

# USB-87P1/2/4/8

# User Manual

Version 1.4

Apr. 2023

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Edited by Sunny Chiu



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ICP DAS, Co., LTD [www.icpdas.com](http://www.icpdas.com)

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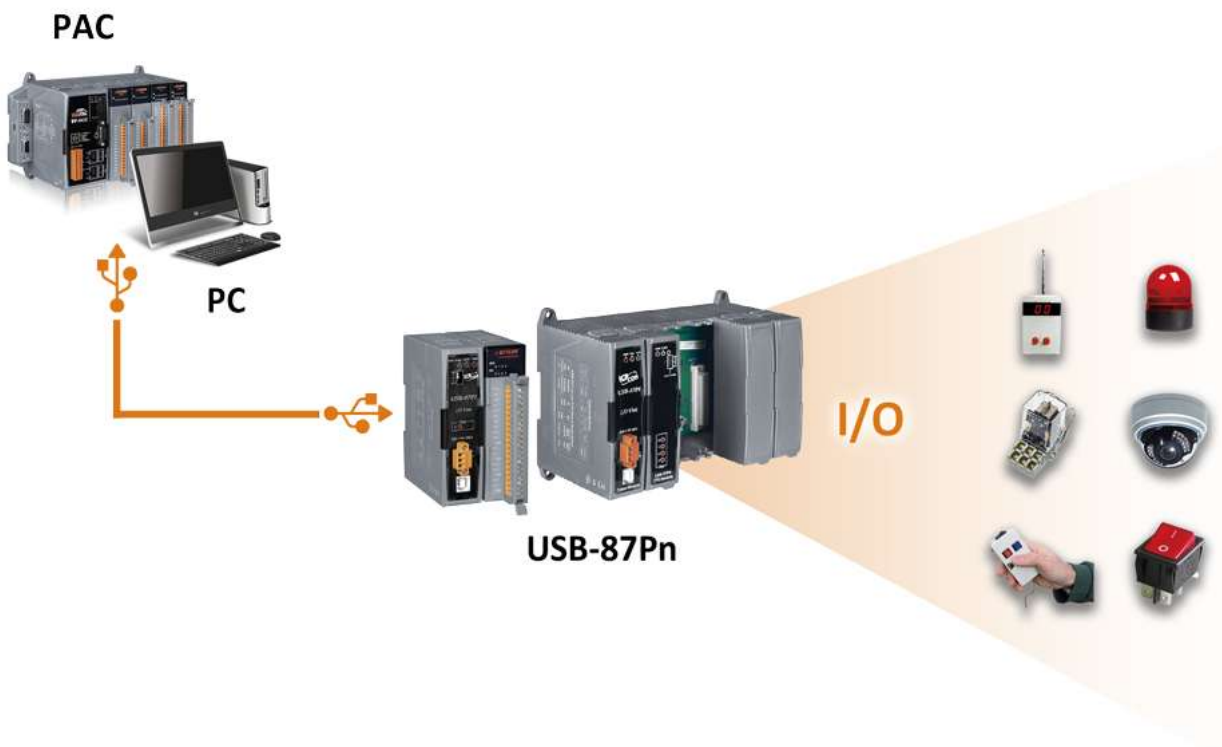
# 1. Introduction

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USB-87Pn series is an intelligent I/O expansion unit, it features USB communication interface, hot swap, and most of all, USB-87Pn can connects to various I/O signals in the field by plugging in properly kind of **High profile I-87K I/O modules**. It is used for industrial monitoring and controlling applications. There are more than 30 I/O modules supported with the unit, including analog input/output, digital input/output, and counter/frequency I/O modules.

USB-87Pn is designed with a wide power input range from +10 to 30VDC and a wide operating temperature range from -25°C to 75°C for running in harsh and noisy environment. It simplifies installation and maintenance of I/O modules with hot swap and auto configuration, fault and error detection, dual watchdog, programmable Power On and Safe values.

Various software development kits (SDK) and demos are provided, such as DLL, ActiveX, LabVIEW driver, InduSoft driver, Linux driver and OPC Server. The I-87K series I/O modules plugged in the USB-87Pn can be easily integrated into variant software system.



# Features

## ► Hot Swap

The USB-87Pn doesn't need to shut down its power to replace or plug I-87K I/O modules. Therefore, the whole system can keep operating without any interruption.

## ► Auto-Configuration

Configurations of I-87K I/O modules can be pre configured and stored in the nonvolatile memory of the USB-87Pn. When the USB-87Pn is power on or an I-87K I/O module is plug in, the USB-87Pn automatically check and restore these configurations to each I-87K I/O modules on it.

## ► Easy Duplicate System

Using the DCON Utility Pro, you can easily make a backup of the I-87K module configurations and write to another USB-87Pn. This design can easily and quickly duplicate multiple USB-87Pn units with the same configuration.



## ► Easy Maintenance and Diagnostic

The basic configurations (Auto Config, ON/OFF) are set by the DIP switch. The operator can use only one screwdriver to set the USB-87Pn. And there are several LED status indicators to show whether I-87K modules are configured and work properly.

If one I-87K module is damage, the user just need to get a new module of the same model to replace the damaged one. And then check the LED indicators to know whether the replacement is performed correctly. The design of **Auto Config** dip switch and slot LED indicators are helpful for ease maintenance with no need of a PC or a laptop.

## ► **Communication**

### ■ **USB interface**

The USB-87Pn is equipped with USB communication interface. It requires no converter, plug and play at run time, very simple and convenient to connect with your PC.

### ■ **DCON protocol**

The DCON protocol for communicating with I-87K series I/O modules plugged in a USB-87Pn is a simple command/response protocol. All commands and responses are in easy used ASCII format.

## ► **Rugged Industrial Environment**

### ■ **Dual watchdog design**

The I-87K series I/O modules provides module watchdog and host watchdog. The module watchdog is a hardware watchdog; the host watchdog is a software watchdog. The module watchdog is designed to automatically reset the microprocessor when the module hangs. The host watchdog monitors the host controller (PC or PLC). The output of module can go to the Safe Value state when the host fails.

### ■ **Programmable power on and Safe Value**

Power on value is applied when the USB-87Pn unit is powered on or reset by module watchdog timeout, while Safe value is applied when host watchdog timeout occurs. They are programmable for analog and digital channels to prevent unexpected outputs when a module or a host fails.

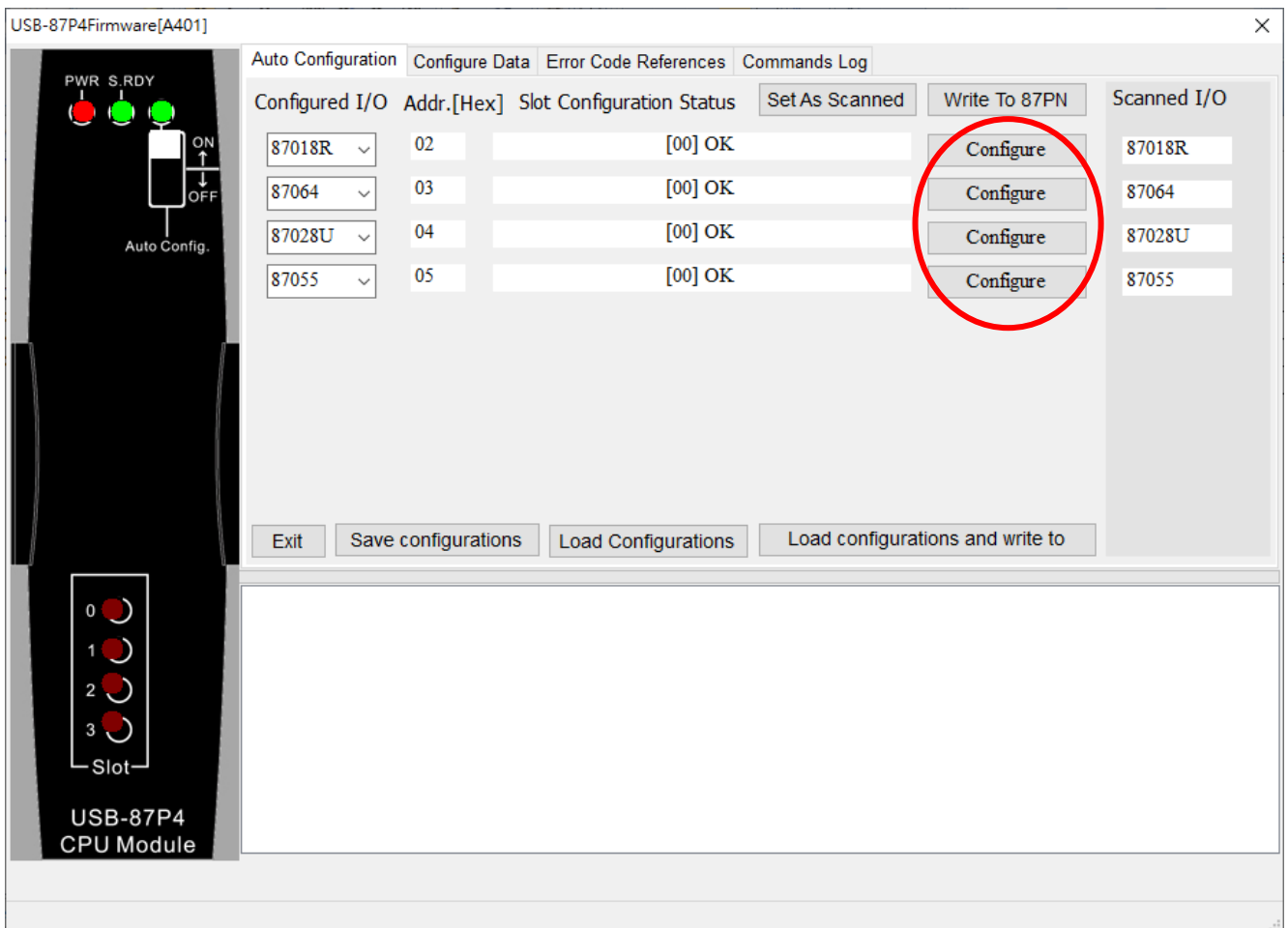
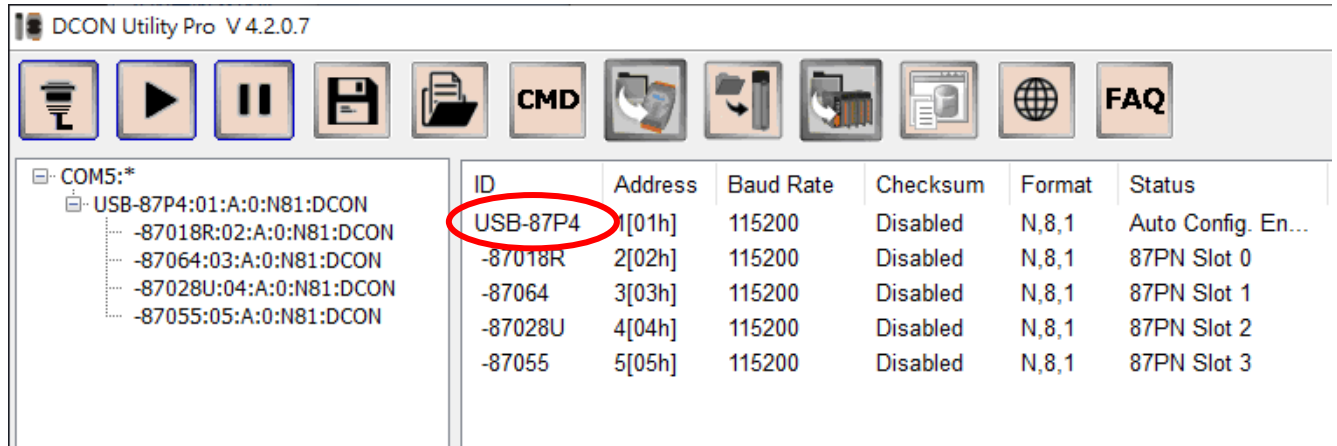
### ■ **Wide range power input (10~30 VDC)**

### ■ **Wide range operating temperature (-25 °C ~ +75 °C)**

## ► Fully Software Support

USB-87Pn provides free and easy-to-use configuration utility, a variety of software development kits (including demo programs) and drivers for integrating USB-87Pn I/O expansion units into SCADA systems, allowing you to get started easily.

### ■ DCON Utility Pro for configuring I/O modules and monitoring real-time data



## ■ EZ Data Logger

EZ Data Logger is small data logger software. It can be applied to small remote I/O system. With its user-friendly interface, users can quickly and easily build a data logging software without any programming skill.

# EZ Data Logger



## ■ Support Variant Software Development Toolkits

DLL library, ActiveX, LabVIEW toolkit, InduSoft driver, DasyLab driver and Linux driver are included.



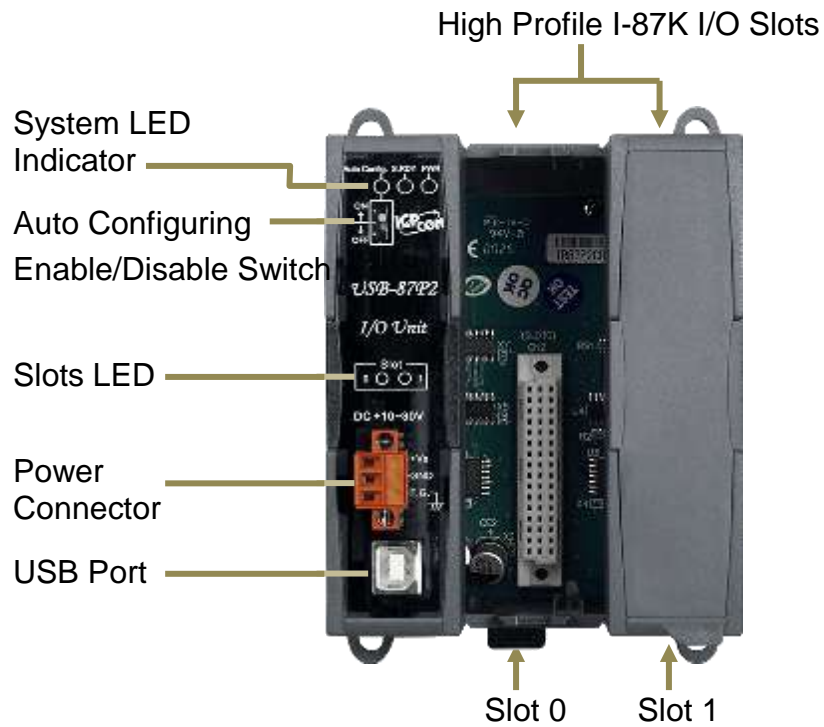
## 2. Hardware Configuration

### 2.1. Specifications

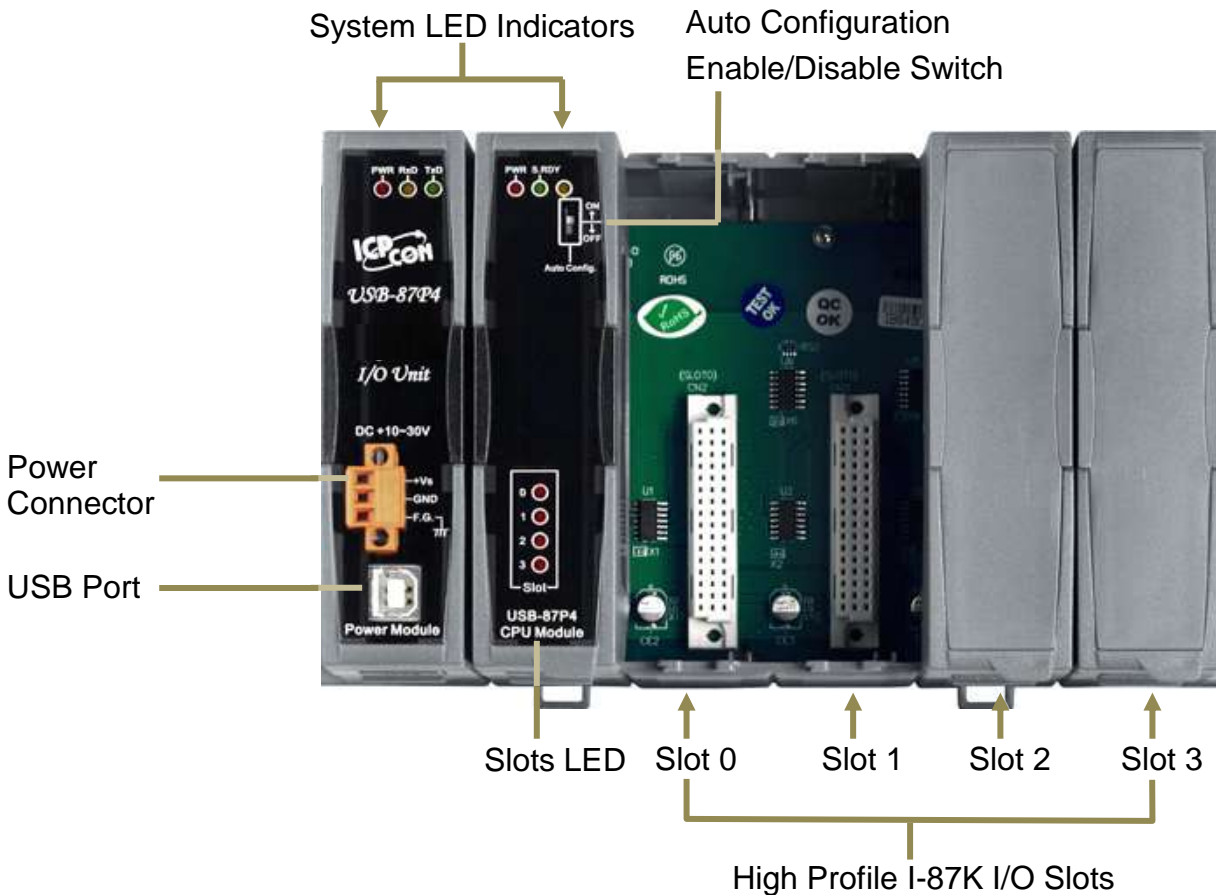
Models	USB-87P1	USB-87P2	USB-87P4	USB-87P8
<b>Communication Interface</b>				
Port Type	1 x USB Type B Connector (3000 VDC Isolated)			
ESD Protection	±4 K Contact Discharge and ±8 K Air Discharge			
Communication Protocol	DCON Protocol (ASCII Format)			
<b>HMI</b>				
DIP Switch	1-bit for Auto Configuration			
<b>LED Indicators</b>				
I/O LED Indicator	1	2	4	8
System LED Indicator	1 x Power, 1 x System, 1 x Auto Configuration			
<b>I/O Expansion</b>				
I/O Type	High Profile I-87K series			
Slots	1	2	4	8
<b>Mechanical</b>				
Dimensions (mm) (W x H x D)	64 x 120 x 111	95 x 132 x 111	188 x 132 x 111	312 x 132 x 111
Installation	DIN-Rail, Wall mounting			
<b>Power</b>				
Input Range	+10 ~ 30 VDC (1 kV Isolated)			
Reverse Polarity Protection	Yes			
Consumption	1.0 W		2.0 W	2.4 W
Power Board Driving	5.0 W	8.0 W	30.0 W	
<b>Environmental</b>				
Operating Temperature	-25°C to +75°C			
Storage Temperature	-30°C to +80°C			
Humidity	10 ~ 90% RH, non-condensing			

## 2.2. Appearance

### ■ USB-87P2



### ■ USB-87P4



The details of these items are as follows:

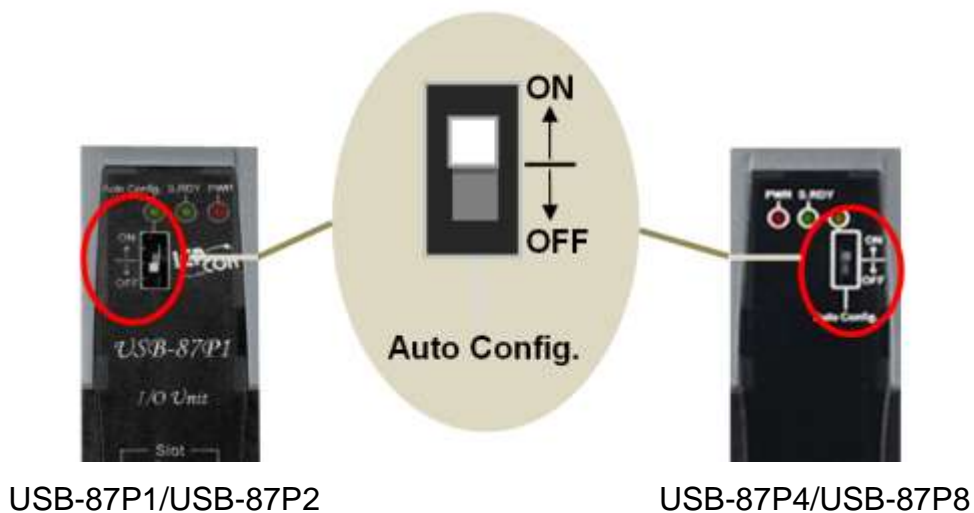
## System LED Indicators

LED Indicator	Color	Status	Description
PWR	Red	On	Power is on.
S.RDY	Green	On	All of the I/O modules pass test
		Flashing	One or more I/O modules are not configured.
Auto Config.	Green	On	Auto Config. is in ON position.
		Off	Auto Config. is in OFF position.
Slot n	Red	On	The module is not the same as configured.
		Flashing	The module is not configured.
		Off	The module is configured and performed correctly, or there is no module installed in this slot.

## Auto Config Dip Switch

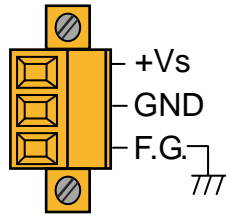
The built-in **Auto Configuration** function of USB-87Pn allows users to pre-configure the I/O modules and store the information in USB-87Pn, even though those modules are offline. If the **Auto Configuration** is enabled, the USB-87Pn will automatically configure a new module according to the pre-configuration.

The factory default position of the **Auto Config.** dip switch is ON to enable the **Auto Configuration** function.



## Power Connector

The USB-87Pn has a 3-wire terminal for +10 ~ 30 VDC power input.



## USB Port

The USB-87Pn comes equipped with a USB Type B female connector on the front. A USB 2.0 type A male to type B male cable is included with USB-87P2/ USB-87P4/USB-87P4 to connect with PC.



