RU-87P1/2/4/8

User Manual

Version 1.4

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New Feature:

A400 firmware adds Addr. Mode function that can help users update system from I-87Kn to RU-87Pn without modification software.

About more detail information, please refer **Chapter 2.3 Addr. Mode function**

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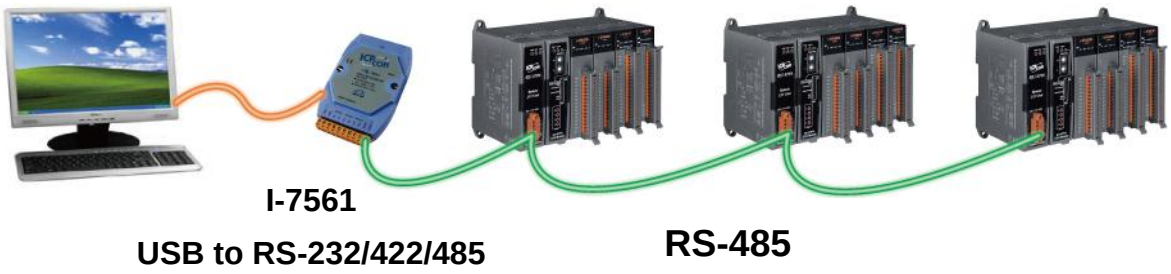
Chapter 1 Introduction

RU-87Pn series is a remote intelligent I/O expansion unit that used to expand I-87K series I/O modules over the RS-485 for industrial monitoring and controlling applications. There are more than 50 I/O modules supported with the unit, including analog input/output, digital input/output, and counter/frequency I/O modules.

RU-87Pn is designed to be used in harsh and noisy environment, so the hardware is manufactured with wide power input range (10 ~ 30 VDC) and operating temperature (-25 °C ~ +75 °C). It simplifies installation and maintenance of I/O modules with hot swappable 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 PACSDK, LabVIEW driver, InduSoft driver, Linux driver, OPC Server, etc. The I-87K series I/O modules plugged in the RU-87Pn can be easily integrated into variant software system.



Features

➢ Hot Swap

The RU-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 RU-87Pn. When the RU-87Pn is power on or an I-87K I/O module is plug in, the RU-87Pn automatically check and restore these configurations to each I-87K I/O modules on it.

➢ Easy Duplicate System

Using the DCON Utility, you can easily make a backup of the I-87K module configurations and write to another RU-87Pn. This design can easily and quickly duplicate many RU-87Pn.

➢ Easy Maintenance and Diagnostic

The basic configurations (includes station number, baud rate) are set by the rotary and DIP switch. The operator can use only one screwdriver to set the RU-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 damaged, the operator just need to get one good I-87K module with the same item number to replace the damaged one. And then check the LED indicators to know whether the replacement is performed correctly. The switch and LED design makes it easy for maintenance. There is no PC and Notebook needed.

➢ Communication

RS-485 industrial multi-drop network

The RU-87Pn uses the industrial EIA RS-485 communication to transmit and receive data over long distance (1.2 Km).

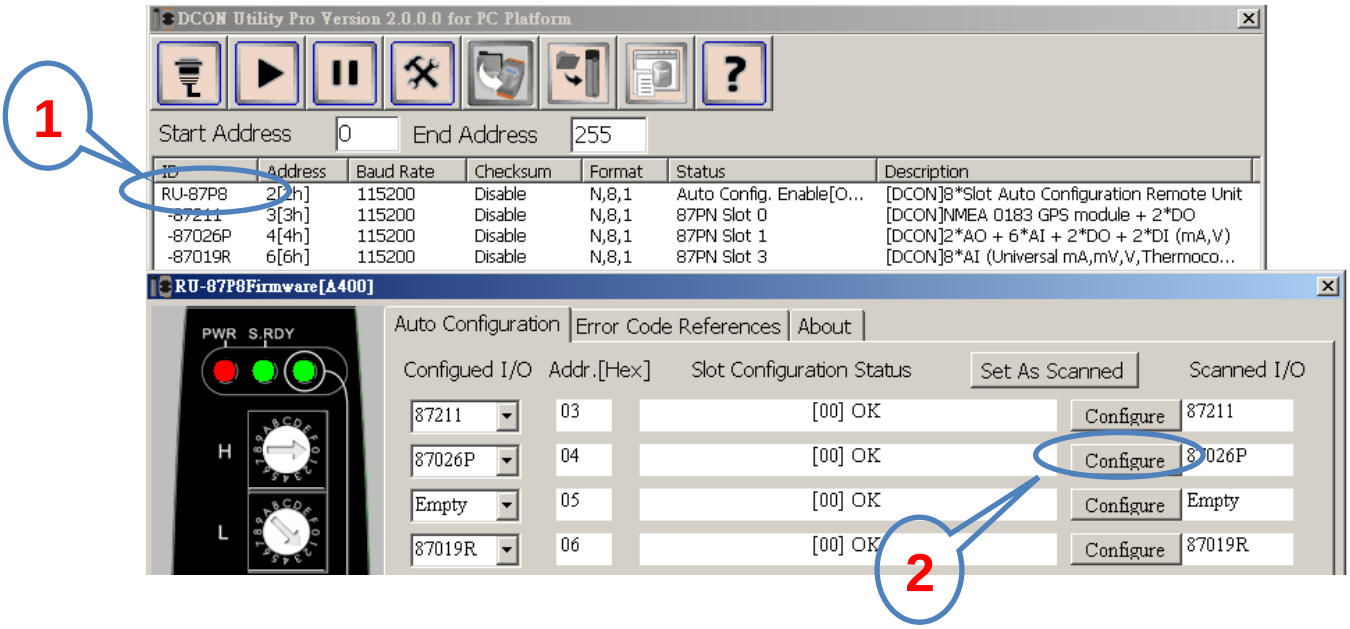
DCON protocol

I-87K series I/O modules plugged in a RU-87Pn provide a simple command/response protocol (Called DCON protocol) for communication. All command/response are in easy used ASCII format.

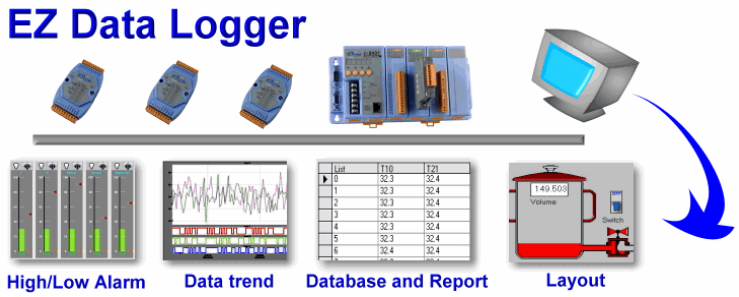
➢ Fully Software Support

The free charge software utility and development kits include

DCON Utility: for configuration



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 logger software without any programming skill.

OPC Servers:

OPC is an industrial standard interface based on OLE technology. With the OPC Server, I/O modules can be easily integrated to any software that has OPC client capability.

Support Variant Software Develop Toolkits

It's free charge for PACSDK, LabVIEW driver, InduSoft driver, Linux driver, and etc driver.

➢ 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

The analog and digital output of modules can be programmed power on and Safe Value.

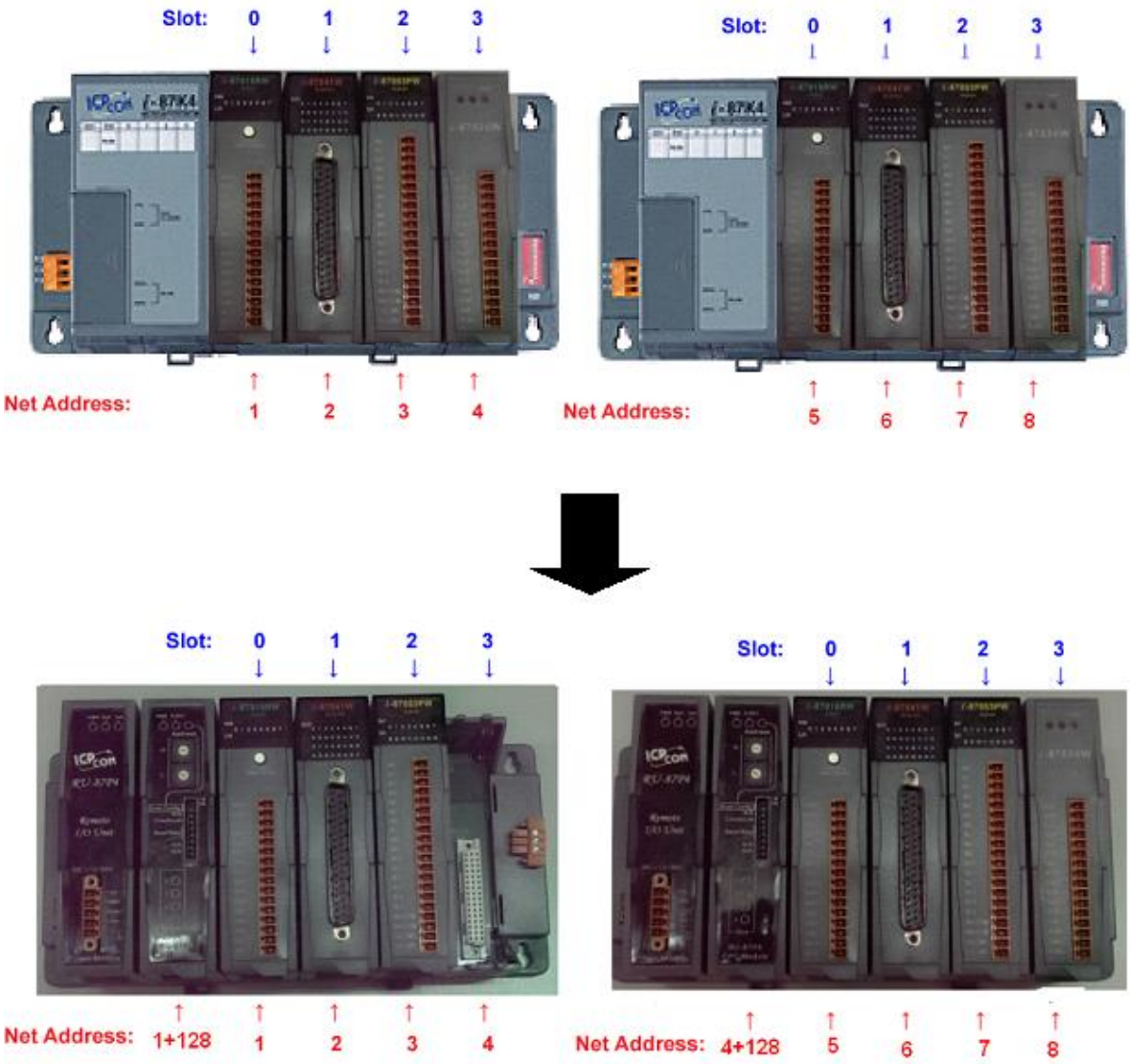
Wide range power input (10~30 VDC)

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

➢ Update I-87Kn to RU-87Pn without modification software.

User can update I-87Kn to RU-87Pn without modification his software, then it can have How Swap, Auto-Configuration and etc useful features as above description.

Note: In RU-87P1/2/4/8 firmware A4.00 or later version, user can set Addr. Mode “ON” and address of I/O module begin as 1. Then user can update I-87Kn to RU-87Pn using the same software program to controller I-87K module. About more detail information about Addr. Mode, please refer **Chapter 2.3 Addr. Mode function**



1.1 Specifications

■ Interface Type (RS-485)			
Baud rate		115200 bps maximum	
Distance		1.2 Km (4000 ft) maximum	
Isolation		3000 VDC	
ESD Protection		+/- 4K Contact Discharge and +/- 8K Air Discharge	
■ Switch			
Rotary Switch		x2 , For RS-485 address	
DIP switch		8 bit *1, For auto configuration, check sum, baud rate	
■ LED Indicators			
Power		Yes	
System Ready		Yes	
Auto-Configuration		Yes	
Slot Status		Yes	
■ I/O Expansion Slots			
Hot Swap		Yes	
Auto-Configuration		Yes	
Support Module Type		High profile I-87K module only	
Dimensions (W x H x D)	RU-87P1	64 x 117 x 110 mm	
	RU-87P2	95 x 132 x 111 mm	
	RU-87P4	188 x 132 x 111 mm	
	RU-87P8	312 x 132 x 111 mm	
■ Power			
Input Range		10~30 VDC	
Reverse Polarity Protection		Yes	
Isolation		3000 VDC	
Frame Ground		Yes	
Module		***Consumption***	***Power Board Driving***
RU-87P1		1 W	5 W
RU-87P2		1 W	8 W
RU-87P4		2 W	15 W
RU-87P8		2.4 W	30 W
■ Environment			
Operating Temperature		–25 °C ~ +75 °C	
Storage Temperature		–30 °C ~ +85 °C	
Humidity		5 ~ 95% RH, non-condensing	

Chapter 2 Hardware Configuration

2.1 View of the RU-87PN

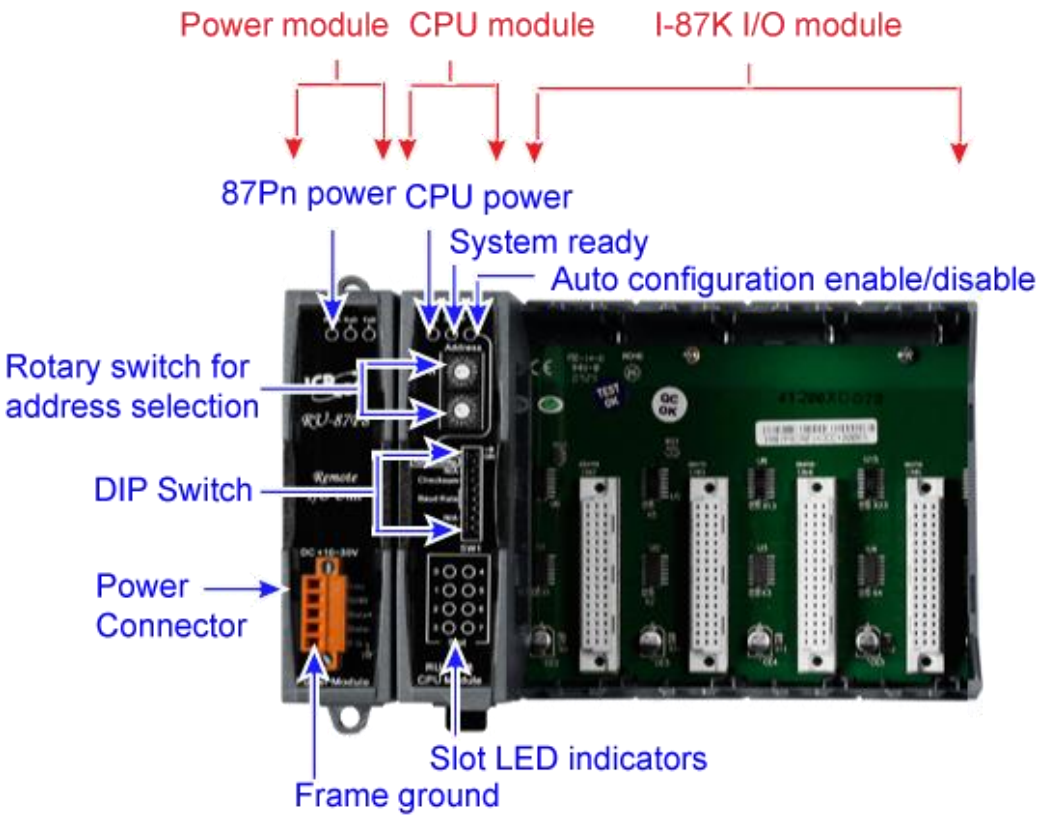


Fig.1：View of 87Pn

2.1.1 Preparation

➢ **Power Supply: +10 V ~ +30 V / DC (Ex: DP-665)**

http://www.icpdas.com/products/Accessories/power_supply/power_list.htm

➢ **Converter: RS-232 to RS-485 (Ex: I-7520) or USB to RS-485 (Ex: I-7561)**

CD: \ Napdos\7000\Manual\7520.pdf or
http://www.icpdas.com/products/Industrial/communication_module/communication_list.htm

➢ **Install the DCON Utility to PC (Version 4.5.0 or above version)**

CD: \ Napdos\Driver\DCON_Utility or
ftp://ftp.icpdas.com/pub/cd/8000cd/napdos/driver/dcon_utility/

2.1.2 Wire the 87Pn to power and PC

➢ RU-87P4

1. +Vs ⟷ Power Supply : +Vs (+10 ~ 30 V) / I-7520 : +Vs
2. GND ⟷ Power Supply : GND / I-7520 : GND
3. Data+ ⟷ I-7561/ I-7520 : Data+
4. Data- ⟷ I-7561/ I-7520 : Data-

➢ I-7561/ I-7520

1. I-7561's USB Port ⟷ PC's USB Port
2. I-7520's RS-232 Port ⟷ PC's COM Port

P.S. If using I-7520, don't forget to connect the power (+Vs, GND)!

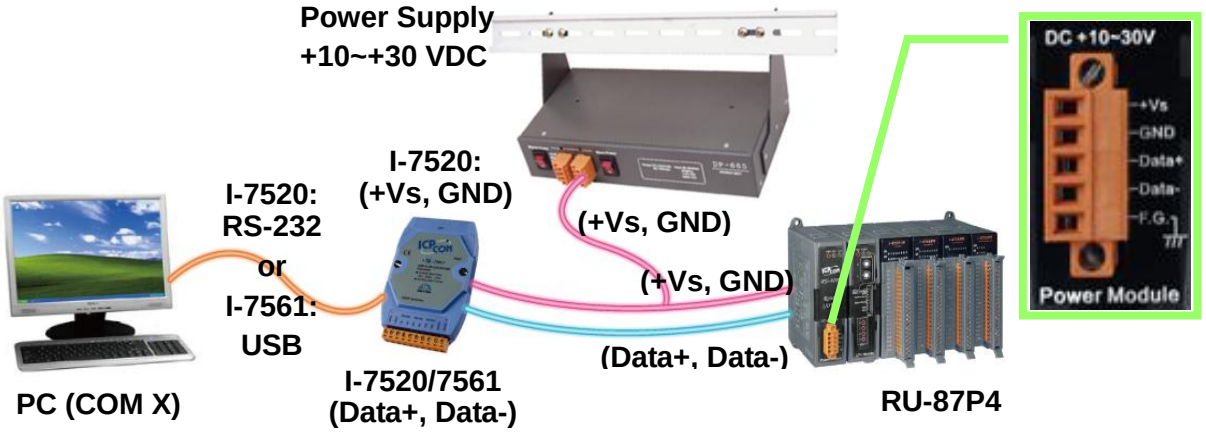


Fig.2：Wire the 87Pn to power and PC

2.1.3 Factory default value of 87Pn's CPU module:

The factory default values are as following table:

Switch	Label	Setting	Description
Rotary Switch (Address)	H	0	Net address = 1 H: High Byte L: Low Byte
	L	1	
DIP switch (SW1)	Auto Config.	ON	Enable
	Checksum	OFF	Disable
	Baud Rate	ON, ON, ON	115200
	Addr. Mode	OFF	CPU address as Rotary Switch (Note 1.)

Note1: The Addr. Mode is support by RU-87P1/2/4/8 firmware A400 or later version.

When Addr. Mode is "OFF", the address between CPU and I/O module are the same as old firmware version.

Note2: The ON of DIP switch for 87P1 & 87P2 are switching to the **left**, for 87P4 & P8 are to the **right**.

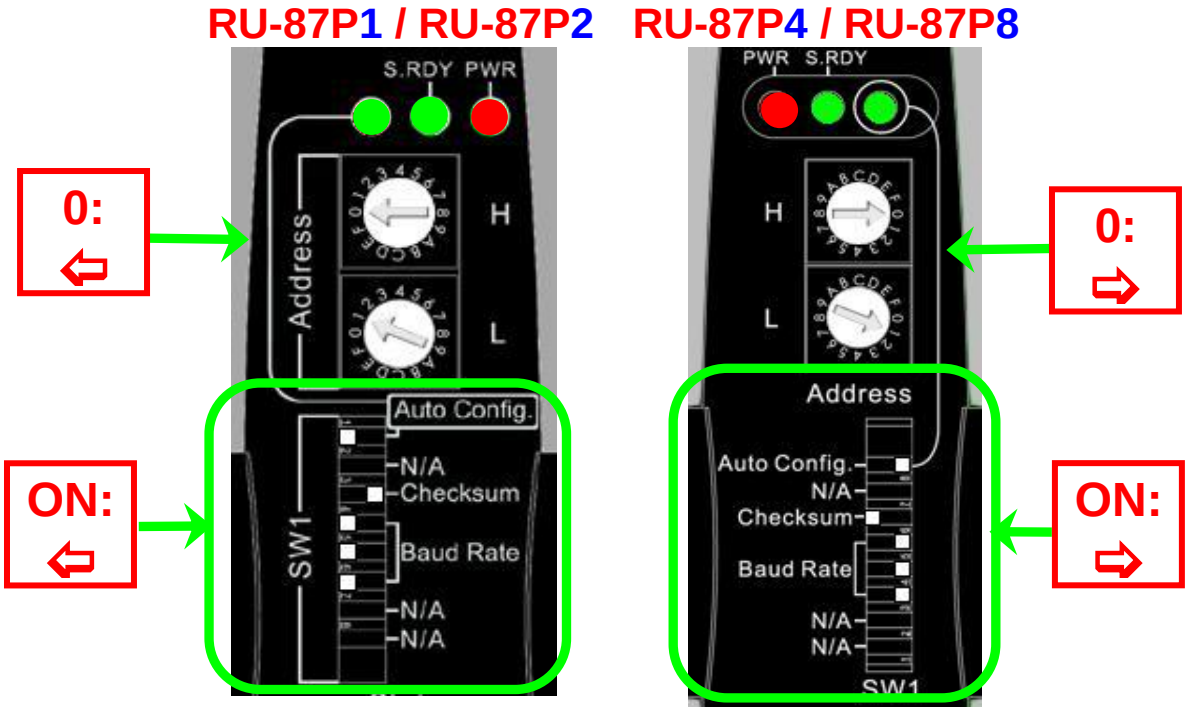


Fig.3：87Pn's CPU module

Rotary Switch
(Address)
1~255 (0x01)

Dip Switch (SW1)
Auto Config (On)
Checksum (Off)
Baud Rate
(On,On,On,115200)
Addr. Mode (Disable)

Module Status LED：
1. Configuring
   Flashing per 100ms.
2. Pass
   Turn off.
3. Fail
   Flashing per 2second.

