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Chapter 13 IO-Link Communication Module AS04SIL

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13.1 Overview

Thank you for using the IO-Link master module AS04SIL-A. To ensure that your AS04SIL-A is installed and operated correctly, read this manual carefully before using the module.

The AS04SIL-A module is an AS series IO-Link communication module (hereafter referred to as “SIL” module) connected on the right side of AS CPU module or AS00SCM-A (RTU mode). When the communication card AS-FCOPM is being used together, they serve as a CAN remote device. SIL provides 4 channels, which can be separately configured in IO-Link master or standard I/O (SIO) mode. IO-Link master can freely connect with IO-Link devices and supports the hybrid use of IO-Link sensors and traditional sensors. Digital I/O of the SIL module can be extended with IO-Link hubs so that the sensors which do not support IO-Link can be connected to. Therefore it is pretty flexible to use the SIL module.

The setup software for AS04SIL-A is HWCONFIG 4.0 which is built in ISPSoft. You can use it after downloading the software from Delta official website and installing it.

13.1.1 Firmware and Software Versions

Firmware			
Model	AS series CPU	AS00SCM-A	AS04SIL-A
Version	V1.08 and later	V2.06 and later	V1.00 and later

Software			
Model	ISPSoft	HWCONFIG 4.0	AS00SCM-A CANopen EDS file
Version	V3.11 and later	V4.03 and later	V2.06 and later

13.2 Specification and Wiring

13.2.1 Specifications

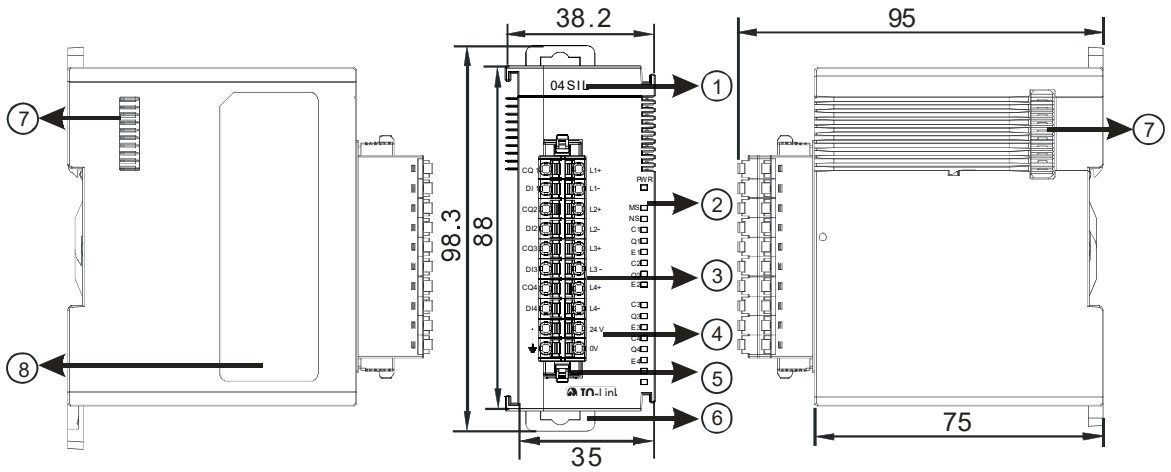
- **Unit Specification**

Item		Specifications
Module type		IO-Link master
Model name		AS04SIL-A
Number of IO-Link ports		4
Communication	**Baud rate**	4.8kbps, 38.4kbps,230.4kbps
	Topology	1 : 1
	Compliant standards	● IO-Link Interface and System Specification Version 1.1.2 ● IO-Link Tester Specification Version 1.1.2
Mode	**IO-Link**	Yes
	SIO (DI)	Yes
	SIO (DO)	Yes, up to 100 mA / channel
Cyclic communications		Min. 2 ms; dynamic, according to the valid data length
Input: data size in each communication port		Max. 32 bytes
Output: data size in each communication port		Max. 32 bytes
Input: data size in each module		Max. 128 bytes
Output: data size in each module		Max. 128 bytes
Input PDO data size		Max. 100 words
Output PDO data size		Max. 100 words
Backup		Yes
Cable specification	**Type**	Unshielded (can also apply to shielded ones)
	Length	Max. 20 m
	Electrostatic capacity between lines	Max. 3 nF
	Loop resistance	Max. 6 Ω
External connection terminals		Removable terminal block, clamping connector

- **Electrical Specifications**

Item		Specifications
Power supply to device in IO-Link mode or SIO (DI) mode	**Rated voltage**	24VDC (20.4VDC~ 28.8VDC) (-15%~+20%)
	Max. load current	0.2A/port
	Short-circuit protection	Yes
Digital inputs in SIO (DI) mode	**Internal I/O common**	NPN, PNP
	Input voltage/ current	24VDC, 5mA
	ON voltage	>15VDC
	OFF voltage	<5VDC
	Input filter time	No filter, 1ms (default), 2ms, 4ms, 8ms, 16ms, 32ms, 64ms, 128ms, 256ms
Digital outputs in SIO (DO) mode	**Internal I/O common**	NPN, PNP
	Output voltage/ current	24VDC (20.4VDC~ 28.8VDC),0.1A/port
	Short-circuit protection	Yes
	Leakage current	<0.1mA
	Residual voltage	<1.5VDC
Digital inputs for Pin2 in IO-Link mode	**Internal I/O common**	NPN, PNP
	Input voltage/ current	24 VDC, 2mA
	ON voltage	>15VDC
	OFF voltage	<5VDC
	Input filter time	No filter, 1ms (default), 2ms, 4ms, 8ms, 16ms, 32ms, 64ms, 128ms, 256ms
Power consumption		0.8W
Weight		133g

13.2.2 Profile



Unit: mm

Number	Name	Description
1	Model name	Model name of the module
2	POWER LED indicator (Blue)	Indicates the status of the power supply ON: the power is on OFF: no power or the power voltage is too low
	Module LED indicator (Red)	Error status of the module OFF: The module is normal. ON: The communication with its left-side PLC or RTU module fails. Blinking: 1. Module setting or communication error (blinks every 1 second) 2. Hardware or low voltage error (blinks every 0.2 second)
	Network LED indicator (Orange)	Error status of the network ON: No external power supply Blinking: Scanning is ongoing or the module is already configured and the diagnosis is done. OFF: The module has been configured but the diagnosis has not done yet.
	C1, C2, C3, C4 LED indicator (Orange)	IO-Link connection status of each communication port ON: The communication port is in IO-Link mode and a device is connected. Blinking: The communication port is in IO-Link mode but no device is connected or the device connected is not configured. OFF: The communication port is disabled or in SIO mode.
	Q1, Q2, Q3, Q4 LED indicator (Orange)	Indicates the status of input / output in SIO mode ON: The input/output is working in SIO mode. OFF: The communication port is disabled or in IO-Link mode.
	E1, E2, E3, E4 LED indicator (red)	Indicates if any warning or error occurs in each communication port of the IO-Link connection. Blinking: A warning or an error occurs OFF: No warnings or errors
3	Removable terminal block	IO-Link

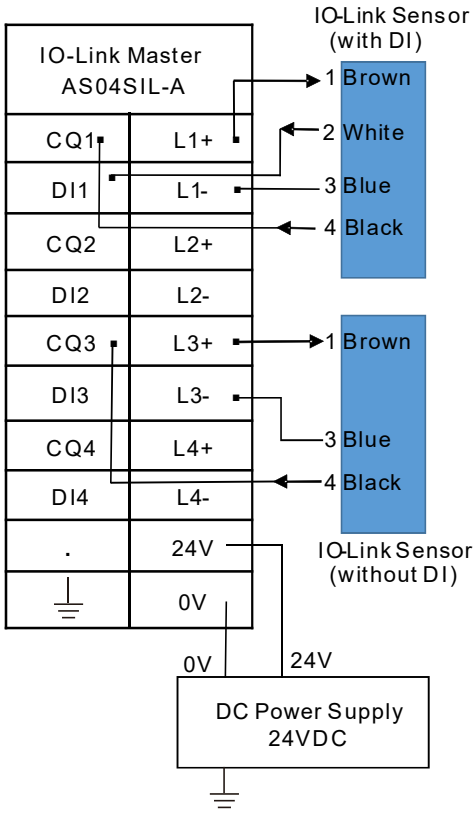
Number	Name	Description
4	Arrangement of the input/output terminals	Arrangement of the terminals
5	Terminal block clip	Removal of the terminal block
6	DIN rail clip	Secures the module onto the DIN rail
7	Module connecting set	Connects the modules
8	Label	Nameplate

13.2.3 Wiring

13.2.3.1 IO-Link Mode Wiring for Power and Communication

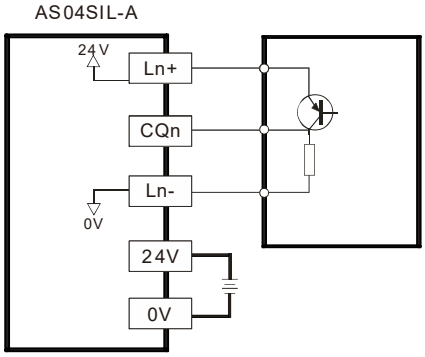
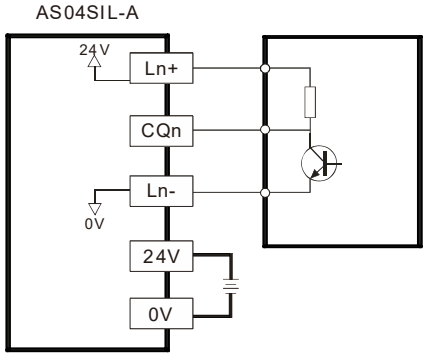
Precautions:

1. Keep the input cables, output cables and power cable separate from one another. It is suggested to use independent power for AS04SIL-A. See the example below.



2. The 24 VDC cable should be twisted and connected to a module within a short distance.
3. Do not bundle 110 VAC cable, 220 VAC cable, 24 VDC cable, the (high-voltage high-current) main circuit, and the I/O signal cable together and keep the power cables away from the earth cable. It is suggested that the distance between adjacent cables should be more than 100 millimeters.
4. Connect a cable with a diameter of 14 AWG or higher to ground.
5. Use single-wire cables or two-wire cables with a diameter of 20 AWG to 14 AWG. Only use copper conducting wires with a temperature rating of 60/75°C.

13.2.3.2 Digital Input Wiring in SIO Mode

When the connected device is a PNP type	When the connected device is a NPN type
	
Note: n= 1~4	

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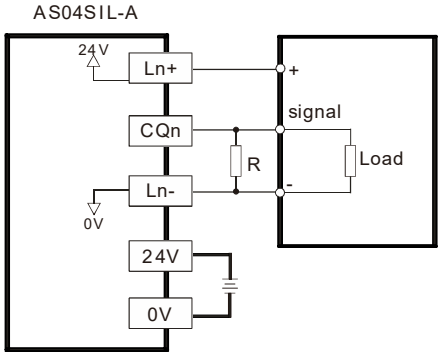
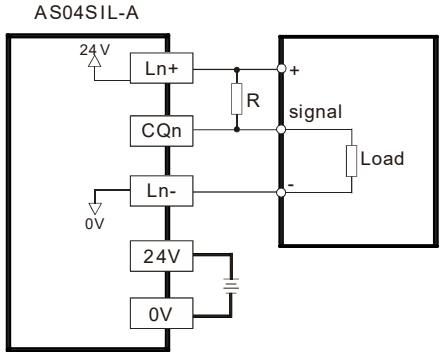
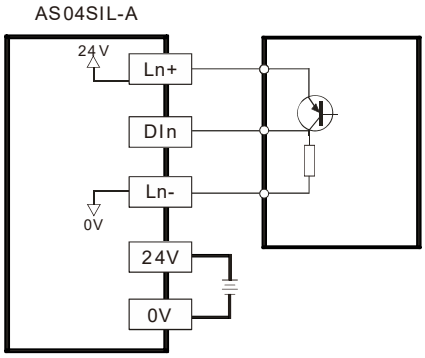
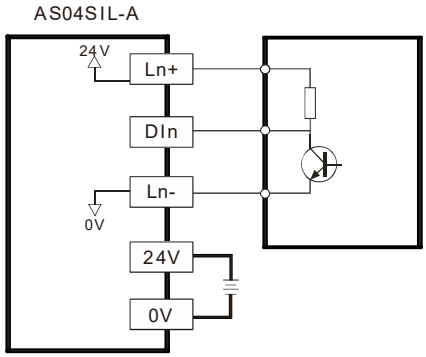
13.2.3.3 Digital Output Wiring in SIO Mode

When the connected device is a PNP type	When the connected device is a NPN type
	
Note: n= 1~4	

13.2.3.4 Digital Input Wiring

When the connected device is a PNP type	When the connected device is a NPN type
	
Note: n=1~4	

13.3 Functions

AS04SIL-A supports the IO-Link devices when it works as the IO-Link master. Between the master and the devices is the point-to-point connection adopting the reliable 3-wire technology and the unshielded standard cable to connect intelligent sensors/actuators which function as IO-Link devices. AS04SIL-A is compatible with traditional digital sensors/actuators. The designs for circuit status and data channels are both based on the reliable 24VDC technology.

13.3.1 Basic Functions

13.3.1.1 Cyclic Communication Function

I/O data (process data) in the IO/Link devices is cyclically exchanged with the IO-Link master module which operates as the IO-Link communication master. Meanwhile as the extension module of the upper device, AS04SIL-A can cyclically update the device data and status of the IO-Link master to the upper device.

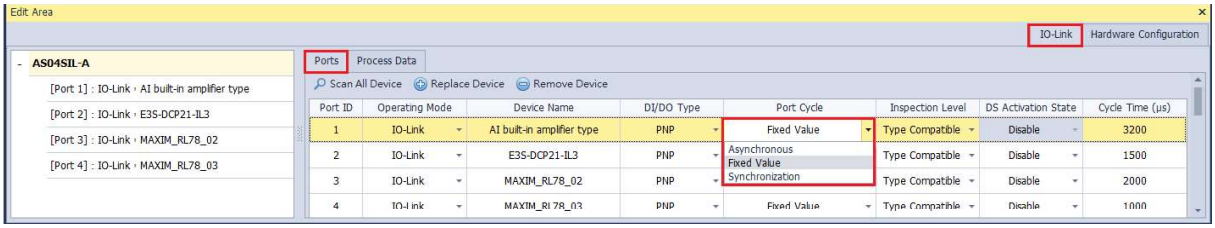
For example, users can use cyclic communications to check the amount of incident light for photoelectric sensors, stability detection margins, and excessive proximity for proximity sensors, etc. as well as detect the amount of performance deterioration in devices and changes in usage conditions.

There are three modes for cyclic communications:

(1) Asynchronous: AS04SIL-A and IO-Link device defines the cycle time for each port and uses the shortest update cycle time.

(2) Fixed Value: the system uses what you have set for the update cycle time here. The value here should be within the cycle time range of the connected device and the minimum value should be a number bigger than the shortest cycle time that the connected device supports.

(3) Synchronization: AS04SIL-A defines the update cycle time for all the selected communication ports synchronously. (You need to select at least two ports.) Since different device supports different update cycle time, the system uses the biggest time among all the shortest cycle times to have every device covered.

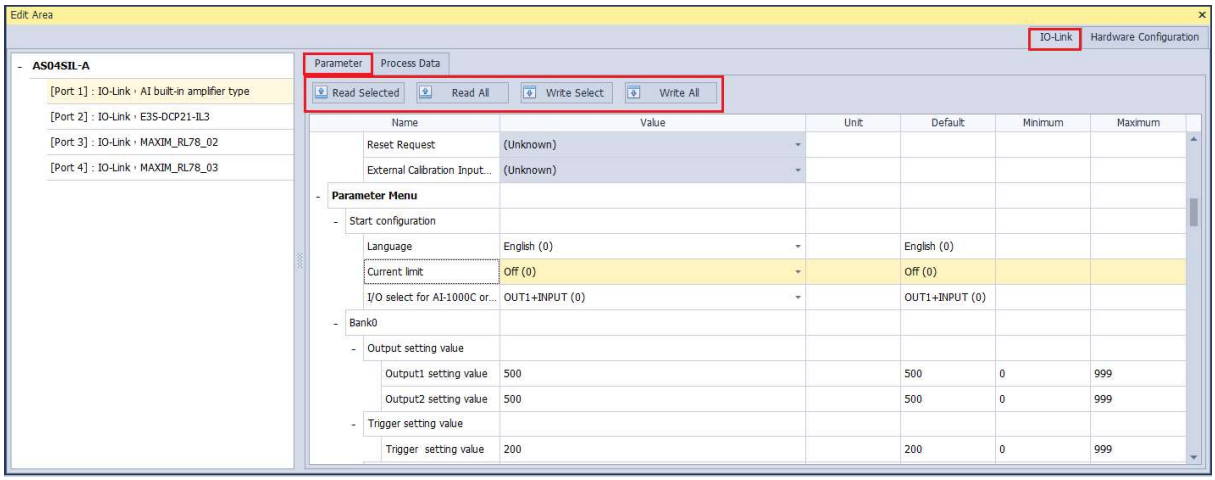


13.3.1.2 Message Communication Funciton

AS04SIL-A receives messages (non-cyclic) from ISPSoft, sends the data to IO-Link devices and sends back the response from IO-Link devices to AS04SIL-A.

