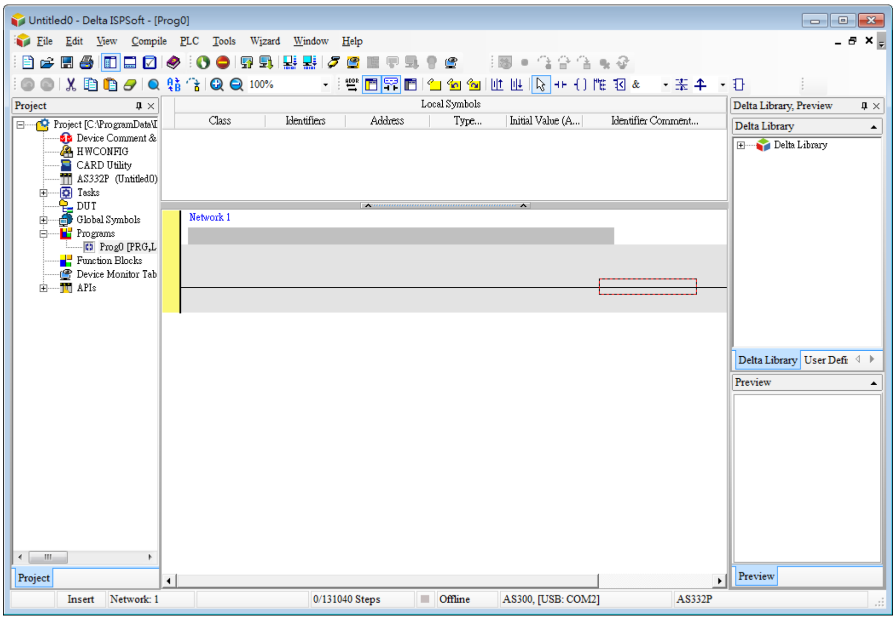
Number	Name	Description
1	RUN LED Indicator	Operating status of the module ON: the module is running. OFF: the module is not running.
2	ERROR LED Indicator	Error status of the module ON: a serious error exists in the module. OFF: the module is operating normally. Blink: a minor error exists in the module.
3	Analog-to-Digital Conversion Indicator	Conversion status Blinking: conversion is in process. OFF: conversion has stopped.

6.3. HWCONFIG in ISPSoft

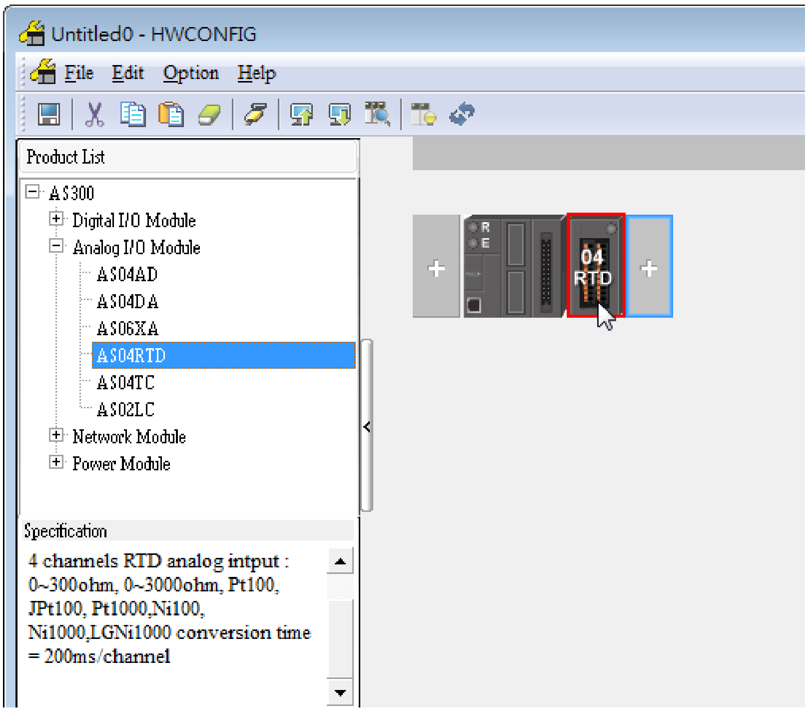
6.3.1 Initial Setting

The following users AS04RTD-A as an example to demonstrate.

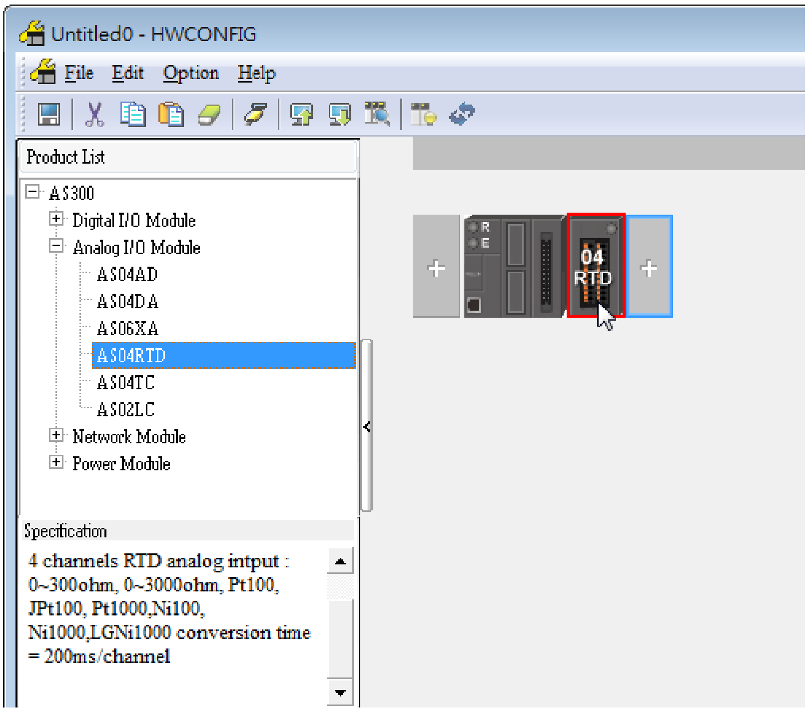
(1) Start ISPSoft and double-click **HWCONFIG**.

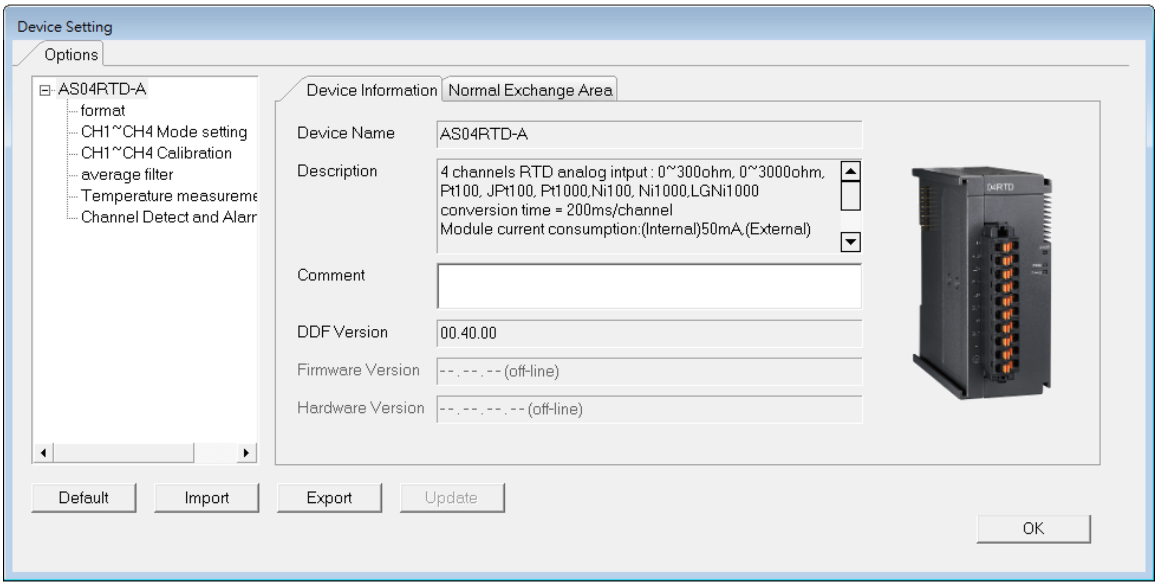


(2) Select a module and drag it to the working area.



(3) Double-click the module in the working area to open the Device Setting page.





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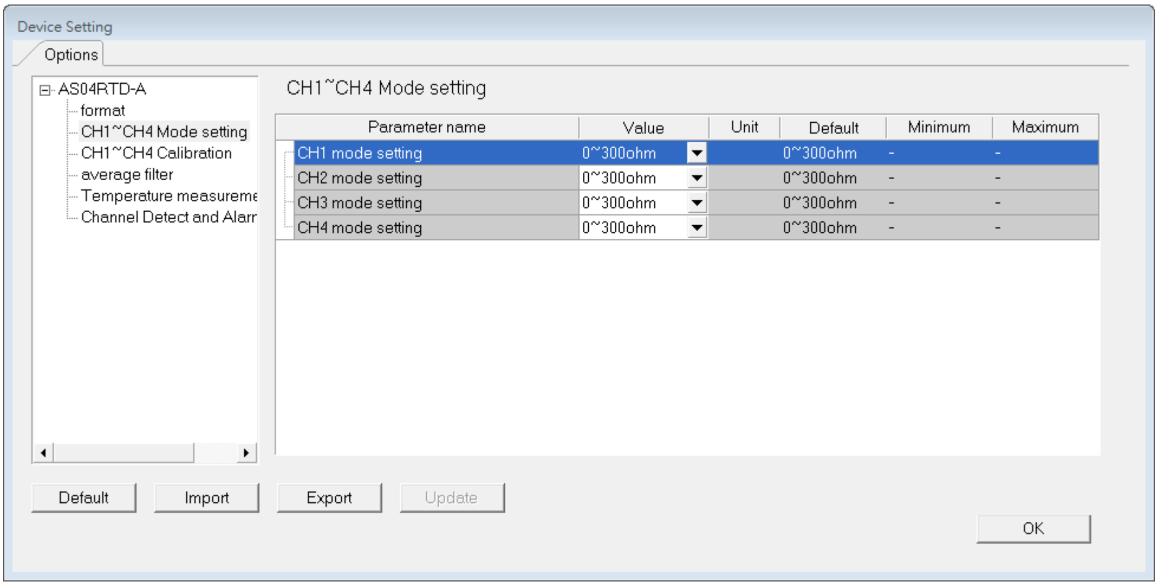
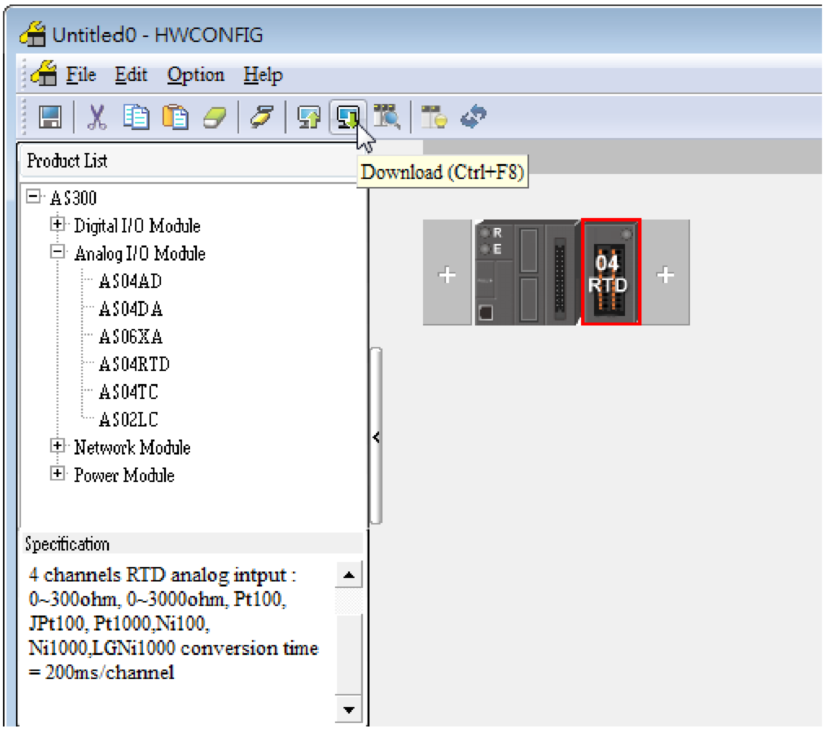
(4) Choose the parameter, set the values, and click **OK**.



(5) Click **Download** on the toolbar to download the parameters. Note that you cannot download the parameters while the CPU module is running.



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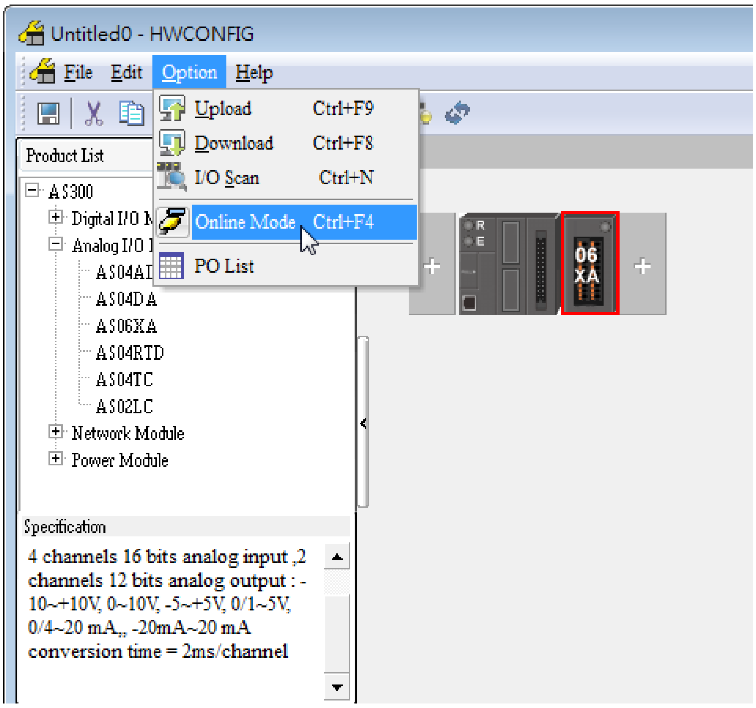
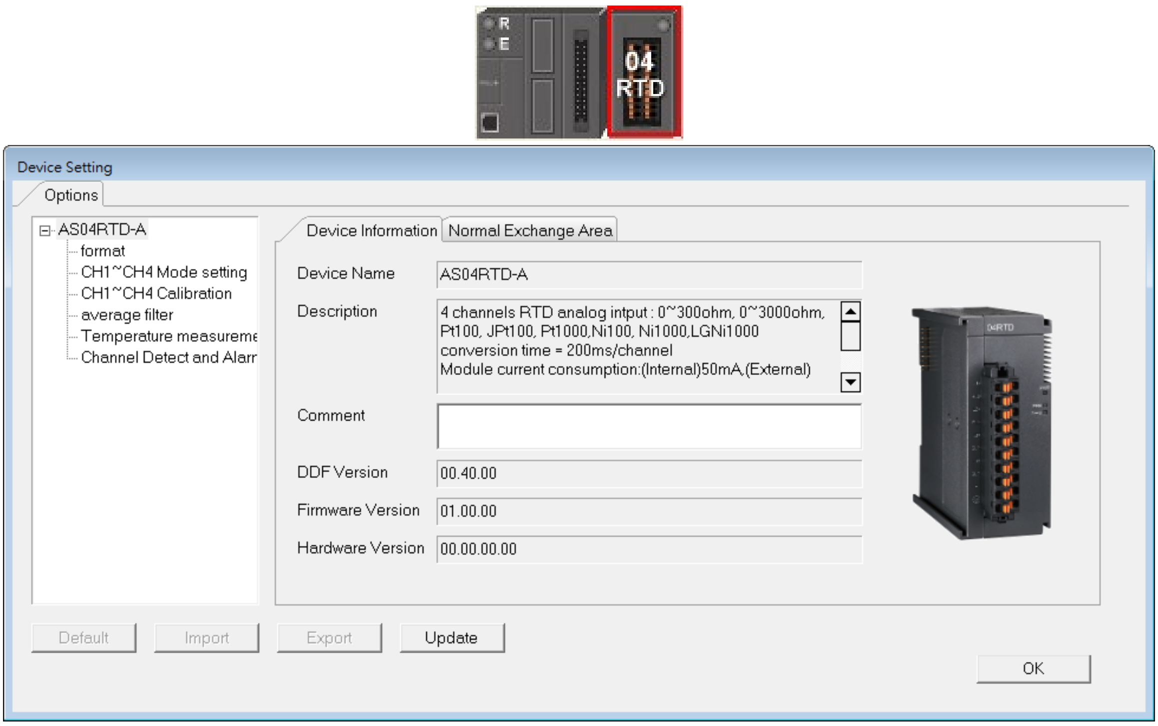
6.3.2 Checking the Version of a Module

(1) On the **Option** menu, click **Online Mode**.



(2) Double-click the module to open the Device Setting page. The versions of both the firmware and the hardware are displayed.



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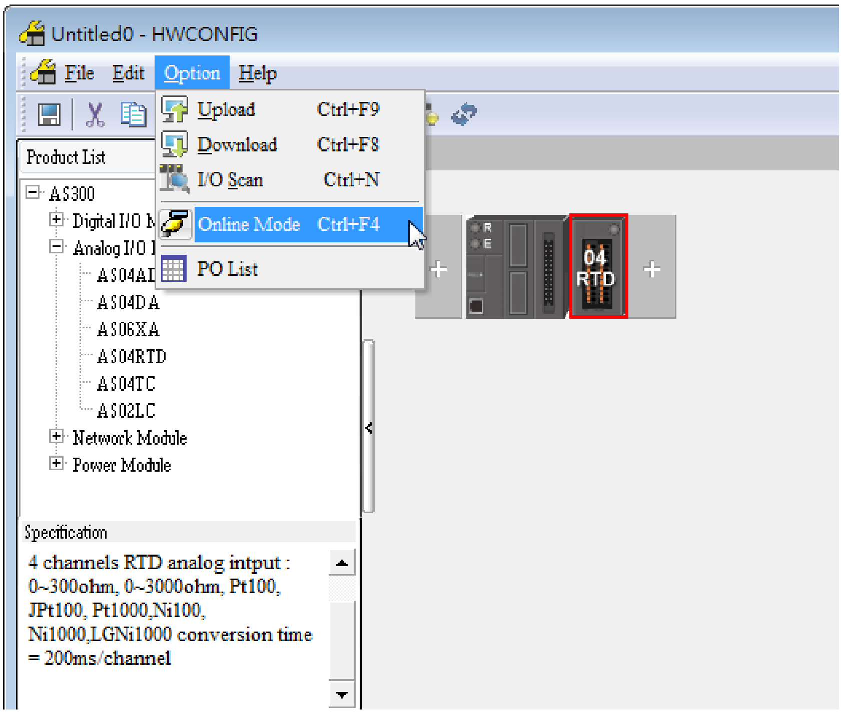
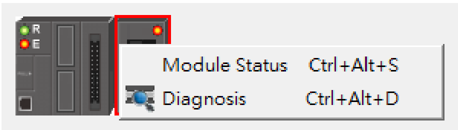
6.3.3 Online Mode

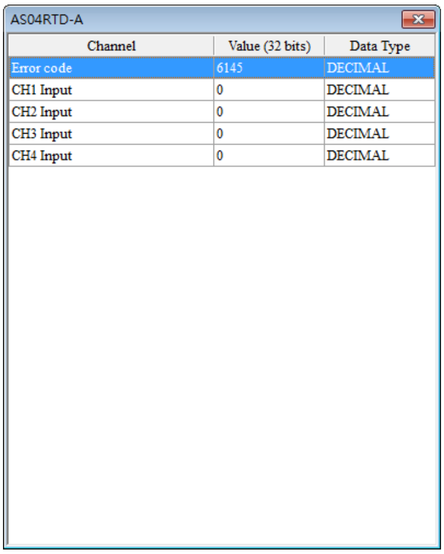
(1) On the **Option** menu, click **Online Mode**.



(2) Right-click the module and click **Module Status**.

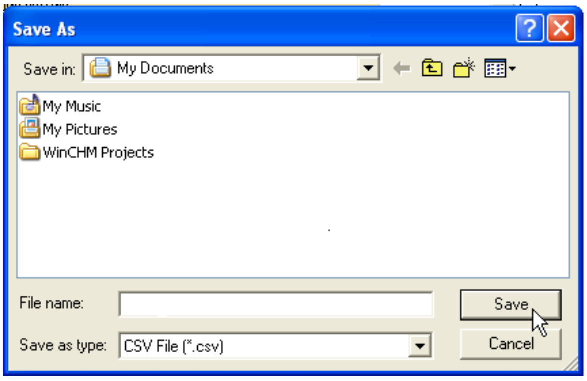


(3) View the module status.

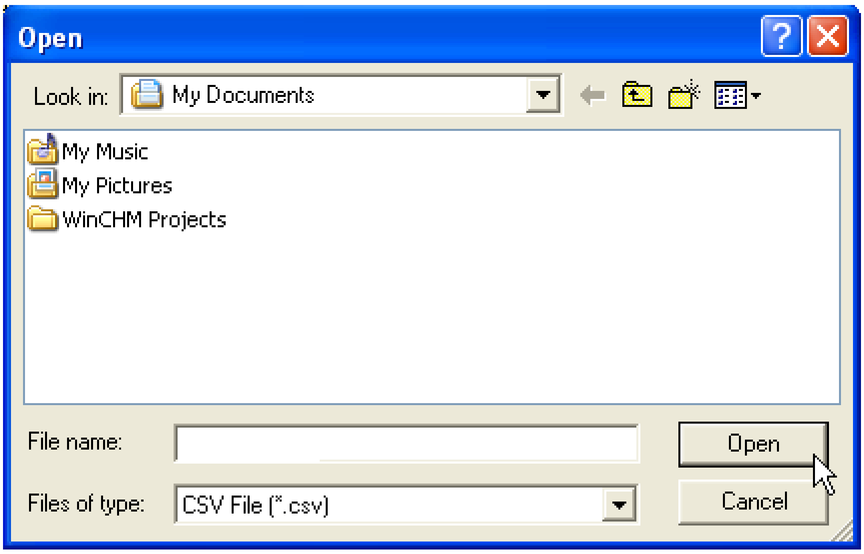


6.3.4 Importing/Exporting a Parameter File

(1) Click **Export** in the Device Setting dialog box to save the current parameters as a CSV file (.csv).

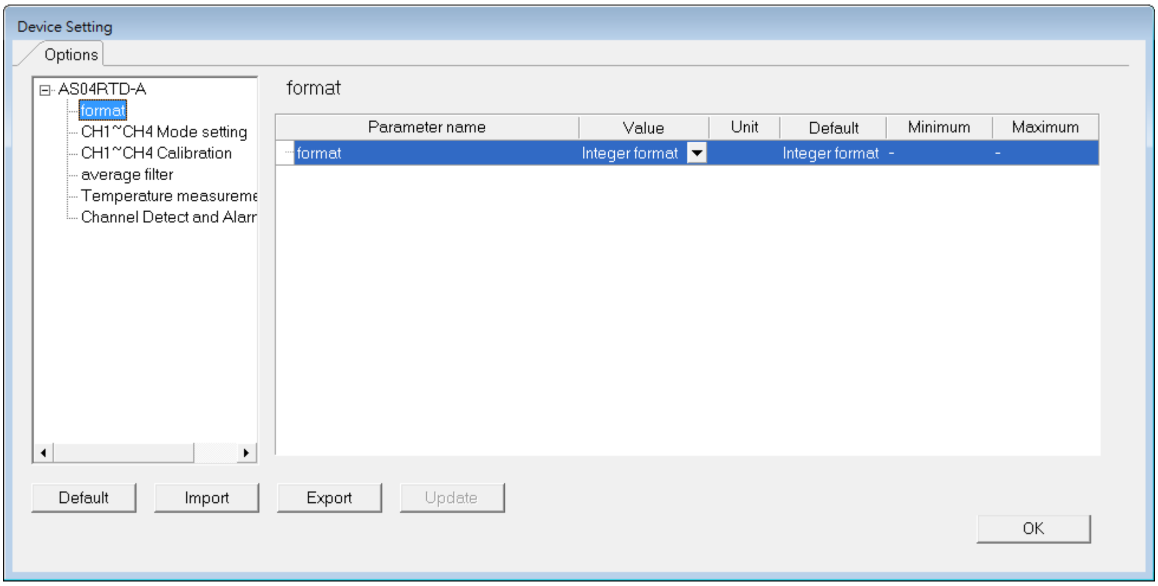


(2) Click **Import** in the Device Setting dialog box and select a CSV file to import saved parameters.

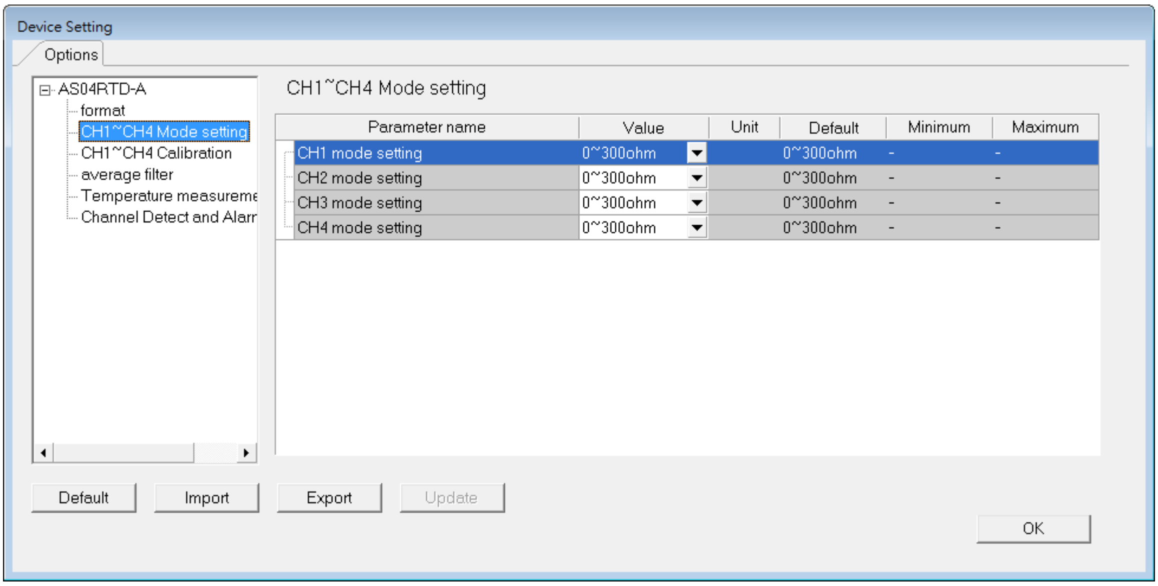


6.3.5 Parameters

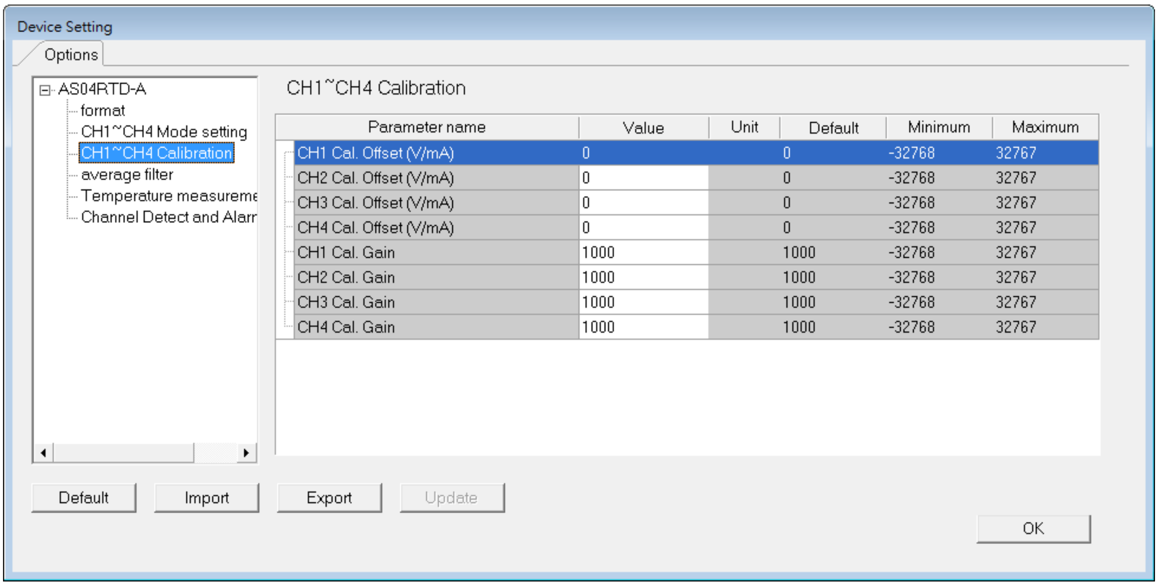
(1) The input modes of the channels



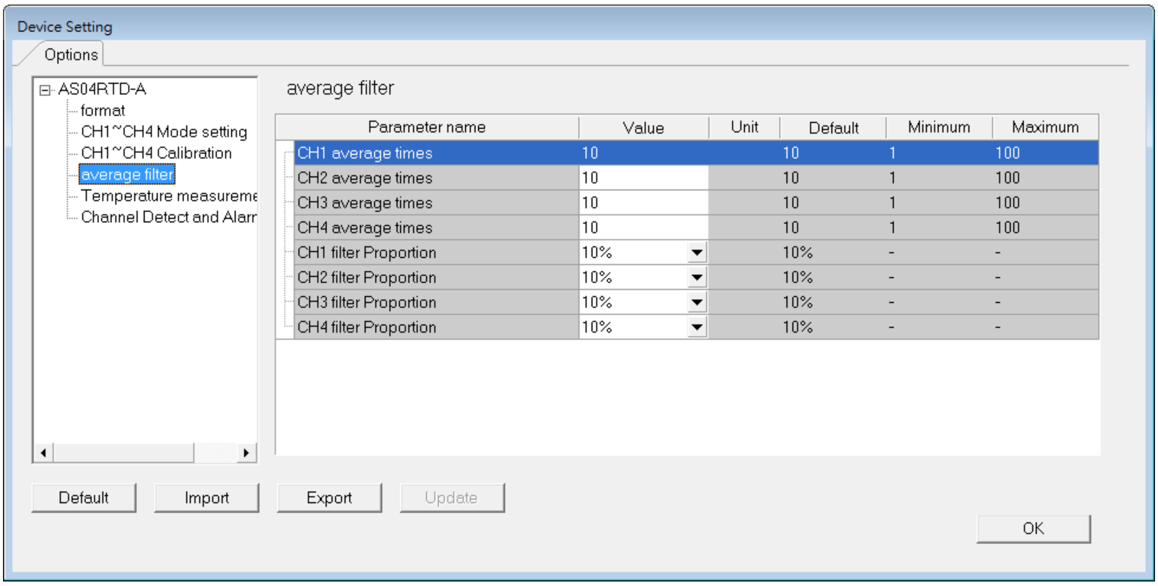
(2) Input CH1–CH4 (channel 1–channel 4) mode settings



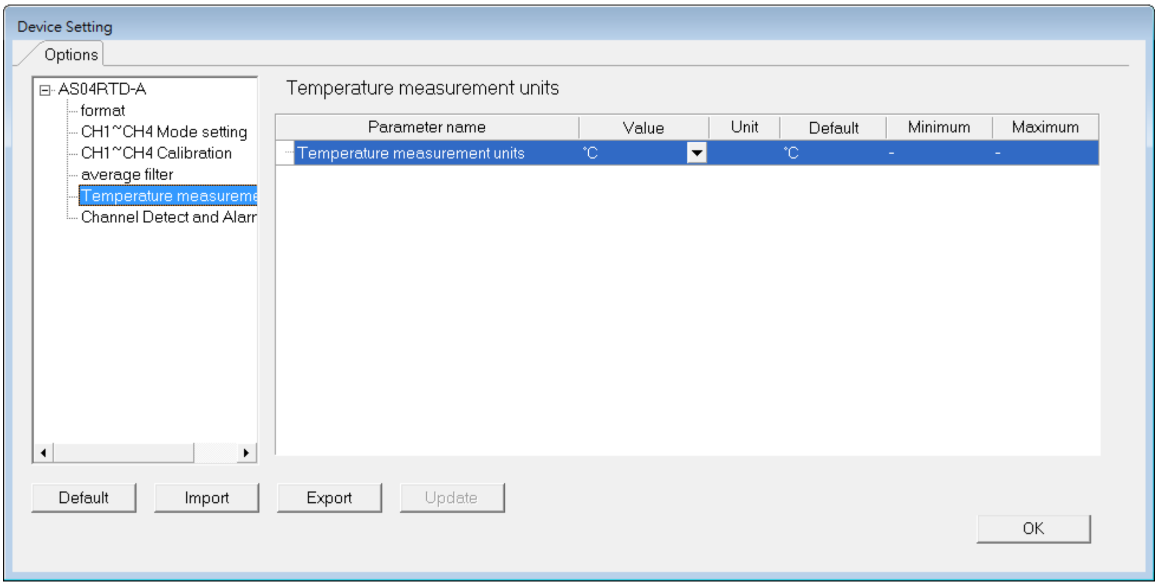
(3) Input CH1-CH4 calibration



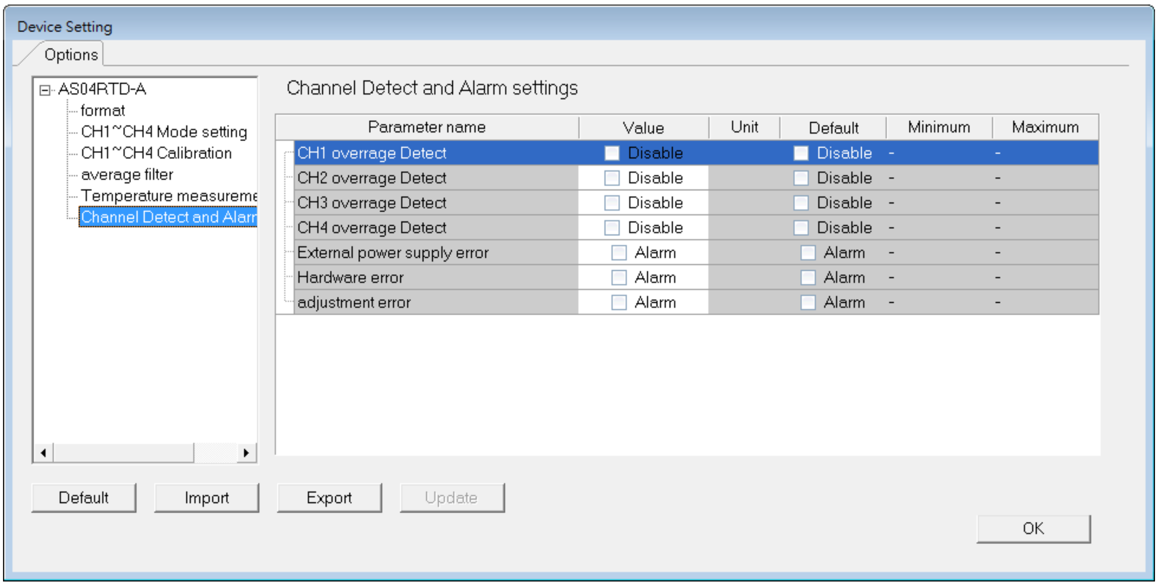
(4) Input average filter



(5) Temperature measurement



(6) Input channel detection and alarm settings

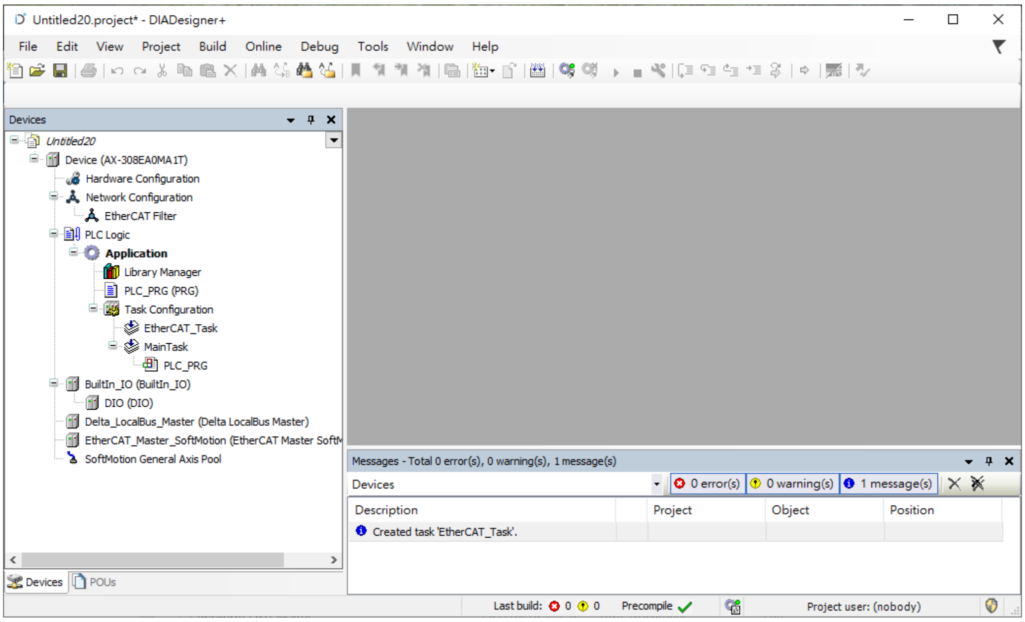


6.4 DIADesigner+ (Hardware Configuration)

The following example uses AS04DTD-A.

6.4.1 Initial Setting

(1) Start DIADesigner+, click **New Project**, and then **Project+Device** to create a new project.

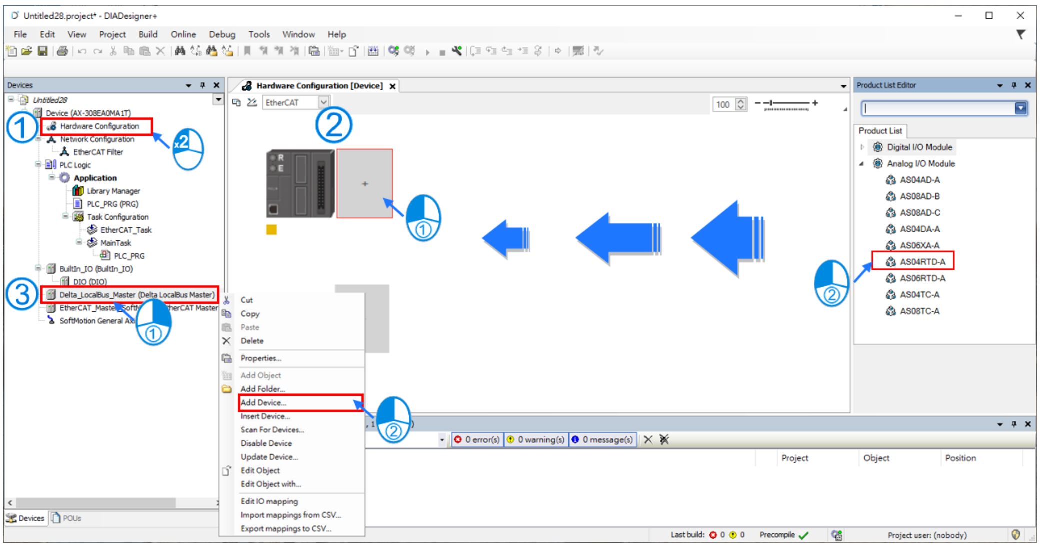


(2) Add modules in:

① Double-click **Hardware Configuration**

② Select the **+ section** and drag and drop the module that you want to add from the Product List to the + section.

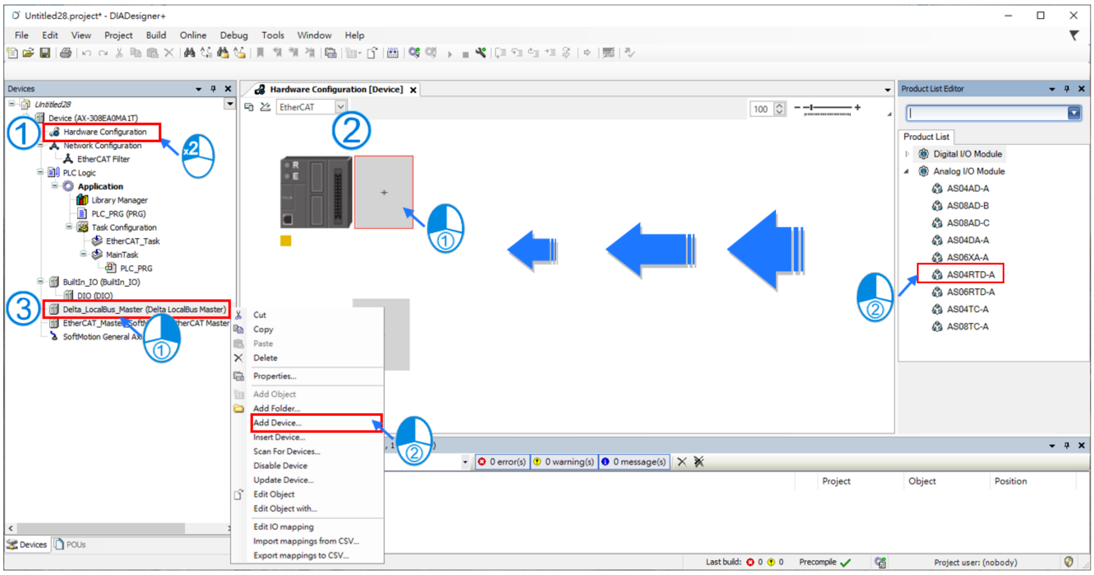
or ③ Right-click **Delta_Localbus Master** to see the context meun and then double-click **Add Device** to add devices manually or double-click **Scan for Devices**.



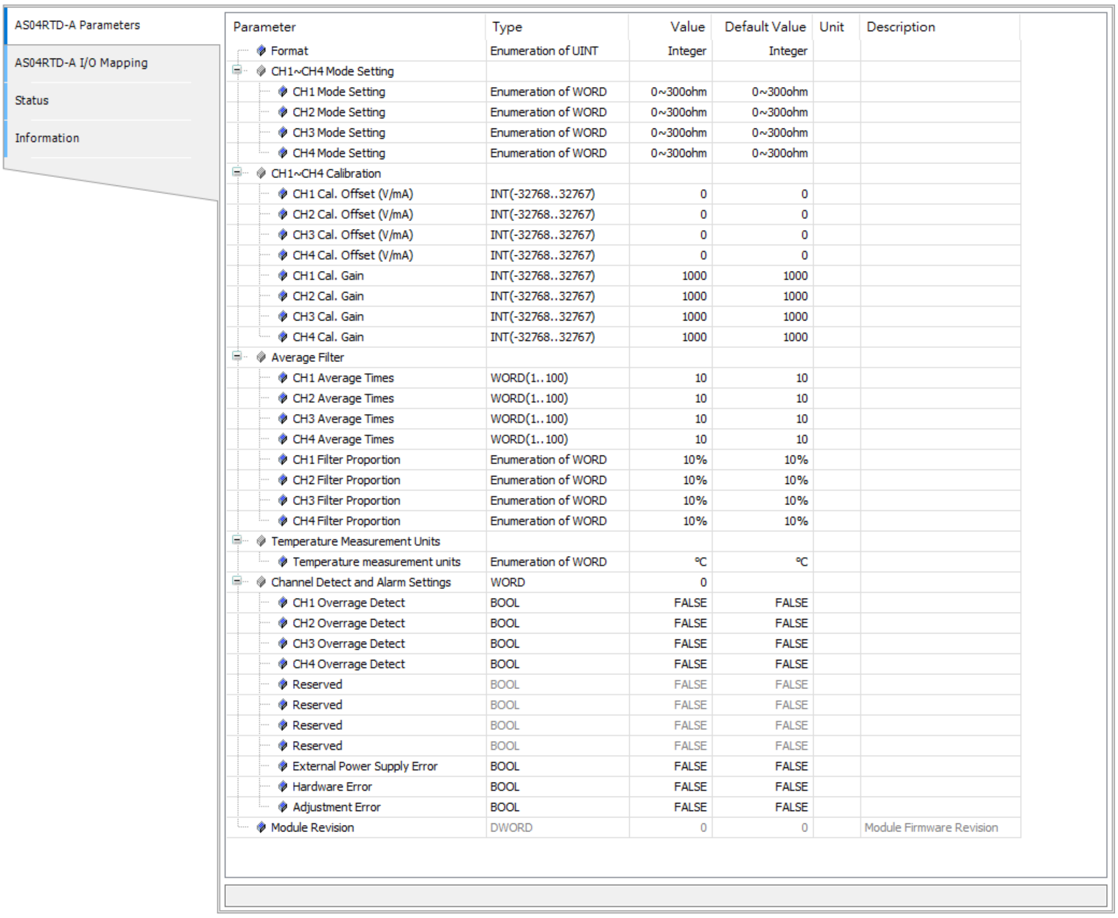
(3) Select modules:

① Double-click the module name in the **Hardware Configuration** area.

or ② Double-click the module name shown in the node.

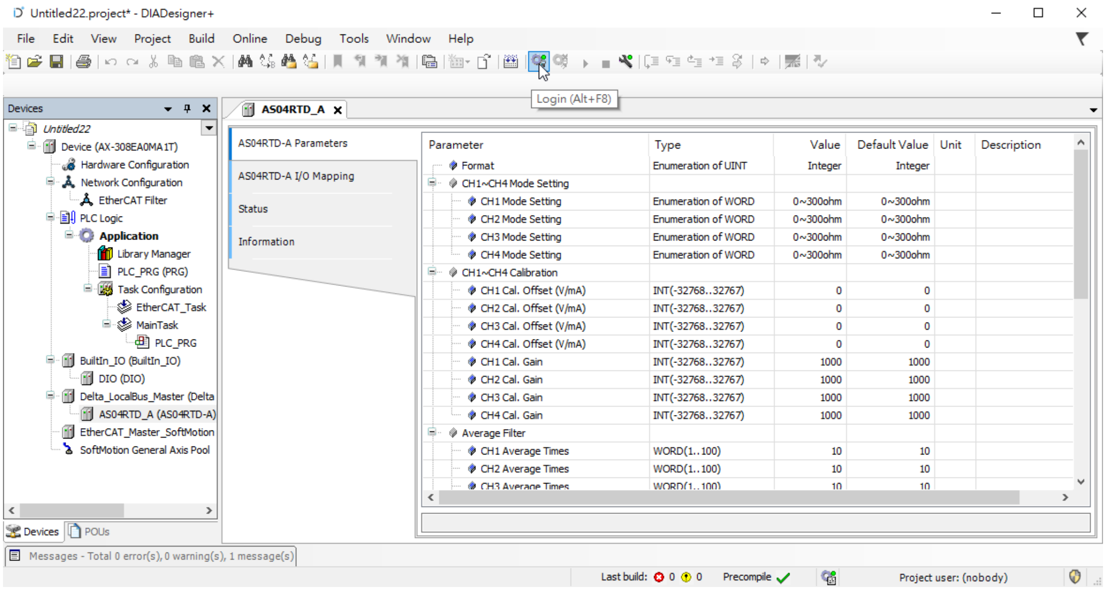


(4) Module parameter setting page:



Parameter	Type	Value	Default Value	Unit	Description
Format	Enumeration of UINT	Integer	Integer		
CH1~CH4 Mode Setting					
CH1 Mode Setting	Enumeration of WORD	0~300ohm	0~300ohm		
CH2 Mode Setting	Enumeration of WORD	0~300ohm	0~300ohm		
CH3 Mode Setting	Enumeration of WORD	0~300ohm	0~300ohm		
CH4 Mode Setting	Enumeration of WORD	0~300ohm	0~300ohm		
CH1~CH4 Calibration					
CH1 Cal. Offset (V/mA)	INT(-32768..32767)	0	0		
CH2 Cal. Offset (V/mA)	INT(-32768..32767)	0	0		
CH3 Cal. Offset (V/mA)	INT(-32768..32767)	0	0		
CH4 Cal. Offset (V/mA)	INT(-32768..32767)	0	0		
CH1 Cal. Gain	INT(-32768..32767)	1000	1000		
CH2 Cal. Gain	INT(-32768..32767)	1000	1000		
CH3 Cal. Gain	INT(-32768..32767)	1000	1000		
CH4 Cal. Gain	INT(-32768..32767)	1000	1000		
Average Filter					
CH1 Average Times	WORD(1..100)	10	10		
CH2 Average Times	WORD(1..100)	10	10		
CH3 Average Times	WORD(1..100)	10	10		
CH4 Average Times	WORD(1..100)	10	10		
CH1 Filter Proportion	Enumeration of WORD	10%	10%		
CH2 Filter Proportion	Enumeration of WORD	10%	10%		
CH3 Filter Proportion	Enumeration of WORD	10%	10%		
CH4 Filter Proportion	Enumeration of WORD	10%	10%		
Temperature Measurement Units					
Temperature measurement units	Enumeration of WORD	℃	℃		
Channel Detect and Alarm Settings	WORD	0			
CH1 Overrage Detect	BOOL	FALSE	FALSE		
CH2 Overrage Detect	BOOL	FALSE	FALSE		
CH3 Overrage Detect	BOOL	FALSE	FALSE		
CH4 Overrage Detect	BOOL	FALSE	FALSE		
Reserved	BOOL	FALSE	FALSE		
Reserved	BOOL	FALSE	FALSE		
Reserved	BOOL	FALSE	FALSE		
Reserved	BOOL	FALSE	FALSE		
External Power Supply Error	BOOL	FALSE	FALSE		
Hardware Error	BOOL	FALSE	FALSE		
Adjustment Error	BOOL	FALSE	FALSE		
Module Revision	DWORD	0	0		Module Firmware Revision

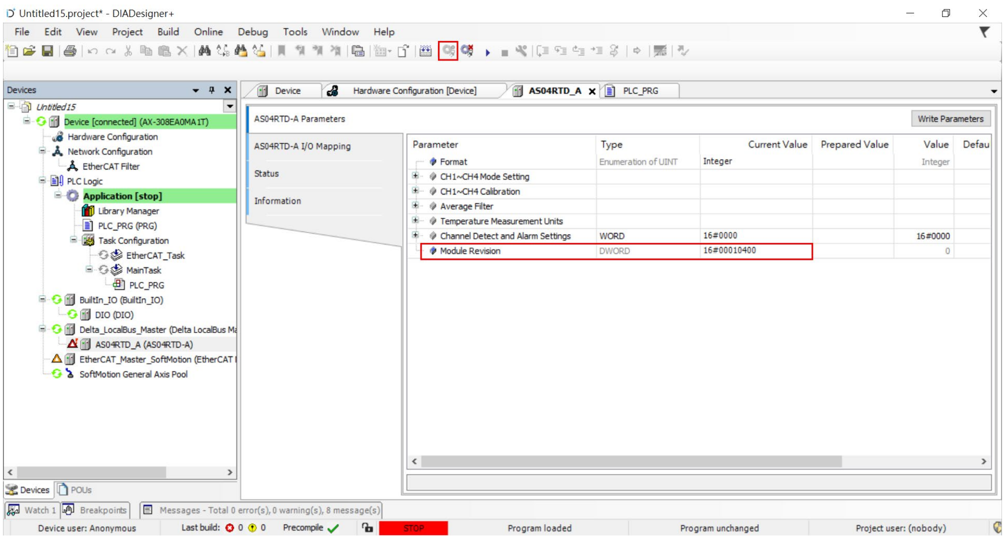
(5) After setting is complete, select the module and click **Login** on the tool bar to download the settings to the modules.



6.4.2 Checking the Version of a Module

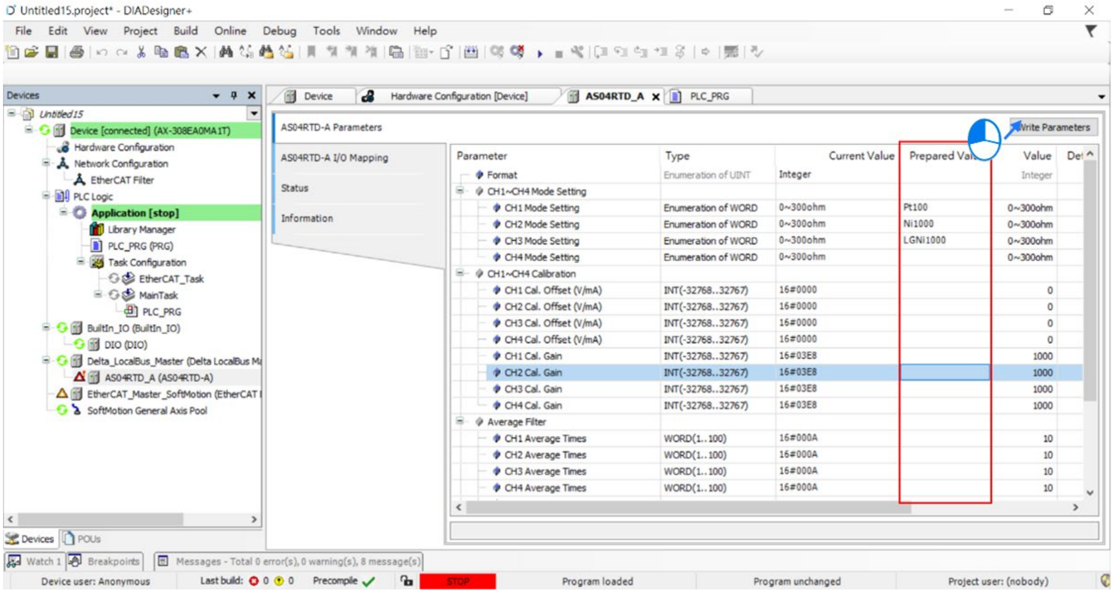
(1) Select the module and click the Information tab to see the module information.

(2) Select the module and click **Login** on the tool bar to go to Online Mode. You can find the Module Revision from the Parameters tab.

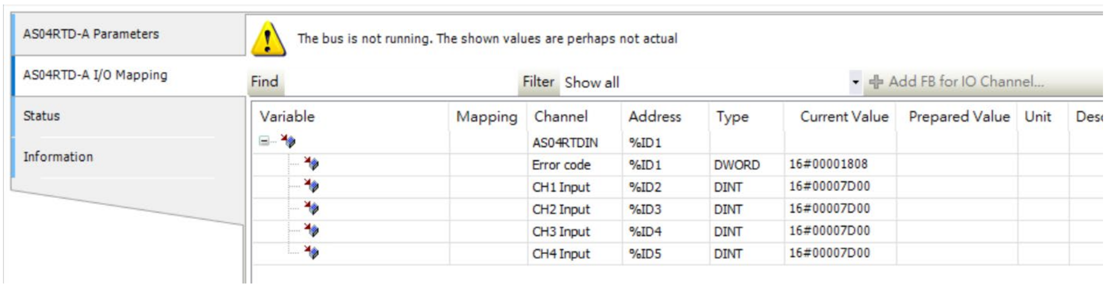


6.4.3 Online Mode

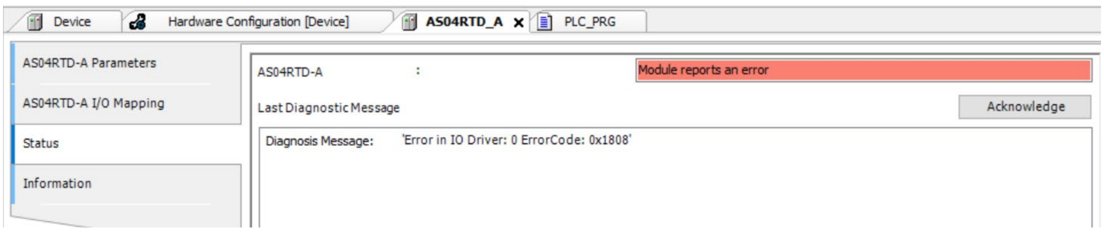
(1) Select the module and click **Login** on the tool bar to go to **Online Mode**. You can monitor all configuration parameters. Vaules in the column of Prepared Value are configurable online. After editing the values in the Prepared Value column, click **Write Parameter** to confirm the change.



(2) You can monitor the values, status, error codes in each channel from the I/O Mapping tab.



(3) You can monitor the current status and error codes from the Status tab.



6.4.4 Parameters

(1) You can set up the value format to **Integer** or **Floating** for Channel 1 to 4.

Parameter	Type	Value	Default Value	Unit	Description
Format	Enumeration of UINT	Integer	Integer		
CH1~CH4 Mode Setting					
CH1 Mode Setting	Enumeration of WORD				
CH2 Mode Setting	Enumeration of WORD				
CH3 Mode Setting	Enumeration of WORD	-10V~+10V	-10V~+10V		
CH4 Mode Setting	Enumeration of WORD	-10V~+10V	-10V~+10V		

Integer
Floating

(2) You can set up the values for Channel 1 to 4.

CH1~CH4 Mode Setting			
CH1 Mode Setting	Enumeration of WORD	0~300ohm	0~300ohm
CH2 Mode Setting	Enumeration of WORD		
CH3 Mode Setting	Enumeration of WORD		
CH4 Mode Setting	Enumeration of WORD		
CH1~CH4 Calibration			
CH1 Cal. Offset (V/mA)	INT(-32768..32767)		
CH2 Cal. Offset (V/mA)	INT(-32768..32767)		
CH3 Cal. Offset (V/mA)	INT(-32768..32767)		
CH4 Cal. Offset (V/mA)	INT(-32768..32767)		
CH1 Cal. Gain	INT(-32768..32767)		

Close
0~300ohm
0~3000ohm
Pt100
JPt100
Pt1000
Ni100
Ni1000
LGNi1000
Cu50
Cu100

(3) You can set up the calibrations for for Channel 1 to 4.

CH1~CH4 Calibration			
CH1 Cal. Offset (V/mA)	INT(-32768..32767)	0	0
CH2 Cal. Offset (V/mA)	INT(-32768..32767)	0	0
CH3 Cal. Offset (V/mA)	INT(-32768..32767)	0	0
CH4 Cal. Offset (V/mA)	INT(-32768..32767)	0	0
CH1 Cal. Gain	INT(-32768..32767)	1000	1000
CH2 Cal. Gain	INT(-32768..32767)	1000	1000
CH3 Cal. Gain	INT(-32768..32767)	1000	1000
CH4 Cal. Gain	INT(-32768..32767)	1000	1000

(4) You can set up the average filtering for Channel 1 to 4.

Average Filter			
CH1 Average Times	WORD(1..100)	10	10
CH2 Average Times	WORD(1..100)	10	10
CH3 Average Times	WORD(1..100)	10	10
CH4 Average Times	WORD(1..100)	10	10
CH1 Filter Proportion	Enumeration of WORD	10%	10%
CH2 Filter Proportion	Enumeration of WORD	10%	10%
CH3 Filter Proportion	Enumeration of WORD	10%	10%
CH4 Filter Proportion	Enumeration of WORD	10%	10%

(5) You can set up the temperature measurement units.

Temperature Measurement Units			
Temperature measurement units	Enumeration of WORD	℃	℃
Channel Detect and Alarm Settings	WORD	16#0000	
Module Revision	DWORD	0	0

(6) You can set up the channel detect and alarm settings.

Channel Detect and Alarm Settings	WORD	0	
CH1 Overrage Detect	BOOL	FALSE	FALSE
CH2 Overrage Detect	BOOL	FALSE	FALSE
CH3 Overrage Detect	BOOL	FALSE	FALSE
CH4 Overrage Detect	BOOL	FALSE	FALSE
Reserved	BOOL	FALSE	FALSE
Reserved	BOOL	FALSE	FALSE
Reserved	BOOL	FALSE	FALSE
Reserved	BOOL	FALSE	FALSE
External Power Supply Error	BOOL	FALSE	FALSE
Hardware Error	BOOL	FALSE	FALSE
Adjustment Error	BOOL	FALSE	FALSE

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6.5 Troubleshooting

6.5.1 Error Codes

Error Code	Description	A↔ D LED Indicator	ERROR LED Indicator
16#1605	Hardware failure	OFF	ON
16#1607	The external voltage is abnormal.	OFF	ON
16#1608	The factory calibration is abnormal.	OFF	ON
16#1801	The external voltage is abnormal.	OFF	Blinking
16#1802	Hardware failure	OFF	Blinking
16#1804	The factory calibration is abnormal.	OFF	Blinking
16#1808	The signal received by channel 1 exceeds the range of inputs that the hardware can receive.	Run: blinking Stop: OFF	Blinking
16#1809	The signal received by channel 2 exceeds the range of inputs that the hardware can receive.		
16#180A	The signal received by channel 3 exceeds the range of inputs that the hardware can receive.		
16#180B	The signal received by channel 4 exceeds the range of inputs that the hardware can receive.		
16#180C	The signal received by channel 5 exceeds the range of inputs that the hardware can receive.		
16#180D	The signal received by channel 6 exceeds the range of inputs that the hardware can receive.		
-	When power-on, the module is not detected by CPU module.	OFF	Blinking once or twice and after 2 seconds, it blinks repeatedly

6.5.2 Troubleshooting Procedure

Description	Procedure
The external voltage is abnormal.	Ensure the external 24 V power supply to the module is functioning normally.
Hardware failure	Return the module to the factory for repair.
Internal error The factory calibration is abnormal.	Contact the factory.
The signal received by channel 1 exceeds the range of inputs that the hardware can receive.	Check the signal received by channel 1.
The signal received by channel 2 exceeds the range of inputs that the hardware can receive.	Check the signal received by channel 2.
The signal received by channel 3 exceeds the range of inputs that the hardware can receive.	Check the signal received by channel 3.
The signal received by channel 4 exceeds the range of inputs that the hardware can receive.	Check the signal received by channel 4.
The signal received by channel 5 exceeds the range of inputs that the hardware can receive.	Check the signal received by channel 5.
The signal received by channel 6 exceeds the range of inputs that the hardware can receive.	Check the signal received by channel 6.
When power-on, the module is not detected by CPU module.	Check if the connection between module and CPU module is working. If not, connect again.

6.5.3 State of the Connection

State of connection			Channel value
L+	L-	I-	
●	●	●	Maximum value for the channel
●	●		Maximum value for the channel
●		●	Maximum value for the channel
●			Maximum value for the channel
	●	●	Maximum value for the channel
	●		Maximum value for the channel
		●	Minimum value for the channel*1

●: Disconnection

*1: for AS06RTD Series: in the modes of 0-300Ω and 0-3000Ω, it cannot detect I- state of connection.

7

Chapter 7 Temperature Measurement Module AS04/08TC

Table of Contents

7.1 Overview

This chapter describes the specifications for the ASTC-A module, its operation, and its programming. The AS04TC-A is a temperature measurement module that converts temperatures received from thermocouples (type J, K, R, S, T, E, N, or B, with ±100 mV voltage inputs) into digital signals. You can select either Celsius (resolution: 0.1° C) or Fahrenheit (resolution: 0.1° F) as the unit of measurement.

An introduction to thermocouples

A thermocouple uses the Seebeck effect to measure differences in temperature. Generally speaking, a thermocouple consists of two conductors of different materials that produce a voltage at the point where the two conductors contact. The voltage produced depends on the difference of temperature between the junctions with other parts of those conductors, and it ranges from several dozen microvolts to several thousand microvolts. Because the voltage is so low, it needs to be amplified.

Differential operations are used to eliminate external noise. Thermocouples are more stable than thermistors, resistance thermometers, and thermal resistors, so thermocouples are widely used in industrial applications.

A thermocouple consists of a circuit having two wires of different metals or metal alloys welded together or joined at both ends. One of the junctions—normally the cold junction—is maintained at a known reference temperature, and the other junction is at the temperature to be sensed. A temperature gradient across the junction of the wires gives rise to an electric potential according to the Seebeck effect. The voltage produced is proportional to the difference of temperature between the junctions with other parts of those conductors.

The voltage can be derived from the following equation.

$$V = \int_{T_1}^{T_2} (Q_A - Q_B) dT \qquad \text{(A)}$$

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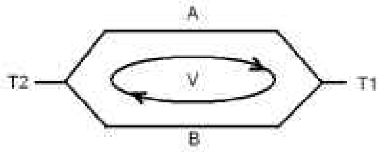
where Q_A and Q_B are the thermopowers (Seebeck coefficient) of the metals A and B, and T_1 and T_2 are the temperatures of the two junctions.



Principle of operation

Because Q_A and Q_B are almost unrelated to temperature, formula (A) above can be approximated as in equation (B).

$V=\alpha(T_2 - T_1)$ (B)

There are two types of thermocouple thermometers: wrapped thermocouples and bare thermocouples. A wrapped thermocouple is wrapped in protective metal, and is similar to an electric spoon in appearance. Wrapped thermocouples are used to measure temperature of liquid, and bare thermocouples are used to measure temperature of gas.

7.1.1 Characteristics

(1) **Select a sensor based on its practical application.**

Type J thermocouples, type K thermocouples, type R thermocouples, type S thermocouples, type T thermocouples, type E thermocouples, or type N thermocouples, with ±100 mV voltage inputs

(2) **Select a module based on its practical application.**

AS04TC-A: Has four channels. Inputs received by a channel are temperatures.

AS08TC-A: Has eight channels. Inputs received by a channel are temperatures.

(3) **High-speed conversion**

A temperature is converted into a digital signal at a speed of 200 ms per channel.

(4) **High accuracy**

Conversion accuracy: the error range is ±0.5% of the input at ambient temperature of 25° C ±5° C.

(5) **Disconnection detection**

When a sensor is disconnected, the module produces an alarm or a warning.

(6) **PID control**

An object’s temperature can be maintained through PID control actions.

(7) **Use the utility software to configure the module.**

The HWCONFIG software is built into ISPSoft. You can set modes and parameters directly in HWCONFIG without spending time writing programs to set registers to manage functions.

7.2 Specifications and Functions

7.2.1 Specifications

- **Electrical specifications**

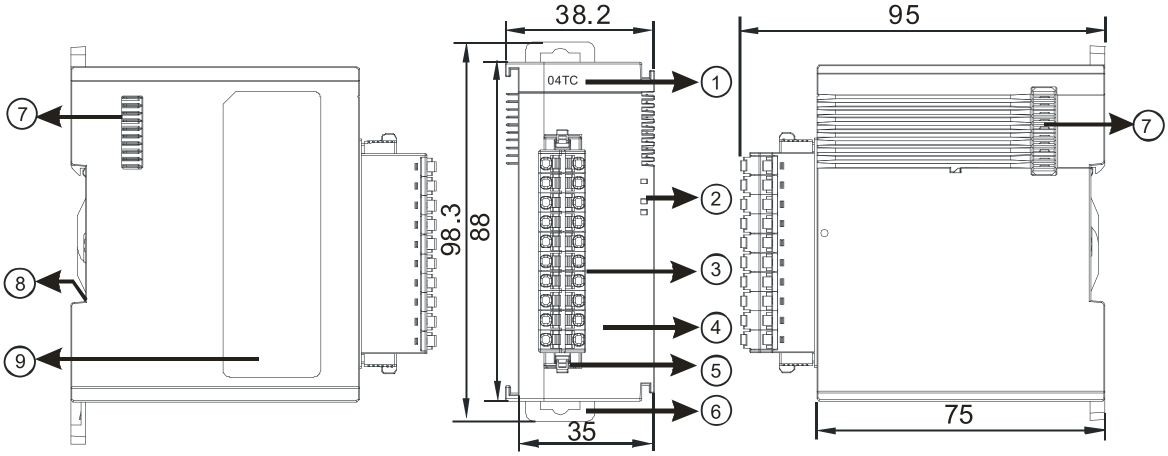
Module Name	**AH04TC-A**	**AH08TC-A**
Number of Analog Inputs	4	8
Applicable Sensor	Type J, type K, type R, type S, type T, type E, type N, and type B thermocouples; ±100 mV voltage inputs	
Supply Voltage	24 VDC (20.4–28.8 VDC) (-15% to +20%)	
Connector Type	Removable terminal block	
Overall Accuracy	25° C/77° F: The error range allowed is ±0.5% of full scale. -20° C to +60° C/-4° F to +140° F: the error range allowed is ±1% of full scale.	
Conversion Time	200 ms/channel	
Isolation	An analog circuit is isolated from a digital circuit by a digital integrated circuit/ optocoupler, and the analog channels are isolated from one another by optocouplers. Isolation between a digital circuit and the ground: 500 VDC Isolation between an analog circuit and the ground: 500 VDC Isolation between an analog circuit and a digital circuit: 500 VDC Isolation between the 24 VDC and the ground: 500 VDC Isolation between analog channels: 120 VAC	
Weight	115g	125g

- **Functional specifications**

Analog-to-Digital Conversion	**Centigrade (°C)**	**Fahrenheit (°F)**	**Voltage Input**
Rated Input Range[*1]	Type J: -100° C to +1,200° C Type K: -100° C to +1,350° C Type R: 0° C to 1,750° C Type S: 0° C to 1,750° C Type T: -150° C to +400° C Type E: -150° C to +980° C Type N: -150° C to +1,300° C Type B: 200° C to +1,800° C	Type J: -148° F to +2,192° F Type K: -148° F to +2,462° F Type R: 32° F to 3,182° F Type S: 32° F to 3,182° F Type T: -238° F to +734° F Type E: -238° F to +1,796° F Type N: -238° F to +2,372° F Type B: 392°F to 3,272°F	±100 mV
Average Function	Range: 1-100		
Self-Diagnosis	Disconnection detection		

*1 If the measured temperature exceeds the upper limit, it only shows the maximum value. If the measured temperature is below the lower limit, it only shows the minimum value.

7.2.2 Profile



Unit: mm

Number	Name	Description
1	Model Name	Model name of the module
2	RUN LED Indicator	Operating status of the module ON: the module is running. OFF: the module is not running.
	ERROR LED Indicator	Error status of the module ON: a serious error exists in the module. OFF: the module is operating normally. Blink: a minor error exists in the module.
	Analog-to-Digital Conversion Indicator	Conversion status Blinking: conversion is in process. OFF: conversion has stopped.
3	Removable Terminal Block	The inputs are connected to transducers. The outputs are connected to loads to be driven.
4	Arrangement of the Input/Output Terminals	Arrangement of the terminals
5	Clip	For removing the terminal block
6	DIN rail clip	Secures the module onto the DIN rail
7	Module connecting set	Connects the modules
8	Ground clip	

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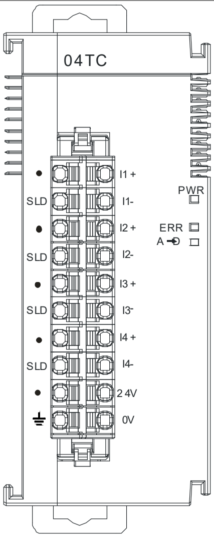
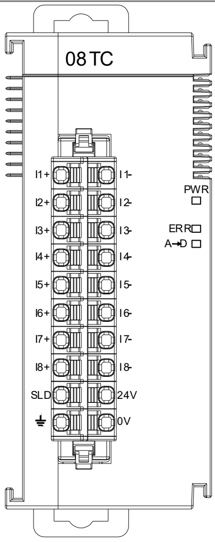
7.2.3 Arrangement of Terminals

AS04TC-A	AS08TC-A
	

7.2.4 AS04TC Control Registers

*If you use HWCONFIG to set values in CRs, once the set value is downloaded, the values can be retained in the module; however if you use TO instruction to write data into CRs, the values CANNOT be retained, after power failure or after transition of the CPU from STOP to RUN.

Note: The attribute of the CR must be W (write) to use TO instruction.

CR#	Name	Description	Atr.	Defaults
0	Format Setup	0: integer format 1: floating point format	R	0
1	Channel 1 mode setup	0: closed 1: -100 mV to +100 mV 2: J-Type 3: K-Type 4: R-Type 5: S-Type 6: T-Type 7: E-Type 8: N-Type 9: B-Type	R/W	1
2	Channel 2 mode setup			
3	Channel 3 mode setup			
4	Channel 4 mode setup			
5	Channel 1 offset	Range: -32768 to +32767	R/W	0
6	Channel 2 offset			
7	Channel 3 offset			

CR#	Name	Description	Atr.	Defaults
8	Channel 4 offset			
9	Channel 1 gain	Range: -32768 to +32767	R/W	1000
10	Channel 2 gain		R/W	
11	Channel 3 gain		R/W	
12	Channel 4 gain		R/W	
13	Channel 1 average times	Range: 1–100	R/W	10
14	Channel 2 average times			
15	Channel 3 average times			
16	Channel 4 average times			
17	Channel 1 filter average percentage	Range: 0–3 Unit: ±10%	R/W	1
18	Channel 2 filter average percentage			
19	Channel 3 filter average percentage			
20	Channel 4 filter average percentage			
21	Units of temperature	0: Fahrenheit 1: Celsius	R/W	0
22	Channel alarm setup	0: open channel alarm 1: close channel alarm bit0: channel 1 bit1: channel 2 bit2: channel 3 bit3: channel 4 0: warning 1: alarm	R/W	0

7

CR#	Name	Description	Atr.	Defaults
		bit8: error in the power supply bit9: error in the module hardware bit10: error in calibration bit11: error in CJC temperature		
201	Instruction set	16#0101: record the peak value again for channel 1 16#0102: record the peak value again for channel 2 16#0104: record the peak value again for channel 3 16#0108: record the peak value again for channel 4 16#010F: record the peak values again for channels 1–4 16#0201: enable recording for channel 1 16#0202: enable recording for channel 2 16#0204: enable recording for channel 3 16#0208: enable recording for channel 4 16#020F: enable recording for channels 1–4 16#0211: disable recording for channel 1 16#0212: disable recording for channel 2 16#0214: disable recording for channel 3 16#0218: disable recording for channel 4 16#021F: disable recording for channels 1–4 16#0502: restore default settings	W	0
210	The maximum peak value for channel 1	Integer format; the maximum peak value for analog inputs	R	-
211	The maximum peak value for channel 2			-
212	The maximum peak value for channel 3			-
213	The maximum peak value for channel 4			-
214	The minimum peak	Integer format; the minimum peak value for	R	-

CR#	Name	Description	Atr.	Defaults
	value for channel 1	analog inputs		
215	The minimum peak value for channel 2			-
216	The minimum peak value for channel 3			-
217	The minimum peak value for channel 4			-
222	The time to record for channel 1	Unit: 100 ms Range: 1–100 The time to record the digital value for the channels	R/W	1
223	The time to record for channel 2			1
224	The time to record for channel 3			1
225	The time to record for channel 4			1
240	The number of records for channel 1	Range: 0-500, display the current records	R	0
241	The number of records for channel 2			0
242	The number of records for channel 3			0
243	The number of records for channel 4			0
4000 ~4499	Records for channel 1	500 records for channel 1	R	-
4500 ~4999	Records for channel 2	500 records for channel 2	R	-
5000 ~5499	Records for channel 3	500 records for channel 3	R	-
5500 ~5999	Records for channel 4	500 records for channel 4	R	-

7.2.5 AS08TC Control Registers

*If you use HWCONFIG to set values in CRs, once the set value is downloaded, the values can be retained in the module; however if you use TO instruction to write data into CRs, the values CANNOT be retained, after power failure or after transition of the CPU from STOP to RUN.

Note: The attribute of the CR must be W (write) to use TO instruction.

CR#	Name	Description	Atr.	Defaults
0	Format Setup	0: integer format 1: floating point format	R	0
1	Channel 1 mode setup	0: closed 1: -100 mV to +100 mV 2: J-Type 3: K-Type 4: R-Type 5: S-Type 6: T-Type 7: E-Type 8: N-Type 9: B-Type	R/W	1
2	Channel 2 mode setup		R/W	
3	Channel 3 mode setup		R/W	
4	Channel 4 mode setup		R/W	
5	Channel 5 mode setup		R/W	
6	Channel 6 mode setup		R/W	
7	Channel 7 mode setup		R/W	
8	Channel 8 mode setup		R/W	
9	Channel 1 offset	Range: -32768 to +32767	R/W	0
10	Channel 2 offset			
11	Channel 3 offset			
12	Channel 4 offset			
13	Channel 5 offset			
14	Channel 6 offset			
15	Channel 7 offset			
16	Channel 8 offset			
17	Channel 1 gain	Range: -32768 to +32767	R/W	1000
18	Channel 2 gain			
19	Channel 3 gain			
20	Channel 4 gain			
21	Channel 5 gain			
22	Channel 6 gain			
23	Channel 7 gain			
24	Channel 8 gain			

CR#	Name	Description	Atr.	Defaults
25	Channel 1 average times	Range: 1–100	R/W	10
26	Channel 2 average times			
27	Channel 3 average times			
28	Channel 4 average times			
29	Channel 5 average times			
30	Channel 6 average times			
31	Channel 7 average times			
32	Channel 8 average times			
33	Channel 1 filter average percentage	Range: 0–3 Unit: ±10%	R/W	1
34	Channel 2 filter average percentage		R/W	
35	Channel 3 filter average percentage		R/W	
36	Channel 4 filter average percentage		R/W	
37	Channel 5 filter average percentage		R/W	
38	Channel 6 filter average percentage		R/W	
39	Channel 7 filter average percentage		R/W	
40	Channel 8 filter average percentage		R/W	
41	Units of temperature	0: Fahrenheit 1: Celsius	R/W	0
42	Channel alarm setup	0: open channel alarm 1: close channel alarm bit0: channel 1 bit1: channel 2 bit2: channel 3 bit3: channel 4	R/W	0

CR#	Name	Description	Atr.	Defaults
201		bit4: channel 5 bit5: channel 6 bit6: channel 7 bit7: channel 8 0: warning 1: alarm bit8: error in the power supply bit9: error in the module hardware bit10: error in calibration bit11: error in CJC temperature		
201	Instruction set	16#0101: record the peak value again for channel 1 16#0102: record the peak value again for channel 2 16#0104: record the peak value again for channel 3 16#0108: record the peak value again for channel 4 16#0110: record the peak value again for channel 5 16#0120: record the peak value again for channel 6 16#0140: record the peak value again for channel 7 16#0180: record the peak value again for channel 8 16#01FF: record the peak value again for channels 1-8 16#0201: enable recording for channel 1 16#0202: enable recording for channel 2 16#0204: enable recording for channel 3 16#0208: enable recording for channel 4	W	0

CR#	Name	Description	Atr.	Defaults
		16#0210: enable recording for channel 5 16#0220: enable recording for channel 6 16#0240: enable recording for channel 7 16#0280: enable recording for channel 8 16#02FF: enable recording for channels 1-8 16#0301: disable recording for channel 1 16#0302: disable recording for channel 2 16#0304: disable recording for channel 3 16#0308: disable recording for channel 4 16#0310: disable recording for channel 5 16#0320: disable recording for channel 6 16#0340: disable recording for channel 7 16#0380: disable recording for channel 8 16#03FF: disable recording for channels 1-8 16#0501: restore default settings, clear setting values in the Flash 16#0502: restore default settings, do not clear setting values in the Flash		
210	The maximum peak value for channel 1	Integer format; the maximum peak value for analog inputs	R	-
211	The maximum peak value for channel 2			-
212	The maximum peak value for channel 3			-
213	The maximum peak value for channel 4			-
214	The maximum peak value for channel 5			-
215	The maximum peak value for channel 6			-
216	The maximum peak value for channel 7			-

CR#	Name	Description	Atr.	Defaults
217	The maximum peak value for channel 8			-
218	The minimum peak value for channel 1	Integer format; the minimum peak value for analog inputs	R	-
219	The minimum peak value for channel 2			-
220	The minimum peak value for channel 3			-
221	The minimum peak value for channel 4			-
222	The minimum peak value for channel 5			-
223	The minimum peak value for channel 6			-
224	The minimum peak value for channel 7			-
225	The minimum peak value for channel 8			-
226	The time to record for channel 1	Unit: 100 ms Range: 1–100 The time to record the digital value for the channels	R/W	1
227	The time to record for channel 2		R/W	1
228	The time to record for channel 3		R/W	1
229	The time to record for channel 4		R/W	1
230	The time to record for channel 5		R/W	1
231	The time to record for channel 6		R/W	1
232	The time to record for channel 7		R/W	1
233	The time to record for channel 8		R/W	1

CR#	Name	Description	Atr.	Defaults
240	The number of records for channel 1	Range: 0-100, display the current records	R	0
241	The number of records for channel 2			
242	The number of records for channel 3			
243	The number of records for channel 4			
244	The number of records for channel 5			
245	The number of records for channel 6			
246	The number of records for channel 7			
247	The number of records for channel 8			
4000 ~4099	Records for channel 1	100 records for channel 1	R	-
4500 ~4599	Records for channel 2	100 records for channel 2	R	-
5000 ~5099	Records for channel 3	100 records for channel 3	R	-
5500 ~5599	Records for channel 4	100 records for channel 4	R	-
6000 ~6099	Records for channel 5	100 records for channel 5	R	-
6500 ~6599	Records for channel 6	100 records for channel 6	R	-
7000 ~7099	Records for channel 7	100 records for channel 7	R	-
7500 ~7599	Records for channel 8	100 records for channel 8	R	-

7.2.6 Functions

Item	Function	Description
1	Enable/Disable a Channel	1. Enable or disable a channel. 2. If a channel is disabled, the total conversion time decreases.
2	Unit of Measurement	Select the unit of measurement: Fahrenheit or Celsius.
3	Calibration	Calibrate a linear curve.
4	Average	Conversion values are averaged and filtered.
5	Disconnection Detection	If the channel is open, the module can detect when it is disconnected. If the input is open-circuited, the module produces an alarm or a warning.
6	Channel Detection and Alarm	If an input signal exceeds the range of inputs that the hardware can receive, the module produces an alarm or a warning. You can disable this function.
7	Limit Detections for Channels	Save the maximum/minimum values for channels.
8	Records for Channels	Save the analog curves for channels.
9	PID Algorithm	PID control modes

1. Enable/Disable a Channel

7

An analog signal is converted into a digital signal at a rate of 200 ms per channel. If a channel is not used, you can disable it to decrease the total conversion time.

2. Unit of Measurement

Select the unit of measurement, Fahrenheit or Celsius, according to your needs.

3. Calibration

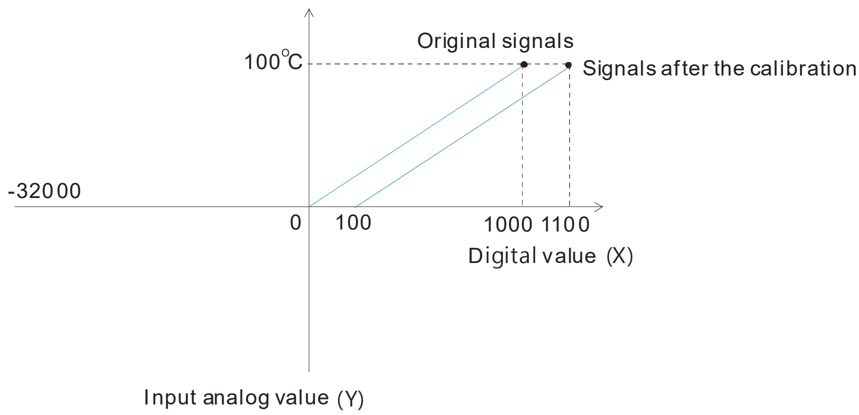
To make a curve meet specific needs, calibrate the curve by changing the offset and the gain. The calibration range depends on the range of inputs that the hardware can receive. The formula is:

$$Output = \frac{(Input \times Gain)}{1000} + Offset$$

Example:

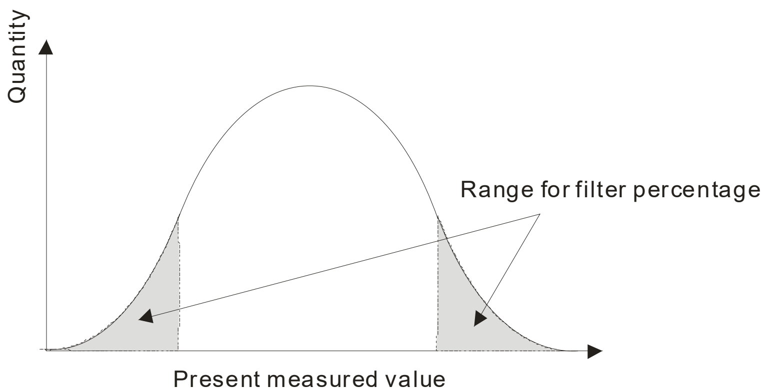
If the gain is 1000 and the offset is 0, the corresponding value for the original signal 0° C to 100° C is 0–1000. If you change the offset to 100, the calibrated value for the original signal 0° C to 100° C becomes 100–1100.

Gain = 1000, Offset = 0



4. Average

You can set the average value between 1–100. It is a steady value obtained from the sum of the recorded values. If the recorded values include an acute pulse due to unavoidable external factors, however, you may observe violent changes in the average value. Use the filtering function to exclude the acute pulses from the sum-up and equalization, so the computed average value is not affected by the acute recorded values. Set the filter percentage to the range of 0–3, where the unit is 10%. If you set the filter range to 0, for example, the system sums up all the recorded values and divides them to obtain the average value, but if you set the filter range to 1, the system excludes the bottom 10% and the top 10% of the values and averages only the remaining values to obtain the average value.



5. Disconnection Detection

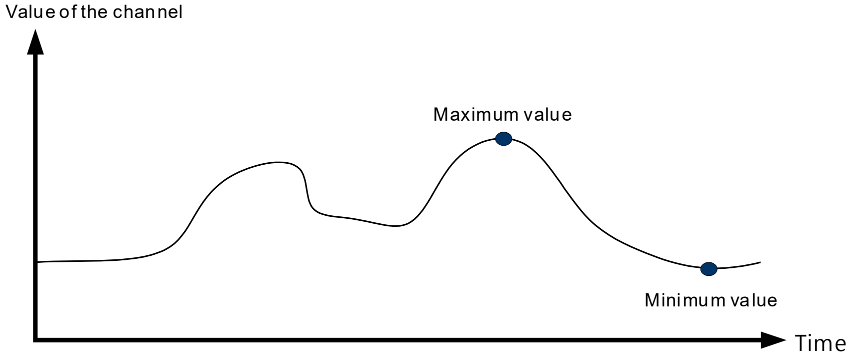
If the channel is open, the module can detect when it is disconnected. If the input is open-circuited, the module produces an alarm or a warning.

6. Channel Detection

If an input signal exceeds the allowable range of inputs that the hardware can receive, an error message appears and the Error LED blinks. You can disable this function so that the module does not produce an alarm or warning and the Error LED also does not blink when the input signal exceeds the input range.

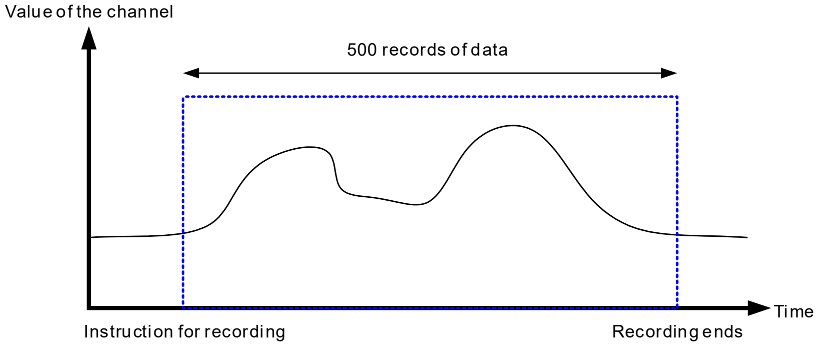
7. Limit Detections for Channels

This function saves the maximum and minimum values for channels so that you can determine the peak to peak values.



8. **Records for channels**

Record the input values of the cyclic sampling for each channel. For AS04TC-A, the system saves up to 500 data points and the recording time is 10 ms. For example, if the conversion time is 2 ms and 4 channels are open, the recording time is 8 ms x 500 data points = 4 seconds in total. And the system saves up to 100 data points for AS08TC-A and the recording time is 100 ms. The following uses AS04TC-A as an example to demonstrate.



9. **PID control**

PID algorithm is available for every channel. With its auto tuning function, parameters such as Kp, Ki, Kd and more can be calculated and therefore temperature control can be achieved. You can also use DMPID instruction to calculate relative parameters by entering the parameters in the endpoints of the corresponding instruction image and then you can then obtain the output values from the output endpoints. Note: DMPID instruction is available for AS04TC-A (V1.04 or later), AS08TC-A (V1.00 or later), AS Series PLC (V1.06 or later) and AS-SCM (V2.04 or later).

7.2.7 Control Mode

You can also use DMPID to execute PID control. The applicable models and FW are AS04TC-A (V1.04 or later), AS08TC-A (V1.00 or later), AS Series PLC (V1.06 or later) and AS-SCM (V2.04 or later).

API	Instruction code				Operand	Function
1417	D	MPID			**As shown in the following table**	PID algorithm for RTD/TC modules

Device	X	Y	M	S	T	C	HC	D	FR	SM	SR	E	K	16#	"$"	F
GROUP								●					○	○		
MODULE								●					○	○		
CH								●					○	○		
UPDATE	●	●	●	●				●								
PID_RUN	●	●	●	●				●								
SV								●					○	○		
PID_MODE								●					○	○		
PID_MAN	●	●	●	●				●								
MOUT_AUTO	●	●	●	●				●								
AUTO_DBW								●					○	○		
Kc_Kp								●								○
Ti_Ki								●								○
Td_Kd								●								○
Tf								●								○
PID_EQ	●	●	●	●				●								
PID_DE	●	●	●	●				●								
PID_DIR	●	●	●	●				●								
ERR_DBW								●								
ALPHA								●					○	○		
BETA								●					○	○		
MOUT								●								
BIAS								●					○	○		
CYCLE								●					○	○		
MV								●								
PV								●								
I_MV								●								
ERROR								●								

Data type	BOOL	WORD	DWORD	LWORD	UINT	INT	DINT	LINT	REAL	LREAL	TMR	CNT	STRING
See the explanation below													

Pulse instruction	16-Bit instruction	32-Bit instruction
-	-	AS

DMPID	
En	MV
GROUP	PV
MODULE	I_MV
CH	ERROR
UPDATE	
PID_RUN	
SV	
PID_MODE	
PID_MAN	
MOUT_AUTO	
AUTO_DBW	
Kc_Kp	
Ti_Ki	
Td_Kd	
Tf	
PID_EQ	
PID_DE	
PID_DIR	
ERR_DBW	
ALPHA	
BETA	
MOUT	
BIAS	
CYCLE	

GROUP : Group number
MODULE : Module number
CH : Channel number
UPDATE : Update PID parameters
PID_RUN : Enable the PID algorithm
SV : Target value (SV)
PID_MODE : PID control mode
PID_MAN : PID Auto/Manual mode
MOUT_AUTO : Manual/Auto output value
AUTO_DBW : Range within which the auto tuning is not working
Kc_Kp : Proportional gain
Ti_Ki : Integral coefficient (sec. or 1/sec)
Td_Kd : Derivative coefficient (sec)
Tf : Derivate-action time constant (sec)
PID_EQ : PID formula types
PID_DE : Calculation of the PID derivative error
PID_DIR : PID forward/reverse direction
ERR_DBW : Range within which the error value is counted as 0
ALPHA : Initial value compensation of integral calculus (for heating up)
BETA : Initial value compensation of integral calculus (for cooling down)
MOUT : Manual output value
BIAS : Feed forward output value
CYCLE : Sampling time
MV : Output value (MV)
PV : Present value
I_MV : Accumulated integral value
ERROR : Error code

Operand	Data type	Function	Setting range	Description
GROUP	DWORD/DINT	Group number	The RTD/TC module group number that is connected to the right side of PLC directly or connected to the remote module that acts as PLC, e.g. the first connected module group is group number 1, the second connected module group is group number 2. Up to 15 module group can be connected and counted.	
MODULE	DWORD/DINT	Module number	The module number that is connected to the right side of PLC directly or connected to the remote module that acts as PLC, e.g. the first connected module is module number 1, the second connected module is module number 2. Up to 32 modules can be	

Operand	Data type	Function	Setting range	Description
			connected and counted and each type of modules should be included in the count.	
CH	DWORD/DINT	Channel number	Channel number for PID algorithm, e.g. channel 1 is number 1 for PID algorithm and channel 2 is number 2 for PID algorithm and so forth.	
UPDATE	BOOL	Update PID parameters	True：Update PID related parameters in the module, such as PID_RUN~CYCLE. False: After updating is complete, it refreshes to False.	
PID_RUN	BOOL	Enabling the PID algorithm	True: use the PID algorithm. False: reset the output value (MV) to 0, and stop using the PID algorithm.	
SV	DWORD/DINT	Target value	-32768~32767	Target value
PID_MODE	DWORD/DINT	PID control mode	0: Automatic control When PID_MAN switches from True to False, invoke the output value (MV) in the automatic algorithm. 1: Auto tuning the parameters for the temperature control. After tuning is done, the sysem switches to auto control mode (PID_MODE is set to 0) and fill in the appropriate parameters (Kc_Kp, Ti_Ki, Td_Kd, Tf, ALPHA and BETA) Note: when the mode is set to 1, auto tuning the parameter, you cannot use numerical value to set up.	
PID_MAN	BOOL	PID A/M mode	True: Manual Output the MV according to MOUT. This setting has no effect when PID_MODE is set to 1.	

Operand	Data type	Function	Setting range	Description
			False: Automatic Output the MV according to the PID algorithm.	
MOUT_AUTO	BOOL	MOUT automatic change mode	True: Automatic MOUT varies with the MV. False: Normal MOUT does not vary with the MV.	
AUTO_DBW	DWORD/DINT	Range within which the auto tuning is not working	0~32000	Used when the mode is set to auto tuning, within the range of SV ± dead band, the auto tuning is not working.
Kc_Kp	REAL	Calculated proportional coefficient (Kc or Kp, according to the settings in PID_EQ)	Range of positive single-precision floating-point numbers	If the P coefficient is less than 0, the Kc_Kp is 0. Independently, if Kc_Kp is 0, it is not controlled by P.
Ti_Ki	REAL	Integral coefficient (Ti or Ki, according to the settings in PID_EQ)	Range of positive single-precision floating-point numbers (unit: Ti = sec; Ki = 1/sec)	If the calculated coefficient I is less than 0, Ti_Ki is 0. If Ti_Ki is 0, it is not controlled by I.
Td_Kd	REAL	Derivative coefficient (Td or Kd, according to the settings in PID_EQ)	Range of positive single-precision floating-point numbers (unit: sec)	If the calculated coefficient D is less than 0, Td_Kd is 0. If Ti_Ki is 0, it is not controlled by D.

Operand	Data type	Function	Setting range	Description
Tf	REAL	Derivate-action time constant	Range of positive single-precision floating-point numbers (unit: sec)	If the derivate-action time constant is less than 0, Tf is 0 and it is not controlled by the derivate-action time constant (derivative smoothing).
PID_EQ	BOOL	PID formula types	True: dependent formula False: independent formula	
PID_DE	BOOL	The calculation of the PID derivative error	True: use the variations in the PV to calculate the control value of the derivative (Derivative of the PV). False: use the variations in the error (E) to calculate the control value of the derivative (derivative of the error).	
PID_DIR	BOOL	PID forward/reverse direction	True: reverse action; heating up (E=SV-PV) False: forward action; cooling down (E=PV-SV)	
ERR_DBW	DWORD/DINT	Range within which the error value is counted as 0.	-32768~32767	The error value (E) is the difference between the SV and the PV. When the setting value is 0, the function disabled; otherwise the CPU module checks whether the present error is less than the absolute value of ERR_DBW, and checks whether the

Operand	Data type	Function	Setting range	Description
				present error meets the cross status The error value (E) is the difference between the SV and the PV. When the ERR_DBW setting value is 0, the function is disabled; otherwise the CPU PLC checks whether the present error is less than the absolute value of ERR_DBW, and checks whether the present error meets the cross status condition. If the present error is less than the absolute value of ERR_DBW, and meets the cross status condition, the present error is counted as 0, and the PLC applies the PID algorithm ; otherwise the present error is brought into the PID algorithm.

Operand	Data type	Function	Setting range	Description
ALPHA	DWORD/DINT	Initial value compensation of integral calculus (for heating up)	0.0~100.0 (unit: 1%)	Initial value compensation of integral calculus (for heating up)
BETA	DWORD/DINT	Initial value compensation of integral calculus (for cooling down)	0.0~100.0 (unit: 1%)	Initial value compensation of integral calculus (for cooling down)
MOUT	DWORD/DINT	MV	0~1000 (unit: 0.1%)	When set to PID Manual (PID_MAN=True), the MV value is outputted as the value set manually for MOUNT.
BIAS	DWORD/DINT	Feed forward output value	-32768~32767	Feed forward output value, used for the PID feed forward.
CYCLE	DWORD/DINT	Sampling time (T_S)	1~1000 (unit: 100 ms)	When the instruction is scanned, use the PID algorithm according to the sampling time, and refresh MV.
MV	REAL	MV output value	0.0~100.0 (unit: 1%)	
PV	DWORD/DINT/REAL	Present value	Format is defined in HWCONFIG.	
I_MV	REAL	Accumulated integral value	Accumulated integral value is for reference. When the MV is out of the range of 0-100%, the accumulated integral value in I_MV stops changing.	
ERROR	DWORD/DINT	Error / status codes	16#0000：instruction is being executed and is working normally 16#1400：the module you are using	

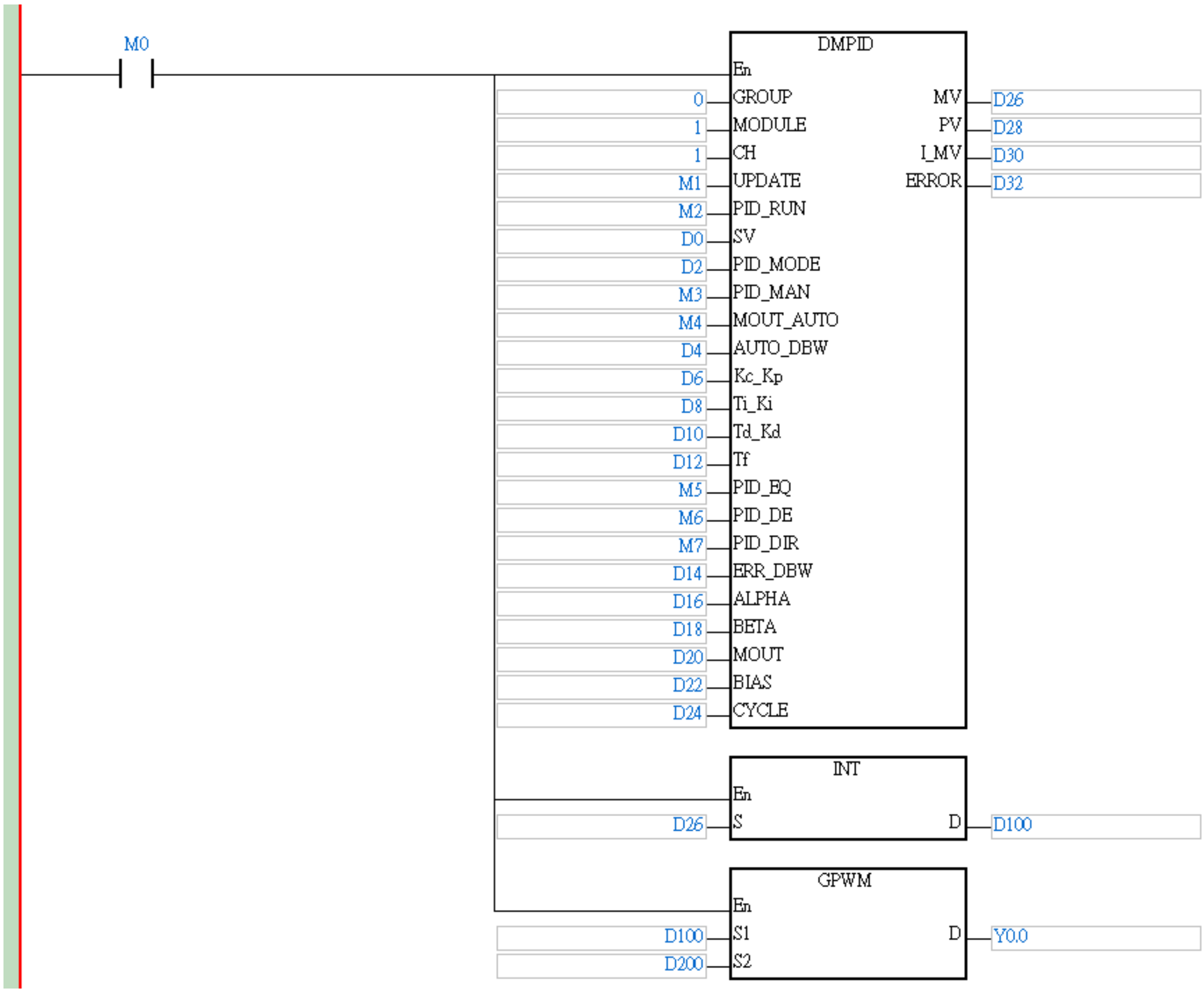
Operand	Data type	Function	Setting range	Description
			does not support this instruction. 16#1401：group number or module number setting error 16#1402：the module you are using does not respond and communication time out 16#1403：channel setting error	

Note:

1. If the PID parameter exceeds the upper limit, only the maximum value can be written in the module, if the PID parameter is below the lower limit, only the minimum value can be written in the module.
2. When PID_RUN switches from True to False, it clears the MV output value to 0. If you need to keep the last MV output value, you can switch the operand EN to False to close this instruction and the MV output value can be kept.

Example

1. You need to set up the parameters before executing DMPID. Switch the operand EN from False to True to execute this instruction. If you need to change parameters during execution, you can use the UPDATE flag to update the parameters (including **PID_RUN** ~ **CYCLE)**. After the parameters are updated, the system clears the flag UPDATE.
2. When M0 is ON, the instruction is executed. When M2 is ON, the DMPID starts to process. When M2 is OFF, MV value is 0. And the value in MV is stored in D16. When M0 is OFF, the instruction is not executed. And the values in the instruction is not changed.
3. When the mode is set to 1, the system starts to auto tuning the parameters for the temperature control. After tuning is done, the system switches to auto control mode (PID_MODE is set to 0) and fill in the appropriate parameters (Kc_Kp, Ti_Ki, Td_Kd, Tf, ALPHA and BETA) to data devices. You can also use retentive devices to retain PID parameters.



Use PID parameters

CR#								Operand	Function	Description	Defaults
CH1	CH2	CH3	CH4	CH5	CH6	CH7	CH8				
600	630	660	690	720	750	780	810	PID_RUN	Enable the PID algorithm	1: the PID algorithm is implemented. 0: the output value (MV) is reset to 0, and the PID algorithm is not implemented.	0

CR#								Operand	Function	Description	Defaults
CH1	**CH2**	**CH3**	**CH4**	**CH5**	**CH6**	**CH7**	**CH8**				
601	631	661	691	721	751	781	811	SV	SV	Target value	0
602	632	662	692	722	752	782	812	PID_MODE	PID control mode	0: automatic control When PID_MAN is switched from 1 to 0, the output value (MV) is included in the automatic algorithm. 1: the parameters are tuned automatically for the temperature control. When the tuning is complete, the device is automatically reset to 0, and the parameters Kc_Kp, Ti_K_i, Td_K_d, and Tf are set appropriately.	0
603	633	663	693	723	753	783	813	PID_MAN	PID A/M mode	0: auto; the MV is output based on the PID algorithm. 1: manual; the MV is output based on the MOUT. When	0

CR#								Operand	Function	Description	Defaults
CH1	CH2	CH3	CH4	CH5	CH6	CH7	CH8				
										PID_MODE is also set to 1, this setting is ineffective.	
604	634	664	694	724	754	784	814	MOUT_AUTO	MOUT automatic change mode	0: normal; the MOUT does not vary with the MV. 1: auto; the MOUT varies with the MV.	0
605	635	665	695	725	755	785	815	Auto DBWA	Auto tuning non-action zone	Range: 0–32000, used when SV is in the ±dead band in auto tuning mode.	0
606 607	636 637	666 667	696 697	726 727	756 757	786 787	816 817	Kc_Kp	Calculated proportional coefficient (Kc or Kp)	Kc_Kp are floating-point numbers. If the P coefficient is less than 0, the Kc_Kp is 0. Independently, if Kc_Kp is 0, it is not controlled by P.	3.846
608 609	638 639	668 669	698 699	728 729	758 759	788 789	818 819	Ti_Ki	Integral coefficient (Ti or Ki)	Ti_Ki are floating-point numbers. If the calculated coefficient I is less than 0, Ti_Ki is 0. If Ti_Ki is 0, it is not controlled by I.	0.013
610 611	640 641	670 671	700 701	730 731	760 761	790 791	820 821	Td_Kd	Derivative coefficient	Td_Kd are floating-point	190.078

CR#								Operand	Function	Description	Defaults
CH1	CH2	CH3	CH4	CH5	CH6	CH7	CH8				
									(Td or K_d)	numbers. If the calculated coefficient D is less than 0, Td_Kd is 0. If Ti_Ki is 0, it is not controlled by D.	
612 613	642 643	672 673	702 703	732 733	762 763	792 793	822 823	Tf	Derivate-action time constant	If the derivate-action time constant is less than 0, Tf is 0 and it is not controlled by the derivate-action time constant.	4.941
614	644	674	704	734	764	794	824	PID_EQ	PID formula types	0: independent formula 1: dependent formula	0
615	645	675	705	735	765	795	825	PID_DE	The calculation of the PID derivative error	0: use the variations in the error (E) to calculate the control value of the derivative (derivative of E). 1: use the variations in the PV to calculate the control value of the derivative (derivative of	0

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CR#								Operand	Function	Description	Defaults
CH1	CH2	CH3	CH4	CH5	CH6	CH7	CH8				
										PV).	
616	646	676	706	736	766	796	826	PID_DIR	PID forward/ reverse direction	0: heating action (E=SV-PV) 1: cooling action (E=PV-SV)	0
617	647	677	707	737	767	797	827	ERR_DBW	Range within which the error value is counted as 0	The error value (E) is the difference between the SV and the PV. When this setting is 0, the function is not enabled. When this setting is enabled, the CPU module checks whether the present difference is less than the absolute value of ERR_DBW, and it checks whether the present difference meets the cross status condition. If the present difference is less than the absolute value of ERR_DBW and it meets the cross status condition, the present error is counted as 0, and the PID algorithm	0

CR#								Operand	Function	Description	Defaults
CH1	CH2	CH3	CH4	CH5	CH6	CH7	CH8				
										is implemented. Otherwise the present error is brought into the PID algorithm normally.	
618	648	678	708	738	768	798	828	α value	Integral sum	Range: 0–100 Unit: 0.01	31
619	649	679	709	739	769	799	829	β value	Integral sum		0
620	650	680	710	740	770	800	830	MOUT	Manual output value (MOUT)	When PID_MAN is set to 1, the MV value is output as this manual MOUT value, between MV_MAX and MV_MIN. Range: 0–1000 (0%–100%)	0
621	651	681	711	741	771	801	831	BIAS	Feedforward output value	Feedforward output value, used for the PID feedforward	0
622 623	652 653	682 683	712 713	742 743	772 773	802 803	832 833	MV	Output value (MV)	A floating-point number Range: 0–100 Unit: %	--
624 625	654 655	684 685	714 715	744 745	774 775	804 805	834 835	I_MV	Accumulated integral value	Floating-point format. The accumulated integral value is temporarily stored for reference. When the MV is out of the range	--

CR#								Operand	Function	Description	Defaults
CH1	CH2	CH3	CH4	CH5	CH6	CH7	CH8				
										0%–100%, the accumulated integral value in I_MV is unchanged.	
626	656	686	716	746	776	806	836	CYCLE	Sampling time (T_S)	When this instruction is read, the PID algorithm is implemented according to the sampling time, and the MV is refreshed. If T_S is less than 1, it is read as 1. If T_S is larger than 1,000, it is read as 1,000. Unit: 100 ms	1

Note: When using PID parameters to set up control registers: PID control registers of AS04TC-A and RTD-A are retainable; however PID control registers of AS06RTD-A and AS08TC-A are not retainable.

PID formula:

1. When the PID_MODE is set to 0, the mode is set to auto:

- **Independent Formula & Derivative of E (PID_EQ=False & PID_DE=False)**

$$MV = K_P E + Ki\int_0^t Edt + K_d * \frac{dE}{dt} + BIAS \quad (E = SV - PV \quad \text{or} \quad E = PV - SV)$$

- **Independent Formula & Derivative of PV (PID_EQ=False & PID_DE=True)**

$$MV = K_P E + Ki\int_0^t Edt - K_d * \frac{dPV}{dt} + BIAS \quad (E = SV - PV)$$

Or

$$MV = K_P E + Ki\int_0^t Edt + K_d * \frac{dPV}{dt} + BIAS \quad (E = PV - SV)$$

- **Dependent Formula & Derivative of E (PID_EQ=True & PID_DE=False)**

$$MV = K_c\left[E + \frac{1}{T_i}\int_0^t E dt + T_d * \frac{dE}{dt}\right] + BIAS \quad (E = SV - PV \quad \text{or} \quad E = PV - SV)$$

- **Dependent Formula & Derivative of PV (PID_EQ=True & PID_DE=True)**

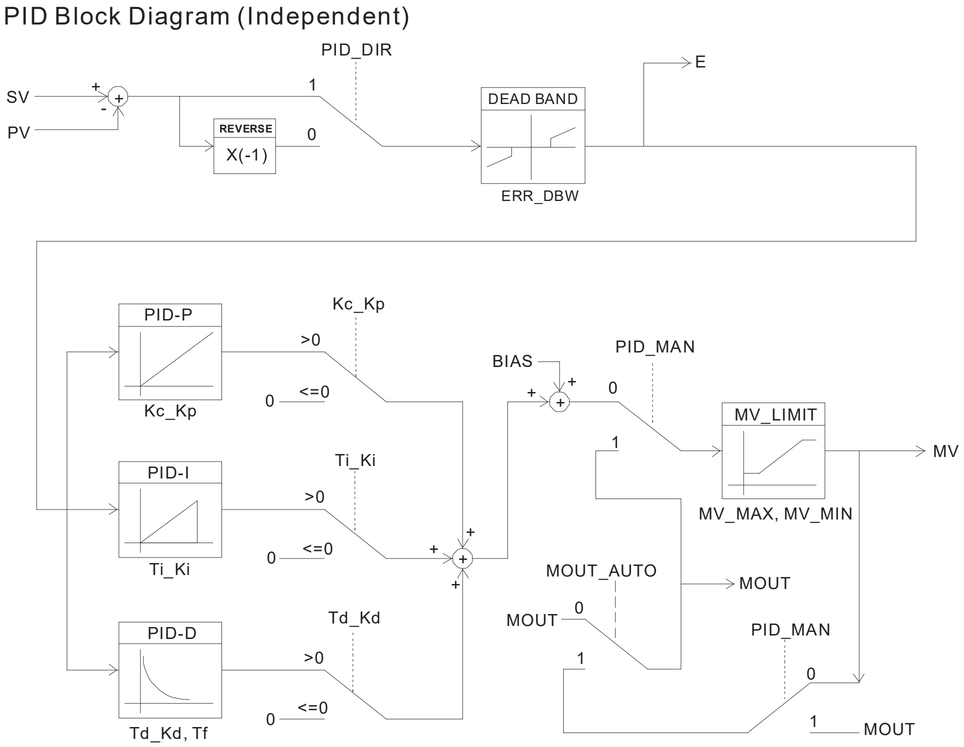
$$MV = K_c\left[E + \frac{1}{T_i}\int_0^t E dt - T_d * \frac{dE}{dt}\right] + BIAS \quad (E = SV - PV)$$

Or

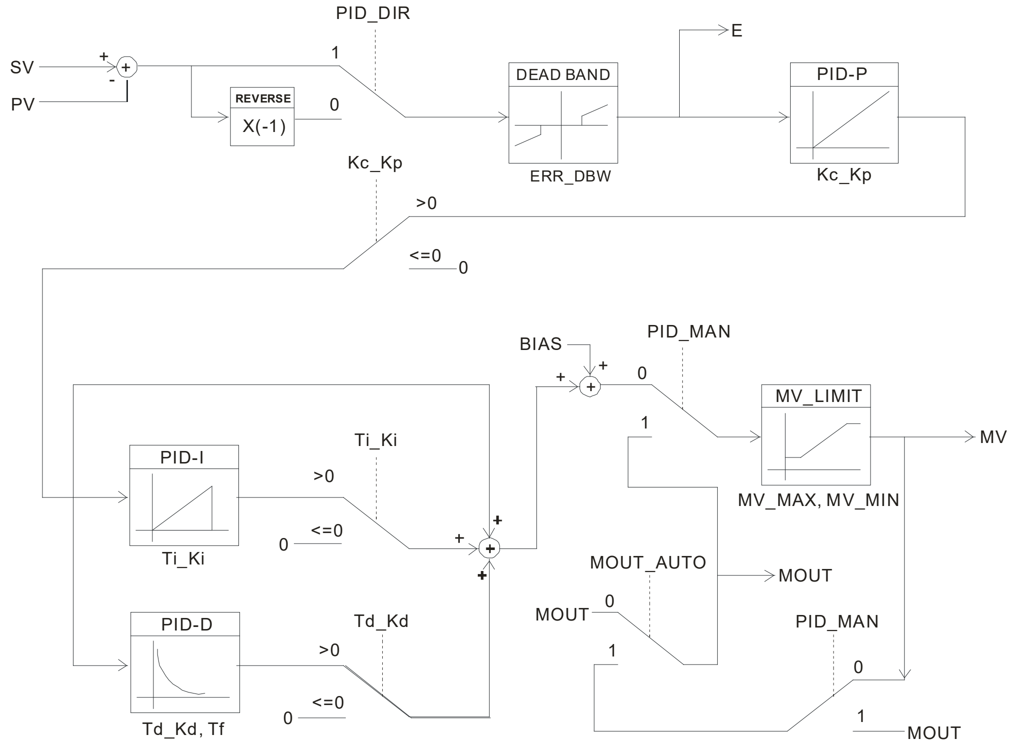
$$MV = K_c\left[E + \frac{1}{T_i}\int_0^t E dt + T_d * \frac{dE}{dt}\right] + BIAS \quad (E = PV - SV)$$

2. When you set the PID_MODE to 1, auto tuning mode is enabled. When auto tuning is complete, the value becomes 0 and switches off the auto tuning mode automatically.

PID Control Block Diagram:

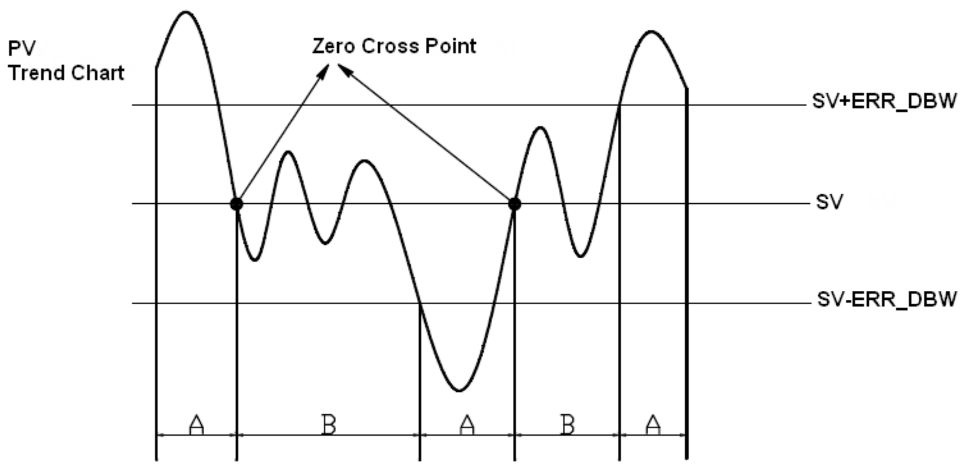


PID Block Diagram (Dependent)



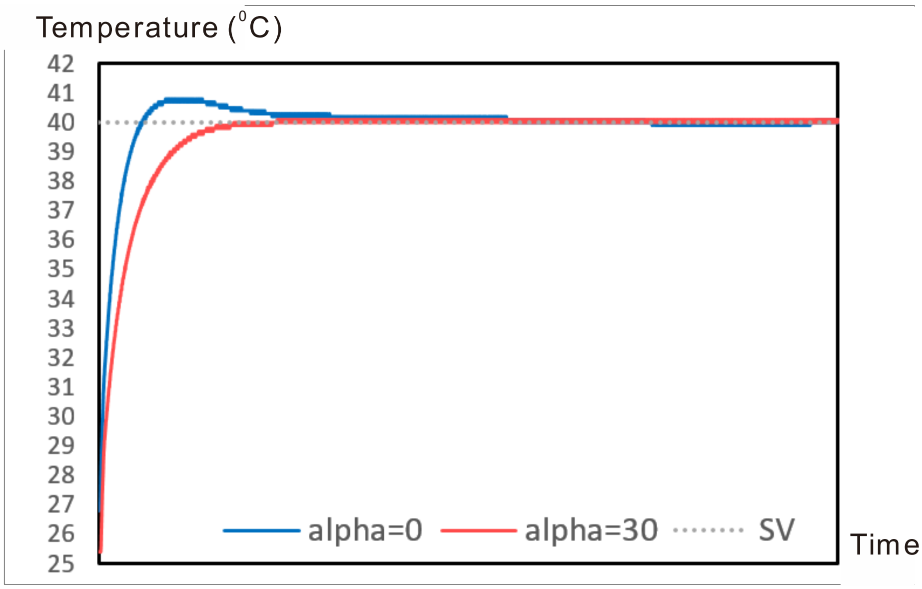
ERR_DBW

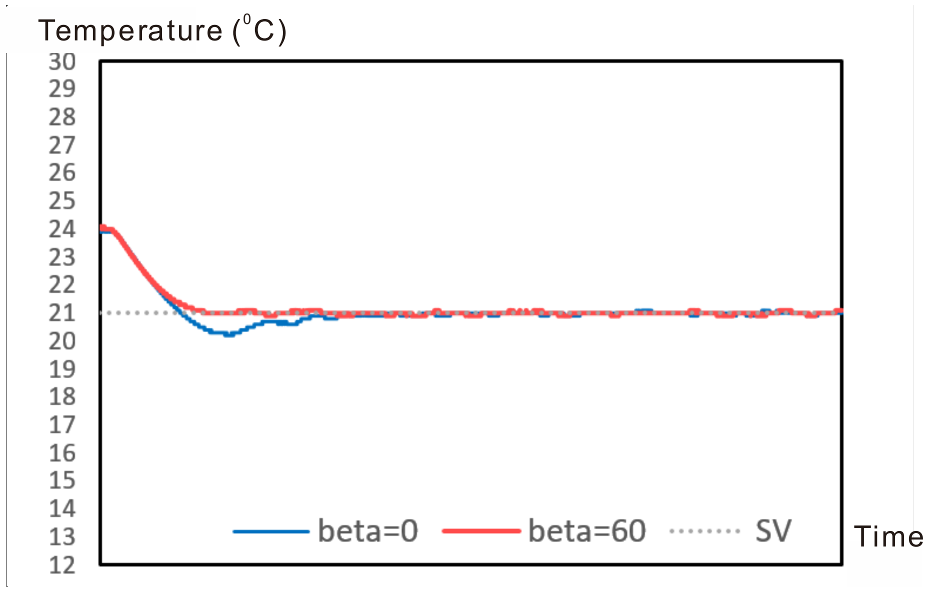
When the PV (present value) is in the range of **ERR_DBW**, at the beginning, the present error is brought into the PID algorithm according to the normal processing, and then the CPU module checks whether the present error meets the cross status condition: PV (present value) goes beyond the SV (target value). Once the condition is met, the present error is counted as 0 when applying the PID algorithm. After the PV (present value) is out of the **ERR_DBW** range, the present error is brought into the PID algorithm again. If PID_DE is true, that means it uses the variations in the PV to calculate the control value of the derivative, and after the cross status condition is met, the PLC treats Δ **PV** as 0 to apply the PID algorithm. (Δ **PV**= current **PV** – previous **PV**). In the following example, the present error is brought into the PID algorithm according to the normal processing in section A ,and the present error or Δ **PV** is counted as 0 to apply the PID algorithm in the section B.



α、β Value

To reduce overshoot, you can use parameters of ALPHA or BETA in the beginning of the PID operation or while SV (target value) varies to compensate initial value of integral calculus (for heating up or cooling down). See the images below. Use ALPHA parameter to reduce overshoot while the temperature is climbing up. Use BETA parameter to reduce overshoot while the temperature is dropping.





7

Formula of the output cycle:

- Output cycle width = MV (%) x output cycle

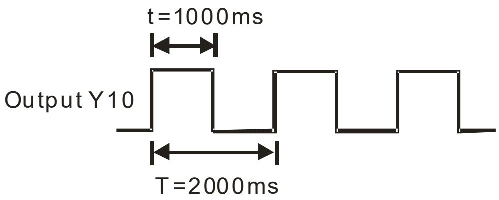
Execute the general pulse with modulation instruction (GPWM) to set output cycle width and output cycle sampling time to manage the cycle.

Example:

If the output cycle is 2000 ms, then the output value is 50% after the PID algorithm is implemented.

- Output cycle width = 50% × 2000 ms = 1000 ms

In other words, the GWPM instruction can be set to output cycle width = 1000 and output cycle = 2000.



Note:

1. When tuning the parameters Kc_Kp, Ti_Ki, and Td_Kd (**PID_MODE**=0), set the Kc_Kp value first, and then set the Ti_Ki and Td_Kd values to 0. In a controlled environment, you can increase the values of Ti_Ki (from smaller to bigger) and Td_Kd (from bigger to smaller). When the value of Kc_Kp is 1, the proportional gain is 100%. That is, the error values increase by a factor of one. When the proportional gain is less than 100%, the error values decrease. When the proportional gain is greater than 100%, the error values increase.

2. The parameters which have been automatically tuned are not necessarily suitable for every controlled environment. You can, therefore, further modify the automatically-tuned parameters, but it is recommended that you only modify the values of Ti_Ki or Td_Kd.

3. The operand CYCLE is to set the sampling time to use the PID algorithm and refresh MV.

4. When the number of the channel for measurement is changed, the time to refresh the measured value also changes. For example, the measured value is refreshed every 200 ms when there is only 1 channel for measurement. The measured value is refreshed every 800 ms when there are 4 channels for measurement. The Kc_Kp, Ti_Ki, Td_Kd parameters may differ when the number of channel for measure is different.

7.2.8 Wiring

- **Precautions**

To ensure the analog-to-digital module functions well and reliably, the external wiring must prevent noise. Before you install the cables, follow the precautions below.

(1) To prevent a surge and induction, the AC cable and the input signal cables that are connected to the ASTC-A Series must be separate cables.

(2) Do not install the cable near a main circuit, a high-voltage cable, or a cable connected to a load which is not a PLC. In addition, the cable must not be bound to a main circuit, a high-voltage cable, or a cable connected to a load which is not a PLC.

(3) Ground shielded cables and hermetically sealed cables separately.

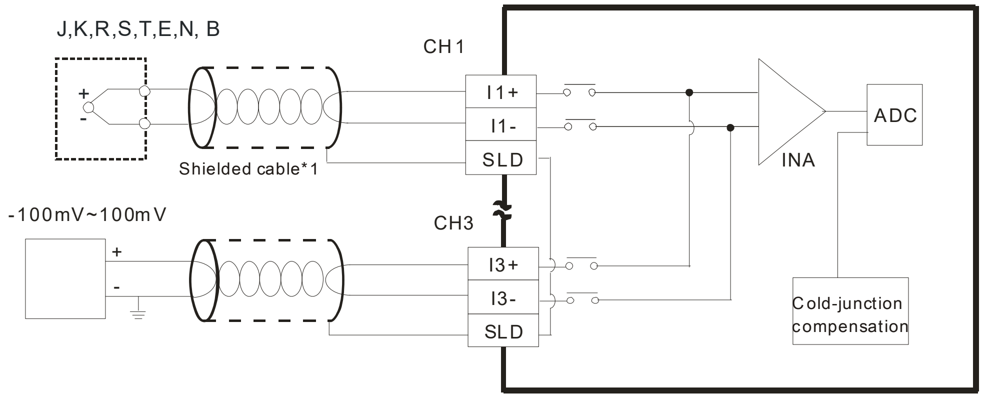
(4) Terminals with insulation sleeves cannot be arranged as a terminal block, so you should cover the terminals with insulation tubes.

(5) Note1: do not wire empty terminals.

(6) Note2: only use copper conducting wires with a temperature rating of 60/75°C and the length must be less than 50 m.

(7) Note3: TC modules must run for 30 minutes before they start to take any temperature measurement.

- **External wiring**



*1. Use shielded twisted pair cables for Type J, type K, type R, type S, type T, type E, type N and type B thermocouples, and keep them separate from power cables and other cables which generate noise.

7.2.9 LED Indicators

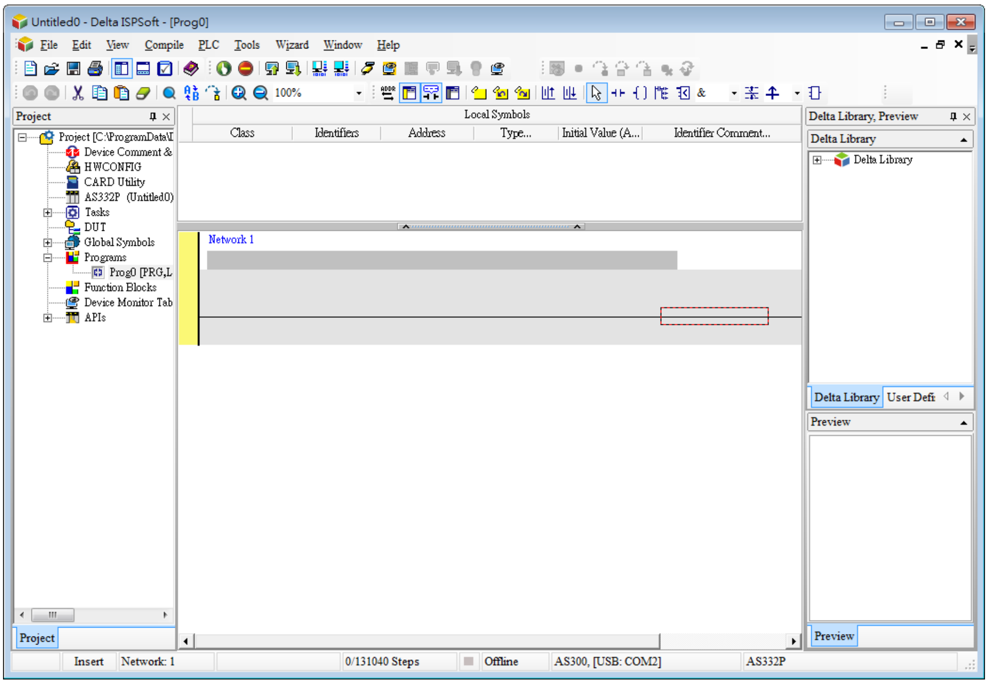
Number	Name	Description
1	RUN LED Indicator	Operating status of the module ON: the module is running. OFF: the module is not running.
2	ERROR LED Indicator	Error status of the module ON: a serious error exists in the module. OFF: the module is operating normally. Blink: a minor error exists in the module.
3	Analog-to-Digital Conversion Indicator	Conversion status Blinking: conversion is in process. OFF: conversion has stopped.

7.3 HWCONFIG in ISPSoft

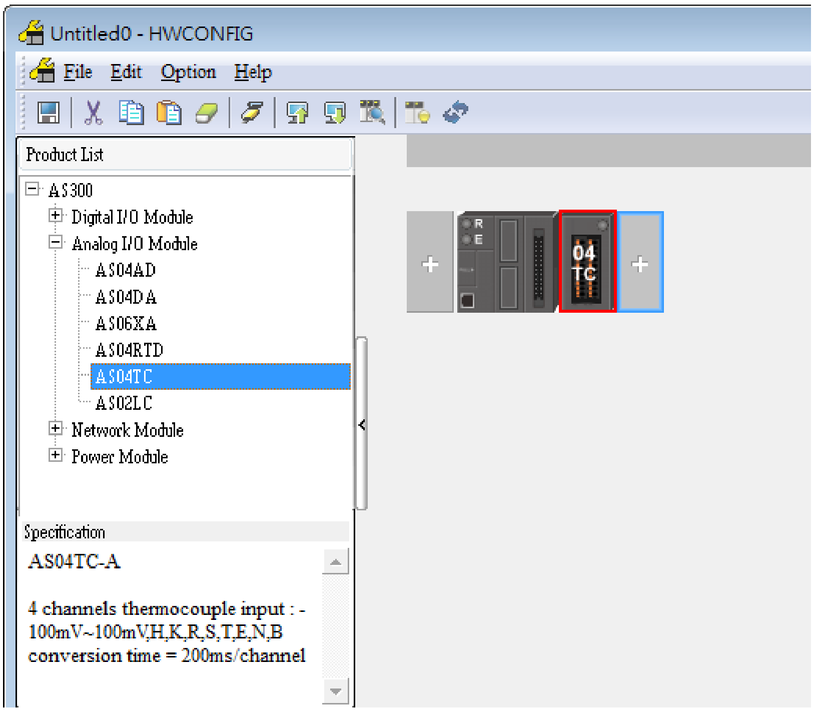
7.3.1 Initial Setting

The following uses AS04TC-A as an example to demonstrate.

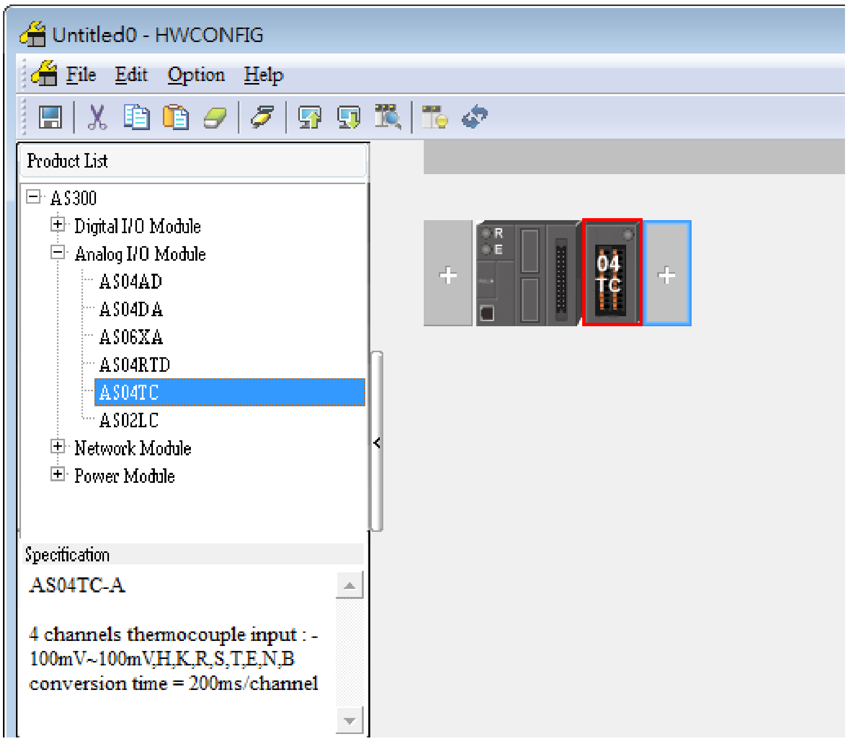
(1) Start ISPSoft and double-click **HWCONFIG**.



(2) Select a module and drag it to the working area.



(3) Double-click the module in the working area to open the Device Setting page.



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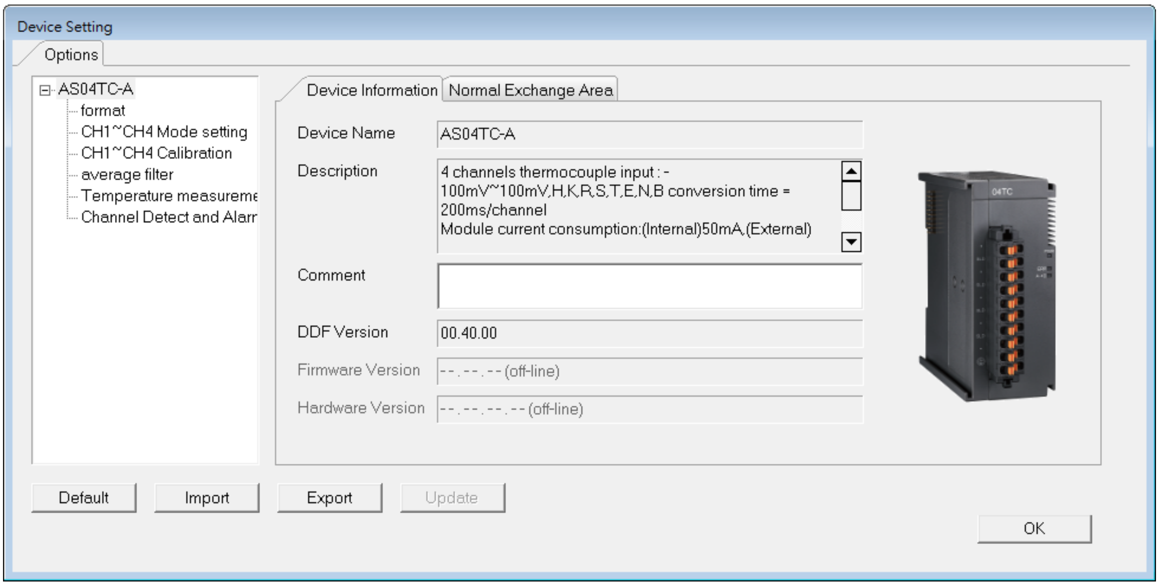
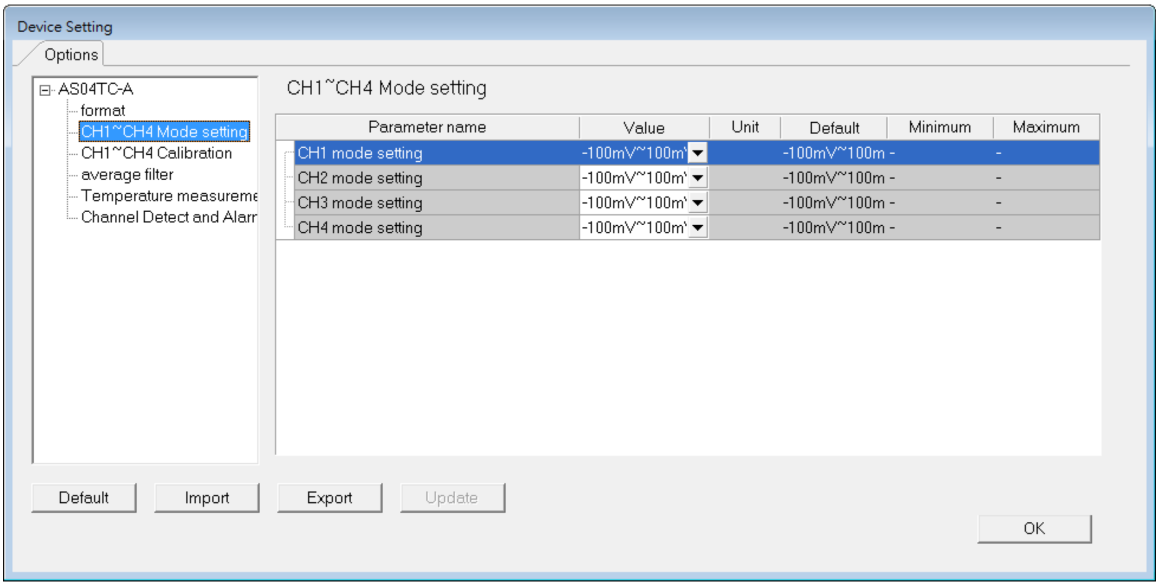
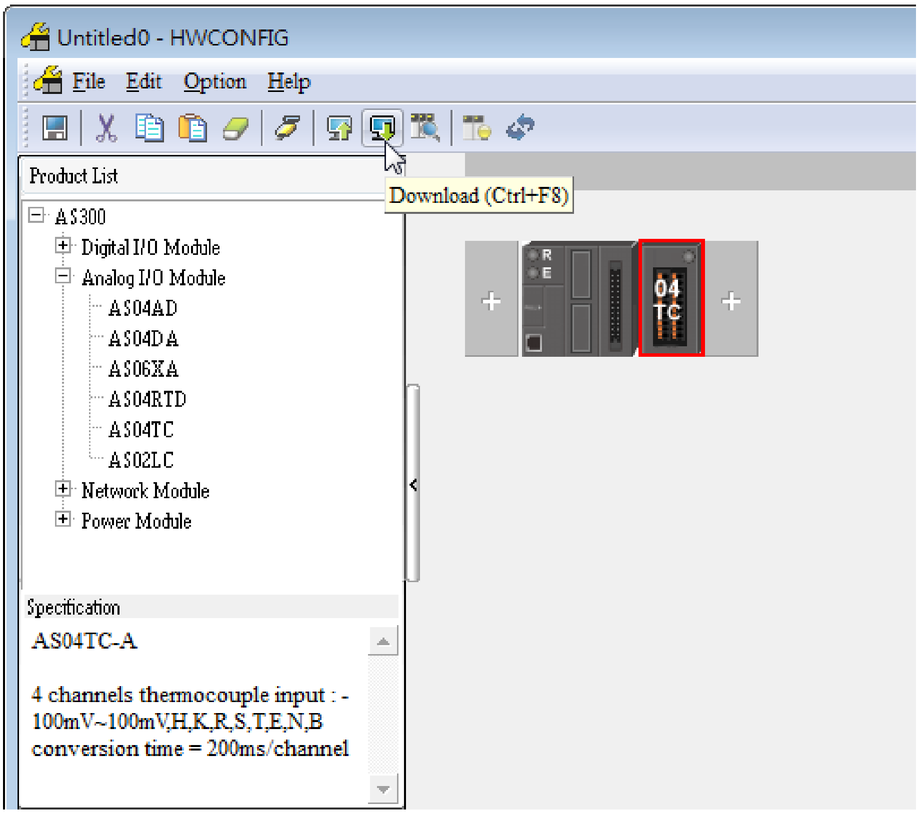


(4) Choose the parameter, set the values, and click **OK**.

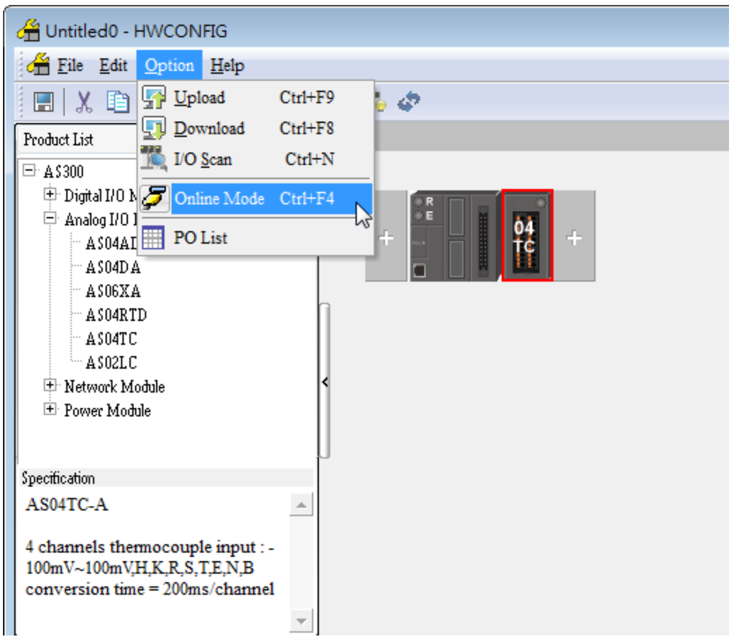


(5) Click **Download** on the toolbar to download the parameters. Note that you cannot download the parameters while the CPU module is running.

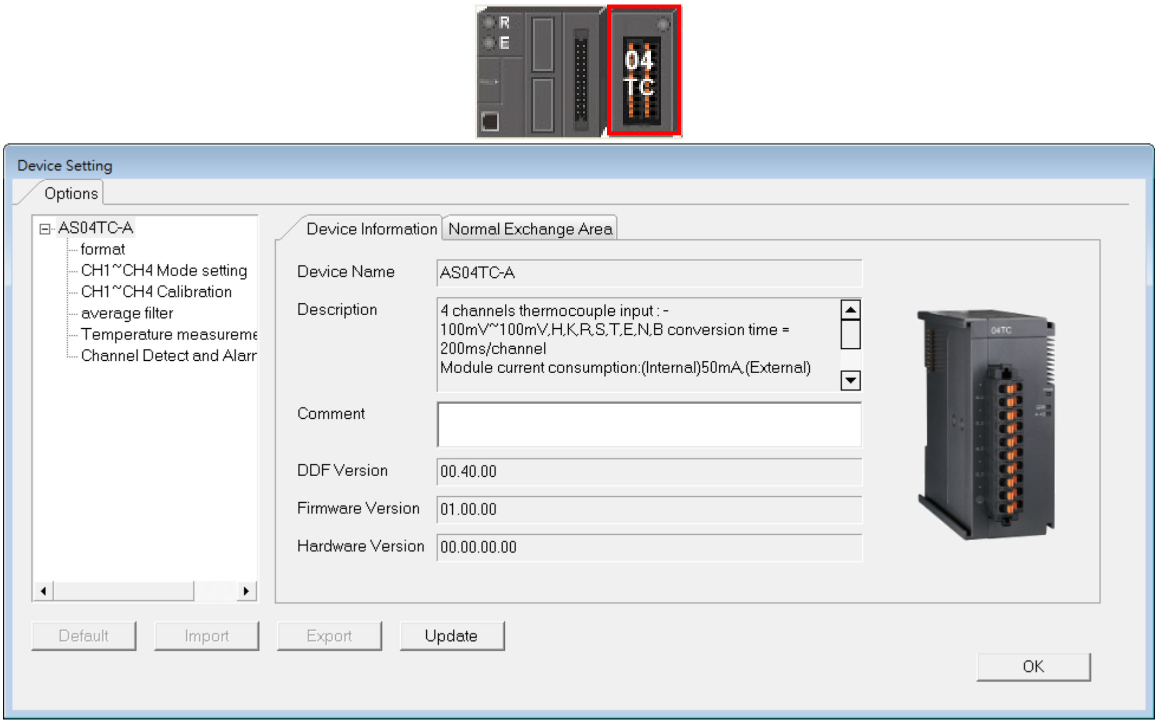


7.3.2 Checking the Version of a Module

(1) On the **Option** menu, click **Online Mode**.

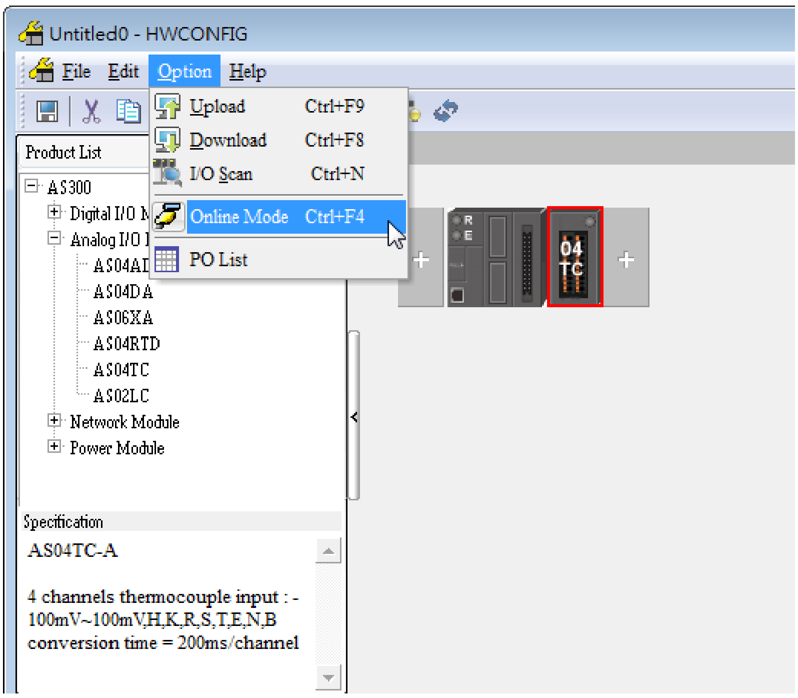


(2) Double-click the module to open the Device Setting page. The versions of both the firmware and the hardware are displayed.

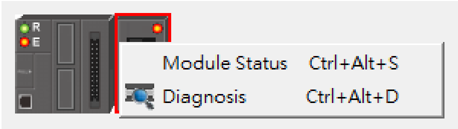


7.3.3 Online Mode

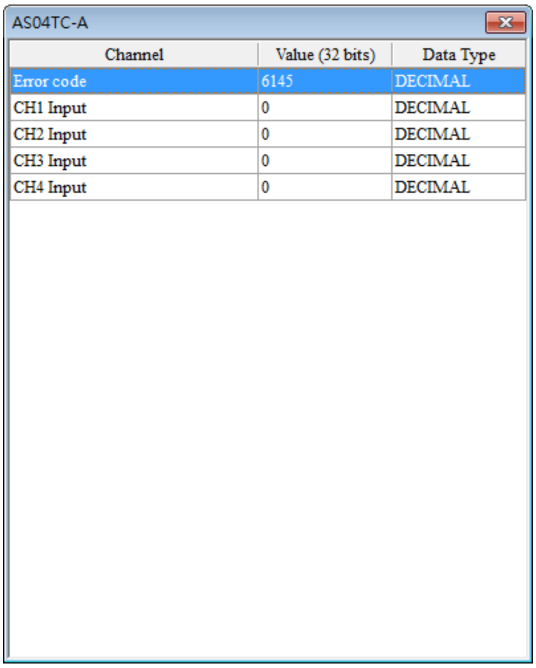
(1) On the **Option** menu, click **Online Mode**.



(2) Right-click the module and click **Module Status**.

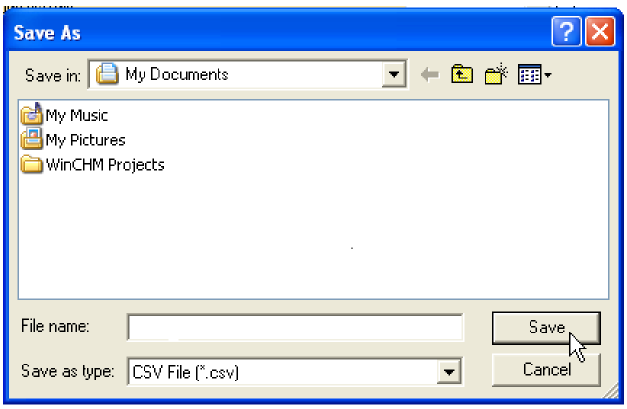


(3) View the module status.

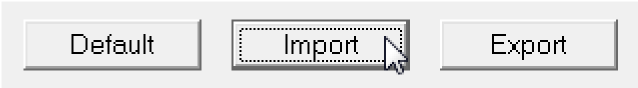


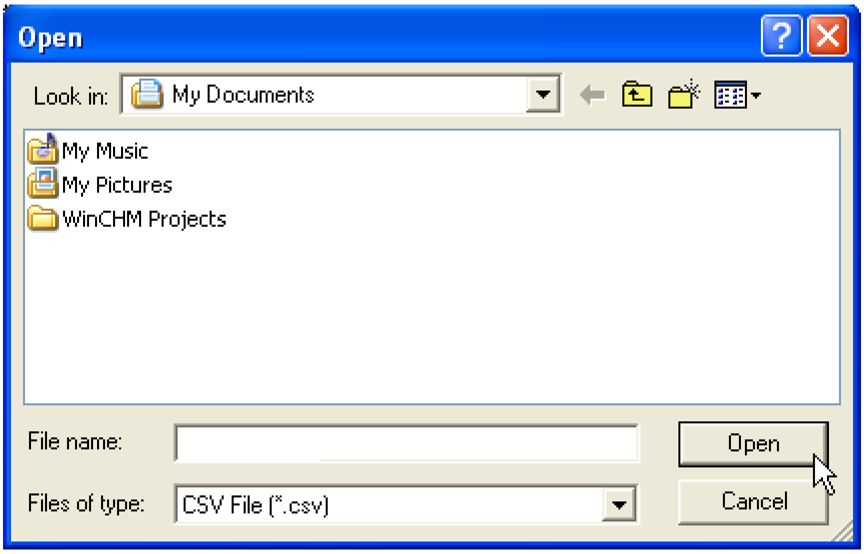
7.3.4 Importing/Exporting a Parameter File

(1) Click **Export** in the Device Setting dialog box to save the current parameters as a CSV file (.csv).



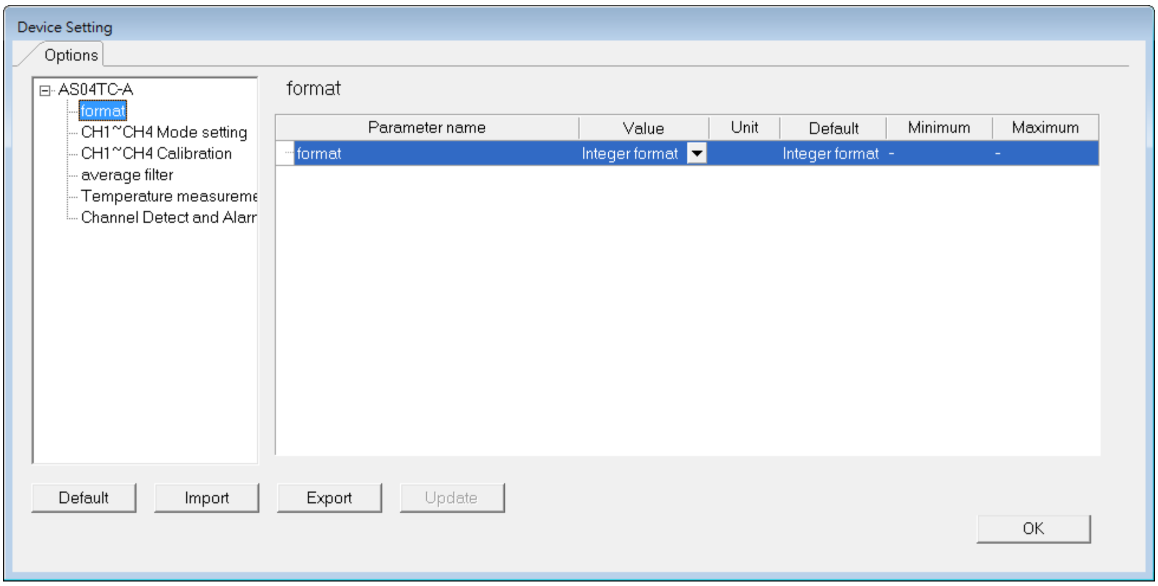
(2) Click **Import** in the Device Setting dialog box, and select a CSV file to import saved parameters.





7.3.5 Parameters

(1) The input modes of the channels



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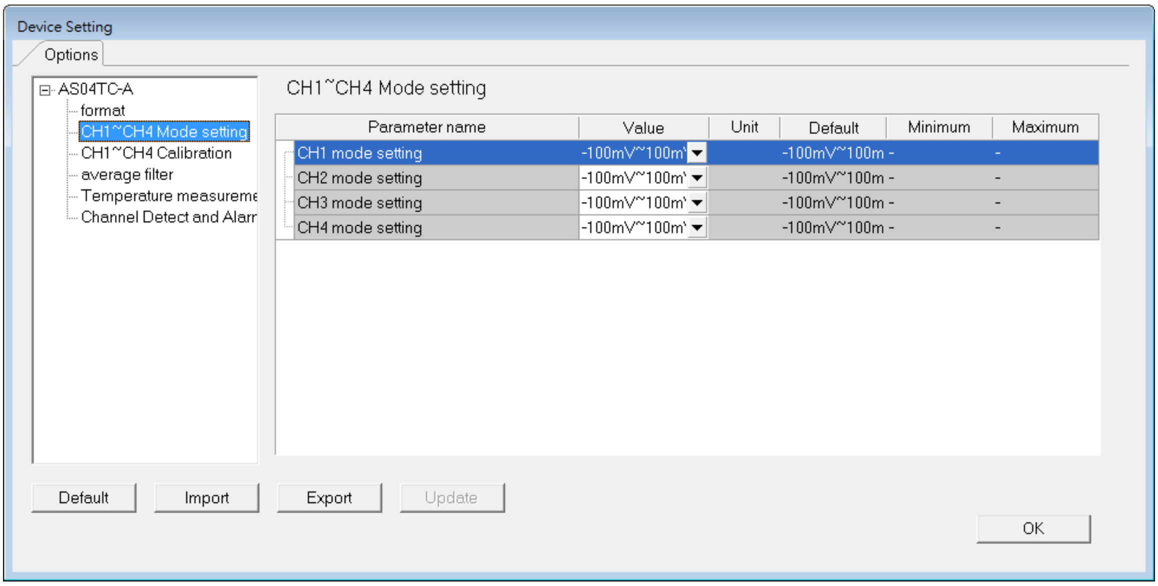
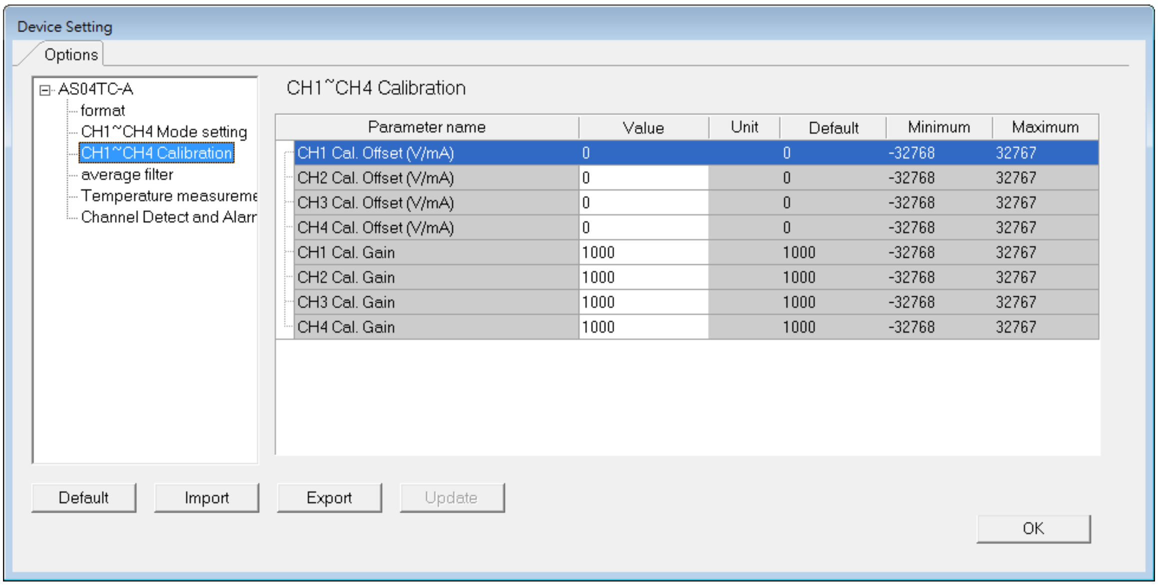
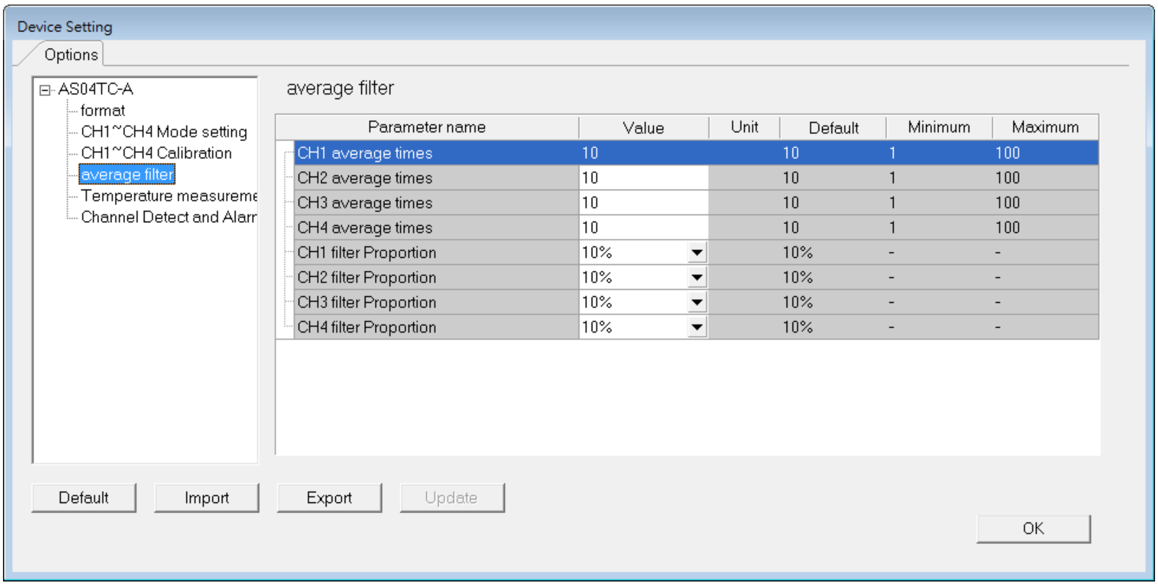
(2) Input CH1–CH4 (channel 1–channel 4) mode settings



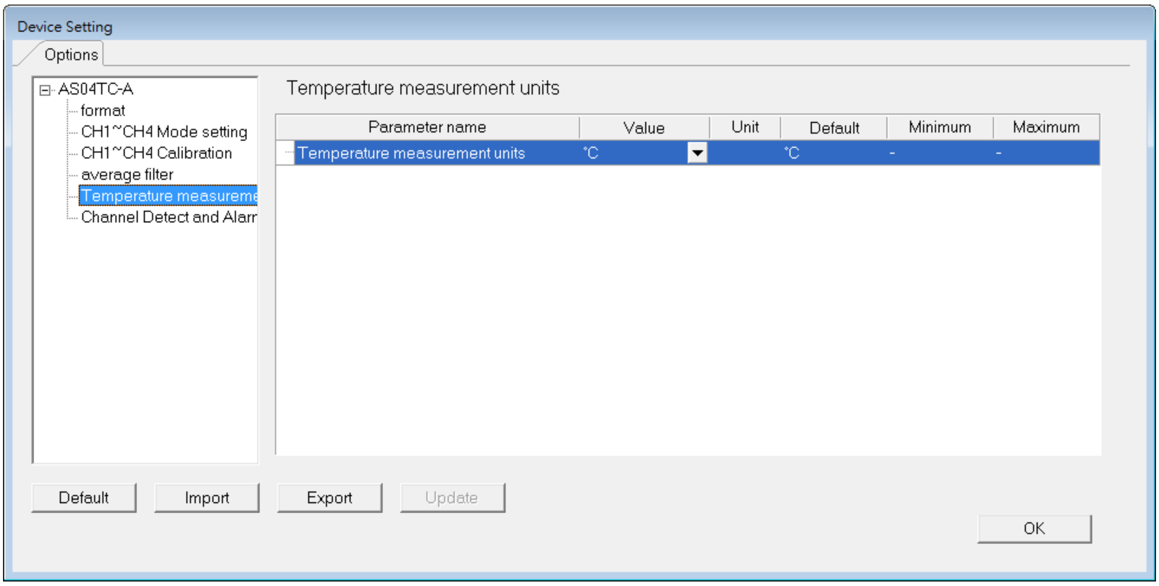
(3) Input CH1-CH4 calibration



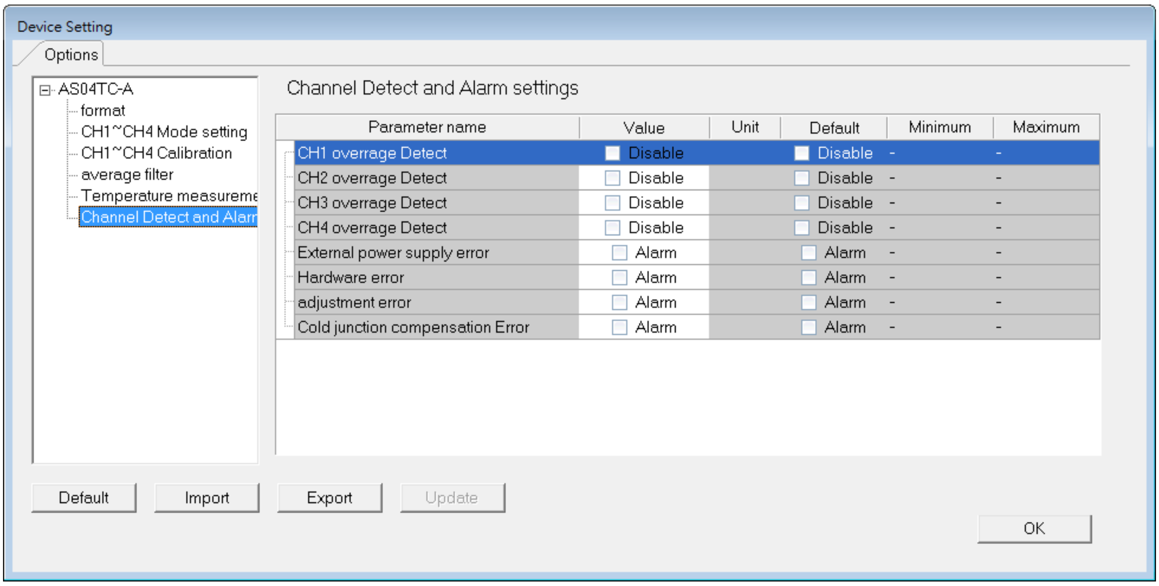
(4) Input average filter



(5) Temperature measurement



(6) Input channel detect and alarm settings



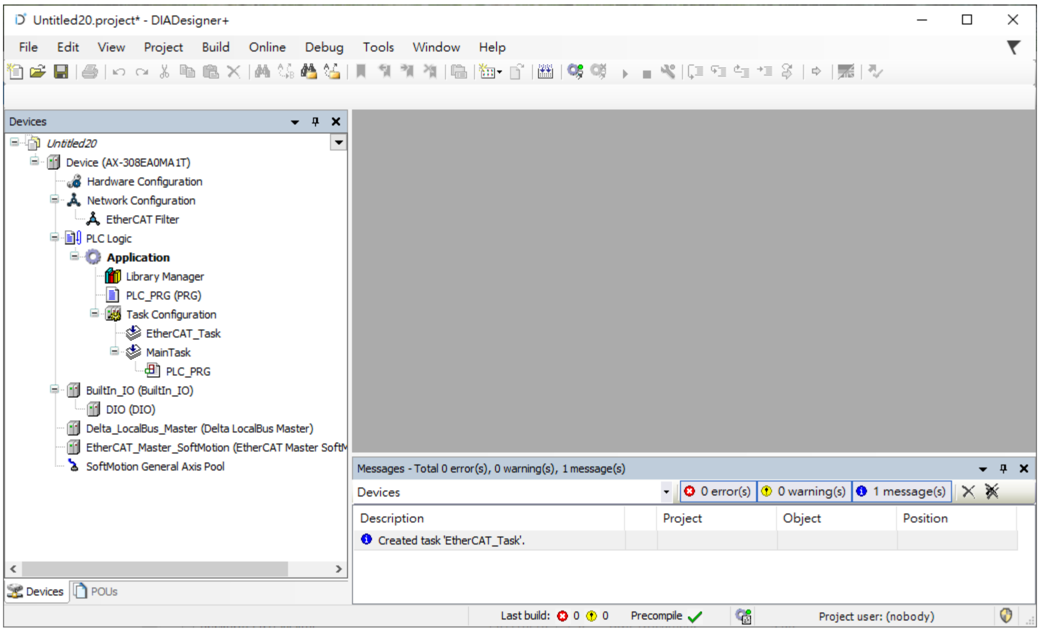
7

7.4 DIADesigner+ (Hardware Configuration)

The following example uses AS04TC-A.

7.4.1 Initial Setting

(1) Start DIADesigner+, click **New Project**, and then **Project+Device** to create a new project.

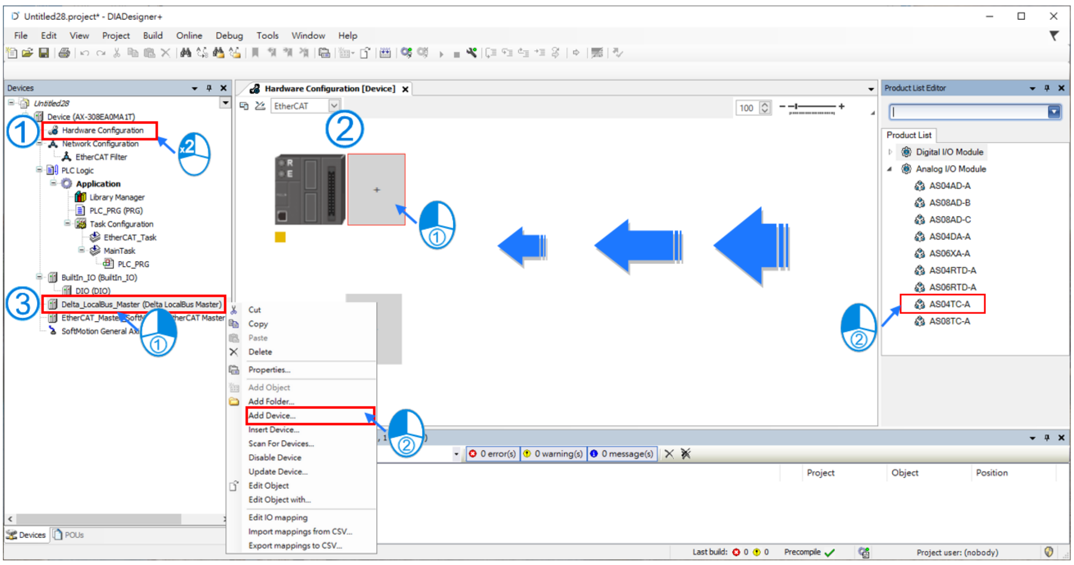


(2) Add modules in:

① Double-click **Hardware Configuration**

② Select the **+ section** and drag and drop the module that you want to add from the Product List to the + section.

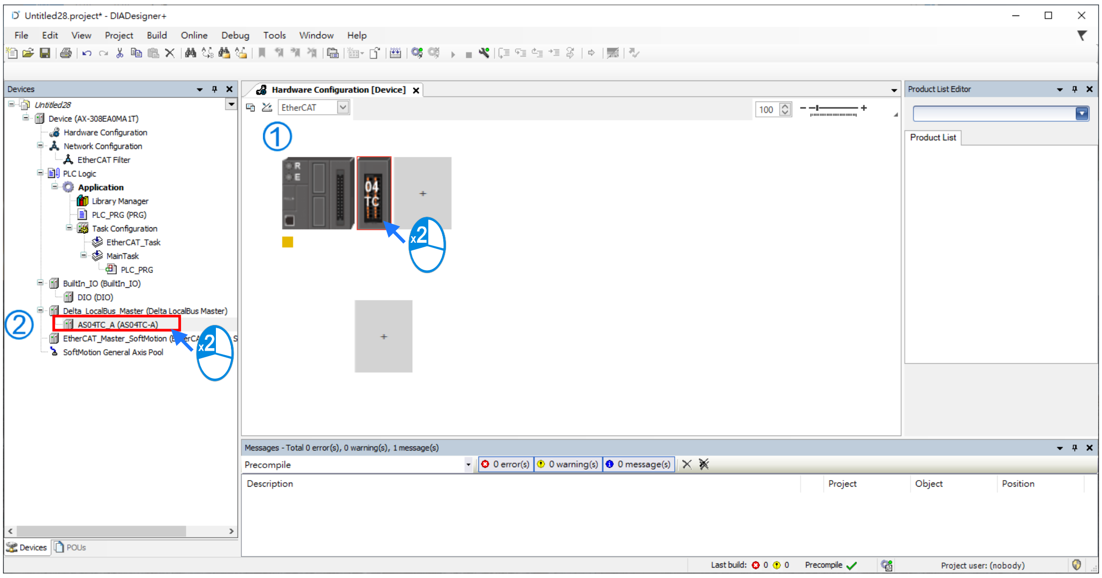
or ③ Right-click **Delta_Localbus Master** to see the context meun and then double-click **Add Device** to add devices manually or double-click **Scan for Devices**.



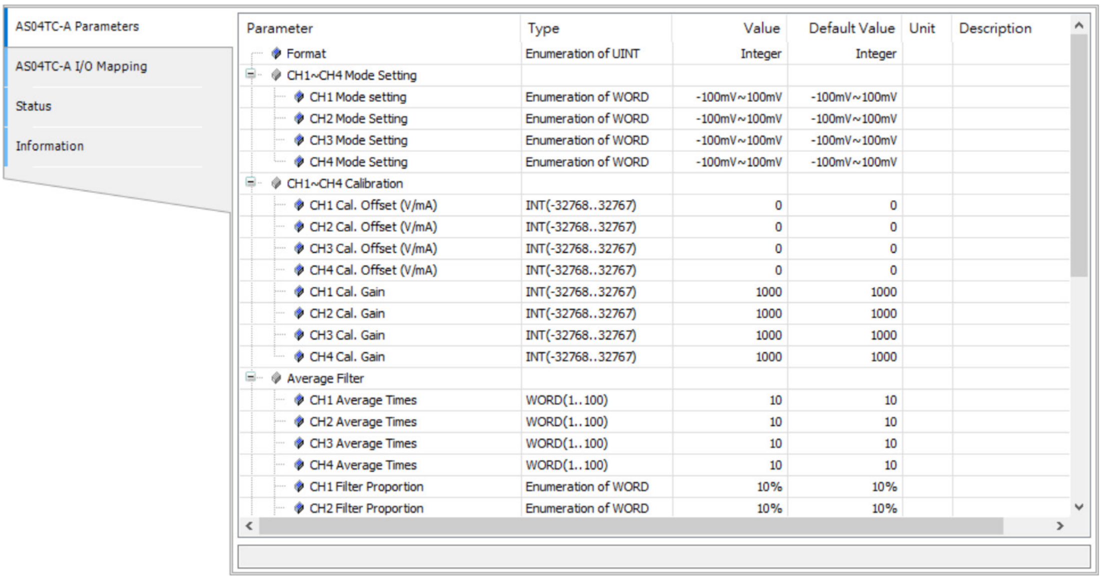
(3) Select modules:

① Double-click the module name in the **Hardware Configuration** area.

or ② Double-click the module name shown in the node.

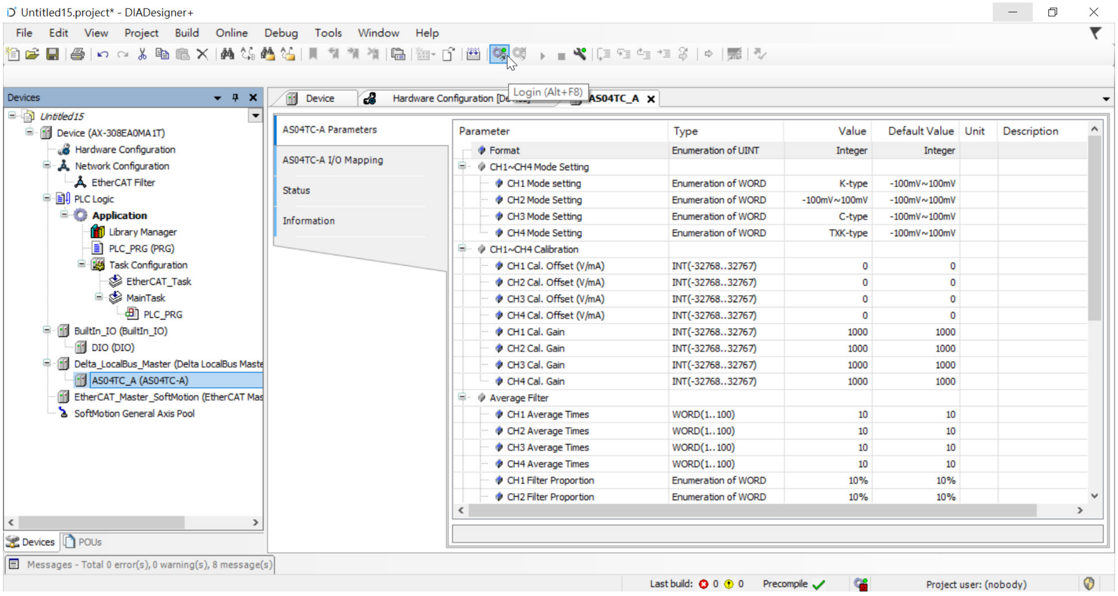


(4) Module parameter setting page:



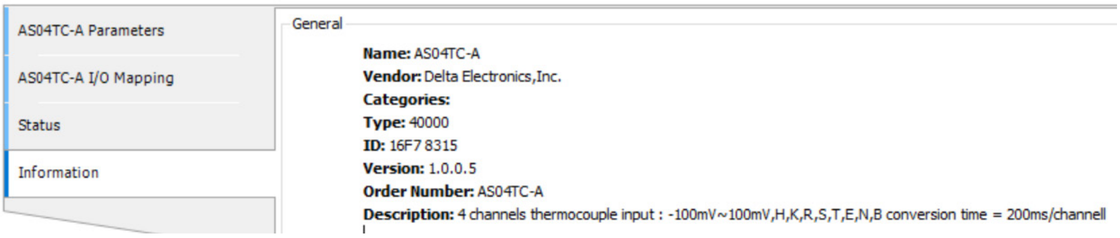
Parameter	Type	Value	Default Value	Unit	Description
Format	Enumeration of UINT	Integer	Integer		
CH1~CH4 Mode Setting					
CH1 Mode setting	Enumeration of WORD	-100mV~100mV	-100mV~100mV		
CH2 Mode Setting	Enumeration of WORD	-100mV~100mV	-100mV~100mV		
CH3 Mode Setting	Enumeration of WORD	-100mV~100mV	-100mV~100mV		
CH4 Mode Setting	Enumeration of WORD	-100mV~100mV	-100mV~100mV		
CH1~CH4 Calibration					
CH1 Cal. Offset (V/mA)	INT(-32768..32767)	0	0		
CH2 Cal. Offset (V/mA)	INT(-32768..32767)	0	0		
CH3 Cal. Offset (V/mA)	INT(-32768..32767)	0	0		
CH4 Cal. Offset (V/mA)	INT(-32768..32767)	0	0		
CH1 Cal. Gain	INT(-32768..32767)	1000	1000		
CH2 Cal. Gain	INT(-32768..32767)	1000	1000		
CH3 Cal. Gain	INT(-32768..32767)	1000	1000		
CH4 Cal. Gain	INT(-32768..32767)	1000	1000		
Average Filter					
CH1 Average Times	WORD(1..100)	10	10		
CH2 Average Times	WORD(1..100)	10	10		
CH3 Average Times	WORD(1..100)	10	10		
CH4 Average Times	WORD(1..100)	10	10		
CH1 Filter Proportion	Enumeration of WORD	10%	10%		
CH2 Filter Proportion	Enumeration of WORD	10%	10%		

(5) After setting is complete, select the module and click **Login** on the tool bar to download the settings to the modules.