System LED

(Red) PWR LED：
Power On – Bright.
Power Off – Dark.

(Green) S.RDY LED
Any module configuring
Flashing per 100ms
All of the modules pass the test
Bright.
One or more module test fail
Flashing per 2 second.

(Green) Auto Config. LED：
Auto Config. On – Bright.
Auto Config. Off – Dark.

Fig.4：About CPU module

2.1.4 RU-87Pn series CPU Module Description

Check the left side of the Power Board for the CPU module LED and DIP switch description.

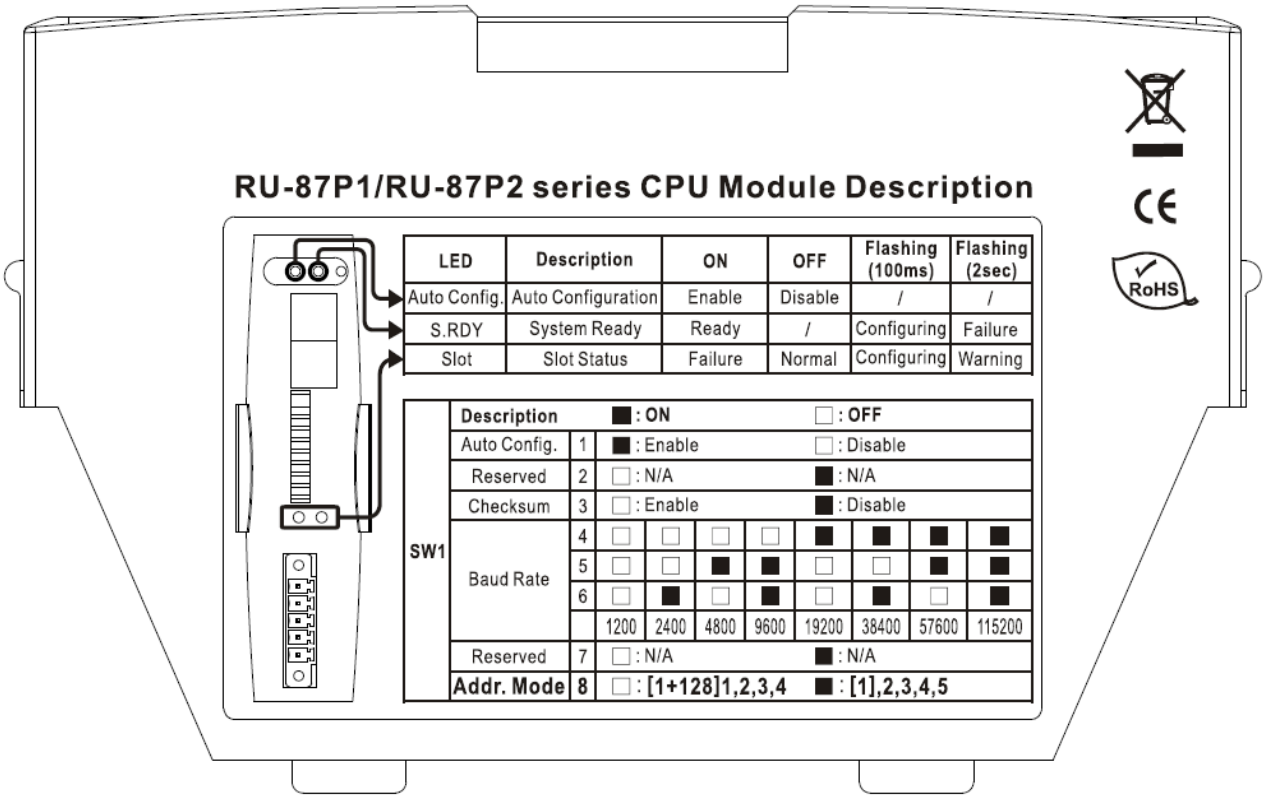


Fig.5：RU-87P1/P2 CPU module description

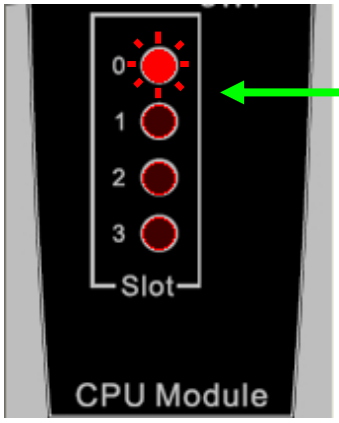
2.1.5 Plug in the I/O modules:

At present, ICP DAS divides most of the same I-87K I/O module into the Low Profile and High Profile two kinds of version, **if you want to use the module on 87Pn expansion slot, you must choose the High Profile** to assure Auto Config. and Hot Swap function is normal operation.

The related product information about I-87K I/O module is in the CD. You can refer I-87K High Profile series I/O modules in following path:
CD:\Napdos\DCON\IO_Module\87k_modules.htm or to following web-site
http://www.icpdas.com/root/product/solutions/remote_io/rs-485/i-8k_i-87k/i-8k_i-87k_selection.html

RU-87Pn is only support I-87K series High profile modules.

Example: Plug in I-87019R to Slot 0



- After plugged in, the slot indicator is flashing per 100 ms.
- When configuration is completed, the LED becomes off.
- If configuration is failed, the LED is always on.

2.1.6 Wiring the I/O modules

Before wiring the I-87K I/O modules, please check the pin assignment and wiring according to each hardware user manual.

For each I-87K I/O module's hardware user manual please refer to CD:\Napdos\DCON\IO_Module\87k_modules.htm

According to the internal circuitry diagram and wire connection diagram, please connect the power cable or communication cable to each channel on terminal block of I/O module.

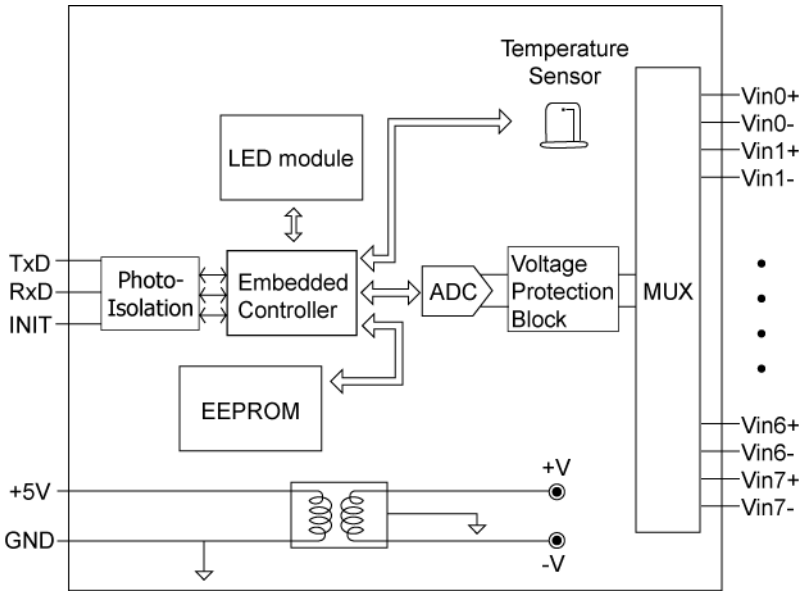


Fig.6：I-87019R - Internal I/O structure

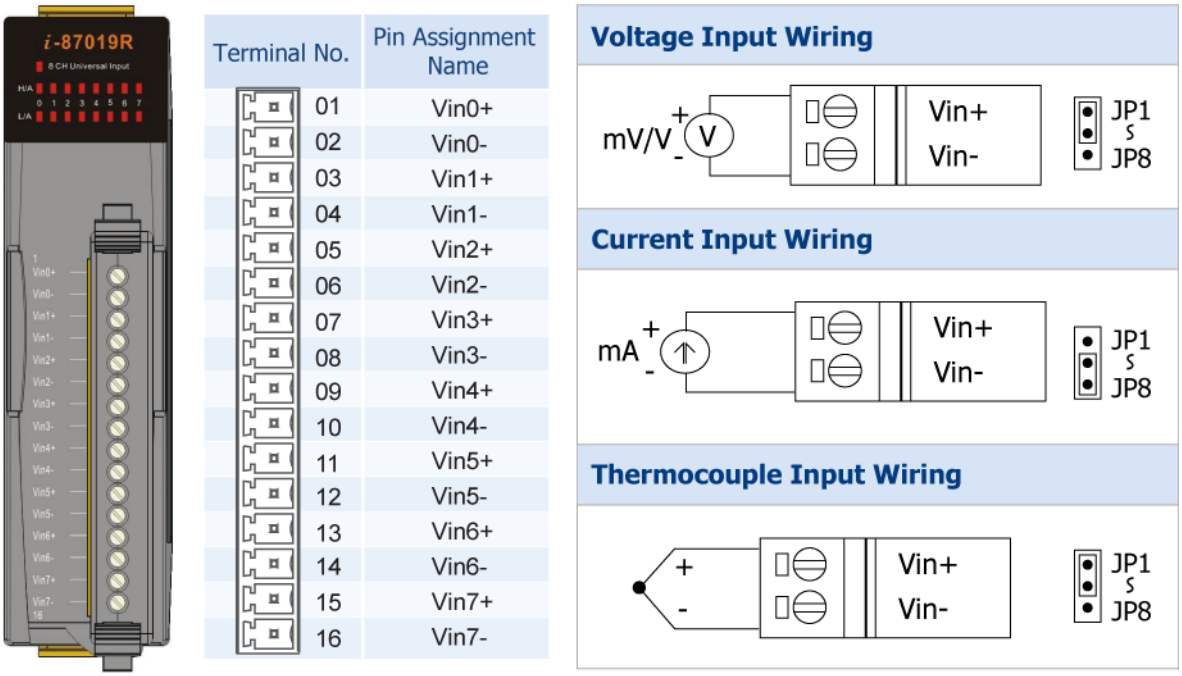


Fig. 7：I-87019R - Pin assignments & Wire Connection

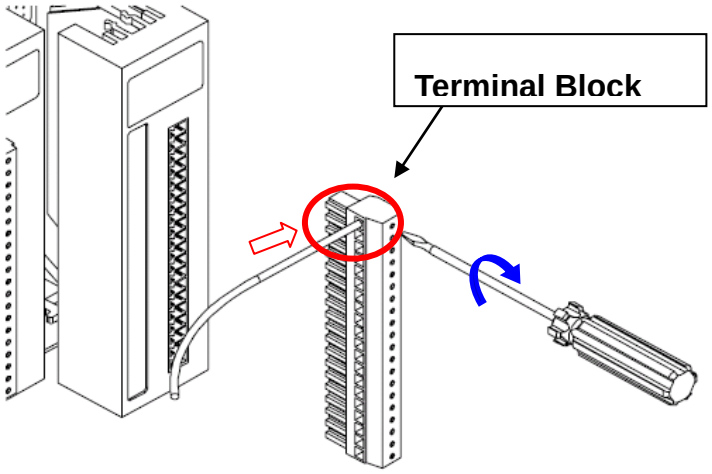
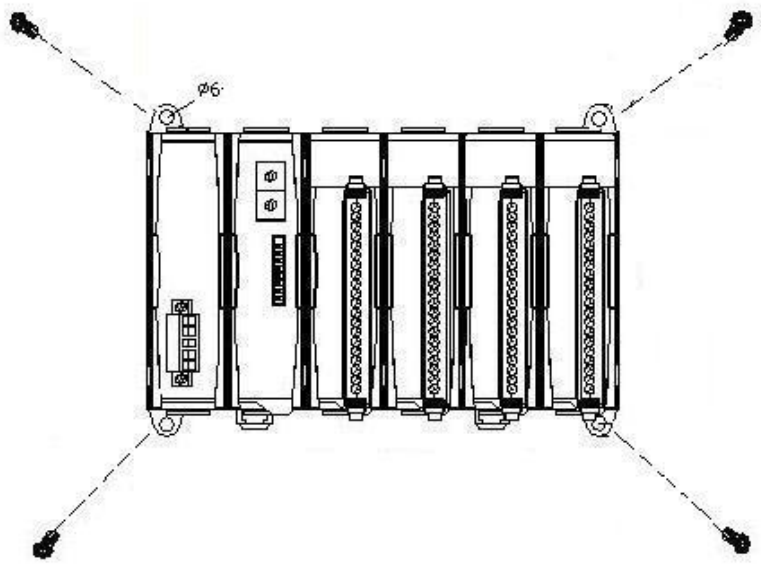


Fig. 8：I/O module terminal connection

2.1.7 Installing RU-87Pn extension unit

Method 1: using the screw to fixed.



Method 2: using the DIN rail clips to fixed.

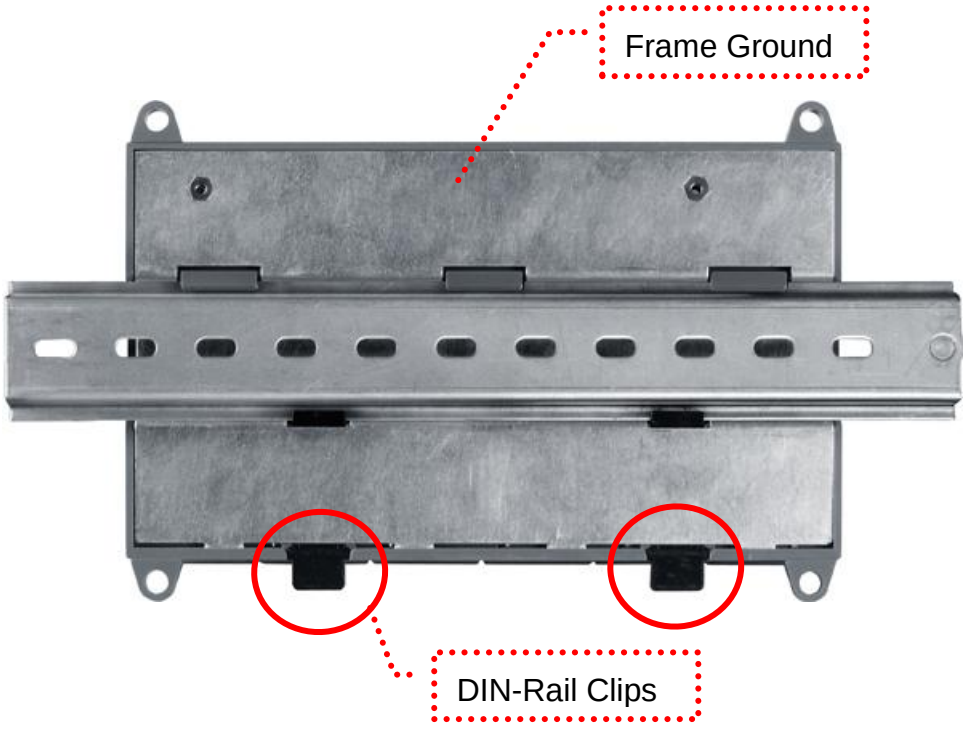


Fig.9：Installing RU-87Pn extension unit

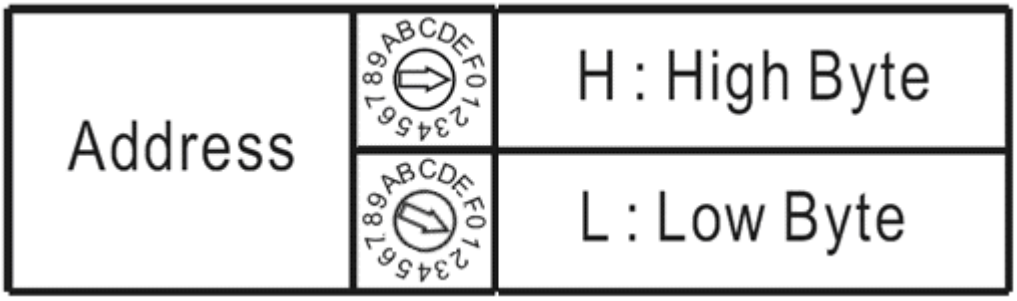
2.2 Setup the 87Pn system parameter

2.2.1 Communication parameters of 87Pn CPU module:

The 87Pns setup its Address, Baud rate and Checksum by adjusting the DIP switch and Rotary Switch which on 87Pn CPU module. It's not setup by software, please setup the communication condition at first and don't change the communication condition under operating mode.

Step1. Adjusting the Rotary Switch as following diagram, Address is set to the hexadecimal code, divided into High byte and low byte two groups.

Ex: The high byte turns to **0**, the low byte turns to **1** then the address of RS-485 is 16x0+1=1 ;



Ex: The high byte turns to **1**, the low byte turns to **0** then the address of RS-485 is 16x1+0=16.

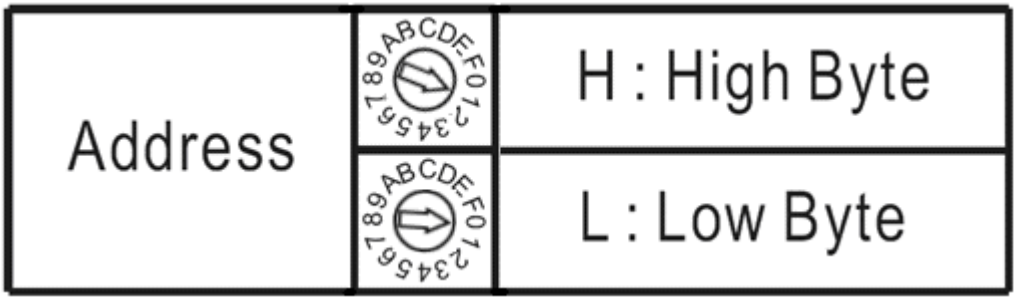


Fig.10：Setup the address of Rotary Switch on 87P4 CPU module

Note1: The maximum address for RU-87P1/2/4/8 and I/O modules only can be set as 127(0x7F)

Note2: If you change the address to 00, no matter where is the actual position of DIP switch, the system parameter will return to default value! (Auto config. On, Checksum off, Baud rate 115200)

Step2. Setup the DIP switch as following description：

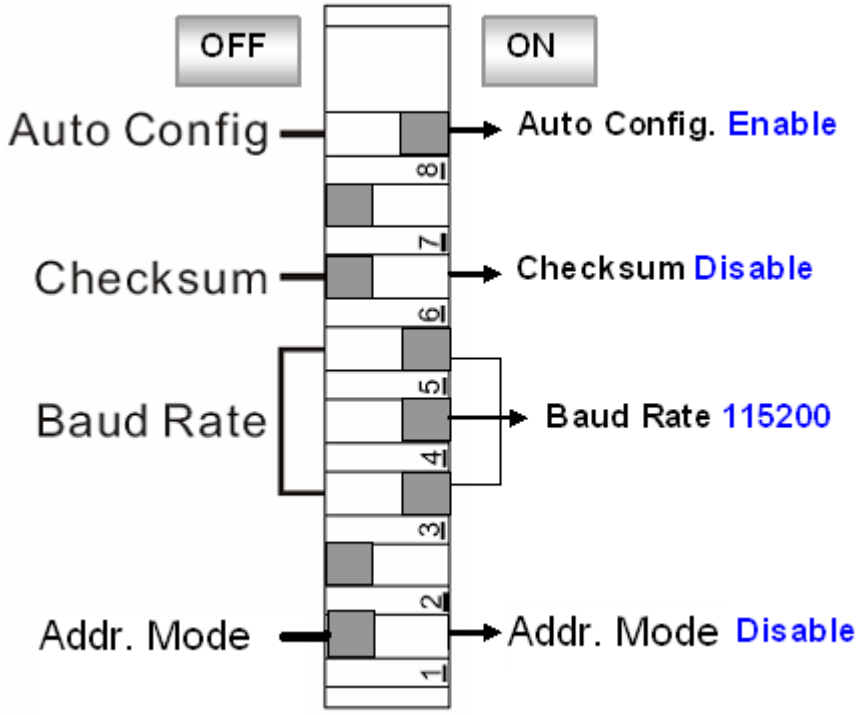


Fig.11：Function description of DIP switch on RU-87P4 CPU module

Note 1: When parameter is changed, RU-87Pn will auto re-change the internal communication parameters or system parameters, if the external control project is running in the same time, it will cause communication error. Thus don't change communication parameters and system parameter when system is running.

Note 2: if 87Pn's communication parameter has been changed, the external control program must to change the related parameters synchronously.

Note 3: Addr. Mode function is only support by RU-87P1/2/4/8 firmware A400 or later version.