## Module Description

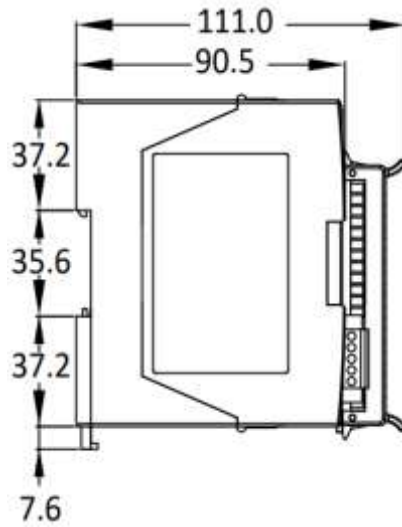
Default Setting					
Address	Baud Rate	Parity	Data Length	Stop bit	Checksum
01	115,200	None	8	1	Disable

USB-87P series CPU Board Description					
LED	Description	ON	OFF	Flashing (100ms)	Flashing (2sec)
S.RDY	System Ready	Ready	/	Configuring	Failure
Auto Config	Auto Configuration	Enable	Disable	/	/
Slot	Slot Status	/	Normal	Configuring	Failure



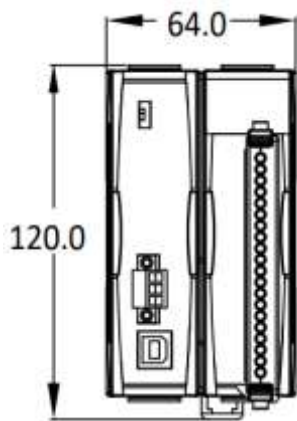
## 2.3. Dimensions

### ■ USB-87P1/USB-87P2/USB-87P4/USB-87P8



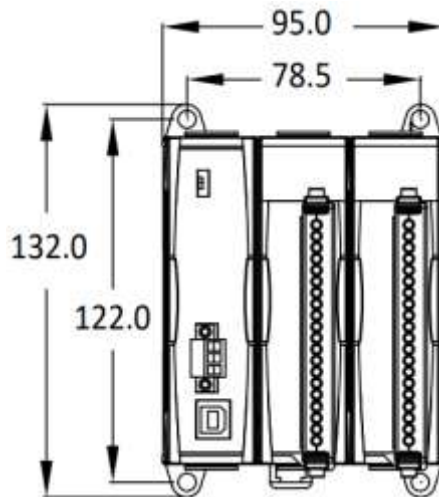
Left Side View

### ■ USB-87P1



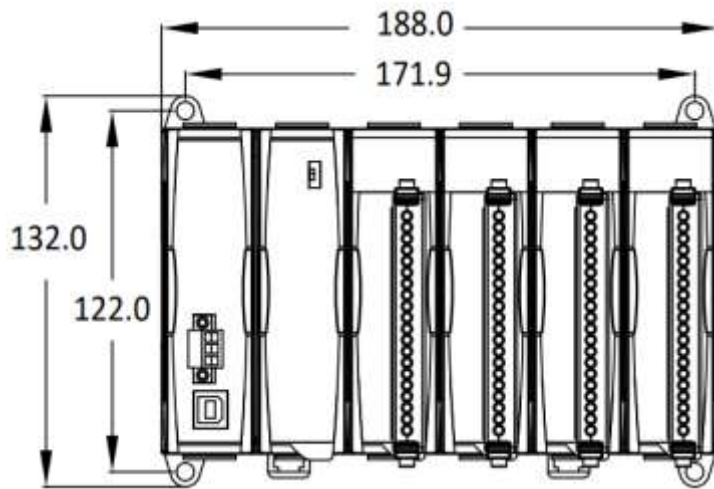
Front View

### ■ USB-87P2



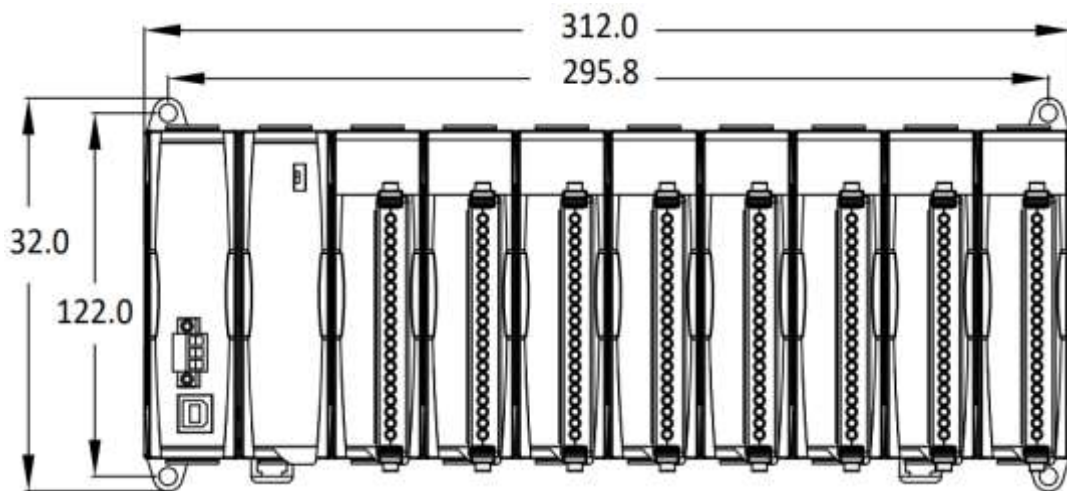
Front View

■ USB-87P4



Front View

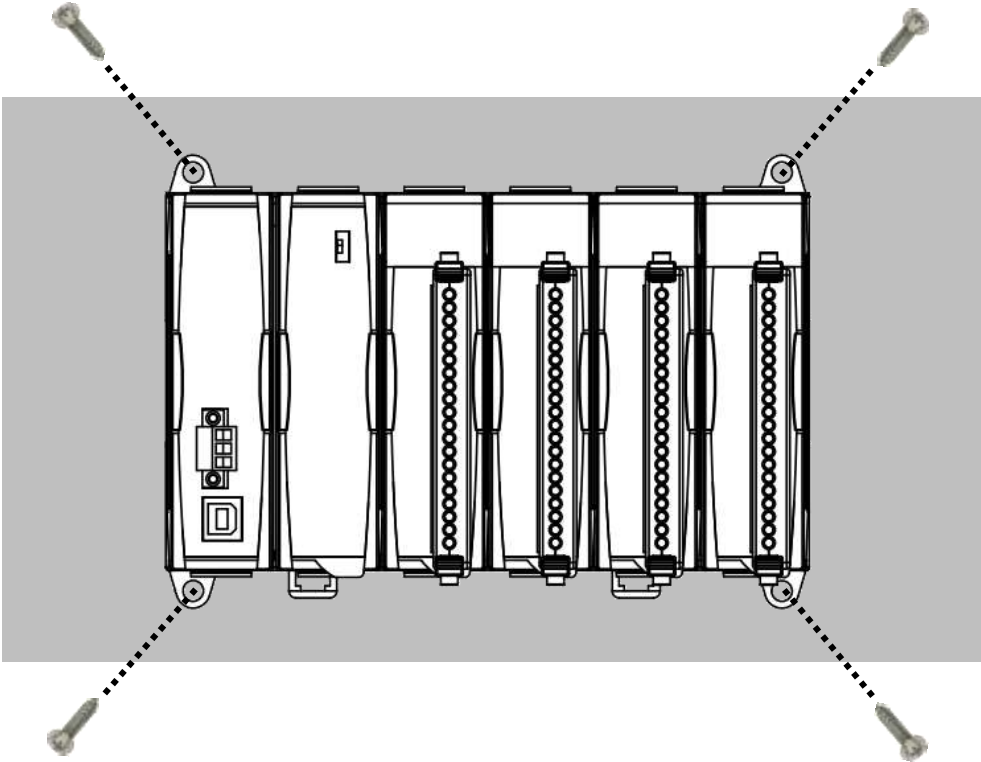
■ USB-87P8



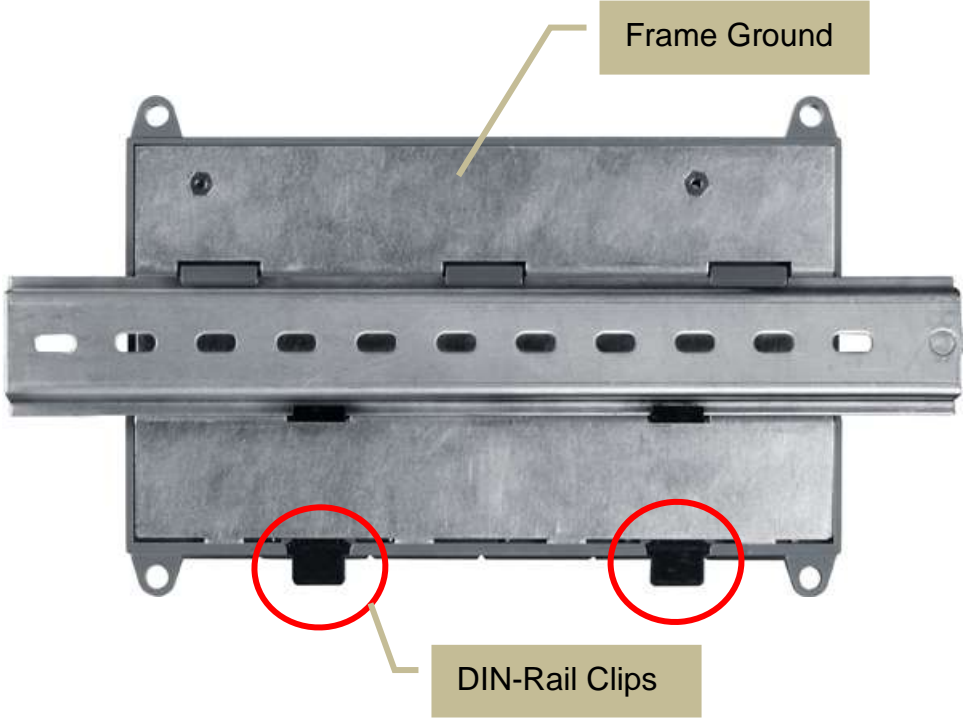
Front View

# 2.4. Mounting the USB-87Pn

## ■ Wall/Panel mounting



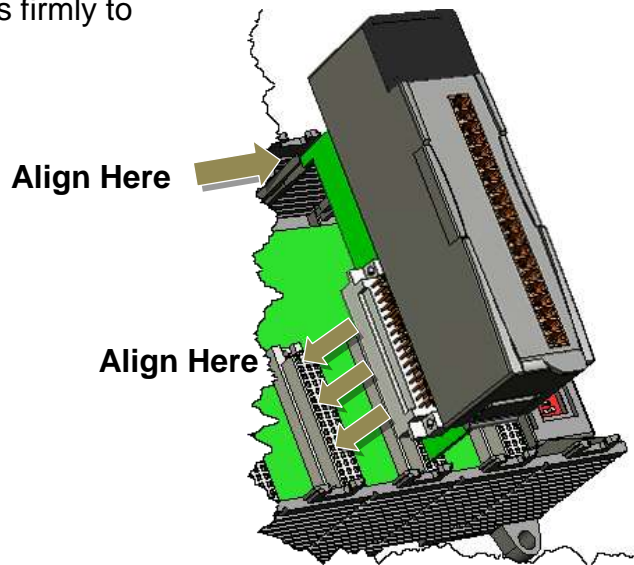
## ■ DIN Rail mounting



## 2.5. Installing the I/O Modules

USB-87Pn has 1/2/4/8 I/O slots and only supports **High Profile** I-87K series I/O modules.

1. Align circuit card with slot and press firmly to seat module into connector



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### Tips & Warnings

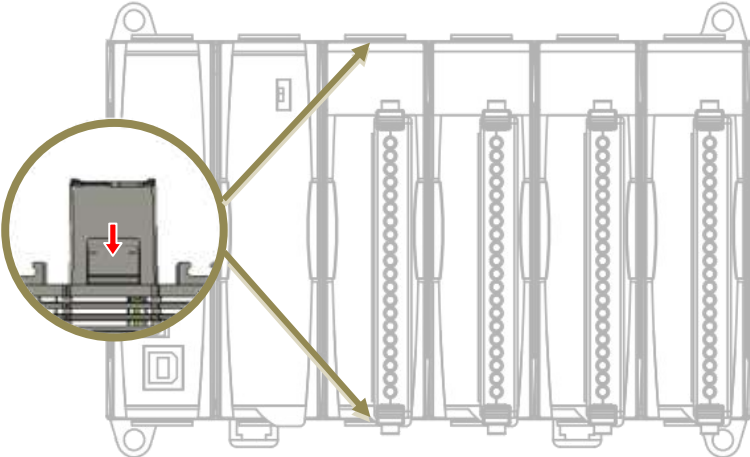


It is recommended to turn off the power to the USB-87Pn when wiring the I/O modules which are installed in the slots.

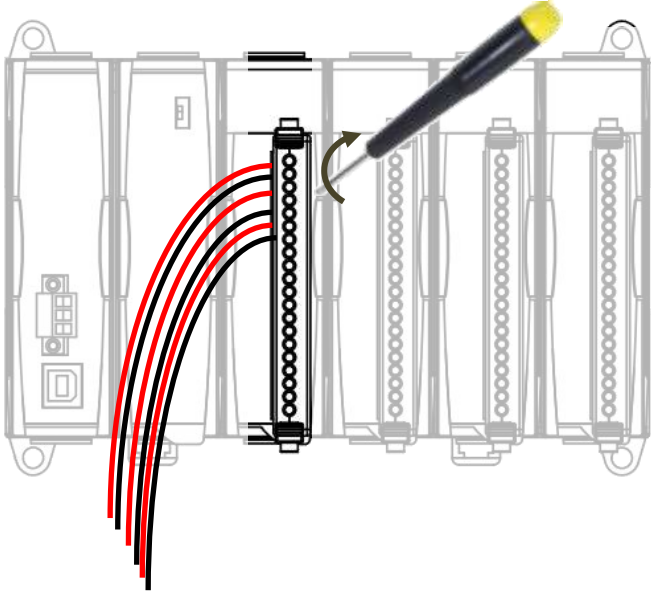
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2. Pull top and bottom locking tabs toward module face. Click indicates lock is engaged.



3. Wiring using the terminal block.



### 3. Getting Started

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Before starting any task, please check the package contents. If any of the following package contents are missing or damaged, contact your dealer, distributor.



USB-87Pn



USB Cable (1.8M)



Software CD



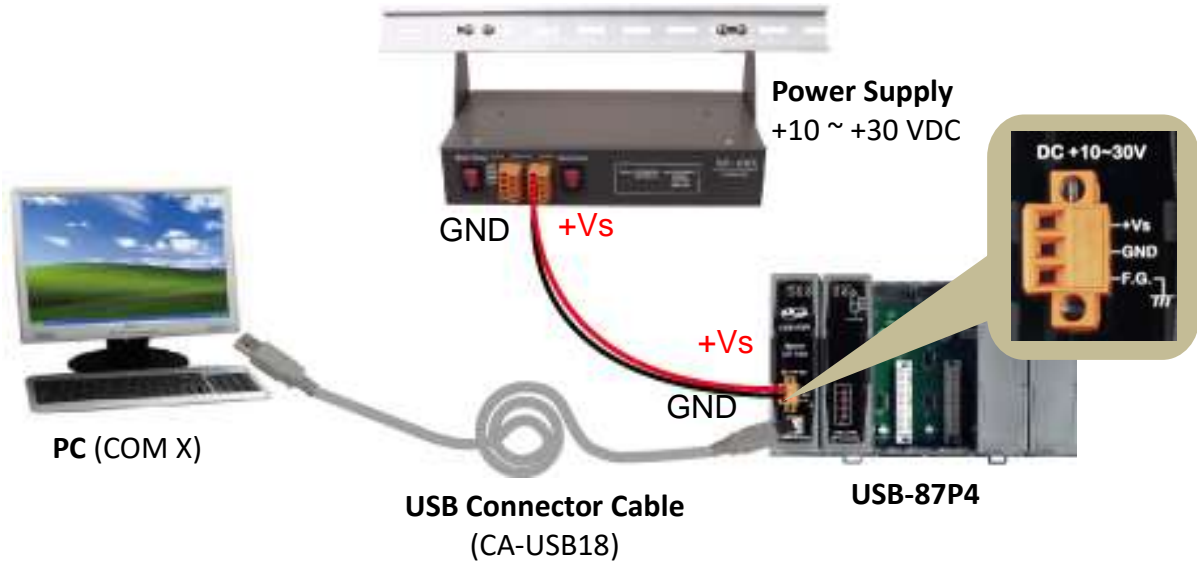
Screw Driver

The USB 2.0 type A male to type B male cable is included with USB-87P2/ USB-87P4/ USB-87P4 only.

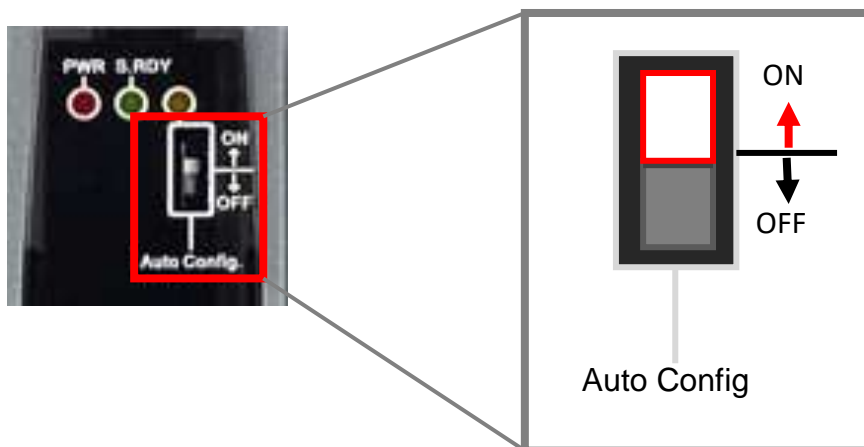
### 3.1. Hardware Configuration

**NOTE:** USB-87Pn is available for **High Profile I-87K I/O modules** only, please **DO NOT** use Low Profile I/O modules.

1. Wire the USB-87Pn unit to power and PC.



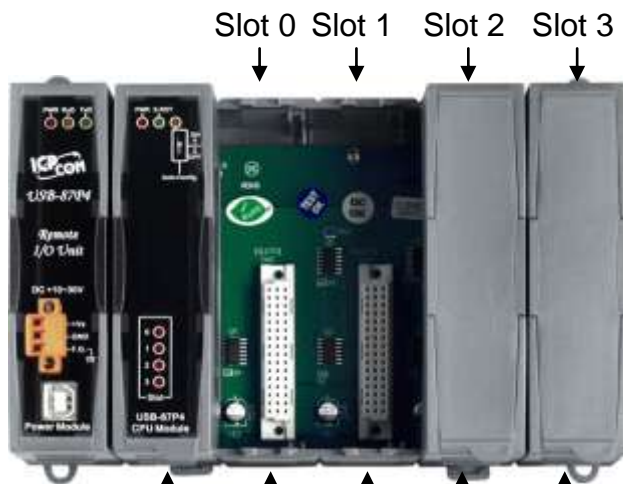
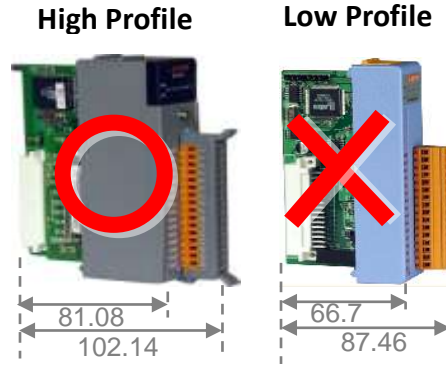
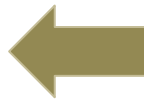
2. Make sure that the **Auto Config** switch is in **ON** position (auto configuration enabled).



3. Plug in the **High Profile** I/O modules and power on the USB-87Pn unit.

**Example: Plugging I-87018R in Slot 0**

(I-87018R is a High Profile analog input module.)



Net Address: 1 2 3 4 5

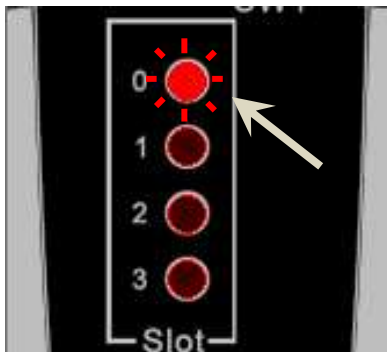
I-87018R is auto-configured:

Baud Rate: 115200

Checksum: Disable

Net Address: 2

**Note:** The Net Address of USB-87Pn is fixed to 1.



- After a module is plugged in, the slot indicator flashes once per 2 seconds.
- When software configuration is completed, the LED becomes off.
- If module communication is not correct, the LED is always on.