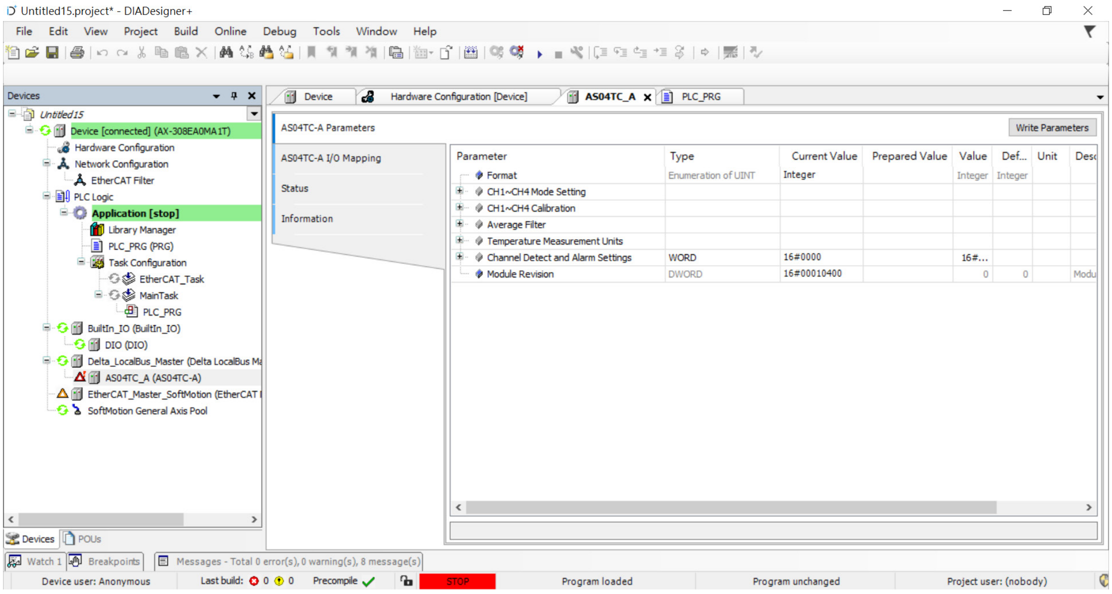


7.4.2 Checking the Version of a Module

(1) Select the module and click the Information tab to see the module information.

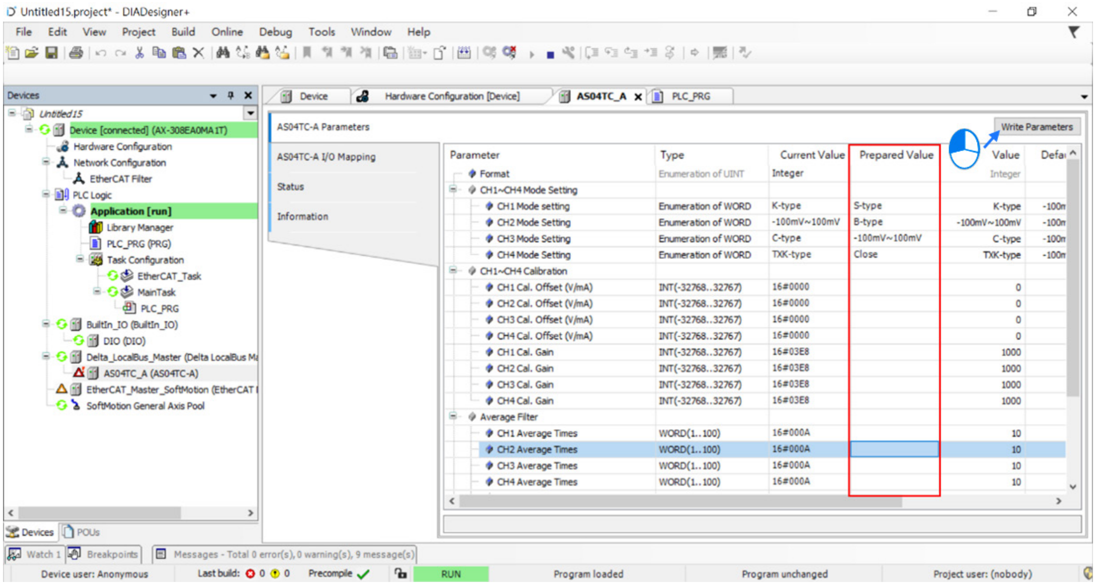


(2) Select the module and click **Login** on the tool bar to go to Online Mode. You can find the Module Revision from the Parameters tab.

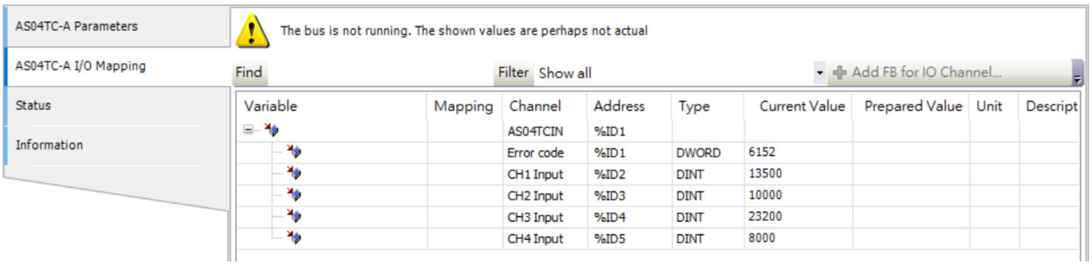


7.4.3 Online Mode

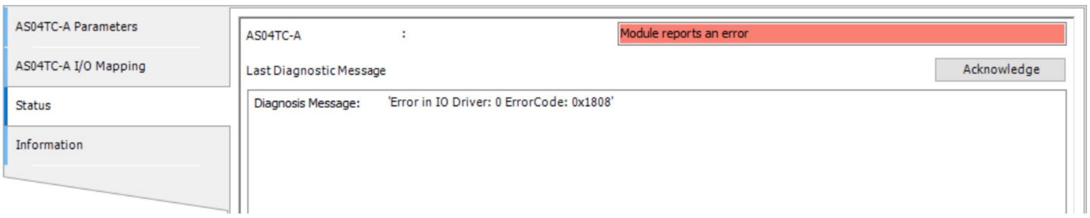
(3) Select the module and click **Login** on the tool bar to go to **Online Mode**. You can monitor all configuration parameters. Vaules in the column of Prepared Value are configurable online. After editing the values in the Prepared Value column, click **Write Parameter** to confirm the change.



(4) You can monitor the values, status, error codes in each channel from the I/O Mapping tab.

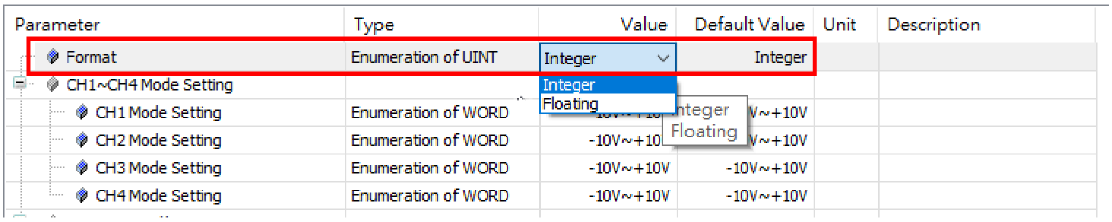


(5) You can monitor the current status and error codes from the Status tab.



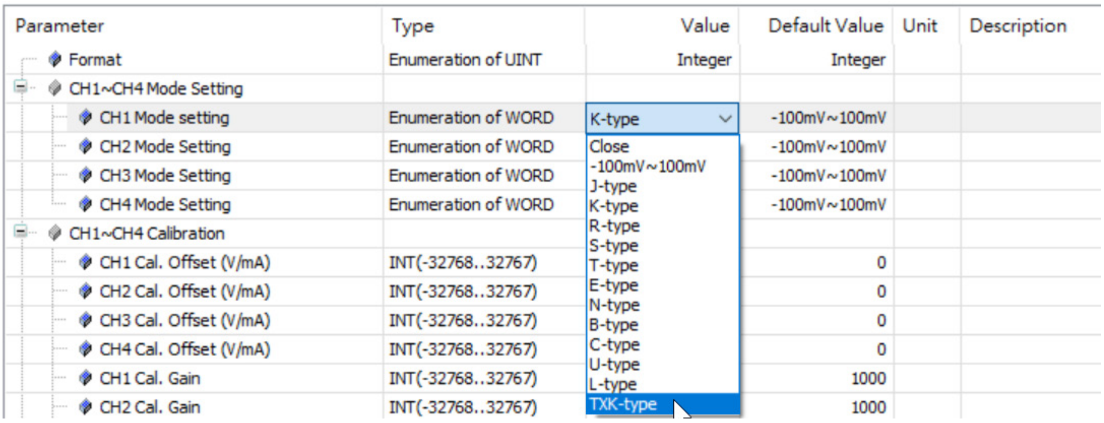
7.4.4 Parameters

(1) You can set up the value format to **Integer** or **Floating** for Channel 1 to 4.



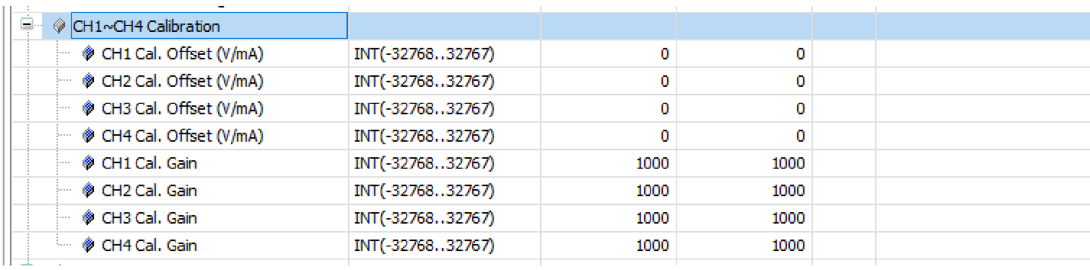
Parameter	Type	Value	Default Value	Unit	Description
Format	Enumeration of UINT	Integer	Integer		
CH1~CH4 Mode Setting					
CH1 Mode Setting	Enumeration of WORD	[illegible]	[illegible]		
CH2 Mode Setting	Enumeration of WORD	-10V~+10	[illegible]		
CH3 Mode Setting	Enumeration of WORD	-10V~+10V	-10V~+10V		
CH4 Mode Setting	Enumeration of WORD	-10V~+10V	-10V~+10V		

(2) You can set up the values for Channel 1 to 4.



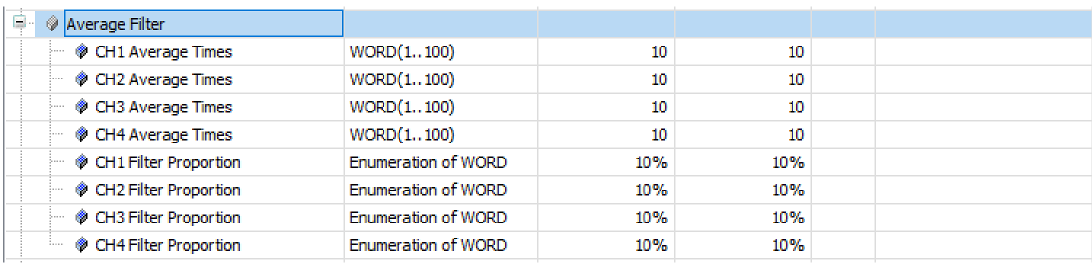
Parameter	Type	Value	Default Value	Unit	Description
Format	Enumeration of UINT	Integer	Integer		
CH1~CH4 Mode Setting					
CH1 Mode setting	Enumeration of WORD	K-type	-100mV~100mV		
CH2 Mode Setting	Enumeration of WORD		-100mV~100mV		
CH3 Mode Setting	Enumeration of WORD		-100mV~100mV		
CH4 Mode Setting	Enumeration of WORD		-100mV~100mV		
CH1~CH4 Calibration					
CH1 Cal. Offset (V/mA)	INT(-32768..32767)		0		
CH2 Cal. Offset (V/mA)	INT(-32768..32767)		0		
CH3 Cal. Offset (V/mA)	INT(-32768..32767)		0		
CH4 Cal. Offset (V/mA)	INT(-32768..32767)		0		
CH1 Cal. Gain	INT(-32768..32767)		1000		
CH2 Cal. Gain	INT(-32768..32767)		1000		

(3) You can set up the calibrations for for Channel 1 to 4.



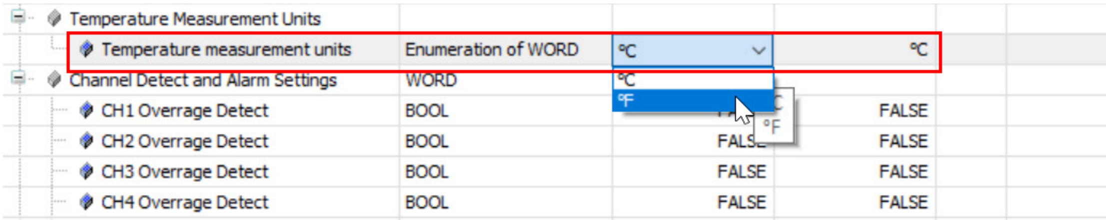
CH1~CH4 Calibration					
CH1 Cal. Offset (V/mA)	INT(-32768..32767)	0	0		
CH2 Cal. Offset (V/mA)	INT(-32768..32767)	0	0		
CH3 Cal. Offset (V/mA)	INT(-32768..32767)	0	0		
CH4 Cal. Offset (V/mA)	INT(-32768..32767)	0	0		
CH1 Cal. Gain	INT(-32768..32767)	1000	1000		
CH2 Cal. Gain	INT(-32768..32767)	1000	1000		
CH3 Cal. Gain	INT(-32768..32767)	1000	1000		
CH4 Cal. Gain	INT(-32768..32767)	1000	1000		

(4) You can set up the average filtering for Channel 1 to 4.

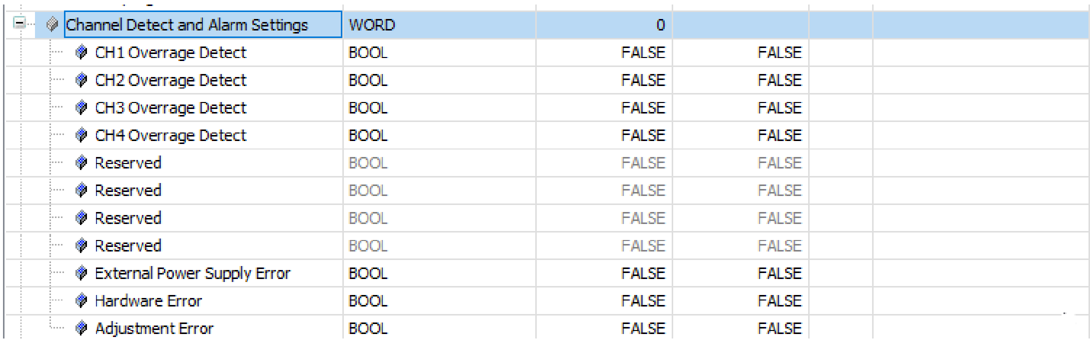


Average Filter					
CH1 Average Times	WORD(1..100)	10	10		
CH2 Average Times	WORD(1..100)	10	10		
CH3 Average Times	WORD(1..100)	10	10		
CH4 Average Times	WORD(1..100)	10	10		
CH1 Filter Proportion	Enumeration of WORD	10%	10%		
CH2 Filter Proportion	Enumeration of WORD	10%	10%		
CH3 Filter Proportion	Enumeration of WORD	10%	10%		
CH4 Filter Proportion	Enumeration of WORD	10%	10%		

(5) You can set up the temperature measurement units Channel 1 to 4.



(6) You can set up the channel detect and alarm settings.



7

7.5 Troubleshooting

7.5.1 Error Codes

Error Code	Description	A↔ D LED Indicator	ERROR LED Indicator
16#1605	Hardware failure	OFF	ON
16#1607	The external voltage is abnormal.	OFF	ON
16#1608	The factory calibration is abnormal.	OFF	ON
16#1801	The external voltage is abnormal.	OFF	Blinking
16#1802	Hardware failure	OFF	Blinking
16#1804	The factory calibration is abnormal.	OFF	Blinking
16#1808	The signal received by channel 1 exceeds the range of inputs that the hardware can receive.	Run: blinking Stop: OFF	Blinking
16#1809	The signal received by channel 2 exceeds the range of inputs that the hardware can receive.		
16#180A	The signal received by channel 3 exceeds the range of inputs that the hardware can receive.		
16#180B	The signal received by channel 4 exceeds the range of inputs that the hardware can receive.		
16#180C	The signal received by channel 5 exceeds the range of inputs that the hardware can receive.		
16#180D	The signal received by channel 6 exceeds the range of inputs that the hardware can receive.		
16#180E	The signal received by channel 7 exceeds the range of inputs that the hardware can receive.		
16#180F	The signal received by channel 8 exceeds the range of inputs that the hardware can receive.		
-	When power-on, the module is not detected by CPU module.	OFF	Blinking once or twice and after 2 seconds, it blinks repeatedly

7.5.2 Troubleshooting Procedure

Description	Procedure
The external voltage is abnormal.	Ensure the external 24 V power supply to the module is functioning normally.
Hardware failure	Return the module to the factory for repair.
Internal error The factory calibration is abnormal.	Contact the factory.
The signal received by channel 1 exceeds the range of inputs that the hardware can receive.	Check the signal received by channel 1.
The signal received by channel 2 exceeds the range of inputs that the hardware can receive.	Check the signal received by channel 2.
The signal received by channel 3 exceeds the range of inputs that the hardware can receive.	Check the signal received by channel 3.
The signal received by channel 4 exceeds the range of inputs that the hardware can receive.	Check the signal received by channel 4.
The signal received by channel 5 exceeds the range of inputs that the hardware can receive.	Check the signal received by channel 5.
The signal received by channel 6 exceeds the range of inputs that the hardware can receive.	Check the signal received by channel 6.
The signal received by channel 7 exceeds the range of inputs that the hardware can receive.	Check the signal received by channel 7.
The signal received by channel 8 exceeds the range of inputs that the hardware can receive.	Check the signal received by channel 8.
When power-on, the module is not detected by CPU module.	Check if the connection between module and CPU module is working. If not, connect again.

MEMO

8

Chapter 8 Load Cell Module AS02LC

Table of Contents

8.1 Overview

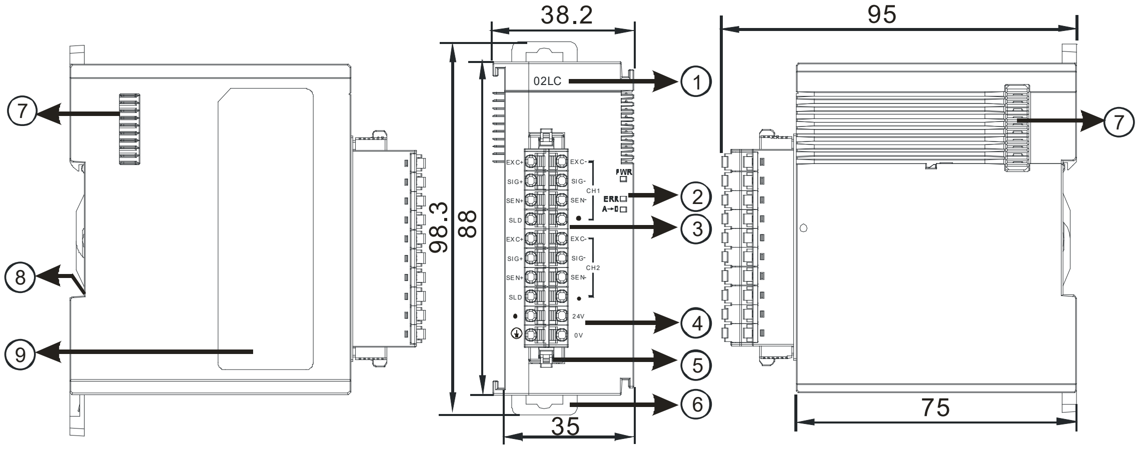
This chapter describes the specifications for load cell modules, their operation, and their programming. You can use the AS02LC load cell module with four-wire or six-wire load cells with various eigenvalues, so you can adjust its response time according to your requirements. In addition, the AS02LC-A can read and write data via the AS Series PLC units using the FROM/TO instructions. To ensure that the product is correctly installed and operated, read the manual carefully before use. This manual provides functional specifications, and it also introduces installation, basic operation, and settings. Refer to load cell related literature for more details on the principles of operating load cells.

8.2 Specifications

8.2.1 Specifications

Load Cell Module	Voltage Output
Rated Supply Voltage/Power Consumption	24 VDC (-15% to +20%)/5 W
Minimum/Maximum Voltage	18–31.2 VDC
Maximum Current Consumption	150 mA
Input Signal Range	±40 mVDC
Sensibility	+5 VDC +/-10%
Highest Accuracy	0.04 % of full scale
Communication Interface	RS-232, RS-485
Applicable Sensor Type	4-wire or 6-wire load cell
Expanding a Temperature Coefficient	≤ ±50 ppm/K v. E
Reducing a Temperature Coefficient to Zero	≤ ±0.4 μV/K
Linearity Error	≤0.02%
Response Time	2.5, 10, 16, 20, 50, 60, 100, 200, and 400 ms
Eigenvalue Applicable to a Load Cell	0–1, 0–2, 0–4, 0–6, 0–20, 0–40 and 0–80 mV/V
Maximum Distance for Connecting a Load Cell	100 meters
Maximum Output Current	5 VDC x 160 mA
Allowable Load	40–4010 Ω
Common-mode Rejection Ratio (CMRR @50/60 Hz)	≥100 dB
Dynamic Filter	K1–K5
Average Weights	K1–K100
Isolation	Between a digital circuit and the ground: 500 VAC Between an analog circuit and the ground: 500 VAC Between an analog circuit and a digital circuit: 500 VAC

8.2.2 Profile



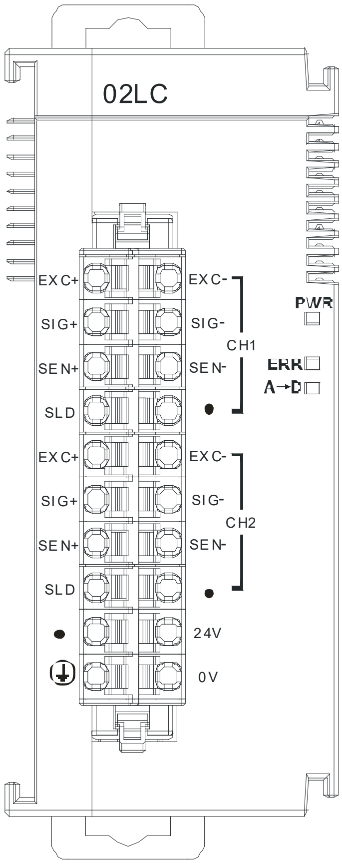
Unit: mm

Number	Name	Description
1	Model Name	Model name of the module
2	RUN LED Indicator	Operating status of the module ON: the module is running. OFF: the module is not running.
	ERROR LED Indicator	Error status of the module ON: a serious error exists in the module. OFF: the module is operating normally. Blink: a minor error exists in the module.
	Analog-to-Digital Conversion Indicator	Conversion status Blinking: conversion is in process. OFF: conversion has stopped.
3	Removable Terminal Block	The inputs are connected to transducers. The outputs are connected to loads to be driven.
4	Arrangement of the Input/Output Terminals	Arrangement of the terminals
5	Clip	For removing the terminal block
6	DIN Rail Clip	Secures the module onto the DIN rail
7	Module Connecting Set	Connects the modules
8	Ground Clip	

8

8.2.3 Arrangement of Terminals

AS02LC-A



8.2.4 Control Registers

*If you use HWCONFIG to set values in CRs, once the set value is downloaded, the values can be retained in the module; however if you use TO instruction to write data into CRs, the values CANNOT be retained, after power failure or after transition of the CPU from STOP to RUN.

Note: The attribute of the CR must be W (write) to use TO instruction.

CR#	Name	Description	Att.	Default
0	Display options for CH1	0: disabled 1: gross weight 2: net weight 3: raw data	R/W	1
1	Eigenvalue for CH1	0: 1 mV/V 1: 2 mV/V 2: 4 mV/V 3: 6 mV/V 4: 20 mV/V 5: 40 mV/V 6: 80 mV/V	R/W	1
2	Sampling cycle for CH1	0: 2.5ms 1: 10ms 2: 16ms 3: 20ms 4: 50ms 5: 60ms 6: 100ms 7: 200ms 8: 400ms	R/W	4
3	Weight measured times in a stability range for CH1	Range: K1–K500	R/W	5
4 5	Stability range for CH1	Floating-point format Range: 0–100000	R/W	10
6	Maximum weight for CH1	Floating-point format Maximum measuring weight; when the	R/W	100,000

CR#	Name	Description	Att.	Default
7		weight measured exceeds the limit, an alarm is triggered. The value should be greater than 1.		
8	Filter mode for CH1	0: no filter (default) 1: maximum filter mode 2: average filter mode	R/W	0
9	Maximum filter for CH1	Range: 0–8; the bigger the number the stronger the filter	R/W	1
10	Average weight measured times for CH1	Range: 1–100 (for FW V1.04: 1–400 is available)	R/W	10
11 12	Upper limit of the zero return for CH1	Floating-point format Determines the current weight as the zero point in the upper/lower range; when the lower range is larger than the upper range, the lower range is read as the upper range and vice versa.	R/W	10
13 14	Lower limit of the zero return for CH1		R/W	-10
15	Zero point tracking time for CH1	Range: 5–500 Unit: 100 ms	R/W	10
16 17	Zero point tracking range for CH1	Floating-point format Range: 0–10000; 0: disabled	R/W	0
18	Calibration points for CH1	Range: 2–20	R/W	2
19–58	Calibrated weight for CH1	Floating-point format Calibrated weight of the calibration points 1–20	R/W	-
59	Display options for CH2	0: disabled 1: gross weight 2: net weight 3: raw data	R/W	1
60	Eigenvalue for CH2	0：1 mV/V 1：2 mV/V 2：4 mV/V	R/W	1

CR#	Name	Description	Att.	Default
		3：6 mV/V 4：20 mV/V 5：40 mV/V 6：80 mV/V		
61	Sampling cycle for CH2	0：2.5 ms 1：10 ms 2：16 ms 3：20 ms 4：50 ms 5：60 ms 6：100 ms 7：200 ms 8：400 ms	R/W	4
62	Weight measured times in a stability range for CH2	Range: K1–K500	R/W	5
63 64	Stability range for CH2	Floating-point format Range: 0–100000	R/W	10
65 66	Maximum weight for CH2	Floating-point format Maximum measuring weight; when the weight measured exceeds the limit, an alarm is triggered. The value should be greater than 1.	R/W	100,000
67	Filter mode for CH2	0: no filter (default) 1: maximum filter mode 2: average filter mode	R/W	0
68	Maximum filter for CH2	Range: 0–8; the bigger the number the stronger the filter	R/W	1
69	Average weight measured times for CH2	Range: 1–100 (for FW V1.04: 1–400 is available)	R/W	10
70 71	Upper limit of the zero return for CH2	Floating-point format Determines the current weight as the zero point in the upper/lower range; when the lower range is larger than the upper range,	R/W	10
72 73	Lower limit of the zero return for CH2		R/W	-10

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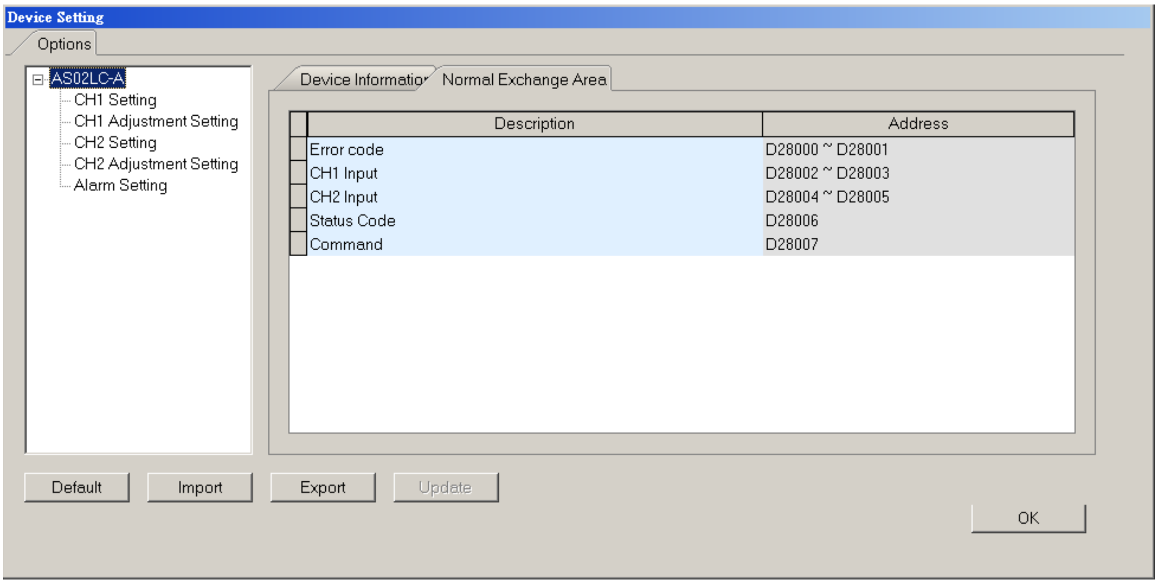
CR#	Name	Description	Att.	Default
		the lower range is read as the upper range and vice versa.		
74	Zero point tracking time for CH2	Range: 5–500 Unit: 100 ms	R/W	10
75	Zero point tracking range for CH2	Floating-point format Range: 0–10000; 0: disabled	R/W	0
76				
77	Calibration points for CH2	Range: 2–20	R/W	2
78–117	Calibrated weight for CH2	Floating-point format Calibrated weight of the calibration points 1–20	R/W	-
118	Decimal place for CH1	Range: 0–4	R/W	1
119	Decimal place for CH2	Range: 0–4	R/W	1
120	Alarm	0: warning 1: alarm Bit0: error in the power supply Bit1: error in the module hardware Bit2: error in the driver board	R/W	1
200	State register	Refer to the explanation below.	R/W	-
201	Command set	Refer to the explanation below.	W	0
210	The maximum peak value for CH1	Floating-point format Maximum peak value for CH1	R	-
211				-
212	The maximum peak value for CH2	Floating-point format Maximum peak value for CH2	R	-
213				-
214	The minimum peak value for CH1	Floating-point format Minimum peak value for CH1	R	-
215				-
216	The minimum peak value for CH2	Floating-point format Minimum peak value for CH2	R	-
217				-
222	The time to record for CH1	Unit: 1 ms Range: 1–100 (1 ms–1 s) Time to record the digital value for the channels	R/W	50
223	The time to record for CH2			50
240	The number of records for CH1	Range: 0–500; display the current records	R	-

CR#	Name	Description	Att.	Default
241	The number of records for CH2			-
604	Tare weight measured by CH1	Display the tare weight measured by CH1	R/W	-
605				-
606	Tare weight measured by CH2	Display the tare weight measured by CH2	R/W	-
607				-
700–739	Theoretical calibration for CH1	Floating-point format Output voltage unit: mV	R/W	0
740–779	Theoretical calibration for CH2	Floating-point format Output voltage unit: mV	R/W	0
4000–4999	Records for CH1	Floating-point format 500 records for CH1	R	-
5000–5999	Records for CH2	Floating-point format 500 records for CH2	R	-

Normal Exchange Area

Explanation

You can view the error code, the channel value, and the state code, as well as the data registers that correspond to their commands under the Normal Exchange Area tab of the Device Setting dialog box in the HWCONFIG utility in ISPSoft.



CR#200: Codes for the state register

Explanation

Bit	Code	Definition	Bit	Code	Definition
b0	16#0001	Error exists in the power supply.	b1	16#0002	Error exists in the module hardware.
b2	16#0004	Error exists in the driver board.	b3	16#0008	Calibration disabled
b4	16#0010	Reserved	b5	16#0020	Reserved
b6	16#0040	The weight measured by CH1 exceeds the maximum weight that can be measured, or the voltage of SEN is incorrect.	b7	16#0080	The weight measured by CH2 exceeds the maximum weight that can be measured, or the voltage of SEN is incorrect.
b8	16#0100	The weight measured by CH1 exceeds the maximum weight that can be measured.	b9	16#0200	The weight measured by CH2 exceeds the maximum weight that can be measured.
b10	16#0400	CH1 has been adjusted incorrectly.	b11	16#0800	CH2 has been adjusted incorrectly.
b12	16#1000	CH1 is not measuring any weight.	b13	16#2000	CH2 is not measuring any weight.
b14	16#4000	The weight measured by CH1 is in the stability range specified.	b15	16#8000	The weight measured by CH2 is in the stability range specified.
Note: The state is determined by the corresponding bit and it is possible to have more than 2 states at the same time.					

CR#201: Command set

Explanation

Input value	Description	Input value	Description
0	No action	16#0101	Start a new recording of the peak value for CH1.
1–20	Commands for calibrating the calibration points 1–20 on CH1	16#0102	Start a new recording of the peak value for CH2.
21–40	Commands for calibrating the calibration points 1–20 on CH2	16#010F	Start a new recording of the peak value for CH1 - CH2.
98	Activate the weight calibration.	16#0201	Start a new recording for CH1.
99	Deactivate the weight calibration.	16#0202	Start a new recording for CH2.

Input value	Description	Input value	Description
100	Subtract the weight on CH1. Use the subtracted weight as the tare weight and store it in CR604 and CR605 (DWORD).	16#020F	Start a new recording for CH1 - CH2.
101	Restore the tare weight stored in CR604 and CR605 to CH1.	16#0211	Stop recording for CH1.
102	Clear the weight measured by CH1 to zero. You might need to execute this command after each power-off.	16#0212	Stop recording for CH2.
103	Subtract the weight on CH2. Use the subtracted weight as the tare weight and store it in CR606 and CR607 (DWORD).	16#021F	Stop recording for CH1 - CH2.
104	Restore the tare weight stored in CR606 and CR607 to CH2.	16#0301	Start a theoretical calibration for CH1.
105	Clear the weight measured by CH2 to zero. You might need to execute this command after each power-off.	16#0302	Start a theoretical calibration for CH2.
16#030F	Start a theoretical calibration for CH1 - CH2.	16#0501	Restore default settings and clear settings in Flash.
16#0502	Restore default settings and settings in Flash stay intact.	16#6000	Read the current settings from Flash
16#6001	Write the current settings into Flash		

8.2.5 Functions

Item	Function	Description
1	Measuring net weight	Various measuring modes to choose from
2	Stability check	When an object is put on a load cell, you can check whether the present weight of the object is in a specified stability range.
3	Determining zero point	If an object is removed from the load cell, no weight is measured.
4	Filter out weights	Filter out the maximum or minimum weight measured or use an average weight for a more accurate value.
5	Multi-point adjustment	There are as many as 20 points for adjustment
6	Theoretical calibration	Calibration based on the output value of the sensor instead of the real weight calibration
7	Zero point tracking	Zero point tracking
8	Limit detections for channels	Save the maximum and minimum values for channels.
9	Records for channels	Save the analog curves for channels.

1. Measuring net weight

You can choose to measure either the net weight or the gross weight of an object. Net weight is the actual weight of a product without its package. The weight of a package is the tare weight. Gross weight is the total weight: net weight plus tare weight.

- Tare weight: the weight of a package
- Net weight: the weight of a product, that is, the actual weight of a product without its package
- Gross weight: the total weight, that is, the net weight of a product plus the tare weight of its package
- Gross weight=Net weight+Tare weight

  Example: a product weighs 10 kg, and the carton in which the product is packed weighs 0.2 kg. The gross weight is 10.2 kg.

  Net weight = 10 kg

  Tare weight = 0.2 kg

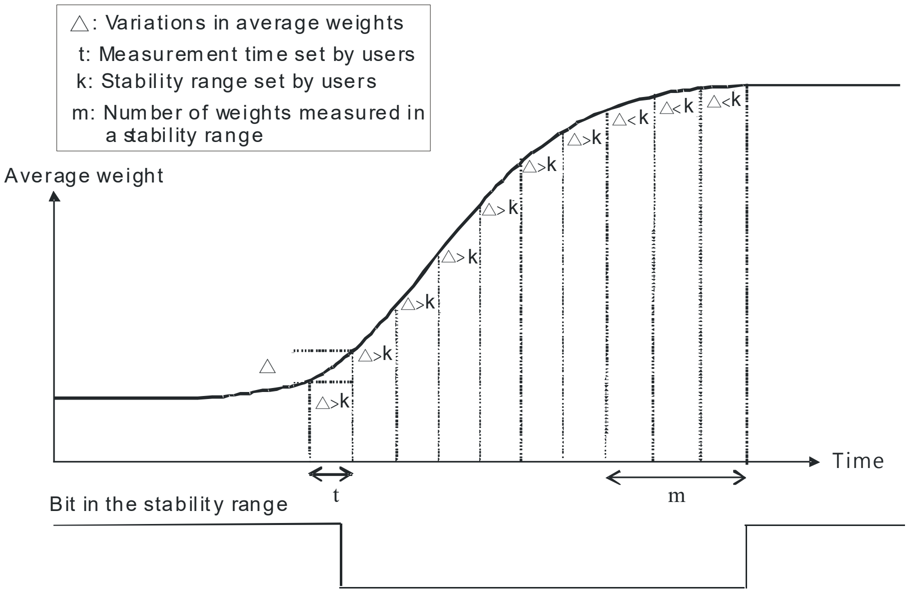
  Gross weight = 10.2 kg

2. Checking stability

When an object is placed on a load cell, you can check whether the present weight of the object is in a specified stability range.

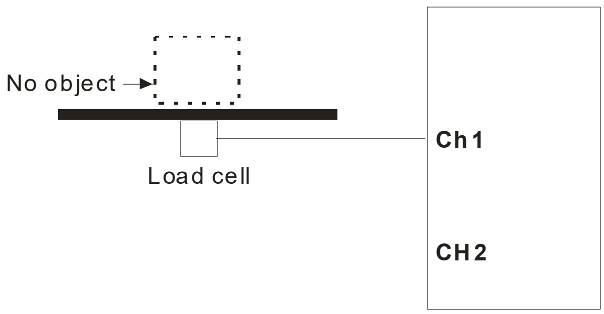
- If the weight measured is in the specified stability range, the corresponding bit is set to 1.
- If the weight measured exceeds the specified stability range, the corresponding bit is set to 0 until the number of objects weighed in the stability range reaches the setting.

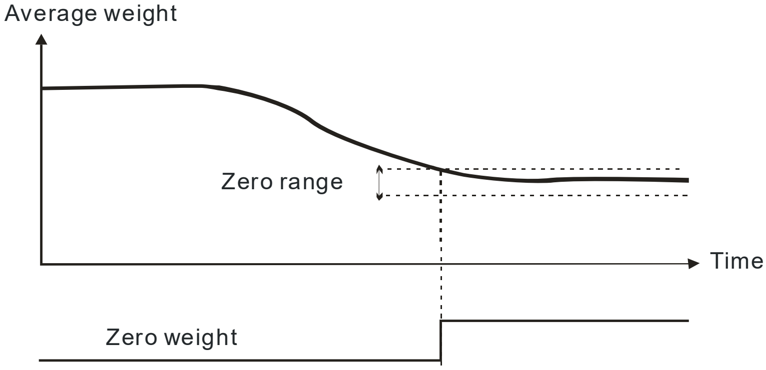
Example: the measurement time set is 10 ms, the number of weights measured in a stability range is 10, and the stability range is 1000 g. If a variation exceeds 1000 g, the corresponding bit is set to 0. If the variations within 100 ms (10×10 ms) are within 1000 g, the corresponding bit is set to 1. You should determine whether the present weight measured is in the stability range before you perform control actions.



3. Determining zero point

If an object is removed from the load cell, the corresponding bit is set to 1, and you can perform the next control action. If a weight measured is in the specified zero range, the corresponding bit is also set to 1.





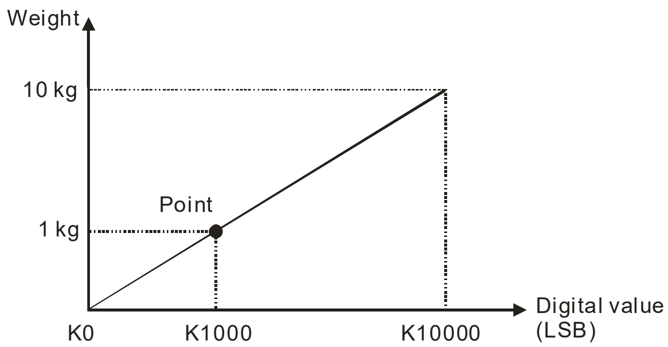
4. Filtering out weights

There are two ways to filter out weights.

- Filtering out the maximum/minimum weight measured: If there is a maximum weight or a minimum weight, you can filter out the maximum weight or the minimum weight. The larger the value, the more weights are filtered out. Range: K0–K8
- Averaging weights: The values recorded are averaged so that a steady value is obtained. There may be peak values due to unavoidable external factors, and the average value obtained may change accordingly. A maximum of 100 values can be averaged.

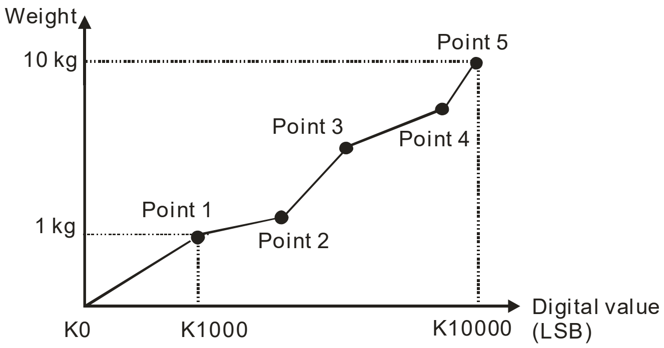
5. Making multi-point adjustments

Make adjustments to get the weight measured by a cell to correspond to the digital value displayed by the load cell module. Generally, two points are adjusted. After a system is set up, put no load on the scale. The weight measured is 0 grams when there is no load. Then place an object of a given weight on the scale, and set a digital value corresponding to the weight. At that point, two points have been adjusted. For example, if you have a load cell sensor which can measure a maximum weight of 10 kg, and if 1 kg corresponds to K1000, the curve is like the one shown below.



Adjusting two points

In addition to this two-point adjustment, the load cell also supports adjustments of up to 20 points. A characteristic curve is shown below.



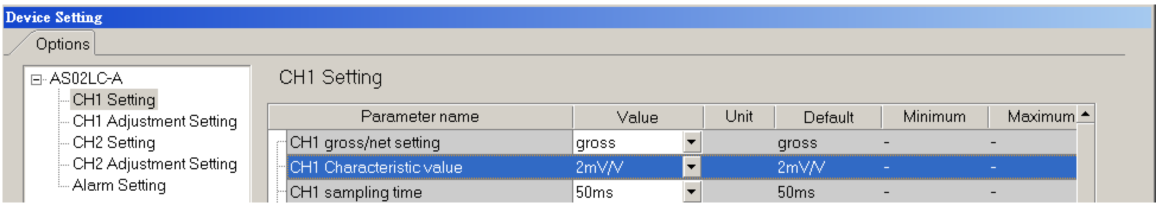
Adjusting multiple points

6. Determining theoretical calibration

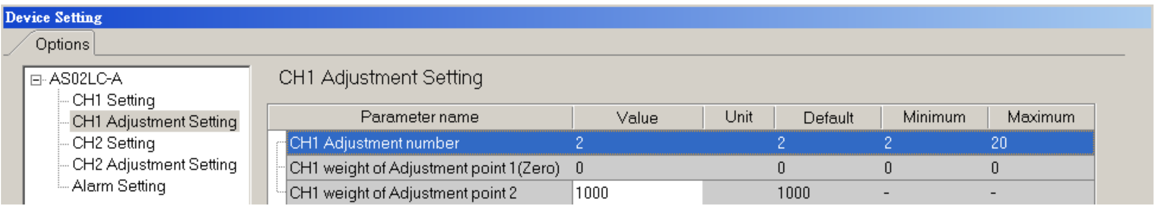
Theoretical calibration is determined according to the sensor specification in order to input the voltage values corresponding to various weights. The registers for storing the voltage values are CR#700–739 for CH1 and CR#740–779 for CH2. After entering the voltage values into the registers, you can use the command set 16#301–302 to execute the calibration.

Example: the sensor specification is 10 kg and its eigenvalue is 2 mV/V. When the sensor is loaded with a 10 kg weight, the output is 10 mV. The theoretical calibration steps are:

Step 1: set the eigenvalue.



Step 2: set the 2-point adjustment; when the sensor is loaded with a 1 kg weight, set the value to 1000.



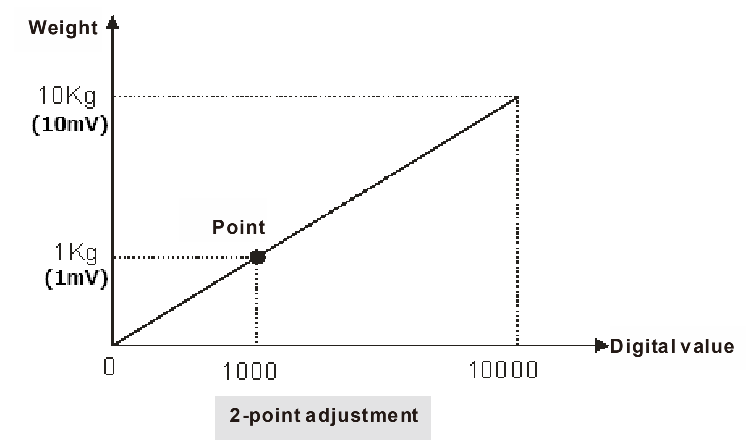
Step 3: set the voltage calibration for the zero point to 0 (0 mV) in the CR#700/701 registers, and to 1.0 (1 mV) in the CR702/703 registers.

Step 4: enable the calibration function and enter 98 into the command set CR#201.

Step 5: enter 16#0301 into the command set CR#201 to execute a theoretical calibration for channels 1.

Step 6: do not put any load on the sensor and enter 16#102 into the command set CR#201 to reset the value to 0 for CH1.

Step 7: disable the calibration function to prevent inappropriate changes. To complete the theoretical calibration, enter 99 into the command set CR#201. Put a 1 kg weight on the sensor and the load cell should show 1000.



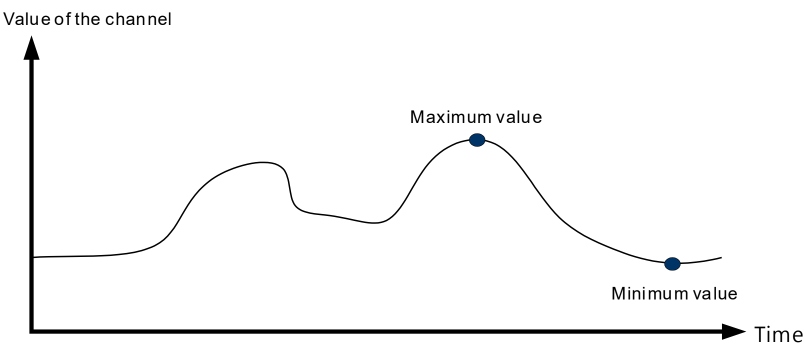
Step 8: write 16#6001 in CR#201 to disable the calibration function to write the current settings into Flash and have the settings in the latched area.

7. Zero point tracking

Zero point tracking refers to resetting the current value to 0. You can reset the value to 0 within a certain duration or at a certain weight. This is especially useful when the sensor is no longer as accurate as it was before.

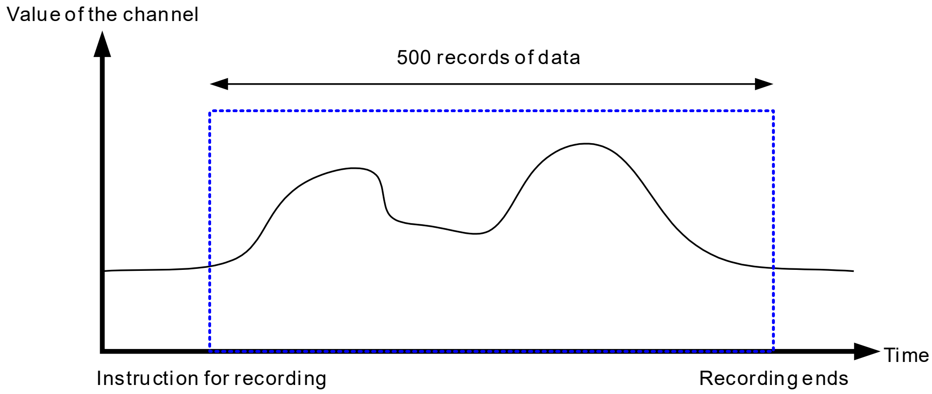
8. Limit detections for channels

Save the maximum and minimum values for channels so you can determine the peak to peak values.



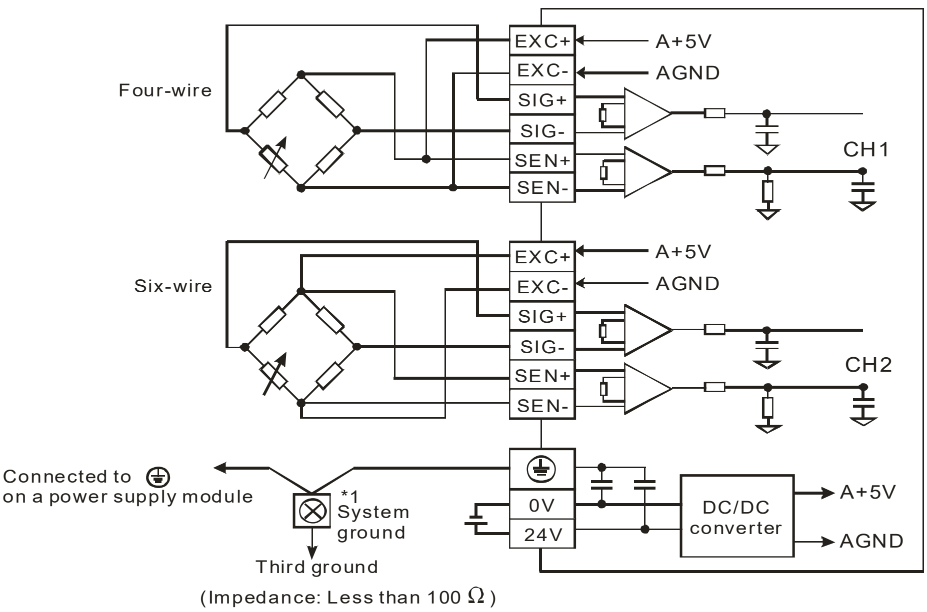
9. Recording channels

Record the input values of the cyclic sampling for each channel. The system saves up to 500 data points and the recording time is 10 ms.

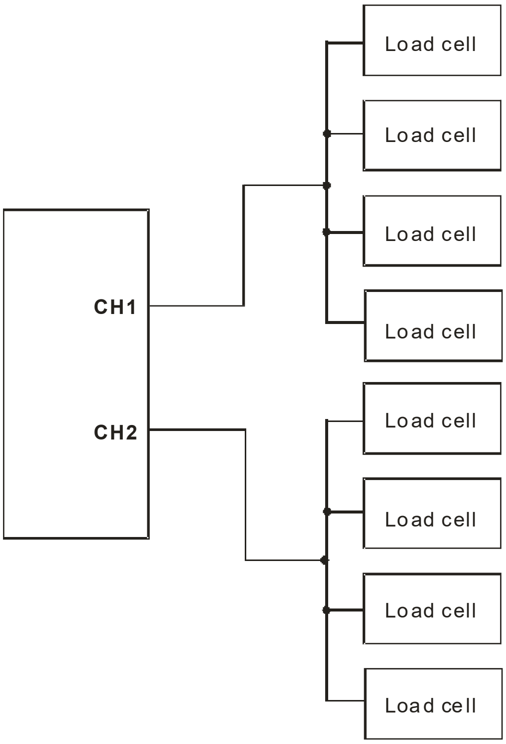


8.2.6 Wiring

- **External wiring**



- Multiple load cells connected in parallel are connected to a single load cell module.



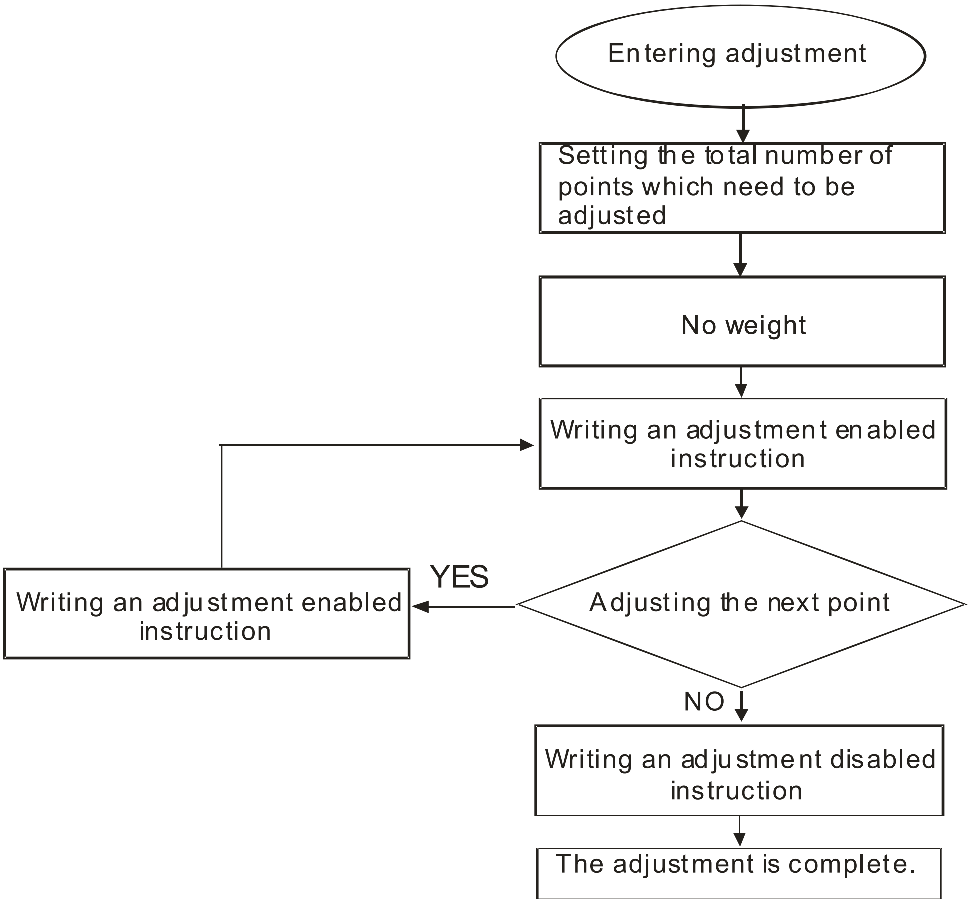
Note 1: Please connect ⏚ on the power supply module and ⏚ on the load cell module to a system ground, and then ground the system ground or connect the system ground to a distribution box.

Note 2: If multiple load cells are connected in parallel, the total impedance should be greater than 40 Ω.

8.3 Making Adjustments

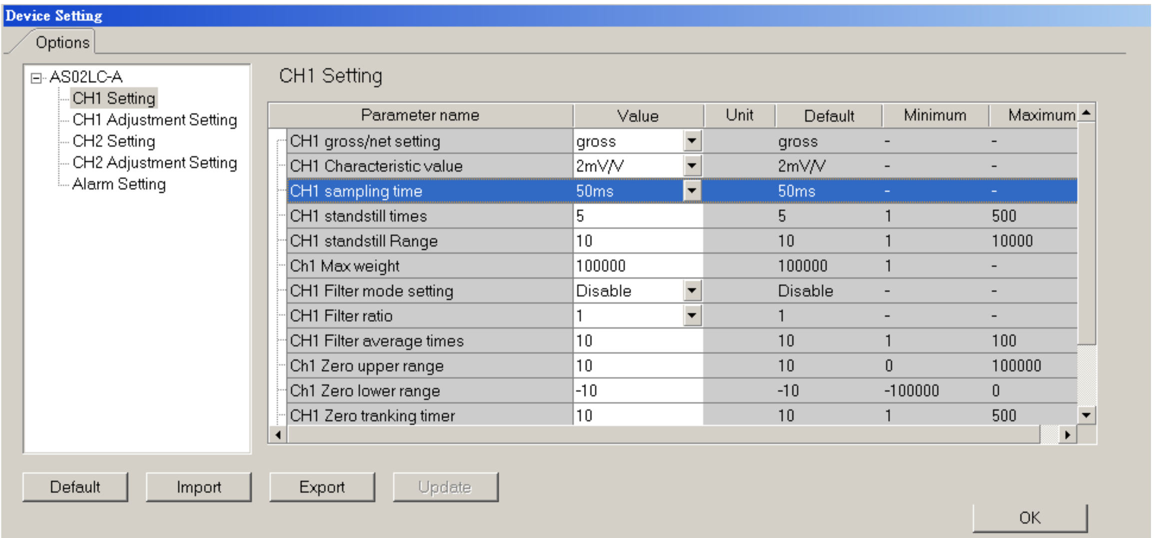
Make adjustments to get the weight measured by a cell to correspond to the digital value displayed by the load cell module. You can make adjustments by following the commands below or by setting up the theoretical calibration (refer to section 8.2.5 for more details).

8.3.1 Steps to adjust points



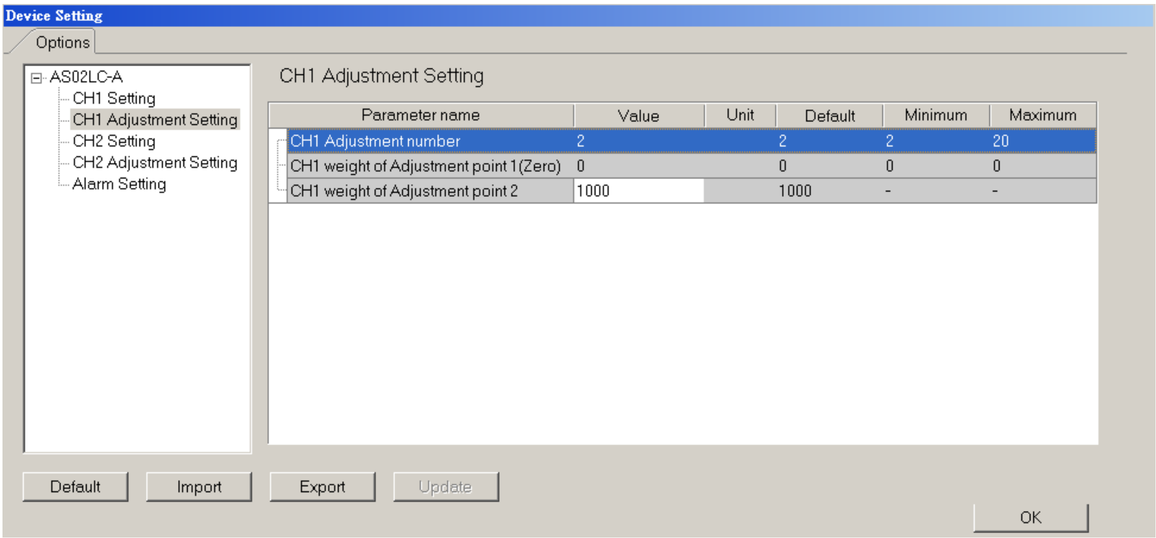
8.3.2 Adjustment settings / LC Wizard

Step 1: set the eigenvalue in the HWCONFIG utility in ISPSoft.



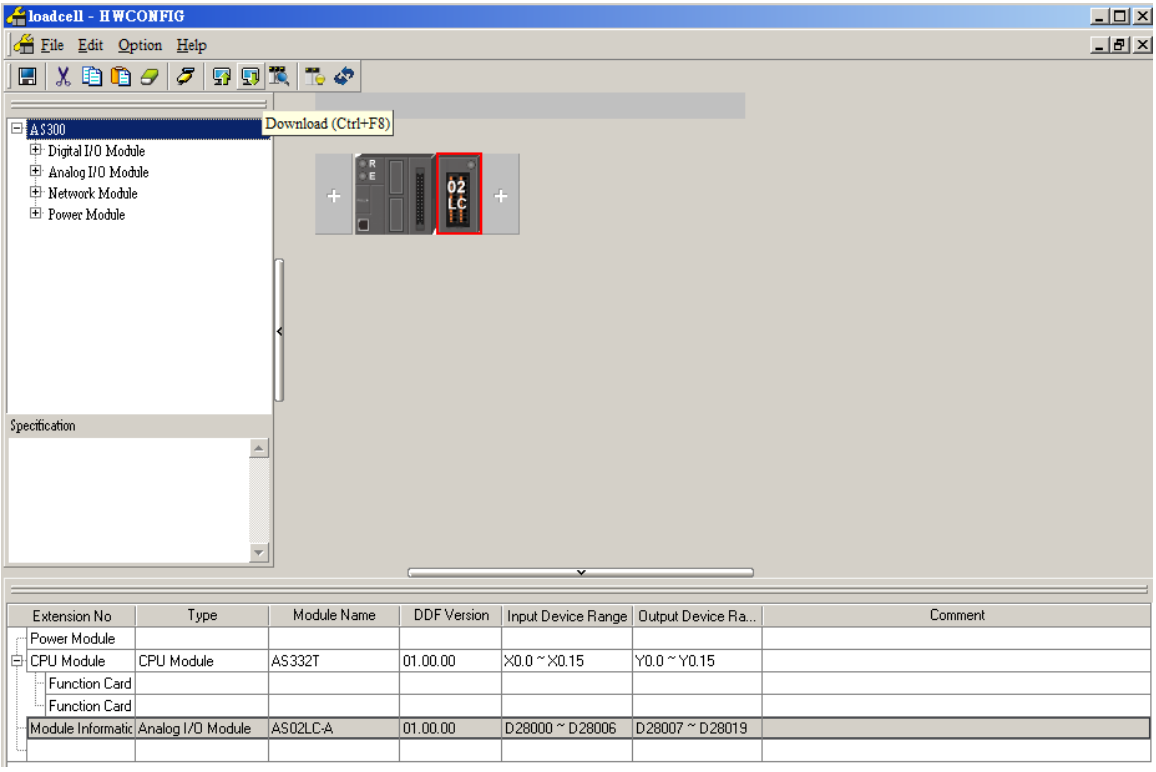
Parameter name	Value	Unit	Default	Minimum	Maximum
CH1 gross/net setting	gross		gross	-	-
CH1 Characteristic value	2mV/V		2mV/V	-	-
CH1 sampling time	50ms		50ms	-	-
CH1 standstill times	5		5	1	500
CH1 standstill Range	10		10	1	10000
Ch1 Max weight	100000		100000	1	-
CH1 Filter mode setting	Disable		Disable	-	-
CH1 Filter ratio	1		1	-	-
CH1 Filter average times	10		10	1	100
Ch1 Zero upper range	10		10	0	100000
Ch1 Zero lower range	-10		-10	-100000	0
CH1 Zero tranking timer	10		10	1	500

Step 2: set the number of adjustments and their corresponding values. The example below shows a 2-point adjustment in which point 1 = 0 and point 2 = 1000, corresponding to 1 kg.

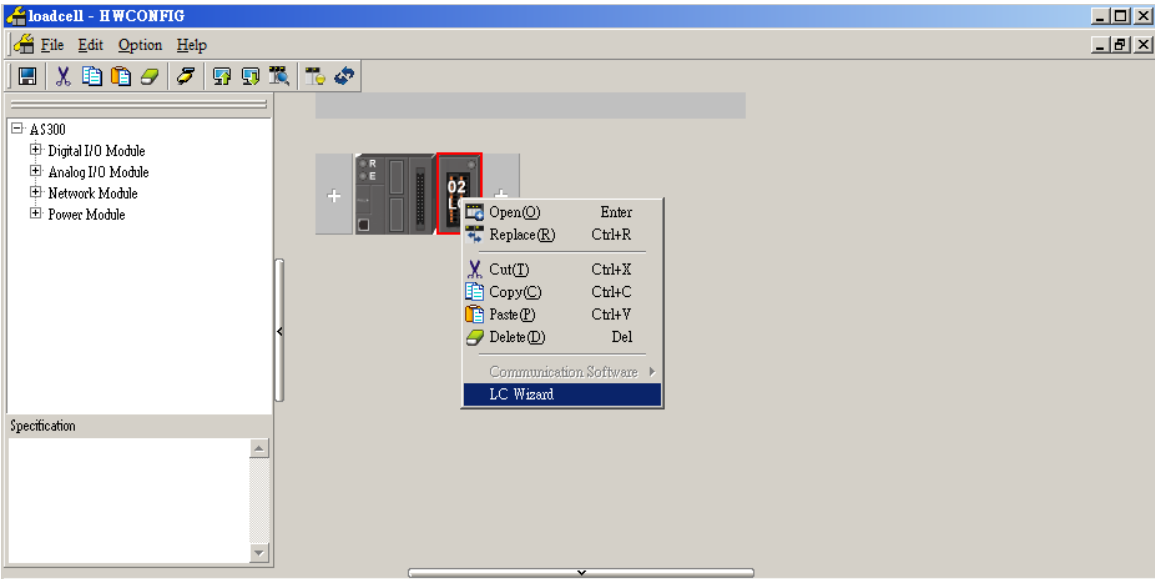


Parameter name	Value	Unit	Default	Minimum	Maximum
CH1 Adjustment number	2		2	2	20
CH1 weight of Adjustment point 1(Zero)	0		0	0	0
CH1 weight of Adjustment point 2	1000		1000	-	-

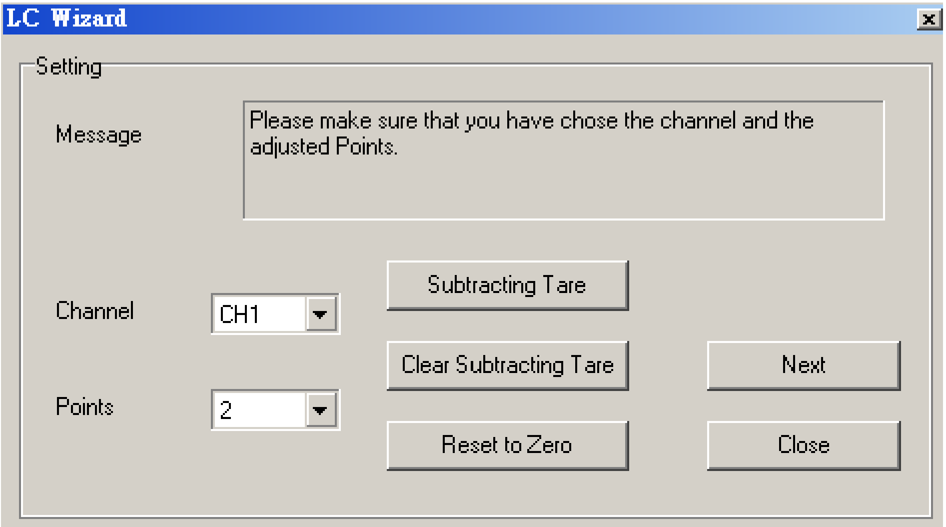
Step 3: after the configuration is complete, download the parameters to the module.



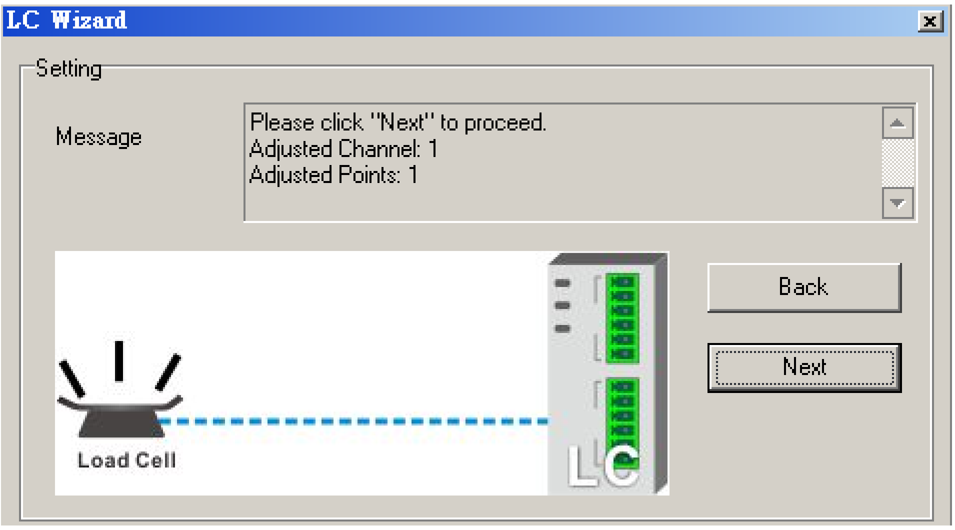
Step 4: right click the module and then click on **LC Wizard** to open the LC Wizard.



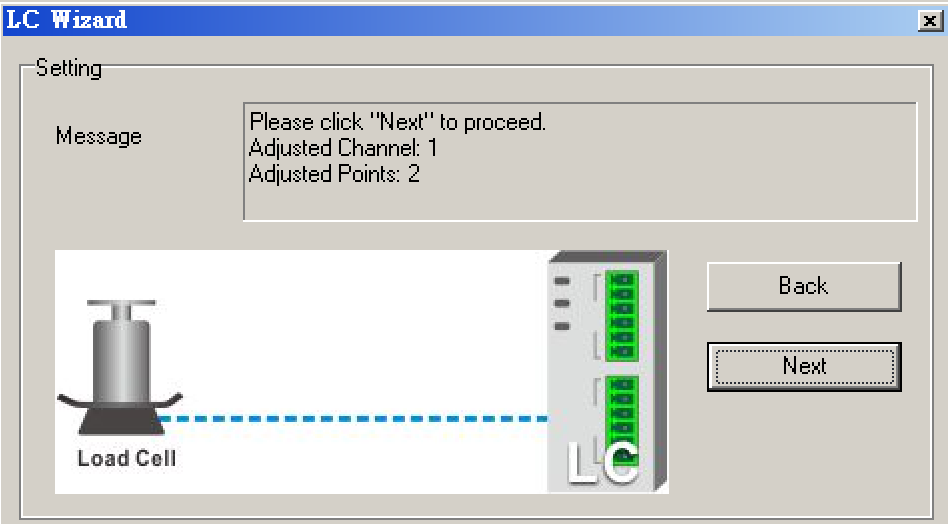
Step 5: make sure the channel and the adjusted points displayed are the same as you have set.



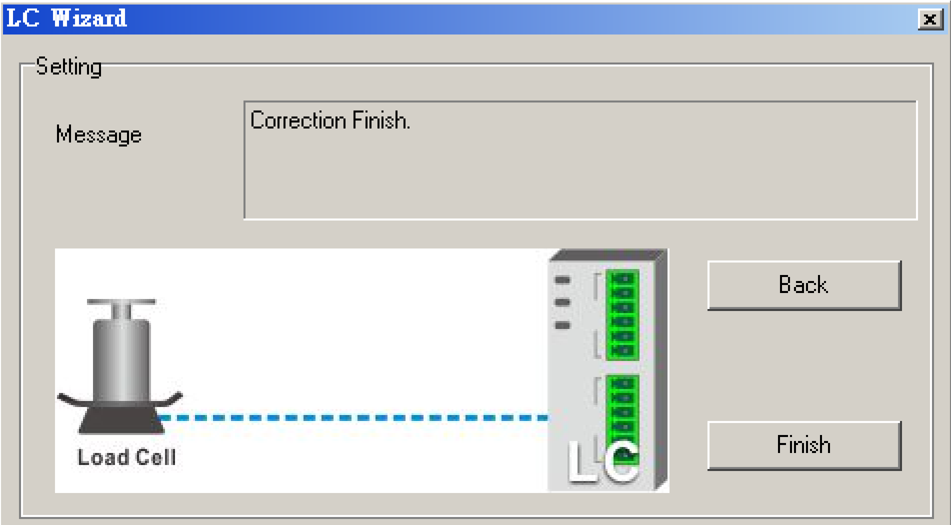
Step 6: put no load on the load cell (adjustment point 1) and click **Next** to proceed.



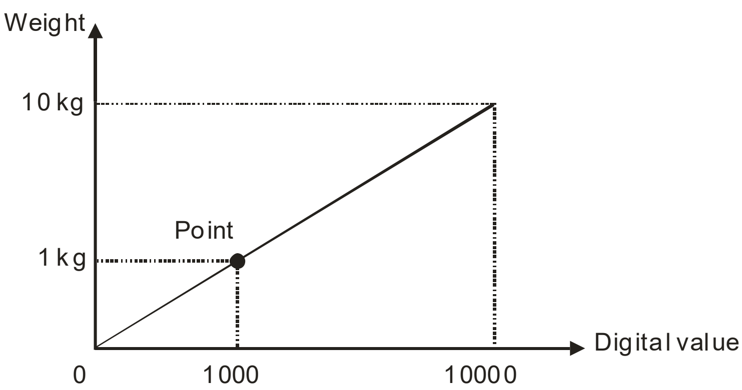
Step 7: Put a load on the load cell (adjustment point 2). For multi-point adjustment, repeat this step. This example uses a 1 kg weight.



Step 8: the calibration is complete.



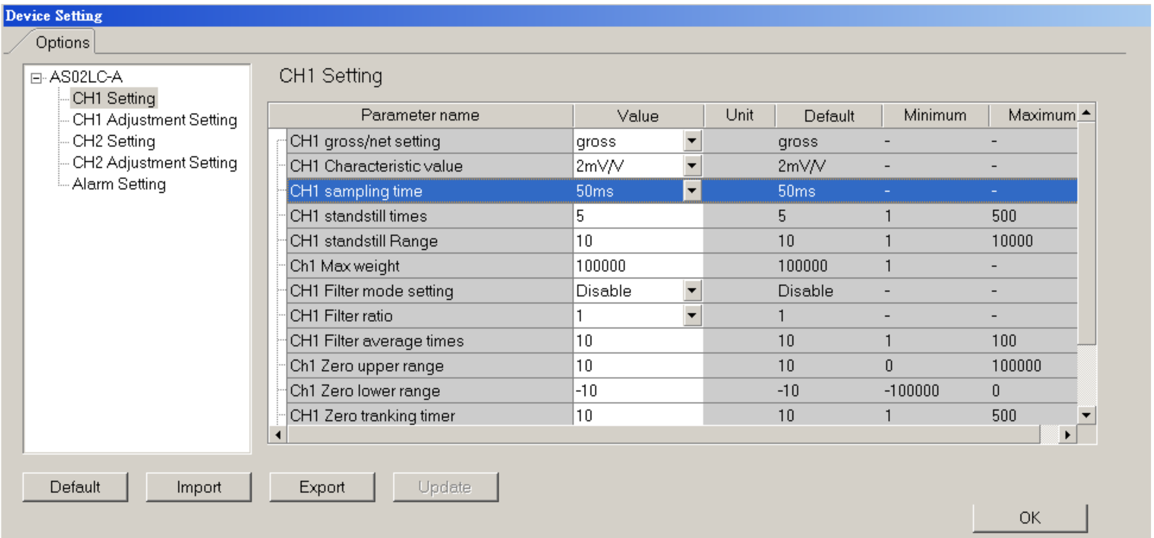
A characteristic curve is shown below.



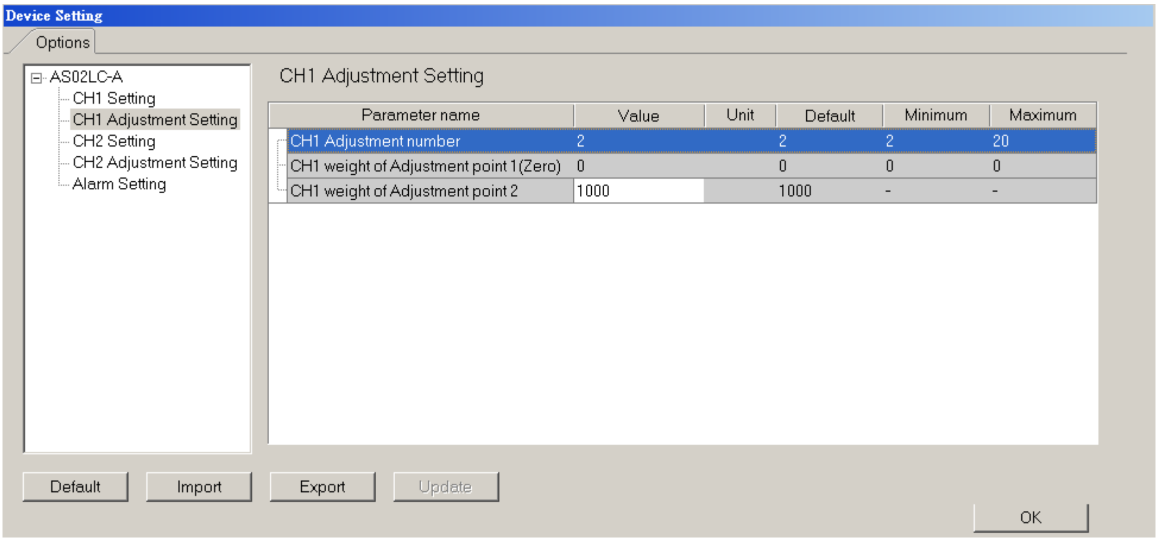
Adjusting two points

8.3.3 Adjustment Settings / Calibrational Commands

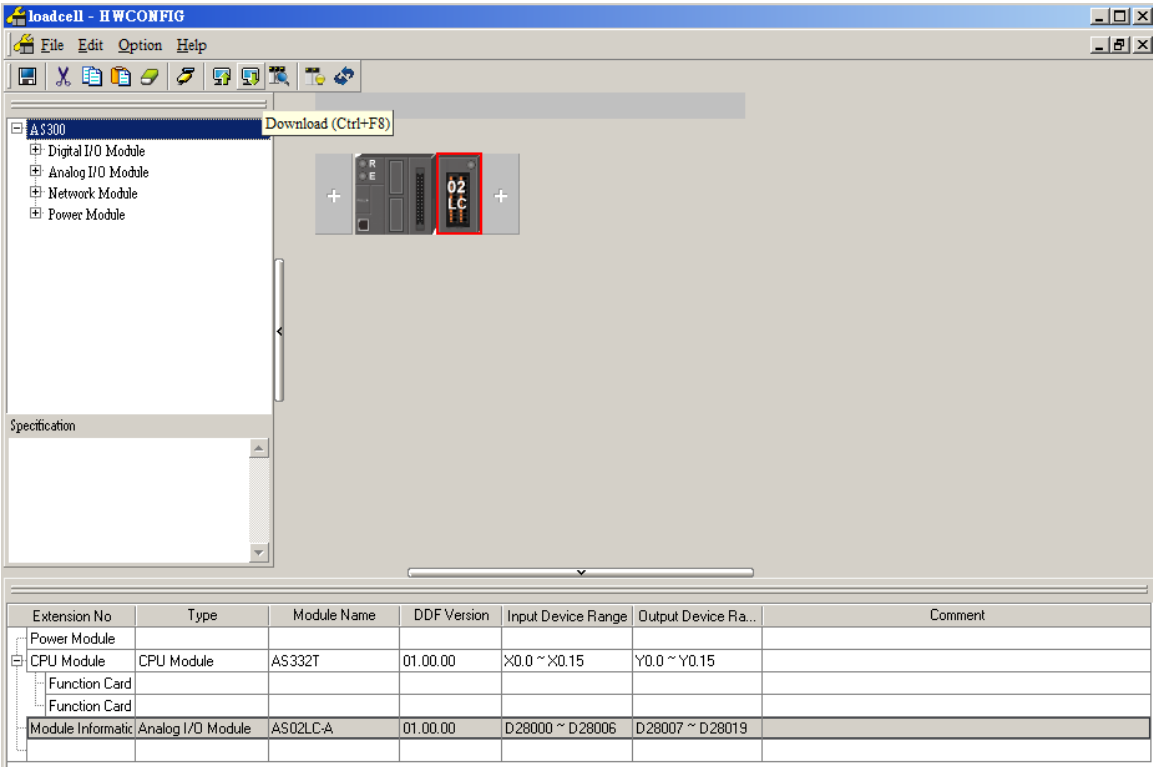
Step 1: set the eigenvalue in the HWCONFIG utility in ISPSoft.



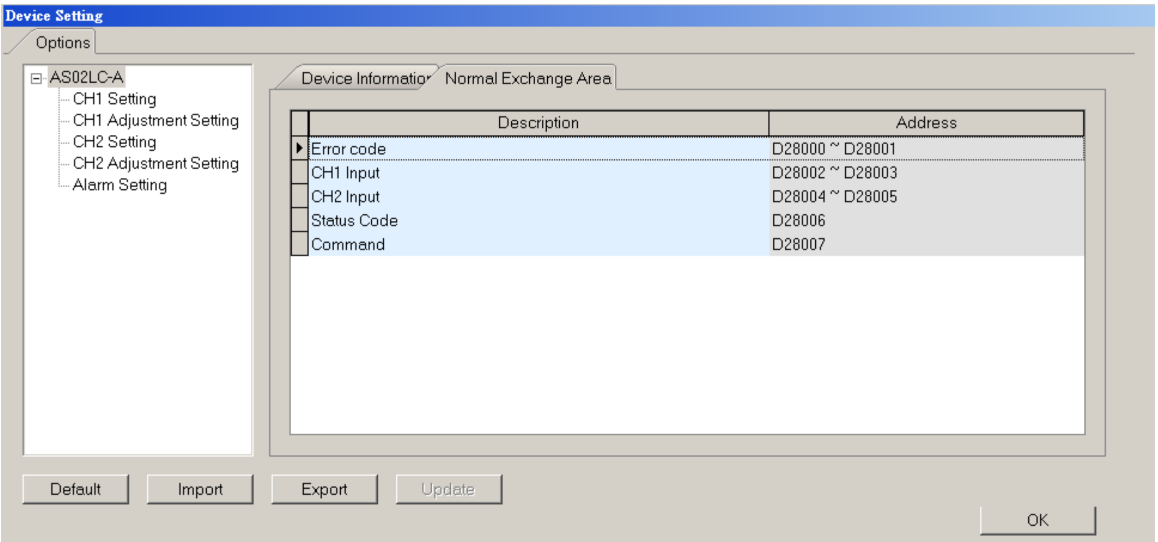
Step 2: set the number of adjustments and their corresponding values. The example below shows a 2-point adjustment where point 1 = 0 and point 2 = 1000, corresponding to 1 kg.



Step 3: after the configuration is complete, download the parameters to the module.



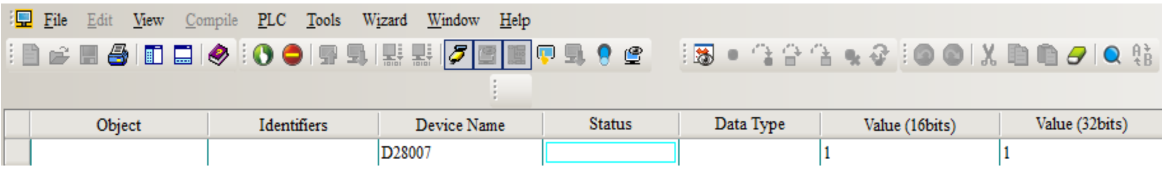
Step 4: verify that the corresponding address the command is D28007 in the Normal Exchange Area.



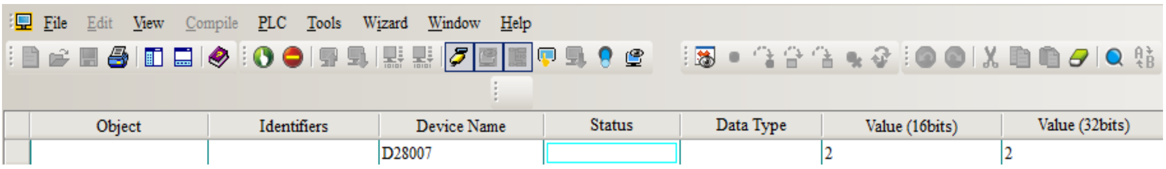
8

Step 5: enter the command for activating the weight calibration 98 into D28007.

Step 6: put no load on the load cell (adjustment point 1) and enter 1 into D28007. 1 represents CH1 and 2 represents CH2.

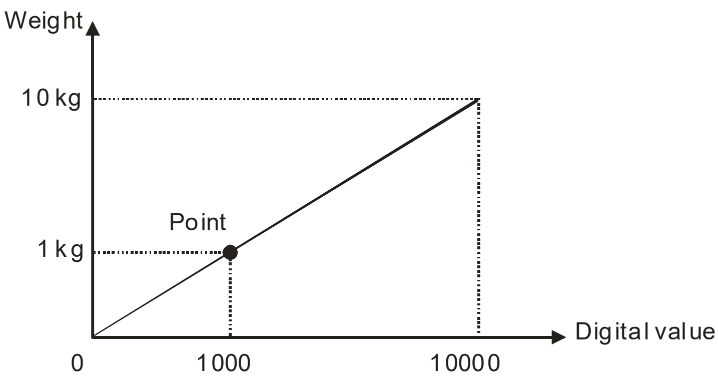


Step 7: put a load on the load cell (adjustment point 2). For multi-point adjustment, repeat this step. This example uses a 1 kg weight.



Step 8: to complete the adjustment, enter the command for deactivating the weight calibration 99 into D28007.

A characteristic curve is shown below.



Adjusting two points

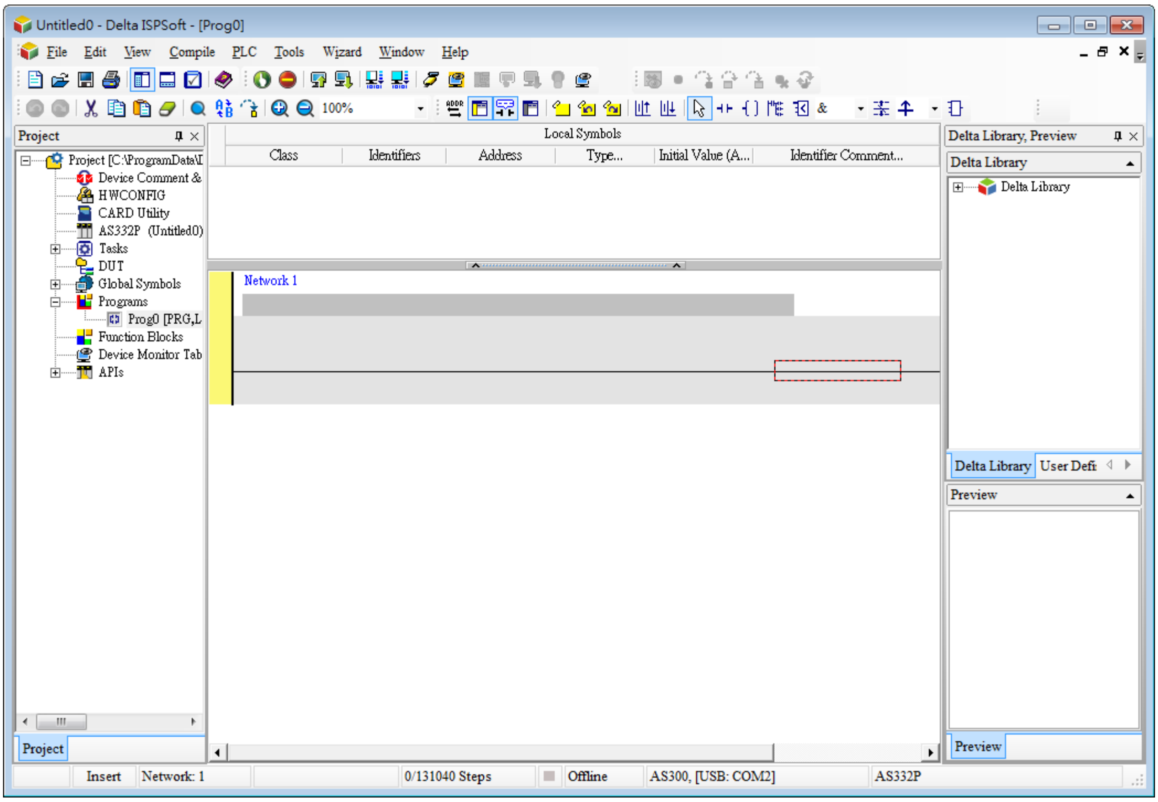
8.3.4 LED Indicators

Number	Name	Description
1	RUN LED Indicator	Operating status of the module ON: the module is running. OFF: the module is not running.
2	ERROR LED Indicator	Error status of the module ON: a serious error exists in the module. OFF: the module is operating normally. Blink: a minor error exists in the module.
3	Analog-to-Digital Conversion Indicator	Conversion status Blinking: conversion is in process. OFF: conversion has stopped.

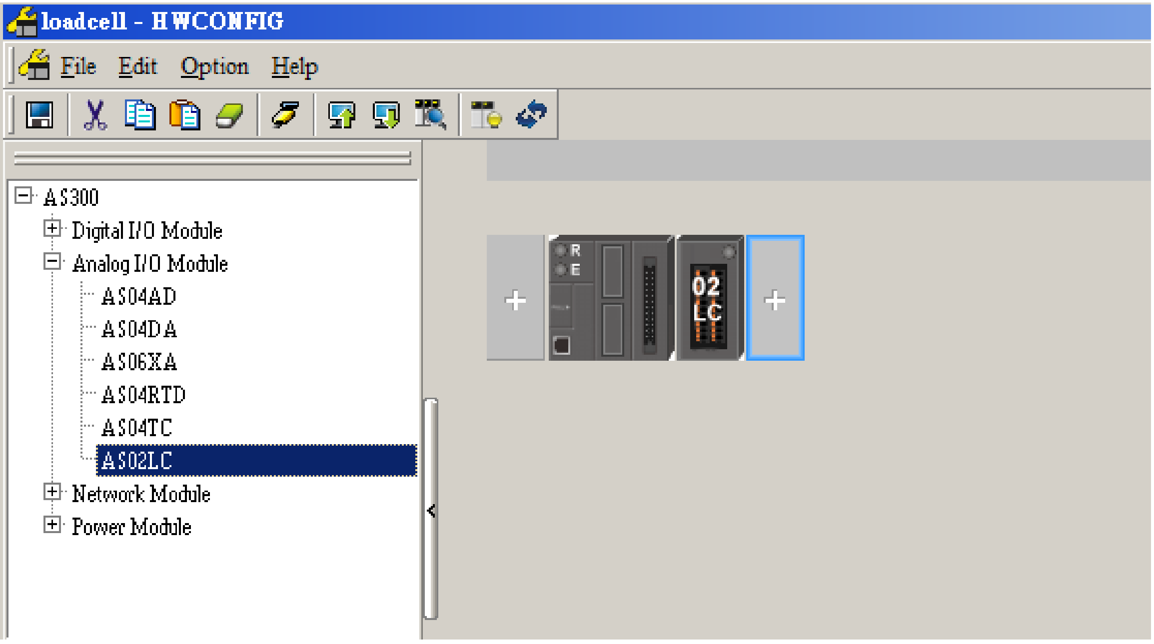
8.4 HWCONFIG in ISPSoft

8.4.1 Initial Setting

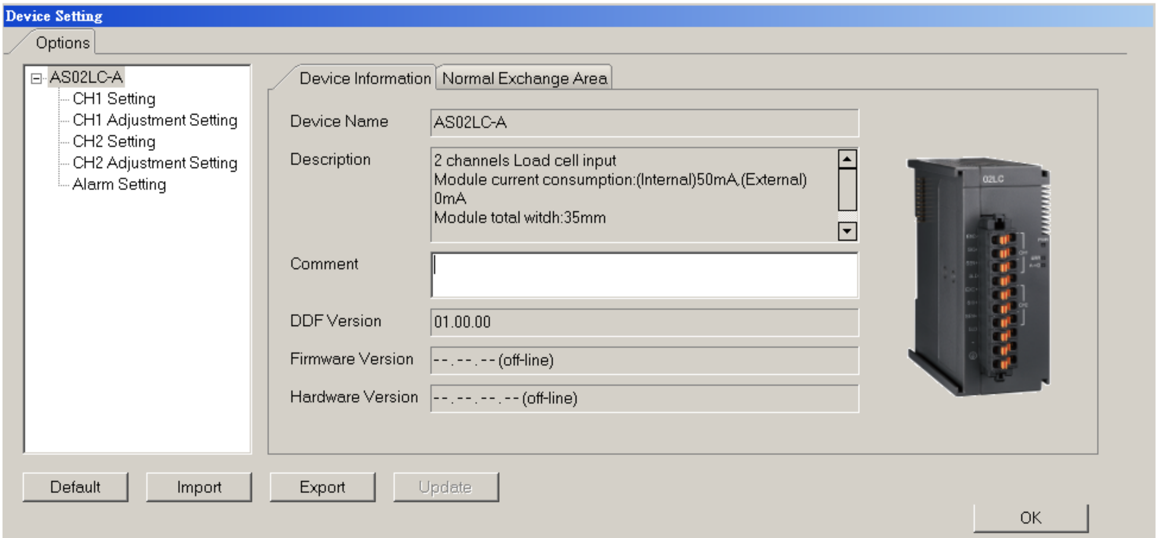
(1) Start ISPSoft and double-click **HWCONFIG**.



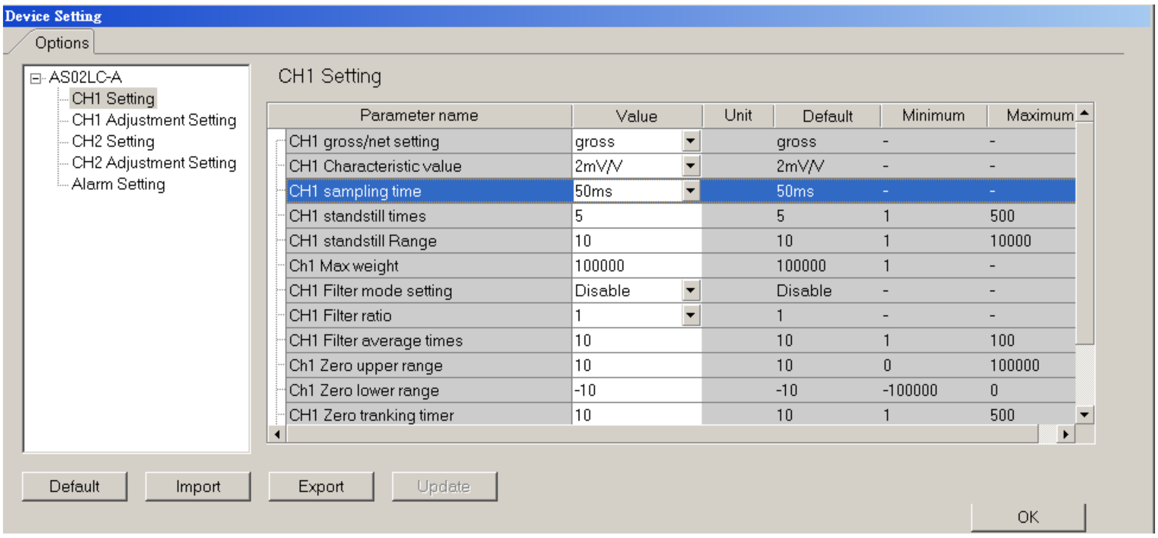
(2) Select a module and drag it to the working area.



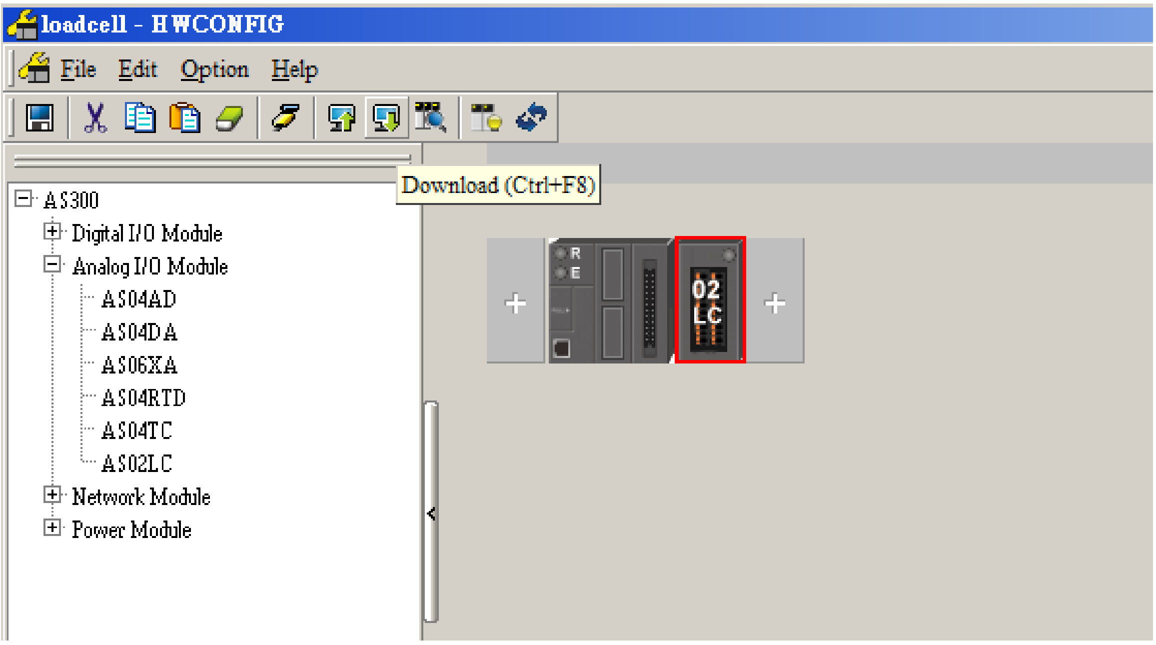
(3) Double-click the module in the working area to open the Device Setting page.



(4) Choose the parameter, set the values, and click **OK**.



(5) Click **Download** on the toolbar to download the parameters. Note that you cannot download the parameters while the CPU module is running.)



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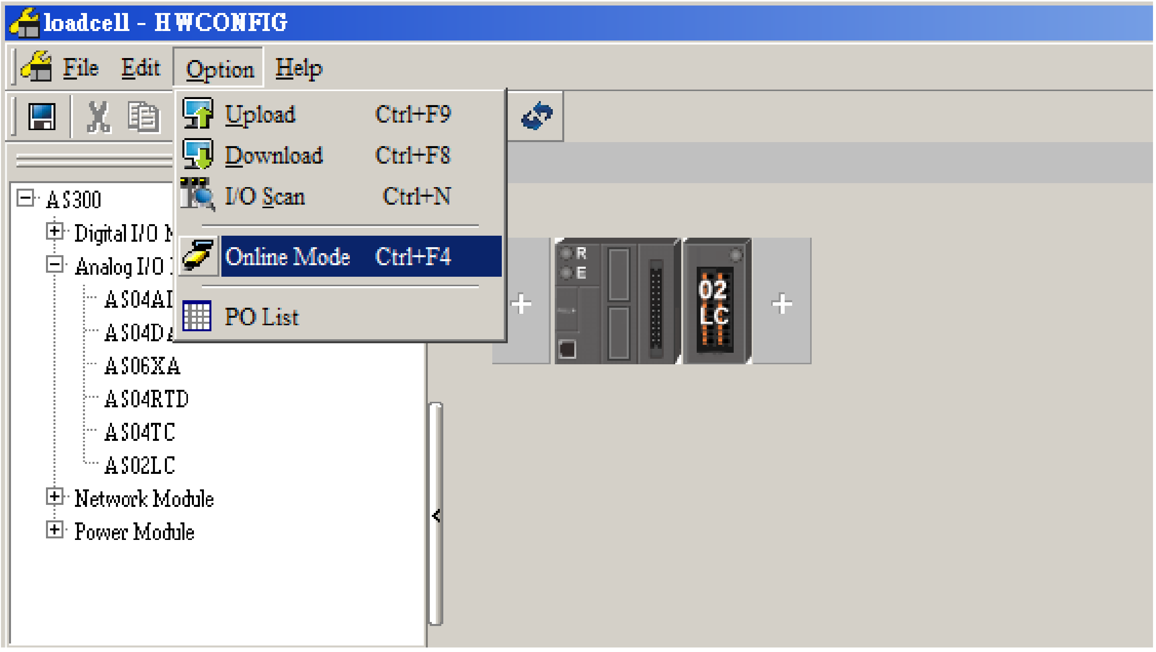
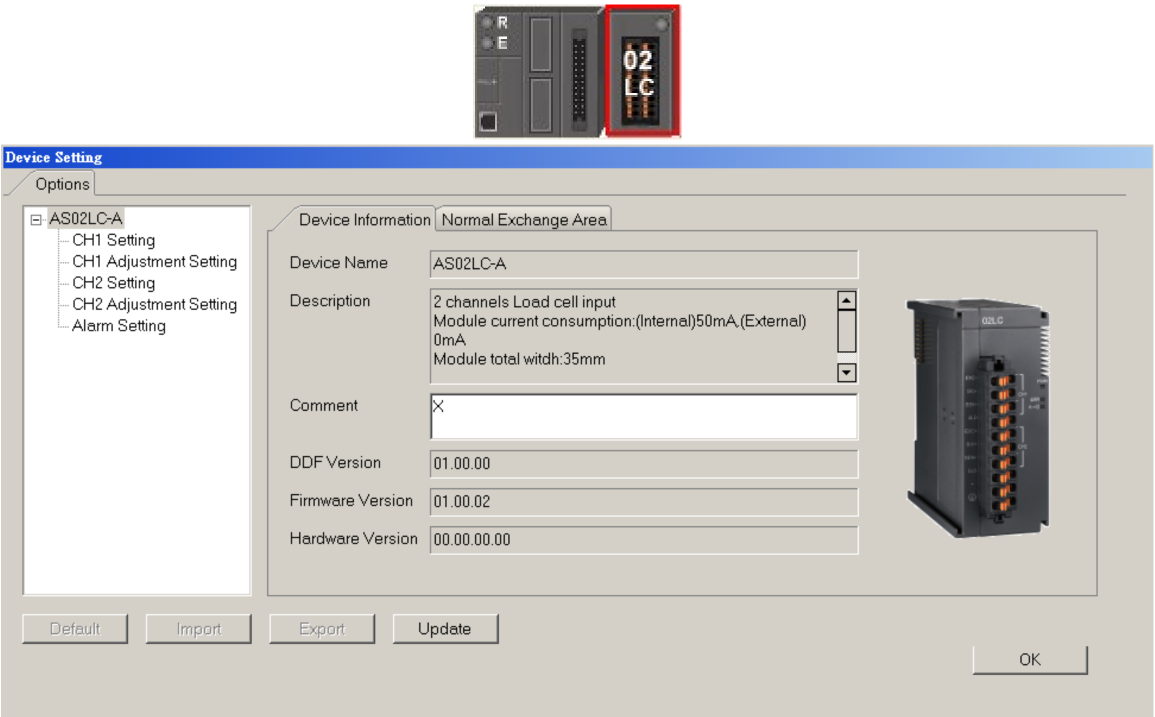
8.4.2 Checking the Version of a Module

(1) On the **Option** menu, click **Online Mode**.

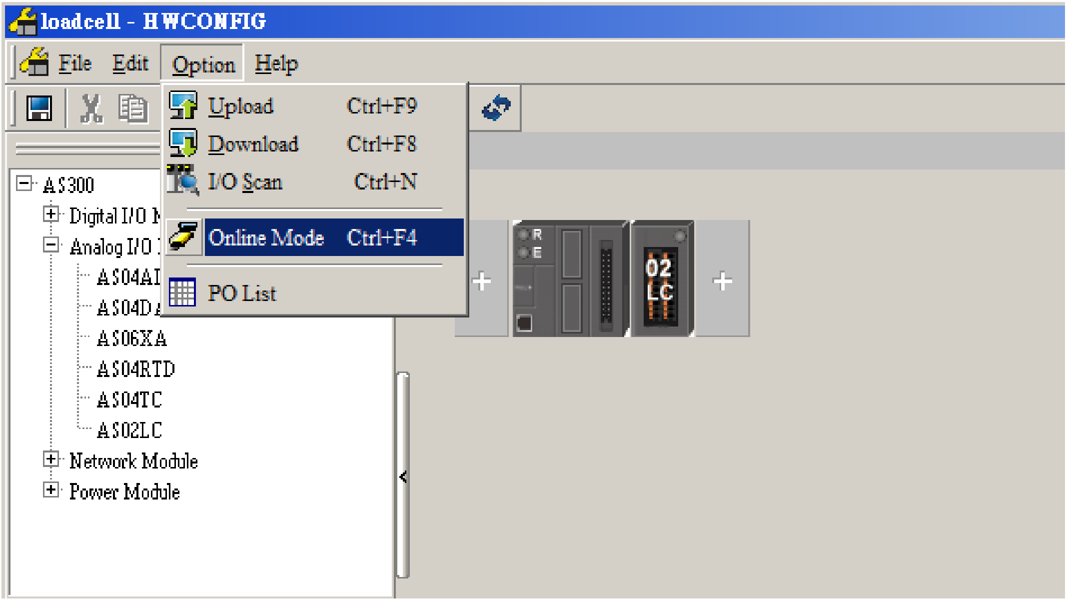


(2) Double-click the module to open the Device Setting page. The versions of both the firmware and the hardware are displayed.

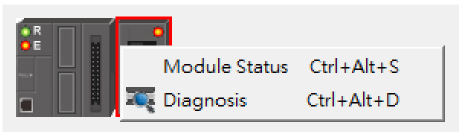


8.4.3 Online Mode

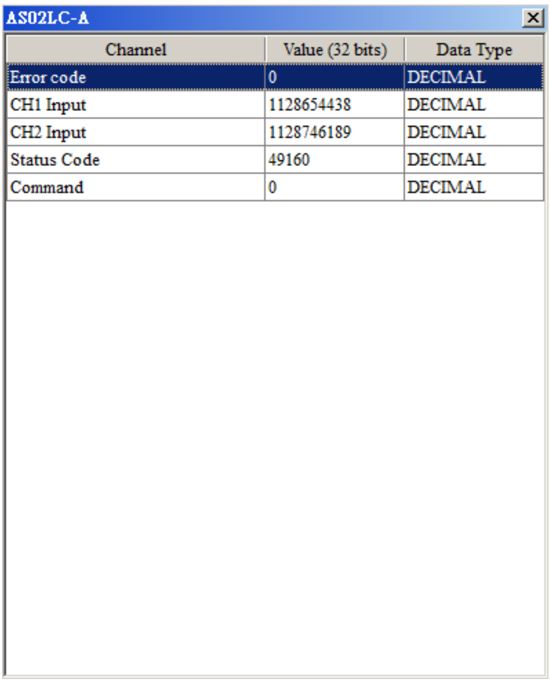
(1) On the **Option** menu, click **Online Mode**.



(2) Right-click the module and click **Module Status**.

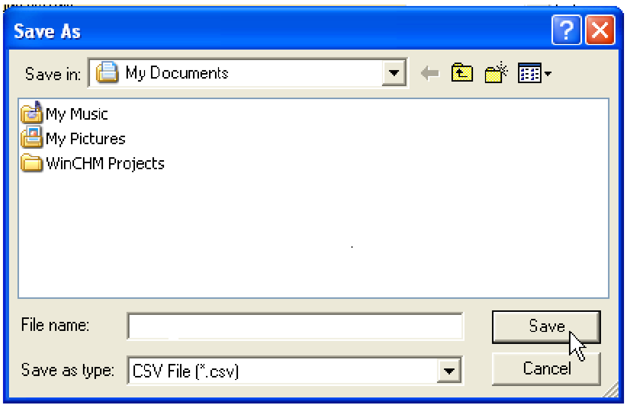


(3) View the module status.

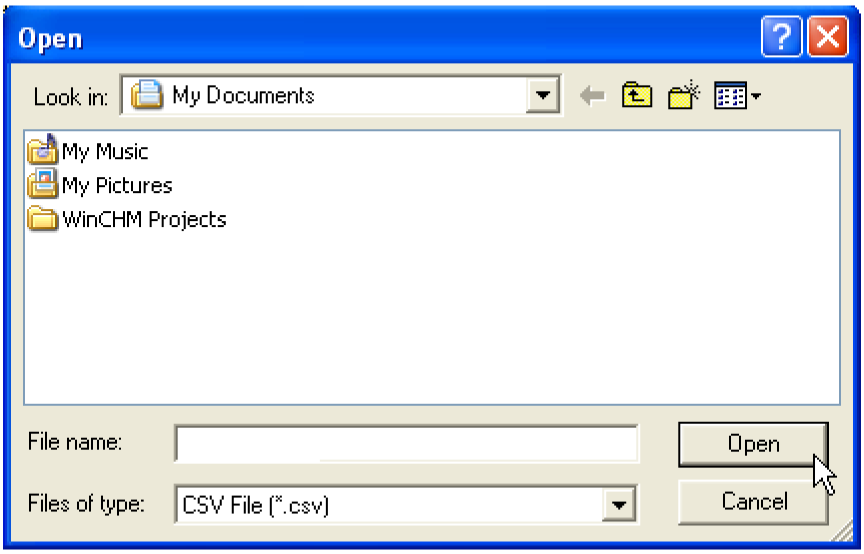


8.4.4 Importing/Exporting a Parameter File

(1) Click **Export** in the Device Settings dialog box to save the current parameters as a CSV file (.csv).

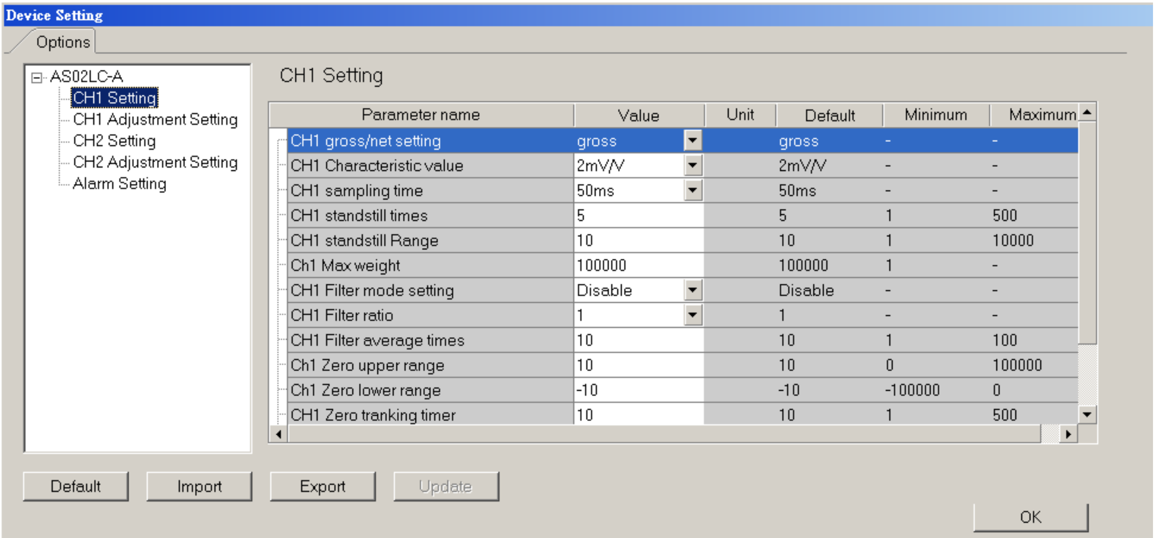


(2) Click **Import** in the Device Settings dialog box and select a CSV file to import saved parameters.

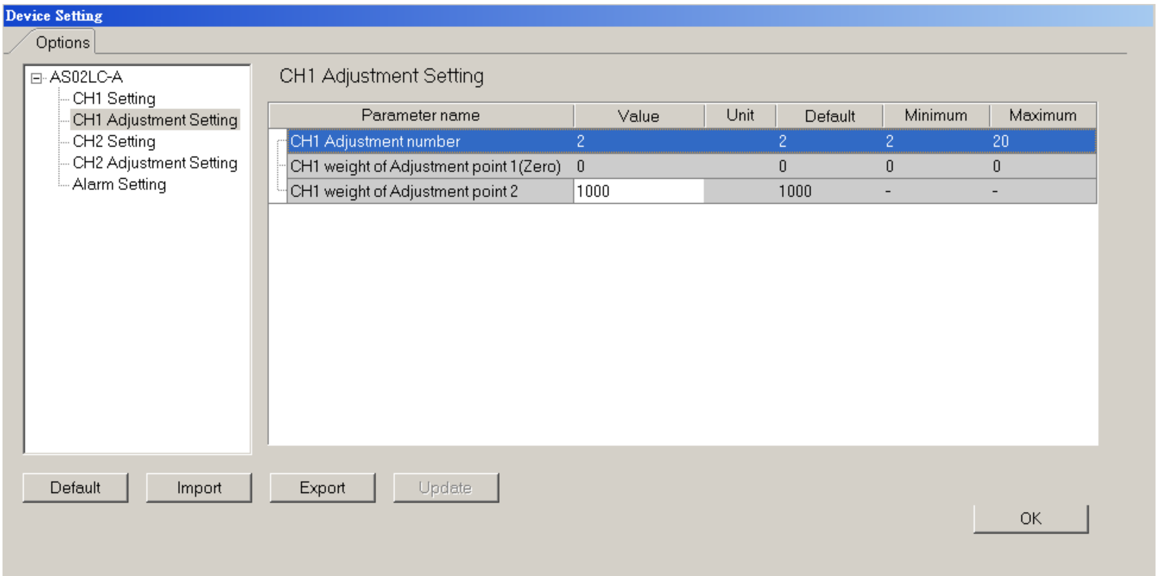


8.4.5 Parameters

(1) Settings for CH1



(2) Adjustment for CH1



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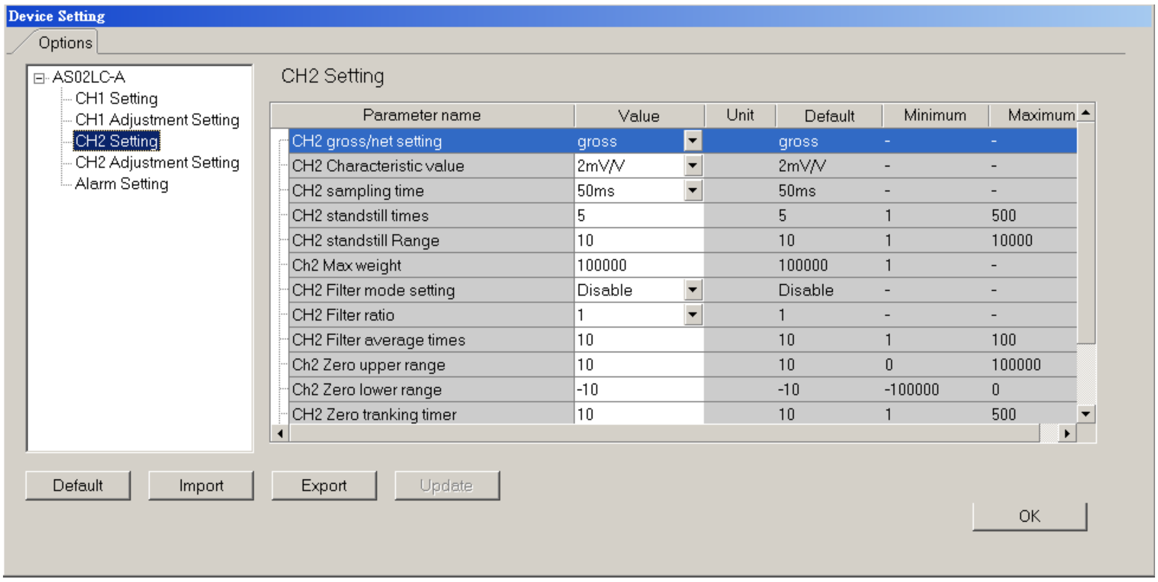
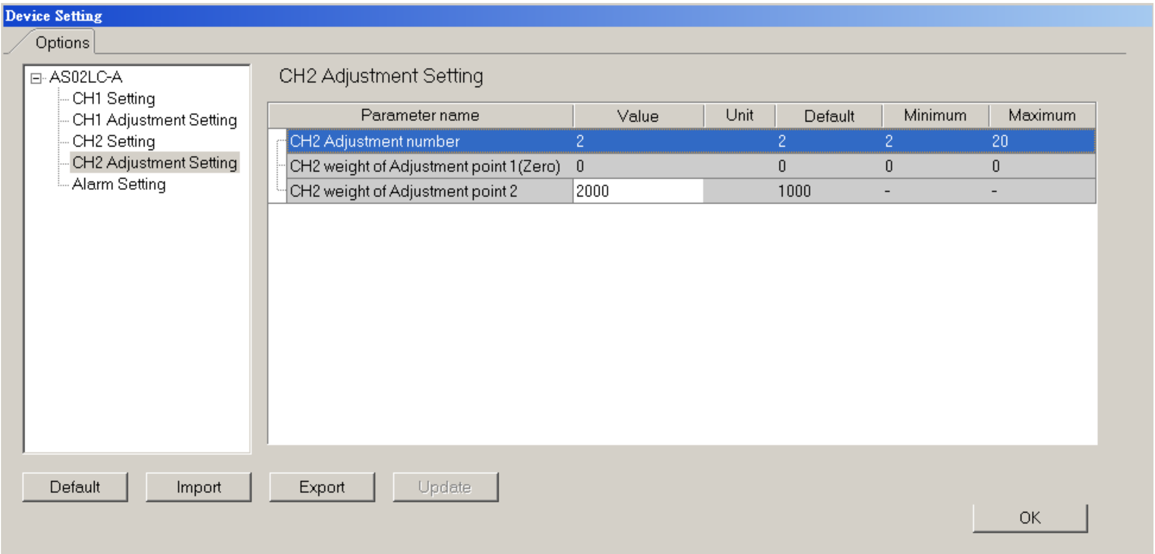
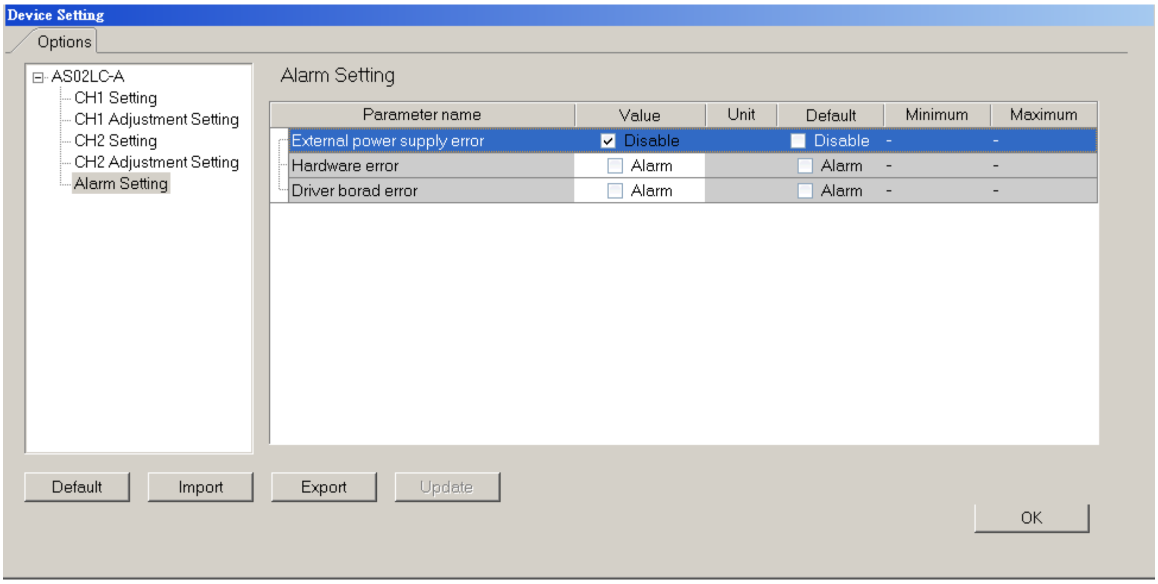
(3) Settings for CH2



(4) Adjustment for CH2



(5) Alarm settings



8.5 Troubleshooting

8.5.1 Error Codes

<table>
<tr><th>Error Code</th><th>Description</th><th>A↔ D LED indicator</th><th>ERROR LED indicator</th></tr>
<tr><td>16#1605</td><td>Hardware failure</td><td>OFF</td><td>ON</td></tr>
<tr><td>16#1607</td><td>The external voltage is abnormal.</td><td>OFF</td><td>ON</td></tr>
<tr><td>16#1801</td><td>The external voltage is abnormal.</td><td>OFF</td><td>Blinking</td></tr>
<tr><td>16#1802</td><td>Hardware failure</td><td>OFF</td><td>Blinking</td></tr>
<tr><td>16#1807</td><td>The driver board is abnormal.</td><td>OFF</td><td>Blinking</td></tr>
<tr><td>16#1808</td><td>The weight measured by CH1 exceeds the maximum weight that can be measured, or the voltage of SEN is incorrect.</td><td rowspan="6">Run: blinking
Stop: OFF</td><td rowspan="6">Blinking</td></tr>
<tr><td>16#1809</td><td>The weight measured by CH1 exceeds the maximum weight that can be measured.</td></tr>
<tr><td>16#180A</td><td>CH1 is adjusted incorrectly.</td></tr>
<tr><td>16#180B</td><td>The weight measured by CH2 exceeds the maximum weight that can be measured, or the voltage of SEN is incorrect.</td></tr>
<tr><td>16#180C</td><td>The weight measured by CH2 exceeds the maximum weight that can be measured.</td></tr>
<tr><td>16#180D</td><td>CH2 is adjusted incorrectly.</td></tr>
</table>

Error Code	Description	A↔ D LED indicator	ERROR LED indicator
-	When power-on, the module is not detected by CPU module.	OFF	Blinking once or twice and after 2 seconds, it blinks repeatedly

8.5.2 Troubleshooting Procedure

Description	Procedure
The external voltage is abnormal.	Ensure the power supply is functioning correctly.
Hardware failure	Return the module to the factory for repair.
The driver board is abnormal.	Return the module to the factory for repair.
The weight measured by CH1 exceeds the maximum weight that can be measured, or the voltage of SEN is incorrect.	Check the signal received by CH1 and its wiring.
The weight measured by CH1 exceeds the maximum weight that can be measured.	Check the parameters of the related weight values for CH1.
CH1 is adjusted incorrectly.	Check the adjusted weight value and the adjustment steps for CH1.
The weight measured by CH2 exceeds the maximum weight that can be measured, or the voltage of SEN is incorrect.	Check the signal received by CH2 and its wiring.
The weight measured by CH2 exceeds the maximum weight that can be measured.	Check the parameters of the related weight values for CH2.
CH2 is adjusted incorrectly.	Check the adjusted weight value and the adjustment steps for CH2.
When power-on, the module is not detected by CPU module.	Check if the connection between module and CPU module is working. If not, connect again.

9

Chapter 9 Serial Communication Module AS00SCM

Table of Contents

9.1 Introduction

Thank you for using the AS00SCM-A, a serial communication module. To ensure that your AS00SCM-A is installed and operated correctly, read this manual carefully before using the module.

The AS00SCM-A is a serial communication module, supporting AS series communication extension modules as well as the remote modules (RTU) and the following communication cards:

- Serial communication cards: AS-F232, AS-F422, and AS-F485 support Modbus and UD Link (user-defined format).
- CANopen communication card AS-FCOPM supports CANopen DS301.
- Ethernet communication card AS-FEN02 supports EtherNet/IP Adapter.
- Ethernet communication card AS-FPEN02 supports PROFINET. Refer to Chapter 10 of AS Module Manual for more information.

AS00SCMVersion and its supporting functions	**COM. (serial communication extension module mode)**		**RTU (remote module mode)**			
	MODBUS UD Link	CANopen DS301 (Slave)	AS Remote Communication, Delta Special Driver & AS Remote Mode	CANopen DS301 (Slave)	EtherNet/IP Adapter	PROFINET Device
Card	AS-F232 AS-F485 AS-F422	AS-FCOPM	AS-FCOPM		AF-FEN02 (V1.02 or later)	AS-FPFN02 (V2.00 or later
Card Slot	Card 1 / Card 2	Card 2	Card 2			
V1.00	V	-	-	-	-	-
V2.00	V	V	V	-	-	-
V2.02	V	V	V	V	V	-
V2.06	V	V	V	V	V	V

When AS00SCM-A is used as a remote module, its right side supports AS Series IO modules.

- For firmware version V2.06 or later: when AS00SCM-A works with AS-FCOPM and acts as a remote module, its right side supports AS04SIL-A. Refer to Chapter 13 of AS Module Manual for more information.
- For firmware version V2.06 or later: when AS00SCM-A works with AS-FPFN02 and acts as a remote module, its right side supports all AS Series module types, except AS02LC-A.

When AS00SCM-A acts as a serial communication extension module, it should work with AS PLC CPU for configuration. Use ISPSoft to configure AS00SCM-A. You can download ISPSoft V3.09 or later versions from Delta's official website. If you use UD Link, configure it through SCMSoft, which is embedded in DCISoft. Download DCISoft V1.20 or later from Delta's official website. You can set up the EtherNet/IP via EIP Builder. Download EIP Builder V1.07 or later from Delta's official website.

9.2 Specification, Function and Wiring

9.2.1 The functional specifications

- **RS-485/RS-422 communication interface**

Item	Specifications
Connector type	5- pin European-style terminal block, spring-clip connector
Transmission speed	300, 600, 1200, 2400, 4800, 9600, 19200, 38400, 57600, 76800 115200 and 230400 bps
Communication format	Stop bit: 1 bit and 2 bits Parity bit: none, an odd parity bit, and an even parity bit Data bit: 7 bits and 8 bits
Communication protocol	Modbus ASCII/RTU UD Link

- **CANopen communication interface**

Item	Specifications
Connector type	RJ45*2
Transmission speed	10k, 20k, 50k, 125k, 250k, 500k, and 1000k bps
Communication protocol	AS remote mode (RTU mode) CANopen (firmware V2.00 or later)

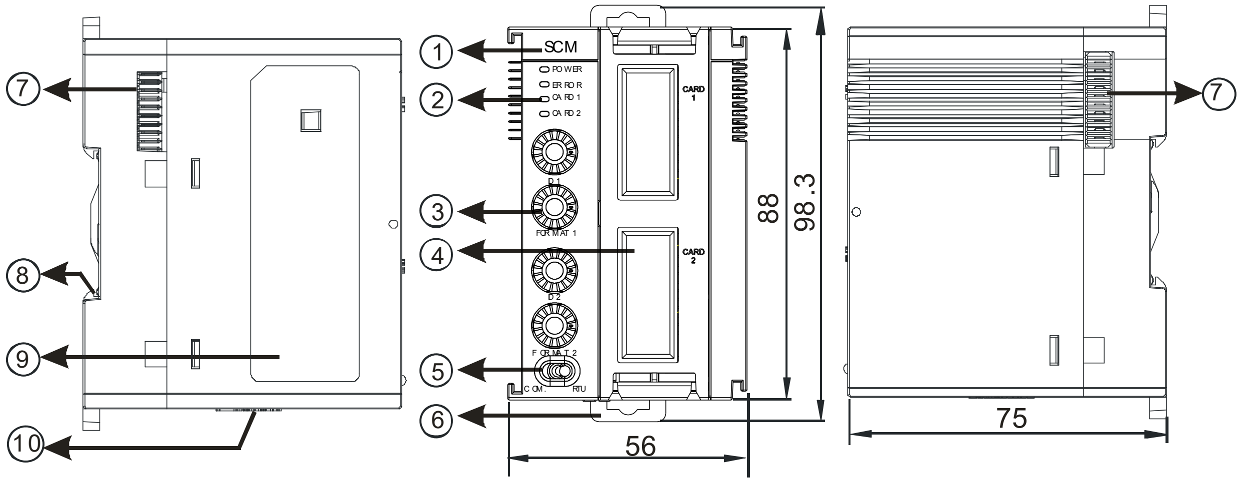
- **Ethernet communication interface**

Item	Specifications
Connector type	RJ45*2
Transmission speed	10M, 100Mbps
Communication protocol	EtherNet/IP (firmware V2.02 or later), PROFINET (firmware V2.06 or later)

- **Electrical specifications**

Item	Specifications
Supply voltage	24 VDC
Electric energy consumption	0.6 W
Weight	Approximately 169 g

9.2.2 Dimensions and Profile



Unit: mm

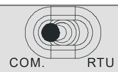
Number	Name	Description
1	Model Name	Model name of the module
2	RUN LED Indicator (blue)	Operating status of the module ON: the module is running. OFF: the module has low voltage or no power.
	ERROR LED Indicator (red)	Error status of the module ON: there is a hardware error. OFF: the module is operating normally. Blink: an error has occurred or occurs on the module; refer to section 9.7 for more information.
	Function card 1 Indicator (orange)	Blink: data is being transmitted to function card 1. OFF: there is no data transmission to function card 1.
	Function card 2 Indicator (orange)	Blink: data is being transmitted to function card 2. OFF: there is no data transmission to function card 2.
3	Knob for the Node ID and Format	2 sets, one for function card 1 and the other for function card 2
4	Function Card 1 Slot	COM Mode: for AS-F232, AS-F422, AS-F485
	Function Card 2 Slot	COM Mode: for AS-F232, AS-F422, AS-F485, AS-FCOPM RTU Mode: for AS-FCOPM, AS-FEN02, AS-FPFN02
5	Knob for the Work Mode	COM Mode: serial communication extension mode RTU Mode: remote module mode
6	DIN Rail Clip	Secures the module onto the DIN rail
7	Module Connecting Set	Connects the modules
8	Ground Clip	
9	Label	Nameplate
10	RTU Power Input	Supplies power to the RTU module for RTU Mode only

9.2.3 Knob Functions

- **Restore default settings:** for all communication cards and work mode, you can cut the device power off and turn the knobs to the position F, and resupply the power. The AS00SCM-A module restores back to default setting once it is resupplied with power. This act does NOT affect the communication cards. Cut the power off again and turn the knobs to set the new values and then resupply the power. After that the ASSCCM00-A is set with new settings.

- **Modbus communication (AS-F232/AS-F422/AS-F485):** can be installed in Card 1 and Card 2 (in COM mode only).
  1. Use the knob to set the node ID1 and ID2; its setting range is 0x01–0x0F. You can use ISPSoft (HWCONFIG) to set up the node ID, if the knob is turned to 0. Follow the descriptions shown on the HWCONFIG for node ID setting range.

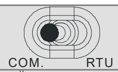
ID Setup (AS-F232/AS-F422/AS-F485)



ID1/ID2	Node ID Setup	ID1/ID2	Node ID Setup
0	Use ISPSoft (HWCONFIG)	1-F	Manual Setting

2. Modbus communication (AS-F232/AS-F422/AS-F485): can be installed in Card 1 and Card 2 (in COM mode only). Use the Format Knob to set the communication mode. You can use ISPSoft (HWCONFIG) to set up the communication mode, when the Format Knob is turned to 0. If you need to set the communication mode to UD Link, you need to turn the Format Knob to 0. Refer to section 9.3.2 for more details.

Modbus (AS-F232/AS-F422/AS-F485) in COM mode

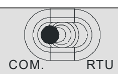


Format 1/ Format 2	Baud rate (bps)	Data (bits)	Parity	Stop (bits)	ASCII/ RTU	Format 1/ Format 2	Baud rate (bps)	Data (bits)	Parity	Stop (bits)	ASCII/ RTU
0	Software setting					8	38400	8	None	2	RTU
1	9600	7	Even	1	ASCII	9	38400	8	None	1	RTU
2	9600	8	Even	1	RTU	A	38400	7	Even	1	ASCII
3	9600	7	None	2	ASCII	B	57600	8	None	1	ASCII
4	9600	8	None	1	RTU	C	76800	8	None	1	RTU
5	19200	7	Even	1	ASCII	D	115200	7	None	1	ASCII
6	19200	8	None	1	RTU	E	115200	8	Even	1	RTU
7	19200	8	Odd	2	RTU	F	115200	7	None	2	ASCII

- **CANopen (AS-FCOPM):** can only be installed in Card 2 for COM mode or RTU mode.

1. **COM Mode (SCM mode):** use the knob to set the node ID and its setting range is 0x01–0x0F. You can use ISPSoft (HWCONFIG) to set up the node ID, when the knob is turned to 0. Follow the descriptions shown on the HWCONFIG for node ID setting range. Thee setting varies according to different CANopen communication mode; refer to section 9.4.1 for more details.

ID Setup (AS-FCOPM in COM mode)



ID2	Node ID Setup	ID2	Node ID Setup
0	Use ISPSoft (HWCONFIG)	1-F	Manual Setting

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2. COM and RTU Mode:

Refer to the following table and use FORMAT 2 knob to set up the communication. You can NOT use ISPSoft (HWCONFIG) to set up the communication mode in this format.

CANopen (AS-FCOPM) in COM Mode and RTU Mode								
FORMAT 2	1	2	3	4	5	6	7	8-F
Bit rates (bps)	10K	20K	50K	125K	250K	500K	1000K	NA
Distance (m)	5000	2500	1000	500	250	100	25	NA

- **EtherNet/IP (AS-FEN02):** can only be installed in Card 2 for RTU mode.

When using the communication card AS-FEN02, you need to set ID1 and FORMAT1 to 0. The IP address can be edited through knobs.

<table>
<tr><th colspan="5">IP Address Setup (AS-FEN02) in RTU Mode</th></tr>
<tr><td>ID1</td><td colspan="4">0</td></tr>
<tr><td>Format 1</td><td colspan="4">0</td></tr>
<tr><td>ID2</td><td>0</td><td>F</td><td rowspan="2">Other combination</td><td>$x16^1$</td></tr>
<tr><td>Format 2</td><td>0</td><td>F</td><td>$x16^0$</td></tr>
<tr><td>IP Address Setup</td><td>Use ISPSoft (HWCONFIG)</td><td>DHCP</td><td colspan="2">IP Address
192.168.1.x，x=1~FE（1~254）</td></tr>
</table>

The parameters of AS-FEN02 are stored in AS300 PLC or AS00SCM-A. Thus you need to use the knobs to set up the IP address for AS-FEN02 or use COMMGR or IP Setup tool to scan and check for the IP address of AS-FEN02. Refer to section 9.4.2 for more information.

1. When both knobs ID2 and FORMAT 2 are set to 0, IP address is set through EIP Builder (ISPSoft -> HWCONFIG).
   - Open EIP Builder and add AS00SCM (RTU) + AS-FEN02 to your network. Double-click HWCONFIG to set up.
   - Open EIP Builder and select **IP Setting Tool** from the **Tool** on the tool bar to scan for the device IP address for setup.
2. When both ID2 and FORMAT 2 are set to F, IP setting mode is in DHCP mode. After setting is complete, you need to turn the power OFF and then ON to make sure the modules are sending DHCP requests. Check the sticker on the AS-FEN02 communication card for the MAC address. After that open EIP Builder and select **IP Manager** from the **Tool** on the tool bar and click **Start the Server** to set up the correspondences between MAC address and IP address.
3. When either ID2 or FORMAT 2 is NOT 0 or F, IP address is set by knobs ID2 and FORMAT 2. Hexadecimal format is used and ID2 corresponds to $x16^1$ and FORMAT 2 to $x16^0$. The possible IP address is 192.168.1.x, x=1~FE (1~254).

- **PROFINET (AS-FPFN02):** You can use the knob to restore back to default settings.

9.2.4 Wiring

9.2.4.1 AS00SCM-A Power Wiring

- COM mode: Serial communication extension mode

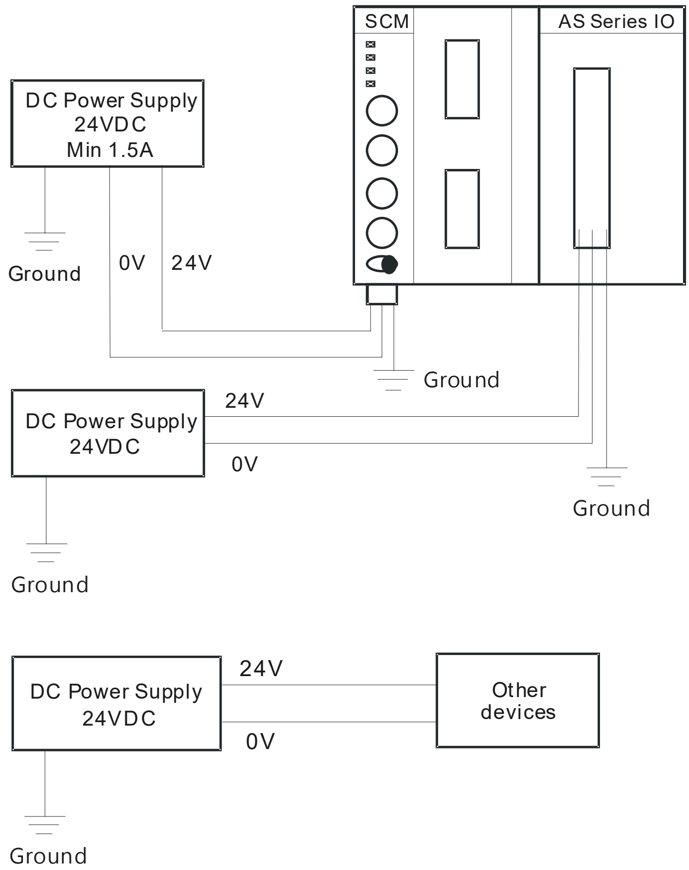
Turn the work mode to COM. Install the module on the right hand side of the AS Series CPU. To avoid problems, do not use an external power supply for AS00SCM-A.

- RTU mode: Remote module mode

Turn the work mode to RTU. This module is equipped with an independent DC power connecter.

To ensure the serial communication module functions well and reliably, the external wiring must prevent noise. Before you install cables, follow the precautions below.

(1) To prevent a surge and induction, the DC cable and other power cables that are connected to the AS00SCM-A must be separate cables. An independent power supply is recommended for the AS00SCM-A.



(2) The 24 VDC cable should be twisted pair, and the shorter end should be connected to the module.

(3) The cable (110 VAC, 220 VAC, and 24 VDC) must not be installed near a main circuit, a high-voltage cable, or a cable connected to a load that is not a PLC. In addition, the cable must not be bound to a main circuit, a high-voltage cable, or a cable connected to a load that is not a PLC. All the cables should be wired at least 100 mm apart.

(4) Ground the power supply using a 14 AWG wire.

(5) Connect 20–14 AWG (1 mm) wires to the input/output terminals. Use only copper leads that can resist temperatures above 60° C /75° C.

9.2.4.2 AS00SCM-A Communication Interface

- COM mode: Serial communication extension mode

This module comes with two function card slots, supporting AS-F232, AS-F422, and AS-F485 communication cards. The Card 2 slot also supports the AS-FCOPM communication card (firmware V2.00 or later). Refer to Chapter 10 for more information on wiring the cards.

- RTU mode: Remote module mode

The Card 2 slot supports the AS-FCOPM communication card (firmware V2.00 or later), AS-FEN02 (firmware V2.02 or later) and AS-FPFN02 (firmware V2.06 or later). Refer to Chapter 10 for more information on wiring the cards.

9.3 COM mode

This section introduces communication modes of AS00SCM-A module (firmware V2.00) when the communication protocol is Modbus, UD Link or CANopen.

9.3.1 Modbus

The AS00SCM-A supports standard communication protocols such as Modbus RS232, RS422, and RS485. Once you create a data exchange table, you can exchange data with slave modules.

- You can set up communication format and node ID via HWCONFIG. Refer to section 9.2.3 for more details.
- When AS00SCM-A acts as scanner/master, you can create a data exchange table and exchange data with slave modules. To initialize Modbus communication: Open ISPSoft. -> HWCONFIG -> Set up the node ID and communication format. -> Create a data exchange table. -> Select a Mode (Program Control, PLC Run, or Always Enable). -> Download HWCONFIG. -> Enable data exchange. Refer to section 9.3 in AS Series Operation Manual for more details.
- When you use HWCONFIG to scan the modules, the data exchange table of AS00SCM-A can NOT be copied back to HWCONIG. If you need the data exchange table of AS00SCM-A, you can use **Upload** on the tool bar to send the data exchange table of AS00SCM-A back to HWCONFIG.
- When AS00SCM acts as adapter/slave, it provides a communication channel for AS series PLC to read and write.

Supporting function codes and addresses are shown below.

Function Code	Attribute	Supporting addresses
0x03 0x04	Read	16#0000~16#0063 16#0100~16#0163 16#0200~16#0263 16#0300~16#0363
0x06 0x10	Write	16#0000~16#0063 16#0200~16#0263
0x17	Read	16#0000~16#0063 16#0100~16#0163 16#0200~16#0263 16#0300~16#0363
	Write	16#0000~16#0063 16#0200~16#0263

Addresses and corresponding registers for function card 1 / 2

Funciton cards	Address for data to be written	Length (character)	Address for data to be read	Length (character)
Function card 1	16#0000	100	16#0100	100
Function card 2	16#0200	100	16#0300	100

- Corresponding data registers can be obtained when AS series PLC uses AS00SCM-A for communication and via HWCONFIG to set up. Refer to section 9.6.1 for more details.

9.3.2 UD Link

The UD Link provides communications with devices that communicate via RS232, RS422 or RS485. You can edit a packet according to its communication format to send and receive packets. This section introduces the use of UD Link communications in COM mode. Make sure the knob of SCM module is turned to 0 before operation. SCMSoft is embedded in DCISoft. Go to www.deltaww.com to download DCISoft V1.19 or later. And after that you can use SCMSoft in ISPSoft.

The steps for creating a UD Link protocol communication are:

- In HWCONFIG

Set up the function card. -> Set the communication protocol to UD Link. -> Set up the communication format and baud rate. -> Download to HWCONFIG. -> Use data length 8 byte as the communication format, 8E1, 8N1, 8O2 and so forth to ensure a complete transmission. After setting, right-click the module to open SCMSoft in HWCONFIG.

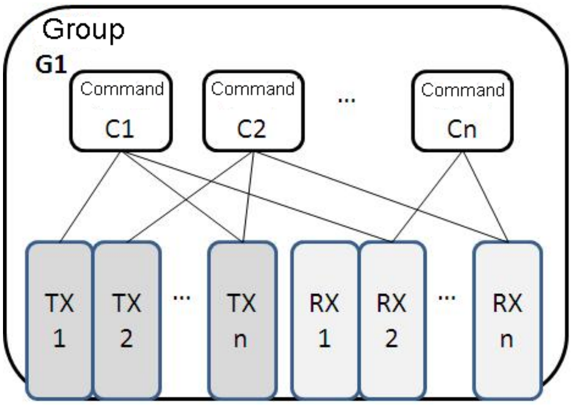
- In SCMSoft

Upload the module parameters to UD Link. -> Right-click Group List to create a group list. -> Double-click the Group List 1 to set up the slot number on the editing window on the right -> Right-click the created group list on the node to create groups for data mapping. -> Define the Group ID and Group Name on the editing window on the right.

The slot number in the group list is the actual placement order of AS00SCM-A on the right-side of the PLC. For example, the slot number 2 in the group list corresponds to the second module on the right-side of the PLC. Once the group list is assigned to a certain slot, the CARD 1 and CARD 2 of its corresponding module can trigger the group list of the selected slot. You need to create a new group list for different module that needs to use UD Link.

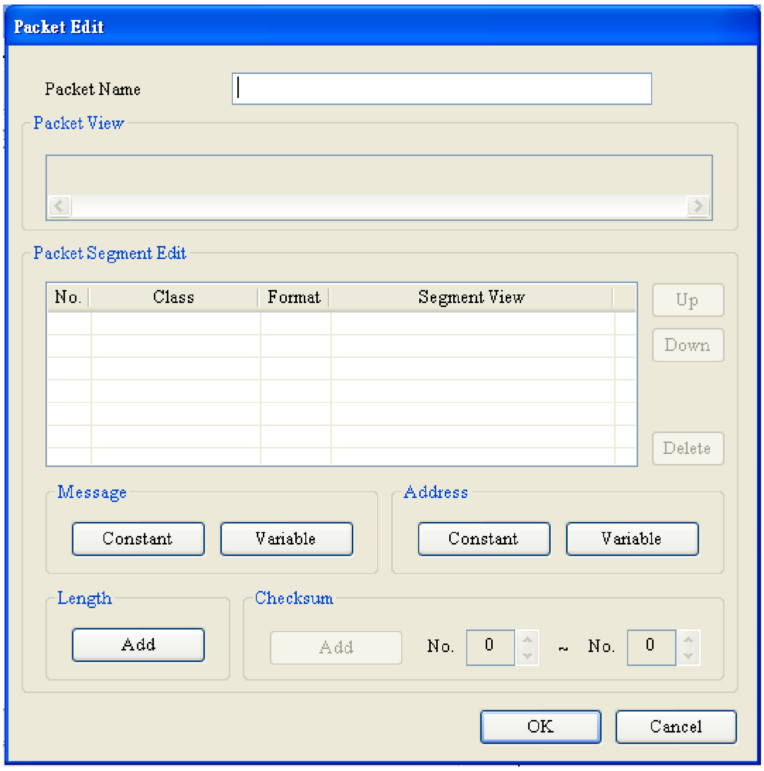
After the group list is created, you can edit packets for transmission.

Edit TX and RX packets. -> Create commands. -> Download parameters to UD Link. -> Download in groups and once a group number is trigger, the function card starts to send and receive packets according to the comment order.



9.3.2.1 TX Packets and RX Packets

You can create several TX and RX packets in a group. A packet includes messages, an address, a length, and a checksum.



- **Packet Name**: enter the packet name.
- **Packet View**: shows the packet contents.
- **Packet Segment Edit**: adjust the sequence of segments and add or delete segments.

  No.: the segment number. You can create no more than 64 segments.

  Class: the segment class. The available classes are Message, Address, Length, and Checksum.

  Format: the data format of the segment. The available data formats are Hex (hexadecimal), ASCII, and Code.

  Segment View: the contents of the segment
- **Message**: a message may be either Constant or Variable. Messages can be applied to a header segment, a start bit segment, an end bit segment, and a data segment. There can be several messages in a packet.
- **Address**: an address may be either Constant or Variable. There can be only one address segment in a packet.
- **Length**: enter the length of a packet. There can be only one length segment in a packet.

  Class: 1 byte or 2 byes

  Format: select a format for the length, Hex or ASCII

  Value: enter a value for the length according to the format; unit: byte
- **Checksum**: edit the checksum. There can be only one checksum segment in a packet.

  Class: select a Class.
  Format: select the Format for the checksum.
  Initial value: set the initial value for the checksum.

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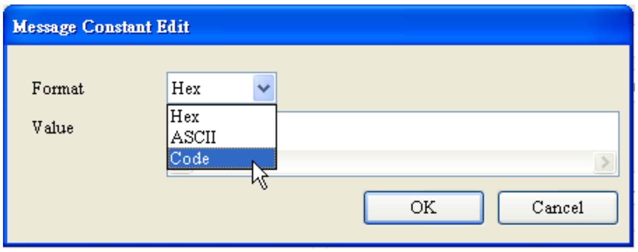
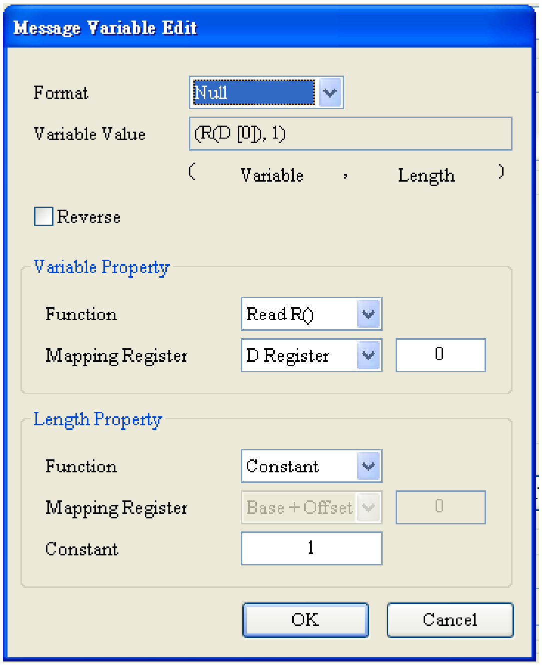
Reverse: the high byte of a one-word checksum is calculated, and the high byte (word) and low byte (byte) of the checksum are reversed.



- **Constant**: enter a constant.

  Format: Select **Hex**, **ASCII**, or **Code** in the **Format** box. If you select **Code**, the data is a control code.

  Value: enter a constant .



- **Variable**: a variable data to read or write. Specify either an internal register in AH10SCM-A or a register in a CPU module.
- **Format**: select the format for the data.

  Null: data is not processed.

  Hex: ASCII data is converted into hexadecimal data. ASCII data that cannot be converted into hexadecimal data is converted into 0.

  ASCII: Hexadecimal data is converted into ASCII data. Hexadecimal data that cannot be converted into ASCII data is converted into 0.

- **Reverse**: the high byte of a one-word checksum which is calculated, and the low byte of the checksum are reversed.
- **Variable Property**:

  Function: for a TX packet, select Read R() for the **Function**. For an RX packet, select **Read R()**, **Write W()**, or * for the **Function**.

  Mapping Register: select a register in the PLC.

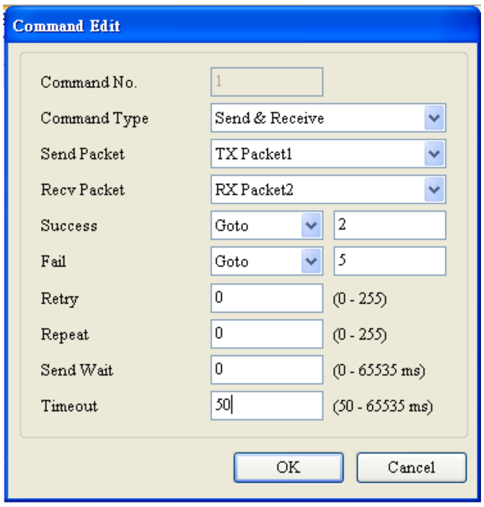
- **Length Property**:

  Function: Select Read R ( ) for a variable. And then you can select its corresponding register. The value here is the length. Select Constant and then you can define the data length. You can also select to determine the length (*) automatically. The data length can be specified between the packet interval (around 4 character time length).

  For a TX packet, you can select the variable and the constant length. For a RX packet, you can select a variable, constant and determine the length (*) automatically.

9.3.2.2 Command

After creating several TX and RX packets, create commands to select packets to be sent and packets to be received. Also create a sequence to execute the commands.



- **Command No.**: every command has a number. The Command Number indicates the execution order. You can also use this Command Number to appoint a certain packet for transmission when using Goto function.
- **Command Type**: select **Send**, **Receive**, or **Send** & **Receive** for the **Command Type**. Once the type **Send** is selected, when the packet is sent, the transmission is considered successful. Once the type **Send** & **Receive** is selected, AS00SCM-A checks if the received data met the definition of RX packet. When they are matched, the transmission is considered successful.
- **Send Packet**: select a packet to send.
- **Receive Packet**: select a packet to receive.
- **Success**: specify the action to follow the successful execution of the command: **Next**, **Goto**, or **End**.
  - **Next**: the next command is executed based on Command Number. If the command that is being executed is command 1, the next command that will be executed is command 2.
  - **Goto**: specify a later command to be executed based on its Command Number.
  - **End**: end the sequence of commands.
- **Fail**: specify the action to follow the failure of the command: **Next**, **Goto**, or **Abort**.
  - **Next**: the next command is executed based on Command Number. If the command that is being executed is command 1, the next command that will be executed is command 2.
  - **Goto**: specify a later command to be executed based on its Command Number.

- **Abort**: end the sequence of commands.

- **Retry:** set the number of times the command will be retried after a failure.
- **Repeat**: set the number of times the command will be repeated after successful execution.
- **Send Wait**: set an interval in milliseconds for the sequence to wait between commands. The default is 0 milliseconds, which causes the next command to be executed immediately after a reply is received.
- **Timeout**: set the amount of time in milliseconds for the system to wait for the command to be executed before the system reports a communication timeout. The default is 50 milliseconds. When it is set to 0, there is no timeout message and the module is at the status of waiting to receive.

9.3.3 CANopen Mode

The installed on the right side of AS Series PLC CPU, AS00SCM-A (firmware V2.00 or later) can be connected to an AS-FCOPM module through the Card 2 slot. It can then be used as a slave for other modules in the CANopen network environment.

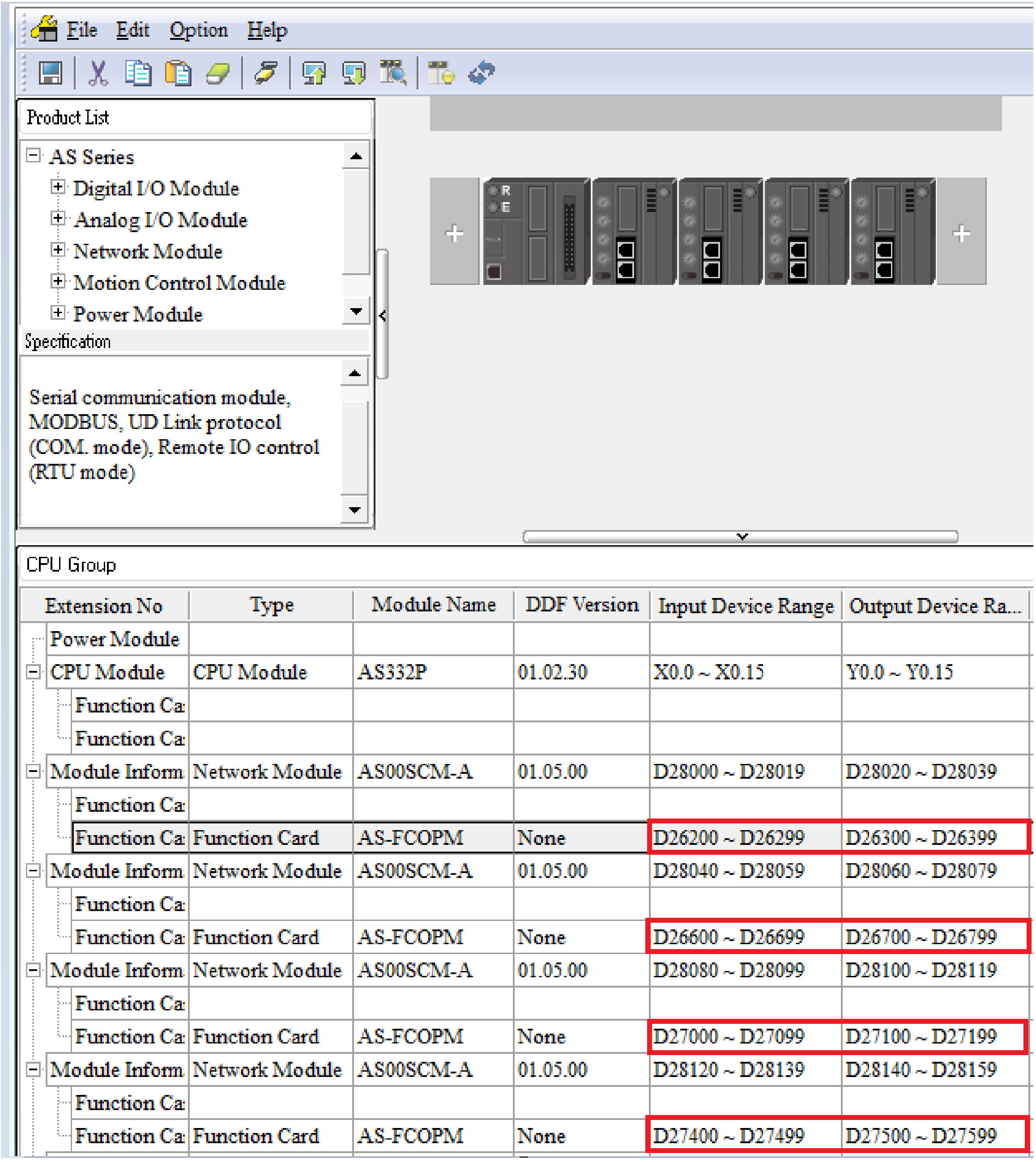
9.3.3.1 Features

When using the AS00SCM-A as a slave module, it has the following features:

- Complies with CANopen DS301 V4.02
- Supports NMT Slave
- Error-controlled; supports Heartbeat and Node-Guarding Protocols
- Supports PDO; up to 8 TxPDO and 8 RxPDO can be configured for every slave.
- Supports SDO:
  Server: 1
  User: 0
  Supports SDO (expedited SDO) transmission mode
- Supports Emergency Protocol

9.3.3.2 Corresponding Input / Output Device Range

When the AS00SCM-A module acts as a CANopen slave, the CPU PLC assigns the input/output device ranges according to the placement of the AS00SCM-A. The corresponding input/output device ranges from the right hand side of the CPU PLC are shown in the example below from the HWCONFIG utility. The red box below is the data exchange section for AS00SCM-A, when the AS00SCM-A acting as a CANopen slave.



9.4 RTU Mode

9.4.1 CANopen Mode (AS-FCOPM)

When the function card AS-FCOPM works with an AS series PLC, it supports three kinds of RTU modes, including AS Remote Communication, CANopen DS301 Mode and Delta Special Driver & AS Remote Mode. Use the knob FORMAT 1 to turn among three RTU modes.

A. RTU Communication Mode Setup Knob "FORMAT 1"

FORMAT1	Description
0	AS Remote Communication
4	CANopen DS301
8	Delta Special Driver & AS Remote Mode

B. Node ID Setup Knob "ID1/ID2"

- ID1: 0 (recommended)
- ID2: 0 (the knob is no function; set up through ISPSoft); see the table below for the knob setting range.

RTU mode	ID2 setting range
AS Remote Communication	1~F (by the number of slaves)
Delta Special Driver & AS Remote Mode	1~F (by the number of slaves)
CANopen DS301	1~F (if the knob is at 0, the setting range is set by HWCONFIG)

C. RTU Communication Speed Setup Knob "FORMAT 2"

Use the knob for setting. You cannot use ISPSoft (HWCONFIG) to set up the communication mode in this format.

FORMAT2	1	2	3	4	5	6	7	8-F
Byte (bps)	10K	20K	50K	125K	250K	500K	1000K	NA
Distance (m)	5000	2500	1000	500	250	100	25	NA

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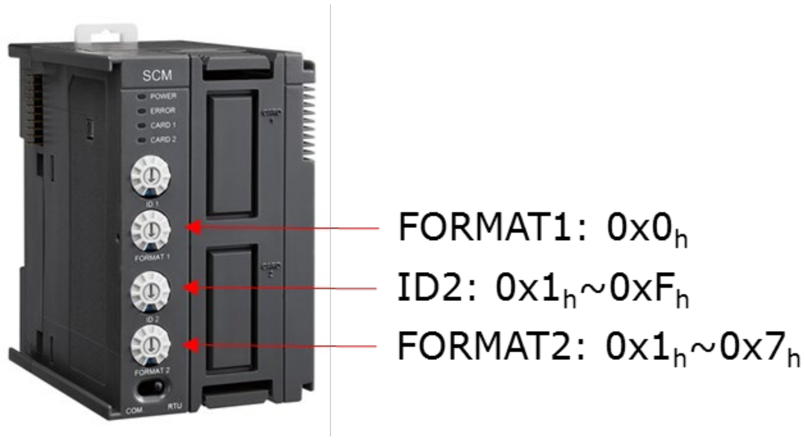
9.4.1.1 AS Remote Communication Mode

- Double-click the AS Series PLC, then in Device Setting click **Function Card 2 Setting** and set the function card 2 to AS-FCOPM, set to working mode to AS Remote Communication Mode, enter the number of the AS remote module and set up the baud rate. After the setting is done, download the parameters.

Parameter name	Value	Unit	Default	Minimum	Maximum
Card 2 Detect mode	Manual		Auto Detect	-	-
Manual Select Card	AS-FCOPM Ca		None	-	-
Card 2 ID No.	1		1	1	254
Protocol Setup Opportunity	Stop --> Run		Stop --> Run	-	-
Baud Rate	9600	bps	9600	-	-
Data bit	7	bit	7	-	-
Parity bit	Even		Even	-	-
Stop bit	1	bit	1	-	-
MODBUS mode	ASCII		ASCII	-	-
Delay time to Reply	0	ms	0	0	3000
Received Data Timeout	200	ms	200	0	3000
F2AD Analog Input mode	0~10V		0~10V	-	-
F2DA Analog Output mode	0~10V		0~10V	-	-
F2AD Sampling Time	3	ms	3	3	15
F2AD Average Times	10		10	1	15
AS-FCOPM Working mode	AS Remote Co		AS Remote Cc	-	-
AS-FCOPM node ID	1		1	1	254
AS Remote module No.	1	unit	1	1	15
Select Run mode after detect remote mc	Run connectec		Run connectec	-	-

Turn the FORMAT1 knob to 0 and it is in AS Remote Communication Mode. In AS Remote Communication mode, an AS series CPU PLC can connect to as many as 15 AS00SCM-A modules, as long as they are all in RTU mode. The RTU station number should be set from 1 to 15 in numerical order. RTU mode and baud rate cannot be set via ISPSoft (HWCONFIG). Use the knob ID2 to set up Node ID and use the knob FORMAT2 to set up the baud rate. (The baud rate should be the same as the PLC's baud rate.)



Steps for a quick setup

1. Set up the PLC: AS Remote Communication mode, number of the device: 1; baud rate: 1000kbps; download the parameters.
2. Set up AS00SCM-A; set the ID1 knob to 0 and FORMAT1 to 0; ID2 knob to 1 and FORMAT2 to 7.
3. Supply power to AS00SCM-A and connect AS00SCM-A to the PLC with a CANopen cable.
4. Resupply power to the PLC and the indicator of CARD2 should keep blinking. That indicates AS00SCM-A and the PLC are connected. The PLC error indicator should be blinking too, since the setting is not done yet.
5. Use HWCONFIG to scan the connected devices to see if AS00SCM-A is connected.
6. Download the parameters and check if the PLC error indicator has stopped blinking. Then the setting of one RTU device is complete.

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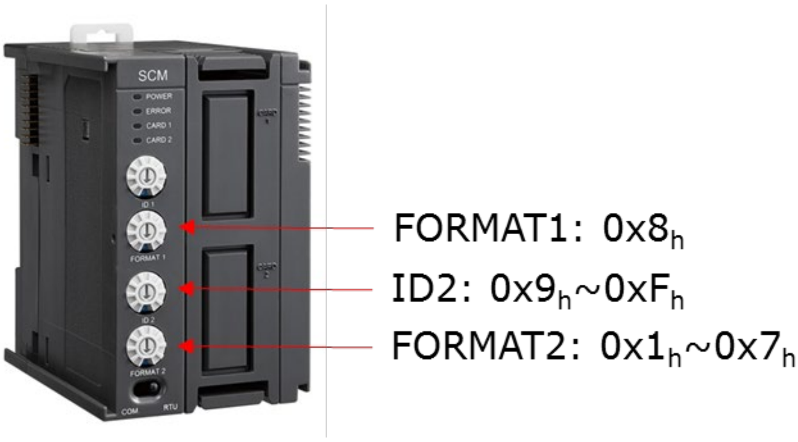
9.4.1.2 Delta Special Driver & AS Remote Mode

- Double-click the AS Series PLC, then in Device Setting click **Function Card 2 Setting** and set the function card 2 to AS-FCOPM, set to working mode to Delta Special Driver & AS Remote Mode and enter the number of the AS remote module and set up the baud rate. After the setting is done, download the parameters.

Parameter name	Value	Unit	Default	Minimum	Maximum
Card 2 Detect mode	Manual		Auto Detect	-	-
Manual Select Card	AS-FCOPM Card		None	-	-
Card 2 ID No.	1		1	1	254
Protocol Setup Opportunity	Stop --> Run		Stop --> Run	-	-
Baud Rate	9600	bps	9600	-	-
Data bit	7	bit	7	-	-
Parity bit	Even		Even	-	-
Stop bit	1	bit	1	-	-
MODBUS mode	ASCII		ASCII	-	-
Delay time to Reply	0	ms	0	0	3000
Received Data Timeout	200	ms	200	0	3000
F2AD Analog Input mode	0~10V		0~10V	-	-
F2DA Analog Output mode	0~10V		0~10V	-	-
F2AD Sampling Time	3	ms	3	3	15
F2AD Average Times	10		10	1	15
AS-FCOPM Working mode	Delta Special Dri		AS Remote Com	-	-
AS-FCOPM node ID	1		1	1	254
Number of remote module for ASDA	1		0	0	7
Select Run mode after detect remote module	Run connected r		Run connected	-	-
AS CPU module keep or Stop when slave no	Only Show Error		Only Show Erro	-	-
Remote Communication time out	100	ms	100	0	3000
Re-connected Retry number after time out	60		60	0	255
Auto Retry connection after Disconnected	60	sec	60	0	255
AS-FCOPM Bit Rate	1000k	bps	125k	-	-

Turn the FORMAT1 knob to 8, and it is in Delta Special Driver & AS Remote Mode. In this mode, an AS series CPU PLC can connect to as many as 7 AS00SCM-A modules, as long as they are all in RTU mode. The RTU station number should be set from 9 to 15 in numerical order. RTU mode and baud rate cannot be set via ISPSoft (HWCONFIG). Use the knob ID2 to set up Node ID and use the knob FORMAT2 to set up the baud rate. (The baud rate should be the same as the PLC's baud rate.)

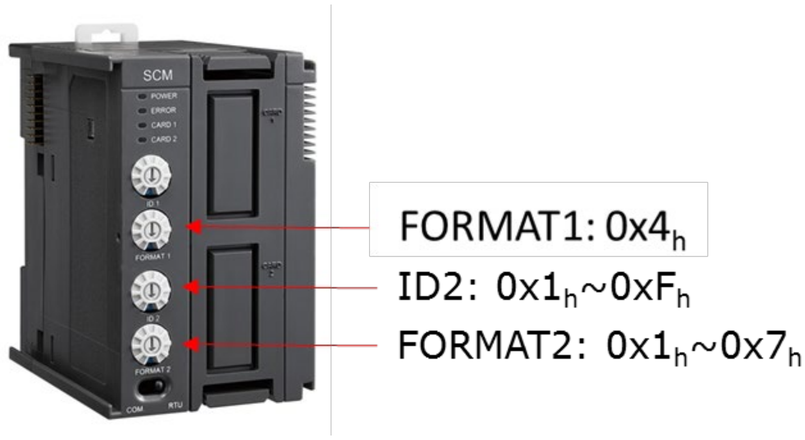


Steps for a quick setup

1. Set up the PLC: Delta Special Driver & AS Remote Modem mode, number of the device: 1; baud rate: 1000kbps; download the parameters.
2. Set up AS00SCM-A; set the ID1 knob to 0 and FORMAT1 to 8; ID2 knob to 9 and FORMAT2 to 7.
3. Supply power to AS00SCM-A and connect AS00SCM-A to the PLC with a CANopen cable.
4. Resupply power to the PLC and the indicator of CARD2 should keep blinking. That indicates AS00SCM-A and the PLC are connected. The PLC error indicator should be blinking too, since the setting is not done yet.
5. Use HWCONFIG to scan the connected devices to see if AS00SCM-A is connected.
6. Download the parameters and check if the PLC error indicator has stopped blinking. Then the setting of one RTU device is complete.

9.4.1.3 CANopen DS301 Mode

- This mode supports AS Series PLC acts as the CPU and the 3rd party CANopen DS301 devices (non-AS series devices and non-Delta PLC). When using Delta PLC as the CPU, you need to use CANopen Builder to set up.
- Before using a 3rd party PLC, use AS Series PLC as the CPU and select the AS Remote Communication Mode.
- Before connecting to CANopen DS301, turn the AS00SCM-A FORMAT1 knob to 4, and the adjustable range for station knob ID2 becomes $0x1_h$~$0xF_h$. This mode is used to communicate with a Master PLC from other brand. See the detail in section 9.6.3. when the PDO data is mapped, AS00SCM-A can control the IO modules from its right side.
- Double-click the AS Series PLC, then in Device Setting click Function Card 2 Setting and set the function card 2 to AS-FCOPM, set to working mode to CANopen DS301.



Steps for a quick setup

1. Set up the PLC: in AS Remote Communication Mode, connect AS series PLC to AS00SCM-A, refer to section 9.4.1.1 for more details.
2. Use AS series PLC to scan the I/O modules installed on the right-side of AS00SCM-A and download the parameters.
3. If using HWCONFIG to set up the node ID, you can use COM mode to connect AS00SCM-A to the right-side of AS series PLC directly and no I/O module behind it. Use AS series PLC's HWCONFIG to scan and add AS00SCM-A in and then double-click the module to set up its node ID and then download the parameters. After that, knob ID2 to 0.
4. Install the I/O module to the right side of AS00SCM-A and turn the working mode to RTU.
5. Turn FORMAT1 to 4 and use the CANopen cable to connect to the PLC, and then supply power to AS series PLC.
6. Follow master's CANopen setting method to install the slaves.

Refer to section 9.6.3 PDO examples, if you are using AH10COPM-5A as the CPU.

9

9.4.2 EtherNet/IP Mode

AS-FEN02 can be installed on AS00SCM-A (firmware V2.02 or later). However AS00SCM-A can only be used in RTU mode. You can use Delta PLC or the 3rd party EtherNet/IP device to control the right-side modules of the AS00SCM-A. Refer to section 10.2.7 for more details on the operations of AS-FEN02 installed on AS Series PLC.

9.4.2.1 LED Indicators

- AS00SCM-A acting as a remote module

LED Indicator	Description
CARD 1 LED indicator	Orange light blinking: when AS-FEN02 sends data to AS00SCM-A
CARD 2 LED indicator	Orange light blinking: when AS00SCM-A sends data to AS-FEN02
Error LED indicator (red)	Indicates if there is any error on the module OFF: the module is operating normally Blinking: an error has occurred or occurs on the module; refer to section 9.7 for more information.

- AS-FEN02 installed on AS00SCM-A

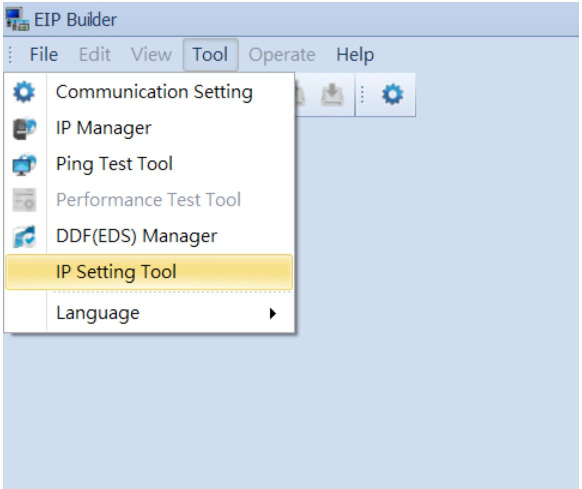
LED Indicator	Description
MS indicator	Indicates the status of the communication card Green light ON: the operation is normal Green light Blinking: the setting is not complete Red light ON: internal communication failure, NOT being able to recover Red light Blinking: internal communication timeout OFF: no power
NS indicator	Indicates the status of Ethernet connection Green light ON: a CIP connection is established Green light Blinking: a CIP connection is not established Red light ON: duplicated IP address, after fixing this issue, resupply the power Red light Blinking: communication timeout / CIP connection is established after power-on / IP address change OFF: no power / network cable is not connected
LINK indicator X1/X2	Indicates the status of Ethernet connection Green light ON: a network connection is established OFF: a network connection is not established
ACT indicator X1/X2	Indicates the status of Ethernet communication Orange BLINKING: data transmission OFF: no data transmission

9

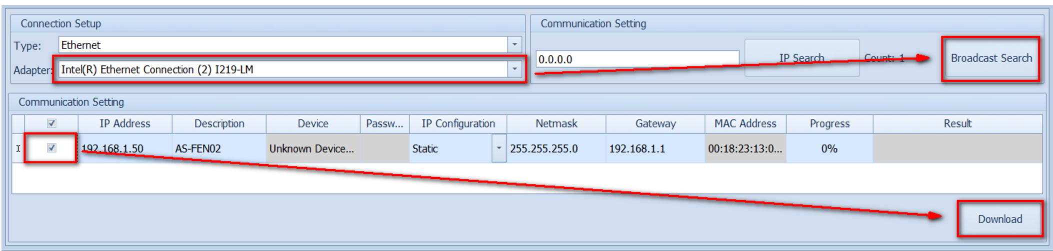
9.4.2.2 IP Setting Tool

AS-FEN02 can be installed on AS00SCM-A (firmware V2.02 or later) so that AS00SCM-A can act as a remote module. When the knob is set to 0, the IP address is 192.168.1.3 by default. If there are more than one AS00SCM-A in the system, you need to set up the IP addresses for them. Three methods for you to set up the IP addresses for AS-FEN02 installed on AS00SCM-A.

- Using knobs: Highly suggested. You can use ID2 and FORMAT2 knobs to set up the IP address. Hexadecimal format is used and ID2 corresponds to $x16^1$ and FORMAT 2 to $x16^0$. The possible IP address is 192.168.1.x, x=1~FE (1~254).
- Using EIP Builder: You can use **IP Setting Tool** in EIP Builder to set up the IP address. But first you need to check the sticker on the AS-FEN02 communication card for the MAC address.
  - ◆ Open EIP Builder and add AS00SCM (RTU) + AS-FEN02 to your network. Make sure all four knobs on the AS00SCM-A (remote module) are turned to 0. And then use Ethernet to connect with your computer.
  - ◆ Select **IP Setting Tool** from the **Tool** on the tool bar to scan for the device for IP address setup.

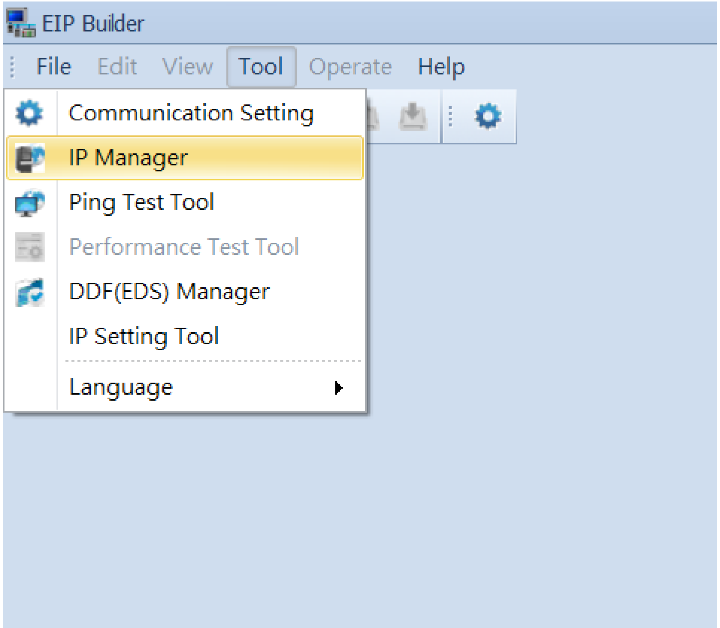


  - ◆ Select the adapter type and click **Broadcast Search** and then you can edit the parameters. After the editing is complete, select the device you'd like to download and then click **Download**.