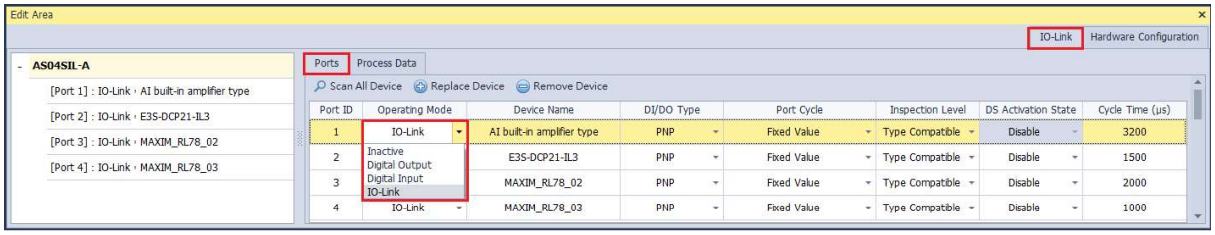
Non-cyclic data, including device parameters and events, uses specific index and sub-index for searching. AS04SIL-A uses explicit message to read and write these data. It is very useful to use index or sub-index in reading and writing data.

You can select the data or parameter type to read or write as the setting image shown below. For example, during operation you can change and adjust device parameters, such as threshold settings, execution tuning, and ON-delay time from a program as well as check the internal status, such as the operating time of devices.



13.3.1.3 Communication Mode Setting

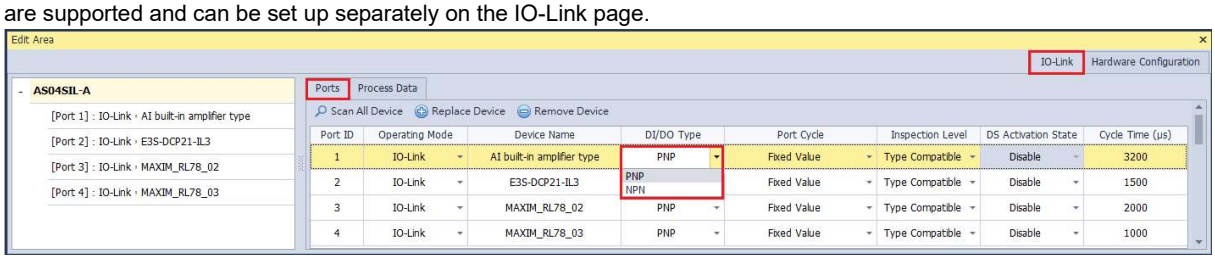
You can select one operating mode among the modes of **Inactive, SIO (Digital Output, Digital Input) and IO-Link** for each communication port on the following software page.



A mixture of IO-Link communication and digital I/O can apply to the same AS04SIL-A module.

13.3.1.4 Digital Input and Digital Output Function (SIO)

CQ1-CQ4 of AS04SIL-A can be used independently as the standard input or output. The DI/DO types of PNP and NPN are supported and can be set up separately on the IO-Link page.

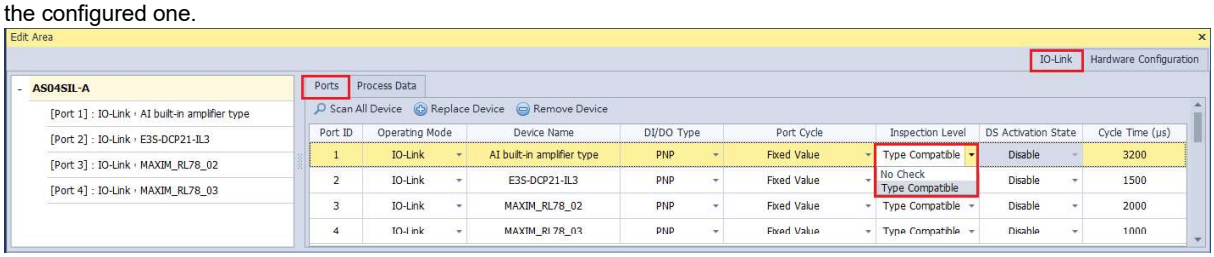


13.3.1.5 Automatic IO-Link Baud Rate Setting

AS04SIL-A can automatically match one of existing baud rates (4.8kbps, 38.4kbps and 230.4kbps) of IO-Link devices and communicate with them. Thus there is no need to set the baud rate at communication ports for connected devices.

13.3.1.6 Connected Device Verification

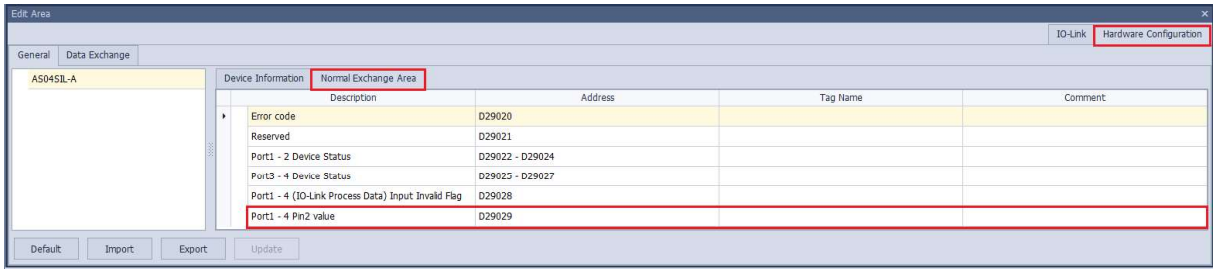
As long as the **Type Compatible** option under **Inspection Level** is enabled and the setting is downloaded, AS04SIL-A will check if the IO-Link device actually connected matches the product model of the configured device. If not matched, the status code of the communication port will show 16#8CA2 which indicates that the connected device is inconsistent with the configured one.



13.3.1.7 DI (Digital Input) Function of IO-Link Pin2

The IO-Link system may not respond fast enough for high-speed applications. When the connected IO-Link sensor supports the second output, connect the sensor's pin2 to DI of the port of AS04SIL-A. At this moment, the sensor can still be watched and set up via the sensor's pin4.

The real-time data can be monitored through **Port 1- 4 Pin2 value** of **Normal Exchange Area**. See the following figure as an example.



The mapped register for **Port 1- 4 Pin2 value** of **Normal Exchange Area** is D29029. For the pin2 input value, the addresses D29029.0~ D29029.3 correspond to port 1~ port 4 respectively.

Communication Port	Address
Port 1	D29029.0
Port 2	D29029.1
Port 3	D29029.2
Port 4	D29029.3

DI1-DI4 of AS04SIL-A can also be used separately as standard inputs.

13.3.1.8 IO-Link Communications Error Detection

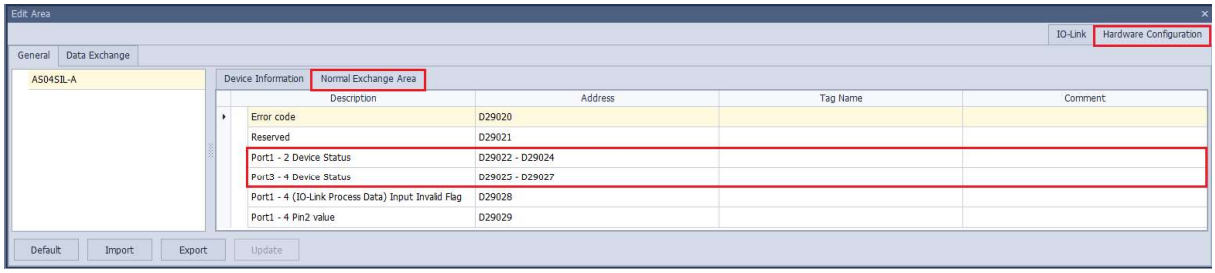
This function detects I/O-Link cable breaks, disconnections from IO-Link device ports, error-level device events, device configuration verification errors, and IO-Link device malfunctions. See section 13.5 for IO-Link event codes.

13.3.1.9 Detection of Short-Circuits in I/O Cables

This function detects short-circuits in I/O cables. The status code for communication ports will show 16#8CA4 if an error occurs.

13.3.1.10 Event Log

The IO-Link event codes listed in section 13.5 are refreshed in the mapped devices for ports in the **Normal Exchange Area** section as below.



The device status for each port should be set to 3 bytes in length. See the following table of above device addresses corresponding to ports in order.

Description	Address
Port 1	D29022_H, D29022_L, D29023_H
Port 2	D29023_L, D29024_H, D29024_L
Port 3	D29025_H, D29025_L, D29026_H
Port 4	D29026_L, D29027_H, D29027_L

Device status consists of Event qualifier and Event Code as follows.

For event codes, see section 13.5.

Event Qualifier	Event Code	
Byte 0	Byte 1	Byte 2

The data frame of Event Qualifier:

MODE		TYPE		SOURCE	INSTANCE		
Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0

Bit 0~ Bit 2: INSTANCE

Value	Definition
0	Unknown
1-3	Reserved
4	Application
5-7	Reserved

Bit 3: SOURCE

Value	Definition
0	Device (Remote)
1	Master (Local)

Bit 4~ Bit 5: TYPE

Value	Definition
0	Reserved
1	Notification
2	Warning
3	Error

Bit 6~ Bit 7: MODE

Value	Definition
0	Reserved
1	Event single shot
2	Event disappears
3	Event appears

13.3.1.11 Notification of Input Data Invalidity

Input Invalid Flag is used to determine whether the process input data in the upper device is invalid for the IO-Link communication or not.

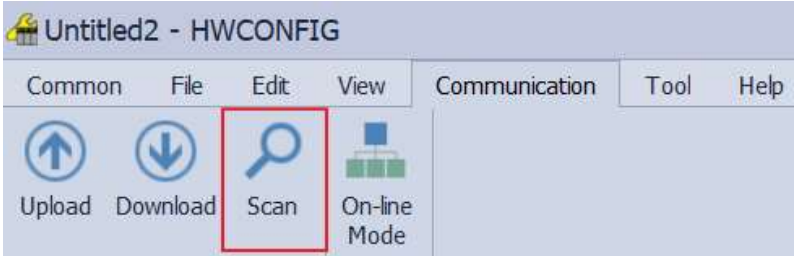
Whether the input data is invalid or not can be monitored by **Port1 – 4(IO-Link Process Data) Input Invalid Flag** of the **Normal Exchange Area** section. If the flag is 1, then the input data is invalid. If it is 0, the input data is valid.
See the example in the following figure.

The mapped register for **Port1 – 4(IO-Link Process Data) Input Invalid Flag** is D29028 and for the input invalid flag, D29028.0~ D29028.3 correspond to Port 1~Port 4 respectively as shown in the following table.

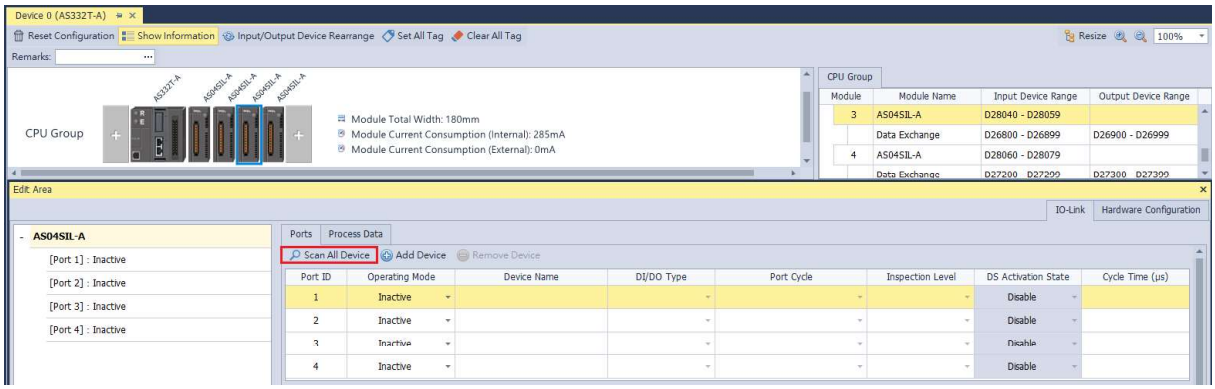
Communication Port	Address
Port 1	D29028.0
Port 2	D29028.1
Port 3	D29028.2
Port 4	D29028.3

13.3.1.12 IO-Link Device Scan Function

HWCONFIG 4.0 can enable AS04SIL-A to auto-identify all IO-Link devices at its communication ports via a click on **Scan** button.



You can also select any AS04SIL-A module and then click **Scan All Device** to scan all the IO-Link devices connected to the communication port of AS04SIL-A.



While SIL is auto-identifying devices, all IO-Link devices connected to IO-Link master need be restarted and therefore the devices will probably stop running for a short time.

13.3.2 Application Functions

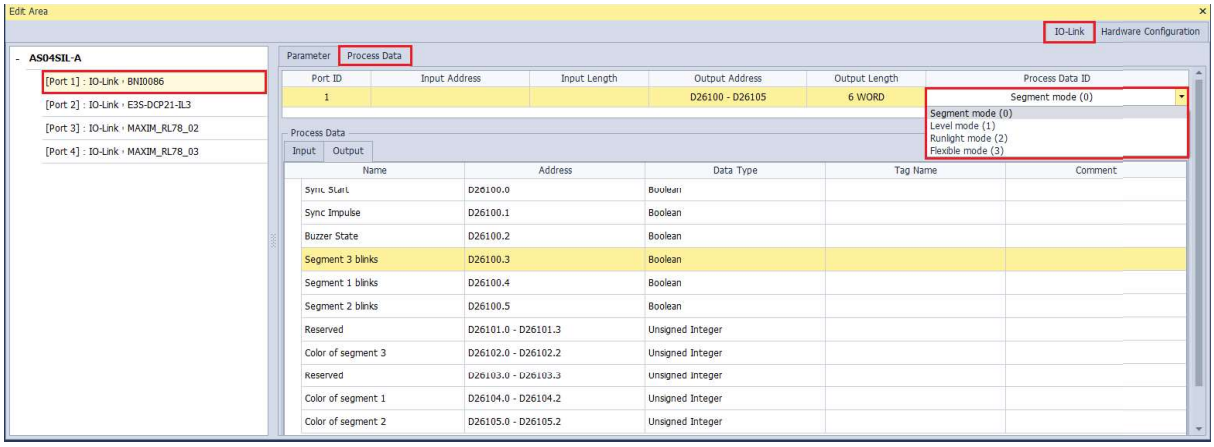
13.3.2.1 Load Rejection for Upper Device Stop or Communication Error

When the upper device enters STOP state or the communication with the upper device fails in IO-Link or SIO mode, the output function of AS04SIL-A is disabled and all process data outputs are 0. This function is used to prevent the incorrect output from the upper device as a communications error occurs.

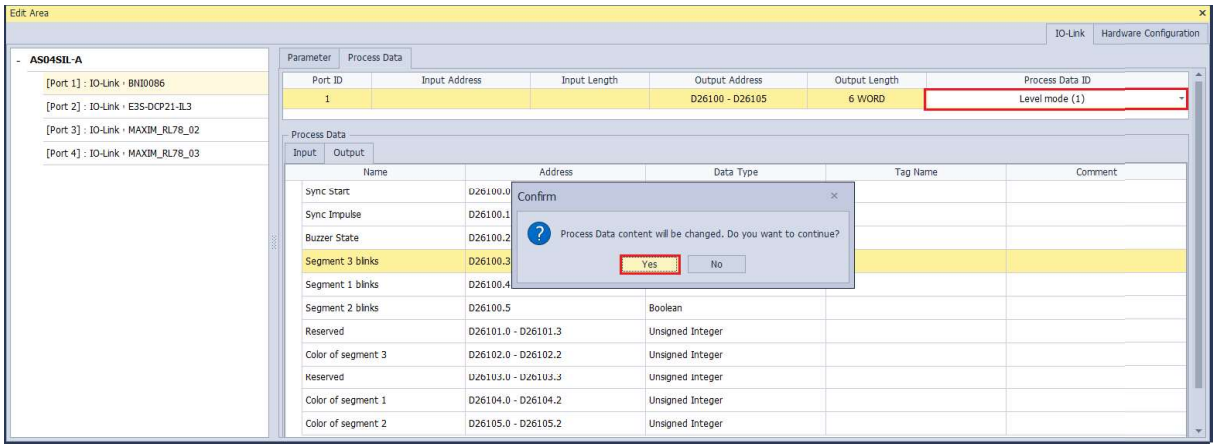
13.3.2.2 The Switch among Process Data Parameter Sets

IODD file allows IO-Link devices support several work modes, each of which corresponds to different Process Data parameter sets. Therefore SIL supports the switch among Process Data parameter sets if the IODD file of the configured device supports more than two work modes. However, the Process Data parameter set can not be changed if the IODD file of the configured device supports only one work mode.

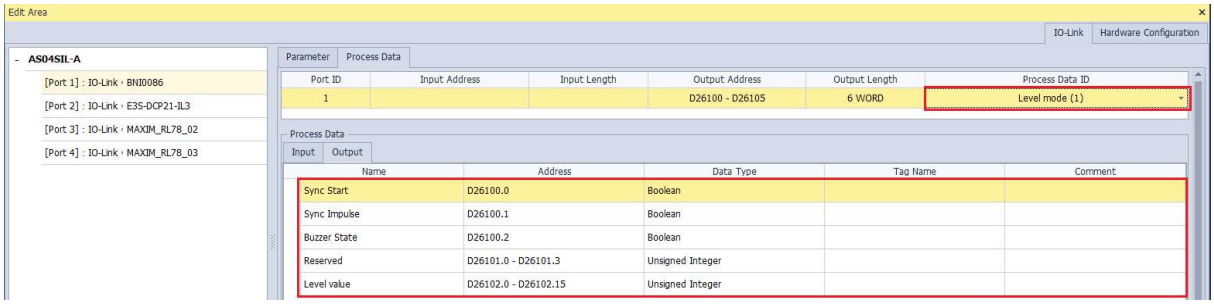
For example, the IO-Link device configured for Port 1 supports four work modes in the following figure. The default work mode is Segment mode (0).