## 3.2. Software Configuration

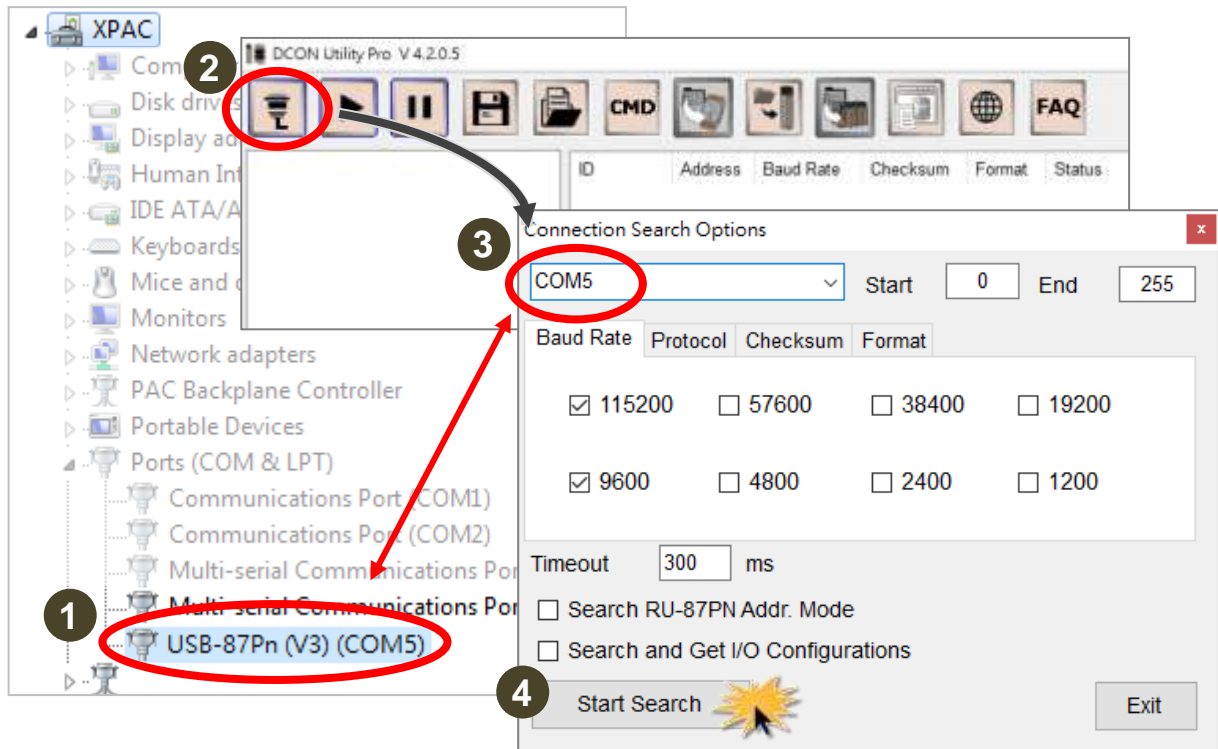
1. Install the USB-87Pn driver

<https://www.icpdas.com/en/download/show.php?num=2974>

2. Download the DCON Utility Pro and decompress it

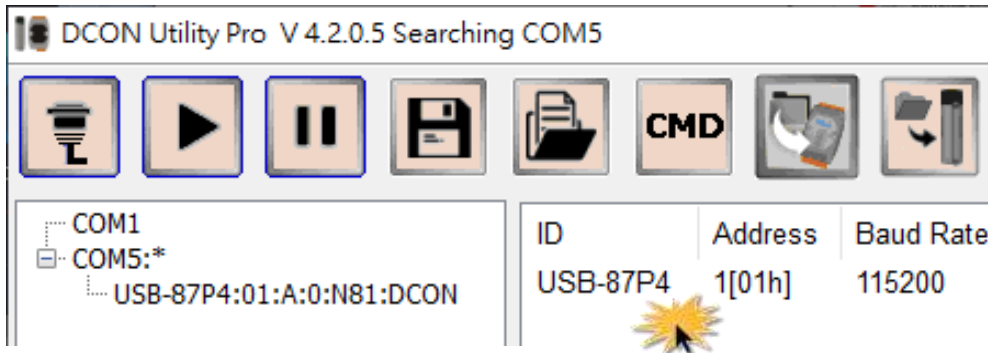
<https://www.icpdas.com/en/download/show.php?num=1046>

3. Run **DCON\_Utility\_Pro.exe** to search the USB-87Pn (e.g. USB-87P4)

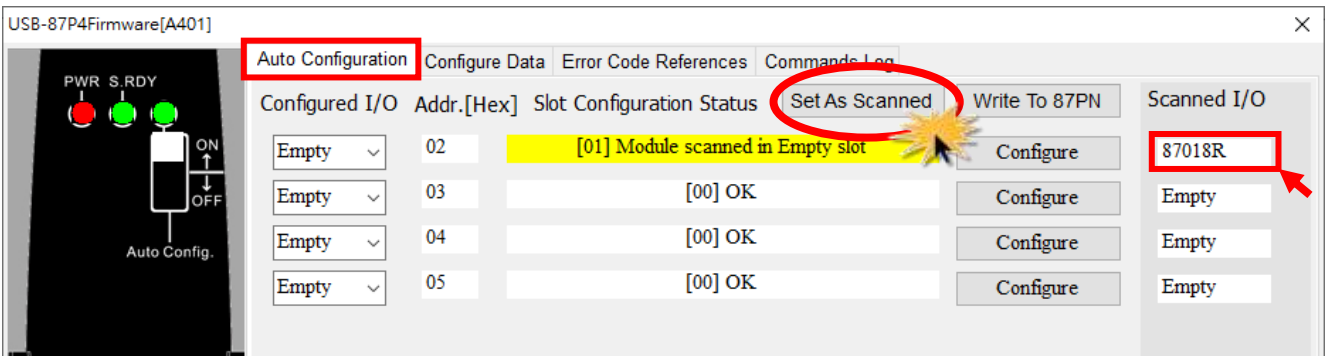


- Check the COM port number created for the USB-87Pn in **Device Manager** under **Ports (COM & LPT)** section.
- Select the COM port on the “**Configuration Search Options**” dialog box, make sure that 115200 bps is checked on Baud Rate tab and click the Start Search button.

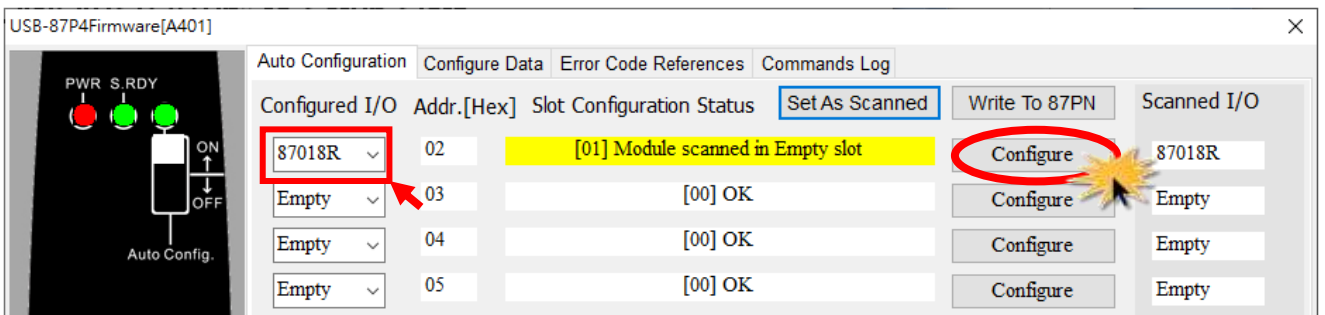
4. Click on the name of the searched module.



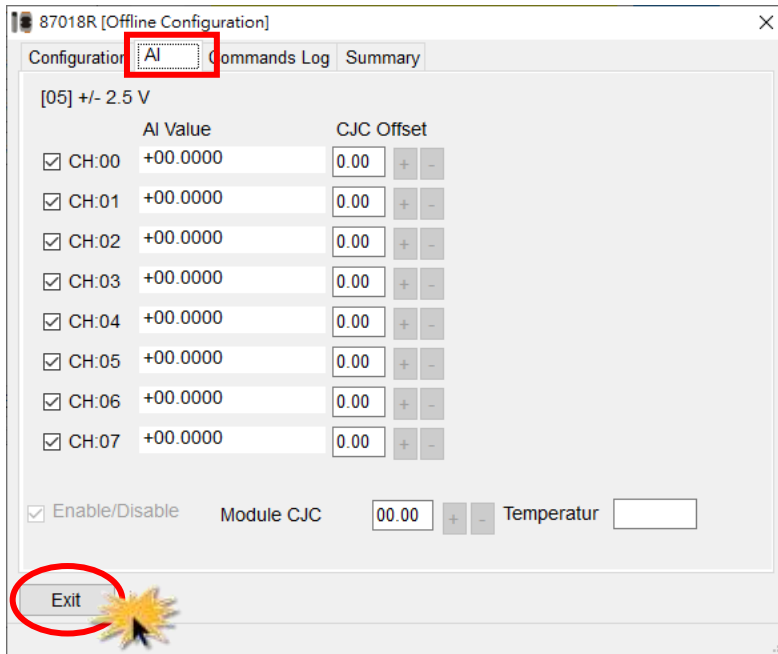
5. Make sure that the module name (e.g. I-87018R) is displayed in the text box for Addr 02 (slot 0) in the Scanned I/O column, and click the **Set As Scanned** button.



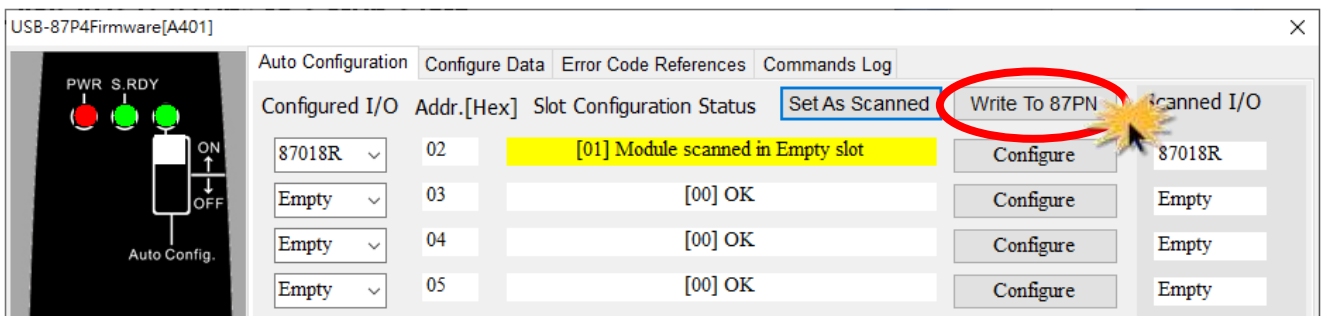
6. After the module name shows in the Configured I/O column, click the **Configure** button for it (Addr 02, slot 0).



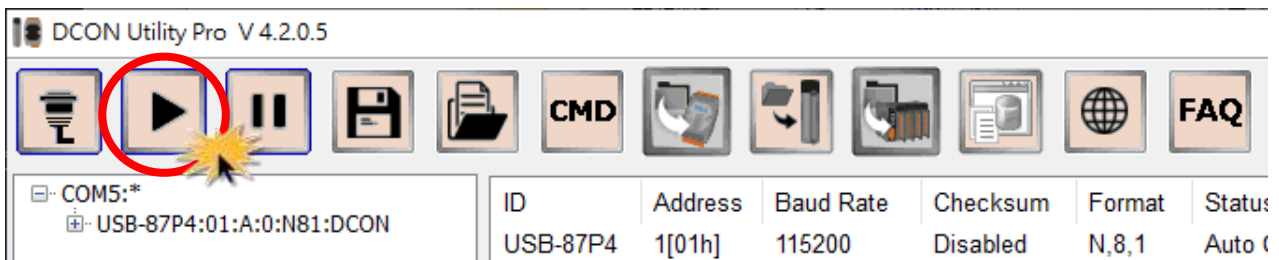
7. Configure the module and click the **Exit** button.



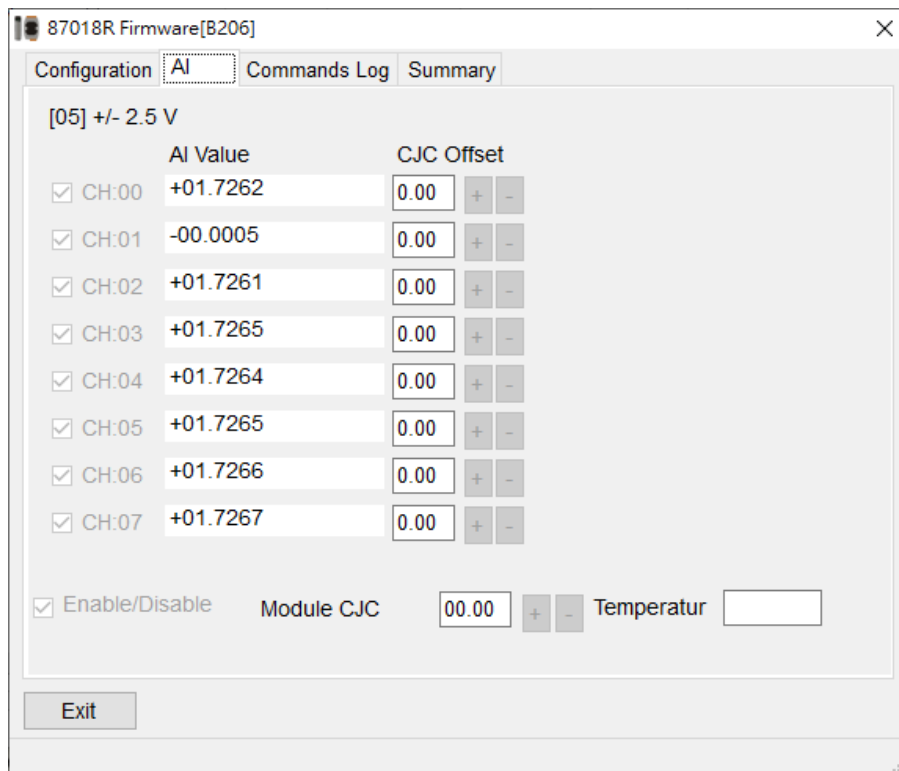
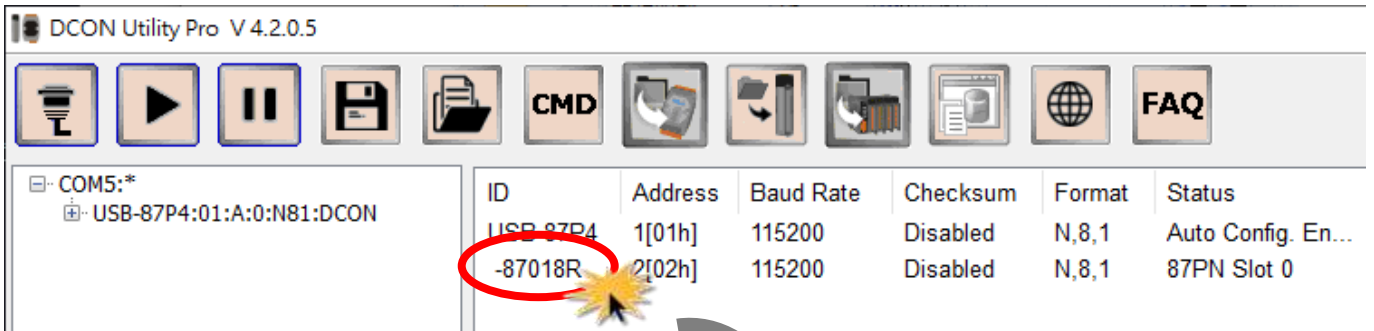
8. Click the **Write to 87Pn** button and click the **Yes** button in the pop-up box.



9. Click the **Start Search** icon to search module again.



10. Click the I/O module name to view real-time data on the module.





## 4. Setting up the USB-87Pn

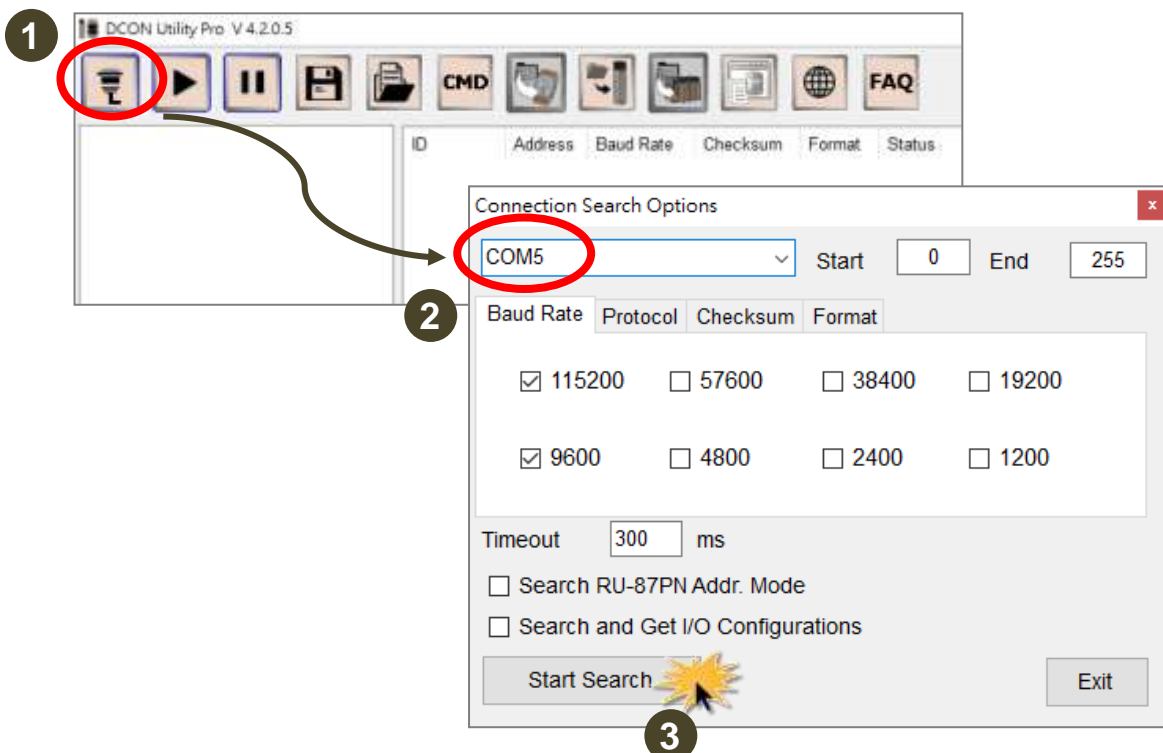
In this chapter, we will use DCON Utility Pro to complete software configuration of the USB-87Pn. Please confirm that PC and power are connected to USB-87Pn.

(Refer to [Chapter 3](#))

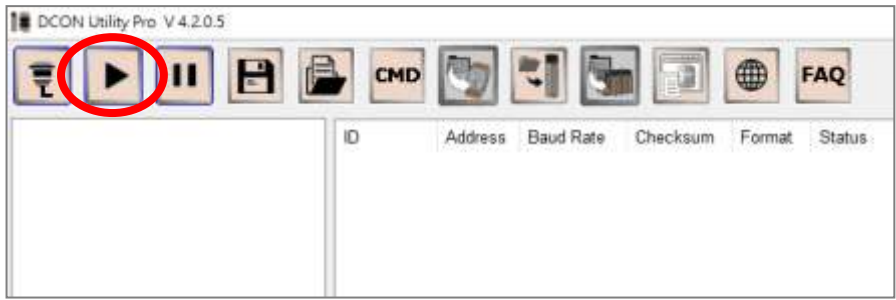
- 4.1. [Searching the USB-87Pn](#)
- 4.2. [Configuring I/O Modules](#)
- 4.3. [Accessing I/O Modules without Auto Configuration](#)
- 4.4. [Project Backup and Quick Recovery](#)
- 4.5. [Operating in Off-line Mode](#)

### 4.1. Searching the USB-87Pn

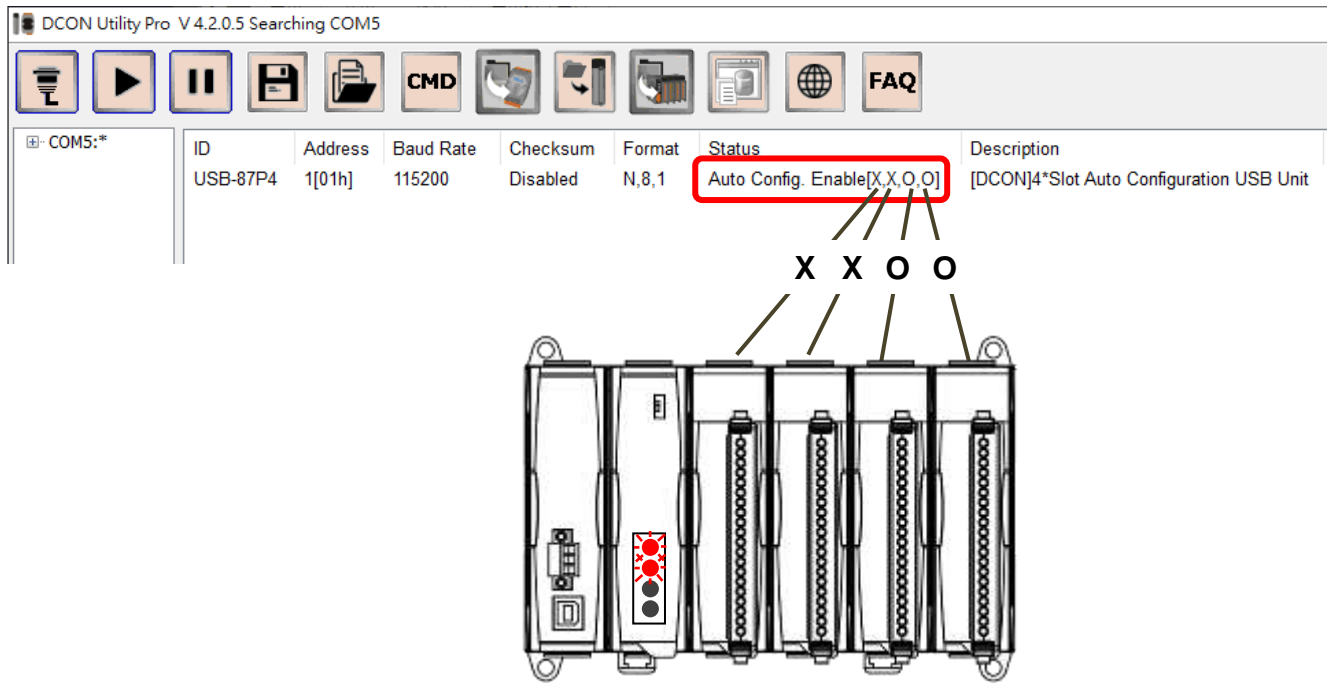
At first, please run **DCON\_Utility\_Pro.exe** then click the **Connection Options** icon, select the COM Port and baud rate for communicating with the USB-87Pn. You can check your PC's "Device Manager" to make sure which COM number is assigned for the driver. Then click the "**Start Search**" button.



Or click the **Start Search** icon to start the search function.

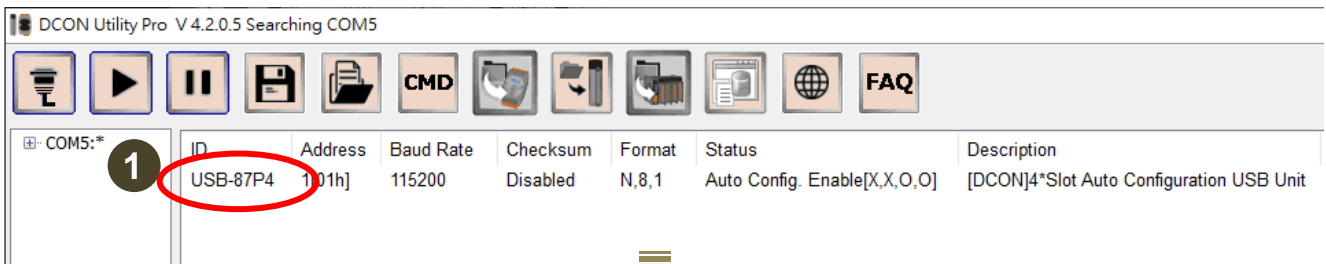


At the first time you can search “USB-87Pn” only, because I/O modules in slots are not configured. The first 2 X characters in [X,X,O,O] in Status field represent that modules in slot 0 and 1 are not configured or not correct. The following 2 O characters mean that modules in slot 2 and 3 are correct or there are no modules in the two slots.

