Smarter. Greener. Together.


**Industrial Automation Headquarters**

**Delta Electronics, Inc.**
Taoyuan Technology Center
No.18, Xinglong Rd., Taoyuan City,
Taoyuan County 33068, Taiwan
TEL: 886-3-362-6301 / FAX: 886-3-371-6301

**Asia**

**Delta Electronics (Jiangsu) Ltd.**
Wujiang Plant 3
1688 Jiangxing East Road,
Wujiang Economic Development Zone
Wujiang City, Jiang Su Province, P.R.C. 215200
TEL: 86-512-6340-3008 / FAX: 86-769-6340-7290

**Delta Greentech (China) Co., Ltd.**
238 Min-Xia Road, Pudong District,
ShangHai, P.R.C. 201209
TEL: 86-21-58635678 / FAX: 86-21-58630003

**Delta Electronics (Japan), Inc.**
Tokyo Office
2-1-14 Minato-ku Shibadaimon,
Tokyo 105-0012, Japan
TEL: 81-3-5733-1111 / FAX: 81-3-5733-1211

**Delta Electronics (Korea), Inc.**
1511, Byucksan Digital Valley 6-cha, Gasan-dong,
Geumcheon-gu, Seoul, Korea, 153-704
TEL: 82-2-515-5303 / FAX: 82-2-515-5302

**Delta Electronics Int'l (S) Pte Ltd.**
4 Kaki Bukit Ave 1, #05-05, Singapore 417939
TEL: 65-6747-5155 / FAX: 65-6744-9228

**Delta Electronics (India) Pvt. Ltd.**
Plot No 43 Sector 35, HSIIDC
Gurgaon, PIN 122001, Haryana, India
TEL : 91-124-4874900 / FAX : 91-124-4874945

**Americas**

**Delta Products Corporation (USA)**
Raleigh Office
P.O. Box 12173,5101 Davis Drive,
Research Triangle Park, NC 27709, U.S.A.
TEL: 1-919-767-3800 / FAX: 1-919-767-8080

**Delta Greentech (Brasil) S.A.**
Sao Paulo Office
Rua Itapeva, 26 - 3° andar Edificio Itapeva One-Bela Vista
01332-000-São Paulo-SP-Brazil
TEL: 55 11 3568-3855 / FAX: 55 11 3568-3865

**Europe**

**Delta Electronics (Netherlands) B.V.**
Eindhoven Office
De Witbogt 20, 5652 AG Eindhoven, The Netherlands
TEL : +31 (0)40-8003800 / FAX : +31 (0)40-8003898



AS-0249820-04





2018/11/26



AS **Series Module Manual**



# AS **Series Module Manual**


www.deltaww.com


Smarter. Greener. Together.

# 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.<br>2. Chapter 2: Added information concerning new models AS08AD-B andAS08AD-C.<br>3. Chapter 3: Updated information concerning CR#23-24 and software new screenshots.<br>4. Chapter 4: Updated information concerning CR#35-54/CR#210-225 and software new screenshots.<br>5. Chapter 5: Updated information concerning CR#1-4/CR#210-217 and software new screenshots.<br>6. Chapter 6: Updated information concerning CR#210-217 and software new screenshots.<br>7. Chapter 7: Updated information concerning theoretical calibration and software new screenshots<br>8. Chapter 8: Updated information concerning new firmware 2.0. | 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.<br>2. Chapter 5: Added information concerning new model AS06RTD-A.<br>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.<br>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.<br>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.<br>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.<br>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.<br>6. Chapter 6: section 6.2.1 revised type B range and added a note, section 6.2.4-6.2.5 added notes on CR, and revised CR# for the records, updated section 6.2.6 PID information, and revised section 6.2.7 control mode.<br>7. Chapter 7: section 7.2.4 added notes on CR.<br>8. Chapter 8: added new functions concerning new firmware V2.02<br>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 |

AS Series Module Manual

Table of Contents

**Chapter 3 Analog Output Module AS04DA**



**Chapter 4 Analog Input/Output Module AS06XA**

**Chapter 9 Function Cards**

1

# Chapter 1 Introduction

## Table of Contents

1

## 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. They are described in the following table.

| Classification | Model Name | Description |
|---|---|---|
| Analog input/output module | AS04AD-A | 4-channel analog input module<br>Hardware resolution: 16 bits<br>0–10 V, 0/1–5 V, -5 to +5 V, -10 to +10 V, 0/4–20 mA, -20 to +20 mA<br>Conversion time: 2 ms/channel |
| | AS08AD-B | 8-channel analog input module<br>Hardware resolution: 16 bits<br>0–10 V, 0/1–5 V, -5 to +5 V, -10 to +10 V<br>Conversion time: 2 ms/channel |
| | AS08AD-C | 8-channel analog input module<br>Hardware resolution: 16 bits<br>0/4–20 mA, -20 to +20 mA<br>Conversion time: 2 ms/channel |
| | AS04DA-A | 4-channel analog input module<br>Hardware resolution: 12 bits<br>-10 to +10 V, 0–20 mA, 4–20 mA<br>Conversion time: 2 ms/channel |
| | AS06XA-A | 4-channel analog input module<br>Hardware resolution: 16 bits<br>0–10 V, 0/1–5 V, -5 to +5 V, -10 to +10 V, 0/4–20 mA, -20 to +20 mA<br>Conversion time: 2 ms/channel<br>2-channel analog input module<br>Hardware resolution: 12 bits<br>-10 to +10 V, 0–20 mA, 4–20 mA<br>Conversion time: 2 ms/channel |
| Temperature measurement module | AS04RTD-A | 4-channel, 2-wire/3-wire RTD<br>Sensor type: Pt100 / Ni100 / Pt1000 / Ni1000 / JPt100 / LG-Ni1000 / Cu50 / Cu100 / 0–300Ω / 0–3000Ω input impedance<br>Resolution: 0.1°C/0.1°F (16 bits) |

| Classification | Model Name | Description |
|---|---|---|
| | | Conversion time: 200 ms/channel |
| | AS06RTD-A | 6-channel, 2-wire/3-wire RTD<br>Sensor type: Pt100 / Ni100 / Pt1000 / Ni1000 / JPt100 / LG-Ni1000 / Cu50 / Cu100 / 0–300Ω / 0–3000Ω input impedance<br>Resolution: 0.1°C/0.1°F (16 bits)<br>Conversion time: 200 ms/channel |
| | AS04TC-A | 4-channel thermocouple<br>Sensor type: J, K, R, S, T, E, N, B, and -100 to +100 mV<br>Resolution: 0.1°C/0.1°F (24 bits)<br>Conversion time: 200 ms/channel |
| | AS08TC-A | 8-channel thermocouple<br>Sensor type: J, K, R, S, T, E, N, B, and -100 to +100 mV<br>Resolution: 0.1°C/0.1°F (24 bits)<br>Conversion time: 200 ms/channel |
| Load cell module | AS02LC-A | 2-channel, 4-wire/6-wire load cell sensor<br>Eigenvalue applicable to a load cell: 1, 2, 4, 6, 20, 40, 80 mV/V<br>Highest precision: 1/10000 @ 50 ms of the conversion time<br>ADC Resolution : 24 bits<br>Conversion time: 2.5–400 ms (nine options to choose from) |
| Network module | AS00SCM-A | Serial communication module, 2x communication ports, applicable to communication cards, supporting MODBUS protocols |
| Remote I/O module | AS00SCM-A<br>+<br>AS-FCOPM | Applicable to AS-FCOPM function cards |
| 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<br>0–10 V (12 bits), 4–20 mA (11 bits)<br>Conversion time: 3 ms/channel |

| Classification | Model Name | Description |
|---|---|---|
| | AS-F2DA | 2-channel analog input<br>0–10 V, 4–20 mA (12 bits)<br>Conversion time: 2 ms/channel |

# 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%<br>No condensation |
| **Storage humidity** | 5–95%<br>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:<br>5 Hz ≦ f ≦ 8.4 Hz, constant amplitude 3.5 mm<br>8.4 Hz ≦ f ≦ 150 Hz, constant acceleration 1 g<br>Duration of oscillation: 10 sweep cycles per axis on each direction of the three mutually perpendicular axes<br>International Standard IEC 61131-2 & IEC 60068-2-6 (TEST Fc) |
| **Shock resistance** | Tested with:<br>Half-sine wave<br>Strength of shock: 15 g peak value, 11 ms duration<br>Shock direction: The shocks on each direction per axis, of the three mutually perpendicular axes (for a total of 18 shocks)<br>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)<br>Storage:1080 ~ 660hPa (-1000 ~ 3500 m) |

## 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

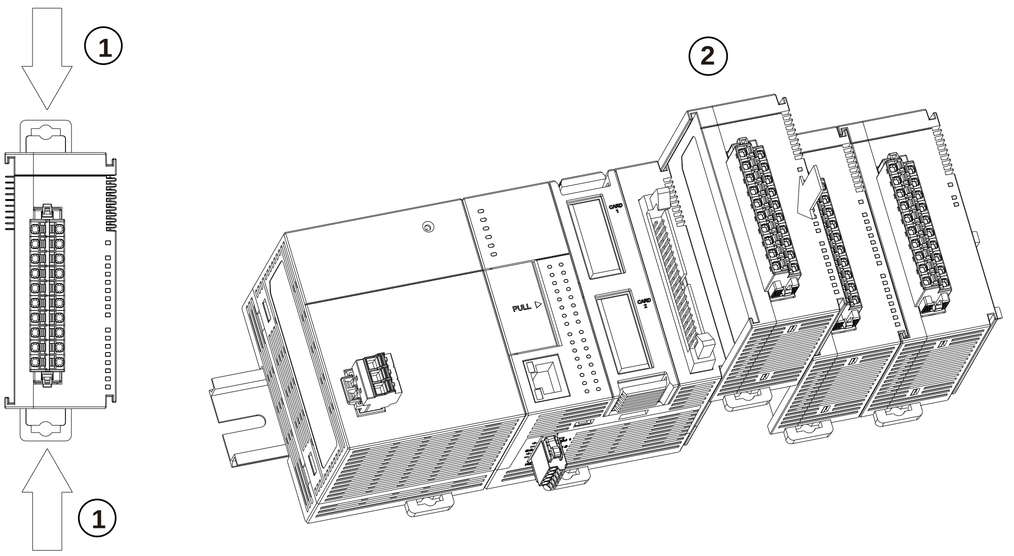
| Environmental Phenomenon | | Fast Transient Burst | High Energy Surge | Radio Frequency Interference |
|---|---|---|---|---|
| **Reference Standard** | | **IEC 61000-4-4** | **IEC 61000-4-5** | **IEC 61000-4-6** |
| **Interface/Port** | **Specific Interface/Port** | **Test Level** | **Test Level** | **Test Level** |
| Data communication | Shielded cable | 1 kV | 1 kV CM | 10 V |

| 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 |
| | Unshielded cable | 1 kV | 1 kV CM | 10 V |
| Digital and analog I/O | AC I/O (unshielded) | 2 kV | 2 kV CM<br>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<br>1 kV DM | 10 V |
| | DC power | 2 kV | 0.5 kV CM<br>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<br>1 kV DM | 10 V |
| | DC I/O and DC auxiliary power | 2 kV | 0.5 kV CM<br>0.5 kV DM | 10 V |

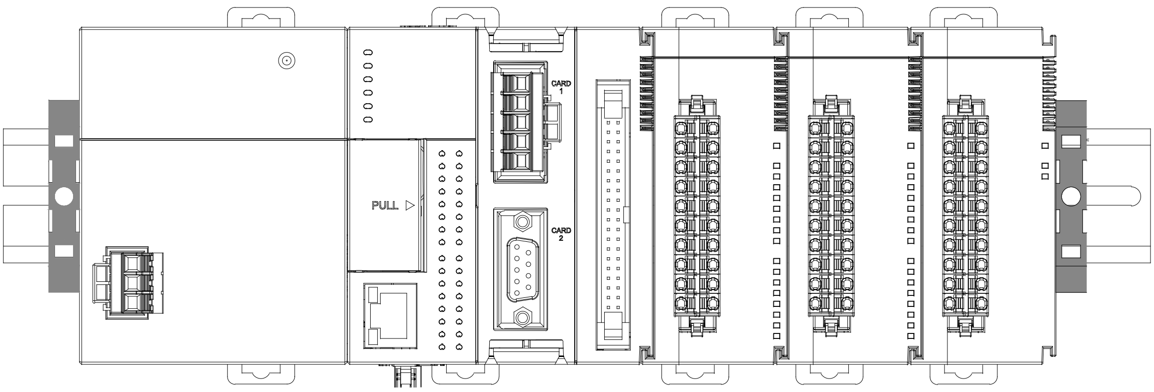
# 1.3 Installation

## 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.

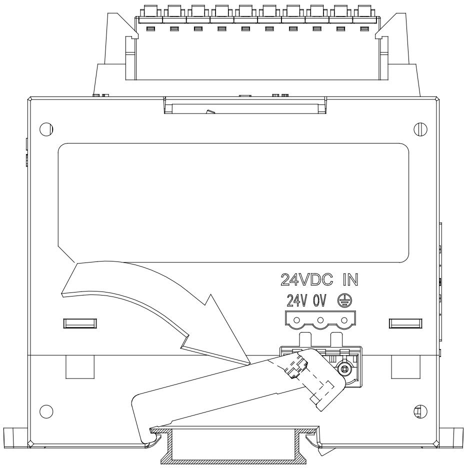



If there is a vibration source near the installation site, install anti-vibration baffles on the sides of the AS Series modules for better stabilization, such as the gray baffles show below.

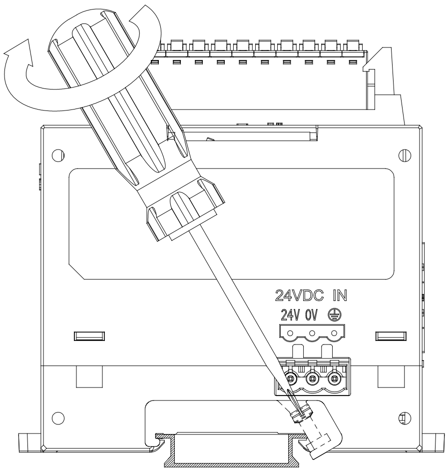


- **Install the baffles:**

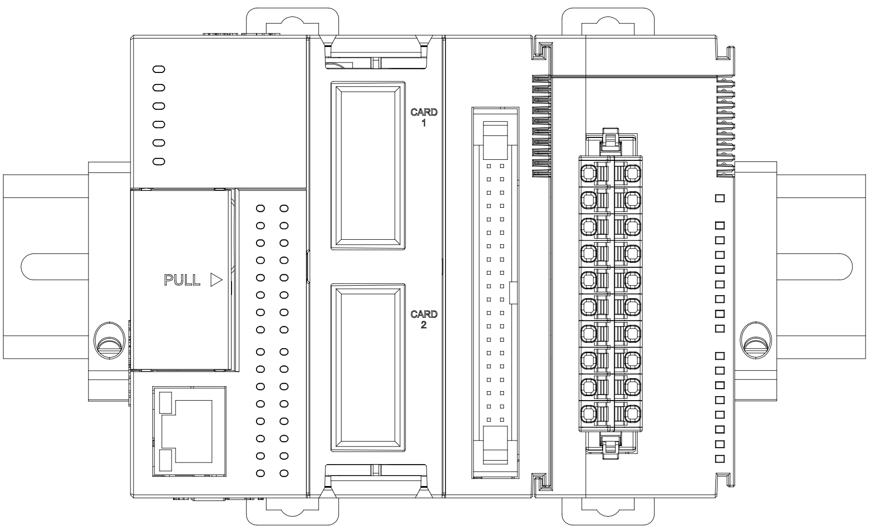
1. Hook the baffle onto the DIN rail and press it down as the directional arrow shows below.




2. Use screws to secure the baffle.




3. The completed baffle installation is shown below.

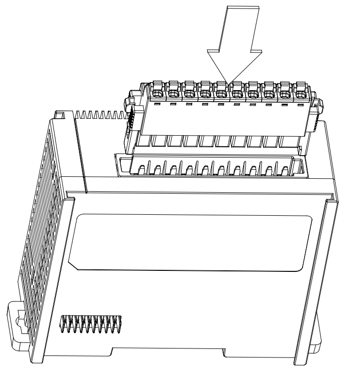


### 1.3.2 Installing a Removable Terminal Block

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

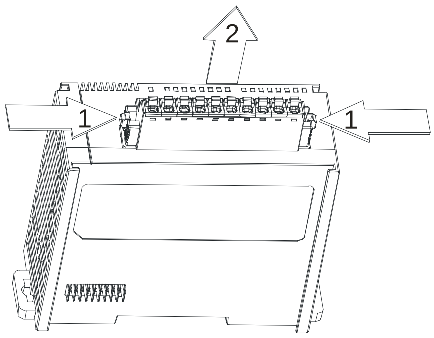
- **Installation**

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



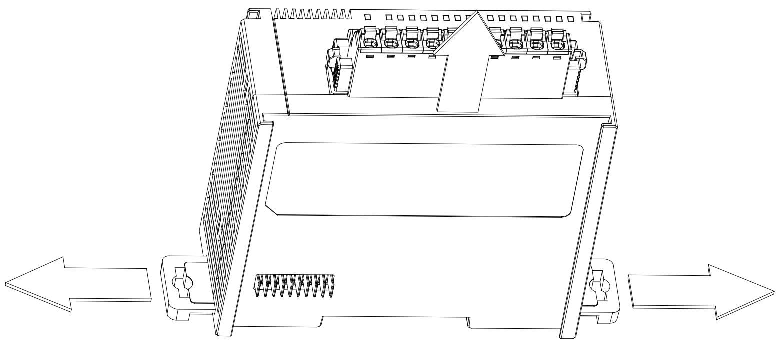
- **Removal**

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

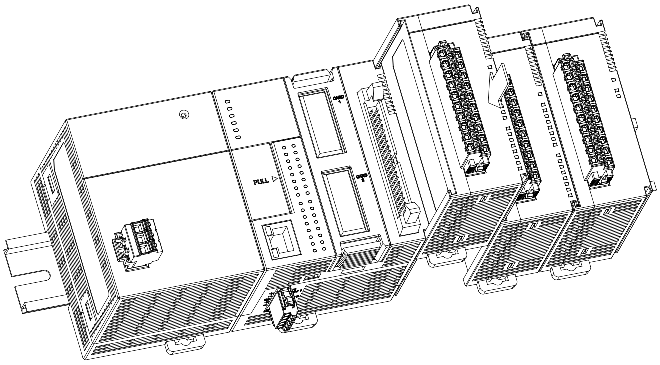
1. Take the removable terminal block out of the module, and then pull the clip out from the DIN rail as shown below.



1

2. Remove the module.

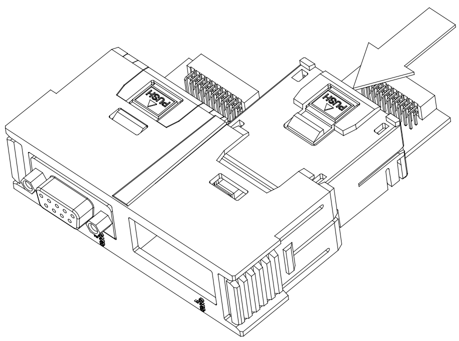
3. Slide the new module in as shown below.



### 1.3.4 Installing and Removing an Extension Card

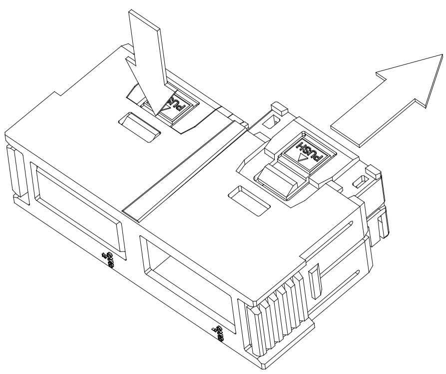
- **Installation**

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



- **Removal**

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



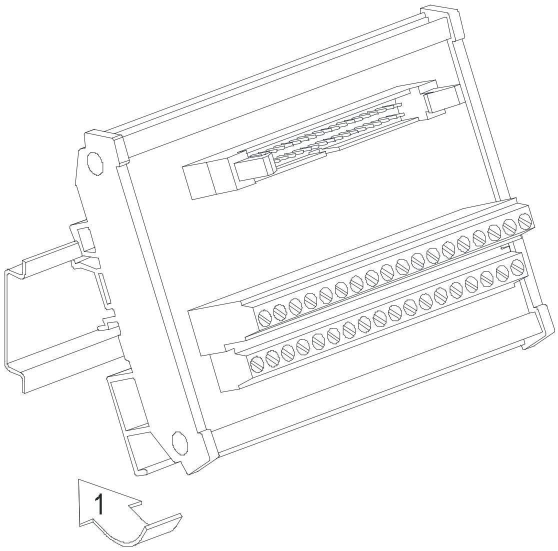
### 1.3.5 Installing a Wiring Module

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.

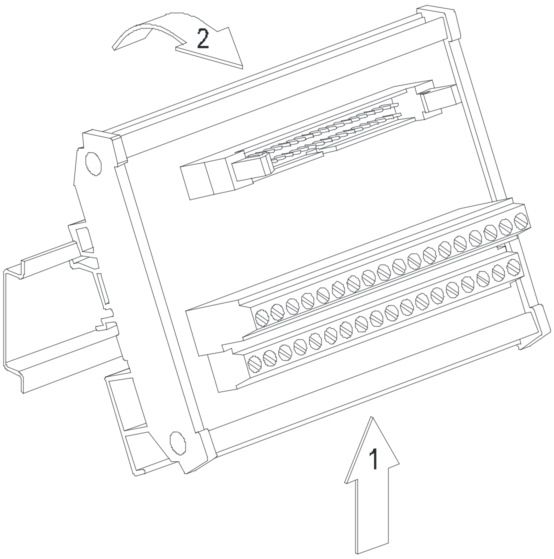
  2. Press the driver board in the direction indicated by arrow 1, and make sure that the groove is attached to the DIN rail.




- **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.



**MEMO**

2

# Chapter 2 Analog Input Module AS04/08AD

## Table of Contents

## 2.1 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.

### 2.1.1 Characteristics

2

(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.

## 2.2 Specifications and Functions

### 2.2.1 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.<br>Isolation between a digital circuit and a ground: 500 VDC<br>Isolation between an analog circuit and a ground: 500 VDC<br>Isolation between an analog circuit and a digital circuit: 500 VDC<br>Isolation between the 24 VDC and a ground: 500 VDC |
| **Weight** | 145g |

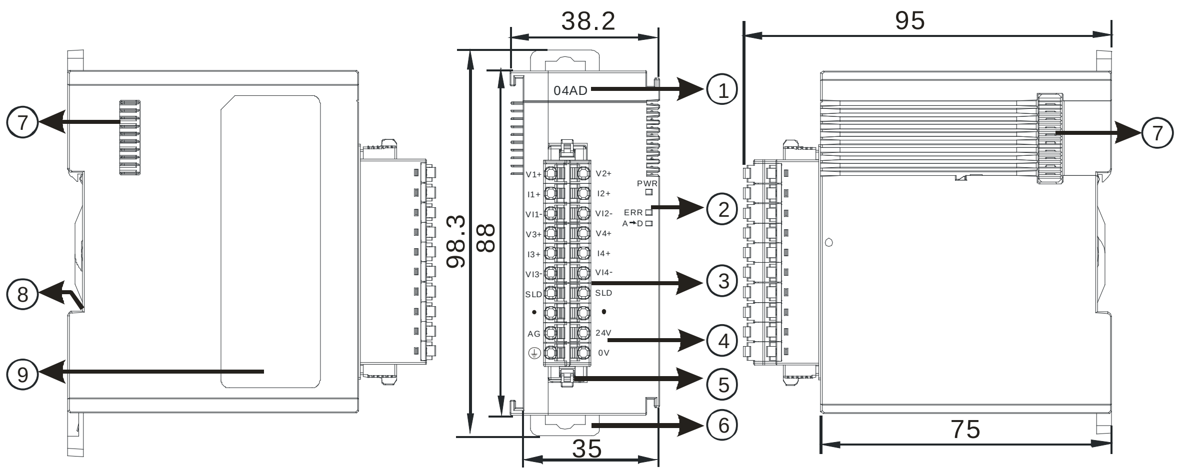
- **Functional specifications**

| **Analog-to-Digital Conversion** | **Voltage Input** | | | | |
|---|---|---|---|---|---|
| **Rated Input Range** | -10 V to +10 V | 0 V–10 V | ±5 V | 0 V–5 V | 1 V–5 V |
| **Digital Conversion Range** | K-32000–K+32000 | K0–K32000 | K-32000–K+32000 | K0–K32000 | K0–K32000 |
| **Hardware Input Range** | -10.1 V to +10.1 V | -0.1 V to +10.1 V | -5.05 V to +5.05 V | -0.05 V to +5.05 V | 0.95 V–5.05 V |
| **Error Rate (Room Temperature)** | ±0.2% | | | | |
| **Error Rate (Full Temperature Range)** | ±0. 5% | | | | |
| **Linearity Error (Room Temperature)** | ±0.02% | | | | |
| **Linearity Error (Full Temperature Range)** | ±0.06% | | | | |
| **Hardware Resolution** | 16 bits | | | | |
| **Input Impedance** | ≧2MΩ | | | | |
| **Absolute Input Range** | ±15 V | | | | |

| Analog-to-Digital Conversion | Current Input | | |
|---|---|---|---|
| **Rated Input Range** | ±20 mA | 0 mA–20 mA | 4 mA–20 mA |
| **Digital Conversion Range** | K-32000 to K+32000 | K0–K32000 | K0–K32000 |
| **Hardware Input Range** | -20.2 mA to +20.2 mA | -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) (Full Temperature Range)** | ±0.04% | | |
| **Linearity Error** | ±0.10% | | |
| **Hardware Resolution** | 16 bits | | |
| **Input Impedance** | 250 Ω | | |
| **Absolute Input Range** | ±32 mA | | |

## 2.2.2 Profile

- **AS04AD-A**

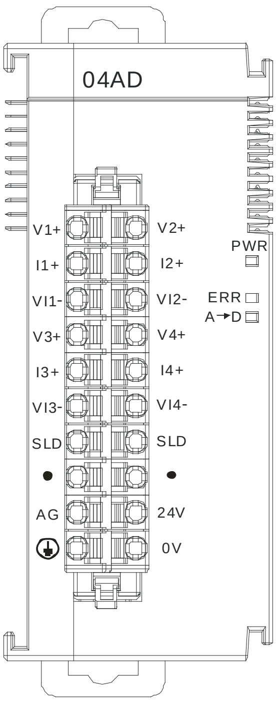



Unit: mm

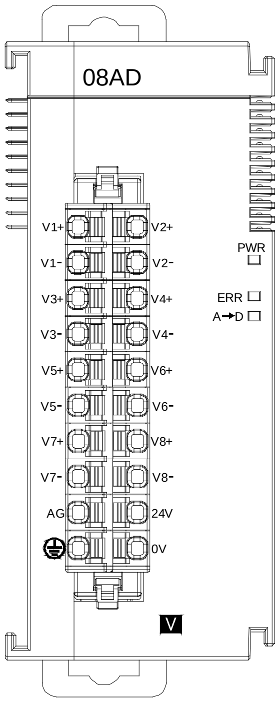
| Number | Name | Description |
|---|---|---|
| 1 | Model Name | Model name of the module |
| 2 | POWER LED Indicator | Status of the power supply<br>ON: the power is on.<br>OFF: the power is off. |
| | ERROR LED Indicator | Error status of the module<br>ON: a serious error exists in the module.<br>OFF: the module is operating normally.<br>Blinking: A minor error exists in the module. |
| | Analog to Digital Conversion Indicator | Analog-to-digital conversion status<br>Blinking: conversion is in process.<br>OFF: conversion has stopped. |
| 3 | Removable Terminal Block | Inputs are connected to sensors.<br>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 |

## 2.2.3 Arrangement of Terminals

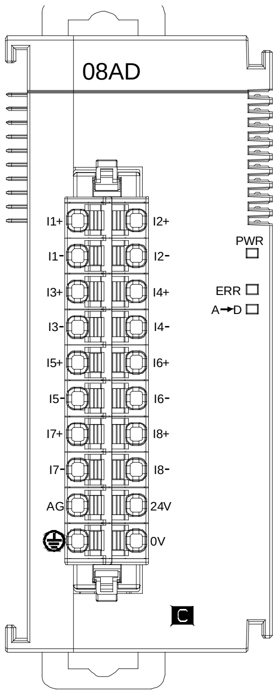
**AS04AD-A**




**AS08AD-B**




**AS08AD-C**




## 2.2.4 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.

| CR# | Name | Description | Defaults |
|---|---|---|---|
| 0 | Format Setup | 0: integer format<br>1: floating point format | 0 |
| 1 | Channel 1 mode setup | 0: closed<br>1: -10 V to +10 V<br>2: 0 V–10 V<br>3: -5 V to +5 V<br>4: 0 V–5 V<br>5: 1 V–5 V<br>6: 0 mA–20 mA<br>7: 4 mA–20 mA<br>8: -20 mA to +20 mA | 1 |
| 2 | Channel 2 mode setup | | |
| 3 | Channel 3 mode setup | | |
| 4 | Channel 4 mode setup | | |

| CR# | Name | Description | Defaults |
|---|---|---|---|
| 5 | Channel 1 offset | Range: -32768 to +32767 | 0 |
| 6 | Channel 2 offset | | |
| 7 | Channel 3 offset | | |
| 8 | Channel 4 offset | | |
| 9 | Channel 1 gain | Range: -32768 to +32767 | 1000 |
| 10 | Channel 2 gain | | |
| 11 | Channel 3 gain | | |
| 12 | Channel 4 gain | | |
| 13 | Channel 1 average times | Range: 1–100 | 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<br>Unit: ±10%<br>1: ±10%<br>2: ±20%<br>3: ±30% | 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<br>1: 4 ms<br>2: 10 ms<br>3: 15 ms<br>4: 20 ms<br>5: 30 ms<br>6: 40 ms<br>7: 50 ms<br>8: 60 ms<br>9: 70 ms<br>10: 80 ms<br>11: 90 ms | 0 |

| CR# | Name | Description | Defaults |
|---|---|---|---|
| | | 12: 100 ms | |
| 22 | Channel Alarm Setup | 0: open channel alarm<br>1: close channel alarm<br>bit0: channel 1<br>bit1: channel 2<br>bit2: channel 3<br>bit3: channel 4<br><br>0: warning<br>1: alarm<br>bit8: error in the power supply<br>bit9: error in the module hardware<br>bit10: error in calibration | 0 |
| 23 | The minimum scale range for channel 1 | 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.<br>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.<br>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. When the format is set to integer in HWCONFIG, the scale range is invalid.<br>You can also use PLC instruction DSCLP (API0217) and set SM685 to ON to use floating-point operations. | -10.0 |
| 24 | | | |
| 25 | The minimum scale range for channel 2 | | -10.0 |
| 26 | | | |
| 27 | The minimum scale range for channel 3 | | -10.0 |
| 28 | | | |
| 29 | The minimum scale range for channel 4 | | -10.0 |
| 30 | | | |
| 31 | The maximum scale range for channel 1 | | 10.0 |
| 32 | | | |
| 33 | The maximum scale range for channel 2 | | 10.0 |
| 34 | | | |
| 35 | The maximum scale range for channel 3 | | 10.0 |
| 36 | | | |
| 37 | The maximum scale range for channel 4 | | 10.0 |
| 38 | | | |

| CR# | Name | Description | Defaults |
|---|---|---|---|
| 201 | Instruction Set | Instructions for peak values<br>16#0101: record the peak value again for channel 1<br>16#0102: record the peak value again for channel 2<br>16#0104: record the peak value again for channel 3<br>16#0108: record the peak value again for channel 4<br>16#010F: record the peak values again for channels 1–4<br>16#0201: enable recording for channel 1<br>16#0202: enable recording for channel 2<br>16#0204: enable recording for channel 3<br>16#0208: enable recording for channel 4<br>16#020F: enable recording for channels 1–4<br>16#0211: disable recording for channel 1<br>16#0212: disable recording for channel 2<br>16#0214: disable recording for channel 3<br>16#0218: disable recording for channel 4<br>16#021F: disable recording for channels 1–4<br>16#0502: restore default settings | 0 |
| 210 | The maximum peak value for channel 1 | Integer format; the maximum peak value for analog inputs | 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 minimum peak value for channel 1 | Integer format; the minimum peak value for analog inputs | 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 |

| CR# | Name | Description | Defaults |
|---|---|---|---|
| 222 | The time to record for channel 1 | Unit: 10 ms<br>Range: 1–100<br>Time to record the digital value for the channel | 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 | 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 | -- |
| 4500–4999 | Records for channel 2 | 500 records for channel 2 | -- |
| 5000–5499 | Records for channel 3 | 500 records for channel 3 | -- |
| 5500–5999 | Records for channel 4 | 500 records for channel 4 | -- |

## 2.2.5 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.



| CR# | Name | Description | Defaults |
|---|---|---|---|
| 0 | Format Setup | 0: integer format<br>1: floating point format | 0 |
| 1 | Channel 1 mode setup | AS08AD-B<br>0: closed<br>1: -10 V to +10 V<br>2: 0 V–10 V<br>3: -5 V to +5 V<br>4: 0 V–5 V<br>5: 1 V–5 V<br><br>AS08AD-C<br>0: closed<br>1: -20 mA to +20 mA<br>2: 0 mA–20 mA<br>3: 4 mA–20 mA | 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 | 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 | 1000 |

2

| CR# | Name | Description | Defaults |
|---|---|---|---|
| 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 | 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<br>Unit: ±10%<br>1: ±10%<br>2: ±20%<br>3: ±30% | 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 percentage | | |

| CR# | Name | Description | Defaults |
|---|---|---|---|
| 41 | Channel Sampling Cycle (Sampling/Integration Time) | 0: 2 ms<br>1: 4 ms<br>2: 10 ms<br>3: 15 ms<br>4: 20 ms<br>5: 30 ms<br>6: 40 ms<br>7: 50 ms<br>8: 60 ms<br>9: 70 ms<br>10: 80 ms<br>11: 90 ms<br>12: 100 ms | 0 |
| 42 | Channel Alarm Setup | 0: open channel alarm<br>1: close channel alarm<br>bit0: channel 1<br>bit1: channel 2<br>bit2: channel 3<br>bit3: channel 4<br>bit4: channel 5<br>bit5: channel 6<br>bit6: channel 7<br>bit7: channel 8<br><br>0: warning<br>1: alarm<br>bit8: error in the power supply<br>bit9: error in the module hardware<br>bit10: error in calibration | 0 |
| 43 | The minimum scale range for channel 1 | 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 | -10.0 |
| 44 | | | |
| 45 | The minimum scale range for channel 2 | | |
| 46 | | | |

| CR# | Name | Description | Defaults |
|---|---|---|---|
| 47<br>48 | The minimum scale range for channel 3 | of corresponding floating-point values for channels.<br>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.<br>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. When the format is set to integer in HWCONFIG, the scale range is invalid.<br>You can also use PLC instruction DSCLP (API0217) and set SM685 to ON to use floating-point operations. | |
| 49<br>50 | The minimum scale range for channel 4 | | |
| 51<br>52 | The minimum scale range for channel 5 | | |
| 53<br>54 | The minimum scale range for channel 6 | | |
| 55<br>56 | The minimum scale range for channel 7 | | |
| 57<br>58 | The minimum scale range for channel 8 | | |
| 59<br>60 | The maximum scale range for channel 1 | | 10.0 |
| 61<br>62 | The maximum scale range for channel 2 | | |
| 63<br>64 | The maximum scale range for channel 3 | | |
| 65<br>66 | The maximum scale range for channel 4 | | |
| 67<br>68 | The maximum scale range for channel 5 | | |
| 69<br>70 | The maximum scale range for channel 6 | | |
| 71<br>72 | The maximum scale range for channel 7 | | |
| 73<br>74 | The maximum scale range for channel 8 | | |

| CR# | Name | Description | Defaults |
|---|---|---|---|
| 201 | Instruction Set | Instructions for peak values<br>16#0101: record the peak value again for channel 1<br>16#0102: record the peak value again for channel 2<br>16#0104: record the peak value again for channel 3<br>16#0108: record the peak value again for channel 4<br>16#010F: record the peak values again for channels 1-4<br>16#0201: enable recording for channel 1<br>16#0202: enable recording for channel 2<br>16#0204: enable recording for channel 3<br>16#0208: enable recording for channel 4<br>16#020F: enable recording for channels 1–4<br>16#0211: disable recording for channel 1<br>16#0212: disable recording for channel 2<br>16#0214: disable recording for channel 3<br>16#0218: disable recording for channel 4<br>16#021F: disable recording for channels 1–4<br>16#0502: restore default settings | 0 |
| 210 | The maximum peak value for channel 1 | Integer format; the maximum peak value for analog inputs | 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 |
| 216 | The maximum peak value for channel 7 | | 0 |
| 217 | The maximum peak value for channel 8 | | 0 |

| CR# | Name | Description | Defaults |
|---|---|---|---|
| 218 | The minimum peak value for channel 1 | Integer format; the minimum peak value for analog inputs | 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<br>Range: 1–100<br>Time to record the digital value for the channels | 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 |

### 2.2.6 Functions

| Item | Function | Description |
|---|---|---|
| 1 | Enable/Disable a Channel | 1. Enable or disable a channel.<br>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. |

| Item | Function | Description |
|---|---|---|
| 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.

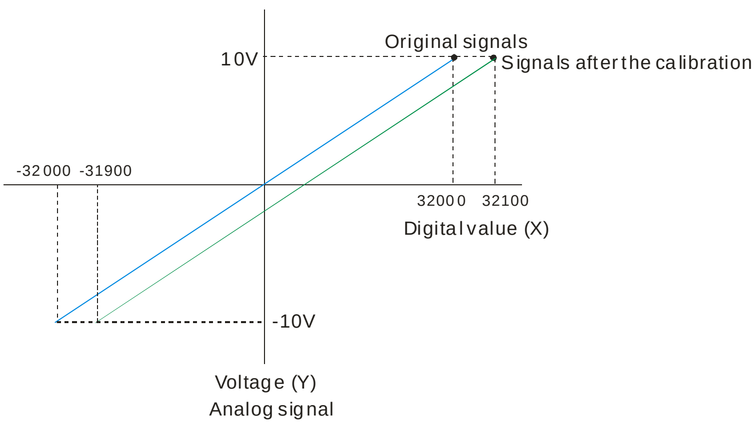
**2. Calibration**

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:

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

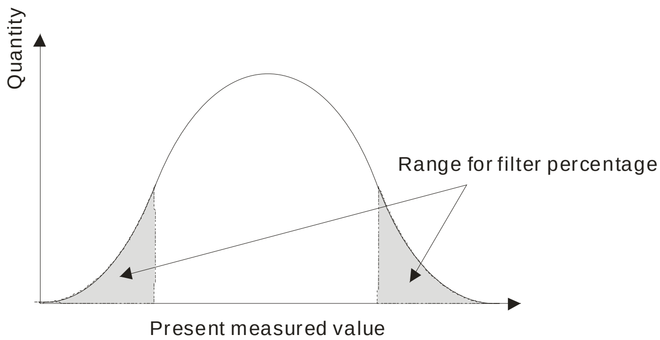
**Example:**

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.



**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**

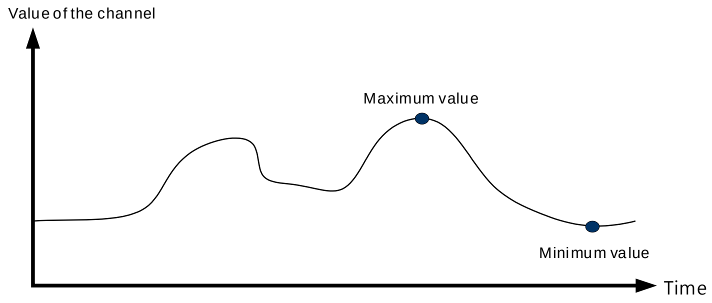
Disconnection detection only operates when the analog range is 4–20 mA or 1–5 V. If a module that can receive inputs between 4–20 mA or from 1–5 V is disconnected, the input signal exceeds the range of allowable inputs, so the module produces an alarm or a warning.

**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**

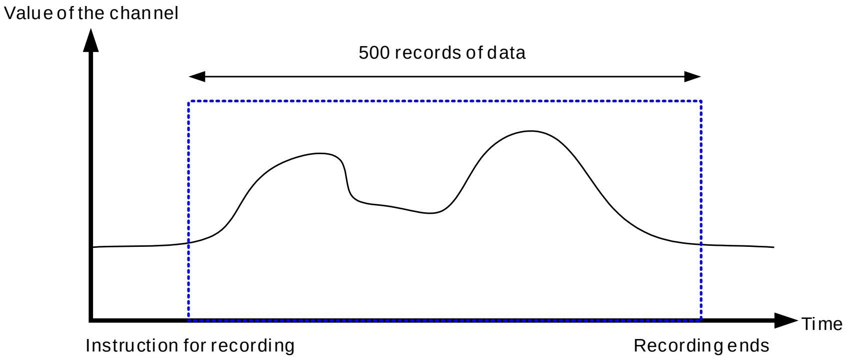
This function saves the maximum and minimum values for channels so that you can determine the peak to peak values.





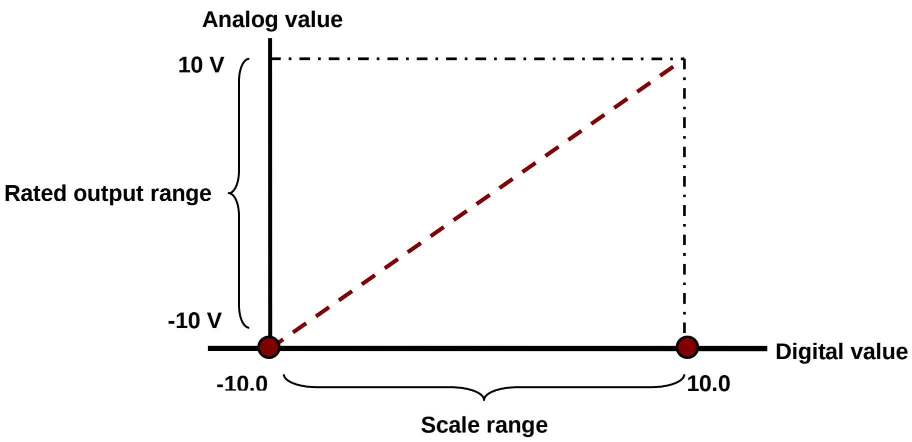

**7. Records for channels (applicable for AS04AD)**

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.



## 2.2.7 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.

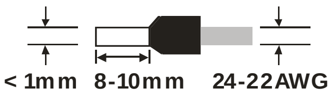
(1) To prevent a surge and induction, the AC cable and the input signal cables that are connected to the module must be separate cables.

(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.



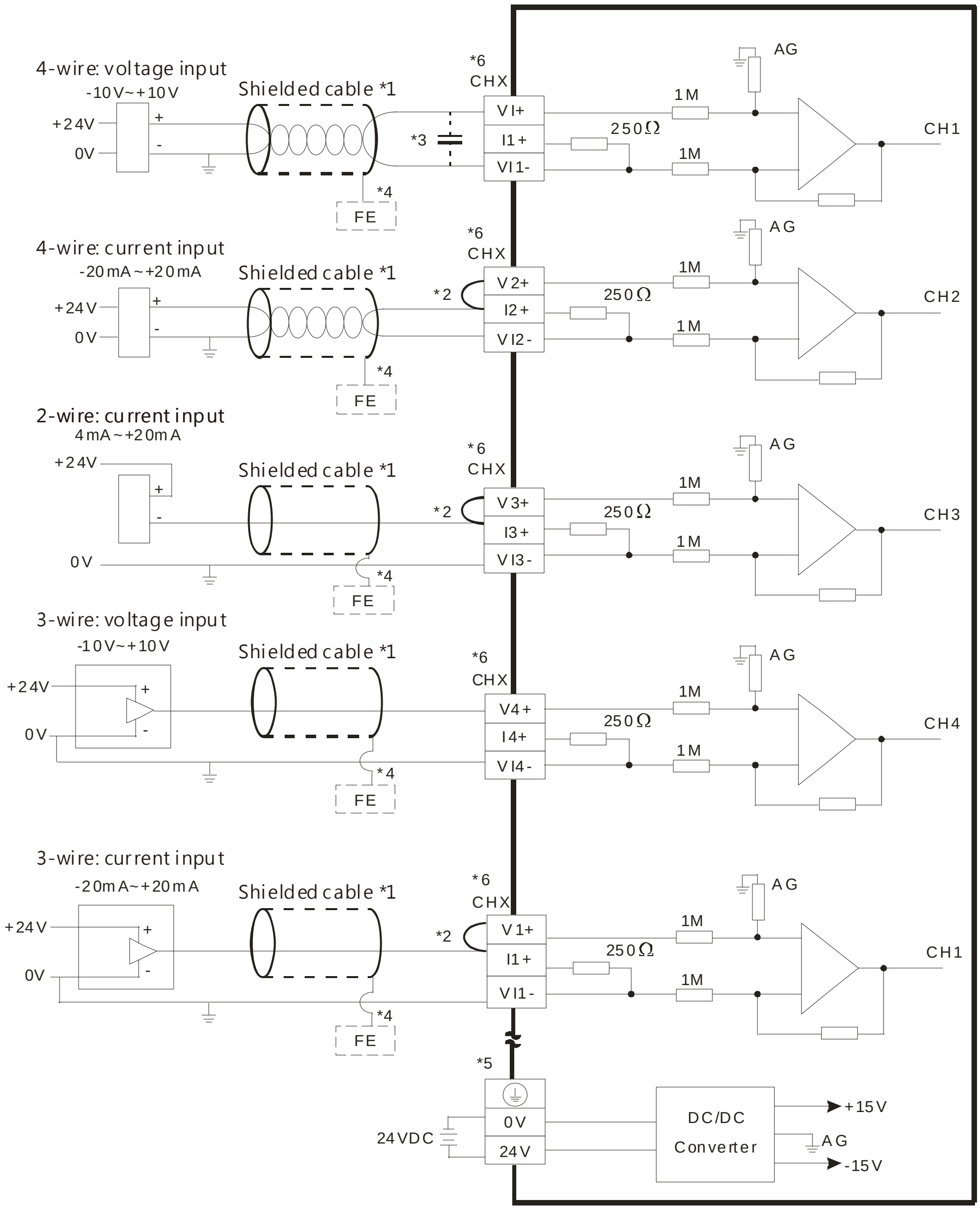

(6) Notes on two-wire, three-wire, and four-wire connections:

- 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.

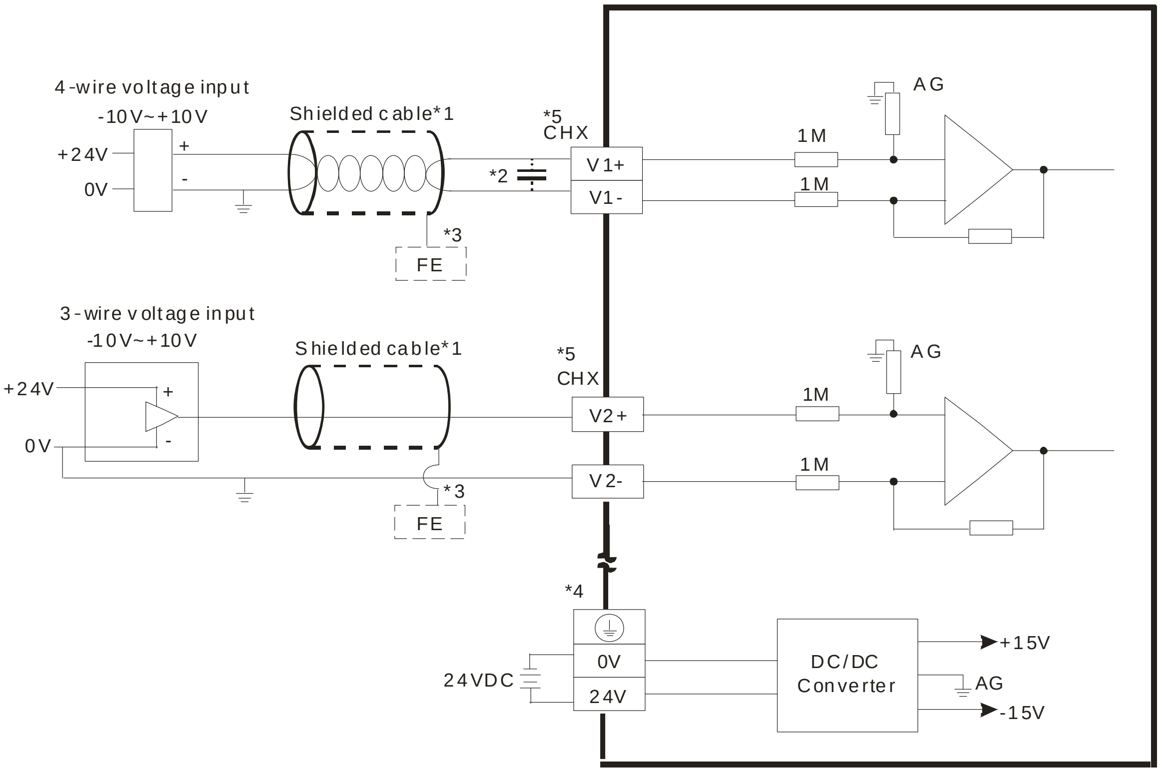
*4. Connect the shielded cable to the terminal FE.

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

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

2

- **AS08AD-B External wiring**




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

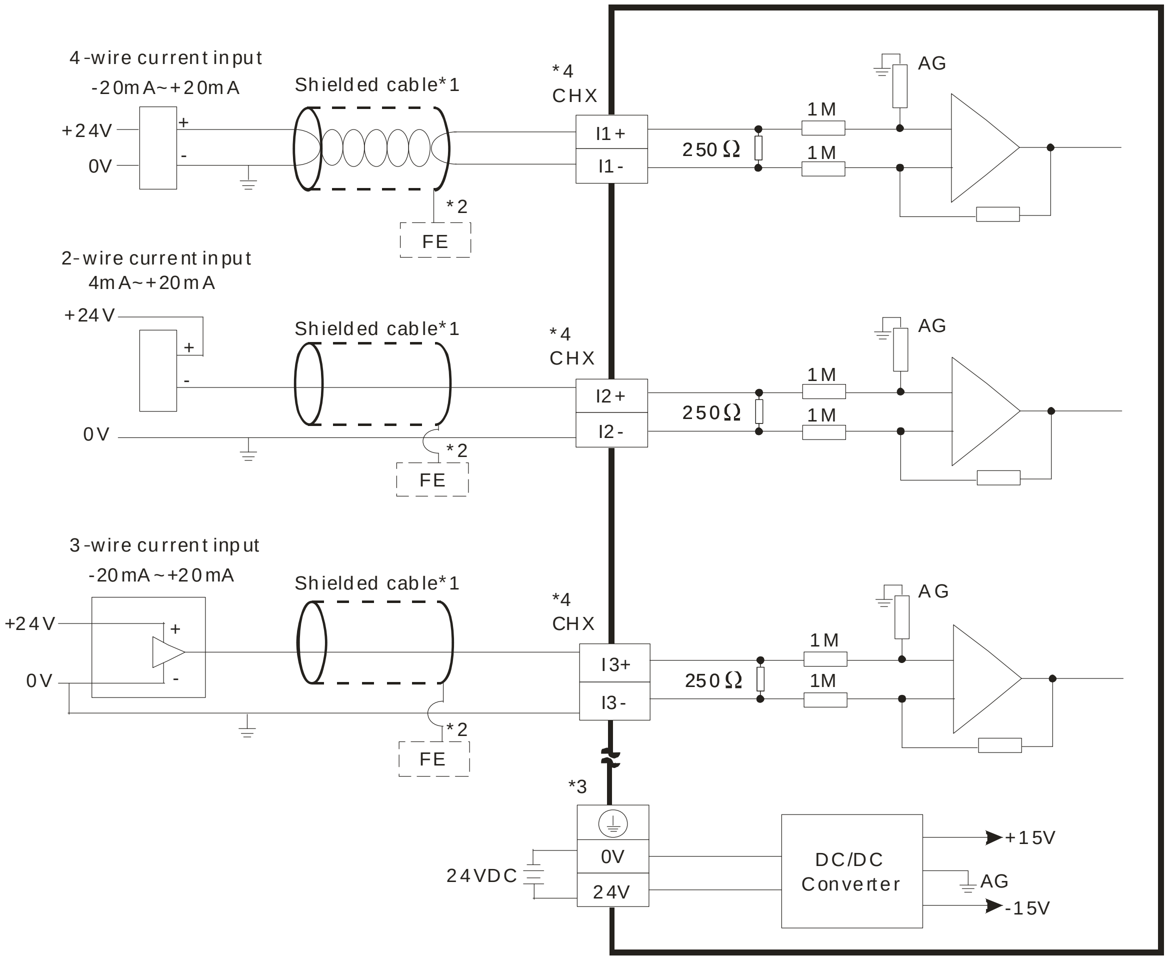
*2. If variability in the input voltage results in interference within the wiring, connect the module to a capacitor with a capacitance between 0.1–0.47 μF and a working voltage of 25 V.

*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.

### 2.2.8 LED Indicators

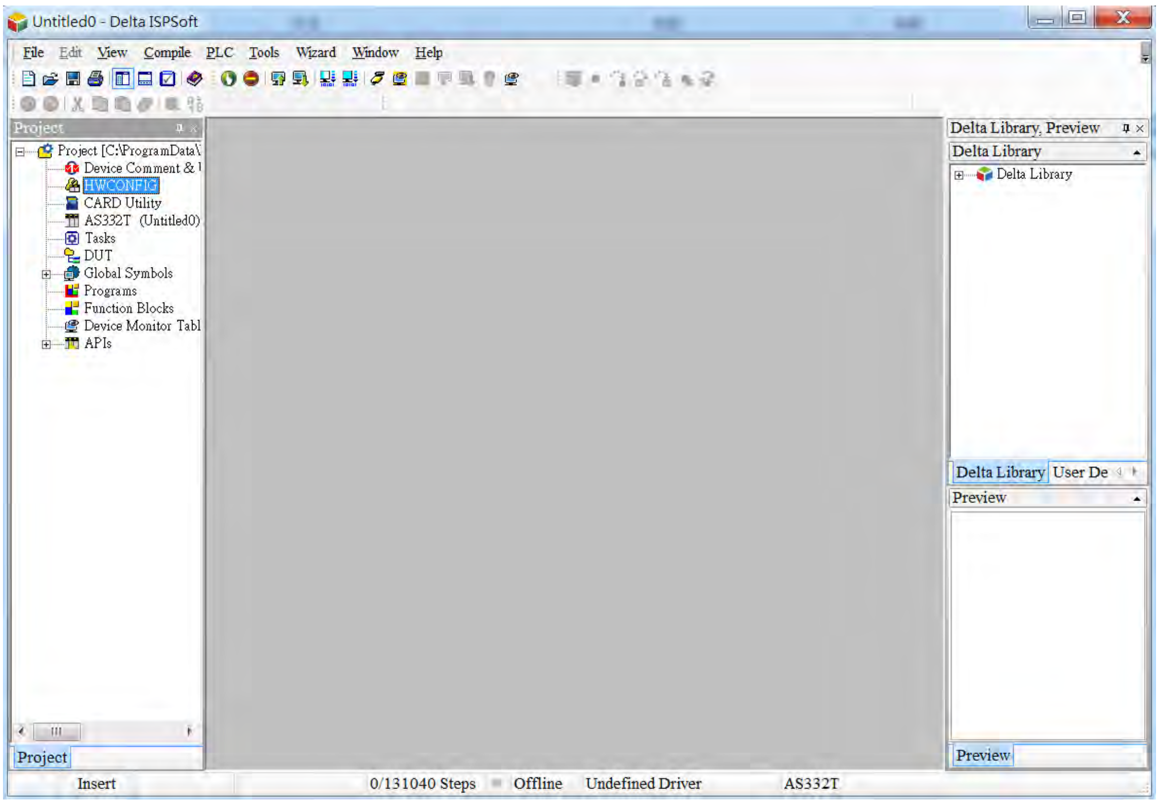
| Number | Name | Description |
|---|---|---|
| 1 | RUN LED Indicator | Operating status of the module<br>ON: the module is running.<br>OFF: the module is not running. |
| 2 | ERROR LED Indicator | Error status of the module<br>ON: a serious error exists in the module.<br>OFF: the module is operating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

## 2.3 HWCONFIG in ISPSoft

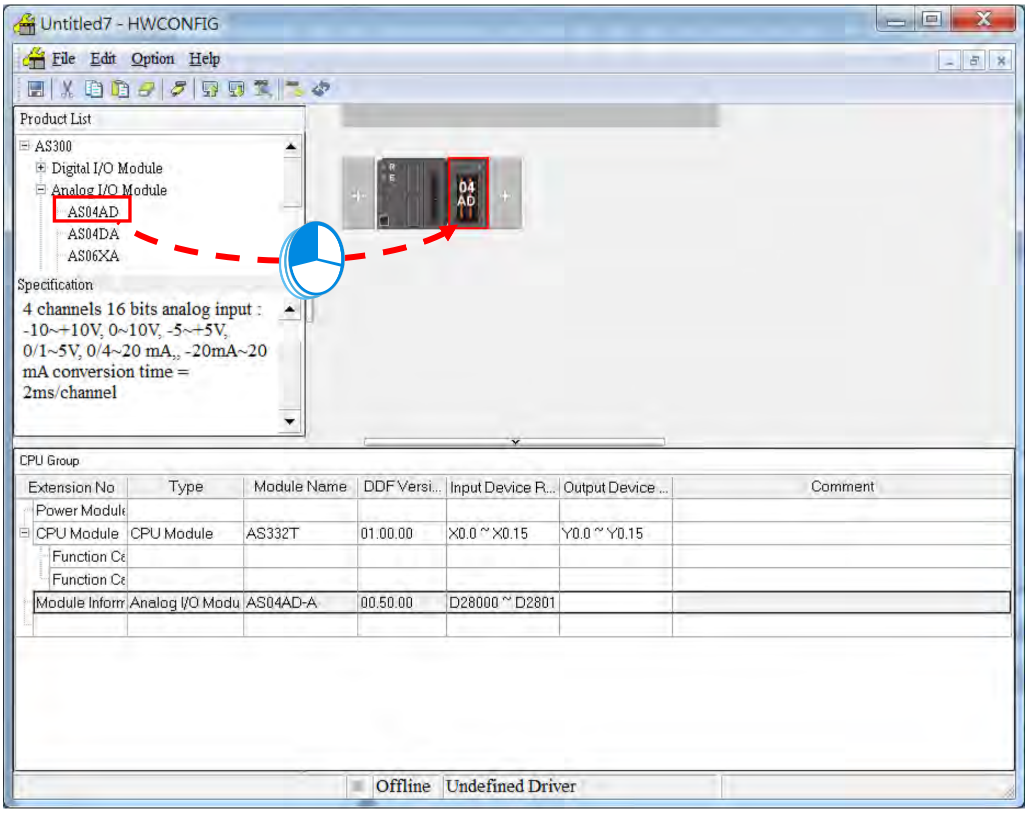
The following example uses the AS04AD-A module.

### 2.3.1 Initial Setting

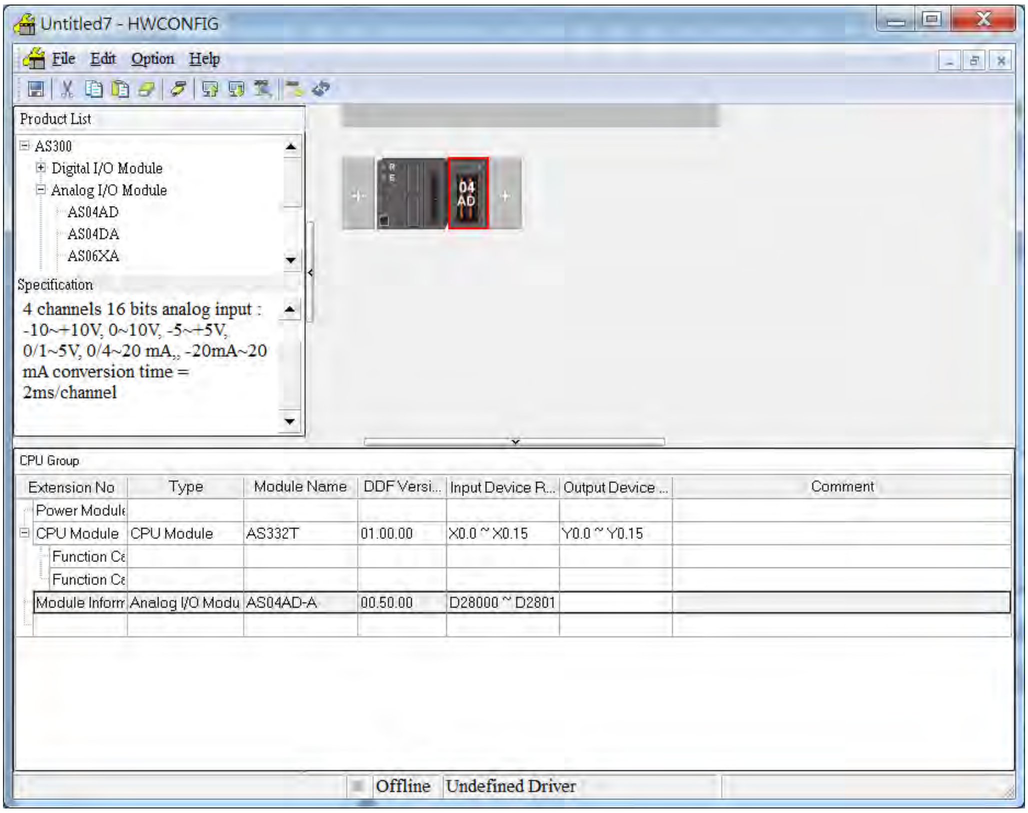
(1) Start ISPSoft and double-click **HWCONFIG**.

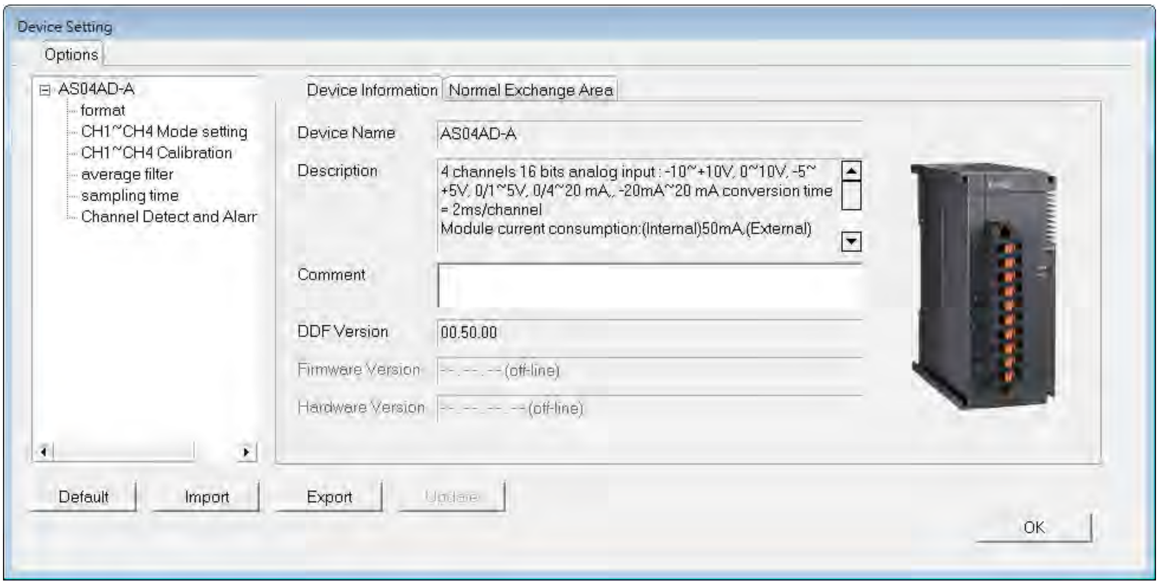


(2) Select a module and drag it to the working area.

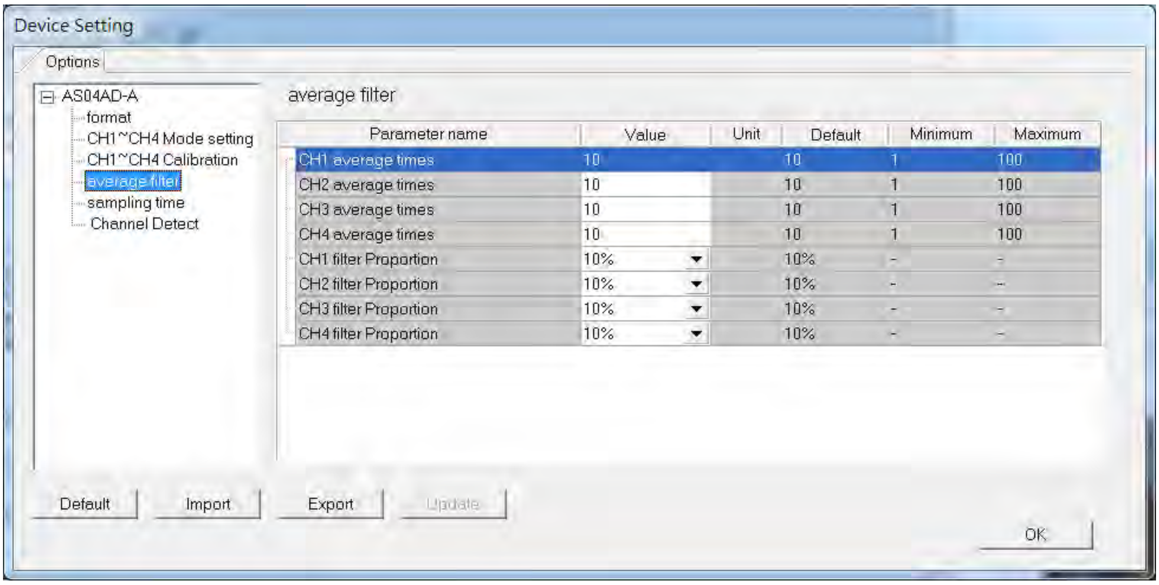


(3) Double-click the module in the working area to open the Device Setting page.

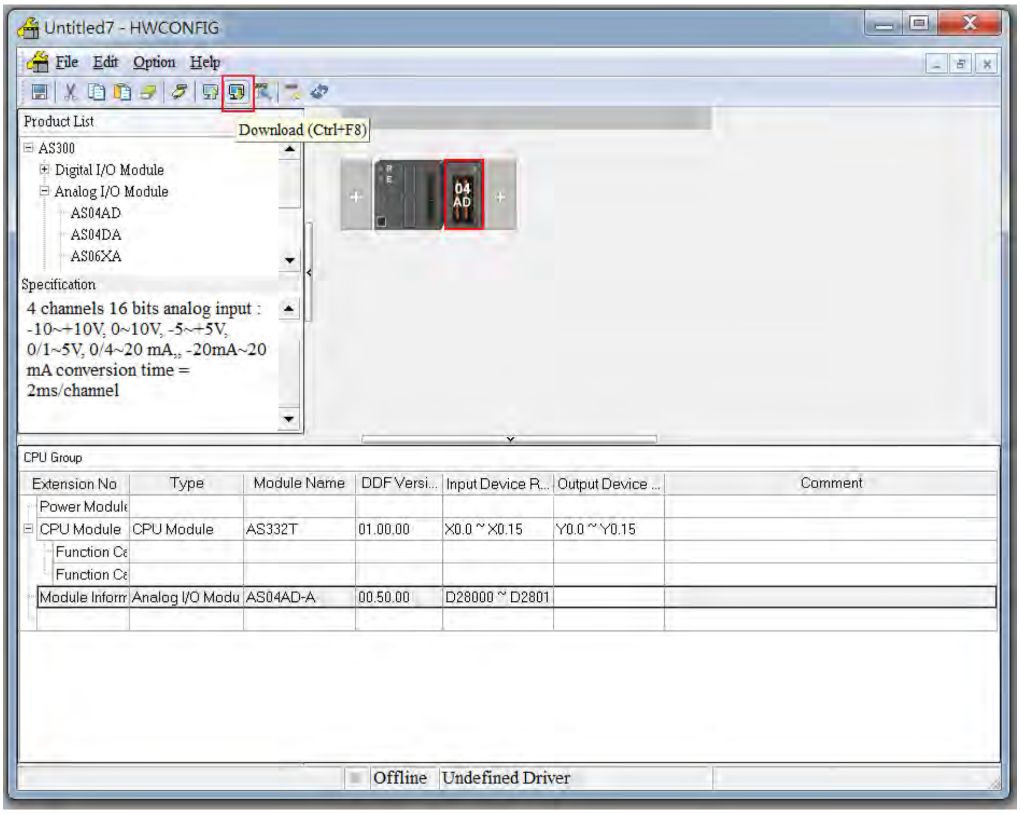





(4) Choose a parameter, set the values, and click **OK**.

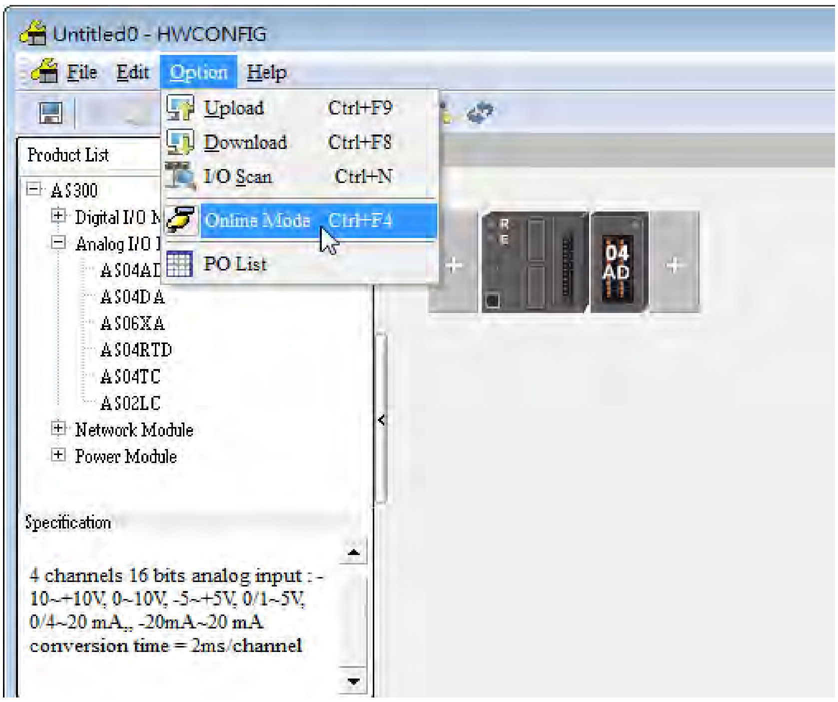


(5) Click **Download** on the toolbar to download the parameters. Note that you cannot download the parameters while the CPU module is running.

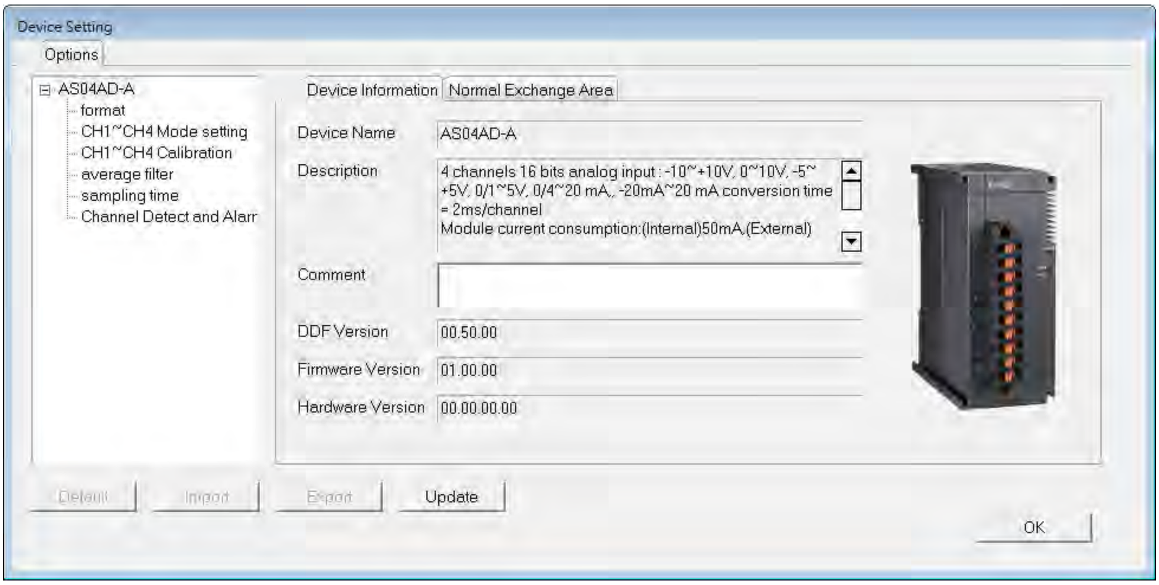


## 2.3.2 Checking the Version of a Module

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

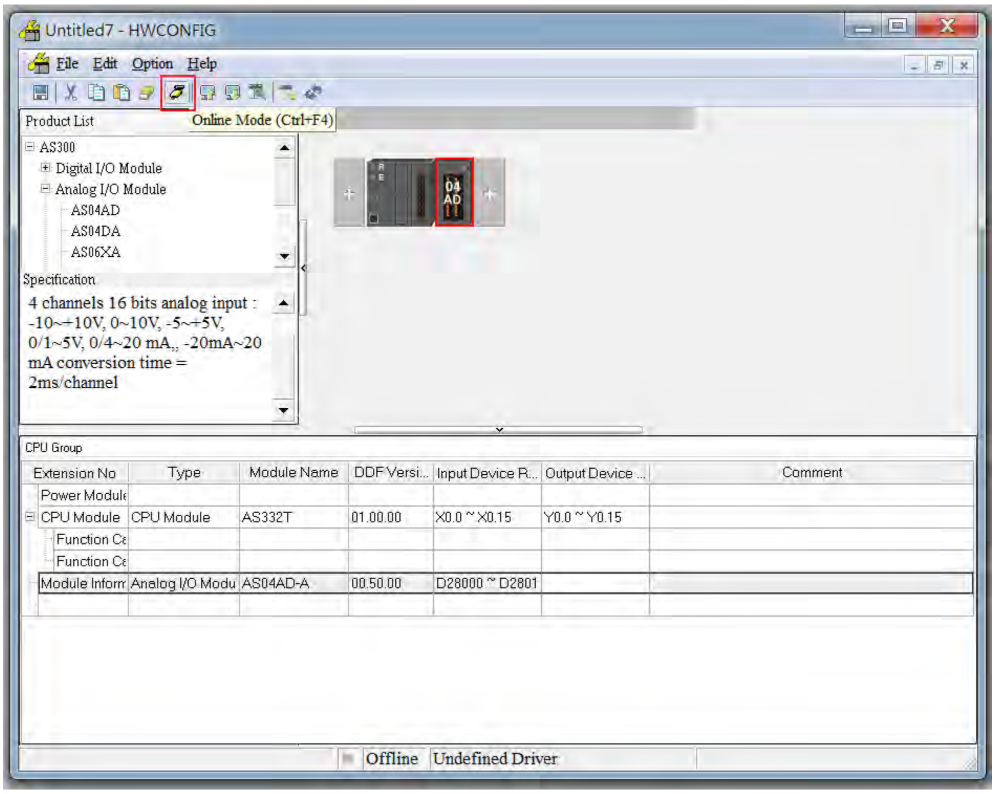


(2) Double-click the module to open the Device Setting page. The versions of both the firmware and the hardware are displayed.

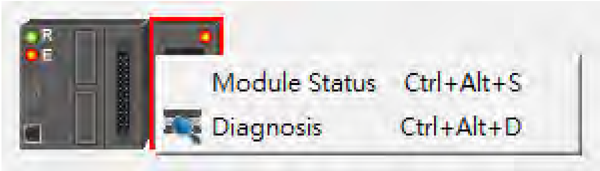




## 2.3.3 Online Mode

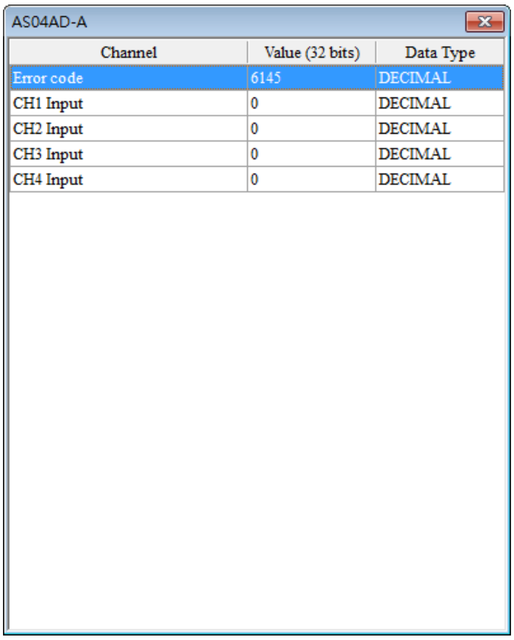
(1) Click **Online Mode** on the toolbar.



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

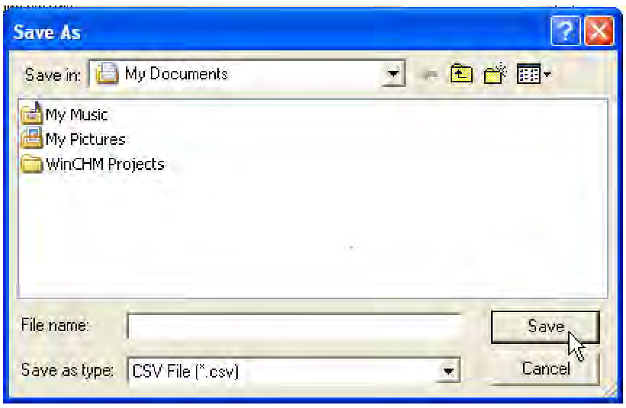



(3) View the module status.



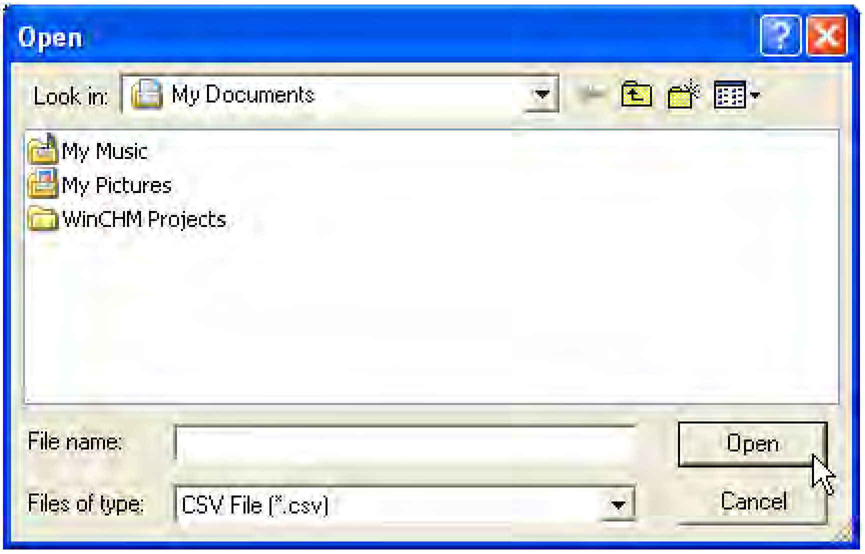

## 2.3.4 Importing/Exporting a Parameter File

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

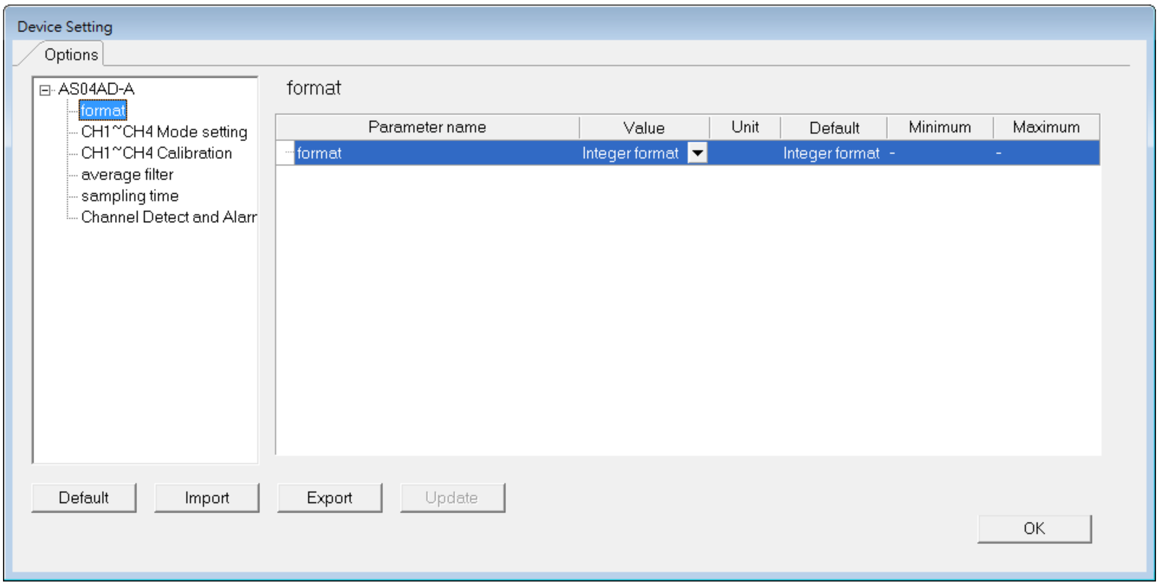

2

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

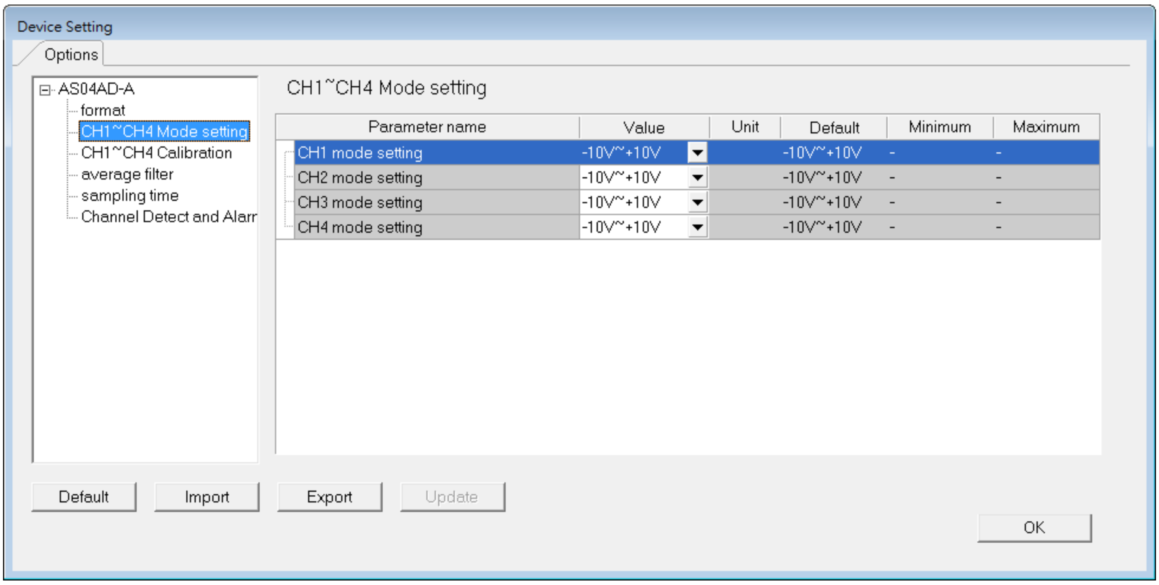




## 2.3.5 Parameters

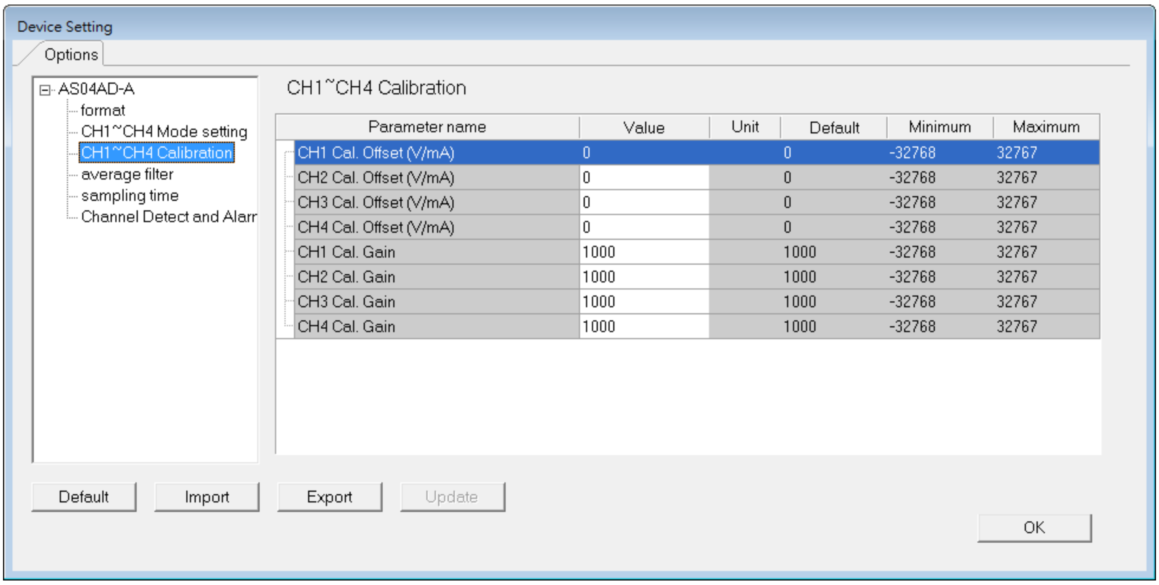
(1) The input formats of the channels



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

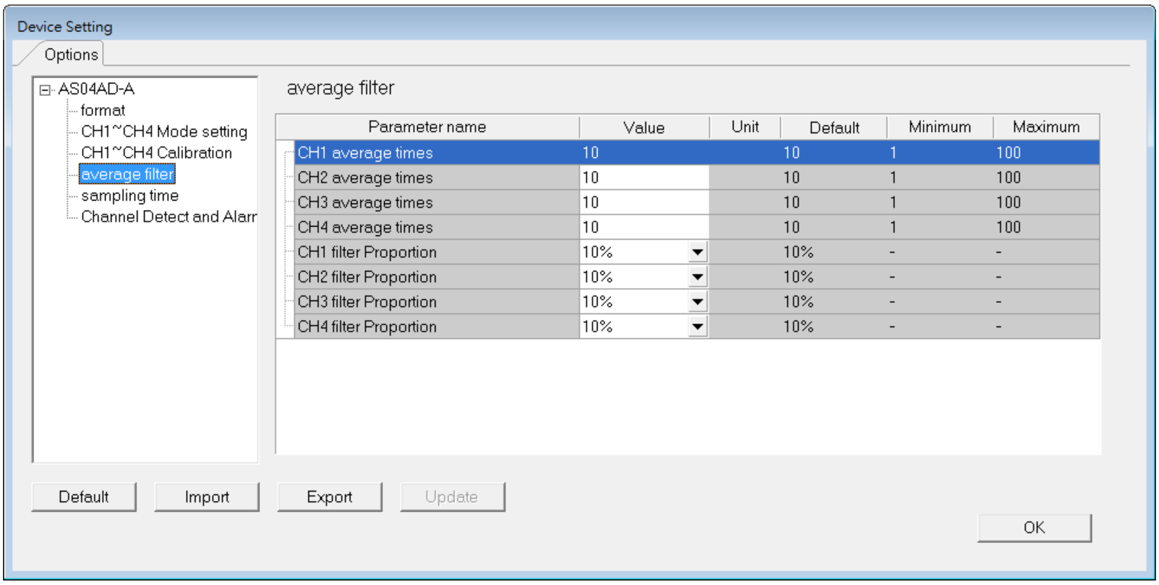



(3) The CH1-CH4 calibration settings

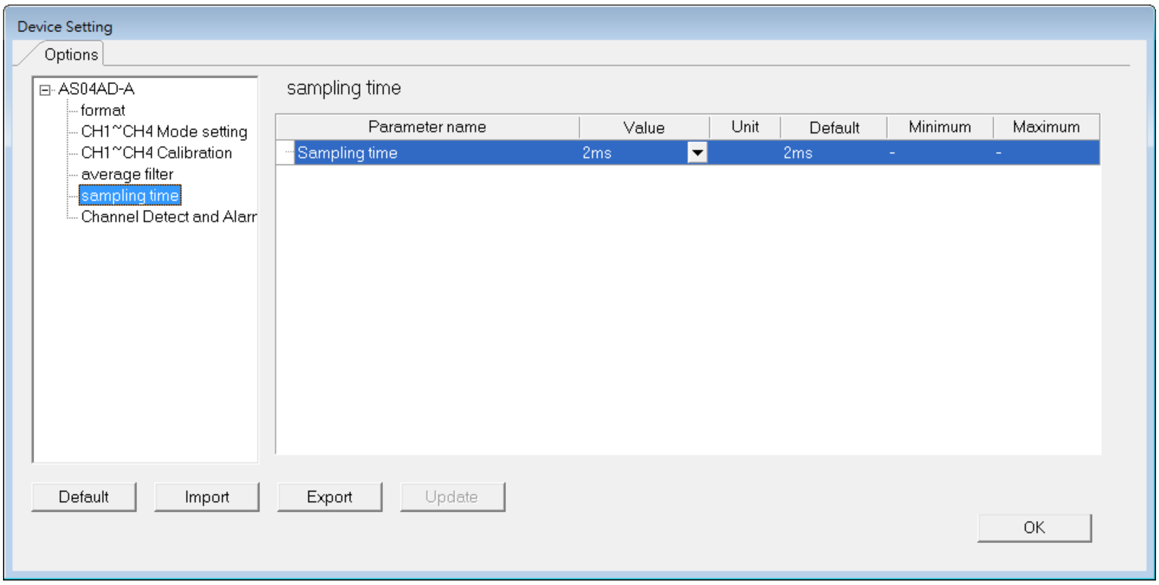


2

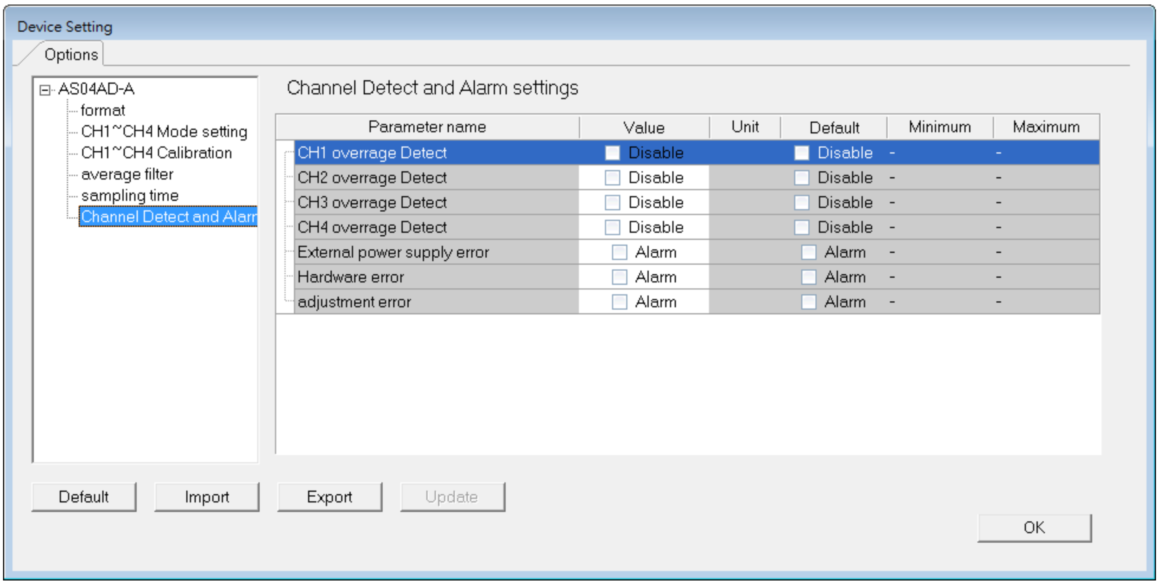
(4) The average filter settings




(5) The sampling time settings



(6) The channel detection settings




# 2.4 Troubleshooting

## 2.4.1 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<br>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. | | |

| Error Code | Description | A → D LED Indicator | ERROR LED Indicator |
|---|---|---|---|
| 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. | | |

2

### 2.4.2 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<br>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. |

3

# Chapter 3 Analog Output Module AS04DA

## Table of Contents

# 3.1 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).

## 3.1.1 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.

# 3.2 Specifications and Functions

## 3.2.1 Specifications

- **Electrical specifications**

| **Module Name** | **AS04DA-A** |
|---|---|
| **Number of Outputs** | 4 |
| **Analog-to-Digital 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.<br>Isolation between a digital circuit and a ground: 500 VDC<br>Isolation between an analog circuit and a ground: 500 VDC<br>Isolation between an analog circuit and a digital circuit: 500 VDC<br>Isolation between the 24 VDC and a ground: 500 VDC |
| **Weight** | 145 g |

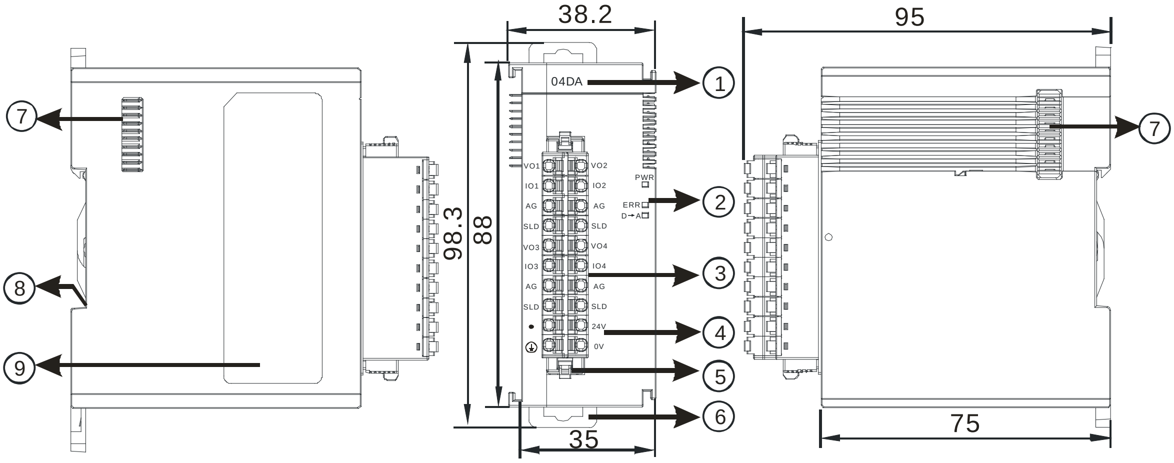
- **Functional specifications**

| Analog-to-Digital Conversion | Voltage Output | | | | |
|---|---|---|---|---|---|
| **Rated Output Range** | ±10 V | 0 V~10 V | ±5 V | 0 V~5 V | 1 V~5 V |
| **Analog to Digital 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 | | | | |
| **Output Impedance** | ≧1 kΩ | | ≧500 Ω | | |

| Analog-to-Digital Conversion | Current Output | |
|---|---|---|
| **Rated Output Range** | 0 mA–20 mA | 4 mA–20 mA |
| **Analog to Digital 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% | |

| Analog-to-Digital Conversion | Current Output |
|---|---|
| **Hardware Resolution** | 12 bits |
| **Output Impedance** | ≦550 Ω |

## 3.2.2 Profile

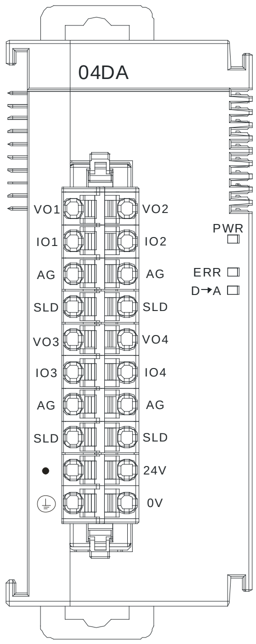



unit: mm

| Number | Name | Description |
|---|---|---|
| 1 | Model Name | Model name of the module |
| | POWER LED Indicator | Status of the power supply<br>ON: the power is on.<br>OFF: the power is off. |
| 2 | ERROR LED Indicator | Error status of the module<br>ON: a serious error exists in the module.<br>OFF: the module is operating normally.<br>Blinking: a minor error exists in the module. |
| | Analog to Digital Conversion Indicator | Analog-to-digital conversion status<br>Blinking: conversion is in process.<br>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 |

| Number | Name | Description |
|---|---|---|
| 7 | Module Connecting Set | Connects the modules |
| 8 | Ground Clip | |
| 9 | Label | Nameplate |

### 3.2.3 Arrangement of Terminals

| AS04DA-A |
|---|
|  |





### 3.2.4 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.

| CR# | Name | Description | Defaults |
|---|---|---|---|
| 0 | Format Setup | 0: integer format<br>1: floating-point format | 0 |
| 1 | Channel 1 mode setup | 0: closed<br>1: -10 V to +10 V (default)<br>2: 0 V–10 V<br>3: -5 V to +5 V<br>4: 0 V–5 V<br>5: 1 V–5 V | 1 |
| 2 | Channel 2 mode setup | | |
| 3 | Channel 3 mode setup | | |

| CR# | Name | Description | Defaults |
|---|---|---|---|
| 4 | Channel 4 mode setup | 6: 0 mA–20 mA<br>7: 4 mA–20 mA | |
| 5 | Channel 1 offset | Range: -32768 to +32767 | 0 |
| 6 | Channel 2 offset | | |
| 7 | Channel 3 offset | | |
| 8 | Channel 4 offset | | |
| 9 | Channel 1 gain | Range: -32768 to +32767 | 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.<br>1: when the PLC stops, the value of the analog output is retained. | 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)<br>Unit: 10 ms<br>Any value less than 10 is processed as 0. Any value larger than 3200 is processed as 3200.<br>Set the value to 0 to disable this function. | 0 |
| 18 | Refreshing the time for an output sent by channel 2 | | |
| 19 | Refreshing the time for an output sent by channel 3 | | |
| 20 | Refreshing the time for an output sent by channel 4 | | |
| 21<br>22 | The minimum scale range for channel 1 | For digital-analog 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.<br>For example, if the scale range for a digital to analog output channel is ±10.0 V, it indicates the maximum | -10.0 |
| 23<br>24 | The minimum scale range for channel 2 | | -10.0 |
| 25<br>26 | The minimum scale range for channel 3 | | -10.0 |
| 27 | The minimum scale range | | -10.0 |

| CR# | Name | Description | Defaults |
|---|---|---|---|
| 28 | for channel 4 | value is +10.0 V and the minimum value is -10.0 V.<br>If the scale range for a digital to analog output channel is 4 mA ~ 20 mA. It indicates the maximum value is 20 mA and the minimum value is 4 mA. When the format is set to integer in HWCONFIG, the scale range is invalid.<br>You can also use PLC instruction DSCLP (API0217) and set SM685 to ON to use floating-point operations. | |
| 29<br>30 | The maximum scale range for channel 1 | | 10.0 |
| 31<br>32 | The maximum scale range for channel 2 | | 10.0 |
| 33<br>34 | The maximum scale range for channel 3 | | 10.0 |
| 35<br>36 | The maximum scale range for channel 4 | | 10.0 |
| 37 | Channel alarm setup | 0: warning<br>1: alarm<br>bit0: error in the power supply<br>bit1: error in the module hardware<br>bit2: error in calibration | 0 |

## 3.2.5 Functions

| Item | Function | Description |
|---|---|---|
| 1 | Enable/Disable a Channel | 1. Enable or disable a channel.<br>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**

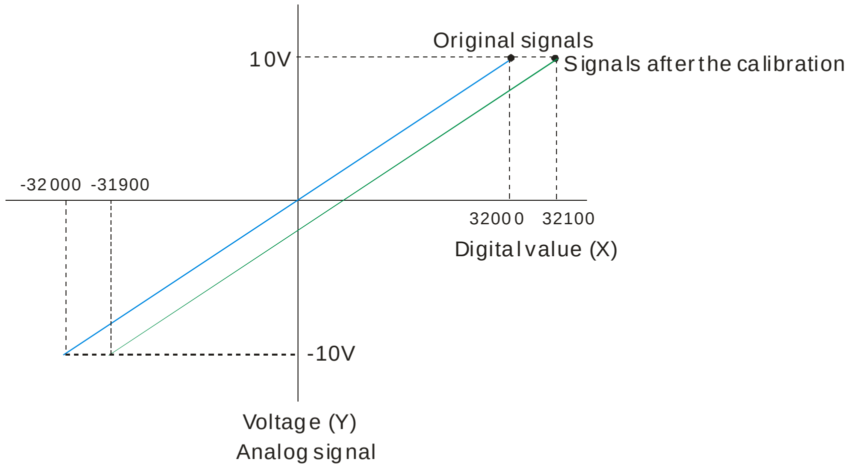
To make a curve meet specific needs, calibrate the curve by changing the offset and the gain. The calibration range depends on the range of inputs that the hardware can receive. The formula is:

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

**Example:**



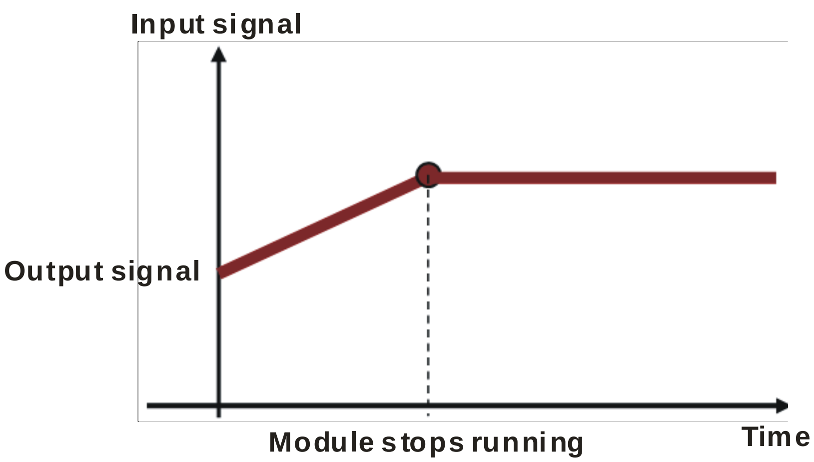
A channel receives voltage inputs between -10.0 V to +10.0 V. The gain is 1000, and the offset is 0. The corresponding value for the original signal -10.0 V to +10.0 V is -32000 to +32000. If you change the offset to -100, the calibrated value for the original signal -10.0 V to +10.0 V becomes -31900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



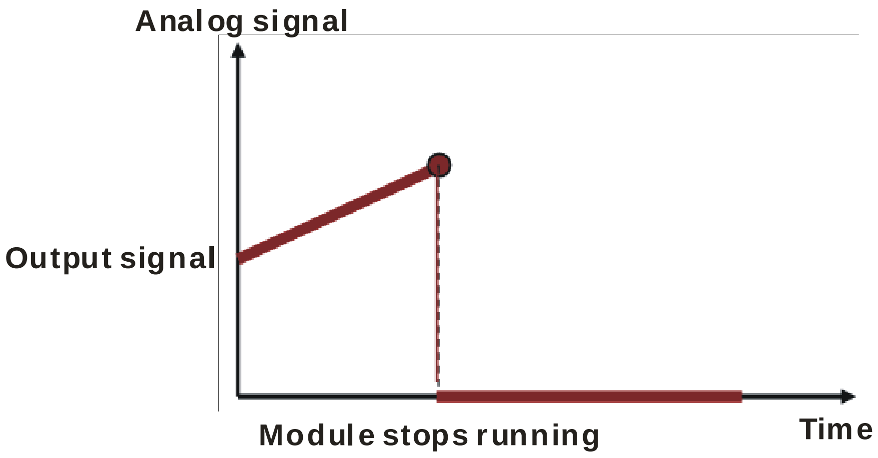

**3. Retain an Output**

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

**The output is retained:**

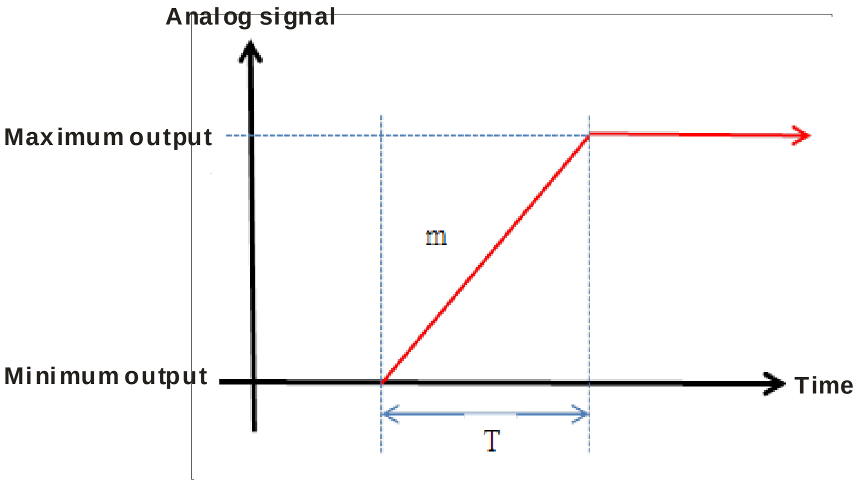


**The output is not retained:**

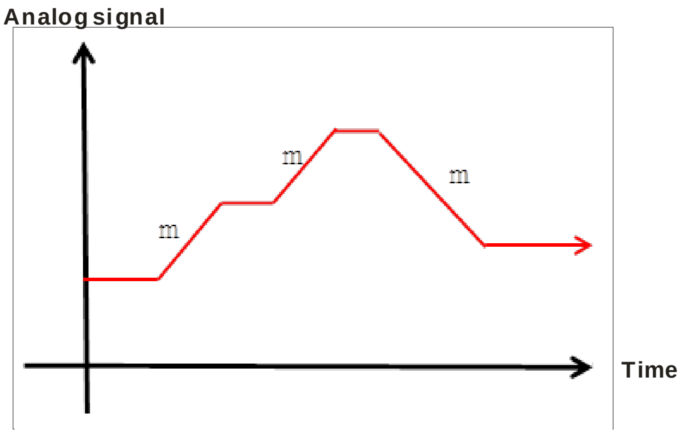



### 3. Refresh time for an Output

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



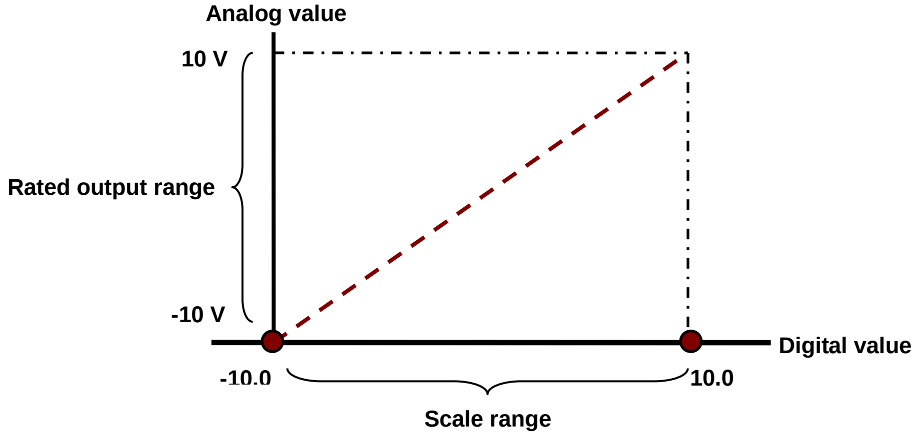

When the analog output signal changes, the system updates the value of the analog output according to the value set in the slope, as shown in the image below.



3

**4. 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.




## 3.2.6 Wiring

- **Precautions**

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

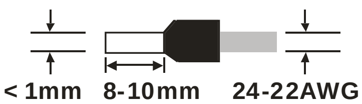
(1) To prevent a surge and induction, the AC cable and the output signal cables that are connected to the AS04DA-A must be separate cables.

(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.

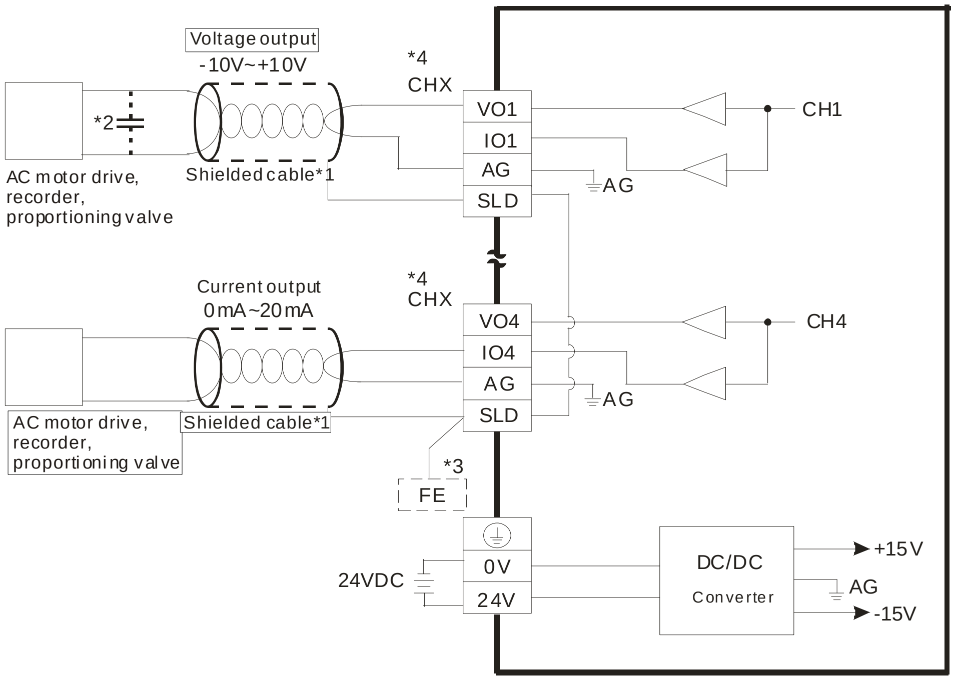
(4) Terminals with insulation sleeves cannot be arranged as a terminal block, so you should cover the terminals with insulation tubes.

(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.

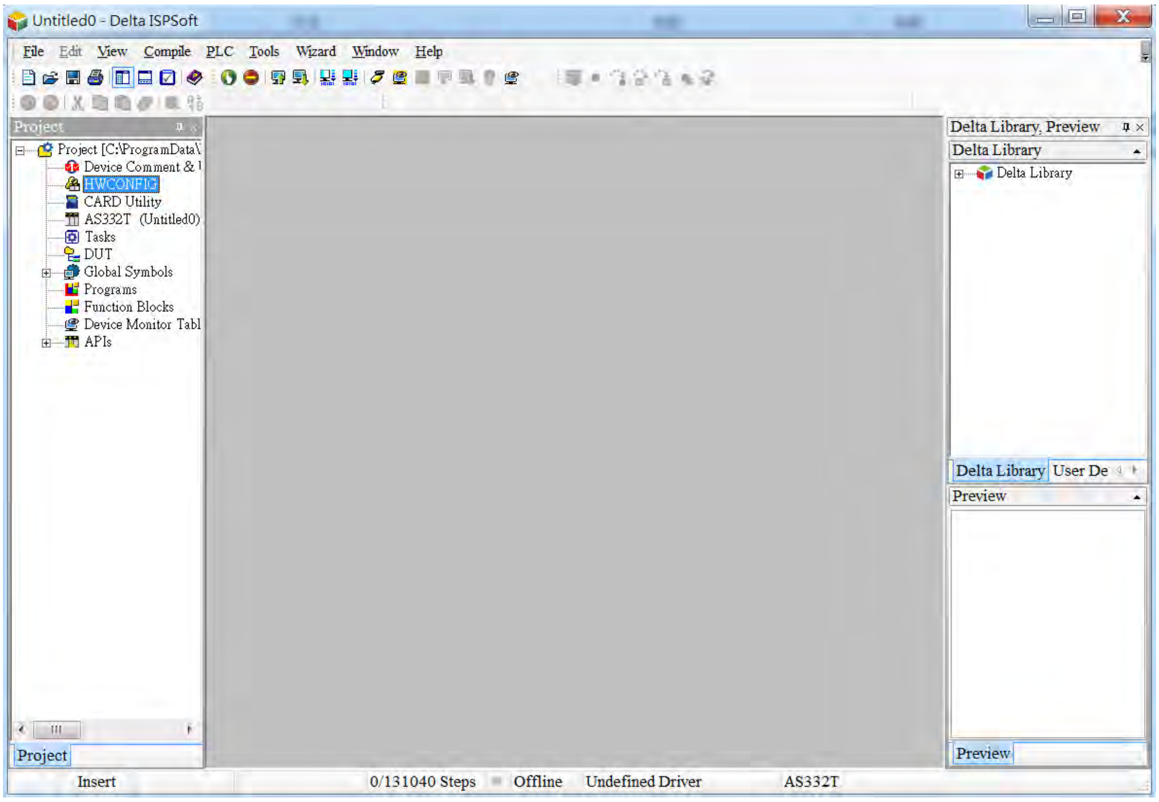
## 3.2.7 LED Indicators

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

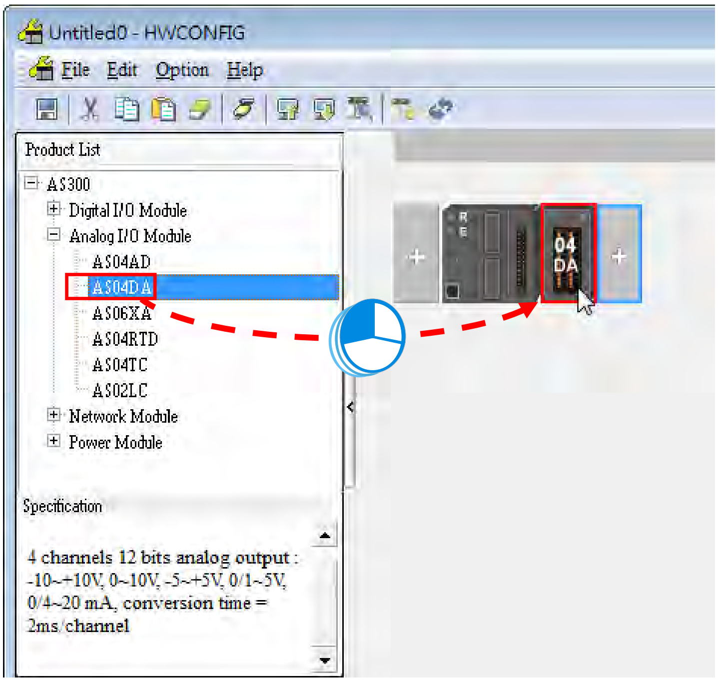
# 3.3 HWCONFIG in ISPSoft

## 3.3.1 Initial Setting

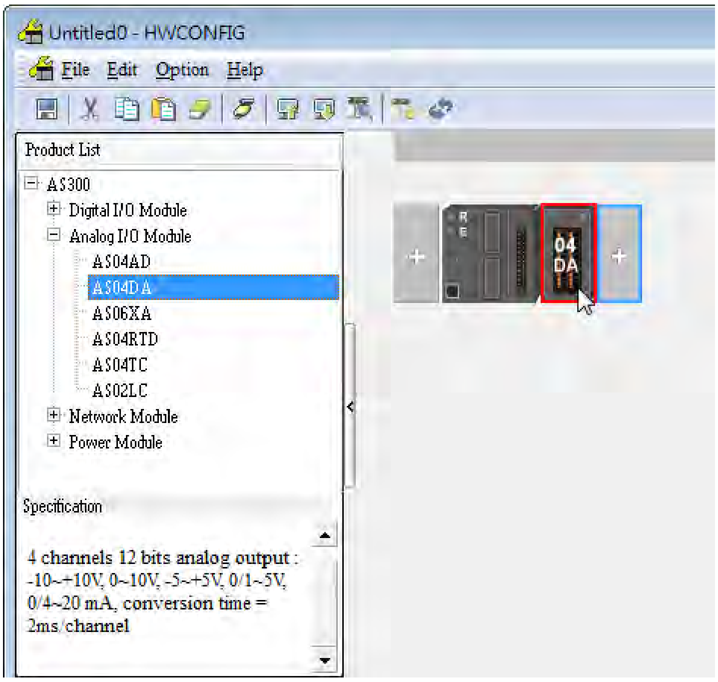
(1) Start ISPSoft and double-click **HWCONFIG**.

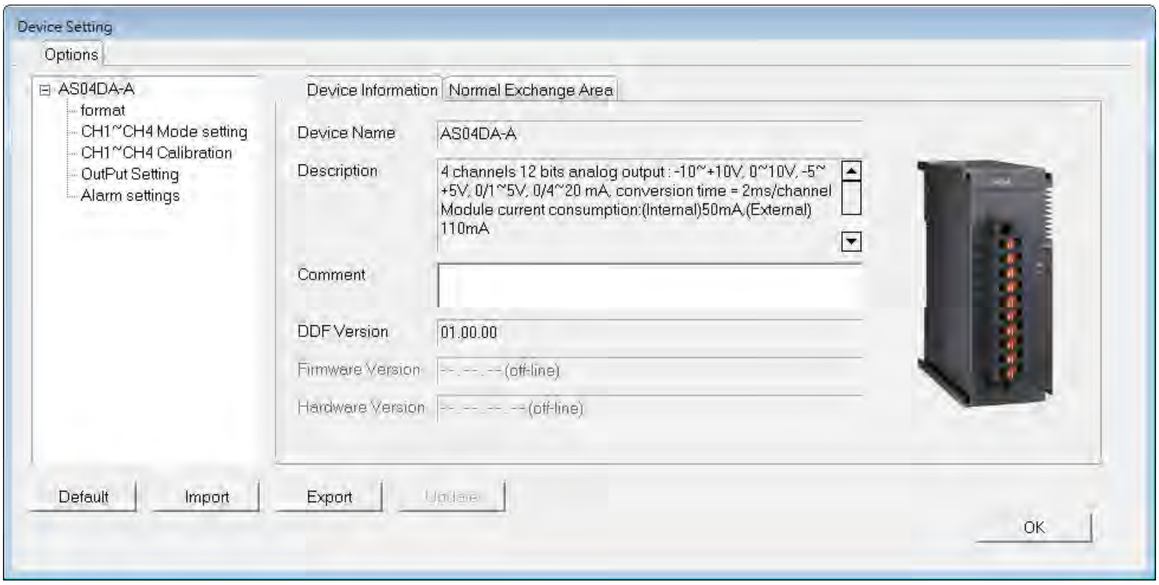



(2) Select a module and drag it to the working area.

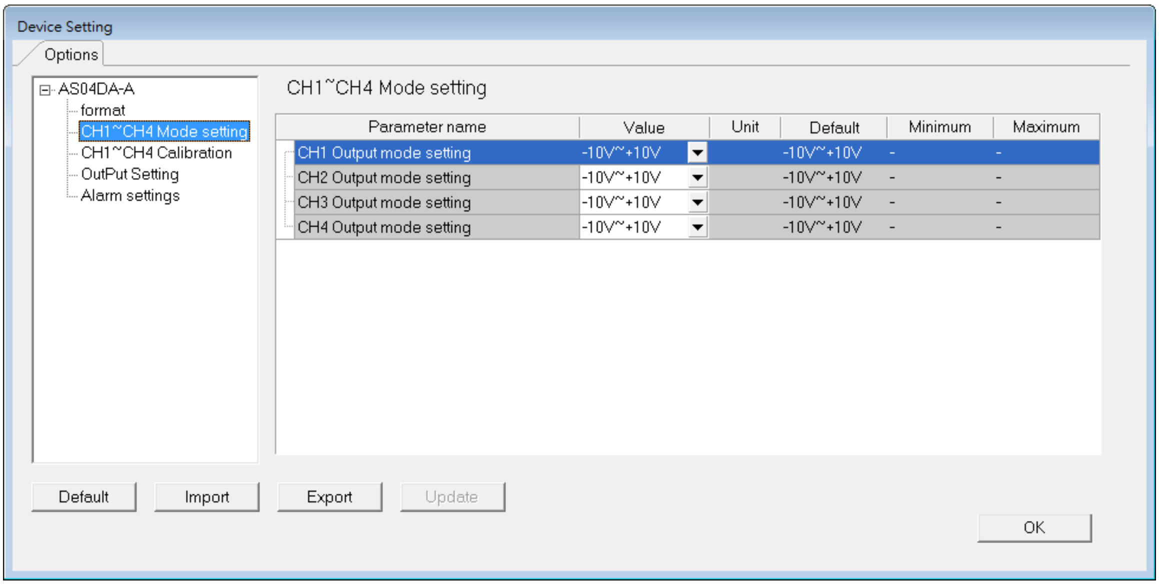


(3) Double-click the module in the working area to open the Device Setting page.



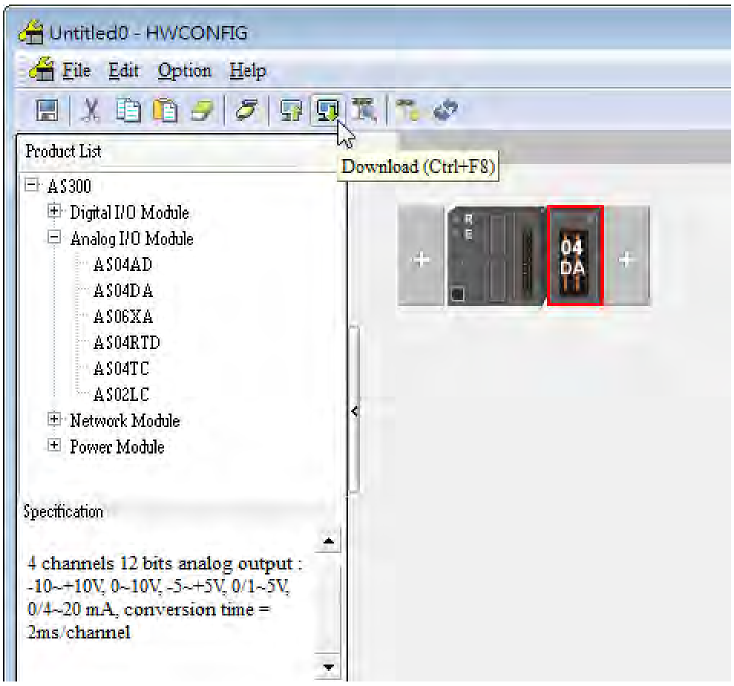



(4) Choose a parameter, set the values, and click **OK**.



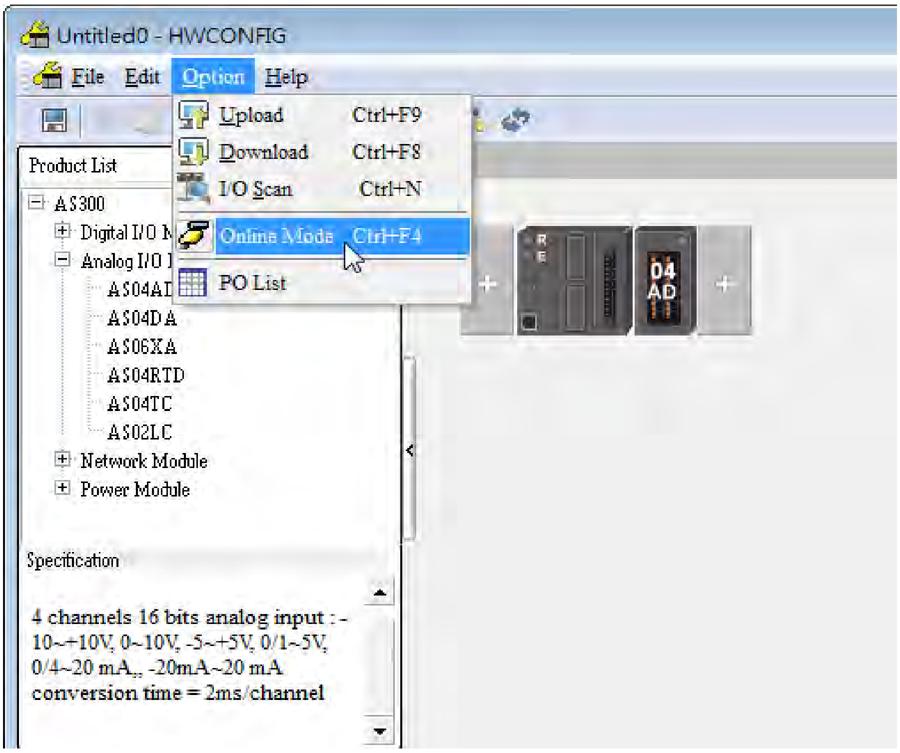



(5) Click **Download** on the toolbar to download the parameters. Note you cannot download the parameters cannot be downloaded.

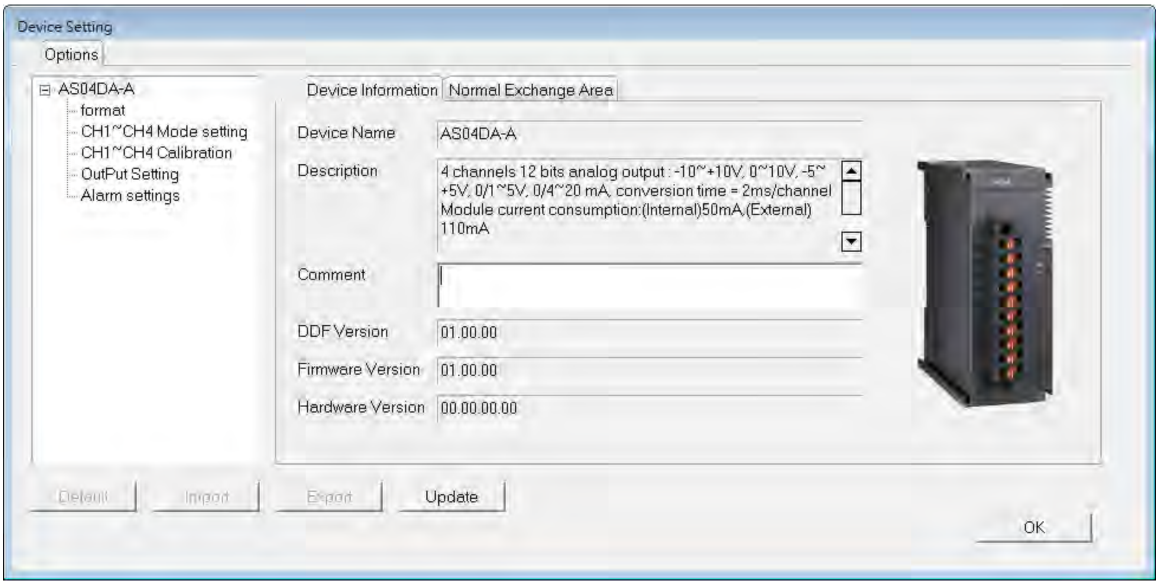


## 3.3.2 Checking the Version of a Module

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

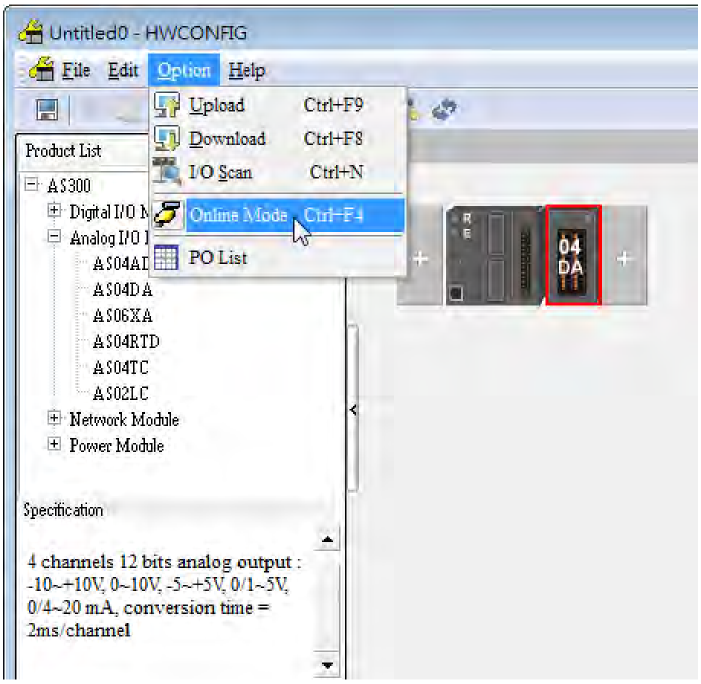



(2) Double-click the module to open the Device Setting page. The versions of both the firmware and the hardware are displayed.

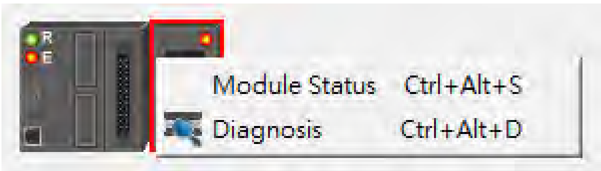



### 3.3.3 Online Mode

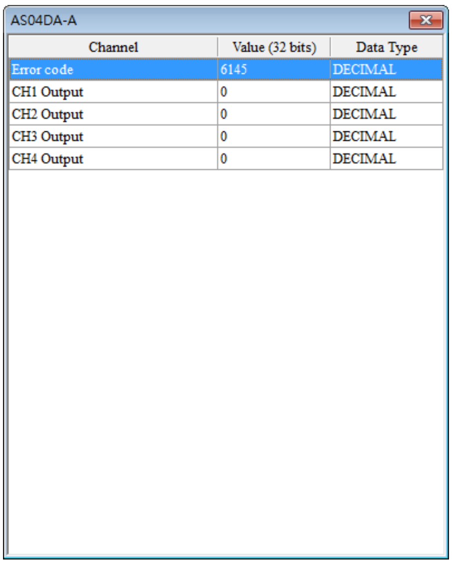
(1) On the **Option** menu, click **Online Mode**.




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

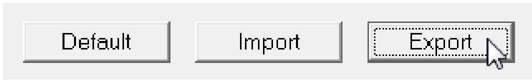


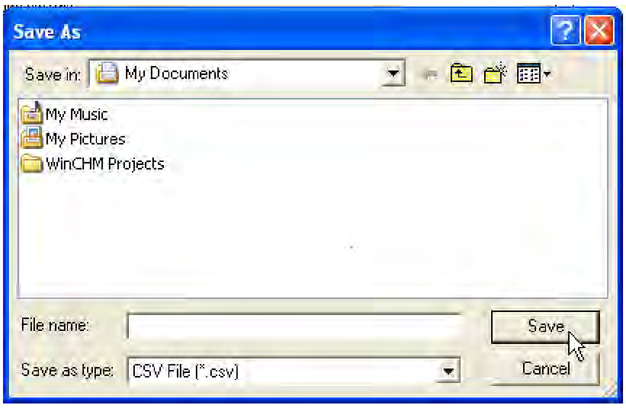

(3) View the module status.



## 3.3.4 Importing/Exporting a Parameter File

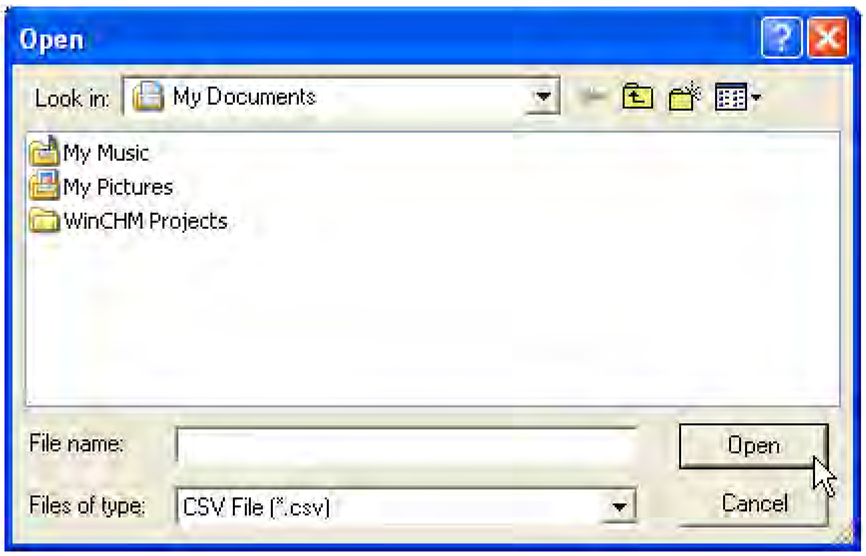
(1) Click **Export** in the Device Settings dialog box to save the current parameters as a CSV file (.csv).