When Level mode (1) is switched to, a **Confirm** dialog box will appear to alert that the Process Data content will be changed.



Clicking **Yes** button, the Process Data content will be refreshed in the software.

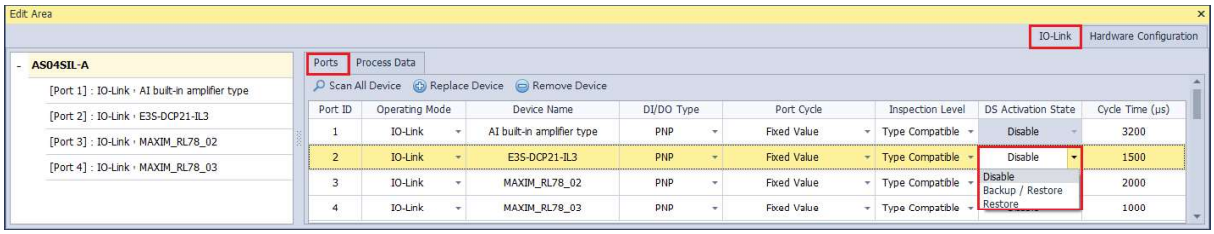


Click menu **Communication** > **Download**. The switch is completed once the download is done.

13.3.2.3 Backup and Restoration of Parameter Setup in IO-Link Devices

The V1.1 IO-Link devices support the Backup and Restore functions which are not necessary functions and are determined by their IODD files.

IO-Link device parameter settings are backed up to the IO-Link master or restored to IO-Link devices. When IO-Link devices are replaced, the communication can be resumed according to original settings instead of setting parameters once again. See the setting page below.



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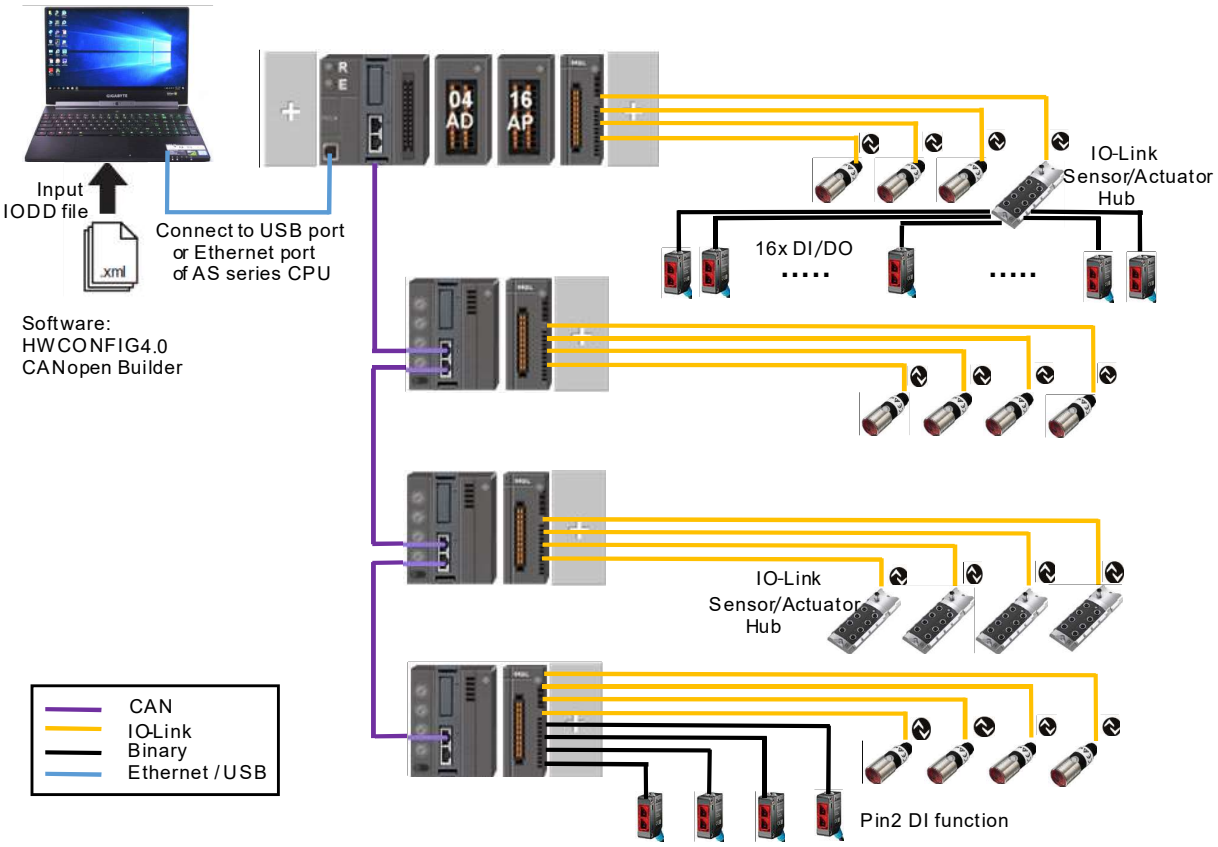
Option	Description
Disable	The backup function is disabled and the backed up process data is cleared.
Backup/Restore	The backup file is empty if no data exists. It is allowed to back up the parameters read from the connected device to the master and write the parameters to the connected device.
Restore	To write parameters to the connected device is allowed.

13.4 Application Examples

13.4.1 Using AS Series CPU as Upper Device

The AS04SIL-A module can be connected on the right side of AS series CPU or AS00SCM-A (RTU mode). If AS04SIL-A is placed on the right of AS00SCM-A (RTU mode), the AS-FCOPM communication card need be added to AS00SCM-A. AS04SIL-A supports three remote communication modes and communicates with the upper device via CAN port. When the upper device is an AS series CPU, the application situation is as illustrated in the following figure.



An AS04SIL-A module can connect with 4 IO-Link devices at most. If the hybrid use of the IO-Link devices and multiple traditional sensors (binary sensors) is needed, there are two connection methods based on the number of traditional sensors on site.

1. If there is only a small number of traditional sensors to be connected, each of AS04SIL-A module's ports can connect with one traditional sensor by using the DI function of Pin2 for each port.
2. If there are many traditional sensors to be connected, use the IO-Link hub from other brand to extend the connectable digital I/O devices.

There are three communication modes for AS00SCM-A plus AS-FCOPM.

Work mode	Description
AS Special Remote Mode	The AS04SIL-A module is a NIO module. The number of configurable modules is limited to AS series CPU including remote modules. 4 NIO modules can be configured at most.
Delta Special Driver & AS Remote Mode	All SIL modules and IO-Link devices can be configured in HWCONFIG 4.0. and can be monitored online by the software.
CANopen DS301 Mode	Here AS CPU is a CANopen master and AS00SCM-A is a CANopen slave. Up to 4 SIL modules can be configured on the right side of the slave AS00SCM-A (RTU). As many as 64 slaves can be connected to the AS CPU. CANopen Builder does not support the configuration of extension modules on the right side of AS00SCM-A and connected IO-Link devices. First make the connection in AS special remote mode, complete the configuration of all extension modules and IO-Link devices in HWCONFIG 4.0 and then switch the mode back to CANopen DS301 mode. Open CANopen Builder and configure PDO mapping according to the EDS file of AS00SCM-A with V2.06 or later. For details on operation, see section 13.4.5.

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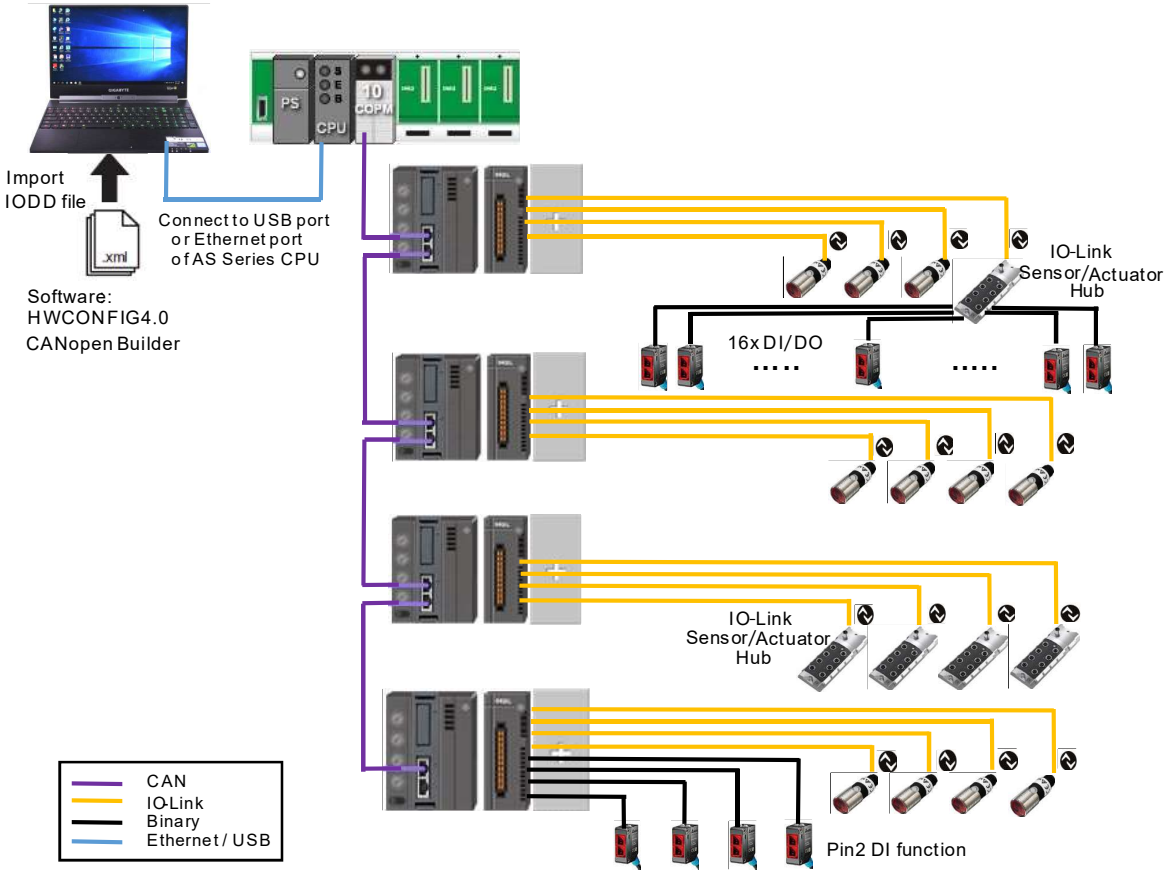
13.4.2 Using AH Series CPU or Non-Delta Master PLC as Upper Device

As CANopen master, AH series CPU need be used together with AH10COPM-5A module to communicate with the CANopen slave AS00SCM-A. See the application situation as illustrated in the following figure.



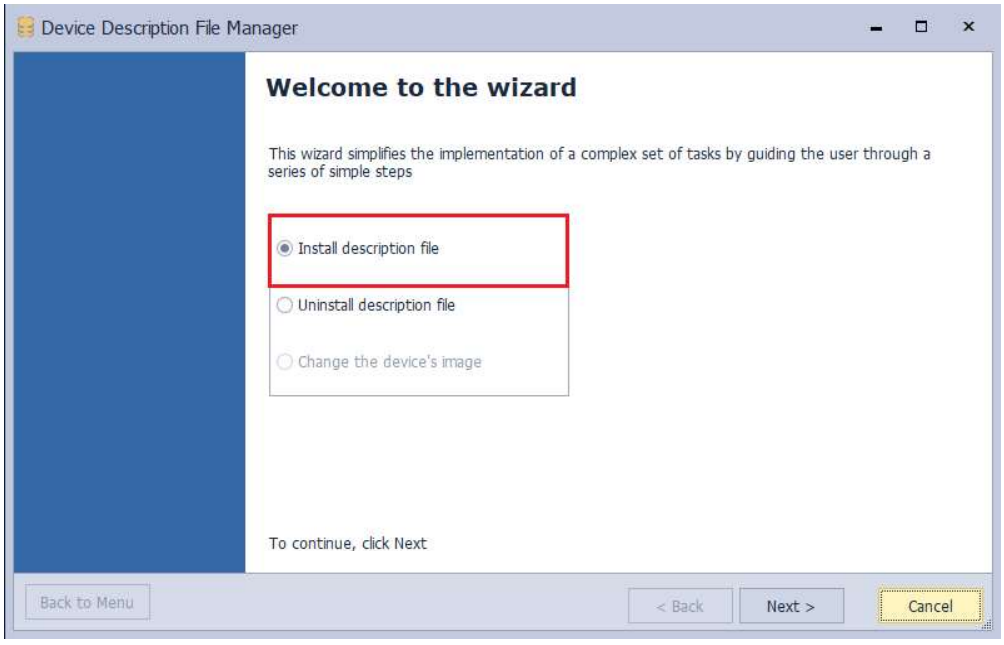
According to the description on CANopen DS301 Mode in section 13.4.1, connect the AS00SCM-A module to AS CPU in AS special remote mode, configure all extension modules and IO-Link devices in HWCONFIG 4.0 and then switch the mode back to the CANopen DS301 mode.
If the upper device is an AH series CPU, the CANopen Builder software can be opened. Configure the PDO mapping list according to the EDS file of the AS00SCM-A module. See the details in section 13.4.5.
If the upper device is a master PLC from other brand, use the software from the brand to configure the CANopen slaves and PDO mapping.

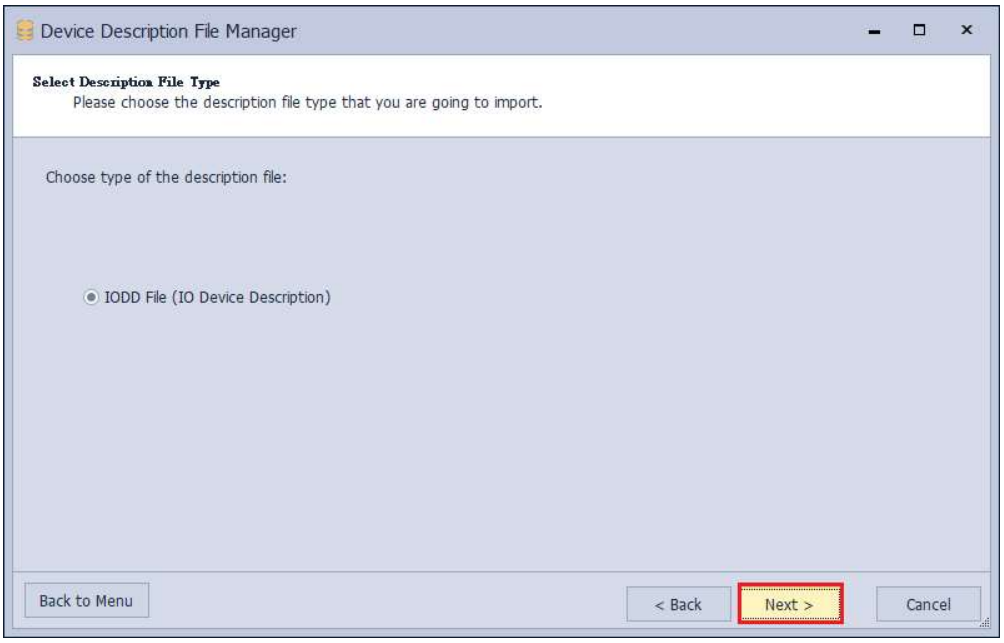
13.4.3 Application of AS Special Remote Mode

See the following table of devices used in the application example:

Model name	Device type
AS332T-A	PLC
AS00SCM-A	RTU
AS04SIL-A	IO-Link Master
AI-B100	3rd IO-Link Device
E3S-DCP21-IL3	3rd IO-Link Device
MAXREFDES27#	3rd IO-Link Device
MAXREFDES36#	3rd IO-Link Device

First of all, open the HWCONFIG 4.0 software and import the IODD files of IO-Link devices which can be downloaded from vendors' official websites. Follow the steps here to import the IODD files through the **Device Description File Manager** tool.