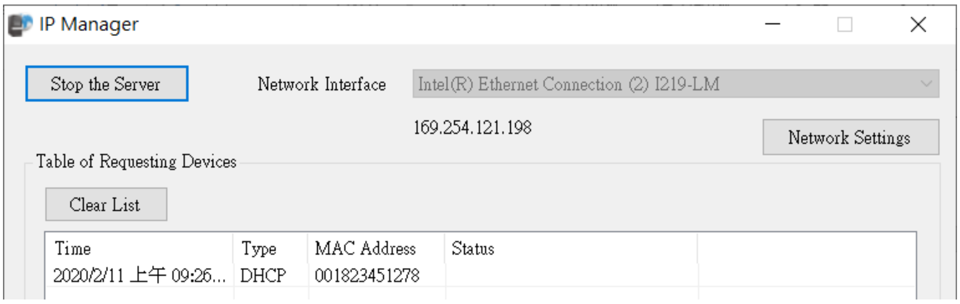


  - ◆ Using **IP Setting Tool**, you can also edit the devices in different network segments. For example, the IP address of the device by default is 192.168.1.3 but the IP address of the computer is 192.168.10.5. You can use **IP Setting Tool** to edit the device IP address. This tool uses MAC address to recognize the identities of different devices and thus the IP duplication is allowed. It is very useful when you need to edit the IP addresses of multiple devices at the same time, as long as you know the MAC address of each device.
  - ◆ Using **IP Setting Tool** to change the IP setting mode to DHCP. And after that you can go to **IP Manager** to set up the correspondences between the specific MAC address and specific IP address. Follow the steps below for DHCP setup.

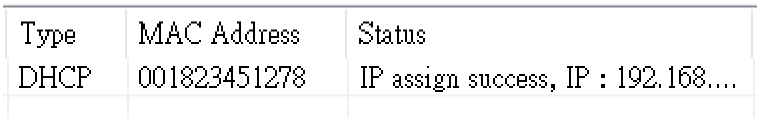
- Using DHCP: Besides using **IP Setting Tool** to set the IP setting mode to DHCP mode, you can also use knob to set the mode to DHCP.
    - When both ID1 and FORMAT 1 are set to 0 and both ID2 and FORMAT 2 are set to F, IP setting mode is in DHCP mode. And then use Ethernet to connect with your computer.
    - Open EIP Builder and select **IP Manager** from the **Tool** on the tool bar.



- Click **Stop the Server** and then select a suitable **Network Interface**. Click **Start the Server** to complete the setting. After that, you need to turn the power OFF and then ON so that the devices will send DHCP requests to the computer.



- Check the device in the DHCP request form to assign the IP address to its corresponding MAC address. You can also export the corresponding table. After the assignment is complete, you can see the result in the status section.



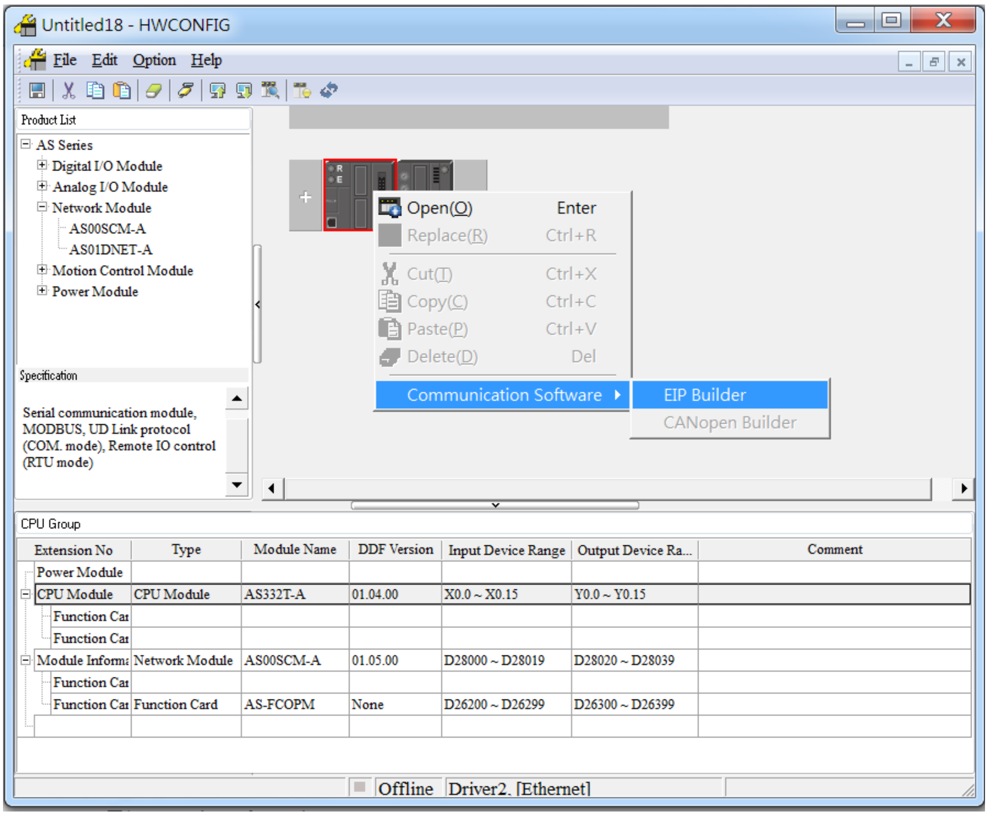
Type	MAC Address	Status
DHCP	001823451278	IP assign success, IP : 192.168....

- After IP setting is complete, you can decide whether to disable DHCP function or not. If the system is in the absence of a DHCP server (or use **IP Setting Tool** only for once), it is suggested to use **IP Setting Tool** to change the IP setting mode to static mode. If the system includes a DHCP server, it is suggested to keep the IP setting mode in DHCP mode. Whenever the power of the remote module is OFF, the system clears all the IP parameters and sends DHCP request out whenever the power of the remote module is ON to make sure the DHCP server is working.

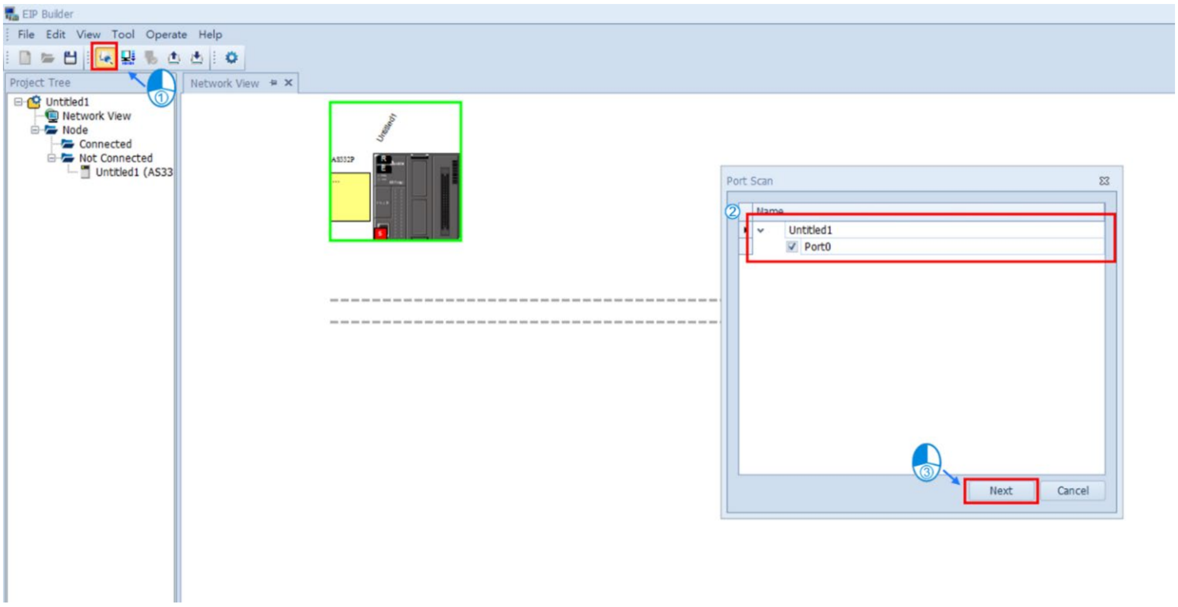
9.4.2.3 Connecting to Delta PLC Scanner through EIP Builder

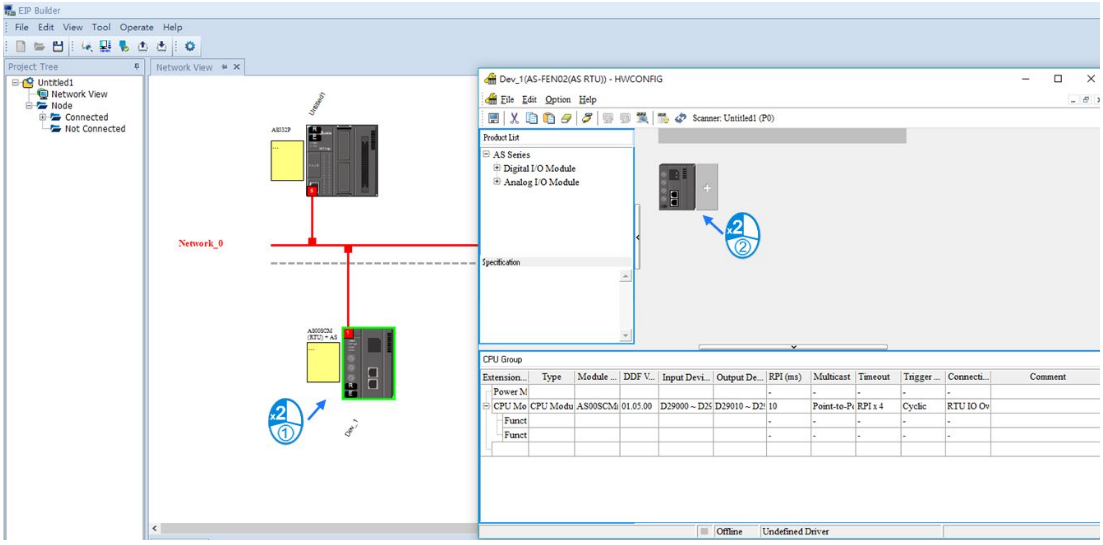
Through EIP Builder, an AS Series PLC (when acting as a scanner) can create an EtherNet/IP connection to AS00SCM-A (when installed) on AS-FEN02. Below shows an example of AS Series PLC acting as a scanner to create an EIP connection.

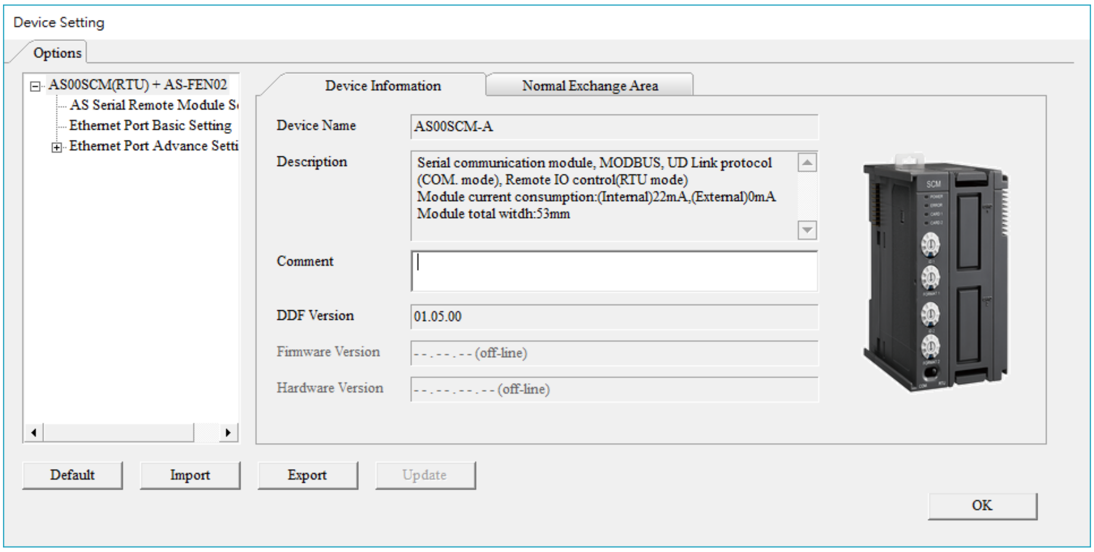
1. An AS Series PLC, AS-FEN02 and a computer can be connected together through an Ethernet knob. Configure the parameters in HWCONFIG and right-click the CPU to open EIP Builder.



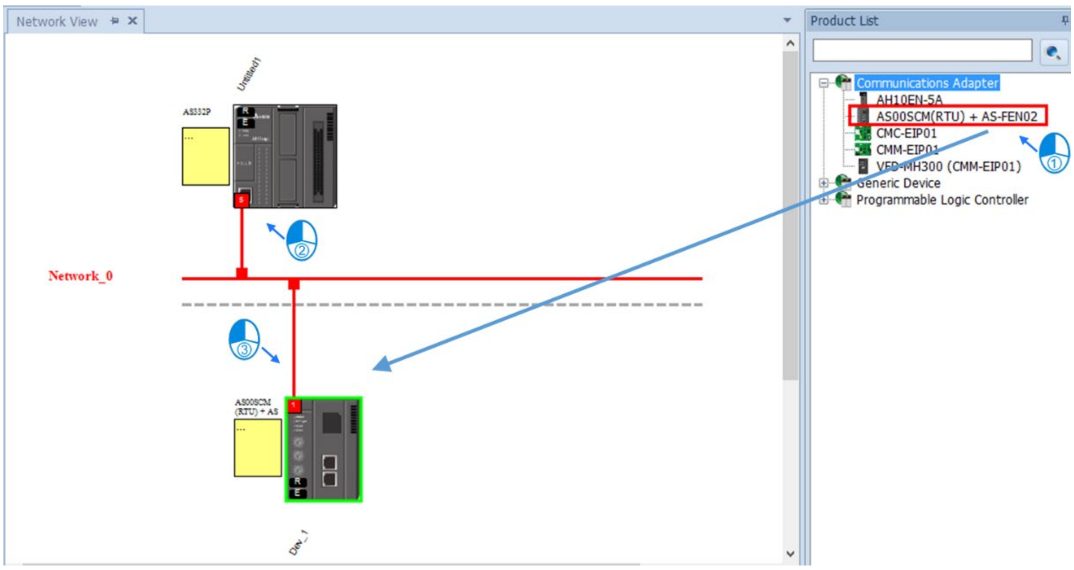
2. Scan the network to add AS-FEN02 (AS RTU) in EIP Builder. Drag the red block and drag it to the same network (Network_0) as the AS Series PLC does. Double-click AS-FEN02 to open HWCONFIG and set the parameters for AS-FEN02.





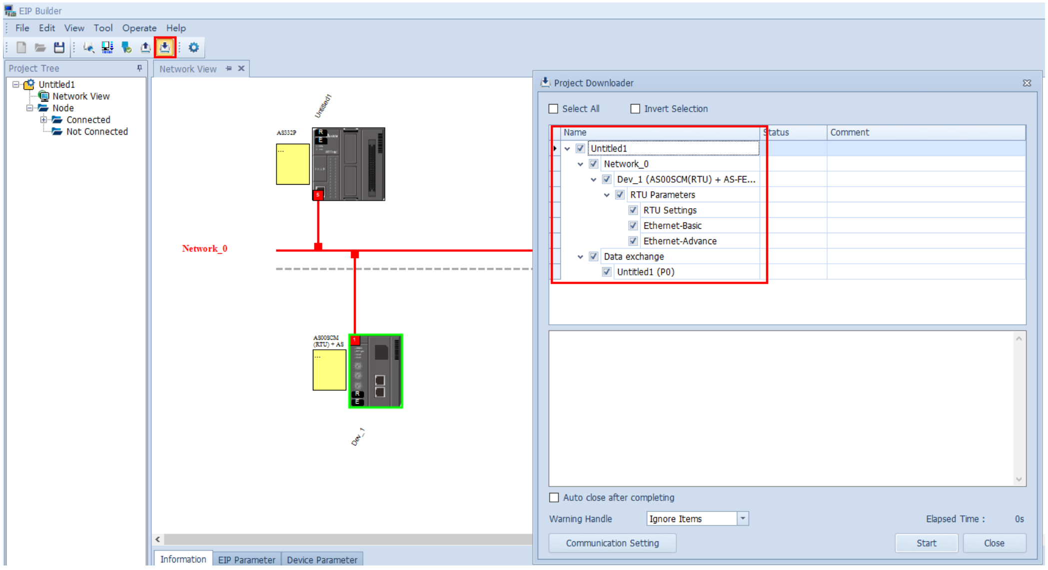


3. If the PLC is not connected to any module, you can drag and drop AS-FEN02 (AS RTU) from the Product List on the right to add it into the Network View.



4. After the settings are complete, click the Downloader icon and then select the parameters that you'd like to download. Parameters include:

- RTU parameters: all the parameters set in the previous step
- Data Exchange: data mapped from the RTU right-side modules of AS00SCM-A to the PLC



5. While downloading, the connection of PLC and RTU is off. After the downloading is complete, the connection will be re-established. Refer to section 9.4.3 for more details on the connection establishment of AS00SCM-A RTU modules.

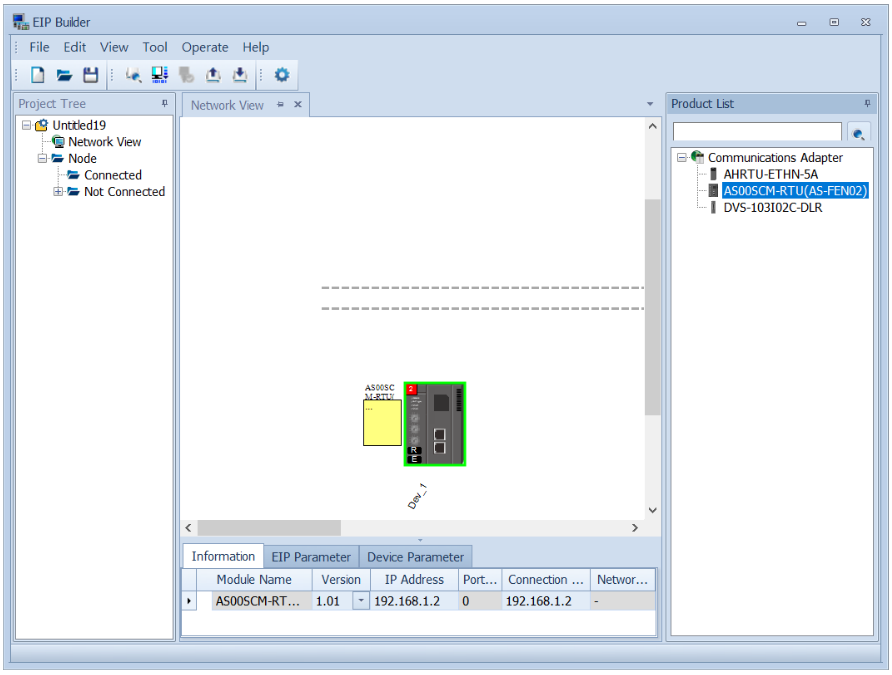
9

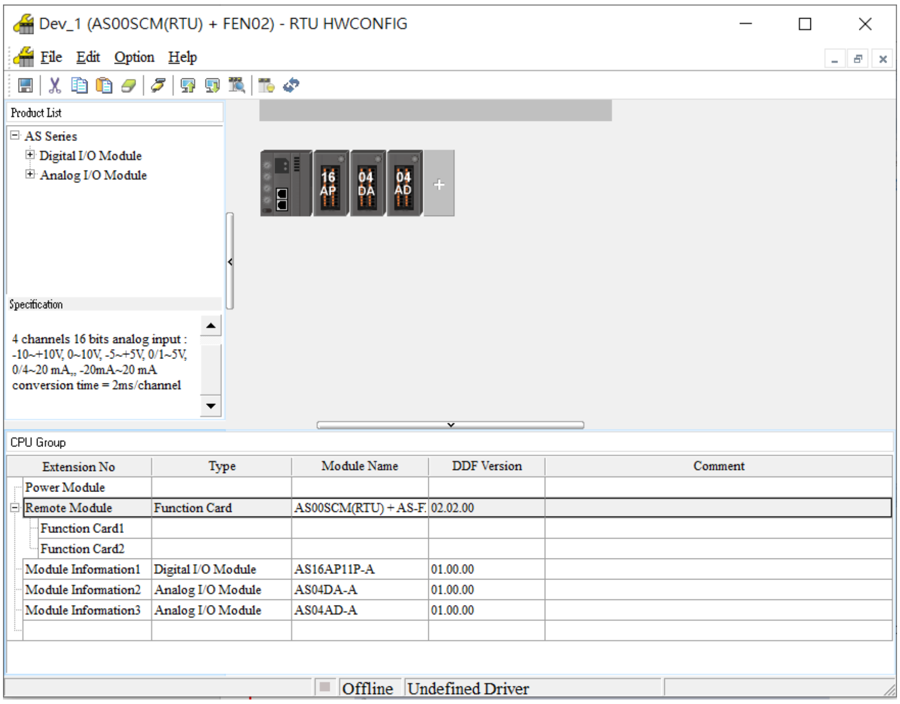
9.4.2.4 Connecting to 3rd Party PLC Scanner through EIP Builder

Through EIP Builder, a 3rd party PLC (when acting as a scanner) can create an EtherNet/IP connection to AS00SCM-A (when AS-FEN02 is installed). Use the 3rd party PLC to connect to the computer and open EIP Builder to edit the right side modules of AS00SCM-A.

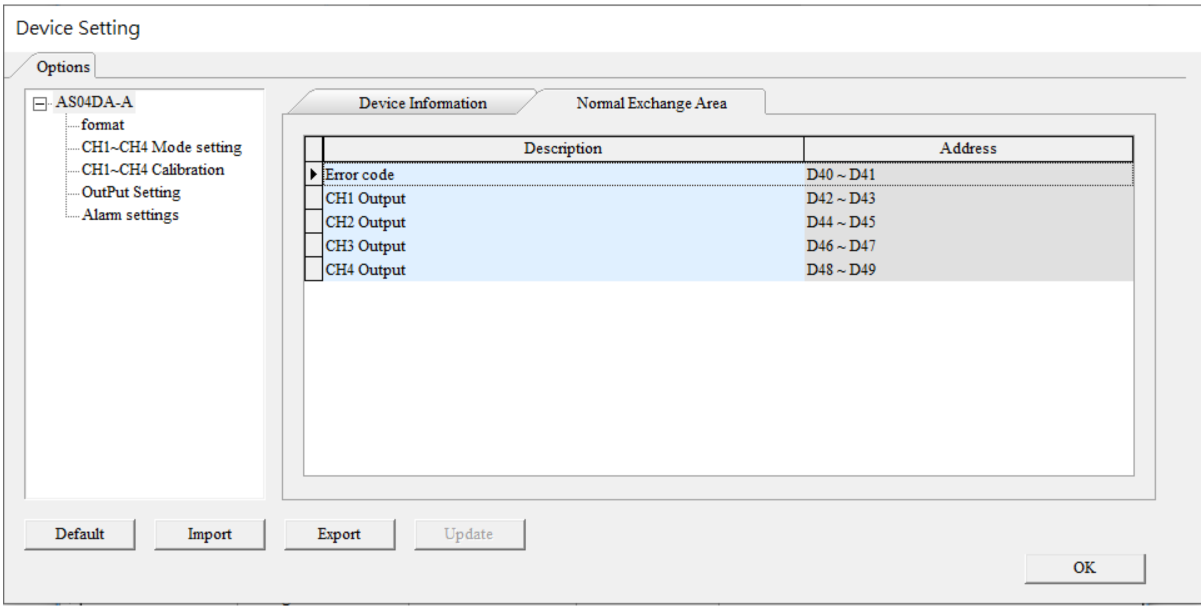
- Editing via EIP Builder:

1. You can manually or scan the network to add the AS00SCM(RTU) + AS-FEN02 to the network. Click the remote module to open HWCONFIG to scan and download the parameters of the right side modules of AS00SCM-A.



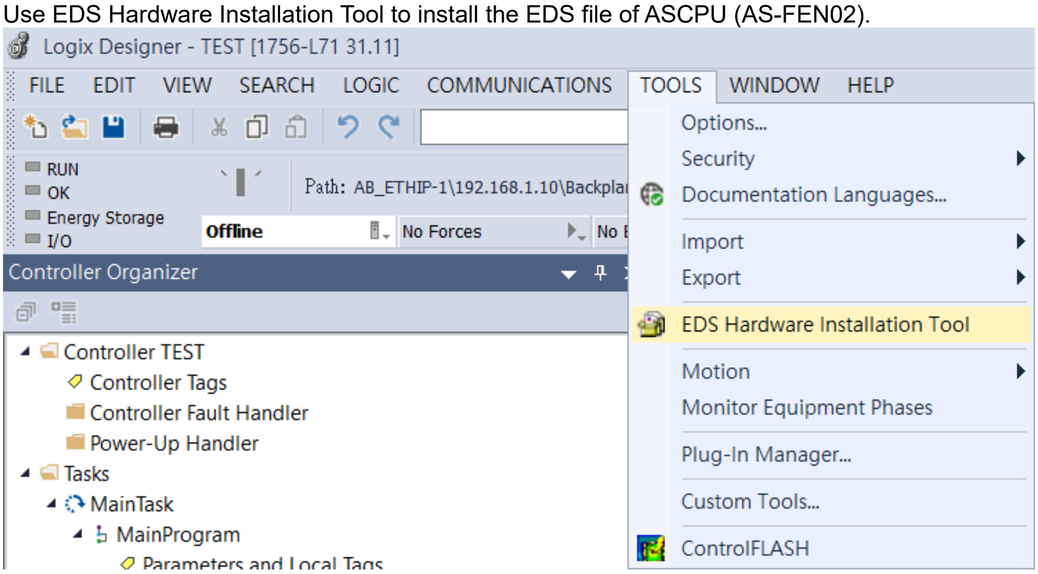


2. Write down the information in Normal Exchange Area. This is the working order for the 3rd party device to perform the data exchange. Use AS04DA-A as an example, the first input value is the error code. (all of the module error codes are the input values; the exchange direction is from remote module inputs to scanner) the 1st value is the value in channel 1; the 2nd value is the value in channel 2 and so forth. The unit is REAL.

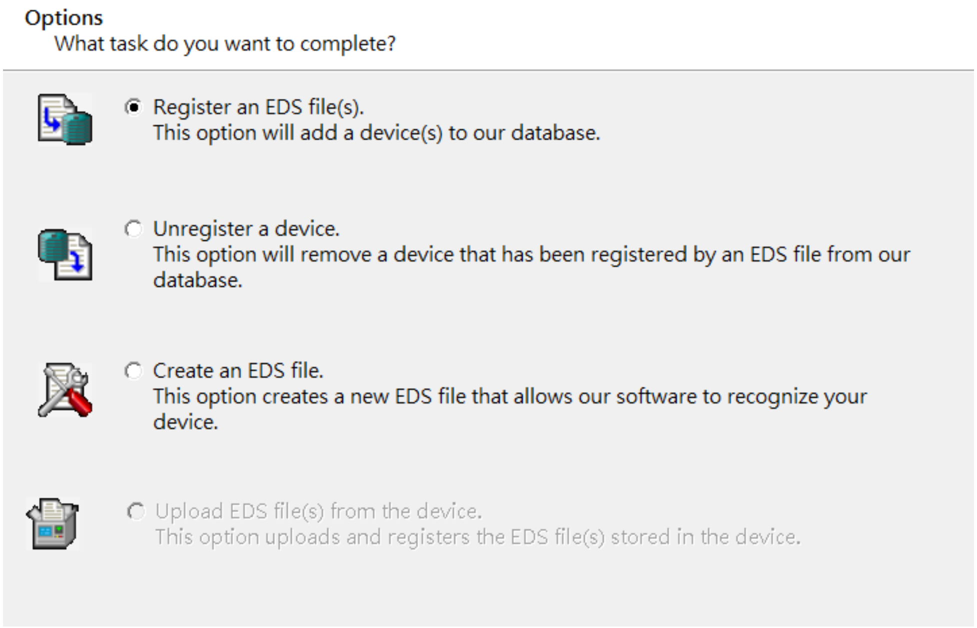


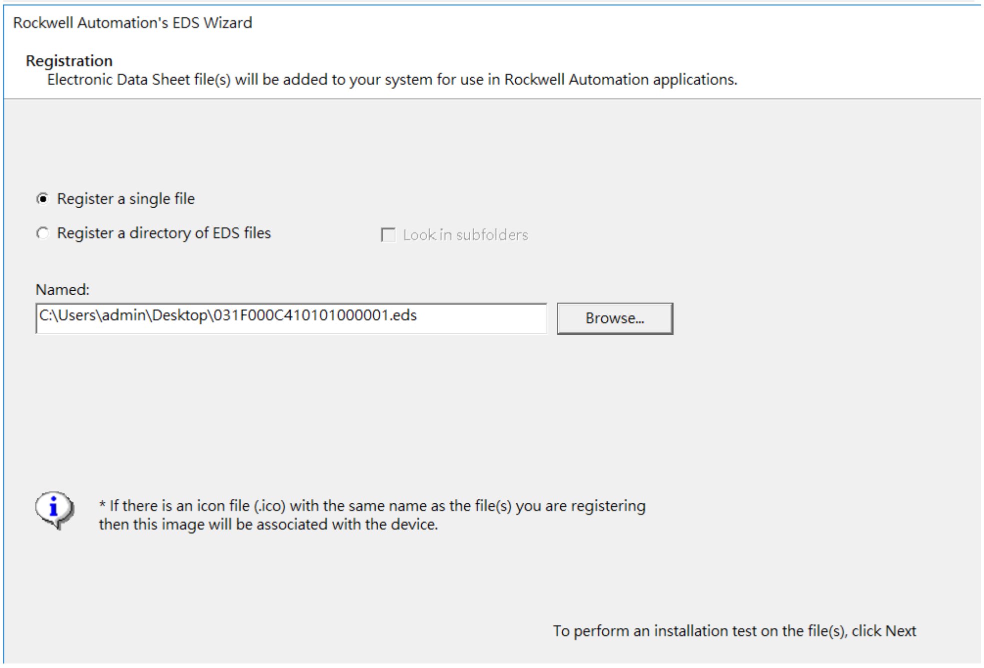
- The following example uses Rockwell software Studio 5000. Before you begin, you need to go to www.deltaww.com to download EDS file.

  1. Use EDS Hardware Installation Tool to install the EDS file of ASCPU (AS-FEN02).

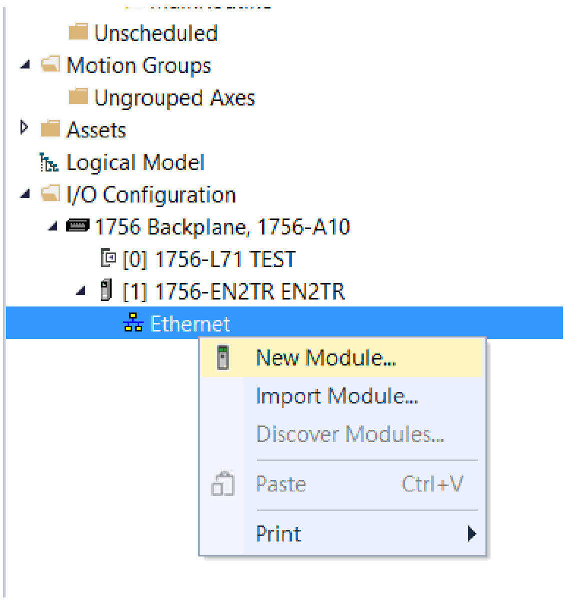


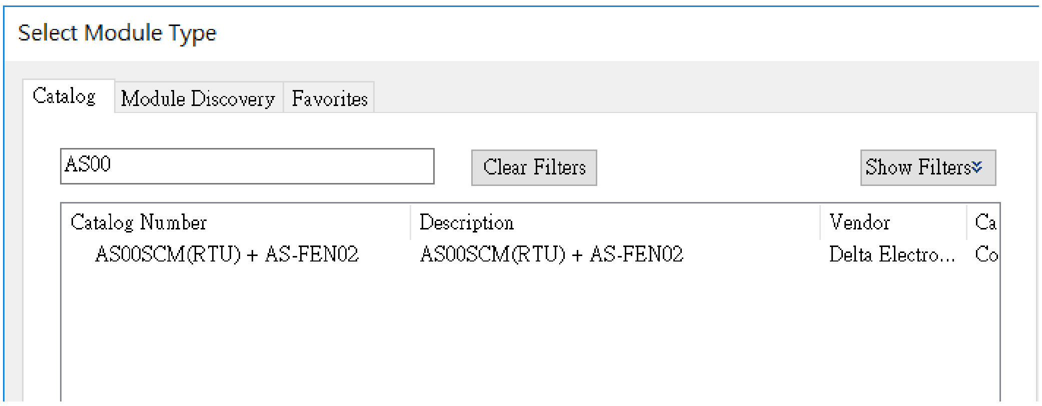
9

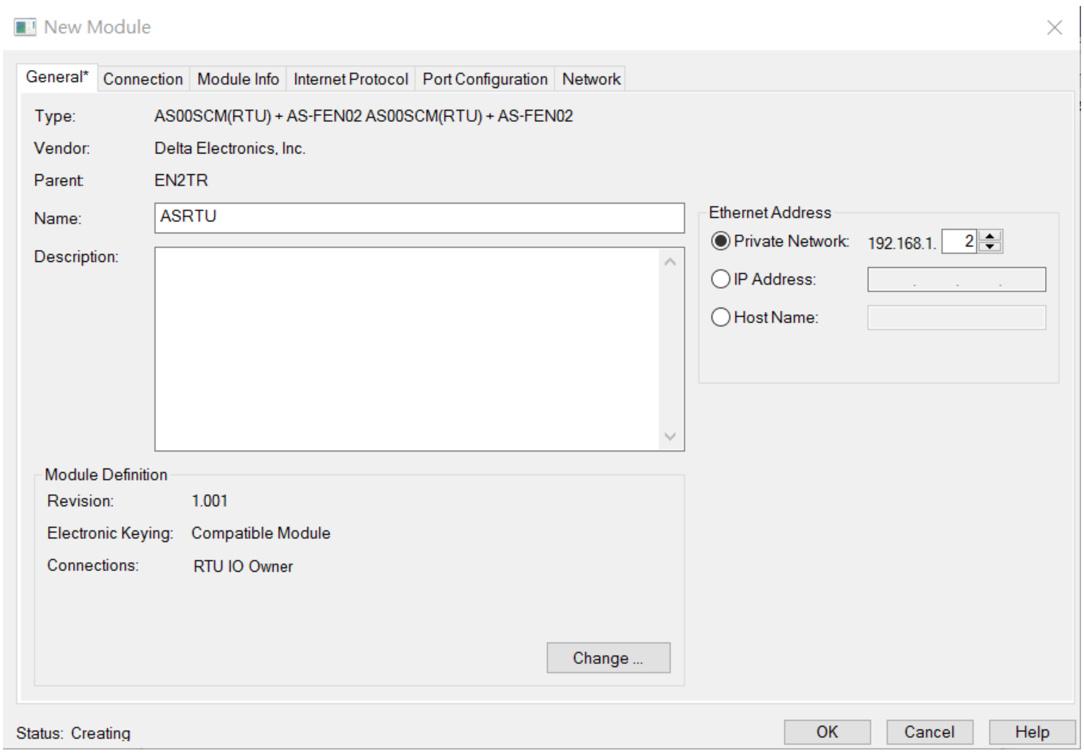

Options
What task do you want to complete?
Register an EDS file(s).
This option will add a device(s) to our database.
Unregister a device.
This option will remove a device that has been registered by an EDS file from our database.
Create an EDS file.
This option creates a new EDS file that allows our software to recognize your device.
Upload EDS file(s) from the device.
This option uploads and registers the EDS file(s) stored in the device.


Rockwell Automation's EDS Wizard
Registration
Electronic Data Sheet file(s) will be added to your system for use in Rockwell Automation applications.
Register a single file
Register a directory of EDS files
Look in subfolders
Named:
C:\Users\admin\Desktop\031F000C410101000001.eds
Browse...
* If there is an icon file (.ico) with the same name as the file(s) you are registering
then this image will be associated with the device.
To perform an installation test on the file(s), click Next

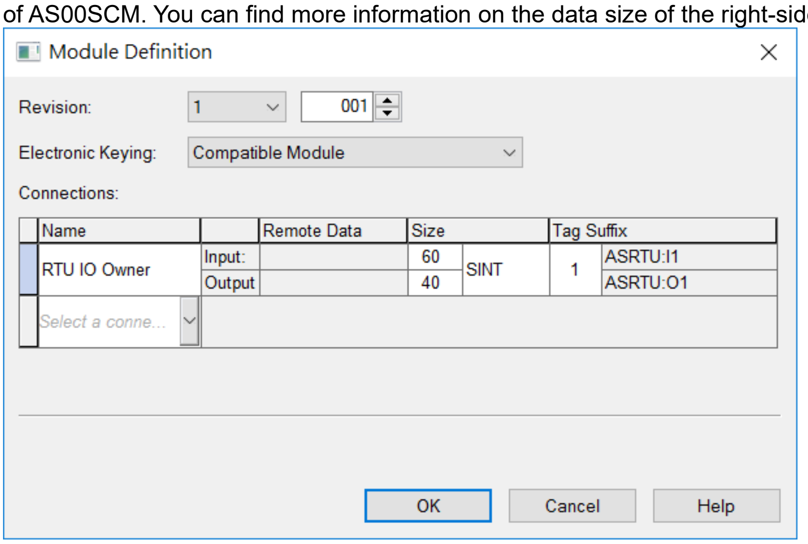
2. Right-click **Ethernet** to see the context menu and click **New Module** to add a new device in.







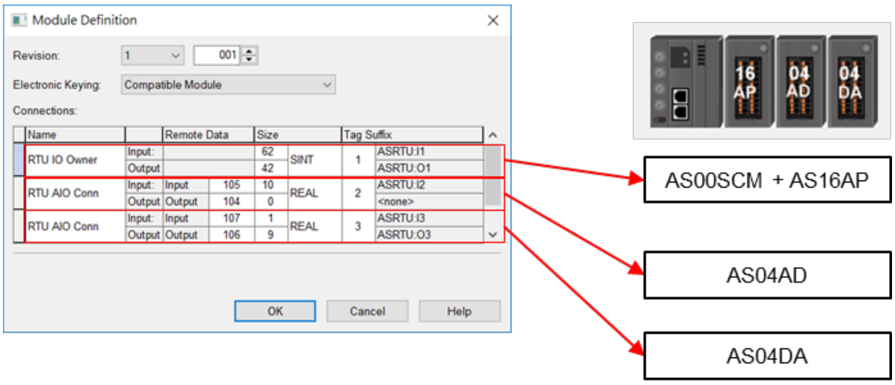
3. Click **Change** in the section of Module Definition under the General tab to change the data length (see the image above). You can see the default data size as shown below. Here only shows the data exchange area of AS00SCM. You can find more information on the data size of the right-side modules in the following steps.



4. Digital modules: the data size of every digital modules is incremented in **RTU IO Owner**. You can refer to the following table for the data size of each module; the unit is INT. When converting INT value to SINT value, the INT value needs to multiply 2 and add the sum to the value to make it a SINT value. Use AS16AP11P-A as an example, if the INT value is 1 and to convert it to SINT value, the INT value 1 multiplies 2 is 2. Add the sum 2 to the value to make it a SINT value. The input data size is 62 (60+ (1*2)), the output data is 42 (40+(1*2)).

Digital I/O Module	I/O Data Length (Unit: INT)	
	ASRTU-FEN02 → EtherNet/IP Scanner (Input)	EtherNet/IP Scanner → ASRTU-FEN02 (Output)
AS08AM10N-A	1	0
AS08AN01T-A	0	1
AS08AN01P-A	0	1
AS08AN01R-A	0	1
AS16AM10N-A	1	0
AS16AP11T-A	1	1
AS16AP11P-A	1	1
AS16AP11R-A	1	1
AS16AN01T-A	0	1
AS16AN01P-A	0	1
AS16AN01R-A	0	1
AS32AM10N-A	2	0
AS32AN02T-A	0	2
AS64AM10N-A	4	0
AS64AN02T-A	0	4

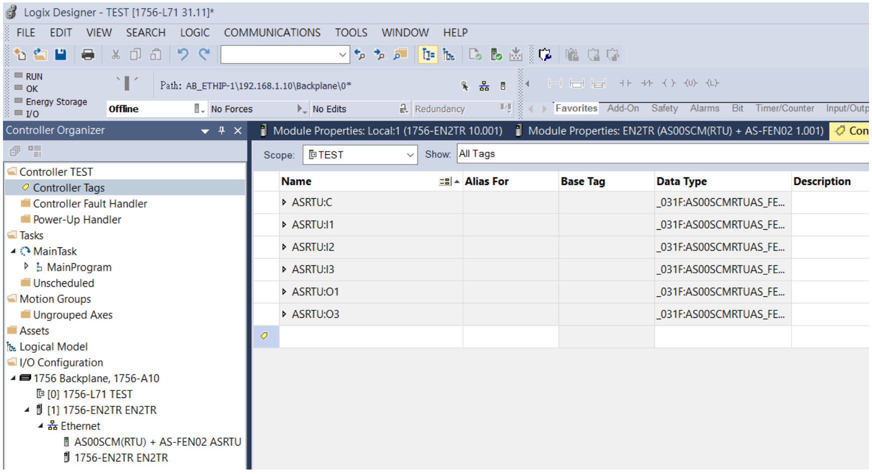
5. Analog module: Refer to the following table to enter the corresponding instances in the fields. The following example shows AS04AD-A is installed in I/O 2. And according to the table below, you need to enter the value 105 in the field of input and 104 in the field of output in the Remote Data section. As for the data size, enter 10 for the input and 0 for the output. The unit is REAL.

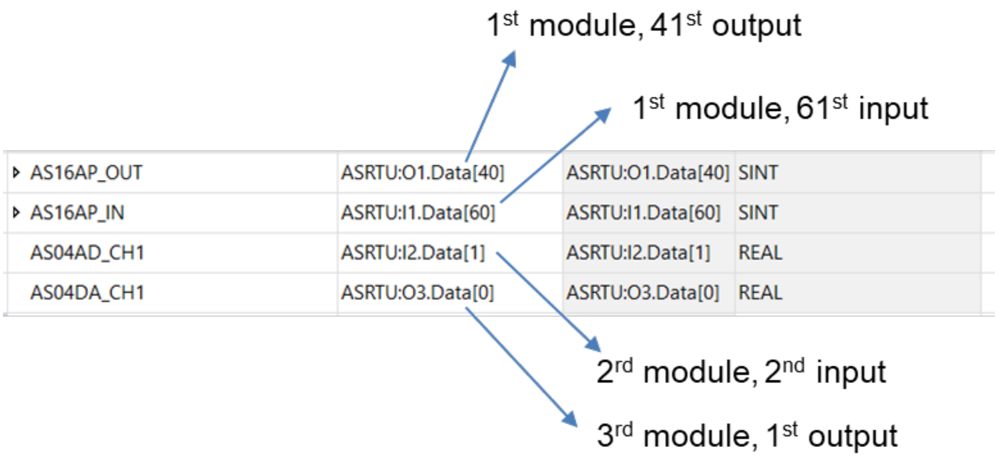


	I/O 1	I/O 2	I/O 3	I/O 4	I/O 5	I/O 6	I/O 7	I/O 8
Input	103	105	107	109	111	113	115	117
Output	102	104	106	108	110	112	114	116

Analog I/O Module	I/O Data Size (Unit: REAL)	
	ASRTU-FEN02 → EtherNet/IP Scanner (Input)	EtherNet/IP Scanner → ASRTU-FEN02 (Output)
AS04AD-A	10	0
AS08AD-B	10	0
AS08AD-C	10	0
AS04DA-A	1	9
AS06XA-A	5	5
AS04RTD-A	10	0
AS06RTD-A	10	0
AS04TC-A	10	0
AS08TC-A	10	0

6. After the setting is complete, you can see the data exchange area of the remote module in Controller Tag. The first module on the right side can start data mapping from the 41st byte (Data[40]). See the image below. ASRTU: bit0~bit7 of O1.Data[40] are mapping to Y0~Y7 of AS16AP11P-A and 13.Data is to AS04AD-A and so forth.

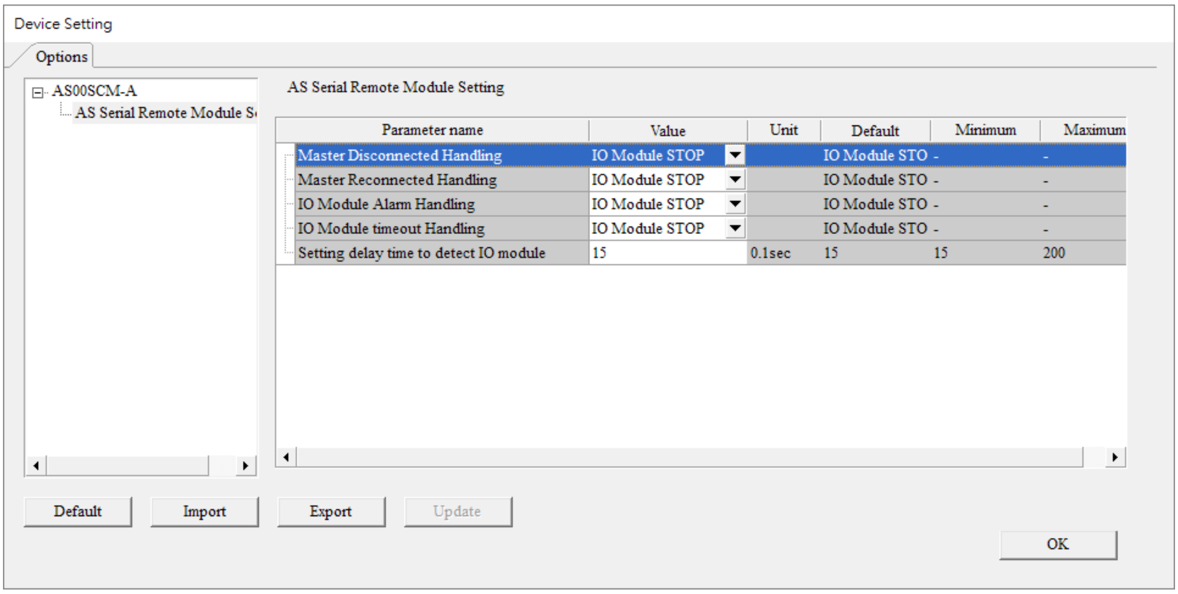




9

9.4.3 Remote Module Setting

1. Double-click AS00SCM-A -> AS remote module in Device Setting and click **AS Serial Remote Module**. To set up the remote module in RTU mode, set the function card type 2 to AS-FCOPM, AS-FEN02 or AS-FPFN02:



For the following four situations, you can either stop I/O module (all I/O modules stop running) or keep I/O module running (all I/O modules keep the same state).

1) When a Master connection is lost
- I/O modules stop running: all I/O modules stop running
- I/O modules keep the same state: all modules keep running

2) When a Scanner has reconnected after the connection lost
- I/O modules stop running: all I/O modules stop running
- I/O modules keep the same state: all modules keep running

3) When an alarm occurs in an I/O module
- I/O modules stop running: all I/O modules stop running (after resupply power to resume running)
- I/O modules keep the same state: all modules keep running

4) When an I/O connection is lost
- I/O modules stop running: all I/O modules stop running (after resupply power to resume running)
- I/O modules keep the same state: all modules keep running

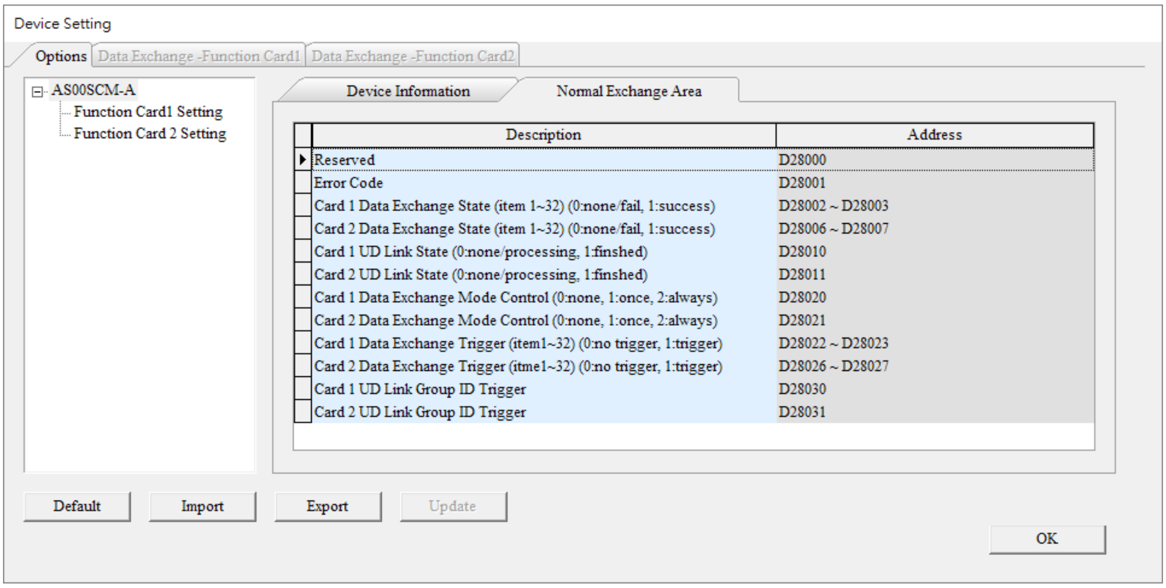
<table>
<tr><th rowspan="2">Procedure</th><th rowspan="2">Settings (RTU)</th><th rowspan="2">Digital & Analog Input Modules</th><th rowspan="2">Digital Output Modules</th><th colspan="2">Analog Output Module (I/O Module Settings)</th></tr>
<tr><th>Clear</th><th>Keep</th></tr>
<tr><td rowspan="2">Master connection lost</td><td>I/O module stops running</td><td rowspan="2">Cannot update data on the master</td><td>Output value = 0</td><td>Output value = 0</td><td>No change to the output value</td></tr>
<tr><td>I/O module keeps the same state</td><td colspan="3">No change to the output value</td></tr>
</table>

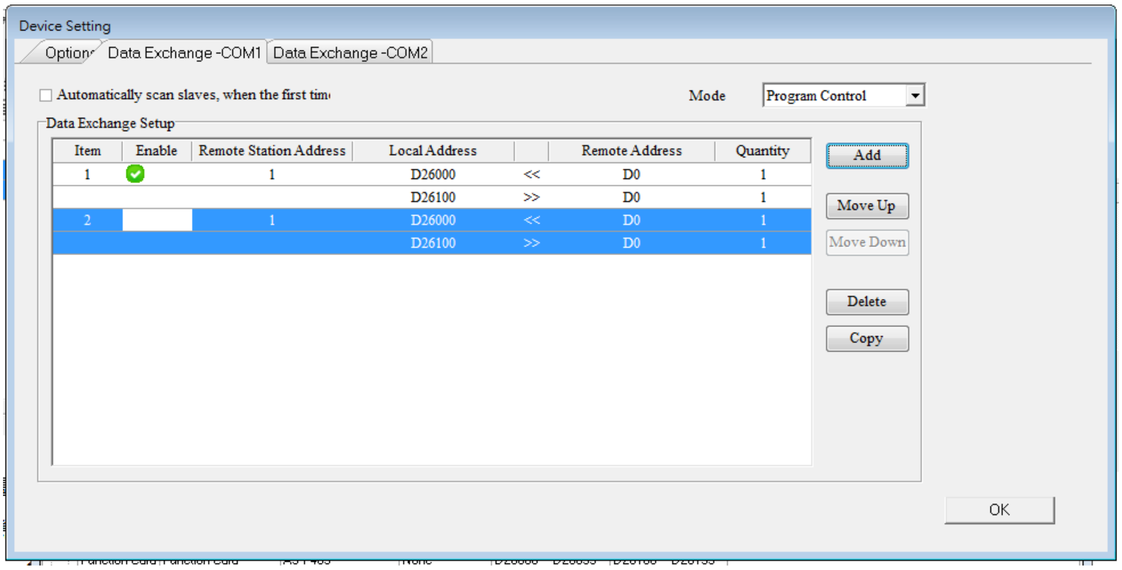
<table>
<tr><td rowspan="2">Master has reconnected after connection lost.</td><td>I/O module stops running</td><td rowspan="2">Keep updating data on the master</td><td>Output value = 0</td><td>Output value = 0</td><td>No change to the output value</td></tr>
<tr><td>I/O module keeps the same state</td><td colspan="3">Output value = output value of the master</td></tr>
<tr><td rowspan="2">Alarm in I/O module (Ex. module is broken)</td><td>I/O module stops running</td><td>No change to the output value</td><td>Output value = 0</td><td>Output value = 0</td><td>No change to the output value</td></tr>
<tr><td>I/O module keeps the same state</td><td>Other functional modules: keep updating data on the master</td><td colspan="3">Other functional modules:
output value = output value of the master</td></tr>
<tr><td rowspan="2">I/O connection lost (Ex. unstable connection)</td><td>I/O module stops running</td><td>No change to the output value</td><td>Output value = 0</td><td>Output value = 0</td><td>No change to the output value</td></tr>
<tr><td>I/O module keeps the same state</td><td>Other functional modules: keep updating data on the master</td><td colspan="3">Other functional modules:
output value = output value of the master</td></tr>
</table>

- Module configurations: refer to Section 9.1.2 in the AS Series Operation Manual.
- Module setups: refer to other chapters in the AS Series Module Manual.

9.5 Normal Exchange Area

1) COM mode

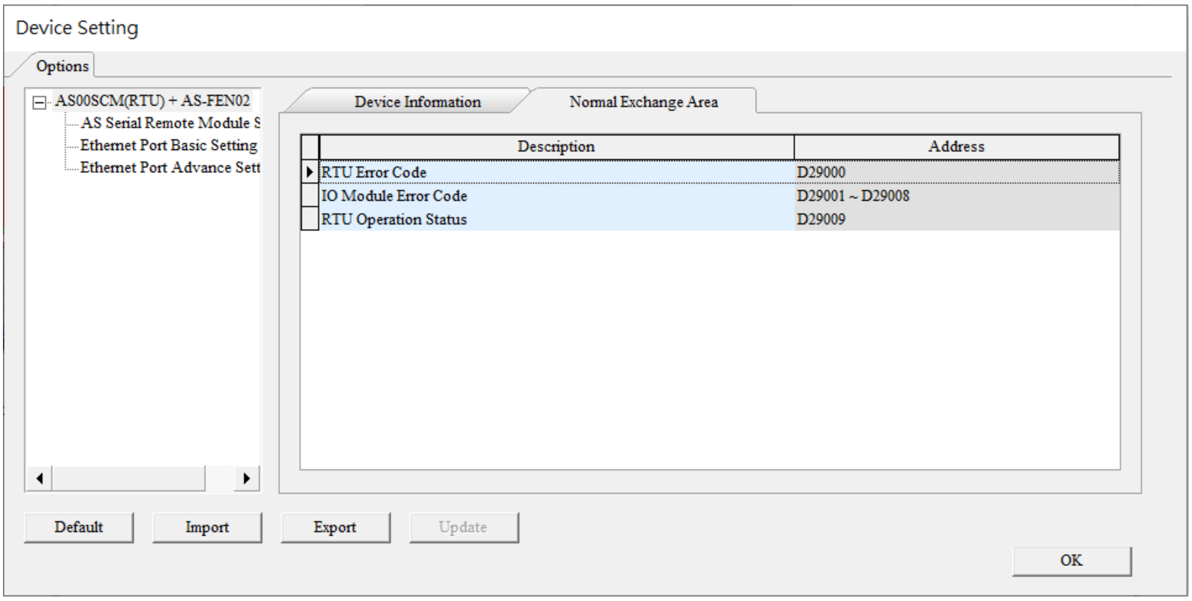




In the examples above, note that the Normal Exchange Area shows the corresponding data registers of the module and the PLC.

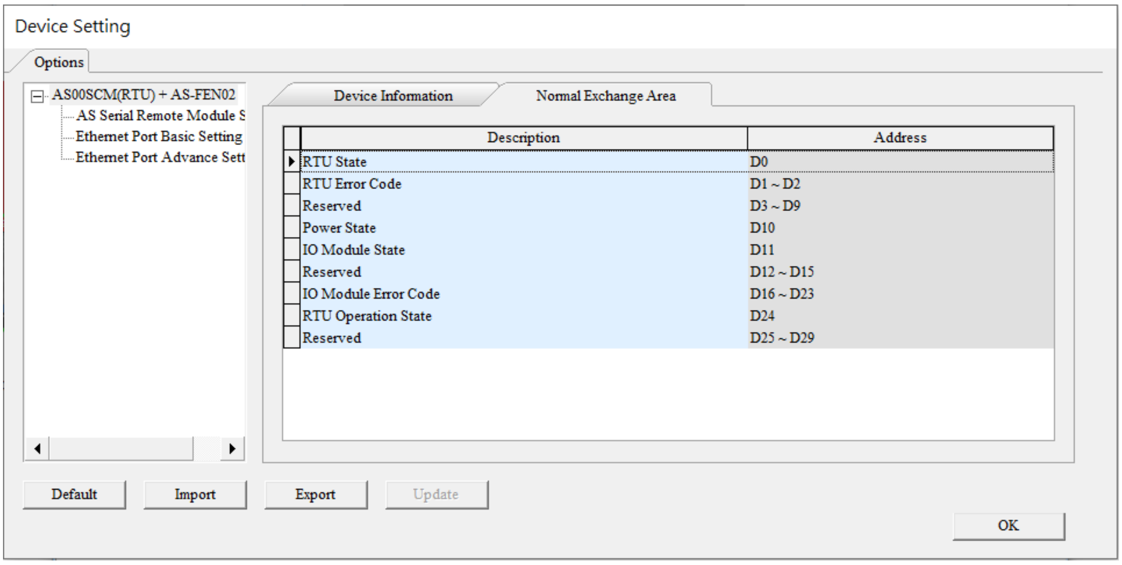
- Module Status: 0 = stop, 1 = run
- Error Code: refer to Section 9.7 for more information.
- Card 1 & Card 2 Data Exchange State: occupies 4 data registers (32-bit data); each bit 1–32 represents the state of the corresponding data point 1–32 to be exchanged: 0 = none/fail, 1 = success.
- Card 1 & Card 2 Data Exchange Mode Control: set the data register to 0: none, 1: once, 2: always.
- Card 1 & Card 2 Data Exchange Trigger: occupies 4 data registers; each bit 1–32 represents the state of the corresponding data point 1–32 to be exchanged: 0 = no trigger, 1 = trigger.
- Card 1 & Card 2 UD Link Group ID Trigger: set the group ID to be triggered.

2) RTU Mode: (AS Series PLC acting as a Scanner)



- RTU Error Code: refer to Section 9.7 for more information.
- I/O Module Error Code: refer to the I/O module manual for more information.
- RTU Operation Status: 0 = communication module stop, 1 = communication module run

3) RTU Mode: (AH Series PLC acting as a Scanner)



- RTU State: 0 = communication module is working fine, 1 = communication module is NOT working fine.
- RTU Error Code: refer to Section 9.7 for more information.
- Power State: 0 = power error, 1 = power normal
- I/O Module State: each I/O module uses 1 bit to show its status (0 = normal , 1 = not running normally)
- I/O Module Error Code: refer to the I/O module manual for more information.
- RTU Operation State: 0 = communication module stop, 1 = communication module run

9.6 Application

9.6.1 Modbus

This section introduces how to use the Modbus protocol to connect the AS00SCM-A to other Delta industrial products such as human-machine interfaces, temperature controllers, programmable logic controllers, AC motor drives, and servo motors.

9.6.1.1 Modbus Slave – Connection to Delta Products

The following table shows the slave station supports the following function codes and their corresponding addresses.

Function Code	Attribute	Addresses Supported
0x03 0x04	Read	16#0000–16#0063 16#0100–16#0163 16#0200–16#0263 16#0300–16#0363
0x06 0x10	Write	16#0000–16#0063 16#0200–16#0263
0x17	Read	16#0000–16#0063 16#0100–16#0163 16#0200–16#0263 16#0300–16#0363
	Write	16#0000–16#0063 16#0200–16#0263

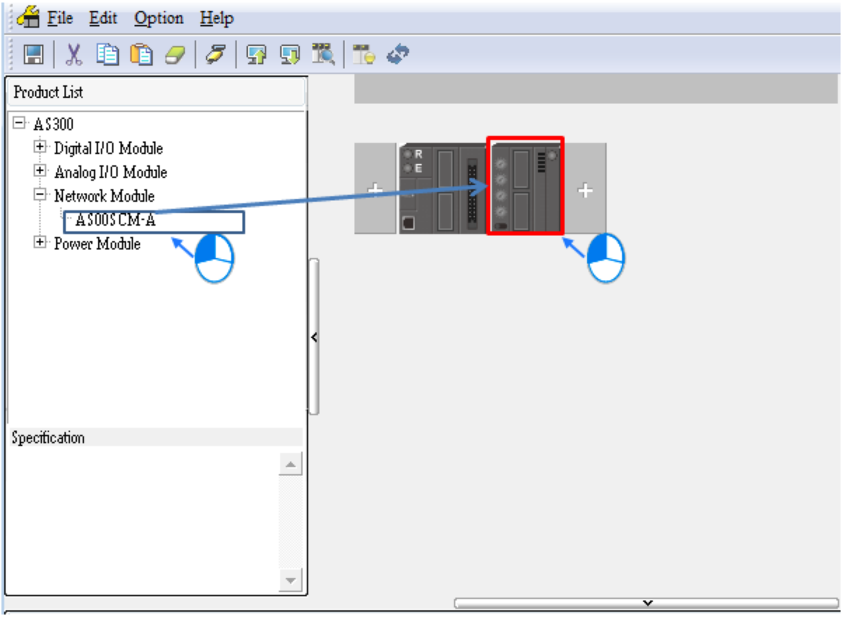
The structures:

Example of a slave structure: HMI (master station) → AS-F485 + AS00SCM-A COM1 (slave station)

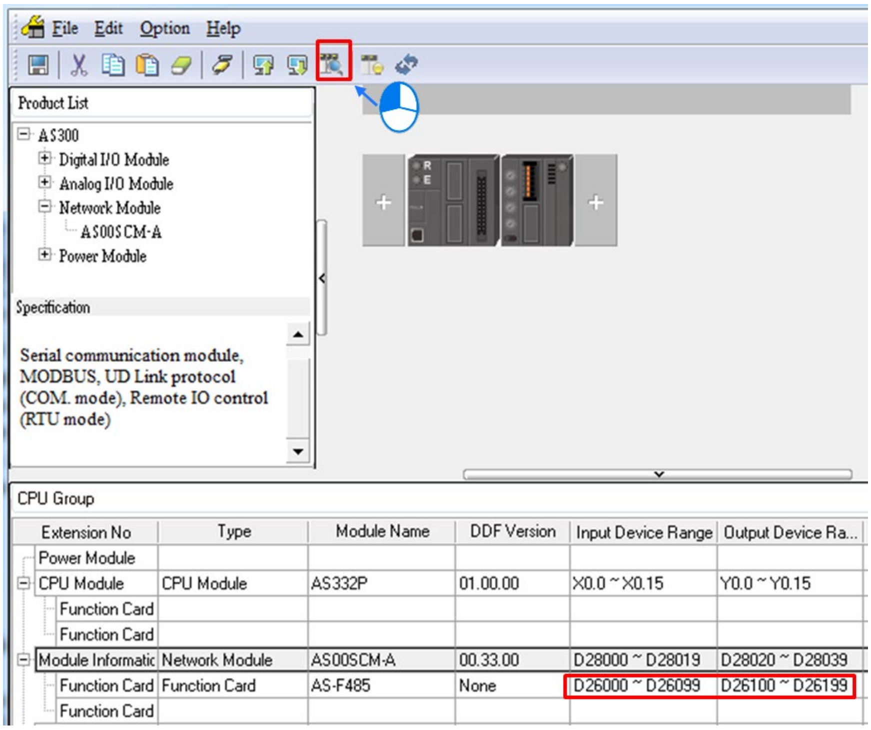
Product	Slave ID	Communication protocol	Device from which data is read	Register in the CPU module	Device into which data is written	Register in the CPU module
HMI	5	9600, RTU, 8, E, 1	16#0100	D26100	16#0000	D26000

If the AS00SCM-A functions as a Modbus slave, you need to set a slave ID and baud rate.

1) Drag to add AS00SCM-A in the system configuration area. Make sure the knob of AS00SCM-A is turned to COM mode and no power connected to it.

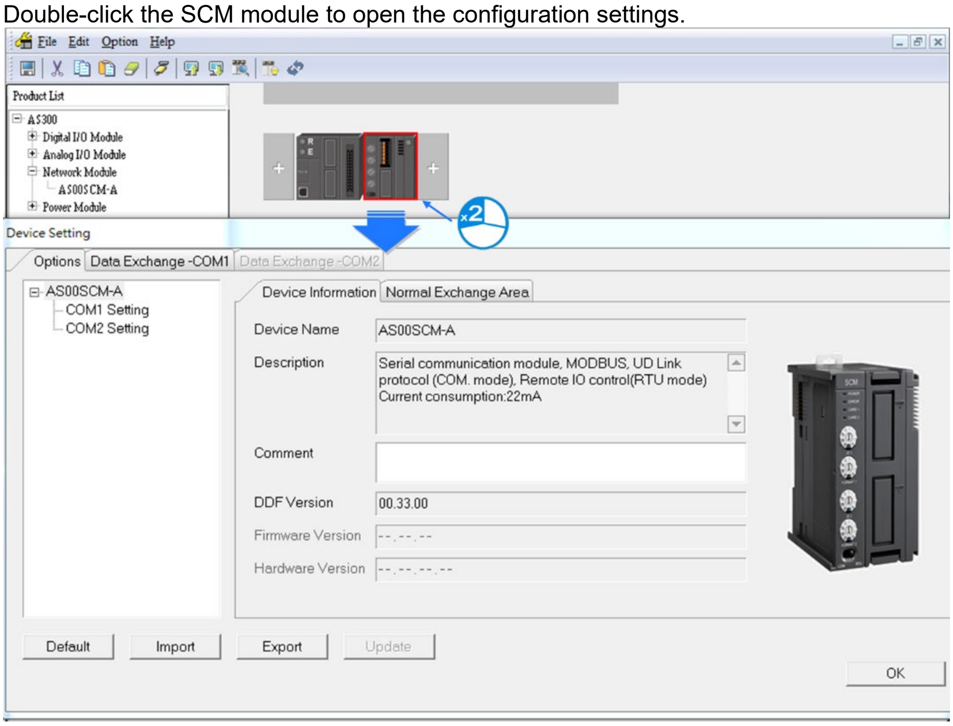


2) Click the I/O Scan button to make the system read the module's current configuration. The PLC assigns the input and output device ranges.

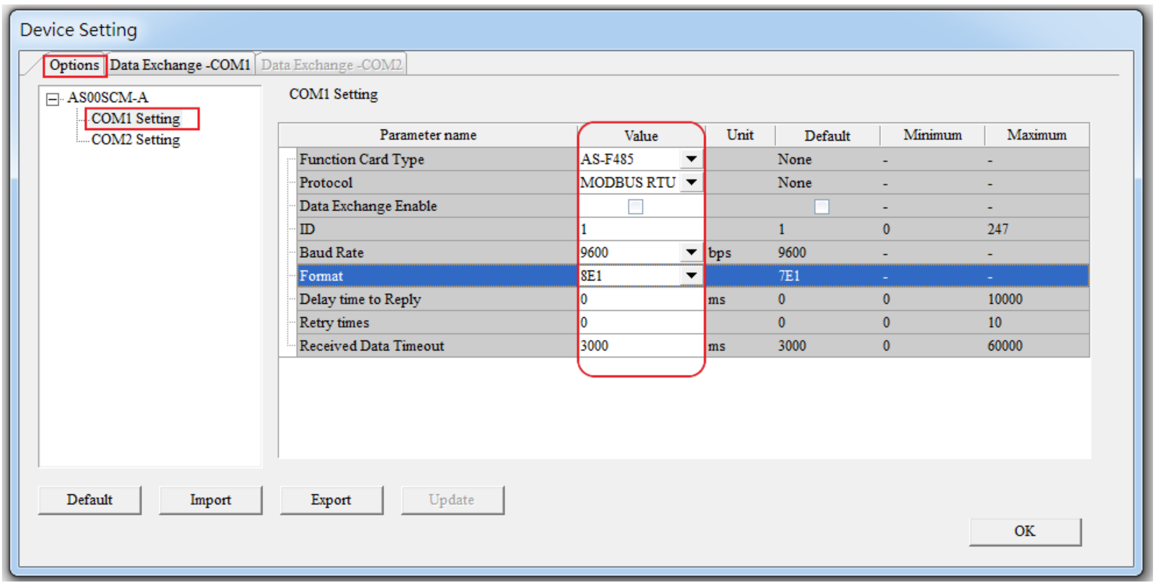


Function card	Device from which data is read	Register in the CPU module	Device into which data is written	Register in the CPU module
Function card 1	16#0000	D26000	16#0100	D26100
Function card 2	16#0200	D26200	16#0300	D26300

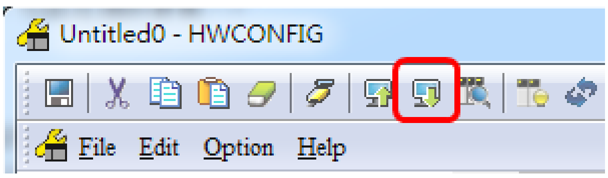
3) Double-click the SCM module to open the configuration settings.



4) Set the communication protocol values for COM1 using the HMI settings.



5) Click the Download button to download the parameters to the AS00SCM-A.



NOTE: Double-click the module to open the Device Setting dialog box to configure the parameters.

9.6.1.2 Modbus Master – Connection to Delta Products

This section introduces how to use COM2 to connect the AS00SCM-A to other Delta industrial products such as programmable logic controllers, AC motor drives, and servo motors.

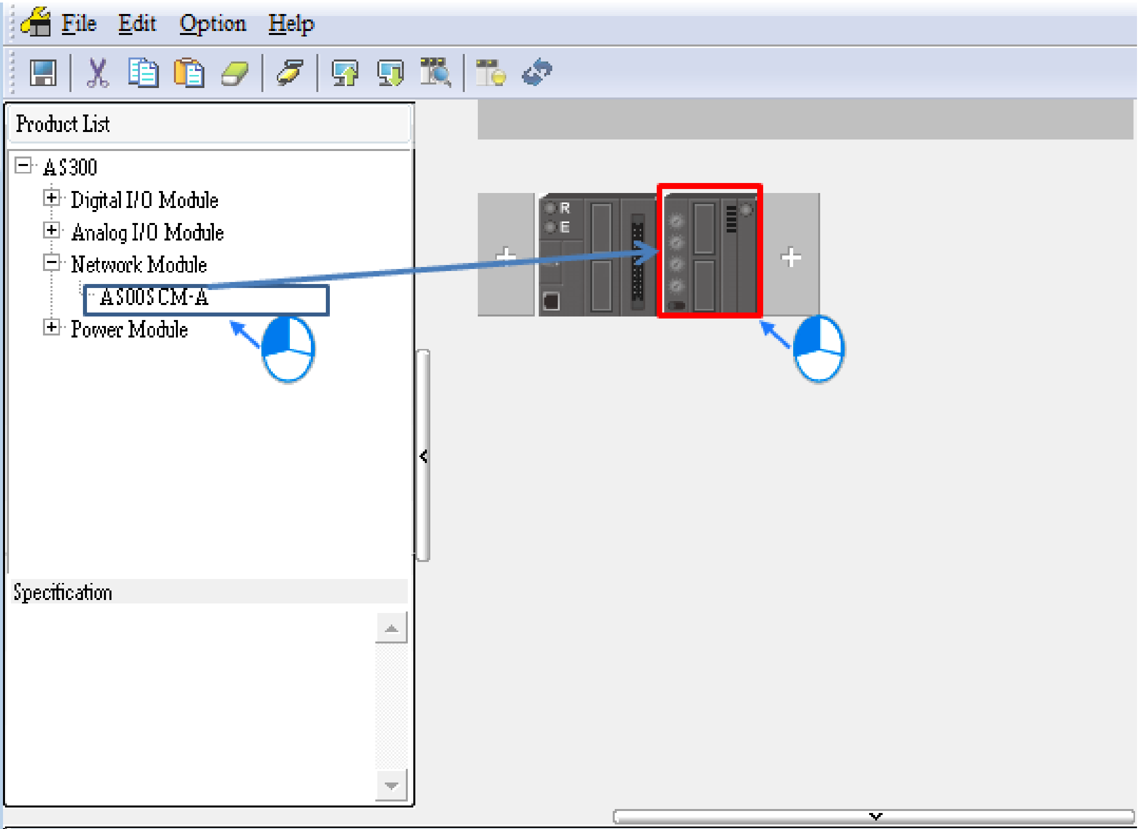
The structures:

Example of a master structure: AS-F485 + AS00SCM-A COM2 (master station) → VFD, ASDA, and DVP series PLC

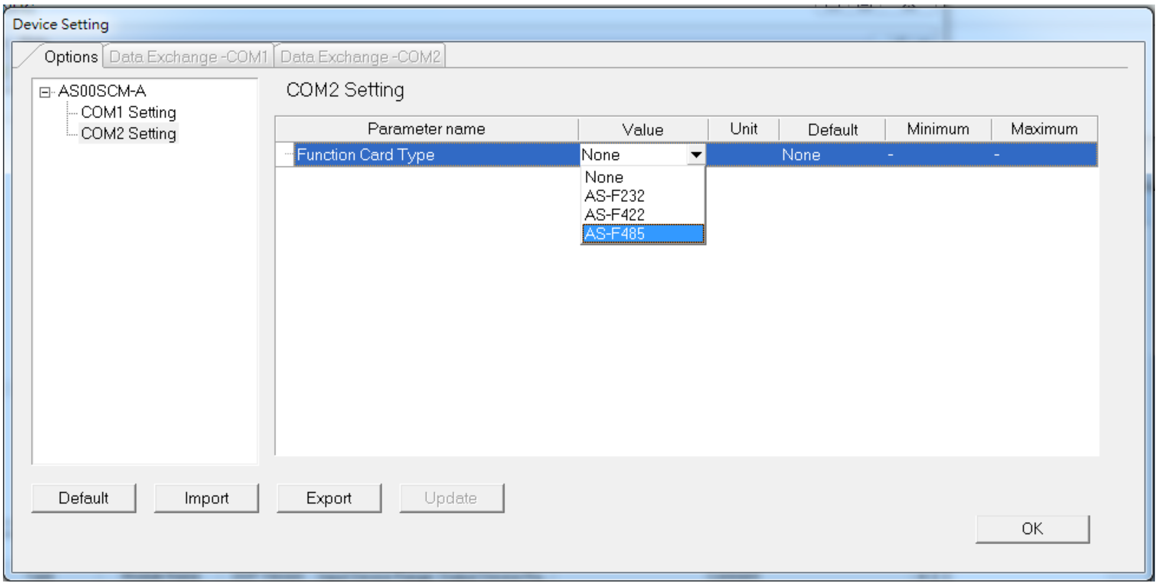
Product	Slave ID	Communication protocol	Device from which data is read	Register in the CPU module	Device into which data is written	Register in the CPU module
VFD	10	38400, ASCII, 7, E, 1	16#2103	D26200	16#2000 16#2001	D26300-D26301
ASDA	11	38400, ASCII, 7, E, 1	16#0101	D26210	16#0101	D26310
PLC	12	38400, ASCII, 7, E, 1	D100-D109	D26220-D26229	D200-D204	D26320-D26324

If the AS00SCM-A is functioning as a Modbus master, you need to set a slave ID and baud rate.

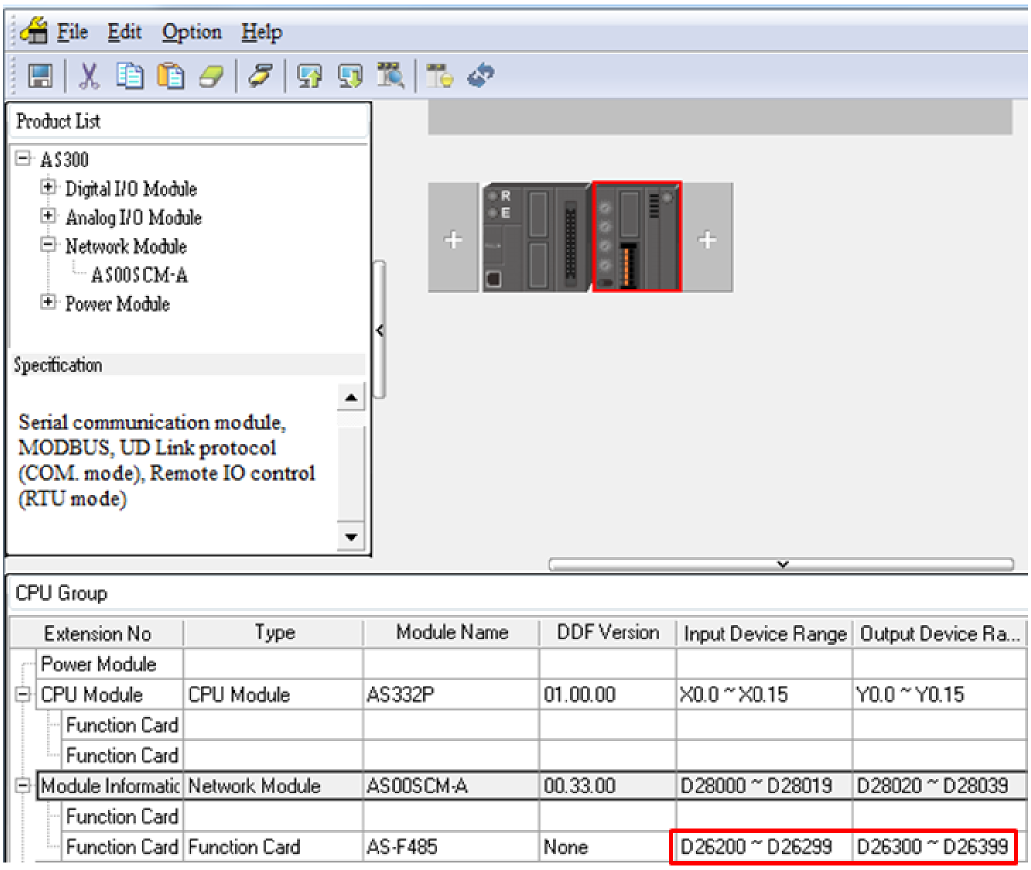
1) Drag to add AS00SCM-A in the system configuration area. Make sure the knob of AS00SCM-A is turned to COM mode and no power connected to it.



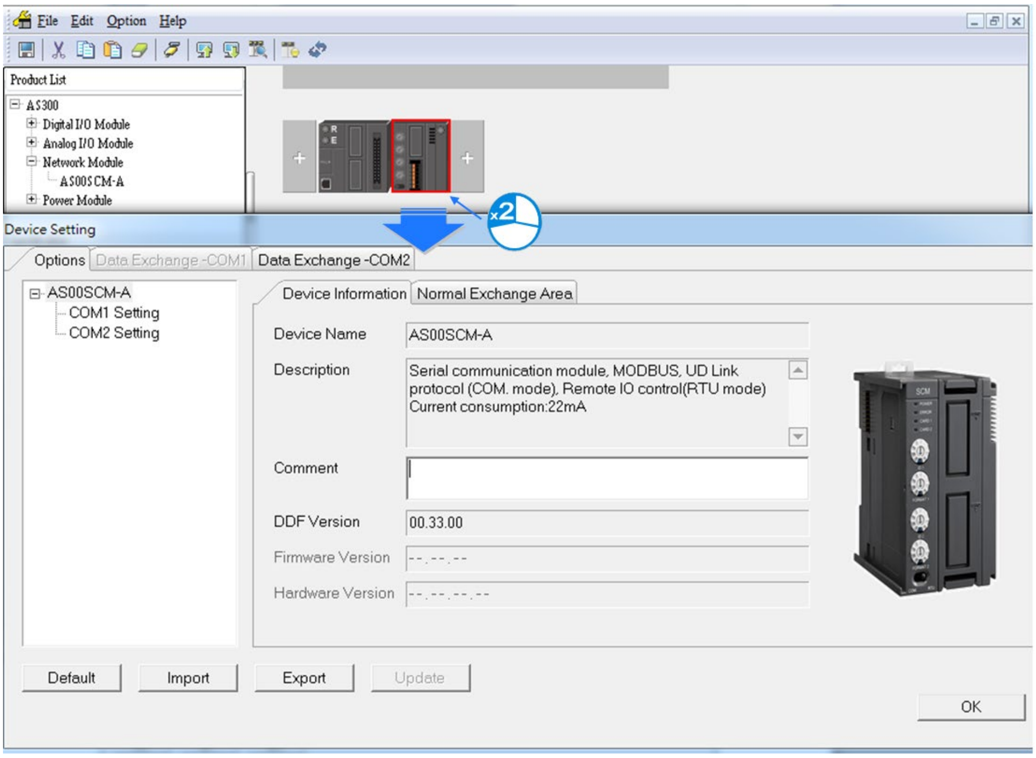
2) Double-click **COM2 Setting** and set the Function Card Type to **AS-F485**.



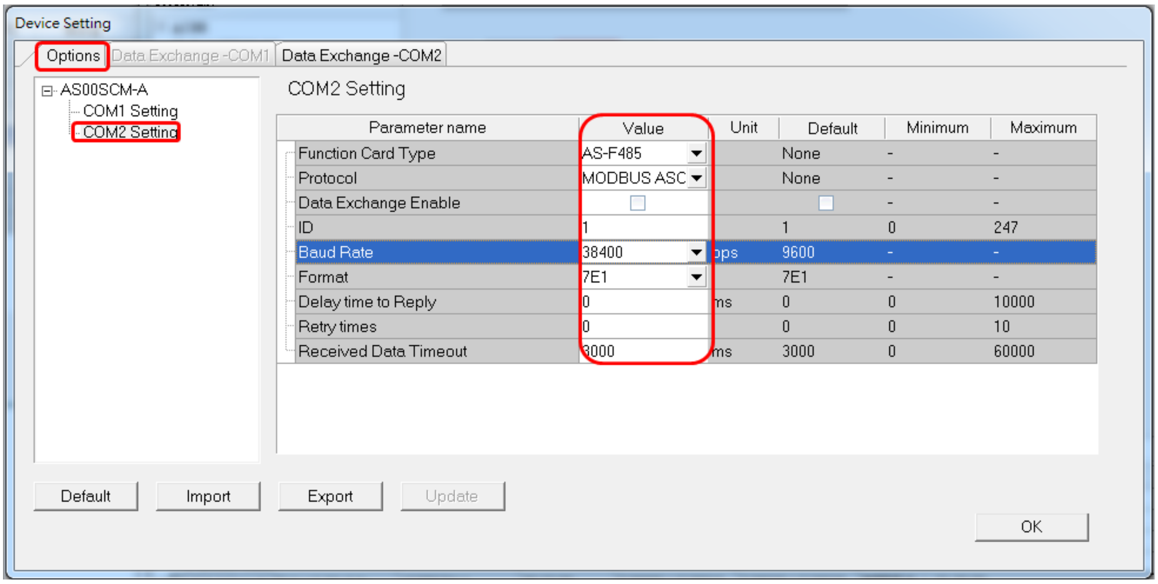
3) Click the I/O Scan button to make the system read the module's current configuration. The PLC assigns the input and output device ranges.



4) Double-click the SCM module to open the configuration settings.

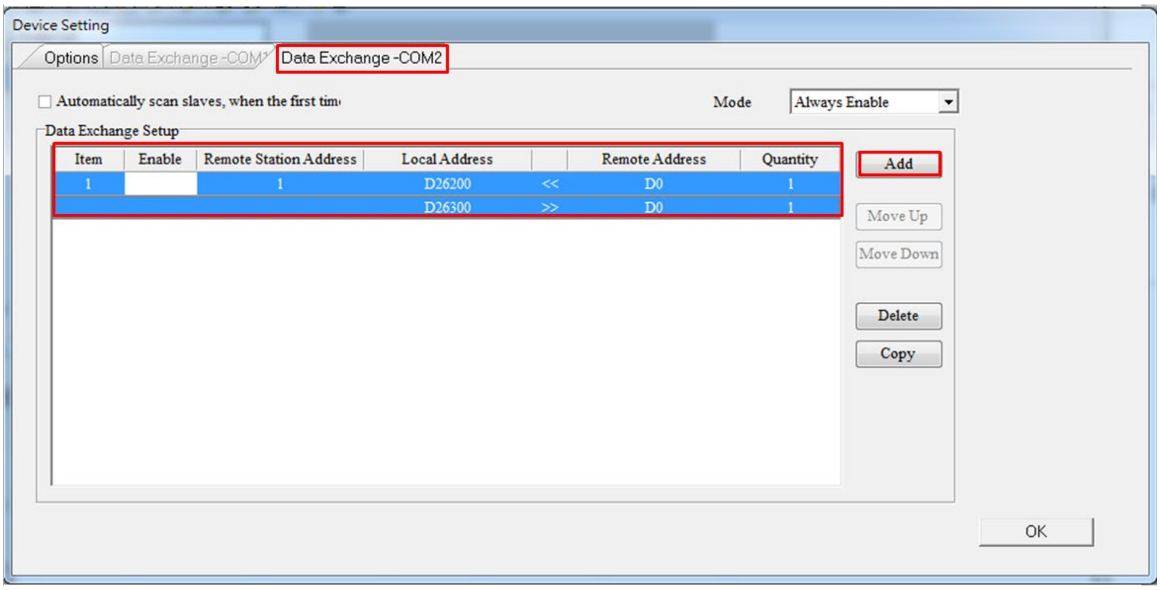


5) Set the communication protocol values for COM2:

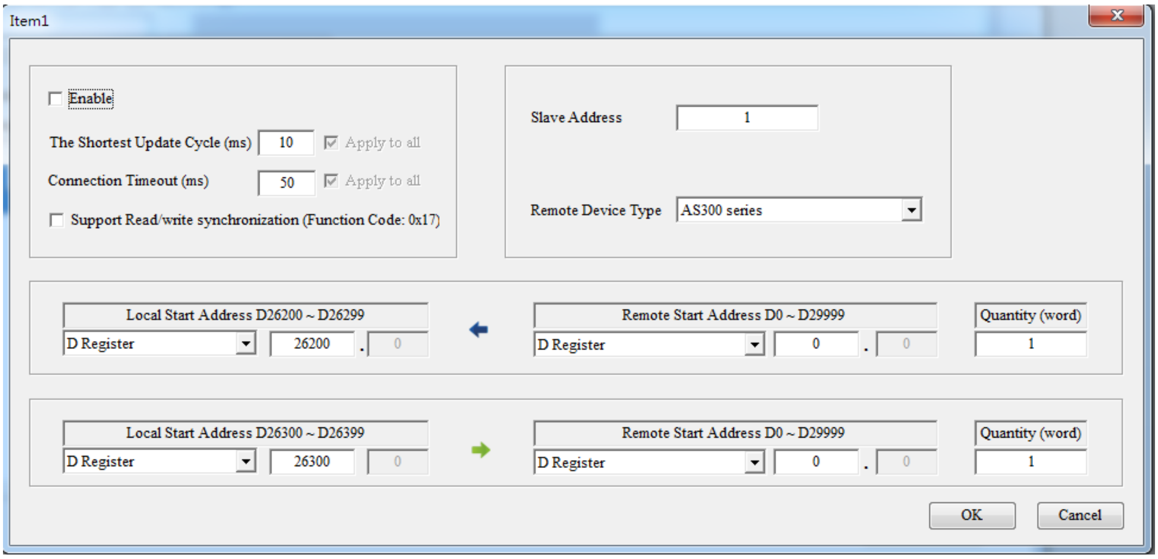


9

6) Set up the data exchange table: select **Data Exchange – COM2** and click **Add** to create a new Data Exchange Setup table.

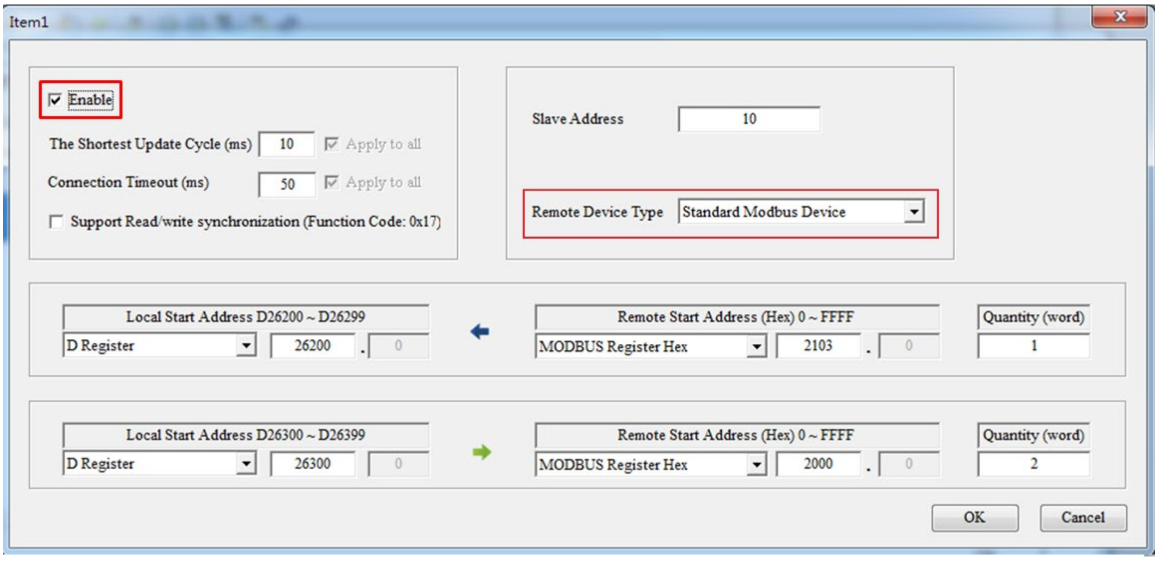


7) In the Data Exchange Setup table double-click an item to edit its settings.



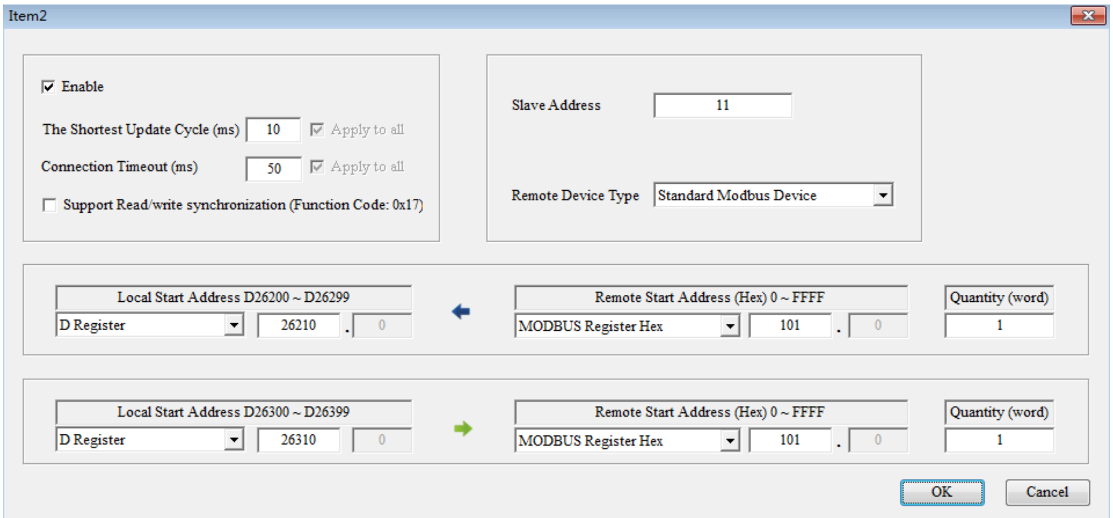
- Select **Standard Modbus Device** as the **Remote Device Type**, enter the parameters, and check **Enable**.

Product	Slave ID	Communication protocol	Device from which data is read	Register in the CPU module	Device into which data is written	Register in the CPU module
VFD	10	38400, ASCII, 7, E, 1	16#2103	D26200	16#2000 16#2001	D26300- D26301



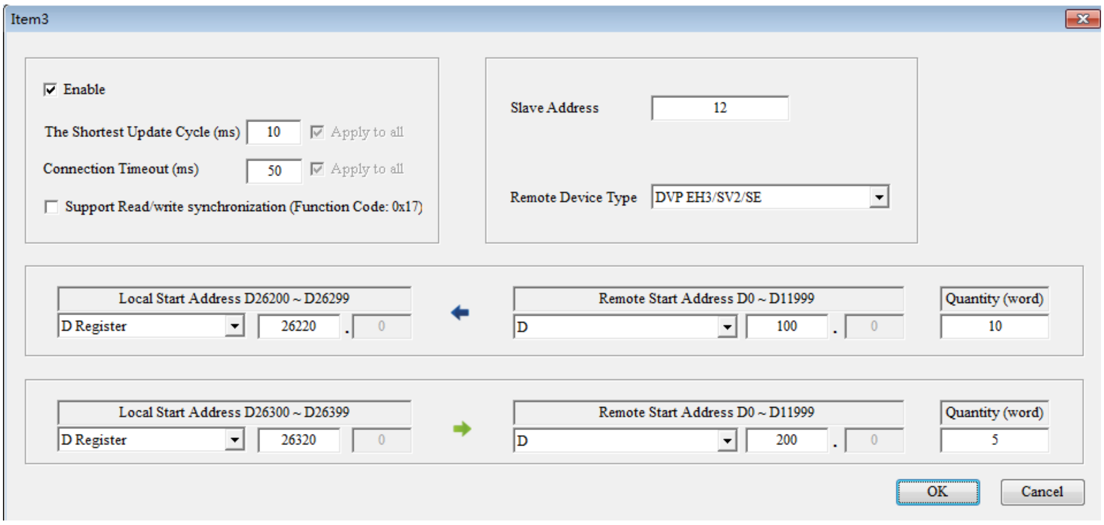
- Select **Standard Modbus Device** as the **Remote Device Type**, enter the ASDA parameters, and check **Enable**.

Product	Slave ID	Communication protocol	Device from which data is read	Register in the CPU module	Device into which data is written	Register in the CPU module
ASDA	11	38400, ASCII, 7, E, 1	16#0101	D26210	16#0101	D26310

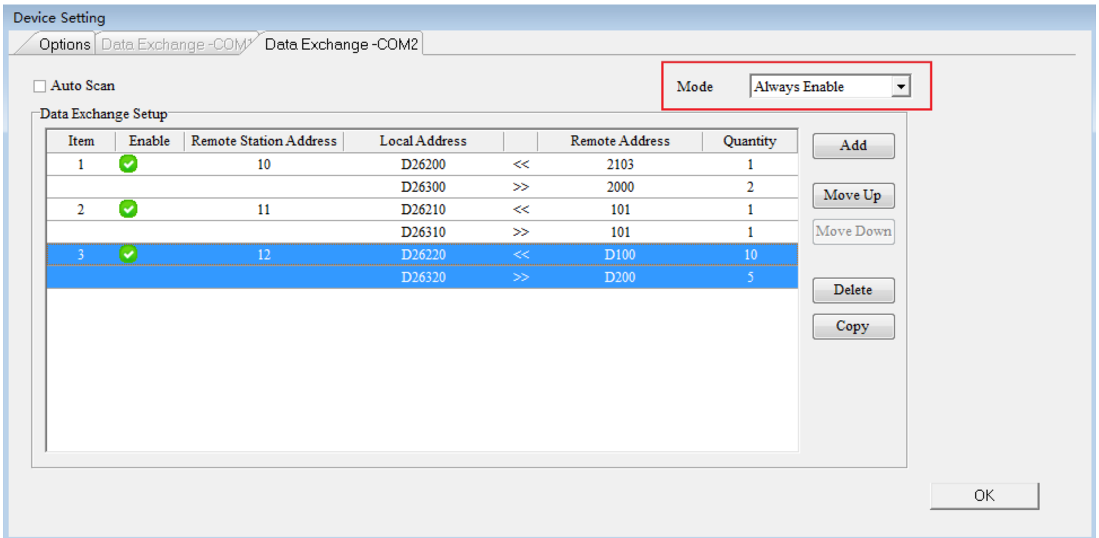


- Select **PLC devices** as the **Remote Device Type**, enter the PLC parameters, and check **Enable**.

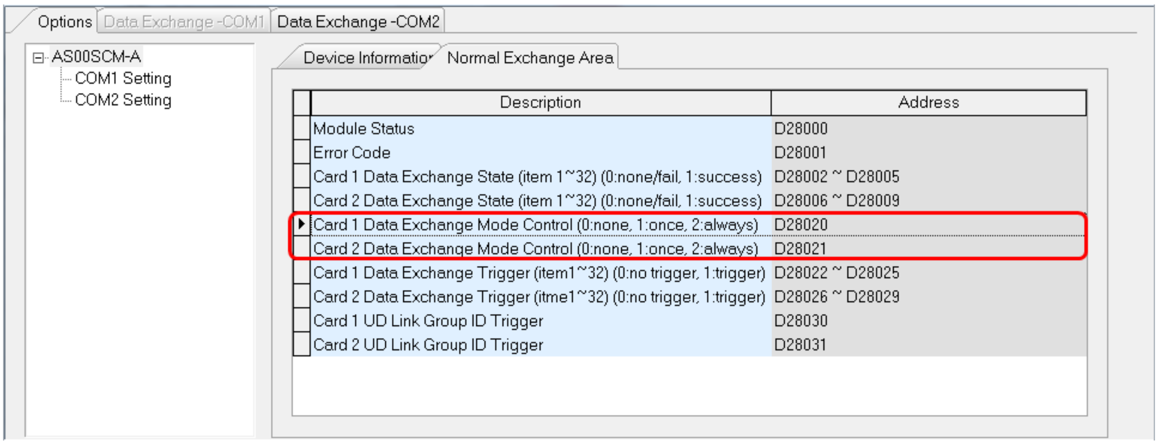
Product	Slave ID	Communication protocol	Device from which data is read	Register in the CPU module	Device into which data is written	Register in the CPU module
PLC	12	38400, ASCII, 7, E, 1	D100-D109	D26220-D26229	D200-D204	D26320-D26324



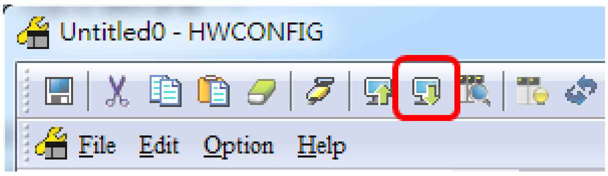
8) Select **Always Enable** in the **Mode**.



NOTE: If the Data Exchange Mode Control is set by the program, you can check and control the register address on the Normal Exchange Area page. The following example shows when writing “2: always” to D28021, it indicates Card 2 is always the one to perform data mapping.

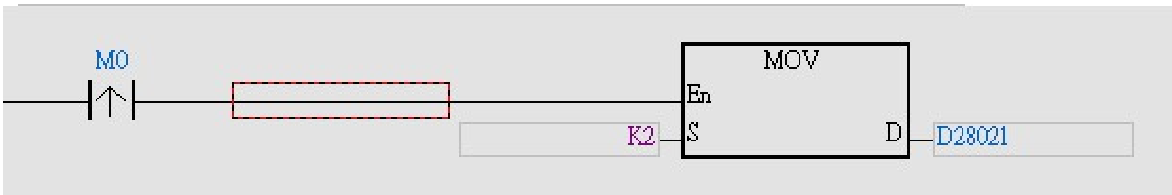


9) Download the parameters to the AS00SCM-A.



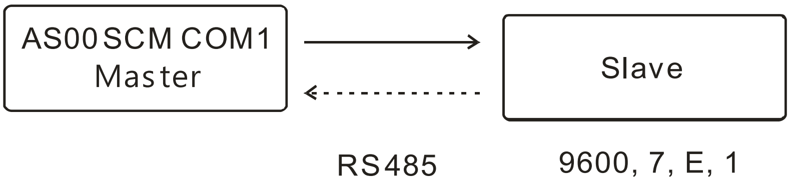
If you set Mode to Always Enable, the data exchange begins immediately after downloading the parameters.

If you set Mode to Program Control, the program starts the data exchange after downloading the parameters.



9.6.2 UD Link

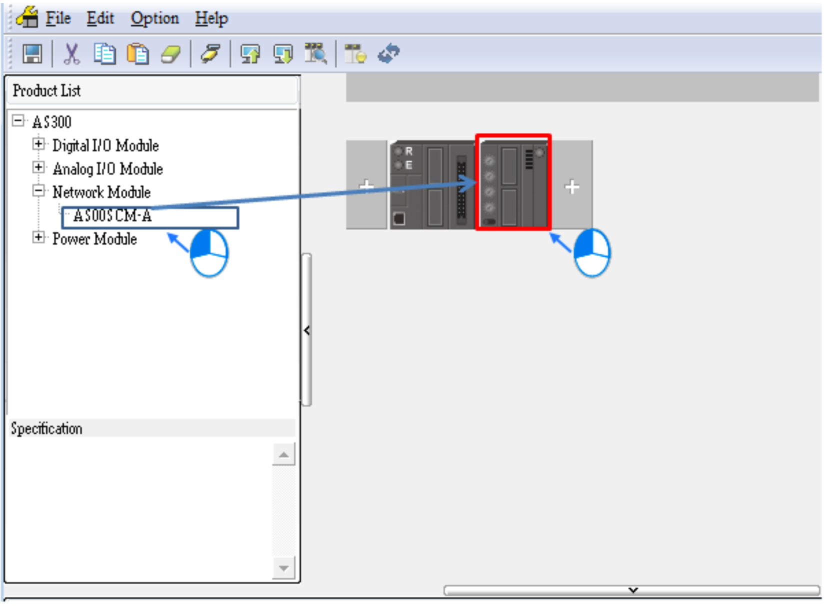
This section introduces how to use a non-Modbus RS485 communication port on the AS00SCM-A to connect to other industrial products.



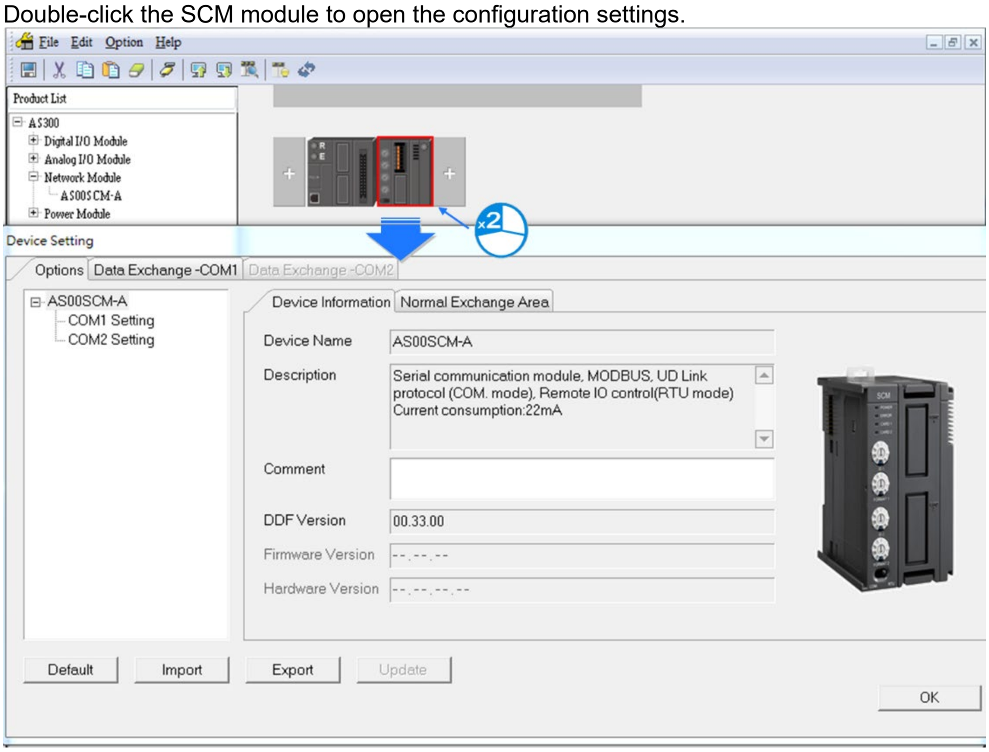
Communication with a slave

Packet to Send (→)	Packet to Receive (←)	Description
POS, xxx, yyy	POS, ACT	xxx and yyy are coordinates (0–999)

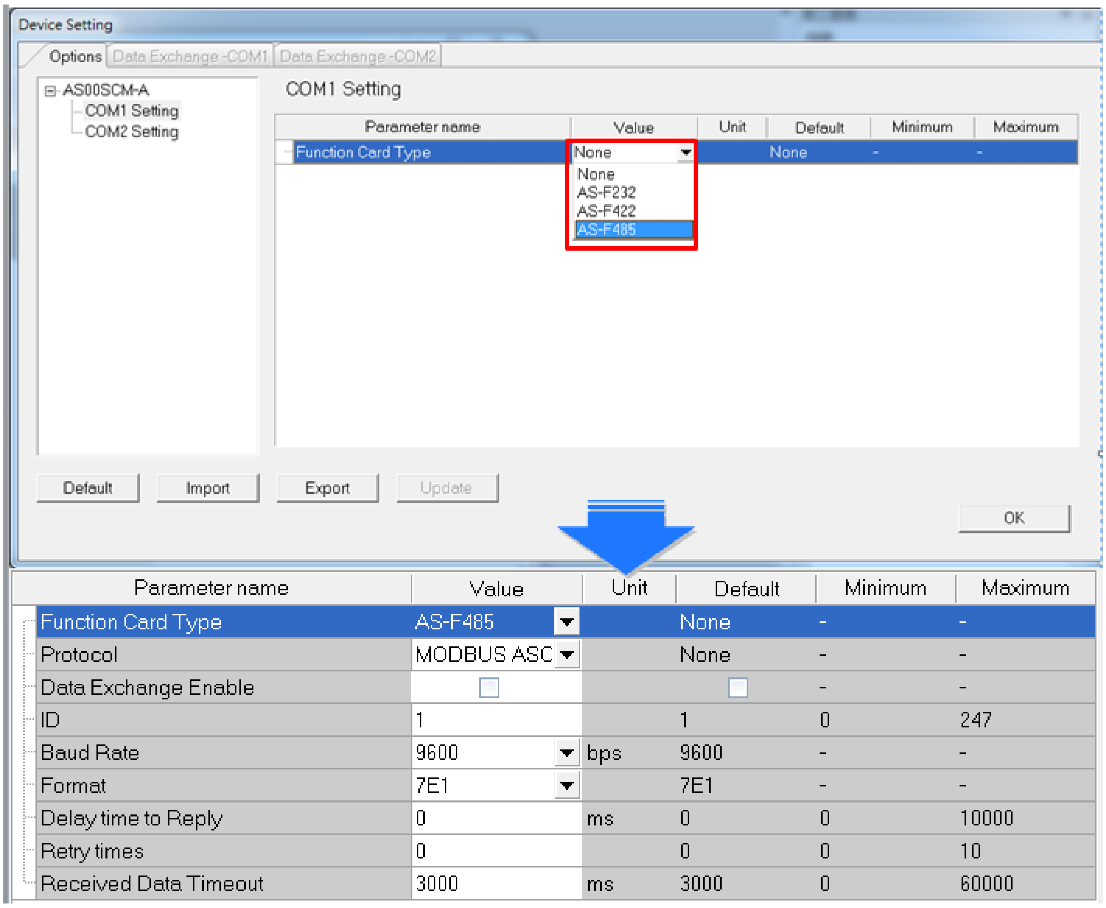
1) Drag to add AS00SCM-A in the system configuration area. Make sure the knob of AS00SCM-A is turned to COM mode and no power connected to it.



2) Double-click the SCM module to open the configuration settings.



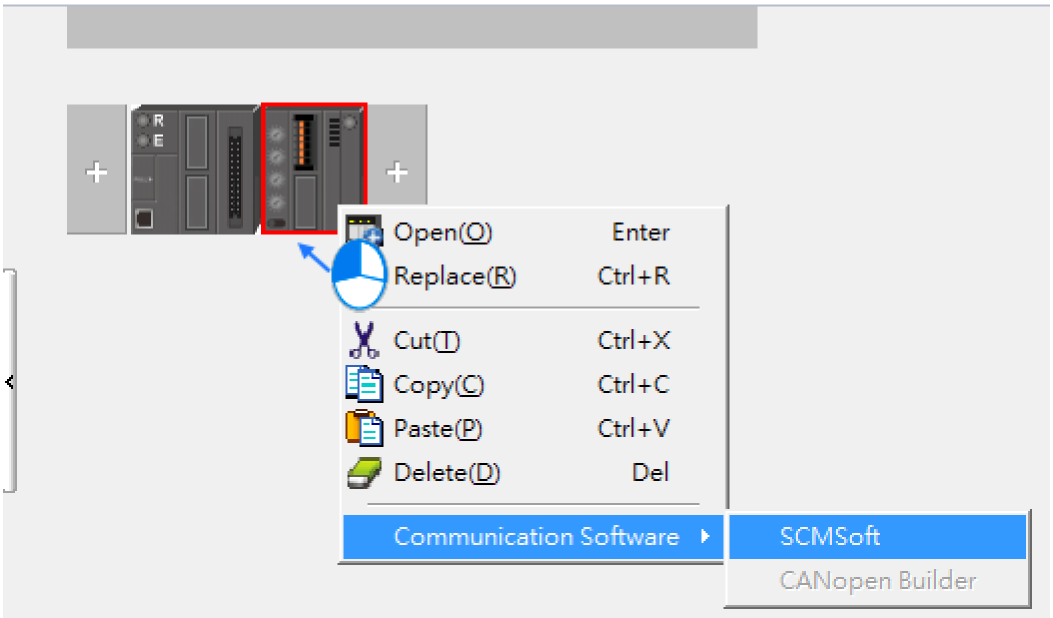
3) Select **AS-F485** as the **Function Card Type** for COM1.

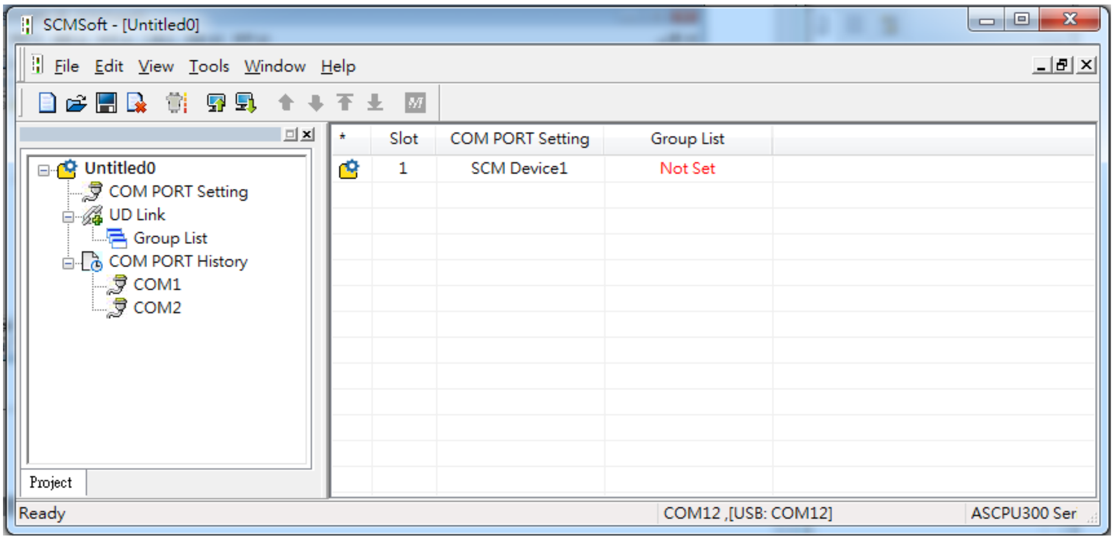


4) Select **UD Link** as the **Protocol**, set the **Baud Rate** and **Format**, and click **OK**.

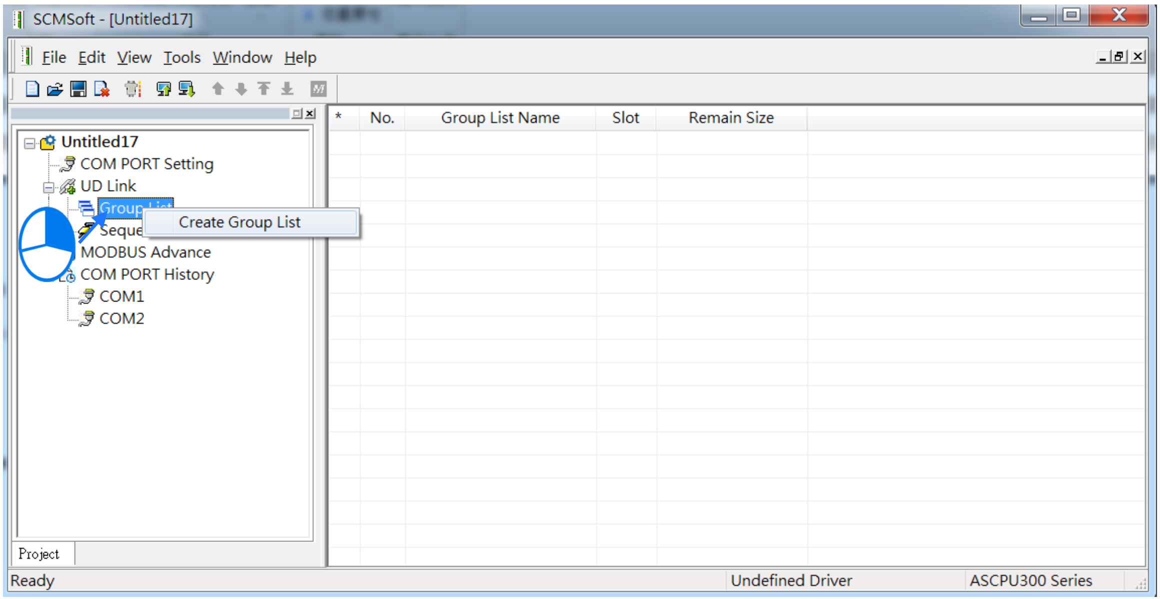
Parameter name	Value	Unit	Default	Minimum	Maximum
Function Card Type	AS-F485		None	-	-
Protocol	UD LINK		None	-	-
Baud Rate	9600	bps	9600	-	-
Format	7E1		7E1	-	-

5) Right-click the AS00SCM-A and click **Communication Software** and then click **SCMSoft**.

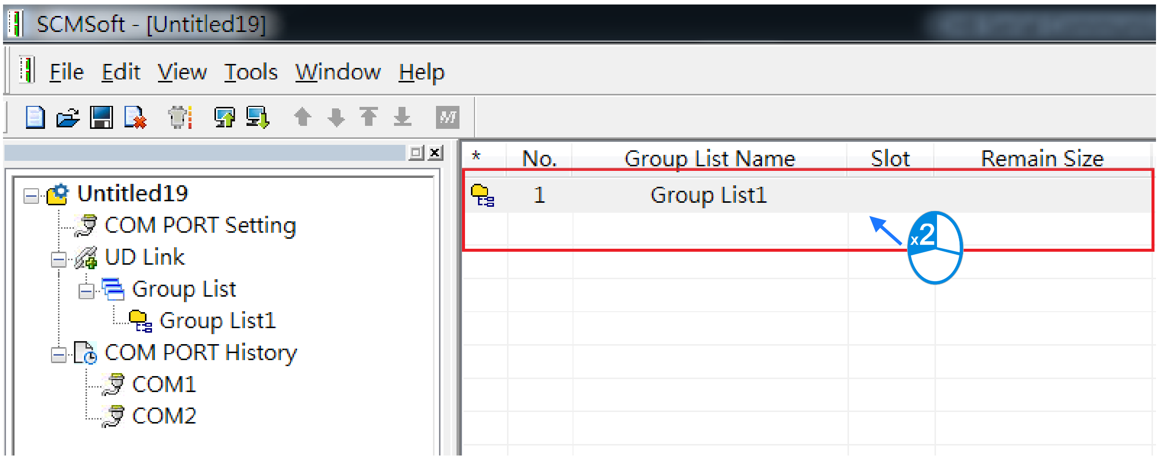




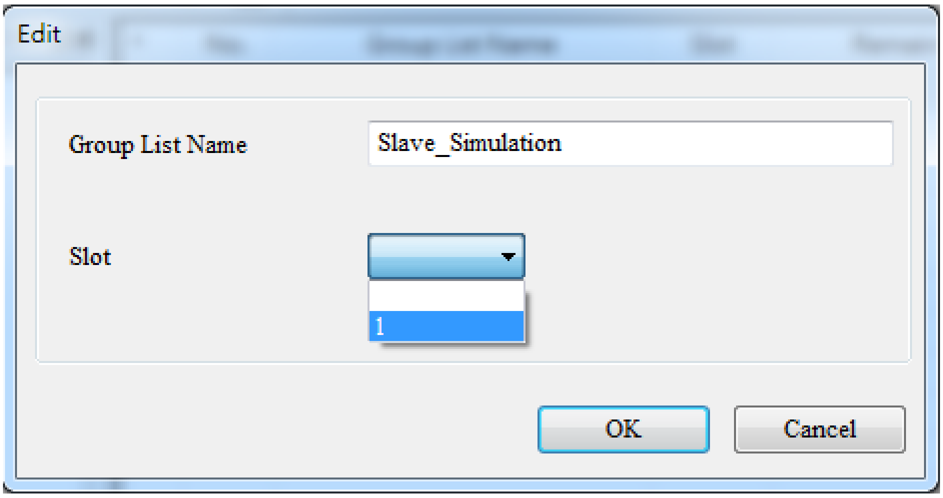
6) Right-click **Group List** and then click **Create Group List** to create a group list.



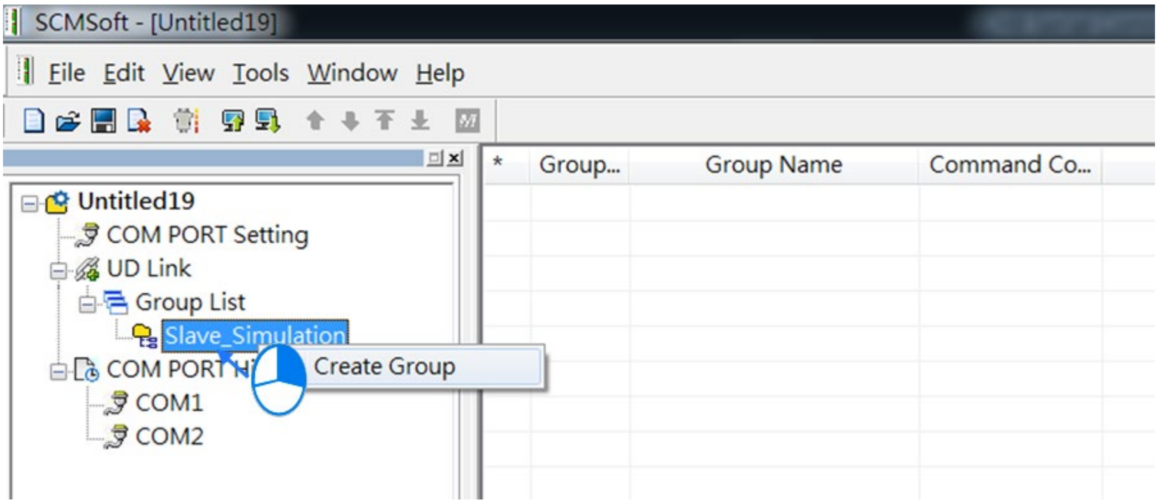
7) You can find a created Group List1. Double-click it to open an editing window to edit the Group List Name and the Slot.



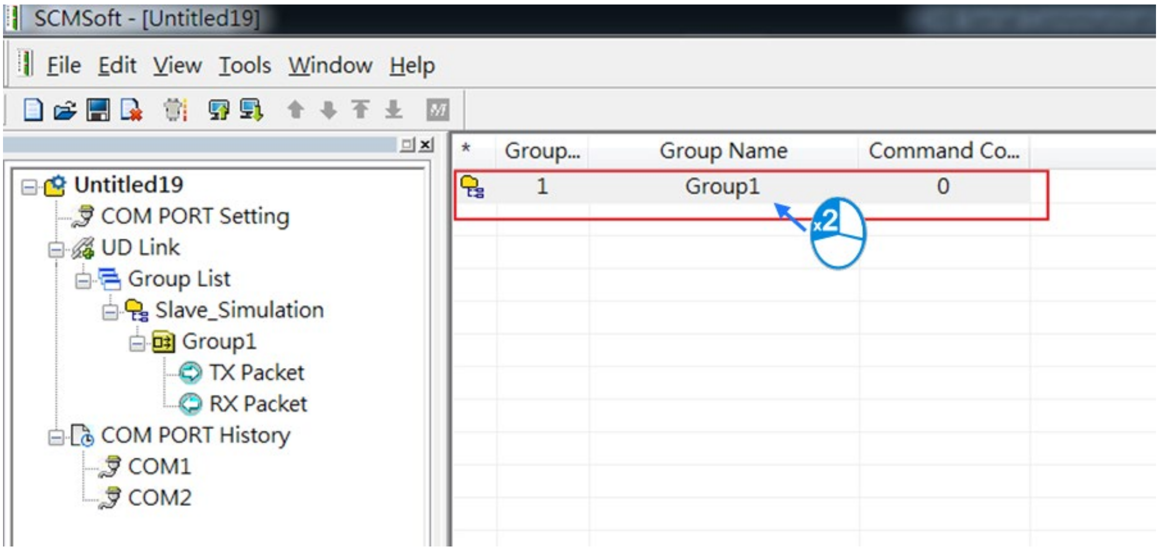
Give the group list a Name (this example uses “Slave_Simulation”) and select 1 (COM1) as the **Slot** number.



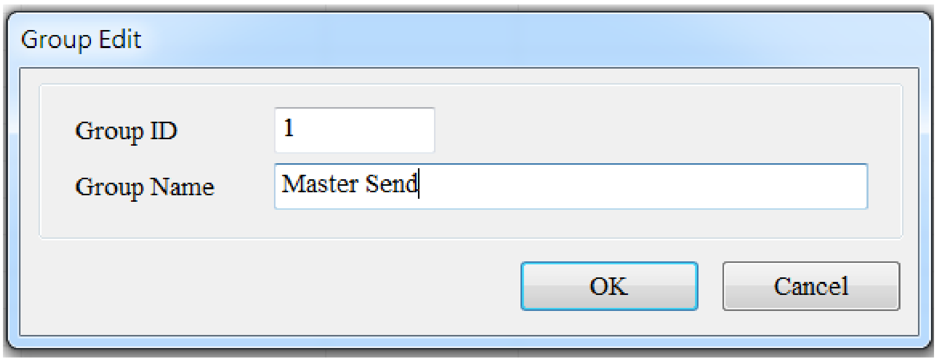
8) Right-click **Slave_Simulation** and click **Create Group List** to create a group list for the Slave_Simulation group.



9) You can find a created Group List1. Double-click it to open an editing window to edit the Group List Name and the Slot.



Create a group and name it “Master Send”.



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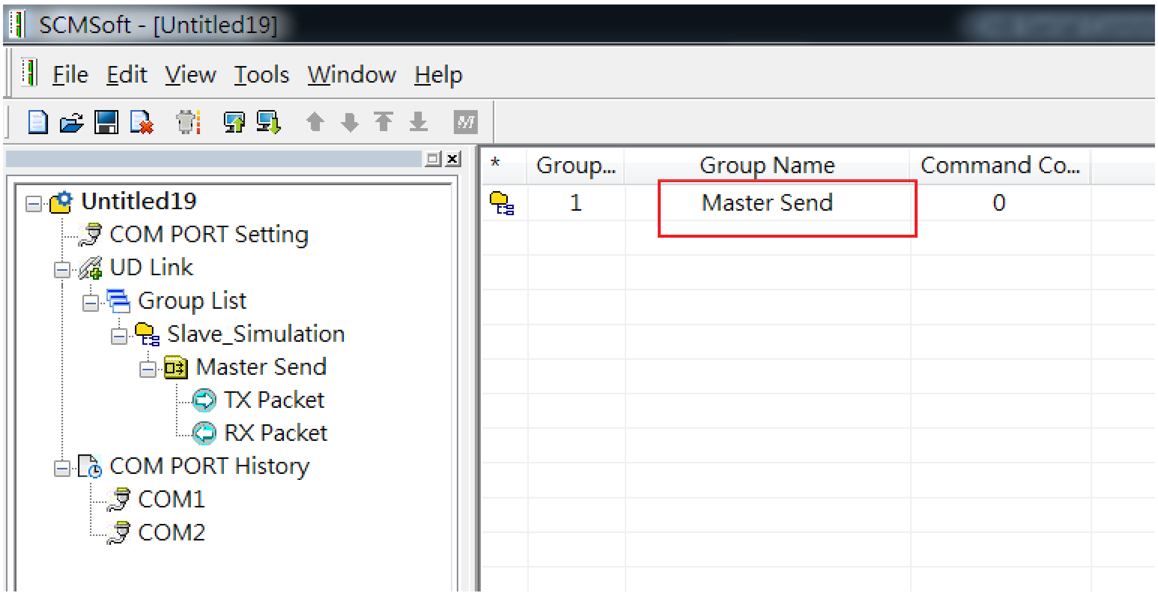
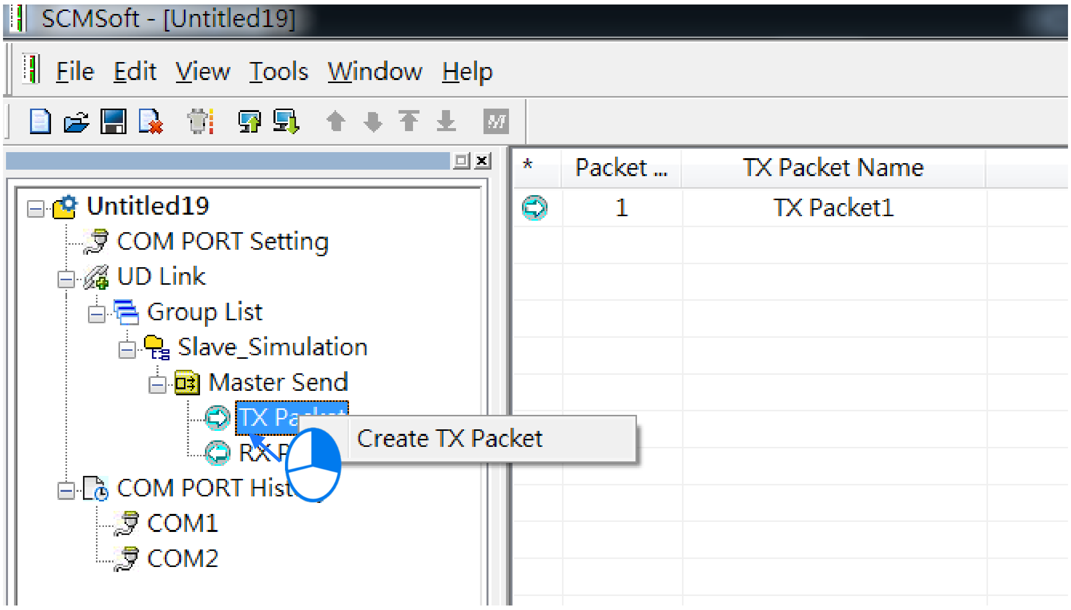
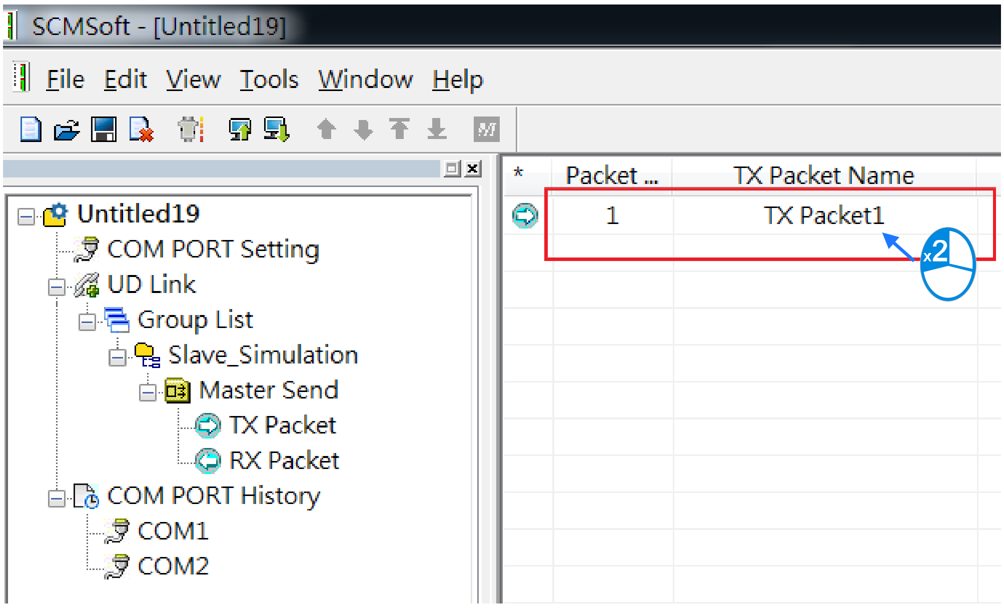


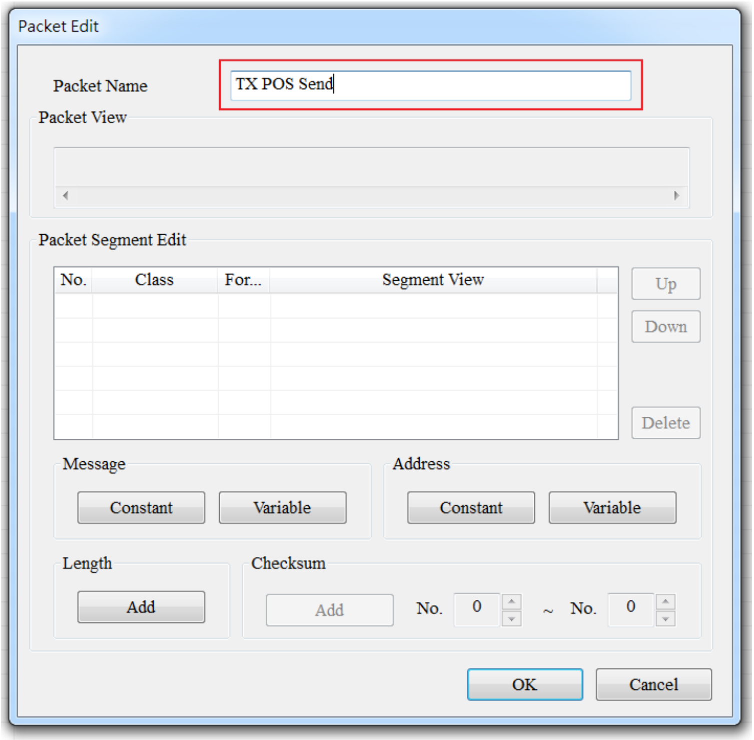
10) Right-click **TX Packet** and click **TX Packet** to create a TX Packet1.



11) Double-click **TX Packet1** to open the **Packet Edit form**.

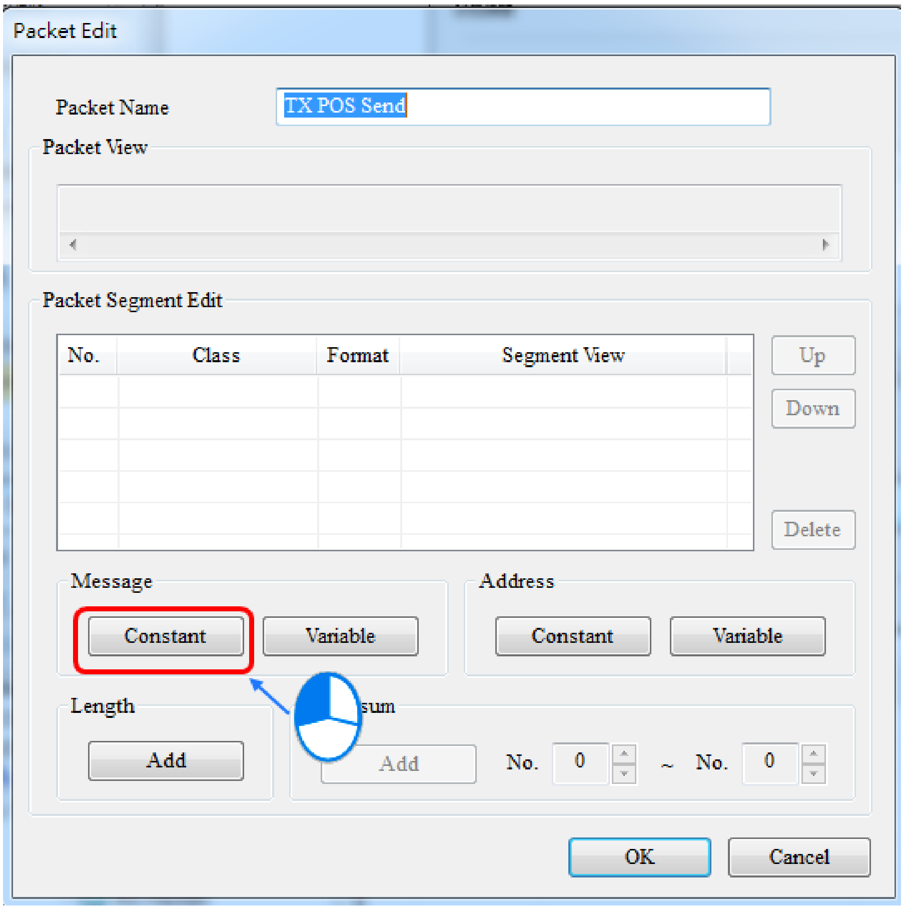


12) Give the Packet a Name (This example uses “TX POS Send”)

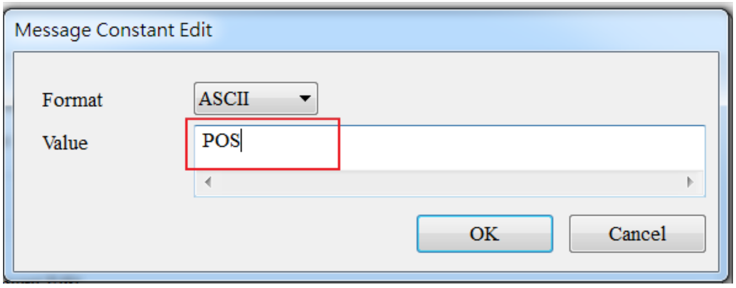


13) Edit the TX packet, “POS, xxx, yyy” (The example below uses POS, 123, 123)

14) Click **Constant** in the Message area.



Enter “POS” in the Value area. Click **OK** and verify the packet contents in the Packet View.



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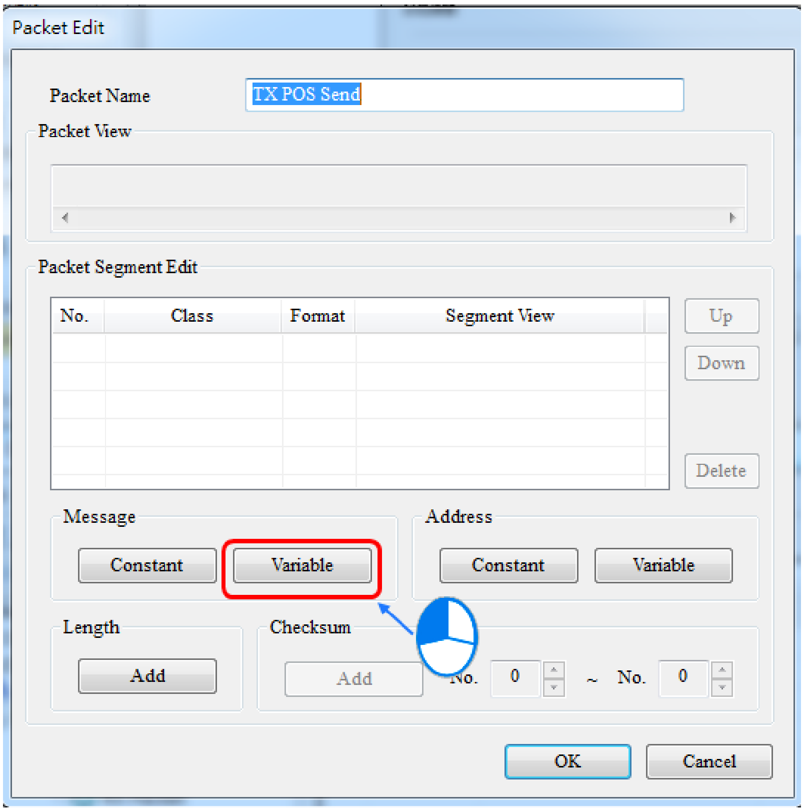
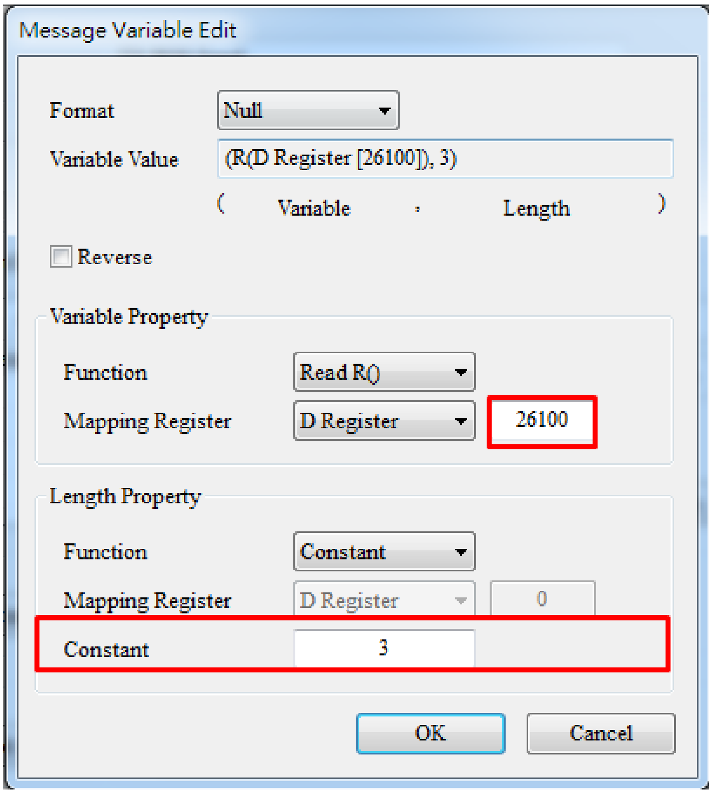
15) [xxx] is a variable, so click **Variable** in the Message area to edit it. Use ISPSoft to get the value from data registers D26100–D26101. The example below uses D26100: 16#3132 and D26101: 16#3300 and the value is 123.



16) Enter the data register that contains the value you want to find. The example below uses D26100 and the value returned is 3. Use ISPSoft to get the value from data registers D26100–D26199.



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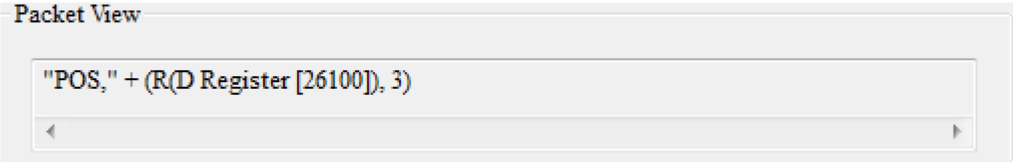
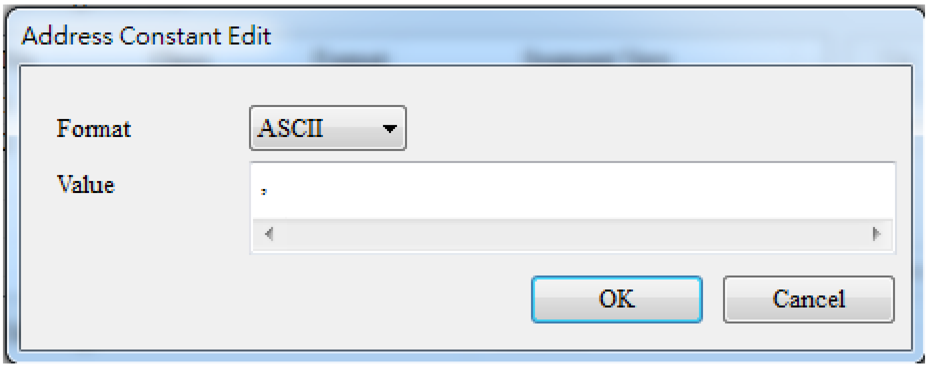
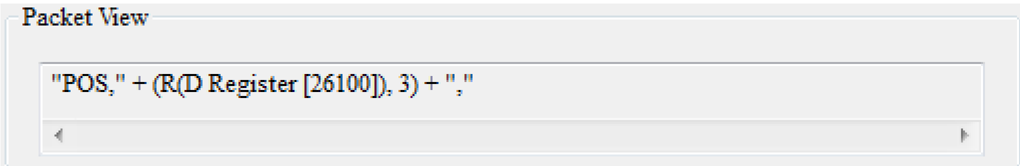
Click **OK** and verify the values ("POS,"+ (R (D Register [26100], 3)) in the Packet View.



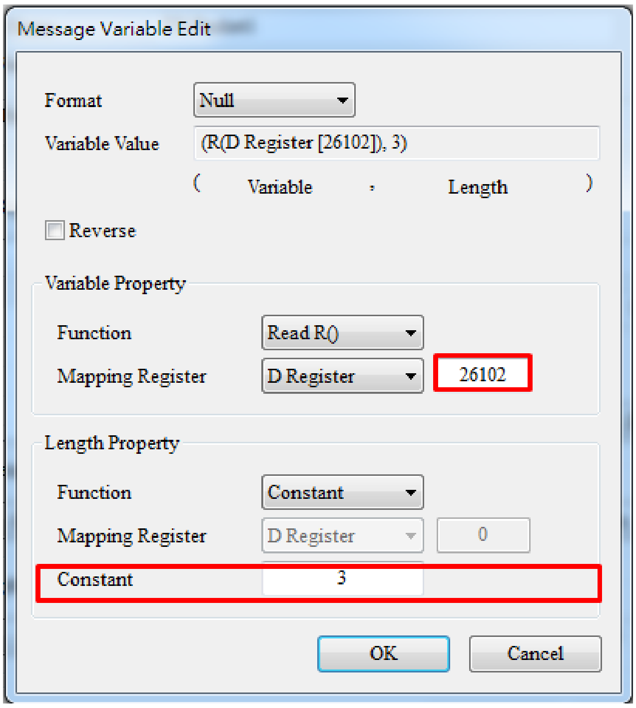
17) [,]: Use Address Constant to enter this Value and set the Format to ASCII.



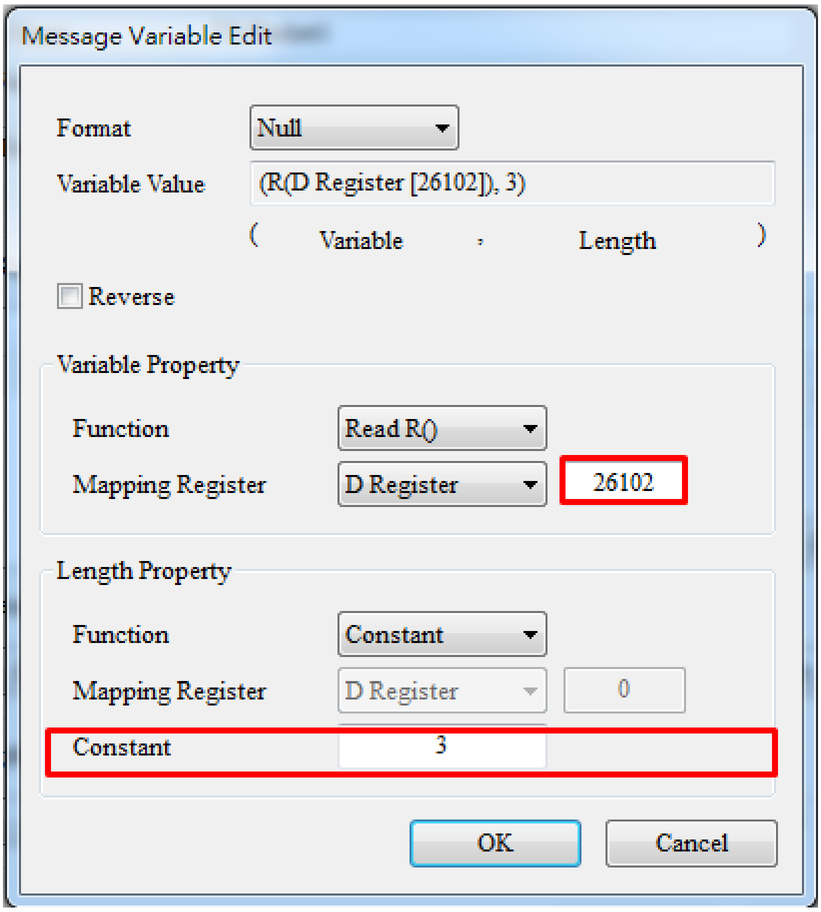
Click OK and verify the values ("POS,"+ (R (D Register [26100], 3)) in the Packet View.



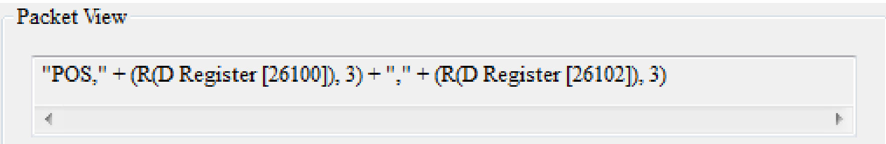
18) [yyy] is a variable, so click **Variable** in the Message area to edit it. Use ISPSoft to get the value from data registers D26102–D26103. The example below uses D26102: 16#3132 and D26103: 16#3300 and the value is 123.



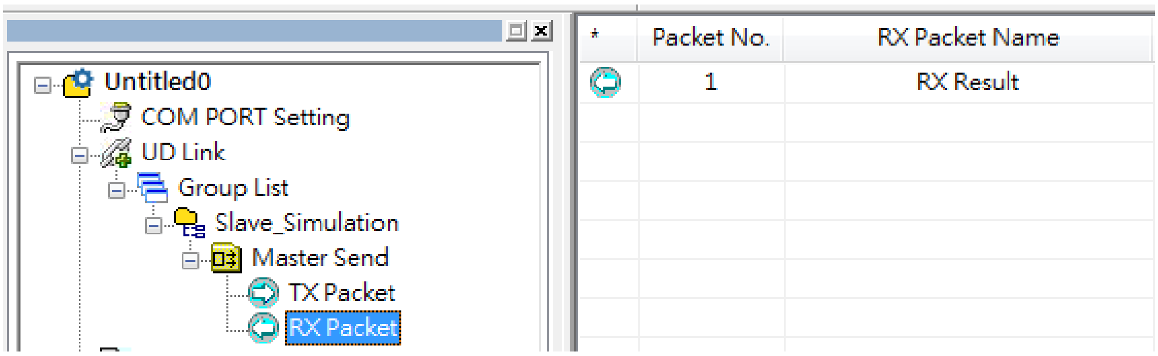
19) Enter the data register that contains the value you want to find. The example below uses D26102 and the value returned is 3. Use ISPSoft to get the value from the data registers D26100–D26199.



Click **OK** and verify the values ("POS,"+ (R (D Register [26102], 3)) in the Packet View.



20) Edit the packet: Create a packet and name it "RX Result". Double-click it to open the editing window.



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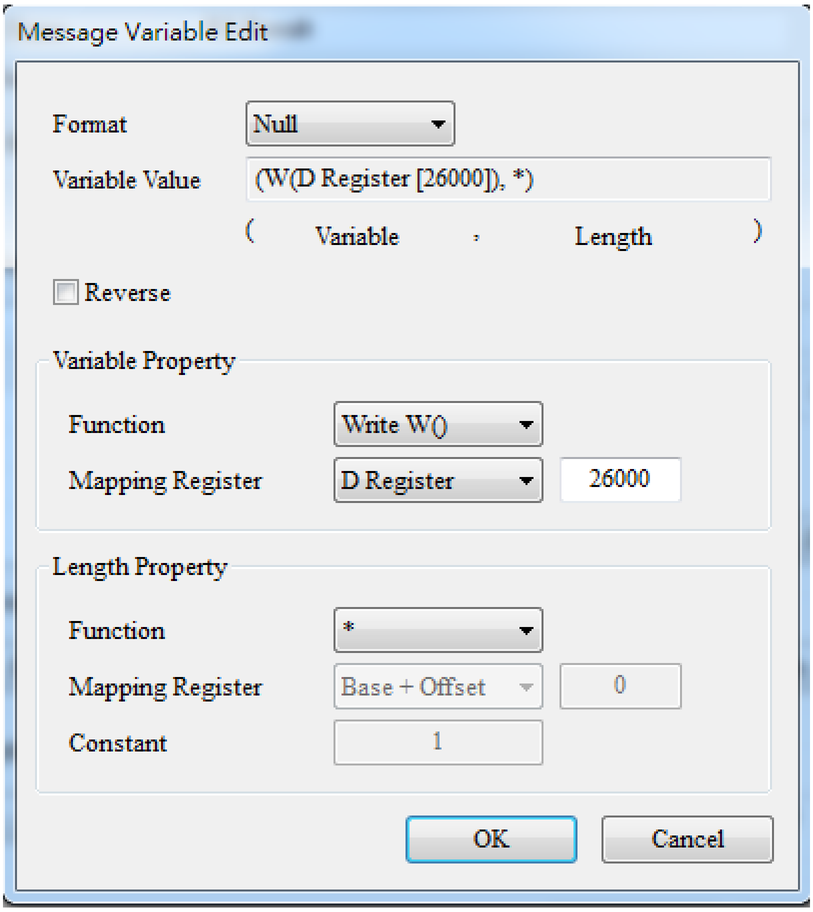
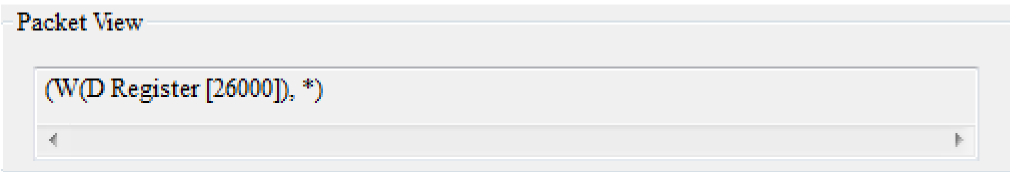
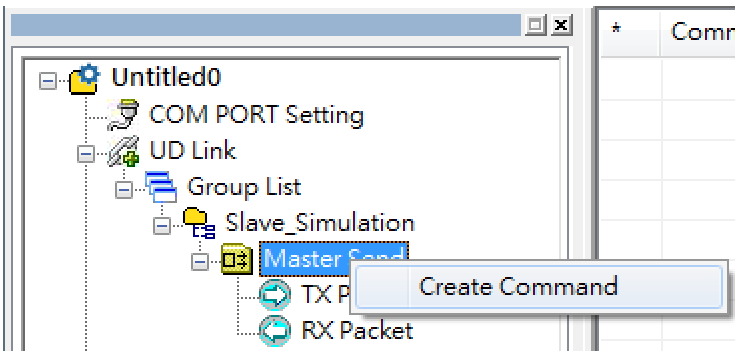
Enter the sending packet into the D26000 register of the AS300 CPU. “*” indicates that the length is not specified.



The packet should look like the example below.



21) Create a command: Right-click **Master Send** and click the **Create Command**.



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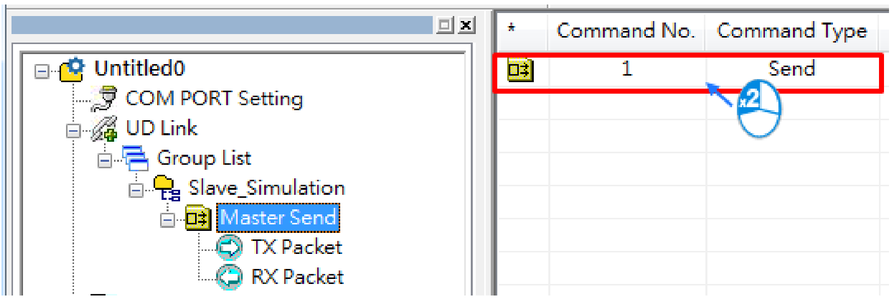
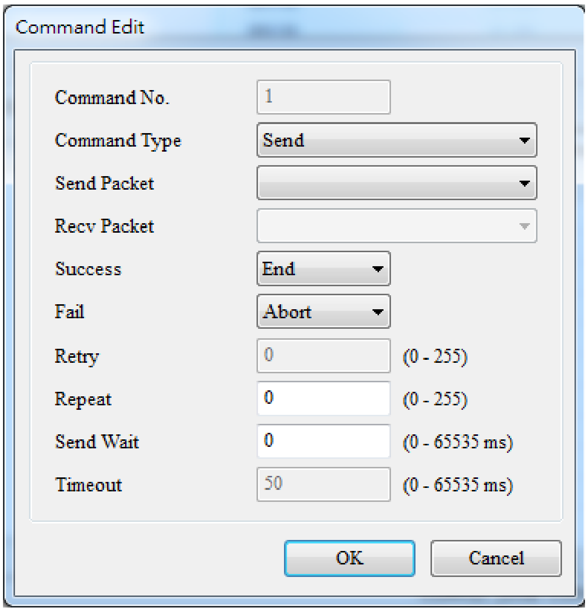
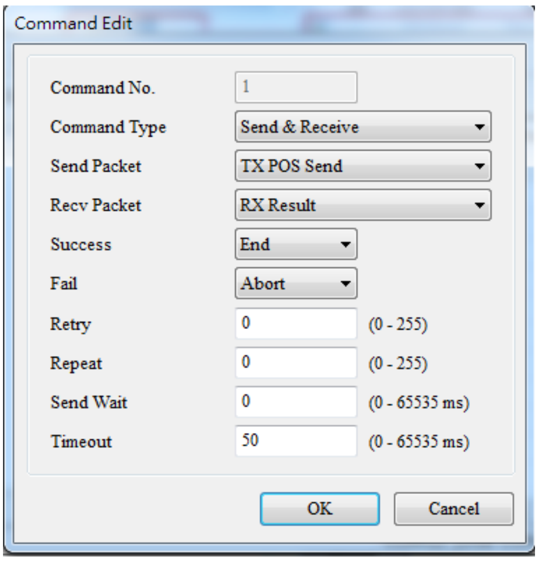
22) Double-click the new command on the list to open the Command Edit window.

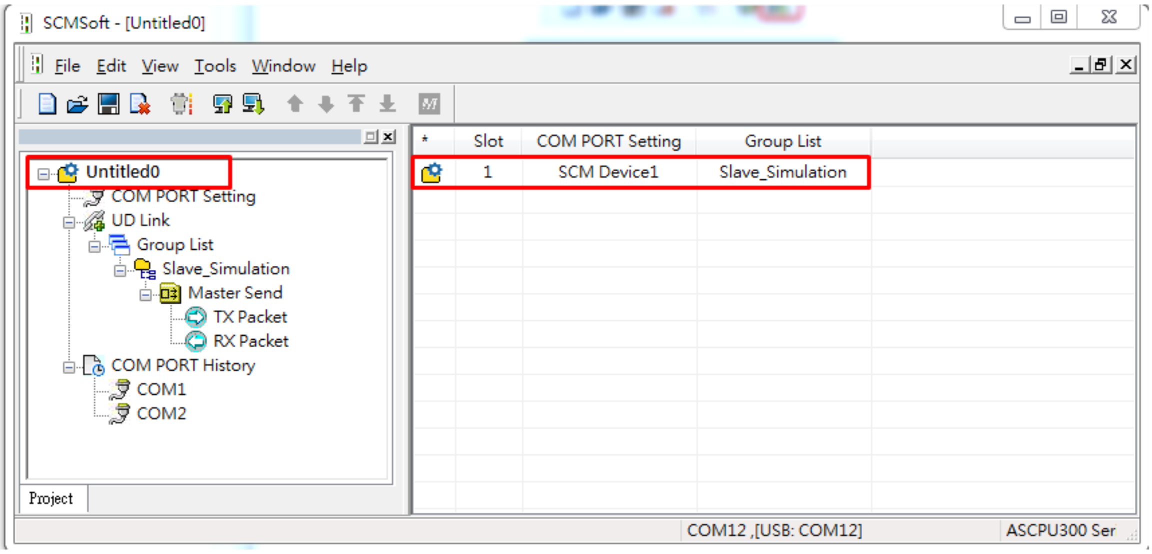




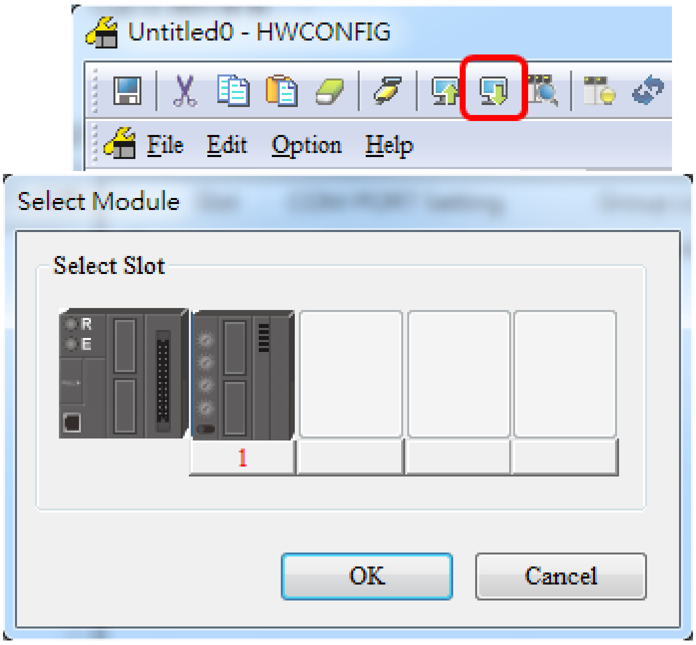
23) Set **Send Packet** to “TX POS Send” and set **Recv Packet** (received contents) to “RX Result”.



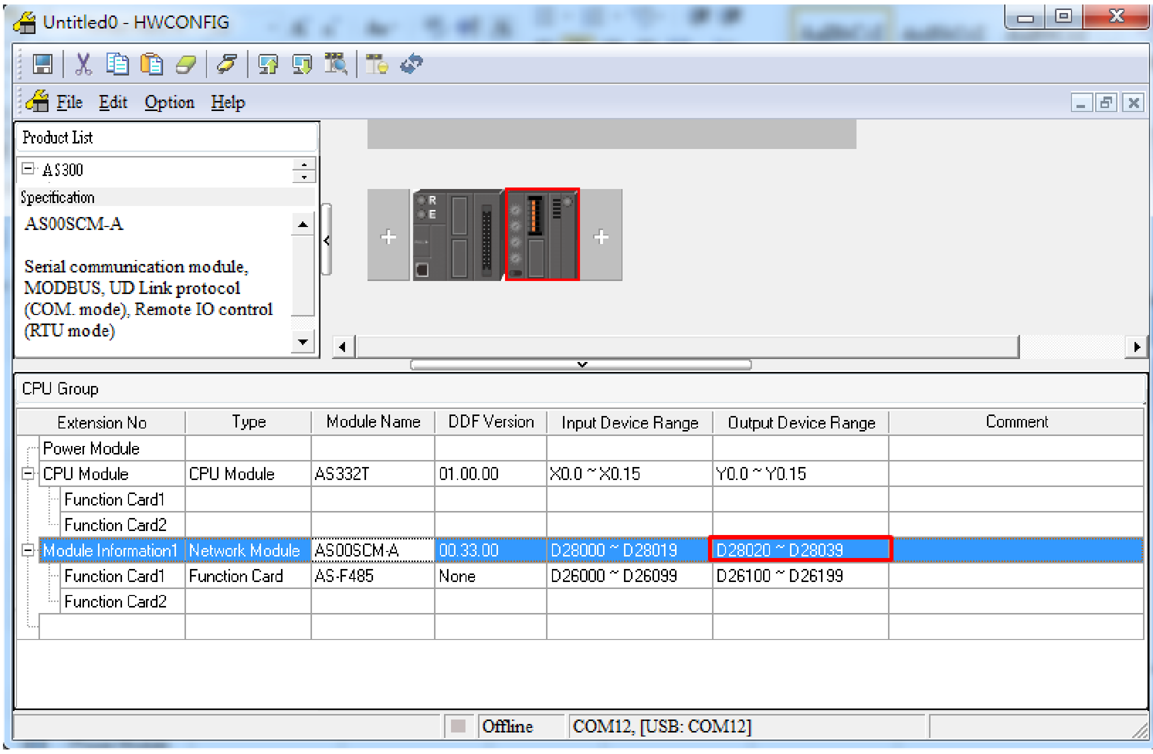
24) Make sure the Group is in slot 1 (COM1).



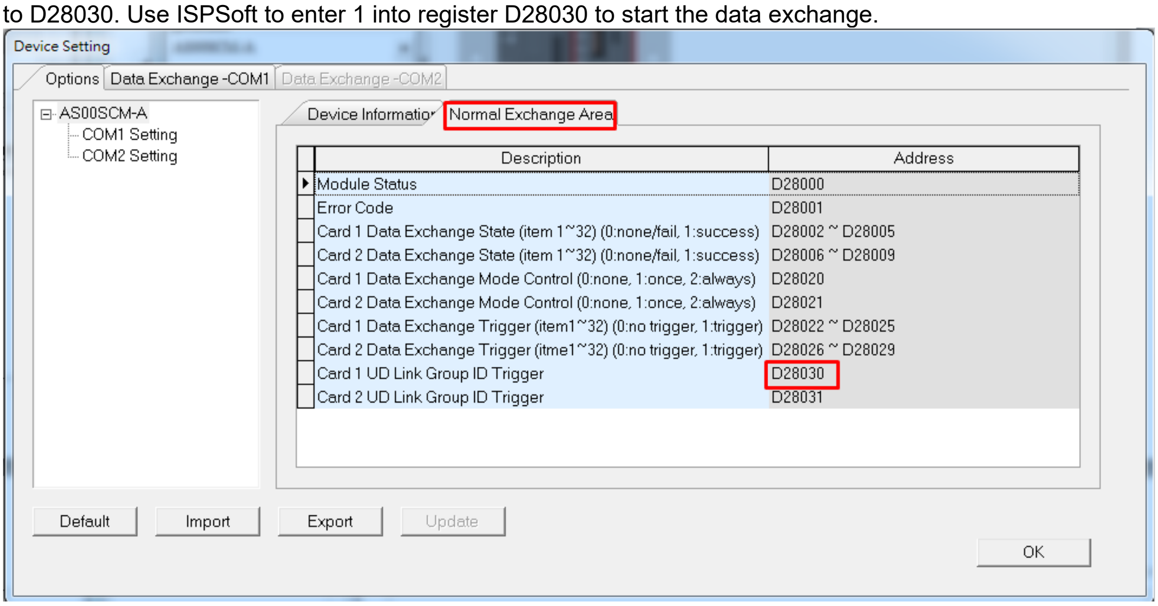
25) Click the Download button to download the parameters to the AS00SCM.



26) Set up the devices for the UD Link Group ID Trigger in HWCONFIG. Once you create the AS00SCM-A module, the system automatically assigns the corresponding addresses.

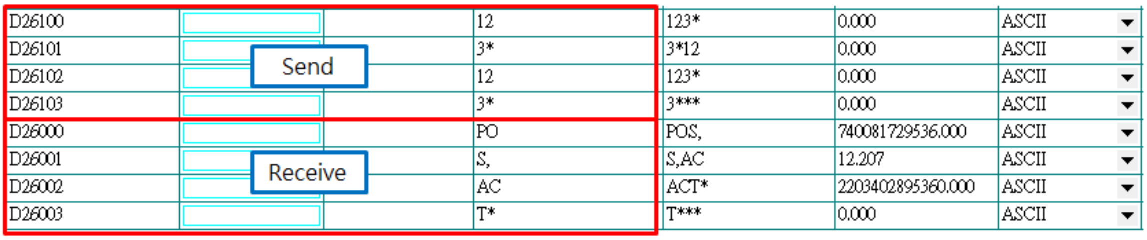


27) Double-click AS00SCM-A to open the Device Setting page. Verify that the Card 1 UD Link Group ID Trigger is set to D28030. Use ISPSoft to enter 1 into register D28030 to start the data exchange.



9

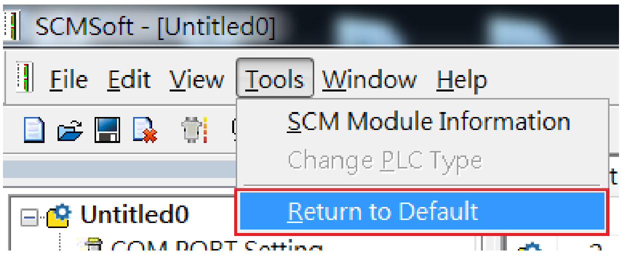
28) Use the monitor function in ISPSoft to verify that the transmission is working correctly.



D26100		12	123*	0.000	ASCII
D26101		3*	3*12	0.000	ASCII
D26102		12	123*	0.000	ASCII
D26103		3*	3***	0.000	ASCII
D26000		PO	POS,	740081729536.000	ASCII
D26001		S,	S,AC	12.207	ASCII
D26002		AC	ACT*	2203402895360.000	ASCII
D26003		T*	T***	0.000	ASCII

29) In SCMSoft, right-click the item COM PORT History on the left and click the option “Upload COM History Data” to see the transmission history of COM1 and COM2 respectively. Under the item COM1 and COM2, you can view recent transmission history; however the shown recent history cannot be deleted or saved.

30) Select *Tools -> Return to Default* to clear the previous settings and have all the settings back to defaults. After this, turn the power off and on again.



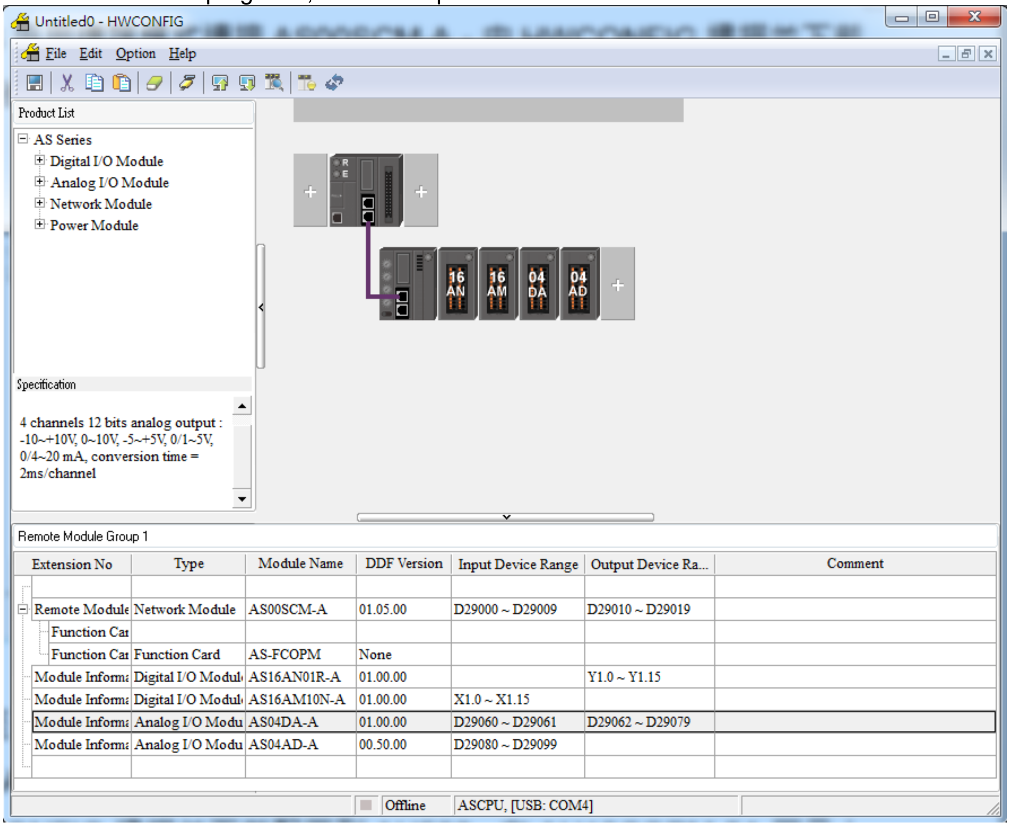
9.6.3 Remote IO Application (AS-FCOPM)

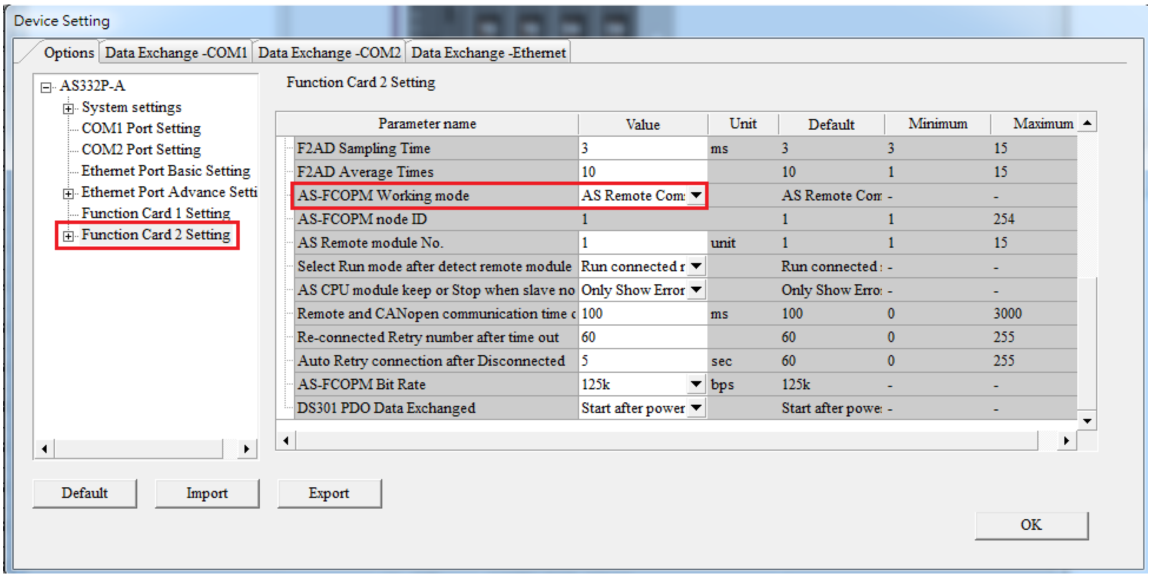
This example shows other series PLC, AH10COPM-5A, as a CANopen Master that controls four IO modules on the right side of AS00SCM-A that acts as a CANopen Slave. (You can use this method to connect to a 3rd party PLC.)

Device	Function
AS300	Scan and download AS00SCM-A (RTU mode), right side module configurations
AS00SCM-A + AS-FCOPM	CANopen Slave
AHCPU530-EN + AH10COPM-5A	CANopen Master
AS16AN10R-A	16 Digital outputs
AS16AM01N-A	16 Digital inputs
AS04DA-A	4 Analog channels for output
AS04AD-A	4 Analog channels for input

Step 1

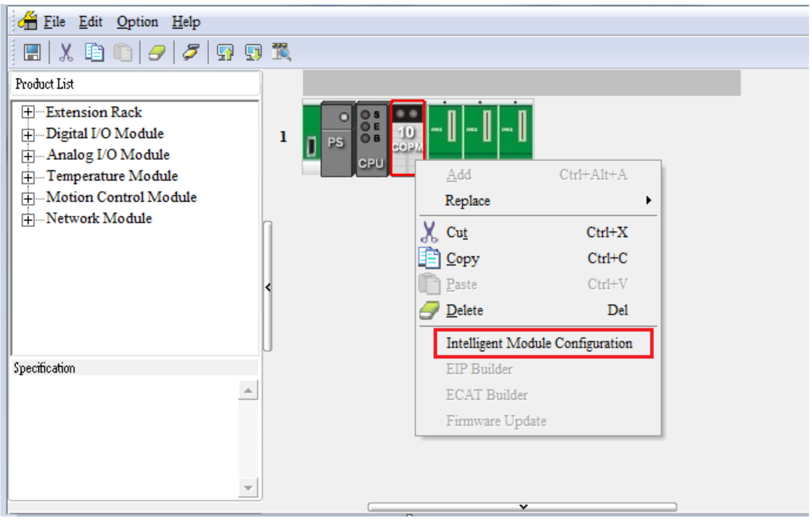
Use AS300 to connect to AS00SCM-A through AS Remote Communication (RTU mode) and then use HWCONFIG to scan and download the parameters. If the Card 2 LED is blinking normally, with no error messages, and no need to download the PLC programs, the device power can be turned off. Refer to Section 9.4.1.1 for reference.





Step 2

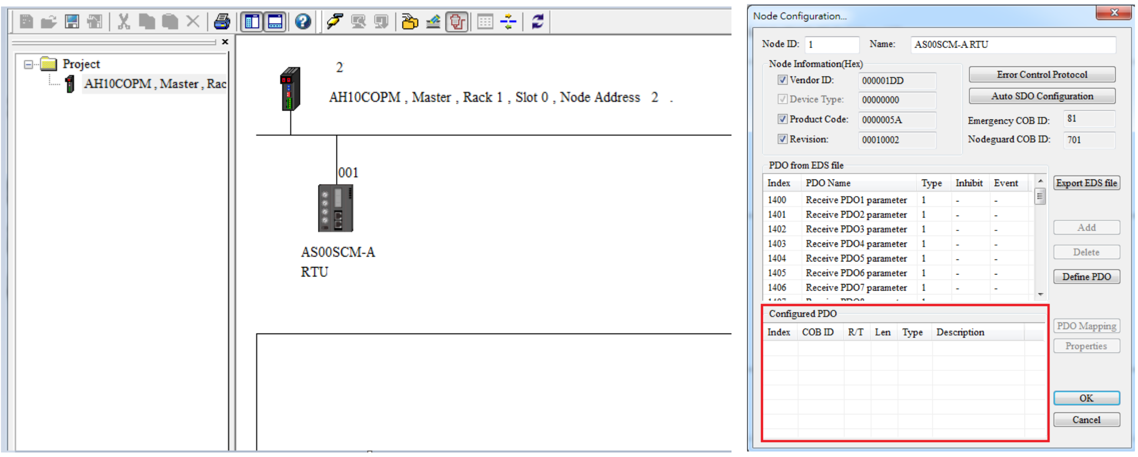
Turn the Format 1 of AS00SCM-A to 4 (using CANopen DS301 mode) and turn Format 2 to 7 (setting the bit rate to 1000kbps) and then turn the power off and on again. After that wiring AH10COPM-5A and set the node ID to 2 and set the bit rate to 1000kbps. Use ISPSoft (V3.04 or later) and HWCONFIG to scan and download the parameters to AH500. Right click AH10COPM-5A and open **Intelligent Module Configuration** (CANopen Builder) from the menu.



Step 3

Use CANopen Builder to scan the network. You should find Node ID 1 and its name to be AS00SCM-A RTU.