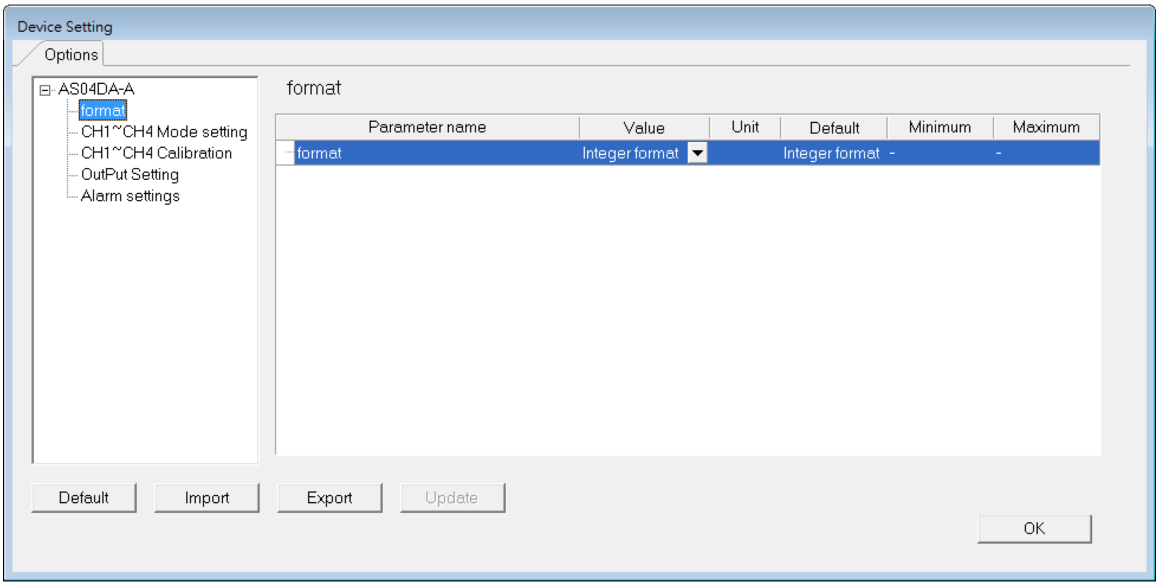


(2) Click **Import** in the Device Settings dialog box and select a CSV file to import save parameters.

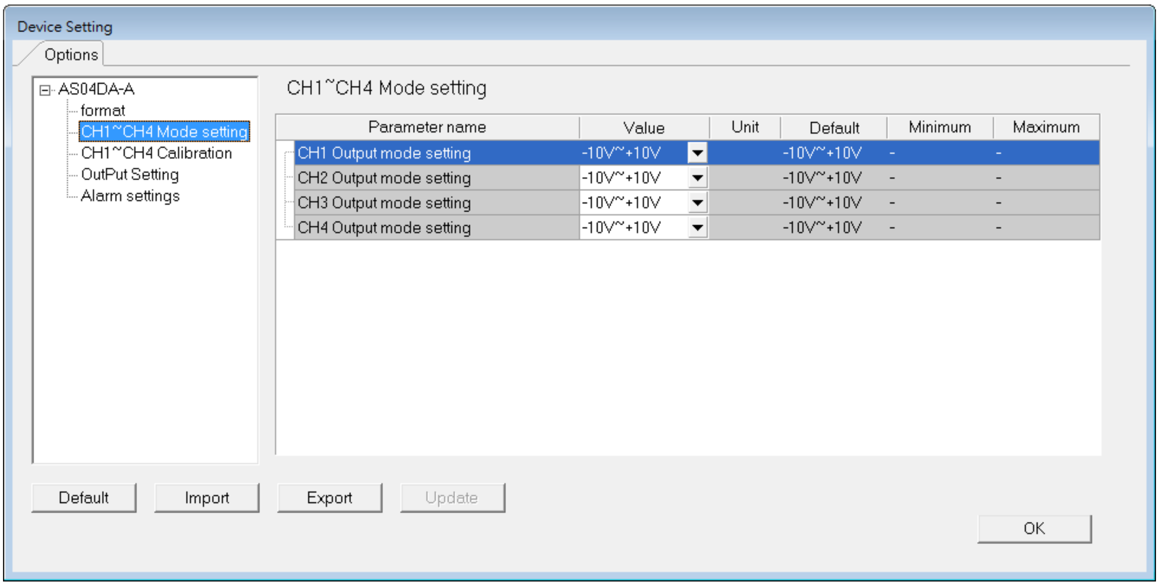



## 3.3.5 Parameters

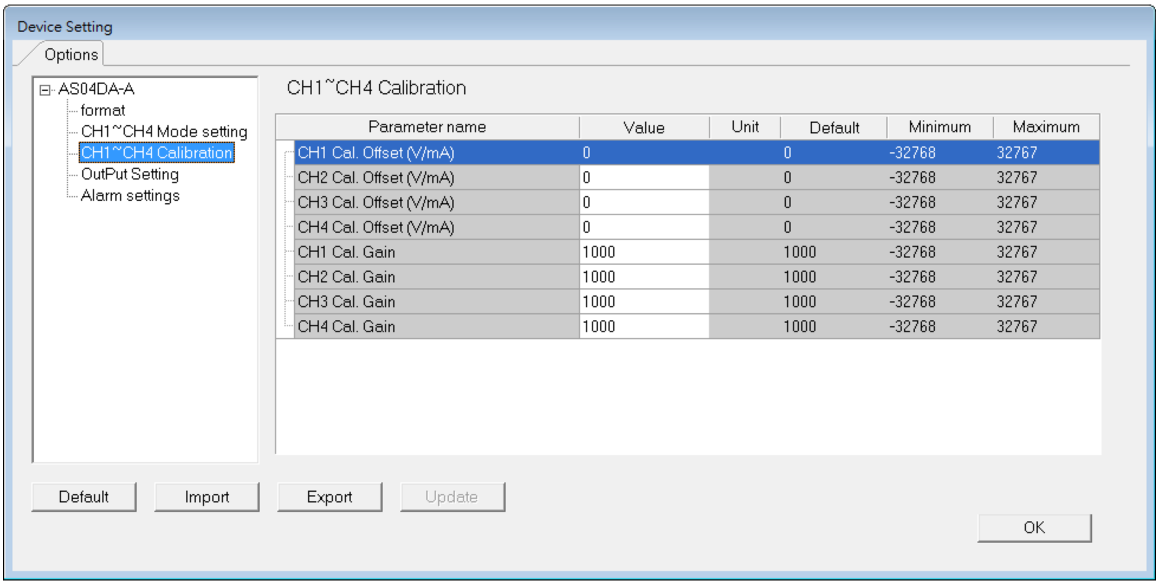
(1) The output formats of the channels



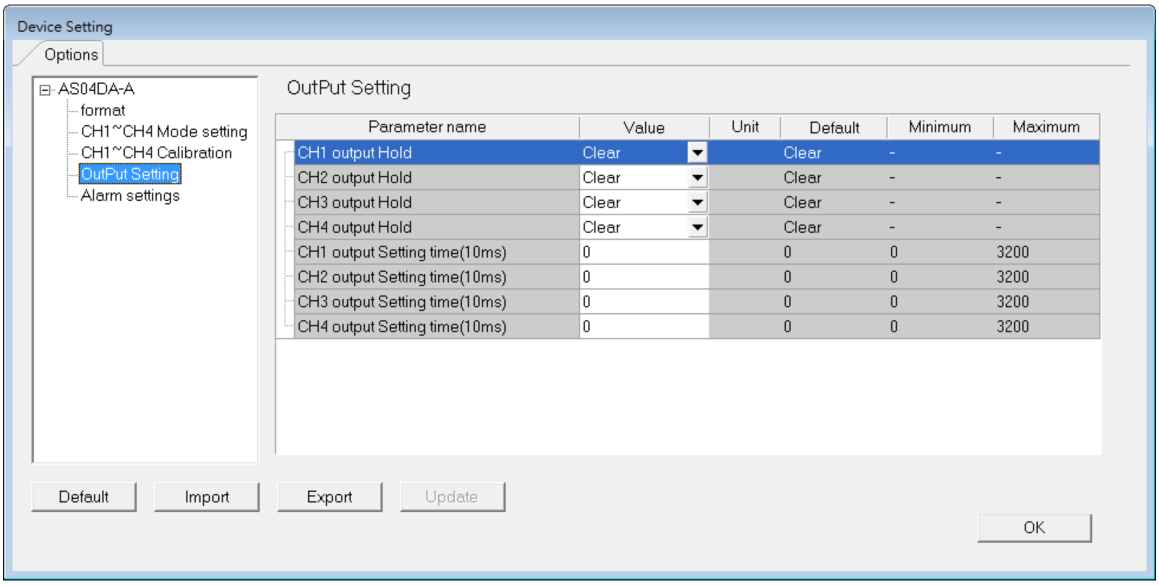

(2) The CH1–CH4 (channel 1–channel 4) mode settings



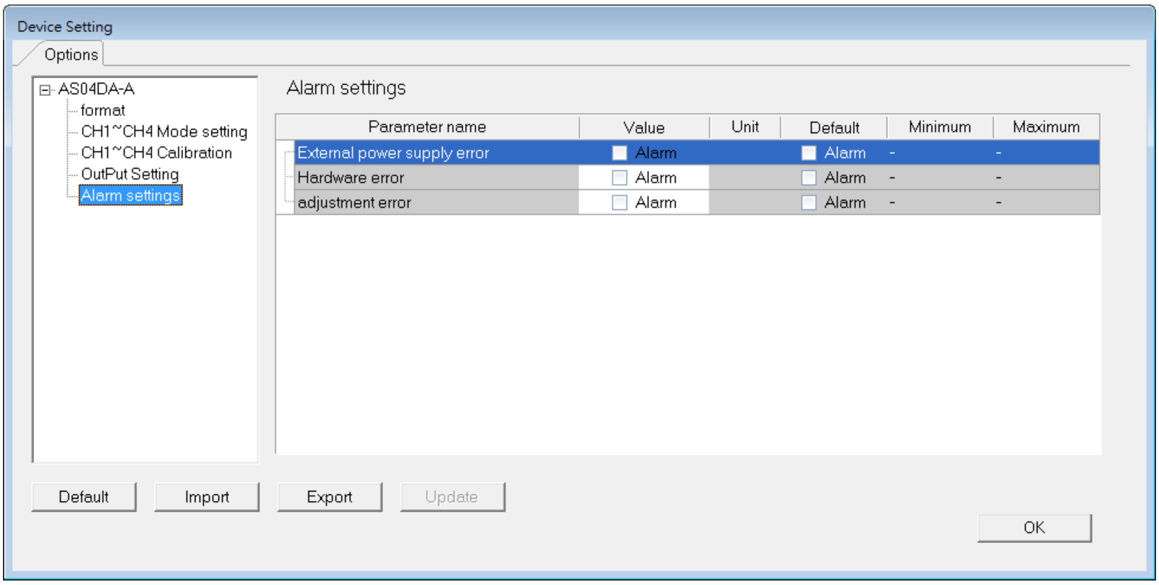
(3) The CH1–CH4 calibration settings




(4) The output settings



(5) The alarm settings






# 3.4 Troubleshooting

## 3.4.1 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 |

## 3.4.2 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<br>The factory calibration is abnormal. | Contact the factory. |

4

# Chapter 4 Analog Input/Output Module AS06XA

## Table of Contents

# 4.1 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

## 4.1.1 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.

# 4.2 Specifications and Functions

## 4.2.1 Specifications

- **Electrical specifications**

| **Module Name** | **AS06XA-A** |
|---|---|
| **Number of Analog Inputs/Outputs** | 4 inputs<br>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.<br>Isolation between a digital circuit and the ground: 500 VDC<br>Isolation between an analog circuit and the ground: 500 VDC<br>Isolation between an analog circuit and a digital circuit: 500 VDC<br>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 to +10 V | 0 V–10 V | ±5 V | 0–5 V | 1–5 V |
| **Analog to Digital Conversion Range** | K-32000 ~ K32000 | K0 ~ K32000 | K-32000 ~ K32000 | K0 ~ K32000 | K0 ~ K32000 |
| **Hardware Input Range** | -10.1 V to +10.1 V | -0.1 V to +10.1 V | -5.05 V to +5.05 V | -0.05 V to +5.05 V | 0.95– 5.05 V |
| **Error Range (Room Temperature)** | ±0.2% | | | | |
| **Error Range (Full Temperature Range)** | ±0.5% | | | | |
| **Linearity error (Room Temperature)** | ±0.02% | | | | |

| | |
|---|---|
| **Linearity error (Full Temperature Range)** | ±0.06% |
| **Hardware Resolution** | 16 bits |
| **Input Impedance** | 2 MΩ |
| **Absolute Input Range** | ±15 V |

| **Analog-to-Digital Conversion** | **Current Input** | | |
|---|---|---|---|
| **Rated Input Range** | ±20 mA | 0–20 mA | 4–20 mA |
| **Analog to Digital Conversion Range** | K-32000 ~ K32000 | K0 ~ K32000 | K0 ~ K32000 |
| **Hardware Input Range** | -20.2 mA to +20.2 mA | -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)** | ±0.04% | | |
| **Linearity Error (Full Temperature Range)** | ±0.10% | | |
| **Hardware Resolution** | 16 bits | | |
| **Input Impedance** | ≧250 Ω | | |
| **Absolute Input Range** | ±32 mA | | |

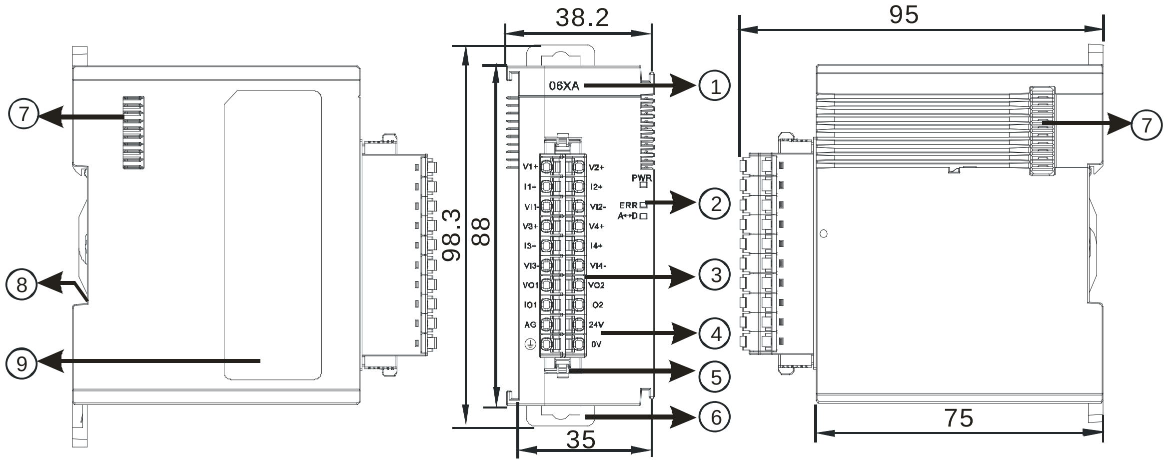
- **Functional specifications for the digital-to-analog conversion**

| **Digital-to-Analog Conversion** | **Voltage Output** | | | | |
|---|---|---|---|---|---|
| **Rated Output Range** | ±10 V | 0–10 V | ±5 V | 0–5 V | 1–5 V |
| **Analog to Digital Conversion Range** | K-32000 ~ K32000 | K0 ~ K32000 | K-32000 ~ K32000 | K0 ~ K32000 | K0 ~ K32000 |
| **Hardware Output Range** | -10.1 V to +10.1 V | -0.1 V to +10.1 V | -5.05 V to +5.05 V | -0.05 V to +5.05 V | 0.95–5.05 V |
| **Error Rate** | ±0.2% | | | | |

| | | |
|---|---|---|
| **(Room Temperature)** | | |
| **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 |
| **Analog to Digital 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 (Full Temperature Range)** | ±0.10% | |
| **Hardware Resolution** | 12 bits | |
| **Permissible Load Impedance** | ≦550 Ω | |

### 4.2.2 Profile



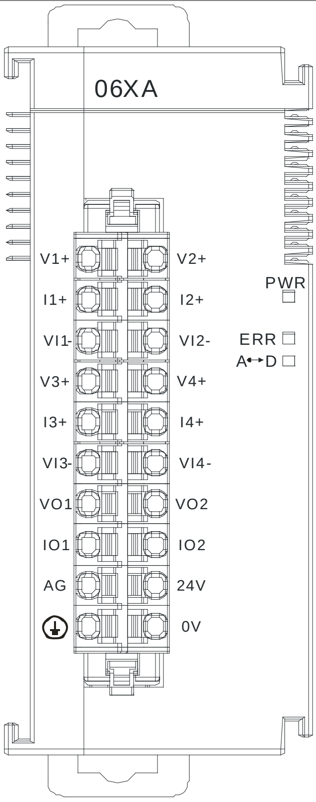

Unit: mm



| Number | Name | Description |
|---|---|---|
| 1 | Model Name | Model name of the module |
| 2 | RUN LED Indicator | Operating status of the module<br>ON: the module is running.<br>OFF: the module is not running. |
| | ERROR LED Indicator | Error status of the module<br>ON: a serious error exists in the module.<br>OFF: the module is operating normally.<br>Blink: a minor error exists in the module. |
| | Digital to Analog Conversion Indicator | Digital-to-analog conversion status<br>Blinking: conversion is in process.<br>OFF: conversion has stopped. |
| 3 | Removable Terminal Block | Inputs are connected to transducers.<br>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 | |
| 9 | Label | Nameplate |

## 4.2.3 Arrangement of Terminals

**AS06XA-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.

| CR# | Name | Description | Defaults |
|---|---|---|---|
| 0 | Format Setup | 0: integer format<br>1: floating point format | 0 |
| 1 | Input channel 1 mode setup | 0: closed<br>1: -10 V to +10 V (default)<br>2: 0–10 V<br>3: -5 to +5 V<br>4: 0–5 V<br>5: 1–5 V | 1 |
| 2 | Input channel 2 mode setup | | |
| 3 | Input channel 3 mode setup | | |

| CR# | Name | Description | Defaults |
|---|---|---|---|
| 4 | Input channel 4 mode setup | 6: 0–20 mA<br>7: 4–20 mA<br>8: -20 mA to +20 mA | |
| 5 | Input channel 1 offset | Range: -32768 to +32767 | 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 | 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 | 10 |
| 14 | Input channel 2 average times | | |
| 15 | Input channel 3 average times | | |
| 16 | Input channel 4 average times | | |
| 17 | Input channel 1 filter average percentage | Range: 0–3<br>Unit: ±10%<br>1: ±10%<br>2: ±20%<br>3: ±30% | 1 |
| 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<br>1: 4 ms<br>2: 10 ms<br>3: 15 ms<br>4: 20 ms | 0 |

| CR# | Name | Description | Defaults |
|---|---|---|---|
| | | 5: 30 ms<br>6: 40 ms<br>7: 50 ms<br>8: 60 ms<br>9: 70 ms<br>10: 80 ms<br>11: 90 ms<br>12: 100 ms | |
| 22 | Input channel alarm setup | 0: open channel alarm<br>1: close channel alarm<br>bit0: channel 1<br>bit1: channel 2<br>bit2: channel 3<br>bit3: channel 4<br><br>0: warning<br>1: alarm<br>bit8: error in the power supply<br>bit9: error in the module hardware<br>bit10: error in calibration | |
| 23 | Output channel 1 mode setup | 0: closed<br>1: -10 V to +10 V (default)<br>2: 0–10 V<br>3: -5 V to +5 V<br>4: 0–5 V<br>5: 1–5 V<br>6: 0–20 mA<br>7: 4–20 mA | 1 |
| 24 | Output channel 2 mode setup | | |
| 25 | Output channel 1 offset | Range: -32768 to +32767 | 0 |
| 26 | Output channel 2 offset | | |
| 27 | Output channel 1 gain | Range: -32768 to +32767 | 1000 |
| 28 | Output channel 2 gain | | |

| CR# | Name | Description | Defaults |
|---|---|---|---|
| 29 | Retain the output sent by channel 1 | 0: When the PLC stops, the value of the analog output is reset to 0.<br>1: When the PLC stops, the value of the analog output is retained. | 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)<br>Unit: 10 ms<br>Any value less than 10 is read as 0. Any value larger than 3200 is read as 3200.<br>Set the value to 0 to disable this function. | 0 |
| 32 | Refreshing the time for an output sent by channel 2 | | |
| 33 | The minimum scale range for input channel 1 | 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.<br>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.<br>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. When the format is set to integer in HWCONFIG, the scale range is invalid.<br>You can also use PLC instruction DSCLP (API0217) and set SM685 to ON to use floating-point operations. | -10.0 |
| 34 | | | |
| 35 | The minimum scale range for input channel 2 | | -10.0 |
| 36 | | | |
| 37 | The minimum scale range for input channel 3 | | -10.0 |
| 38 | | | |
| 39 | The minimum scale range for input channel 4 | | -10.0 |
| 40 | | | |
| 41 | The minimum scale range for output channel 1 | | -10.0 |
| 42 | | | |
| 43 | The minimum scale range for output channel 2 | | -10.0 |
| 44 | | | |
| 45 | The maximum scale range for input channel 1 | | 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 | | 10.0 |

| CR# | Name | Description | Defaults |
|---|---|---|---|
| 56 | for output channel 2 | | |
| 201 | Instruction Set | Instructions for peak values<br>16#0101: record the peak value again for channel 1<br>16#0102: record the peak value again for channel 2<br>16#0104: record the peak value again for channel 3<br>16#0108: record the peak value again for channel 4<br>16#010F: record the peak values again for channels 1–4<br>16#0201: enable recording for channel 1<br>16#0202: enable recording for channel 2<br>16#0204: enable recording for channel 3<br>16#0208: enable recording for channel 4<br>16#020F: enable recording for channels 1–4<br>16#0211: disable recording for channel 1<br>16#0212: disable recording for channel 2<br>16#0214: disable recording for channel 3<br>16#0218: disable recording for channel 4<br>16#021F: disable recording for channels 1–4<br>16#0502: restore default settings | 0 |
| 210 | The maximum peak value for channel 1 | Integer format; the maximum peak value for analog inputs | - |
| 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 | - |
| 215 | The minimum peak value for channel 2 | | - |
| 216 | The minimum peak value for channel 3 | | - |
| 217 | The minimum peak value | | - |

4

| CR# | Name | Description | Defaults |
|---|---|---|---|
| | for channel 4 | | |
| 222 | The time to record for channel 1 | Unit: 10 ms<br>Range: 1–100<br>Time to record the digital value for the channels | 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 | 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 | -- |
| 4500-4999 | Records for channel 2 | 500 records for channel 2 | -- |
| 5000-5499 | Records for channel 3 | 500 records for channel 3 | -- |
| 5500-5999 | Records for channel 4 | 500 records for channel 4 | -- |

### 4.2.5 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.<br>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**

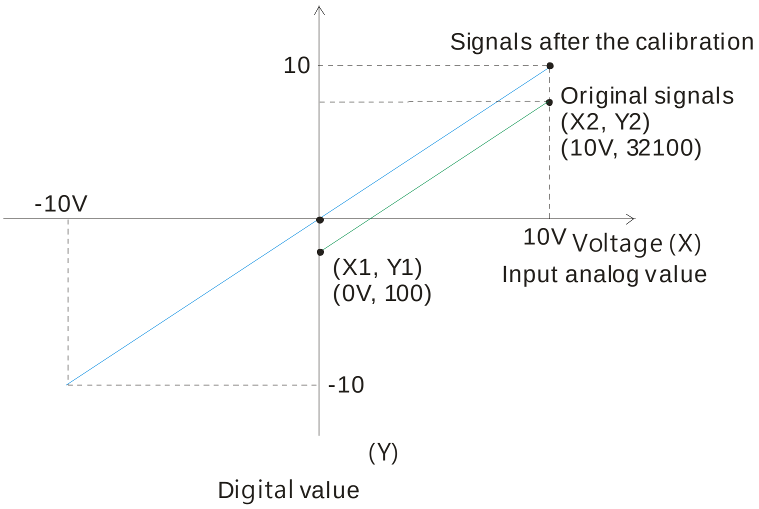
To make a curve meet specific needs, calibrate the curve by changing the offset and the gain. The calibration range depends on the range of inputs which can be received by the hardware. The formula is:

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

**Example:**

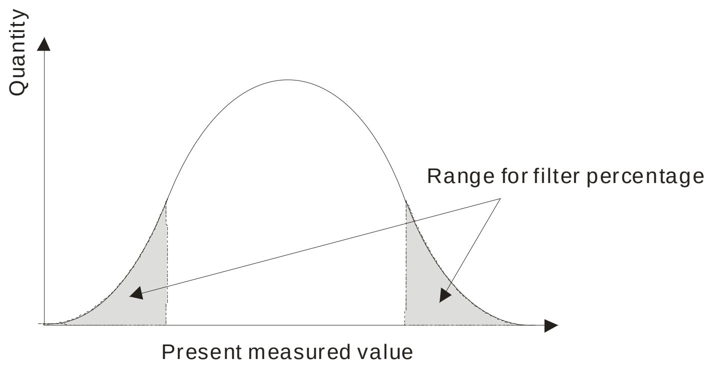
A channel receives voltage inputs between -10.0 V to +10.0 V. The gain is 1000, and the offset is 0. The corresponding value for the original signal -10.0 V to +10.0 V is -32000 to +32000. If you change the offset to -100, the calibrated value for the original signal -10.0 V to +10.0 V becomes -31900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

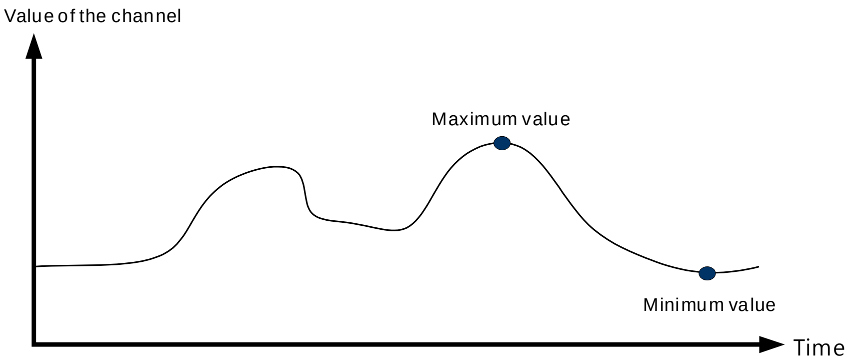
Disconnection detection only operates when the analog range is 4–20 mA or 1–5 V. If a module which can receive inputs between 4–20 mA or between 1–5 V is disconnected, the input signal exceeds the range of allowable inputs, so the module produces an alarm or a warning.

**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.

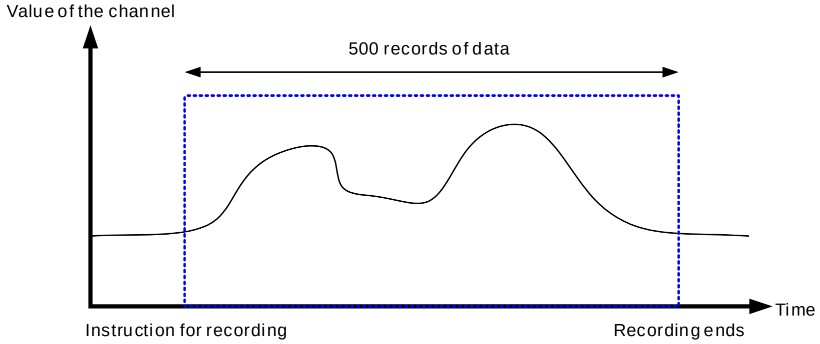
**6. Limit detections for channels**

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



7. **Records for Channels**

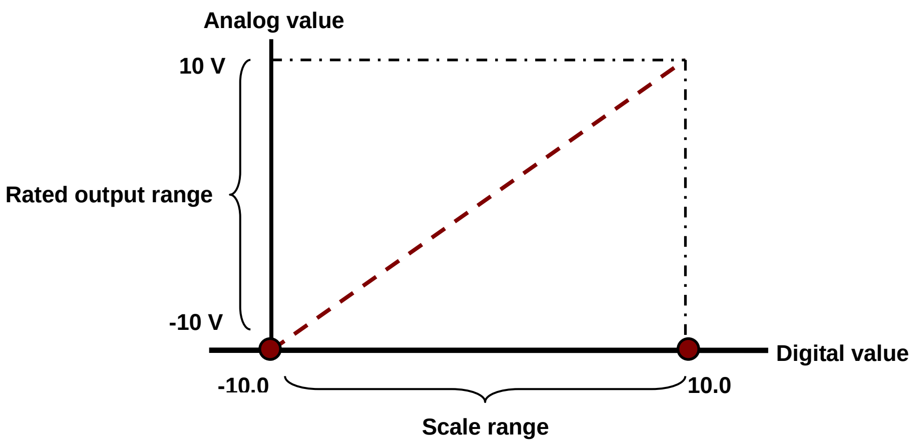
Record the input values of the cyclic sampling for each channel. The system saves up to 500 data points and the recording time is 10 ms.






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.<br>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 |

| Item | Function | Description |
|---|---|---|
| | | 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.

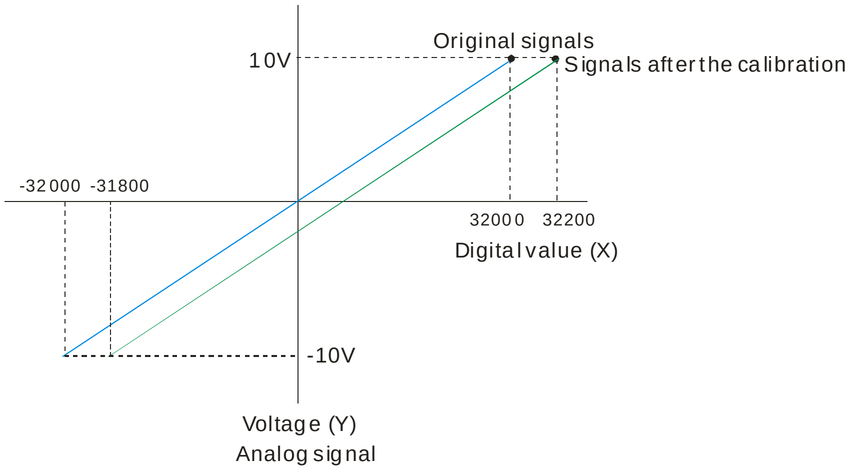
**2. Calibration**

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:**

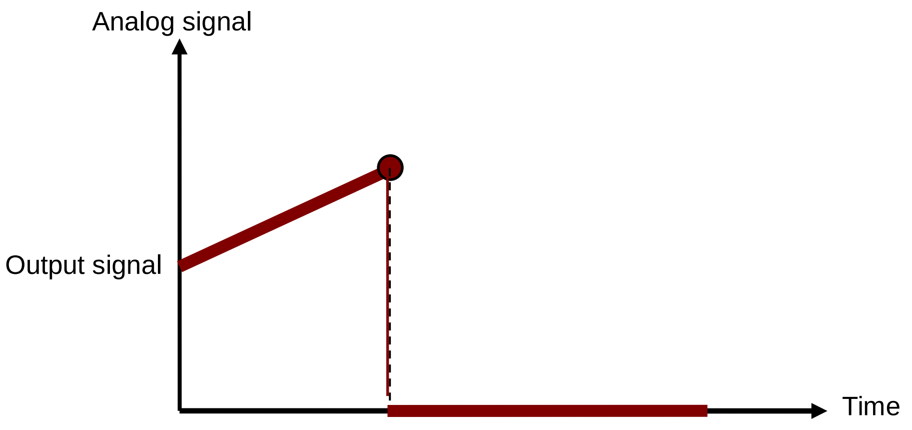
A channel receives voltage inputs between -10.0 V to +10.0 V. The gain is 1000, and the offset is 0. The corresponding value for the original signal -10.0 V to +10.0 V is -32000 to +32000. If you change the offset to 200 and the gain to 1000, the calibrated value for the original signal -10.0 V to +10.0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



**3. Retain an Output**

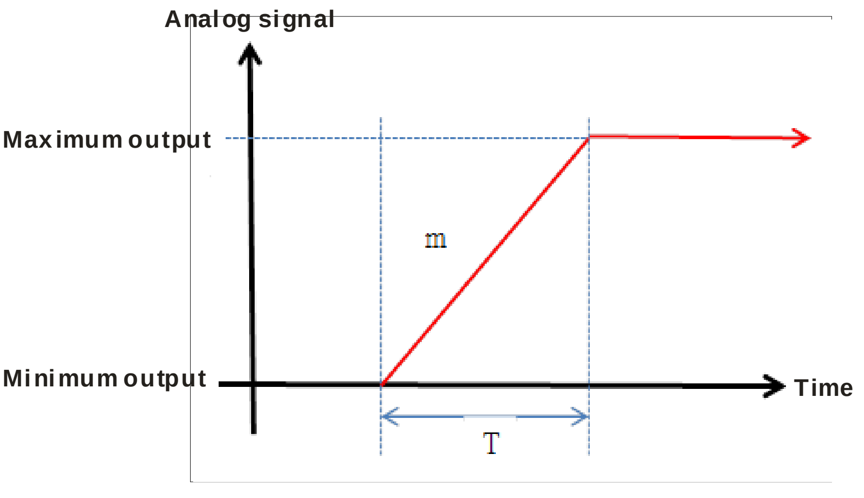
When a module stops running, the system retains the signal sent by the module.

The output is not retained:

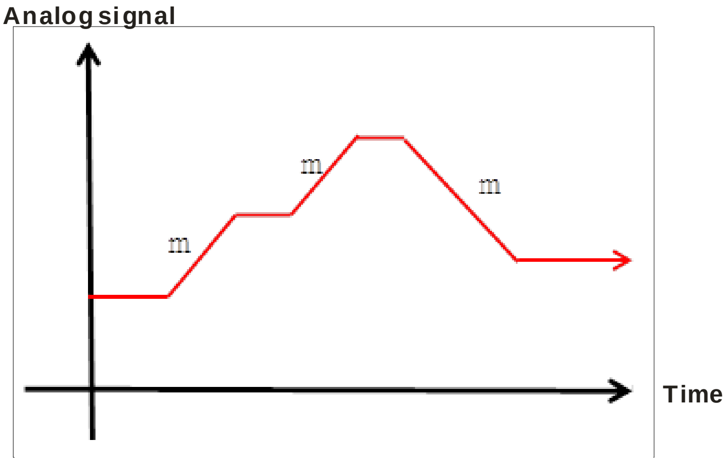



**4. Refresh Time for an Output**

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.

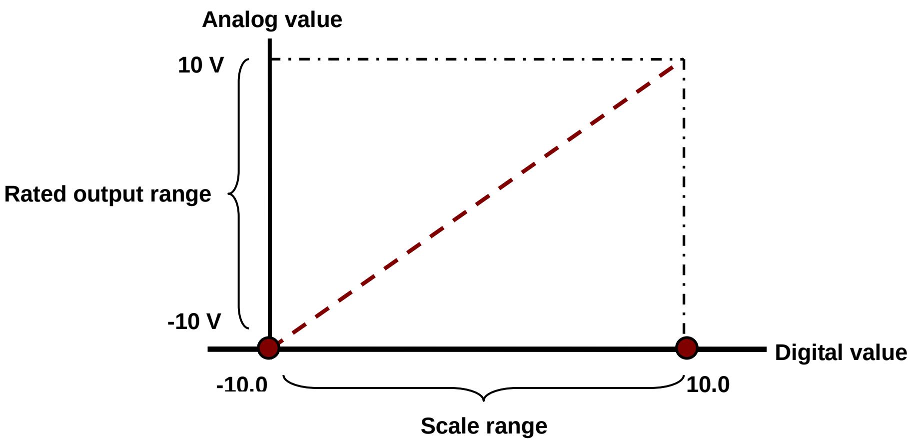



*The output conversion time and the input channel sampling cycle are the same.

4

### 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 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.

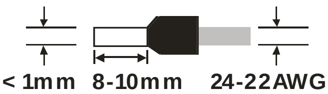
(2) Do not install the cable near a main circuit, a high-voltage cable, or a cable connected to a load that is not a PLC. In addition, the cable must not be bound to a main circuit, a high-voltage cable, or a cable connected to a load which is not a PLC.

(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.

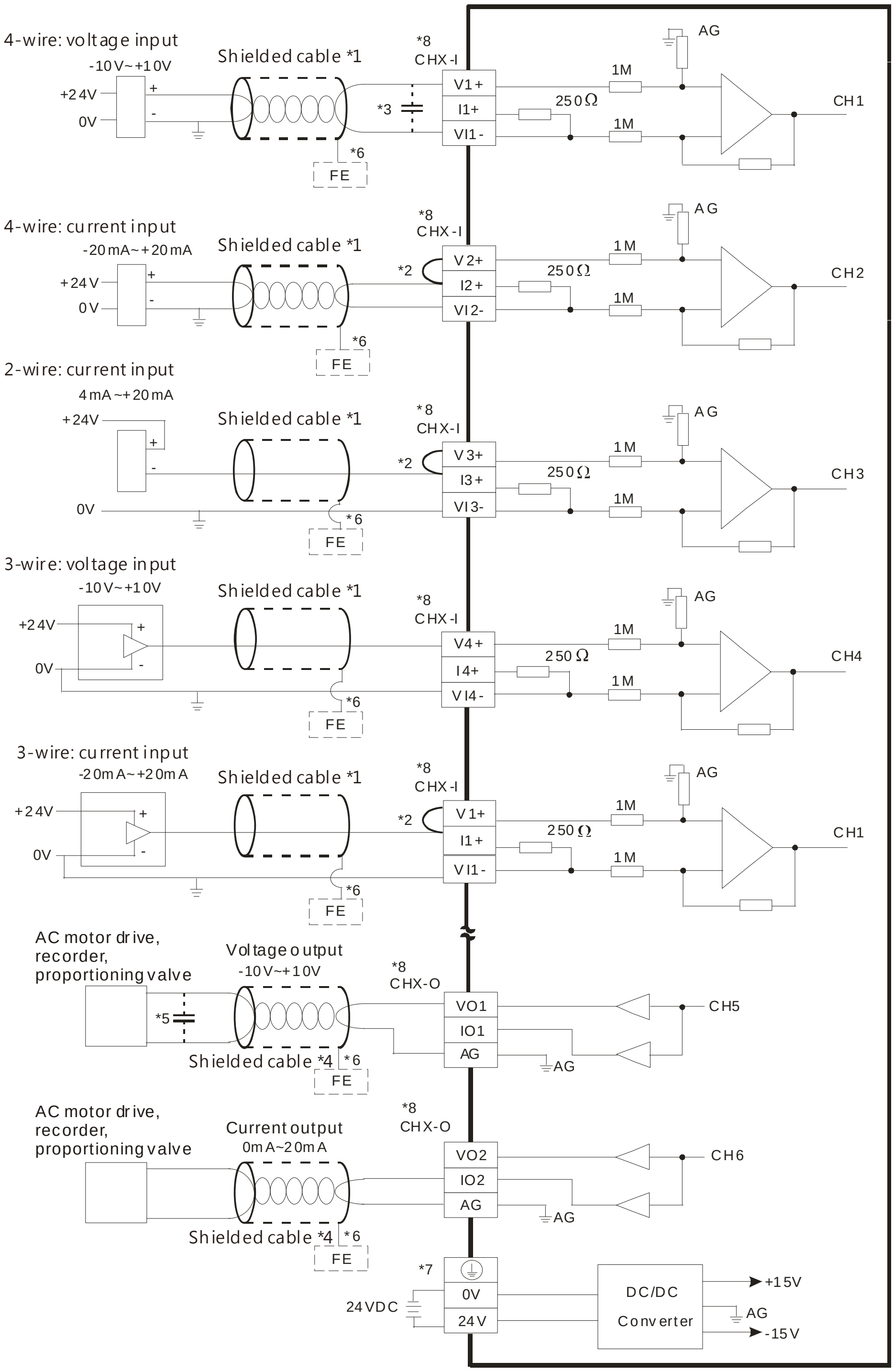
(7) Notes on two-wire, three-wire, and four-wire connections:

- 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.

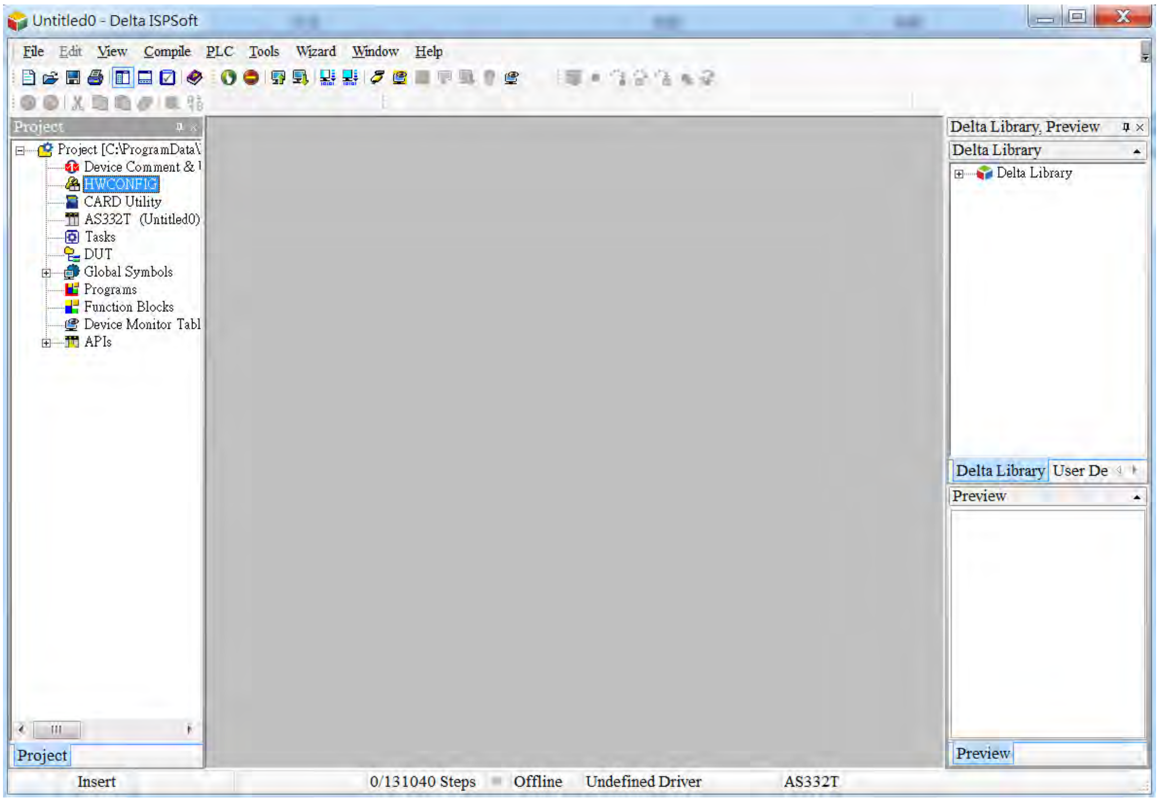
### 4.2.7 LED Indicators

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

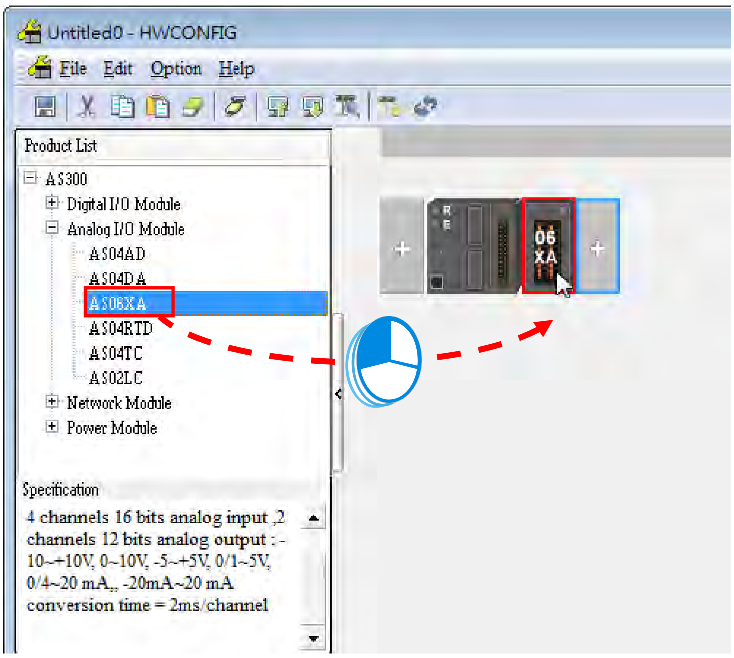
# 4.3 HWCONFIG in ISPSoft

## 4.3.1 Initial Setting

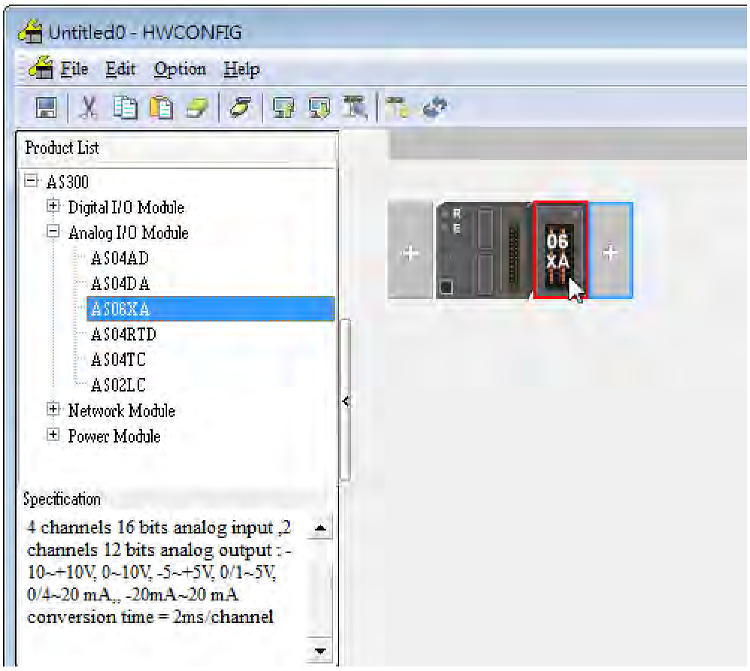
(1) Start ISPSoft and double-click **HWCONFIG**.

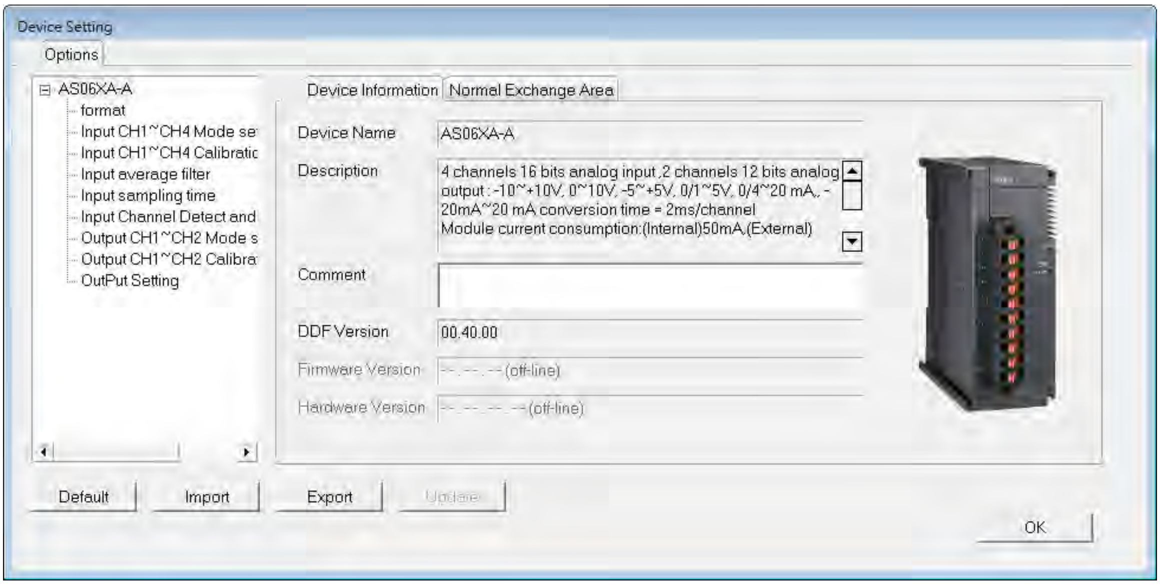



(2) Select a module and drag it to the working area.

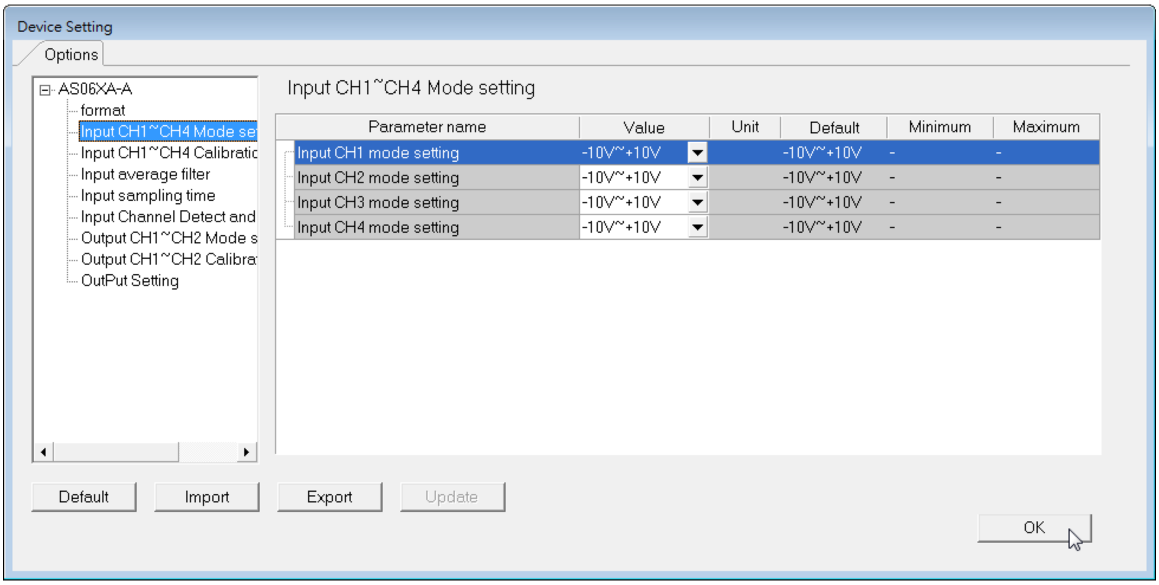


(3) Double-click the module in the working area to open the Device Setting page.

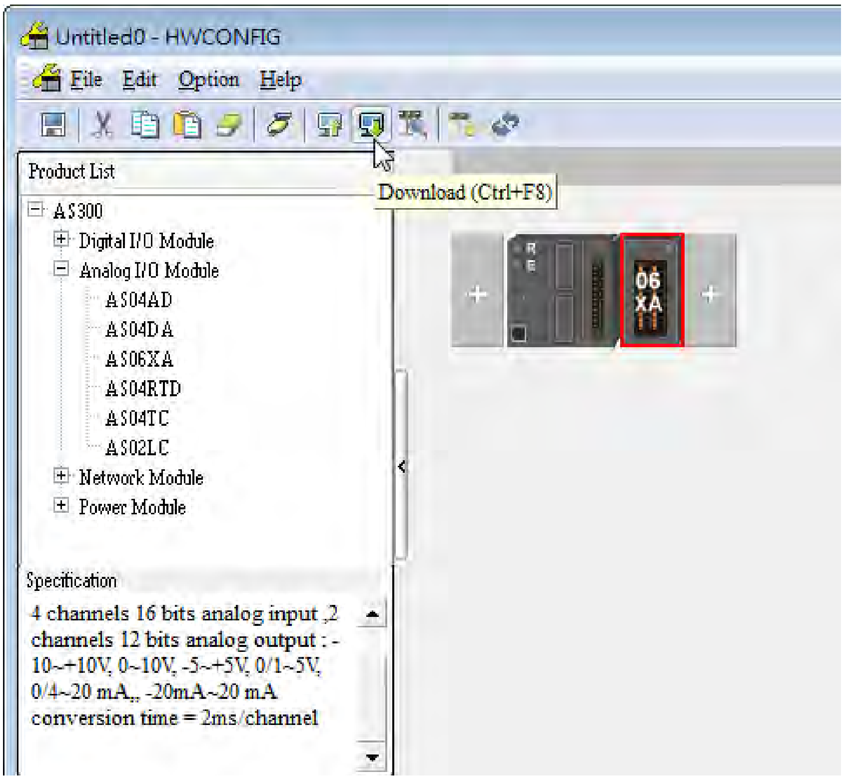


(4) Choose the parameter, set the values, and click **OK**.

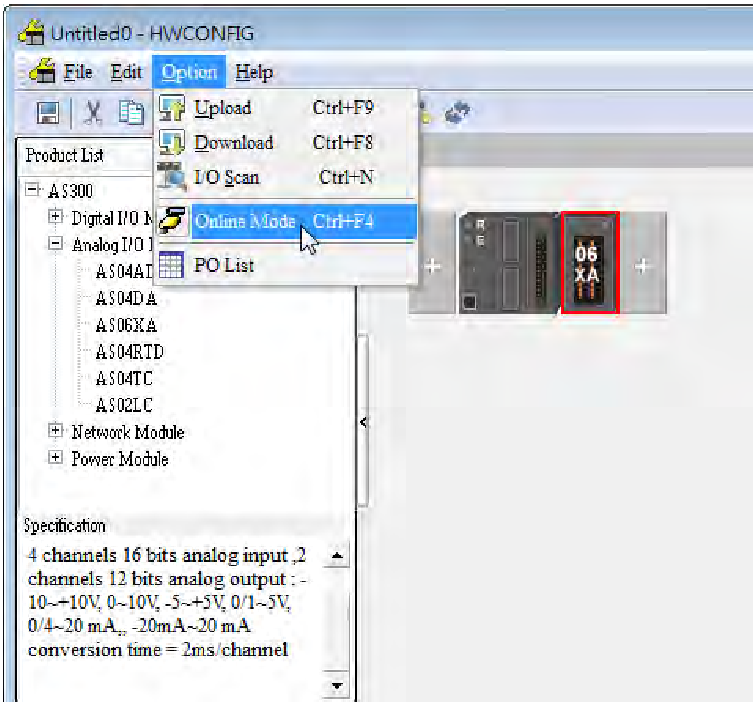



(5) Click **Download** on the toolbar to download the parameters. Note that you cannot download the parameters while the CPU module is running.

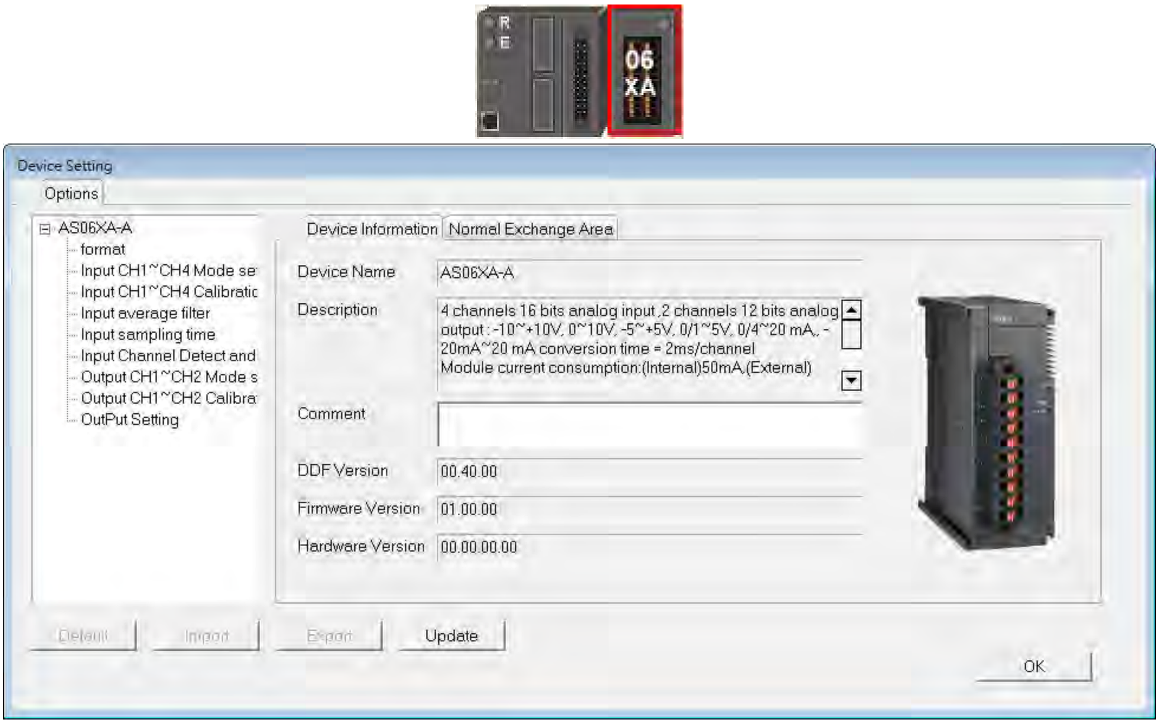


## 4.3.2 Checking the Version of a Module

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

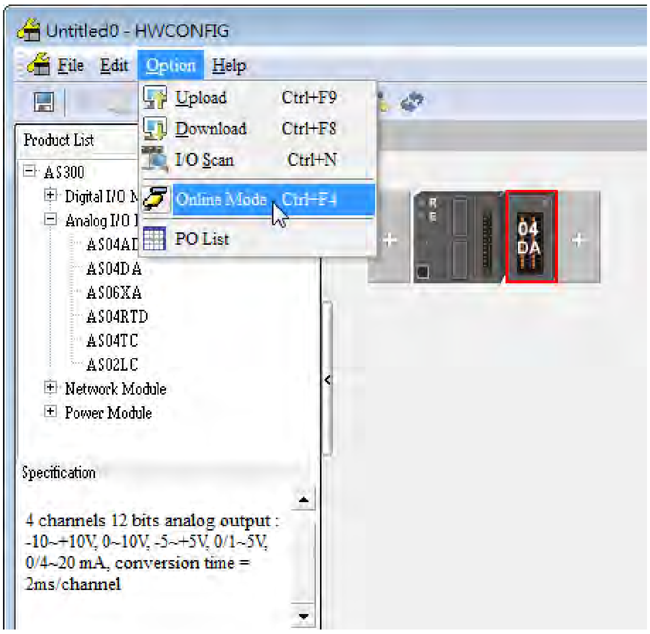



(2) Double-click the module to open the Device Setting page. The versions of both the firmware and the hardware are displayed.

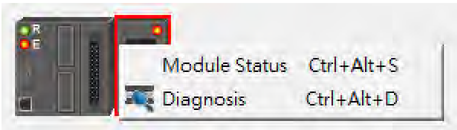


### 4.3.3 Online Mode

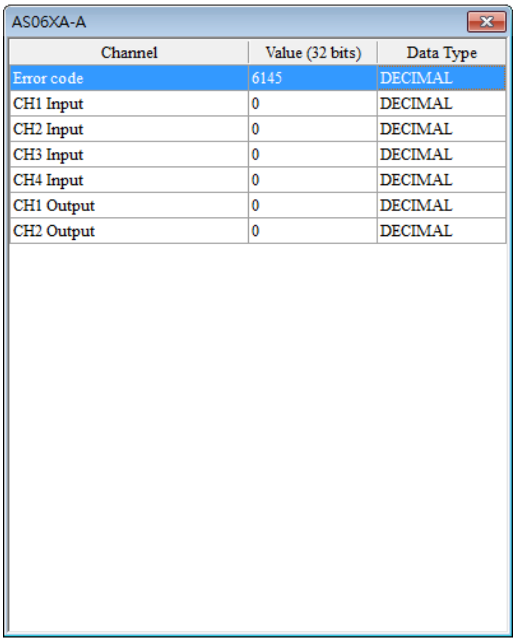
(1) On the **Option** menu, click **Online Mode**.




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

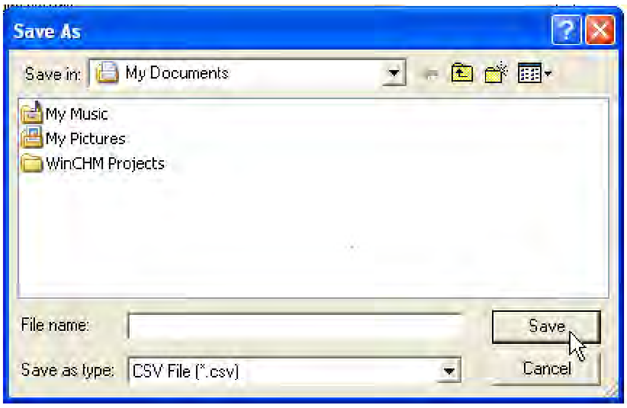



(3) View the module status.



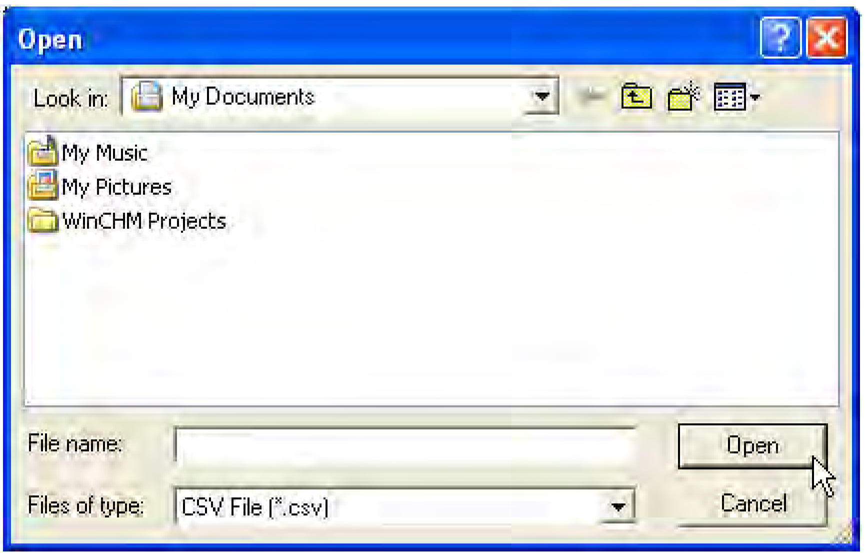
### 4.3.4 Importing/Exporting a Parameter File

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

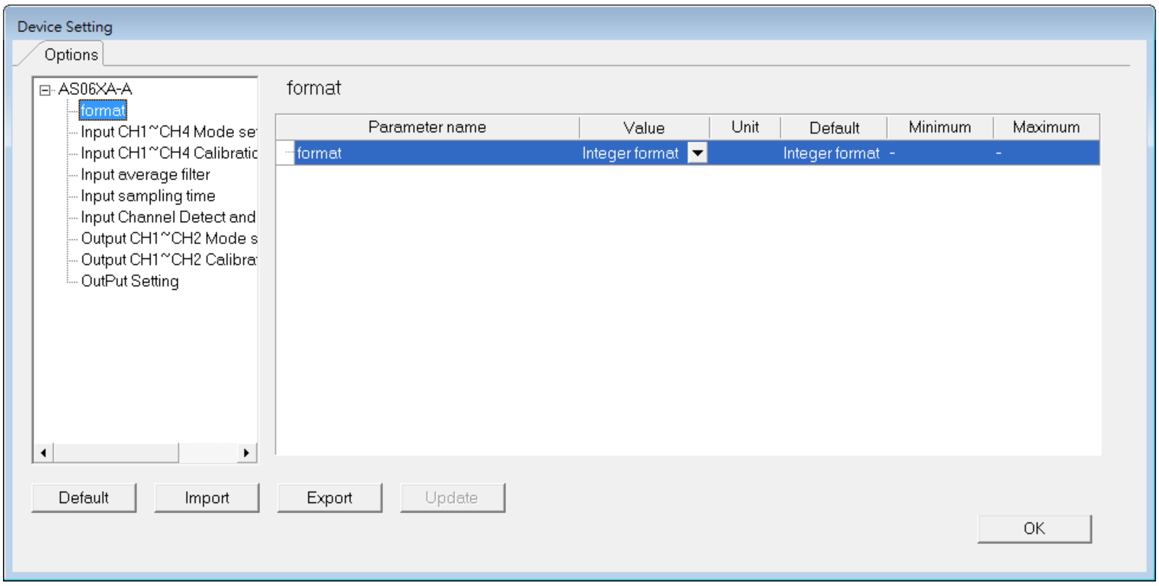


(2) Click **Import** in the Device Settings dialog box and select a CSV file to import saved parameters.

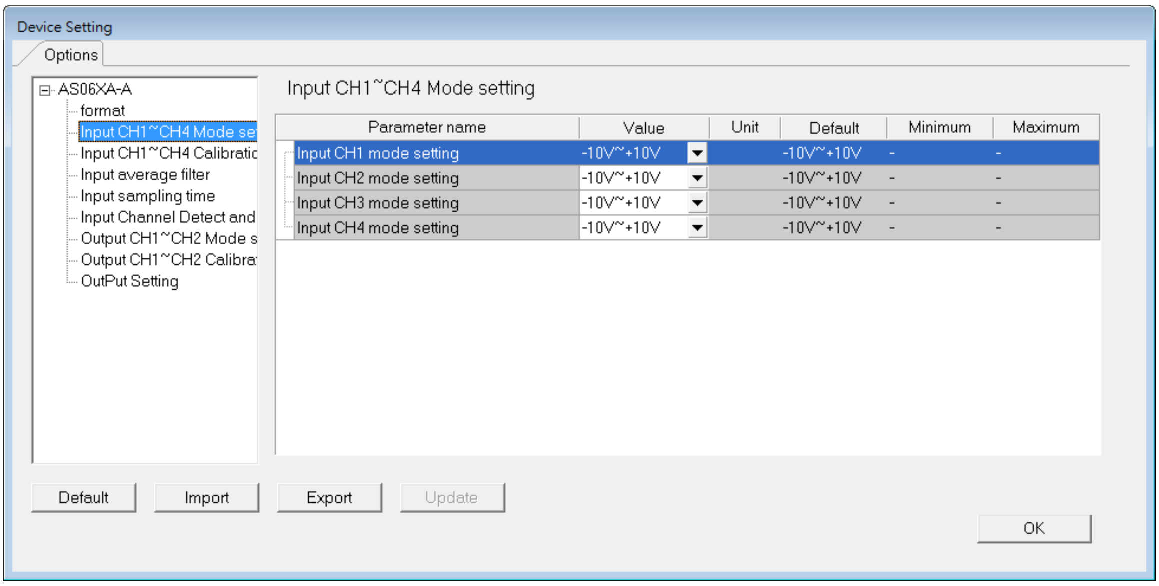



### 4.3.5 Parameters

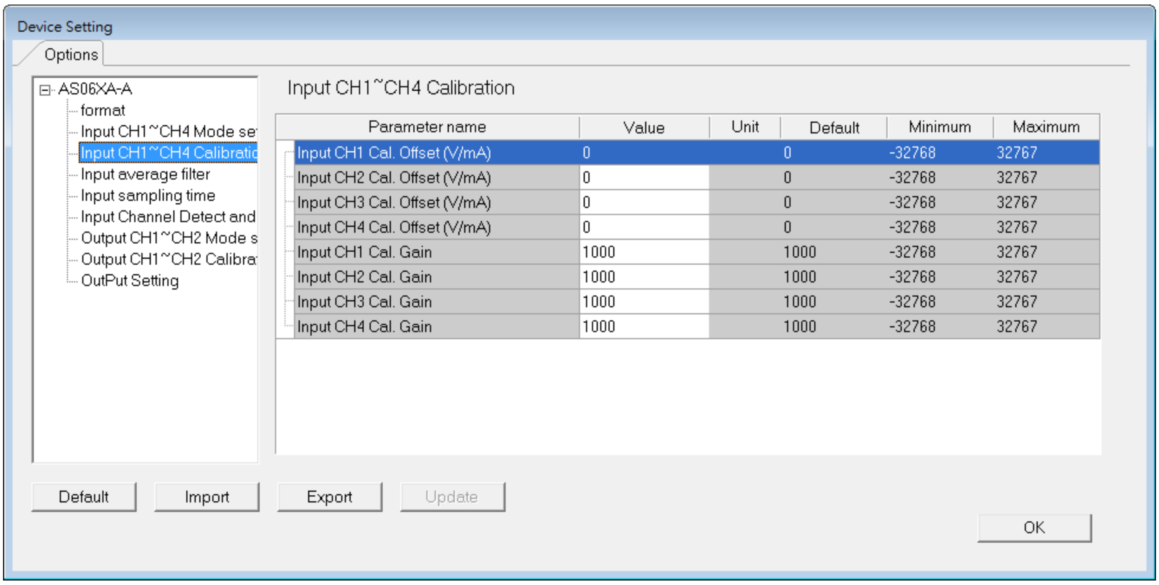
(1) The input modes of the channels



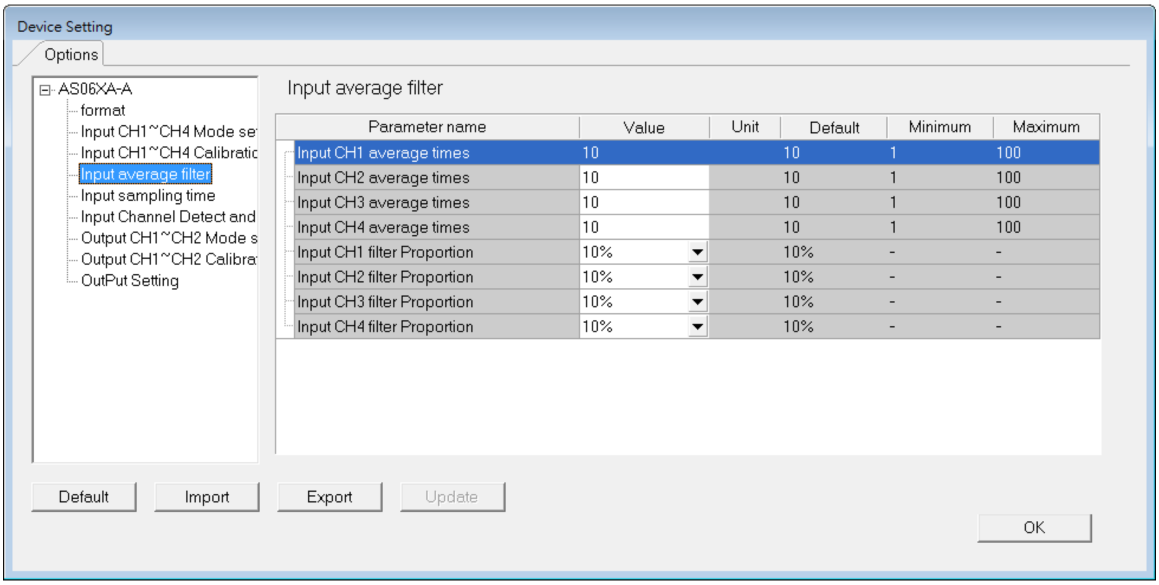

(2) Input CH1–CH4 (channel 1–channel 4) mode settings



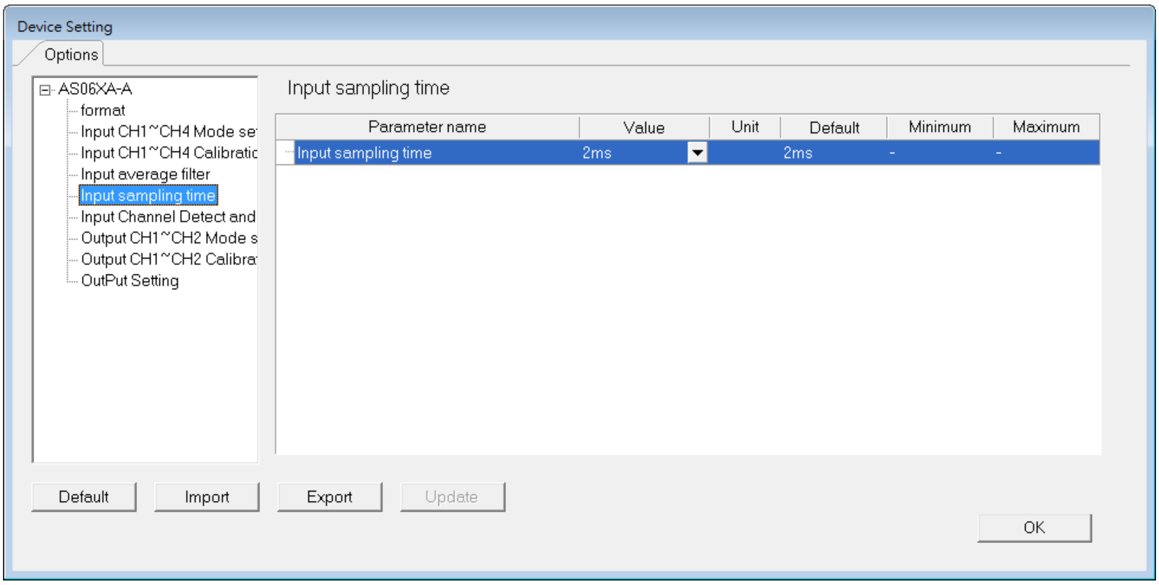
(3) Input CH1–CH4 calibration




(4) Input average filter

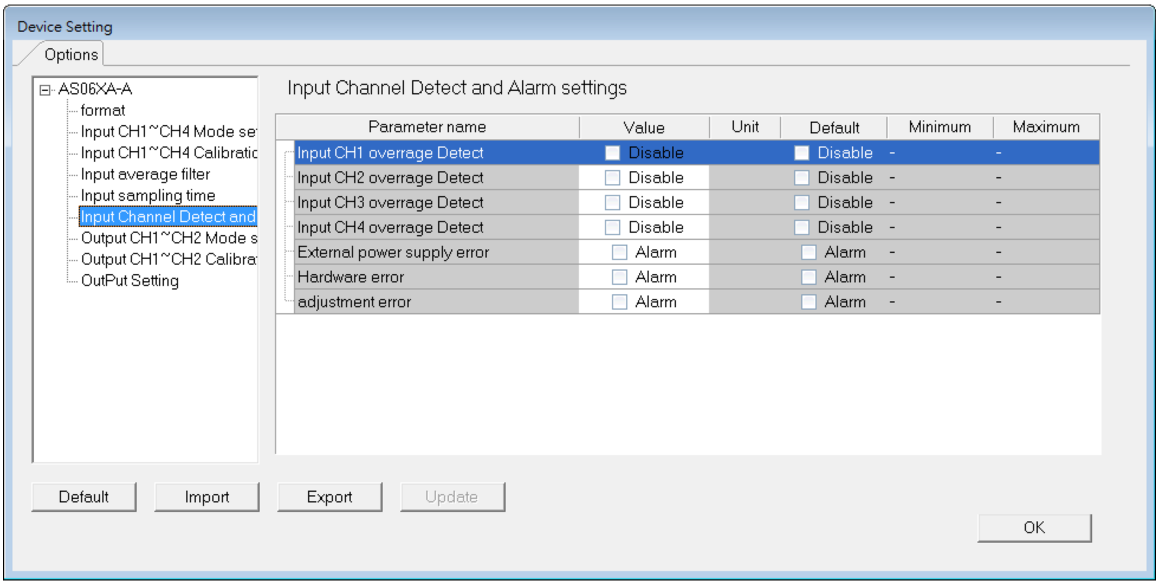


(5) Input sampling time

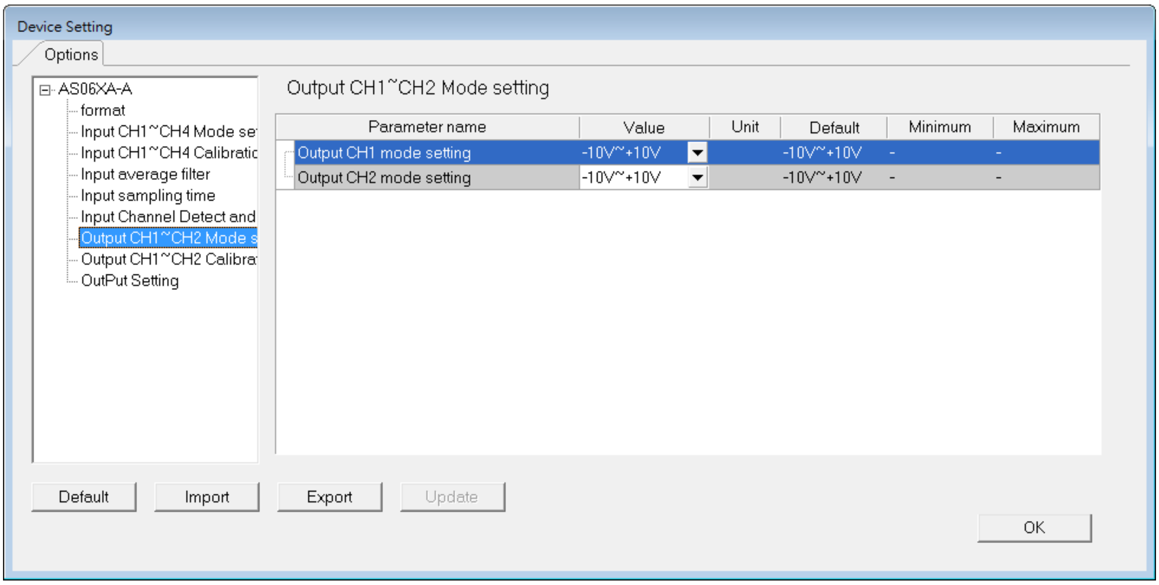




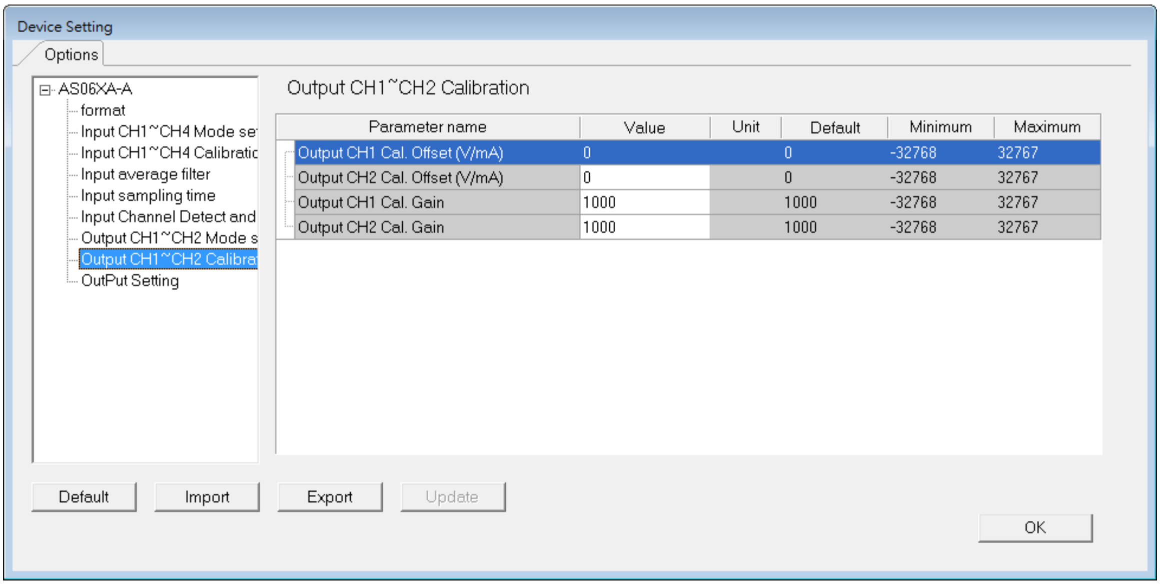

(6) Input channel detection and alarm settings



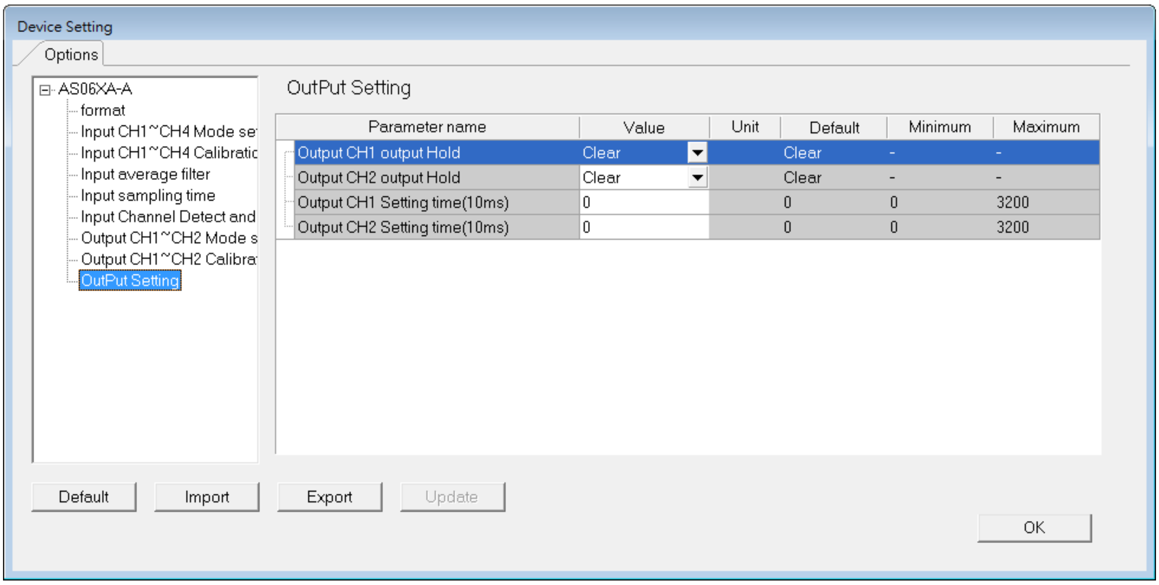
(7) Output CH1-CH2 mode settings




(8) Output CH1-2 calibration



(9) Output Settings




# 4.4 Troubleshooting

## 4.4.1 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<br>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. | | |

### 4.4.2 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<br>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. |

4

5

# Chapter 5 Temperature Measurement Module AS04/06RTD

## Table of Contents

# 5.1 Overview

## 5.1.1 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.

## 5.1.2 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.

# 5.2 Specifications and Functions

## 5.2.1 Specifications

- **Electrical specifications**

| **Module** | **AS04RTD-A** | **AS06RTD-A** |
|---|---|---|
| Number of Analog Inputs | 4 | 6 |
| Applicable Sensor | 2-Wire & 3-Wire<br>Pt100/Ni100/Pt1000/Ni1000/JPt100/LG-Ni1000/Cu50/Cu100/0–300 Ω/0–3000 Ω<br>Pt100: DIN 43760-1980 JIS C1604-1989; 100 Ω 3850 PPM/°C<br>Pt1000: DIN EN60751; 1 kΩ 3850 PPM/°C<br>Ni100/Ni1000: DIN 43760<br>JPt100: JIS C1604-1989<br>LG-Ni1000<br>Cu50/Cu100 | |
| Supply Voltage | 24 VDC (20.4–28.8 VDC) (-15% to +20%) | |
| Connector Type | Removable terminal block | |
| Overall Accuracy | Pt100/Ni100/Pt1000/Ni1000/JPt100<br>25° C/77° F: The allowed error range is ±0.1% of full scale.<br>-20° C to 60° C/-4° F to 140° F: The allowed error range is ±0.5% of full scale. | |
| | LG-Ni1000<br>25° C/77° F: The allowed error range is ±0.1% of full scale. | |
| | Cu50<br>25° C/77° F: The allowed error range is ±4% of full scale. | |
| | Cu100<br>25° C/77° F: The allowed error range is ±2% of full scale. | |
| Conversion Time | Two-wire/Three-wire configuration: 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.<br>Isolation between a digital circuit and the ground: 500 VDC<br>Isolation between an analog circuit and the ground: 500 VDC<br>Isolation between an analog circuit and the digital circuit: 500 VDC<br>Isolation between the 24 VDC and the ground: 500 VDC | |

| | | |
|---|---|---|
| Weight | 115 g | 125 g |

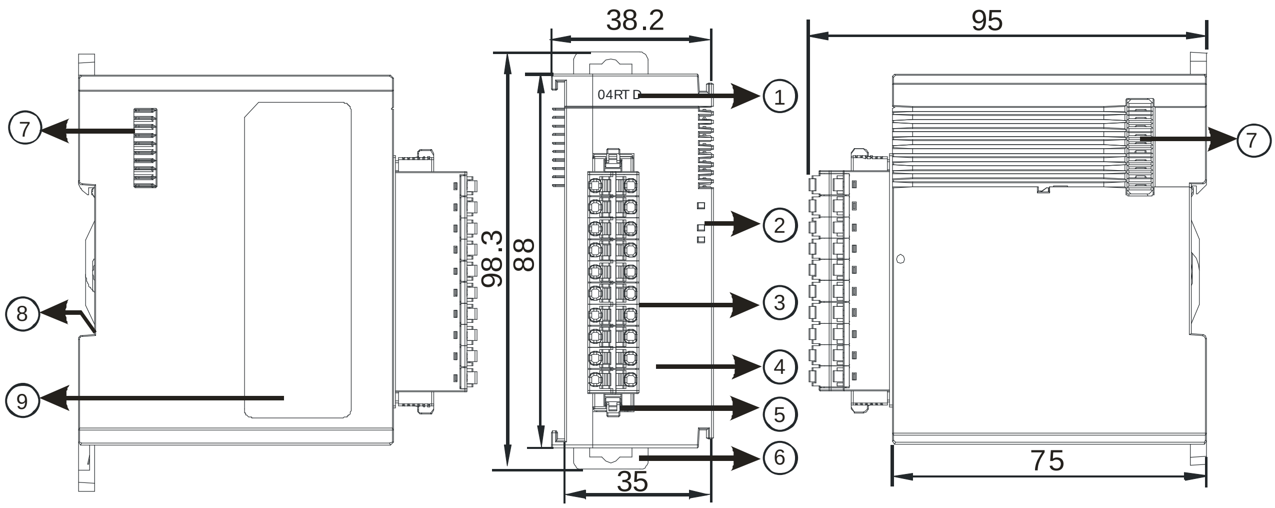
- **Functional specifications**

| Analog-to-Digital Conversion | Centigrade (°C) | Fahrenheit (°F) | Input Impedance |
|---|---|---|---|
| **Rated Input Range**[*1] | Pt100 : -180° C to +800° C<br>Ni100 : -80° C to +170° C<br>Pt1000 : -180° C to +800° C<br>Ni1000 : -80° C to +170° C<br>JPt100 : -180° C to +500° C<br>LG-Ni1000 : -50° C to +180° C<br>Cu50 : -50° C to +150° C<br>Cu100 : -50° C to +150° C | Pt100 : -292° F to +1,472° F<br>Ni100 : -112° F to +338° F<br>Pt1000 : -292° F to +1,472° F<br>Ni1000 : -112° F to +338° F<br>JPt100 : -292° F to +932° F<br>LG-Ni1000 : -58° F to +356° F<br>Cu50 : -58° F to +302° F<br>Cu100 : -58° F to +302° F | 0–300 Ω<br>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.

5

## 5.2.2 Profile

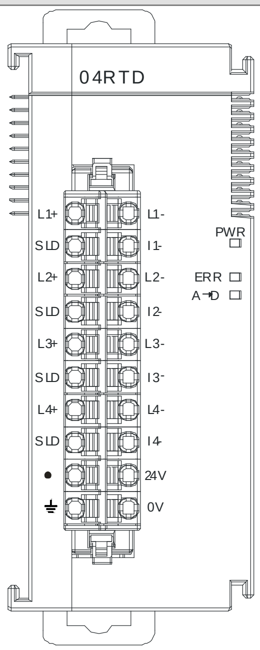


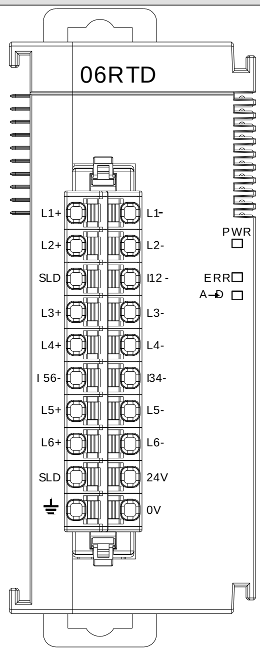

Unit: mm

| Number | Name | Description |
|---|---|---|
| 1 | Model Name | Model name of the module |
| 2 | RUN LED Indicator | Operating status of the module<br>ON: the module is running. |

| Number | Name | Description |
|---|---|---|
| | | OFF: the module is not running. |
| | ERROR LED Indicator | Error status of the module<br>ON: a serious error exists in the module.<br>OFF: the module is operating normally.<br>Blink: a minor error exists in the module. |
| | Digital-to-Analog Conversion Indicator | Digital-to-analog conversion status<br>Blinking: conversion is in process.<br>OFF: conversion has stopped. |
| 3 | Removable Terminal Block | The inputs are connected to transducers.<br>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 | |

## 5.2.3 Arrangement of Terminals

<table>
<tr><th>AS04RTD-A</th><th>AS06RTD-A</th></tr>
<tr><td>


</td><td>


</td></tr>
</table>

## 5.2.4 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.

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

| CR# | Name | Description | Defaults |
|---|---|---|---|
| 19 | Channel 3 filter average percentage | | |
| 20 | Channel 4 filter average percentage | | |
| 21 | Units of temperature | 0: Fahrenheit<br>1: Celsius | 0 |
| 22 | Channel alarm setup | 0: open channel alarm<br>1: close channel alarm<br>bit0: channel 1<br>bit1: channel 2<br>bit2: channel 3<br>bit3: channel 4<br><br>0: warning<br>1: alarm<br>bit8: error in the power supply<br>bit9: error in the module hardware<br>bit10: error in calibration | 0 |
| 201 | Instruction set | 16#0101: record the peak value again for channel 1<br>16#0102: record the peak value again for channel 2<br>16#0104: record the peak value again for channel 3<br>16#0108: record the peak value again for channel 4<br>16#010F: record the peak values again for channels 1–4<br>16#0201: enable recording for channel 1<br>16#0202: enable recording for channel 2<br>16#0204: enable recording for channel 3<br>16#0208: enable recording for channel 4<br>16#020F: enable recording for channels 1–4<br>16#0211: disable recording for channel 1 | 0 |

| CR# | Name | Description | Defaults |
|---|---|---|---|
| | | 16#0212: disable recording for channel 2<br>16#0214: disable recording for channel 3<br>16#0218: disable recording for channel 4<br>16#021F: disable recording for channels 1–4<br>16#0502: restore default settings | |
| 210 | The maximum peak value for channel 1 | Integer format; the maximum peak value for analog inputs | - |
| 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 | - |
| 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<br>Range: 1–100<br>The time to record the digital value for the channels | 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 | 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 | -- |
| 4500-4999 | Records for channel 2 | 500 records for channel 2 | -- |
| 5000-5499 | Records for channel 3 | 500 records for channel 3 | -- |
| 5500-5999 | Records for channel 4 | 500 records for channel 4 | -- |

5

### 5.2.5 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.

| CR# | Name | Description | Defaults |
|---|---|---|---|
| 0 | Format Setup | 0: integer format<br>1: floating point format | 0 |
| 1 | Channel 1 mode setup | 0: closed<br>1：0–300 Ω (default)<br>2：0–3000 Ω<br>3：Pt100<br>4：JPt100<br>5：Pt1000<br>6：Ni100<br>7：Ni1000<br>8：LG-Ni1000<br>9：Cu50<br>10：Cu100 | 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 | 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 | 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 | 10 |
| 20 | Channel 2 average times | | |

| CR# | Name | Description | 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<br>Unit: ±10% | 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<br>1: Celsius | 0 |
| 32 | Channel alarm setup | 0: open channel alarm<br>1: close channel alarm<br>bit0: channel 1<br>bit1: channel 2<br>bit2: channel 3<br>bit3: channel 4<br>bit4: channel 5<br>bit5: channel 6<br><br>0: warning<br>1: alarm<br>bit8: error in the power supply<br>bit9: error in the module hardware<br>bit10: error in calibration | 0 |
| 201 | Instruction set | 16#0101: record the peak value again for channel 1<br>16#0102: record the peak value again for channel 2<br>16#0104: record the peak value again for channel 3 | 0 |

| CR# | Name | Description | Defaults |
|---|---|---|---|
| | | 16#0108: record the peak value again for channel 4<br>16#110: record the peak values again for channels 5<br>16#120: record the peak values again for channels 6<br>16#013: record the peak values again for channels 1-6<br><br>16#0201: enable recording for channel 1<br>16#0202: enable recording for channel 2<br>16#0204: enable recording for channel 3<br>16#0208: enable recording for channel 4<br>16#0210: enable recording for channels 5<br>16#0220: enable recording for channels 6<br>16#023F: enable recording for channels 1-6<br><br>16#0301: disable recording for channel 1<br>16#0302: disable recording for channel 2<br>16#0304: disable recording for channel 3<br>16#0308: disable recording for channel 4<br>16#0310: disable recording for channel 5<br>16#0320: disable recording for channel 6<br>16#033F: disable recording for channel1-6<br><br>16#0501: restore default settings, clear setting values in the Flash<br>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 | - |
| 211 | The maximum peak value for channel 2 | | - |
| 212 | The maximum peak value for channel 3 | | - |
| 213 | The maximum peak value for channel 4 | | - |

| CR# | Name | Description | Defaults |
|---|---|---|---|
| 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 | - |
| 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<br>Range: 1–100<br>The time to record the digital value for the channels | 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 | 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 |
| 244 | The number of records for channel 5 | | 0 |
| 245 | The number of records for channel 6 | | 0 |
| 4000<br>-4199 | Records for channel 1 | 200 records for channel 1 | - |
| 4500<br>-4699 | Records for channel 2 | 200 records for channel 2 | - |
| 5000<br>-5199 | Records for channel 3 | 200 records for channel 3 | - |
| 5500<br>-5699 | Records for channel 4 | 200 records for channel 4 | - |
| 6000<br>-6199 | Records for channel 4 | 200 records for channel 5 | - |
| 6500<br>-6699 | Records for channel 4 | 200 records for channel 6 | - |

### 5.2.6 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.<br>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.

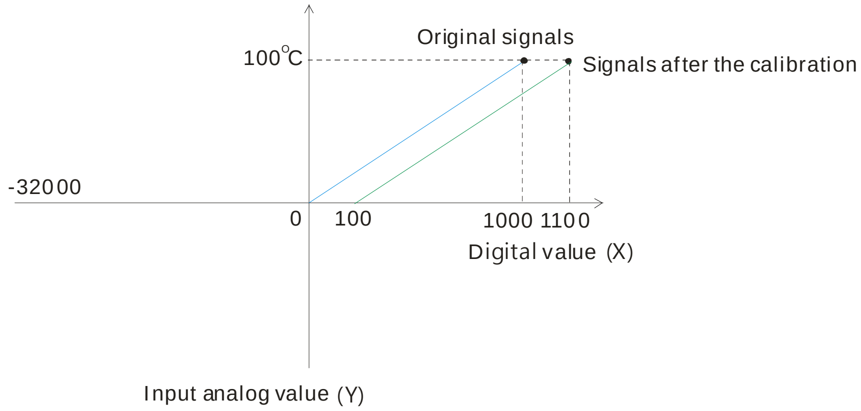
### 3. Calibration

- 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:

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

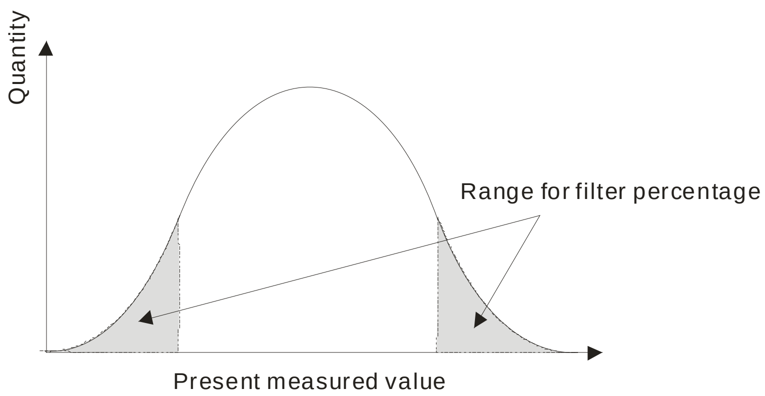
**Example:**

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**

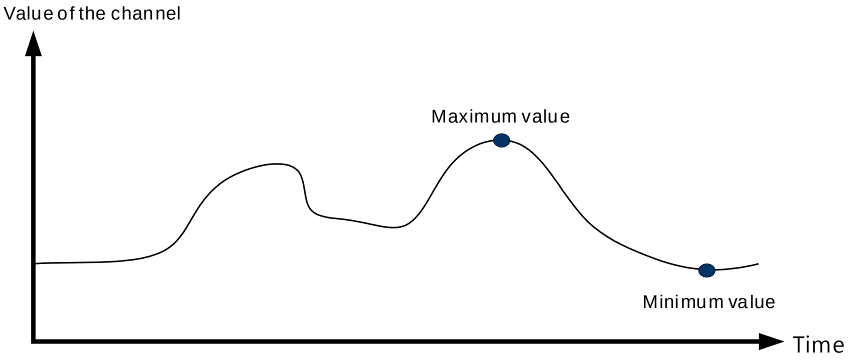
If the channel is open, the module can detect when it is disconnected. If the input is open-circuited, the module produces an alarm or a warning.

**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.

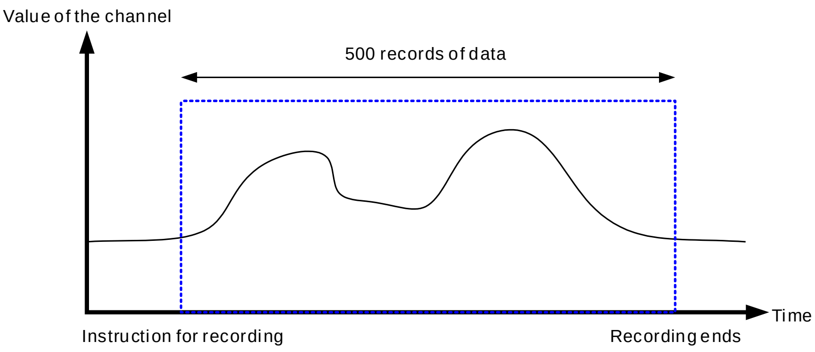
**7. Limit Detections for Channels**

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).

### 5.2.7 Control Mode

1. Refer to section 6.2.7 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.

### 5.2.8 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.

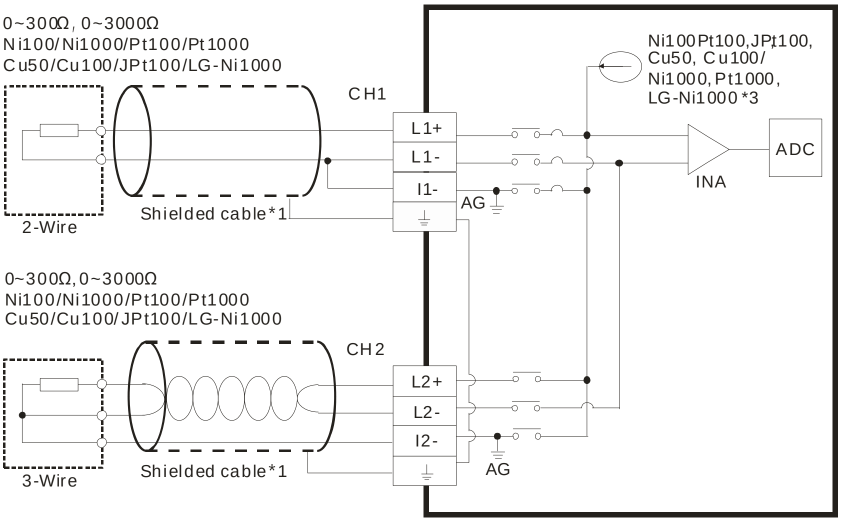
(3) Ground shielded cables and hermetically sealed cables separately.

(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.

- **External wiring**

(1) AS04RTD-A



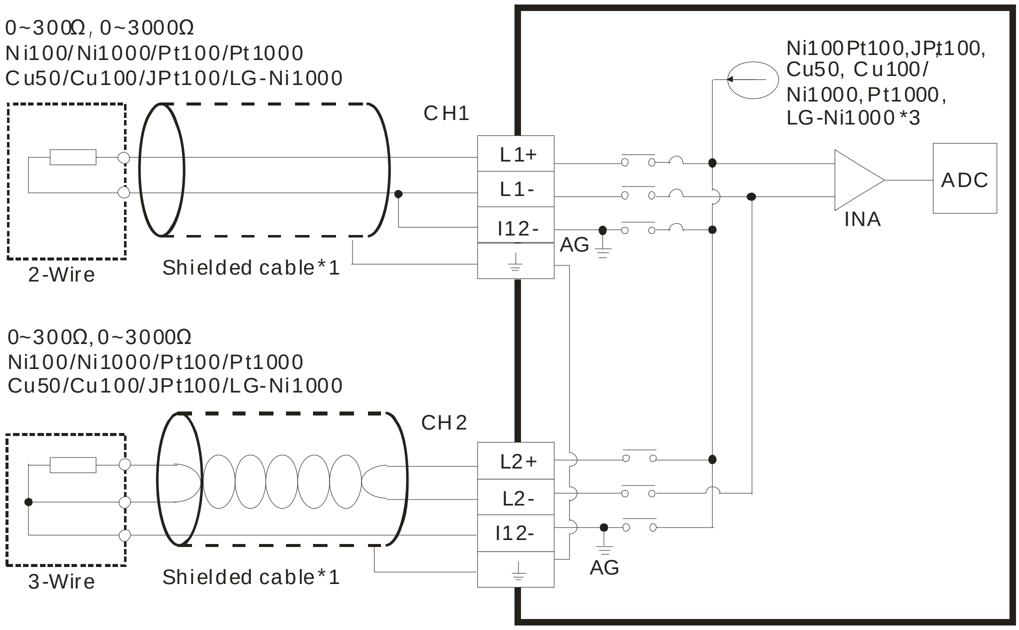

*1. Use shielded twisted pair cables for Ni100/Ni1000, Pt100/Pt1000, Cu50/Cu100, JPt100, and LG-Ni1000 temperature sensors, and keep them separate from power cables and other cables that generate noise. Use a three-wire temperature sensor. If you must use a two-wire temperature sensor, L**n**+ and I**n**+ must be short-circuited, and L**n**- and I**n**- also must be short-circuited (where **n** is between 1–4).

*2. If you want to measure resistance between 0-300 Ω, use a two-wire or three-wire sensor instead of a four-wire sensor.

*3. You must select an appropriate sensor. If you are using a Ni100 temperature sensor, a Pt100 sensor, a JPt100, a Cu50/Cu100, or a resistance sensor, the internal excitation current is 1.53 mA. If you are using a Ni1000 temperature sensor, a Pt1000 temperature sensor, or a LG-Ni1000 sensor, the internal excitation current is 204.8 µA.

5

(2) AS04RTD-A




*1. Use shielded twisted pair cables for Ni100/Ni1000, Pt100/Pt1000, Cu50/Cu100, JPt100, and LG-Ni1000 temperature sensors, and keep them separate from power cables and other cables that generate noise. Use a three-wire temperature sensor. If you must use a two-wire temperature sensor, Ln+ and In+ must be short-circuited, and Ln- and In- also must be short-circuited (where n is between 1–4).

*2. If you want to measure resistance between 0-300 Ω, use a two-wire or three-wire sensor instead of a four-wire sensor.

*3. You must select an appropriate sensor. If you are using a Ni100 temperature sensor, a Pt100 sensor, a JPt100, a Cu50/Cu100, or a resistance sensor, the internal excitation current is 1.0389 mA. If you are using a Ni1000 temperature sensor, a Pt1000 temperature sensor, or a LG-Ni1000 sensor, the internal excitation current is 208.3 μA.

### 5.2.9 LED Indicators

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

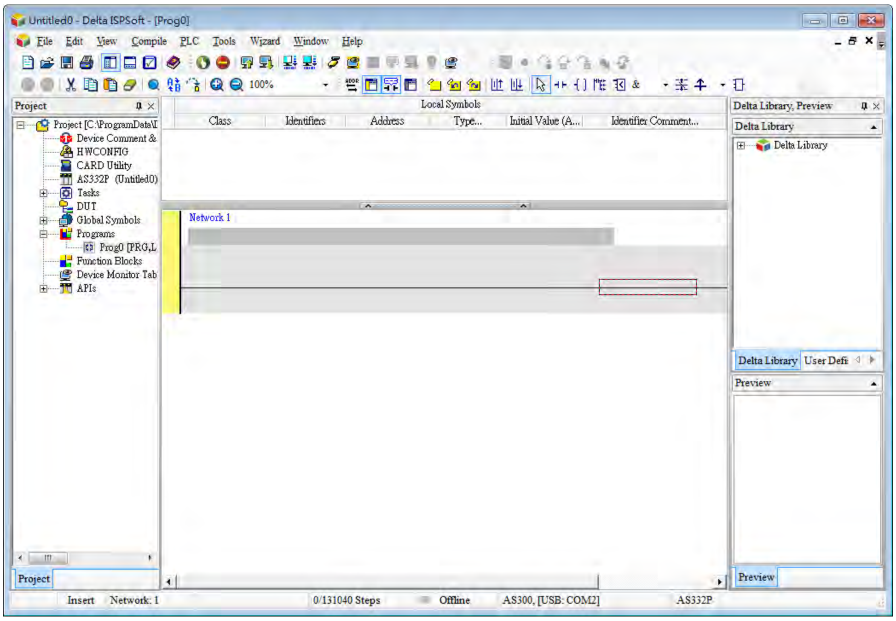


## 5.3. HWCONFIG in ISPSoft

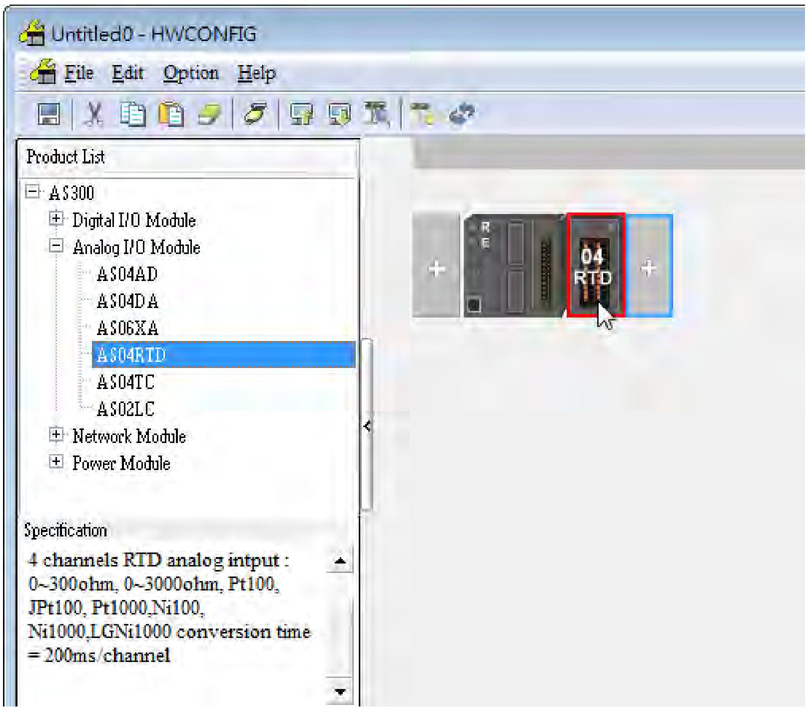
### 5.3.1 Initial Setting

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

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

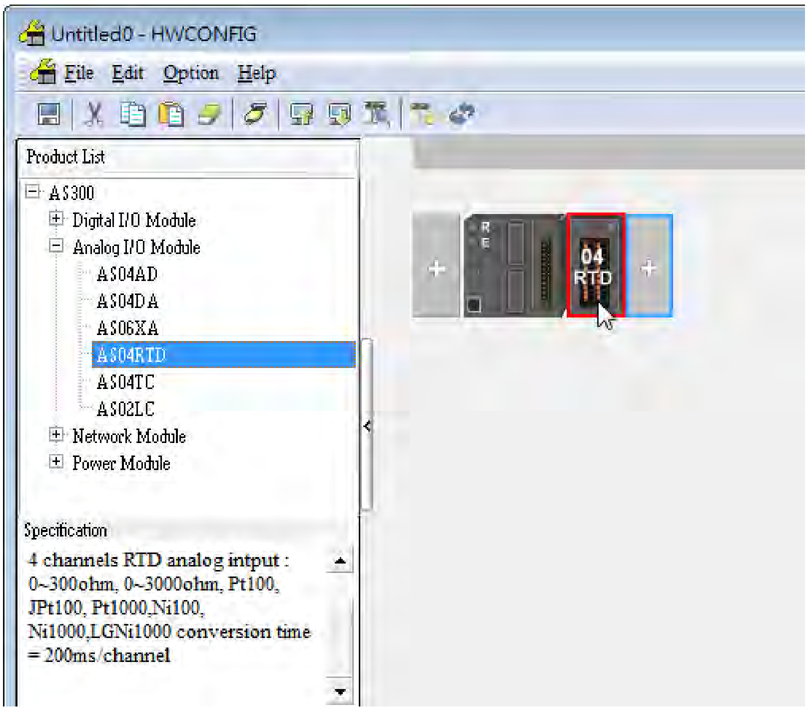


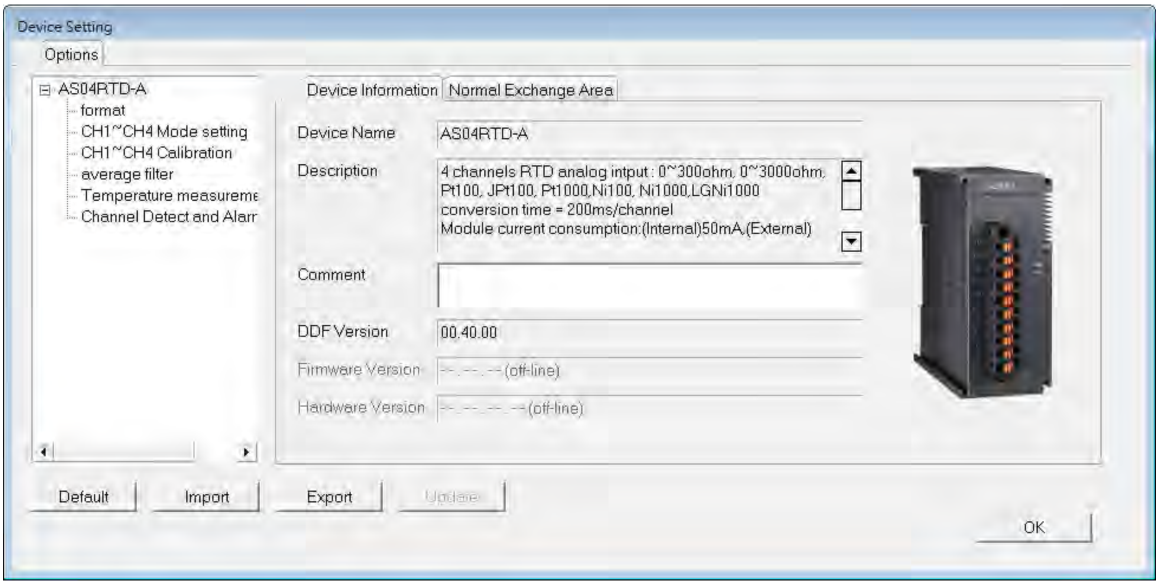
(2) Select a module and drag it to the working area.



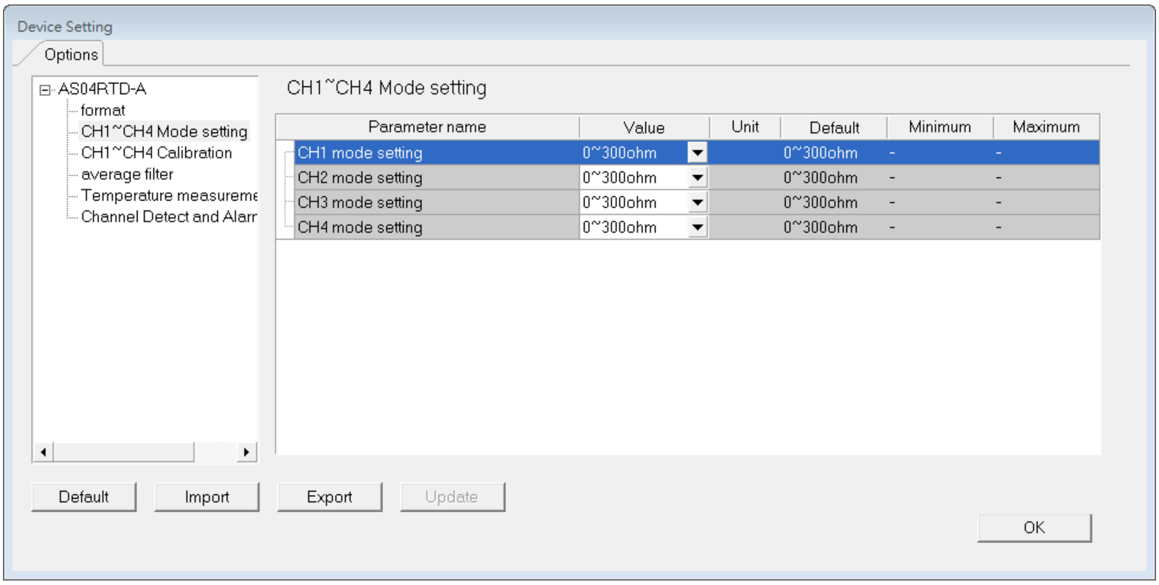



(3) Double-click the module in the working area to open the Device Setting page.

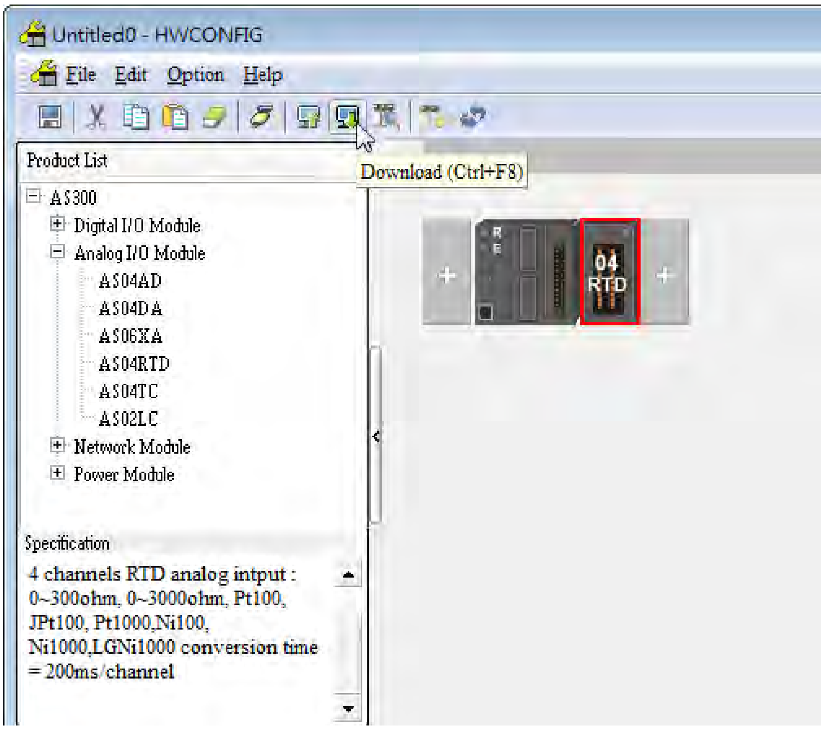





(4) Choose the parameter, set the values, and click **OK**.



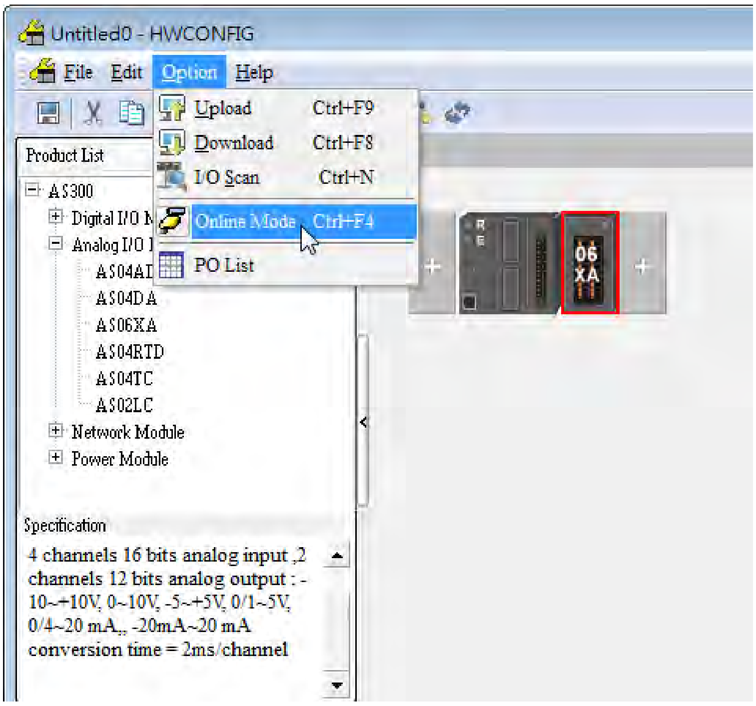
(5) Click **Download** on the toolbar to download the parameters. Note that you cannot download the parameters while the CPU module is running.



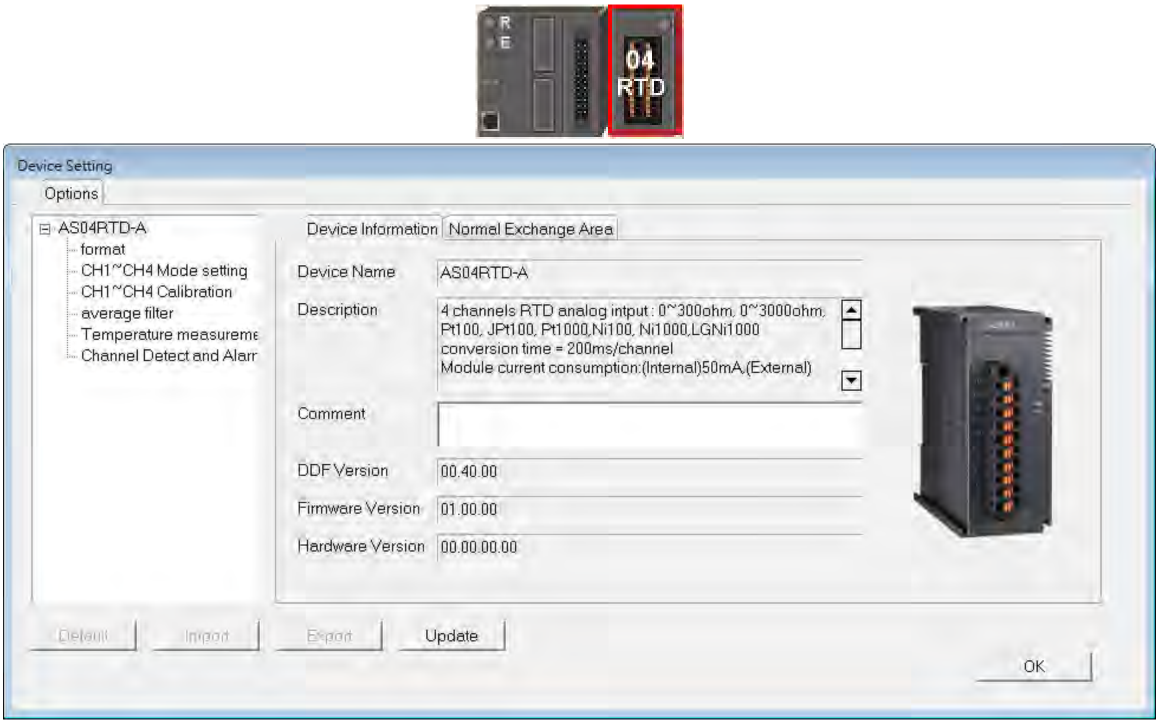



## 5.3.2 Checking the Version of a Module

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

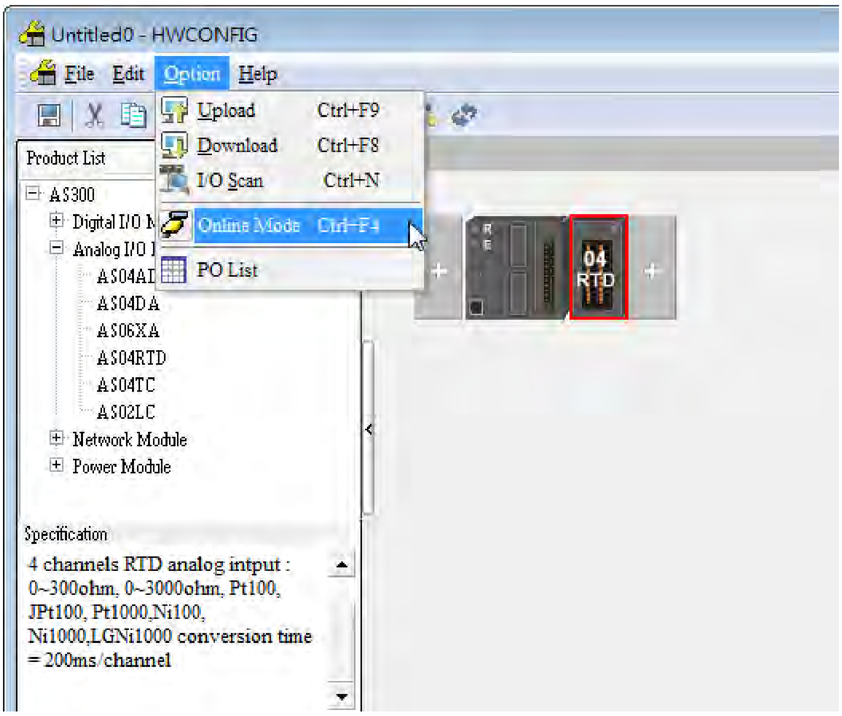


(2) Double-click the module to open the Device Setting page. The versions of both the firmware and the hardware are displayed.

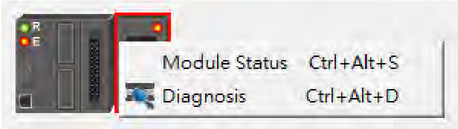



## 5.3.3 Online Mode

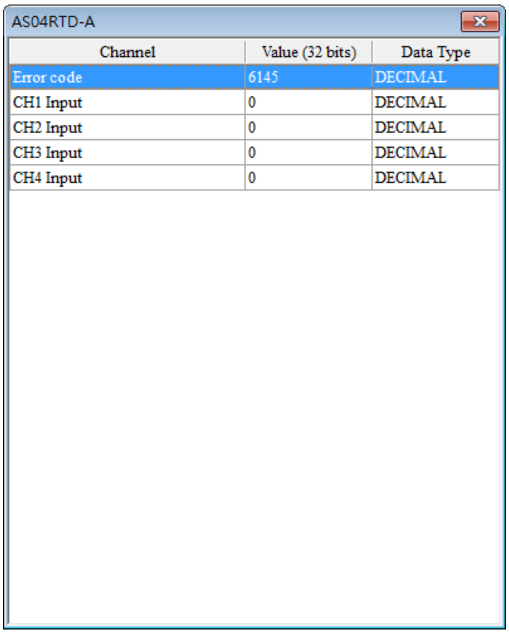
(1) On the **Option** menu, click **Online Mode**.



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

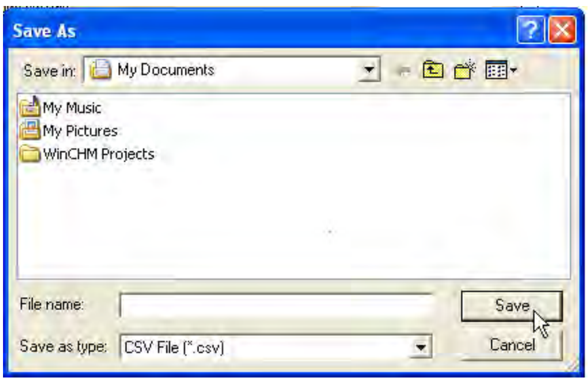



(3) View the module status.

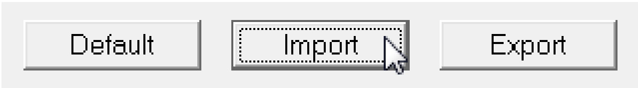


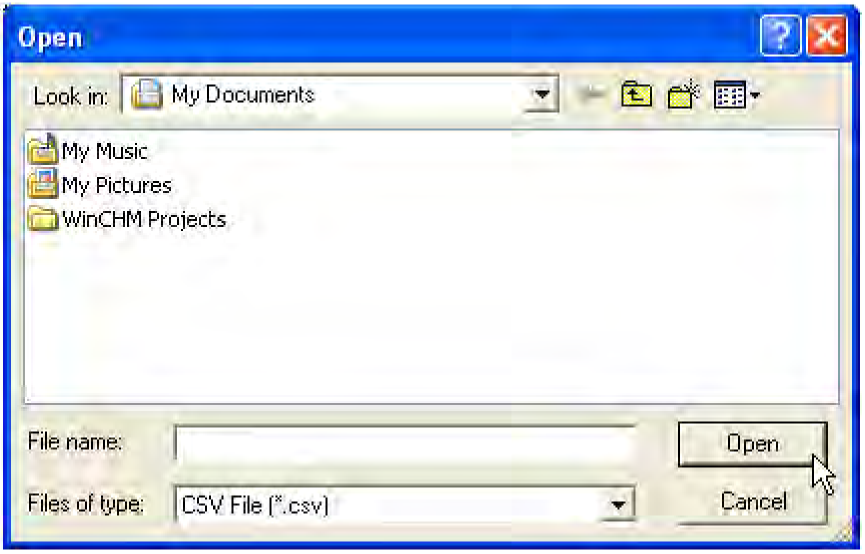

## 5.3.4 Importing/Exporting a Parameter File

(1) Click **Export** in the Device 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.