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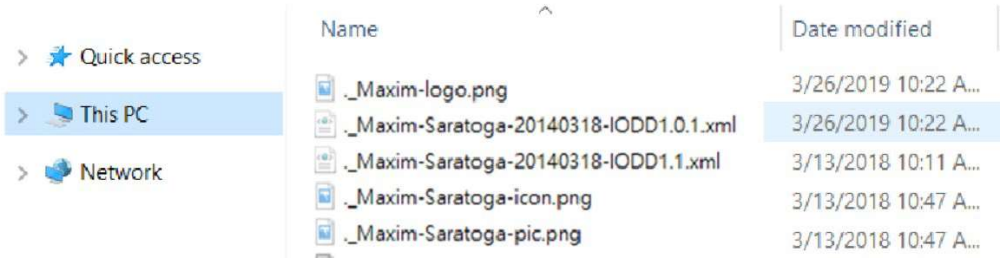
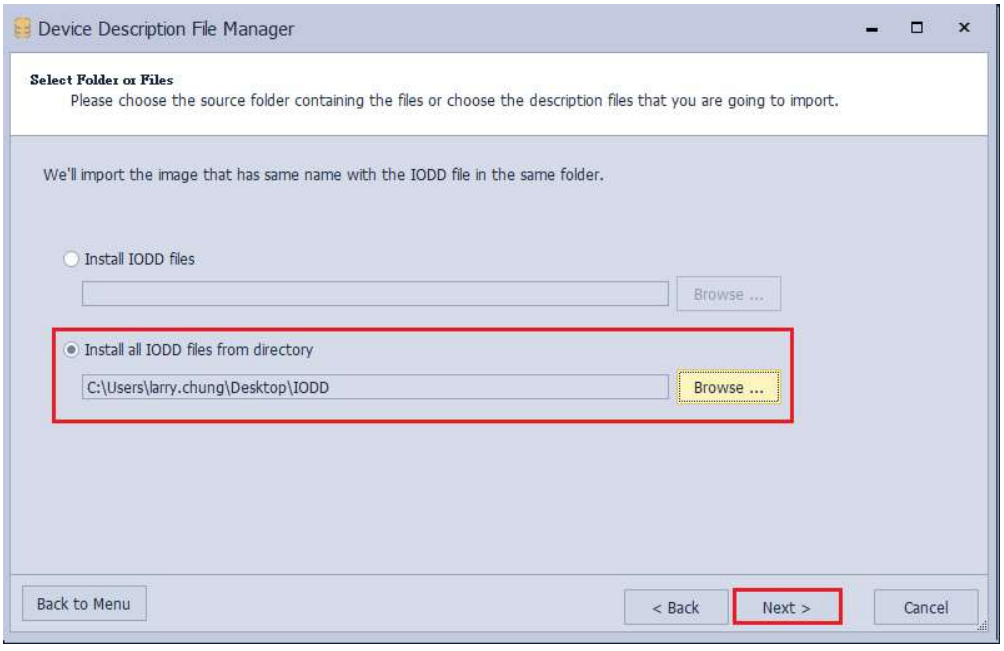
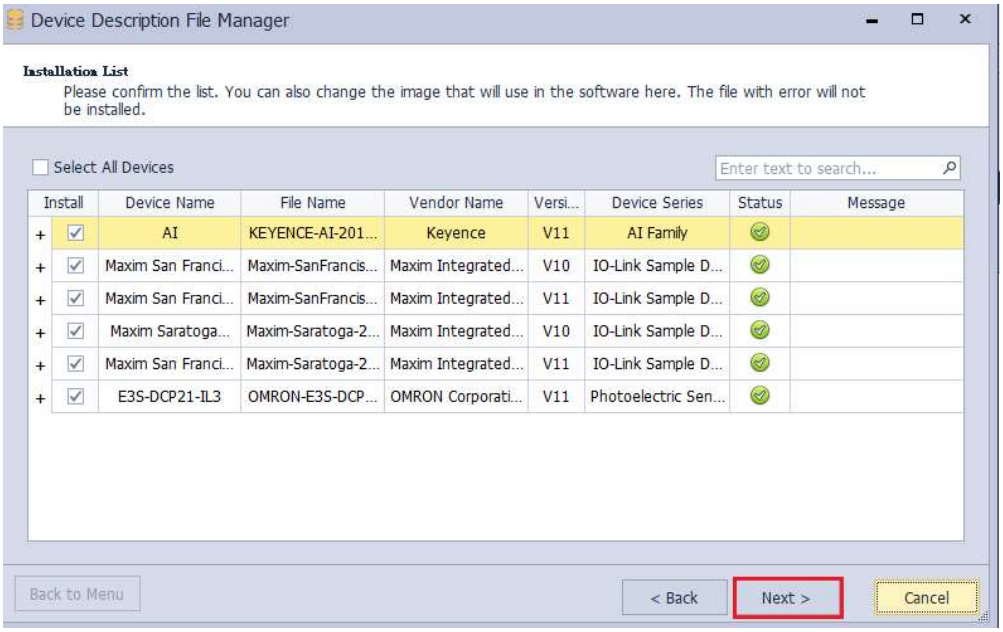
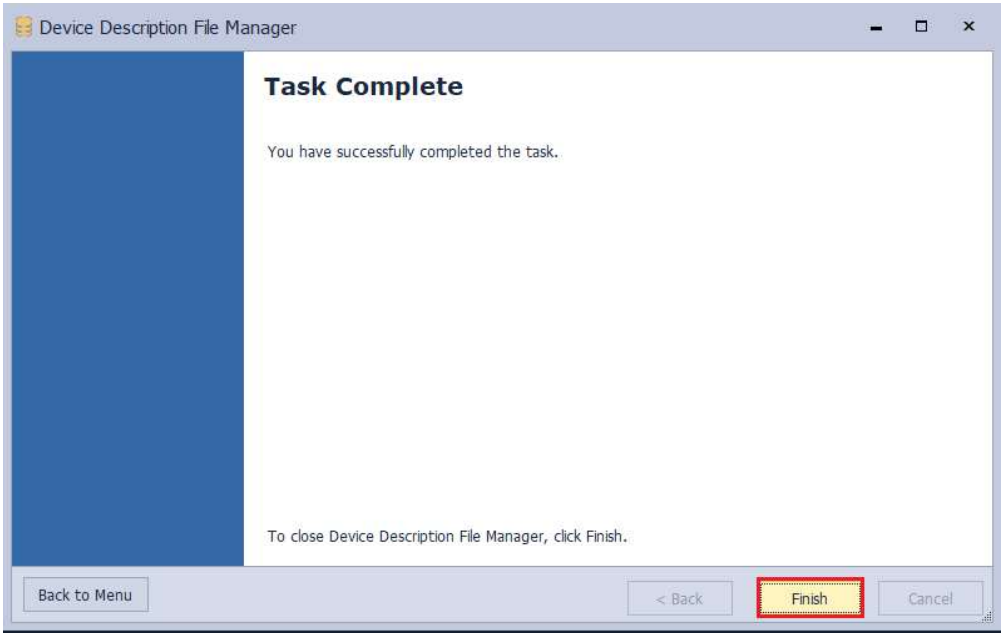
Put all IODD files in the same folder so as to import multiple IODD files at a time.





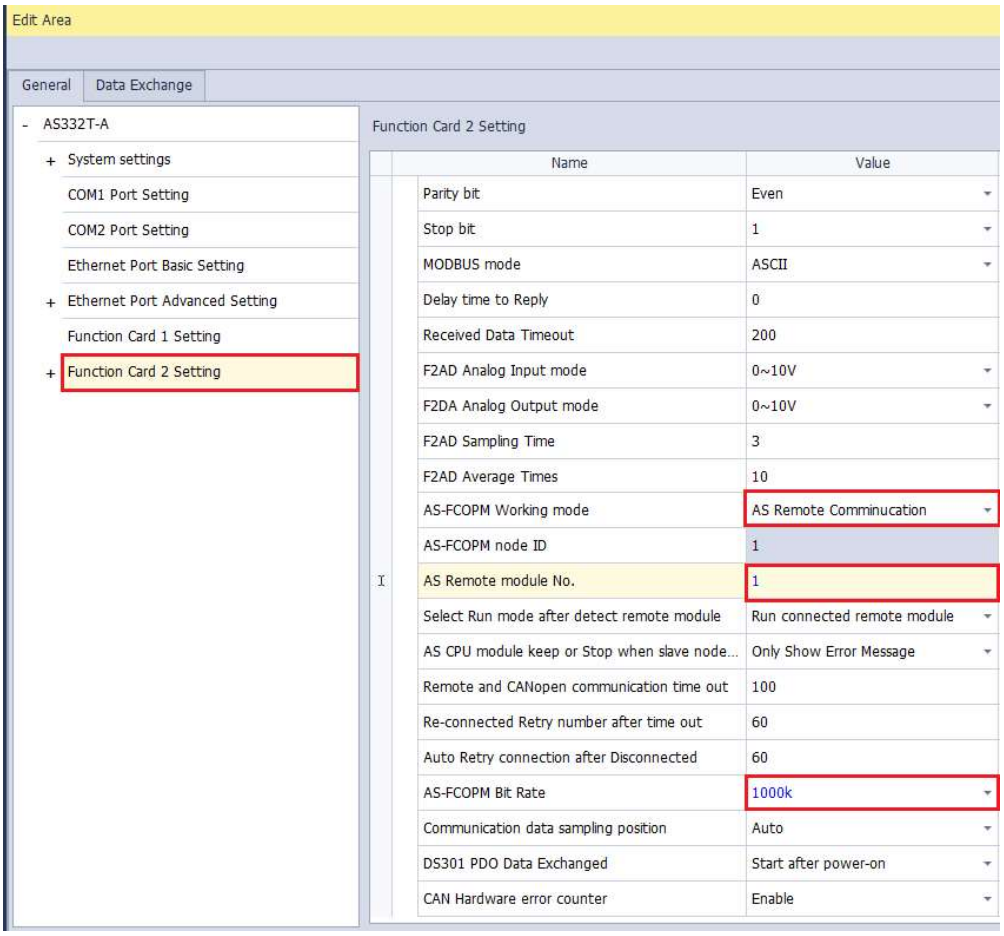


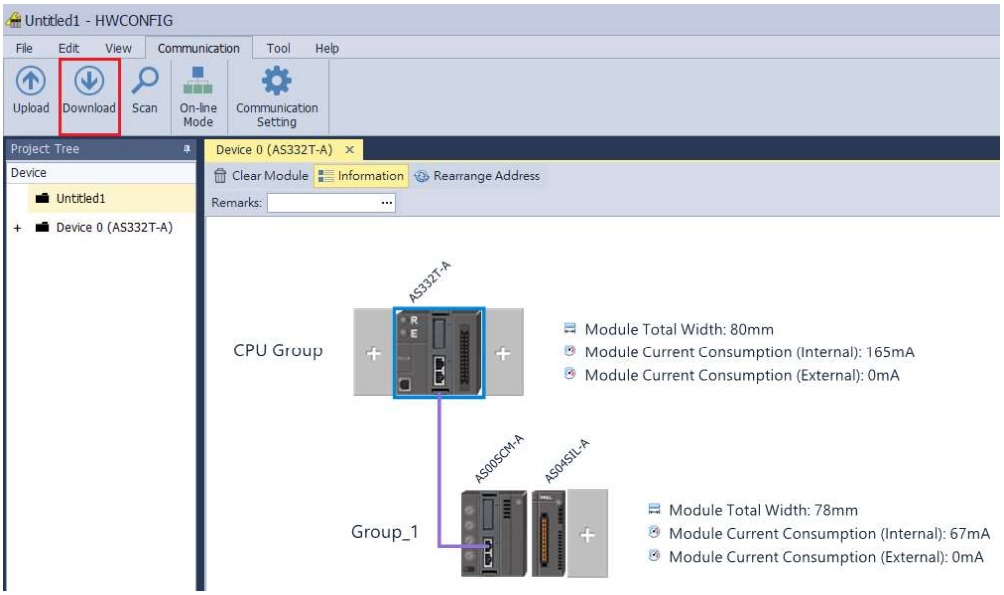


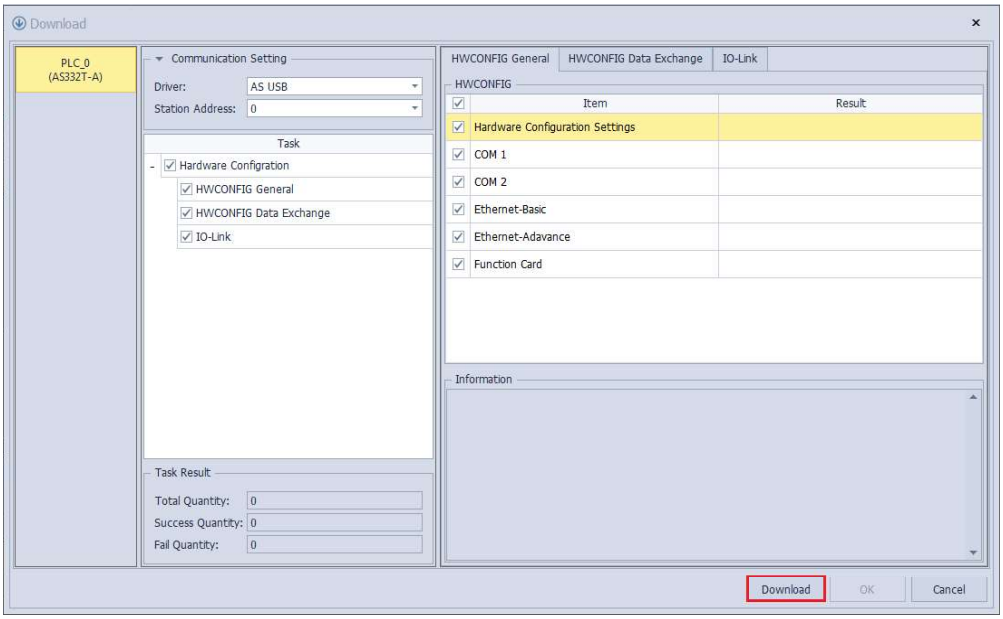
Check the following setups before the AS00SCM-A module is powered on.

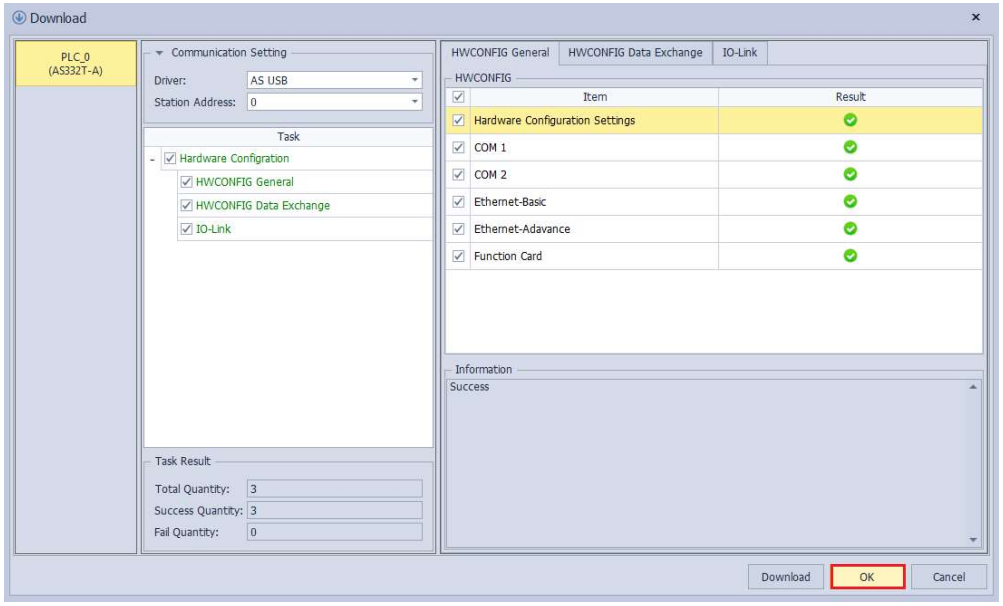
1. The AS-FCOPM card is inserted to AS00SCM-A via Card 2. (The 120Ω terminal resistor is enabled.)
2. Use Delta standard cables to connect to AS CPU and the mode switch is turned to RTU mode.
3. Four switches are set to ID1: 0/ FORMAT1: 0/ ID2: 1/ FORMAT2: 7 and the status is set to AS Remote Communication, node ID 1 and baud rate 1Mbps.
4. AS04SIL-A is connected on the right side of AS00SCM (RTU). Ensure that IO-Link devices are connected to the four ports according to the wiring in section 13.2.3.

Switch the power on after the AS-FCOPM card is inserted to AS332T-A via Card 2. (The 120Ω terminal resistor is enabled.) Open the HWCONFIG 4.0 software, set up function card 2 for AS CPU and then download the settings as follows.



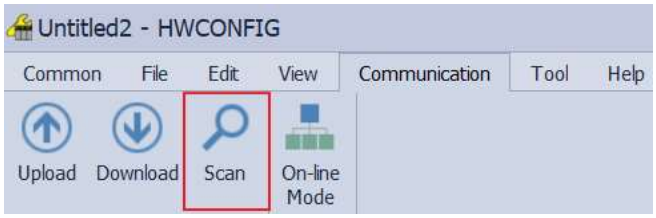


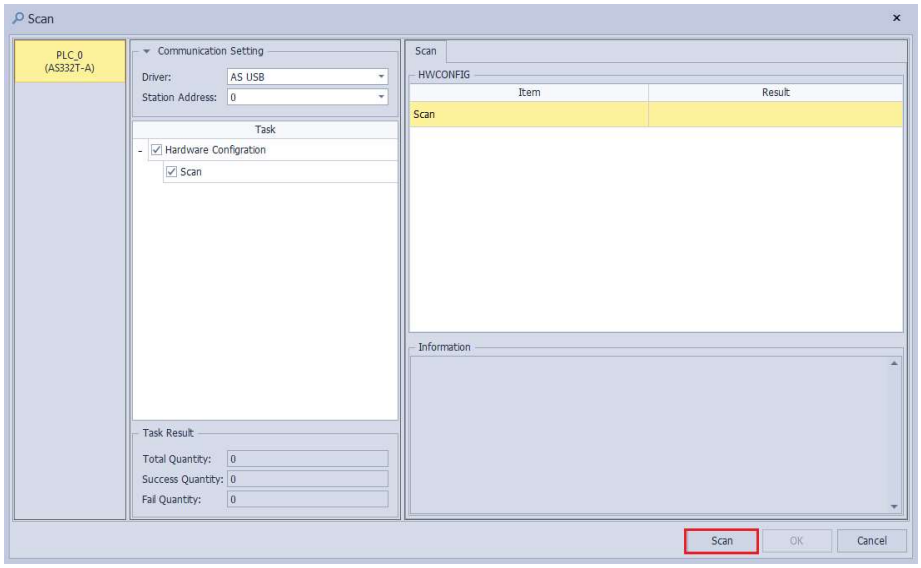


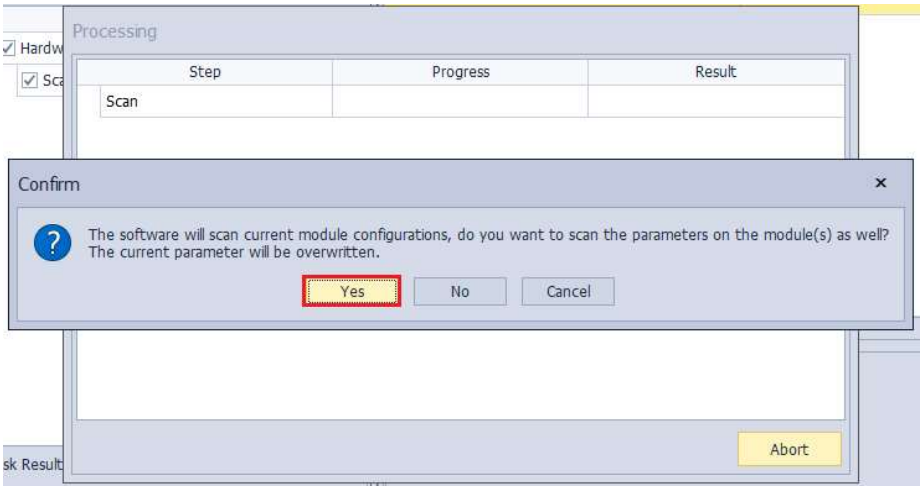


Ensure that the CANopen cables are connected properly and the AS00SCM-A module is already powered on. Check if the Card2 LED indicator of AS00SCM-A keeps blinking after the configuration of AS332T-A is downloaded so as to make sure the communication works normally.