If not, check if you follow the first two steps right. And repeat the previous steps. Recommended to set the value in cycle period to 50 ms to ensure a more complete module functions. Double click the module to open the **Node Configuration** window and set up the PDO manually. RPDO is for DO/AO and TPDO is for DI/AI and error codes of RTU/IO.

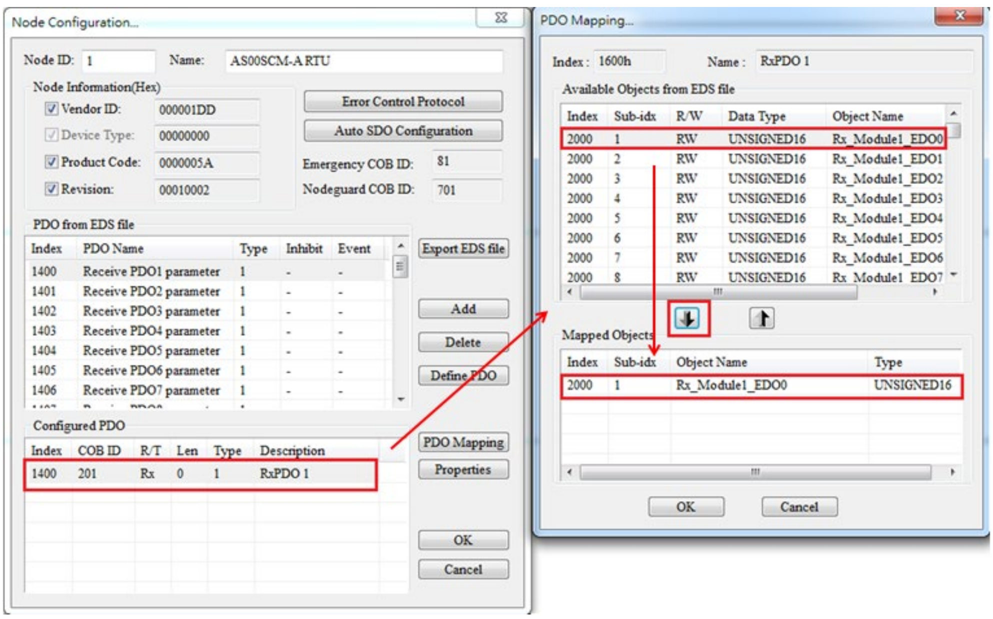


Step 4

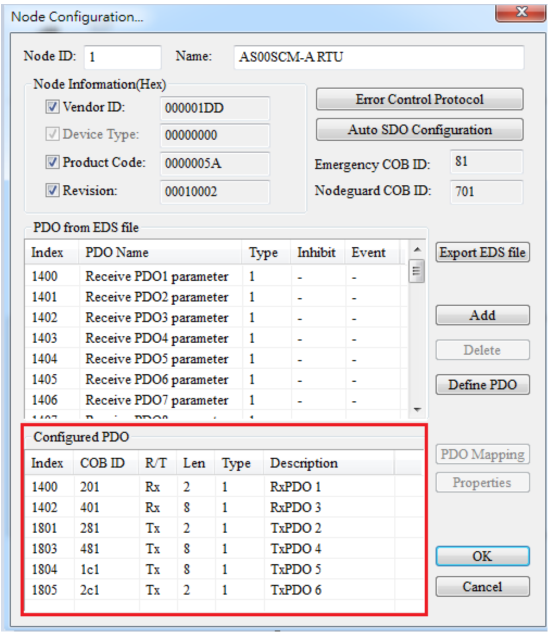
Here uses a first right side digital output module (16 points) as an example.

1. Since it is the first one, here it corresponds to Receive PDO1 (index: 1400), indicating RTU receives data from Master through CANopen communication. (If this is an input module, it sends data to Master through CANopen communication.) Double click to add it in the table. Double click the table to open the PDO setting window.

2. Since it is the first one, here it corresponds to Rx_Module 1. It is a 16-point digital output module so that only the object of one word Rx_Module1_EDO0 (Index: 2000) should be selected. Click the arrow to add it into the data mapping parameter table and you have set up a PDO for the first module. If t is a 32-point digital output module, objects of 2 words Rx_Module1_EDO0 and Rx_Module1_EDO1 should be selected in numerical order.



3. Follow the previous steps to set up more modules.



Device	Function	PDO	PDO Mapping	Mapping Registers
AS16AN01R-A	16 digital outputs	RxPDO1	Rx_Module1_EDO0	D6000
AS16AM01N-A	16 digital inputs	TxPDO2	Tx_Module2_EDI0	D5000
AS04DA-A	4 Analog channels for output (Integer format)*	RxPDO3	Rx_Module3_EDO0 Rx_Module3_EDO1 Rx_Module3_EDO2 Rx_Module3_EDO3	D6001 D6002 D6003 D6004
AS04AD-A	4 Analog channels for input (Integer format)*	TxPDO4	Tx_Module4_EDI0 Tx_Module4_EDI1 Tx_Module4_EDI2 Tx_Module4_EDI3	D5001 D5002 D5003 D5004
IO Module Error Code	-	TxPDO5	Tx_Module1_error_code Tx_Module2_error_code Tx_Module3_error_code Tx_Module4_error_code	D5005 D5006 D5007 D5008
RTU Error Code	-	TxPDO6	Tx_RTU_error_code	D5009

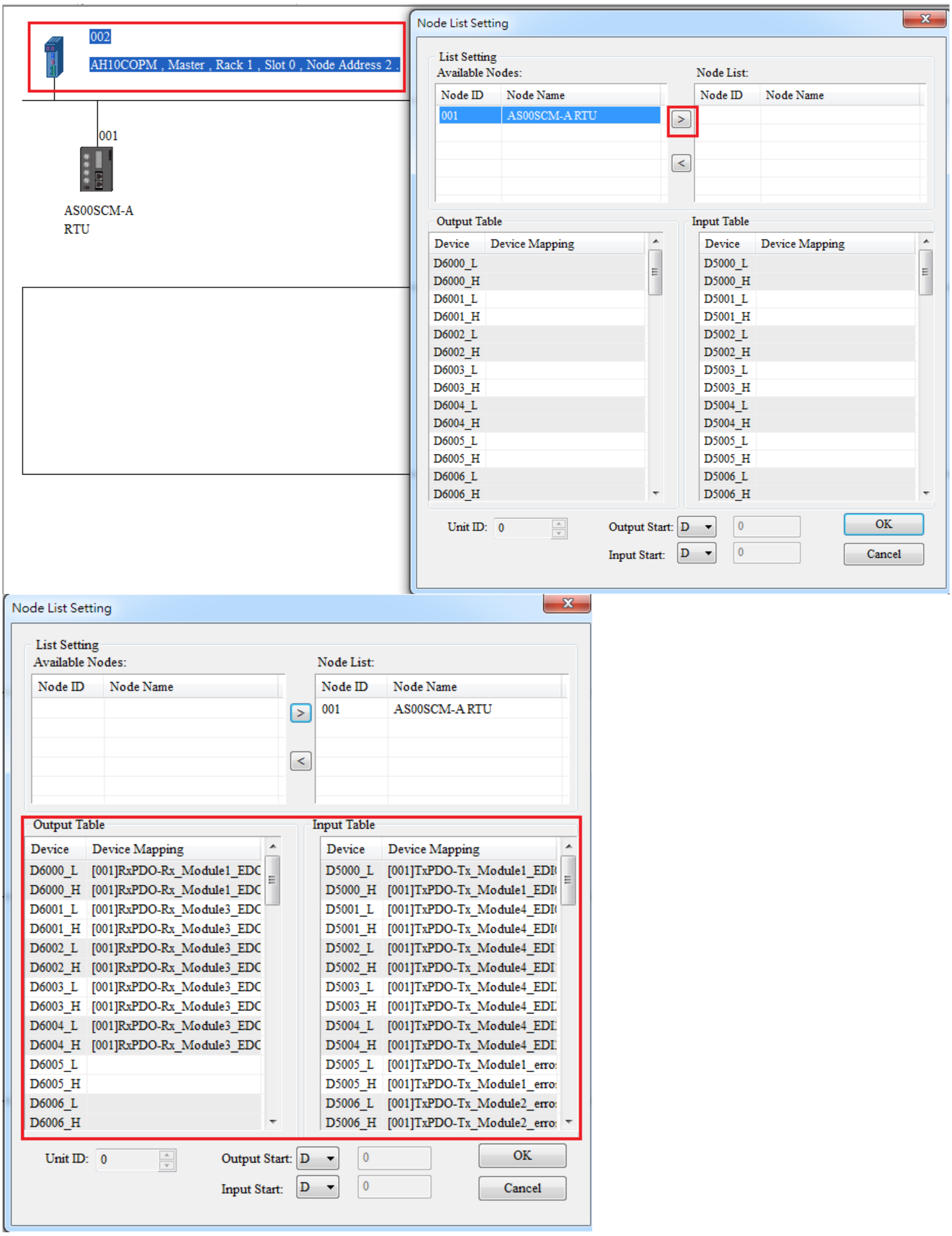
* Here the analog module uses integer format; if you need to use floating point format, two PDOs will be used per channel.

* Index 2002 to Index 200d are for system internal use only. Avoid using this range, when PDO is used.

* Only synchronization cycle is supported.

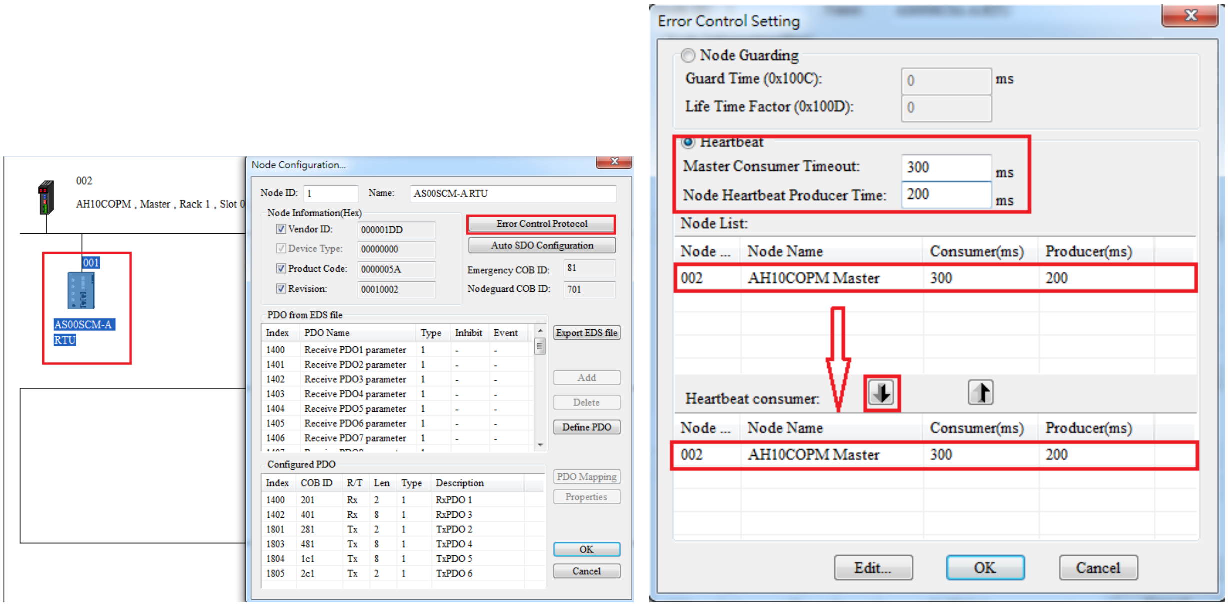
Step 5

Double click the PLC icon and select Node ID 001 from the available nodes and then use the **Right** arrow to add the selected one into the Node List. Output and Input tables are mapping registers for PDOs.

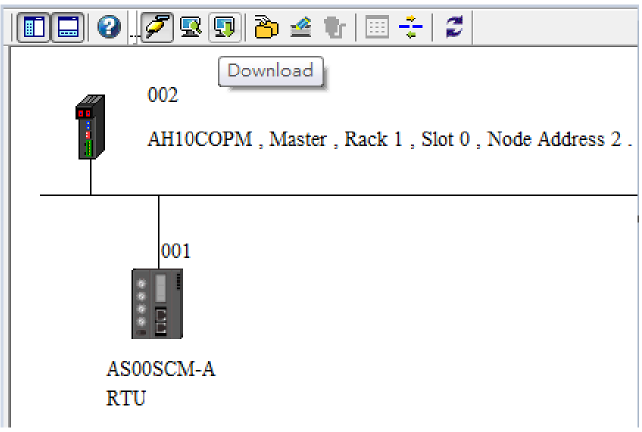


Step 6

Double click the module icon and the **Node Configuration** window appears. Click **Error Control Protocol** and then Error Control Setting windows appears. Select **Heartbeat** and set values for the **Master Consumer Timeout** and **Node Heartbeat Producer Timer**. Select AH10COPM Master from the Node List and click the **Down** arrow to add it to the list of Heart Consumer and then disconnection detection is now available for AS00SCM-A (RTU mode).

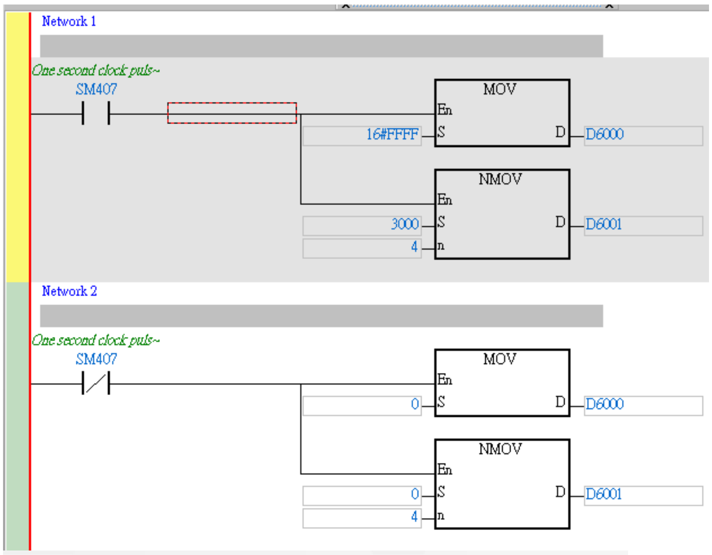


Click OK to confirm the setting. Download the parameters to the PLC. And then PLC can control the input/output of the IO module remotely.



An example of using PLC to control the input/output of the IO module remotely:

Start ISPSoft and download the program from AH series PLC. Switch digital output module between 1 and 0 in every 0.5 seconds; change output values of the analog output module. Wire DI/DO modules to AI/AO modules and then you can see the changes of D6000 from D5000 and D6001-D6004 from D5001-D5004 as the example below shown. The module error codes are stored in D5005-D5009. Refer to relevant module manuals for error code definitions.



Device Name	Value (16bits)	Radix
D6000	FFFF	Hexadecimal
D5000	FFFF	Hexadecimal
D6001	3000	Signed Decimal
D5001	2994	Signed Decimal
D6002	3000	Signed Decimal
D5002	2983	Signed Decimal
D6003	3000	Signed Decimal
D5003	2992	Signed Decimal
D6004	3000	Signed Decimal
D5004	2985	Signed Decimal

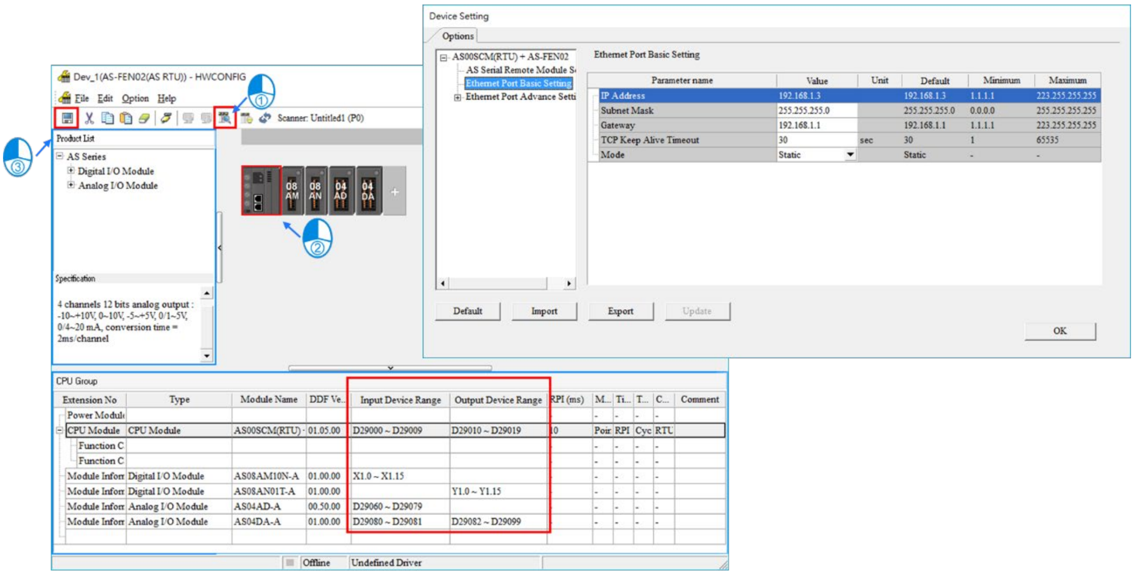
9.6.4 Remote IO Application (AS-FEN02)

When the firmware is V2.02 or later, AS-FEN02 can be installed on AS00SCM-A (RTU mode) and then PLC can monitor right side IO modules remotely.

Device	Function	IP Address / Location	Data Mapping Range
AS300	EtherNet/IP Master	192.168.1.5	D29000~D29019
AS00SCM-A + AS-FEN02	EtherNet/IP Slave	192.168.1.3	
AS08AM10N	Digital Input	right side of AS00SCM-A	X1.0~X1.15
AS08AN01T	Digital Output	right side of AS00SCM-A	Y1.0~Y1.15
AS04AD-A	Analog Input	right side of AS00SCM-A	D29060~D29079
AS04DA-A	Analog Output	right side of AS00SCM-A	D29080~D29099

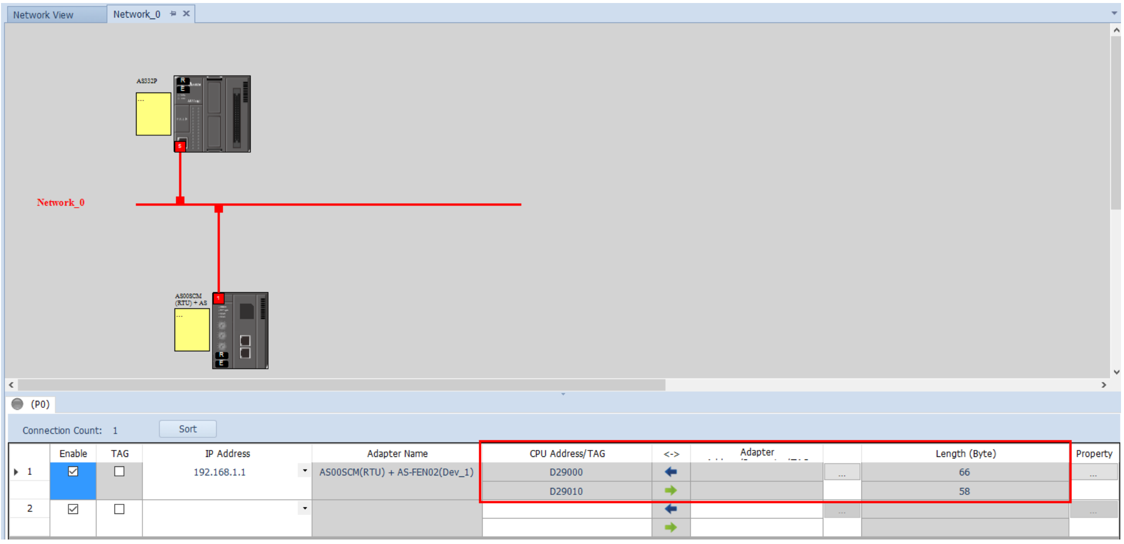
Step 1

After setting up AS300 in ISPSoft and HWCONFIG. Open EIP Builder and scan the network to add AS00SCM-A (RTU) + AS-FEN02 to the Network. Double-click RTU module to open HWCONFIG and scan to obtain the configuration and mapped register addresses of the I/O module on the right side of AS00SCM-A. You can also edit the module configurations and write down the mapped register addresses. After saving, close HWCONFIG. Refer to Section 9.4.2.3 for more details.



Step 2

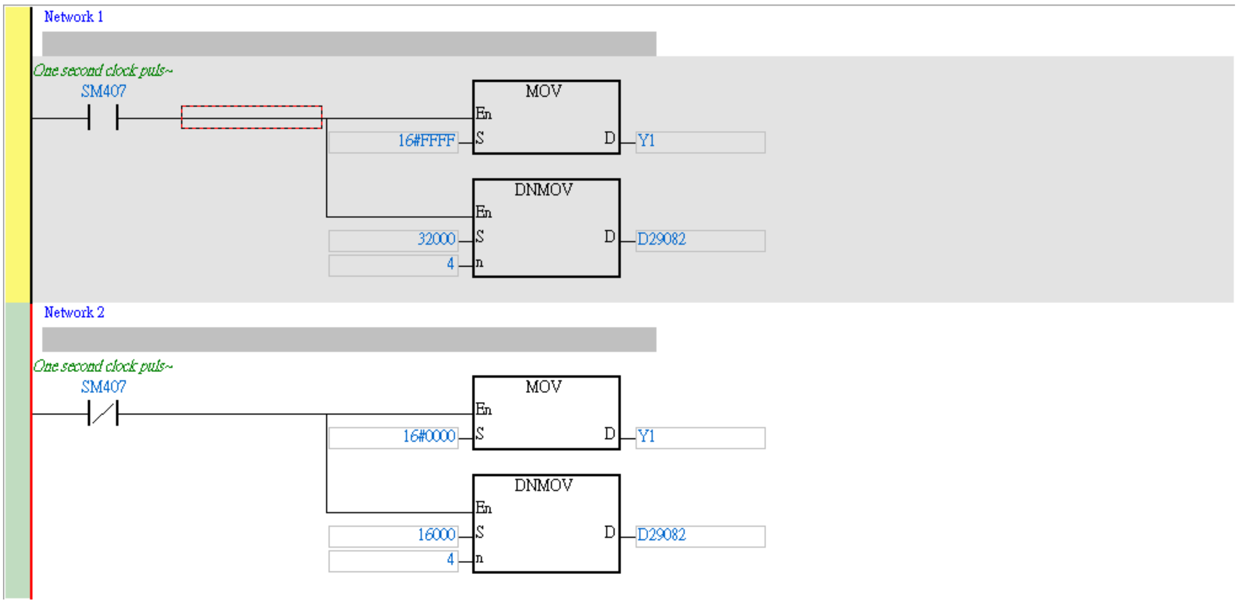
You can see the IP address and the data length from the data mapping table in EIP Builder. The data mapping table can be downloaded and upload the mapped data to the device.



Step 3

An example of using PLC to control the input/output of the IO module remotely:

Start ISPSoft and switch digital output module between 1 and 0 in every 0.5 seconds and shift output values of the analog output module between 10 V and 5V. Wire DI/DO modules to AI/AO modules. Refer to Chapter 2, 3 and 4 in this manual for more details on module operation.



9.6.5 Remote IO Application (Multiple AS-FEN02)

When AS-FEN02 is installed on AS Series PLC, it can be used as the Ethernet port of the CPU.

The following example shows how to add multiple AS00SCM-A (RTU) + AS-FEN02 (hereafter referred to as the “RTU”) to an AS Series PLC in EIP connection. All IP addresses of RTU are set by the software.

Device	Function	IP Address	Data Mapping Area
AS200	EtherNet/IP master/scanner	192.168.1.5	
AS00SCM-A + AS-FEN02	EtherNet/IP slave/adapter	192.168.1.30	D29540~D29559
AS00SCM-A + AS-FEN02	EtherNet/IP slave/adapter	192.168.1.31	D29180~D29199
AS00SCM-A + AS-FEN02	EtherNet/IP slave/adapter	192.168.1.32	D29360~D29379
AS08AN01T	Digital output	The right side of RTU	Y1.0~Y1.15
AS16AM10N-A	Digital input	The right side of RTU	X1.0~X1.15
AS08AM10N-A	Digital input	The right side of RTU	X2.0~X2.15

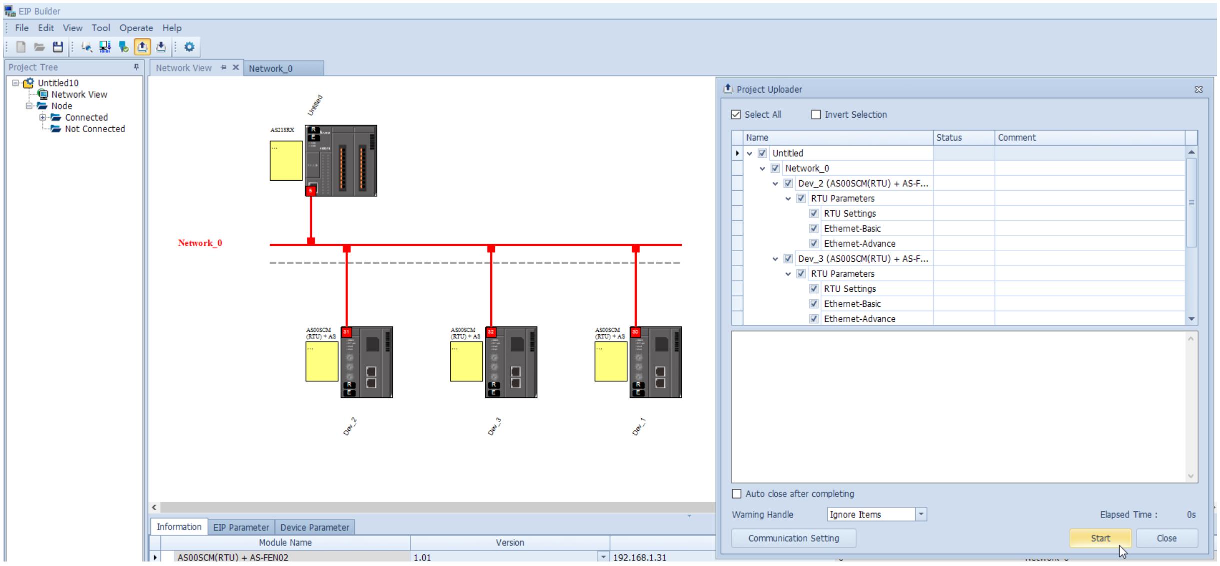
Step 1 Set up an IP address for the RTU

Turn all the knobs of the FORMAT 2 of the 3 new RTUs to 0. The default IP addresses are 192.168.1.3. Refer to section 9.4.2.2 for more information on using **IP Setting Tool** to set up the IP address.

Step 2

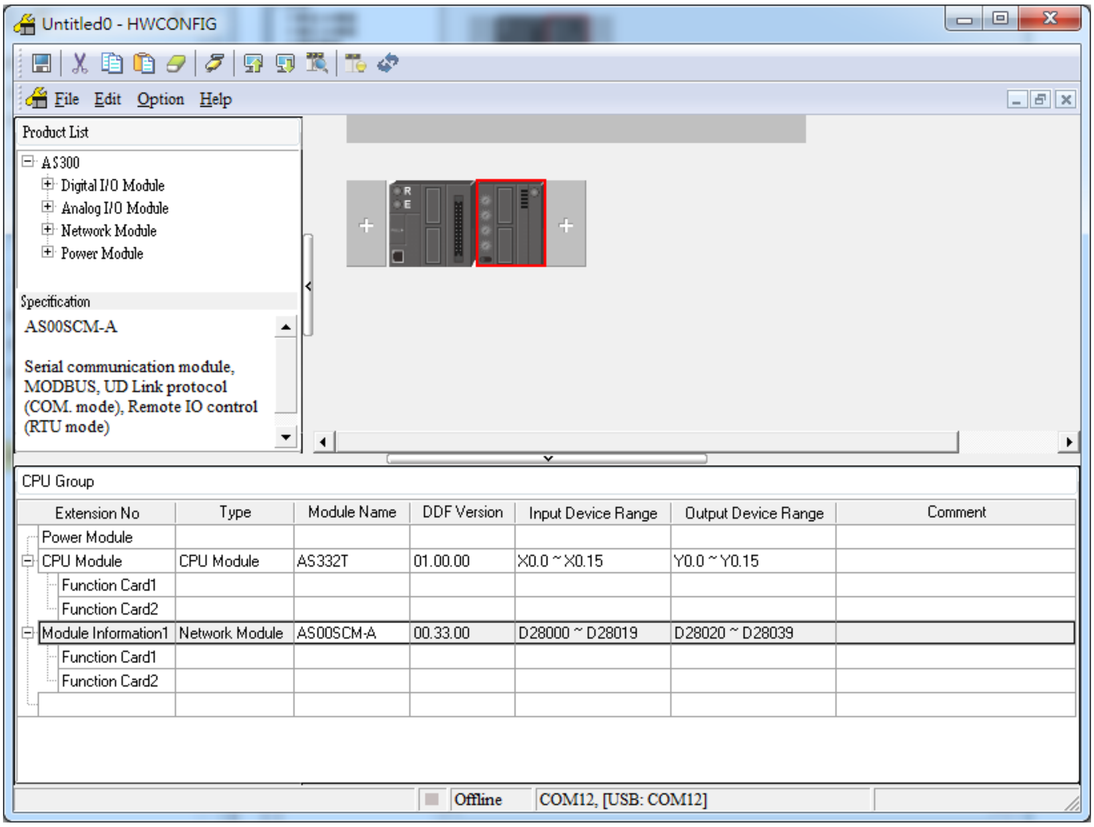
After the IP addresses of the 3 new RTUs are set, you can scan and add them in the network and connect to the AS Series PLC. Do not download the project before uploading the already set RTU values to the network.

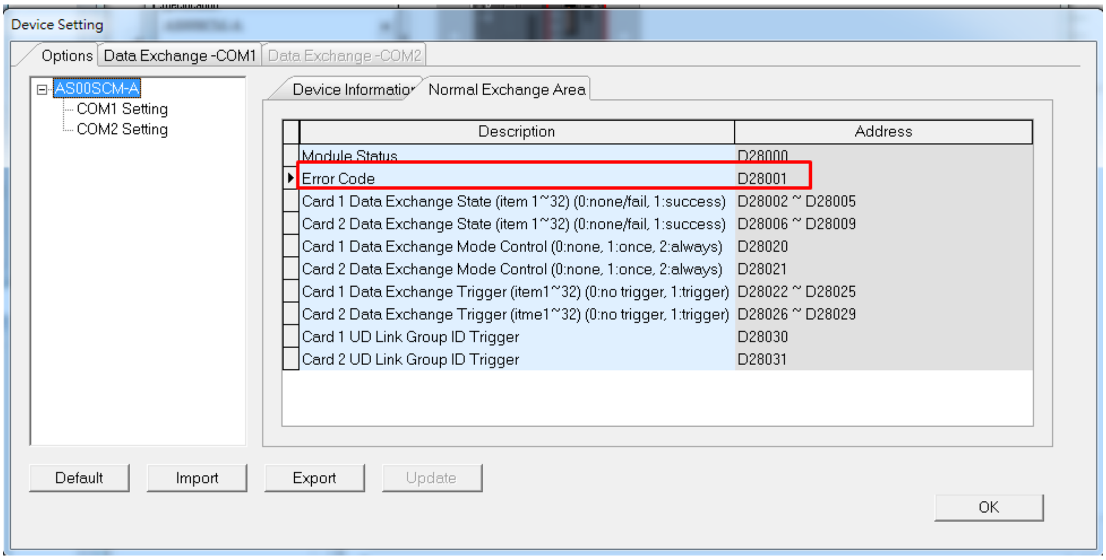
Now you can set up the right-side module of RTU. Refer to section 9.6.4 for more details. Scan all the RTU and save the parameters. Make sure the data mapping table is updated and then download the project, including the parameters, configurations, and data mapping table to the AS Series PLC and the RTUs.



9.7 Error Codes

The error flags and the UD Link status codes are stored in data registers. You can modify the input device range as needed.





9

9.7.1 Troubleshooting for Module AS00SCM-A as a Communication Module

9.7.1.1 ERROR LED Indicators are ON

The following error codes indicate possible errors when the AS00SCM-A module is installed on the right side of the CPU module and is acting as a communication module.

Error Code	Description	Solution
16#1605	Hardware failure	1. Check that the module is securely installed. 2. Install a new AS00SCM-A or contact the factory.
16#1606	The function card setting is incorrect.	1. Check if the function card is securely installed. 2. Install a new function card or contact the factory. 3. Check if the setting in HWCONFIG is consistent with the function card setting. 4. Install a new AS00SCM-A or contact the factory.

9.7.1.2 ERROR LED Indicators Blinking Every 0.5 Seconds

The following error codes identify possible errors when the AS00SCM-A module is installed on the right side of the CPU module and acts as a communication module.

Error Code	Description	Solution
16#1802	Incorrect parameters	Check the parameter in HWCONFIG. Download the parameter again.
16#1803	Communication timeout	1. Check whether the communication cable is properly connected. 2. Check if the station number and the communication format are correctly set. 3. Check if the connection with the function card is working correctly.
16#1804	The UD Link setting is incorrect.	1. Check the settings of the UD Link. 2. Check the warning settings in the PLC.

The following error codes can only be viewed with SCMSoft; when the following errors occur, they are not shown on the LED indicators and the system does not send the error messages to the CPU module.

Error Code	Description	Solution
16#0107	The settings in HWCONFIG and manual settings are not consistent with function card 1.	Check the settings in HWCONFIG and manual settings for function card 1.
16#0108	The settings in HWCONFIG and manual settings are not consistent for function card 2.	Check the settings in HWCONFIG and manual settings for function card 2.
16#0201	Incorrect parameters	Check the parameter in HWCONFIG. Download the parameter again.
16#0301	Function card 1 communication timeout	1. Check if the station number and the communication format are correctly set. 2. Check if the connection with the function card is working correctly.

Error Code	Description	Solution
16#0302	Function card 2 communication timeout	1. Check if the station number and the communication format are correctly set. 2. Check if the connection with the function card is working correctly.
16#0400	Invalid UD Link Group ID for function card 1	1. Check the UD Link settings. 2. Check the warning settings in the PLC.
16#0401	Invalid UD Link Group ID for function card 2	1. Check the UD Link settings. 2. Check the warning settings in the PLC.
16#0402	Invalid UD Link Command for function card 1	1. Check the UD Link settings. 2. Check the warning settings in the PLC.
16#0403	Invalid UD Link Command for function card 1	1. Check the UD Link settings. 2. Check the warning settings in the PLC.

9.7.2 Troubleshooting for Module AS00SCM-A as a Remote Module

Errors from the remote modules are regarded as warnings for AS Series CPU modules. The LED indicator of the CPU module blinks and the CPU module can still operate. Use flag SM30 to manage error presentation in the remote modules.

9.7.2.1 ERROR LED Indicators Are ON

Error codes:

Error Code	Description	Solution
16#1301	Hardware failure	1. Check if the module is securely installed. 2. Change and install a new AS00SCM-A or contact the factory.
16#1302	The function card setting is incorrect.	1. Check if the function card is securely installed with the AS-FCOPM card. 2. Change and install a new function card or contact the factory. 3. Check if the setting in HWCONFIG is consistent with the function card setting. 4. Install a new AS00SCM-A or contact the factory.

9.7.2.2 ERROR LED Indicators Blinking Every 1 Seconds

This indicates the remote module had been stopped before but the problem was cleared. The reasons for the remote module to stop include lost connection with the master, lost connection with the IO module, and alarm occurring in IO module. Refer to section 9.4.3 for more details.

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9.7.2.3 ERROR LED Indicators Blinking Every 0.5 Seconds

Error codes:

Error Code	Description	Solution
16#1500	Remote module communication timeout	Make sure the communication cable is well connected
16#1502	Incorrect parameters	Check the parameter in HWCONFIG. Download the parameter again.
16#1503	Remote extension module communication timeout	Make sure the communication cable is well connected and the module is properly connected to the CPU module and turn the modules on again.
16#1505	The actual placement of the extension modules is NOT the same as it is set.	Check if the parameter in HWCONFIG is the same as the actual placement.

9.7.2.4 ERROR LED Indicators Blinking Every 0.2 Seconds

This happens when the 24 VDC power supply for the remote module is not sufficient. Check the power supply. If the power supply is normal, remove the extension module from the CPU module and then check if the SCM remote module is out of order. Error codes:

Error Code	Description	Solution
16#1303	24VDC power supply had not been sufficient before and then recovered from low-voltage that was less than 10 ms.	Check whether the 24 V power supply to the module is normal.

10

Chapter 10 Function Cards

Table of Contents

10.1 Introduction

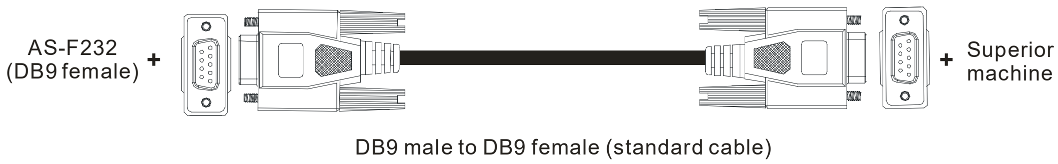
Function cards are extension cards such as analog input/output (AI/AO) and communication cards for the AS Series PLC.

10.2 Specification and Function

10.2.1 AS-F232

The AS Series PLC is built with COM1 (RS-485) and COM2 (RS-485) ports. You can use the AS-F232 extension card for communication other interfaces such as RS-232, PC, and so on. Except for the communication interface, however, the communication functions are the same as the built-in ones. You can set up the communication port as either a slave or a master node. After installing the extension card, use HWCONFIG in ISPSoft to configure the communication.

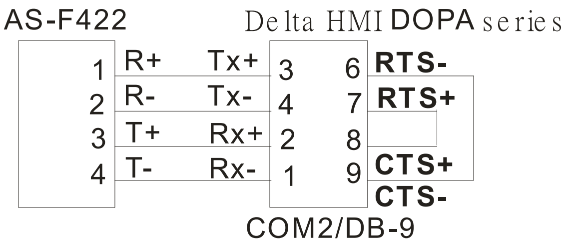
■ Wiring example



10.2.2 AS-F422

Use the AS-F422 extension card to communicate with Delta HMI devices or other devices that use an RS-422 communication port. Other than the different communication interface, the communication functions remain the same as the built-in ones. You can set the communication port as either a slave or a master node. After installing the extension card, use HWCONFIG in ISPSoft to configure the communication.

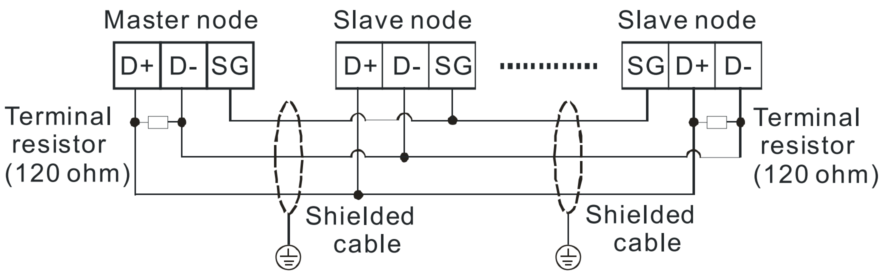
■ Wiring example for communication with Delta HMI DOPA series via COM2



10.2.3 AS-F485

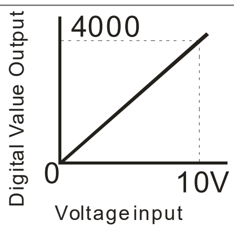
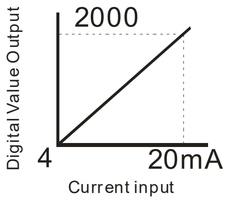
With its own standalone communication port, the AS-F485 card can work independently and can be either a slave or a master node. After installing the extension card, use HWCONFIG in ISPSoft to configure the communication.

■ Wiring example



10.2.4 AS-F2AD

2 DC analog signal input channels:

Item	Voltage Input	Current Input
Rated Input Range	0 V - 10 V	4 mA - 20 mA
Resolution	12-bit	11-bit
Digital Conversion Range	0 - 4000	0 - 2000
Hardware Input Limit*1	0V ~ +10.24V	4mA ~ 20.37mA (FW V1.00) 3.63mA ~ 20.37mA (FW V1.20 or later)
Digital Conversion Limit*2	0 ~ 4095	0 ~ 2047 (FW V1.00) - 48 ~ 2047(FW V1.20 or later)
Error Rate	room temperature: ±0.5% ; full temperature range: ±1.0%	
Input Impedance	2 MΩ	250 Ω
Conversion Time*3	3 ms / CH	
Characteristic Curve		
Digital Value Output*4	Card 1	SR168 (CH1), SR169 (CH2)
	Card 2	SR170 (CH1), SR171 (CH2)

*1: The input signal should NOT exceed the limit. If exceeding the limit, damage may occur.

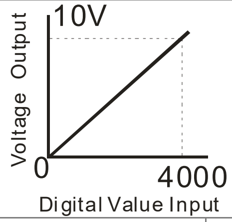
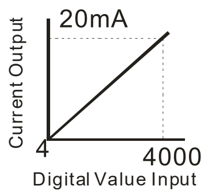
*2: If the input signal exceeds the hardware input limit, the module only shows the maximum value. If the input signal is below the lower limit, it only shows the minimum value. If the input signal exceeds the hardware input limit, it also exceeds the digital conversion limit and a conversion limit error appears. For example in the current input mode (4 mA to 20 mA), when the input signal is 0 mA, exceeding the hardware lower limit, it also exceeds the conversion lower limit. The module uses the lower limit value (-48) as the input signal. If a disconnected analysis is required, you can check if the digital conversion value is -48.

*3: The conversion time is the time for each channel to convert signals to hardware input signals. If you need to calculate a complete conversion time, you need to add the PLC scan time.

*4: Use the program to read the values in SR to obtain the corresponding A/D conversion value for the channel.

10.2.5 AS-F2DA

2 DC analog signal output channels:

Item	Voltage Output		Current Output
Analog Signal	0 V - 10 V		4 mA - 20 mA
Resolution	12-bit		12-bit
Digital Conversion Limit	0 - 4000		0 - 4000
Error Rate	room temperature: ±0.5% ; full temperature range: ±1.0%		
Impedance Allowance	≥1 kΩ		≤500 Ω
Conversion Time*1	2ms / CH		
Characteristic Curve			
Digital Value Output*2	Card 1	SR172 (CH1)	SR173 (CH2)
	Card 2	SR174 (CH1)	SR175 (CH2)

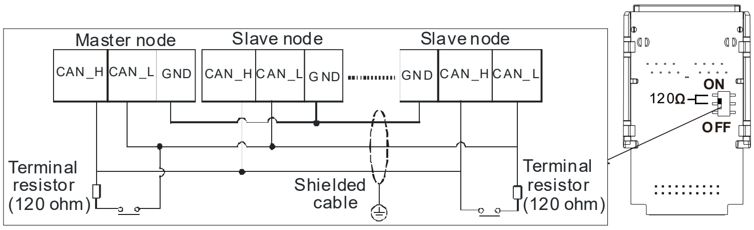
*1: The conversion time is the time for each channel to convert signals to hardware input signals. If you need to calculate a complete conversion time, you need to add the PLC scan time.

*2: Use the MOV instruction to move the value to the SR to obtain the corresponding voltage output value.

10.2.6 AS-FCOPM

With its own standalone communication port, the AS-FCOPM card can work independently and can be either a slave or a master node. After installing the extension card, use HWCONFIG in ISPSoft to configure the communication.

■ Wiring example



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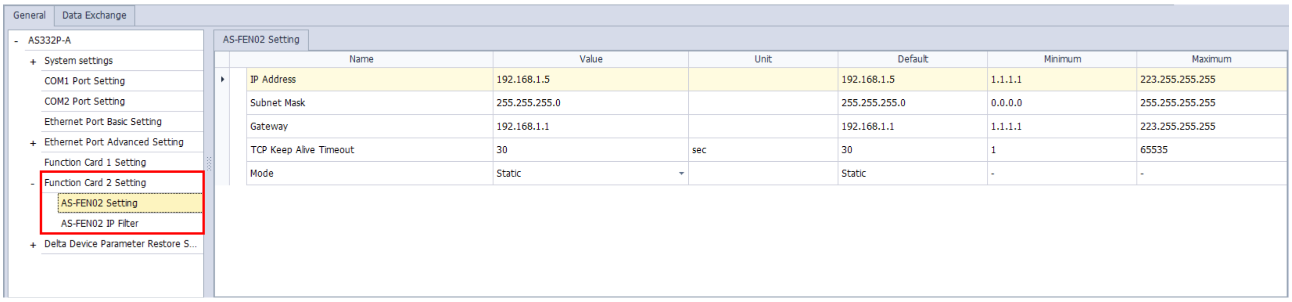
10.2.7 AS-FEN02

This communication card can work independently and does NOT occupy the communication port of PLC CPU. It can act as Modbus TCP Server or Client and EtherNet/IP Adapter. After AS-FEN02 is installed, you can go to HWCONFIG from ISPSoft to do the editing in the Function Card 2 section.



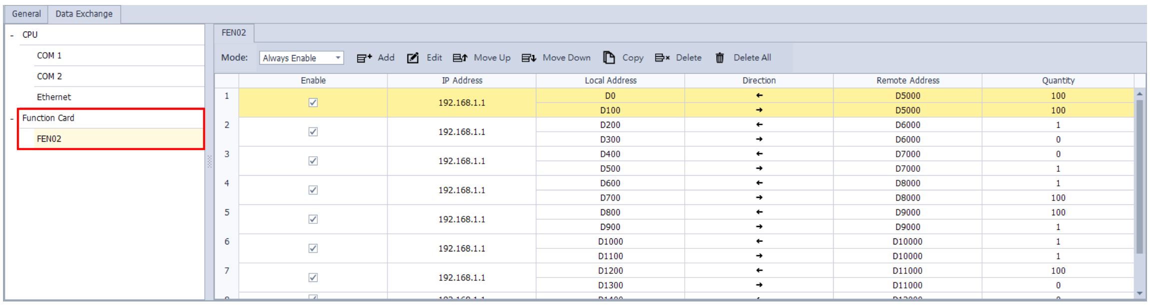
All the AS-FEN02 parameters are stored in AS300 PLC CPU or AS00SCM-A. If you need the IP address of AS-FEN02, you need to go to HWCONFIG from ISPSoft to check its IP address in the Function Card 2 section. You can also use COMMGR to see the IP address of this device.

10.2.7.1 Supported Software and Firmware Versions

- The firmware of AS300 Series PLC should be V1.06 or later for AS-FEN02 to be installed on it.
- The firmware of AS00SCM-A module (in RTU mode) should be V2.02 or later for AS-FEN02 to be installed on it.
- ISPSoft version should be V3.06 or later.
- EIP Builder version should be V1.06 or later.

10.2.7.2 Features

- AS-FEN02 can be installed on AS300 Series PLC and AS00SCM-A (in RTU mode). This section introduces the operations when it is installed on AS300 Series PLC. For the operations when it is installed on AS00SCM-A and acting as remote module for AS/AH Series PLC, refer to section 9.4.2 for more details.
- When AS-FEN02 is installed on AS300 Series PLC, it acts as a Master or a Slave for Modbus TCP connection. The operation is the same as using the built-in connection port for communication and select FEN02 as the Function Card on Data Exchange tab, refer to section 9.3.1.2 of AS Series Operation Manual for more details.



- When AS-FEN02 is installed on AS300 Series PLC, it acts as a EthernNet/IP Adapter but not EtherNet/IP Scanner for EtherNet/IP connection. The operation is the same as the EtherNet/IP port on AS Series PLC, refer to Section 10.2.7.6 in this manual and Chapter 9 of AS Series Operation Manual for more details.

10.2.7.3 Specifications

- **System Specifications**

Item		Specification
General	**Device type**	Master, Slave and RTU
	Topology	Star and linear topologies are supported.
	IP Settings	● When installed on AS300 PLC CPU, you can only use HWCONFIG from ISPSoft for editing. ● When installed on AS00SCM-A and used for RTU application, you can edit via software or hardware. ■ Software: Set the ID2 and FORMAT2 to 0x000 and use HWCONFIG from EIP Builder for editing. ■ Hardware: Use the ID2 and FORMAT2 to set IP address to 192.168.1.X (X=1~254) or turn ID2 and FORMAT2 to 0xFF to make it in DHCP mode.
	Availability	AS300 Series PLC AS00SCM-A (available only for RTU mode)
Web	**Max. connection number**	8
	Functions	View device information Account management AS-FEN02 firmware update When installed in AS00SCM-A and in RTU mode, the module monitoring is supported.

- **MODBUS TCP Specifications (only available for CPU modules)**

Item		Specification
General	**Device type**	Server, Client
MODBUS TCP Server	**Max. connection number**	8
	Max. data length/per transmission	200 words
MODBUS TCP Client	**Max. connection number**	8
	Max. data length/per transmission	200 words
Note: The connection numbers of Server and Client are counted separately.		

- **EtherNet/IP Specifications**

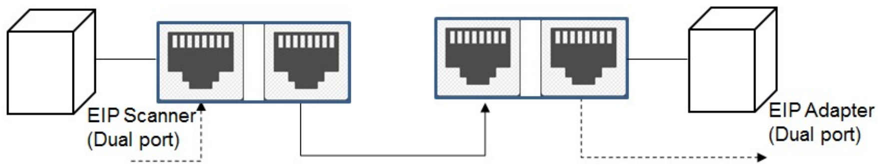
Item		Specification
General	**Device type**	Adapter
CIP Network I/O Connection	**CIP connection number**	8
	TCP connection number	8 (Servers)
	Requested Packet Interval (RPI)	1 ms~1000ms
	Max. Transmission Speed	10,000 pps
	Max. data length/per transmission	200 bytes
CIP Network Explicit Message	**Class 3 (Connected Type)**	Total 8 (Servers) (for both class 3 and UCMM connection types)
	UCMM	

Item		Specification
	(Non-Connected Type, only uses TCP connections)	
	CIP Objects	Identity Object (16#01) Message Router Object (16#02) Assembly Object (16#04) Connection Manager Object (16#06) Port Object (16#F4) TCP/IP Interface Object (16#F5) Ethernet Link Object (16#F6) Not supporting self-defined objects

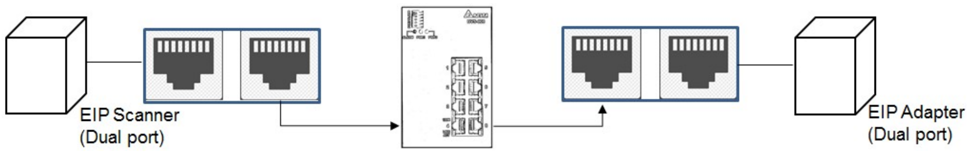
10.2.7.4 Topology

With its own standalone communication port, the AS-FEN02 card can work independently and can be MODBUS TCP Server, Client and EtherNet/IP Adapter. After installing the extension card, use HWCONFIG in ISPSoft to configure the communication.

- **Linear Topology**



- **Star Topology**



10.2.7.5 SM/SR

- **Special Auxiliary Relays (SM)**

SM	Function	AS300 Series	AS200 Series	OFF ⇩ ON	STOP ⇩ RUN	RUN ⇩ STOP	Latched	Attribute	Default
SM1006	Data exchange through AS-FEN02 enabled by ISPSoft.	○	–	OFF	–	OFF	N	R/W	OFF
SM1008	Connection 1 for data exchange through AS-FEN02 started	○	–	OFF	–	–	N	R/W	OFF
SM1009	Connection 2 for data exchange through AS-FEN02 started	○	–	OFF	–	–	N	R/W	OFF
SM1010	Connection 3 for data exchange through AS-FEN02 started	○	–	OFF	–	–	N	R/W	OFF
SM1011	Connection 4 for data exchange through AS-FEN02 started	○	–	OFF	–	–	N	R/W	OFF
SM1012	Connection 5 for data exchange through AS-FEN02 started	○	–	OFF	–	–	N	R/W	OFF
SM1013	Connection 6 for data exchange through AS-FEN02 started	○	–	OFF	–	–	N	R/W	OFF
SM1014	Connection 7 for data exchange through AS-FEN02 started	○	–	OFF	–	–	N	R/W	OFF
SM1015	Connection 8 for data exchange through AS-FEN02 started	○	–	OFF	–	–	N	R/W	OFF
SM1016	Successful data exchange connection 1 through AS-FEN02	○	–	OFF	–	–	N	R	OFF
SM1017	Successful data exchange connection 2 through AS-FEN02	○	–	OFF	–	–	N	R	OFF
SM1018	Successful data exchange connection 3 through AS-FEN02	○	–	OFF	–	–	N	R	OFF
SM1019	Successful data exchange connection 4 through AS-FEN02	○	–	OFF	–	–	N	R	OFF
SM1020	Successful data exchange connection 5 through AS-FEN02	○	–	OFF	–	–	N	R	OFF
SM1021	Successful data exchange connection 6 through AS-FEN02	○	–	OFF	–	–	N	R	OFF
SM1022	Successful data exchange connection 7 through AS-FEN02	○	–	OFF	–	–	N	R	OFF
SM1023	Successful data exchange connection 8 through AS-FEN02	○	–	OFF	–	–	N	R	OFF
SM1024	Error in data exchange connection 1 through AS-FEN02	○	–	OFF	–	–	N	R	OFF
SM1025	Error in data exchange connection 2 through AS-FEN02	○	–	OFF	–	–	N	R	OFF
SM1026	Error in data exchange connection 3 through AS-FEN02	○	–	OFF	–	–	N	R	OFF
SM1027	Error in data exchange connection 4 through AS-FEN02	○	–	OFF	–	–	N	R	OFF
SM1028	Error in data exchange connection 5 through AS-FEN02	○	–	OFF	–	–	N	R	OFF
SM1029	Error in data exchange connection 6 through AS-FEN02	○	–	OFF	–	–	N	R	OFF

SM	Function	AS300 Series	AS200 Series	OFF ⇩ ON	STOP ⇩ RUN	RUN ⇩ STOP	Latched	Attribute	Default
SM1030	Error in data exchange connection 7 through AS-FEN02	○	–	OFF	–	–	N	R	OFF
SM1031	Error in data exchange connection 8 through AS-FEN02	○	–	OFF	–	–	N	R	OFF

Special auxiliary relay	Refresh time
SM1006	After the parameters of data exchange are downloaded, you set the flag to ON or OFF.
SM1008~SM1015	After the parameters of data exchange are downloaded, you set the flag to ON or OFF.
SM1016~SM1031	The flag is ON, when the system is refreshed automatically.

- **Special Data Registers (SR)**

SR	Function	AS300 Series	AS200 Series	OFF ⇩ ON	STOP ⇩ RUN	RUN ⇩ STOP	Latched	Attribute	Default
SR1520	Actual connection time for data exchange through the AS-FEN02 connection 1	○	–	0	–	–	N	R	0
SR1521	Actual connection time for data exchange through the AS-FEN02 connection 2	○	–	0	–	–	N	R	0
SR1522	Actual connection time for data exchange through the AS-FEN02 connection 3	○	–	0	–	–	N	R	0
SR1523	Actual connection time for data exchange through the AS-FEN02 connection 4	○	–	0	–	–	N	R	0
SR1524	Actual connection time for data exchange through the AS-FEN02 connection 5	○	–	0	–	–	N	R	0
SR1525	Actual connection time for data exchange through the AS-FEN02 connection 6	○	–	0	–	–	N	R	0
SR1526	Actual connection time for data exchange through the AS-FEN02 connection 7	○	–	0	–	–	N	R	0
SR1527	Actual connection time for data exchange through the AS-FEN02 connection 8	○	–	0	–	–	N	R	0
SR1528	The error code for data exchange through the AS-FEN02 connection 1	○	–	0	–	–	N	R	0
SR1529	The error code for data exchange through the AS-FEN02 connection 2	○	–	0	–	–	N	R	0
SR1530	The error code for data exchange through the AS-FEN02 connection 3	○	–	0	–	–	N	R	0
SR1531	The error code for data exchange through the AS-FEN02 connection 4	○	–	0	–	–	N	R	0
SR1532	The error code for data exchange through the AS-FEN02 connection 5	○	–	0	–	–	N	R	0
SR1533	The error code for data exchange through the AS-FEN02 connection 6	○	–	0	–	–	N	R	0
SR1534	The error code for data exchange through the AS-FEN02 connection 7	○	–	0	–	–	N	R	0

SR	Function	AS300 Series	AS200 Series	OFF ⇩ ON	STOP ⇩ RUN	RUN ⇩ STOP	Latched	Attribute	Default
SR1535	The error code for data exchange through the AS-FEN02 connection 8	○	–	0	–	–	N	R	0
SR1536	AS-FEN02/FOPC02 TCP current connection number	○	–	0	–	–	N	R	0
SR1537	AS-FEN02 MODBUS/TCP Server connection number	○	–	0	–	–	N	R	0
SR1538	AS-FEN02 MODBUS/TCP Client connection number	○	–	0	–	–	N	R	0
SR1539	AS-FEN02/FOPC02 EtherNet/IP Adapter connection number	○	–	0	–	–	N	R	0

Special data register	Refresh time
SR1520~SR1535	Refresh after AS-FEN02 communication is done.
SR1536~SR1539	The flag is ON, when the system is refreshed automatically.

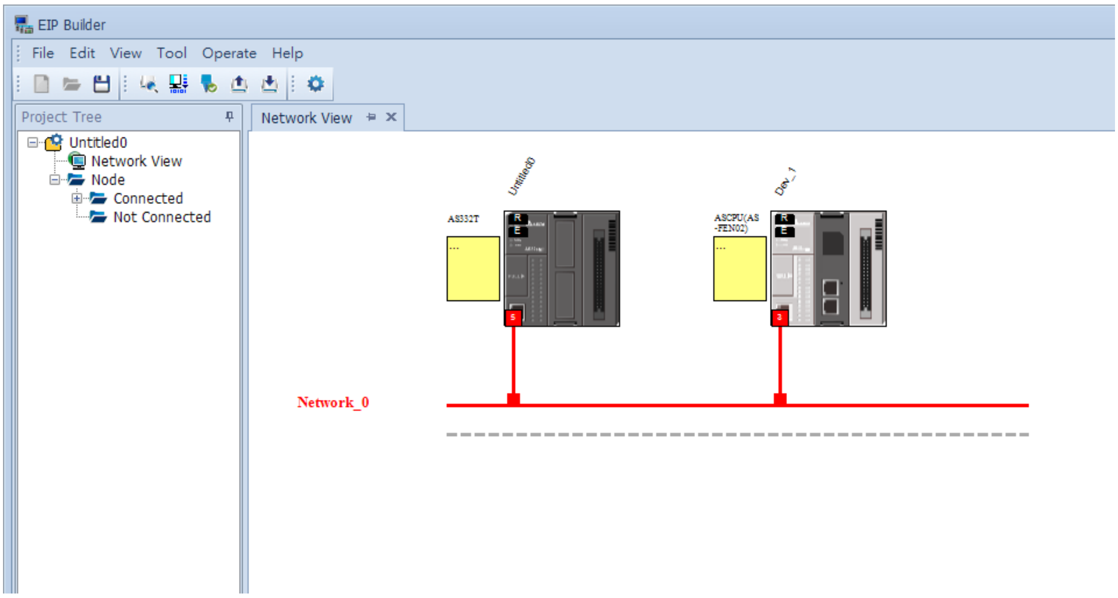
10.2.7.6 Data Mapping through EtherNet/IP Adapter

When AS-FEN02 is installed on AS Series PLC, you can create a connection through EIP Builder and make it act as an EtherNet/IP adapter. The below example uses two AS Series PLCs (one with AS-FEN02) to connect to each other and perform data mapping through EtherNet/IP connection. Refer to Chapter 9 in AS Series Operation Manual for more details on AS Series PLC acting as EtherNet/IP Scanner.

Device	Function	IP Address	Data Mapping Area
AS300	EtherNet/IP Scanner	192.168.1.5	D100, D200
AS300+ AS-FEN02	EtherNet/IP Adapter	192.168.1.3	D200, D300

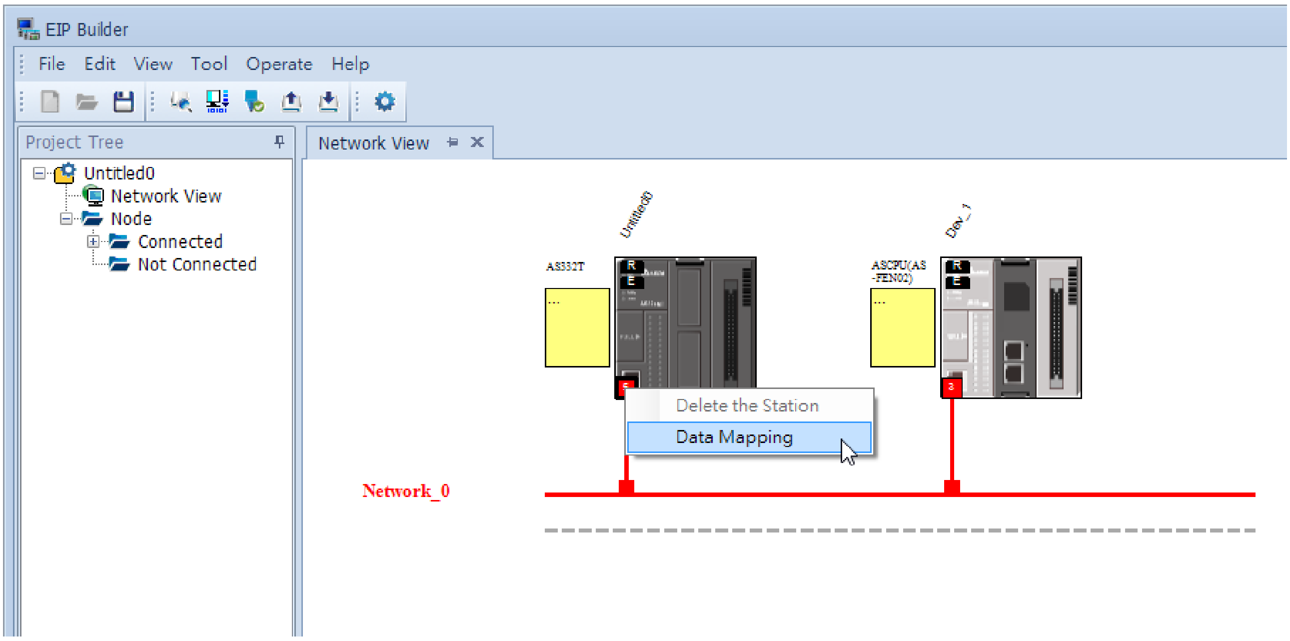
Step 1

Double click AS Series PLC in HWCONFIG and the **Device Setting** window appears. Set up the IP Address of the AS-FEN02 to 192.168.1.3 and then connect the scanner EtherNet/IP port to the AS-FEN02 through a network cable. Right-click the AS300 Series PLC to open EIP Builder and then scan the network or drag and drop the ASCPU (AS-FEN02) to add it to the same network as the scanner's.



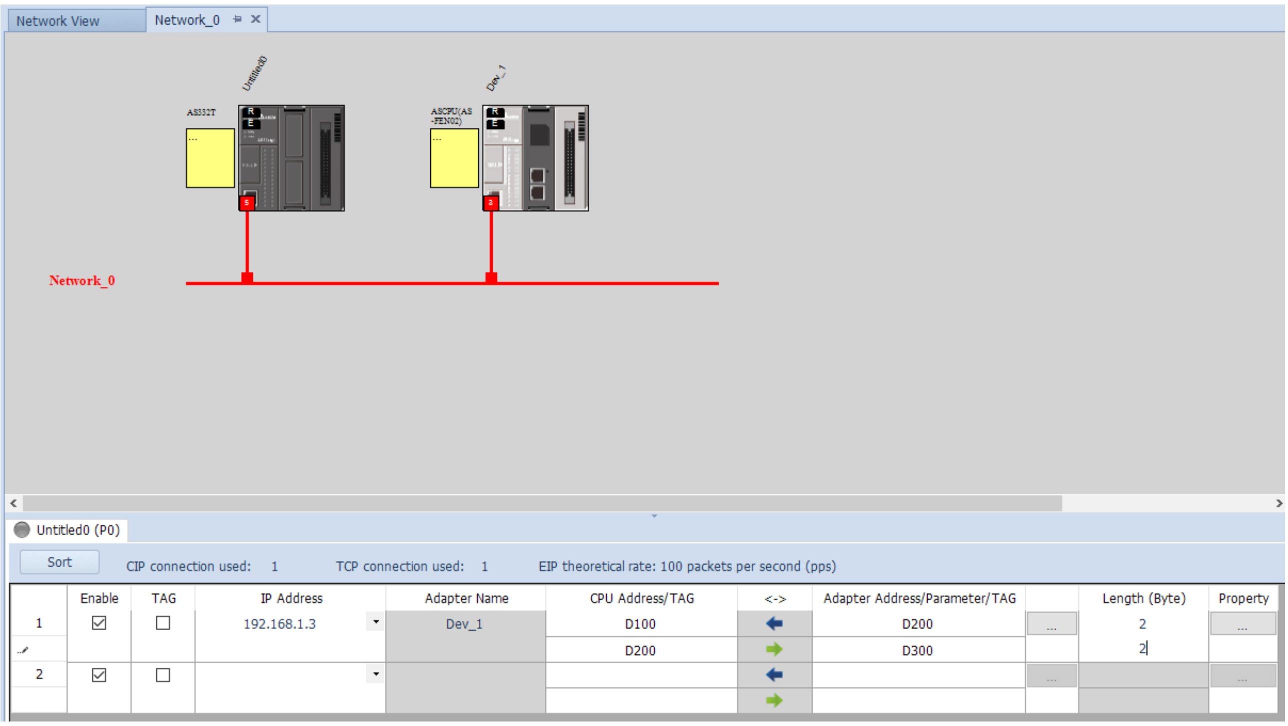
Step 2

Right click the Scanner's communication port (red spot) and select Data Mapping from the menu. Data mapping table appears for editing.



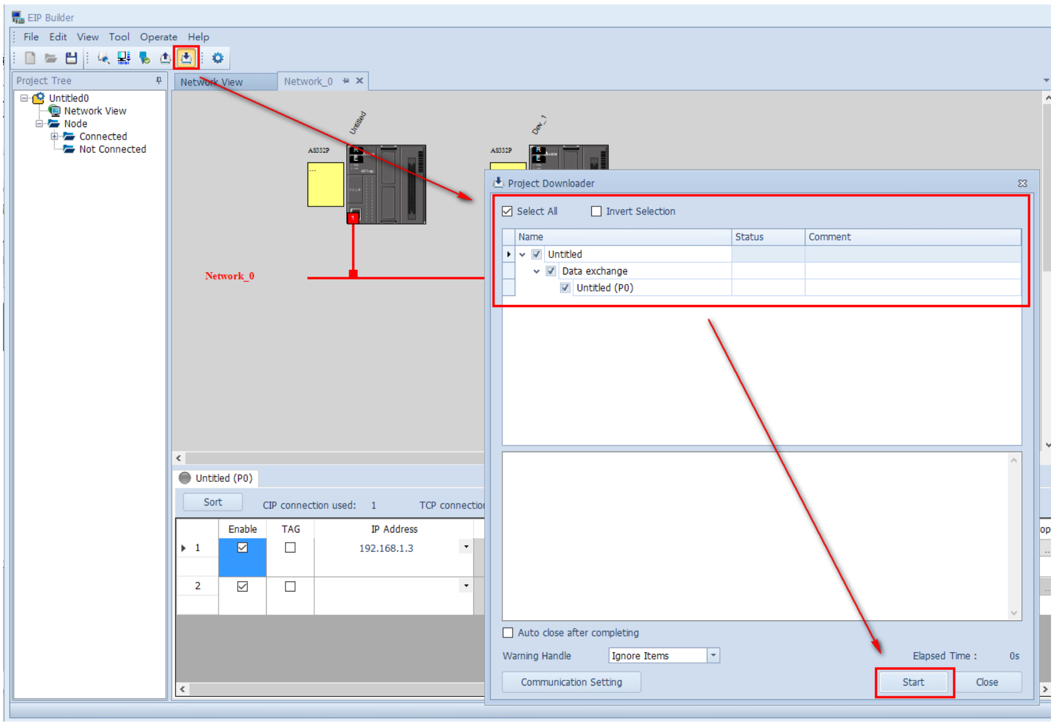
Step 3

Editing the data mapping table. You can enter the starting register address and the data length for data mapping between the scanner and adapter. The unit for data length is byte. As the below example shows the value in the scanner's D200 is written by the data from the adapter's D300. Read data from the adapter's D200 and store the data in the scanner's D100.



Step 4

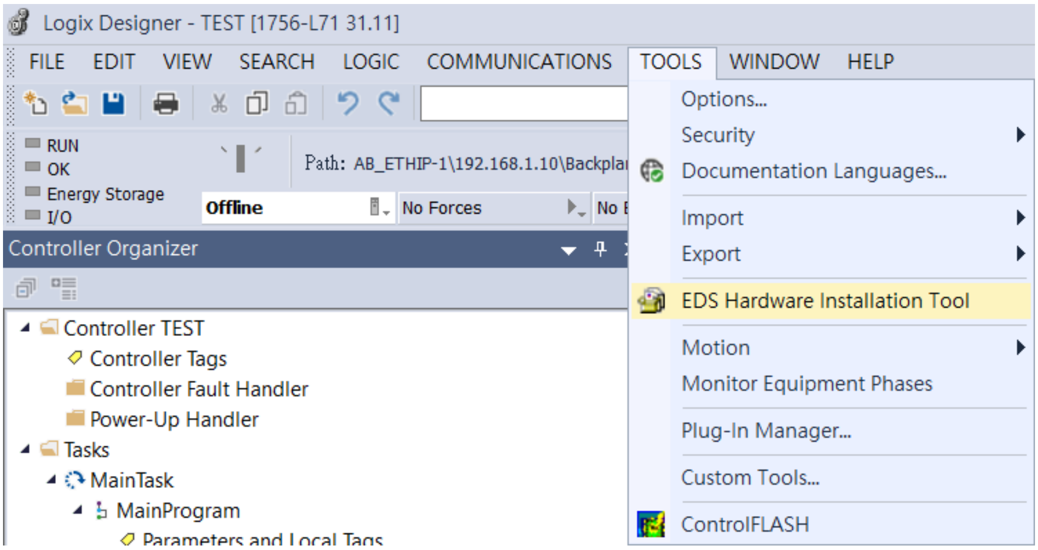
Click the **Downloader** icon and then select the parameters that you'd like to download. After the scanner starts to run, check if the data stored in the adapter D300 and D200 increment by 1 every second to determine if the data mapping is going well.



10.2.7.7 Example of Connecting to 3rd Party PLC Scanner through EIP Builder

Through EIP Builder, a 3rd party PLC (when acting as a scanner) can create an EtherNet/IP connection to AS300 Series PLC (when AS-FEN02 is installed). The following example uses Rockwell PLC as a scanner and Rockwell software Studio 5000 to perform data mapping with a Delta PLC. Before you begin, you need to go to www.deltaww.com to download EDS file.

(1) Use EDS Hardware Installation Tool to install the EDS file of ASCPU (AS-FEN02).



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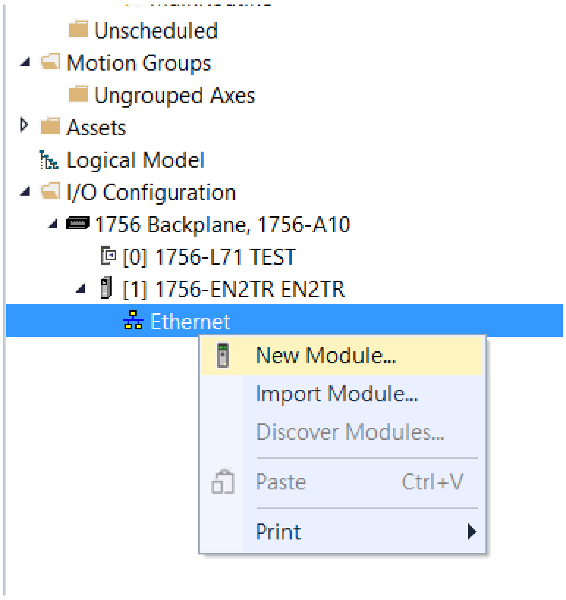
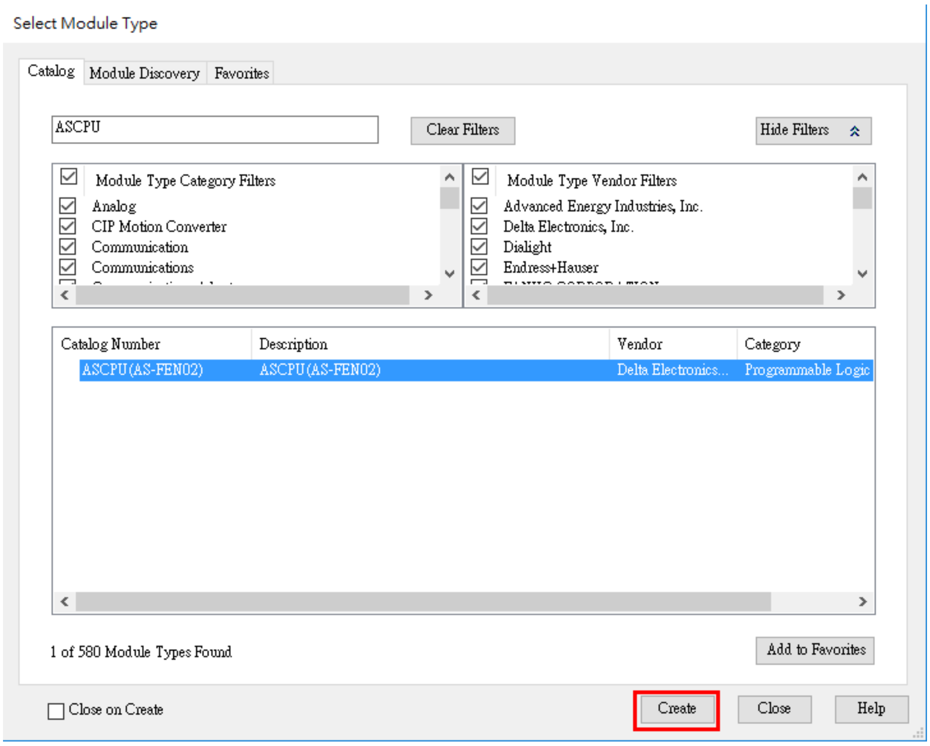
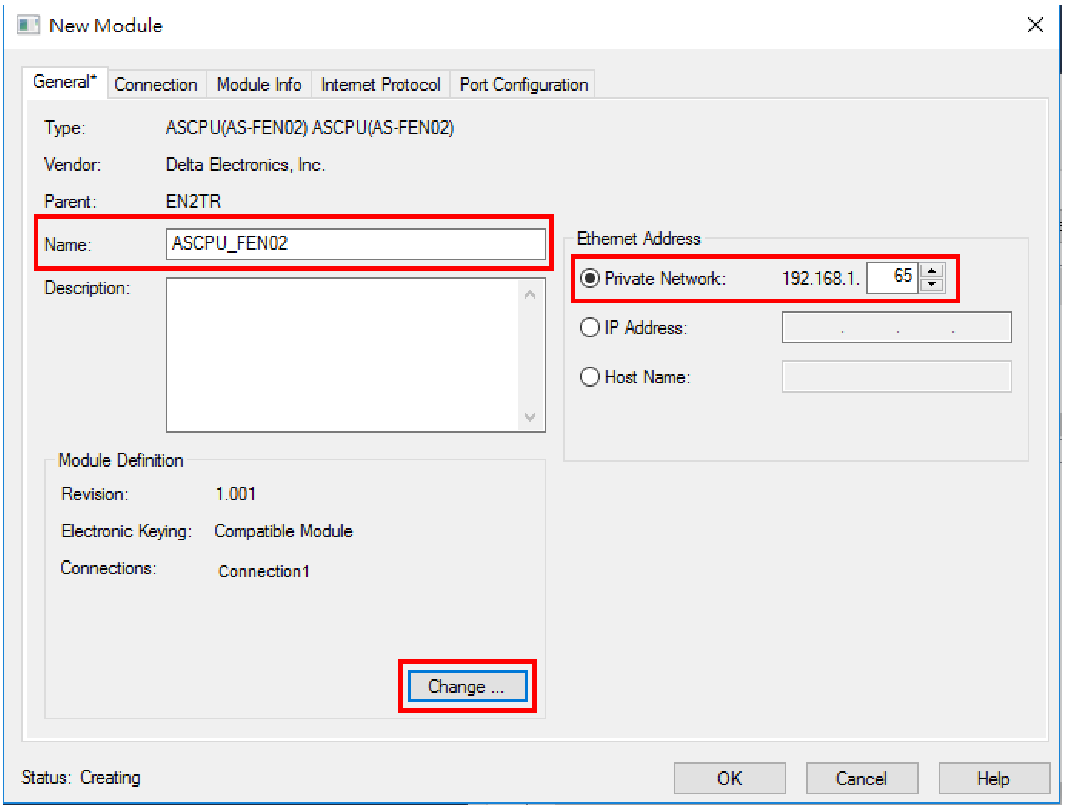
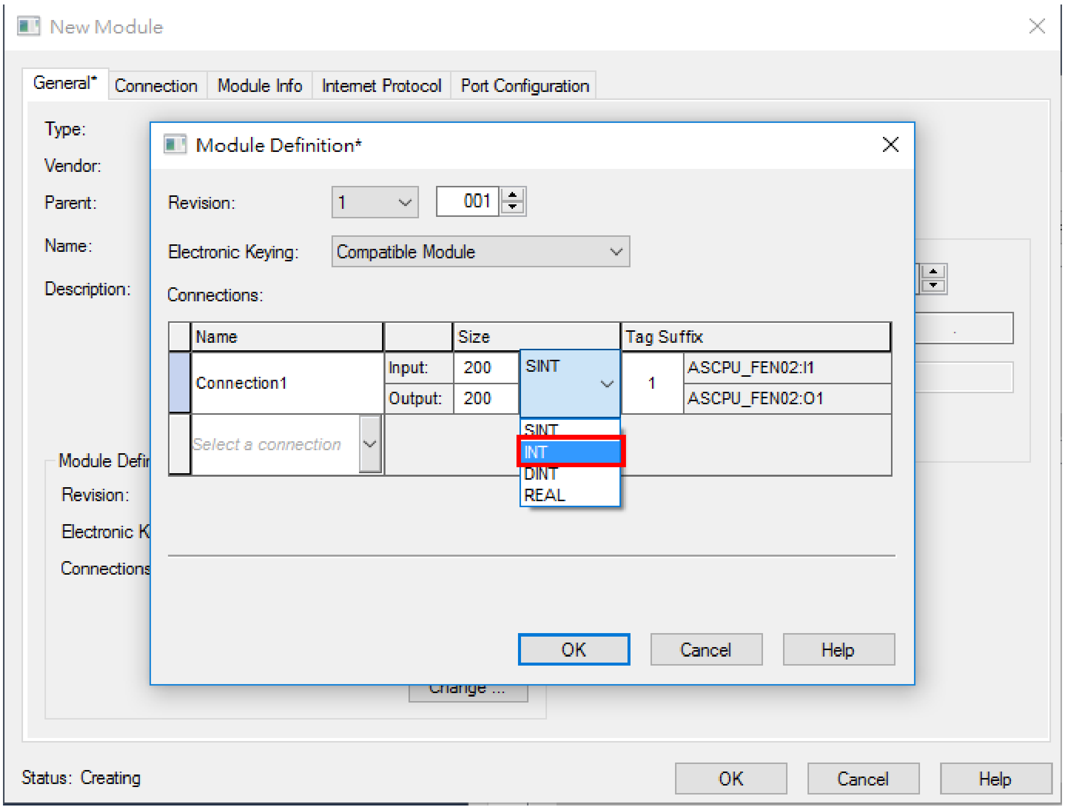
(2) Right-click **Ethernet** to see the context menu and click **New Module** to add a new device in.



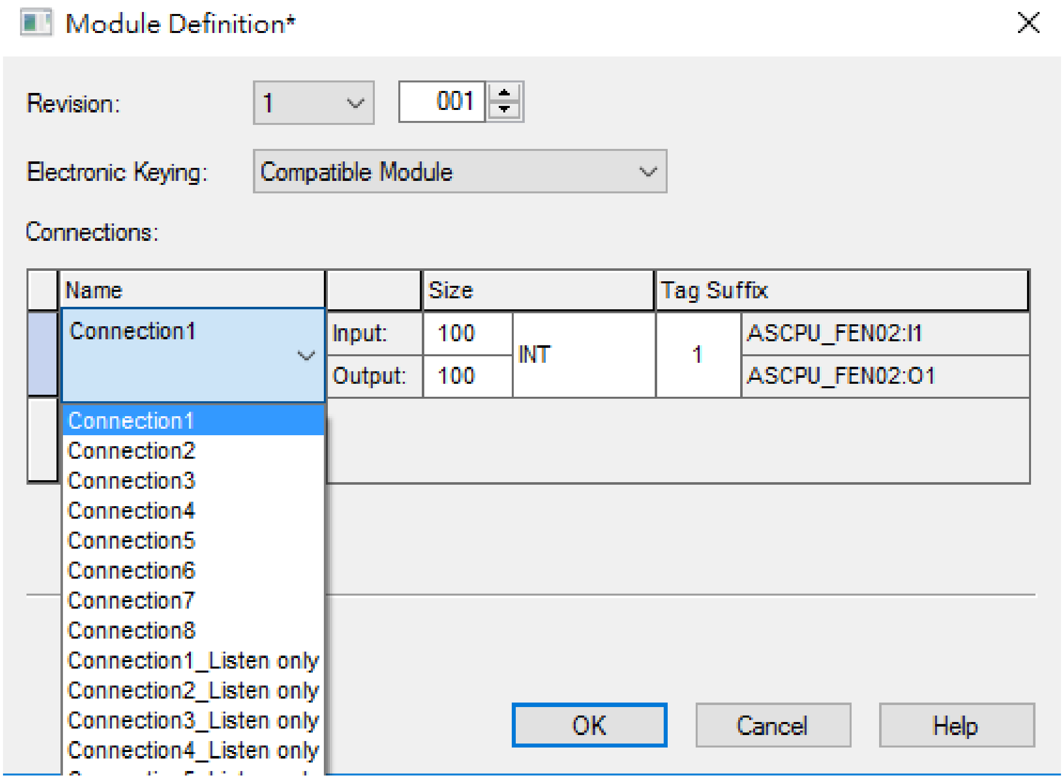


(3) Set up the parameters including device name, IP address and many more. For basic operation, you can use the default EDS file directly. No need to edit the EDS file. But you should change the data type to meet the system format. Click **Change** in the section of Module Definition on the General tab to change the data type according to your needs. Here the data type is INT, meaning when monitoring, data in each deice is shown in one word (a D device).





(4) Setting up the data mapping table



I: Input data (T→O), Ex. Connection 1 is corresponding to PLC D3000~D3099.

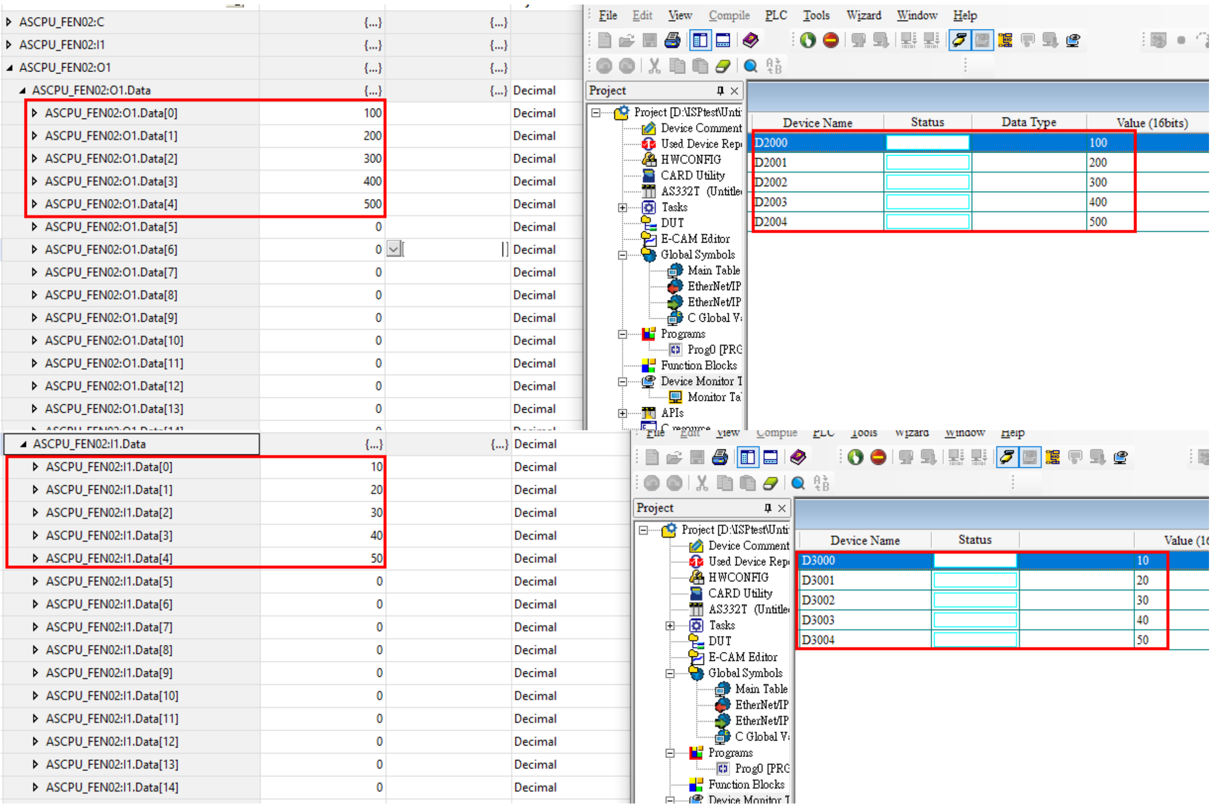
O: Output data (O→T), Ex. Connection 1 is corresponding to PLC D2000~D2099.

C: here corresponds to the configurations. You can edit the corresponding PLC addresses of input and output. After editing, you need to download the parameters to Rockwell PLC.

	I/O Message Connection			
Connection No.	**Function**	**Instance Attribute**	**Length**	**Defaults**
Connection 1	Input (T→O)	0x65	100 words	D3000~D3099
	Output (O→T)	0x64	100 words	D2000~D2099
	Configuration	0x80	8 words	Refer to the table below
Connection 2	Input (T→O)	0x67	100 words	D3100~D3199
	Output (O→T)	0x66	100 words	D2100~D2199
	Configuration	0x81	8 words	Refer to the table below
Connection 3	Input (T→O)	0x69	100 words	D3200~D3299
	Output (O→T)	0x68	100 words	D2200~D2299
	Configuration	0x82	8 words	Refer to the table below
Connection 4	Input (T→O)	0x6B	100 words	D3300~D3399
	Output (O→T)	0x6A	100 words	D2300~D2399
	Configuration	0x83	8 words	Refer to the table below
Connection 5	Input (T→O)	0x6D	100 words	D3400~D3499
	Output (O→T)	0x6C	100 words	D2400~D2499
	Configuration	0x84	8 words	Refer to the table below

	I/O Message Connection			
Connection No.	**Function**	**Instance Attribute**	**Length**	**Defaults**
Connection 6	Input (T→O)	0x6F	100 words	D3500~D3599
	Output (O→T)	0x6E	100 words	D2500~D2599
	Configuration	0x85	8 words	Refer to the table below
Connection 7	Input (T→O)	0x71	100 words	D3600~D3699
	Output (O→T)	0x70	100 words	D2600~D2699
	Configuration	0x86	8 words	Refer to the table below
Connection 8	Input (T→O)	0x73	100 words	D3700~D3799
	Output (O→T)	0x72	100 words	D2700~D2799
	Configuration	0x87	8 words	Refer to the table below

Configuration address	Data type	Description	Defaults (Connection 1)
Word[0]	UINT	Input corresponding device 0: D, 1: X, 2: Y	0
Word[1]	UINT	Reserved	200
Word[2-3]	DWORD	Input corresponding device number	3000
Word[4]	UINT	Output corresponding device 0: D, 2: Y	0
Word[5]	UINT	Reserved	200
Word[6-7]	DWORD	Output corresponding device number	2000



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10.2.7.8 Data Mapping through Modbus TCP

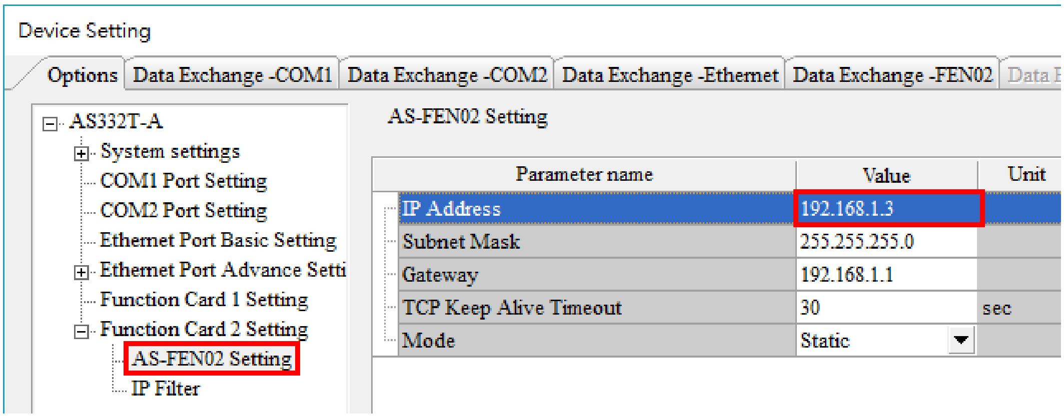
When AS-FEN02 is installed on AS Series PLC, you can create a connection by configuring the IP address and some relevant parameters to make it act as a Modbus TCP Slave device.

The following example shows two AS Series PLCs (one with AS-FEN02) to connect each other and one as Master and the other as Slave (AS-FEN02) to perform data mapping through the Modbus TCP connection. For the support function codes and corresponding addresses, refer to AS Series Operation Manual for more details.

Device	Function	IP Address	Data Mapping Area
AS300	Modbus TCP Master	192.168.1.5	D100, D200
AS300+ AS-FEN02	Modbus TCP Slave	192.168.1.3	D200, D300

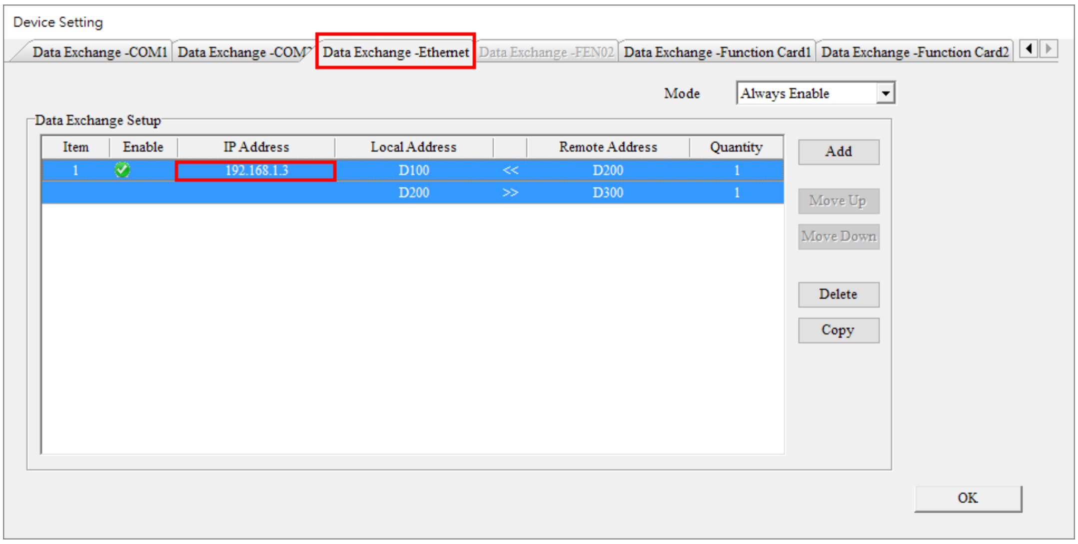
Step 1

Double click AS Series PLC in HWCONFIG and the **Device Setting** window appears. Set up the IP Address of the A to 192.168.1.3 and then connect Master and Slave AS-FEN02.



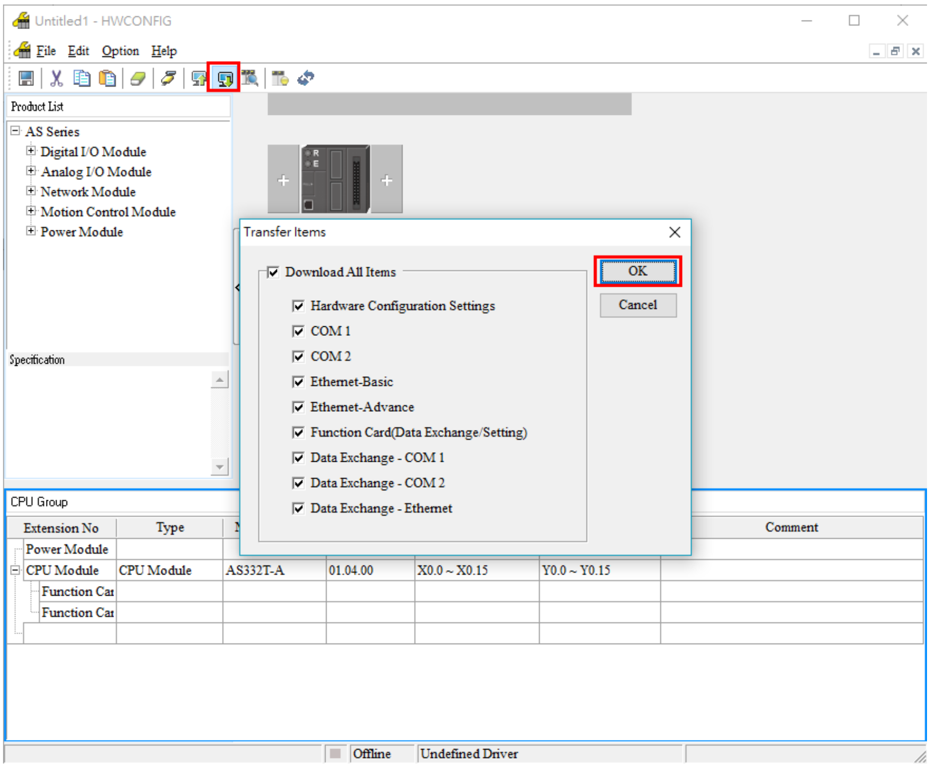
Step 2

Create a data mapping table in the Master and then perform data mapping with the Slave (AS-FEN02).



Step 3

Click the **Downloader** icon and then select the parameters that you'd like to download.



10.2.7.9 Webpage

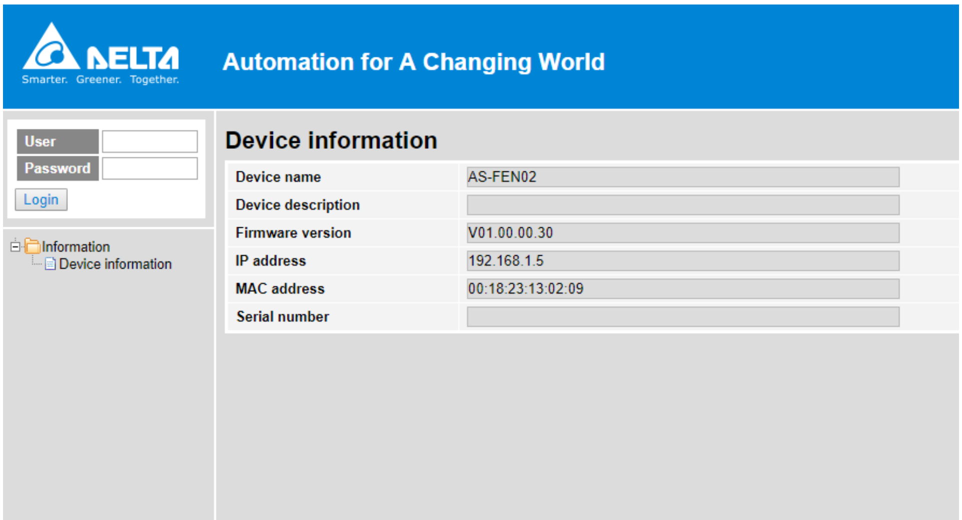
When AS-FEN02 is installed on AS300 Series PLC or AS00SCM-A (RTU mode), you can enter AS-FEN02 IP address in the search bar of your browser to connect to your device. After that you can set up, update firmware and monitor AS-FEN02. The webpage displays differently, when AS-FEN02 is installed on AS300 Series PLC or AS00SCM-A (RTU mode). They will be explained in different sections.

List of browsers that support AS-FEN02 webpage:

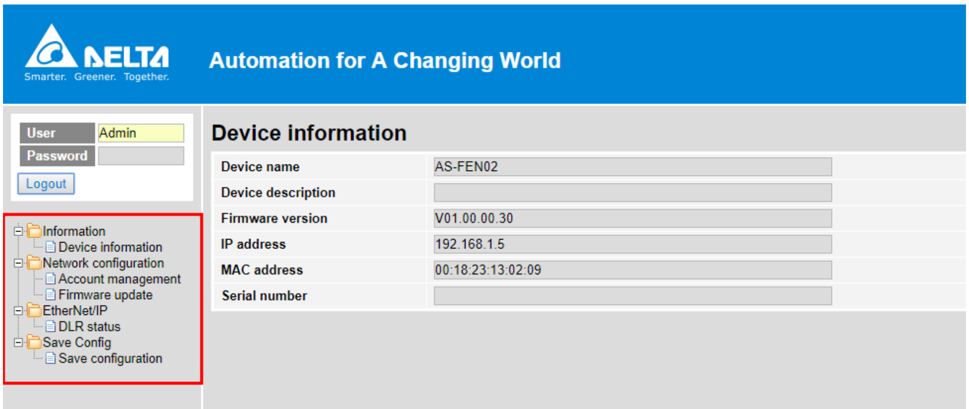
Provider	Browser	Supported versions
Microsoft	Internet Explorer	V10.0 and later
Microsoft	Edge	V20 and later
Google	Chrome	V14 and later
Mozilla	Firefox	V17 and later
Apple	Safari	V5.1 and later

- **When AS-FEN02 is installed on AS300 Series PLC**

a. After the setting IP address in HWCONFIG of ISPSoft. Open your browser and enter AS-FEN02 IP address in the search bar to connect to AS-FEN02. After the webpage appears, enter “Admin” in the User section and click Login without entering any password. You can set up the password after login.



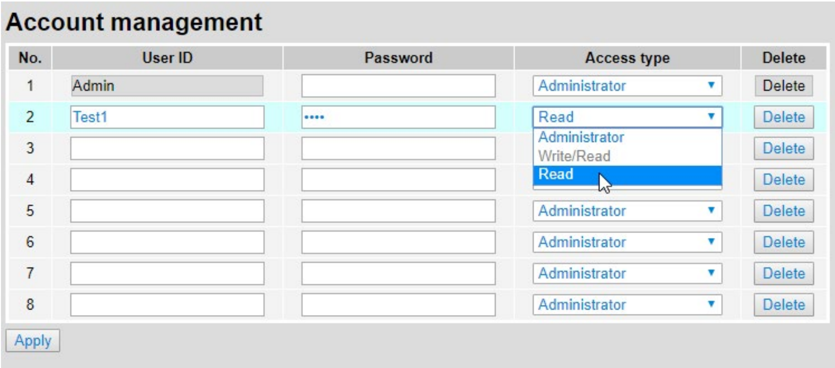
b. After login, you can setting items on the left section.



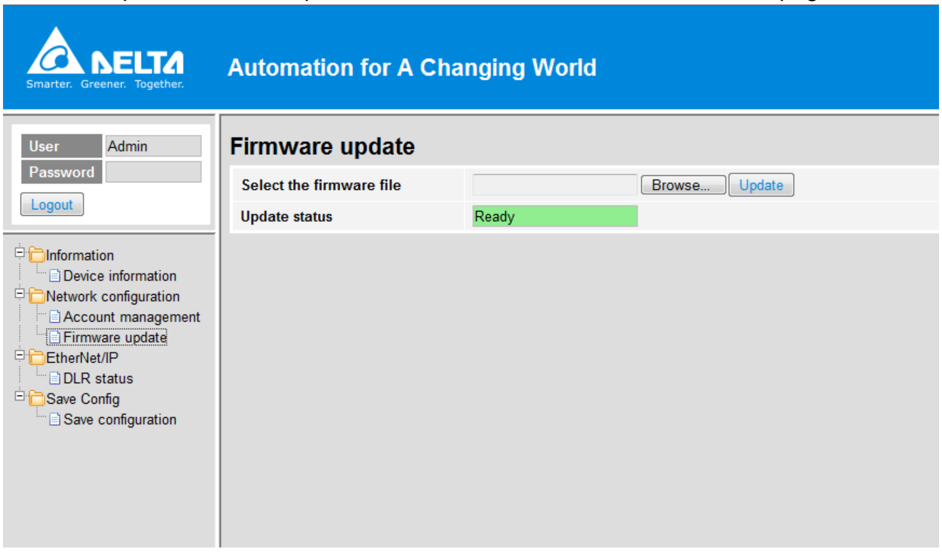
c. The menu shows data based on the permission of the current user.

Nodes	Permission	
	Administrator	Read
Device information	V	V
Account management	V	X
Firmware update	V	X
DLR status	V	V
Save configuration	V	X

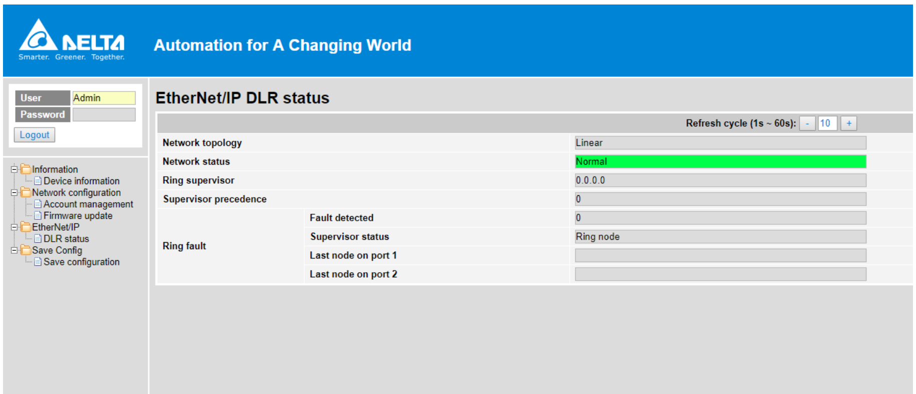
d. Account Management: You can set 2 kinds of access types, Administrator and Read. After the setting is done, click Apply and save the settings in Save configuration.



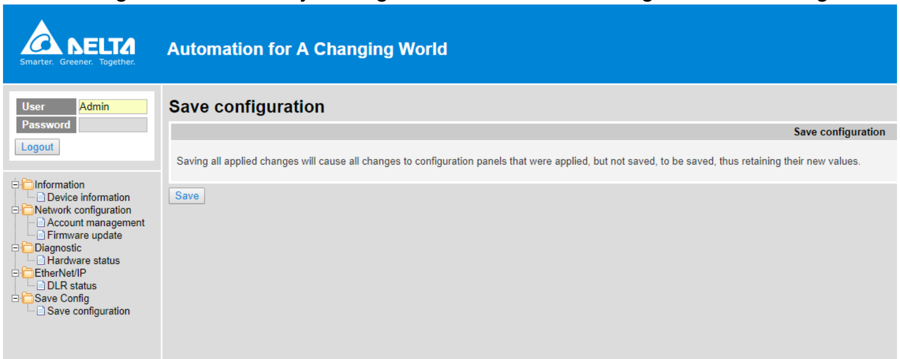
e. Firmware Update: You can update the firmware of AS-FEN02 via the webpage.



f. DLR Status: You can view the current DLR status and edit the refresh cycle. It is required to use AS-FEN02 with firmware V1.04 or later for DLR function.



g. Save Configuration: After any setting is done, save the settings in Save Configuration to reflect the changes.



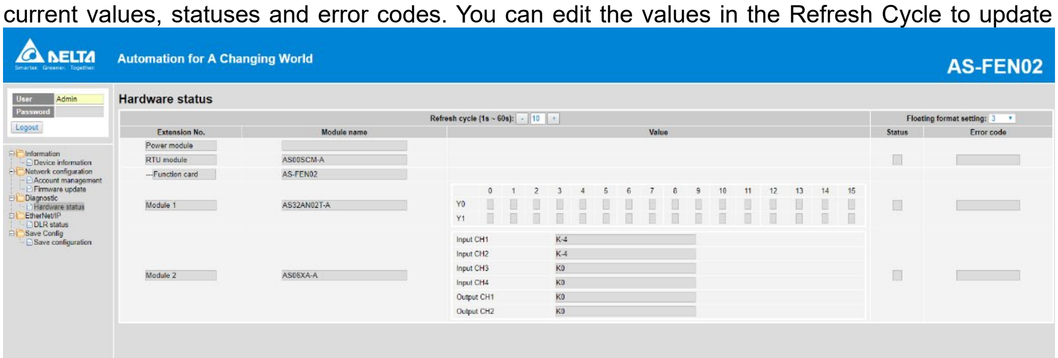
- **When AS-FEN02 is installed on AS00SCM-A**

a. Use the switches on AS00SCM-A to set the AS-FEN02 IP address. Open your browser and enter AS-FEN02 IP address in the search bar to connect to AS-FEN02. After the webpage appears, enter “Admin” in the User section and click Login without entering any password. You can set up the password after login.

b. The menu shows data based on the permission of the current user. When it is installed on AS00SCM-A, you can monitor the Hardware Status.

Nodes	Permission	
	Administrator	Read
Device information	V	V
Account management	V	X
Firmware update	V	X
Hardware status	V	V
DLR status	V	V
Save configuration	V	X

c. Hardware Status: you can monitor the connected right-side I/O modules, including their module names, the current values, statuses and error codes. You can edit the values in the Refresh Cycle to update the cycle.



10.2.8 AS-FPFN02

When AS-FPFN02 is installed on AS300 PLC CPU, this communication card can work independently and does NOT occupy the communication port of PLC CPU. AS-FPFN02 can act as a PROFINET adapter and connect to a PROFINET scanner to exchange data on the PROFINET Network (PN). When AS-FPFN02 is installed on AS00SCM-A, Delta AS Series I/O modules can be used remotely. However Delta software does NOT support PN network configuration, you can use software from the PN scanner for editing the PN parameters. After editing, you need to download the updated parameters to the scanner and then the scanner transfers the settings to AS-FPFN02.

10.2.8.1 Supported Firmware Versions

- When installed on AS300 series PLC CPU:
  The firmware of AS300 Series PLC should be V1.08 or later.
  The firmware of AS-FPFN02 should be V1.00 or later.
- When installed on AS00SCM:
  The firmware of AS00SCM should be V2.06 or later.
  The firmware of AS-FPFN02 should be V2.00 or later.

10.2.8.2 Features

- When AS-FPFN02 is installed on AS300/AS00SCM Series PLC, it acts as a PROFINET device and exchanges data with PN Controller.
- Architecture: you can use software from the PN scanner for editing the PN parameters. After editing, you need to download the updated parameters to the scanner and then the scanner transfers the settings to AS-FPFN02.

10.2.8.3 Specifications

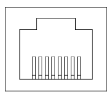
Item	Specification	
Installed on PLC	AS300	AS00SCM
Communication Protocol	PROFINET RT	
EtherNet/IP Interface	100 Mbit with 2 x RJ45	
Fieldbus	PROFINET Devices	
Network Cable Length	100 meter	
Error Indicator	System Fail (SF): Red; Bus Fail (BF): Red	
Max. IO Slot Supported	17	9
Devices to Read and Write	AS300 series data registers	RTU modules
Minimum Time for Data Exchange to Operate	10 ms	
Maximum Data Length/Per Transmission	Input: 250 words Output: 250 words	
PROFINET Configuration	Download PROFINET Configurations from PN Controller	

10.2.8.4 LED Indicators

Number	Name	Description
1	SF indicator	System Fault Indicator RED light ON: an error occurs in PROFINET configuration or incorrect data for exchange OFF: no system error
2	BF indicator	Bus Fault Indicator RED light ON: the network connection is OFF. RED light BLINKING: the network connection is working fine but the communication with PN Controller is NOT normal. OFF: the communication with PN Controller is working fine.
3	LINK indicator X1/X2	Indicates the status of Ethernet connection Green light ON: a network connection is established OFF: a network connection is not established
4	ACT indicator X1/X2	Indicates the status of Ethernet communication Orange BLINKING: data transmission OFF: no data transmission

RJ-45 Pin Definition

1 TX+	2 TX-	3 RX+	4 N/C
5 N/C	6 RX-	7 N/C	8 N/C



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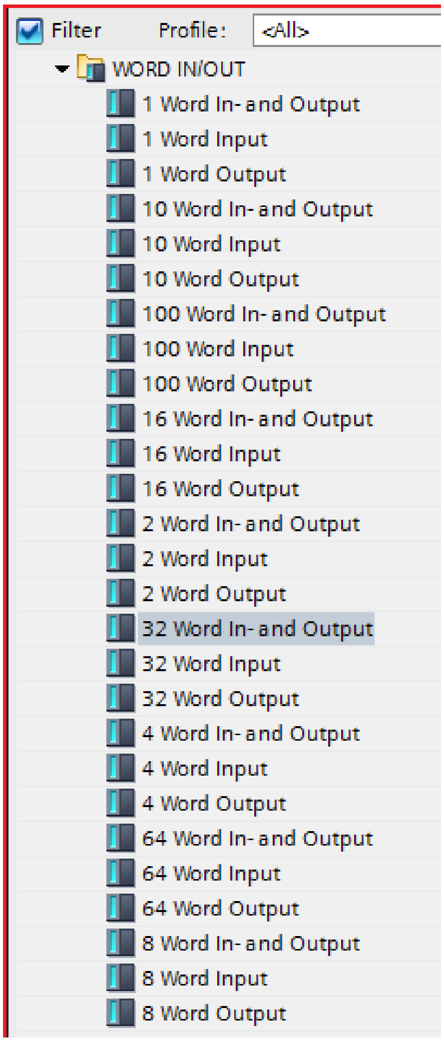
10.2.8.5 Configuring the Data Length for I/O Module (Works with AS300)

When AS-FPFN02 communication card is installed on AS300 Series PLC, up to 500/500 bytes of I/O address area are available. You can use PN Controller's Software (the example below uses Siemens TIA Portal software) to configure the modules and set up the data size for data exchange. You can also set up the corresponding I/O module addresses to the AS300 data register addresses. Refer to Section 10.2.8.10 for more reference. The total data size and the number of modules used are relevant. The total usage of I/O address area should also include Device Access Point (DAP) and the bytes for information, such as IO Production Status (IOPS) and IO Consumption Status (IOCS) of each module.



Module Type (for both DIO and AIO modules)	Data Length (IOPS & IOCS)
Slot 0 (DAP)	4 bytes
Input module	1 byte
Output module	1 byte
I/O module	2 bytes

Example:

Device overview

Module	...	Rack	Slot	I address	Q address	Type
AS300-CPU		0	0			ASCPU(AS-FPFN02)
PN-IO		0	0 X1			AS300-CPU
Status Register_1		0	1	0...7		Status Register
100 Word In-and Output_1		0	2	8...207	0...199	100 Word In-and Outp...
100 Word In-and Output_2		0	3	208...407	200...399	100 Word In-and Outp...
16 Word In-and Output_1		0	4	408...439	400...431	16 Word In-and Output
16 Word In-and Output_2		0	5	440...471	432...463	16 Word In-and Output
08 Word In-and Output_1		0	6	472...487	464...479	08 Word In-and Output
04 Word In-and Output_1		0	7	488...495	480...487	04 Word In-and Output
02 Word In-and Output_1		0	8	496...499	488...491	02 Word In-and Output
04 Word Output_1		0	9		492...499	04 Word Output
		0	10			
		0	11			
		0	12			

The address area used is within 500/500 bytes. But you need to add bytes used on IO Production Status (IOPS) and IO Consumption Status (IOCS) of each module too. Here the example shows the address area of the input module is taken by 500 bytes (data length) + 4 bytes (Slot 0) + 2 bytes *7 (7 I/O modules) + 1 byte (Slot 1) = 519 bytes. The same example shows that the address area of the output module is taken by 500 bytes (data length) + 4 bytes (Slot 0) + 2 bytes *7 (7 I/O modules) + 1 byte (Slot 9) = 519 bytes. The data exceeds the total permitted maximum data length of 500/500 bytes. An error message appears as the image shown below by TIA Portal.

Note: this error message shown indicates the IO data length is abnormal.

PLC_2
Hardware configuration
S71500/ET200MP station_1
Rail_0
PLC_2
PROFINET interface_1
The device replacement without exchangeable medium function cannot be used for device 'ascpu' without configuration of topology.
PLC_2
PLC_2 does not contain a configured protection level
CPU display_1
The S7-1500 CPU display does not contain any password protection.

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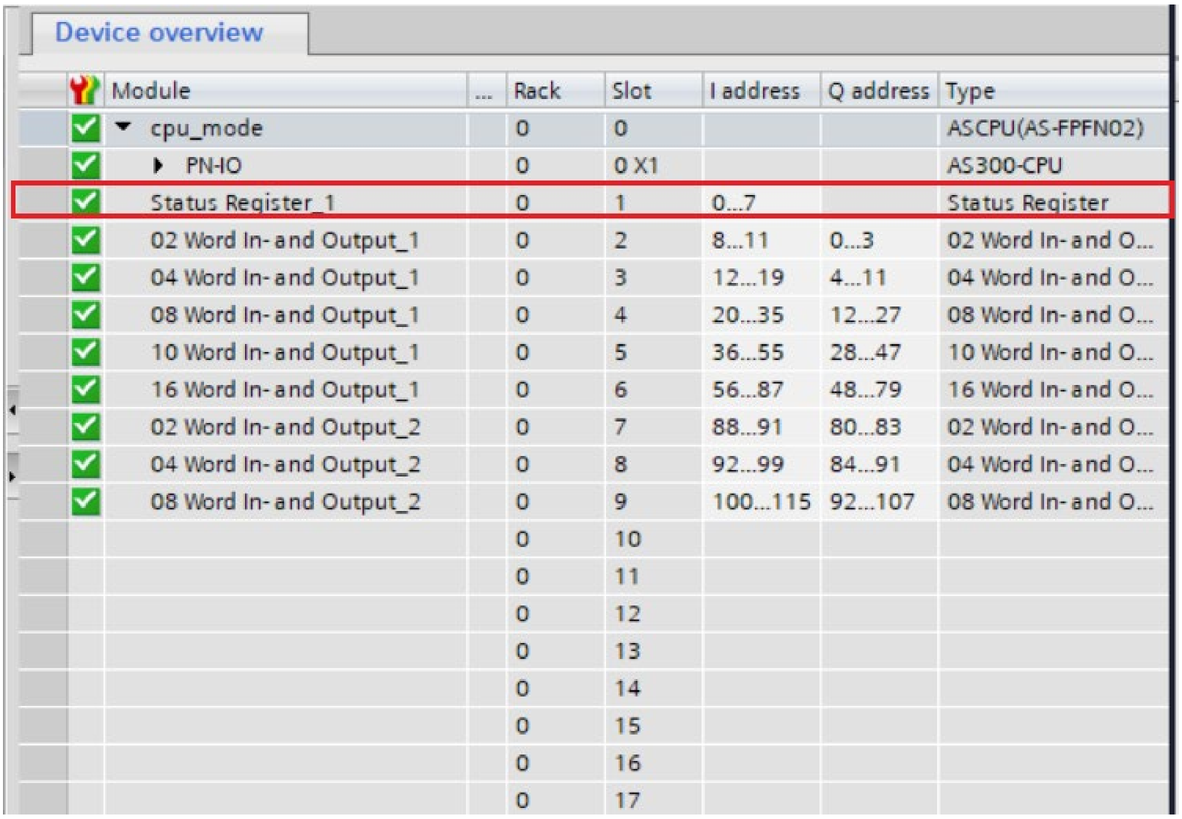
10.2.8.6 Status Register (Works with AS300)

When AS-FPFN02 is installed on AS300 Series PLC, and Slot 1 is used as status register to show the communication card status. Up to 8 bytes of status registers can be used for displaying the status of PN Device. See the example below.



Device overview

Module	...	Rack	Slot	I address	Q address	Type
cpu_mode		0	0			ASCPU(AS-FPFN02)
PN-IO		0	0 X1			AS300-CPU
Status Register_1		0	1	0...7		Status Register
02 Word In-and Output_1		0	2	8...11	0...3	02 Word In-and O...
04 Word In-and Output_1		0	3	12...19	4...11	04 Word In-and O...
08 Word In-and Output_1		0	4	20...35	12...27	08 Word In-and O...
10 Word In-and Output_1		0	5	36...55	28...47	10 Word In-and O...
16 Word In-and Output_1		0	6	56...87	48...79	16 Word In-and O...
02 Word In-and Output_2		0	7	88...91	80...83	02 Word In-and O...
04 Word In-and Output_2		0	8	92...99	84...91	04 Word In-and O...
08 Word In-and Output_2		0	9	100...115	92...107	08 Word In-and O...
		0	10			
		0	11			
		0	12			
		0	13			
		0	14			
		0	15			
		0	16			
		0	17			

Status Register (Siemens S7-1500)	Name	Description
%I0.0	Input Data Available	If the value is TRUE, the input data to be sent to PN Controller is valid. If the value is 0, the input data to be sent to PN Controller is invalid.
%I4.0 - %I4.7	Connection Status	Indicates PN connection status of Slot 2 ~ Slot 9. If the value is TRUE, the Slot is with a working PN connection (with IO module) If the value is FALSE, the Slot is without a working PN connection.
%I5.0 - %I5.7		Indicates PN connection status of Slot 10 ~ Slot 17. If the value is TRUE, the Slot is with a working PN connection (with IO module) If the value is FALSE, the Slot is without a working PN connection.

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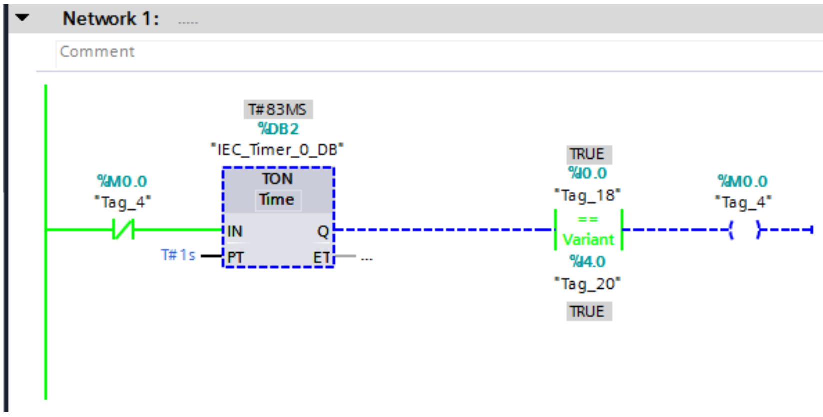
- Determine whether the input data is valid.

  You can check the first bit of the bytes %I0.0 (device register) to see if the data exchange is started; this can be used when the PN device starts to work. You can determine if the input data is valid by checking %I0.0 (device register); if it says TRUE, the input data is valid and data exchange can begin.



- Determine if the Slot is with a working PN connection.

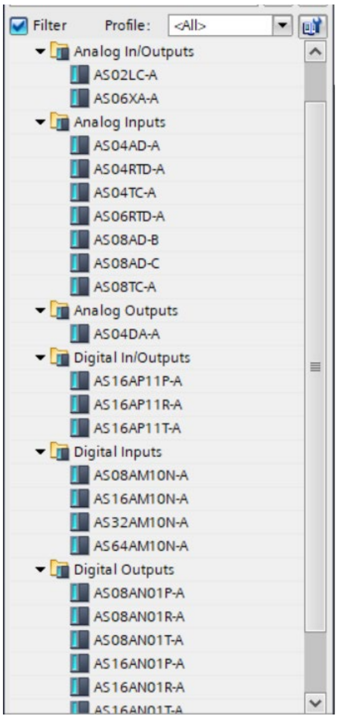
  You can check the corresponding registers %I4.0~%I4.7 and %I5.0~%I5.7 to see if the Slot 2~17 is with a working PN connection.
  The following example shows the values in the corresponding registers %I4.0~14.22 are TRUE and that indicates Slot 2~4 are with PN connections respectively.

Module	...	Rack	Slot	I address	Q address	Type
cpu_mode		0	0			ASCPU(AS-FPFN02)
PN-IO		0	0 X1			AS300-CPU
Status Register_1		0	1	0...7		Status Register
02 Word In-and Output_1		0	2	8...11	0...3	02 Word In-and O...
04 Word In-and Output_1		0	3	12...19	4...11	04 Word In-and O...
08 Word In-and Output_1		0	4	20...35	12...27	08 Word In-and O...
		0	5			
		0	6			
		0	7			
		0	8			
		0	9			
		0	10			
		0	11			
		0	12			
		0	13			
		0	14			
		0	15			
		0	16			
		0	17			

%I4.0	Bool	TRUE
%I4.1	Bool	TRUE
%I4.2	Bool	TRUE
%I4.3	Bool	FALSE
%I4.4	Bool	FALSE
%I4.5	Bool	FALSE
%I4.6	Bool	FALSE
%I4.7	Bool	FALSE
%I5.0	Bool	FALSE
%I5.1	Bool	FALSE
%I5.2	Bool	FALSE
%I5.3	Bool	FALSE
%I5.4	Bool	FALSE
%I5.5	Bool	FALSE
%I5.6	Bool	FALSE
%I5.7	Bool	FALSE

10.2.8.7 I/O Module Selection (Works with AS00SCM-A)

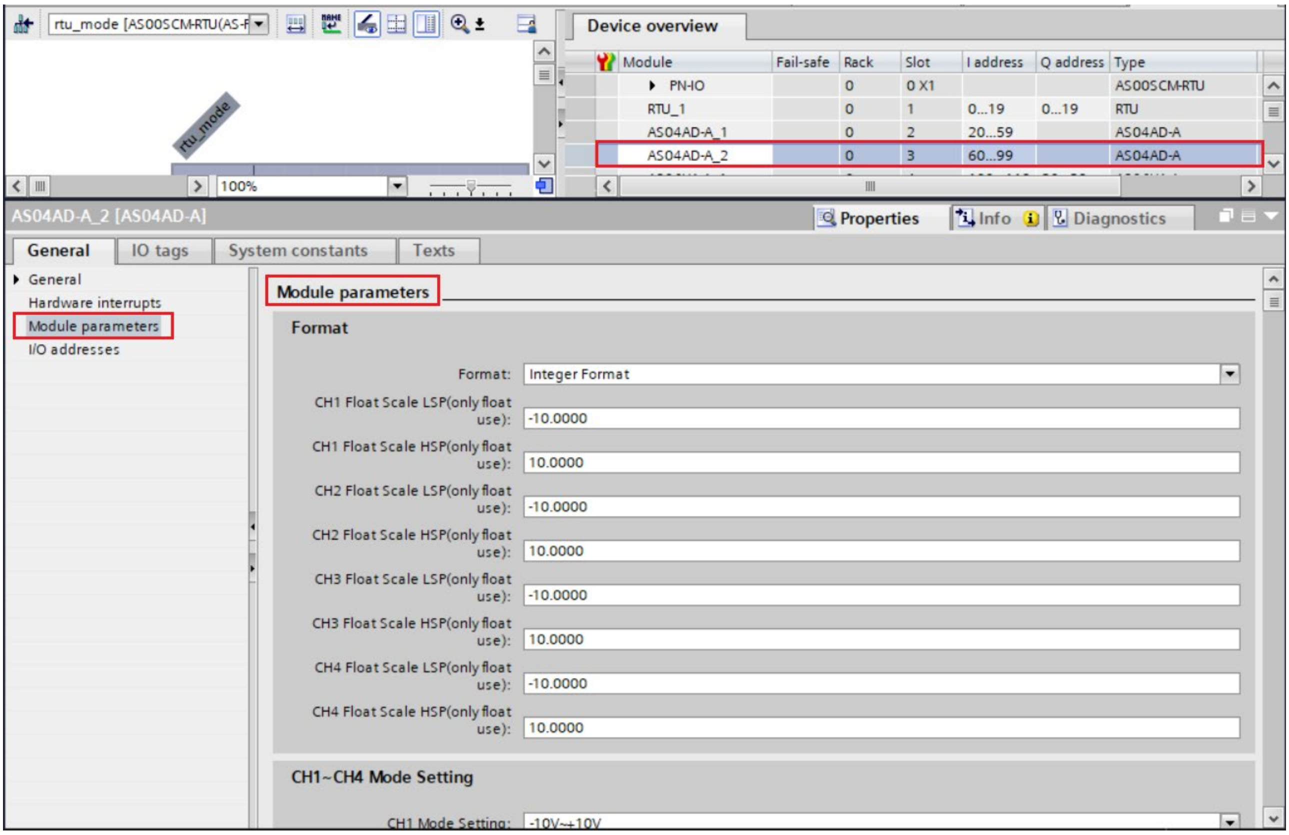
When AS-FPFN02 communication card is installed on AS00SCM-A, you can use PN Controller's Software (the example below uses Siemens TIA Portal software) to configure the modules.



Device overview

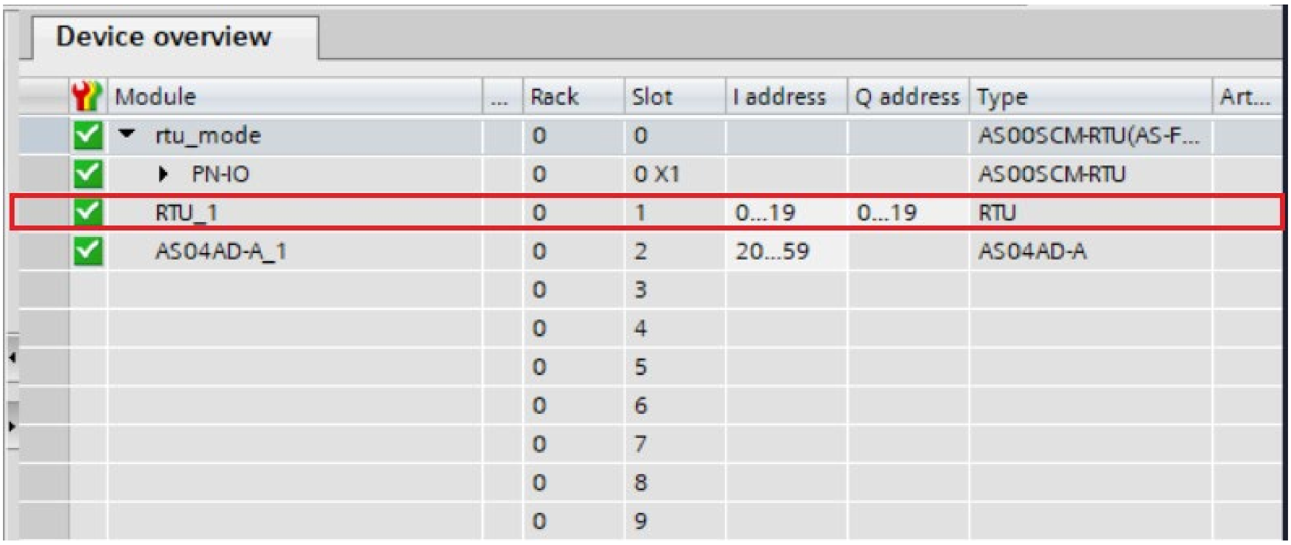
Module	Fail-safe	Rack	Slot	I address	Q address	Type
rtu_mode		0	0			AS00SCM-RTU(AS-F...
PN-IO		0	0 X1			AS00SCM-RTU
RTU_1		0	1	0...19	0...19	RTU
AS04AD-A_1		0	2	20...59		AS04AD-A
AS04AD-A_2		0	3	60...99		AS04AD-A
AS06XA-A_1		0	4	100...119	20...39	AS06XA-A
AS16AP11P-A_1		0	5	120...121	40...41	AS16AP11P-A
AS06RTD-A_2		0	6	180...219		AS06RTD-A
AS08AD-B_1		0	7	220...259		AS08AD-B
AS16AP11R-A_1		0	8	122...123	42...43	AS16AP11R-A
AS16AP11T-A_1		0	9	124...125	44...45	AS16AP11T-A

You can drag and drop the I/O modules to Slot 2 ~ 9. And then you can double-click the module to open the setting page and configure the module parameters.



10.2.8.8 Status Register (Works with AS00SCM-A)

When AS-FPFN02 is installed on AS00SCM-A, and Slot 1 is used as status register. As the example image shown, the input data length of I address is 10 words for storing the current status of AS00SCM-A. Q address occupies 10 words and reserves for output data.



Device overview

Module	...	Rack	Slot	I address	Q address	Type	Art...
rtu_mode		0	0			AS00SCM-RTU(AS-F...	
PN-IO		0	0 X1			AS00SCM-RTU	
RTU_1		0	1	0...19	0...19	RTU	
AS04AD-A_1		0	2	20...59		AS04AD-A	
		0	3				
		0	4				
		0	5				
		0	6				
		0	7				
		0	8				
		0	9				

Status Register (Siemens S7-1500)	Name	Description
%IW2	Error Code	For AS00SCM-A
%IW4 - %IW18		For Slot 2 to slot 9

The unit for the address series is byte. The data size for each status register is one word; the indication is %IW0 (%IB0 & %IB1) and %IW2 (%IB2 & %IB3) and so forth.

See the example below:

AS00SCM-A is working normally.

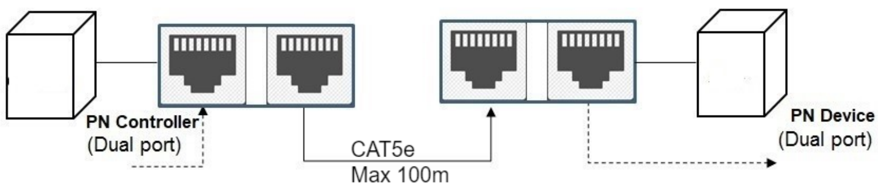
	i	Name	Address	Display format	Monitor value	Modify value	
1			%IW0	Hex	16#0001		
2			%IW2	Hex	16#0000		
3			%IW4	Hex	16#0000		
4			%IW6	Hex	16#0000		
5			%IW8	Hex	16#0000		
6							

AS00SCM-A is working abnormally. Errors occur on its right side modules.

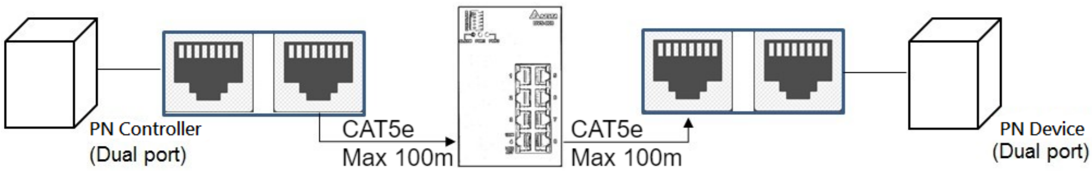
	i	Name	Address	Display format	Monitor value	Modify value	
1			%IW0	Hex	16#0000		
2			%IW2	Hex	16#1503		
3			%IW4	Hex	16#1604		
4			%IW6	Hex	16#0000		
5			%IW8	Hex	16#0000		
6							

10.2.8.9 Topology

- **Linear Topology**



- **Star Topology**



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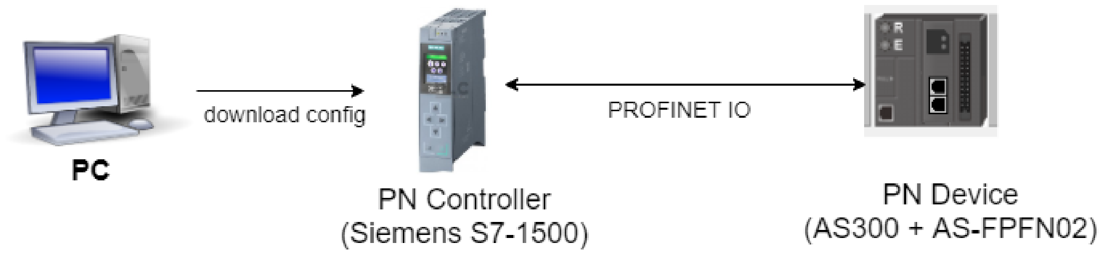
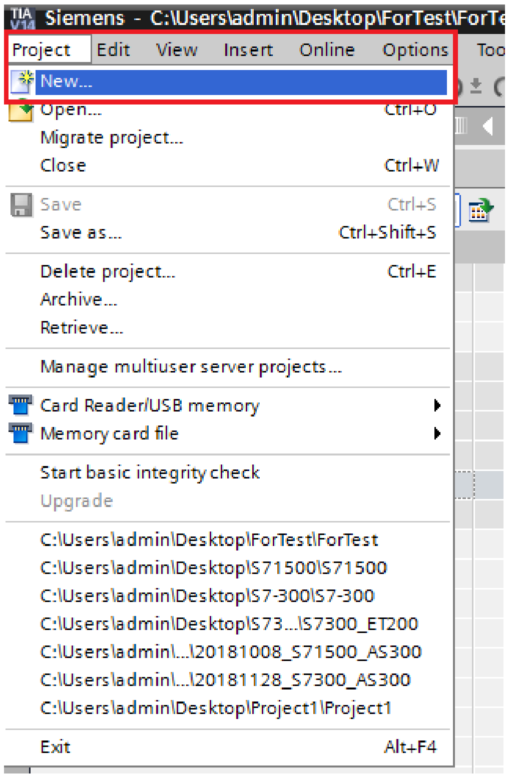
10.2.8.10 PROFINET Device Example (Adapter)

This section shows using Siemens TIA-Portal software to create a PROFINET IO from Siemens S7-1500 and PLC and uses the function card AS-FPFN02 to read data registers in Delta AS300 Series PLC.

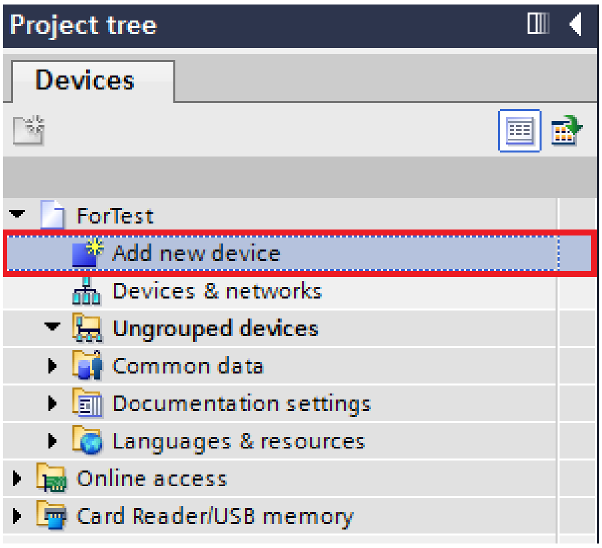
1. The arrangement is as the image shown below. The connection is established by using RJ45 connectors through Ethernet communication. The IP addresses of your PC and PN controller should be in the same network segment. The IP address of your PN device can be edit by PN Controller; see the steps below.



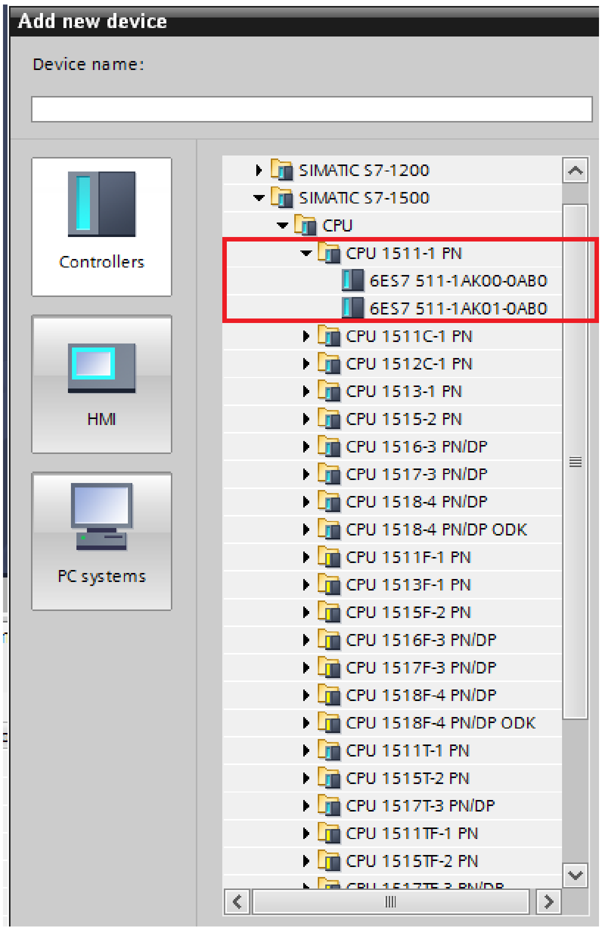
2. Create a new TIA-Portal project.



- Add a new device



- Select a PN Controller Model



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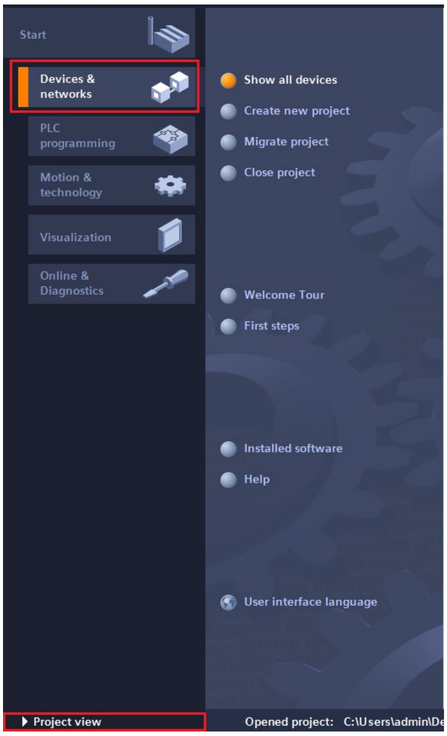
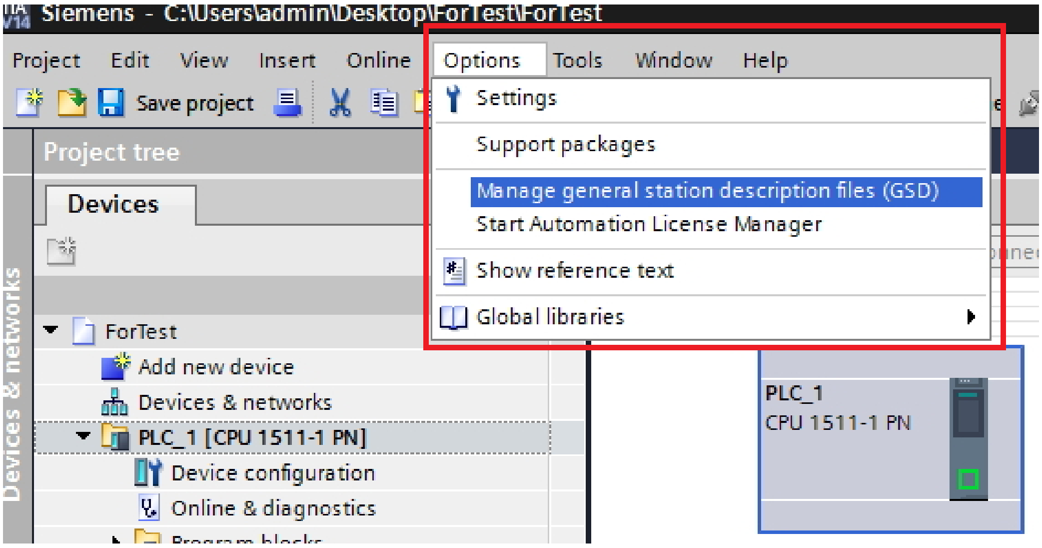
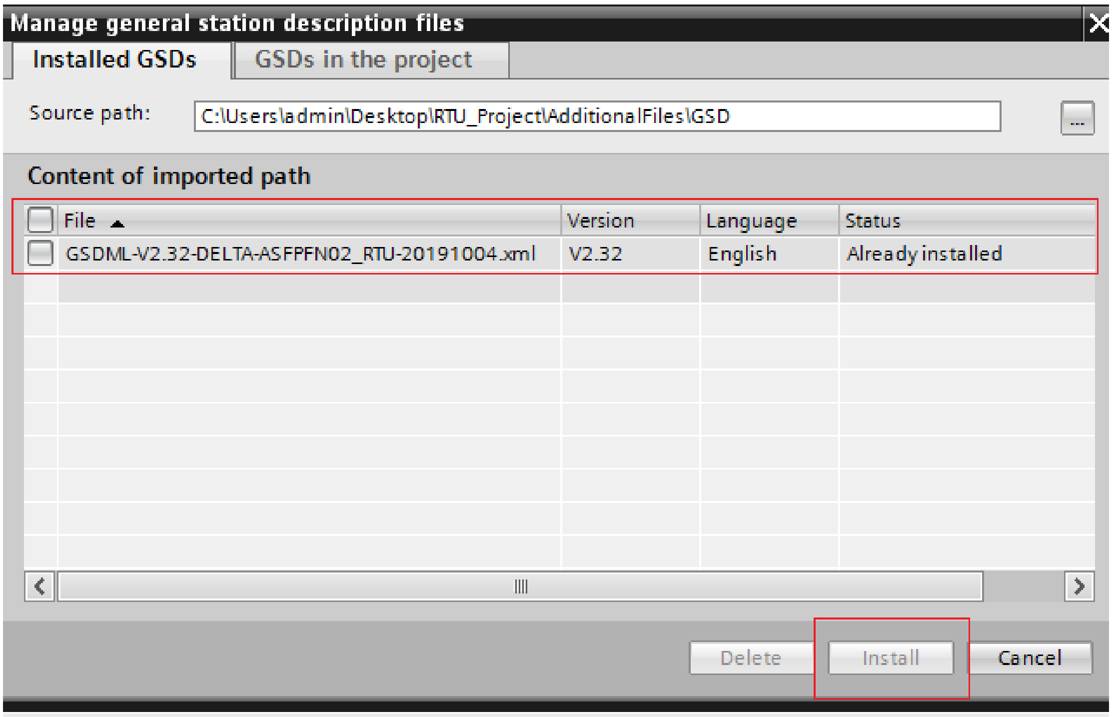
- Select the Project View or click **Device & Network** to enter the Project View.

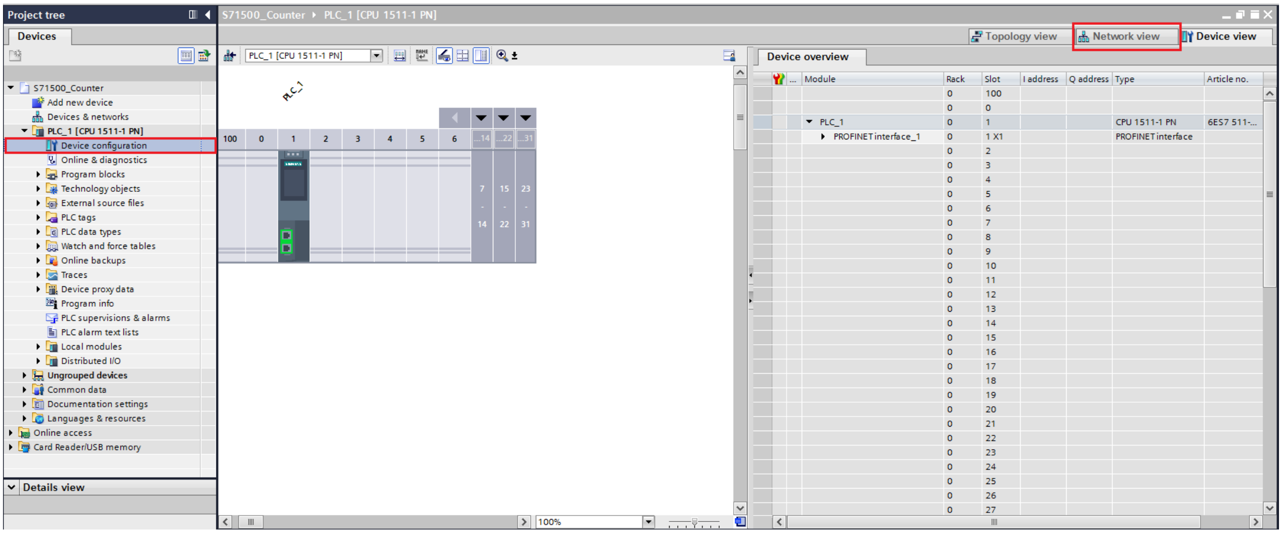


3. Click **Manage general station description files (GSDML)** to install the GSD files.

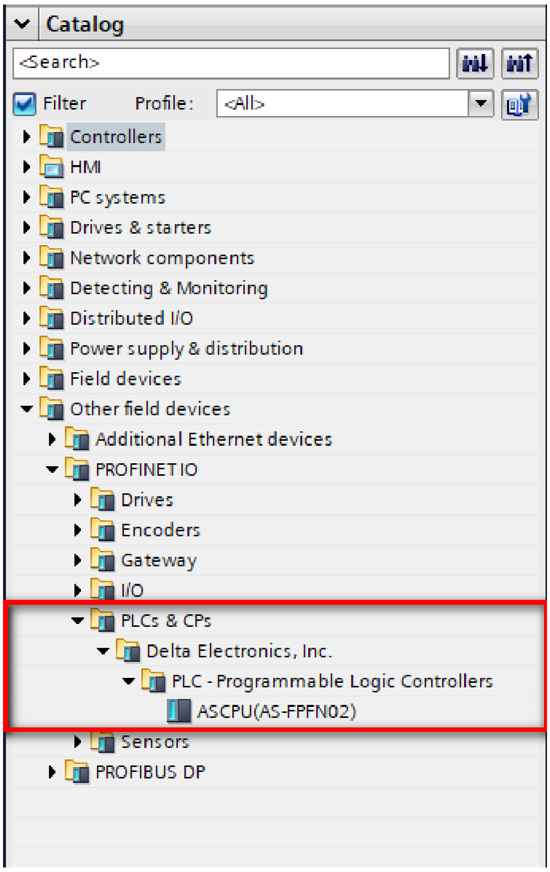




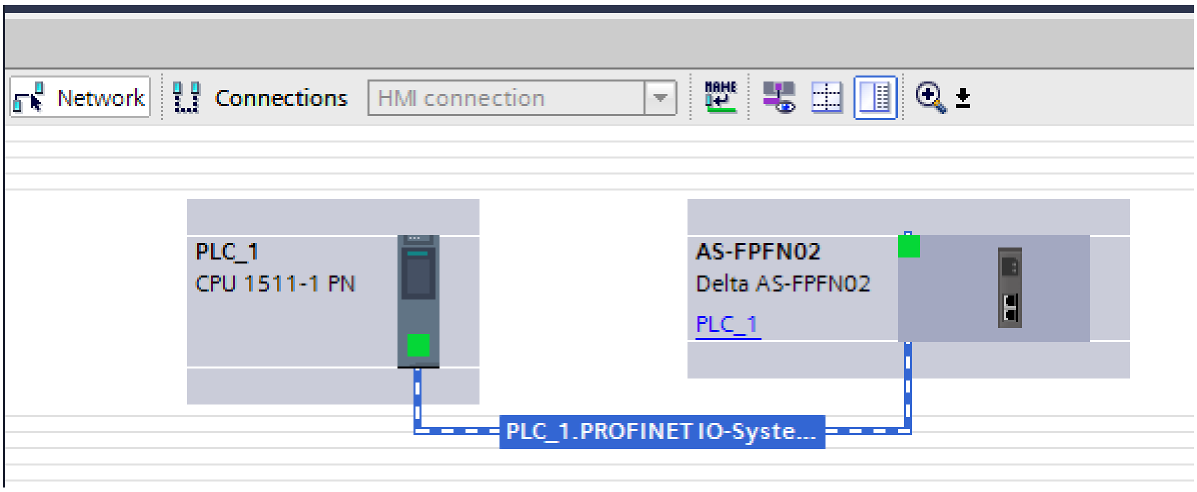
- After the installation is complete, select **Device Configuration** and **Network View**.

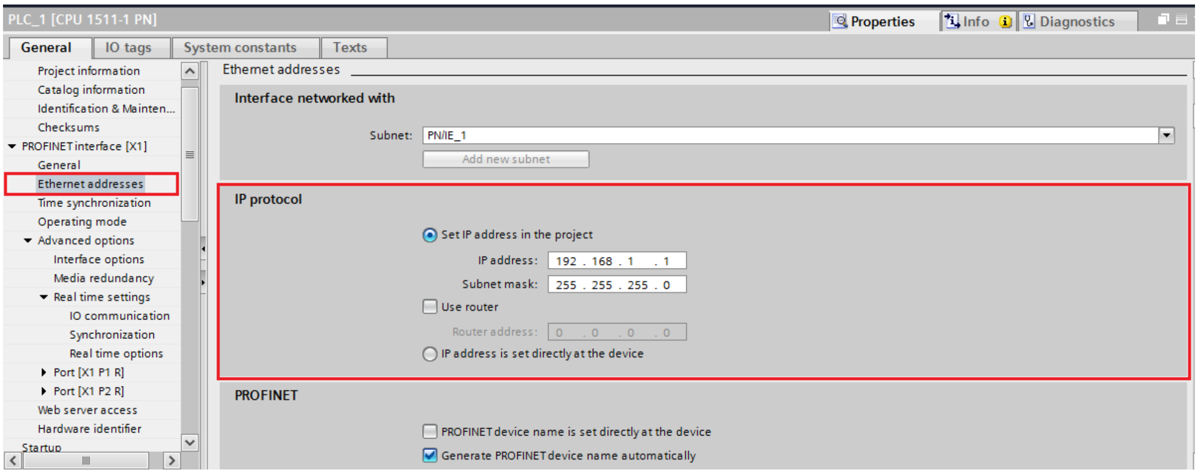


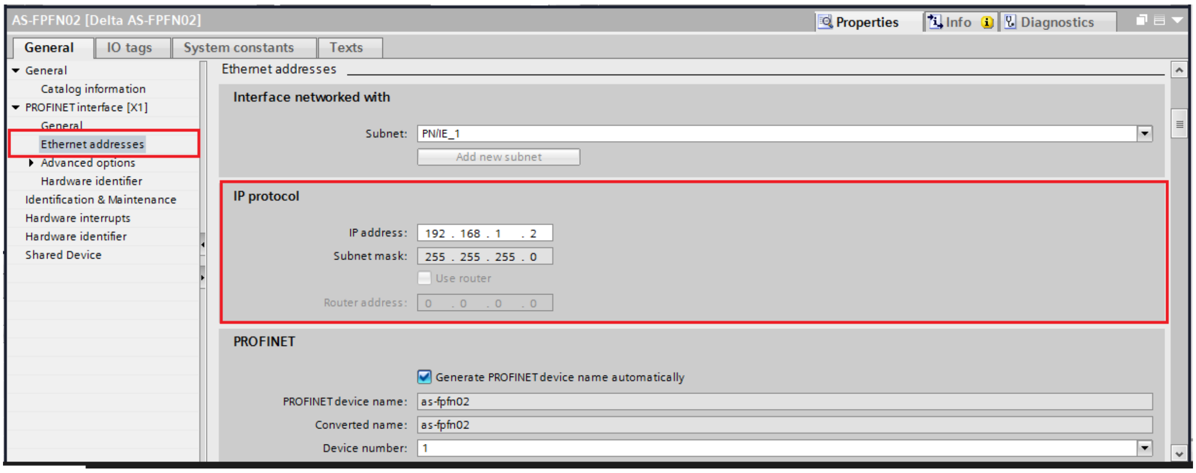
- Find and select the just-installed device from the **Catalog** on the right and drag and drop the selected device to **Device View** on the left.



- Connect S7-1500 and AS-FPFN02 together with an Ethernet connection and edit their IP addresses.

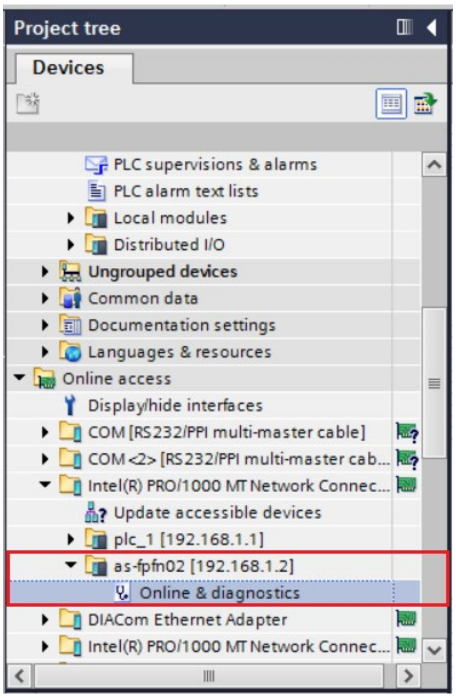




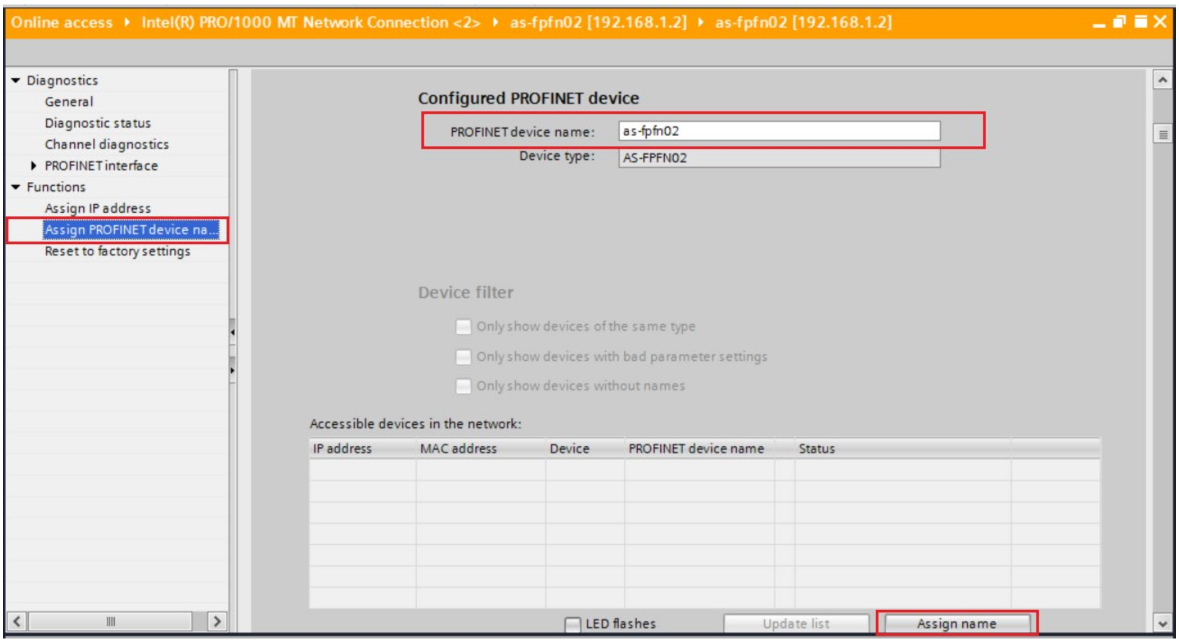


4. Define PN Device Name

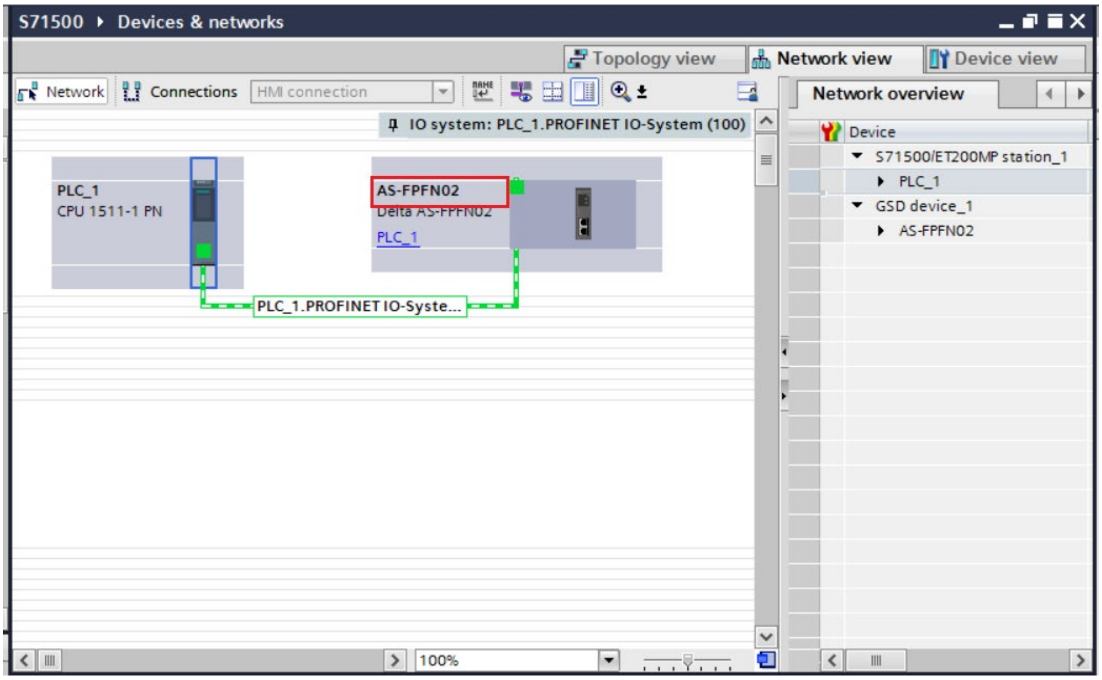
- Under the option of **Online access**, you can find the name of the function card and that is the PROFINET device name.



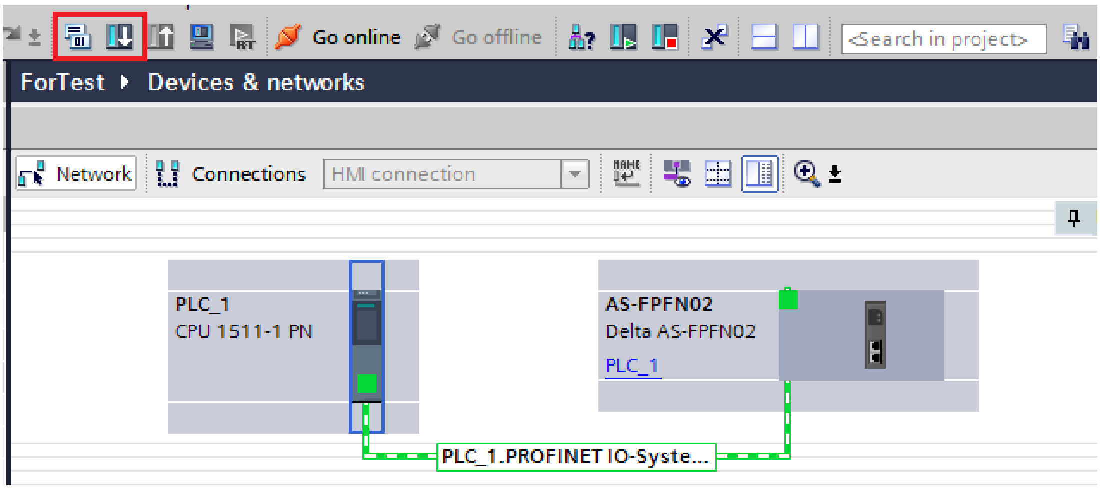
- Click **Online & diagnostics** and select **Assign PROFINET device name**. You can enter a new PROFINET device name and after that click **Assign name** to save the change.

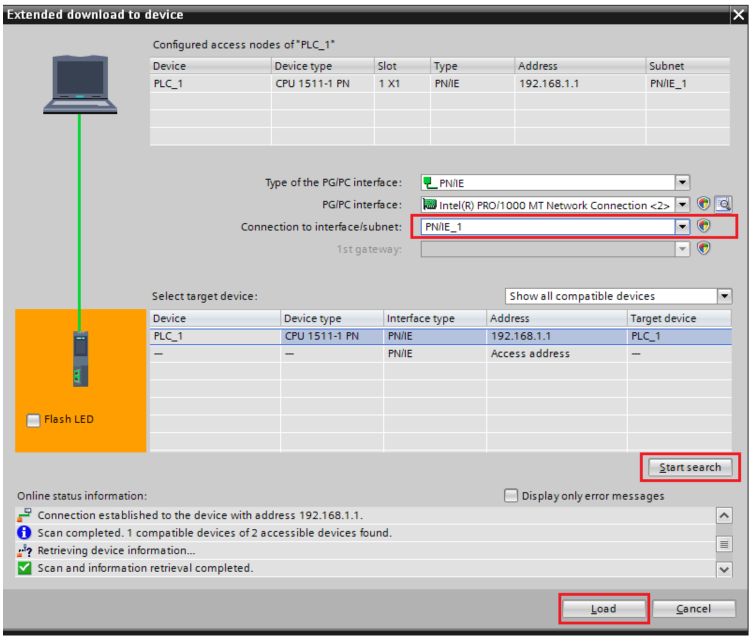


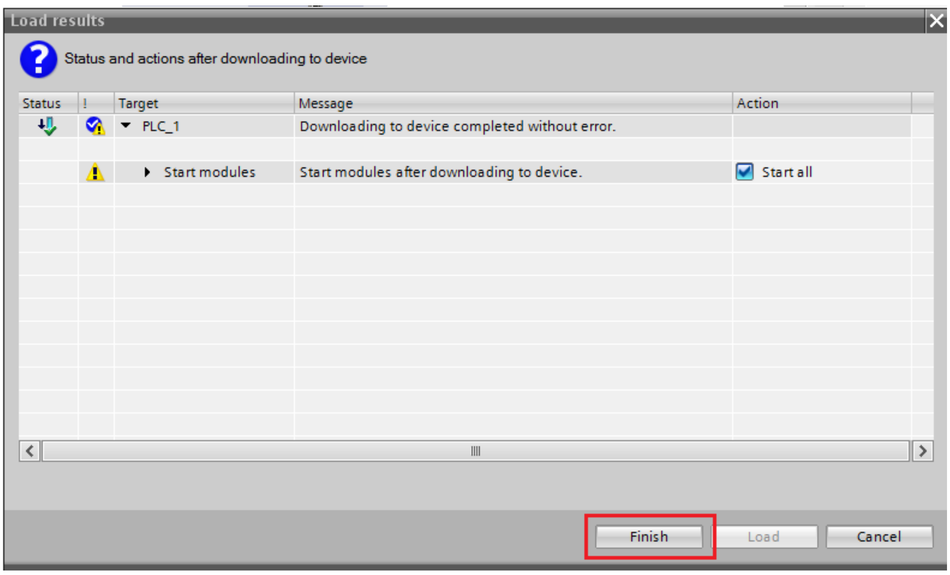
- Go back to the Network View and enter the new device name again in the red box as shown below.



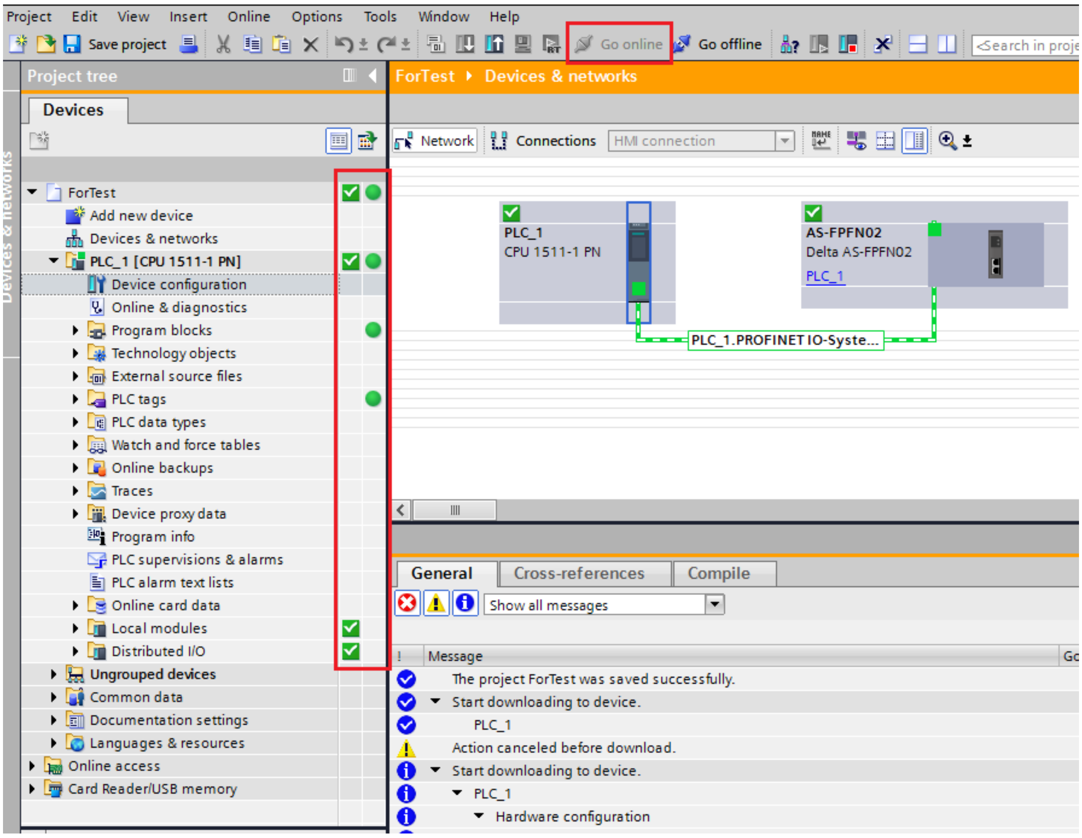
5. Compile and download the project.





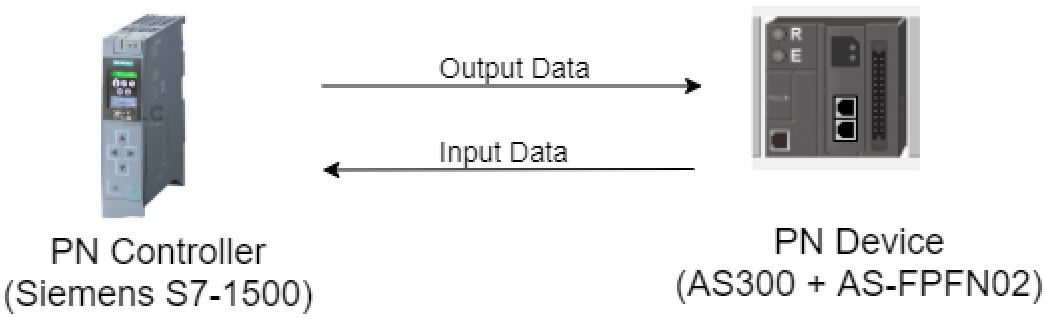


6. If the project is downloaded successfully and the operation is normal, after you click **Go Online**, you can see a similar view as the image shown below. And the basic configurations are complete.



7. Data Exchange

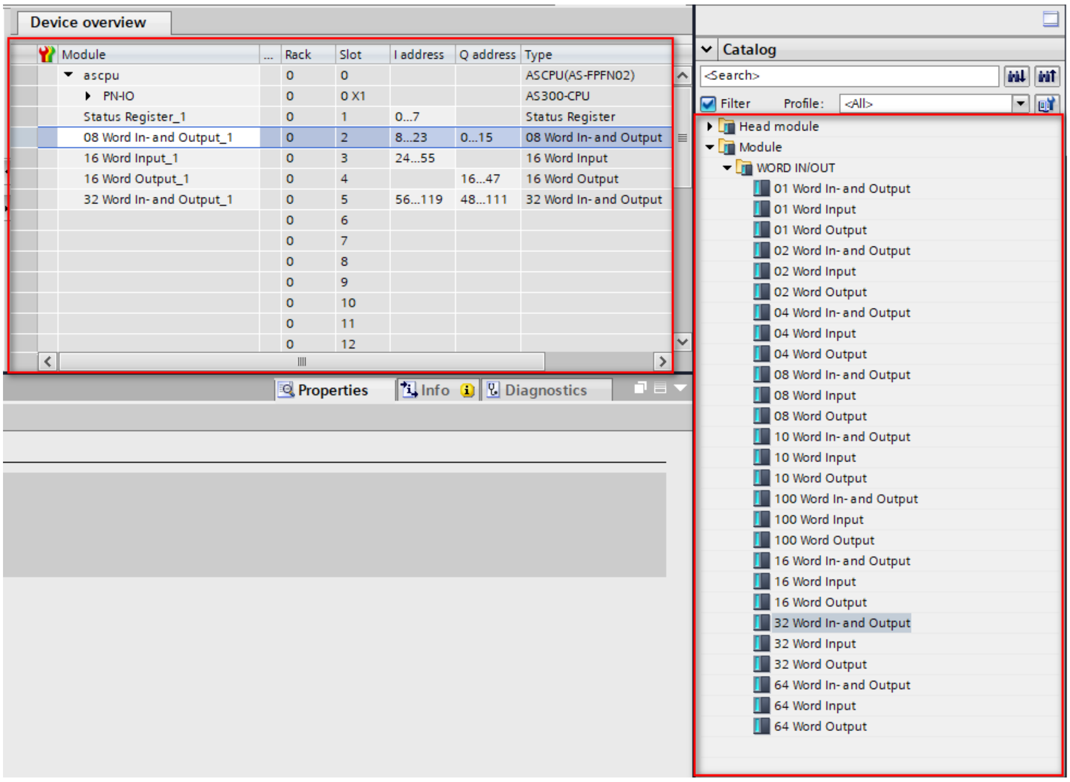
The range of data registers in AS300 Series PLC that an AS-FPFN02 can read/write is between D0 and D29999.



a. Configuring the data length for I/O

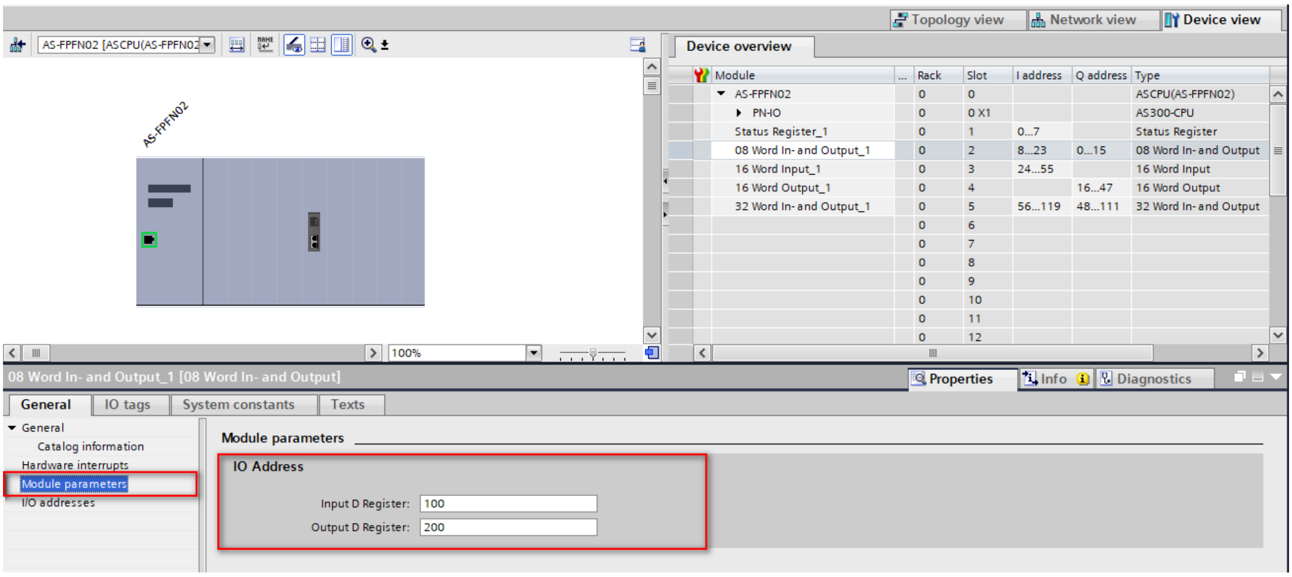
Select a module and configure the data length for it, as the image shown below.

Up to 250/250 Words of I/O address area are available for I/O of AS-FPFN02. If exceeding the limit, an error message shows up. Refer to Section 10.2.8.5 for more details.



b. Setting up the starting address of the data register to exchange data.

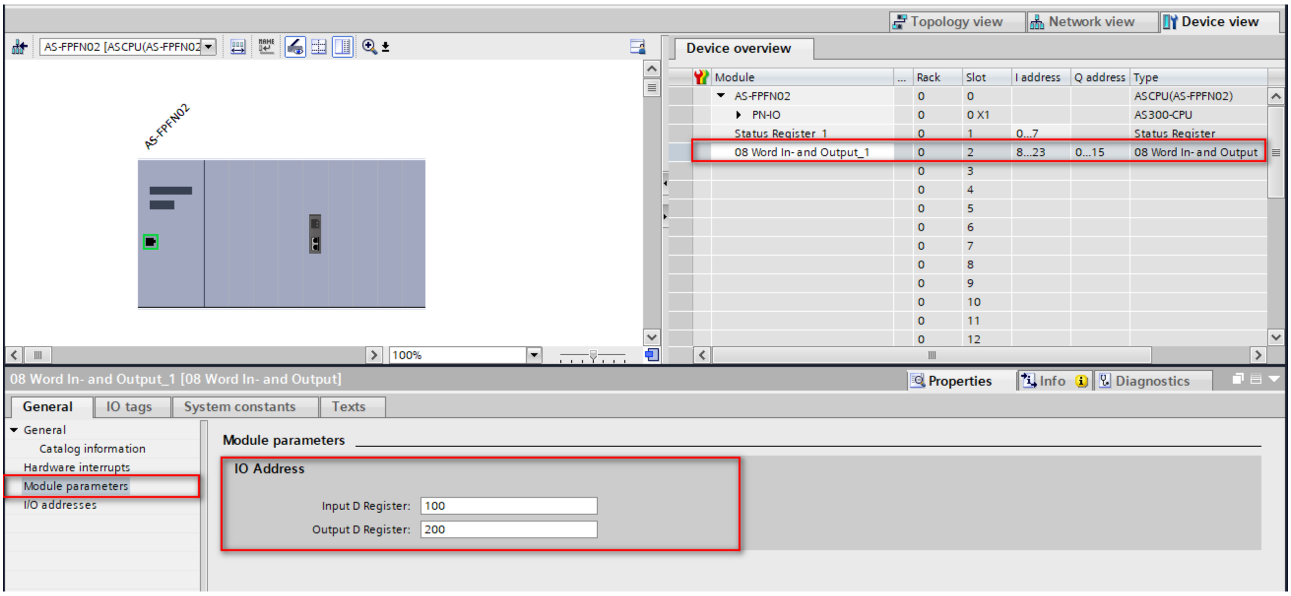
Enter the starting address in Module Parameters for data exchange. When entering 100 in Input D Register and 200 in Output D Register and using a 8 Word In/Out module, the PN Controller reads values starting from D100 to D115 and writes the values in the data register starting from D200 to D215.