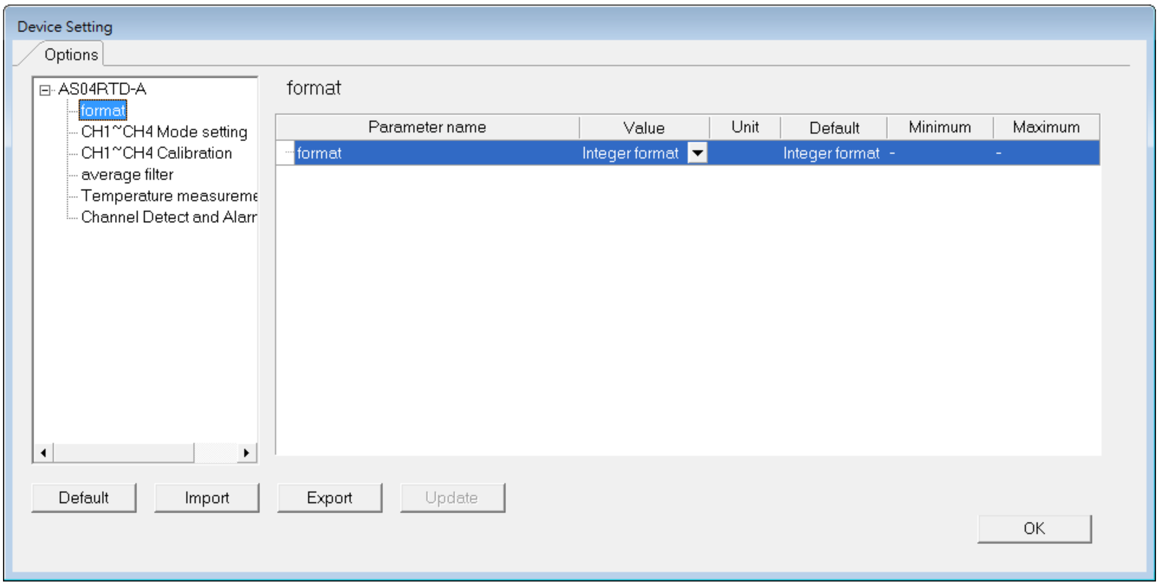


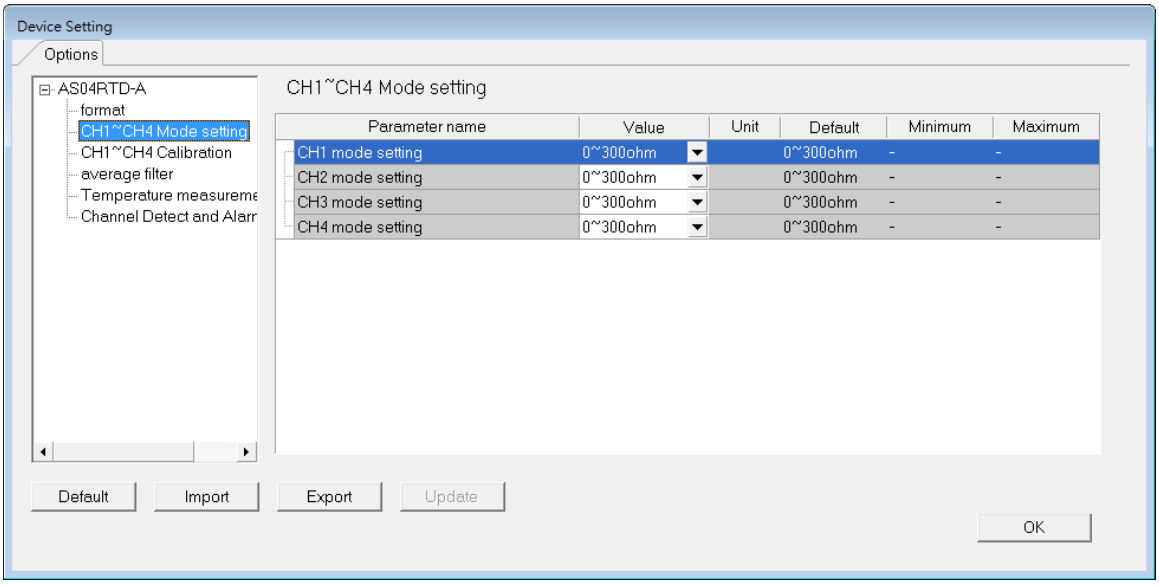



## 5.3.5 Parameters

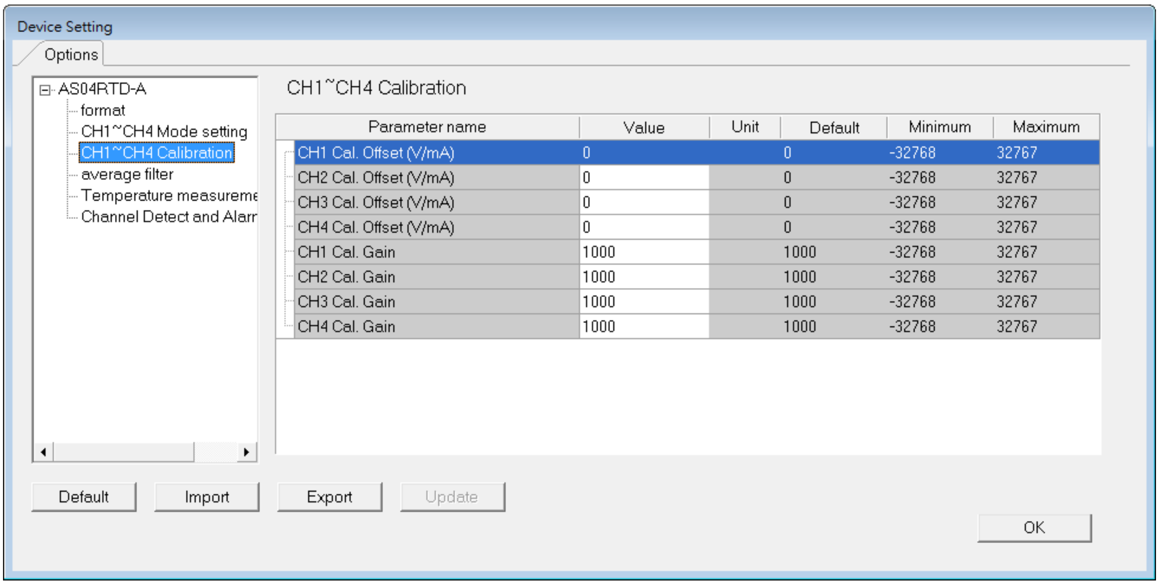
(1) The input modes of the channels



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

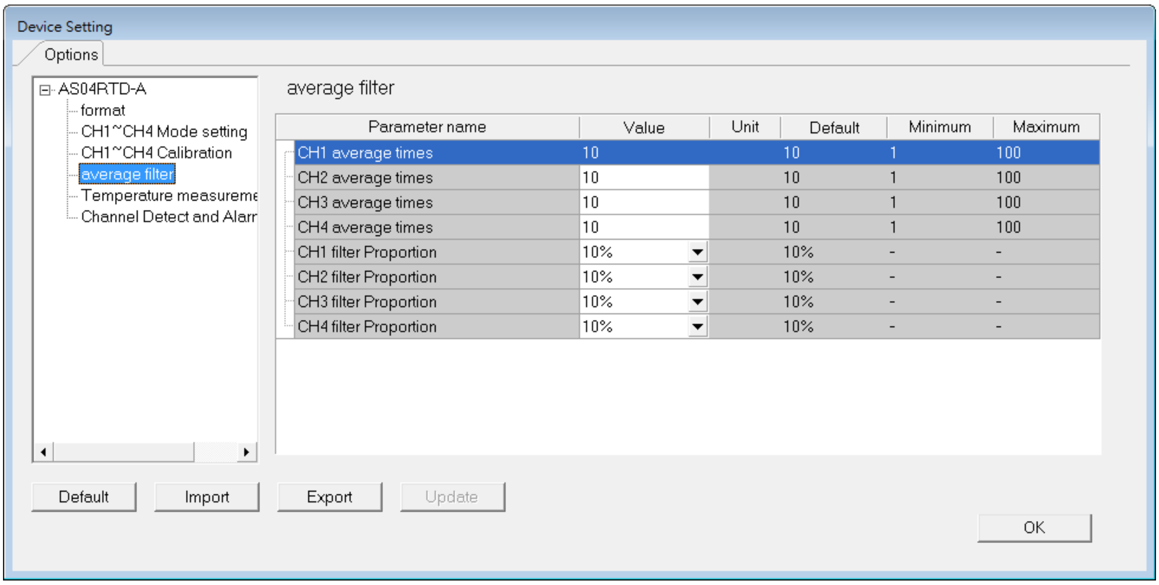



(3) Input CH1-CH4 calibration



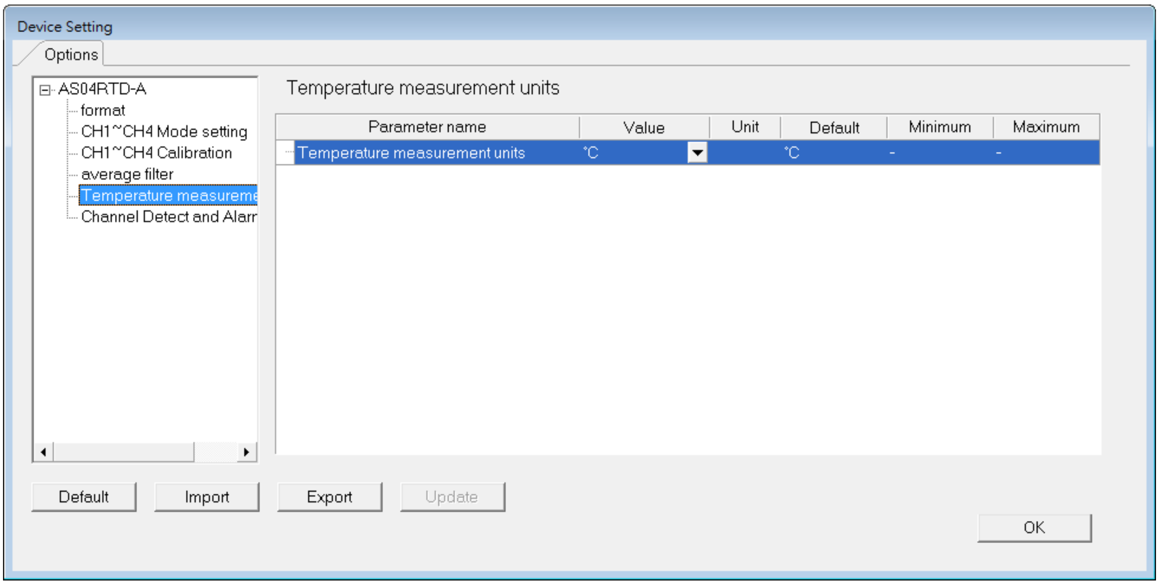

5

(4) Input average filter

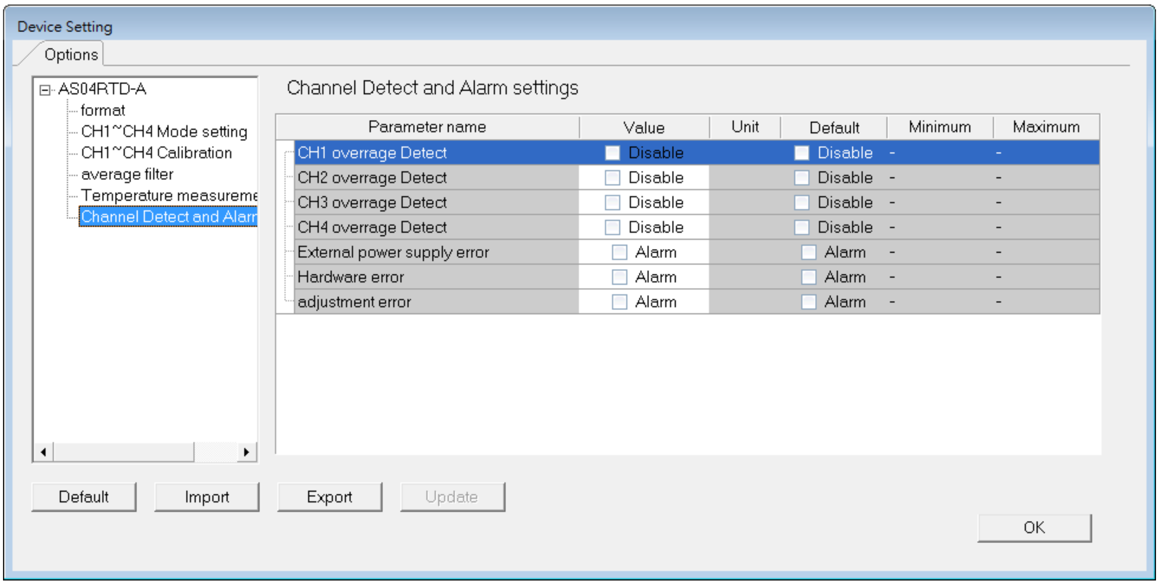



(5) Temperature measurement





(6) Input channel detection and alarm settings




# 5.4 Troubleshooting

## 5.4.1 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#1608</td><td>The factory calibration 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#1804</td><td>The factory calibration is abnormal.</td><td>OFF</td><td>Blinking</td></tr>
<tr><td>16#1808</td><td>The signal received by channel 1 exceeds the range of inputs that the hardware can receive.</td><td rowspan="4">Run: blinking<br>Stop: OFF</td><td rowspan="4">Blinking</td></tr>
<tr><td>16#1809</td><td>The signal received by channel 2 exceeds the range of inputs that the hardware can receive.</td></tr>
<tr><td>16#180A</td><td>The signal received by channel 3 exceeds the range of inputs that the hardware can receive.</td></tr>
<tr><td>16#180B</td><td>The signal received by channel 4 exceeds the range of inputs that the hardware can receive.</td></tr>
</table>

| Error Code | Description | A↔ D LED Indicator | ERROR LED Indicator |
|---|---|---|---|
| 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. | | |

### 5.4.2 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<br>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. |

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

**MEMO**

6

# Chapter 6 Temperature Measurement Module AS04/08TC

## Table of Contents

## 6.1 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.

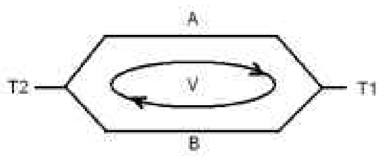
A thermocouple consists of a circuit having two wires of different metals or metal alloys welded together or joined at both ends. One of the junctions—normally the cold junction—is maintained at a known reference temperature, and the other junction is at the temperature to be sensed. A temperature gradient 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.

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

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.

### 6.1.1 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.

# 6.2 Specifications and Functions

## 6.2.1 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.<br>-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.<br>Isolation between a digital circuit and the ground: 500 VDC<br>Isolation between an analog circuit and the ground: 500 VDC<br>Isolation between an analog circuit and a digital circuit: 500 VDC<br>Isolation between the 24 VDC and the ground: 500 VDC<br>Isolation between analog channels: 120 VAC | |
| **Weight** | 115g | 125g |

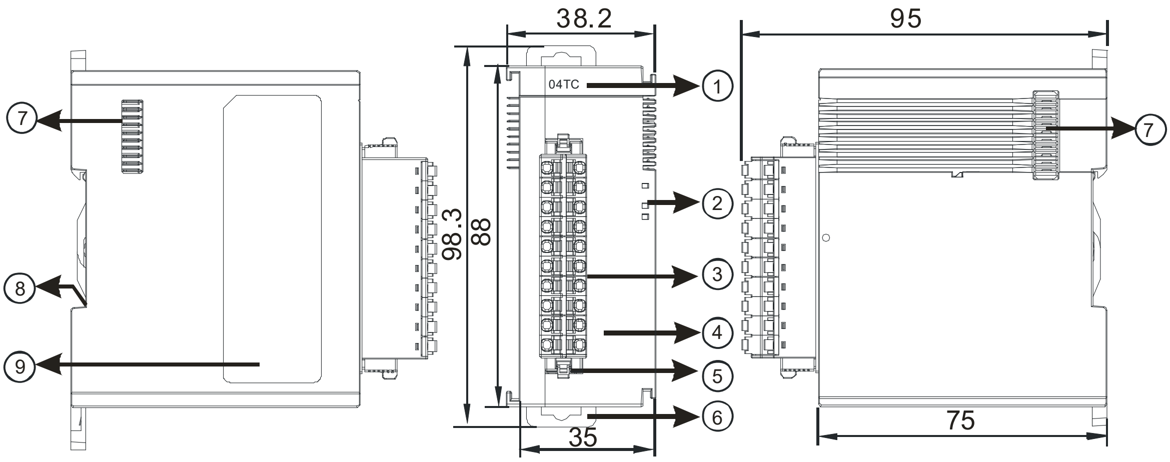
6

- **Functional specifications**

| **Analog-to-Digital Conversion** | **Centigrade (°C)** | **Fahrenheit (°F)** | **Voltage Input** |
|---|---|---|---|
| **Rated Input Range**[*1] | Type J: -100° C to +1,200° C<br>Type K: -100° C to +1,350° C<br>Type R: 0° C to 1,750° C<br>Type S: 0° C to 1,750° C<br>Type T: -150° C to +400° C<br>Type E: -150° C to +980° C<br>Type N: -150° C to +1,300° C<br>Type B: 200° C to +1,800° C | Type J: -148° F to +2,192° F<br>Type K: -148° F to +2,462° F<br>Type R: 32° F to 3,182° F<br>Type S: 32° F to 3,182° F<br>Type T: -238° F to +734° F<br>Type E: -238° F to +1,796° F<br>Type N: -238° F to +2,372° F<br>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.

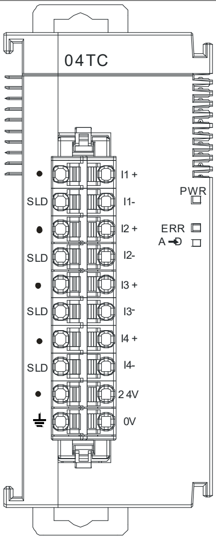
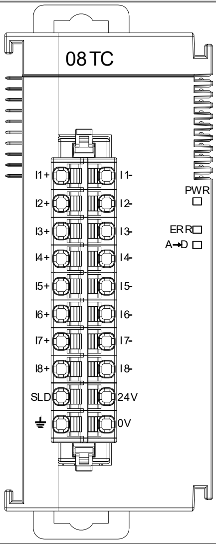
## 6.2.2 Profile




Unit: mm

| Number | Name | Description |
|---|---|---|
| 1 | Model Name | Model name of the module |
| 2 | RUN LED Indicator | Operating status of the module<br>ON: the module is running.<br>OFF: the module is not running. |
| | ERROR LED Indicator | Error status of the module<br>ON: a serious error exists in the module.<br>OFF: the module is operating normally.<br>Blink: a minor error exists in the module. |
| | Digital to Analog Conversion Indicator | Digital-to-analog conversion status<br>Blinking: conversion is in process.<br>OFF: conversion has stopped. |
| 3 | Removable Terminal Block | The inputs are connected to transducers.<br>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 | |

## 6.2.3 Arrangement of Terminals

| AS04TC-A | AS08TC-A |
|---|---|
|   |   |



## 6.2.4 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.

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

| CR# | Name | Description | Defaults |
|---|---|---|---|
| 9 | Channel 1 gain | Range: -32768 to +32767 | 1000 |
| 10 | Channel 2 gain | | |
| 11 | Channel 3 gain | | |
| 12 | Channel 4 gain | | |
| 13 | Channel 1 average times | Range: 1–100 | 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<br>Unit: ±10% | 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<br>1: Celsius | 0 |
| 22 | Channel alarm setup | 0: open channel alarm<br>1: close channel alarm<br>bit0: channel 1<br>bit1: channel 2<br>bit2: channel 3<br>bit3: channel 4<br><br>0: warning<br>1: alarm<br>bit8: error in the power supply<br>bit9: error in the module hardware<br>bit10: error in calibration<br>bit11: error in CJC temperature | 0 |

6

| CR# | Name | Description | Defaults |
|---|---|---|---|
| 201 | Instruction set | 16#0101: record the peak value again for channel 1<br>16#0102: record the peak value again for channel 2<br>16#0104: record the peak value again for channel 3<br>16#0108: record the peak value again for channel 4<br>16#010F: record the peak values again for channels 1–4<br>16#0201: enable recording for channel 1<br>16#0202: enable recording for channel 2<br>16#0204: enable recording for channel 3<br>16#0208: enable recording for channel 4<br>16#020F: enable recording for channels 1–4<br>16#0211: disable recording for channel 1<br>16#0212: disable recording for channel 2<br>16#0214: disable recording for channel 3<br>16#0218: disable recording for channel 4<br>16#021F: disable recording for channels 1–4<br>16#0502: restore default settings | 0 |
| 210 | The maximum peak value for channel 1 | Integer format; the maximum peak value for analog inputs | - |
| 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 | - |
| 215 | The minimum peak value for channel 2 | | - |
| 216 | The minimum peak value for | | - |

| CR# | Name | Description | Defaults |
|---|---|---|---|
| | channel 3 | | |
| 217 | The minimum peak value for channel 4 | | - |
| 222 | The time to record for channel 1 | Unit: 100 ms<br>Range: 1–100<br>The time to record the digital value for the channels | 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 | 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 | -- |
| 4500-4999 | Records for channel 2 | 500 records for channel 2 | -- |
| 5000-5499 | Records for channel 3 | 500 records for channel 3 | -- |
| 5500-5999 | Records for channel 4 | 500 records for channel 4 | -- |

## 6.2.5 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.

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

| CR# | Name | Description | Defaults |
|---|---|---|---|
| 25 | Channel 1 average times | Range: 1–100 | 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<br>Unit: ±10% | 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 percentage | | |
| 41 | Units of temperature | 0: Fahrenheit<br>1: Celsius | 0 |
| 42 | Channel alarm setup | 0: open channel alarm<br>1: close channel alarm<br>bit0: channel 1<br>bit1: channel 2<br>bit2: channel 3<br>bit3: channel 4 | 0 |

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

| CR# | Name | Description | Defaults |
|---|---|---|---|
| | | 16#0210: enable recording for channel 5<br>16#0220: enable recording for channel 6<br>16#0240: enable recording for channel 7<br>16#0280: enable recording for channel 8<br>16#02FF: enable recording for channels 1-8<br><br>16#0301: disable recording for channel 1<br>16#0302: disable recording for channel 2<br>16#0304: disable recording for channel 3<br>16#0308: disable recording for channel 4<br>16#0310: disable recording for channel 5<br>16#0320: disable recording for channel 6<br>16#0340: disable recording for channel 7<br>16#0380: disable recording for channel 8<br>16#03FF: disable recording for channels 1-8<br><br>16#0501: restore default settings, clear setting values in the Flash<br>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 | - |
| 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 | | - |

6

| CR# | Name | Description | 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 | - |
| 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<br>Range: 1–100<br>The time to record the digital value for the channels | 1 |
| 227 | The time to record for channel 2 | | 1 |
| 228 | The time to record for channel 3 | | 1 |
| 229 | The time to record for channel 4 | | 1 |
| 230 | The time to record for channel 5 | | 1 |
| 231 | The time to record for channel 6 | | 1 |
| 232 | The time to record for channel 7 | | 1 |
| 233 | The time to record for channel 8 | | 1 |

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

6

## 6.2.6 Functions

| Item | Function | Description |
|---|---|---|
| 1 | Enable/Disable a Channel | 1. Enable or disable a channel.<br>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**

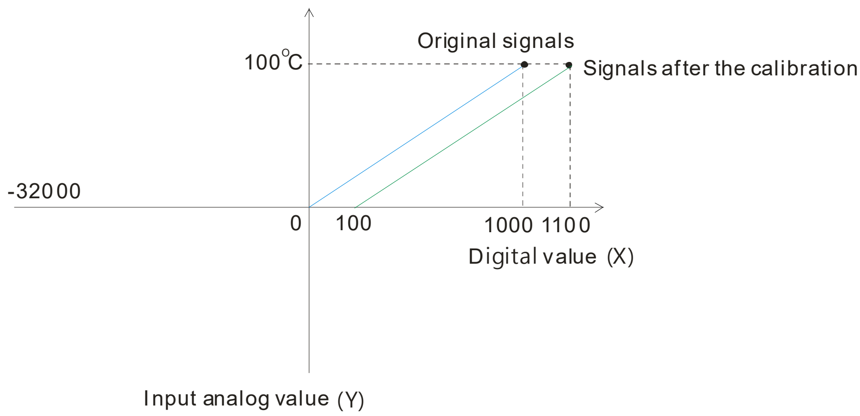
To make a curve meet specific needs, calibrate the curve by changing the offset and the gain. The calibration range depends on the range of inputs that the hardware can receive. The formula is:

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

**Example:**

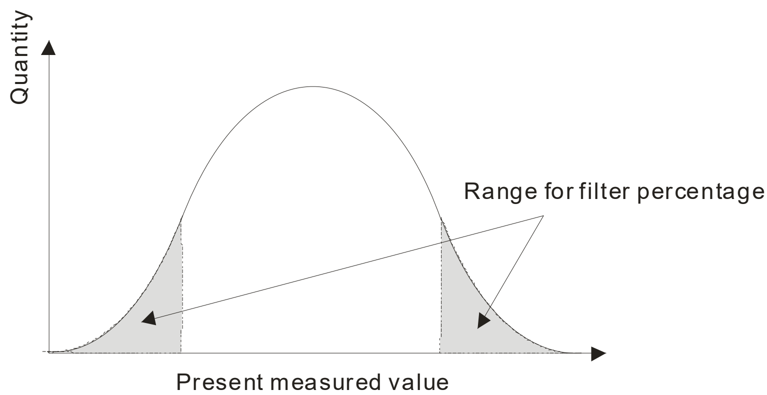
If the gain is 1000 and the offset is 0, the corresponding value for the original signal 0° C to 100° C is 0–1000. If you change the offset to 100, the calibrated value for the original signal 0° C to 100° C becomes 100–1100.

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.

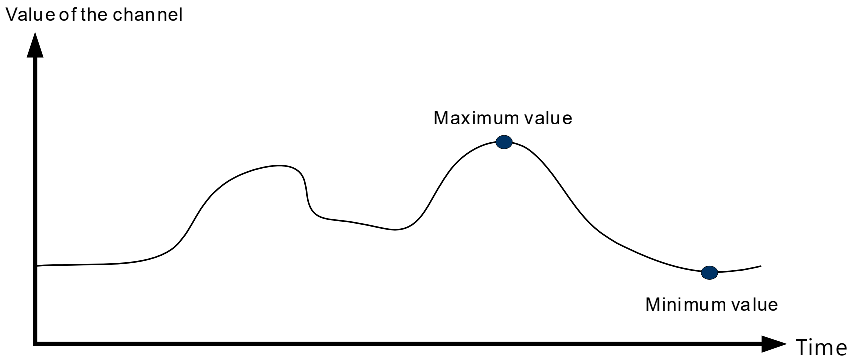
6

**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.

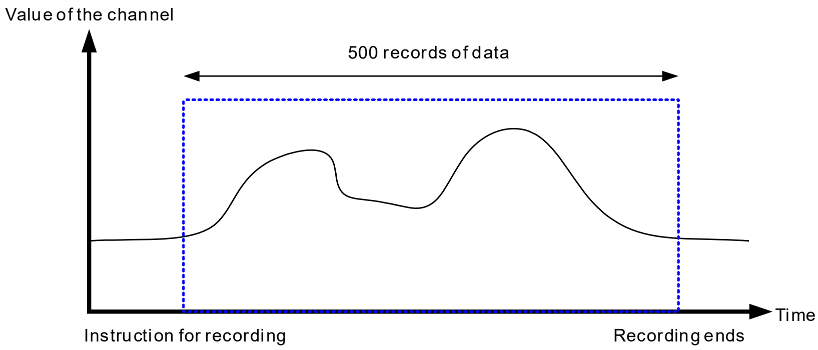
**7. Limit Detections for Channels**

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 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

**Use DMPID to execute PID control**

| 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 connected | |

| Operand | Data type | Function | Setting range | Description |
|---|---|---|---|---|
| | | | 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.<br>False: After updating is complete, it refreshes to False. | |
| **PID_RUN** | BOOL | Enabling the PID algorithm | True: use the PID algorithm.<br>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<br>When PID_MAN switches from True to False, invoke the output value (MV) in the automatic algorithm.<br>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)<br>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<br>Output the MV according to MOUT. This setting has no effect when PID_MODE is set to 1.<br>False: Automatic | |

| Operand | Data type | Function | Setting range | Description |
|---|---|---|---|---|
| | | | Output the MV according to the PID algorithm. | |
| **MOUT_AUTO** | BOOL | MOUT automatic change mode | True: Automatic<br>MOUT varies with the MV.<br>False: Normal<br>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 | Calculated proportional coefficient (Kc or Kp)<br>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- | 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 |
|---|---|---|---|---|
| | | | point numbers (unit: sec) | |
| **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<br>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).<br>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)<br>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 |

6

| Operand | Data type | Function | Setting range | Description |
|---|---|---|---|---|
| | | | | 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 according to the normal processing. |
| **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. |

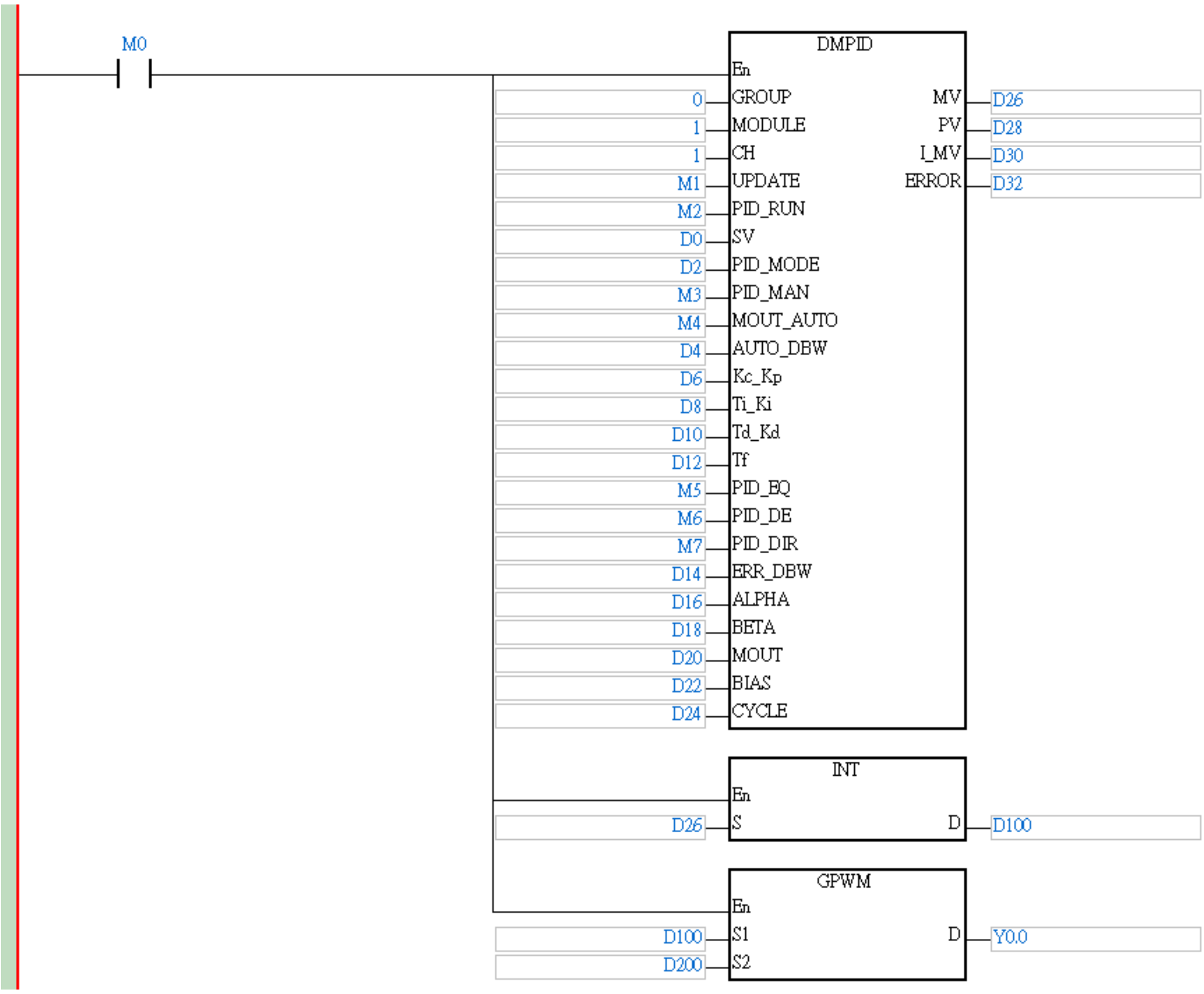
| Operand | Data type | Function | Setting range | Description |
|---|---|---|---|---|
| **BIAS** | DWORD/DINT | Feed forward output value | -32768~32767 | Feed forward output value, used for the PID feed forward. |
| **CYCLE** | DWORD/DINT | Sampling time ($T_S$) | 1~1000 (unit: 100 ms) | When the instruction 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<br>16#1400：the module you are using does not support this instruction.<br>16#1401：group number or module number setting error<br>16#1402：the module you are using does not respond and communication time out<br>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 swith 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 paraemters 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 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) to data devices. You can also use retentive devices to retain PID parameters.



**Use PID parameters**

| CR# | | | | | | | | Operand | Function | Description | Range |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 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.<br>0: the output value (MV) is reset to 0, and the PID algorithm is not implemented. | 0 |
| 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<br>When PID_MAN is switched from 1 to 0, the output value (MV) is included in the automatic algorithm.<br>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 | 0 |

| CR# | | | | | | | | Operand | Function | Description | Range |
|---|---|---|---|---|---|---|---|---|---|---|---|
| CH1 | CH2 | CH3 | CH4 | CH5 | CH6 | CH7 | CH8 | | | | |
| | | | | | | | | | | appropriately. | |
| 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.<br>1: manual; the MV is output based on the MOUT. When PID_MODE is also set to 1, this setting is ineffective. | 0 |
| 604 | 634 | 664 | 694 | 724 | 754 | 784 | 814 | MOUT_AUTO | MOUT automatic change mode | 0: normal; the MOUT does not vary with the MV.<br>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<br>607 | 636<br>637 | 666<br>667 | 696<br>697 | 726<br>727 | 756<br>757 | 786<br>787 | 816<br>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 |

| CR# | | | | | | | | Operand | Function | Description | Range |
|---|---|---|---|---|---|---|---|---|---|---|---|
| CH1 | CH2 | CH3 | CH4 | CH5 | CH6 | CH7 | CH8 | | | | |
| 608<br>609 | 638<br>639 | 668<br>669 | 698<br>699 | 728<br>729 | 758<br>759 | 788<br>789 | 818<br>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<br>611 | 640<br>641 | 670<br>671 | 700<br>701 | 730<br>731 | 760<br>761 | 790<br>791 | 820<br>821 | Td_Kd | Derivative coefficient (Td or $K_d$) | Td_Kd are floating-point 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. | 190.078 |
| 612<br>613 | 642<br>643 | 672<br>673 | 702<br>703 | 732<br>733 | 762<br>763 | 792<br>793 | 822<br>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<br>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 | 0 |

| CR# | | | | | | | | Operand | Function | Description | Range |
|---|---|---|---|---|---|---|---|---|---|---|---|
| CH1 | CH2 | CH3 | CH4 | CH5 | CH6 | CH7 | CH8 | | | | |
| | | | | | | | | | | (derivative of E).<br>1: use the variations in the PV to calculate the control value of the derivative (derivative of PV). | |
| 616 | 646 | 676 | 706 | 736 | 766 | 796 | 826 | PID_DIR | PID forward/ reverse direction | 0: heating action (E=SV-PV)<br>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 | 0 |

6

| CR# | | | | | | | | Operand | Function | Description | Range |
|---|---|---|---|---|---|---|---|---|---|---|---|
| CH1 | CH2 | CH3 | CH4 | CH5 | CH6 | CH7 | CH8 | | | | |
| | | | | | | | | | | 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 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<br>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.<br>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<br>623 | 652<br>653 | 682<br>683 | 712<br>713 | 742<br>743 | 772<br>773 | 802<br>803 | 832<br>833 | MV | Output value (MV) | A floating-point number<br>Range: 0–100<br>Unit: % | -- |

6

| CR# | | | | | | | | Operand | Function | Description | Range |
|---|---|---|---|---|---|---|---|---|---|---|---|
| CH1 | CH2 | CH3 | CH4 | CH5 | CH6 | CH7 | CH8 | | | | |
| 624<br>625 | 654<br>655 | 684<br>685 | 714<br>715 | 744<br>745 | 774<br>775 | 804<br>805 | 834<br>835 | I_MV | Accumulated integral value | Floating-point format.<br>The accumulated integral value is temporarily stored for reference.<br>When the MV is out of the range 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.<br>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.<br>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）**

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

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

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

**Or**

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

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

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

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

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

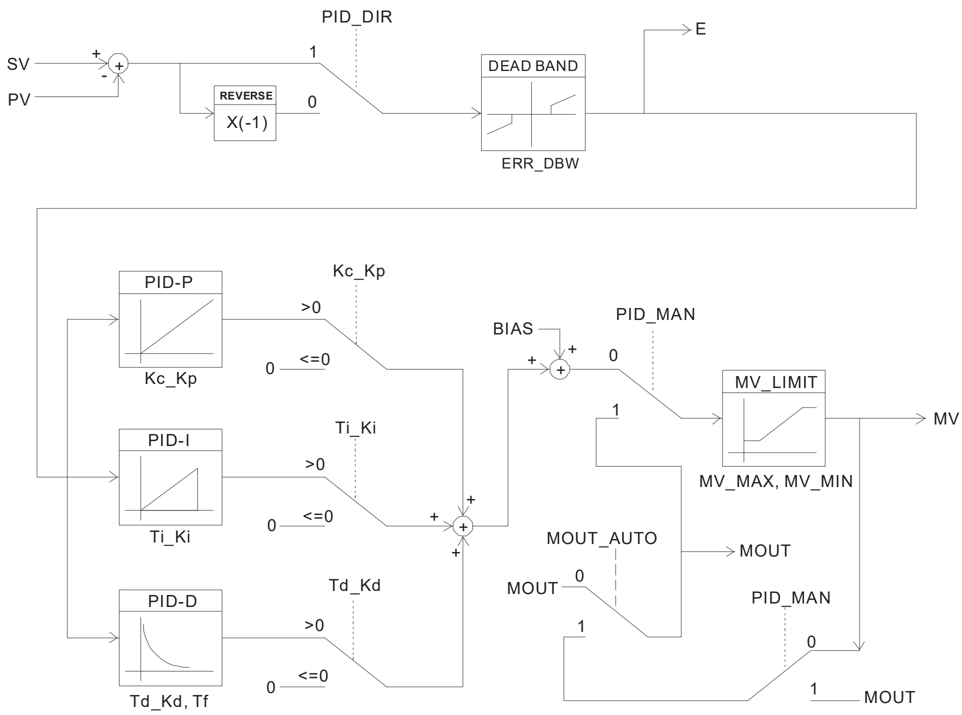
**Or**

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

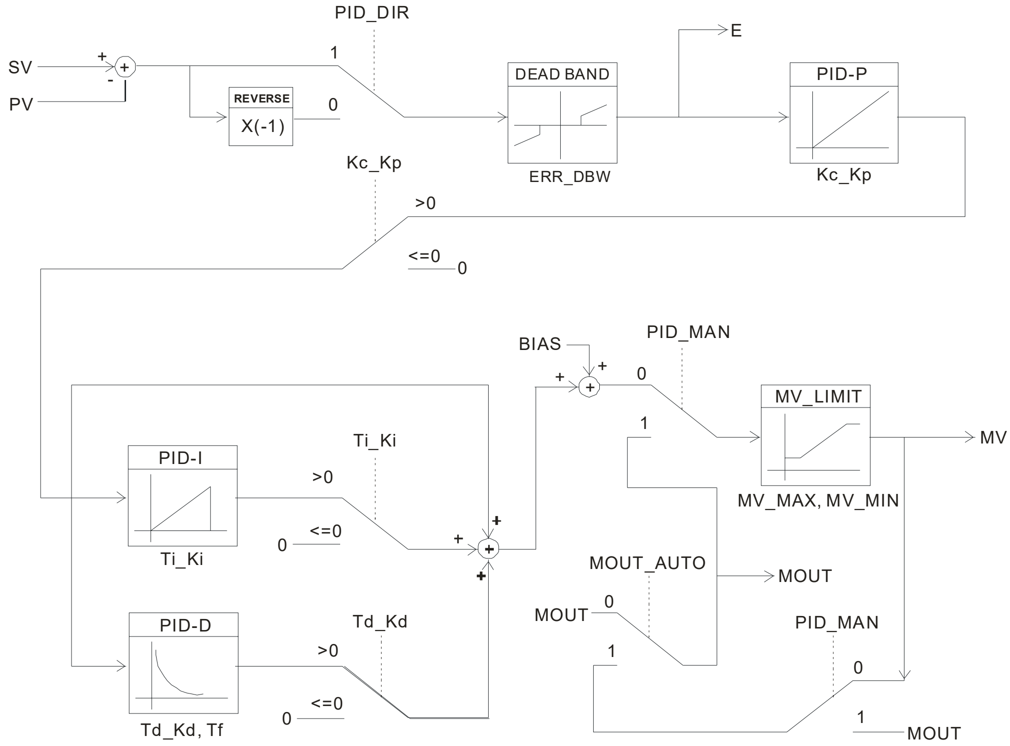
2. When you set the PID_MODE to 1, auto tuning mode is enabled. When auto tuning is complete, the value becomes 0 and switches off the auto tuning mode automatically.

**PID Control Block Diagram:**

PID Block Diagram (Independent)

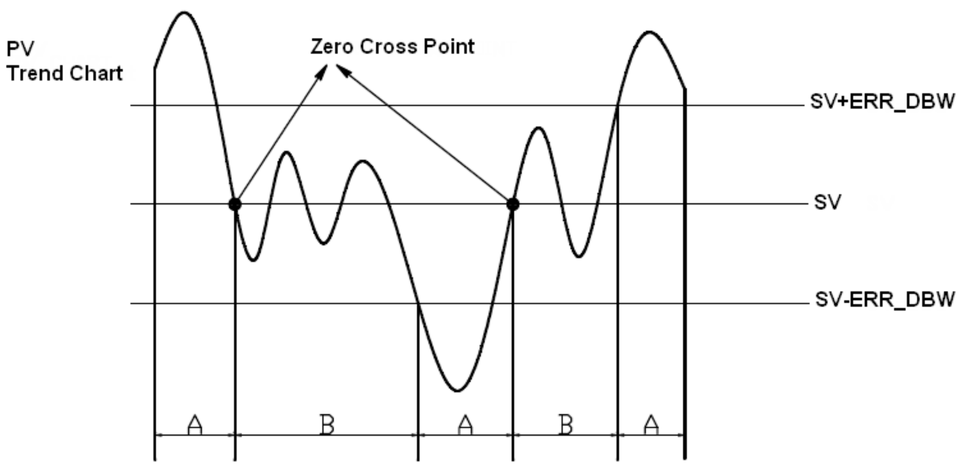


PID Block Diagram (Dependent)



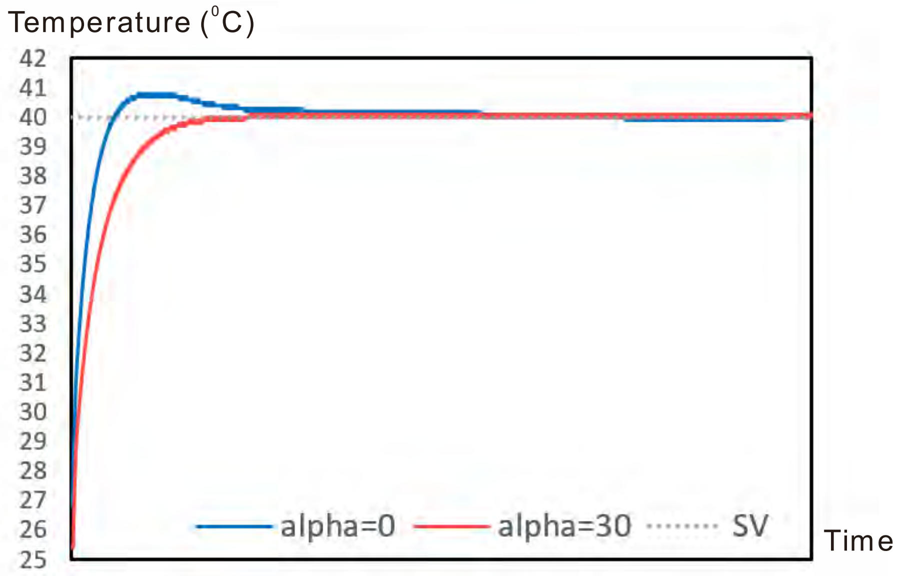

## ERR_DBW

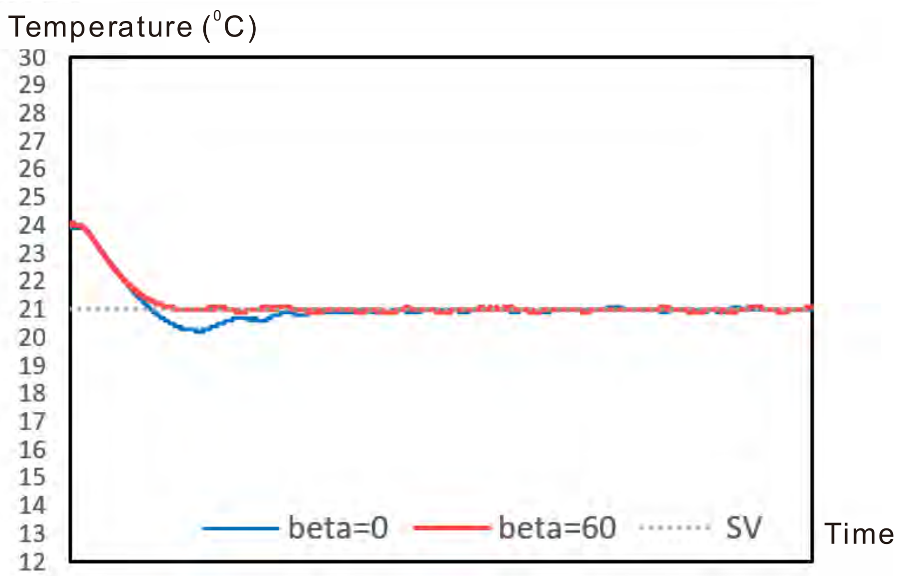
When the PV (present value) is in the range of **ERR_DBW**, at the beginning, the present error is brought into the PID algorithm according to the normal processing, and then the CPU module checks whether the present error meets the cross status condition: PV (present value) goes beyond the SV (target 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.



**Formula of the output cycle:**

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

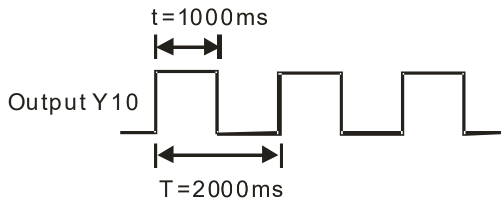
Execute the general pulse with modulation instruction (GPWM) to set output cycle width and output cycle sampling time to manage the cycle.

**Example:**

If the output cycle is 200 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.

## 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 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.

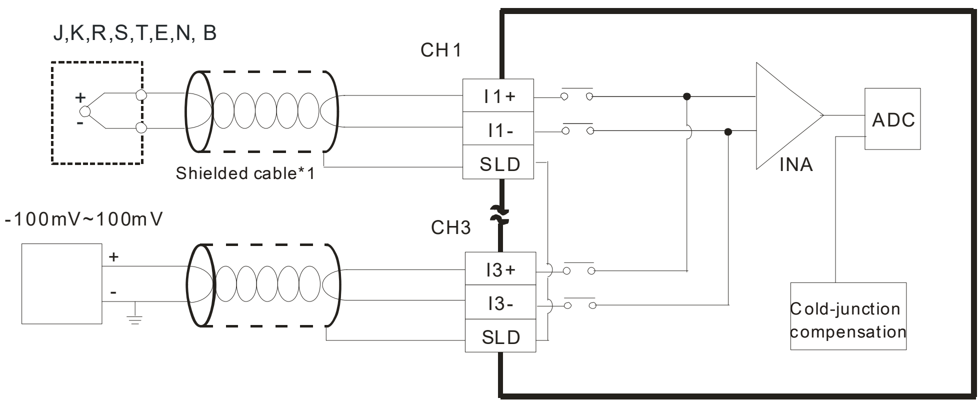
(4) Terminals with insulation sleeves cannot be arranged as a terminal block, so you should cover the terminals with insulation tubes.

(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.

### 6.2.9 LED Indicators

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

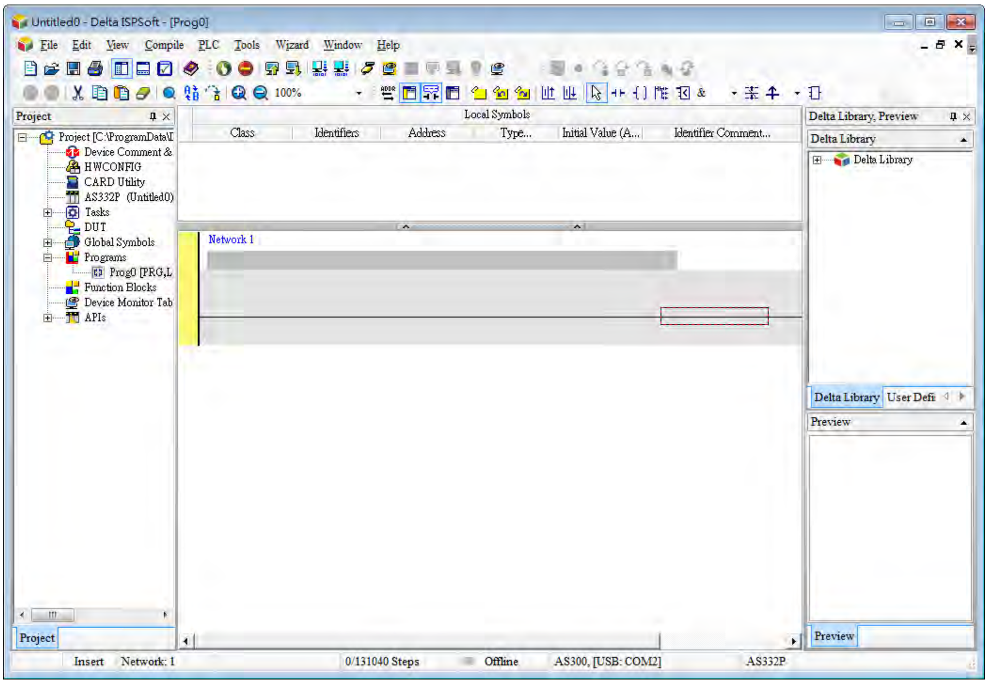
## 6.3 HWCONFIG in ISPSoft

### 6.3.1 Initial Setting

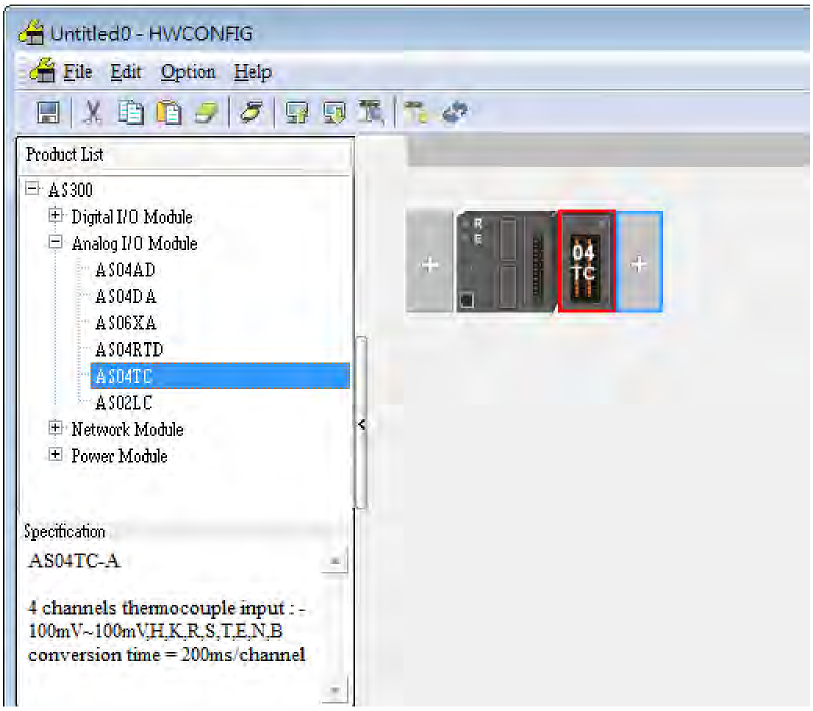
The following uses AS04TC-A as an example to demonstrate.



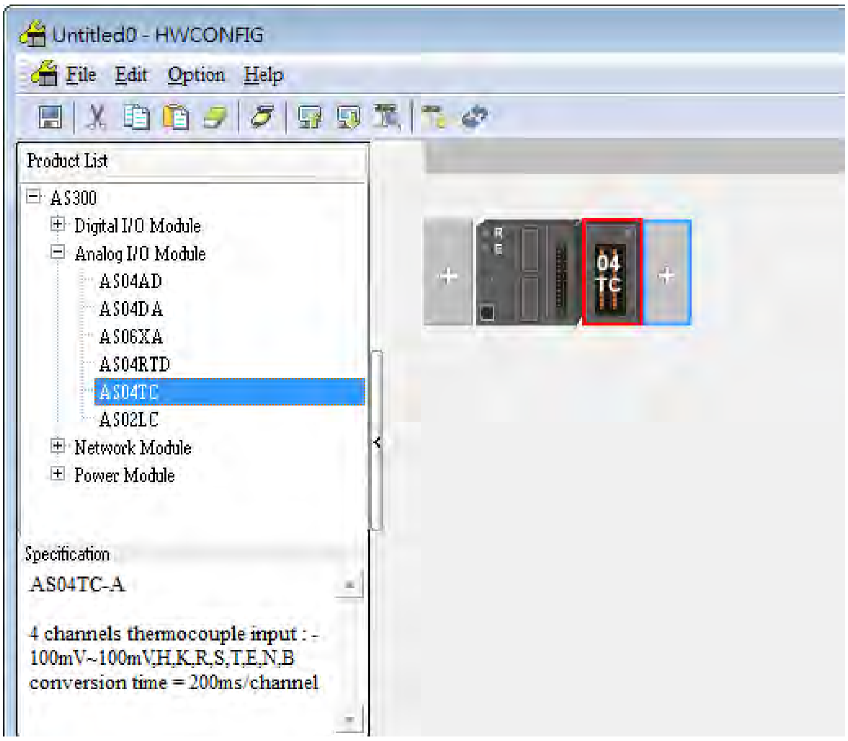
(1) Start ISPSoft and double-click **HWCONFIG**.



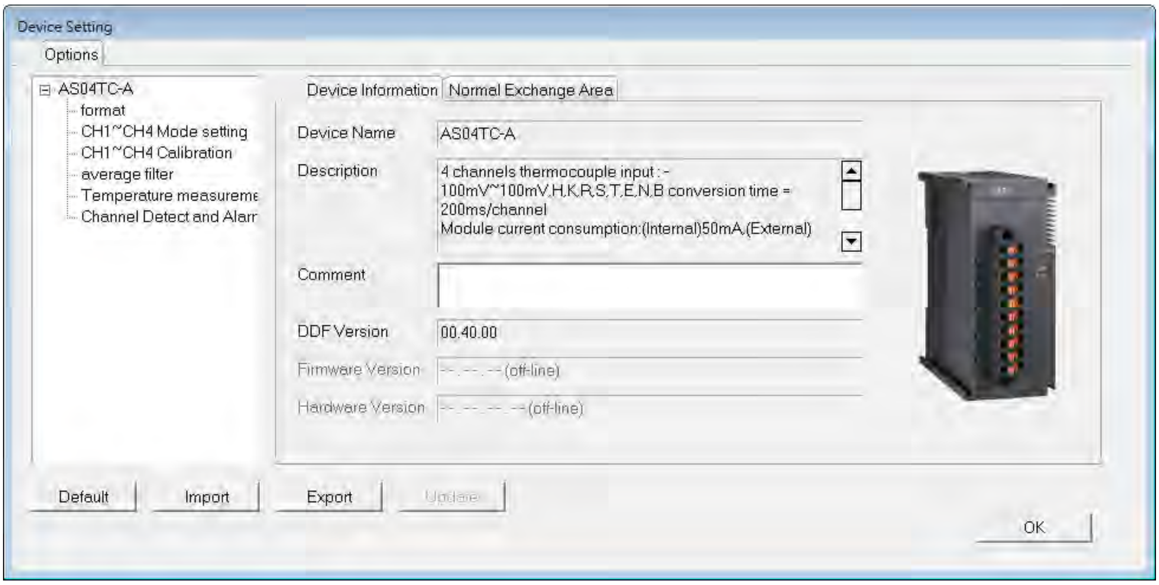
(2) Select a module and drag it to the working area.



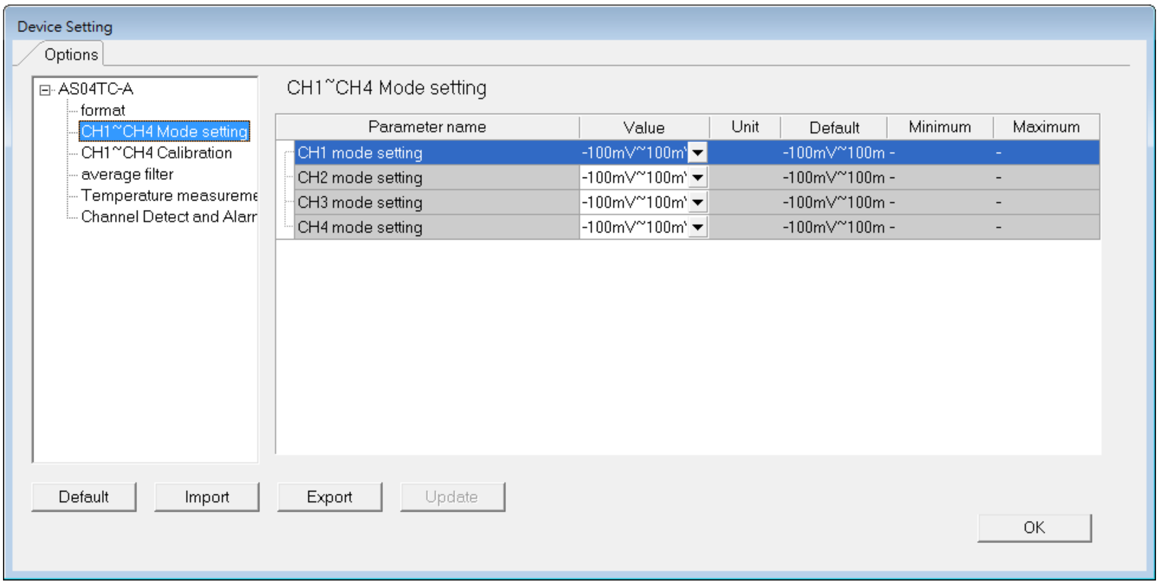

(3) Double-click the module in the working area to open the Device Setting page.



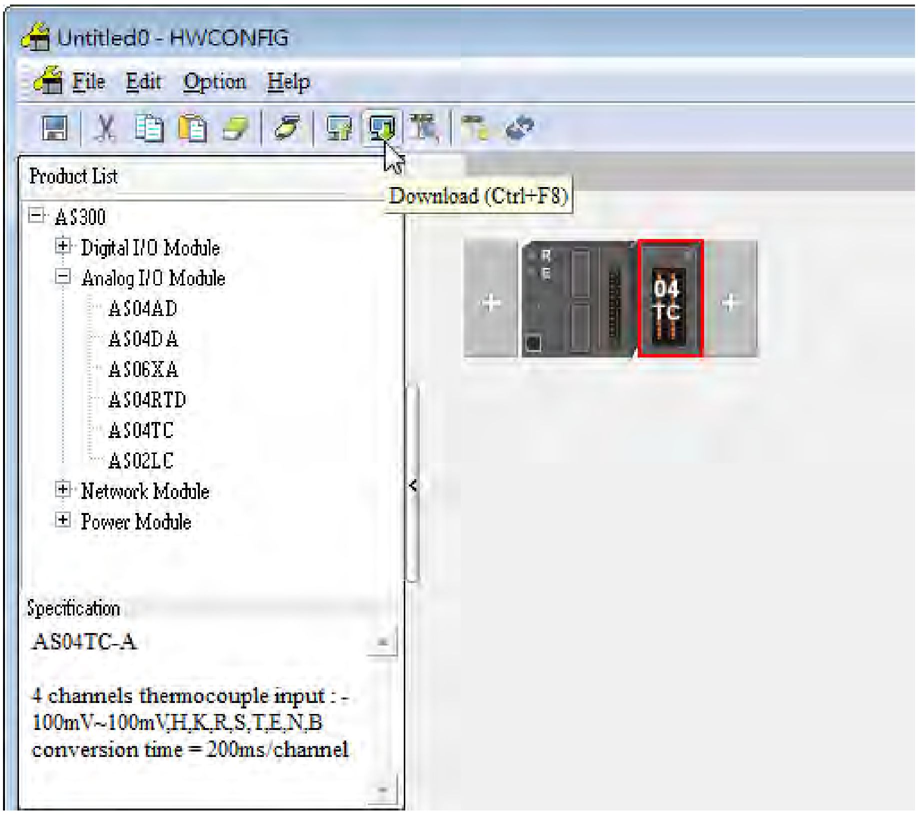

6




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



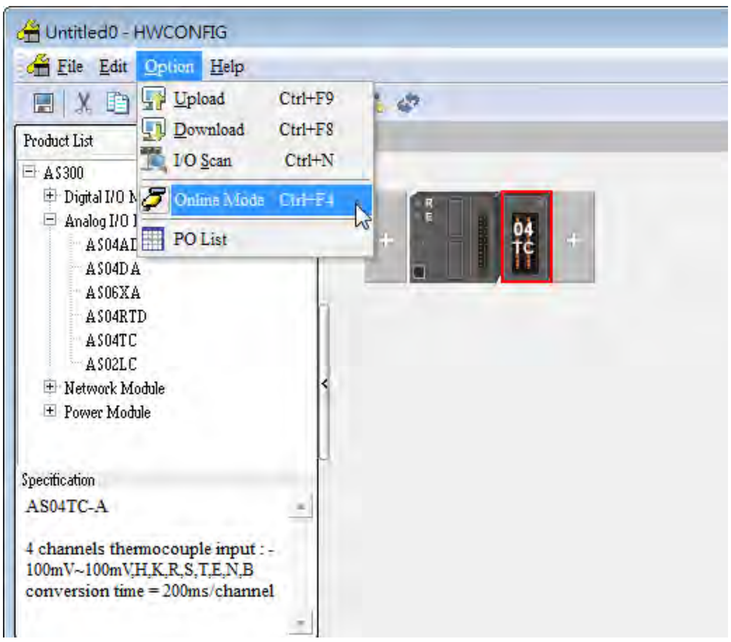
(5) Click **Download** on the toolbar to download the parameters. Note that you cannot download the parameters while the CPU module is running.



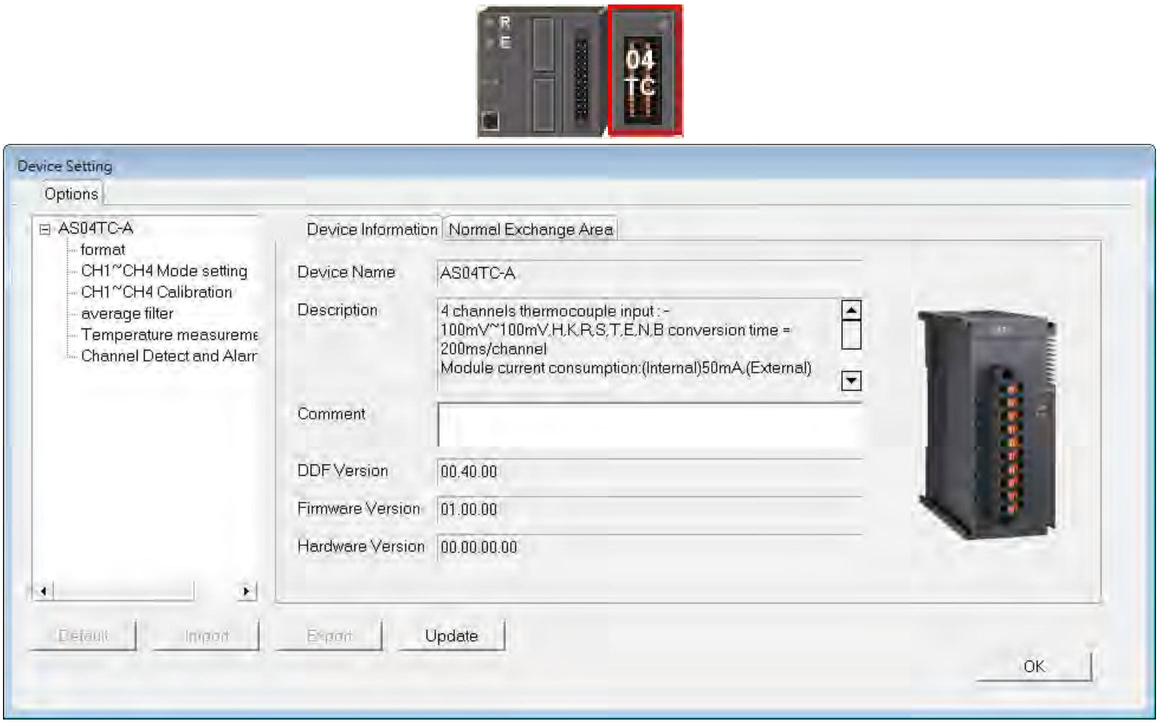

6

### 6.3.2 Checking the Version of a Module

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

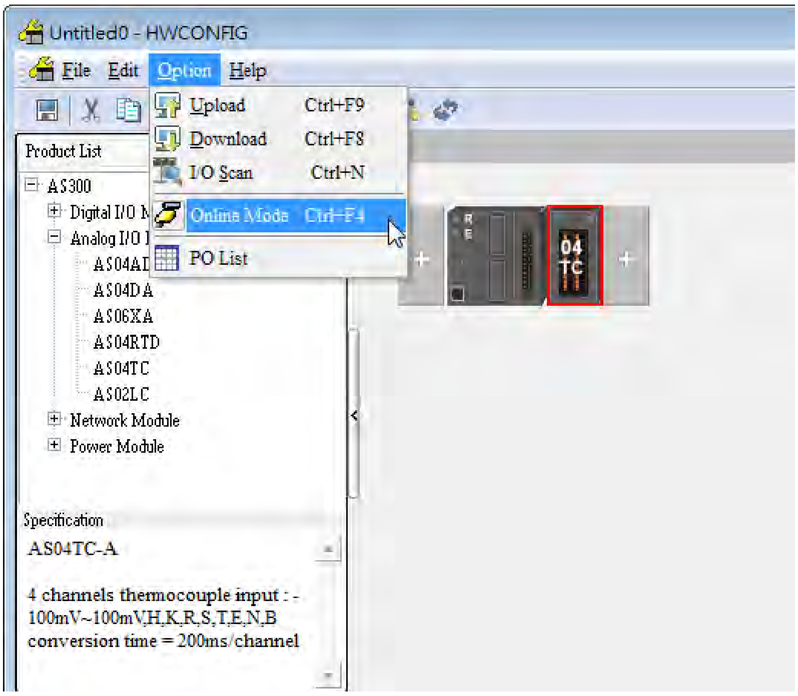


(2) Double-click the module to open the Device Setting page. The versions of both the firmware and the hardware are displayed.

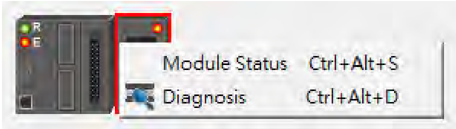



## 6.3.3 Online Mode

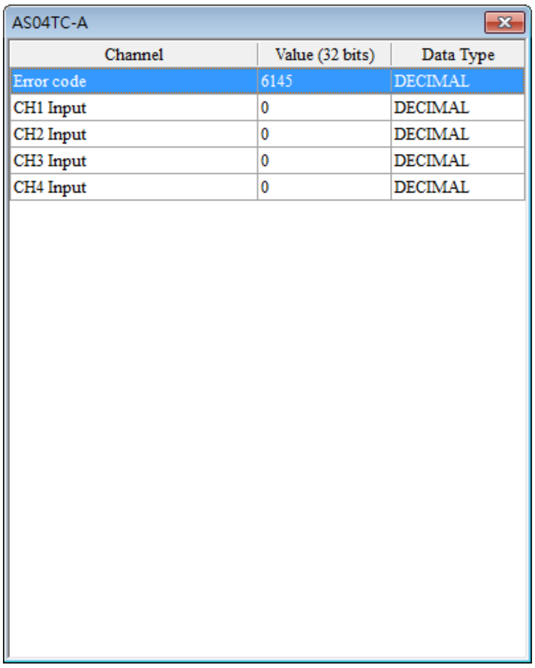
(1) On the **Option** menu, click **Online Mode**.



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

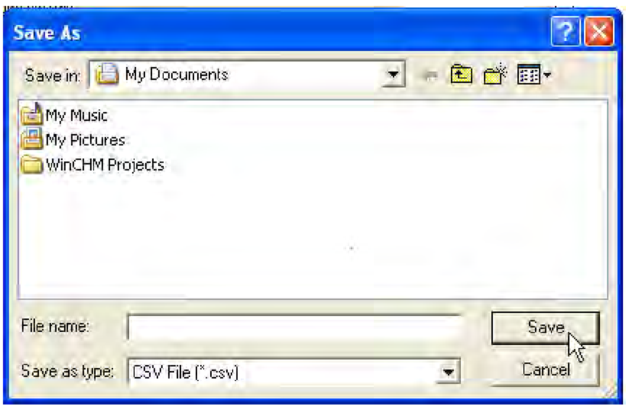



(3) View the module status.

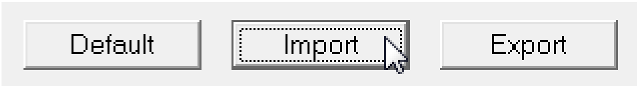


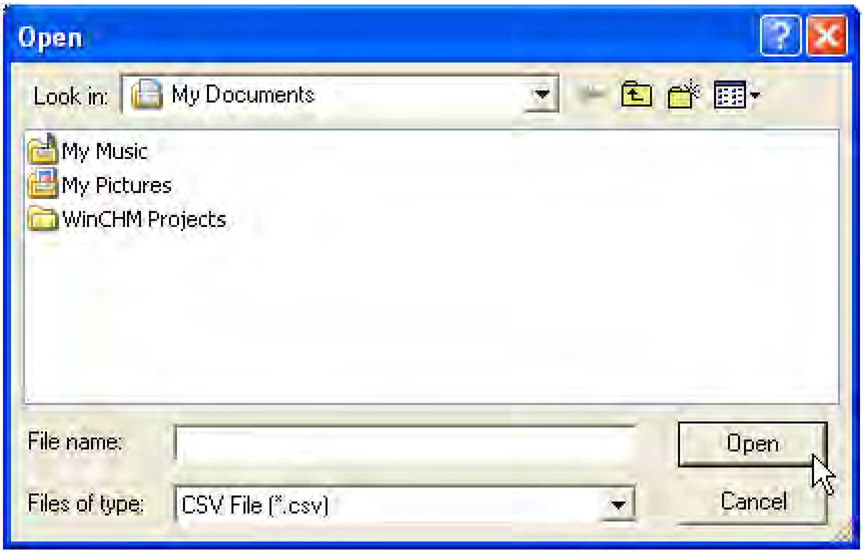

## 6.3.4 Importing/Exporting a Parameter File

(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.

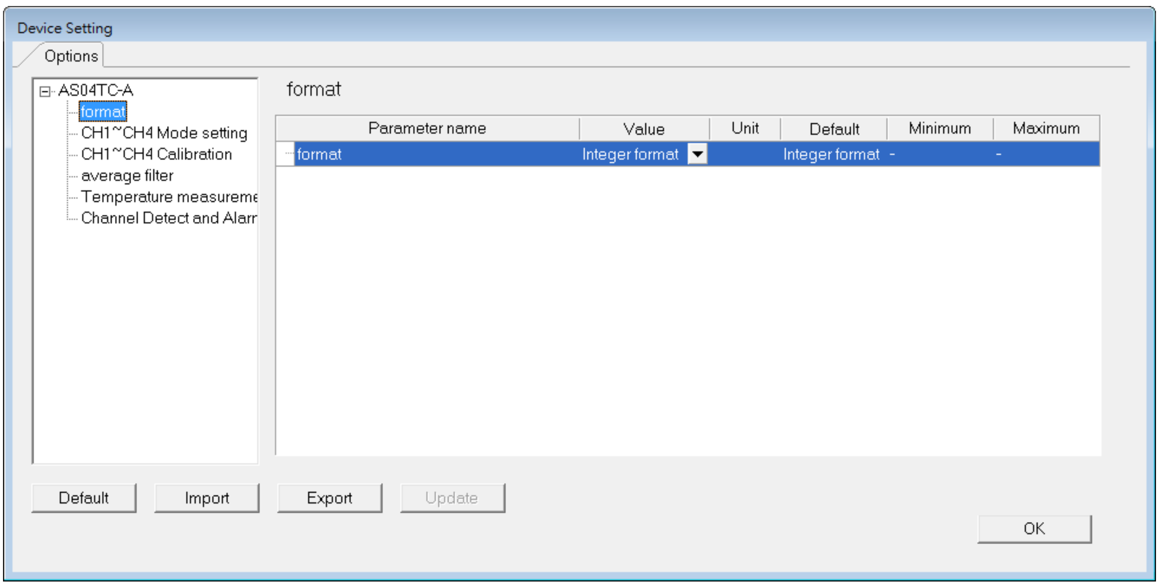


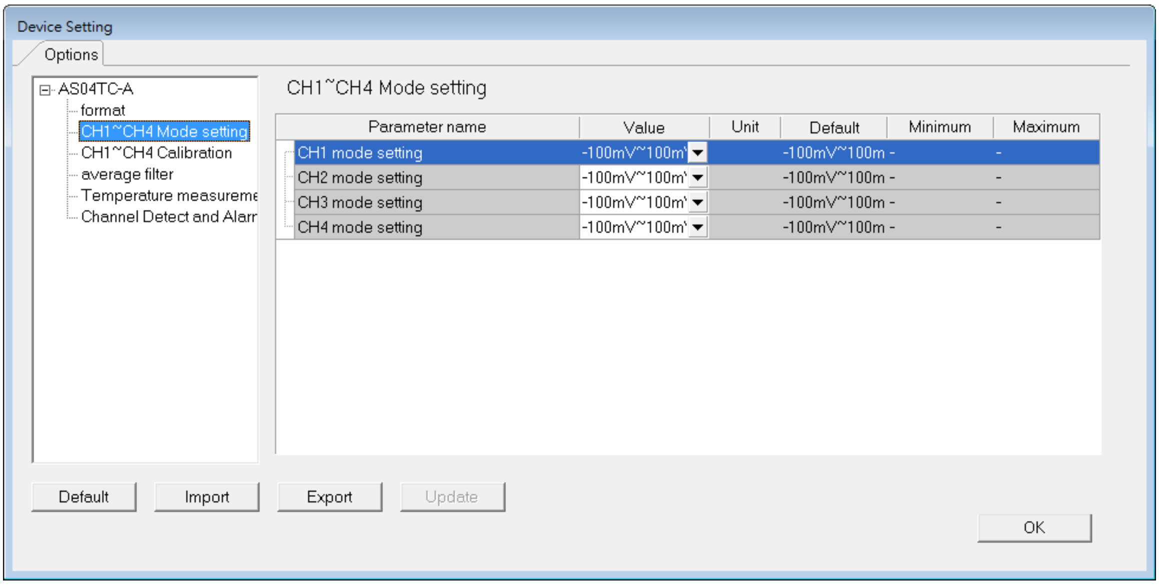

6

## 6.3.5 Parameters

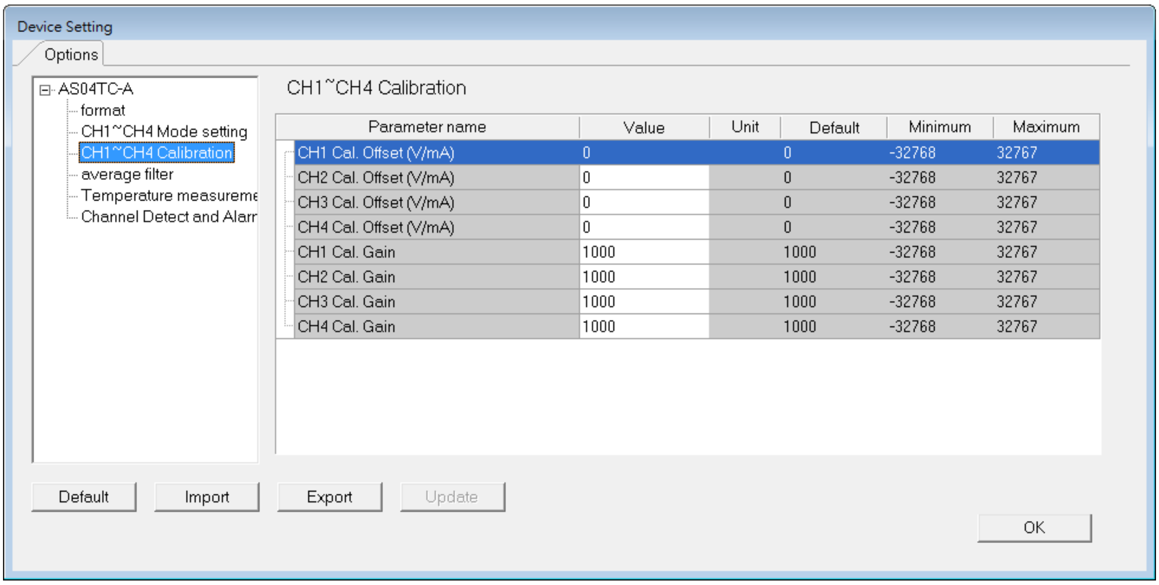
(1) The input modes of the channels



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

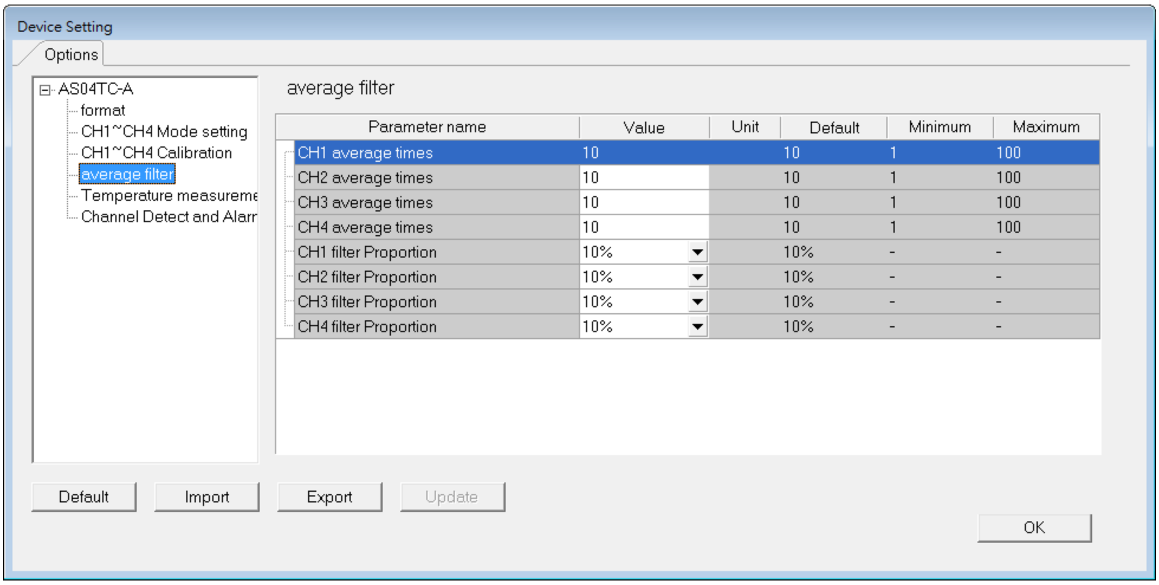



(3) Input CH1-CH4 calibration

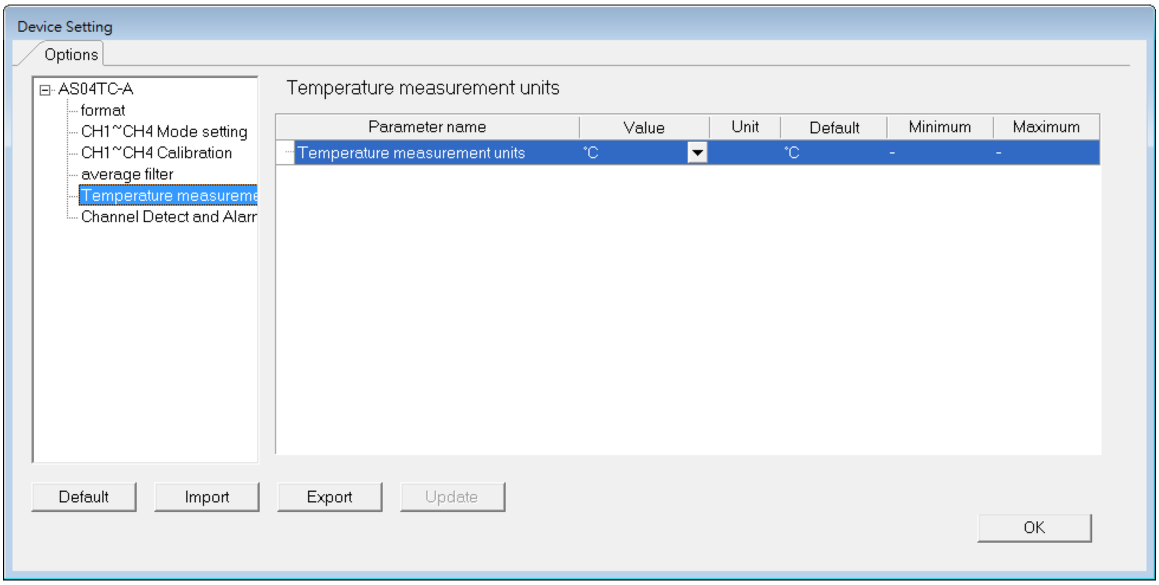



6

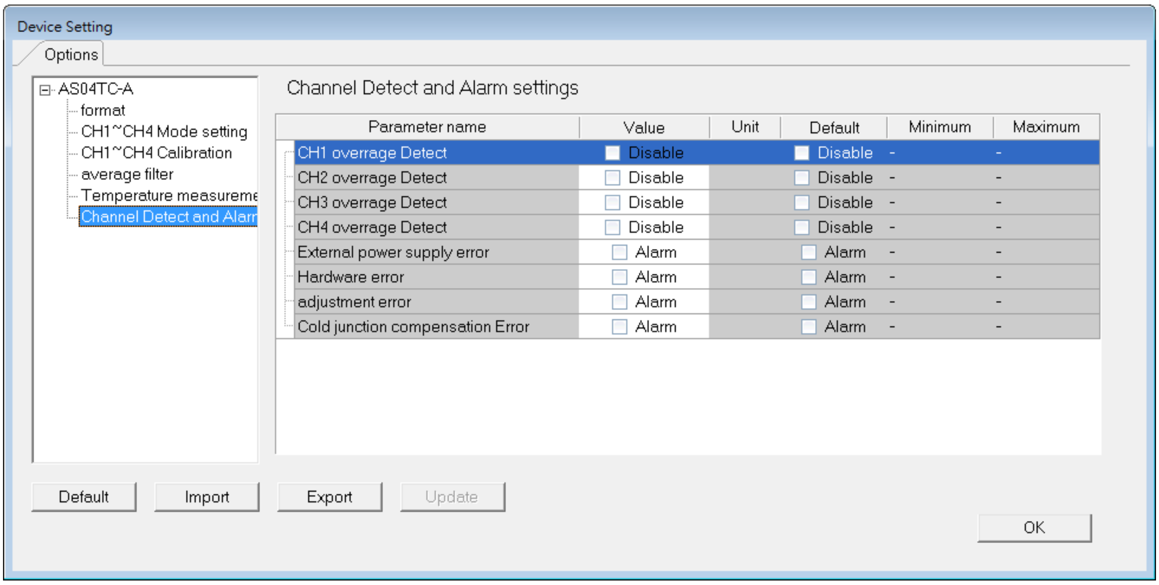
(4) Input average filter




(5) Temperature measurement



(6) Input channel detect and alarm settings




# 6.4 Troubleshooting

## 6.4.1 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#1608</td><td>The factory calibration 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#1804</td><td>The factory calibration is abnormal.</td><td>OFF</td><td>Blinking</td></tr>
<tr><td>16#1808</td><td>The signal received by channel 1 exceeds the range of inputs that the hardware can receive.</td><td rowspan="4">Run: blinking<br>Stop: OFF</td><td rowspan="4">Blinking</td></tr>
<tr><td>16#1809</td><td>The signal received by channel 2 exceeds the range of inputs that the hardware can receive.</td></tr>
<tr><td>16#180A</td><td>The signal received by channel 3 exceeds the range of inputs that the hardware can receive.</td></tr>
<tr><td>16#180B</td><td>The signal received by channel 4 exceeds the range of inputs that the hardware can receive.</td></tr>
</table>

| Error Code | Description | A↔ D LED Indicator | ERROR LED Indicator |
|---|---|---|---|
| 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. | | |

### 6.4.2 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<br>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. |

# Chapter 7 Load Cell Module AS02LC

## Table of Contents

# 7.1 Overview

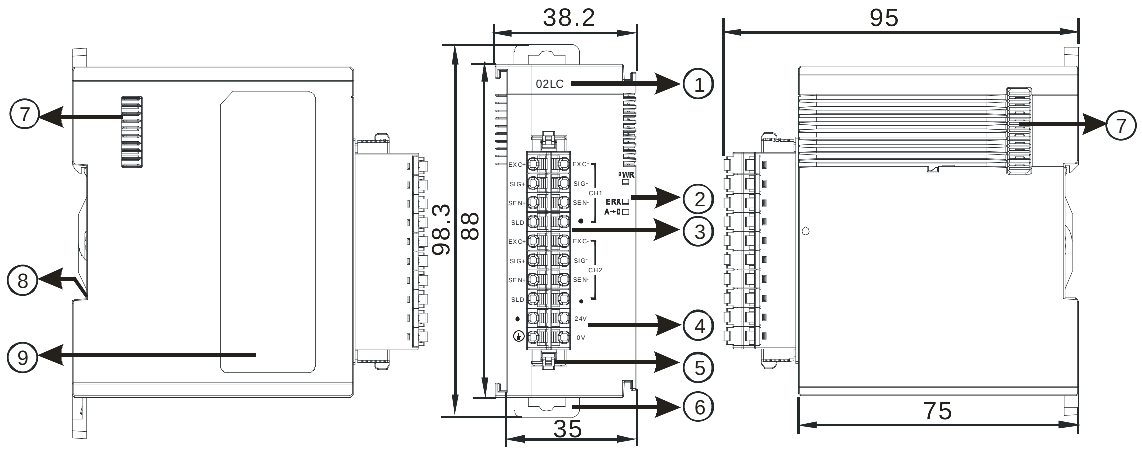
This chapter describes the specifications for load cell modules, their operation, and their programming. You can use the AS02LC load cell module with four-wire or six-wire load cells with various eigenvalues, so you can adjust its response time according to your requirements. In addition, the AS02LC-A 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.

# 7.2 Specifications

## 7.2.1 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 Precision** | 0.04% |
| **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<br>Between an analog circuit and the ground: 500 VAC<br>Between an analog circuit and a digital circuit: 500 VAC |

### 7.2.2 Profile

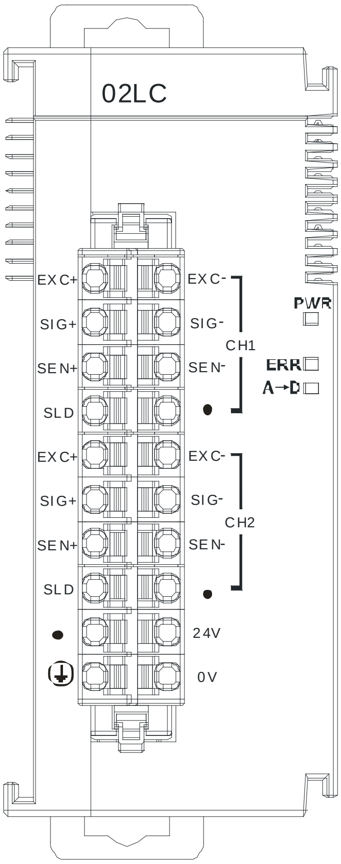



Unit: mm

| Number | Name | Description |
|---|---|---|
| 1 | Model Name | Model name of the module |
| 2 | RUN LED Indicator | Operating status of the module<br>ON: the module is running.<br>OFF: the module is not running. |
| | ERROR LED Indicator | Error status of the module<br>ON: a serious error exists in the module.<br>OFF: the module is operating normally.<br>Blink: a minor error exists in the module. |
| | Digital-to-Analog Conversion Indicator | Digital-to-analog conversion status<br>Blinking: conversion is in process.<br>OFF: conversion has stopped. |
| 3 | Removable Terminal Block | The inputs are connected to transducers.<br>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 | |

## 7.2.3 Arrangement of Terminals

**AS02LC-A**




## 7.2.4 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.



| CR# | Name | Description | Defaults |
|---|---|---|---|
| 0 | Display of the nw/gw for channel 1 | 0: disabled<br>1: net weight<br>2: gross weight | 1 |
| 1 | Eigenvalue for channel 1 | 0: 1 mV/V<br>1: 2 mV/V<br>2: 4 mV/V<br>3: 6 mV/V<br>4: 20 mV/V<br>5: 40 mV/V<br>6: 80 mV/V | 1 |

| CR# | Name | Description | Defaults |
|---|---|---|---|
| 2 | Sampling cycle for channel 1 | 0: 1 mV/V<br>1: 2 mV/V<br>2: 4 mV/V<br>3: 6 mV/V<br>4: 20 mV/V<br>5: 40 mV/V<br>6: 80 mV/V | 4 |
| 3 | Weight measured times in a stability range for channel 1 | 0: 2.5 ms<br>1: 10 ms<br>2: 16 ms<br>3: 20 ms<br>4: 50 ms<br>5: 60 ms<br>6: 100 ms<br>7: 200 ms<br>8: 400 ms | 5 |
| 4 | Stability range for channel 1 | Floating-point format<br>Range: K1–K10000 | 10 |
| 5 | | | |
| 6 | Maximum weight for channel 1 | Floating-point format<br>Maximum measuring weight; when the weight measured exceeds the limit, an alarm is triggered. The value should be greater than 1. | 100,000 |
| 7 | | | |
| 8 | Filter mode for channel 1 | 0: no filter (default)<br>1: maximum filter mode<br>2: average filter mode | 0 |
| 9 | Maximum filter for channel 1 | Range: 0–8; the bigger the number the stronger the filter | 1 |
| 10 | Average weight measured times for channel 1 | Range: 1–100 | 10 |
| 11 | Upper limit of the zero return for channel 1 | Floating-point format<br>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 | 10 |
| 12 | | | |
| 13 | Lower limit of the zero return for channel 1 | | -10 |
| 14 | | | |

| CR# | Name | Description | Defaults |
|---|---|---|---|
| | | read as the upper range and vice versa. | |
| 15 | Zero point tracking time for channel 1 | Range: 1–500<br>Unit: 100 ms | 10 |
| 16<br>17 | Zero point tracking range for channel 1 | Floating-point format<br>Range: 0–10000; 0: disabled | 0 |
| 18 | Calibration points for channel 1 | Range: 2–20 | 2 |
| 19–58 | Calibrated weight for channel 1 | Floating-point format<br>Calibrated weight of the calibration points 1–20 | - |
| 59 | Display of the nw/gw for channel 2 | 0: disabled<br>1: net weight<br>2: gross weight | 1 |
| 60 | Eigenvalue for channel 2 | 0：1 mV/V<br>1：2 mV/V<br>2：4 mV/V<br>3：6 mV/V<br>4：20 mV/V<br>5：40 mV/V<br>6：80 mV/V | 1 |
| 61 | Sampling cycle for channel 2 | 0：2.5 ms<br>1：10 ms<br>2：16 ms<br>3：20 ms<br>4：50 ms<br>5：60 ms<br>6：100 ms<br>7：200 ms<br>8：400 ms | 4 |
| 62 | Weight measured times in a stability range for channel 2 | Range: K1–K500 | 5 |
| 63<br>64 | Stability range for channel 2 | Floating-point format<br>Range: K1–K10000 | 10 |
| 65 | Maximum weight for | Floating-point format | 100,000 |

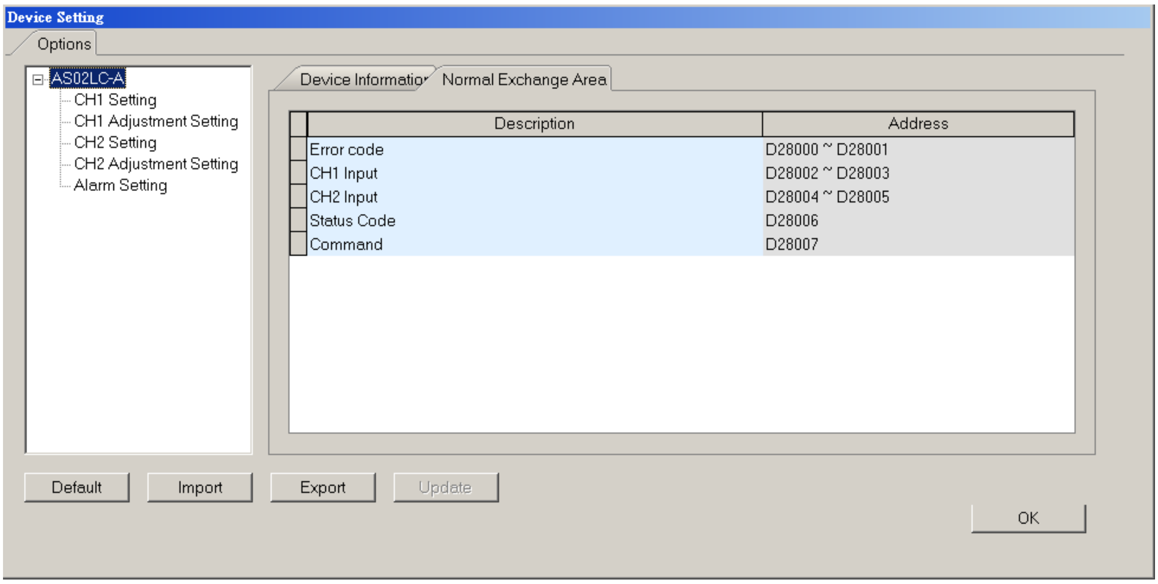
| CR# | Name | Description | Defaults |
|---|---|---|---|
| 66 | channel 2 | Maximum measuring weight; when the weight measured exceeds the limit, an alarm is triggered. The value should be greater than 1. | |
| 67 | Filter mode for channel 2 | 0: no filter (default)<br>1: maximum filter mode<br>2: average filter mode | 0 |
| 68 | Maximum filter for channel 2 | Range: 0–8; the bigger the number the stronger the filter | 1 |
| 69 | Average weight measured times for channel 2 | Range: 1–100 | 10 |
| 70<br>71 | Upper limit of the zero return for channel 2 | Floating-point format<br>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. | 10 |
| 72<br>73 | Lower limit of the zero return for channel 2 | | -10 |
| 74 | Zero point tracking time for channel 2 | Range: 1–500<br>Unit: 100 ms | 10 |
| 75<br>76 | Zero point tracking range for channel 2 | Floating-point format<br>Range: 0–10000; 0: disabled | 0 |
| 77 | Calibration points for channel 2 | Range: 2–20 | 2 |
| 78–117 | Calibrated weight for channel 2 | Floating-point format<br>Calibrated weight of the calibration points 1–20 | - |
| 118 | Decimal place for channel 1 | Range: 0–4 | 1 |
| 119 | Decimal place for channel 2 | Range: 0–4 | 1 |
| 120 | Alarm | 0: warning<br>1: alarm<br>Bit1: error in the power supply<br>Bit2: error in the module hardware<br>Bit3: error in the driver board | 0 |
| 200 | State register | Refer to the explanation below. | - |
| 201 | Instruction set | Refer to the explanation below. | 0 |
| 210 | The maximum peak value | Floating-point format | - |

| CR# | Name | Description | Defaults |
|---|---|---|---|
| 211 | for channel 1 | Maximum peak value for channel 1 | - |
| 212 | The maximum peak value for channel 2 | Floating-point format<br>Maximum peak value for channel 2 | - |
| 213 | | | - |
| 214 | The minimum peak value for channel 1 | Floating-point format<br>Minimum peak value for channel 1 | - |
| 215 | | | - |
| 216 | The minimum peak value for channel 2 | Floating-point format<br>Minimum peak value for channel 2 | - |
| 217 | | | - |
| 222 | The time to record for channel 1 | Unit: 1 ms<br>Range: 1–100 (1 ms–1 s)<br>Time to record the digital value for the channels | 50 |
| 223 | The time to record for channel 2 | | 50 |
| 240 | The number of records for channel 1 | Range: 0–500; display the current records | - |
| 241 | The number of records for channel 2 | | - |
| 604 | Tare measured by channel 1 | Display the tare measured by channel 1 | - |
| 605 | | | - |
| 606 | Tare measured by channel 2 | Display the tare measured by channel 2 | - |
| 607 | | | - |
| 700–739 | Theoretical calibration for channel 1 | Floating-point format<br>Output voltage unit: mV | 0 |
| 740–779 | Theoretical calibration for channel 2 | Floating-point format<br>Output voltage unit: mV | 0 |
| 4000–4999 | Records for channel 1 | Floating-point format<br>500 records for channel 1 | - |
| 5000–5999 | Records for channel 2 | Floating-point format<br>500 records for channel 2 | - |

**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 instructions on 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 | b9 | 16#0200 | The weight measured by CH2 exceeds the |

| Bit | Code | Definition | Bit | Code | Definition |
|---|---|---|---|---|---|
| | | that can be measured. | | | 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:** Instruction set

**Explanation**

| Input value | Description | Input value | Description |
|---|---|---|---|
| 0 | No action | 16#0101 | Start a new recording of the peak value for channel 1. |
| 1–20 | Instructions for calibrating calibration points 1–20 in channel 1 | 16#0102 | Start a new recording of the peak value for channel 2. |
| 21–40 | Instructions for calibrating calibration points 1–20 in channel 2 | 16#010F | Start a new recording of the peak value for channels 1–2. |
| 98 | Activate the weight calibration. | 16#0201 | Start a new recording for channel 1. |
| 99 | Deactivate the weight calibration. | 16#0202 | Start a new recording for channel 2. |
| 100 | Subtract the tare measured by CH1. | 16#020F | Start a new recording for channels 1–2. |
| 101 | Do not subtract the tare measured by CH1. | 16#0211 | Stop recording for channel 1. |
| 102 | Restore the weight measured by CH1 to 0. | 16#0212 | Stop recording for channel 2. |
| 103 | Subtract the tare measured by CH2. | 16#021F | Stop recording for channels 1–2. |
| 104 | Do not subtract the tare measured by CH2. | 16#0301 | Start a theoretical calibration for channel 1. |

| Input value | Description | Input value | Description |
|---|---|---|---|
| 105 | Restore the weight measured by CH2 to 0. | 16#0302 | Start a theoretical calibration for channel 2. |
| 16#030F | Start a theoretical calibration for channels 1–2. | 16#0502 | Restore default settings |

### 7.2.5 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. Gross weight is the total weight: net weight plus tare.

- Tare: 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

  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=0.2 kg

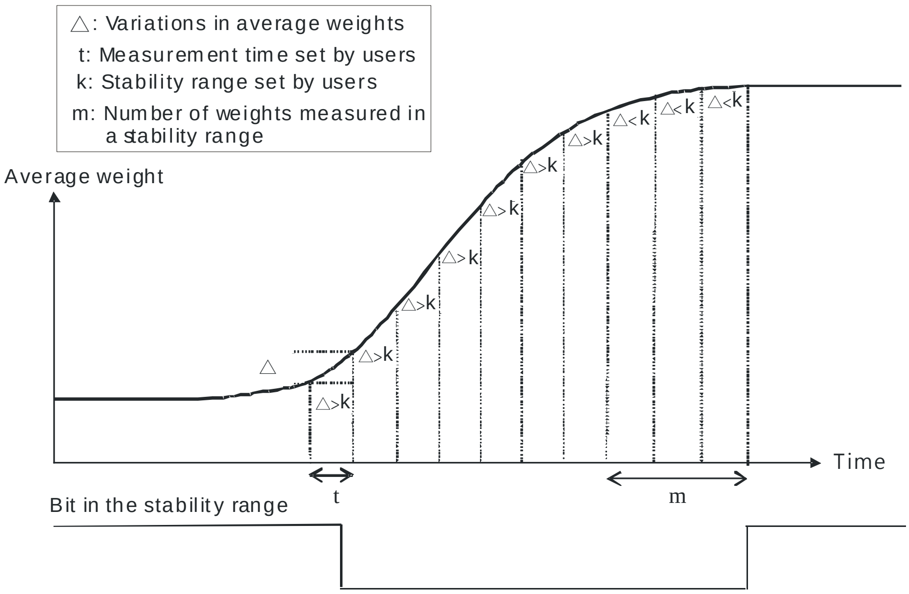
  Gross weight=10.2 kg

**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.

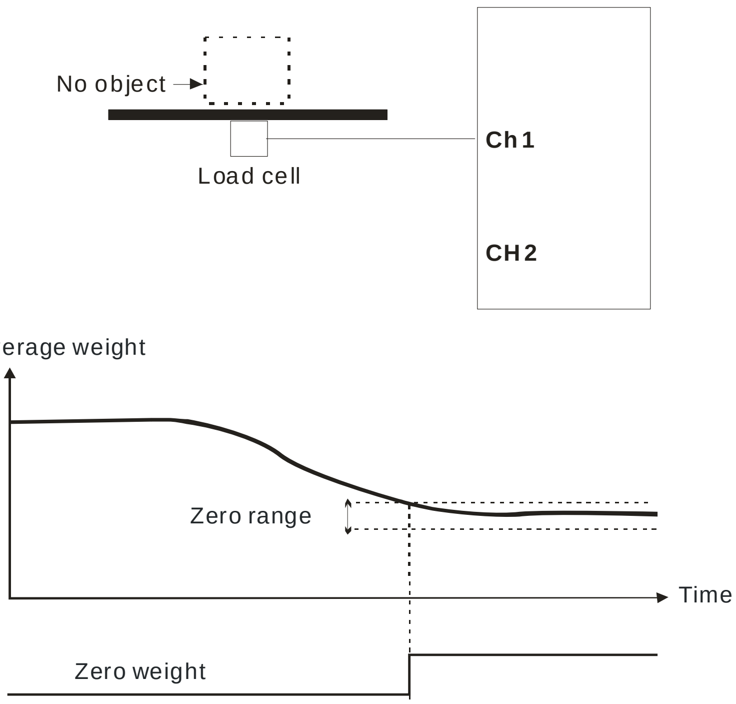
- If the weight measured is in the specified stability range, the corresponding bit is set to 1.
- If the weight measured exceeds the specified stability range, the corresponding bit is set to 0 until the number of objects weighed in the stability range reaches the setting.

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.



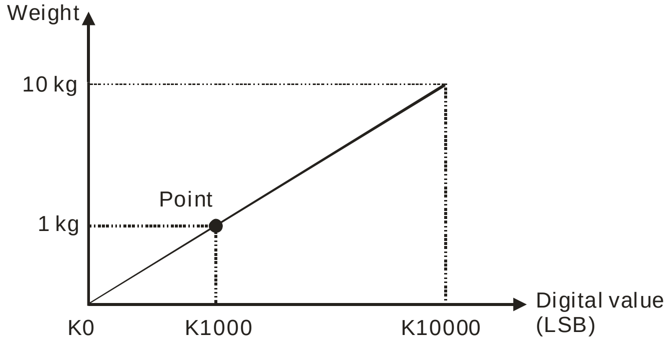
**4. Filtering out weights**

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.

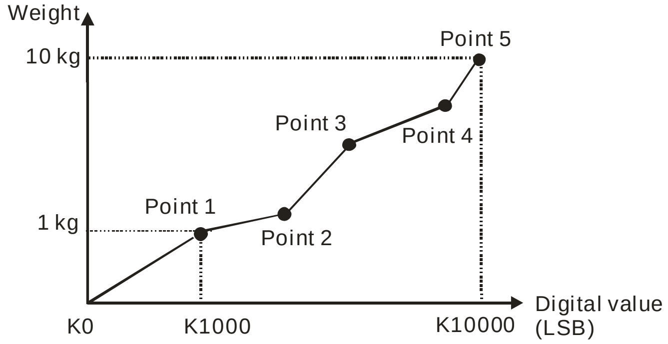
**5. Making multi-point adjustments**

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.



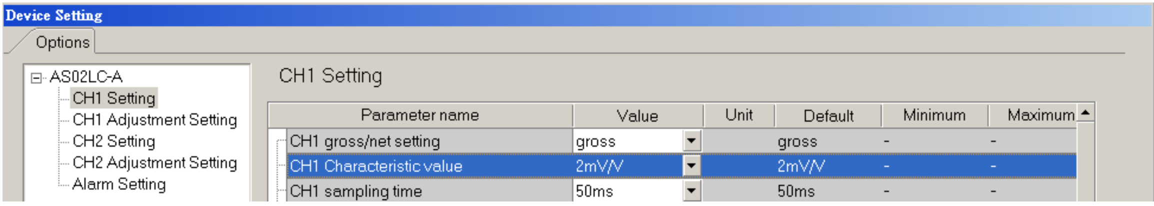

Adjusting multiple points

**6. Determining theoretical calibration**

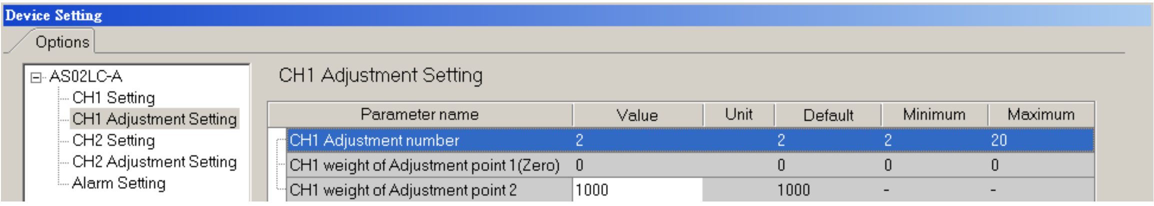
Theoretical calibration is determined according to the sensor specification in order to input the voltage values corresponding to various weights. The registers for storing the voltage values are CR#700–739 for channel 1 and CR#740–779 for channel 2. After entering the voltage values into the registers, you can use the instruction 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.



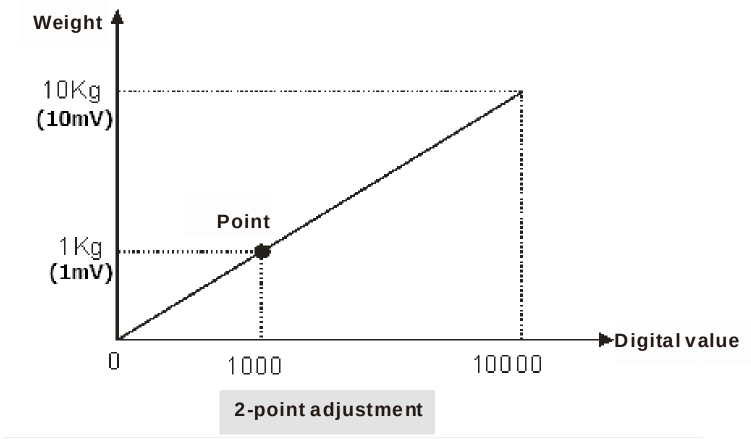

Step 3: set the voltage calibration for the zero point to 0 (0 mV) in the CR#700/701 registers, and to 1.0 (1 mV) in the CR702/703 registers.

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

Step 5: enter 16#0301 into the instruction 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 instruction set CR#201 to reset the value to 0 for channel 1.

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

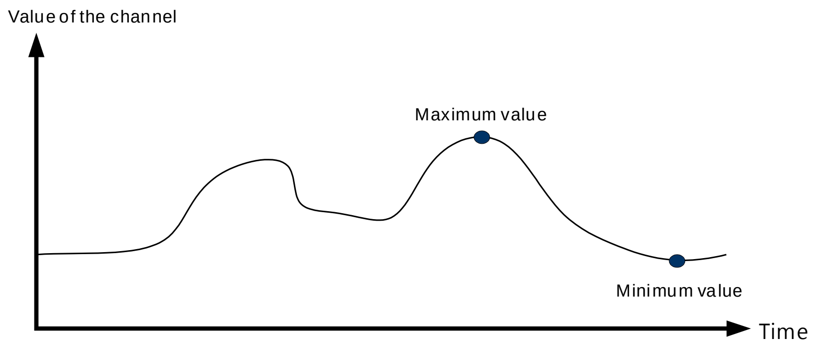



**7. Zero point tracking**

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**

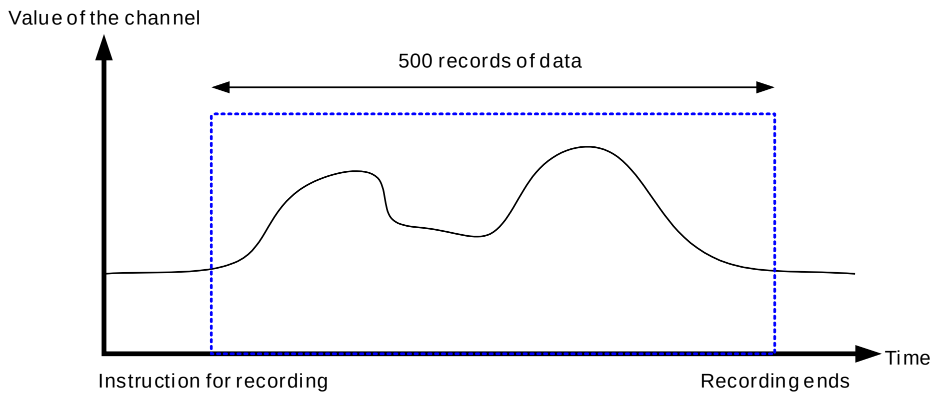
Save the maximum and minimum values for channels so you can determine the peak to peak values.





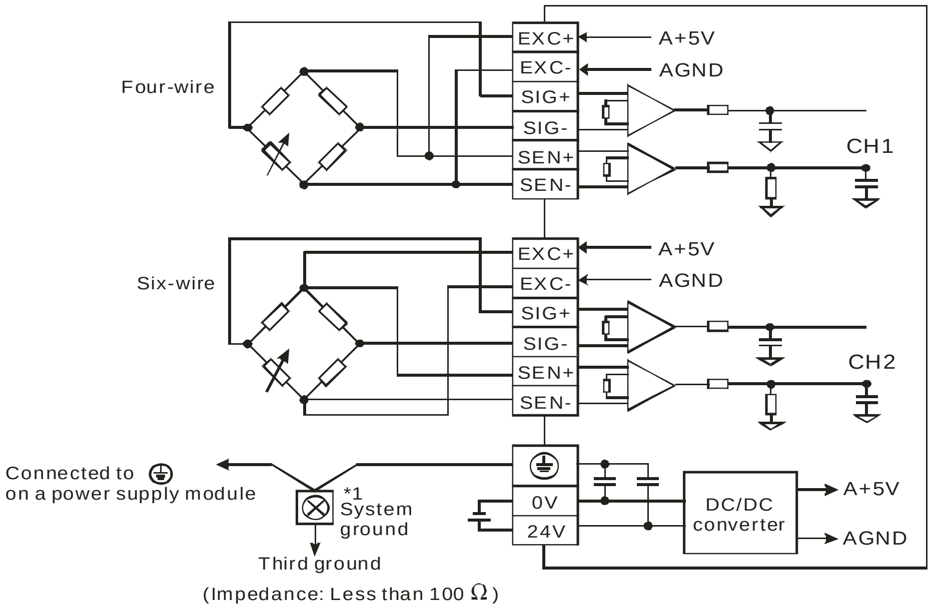

**9. Recording channels**

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.

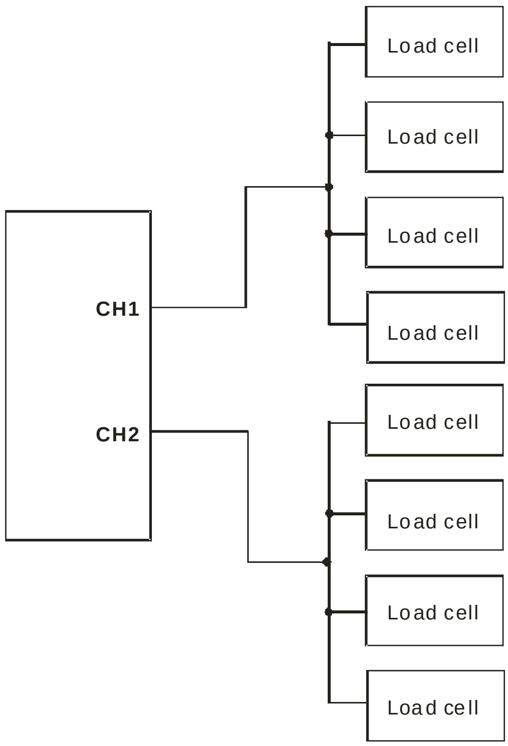


### 7.2.6 Wiring

- **External wiring**




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



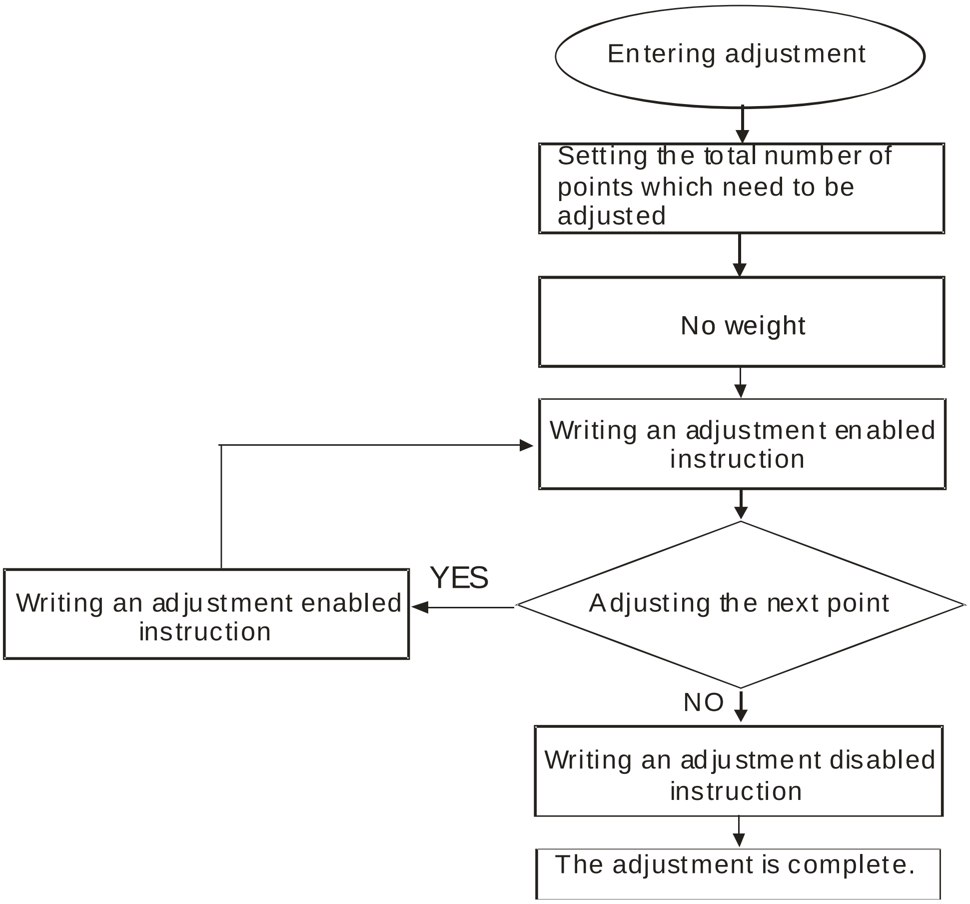

Note 1: Please connect ⏚ on the power supply module and ⏚ on the load cell module to a system ground, and then ground the system ground or connect the system ground to a distribution box.

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

## 7.3 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 instructions below or by setting up the theoretical calibration (refer to section 7.2.5 for more details).

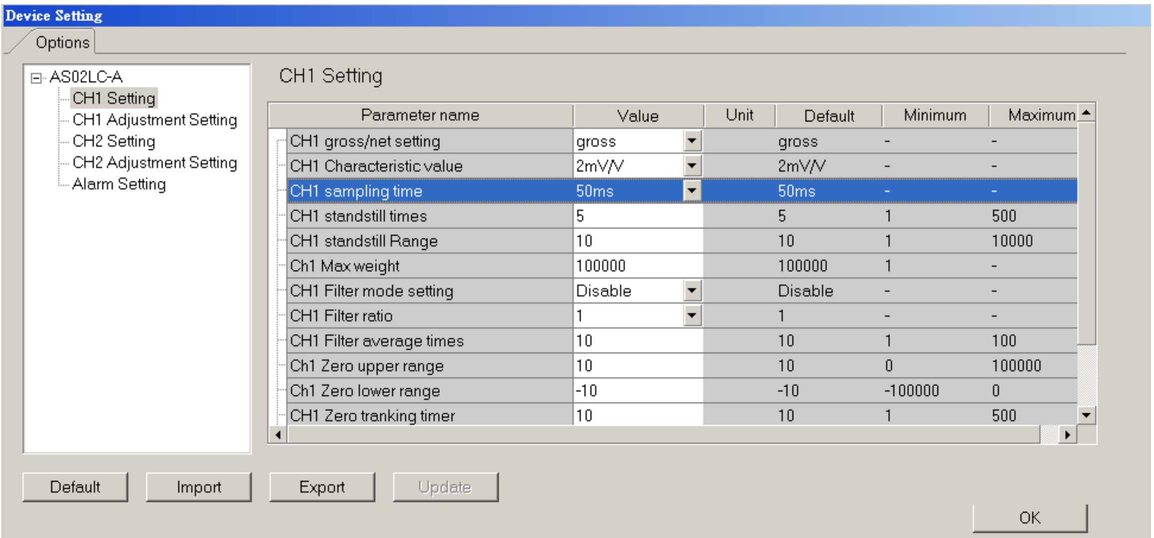
### 7.3.1 Steps to adjust points



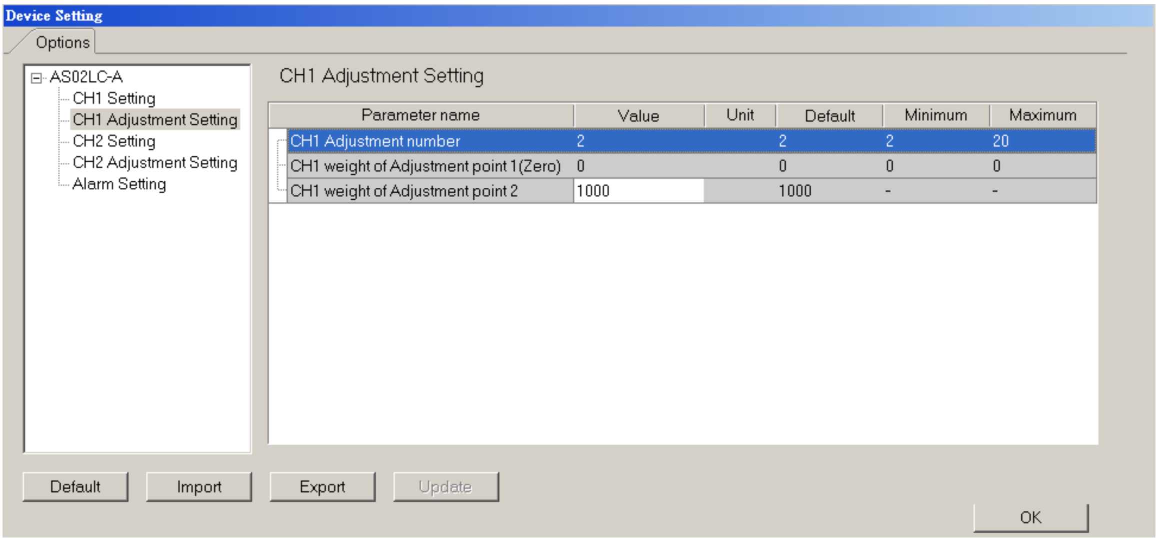

7

### 7.3.2 Adjustment settings / LC Wizard

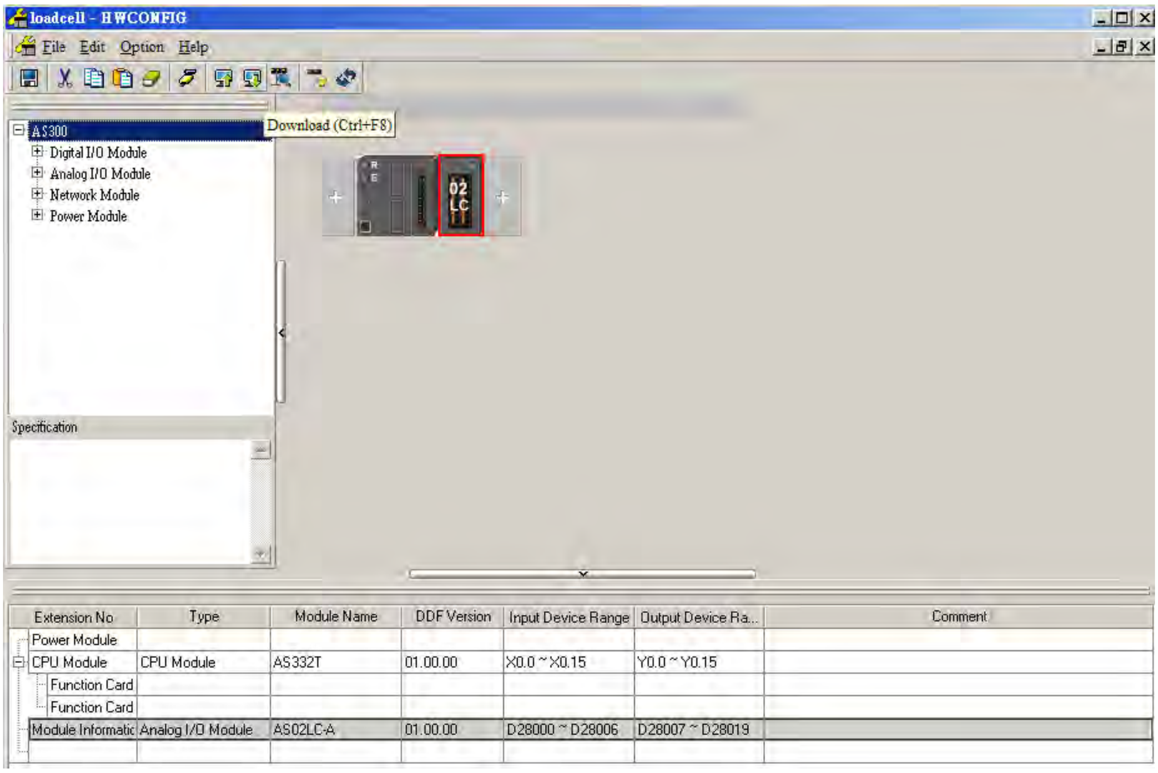
Step 1: set the eigenvalue in the HWCONFIG utility in ISPSoft.



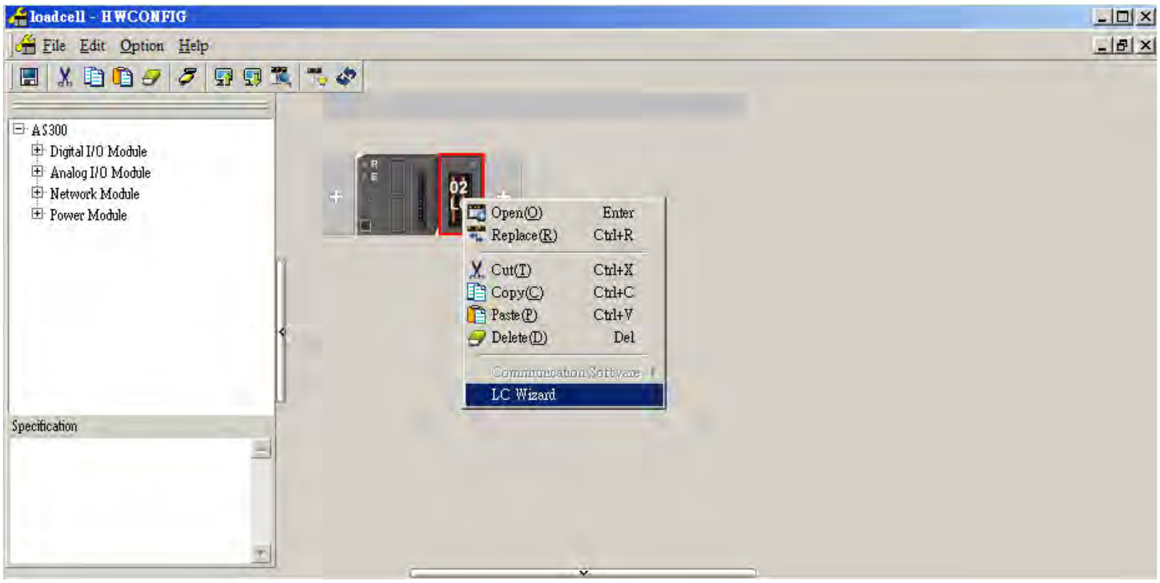

Step 2: set the number of adjustments and their corresponding values. The example below shows a 2-point adjustment in which point 1 = 0 and point 2 = 1000, corresponding to 1 kg.



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

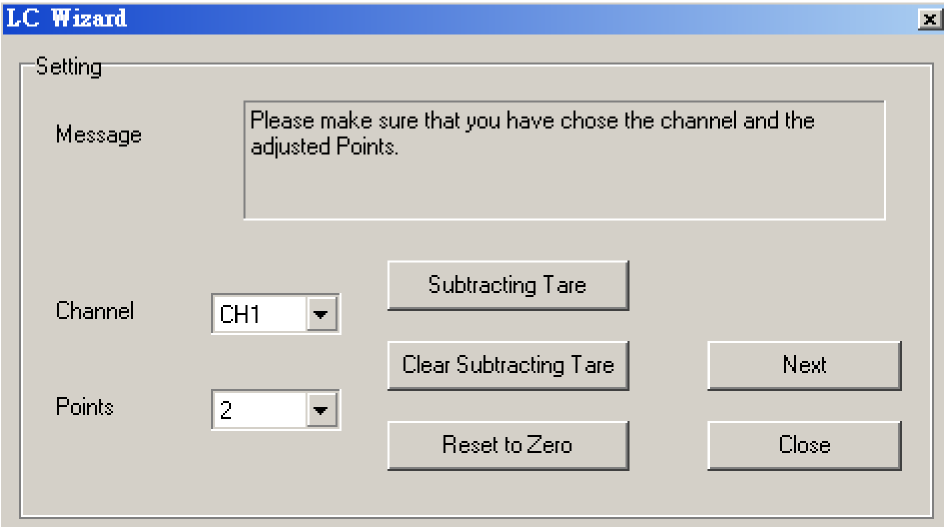



Step 4: right click the module and then click on **LC Wizard** to open the LC Wizard.

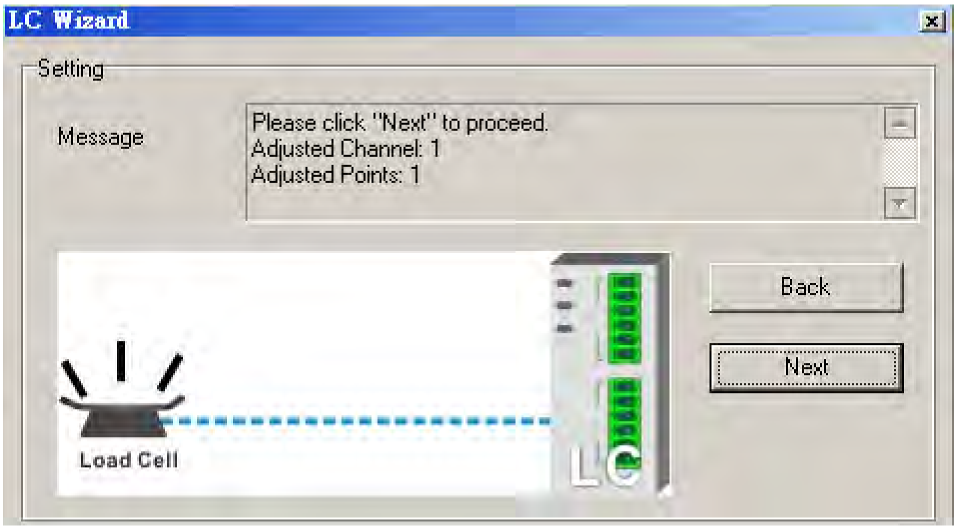



7

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

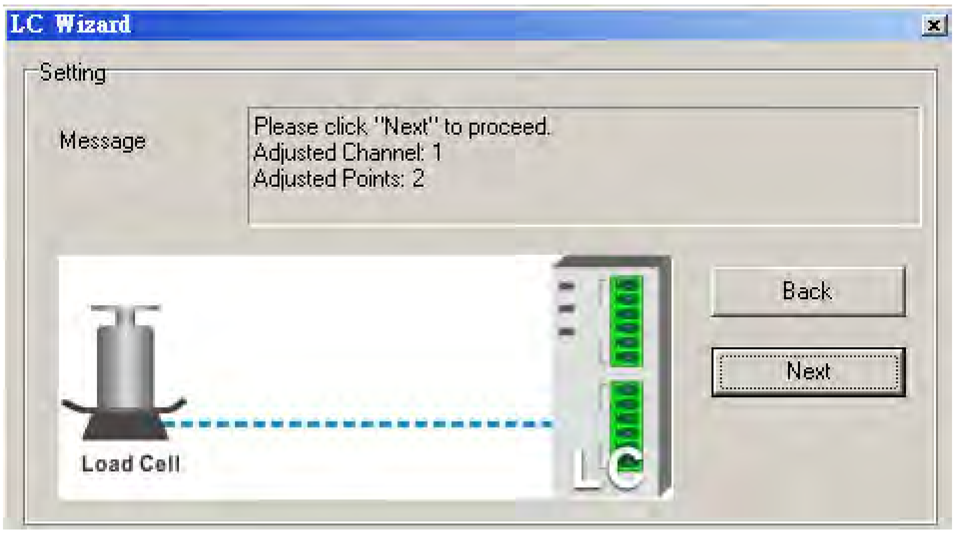



Step 6: put no load on the load cell (adjustment point 1) and click **Next** to proceed.

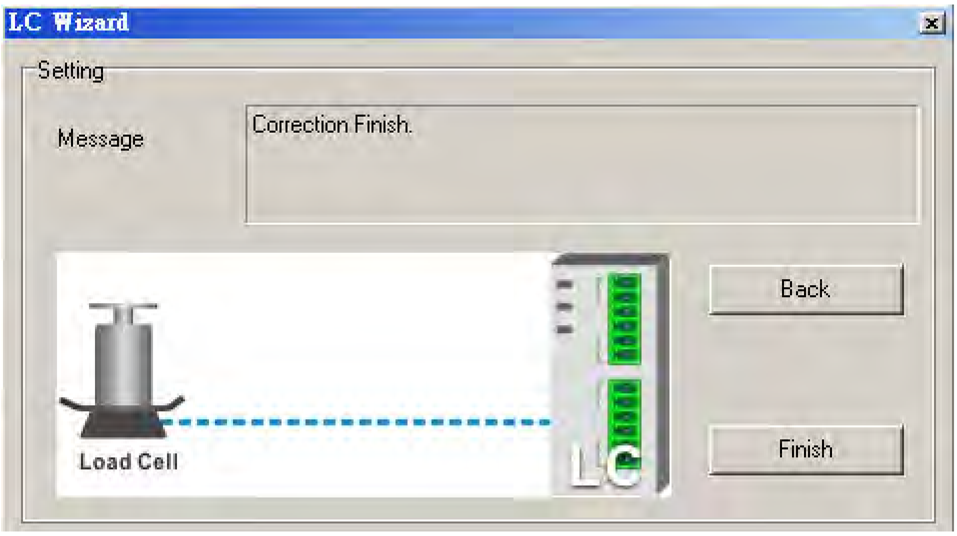



7

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.

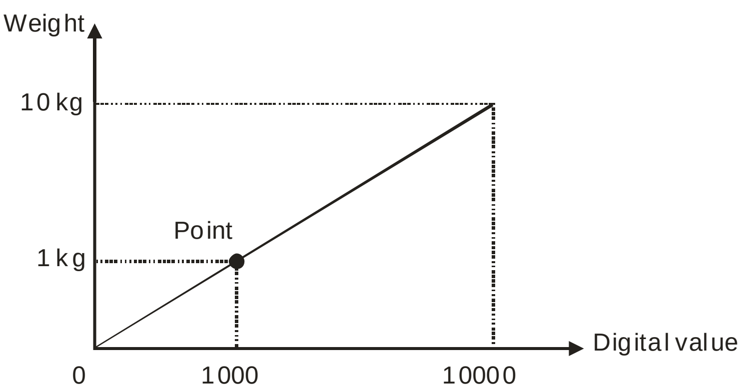



Step 8: the calibration is complete.




7

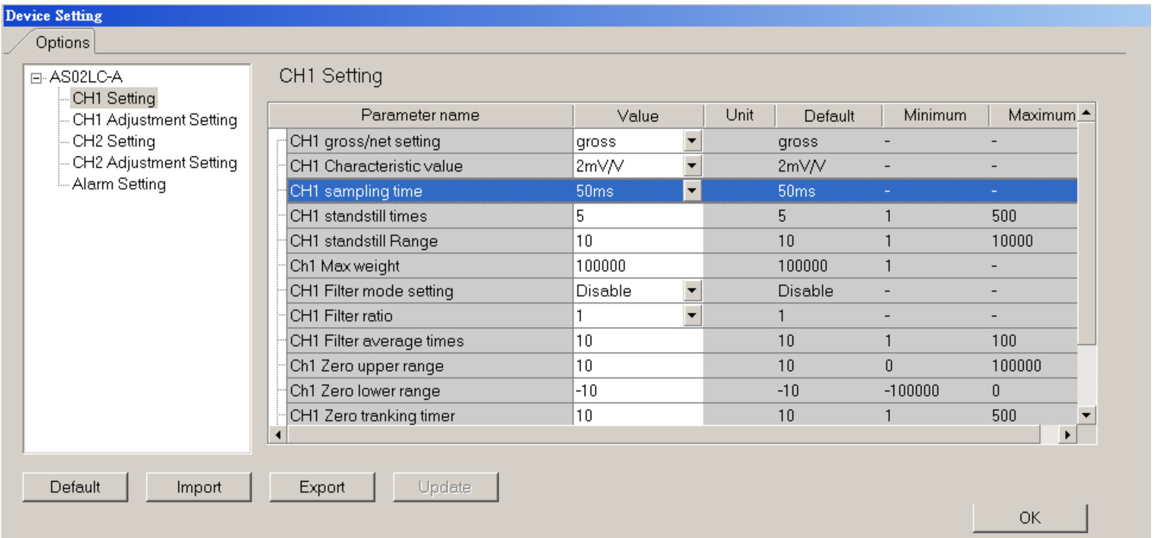
A characteristic curve is shown below.



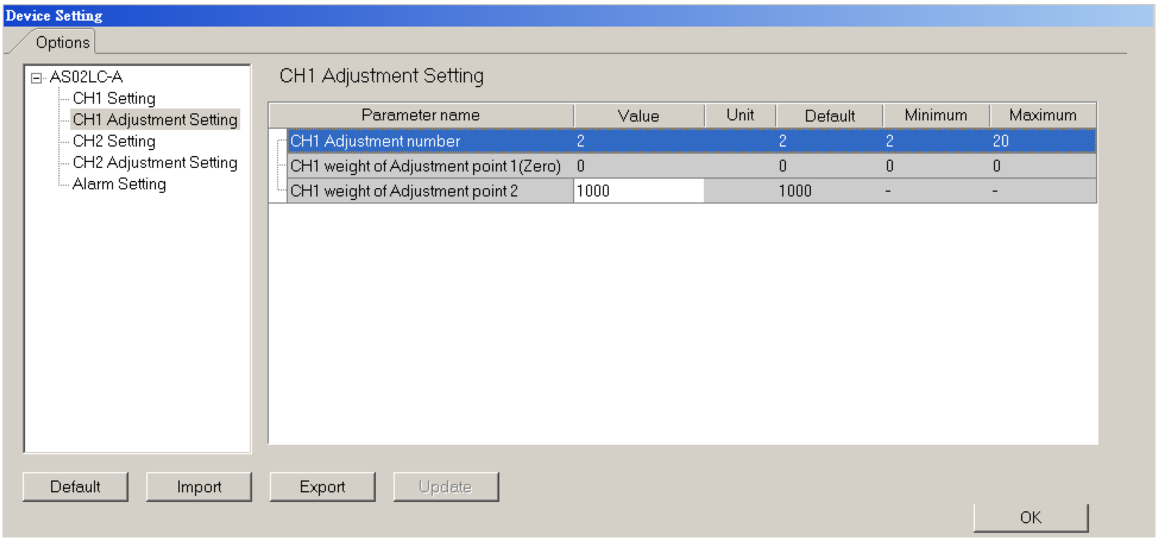

Adjusting two points

### 7.3.3 Adjustment settings / Instructional calibration

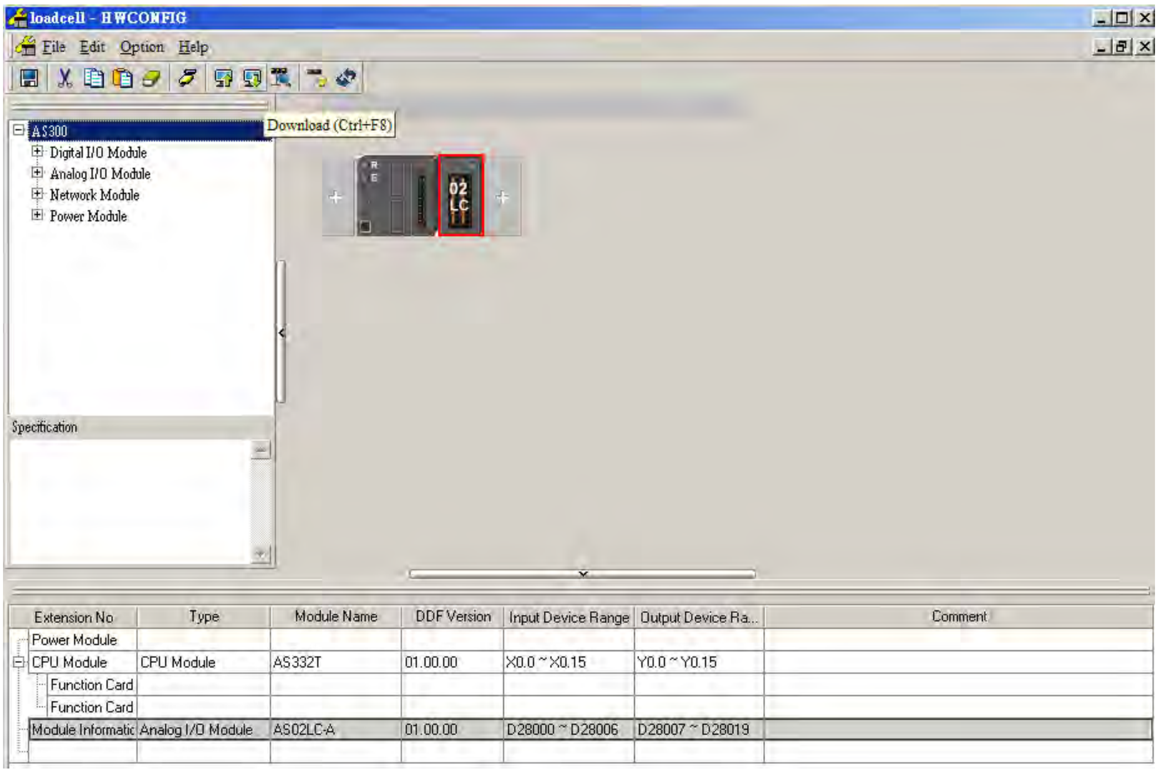
Step 1: set the eigenvalue in the HWCONFIG utility in ISPSoft.