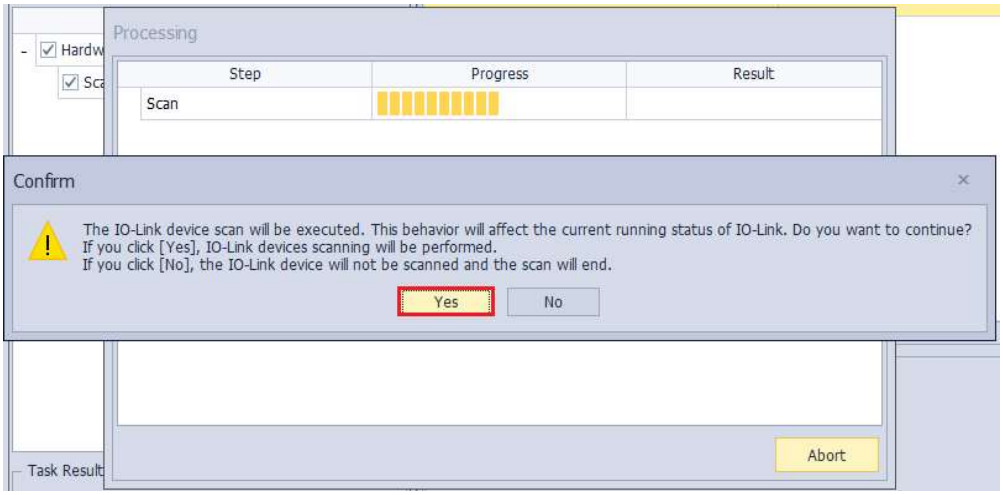
Click **Scan** button.



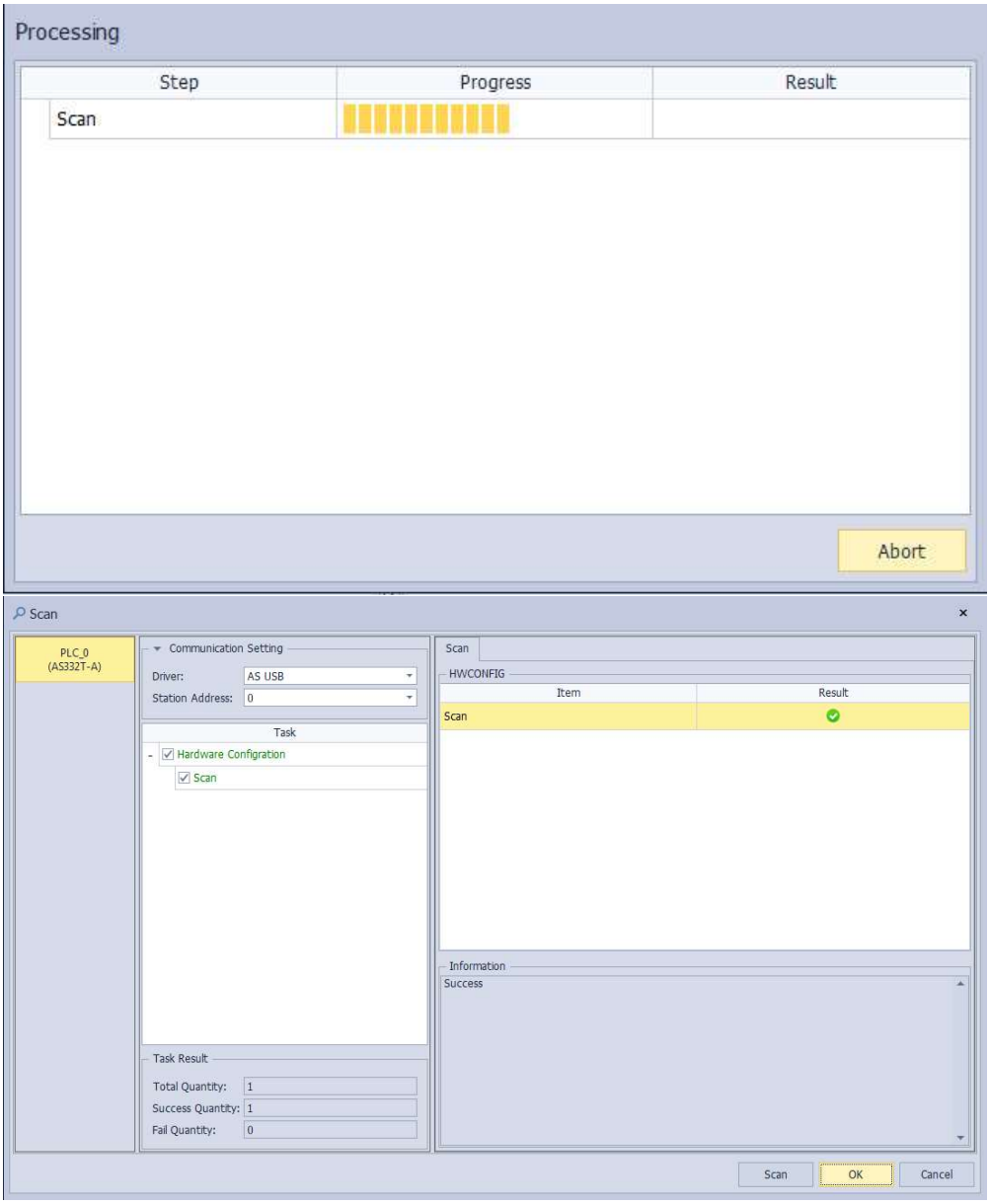




Once any AS04SIL-A module is detected through the software scan, the software will ask whether to scan the connected IO-Link device.

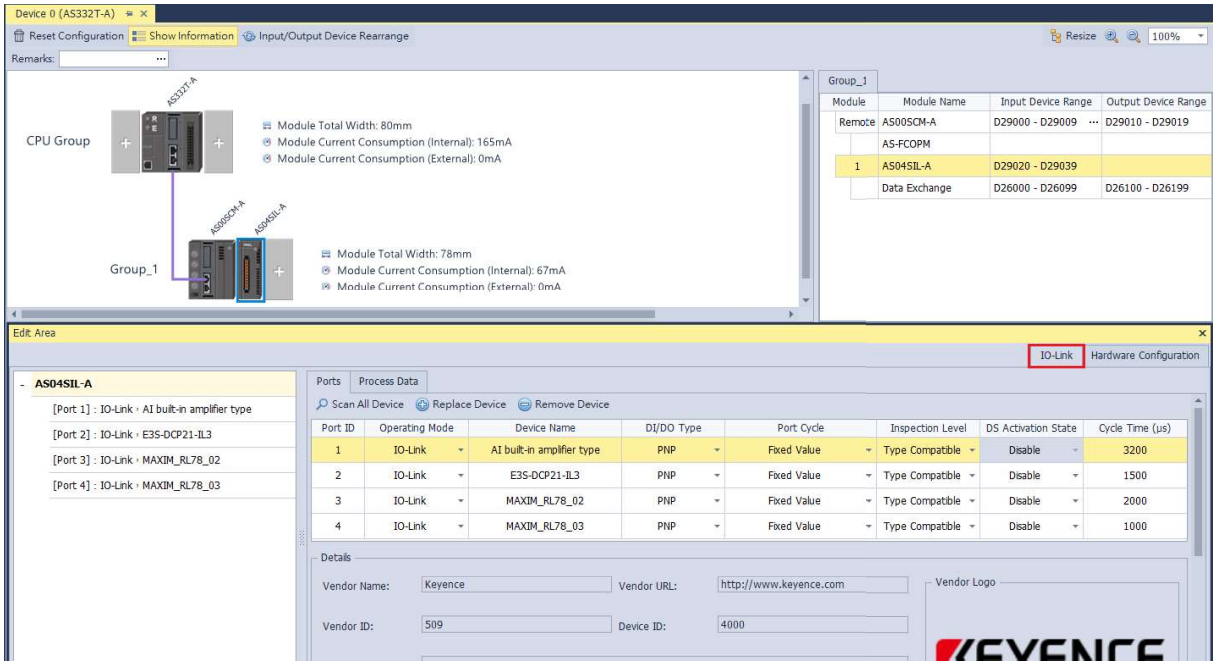


Perform the scan of IO-Link devices. If some configured devices are in communication during the scan, they will fail to be used temporarily. Restart the devices after the scan is over and restore the original work mode.



Click the IO-Link module and then select the **IO-Link** page where each device model and related information are can be seen and the parameters to be set up are all default values.

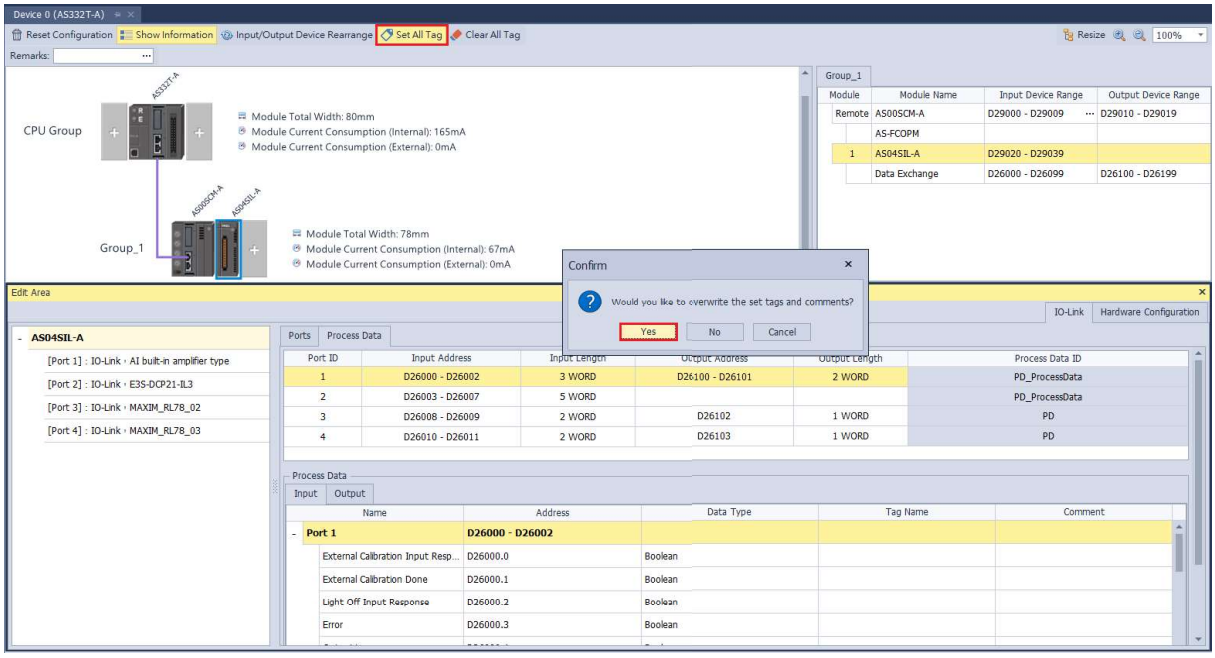
If no matched IODD file can be found out for the scanned device, **Unknown Device** will be shown in the device name field. Users need download the IODD file of the device from the coporate website of the device product according to the scanned device details such as Vendor Name, Vendor ID, Device ID and Device Name and then import the file into the HWCONFIG software.



Under the Process Data tab, you can find the supported register addresses of each port. Since ISPSoft V3.11 supports using tags in PLC programming, it is very useful to set up the tags and its corresponding register addresses.
Follow the steps 1~3 below to set up the tabs.

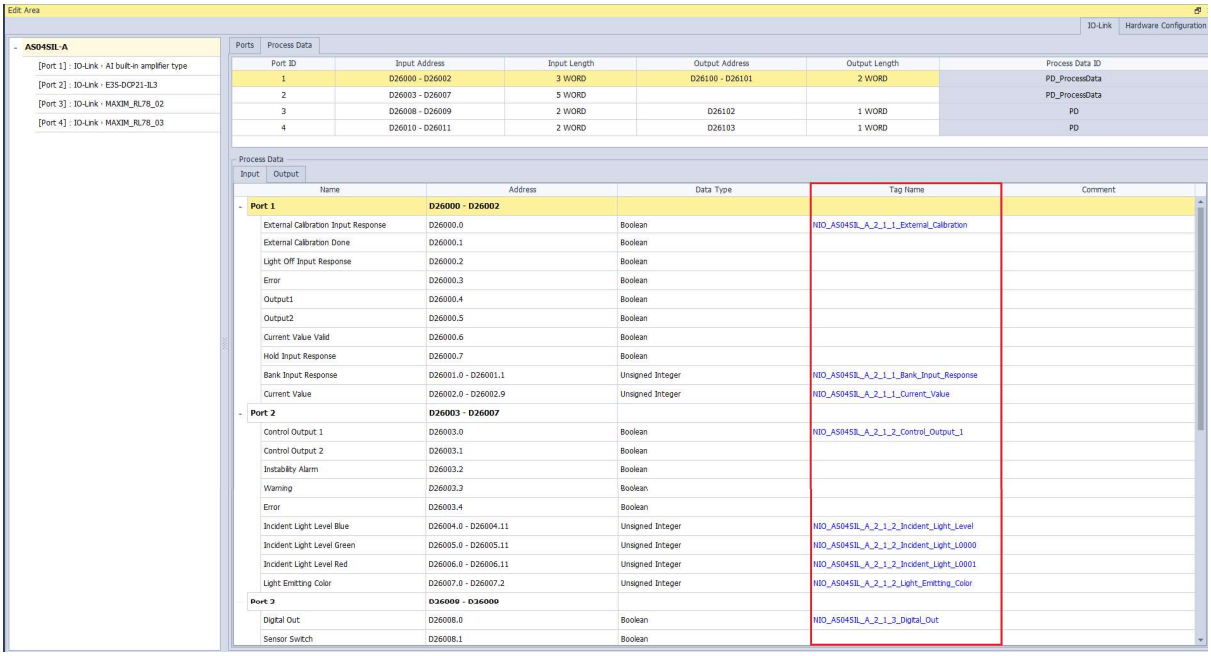
Step 1: Click **Set All Tag**

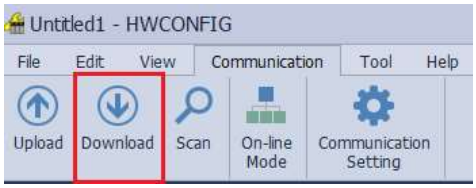
Step 2: A confirmation shows up asking you if you want to overwrite the set tags and comments. Click Yes to proceed.