Step3. Communication parameters of I-87K I/O modules:

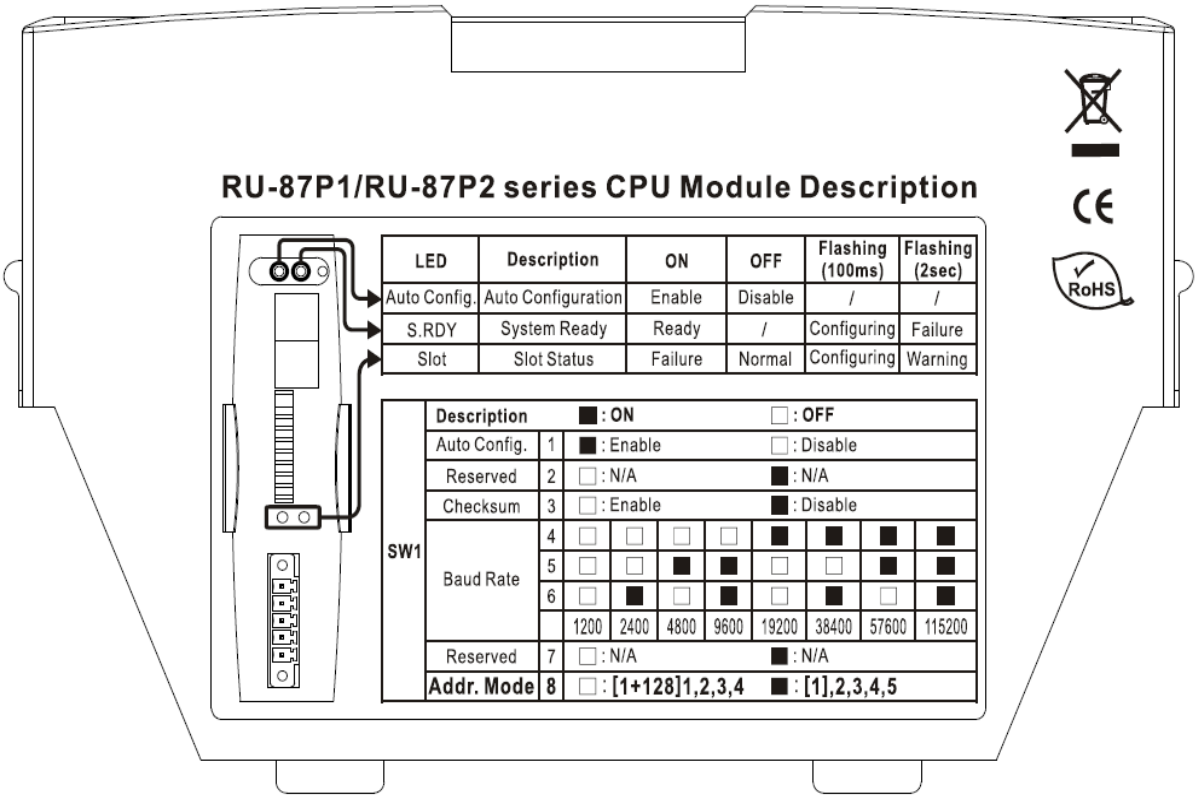
The communication parameters of 87K I/O modules are Auto-configured by CPU module.

Rule 1: the Baud Rate & Checksum of the I/O modules on 87Pn expansion slot are always the same as **87Pn CPU module**.

(Default: Auto Config.: Enable , Baud Rate: 115200 , Checksum: Disable)

Rule 2: the **Net Address** of CPU and I/O modules on the slot is based on Rotary Switch and Addr. Mode.

2.3 Addr. Mode function



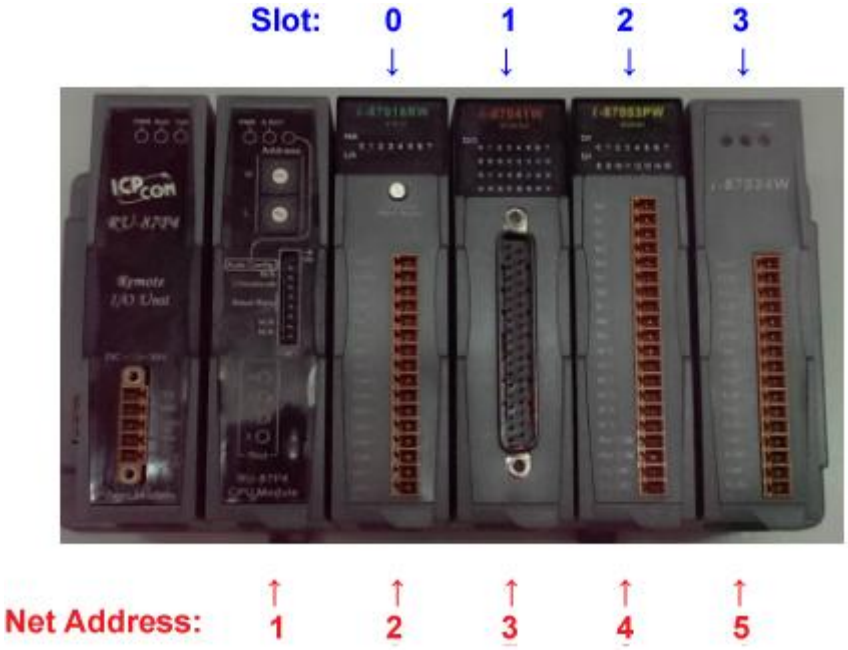
In RU-87P1/2/4/8 firmware A4.00 or later version, user can set Addr. Mode “ON”. and address of 1st I/O module cab be set as 1. User can update system from I-87Kn to RU-87Pn without modification software program to controller I-87K modules. The address of Addr. Mode “OFF” is the same as old firmware version.

The relationship of address for CPU and I/O module will be as below:

Addr. Mode	ON	OFF
CPU address	Rotary Switch address +128	Rotary Switch address
I/O modules address	Address of Slot 0 will be as Rotary Switch	Address of Slot 0 will be as Rotary Switch address+1

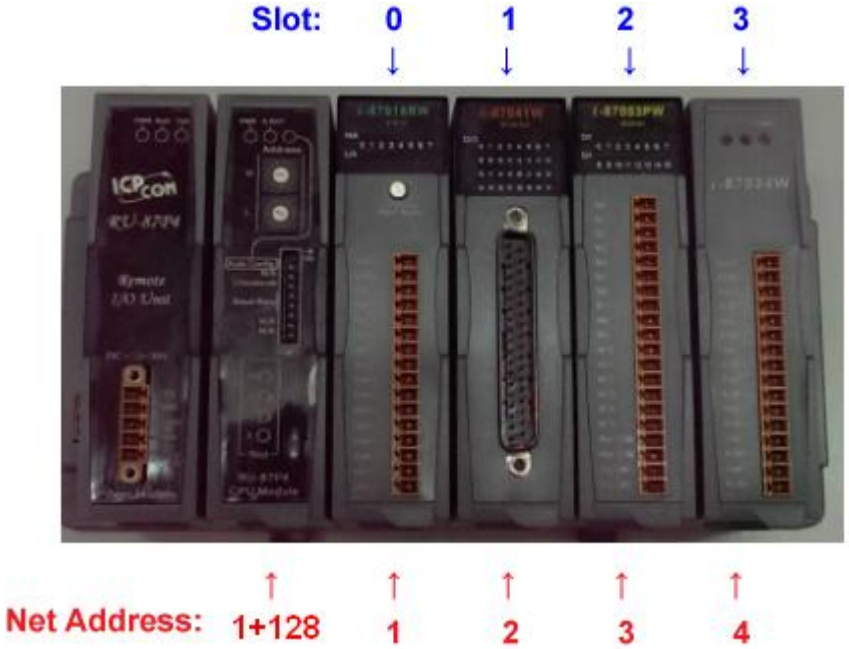
For example:
There is a RU-87P4 and rotary switch address as 1, the result for CPU and I/O modules address as below:

Addr. Mode OFF, Rotary Switch address 1:



The address of CPU will as Rotary Switch (CPU address 1) and the address of Slot will as Rotary Switch +1, +2 and etc (I/O address 2,3,4,5). This function is the same as old firmware version (without Addr. Mode function).

Addr. Mode ON, Rotary Switch address 1:

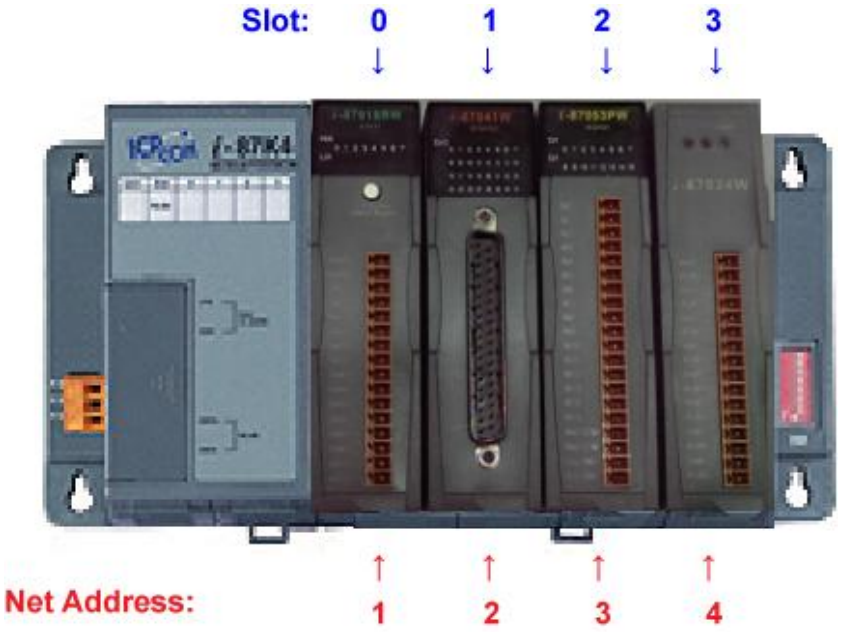


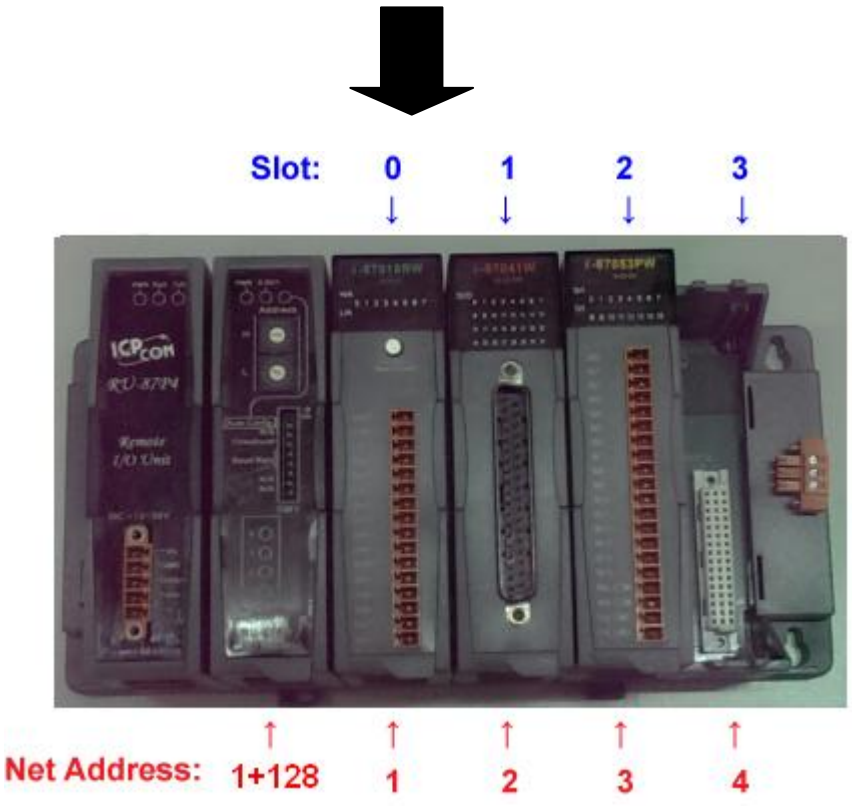
The address of CPU will as Rotary Switch+128 (CPU address=1+128=129,0x81), the address of Slot will as Rotary Switch, +1 and etc (I/O address= 1,2,3,4). This function is support RU-87P1/2/4/8 firmware A400 or later version.

Addr. Mode ON can fix two issues:

1. The address of I/O modules can be start as address 1:

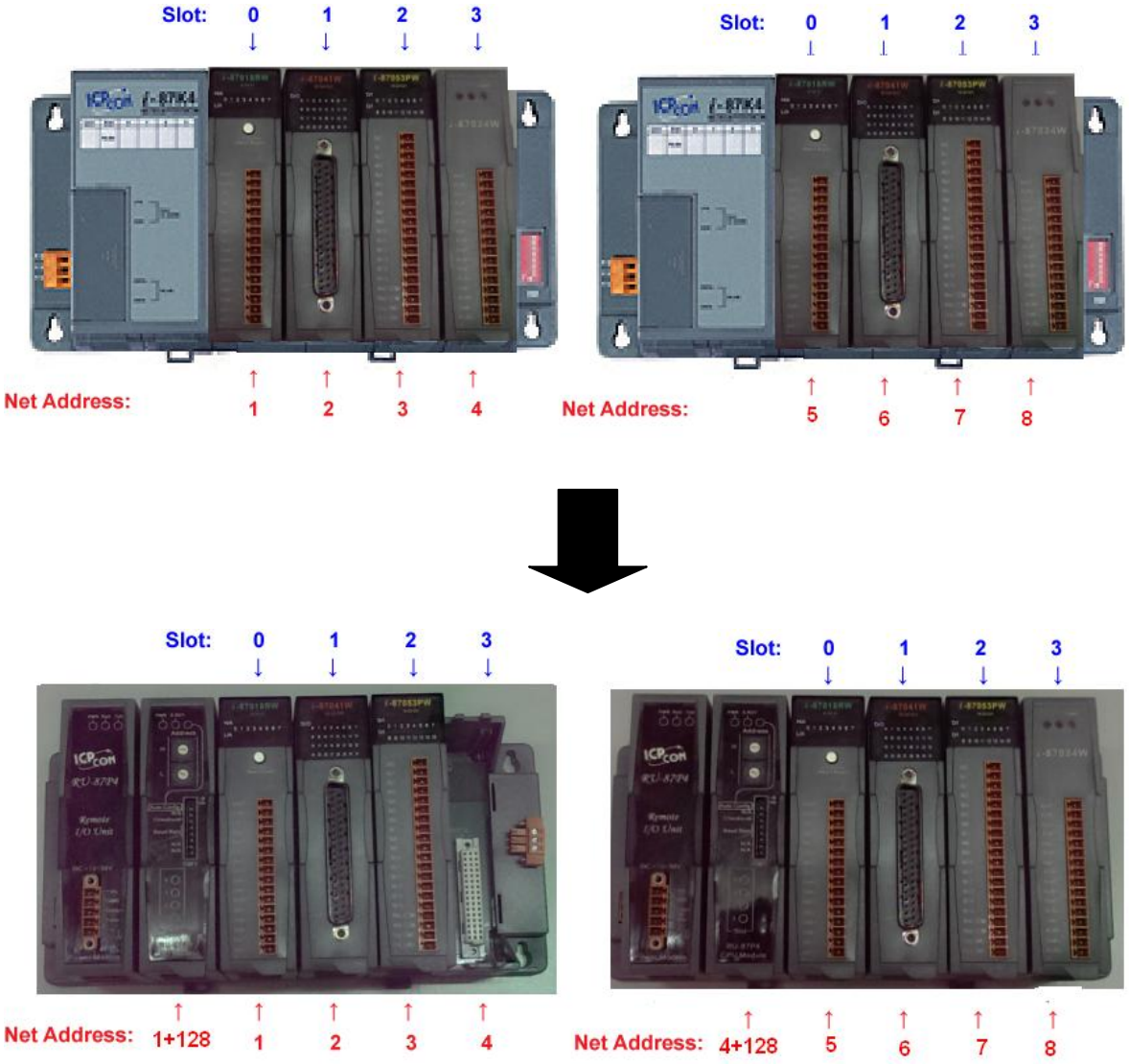
In RU-87Pn old firmware, the minimum address of CPU must be 1 and I/O must be 2. If I/O address start as 1 in I-87Kn, it need to modify software when update I-87Kn to RU-87Pn. Now user can set Addr. Mode as ON on RU-87Pn A400 or later firmware, it can set I/O address as below:





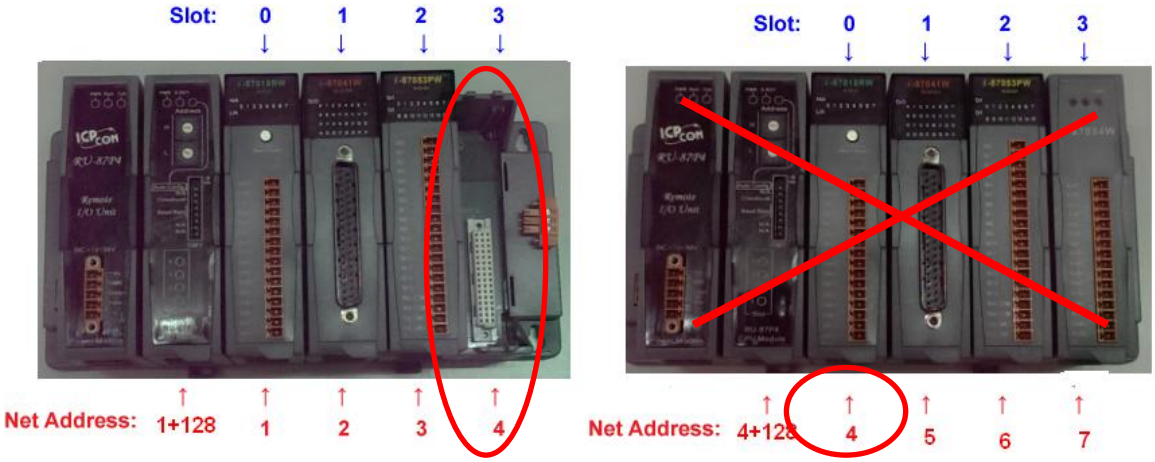
2. The address of I/O modules can be continuous:

If address of I/O modules is continuous (for example address 1~ address 8), it needs to modify his software using old RU-87Pn firmware. (for example: I/O address for 2~5, and 7~10, address 1 and 6 for CPU module.) Now user can set Addr. Mode as ON, it can set address of I/O modules continuous as below:



I/O modules is continuous, address 1 ~ address 7

If user uses 2 or more RU-87Pn and there is no module on some of slot, the Net Address of I/O modules will be reserved. User needs to set his system as above picture and can't set its system as below or it will be caused some problems.



Slot 3 of 1st RU-87Pn (address 4) without no module, and it needs to be reserved.

The 2nd RU-87Pn can't use that address (2nd RU87P4 slot 0 address 4) or it will caused some problem.

Chapter 3 Software Configuration

In this chapter, we will use DCON Utility to complete software configuration of the RU-87Pn, please confirm the hardware equipment has connected and communication parameters of 87Pn CPU module has setup completes. (Please refer to **Chapter 2**)

3.1 Setup RU-87Pn with DCON Utility

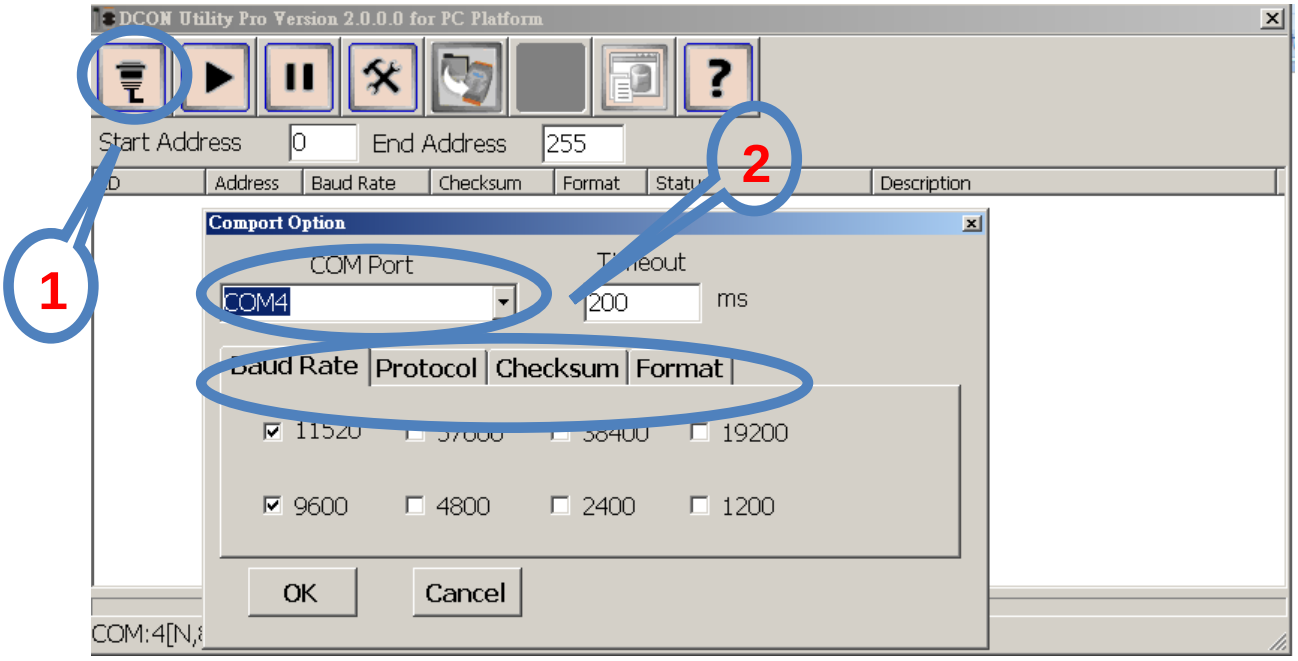
3.2 Save & Load 87Pn configure file

3.3 Load & Write configure file

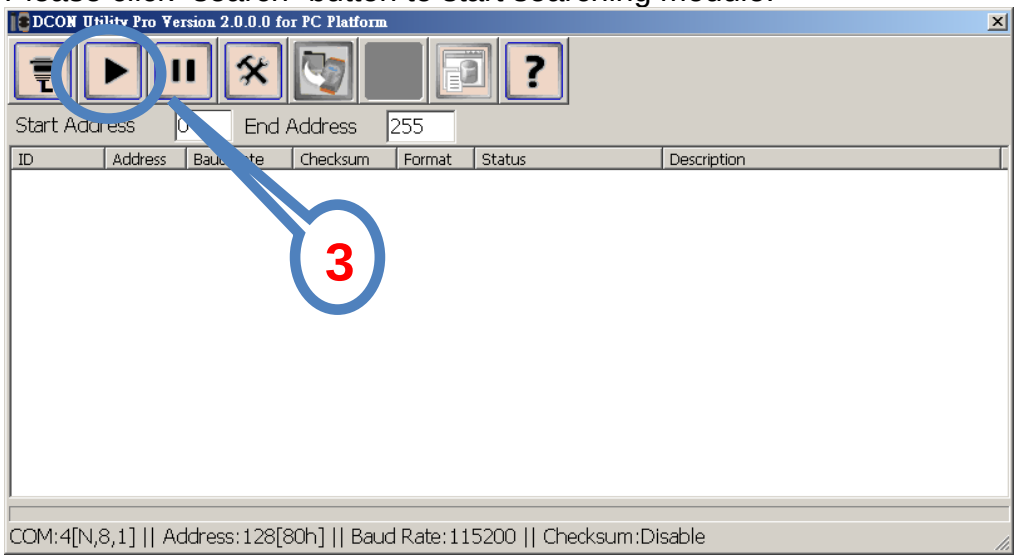
3.4 Operating in off-line mode

3.1 Setup RU-87Pn with DCON Utility

At first, please run DCON Utility then click “COM Port” to select COM Port, baud rate and etc communication parameters.