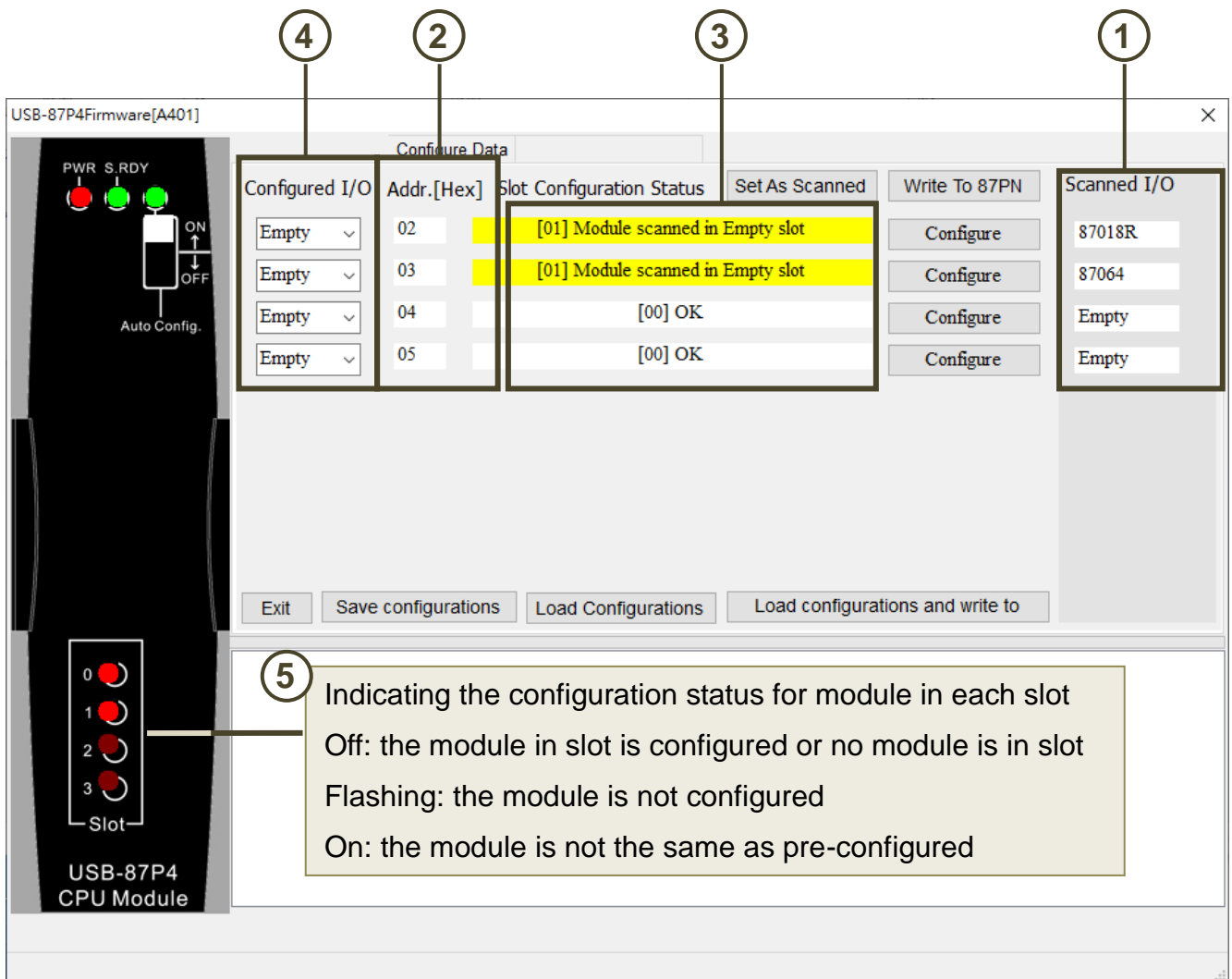


## 4.2. Configuring I/O Modules

1. Click **USB-87Pn** to open the configuration window.

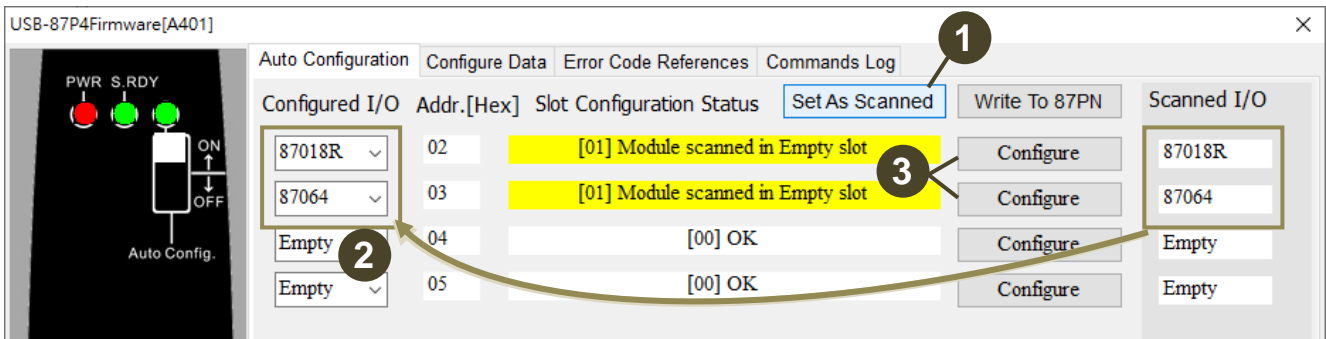


USB-87Pn can store I/O modules configuration, so the name of a pre-configured module will be displayed in the relevant field in **Configured I/O** section (4) when the configuration window opens. Empty indicates that there is no module configured in this slot.

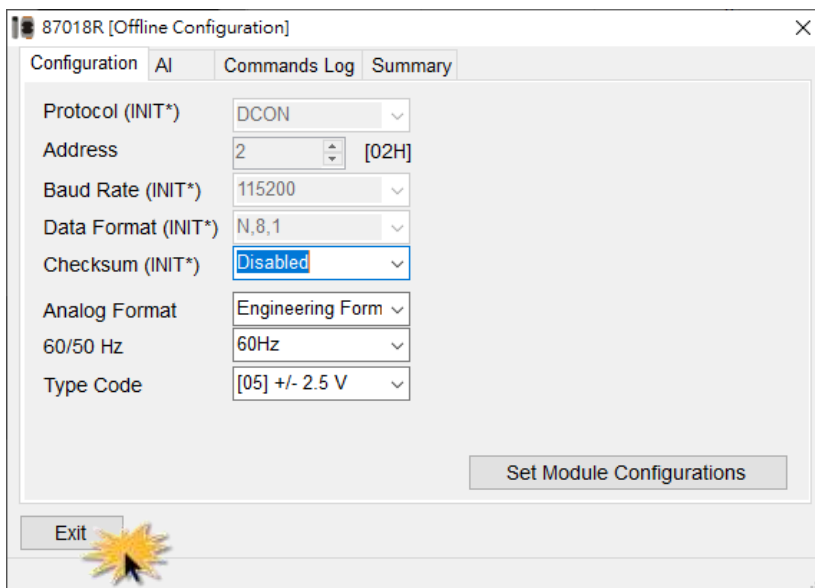


No	Name	Description
1	Scanned I/O	The I/O module scanned in search process.
2	Addr.[Hex]	The address for communicating with the module in slot.
3	Slot Configuration Status	The configuration status for the I/O module in slot.
4	Configured I/O	Empty: no configuration data for this slot Module name: module configured for this slot

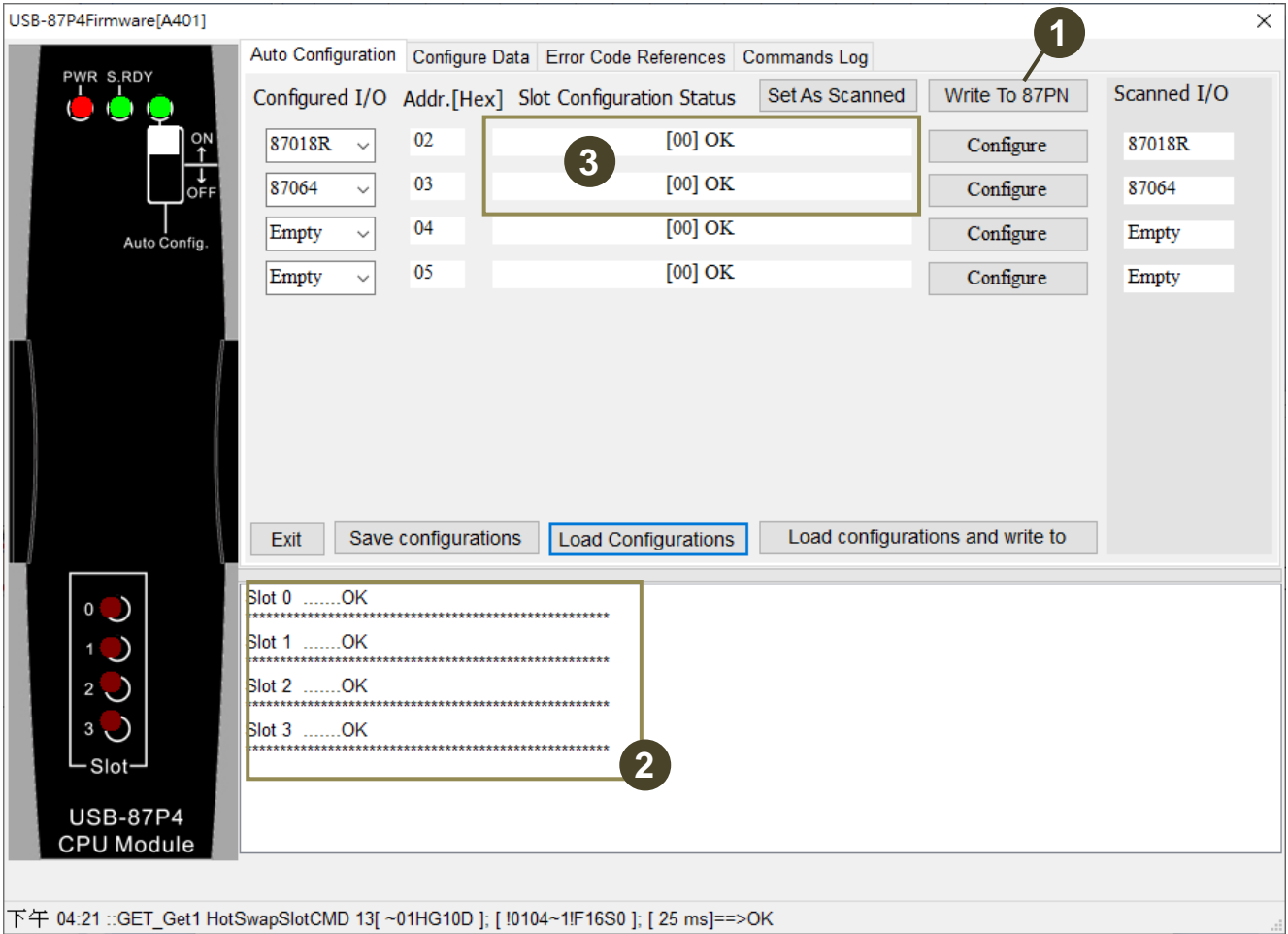
2. Click the **Set As Scanned** button, the module name in **Scanned I/O** field will be shown in the Configured I/O field, and then click the **Configure** button to set the I/O module.



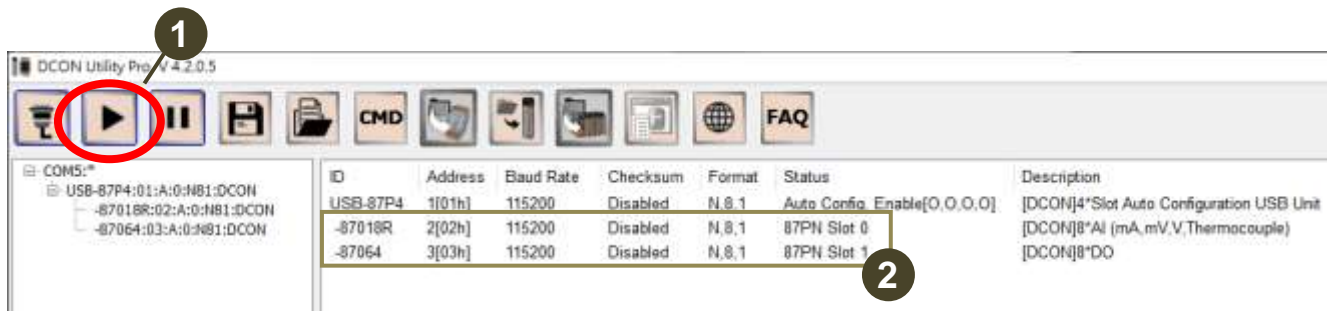
3. Set properly parameters for each module and then click the **Exit** button.



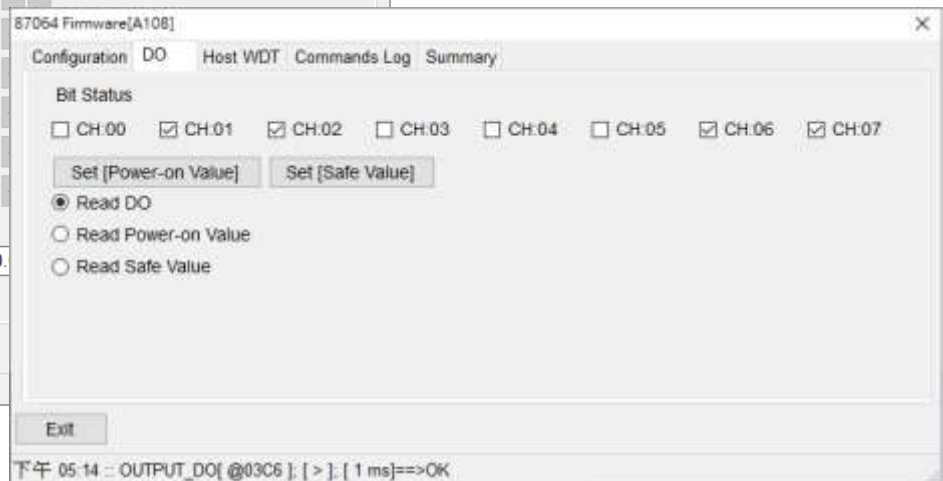
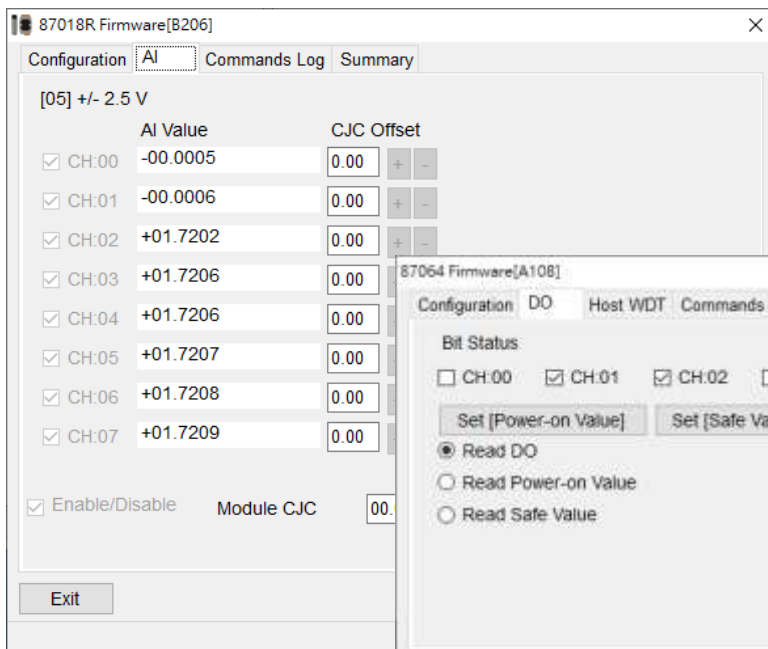
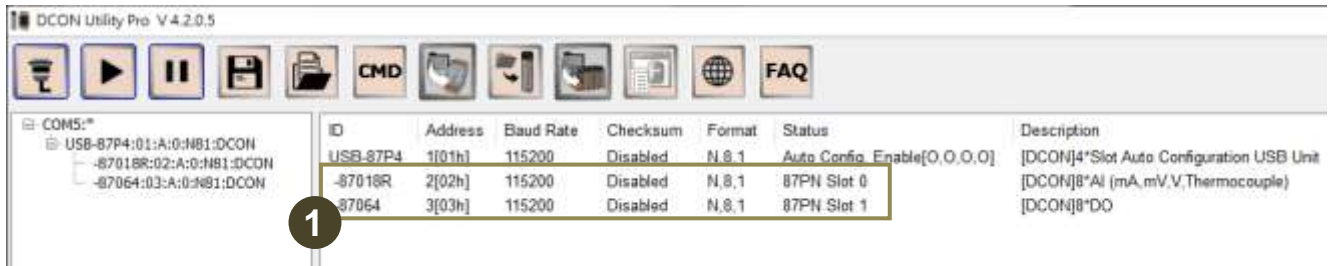
4. After all the modules on the USB-87Pn are configured, click the **Write to 87PN** button, and click the **Yes** button on the popup confirmation boxes. The finish message for each slot will be shown in the bottom pane (2), and the Slot Configuration Status for new modules are **[00]OK** (3).



5. Click the **Start Search** icon again, you can see each plugged I/O module name listed under the USB-87Pn.

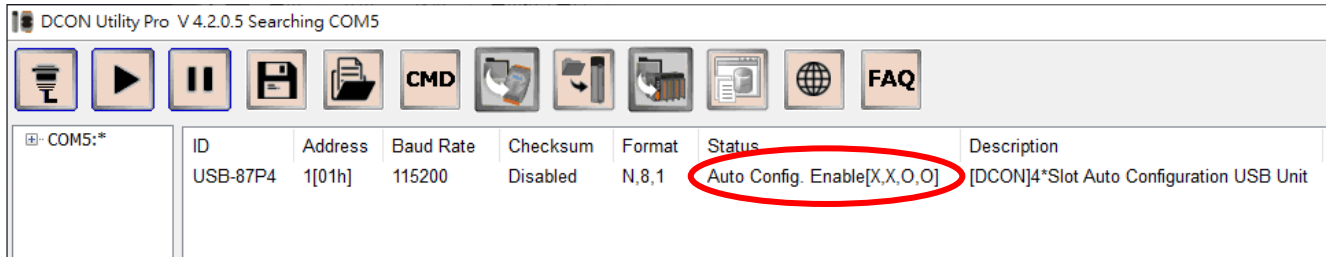


6. Click the module name to open its configuration window. Real-time data on the module can be viewed in the window.

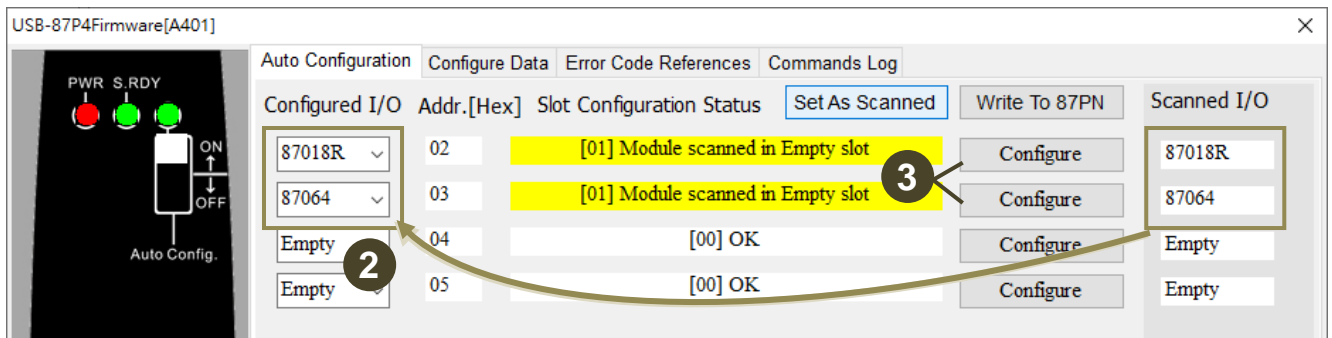
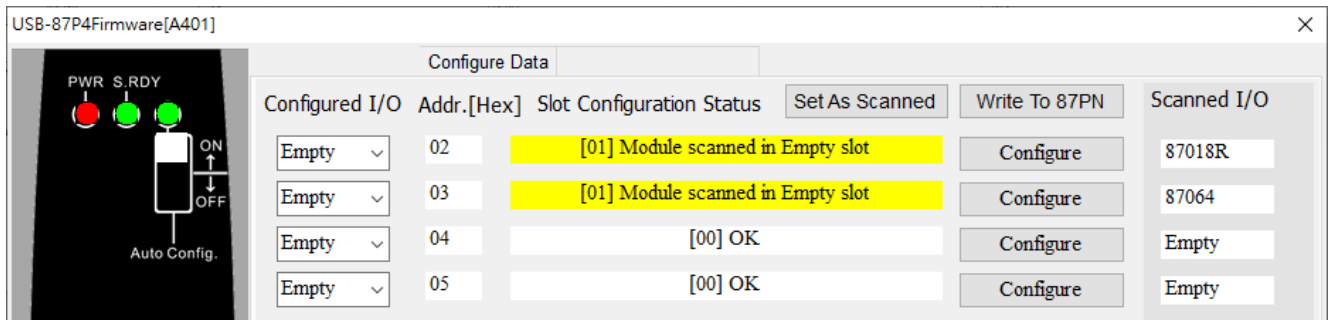


In conclusion, if an I-87K I/O module does not install correctly under **Auto Config. Enable** mode, it will be forbidden to function and you can't search or configure it in DCON Utility Pro.