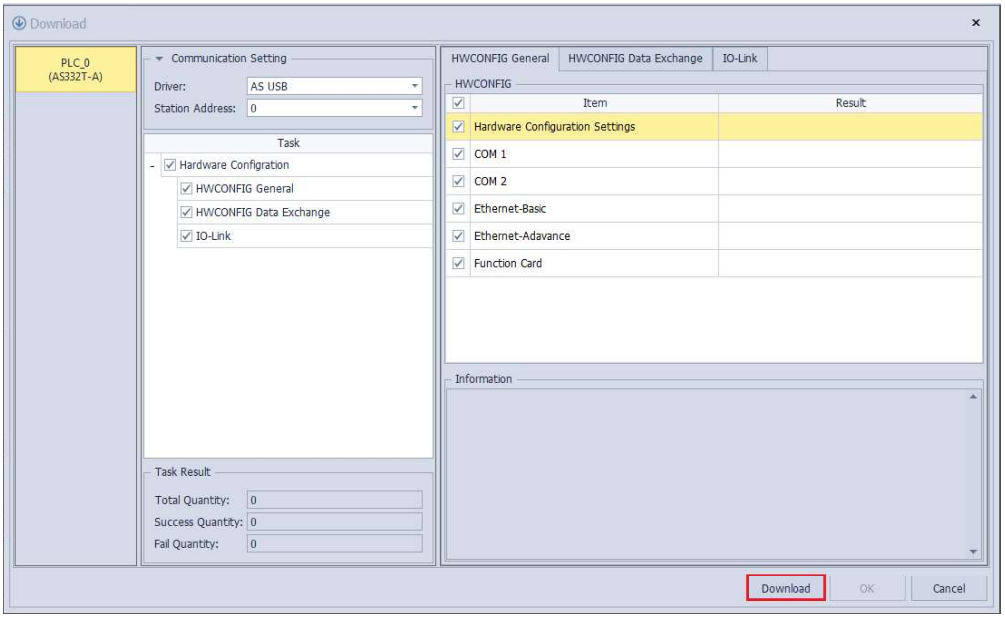


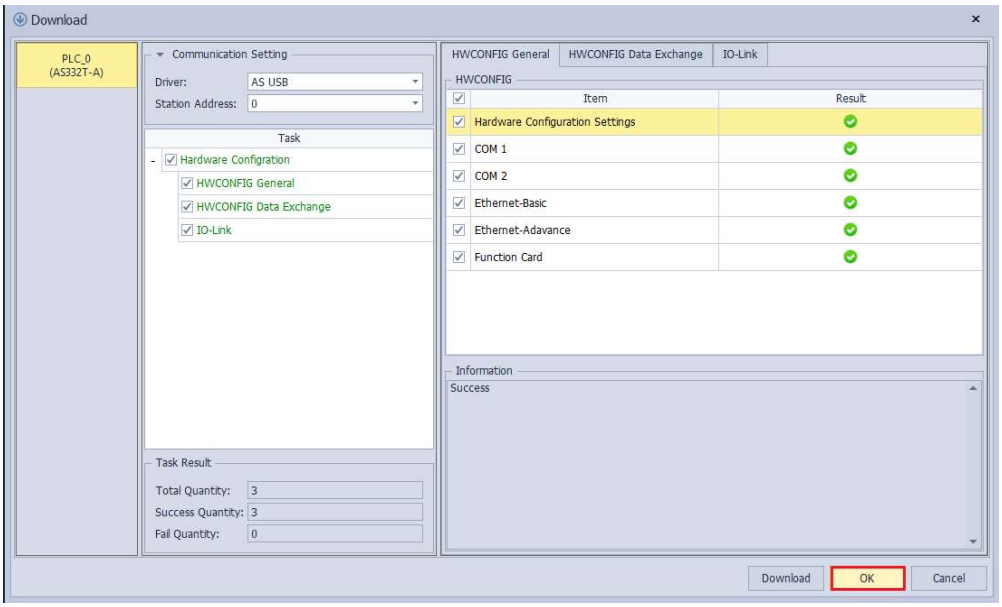
Step 3: All the editable tags show up. Double-click the tags in blue to edit if you need to use a different name other than the default ones.

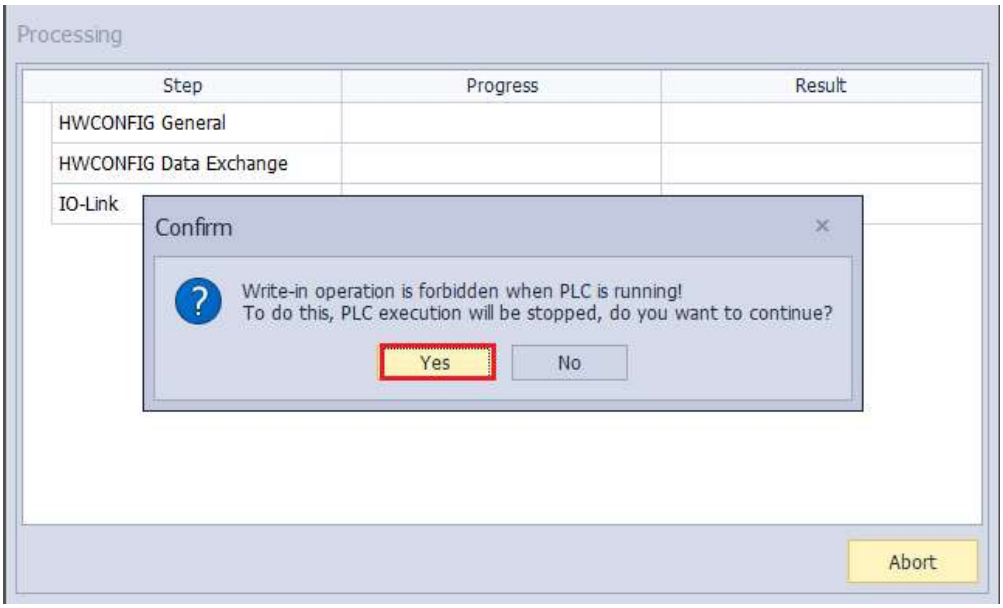
Note: One register address coresponds to one tag, and it shows on the first group of address.

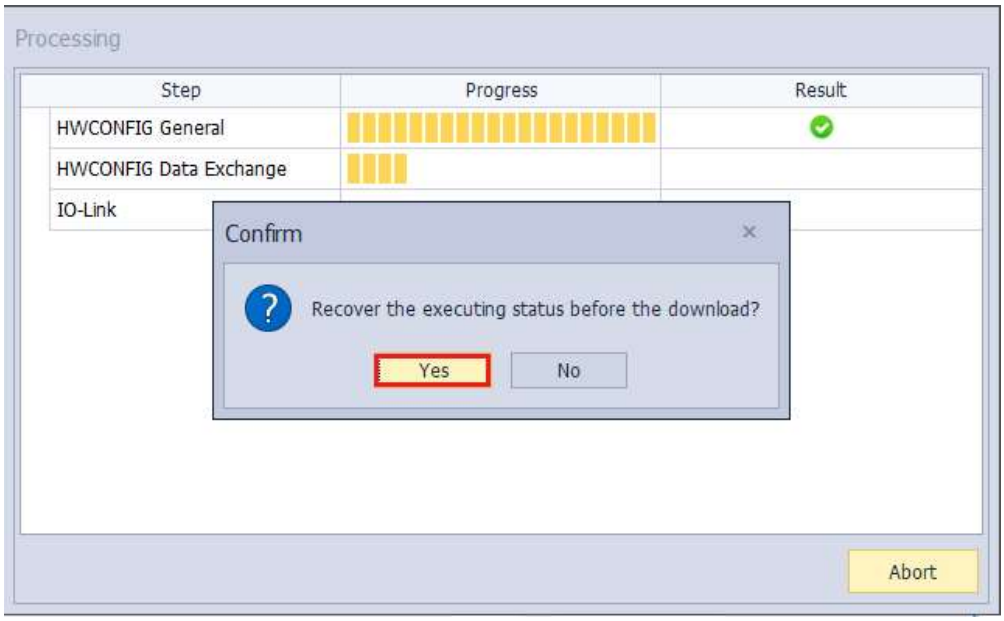


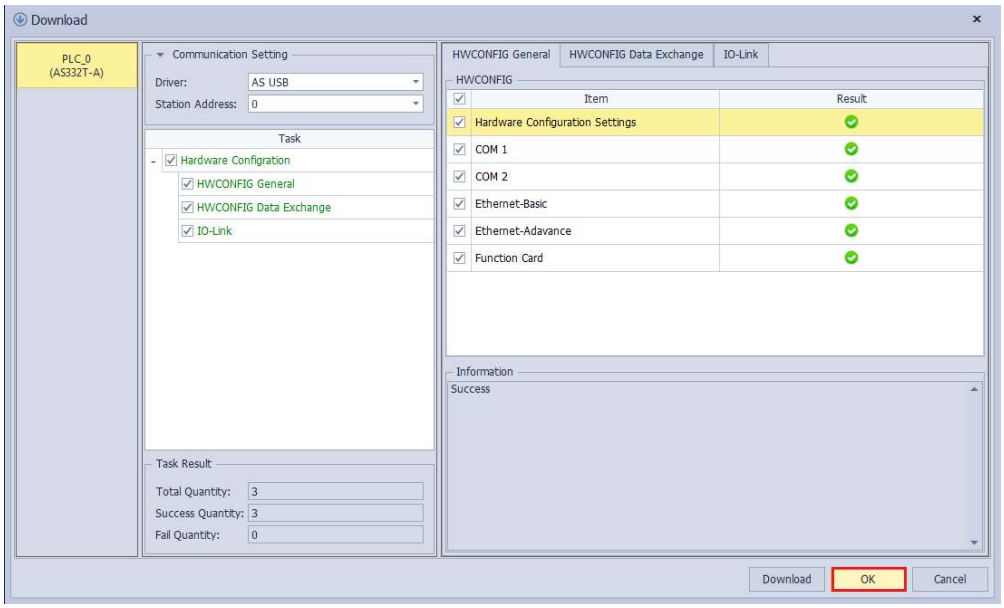





Download
PLC_0
(AS332T-A)
Communication Setting
Driver:
AS USB
Station Address:
0
Task
Hardware Configration
HWCONFIG General
HWCONFIG Data Exchange
IO-Link
Task Result
Total Quantity:
3
Success Quantity:
3
Fail Quantity:
0
HWCONFIG General
HWCONFIG Data Exchange
IO-Link
HWCONFIG
Item
Result
Hardware Configuration Settings
COM 1
COM 2
Ethernet-Basic
Ethernet-Adavance
Function Card
Information
Success
Download
OK
Cancel

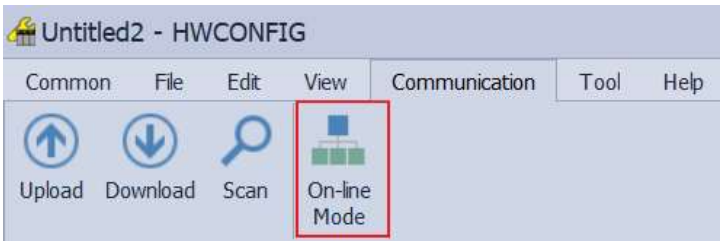

Processing
Step
Progress
Result
HWCONFIG General
HWCONFIG Data Exchange
IO-Link
Confirm
Write-in operation is forbidden when PLC is running!
To do this, PLC execution will be stopped, do you want to continue?
Yes
No
Abort

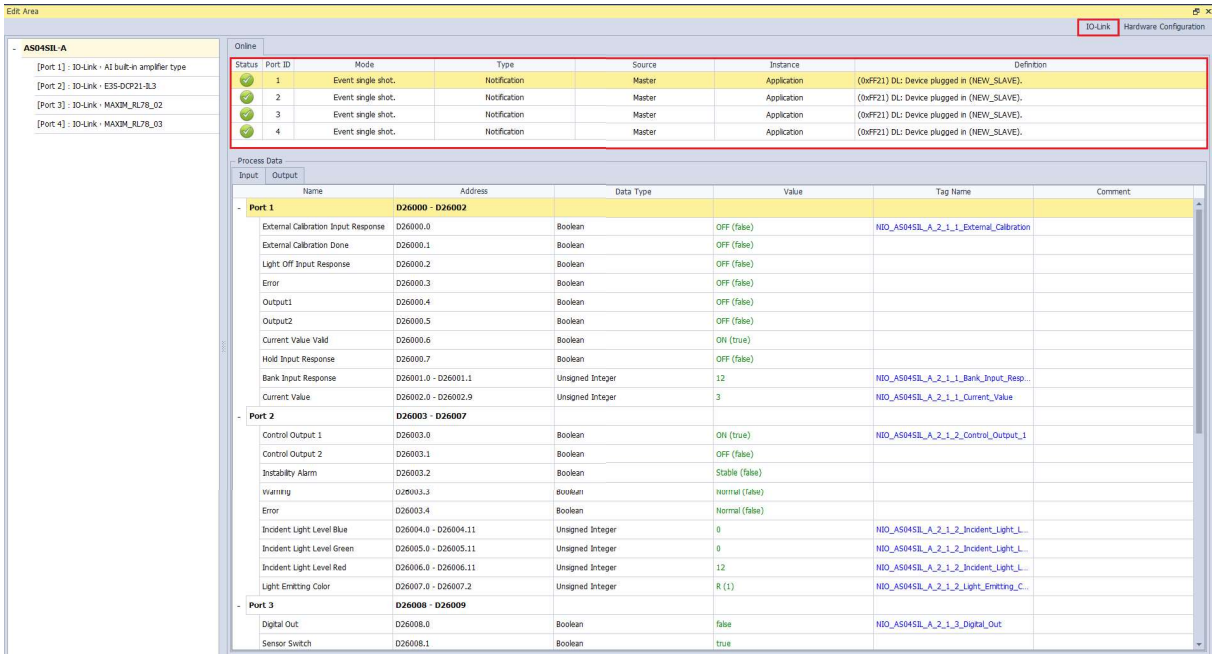

Processing
Step
Progress
Result
HWCONFIG General
HWCONFIG Data Exchange
IO-Link
Confirm
Recover the executing status before the download?
Yes
No
Abort


Download
PLC_0
(AS332T-A)
Communication Setting
Driver:
AS USB
Station Address:
0
Task
Hardware Configration
HWCONFIG General
HWCONFIG Data Exchange
IO-Link
Task Result
Total Quantity:
3
Success Quantity:
3
Fail Quantity:
0
HWCONFIG General
HWCONFIG Data Exchange
IO-Link
HWCONFIG
Item
Result
Hardware Configuration Settings
COM 1
COM 2
Ethernet-Basic
Ethernet-Adavance
Function Card
Information
Success
Download
OK
Cancel

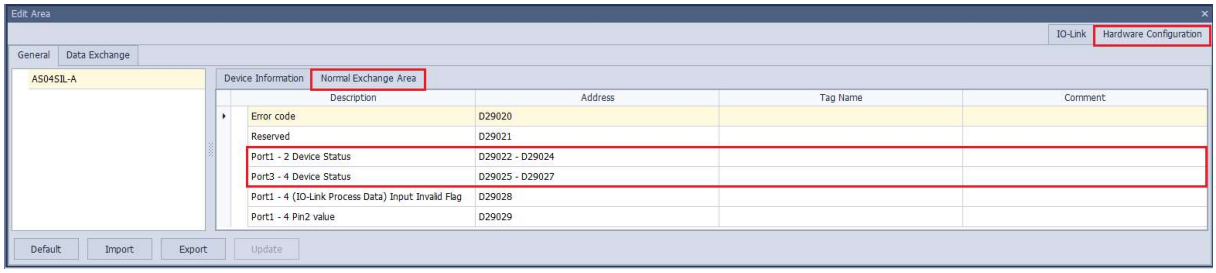
13

Click the **On-line Mode** button on the IO-Link page and then see the connection status of all devices and the real time monitored values of input and output process data.

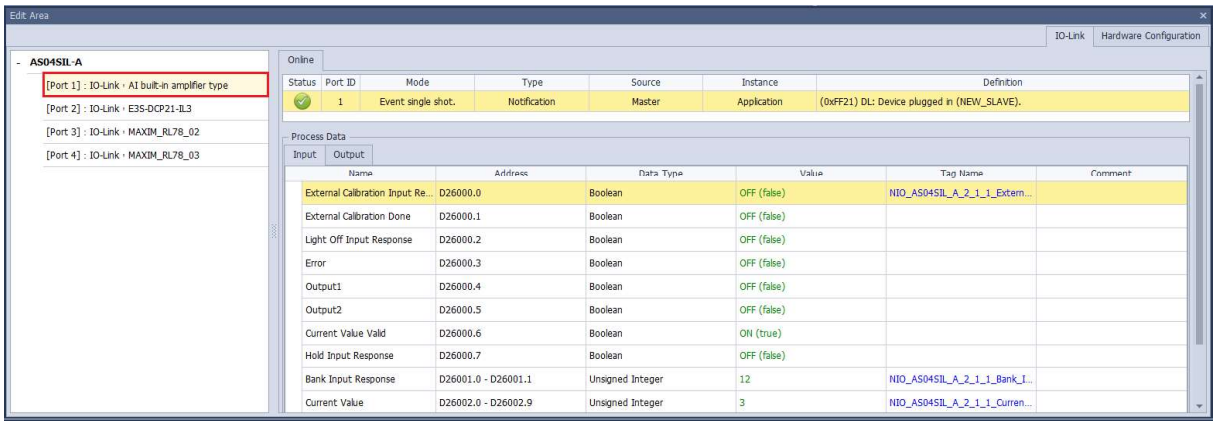




The **Status** of Port 1~ Port 4 above can also be known through the parsing in the **Normal Exchange Area** of the AS04SIL-A module below.



With a click on any device, only the input and output process data of the clicked single device will be displayed.



13.4.4 Application of Delta Special Driver & AS Remote Mode

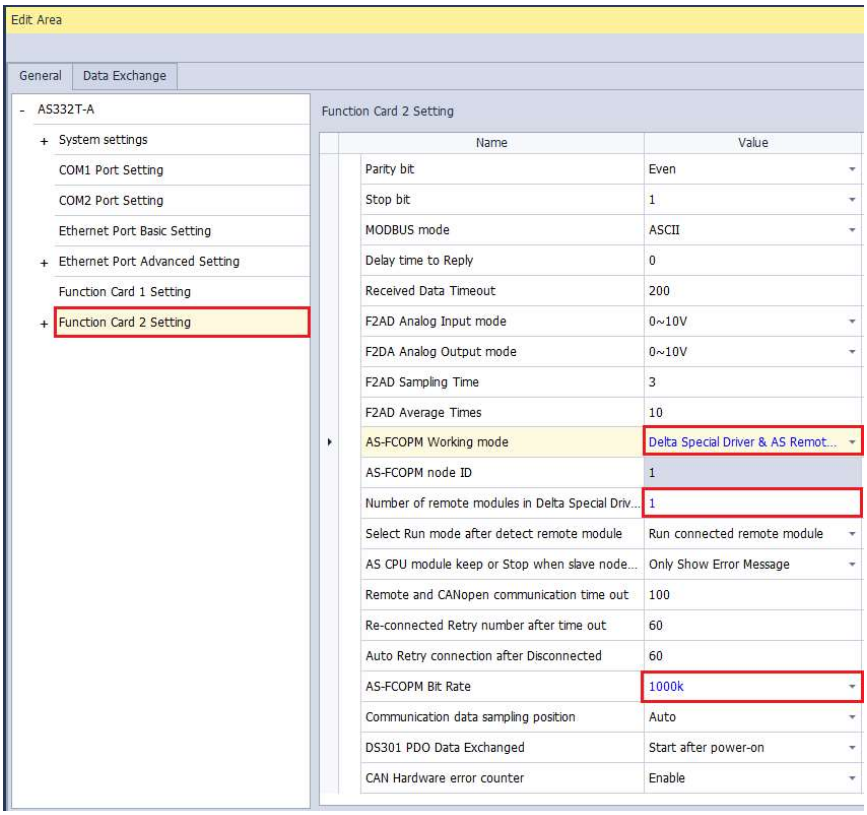
The device list in the following example is the same as that in section12.4.3.