Please click “search” button to start searching module.



At the first time you can search for “RU-87Pn” only, because the slots of RU-87Pn haven’t completed the configuration. The “[X,X,X,X]” of “Status” means the configuration of that slot is not completed or corrected.

Please click “stop search” to stop the search.

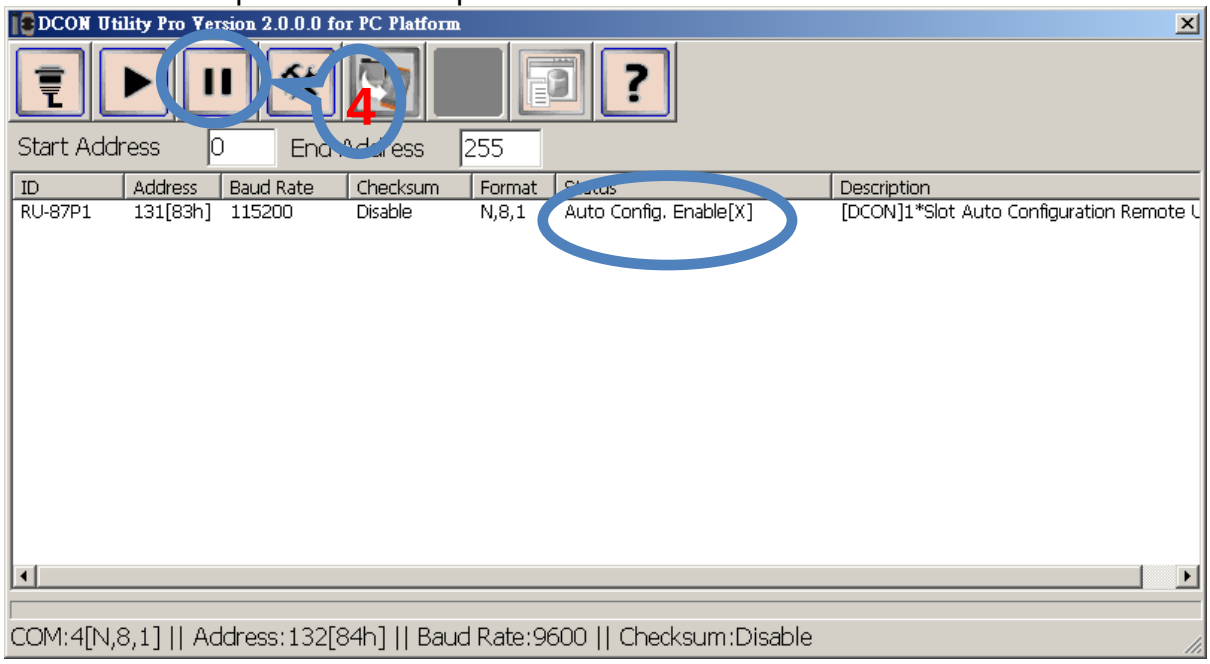
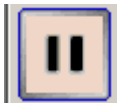
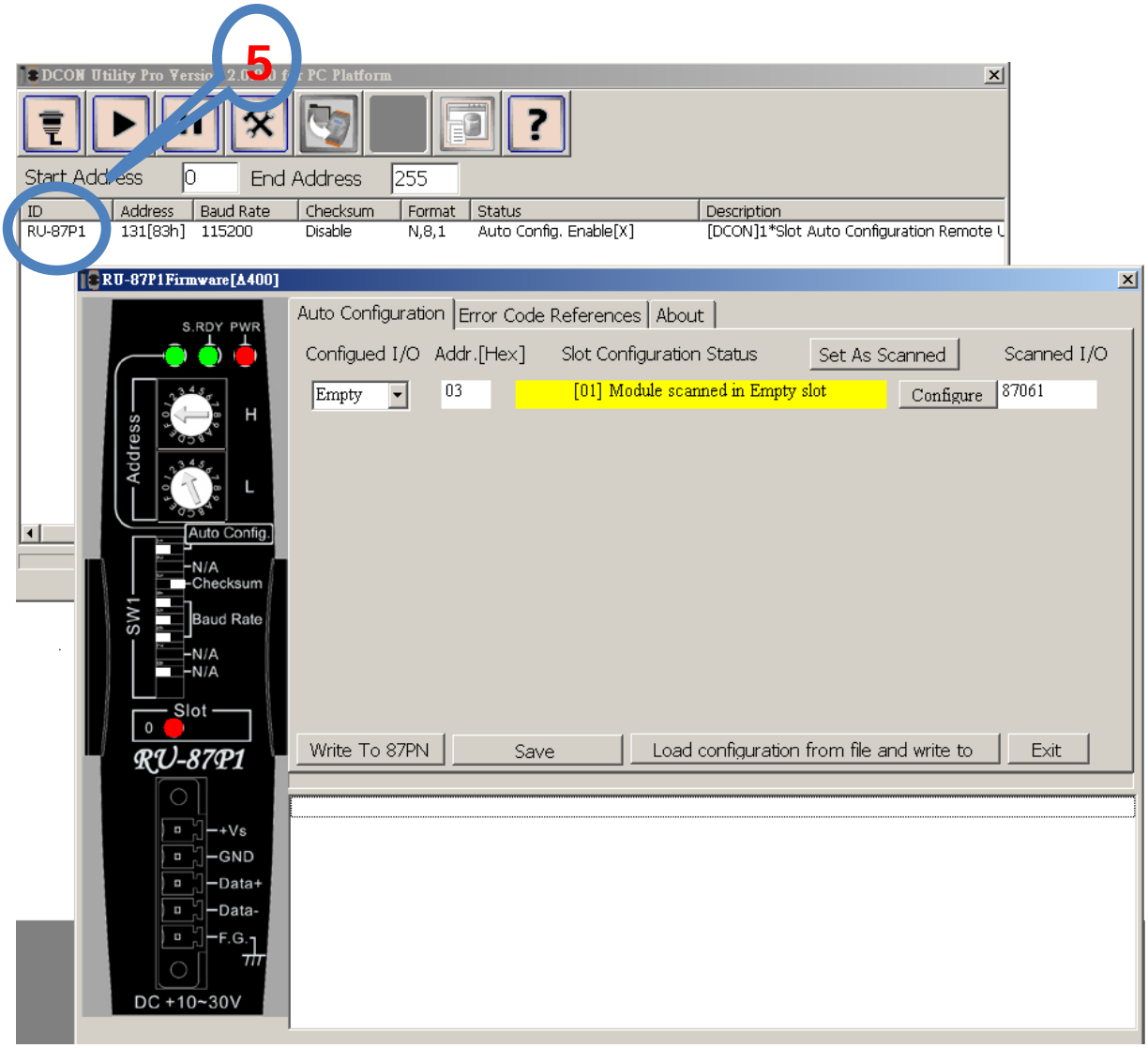


Fig 12

When found RU-87P1 out. Click  to stop search. [x] of “Status” means the configuration of that slot I/O module is not completed or corrected. Users can click “RU-87P1” module name to configure slot I/O module.

Click “RU-87P11” to setup I/O slots.



3.1.1 87Pn Auto Config. Enable:

In Fig.12 "Auto Config. ON" expressed that the 87Pn's Auto-Configuration function is "enable", "off" means "disable".

Working Distinction:
If I-87K I/O modules didn’t pass the 87Pn correct setup, and install into expansion slot under “Auto Config. Enable” mode, it will regard as incorrect module. For guarantee system's normal operation, the 87Pn will forbid this module external communication. You can’t search and configure I/O modules directly by DCON Utility.

The “Auto Config. Enable [X,X,O,X,X,O,X,X]“ in Status column means the module configurations of that slot are some correct (O is means configuration correct) and some is not correct (X is means configuration not correct). Click “RU-87P8” and select to enter configure screen and know the detail settings about module.

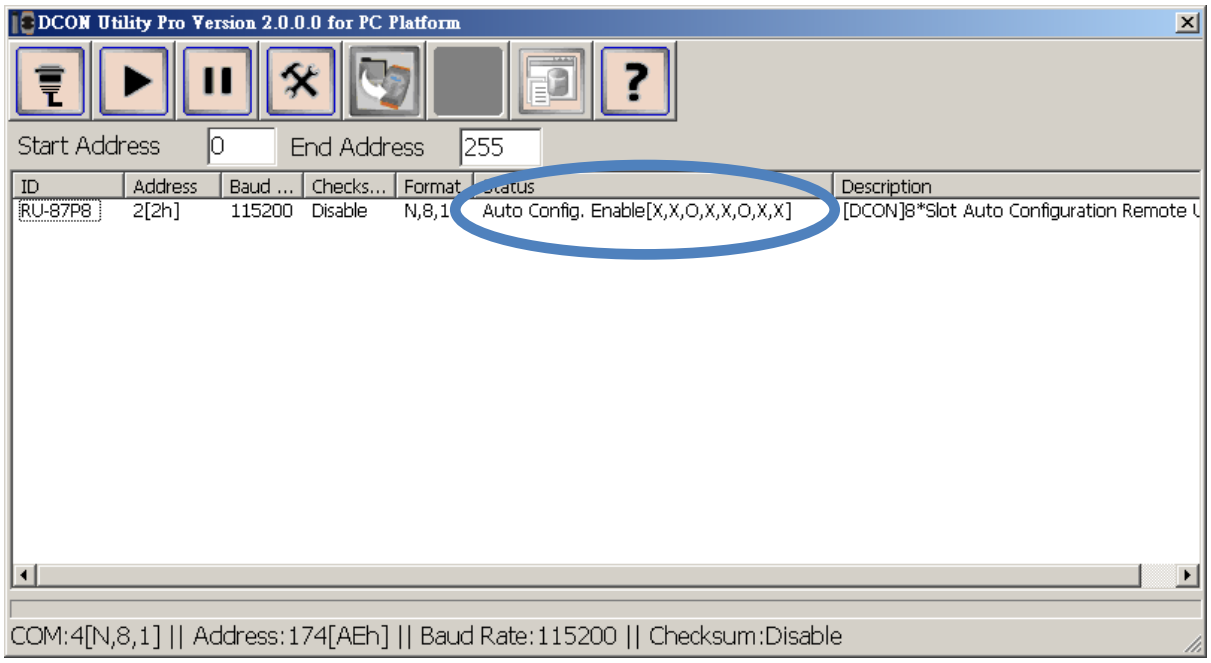


Fig.12：When Auto Config. Enable, incorrect module can’t external communication

In 87Pn configure screen, you can see the scanned module name in ”Scanned I/O on Slot“ column. Click "Set As Scanned” button to assign module name and click "configure" to setup the I/O module according to the user demand. Finally click "write to 87Pn" for the settings to take effect.

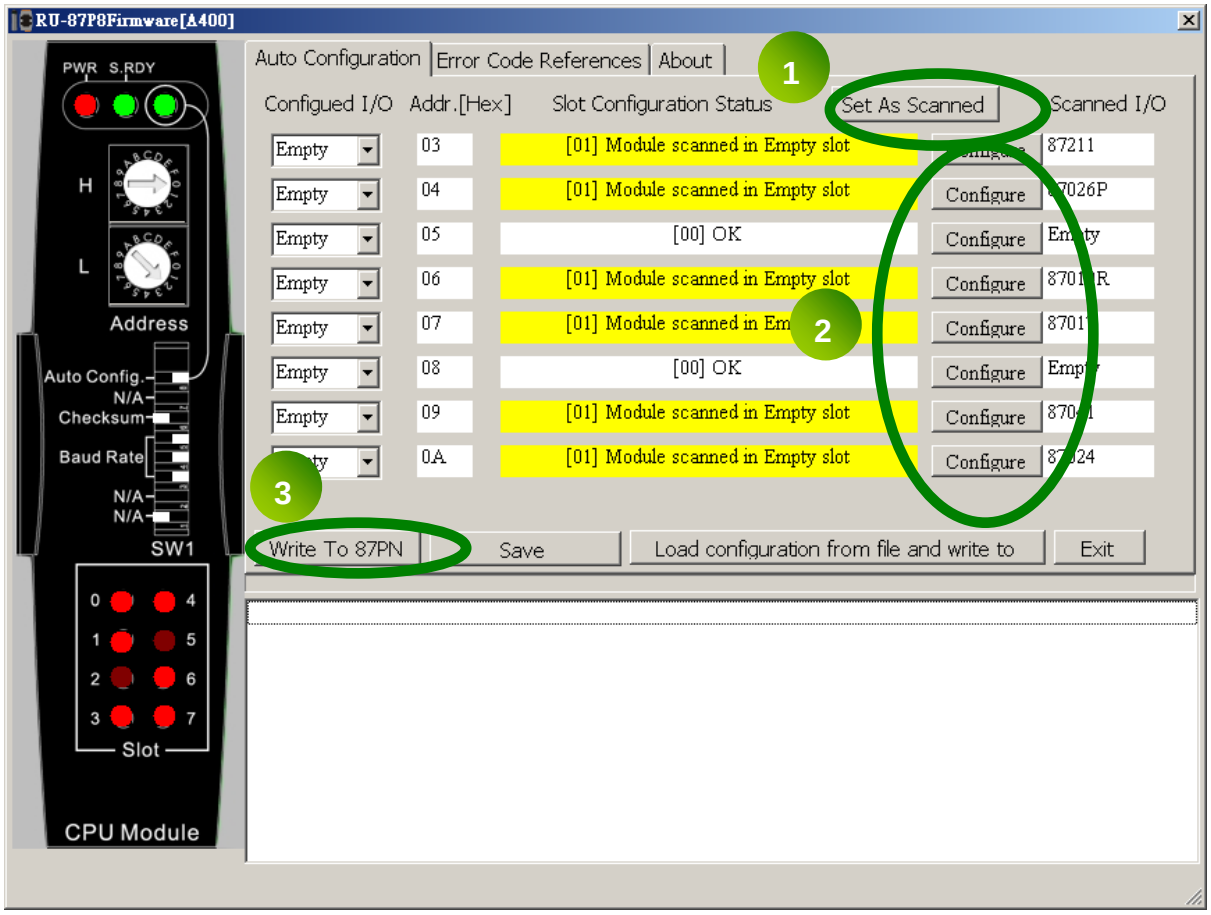


Fig.13：Click “Write to 87Pn” to complete 87Pn module configuration

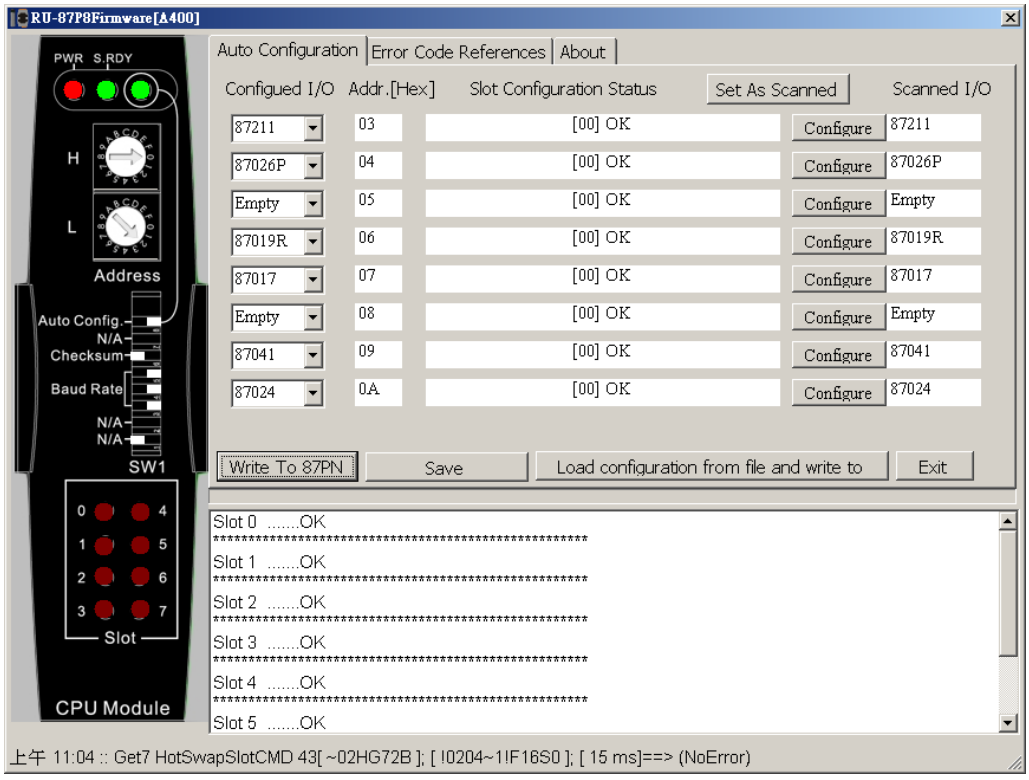


Fig.14：The status after complete the 87Pn module configuration

As above, the I-87K I/O modules on 87Pn expansion slot has configured correctly by "DCON Utility", and then search the module again, you can see the module appear in the search screen. The ”Auto Config. Enable [0,0,0,0]” of “Status”, means “The I/O configuration of each slot is correct. Each plugged I/O module will be listed under the RU-87Pn.

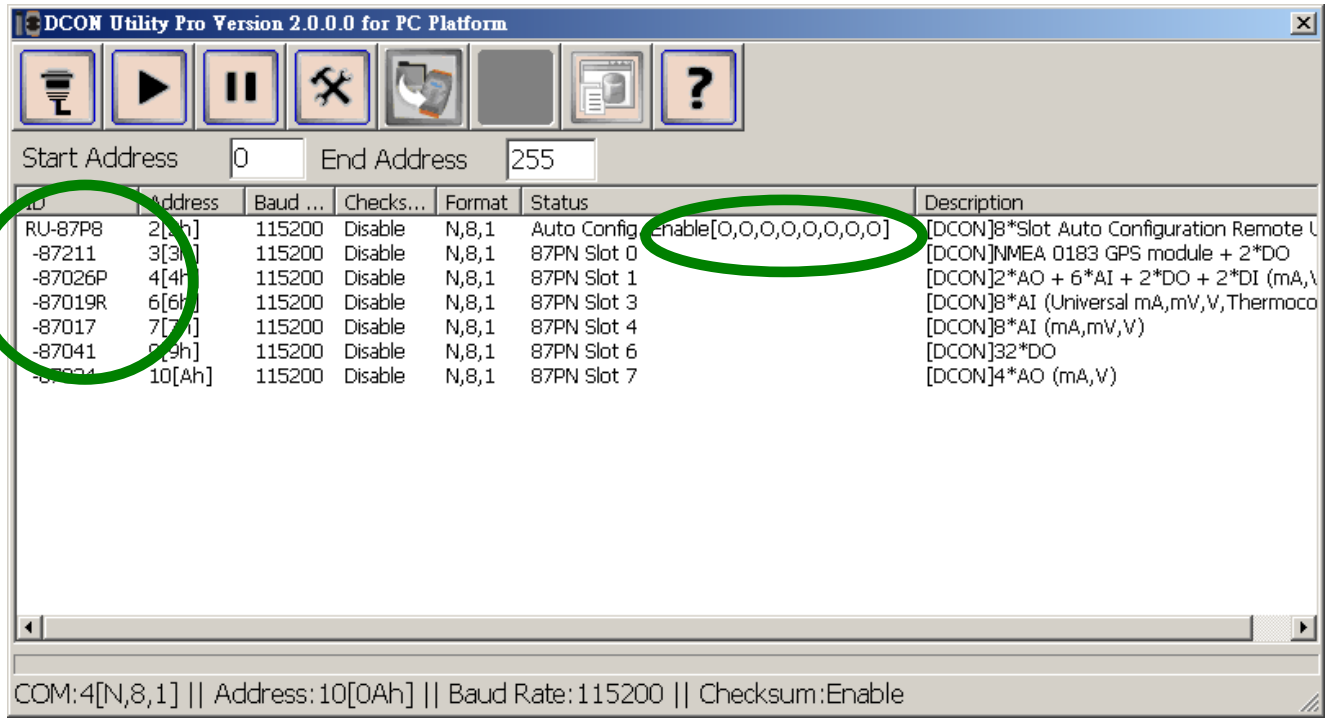


Fig.15：After configuring, you can find out the entire module

If the module passed correct configuration, some day when module damage, you don’t need to shutdown the power, just remove the damaged module and install the same model number of new module. You needn't configure it again, 87Pn will write the previous settings to the module automatically.