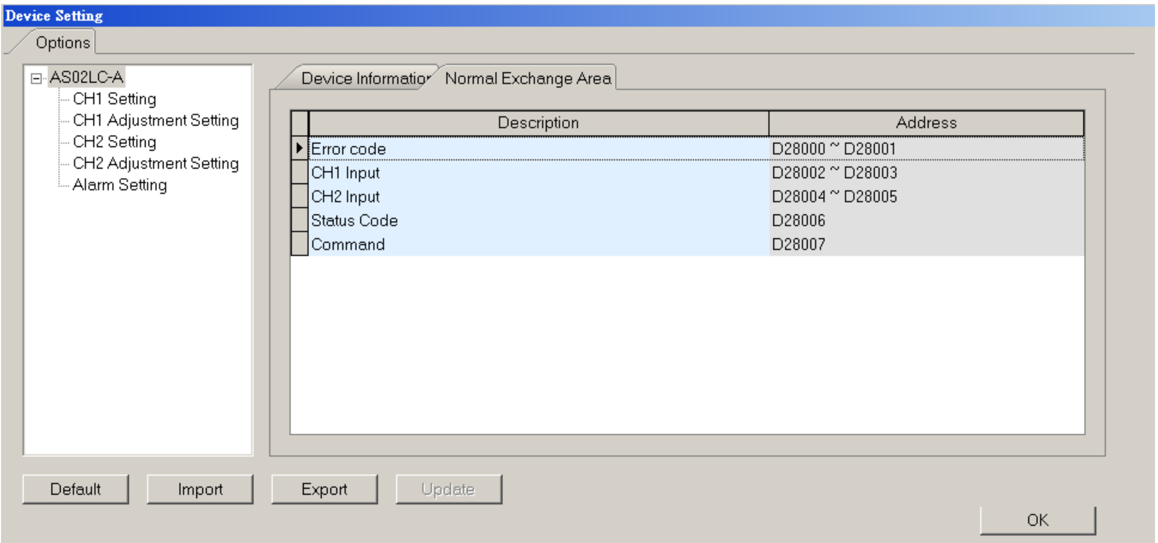

Step 2: set the number of adjustments and their corresponding values. The example below shows a 2-point adjustment where point 1 = 0 and point 2 = 1000, corresponding to 1 kg.



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

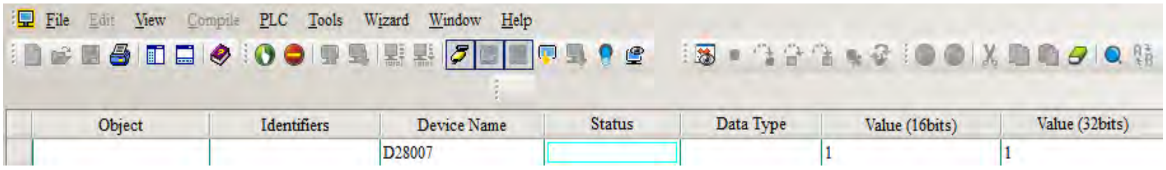



Step 4: verify that the corresponding address the instruction is D28007 in the Normal Exchange Area.



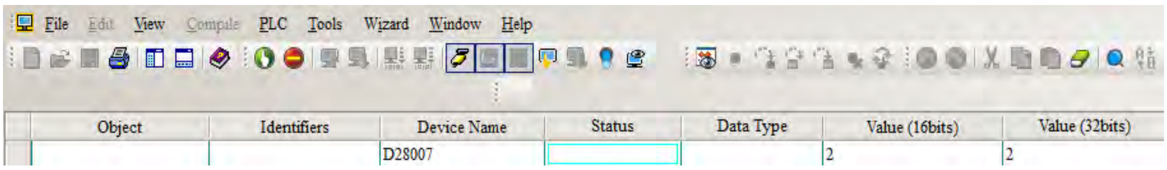
Step 5: enter the instruction for activating the weight calibration 98 into D28007.

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

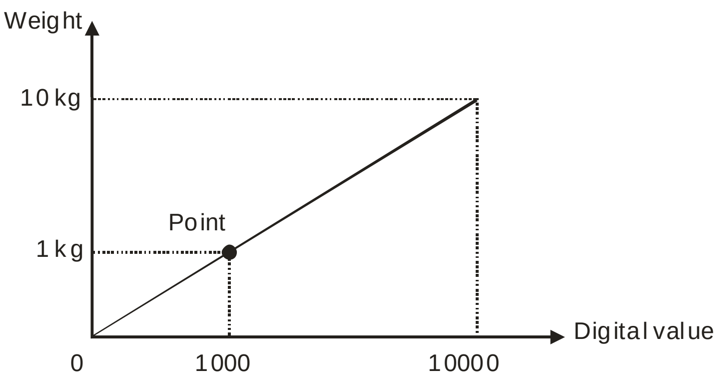

| Object | Identifiers | Device Name | Status | Data Type | Value (16bits) | Value (32bits) |
| --- | --- | --- | --- | --- | --- | --- |
| | | D28007 | | | 1 | 1 |

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.


| Object | Identifiers | Device Name | Status | Data Type | Value (16bits) | Value (32bits) |
| --- | --- | --- | --- | --- | --- | --- |
| | | D28007 | | | 2 | 2 |

Step 8: to complete the adjustment, enter the instruction for deactivating the weight calibration 99 into D28007. A characteristic curve is shown below.




Adjusting two points

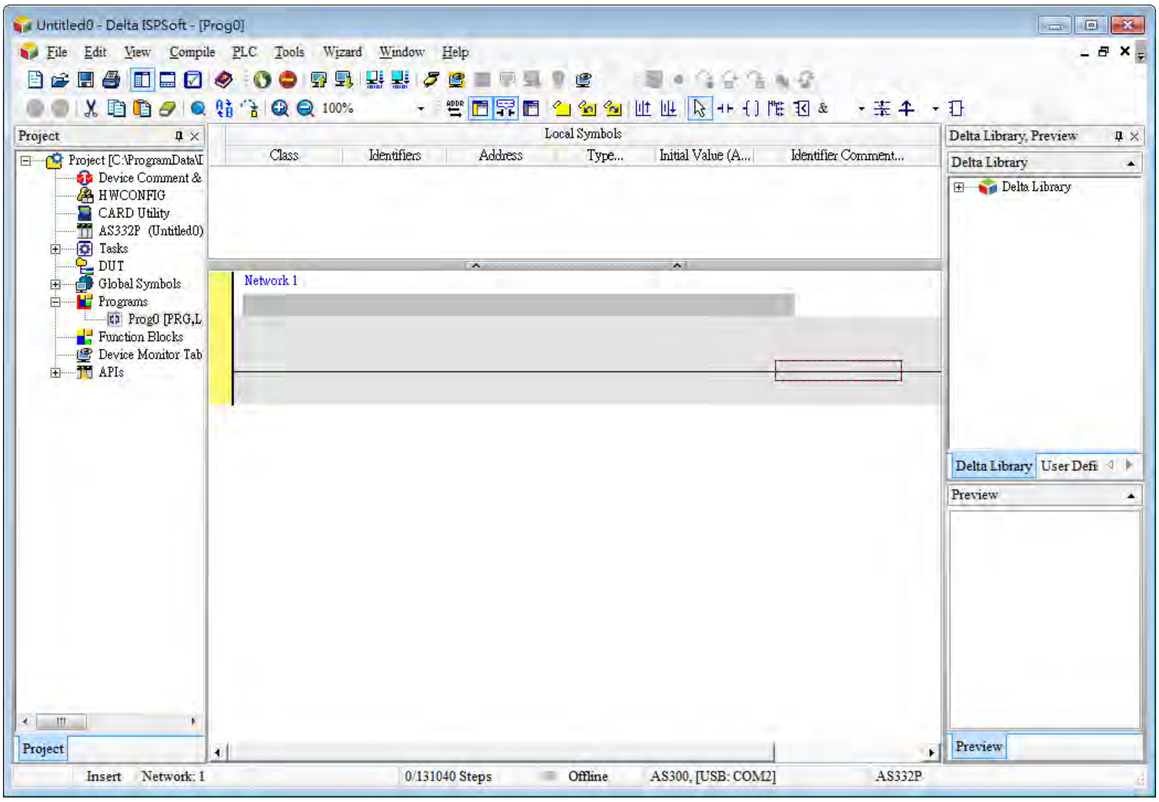
### 7.3.4 LED Indicators

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

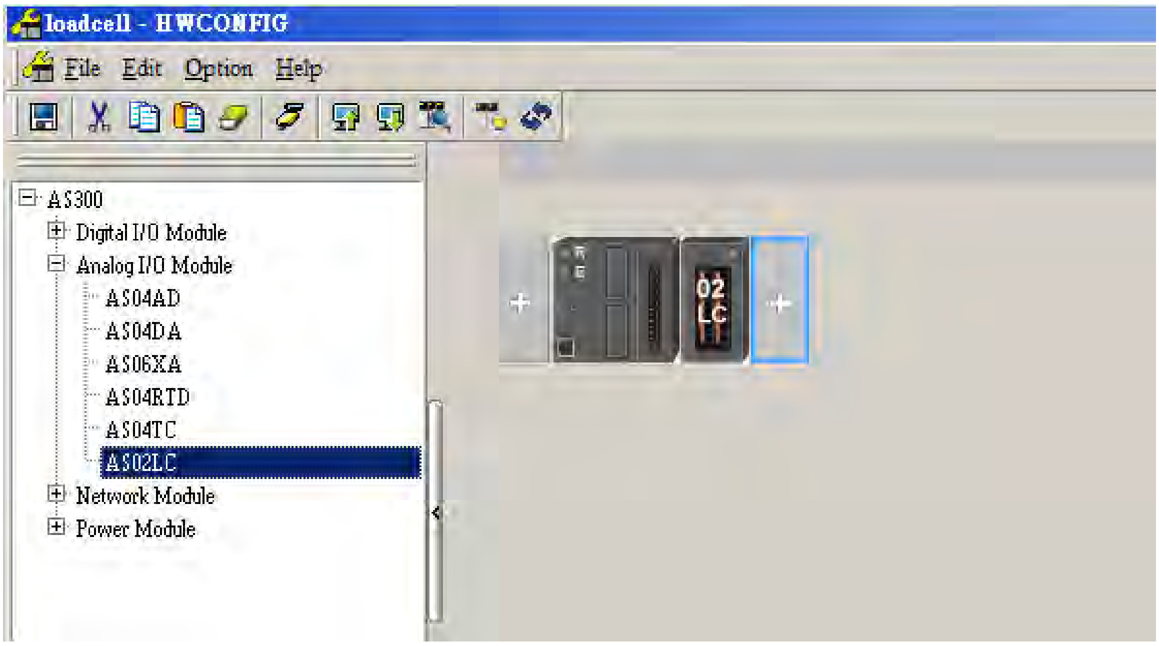
## 7.4 HWCONFIG in ISPSoft

### 7.4.1 Initial Setting

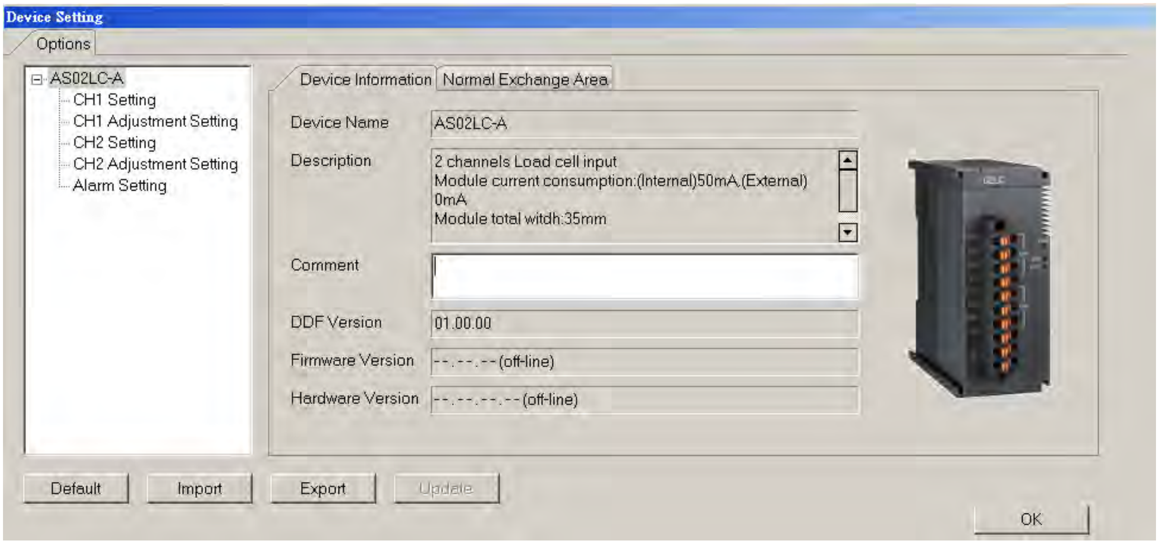
(1) Start ISPSoft and double-click **HWCONFIG**.



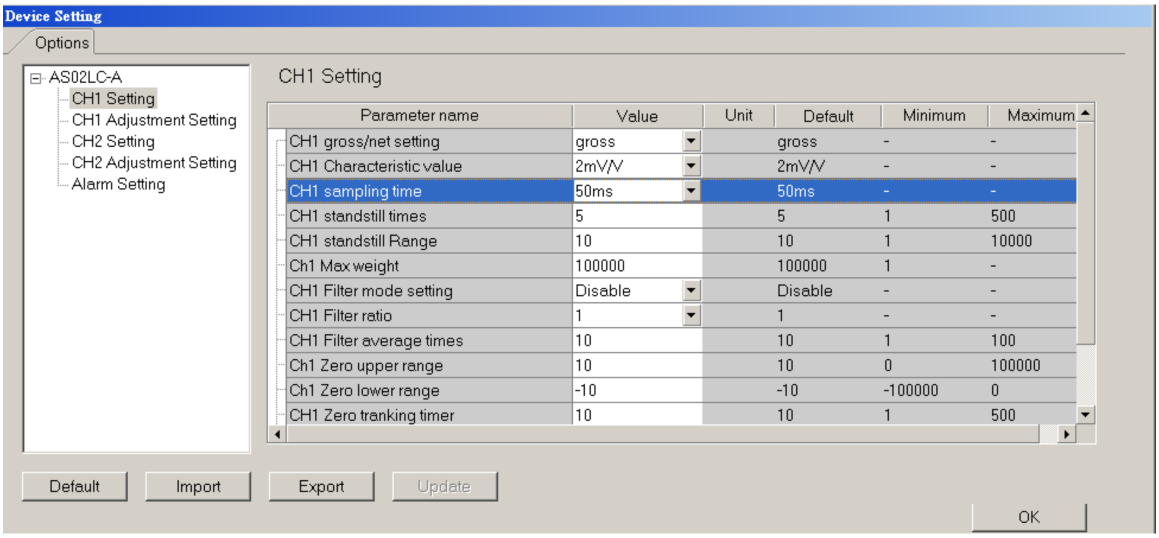
(2) Select a module and drag it to the working area.



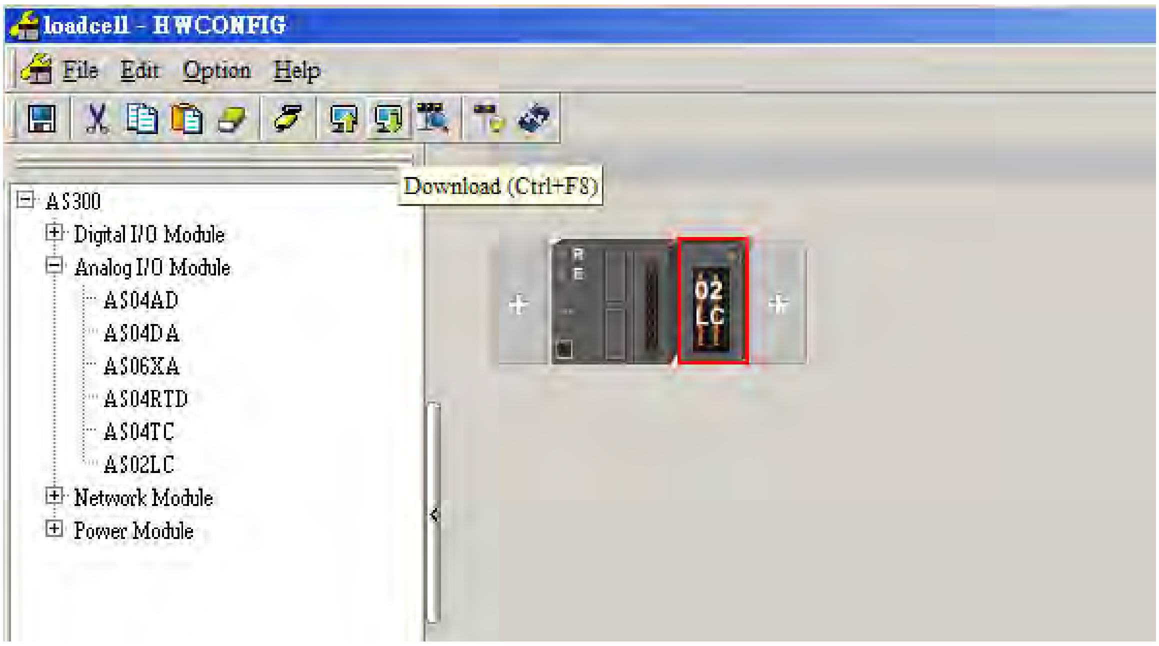

(3) Double-click the module in the working area to open the Device Setting page.



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

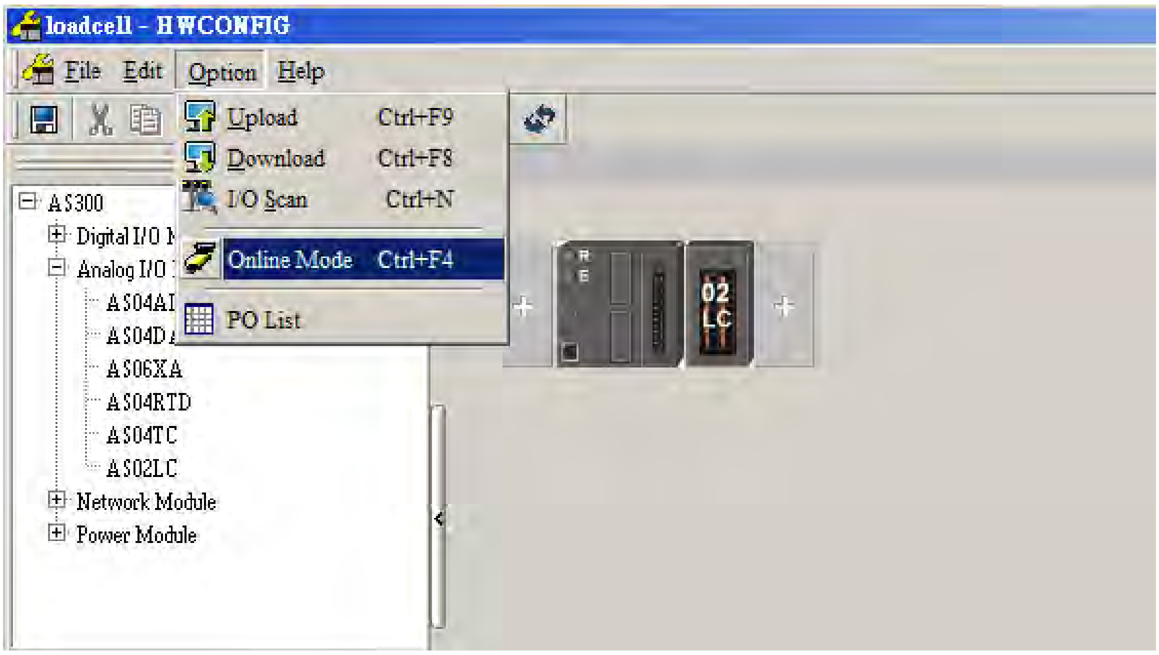



(5) Click **Download** on the toolbar to download the parameters. Note that you cannot download the parameters while the CPU module is running.)

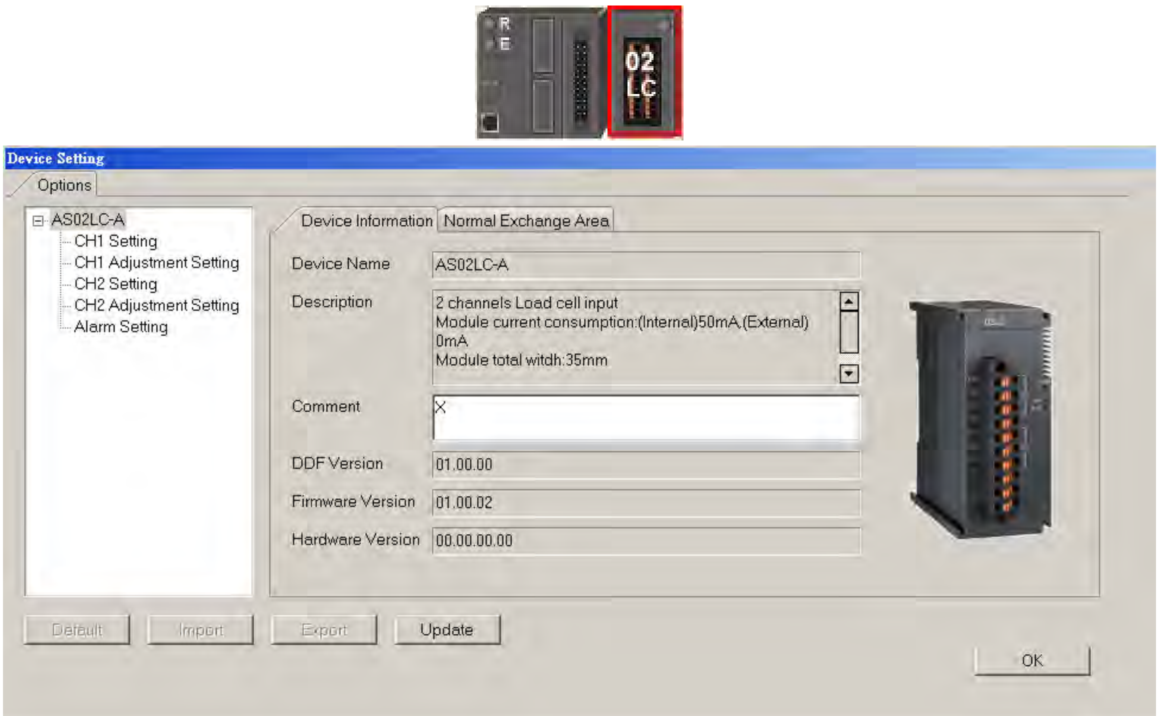


## 7.4.2 Checking the Version of a Module

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

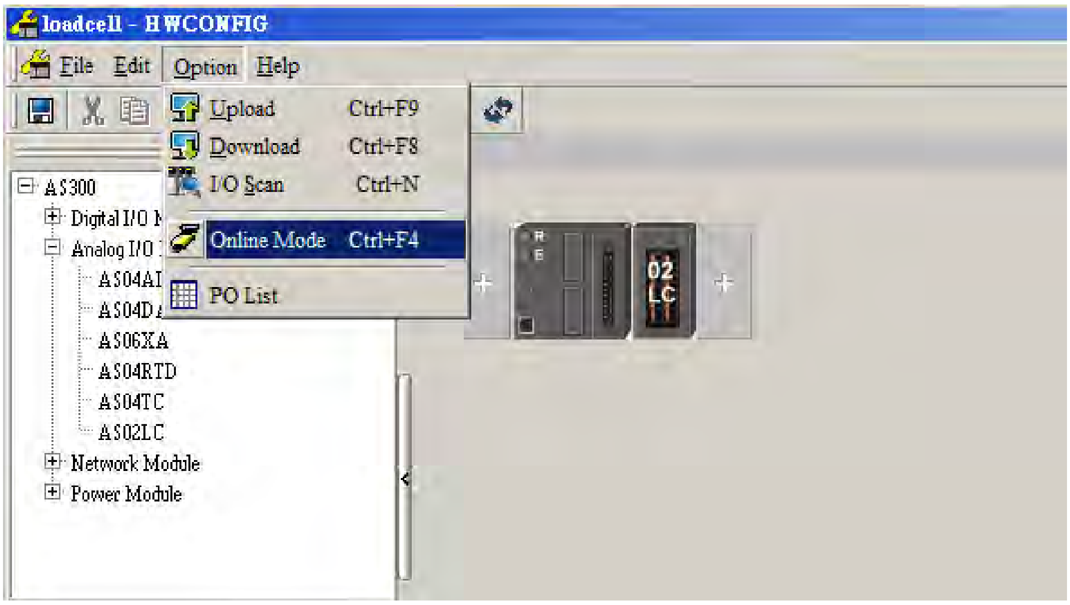



(2) Double-click the module to open the Device Setting page. The versions of both the firmware and the hardware are displayed.

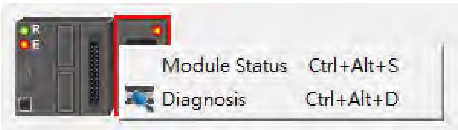


## 7.4.3 Online Mode

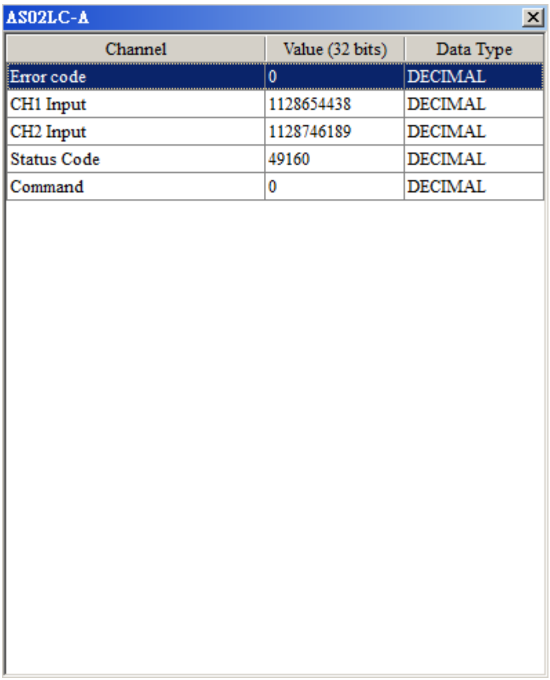
(1) On the **Option** menu, click **Online Mode**.




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



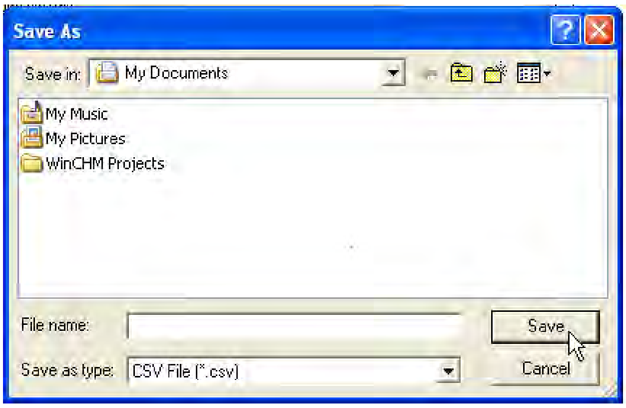

(3) View the module status.


AS02LC-A

| Channel | Value (32 bits) | Data Type |
|---|---|---|
| Error code | 0 | DECIMAL |
| CH1 Input | 1128654438 | DECIMAL |
| CH2 Input | 1128746189 | DECIMAL |
| Status Code | 49160 | DECIMAL |
| Command | 0 | DECIMAL |

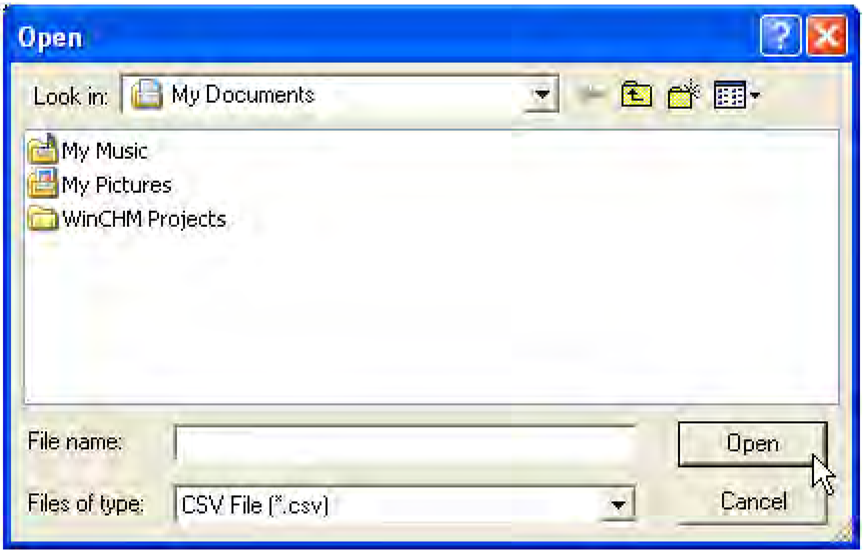
### 7.4.4 Importing/Exporting a Parameter File

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

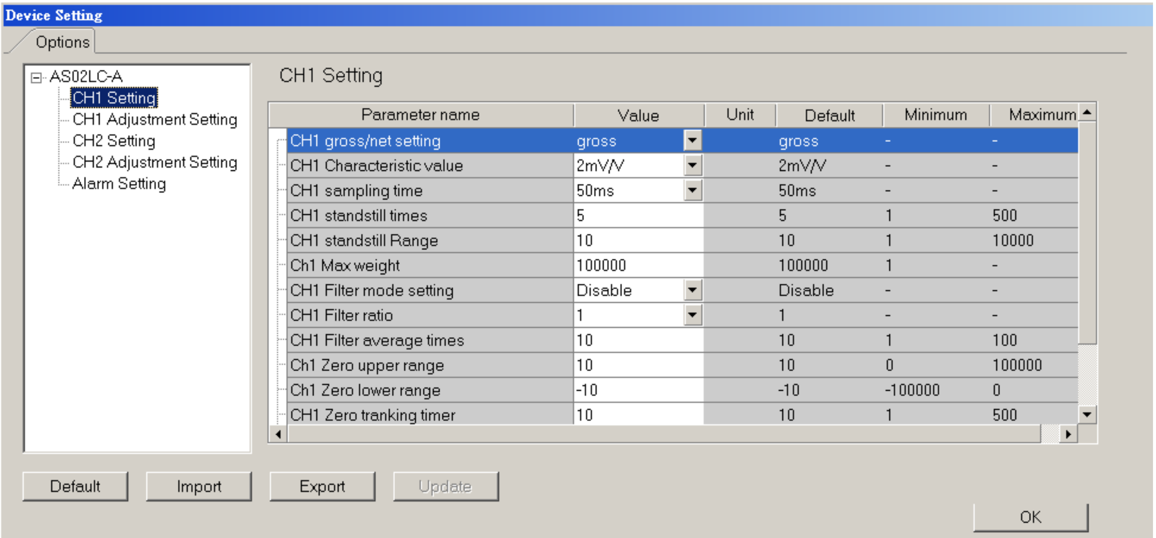


(2) Click **Import** in the Device Settings dialog box and select a CSV file to import saved parameters.

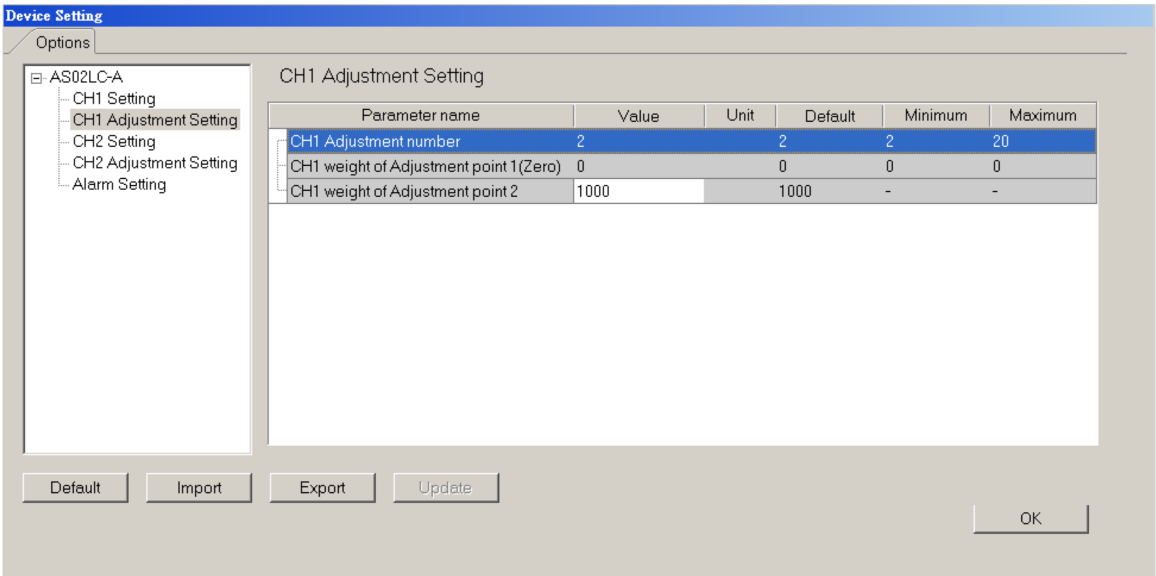



## 7.4.5 Parameters

(1) Settings for channel 1

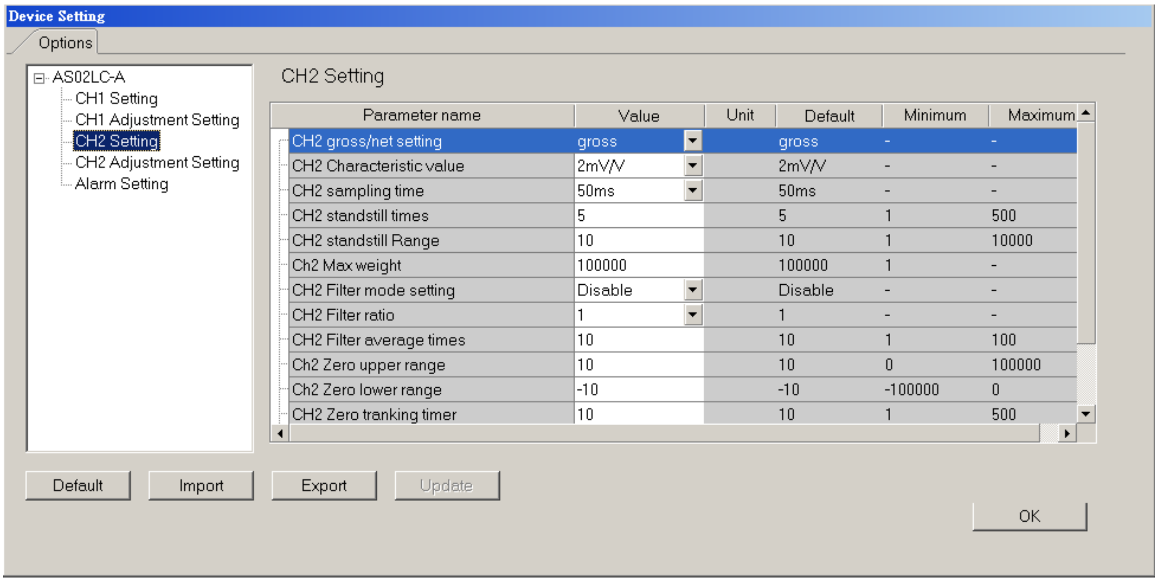



(2) Adjustment for channel 1

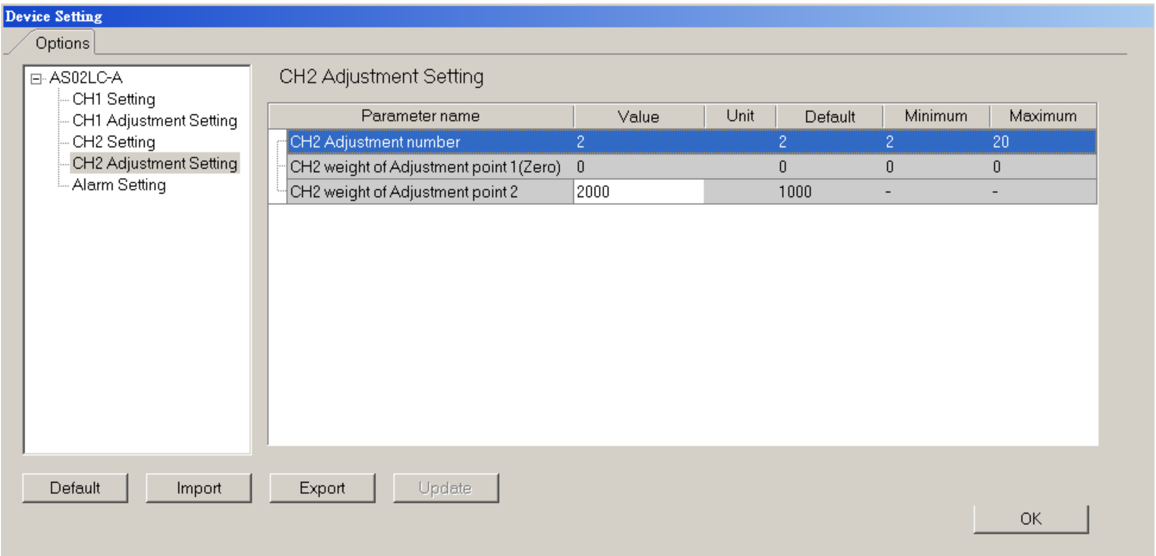



7

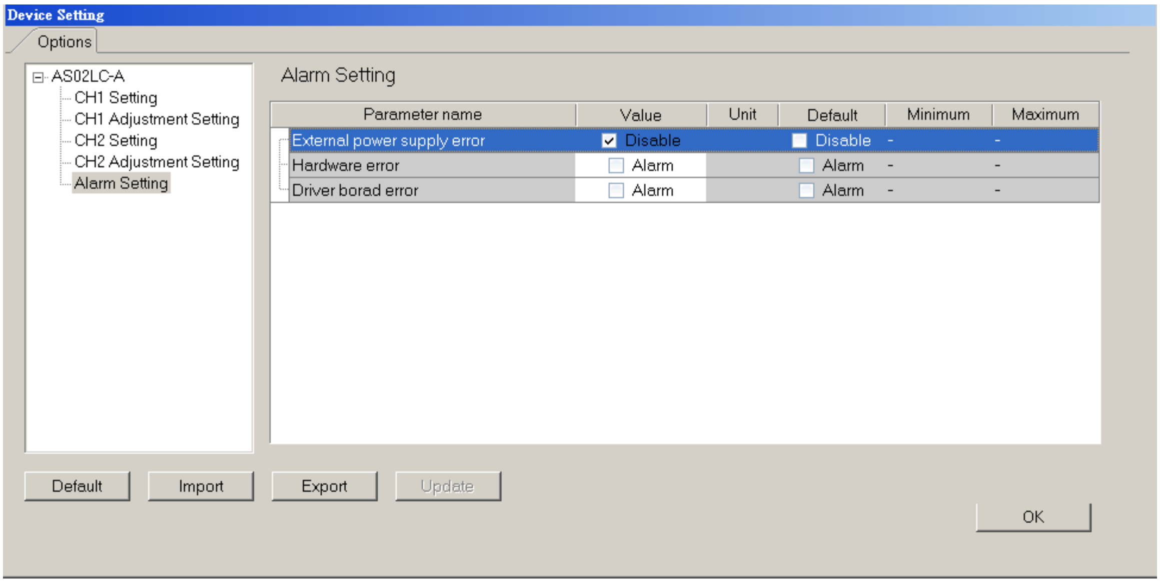
(3) Settings for channel 2




(4) Adjustment for channel 2



(5) Alarm settings




# 7.5 Troubleshooting

## 7.5.1 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<br>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>

### 7.5.2 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 channel 1 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 channel 1. |
| CH1 is adjusted incorrectly. | Check the adjusted weight value and the adjustment steps for channel 1. |
| 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 channel 2 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 channel 2. |
| CH2 is adjusted incorrectly. | Check the adjusted weight value and the adjustment steps for channel 2. |

Memo

8

# Chapter 8 Serial Communication Module AS00SCM

## Table of Contents

## 8.1 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 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 (Card 2) can be used as AS series remote module and supports CANopen DS301. AS00SCM-A should be firmware V2.00 or later.
- Ethernet communication card AS-FEN02 (Card 2) supports Modbus TCP Client/Server and EtherNet/IP Adapter (DLR function not included). AS00SCM-A should be firmware V2.02 or later.

You can configure the AS00SCM-A by using ISPSoft. Download ISPSoft V3.06 or later from Delta's official website. If you use UD Link, configure it through SCMSoft, which is embedded in DCISoft. Download DCISoft V1.19 or later from Delta's official website. You can set up the EtherNet/IP via EIP Builder. Download EIP Builder V1.06 or later from Delta's official website.

<table>
<tr><th rowspan="2"></th><th rowspan="2">Protocols</th><th colspan="2">COM (series COM ports)</th><th>RTU (Remote control)</th></tr>
<tr><th>Card 1</th><th>Card 2</th><th>Card 2</th></tr>
<tr><td>AS-F232</td><td rowspan="3">MODBUS<br>UD Link</td><td>V</td><td>V</td><td>-</td></tr>
<tr><td>AS-F485</td><td>V</td><td>V</td><td>-</td></tr>
<tr><td>AS-F422</td><td>V</td><td>V</td><td>-</td></tr>
<tr><td rowspan="3">AS-FCOPM</td><td>AS Remote Communication</td><td rowspan="2">-</td><td rowspan="3">V (Slave)<br>(Firmware V2.00 or later)</td><td rowspan="2">(Firmware V2.00 or later)</td></tr>
<tr><td>Delta Special Driver & AS Remote Mode</td></tr>
<tr><td>CANopen DS301</td><td>-</td><td>(Firmware V2.02 or later)</td></tr>
<tr><td>AS-FEN02</td><td>EtherNet/IP<br>MODBUS TCP</td><td>-</td><td>-</td><td>(Firmware V2.02 or later)</td></tr>
</table>

# 8.2 Specification, Function and Wiring

## 8.2.1 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<br>Parity bit: none, an odd parity bit, and an even parity bit<br>Data bit: 7 bits and 8 bits |
| **Communication protocol** | Modbus ASCII/RTU<br>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)<br>CANopen (firmware V2.00 or later) |

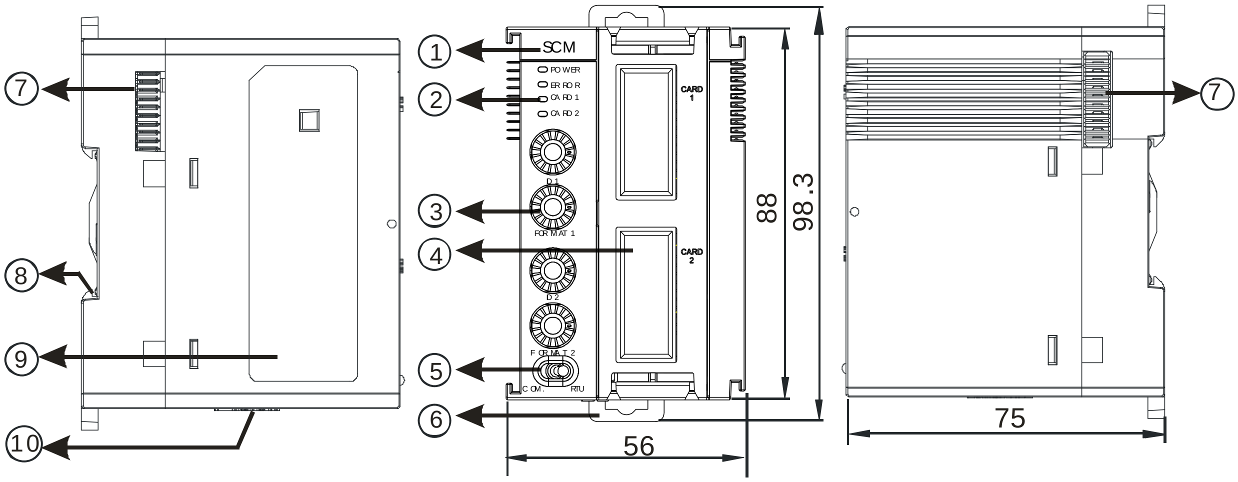
■ **Ethernet communication interface**

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

■ **Electrical specifications**

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

## 8.2.2 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<br>ON: the module is running.<br>OFF: the module has low voltage or no power. |
| | ERROR LED Indicator (red) | Error status of the module<br>ON: there is a hardware error.<br>OFF: the module is operating normally.<br>Blink: 1. the configuration of the module is invalid, or there is a communication error (blinking every 1 second).<br>2. hardware/low voltage error (blinking every 0.2 seconds) |
| | Function card 1 Indicator (orange) | Blink: data is being transmitted to function card 1.<br>OFF: there is no data transmission to function card 1. |
| | Function card 2 Indicator (orange) | Blink: data is being transmitted to function card 2.<br>OFF: there is no data transmission to function card 2. |
| 3 | Switch 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 | For AS-F232, AS-F422, AS-F485 |
| | Function Card 2 Slot | For AS-F232, AS-F422, AS-F485, AS-FCOPM, and AS-FEN02 (in RTU mode only) |
| 5 | Switch for the Work Mode | COM: communication mode<br>RTU: remote control 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 |

- **Switch for the node ID and format**

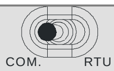
1. Modbus communication (AS-F232/AS-F422/AS-F485): can be installed in Card 1 and Card 2 (in COM mode only). Use the switch to set the node ID and its setting range is 0x01–0x0F. You can use ISPSoft (HWCONFIG) to set up the node ID, when the switch is turned to 0. Follow the descriptions shown on the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

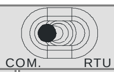
**COM Mode (SCM mode):** use the switch to set the node ID and its setting range is 0x01–0x0F. You can use ISPSoft (HWCONFIG) to set up the node ID, when the switch is turned to 0. Follow the descriptions shown on the HWCONFIG for node ID setting range.

**RTU Mode:** the setting varies according to different CANopen communication mode; refer to section 8.4.1 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 |

- **Switch for the format**

1. Modbus communication (AS-F232/AS-F422/AS-F485): can be installed in Card 1 and Card 2 (in COM mode only). Use the Format Switch to set the communication mode. You can use ISPSoft (HWCONFIG) to set up the communication mode, when the Format Switch is turned to 0. If you need to set the communication mode to UD Link, you need to turn the Format Switch to 0. Refer to section 8.3.2 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 |

2. CANopen (AS-FCOPM): can only be installed in Card 2; the communication mode can be set to COM/RTU mode. Refer to the following table and use switch to set up. You cannot use ISPSoft (HWCONFIG) to set up the communication mode in this format.

| CANopen (AS-FCOPM) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **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 |

- **Switch for IP address (AS-FEN02)**

When using the communication card AS-FEN02, it only supports RTU mode and the IP address can be edited through FORMAT 2. The parameters of AS-FEN02 are stored in AS300 PLC or AS00SCM-A. Thus you need to set up the IP address for AS-FEN02 or use COMMGR to scan and check for the IP address of AS-FEN02.

1. When both switches ID2 and FORMAT 2 are set to 0, IP address is set through EIP Builder (ISPSoft -> HWCONFIG).
   - When connected to Delta AS/AH series, you can open HWCONFIG and EIP Builder through ISPSoft. Add AS00SCM (RTU) + AS-FEN02 to your network and click the scanner device from the created network in EIP Builder to open HWCONFIG to set up.
   - When the scanner is from the third party, you can open EIP Builder directly. Add AS00SCM (RTU) + AS-FEN02 to your network and click the scanner device from the created network in EIP Builder to open HWCONFIG to set up.
2. When either ID2 or FORMAT 2 is NOT 0, IP address is set by switches 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).

## 8.2.3 Wiring

### 8.2.3.1 AS00SCM-A Power Wiring

- COM mode:

Switch 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 this module.

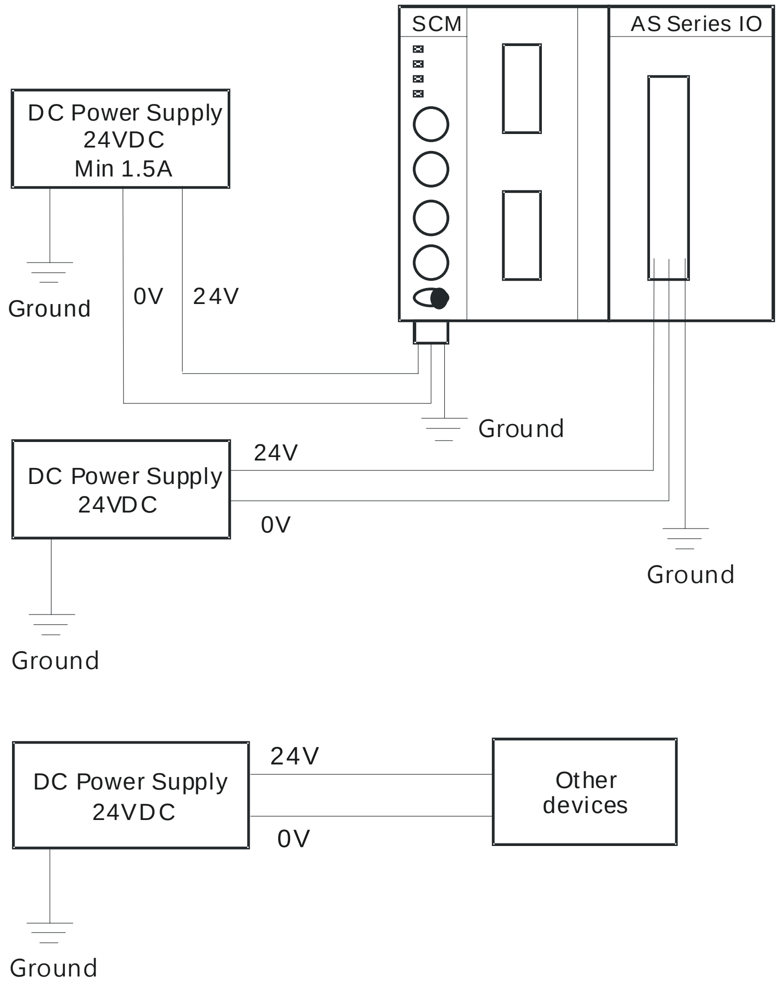
- RTU mode:

Switch 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.

8




(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.



### 8.2.3.2 AS00SCM-A Communication Interface

- COM 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 when the firmware is V2.00 or later. Refer to Chapter 9 for more information about wiring the cards.

- RTU mode:

The card 2 slot supports the AS-FCOPM communication card when the firmware is V2.00 or later and supports AS-FEN02 when the firmware is V2.02. For wiring information, refer to Chapter 9.

## 8.3 COM mode

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

### 8.3.1 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 8.2.2 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 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 this function. Refer to section 8.3 in AS Series Operation Manual for more details.
- 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<br>0x04 | Read | 16#0000~16#0063<br>16#0100~16#0163<br>16#0200~16#0263<br>16#0300~16#0363 |
| 0x06<br>0x10 | Write | 16#0000~16#0063<br>16#0200~16#0263 |
| 0x17 | Read | 16#0000~16#0063<br>16#0100~16#0163<br>16#0200~16#0263<br>16#0300~16#0363 |
| | Write | 16#0000~16#0063<br>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 8.6.1 for more details.

8

## 8.3.2 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 switch 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.

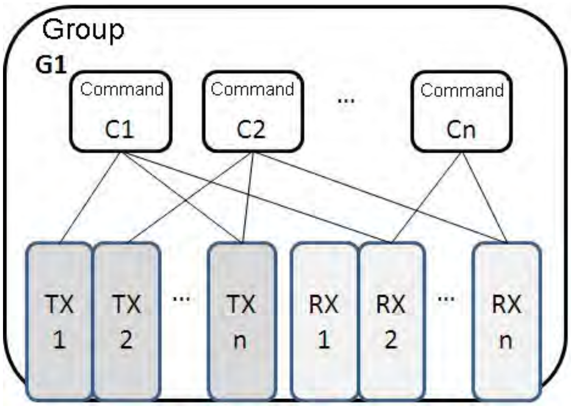
- In SCMSoft

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.

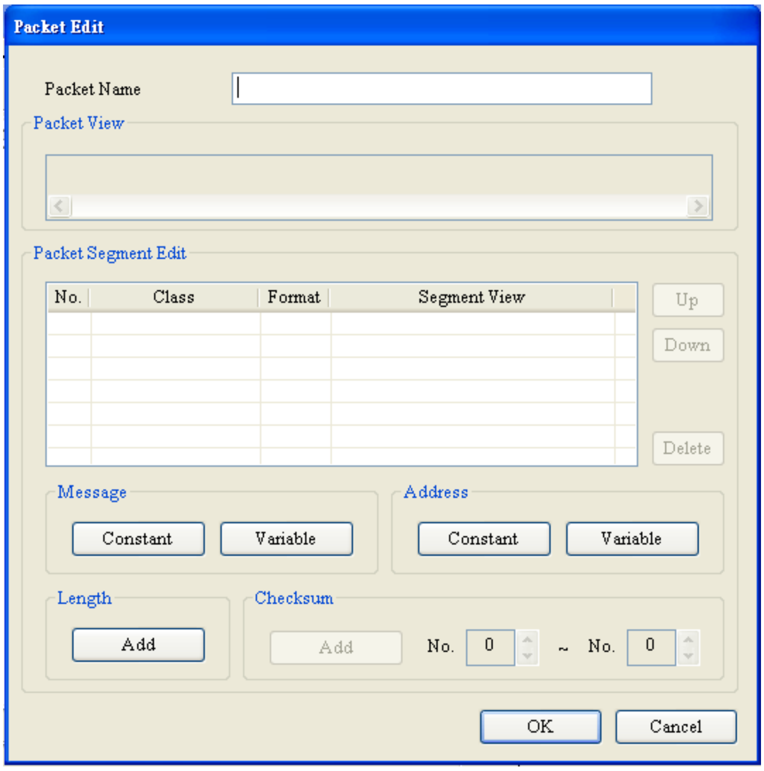
Edit TX and RX packets. -> Create commands. -> Download parameters to UD Link. -> Download in groups and once a group number is trigger, the function card starts to send and receive packets according to the comment order.




8

### 8.3.2.1 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.

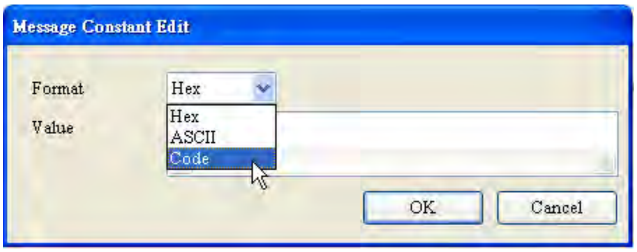
  **Class:** 1 byte or 2 byes

  **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.

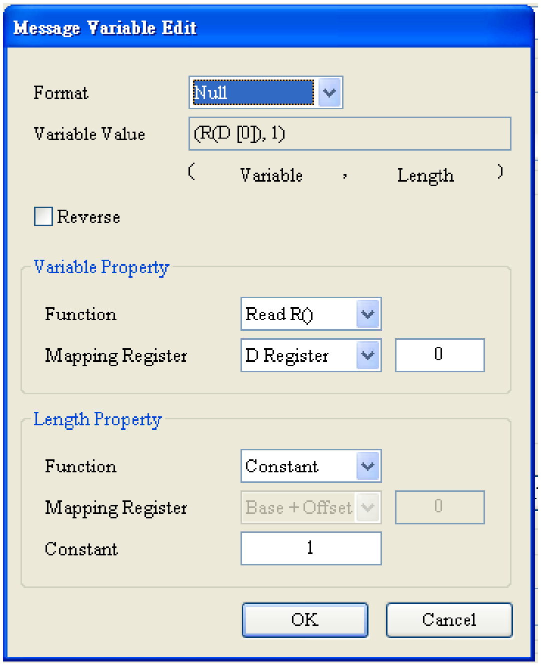
**Reverse**: the high byte of a one-word checksum is calculated, and the high byte (word) and low byte (byte) of the checksum are reversed.




- **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**.

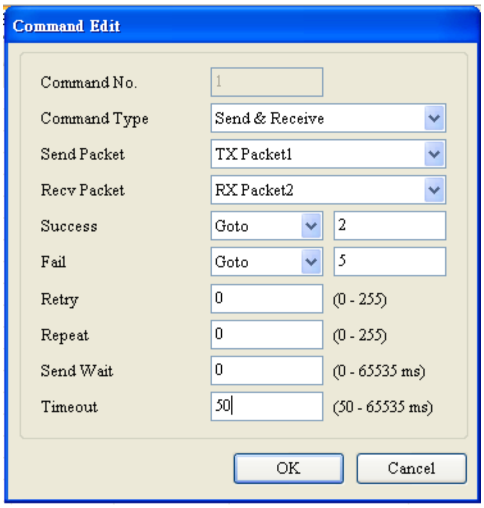
**Mapping Register**: select a register in the PLC.

8

- **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.

### 8.3.2.2 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.

8

- **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.

## 8.3.3 CANopen Mode

The 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 master modules in the CANopen network environment.

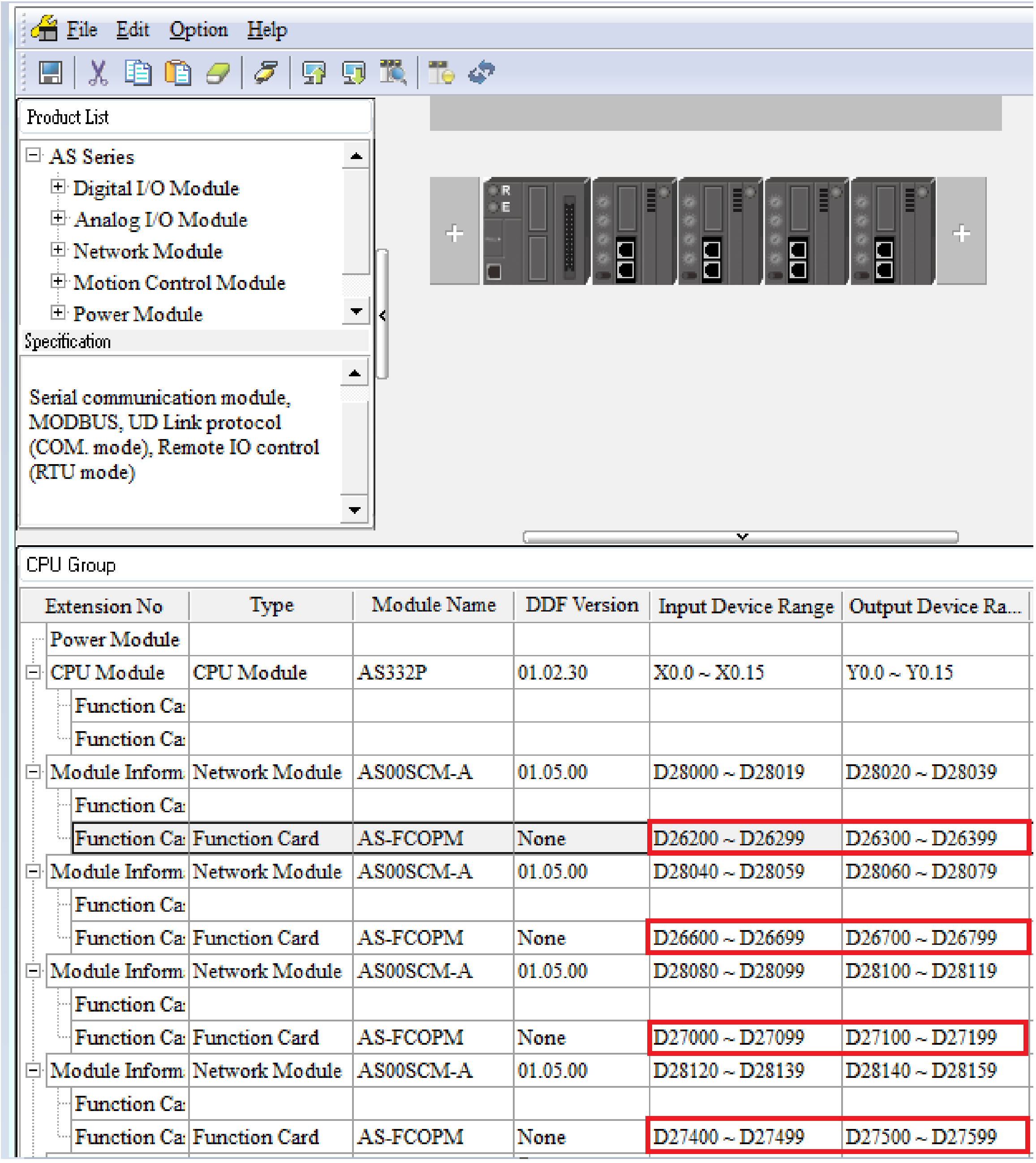
### 8.3.3.1 Features

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

### 8.3.3.2 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.




8

# 8.4 RTU Mode

## 8.4.1 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 switch FORMAT 1 to switch among three RTU modes.

A. RTU Communication Mode Setup Switch ″FORMAT 1″

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

B. Node ID Setup Switch ″ID1/ID2″

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

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

C. RTU Communication Speed Setup Switch ″FORMAT 2″

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

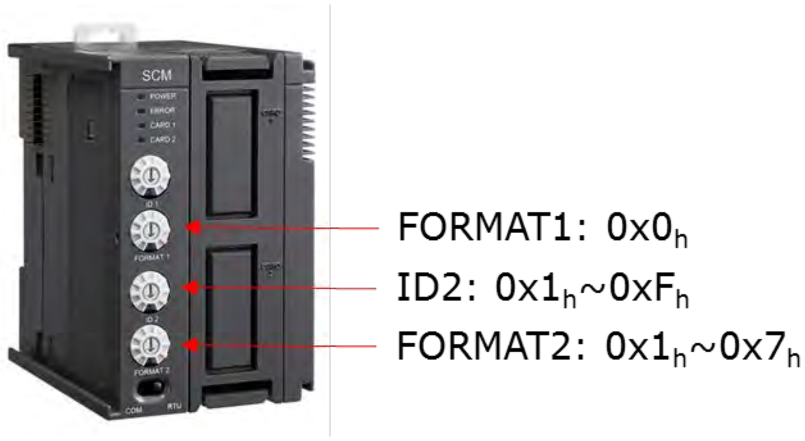
| FORMAT2 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8-F |
|---|---|---|---|---|---|---|---|---|
| **Byte (bps)** | 10K | 20K | 50K | 125K | 250K | 500K | 1000K | NA |
| **Distance (m)** | 5000 | 2500 | 1000 | 500 | 250 | 100 | 25 | NA |

### 8.4.1.1 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 Co | - | - |
| 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 switch 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 switch ID2 to set up Node ID and use the switch 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 switch to 0 and FORMAT1 to 0; ID2 switch to 1 and FORMAT2 to 7.

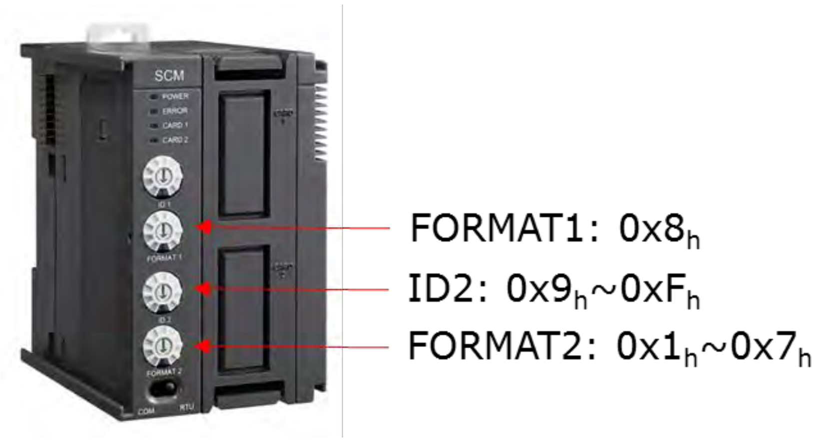
3. Supply power to AS00SCM-A and connect AS00SCM-A to the PLC with a CANopen cable.
4. Resupply power to the PLC and the indicator of CARD2 should keep blinking. That indicates AS00SCM-A and the PLC are connected. The PLC error indicator should be blinking too, since the setting is not done yet.
5. Use 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.

### 8.4.1.2 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 Car( | | 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 switch 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 switch ID2 to set up Node ID and use the switch FORMAT2 to set up the baud rate. (The baud rate should be the same as the PLC's baud rate.)



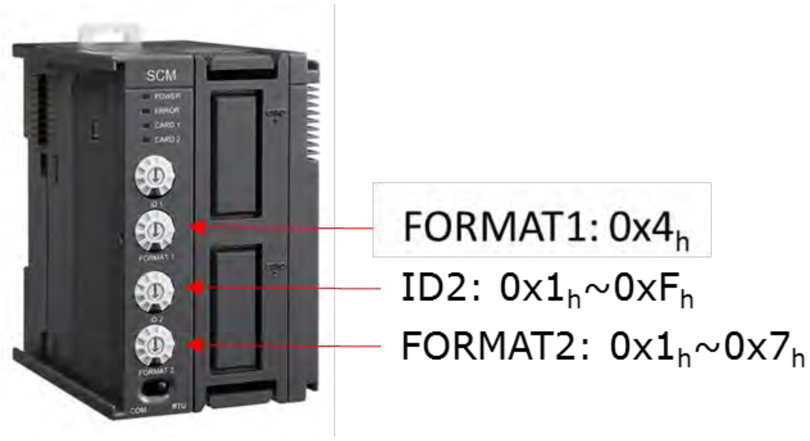

**Steps for a quick setup**

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 switch to 0 and FORMAT1 to 8; ID2 switch 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.

### 8.4.1.3 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 switch 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 8.6.3. 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.

8




**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 8.4.1.1 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, switch ID2 to 0.
4. Install the I/O module to the right side of AS00SCM-A and switch the working mode to RTU.
5. Switch 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 8.6.3 PDO examples, if you are using AH10COPM-5A as the CPU.

## 8.4.2 EtherNet/IP Mode

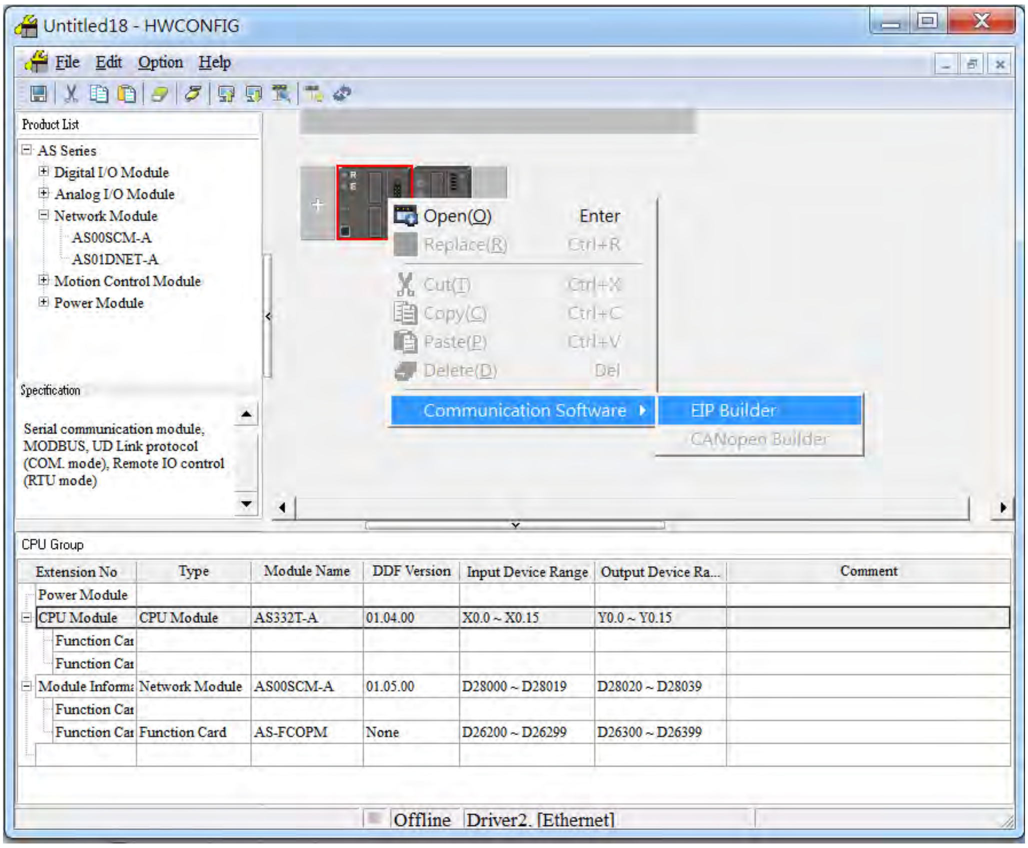
AS00SCM-A (firmware V2.02 or later) can be installed on AS-FEN02. However it can only be used in RTU mode and you can use Delta PLC or the 3rd party EtherNet/IP device to control the right-side modules of the AS00SCM-A. Refer to section 9.2.7 for more details on the operations of AS-FEN02 installed on AS Series PLC.



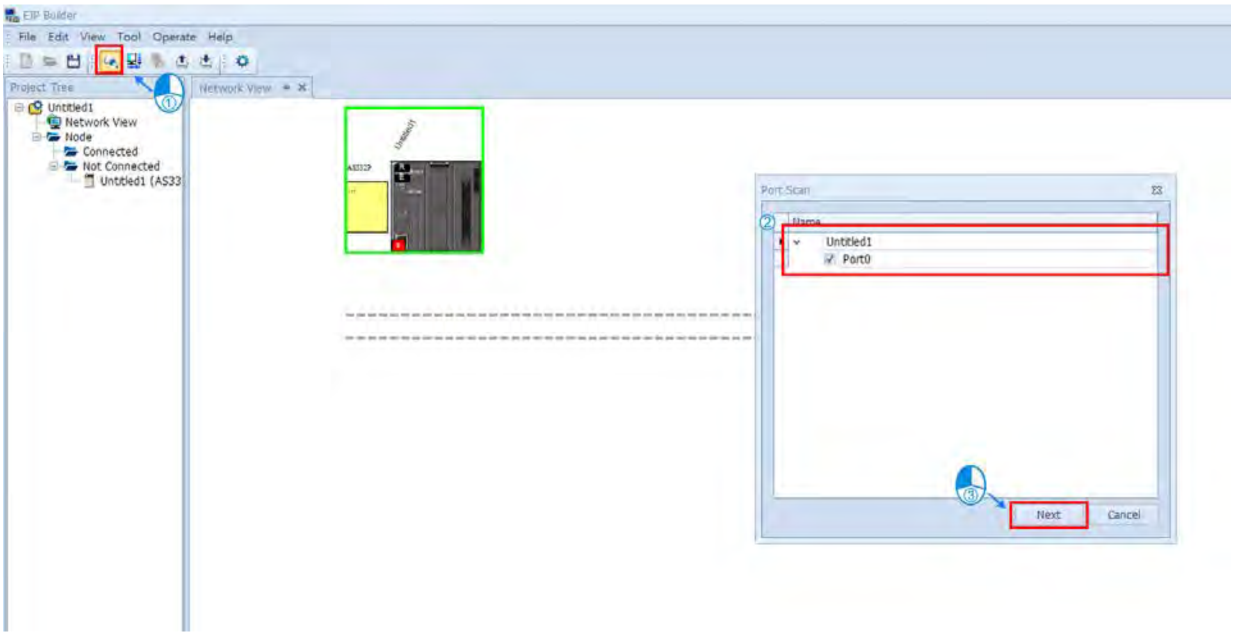
### 8.4.2.1 Connecting to Delta PLC Scanner through EIP Builder

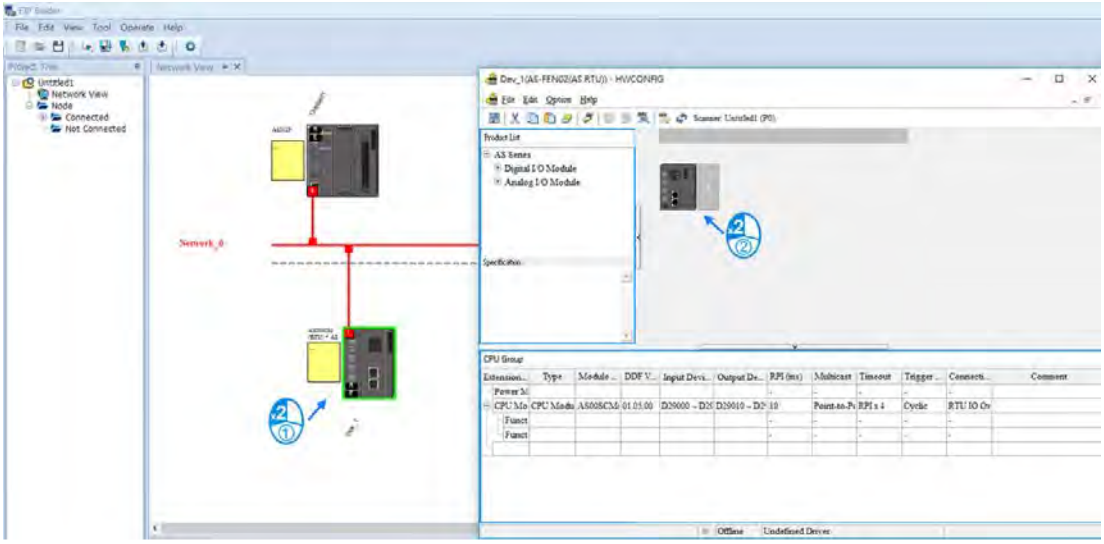
Through EIP Builder, an AS Series PLC (when acting as a scanner) can create an EtherNet/IP connection to AS00SCM-A (when installed) on AS-FEN02. Below shows an example of AS Series PLC acting as a scanner to create an EIP connection.

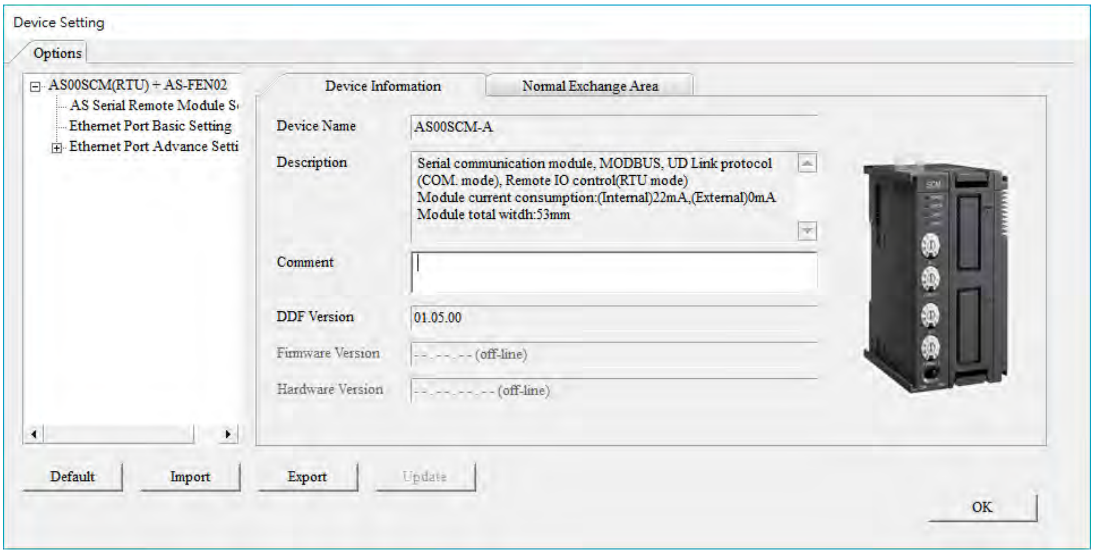
1. An AS Series PLC, AS-FEN02 and a computer can be connected together through an Ethernet switch. Configure the parameters in HWCONFIG and right-click the CPU to open EIP Builder.



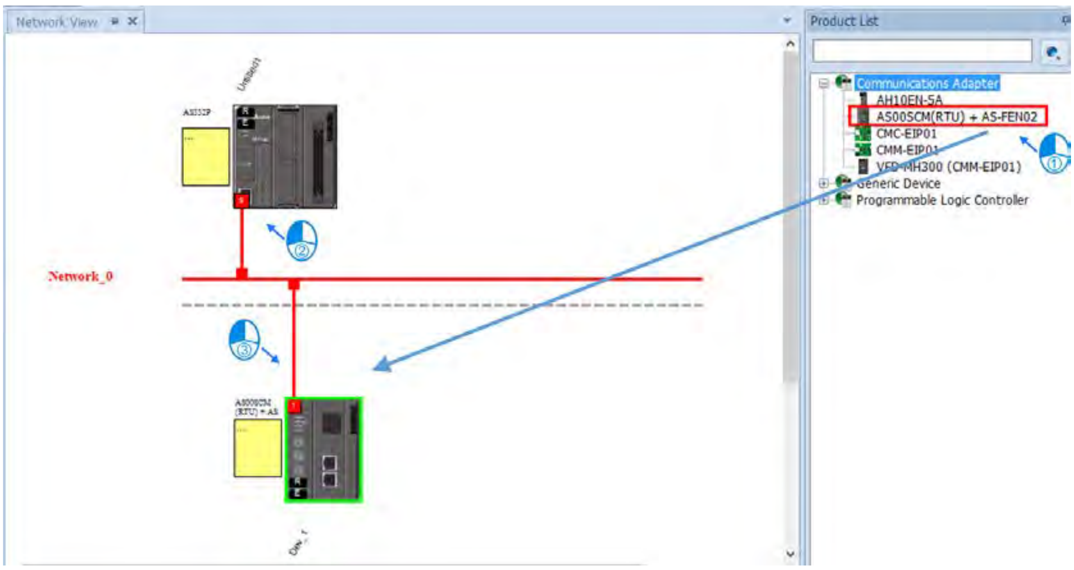

2. Scan the network to add AS-FEN02 (AS RTU) in EIP Builder. Drag the red block and drag it to the same network (Network_0) as the AS Series PLC does. Double-click AS-FEN02 to open HWCONFIG and set the parameters for AS-FEN02.





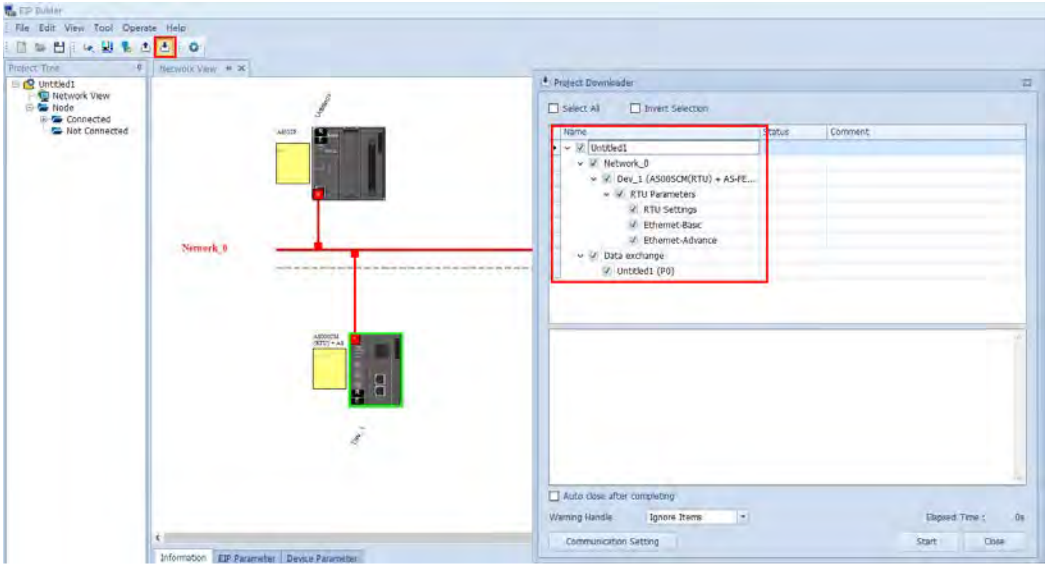




3. If the PLC is not connected to any module, you can drag and drop AS-FEN02 (AS RTU) from the Product List on the right to add it into the Network View.



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

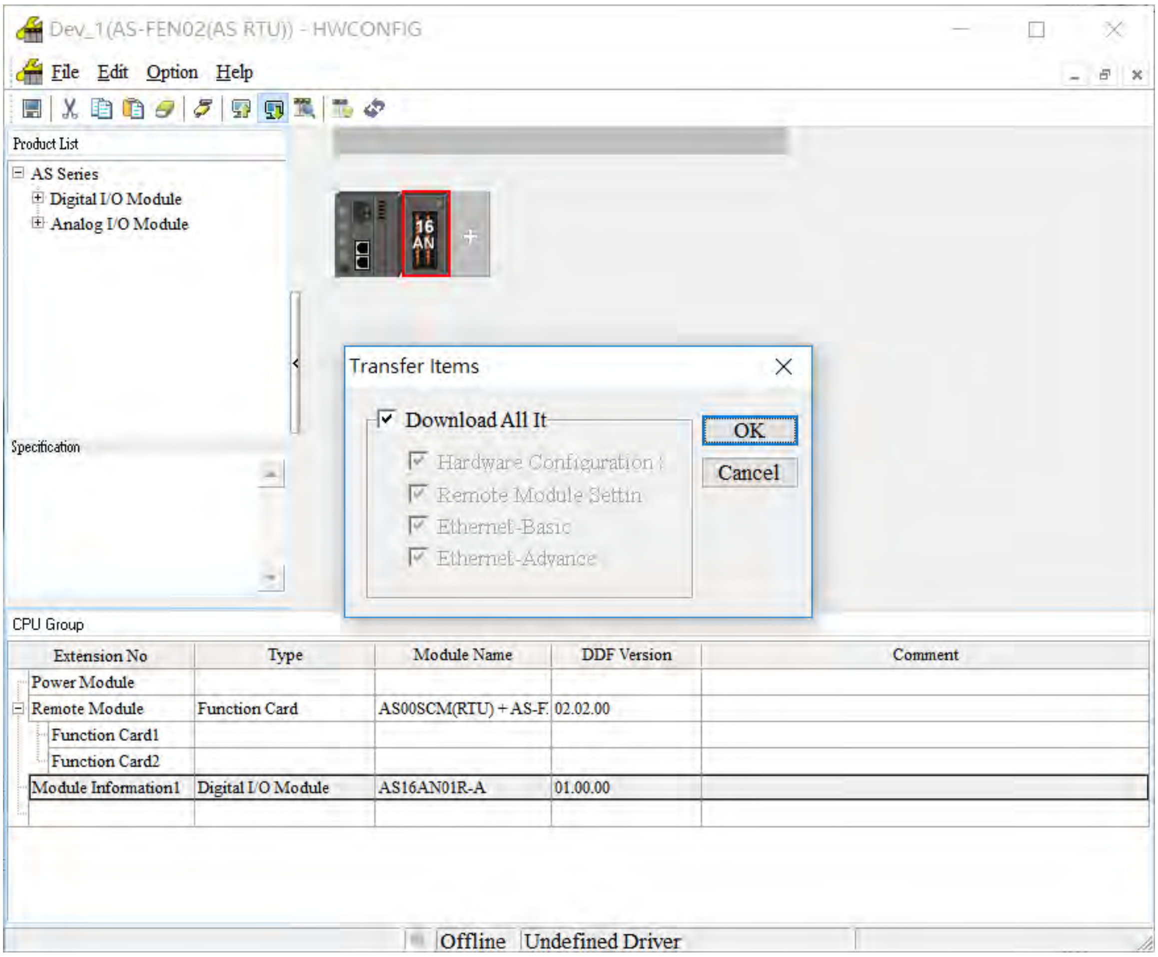
- RTU parameters: all the parameters set in the previous step
- Data Exchange: data mapped from the RTU right-side modules of AS00SCM-A to the PLC




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 8.4.3 for more details on the connection establishment of AS00SCM-A RTU modules.

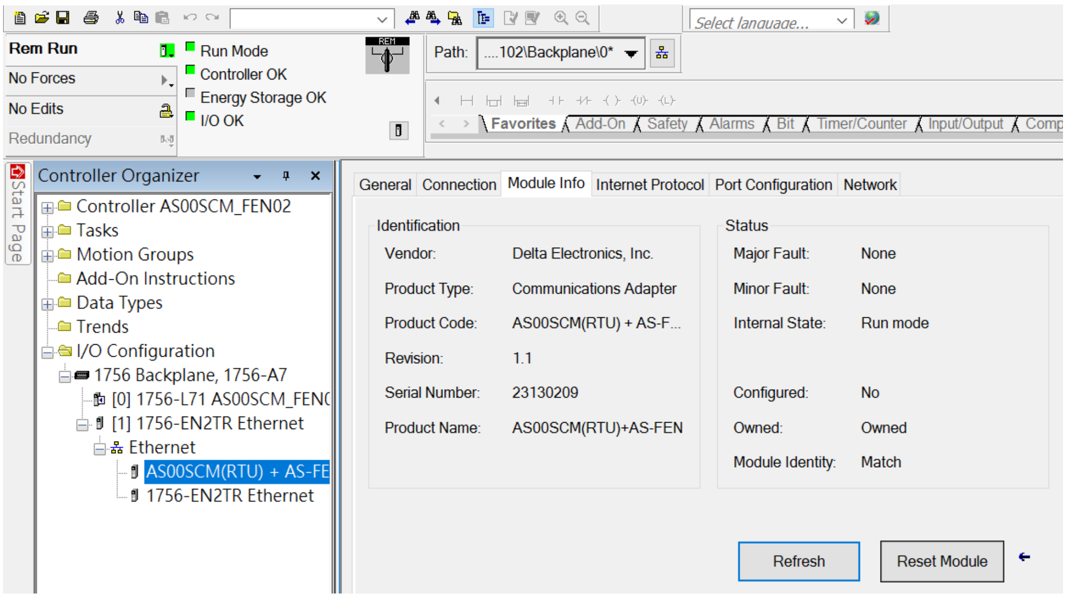
### 8.4.2.2 Connecting to 3rd Party PLC Scanner through EIP Builder

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. 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.

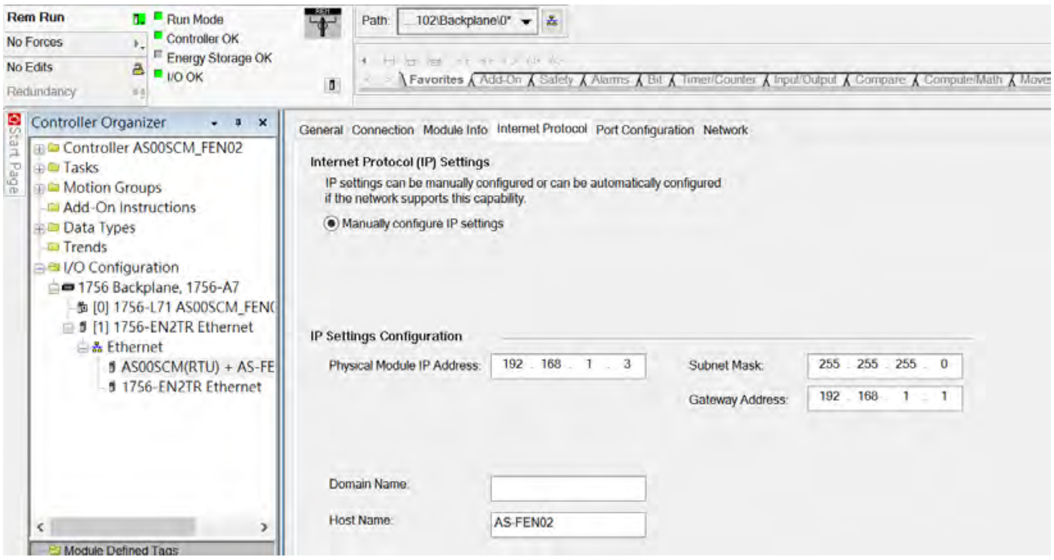



- Go to www.deltaww.com to download EDS file and install the downloaded EDS file to the software of the 3rd party scanner. Refer to section 9.7 of AS Operation Manual for an operational example of Rockwell Studio 5000.
- The following example uses Rockwell PLC.

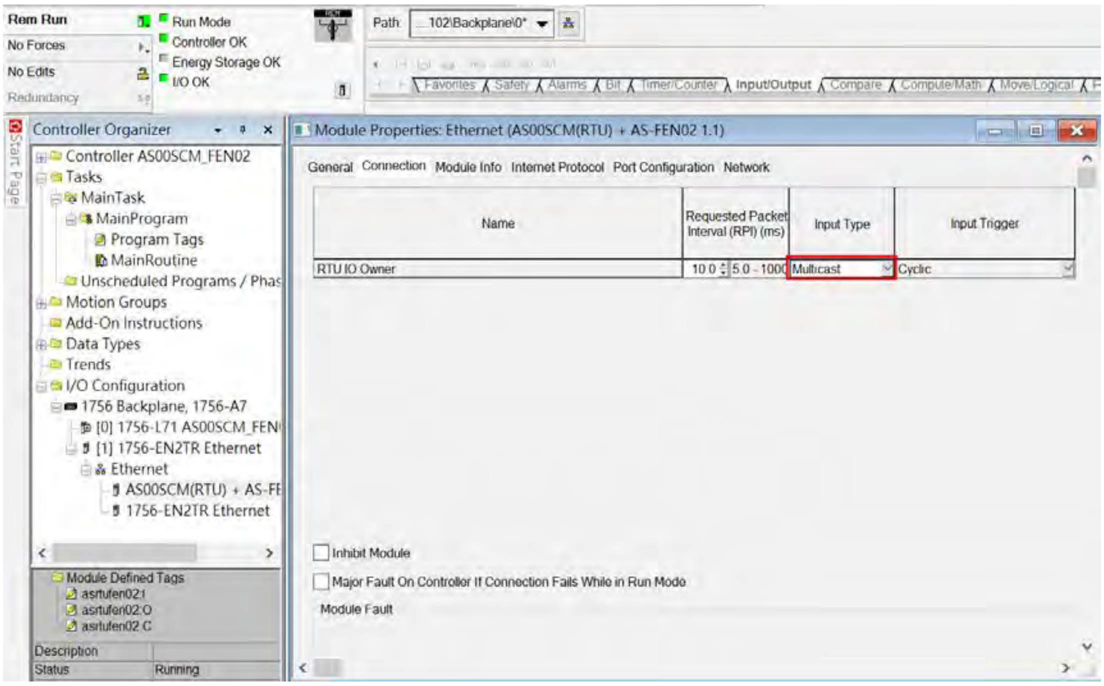
1. After the installation is done, you can see AS00SCM(RTU) + AS-FEN02 in the list. Click it to see the module information page.



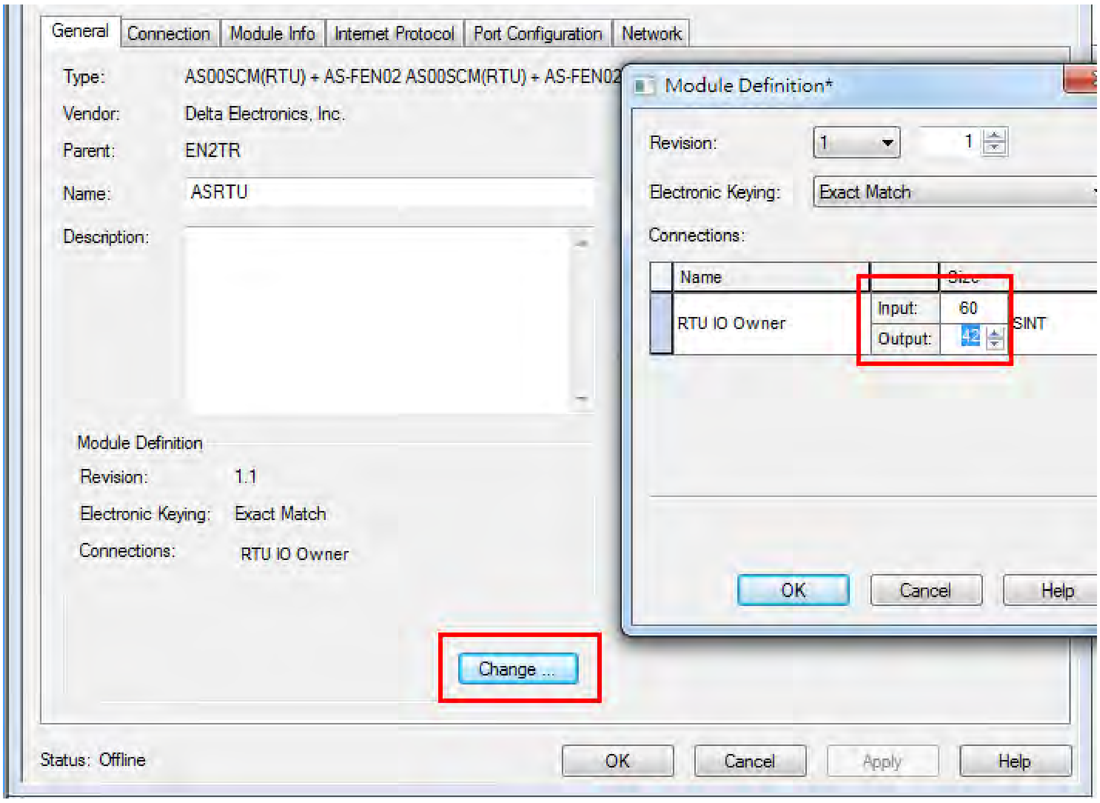

8



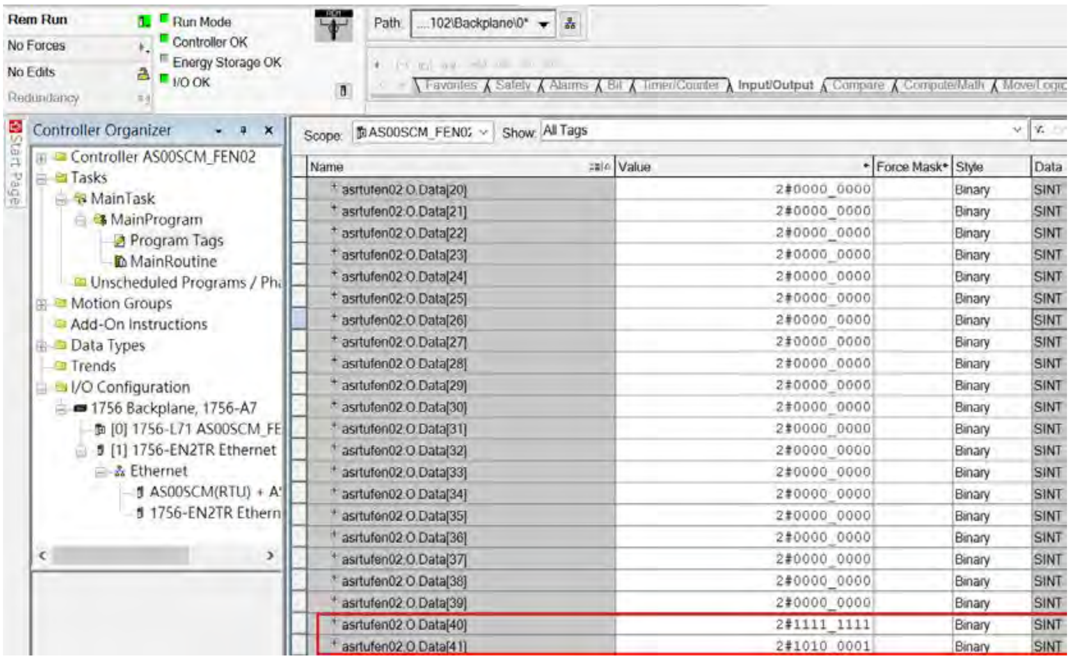

2. Select **Multicast** in the field of Input Type in the Connection sheet.




3. Click **Change** in the General sheet to change the data length. To set up the data length, refer to the register length that a module occupies in HWCONFIG. The following uses a 16-point digital output module as an example. The output point of this module occupies 2 words. If the data type is SINT, the length unit is byte. Add 2 to the output default value 40.



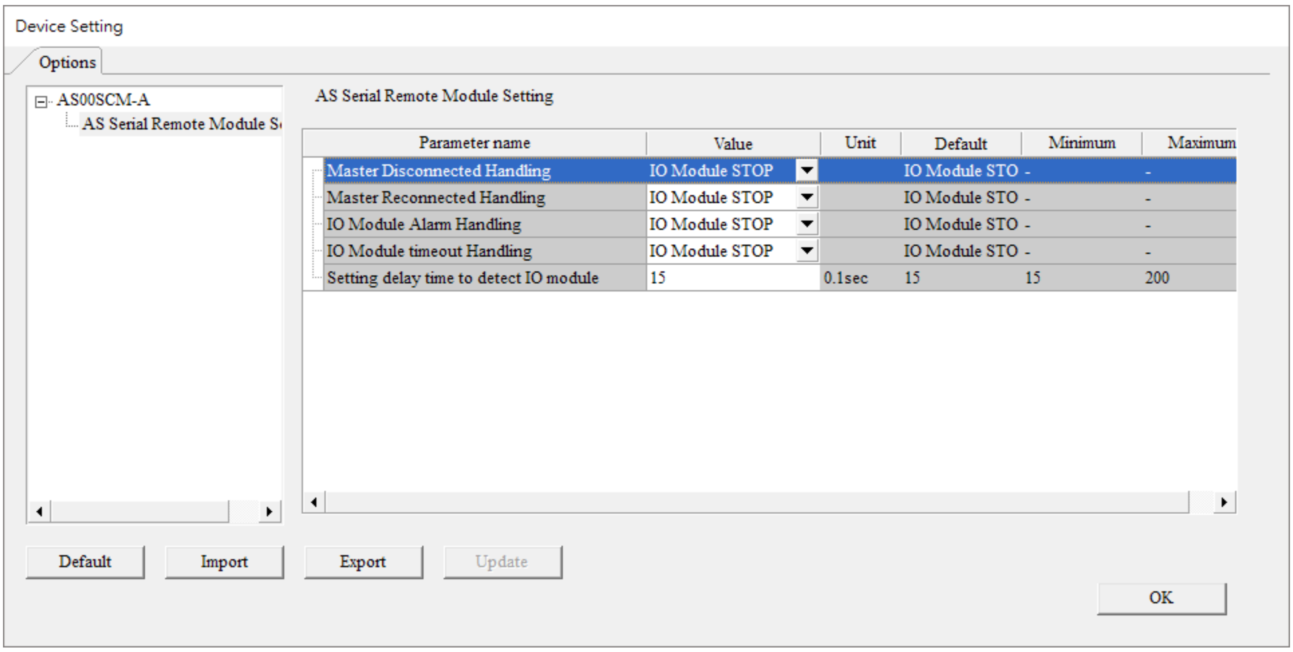

4. The first module on the right side can start data mapping from the 41st byte (Data[40]). See the image below. bit0~bit7 of O.Data[40] are mapping to Y0~Y7 and bit0~bit7 of O.Data[41] are mapping to Y8~Y15. If the module is an input module, you need to edit the input length and use I.Dat mapping to a.




8


## 8.4.3 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 or AS-FEN02:



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).

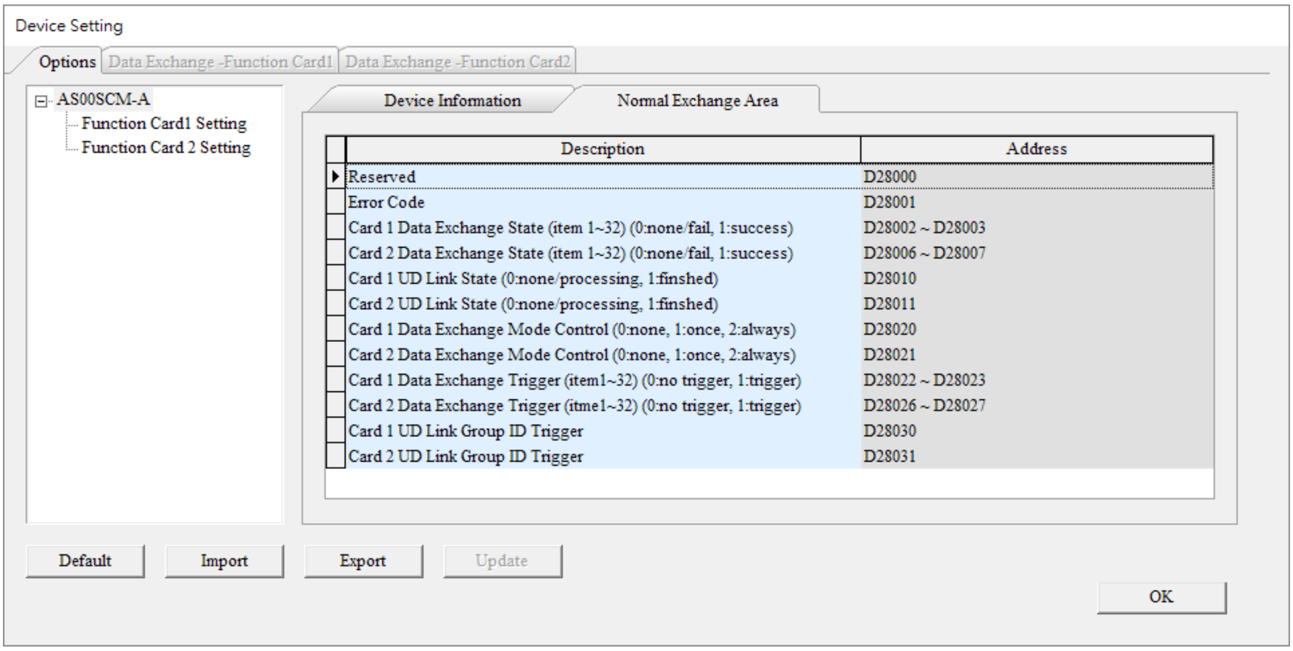
1) When a Master connection is lost
   - I/O modules stop running: all I/O modules stop running
   - I/O modules keep the same state: all modules keep running
2) When a Scanner has reconnected after the connection lost
   - I/O modules stop running: all I/O modules stop running
   - I/O modules keep 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

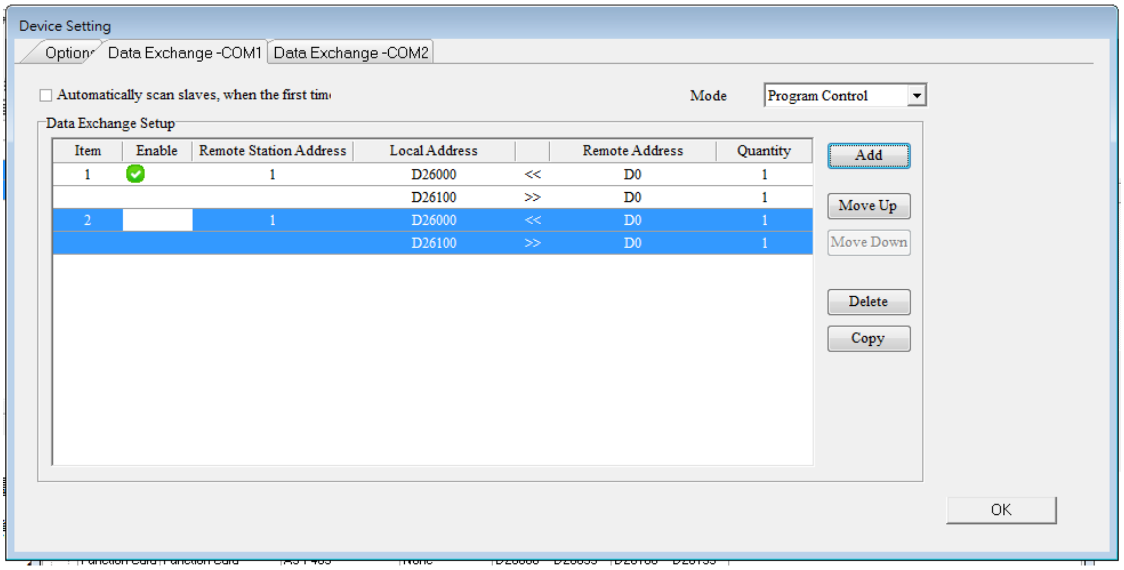
<table>
<tr><th rowspan="2">Procedure</th><th rowspan="2">Settings (RTU)</th><th rowspan="2">Digital & Analog Input Modules</th><th rowspan="2">Digital Output Modules</th><th colspan="2">Analog Output Module (I/O Module Settings)</th></tr>
<tr><th>Clear</th><th>Keep</th></tr>
<tr><td rowspan="2">Master 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>
<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:<br>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:<br>output value = output value of the master</td></tr>
</table>

- Module configurations: refer to Section 8.1.2 in the AS Series Operation Manual.
- Module setups: refer to other chapters in the AS Series Module Manual.

# 8.5 Normal Exchange Area

1) COM mode



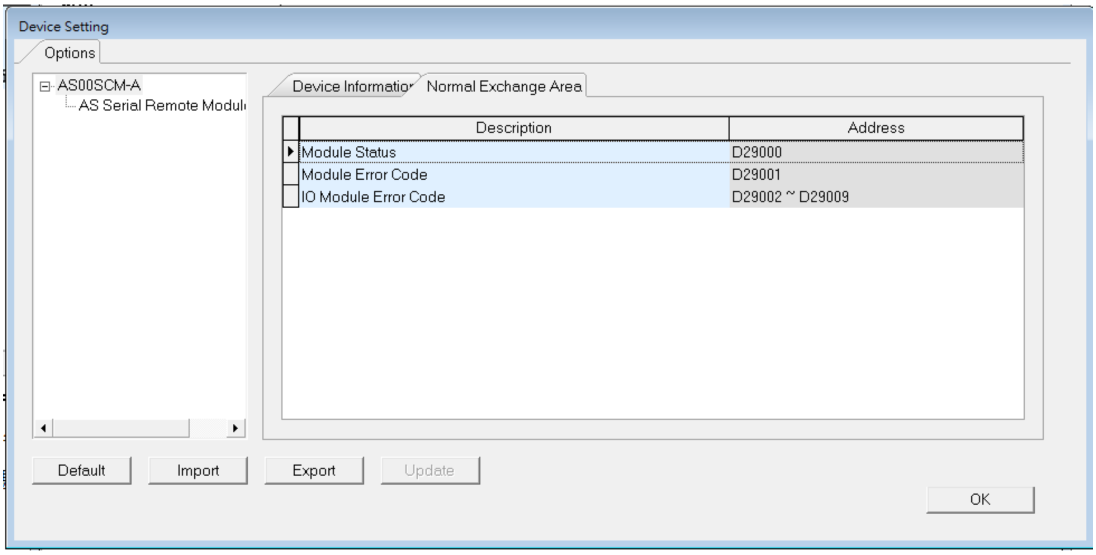

In the examples above, note that the Normal Exchange Area shows the corresponding data registers of the module and the PLC.

1. Module Status: 0 = stop, 1 = run
2. Error Code: refer to Section 8.7 for more information.
3. 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
4. Card 1 & Card 2 Data Exchange Mode Control: set the data register to 0: none, 1: once, 2: always.

5. 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

6. 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 Module Status: 0 = communication module stop, 1 = communication module run
- Module Error Code: refer to Section 8.7 for more information.
- Power Status: 0 = power error, 1 = power normal
- I/O Module Status: 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.

# 8.6 Application

## 8.6.1 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.

### 8.6.1.1 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<br>0x04 | Read | 16#0000–16#0063<br>16#0100–16#0163<br>16#0200–16#0263<br>16#0300–16#0363 |
| 0x06<br>0x10 | Write | 16#0000–16#0063<br>16#0200–16#0263 |
| 0x17 | Read | 16#0000–16#0063<br>16#0100–16#0163<br>16#0200–16#0263<br>16#0300–16#0363 |
| | Write | 16#0000–16#0063<br>16#0200–16#0263 |

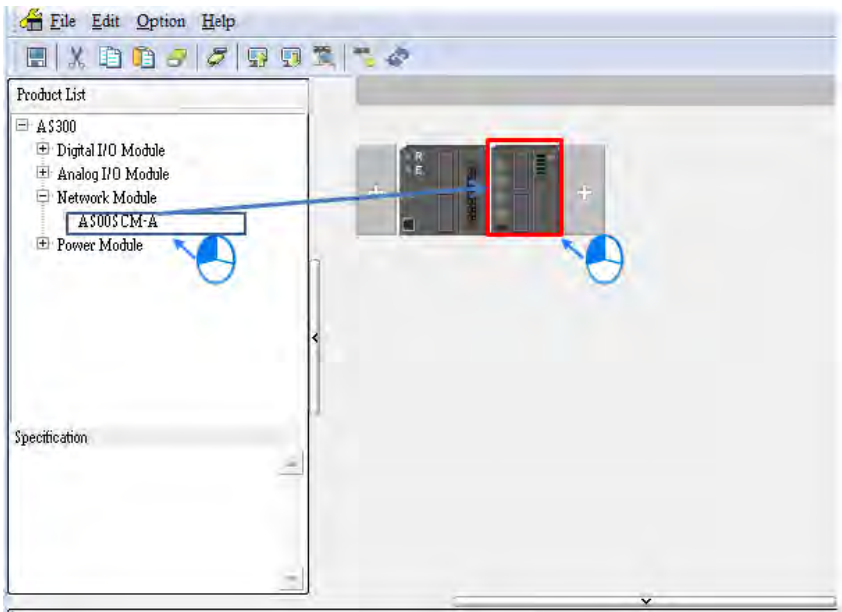
The structures:

Example of a slave structure: HMI (master station) → AS-F485 + AS00SCM-A COM1 (slave station)

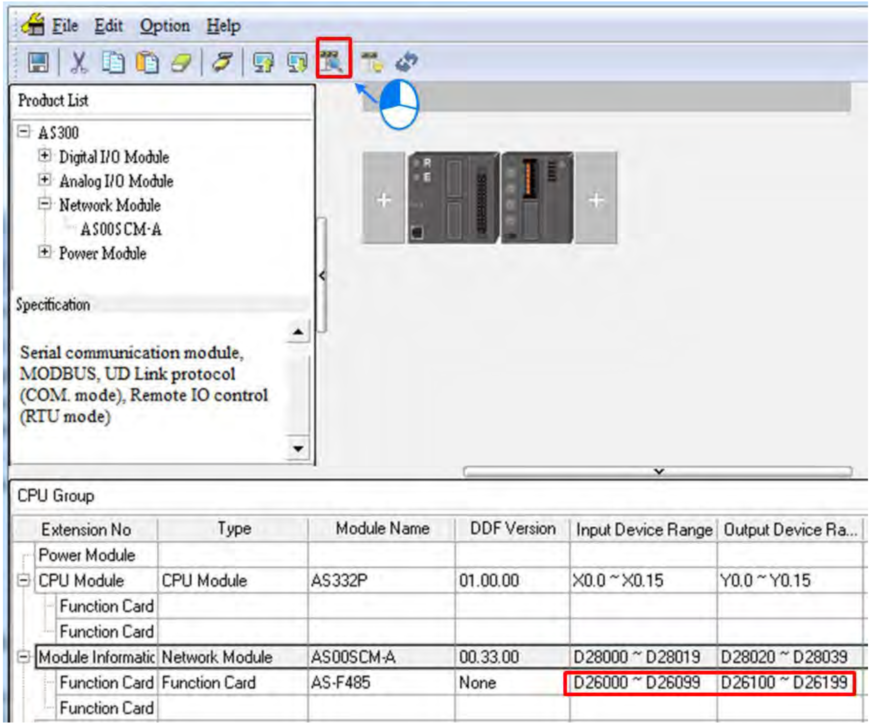
| Product | Slave ID | Communication protocol | Device from which data is read | Register in the CPU module | Device into which data is written | Register in the CPU module |
|---|---|---|---|---|---|---|
| HMI | 5 | 9600, RTU, 8, E, 1 | 16#0100 | D26100 | 16#0000 | D26000 |

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 switch of AS00SCM-A is turned to COM mode and no power connected to it.

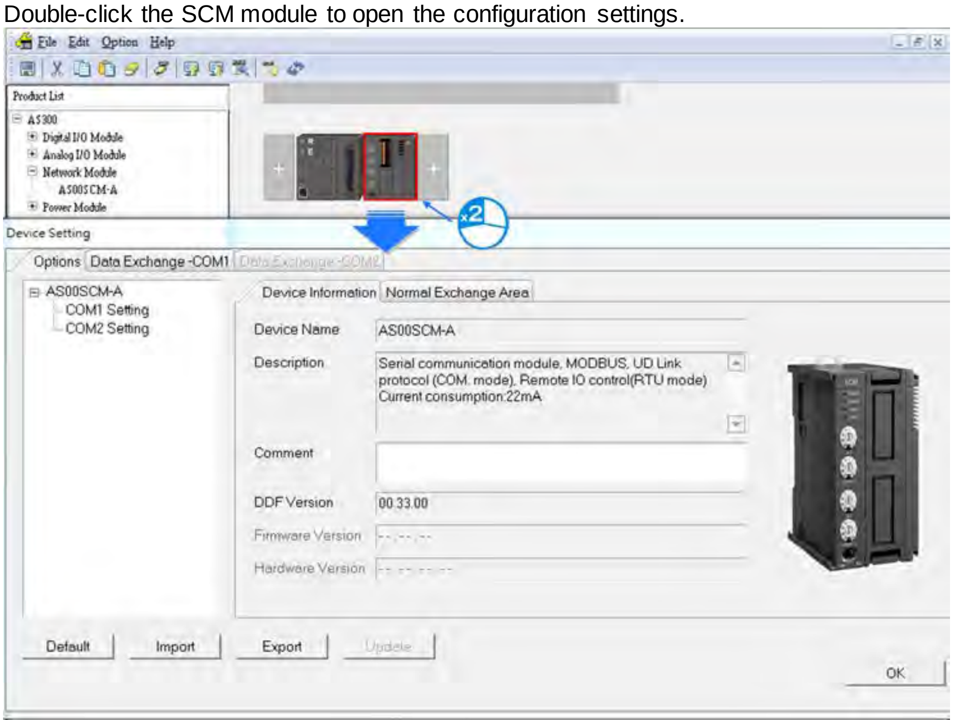


2) Click the I/O Scan button to make the system read the module's current configuration. The PLC assigns the input and output device ranges.

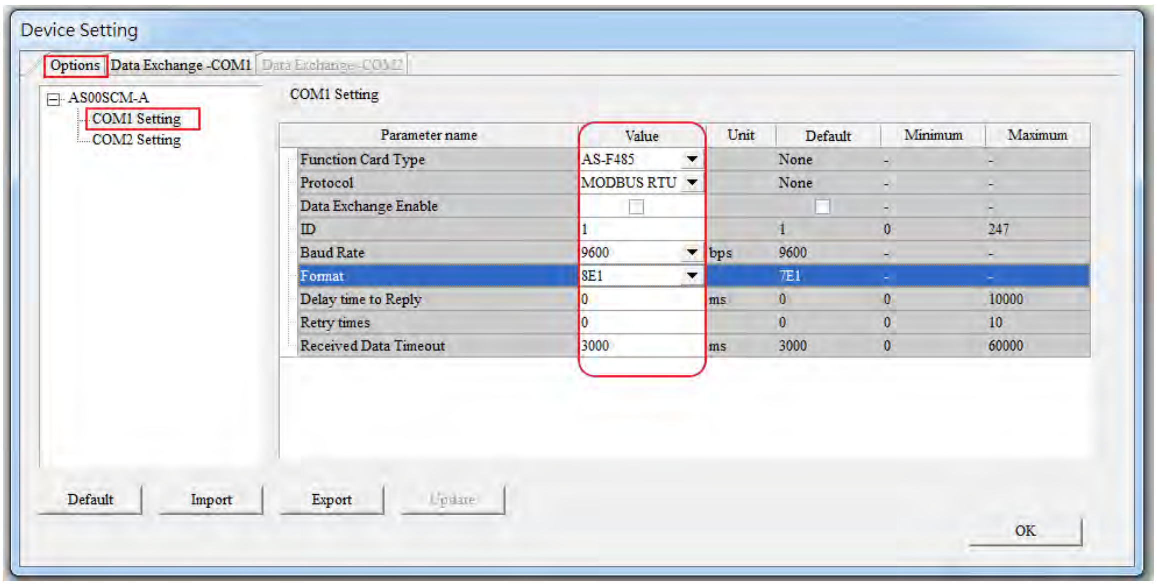



| Function card | Device from which data is read | Register in the CPU module | Device into which data is written | Register in the CPU module |
|---|---|---|---|---|
| Function card 1 | 16#0000 | D26000 | 16#0100 | D26100 |
| Function card 2 | 16#0200 | D26200 | 16#0300 | D26300 |

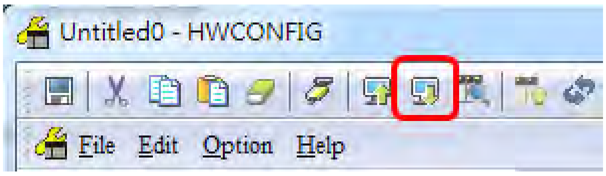
3) Double-click the SCM module to open the configuration settings.



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.

### 8.6.1.2 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.

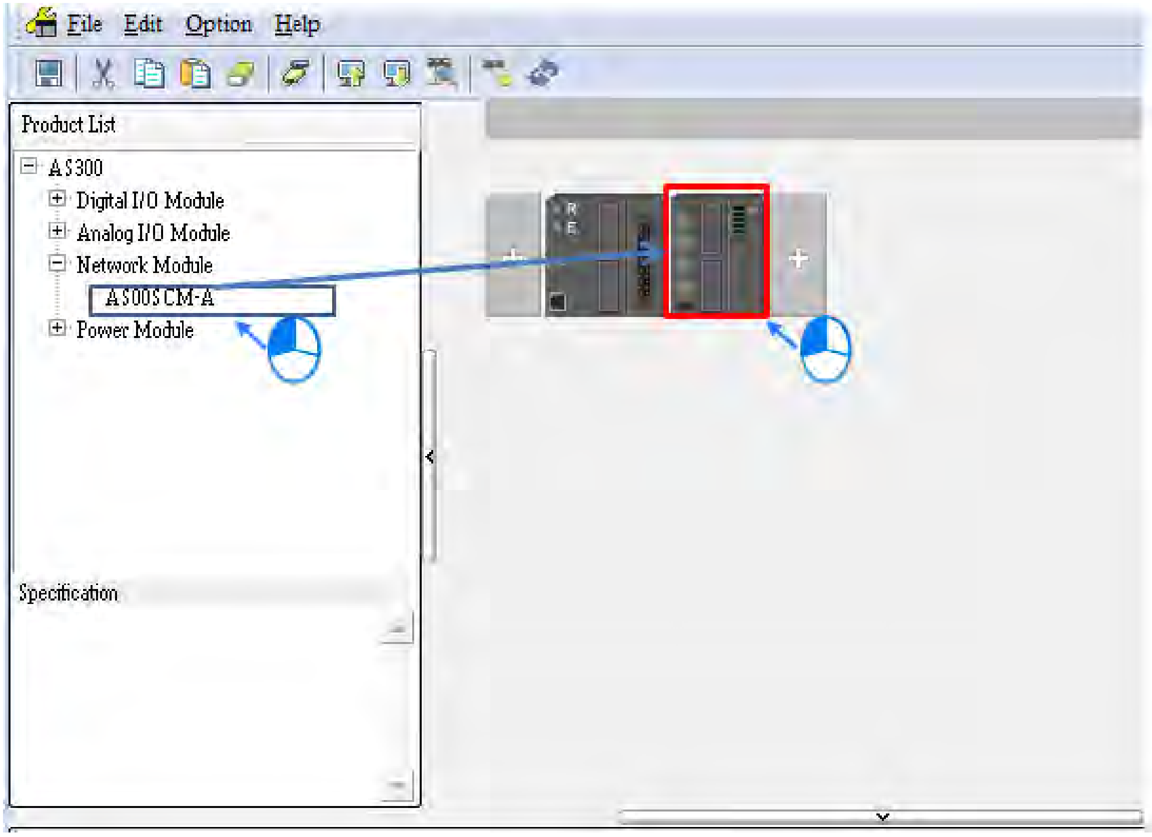
The structures:

Example of a master structure: AS-F485 + AS00SCM-A COM2 (master station) → VFD, ASDA, and DVP series PLC

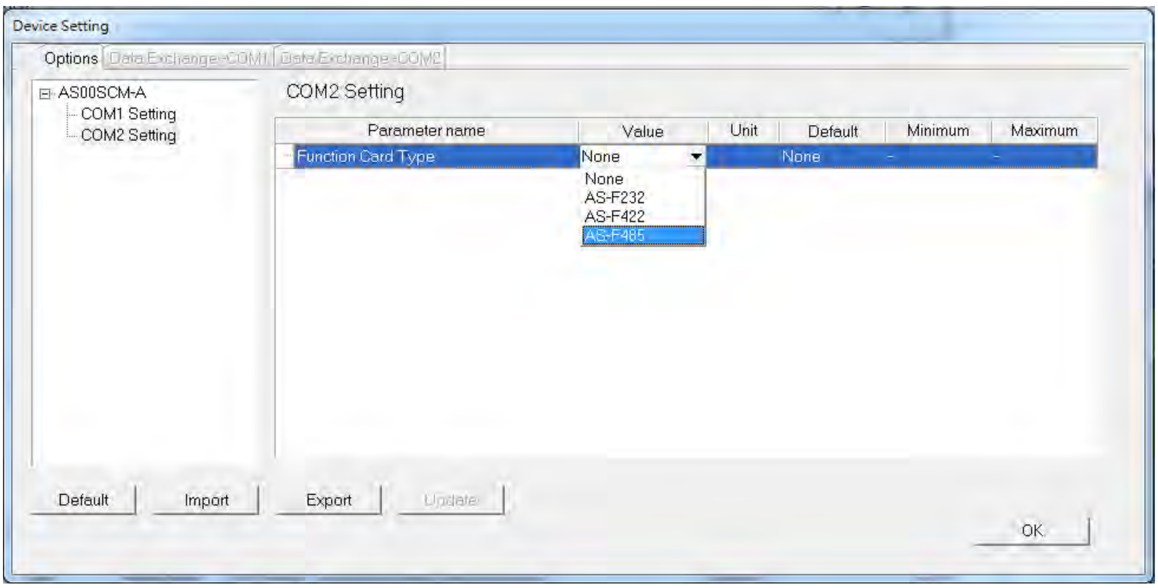
| Product | Slave ID | Communication protocol | Device from which data is read | Register in the CPU module | Device into which data is written | Register in the CPU module |
|---|---|---|---|---|---|---|
| VFD | 10 | 38400, ASCII, 7, E, 1 | 16#2103 | D26200 | 16#2000<br>16#2001 | D26300-<br>D26301 |
| ASDA | 11 | 38400, ASCII, 7, E, 1 | 16#0101 | D26210 | 16#0101 | D26310 |
| PLC | 12 | 38400, ASCII, 7, E, 1 | D100-D109 | D26220-<br>D26229 | D200-D204 | D26320-<br>D26324 |

If the AS00SCM-A is functioning as a Modbus master, you need to set a slave ID and baud rate.

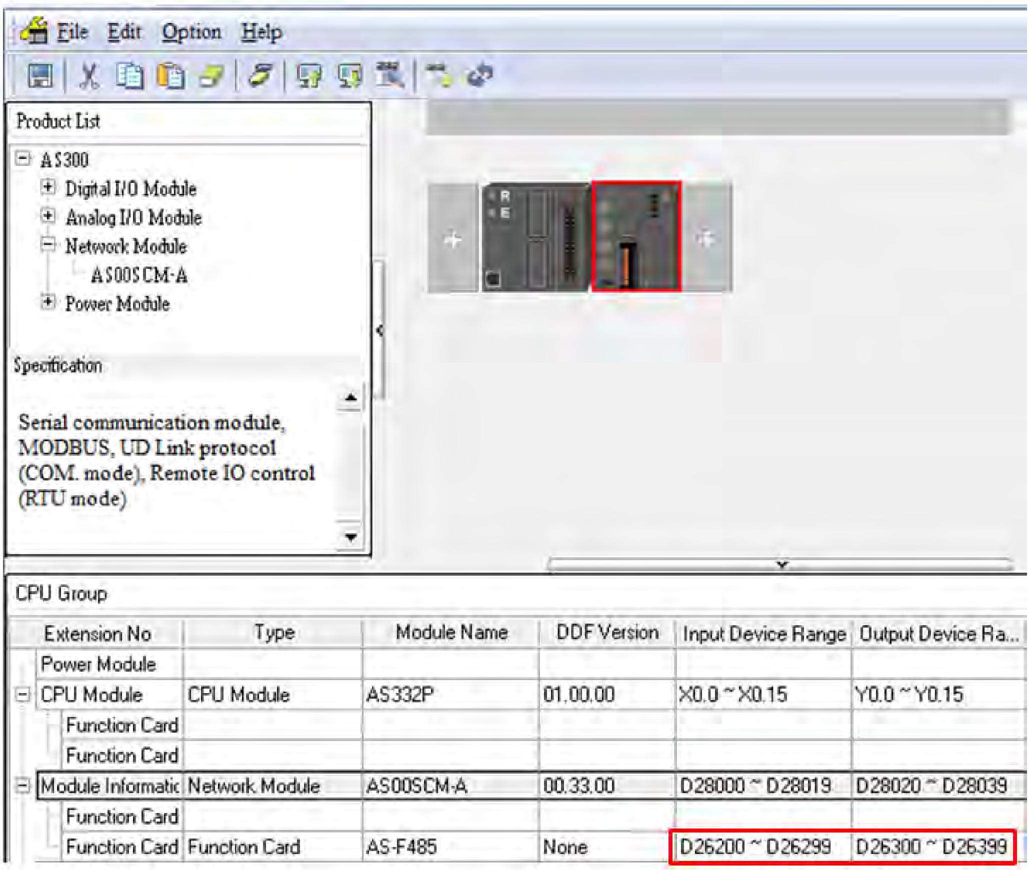
1) Drag to add AS00SCM-A in the system configuration area. Make sure the switch of AS00SCM-A is turned to COM mode and no power connected to it.



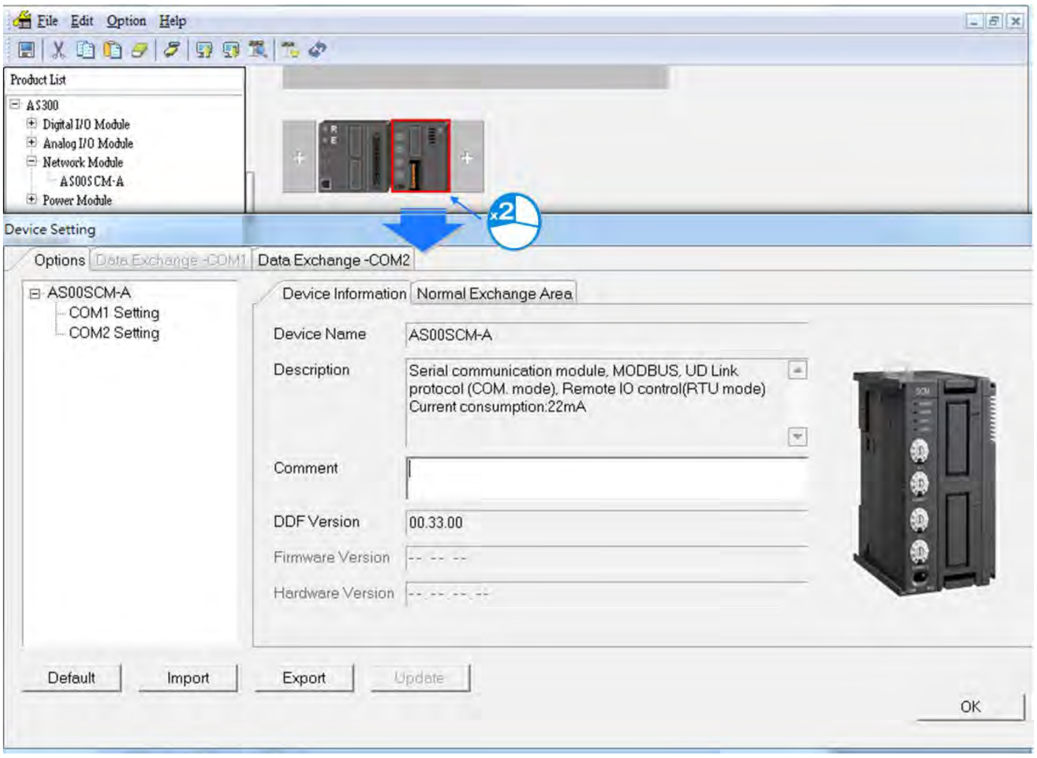

2) Double-click **COM2 Setting** and set the Function Card Type to **AS-F485**.



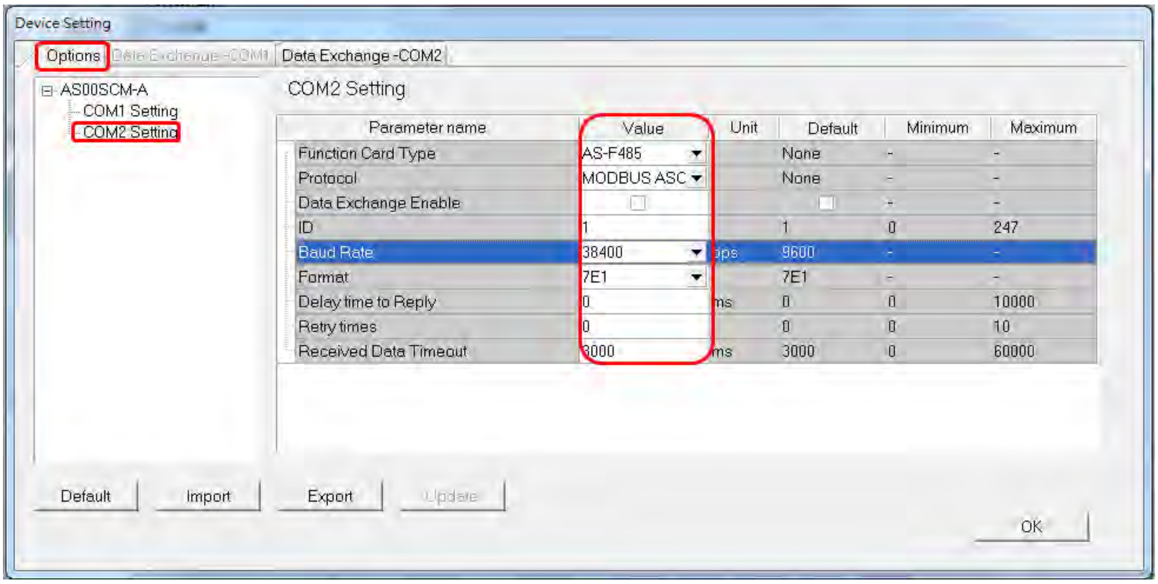
3) Click the I/O Scan button to make the system read the module's current configuration. The PLC assigns the input and output device ranges.