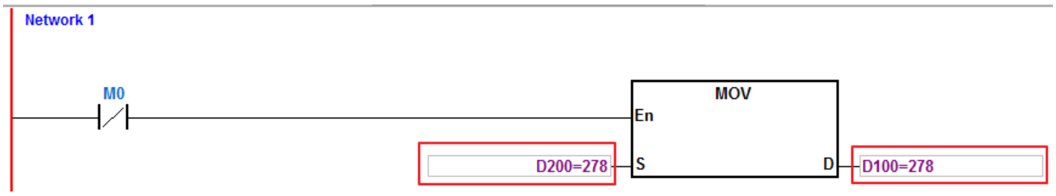
- PN Controller transmits 8 Words of data (Q0~Q15) to the data register D200~D207 in AS300 Series PLC.
- AS-FPFN02 transmits 8 Words of data (D100~D107) to the data register I0~I15 in S7-1500.

To determine if the data exchange is successful, you can check the program in Siemens TIA-Portal software. With a created PLC program, when clicking Main [OB1], the value in the register QW0 increments every second and that indicates the data exchange is successful.

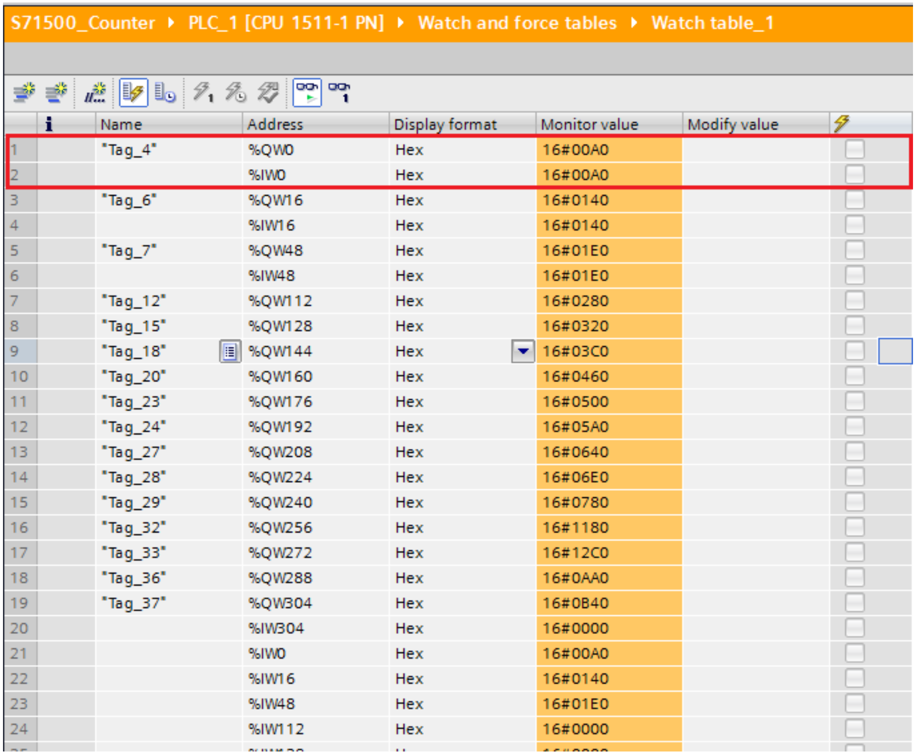
The data exchange can only begin when the Bit Input Data Available is TRUE. Refer to Section 10.2.8.6 for more details.



To determine if the data exchange is successful, you can check the program in ISPSoft. Use the MOVE instruction, you can see the value in D200 moves to D100 and PN Controller can read the data and that indicates the data exchange is successful.



Check if the monitor values of registers QW0 and IW0 in the Watch Table are the same to determine the data exchange is successful and if the exchanged data is accurate.

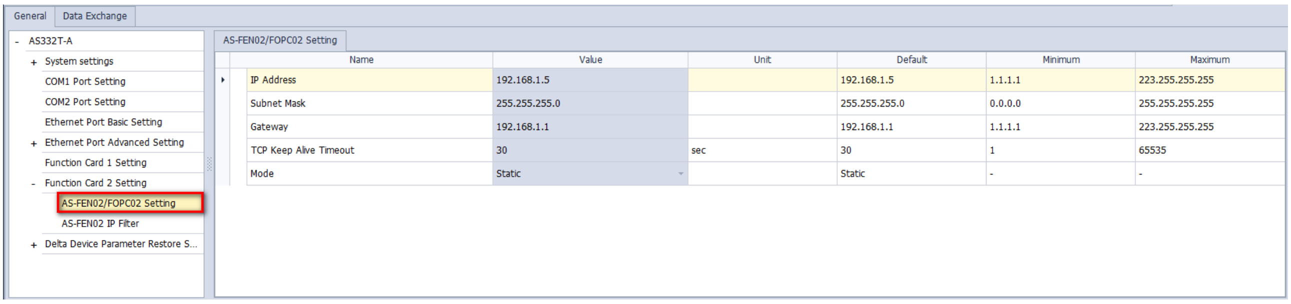


S71500_Counter ▸ PLC_1 [CPU 1511-1 PN] ▸ Watch and force tables ▸ Watch table_1

	i	Name	Address	Display format	Monitor value	Modify value	
1		"Tag_4"	%QW0	Hex	16#00A0		
2			%IW0	Hex	16#00A0		
3		"Tag_6"	%QW16	Hex	16#0140		
4			%IW16	Hex	16#0140		
5		"Tag_7"	%QW48	Hex	16#01E0		
6			%IW48	Hex	16#01E0		
7		"Tag_12"	%QW112	Hex	16#0280		
8		"Tag_15"	%QW128	Hex	16#0320		
9		"Tag_18"	%QW144	Hex	16#03C0		
10		"Tag_20"	%QW160	Hex	16#0460		
11		"Tag_23"	%QW176	Hex	16#0500		
12		"Tag_24"	%QW192	Hex	16#05A0		
13		"Tag_27"	%QW208	Hex	16#0640		
14		"Tag_28"	%QW224	Hex	16#06E0		
15		"Tag_29"	%QW240	Hex	16#0780		
16		"Tag_32"	%QW256	Hex	16#1180		
17		"Tag_33"	%QW272	Hex	16#12C0		
18		"Tag_36"	%QW288	Hex	16#0AA0		
19		"Tag_37"	%QW304	Hex	16#0B40		
20			%IW304	Hex	16#0000		
21			%IW0	Hex	16#00A0		
22			%IW16	Hex	16#0140		
23			%IW48	Hex	16#01E0		
24			%IW112	Hex	16#0000		

10.2.9 AS-FOPC02

This communication card can work independently and does NOT occupy the communication port of PLC CPU. It can act as OPC-UA Server or EtherNet/IP Adapter. After AS-FOPC02 is installed, you can go to HWCONFIG from ISPSoft to do the editing in the Function Card 2 section.



All the AS-FOPC02 parameters are stored in AS300 PLC CP. If you need the IP address of AS-FOPC02, you need to go to HWCONFIG from ISPSoft to check its IP address in the Function Card 2 section. You can also use COMMGR to see the IP address of this device.

10.2.9.1 Supported Firmware Versions

- The firmware of AS300 Series PLC should be V1.10.00 or later for AS-FOPC02 to be installed on it.
- AS00SCM-A does NOT support AS-FOPC02. You can NOT install AS-FOPC02 on AS00SCM-A.
- ISPSoft version should be V3.11 or later.
- EIP Builder version should be V1.08 or later.

10.2.9.2 Features

- When AS-FOPC02 is installed on AS300 Series PLC, it can act as OPC-UA Server. The tag settings are the same as the network communication settings for AS Series; refer to Section 10.5.2 from AS Series Operation Manual for more information.
- When AS-FOPC02 is installed on AS300 Series PLC, it can act as EtherNet/IP Adapter but NOT EtherNet/IP Scanner. dapter. The EtherNet/IP settings for AS-FOPC02 are the same as the EtherNet/IP settings for AS-FEN02, refer to Section 10.2.7.6 for more information.

10.2.9.3 Specifications

- **System Specifications**

Item		Specification
General	**Device type**	Slave
	Topology	Star and linear topologies are supported.
	IP Settings	When installed on AS300 PLC CPU, you can use HWCONFIG from ISPSoft for editing
	Availability	AS300 Series PLC
Web	**Max. connection number**	8
	Functions	View device information Account management AS-FOPC02 firmware update

- **OPC-UA Specifications**

Item		Specification
General	**Device type**	Server
OPC-UA Server	**Max. connection number**	2
	Max. tag number	64
Security mode		(1) None (2) Sign (3) Sign and Encrypt
Security policy		(1) Basic128Rsa15 (2) Basic256 (3) Basic256Sha256
Authentication		(1) Anonymous (2) User name/Password
Transport protocol / encoding		opc.tcp / binary
Supported profiles		UA v1.03 Nano Embedded Device Server Profile

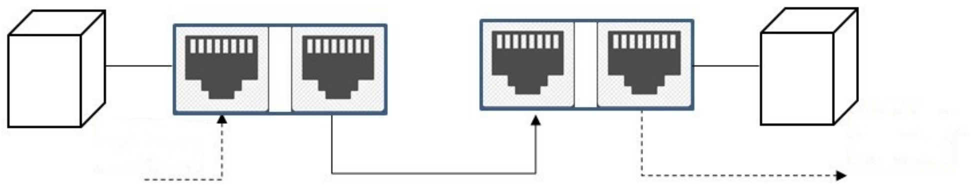
- **EtherNet/IP Specifications**

Item		Specification
General	**Device type**	Adapter
CIP Network I/O Connection	**CIP connection number**	8
	TCP connection number	8 (Servers)
	Requested Packet Interval (RPI)	1 ms~1000ms
	Max. Transmission Speed	10,000 pps
	Max. data length/per transmission	200 bytes
CIP Network Explicit Message	**Class 3 (Connected Type)**	Total 8 (Servers) (for both class 3 and UCMM connection types)
	UCMM (Non-Connected Type, only uses TCP connections)	
	CIP Objects	Identity Object (16#01) Message Router Object (16#02) Assembly Object (16#04) Connection Manager Object (16#06) Port Object (16#F4) TCP/IP Interface Object (16#F5) Ethernet Link Object (16#F6) Not supporting self-defined objects

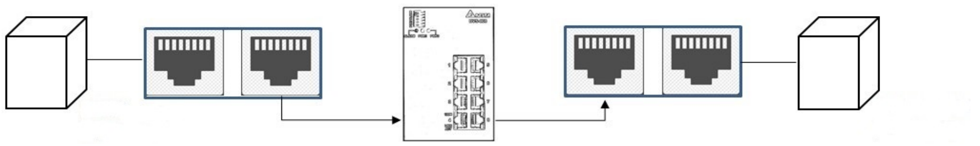
10.2.9.4 Topology

After installing the extension card, use HWCONFIG in ISPSoft to configure the communication.

- **Linear Topology**



- **Star Topology**



10.2.9.5 Special Data Registers (SR)

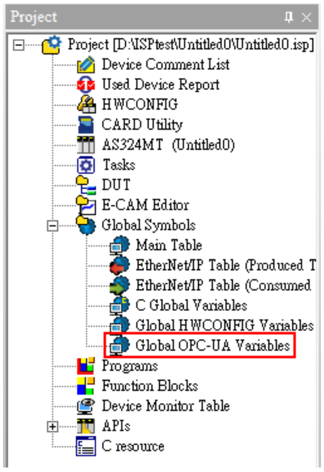
SR	Function	AS300 Series	AS200 Series	OFF ⇩ ON	STOP ⇩ RUN	RUN ⇩ STOP	Latched	Attribute	Default
SR1536	AS-FEN02/FOPC02 TCP current connection number	○	–	0	–	–	N	R	0
SR1539	AS-FEN02/FOPC02 EtherNet/IP Adapter connection number	○	–	0	–	–	N	R	0

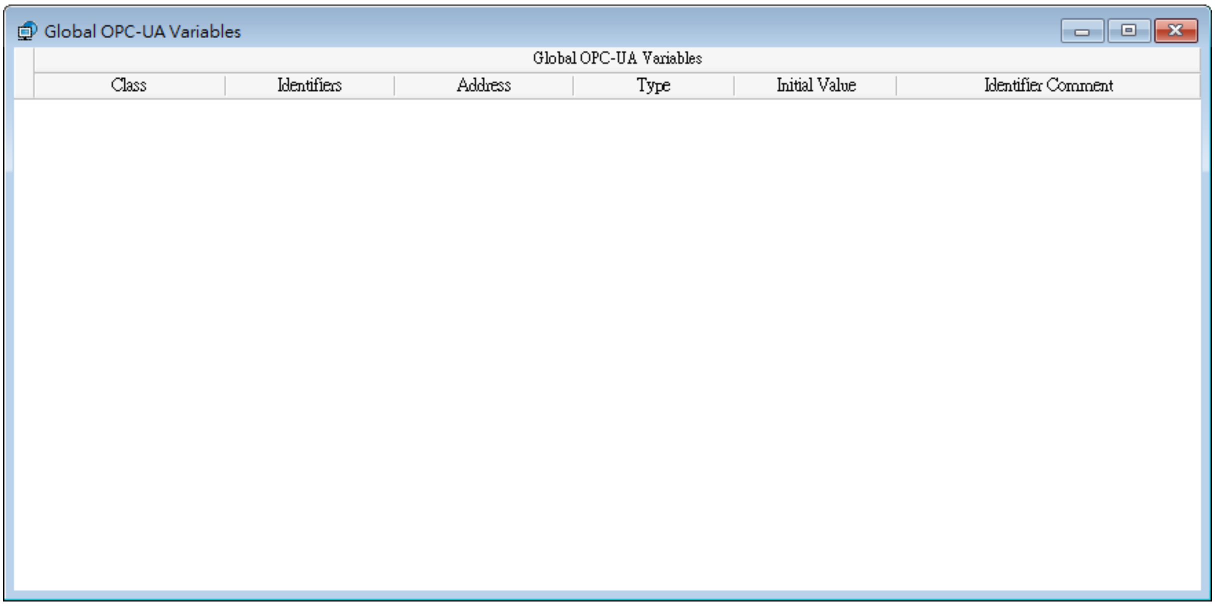
Special data register	Refresh time
SR1536	The flag is ON, when the system is refreshed automatically.
SR1539	

10.2.9.6 OPC-UA Slave

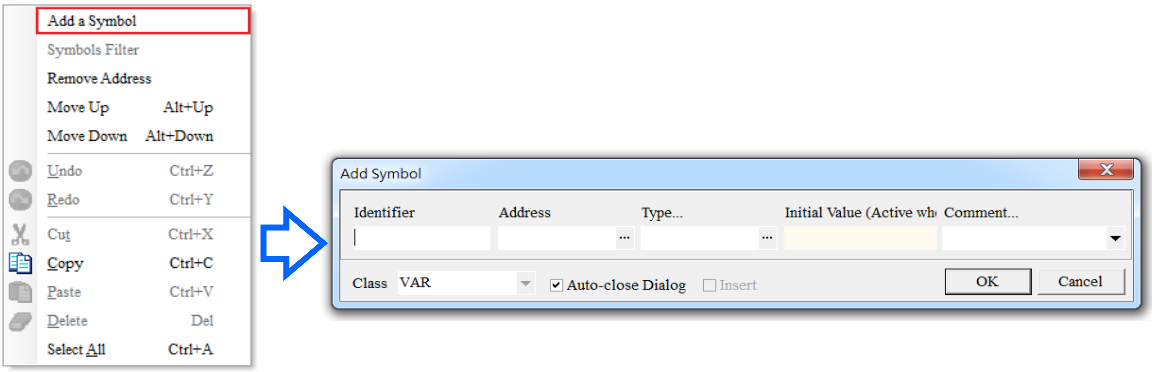
When AS-FOPC02 is installed on AS300 Series PLC, it can act as an OPC-UA Sever. Follow the steps below to create Tags on AS300 Series PLC via OPC-UA variables.

(1) Open ISPSoft and create a new project and then double-click **Global OPC-UA Variables** under the **Global Symbols** node to open the **Global OPC-UA Variables** setting table.

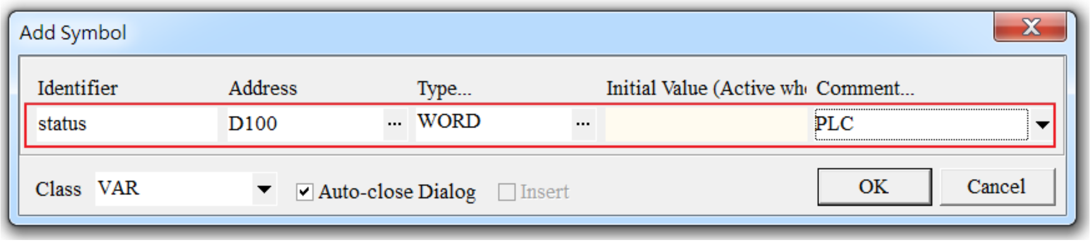




(2) Right-click on the **Global OPC-UA Variables** setting table to see the context menu. Click **Add a Symbol** to open the setting page.



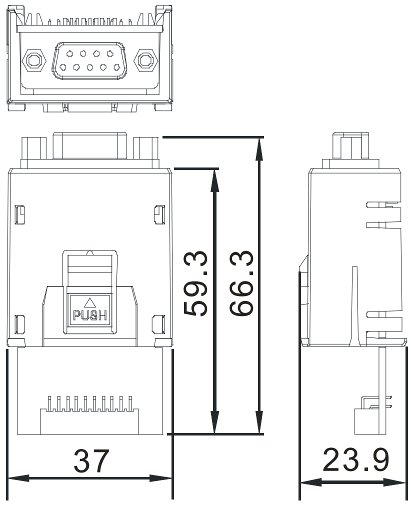
(3) Set up the OPC-UA tag. See the following example for reference.



(4) After the settings are complete, download the settings to PLC. After that devices can read/write the Tag. The way to connect to the Tags varies in different brands. Refer to the specific device manual for more information on using tags to connect.

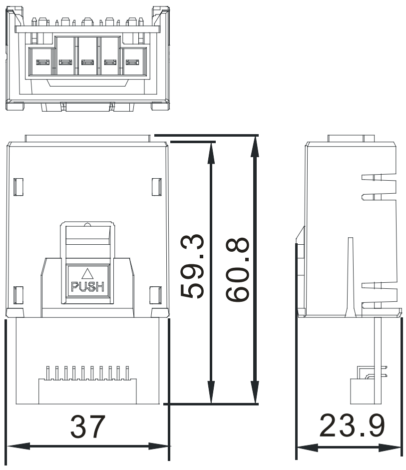
10.3 Profiles and Dimensions

10.3.1 AS-F232



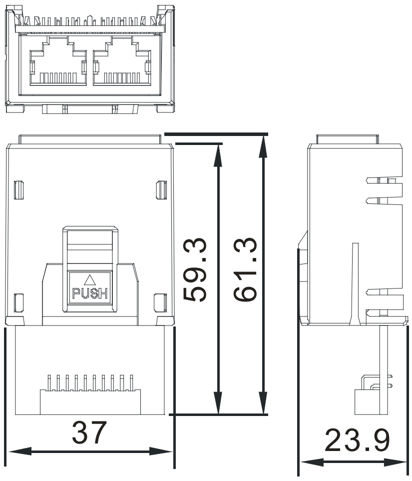
Unit: mm

10.3.2 AS-F422/AS-F485/AS-F2AD/AS-F2DA



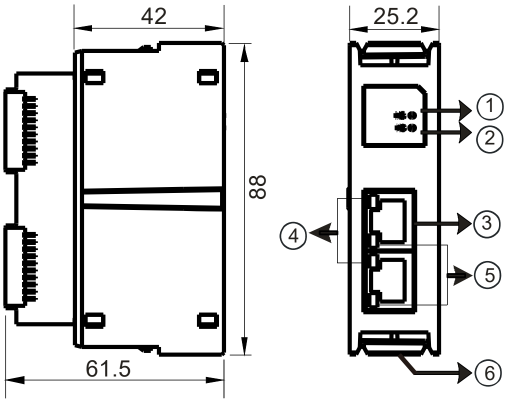
Unit: mm

10.3.3 AS-FCOPM



Unit: mm

10.3.4 AS-FEN02

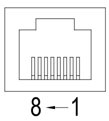


Unit: mm

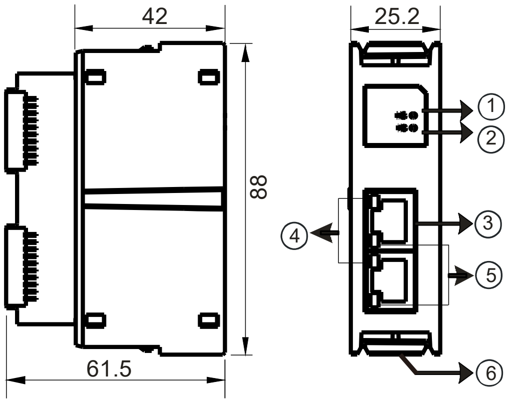
Number	Name	Description
1	MS indicator	Indicates the status of the communication card Green light ON: the operation is working normal Green light BLINKING: the setting is not complete Red light ON: internal communication fail, can NOT be recovered Red light BLINKING: internal communication timeout OFF: no power
2	NS indicator	Indicates the status of Ethernet connection Green light ON: a CIP connection is established Green light BLINKING: a CIP connection is not established after power-on Red light ON: duplicated IP address Red light BLINKING: communication timeout (a CIP connection has been established after power-on) / IP address change OFF: no power / network cable is not connected
3	RJ-45 port X1/X2	For network connections
4	LINK indicator X1/X2	Indicate the status of Ethernet connection Green light ON: a network connection is established OFF: a network connection is not established
5	ACT indicator X1/X2	Indicate the status of Ethernet communication Orange BLINKING: data transmission OFF: no data transmission
6	Clip ring	Secures AS series

RJ-45 Pin Definition

Pin No.	RJ-45
1	TX+
2	TX-
3	RX+
4	N/C
5	N/C
6	RX-
7	N/C
8	N/C



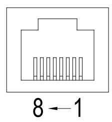
10.3.5 AS-FPFN02



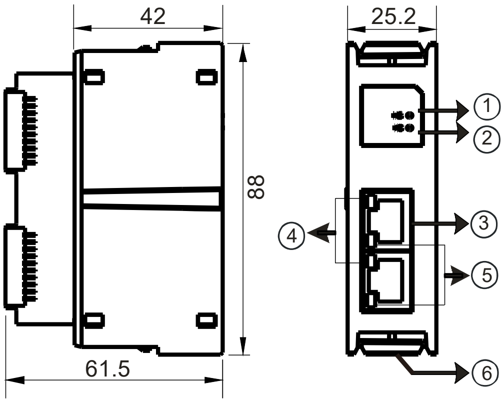
Unit: mm

Number	Name	Description
1	SF indicator	System Fail Indicator Red light ON: an error occurs in the system Example: the parameters downloaded to the Controller are different from the actual placement, connecting port 2, instead of connecting to port 1 OFF: no system error
2	BF indicator	Bus Fail Indicator Red light ON: the connection with PROFINET Controller is OFF. Red light BLINKING: the connection is working fine but the communication with PROFINET Controller is NOT normal. OFF: the connection with PN-Controller is working fine.
3	RJ-45 port X1/X2	Uses for network connections
4	LINK indicator X1/X2	Indicates the status of Ethernet connection Green light ON: a network connection is established OFF: a network connection is not established
5	ACT indicator X1/X2	Indicates the status of Ethernet communication Orange BLINKING: data transmission OFF: no data transmission
6	Clip ring	Secures AS series

RJ-45 Pin Definition

Pin No.	RJ-45	
1	TX+	
2	TX-	
3	RX+	
4	N/C	
5	N/C	
6	RX-	
7	N/C	
8	N/C	

10.3.6 AS-FOPC02

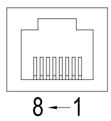


Unit: mm

Number	Name	Description
1	MS indicator	Indicates the status of the communication card Green light ON: the operation is working normal Green light BLINKING: the setting is not complete Red light ON: internal communication fail, can NOT be recovered Red light BLINKING: internal communication timeout OFF: no power
2	NS indicator	Indicates the status of Ethernet connection Green light ON: a CIP / OPC-UA connection is established Green light BLINKING: a CIP / OPC-UA connection is not established after power-on Red light ON: duplicated IP address Red light BLINKING: communication timeout (a CIP / OPC-UA connection has been established after power-on) / IP address change OFF: no power / network cable is not connected
3	RJ-45 port X1/X2	For network connections
4	LINK indicator X1/X2	Indicate the status of Ethernet connection Green light ON: a network connection is established OFF: a network connection is not established
5	ACT indicator X1/X2	Indicate the status of Ethernet communication Orange BLINKING: data transmission OFF: no data transmission
6	Clip ring	Secures AS series

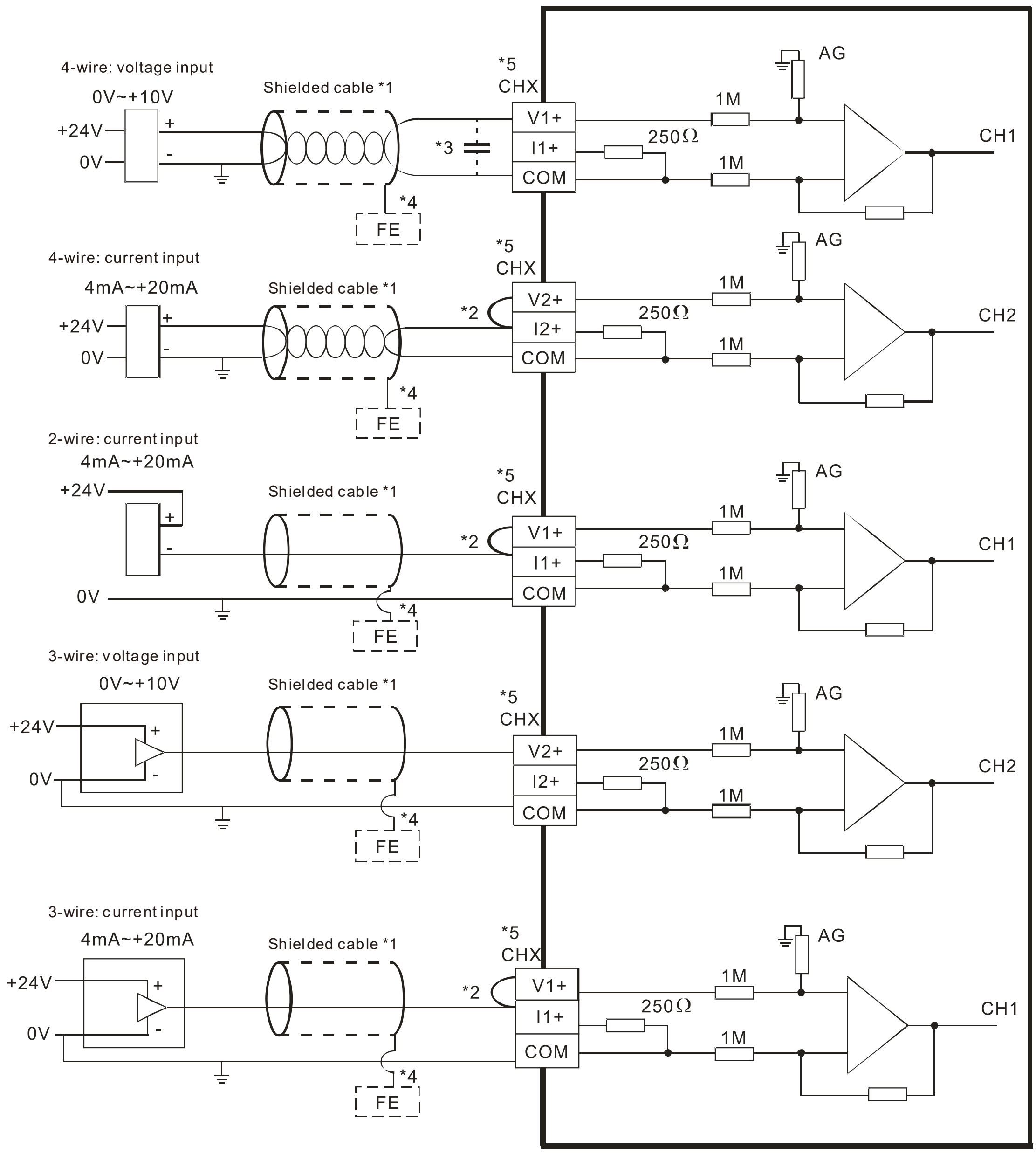
RJ-45 Pin Definition

Pin No.	RJ-45
1	TX+
2	TX-
3	RX+
4	N/C
5	N/C
6	RX-
7	N/C
8	N/C



10.4 Wiring

10.4.1 AS-F2AD



*1. Use shielded cables to isolate the analog input signal cable from other power cables.

*2. If the module is connected to a current signal, the terminals Vn and In+ (n=1–2) must be short-circuited.

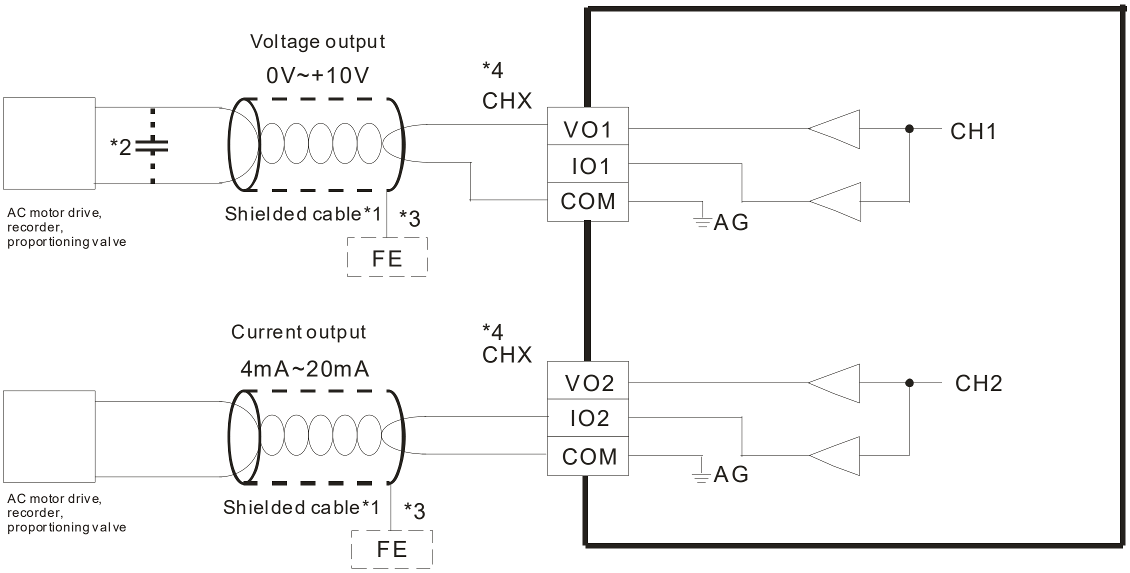
*3. If variability in the input voltage results in interference within the wiring, connect the module to a capacitor having a capacitance in the range of 0.1–0.47 μF and a working voltage of 25 V.

*4. Connect the shielded cable to the terminal FE.

*5. The wording “CHX” indicates that you can use the five wiring methods listed above for every input channel.

10

10.4.2 AS-F2DA



*1. Use shielded cables to isolate the analog input signal cable from other power cables.

*2. If variability in the input voltage results in interference within the wiring, connect the module to a capacitor having a capacitance in the range of 0.1–0.47 μF and a working voltage of 25 V.

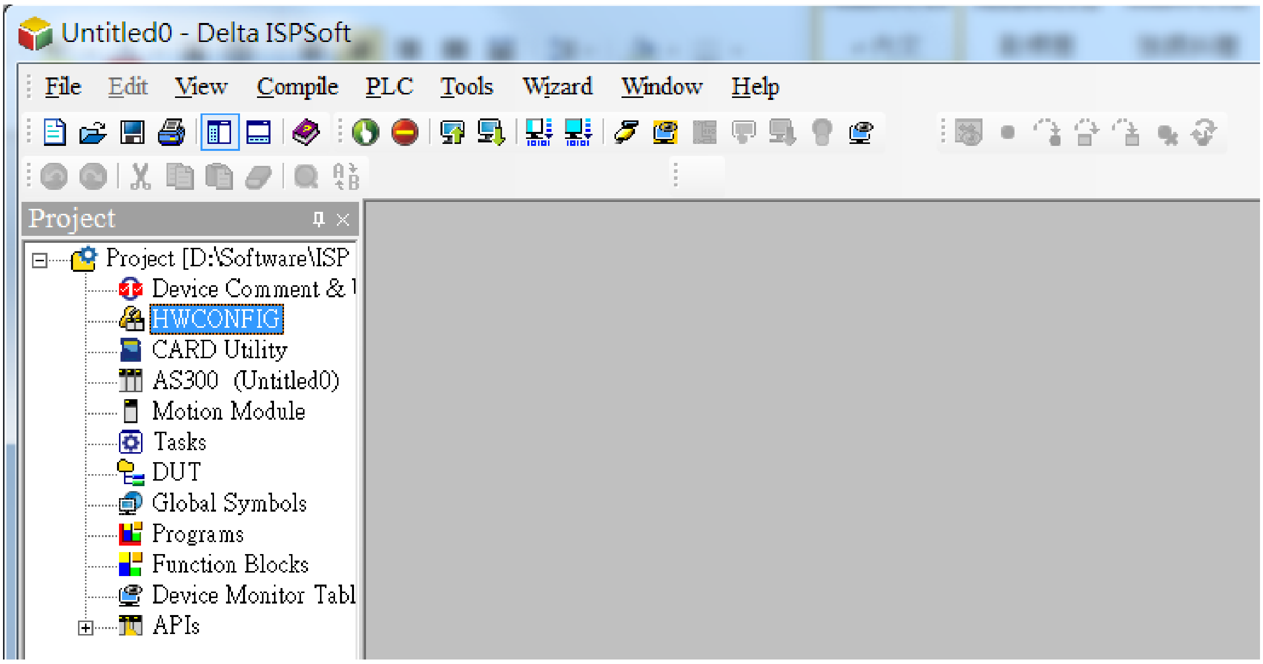
*3. Connect the shielded cable to the terminal FE.

*4. The wording “CHX” indicates that you can use the two wiring methods listed above for every input channel.

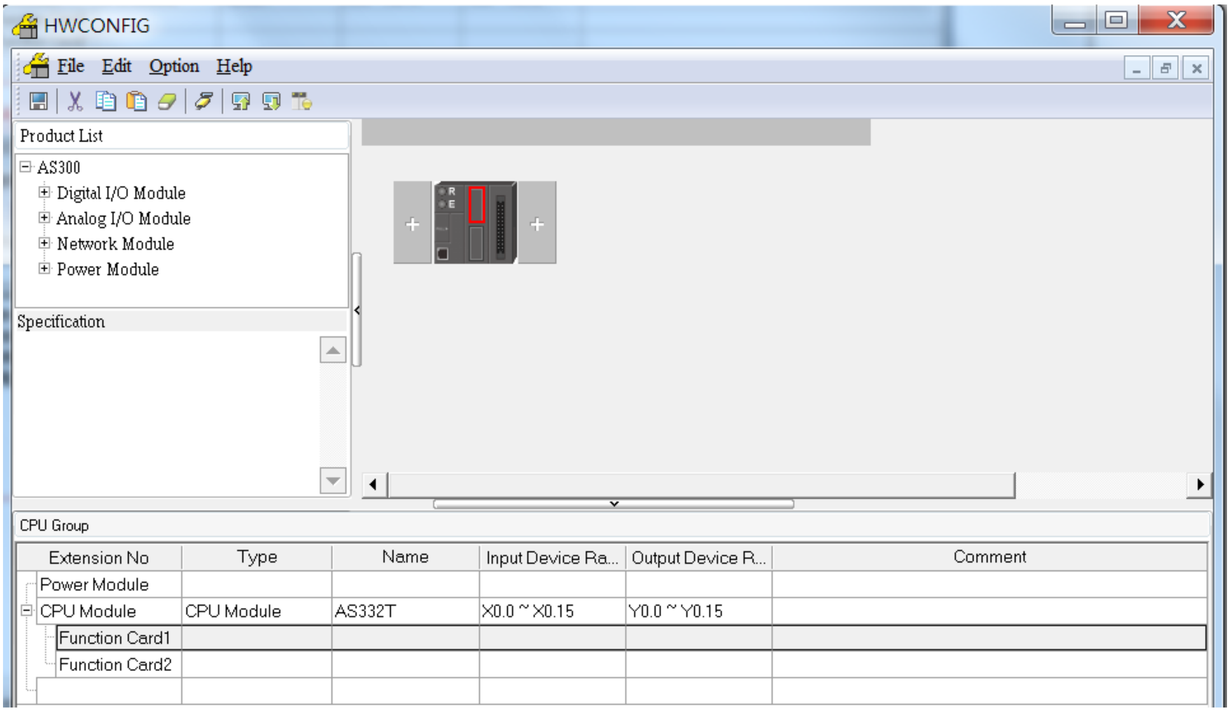
10.5 HWCONFIG in ISPSoft

10.5.1 Initial Setting

(1) Start ISPSoft and double-click **HWCONFIG**.

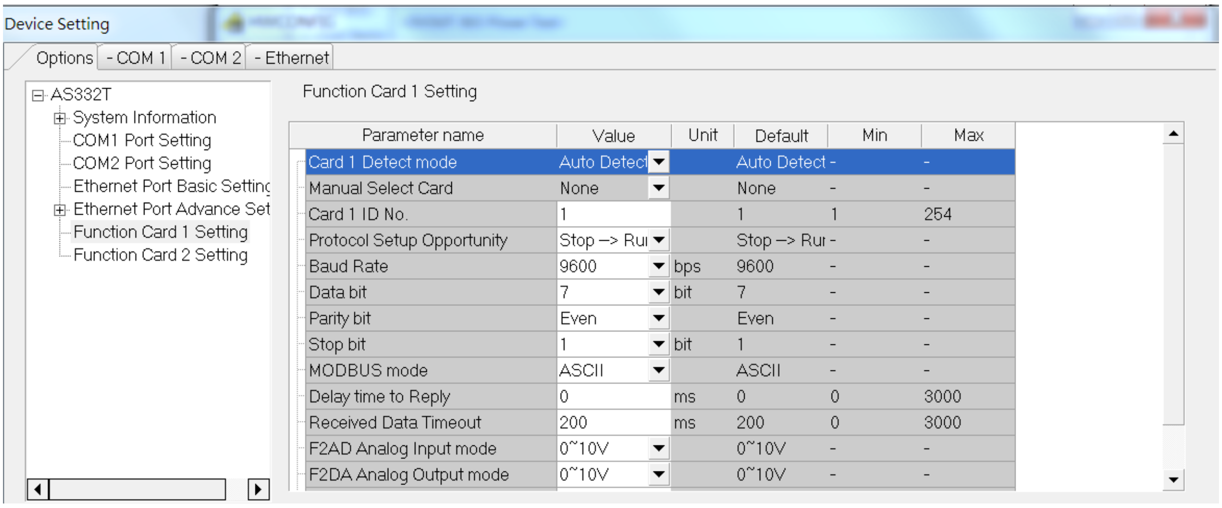


(2) Select a function card on the module.

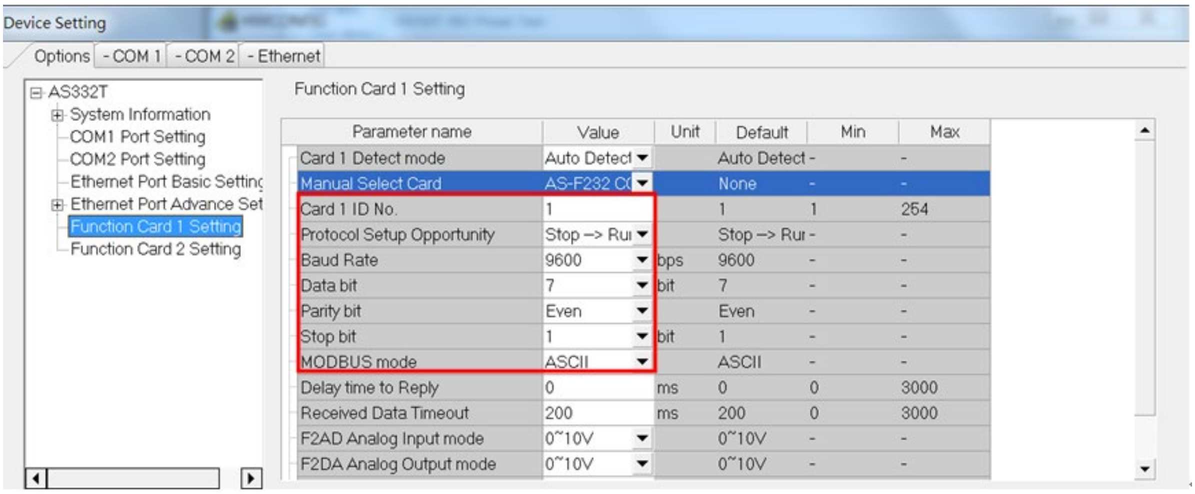


(3) Double-click the function card to open the Device Setting page.

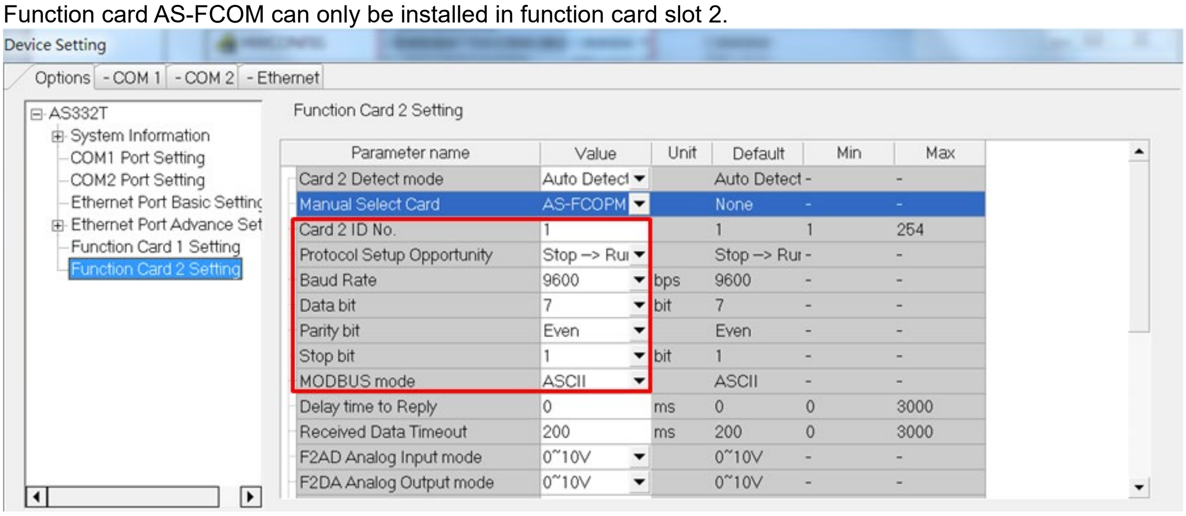
Card1 Detect mode: select Auto Detect or choose the function card model.



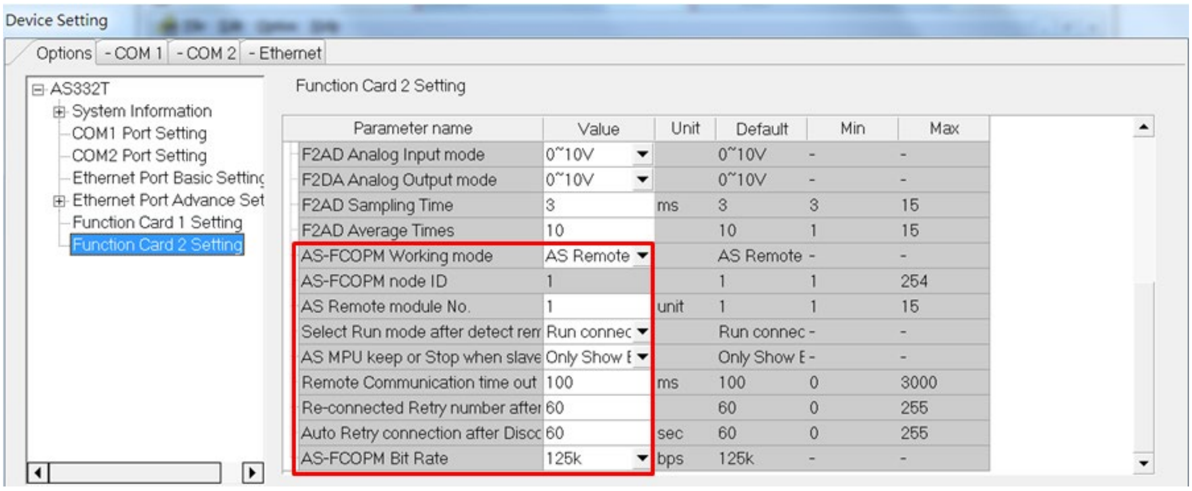
(a) When the function card is an AS-F232, AS-F422, or AS-F485, configure the communication settings in the red box.



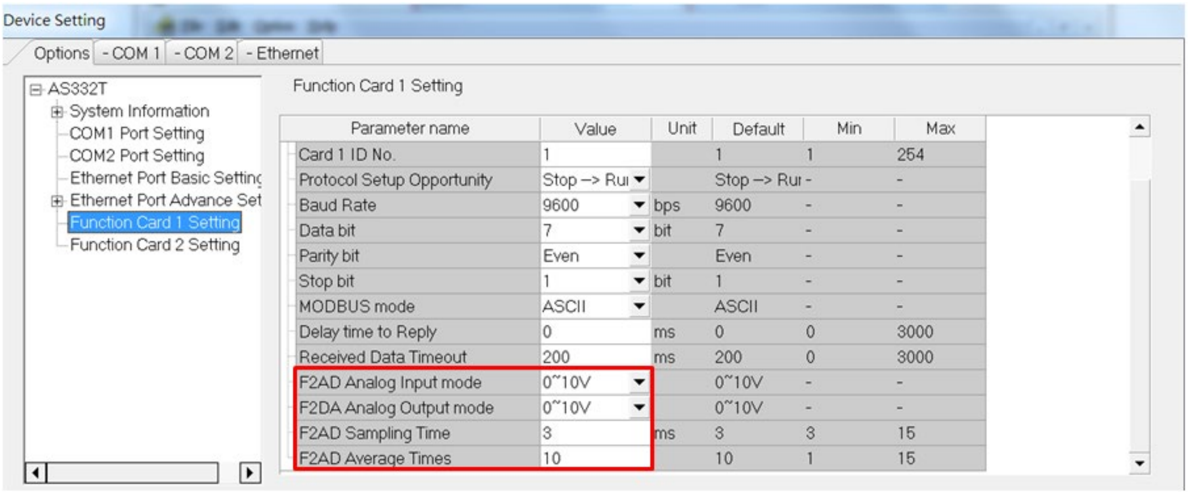
(b) Function card AS-FCOM can only be installed in function card slot 2.



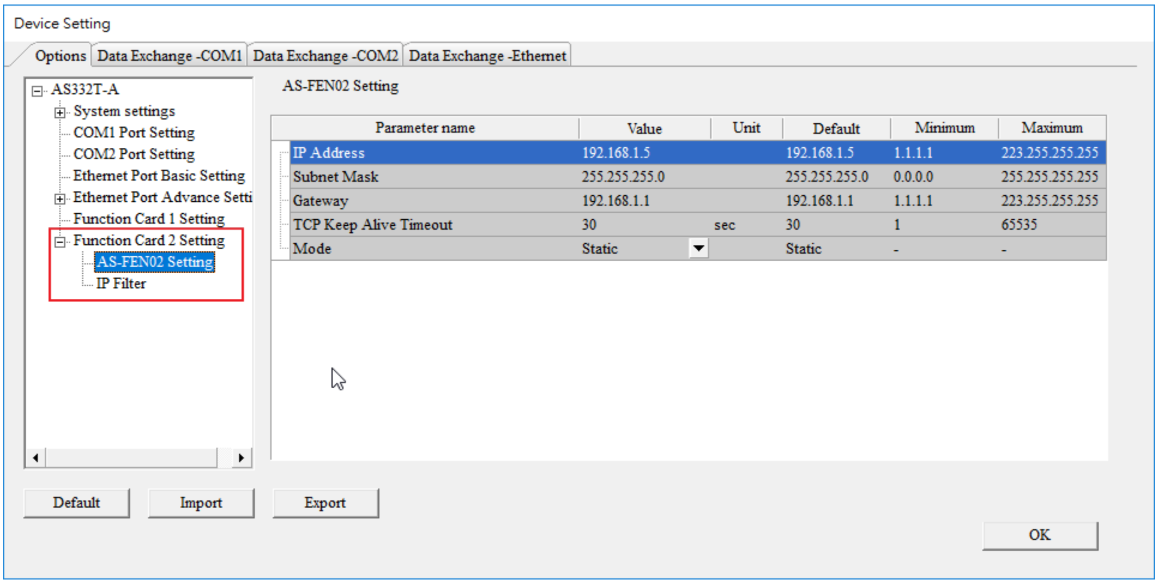
(c) Configure the communication settings in the red box.



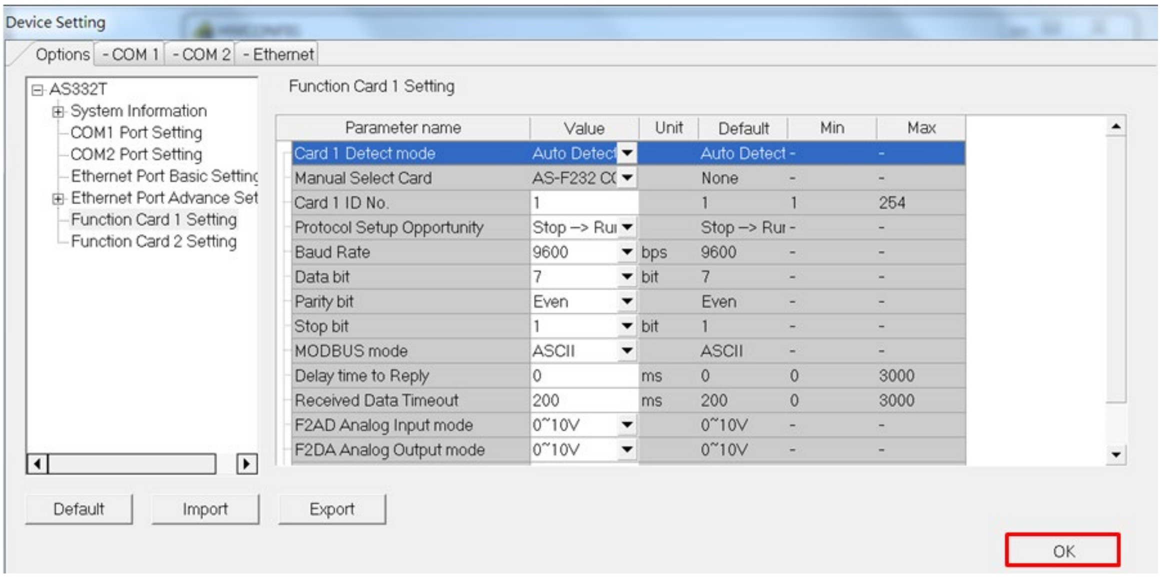
(d) When the function card is an AS-F2AD or AS-F2DA, configure the communication settings in the red box.



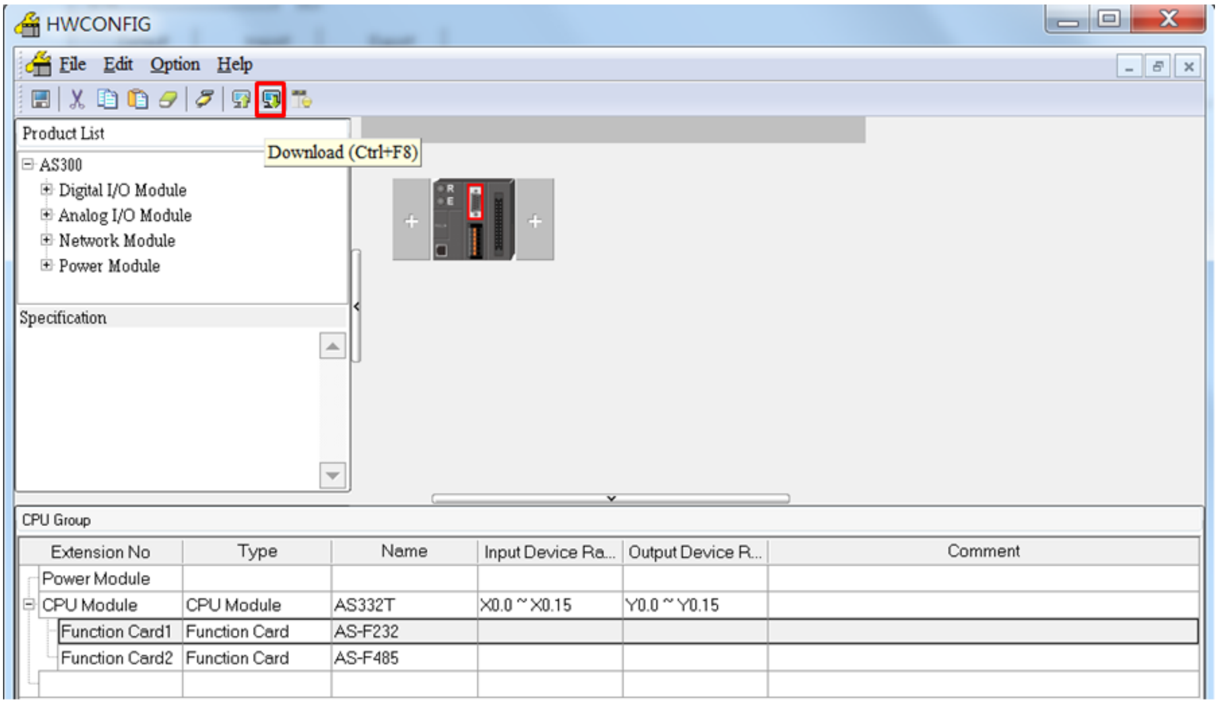
(e) When the function card is an AS-FEN02, configure the communication settings in the red box.



(f) Click **OK** to confirm the settings.



(4) Click **Download** on the toolbar to download the parameters. Note that you cannot download the parameters while the CPU module is running.



11

Chapter 11 DeviceNet Master Scanner Module AS01DNET-A

Table of contents

11.1 Introduction of AS01DNET-A

- Thank you for choosing Delta AS01DNET-A. Please read this chapter carefully before use so as to ensure correct installation and operation of AS01DNET-A.
- The instruction is simply a guideline for operation of the product and the details on the DeviceNet protocol is excluded here. Please refer to relevant articles and literatures for more details on the DeviceNet protocol.
- AS01DNET-A, a DeviceNet network module can work in two modes: master /slave and RTU. The RTU-Master/Slave switch is used for selecting one of the two modes. When AS01DNET-A works in master/slave mode, it makes up the DeviceNet master or slave with AS-series PLC together. When working in RTU mode, AS01DNET-A needs an external 24VDC power supply and can connect AS-series I/O modules onits right side.

Refer to Section 11.4 and 11.5 for details about master/slave mode and RTU mode.

11.1.1 Feature

- Supports the Group 2 server slave and Group 2 only servers.
- Supports the explicit connection in the predefined master/slave connection and I/O polling connection.
- Able to work as a DeviceNet master or slave as well as a remote RTU connecting AS series I/O modules.
- The network configuration software DeviceNet Builder offers the graphical configuration interface.
- Supports the EDS file configuration in the DeviceNet network configruation tool.

11.1.2 Specifications

- **DeviceNet Connector**

Item	Specifications
Transmission method	CAN
Electrical isolation	DC500V
Connector type	Removable terminal block with screws (5.08mm)
Communication cable	2 communication wires, 2 power wires and 1 shielded wire included.

- **DeviceNet Communication**

Item	Specifications
Message type	I/O polling connection, explicit connection
Baud rate	Standard: 125 kbps, 250 kbps and 500 kbps Extension: 10 kbps, 20 kbps, 50 kbps, 125 kbps, 250 kbps, 500 kbps, 800kbps and 1M bps.

- **Electrical Specification**

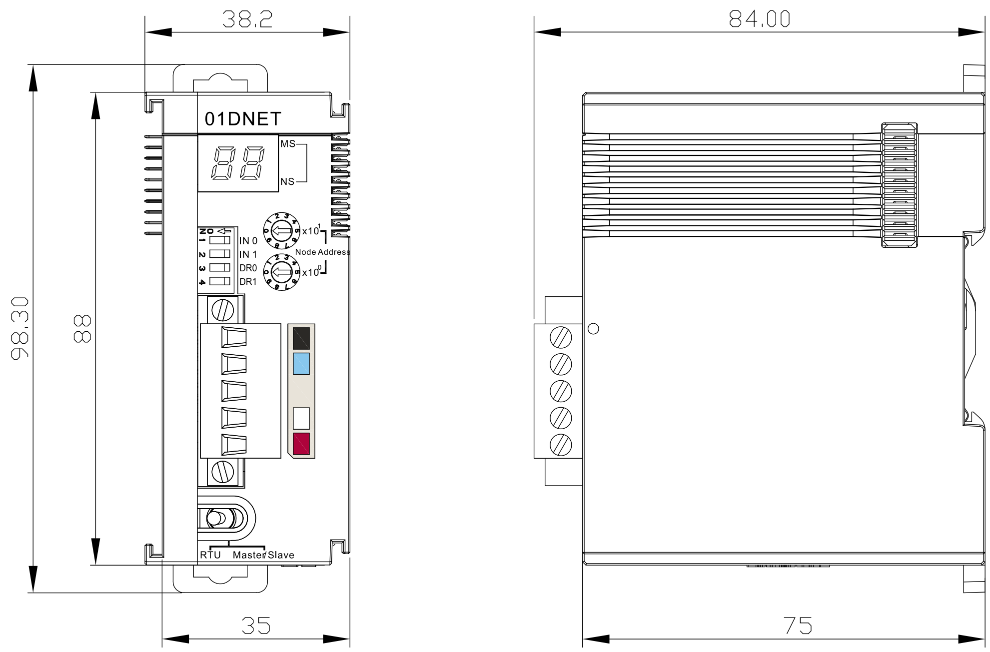
Item	Specifications
Voltage	The power wires of the communication cable provide 11 ~ 25 VDC.
Current	28mA (typical value), 125mA impulse current (24 VDC)

- **Environment**

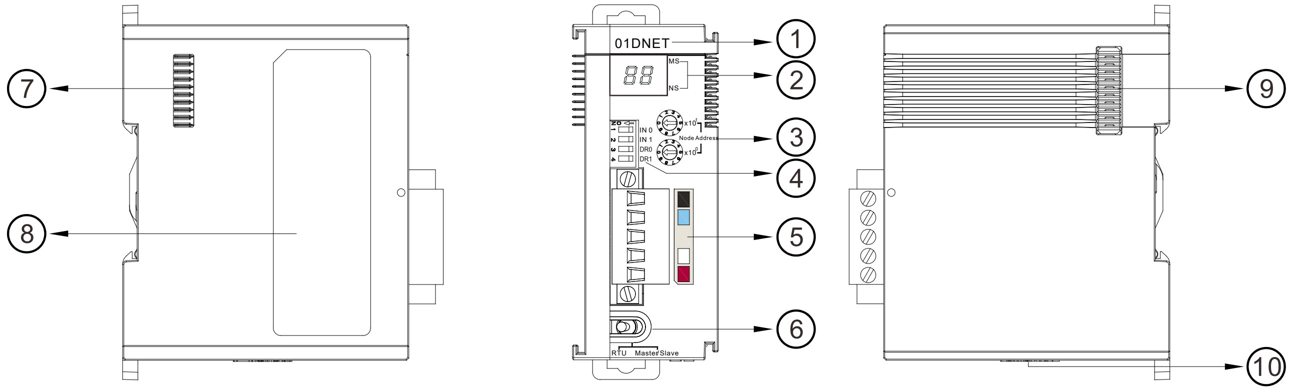
Item	Specifications
Noise immunity	ESD (IEC 61131-2, IEC 61000-4-2): 8KV Air Discharge EFT (IEC 61131-2, IEC 61000-4-4): Power Line: 2KV, Digital I/O: 1KV Analog & Communication I/O: 1KV Damped-Oscillatory Wave: Power Line: 1KV, Digital I/O: 1KV RS (IEC 61131-2, IEC 61000-4-3): 26MHz ~ 1GHz, 10V/m
Operating Environment	-20ºC ~ 60ºC (Temperature); 5 ~ 95% (Humidity), no condensation; pollution degree: 2
Storage Environment	-40ºC ~ 80ºC (Temperature); 5~95% (Humidity), no condensation
Vibration/Shock resistance	International standard IEC 61131-2, IEC 68-2-6 (TEST Fc)/IEC 61131-2 & IEC 68-2-27 (TEST Ea)
Safety	Conforms to IEC 61131-2, UL508
Weight	128 g

11.2 Components of AS01DNET-A

11.2.1 Profile and Dimensions



11.2.2 Components



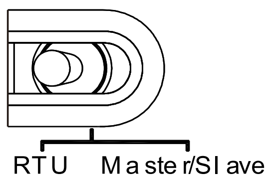
①	Model name	⑥	Mode toggle (RTU-Master/Slave)
②	State indicators	⑦	Left-side extension port
③	Address switch	⑧	Nameplate
④	Function switch	⑨	Right-side extension port
⑤	DeviceNet communication port	⑩	24V DC power input port for RTU mode

Note:

The power input port of the network module is required to connect an external 24VDC power supply only when the toggle (RTU- Master/Slave) is switched to RTU mode. Otherwise, the port does not need an external 24VDC power supply connected when the toggle (RTU- Master/Slave) is switched to Master/Slave mode.

11.2.3 Mode Toggle (RTU- Master/Slave)

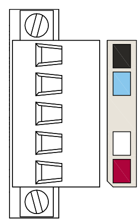
Mode Selection	Description
Master/Slave	Works in master or slave mode and constitutes a DeviceNet master or slave without external power supply.
RTU	When working in remote (RTU) mode, AS01DNET-A is required to connect the external DC 24V power supply and can have AS series I/O modules connected on its right side.



11.2.4 DeviceNet Connector

The connector is used for the connection to DeviceNet. Wire by using the connector enclosed with AS01DNET –A.

Pin	Signal	Color	Description
1	V-	Black	0 VDC
2	CAN_L	Blue	Signal-
3	SHIELD	-	Shielded wire
4	CAN_H	White	Signal+
5	V+	Red	24 VDC



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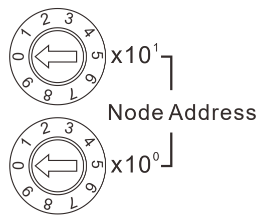
11.2.5 Address Switch

The switch is used for setting up the node address of AS01DNET-A in DeviceNet network. Range: 00~63 (64~99 are forbidden.)

Switch setting	Description
0 … 63	Valid DeviceNet node address
64…99	Invalid DeviceNet node address



Example: If users need to set the node address of AS01DNET-A to 26, simply switch the corresponding switch of x101 to 2 and the corresponding switch of x100 to 6.

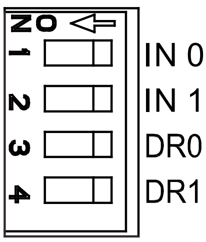
Note:

- ✓ After the setup is completed, repower AS01DNET-A.
- ✓ While AS01DNET-A is working, changing the setting of the node address is invalid.
- ✓ Rotate the switch carefully with a slotted screwdriver to prevent damage to the switch.

11.2.6 Function Switch

- **The function switches are used for:**
  - Setting up the work mode (IN0)
  - Setting up the baud rate of DeviceNet network (DR0~DR1)

DR1	DR0	Baud Rate
OFF	OFF	125 Kbps
OFF	ON	250 Kbps
ON	OFF	500 Kbps
ON	ON	Entering the mode of extended baud rate
IN0	ON	When the slave is off-line, the I/O data in the buffer area will be held.
	OFF	When the slave is off-line, the I/O data in the buffer area will be cleared.
IN1	Reserved	

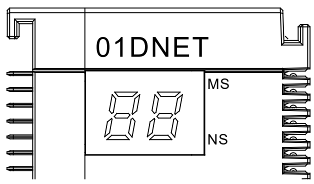


Note:

- ✓ After the setup of the function switch is completed during power off, repower AS01DNET-A.
- ✓ While AS01DNET-A is working, changing the setting of the node address is invalid.
- ✓ Adjust the DIP switch carefully with a slotted screwdriver to prevent any damage to the switch.

11.2.7 Digital Displayer

- The digital displayer provides following functions:
  - Showing the node address of AS01DNET-A and error ID
  - Showing the error information about a slave



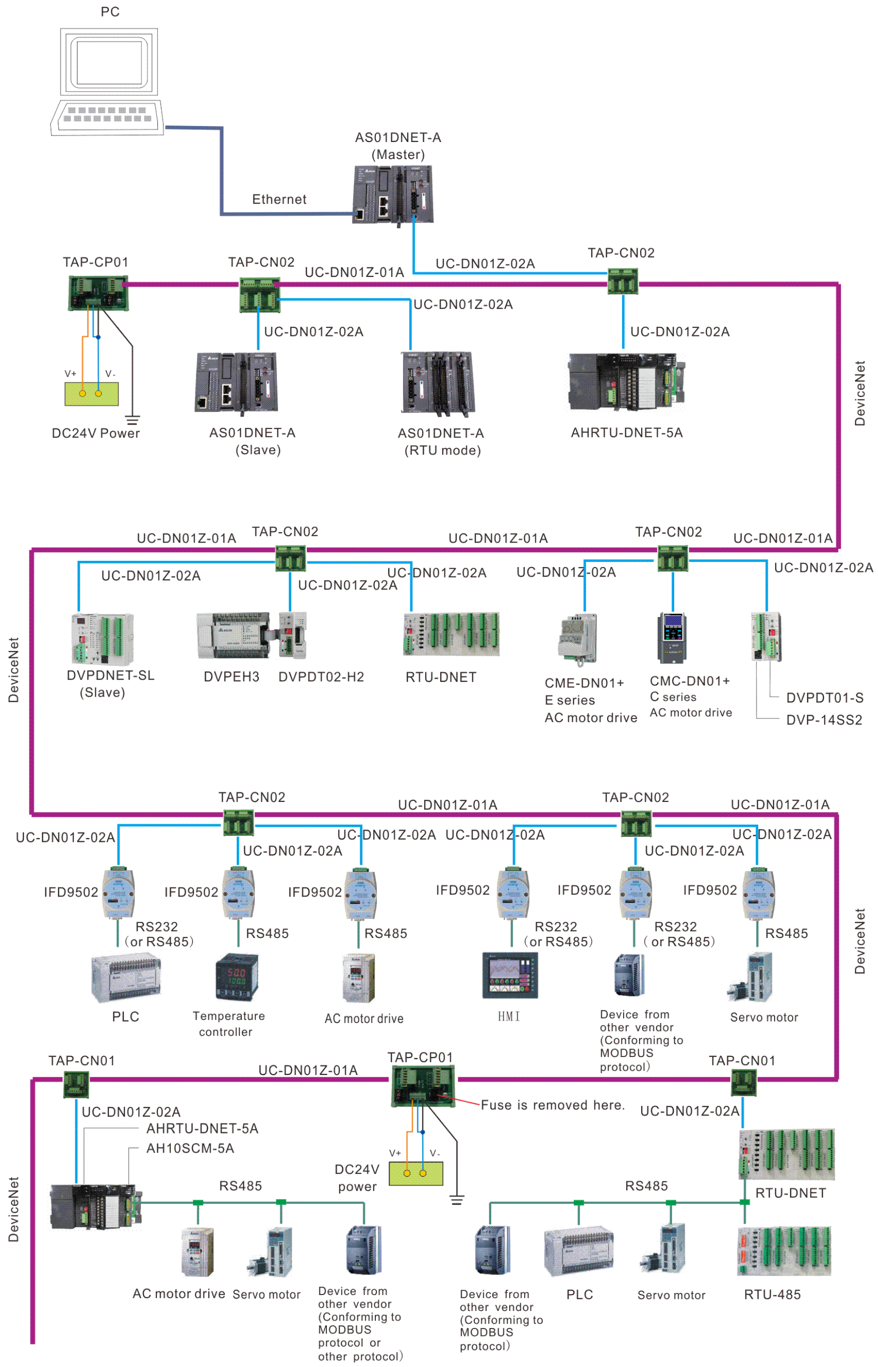
11.3 DeviceNet Network Communication

11.3.1 Relationship between Transmission Distance and Baud Rate

The transmission distance of a DeivceNet network is determined by the baud rate. The following table shows the corresponding maximum communication distance at different baud rates.

Baud rate (bits/s)	10K	20K	50K	125K	250K	500K	800K	1M
Max. transmission distance (M)	5000	2500	1000	500	250	100	50	25

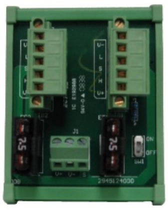
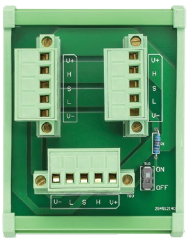
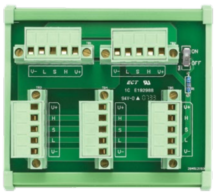
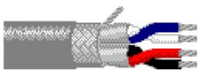
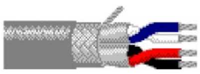
11.3.2 DeivceNet Network Topology Structure



List of Delta DeviceNet Fieldbus Network Products:

Product picture	Model	Function
	AS01DNET-A	1. AS01DNET-A, a DeviceNet module running on the right of AS PLC can work as a DeviceNet master or slave. 2. AS01DNET-A can also be used as AS series remote IO module for connecting AS series DI/DO modules and AI/AO modules to DeviceNet network.
	AH10DNET-5A	AH10DNET-5A, a DeviceNet module, running on the right of AH500 series PLC can work as a DeviceNet master or slave.
	AHRTU-DNET-5A	AHRTU-DNET-5A, a remote I/O module of AH series, is used for connecting AH500 series DI/DO module, AI/AO module and 10SCM module to DeviceNet network.
	DVPDNET-SL	DVPDNET-SL, a DeviceNet module, running on the left of S series PLC can work as a DeviceNet master or slave.
	RTU-DNET	RTU-DNET, a remote I/O module of S series, is used for connecting S-series DI/DO module, AI/AO module and other device to DeviceNet network.

Product picture	Model	Function
	IFD9502	Used for connection of the DeviceNet network and electromechanical equipment such as AC motor drive, PLC, temperature controller, servo drive, HMI, user-defined device.
	IFD6503	A fieldbus data analysis tool, with one end: CAN interface and the other end: USB interface can be used for getting the CAN data or sending the data to the CAN node. It is used with the Netview Builder software together.
	E-series AC motor drive	Used for connecting AC motor drive to DeviceNet network via CME-DN01 card.
	CMC-DN01	Used for connecting C2000 series AC motor drive to the DeviceNet network.
	DN-02	Used for the connection of DeviceNet network and AC motor drive.
	DVPDT01-S	Used for the connection of DeviceNet network and S series PLC.

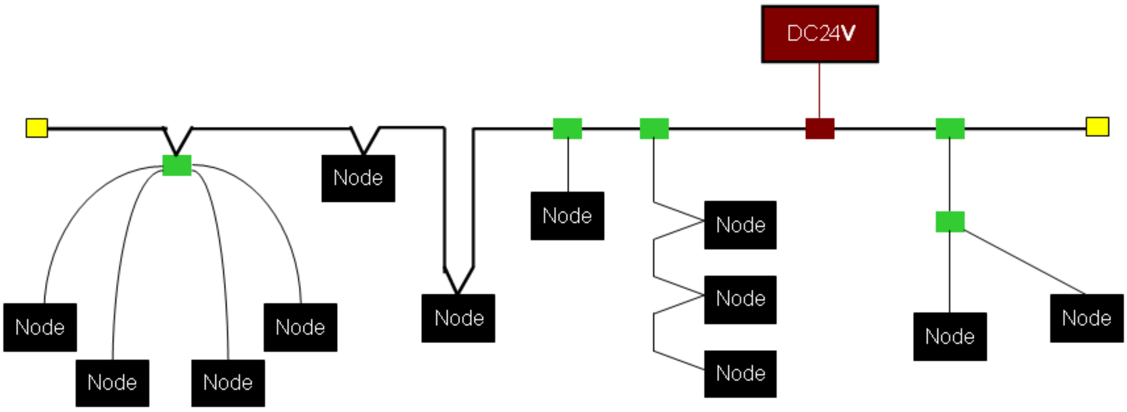
Product picture	Model	Function
	DVPDT02-H2	Used for the connection of DeviceNet network and DVP-EH2 series PLC.
	TAP-CP01	The distribution box for CAN topology, with the 120 ohm resistor enclosed which is controlled to take effect or not via its switch.
	TAP-CN01	The distribution box for CAN topology, with the 120 ohm resistor enclosed which is controlled to take effect or not via its switch.
	TAP-CN02	The distribution box for CAN topology, with the 120 ohm resistor enclosed which is controlled to take effect or not via its switch.
	UC-DN01Z-01A	UC-DN01Z-01A: DeviceNet trunk cable.
	UC-DN01Z-02A	UC-DN01Z-02A: DeviceNet branch cable.

11.3.3 Choice and Purpose of a DeviceNet Terminal Resistor

- **Choice of a DeviceNet Terminal Resistor**

A DeviceNet network requires two terminal resistors of 121 Ω connected at both ends of the trunk cable respectively.

The thick cable represents the trunk cable, the thin cable represents the branch cable and the yellow boxes at the two ends are terminal resistors in the following figure.



- **Purpose of a DeviceNet Terminal Resistor**

The terminal resistor is used for eliminating the signal reflection in the communication cable.

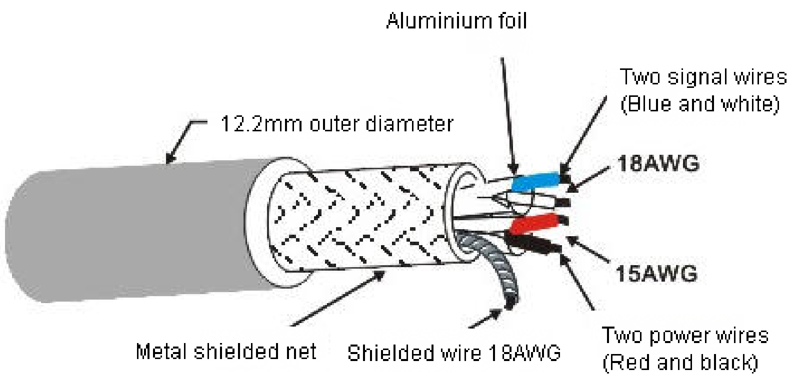
All signal transmission cables have the characteristic impedance. The characteristic impedance of Delta DeviceNet communication cable is about 121 Ω.

When being transmitted to the end of the communication cable, because the impedance of the end is different from the characteristic impedance, the signal will be reflected, which will interfere with the new signal and the signal wave form distortion will happen.

The phenomenon of the signal wave form distortion is not obvious in the short-distance transmission. But the wave form distortion will become severer in the increasingly long communication cable. Therefore, the two ends of the trunk cable must be installed with the terminal resistors respectively.

- **Installation Position of Terminal Resistors**

The DeviceNet communication cable consists of five wires such as red wire, blue wire, white wire, black wire and shielded wire as below.



The terminal resistors must be installed to the two ends of the trunk cable only. Since the blue wire and white wire are for signal transmission, both of the terminal resistors must be installed between blue wire and white wire at the two ends of the main cable.

11.3.4 DeviceNet Network Supply Power

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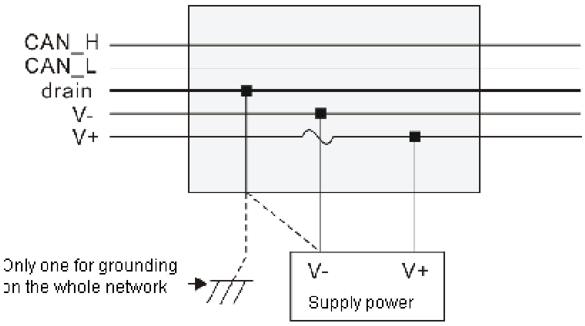
The network requires one or multiple supply powers to supply the power to each piece of network equipment via the bus cable.

Delta DeviceNet communication cable consists of five wires, among which the power cable and signal cable occupy two wires respectively and the one on the left is the shielded wire as the above figure shows.

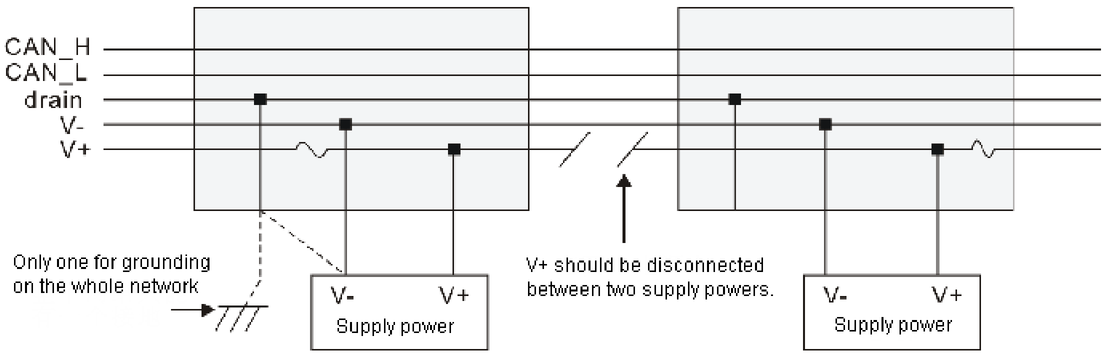
The supply power for the bus is optional and could be a single supply power or multiple supply powers according to the actual demand.

- **Single Supply Power**



- **Multiple Supply Powers**

Wiring of multiple supply powers on the network



11.4 Master /Slave Mode

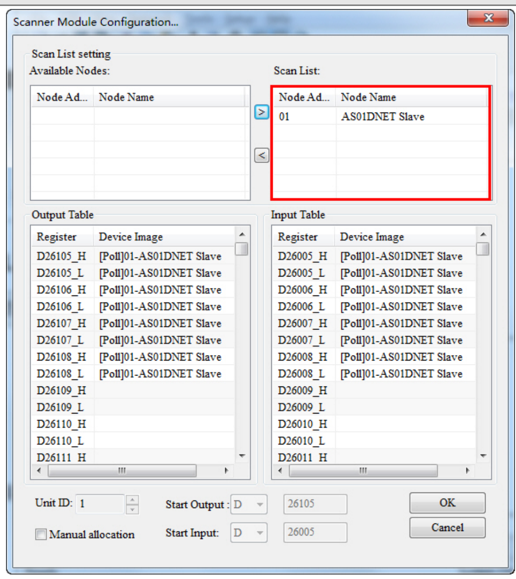
11.4.1 Introduction of Master/Slave Mode

AS01DNET-A can work as a DeviceNet master as well as slave with at most 4 AS01DNET modules connectable to the right side of AS PLC. Running on the right of AS-series PLC, AS01DNET-A with AS-series PLC together constitutes the DeviceNet master or slave. When working in Master/Slave mode, AS01DNET-A is required to switch the function toggle (RTU- Master/Slave) to Master/Slave mode and the DeviceNet Builder of version 2.04 and above is used for the setup.

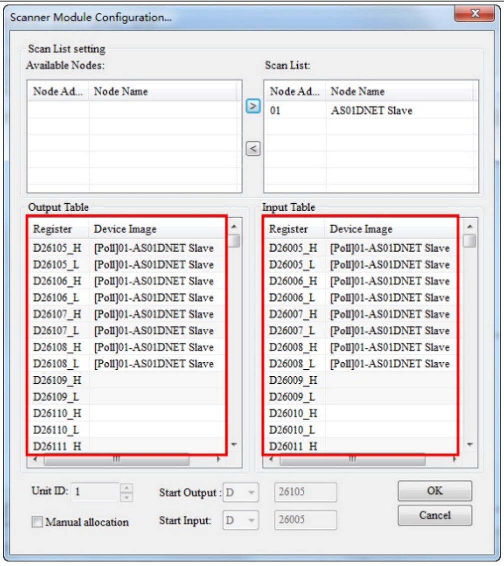
For details about the setup, refer to Section 11.4.10.

- As a master, AS01DNET-A can provide the following function.
  - Supporting the Client function of Explicit message;
  - Supporting IO polling connection with slaves;
  - The network configuration software DeviceNet Builder provides graphic configuration interface.
  - Sending explicit messages to read and write the data in slave through the explicit message instruction DNETRW.
  - Automatically performing data exchange with the PLC module; users just need write a program for D register in the PLC without using FROM/TO instructions.
  - Offering 190 bytes of output data area and 190 bytes of input data area for exchanging data with the master.
- As a slave, AS01DNET-A can provide the following function.
  - Explicit message Server and Group 2 only server connection mode;
  - Polling connection;
  - Offering 200 bytes of input data area and 200 bytes of output data area for exchanging data with master;
  - Automatically exchanging data with the PLC. The user just need to write a program for D register in the PLC without using FROM/TO instruction.

11.4.1.1. Scan List, Input Table and Output Table

Item	Description	Figure
Scan List	Before AS01DNET-A module works, the scan list must be configured through the configuration software. The scan list stores slave information including node address, I/O type, I/O size and etc. for data exchange. The scanner module manages the slaves in the scan list, makes a connection with slaves and exchange I/O data with them. For those slaves which have not been configured to the scan list, AS01DNET-A will not make a connection and I/O data exchange with them.	

<table>
<tr>
<td>Input/output Table</td>
<td>The scanner module provides an input table of total size: 190 bytes and an output table of total size: 190 bytes for data exchange with slaves. When one slave is configured to the scan list, the configuration software will automatically assign corresponding size of I/O data exchange area to the slave. Input Table and Output Table are the interface for data exchange between the PLC of the master and slaves and show the mapping relationships between the D registers in the PLC of the master and the I/O data of slaves.

After the configuration is finished, download the configuration data to the scanner module. Then the module will exchange I/O data with corresponding slaves according to the configuration. The data in the output table will be transmitted to slaves and the data returned from slaves will be filled in the input table.</td>
<td>
</td>
</tr>
</table>

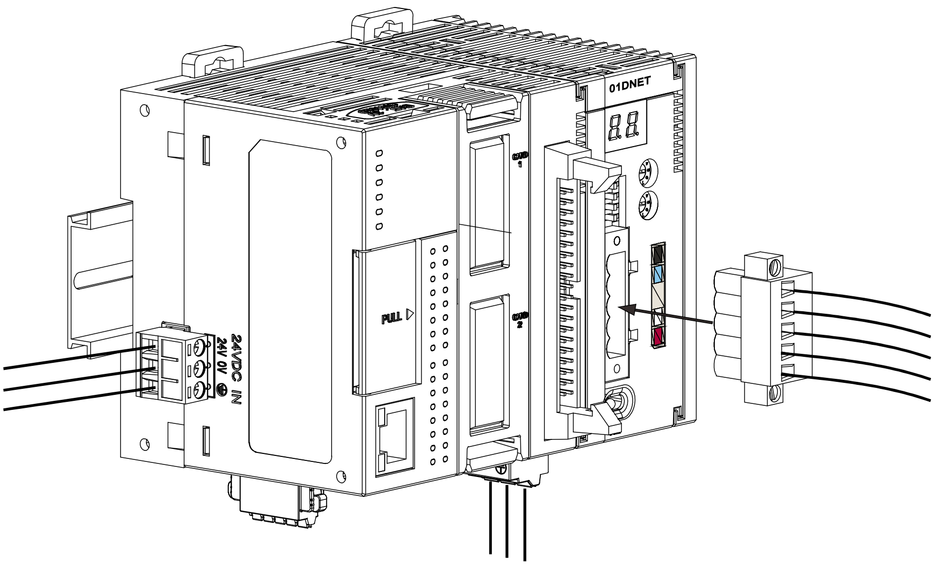
11.4.2 Installation

11.4.2.1. Connecting AS01DNET-A Module to AS series PLC

For the details on how AS01DNET-A (in Master/slave mode) is connected to AS series PLC, refer to Section 1.3.1 Installing a Module in AS Series Module Manual.

11.4.2.2. Connecting the DeviceNet Communication Connector

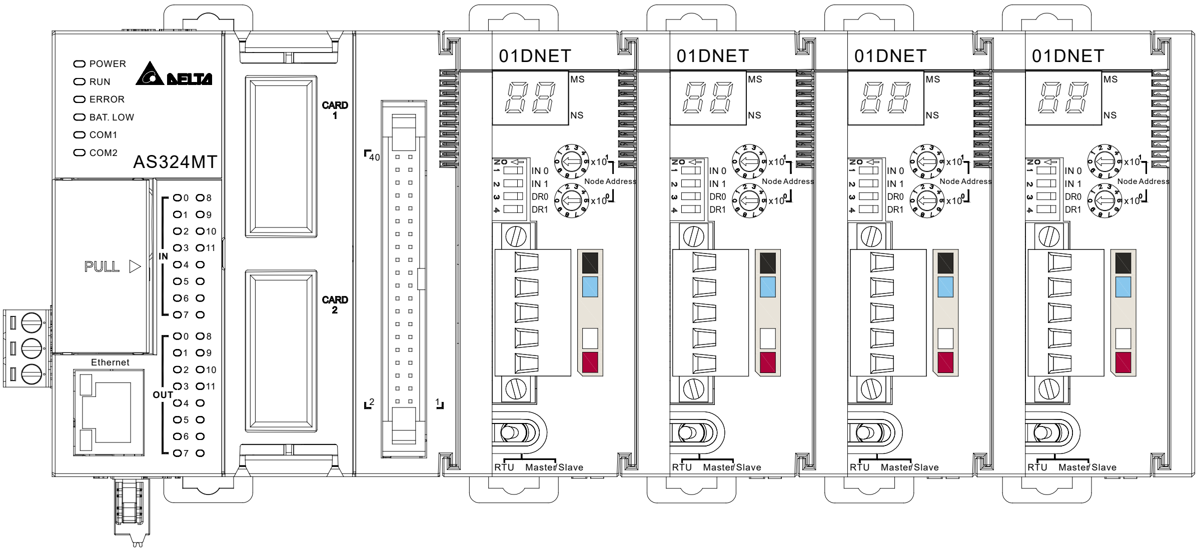
- Make sure that the color marks for the PINs of the DeviceNet connection port match the colors of the connection cables and the cable should be connected to the right PIN.
- Delta's power module is recommended as the power module in the communication.



11.4.3 IO Mapping for AS01DNET in AS PLC

11.4.3.1. Data Mapping between Modules and AS PLC

Up to four AS01DENT modules can be connected to the right side of AS PLC at most. After AS01DNET modules and PLC are connected, PLC will assign data mapping areas to each module.



AS01DNET modules are connected to the right of the PLC. The position of the first module on the right of AS PLC is 1, the second module is 2, the third module is 3 and the fourth module is 4. The position is only defined for network modules such as AS01DNET and AS00SCM, instead of digital modules, analog modules, temperature modules, and weight-measurement modules. The positions of AS01DNET modules on the right of the PLC are shown in the following table where there are two arrangement ways of module connections.

Example 1		**Example 2**	
Position of AS01DNET on the right of the PLC	**Arrangement order of AS PLC and modules on the right of the PLC**	**Position of AS01DNET on the right of the PLC**	**Arrangement order of AS PLC and modules on the right of the PLC**
	AS PLC		AS PLC
1	AS01DNET	1	AS01DNET
	AS04AD		AS04AD
2	AS01DNET		AS00SCM
		3	AS01DNET

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When AS01DNET is at different positions of the right of the PLC, the input and output mapping areas for the AS01DNET module in AS PLC are listed in the following table.

Position of AS01DNET on the right of the PLC	Output mapping area	Input mapping area
1	D26100 – D26199	D26000 – D26099
2	D26500 – D26599	D26400 – D26499
3	D26900 – D26999	D26800 – D26899
4	D27300 – D27399	D27200 – D27299

11.4.3.2. Tables of Input Mapping and Output Mapping areas

- When AS01DNET works in master mode, the input and output mapping areas for AS01DNET at different positions of the right of AS PLC are listed in the following table.

Position of AS01DNET on the right of the PLC	Output mapping area (for sending data to the slave)			Input mapping area (for receiving data from the slave)		
	D register	Mapping area	Data size	D register	Mapping area	Data size
1	D26100~D26103	Bit-strobe command area	4 words	D26000~D26003	Scan-list node status indication area	4 words
	D26104	Reserved	1word	D26004	Module status indication area	1 word
	D26105~D26199	DeviceNet output data area	95 words	D26005~D26099	DeviceNet input data area	95 words
2	D26500~D26503	Bit-strobe command area	4 words	D26400~D26403	Scan-list node status indication area	4 words
	D26504	Reserved	1word	D26404	Module status indication area	1 word
	D26505~D26599	DeviceNet output data area	95 words	D26405~D26499	DeviceNet input data area	95 words
3	D26900~D26903	Bit-strobe command area	4 words	D26800~D26803	Scan-list node status indication area	4 words
	D26904	Reserved	1word	D26804	Module status indication area	1 word
	D26905~D26999	DeviceNet output data area	95 words	D26805~D26899	DeviceNet input data area	95 words
4	D27300~D27303	Bit-strobe command area	4 words	D27200~D27203	Scan-list node status indication area	4 words
	D27304	Reserved	1word	D27204	Module status indication area	1 word
	D27305~D27399	DeviceNet	95	D27205~D27299	DeviceNet input	95

Position of AS01DNET on the right of the PLC	Output mapping area (for sending data to the slave)			Input mapping area (for receiving data from the slave)		
	D register	Mapping area	Data size	D register	Mapping area	Data size
		output data area	words		data area	words

Note: See Section 11.4.5 for further explanation of scan-list node status indication areas and module status indication areas. The input and output mentioned here are defined in the perspective of the master of the entire fieldbus system.

- When AS01DNET works in slave mode, the input and output mapping areas for AS01DNET at different positions of the right of AS PLC are listed in the following table.

Position of AS01DNET on the right of the PLC	Area for sending data to the master		Area for receiving data from the master	
	D register	Data length	D register	Data length
1	D26100~D26199	100 words	D26000~D26099	100 words
2	D26500 – D26599	100 words	D26400 – D26499	100 words
3	D26900 – D26999	100 words	D26800 – D26899	100 words
4	D27300 – D27399	100 words	D27200 – D27299	100 words

11.4.4 Bit-strobe Command

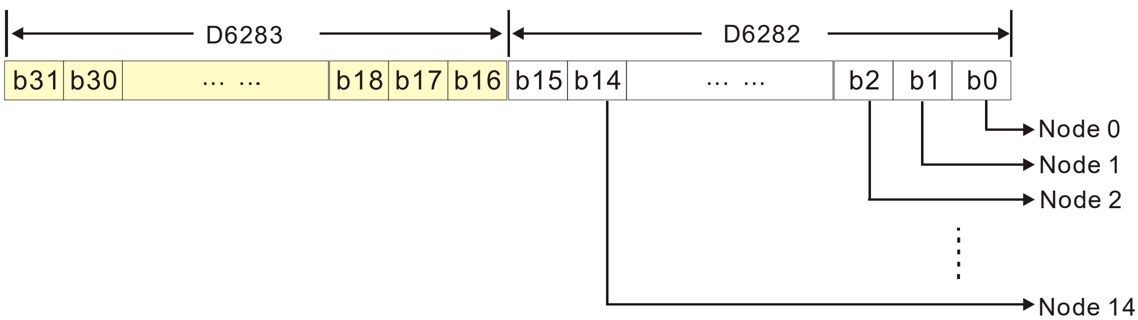
11.4.4.1. Bit-strobe Work Principle

Bit strobe is one of the standard DeviceNet I/O transmission methods. The command length is fixed to 8 bytes, i.e. 64 bits. (Maximum 64 stations exist in a DeviceNet network.) One bit corresponds to one node. The following table takes the first AS01DNET on the right of AS PLC for example.

Bit-strobe register	Corresponding network node					
	b15	**b14**	**b13**	**… …**	**b1**	**b0**
D26100	Node 15	Node 14	Node 13	… …	Node 1	Node 0
D26101	Node 31	Node 30	Node 29	… …	Node 17	Node 16
D26102	Node 47	Node 46	Node 45	… …	Node 33	Node 32
D26103	Node 63	Node 62	Node 61	… …	Node 49	Node 48

When the value of bit0 of D26100 is 0, node 0 is selected and need return data to the master.

When the values of bit0 and bit1 of D26100 are both 0, node 0 and node 1 are selected and they need return data to the master.



In the bit-strobe method, the master does not send control data to the slave node. However, the slave node need return I/O data to the master if the corresponding bit is set to 0. If the corresponding bit is set to 1, the slave node does not need to return I/O data to the master.

11.4.5 Network Node Status Display

11.4.5.1. Scan-List Node Status Indication

The following table takes the first AS01DNET on the right of AS PLC for example. AS01DNET master can monitor whether the configured slave is online or not in real time and have the status of the configured slave mapped to one bit. Users can get the status of network nodes by monitoring the contents in D26000~D26003. The corresponding relationships between devices in the PLC and network nodes are shown in the following table. If the node in Scan List is normal, the corresponding bit is OFF. If the node in Scan List is abnormal, the corresponding bit is ON.

Register in the PLC	**Corresponding network node**					
	b15	b14	b13	… …	b1	b0
D26000	Node15	Node 14	Node 13	… …	Node 1	Node 0
D26001	Node 31	Node 30	Node 29	… …	Node 17	Node 16
D26002	Node 47	Node 46	Node 45	… …	Node 33	Node 32
D26003	Node 63	Node 62	Node 61	… …	Node 49	Node 48

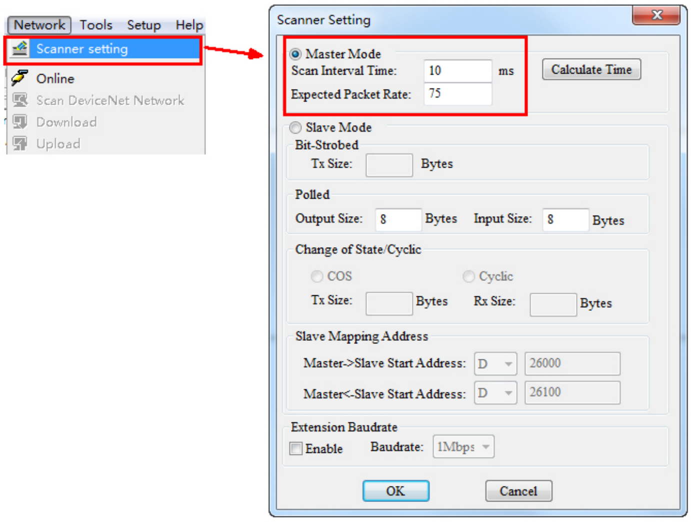
11.4.5.2. Module Status Indication

The following table takes the first AS01DNET on the right of AS PLC for example. Users can get the status of the network node by monitoring the content in D26004. When the module works normally, the content in D26004 is 0. When the module is initializing, the content in the high byte of D26004 is 1 and the content in the low byte is 0. When an error occurs in the module, the content in the high byte of D26004 is 2 and the content in the low byte is an error code. For details on error codes, see Digital Displayer.

Register in the PLC	**Description**															
	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
D26004	Module status (0: Normal, 1: Initializing, 2: error)								Error code in the module							

11.4.6 Setting the Time for Data Exchange between Master and Slaves

When AS01DNET works in master mode, the period of time for a data exchange between master and all slaves need be set. Master and all salves will periodically perform the data exchange based on the set time. See the following explanation for details. Click menu **Network** >> **Scanner Setting** on the DeviceNet Builder software page. The **Scanner Setting** window appears as below.



The explanation of **Scan Interval Time** and **Expected Packet Rate** is shown in the following table.

Scan Interval Time	The period of time needed for a data exchange between master and all slaves. Master and all salves will periodically exchange data based on the set interval time.
Expected Packet Rate (EPR)	Sets the timeout time for connection of master and slaves. The calculation method: 4 X EPR with the unit: ms. The default EPR is 75. The EPR for the connection of master and slaves is 4 X 75 = 300ms. The value indicates that the IO data exchange should be achieved once at least within 300 ms. Otherwise, the connection will fail due to communication timeout and then the connection will have to be re-made so that the IO data exchange can proceed.

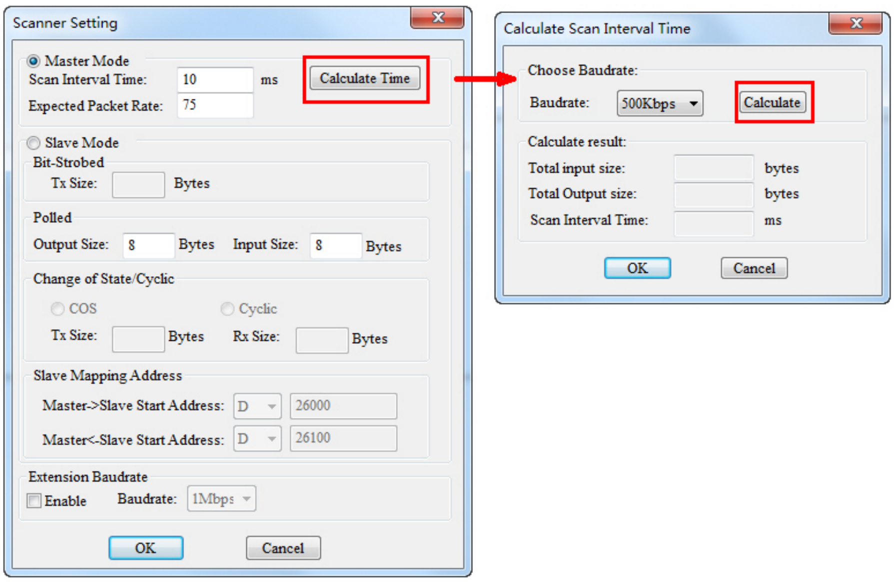
Since most DeviceNet slaves only support polled IO data exchange, the EPR value is related to the value of **Scan Interval Time**. Make sure that the actual setting must meet the following condition.

Scan Interval Time < (4 X EPR)

We suggest users refer to the following condition while setting the value of **Scan Interval Time**.

Scan Interval Time < (4 X EPR) / 5

Click the **Calculate Time** button. The **Calculate Scan Interval Time** dialog box comes out. Clicking the **Calculate** button, the values of **Total input size**, **Total output size** and **Scan Interval Time** are calculated. The value of **Scan Interval Time** is a value in theory. We suggest users should set the scan interval time to a value slightly greater than the actually calculated time. The scan interval time calculated here will not be filled in the **Scan Interval Time** box automatically and so users need enter the value manually.



11.4.7 Application Example

To explain how to configure a DeviceNet network through an application example

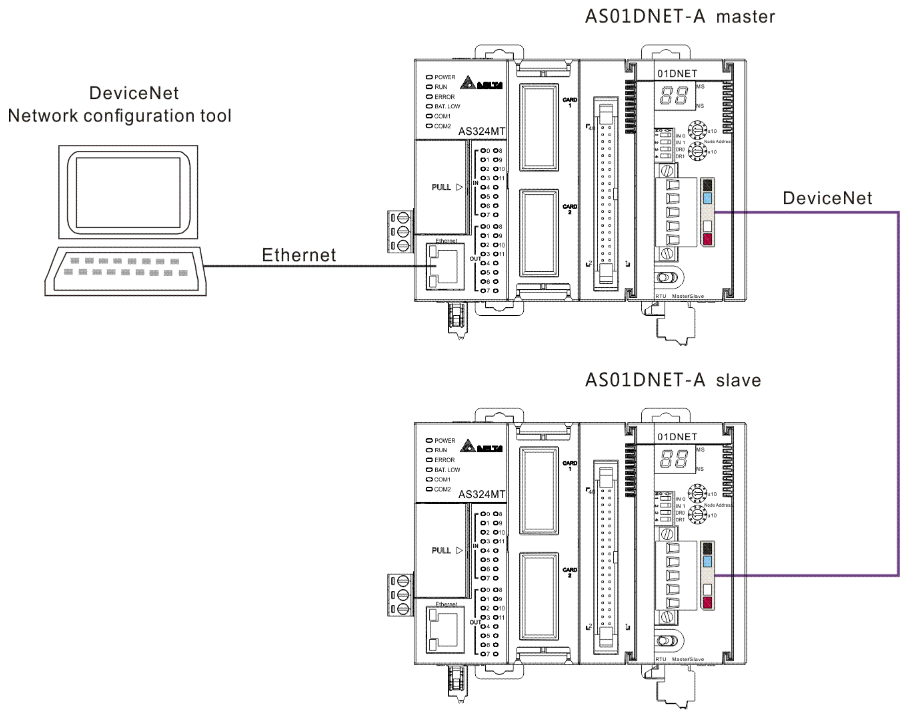
Control requirement: AS PLC remotely monitors D26105~D26108 and D26005~D26008 in AS module through DeviceNet network to achieve the data exchange as AS01DNET-A works as master and slave respectively.

11.4.7.1. Constructing One DeviceNet Network

This section describes how to construct a DeviceNet network configuration through an application example. Before constructing a DeviceNet network, users should understand the control requirement of the network; plan the data for exchange in advance such as maximum communication distance, slaves, total data length for exchange as well as the requreiment for response time during data exchange.

The information above will determine whether the constructed network is reasonable and able to meet the demand. Even it will directly affect the future maintenance and convenience of network capacity expansion and upgrade.

- **Connection Figure**



Note: Both of the ends of the DeviceNet Bus cable must connect one 121Ω terminal resistor respectively. The terminal resistor is connected between CAN_H and CAN_L.

- **Modules Setting**

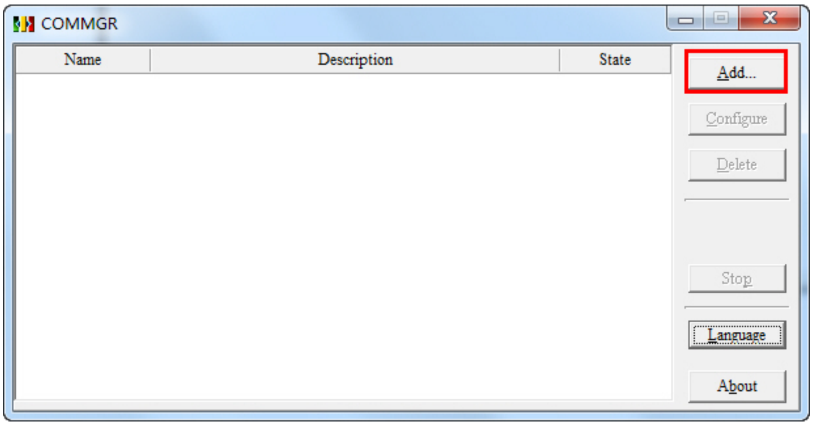
Prepare two AS PLCs and two AS01DNET-A modules for constructing one DeviceNet network. The setups for two AS01DNET-A modules are shown in the follwing table.

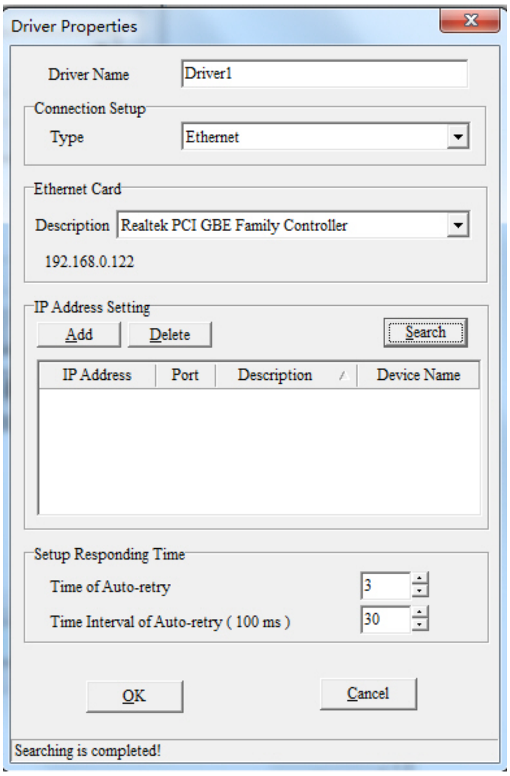
DeviceNet network module	Node address	Baud rate
AS01DNET-A (Master)	0	500kbps
AS01DNET-A (Slave)	1	500kbps

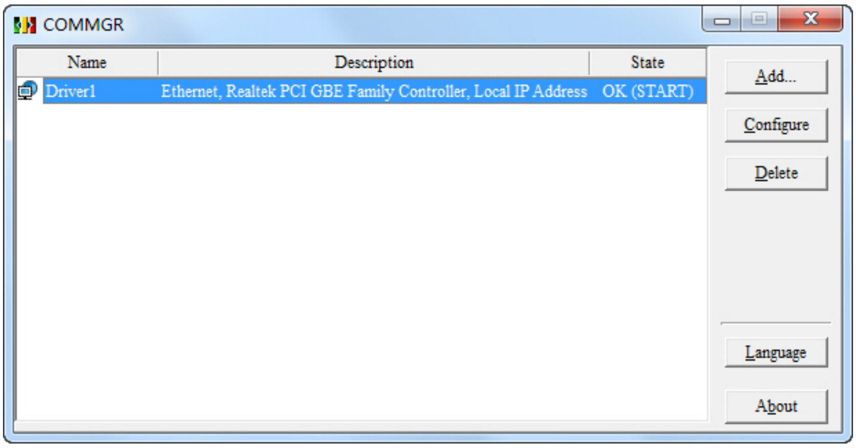
11.4.7.2. Using DeviceNet Builder to Configure a DeviceNet Network

- **Configuring DeviceNet slave**

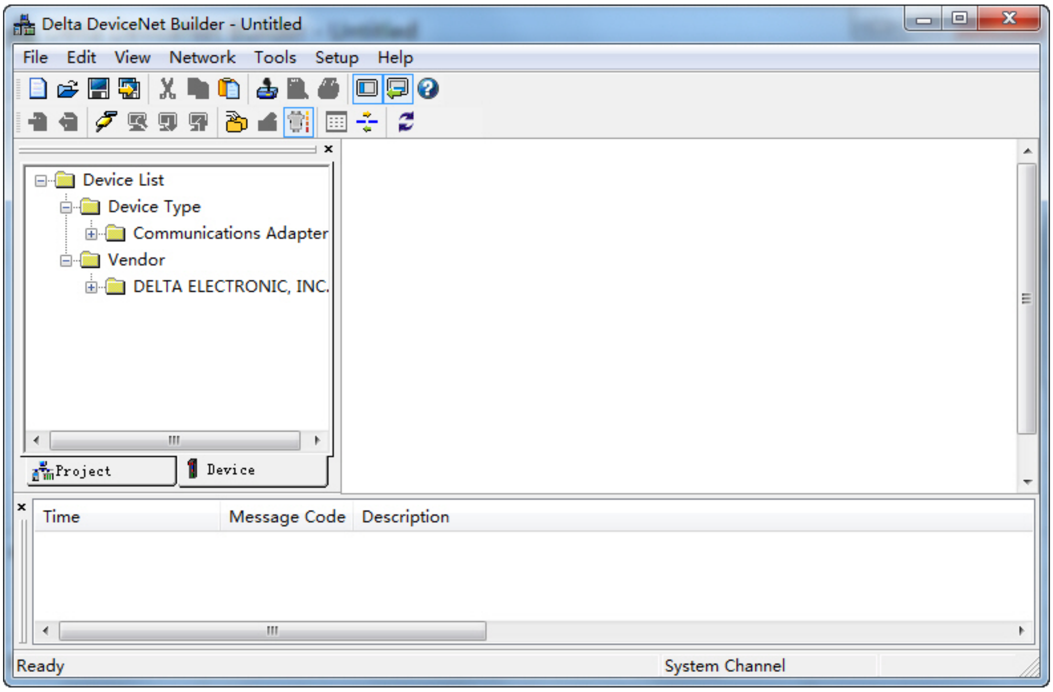
1. Set the driver for the connection of AS PLC and PC. Clicking **Add**, the **Driver Properties** dialog box appears. Select the connection type for AS PLC and PC in the **Type** field. In this example, select Ethernet as the connection type. Click **Search** to search the PLC and then click **OK** after searching is finished.



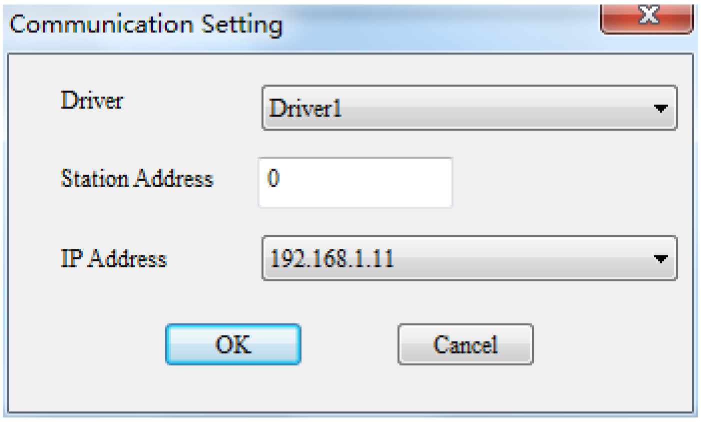




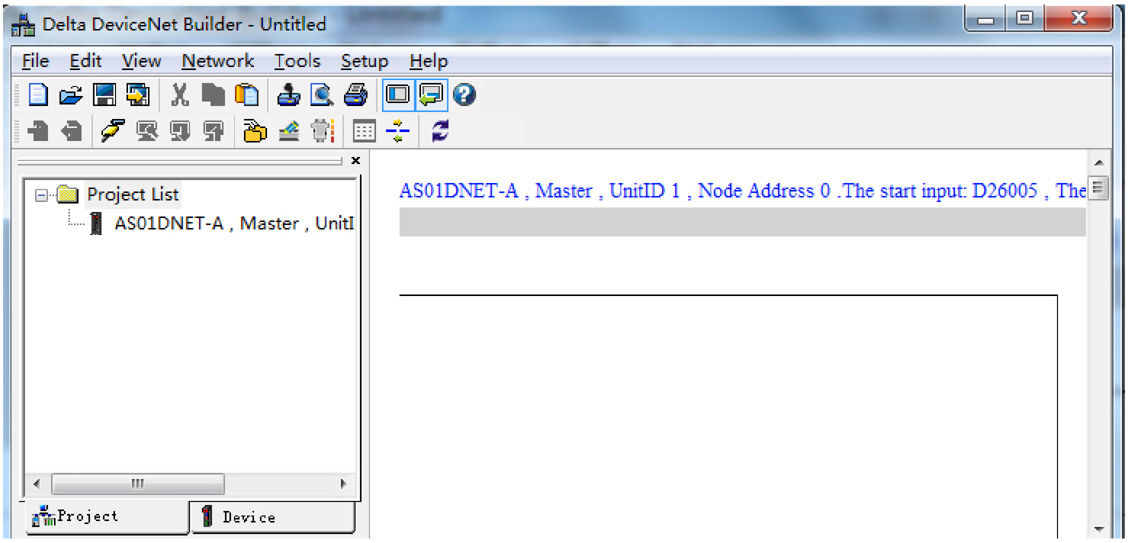
2. Opening the DeviceNet Builder software, the following window appears.



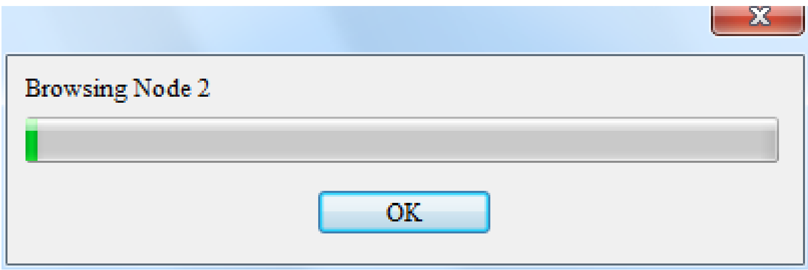
3. Selecting **Setup**>> **Communication Setting**, the following dialog box appears. Select the driver for connection of AS PLC and PC as below. Click **OK** to finish the selection of Driver.



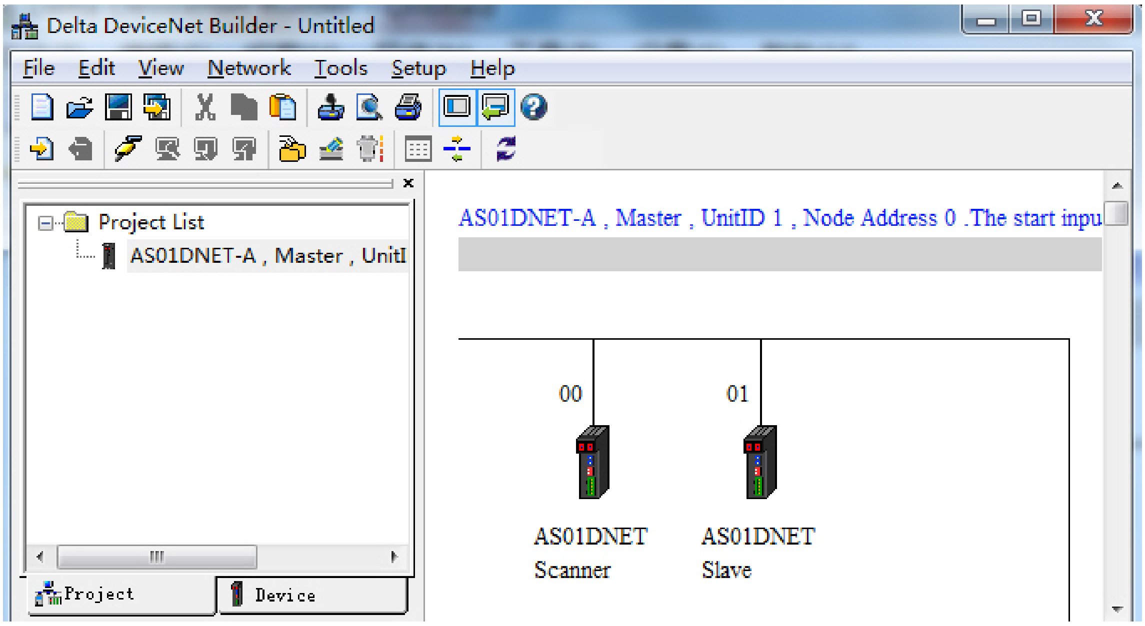
4. Click **Network** >> **Online** to scan the connected master.



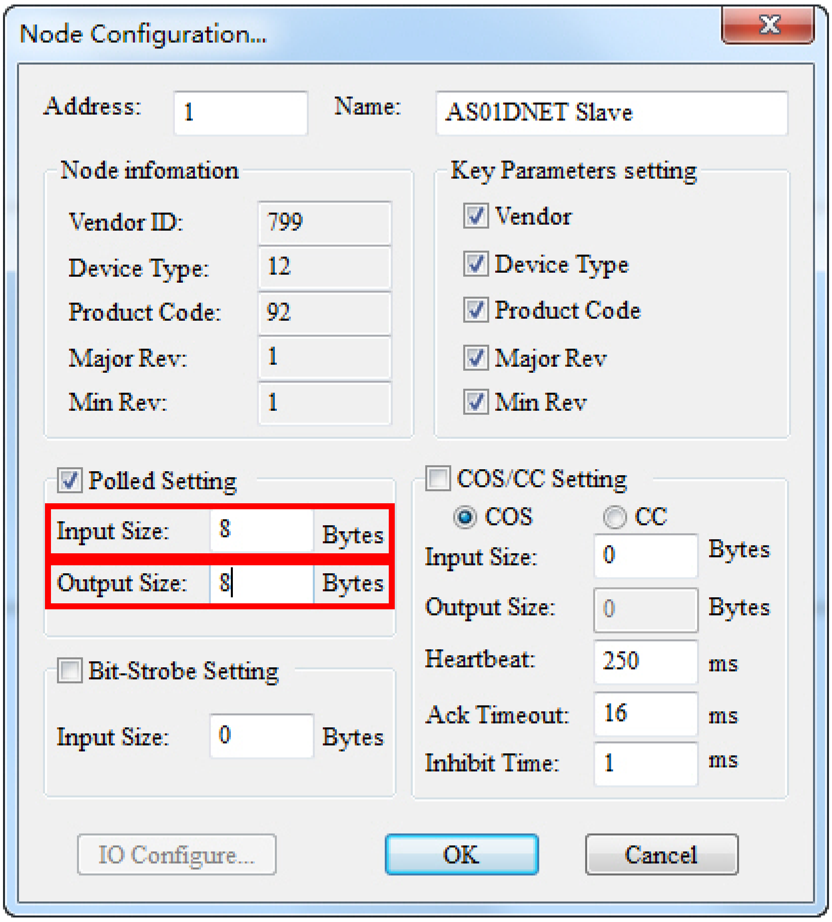
5. Click **Network**>> **Scan DeviceNet Network.**



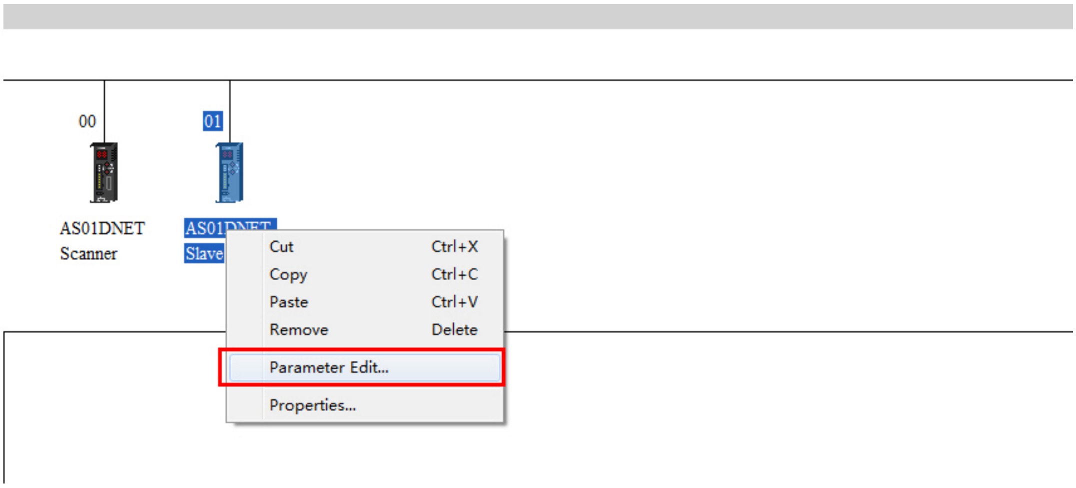
6. After scanning is finished, all node icons and device names which have been scanned in the network will appear on the following interface. The node address of AS01DNET-A is 00 in this example.

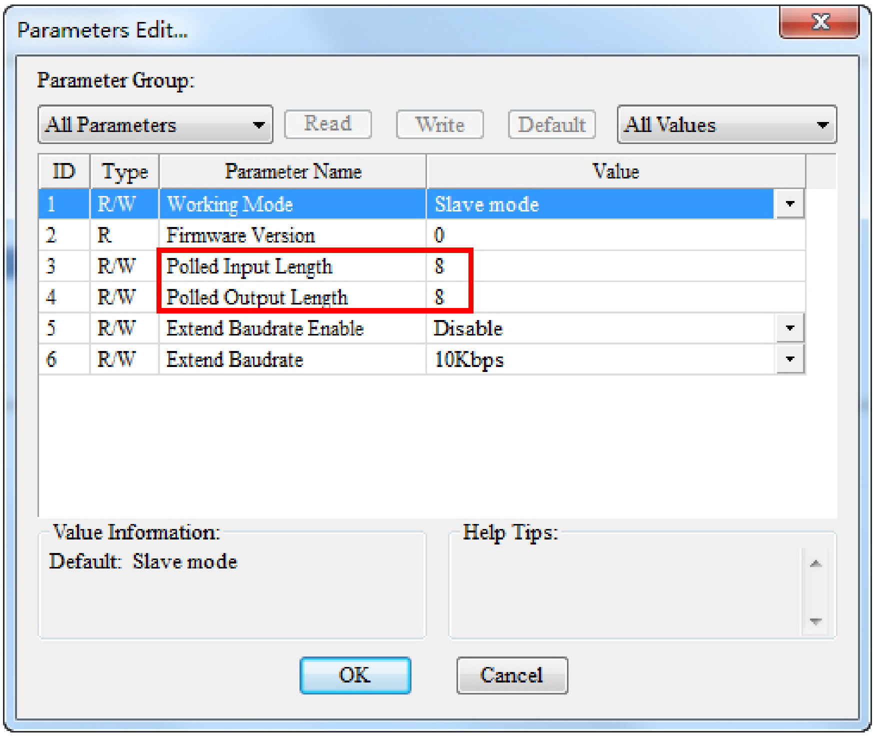


7. Double click the icon of AS01DNET Slave. Then the **Node Configuration…** dialogue box appears. Input Size and Output Size are both set to 8 bytes. Click OK to finish the setting.



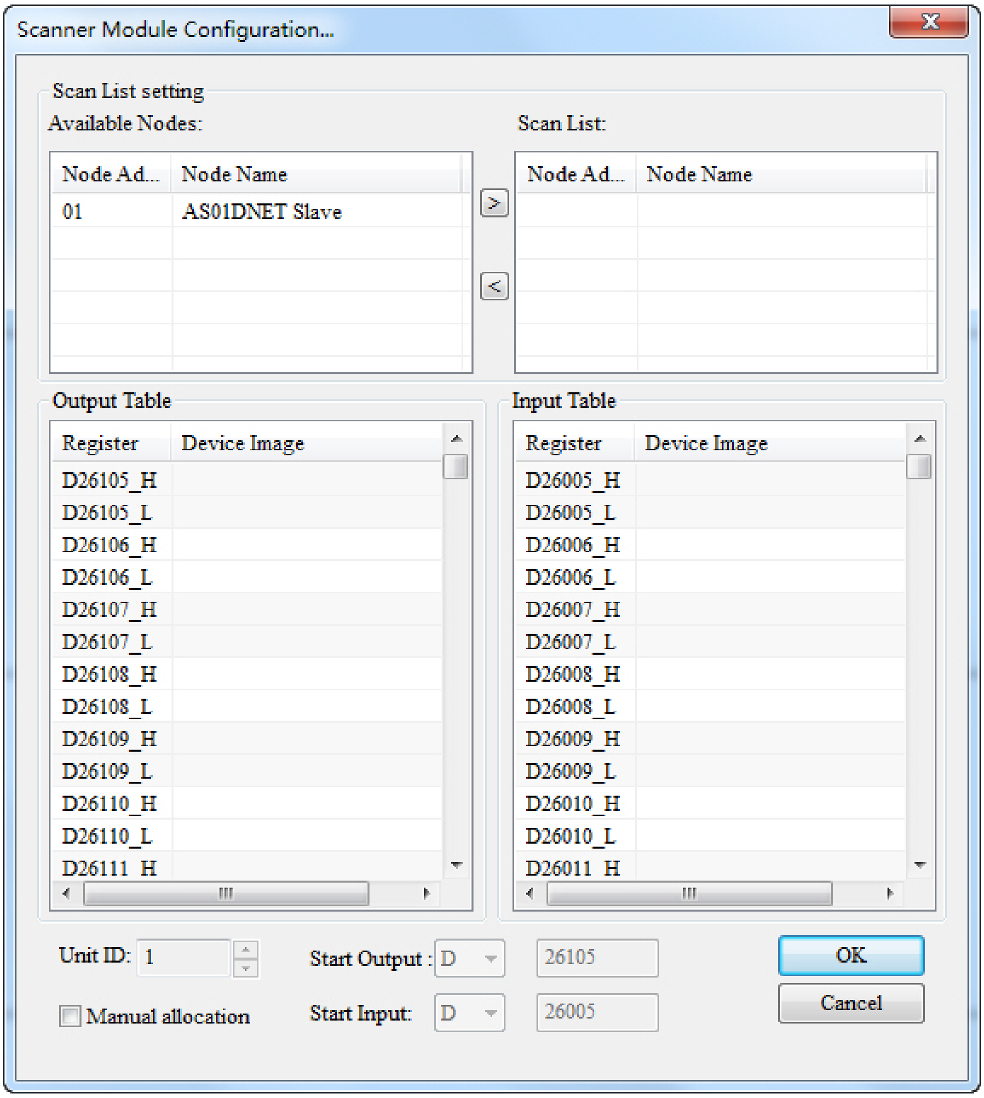
8. Right click the icon of AS01DNET Slave and click **Parameter Edit…** on the drop-down menu. The **Parameters Edit…** dialog box appears and **Polled Input Length** and **Polled Output Length** are both set to 8 bytes as shown in the following red box. Then click **Write** button. Click **OK** after writing is finished. Afterwards, repower AS01DNETSlave.



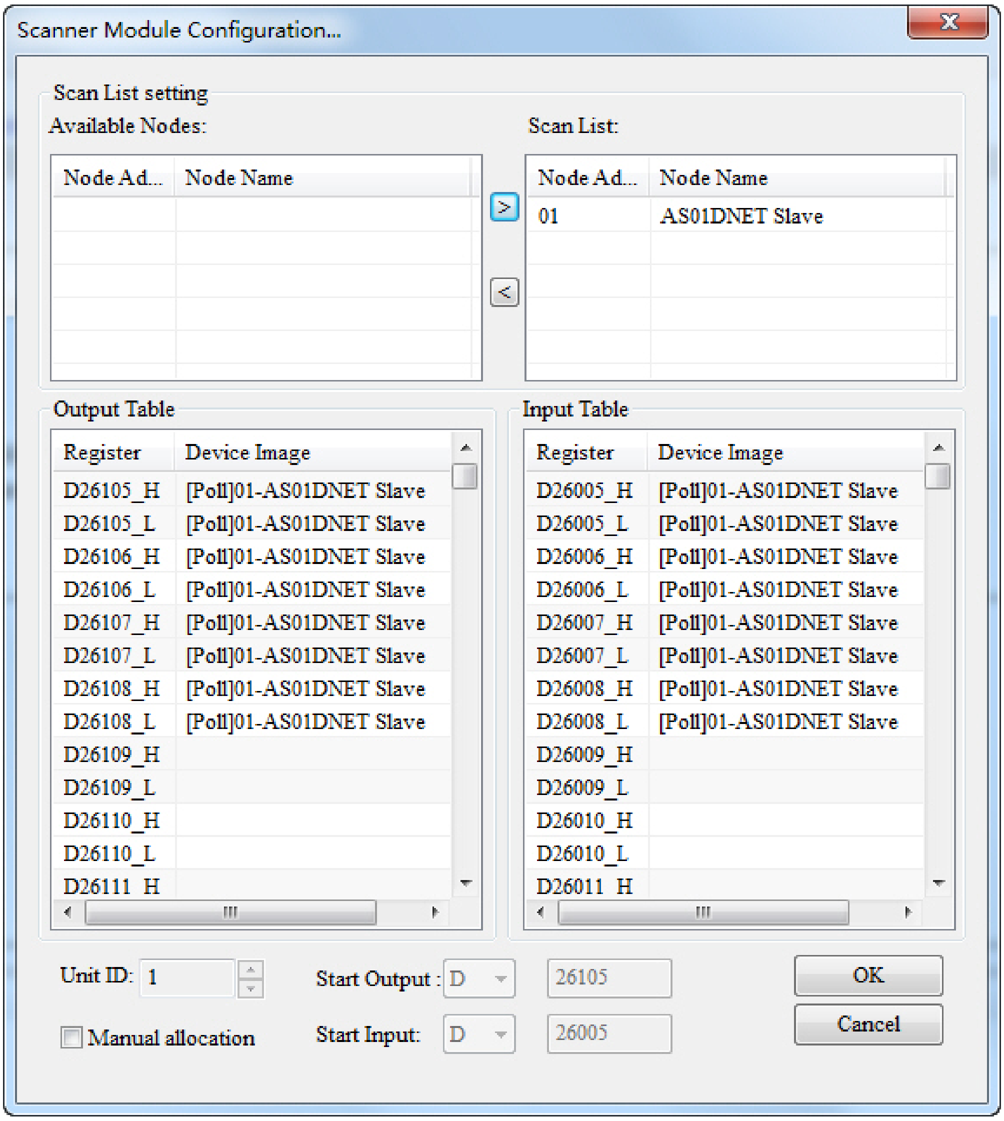


- **Configuring AS01DNET-A**

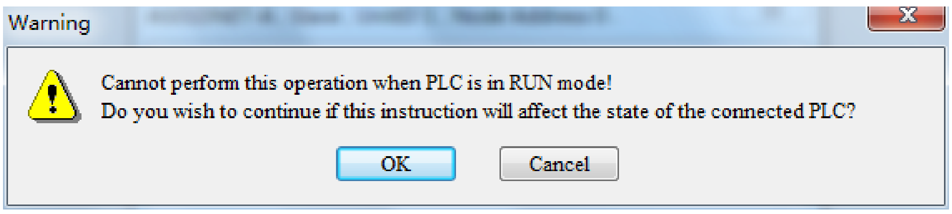
1. Double click the icon of AS01DNET Scanner (node 0). The **Scanner Module Configuration…** dialog box appears. The left list shows the current available node AS01DNET Slave and the right Scan List is empty as below.



2. Move the DeviceNet slaves from the left list to Scan List of the right side. Follows the steps: Select one DeviceNet slave node and then click >. Then the DeviceNet slave nodes are moved to the Scan List one by one.



3. Click **OK** to finish the configuration above. Then download the configuration data to AS01DNET-A. During the download, the **Warning** dialog box will pop out if AS PLC is in RUN mode. Click **OK** to continue the download.



- **Configure the DeviceNet network by following the steps above. The IO data mappings between AS01DNET-A and the slave are shown in the following tables.**

  - **AS01DNET-A → Slave**

AS PLC	AS01DNET(Master)	AS01DNET(Slave)	AS PLC
D26105			D26000
D26106	⇨	⇨	D26001
D26107			D26002
D26108			D26003

  - **Slave → AS01DNET-A**

AS PLC	AS01DNET(Master)	AS01DNET(Slave)	AS PLC
D26005			D26100
D26006	⇦	⇦	D26101
D26007			D26102
D26008			D26103

- **Saving configuration data**

  Select **File**>> **Save** to save current network configuration.

11.4.7.3. DeviceNet Network Control

This section describes how to write a ladder program to achieve the control requirement of the DeviceNet network.

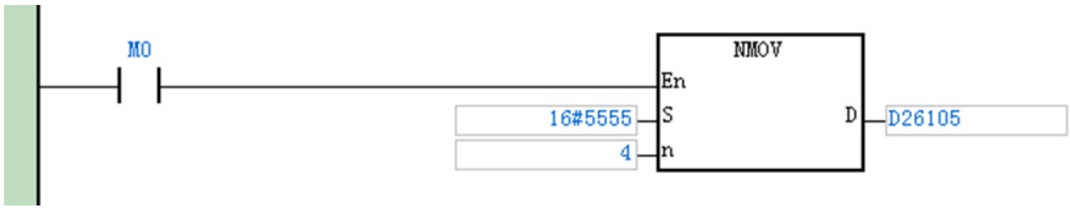
- **PLC Programs**

  - The program in the PLC connecting AS01DNET slave:

Program Explanation:

The contents in D26000~D26003 are the data received from the master and the contents in D26100~D26103 are the data transmitted to the master. SM400 is a normally open contact. The program above can make the contents in D26000~D26003 move to D26100~D26103.

  - The program in the PLC connecting AS01DNET master:



Program Explanation:

1. When M0 changes to ON, the value 16#5555 is written to D26105~D26108 in AS PLC. The data are transmitted to the slave cyclically via DeviceNet Bus.

2. The contents in D26005~D26008 are the data which the master receives from the slave via DeviceNet Bus. When M1 changes to ON, the data in D26005~D26008 are moved to D0, D1, D2 and D3.

11.4.8 Sending Explicit Message through Ladder Diagram

AS01DNET-A supports the sending of explicit messages via DNETRW instruction.

11.4.8.1. Principle of Explicit Message Transmission

1. AS PLC transmits the explicit request message to AS01DNET-A master according to the user program.
2. AS01DNET-A transmits the explicit request message to the slave according to the user program.
3. The slave sends back the response message to AS01DNET-A master after handling data.
4. AS PLC gets back the response message from AS01DNET-A master. Then the explicit message transmission of this time is finished.

11.4.8.2. Explicit Message Transmission Instruction DNETRW

- **DNETRW instruction:**

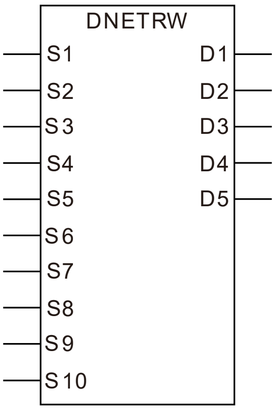
API	Instruction code	Operand	Function
1818	DNETRW	S_1、S_2、S_3、S_4、S_5、S_6、S_7、S_8、S_9、S_{10}、D_1、D_2、D_3、D_4、D_5	Read and write DeviceNet communication data

Device	X	Y	M	S	T	C	HC	D	FR	SM	SR	E	K	16#	"$"	F
S_1								●	●				○	○		
S_2								●	●				○	○		
S_3								●	●				○	○		
S_4								●	●				○	○		
S_5								●	●				○	○		
S_6								●	●				○	○		
S_7								●	●				○	○		
S_8								●								
S_9								●	●				○	○		
S_{10}								●	●				○	○		
D_1		●	●	●												
D_2		●	●	●												
D_3								●								
D_4								●								
D_5								●								

Data type	BOOL	WORD	DWORD	LWORD	UINT	INT	DINT	LINT	REAL	LREAL	TMR	CNT	STRING
S_1		●			●	●							
S_2		●			●	●							
S_3		●			●	●							
S_4		●			●	●							
S_5		●			●	●							
S_6		●			●	●							
S_7		●			●	●							
S_8		●			●	●							
S_9		●			●	●							
S_{10}		●			●	●							
D_1	●												
D_2	●												
D_3		●			●	●							
D_4		●			●	●							
D_5		●			●	●							

Pulse Instruction	16-bit instruction	32-bit instruction
-	AS	~~AS~~

- **Symbol:**



S1	The sequence number of the DeviceNet communication module
S2	DeviceNet node address (MAC ID)
S3	Service Code
S4	Class ID
S5	Instance ID
S6	Attribute ID
S7	Written-data size
S8	The start device where written data are stored
S9	Communication timeout time
S10	Times of re-transmission
D1	Completion flag
D2	Error flag
D3	Error code
D4	Read-data size
D5	The start device where read data are stored

- **Explanation:**
  - **S1** is the sequence number of the module on the right of the PLC. The number of the first module is 1; the second module is 2 and so on. Any type of module need be numbered within the range of 1~32. If the number is out of the range, the instruction will take the minimum (1) or maximum (32) for operation.
  - **S2** is a DeviceNet node address within the range of 0~63. Users can specify the node address of a slave which the master is to read and write. It also can be the node address of the master, which means to read and write the data in the master.

- **S3** is DeviceNet service code:

Service code	Explanation
0x01	Get all attributes (Get_Attribute_All)
0x02	Set all attributes (Set_Attribute_All)
0x0E	Get one single attribute (Get_Attribute_Single)
0x10	Set one single attribute (Set_Attribute_Single)

- **S4**, **S5** and **S6** represent Class ID, Instance ID and Attribute ID respectively.
- **S7** is the written-data size with the unit: Byte.
- **S8** is the start device where written data are stored. The data are arranged in the order from low byte to high byte.
- **S9** is the communication timeout time within the range: 1~100 and with the unit: 0.1 second.
- **S10** is the times of re-transmission within the range: 0~3. When communication timeout occurs, the communication will be resent
- **D3** represents the error codes to read and write.

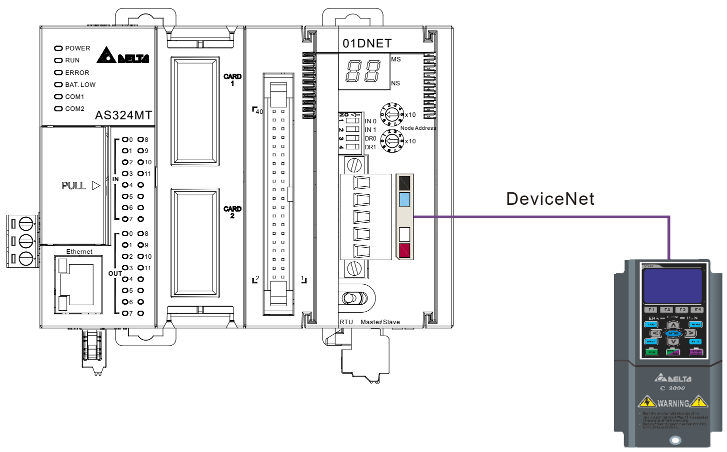
Error Code		Explanation
Code 1 (High Byte)	**Code 2 (Low Byte)**	
XX	FF	Not conform to the DeviceNet standard
20	01	The target slave does not exist.
20	02	Unable to make the connection with the slave
20	03	Sending explicit message failed.
16	00	Explicit message response timeout.

- **D4** is the read-data size with the unit: Byte.
- **D5** is the start device where read data are stored. The data are arranged in the order from low byte to high byte.
- **D1** and **D2** are communication completion flag and error flag respectively.

- **Application Example 1**

Control requirement: when M0=ON, read the data of class1>>instance1>>attribute1 of the DeviceNet function card CMC-DN01.

- **Connection Figure**



■ Parameters Setting and Device Explanation

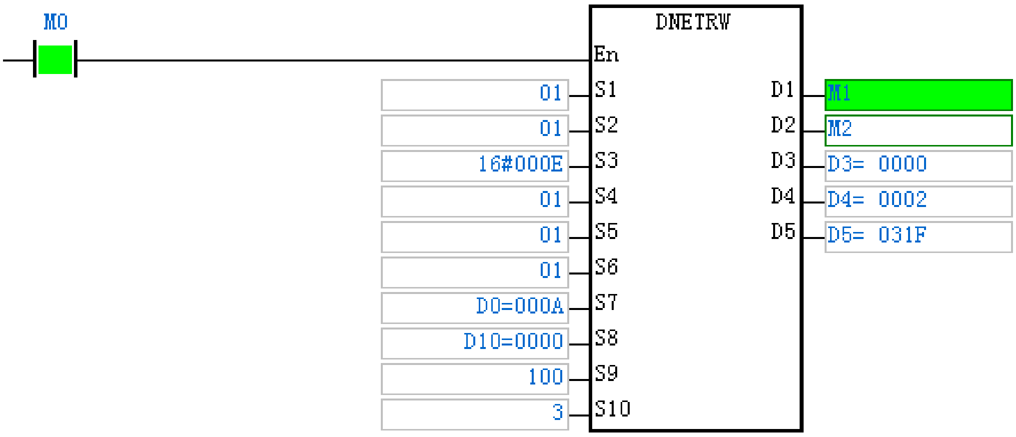
➢ Setup for AS01DNET-A

Parameter	Setting value	Description
Node ID	**00**	Set the node ID of AS01DNET-A to 00.
Baud rate	**500 kbps**	Set the baud rate of AS01DNET-A to 500 kbps.

➢ Setup for VFD-C2000

Parameter	Setting value	Description
00-20	**08**	Frequency command source
00-21	**05**	Operation command source
09-30	**0**	Communication decoding method
09-70	**01**	Node ID of AC motor drive
09-71	**02**	Baud rate: 500Kbps

■ PLC Program



- ➢ S1: The number of the module sending DeviceNet communication. The first one of the right side is 01.
- ➢ S2：DeviceNet node ID (MAC ID); Node ID of VFD-C2000: 01.
- ➢ S3：Service code; 0X0E: read one single attribute content.
- ➢ S4：Class ID; Class ID of CMC-DN01: 01;
- ➢ S5：Instance ID; Instance ID of CMC-DN01: 01;
- ➢ S6：Attribute ID; Attribute ID of CMC-DN01: 01 ;
- ➢ S7：Write data size. When DNETRW instruction is used to read data, the value in S7 can be set to any data.
- ➢ S8：The start device where the written data are stored. When DNETRW instruction is used to read data, the value in S8 can be set to any data.
- ➢ S9：Communication timeout time
- ➢ S10 :Times of re-transmission. Times of re-sending communication when communication timeout occurs.
- ➢ D1：Completion flag

- D2：Error flag
- D3：Error code
- D4：Read data size
- D5：The start device where data are read.

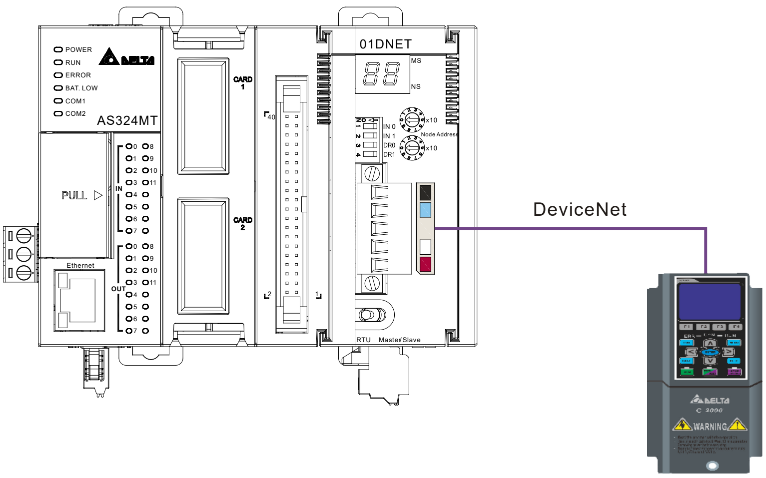
■ **Program Explanation**

- When M0 changes to ON, execute the explicit message instruction DNETRW to read Class 1 >> Instance 1 >> Attribute 1 of the target equipment with node ID: 01. If the explicit message communication succeeds, the completion flag M1 changes to ON.
- When M0 changes to ON, AS01DNET-A sends out the request message only once. If the request message is to be resent, the instruction DNETRW need be re-triggered.
- If the data reading succeeds, the content of Class 1>> Instance1 >> Attribute 1 of CMC-DN01 will be stored in D5. In this example, the content in D5 should be 031FHex.

● **Application Example 2**

Control requirement: When M1 changes to ON, set the content of Class ID: 0x05>> Instance 1>>Attribute ID: 09 of CMC-DN01 to 000AHex.

■ **Connection figure**



■ **Parameters Setting and Device Explanation**

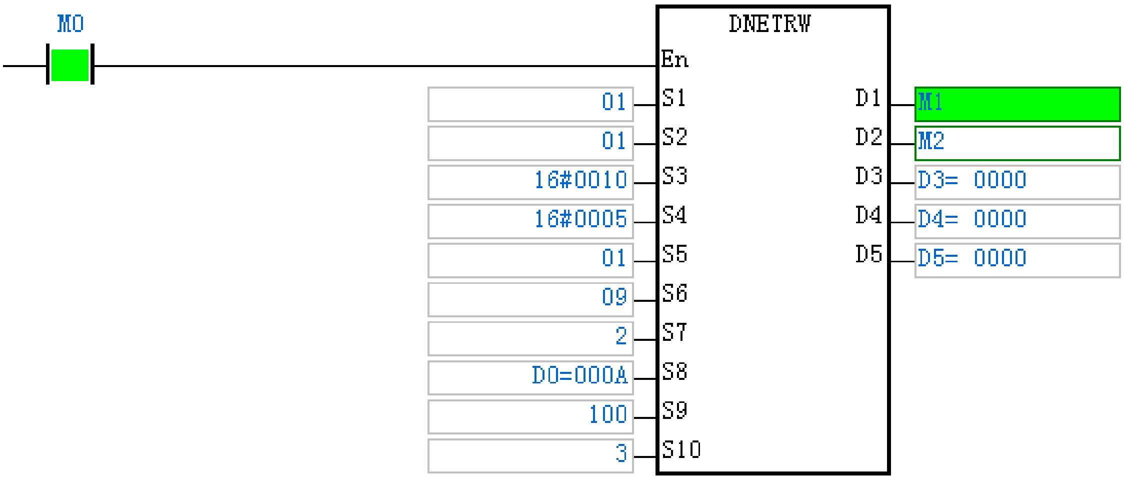
- **Setup for AS01DNET-A**

Parameter	Setting value	Description
Node ID	**00**	Set the node ID of AS01DNET-A to 00.
Baud rate	**500 kbps**	Set the baud rate of AS01DNET-A to 500 kbps.

- **Setup for VFD-C2000**

Parameter	Setting value	Description
00-20	**08**	Frequency command source
00-21	**05**	Operation command source
09-30	**0**	Communication decoding method
09-70	**01**	Node ID of AC motor drive
09-71	**02**	Baud rate: 500Kbps

■ **PLC Program**



- S1：The number of the module sending DeviceNet communication. The first one of the right side is 01.
- S2：DeviceNet node ID (MAC ID); Node ID of VFD-C2000: 00.
- S3：Service code; 0X10: read one single attribute content.
- S4：Class ID; Class ID of CMC-DN01: 05.
- S5：Instance ID; Instance ID of CMC-DN01: 01.
- S6：Attribute ID; Attribute ID of CMC-DN01: 09.
- S7：Write data size with the unit: Byte. The written-data size is 2 in this example.
- S8：The start device where the written data are stored.
- S9：Communication timeout time.
- S10 :Times of re-transmission. Times of re-sending communication when communication timeout occurs.
- D1：Completion flag.
- D2：Error flag.
- D3：Error code.
- D4：Read data size. When DNETRW instruction is used to write data, the value in D4 can be set to any data.
- D5：The start device where read data are stored. When DNETRW instruction is used to write data, the value in D5 can be set to any data.

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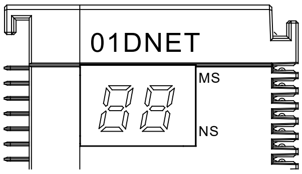
- **Program Explanation**
  - When M0 changes to ON, AS01DNET-A sends the request message and 000AHex is written to Class ID: 05>> Instance 1 >> Attribute ID: 09 of the target equipment with node ID: 01. If explicit message communication succeeds, the completion flag M1 changes to ON.
  - When M0 changes to ON, AS01DNET-A sends out the request message only once. If the request message is to be resent, the instruction DNETRW need be re-triggered.

11.4.9 LED Indicators and Troubleshooting

AS01DNET-A has two LED indicators and one digital displayer. NS LED and MS LED display the connection status of AS01DNET-A. The digital displayer shows the node address and error information of AS01DNET-A as well as error information of the slave.



11.4.9.1. NS LED

LED status	Indication	Correction
OFF	No power; Or duplicate ID check has not been completed.	1. Check if AS01DNET-A is powered and the connection is normal. 2. Make sure that at least one node can communicate normally.
Green light blinking (ON:0.5s and OFF: 0.5s alternately)	The connection to the DeviceNet network failed.	No correction; Refer to Digital Displayer for troubleshooting.
Green light ON	Online; The connection to the DeviceNet network is normal.	No correction
Red light blinking (ON:0.5s and OFF: 0.5s alternately)	Communication error	Refer to Digital Displayer for troubleshooting.
Red light ON	Network trouble, duplicate node ID, no network power or Bus-OFF.	1. Make sure that all the devices in the network have their unique node addresses. 2. Check if the network installation is correct. 3. Check if the baud rates of the master and slave are same. 4. Check if the network power is normal.

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11.4.9.2. MS LED

LED status	Indication	Correction
OFF	No power	Make sure that the power supply for AS01DNET-A is normal and the connection is proper.
Green light blinking (ON:0.5s and OFF: 0.5s alternately)	No module is configured.	Configure the scan list and then download the configuration to AS01DNET.
Green light ON	Input and output data are normal.	--
Red light blinking (ON:0.5s and OFF: 0.5s alternately)	When AS01DNET works as the master, the slave in Scan List can not work normally. When AS01DNET works as the slave, an error occurs in the configuration.	Refer to Digital Displayer. Make sure that the slave information in Scan List matches that of the actually connected slave.
Red light ON	An error inside AS01DNET	1. Check if the configuration is correct. 2. Return the module to factory for repair if the error still exists after repower ON.

11.4.9.3. Combination of MS LED and NS LED

LED status		Indication	Correction
NS LED	**MS LED**		
OFF	**OFF**	No power	Check if the power supply for AS01DNET-A is normal.
OFF	**Green light ON**	Duplicate ID check has not been completed.	Make sure that the baud rate of at least one node in the network is the same as that of the module and their communication is normal.
Red light ON	**Green light ON**	Duplicate ID check failed or Bus-OFF.	1. Ensure that the node ID of AS01DNET is unique. 2. Repower the module.
Red light ON	**Red light blinking (ON:0.5s and OFF: 0.5s alternately)**	No network power	1. Check if the network cable connection is proper. 2. Check if the network power supply is normal.
Red light ON	**Red light ON**	Hardware error	Return the module to the factory for repair.

11.4.9.4. Digital Displayer

Code	Explanation	Correction
0~63	Node address of AS01DNET-A (in normal operation)	--
80	AS01DNET-A is in STOP status.	Turn the PLC to RUN and start I/O data exchange
F0	The node ID of AS01DNET is the same as that of other node or exceeds the allowed range.	1. Ensure that the node address of AS01DNET is unique. 2. Re-power AS01DNET.
F1	No slave is configured in Scan List.	Configure the scan list and then download the configuration to AS01DNET.
F2	Too low voltage of the work power	Check if the power supply for AS01DNET and the PLC is normal.
F3	AS01DNET enters the test mode	Switch the function switch IN1 from On to Off and re-power AS01DNET-A.

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Code	Explanation	Correction
F4	BUS-OFF	1. Check if the network cable is normal and the shielded cable is grounded. 2. Check if the baud rates of all nodes in the network are same. 3. Check if the start and end of the network cable are both connected with a 121Ω terminal resistor. 4. Re-power AS01DNET-A.
F5	No network power	1. Check if the network cable is normal. 2. Ensure that the network power is normal.
F6	Internal error; Flash or RAM check error	If the error still exists after re-power, send AS01DNET-A back to the factory for repair.
F8	Error produced in factory manufacturing	If the error still exists after re-power, send AS01DNET-A back to the factory for repair.
F9	Internal error; EEPROM access failure	If the error still exists after re-power, send AS01DNET-A back to the factory for repair.
FA	Invalid configuration data	1. Configure the network correctly and re-download it to AS01DNET-A. 2. Check if the node address of one slave in the scan list is the same as that of AS01DNET-A.
E0	Identification parameters returned from the slave do not match the configuration data.	1. Check if there is any change in node ID of the slave in the network. 2. Check if some node device in the network is replaced. 3. Re-configure the network.
E1	I/O Data size returned does not match that in the scan list.	Re-configure I/O data size of the slave, download the configuration to AS01DNET-A and run the PLC.
E2	The slave device in the scan list does not exist or is offline when AS01DNET-A is in master mode. The I/O connection between the slave AS01DNET-A and the master is broken when AS01DNET-A is in slave mode.	1. Check if there is a change in the node address of the slave. 2. Check if the communication cable is disconnected or connected loosely. 3. Check if the bus cable length exceeds the maximum transmission distance. If so, the system may not be stable.
E3	AS01DNET-A fails to transmit data.	1. Make sure that the connection between AS01DNET-A and the network is normal. 2. Check if the baud rate of AS01DNET-A is the same as that of other node in the network.
E4	Error detected in sequence of fragmented I/O data from the slave device.	Check if the slave is operating normally.
E5	The slave device returns error when AS01DNET-A attempts to communicate with it.	Check if the slave is operating normally.
E6	IO data size returned from the slave is bigger than that configured in Scan List.	Check that the IO data size of the slave should be the same as that configured in Scan List.
E7	AS01DNET-A is checking MAC ID.	If the code is displayed long, do the troubleshooting according to the following steps. 1. Make sure that at least two nodes work normally in the network. 2. Check if either end of the network is connected with the terminal resistor of 121Ω. 3. Check if the baud rates of the node devices in the network are

Code	Explanation	Correction
		same. 4. Check if the communication cable is normal so as to avoid that the cable is disconnected or connected loosely. 5. Check if the bus cable length exceeds the maximum transmission distance. If so, the system may not be stable. 6. Check if the shielded wire of the network cable is grounded. 7. Re-power AS01DNET-A scanner module.

11.4.10 Master-Slave Mode Switch and 8 Baud Rates Setting via Software

AS01DNET-A can serve as a DeviceNet master or slave by modifying its mode. When the AS01DNET-A module works as a slave, the input and output data sizes are both 8 Bytes by default. The maximum input and output data sizes are both 200 Bytes.

Under standard mode, AS01DNET-A supports three baud rates: 125K, 250K and 500K. Under non-standard mode, AS01DNET-A supports eight baud rates: 10K, 20K, 50K, 125K, 250K, 500K, 800K and1M.

11.4.10.1. Setting AS01DNET-A to Slave Mode

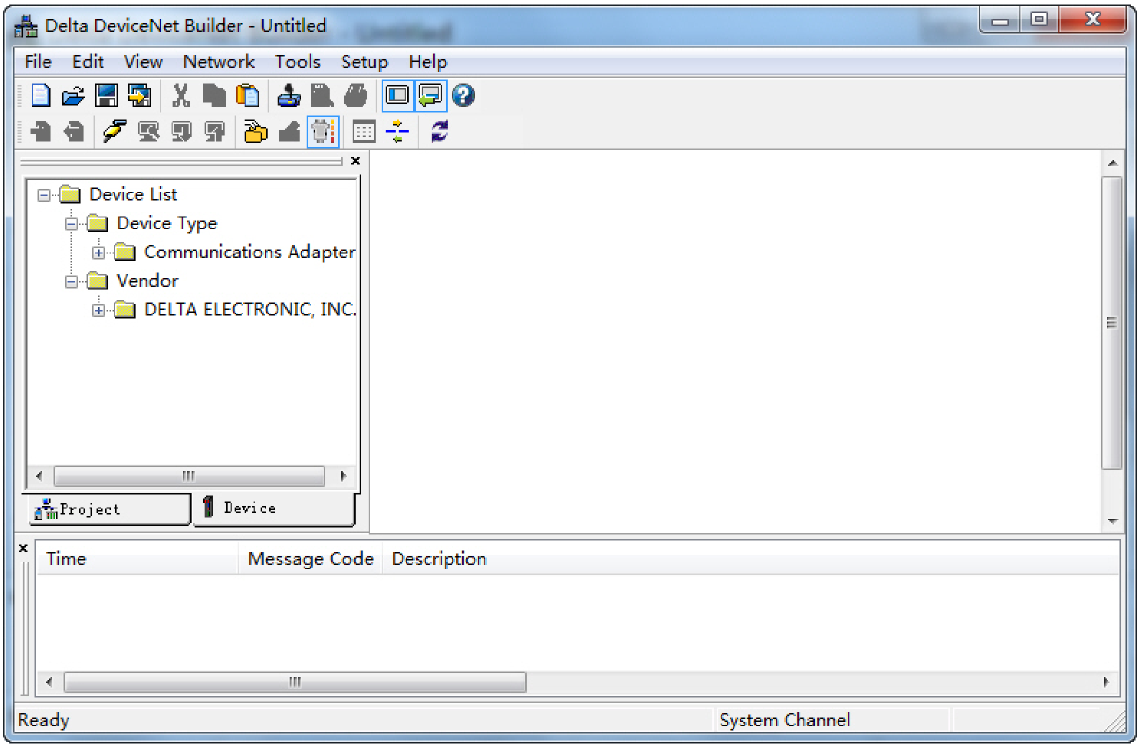
1. Build a driver through the COMMGR software.

   Refer to Section 2.4 Communication Setting in the ISPSoft User Manual for more details.

2. Call the DeviceNet Builder software through the ISPSoft software.

   Refer to Section 11.6 in this manual for details on how to operate.

3. The called DeviceNet Builder software interface is shown as below.



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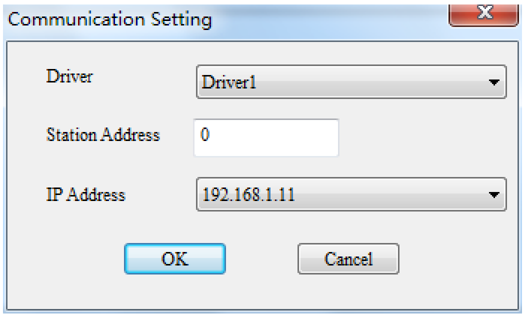
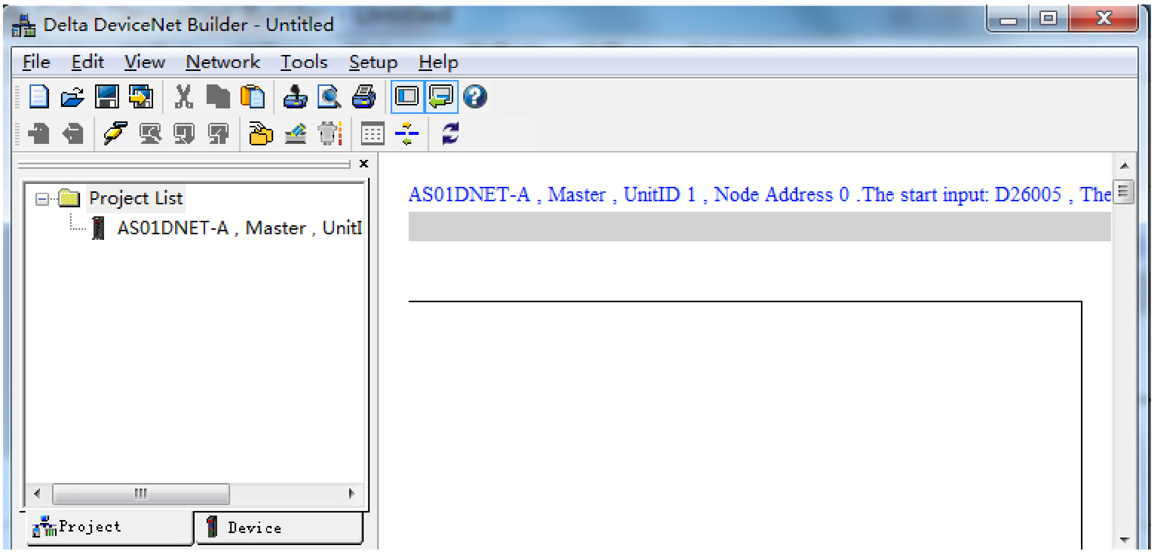
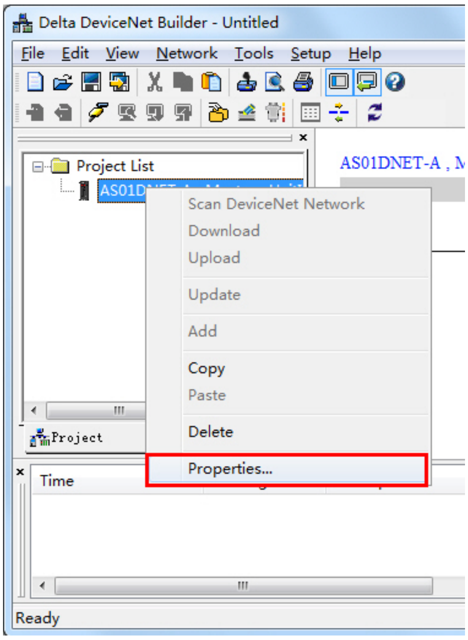
4. Selecting **Setup**>> **Communication Setting**, the following dialog box appears. Select the driver for connection of AS PLC and PC as below. Click **OK** to finish the selection of Driver.

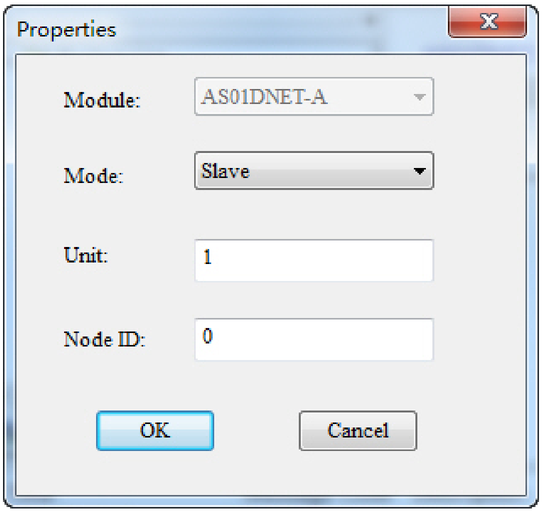


5. Click **Network** >> **Online** to scan the connected master.

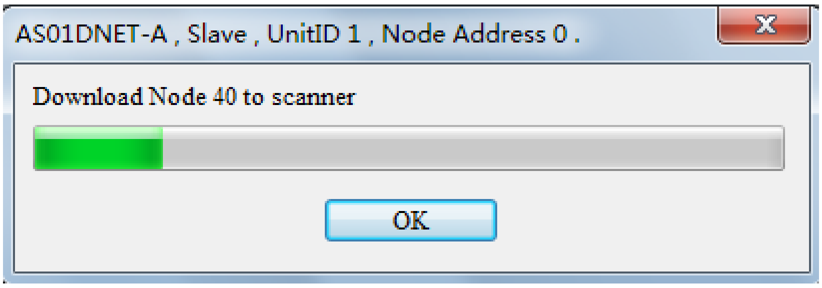


6. Click **Project List**>>**Properties**. Then the **Properties** dialog box appears. Select **Slave** mode and then click **OK**.

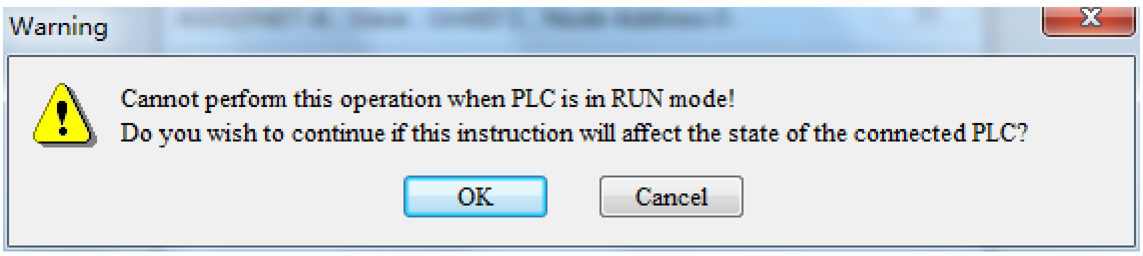


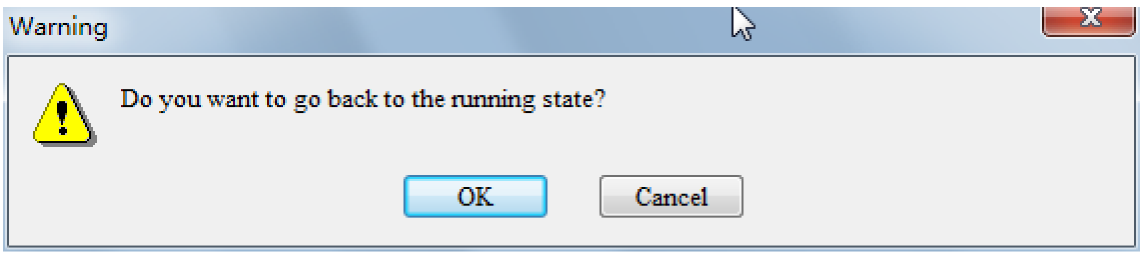


7. Click **Network** >> **Download**. If the PLC is in STOP state, the following dialog box will exist during the download. The dialog box will disappear automatically after the download is finished. AS01DNET-A will be in slave mode after repower ON.



8. If the PLC is in RUN state, the **Warning** dialog boxes will pop out before and after the download. Users can click **OK** or **Cancel** according to actual situation.





11.4.10.2. Setting AS01DNET-A to Master Mode

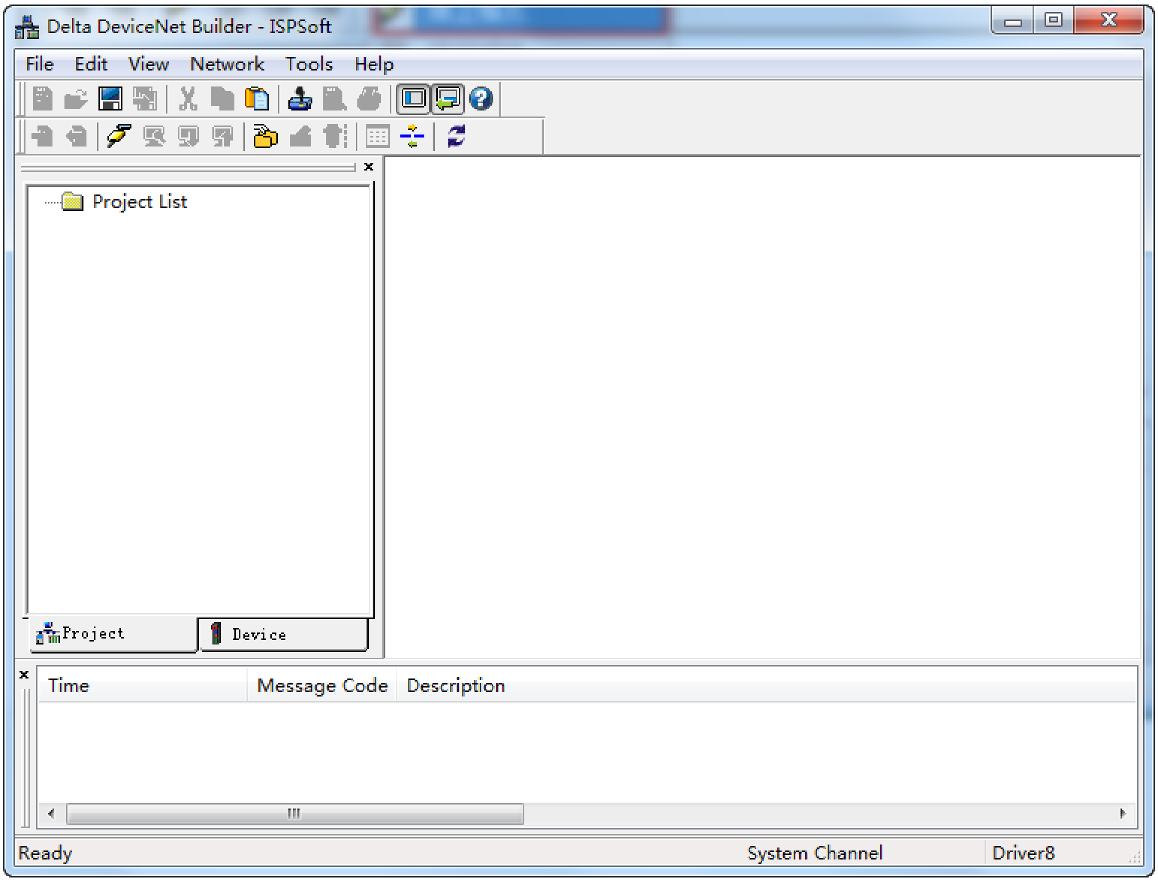
1. Build a driver through the COMMGR software.

   Refer to Section 2.4 Communication Setting in the ISPSoft User Manual for more details.

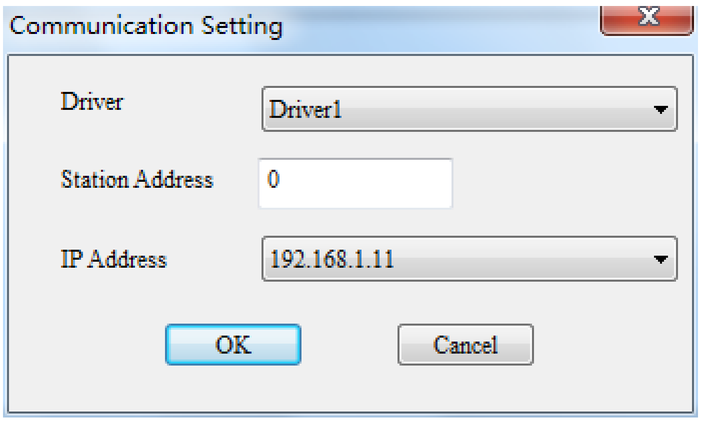
2. Call the DeviceNet Builder software through the ISPSoft software.

   Refer to Section 11.6 in this manual for details on how to operate.

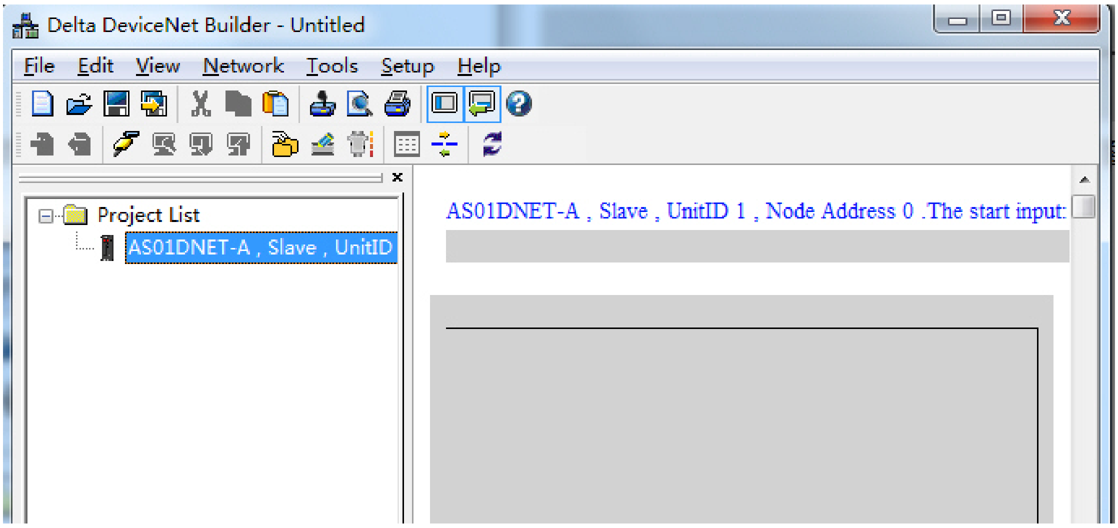
3. The called DeviceNet Builder software interface is shown as below.



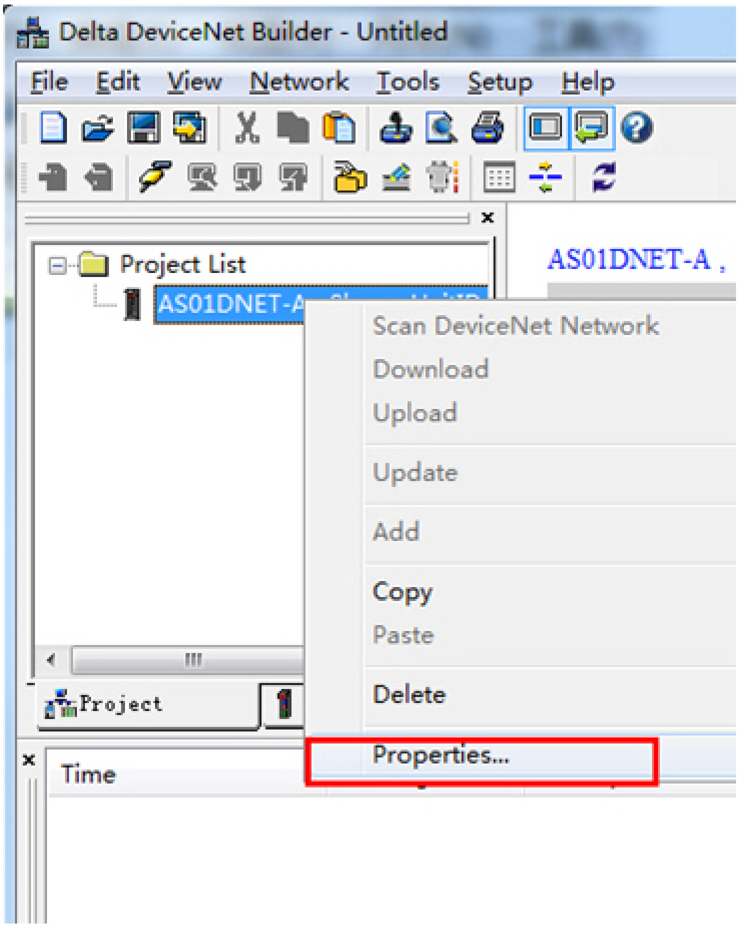
4. Selecting **Setup**>> **Communication Setting**, the following dialog box appears. Select the driver for connection of AS PLC and PC as below. Click **OK** to finish the selection of Driver.

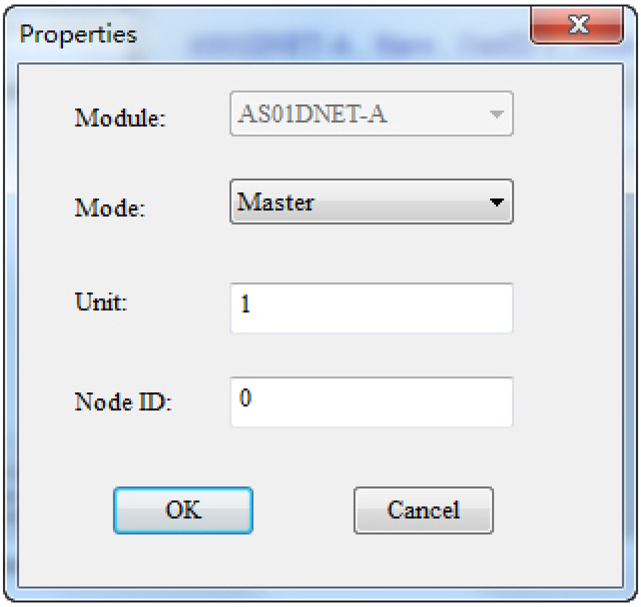


5. Click **Network** >> **Online** to scan the connected slave.

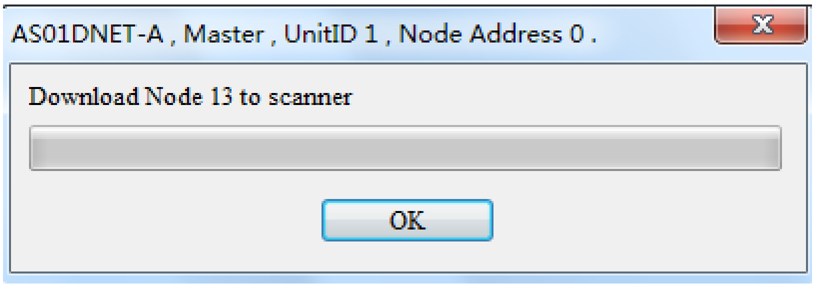


6. Click **Project List**>>**Properties** as below. Then the **Properties** dialog box appears. Select **Master** mode and then click **OK**.