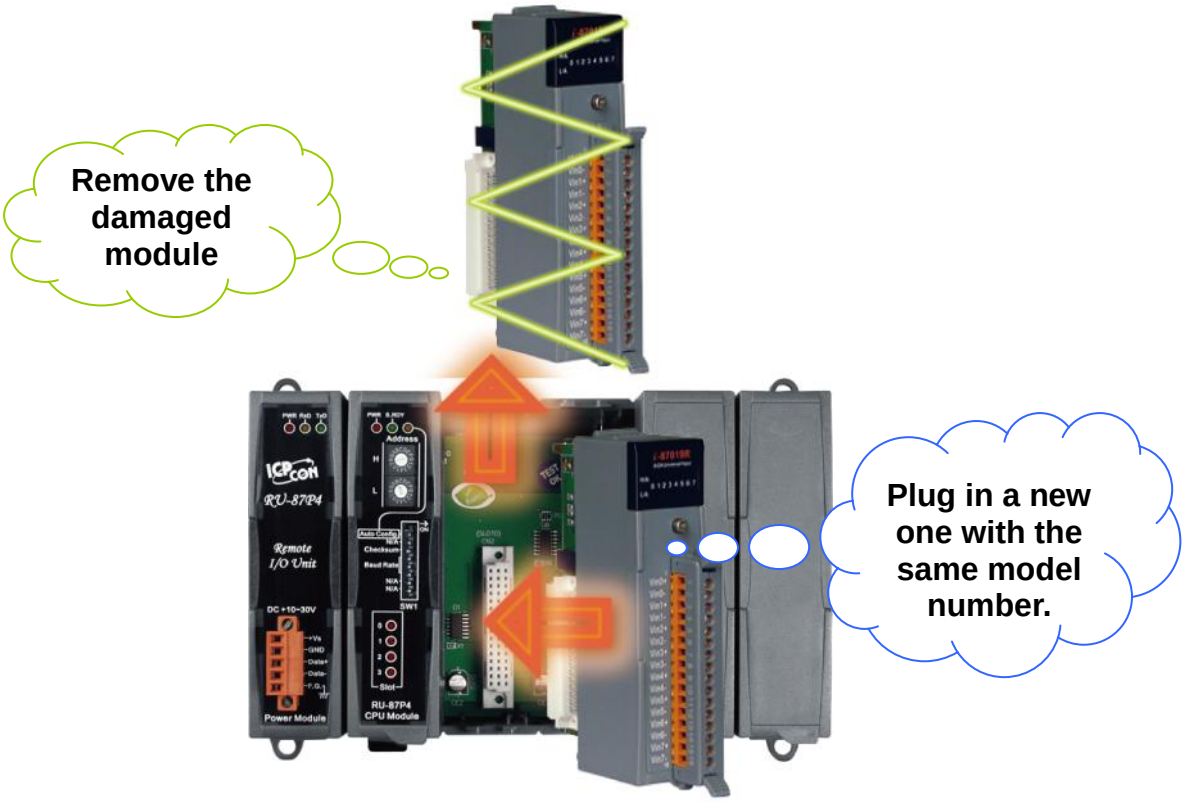


Fig.16：How to complete Auto-Configuration for 87Pn.

3.1.2 87Pn Auto Config. Disable:

Working Distinction:

In 87Pn Auto Config. Disable mode, allow the I-87K I/O modules of expansion slot to external communications. Therefore, when you perform searching by DCON Utility, you could find 87Pn CPU module as well as 87K I/O modules on the expansion slot.

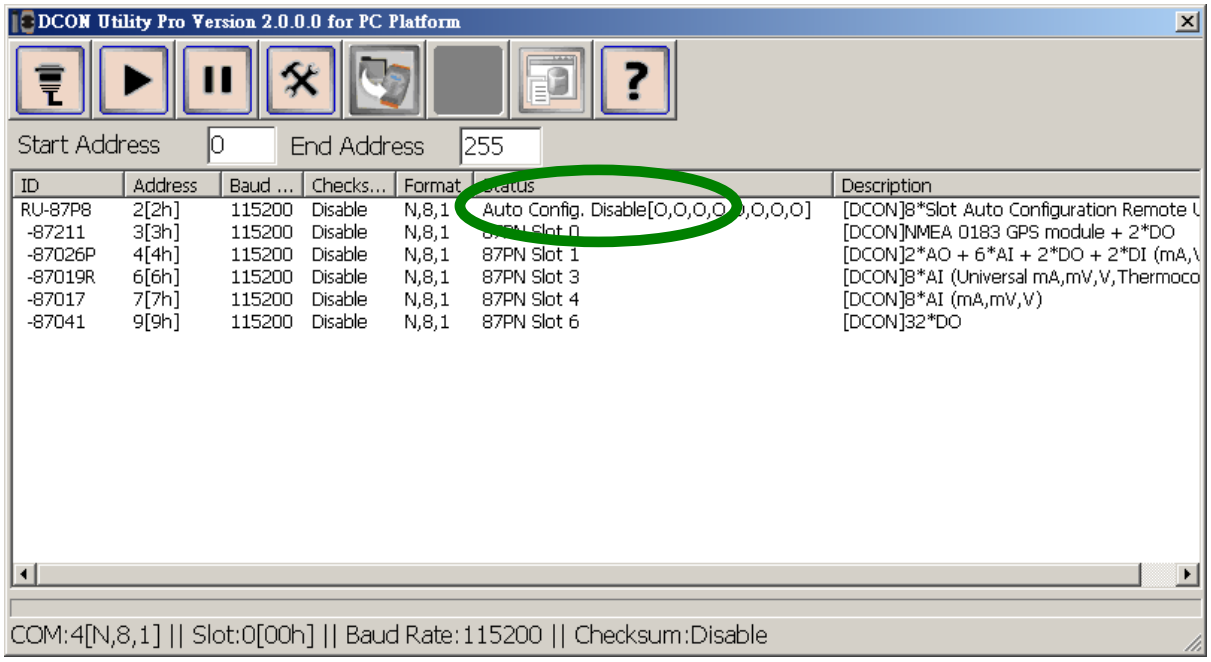


Fig.17：When 87Pn Auto Config.: Disable, all the module can external communication

In 87Pn “Auto Config. Disable”, indicate your hardware device is under “disable” mode. You can’t make any configuration under this mode. the communication parameters of I-87K I/O module which on expansion slot can’t configured by user, it must Auto-Configure by 87Pn, the other usage is the same as the module insert into I-87K4/5/8/9 expansion unit.

In 87Pn “Auto- Config. Disable” mode, doesn't support Auto-Configuration. When module damage, and replace another same model number the module directly, because of their settings (e.g. Type code) may be different, thus can’t ensure its normal working. The user must use DCON Utility to re-configure based on the setting value, and replies the normal operation.

Note：In DCON Utility search screen, the message in status column of 87Pn

The meaning of " Auto Config. Enable [0,X,0,0] " as following description:：

0：Means the module configuration on this slot is successful or have no module.

X：Means the module configuration on this slot is uncorrected.

If the status column of 87Pn shows "**Auto Config. Enable [0,0,0,0]**", means the "Auto Config." of DIP switch is switching to the "On", and the I/O configuration of each slot is correct or has no module.

If the status column of 87Pn shows "**Auto Config. Disable [0,0,0,0]**, means the "Auto Config." of DIP switch is switching to the "Off", and the I/O configuration of each slot can initialization success or have no module.

3.2 Save & Load 87Pn Configure file

When using 87Pn operation screen of DCON Utility to configure the I-87K I/O module, DCON Utility will automatically save the necessary information under the installing path “config\”, the file recording some information of related module that will be saved in 87pn, when save as new file, it can be use for system recover and system backup. The related format and detail about configure file, please refer to Appendix D. Here, just description how to save the file as oneself needs and how to load from files.

Note1: When user open the operation interface of 87Pn, if there is the same file in default path will be deleted.

Note2: Using ”Configure” and ”Write To 87Pn” functions in 87Pn operation screen of DCON Utility will automatically save the related data of module of each slot as filename of fixed format and the same path, if user want to use the file as system recover, system backup or remote support, the best way is save the default file as another name to avoid the file been deleted when next time you open the operation interface of 87Pn.

3.2.1 Save the module command to file:

When all modules has configured properly according to the requirement, because each time entered the configuration screen will delete the default file and re-build, so suggestion to save the settings as another files, if the settings is carelessly changed or need to duplicate the same content of configure, can load in the configure file and write in 87Pn CPU module through operation screen of DCON Utility.

The operation steps is very easy, using ”Configure” to setup each I/O module and write the settings to 87Pn, then click ”Save Configuration” button and input the description or notes for this configuration file. Finally, input the file name of this project to complete. Please refer to the description as following diagram.

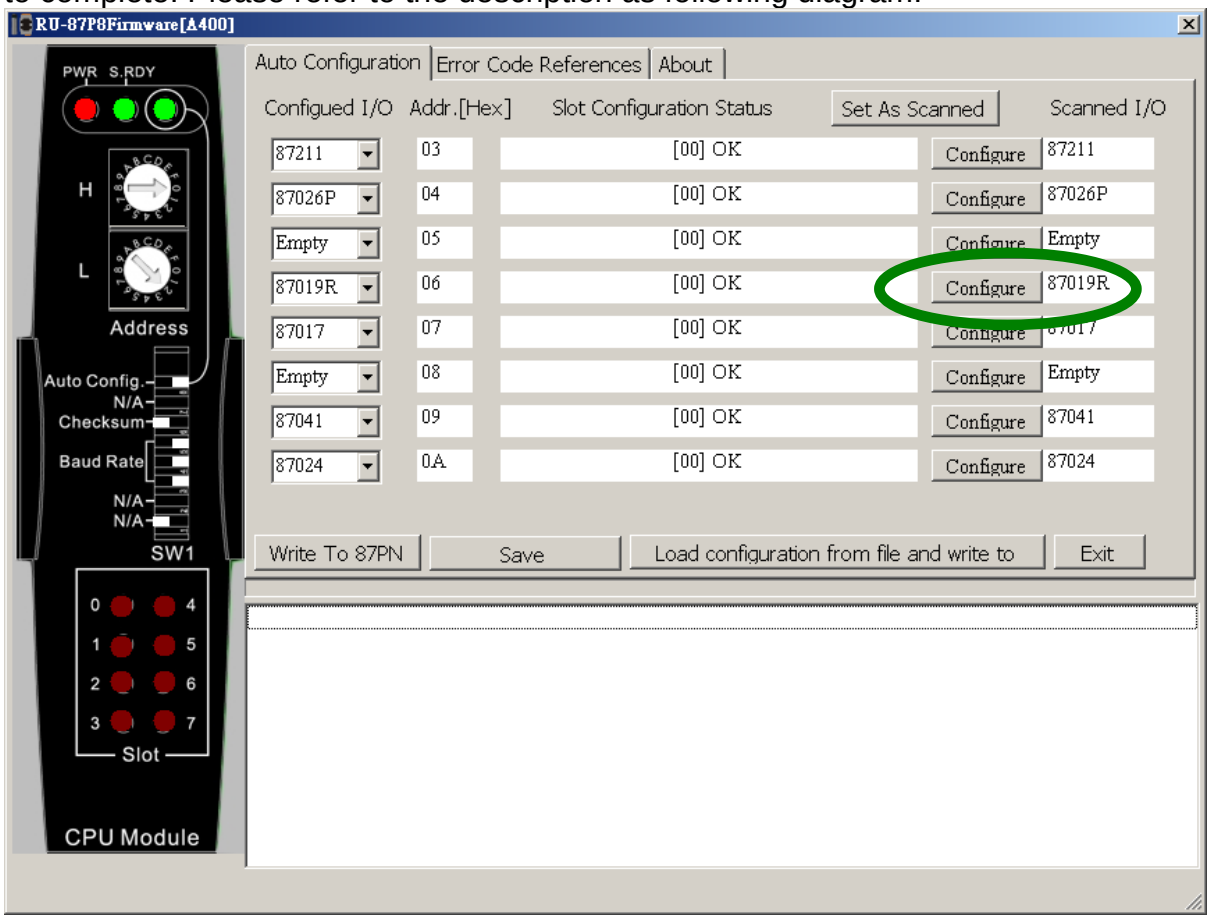


Fig. 18：Click ”Configure” to enter the configure screen

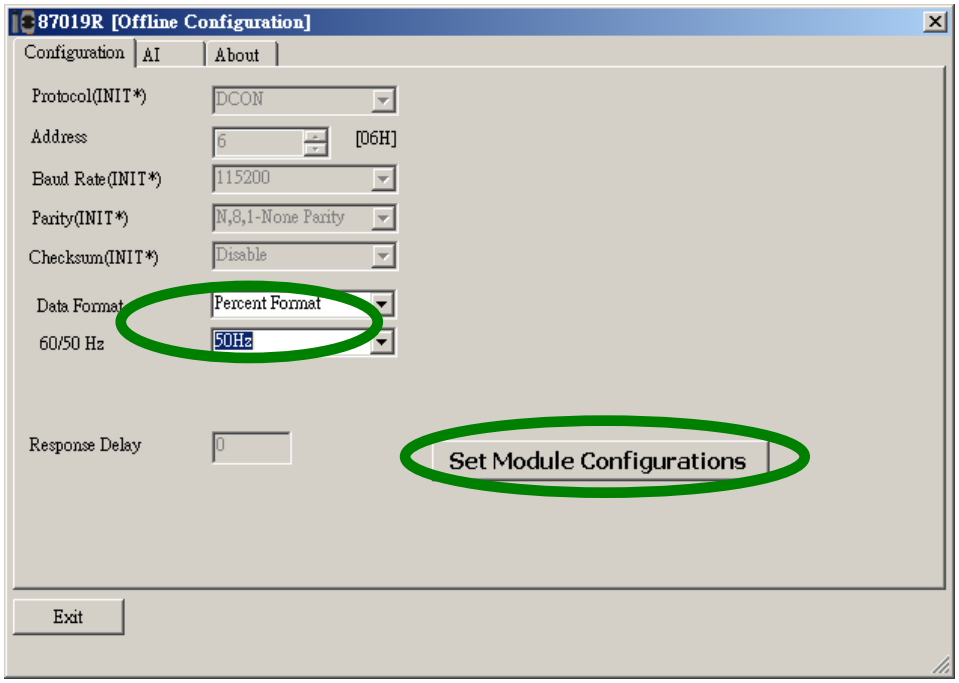


Fig. 19：Select and setup the data format of module

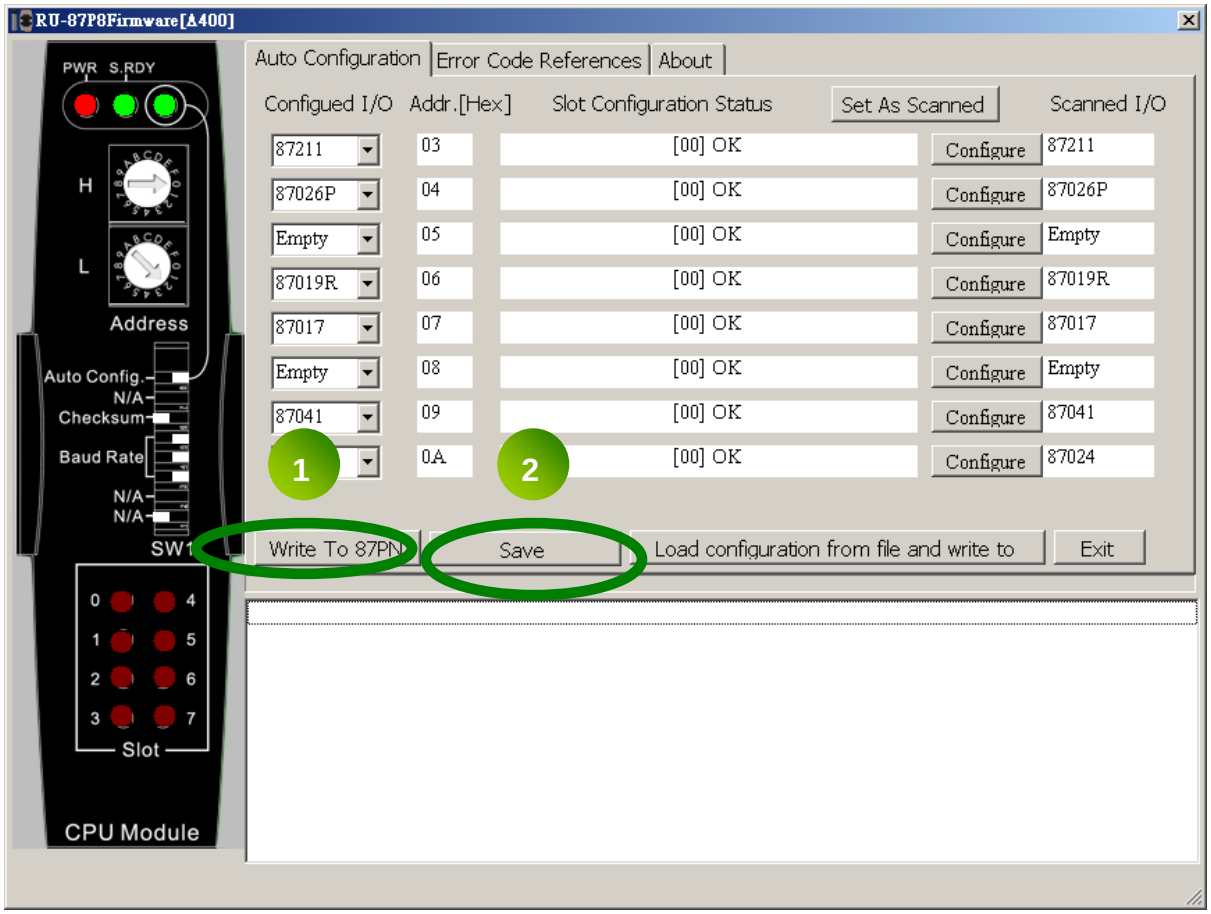


Fig. 20：Write the settings to RU-87Pn and click “save configuration”

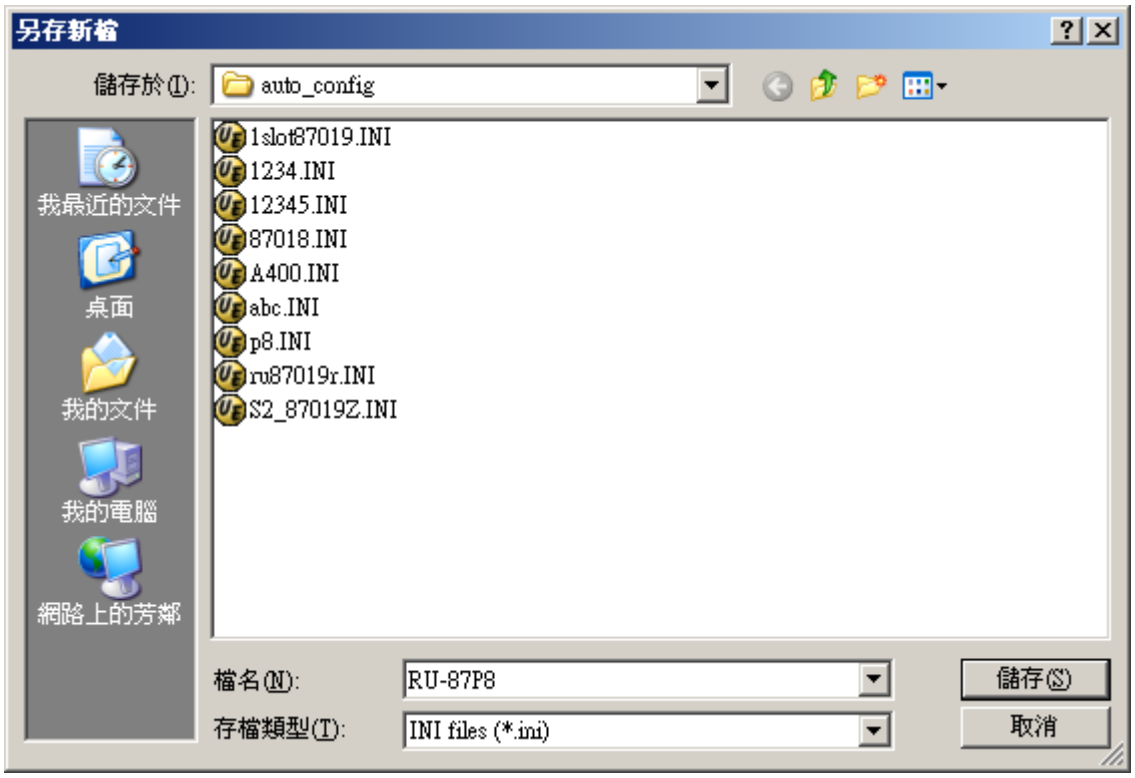
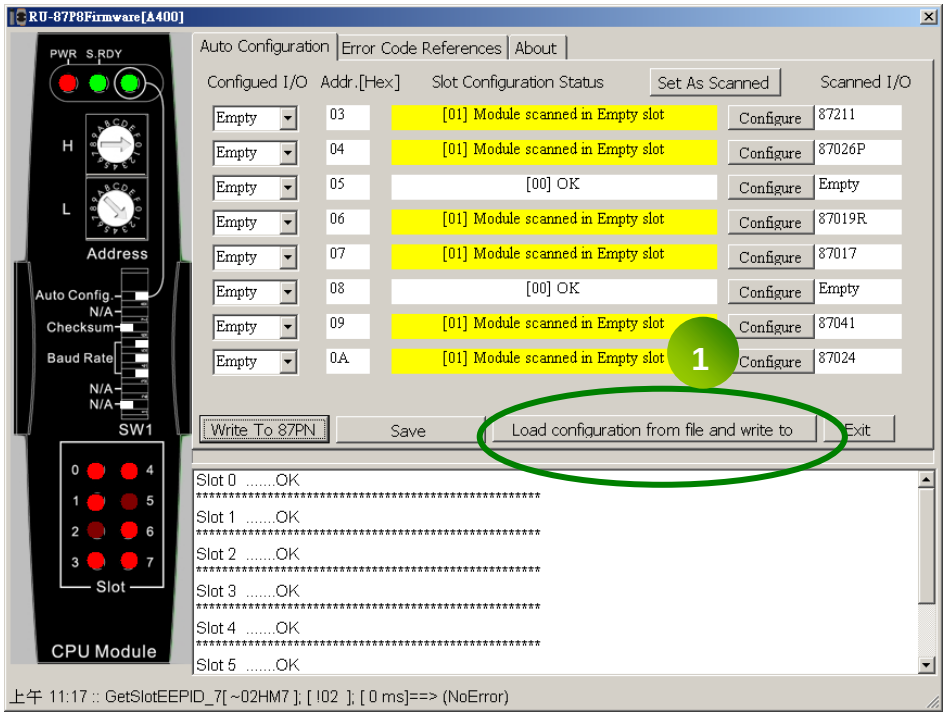


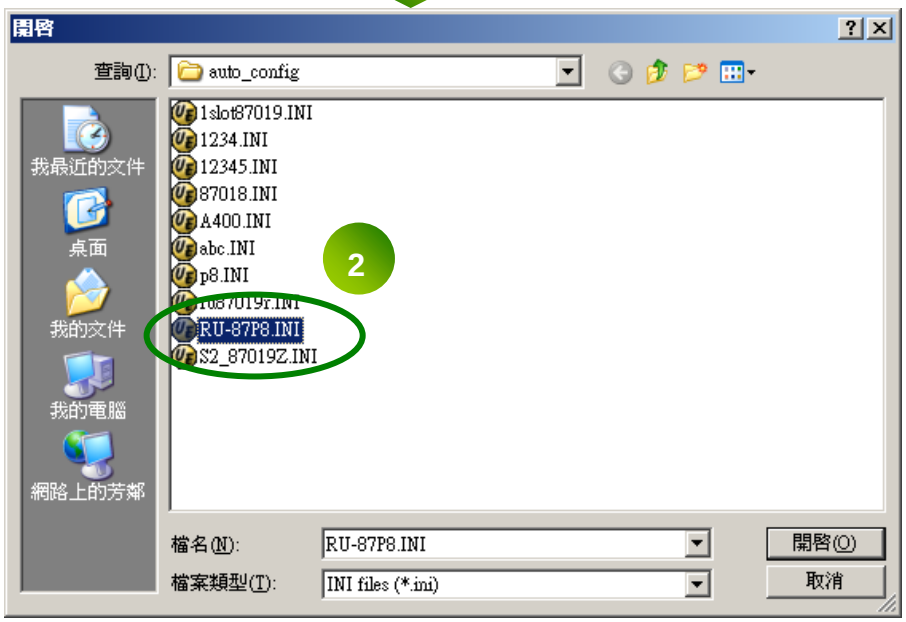
Fig. 21：Save the configuration file

You can save this file as a backup files. If RU-87Pn is damaged, you can write it to a new RU-87Pn without configure I/O module again. You also can write it for the others the same system

3.3 Load & Write configure file

If you sure the contents of configure files is what you need, you can load the configuration and write to 87Pn at the same time. As following diagrams, this function is useful for a lot of copy to other 87Pn (as Fig.26).