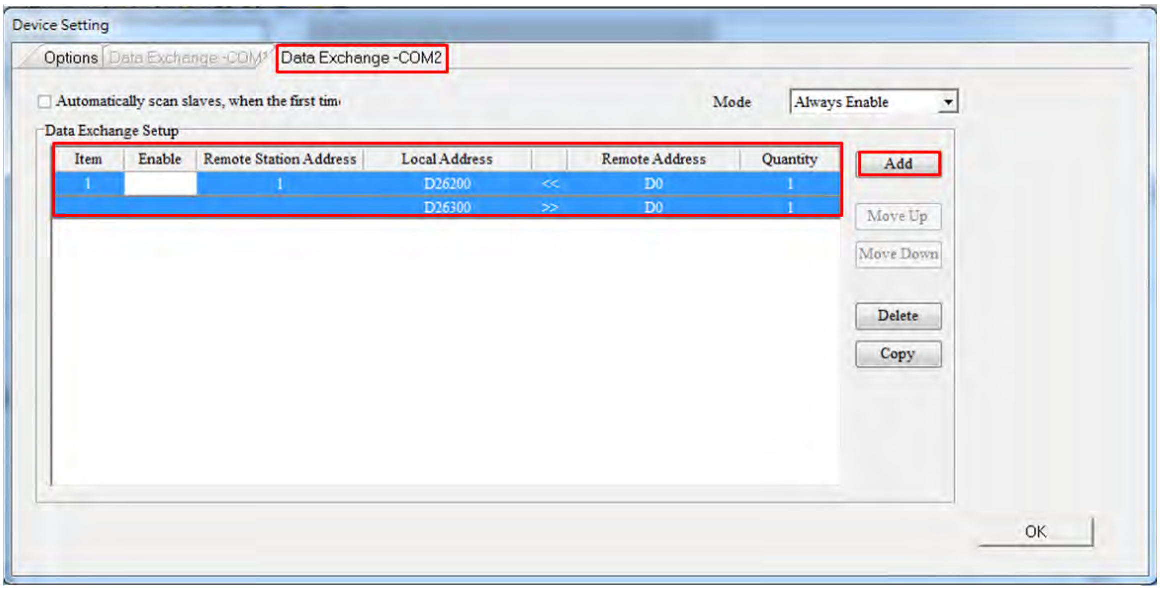

4) Double-click the SCM module to open the configuration settings.



5) Set the communication protocol values for COM2:

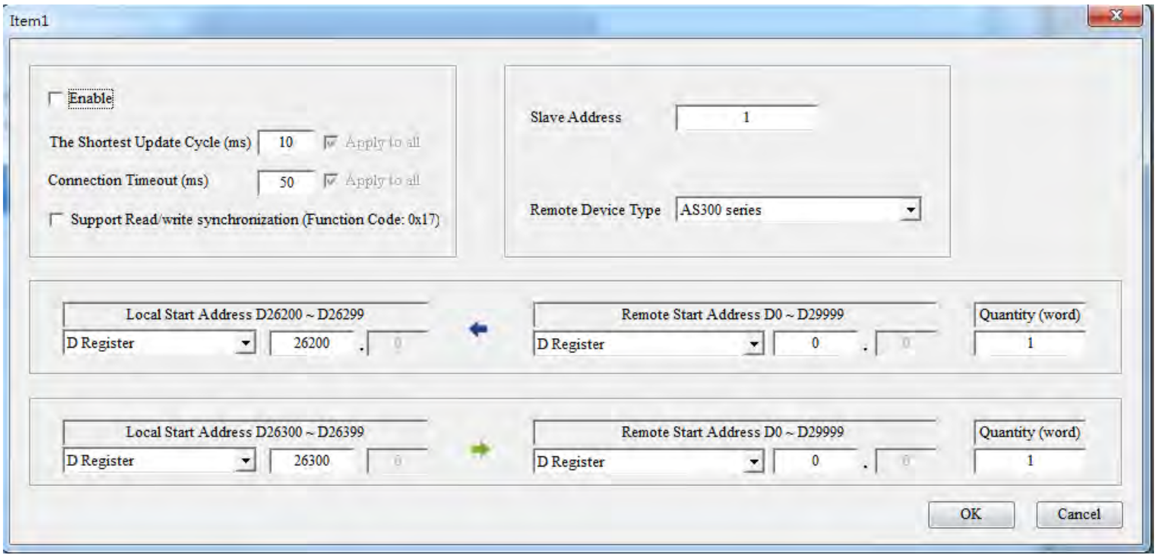



6) Set up the data exchange table: select **Data Exchange – COM2** and click **Add** to create a new Data Exchange Setup table.



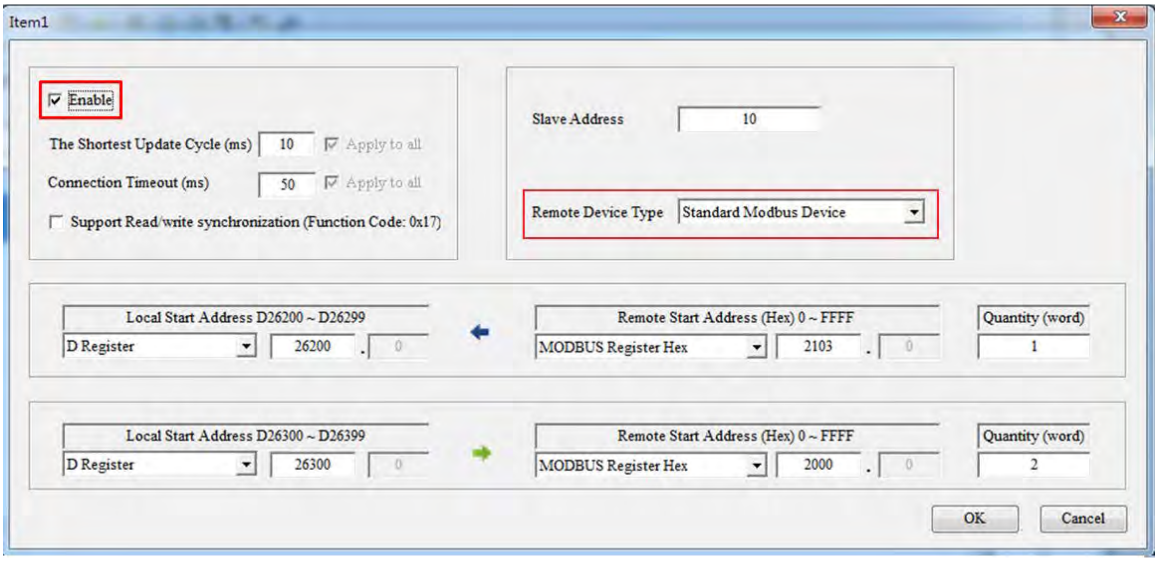

8

7) In the Data Exchange Setup table double-click an item to edit its settings.



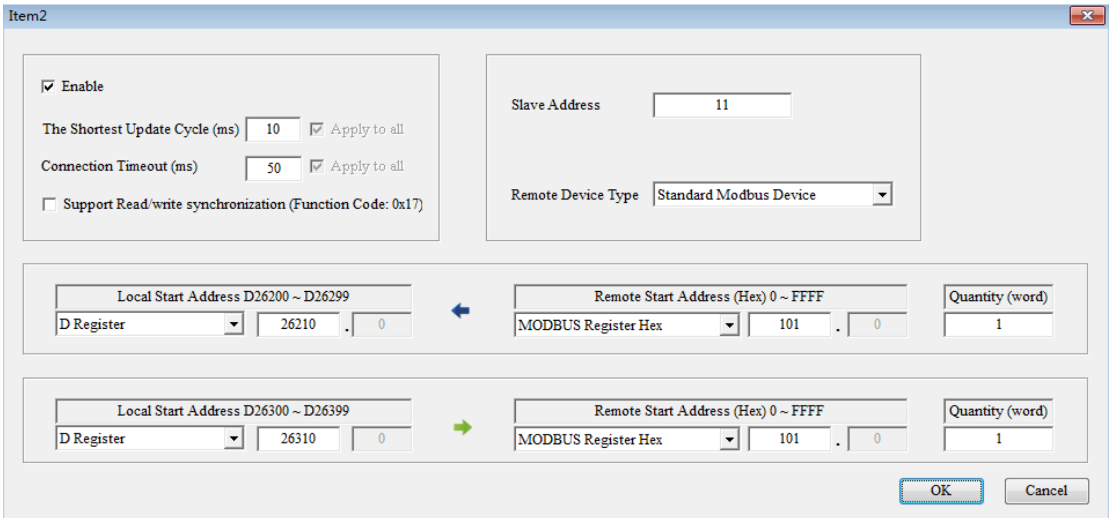

- Select **Standard Modbus Device** as the **Remote Device Type**, enter the parameters, and check **Enable**.

| 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<br>16#2001 | D26300-<br>D26301 |



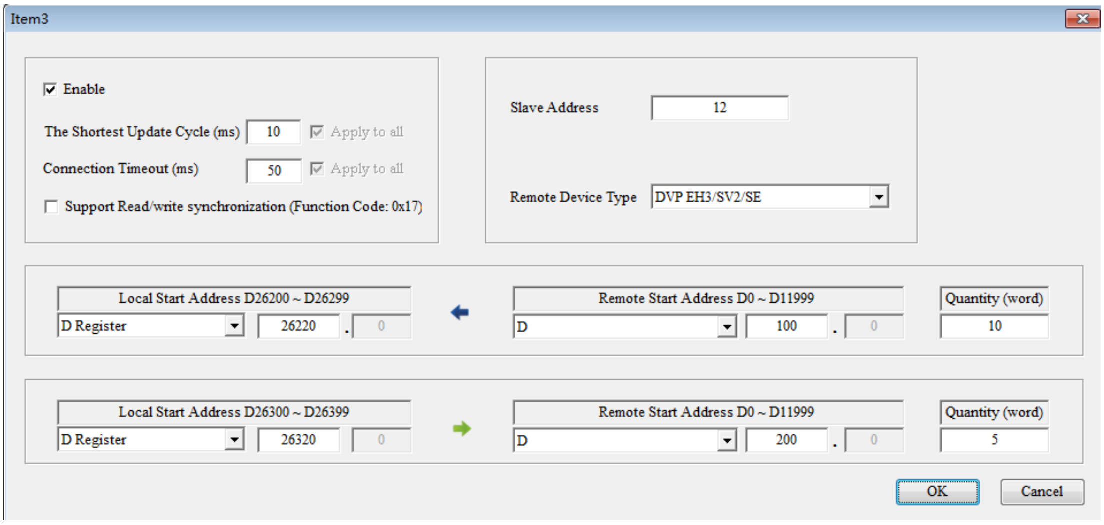

- Select **Standard Modbus Device** as the **Remote Device Type**, enter the ASDA parameters, and check **Enable**.

| 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 |

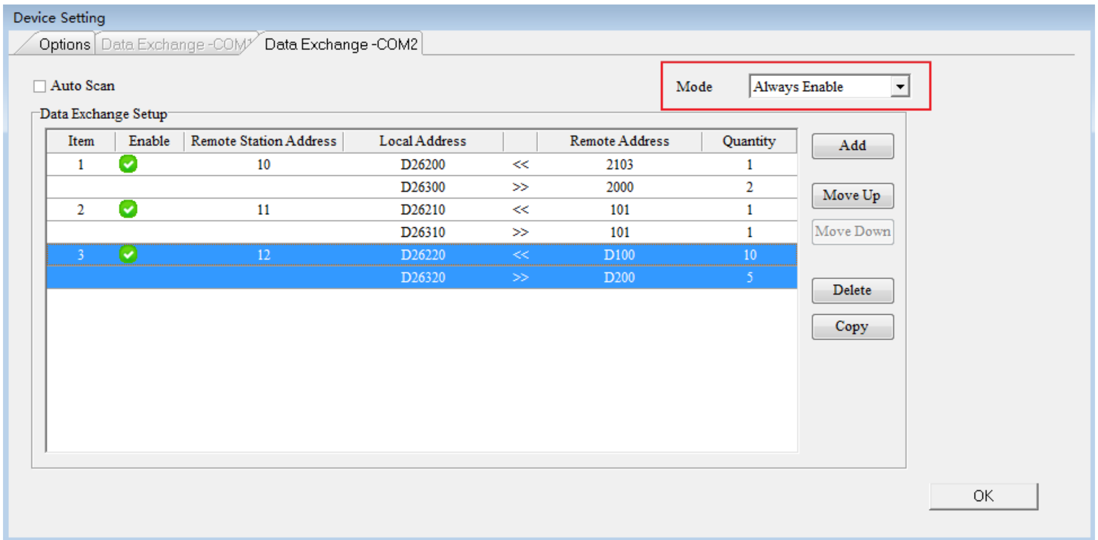



- Select **PLC devices** as the **Remote Device Type**, enter the PLC parameters, and check **Enable**.

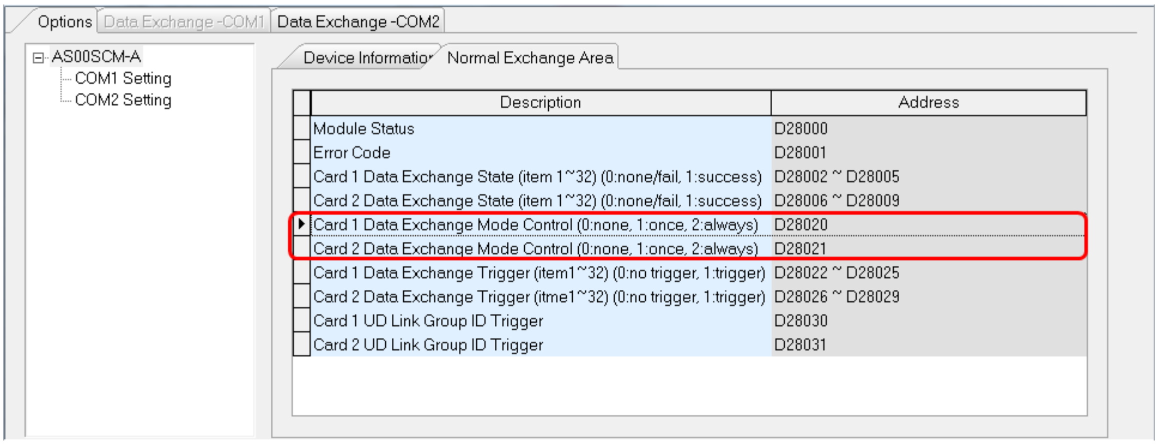
| Product | Slave ID | Communication protocol | Device from which data is read | Register in the CPU module | Device into which data is written | Register in the CPU module |
|---|---|---|---|---|---|---|
| PLC | 12 | 38400, ASCII, 7, E, 1 | D100-D109 | D26220-D26229 | D200-D204 | D26320-D26324 |



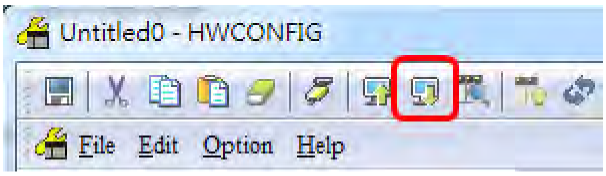
8) Select **Always Enable** in the **Mode**.




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.

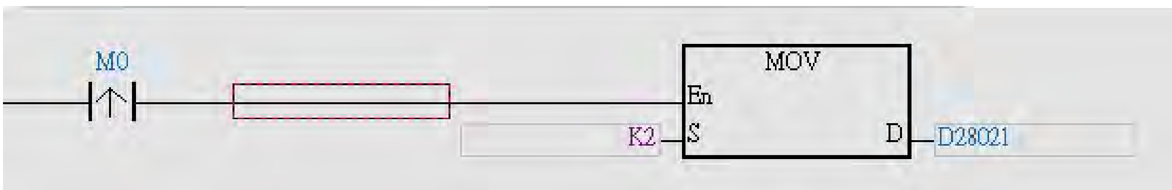



9) Download the parameters to the AS00SCM-A.



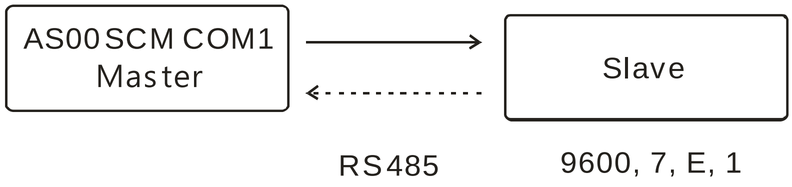

If you set Mode to Always Enable, the data exchange begins immediately after downloading the parameters.

If you set Mode to Program Control, the program starts the data exchange after downloading the parameters.



## 8.6.2 UD Link

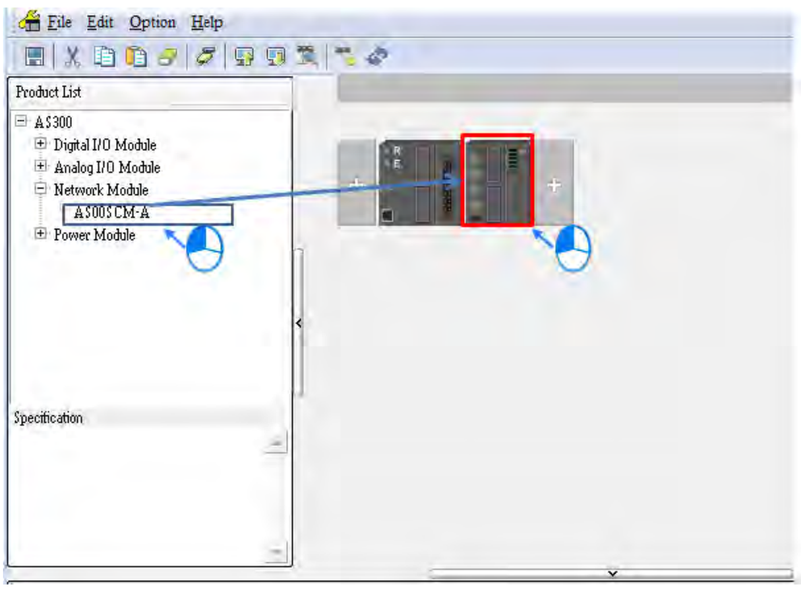
This section introduces how to use a non-Modbus RS485 communication port on the AS00SCM-A to connect to other industrial products.



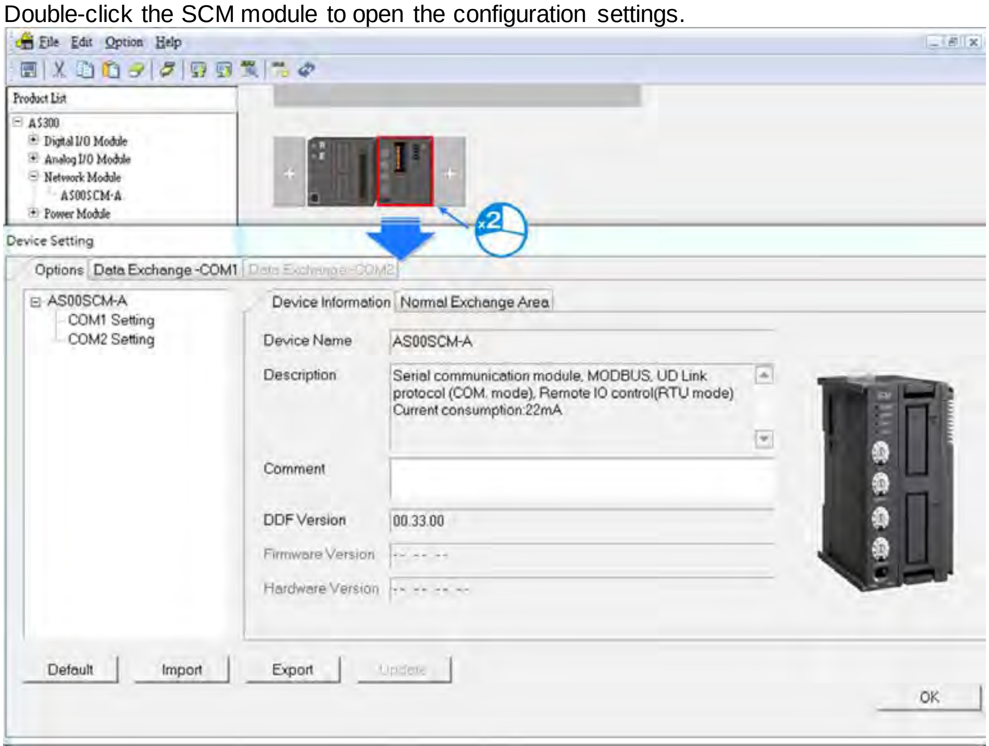

Communication with a slave

| Packet to Send (→) | Packet to Receive (←) | Description |
|---|---|---|
| POS, xxx, yyy | POS, ACT | xxx and yyy are coordinates (0–999) |

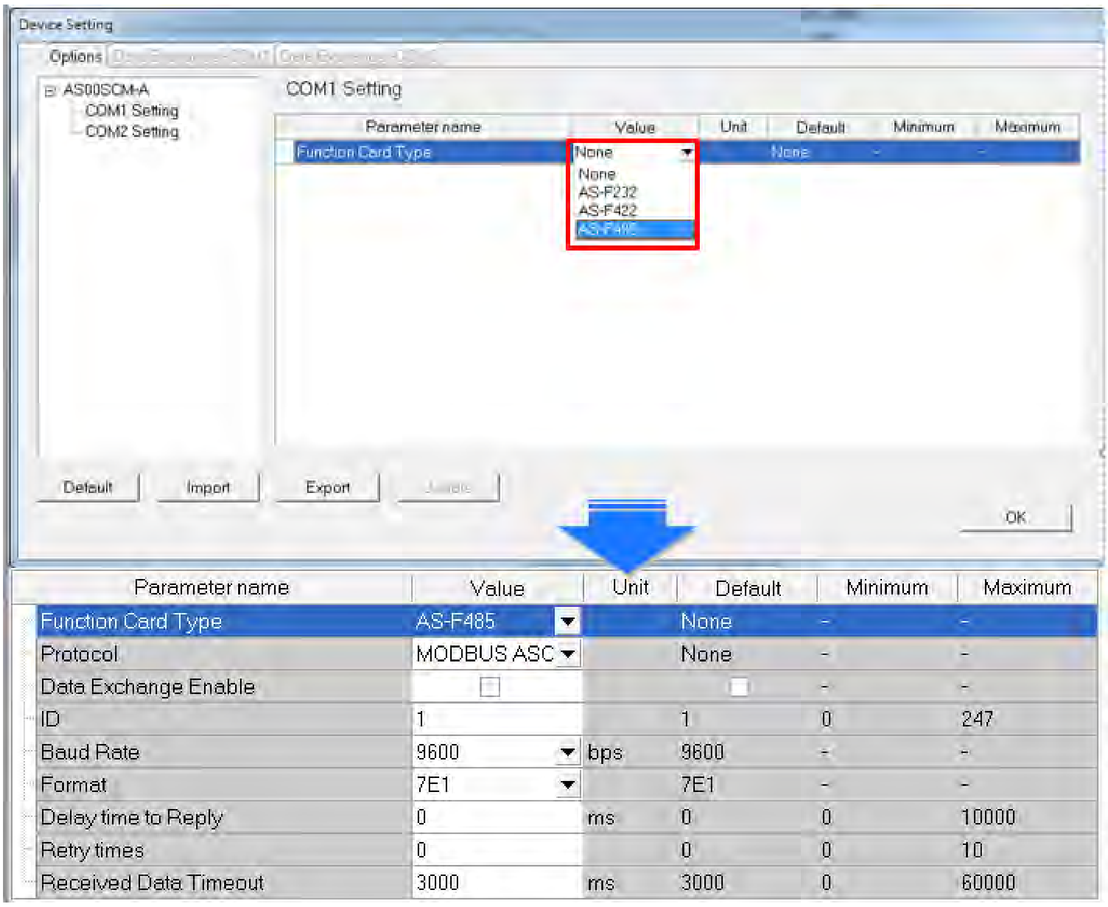
1) Drag to add AS00SCM-A in the system configuration area. Make sure the switch of AS00SCM-A is turned to COM mode and no power connected to it.



2) Double-click the SCM module to open the configuration settings.



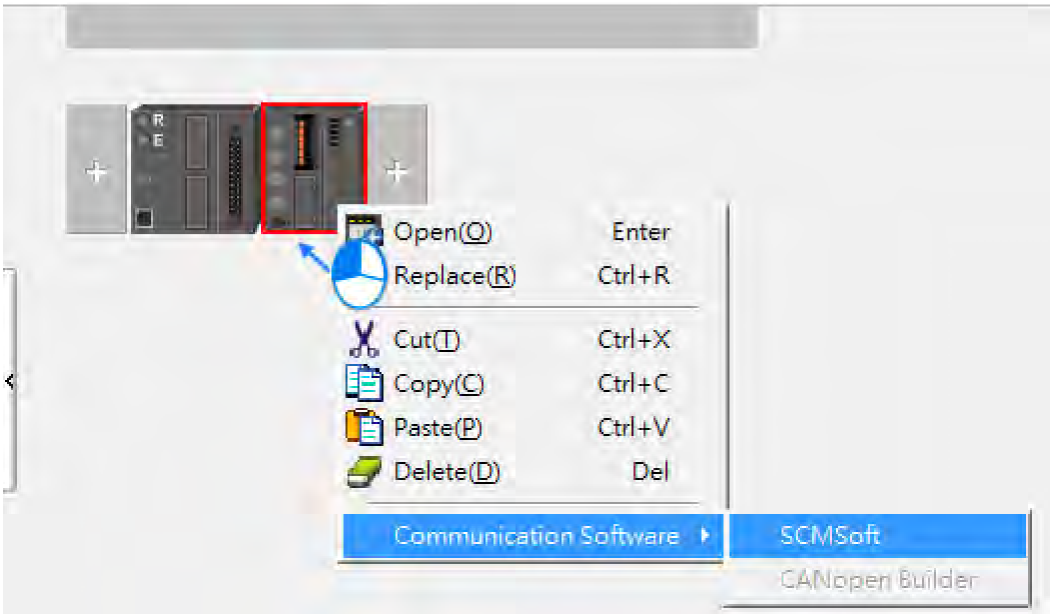

3) Select **AS-F485** as the **Function Card Type** for COM1.

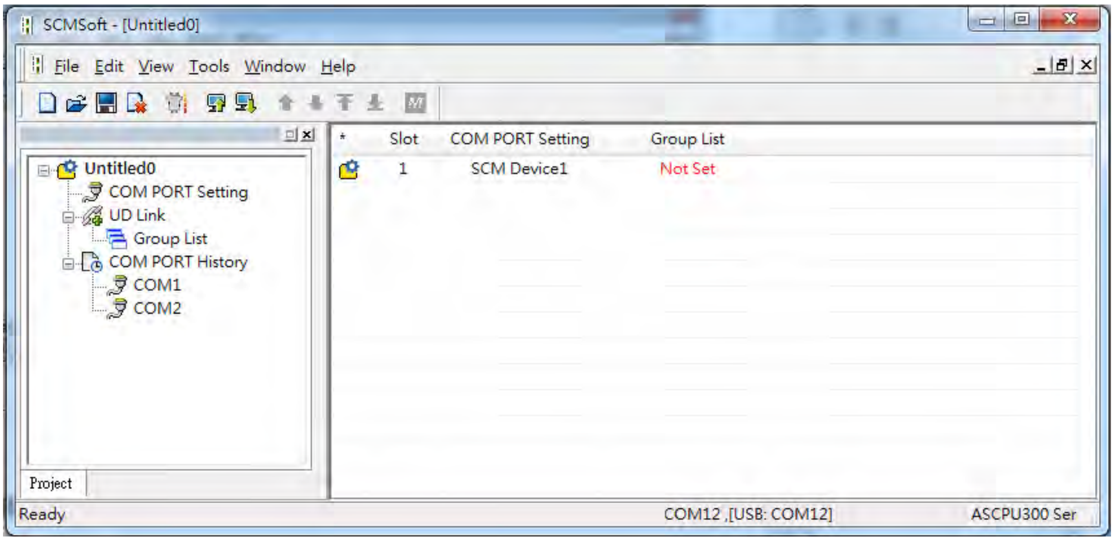


4) Select **UD Link** as the **Protocol**, set the **Baud Rate** and **Format**, and click **OK**.

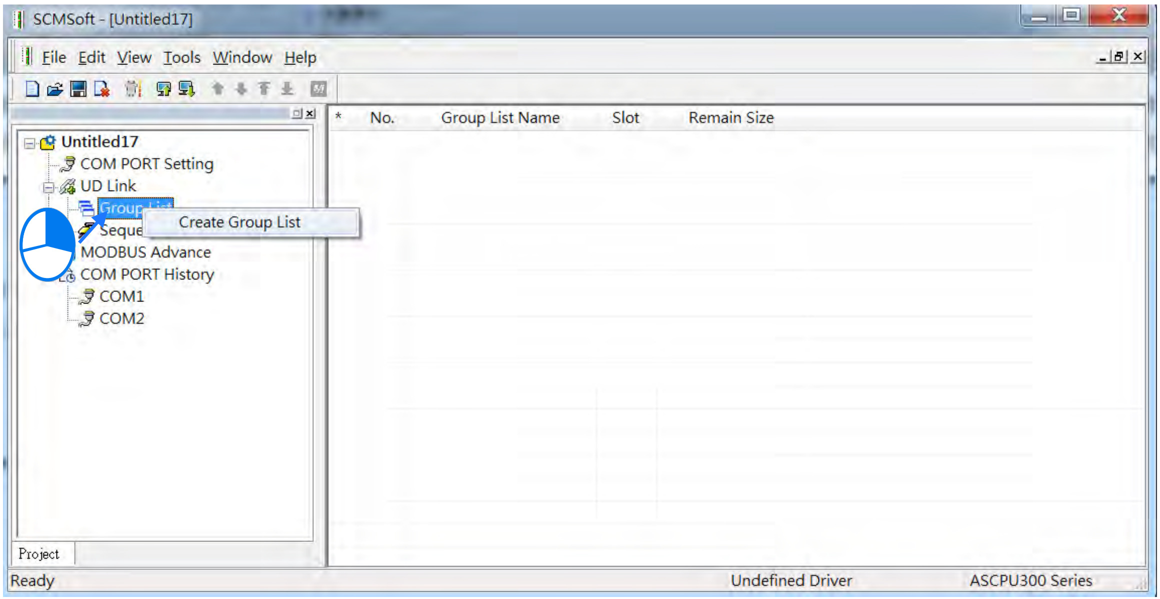
| Parameter name | Value | Unit | Default | Minimum | Maximum |
|---|---|---|---|---|---|
| Function Card Type | AS-F485 | | None | - | - |
| Protocol | UD LINK | | None | - | - |
| Baud Rate | 9600 | bps | 9600 | - | - |
| Format | 7E1 | | 7E1 | - | - |

5) Right-click the AS00SCM-A and click **Communication Software** and then click **SCMSoft**.

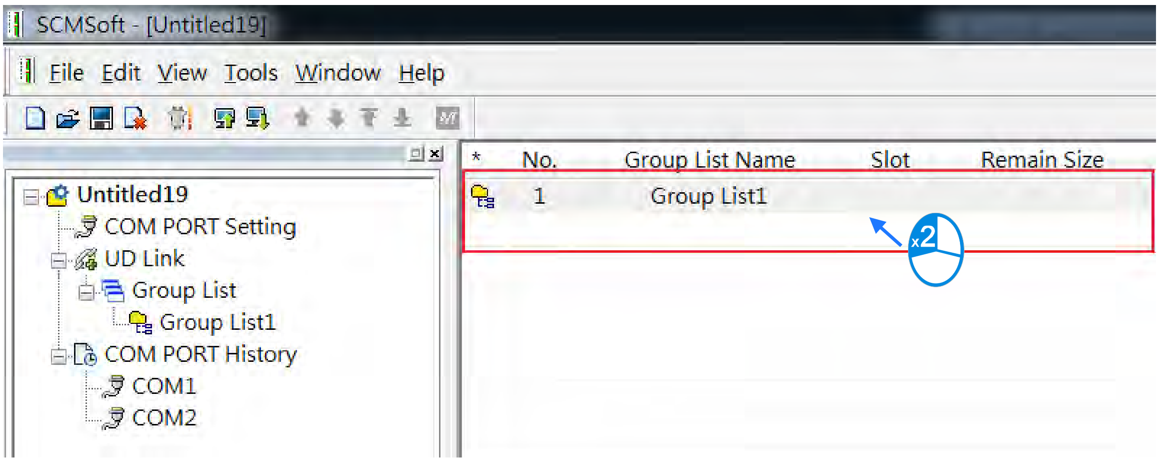


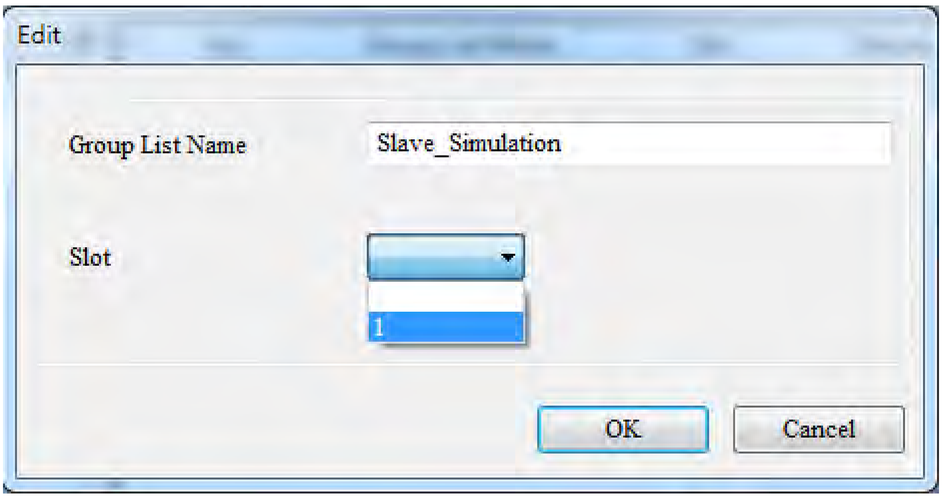
6) Right-click **Group List** and then click **Create Group List** to create a group list.



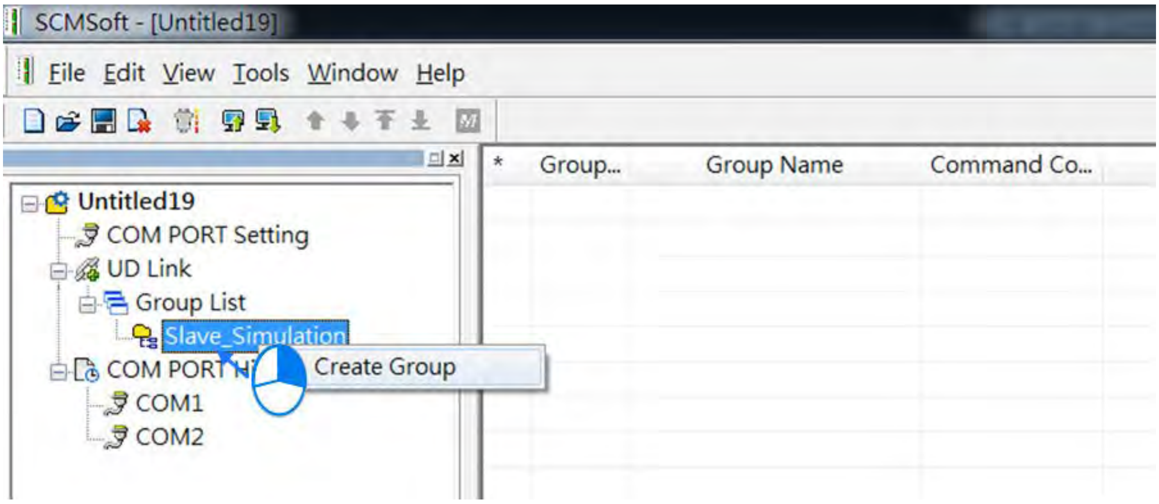

7) You can find a created Group List1. Double-click it to open an editing window to edit the Group List Name and the Slot.



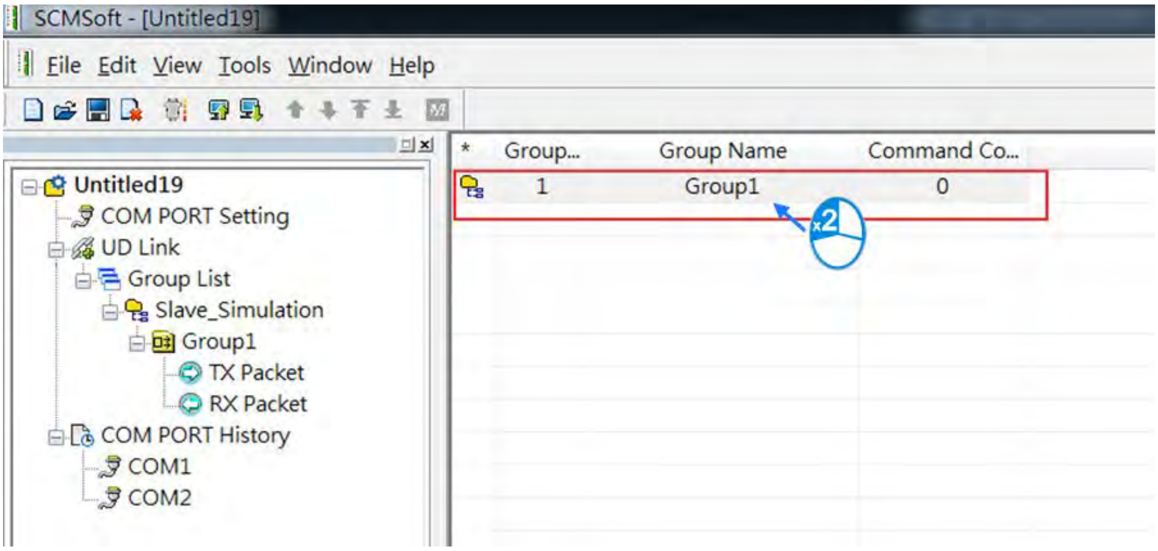

Give the group list a Name (this example uses “Slave_Simulation”) and select 1 (COM1) as the **Slot** number.



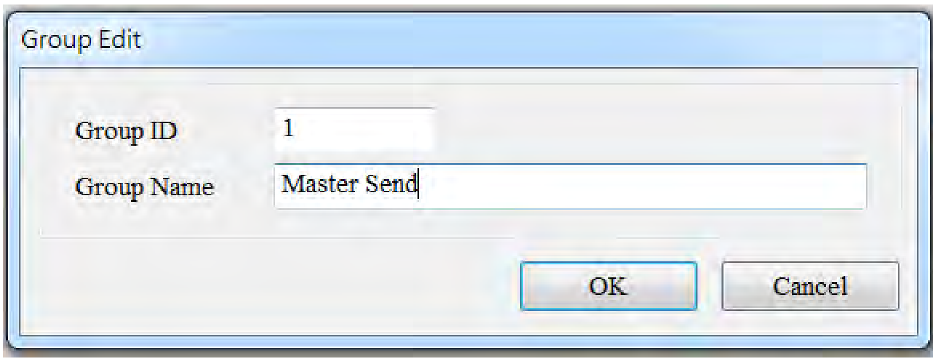
8) Right-click **Slave_Simulation** and click **Create Group List** to create a group list for the Slave_Simulation group.



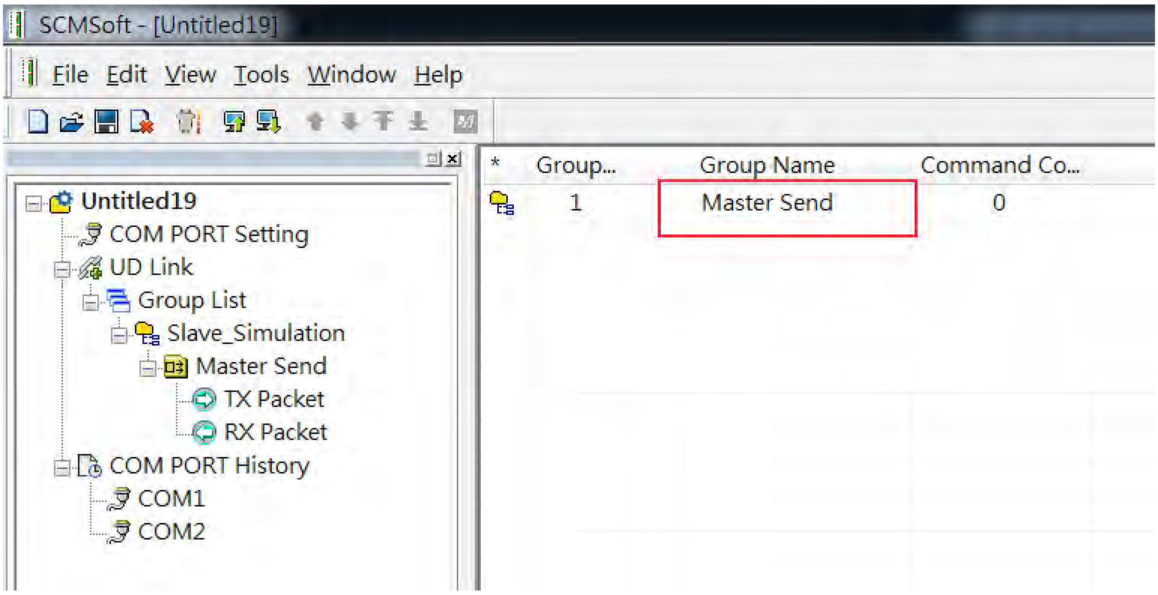

9) You can find a created Group List1. Double-click it to open an editing window to edit the Group List Name and the Slot.



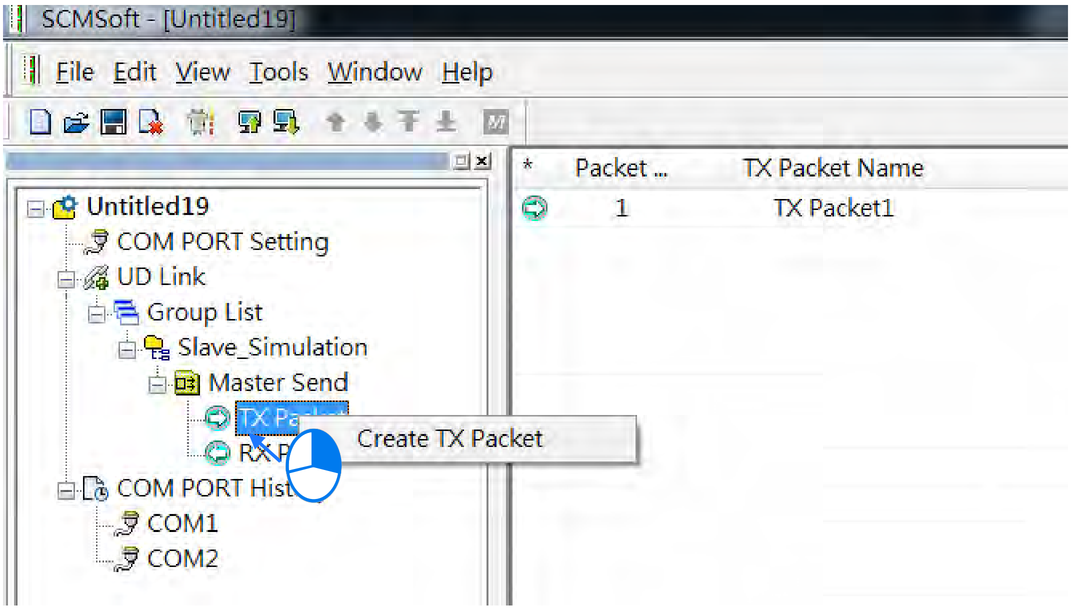

Create a group and name it “Master Send”.



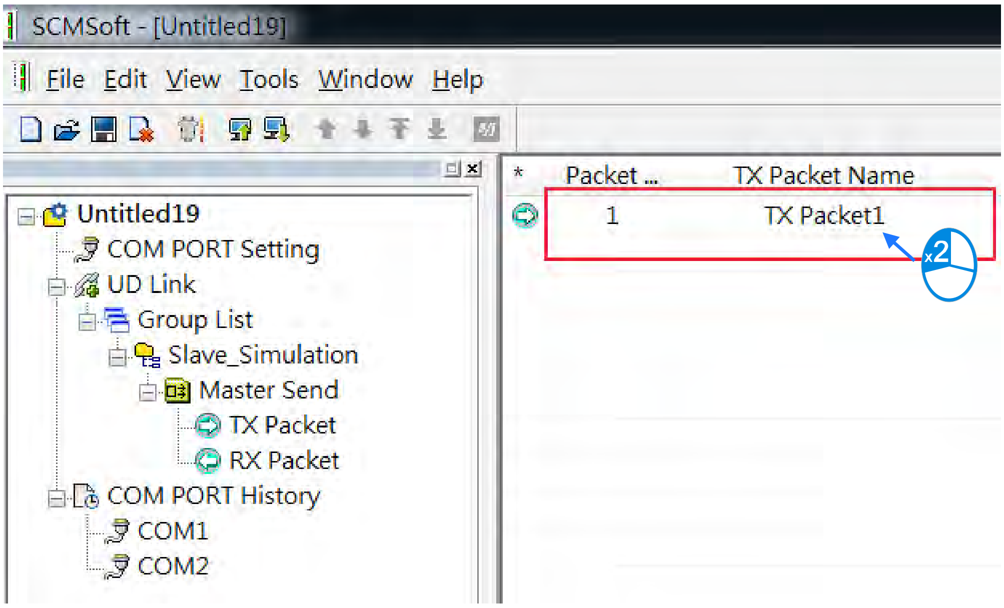

8



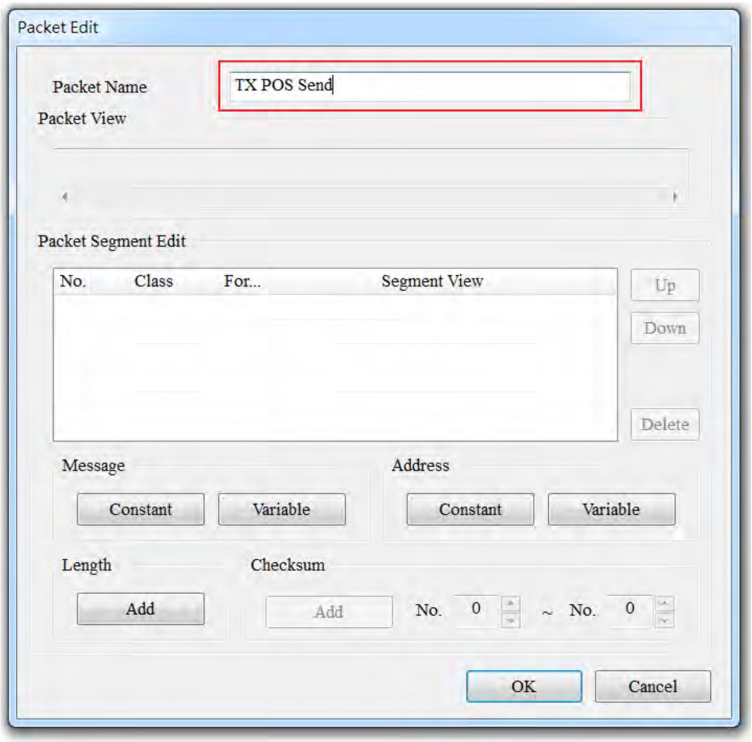

10) Right-click **TX Packet** and click **TX Packet** to create a TX Packet1.



11) Double-click **TX Packet1** to open the **Packet Edit form**.

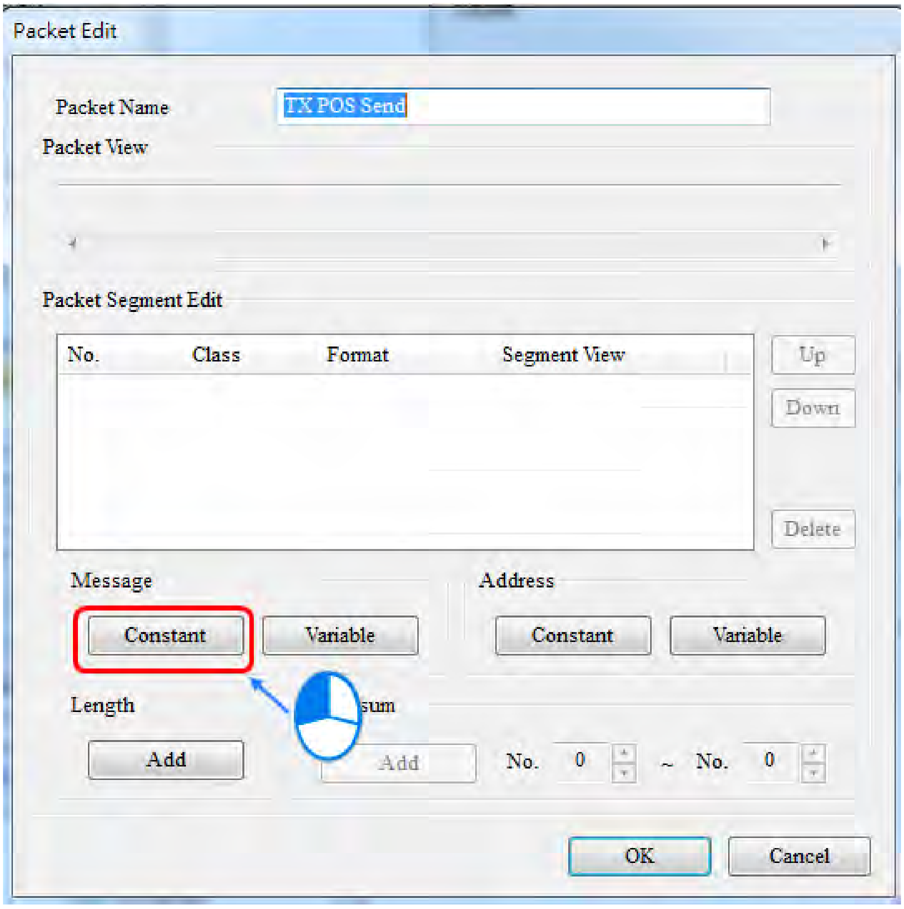



12) Give the Packet a Name (This example uses “TX POS Send”)

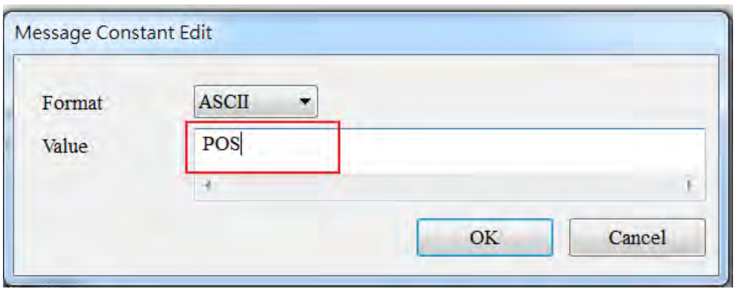


13) Edit the TX packet, “POS, xxx, yyy” (The example below uses POS, 123, 123)

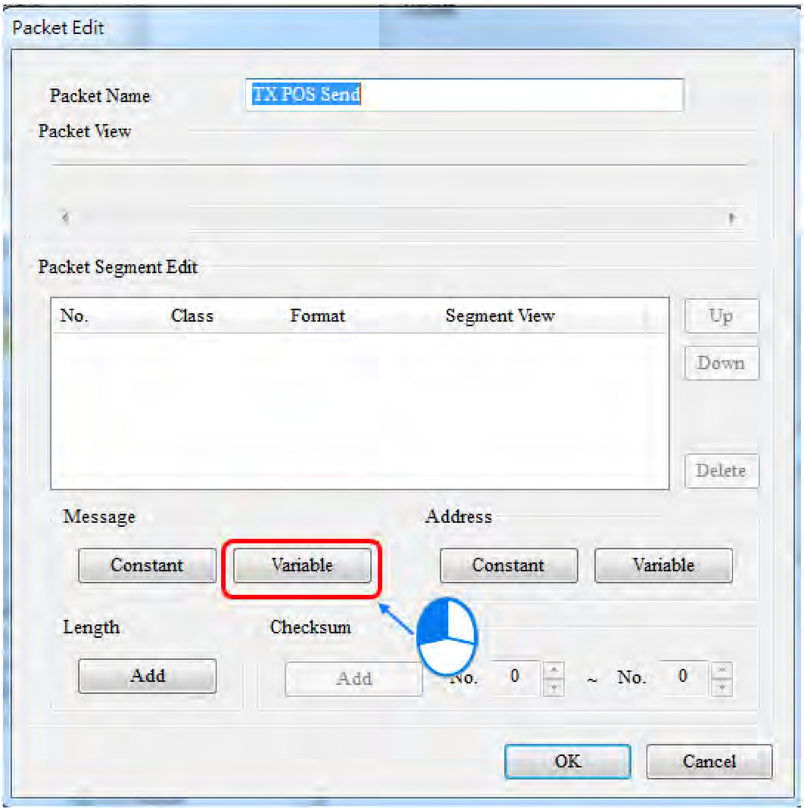
14) Click **Constant** in the Message area.



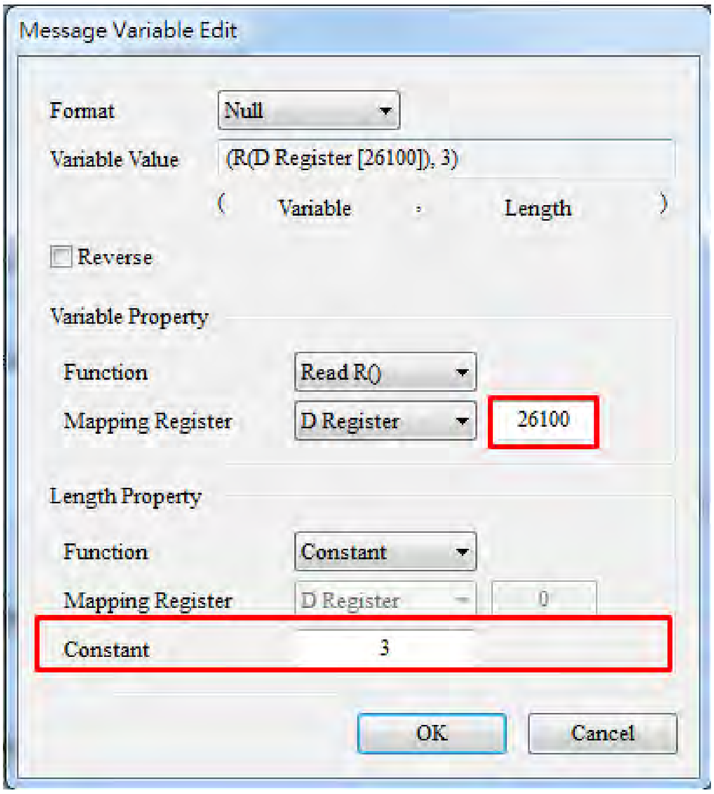

Enter “POS” in the Value area. Click **OK** and verify the packet contents in the Packet View.



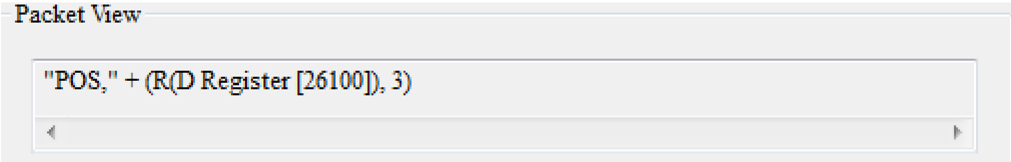
15) [xxx] is a variable, so click **Variable** in the Message area to edit it. Use ISPSoft to get the value from data registers D26100–D26101. The example below uses D26100: 16#3132 and D26101: 16#3300 and the value is 123.



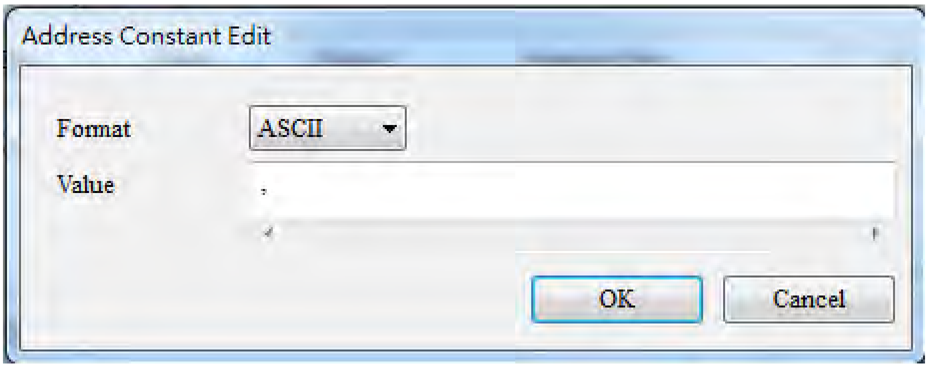

16) Enter the data register that contains the value you want to find. The example below uses D26100 and the value returned is 3. Use ISPSoft to get the value from data registers D26100–D26199.



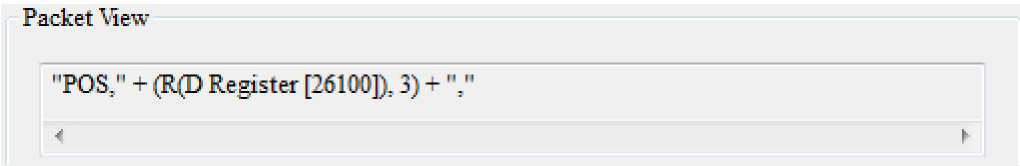
Click **OK** and verify the values ("POS,"+ ( R ( D Register [26100], 3 ) ) in the Packet View.



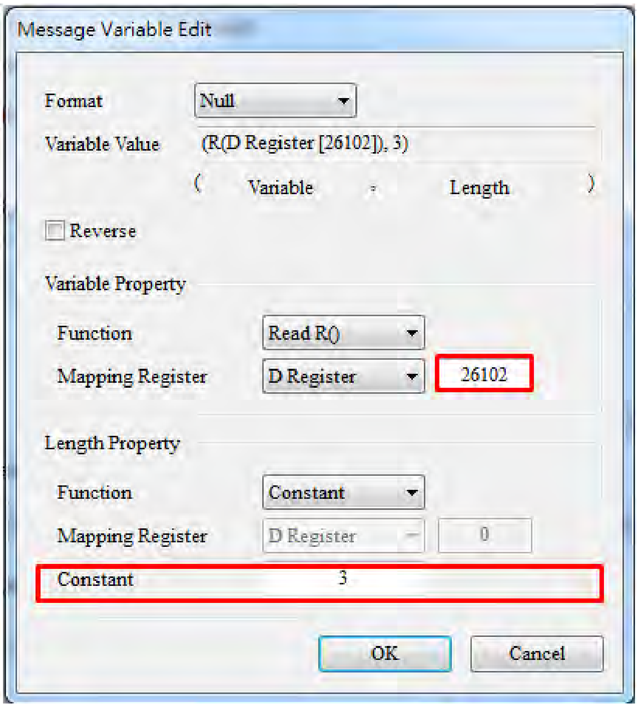

17) [ , ]: Use Address Constant to enter this Value and set the Format to ASCII.



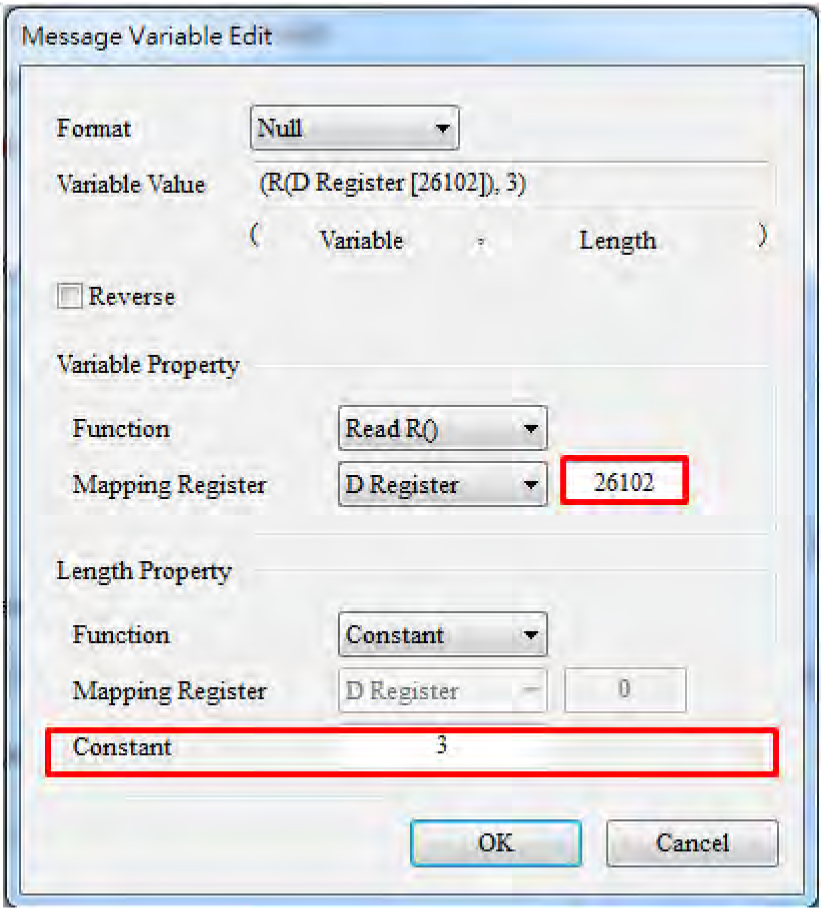

Click OK and verify the values ("POS,"+ ( R ( D Register [26100], 3 ) ) in the Packet View.



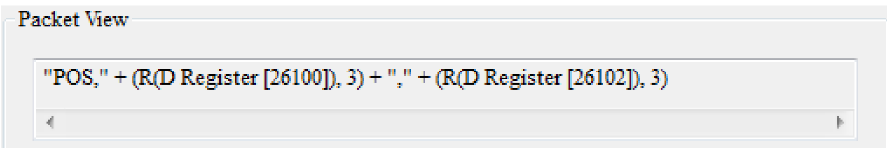

18) [yyy] is a variable, so click **Variable** in the Message area to edit it. Use ISPSoft to get the value from data registers D26102–D26103. The example below uses D26102: 16#3132 and D26103: 16#3300 and the value is 123.



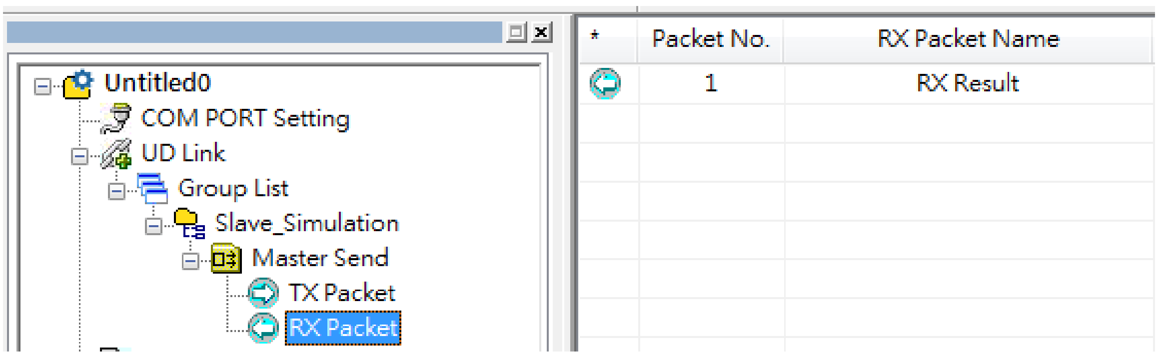
19) Enter the data register that contains the value you want to find. The example below uses D26102 and the value returned is 3. Use ISPSoft to get the value from the data registers D26100–D26199.



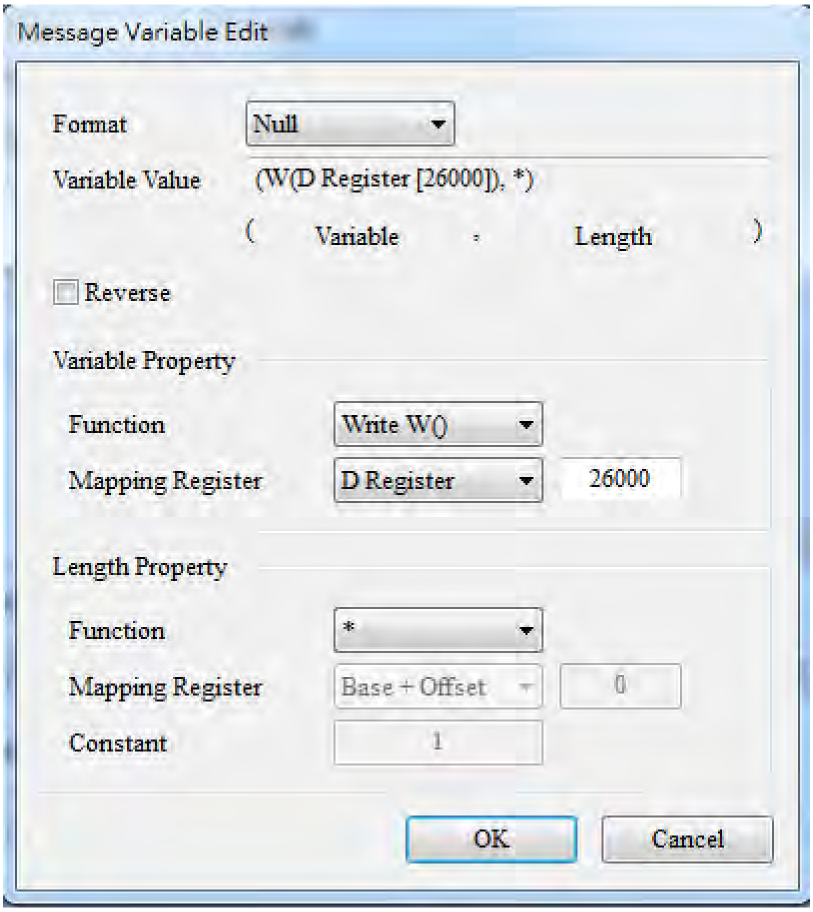

Click **OK** and verify the values ("POS,"+ ( R ( D Register [26102], 3 ) ) in the Packet View.



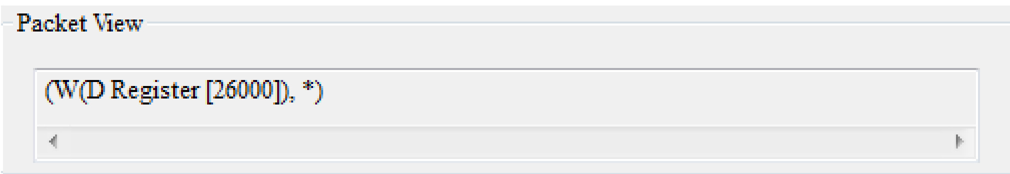

20) Edit the packet: Create a packet and name it “RX Result”. Double-click it to open the editing window.



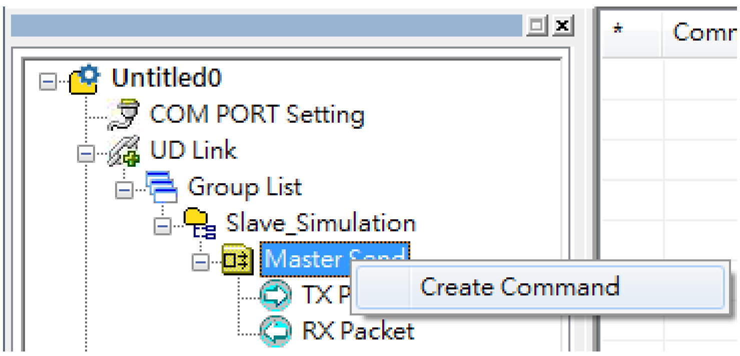
Enter the sending packet into the D26000 register of the AS300 CPU. "*" indicates that the length is not specified.




The packet should look like the example below.

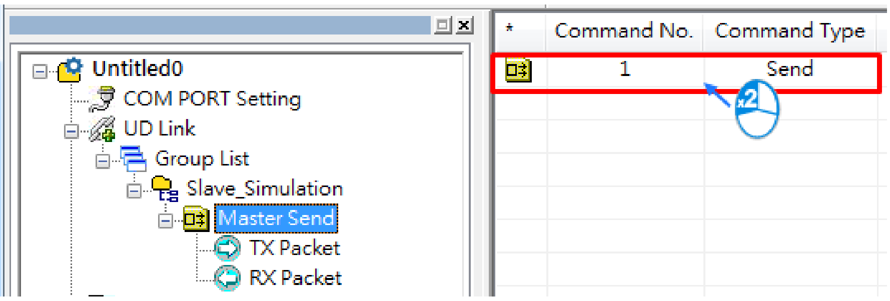


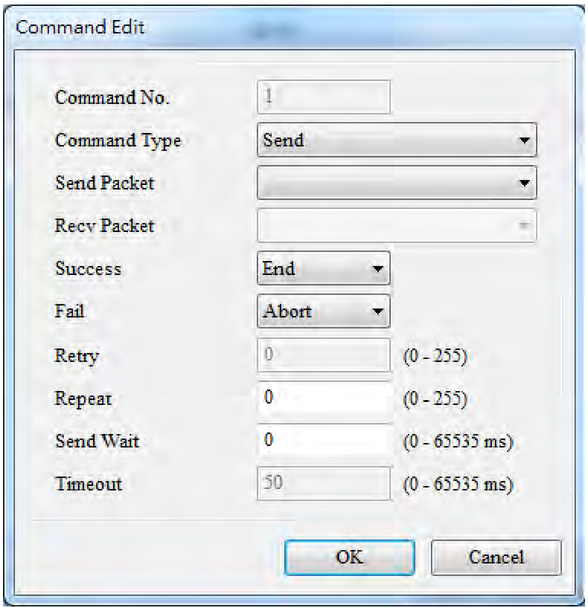

21) Create a command: Right-click **Master Send** and click the **Create Command**.



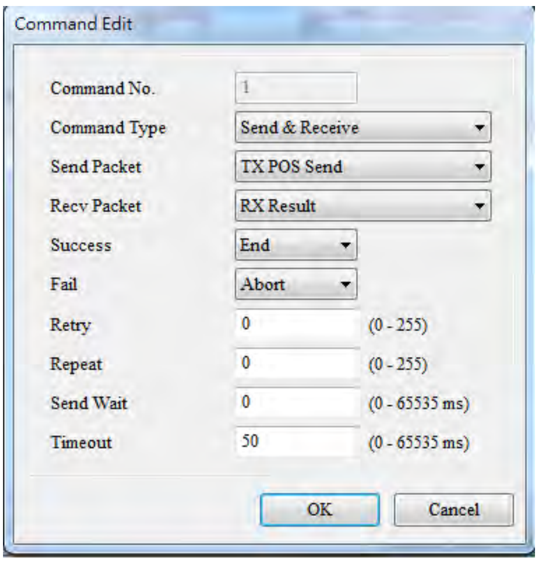

8

22) Double-click the new command on the list to open the Command Edit window.

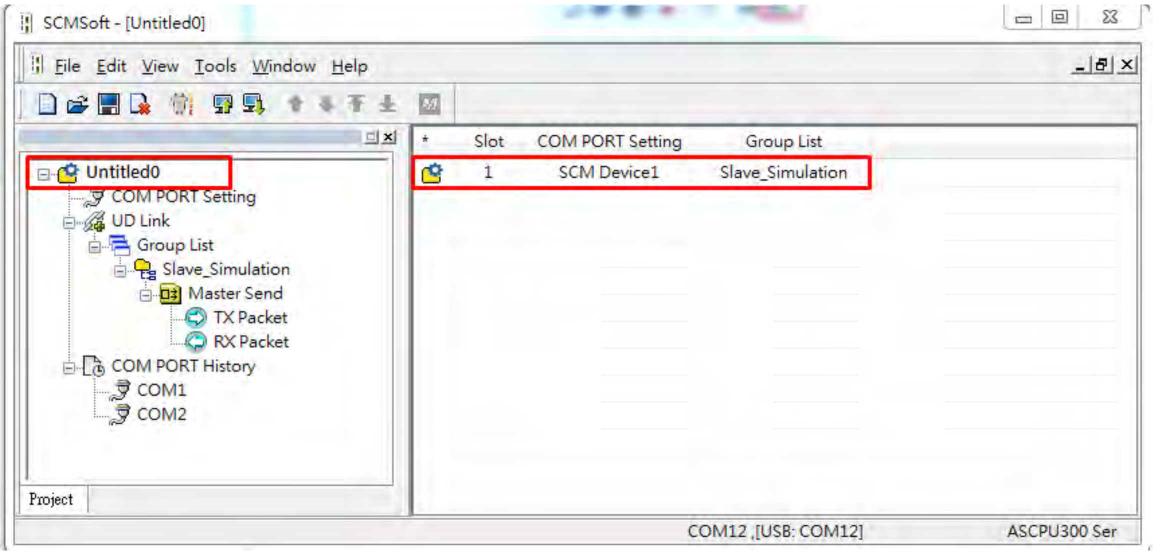


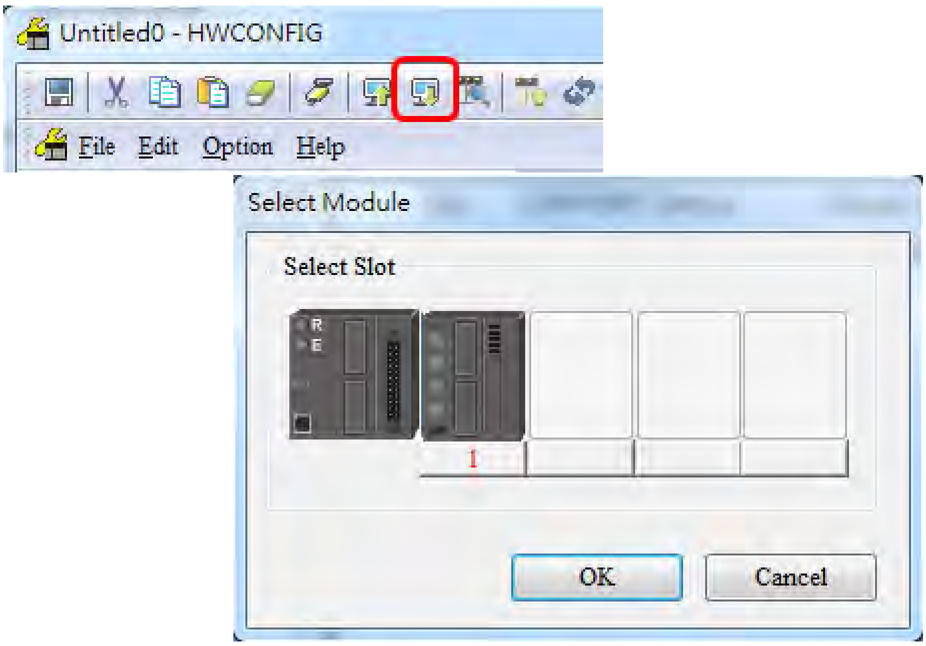

23) Set **Send Packet** to “TX POS Send” and set **Recv Packet** (received contents) to “RX Result”.



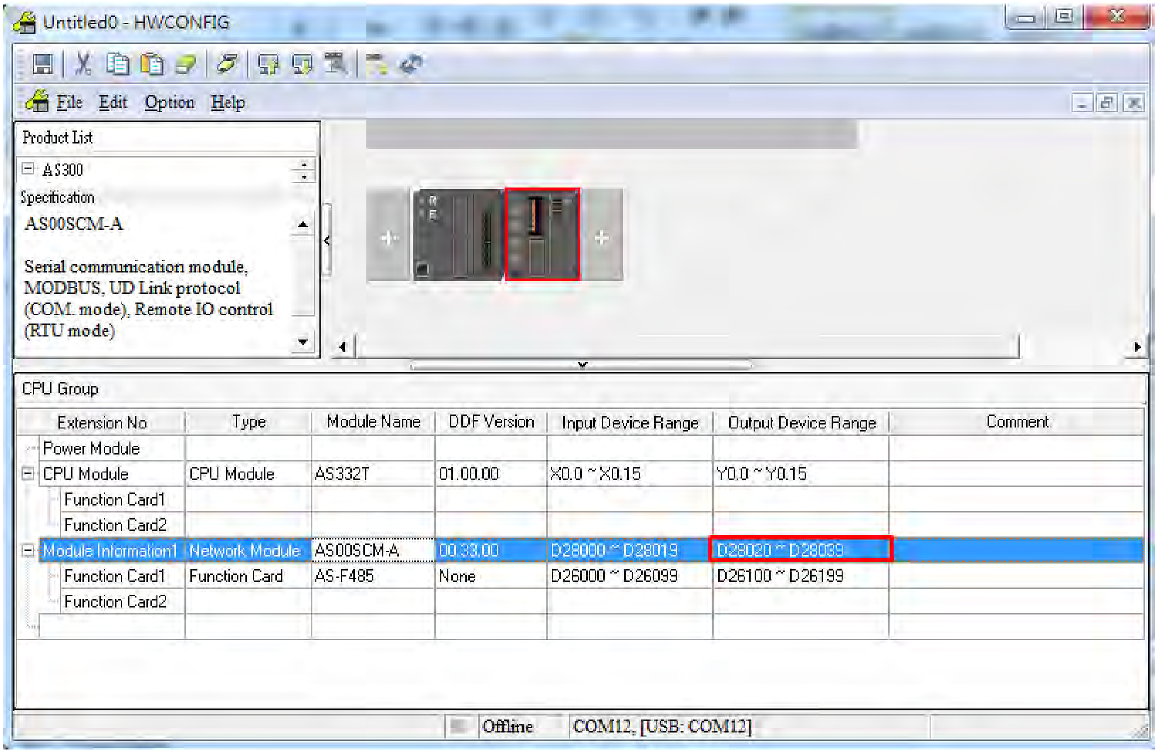
24) Make sure the Group is in slot 1 (COM1).



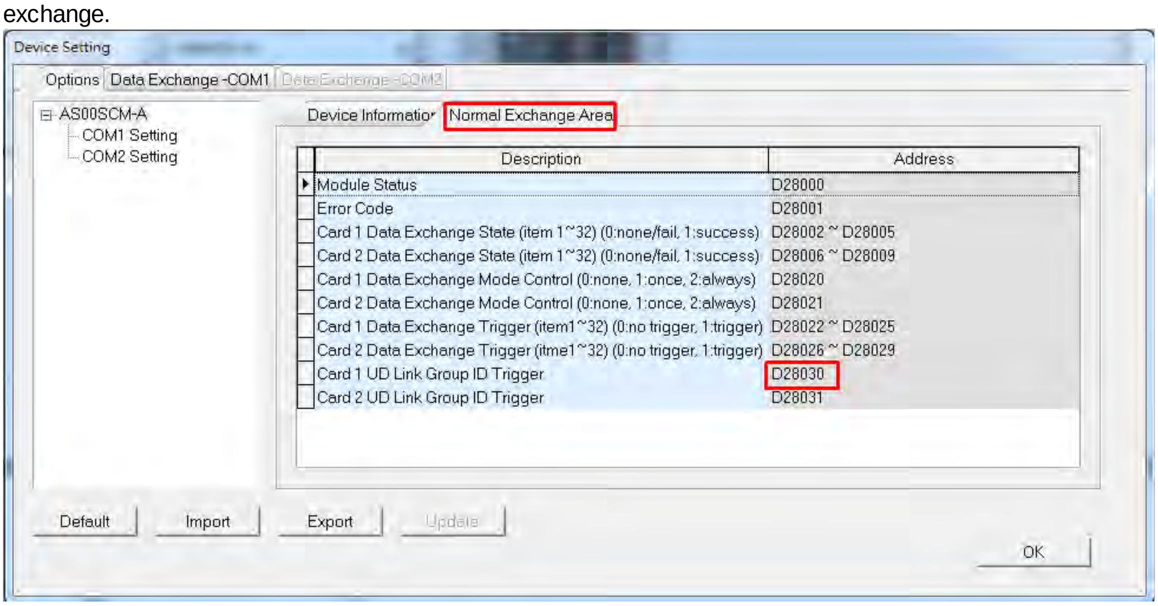

25) Click the Download button to download the parameters to the AS00SCM.



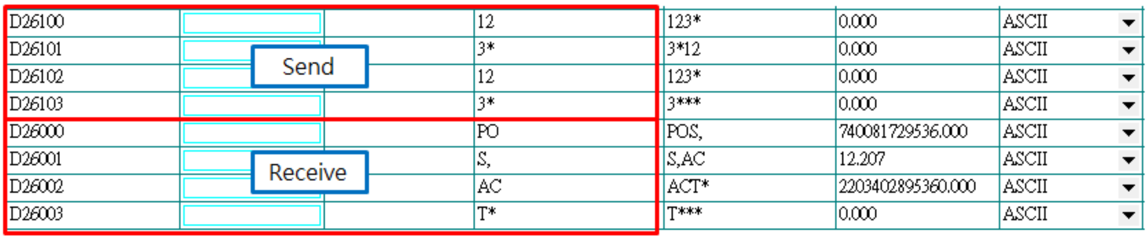
26) Set up the devices for the UD Link Group ID Trigger in HWCONFIG. Once you create the AS00SCM-A module, the system automatically assigns the corresponding addresses.



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.

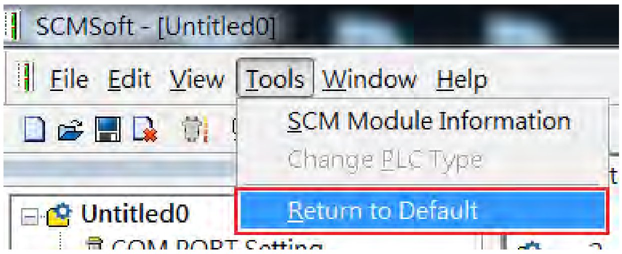


28) Use the monitor function in ISPSoft to verify that the transmission is working correctly.




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.



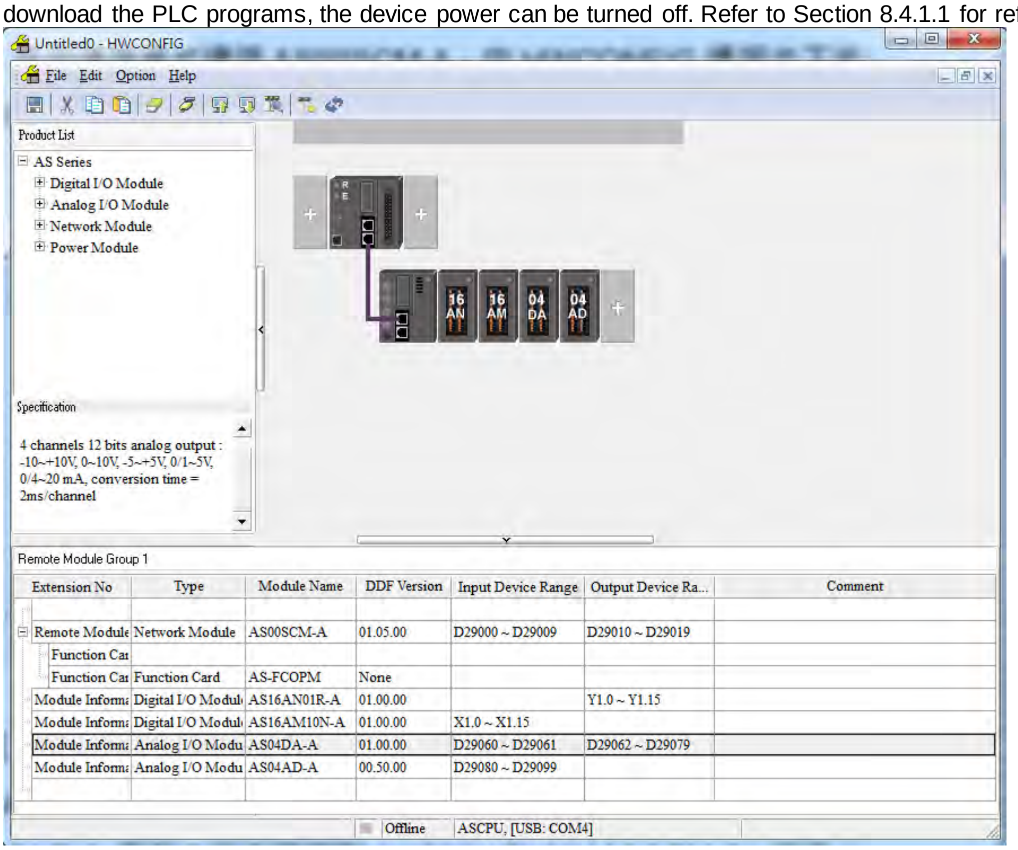

## 8.6.3 Remote IO Application (AS-FCOPM)

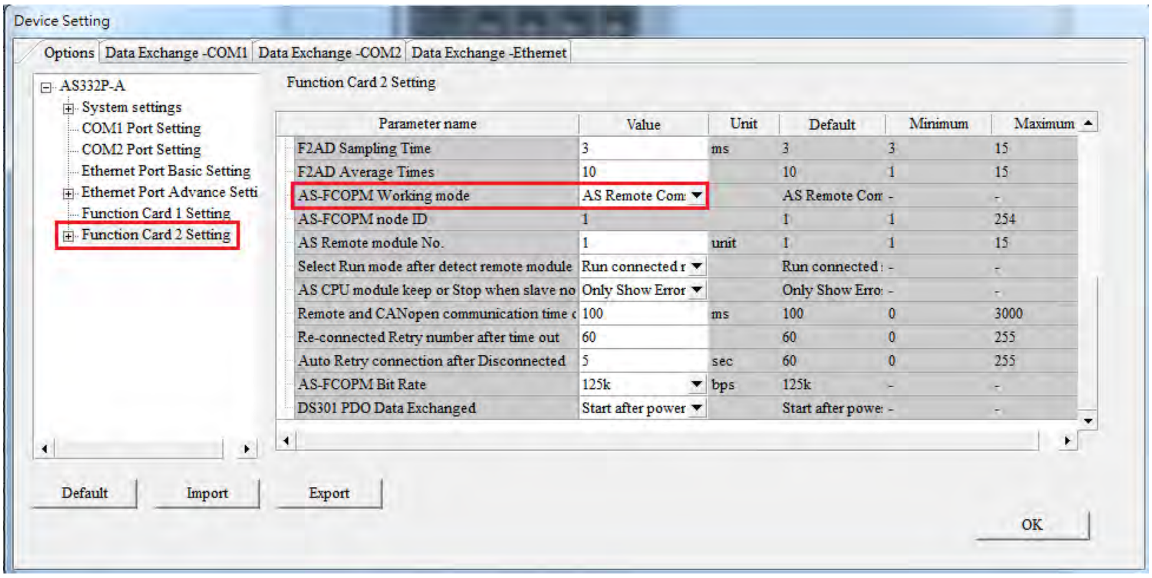
This example shows other series PLC, AH10COPM-5A, as a CANopen Master that controls four IO modules on the right side of AS00SCM-A that acts as a CANopen Slave. (You can use this method to connect to a 3rd party PLC.)

| 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**

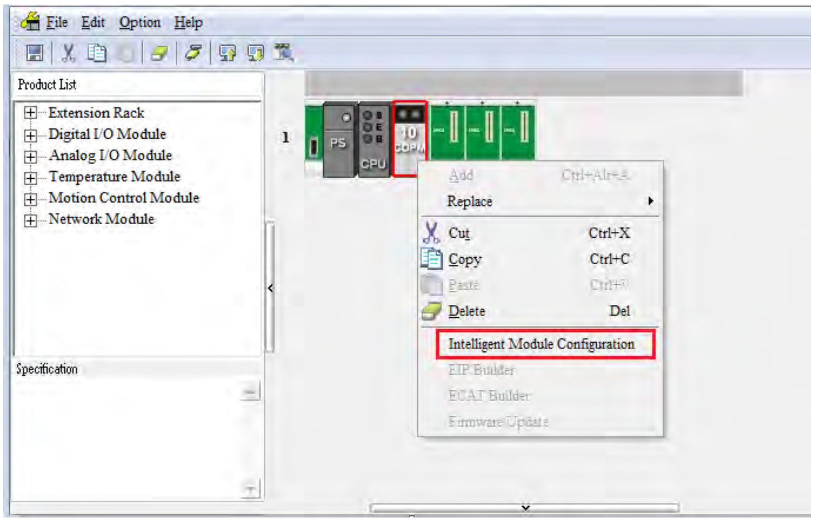
Use AS300 to connect to AS00SCM-A through AS Remote Communication (RTU mode) and then use HWCONFIG to scan and download the parameters. If the Card 2 LED is blinking normally, with no error messages, and no need to download the PLC programs, the device power can be turned off. Refer to Section 8.4.1.1 for reference.





**Step 2**

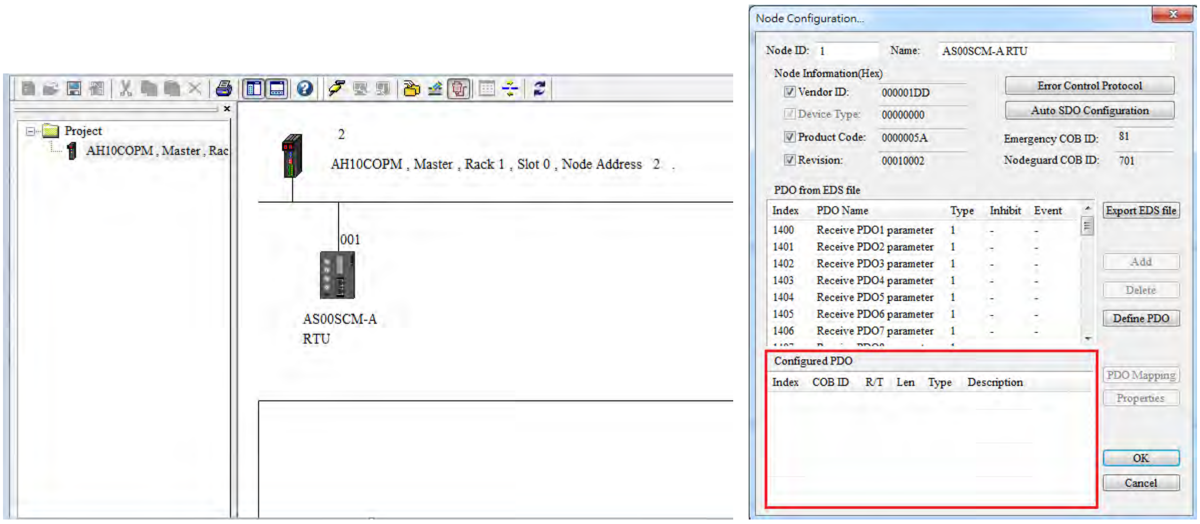
Switch the Format 1 of AS00SCM-A to 4 (using CANopen DS301 mode) and switch Format 2 to 7 (setting the bit rate to 1000kbps) and then turn the power off and on again. After that wiring AH10COPM-5A and set the node ID to 2 and set the bit rate to 1000kbps. Use ISPSoft (V3.04 or later) and HWCONFIG to 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.

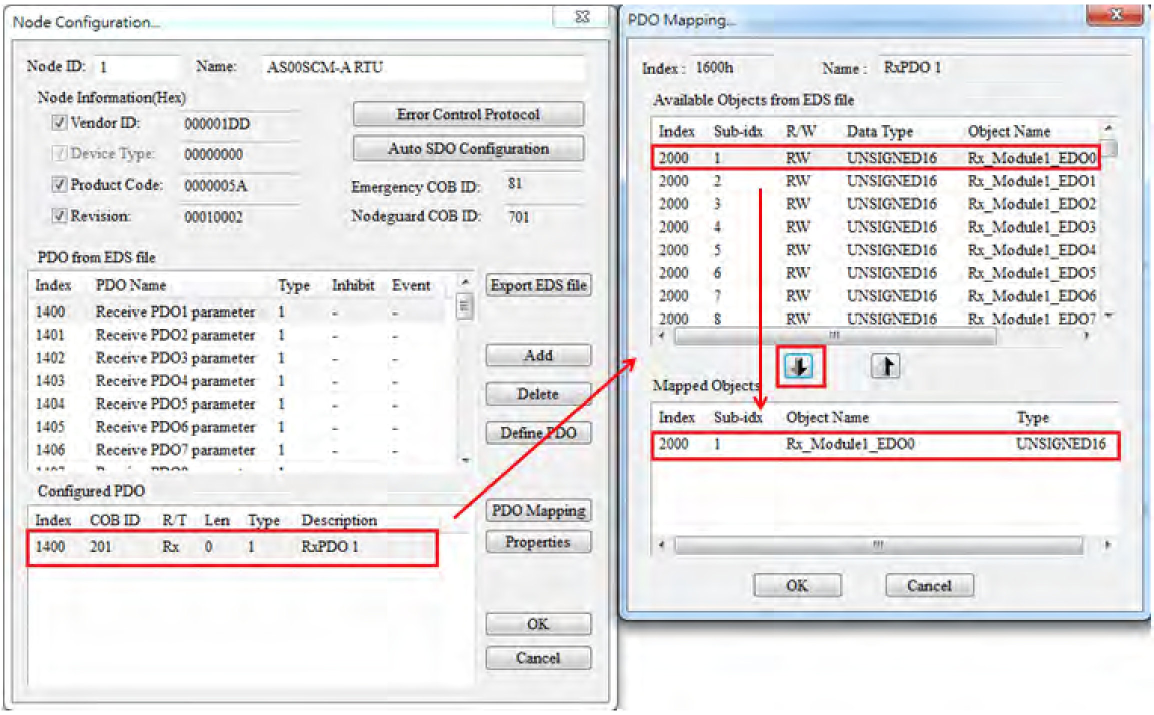


**Step 4**

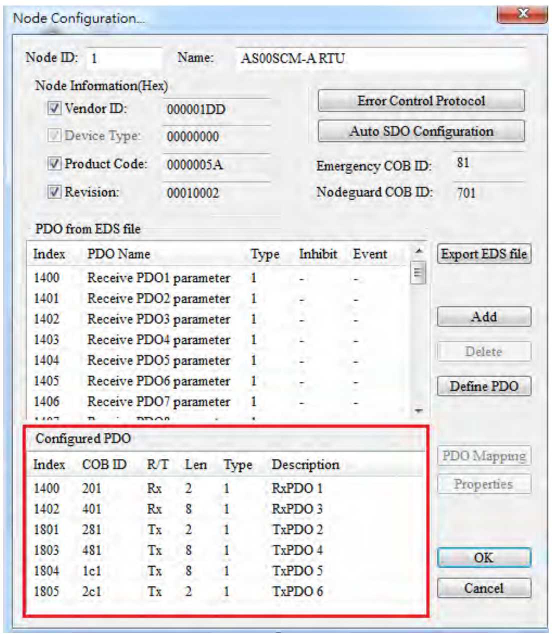
Here uses a first right side digital output module (16 points) as an example.

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<br>Rx_Module3_EDO1<br>Rx_Module3_EDO2<br>Rx_Module3_EDO3 | D6001<br>D6002<br>D6003<br>D6004 |
| **AS04AD-A** | 4 Analog channels for input (Integer format)* | TxPDO4 | Tx_Module4_EDI0<br>Tx_Module4_EDI1<br>Tx_Module4_EDI2<br>Tx_Module4_EDI3 | D5001<br>D5002<br>D5003<br>D5004 |
| **IO Module Error Code** | - | TxPDO5 | Tx_Module1_error_code<br>Tx_Module2_error_code<br>Tx_Module3_error_code<br>Tx_Module4_error_code | D5005<br>D5006<br>D5007<br>D5008 |
| **RTU Error Code** | - | TxPDO6 | Tx_RTU_error_code | D5009 |

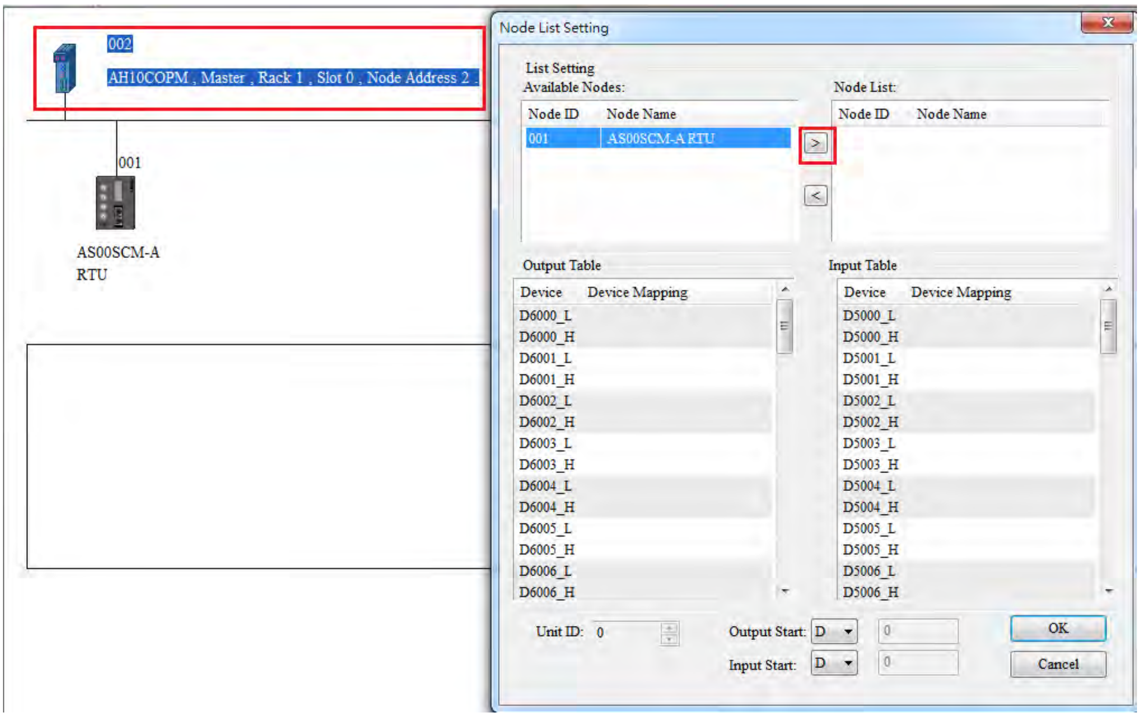
* Here the analog module uses integer format; if you need to use floating point format, two PDOs will be used per channel.

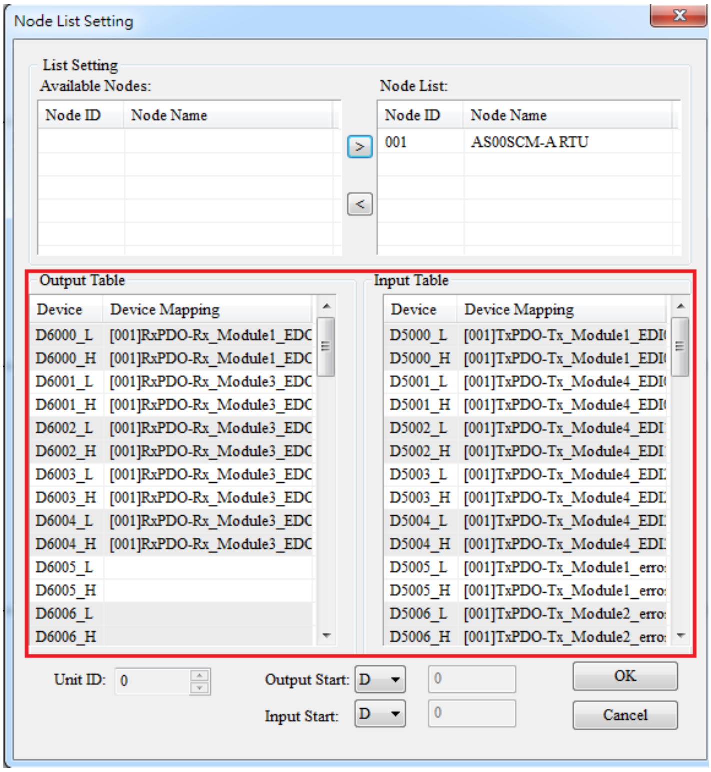
* Index 2002 to Index 200d are for system internal use only. Avoid using this range, when PDO is used.

* Only synchronization cycle is supported.

**Step 5**

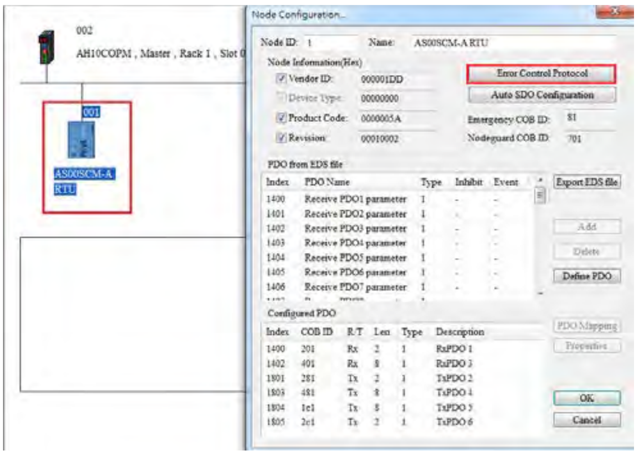
Double click the PLC icon and select Node ID 001 from the available nodes and then use the R**ight** arrow to add the selected one into the Node List. Output and Input tables are mapping registers for PDOs.

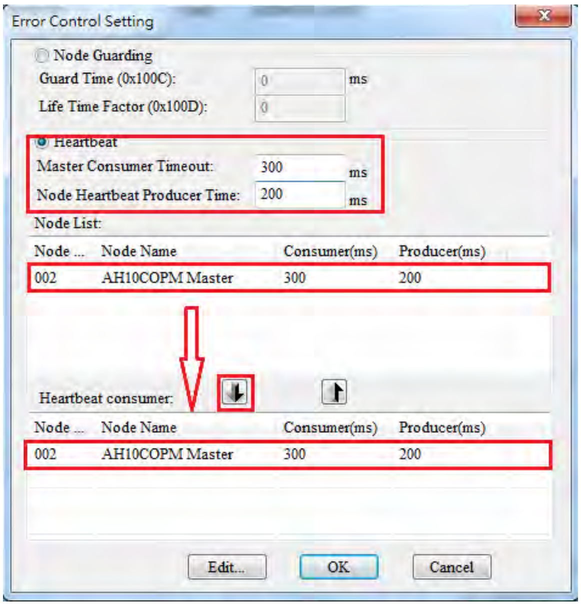




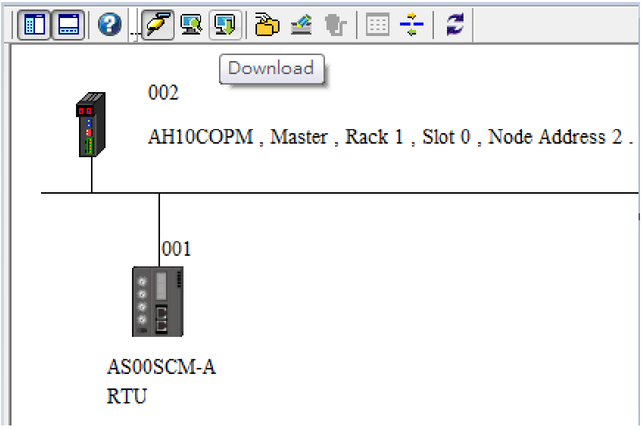

**Step 6**

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).



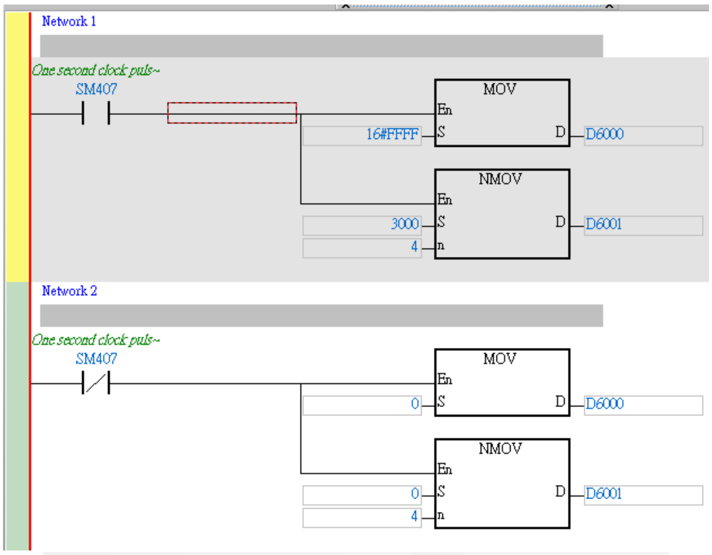



Click OK to confirm the setting. Download the parameters to the PLC. And then PLC can control the input/output of the IO module remotely.




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 |

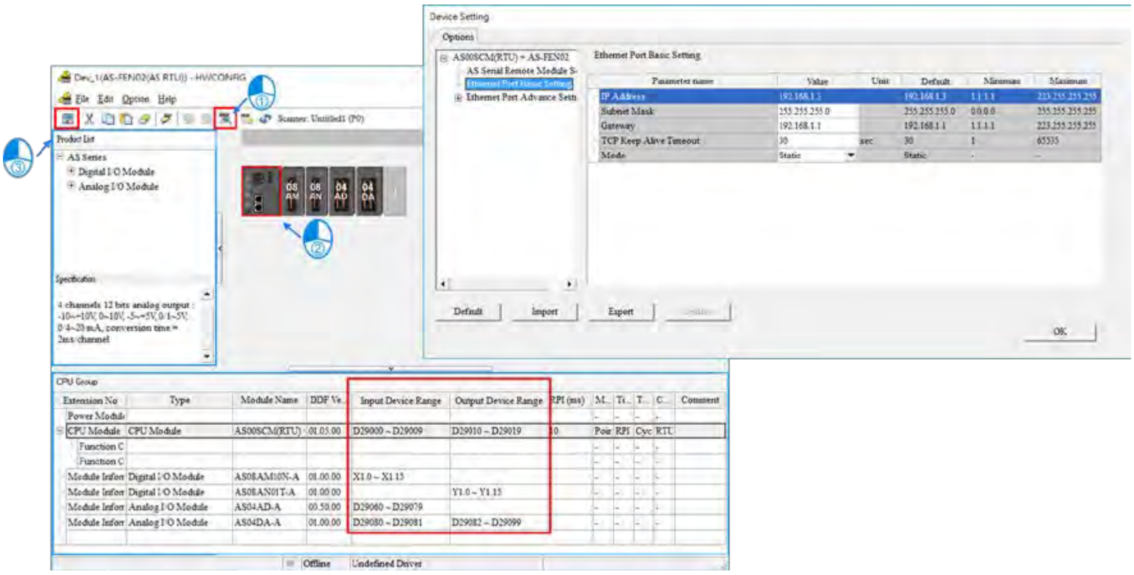
## 8.6.4 Remote IO Application (AS-FEN02)

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. When AS300 Series PLC acts as master/scanner in EtherNet/IP communication, do not install AS-FCOPM; otherwise errors may occur on EtherNet/IP slave/adapter connections.

| 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 |

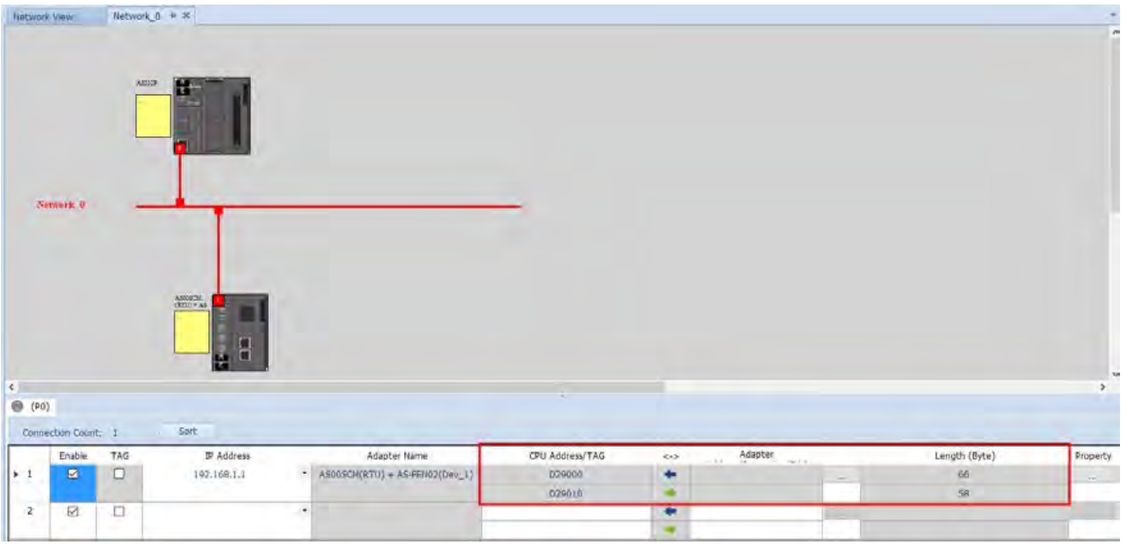
**Step 1**

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 8.4.2.1 for more details.



**Step 2**

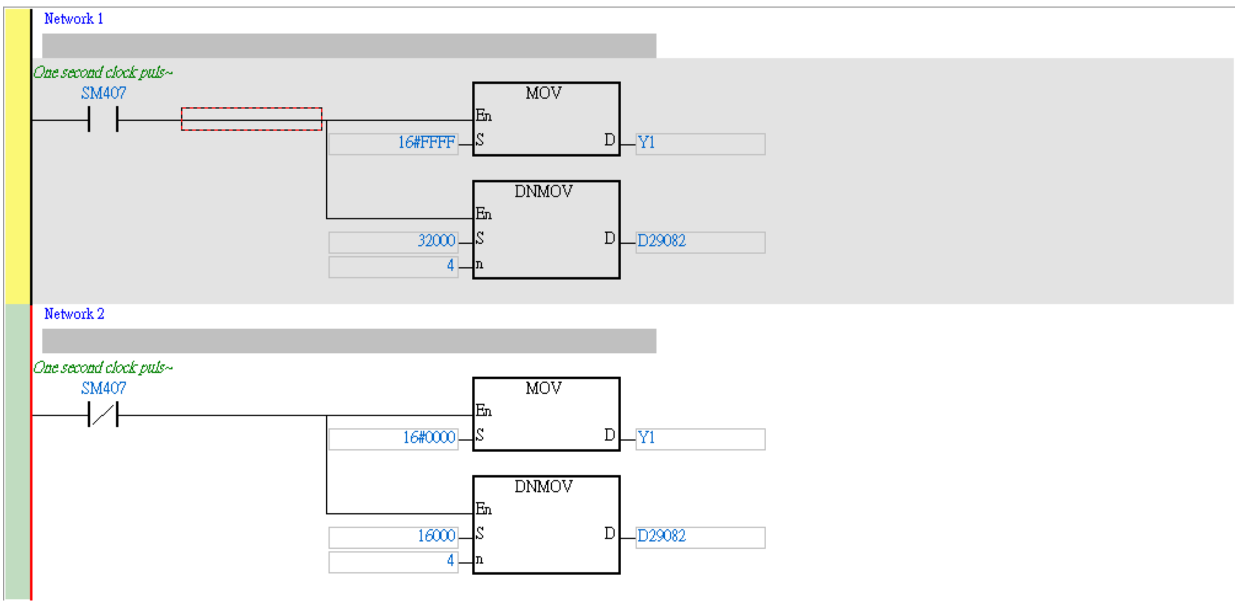
You can see the IP address and the data length from the data mapping table in EIP Builder. The data mapping table can be downloaded and upload the mapped data to the device.



**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 and 3 in this manual for more details on module operation.



## 8.6.5 Remote IO Application (Multiple AS-FEN02)

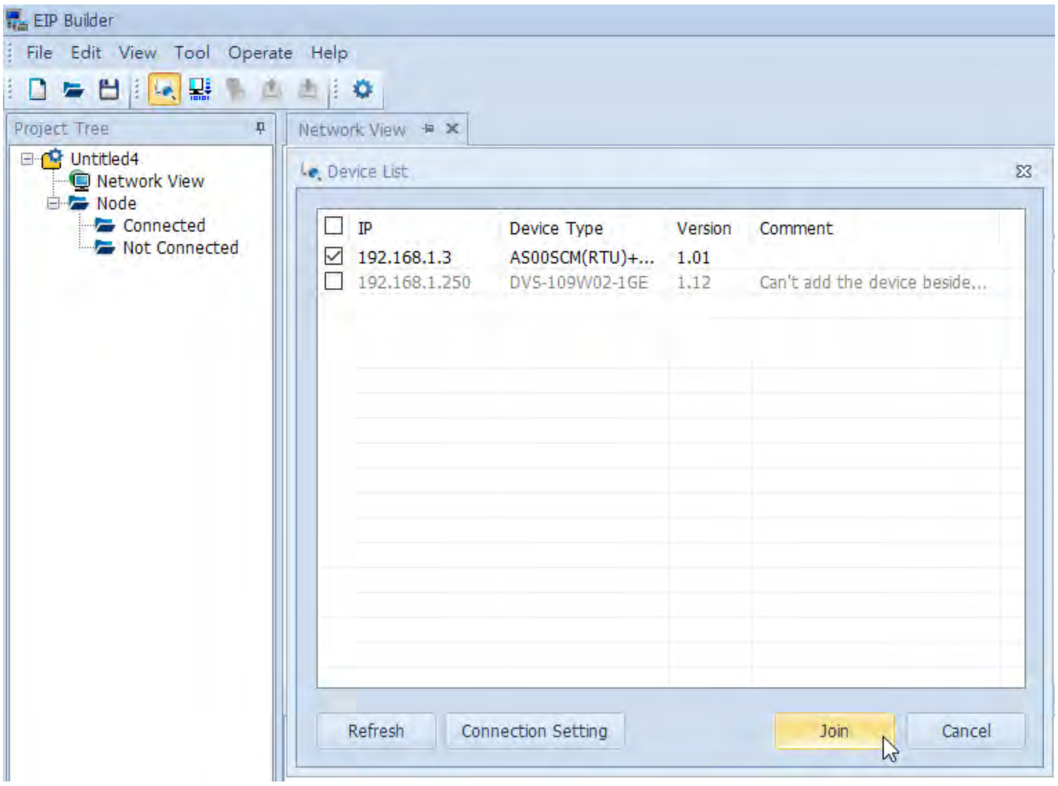
When AS-FEN02 is installed on AS Series PLC, it can be used as the Ethernet port of the CPU.

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.

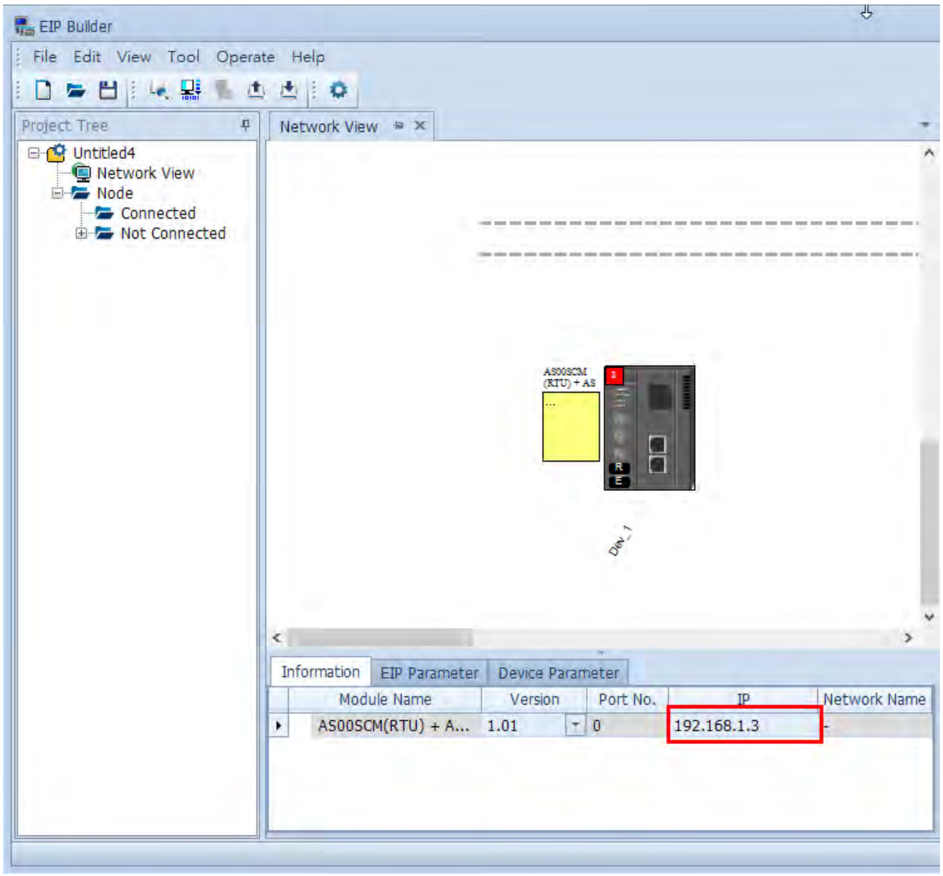
| Device | Function | IP Address | Data Mapping Area |
|---|---|---|---|
| **AS200** | EtherNet/IP master/scanner | 192.168.1.5 | |
| **AS00SCM-A + AS-FEN02** | EtherNet/IP slave/adapter | 192.168.1.30 | D29540~D29559 |
| **AS00SCM-A + AS-FEN02** | EtherNet/IP slave/adapter | 192.168.1.31 | D29180~D29199 |
| **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 switches of the FORMAT 2 of the 3 new RTUs to 0. The default IP address of the 3 new RTUs is 192.168.1.3. Since different IP addresses are essential for devices to be in the same network, you need to use EIP Builder to set up the IP addresses to have the 3 new RTUs in the same network. Connect one RTU to your computer and open EIP Builder to scan the network to add the first RTU with the IP address 192.168.1.3 in.



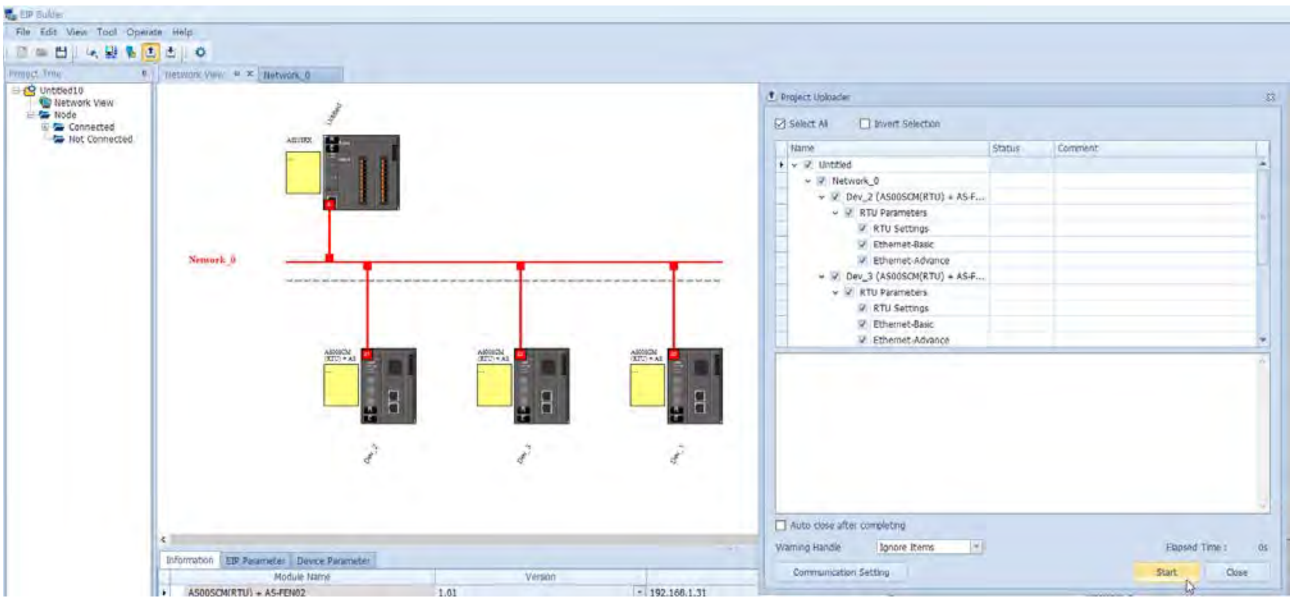

8




Before setting up the EIP network, you can double-click the RTU to open HWCONFIG and set up its IP address to 192.168.1.30 and other parameters. After the setting is complete, download the parameters to the connected module and the new IP address is reflected in the module. To minimize the risks of wrong operation, you can remove the module icon from the network and add another new RTU in. Repeat the previous steps to set up the IP address of the 2nd and 3rd RTU. For the setups of the right-side modules, you can leave them to the 3rd step.

**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.

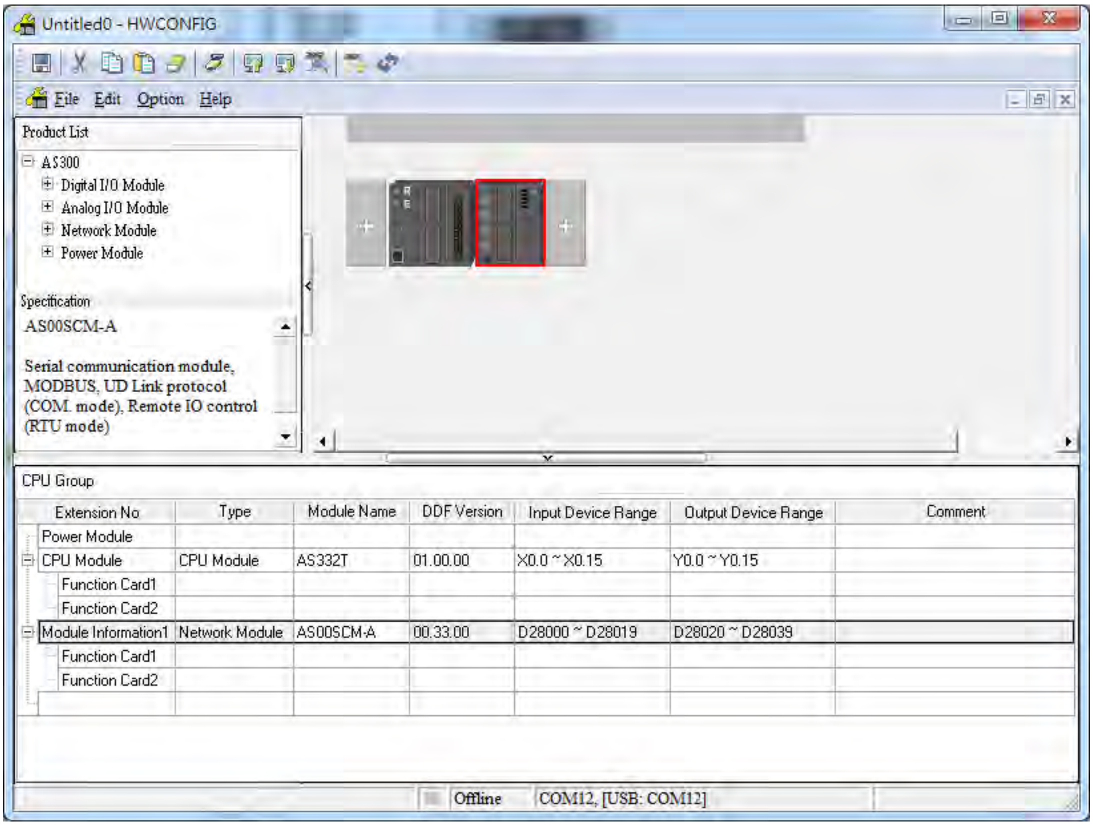


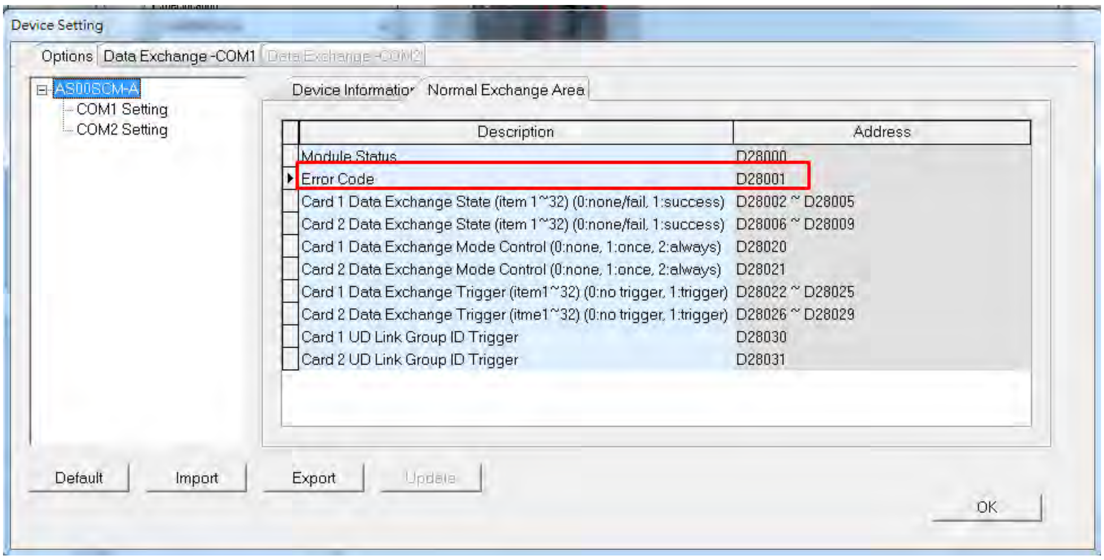
**Step 3**

Now you can set up the right-side module of RTU. Refer to section 8.6.4 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.

## 8.7 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.



## 8.7.1 Troubleshooting for Module AS00SCM-A as a Communication Module

### 8.7.1.1 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.<br>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.<br>2. Install a new function card or contact the factory.<br>3. Check if the setting in HWCONFIG is consistent with the function card setting.<br>4. Install a new AS00SCM-A or contact the factory. |

### 8.7.1.2 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.<br>2. Check if the station number and the communication format are correctly set.<br>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.<br>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.<br>2. Check if the connection with the function card is working correctly. |

8

| Error Code | Description | Solution |
|---|---|---|
| 16#0302 | Function card 2 communication timeout | 1. Check if the station number and the communication format are correctly set.<br>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.<br>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.<br>2. Check the warning settings in the PLC. |
| 16#0402 | Invalid UD Link Command for function card 1 | 1. Check the UD Link settings.<br>2. Check the warning settings in the PLC. |
| 16#0403 | Invalid UD Link Command for function card 1 | 1. Check the UD Link settings.<br>2. Check the warning settings in the PLC. |

## 8.7.2 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.

### 8.7.2.1 ERROR LED Indicators Are ON

Error codes:

| Error Code | Description | Solution |
|---|---|---|
| 16#1301 | Hardware failure | 1. Check if the module is securely installed.<br>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.<br>2. Change and install a new function card or contact the factory.<br>3. Check if the setting in HWCONFIG is consistent with the function card setting.<br>4. Install a new AS00SCM-A or contact the factory. |

8

### 8.7.2.2 ERROR LED Indicators Blinking Every 0.5 Seconds

Error codes:

| Error Code | Description | Solution |
|---|---|---|
| 16#1502 | Incorrect parameters | Check the parameter in HWCONFIG. Download the parameter again. |
| 16#1503 | 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. |

### 8.7.2.3 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 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. |

**MEMO**

8

9

# Chapter 9 Function Cards

## Table of Contents

## 9.1 Introduction

Function cards are extension cards such as analog input/output (AI/AO) and communication cards for the AS Series PLC.

## 9.2 Specification and Function

### 9.2.1 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.

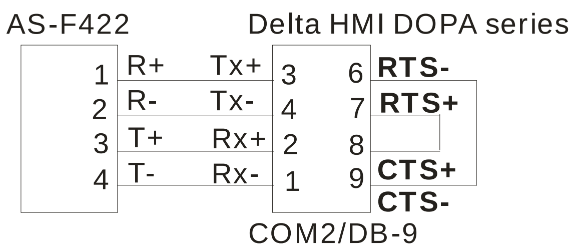
■ Wiring example


DB9 male to DB9 female (standard cable)

### 9.2.2 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.

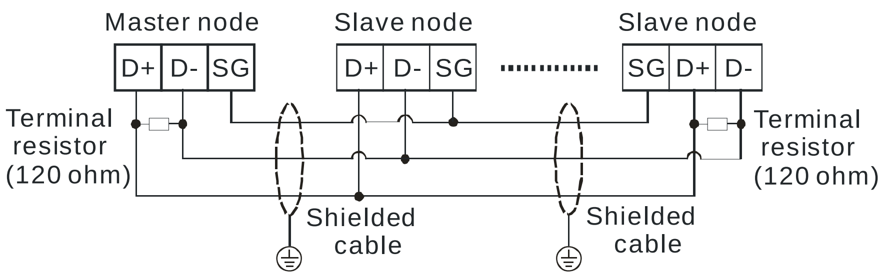
■ Wiring example for communication with Delta HMI DOPA series via COM2




### 9.2.3 AS-F485

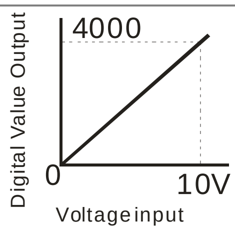
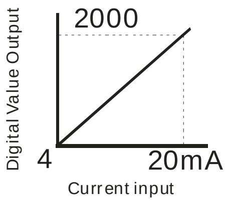
With its own standalone communication port, the AS-F485 card can work independently and can be either a slave or a master node. After installing the extension card, use HWCONFIG in ISPSoft to configure the communication.

■ Wiring example



### 9.2.4 AS-F2AD

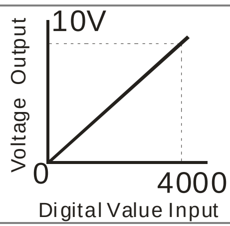
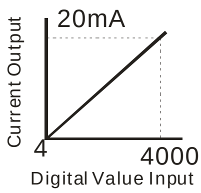
2 analog signal input channels:

| Item | Voltage Input | | Current Input |
|---|---|---|---|
| **Analog Signal** | DC 0 V - 10 V | | DC 4 mA - 20 mA |
| **Resolution** | 12-bit | | 11-bit |
| **Input Impedance** | 2 MΩ | | 250 Ω |
| **Conversion Time** | 3 ms / CH | | |
| **Characteristic Curve** |  | |  |
| **Digital Value Output** | Card 1 | SR168 (CH1) | SR169 (CH2) |
| | Card 2 | SR170 (CH1) | SR171 (CH2) |

Use the program to read the values in SR to obtain the corresponding A/D conversion value for the channel.

### 9.2.5 AS-F2DA

2 analog signal output channels:

| Item | Voltage Output | | Current Output |
|---|---|---|---|
| **Analog Signal** | DC 0 V - 10 V | | DC 4 mA - 20 mA |
| **Resolution** | 12-bit | | 12-bit |
| **Impedance Allowance** | ≥1 kΩ | | ≤500 Ω |
| **Conversion Time** | 2ms / CH | | |
| **Characteristic Curve** |  | |  |
| **Digital Value Output** | Card 1 | SR172 (CH1) | SR173 (CH2) |
| | Card 2 | SR174 (CH1) | SR175 (CH2) |

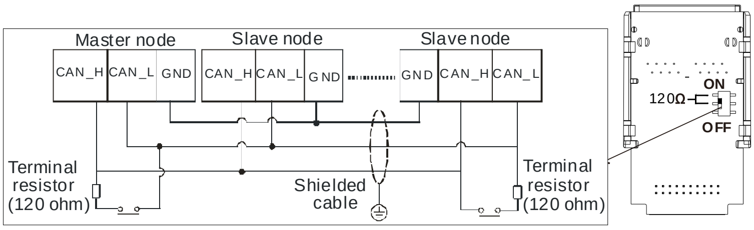
Use the MOV instruction to move the value to the SR to obtain the corresponding voltage output value.

9

## 9.2.6 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




## 9.2.7 AS-FEN02

### 9.2.7.1 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.

### 9.2.7.2 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 8.4.2 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, refer to section 8.3.1.2 of AS Series Operation Manual for more details.
- When AS-FEN02 is installed on AS300 Series PLC, it acts as aj 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 Chapter 9 of AS Series Operation Manual for more details.