Model name	Device type
AS332T-A	PLC
AS00SCM-A	RTU
AS04SIL-A	IO-Link Master
AI-B100	3rd IO-Link Device
E3S-DCP21-IL3	3rd IO-Link Device
MAXREFDES27#	3rd IO-Link Device
MAXREFDES36#	3rd IO-Link Device

Complete the following setups before the AS00SCM-A module is powered on.

1. The AS-FCOPM card is inserted to AS00SCM-A via Card 2. (The 120Ω terminal resistor is enabled.)
2. Use Delta standard cable to connect to AS CPU and the mode switch is turned to RTU mode.
3. Four switches are set to ID1: 0 / FORMAT1: 8 / ID2: 9 / FORMAT2: 7 and the status is set to **Delta Special Driver & AS Remote Communication**, node ID 9 and baud rate 1Mbps.
4. AS04SIL-A is connected on the right side of AS00SCM (RTU). Ensure that IO-Link devices are connected to the four ports according to the wiring in section 13.2.3.

Switch the power on after the AS-FCOPM card is inserted to AS332T-A via Card 2. (The 120Ω terminal resistor is enabled.) Open the HWCONFIG 4.0 software, set up function card 2 for AS CPU and then download the settings as follows.



The following steps are the same as the operation in section 13.4.3.

13.4.5 Application of CANopen DS301 Mode

In this example, the AS00SCM-A RTU module works with EDS V2.06. Please download the EDS from Delta official website and import the CANopen Builder software.

The device list in the following example is the same as that in section12.4.3.

Model name	Device type
AS332T-A	PLC
AS00SCM-A	RTU
AS04SIL-A	IO-Link Master
AI-B100	3rd IO-Link Device
E3S-DCP21-IL3	3rd IO-Link Device
MAXREFDES27#	3rd IO-Link Device
MAXREFDES36#	3rd IO-Link Device

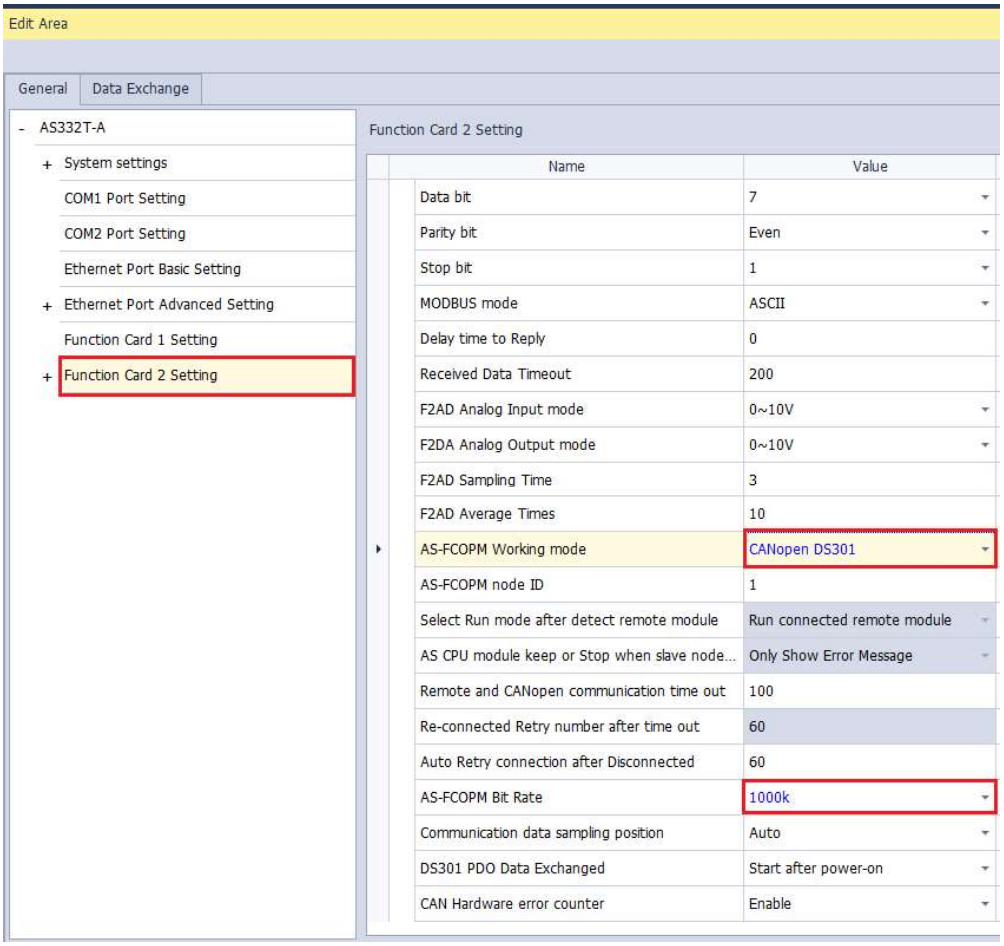
The CANopen Builder does not support the configuration of extension modules on the right of the AS00SCM-A module and connected IO-Link devices.

First make the connection in **AS Special Remote** mode, configure all extension modules and IO-Link devices in the HWCONFIG 4.0 software (see the example in section 13.4.3) and then switch back to the **CANopen DS301** mode.

Please complete the following setups before the AS00SCM-A module is powered on.

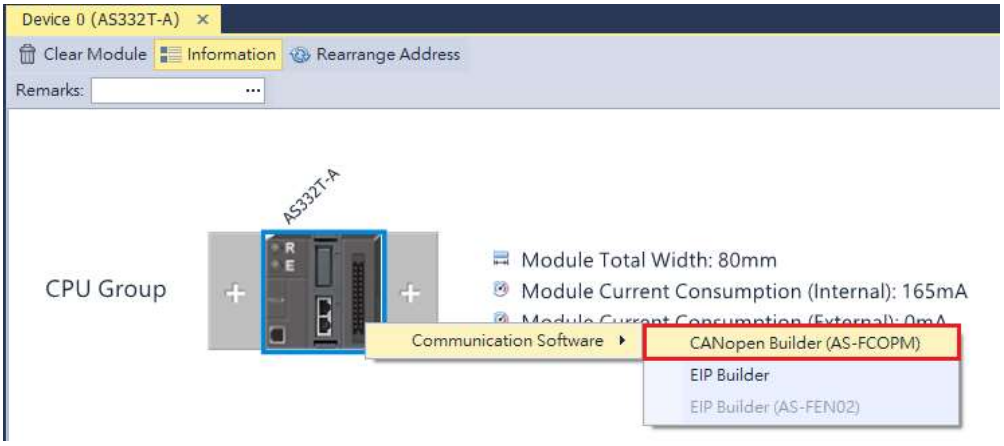
1. The AS-FCOPM card is inserted to AS00SCM-A via Card 2. (The 120Ω terminal resistor is enabled.)
2. Use Delta standard cables to connect to AS CPU and the mode switch is turned to RTU mode.
3. Four switches are set to ID1: 0 / FORMAT1: 4 / ID2: 2 / FORMAT2：7 and the status is set to **CANopen DS301**, node ID 2 and baud rate 1Mbps.
4. AS04SIL-A is connected on the right side of AS00SCM (RTU). Ensure that IO-Link devices are connected to the four ports according to the wiring in section 13.2.3.

Switch the power on after the AS-FCOPM card is inserted to AS332T-A via Card 2. (The 120Ω terminal resistor is enabled.) Open the HWCONFIG 4.0 software, set up function card 2 for AS CPU and then download the settings as follows.

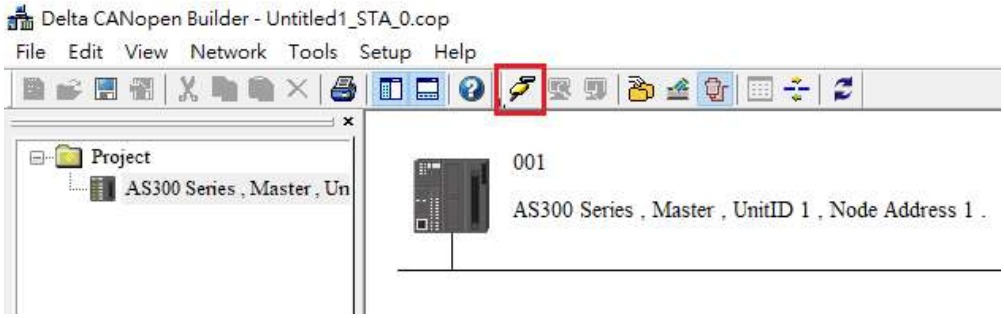


13

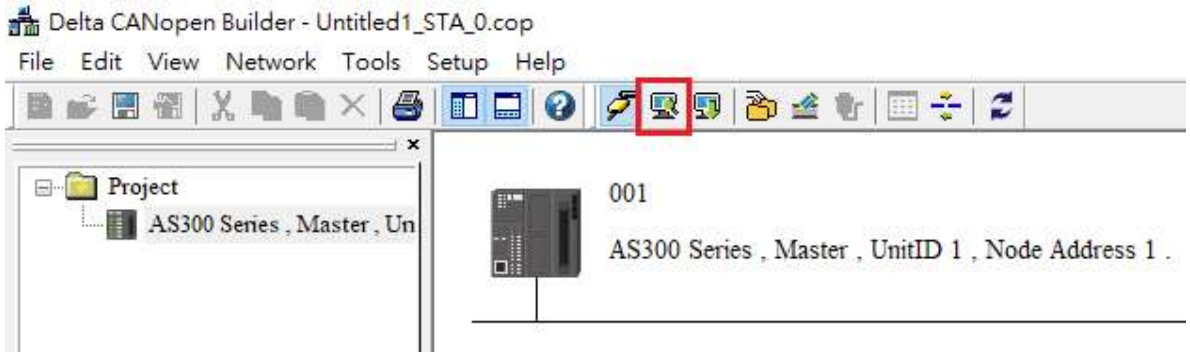
Right-click the AS332T-A symbol and open the CANopen Builder software as below.

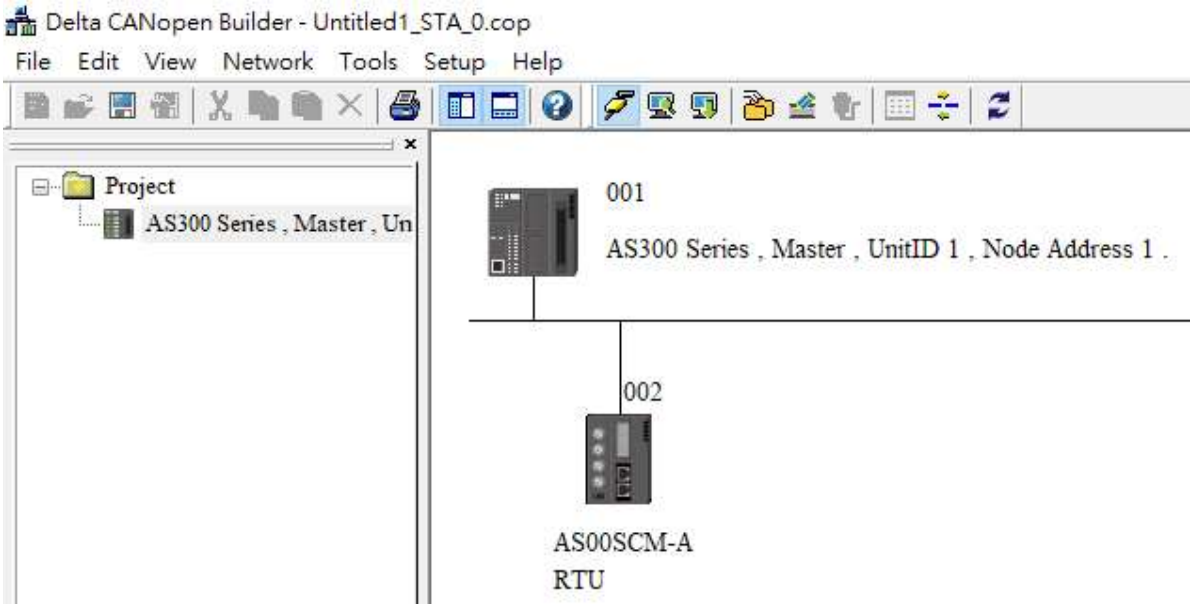


Click the **Online** button.

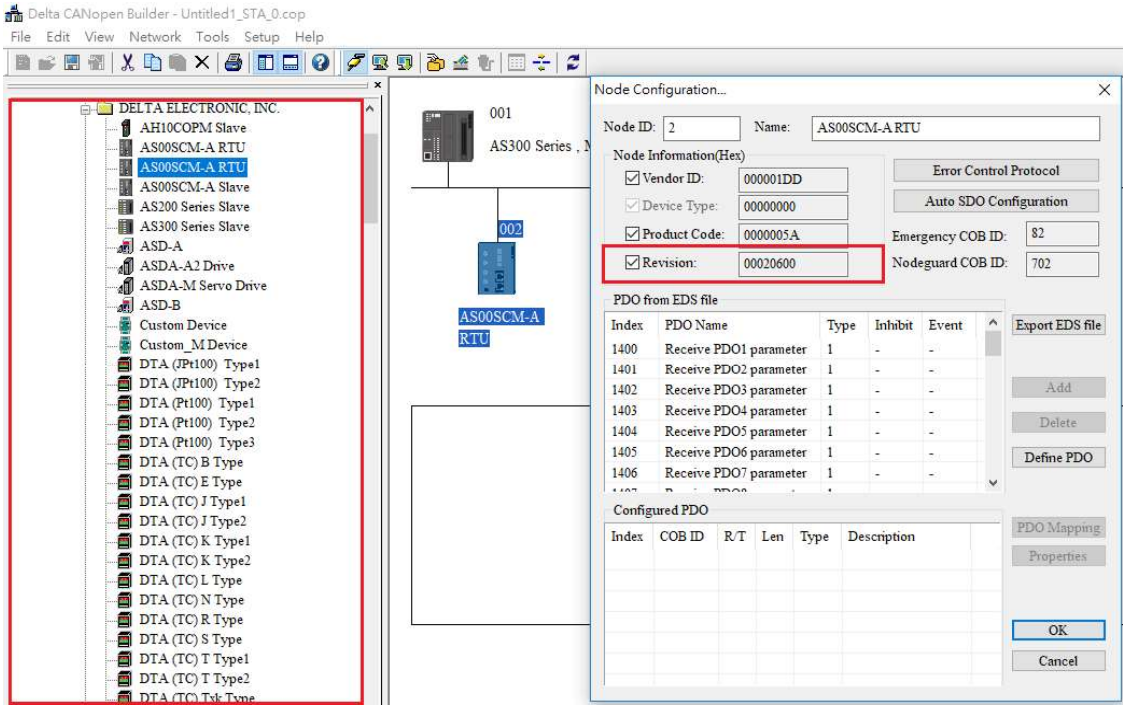


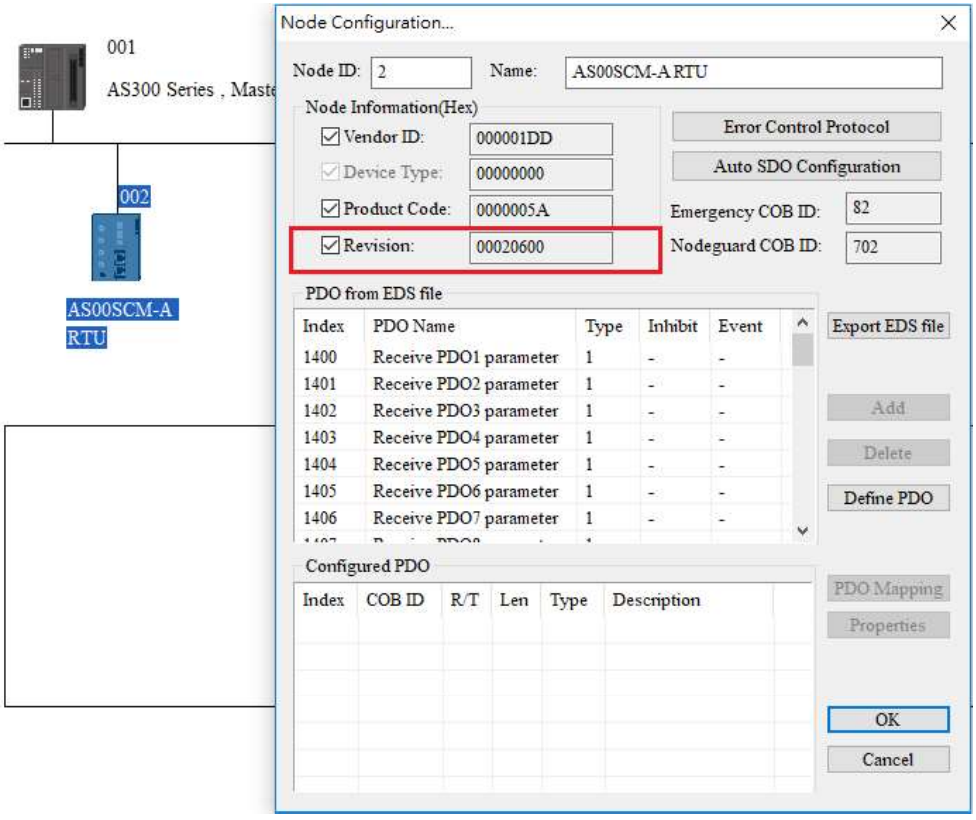
Click the **Scan** button. Then the AS00SCM-A RTU module can be detected.