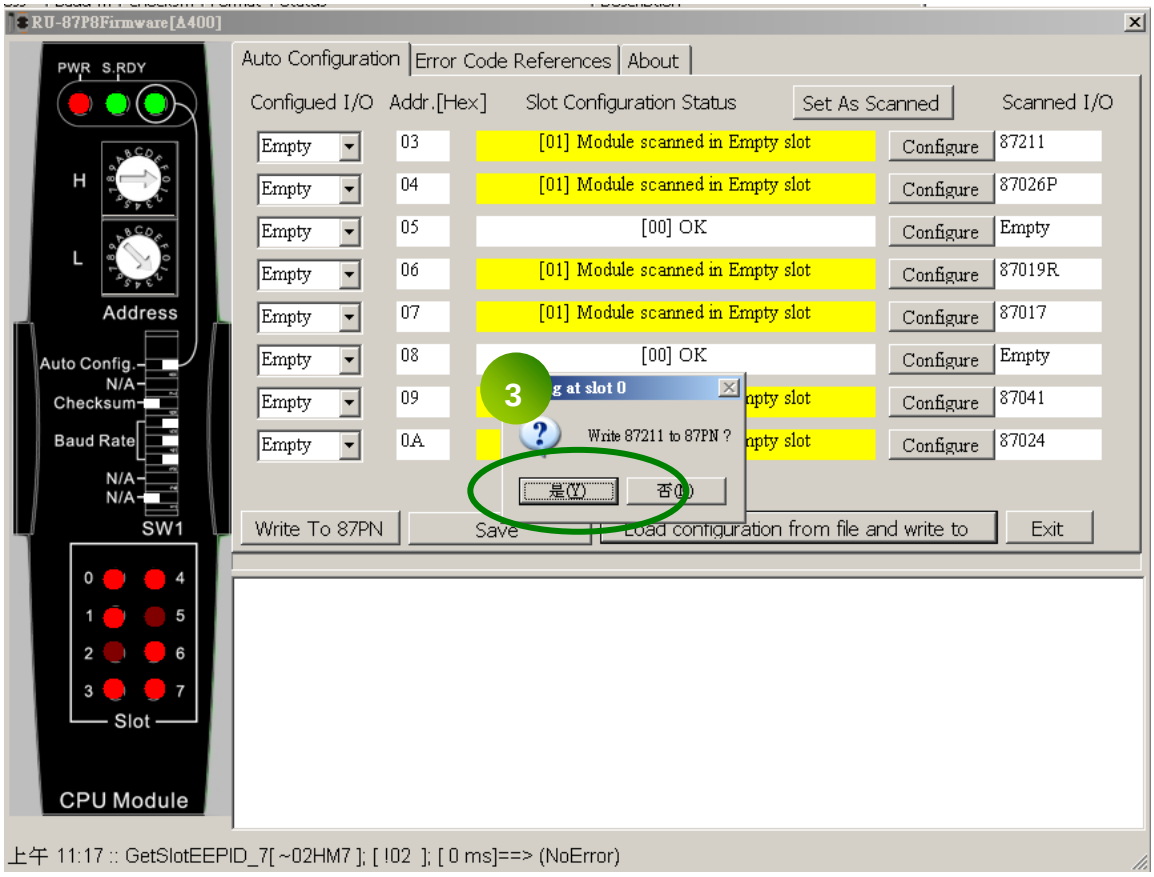
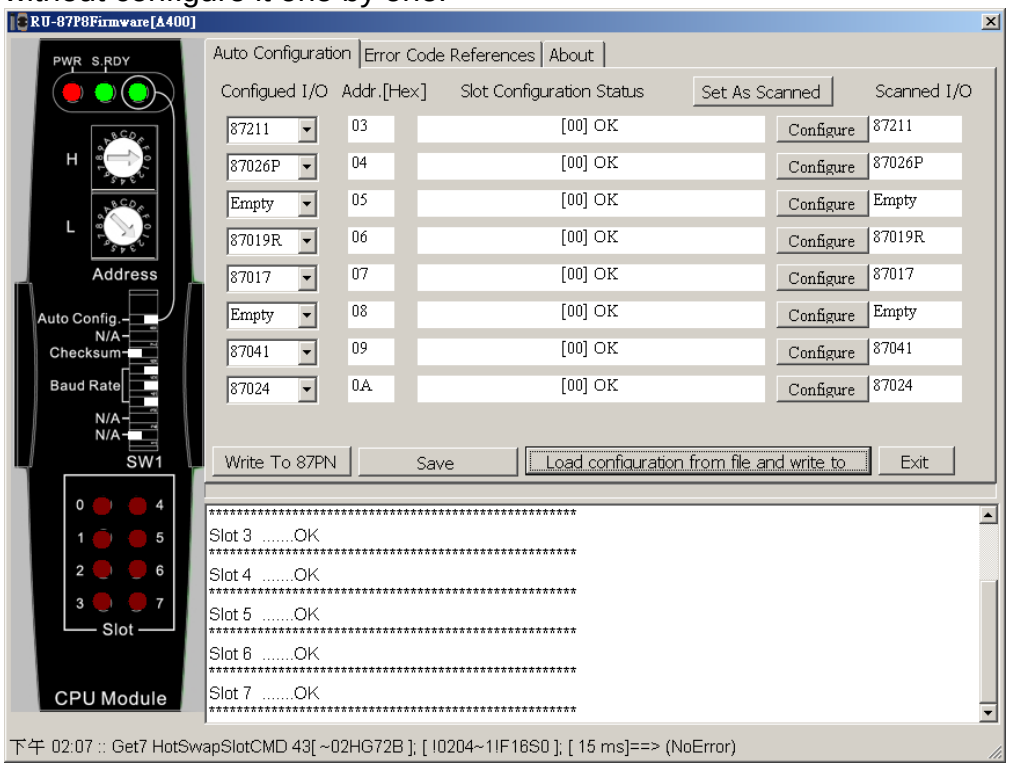


Fig. 22：Load configuration and write to 87Pn CPU module

You can copy file to the others the same system and write configuration to all modules without configure it one by one.



3.4 Operating in off-line mode:

The operation in off-line mode means the computer which operate DCON Utility without connect any module of 87Pn, Using DCON Utility to generated and edit the module command for 87Pn requirement, and then write the command file to another computer which connected with 87Pn , this usage is convenient for remote support or system backup. The contents as following Fig.27、Fig.28.

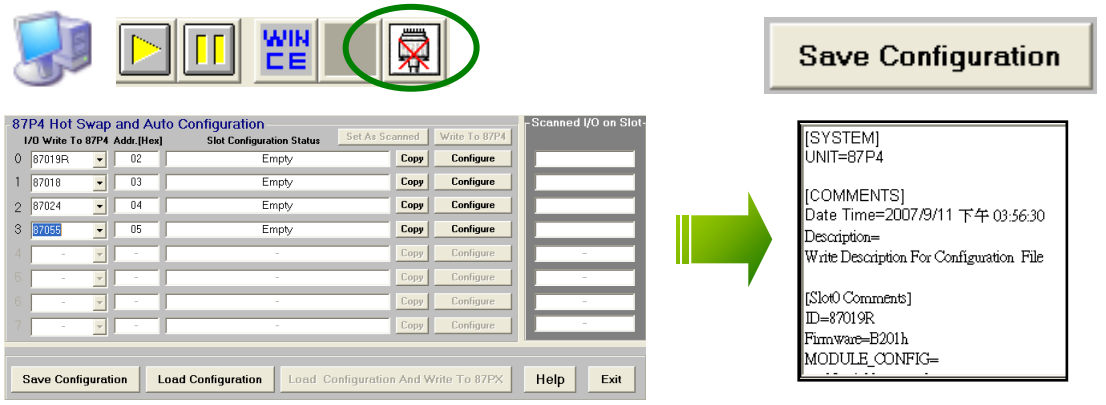


Fig. 23：Configure and save file in off-line mode

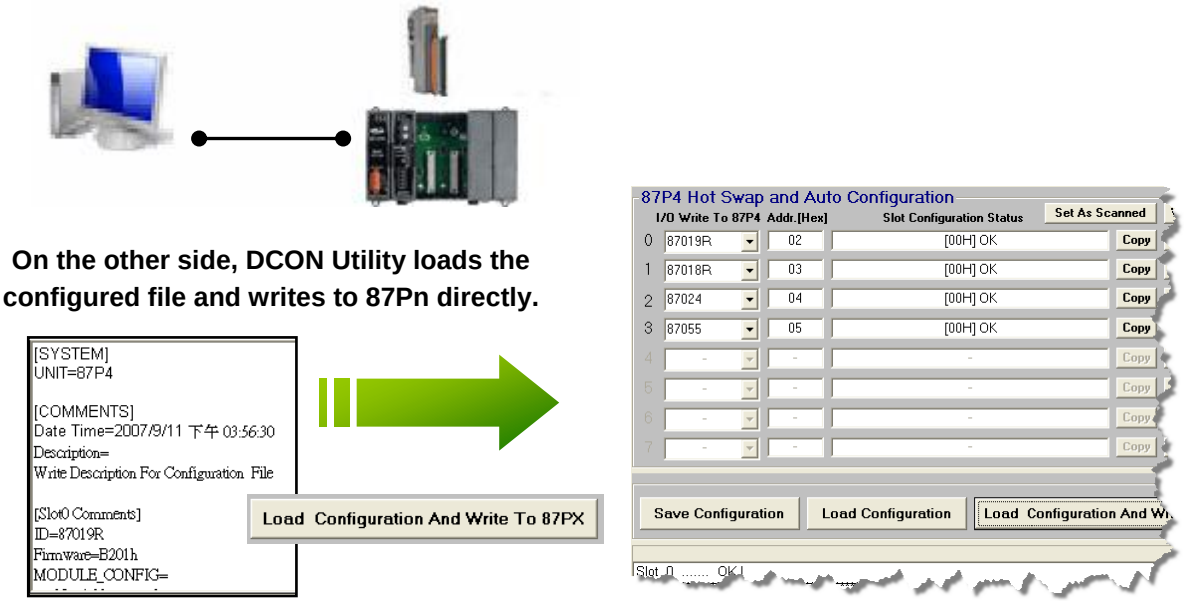
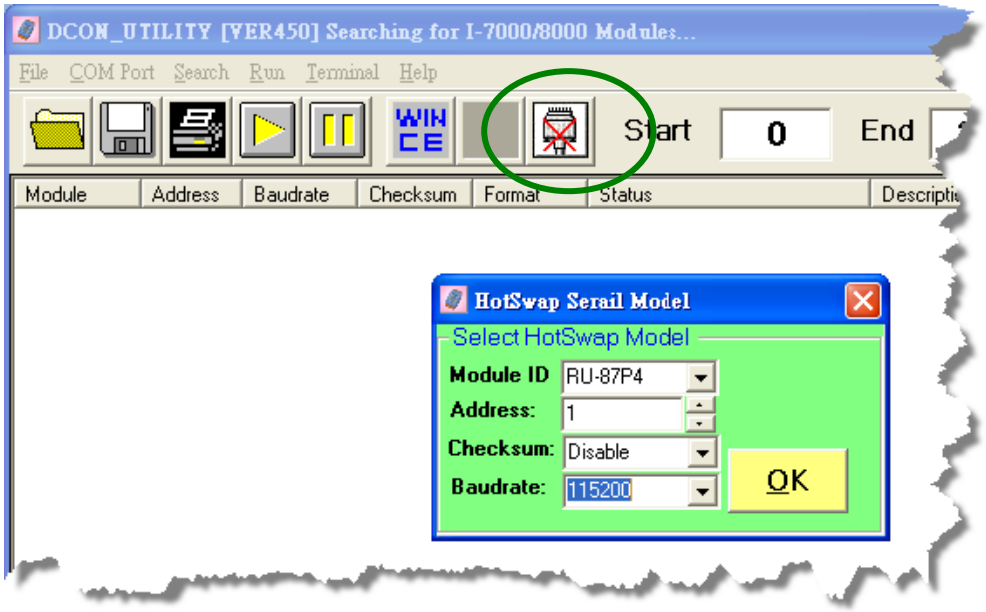
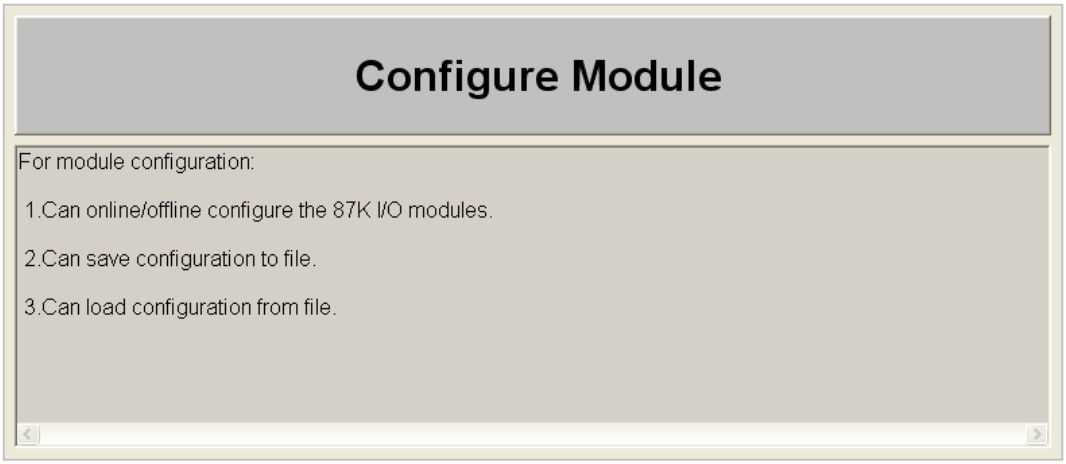


Fig. 24：Load Config ration and w e to 87Pn CPU module in other computer

Step1 : Select the Module ID, Address, Baudrate and Checksum.





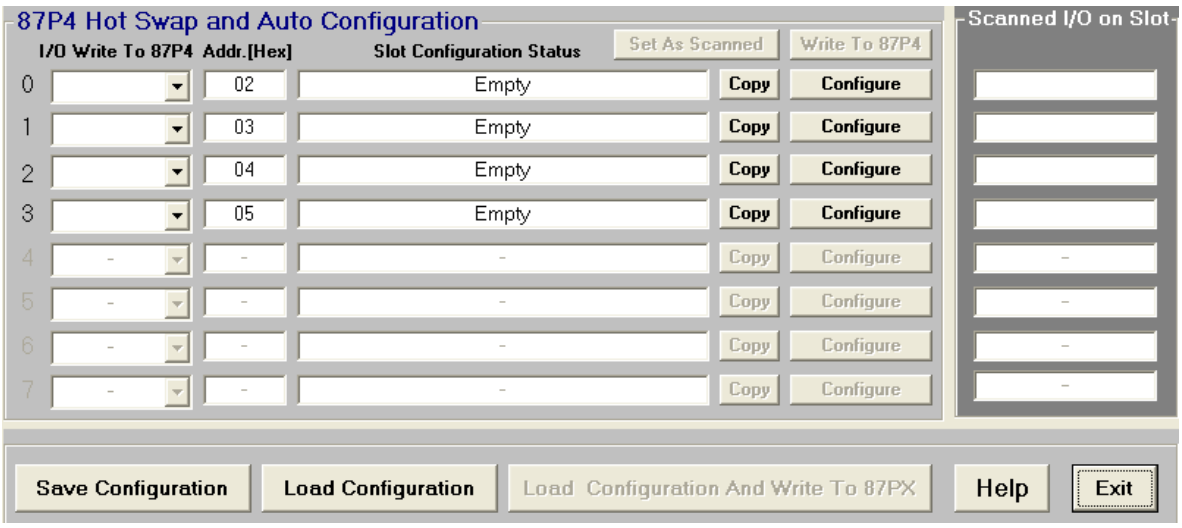


Fig. 25：Off-line operation

Step2 : Select and configure the I/O module, then save the settings as another file name, or else next time when you open the 87Pn screen, the previous settings will be deleted.