### 9.2.7.3 Specifications

- **System Specifications**

| Item | | Specification |
|---|---|---|
| **General** | **Device type** | Master, Slave and RTU |
| | **Topology** | Star, linear, ring topologies are supported. (FW V1.04 or later to support DLR function) |
| | **IP Settings** | Software: switch the ID2 and FORMAT2 to 00<br>Hardware: set the IP address to 192.168.1.X (X=1~254) for ID2 and FORMAT2 |
| | **Availability** | AS300 Series PLC<br>AS00SCM-A (available only for RTU mode) |
| **Web** | **Max. connection number** | 8 |
| | **Functions** | View device information<br>Account management |

| Item | | Specification |
|---|---|---|
| | | AS-FEN02 firmware update<br>Module monitoring (when installed in AS00SCM-A, and in RTU mode) |

- **MODBUS TCP Specifications**

| 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**

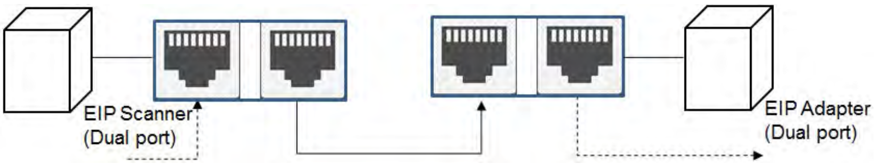
| Item | | Specification |
|---|---|---|
| **General** | **Device type** | Adapter |
| **CIP Network I/O Connection** | **CIP connection number** | 8 |
| | **TCP connection number** | 8 (Servers) |
| | **Requested Packet Interval (RPI)** | 1 ms~1000ms |
| | **Max. Transmission Speed** | 10,000 pps |
| | **Max. data length/per transmission** | 400 bytes |
| **CIP Network Explicit Message** | **Class 3 (Connected Type)** | Total 8 (Servers)<br>(for both class 3 and UCMM connection types) |
| | **UCMM (Non-Connected Type, only uses TCP connections)** | |
| | **CIP Objects** | Identity Object (16#01)<br>Message Router Object (16#02)<br>Assembly Object (16#04)<br>Connection Manager Object (16#06)<br>Port Object (16#F4)<br>TCP/IP Interface Object (16#F5)<br>Ethernet Link Object (16#F6)<br>Not supporting self-defined objects |

9

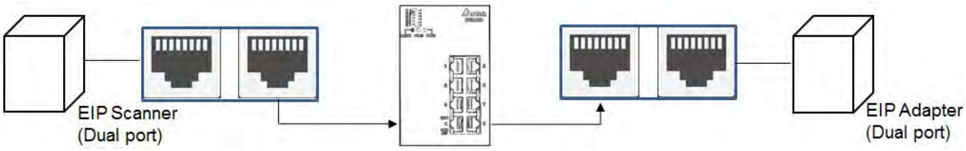
### 9.2.7.4 Topology

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**

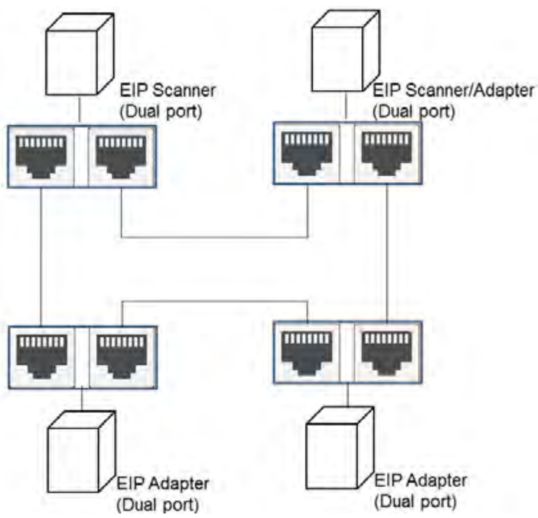



- **Star Topology**

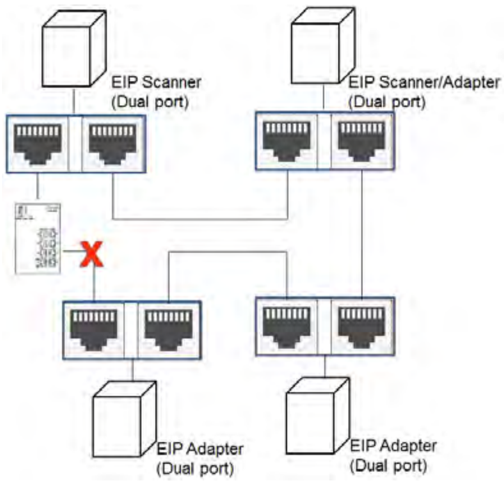



- **Ring Topology**

A DLR function is required to create a ring topology. (AS-FEN02 with firmware V1.04 or later to support DLR function)




When a switch is needed for topology, the switch should support the DLR function. If not, the connection might fail.



### 9.2.7.5 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 |
| 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 |
| SM1110 | Filter setting error in EtherNet setting for 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. |
| SM1110 | The flag is ON, when filter setting error in EtherNet setting for AS-FEN02. |

- **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 |
| SR1535 | The error code for data exchange through the AS-FEN02 connection 8 | ○ | – | 0 | – | – | N | R | 0 |
| SR1536 | AS-FEN02 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 EtherNet/IP Adapter connection number | ○ | – | 0 | – | – | N | R | 0 |
| SR1540 | AS-FEN02 EtherNet/IP Scanner connection number | ○ | – | 0 | – | – | N | R | 0 |

| Special data register | Refresh time |
|---|---|
| SR1520~SR1535 | Refresh after AS-FEN02 communication is done. |
| SR1536~SR1540 | The flag is ON, when the system is refreshed automatically. |

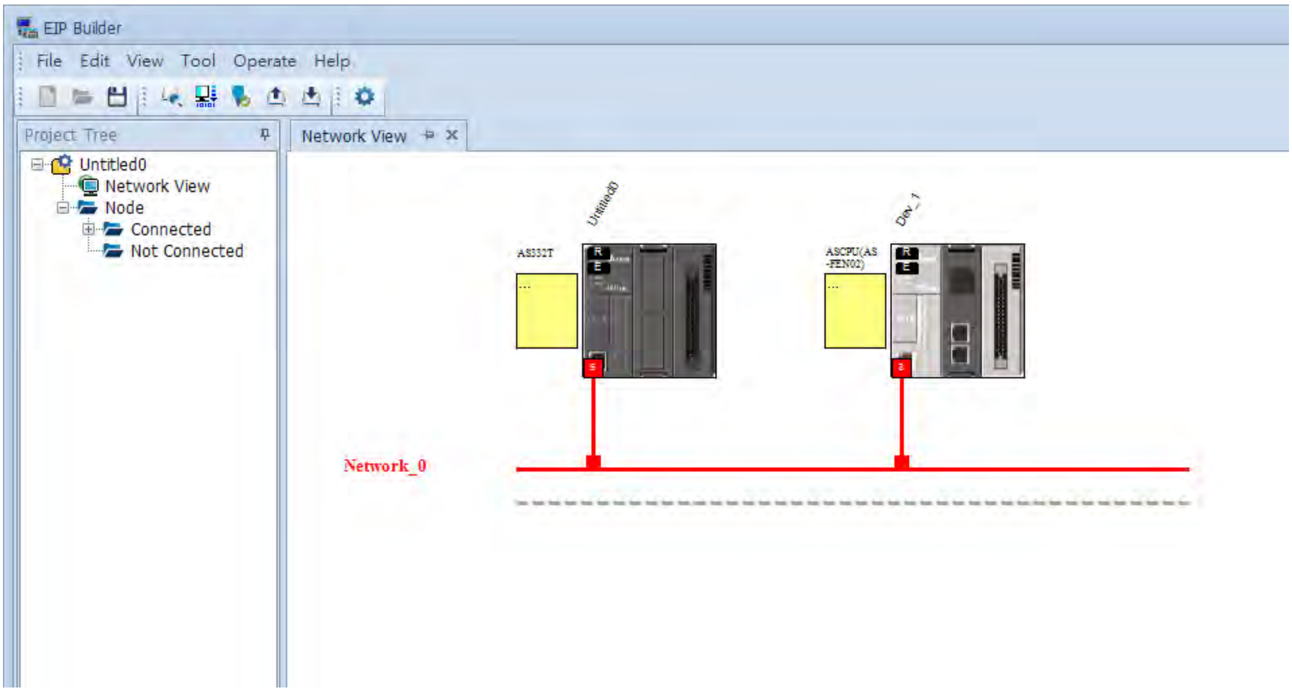
### 9.2.7.6 Data Mapping through EtherNet/IP Adapter

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**

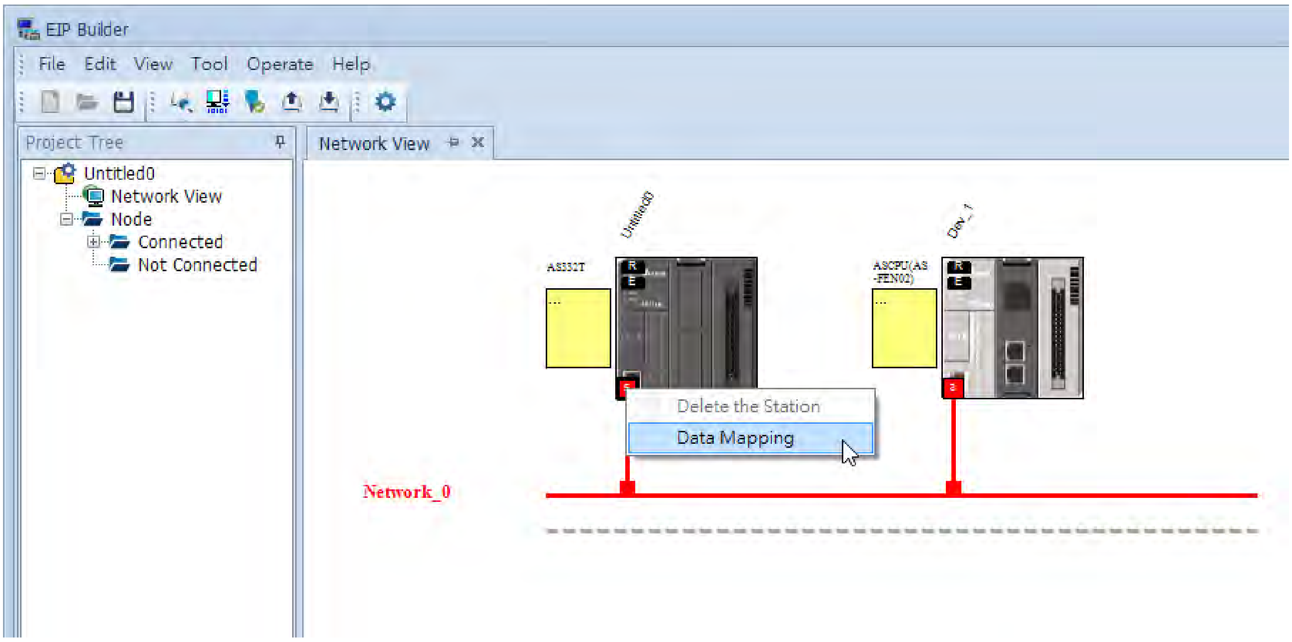
Double click AS Series PLC in HWCONFIG and the **Device Setting** window appears. Set up the IP Address of the AS-FEN02 to 192.168.1.3 and then connect the scanner EtherNet/IP port to the AS-FEN02 through a network cable. Right-click the AS300 Series PLC to open EIP Builder and then scan the network or drag and drop the ASCPU (AS-FEN02) to add it to the same network as the scanner's.




9

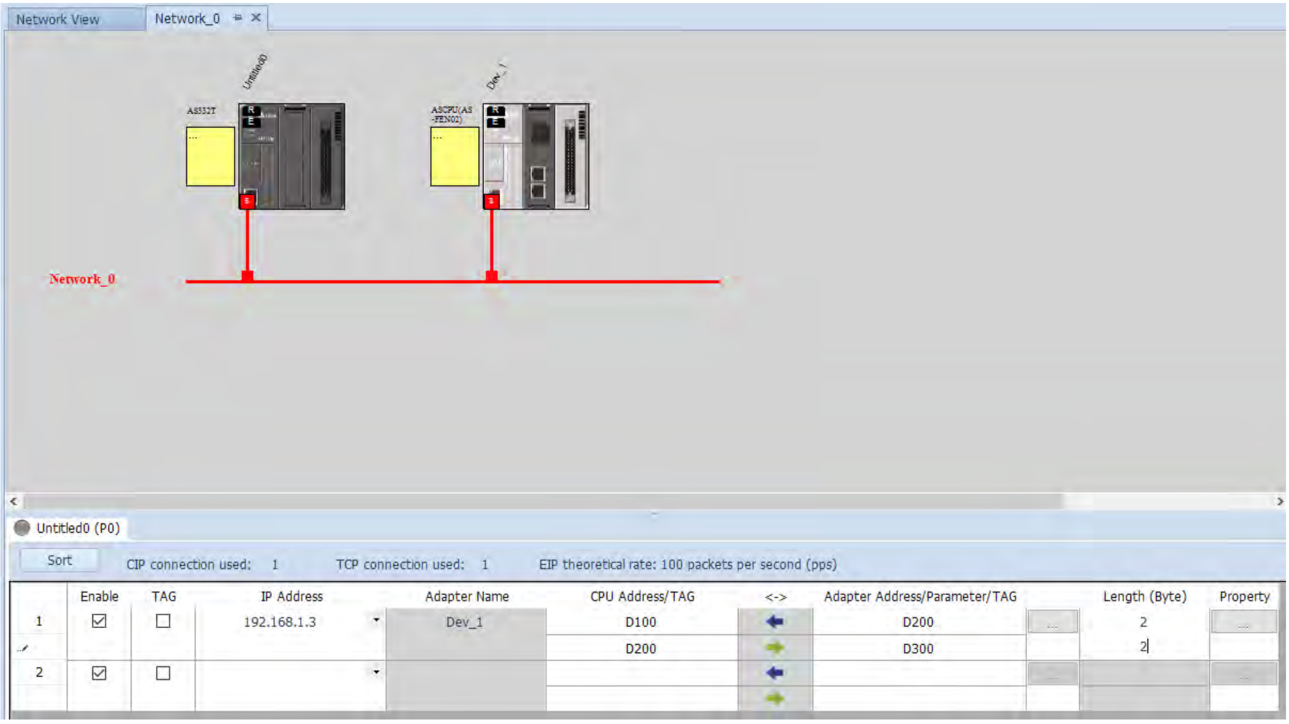
**Step 2**

Right click the Scanner's communication port (red spot) and select Data Mapping from the menu. Data mapping table appears for editing.



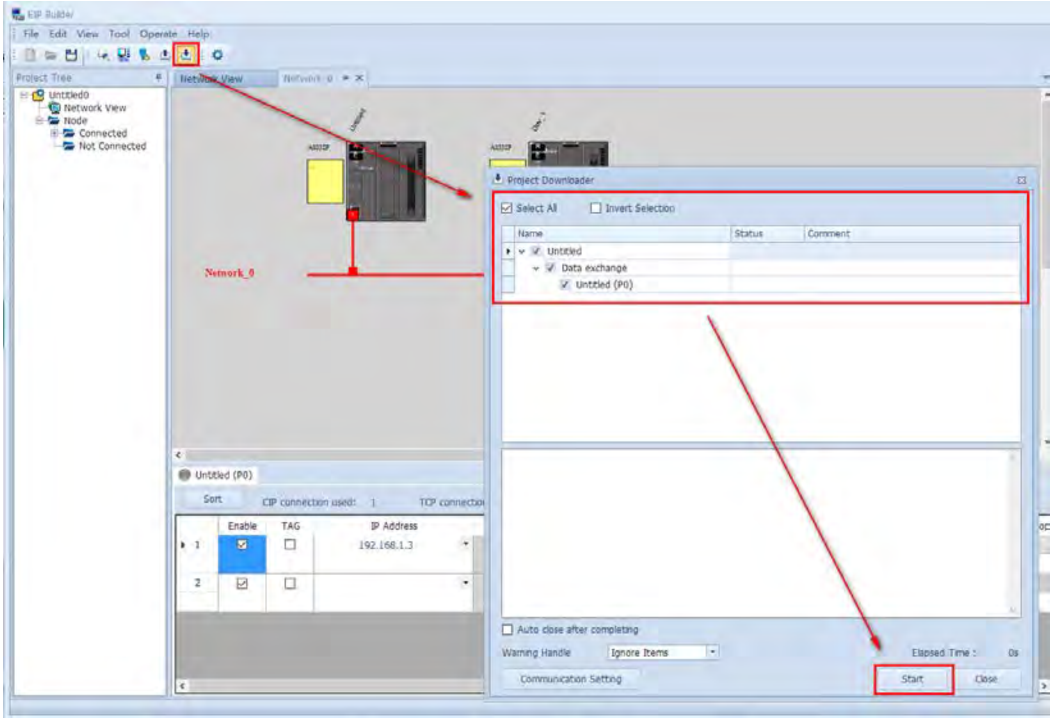

**Step 3**

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**

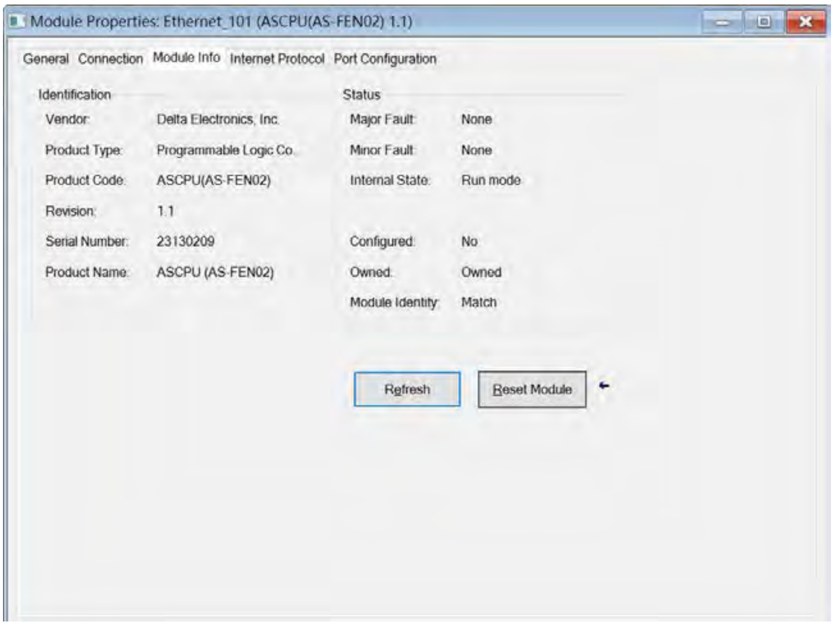
Click the **Downloader** icon and then select the parameters that you'd like to download. After the scanner starts to run, check if the data stored in the adapter D300 and D200 increment by 1 every second to determine if the data mapping is going well.



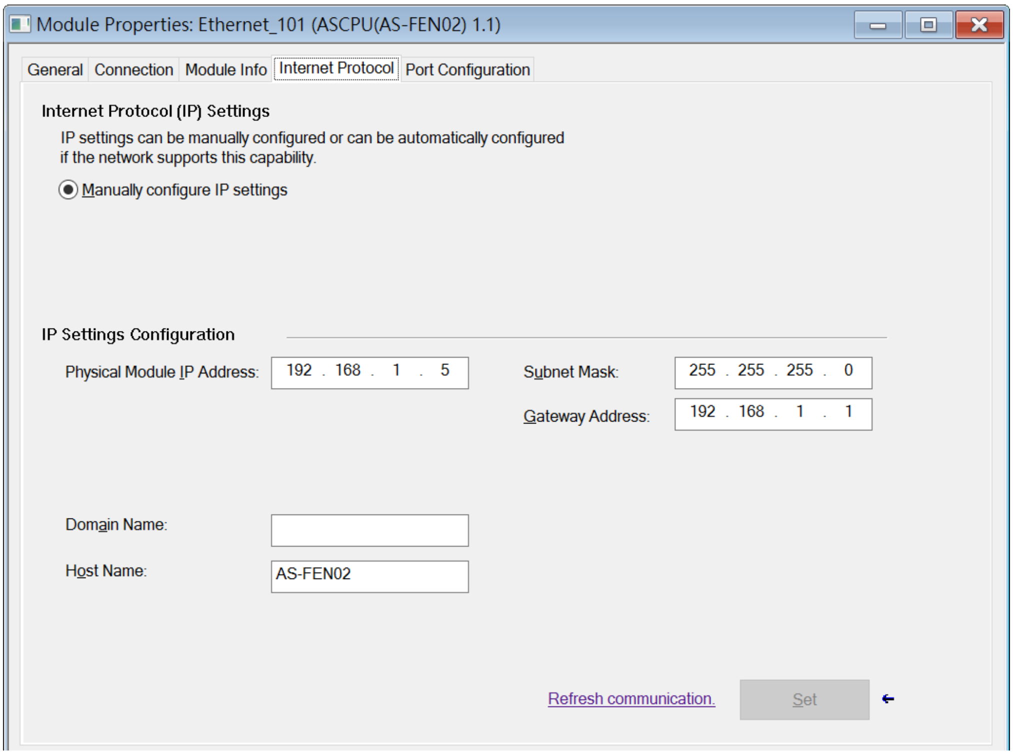

## 9.2.7.7 Example of Connecting to 3rd Party PLC Scanner through EIP Builder

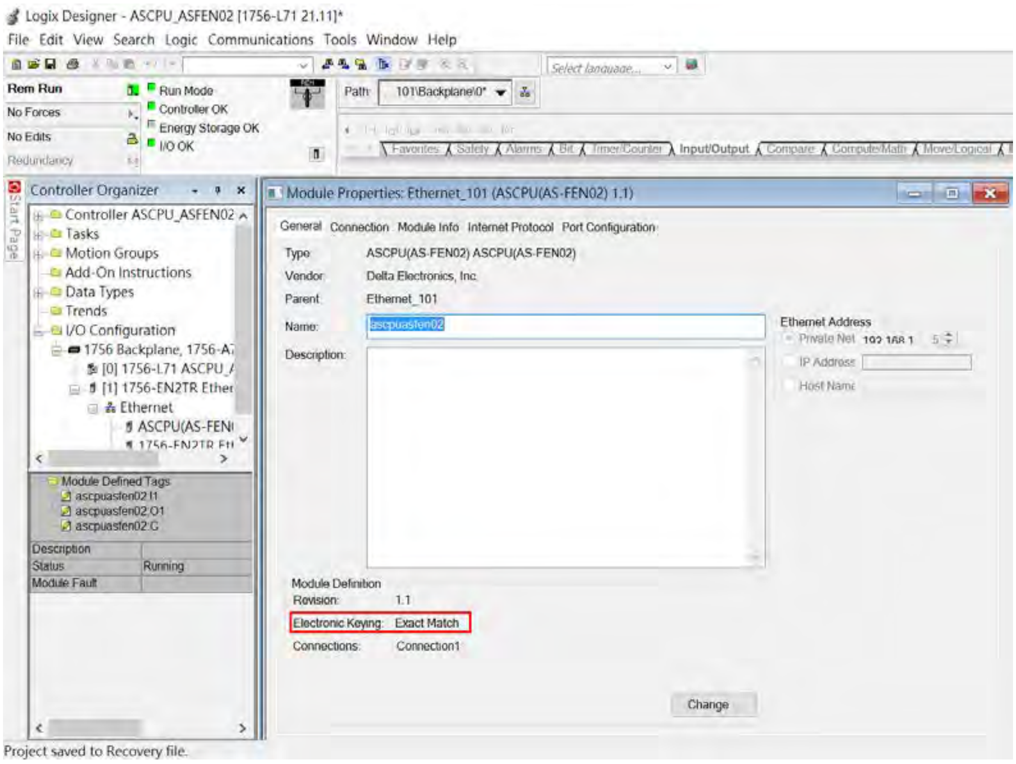
Through EIP Builder, a 3rd party PLC (when acting as a scanner) can create an EtherNet/IP connection to AS300 Series PLC (when AS-FEN02 is installed). The following example uses Rockwell PLC as a scanner to perform data mapping with a Delta PLC.

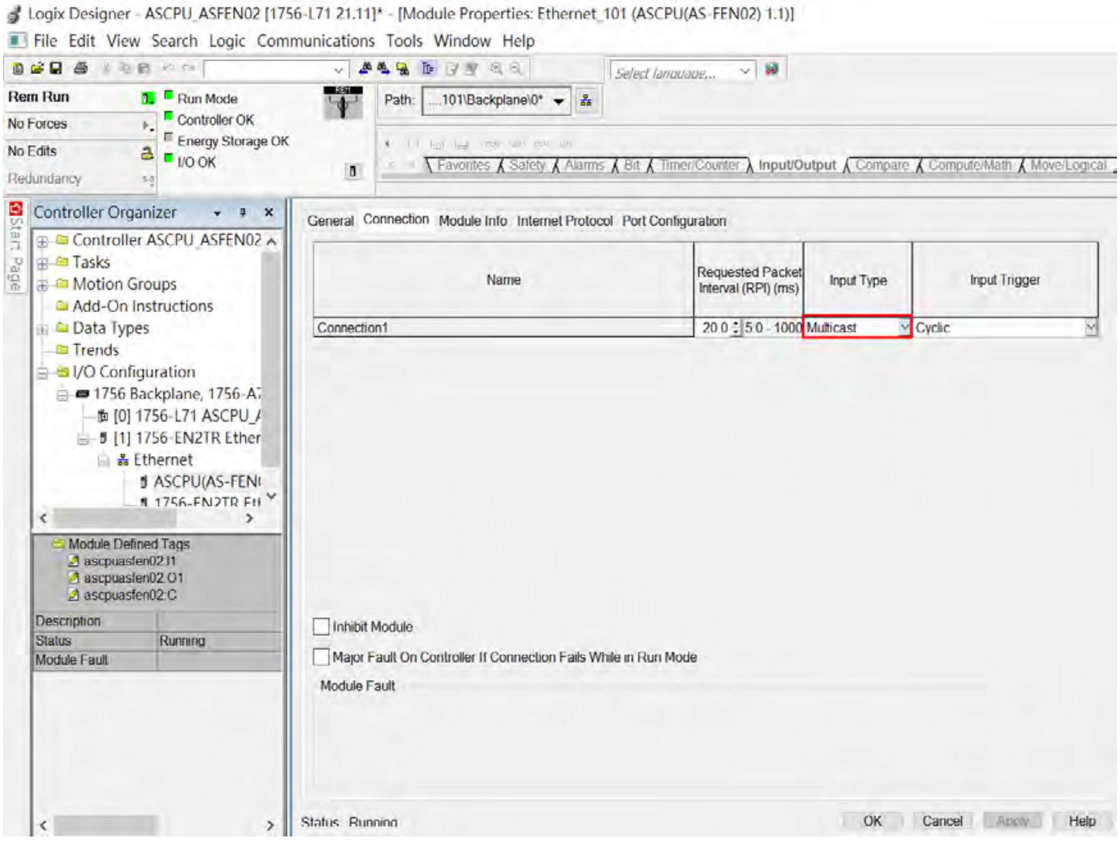
(1) Install the EDS file. After the installation is done, you can see the device information.



(2) Set up the network parameters. Make sure to set the Input Type to Multicast. For basic operation, you can use the default EDS file directly. No need to edit the EDS file.






(3) Setting up the data mapping table

I: Input data (T→O), Ex. Connection 1 is corresponding to PLC D3000~D3099.

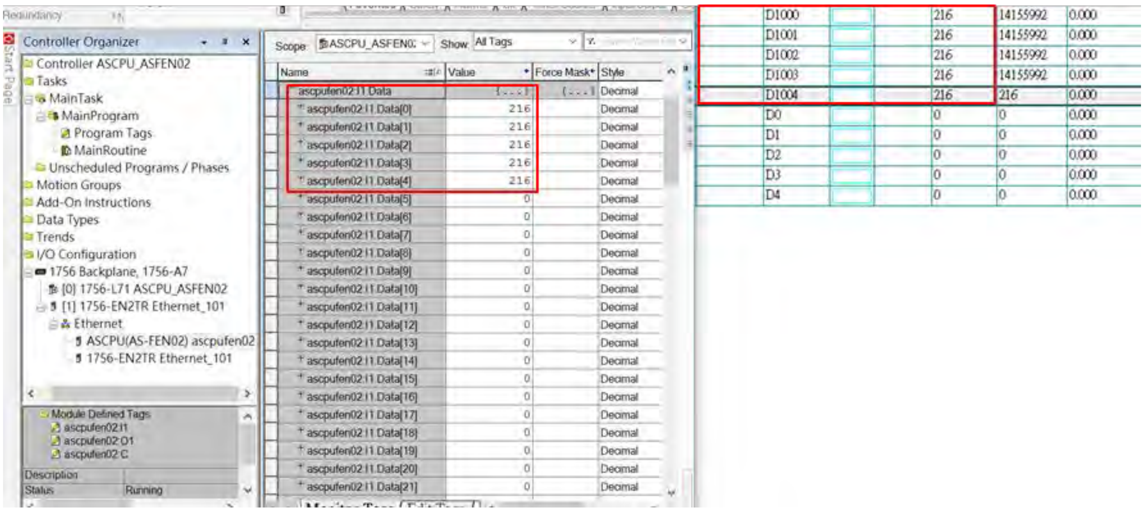
O: Output data (O→T), Ex. Connection 1 is corresponding to PLC D2000~D2099.

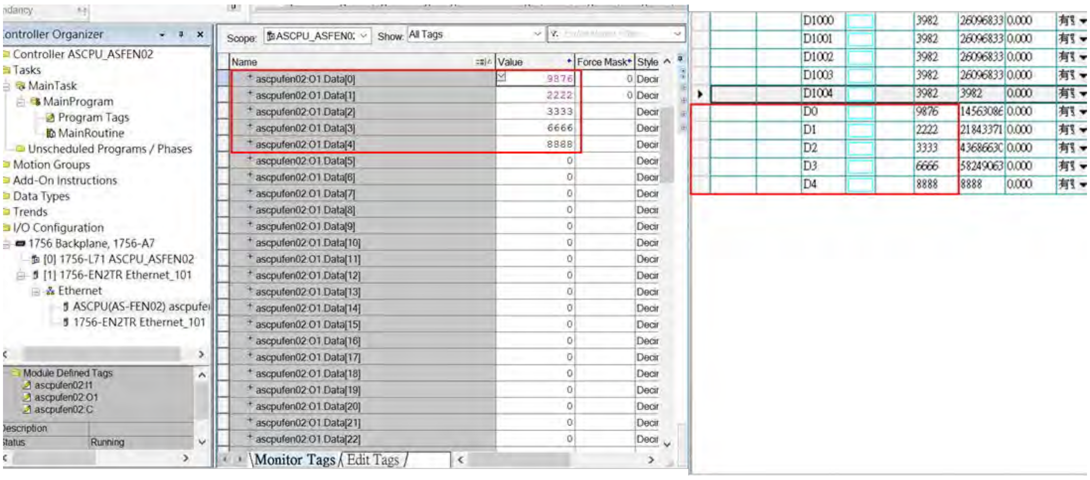
C: here corresponds to the configurations. You can edit the corresponding PLC addresses of input and output. After editing, you need to download the parameters to Rockwell PLC.

| | 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 |

| | I/O Message Connection | | | |
|---|---|---|---|---|
| **Connection No.** | **Function** | **Instance Attribute** | **Length** | **Defaults** |
| | Output (O→T) | 0x6C | 100 words | D2400~D2499 |
| | Configuration | 0x84 | 8 words | Refer to the table below |
| 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<br>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<br>0: D, 2: Y | 0 |
| Word[5] | UINT | Reserved | 200 |
| Word[6-7] | DWORD | Output corresponding device number | 2000 |





### 9.2.7.8 Data Mapping through Modbus TCP

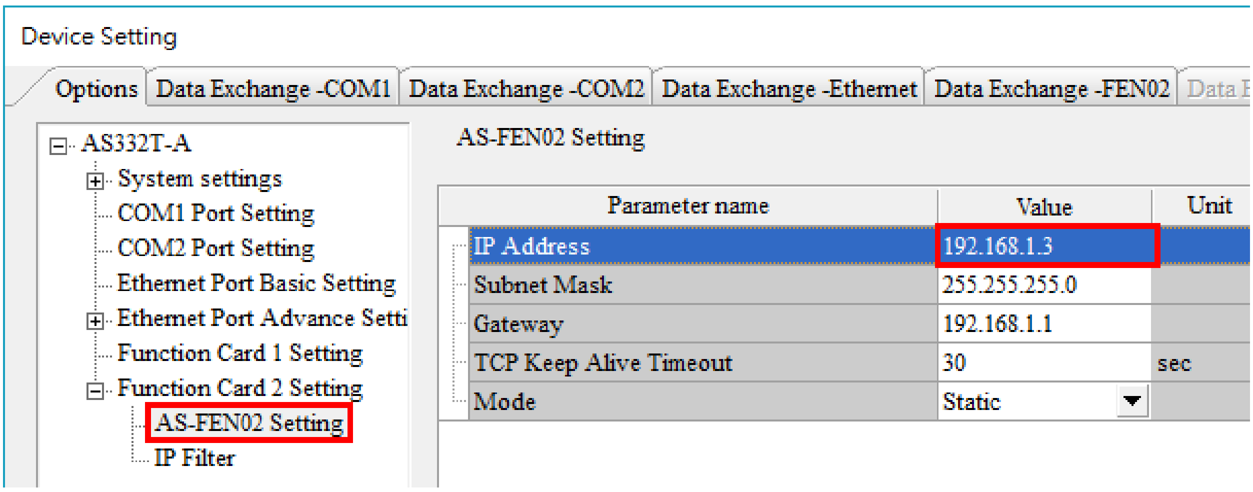
When AS-FEN02 is installed on AS Series PLC, you can create a connection by configuring the IP address and some relevant parameters to make it act as a Modbus TCP Slave device.

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 |

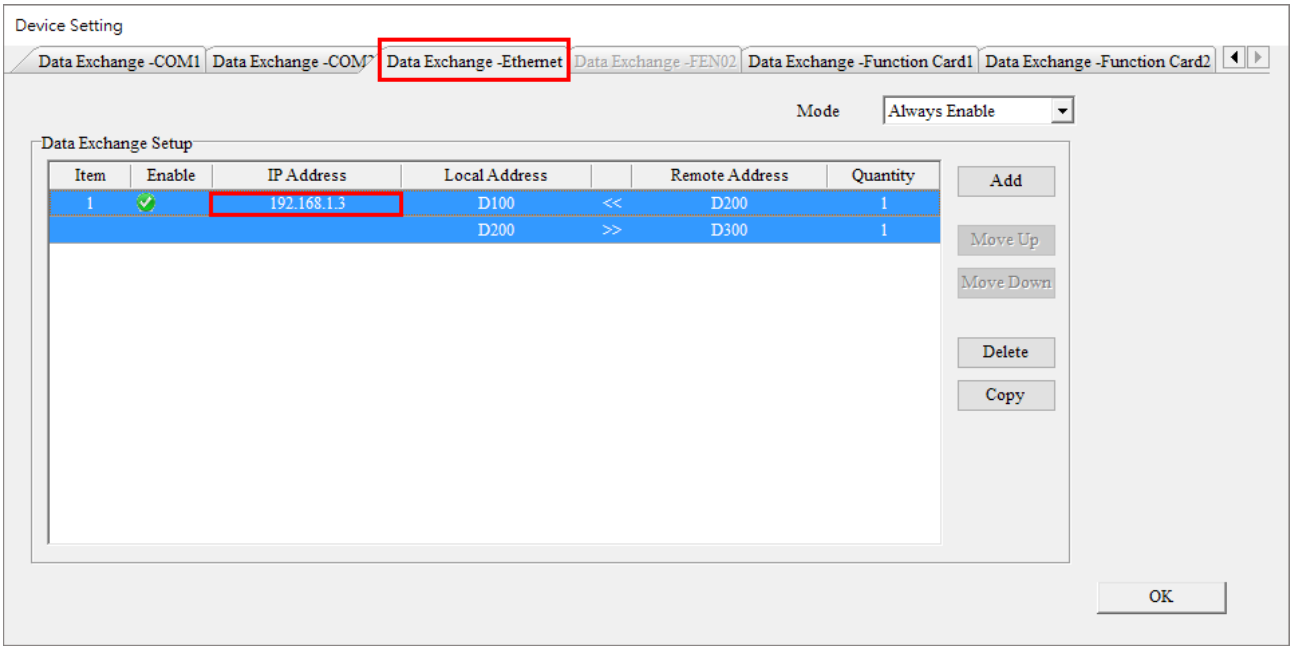
**Step 1**

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.



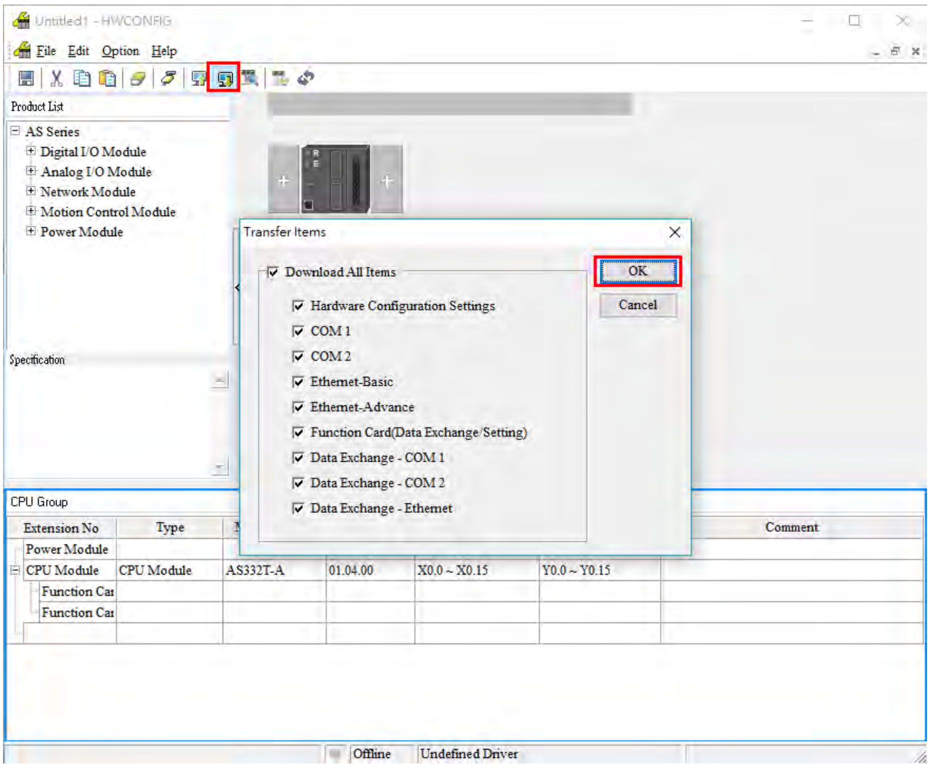
**Step 2**

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.



### 9.2.7.9 Webpage

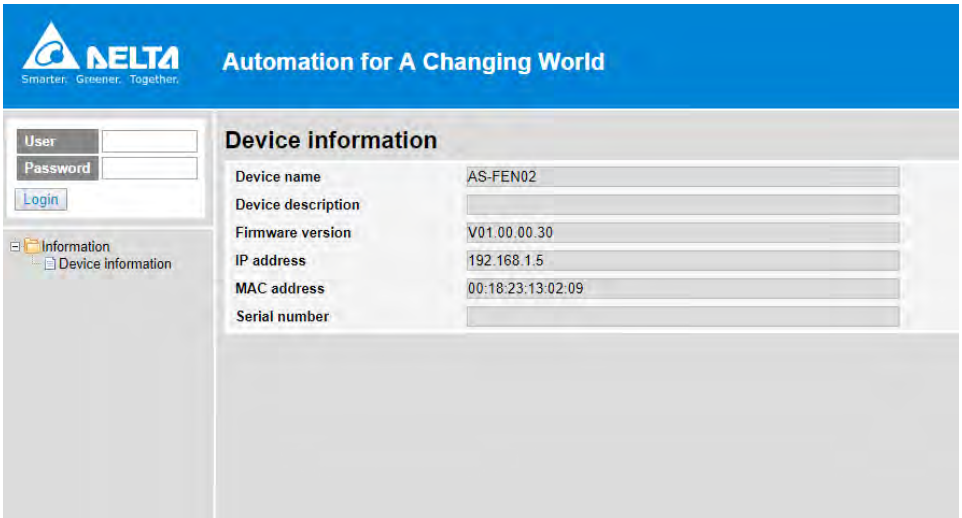
When AS-FEN02 is installed on AS300 Series PLC or AS00SCM-A (RTU mode), you can enter AS-FEN02 IP address in the search bar of your browser to connect to your device. After that you can set up, update firmware and monitor AS-FEN02. The webpage displays differently, when AS-FEN02 is installed on AS300 Series PLC or AS00SCM-A (RTU mode). They will be explained in different sections.

List of browsers that support AS-FEN02 webpage:

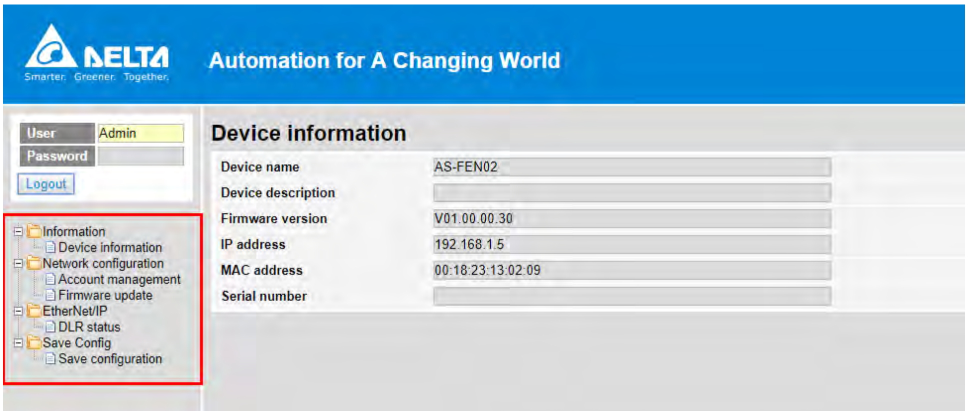
| Provider | Browser | Supported versions |
|---|---|---|
| **Microsoft** | Internet Explorer | V10.0 and later |
| **Microsoft** | Edge | V20 and later |
| **Google** | Chrome | V14 and later |
| **Mozilla** | Firefox | V17 and later |
| **Apple** | Safari | V5.1 and later |

- **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.



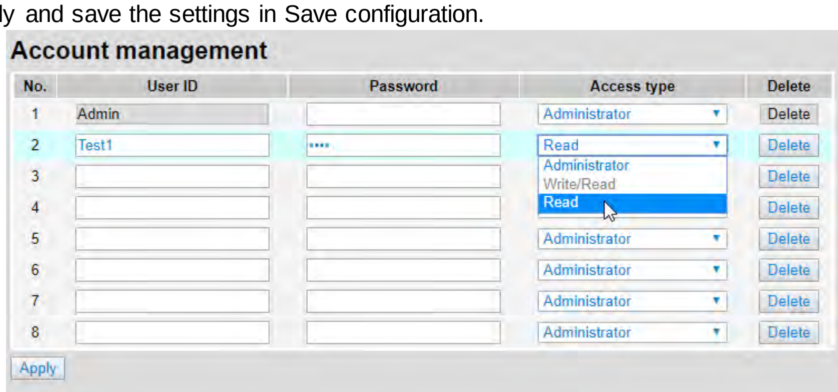
b. After login, you can setting items on the left section.



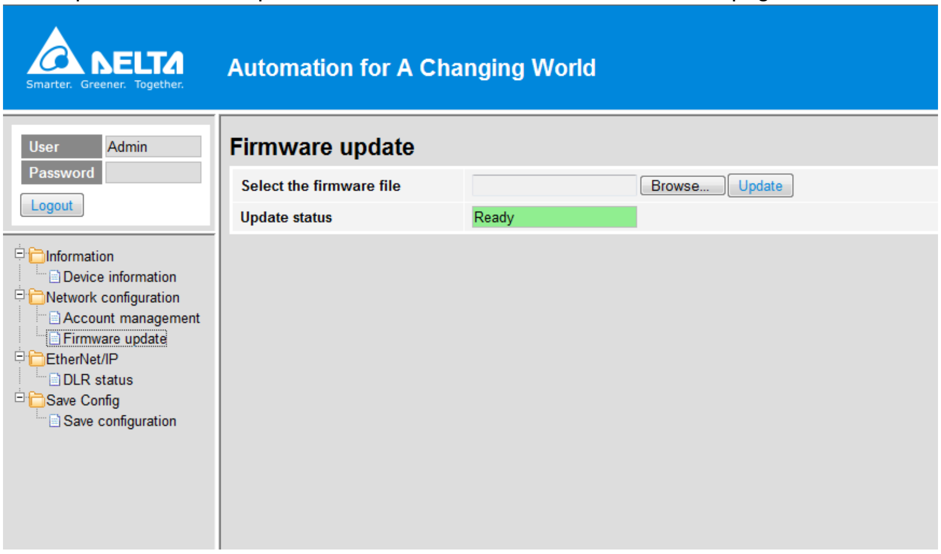

c. The menu shows data based on the permission of the current user.

| Nodes | Permission | |
|---|---|---|
| | Administrator | Read |
| Device information | V | V |
| Account management | V | X |
| Firmware update | V | X |
| DLR status | V | V |
| Save configuration | V | X |

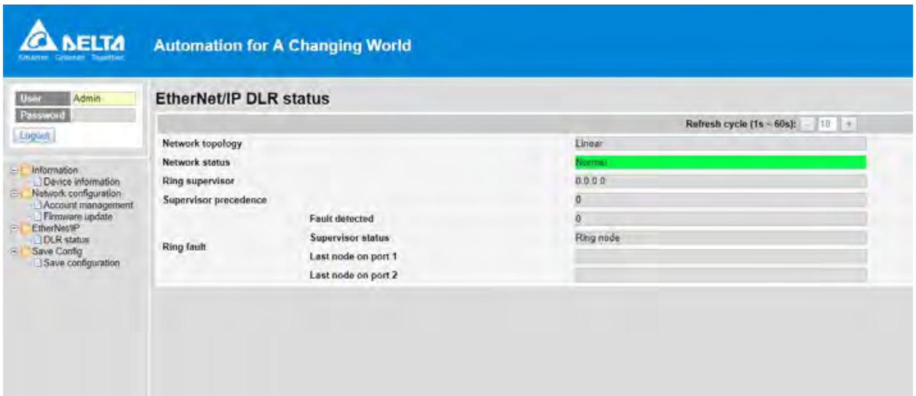
d. Account Management: You can set 2 kinds of access types, Administrator and Read. After the setting is done, click Apply and save the settings in Save configuration.



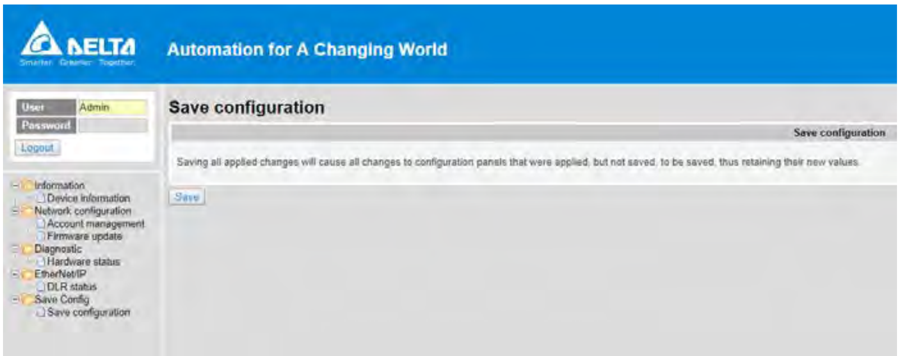
e. Firmware Update: You can update the firmware of AS-FEN02 via the webpage.




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.




9

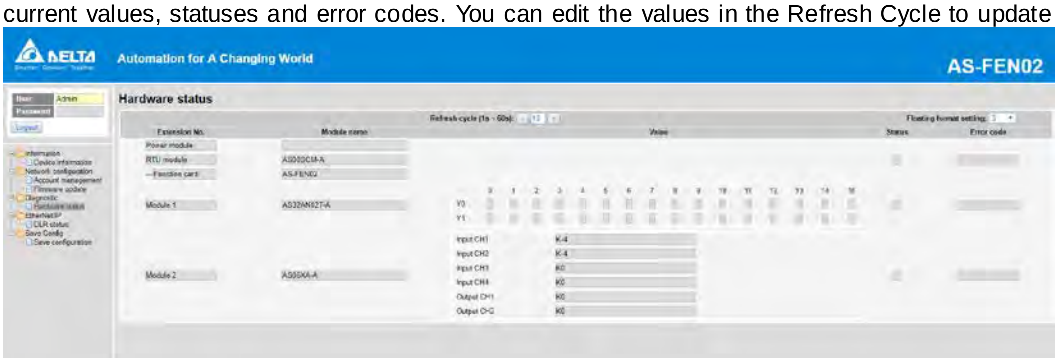
- **When AS-FEN02 is installed on AS00SCM-A**

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.

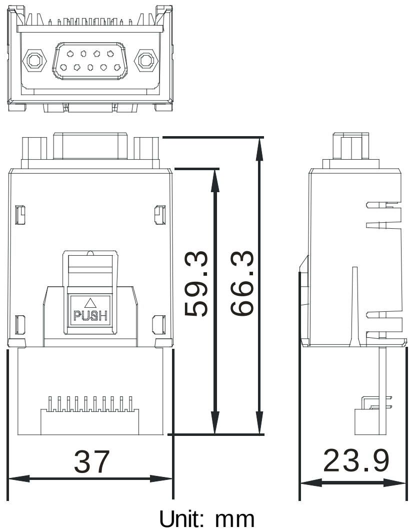
| Nodes | Permission | |
|---|---|---|
| | **Administrator** | **Read** |
| Device information | V | V |
| Account management | V | X |
| Firmware update | V | X |
| Hardware status | V | V |
| DLR status | V | V |
| Save configuration | V | X |

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.

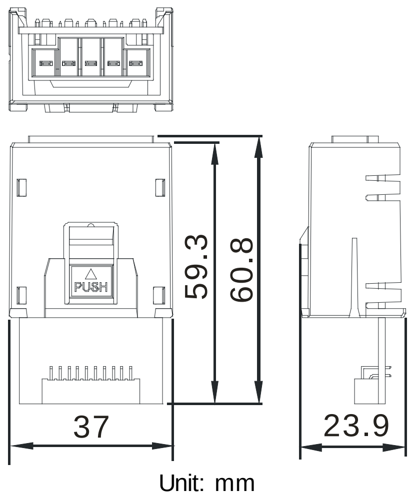


## 9.3 Profiles and Dimensions

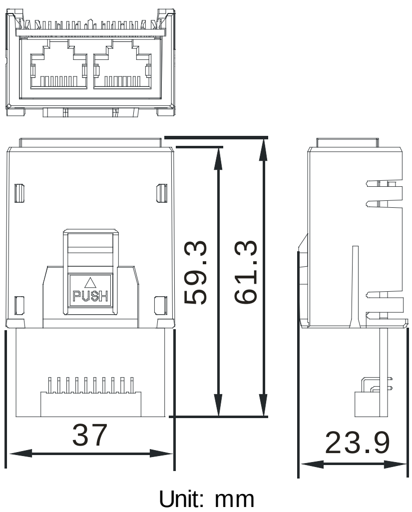
### 9.3.1 AS-F232



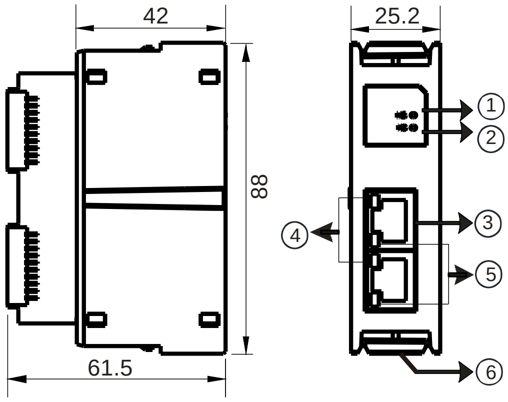

### 9.3.2 AS-F422 / AS-F485 / AS-F2AD / AS-F2DA




### 9.3.3 AS-FCOPM



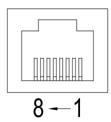
## 9.3.4 AS-FEN02




| Number | Name | Description |
|---|---|---|
| 1 | MS indicator | Indicates if the module has been set<br>ON: the setting is complete<br>Blinking: the setting is not complete<br>OFF: no power |
| 2 | NS indicator | Indicates the status of Ethernet connection<br>Green lignt ON: a CIP connection is established<br>Green lignt BLINKING: a CIP connection is not established<br>Red light ON: duplicated IP address<br>Red light BLINKING: communication timeout / DLR conection lost / IP address change<br>OFF: no power / network cable is not connected |
| 3 | RJ-45 port X1/X2 | Use for network connections |
| 4 | LINK indicator X1/X2 | Indicate the status of Ethernet connection<br>Green light ON: a network connection is established<br>OFF: a network connection is not established |
| 5 | ACT indicator X1/X2 | Indicate the status of Ethernet communication<br>Orange BLINKING: data transmission<br>OFF: no data transmission |
| 6 | Clip ring | Secures AS series |

**RJ-45 Pin Definition**

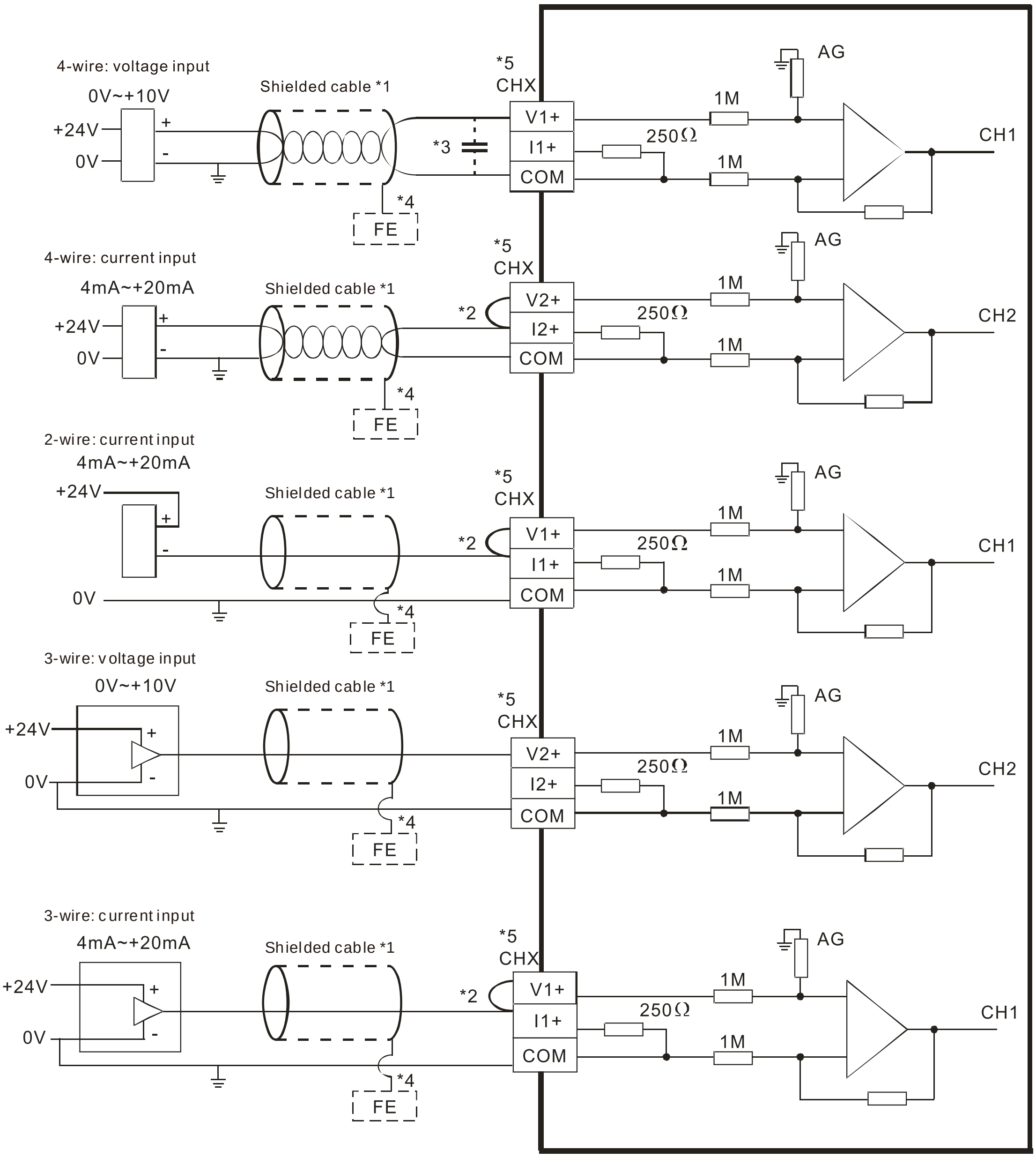
| Pin No. | RJ-45 |
|---|---|
| 1 | TX+ |
| 2 | TX- |
| 3 | RX+ |
| 4 | N/C |
| 5 | N/C |
| 6 | RX- |
| 7 | N/C |
| 8 | N/C |




9

# 9.4 Wiring

## 9.4.1 AS-F2AD




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

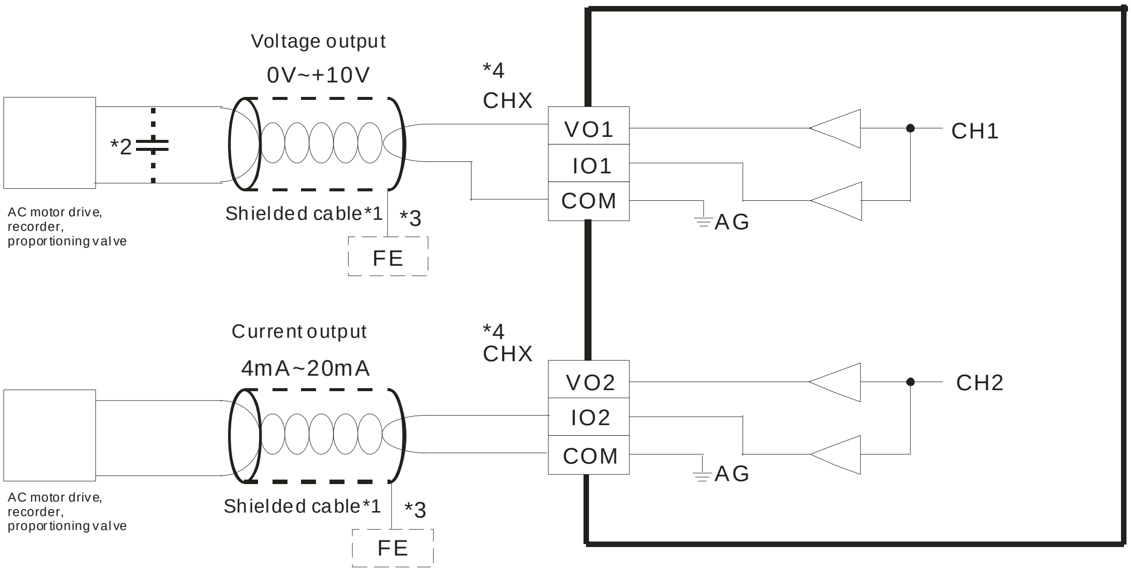
*2. If the module is connected to a current signal, the terminals Vn and In+ (n=1–2) must be short-circuited.

*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.

### 9.4.2 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.

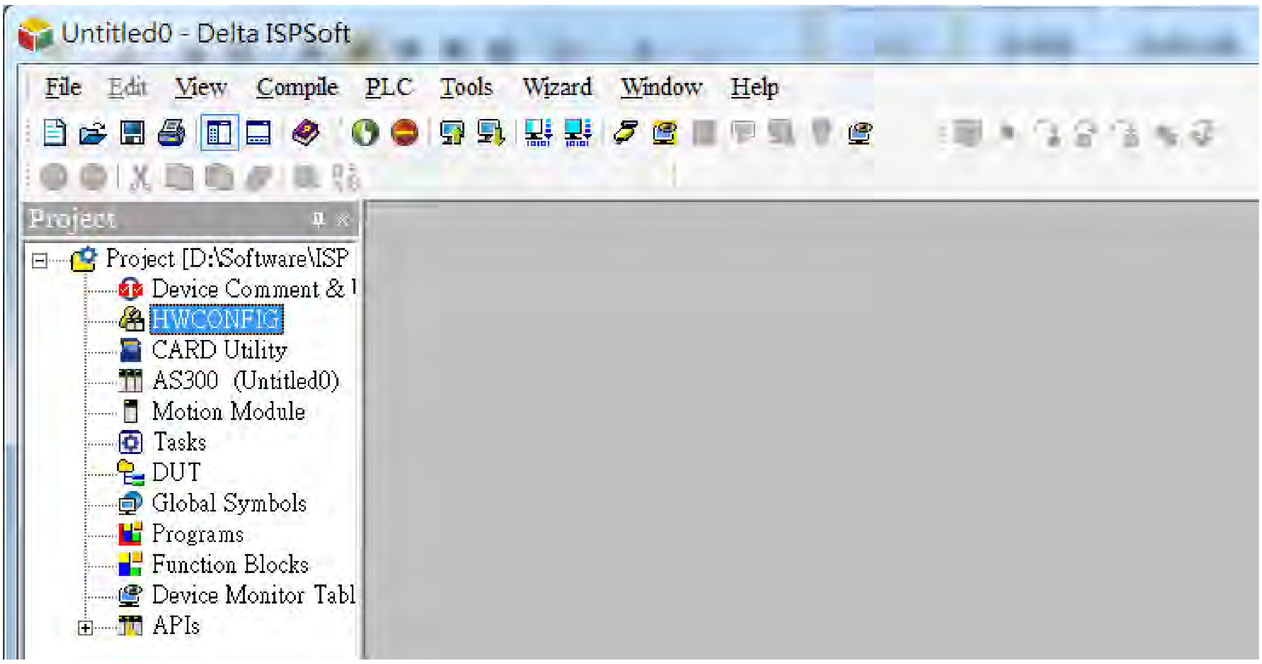
*3. Connect the shielded cable to the terminal FE.

*4. The wording “CHX” indicates that you can use the two wiring methods listed above for every input channel.

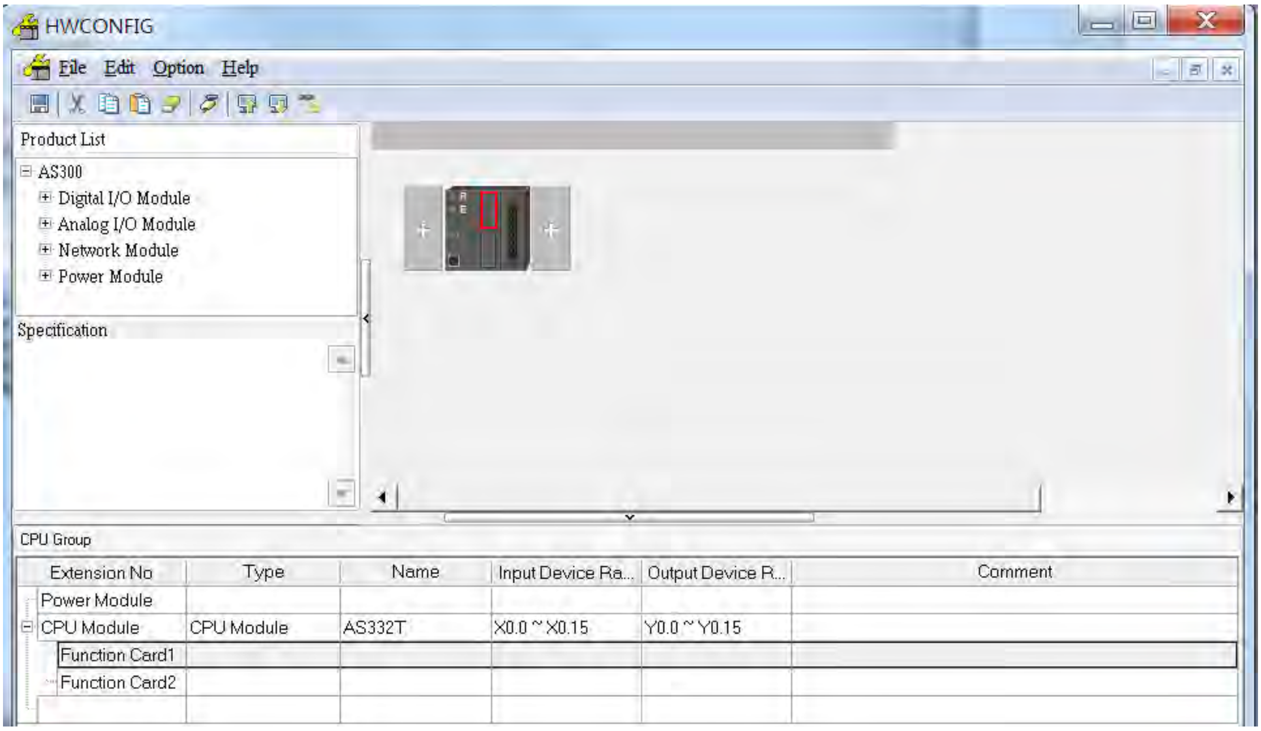
## 9.5 HWCONFIG in ISPSoft

### 9.5.1 Initial Setting

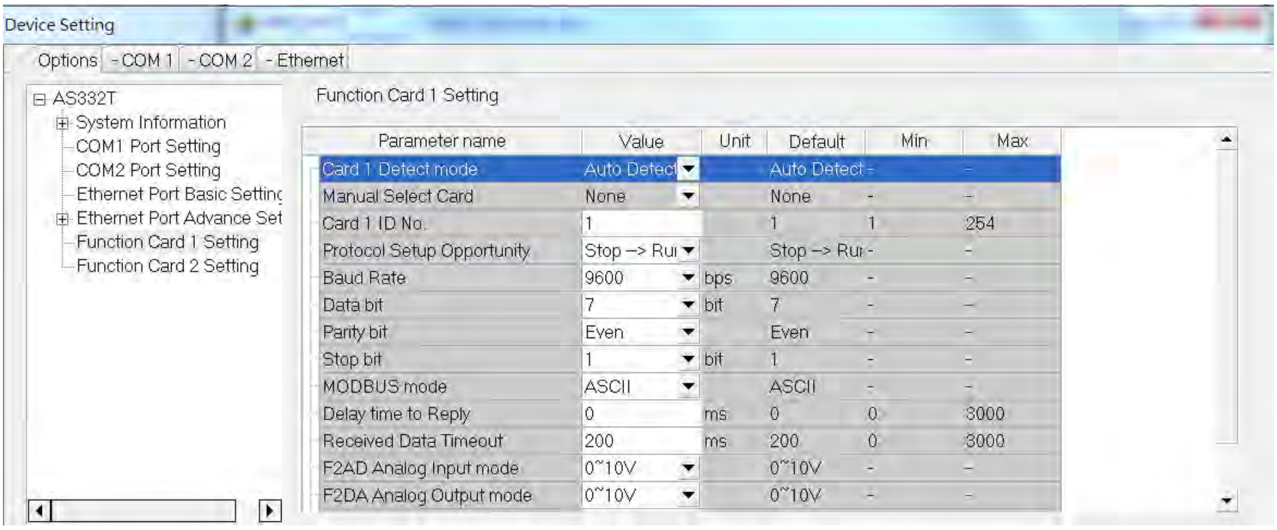
(1) Start ISPSoft and double-click **HWCONFIG**.



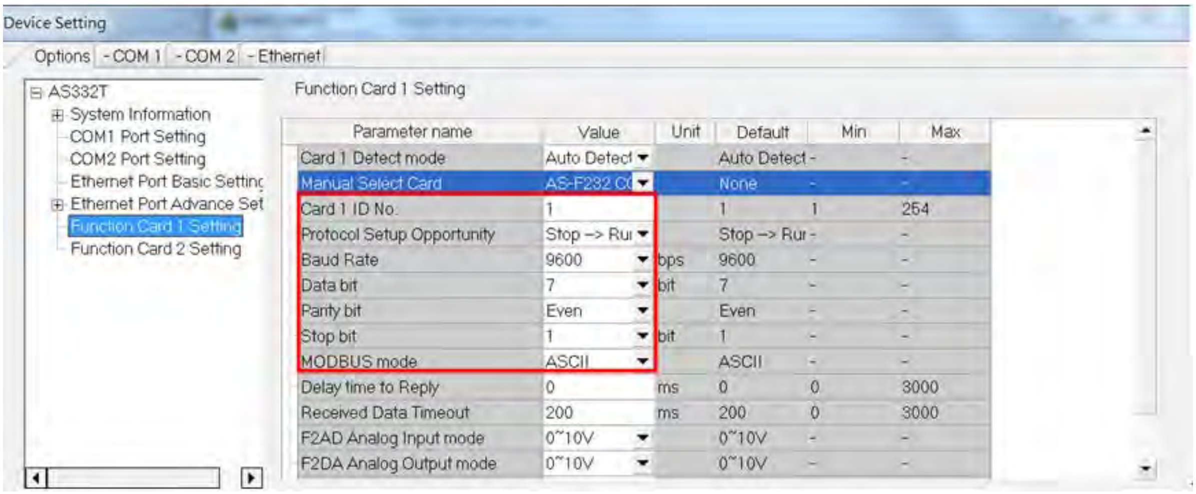
(2) Select a function card on the module.



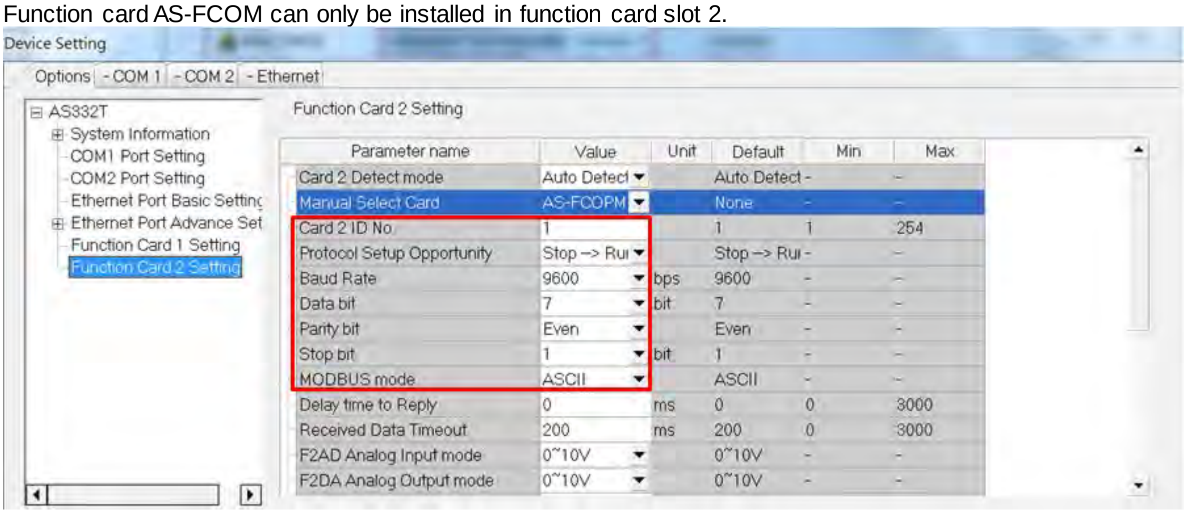

(3) Double-click the function card to open the Device Setting page.
**Card1 Detect mode:** select Auto Detect or choose the function card model.



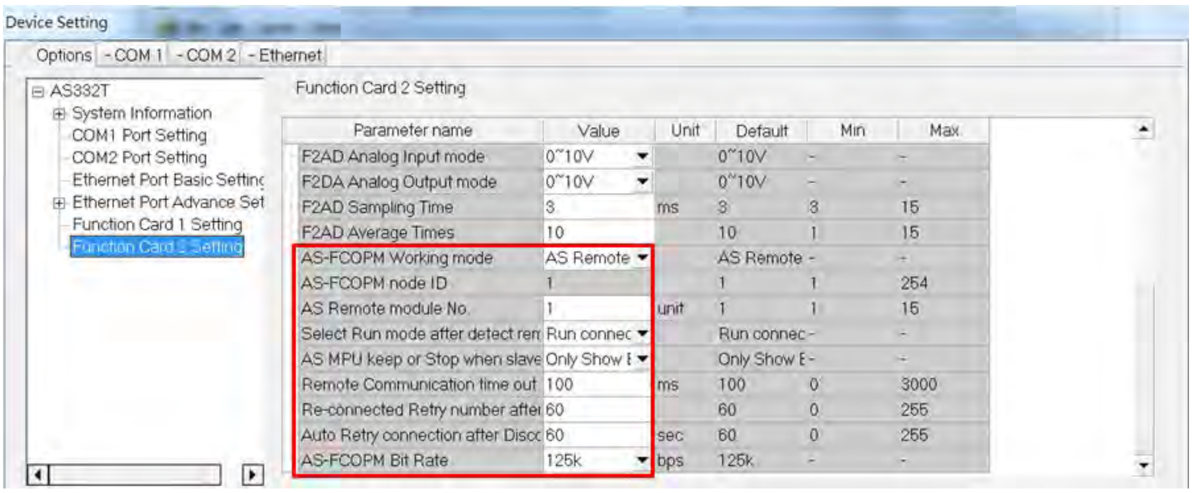
(a) When the function card is an AS-F232, AS-F422, or AS-F485, configure the communication settings in the red box.




(b) Function card AS-FCOM can only be installed in function card slot 2.

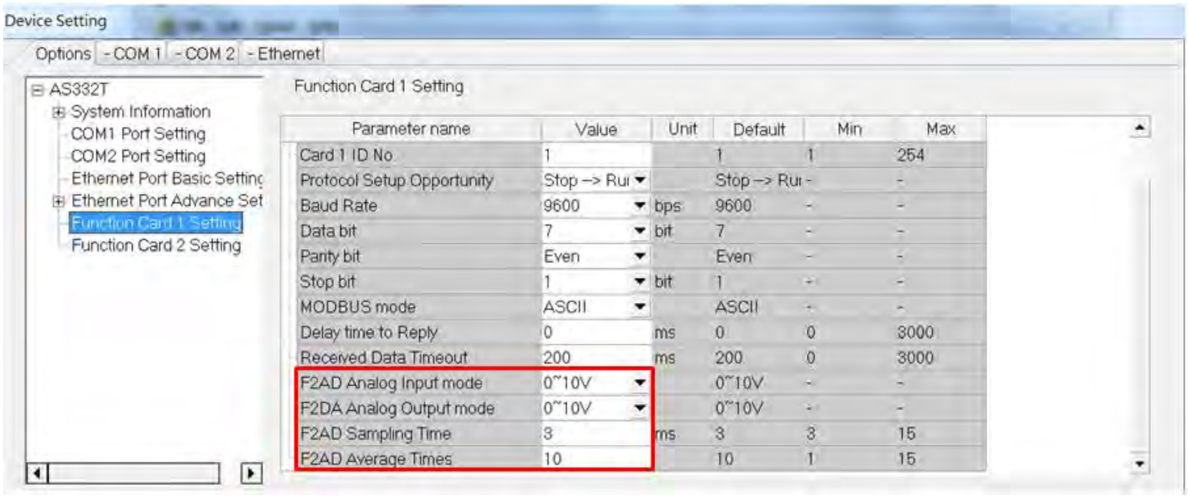



(c) Configure the communication settings in the red box.

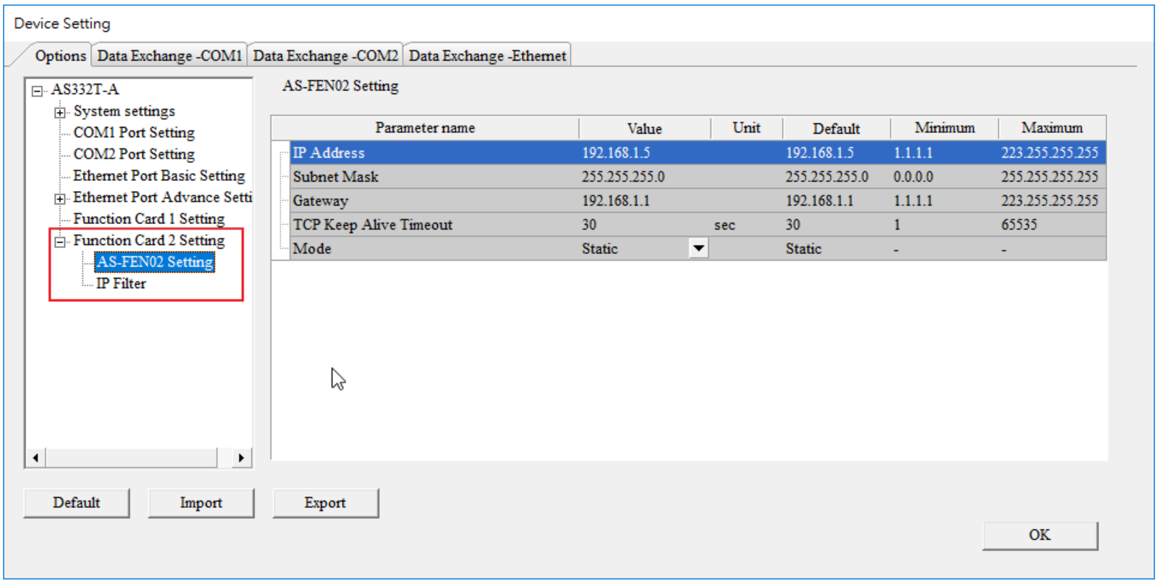



9

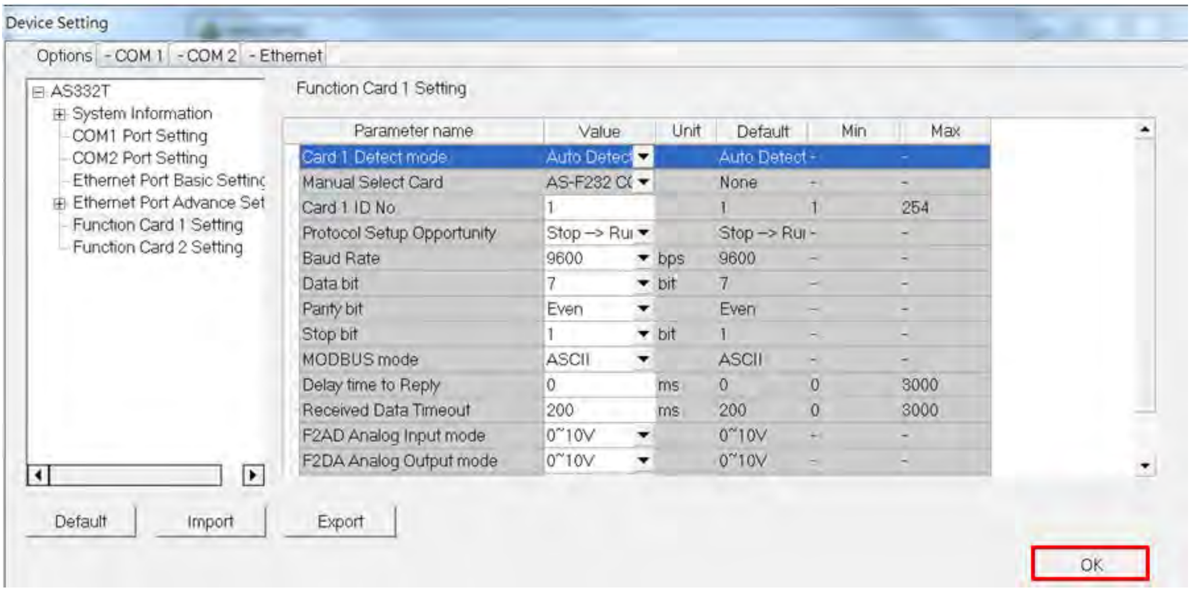
(d) When the function card is an AS-F2AD or AS-F2DA, configure the communication settings in the red box.



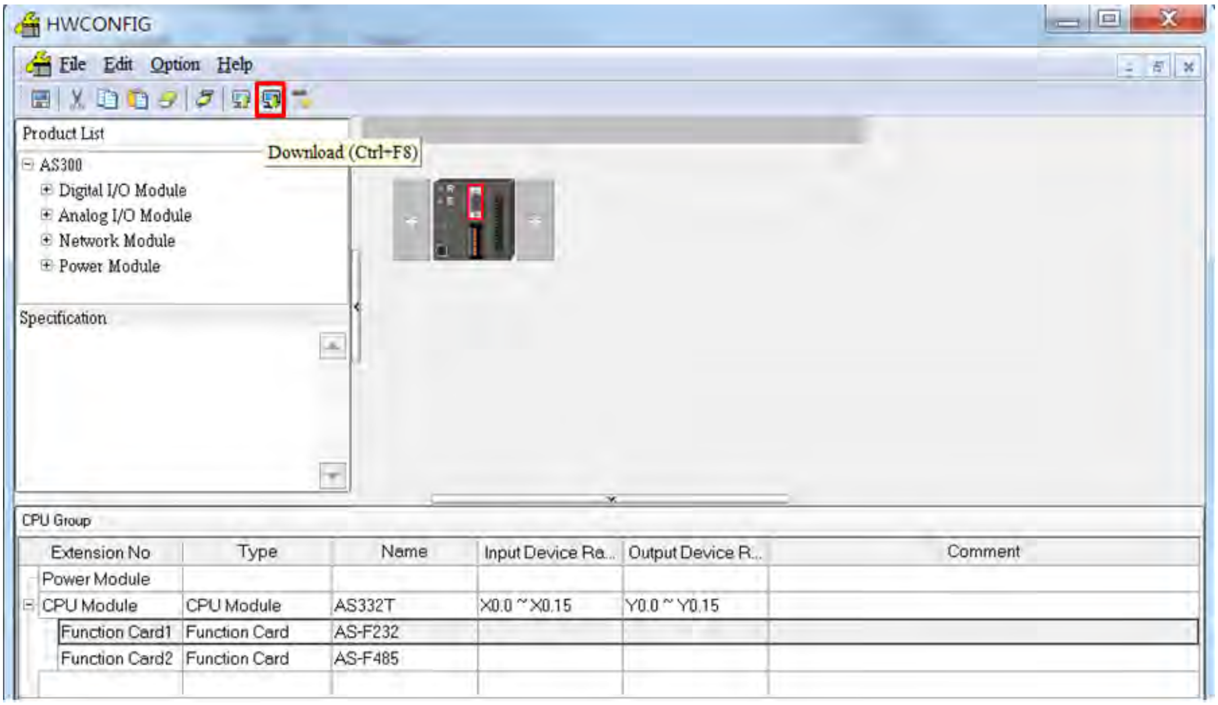

(e) When the function card is an AS-FEN02, configure the communication settings in the red box.



(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.



10

# Chapter 10 DeviceNet Master Scanner Module AS01DNET-A

## Table of contents

10

# 10.1 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 10.4 and 10.5 for details about master/slave mode and RTU mode.

## 10.1.1 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.

## 10.1.2 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<br>Extension: 10 kbps, 20 kbps, 50 kbps, 125 kbps, 250 kbps, 500 kbps, 800kbps and 1M bps. |

- **Electrical Specification**

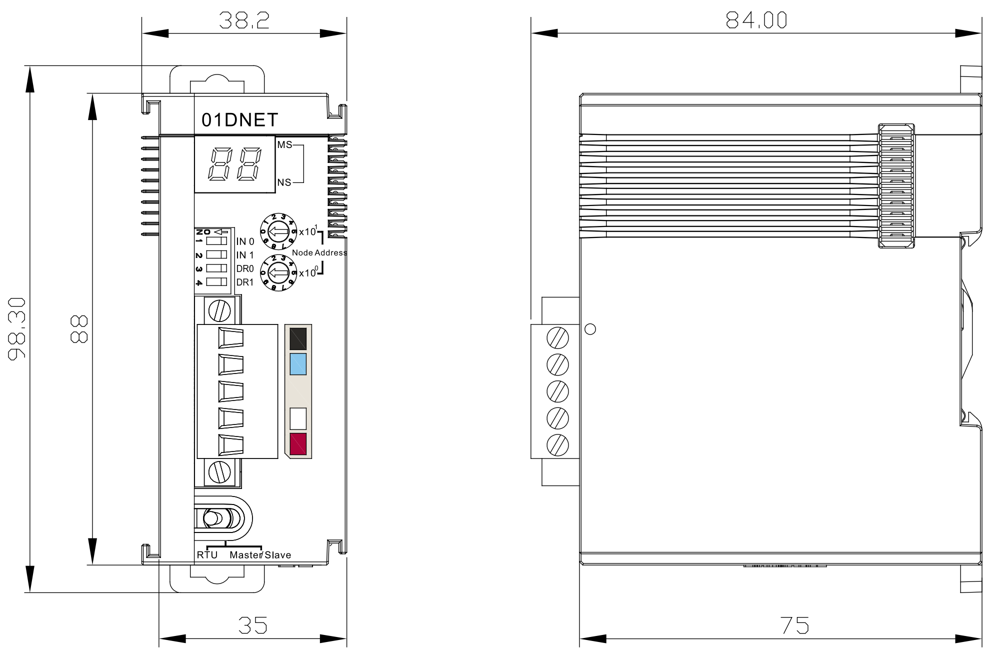
| Item | Specifications |
|---|---|
| Voltage | The power wires of the communication cable provide 11 ~ 25 VDC. |
| Current | 28mA (typical value), 125mA impulse current (24 VDC) |

- **Environment**

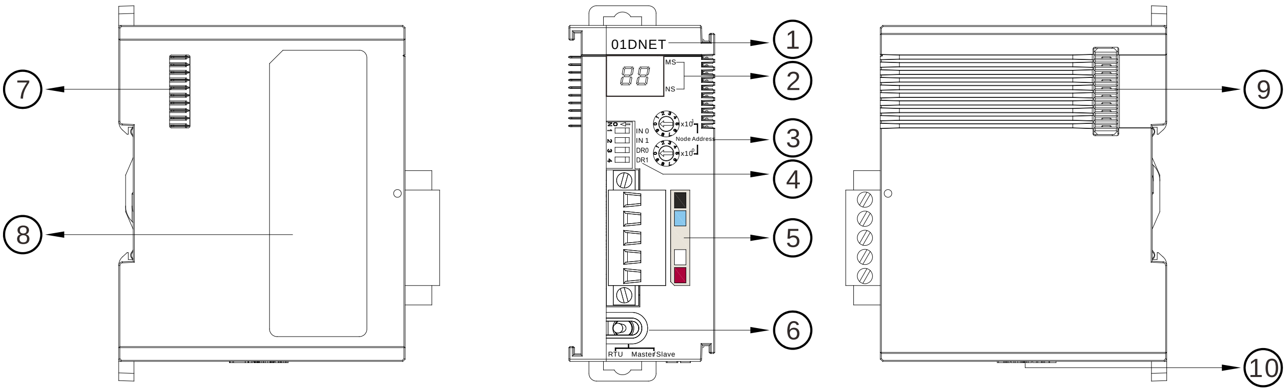
| Item | Specifications |
|---|---|
| Noise immunity | ESD (IEC 61131-2, IEC 61000-4-2): 8KV Air Discharge<br>EFT (IEC 61131-2, IEC 61000-4-4): Power Line: 2KV, Digital I/O: 1KV<br>Analog & Communication I/O: 1KV<br>Damped-Oscillatory Wave: Power Line: 1KV, Digital I/O: 1KV<br>RS (IEC 61131-2, IEC 61000-4-3): 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 |

# 10.2 Components of AS01DNET-A

## 10.2.1 Profile and Dimensions



### 10.2.2 Components



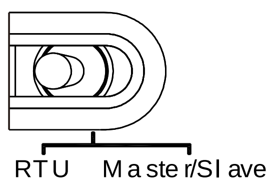

| | | | |
|---|---|---|---|
| ① | Model name | ⑥ | Mode toggle (RTU-Master/Slave) |
| ② | State indicators | ⑦ | Left-side extension port |
| ③ | Address switch | ⑧ | Nameplate |
| ④ | Function switch | ⑨ | Right-side extension port |
| ⑤ | DeviceNet communication port | ⑩ | 24V DC power input port for 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.

### 10.2.3 Mode Toggle ( RTU- Master / Slave )

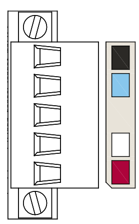
| Mode Selection | Description |
|---|---|
| Master/Slave | Works in master or slave mode and constitutes a DeviceNet master or slave without external power supply. |
| RTU | When working in remote (RTU) mode, AS01DNET-A is required to connect the external DC 24V power supply and can have AS series I/O modules connected on its right side. |




### 10.2.4 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 |

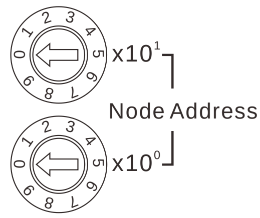


10

### 10.2.5 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 $x10^1$ to 2 and the corresponding switch of $x10^0$ to 6.

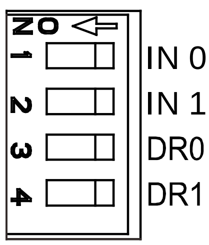
**Note:**

- ✓ 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.

### 10.2.6 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 | |

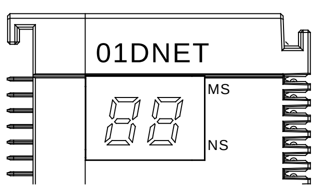



**Note:**

- ✓ 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.

### 10.2.7 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



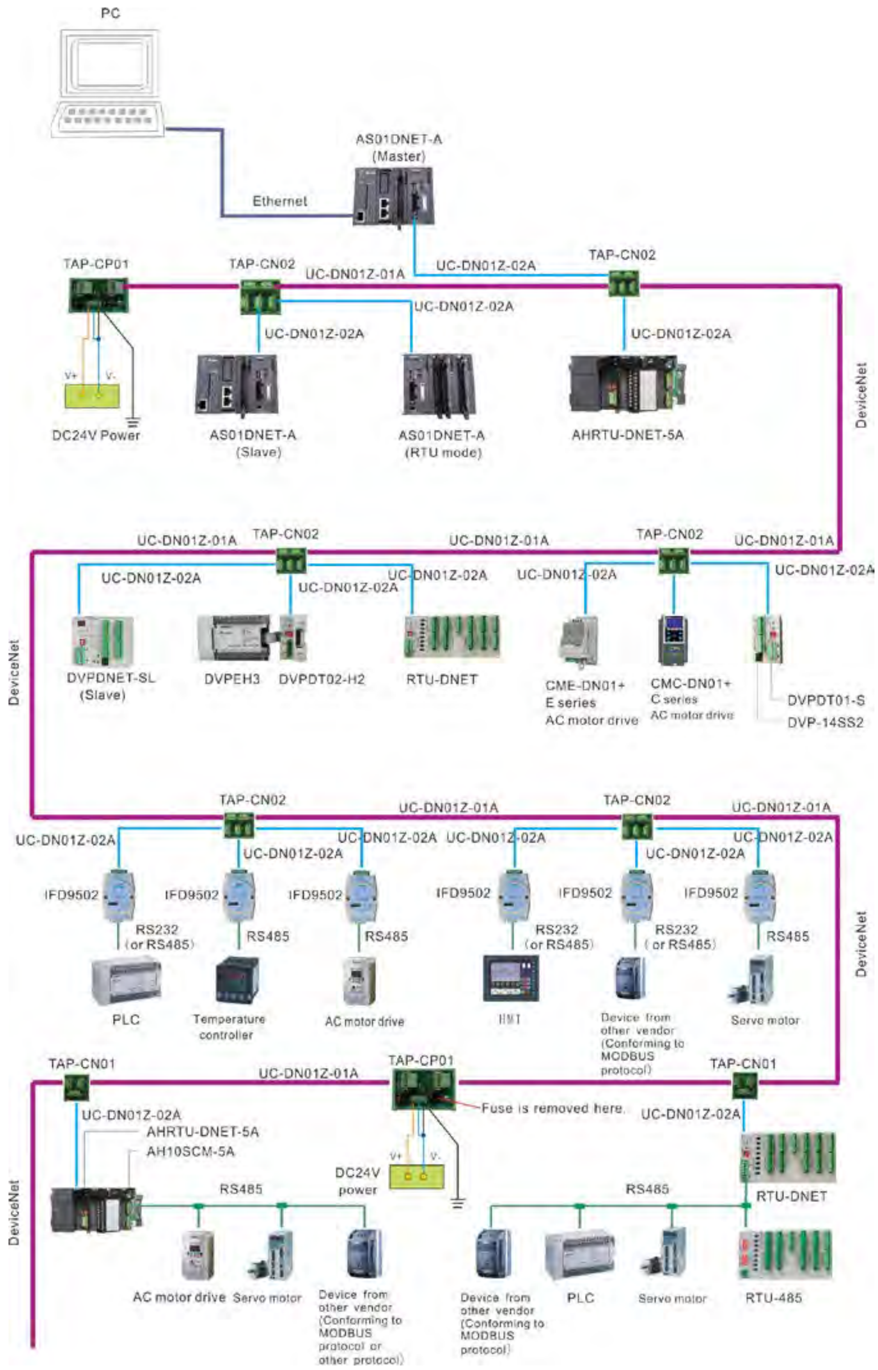
# 10.3 DeviceNet Network Communication

## 10.3.1 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 |

## 10.3.2 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.<br>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. |

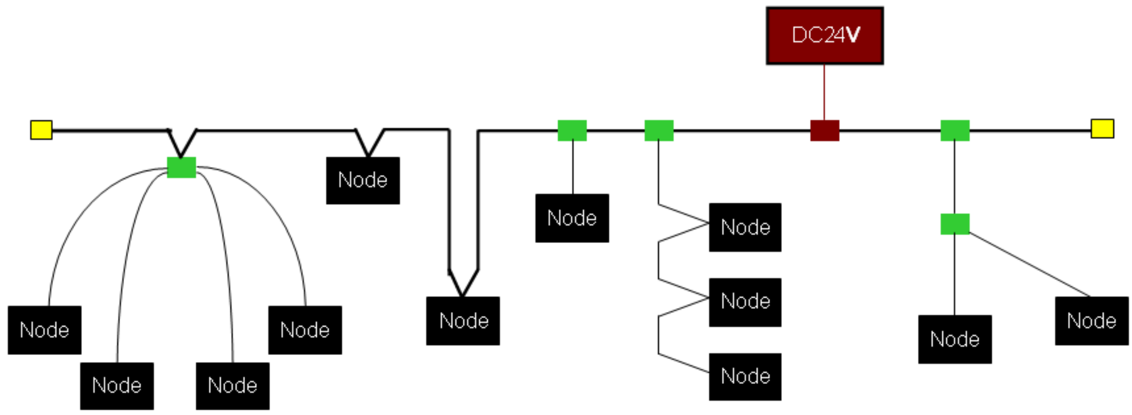
| Product picture | Model | Function |
|---|---|---|
|  | IFD9502 | Used for connection of the DeviceNet network and electromechanical equipment such as AC motor drive, PLC, temperature controller, servo drive, HMI, user-defined device. |
|  | IFD6503 | A fieldbus data analysis tool, with one end: CAN 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. |

### 10.3.3 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.

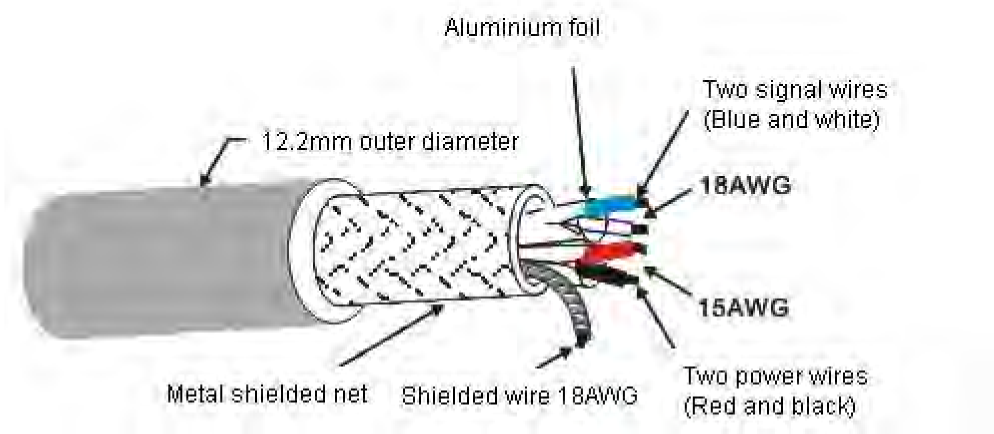
All signal transmission cables have the characteristic impedance. The characteristic impedance of Delta DeviceNet communication cable is about 121 Ω.

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.

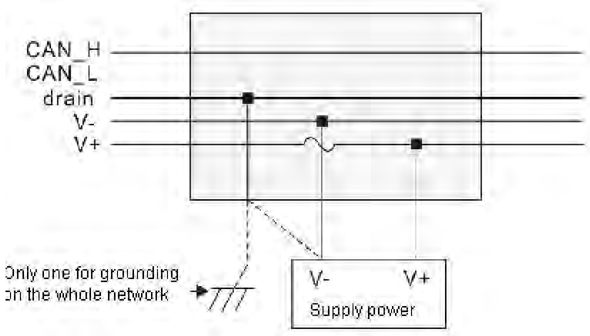
### 10.3.4 DeviceNet Network Supply Power

The network requires one or multiple supply powers to supply the power to each piece of network equipment via the bus cable.

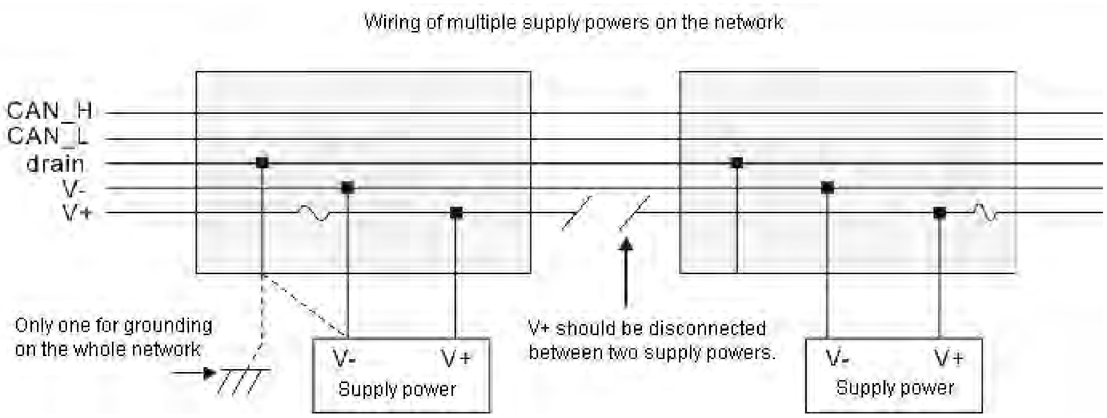
Delta DeviceNet communication cable consists of five wires, among which the power cable and signal cable occupy two wires respectively and the one on the left is the shielded wire as the above figure shows.

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**



# 10.4 Master /Slave Mode

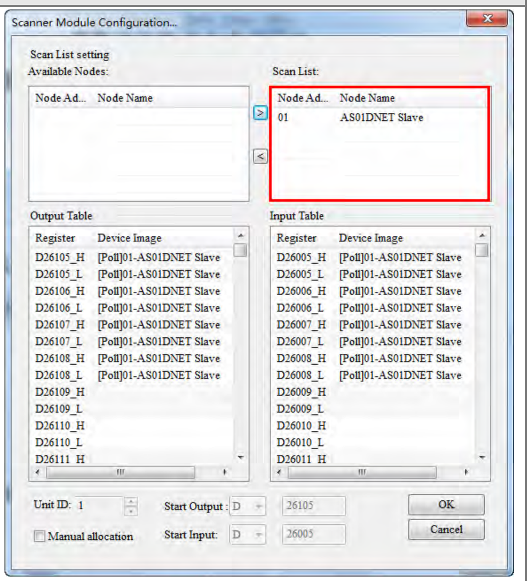
## 10.4.1 Introduction of Master/Slave Mode

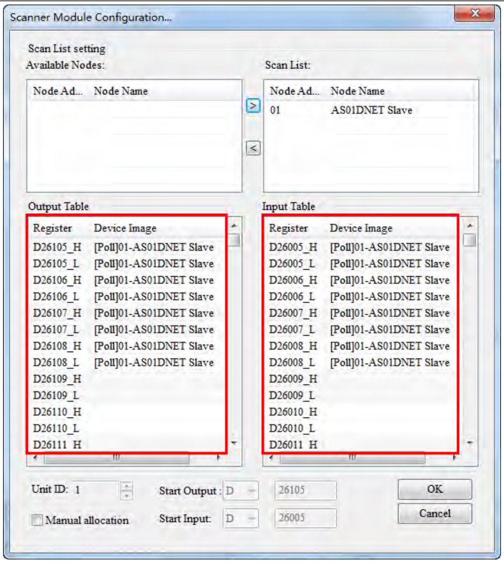
AS01DNET-A can work as a DeviceNet master as well as slave with at most 4 AS01DNET modules connectable to the right side of AS PLC. Running on the right of AS-series PLC, AS01DNET-A with AS-series PLC together constitutes the DeviceNet master or slave. When working in Master/Slave mode, AS01DNET-A is 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 10.4.10.

- 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.

### 10.4.1.1. 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. |  |

| | | |
|---|---|---|
| Input/output Table | 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.<br>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. |  |

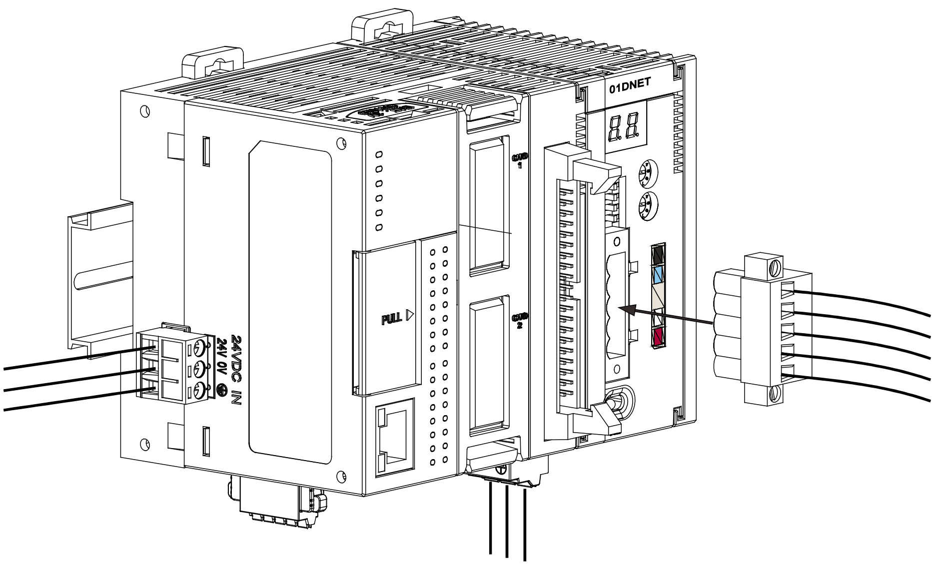
## 10.4.2 Installation

### 10.4.2.1. 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.

### 10.4.2.2. Connecting the DeviceNet Communication Connector

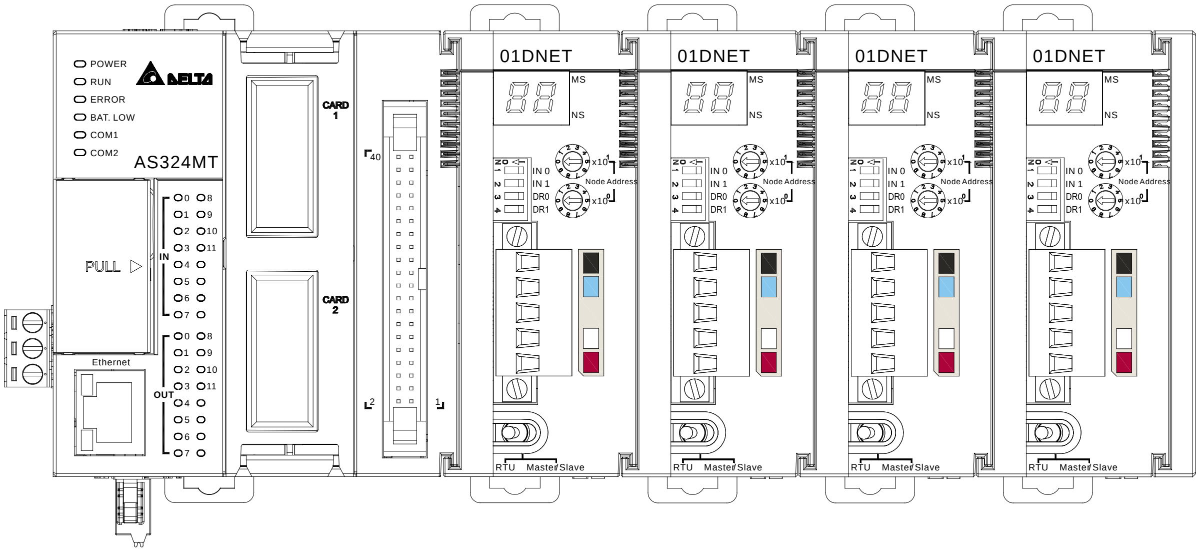
- Make sure that the color marks for the PINs of the DeviceNet connection port match the colors of the connection cables and the cable should be connected to the right PIN.
- Delta's power module is recommended as the power module in the communication.



## 10.4.3 IO Mapping for AS01DNET in AS PLC

### 10.4.3.1. 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 |

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 |

10

| Position of AS01DNET on the right of the PLC | Output mapping area | Input mapping area |
|---|---|---|
| 4 | D27300 – D27399 | D27200 – D27299 |

### 10.4.3.2. 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 output data area | 95 words | D27205~D27299 | DeviceNet input data area | 95 words |

Note: See section 10.4.5 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 |

### 10.4.4 Bit-strobe Command

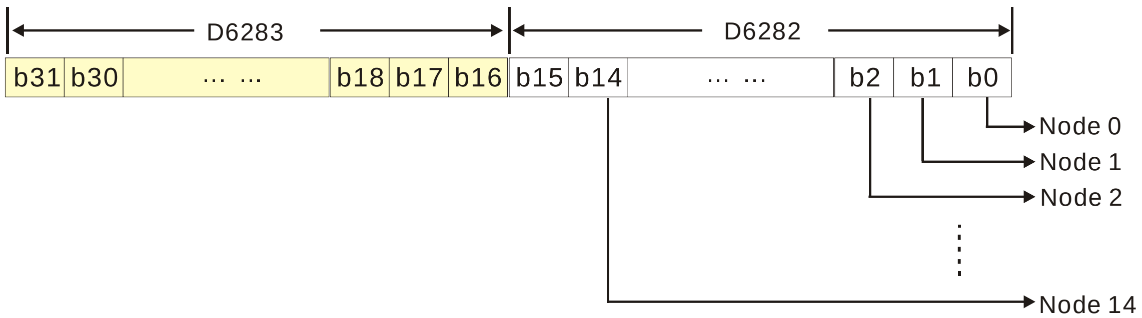
#### 10.4.4.1. Bit-strobe Work Principle

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.

10

## 10.4.5 Network Node Status Display

### 10.4.5.1. 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 |

### 10.4.5.2. Module Status Indication

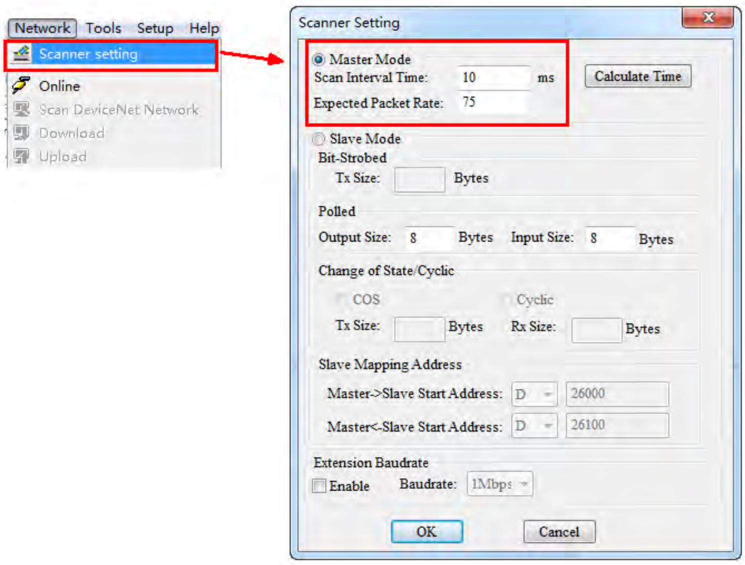
The following table takes the first AS01DNET on the right of AS PLC for example. Users can get the status of the network node by monitoring the content in D26004. When the module works normally, the content in D26004 is 0. When the module is initializing, the content in the high byte of D26004 is 1 and 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 section 10.9.5 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 | | | | | | | |

## 10.4.6 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. |

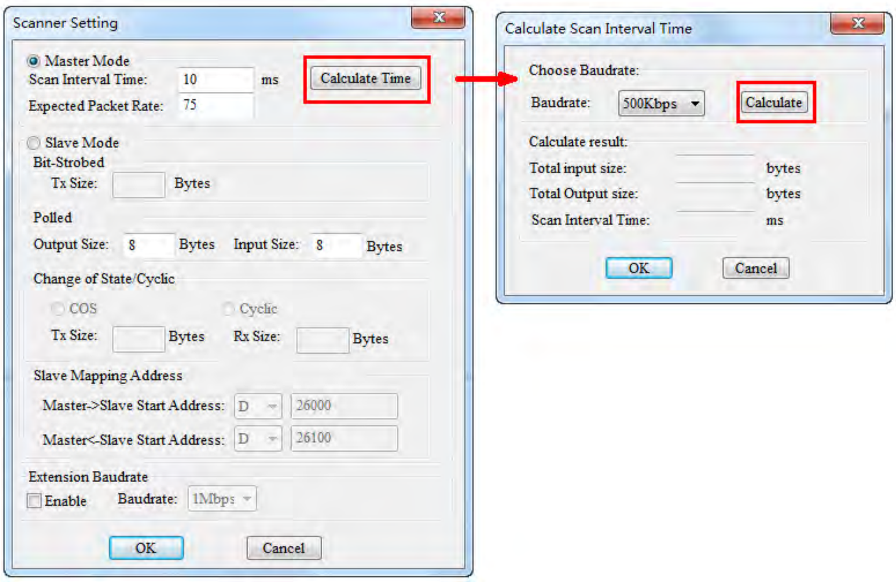
Since most DeviceNet slaves only support polled IO data exchange, the EPR value is related to the value of **Scan Interval Time**. Make sure that the actual setting must meet the following condition.

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.




## 10.4.7 Application Example

To explain how to configure a DeviceNet network through an application example

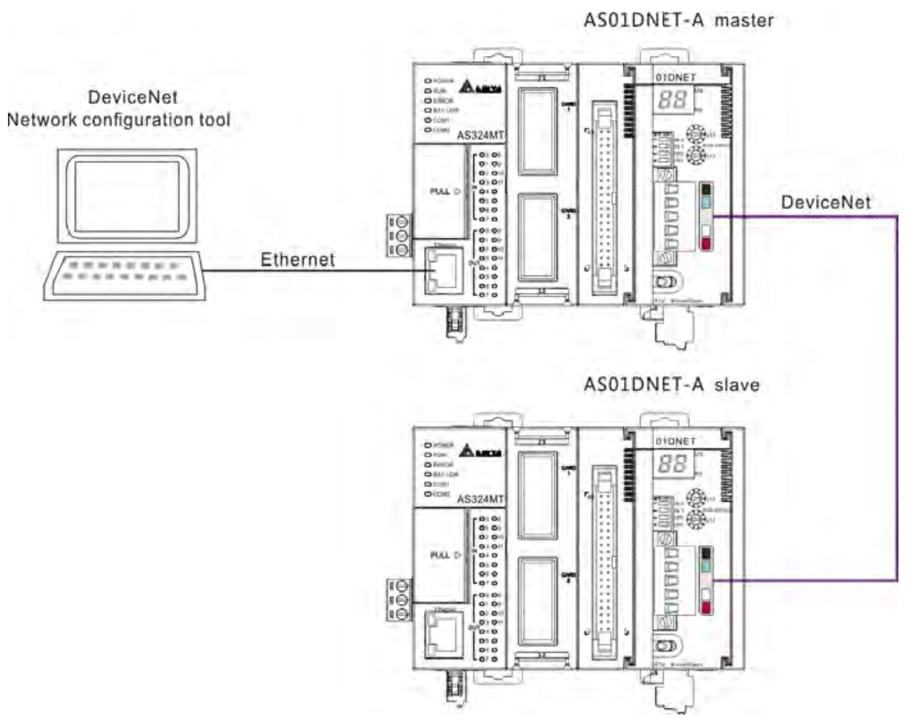
**Control requirement:** AS PLC remotely monitors D26105~D26108 and D26005~D26008 in AS module through DeviceNet network to achieve the data exchange as AS01DNET-A works as master and slave respectively.

### 10.4.7.1. 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**

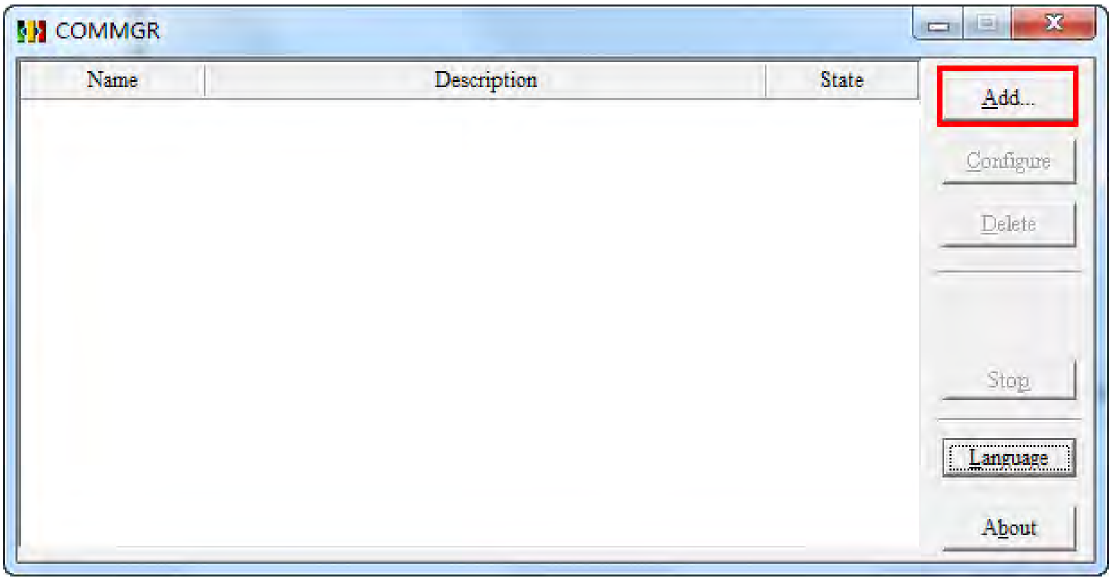
Prepare two AS PLCs and two AS01DNET-A modules for constructing one DeviceNet network. The setups for two AS01DNET-A modules are shown in the follwing table.

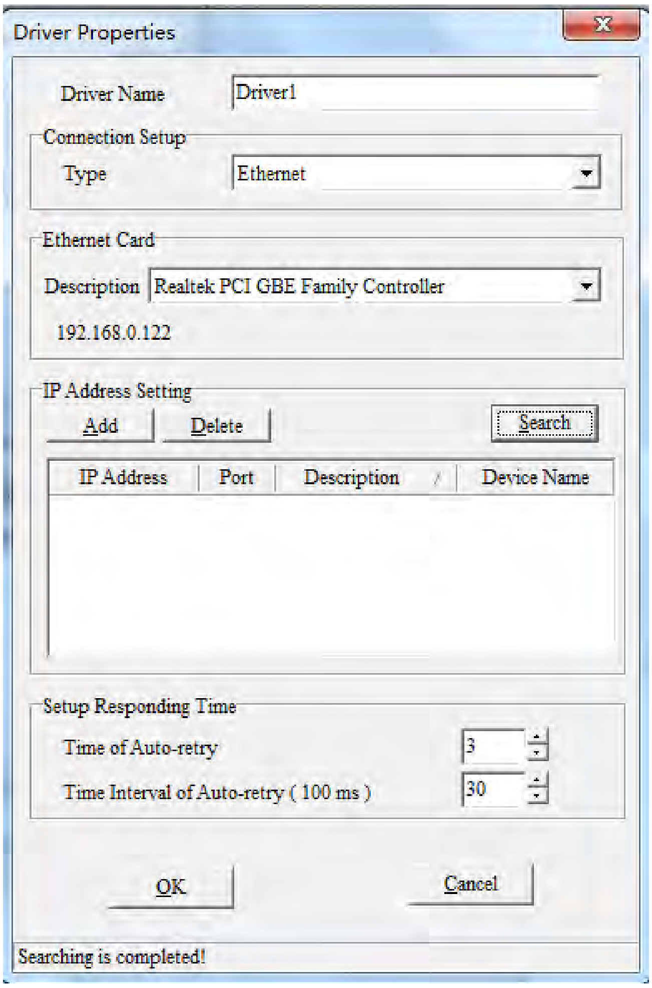
| DeviceNet network module | Node address | Baud rate |
|---|---|---|
| AS01DNET-A (Master) | 0 | 500kbps |
| AS01DNET-A (Slave) | 1 | 500kbps |

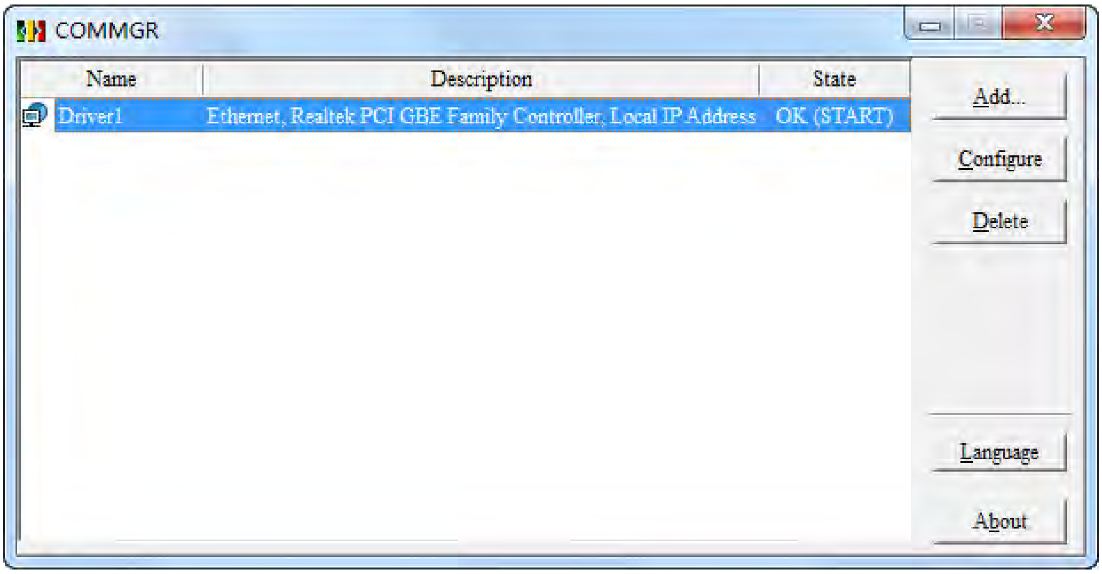
### 10.4.7.2. Using DeviceNet Builder to Configure a DeviceNet Network

- **Configuring DeviceNet slave**

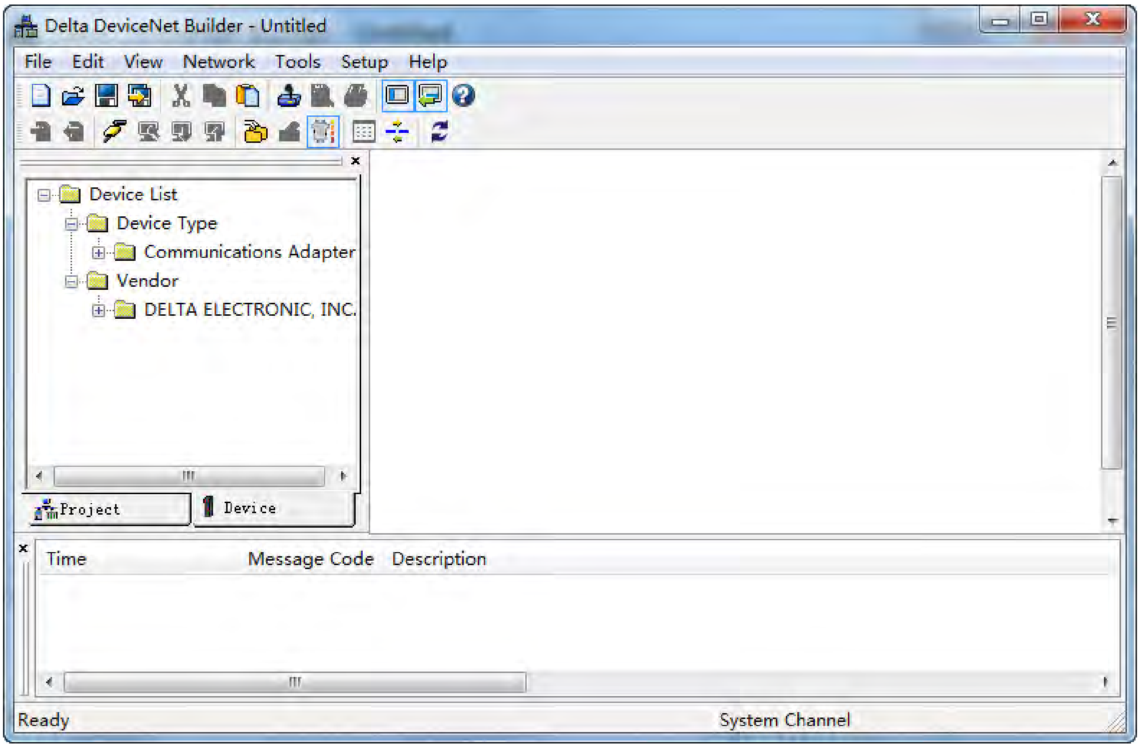
1. Set the driver for the connection of AS PLC and PC. Clicking **Add**, the **Driver Properties** dialog box appears. Select the connection type for AS PLC and PC in the **Type** field. In this example, select Ethernet as the connection type. Click **Search** to search the PLC and then click **OK** after searching is finished.



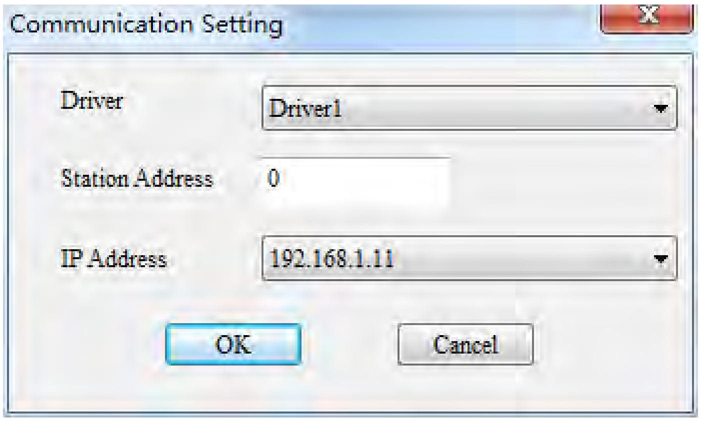





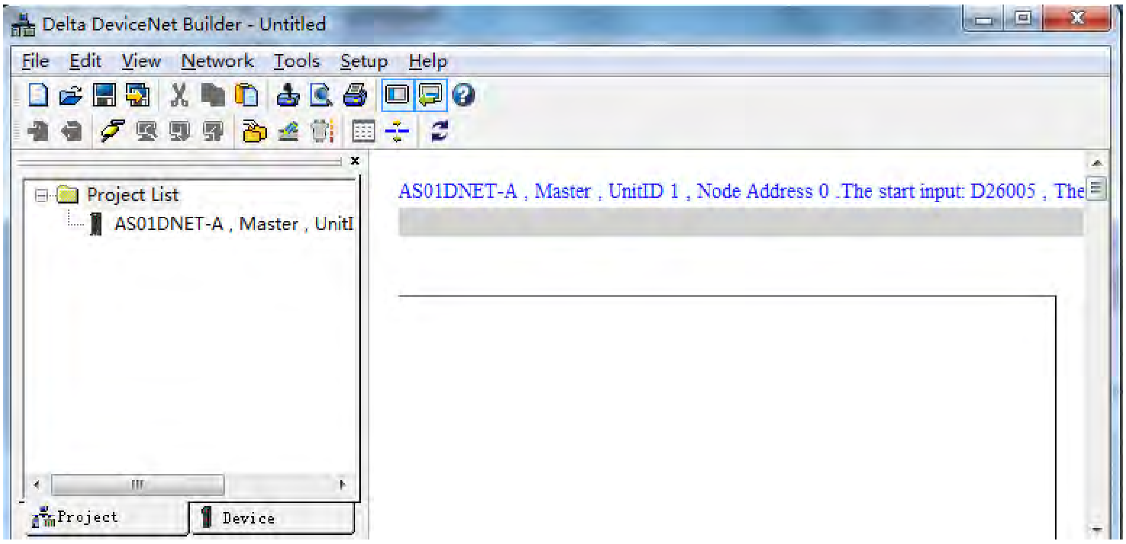

2. Opening the DeviceNet Builder software, the following window appears.



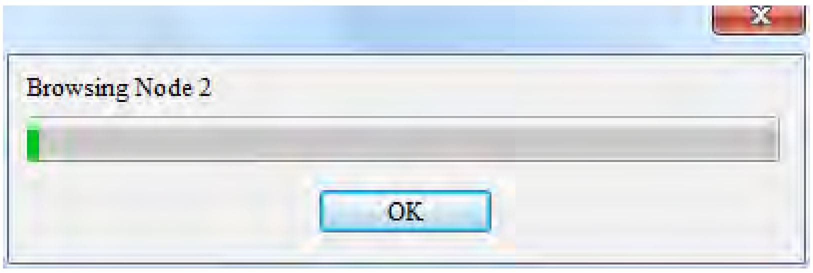
3. Selecting **Setup**>> **Communication Setting**, the following dialog box appears. Select the driver for connection of AS PLC and PC as below. Click **OK** to finish the selection of Driver.



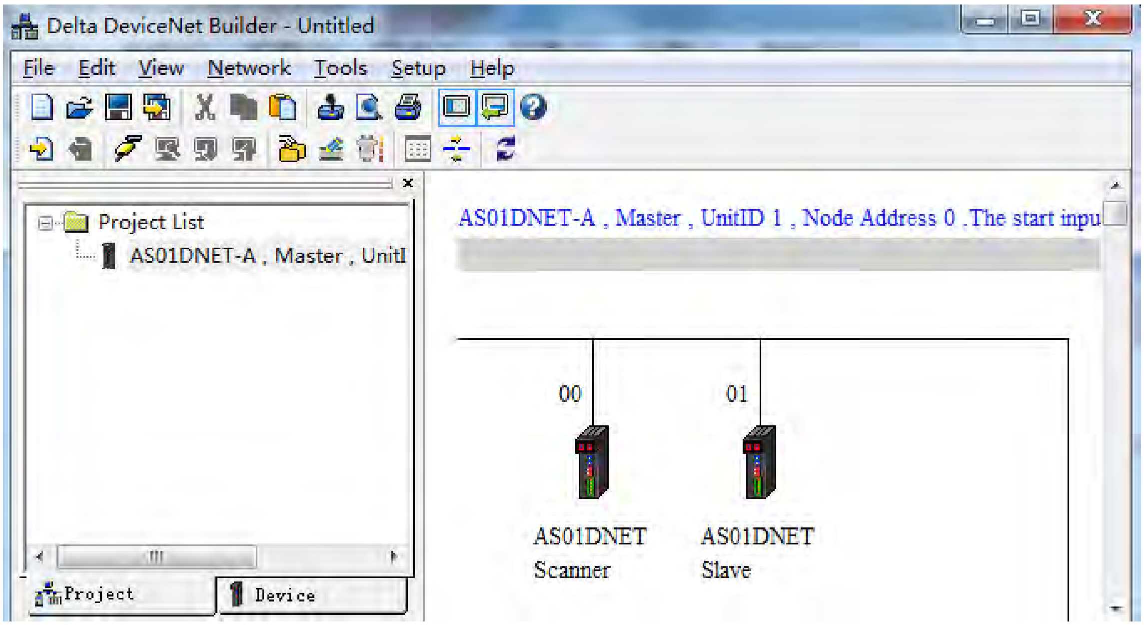

4. Click **Network** >> **Online** to scan the connected master.



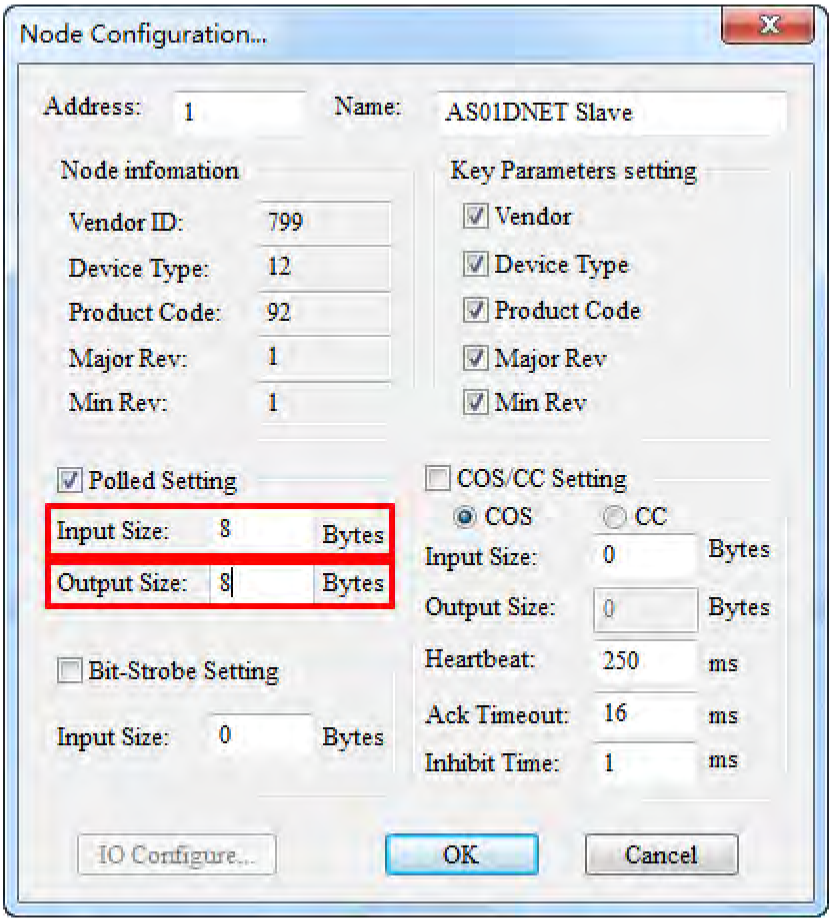

5. Click **Network**>> **Scan DeviceNet Network.**



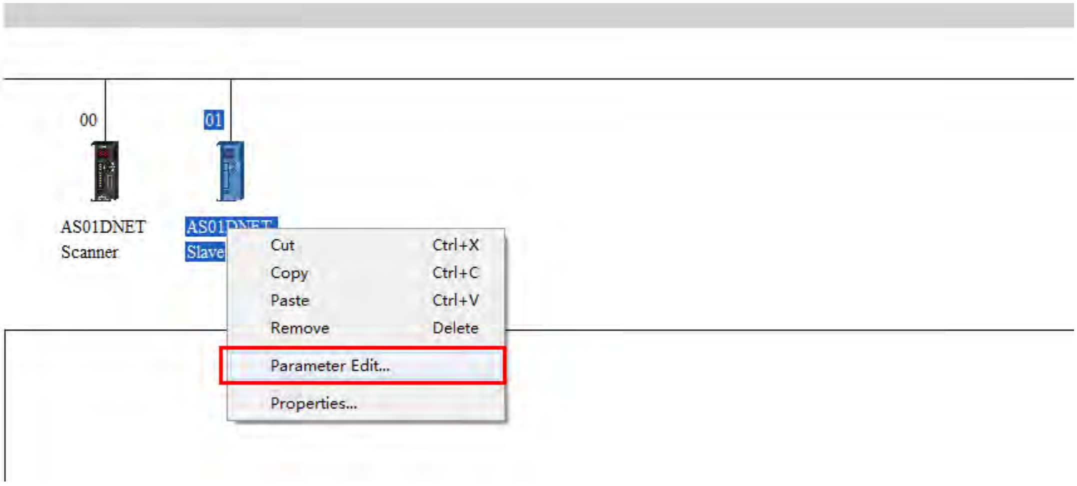
6. After scanning is finished, all node icons and device names which have been scanned in the network will appear on the following interface. The node address of AS01DNET-A is 00 in this example.