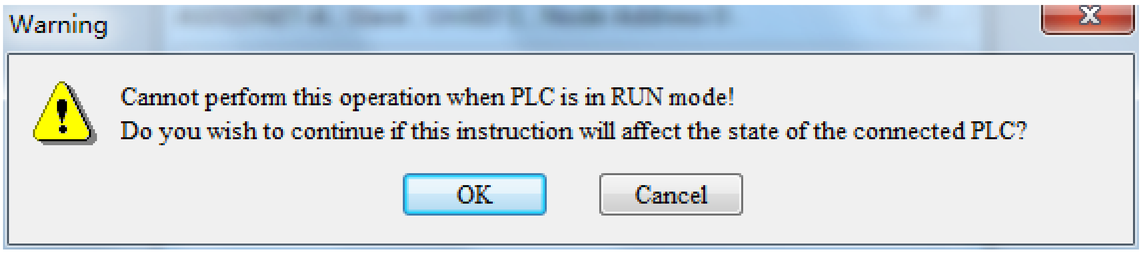


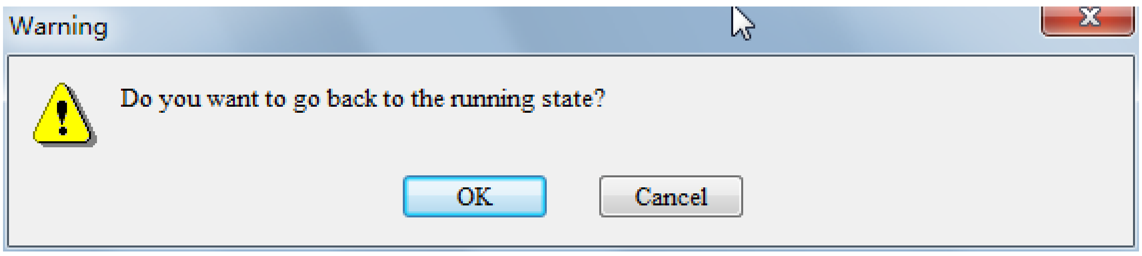


7. Click **Network** >> **Download**. If the PLC is in STOP state, the following dialog box will exist during the download. The dialog box will disappear automatically after the download is finished. AS01DNET-A will be in master mode after repower ON.



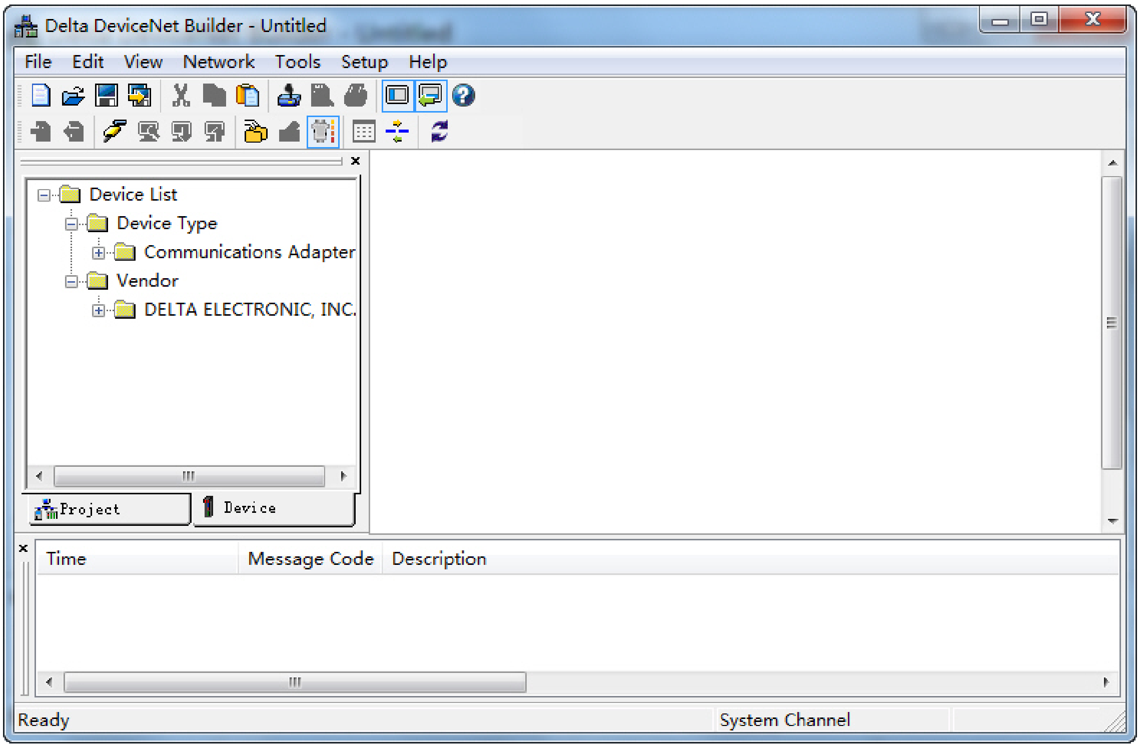
8. If the PLC is in RUN state, the **Warning** dialog boxes will pop out before and after the download. Users can click **OK** or **Cancel** according to actual situation.



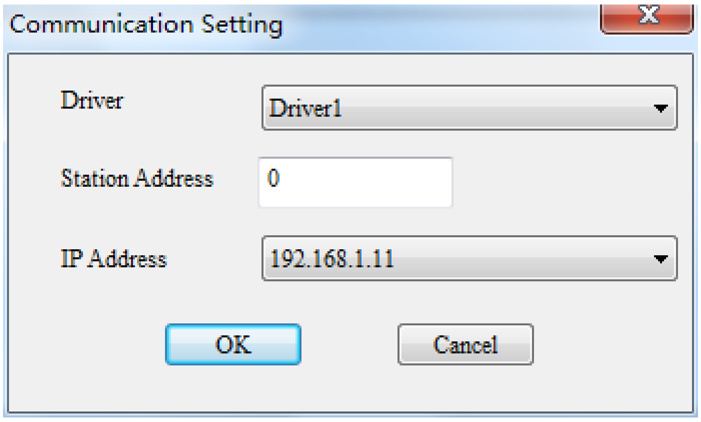


11.4.10.3. Baud Rate Setting of When AS01DNET-A is in Slave Mode

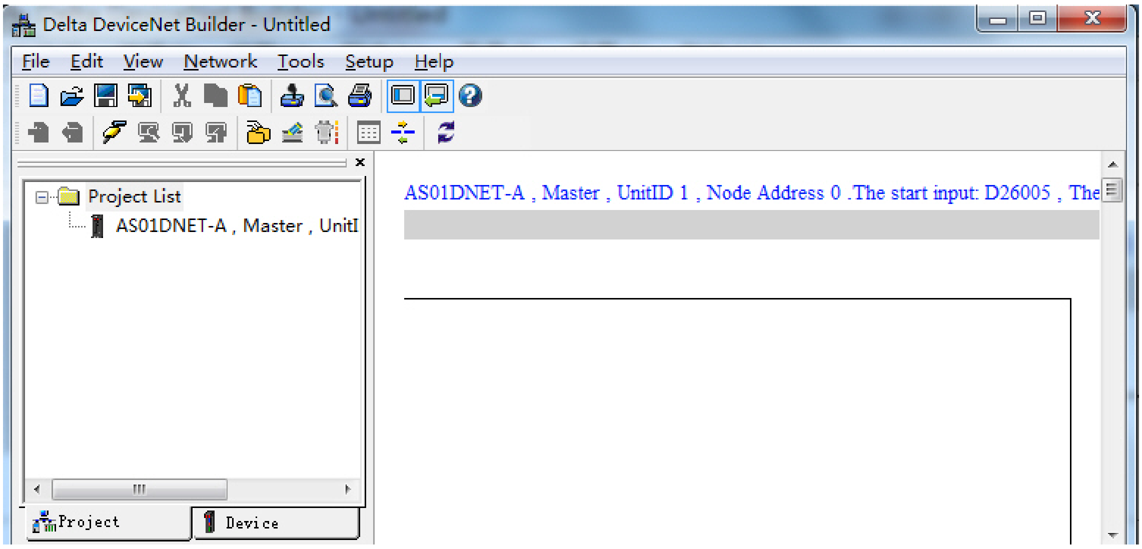
1. Opening the DeviceNet Builder software, the following window appears.



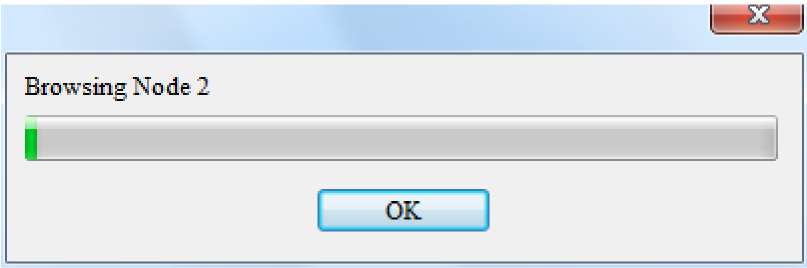
2. Selecting **Setup**>> **Communication Setting**, the following dialog box appears. Select the driver for connection of AS PLC and PC as below. Click **OK** to finish the selection of Driver.



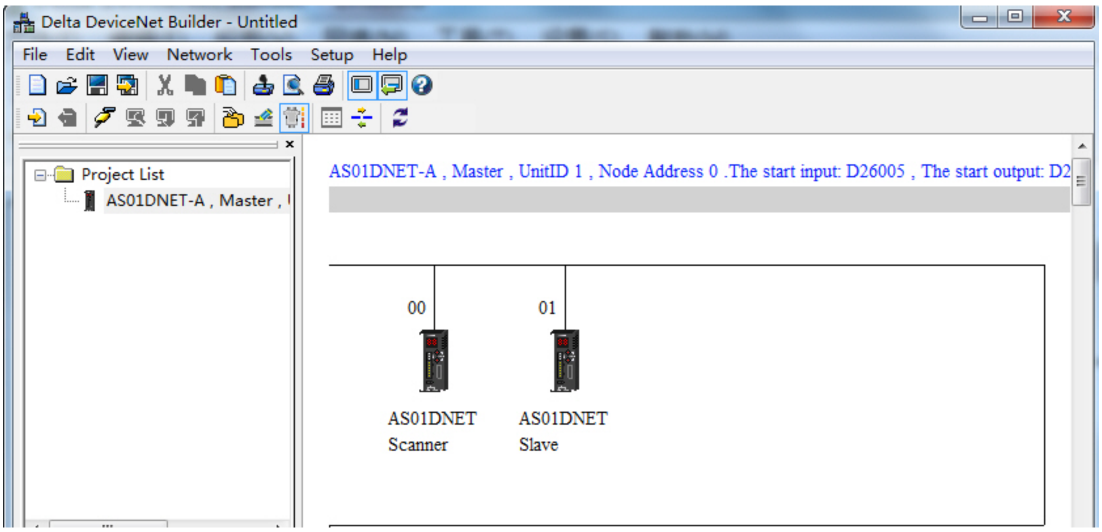
3. Click **Network** >> **Online** to scan the connected master.



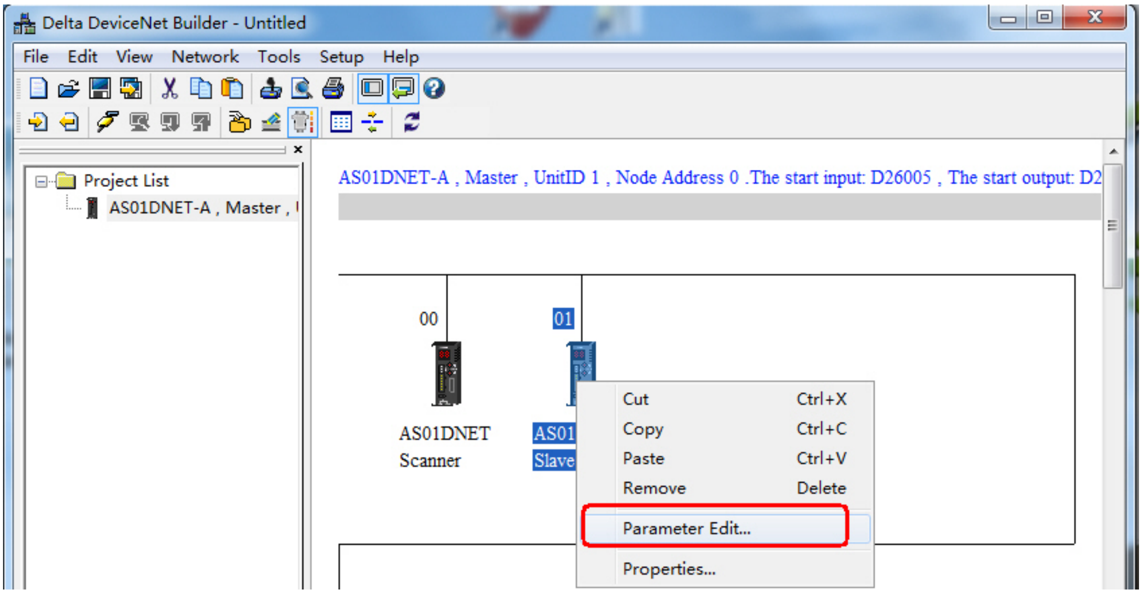
4. Clicking **Network**>> **Scan DeviceNet Network**, the DeviceNet Builder software starts to scan the whole network.



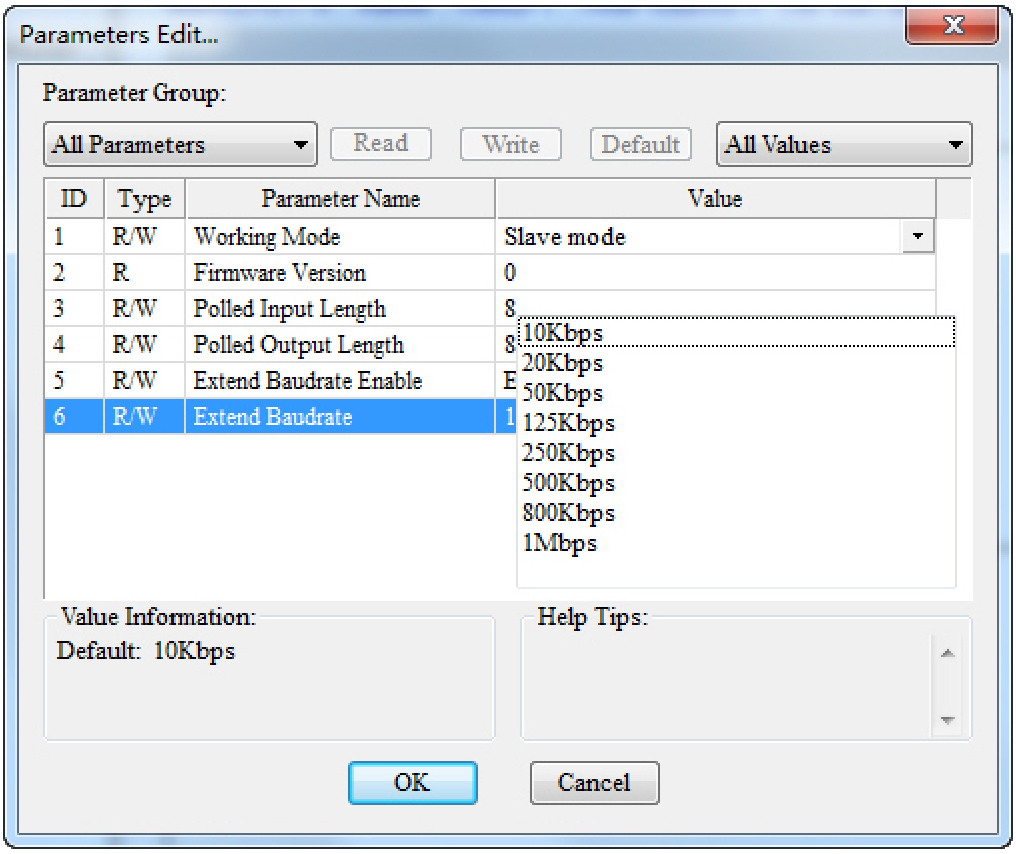
5. After scanning is finished, all node icons and device names which have been scanned in the network will appear on the following interface. The node address of AS01DNET-A is 01 in this example.



6. Right-click AS01DNET(Slave), select **Parameter Edit…** on the drop-down menu to enter the **Parameter Edit** page.



7. Set **Extend Baudrate Enable** to **Enable** and then select the desired baud rate. Click **Write** button after setting is finished.



8. After the download is completed, switch DR0 and DR1 of AS01DNET to ON. Finally, repower AS01DNET-A.

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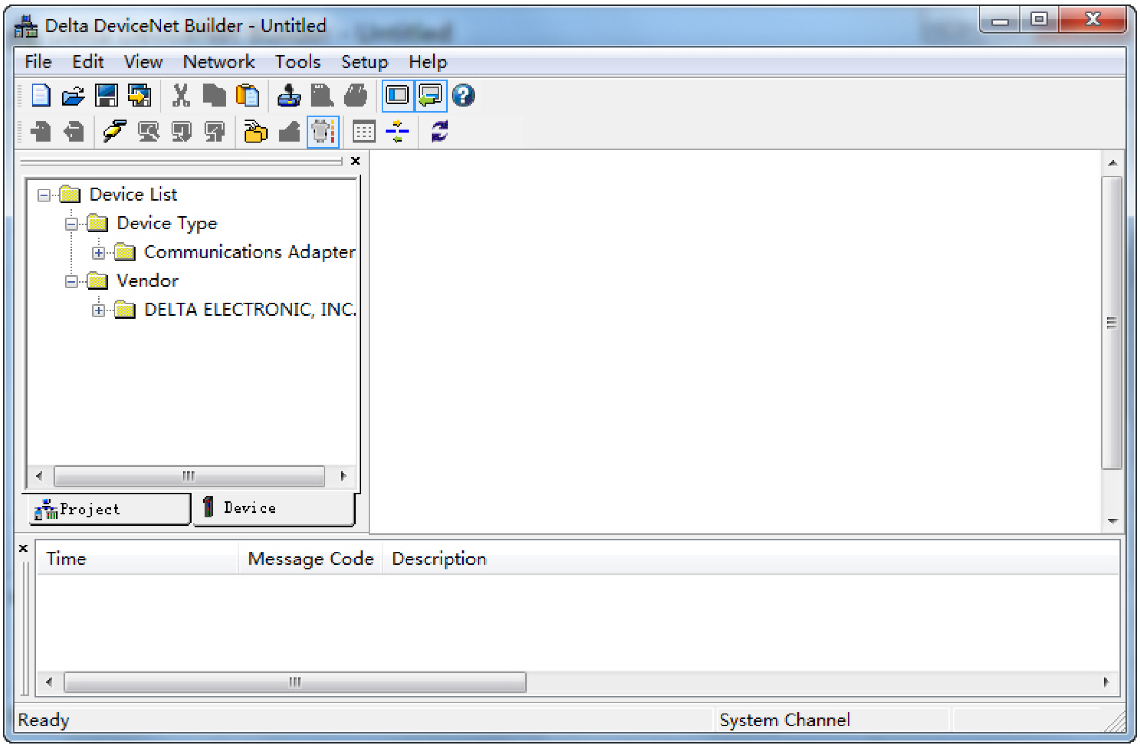
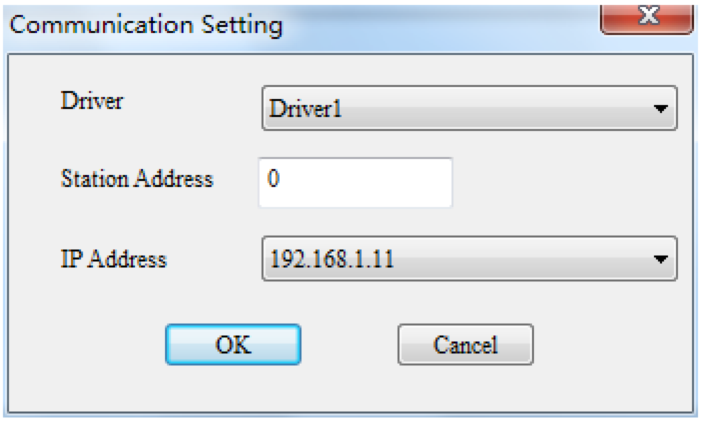
11.4.10.4. Baud Rate Setting of When AS01DNET-A is in Master Mode

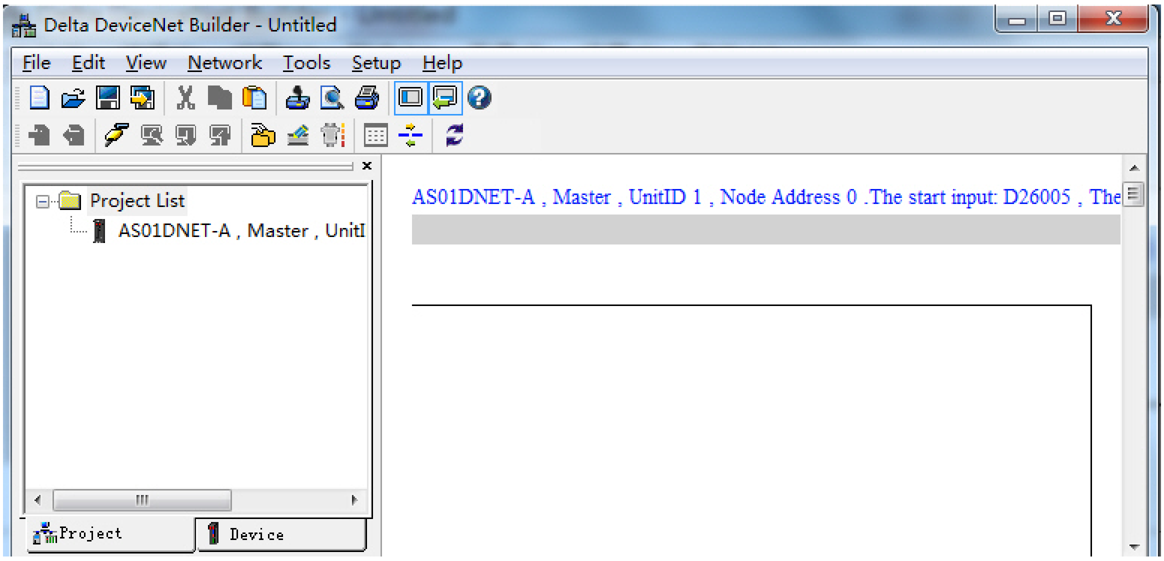
1. Opening the DeviceNet Builder software, the following window appears.



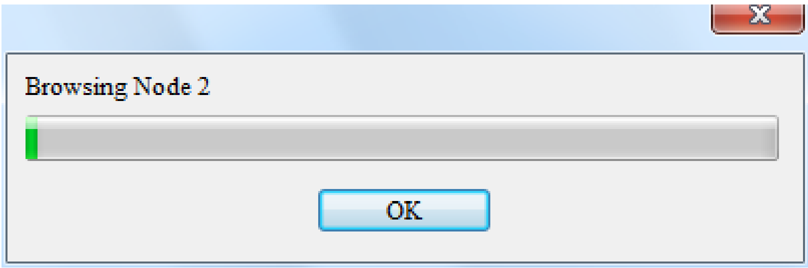
2. Selecting **Setup**>> **Communication Setting**, the following dialog box appears. Select the driver for connection of AS PLC and PC as below. Click **OK** to finish the selection of Driver.



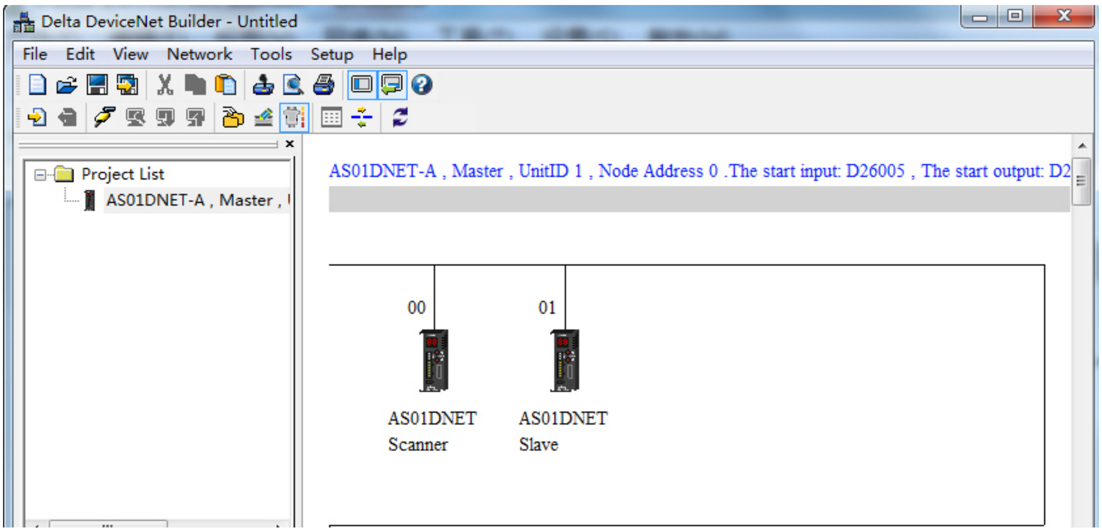
3. Click **Network** >> **Online** to scan the connected master.



4. Clicking **Network**>> **Scan DeviceNet Network**, the DeviceNet Builder software starts to scan the whole network.



5. After scanning is finished, all node icons and device names which have been scanned in the network will appear on the following interface. The node address of AS01DNET-A is 00 in this example.



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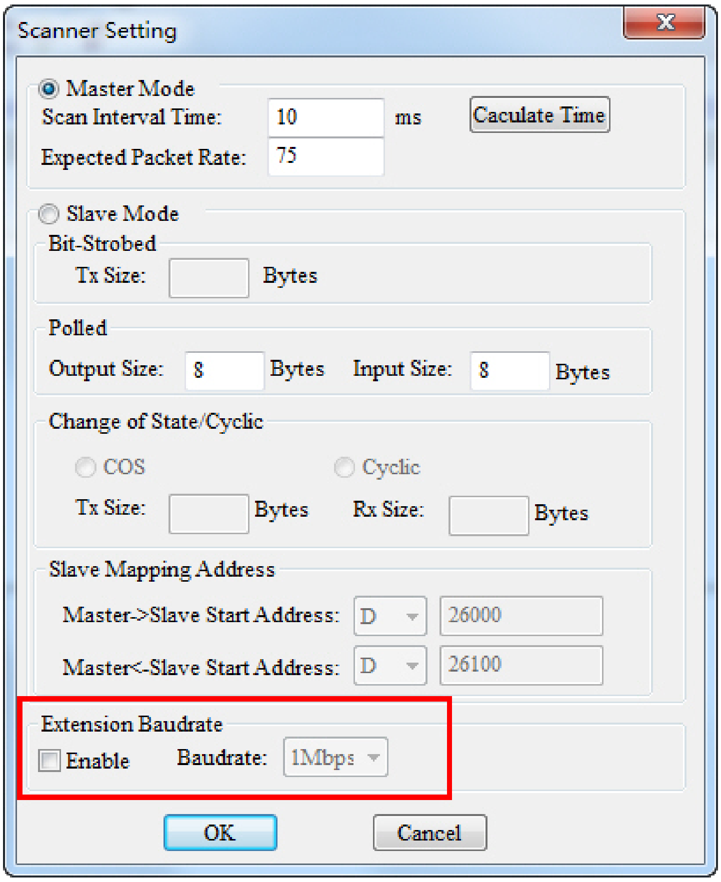
6. Click **Network** >> **Scanner Setting**. The **Scanner Setting** dialog box appears. Select **Enable** under **Extension Baudrate** and the desired baud rate as below. Click **OK** after the setting is finished.



7. Click **Network** >> **Download** to download the extension baud rate setting to the master. After the download is completed, switch DR0 and DR1 of AS01DNET-A to ON. Finally, repower AS01DNET-A.

11.5 RTU Mode

11.5.1 Introduction of AS01DNET (in RTU Mode)

- As DeviceNet slave, AS01DNET-A supports standard DeviceNet communication protocol.
- Supports explicit connection in the predefined master/slave connection and I/O polling connection.
- The network configuration software DeviceNet Builder provides graphic configuration interface, and supports auto scan and recognition of I/O modules, free mapping of special module parameters as I/O exchange data as well as the setting of exception handling and diagnosis of module error states.
- Users can choose to retain the data in registers or not when the network is disconnected according to actual need.
- AS01DNET (in RTU mode) can connect max. 8 AS-series extension modules including digital modules, analog modules, temperature modules and etc. The mapping length of digital modules is determined by number of digital points. The max. length of mapping parameters for input of other module is 20 words and the max. length of mapping parameters for output of other module is 20 words.
- Max lengths for output data and input data of AS01DNET (in RTU mode) are both 100 bytes.
- AS01DNET (in RTU mode) needs the external 24VDC power supply.

11.5.2 AS-Series Extension Modules Connectable to AS01DNET (RTU)

The model and specification of AS-series digital modules connectable to AS01DNET (in RTU mode):

Digital I/O module model	Length of I/O mapping data (Unit: words)	
	(Master→AS01DNET)	(AS01DNET→Master)
AS08AM10N-A	None	1
AS16AM10N-A	None	1
AS32AM10N-A	None	2
AS64AM10N-A	None	4
AS08AN01T-A	1	None
AS08AN01R-A	1	None
AS08AN01P-A	1	None
AS16AN01T-A	1	None
AS16AN01R-A	1	None
AS16AN01P-A	1	None
AS32AN02T-A	2	None
AS64AN02T-A	4	None
AS16AP11T-A	1	1
AS16AP11R-A	1	1
AS16AP11P-A	1	1

The model and specification of AS-series special modules connectable to AS01DNET (in RTU mode):

Special module model	Length of I/O mapping data (Unit: words)	
	DeviceNet→AS01DNET(RTU)	AS01DNET(RTU)→DeviceNet
AS04AD-A	6	None
AS04DA-A	2	4
AS06XA-A	10	4
AS02LC-A	7	1
AS04RTD-A	10	None
AS06RTD-A	14	None
AS04TC-A	10	None
AS08TC-A	18	None
AS08AD-B	18	None
AS08AD-C	18	None

Note:

The length of mapping data of the I/O modules connected to AS01DNET (in RTU mode) is fixed. The default mapping parameters of special modules must be chosen.

Besides default mapping parameter configuration, you can also choose other parameters for I/O mapping according to need when special modules are connected to AS01DNET (RTU). The max. input length and max. output length of default parameters and user-added mapping parameters of each special module are both 20 words.

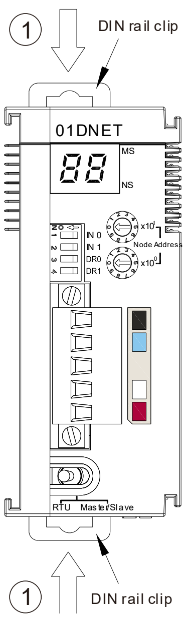
11.5.3 Installation

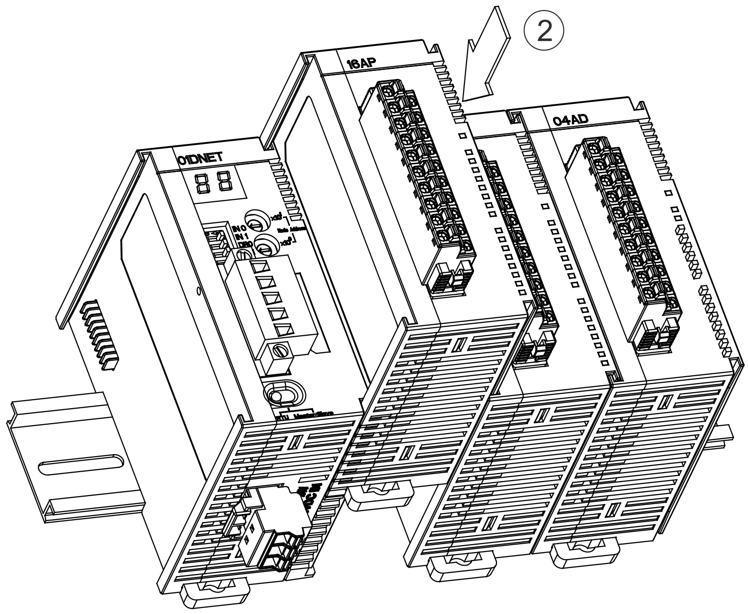
11.5.3.1. Installing AS01DNET (in RTU Mode)

11.5.3.1.1. Connecting AS01DNET-A (in RTU Mode) and Extension Module on DIN Rail

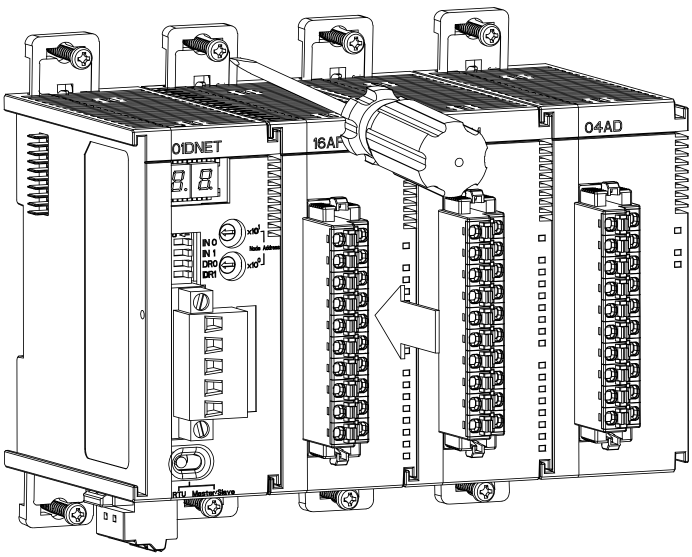
- Please push the clips of AS01DNET-A (RTU) in the directions indicated by arrow ① until hearing a click. That means the DIN clips are interlocked each other. Then insert the module hooks at the bottom into the DIN rail mounting slot until hearing a click. That means AS01DNET-A (RTU) is connected to the DIN rail.

- To install the second module AS16AP11T, push the clips of AS16AP11T in the direction indicated by arrow ①. Then aim the left-side slot of AS16AP11T at the right-side slot of AS01DNET-A (RTU) and push AS16AP11T in the direction as illustrated by arrow ② until hearing a click. That means the module is on the DIN rail and is connected to AS01DNET-A (RTU). In the same way, install more IO modules on the right side of AS01DNET-A (RTU) and DIN rail one by one.



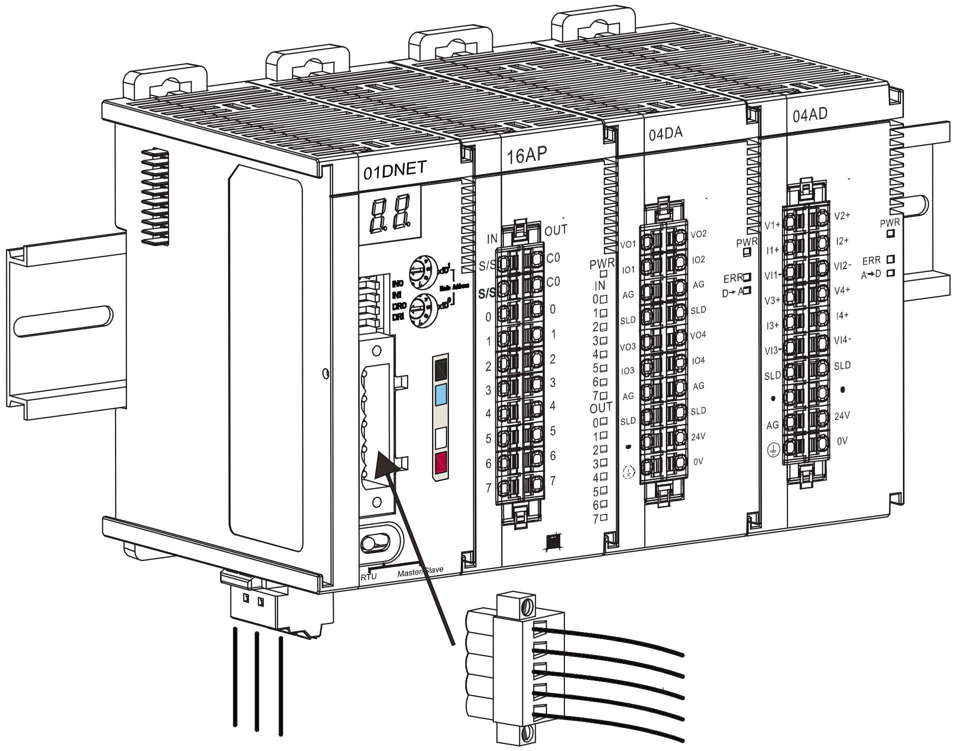


- Tighten the screws on the top of the module at the end of installing.



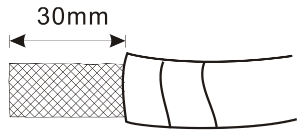
11.5.3.1.2. Connecting the DeviceNet Communication Connector

- The color marks on the communication connector match the colors of the connection cables. During the wiring, please check whether the colors of the connection cable and the color mark are same.
- Delta's power module is recommended as the power module in the communication.

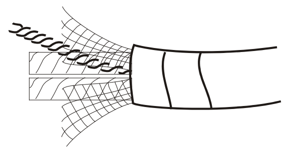


11.5.3.2. Connecting the Cable to DeviceNet Connector

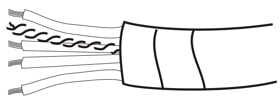
- Use an efficient tool to peel the communication cable for approx. 30mm. DO NOT damage the shielded cable during the peeling.



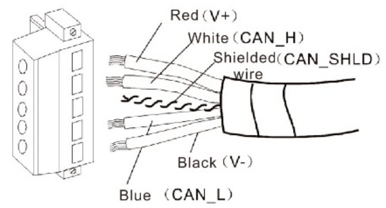
- Peel off the metallic shielded net and foil, and you will see 2 power cables (red and black), 2 signal cables (blue and white) and 1 shielded cable.



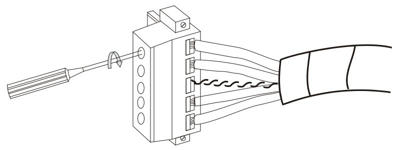
- Peel off the exterior metallic shielded net, foil and the plastic cover of the power cable and signal cable for appropriate length.



- Insert the peeled communication cables into the holes in the connector in correct order.



- Tighten the screws on the connector by a slotted screwdriver and fix the communication cables in the holes in the connector.



11.5.4 Configuring AS01DNET (in RTU mode)

As DeviceNet slave, AS01DNET (RTU) mainly achieves the data exchange between the master and AS-series I/O modules connected to AS01DNET.

- Transmits output data of DeviceNet master to I/O modules.
- Transmits input data from I/O modules to DeviceNet master.

11.5.4.1. Terms

No.	Name	Unit	Description
1	Control word	WORD	The first WORD for output data that the master assigns to AS01DNET is the control word of AS01DNET for setting the work mode of AS01DNET. When the content in the control word is set to 2, AS01DNET is in STOP mode. When the content in the control word is set to 1, AS01DNET is in RUN mode.
2	Status word	WORD	The first WORD for input data that the master assigns to AS01DNET is the status word of AS01DNET for displaying the operation state of AS01DNET. Refer to section 11.5.4.3.4 for more about status word.
5	Range of input data in modules	WORD	Determined by start input address and input mapping parameter length of each module.
6	Range of output data in modules	WORD	Determined by start output address and output mapping parameter length of each module.
7	Input data size	WORD	The sum of the size of status word of AS01DNET and the size of input data of the modules connected to it. The status word occupies one word. Digital input module takes 16 bits as one word. The input data length of analog I/O modules and temperature modules are determined by the default mapping parameter length and user-added parameter length, no more than 20 words.
8	Output data size	WORD	The sum of the size of control word of AS01DNET and the size of output data of the modules connected to it. The control word occupies one word. Digital output module takes 16 bits as one word. The output data length

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No.	Name	Unit	Description
			of analog I/O modules and temperature modules are determined by the default mapping parameter length and user-added parameter length together, no more than 20 words.

11.5.4.2. Introduction of Software

Before the new version of DeviceNet Builder software is used for making a connection with PLC, make sure that the communication manager COMMGR has been installed.

(Refer to ISPSoft user manual for details on COMMGR usage.)

11.5.4.2.1. Making a connection between DeviceNet Builder and PLC

Before making a normal connection between DeviceNet Builder and PLC, you have to do relevant setup for COMMGR software.

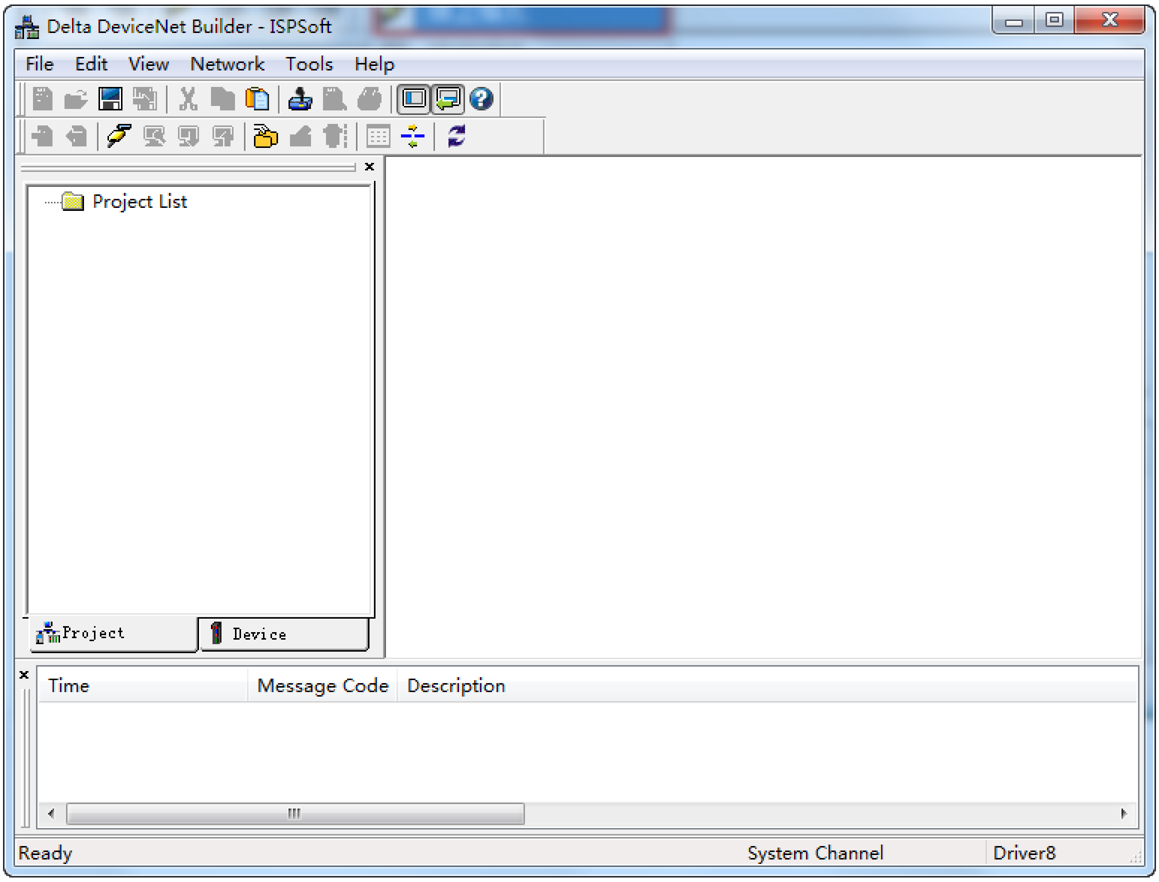
1. Build a driver through the COMMGR software.

   Refer to Section 2.4 Communication Setting in the ISPSoft User Manual for more details.

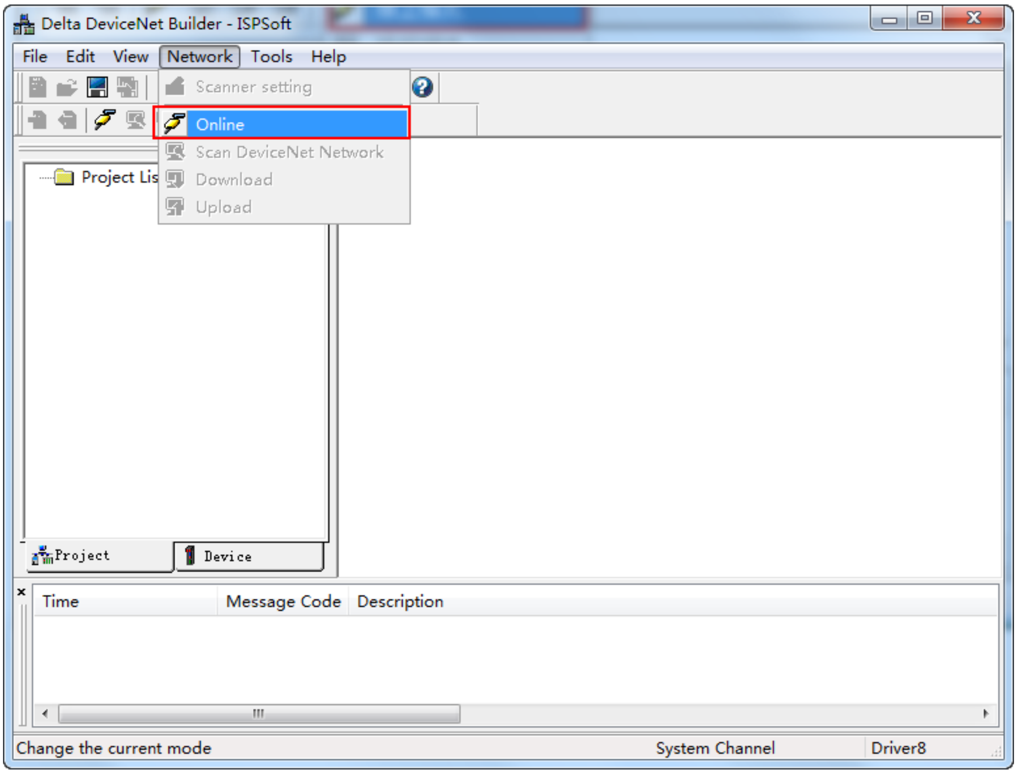
2. Call DeviceNet Builder via ISPSoft

   Refer to Section 11.6 for details on how to operate.

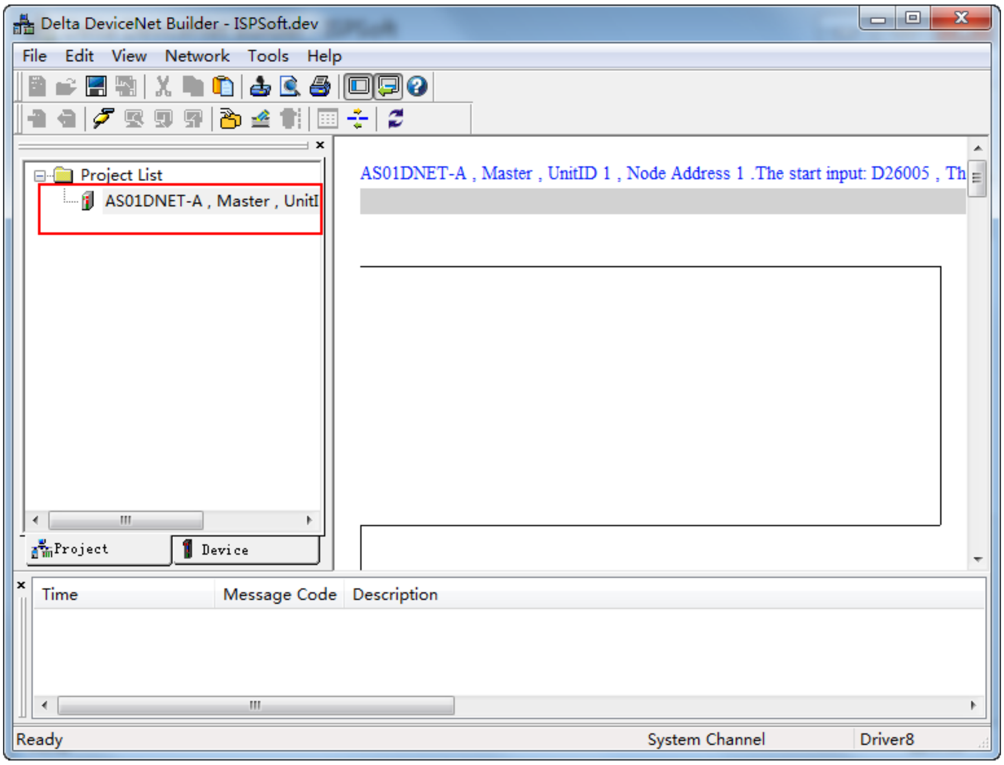
3. The called DeviceNet Builder is started as below.



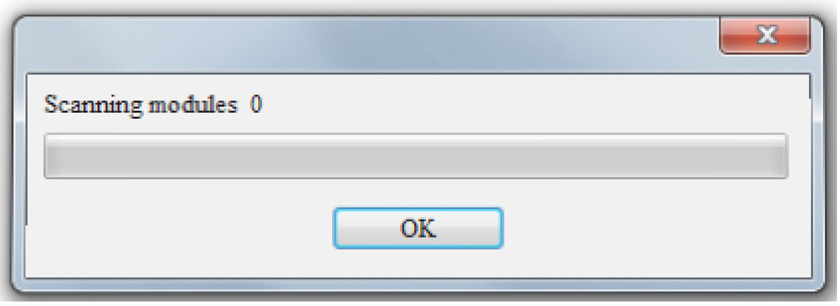
4. Click menu **Network>> Online**.



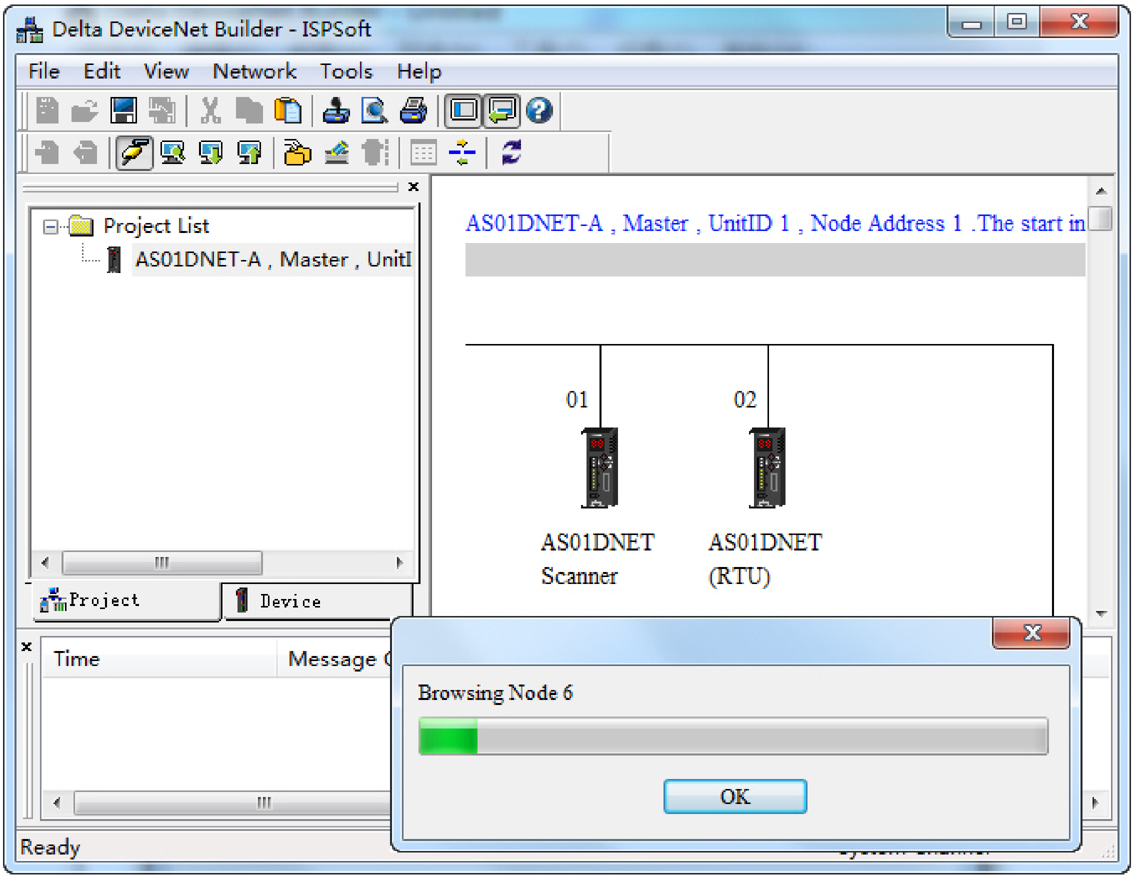
5. The master module AS01DNET-A which has been scanned is shown in the left-side Project List.



6. Click **Network >> Scan DeviceNet Network**.



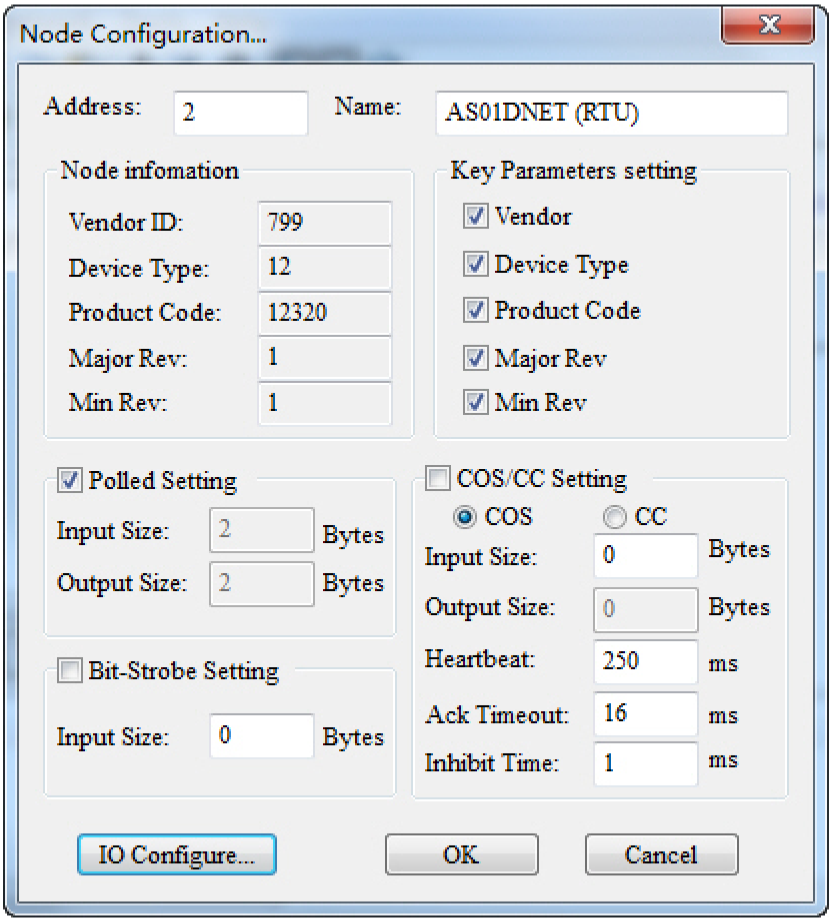
7. After online is implemented, click the **Scan DeviceNet Network** button to start scanning the nodes in the network.



11.5.4.2.2. Main Configuration Page of AS01DNET (RTU)

1. After scanning is finished, double click the AS01DNET (RTU) node in the network. Then the **Node Configuration…** window comes out. The polled transmission is supported with default input data size of 2 bytes and output data size of 2 bytes which are mapping address lengths of control word and status word of AS01DNET (RTU) respectively.

   Input Size and **Output Size** under **Polled Setting** mean the lengths of AS01DNET (RTU) parameters which are mapped in the master.



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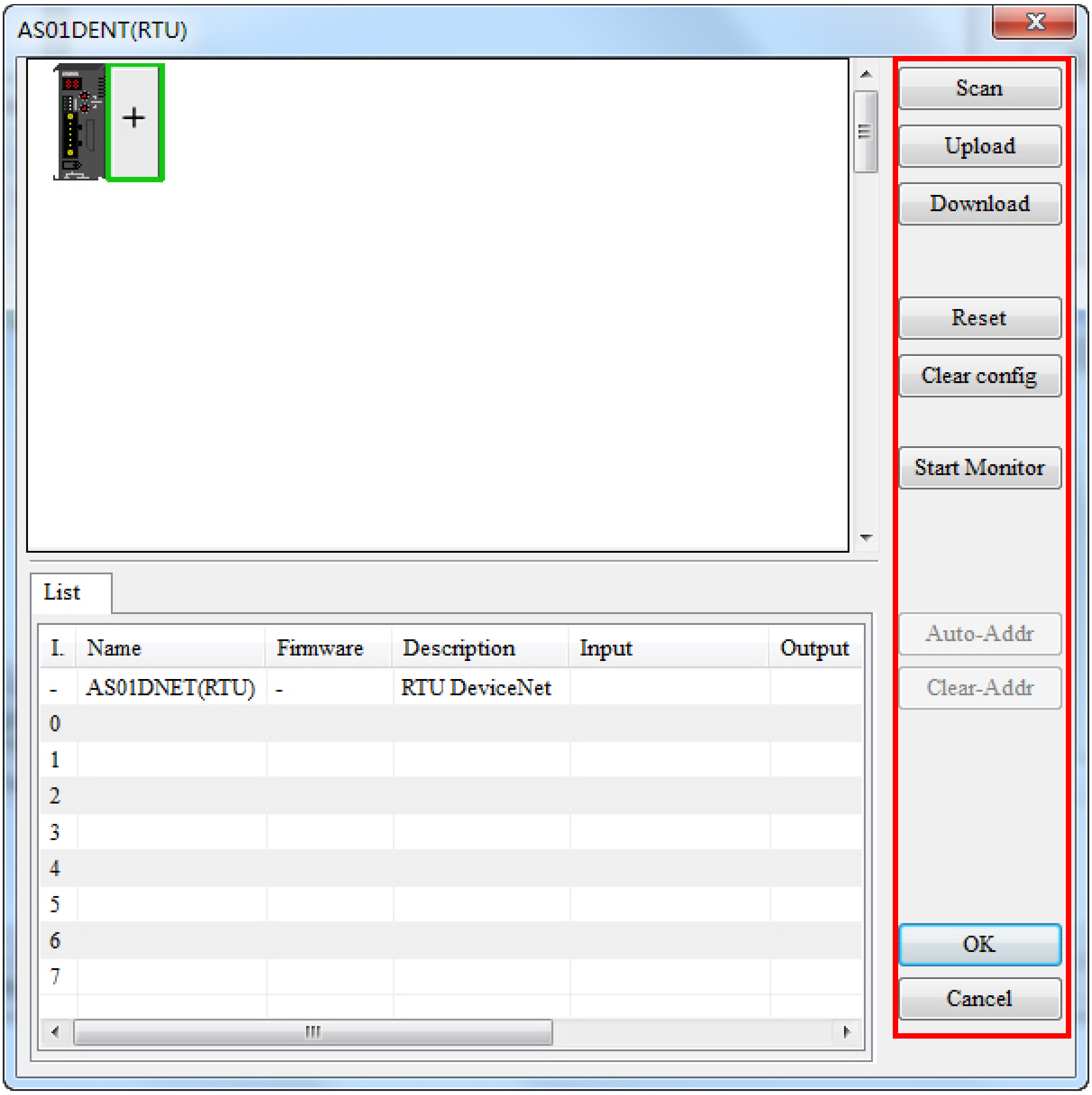
2. Click the **I/O Configure…** button in the **Node Configuration…** window. Then the main configuration page appears as below.

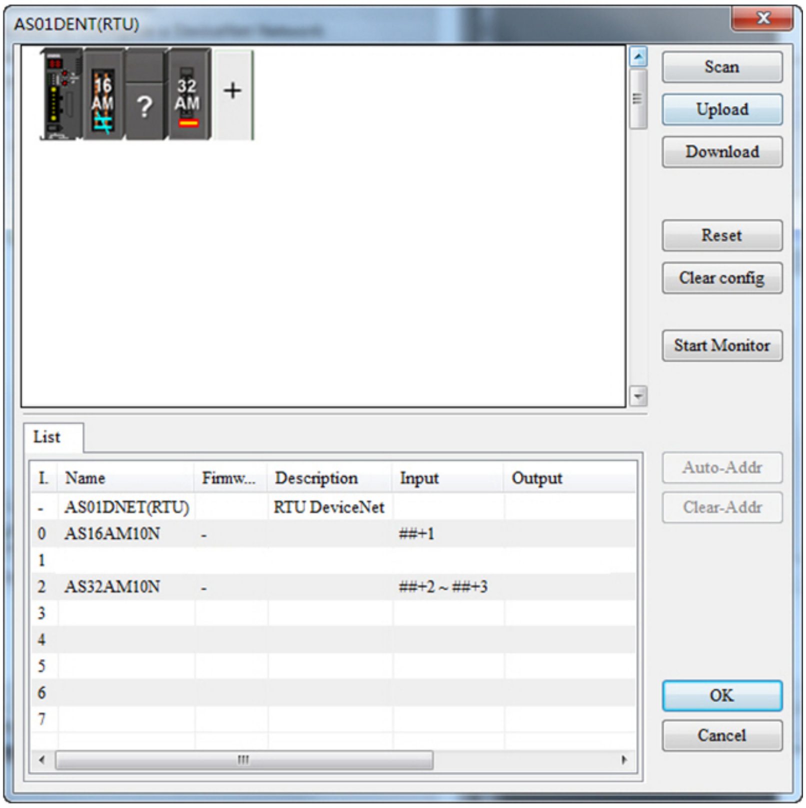


Explanation of parameters on the AS01DNET (RTU) configuration page

Item	Description
Scan	All I/O modules currently connected to the right side of AS01DNET (RTU) are scanned. The existing modules in the software will be compared with the actually connected I/O module. The mismatched one will be displayed in an abnormal icon.
Upload	Upload and show the configuration data including I/O list, I/O configuration, parameter mapping and basic control information in AS01DNET (RTU) in the software.
Download	Download current AS01DNET (RTU) configuration including I/O list, I/O configuration, parameter mapping and basic control information to AS01DNET (RTU), which is retained when the power is turned off.
Reset	Make the connected AS01DNET (RTU) restart.
Clear config	Clear the configuration data stored in the latched area and automatically reset the configuration. Then the indicator displays F1.

Item	Description
Start Monitor	Watch and set in real time the configured exchange data in current system; change output data, watch input data and use control word to control the operation state of AS01DNET (RTU) in real time.
Name	Name of each module
Firmware	Firmware version of each module. Choosing corresponding version of firmware, download the module parameter information which matches the firmware version.
Description	The description of basic information of each module.
Input	The mapping range of input data of each module, determined by start address offset of mapping input data and the size.
Output	The mapping range of output data of each module, determined by start address offset of mapping output data and the size.
Comment	Add a comment for each I/O modules
OK	The current configuration data will not be saved until you click the **OK** button to finish the configuration.
Cancel	Clicking the **Cancel** button to exit AS01DNET (RTU) configuration page, current configuration data will not be saved.

3. Clicking the **Scan** button on the page, the main AS01DNET (RTU) configuration page changes as below.



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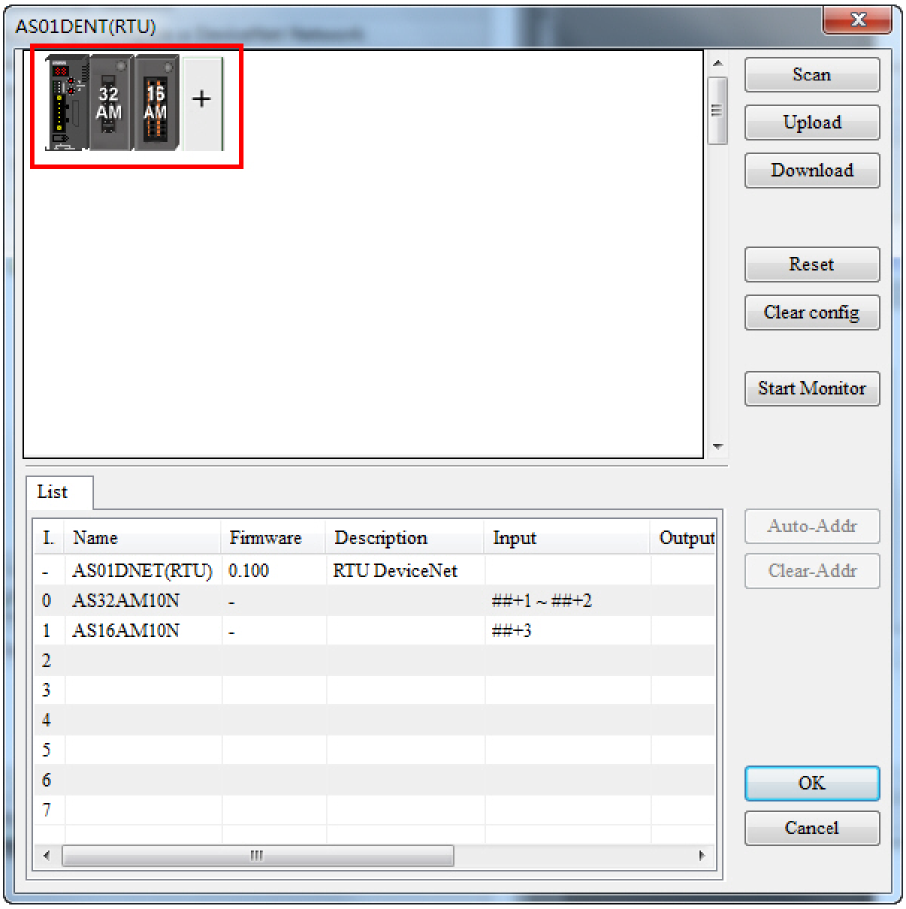
After the I/O modules connected to AS01DNET (RTU) are scanned, abnormal icons may appear.

Here is the list of abnormal icons.

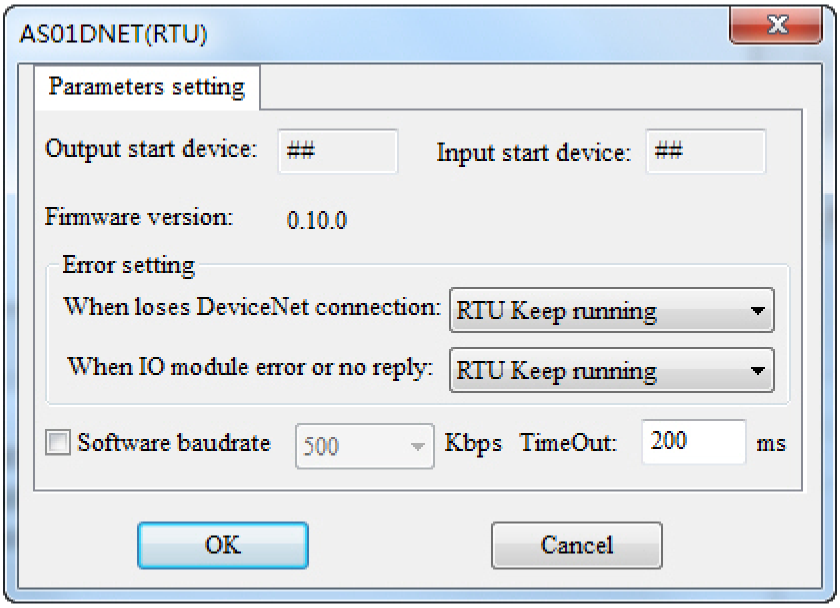
	The I/O module configured in the software does not match the current I/O module actually connected, e.g. the software configuration is AS32AM, but the actually connected module is AS16AP. So the abnormal icon such as left-side icon will appear after the scan. You can change it into current configuration icon with double clicks on it.
	The I/O module in the software configuration does not exist in the actual connection, e.g. the software configuration is AS32AM, but it has not been connected actually. So the abnormal icon such as left-side icon will appear after the scan. You can change it into current configuration icon with double clicks on it.
	AS01DNET (RTU) scans an unknown module. Right click current icon to select **Change** from the menu which appears to change it into a module icon which can be recognized for configuration.

11.5.4.2.3. AS01DNET (RTU) Parameters Setup Page

After I/O modules are scanned, the main configuration interface changes as follows.



Double click **AS01DNET (RTU)** icon on the far left of the configuration page. Then the parameter setting interface of AS01DNET (RTU) comes out for setting the error handling method as follows.



Explanation of AS01DNET (RTU) parameter setup:

Item	Description	Default
Output start address	The start output address of AS01DNET (RTU), occupying one word.	None
Input start address	The start input address of AS01DNET (RTU), occupying one word.	None
When loses DeviceNet connection	AS01DNET (RTU)’s error handling method when AS01DNET (RTU) and DeviceNet master are disconnected. “RTU keep running” and “RTU stop” are for option.	RTU keep running
When IO module error or no reply	AS01DNET (RTU)’s error handling method when an error occurs in any one of I/O modules connected to the right side of AS01DNET (RTU). “RTU keep running” and “RTU stop” are for option.	RTU keep running
Software baud rate	Chooses the extension baud rate of AS01DNET (RTU) after ticking the checkbox of it. The selected baud rate is stored in AS01DNET (RTU) after the download and it will not take effect until the hardware switch of AS01DNET (RTU): DR1 and DR0 are both ON. Refer to Section 11.2.6 for details on function switch.	None
Firmware version	Displays the firmware version of AS01DNET (RTU).	None

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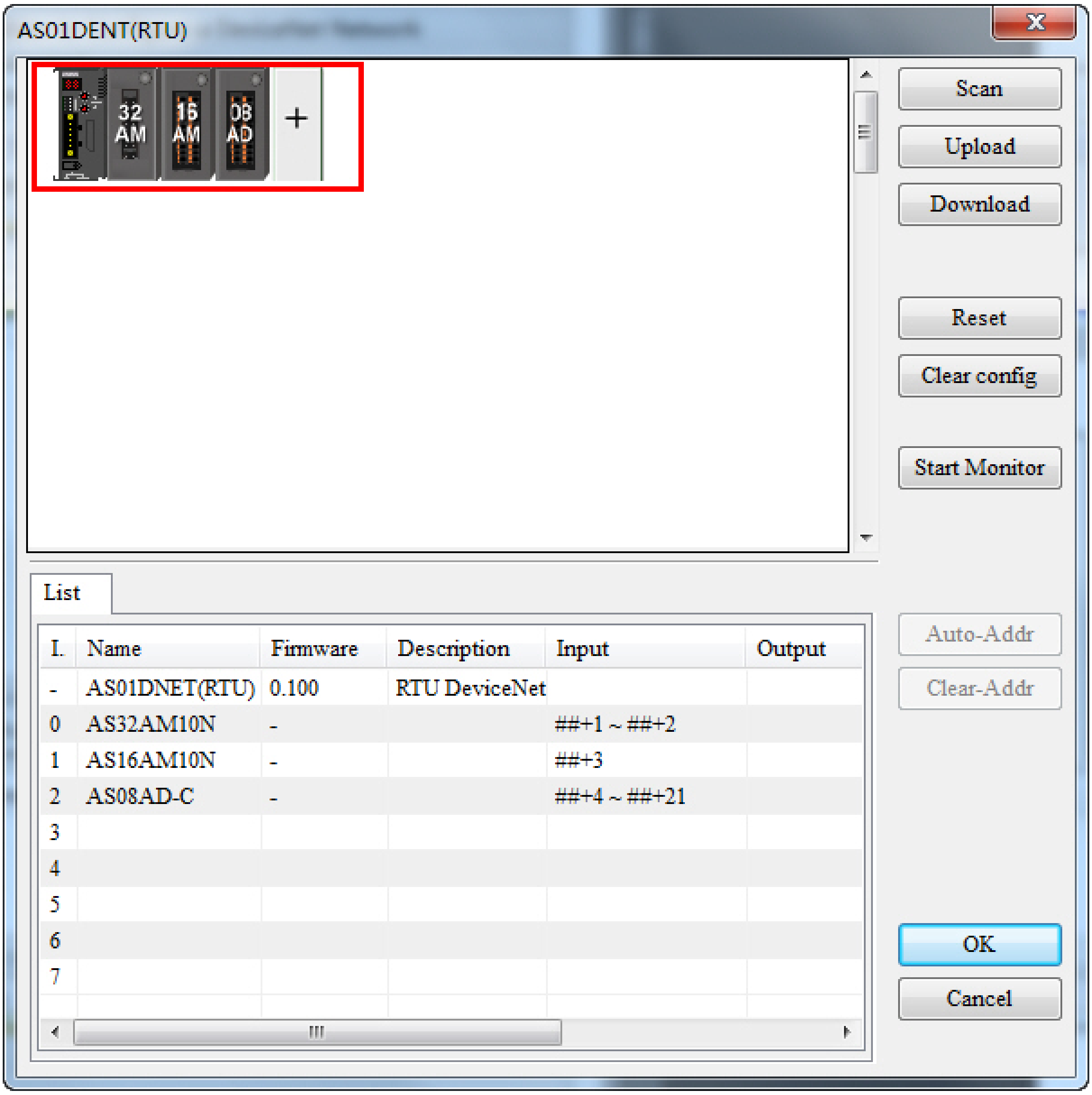
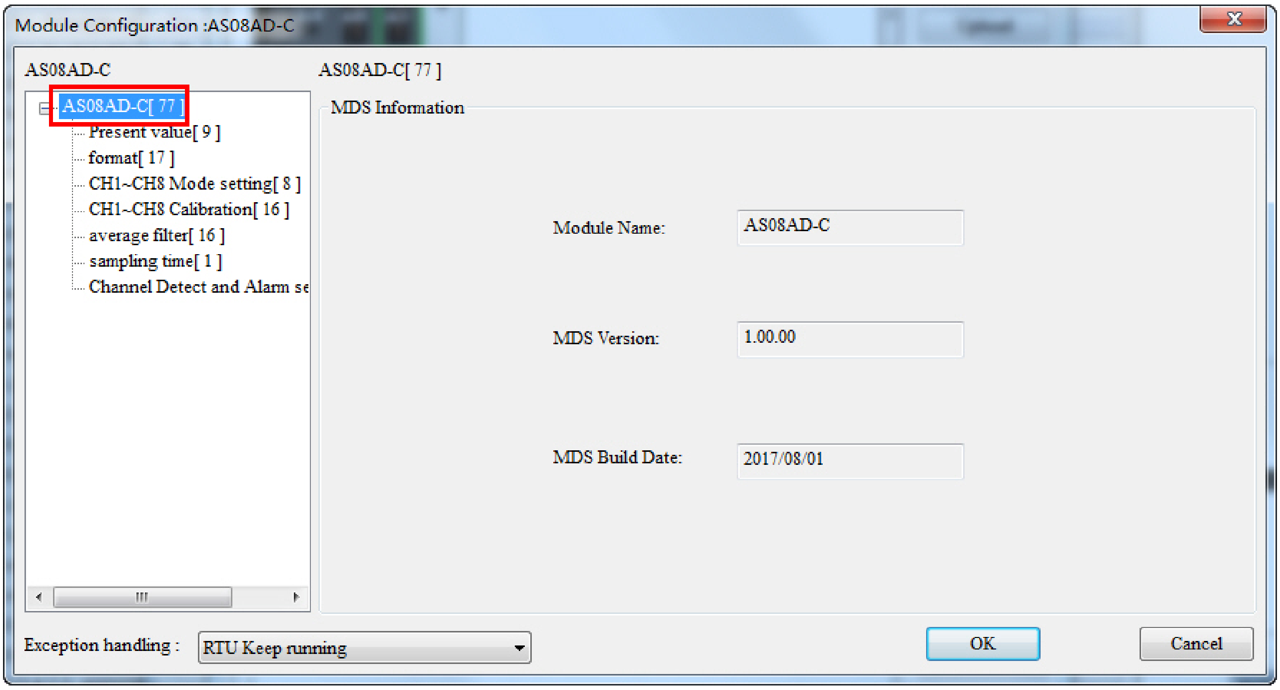
11.5.4.2.4. I/O Module Configuration Page

The mapping parameters of each module can be set through double clicks on the selected I/O module icon on the following interface.



Double click the 08AD icon. Then the AS08AD-C configuration interface appears as below for configuration of parameter mapping of AS08AD-C module.

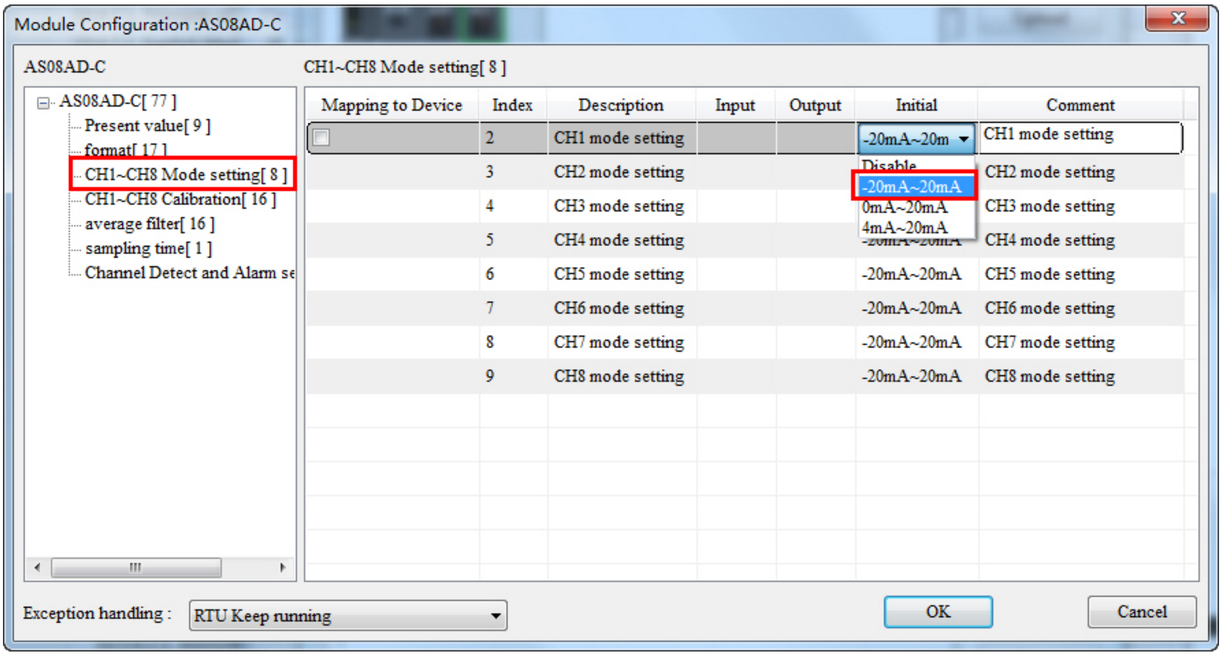


Explanation of I/O module configuration interface:

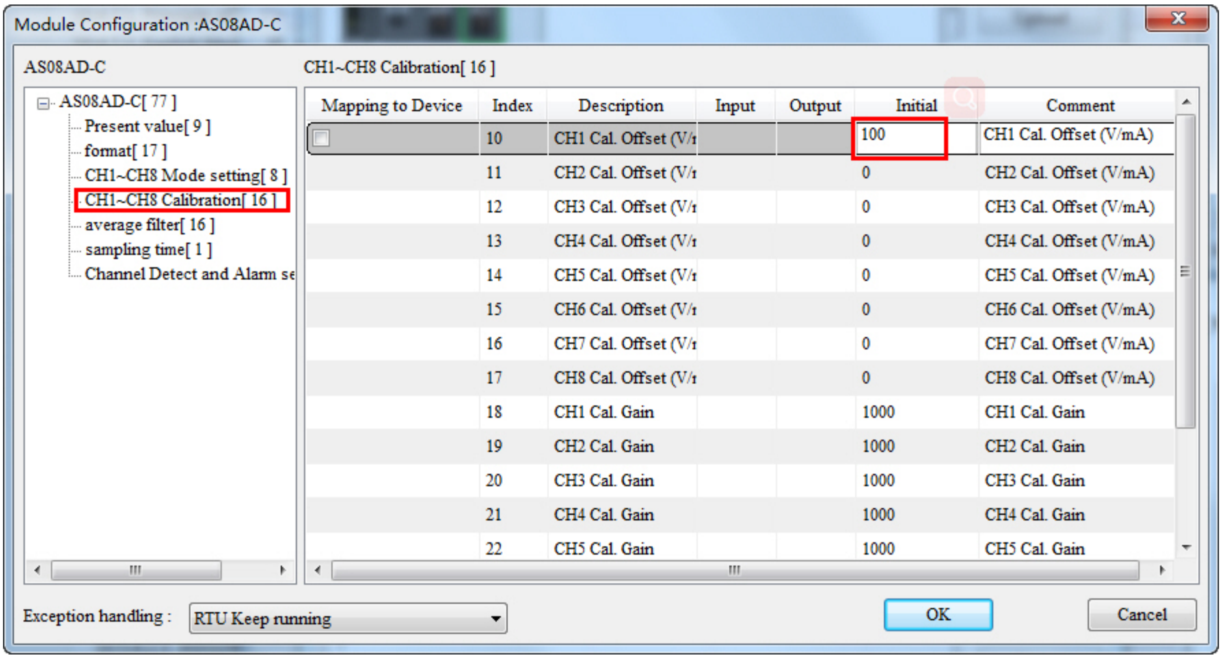
Item	Description
MDS information	Displays module name, MDS version and creation date. The module parameters will be shown in the left-side window based on the MDS file. For explanation of module parameters, refer to the relevant module manual.
I/O parameter list	Displays all module parameters read from the MDS file of the module. Set up these parameters to control the operation of the module.
Exception handling	The error handling of AS01DNET (RTU) when AS01DNET (RTU) detects that an error occurs in the module. “RTU keep running” or “RTU stop” can be selected as the solution to the error.

Generally, the settings for I/O module parameters and device mappings can be made in the following three cases.

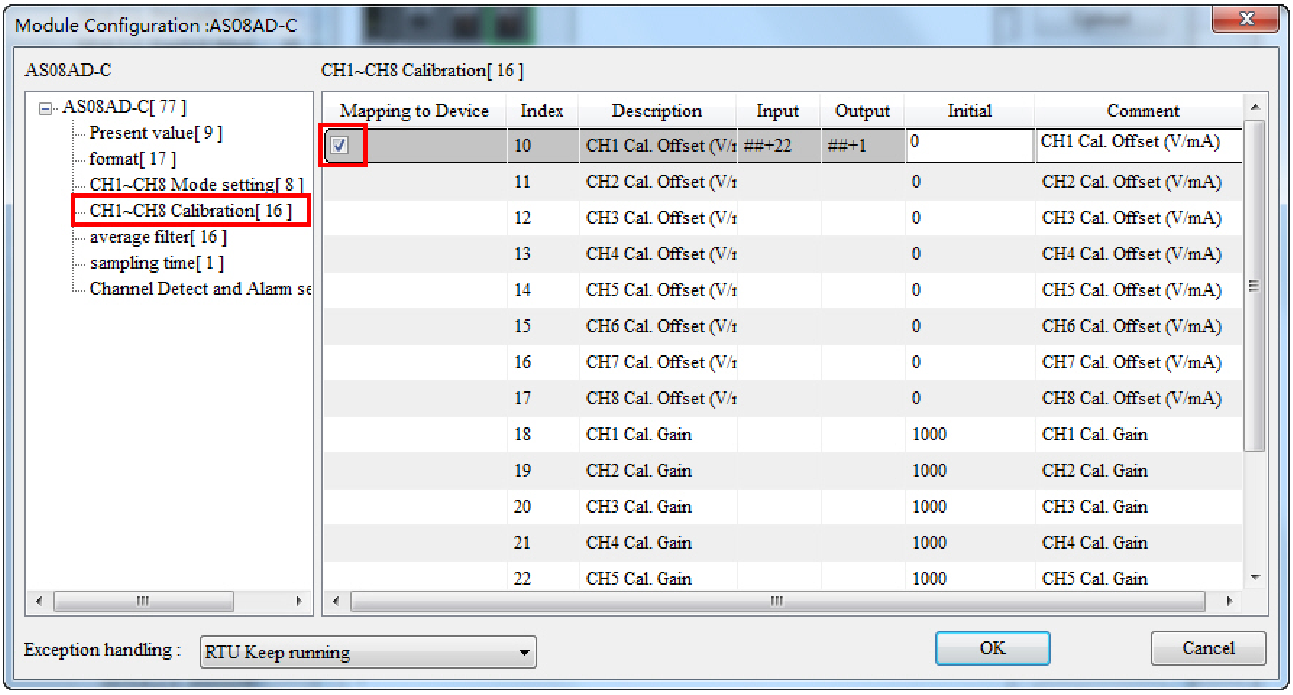
Case 1: Select one appropriate parameter value from the drop-down list in the **Initial** column, e.g. select -20Ma~+20mA as channel 1 input mode of AS08AD-C.



Case 2: Manually enter the value for the parameter to change in the Initial column, e.g. write 100 for CH1 Cal.Offset of AS08AD-C).

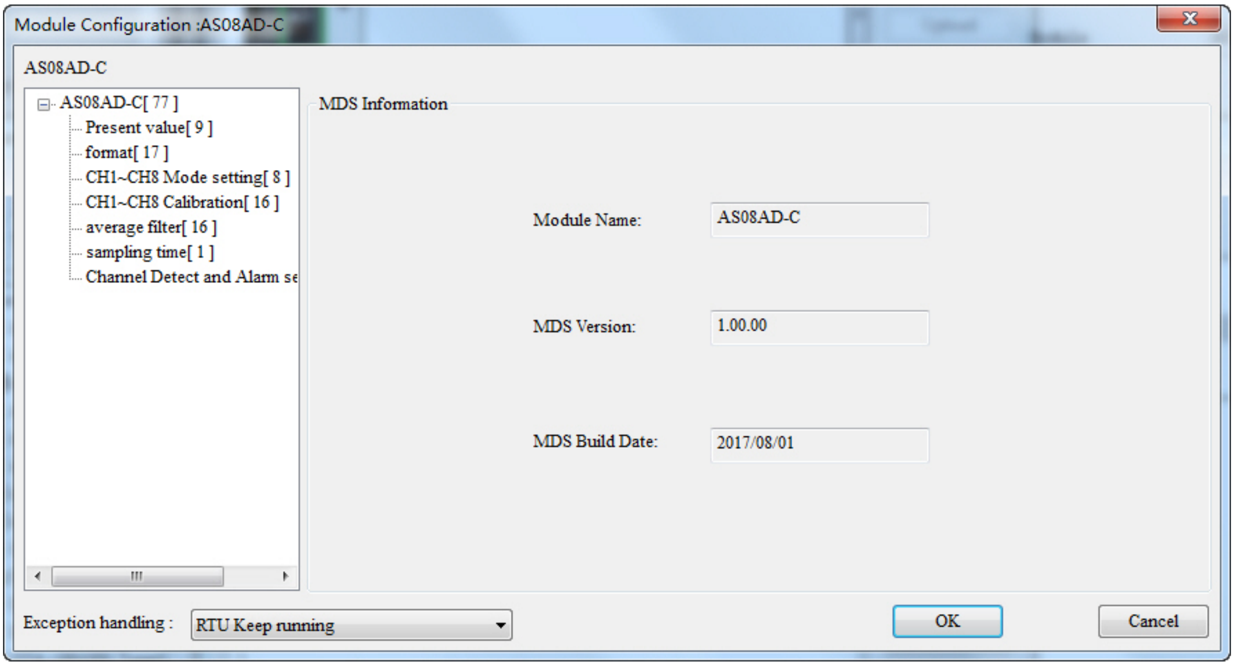


Case 3: For the module parameter which need be monitored in real time or need be modified in its value, tick the desired parameter in the **Mapping to Device** column and then the corresponding value of the parameter will map to the bus data for exchange i.e. the D registers in PLC. After the values of the ticked parameters in the **Mapping to Device** column go to the software monitor page, the current values of parameters can be monitored and modified in real time.

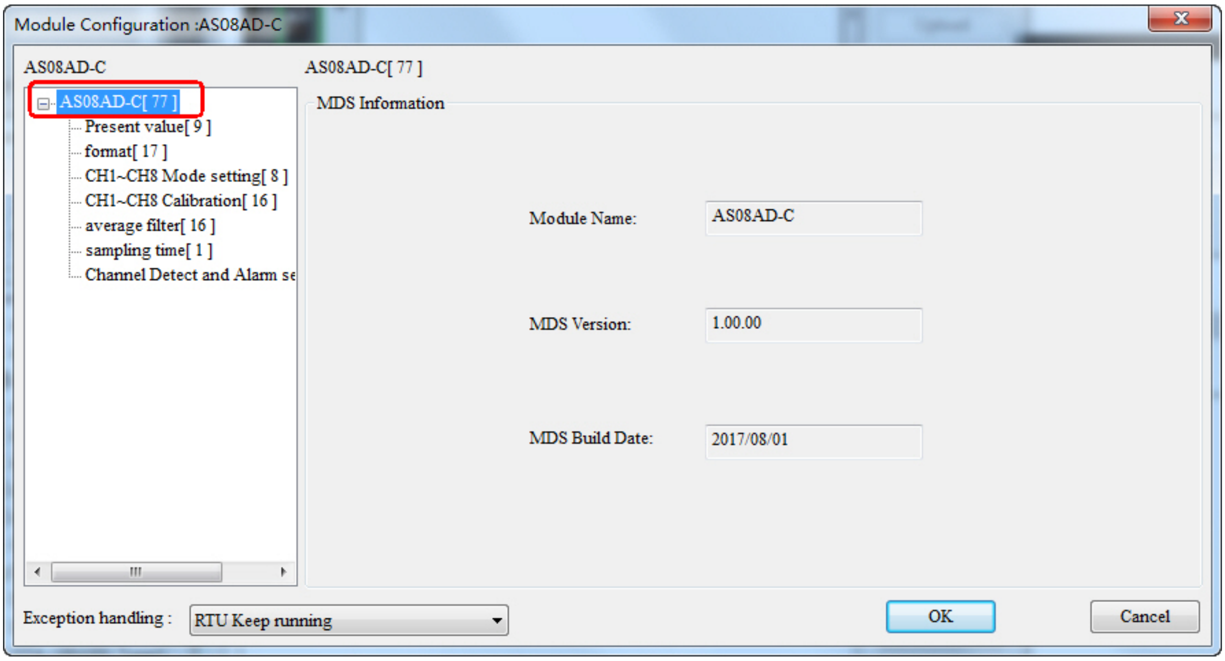


- **Explanation of IO module parameters**

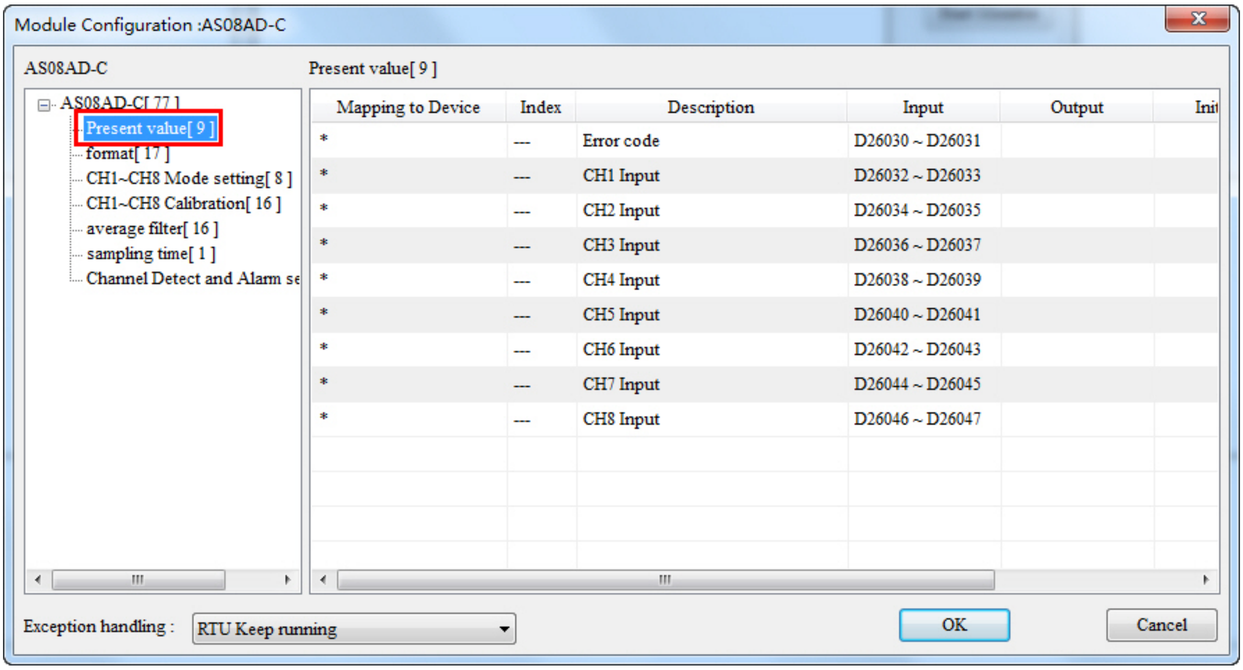
Double click the icon of AS08AD-C module. Then the **Module Configuration: AS08AD-C** dialog box comes out as below.



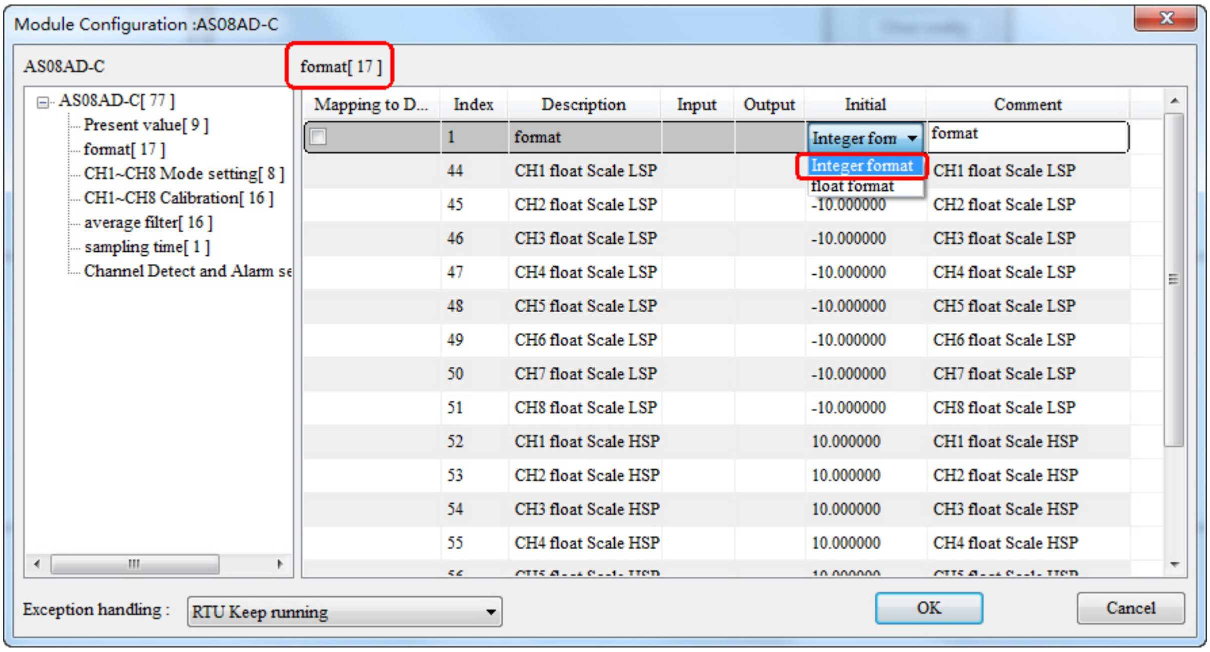
MDS information of AS08AD-C



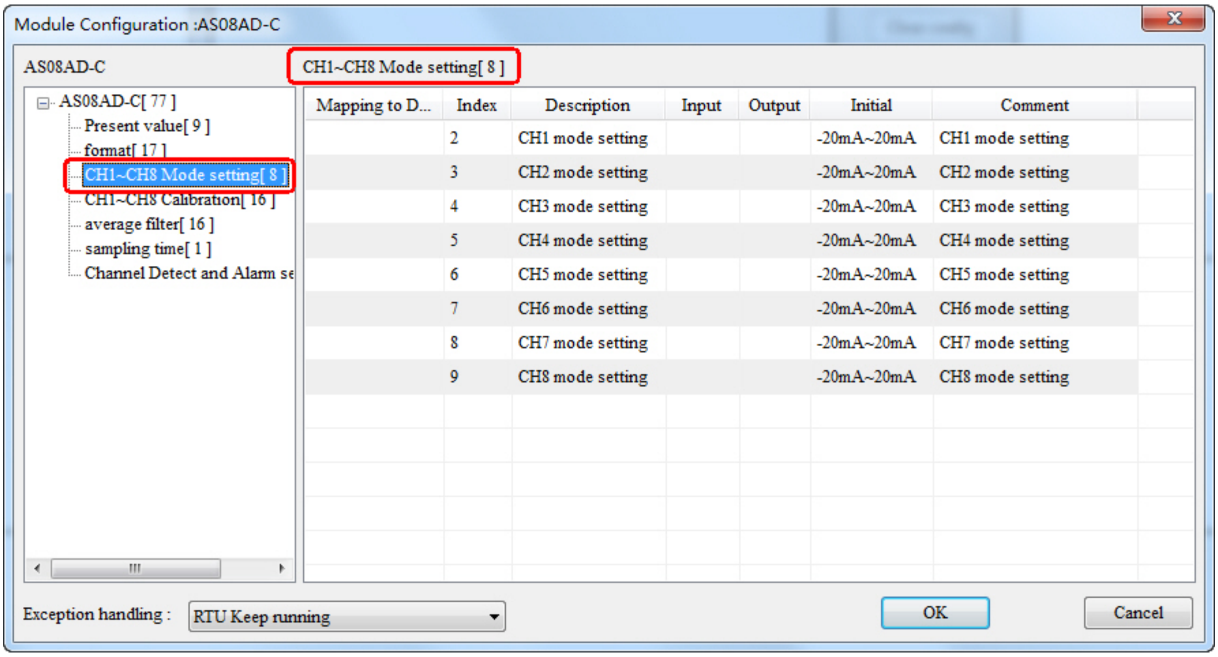
Present value setting



Format setting (Integer format and Float format for option)



CH1~CH8 Mode setting【8】



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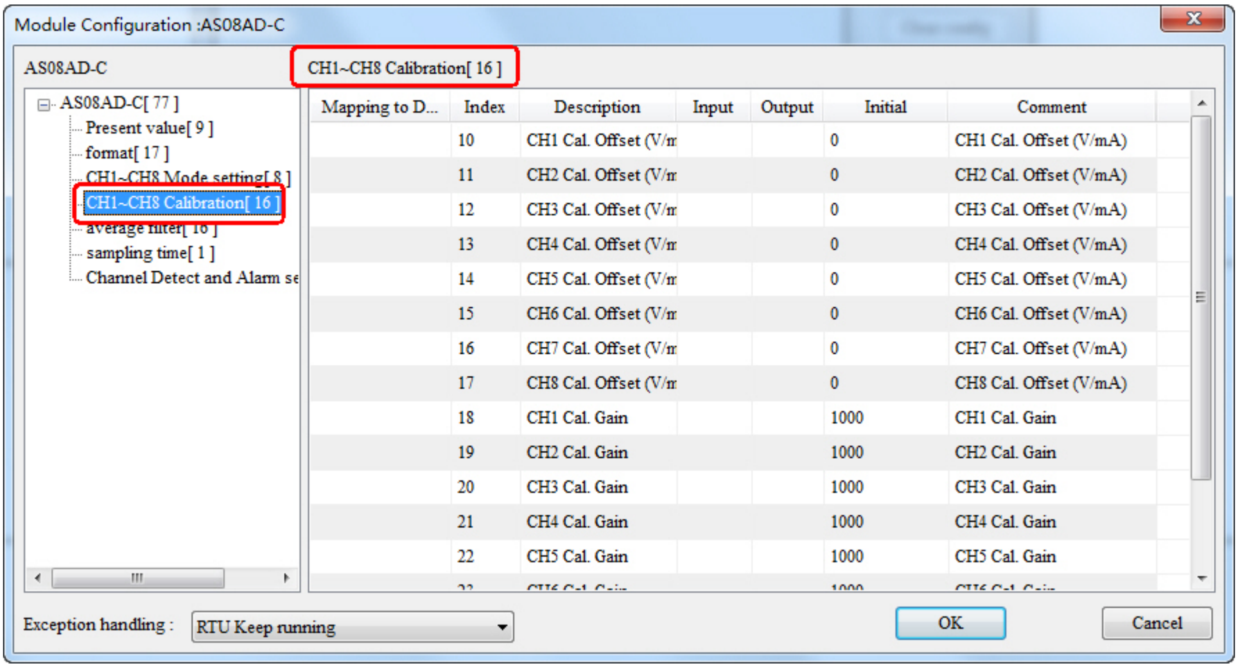
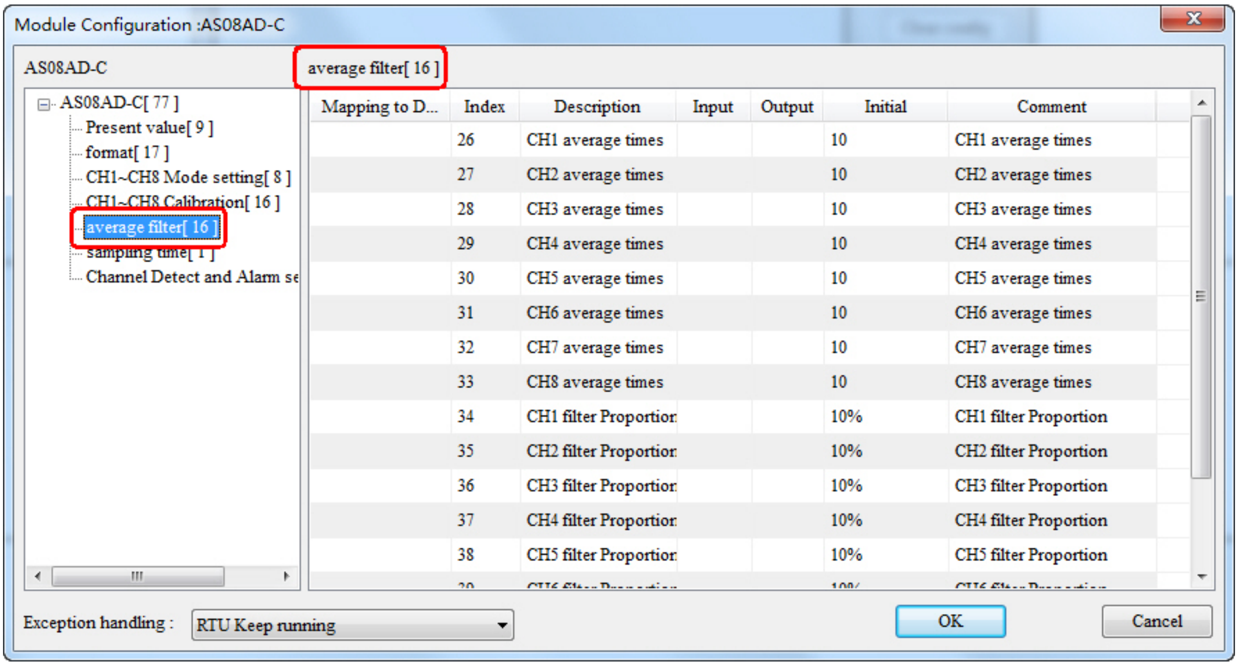
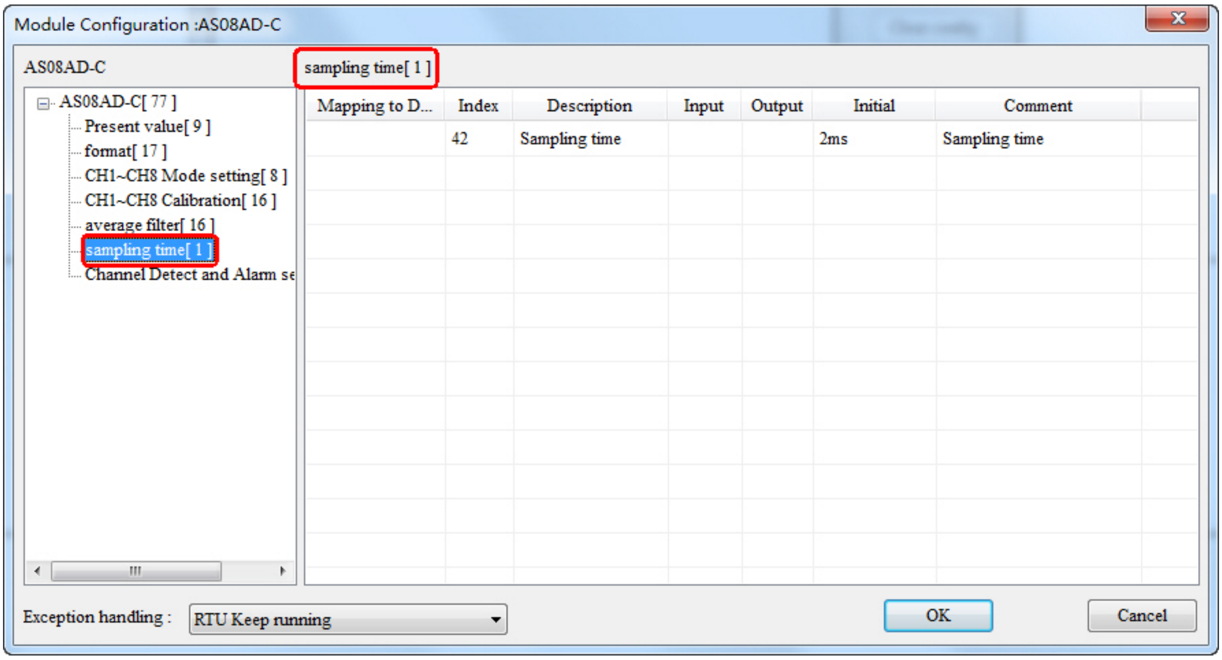
CH1~CH8 Calibration【16】



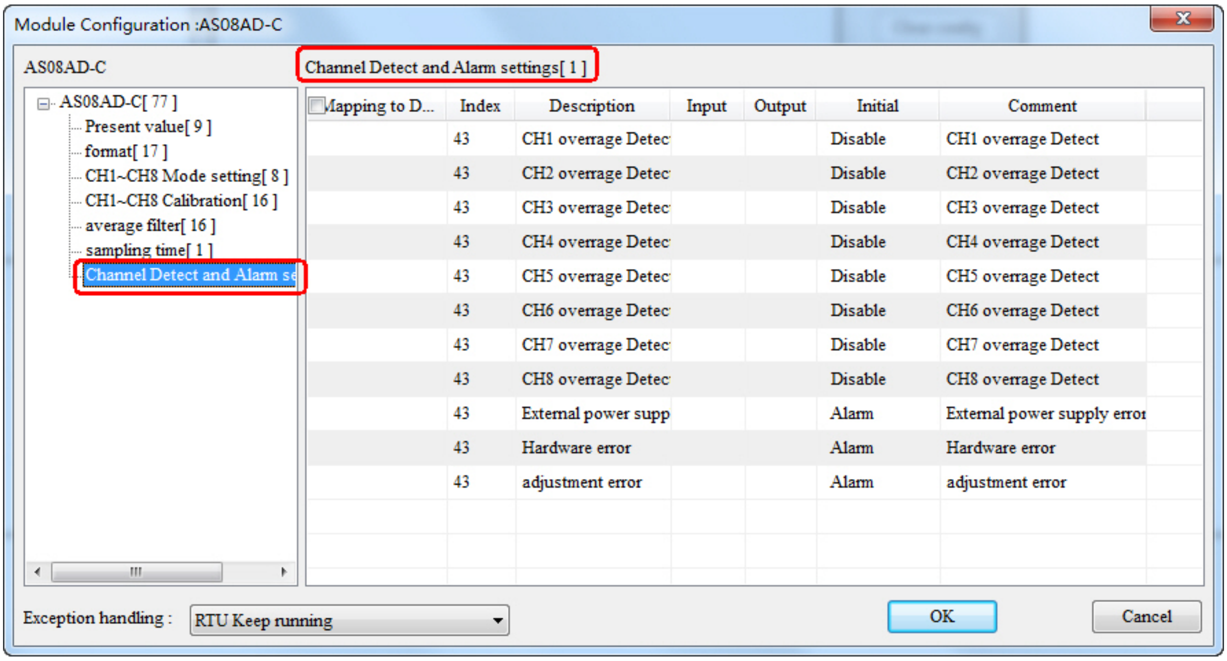
Average filter setting【16】



Sampling time



Channel Detect and Alarm settings



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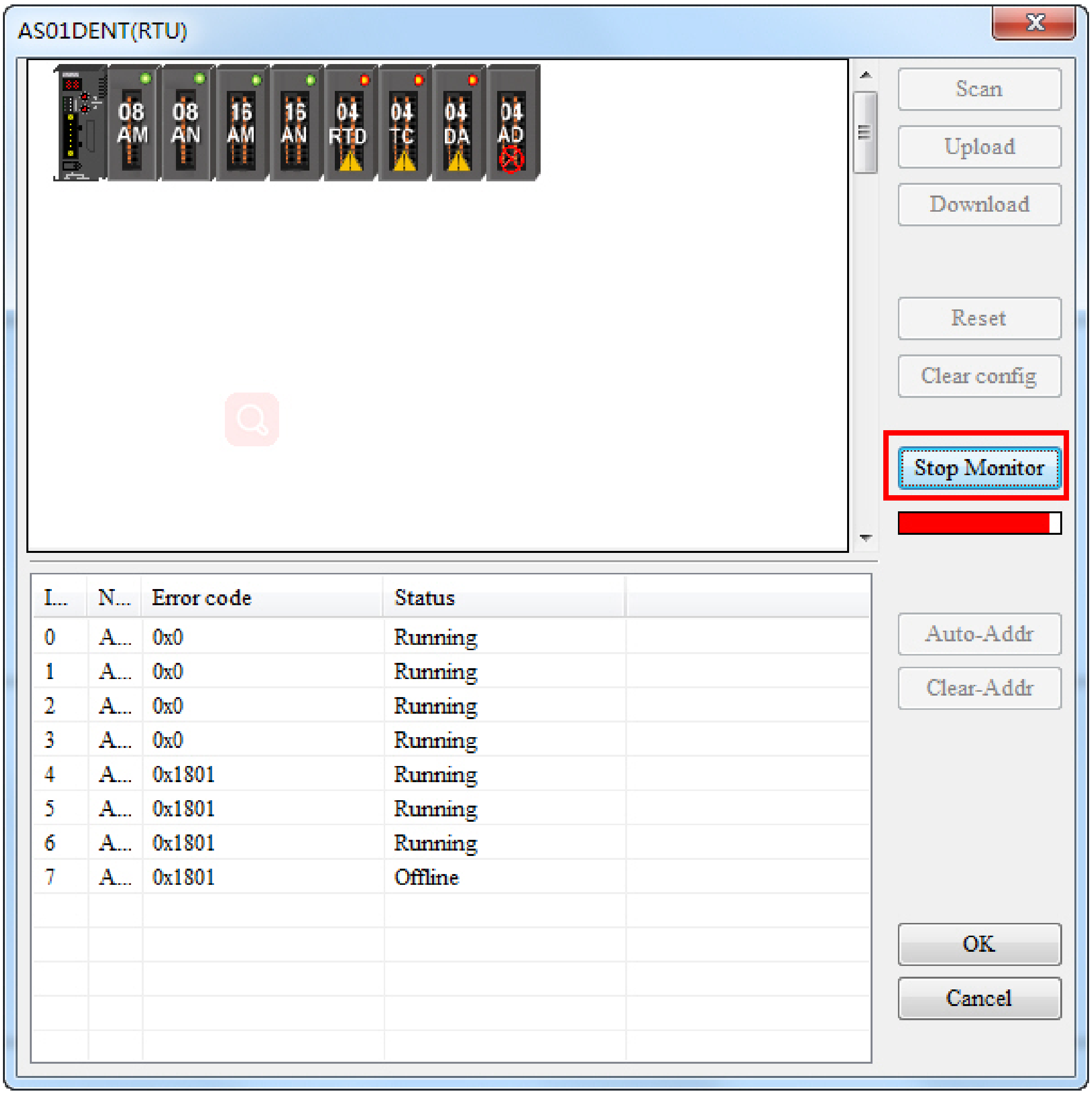
11.5.4.2.5. Monitor Function of the Software

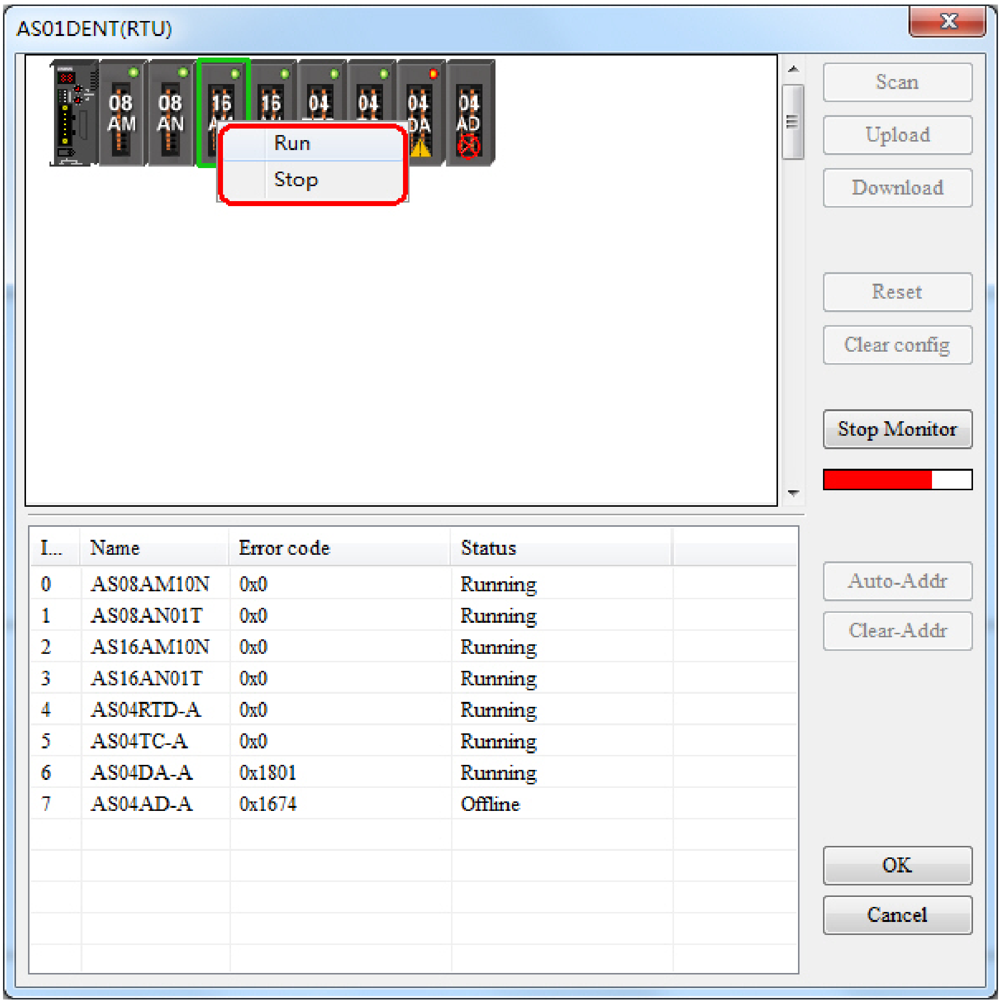
When the software is in online mode and current configuration in AS01DNET (RTU) is the same as that stored in the software, click the **Start Monitor** button to enter the monitor interface and start to monitor the operation states of AS01DNET (RTU) and I/O modules in real time.



The list of operation state of modules:

	Indicates that the module is in the normal operation.
	Indicates that the module is in the Stop state.
	Indicates that the module is in the warning or error state. For details on errors, refer to explanation of error codes in the related product manual.
	Indicates that the actually connected module does not match the module configured in the software or currently configured module has been disconnected.

On the following interface, right click the selected module icon and select RUN or Stop from the drop-down box to change the operation state of the I/O module.



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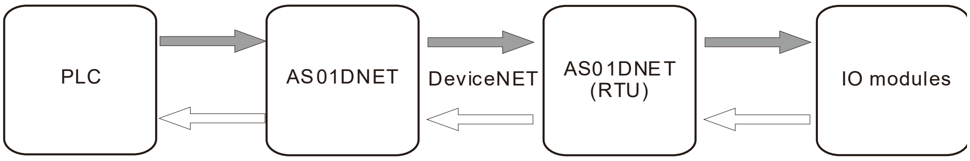
11.5.4.3. DeviceNet Mapping Data

The model of the entire mapping data exchange is displayed below and eventually data will map to the registers in the PLC of the master.

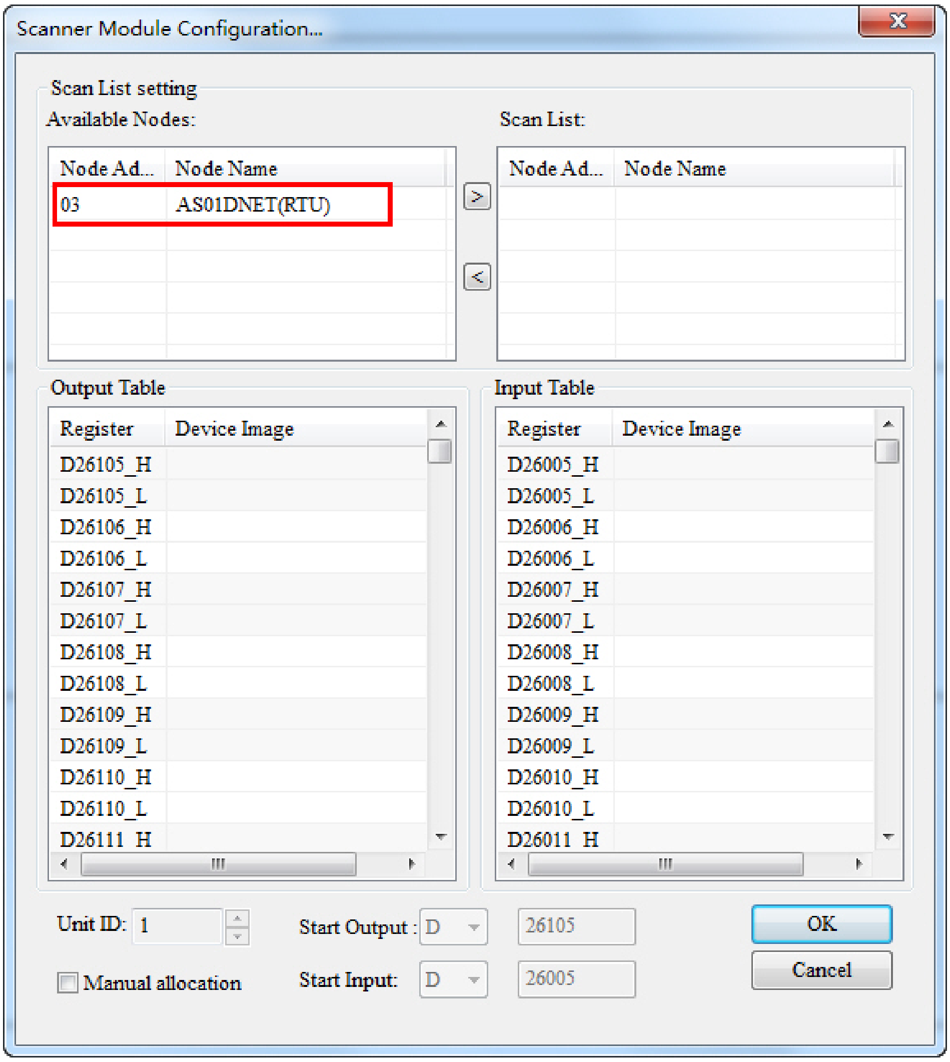


Note: All mapping addresses mentioned below means the D registers in the PLC.

The start input address and start output address of AS01DNET (RTU) are assigned automatically by the master when AS01DNET (RTU) is added to the master. The input mapping address length and output mapping address length of AS01DNET (RTU) are determined by the configuration of modules connected to AS01DNET (RTU).

The start input and output mapping addresses of one I/O module are assigned automatically by the software. Its input mapping address length and output mapping address length are determined by the configuration of the module. The range of input / output mapping address is limited by the input / output mapping address range of AS01DNET (RTU).

11.5.4.3.1. The Rule for Assignment of Mapping Addresses by AS01DNET Master



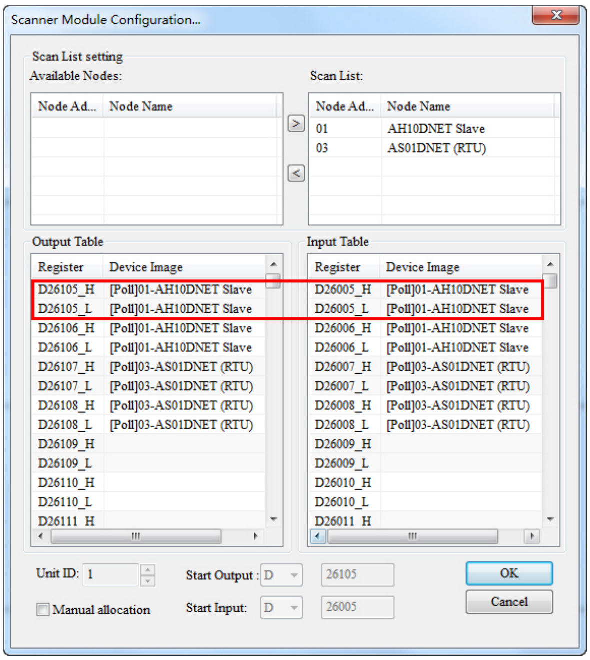
Data mapping areas are assigned according to the following table.

Input area: Slave ⇨ Master			Output area: Master ⇨ Slave		
Register in AS PLC	**Purpose**	**Data size**	**Register in AS PLC**	**Purpose**	**Data size**
D26000~D26003	Scan-list node state indication area	4 words	D26100~D26103	Bit-strobe command area	4 words
D26004	Scanner module state indication area	1 word	D26104	Reserved	1 word
D26005~D26099	DeviceNet input data area; for receiving state data back from slaves	95words	D26105~D26199	DeviceNet output area; the data in the registers will be sent to slaves as control data.	95 words

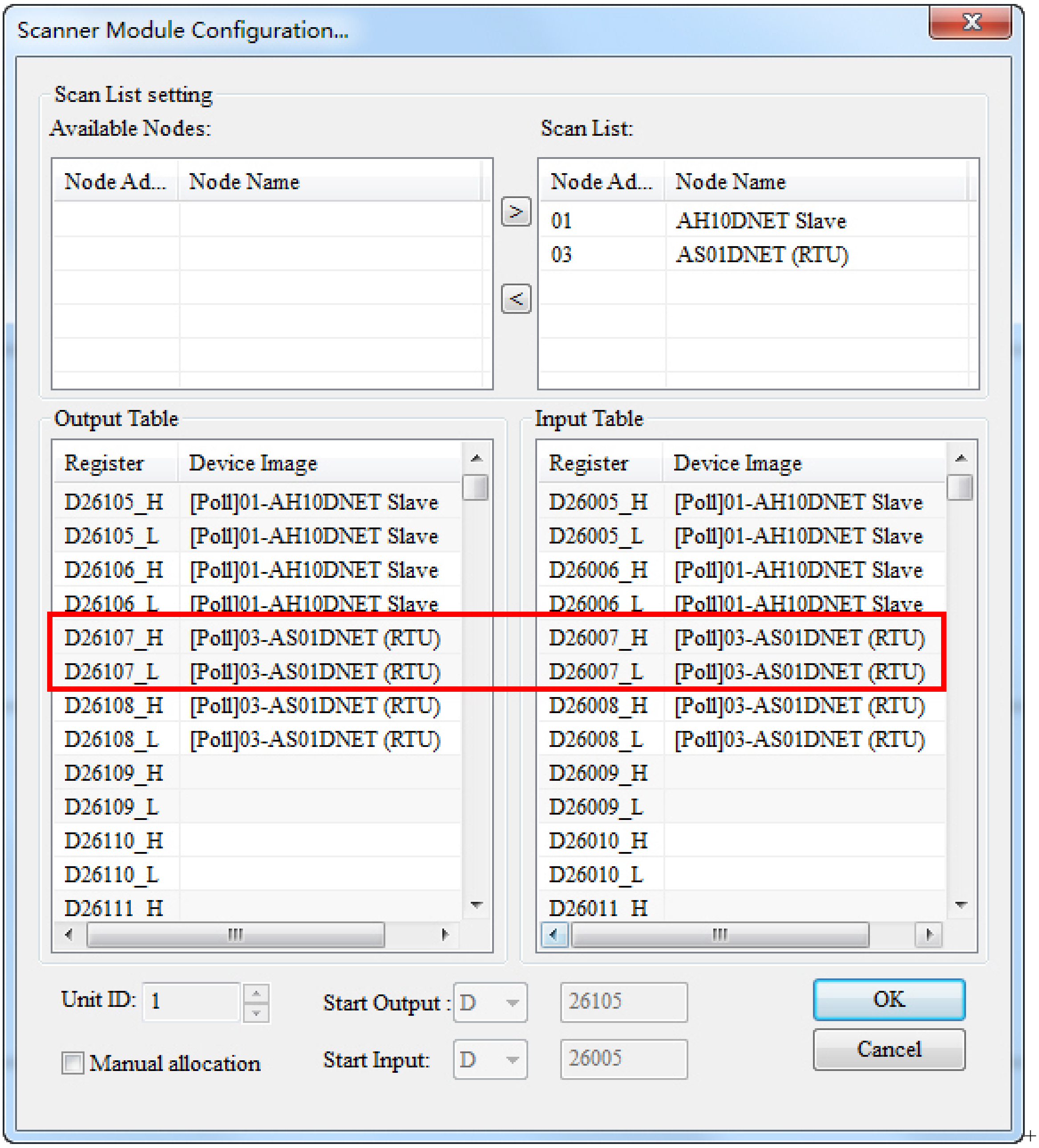
11.5.4.3.2. The Rule for Assignment of Mapping Addresses for AS01DNET (RTU)

The start input and start output mapping addresses of AS01DNET (RTU) are assigned automatically by the master when AS01DNET (RTU) is added to the master. The master assigns mapping addresses of AS01DNET (RTU) according to input mapping address length and output mapping address length. Input mapping address length and output mapping address length are determined by the configuration parameters of all modules connected to AS01DNET (RTU). The start addresses of AS01DNET (RTU) will not be assigned until AS01DNET (RTU) is added to the master and they are related to the order of adding slaves to the master.

When there are two slaves of AH10DNET and AS01DNET (RTU), the input size and output size of AH10DNET are both 4 bytes and the input size and output size of AS01DNET (RTU) are both 4 bytes. If AS01DNET (RTU) is added to the master before AH10DNET is added to the master, then the input mapping addresses and output mapping addresses of AS01DNET (RTU) are respectively D26005~D26006 and D26105~D26106 as below. D26005 and D26105 are respectively the start input mapping address and start output mapping address, i.e. status word and control word of AS01DNET (RTU). The registers after start input mapping address and start output mapping address are for mapping the configuration parameters of I/O modules.



If AS01DNET (RTU) is added to the master after AH10DNET is added to the master, then the input mapping addresses and output mapping addresses of AS01DNET (RTU) are respectively D26007~D26008 and D26107~D26108 as below. D26007 and D26107 are respectively the start input mapping address and start output mapping address, i.e. status word and control word of AS01DNET (RTU). The registers after start input mapping address and start output mapping address are for mapping the configuration parameters of I/O modules.

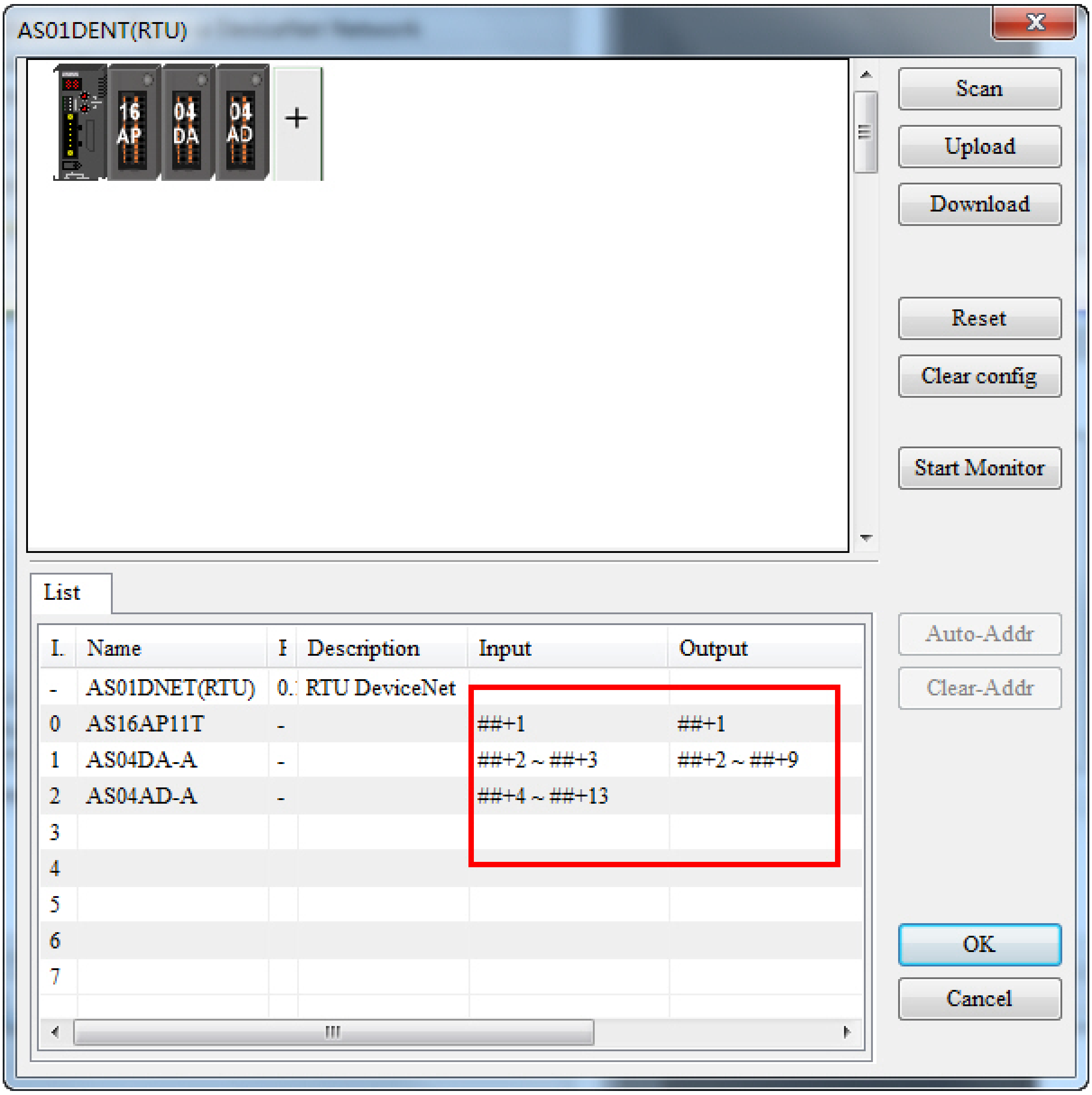


11.5.4.3.3. The Rule for Assignment of Mapping Addresses for I/O Modules

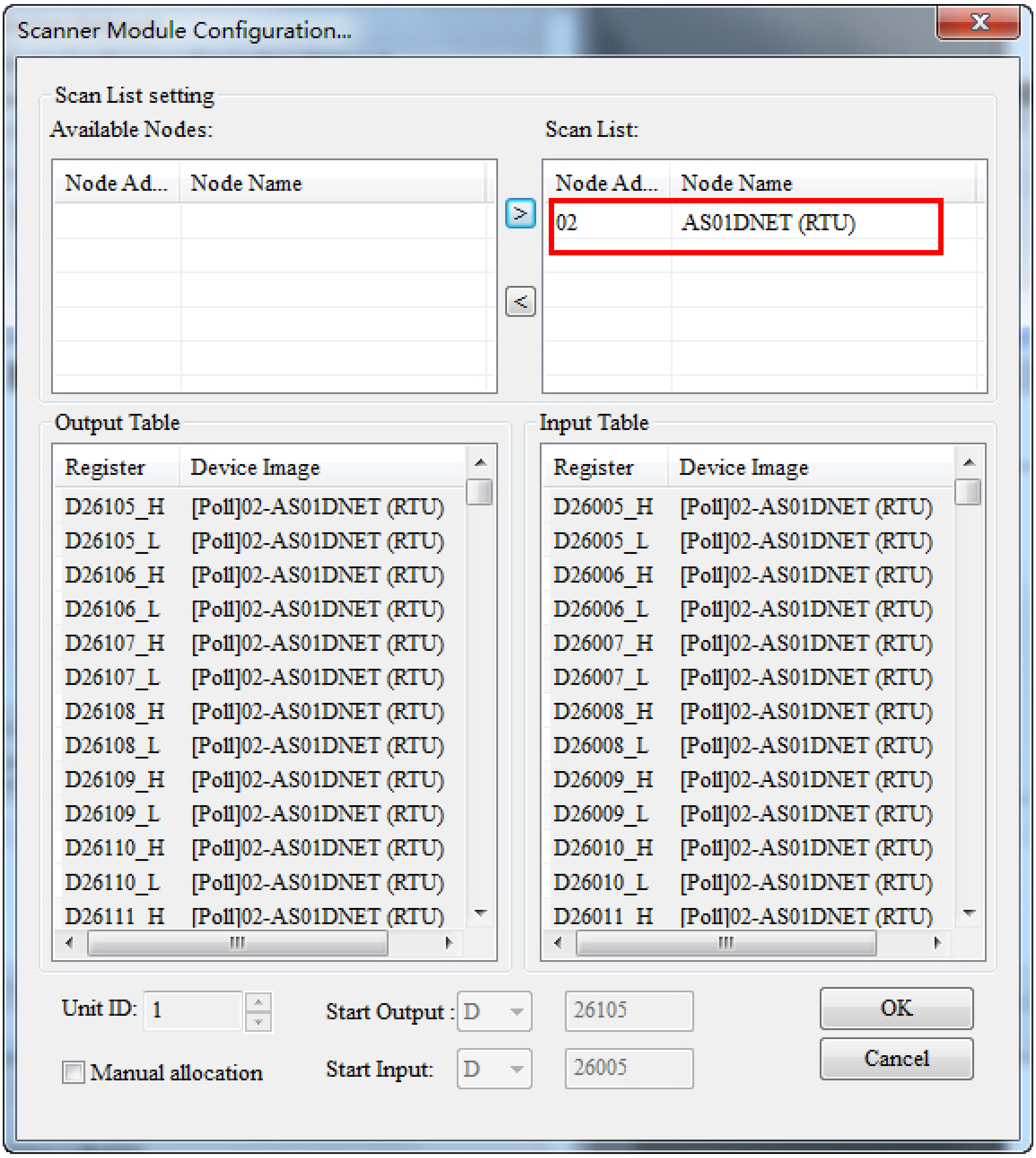
Each module has two forms of data mapping. When DeviceNet master has not assigned the start input mapping address and start output mapping address to AS01DNET (RTU), the contents in **Input** and **Output** in the following figure represent offsets based on start input or start output mapping address of AS01DNET (RTU). After DeviceNet master has assigned the start input mapping address and start output mapping address to AS01DNET (RTU), the contents in **Input** and **Output** in the following figure represent mapping addresses of parameters in the modules on the right of AS01DNET (RTU).

When AS01DNET (RTU) is added to **Scan List** on the page of **Scanner Module Configuration…**, DeviceNet master assigns start input and output mapping addresses to AS01DNET (RTU). When AS01DNET (RTU) is removed from **Scan List** on the page of **Scanner Module Configuration…**, the start input and start output mapping addresses of AS01DNET (RTU) are unknown.

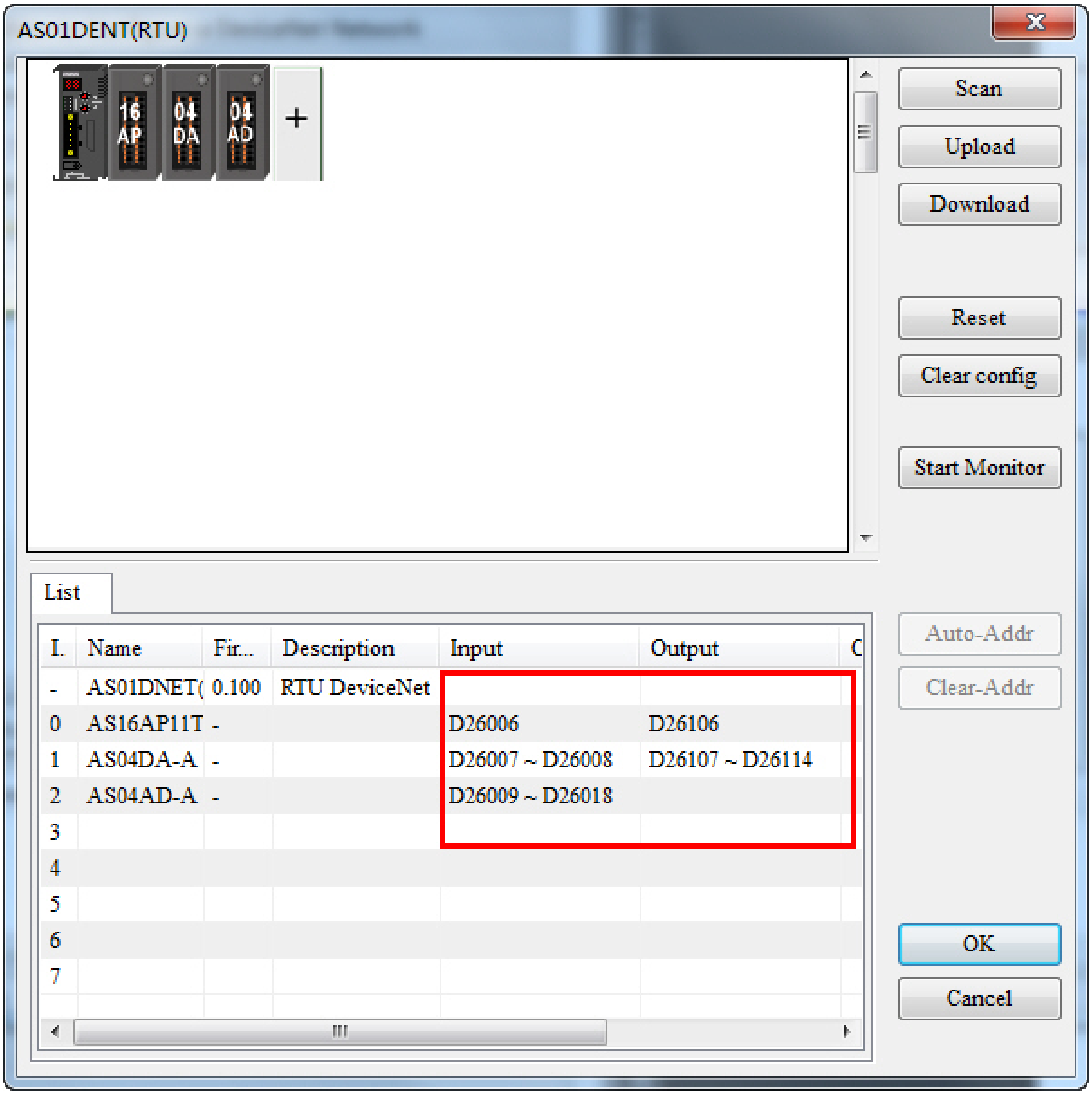
Before the master assigns mapping addresses to AS01DNET (RTU), the device mappings of modules connected to the right side of AS01DNET (RTU) are displayed as below.



After AS01DNET (RTU) is pulled into **Scan List**, the mapping addresses that the master assigns to AS01DNET (RTU) are shown as below.



After the master assigns mapping addresses to AS01DNET (RTU), the mapping devices of the modules connected to the right side of AS01DNET (RTU) are shown as below.



The software automatically assigns mapping addresses of module parameters in the arrangement order of modules connected to the right side of AS01DNET (RTU) from left to right.

Below is the table of configuration of one master AS01DNET and one slave AS01DNET (RTU) and mapping addresses that the software automatically assigns to each module. D26005 and D26105 are the control word and status word of AS01DNET (RTU).The input mapping address and output mapping address of AS16AP are D26006 and D26106 respectively. The input mapping addresses and output mapping addresses of AS04DA are D26007~D26008 and D26107~D26114 respectively. The input mapping addresses of AS04AD are D26009~D26018.

Auto Assignment	Input	Output
AS01DNET(RTU)	D26005 status word	D26105 control word
AS16AP	D26006	D26106
AS04DA	D26007~D26008	D26107~D26114
AS04AD	D26009~D26018	

The input and output mapping addresses of AS01DNET (RTU) are D26005~D26018 and D26105~D26114.

11.5.4.3.4. Status Word and Control Word of AS01DNET (RTU)

The start input address and start output address in the mapping areas of AS01DNET (RTU) are used as the status word and control word of AS01DNET (RTU) respectively with the detailed explanation in the following table.

- **Control word of AS01DNET(RTU)**

Bit	Status value	Description
bit0 ~ bit2	000	Make no control setting for the operation of AS01DNET(RTU)
	001	Set AS01DNET(RTU) to RUN mode
	010	Set AS01DNET(RTU) to STOP mode
	Other	Reserved
bit3	0	Reserved
	1	Restart AS01DNET (RTU)
bit4	0/1	Reserved
bit5	0/1	Reserved
bit6	0/1	Reserved
bit7	0/1	Reserved
bit8	0/1	Reserved
bit9	0/1	Reserved
bit10	0/1	Reserved
bit11	0/1	Reserved
bit12	0/1	Reserved
bit13	0/1	Reserved
bit14	0/1	Reserved
bit15	0/1	Reserved

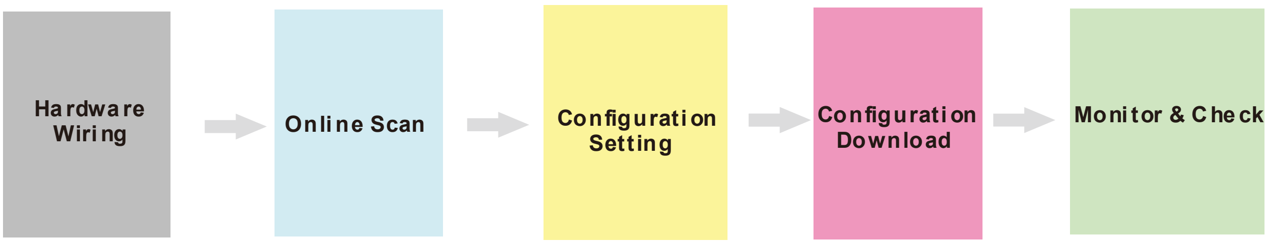
- **Status word of AS01DNET(RTU)**

Bit	Status value	Description
bit0	0	AS01DNET (RTU) in RUN state
	1	AS01DNET (RTU) stops.
bit1	0/1	Reserved
bit2	0	No error occurs in I/O modules.
	1	An error occurs in I/O modules.
bit3	0/1	Reserved
bit4	0	Current connection matches the configuration.
	1	Current connection is inconsistent with the configuration.
bit5	0	AS01DNET (RTU) works normally.
	1	The voltage of the power supply for AS01DNET (RTU) is too low.
bit6	0/1	Reserved
bit7	0	AS01DNET (RTU) works normally.
	1	The number of points/ modules exceeds allowed range.
bit8	0/1	Reserved
bit9	0/1	Reserved
bit10	0/1	Reserved
bit11	0/1	Reserved
bit12	0/1	Reserved

Bit	Status value	Description
bit13	0/1	Reserved
bit14	0/1	Reserved
bit15	0/1	Reserved

11.5.4.4. Connecting AS01DNET (RTU) to the Network

To configure AS01DNET (RTU) successfully and make it work normally in the network, the following steps should be taken for the setup.



- **Hardware wiring**

During hardware wiring, notice that the standard cable should be used and two terminal resistors of 121Ω should be connected respectively to the two ends of the main line in the DeviceNet network. The node IDs of all nodes in the network bus can not be repeated and their baud rates should be consistent.

- **Online scan**

The online scan consists of two parts: scanning online network nodes and scanning I/O modules of AS01DNET (RTU). Before the scan, make sure that the communication channel selected is proper and the communication setup is normal in the communication manager COMMGR.

- **Configuration setting**

The configuration setting includes the master configuration and AS01DNET (RTU) configuration settings. The master configuration contains the master scanner module setting (configuration of master) and the scan list configuration setting. AS01DNET (RTU) configuration contains AS01DNET (RTU) setting and other I/O modules setting.

- **Configuration Download**

Configuration download consists of master configuration download and AS01DNET (RTU) configuration download. During the master configuration download, the seven-segment displayer of AS01DNET (RTU) shows 80 and its node ID alternately. During the AS01DNET (RTU) configuration download, the seven-segment displayer of AS01DNET (RTU) shows 83 and its node ID alternately.

- **Monitor and Check**

After the configuration is downloaded, check if AS01DNET (RTU) works normally. If AS01DNET (RTU) works normally, the digital displayers of the master and AS01DNET (RTU) show their own node IDs and MS and NS indicators are ON in green.

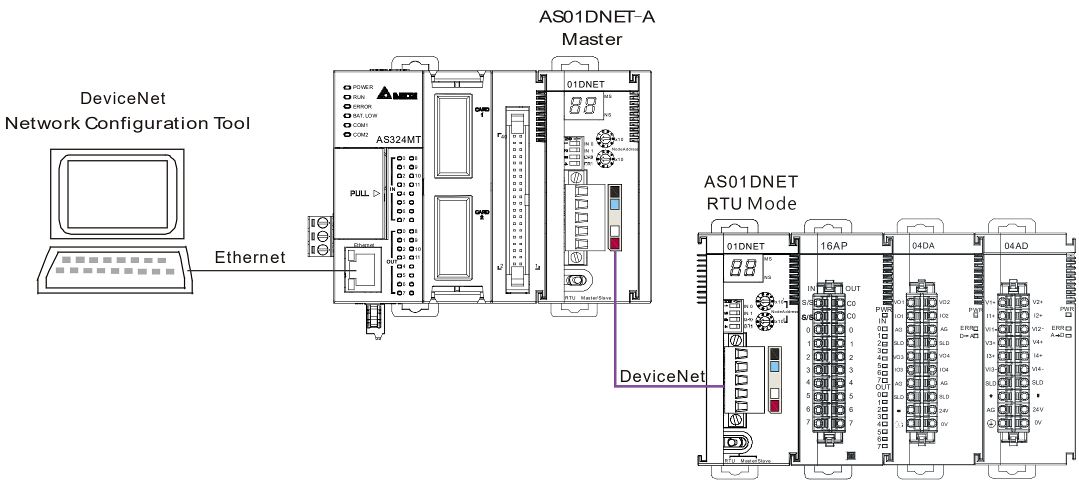
11.5.5 Application Example

This section describes how to configure AS01DNET (RTU) and its right-side I/O module parameters in the DeviceNet Builder software through an application example. And how the parameters of the I/O modules connected to the right side of AS01DNET (RTU) are controlled and accessed through AS01DNET master is illustrated as well.

Control Requirement:

1. Connect the output point of AS16AP to the input point; turn on the output point to make the input point ON.
2. Write one value for channel 1 of AS04DA to change into analog signal and then convert the analog signal to digital signal to output via AS04AD.

11.5.5.1. Network Structure



Note:

1. During the wiring, connect the voltage output of channel 1 of AS04DA to the voltage input of channel 1 of AS04AD. And add the 24 V power to AS04DA and AS04AD respectively.
2. Make sure that the baud rates of AS01DNET and AS01DNET (RTU) match.

Module	Node ID	Baud rate
AS01DNET	0	500Kbps
AS01DNET(RTU)	2	500Kbps

3. Connect the 24V network power module between V+ and V- and a terminal resistor of 121Ω between CAN_H and CAN_L.

11.5.5.2. Using DeviceNet Builder to Configure the Network

11.5.5.2.1. Building and Starting up Driver1 via COMMGR

Build driver1 in the COMMGR software.

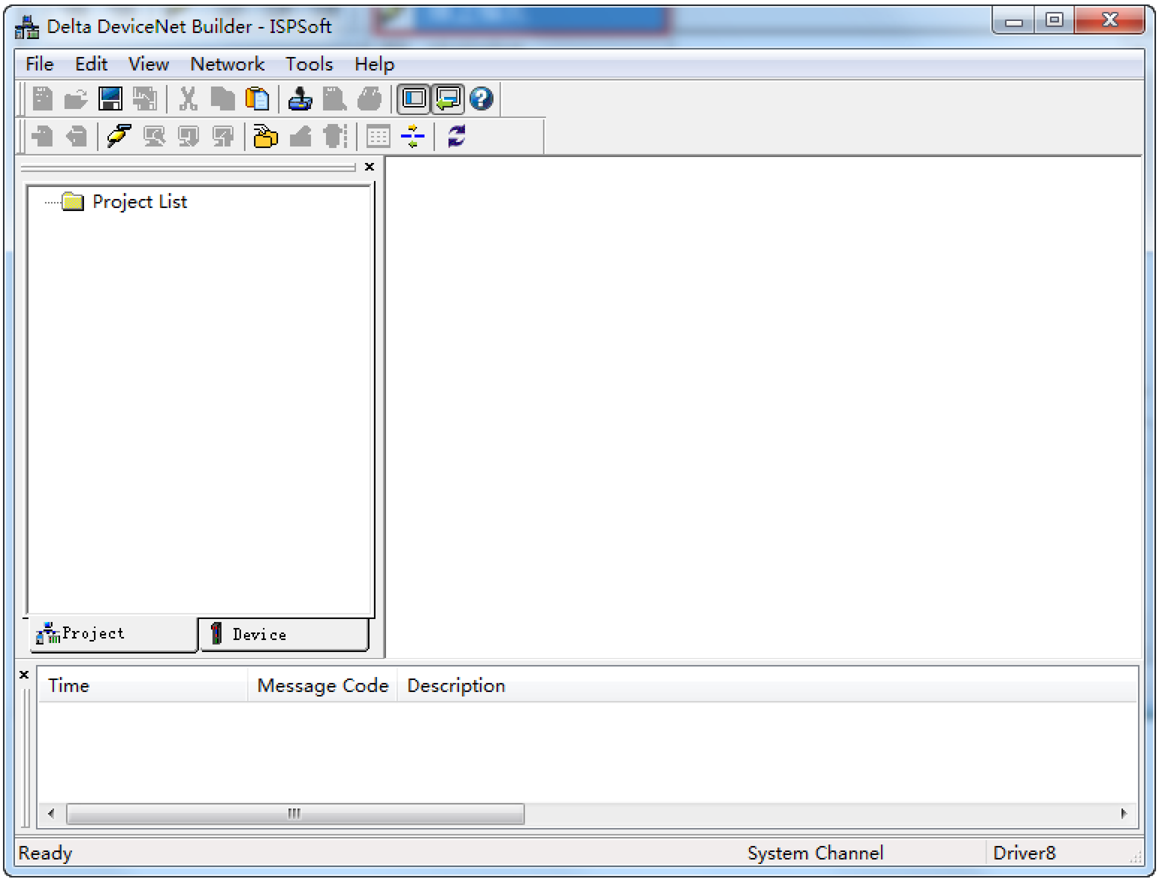
Refer to Section 2.4 Communication Setting in the ISPSoft User Manual for more details.

11.5.5.2.2. Configuring AS01DNET (RTU)

1. Call DeviceNet Builder via ISPSoft.

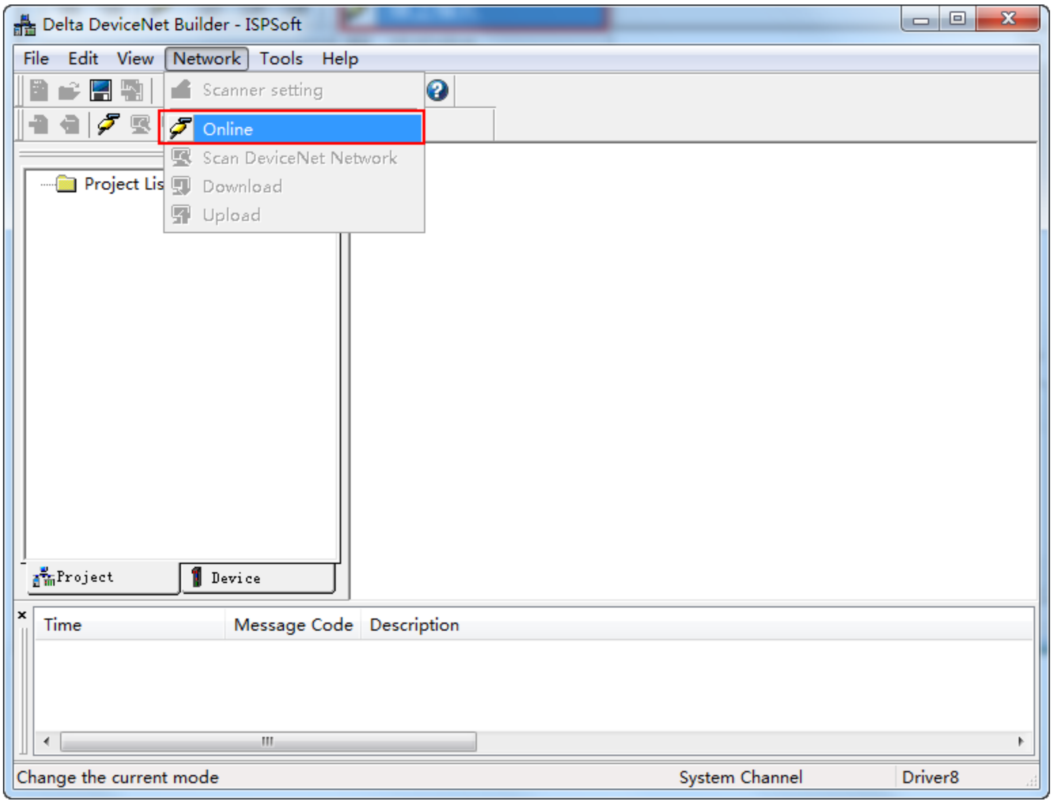
   Refer to Section 11.6 for details on the operation.

2. The called DeviceNet Builder is started as below.

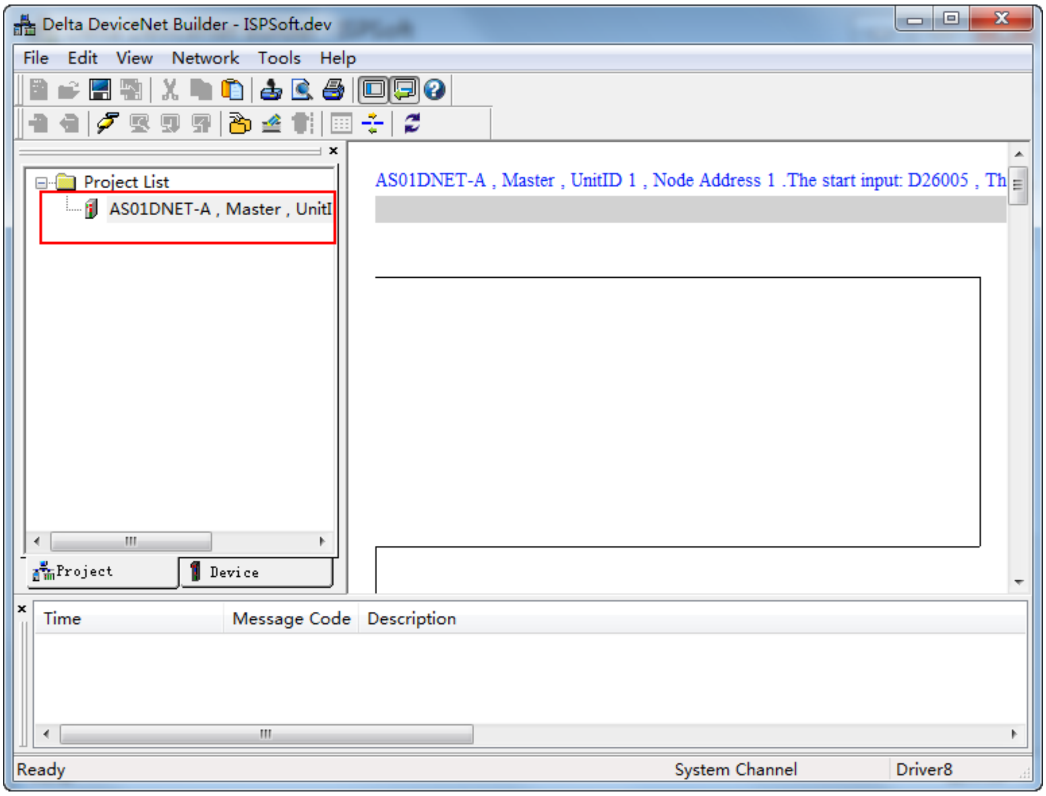


11

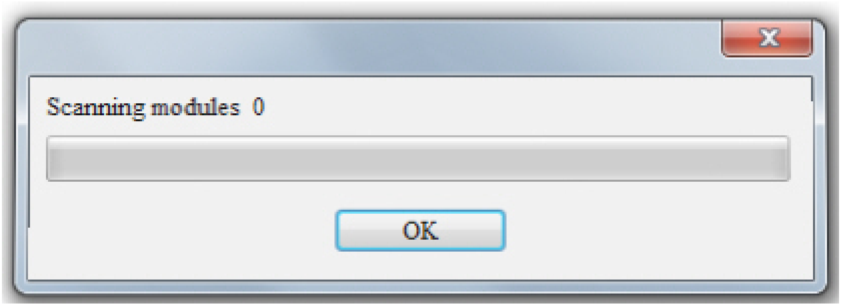
3. Click menu **Network>> Online**.



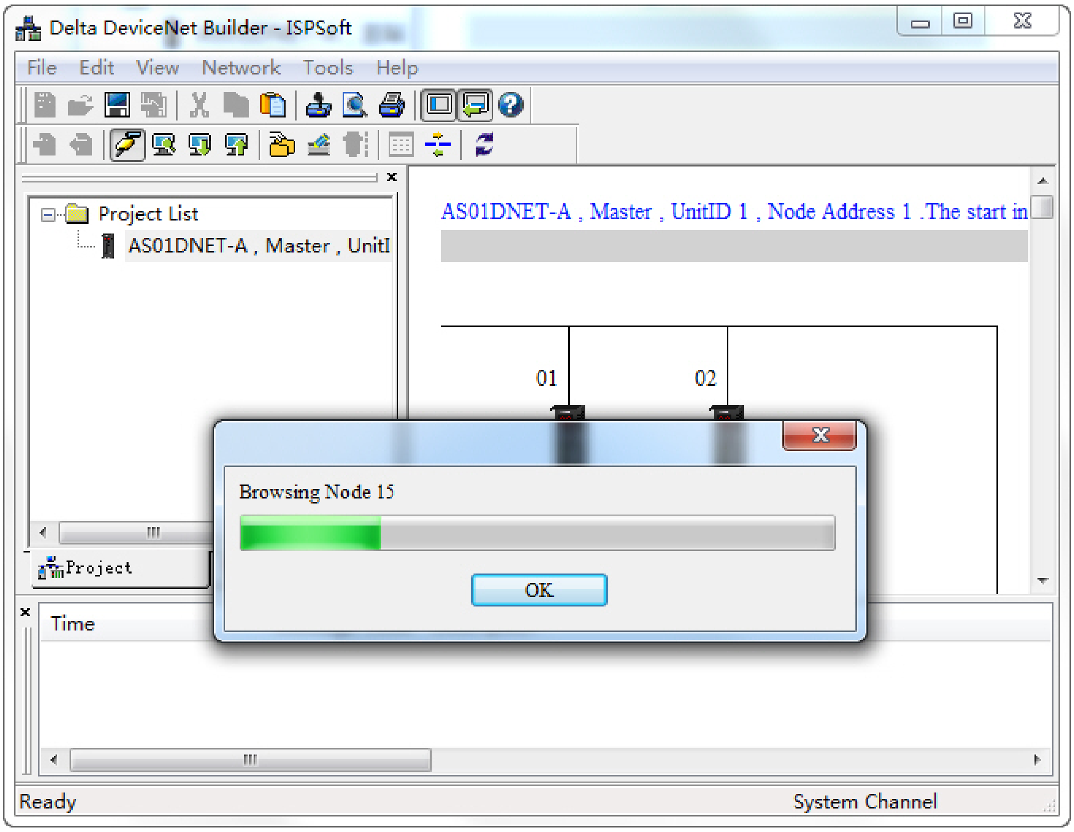
The AS01DNET-A master module which has been scanned is shown in the left-side Project List.



4. Click menu **Network >> Scan DeviceNet Network**.

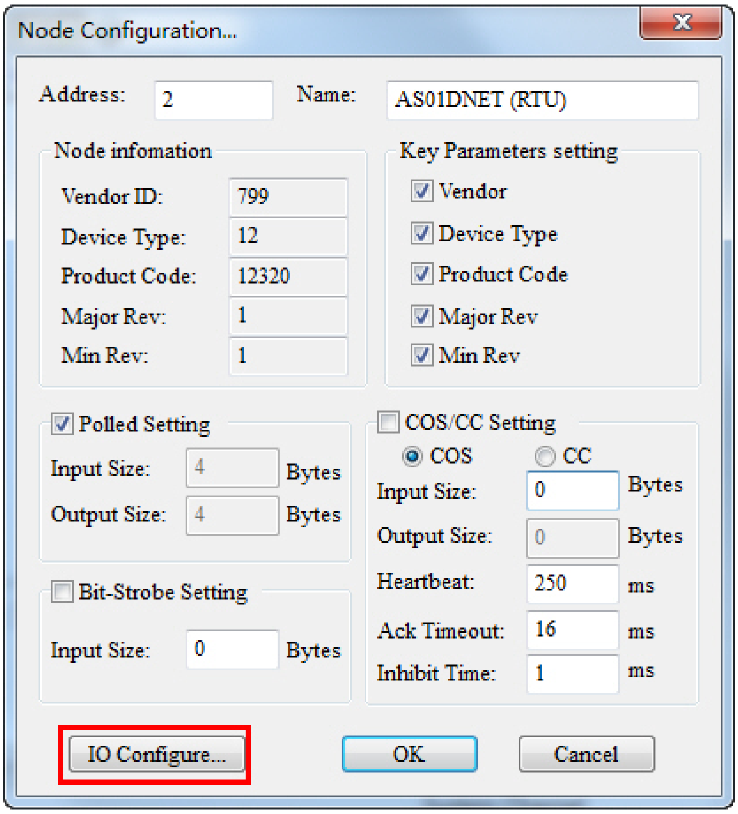


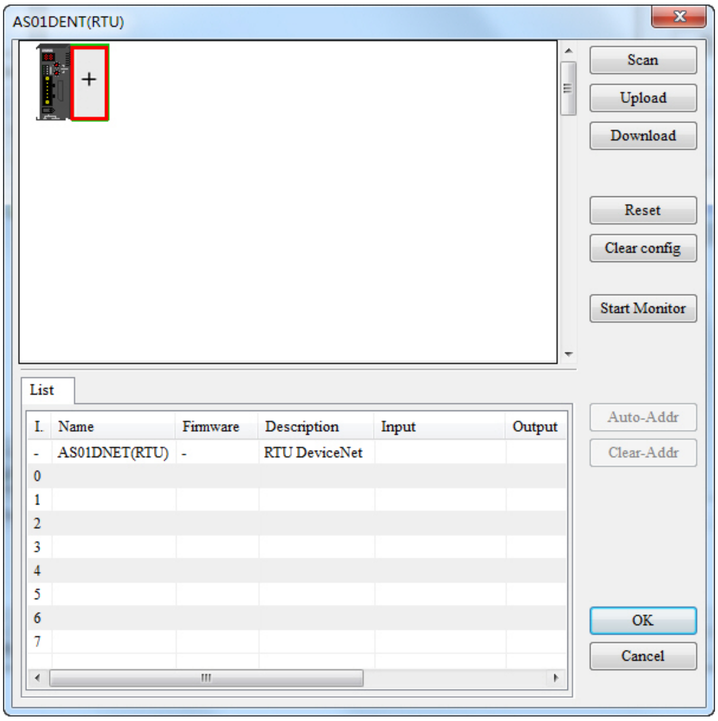
5. The RTU slave in the DeviceNet network is scanned as follows.



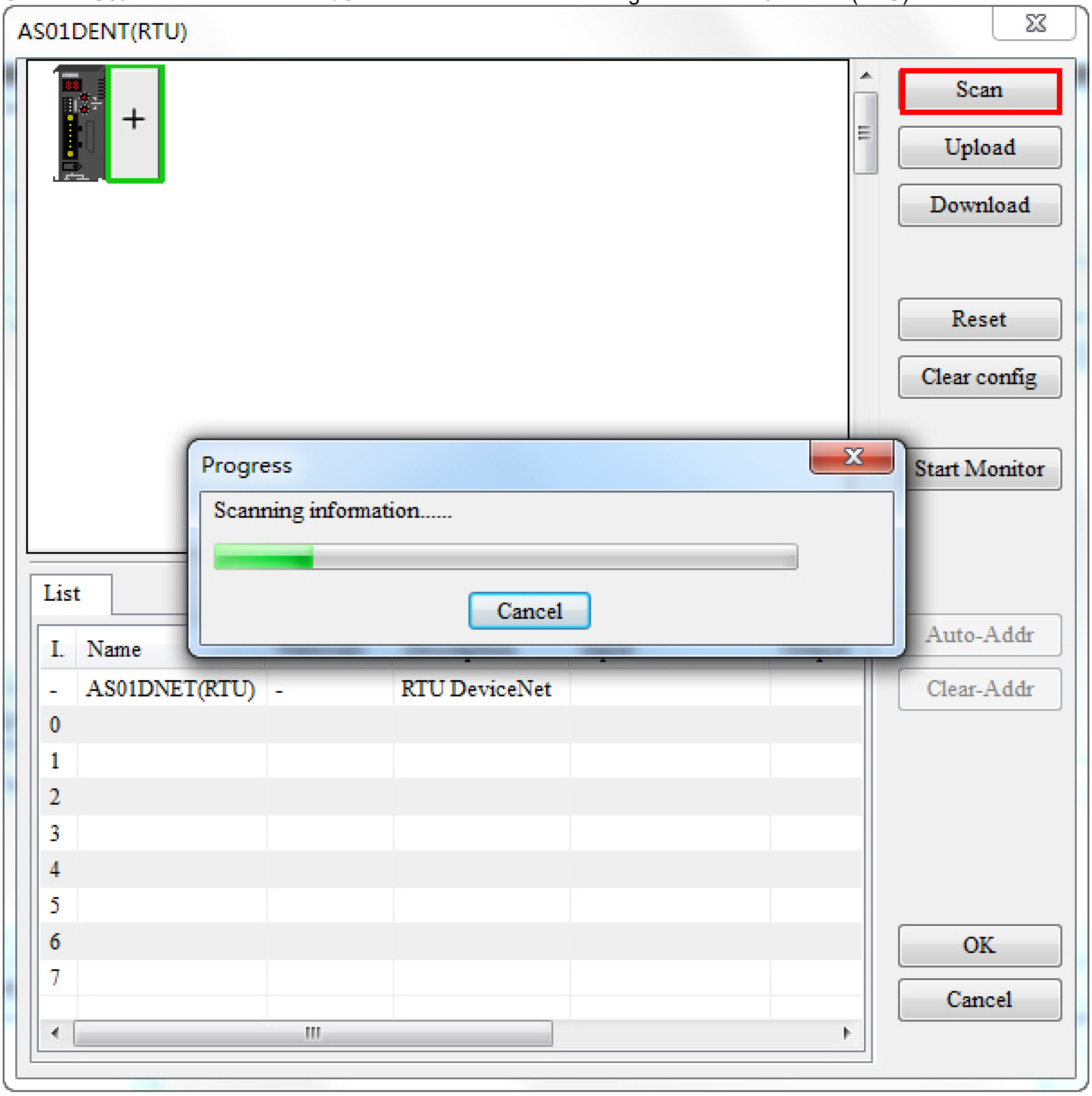
11

6. Double click AS01DNET (RTU). Then the **Node Configuration…** dialog box appears. Click the **IO Configure…** button to make the **AS01RTU-DNET** interface appear, where to configure the modules connected to AS01DNET (RTU).



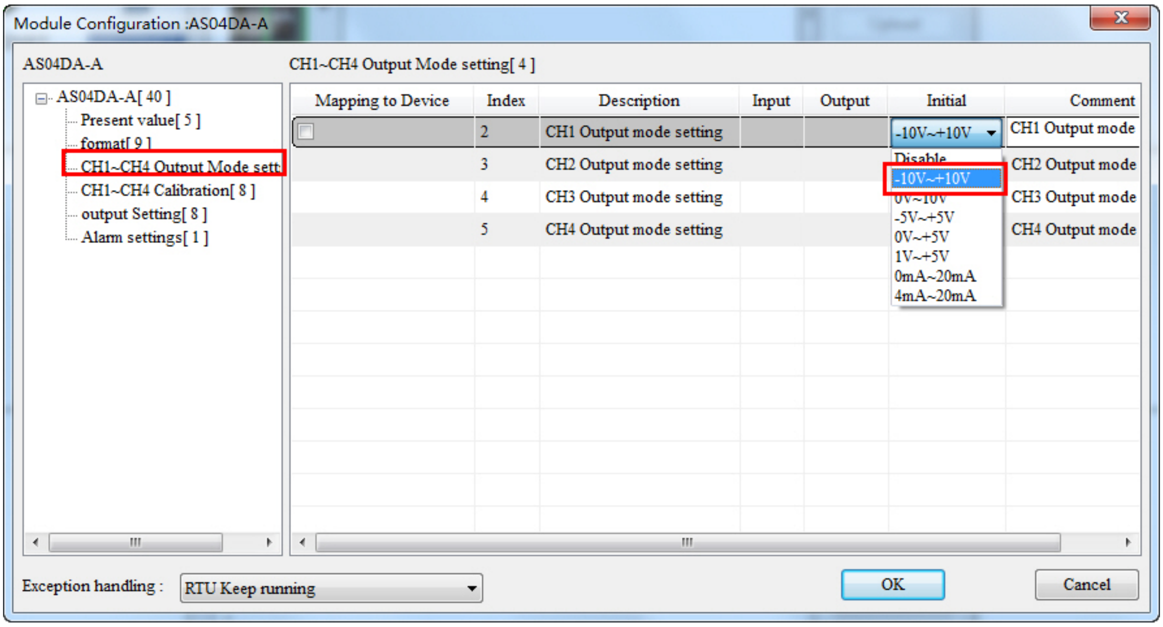


7. Click the **Scan** button to scan the I/O modules connected to the right side of AS01DNET (RTU).

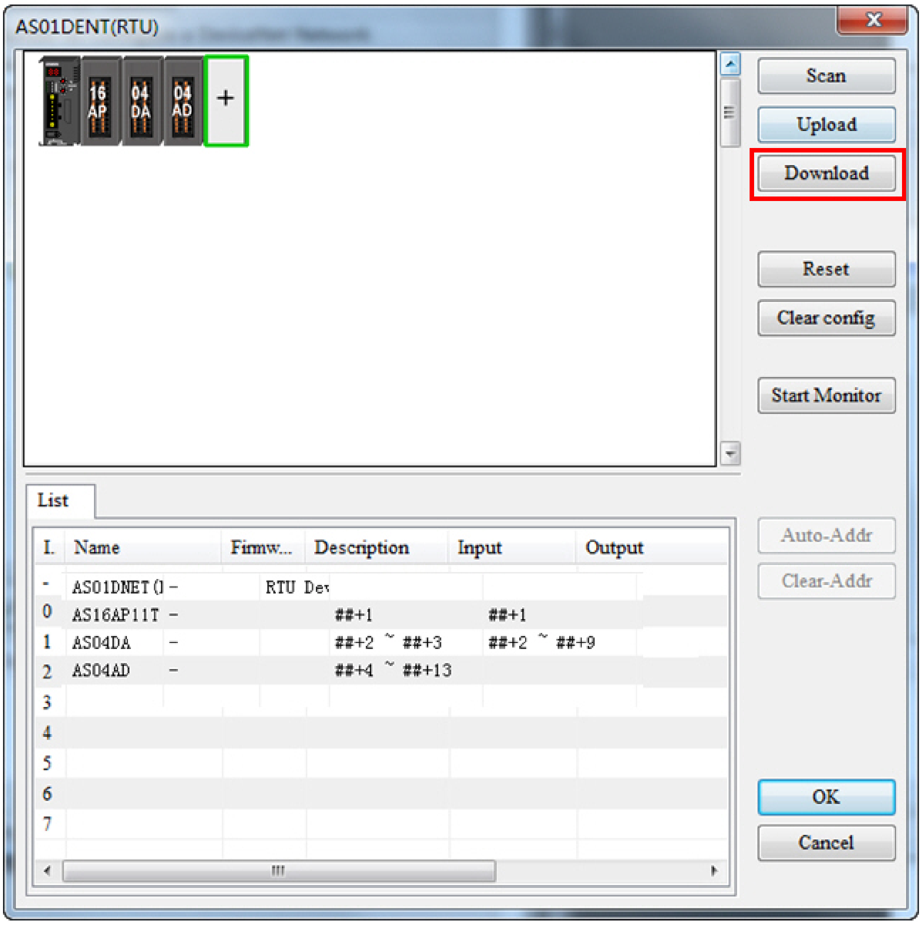


11

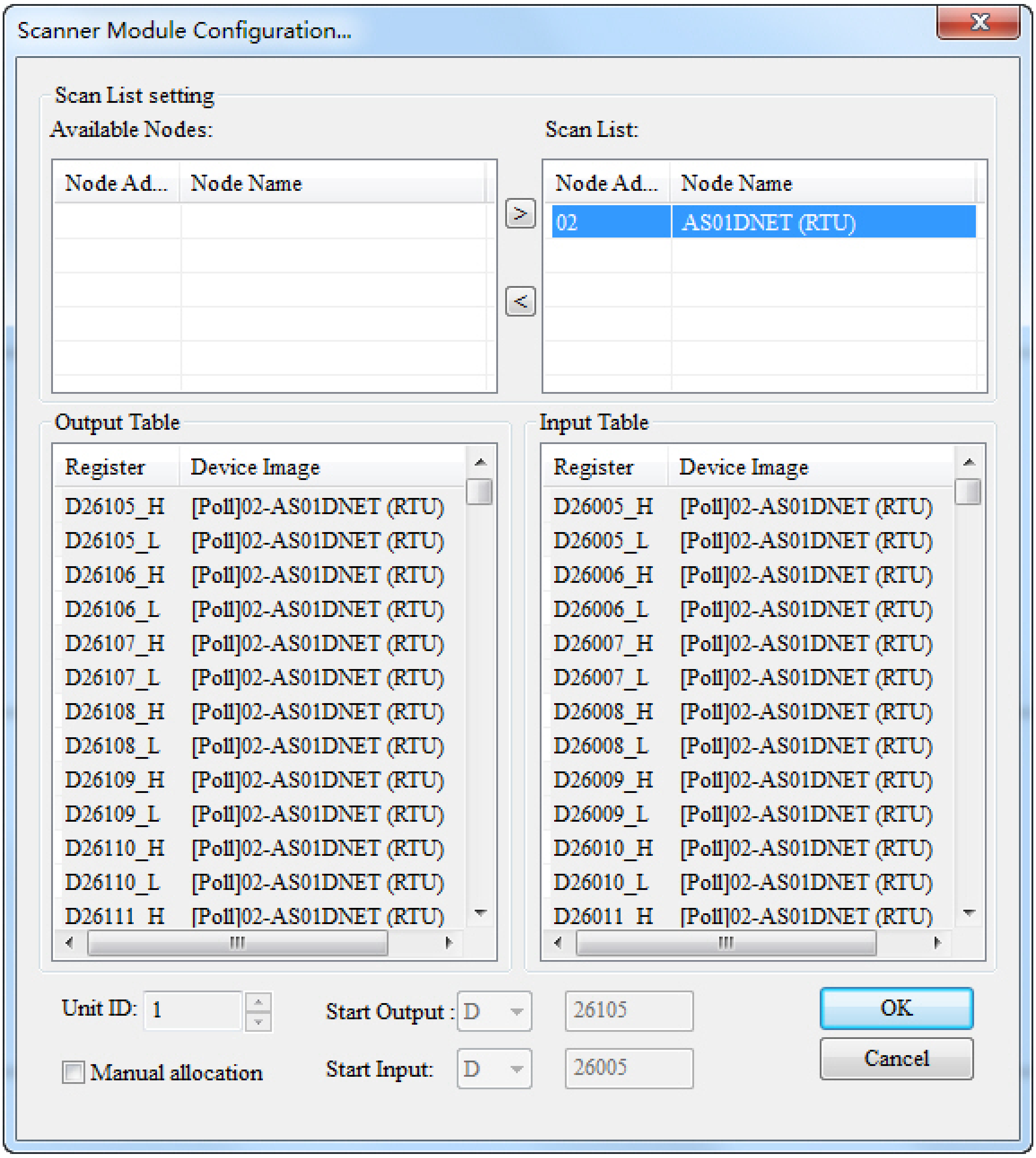
8. After the module is scanned, configure module parameters. Double click AS04DA module and select “-10V~+10V” for channel 1 mode setting. Click the **OK** button to finish the setting. Use the same setting way for channel 1 mode setting of AS04AD and set it to “-10V~+10V” as well.