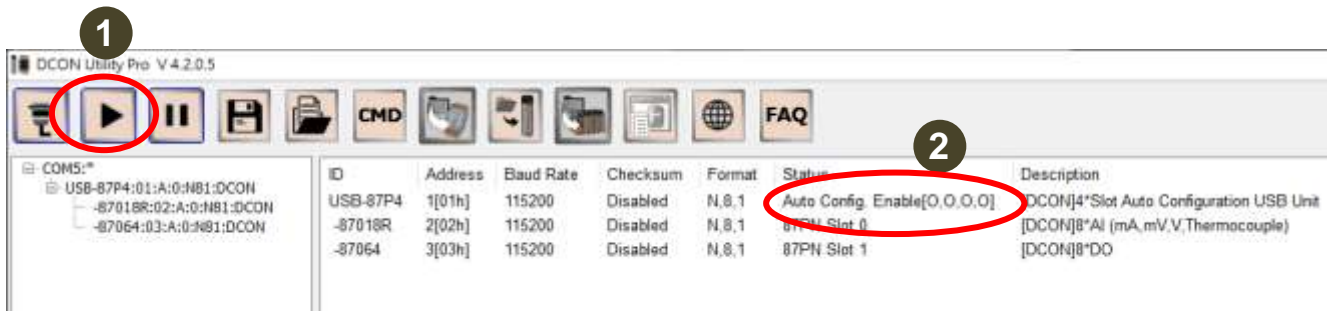
For example, the **Auto Config. Enable [X,X,O,O]** in Status column means that the configuration for modules in first two slots, are not completed or not corrected. You need click **"USB-87P4"** to set these I/O modules.



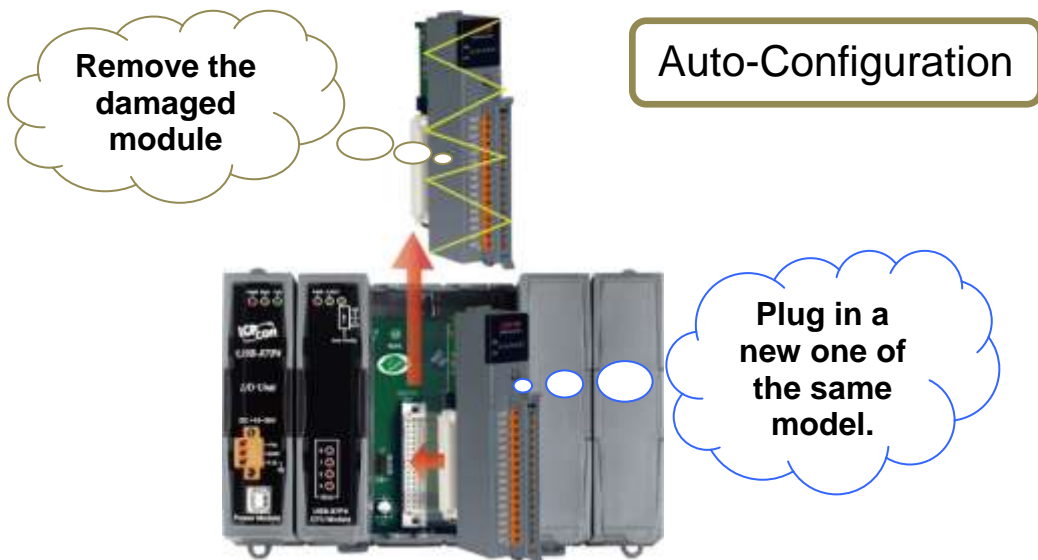
In the configure window, you can see the scanned module name in "Scanned I/O" column. Click the **Set As Scanned** button to assign module name and click **"Configure"** to setup the I/O module according to the user's demand. Finally click **Write to 87PN** for the settings to take effect.



As above, all the settings for each module are configured correctly, and then search the module again, you can see each plugged I/O module name listed under the USB-87Pn name and you can read the real-time data on the I/O modules now.



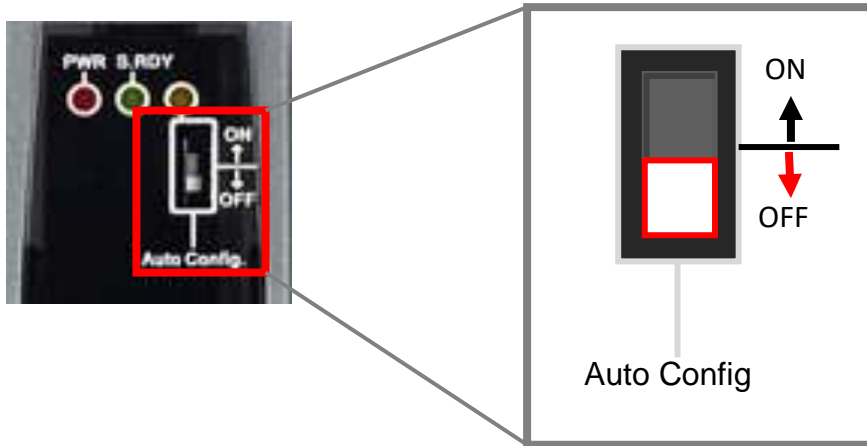
The **Auto Config. Enable [0,0,0,0]** means that each module in slot is correct configuration. If a module is damaged, you don't need to shutdown the power, just remove the damaged module and install a new one of the same model. USB-87Pn will write the previous settings to the module automatically.





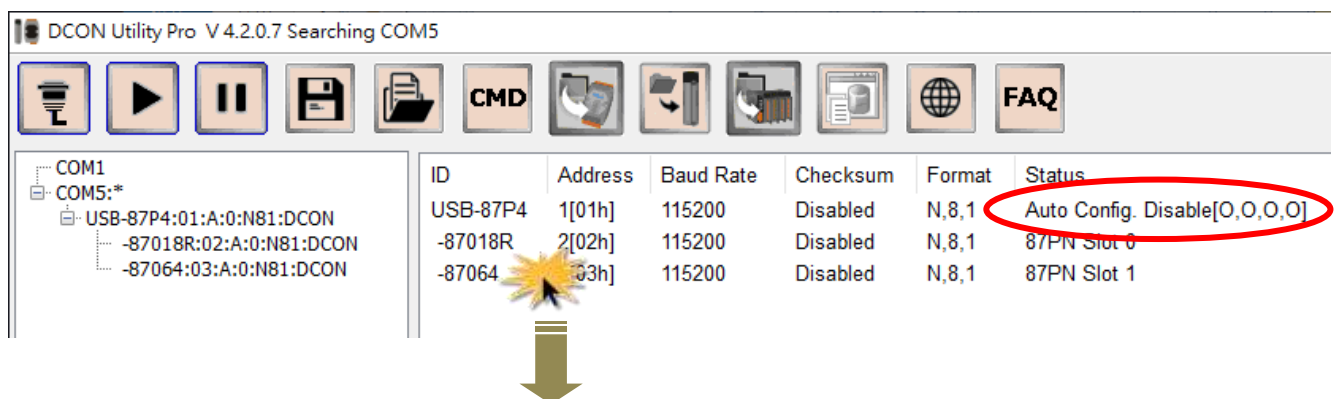
### 4.3. Accessing I/O Modules without Auto Configuration

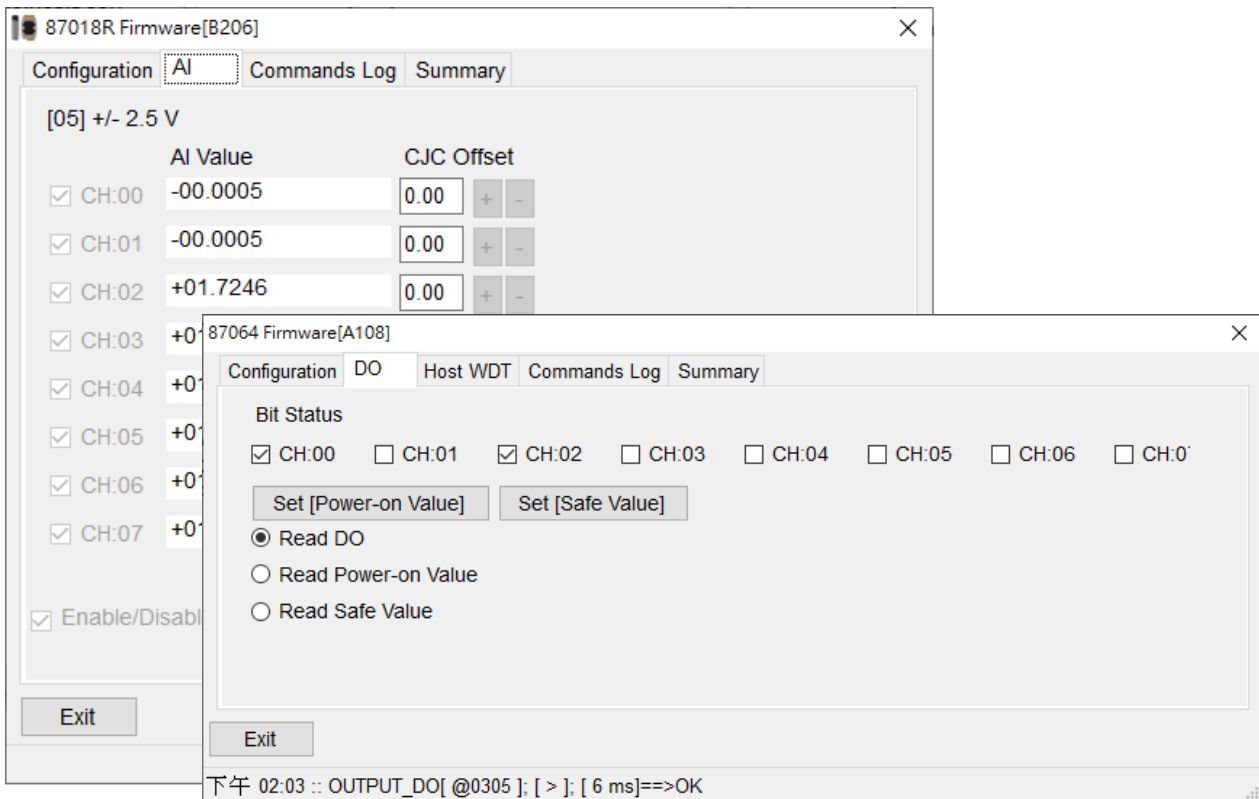
Setting the **Auto Config.** dip switch in the OFF position and then powering on the USB-87Pn unit can disabled the auto configuration function. The USB-87Pn will **not** automatically compare whether the current I/O module is consistent with the information stored in the unit in advance.



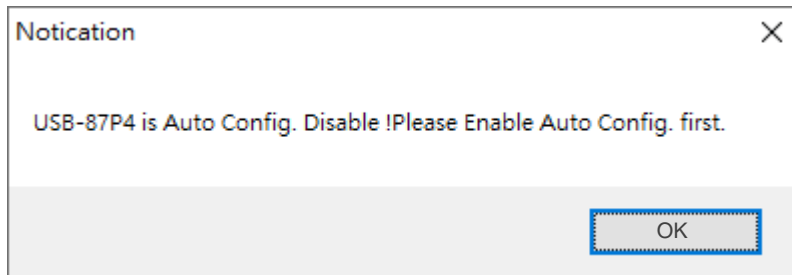
In **Auto Config. Disable** mode, DCON Utility Pro can be used to configure and access the I-87K I/O modules even they are not configured. Therefore, when you perform searching in DCON Utility Pro, you could see both the model name of USB-87Pn and I-87K I/O modules.

The status of USB-87Pn shows **Auto Config. Disable [0, 0, 0, 0]**. It means that auto configuration is disabled now and you can open a configuration window to set up an I-87k module by clicking the module name.





During the auto configuration disabled period, you cannot set the USB-87Pn unit. The following error message will appear when you click the name of USB-87Pn unit.

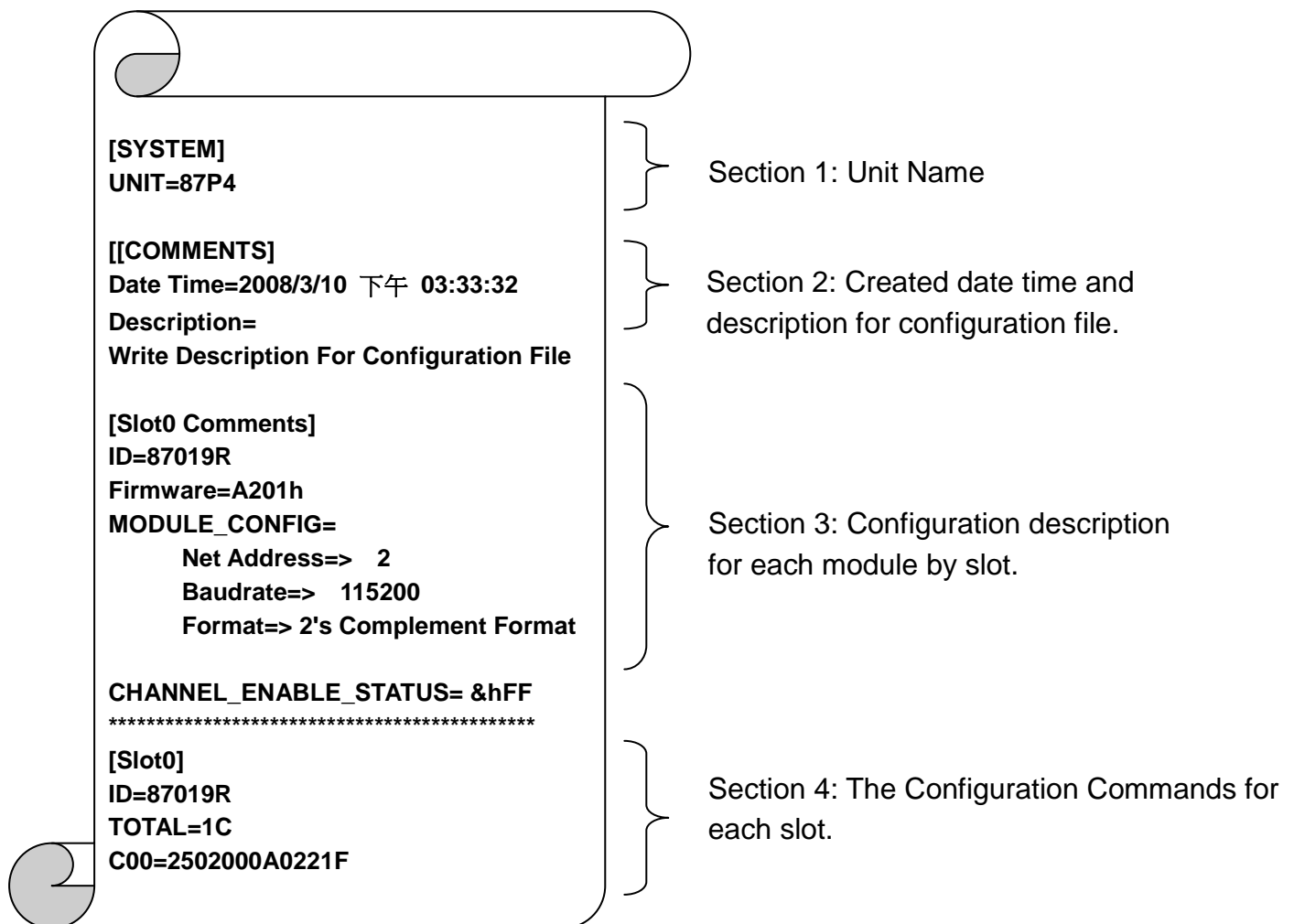


When auto configuration is disabled, you won't be able to fix a damaged I/O module by replacing with a new one only, because their settings (e.g. type code) are different. You have to re-configure the module for maintaining the normal operation.

## 4.4. Project Backup and Quick Recovery

When you completed the module configuration, you can quickly backup all the settings for system backup, system recovery and mass configuration. You can specify the file name and add comments into the file for easy to manage and maintain multiple project files at the same time. The default location of a project file is the **auto\_config** folder in DCON Utility Pro.

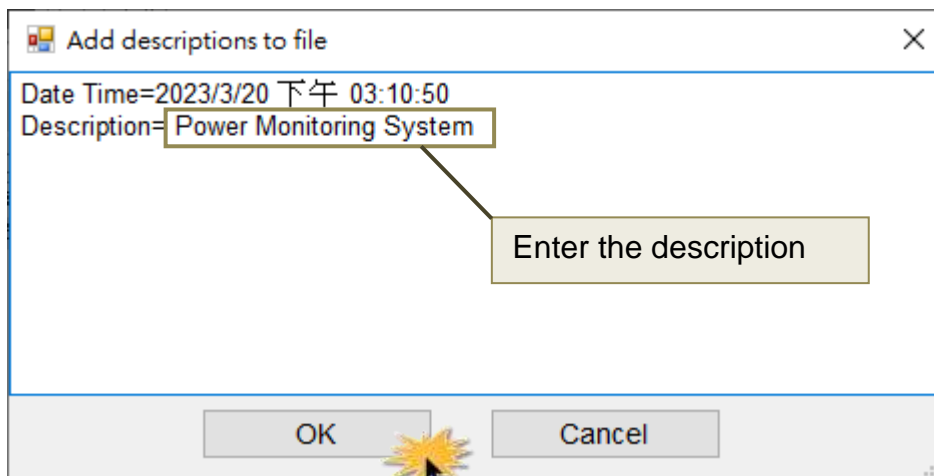
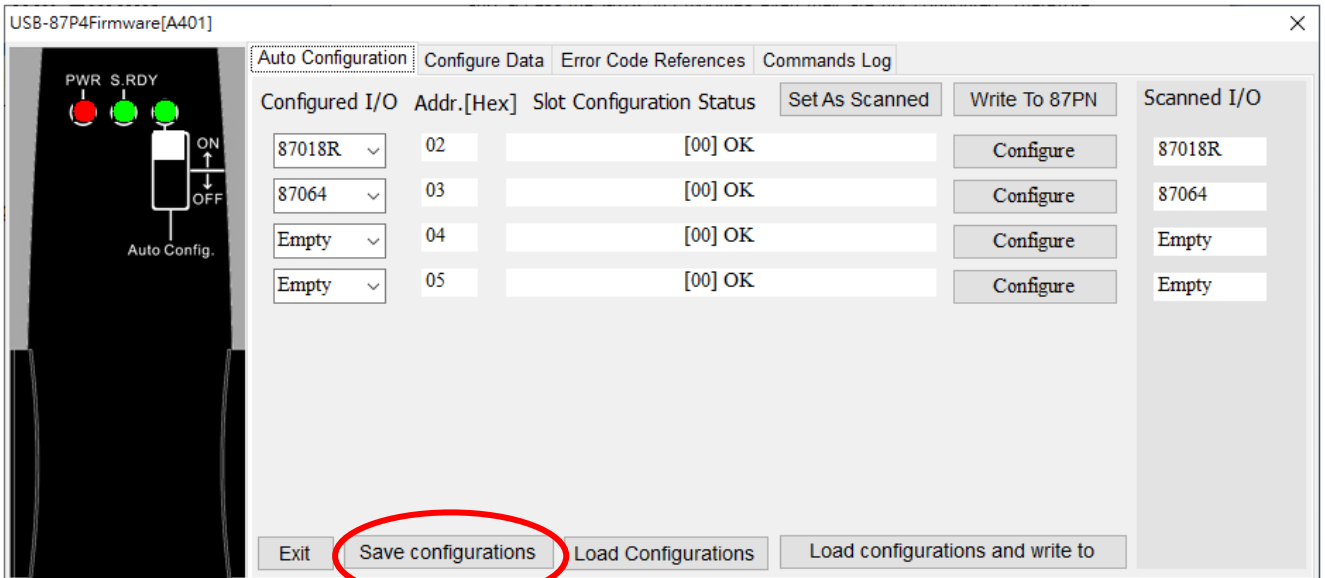
The INI file explains as follows:



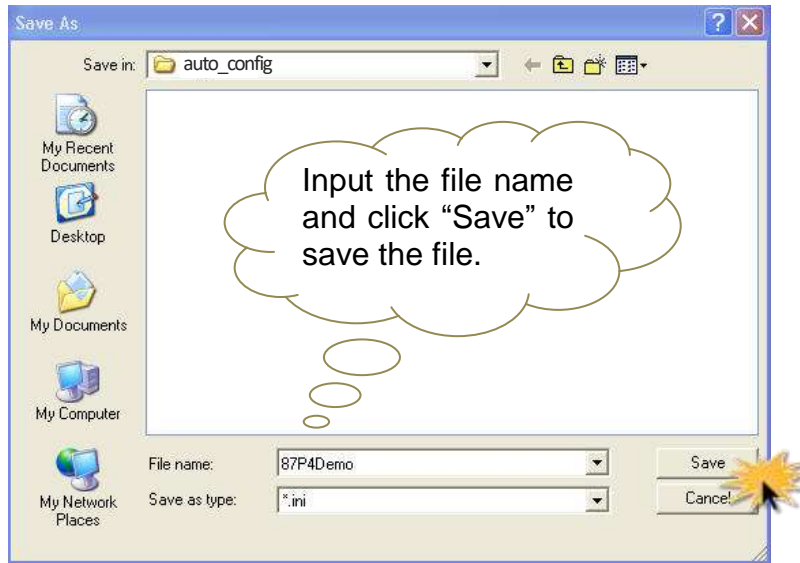
## 4.4.1. Saving the Configure File

When all modules are configured properly, you can save the settings as a file to recover the USB-87Pn settings since it is carelessly changed, or to duplicate a USB-87Pn unit with exactly the same I/O modules and settings.

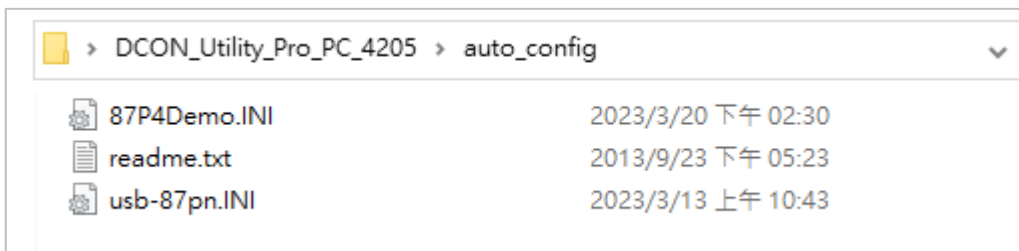
1. Complete all the settings for each I/O module.
2. Click the **Save configurations** button, input the description or notes for this configuration file and click **OK**.