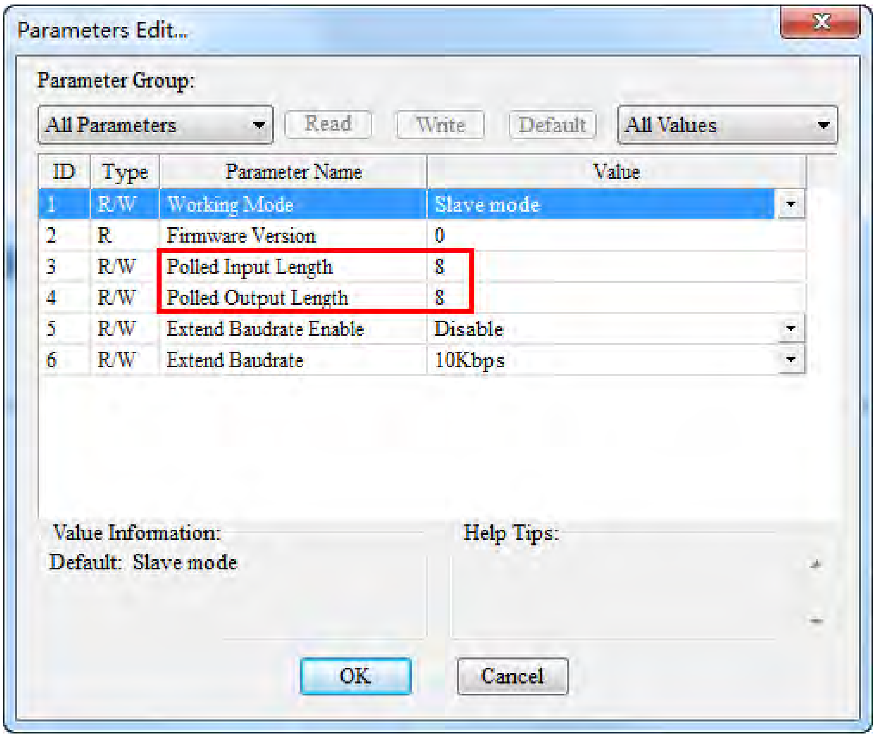



7. Double click the icon of AS01DNET Slave. Then the **Node Configuration…** dialogue box appears. Input Size and Output Size are both set to 8 bytes. Click OK to finish the setting.



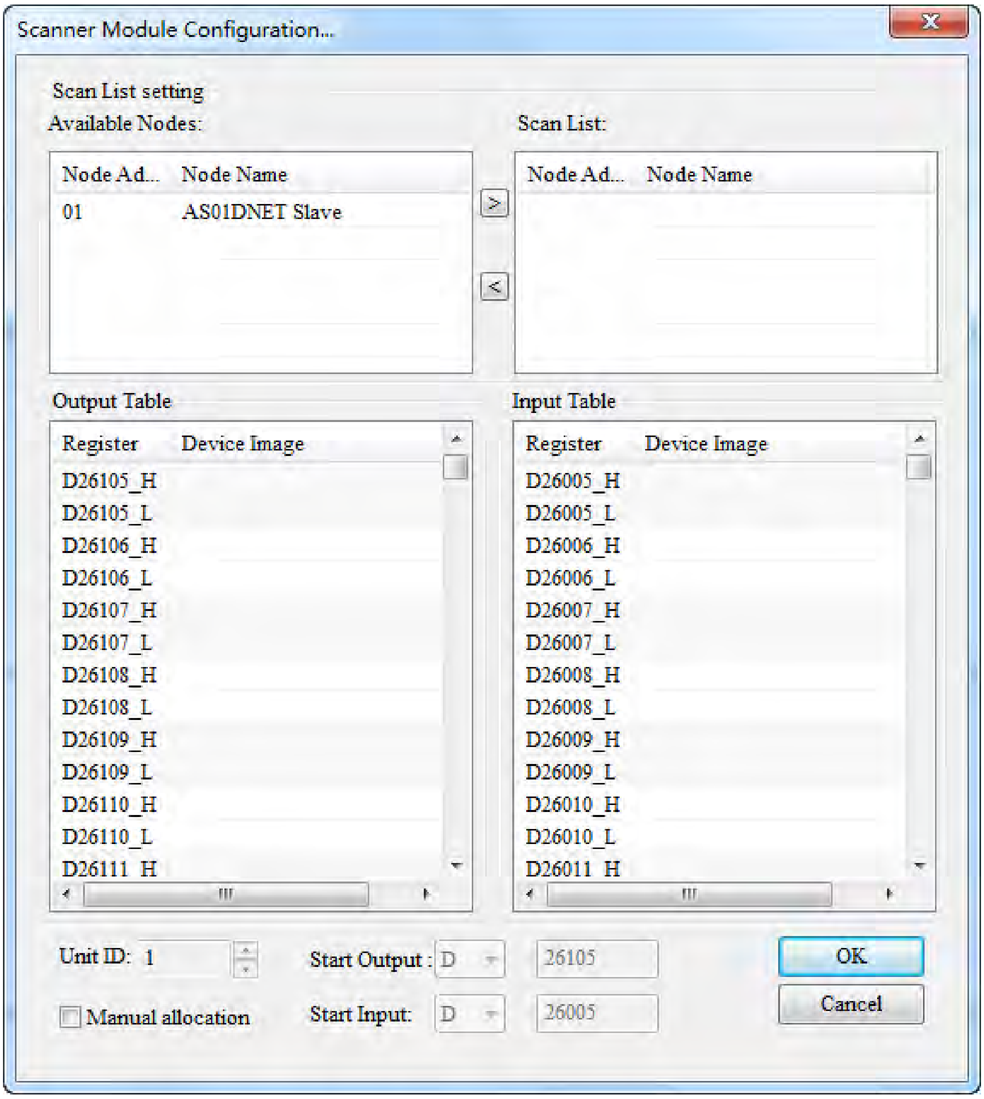
8. Right click the icon of AS01DNET Slave and click **Parameter Edit…** on the drop-down menu. The **Parameters Edit…** dialog box appears and **Polled Input Length** and **Polled Output Length** are both set to 8 bytes as shown in the following red box. Then click **Write** button. Click **OK** after writing is finished. Afterwards, repower AS01DNETSlave.



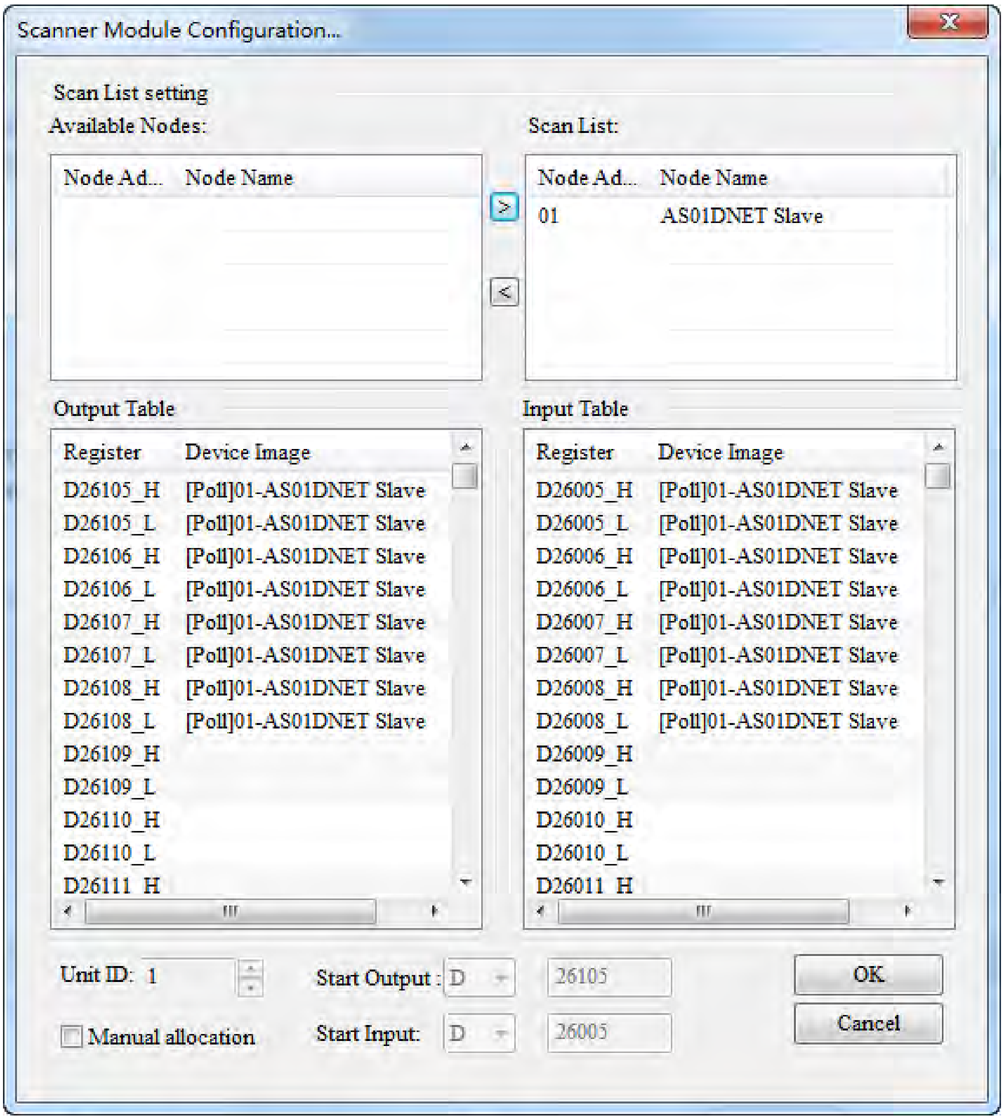



- **Configuring AS01DNET-A**

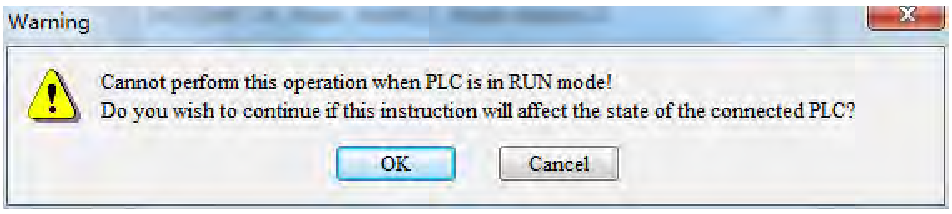
1. Double click the icon of AS01DNET Scanner (node 0). The **Scanner Module Configuration…** dialog box appears. The left list shows the current available node AS01DNET Slave and the right Scan List is empty as below.



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.




10

- **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.

### 10.4.7.3. DeviceNet Network Control

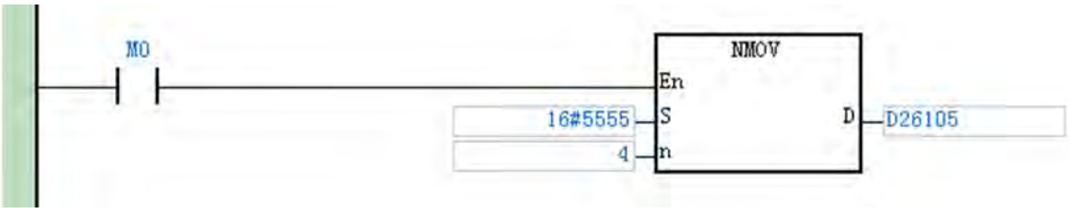
This section describes how to write a ladder program to achieve the control requirement of the DeviceNet network.

- **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.

## 10.4.8 Sending Explicit Message through Ladder Diagram

AS01DNET-A supports the sending of explicit messages via DNETRW instruction.

### 10.4.8.1. 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.

### 10.4.8.2. Explicit Message Transmission Instruction DNETRW

- DNETRW instruction:

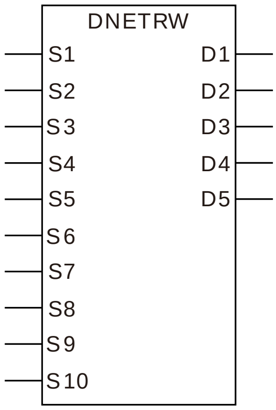
| API | Instruction code | Operand | Function |
|---|---|---|---|
| 1818 | DNETRW | $S_1$、$S_2$、$S_3$、$S_4$、$S_5$、$S_6$、$S_7$、$S_8$、$S_9$、$S_{10}$、$D_1$、$D_2$、$D_3$、$D_4$、$D_5$ | Read and write DeviceNet communication data |

| 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.

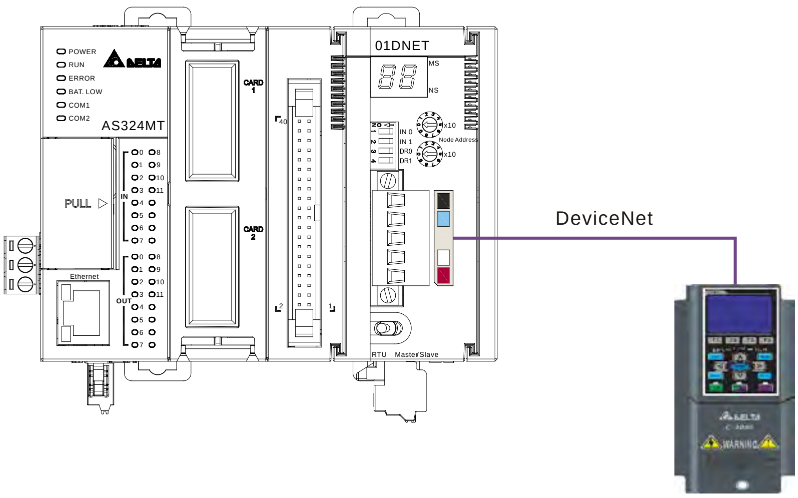
| Error Code | | Explanation |
|---|---|---|
| Code 1 (High Byte) | Code 2 (Low Byte) | |
| XX | FF | Not conform to the DeviceNet standard |
| 20 | 01 | The target slave does not exist. |
| 20 | 02 | Unable to make the connection with the slave |
| 20 | 03 | Sending explicit message failed. |
| 16 | 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**



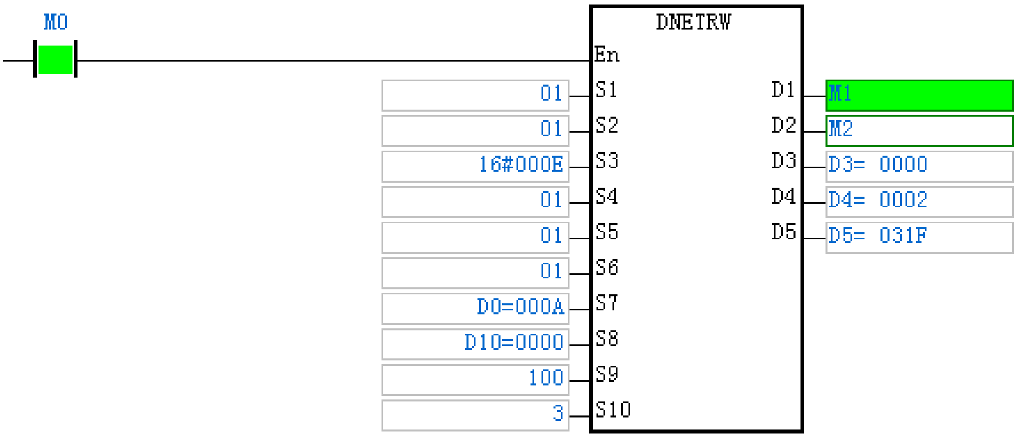
- **Parameters Setting and Device Explanation**
  - **Setup for AS01DNET-A**

| 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.

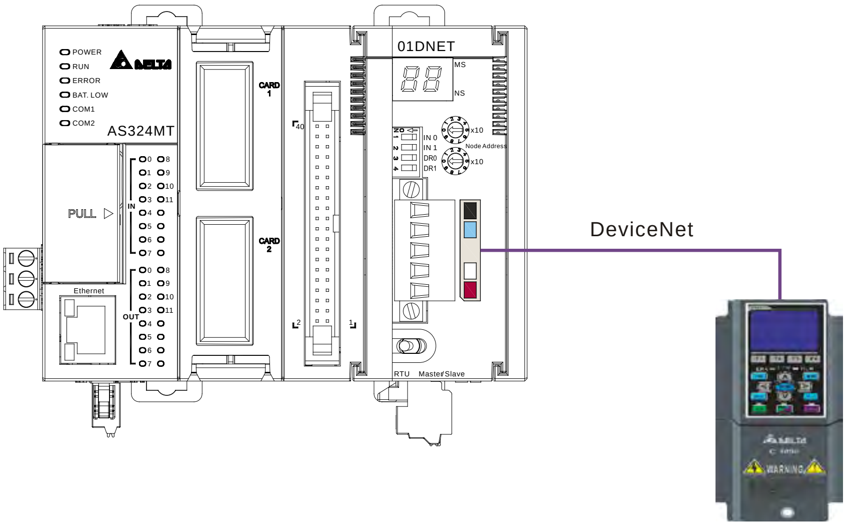
■ **Program Explanation**

- 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**

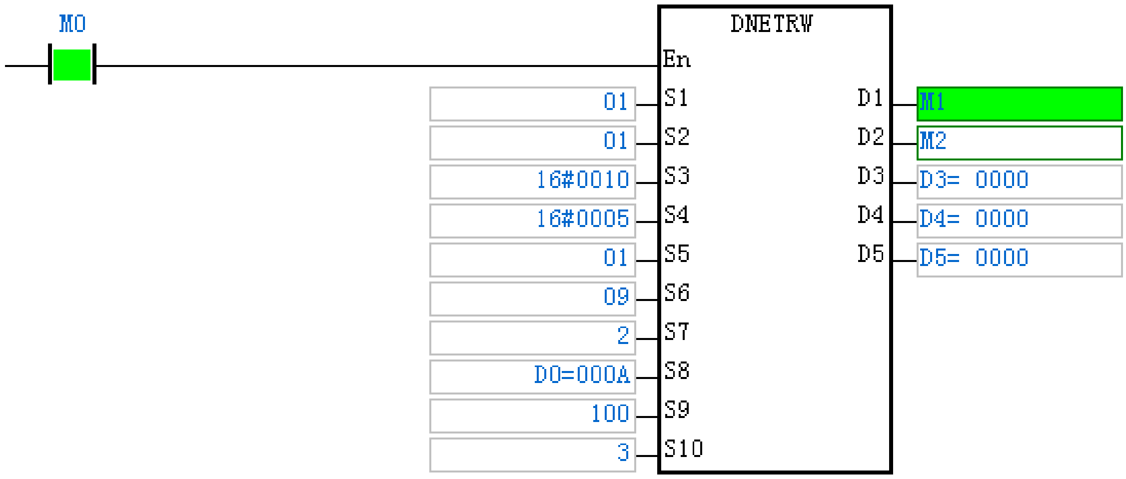
- **Setup for AS01DNET-A**

| 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.

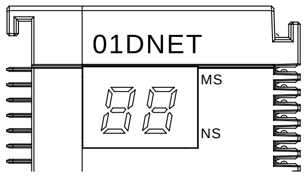
- **Program Explanation**

- 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.

10

## 10.4.9 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.




### 10.4.9.1. NS LED

| LED status | Indication | Correction |
|---|---|---|
| OFF | No power;<br>Or duplicate ID check has not been completed. | 1. Check if AS01DNET-A is powered and the connection is normal.<br>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;<br>Refer to Digital Displayer for troubleshooting. |
| Green light ON | Online;<br>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.<br>2. Check if the network installation is correct.<br>3. Check if the baud rates of the master and slave are same.<br>4. Check if the network power is normal. |

### 10.4.9.2. 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 | When AS01DNET works as the master, the slave in Scan List can not | Refer to Digital Displayer.<br>Make sure that the slave information in Scan List |

| LED status | Indication | Correction |
|---|---|---|
| OFF: 0.5s alternately) | work normally.<br>When AS01DNET works as the slave, an error occurs in the configuration. | matches that of the actually connected slave. |
| Red light ON | An error inside AS01DNET | 1. Check if the configuration is correct.<br>2. Return the module to factory for repair if the error still exists after repower ON. |

### 10.4.9.3. 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.<br>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.<br>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. |

### 10.4.9.4. 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.<br>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. |
| F4 | BUS-OFF | 1. Check if the network cable is normal and the shielded cable is grounded.<br>2. Check if the baud rates of all nodes in the network are same.<br>3. Check if the start and end of the network cable are both connected with a 121Ω terminal resistor.<br>4. Re-power AS01DNET-A. |
| F5 | No network power | 1. Check if the network cable is normal.<br>2. Ensure that the network power is normal. |
| F6 | Internal error; Flash or RAM | If the error still exists after re-power, send AS01DNET-A back to the |

| Code | Explanation | Correction |
|---|---|---|
| | check error | 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.<br>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.<br>2. Check if some node device in the network is replaced.<br>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.<br>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.<br>2. Check if the communication cable is disconnected or connected loosely.<br>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.<br>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.<br>1. Make sure that at least two nodes work normally in the network.<br>2. Check if either end of the network is connected with the terminal resistor of 121Ω.<br>3. Check if the baud rates of the node devices in the network are same.<br>4. Check if the communication cable is normal so as to avoid that the cable is disconnected or connected loosely.<br>5. Check if the bus cable length exceeds the maximum transmission distance. If so, the system may not be stable.<br>6. Check if the shielded wire of the network cable is grounded.<br>7. Re-power AS01DNET-A scanner module. |

## 10.4.10 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.

### 10.4.10.1. Setting AS01DNET-A to Slave Mode

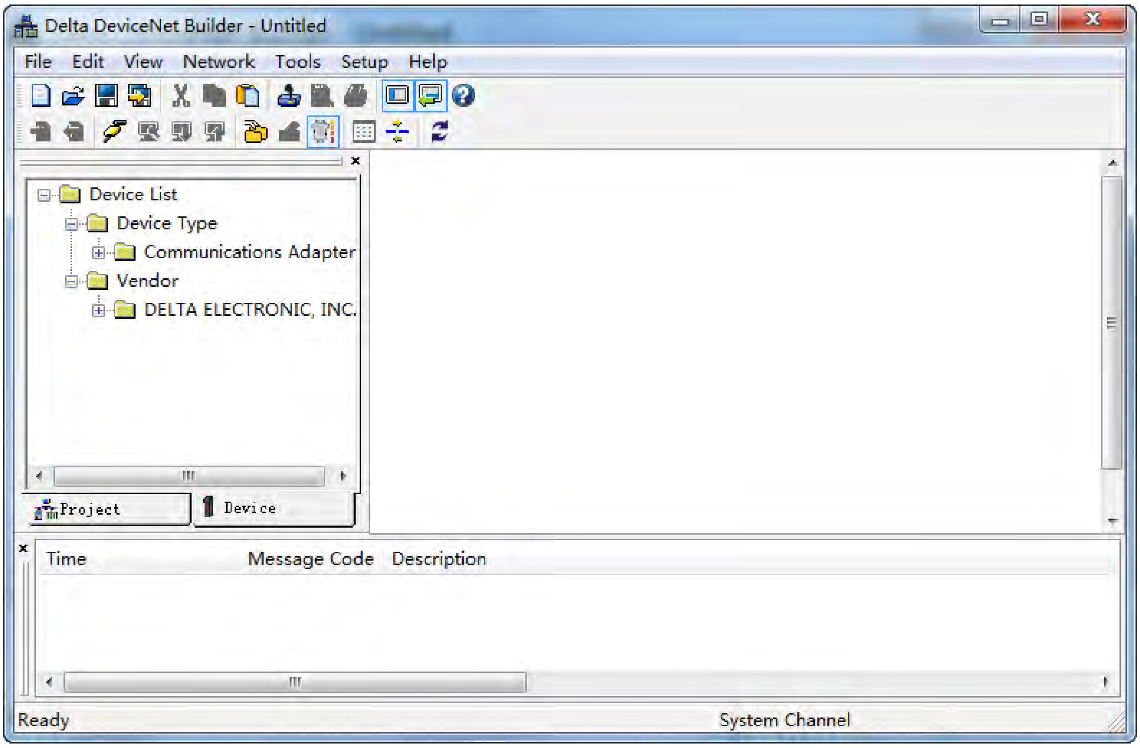
1. Build a driver through the COMMGR software.

   Refer to Section 2.4 Communication Setting in the ISPSoft software for details.

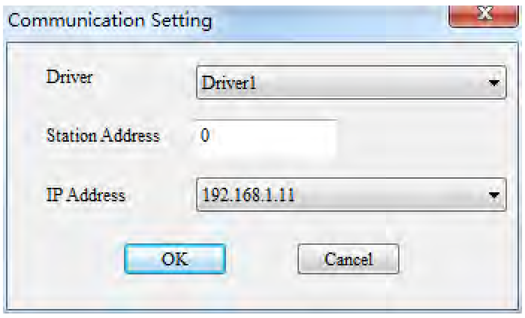
2. Call the DeviceNet Builder software through the ISPSoft software.

   Refer to section 10.6 in this manual for details on how to operate.

3. The called DeviceNet Builder software interface is shown as below.

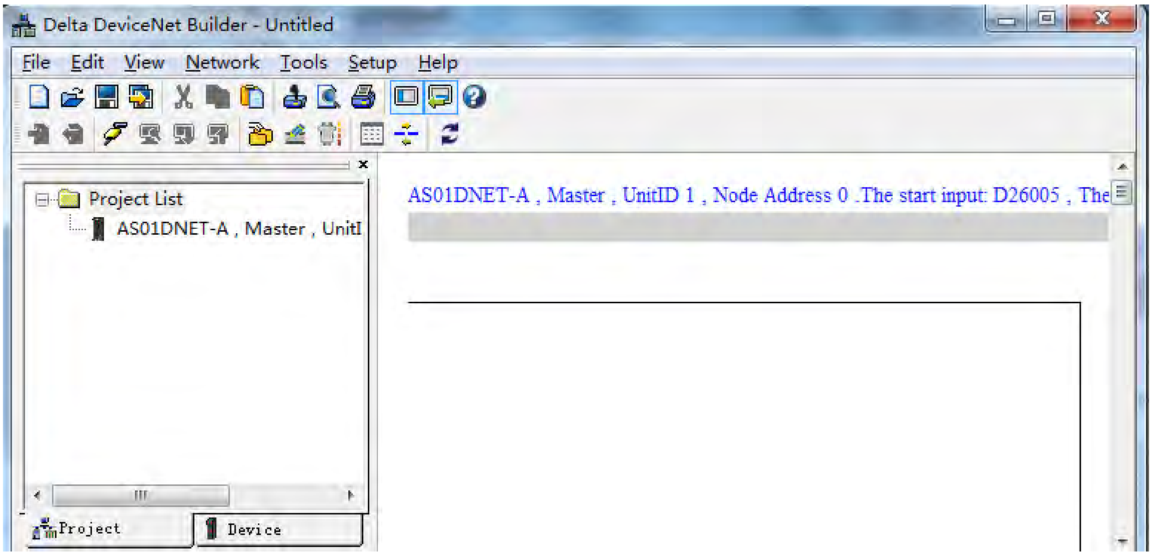



4. Selecting **Setup**>> **Communication Setting**, the following dialog box appears. Select the driver for connection of AS PLC and PC as below. Click **OK** to finish the selection of Driver.

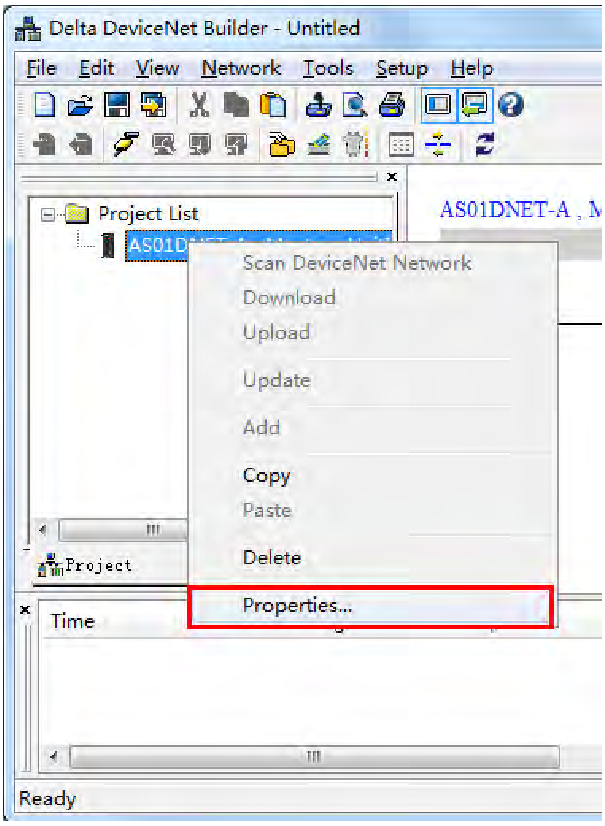


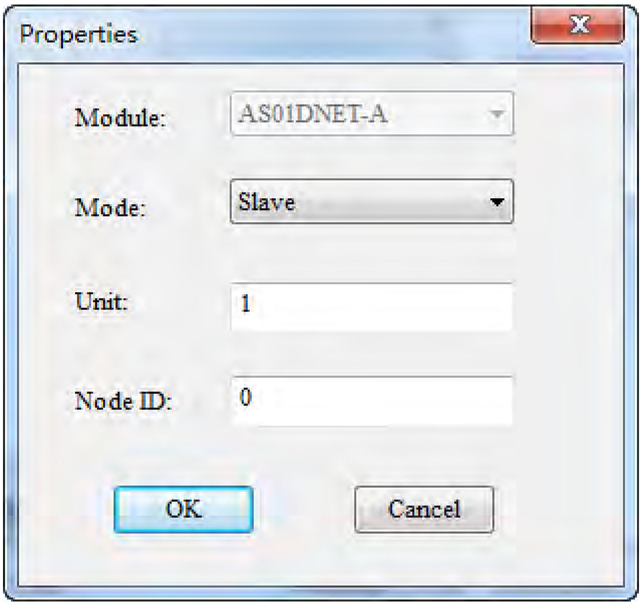

10

5. Click **Network** >> **Online** to scan the connected master.

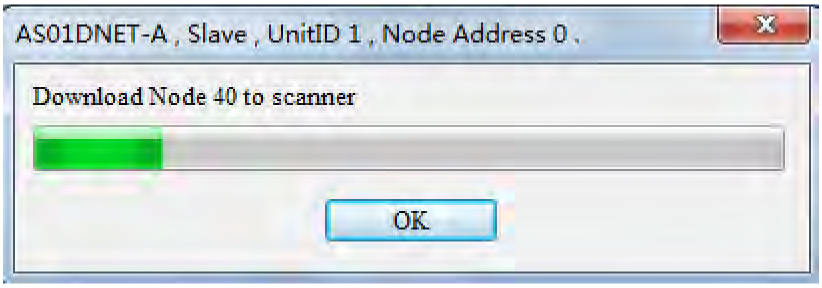



6. Click **Project List**>>**Properties**. Then the **Properties** dialog box appears. Select **Slave** mode and then click **OK**.

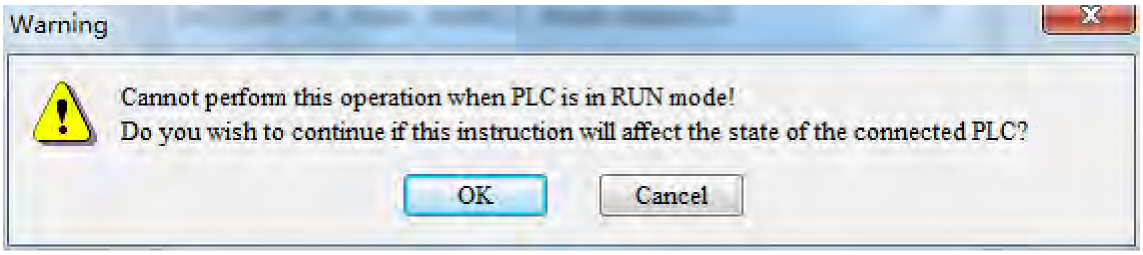


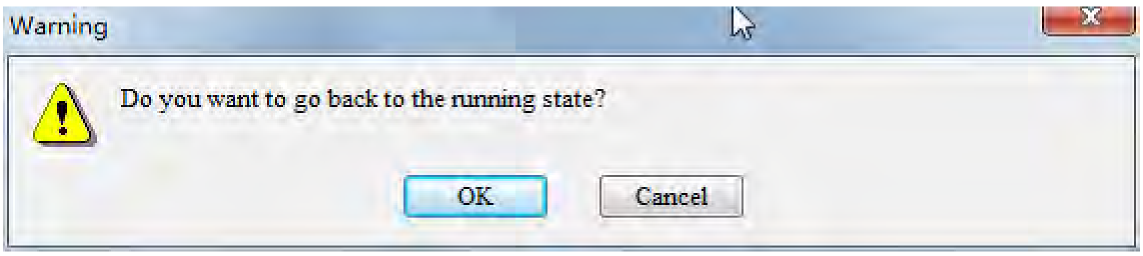



7. Click **Network** >> **Download**. If the PLC is in STOP state, the following dialog box will exist during the download. The dialog box will disappear automatically after the download is finished. AS01DNET-A will be in slave mode after repower ON.




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.



### 10.4.10.2. Setting AS01DNET-A to Master Mode

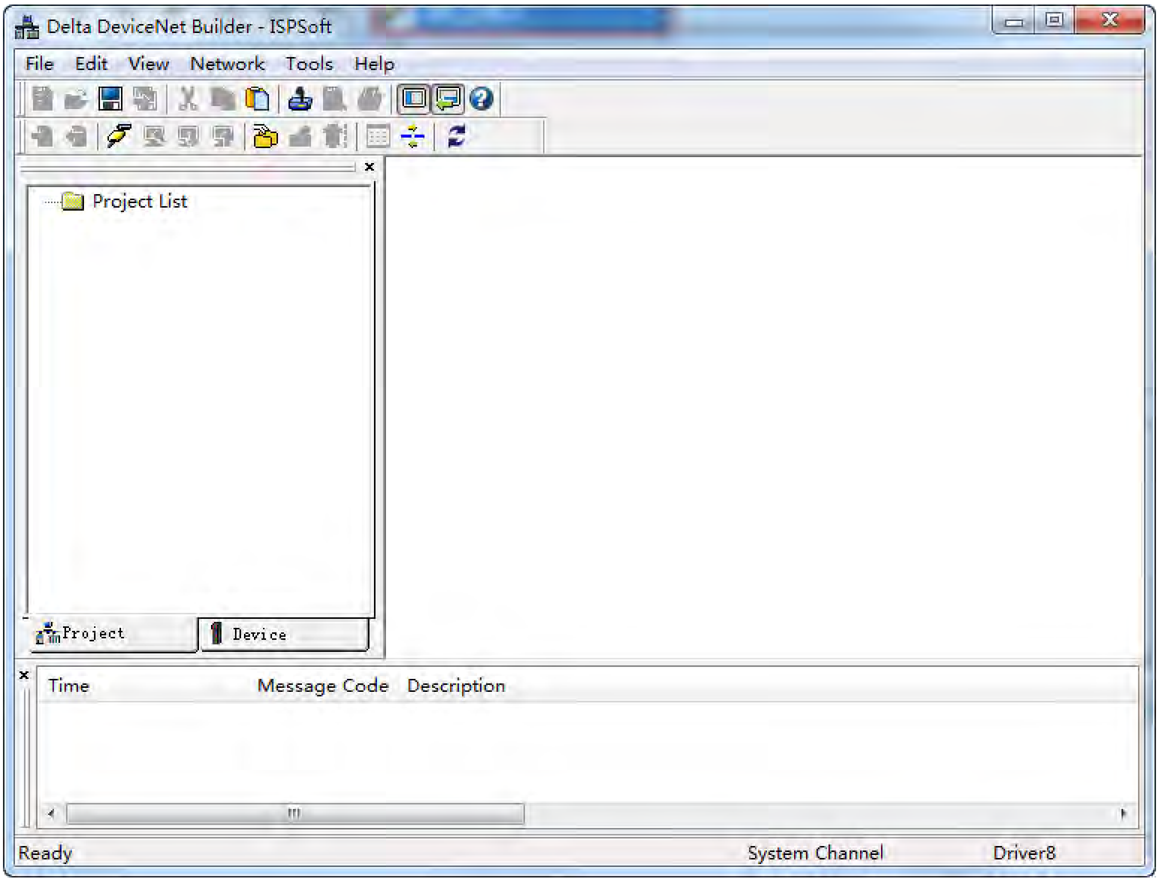
1. Build a driver through the COMMGR software.

   Refer to Section 2.4 Communication Setting in the ISPSoft software for details.

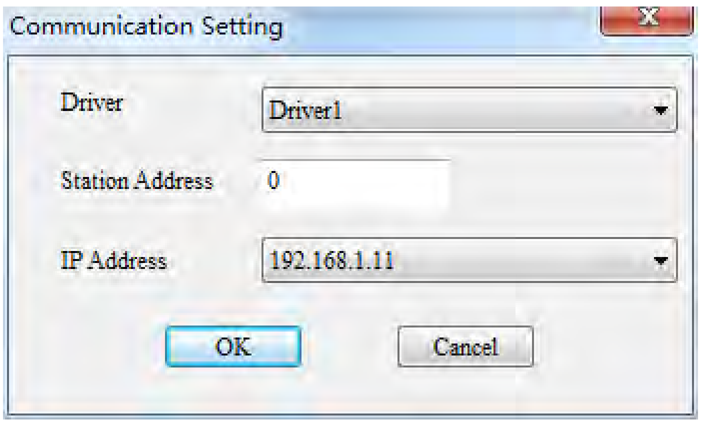
2. Call the DeviceNet Builder software through the ISPSoft software.

   Refer to section 10.6 in this manual for details on how to operate.

3. The called DeviceNet Builder software interface is shown as below.

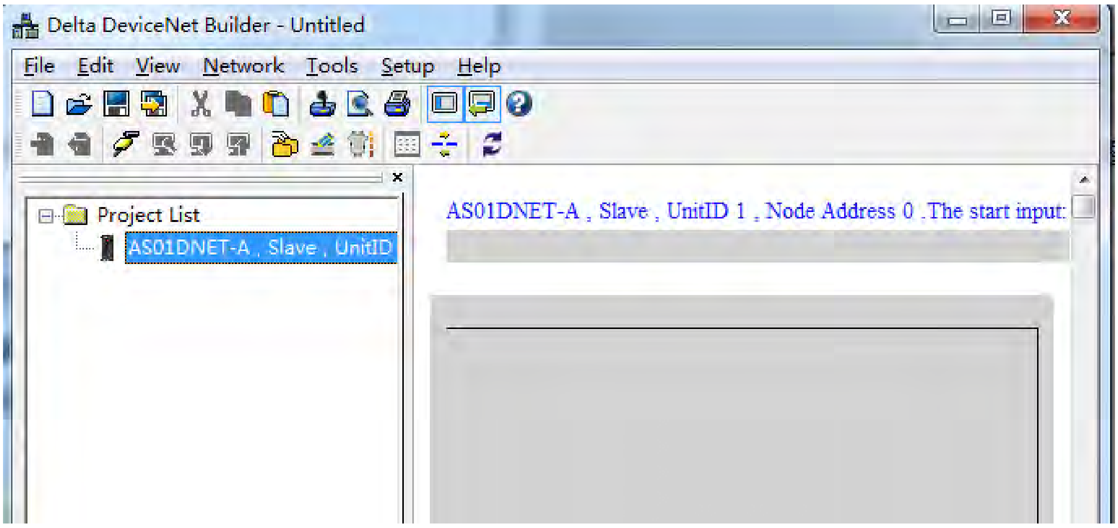



4. Selecting **Setup**>> **Communication Setting**, the following dialog box appears. Select the driver for connection of AS PLC and PC as below. Click **OK** to finish the selection of Driver.

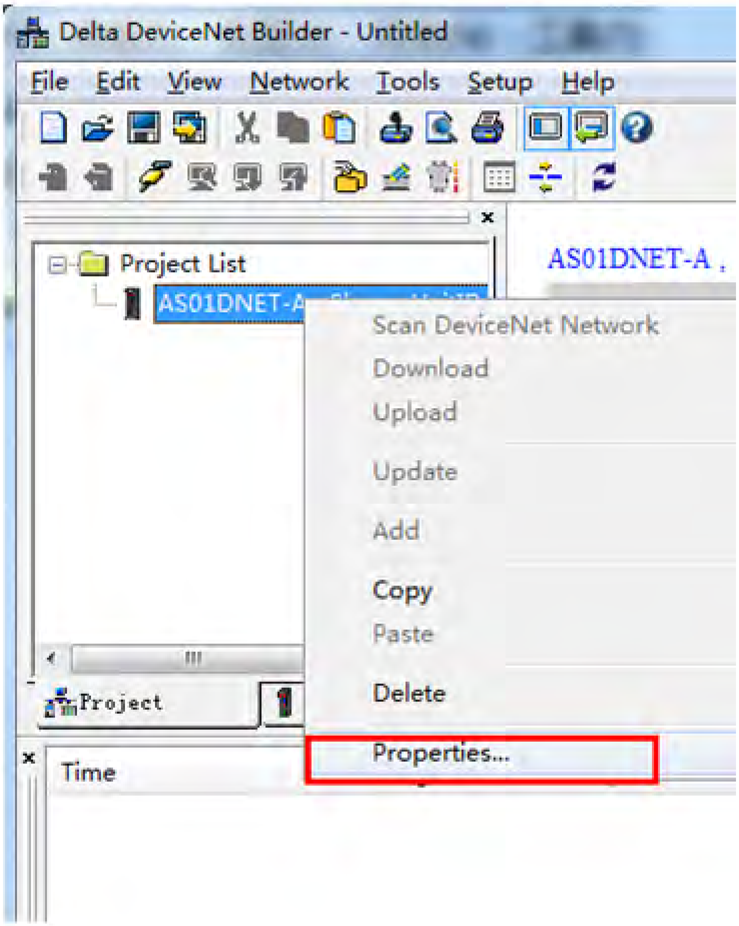


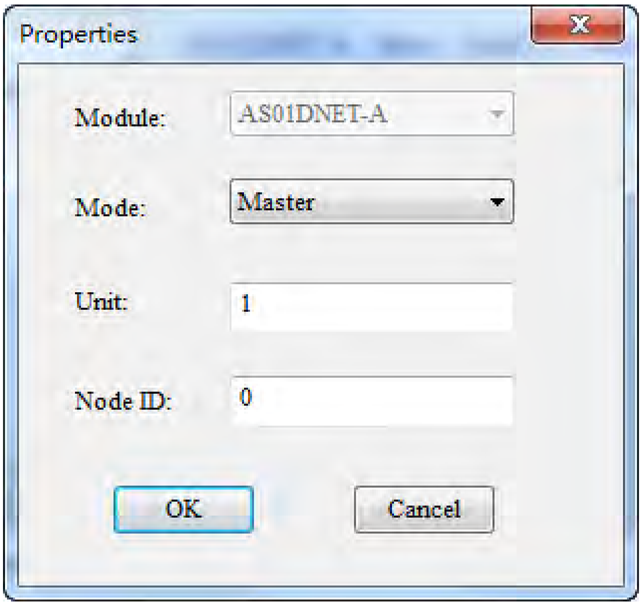

10

5. Click **Network** >> **Online** to scan the connected slave.

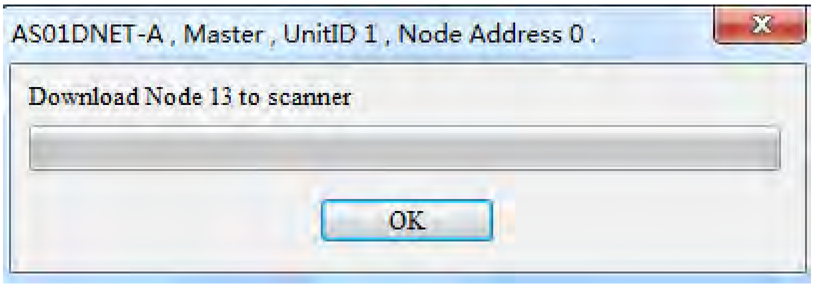



6. Click **Project List**>>**Properties** as below. Then the **Properties** dialog box appears. Select **Master** mode and then click **OK**.

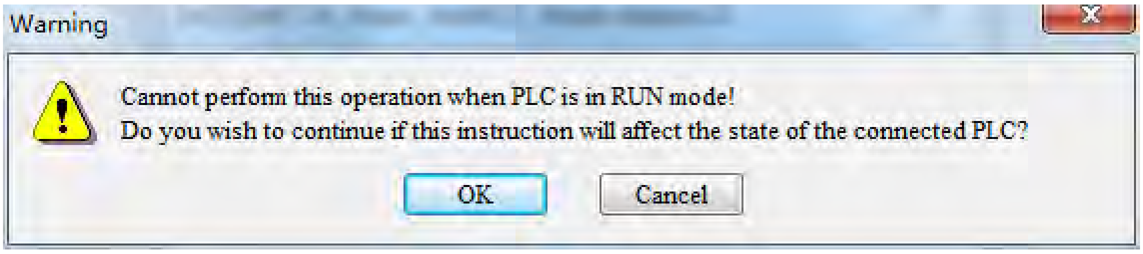


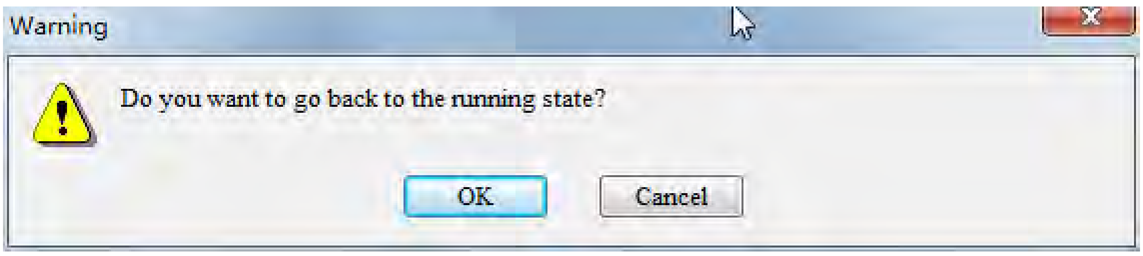



7. Click **Network** >> **Download**. If the PLC is in STOP state, the following dialog box will exist during the download. The dialog box will disappear automatically after the download is finished. AS01DNET-A will be in master mode after repower ON.



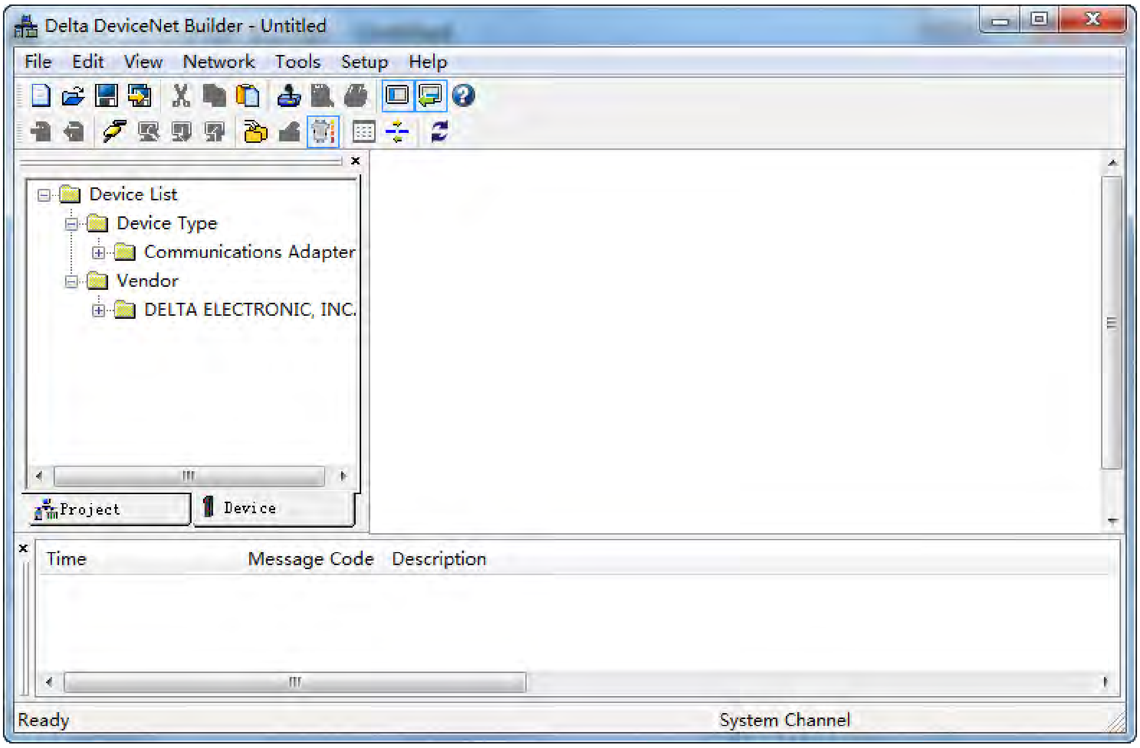

8. If the PLC is in RUN state, the **Warning** dialog boxes will pop out before and after the download. Users can click **OK** or **Cancel** according to actual situation.



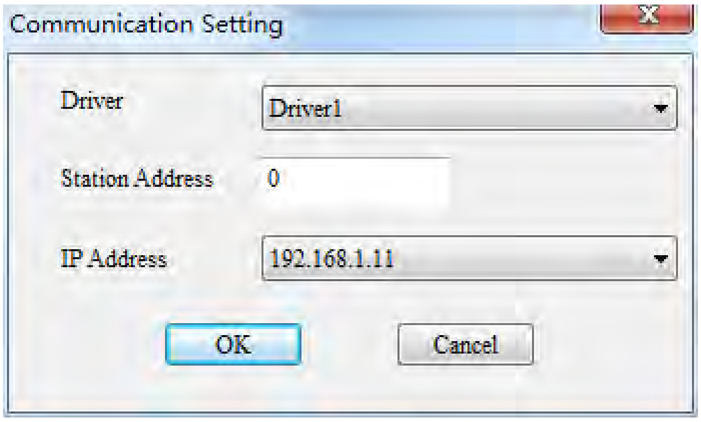



### 10.4.10.3. Baud Rate Setting of When AS01DNET-A is in Slave Mode

1. Opening the DeviceNet Builder software, the following window appears.

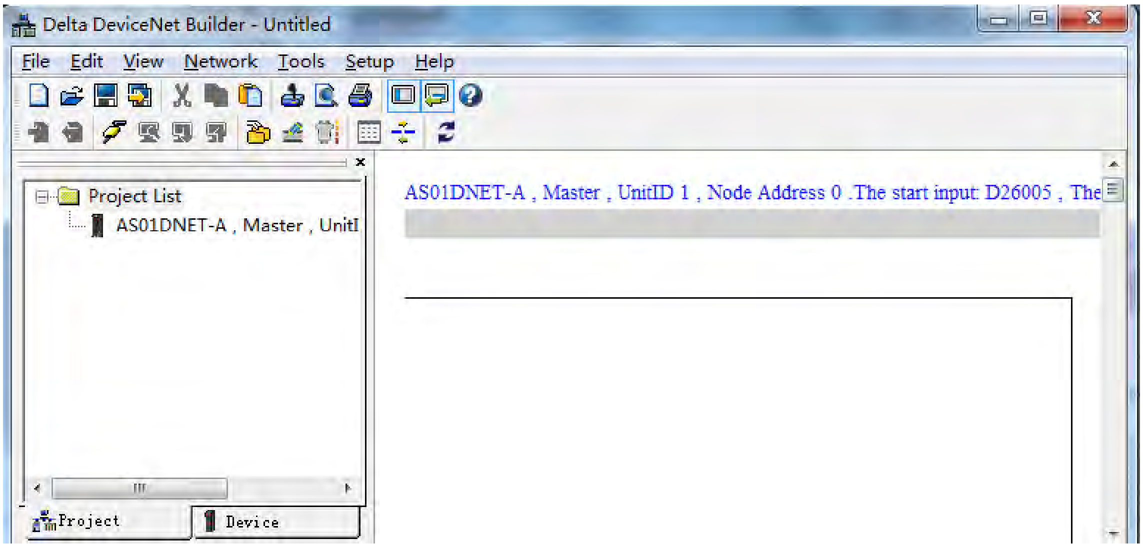



2. Selecting **Setup**>> **Communication Setting**, the following dialog box appears. Select the driver for connection of AS PLC and PC as below. Click **OK** to finish the selection of Driver.

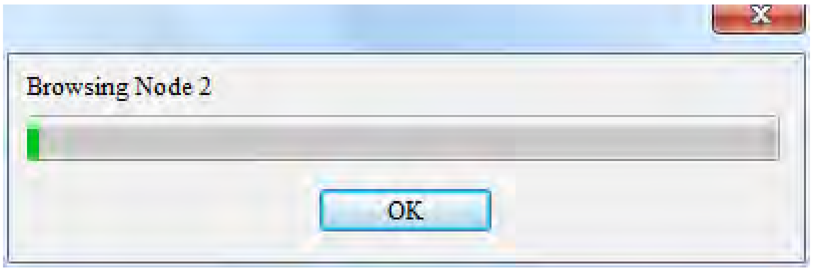



10

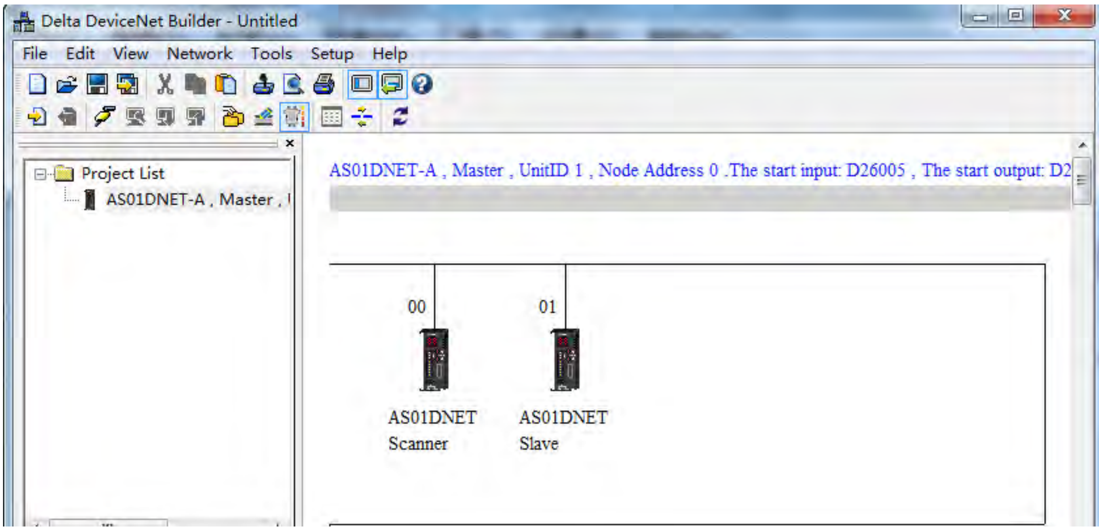
3. Click **Network** >> **Online** to scan the connected master.



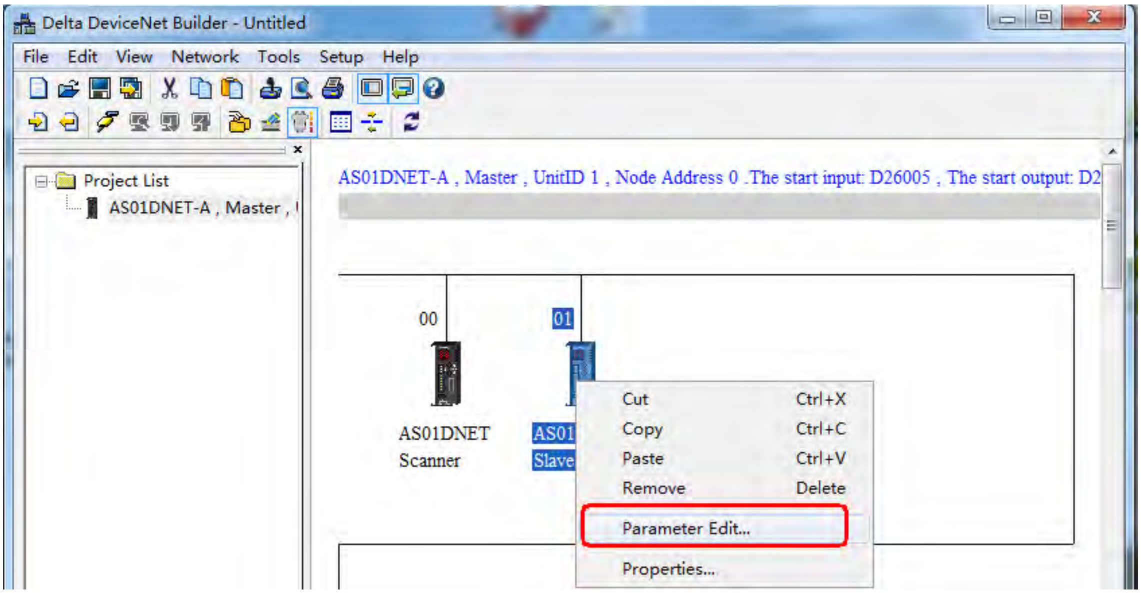

4. Clicking **Network**>> **Scan DeviceNet Network**, the DeviceNet Builder software starts to scan the whole network.



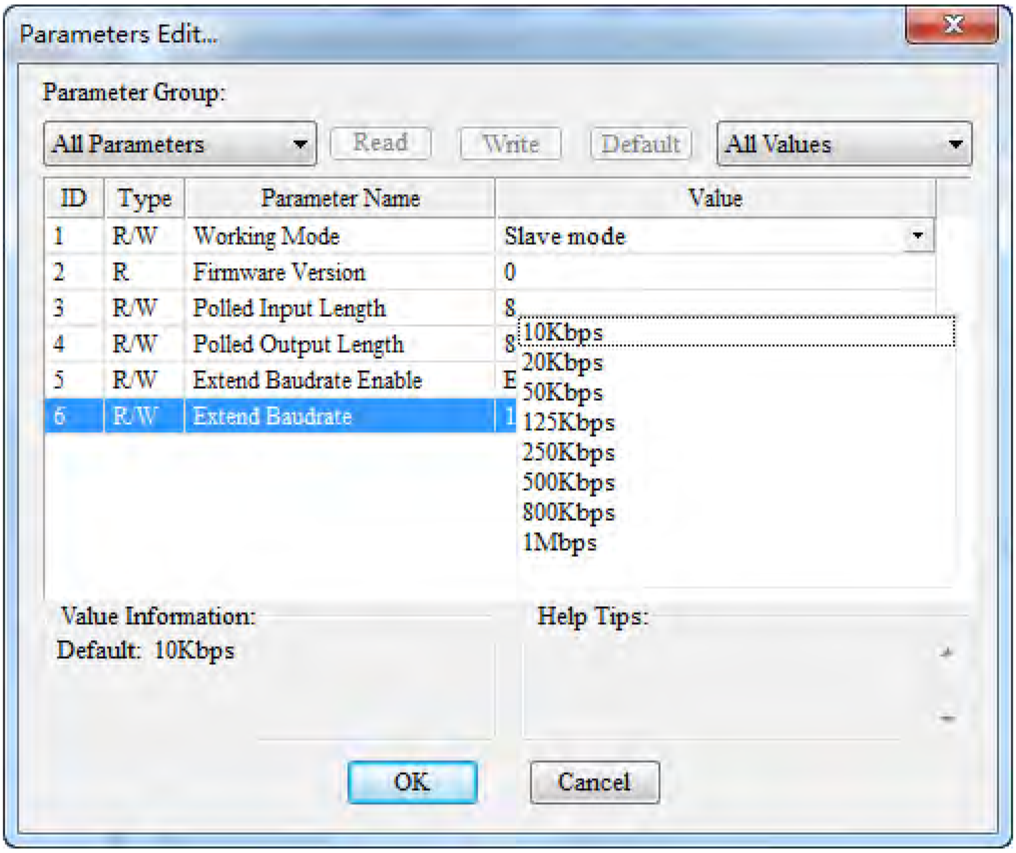

5. After scanning is finished, all node icons and device names which have been scanned in the network will appear on the following interface. The node address of AS01DNET-A is 01 in this example.



6. Right-click AS01DNET(Slave), select **Parameter Edit…** on the drop-down menu to enter the **Parameter Edit** page.



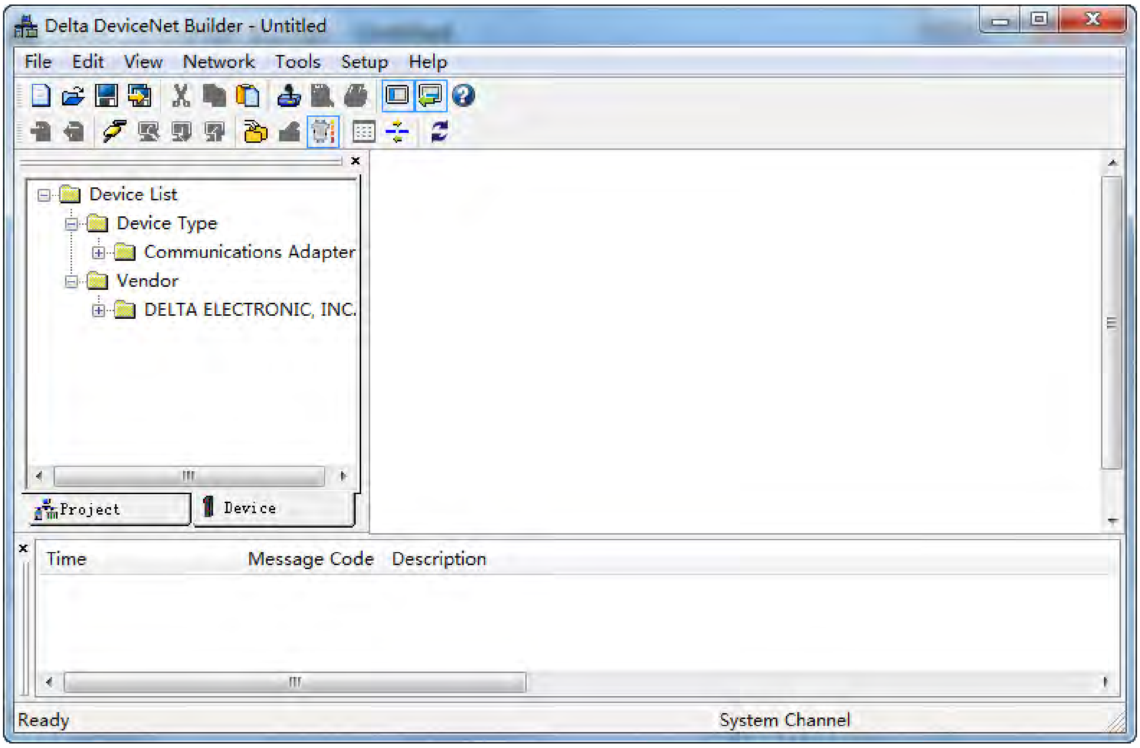

7. Set **Extend Baudrate Enable** to **Enable** and then select the desired baud rate. Click **Write** button after setting is finished.



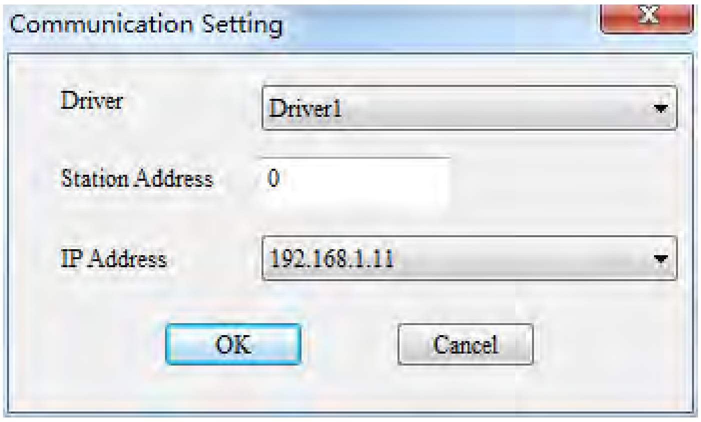

8. After the download is completed, switch DR0 and DR1 of AS01DNET to ON. Finally, repower AS01DNET-A.

### 10.4.10.4. Baud Rate Setting of When AS01DNET-A is in Master Mode

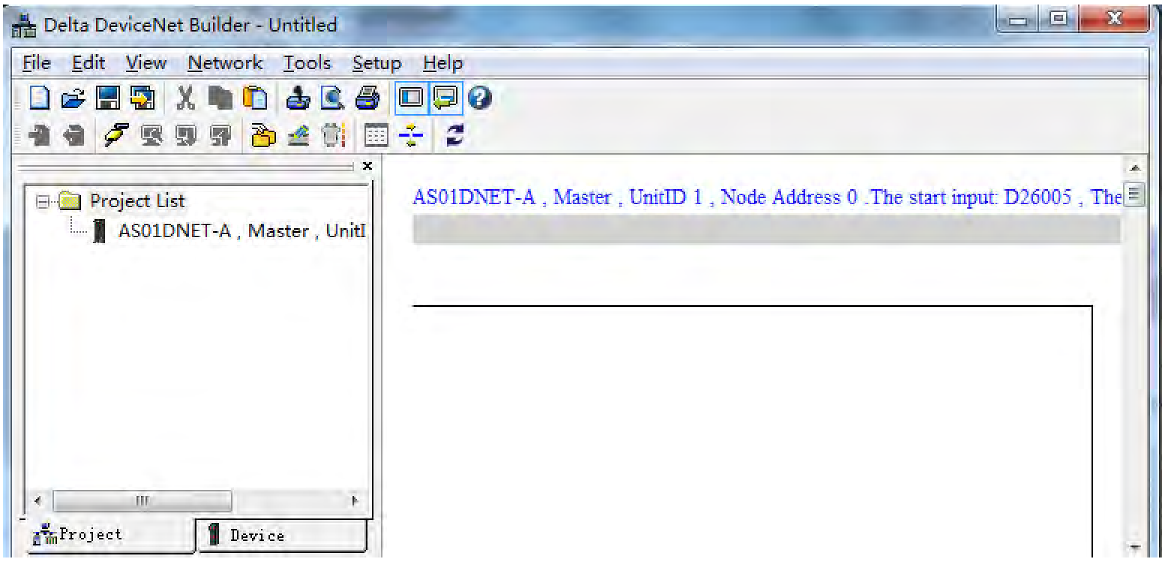
1. Opening the DeviceNet Builder software, the following window appears.



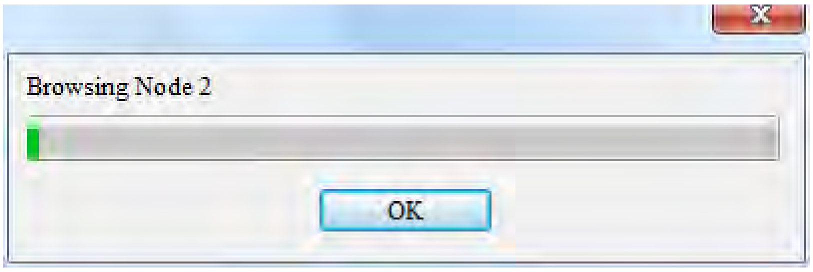

2. Selecting **Setup**>> **Communication Setting**, the following dialog box appears. Select the driver for connection of AS PLC and PC as below. Click **OK** to finish the selection of Driver.



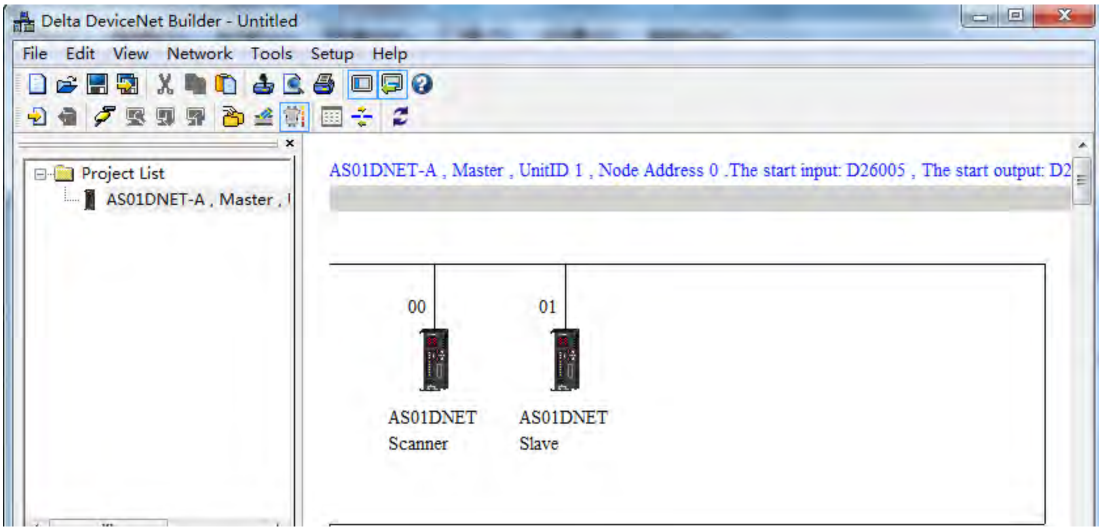
3. Click **Network** >> **Online** to scan the connected master.




4. Clicking **Network**>> **Scan DeviceNet Network**, the DeviceNet Builder software starts to scan the whole network.

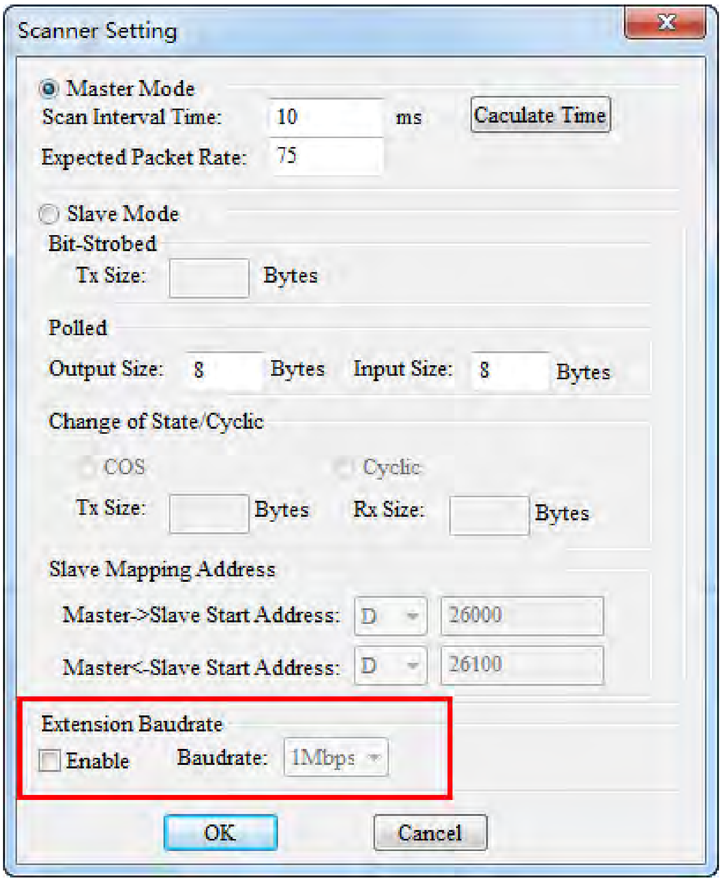



5. After scanning is finished, all node icons and device names which have been scanned in the network will appear on the following interface. The node address of AS01DNET-A is 00 in this example.




10

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.

# 10.5 RTU Mode

## 10.5.1 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.

### 10.5.2 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.

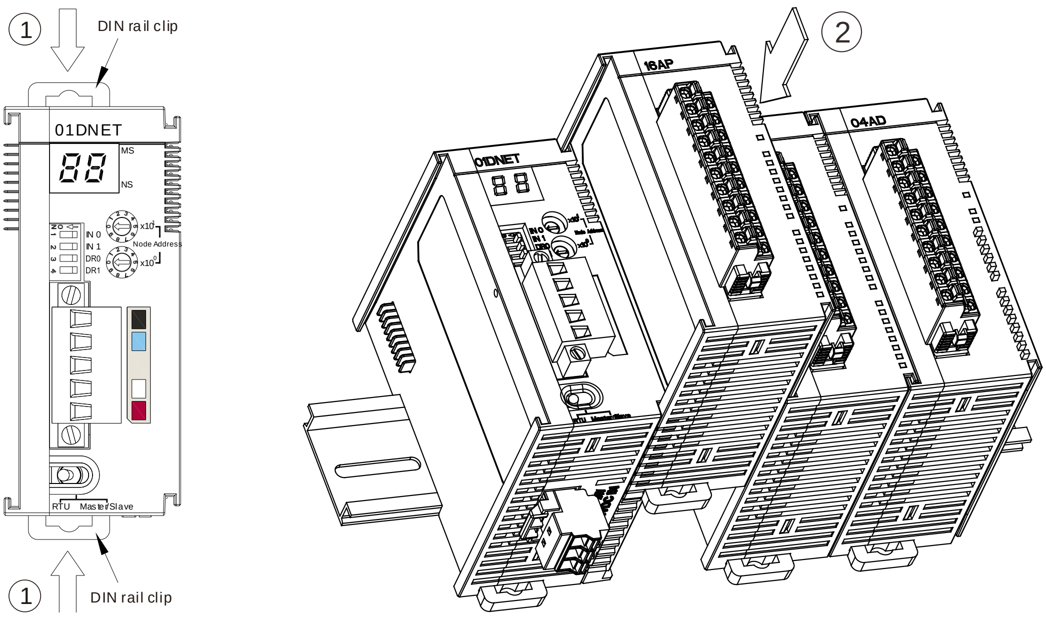
## 10.5.3 Installation

### 10.5.3.1. Installing AS01DNET (in RTU Mode)

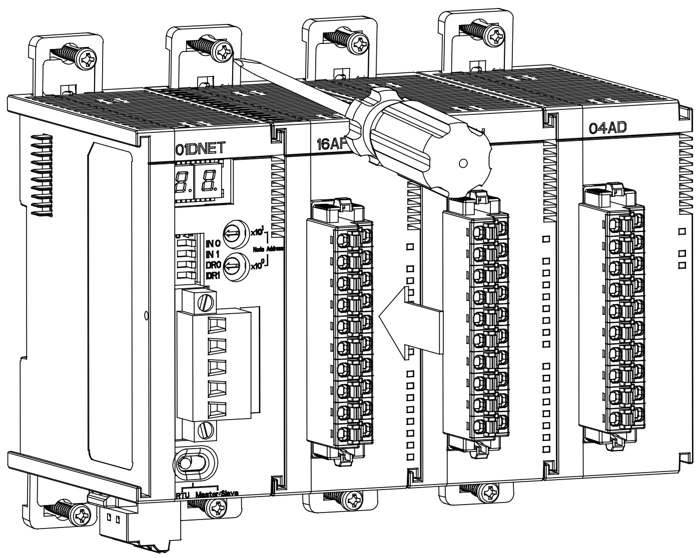
#### 10.5.3.1.1. Connecting AS01DNET-A (in RTU Mode) and Extension Module on DIN Rail

- 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.

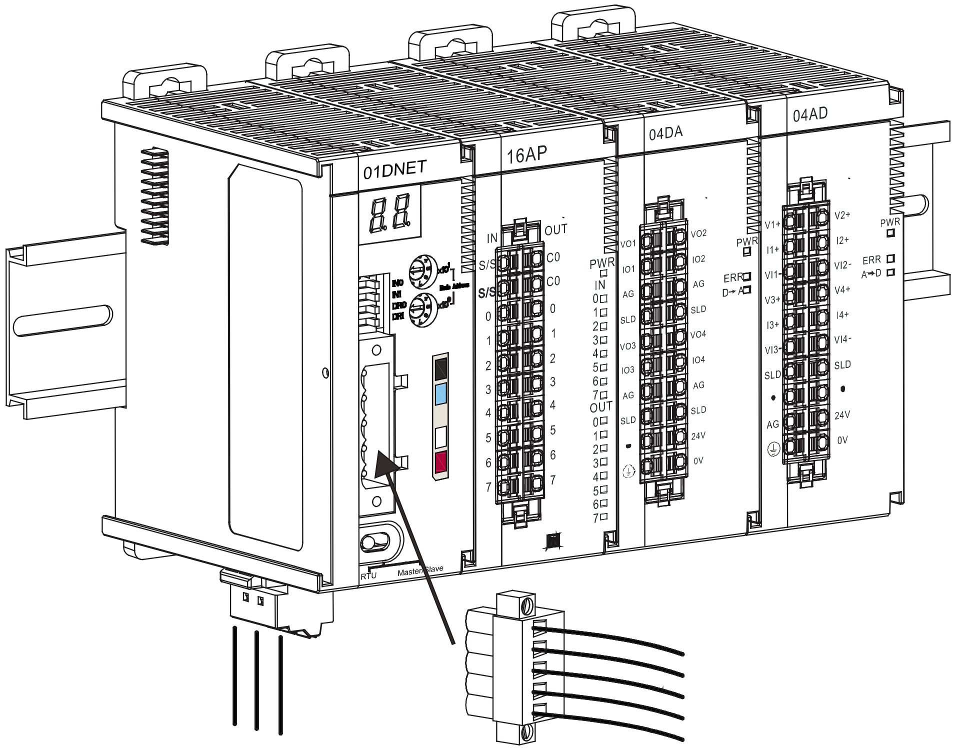



- Tighten the screws on the top of the module at the end of installing.



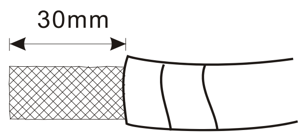
### 10.5.3.1.2. Connecting the DeviceNet Communication Connector

- 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.

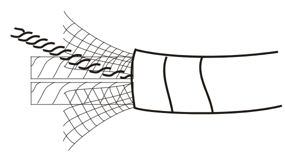



## 10.5.3.2. Connecting the Cable to DeviceNet Connector

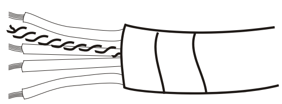
- Use an efficient tool to peel the communication cable for approx. 30mm. DO NOT damage the shielded cable during the peeling.



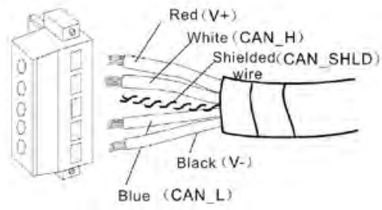

- Peel off the metallic shielded net and foil, and you will see 2 power cables (red and black), 2 signal cables (blue and white) and 1 shielded cable.



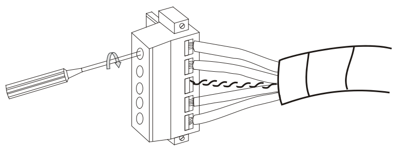
- Peel off the exterior metallic shielded net, foil and the plastic cover of the power cable and signal cable for appropriate length.



- 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.



## 10.5.4 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.

### 10.5.4.1. 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.<br>Refer to 10.5.4.3.4 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 |

| No | Name | Unit | Description |
|---|---|---|---|
| | | | 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 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. |

## 10.5.4.2. 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.)

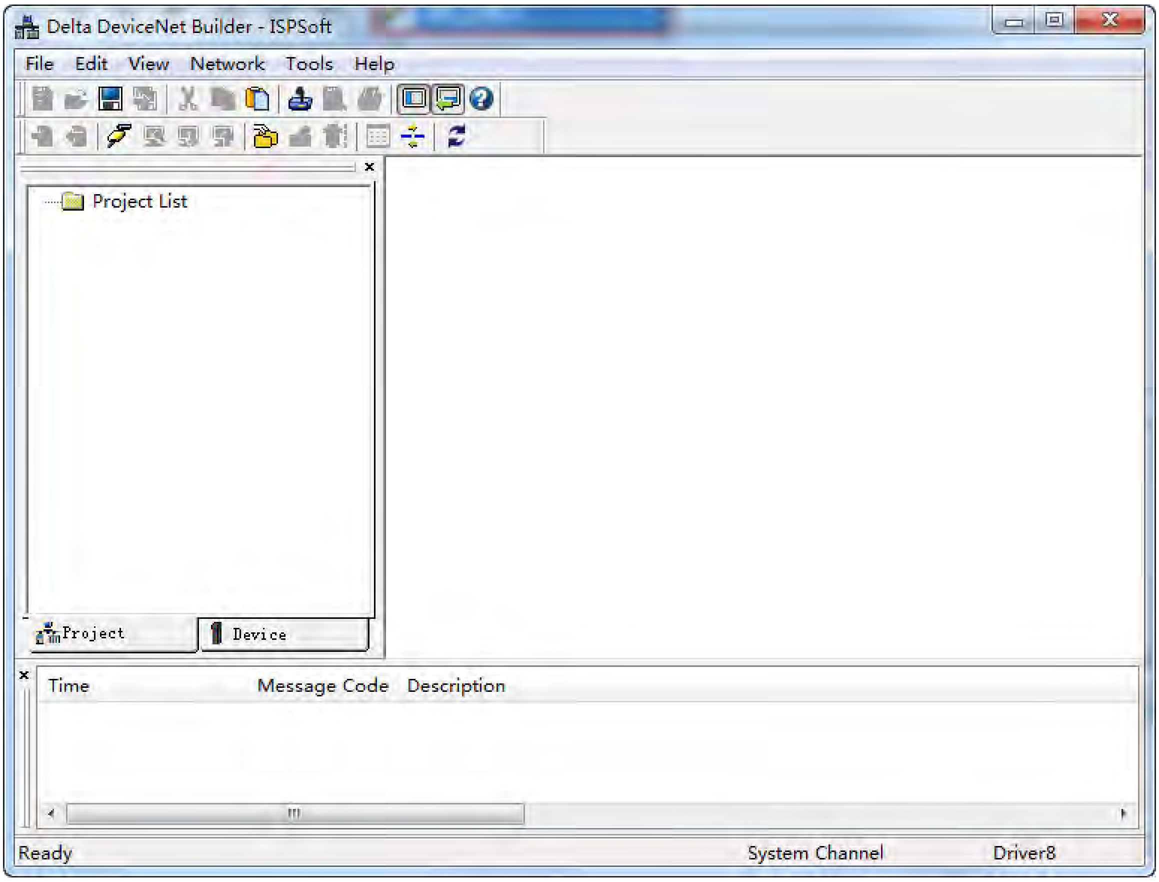
### 10.5.4.2.1. Making a connection between DeviceNet Builder and PLC

Before making a normal connection between DeviceNet Builder and PLC, you have to do relevant setup for COMMGR software.

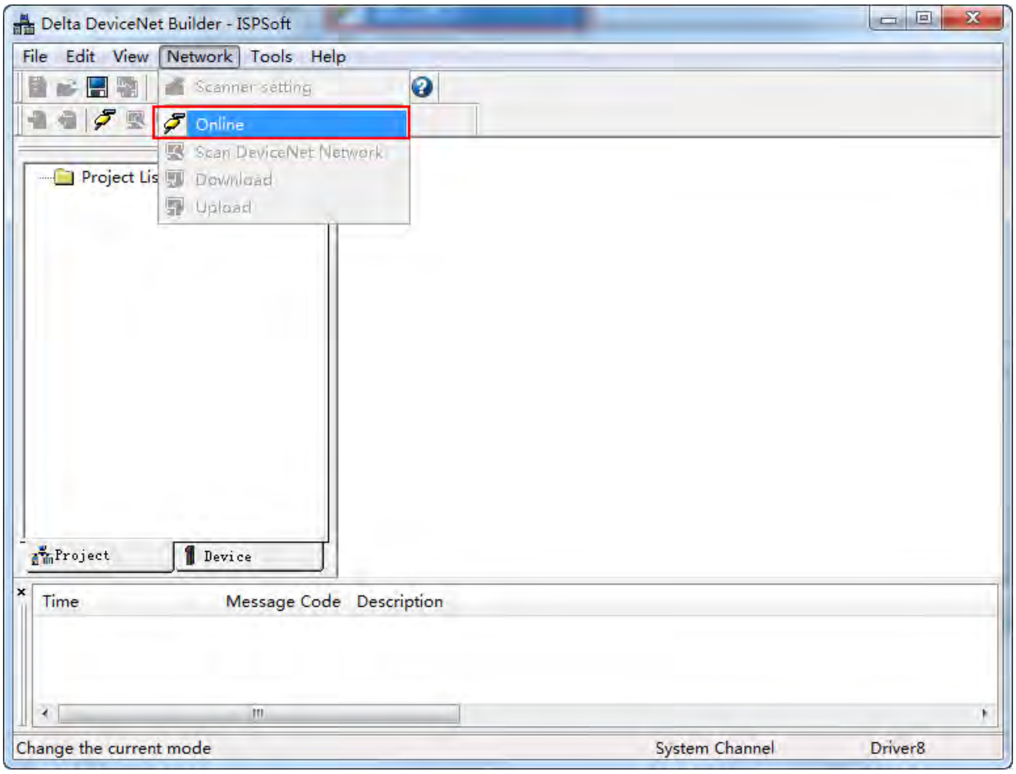
1. Build a driver through the COMMGR software.
   Refer to Section 2.4 Communication Setting in ISPSoft help file.

2. Call DeviceNet Builder via ISPSoft
   Refer to section 10.6 for details on how to operate.

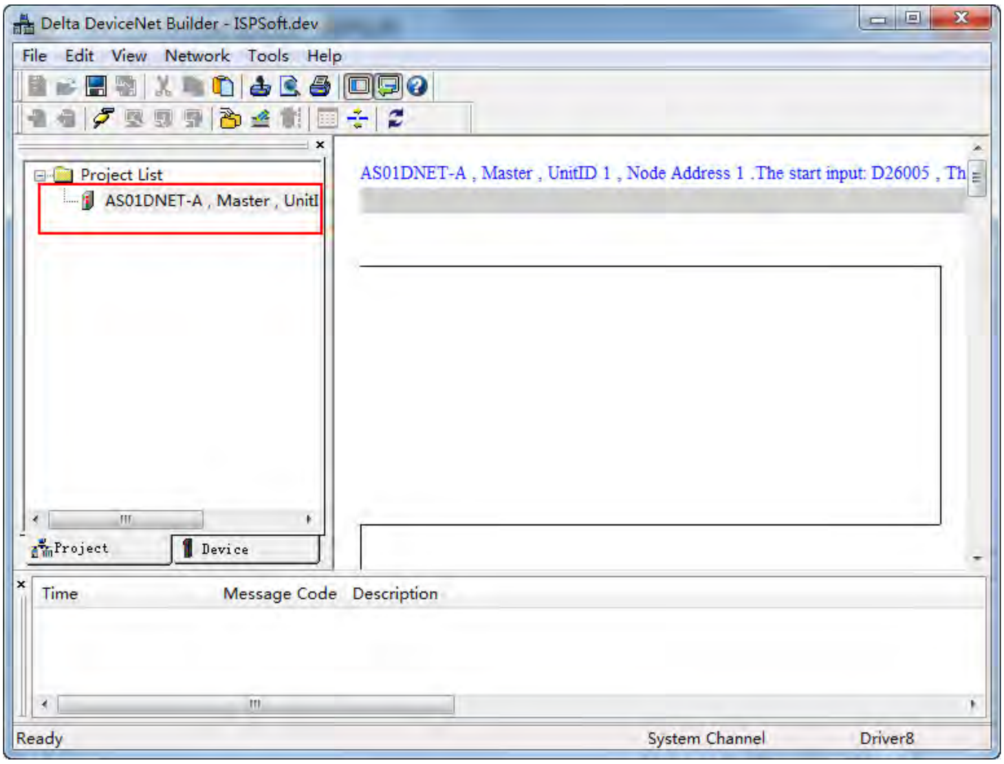
3. The called DeviceNet Builder is started as below.



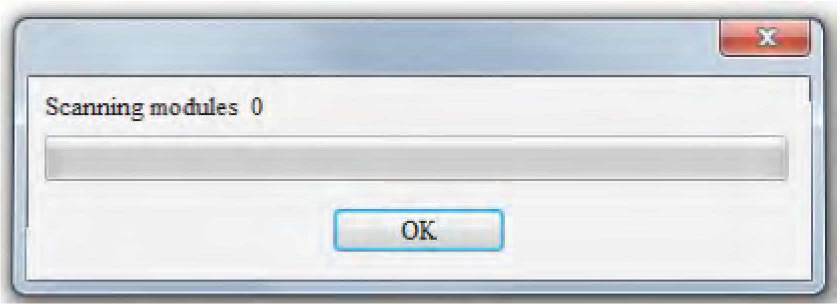
4. Click menu **Network>> Online**.



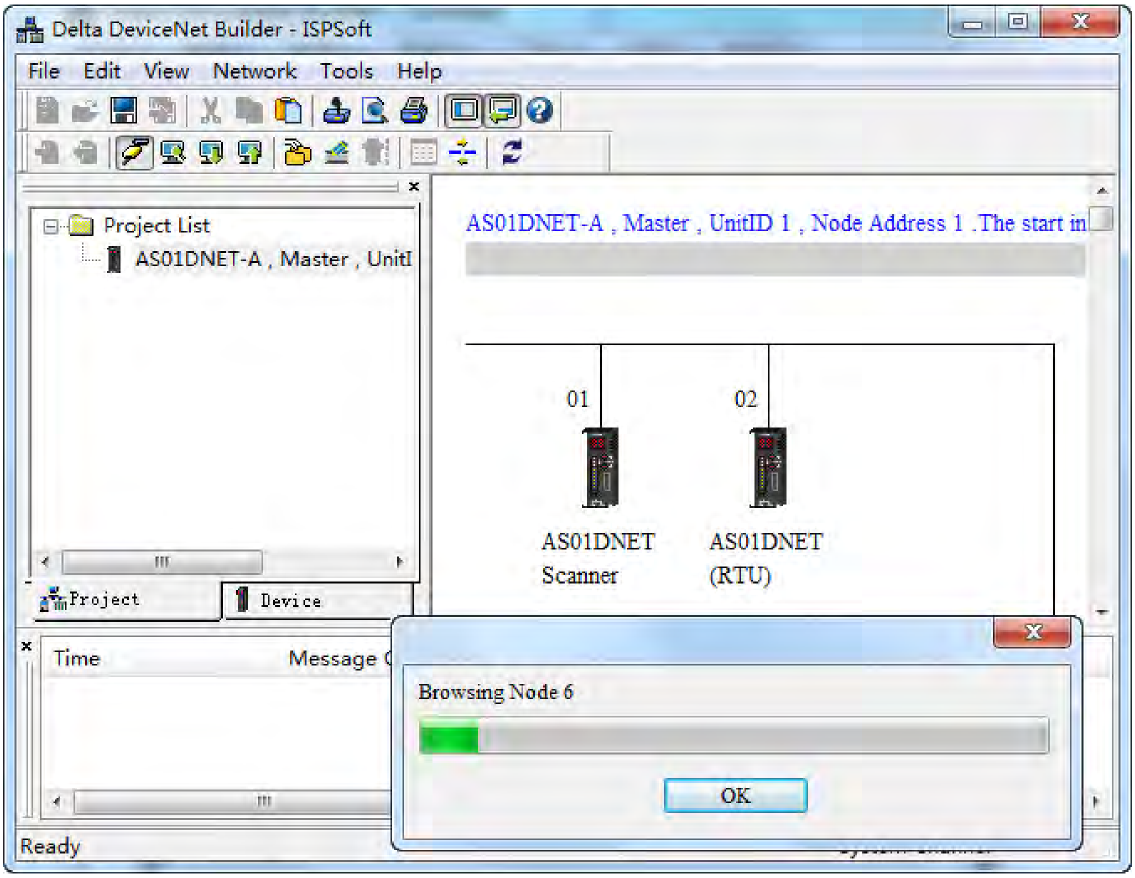

The master module AS01DNET-A which has been scanned is shown in the left-side Project List.



5. Click **Network >> Scan DeviceNet Network**.



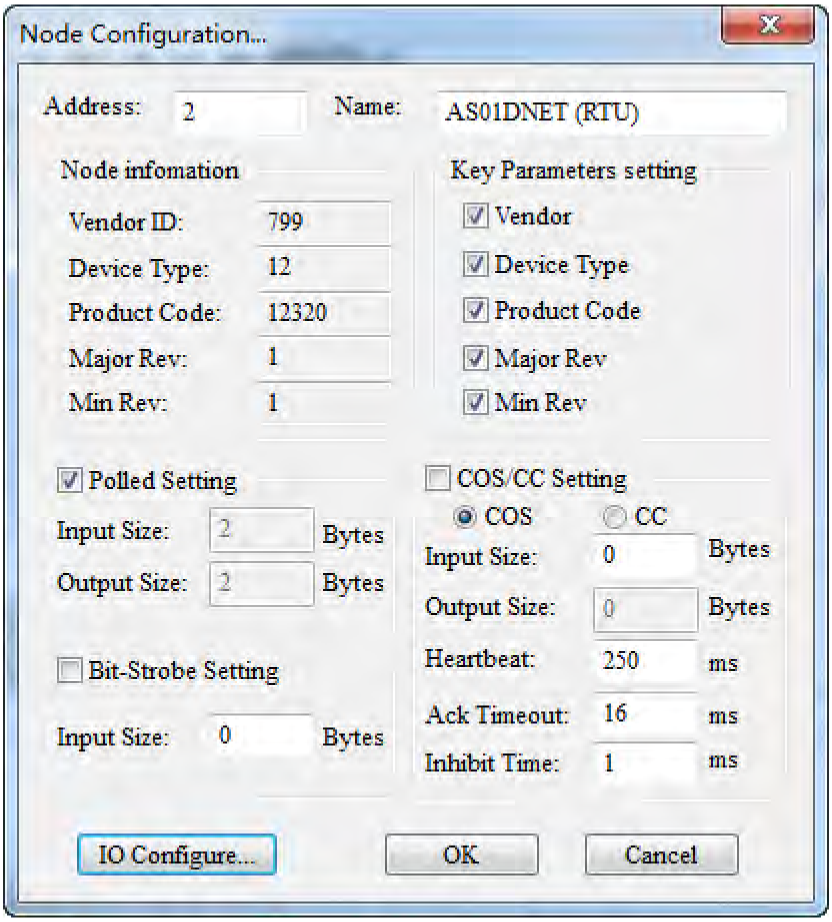

6. After online is implemented, click the **Scan DeviceNet Network** button to start scanning the nodes in the network.



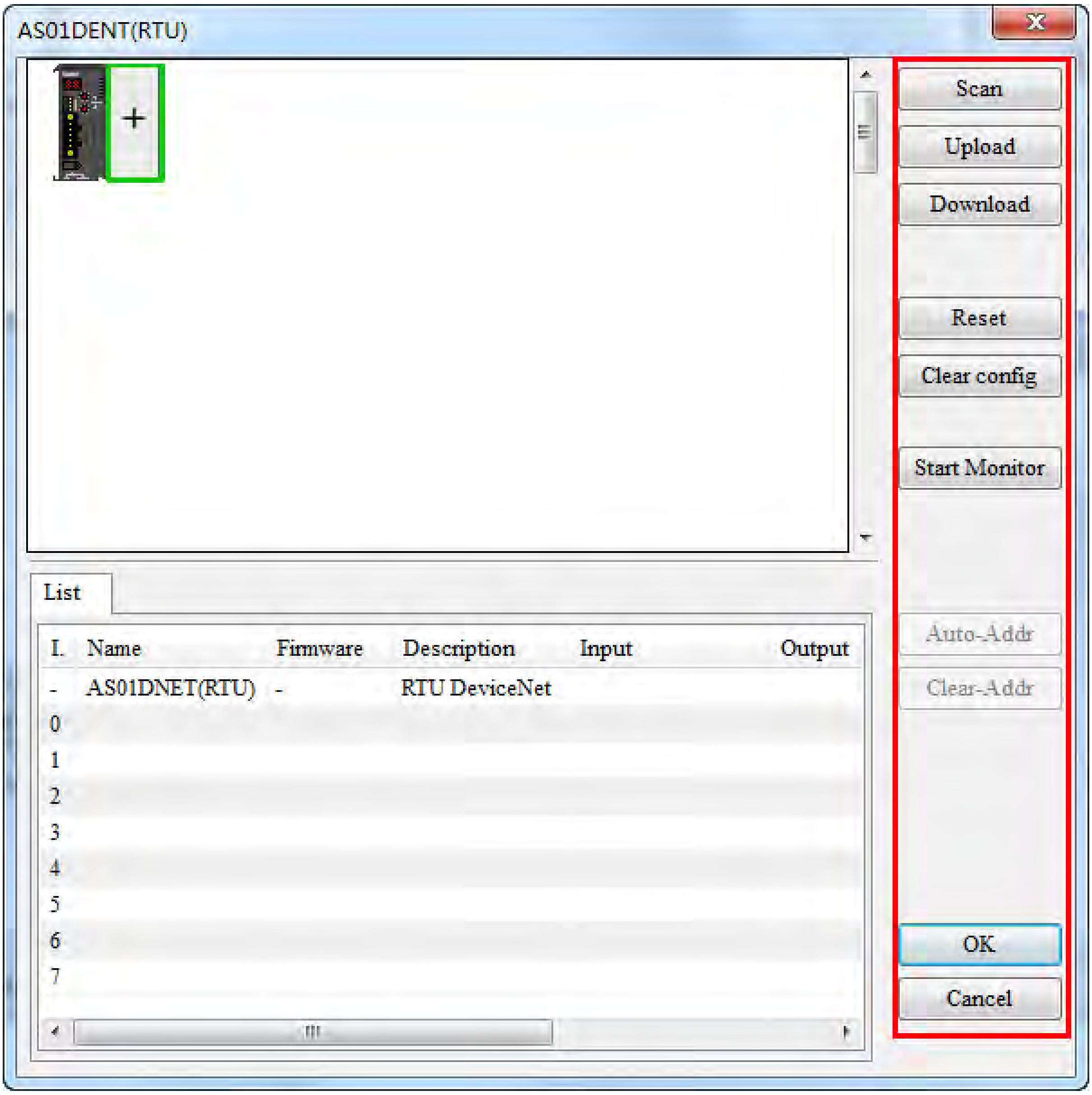
#### 10.5.4.2.2. Main Configuration Page of AS01DNET (RTU)

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.



2. Click the **I/O Configure…** button in the **Node Configuration…** window. Then the main configuration page appears as below.



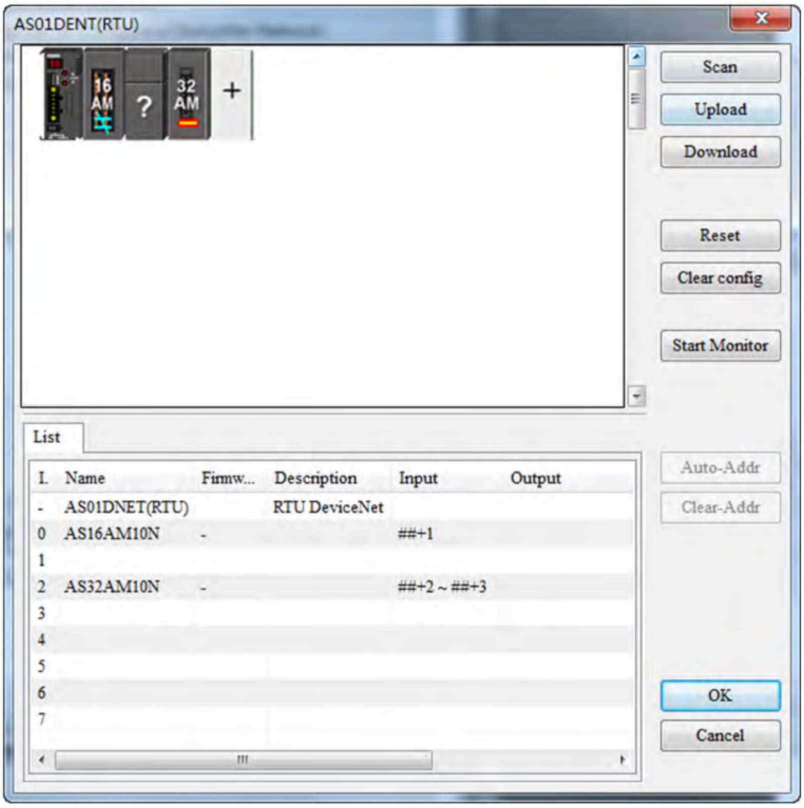

Explanation of parameters on the AS01DNET (RTU) configuration page

| 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. |

10

| Item | Description |
|---|---|
| Clear config | Clear the configuration data stored in the latched area and automatically reset the configuration. Then the indicator displays F1. |
| 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.



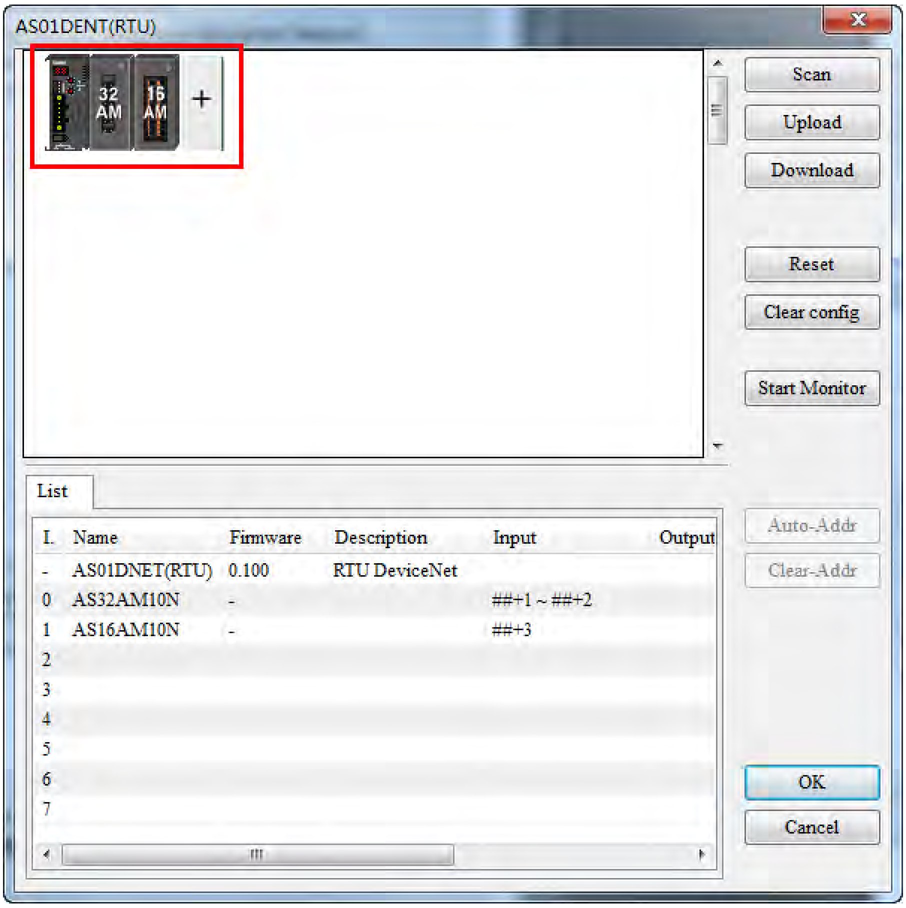
After the I/O modules connected to AS01DNET (RTU) are scanned, abnormal icons may appear.

Here is the list of abnormal icons.

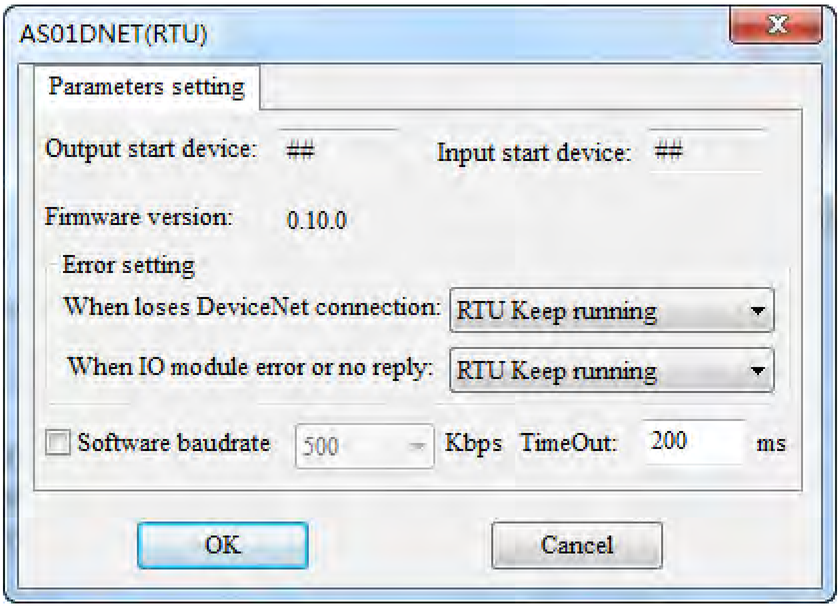
| | |
|---|---|
|  | The I/O module configured in the software does not match the current I/O module actually connected, e.g. the software configuration is AS32AM, but the actually connected module is AS16AP. So the abnormal icon such as left-side icon will appear after the scan. You can change it into 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. |

### 10.5.4.2.3. 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.

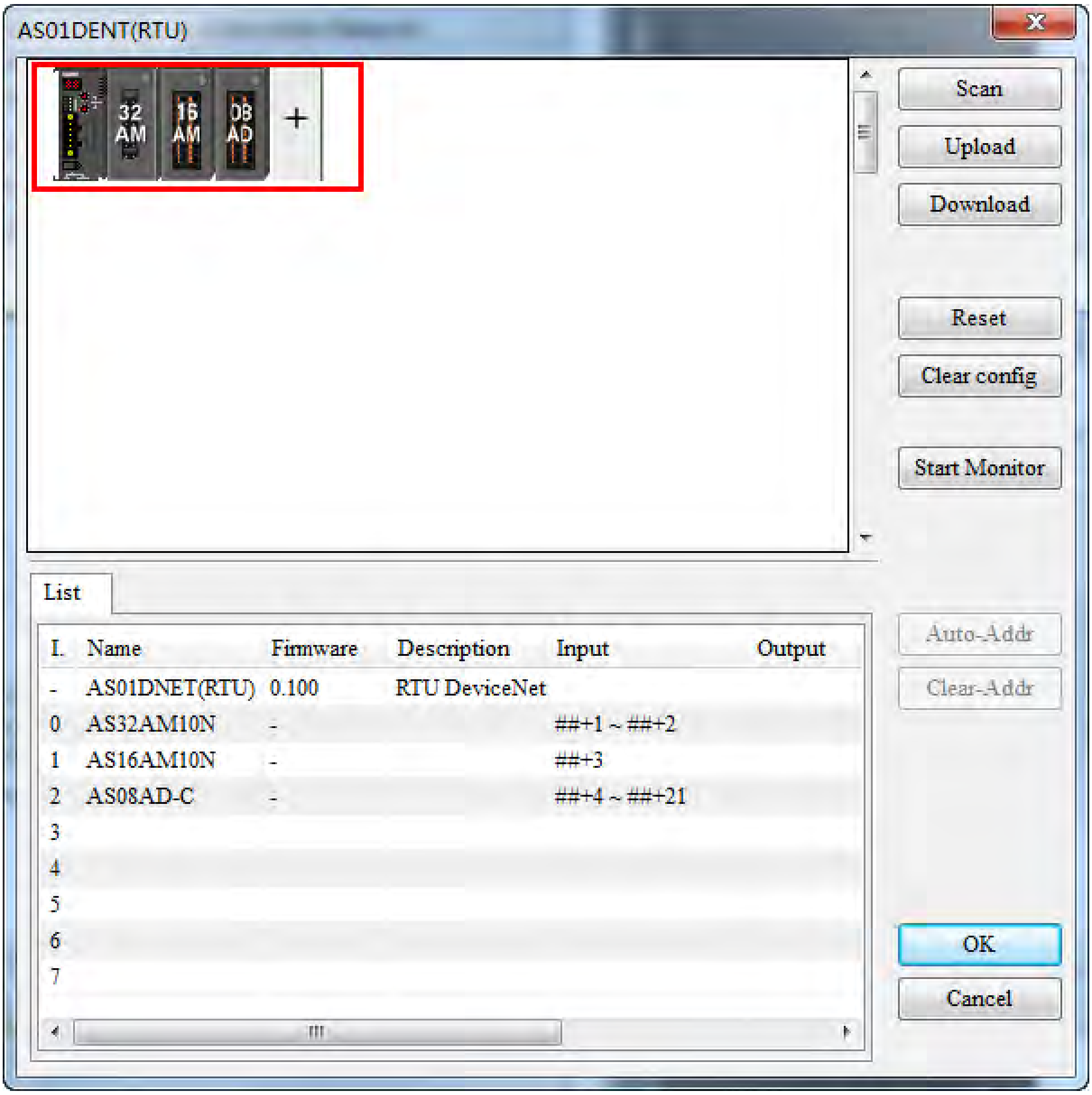



Explanation of AS01DNET (RTU) parameter setup:

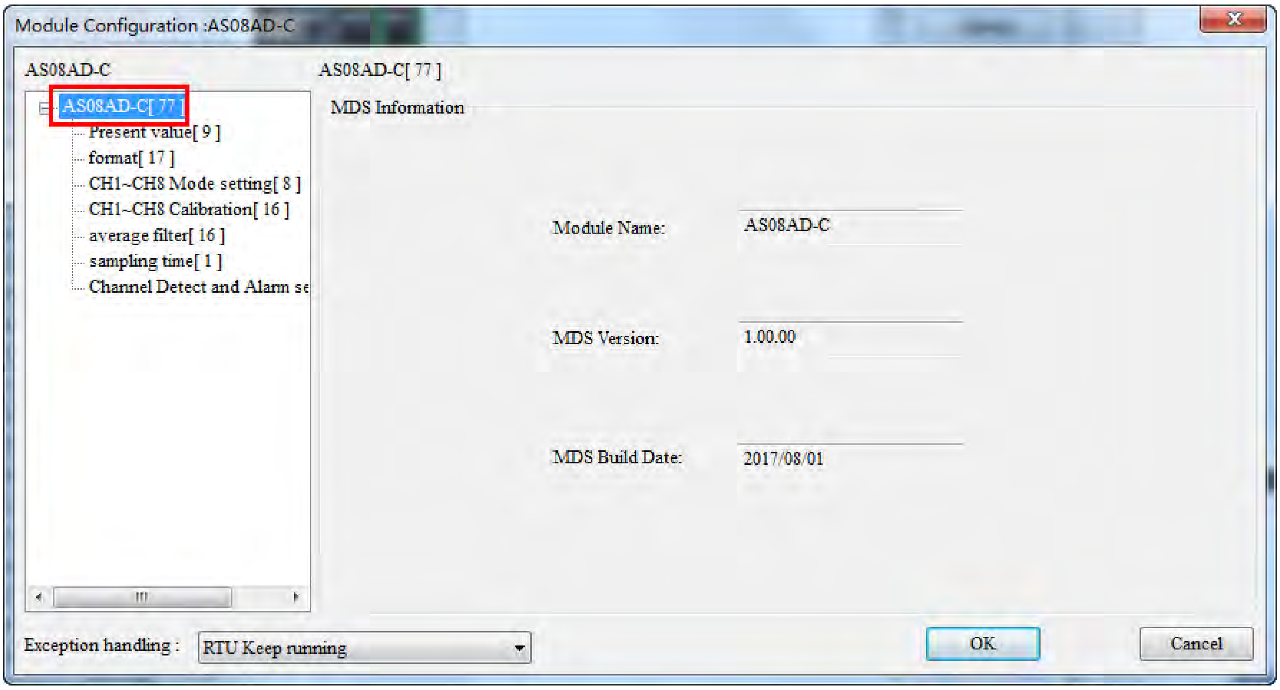
| Item | Description | Default |
|---|---|---|
| Output start address | The start output address of AS01DNET (RTU), occupying one word. | None |
| Input start address | The start input address of AS01DNET (RTU), occupying one word. | None |
| When loses DeviceNet connection | AS01DNET (RTU)'s error handling 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.<br>Refer to section 10.2.6 for details on function switch. | None |
| Firmware version | Displays the firmware version of AS01DNET (RTU). | None |

### 10.5.4.2.4. 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.

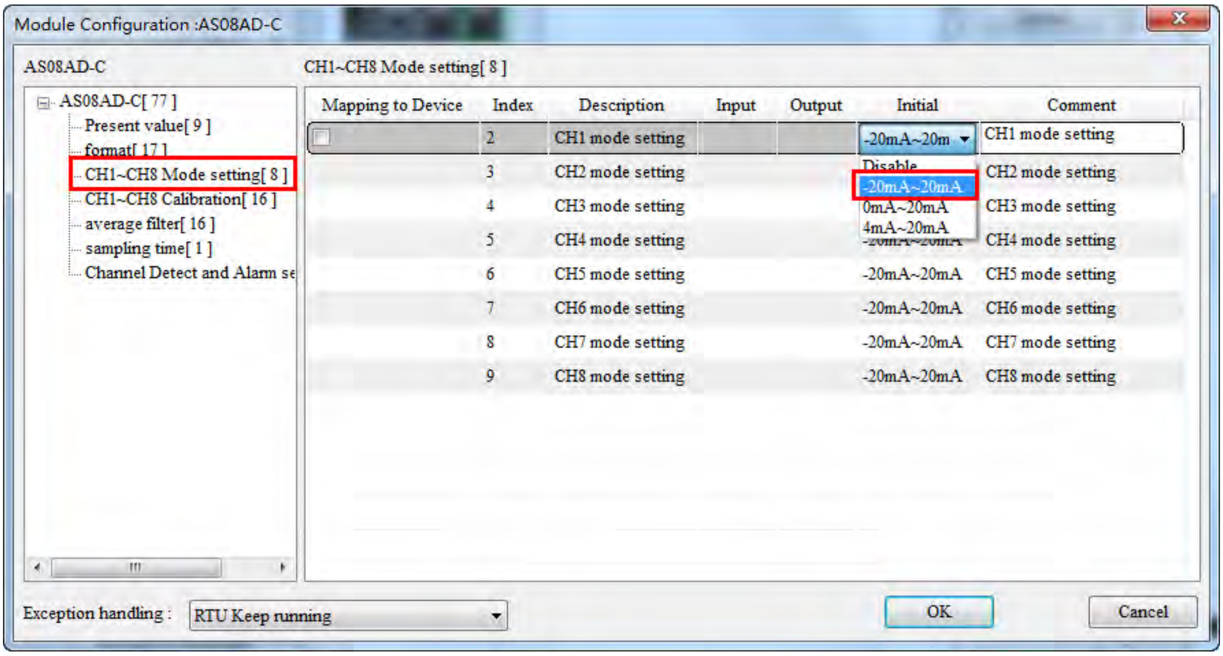



Explanation of I/O module configuration interface:

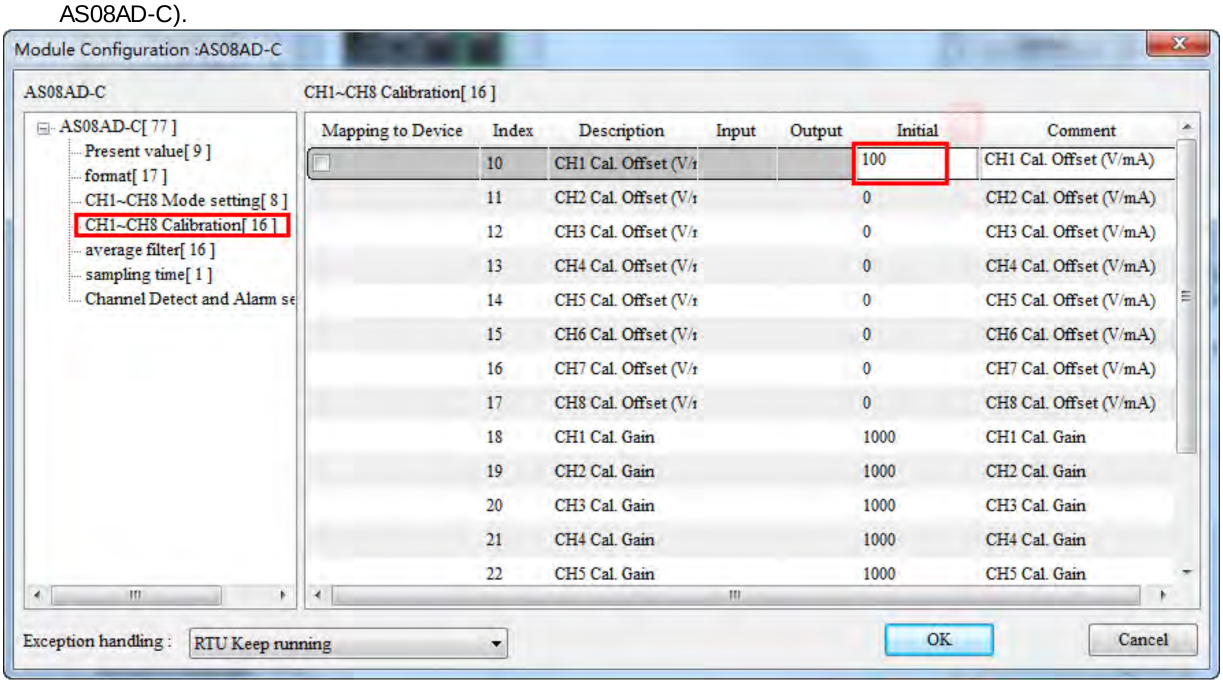
| Item | Description |
|---|---|
| MDS information | Displays module name, MDS version and creation date. The module parameters will be shown in the left-side window based on the MDS file. For explanation of module parameters, refer to the relevant module manual. |
| I/O parameter list | Displays all 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.

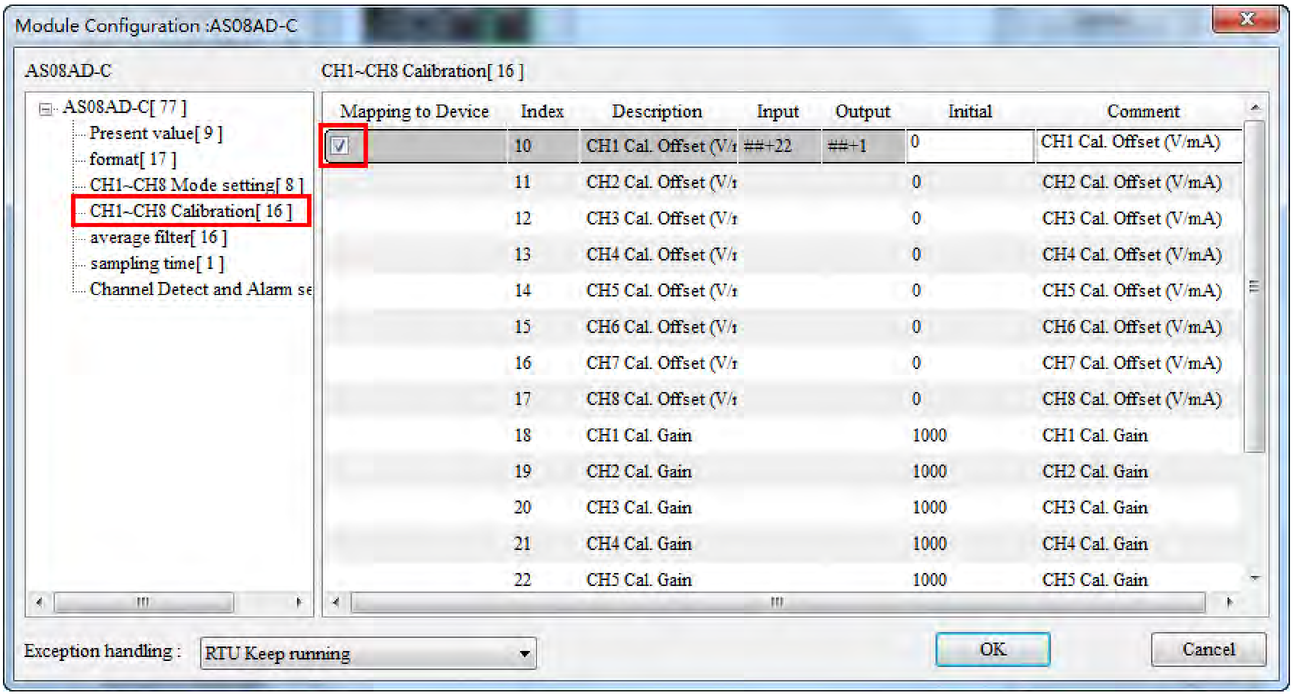
Case 1: Select one appropriate parameter value from the drop-down list in the **Initial** column, e.g. select -20Ma~+20mA as channel 1 input mode of AS08AD-C.




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).

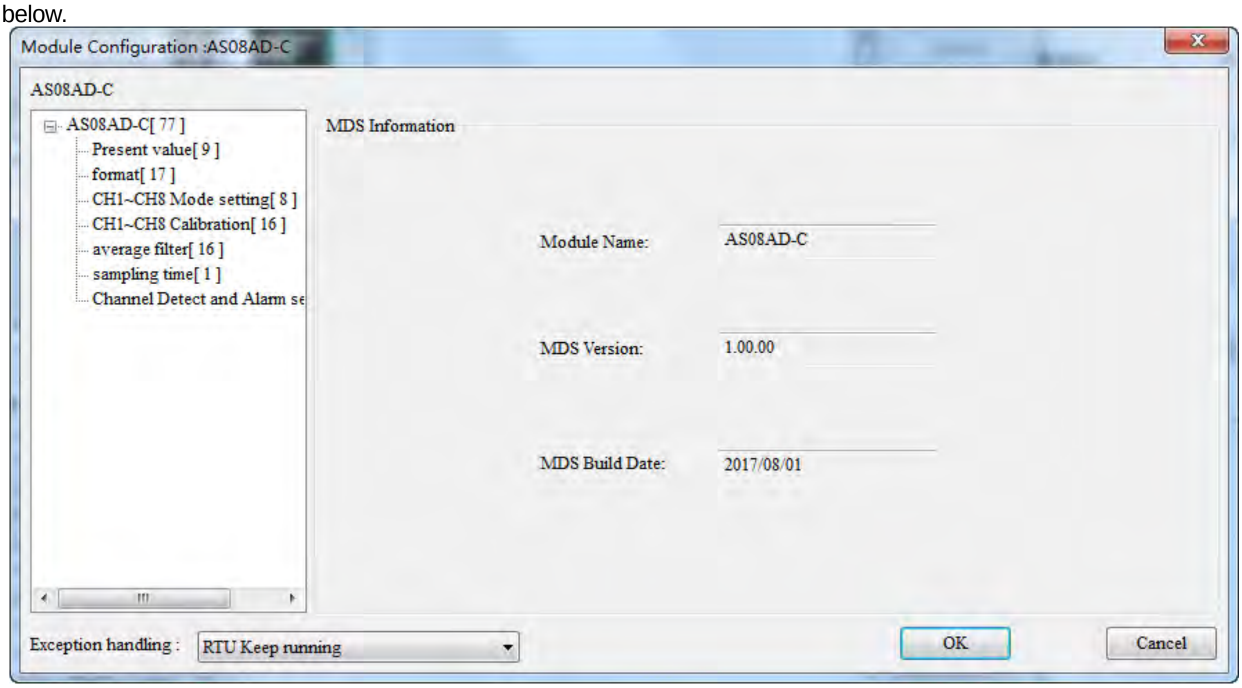


Case 3: For the module parameter which need be monitored in real time or need be modified in its value, tick the desired parameter in the **Mapping to Device** column and then the corresponding value of the parameter will map to the bus data for exchange i.e. the D registers in PLC. After the values 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.

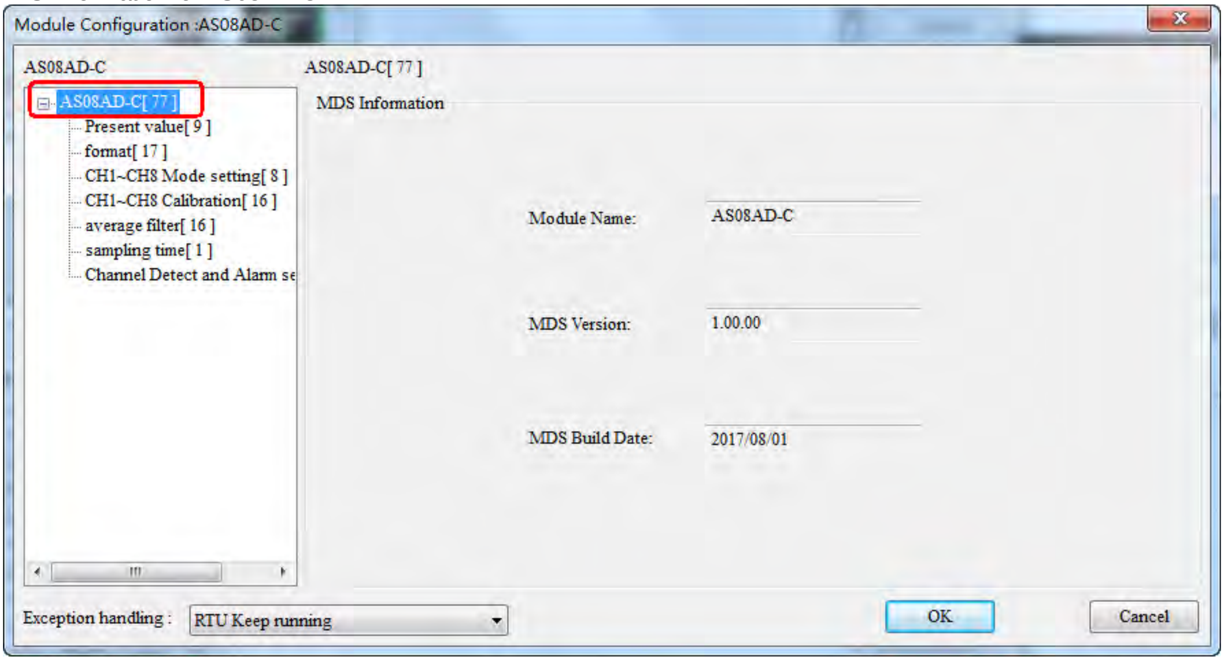



- **Explanation of IO module parameters**

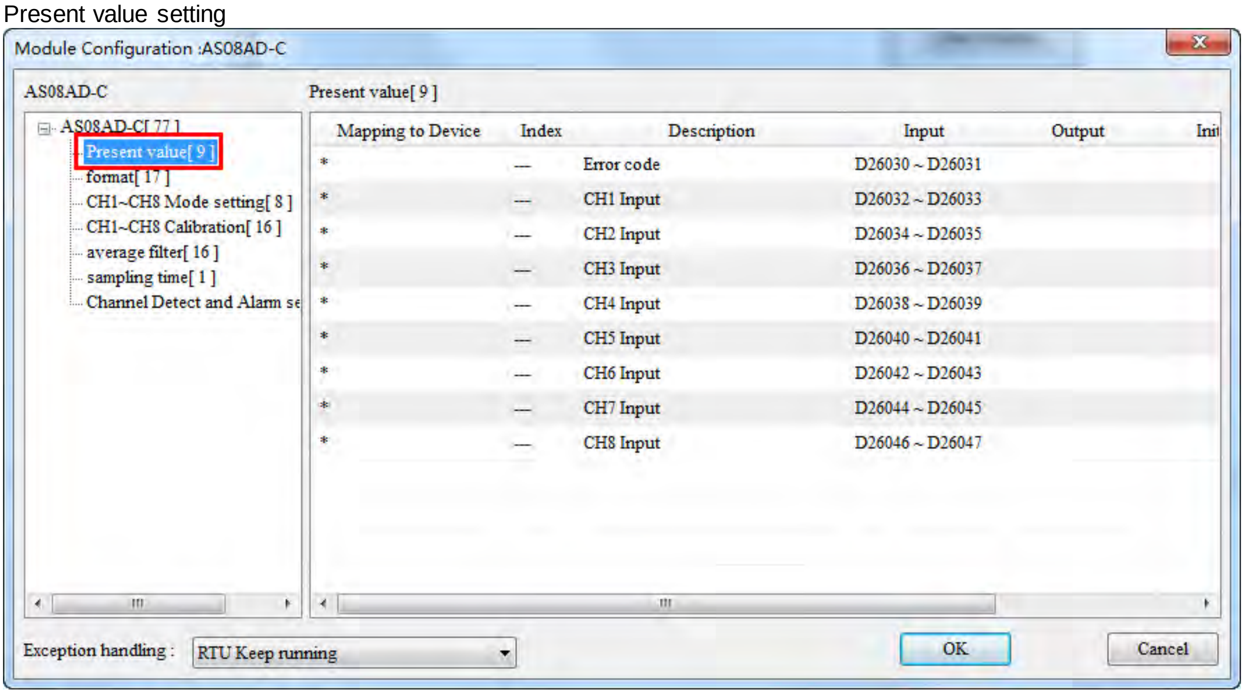
Double click the icon of AS08AD-C module. Then the **Module Configuration: AS08AD-C** dialog box comes out as below.