9. After the configuration of modules is finished, click the **Download** button to download the configuration of I/O modules connected to the right side of AS01DNET (RTU) to AS01DNET (RTU).



10. After the download, click the **OK** button to go back to the main page of the software. Double click AS01DNETScanner icon and then move the slave in **Available Nodes** to **Scan List** on the **Scanner Module Configuration** dialog box. Click the **OK** button to finish the setting.



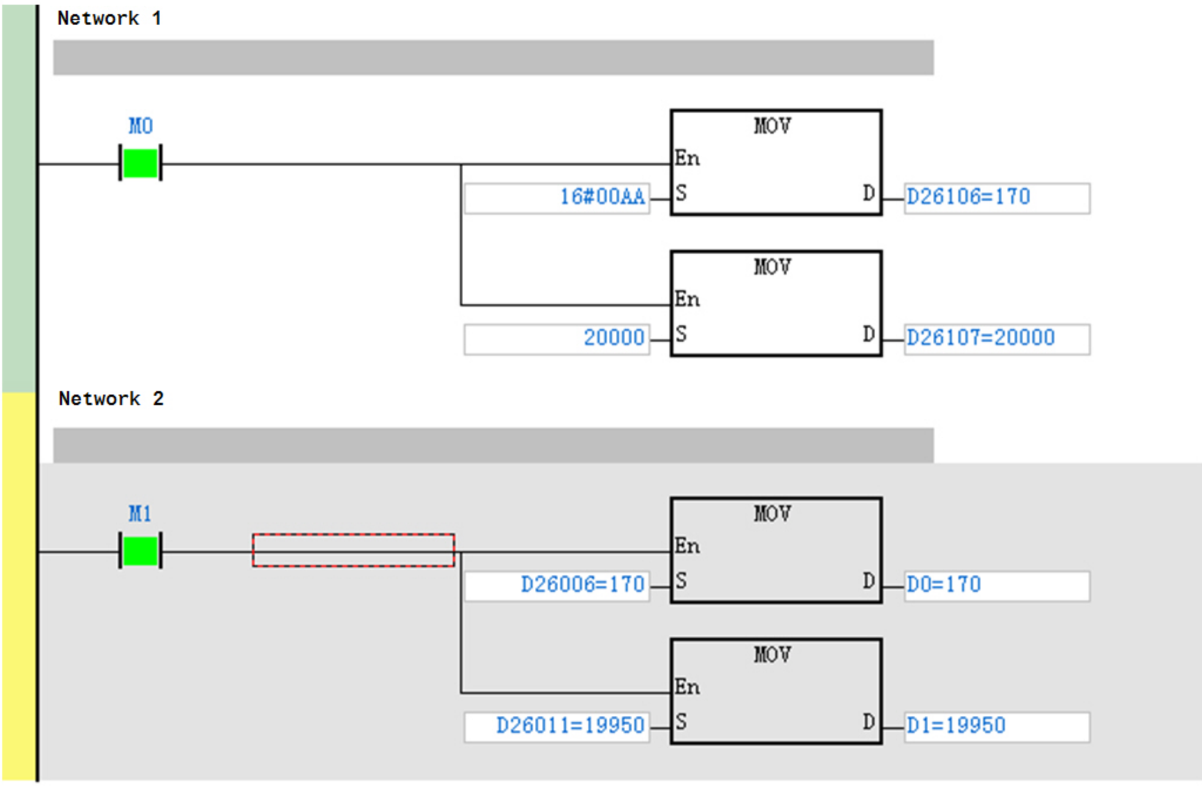
11. Click menu **Network >> Download** to download AS01DNET (RTU) configuration to the master.

The input mapping address D26005~D26018 and output mapping address D26105~D26114 are for AS01DNET (RTU). The start input address D26005 and start output address D26105 are respectively used as the status word and control word of AS01DNET (RTU). The parameter mappings of all modules connected to AS01DNET (RTU) are displayed below.

I..	Name	Firmware	Desc...	Input	Output
-	AS01DNET(RTU)	0.100	RTU Dev		
0	AS16AP11T	-		D26006	D26106
1	AS04DA-A	-		D26007 ~ D26008	D26107 ~ D26114
2	AS04AD-A	-		D26009 ~ D26018	
3					
4					
5					
6					
7					

I/O Module		Input	Output
AS16AP		D26006	D26106-
AS04DA	Status	D26007~D26008	
	Channel 1 output value		D26107~D26108
	Channel 2 output value	-	D26109~D26110
	Channel 3 output value	-	D26111~D26112
	Channel 4 output value	-	D26113~D26114
AS04AD	Status	D2609~D26010	
	Channel 1 input value	D26011~D26012	
	Channel 2 input value	D26013~D26014	
	Channel 3 input value	D26015~D26016	
	Channel 4 input value	D26017~D26018	

11.5.5.3. Using LD Program to Control the Entire Network



Program Explanation:

1. In network 1, write a value for the output of AS16AP and for the output of channel 1 of AS04DA when M0 changes to ON.
2. In network 2, move the input value of AS16AP to D0 and the input value of channel 1 of AS04AD to D1 when M1 changes to ON.

11.5.6 Error Diagnosis and Trouble Shooting

AS01DNET (RTU) provides four diagnosis methods such as LED indicator, seven-segment displayer, status word diagnosis and software diagnosis.

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11.5.6.1. Indicator Diagnosis

- **NS indicator**

LED status	Indication	How to deal with
OFF	No power supply; Or the repeated node ID detection has not been completed.	1. Check the power supply for AS01DNET (RTU) and the connection are normal. 2. Make sure that the baud rates of AS01DNET (RTU) and the master match.
Green light blinking (ON:0.5s and OFF: 0.5s alternately)	No connection between AS01DNET (RTU) and its right-side modules	Configure AS01DNET (RTU) in the DeviceNet software and download the configuration correctly.
Green light ON	Normal I/O data transmission between AS01DNET (RTU) and DeviceNet master	No correction needed
Red light blinking (ON:0.5s and OFF: 0.5s alternately)	I/O connection timeout between AS01DNET (RTU) and DeviceNet master	Refer to the error shooting in Codes in Seven-Segment Displayer below.
Red light ON	Network trouble; Repeated node ID; No network power; Or BUS-OFF.	1. Ensure that the IDs of all nodes are unique on the bus. 2. Check if the network installation is normal. 3. Check if the baud rate of AS01DNET (RTU) is the same as that of the bus. 4. Check if the node ID of AS01DNET (RTU) is valid. 5. Check if the network power supply is normal.

- **MS indicator**

LED status	Indication	How to deal with
OFF	No power	Check if the power supply for AS01DNET (RTU) and connection are normal.
Green light blinking (ON:0.5s and OFF: 0.5s alternately)	1. AS01DNET (RTU) is waiting for the I/O data from DeviceNet master. 2. No I/O data transmission between AS01DNET(RTU) and DeviceNet master 3. The PLC connected to DeviceNet master is in STOP state.	1. Configure AS01DNET (RTU) in the DeviceNet software and download the configuration correctly. 2. Switch the PLC to RUN state
Green light ON	Normal transmission of I/O data between AS01DNET (RTU) and DeviceNet master	No correction needed

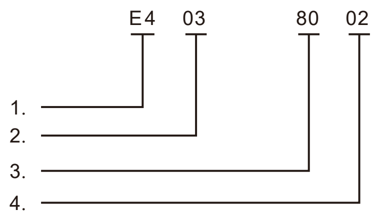
LED status	Indication	How to deal with
Red light blinking (ON:0.5s and OFF: 0.5s alternately)	No network power supply; Configuration error; Module alarms.	1. Check if the network power supply is normal; 2. Reset the internal parameters in AS01DNET (RTU); 3. Check if there is an error or alarm in the I/O modules connected to the right side of AS01DNET (RTU).
Red light ON	Hardware error	Return the product to factory for repair if the error still exists after re-power on.

11.5.6.2. Codes in Seven-Segment Displayer

Code	Indication	How to deal with
0~63	Node ID of the scanner module (When in RUN state)	No correction needed
F0	The node ID is repeated or exceeds allowed range.	1. Ensure that the node ID of AS01DNET (RTU) is unique in the DeviceNet network within the range of 0~63. 2. Repower it on after changing the node ID.
F1	No I/O module is configured to AS01DNET (RTU) in the DeviceNet Builder software.	Add I/O modules in AS01DNET (RTU) in the DeviceNet Builder software and download the configuration data to AS01DNET (RTU) after the configuration is finished.
F2	The work voltage of AS01DNET (RTU) is too low.	Check if the power supply for AS01DNET (RTU) works normally.
F3	AS01DNET (RTU) enters the test mode.	Repower AS01DNET (RTU).
F4	AS01DNET (RTU) is the Bus-Off state.	1. Check if the network communication cable is normal and the shielded cable is grounded. 2. Ensure the baud rates of all network nodes are same. 3. Check if the two ends of the network are both connected with a 120Ω terminal resistor. 4. Repower the scanner module.
F5	No network power supply for AS01DNET(RTU)	1. Check if the network cable is normal. 2. Check if the network power supply is normal. (The external 24V DC network power supply is connected between red V+ and black V- of AS01DNET (RTU) .)
F6	Internal error; An error in the internal storage units of AS01DNET (RTU)	Return the product to factory for repair if the error still exists after re-power on.
F7	Internal error; An error in the data exchange units of AS01DNET (RTU)	Return the product to factory for repair if the error still exists after re-power on.
F8	Manufacture error	Return the product to factory for repair if the error still exists after re-power on.

Code	Indication	How to deal with
F9	Internal error; An error in the access of the Flash of AS01DNET (RTU)	Return the product to factory for repair if the error still exists after re-power on.
E4	Module error	Check if an error occurs in the modules connected to the right side of AS01DNET (RTU); Check if the module exists; Check if current module matches that configured in the software; Check if the unconfigured module is added.
E7	Repeated node ID detection	If the code has emerged for a long time, please shoot troubles in the methods below. 1. Ensure that there are at least two nodes working normally in the network. 2. Check if the two ends of the network are both connected with a 121Ω terminal resistor. 3. Ensure that the baud rates of all network nodes are same. 4. Check if the network cable has a problem such as being disconnected and loosened. 5. Check if the bus communication cable length exceeds maximum transmission distance. If the maximum transmission distance is exceeded, the stability of the system can not be ensured. 6. Check if the shielded wire of the network communication cable is grounded. 7. Turn on the power of AS01DNET (RTU) again.
E9	The number of I/O modules connected to AS01DNET (RTU) exceeds the maximum 8.	Check if the number of I/O modules connected to AS01DNET (RTU) is more than 8.
80	AS01DNET (RTU) is in STOP state.	1. Check if the RUN/STOP switch of the PLC connected to the DeviceNet master is turned to RUN. 2. Check if the value of control word of AS01DNET (RTU) is 1. For details, refer to Section 11.5.4.3.4.
83	The AS01DNET (RTU) configuration in the software is being downloading.	Wait until the download of AS01DNET (RTU) configuration data is completed.

When multiple errors exist, the seven-segment displayer of AS01DNET (RTU) will display error codes cyclically. For example, the error codes: E4 03 80 02 are displayed cyclically. See the detailed meaning as below.



◆ E4 indicates a module error or offline. For details, see the explanation of codes above.

◆ 03 indicates the position of the module where an error occurs. The position of the first module connected to the right side of AS01DNET (RTU) is 1 and that of the second module is 2. Maximum 8 I/O modules are connectable to AS01DNET (RTU) within the range of 1~8.

- 80 means AS01DNET (RTU) is in STOP state.
- 02 is the node ID: 2 of AS01DNET (RTU).

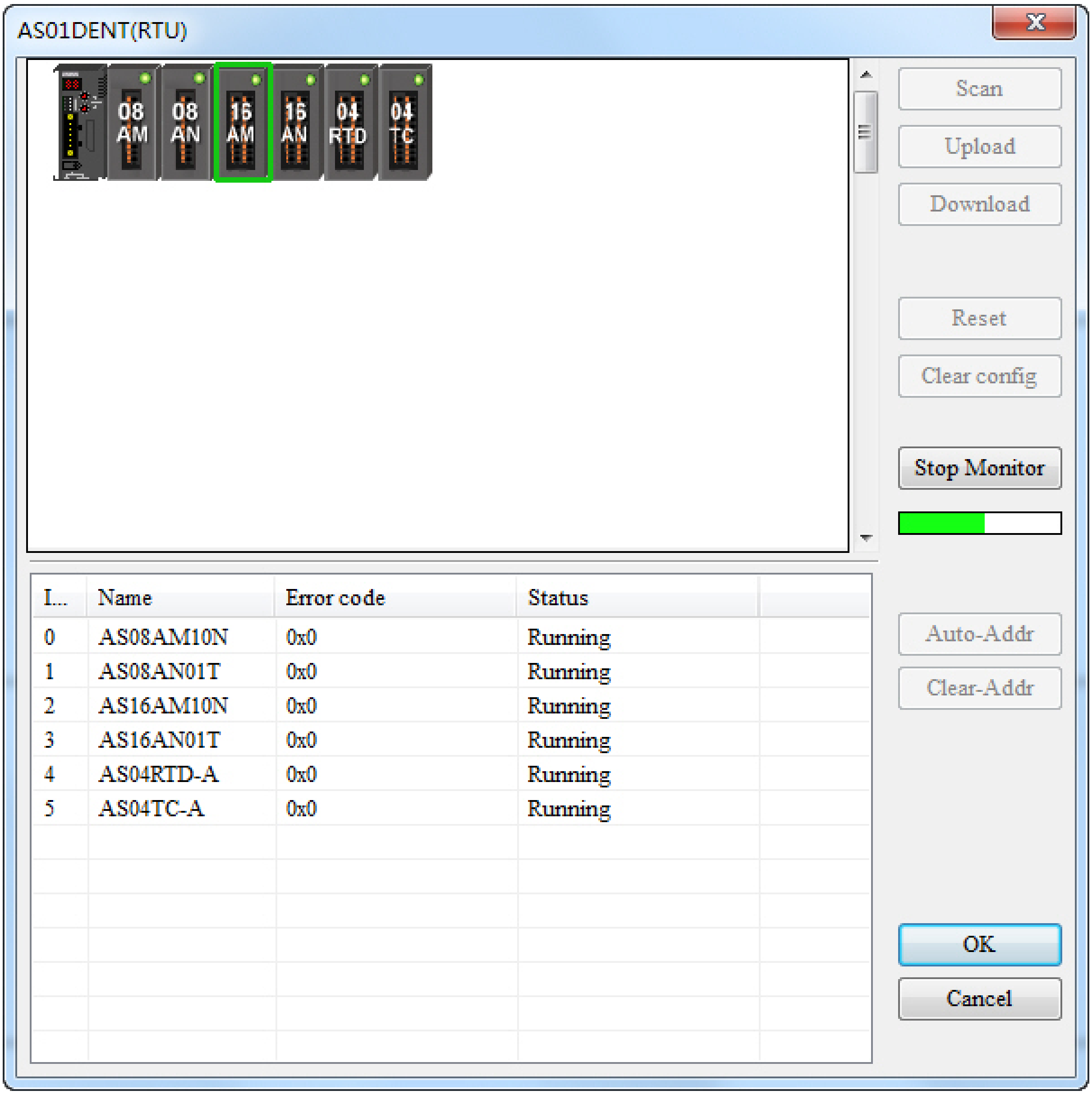
11.5.6.3. Status Word Diagnosis

The status word of AS01DNET (RTU) shows the operation states of special modules and digital I/O modules. See the following table for status word diagnosis and disposal.

Bit	Status value	Description	Disposal
bit0	0	AS01DNET (RTU) is in RUN state	No correction needed
	1	AS01DNET (RTU) is in STOP state.	Restart AS01DNET(RTU)
bit1	0	Valid configuration data in AS01DNET(RTU)	No correction needed
	1	Invalid configuration data in AS01DNET (RTU)	Re-download the configuration data to AS01DNET (RTU) by using the DeviceNet Builder software.
bit2	Reserved	——	——
bit3	Reserved	——	——
bit4	0	Currently connected module matches the configuration in the software.	No correction needed
	1	Currently connected module is inconsistent with the configuration in the software.	1. Check if currently connected module is consistent with the configuration in the software. 2. Change current module to match the configuration in the software or change the configuration in the software to match currently connected module.
bit5	0	AS01DNET(RTU) in normal operation	No correction needed
	1	AS01DNET(RTU) in low voltage	Check if the power supply for AS01DNET (RTU) is normal.
bit6	Reserved	——	——
bit7	0	AS01DNET(RTU) in normal operation	No correction needed
	Reserved	——	——
bit8	Reserved	——	——
bit9	Reserved	——	——
bit10	Reserved	——	——
bit11	Reserved	——	——
bit12	Reserved	——	——
bit13	Reserved	——	——
bit14	Reserved	——	——
bit15	Reserved	——	——

11.5.6.4. Software Diagnosis

Click the **Start Monitor** button on the AS01DNET (RTU) interface. The **Error code** column will show relevant contents as follows.



Error No.	Explanation	Solution
0x8001	AS01DNET (RTU) can not detect the configured module.	1. Check if the module is disconnected. 2. Check if the module is damaged.
0x8002	Current module is not consistent with the configured module.	Ensure that the actually connected module is the same as that configured in the software.

Note: For details on more error codes, refer to the explanation of Error ID in AS-series product manual.

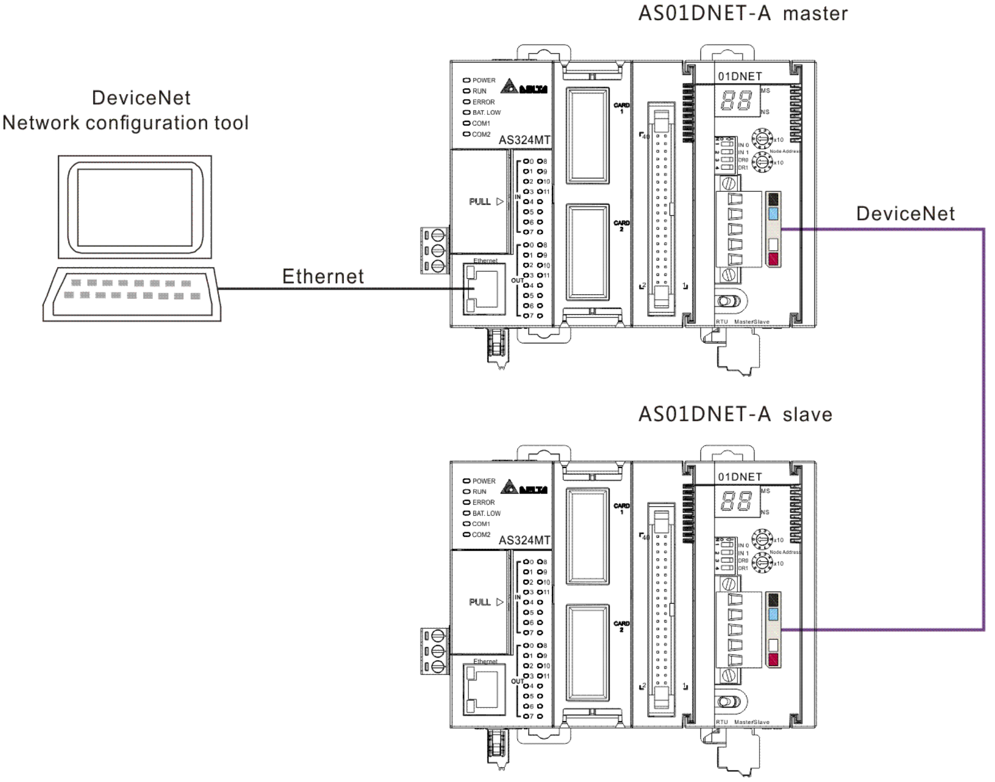
Remark:

➢ The software diagnosis function can not be enabled until the DeviceNet Builder software is online.

11.6 How to Call DeviceNet Builder through ISPSoft (AS-Series PLC)

■ **Network structure**

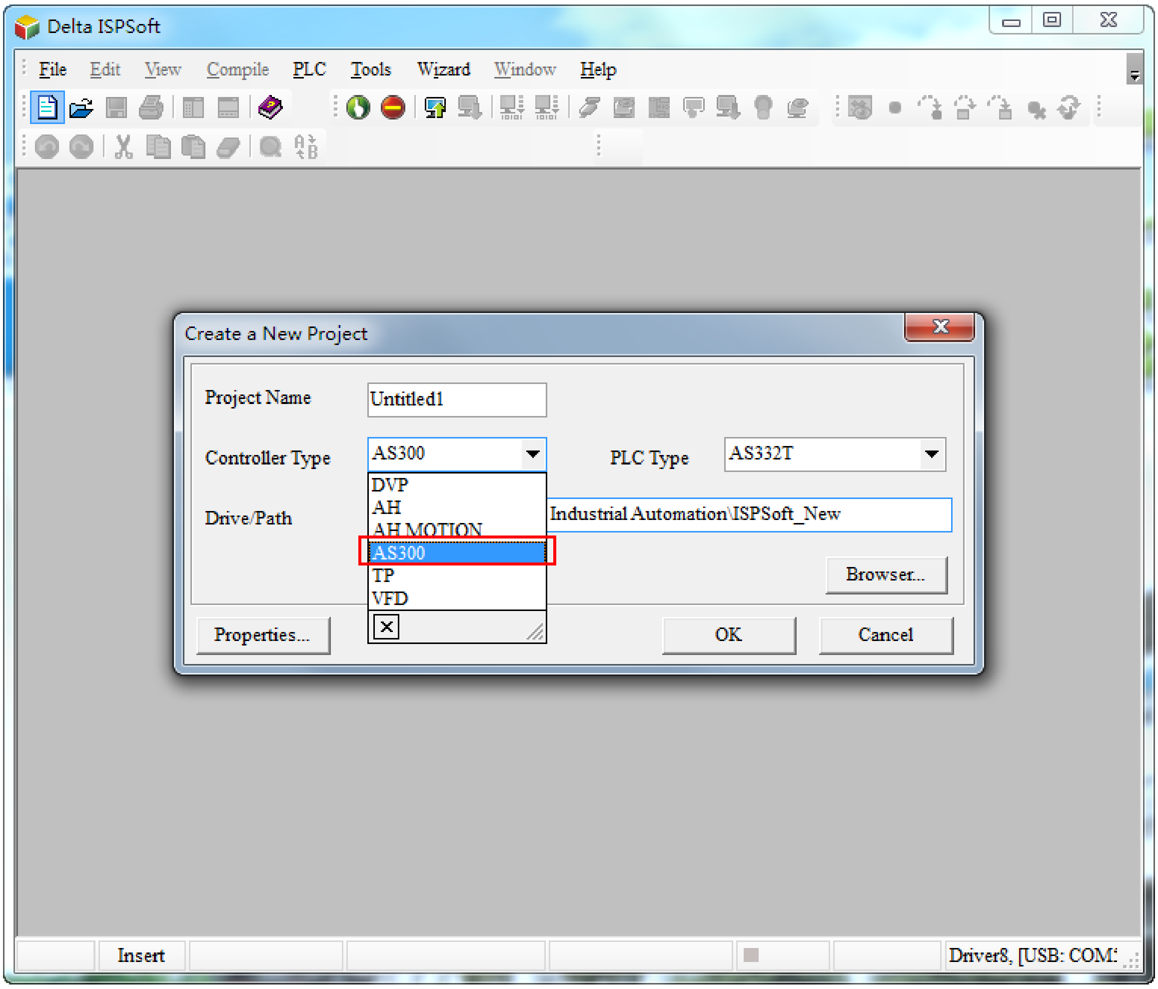
Connect the devices according to the following figure. PC accesses AS-series PLC through Ethernet.



11

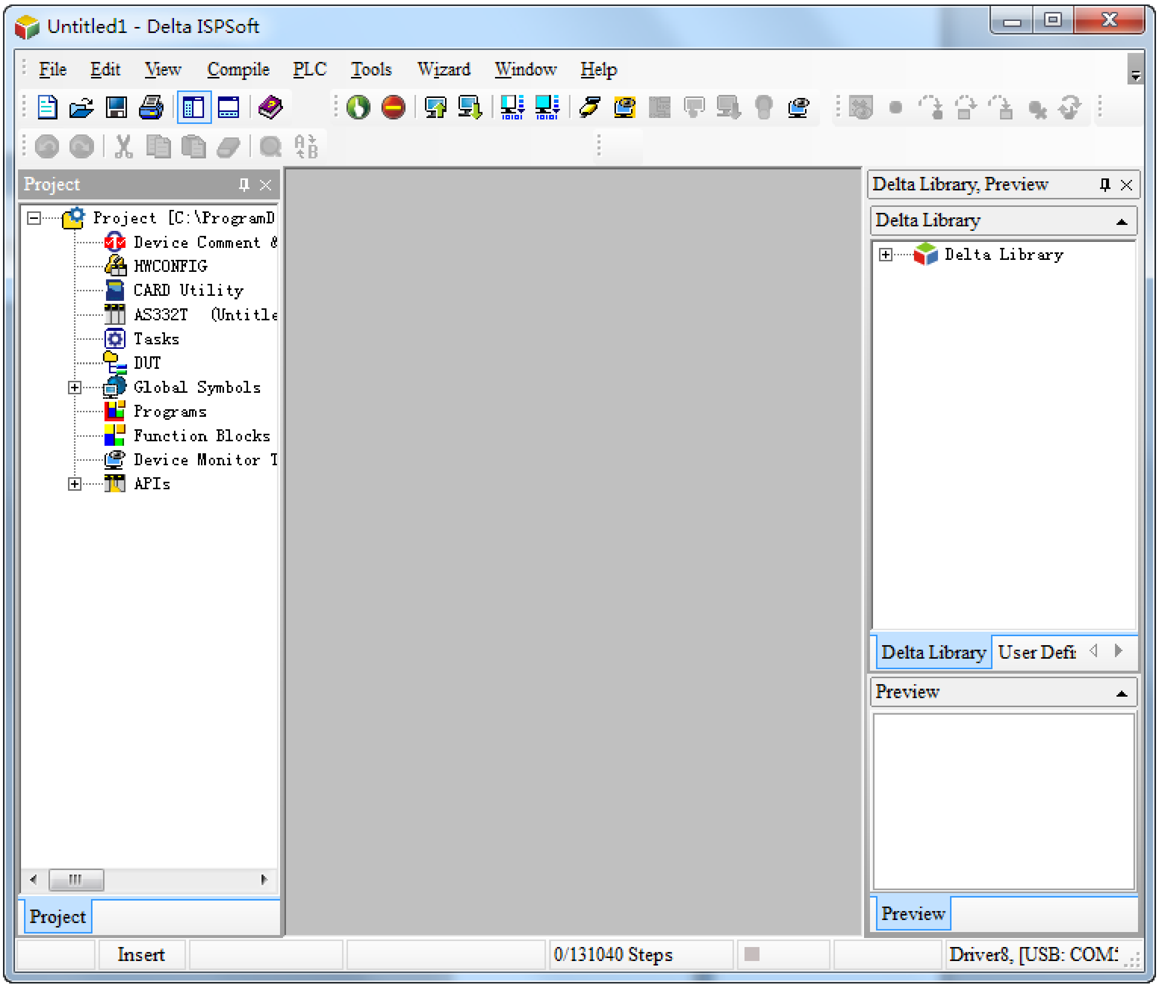
■ Operation of Software

1. Open the ISPSoft software and then select menu **File>> New>> New**. In the following dialog box which appears, select corresponding PLC type **AS** marked in the red box below.



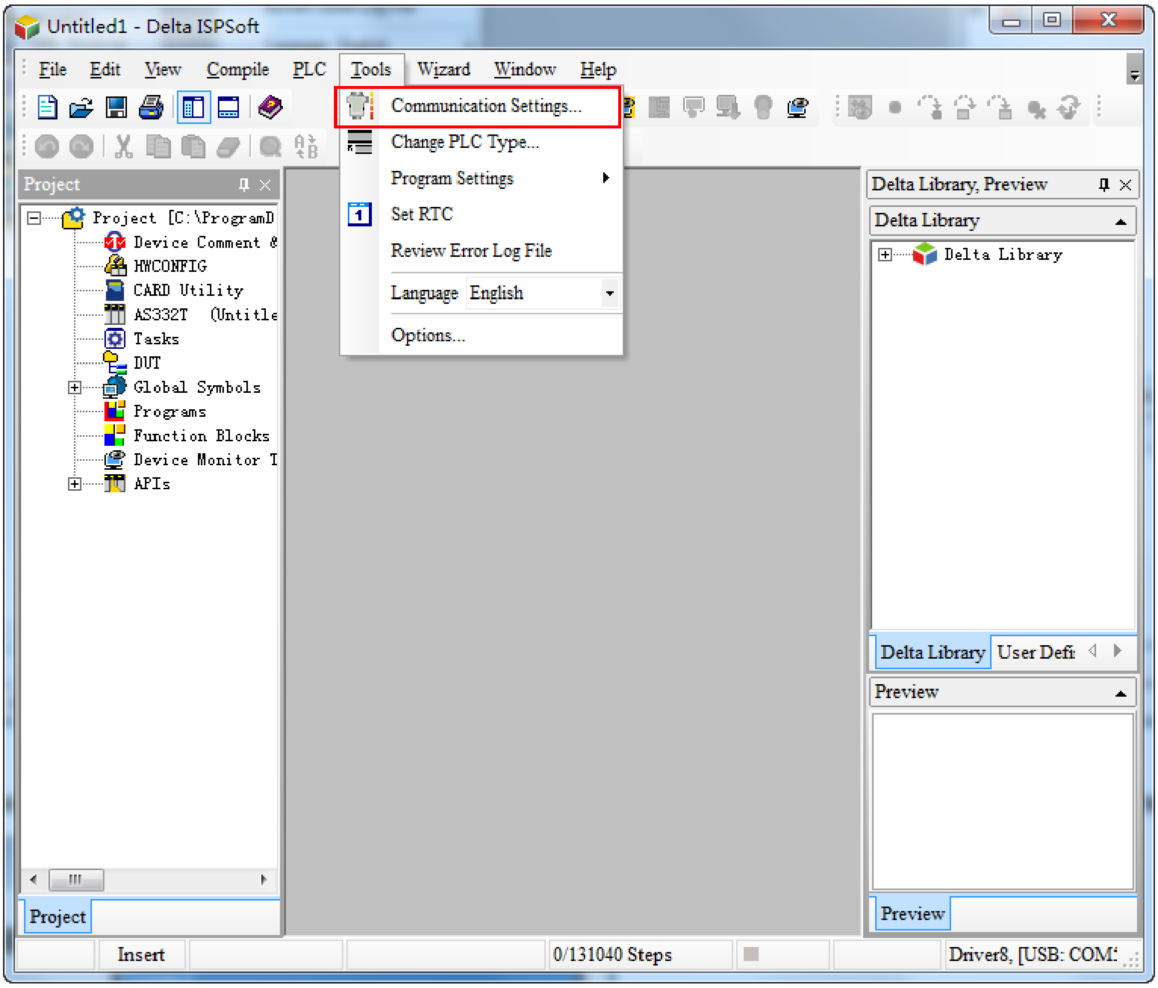
Note: The PLC type used in this section is AS332T-A.

2. Click the **OK** button. Then the main interface of the ISPSoft software appears as below.

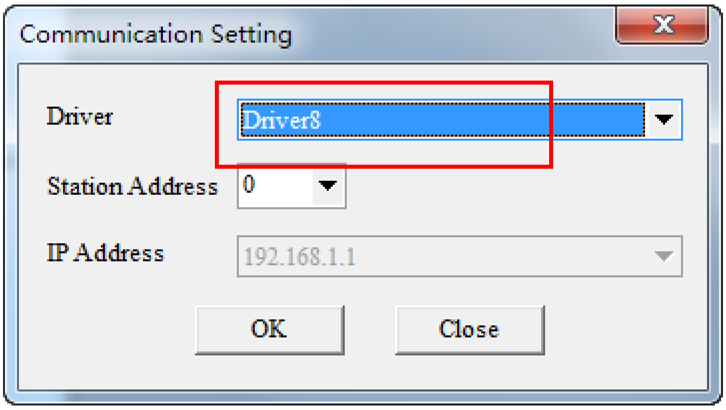


3. Set up COMMGR communication. Refer to Section 2.4 Communication Setting in the ISPSoft User Manual for more details.

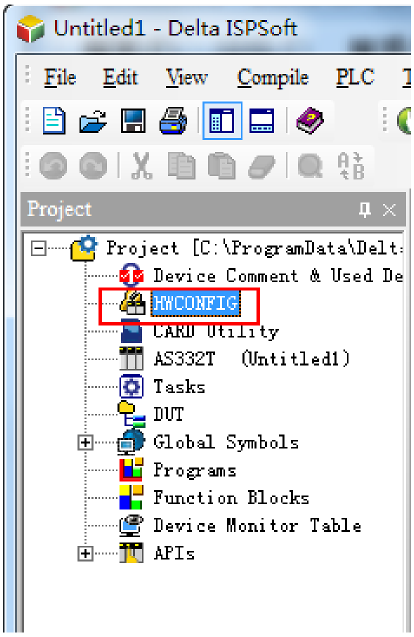
4. After the setup of COMMGR communication is finished, select menu **Tools>> Communication settings…**



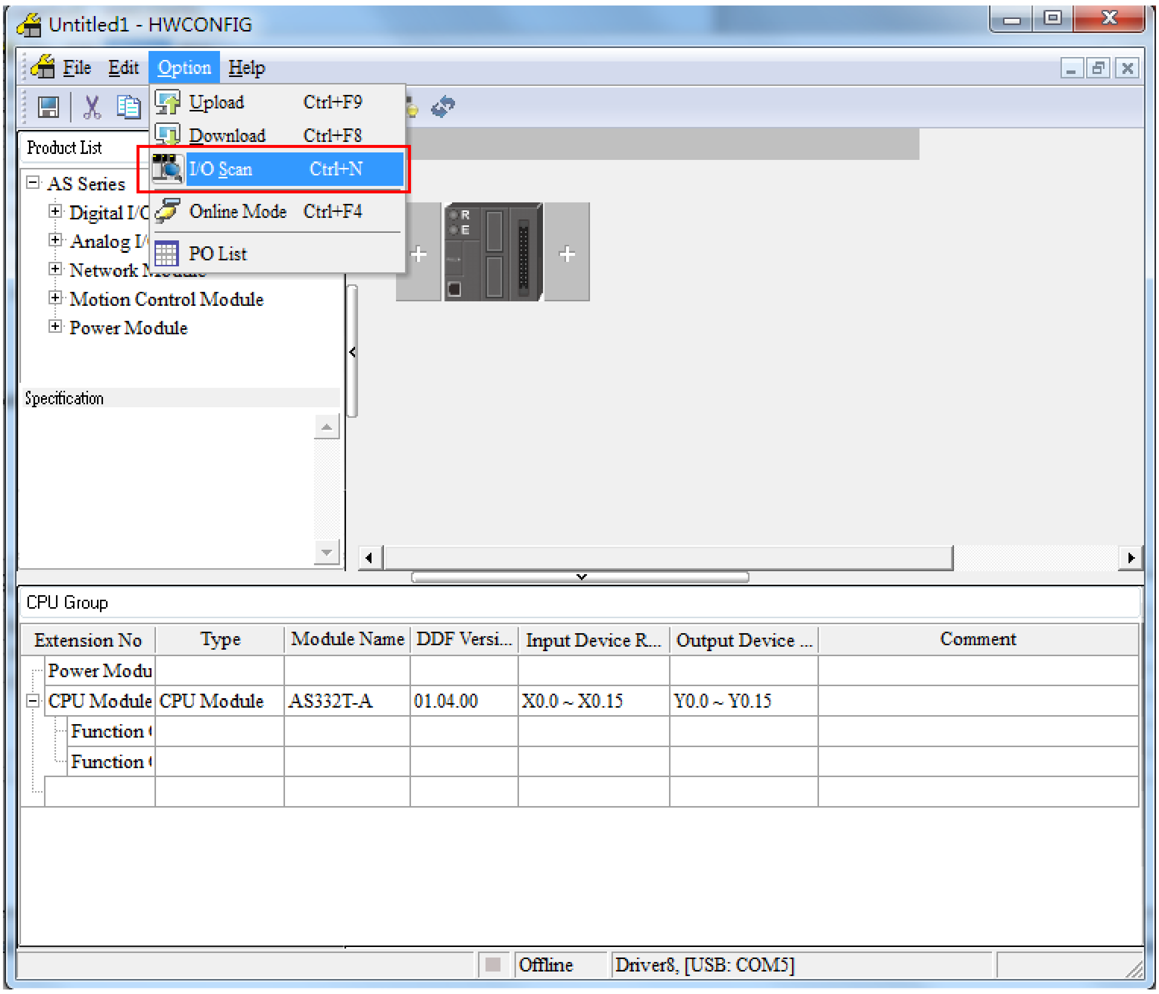
5. The following dialog box appears. Select one desired driver which has been created and then click the **OK** button.



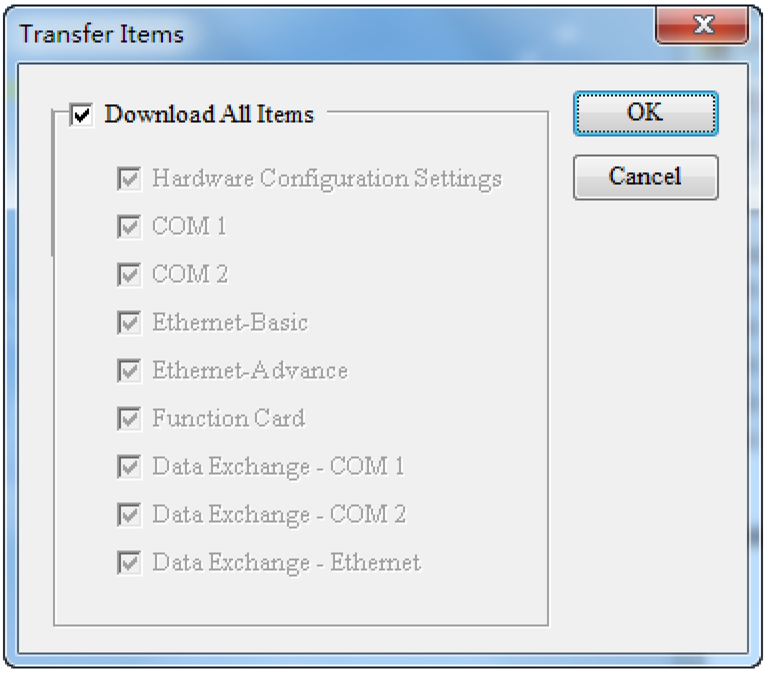
6. Double click **HWCONFIG** marked in the red box below.



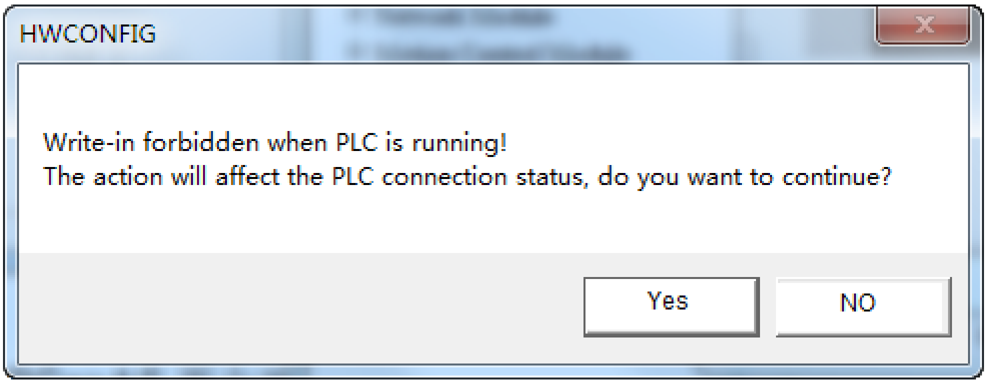
7. Select menu **Option>> I/O Scan** in the following window which pops up. Then the AS01DNET-5A icon will show up.

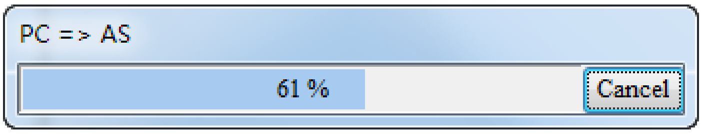


8. Select menu **Option>> Download** in the HWCONFIG window. Then the following dialog box appears. Select the checkbox of **Download All Items** or select the checkboxes of the items which are needed for download. Afterwards, click the **OK** button.

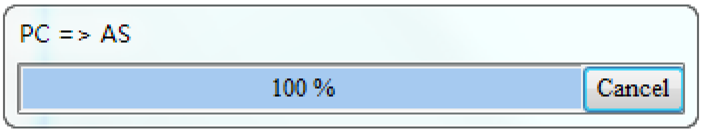


9. Then the following two dialog boxes of **HWCONFIG** and **PC=>AS** appear. Click **Yes** to perform the PC=>AS status.

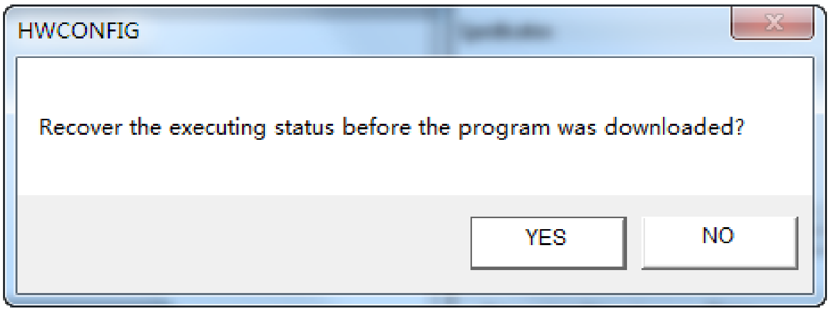




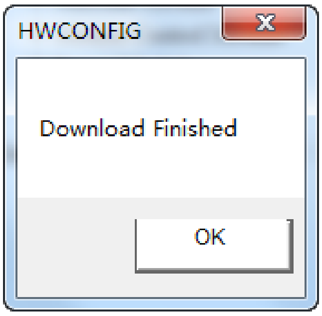
10. When the download is finished, the progress bar is shown as below.



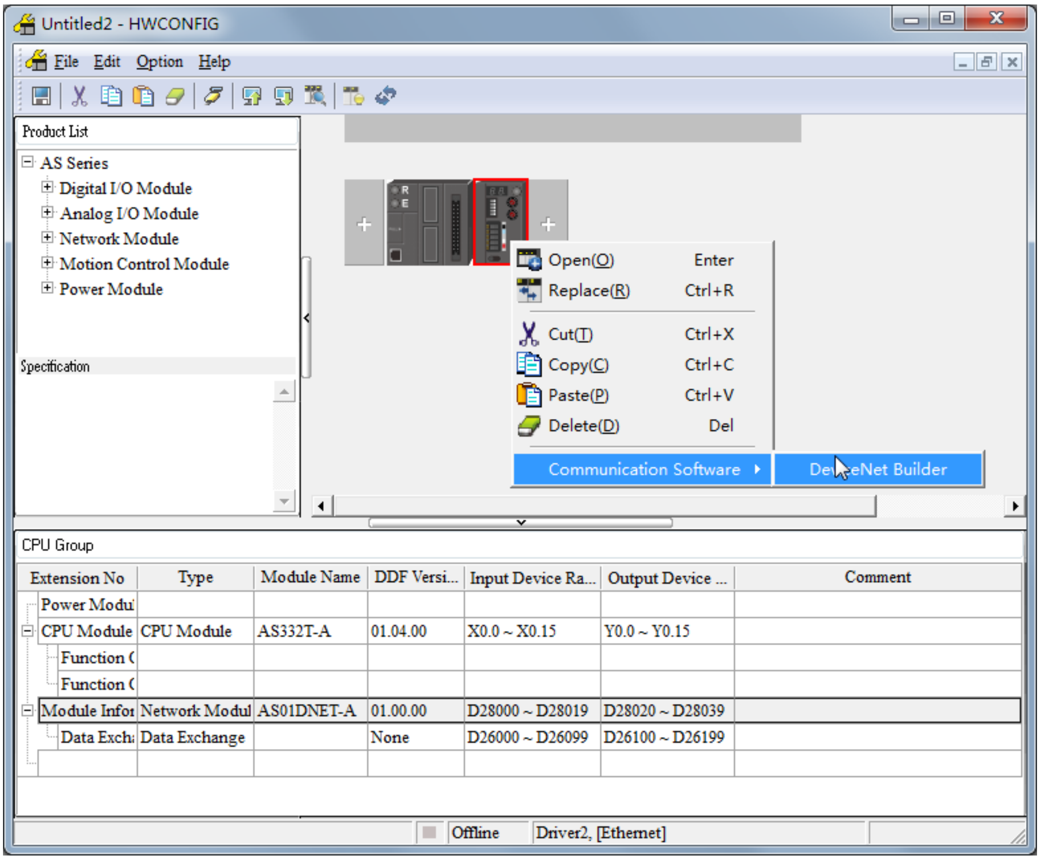
Meanwhile the following dialog box pops out. Click the **Yes** button.



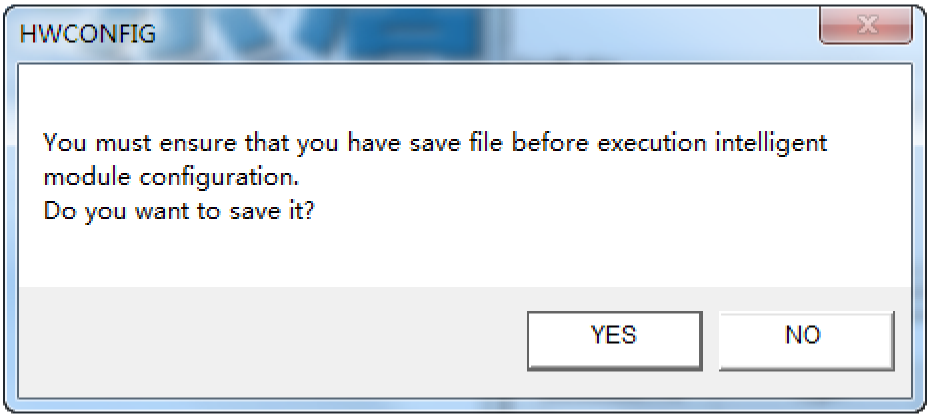
11. The following dialog box appears to show that the download has been finished.



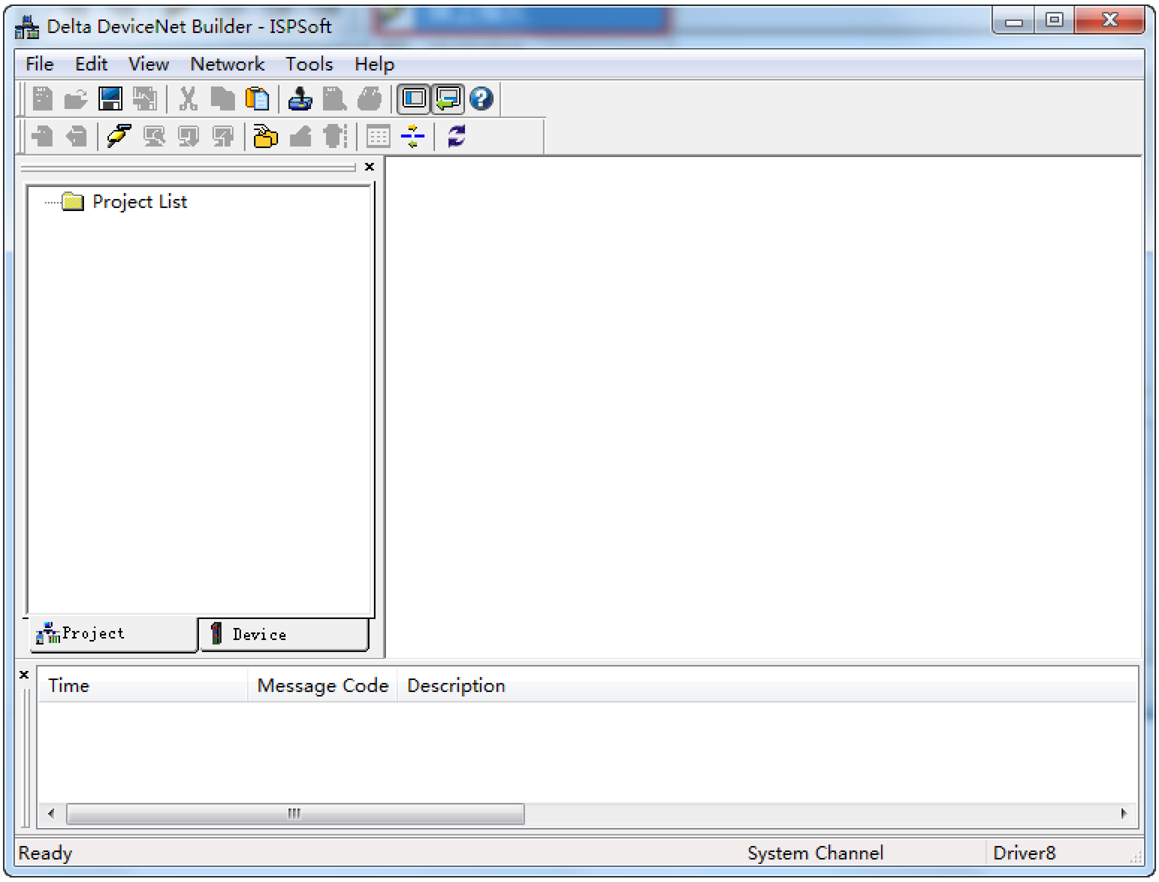
12. Return to the HWCONFIG window and right-click AS01DNET module to make the drop-down menu pop out. Select **Communication Software >> DeviceNet Builder** from the menu.



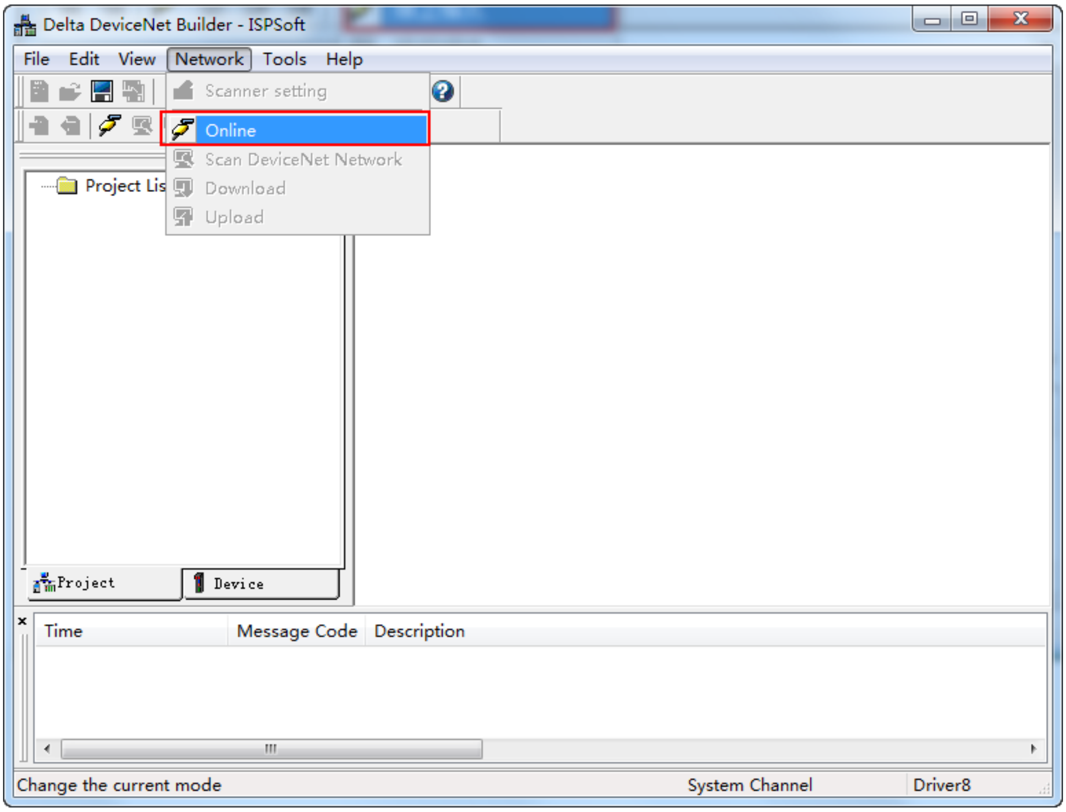
13. The following dialog box pops out. Click the **Yes** button there.



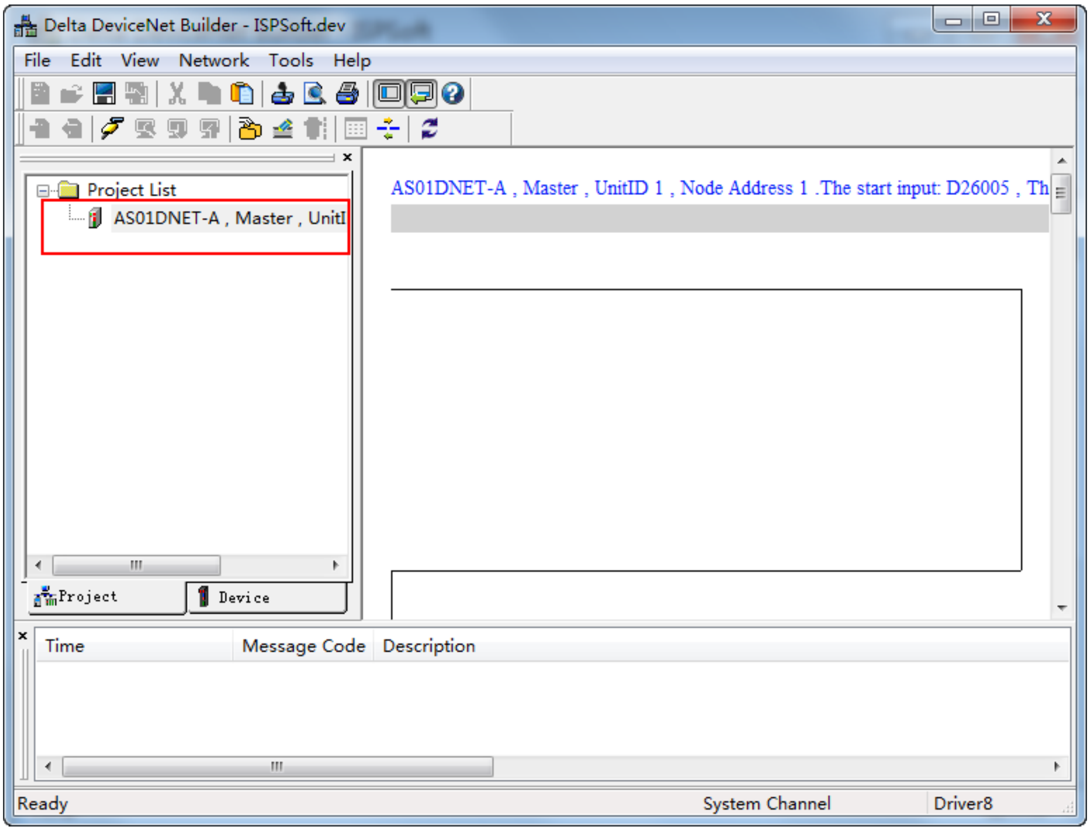
14. The DeviceNet Builder software is opened as below, which means the DeviceNet Builder software has been opened through the ISPSoft software.



15. Click menu **Network>> Online**.



16. The master module AS01DNET-A has been scanned as below.



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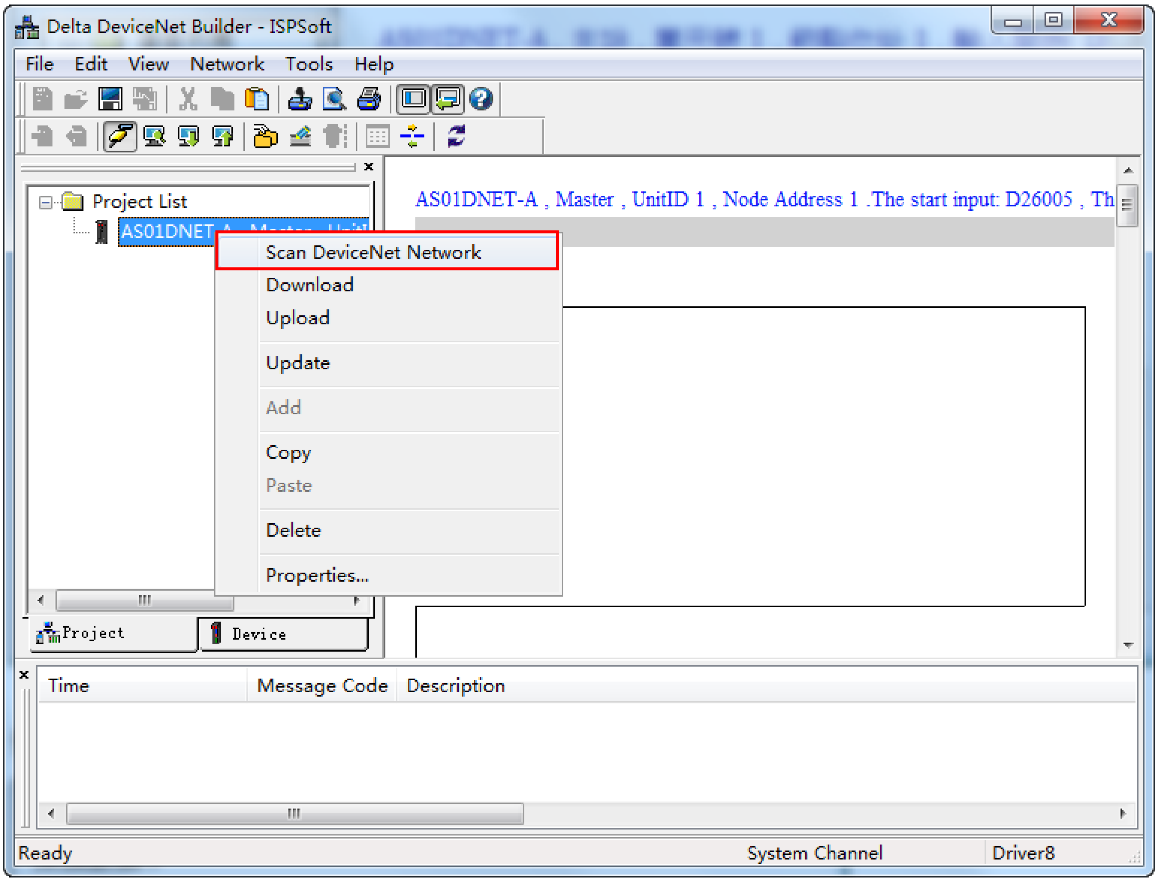
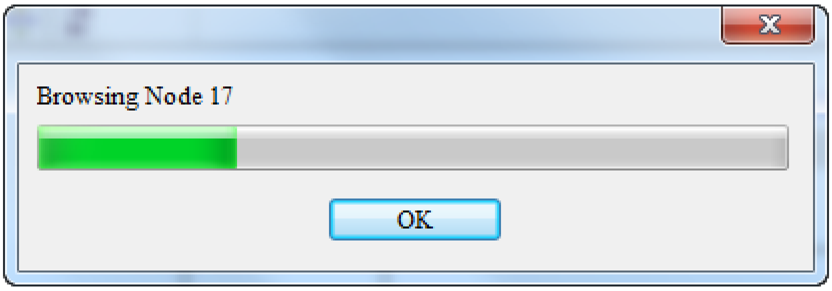
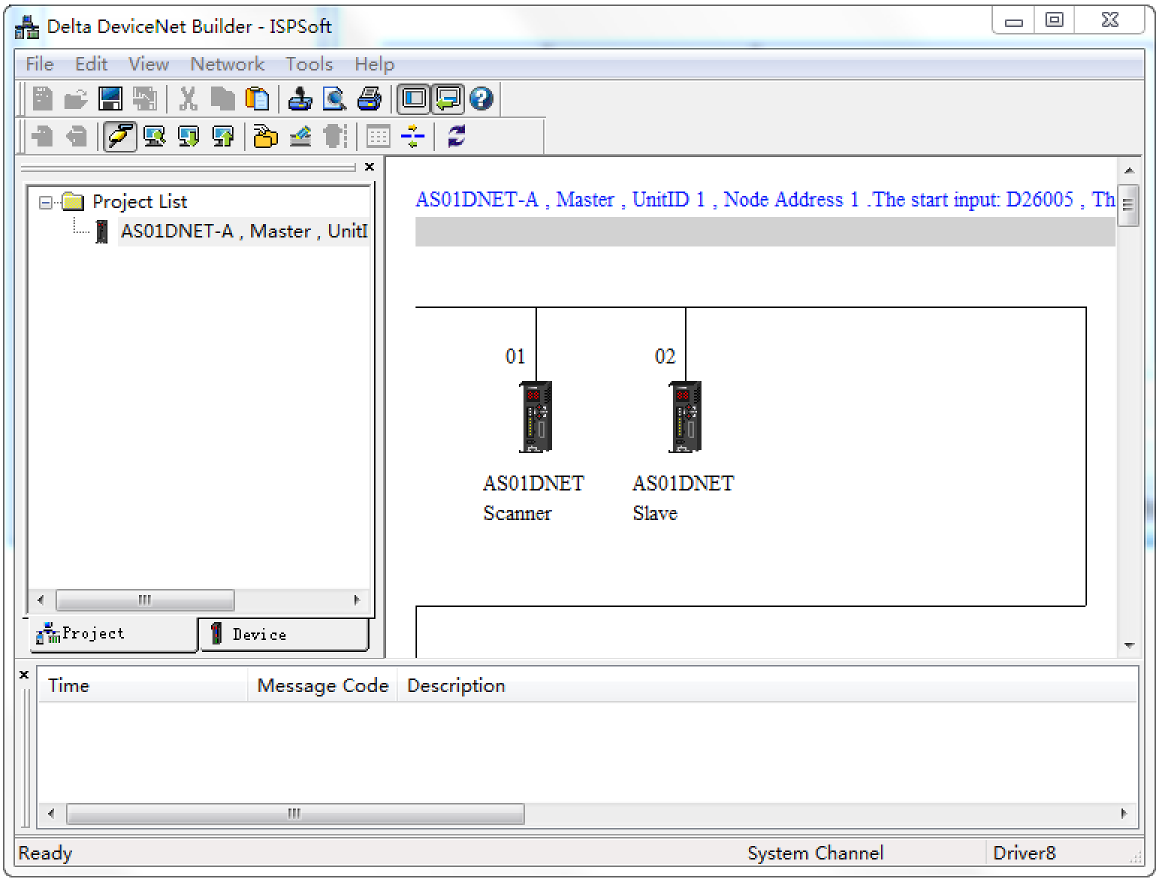
17. Right-click the master module AS01DNET-A under the left-side Project List. Then a drop-down list pops up. Click the option **Scan DeviceNet Network** from the list.



18. The following progress bar appears then.



19. The master and slave which have been scanned both show up in the network.



MEMO

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Chapter 12 Positioning Module AS02/04

Table of Contents

12.1 Overview

This chapter describes the specifications for the positioning module, its operation, and its programming. On the analog input/output module, four channels receive analog signals (voltage or current), and converts those signals into 16-bit digital signals. In addition, the analog input/output module receives two blocks of 16-bit digital data from a CPU module, and converts the digital data into analog signals (voltage or current). The analog input/output module sends the analog signals by two channels

12.1.1. Characteristics

(1) **Use the AS02/04 PU-A module, based on its practical application.**

AS02PU-A: 2-axis differential output, 1 encoder

AS04PU-A: 4-axis NPN transistor (sinking) output

(2) **High-speed input/output**

AS02PU-A: high speed output frequency at 200 k Hz (A/B/Z phase) and 2-axis 200 k HZ differential output

AS04PU: 4-axis NPN transistor (sinking) output at 100 k Hz

(3) **Input/output**

AS02PU-A: 5 direct current input points (sinking or souring)

AS04PU-A: 6 direct current input points (sinking or souring)

(4) **Use the utility software to configure the module.**

The HWCONFIG utility software is built into ISPSoft. You can set modes and parameters directly in HWCONFIG without spending time writing programs to set registers to manage functions.

(5) **Specially designed instructions for the module**

You can use specially designed instructions to control the modules without spending too much time to figure out how to achieve the required applications.

12.2 Specifications and Functions

12.2.1. Specifications

- **Electrical specifications for the inputs**

Module Name		**AS02PU-A**		**AS04PU-A**
Input		**High speed**	**Standard**	**Standard**
Number of Input Points		3 (A+/A-, B+/B-, Z+/Z-)	5 (X0.0-X0.4)	6
Connector Type		Removable terminal block		
Input Form		Differential input	Direct current (sinking or sourcing)	Direct current (sinking or sourcing) Sinking: The inputs are NPN transistors whose collectors are open collectors. Sourcing: The inputs are PNP transistors whose collectors are open collectors.
Input Current		5-24 VDC, 5 mA	24 VDC, 5 mA	24 VDC, 5 mA
Action Level	**OFF→ON**	>3 VDC	>15 VDC	>15 VDC
	ON→OFF	<1.5 VDC	<5 VDC	<5 VDC
Response time		<2.5 μs	<0.5 ms	<0.5 ms
Maximum input frequency		200 k Hz (A+/A-, B+/B-, Z+/Z-)	10 k Hz	10 k Hz
Input impedance		4.7kΩ		
Input isolation		500 VDC		
Input display		When the optocoupler is driven, the input LED indicator is ON.		
Weight		120 g		

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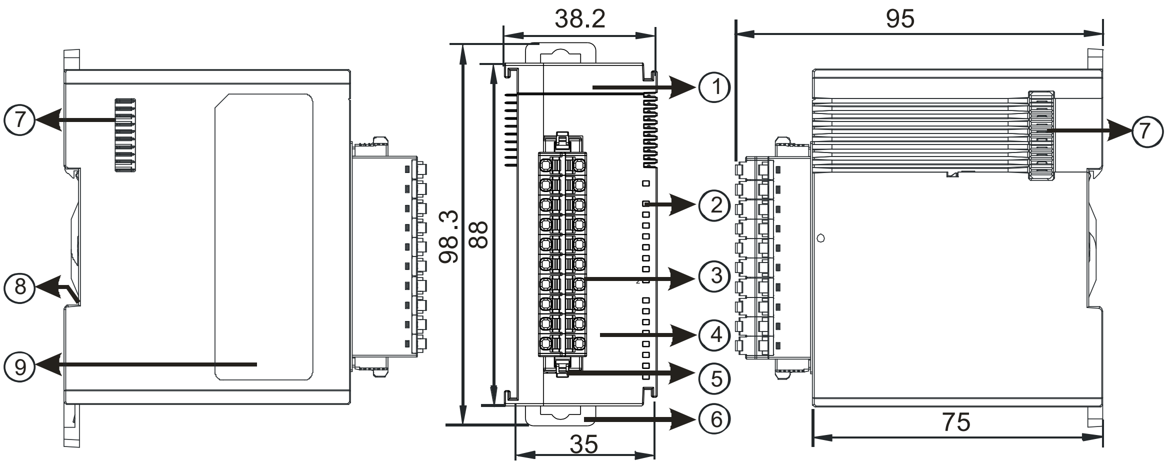
- **Electrical specifications for the outputs**

Item \ Model		AS02PU-A	AS04PU-A
Number of outputs		Four (2-axis)	Eight (4-axis)
Connector type		Removable terminal blocks	
Output form		differential output	Transistor-T (sinking) (NPN)
Output current		5 VDC*1	5-30 VDC
Maximum load	**Resistance**	10 mA	0.1A
	Inductance	N/A	
	Bulb	N/A	
Maximum output frequency*1	**Resistance**	200 kHz	100 kHz
	Inductance	N/A	
	Bulb	N/A	
Maximum Response time	**OFF→ON**	0.1 μs	1.5 μs
	ON→OFF	0.1 μs	1.5 μs
Input isolation		500 VDC	
Weight		120 g	

*1: Acutal output: 4 VDC (high input impedance) to 3.3 VDC (10 mA)/output

12.2.2. Profile

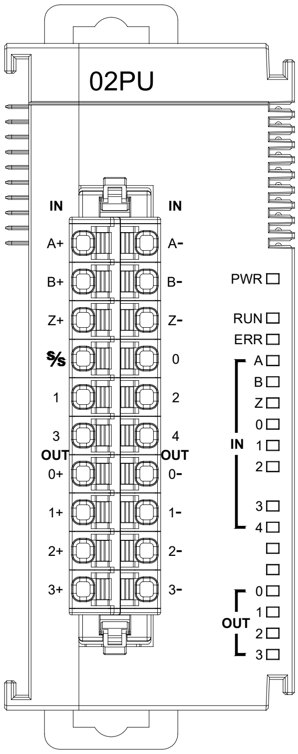
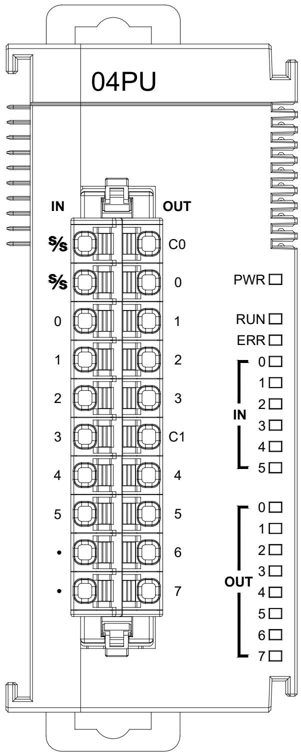


Unit: mm

Number	Name	Description
1	Model name	Model name of the module
2	POWER LED indicator (Blue)	Indicates the status of the power supply ON: the power is on OFF: no power
	Run LED indicator (Green)	Operating status of the module ON: the module is running and ready to accept instructions. OFF: the module is stopped and can NOT accept instrucitons.
	Error LED indicator (Red)	Error status of the module OFF: the module is normal. Blinking (0.2 seconds ON/OFF): hardware error occurs in the module, can NOT operate normally
	Input LED indicator (Red)	ON: Receives an input signal OFF: Receives no input signal
	Output LED indicator (Red)	ON: Receives an output signal OFF: Receives no output signal
3	Removable terminal block	The inputs are connected to sensors. The outputs are connected to loads to be driven.
4	Arrangement of the input/output terminals	Arrangement of the terminals
5	Terminal block clip	Removal of the terminal block
6	DIN rail clip	Secures the module onto the DIN rail

Number	Name	Description
7	Module connecting set	Connects the modules
8	Ground clip	On the DIN reail for grounding
9	Label	Nameplate

12.2.3. Arrangement of Terminals

AS02PU-A	AS04PU-A
	

AS02PU-A	AS04PU-A
Wordings with the same indications that are used on the terminal block and manual	Wordings with the same indications that are used on the terminal block and manual

AS02PU-A

Manual	Terminal Block (left)	Manual	Terminal Block (right)
A+	A+	A-	A-
B+	B+	B-	B-
Z+	Z+	Z-	Z-
S/S	S/S	X0.0	0
X0.1	1	X0.2	2
X0.3	3	X0.4	4
Y0.0+	0+	Y0.0-	0-
Y0.1+	1+	Y0.1-	1-
Y0.2+	2+	Y0.2-	2-
Y0.3+	3+	Y0.3-	3-

AS04PU-A

Manual	Terminal Block (left)	Manual	Terminal Block (right)
S/S	S/S	C0	C0
S/S	S/S	Y0.0	0
X0.0	0	Y0.1	1
X0.1	1	Y0.2	2
X0.2	2	Y0.3	3
X0.3	3	C1	C1
X0.4	4	Y0.4	4
X0.5	5	Y0.5	5
	•	Y0.6	6
	•	Y0.7	7

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12.2.4. Special Designed Instrucitons

Special designed instructions for the positioning modules are listed below:

API	Instruction code		Pulse instruction	Function
	16-bit	32-bit		
1400	FROM	DFROM	✓	Reading data from the control register in an extension module
1401	TO	DTO	✓	Writing data into the control register in an extension module
1402	PUCONF	DPUCONF	✓	Setting output control parameters of PU module
1403	PUSTAT	–	–	Reading PU module output state
1404	–	DPUPLS	–	PU module pulse output (no acceleration)
1405	–	DPUDRI	–	Relative position output of PU module (with acceleration and deceleration)
1406	–	DPUDRA	–	Absolute addressing output of PU module (with acceleration and deceleration)
1407	–	DPUZRN	–	PU module homing
1408	–	DPUJOG	–	PU module jog output
1409	–	DPUMPG	–	PU module MPG output
1410	–	DPUCNT	–	High-speed counter function of PU module

Note: Refer to section 6.15 in AS Series Programming Manual for more information on the instrucions listed above.

12.2.5. Wiring

- **Precautions**

To ensure the positioning module functions well and reliably, the external wiring must prevent noise. Before you install the cables, follow the precautions below.

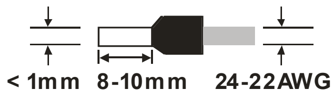
(1) To prevent a surge and induction, the AC cable and the input signal cables that are connected to the AS02/04PU-A must be separate cables.

(2) Do not install the cable near a main circuit, a high-voltage cable, or a cable connected to a load that is not a PLC. In addition, the cable must not be bound to a main circuit, a high-voltage cable, or a cable connected to a load which is not a PLC.

(3) Ground shielded cables and hermetically sealed cables separately.

(4) Terminals with insulation sleeves cannot be arranged as a terminal block, so you should cover the terminals with insulation tubes.

(5) Use single-core cables or twin-core cables with a diameter of 24–22 AWG and with pin-type connectors smaller than 1 mm. The plastic jackets that are removed from the cables should be 8 mm to 10 mm long. Only use copper conducting wires which can withstand temperatures of 60° C /75° C or higher.



(6) Note: use cables with the same length (less than 200 m) and use wire resistance of less than 100 ohm.

(7) Notes on two-wire, three-wire, and four-wire connections:

- Two-wire connection/three-wire connection (passive transducer): connect the transducer and the analog input module to the same power circuit.
- Four-wire connection (active transducer): the transducer uses an independent power supply, so do not connect it to the same power circuit as the analog input module.

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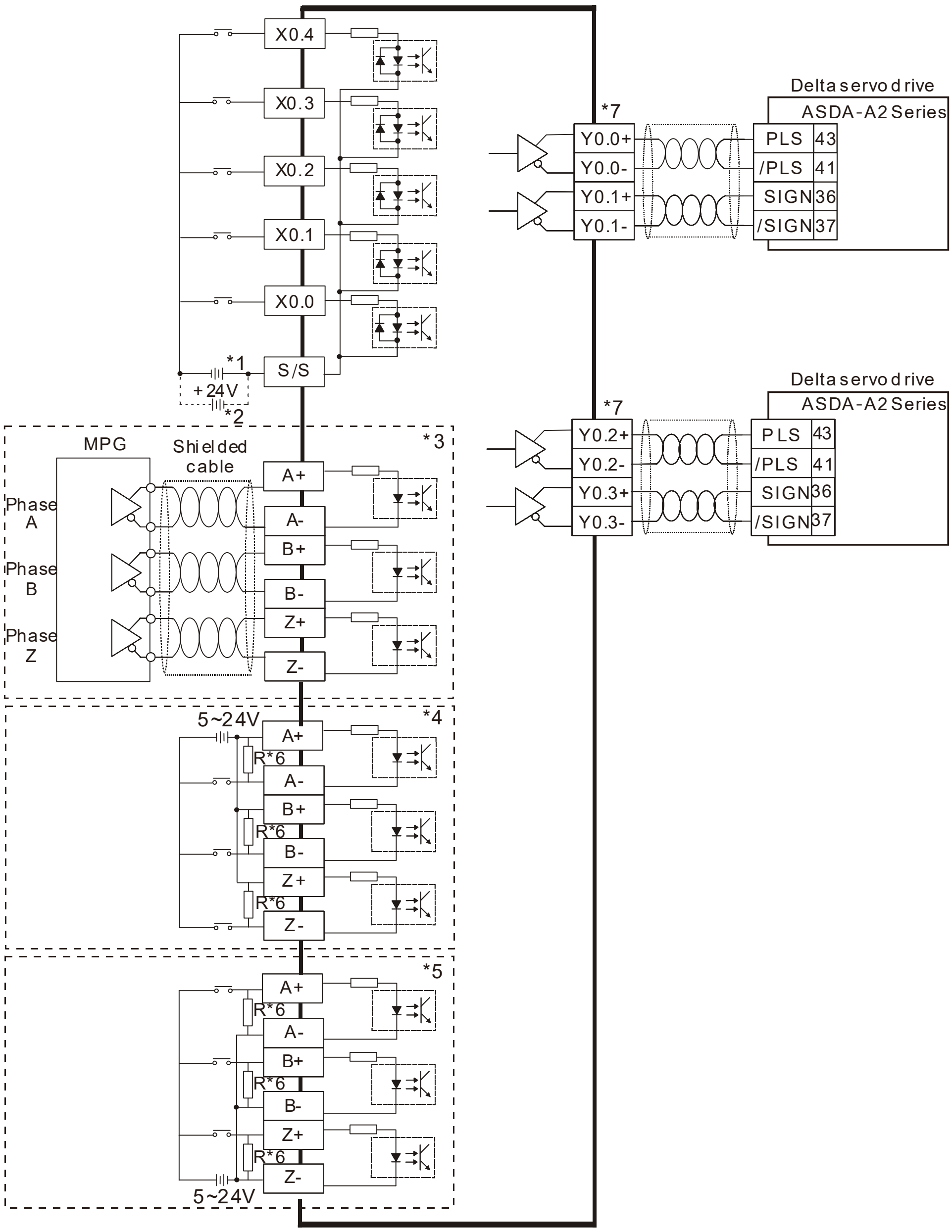
- **External wiring**

(1) AS02PU-A



*1. Sinking

*2. Souring

*3. Differential input

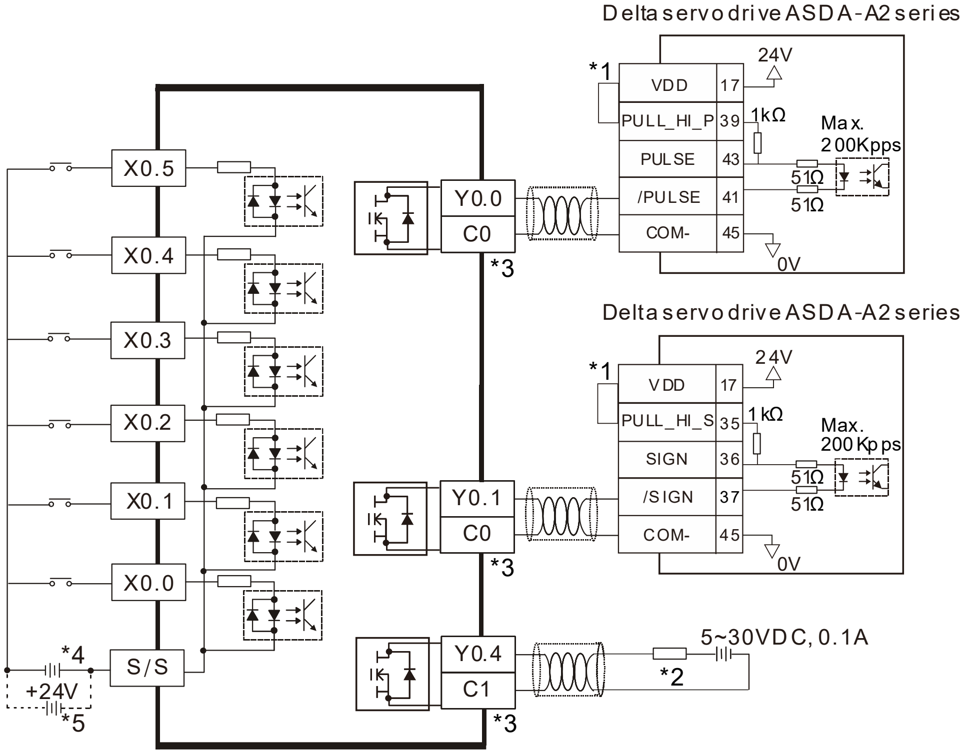
*4. Open collector sinking

*5. Open collector sourcing

*6. Open collector sinking/sourcing to conncet to phase A/B/Z and if the input frequenct is higher than 100 kHz, add a 3W/470 ohm resistor between + the positive end and – the negative end.

*7. Refer to API1402 in AS Series Programming Manual and Delta Servo Drive Manual for more information on the output mode.

(2) AS04PU-A



*1. VDD and COM are seen as a group and its power is provided by Delta servo drive.

*2. It is a load or an input point.

*3. Use the same power supply for the same COM group.

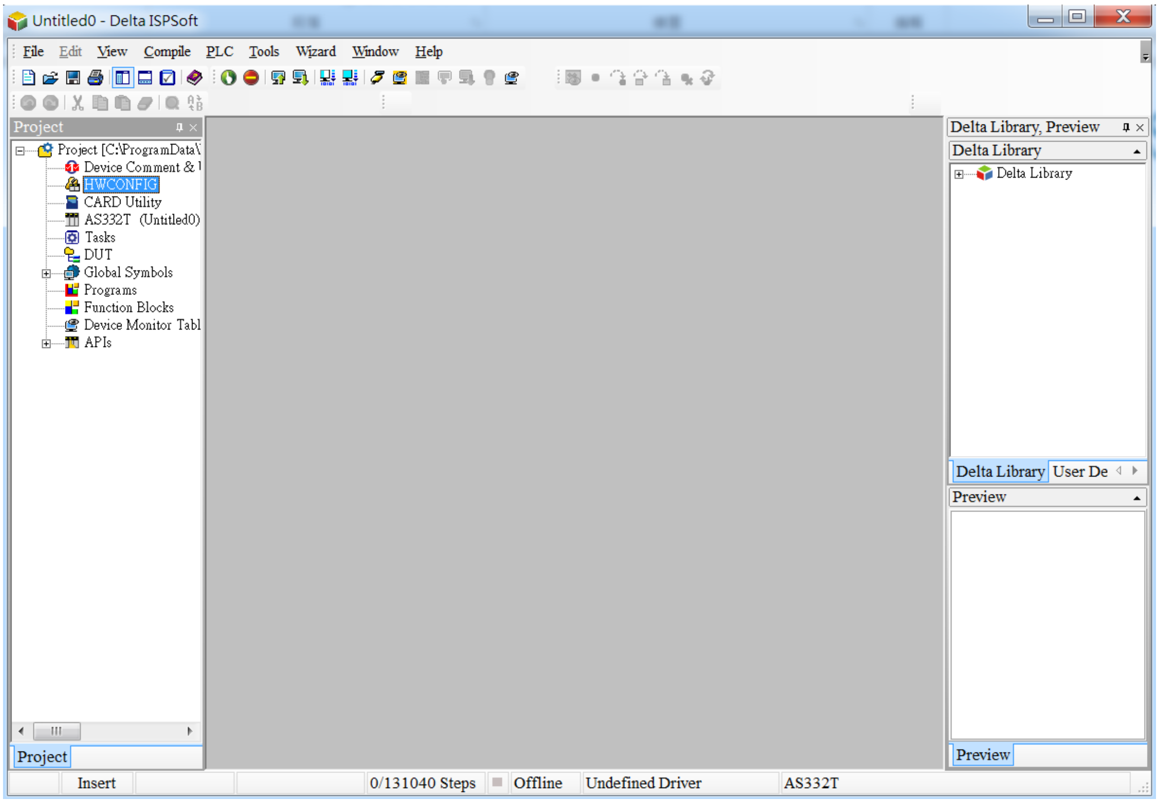
*4. Sinking

*5. Sourcing

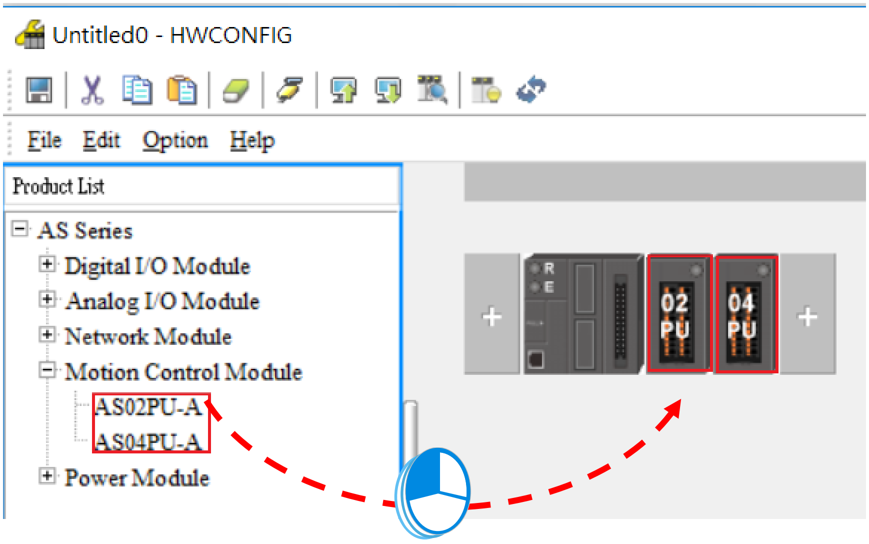
12.3 HWCONFIG in ISPSoft

12.3.1. Initial Setting

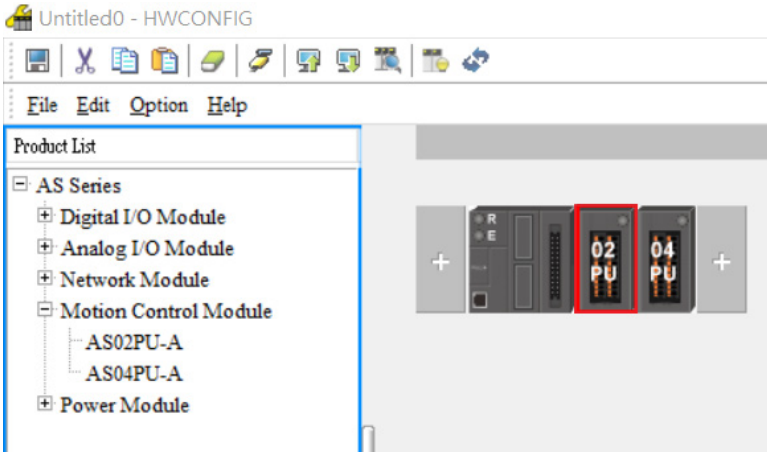
(1) Start ISPSoft and double-click **HWCONFIG**.

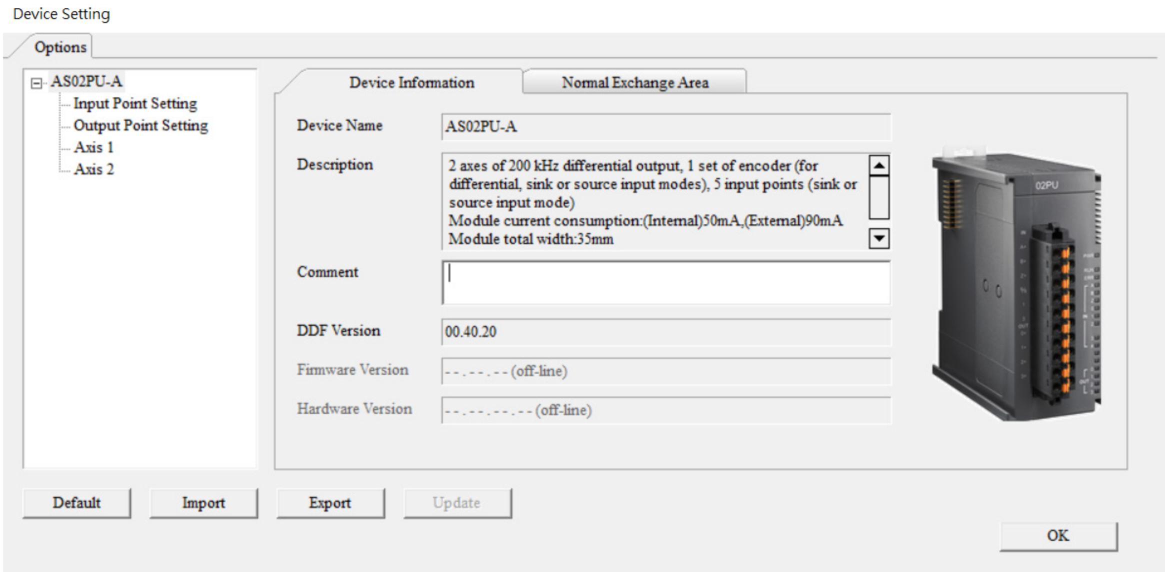


(2) Select a module and drag it to the working area.

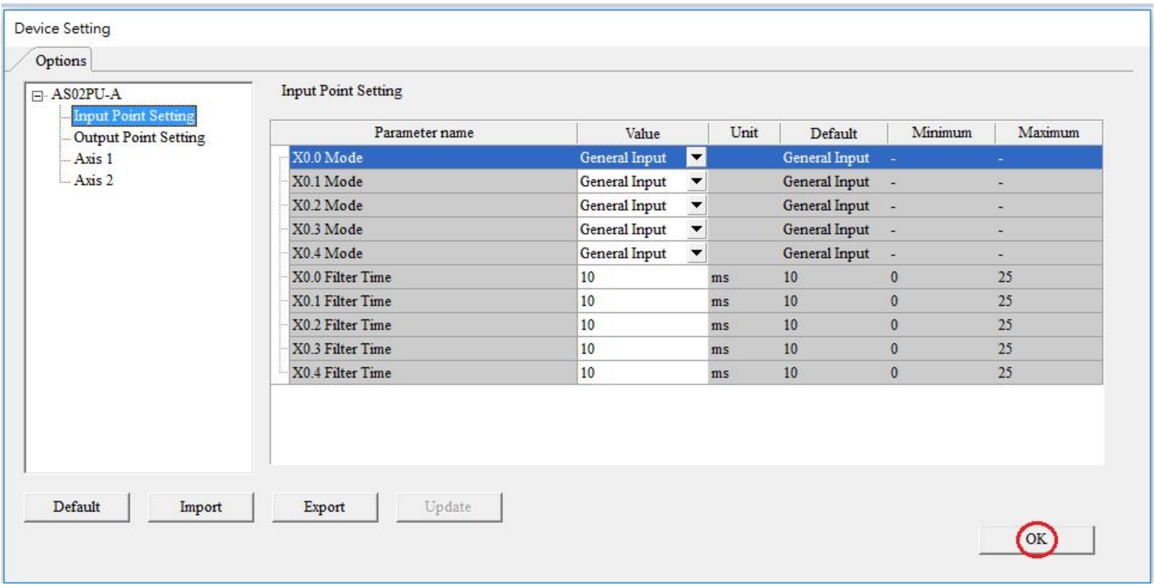


(3) Double-click the module in the working area to open the Device Setting page.

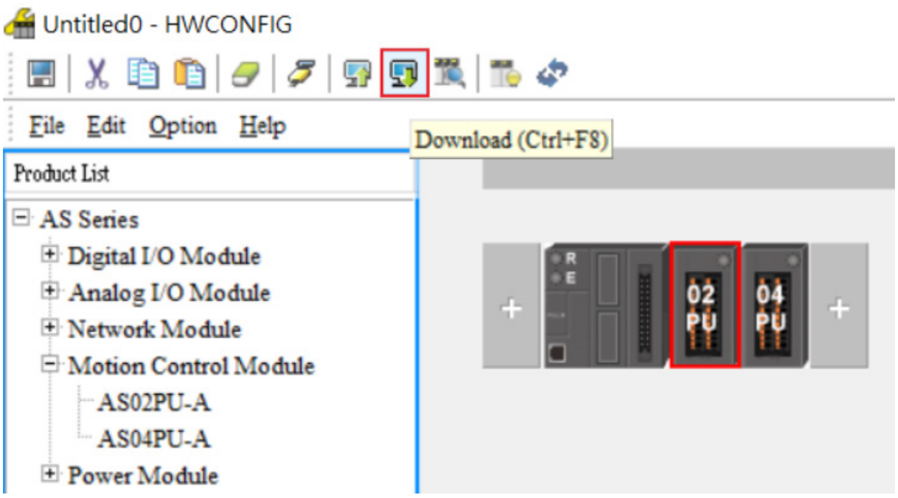




(4) Choose the parameter, set the values, and click **OK**.

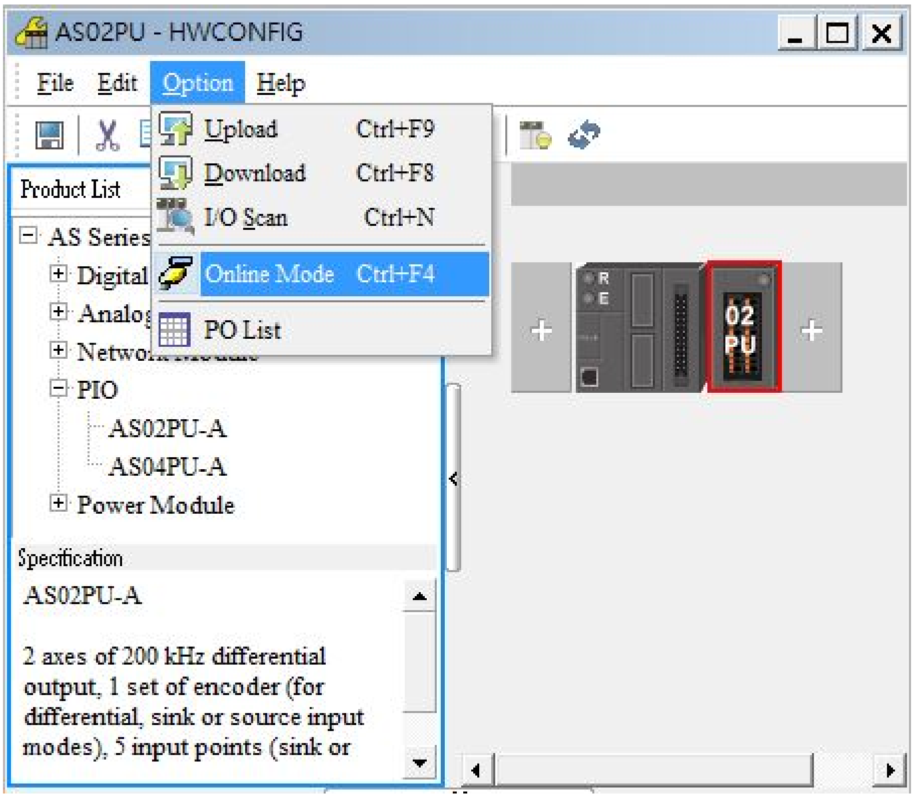


(5) Click **Download** on the toolbar to download the parameters. Note that you cannot download the parameters while the CPU module is running.

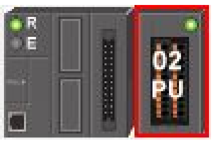


12.3.2. Checking the Version of a Module

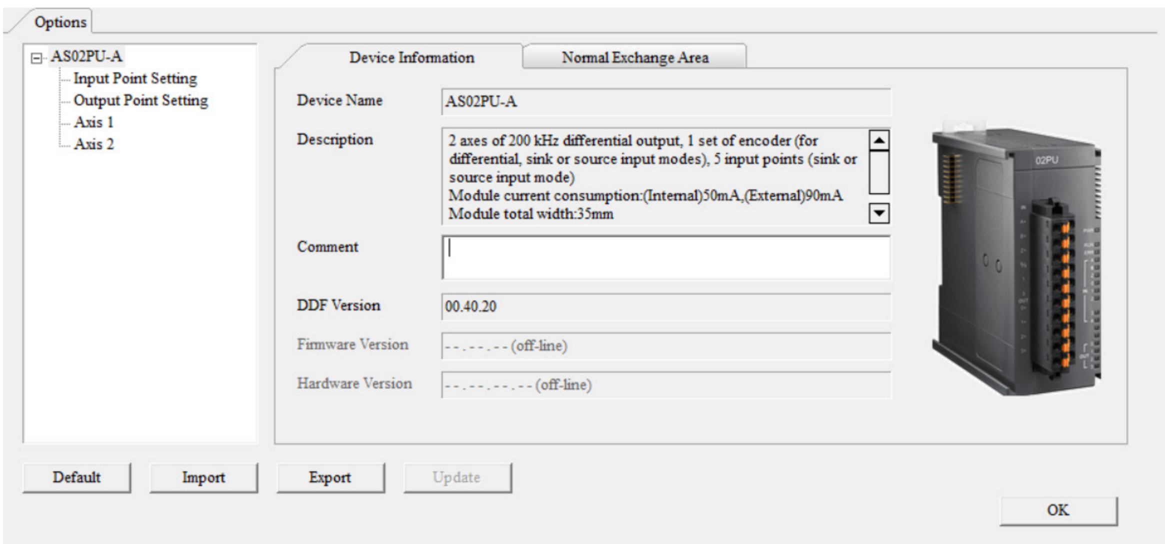
(1) On the **Option** menu, click **Online Mode**.



(2) Double-click the module to open the Device Setting page. The versions of both the firmware and the hardware are displayed.

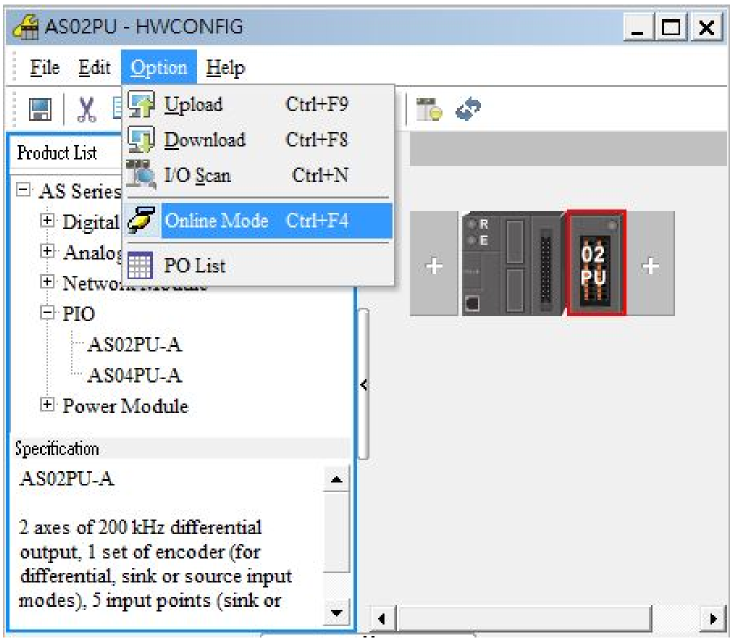


Device Setting

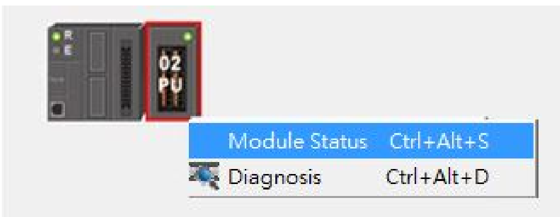


12.3.3. Online Mode

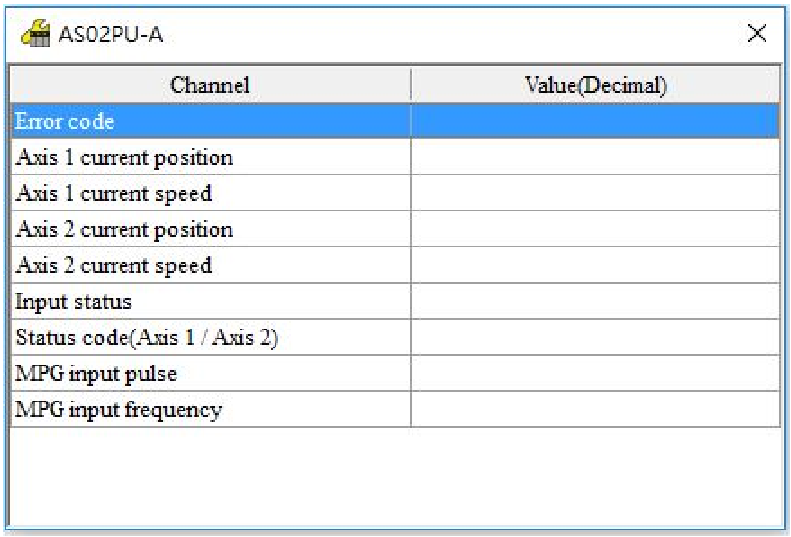
(1) On the **Option** menu, click **Online Mode**.



(2) Right-click the module and click **Module Status**.

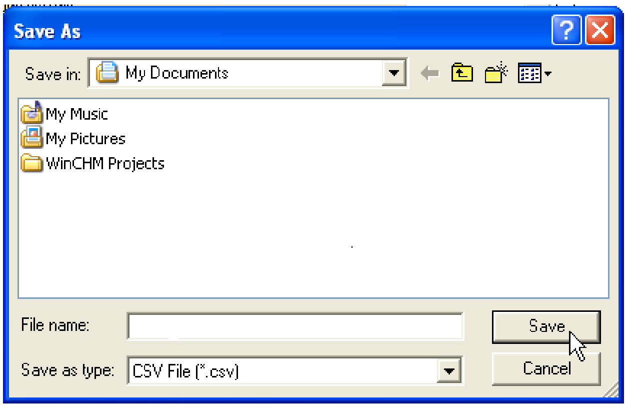


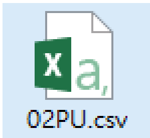
(3) View the module status.



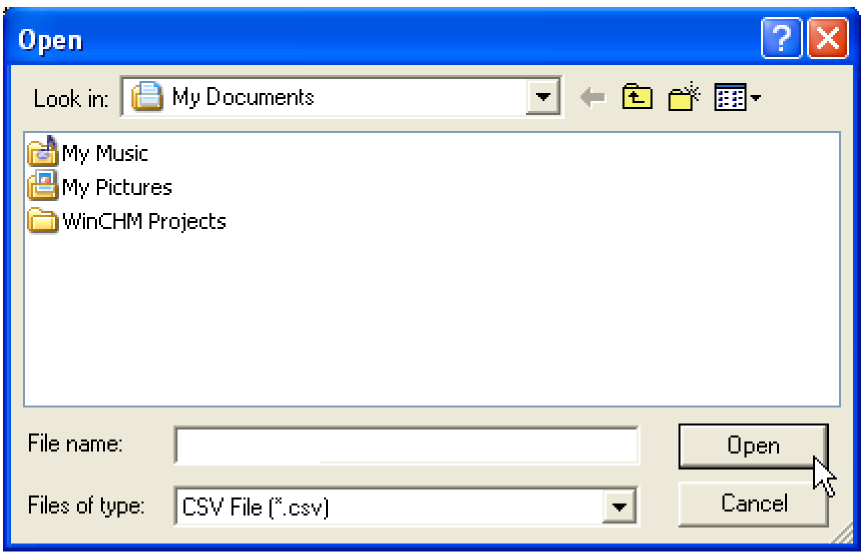
12.3.4. Importing/Exporting a Parameter File

(1) Click **Export** in the Device Settings dialog box to save the current parameters as a CSV file (.csv).





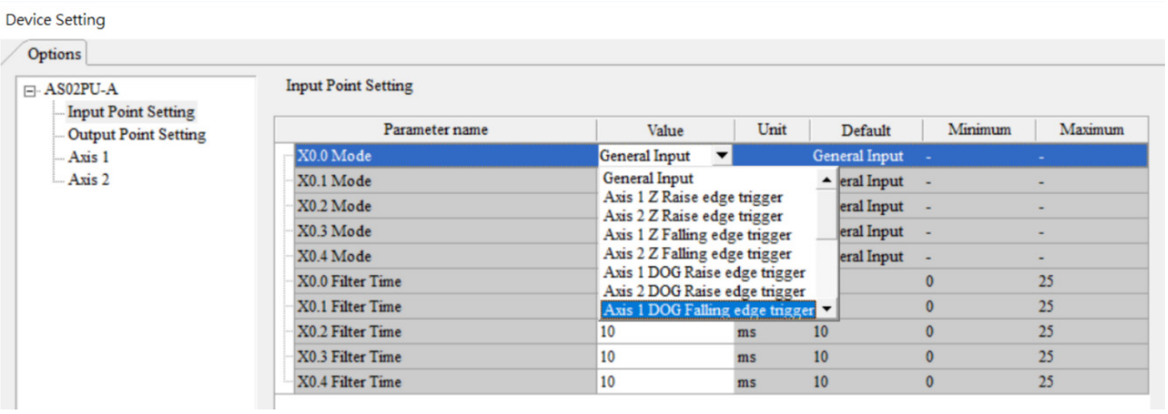
(2) Click **Import** in the Device Settings dialog box and select a CSV file to import saved parameters.



12.3.5. Parameters

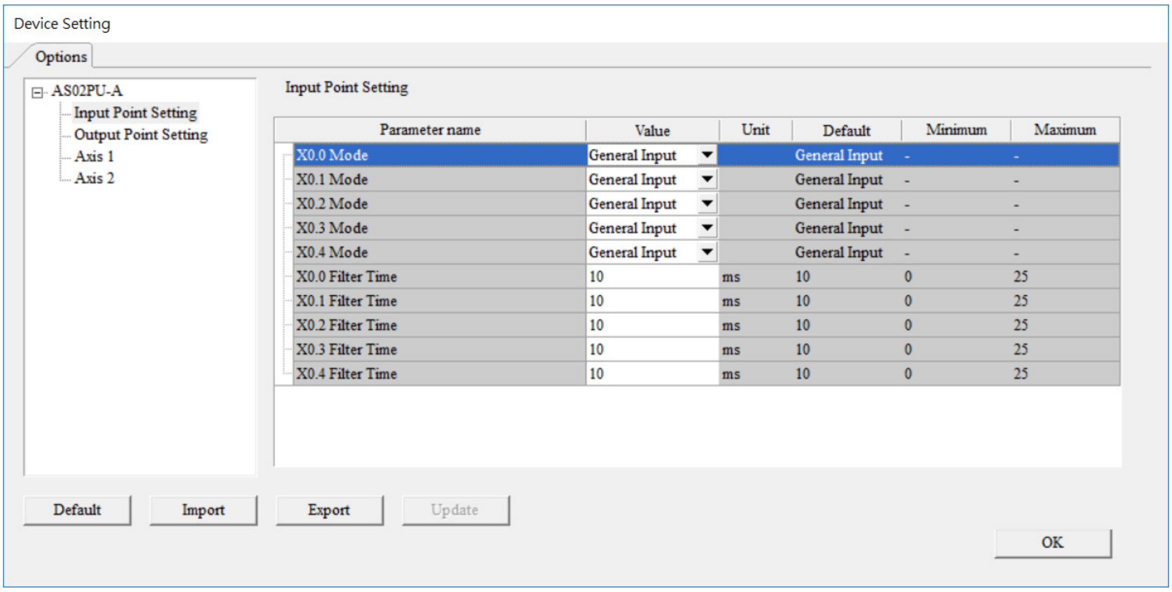
- The input point settings

  You can set values in the input points as the triggering conditions (phase Z, DOG, LSN, LSP) for the axis1 and axis 2 to position. Rising-edge and falling-edge can also be specified in the triggering conditions.



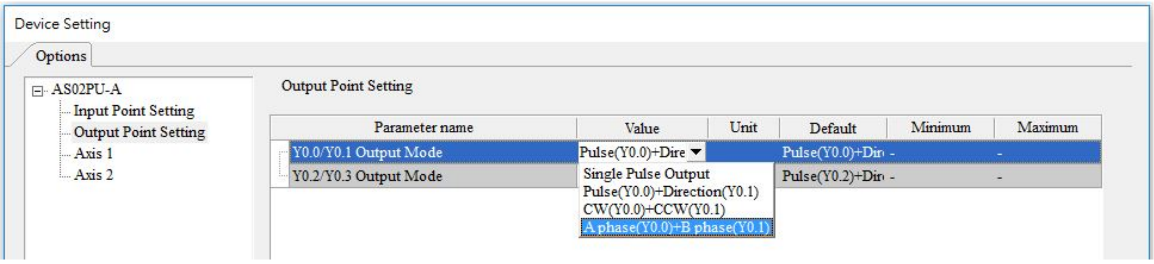
- Filter time settings

  The default setting is 10 ms; the system filters out distortion and noises in a pulse width modulated transmission that is below 10 ms.



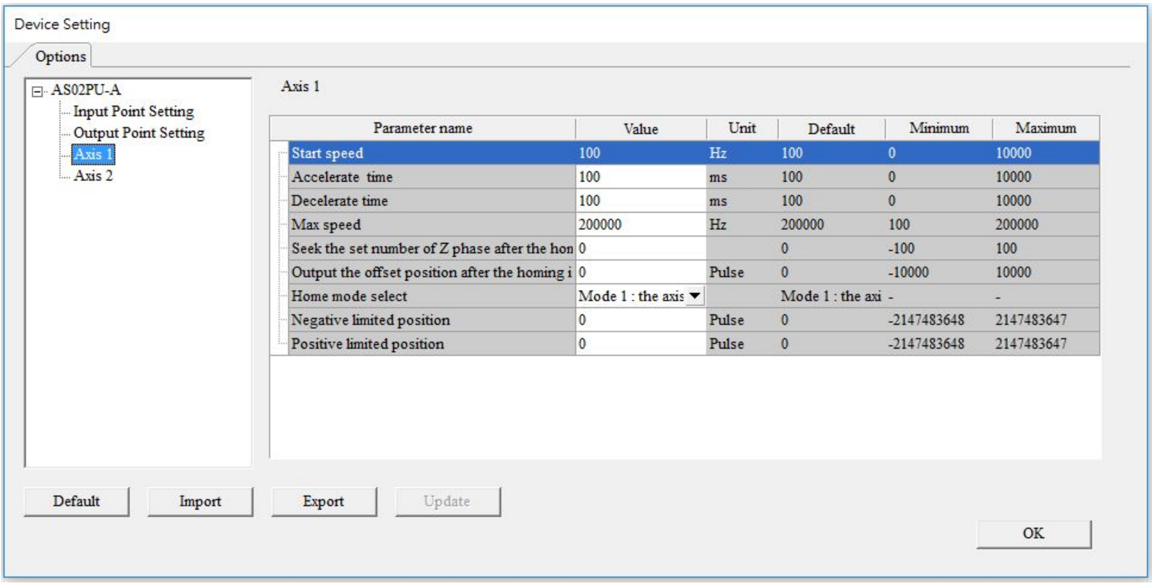
- The output point settings

  You can set values in the output points (single pulse output, pulse + direction, CW+CCW, A phase + B phase). Refer to API1402 in AS Series Programming Manual for more information on output modes.



- Axis settings

You can set up the axis in HWCONFIG or through positioning instructions. Use API1402 to set up the followings starting speed, accelation time, deceleration time, max. speed, seeking the set number of Z phase after homing, output the offset position after homing. Use API1407 to setup homing mode. Refer to API1402 – 1410 in AS Series Programming Manual for more information on the settings of axis.



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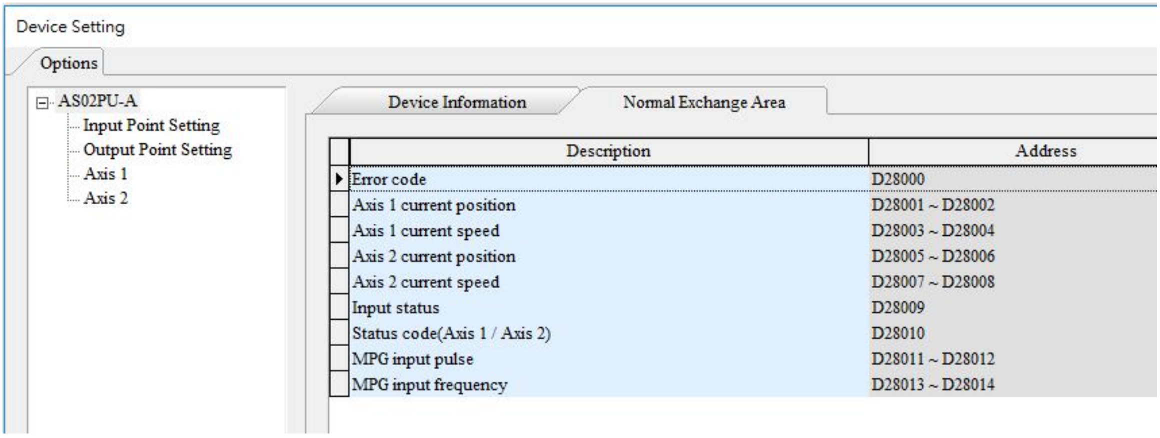
12.3.6. Normal Exchange Area

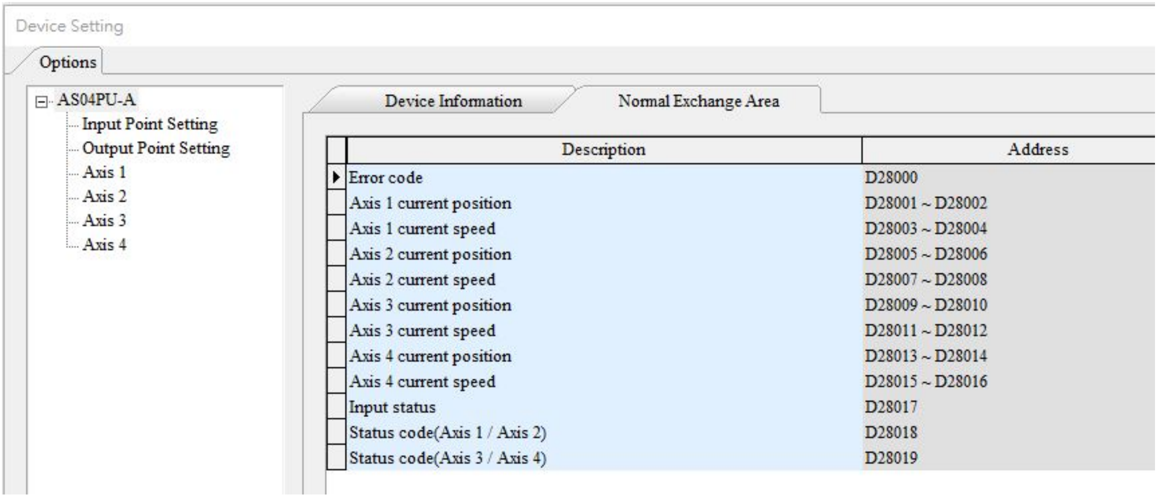
For data exchange among the CPU module and the modules, the system assign special devices for specified parameters.

- AS02PU-A



Description	Address
Error code	D28000
Axis 1 current position	D28001 ~ D28002
Axis 1 current speed	D28003 ~ D28004
Axis 2 current position	D28005 ~ D28006
Axis 2 current speed	D28007 ~ D28008
Input status	D28009
Status code(Axis 1 / Axis 2)	D28010
MPG input pulse	D28011 ~ D28012
MPG input frequency	D28013 ~ D28014

- AS04PU-A



Description	Address
Error code	D28000
Axis 1 current position	D28001 ~ D28002
Axis 1 current speed	D28003 ~ D28004
Axis 2 current position	D28005 ~ D28006
Axis 2 current speed	D28007 ~ D28008
Axis 3 current position	D28009 ~ D28010
Axis 3 current speed	D28011 ~ D28012
Axis 4 current position	D28013 ~ D28014
Axis 4 current speed	D28015 ~ D28016
Input status	D28017
Status code(Axis 1 / Axis 2)	D28018
Status code(Axis 3 / Axis 4)	D28019

12.4 Troubleshooting

12.4.1. Error Codes

Error Code	Description	A↔ D LED indicator	ERROR LED indicator
16#1802	Hardware failure	OFF	Blinking

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12.4.2. Troubleshooting Procedure

Description	Procedure
Hardware failure	Return the module to the factory for repair.

12.4.3. State Codes (Axis 1 - 4)

State Code Byte #	Description	Axis 1-2	Axis 3-4
0	Error flag	Axis 1	Axis 3
1	The output is active.		
2	The output has stopped working.		
3	The instruction execution is complete.		
4	Pulse in positive direction not allowed		
5	Pulse in negative direction not allowed		
6	Current position value overflow		
7	Pulse direction (positive or negative)		
8	Error flag	Axis 2	Axis 4
9	The output is active.		
10	The output has stopped working.		
11	The instruction execution is complete.		
12	Pulse in positive direction not allowed		
13	Pulse in negative direction not allowed		
14	Current position value overflow		
15	Pulse direction (positive or negative)		

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Chapter 13 IO-Link Communication Module AS04SIL

Table of Contents

13.1 Overview

Thank you for using the IO-Link master module AS04SIL-A. To ensure that your AS04SIL-A is installed and operated correctly, read this manual carefully before using the module.

The AS04SIL-A module is an AS series IO-Link communication module (hereafter referred to as “SIL” module) connected on the right side of AS CPU module or AS00SCM-A (RTU mode). When the communication card AS-FCOPM is being used together, they serve as a CAN remote device. SIL provides 4 channels, which can be separately configured in IO-Link master or standard I/O (SIO) mode. IO-Link master can freely connect with IO-Link devices and supports the hybrid use of IO-Link sensors and traditional sensors. Digital I/O of the SIL module can be extended with IO-Link hubs so that the sensors which do not support IO-Link can be connected to. Therefore it is pretty flexible to use the SIL module.

The setup software for AS04SIL-A is HWCONFIG 4.0 which is built in ISPSoft. You can use it after downloading the software from Delta official website and installing it.

13.1.1 Firmware and Software Versions

Firmware			
Model	AS series CPU	AS00SCM-A	AS04SIL-A
Version	V1.08 and later	V2.06 and later	V1.00 and later

Software			
Model	ISPSoft	HWCONFIG 4.0	AS00SCM-A CANopen EDS file
Version	V3.11 and later	V4.03 and later	V2.06 and later

13.2 Specification and Wiring

13.2.1 Specifications

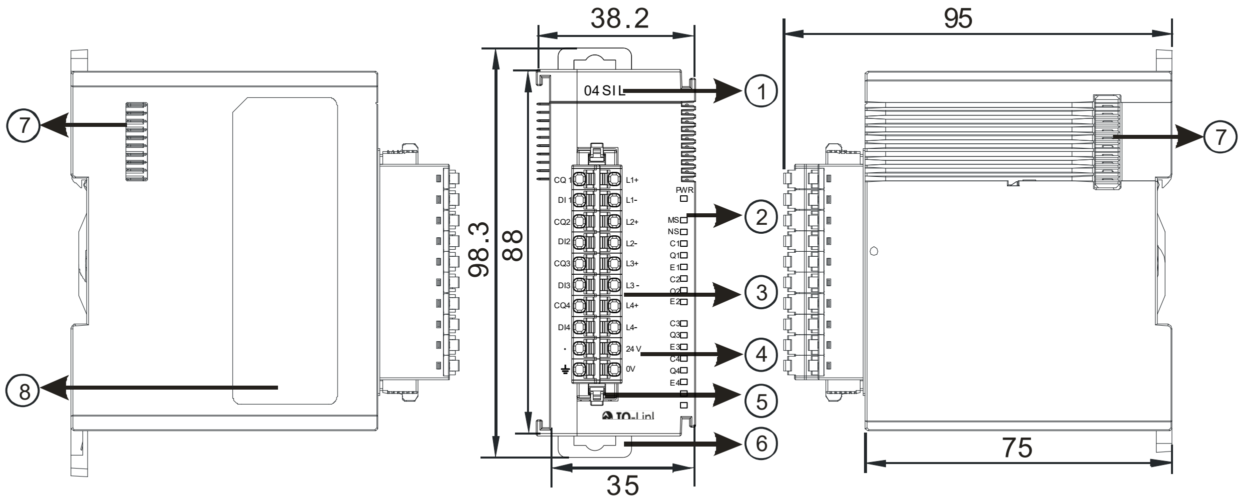
- **Unit Specification**

Item		Specifications
Module type		IO-Link master
Model name		AS04SIL-A
Number of IO-Link ports		4
Communication	**Baud rate**	4.8kbps, 38.4kbps,230.4kbps
	Topology	1 : 1
	Compliant standards	● IO-Link Interface and System Specification Version 1.1.2 ● IO-Link Tester Specification Version 1.1.2
Mode	**IO-Link**	Yes
	SIO (DI)	Yes
	SIO (DO)	Yes, up to 100 mA / channel
Cyclic communications		Min. 2 ms; dynamic, according to the valid data length
Input: data size in each communication port		Max. 32 bytes
Output: data size in each communication port		Max. 32 bytes
Input: data size in each module		Max. 128 bytes
Output: data size in each module		Max. 128 bytes
Input PDO data size		Max. 100 words
Output PDO data size		Max. 100 words
Backup		Yes
Cable specification	**Type**	Unshielded (can also apply to shielded ones)
	Length	Max. 20 m
	Electrostatic capacity between lines	Max. 3 nF
	Loop resistance	Max. 6 Ω
External connection terminals		Removable terminal block, clamping connector

- **Electrical Specifications**

Item		Specifications
Power supply to device in IO-Link mode or SIO (DI) mode	**Rated voltage**	24VDC (20.4VDC~ 28.8VDC) (-15%~+20%)
	Max. load current	0.2A/port
	Short-circuit protection	Yes
Digital inputs in SIO (DI) mode	**Internal I/O common**	NPN, PNP
	Input voltage/ current	24VDC, 5mA
	ON voltage	>15VDC
	OFF voltage	<5VDC
	Input filter time	No filter, 1ms (default), 2ms, 4ms, 8ms, 16ms, 32ms, 64ms, 128ms, 256ms
Digital outputs in SIO (DO) mode	**Internal I/O common**	NPN, PNP
	Output voltage/ current	24VDC (20.4VDC~ 28.8VDC),0.1A/port
	Short-circuit protection	Yes
	Leakage current	<0.1mA
	Residual voltage	<1.5VDC
Digital inputs for Pin2 in IO-Link mode	**Internal I/O common**	NPN, PNP
	Input voltage/ current	24 VDC, 2mA
	ON voltage	>15VDC
	OFF voltage	<5VDC
	Input filter time	No filter, 1ms (default), 2ms, 4ms, 8ms, 16ms, 32ms, 64ms, 128ms, 256ms
Power consumption		0.8W
Weight		133g

13.2.2 Profile



Unit: mm

Number	Name	Description
1	Model name	Model name of the module
2	POWER LED indicator (Blue)	Indicates the status of the power supply ON: the power is on OFF: no power or the power voltage is too low
	Module LED indicator (Red)	Error status of the module OFF: The module is normal. ON: The communication with its left-side PLC or RTU module fails. Blinking: 1. Module setting or communication error (blinks every 1 second) 2. Hardware or low voltage error (blinks every 0.2 second)
	Network LED indicator (Orange)	Error status of the network ON: No external power supply Blinking: Scanning is ongoing or the module is already configured and the diagnosis is done. OFF: The module has been configured but the diagnosis has not done yet.
	C1, C2, C3, C4 LED indicator (Orange)	IO-Link connection status of each communication port ON: The communication port is in IO-Link mode and a device is connected. Blinking: The communication port is in IO-Link mode but no device is connected or the device connected is not configured. OFF: The communication port is disabled or in SIO mode.
	Q1, Q2, Q3, Q4 LED indicator (Orange)	Indicates the status of input / output in SIO mode ON: The input/output is working in SIO mode. OFF: The communication port is disabled or in IO-Link mode.
	E1, E2, E3, E4 LED indicator (red)	Indicates if any warning or error occurs in each communication port of the IO-Link connection. Blinking: A warning or an error occurs OFF: No warnings or errors
3	Removable terminal block	IO-Link

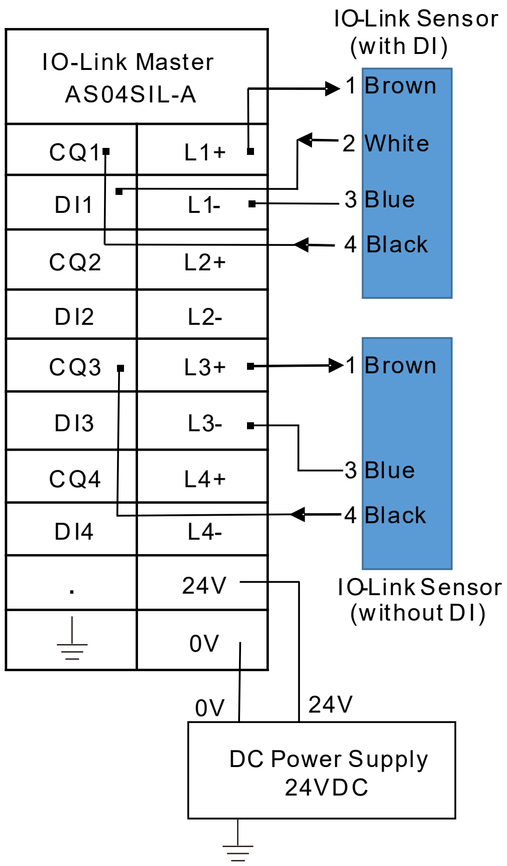
Number	Name	Description
4	Arrangement of the input/output terminals	Arrangement of the terminals
5	Terminal block clip	Removal of the terminal block
6	DIN rail clip	Secures the module onto the DIN rail
7	Module connecting set	Connects the modules
8	Label	Nameplate

13.2.3 Wiring

13.2.3.1 IO-Link Mode Wiring for Power and Communication

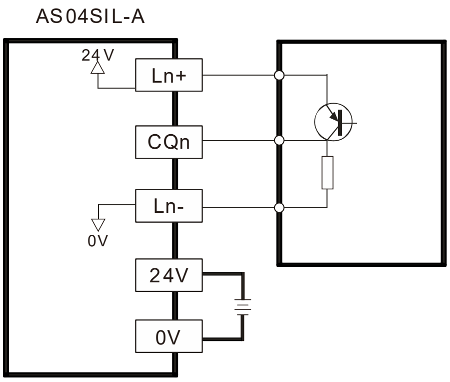
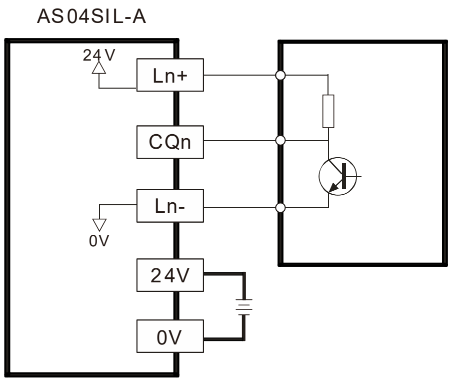
Precautions:

1. Keep the input cables, output cables and power cable separate from one another. It is suggested to use independent power for AS04SIL-A. See the example below.

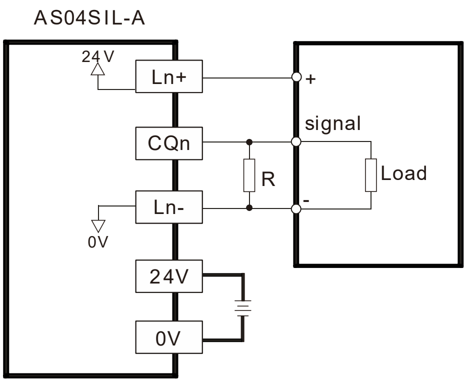
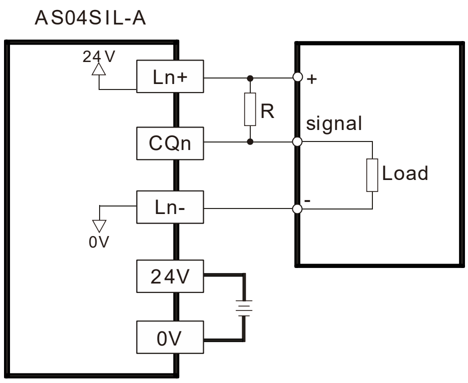


2. The 24 VDC cable should be twisted and connected to a module within a short distance.
3. Do not bundle 110 VAC cable, 220 VAC cable, 24 VDC cable, the (high-voltage high-current) main circuit, and the I/O signal cable together and keep the power cables away from the earth cable. It is suggested that the distance between adjacent cables should be more than 100 millimeters.
4. Connect a cable with a diameter of 14 AWG or higher to ground.
5. Use single-wire cables or two-wire cables with a diameter of 20 AWG to 14 AWG. Only use copper conducting wires with a temperature rating of 60/75°C.

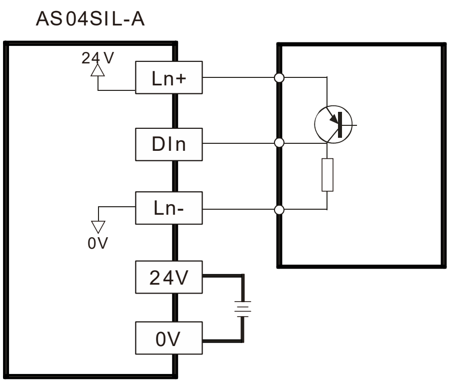
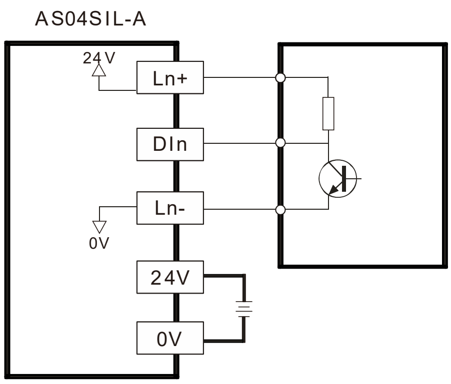
13.2.3.2 Digital Input Wiring in SIO Mode

When the connected device is a PNP type	When the connected device is a NPN type
	
Note: n= 1~4	

13.2.3.3 Digital Output Wiring in SIO Mode

When the connected device is a PNP type	When the connected device is a NPN type
	
Note: n= 1~4	

13.2.3.4 Digital Input Wiring

When the connected device is a PNP type	When the connected device is a NPN type
	
Note: n=1~4	

13.3 Functions

AS04SIL-A supports the IO-Link devices when it works as the IO-Link master. Between the master and the devices is the point-to-point connection adopting the reliable 3-wire technology and the unshielded standard cable to connect intelligent sensors/actuators which function as IO-Link devices. AS04SIL-A is compatible with traditional digital sensors/actuators. The designs for circuit status and data channels are both based on the reliable 24VDC technology.

13.3.1 Basic Functions

13.3.1.1 Cyclic Communication Function

I/O data (process data) in the IO/Link devices is cyclically exchanged with the IO-Link master module which operates as the IO-Link communication master. Meanwhile as the extension module of the upper device, AS04SIL-A can cyclically update the device data and status of the IO-Link master to the upper device.

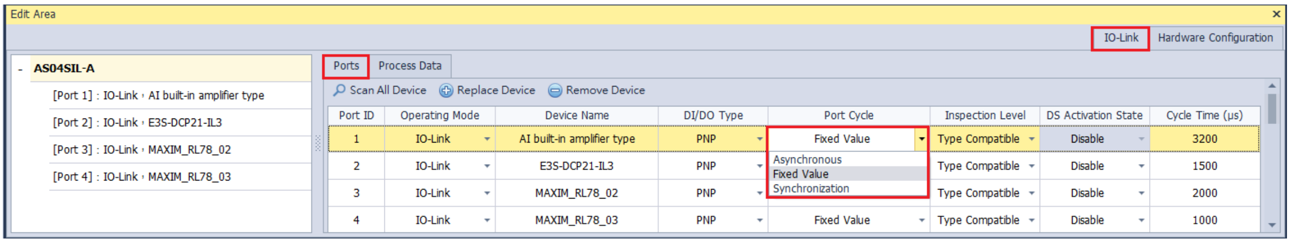
For example, users can use cyclic communications to check the amount of incident light for photoelectric sensors, stability detection margins, and excessive proximity for proximity sensors, etc. as well as detect the amount of performance deterioration in devices and changes in usage conditions.

There are three modes for cyclic communications:

(1) Asynchronous: AS04SIL-A and IO-Link device defines the cycle time for each port and uses the shortest update cycle time.

(2) Fixed Value: the system uses what you have set for the update cycle time here. The value here should be within the cycle time range of the connected device and the minimum value should be a number bigger than the shortest cycle time that the connected device supports.

(3) Synchronization: AS04SIL-A defines the update cycle time for all the selected communication ports synchronously. (You need to select at least two ports.) Since different device supports different update cycle time, the system uses the biggest time among all the shortest cycle times to have every device covered.

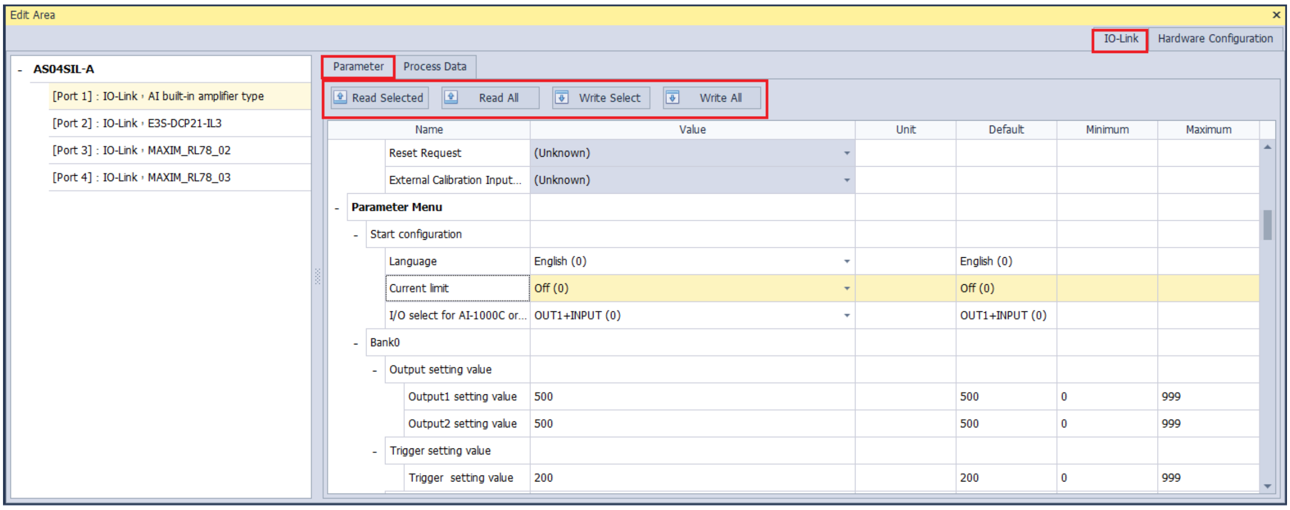


13.3.1.2 Message Communication Funciton

AS04SIL-A receives messages (non-cyclic) from ISPSoft, sends the data to IO-Link devices and sends back the response from IO-Link devices to AS04SIL-A.

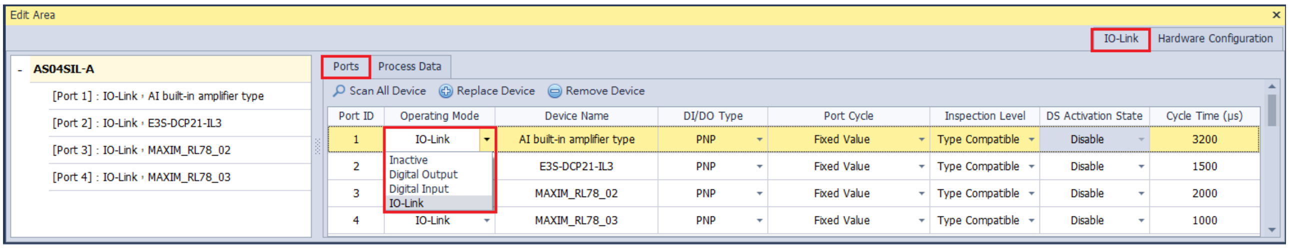
Non-cyclic data, including device parameters and events, uses specific index and sub-index for searching. AS04SIL-A uses explicit message to read and write these data. It is very useful to use index or sub-index in reading and writing data.

You can select the data or parameter type to read or write as the setting image shown below. For example, during operation you can change and adjust device parameters, such as threshold settings, execution tuning, and ON-delay time from a program as well as check the internal status, such as the operating time of devices.



13.3.1.3 Communication Mode Setting

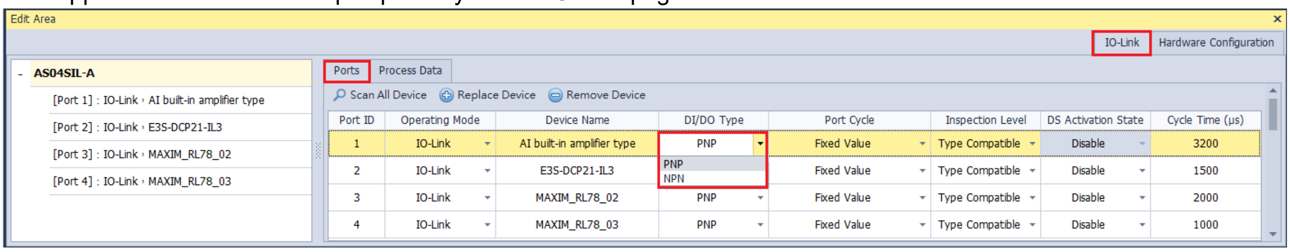
You can select one operating mode among the modes of **Inactive, SIO (Digital Output, Digital Input) and IO-Link** for each communication port on the following software page.



A mixture of IO-Link communication and digital I/O can apply to the same AS04SIL-A module.

13.3.1.4 Digital Input and Digital Output Function (SIO)

CQ1-CQ4 of AS04SIL-A can be used independently as the standard input or output. The DI/DO types of PNP and NPN are supported and can be set up separately on the IO-Link page.

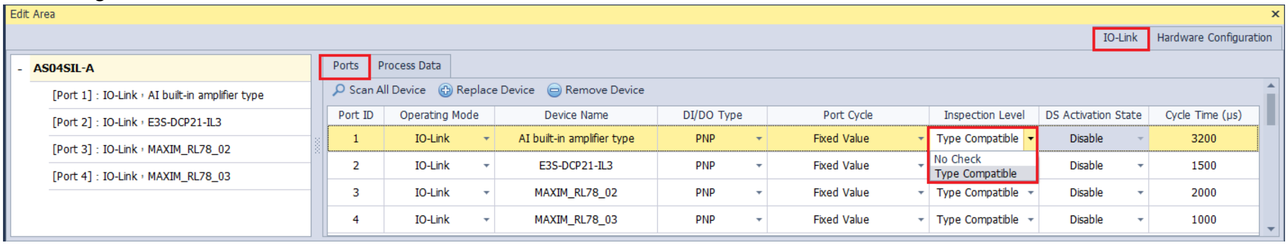


13.3.1.5 Automatic IO-Link Baud Rate Setting

AS04SIL-A can automatically match one of existing baud rates (4.8kbps, 38.4kbps and 230.4kbps) of IO-Link devices and communicate with them. Thus there is no need to set the baud rate at communication ports for connected devices.

13.3.1.6 Connected Device Verification

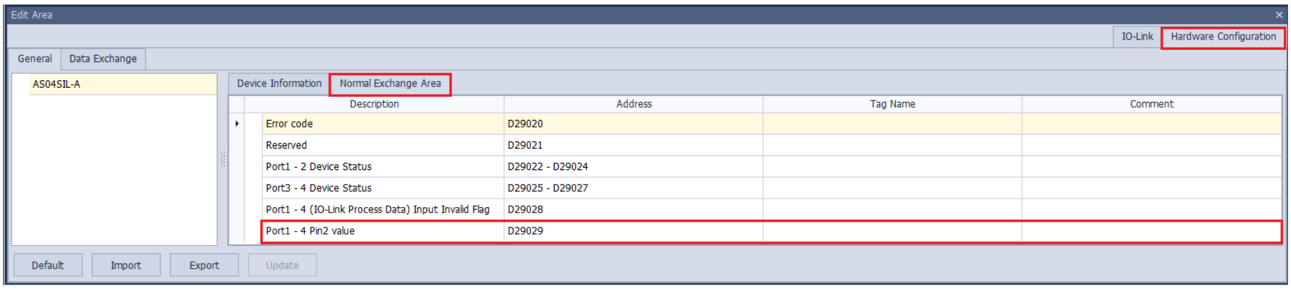
As long as the **Type Compatible** option under **Inspection Level** is enabled and the setting is downloaded, AS04SIL-A will check if the IO-Link device actually connected matches the product model of the configured device. If not matched, the status code of the communication port will show 16#8CA2 which indicates that the connected device is inconsistent with the configured one.



13.3.1.7 DI (Digital Input) Function of IO-Link Pin2

The IO-Link system may not respond fast enough for high-speed applications. When the connected IO-Link sensor supports the second output, connect the sensor's pin2 to DI of the port of AS04SIL-A. At this moment, the sensor can still be watched and set up via the sensor's pin4.

The real-time data can be monitored through **Port 1- 4 Pin2 value** of **Normal Exchange Area**. See the following figure as an example.



The mapped register for **Port 1- 4 Pin2 value** of **Normal Exchange Area** is D29029. For the pin2 input value, the addresses D29029.0~ D29029.3 correspond to port 1~ port 4 respectively.

Communication Port	Address
Port 1	D29029.0
Port 2	D29029.1
Port 3	D29029.2
Port 4	D29029.3

DI1-DI4 of AS04SIL-A can also be used separately as standard inputs.

13.3.1.8 IO-Link Communications Error Detection

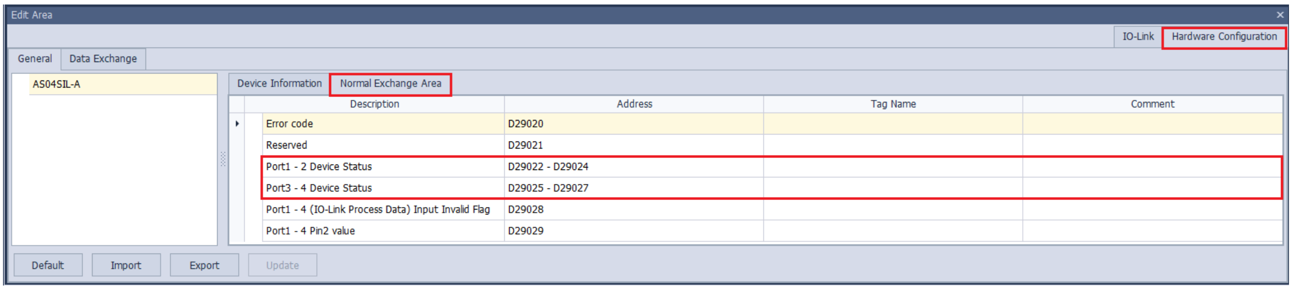
This function detects I/O-Link cable breaks, disconnections from IO-Link device ports, error-level device events, device configuration verification errors, and IO-Link device malfunctions. See section 13.5 for IO-Link event codes.

13.3.1.9 Detection of Short-Circuits in I/O Cables

This function detects short-circuits in I/O cables. The status code for communication ports will show 16#8CA4 if an error occurs.

13.3.1.10 Event Log

The IO-Link event codes listed in section 13.5 are refreshed in the mapped devices for ports in the **Normal Exchange Area** section as below.



The device status for each port should be set to 3 bytes in length. See the following table of above device addresses corresponding to ports in order.

Description	Address
Port 1	D29022_H, D29022_L, D29023_H
Port 2	D29023_L, D29024_H, D29024_L
Port 3	D29025_H, D29025_L, D29026_H
Port 4	D29026_L, D29027_H, D29027_L

Device status consists of Event qualifier and Event Code as follows.

For event codes, see section 13.5.

Event Qualifier	Event Code	
Byte 0	Byte 1	Byte 2

The data frame of Event Qualifier:

MODE		TYPE		SOURCE	INSTANCE		
Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0

Bit 0~ Bit 2: INSTANCE

Value	Definition
0	Unknown
1-3	Reserved
4	Application
5-7	Reserved

Bit 3: SOURCE

Value	Definition
0	Device (Remote)
1	Master (Local)

Bit 4~ Bit 5: TYPE

Value	Definition
0	Reserved
1	Notification
2	Warning
3	Error

Bit 6~ Bit 7: MODE

Value	Definition
0	Reserved
1	Event single shot
2	Event disappears
3	Event appears

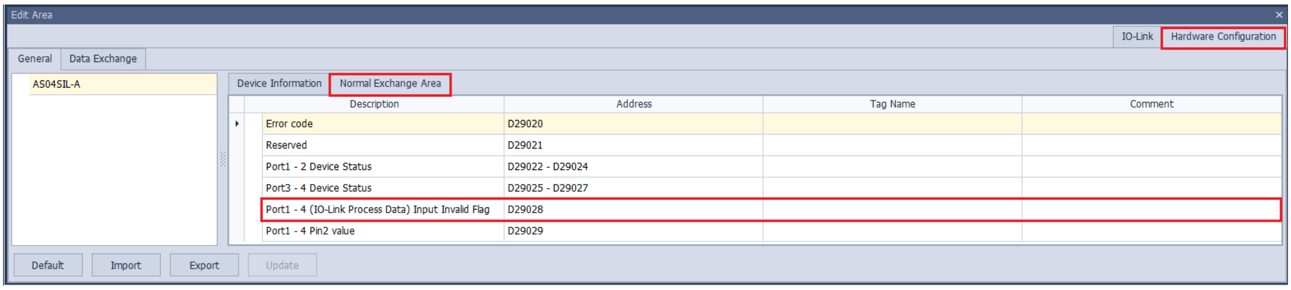
13.3.1.11 Notification of Input Data Invalidity

Input Invalid Flag is used to determine whether the process input data in the upper device is invalid for the IO-Link communication or not.

Whether the input data is invalid or not can be monitored by **Port1 – 4(IO-Link Process Data) Input Invalid Flag** of the **Normal Exchange Area** section. If the flag is 1, then the input data is invalid. If it is 0, the input data is valid. See the example in the following figure.

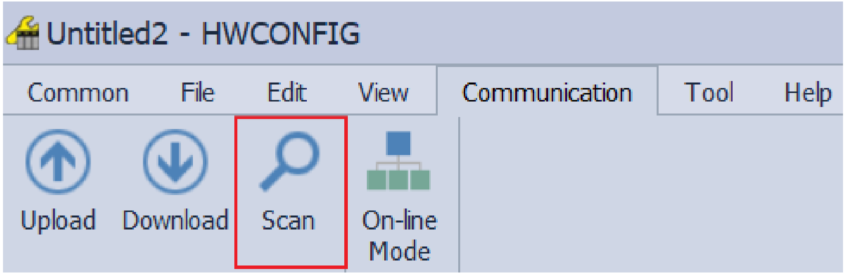
The mapped register for **Port1 – 4(IO-Link Process Data) Input Invalid Flag** is D29028 and for the input invalid flag, D29028.0~ D29028.3 correspond to Port 1~Port 4 respectively as shown in the following table.

Communication Port	Address
Port 1	D29028.0
Port 2	D29028.1
Port 3	D29028.2
Port 4	D29028.3

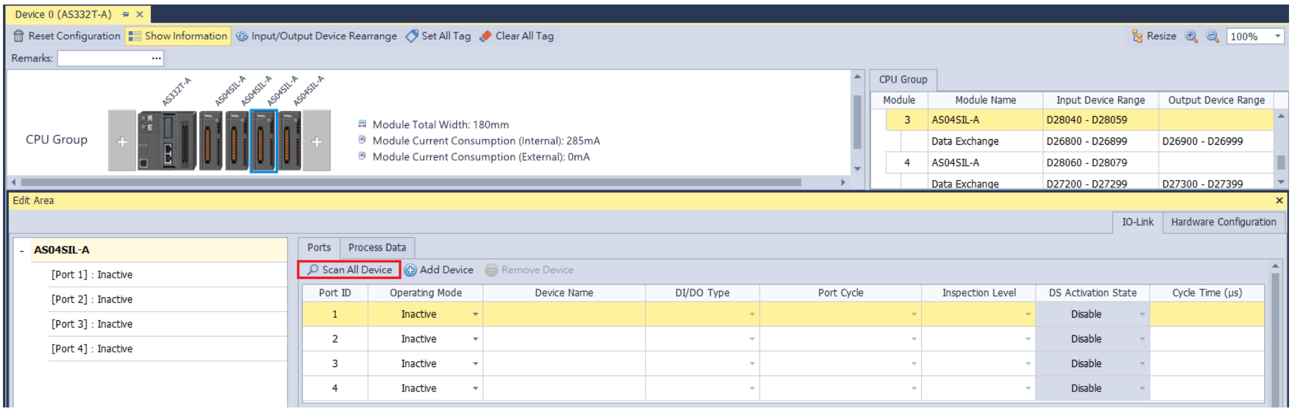


13.3.1.12 IO-Link Device Scan Function

HWCONFIG 4.0 can enable AS04SIL-A to auto-identify all IO-Link devices at its communication ports via a click on **Scan** button.



You can also select any AS04SIL-A module and then click **Scan All Device** to scan all the IO-Link devices connected to the communication port of AS04SIL-A.



While SIL is auto-identifying devices, all IO-Link devices connected to IO-Link master need be restarted and therefore the devices will probably stop running for a short time.

13.3.2 Application Functions

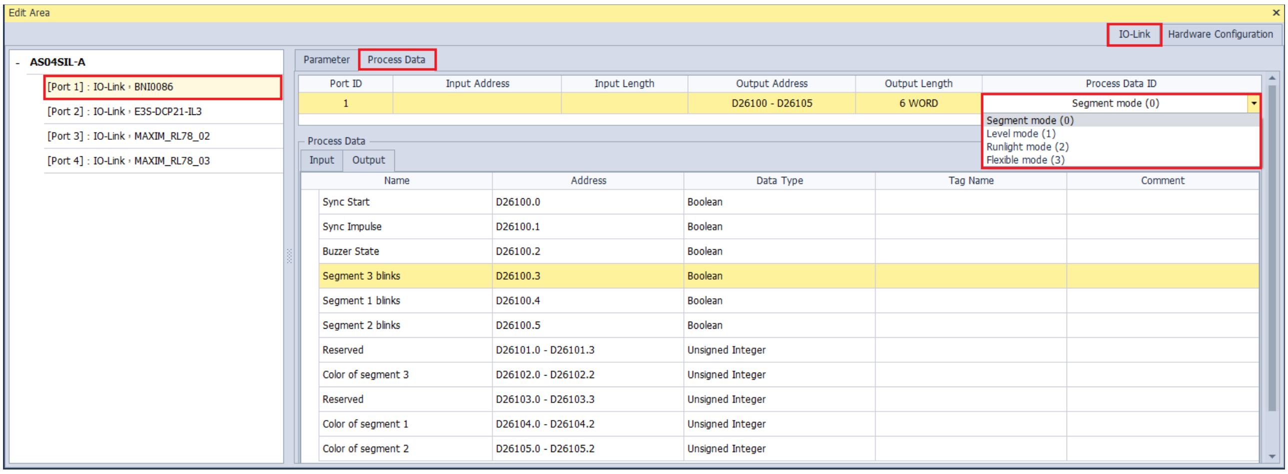
13.3.2.1 Load Rejection for Upper Device Stop or Communication Error

When the upper device enters STOP state or the communication with the upper device fails in IO-Link or SIO mode, the output function of AS04SIL-A is disabled and all process data outputs are 0. This function is used to prevent the incorrect output from the upper device as a communications error occurs.

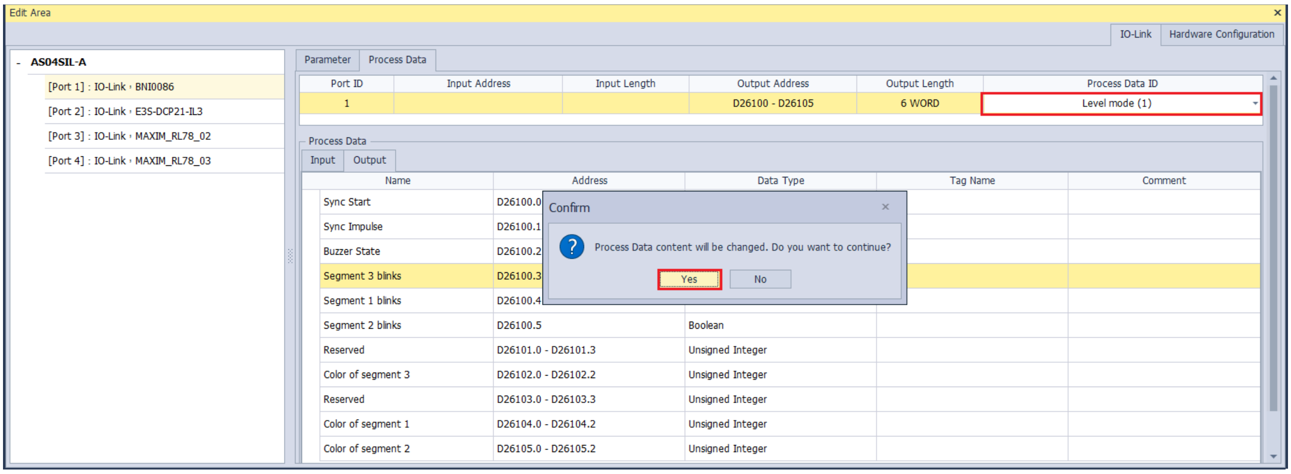
13.3.2.2 The Switch among Process Data Parameter Sets

IODD file allows IO-Link devices support several work modes, each of which corresponds to different Process Data parameter sets. Therefore SIL supports the switch among Process Data parameter sets if the IODD file of the configured device supports more than two work modes. However, the Process Data parameter set can not be changed if the IODD file of the configured device supports only one work mode.

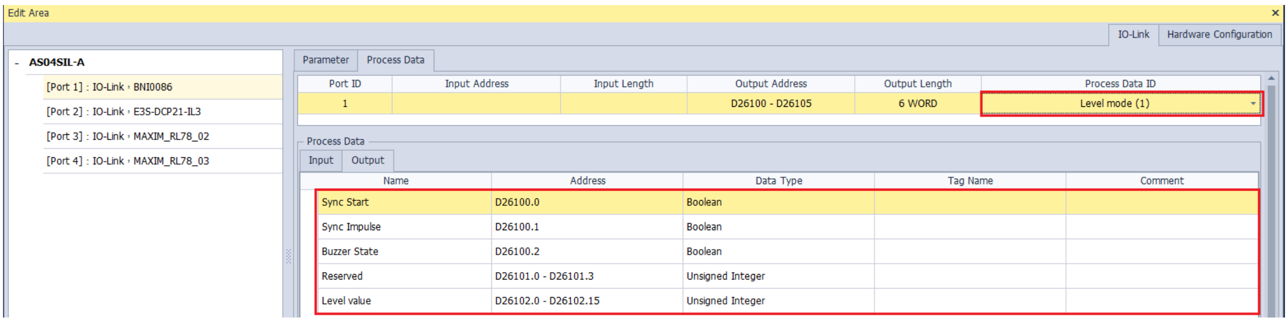
For example, the IO-Link device configured for Port 1 supports four work modes in the following figure. The default work mode is Segment mode (0).



When Level mode (1) is switched to, a **Confirm** dialog box will appear to alert that the Process Data content will be changed.



Clicking **Yes** button, the Process Data content will be refreshed in the software.

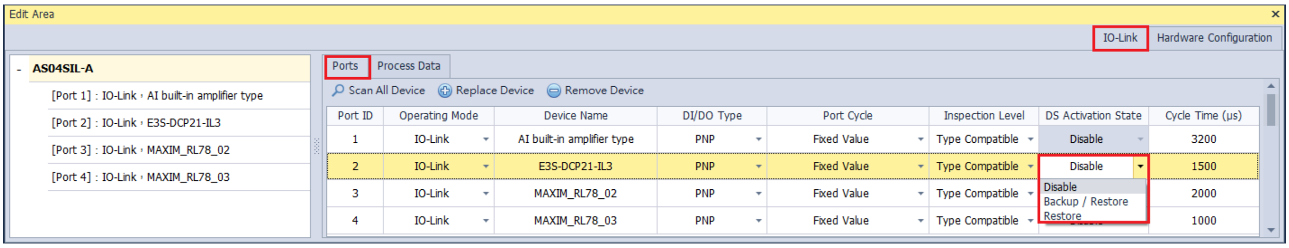


Click menu **Communication** > **Download**. The switch is completed once the download is done.

13.3.2.3 Backup and Restoration of Parameter Setup in IO-Link Devices

The V1.1 IO-Link devices support the Backup and Restore functions which are not necessary functions and are determined by their IODD files.

IO-Link device parameter settings are backed up to the IO-Link master or restored to IO-Link devices. When IO-Link devices are replaced, the communication can be resumed according to original settings instead of setting parameters once again. See the setting page below.

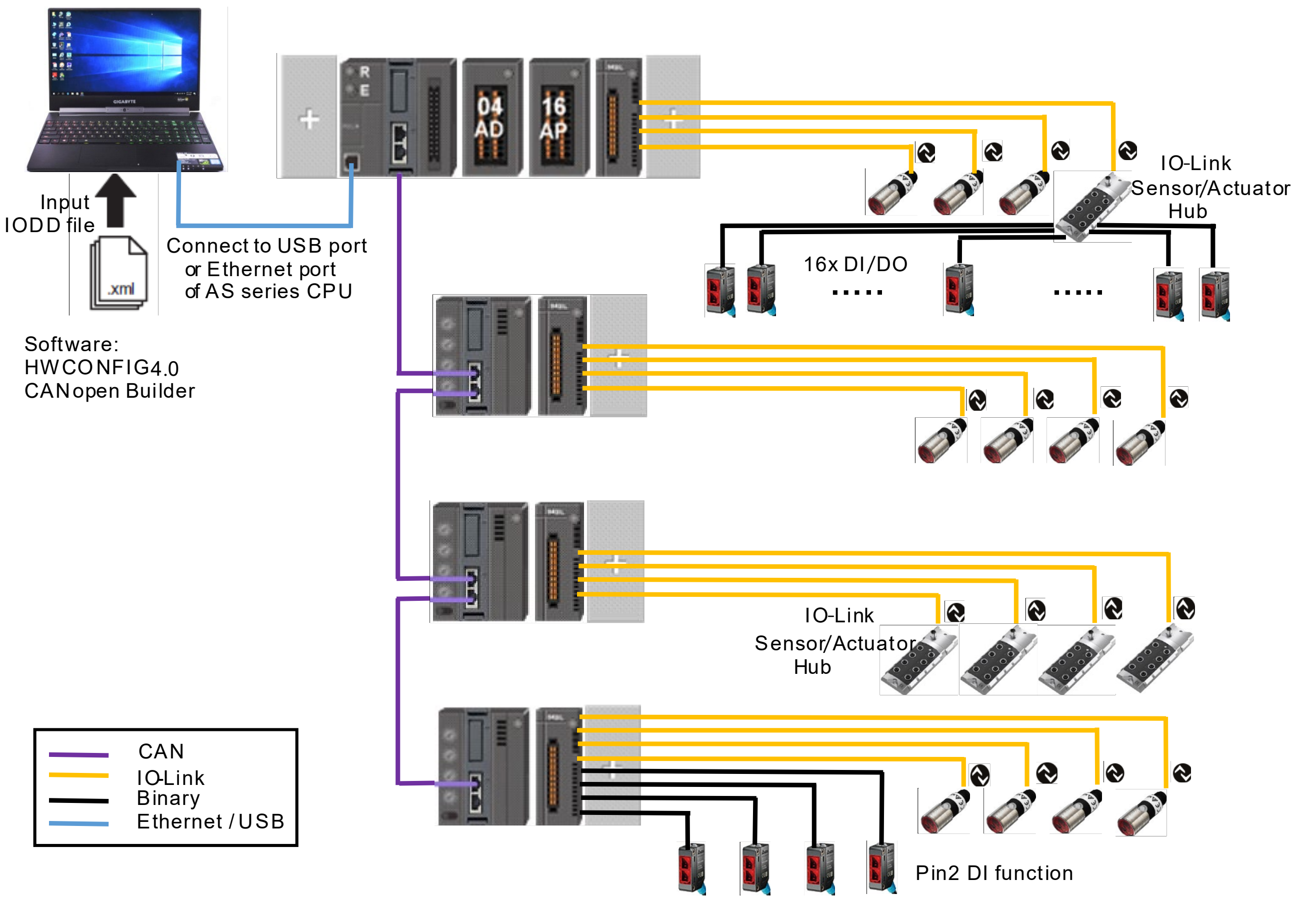


Option	Description
Disable	The backup function is disabled and the backed up process data is cleared.
Backup/Restore	The backup file is empty if no data exists. It is allowed to back up the parameters read from the connected device to the master and write the parameters to the connected device.
Restore	To write parameters to the connected device is allowed.

13.4 Application Examples

13.4.1 Using AS Series CPU as Upper Device

The AS04SIL-A module can be connected on the right side of AS series CPU or AS00SCM-A (RTU mode). If AS04SIL-A is placed on the right of AS00SCM-A (RTU mode), the AS-FCOPM communication card need be added to AS00SCM-A. AS04SIL-A supports three remote communication modes and communicates with the upper device via CAN port. When the upper device is an AS series CPU, the application situation is as illustrated in the following figure.



An AS04SIL-A module can connect with 4 IO-Link devices at most. If the hybrid use of the IO-Link devices and multiple traditional sensors (binary sensors) is needed, there are two connection methods based on the number of traditional sensors on site.

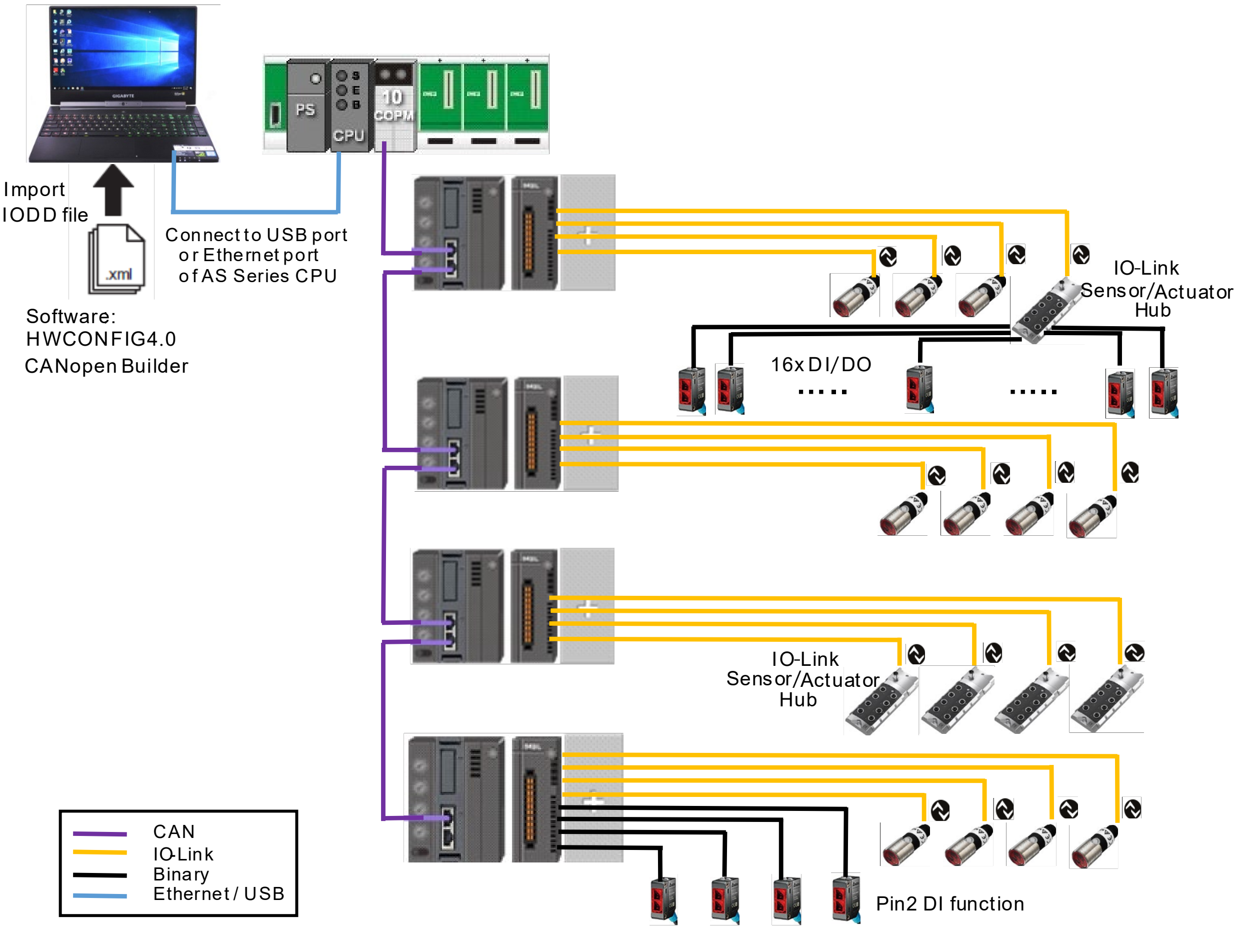
1. If there is only a small number of traditional sensors to be connected, each of AS04SIL-A module's ports can connect with one traditional sensor by using the DI function of Pin2 for each port.
2. If there are many traditional sensors to be connected, use the IO-Link hub from other brand to extend the connectable digital I/O devices.

There are three communication modes for AS00SCM-A plus AS-FCOPM.

Work mode	Description
AS Special Remote Mode	The AS04SIL-A module is a NIO module. The number of configurable modules is limited to AS series CPU including remote modules. 4 NIO modules can be configured at most. All SIL modules and IO-Link devices can be configured in HWCONFIG 4.0. and can be monitored online by the software.
Delta Special Driver & AS Remote Mode	
CANopen DS301 Mode	Here AS CPU is a CANopen master and AS00SCM-A is a CANopen slave. Up to 4 SIL modules can be configured on the right side of the slave AS00SCM-A (RTU). As many as 64 slaves can be connected to the AS CPU. CANopen Builder does not support the configuration of extension modules on the right side of AS00SCM-A and connected IO-Link devices. First make the connection in AS special remote mode, complete the configuration of all extension modules and IO-Link devices in HWCONFIG 4.0 and then switch the mode back to CANopen DS301 mode. Open CANopen Builder and configure PDO mapping according to the EDS file of AS00SCM-A with V2.06 or later. For details on operation, see section 13.4.5.

13.4.2 Using AH Series CPU or Non-Delta Master PLC as Upper Device

As CANopen master, AH series CPU need be used together with AH10COPM-5A module to communicate with the CANopen slave AS00SCM-A. See the application situation as illustrated in the following figure.



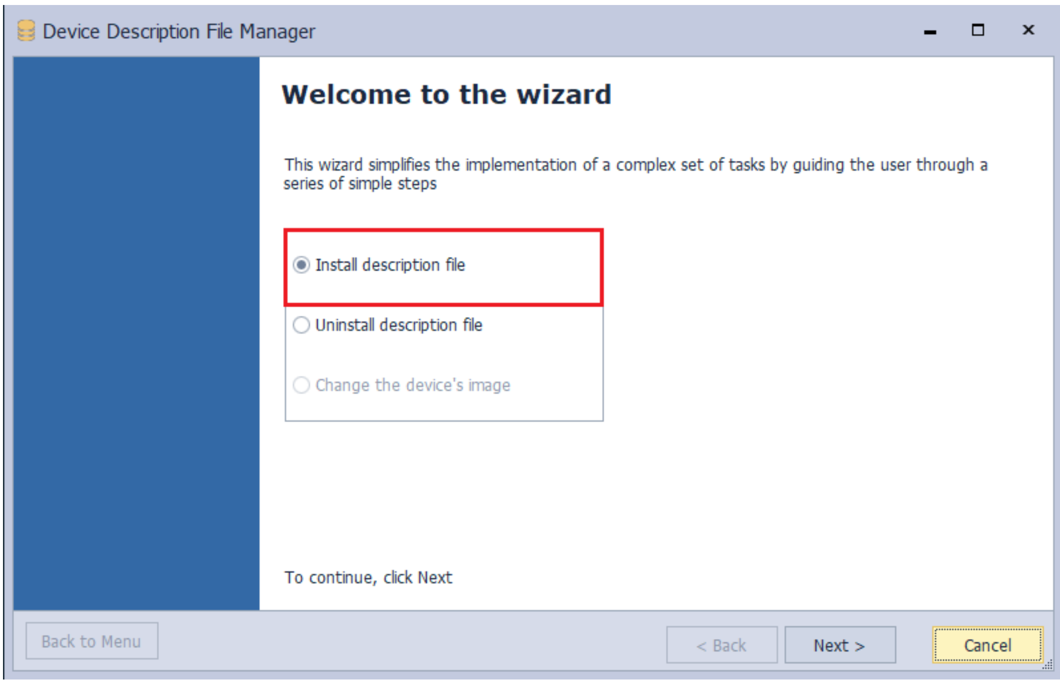
According to the description on CANopen DS301 Mode in section 13.4.1, connect the AS00SCM-A module to AS CPU in AS special remote mode, configure all extension modules and IO-Link devices in HWCONFIG 4.0 and then switch the mode back to the CANopen DS301 mode.
If the upper device is an AH series CPU, the CANopen Builder software can be opened. Configure the PDO mapping list according to the EDS file of the AS00SCM-A module. See the details in section 13.4.5.
If the upper device is a master PLC from other brand, use the software from the brand to configure the CANopen slaves and PDO mapping.

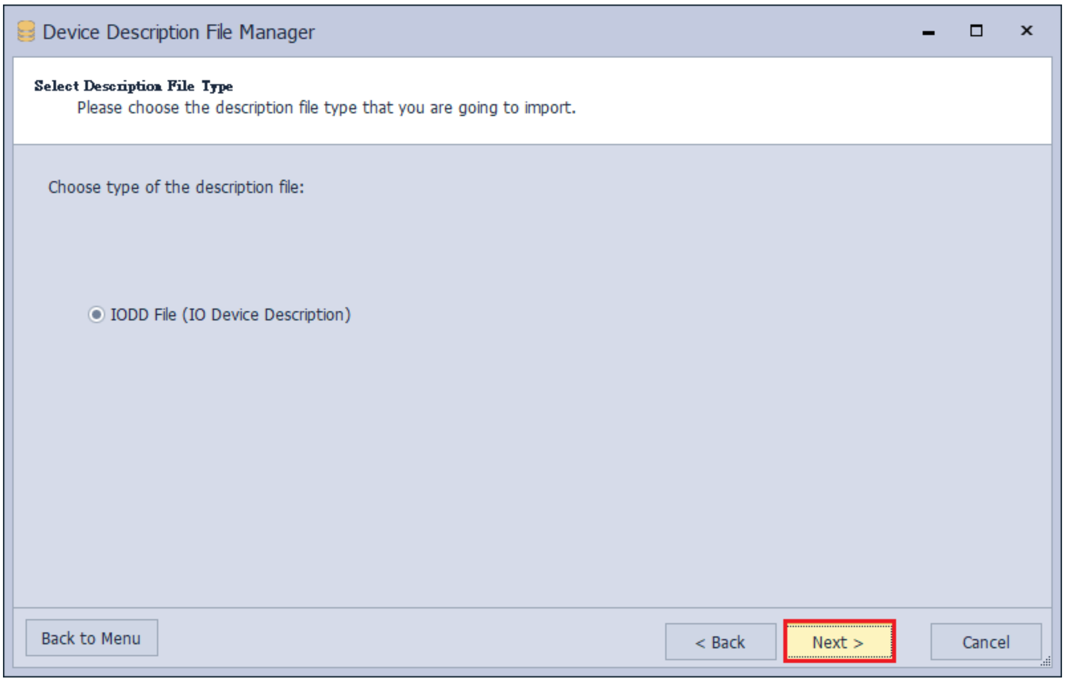
13.4.3 Application of AS Special Remote Mode

See the following table of devices used in the application example:

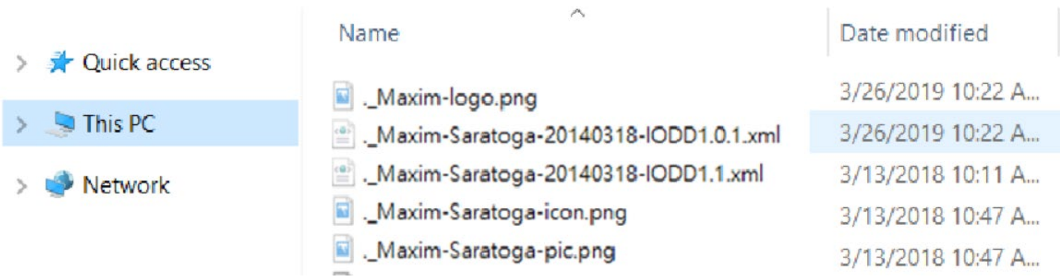
Model name	Device type
AS332T-A	PLC
AS00SCM-A	RTU
AS04SIL-A	IO-Link Master
AI-B100	3rd IO-Link Device
E3S-DCP21-IL3	3rd IO-Link Device
MAXREFDES27#	3rd IO-Link Device
MAXREFDES36#	3rd IO-Link Device

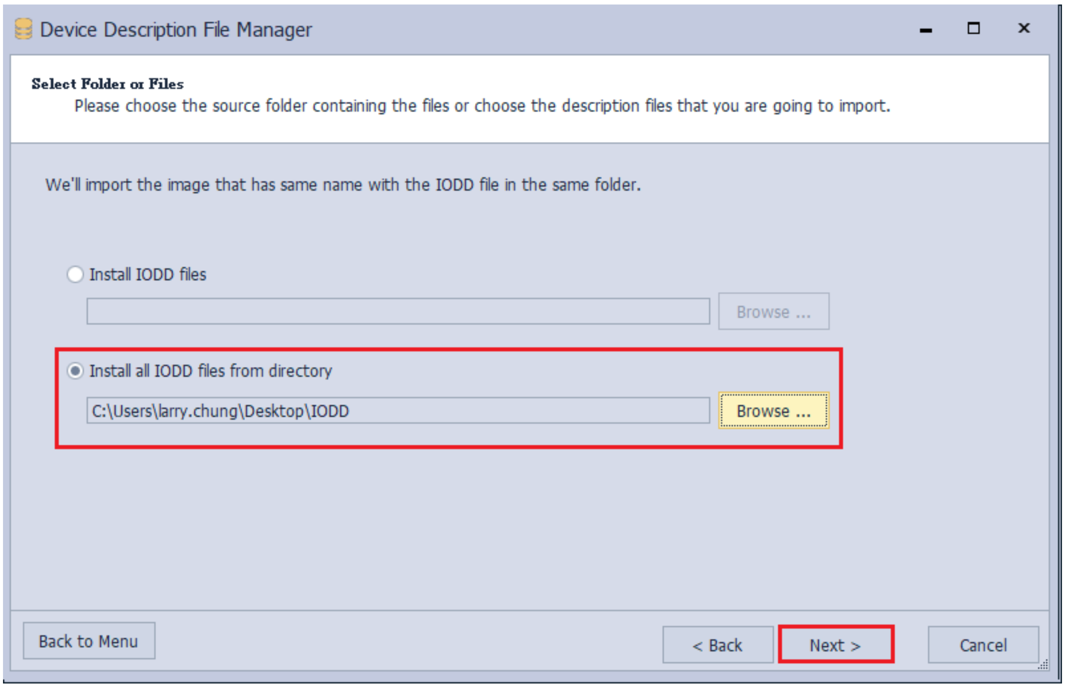
First of all, open the HWCONFIG 4.0 software and import the IODD files of IO-Link devices which can be downloaded from vendors' official websites. Follow the steps here to import the IODD files through the **Device Description File Manager** tool.