3. Finally, enter the file name and click **Save**.



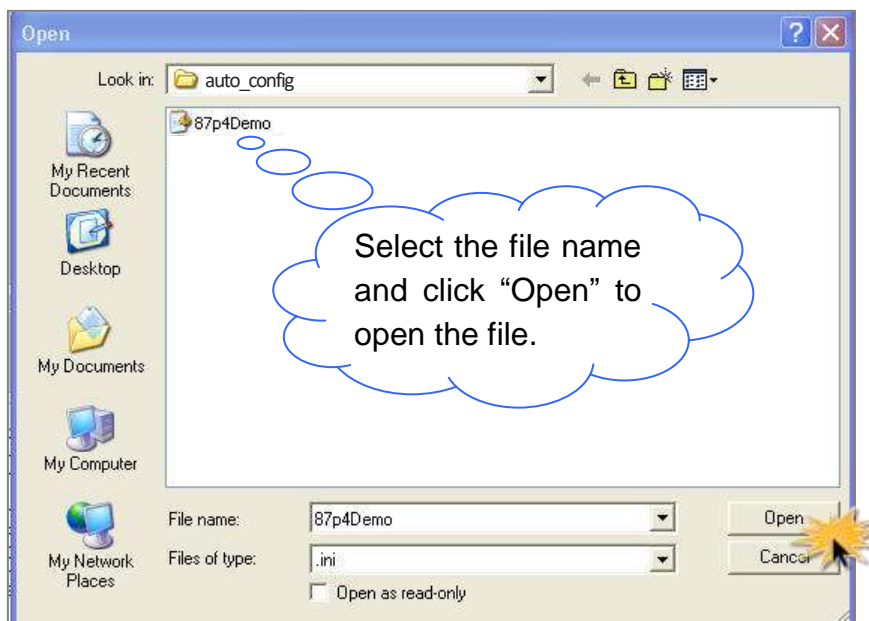
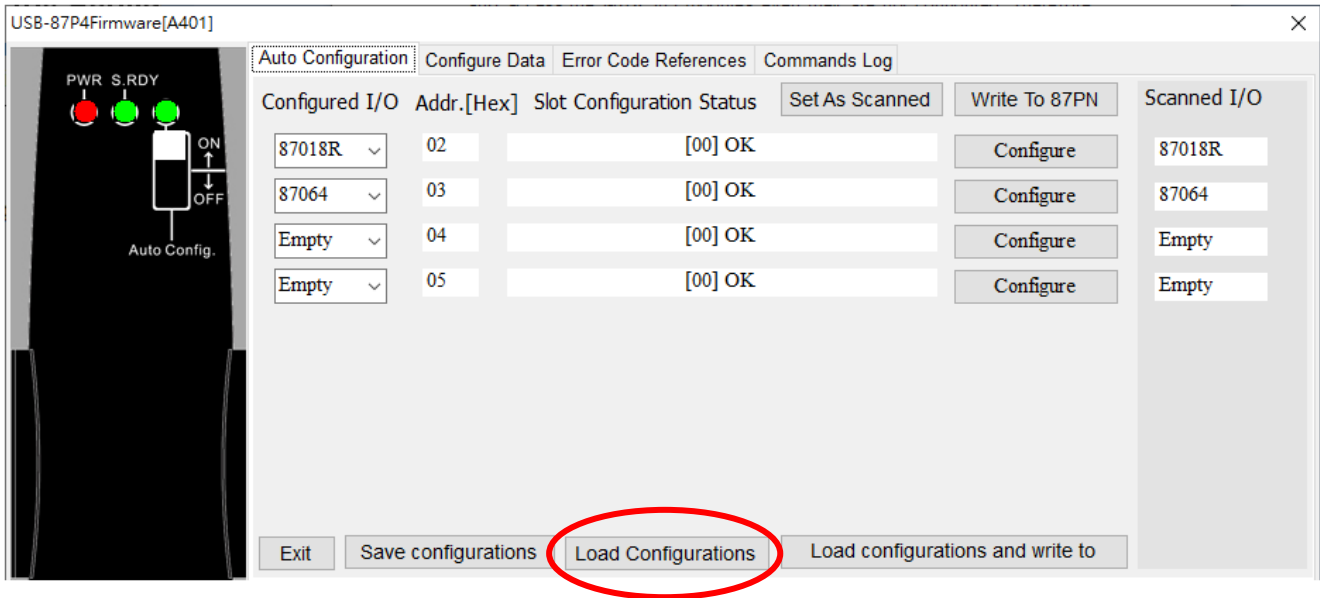
The default path is defined in "DCON Utility Pro\_PC\ auto\_config".



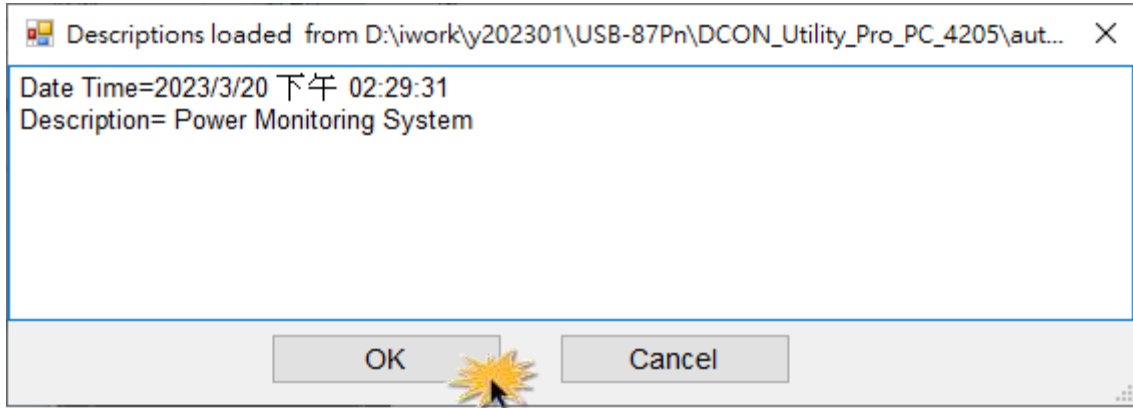
## 4.4.2. Loading the Configure File

You can load the configuration file from DCON Utility Pro to USB-87Pn to recover the I/O settings or to duplicate another USB-87Pn with exactly the same I/O modules and settings.

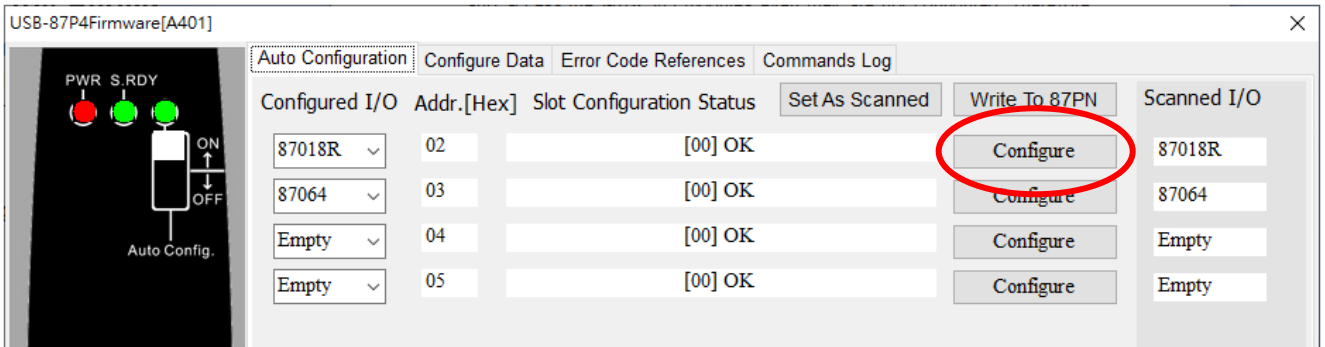
1. Click the **Load Configurations** button.
2. Select your configuration file and click the **Open** button.



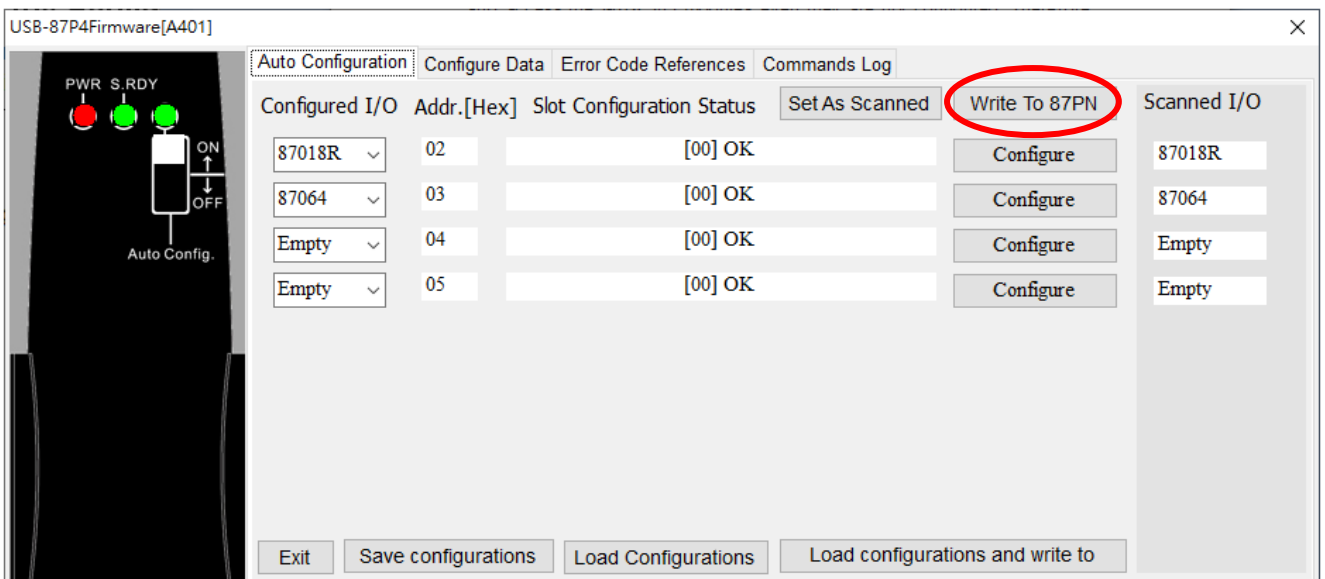
3. Check the description for the configuration file and click the **OK** button.



4. Click the **Configure** button to check whether the settings for each module are correct.

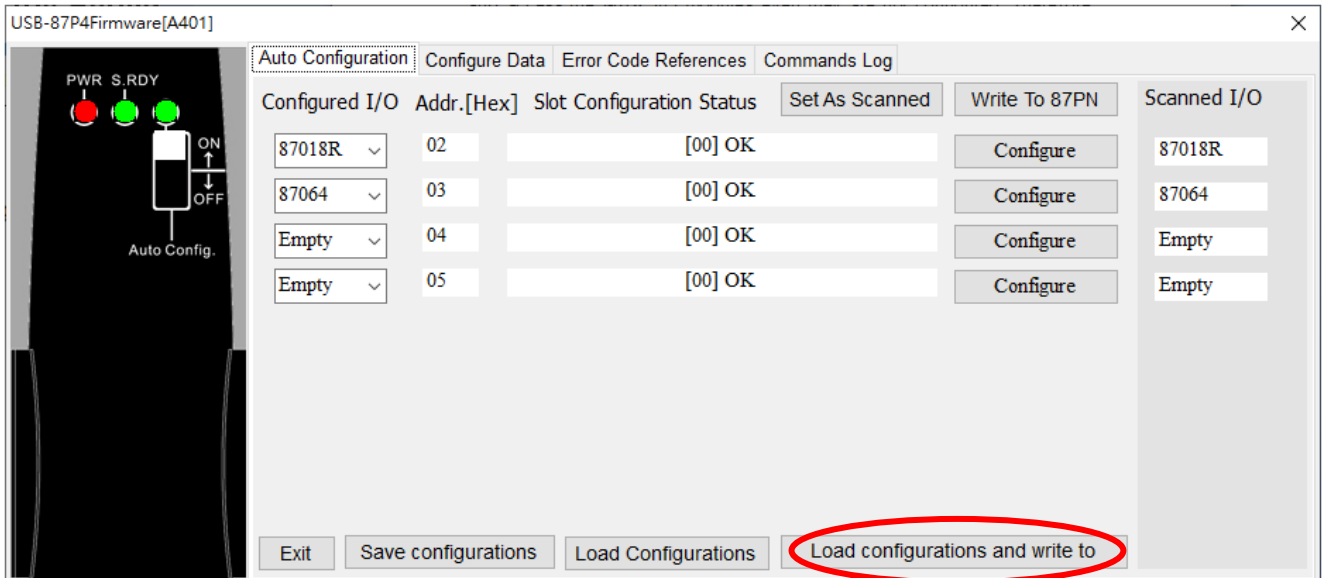


5. Click the **Write to 87PN** button to write the configuration to the USB-87Pn.

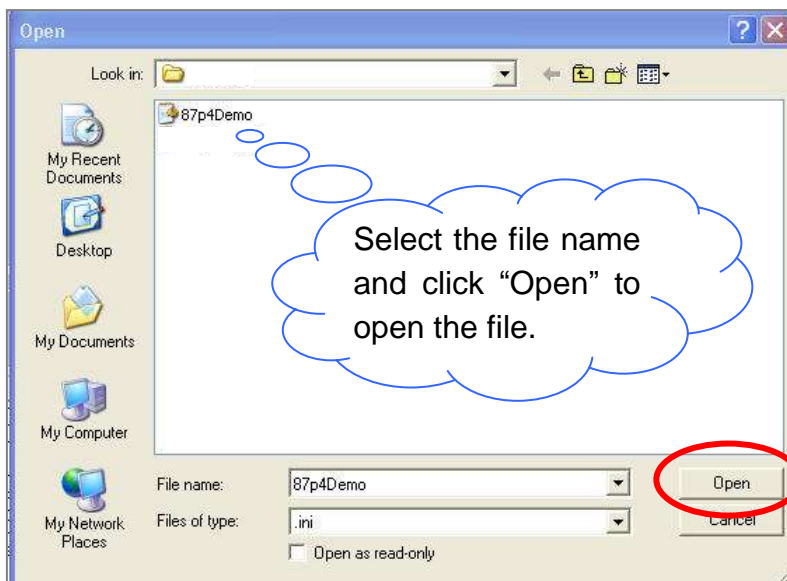


### 4.4.3. Loading and Writing the Configuration File

If you have confirmed that the configuration file is correct, using the **Load configuration and write to** button can help you to speed up the settings.

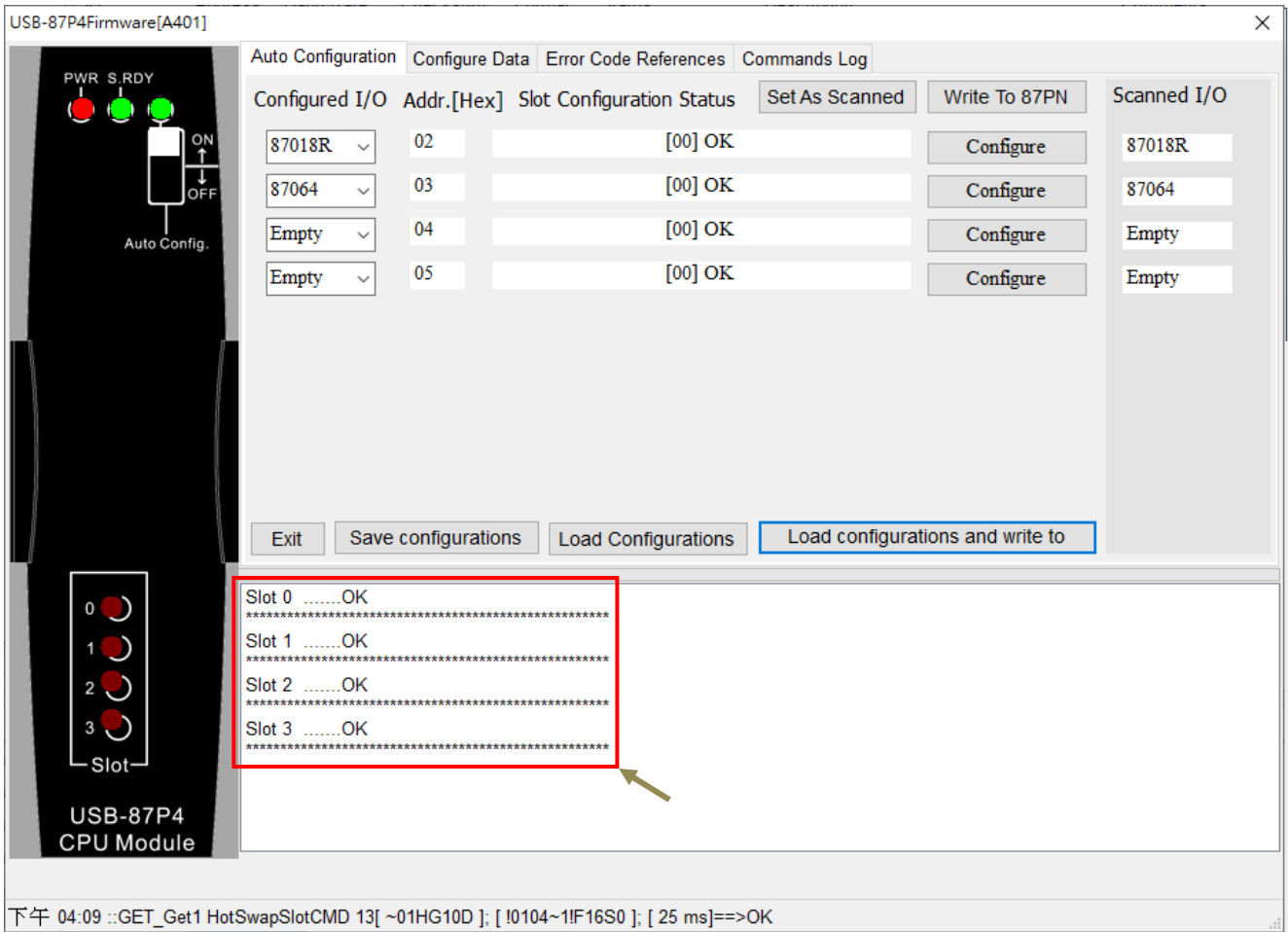


1. Click the **Load configuration and write to** button.
2. Select your configuration file and click the **Open** button.





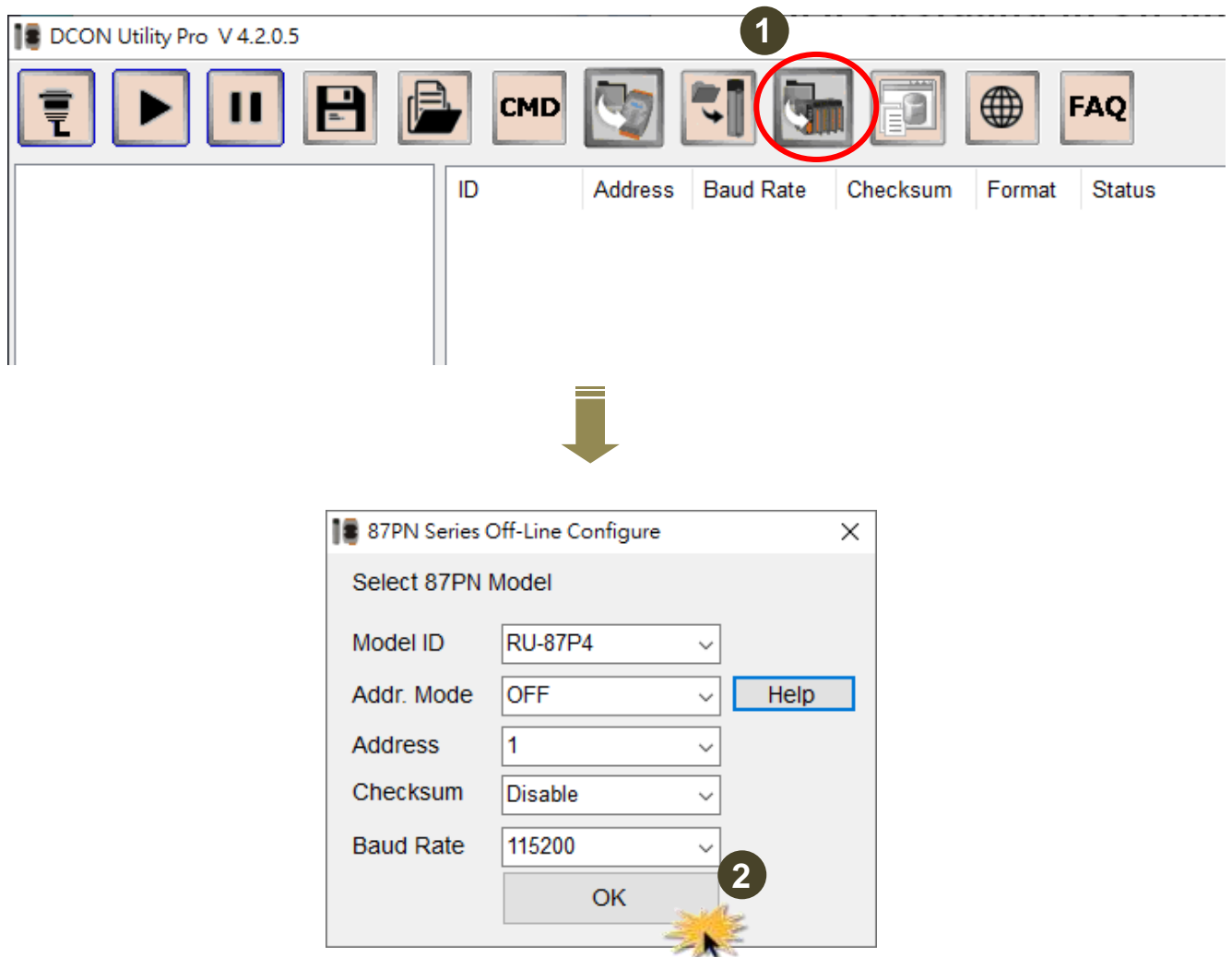
3. Wait for OK messages for each slot to appear in the bottom pane.