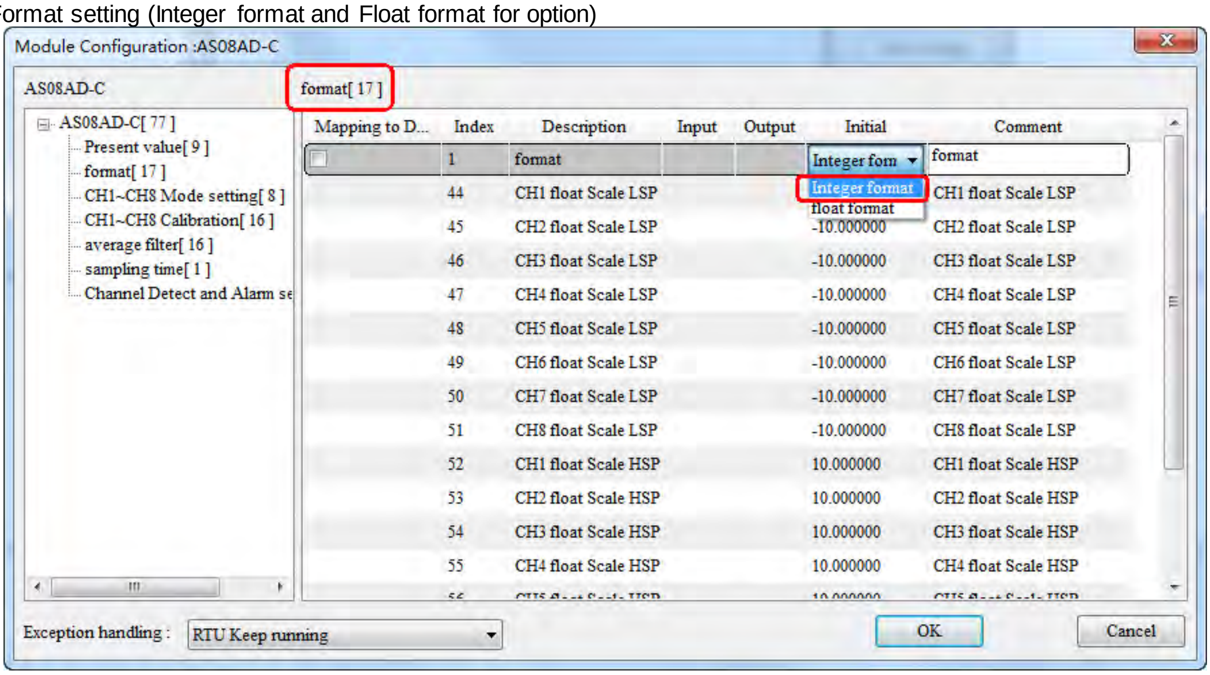
MDS information of AS08AD-C



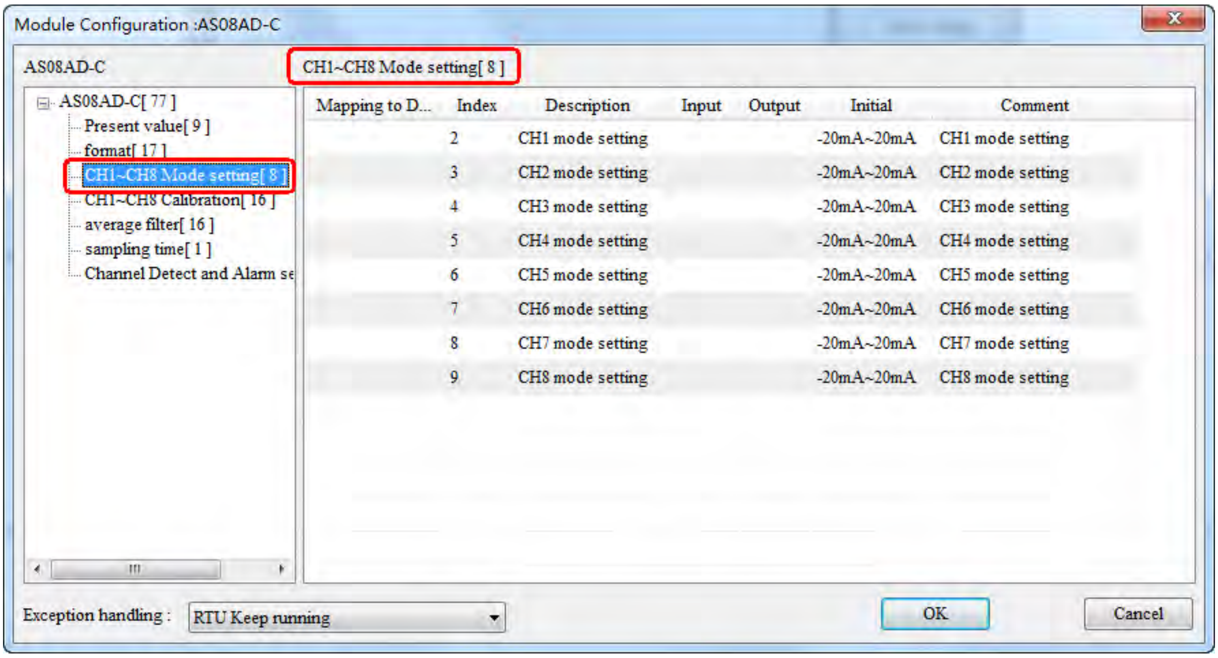

Present value setting



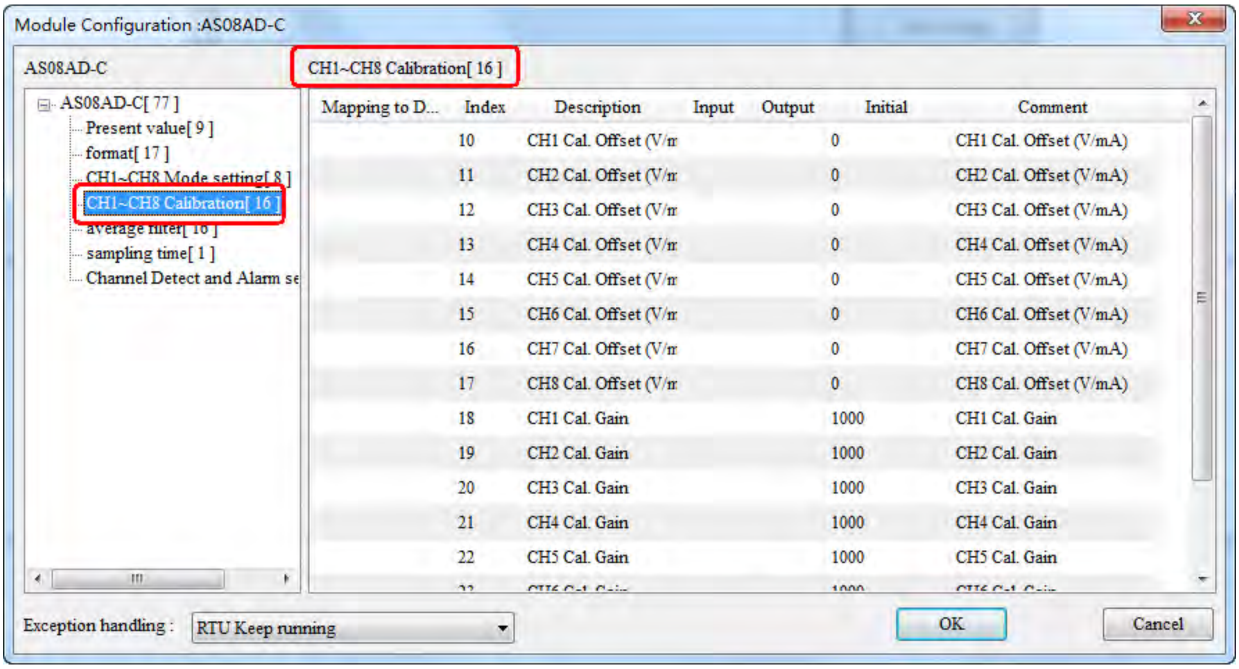
Format setting (Integer format and Float format for option)



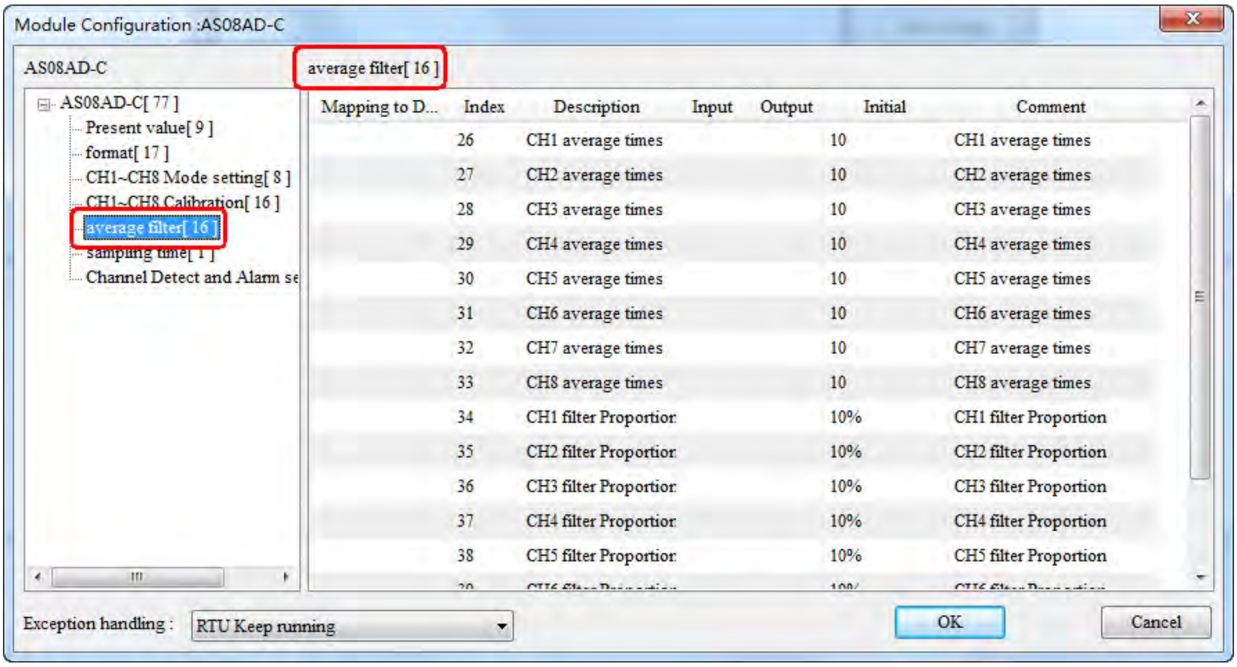

CH1~CH8 Mode setting【8】



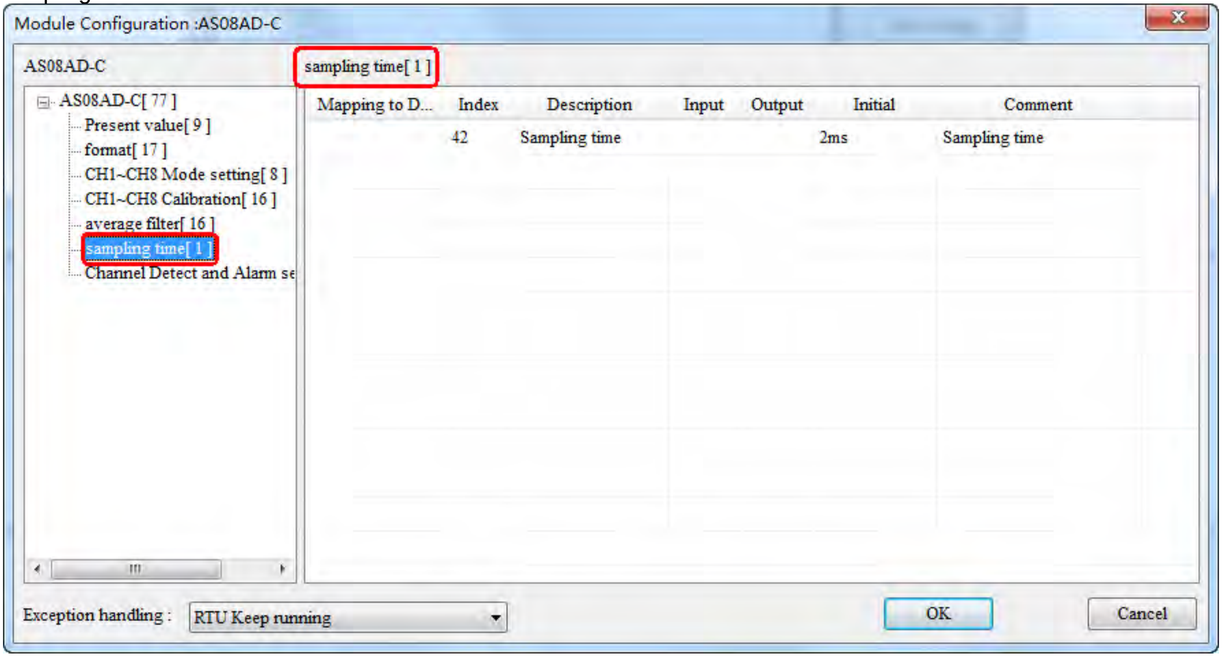
CH1~CH8 Calibration【16】



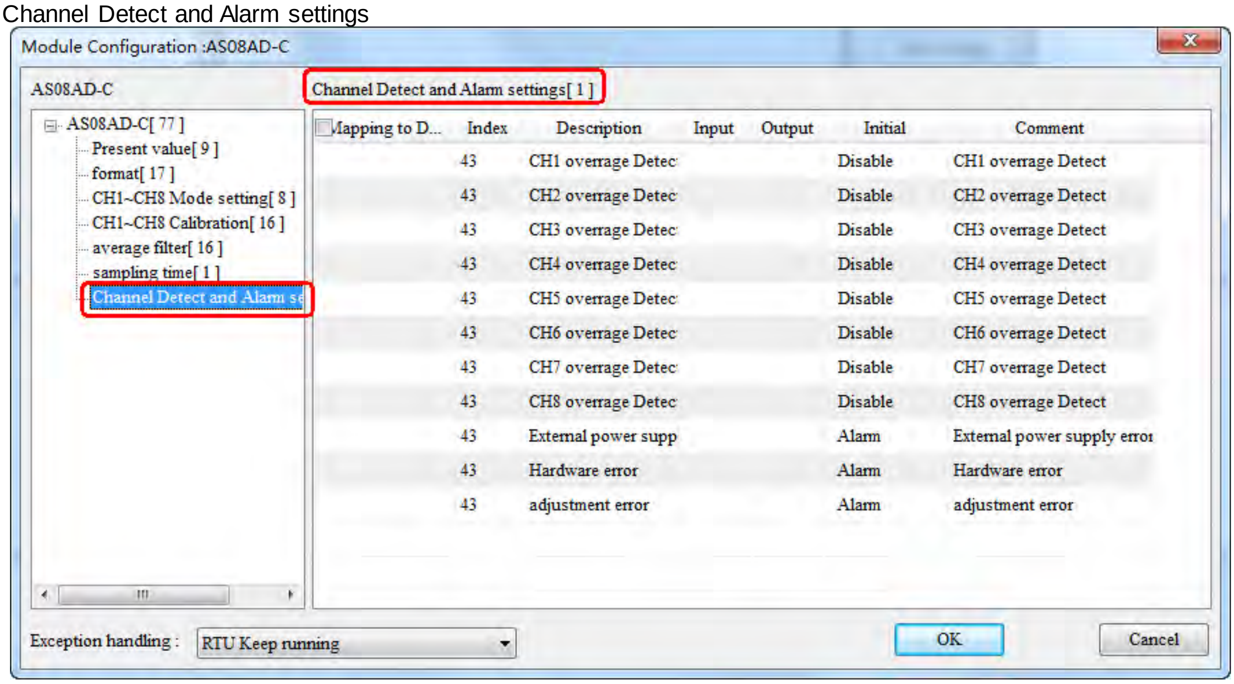

Average filter setting【16】



Sampling time

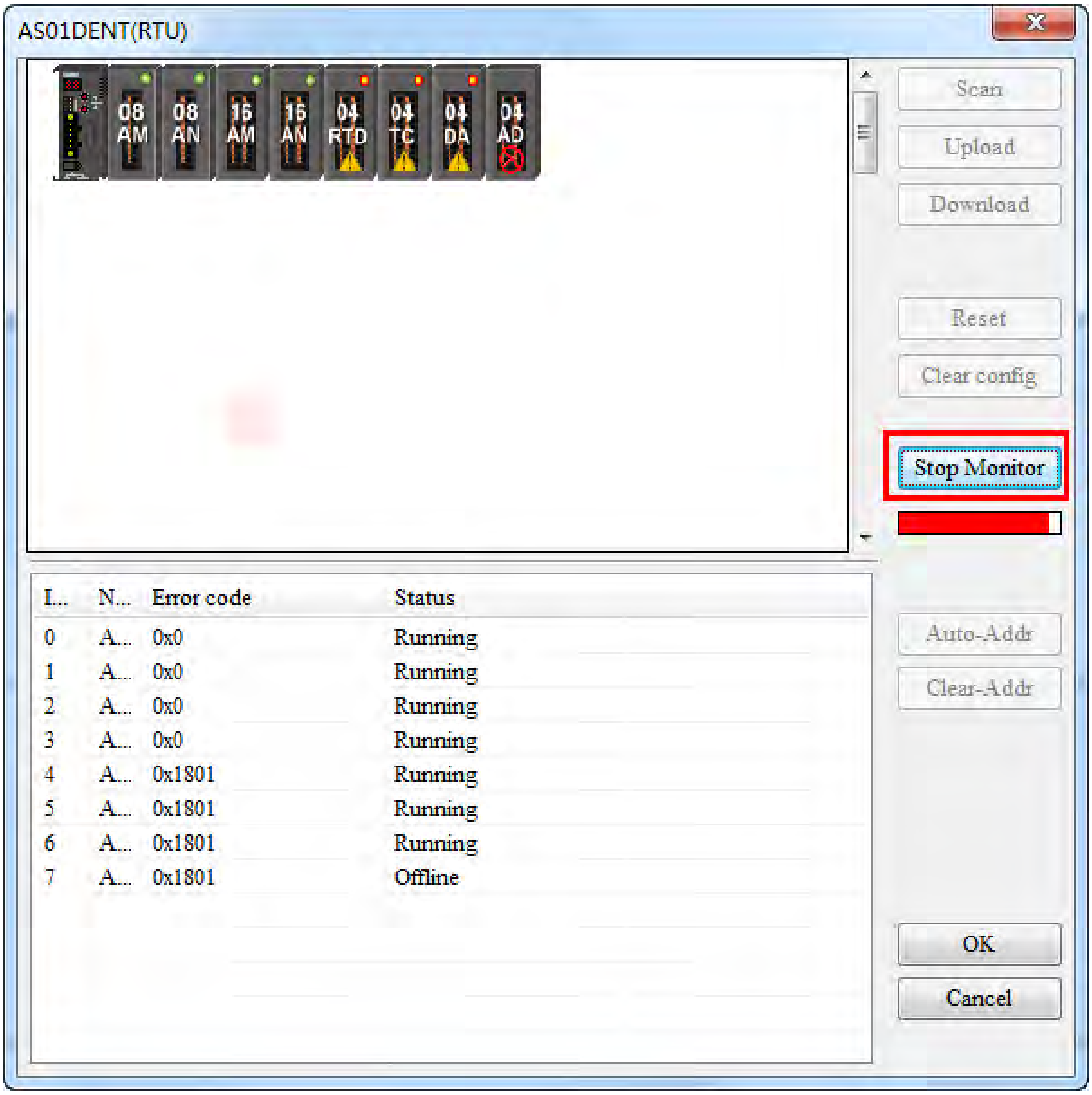



Channel Detect and Alarm settings

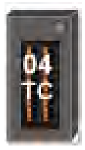


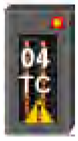
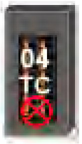
### 10.5.4.2.5. Monitor Function of the Software

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.

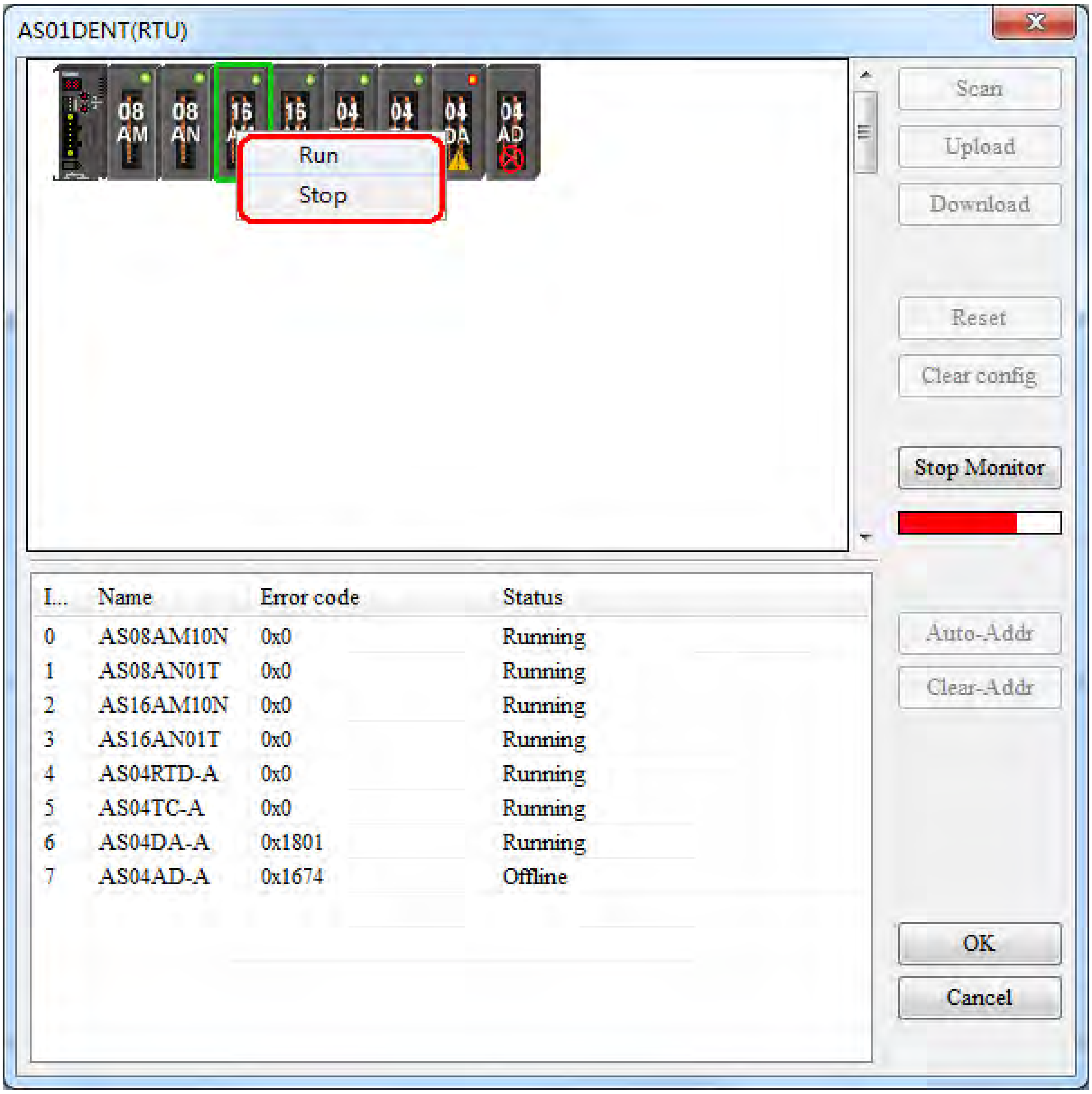



The list of operation state of modules:

| | |
|---|---|
|  | Indicates that the module is in the normal operation. |
|  | Indicates that the module is in the Stop state. |

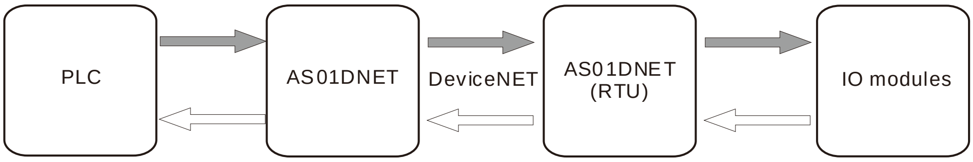
| | |
|---|---|
|  | Indicates that the module is in the warning or error state. For details on errors, refer to explanation of error codes in the related product manual. |
|  | Indicates that the actually connected module does not match the module configured in the software or currently configured module 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.



### 10.5.4.3. 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.

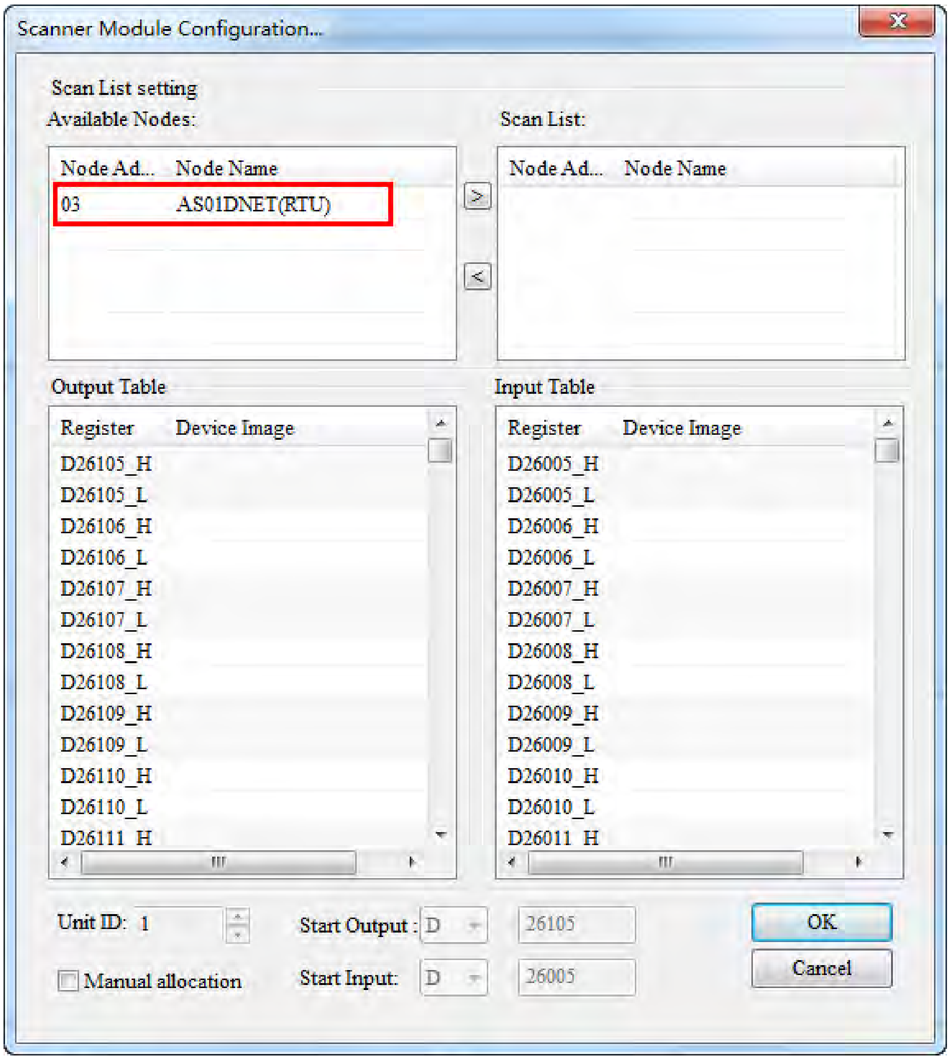



Note: All mapping addresses mentioned below means the D registers in the PLC.

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).

#### 10.5.4.3.1. The Rule for Assignment of Mapping Addresses by AS01DNET Master



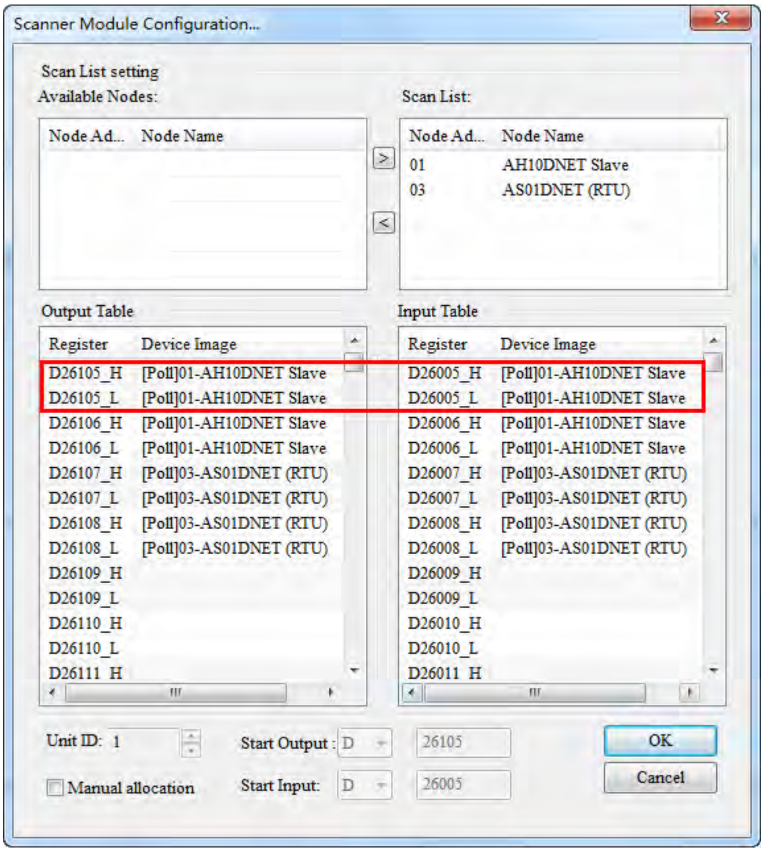
Data mapping areas are assigned according to the following table.

| 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 |

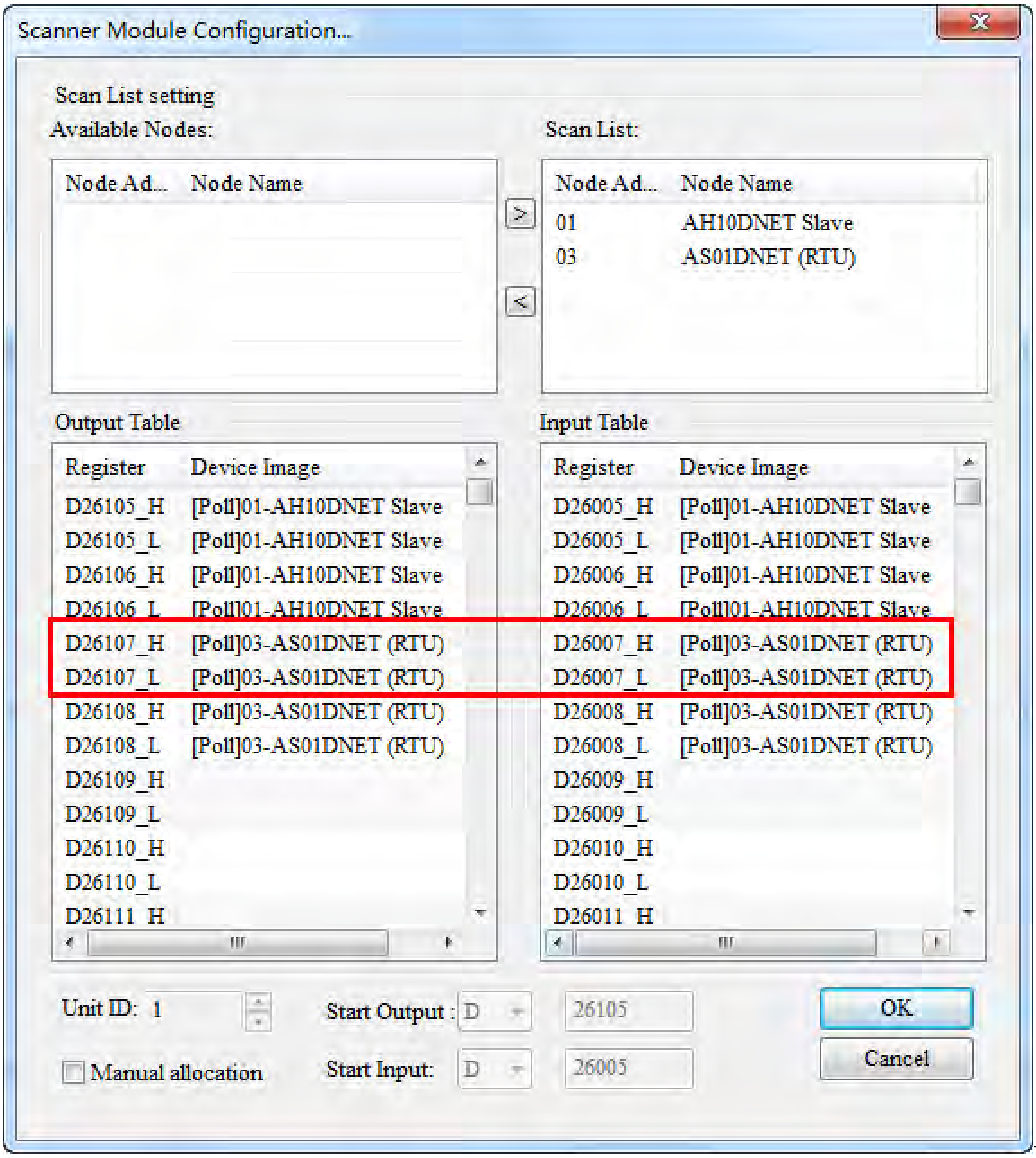
### 10.5.4.3.2. The Rule for Assignment of Mapping Addresses for AS01DNET (RTU)

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.



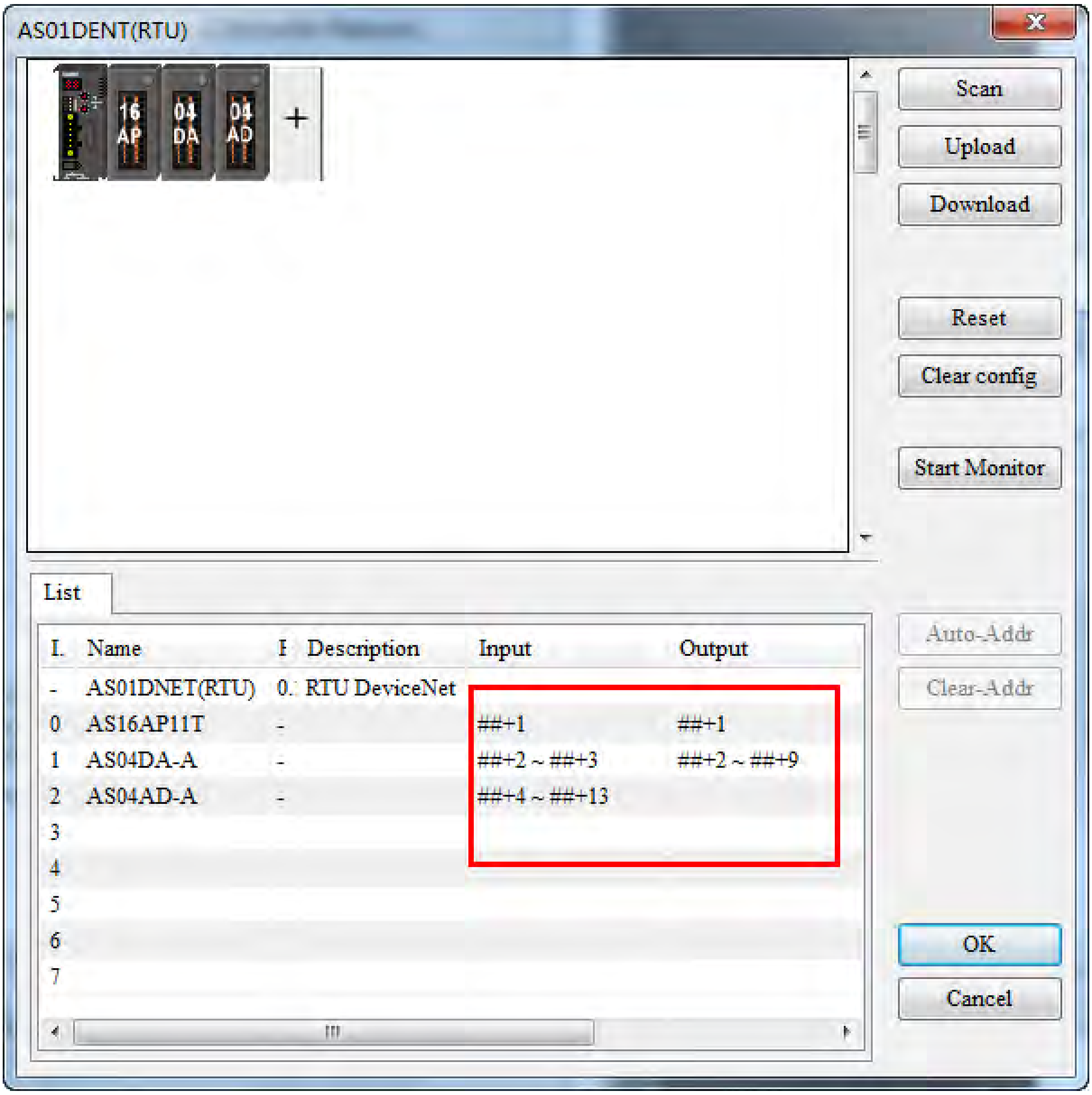

10

#### 10.5.4.3.3. The Rule for Assignment of Mapping Addresses for I/O Modules

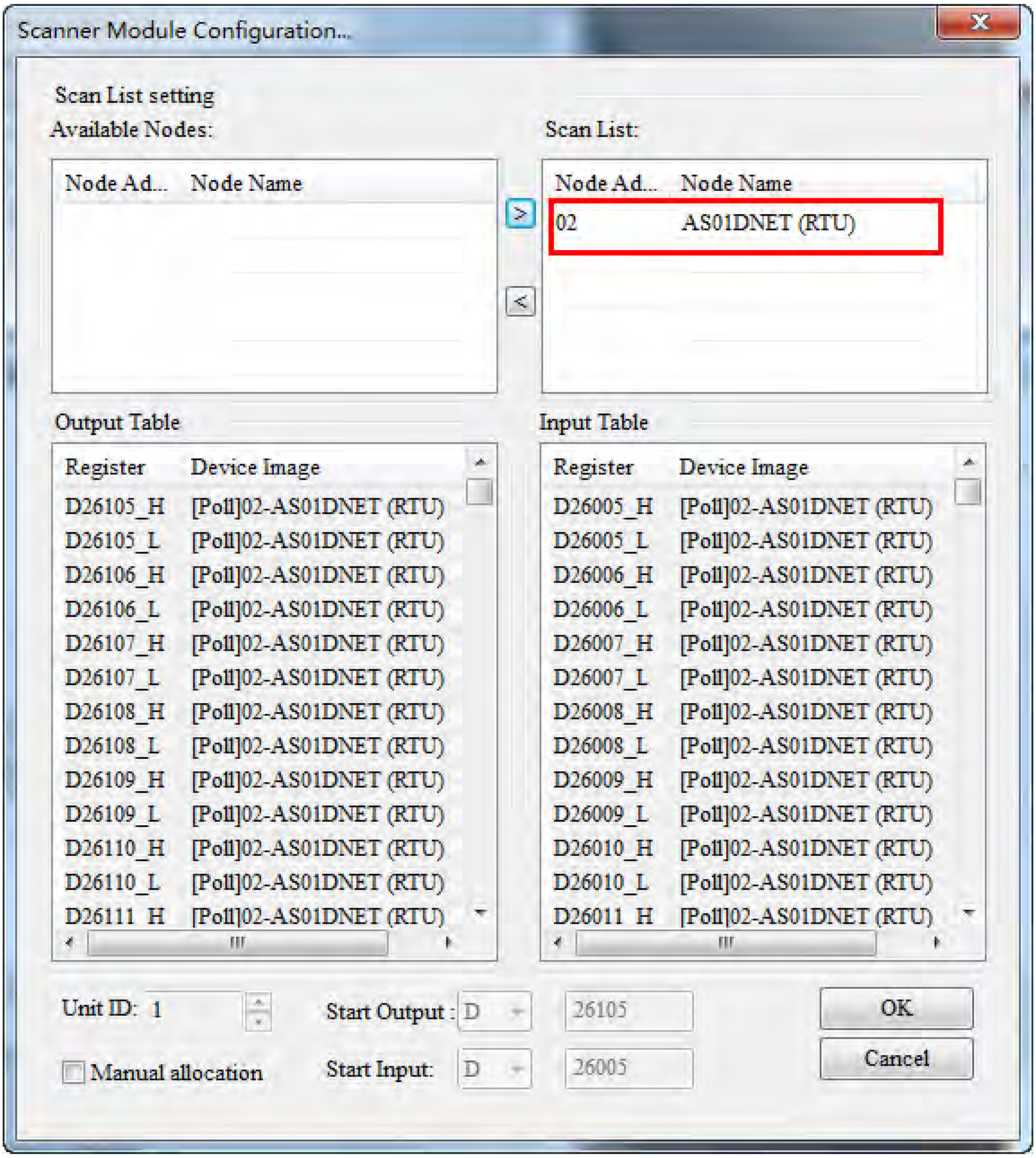
Each module has two forms of data mapping. When DeviceNet master has not assigned the start input mapping address and start output mapping address to AS01DNET (RTU), the contents in **Input** and **Output** in the following figure represent offsets based on start input or start output mapping address 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.

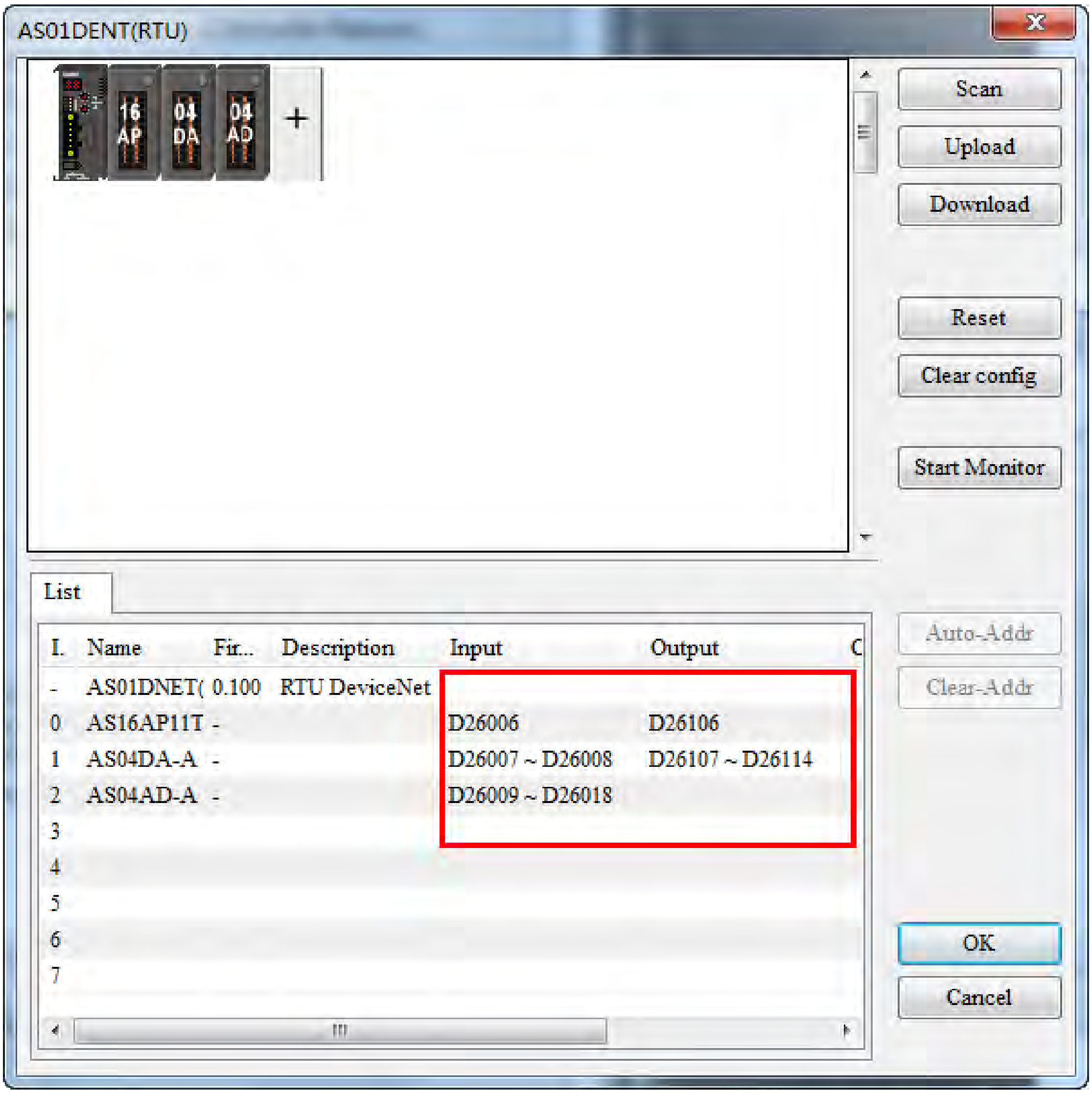
Before the master assigns mapping addresses to AS01DNET (RTU), the device mappings of modules connected to the right side of AS01DNET (RTU) are displayed as below.



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.

### 10.5.4.3.4. 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)**

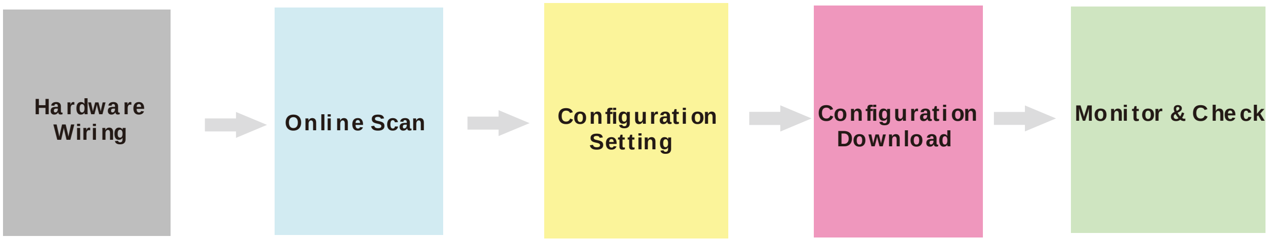
| Bit | Status value | Description |
|---|---|---|
| bit0 ~ bit2 | 000 | Make no control setting for the operation of AS01DNET(RTU) |
| | 001 | Set AS01DNET(RTU) to RUN mode |
| | 010 | Set AS01DNET(RTU) to STOP mode |
| | Other | Reserved |
| bit3 | 0 | Reserved |
| | 1 | Restart AS01DNET (RTU) |
| 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 |
| bit13 | 0/1 | Reserved |
| bit14 | 0/1 | Reserved |
| bit15 | 0/1 | Reserved |

### 10.5.4.4. 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.

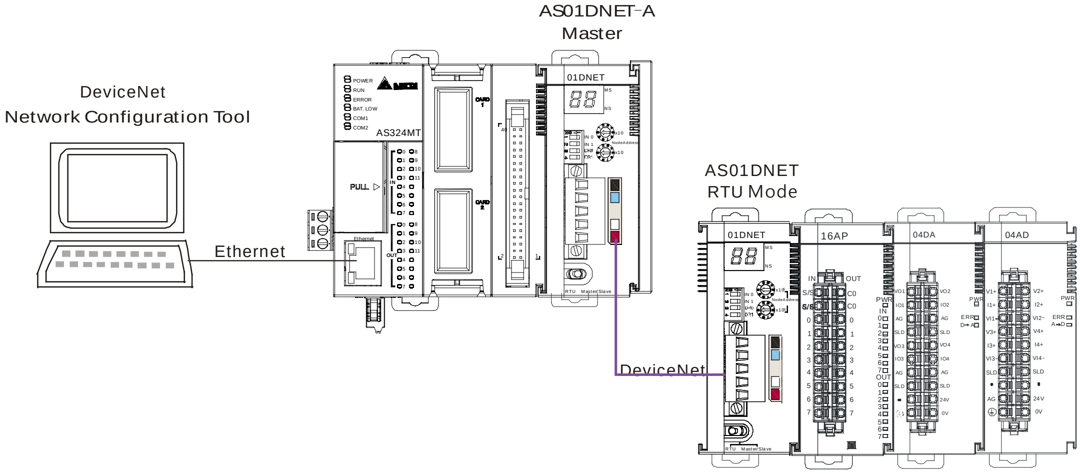
## 10.5.5 Application Example

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.

### 10.5.5.1. 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.

### 10.5.5.2. Using DeviceNet Builder to Configure the Network

#### 10.5.5.2.1. Building and Starting up Driver1 via COMMGR

Build driver1 in the COMMGR software.
Refer to Section 2.4 Communication Setting in ISPSoft help file.

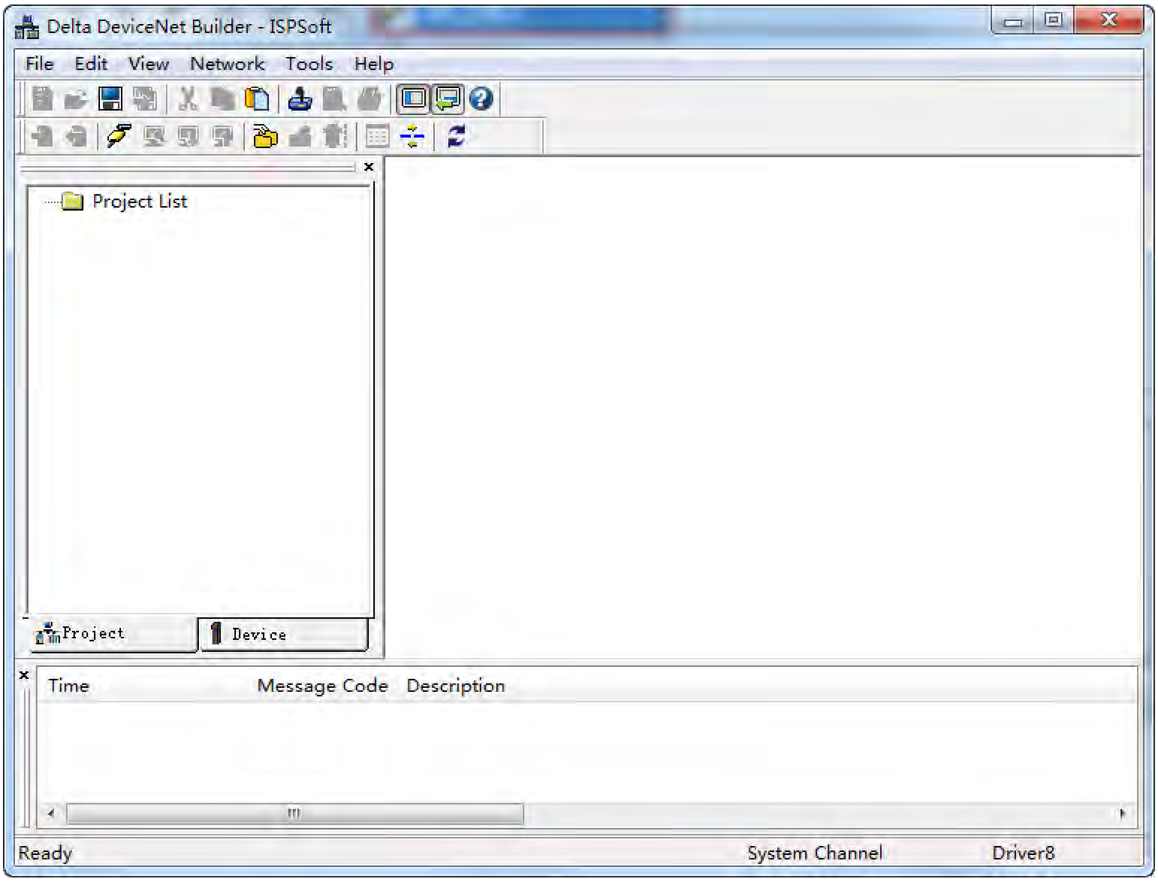
10

### 10.5.5.2.2. Configuring AS01DNET (RTU)

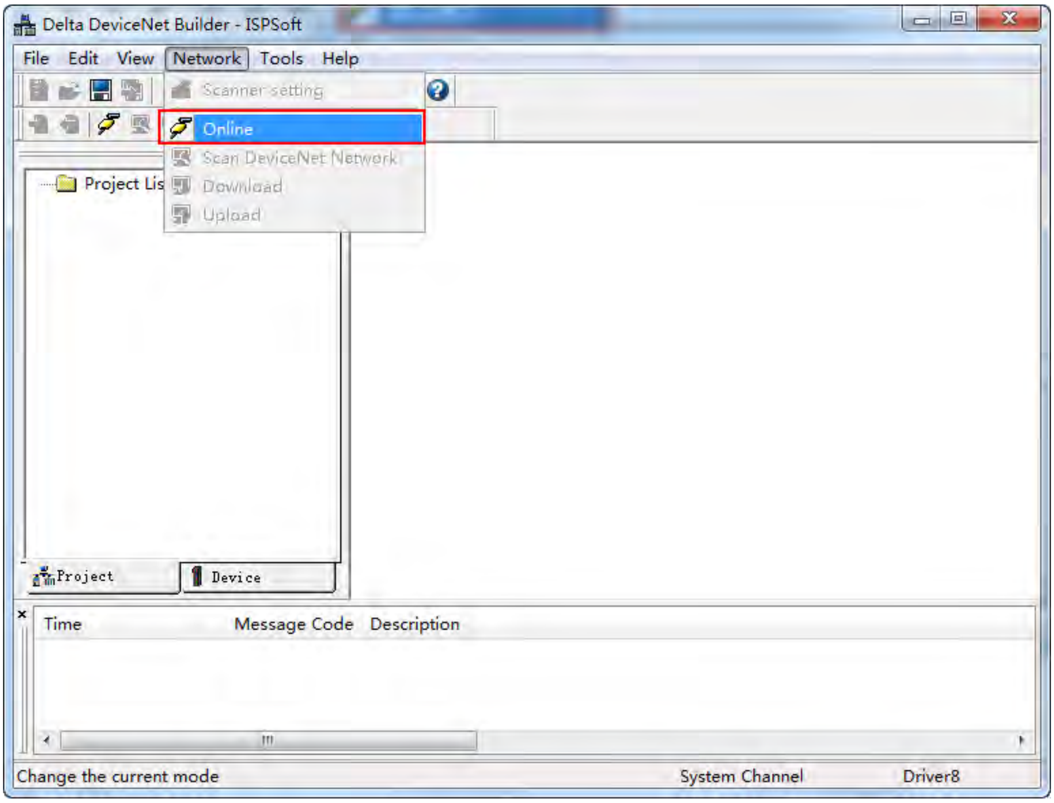
1. Call DeviceNet Builder via ISPSoft.

   Refer to section 10.6 for details on the operation.

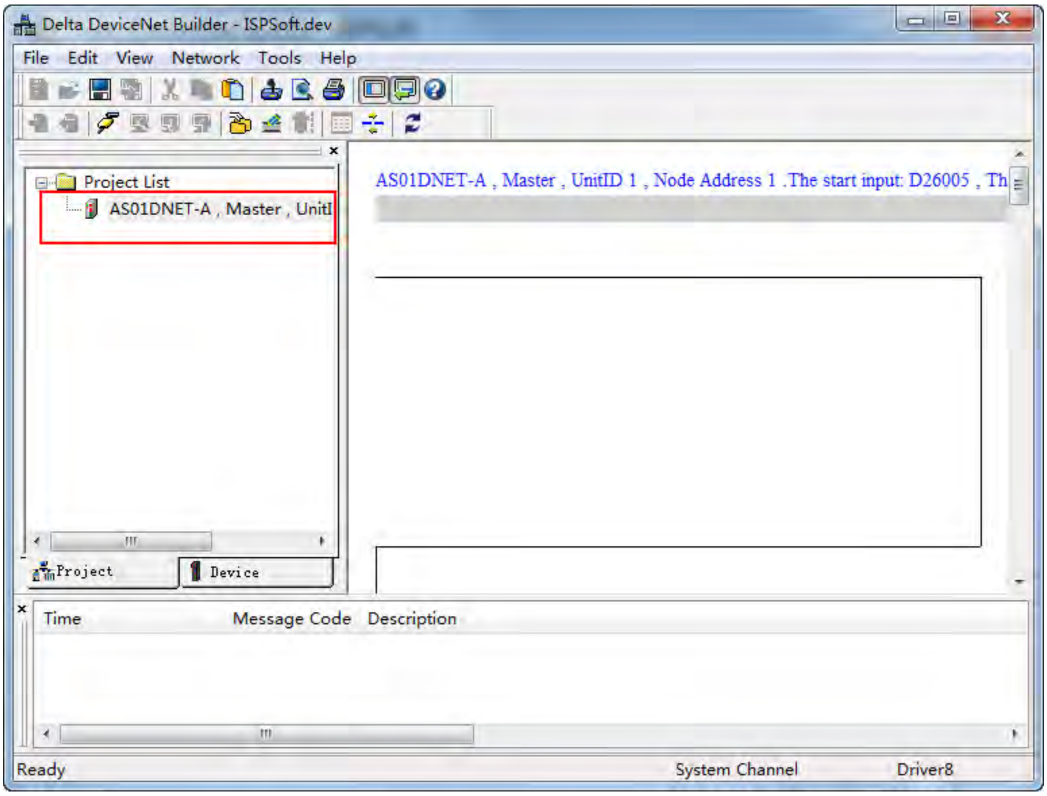
2. The called DeviceNet Builder is started as below.



3. Click menu **Network>> Online**.

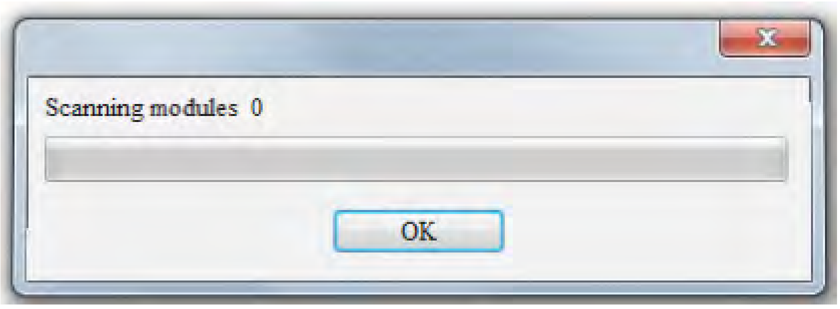



The AS01DNET-A master module which has been scanned is shown in the left-side Project List.

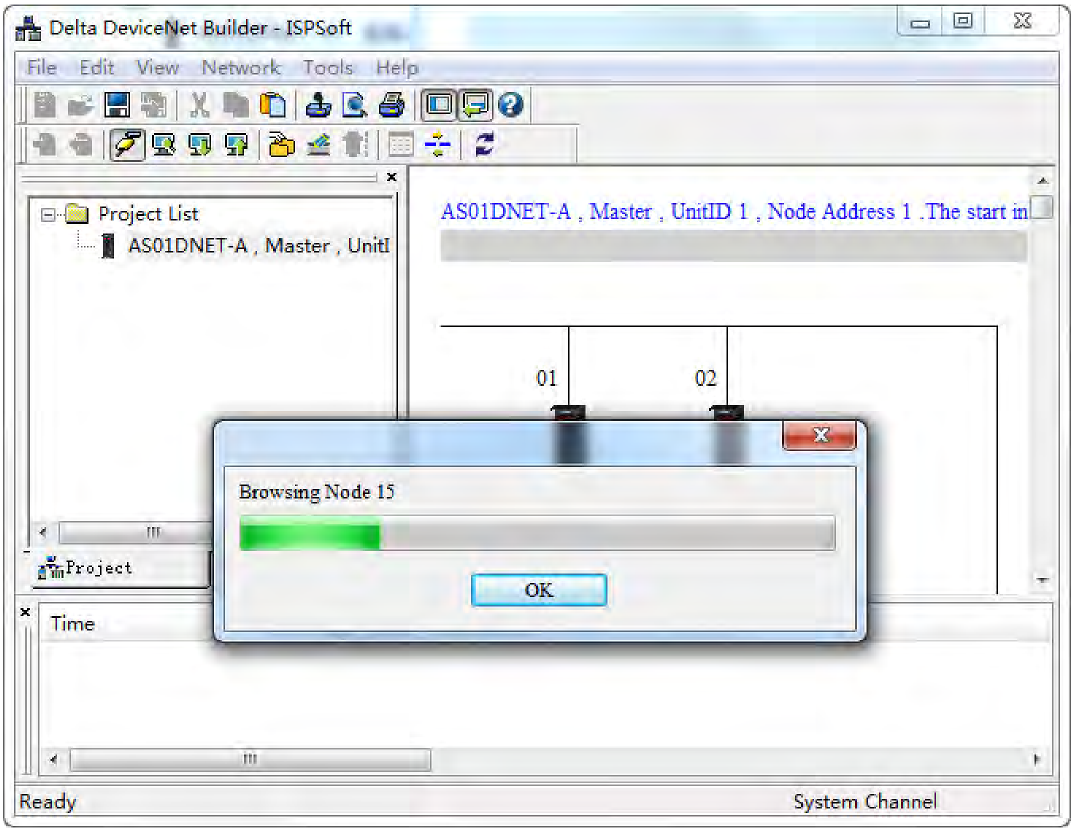



10

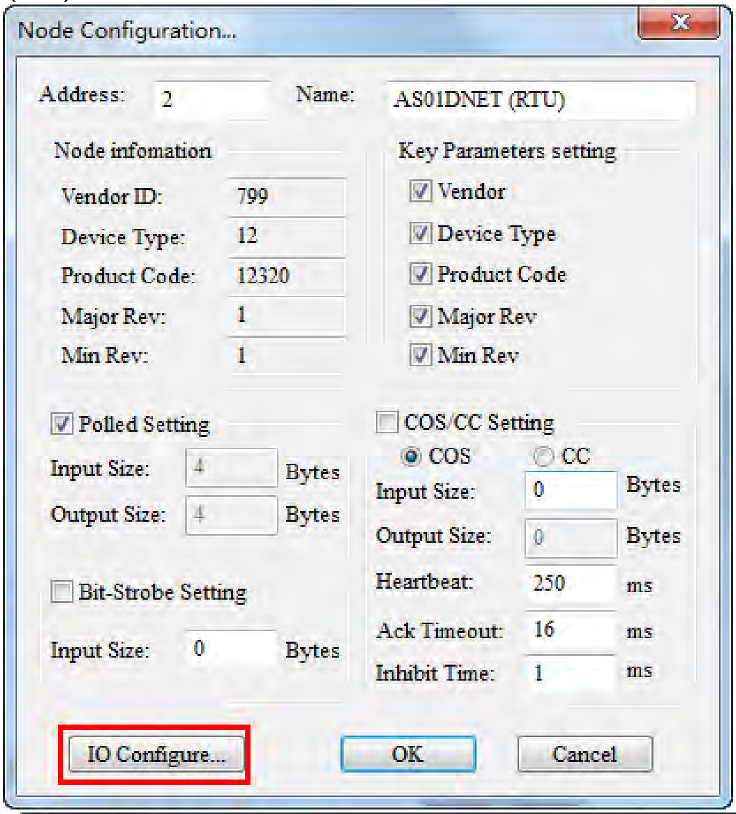
4. Click menu **Network >> Scan DeviceNet Network**.

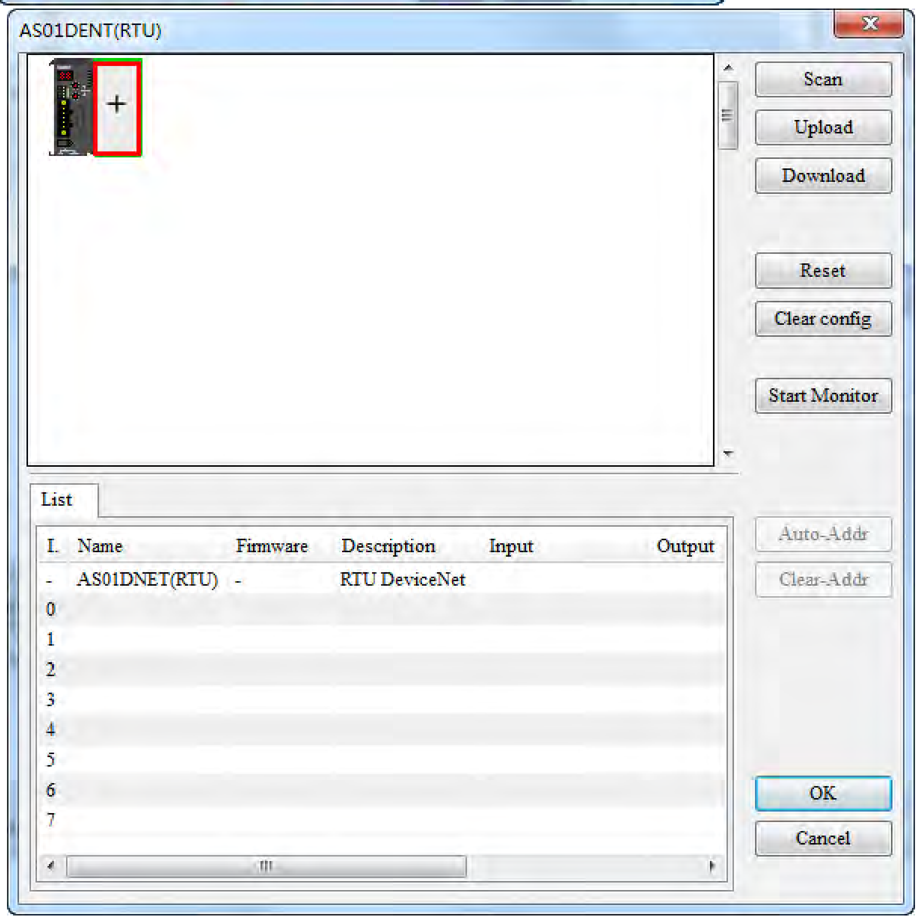



5. The RTU slave in the DeviceNet network is scanned as follows.

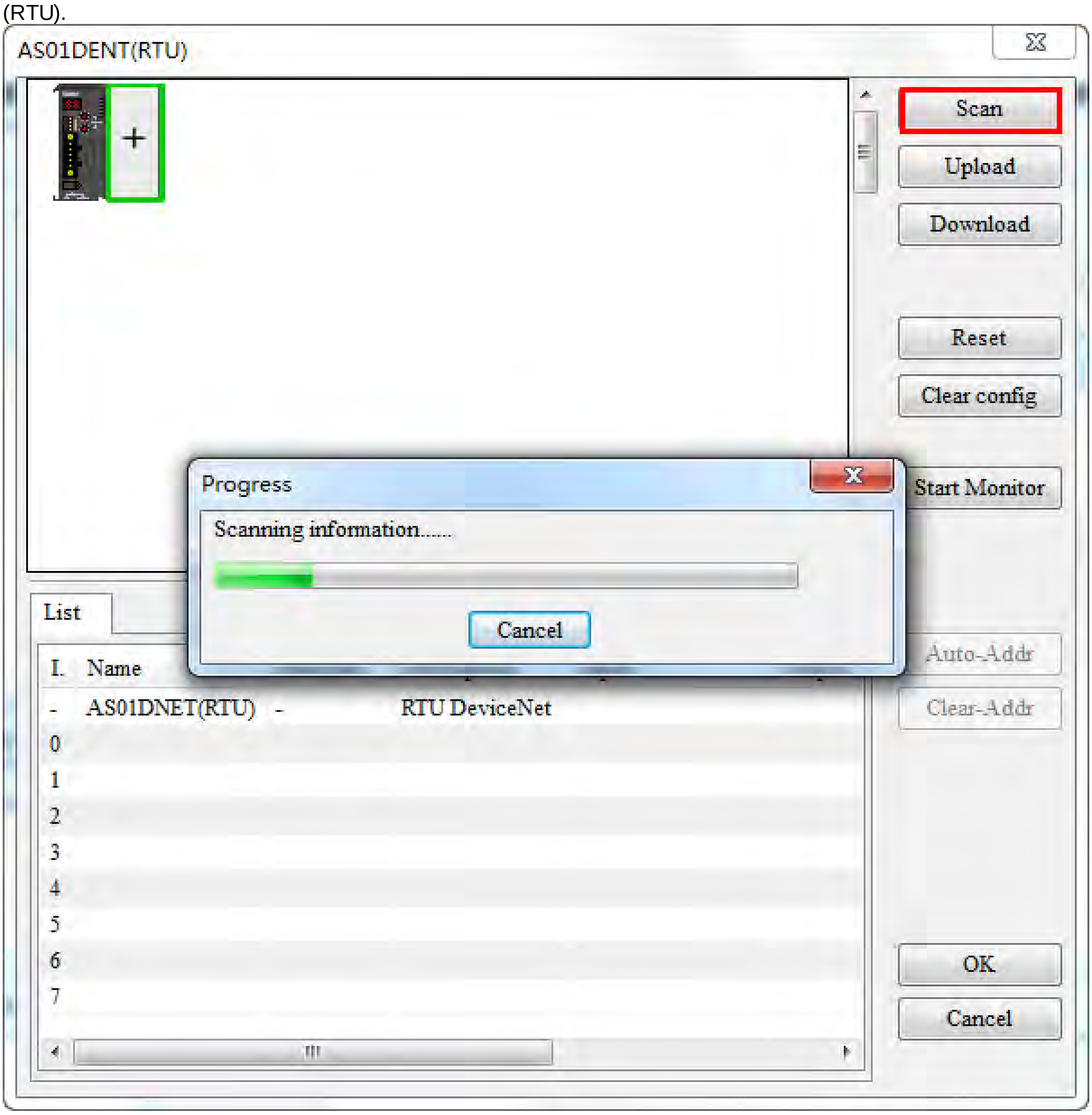


6. Double click AS01DNET (RTU). Then the **Node Configuration…** dialog box appears. Click the **IO Configure…** button to make the **AS01RTU-DNET** interface appear, where to configure the modules connected to AS01DNET (RTU).

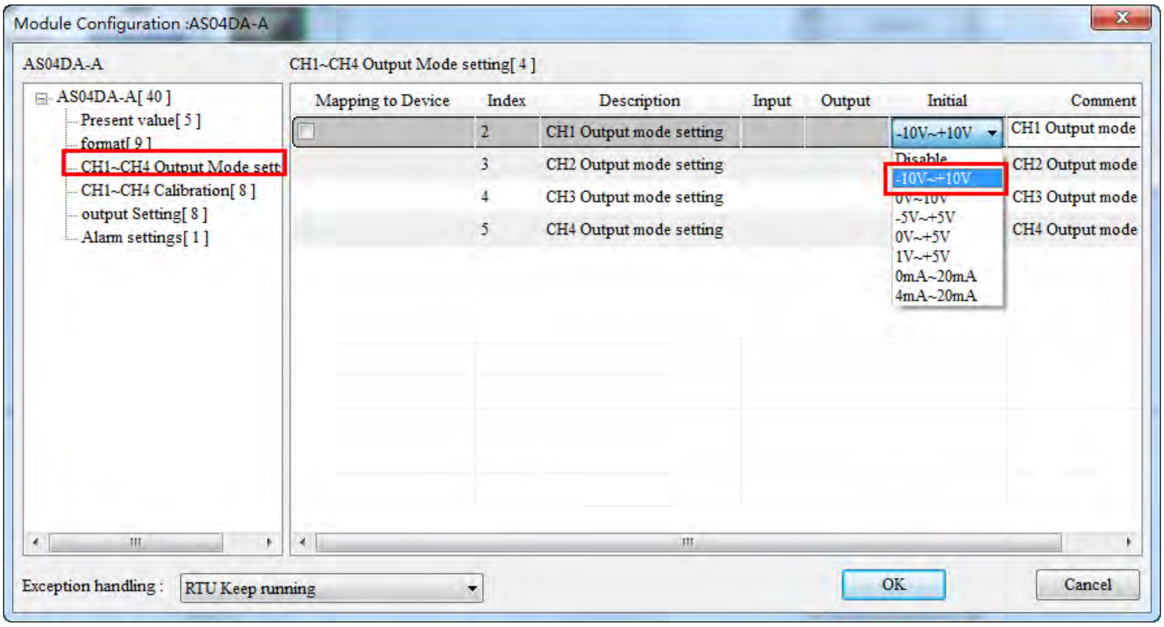


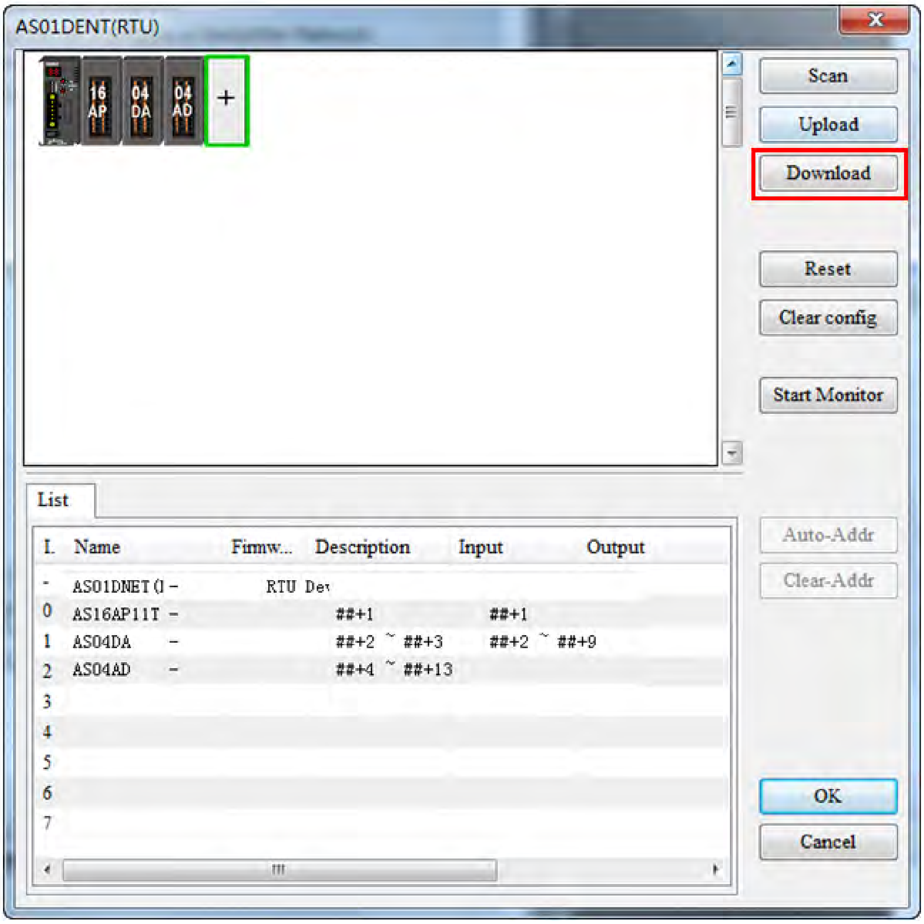
7. Click the **Scan** button to scan the I/O modules connected to the right side of AS01DNET (RTU).



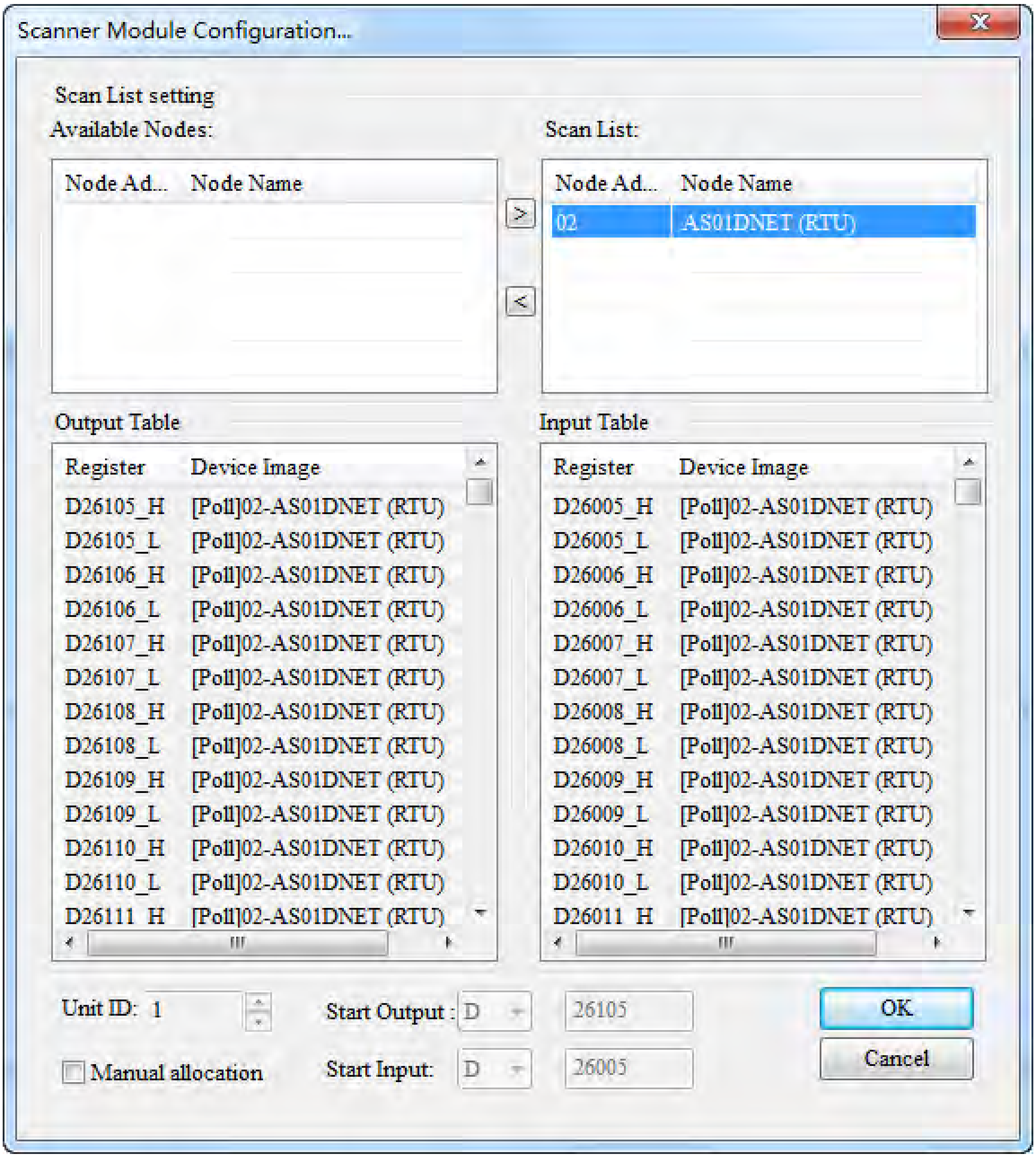
8. After the module is scanned, configure module parameters. Double click AS04DA module and select "-10V~+10V" for channel 1 mode setting. Click the **OK** button to finish the setting. Use the same setting way for channel 1 mode setting of AS04AD and set it to "-10V~+10V" as well.




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).

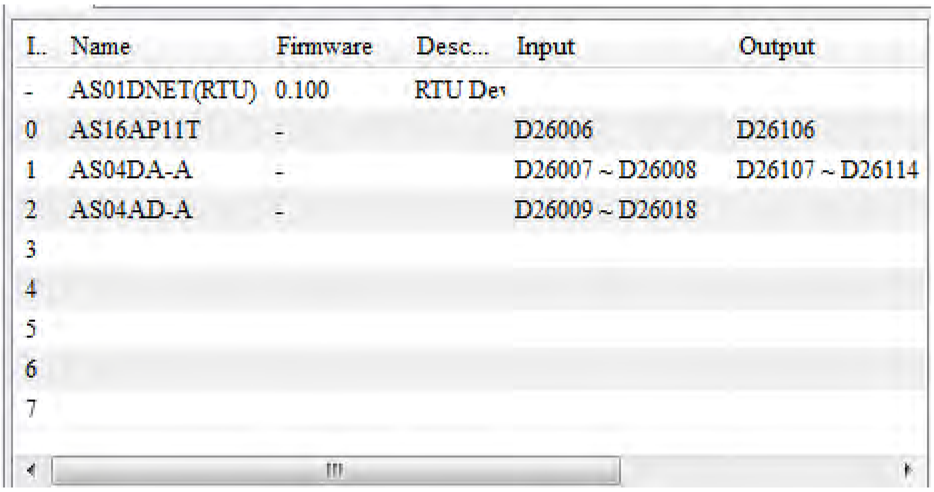


10. After the download, click the **OK** button to go back to the main page of the software. Double click AS01DNETScanner icon and then move the slave in **Available Nodes** to **Scan List** on the **Scanner Module Configuration** dialog box. Click the **OK** button to finish the setting.



11. Click menu **Network >> Download** to download AS01DNET (RTU) configuration to the master.

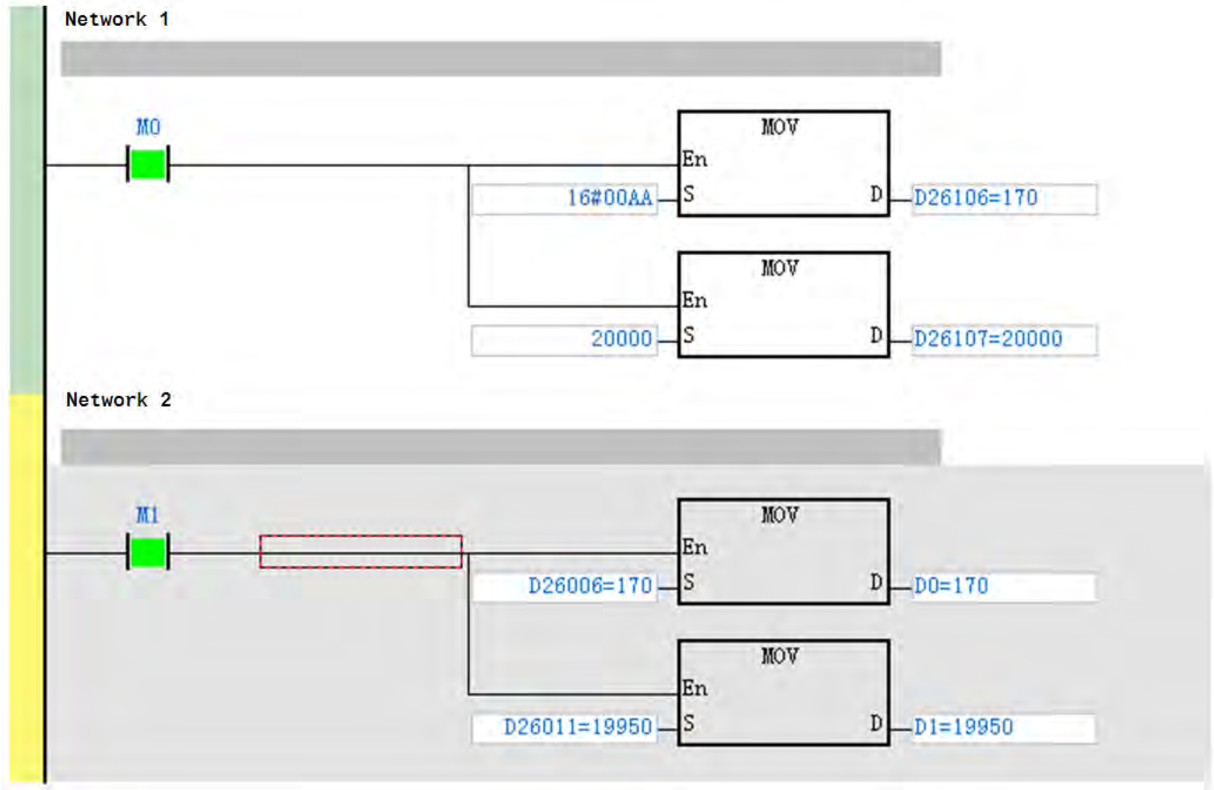
The input mapping address D26005~D26018 and output mapping address D26105~D26114 are for AS01DNET (RTU). The start input address D26005 and start output address D26105 are respectively used as the status word and control word of AS01DNET (RTU). The parameter mappings of all modules connected to AS01DNET (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 | |

### 10.5.5.3. 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.

## 10.5.6 Error Diagnosis and Trouble Shooting

AS01DNET (RTU) provides four diagnosis methods such as LED indicator, seven-segment displayer, status word diagnosis and software diagnosis.

### 10.5.6.1. Indicator Diagnosis

- **NS indicator**

| LED status | Indication | How to deal with |
|---|---|---|
| OFF | No power supply;<br>Or the repeated node ID detection has not been completed. | 1. Check the power supply for AS01DNET (RTU) and the connection are normal.<br>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 |

| LED status | Indication | How to deal with |
|---|---|---|
| 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;<br>Repeated node ID;<br>No network power;<br>Or BUS-OFF. | 1. Ensure that the IDs of all nodes are unique on the bus.<br>2. Check if the network installation is normal.<br>3. Check if the baud rate of AS01DNET (RTU) is the same as that of the bus.<br>4. Check if the node ID of AS01DNET (RTU) is valid.<br>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.<br>2. No I/O data transmission between AS01DNET(RTU) and DeviceNet master<br>3. The PLC connected to DeviceNet master is in STOP state. | 1. Configure AS01DNET (RTU) in the DeviceNet software and download the configuration correctly.<br>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 |
| Red light blinking (ON:0.5s and OFF: 0.5s alternately) | No network power supply;<br>Configuration error;<br>Module alarms. | 1. Check if the network power supply is normal;<br>2. Reset the internal parameters in AS01DNET (RTU);<br>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. |

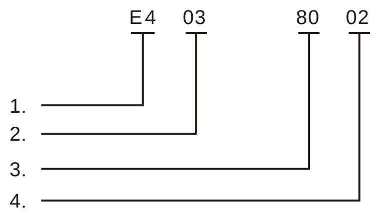
### 10.5.6.2. Codes in Seven-Segment Displayer

| 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.<br>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. |

| Code | Indication | How to deal with |
|---|---|---|
| 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.<br>2. Ensure the baud rates of all network nodes are same.<br>3. Check if the two ends of the network are both connected with a 120Ω terminal resistor.<br>4. Repower the scanner module. |
| F5 | No network power supply for AS01DNET(RTU) | 1. Check if the network cable is normal.<br>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;<br>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;<br>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. |
| F9 | Internal error;<br>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);<br>Check if the module exists;<br>Check if current module matches that configured in the software;<br>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.<br>1. Ensure that there are at least two nodes working normally in the network.<br>2. Check if the two ends of the network are both connected with a 121Ω terminal resistor.<br>3. Ensure that the baud rates of all network nodes are same.<br>4. Check if the network cable has a problem such as being disconnected and loosened.<br>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.<br>6. Check if the shielded wire of the network communication cable is grounded.<br>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. |

| Code | Indication | How to deal with |
|---|---|---|
| 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.<br>2. Check if the value of control word of AS01DNET (RTU) is 1. For details, refer to section 10.5.4.3.4. |
| 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).

### 10.5.6.3. Status Word Diagnosis

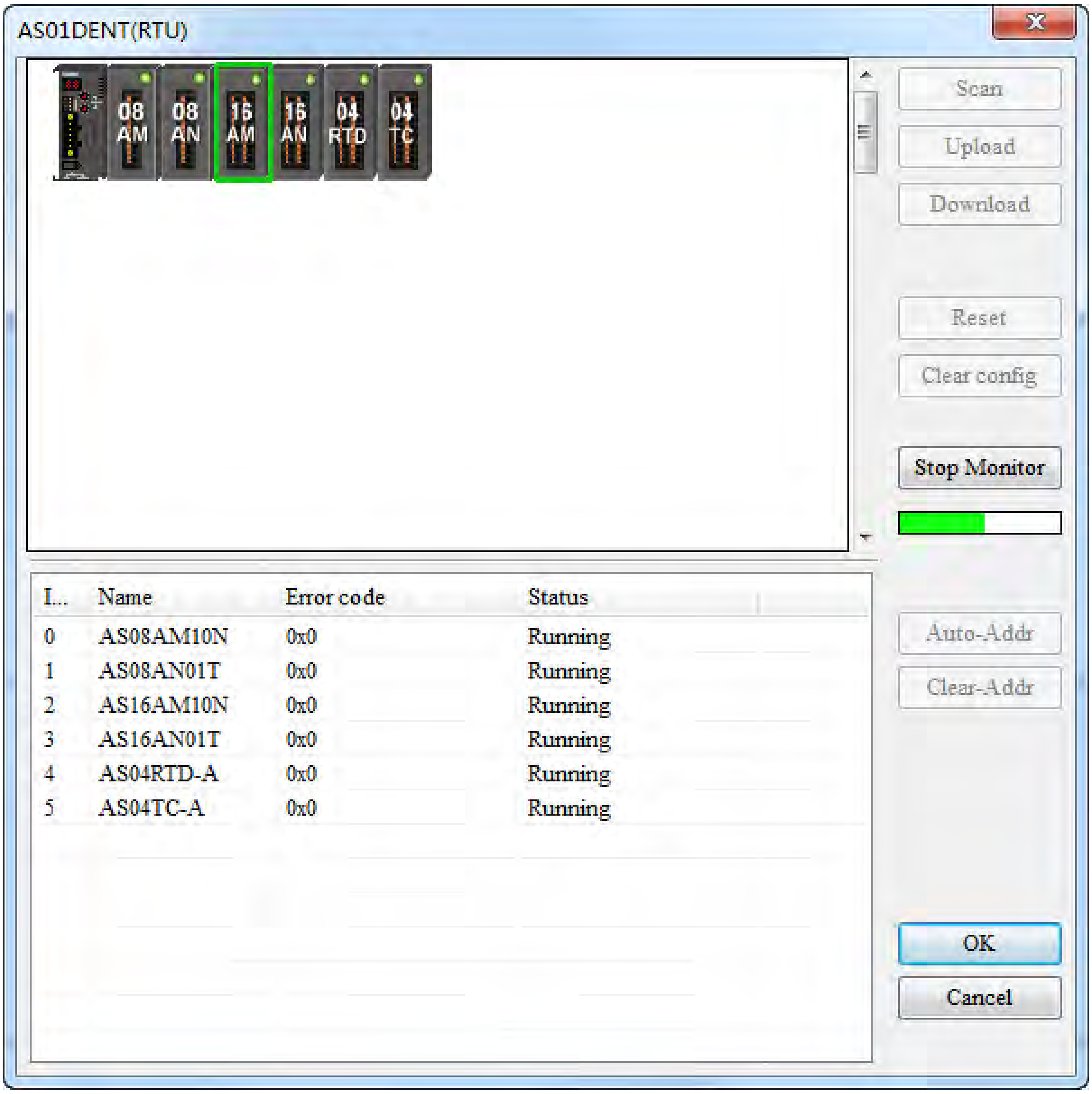
The status word of AS01DNET (RTU) shows the operation states of special modules and digital I/O modules. See the following table for status word diagnosis and disposal.

| 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.<br>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 | —— | —— |

| Bit | Status value | Description | Disposal |
|---|---|---|---|
| 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 | —— | —— |

### 10.5.6.4. 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.<br>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.

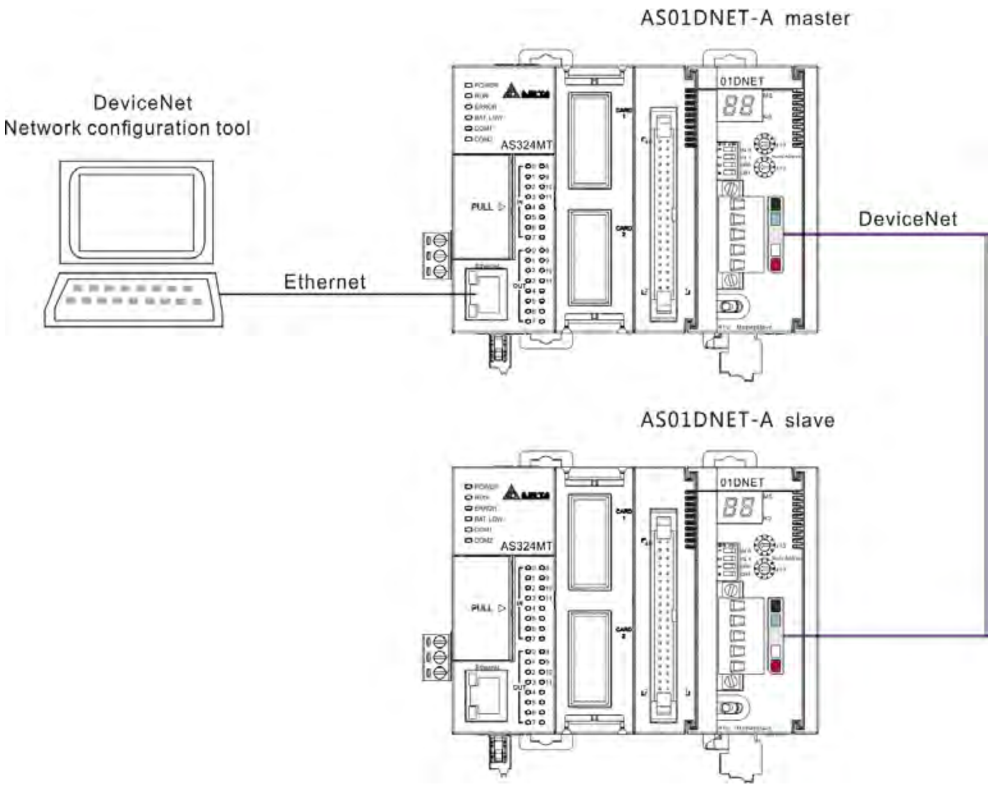
**Remark:**

➢ The software diagnosis function can not be enabled until the DeviceNet Builder software is online.

## 10.6 How to Call DeviceNet Builder through ISPSoft (AS-Series PLC)

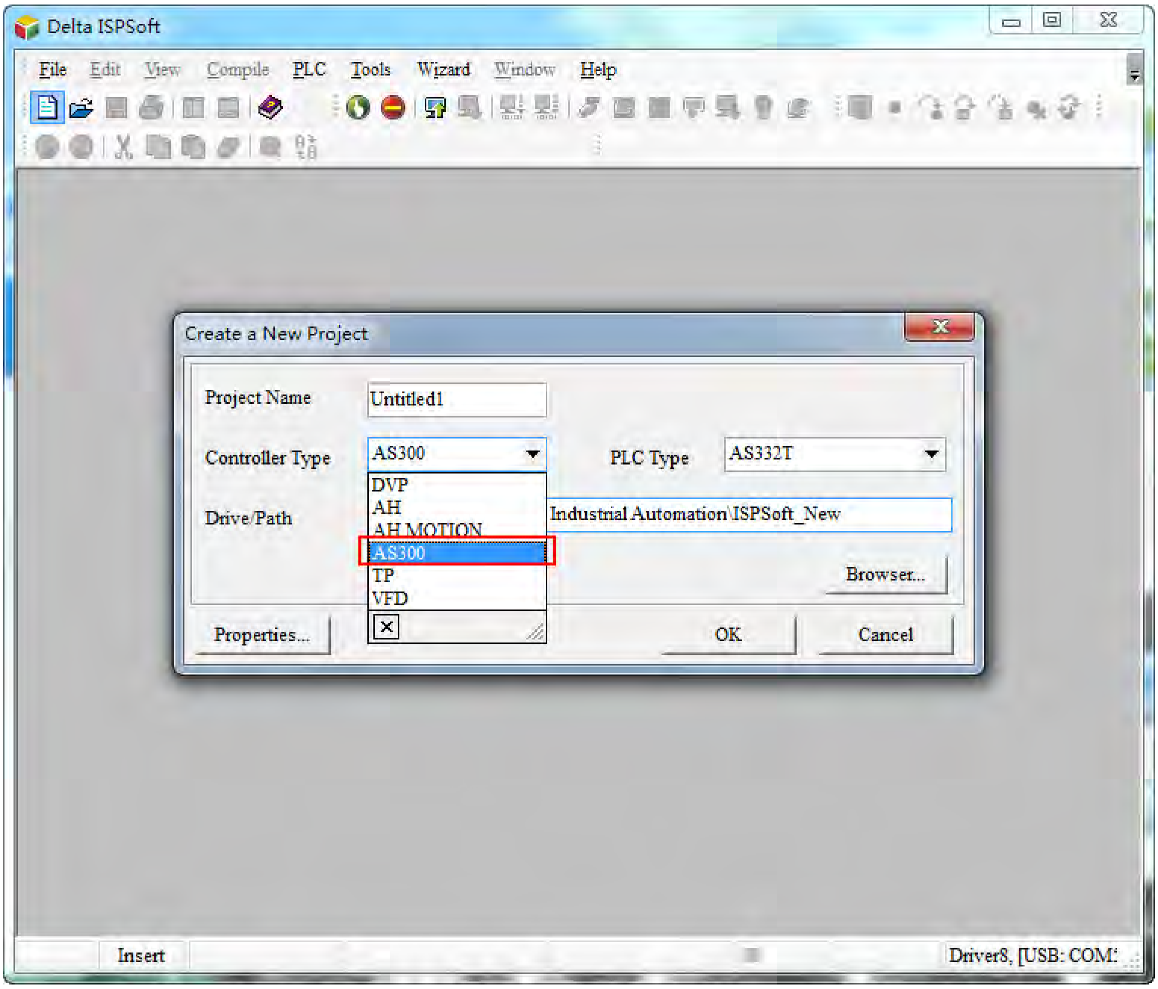
■ **Network structure**

Connect the devices according to the following figure. PC accesses AS-series PLC through Ethernet.



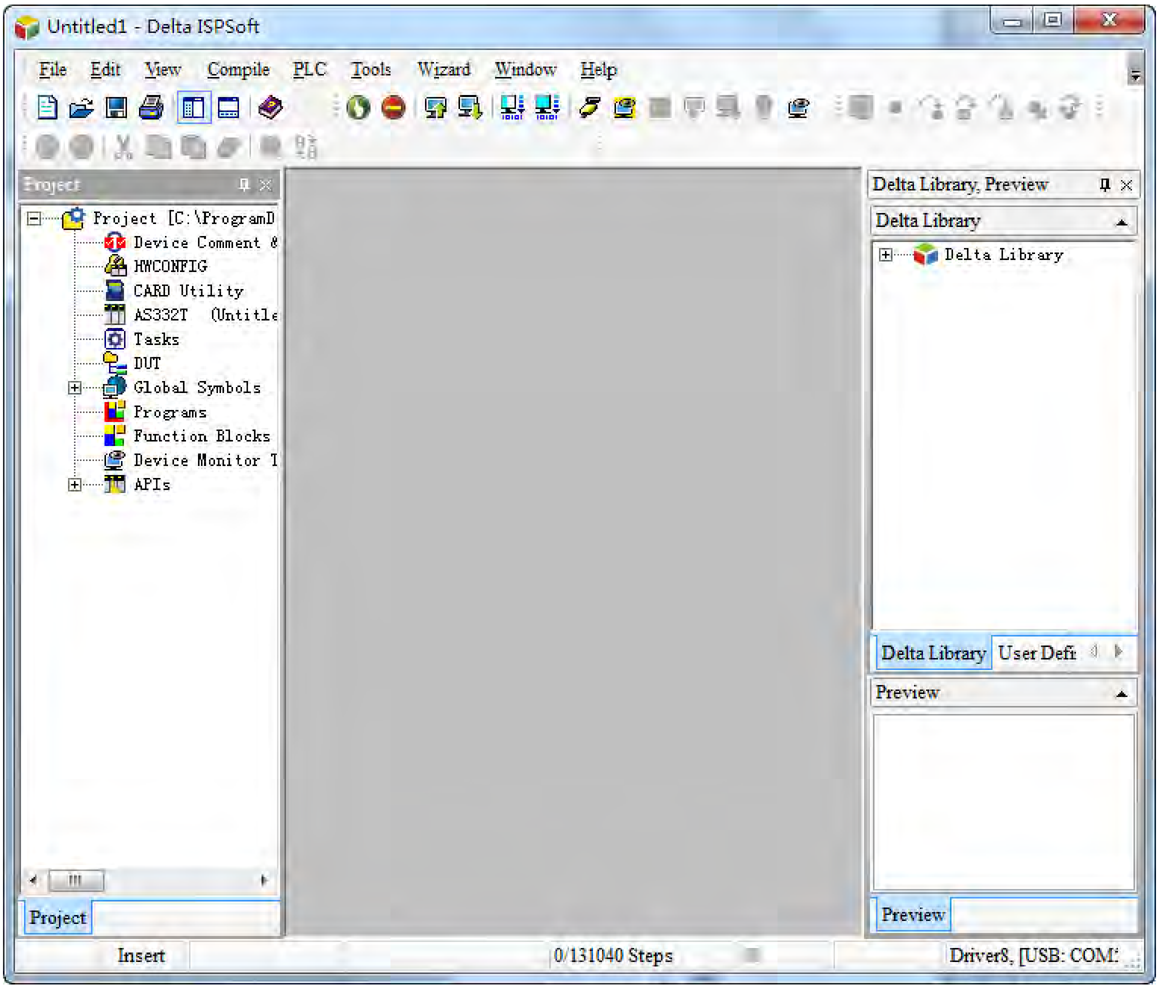
■ **Operation of Software**

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.



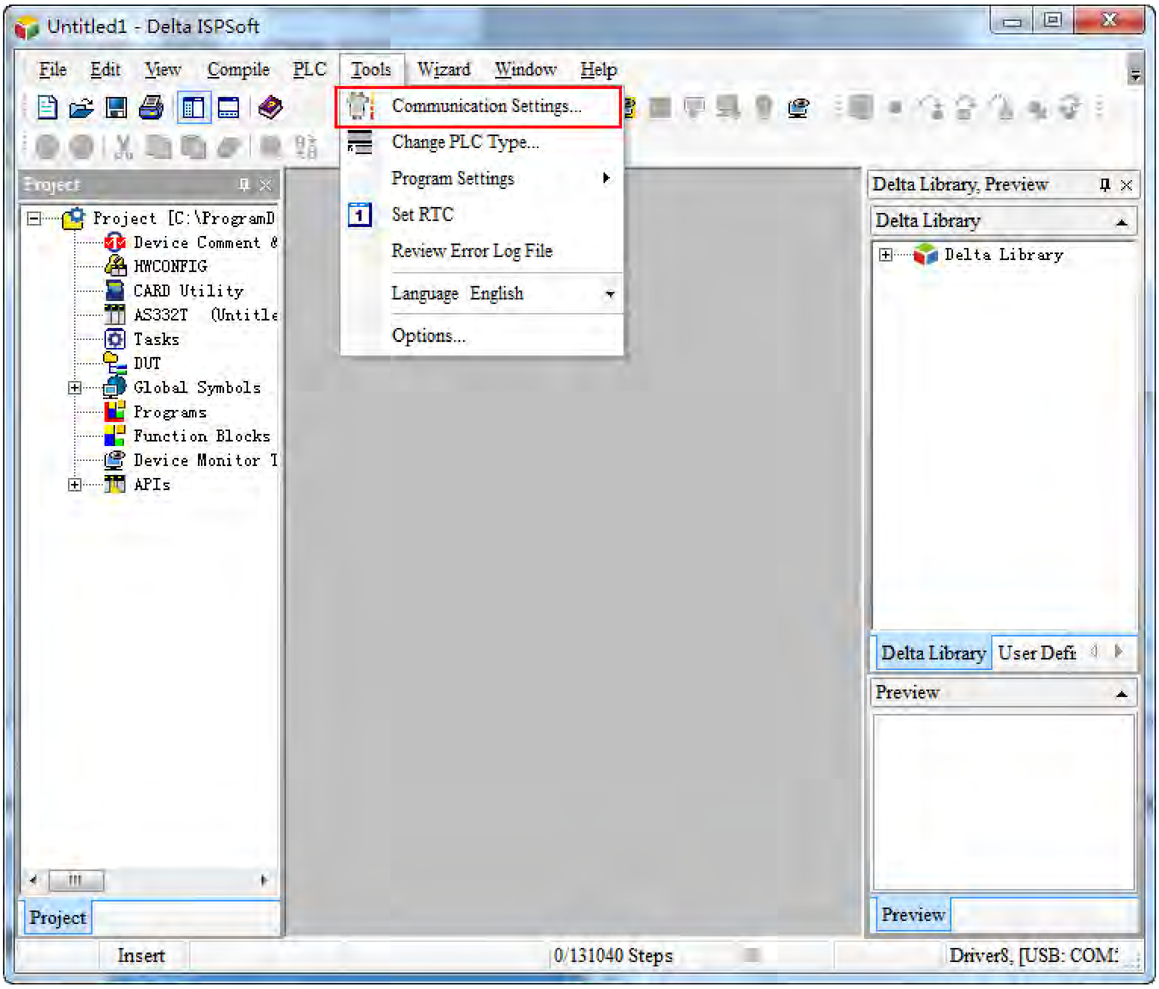

Note: The PLC type used in this section is AS332T-A.

2. Click the **OK** button. Then the main interface of the ISPSoft software appears as below.

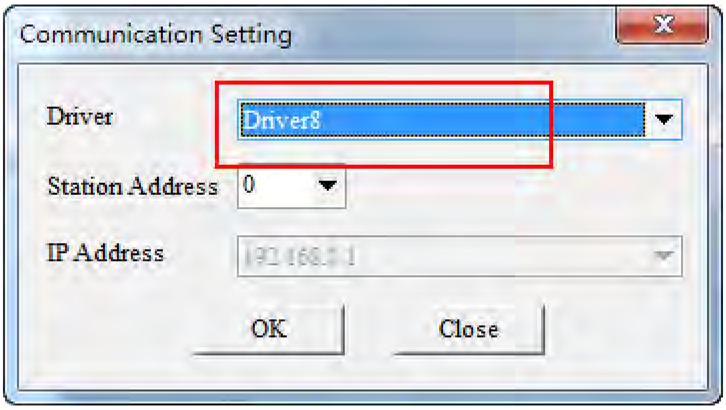



3. Set up COMMGR communication. For details on setup, refer to section 8.1.2 Overview of Communication Setting in COMMGR.

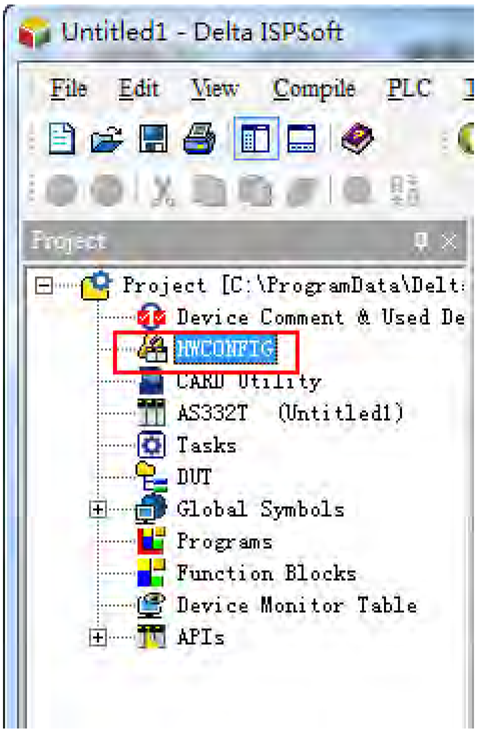
4. After the setup of COMMGR communication is finished, select menu **Tools>> Communication settings…**



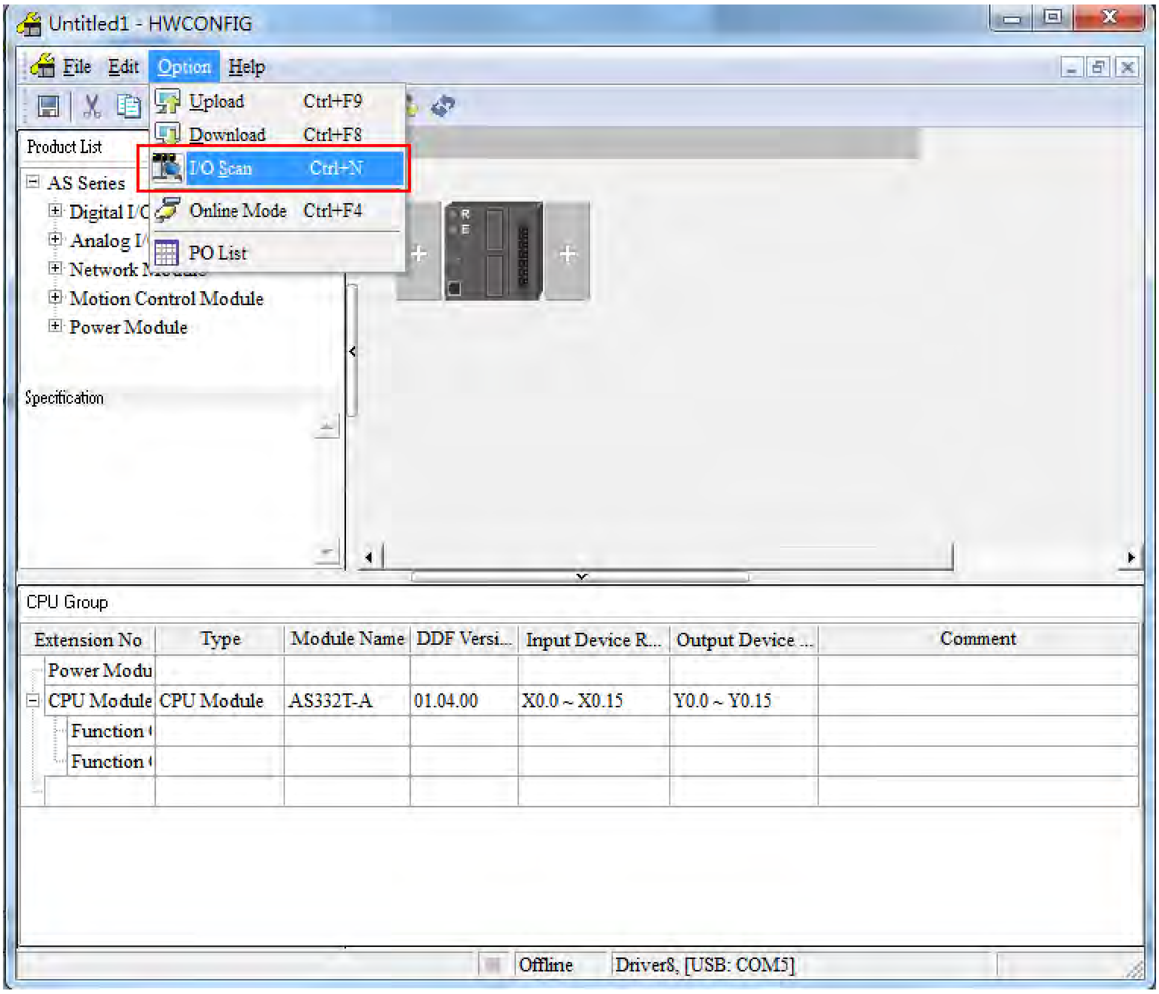

5. The following dialog box appears. Select one desired driver which has been created and then click the **OK** button.



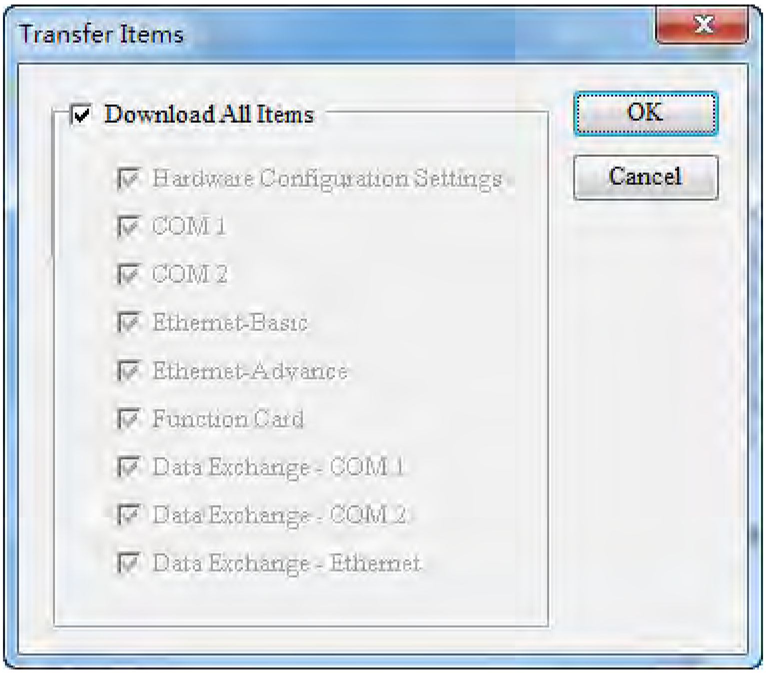
6. Double click **HWCONFIG** marked in the red box below.



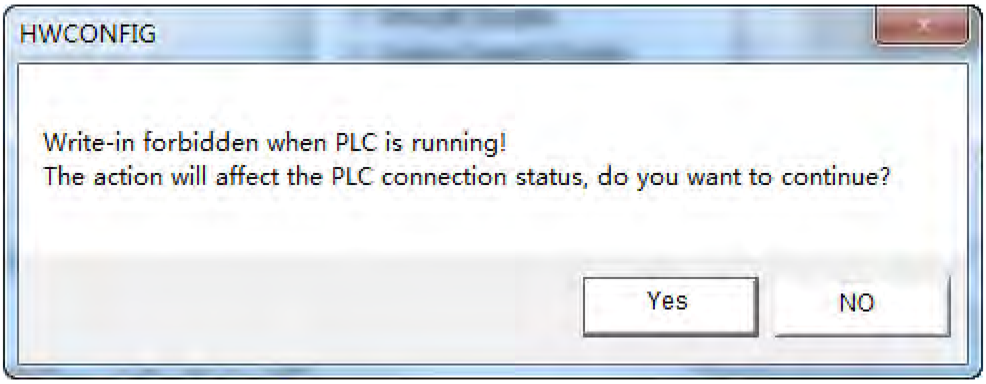

7. Select menu **Option>> I/O Scan** in the following window which pops up. Then the AS01DNET-5A icon will show up.

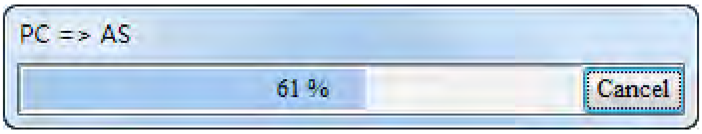


8. Select menu **Option>> Download** in the HWCONFIG window. Then the following dialog box appears. Select the checkbox of **Download All Items** or select the checkboxes of the items which are needed for download. Afterwards, click the **OK** button.

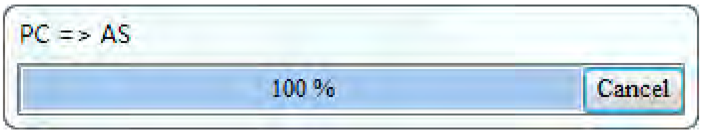



9. Then the following two dialog boxes of **HWCONFIG** and **PC=>AS** appear. Click **Yes** to perform the PC=>AS status.

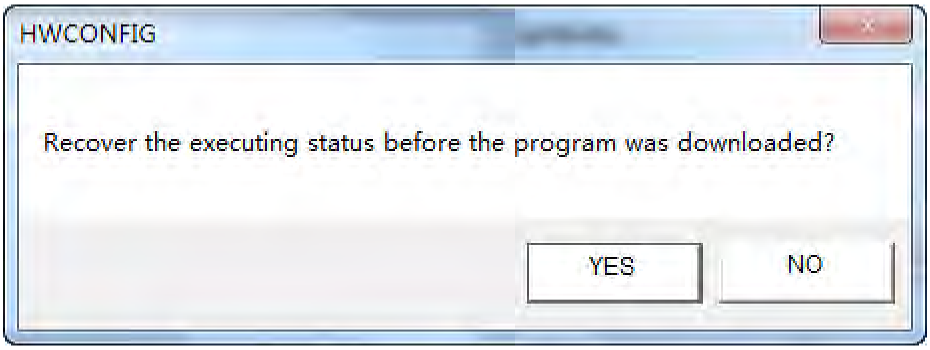


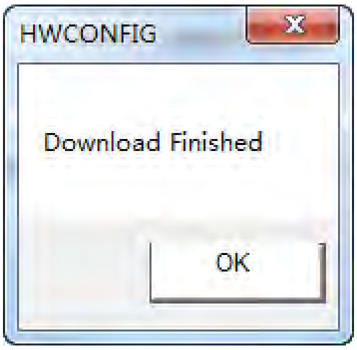

10. When the download is finished, the progress bar is shown as below.



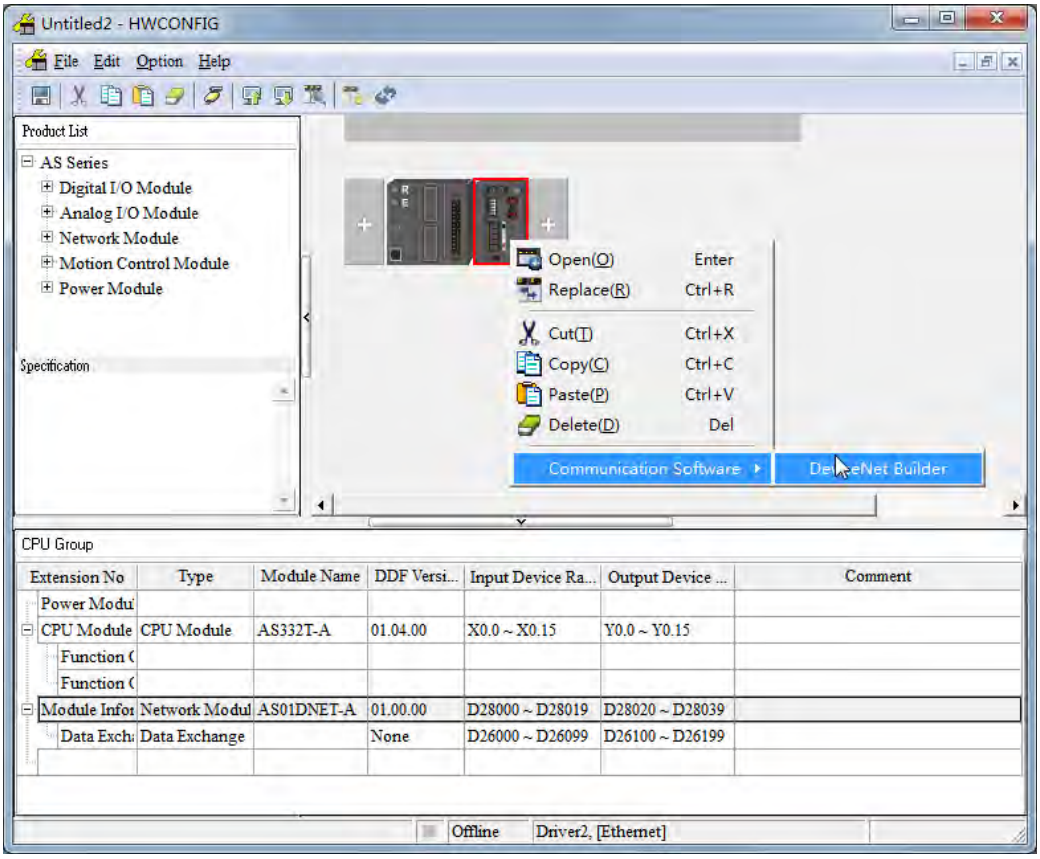
Meanwhile the following dialog box pops out. Click the **Yes** button.



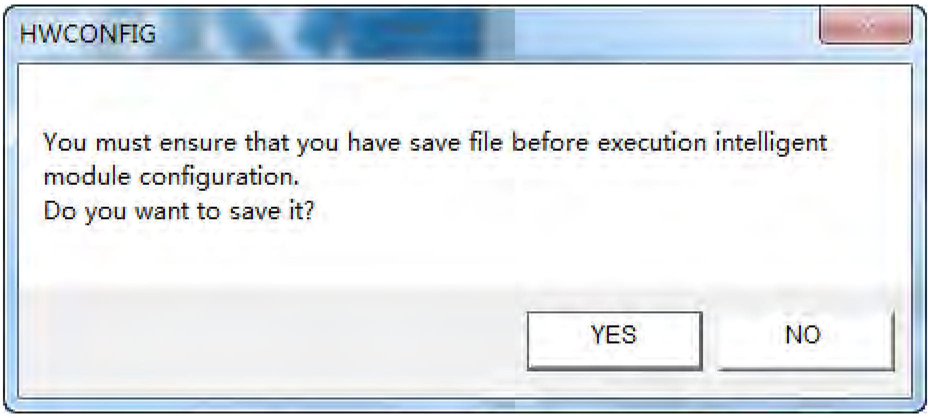

11. The following dialog box appears to show that the download has been finished.



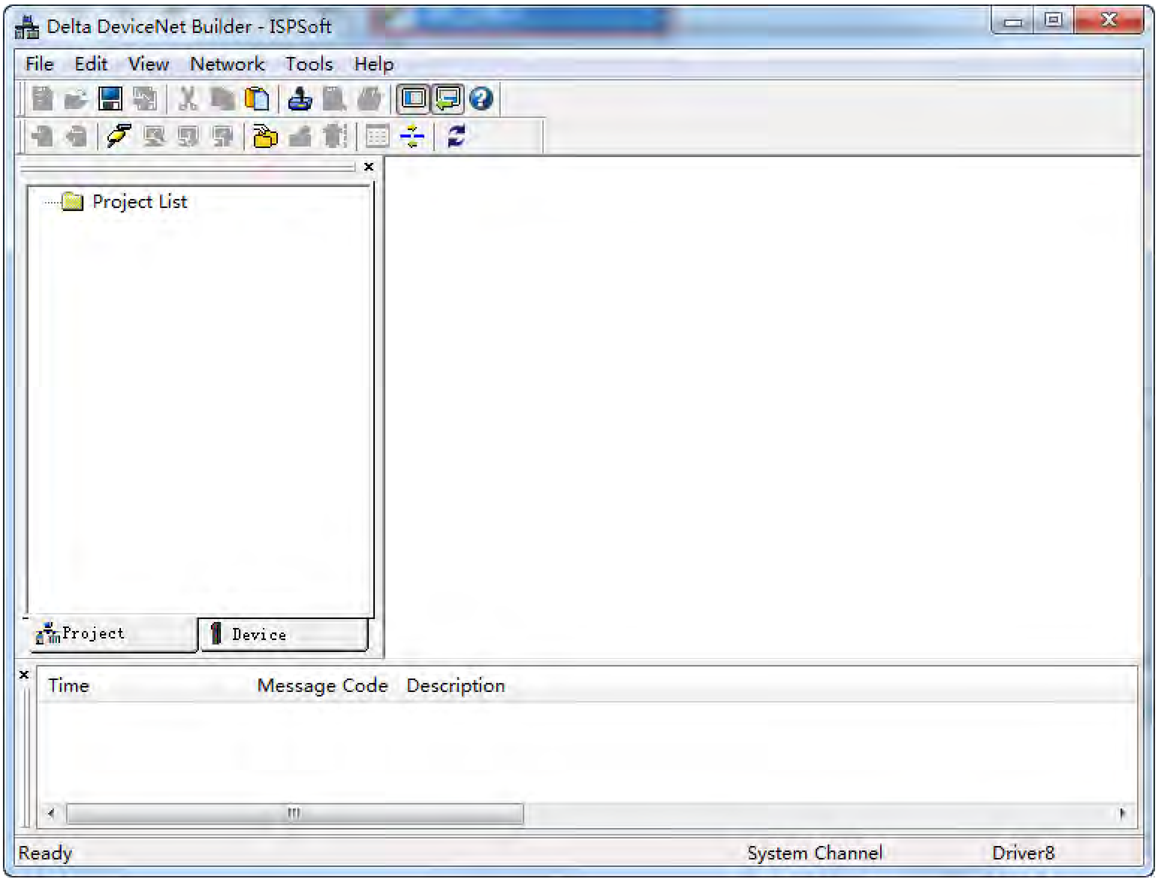

12. Return to the HWCONFIG window and right-click AS01DNET module to make the drop-down menu pop out. Select **Communication Software >> DeviceNet Builder** from the menu.



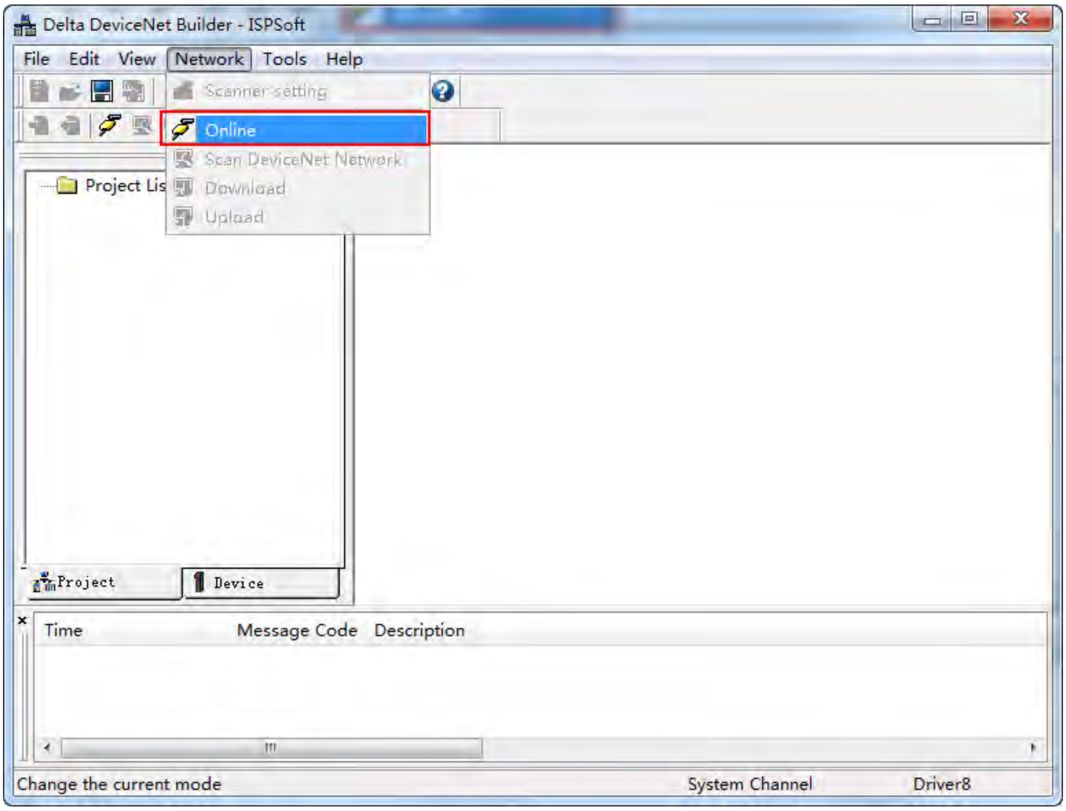
13. The following dialog box pops out. Click the **Yes** button there.



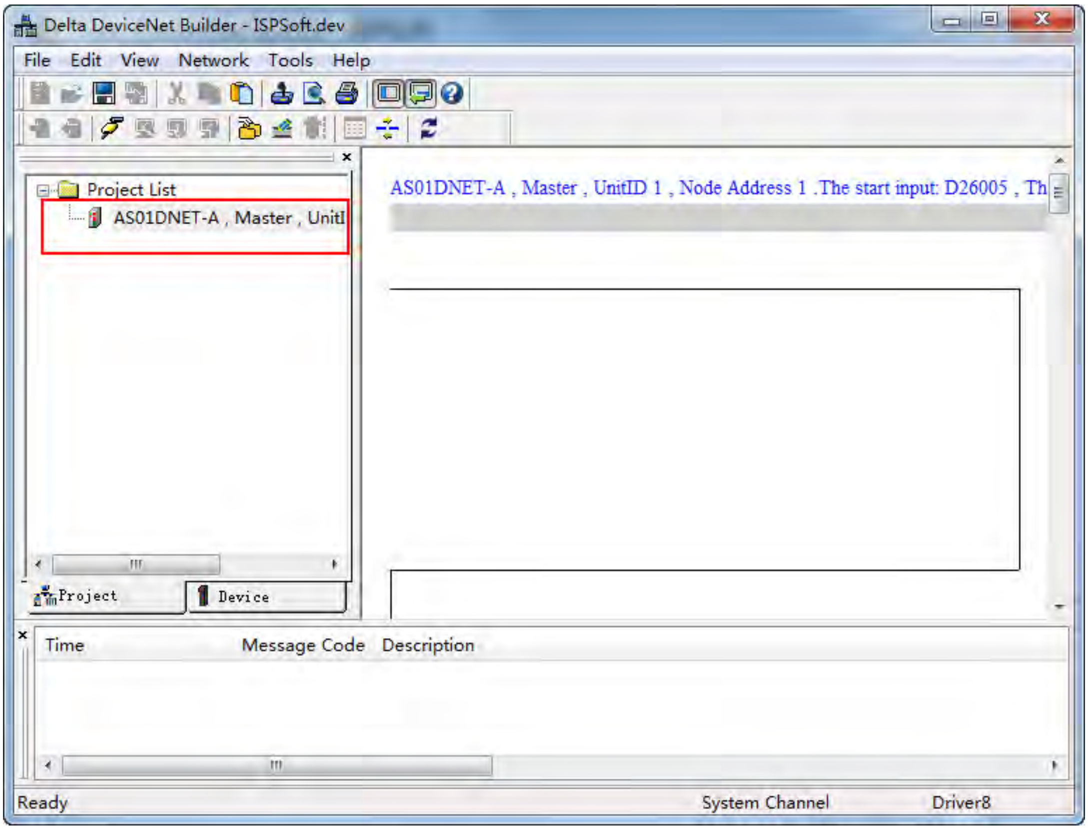

14. The DeviceNet Builder software is opened as below, which means the DeviceNet Builder software has been opened through the ISPSoft software.



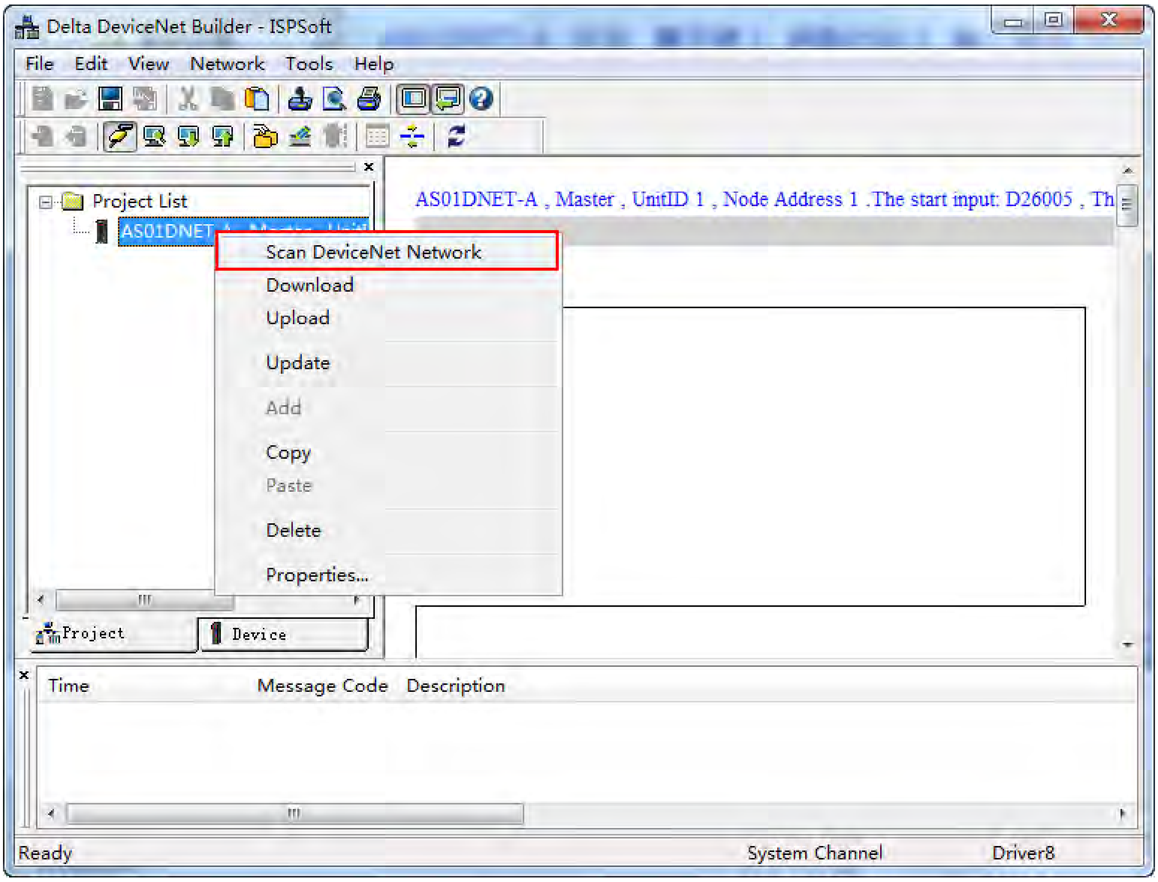
15. Click menu **Network>> Online**.



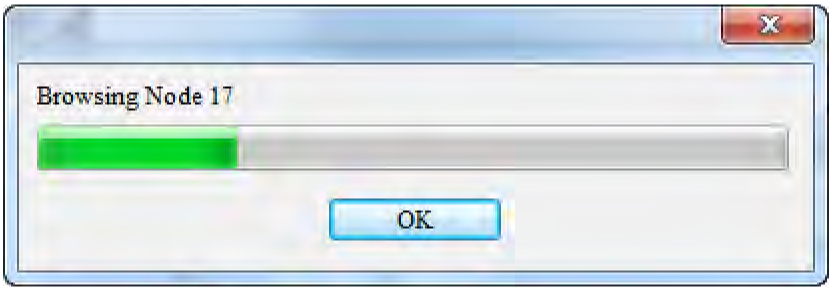

16. The master module AS01DNET-A has been scanned as below.



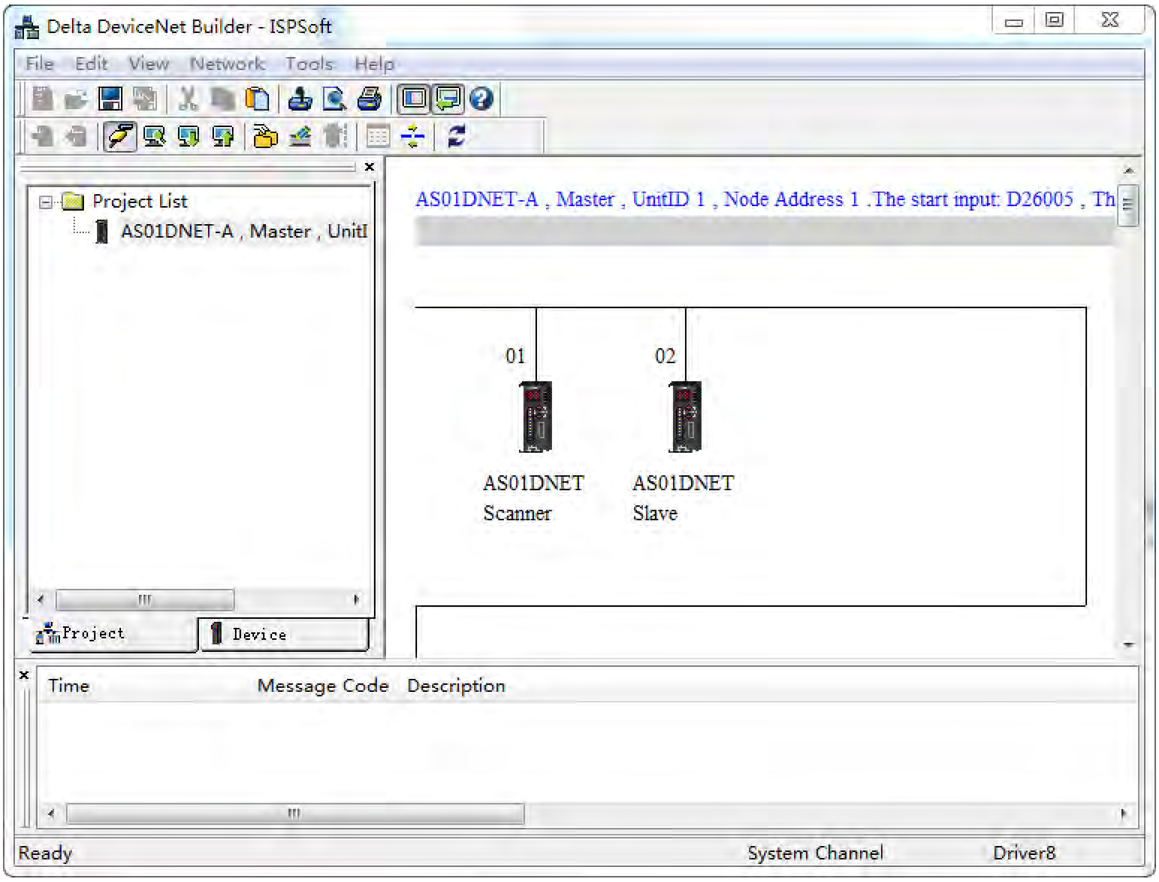
17. Right-click the master module AS01DNET-A under the left-side Project List. Then a drop-down list pops up. Click the option **Scan DeviceNet Network** from the list.




18. The following progress bar appears then.



19. The master and slave which have been scanned both show up in the network.



MEMO