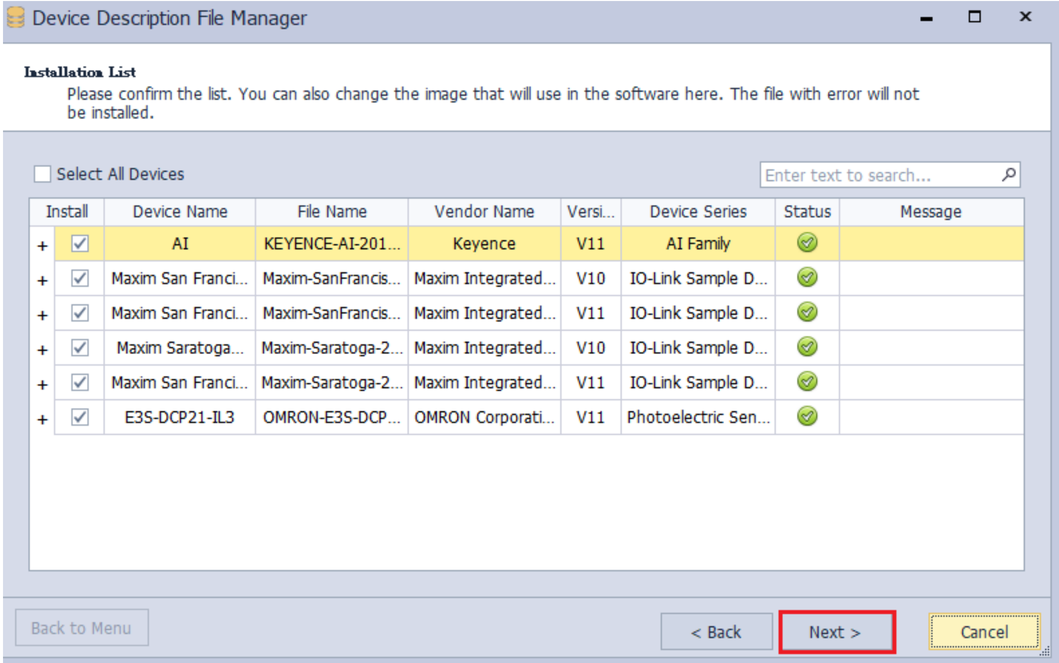


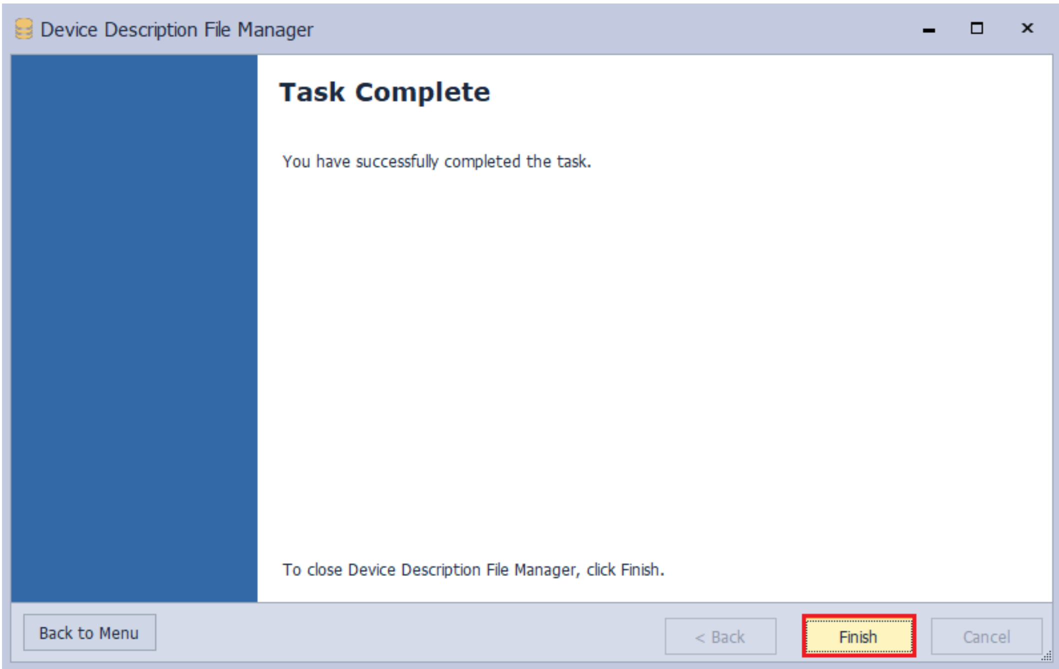


Put all IODD files in the same folder so as to import multiple IODD files at a time.





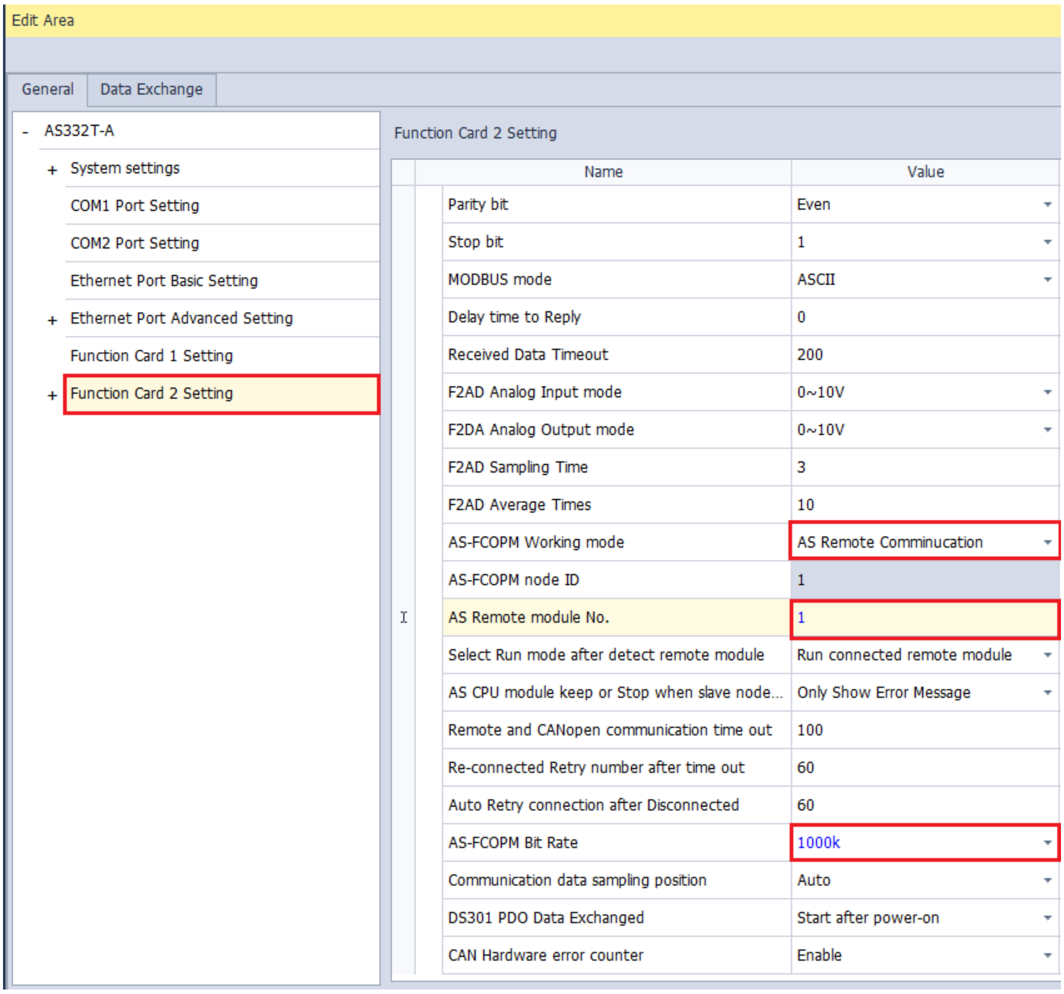


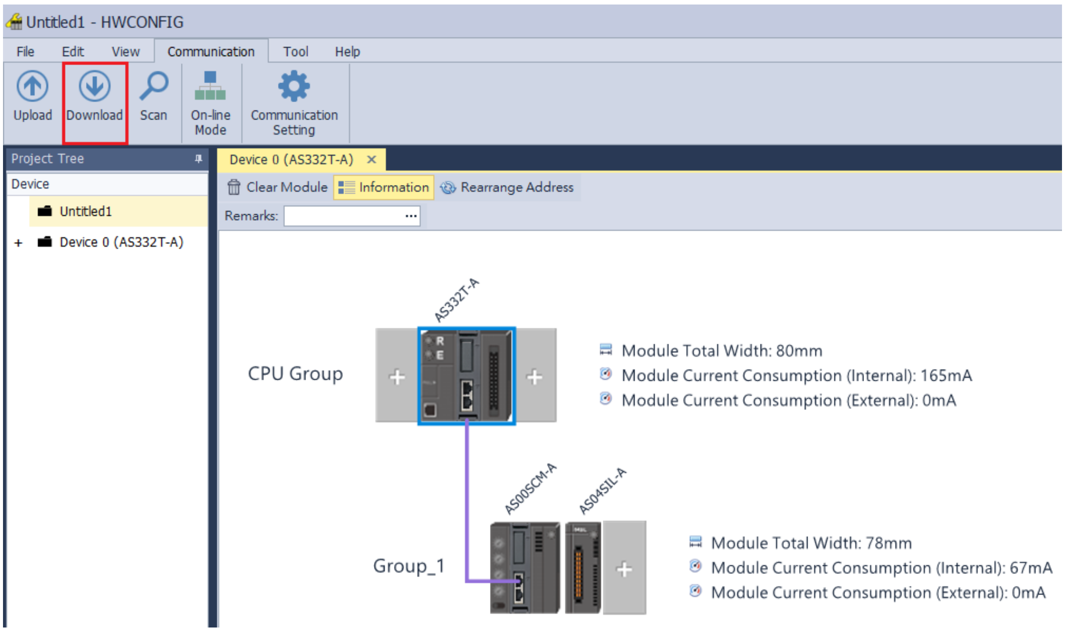


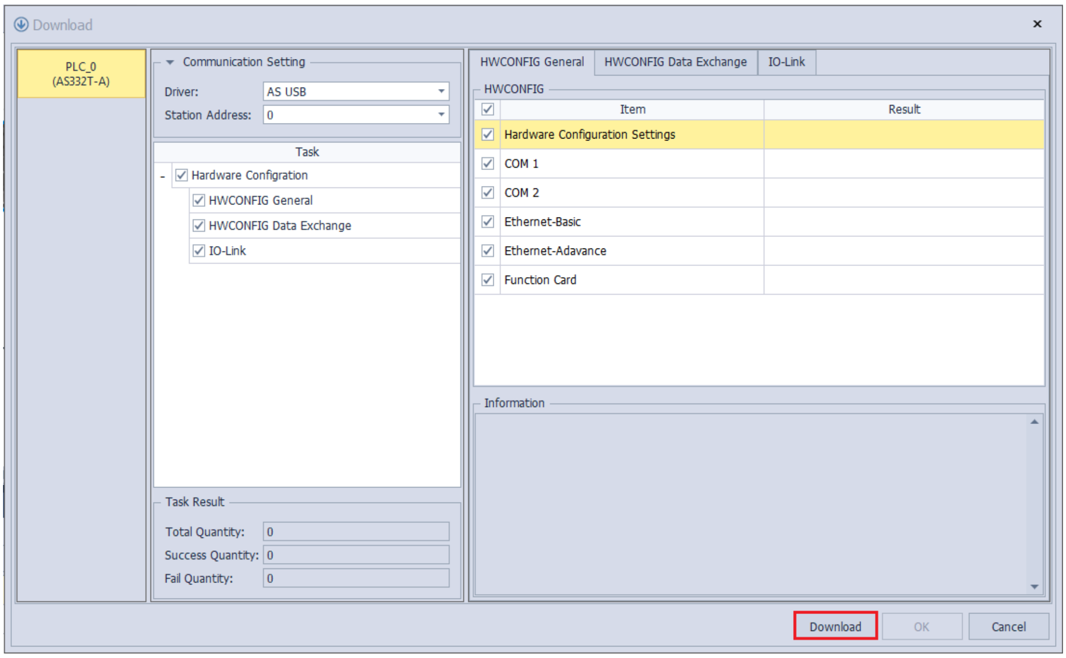
Check the following setups before the AS00SCM-A module is powered on.

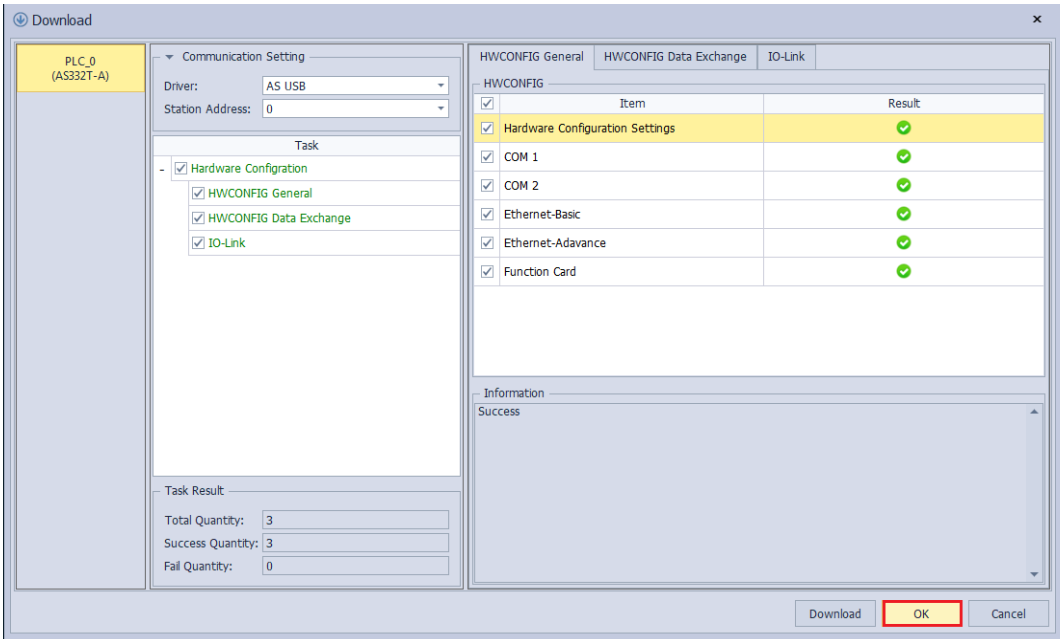
1. The AS-FCOPM card is inserted to AS00SCM-A via Card 2. (The 120Ω terminal resistor is enabled.)
2. Use Delta standard cables to connect to AS CPU and the mode switch is turned to RTU mode.
3. Four switches are set to ID1: 0/ FORMAT1: 0/ ID2: 1/ FORMAT2: 7 and the status is set to AS Remote Communication, node ID 1 and baud rate 1Mbps.
4. AS04SIL-A is connected on the right side of AS00SCM (RTU). Ensure that IO-Link devices are connected to the four ports according to the wiring in section 13.2.3.

Switch the power on after the AS-FCOPM card is inserted to AS332T-A via Card 2. (The 120Ω terminal resistor is enabled.) Open the HWCONFIG 4.0 software, set up function card 2 for AS CPU and then download the settings as follows.



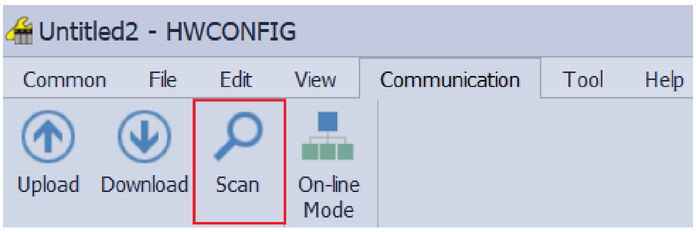


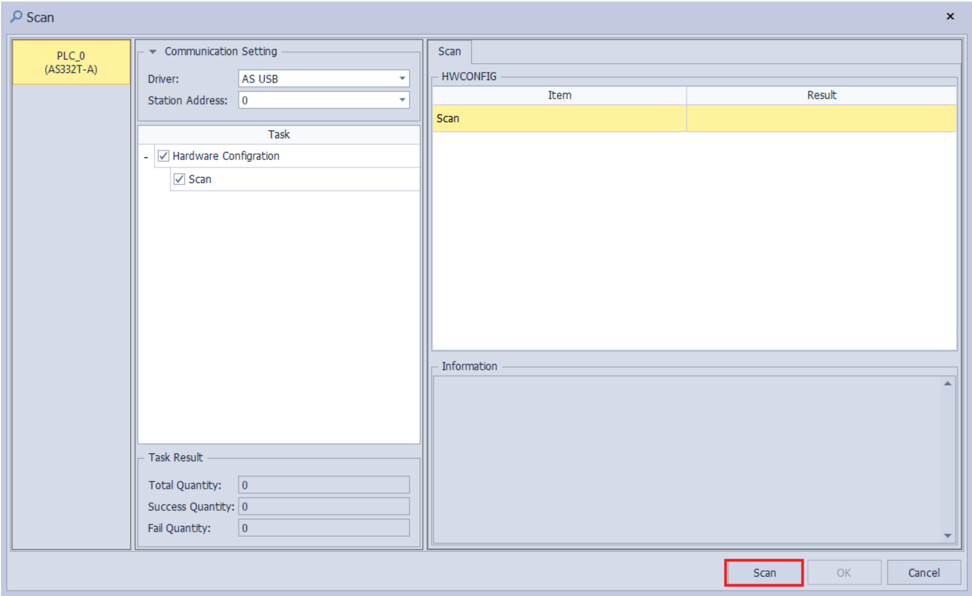


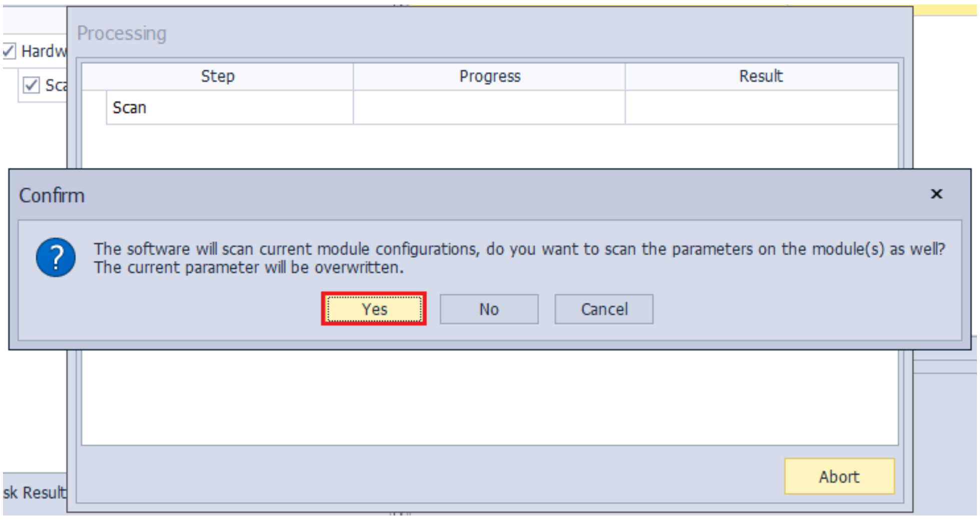


Ensure that the CANopen cables are connected properly and the AS00SCM-A module is already powered on. Check if the Card2 LED indicator of AS00SCM-A keeps blinking after the configuration of AS332T-A is downloaded so as to make sure the communication works normally.

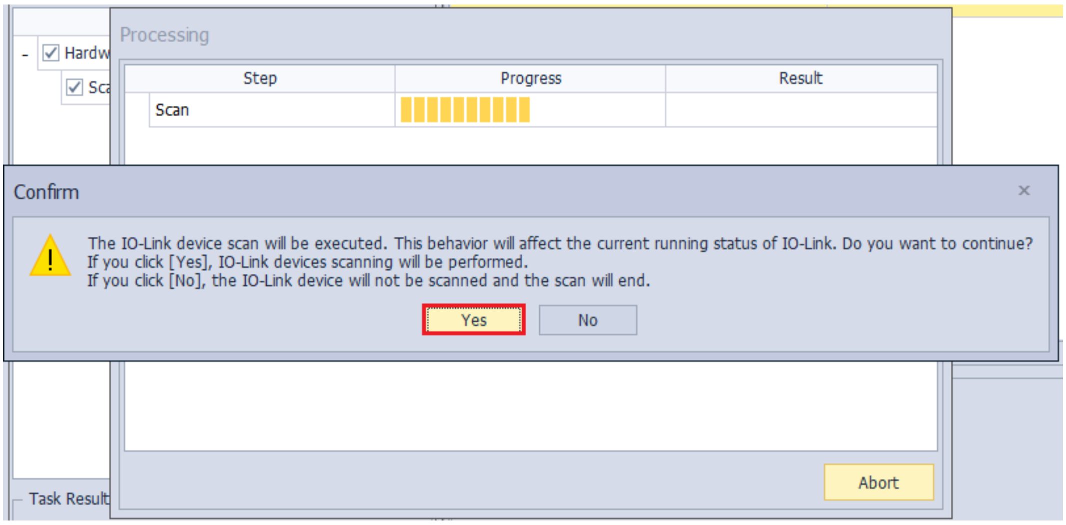
Click **Scan** button.



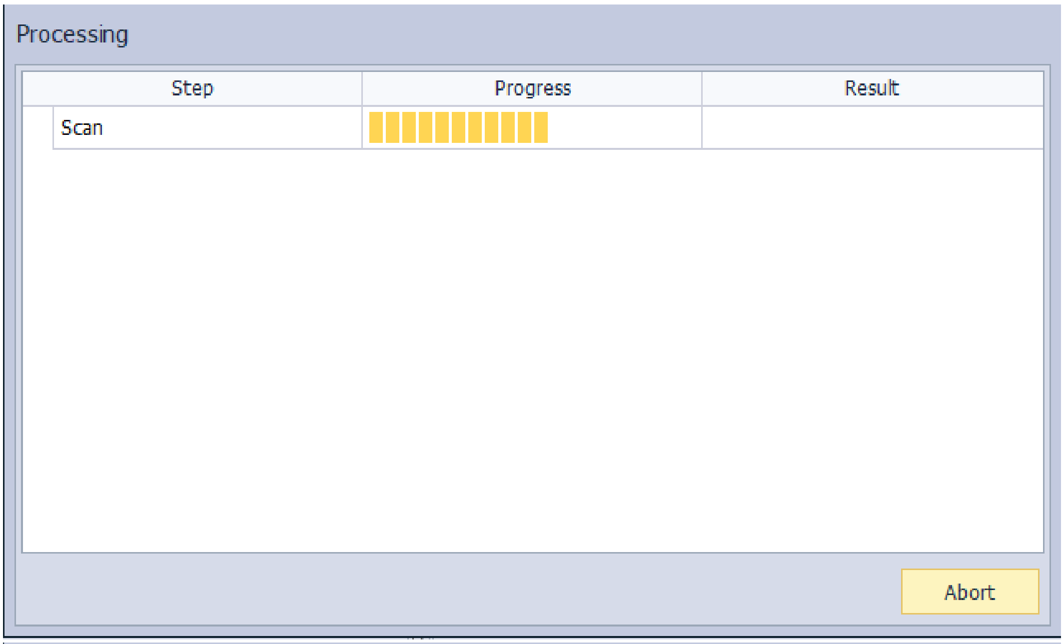


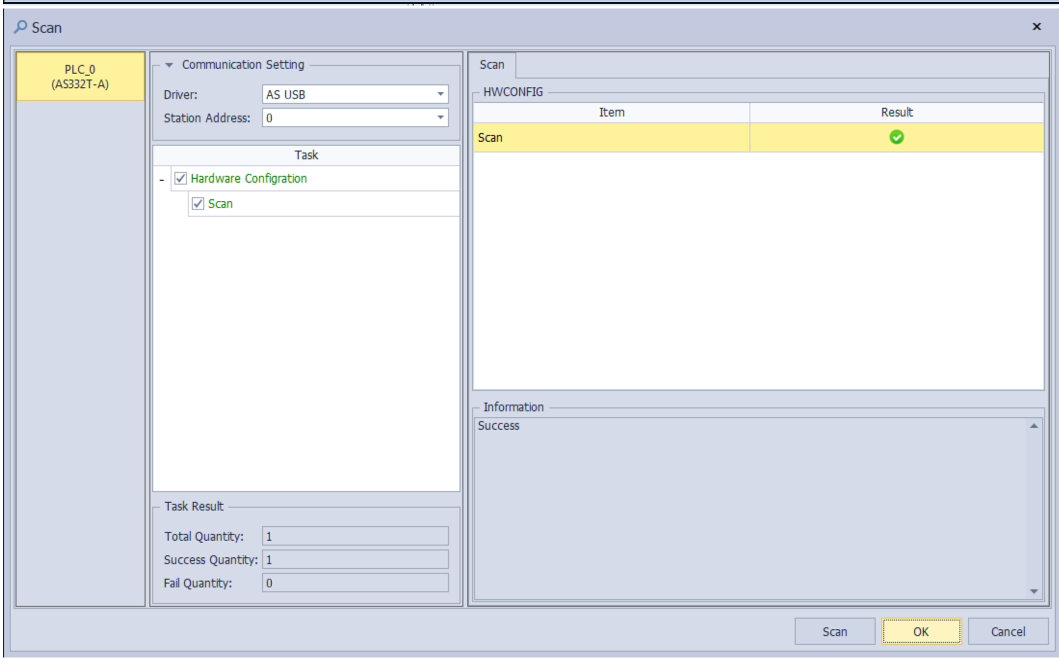


Once any AS04SIL-A module is detected through the software scan, the software will ask whether to scan the connected IO-Link device.



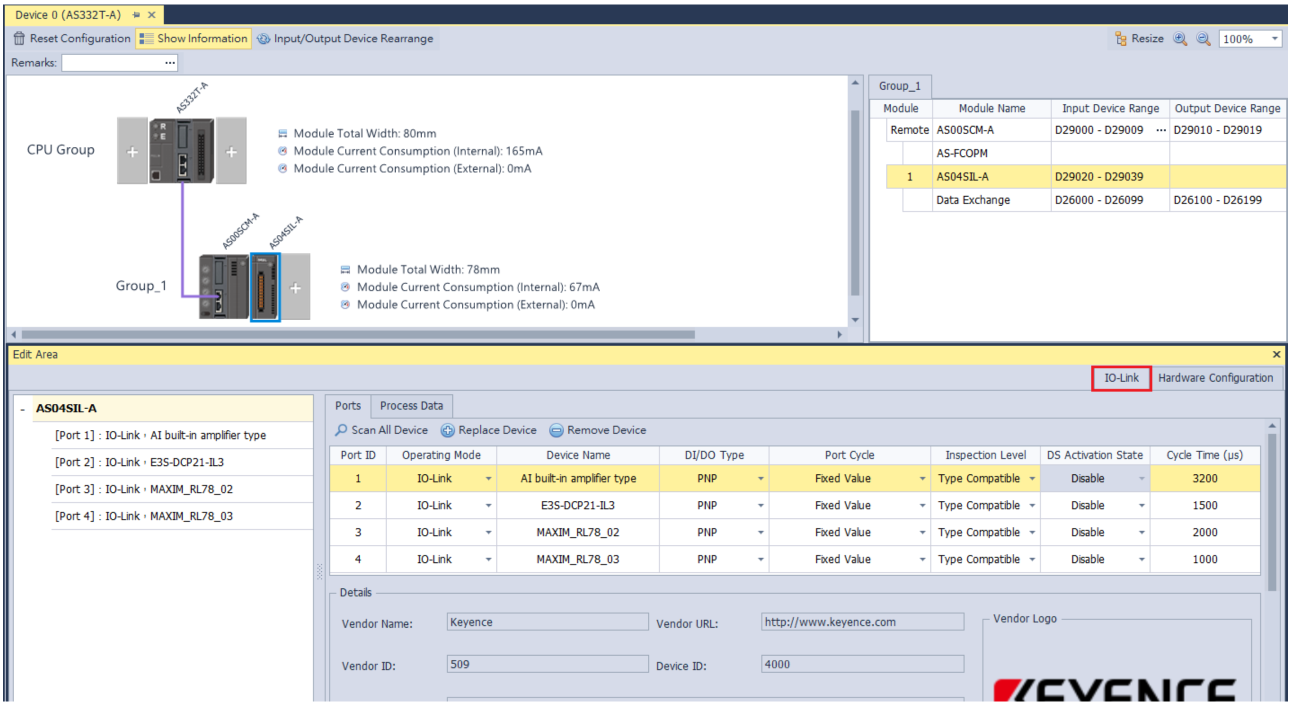
Perform the scan of IO-Link devices. If some configured devices are in communication during the scan, they will fail to be used temporarily. Restart the devices after the scan is over and restore the original work mode.





Click the IO-Link module and then select the **IO-Link** page where each device model and related information are can be seen and the parameters to be set up are all default values.

If no matched IODD file can be found out for the scanned device, **Unknown Device** will be shown in the device name field. Users need download the IODD file of the device from the coporate website of the device product according to the scanned device details such as Vendor Name, Vendor ID, Device ID and Device Name and then import the file into the HWCONFIG software.

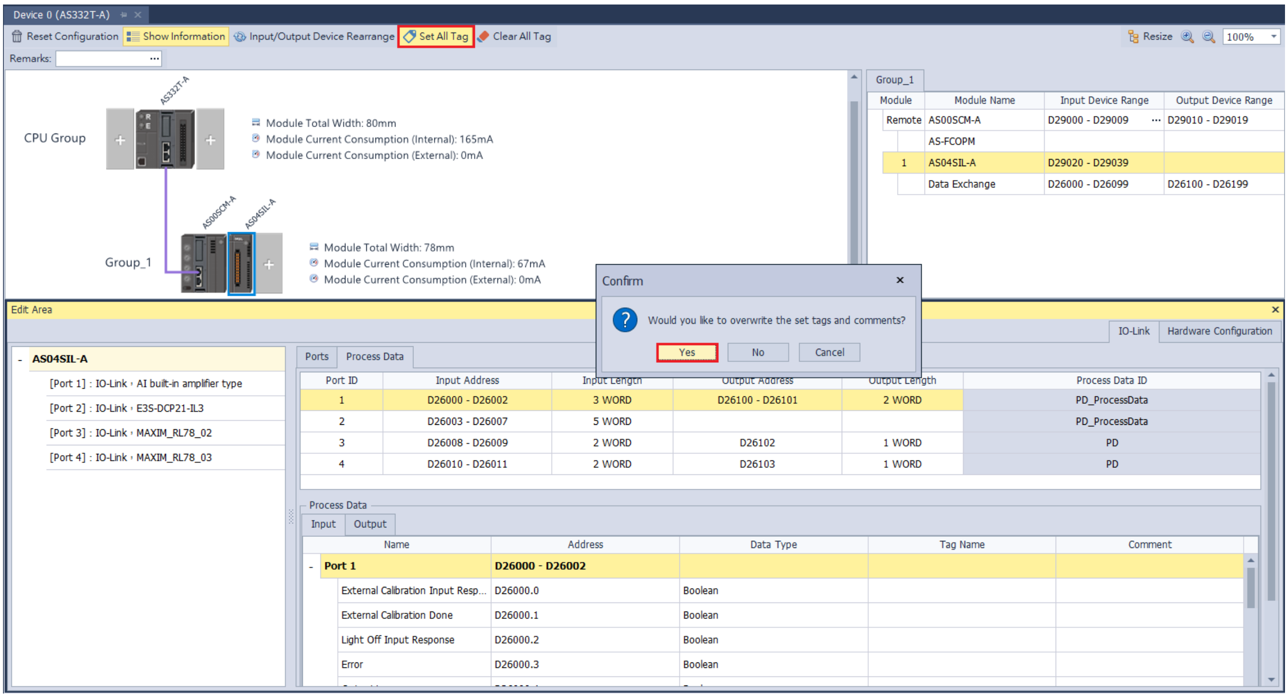


Under the Process Data tab, you can find the supported register addresses of each port. Since ISPSoft V3.11 supports using tags in PLC programming, it is very useful to set up the tags and its corresponding register addresses.

Follow the steps 1~3 below to set up the tabs.

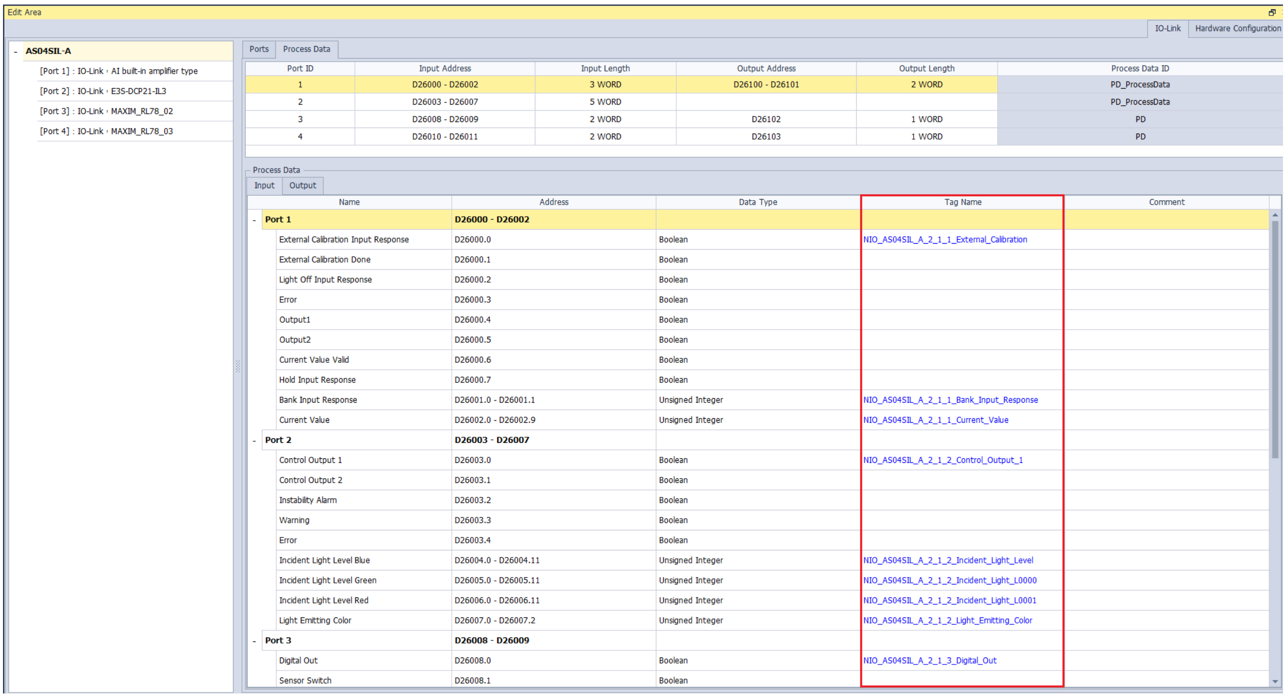
Step 1: Click **Set All Tag**

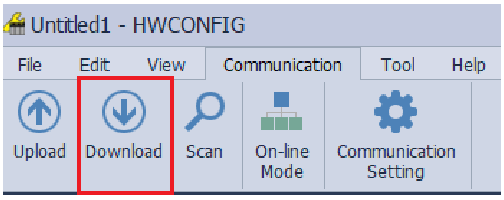
Step 2: A confirmation shows up asking you if you want to overwrite the set tags and comments. Click Yes to proceed.

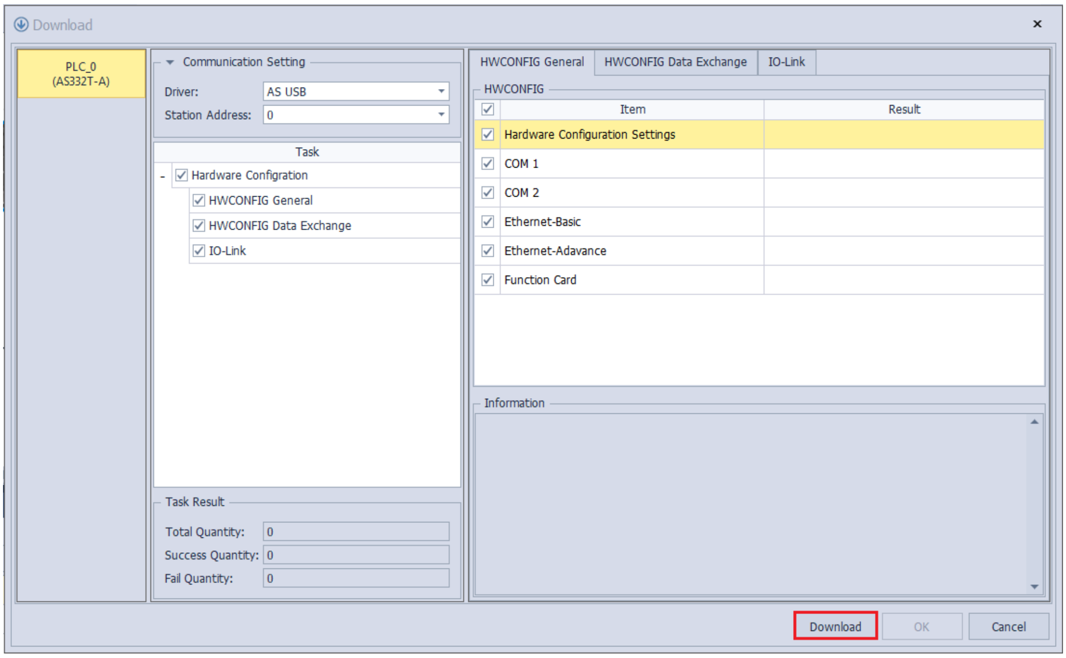


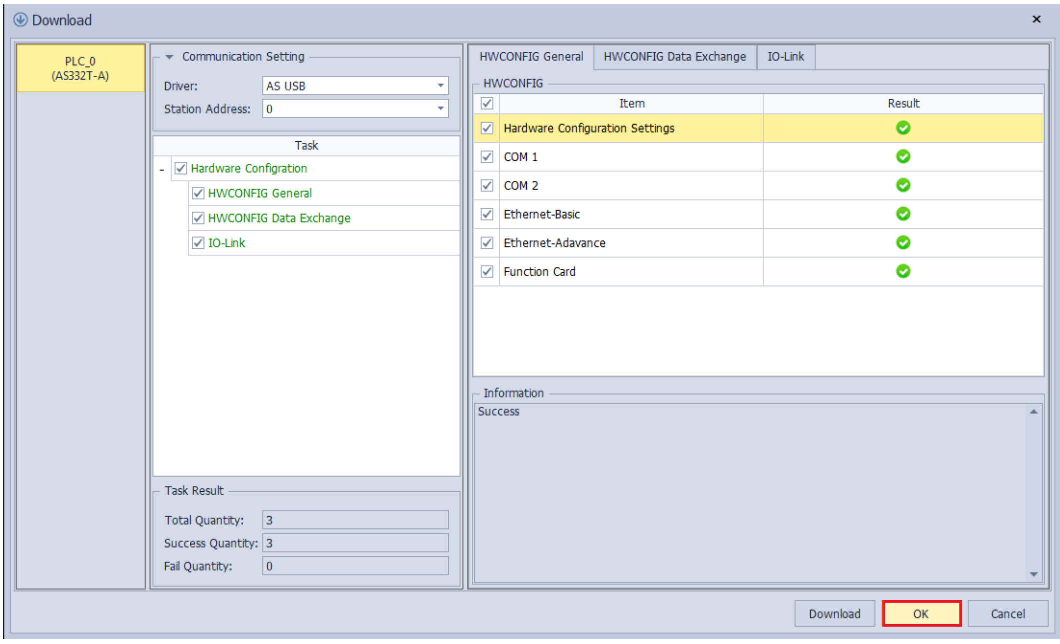
Step 3: All the editable tags show up. Double-click the tags in blue to edit if you need to use a different name other than the default ones.

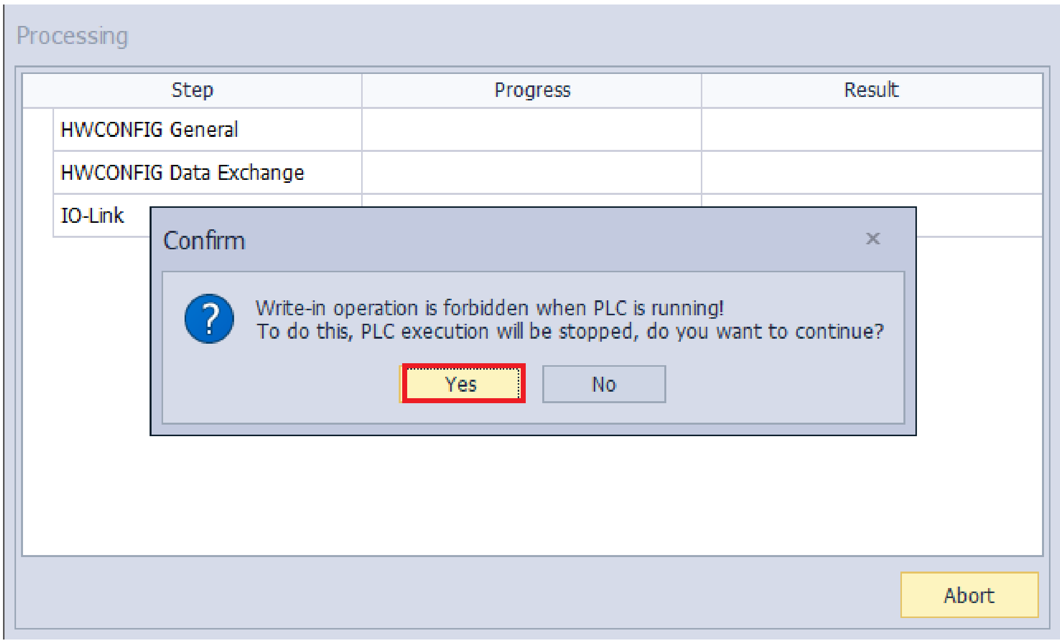
Note: One register address coresponds to one tag, and it shows on the first group of address.

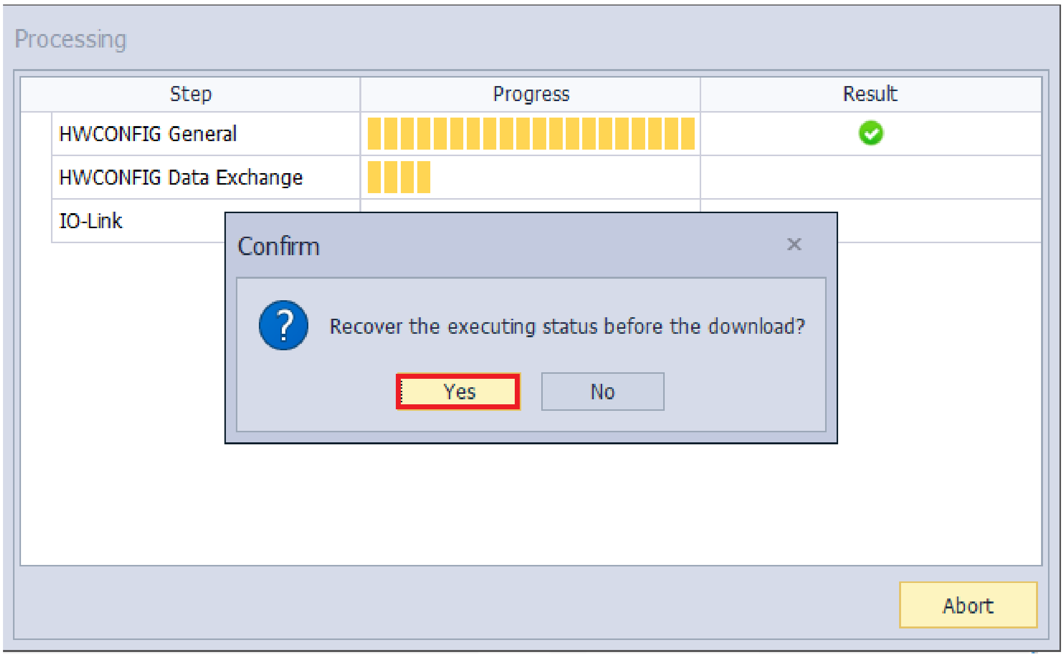


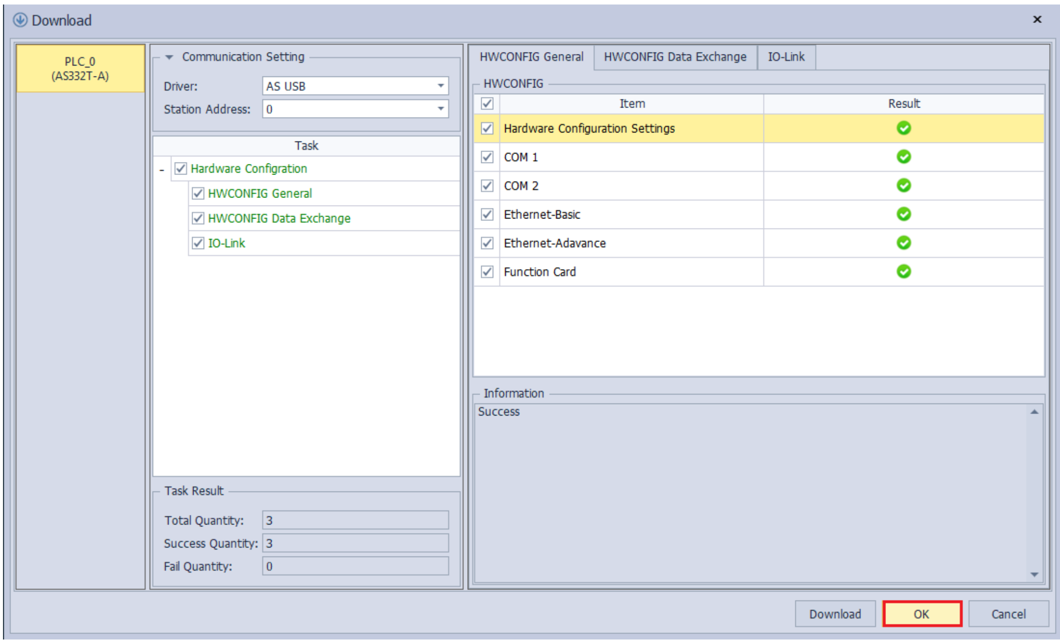




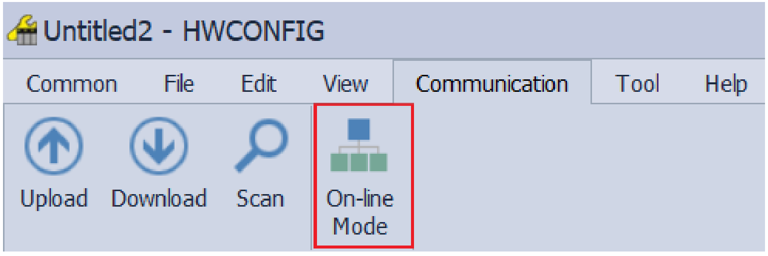

Download
PLC_0
(AS332T-A)
Communication Setting
Driver: AS USB
Station Address: 0
Task
Hardware Configration
HWCONFIG General
HWCONFIG Data Exchange
IO-Link
Task Result
Total Quantity: 3
Success Quantity: 3
Fail Quantity: 0
HWCONFIG General
HWCONFIG Data Exchange
IO-Link
HWCONFIG
Item
Result
Hardware Configuration Settings
COM 1
COM 2
Ethernet-Basic
Ethernet-Adavance
Function Card
Information
Success
Download
OK
Cancel

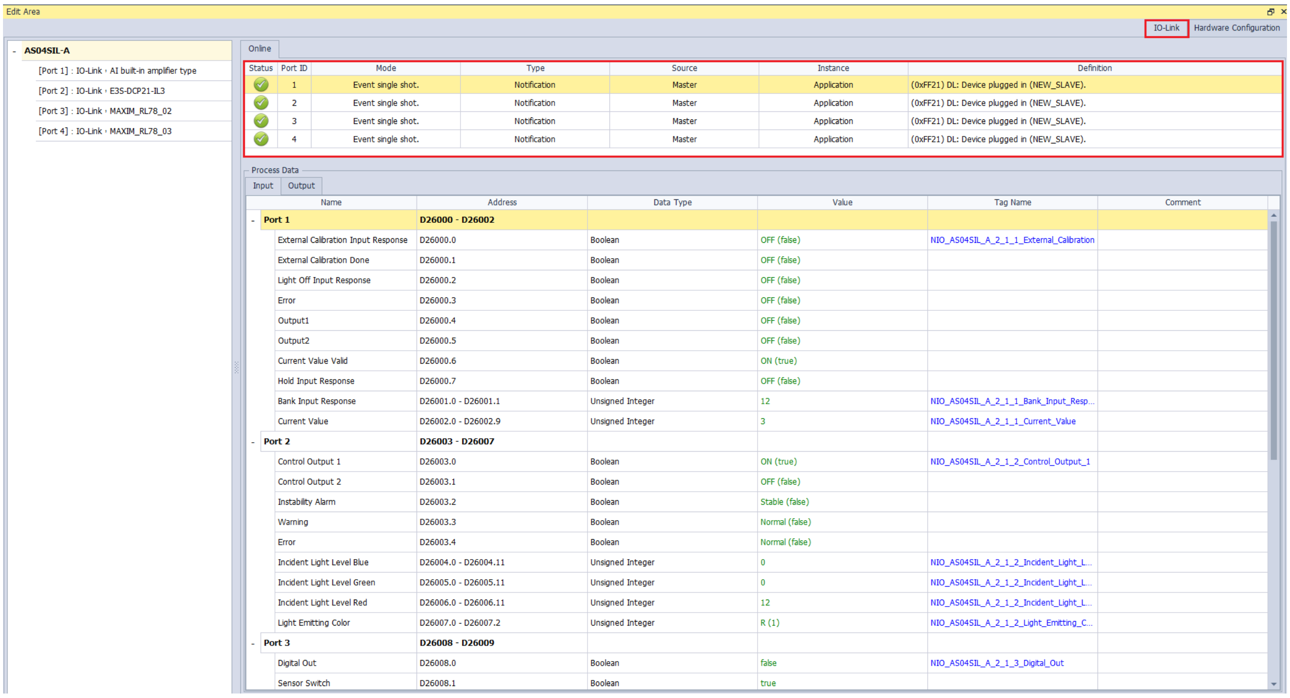

Processing
Step
Progress
Result
HWCONFIG General
HWCONFIG Data Exchange
IO-Link
Confirm
Write-in operation is forbidden when PLC is running!
To do this, PLC execution will be stopped, do you want to continue?
Yes
No
Abort


Processing
Step
Progress
Result
HWCONFIG General
HWCONFIG Data Exchange
IO-Link
Confirm
Recover the executing status before the download?
Yes
No
Abort

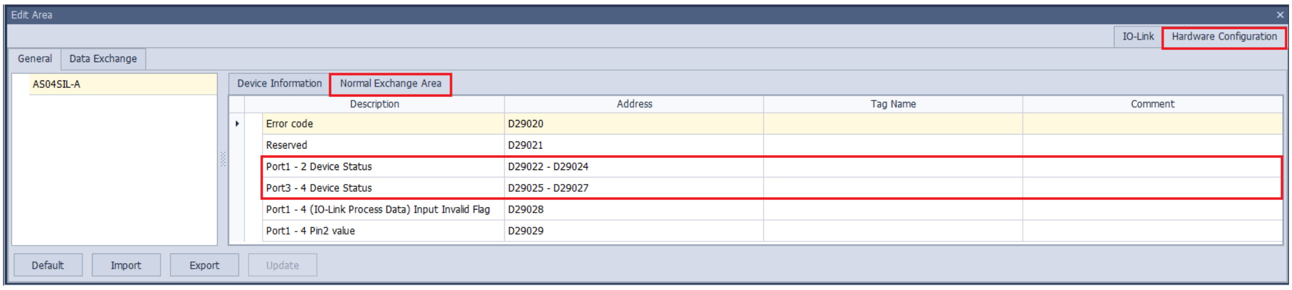

Download
PLC_0
(AS332T-A)
Communication Setting
Driver: AS USB
Station Address: 0
Task
Hardware Configration
HWCONFIG General
HWCONFIG Data Exchange
IO-Link
Task Result
Total Quantity: 3
Success Quantity: 3
Fail Quantity: 0
HWCONFIG General
HWCONFIG Data Exchange
IO-Link
HWCONFIG
Item
Result
Hardware Configuration Settings
COM 1
COM 2
Ethernet-Basic
Ethernet-Adavance
Function Card
Information
Success
Download
OK
Cancel

Click the **On-line Mode** button on the IO-Link page and then see the connection status of all devices and the real time monitored values of input and output process data.

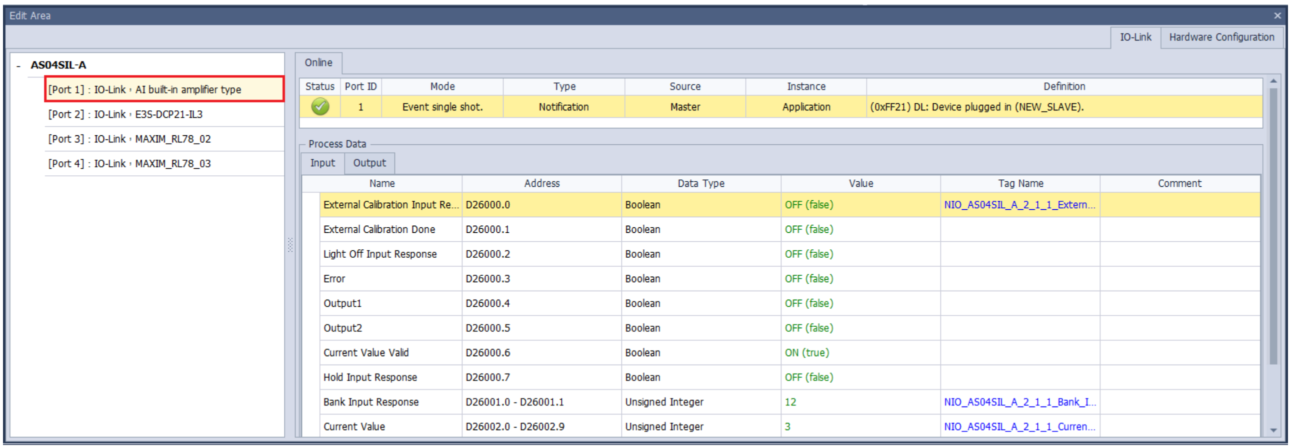




The **Status** of Port 1~ Port 4 above can also be known through the parsing in the **Normal Exchange Area** of the AS04SIL-A module below.



With a click on any device, only the input and output process data of the clicked single device will be displayed.



13.4.4 Application of Delta Special Driver & AS Remote Mode

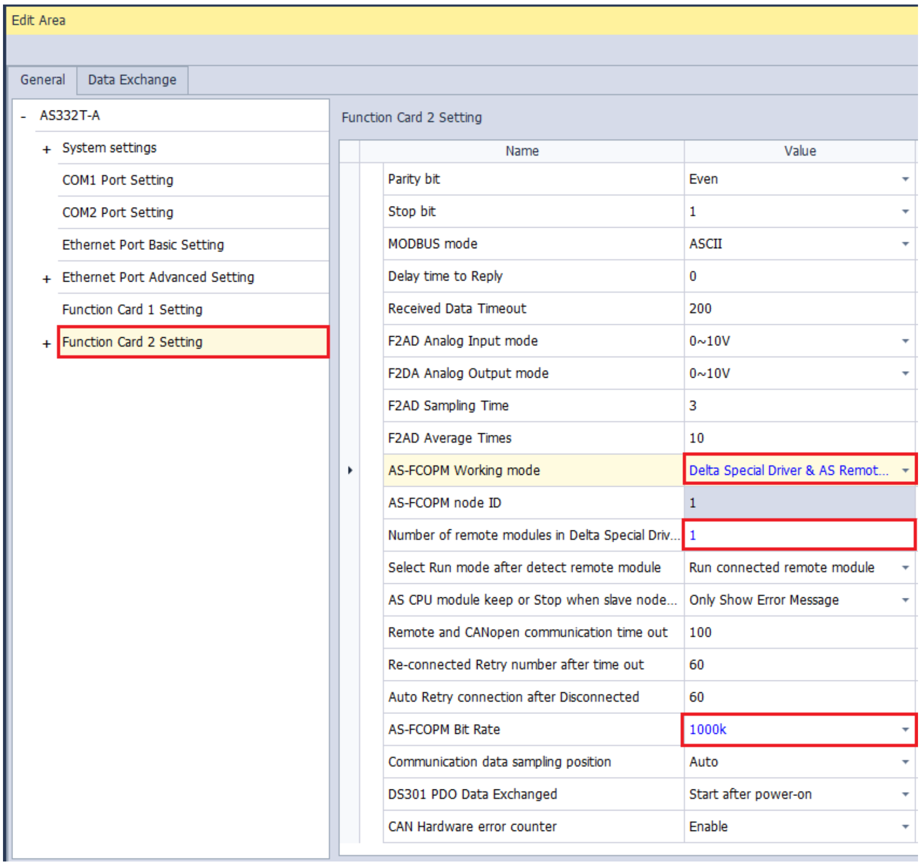
The device list in the following example is the same as that in section12.4.3.

Model name	Device type
AS332T-A	PLC
AS00SCM-A	RTU
AS04SIL-A	IO-Link Master
AI-B100	3rd IO-Link Device
E3S-DCP21-IL3	3rd IO-Link Device
MAXREFDES27#	3rd IO-Link Device
MAXREFDES36#	3rd IO-Link Device

Complete the following setups before the AS00SCM-A module is powered on.

1. The AS-FCOPM card is inserted to AS00SCM-A via Card 2. (The 120Ω terminal resistor is enabled.)
2. Use Delta standard cable to connect to AS CPU and the mode switch is turned to RTU mode.
3. Four switches are set to ID1: 0 / FORMAT1: 8 / ID2: 9 / FORMAT2: 7 and the status is set to **Delta Special Driver & AS Remote Communication**, node ID 9 and baud rate 1Mbps.
4. AS04SIL-A is connected on the right side of AS00SCM (RTU). Ensure that IO-Link devices are connected to the four ports according to the wiring in section 13.2.3.

Switch the power on after the AS-FCOPM card is inserted to AS332T-A via Card 2. (The 120Ω terminal resistor is enabled.) Open the HWCONFIG 4.0 software, set up function card 2 for AS CPU and then download the settings as follows.



The following steps are the same as the operation in section 13.4.3.

13.4.5 Application of CANopen DS301 Mode

In this example, the AS00SCM-A RTU module works with EDS V2.06. Please download the EDS from Delta official website and import the CANopen Builder software.

The device list in the following example is the same as that in section12.4.3.

Model name	Device type
AS332T-A	PLC
AS00SCM-A	RTU
AS04SIL-A	IO-Link Master
AI-B100	3rd IO-Link Device
E3S-DCP21-IL3	3rd IO-Link Device
MAXREFDES27#	3rd IO-Link Device
MAXREFDES36#	3rd IO-Link Device

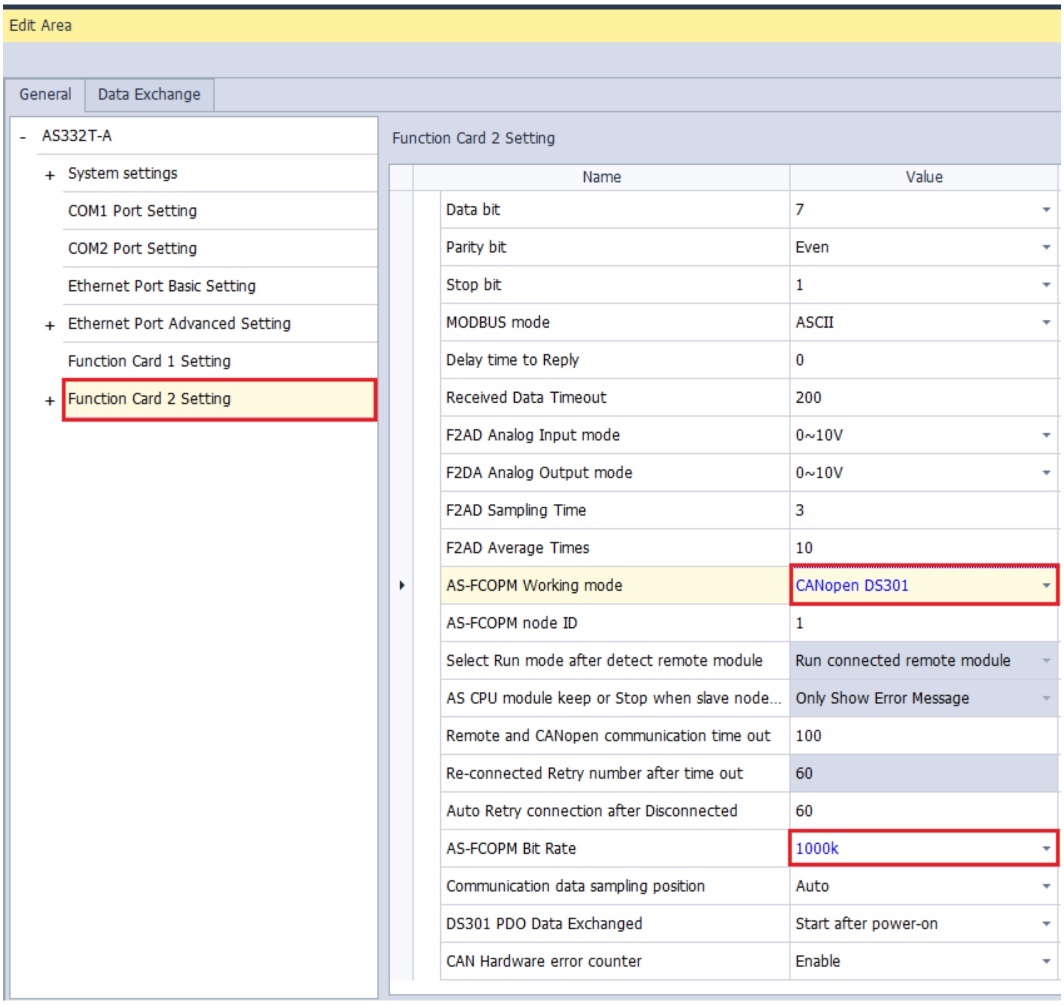
The CANopen Builder does not support the configuration of extension modules on the right of the AS00SCM-A module and connected IO-Link devices.

First make the connection in **AS Special Remote** mode, configure all extension modules and IO-Link devices in the HWCONFIG 4.0 software (see the example in section 13.4.3) and then switch back to the **CANopen DS301** mode.

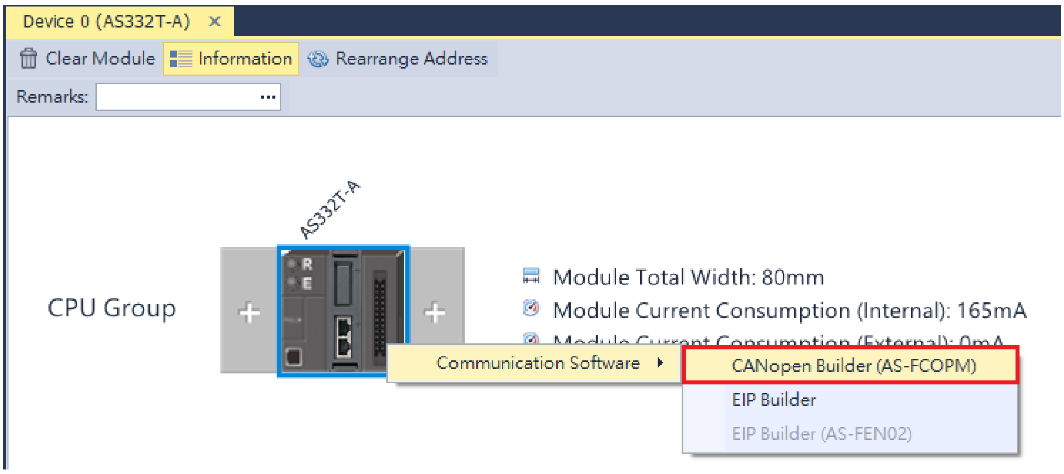
Please complete the following setups before the AS00SCM-A module is powered on.

1. The AS-FCOPM card is inserted to AS00SCM-A via Card 2. (The 120Ω terminal resistor is enabled.)
2. Use Delta standard cables to connect to AS CPU and the mode switch is turned to RTU mode.
3. Four switches are set to ID1: 0 / FORMAT1: 4 / ID2: 2 / FORMAT2: 7 and the status is set to **CANopen DS301**, node ID 2 and baud rate 1Mbps.
4. AS04SIL-A is connected on the right side of AS00SCM (RTU). Ensure that IO-Link devices are connected to the four ports according to the wiring in section 13.2.3.

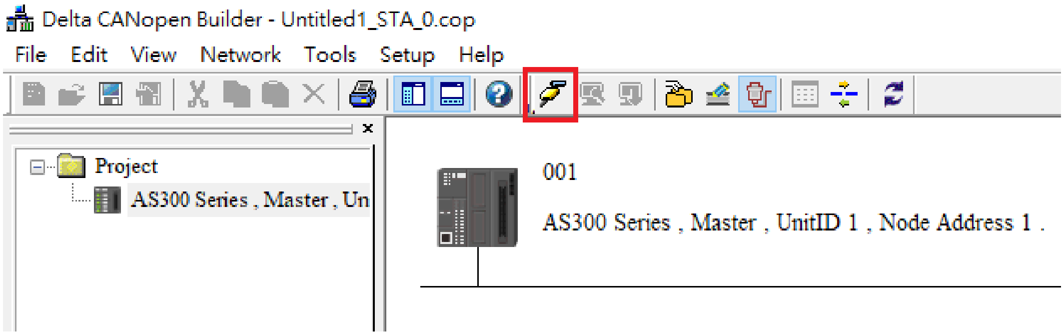
Switch the power on after the AS-FCOPM card is inserted to AS332T-A via Card 2. (The 120Ω terminal resistor is enabled.) Open the HWCONFIG 4.0 software, set up function card 2 for AS CPU and then download the settings as follows.



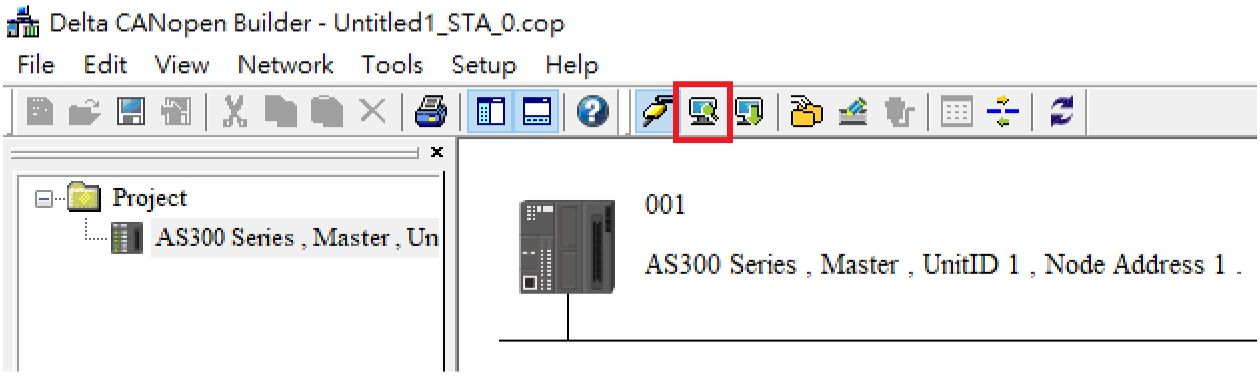
Right-click the AS332T-A symbol and open the CANopen Builder software as below.

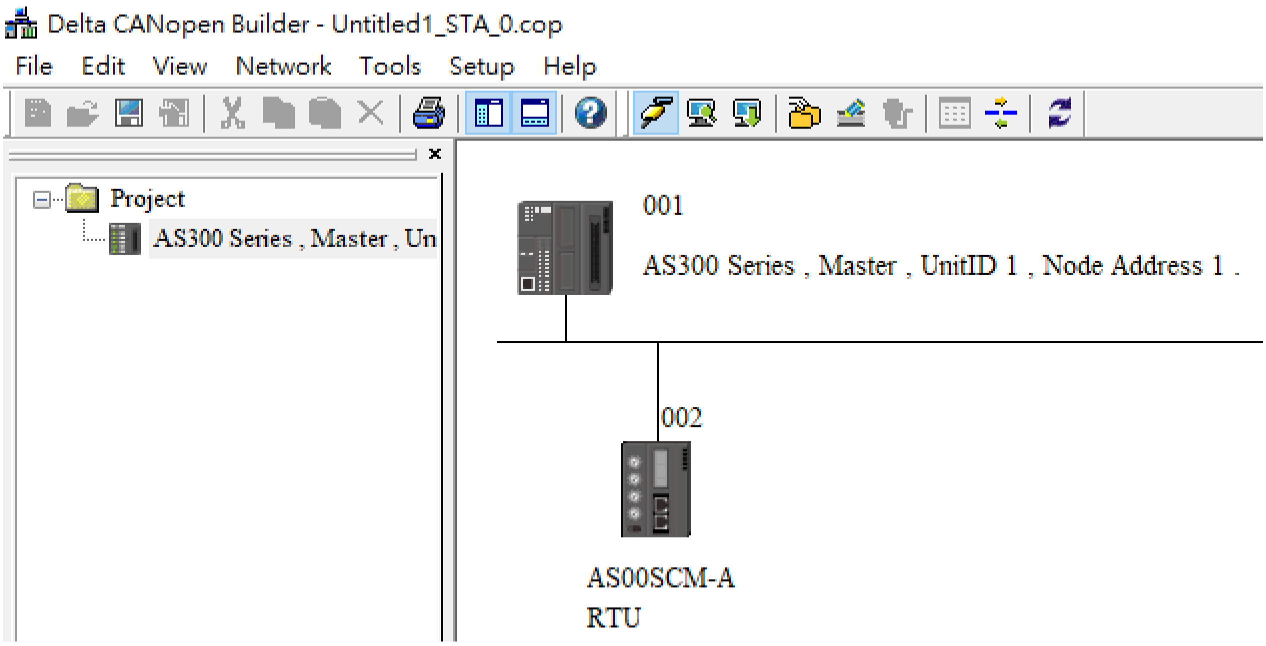


Click the **Online** button.

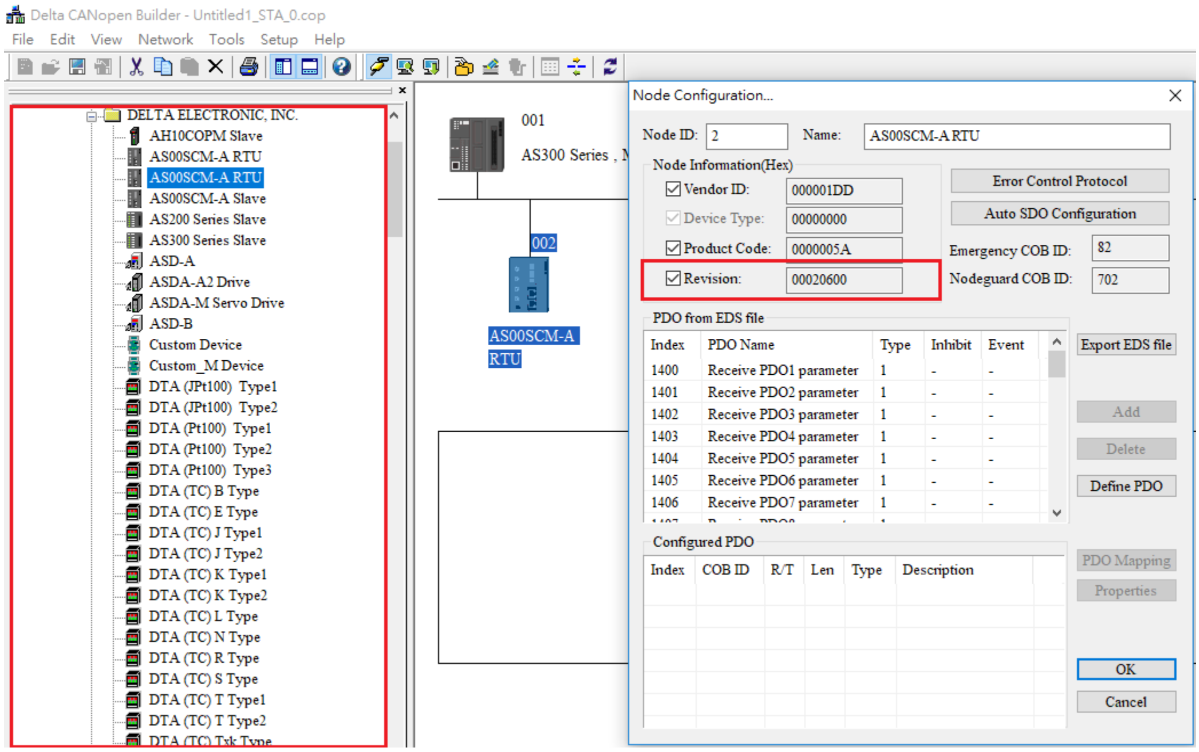


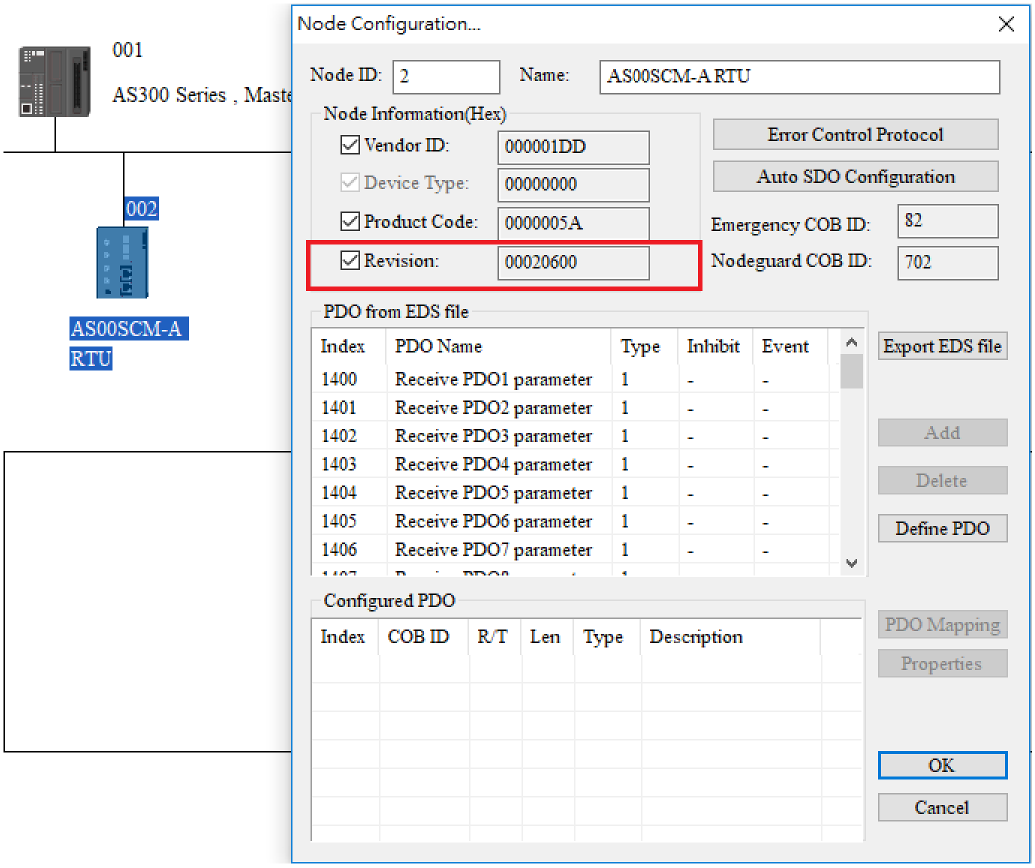
Click the **Scan** button. Then the AS00SCM-A RTU module can be detected.





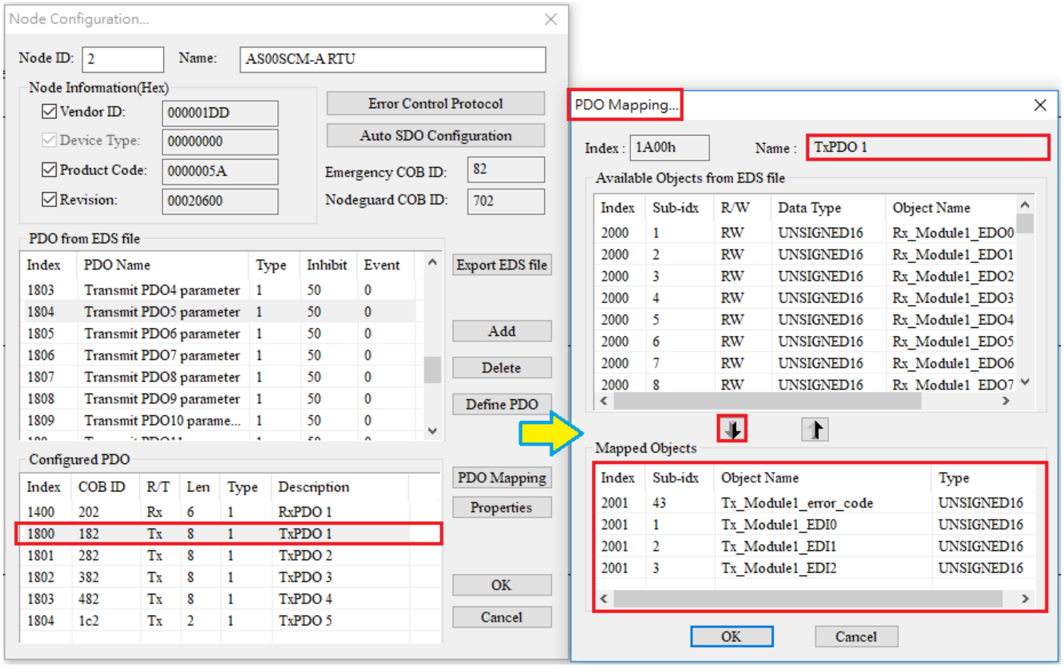
Double-click the detected AS00SCM-A RTU module and ensure that it is with EDS file V2.06 or later. If the EDS file is not matched, check if the V2.06 EDS file has been imported to the left-side device list and the firmware of AS00SCM-A is V2.06 or later.





Each object in the EDS file is 1 word (2 bytes) in size and thus one PDO corresponds to one mapped register. Assign all input parameters to available TxPDOs according to the parameters in the **Normal Exchange Area** of AS04SIL-A in section 13.4.3. The mapped PDO object of the input process data is Tx_ModuleX_EDIY (Exchanging Data Input which is referred to as EDI).

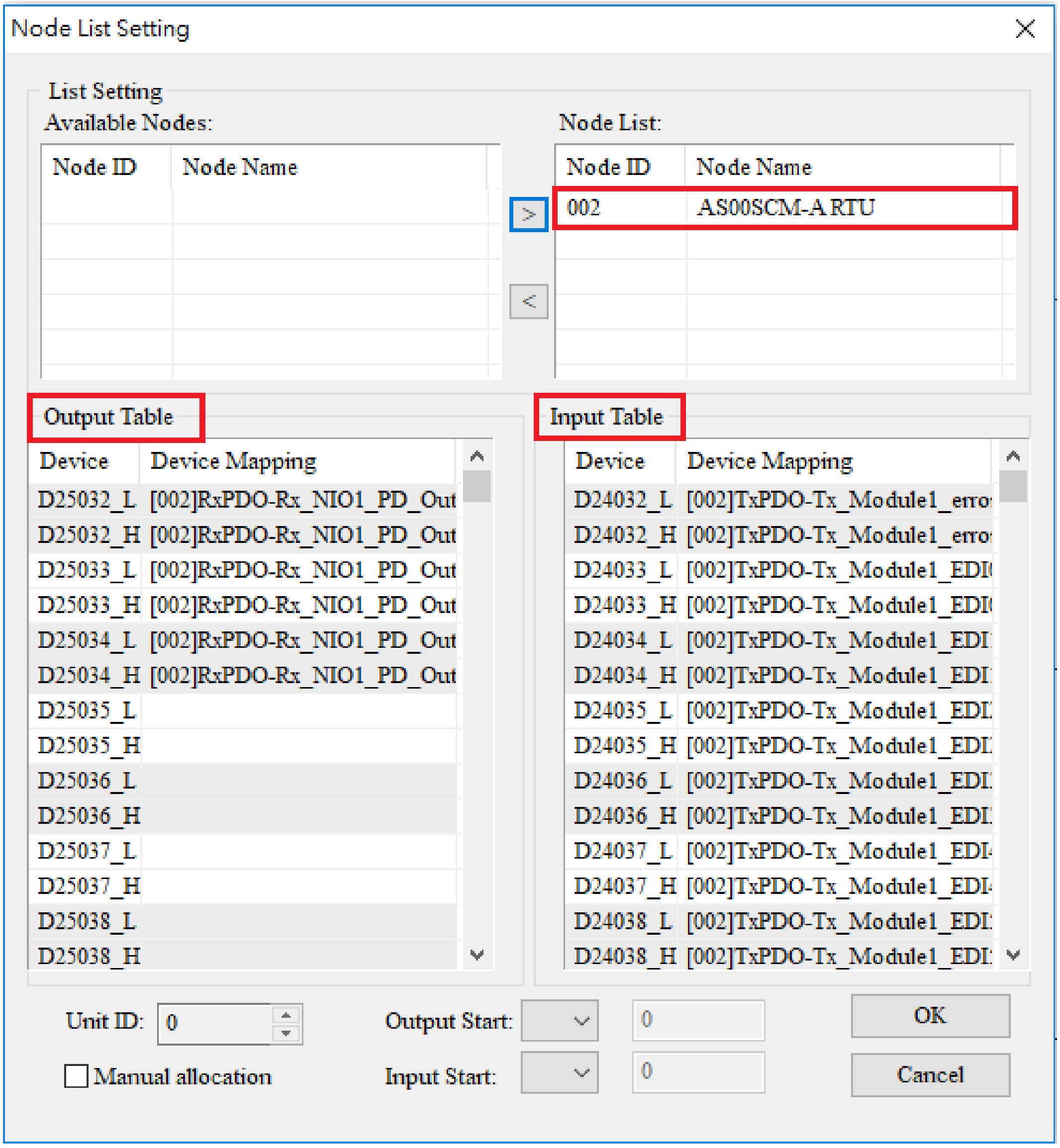
In this example, the AS04SIL-A module is the first one on the right of the RTU module. Therefore the value of X is 1 and the PDO mapped object for error codes is Tx_Module1_error_code. The corresponding objects starts from Tx_Module1_EDI0 as below.



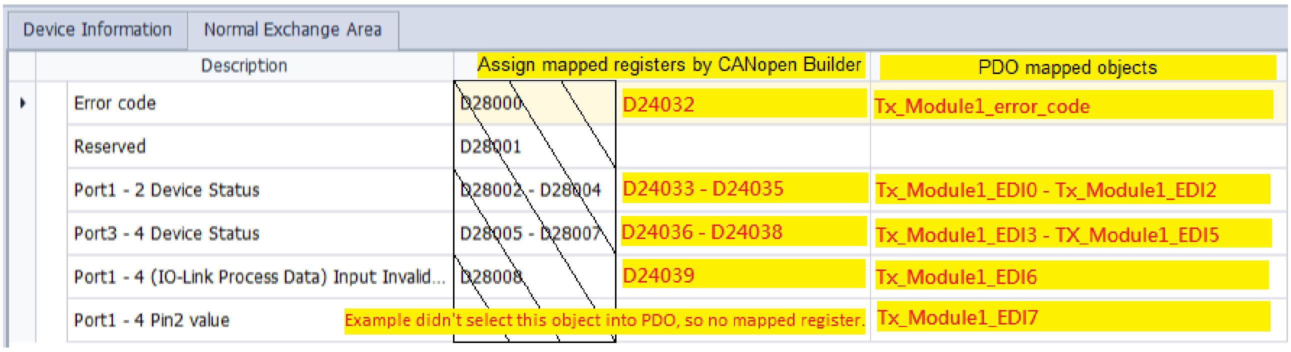
Based on all communication port address information in the HWCONFIG 4.0 software in section 13.4.3, assign all input process data to available TxPDOs, which corresponds to the mapped object Tx_NIOX_PD_InputZ and assign all output process data to available RxPDOs, which corresponds to the mapped object Rx_NIOX_PD_OutputY.

In this example, the AS04SIL-A module is the first one on the right of the RTU module. Therefore the value of X is 1, the input objects starting from Tx_NIO1_PD_Input0 correspond to IO-Link Port1~ Port4 in **Process Data- Input** respectively and the output objects starting from Rx_NIO1_PD_Output0 correspond to IO-Link Port1~ Port4 in **Process Data- Output** respectively.

Configure all parameters which need to be updated continuously (which are called objects in CANopen Builder) to one TxPDO or RxPDO according to the steps described above. Add AS00SCM-A RTU to the slave list (Node List) and then the real addresses of mapped registers in AS CPU show up immediately as below.



According to the **Normal Exchange Area** page in HWCONFIG in section 13.4.3, the PDO mapped objects correspond to the mapped registers assigned by CANopen Builder as follows.



Description		Assign mapped registers by CANopen Builder	PDO mapped objects
Error code	D28000	D24032	Tx_Module1_error_code
Reserved	D28001		
Port1 - 2 Device Status	D28002 - D28004	D24033 - D24035	Tx_Module1_EDI0 - Tx_Module1_EDI2
Port3 - 4 Device Status	D28005 - D28007	D24036 - D24038	Tx_Module1_EDI3 - TX_Module1_EDI5
Port1 - 4 (IO-Link Process Data) Input Invalid...	D28008	D24039	Tx_Module1_EDI6
Port1 - 4 Pin2 value		Example didn't select this object into PDO, so no mapped register.	Tx_Module1_EDI7

Parameter	Configured PDO	PDO mapped object	Mapped register in AS CPU
Error code	TxPDO1	Tx_Module_error_code	D24032
Port 1-2 Device Status		Tx_Module1_EDI0	D24033
		Tx_Module1_EDI1	D24034
		Tx_Module1_EDI2	D24035
Port 3-4 Device Status	TxPDO2	Tx_Module1_EDI3 Tx_Module1_EDI4 Tx_Module1_EDI5	D24036 D24037 D24038
Port1-4 (IO-Link Process Data) Input Invalid Flag		Tx_Module1_EDI6	D24039
Port 1 Process Data- Input	TxPDO3	Tx_NIO1_PD_Input0	D24040
		Tx_NIO1_PD_Input1	D24041
		Tx_NIO1_PD_Input2	D24042
Port 2 Process Data- Input		Tx_NIO1_PD_Input3	D24043
	TxPDO4	Tx_NIO1_PD_Input4	D24044
		Tx_NIO1_PD_Input5	D24045
		Tx_NIO1_PD_Input6	D24046
		Tx_NIO1_PD_Input7	D24047
Port 3 Process Data- Input	TxPDO5	Tx_NIO1_PD_Input8	D24048
		Tx_NIO1_PD_Input9	D24049
Port 4 Process Data- Input		Tx_NIO1_PD_Input10	D24050
		Tx_NIO1_PD_Input11	D24051
Port 1 Process Data- Output	RxPDO1	Rx_NIO1_PD_Output0	D25032
		Rx_NIO1_PD_Output1	D25033
Port 2 Process Data- Output		No parameter need be output	No parameter need be output
Port 3 Process Data- Output		Rx_NIO1_PD_Output2	D25034
Port 4 Process Data- Output		Rx_NIO1_PD_Output3	D25035

13

13

13.5 IO-Link Event Code Table

Here is the table of IO-Link event codes which are recorded in **Port1-4 Device Status** of the **Normal Exchange Area** page. If the sources of events are IO-Link devices, please also refer to the IO-Link device operation manual.

IO-Link Event Codes	Type			Event	Solution	Source	
	Warning	Error	Notifica-tion			IO-Link Master	IO-Link Device
16#4000		V		Device temperature over-load	Lower load		V
16#4210	V			Device temperature over-run	Clear source of heat		V
16#5101		V		Device fuse blown	Change fuse		V
16#5110	V			Power supply voltage over-run	Check tolerance		V
16#5111	V			Power supply voltage under-run	Check tolerance		V
16#6320		V		Parameter error	Check device specifications		V
16#6321		V		Parameter missing	Check device specifications		V
16#7710		V		Device short circuit	Check installation		V
16#8C10	V			Process variable range over-run	Check process data		V
16#8C20		V		Measurement range over-run	Check application		V
16#8C30	V			Process variable range under-run	Check process data		V
16#8CA0	V			No connected IO-Link device	Check installation	V	
16#8CA1	V			The version of the IO-Link protocol is different from the one configured.	Use matching IODD file and configured again.	V	
16#8CA2	V			Connected device is different from the one configured in the software	Check configurations and installation	V	
16#8CA3				Reserved		V	
16#8CA4 16#8CAD 16#8CAE		V		IO-Link device process cable short circuit	Check installation	V	
16#8CA5	V			Master temperature exceeds 135°C	Clear source of heat	V	
16#8CA6		V		Master temperature exceeds 160°C	Clear source of heat and lower load	V	
16#8CA7	V			Device power supply voltage under-run L+ (<18V)	Check the external power supply	V	

IO-Link Event Codes	Type			Event	Solution	Source	
	Warning	Error	Notifica-tion			IO-Link Master	IO-Link Device
16#8CA8		V		Device power supply voltage under-run L+ (<9V)	Check the external power supply	V	
16#8CA9	V			Illegal device ID	Check device specifications	V	
16#8CAA	V			HWCONFIG configured process data exceeding the IO-Link process data range	Check device specifications	V	
16#8CAB	V			IO-Link process data exceeding HWCONFIG configured process data range	Scan the device and download the configuration again	V	
16#8CAC		V		Data storage error	Contact the factory	V	
0xFF21			V	New connected device		V	
0xFF22			V	Device disconnected	Check installation	V	
0xFF23			V	Data storage identification mismatch	Set the Data Storage access locked and set it to backup / restore and then backing up data according to actual placement.	V	
0xFF24			V	Data storage not sufficient	Check device specifications	V	
0xFF25			V	Data storage parameter access denied	Check device specifications	V	

13.6 Module Status Codes

The following error codes identify possible errors when the AS04SIL module as a communication module is installed on the right side of the CPU module or RTU module.

Error Code	Description	Solution
16#1605	Hardware failure	Install a new AS04SIL or contact the factory.
16#1606	24VDC power supply is not sufficient and then recovered from low-voltage for less than 10 ms.	Check whether the 24 V power supply to the module is normal.

Error Code	Description	Solution
16#1800	Error occurs in IO-Link Master	See section 13.5 for more information.
16#1801	Error occurs in IO-Link device	See section 13.5 for more information.
16#1802	No external power supply	Check the external power supply
16#1803	Error in the download of IO-Link device mapping tables	Redownload the configuration by the software
16#1804	Failure to switch the process data parameter set	Check if the connected device is the same as that configured in the software.
16#1805	Error occurs in the communication port 1 of IO-Link connection	1. Cut the external power off for 3 seconds and power-on again 2. Download the configurations again
16#1806	Error occurs in the communication port 2 of IO-Link connection	
16#1807	Error occurs in the communication port 3 of IO-Link connection	
16#1808	Error occurs in the communication port 4 of IO-Link connection	
16#1809	Error occurs in scan device and force to stop scanning	1. Cut the external power off for 3 seconds and power-on again 2. Scan all devices again

MEMO

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Chapter 14 High Speed Counter Module AS02HC

Table of Contents

14.1 Overview

The AS02HC-A module is a high-speed counter module with two built-in channels. It performs counting through receiving the pulse signal input or SSI encoder signal input. It is only connected to the right side of AS series CPU modules. Configuring it to the right side of the remote modules is not allowed. This chapter mainly introduces the specifications, functions and operation of the module.

14.1.1 Characteristics

1. **Pulse signal / SSI signal input interface selection**

   Pulse input: Supports single-phase pulse input, two-phase pulse input (multiplication x2/4) and CW / CCW pulse input, 5V differential signal and 5-24VDC single-ended signal. The counting speed can reach up to 200kHz (for single-phase input).

   SSI input: The data transmission frequency can reach up to 1.25 MHz; the received data length can be up to 31 bits; supports multi-turn and single-turn SSI encoders as well as the conversion of gray and binary codes.

2. **32-bit counter**

   The two channels of AS02HC-A are both 32-bit counters with the counting range of -2147483648 to 2147483647.

3. **Counter type setting**

   Ring counter: cyclical counting between -2147483648 and 2147483647.

   Linear counter: The upper and lower limit values need be set. When the counter value is out of the allowed range, the module can detect that the upper or lower limit is exceeded.

4. **High-speed comparison**

   Preset a comparison value and compare it with the present value of the counter. When they are equal, the external output point actions can be controlled, the interrupt program can be executed or the counter value can be cleared at the same time.

5. **Phase-Z function selection**

   Each of the two channels is configured with a phase Z which can be used as the external input point for Reset, Capture or Gate control.

6. **External output points**

   Four external output points. They can be controlled individually or be used for the output together with high-speed comparison function.

7. **Counter value capture**

   The counting value is captured through a phase Z input trigger or channel comparison-matched trigger.

8. **Pulse rate and rotation rate (RPM) measurement**

   The function measures the input pulse rate and position change rate of the SSI encoder. And the rotation speed (RPM) can be calculated automatically.

9. **Use the tool software for easy settings**

   HWCONFIG built in ISPSoft can be used to create the hardware module configuration so that users can directly select the mode and parameters without spending time programming to set up the registers corresponding to a variety of functions.

10. **Miscellaneous API instructions**

    The functions such as counter control, counter value capture, high-speed comparison output and measurement can be achieved via dedicated API instructions.

14.2 Specifications and Functions

14.2.1 Specifications

Functional specification

Item		Description
Number of channels		2
Pulse Input	Input type	Phase A/B differential pulse input (multiplication x2/4), CW/CCW pulse inputs and pulse + direction inputs
	Max. counting frequency	200 kHz
	Max. transmission distance	200 kHz → 30 m
	Counter type	Ring counter, linear counter
SSI Input	Max. data length	31-bit (The single-turn, multi-turn and status data length can be set.)
	Coding method	binary code, gray code
	Transmission frequency	250 kHz, 500 kHz, 625 kHz, 1 MHz, 1.25 MHz
	Max. transmission distance	250 kHz → 150 m 500 kHz → 50 m 625 kHz → 40 m 1 MHz → 20 m 1.25 MHz → 10 m
	Parity check	None, odd parity, even parity
	Counter type	Absolute counter and ring counter
Counter	Counting range	-2147483648 ~ 2147483647 (32-bit counter)
	Counter control	Reset, preset, gate, capture offset correction for absolute position
	State check	Count direction, counting overflow/underflow, linear counting beyond the lower and upper limit values, SSI feedback, SSI position exceeding the protection limit, SSI parity checking, SSI communication status, a zero point is set beyond SSI encoder resolution
External input point (phase Z)	Input point number	2 (one point per channel)
	Function	Counter reset, gate control, counting value capture
	Digital filtering	Disabled, 100 us, 200 us …20 ms
	Min. software interrupt response time	10 us (hardware response time included)
External output point	Output point number	4
	Output type	NPN transistor (sinking)
Comparison function	Instruction	General comparison output instruction, table comparison output instruction
	Interrupt	Using comparison to achieve the interrupt function
Measurement function	Measured item	Pulse rate and rotation rate (RPM)
	Average times	1 ~ 10 times

Electrical specifications for the inputs

Item \ Model		Pulse input	External input
Number of inputs		4 (A+/B+/A-/B-)	2 (Z+/Z-)
Connector type		D-sub15	
Input voltage / current		5~24 VDC, 6~15 mA	
Action level	OFF→ON	3 V	
	ON→OFF	1 V	
Maximum input frequency		200 kHz	20 kHz
Input impedance		4.7 kΩ	
Input signal		Single-ended signal: 5 ~ 24 VDC (sinking or sourcing); differential signal: 5 V	
Electrical isolation		500 VDC	
Input display		When the optocoupler is driven, the input LED indicator is ON.	
Weight		138 g	

Electrical specifications for the SSI input and output

Item \ Model		SSI input	SSI output
Number of inputs / outputs		2 (DATA+/DATA-)	2 (CLK+/CLK-)
Connector type		D-sub15	
Voltage / Current		5 VDC, 1 mA	5 VDC, ±60 mA (Max)
Action level	OFF→ON	V_{ID}[*1] ≧ 0.2 V	-
	ON→OFF	V_{ID} ≦ -0.2 V	-
Maximum frequency		1.25 MHz	
Impedance		12 kΩ (terminal resistor 120 Ω)	-
Signal		RS-422	
Electrical isolation		500 VDC	
Input / output display		When the optocoupler is driven, the LED indicator is ON.	

*1：V_{ID} is the voltage difference between DATA+ and DATA-.

Electrical specifications for the external outputs

<table>
<tr><th colspan="2">Item \ Model</th><th>AS02HC-A</th></tr>
<tr><td colspan="2">Number of outputs</td><td>4</td></tr>
<tr><td colspan="2">Connector type</td><td>D-sub15</td></tr>
<tr><td colspan="2">Output type</td><td>NPN transistor (sinking)</td></tr>
<tr><td colspan="2">Voltage / Current</td><td>5~30 VDC, 0.1 A</td></tr>
<tr><td rowspan="3">Maximum load</td><td>Resistance</td><td>0.1 A</td></tr>
<tr><td>Inductance</td><td>-</td></tr>
<tr><td>Bulb</td><td>-</td></tr>
<tr><td rowspan="3">Maximum output frequency</td><td>Resistance</td><td>10 kHz</td></tr>
<tr><td>Inductance</td><td>-</td></tr>
<tr><td>Bulb</td><td>-</td></tr>
<tr><td>Maximum Response time</td><td>OFF→ON</td><td>25 us</td></tr>
<tr><td colspan="2">Electrical isolation</td><td>500 VDC</td></tr>
</table>

Electrical specifications for the +5 V encoder power supply

Item \ Model	AS02HC-A
Number of outputs	2 (+5VO/GND)
Connector type	D-sub15
Voltage / Current	5 VDC (±5%), 100 mA (Max)

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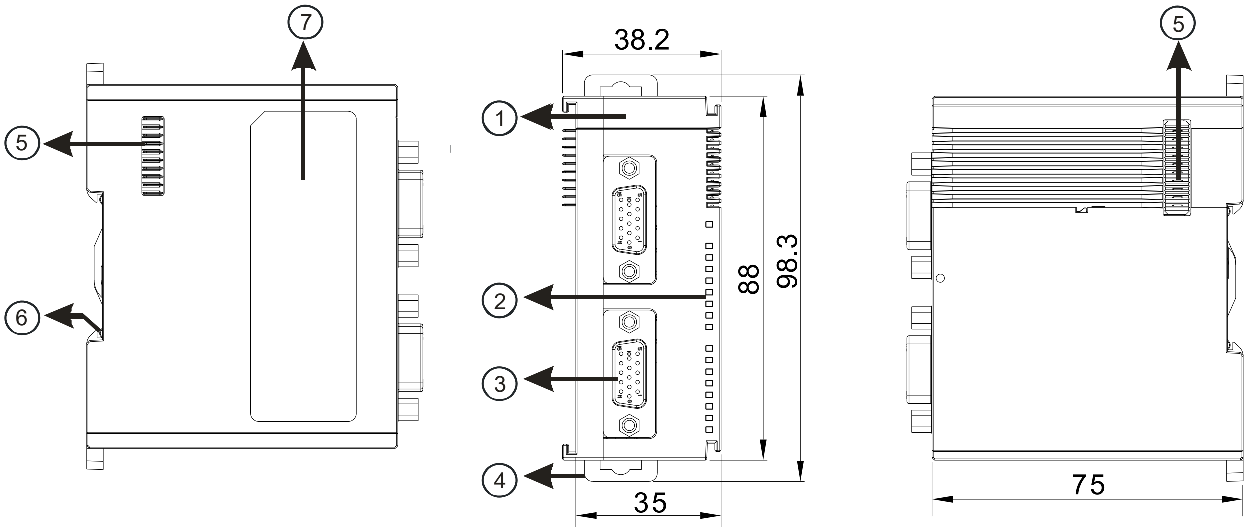
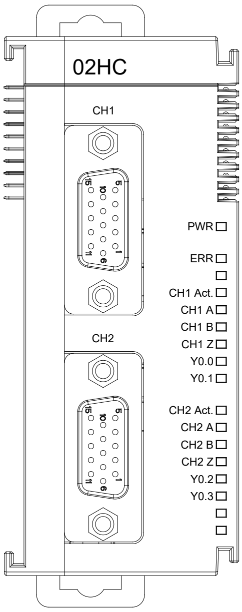
14.2.2 Profile

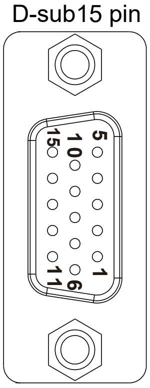


Number	Name	Description
1	Model name	Model name of the module
2	POWER LED indicator	Indicates the status of the power supply ON: The power is on. OFF: No power
	Error LED indicator	Error status of the module ON: A serious error occurs in the module. OFF: The module is normal. Blinking: A minor error occurs in the module.
	Counter LED indicator for Ch1 Act. & Ch2 Act.	Counting status of the module (Green) OFF: The counter is disabled. When the pulse input takes place: ON: The counter is enabled but the result of counting is not changed. Blinking: The result of counting is updating. When the SSI input takes place: Blinking: The counter is enabled and the position value is updating.
	Input / output LED indicator	ON: Receives an input / output signal OFF: Receives no input / output signal Refer to section 14.2.8 for details.
3	D-sub15	Input: Connected for pulse input and encoder Output: Connected to loads to be driven Power: Providing external encoder +5 VDC
4	DIN rail clip	Secures the module onto the DIN rail
5	Extension module port	Connects extension modules
6	Ground clip	For Grounding
7	Label	Nameplate

14.2.3 Terminals



D-sub15 pin

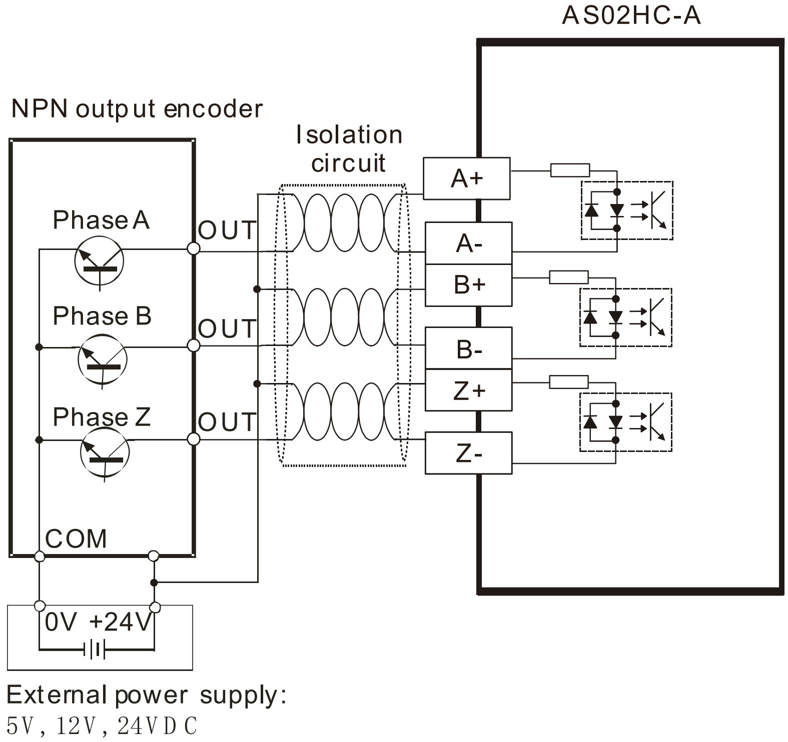


Pin No.	CH1	CH2
8	A1+	A2+
3	A1-	A2-
7	B1+	B2+
2	B1-	B2-
6	Z1+	Z2+
1	Z1-	Z2-
10	CLK1+	CLK2+
5	CLK1-	CLK2-
9	DATA1+	DATA2+
4	DATA1-	DATA2-
14	+5VO1	+5VO2
15	GND1	GND2
12	Y0.0	Y0.2
11	Y0.1	Y0.3
13	COM0	COM1

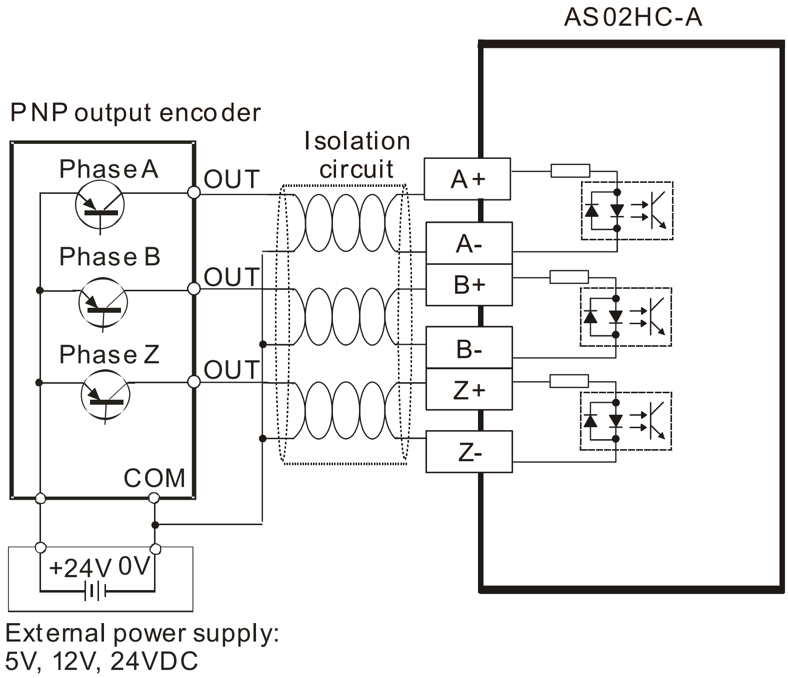
14.2.4 Wiring

14.2.4.1 Pulse Input

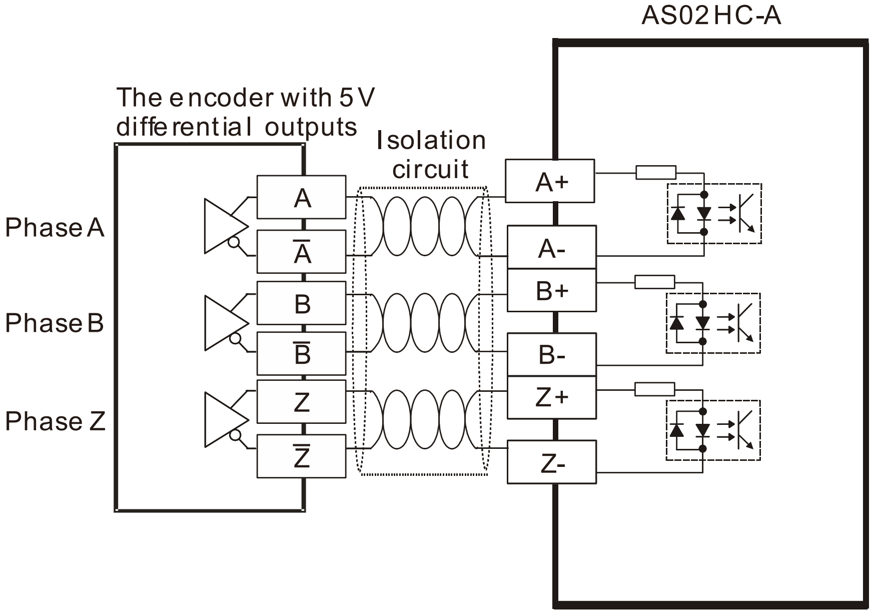
- The NPN output encoder wiring



- The PNP output encoder wiring



- The 5V differential output encoder wiring



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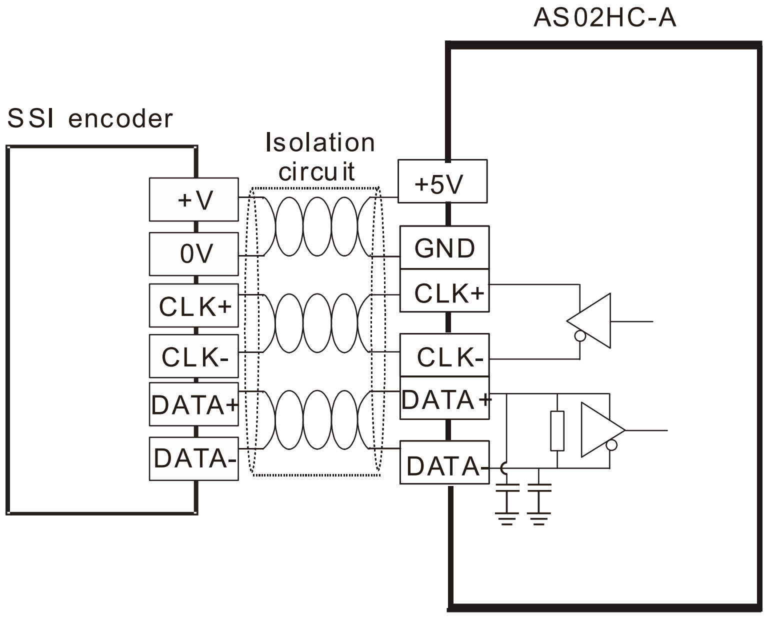
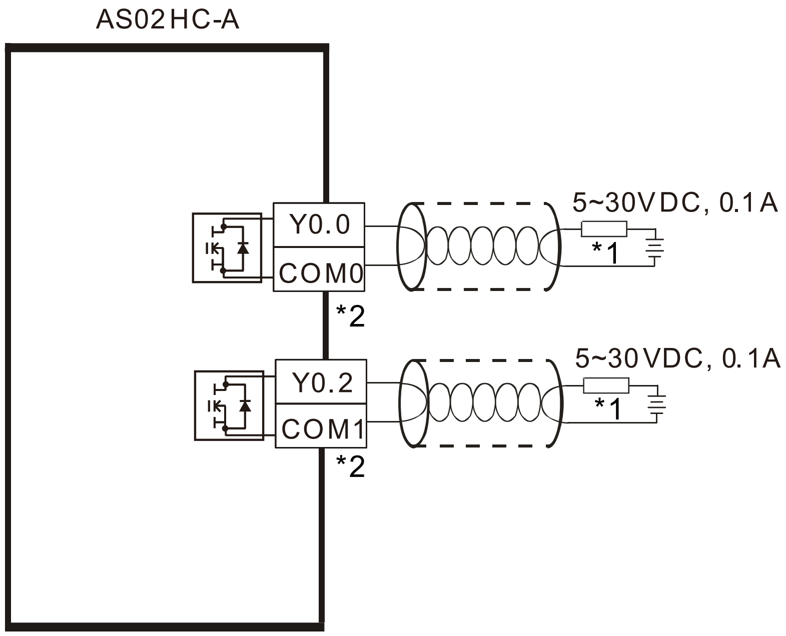
14.2.4.2 SSI Input and Output



Note:

If the power supply to the SSI encoder is non-5 VDC power supply, please supply corresponding external power based on SSI encoder specifications of different vendors.

14.2.4.3 External Output



*1：Loads or input points

*2：Use one single power supply for each COM port.

14.2.5 Pulse Input Counting

To perform the pulse-input counting, first set the configuration of channels, which includes pulse type and counter type selection in HWCONFIG. If the counter type is set to the linear counter, the maximum counting value and minimum counting value need be set. After the configuration setting is completed, use the API instruction DHCCNT which is special for AS02HC-A in a program to obtain the counting value, achieve the counter control as well as get the real time counter state.

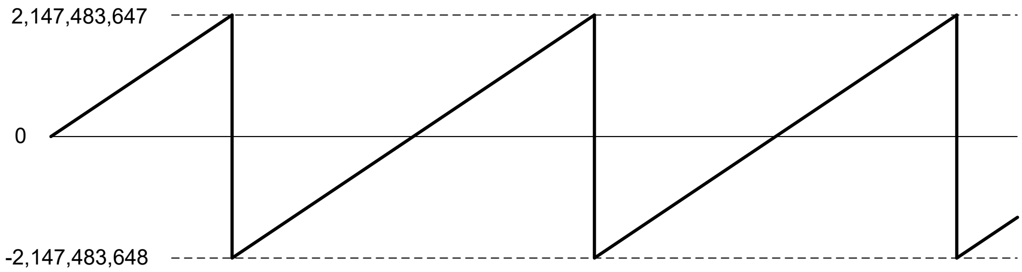
1. Pulse Type

   Specify the pulse input type which can be A/B phase (2x), A/B phase (4x), CW/CCW or pulse + direction.

Parameter	Setting	Unit	Default
Pulse Type	A/B phase (2x), A/B phase (4x), CW/CCW, Pulse + direction	-	A/B phase (2x)

2. Using the ring counter

   The ring counter value is cyclical in the range of -2,147,483,648 to 2,147,483,647. When it is greater than 2,147,483,647, the count value changes to -2,147,483,648 and then the counting continues. When it is less than -2,147,483,648, the count value changes to 2,147,483,647 and then the counting continues.



3. Using the linear counter

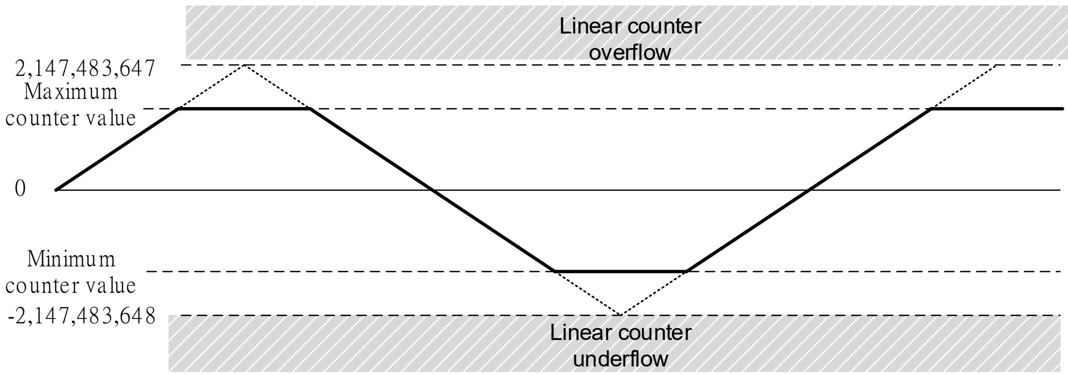
   The maximum and minimum counter values must be set up. The counter counts up and down between the two limit counter value. When the count value exceeds the maximum value, the counter state will show the warning of “The value exceeds the range!” and the count value will be fixed at the maximum counter value. When the count value is below the minimum value, the counter state will show the warning of “The value exceeds the range!” and the count value will be fixed at the minimum counter value.

   When the count value is beyond the allowed range, the counting persists internally in the hardware. The counter returns to normal and the count value is refreshed when the internal count value comes back within the valid range.

   But when the internal count value in the hardware is beyond the valid range of -2,147,483,648 to 2,147,483,647, the counter state shows linear counter overflow or linear counter underflow, the counting stops and the internal count value stops at 2,147,483,647 or -2,147,483,648. The counting can not continue until the count value overflow state of the counter is cleared.

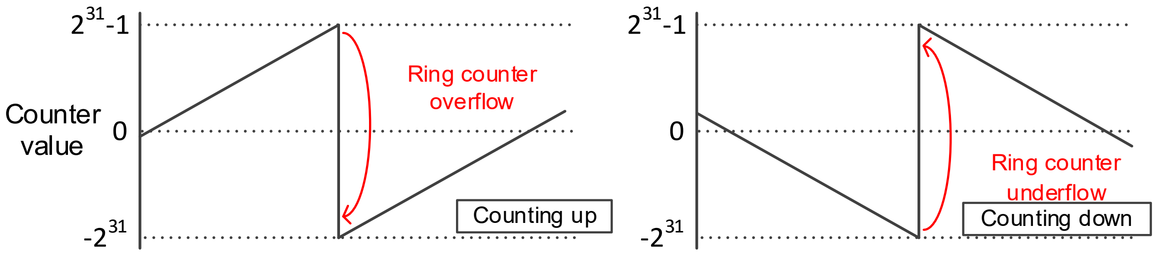
   The methods to clear the states include resetting the counter through phase-Z inputs, executing Reset/Preset via DHCCNT instruction, disabling DHCCNT instruction or changing the CPU from RUN to STOP.

Parameter	Setting	Unit	Default
Max. counter value (upper limit)	0 ~ 2147483647	-	2147483647
Min. counter value (lower limit)	-2147483648 ~ 0	-	-2147483648



4. Ring counter overflow/underflow detection

   Enable the **Ring Counter Overflow/Underflow Detect** function in the Alarm Setting of HWCONFIG. When the overflow or underflow occurs, the alarm will appear.



14.2.6 SSI Input Counting

To perform the SSI input counting, first set the configuration of channels in HWCONFIG which includes encoder coding method, clock rate, SSI data format, monoflop time and maximum variation limit. After the configuration setting is completed, use the API instruction DHCCNT which is special for AS02HC-A in a program to obtain the counting value, achieve the counter control as well as get the real time counter state.

1. Encoder Coding Method

   There are two coding methods, Binary Code and Gray Code for SSI absolute encoder. The Binary Code is the default coding method. If the Gray Code is selected, the gray-code position data (multi-turn and single-turn data) transmitted back from the SSI encoder will be converted into the binary-code position data.

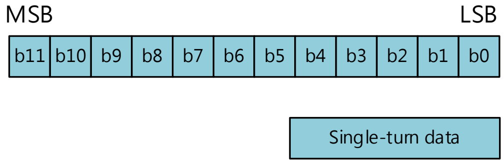
2. Clock Rate

   The HWCONFIG software provides 5 clock rates for option including 250 kHz, 500 kHz, 625 kHz, 1 MHz and 1.25 MHz. Default: 1 MHz.

3. SSI Data Format

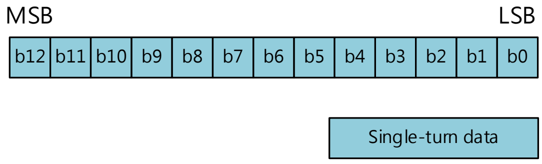
   Set Multi-turn, Single-turn and Status Data start bit & length as well as Parity Check based on the specifications of the used SSI absolute encoder. For SSI data format, 12ST, 13ST, 12 MT+13ST and User-Defined are provided for option. See the descriptions as below for details.

Data Format - 12ST:



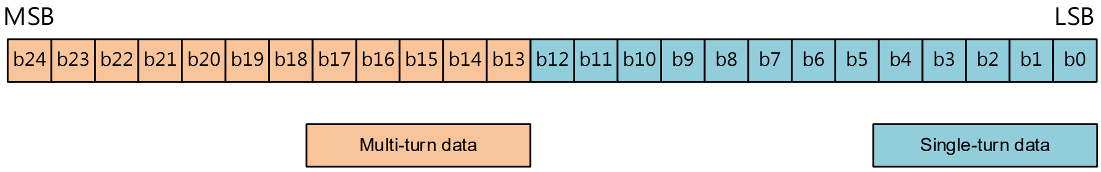
Data Length (bits): 12
Multi-Turn Data Length (bits): 0
Single-Turn Data Length (bits): 12
Single-Turn Data Start Bit: b11
Status Data Length (bits): 0
Parity Check: No check

Data Format - 13ST:



Data Length (bits): 13
Multi-Turn Data Length (bits): 0
Single-Turn Data Length (bits): 13
Single-Turn Data Start Bit: b12
Status Data Length (bits): 0
Parity Check: No check

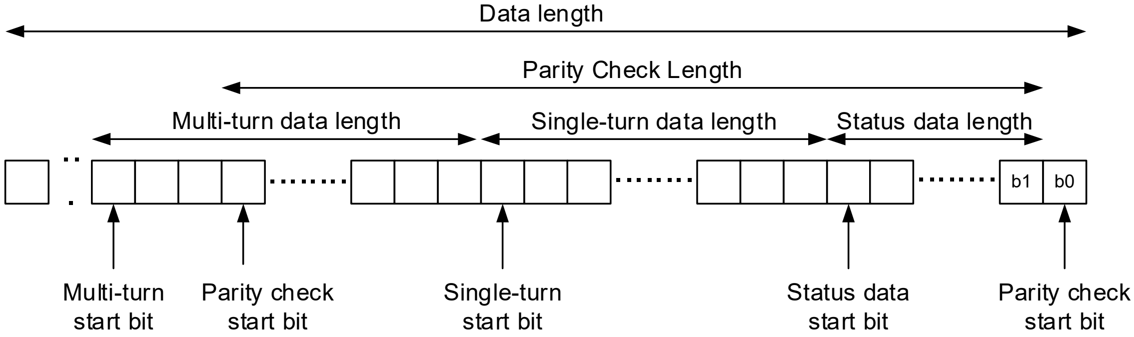
Data Format - 12MT+13ST (Default):



Data Length (bits): 25
Multi-Turn Data Length (bits): 12
Multi-Turn Data Start Bit: b24
Single-Turn Data Length (bits): 13
Single-Turn Data Start Bit: b12
Status Data Length (bits): 0
Parity Check: No check

Data Format – User-Defined:

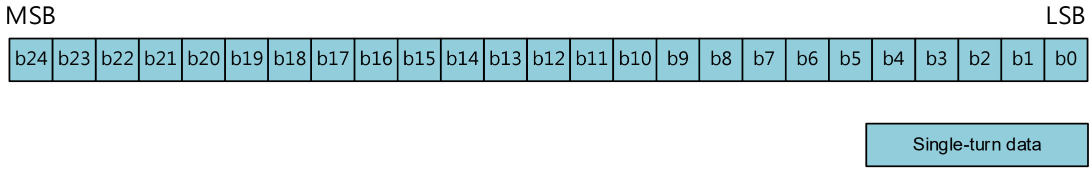
Users can define all parameters based on the illustration in the following diagram.



Note: For a multi-turn encoder, the multi-turn data and single-turn data should be next to each other without additional data placed between them.

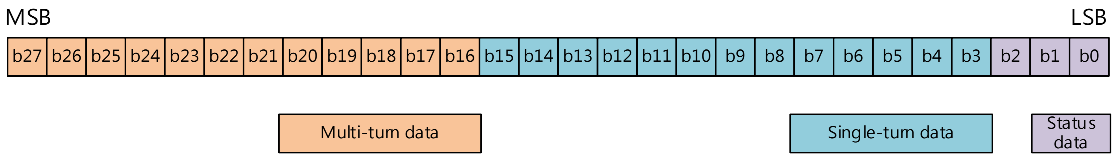
Item	Setting	Default
Data Length (bits)	7 ~ 31	25
Multi-Turn Data Length (bits)	0 ~ 31	12
Multi-Turn Data Start Bit	B0 ~ b30	B24
Single-Turn Data Length (bits)	1 ~ 31	13
Single-Turn Data Start Bit	B0 ~ b30	B12
Status Data Length (bits)	0 ~ 15	0
Status Data Start Bit	B0 ~ b30	B0
Parity Check	No check, odd parity check, even parity check	No check
Parity Check Bit	B0 ~ b30	B0
Parity Check Start Bit	B0 ~ b30	B0
Parity Check Length (bits)	0 ~ 30	0

Example 1: 25-bit Single-Turn Encoder



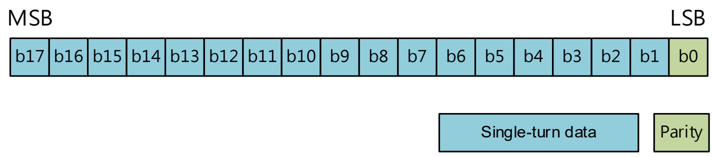
Data Length (bits): 25
Multi-Turn Data Length (bits): 0
Single-Turn Data Length (bits): 25
Single-Turn Data Start Bit: b24
Status Data Length (bits): 0
Parity Check: No check

Example 2: Encoder with Status Data



Data Length (bits): 28
Multi-Turn Data Length (bits): 12
Multi-Turn Data Start Bit: b27
Single-Turn Data Length (bits): 13
Single-Turn Data Start Bit: b15
Status Data Length (bits): 3
Status Data Start Bit: b2
Parity Check: No check

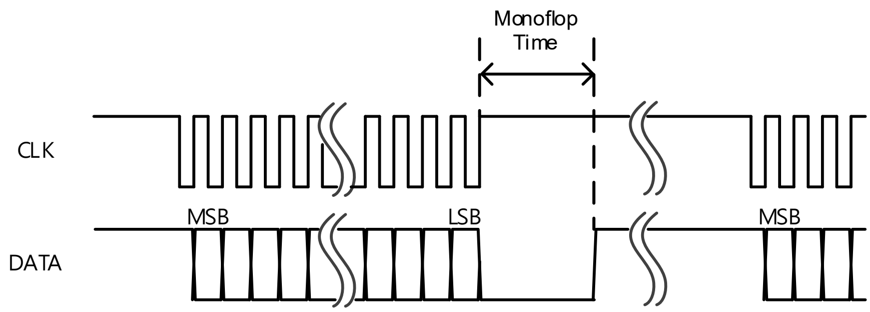
Example 3: Encoder with Parity Check



Data Length (bits): 18
Multi-Turn Data Length (bits): 0
Single-Turn Data Length (bits):17
Single-Turn Data Start Bit: b17
Status Data Length (bits): 0
Parity Check: Even parity check
Parity Check Bit: b0
Parity Check Start Bit: b17
Parity Check Length (bits): 17

4. Monoflop Time

The Monoflop Time parameter determines the interval time between two SSI data frames. The correct position data can be received as long as the setting value is greater than that specified for the connected encoder. The range is set as follows.



Parameter	Setting	Unit	Default
Monoflop time	4 ~ 2500	16us	4

5. Maximum Variation Limit

The parameter is used to prevent sudden errors occurring in reading absolute position values due to noise interference. You can set the limit value for the variation between two consecutive SSI positions.

When the position change exceeds the set limit, the read position value is discarded, the present count value is not refreshed and the error code is displayed in the counter status. When the position change is back within the set range, the counting returns to normal and the error code is cleared.

When the maximum position variation limit is set to 0, the function is disabled and no check on the position change will be done.

Parameter	Setting	Unit	Default
Maximum Variation Limit	0 ~ 2147483647	-	0 (Disabled)

6. Absolute Position

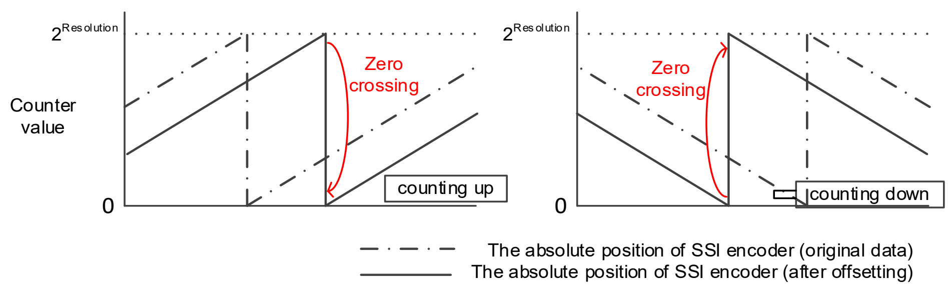
When the **Absolute Position** option is selected as the counter type, the counter value will show the absolute position of the SSI absolute encoder within the range of 0 to $2^{resolution}$. The data information including single-turn data, multi-turn data status, data and counting direction can be displayed independently based on the set data format. The offset setting of the SSI absolute encoder can be modified as well. Refer to DHCCNT instruction for more.

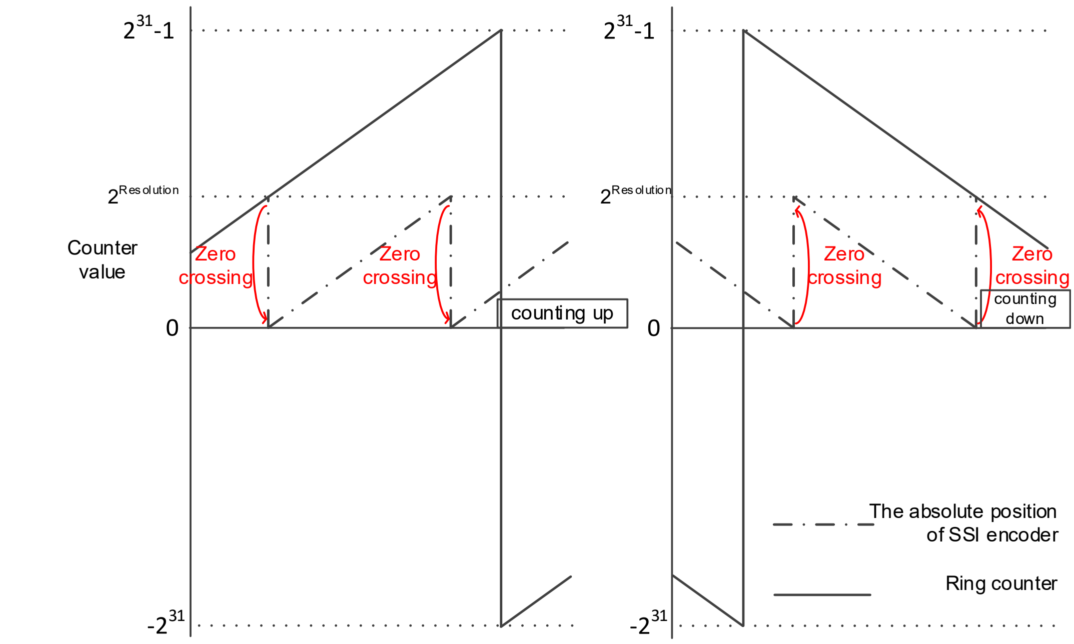
7. Ring Counter

When **Ring Counter** is chosen as the counter type, AS02HC-A is used as a 32-bit ring counter by making two read absolute position variations added up and the count value is changing cyclically in the range of -2147483648 to 2147483647. The counting value changes cyclically within the range of -2147483648 to 2147483647. The ring counter value can be cleared to zero through phase Z. The DHCCNT instruction can also be used to clear and preset the counter value. Refer to DHCCNT instruction for details.

8. Zero Crossing Detection

The **SSI Zero Crossing Detect** function is enabled on the Alarm Setting tab page of the HWCONFIG software. The alarm will appear if the absolute position of the SSI encoder crosses the zero position. The detection function can be used for both the absolute position and ring counters. The timing for the zero crossing is illustrated in the following table.

Absolute Position	

Ring Counter	

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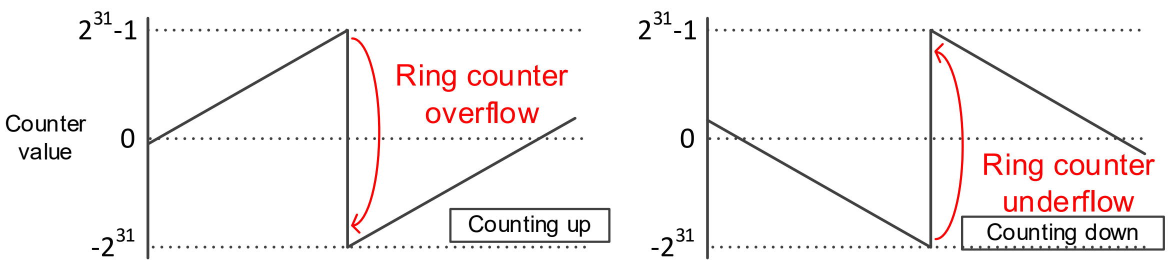
9. Ring Counter Overflow / Underflow Detection

The **Ring Counter Overflow/Underflow Detection** function is enabled on the Alarm Setting tab page of the HWCONFIG software. The alarm will appear as the counter value overflow/underflow occurs.



10. SSI Encoder Rotation Rate Restriction

For the SSI input counting, the rotation rate restriction is influenced by the SSI encoder resolution and monoflop time. Use the corresponding formula in the following table to calculate the rotation speed of the SSI encoder.

Encoder type	Rotation rate (RPM)
Single-turn encoder	$\pm\frac{60}{2\times tp\times 10^{-6}}$ (tp: monoflop time, unit: us)
Multi-turn encoder	$\pm\frac{60\times 2^{MT\ data\ length}}{2\times tp\times 10^{-6}}$(tp: monoflop time, unit: us)

See the reference values for the formula above in the following table.

Monoflop time (us)	Max. rotation rate of single-turn encoders (RPM)	Max. rotation rate of multi-turn encoders (RPM)
64	468750	$468750 \times 2^{MT\ data\ length}$
4000	7500	$7500 \times 2^{MT\ data\ length}$
8000	3750	$3750 \times 2^{MT\ data\ length}$
12000	2500	$2500 \times 2^{MT\ data\ length}$

Monoflop time (us)	Max. rotation rate of single-turn encoders (RPM)	Max. rotation rate of multi-turn encoders (RPM)
16000	1875	$1875 \times 2^{\text{MT data length}}$
20000	1500	$1500 \times 2^{\text{MT data length}}$
24000	1250	$1250 \times 2^{\text{MT data length}}$
28000	1071	$1071 \times 2^{\text{MT data length}}$
32000	938	$938 \times 2^{\text{MT data length}}$
36000	833	$833 \times 2^{\text{MT data length}}$
40000	750	$750 \times 2^{\text{MT data length}}$

14.2.7 Z-Phase Function Setting

AS02HC-A's two channels which are with one input point CH1 Z and CH2 Z respectively should be configured in function by HWCONFIG before they are used to achieve the functions of counter reset, gate control, counter value capture and digital filtering.

Item name	Setting	Unit	Default
Phase-Z Function Setting	Counter Reset, Counter Reset +Yno, Gate Control and Capture	-	Counter Reset

Phase-Z Function	Description	Remark
Counter Reset (Default)	The counter is cleared (the counter value is reset to 0 and the counter status is cleared.)	The counter value can not be cleared if the SSI input and the absolute-position counter type are selected.
Counter Reset +Yno	Same to Counter Reset above. Also clears the output points that are set by the DHCCMP comparison instruction or table comparison instruction DHCCMPT.	The DHCCMP or DHCCMPT instruction is used.
Capture	The counter value capture is triggered through the rising edge and falling edge of phase Z.	The DHCCAP instruction is used.
Gate control	When phase Z is at low level, the counter's counting pauses. When phase Z is at high level, the counter's counting continues.	Applicable to the pulse input only.

Item name	Setting	Unit	Default
Filter time	0 ~ 200	100 us	0 (Disabled)

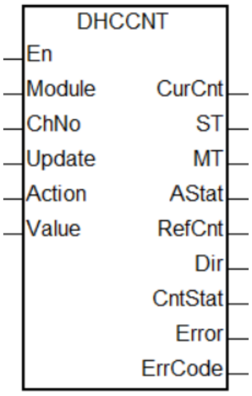
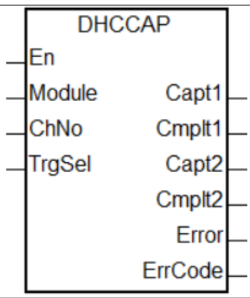
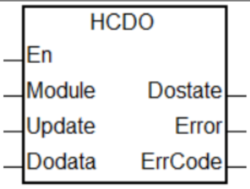
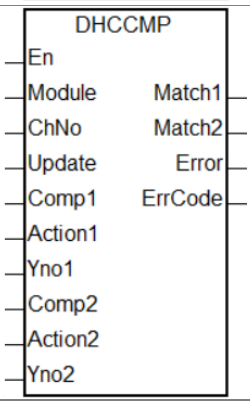
14.2.8 LED Indicators

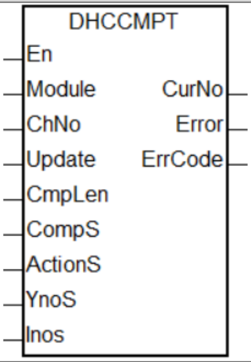
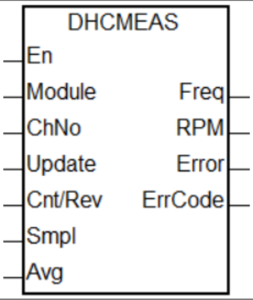
Indicator	Color	Name	Description
PWR	Blue	Power indicator	ON: The power supply is normal. OFF: No power supply
ERR	Red	Error indicator	ON: A major error occurs in the module. OFF: The module is operating normally. Blinking: A minor error exists in the module (Blinks every 0.5 seconds.)
CH1 Act.	Green	Ch1 counter state indicator	OFF: The counter is disabled. Pulse Input - ON: The counter is enabled but there is no change in the counter value. Blinking: The counter value is changing. (Blinks every 0.5 seconds.) SSI Input - Blinking: The counter is enabled and the position value is being updated. (Blinks every 0.5 seconds.)
CH1 A	Red	Ch1 phase-A input indicator	ON: The phase-A input for channel 1 is active. OFF: The phase-A input for channel 1 is not active.
CH1 B	Red	Ch1 phase-B input indicator	ON: The phase-B input for channel 1 is active. OFF: The phase-B input for channel 1 is not active.
CH1 Z	Red	Ch1 phase-Z or DI input indicator	ON: The phase-Z input for channel 1 is active. OFF: The phase-Z input for channel 1 is not active.
Y0.0	Red	Y0.0 output status indicator	ON: The Y0.0 output is active. OFF: The Y0.0 output is not active.
Y0.1	Red	Y0.1 output status indicator	ON: The Y0.1 output is active OFF: The Y0.1 output is not active.
CH2 Act.	Green	Ch2 counter state indicator	OFF: The counter is disabled. Pulse Input - ON: The counter is enabled but there is no change in the counter value. Blinking: The counter value is changing. (Blinks every 0.5 seconds.) SSI Input - Blinking: The counter is enabled and the position value is being updated. (Blinks every 0.5 seconds.)
CH2 A	Red	Ch2 phase-A input indicator	ON: The phase-A input for channel 2 is active. OFF: The phase-A input for channel 2 is not active.
CH2 B	Red	Ch2 phase-B input indicator	ON: The phase-B input for channel 2 is active. OFF: The phase-B input for channel 2 is not active.
CH2 Z	Red	Ch2 phase-Z or DI input indicator	ON: The phase-Z input for channel 2 is active. OFF: The phase-Z input for channel 2 is not active.
Y0.2	Red	Y0.2 output status indicator	ON: The Y0.2 output is active OFF: The Y0.2 output is not active.
Y0.3	Red	Y0.3 output status indicator	ON: The Y0.3 output is active OFF: The Y0.3 output is not active.

14.3 Operation

14.3.1 List of Dedicated API Instructions

The operation of AS02HC-A is realized via dedicated API instructions in HWCONFIG after the counter configuration setting is done. The dedicated API instructions for AS02HC-A include DHCCNT, DHCCAP, HCDO, DHCCMP, DHCCMPT and DHCMEAS. For details on these instructions and application examples, refer to **AS Series Programming Manual**.

Instruction	Symbol	Function
DHCCNT (Counter control)		Enable/ disable the counter Change the count value Clear the counter Preset the counter Show current counter value Show the counting direction Show the counter state Correct SSI offset Show SSI data
DHCCAP (Count vlaue capture)		Set a capture method Show captured count values
HCDO (Output point control)		Control output points Show output-point state
DHCCMP (Comparison output)		Enable/disable comparison output function Set two point comparison values Set comparison-matched actions Show comparison-matched status

Instruction	Symbol	Function
DHCCMPT (Table comparison output)		Enable/disable table comparison output function Set comparison values for up to ten points Set comparison-matched action Show comparison-matched status
DHCMEAS (Rotation rate measurement)		Enable/disable measurement function Set average times Show measured frequency Show measured rotations per minute

14.3.2 The impact of AS CPU Status on AS02HC-A

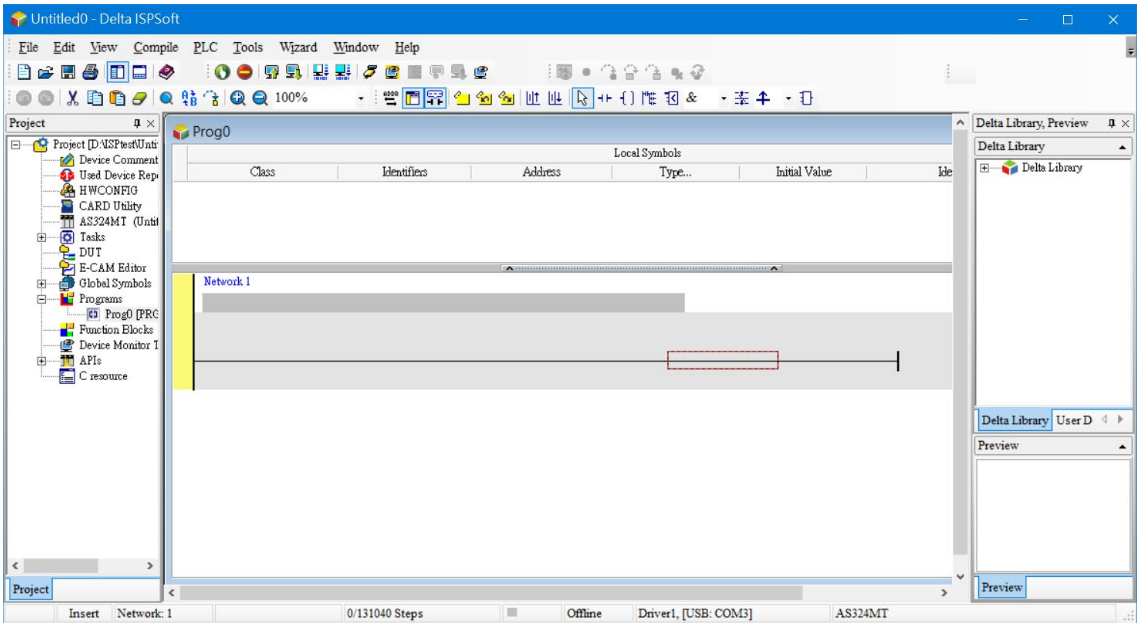
The following table lists the module execution states corresponding to AS CPU operation states of poweroff, and Run -> Stop. After the AS CPU state switches from Stop to Run, the operation state of AS02HC-A module is controlled by the PLC program.

Item	Poweroff, CPU Run -> Stop
Y0.0~Y0.3	Reset to OFF
Phase Z	Disabled
Counter	The counting stops and counter state is cleared.
DHCCNT	The instruction is disabled.
HCDO	The instruction is disabled.
DHCCAP	The instruction is disabled.
DHCCMP	The instruction is disabled; MATCH1 and MATCH2 are cleared.
DHCCMPT	The instruction is disabled and CurNo is cleared.
DHCMEAS	The instruction is disabled.

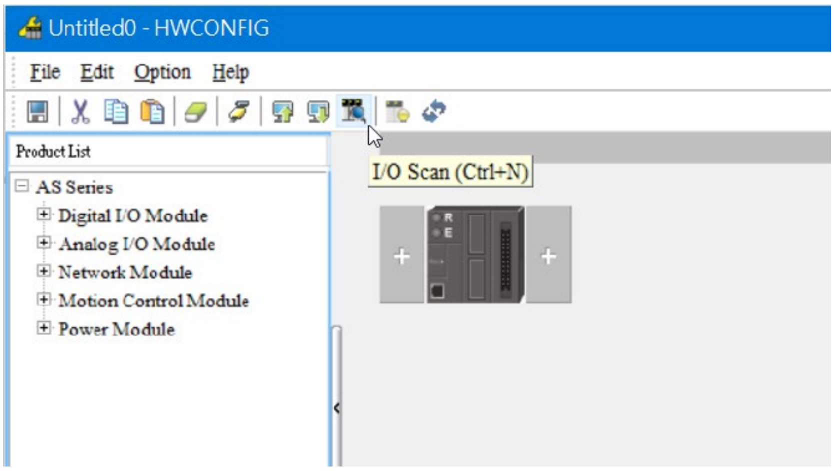
14.4 Hardware Configuration via HWCONFIG in ISPSoft

14.4.1 Initial Setting

1. Start ISPSoft and then double-click **HWCONFIG**.



2. Click the **I/O Scan** button.



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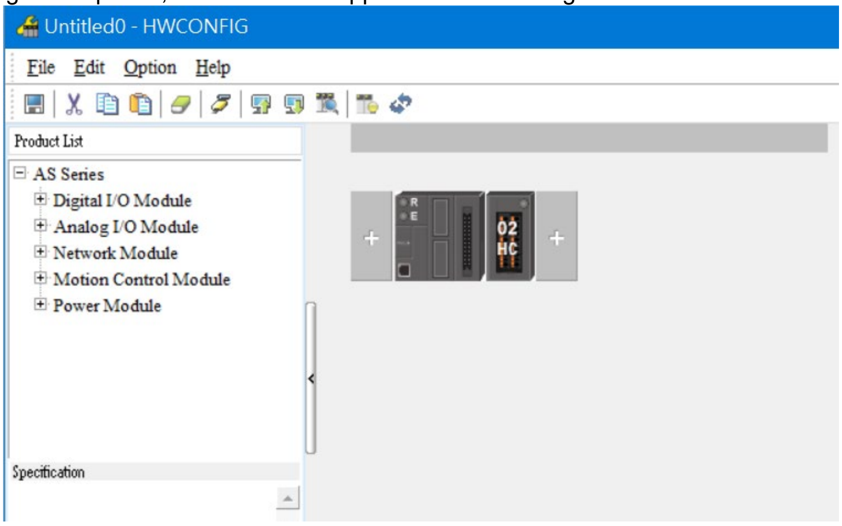
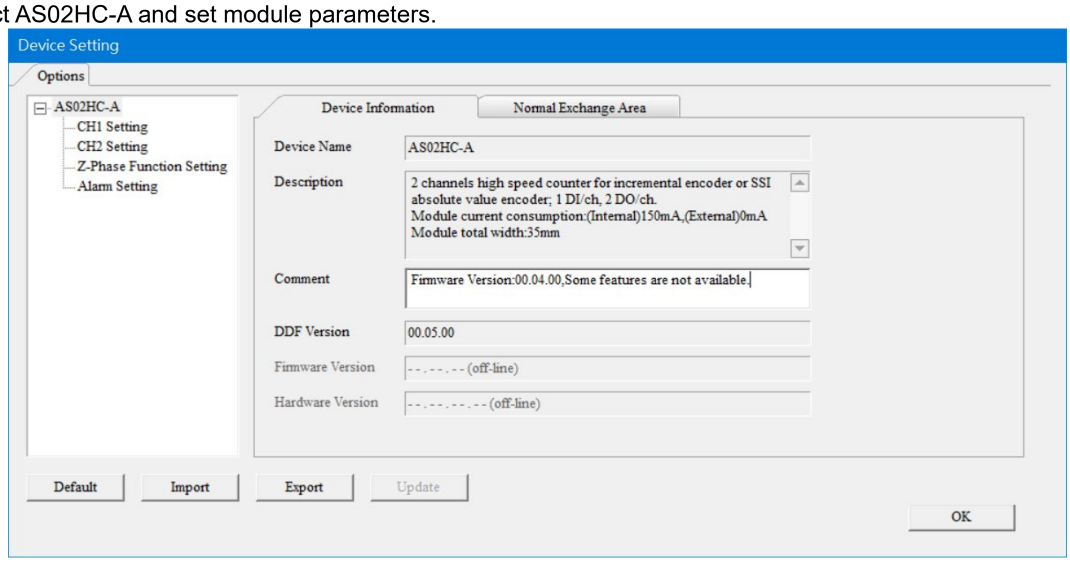
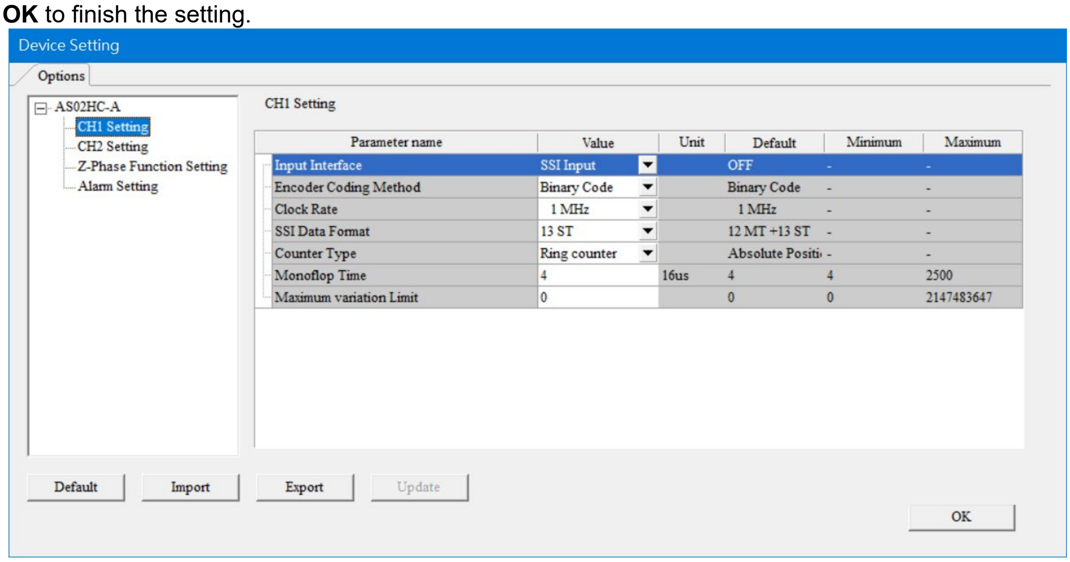
3. After the scanning is completed, AS02HC-A will appear in the following window.



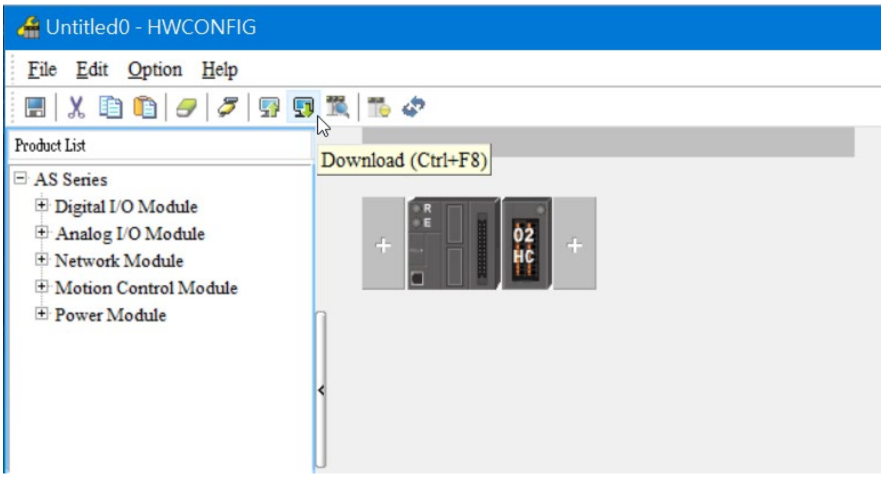
4. Select AS02HC-A and set module parameters.



5. Click **OK** to finish the setting.

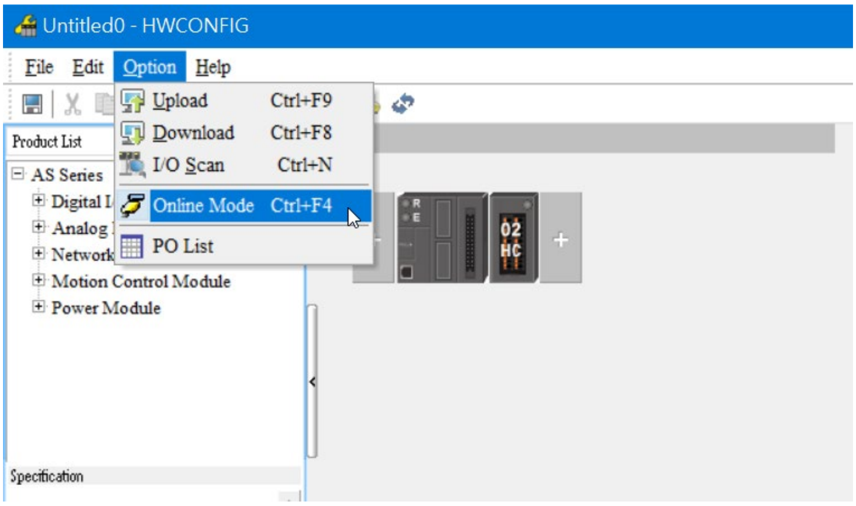


6. Click **Download** to download the configuration data. (The download can not be performed if the CPU is in RUN state)

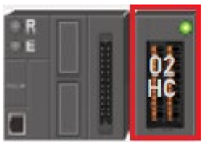


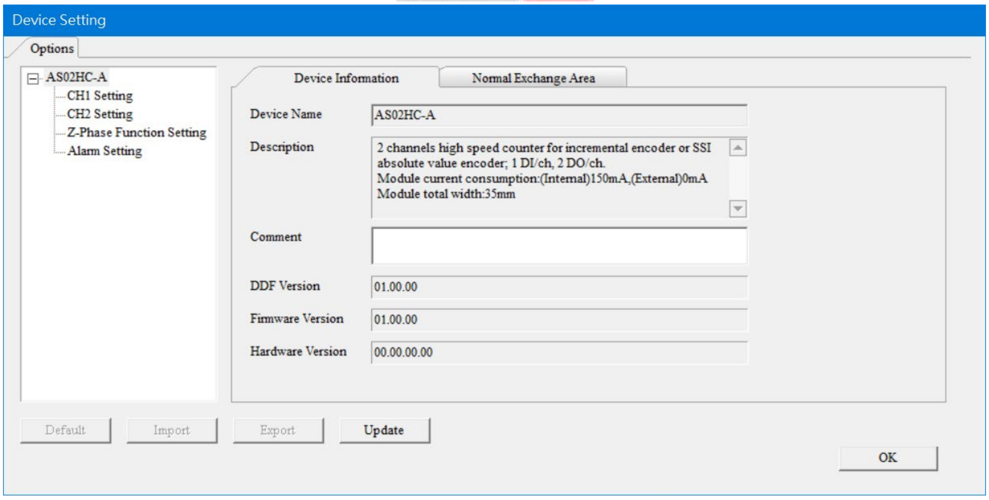
14.4.2 Checking the Module Version

1. Click **Option** menu > **Online Mode**.



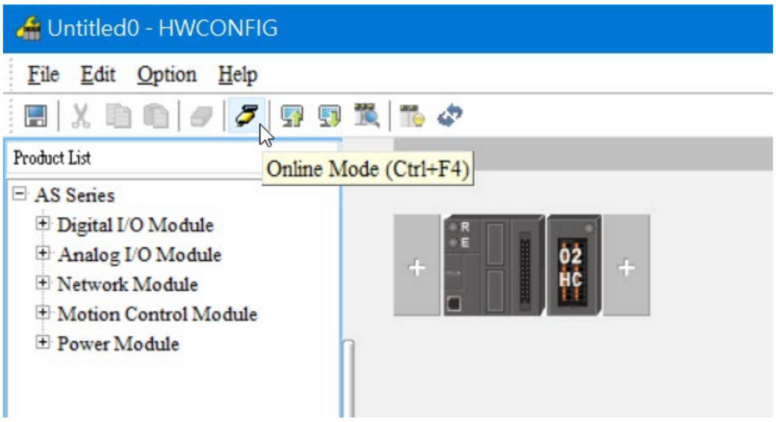
2. Double-click **AS02HC** module to check the firmware version and hardware version.



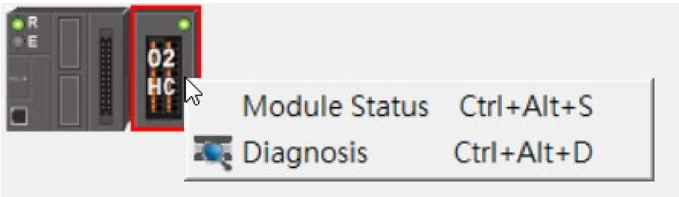


14.4.3 Online Mode

1. Click **Online Mode** to enter the online mode.

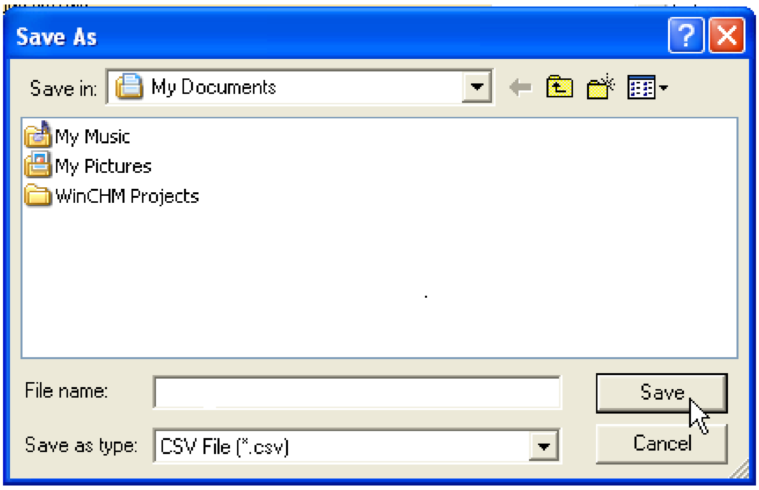


2. Right-click **AS02HC** module and select **Module Status** or **Diagnosis** from the context menu. Then the error code information can be seen in the module state window and module error log can be seen in the diagnosis area.

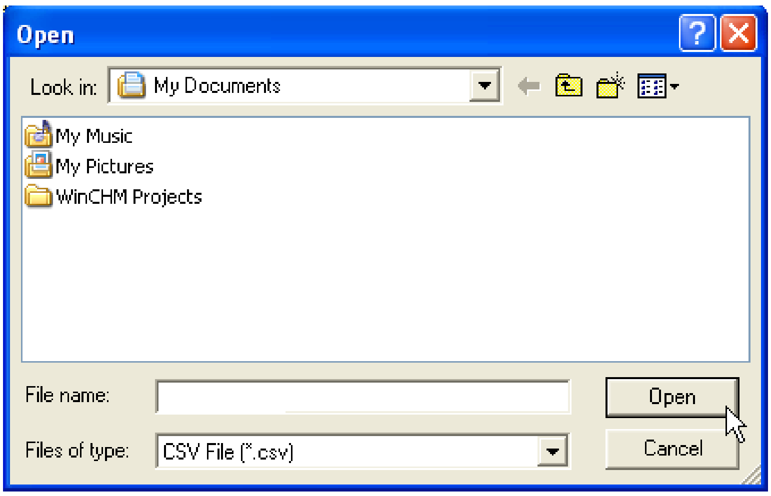


14.4.4 Import and Export a Parameter File

1. Click **Export** in the Device Settings dialog box to save the current parameters as a CSV file (.csv).

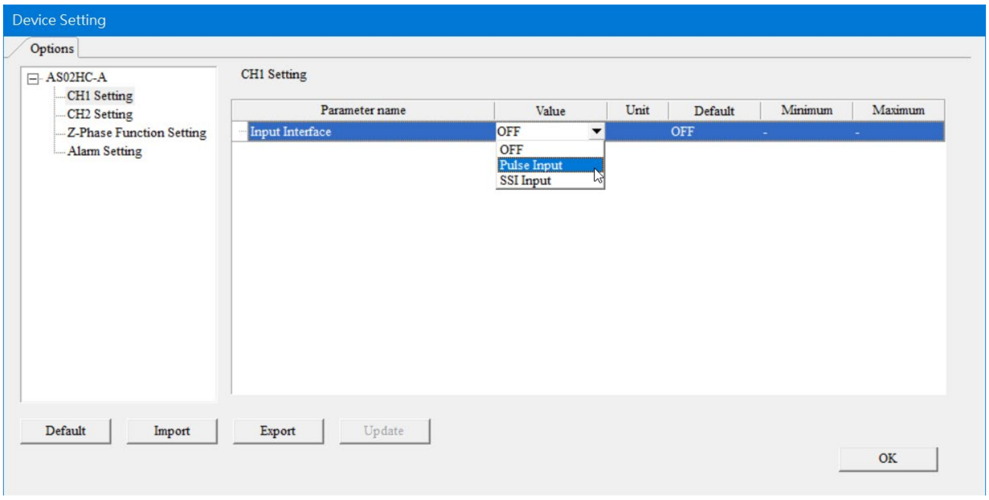


2. Click **Import** in the Device Settings dialog box and select a CSV file to save parameters.

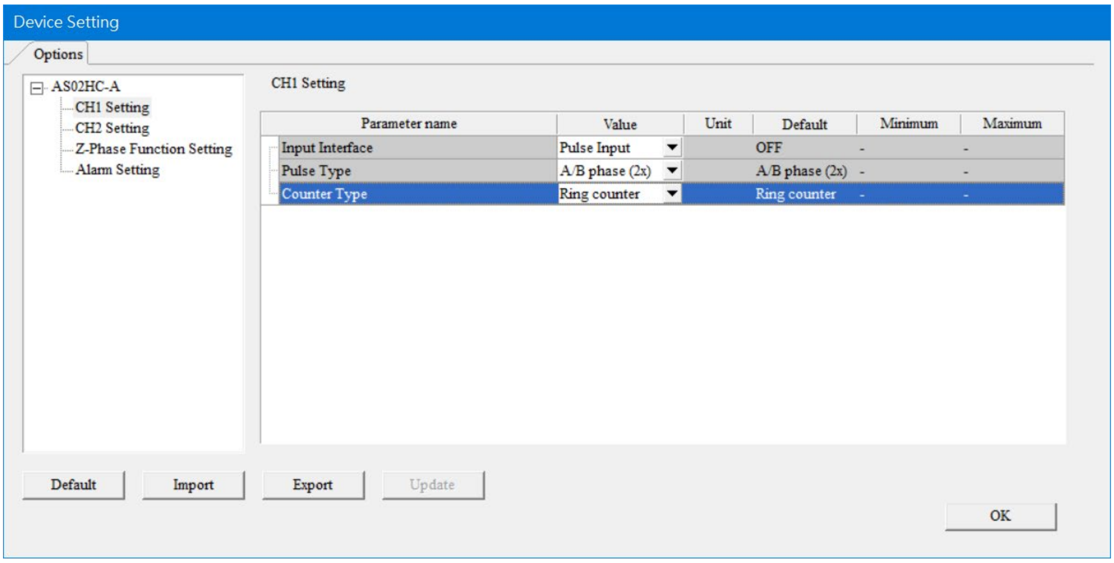


14.4.5 Parameters

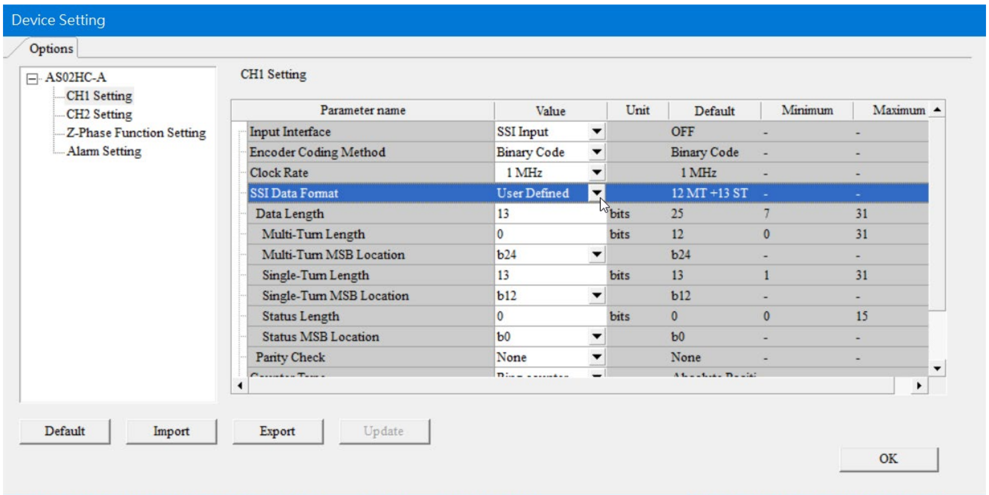
1. Select one input interface in CH1 Setting / CH2 Setting.



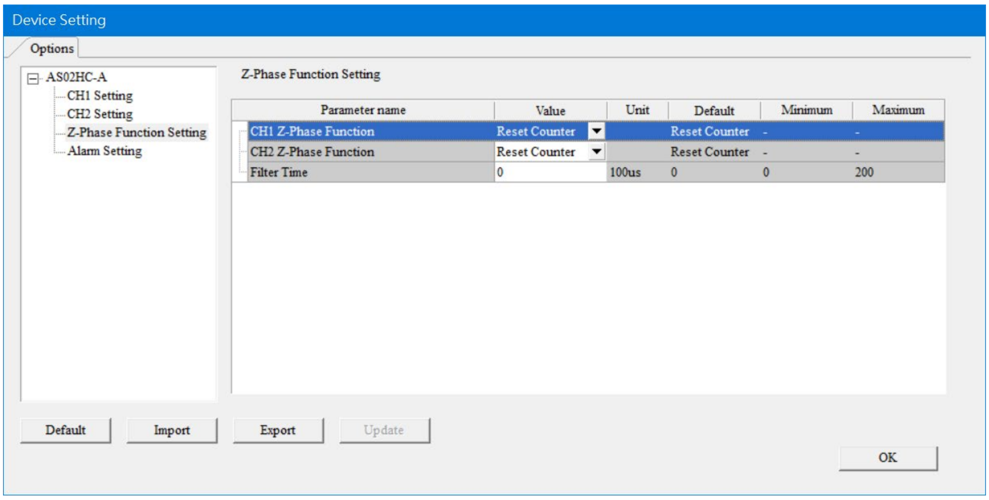
2. Pulse Input in CH1 Setting / CH2 Setting.



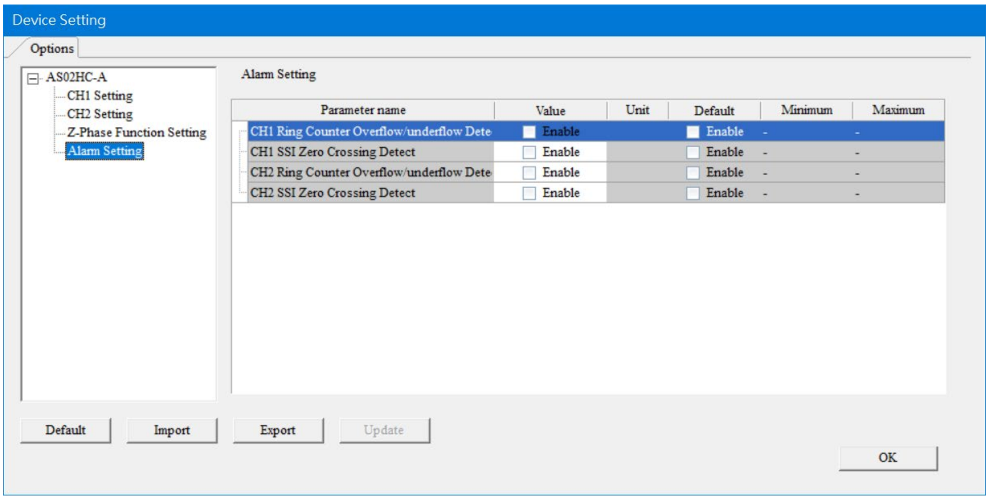
3. SSI Input in CH1 Setting / CH2 Setting



4. Z-Phase Function Setting

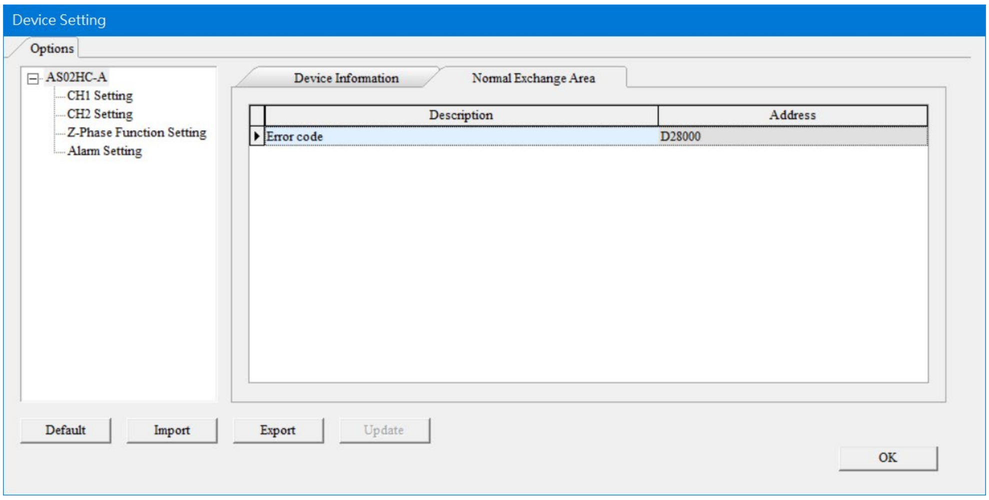


5. Alarm Setting



14.4.6 Normal Exchange Area

The data exchange area between the CPU and a module is in the Device Setting dialog box. The normal exchange areas for modules are different from one another. Special D registers are corresponded to automatically based on the configuration data for the convenience of directly reading the values. The error codes of AS02HC-A are configured in the Normal Exchange Area. The error codes of the module can be known by monitoring D registers.



14.5 Troubleshooting

14.5.1 Error Codes

Error code	Description	ERR LED	Counter action	Remark
16#1605	Counted result in the latched area is not retainable (major error)	ON	The counter module stops operating and counting	The error alarm makes the CPU stop the system. (The module need be set to keep counting or stop for when an error occurs in the module:)
16#1606	Module settings in the latched area is not retainable. (major error)			
16#1607	Module setting error (major error)			
16#1800	Counter overflow / underflow on CH1	Blinking	Linear counter: Counting stops. Ring counter: Counting continues.	Linear counter: Counter value overflow inside the hardware Ring counter: After the Ring Counter Overflow/Underflow Detect function is enabled in the Alarm Setting of HWCONFIG, the alarm will appear when the overflow or underflow occurs.
16#1801	Counter overflow / underflow on CH2			
16#1802	Linear count exceeding the set upper/lower limit on CH1	Blinking	The counting value is fixed at the set max. counter value or the set min. counter value.	The counting inside the hardware persists. When the internal counter value is back within the valid range, the counter returns to normal and the counting value is refreshed.
16#1803	Linear count exceeding the set upper/lower limit on CH2			
16#1804	The variation in relation to an SSI encoder position exceeding the limit on CH1	Blinking	The counting value is fixed at the most recent correct count value.	The variation between two consecutive SSI positions exceeds the setting value.
16#1805	The variation in relation to an SSI encoder position exceeding the limit on CH2			
16#1806	Abnormal SSI communication on CH1	Blinking	The counting value is fixed at the most recent correct count value.	Encoder disconnection/ wiring error/no power supply to the encoder/ data format error/parity check setting error (Error log will not appear unless five consecutive abnormal situations occur.)
16#1807	Abnormal SSI communication on CH2			
16#1808	SSI absolute position cross zero point on CH1	Blinking	Counting continues.	After the SSI Zero Crossing Detect function is enabled on the Alarm Setting tab page of the HWCONFIG software, the alarm will appear as the absolute position of the SSI encoder crosses the zero position.
16#1809	SSI absolute position cross zero point on CH2			

14.5.2 Troubleshooting Procedure

Description	Solution
Counted result in the latched area is not retainable (major error)	Counted data is lost. Switch the module power OFF and ON again. The error code is cleared by the system. Contact the factory if the problem persists.
Module settings in the latched area is not retainable. (major error)	Module setting data is lost. Switch the module power OFF and ON again. Download the HWCONFIG settings again to clear the error code. Contact the factory if the problem persists.
Module setting error (major error)	Check if the setting in HWCONFIG is consistent with the actual placement. Contact the factory if the problem persists.
Counter overflow / underflow on CH1	Check the counter result. If the alarm is not required, disable the alarm output function in HWCONFIG. Use any of the followings to clear the error code: clear, reset, preset the counter, restart the module, or execute DHCCNT instruction again.
Counter overflow / underflow on CH2	
Linear count exceeding the set upper/lower limit on CH1	Check the signal received by channel 1 and 2. Hardware counter is still counting; when the number is back within the range of the maximum to the minimum, the error code will be cleared.
Linear count exceeding the set upper/lower limit on CH2	
The variation in relation to a SSI encoder position exceeding the limit on CH1	Check if there is any interruption and check the device specification to see if the offset setting is matching with the actual placement.
The variation in relation to a SSI encoder position exceeding the limit on CH2	
Abnormal SSI communication on CH1	Check the execution of DHCCNT instruction. If it is parity check, check if there is any interruption and check if the data format is correct. Check if the device wiring is secure, and if the encoder power supply is normal.
Abnormal SSI communication on CH2	
SSI absolute position cross zero point on CH1	Check the SSI absolute encoder specification and modify the setting accordingly. If the alarm is not required, disable the alarm output function in HWCONFIG. Use any of the followings to clear the error code: clear, reset, preset the counter, restart the module, or execute DHCCNT instruction again.
SSI absolute position cross zero point on CH2	

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