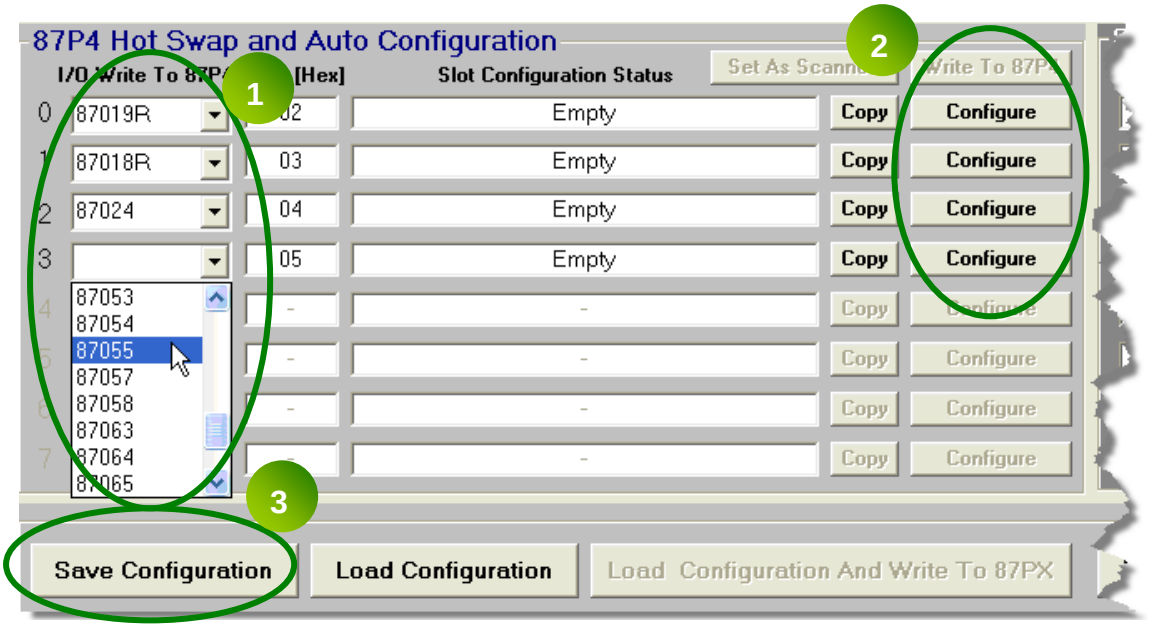
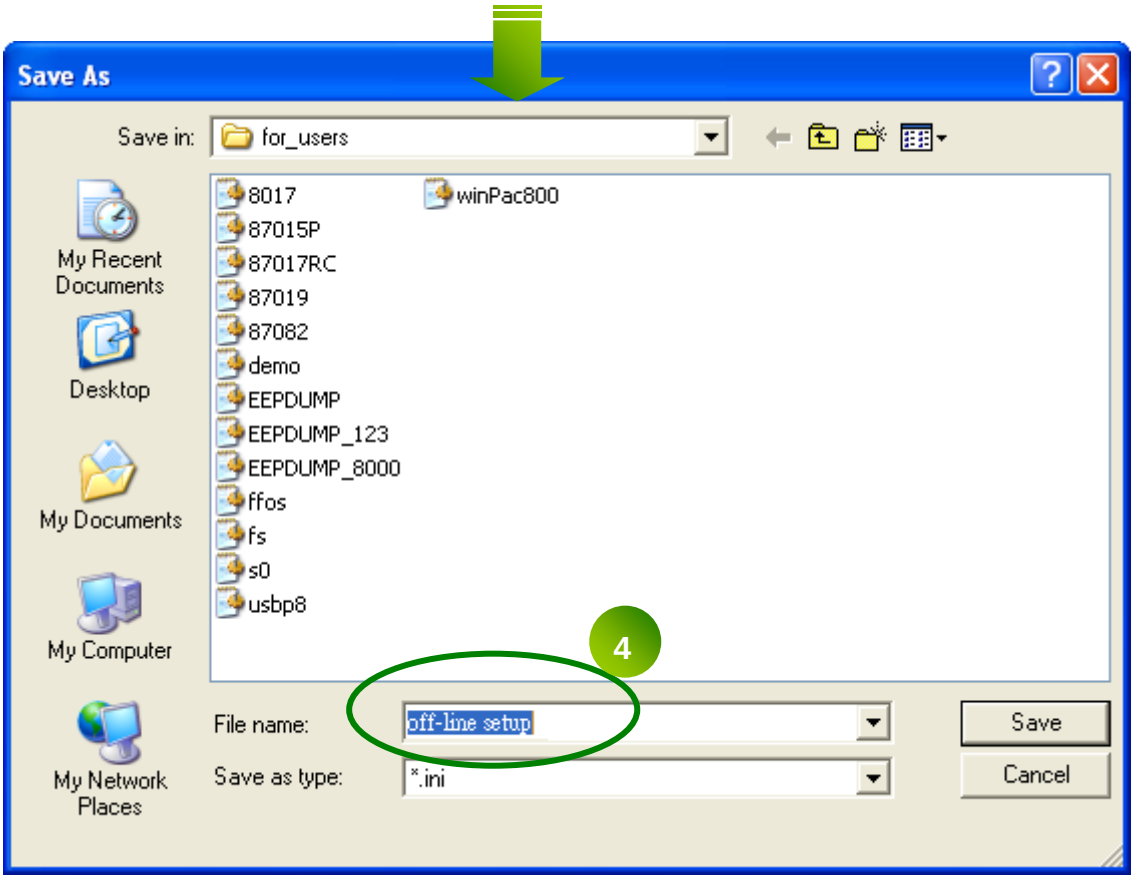


Fig. 26：Off-line operation – Configure & Save file



Note: The configure file will be save to C:\ICPDAS\DCON_Utility\for_users

Step3 : Run DCON Utility in another computer which has connected with 87Pn, load the settings into DCON Utility and you can press "Configure" button to check the settings has written to 87Pn correctly. Follow the steps, you can complete the function of Auto-Configuration also can write to 87Pn directly after loading configuration. As following diagram:

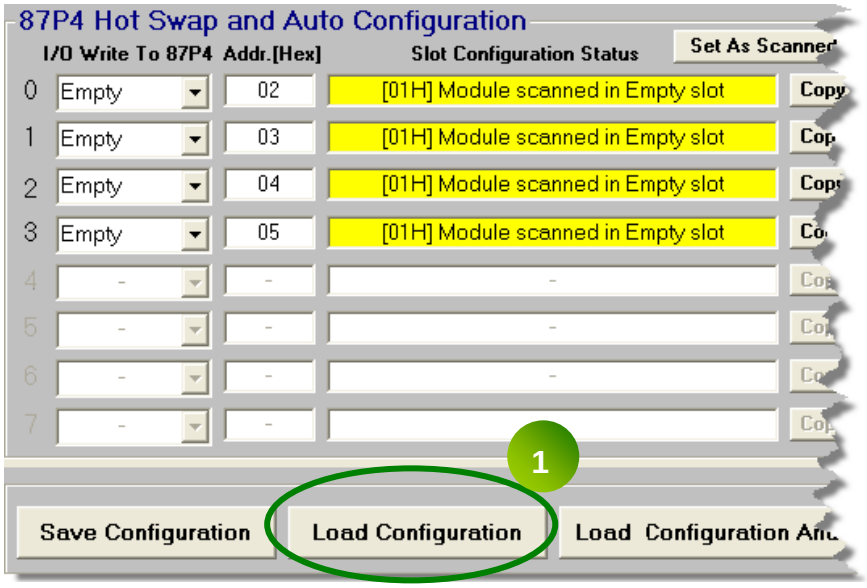
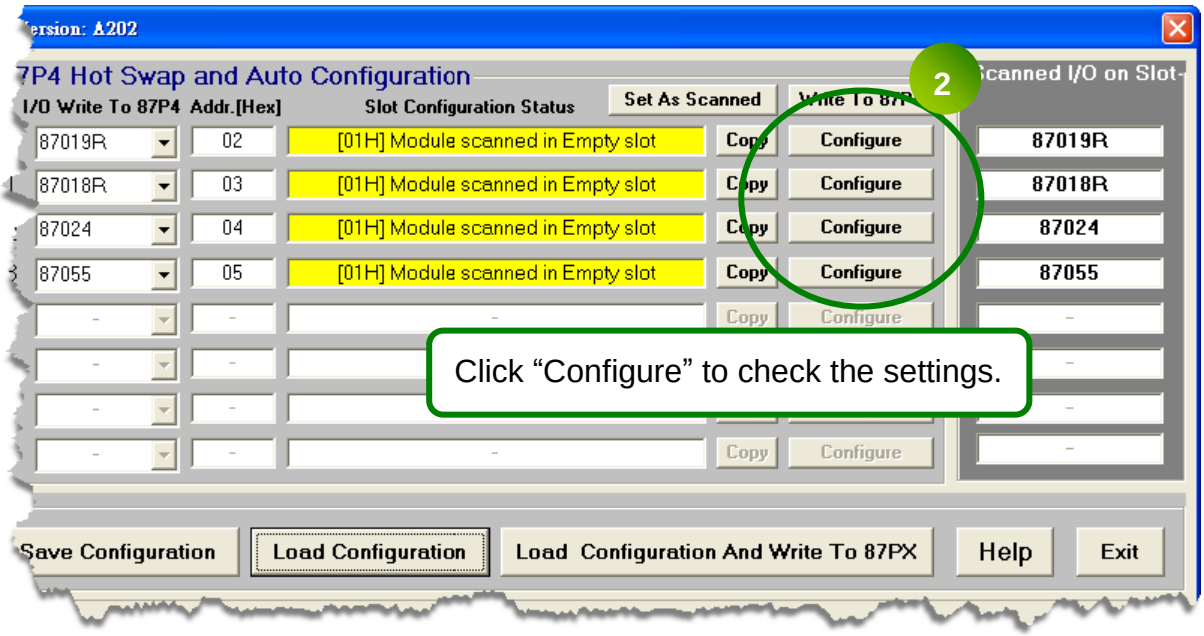


Fig. 27：Load configure file in another PC



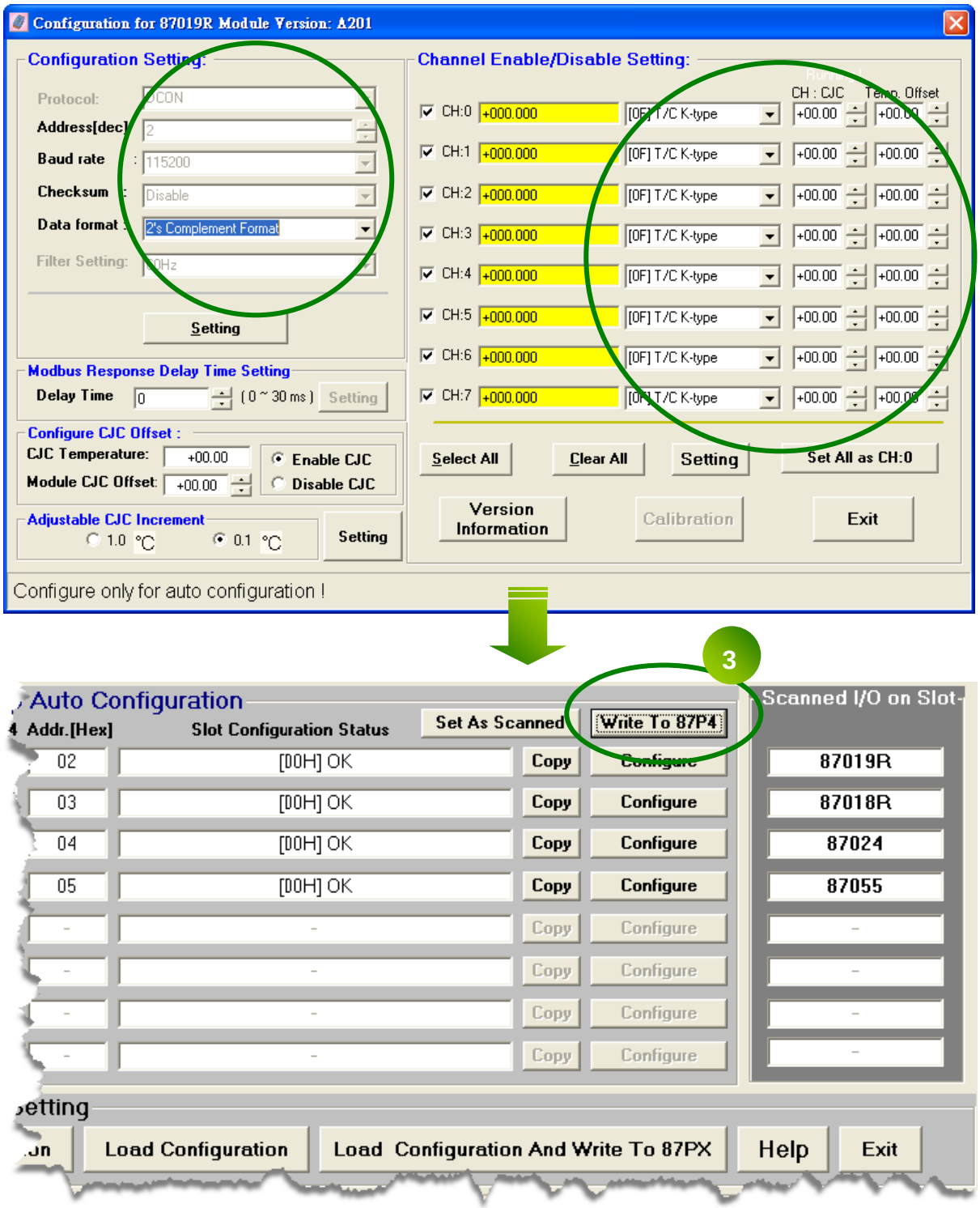
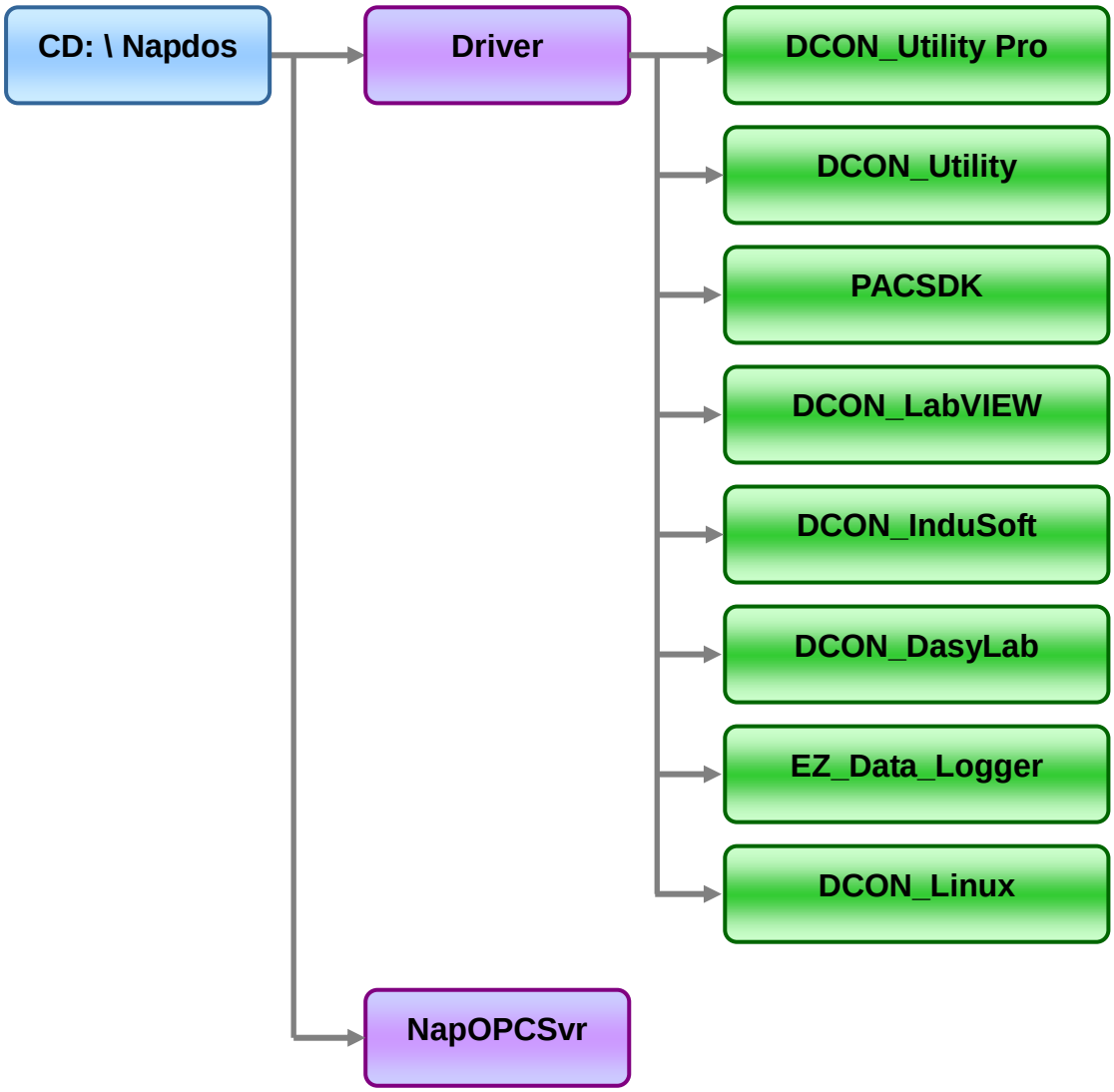


Fig. 28：Write the settings to RU-87Pn

Chapter 4 Software Development Kits (SDK)

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:



4.1 PACSDK

PACSDK provide 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

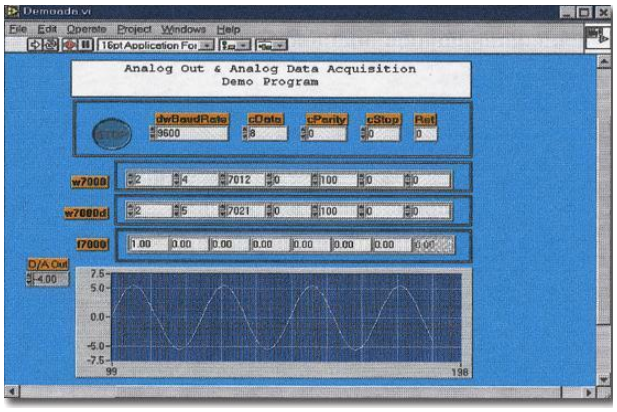
Operation System
Windows XP
Windows 7
Windows

All document for APCSDK is located at CD or FTP (latest version):
CD: \ Napdos\Driver\PACSDK or
ftp://ftp.icpdas.com/pub/cd/8000cd/napdos/driver/pacsdk/

PACSDK can be used on C,C++,C#,Delphi,Borland C and etc Development environment. About more description about it ,please refer its user manual :
ftp://ftp.icpdas.com/pub/cd/8000cd/napdos/driver/pacsdk/document/

Step5: Write the program code

4.2 DCON LabVIEW



DCON LabVIEW

Bundled driver for LabVIEW

Supported module:

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

Supported OS:

Windows 98/NT/2K/XP

File Location:

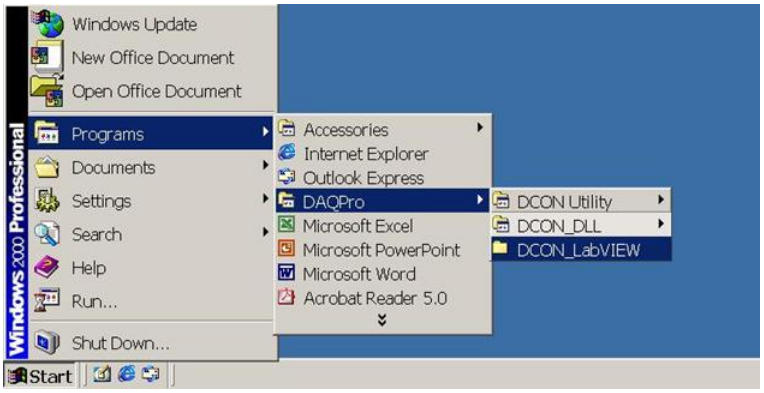
CD: \Napdos\Driver\DCON_Labview

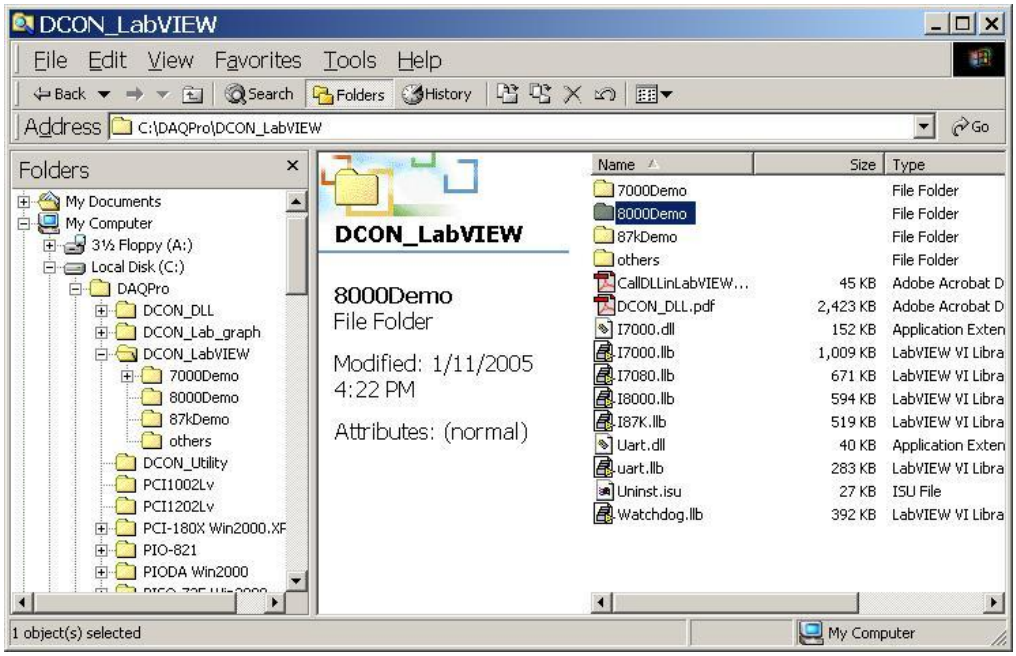
4.2.1 Procedure for using DCON_LabVIEW

Step 1 : Install the DCON LabVIEW by executing:

CD:\Napdos\Driver\ DCON_Labview\ DCON_Labview.exe

After installation, the related information can be found as below:





8000 Demo: Demo programs for I-8000 I/O modules.

8000.llb: LabVIEW library contains all sub-vi for I-8000 I/O modules

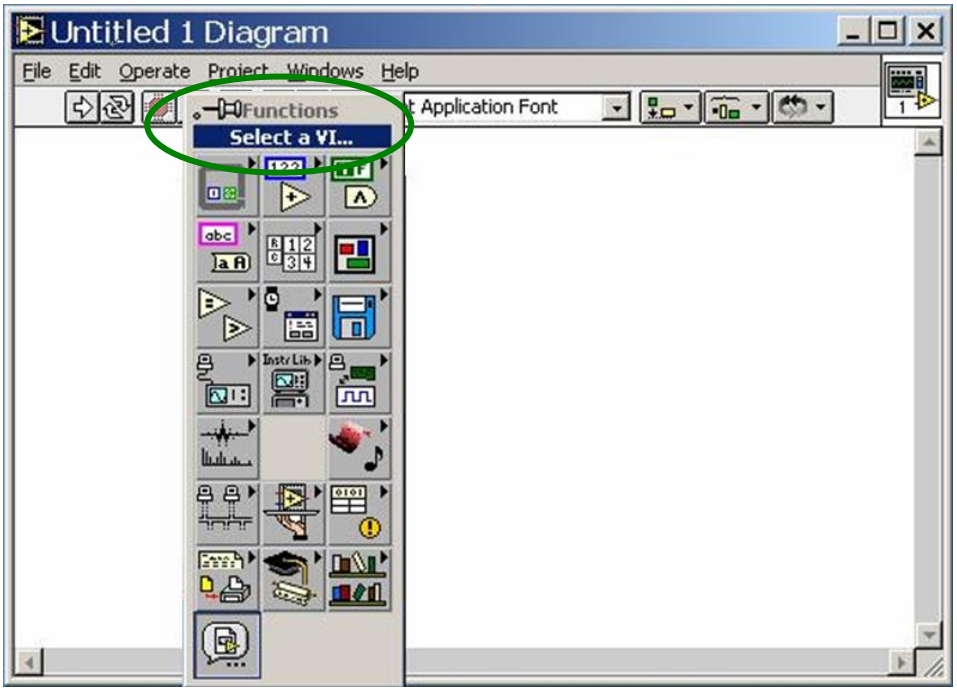
CallDLLinLabVIEW.pdf: Explains how to call a sub-vi of in LabVIEW.