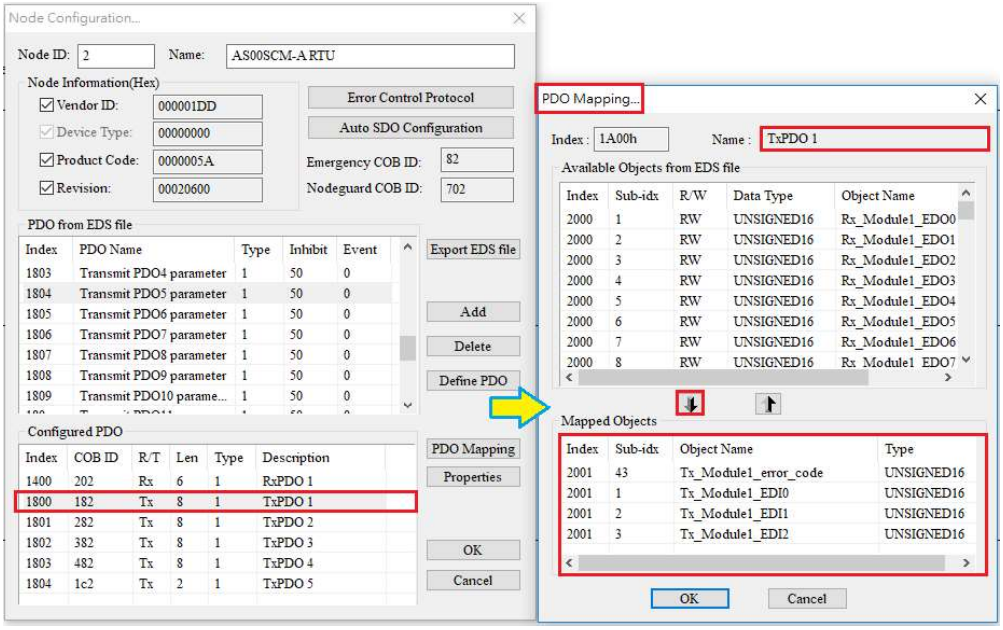
Double-click the detected AS00SCM-A RTU module and ensure that it is with EDS file V2.06 or later. If the EDS file is not matched, check if the V2.06 EDS file has been imported to the left-side device list and the firmware of AS00SCM-A is V2.06 or later.


Delta CANopen Builder - Untitled1_STA_0.cop
File Edit View Network Tools Setup Help
DELTA ELECTRONIC, INC.
AH10COPM Slave
AS00SCM-A RTU
AS00SCM-A RTU
AS00SCM-A Slave
AS200 Series Slave
AS300 Series Slave
ASD-A
ASDA-A2 Drive
ASDA-M Servo Drive
ASD-B
Custom Device
Custom_M Device
DTA (JPt100) Type1
DTA (JPt100) Type2
DTA (Pt100) Type1
DTA (Pt100) Type2
DTA (Pt100) Type3
DTA (TC) B Type
DTA (TC) E Type
DTA (TC) J Type1
DTA (TC) J Type2
DTA (TC) K Type1
DTA (TC) K Type2
DTA (TC) L Type
DTA (TC) N Type
DTA (TC) R Type
DTA (TC) S Type
DTA (TC) T Type1
DTA (TC) T Type2
001
AS300 Series , M
002
AS00SCM-A
RTU
Node Configuration...
Node ID: 2
Name: AS00SCM-A RTU
Node Information(Hex)
Vendor ID: 000001DD
Device Type: 00000000
Product Code: 0000005A
Revision: 00020600
Error Control Protocol
Auto SDO Configuration
Emergency COB ID: 82
Nodeguard COB ID: 702
PDO from EDS file
Index PDO Name Type Inhibit Event
1400 Receive PDO1 parameter 1 - -
1401 Receive PDO2 parameter 1 - -
1402 Receive PDO3 parameter 1 - -
1403 Receive PDO4 parameter 1 - -
1404 Receive PDO5 parameter 1 - -
1405 Receive PDO6 parameter 1 - -
1406 Receive PDO7 parameter 1 - -
Export EDS file
Add
Delete
Define PDO
Configured PDO
Index COB ID R/T Len Type Description
PDO Mapping
Properties
OK
Cancel


001
AS300 Series , Maste
002
AS00SCM-A
RTU
Node Configuration...
Node ID: 2
Name: AS00SCM-A RTU
Node Information(Hex)
Vendor ID: 000001DD
Device Type: 00000000
Product Code: 0000005A
Revision: 00020600
Error Control Protocol
Auto SDO Configuration
Emergency COB ID: 82
Nodeguard COB ID: 702
PDO from EDS file
Index PDO Name Type Inhibit Event
1400 Receive PDO1 parameter 1 - -
1401 Receive PDO2 parameter 1 - -
1402 Receive PDO3 parameter 1 - -
1403 Receive PDO4 parameter 1 - -
1404 Receive PDO5 parameter 1 - -
1405 Receive PDO6 parameter 1 - -
1406 Receive PDO7 parameter 1 - -
Export EDS file
Add
Delete
Define PDO
Configured PDO
Index COB ID R/T Len Type Description
PDO Mapping
Properties
OK
Cancel

Each object in the EDS file is 1 word (2 bytes) in size and thus one PDO corresponds to one mapped register. Assign all input parameters to available TxPDOs according to the parameters in the **Normal Exchange Area** of AS04SIL-A in section 13.4.3. The mapped PDO object of the input process data is Tx_ModuleX_EDIY (Exchanging Data Input which is referred to as EDI).

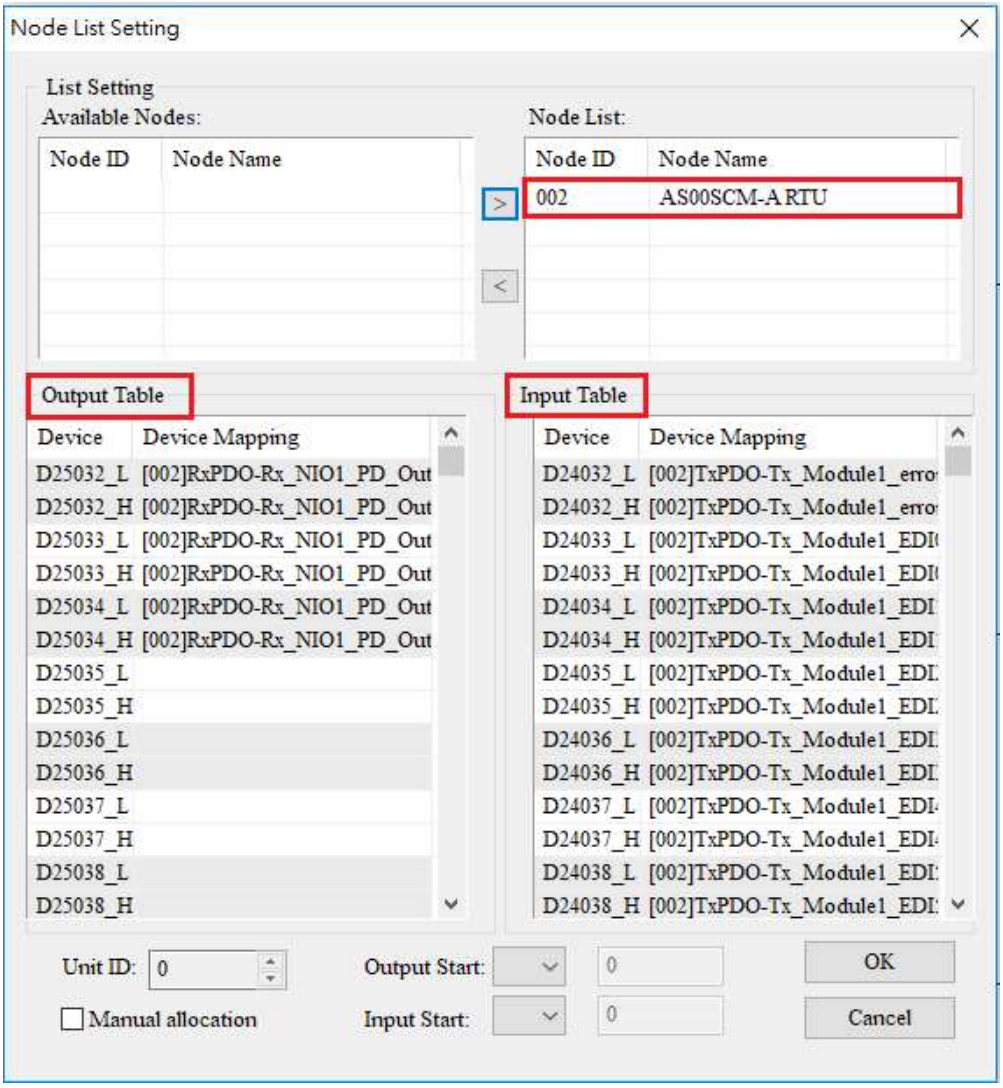
In this example, the AS04SIL-A module is the first one on the right of the RTU module. Therefore the value of X is 1 and the PDO mapped object for error codes is Tx_Module1_error_code. The corresponding objects starts from Tx_Module1_EDI0 as below.



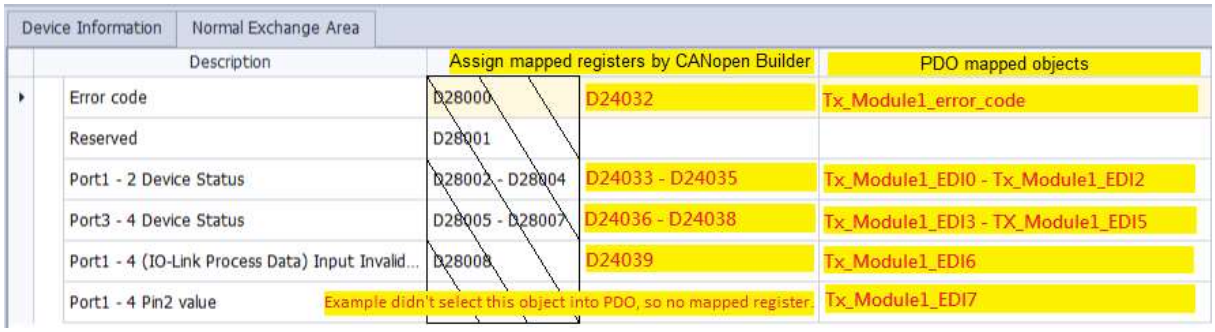
Based on all communication port address information in the HWCONFIG 4.0 software in section 13.4.3, assign all input process data to available TxPDOs, which corresponds to the mapped object Tx_NIOX_PD_InputZ and assign all output process data to available RxPDOs, which corresponds to the mapped object Rx_NIOX_PD_OutputY.

In this example, the AS04SIL-A module is the first one on the right of the RTU module. Therefore the value of X is 1, the input objects starting from Tx_NIO1_PD_Input0 correspond to IO-Link Port1~ Port4 in **Process Data- Input** respectively and the output objects starting from Rx_NIO1_PD_Output0 correspond to IO-Link Port1~ Port4 in **Process Data- Output** respectively.

Configure all parameters which need to be updated continuously (which are called objects in CANopen Builder) to one TxPDO or RxPDO according to the steps described above. Add AS00SCM-A RTU to the slave list (Node List) and then the real addresses of mapped registers in AS CPU show up immediately as below.



According to the **Normal Exchange Area** page in HWCONFIG in section 13.4.3, the PDO mapped objects correspond to the mapped registers assigned by CANopen Builder as follows.



Parameter	Configured PDO	PDO mapped object	Mapped register in AS CPU
Error code	TxPDO1	Tx_Module_error_code	D24032
Port 1-2 Device Status		Tx_Module1_EDI0	D24033
		Tx_Module1_EDI1	D24034
		Tx_Module1_EDI2	D24035
Port 3-4 Device Status	TxPDO2	Tx_Module1_EDI3 Tx_Module1_EDI4 Tx_Module1_EDI5	D24036 D24037 D24038
Port1-4 (IO-Link Process Data) Input Invalid Flag		Tx_Module1_EDI6	D24039
Port 1 Process Data- Input	TxPDO3	Tx_NIO1_PD_Input0	D24040
		Tx_NIO1_PD_Input1	D24041
		Tx_NIO1_PD_Input2	D24042
Port 2 Process Data- Input		Tx_NIO1_PD_Input3	D24043
	TxPDO4	Tx_NIO1_PD_Input4	D24044
		Tx_NIO1_PD_Input5	D24045
		Tx_NIO1_PD_Input6	D24046
		Tx_NIO1_PD_Input7	D24047
Port 3 Process Data- Input	TxPDO5	Tx_NIO1_PD_Input8	D24048
		Tx_NIO1_PD_Input9	D24049
Port 4 Process Data- Input		Tx_NIO1_PD_Input10	D24050
		Tx_NIO1_PD_Input11	D24051
Port 1 Process Data- Output	RxPDO1	Rx_NIO1_PD_Output0	D25032
		Rx_NIO1_PD_Output1	D25033
Port 2 Process Data- Output		No parameter need be output	No parameter need be output
Port 3 Process Data- Output		Rx_NIO1_PD_Output2	D25034
Port 4 Process Data- Output		Rx_NIO1_PD_Output3	D25035

13.5 IO-Link Event Code Table

Here is the table of IO-Link event codes which are recorded in **Port1-4 Device Status** of the **Normal Exchange Area** page. If the sources of events are IO-Link devices, please also refer to the IO-Link device operation manual.

IO-Link Event Codes	Type			Event	Solution	Source	
	Warning	Error	Notification			IO-Link Master	IO-Link Device
16#4000		V		Device temperature over-load	Lower load		V
16#4210	V			Device temperature over-run	Clear source of heat		V
16#5101		V		Device fuse blown	Change fuse		V
16#5110	V			Power supply voltage over-run	Check tolerance		V
16#5111	V			Power supply voltage under-run	Check tolerance		V
16#6320		V		Parameter error	Check device specifications		V
16#6321		V		Parameter missing	Check device specifications		V
16#7710		V		Device short circuit	Check installation		V
16#8C10	V			Process variable range over-run	Check process data		V
16#8C20		V		Measurement range over-run	Check application		V
16#8C30	V			Process variable range under-run	Check process data		V
16#8CA0	V			No connected IO-Link device	Check installation	V	
16#8CA1	V			The version of the IO-Link protocol is different from the one configured.	Use matching IODD file and configured again.	V	
16#8CA2	V			Connected device is different from the one configured in the software	Check configurations and installation	V	
16#8CA3				Reserved		V	
16#8CA4 16#8CAD 16#8CAE		V		IO-Link device process cable short circuit	Check installation	V	
16#8CA5	V			Master temperature exceeds 135°C	Clear source of heat	V	
16#8CA6		V		Master temperature exceeds 160°C	Clear source of heat and lower load	V	
16#8CA7	V			Device power supply voltage under-run L+ (<18V)	Check the external power supply	V	

IO-Link Event Codes	Type			Event	Solution	Source	
	Warning	Error	Notification			IO-Link Master	IO-Link Device
16#8CA8		V		Device power supply voltage under-run L+ (<9V)	Check the external power supply	V	
16#8CA9	V			Illegal device ID	Check device specifications	V	
16#8CAA	V			HWCONFIG configured process data exceeding the IO-Link process data range	Check device specifications	V	
16#8CAB	V			IO-Link process data exceeding HWCONFIG configured process data range	Scan the device and download the configuration again	V	
16#8CAC		V		Data storage error	Contact the factory	V	
0xFF21			V	New connected device		V	
0xFF22			V	Device disconnected	Check installation	V	
0xFF23			V	Data storage identification mismatch	Set the Data Storage access locked and set it to backup / restore and then backing up data according to actual placement.	V	
0xFF24			V	Data storage not sufficient	Check device specifications	V	
0xFF25			V	Data storage parameter access denied	Check device specifications	V	

13.6 Module Status Codes

The following error codes identify possible errors when the AS04SIL module as a communication module is installed on the right side of the CPU module or RTU module.

Error Code	Description	Solution
16#1605	Hardware failure	Install a new AS04SIL or contact the factory.
16#1606	24VDC power supply is not sufficient and then recovered from low-voltage for less than 10 ms.	Check whether the 24 V power supply to the module is normal.

Error Code	Description	Solution
16#1800	Error occurs in IO-Link Master	See section 13.5 for more information.
16#1801	Error occurs in IO-Link device	See section 13.5 for more information.
16#1802	No external power supply	Check the external power supply
16#1803	Error in the download of IO-Link device mapping tables	Redownload the configuration by the software
16#1804	Failure to switch the process data parameter set	Check if the connected device is the same as that configured in the software.
16#1805	Error occurs in the communication port 1 of IO-Link connection	1. Cut the external power off for 3 seconds and power-on again 2. Download the configurations again
16#1806	Error occurs in the communication port 2 of IO-Link connection	
16#1807	Error occurs in the communication port 3 of IO-Link connection	
16#1808	Error occurs in the communication port 4 of IO-Link connection	
16#1809	Error occurs in scan device and force to stop scanning	1. Cut the external power off for 3 seconds and power-on again 2. Scan all devices again

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