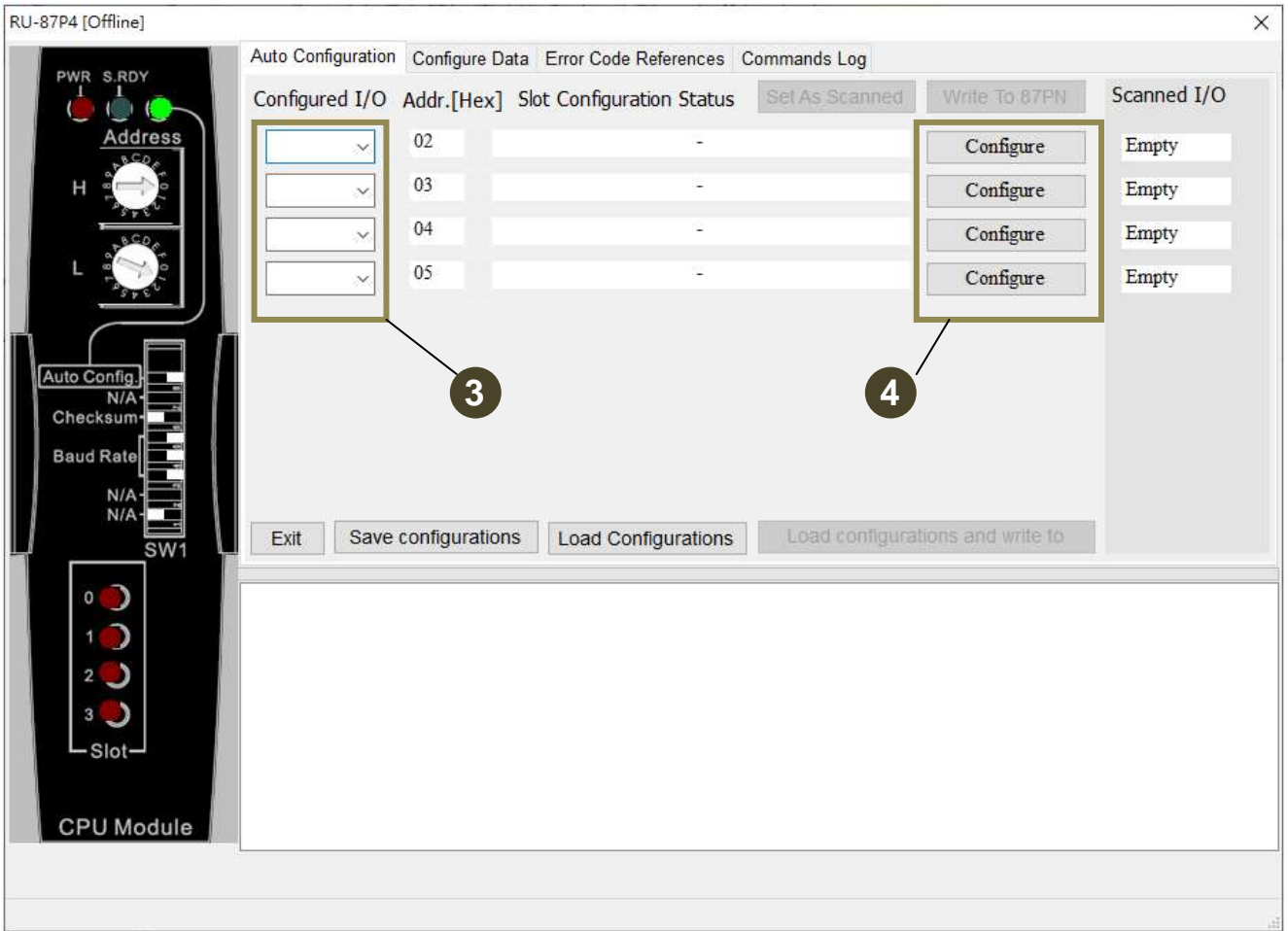
## 4.5. Operating in Off-line Mode

DCON Utility Pro provides the function of setting I/O modules offline, allowing you to edit configuration files for remote users, or to edit I/O module configuration in advance without connecting with a USB-87Pn unit. And then you can copy the file to another computer which is connecting with a USB-87Pn and write the configuration into the USB-87Pn via DCON Utility Pro. It is convenient for remote support or system backup.

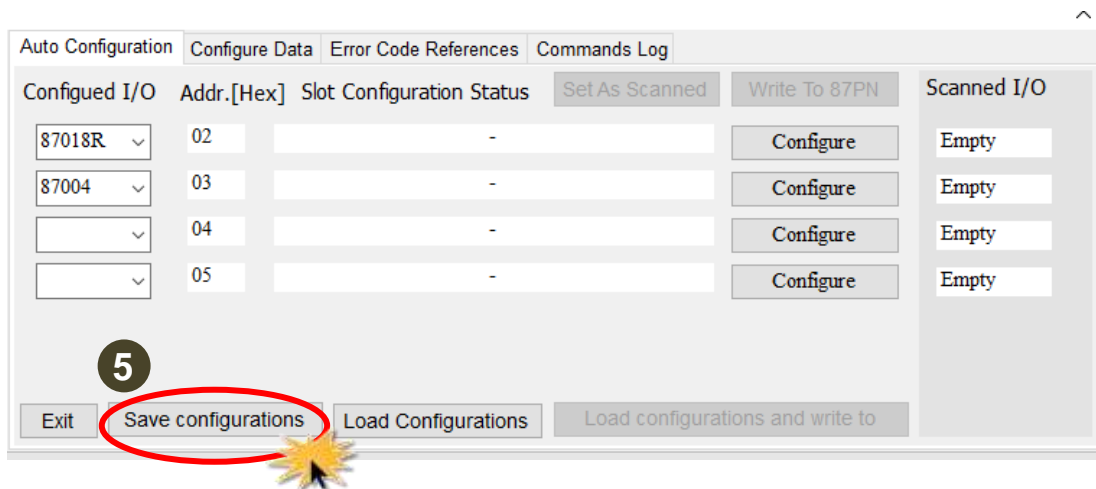
1. Click the **Offline Configuration for 87PN** icon on the toolbar of DCON Utility Pro.
2. Confirm the parameters and click **OK** on the popup box.



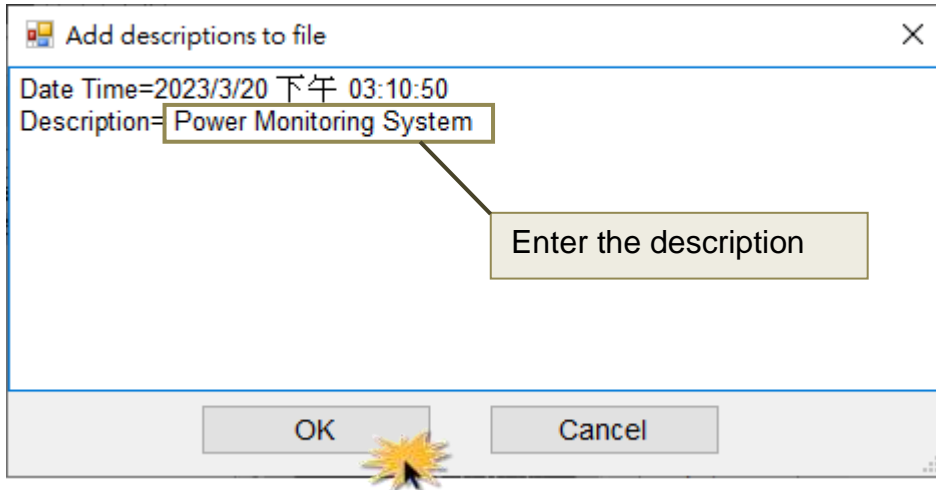
3. Select the model number in the drop-down menu corresponding to the slot that the module will be plugged in.
4. Click the relevant **Configure** button to edit the parameters for the module.



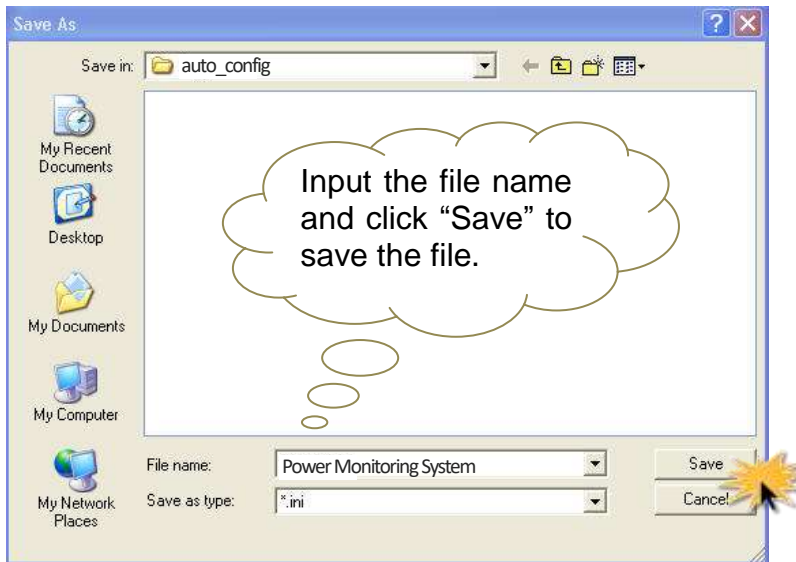
5. After finishing the configuration for all I/O modules, click “**Save configurations**” to save the settings as a \*.ini file.



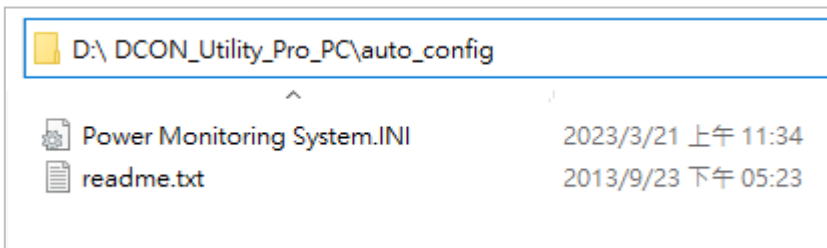
6. Enter the description to note the configuration file and click **OK**.



7. Enter the file name and click the **Save** button.



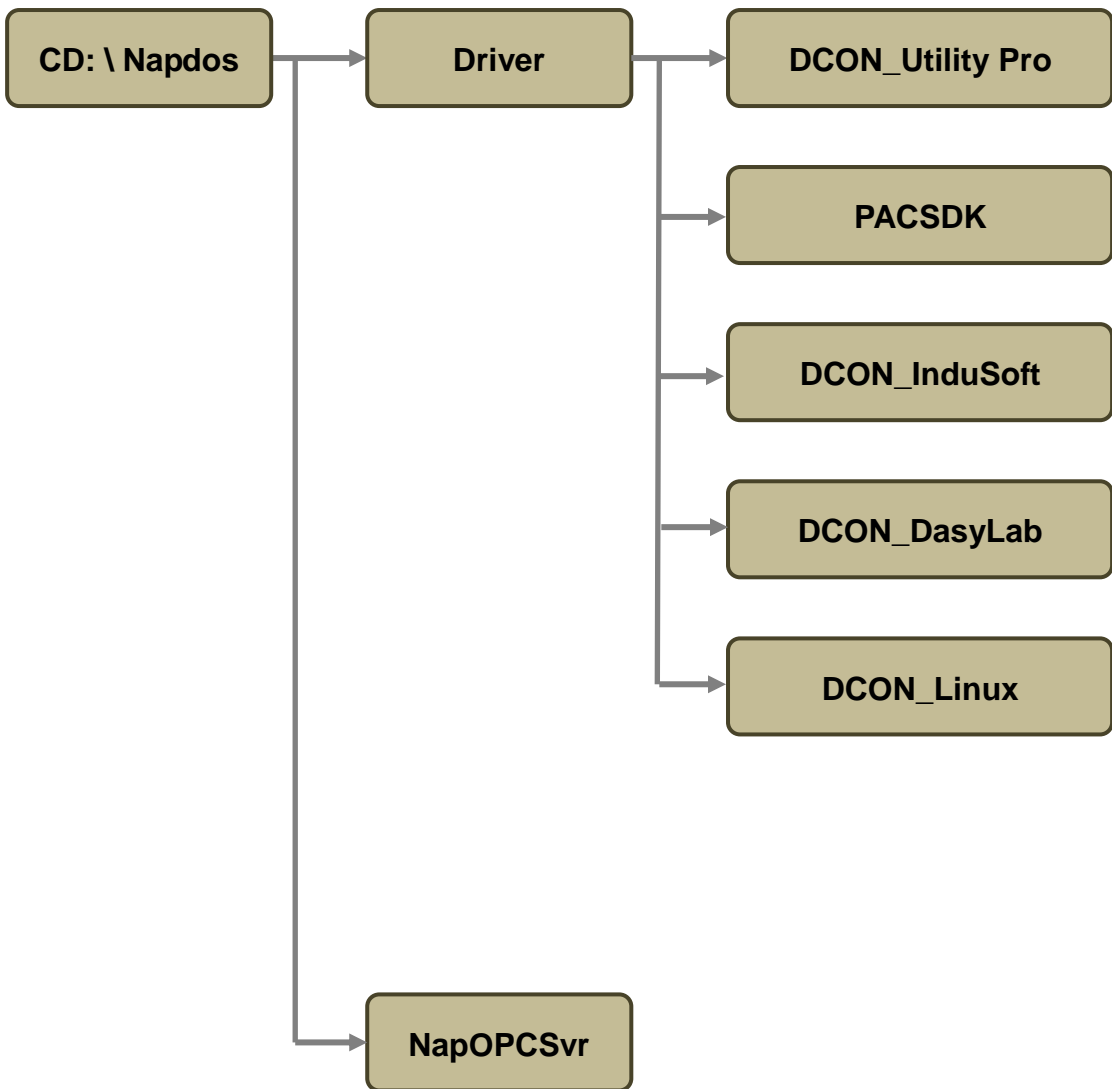
The default path is defined in "**DCON Utility Pro\_PC\_xxxx\auto\_config**". Now you can copy the file to another PC which is connecting with a USB-87Pn and refer to section 4.4.3 to write the configuration file into the USB-87Pn.



# 5. Software Development Kits (SDK)

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The ICP DAS provides a series of free software development kits enables the customer to be fast and simply completes the system setup. Related software tools are in the CD, please refer to following diagram:



## 5.1. PACSDK

PACSDK provides program developers to read the program interface which used on control I/O modules, the position of CD place provides a few basic and simple examples, user can understand how to read the control I/O module through the DLL in following examples:

### Supported Windows OS for PC

- Windows XP/7/10/11

All documents for PACSDK are located at CD or website (latest version):

CD: \Napdos\Driver\PACSDK

PACSDK can be used on C,C++,C#, Delphi, Borland C, etc. development environment.

The latest manuals and examples can be downloaded from the following website:

[https://www.icpdas.com/en/product/guide+Software+Development\\_Tools+PAC\\_SDK](https://www.icpdas.com/en/product/guide+Software+Development_Tools+PAC_SDK)

## 5.2. PACSDK PC LabVIEW

**PACSDK PC LabVIEW** is based on PACSDK, it can be used to read data from I-7000/8000/87k series I/O modules or write data to those IO modules via DCON protocol in LabVIEW. It can be downloaded from

<https://www.icpdas.com/en/download/show.php?num=1845>

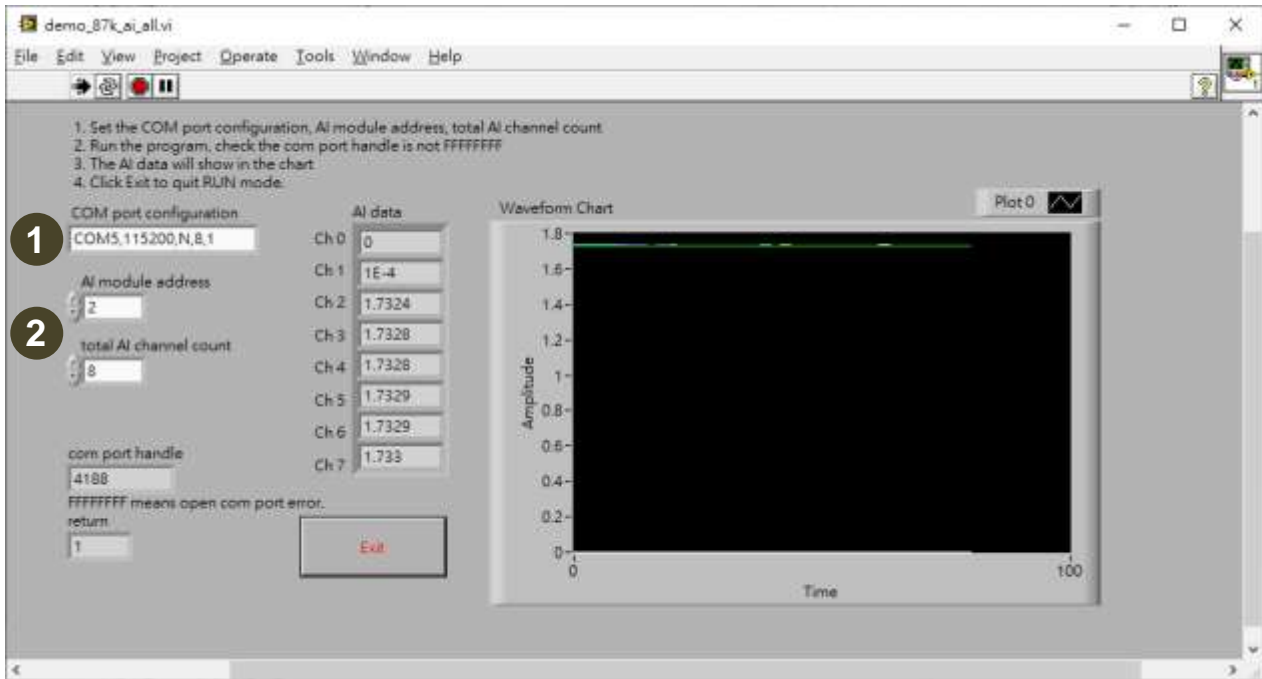
After downloading the **PACSDK PC LabVIEW** package and unzip it, you can find the demo for I-7000/I-87K I/O modules in 7k\_87k folder.

PACSDK	7k_87k	---	Demo for I-7000 and I-87k I/O modules on 87K unit
	8k unit	---	Demo for I-8000 and I-87k I/O modules on 8000 unit
	others	---	Demo for sending and receiving string of ASCII characters
	x64_dll	---	Dll file for 64-bit LabVIEW
	x86_dll	---	Dll file for 32-bit LabVIEW
	IO.llb	---	Sub-vis of PACSDK
	PACSDK.dll		Dll file for 32-bit LabVIEW

The PACSDK.dll in PACSDK directory is for 32-bit LabVIEW. If you are using 64-bit LabVIEW, please first copy the PACSDK.dll in the x64\_dll folder to the PACSDK directory to replace the original one, and then open the demo.

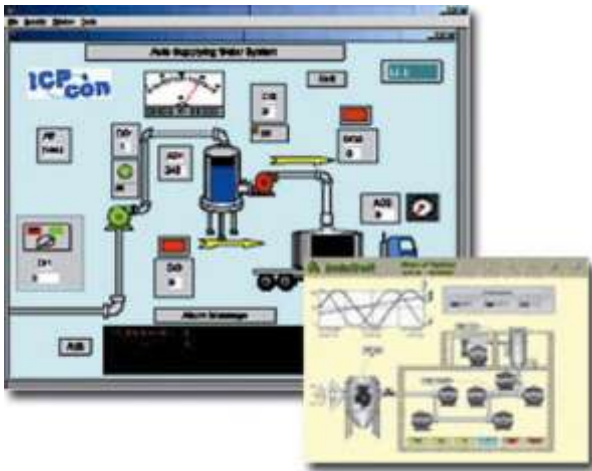
Take reading the AI data from I-87018R in slot 0 (address 2) as an example:

1. Open the demo\_87k\_ai\_all.vi in the 7k\_87k folder.
2. Enter the COM port created by USB-87Pn driver, baud rate 115200 (fixed), N,8,1 in the **COM Port configuration** text box.
3. Enter the module address and total AI channel count
4. Run the demo to view the data.
5. Click the **Exit** button to end the demo.





## 5.3. DCON InduSoft



### [DCON InduSoft](#)

Bundled driver for InduSoft

**Supported module:**

I-7000/8000/87K Series  
(With DCON Protocol)

**Supported OS:**

Windows 98/NT/2K/XP/CE

**File Location:**

CD: \Napdos\Driver\DCON\_InduSoft

### 5.3.1. Procedure for using the InduSoft bundled driver

**Step 1:** Read the basic and important documents

**Readme.txt:** contains the basic and important information, including:

- Files on the shipped CD

**Reversion.txt:** contains the reversion information, including

- Bugs fixed
- New modules supported

**Step 2:** Install the InduSoft bundled driver by executing

- CD:\Napdos\Driver\DCON\_InduSoft\Setup\setup.exe

**Step 3:** Read the manuals describing how to start

- The DCON.pdf user's manual describes how to use the InduSoft bundled driver

**Step 4:** Run the demo programs (ICPDriverTest.zip) to test I/O modules and learn the functions

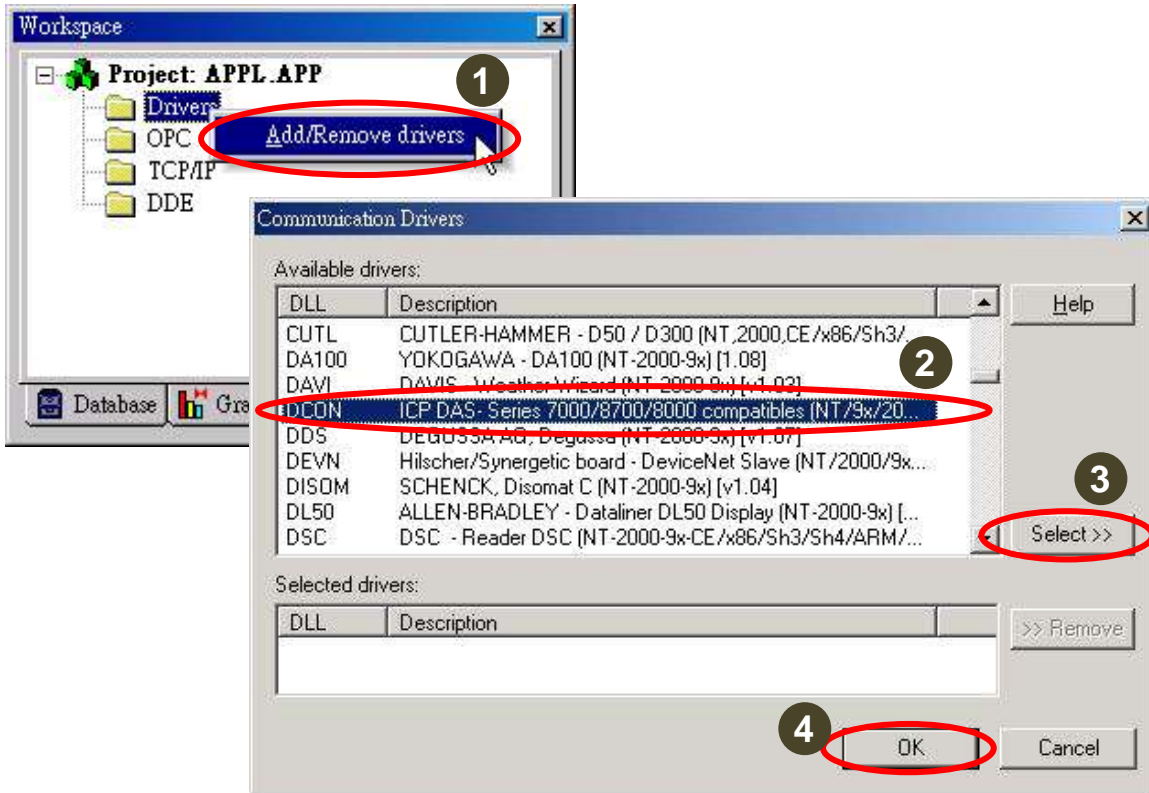
### 5.3.2. InduSoft Example (Reading an analog input value)

The following is an example of reading analog values from an I-87018 inserted in slot 0 of an 8410/8810.

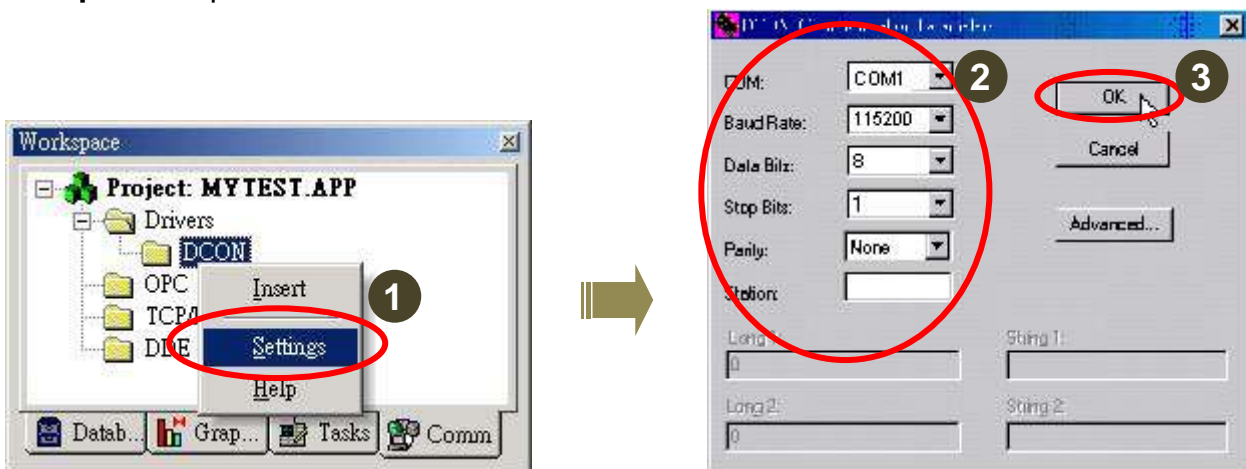
**Step 1:** Run the DCON Utility to configure the I/O modules

**Step 2:** Run InduSoft and create a new project

**Step 3:** Include the DCON driver

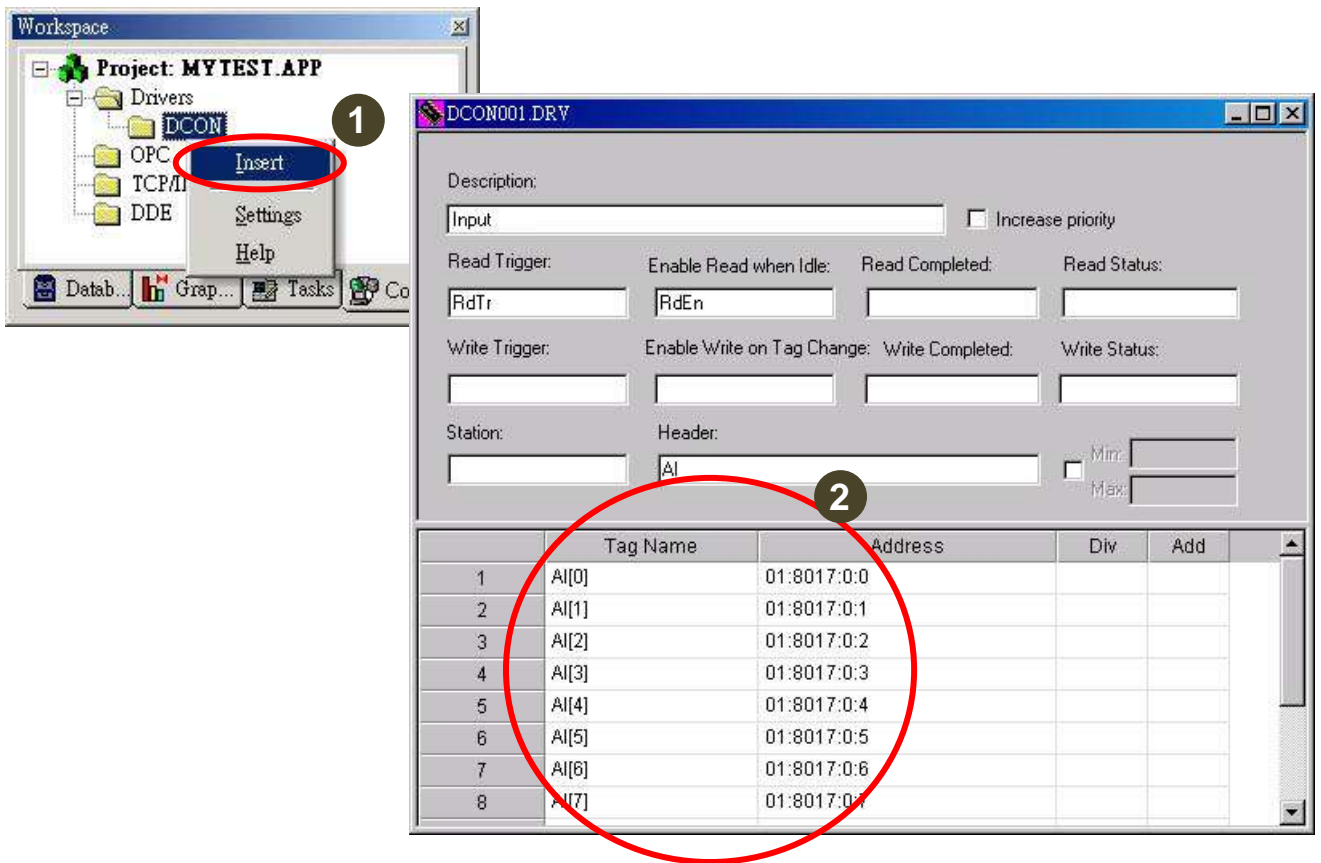


**Step 4:** Setup DCON driver

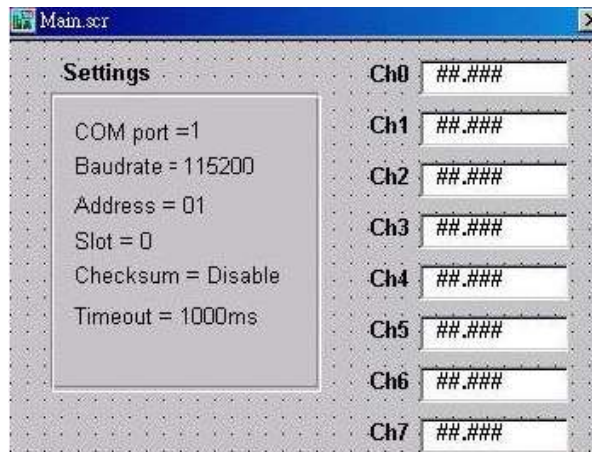


**Step 5 : Insert tags to connect to I/O modules**

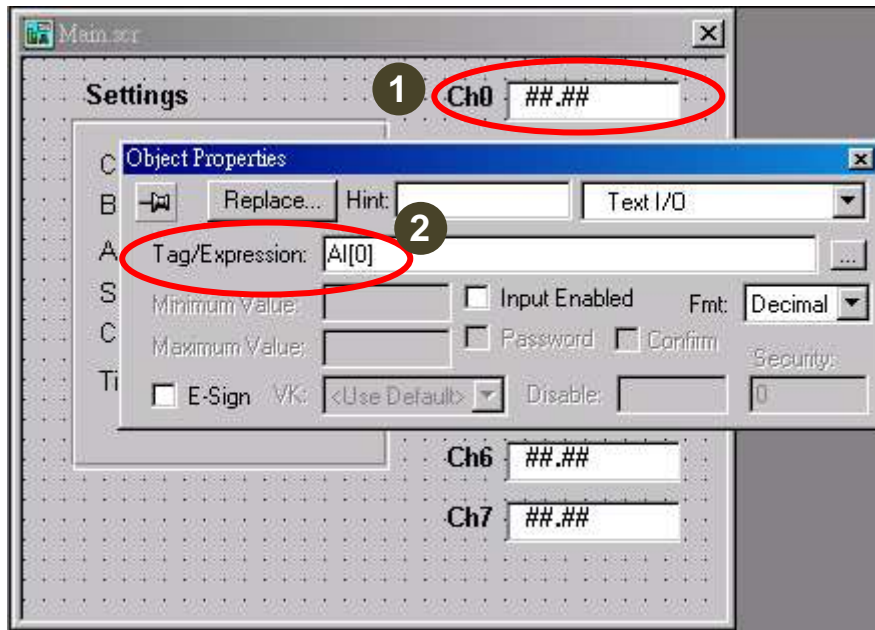
The address format is [Address : Module ID : Slot : Channel]



**Step6 : Arrange all the components on the form**



**Step7:** Double click the text box to assign a tag to it.



**Step8 :** Run the project



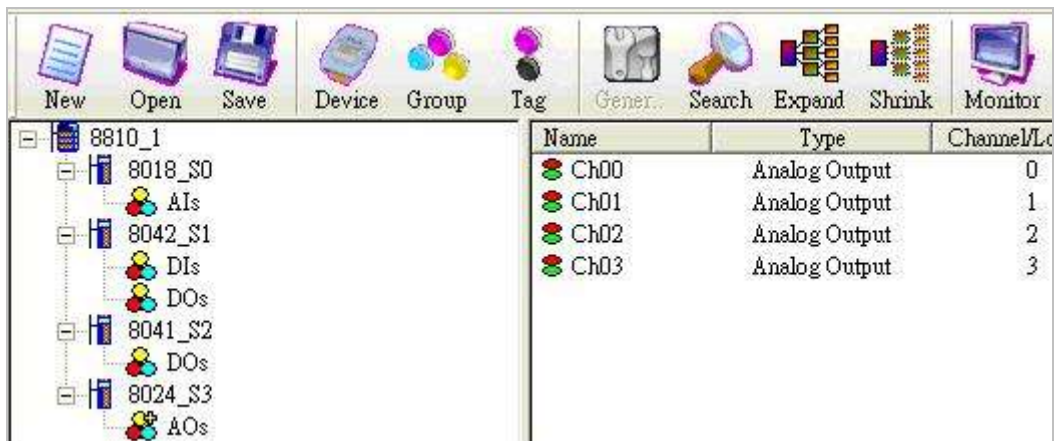
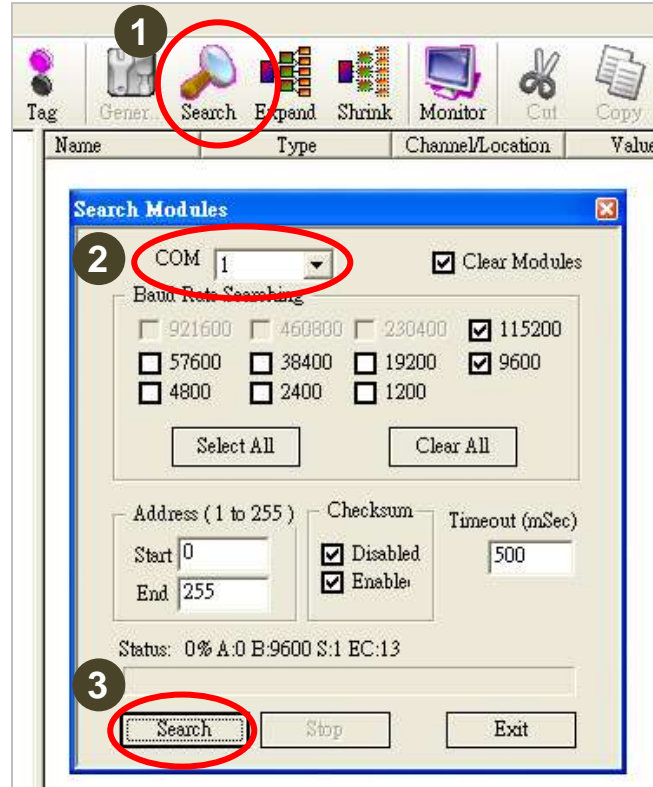


## 5.4.2. OPC Server Example (Reading an analog input value)

The following is an example of reading analog values from an I-87018 inserted in slot 0 of an 8410/8810.

**Step 1:** Run the DCON Utility to configure the I/O modules

**Step 2:** Run the OPC Server to search for I/O modules on COM1



**Step 3:** Save the configuration and close the OPC Server

**Step 4:** Run SCADA software to connect to the OPC Server

The OPC Server user's manual lists the procedures for the following SCADA software:

■ <b>LabVIEW</b>	■ <b>National</b>	■ <b>WIZCON</b>
■ <b>iFix</b>	■ <b>InduSoft</b>	■ <b>Citect</b>

Please refer to “Chapter 4 Connecting to the OPC Server” for more details.

## Appendix A : Compare USB-87Pn with I-87Kn

**Note:** I-87K I/O modules are divided into two groups; one is high profile and the other is low profile. Only high profile I-87K series I/O modules support Hot Swap and Auto-Configuration function correctly.

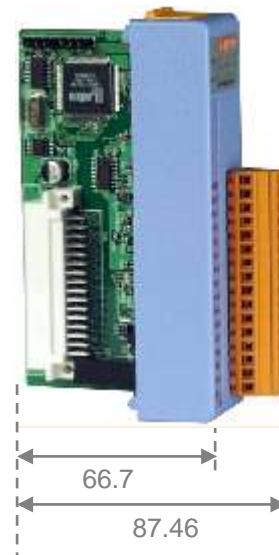
### USB-87Pn & I-87Kn I/O expansion unit comparison

Supported	USB-87Pn with Auto Config. Enable	USB-87Pn with Auto Config. Disable	I-87Kn
I-87K Low Profile module	--	--	☺
I-87K High Profile module	☺	☺	☺
I-87K module Hot Swap	☺	☺	--
Auto- Communication parameter Setup	☺	☺	--
Auto-Configuration	☺	--	--

High Profile



Low Profile



Please refer to web page:

<https://www.icpdas.com/en/product/p02.php?root=537&kind=543>



## Appendix B: Error Code – Causes and Solution

When a module is inserted in the expansion slot of USB-87Pn, the auto configuration function in USB-87Pn will detect the module name and confirm that the module is consistent with the pre-configured information. In the following diagram, the search result only find out the USB-87P4 and an 87019R in slot 0, the Status column shows **Auto Config. Enable [O,X,X,X]**

ID	Address	Baud Rate	Checksum	Format	Status	Description	Comments
USB-87P4	1[01h]	115200	Disabled	N,8,1	Auto Config. Enable[O,X,X,X]	[DCON]4*Slot Auto Configuration USB Unit	Supported
-87018R	2[02h]	115200	Disabled	N,8,1	87PN Slot 0	[DCON]8*AI (mA,mV,V,Thermocouple)	Supported

Click the **USB-87P4** name to open the configuration window to know the module status. The status code in **Slot Configuration Status** column use different background color to represent different error message.

The screenshot shows the 'USB-87P4Firmware[A401]' configuration window. On the left is a physical view of the module with LEDs for PWR, S, and RDY, and a switch for Auto Config. The main window has tabs for 'Auto Configuration', 'Configure Data', 'Error Code References', and 'Commands Log'. The 'Auto Configuration' tab displays a table of slot configurations:

Configured I/O	Addr. [Hex]	Slot Configuration Status	Set As Scanned	Write To 87PN	Scanned I/O
87018R	02	[00] OK	<input type="checkbox"/>	Configure	87018R
87064	03	[06] Can not find module	<input type="checkbox"/>	Configure	Empty
Empty	04	[01] Module scanned in Empty slot	<input type="checkbox"/>	Configure	87064
Empty	05	[01] Module scanned in Empty slot	<input type="checkbox"/>	Configure	87055

Below the table are buttons for 'Exit', 'Save configurations', 'Load Configurations', and 'Load configurations and write to'. A status log at the bottom shows 'Slot 0 .....OK', 'Slot 1 .....OK', 'Slot 2 .....OK', and 'Slot 3 .....OK'. The status bar at the bottom indicates a timeout error: '下午 05:24 :: READ\_GetHotSwapSlotStatus0[ ~01HZ0 ]; [ ]; [ 300 ms]==> (TimeOut)'.

Refer to the following table, you can find more information about error code and LED lamp status.

**Table 1 : The Error Code in Auto Config. Enable mode**

Error Code	Slot LED (Red)	Status	Description	Solution
<b>00H</b>	Dark (ok)	<b>OK</b>	OK	None
<b>01H</b>	Flashing (Warning)	<b>Module scanned in Empty Slot</b>	1. There is a module scanned in this empty setting slot.	1. Remove the module
			2. The first time to setup, no initial value.	Reconfigure it with DCON Utility. 1. Click "Set As Scanned" button and configure module again 2. Click "Write To 87Pn" button to write settings to 87Pn.
<b>02H</b>	Flashing (Warning)	<b>Commands not compatible</b>	<b>Configure failure:</b>	1. Check the I-87K I/O module's firmware.
			This is a 87K I/O module firmware compatibility problem . Some commands at this slot might be too new for this old firmware of 87K I/O module, but it is not serious for system operation.	* Run Dcon Utility→Terminal→Dcon command Line→ setup Baud Rate→Command: \$AAF (EX. 01F) →Send  * You can see the version, Respond=!01A1.9  2. Update the 87K I/O module with a new firmware version.
<b>03H</b>	Bright (Error)	<b>Configuration Failed</b>	<b>Configure failure:</b>	1. Check the 87K I/O module firmware
			Some commands are not supported by this 87K I/O module and this error will be serious for system operation.	2. Update the 87K I/O module with a new firmware version.
<b>04H</b>	Bright (Error)	<b>wrong Configuration format</b>	<b>Configure failure:</b>	1. Run DCON Utility.
			The format of configured commands is wrong for DCON Protocol.	2. Click the "Write To 87Pn" button to write the settings to 87Pn CPU again.
<b>05H</b>	Bright	<b>Read</b>	<b>The memory data is failed :</b>	1. Run DCON Utility.

	(Error)	<b>Configuration failed</b>	The configured commands are wrong for DCON Protocol.	2. Click the "Write To 87Pn" button to write the settings to 87Pn CPU again.
<b>06H</b>	Bright (Error)	<b>Cannot find module</b>	The configured module at this slot has been removed. It is empty now.	1. Please insert a correct module as previous configured one. 2. Or configure with DCON Utility as "Empty" and click the "Write To 87Pn" button to write the configuration to 87Pn CPU.
<b>07H</b>	Bright (Error)	<b>Incorrect module name</b>	<b>Configure failure:</b>	The insert & configure module name are different, insert the correct one or run the Dcon Utility to modify the settings accord with the module name.
			The module inserted in this slot is not the same as previous configured.	
<b>08H</b>	Bright (Error)	<b>Internal INIT* pin failed</b>	<b>Configure failure:</b>	1. Please restart the power to initialize to I/O module 2. If it still failed to initialize, send it back to factory to check.  Note: USB-87Pn only supports high profile 87K I/O modules.
			The INIT Pin is failed to connect with the GND and module failed to initialize.	
<b>09H</b>	Bright (Error)	<b>Module address over 255 (FFh)</b>	The module address is over 255 (FFh).	The maximum address of 87P1 is 254 (FEh) 87P2 is 253 (FDh) 87P4 is 251 (FBh) 87P8 is 247 (F7h)
<b>0AH</b>	Bright (Error)	<b>The command count saved to 87Pn is not the same as DCON Utility</b>	This error might be caused by following reasons. 1. Command length error. 2. Command checksum error. 3. Communication error during the process of writing commands to 87Pn.	Please configure this 87K I/O module with DCON Utility, and click the "Write To 87Pn" button to write the configuration to 87Pn CPU again.

<b>OBH</b>	Bright (Error)	<b>Module response failed</b>	This error might be caused by following reasons. Module response failed above 5 times.	Please restart the power to initialize to I/O module, or configure this 87K I/O module with DCON Utility, and click the "Write To 87Pn" If I/O module often becomes 0xBh error, it may something caused communication failed between 87Pn and I/O module. User can send ~AARCxx command to set XX second to reset I/O module when 0xBH error appears. (XX range is 0~ 0xFF ,can be set 0~256 second)
<b>OCH</b>	Bright (Error)	<b>Module name invalid</b>	The module inserted in this slot is not the same as previous configured.	Module is not 87K high profile I/O modules. Note:87Pn only supports 87K high profile I/O modules, Please replace it as 87K I/O module
<b>ODH</b>	Bright (Error)	<b>Module Init command invalid</b>	This error might be caused by command not complete on I/O module	Reconfigure it with DCON Utility. 1. Click "Set As Scanned" button and configure module again 2. Click "Write To 87Pn" button to write settings to 87Pn.

**Table 2 : The Error Code in Auto Config. Disable mode**

Error Code	Slot LED (Red)	Status	Description	Solution
<b>80H</b>	Dark (ok)	<b>Initialize ok</b>	setup success	None
<b>81H</b>	Bright (Error)	<b>Internal INIT* pin failed</b>	The INIT Pin is failed to connect with the GND and module failed to initialize.	If it still fails after restart the 87Pn many times, please send the 87K I/O module back to factory to check.
<b>82H</b>	Bright (Error)	<b>Module address over 255 (FFh)</b>	The module address is over 255 (FFh).	The maximum address of 87P1 is 254 (FEh) 87P2 is 253 (FDh) 87P4 is 251 (FBh) 87P8 is 247 (F7h)

You can see the LED signals on 87Pn CPU module to know whether the 87Pn is operating properly. Please refer to appendix.

	Auto Config. LED (Green)	S.RDY LED (Green)	Slot Status LED (Red)
<b>Auto Config. Enable</b>			
No Error	Always ON	Always ON	Always OFF
Warning		Always ON	Flash
Failed		Flash	Always ON
<b>Auto Config. Disable</b>			
No Error	Always OFF	Always ON	Always OFF
Failed		Flash	Always ON

## Appendix C: Frame Ground

Electronic circuits are constantly vulnerable to Electro-Static Discharge (ESD), which become worse in a continental climate area. Some I-7000, M-7000 and I-8000 series modules feature a new design for the frame ground, which provides a path for bypassing ESD, allowing enhanced static protection (ESD) capability and ensures that the module is more reliable.

### The following options will provide a better protection for the module:

The USB-87Pn has a metallic board attached to the back of the plastic basket. When it is mounted on DIN rail, the metallic board is in contact with the DIN rail. Therefore, when the DIN rail is connected with the earth ground, the USB-87PN is also connected with the earth ground at the same time.