DCON_DLL.pdf: Descriptions of all sub-function in DCON_DLL.

Step 2: Create a new LabVIEW program.

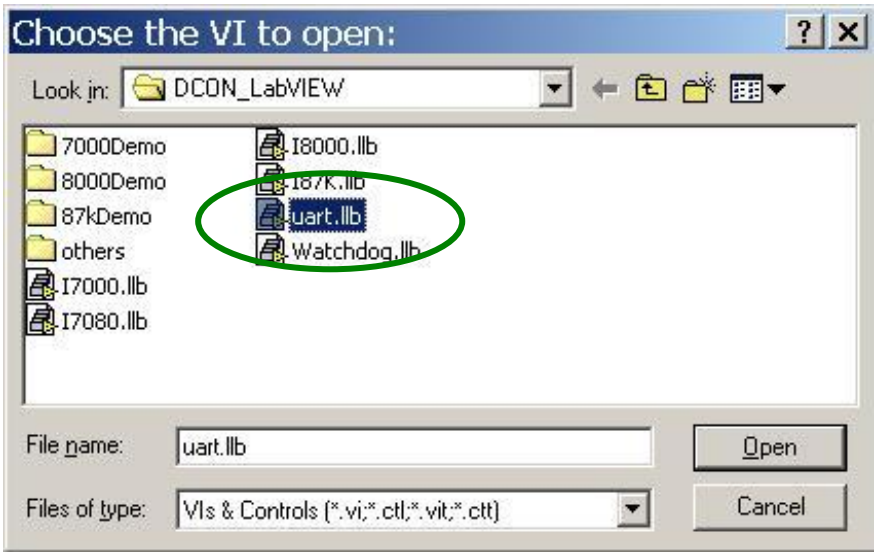
Refer the DCON_DLL.pdf about detail description of the sub-vi and where to select the sub-vi in various library of DCON_LabVIEW.

Step 3: Select the sub-vi form Functions Palette >> Select a VI…



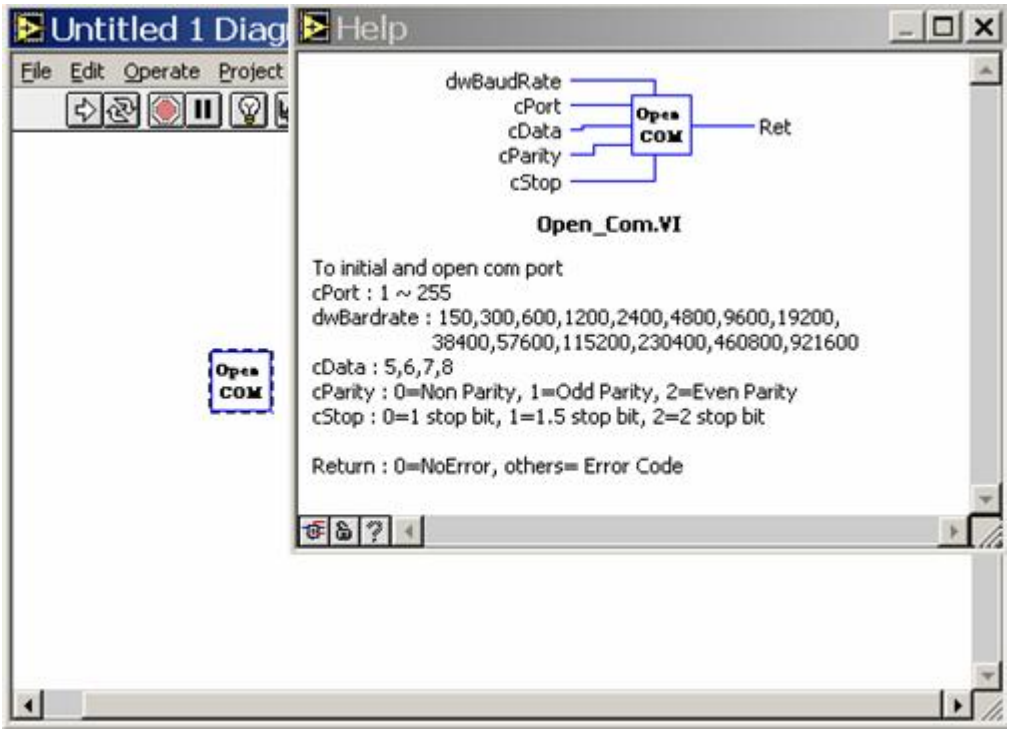
4.2.2 LabVIEW Example (Reading multi-channel analog Input value)

Step 1 : Select the target *.lib file (LabVIEW library file)



Step 2 : Select the desired sub-vi

Step3 : Put the icon of selected sub-vi on Block Diagram, refer the “Help” >> “Show Help” or “**DCON_DLL.pdf”** in step1 for detail.

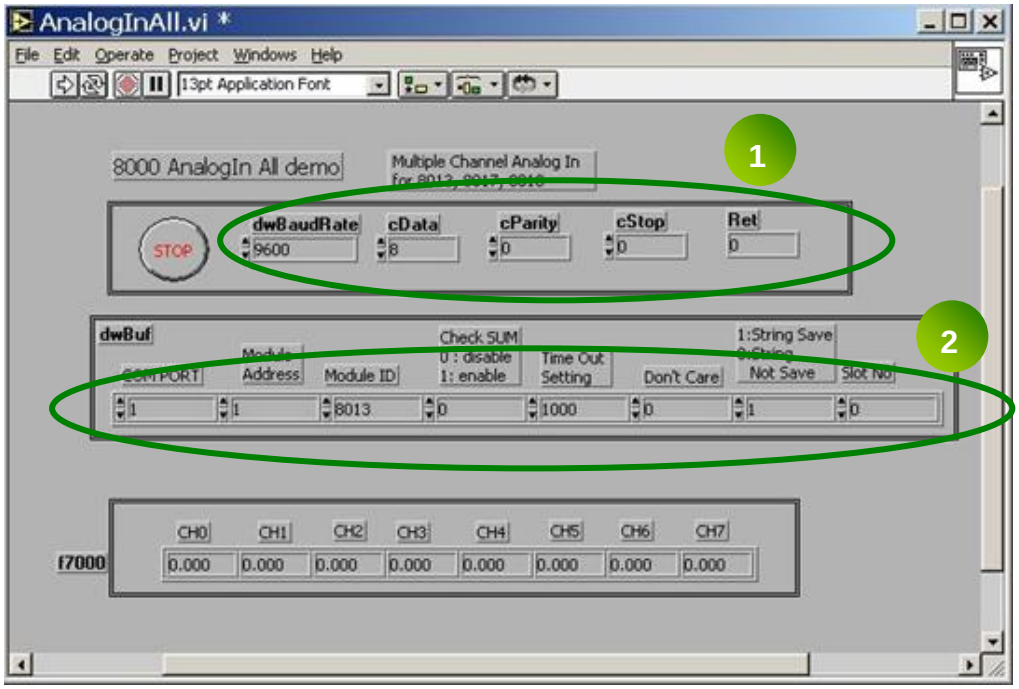


Step 4 : Draw the data flow of sub-vi.

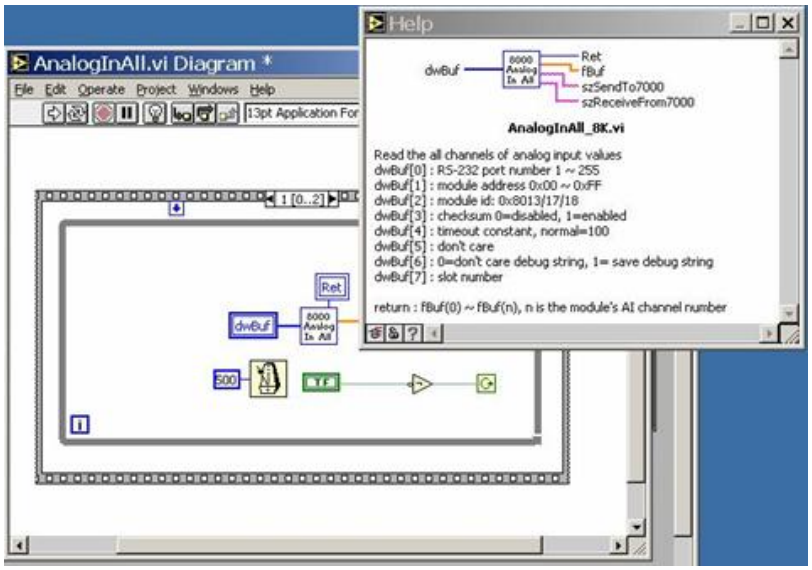
4.2.3 LabVIEW Demo Program (Reading multi-channel analog input value)

Step 1: Select the appropriate demo program (ex. AnalogInAll.vi) by the name according with module's function (ex. I-8017 / AI).

Step2: Set the parameters

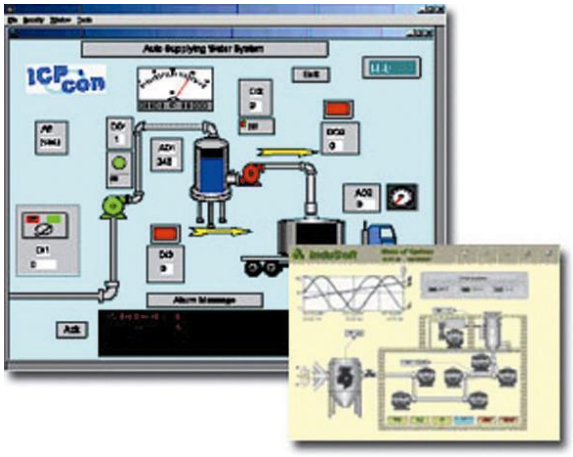


You could also refer the "Help">>"Show Context Help" for getting the simple description of those parameters.



Step3 : Run the Demo.

4.3 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

4.3.1 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

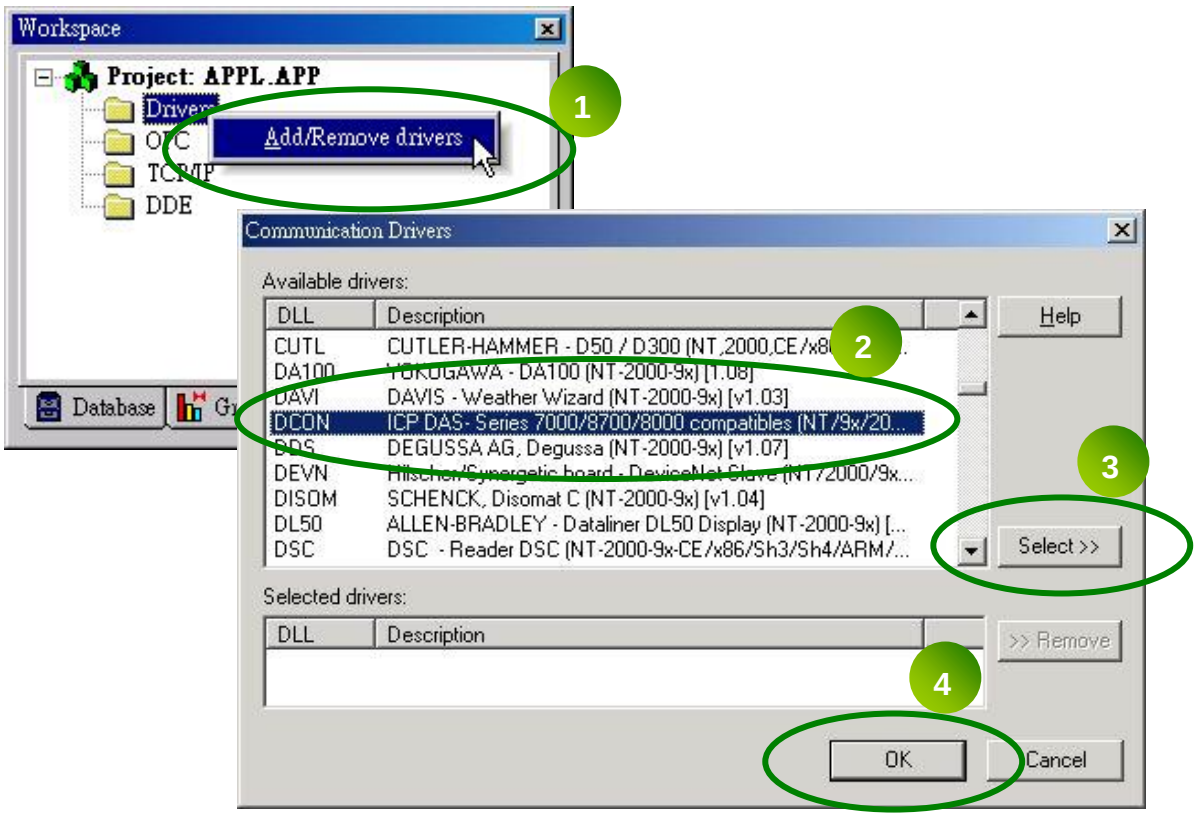
4.3.2 InduSoft Example (Reading an analog input value)

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

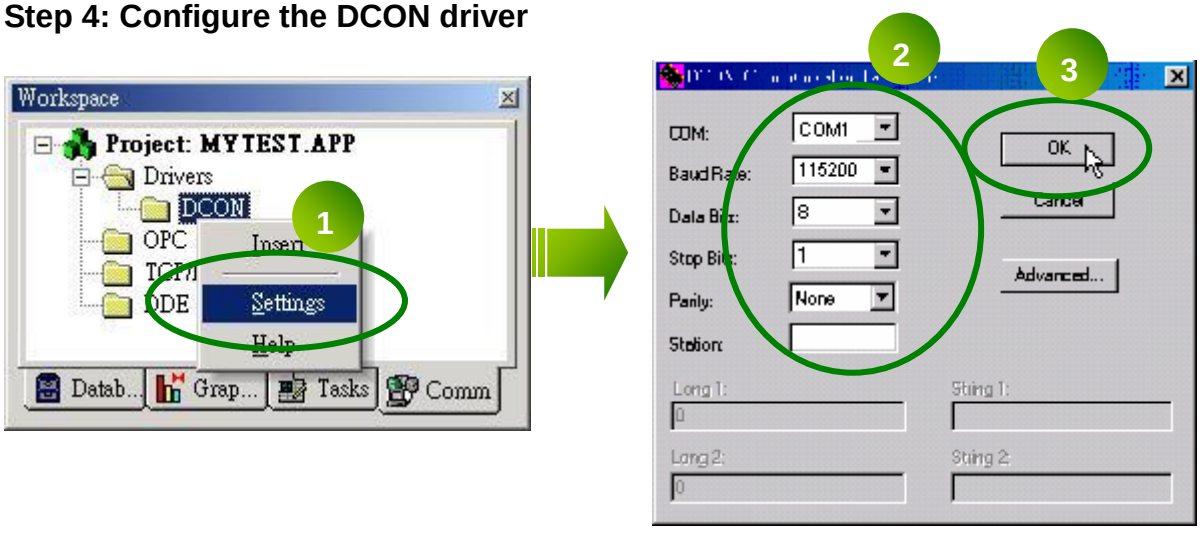
Step 1: Run the DCON Utility to configure the I/O modules

Step 2: Run InduSoft and create a new project

Step 3: Include the DCON driver

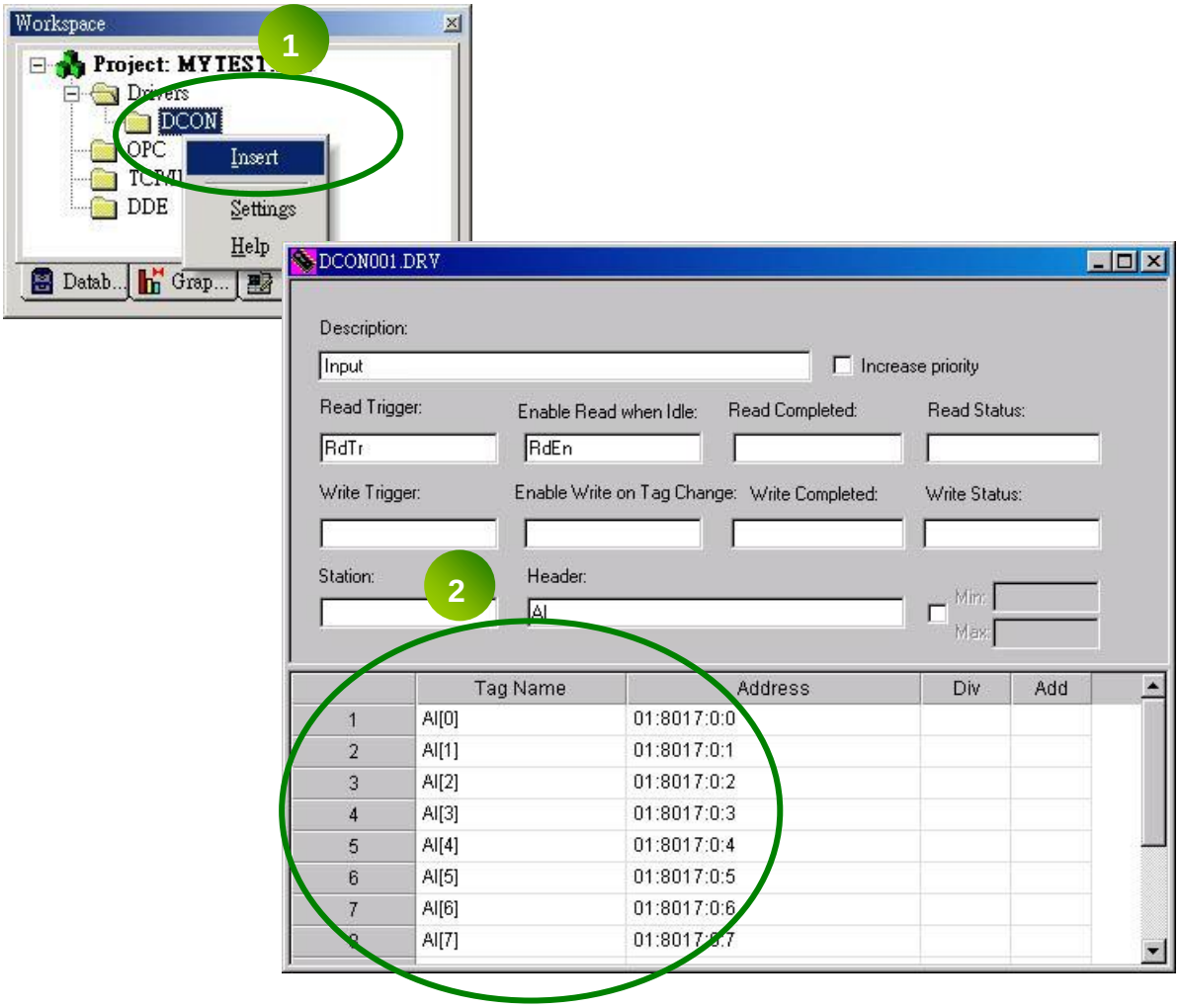


Step 4: Configure the DCON driver

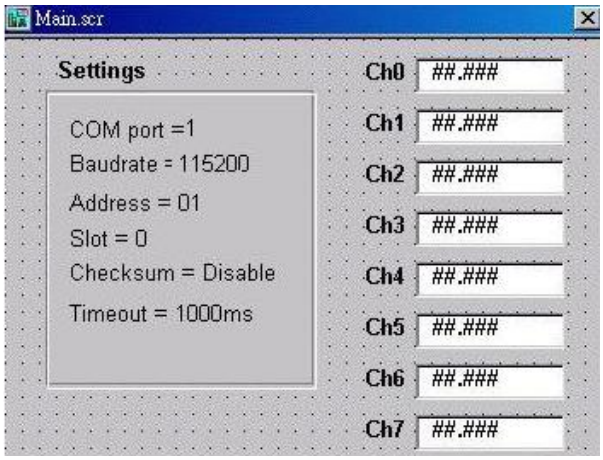


Step 5 : Insert tags to connect to I/O modules

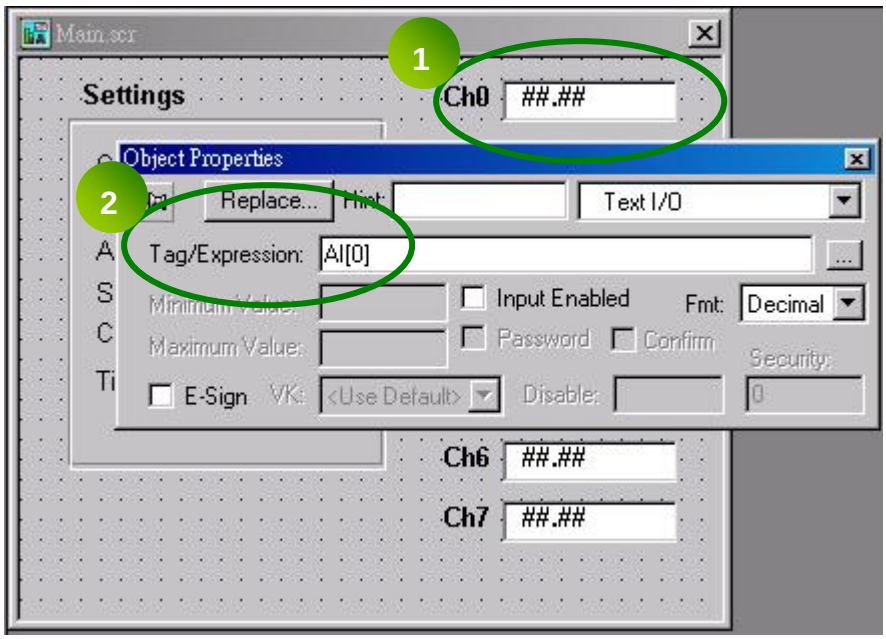
The address format is [Address : Module ID : Slot : Channel]



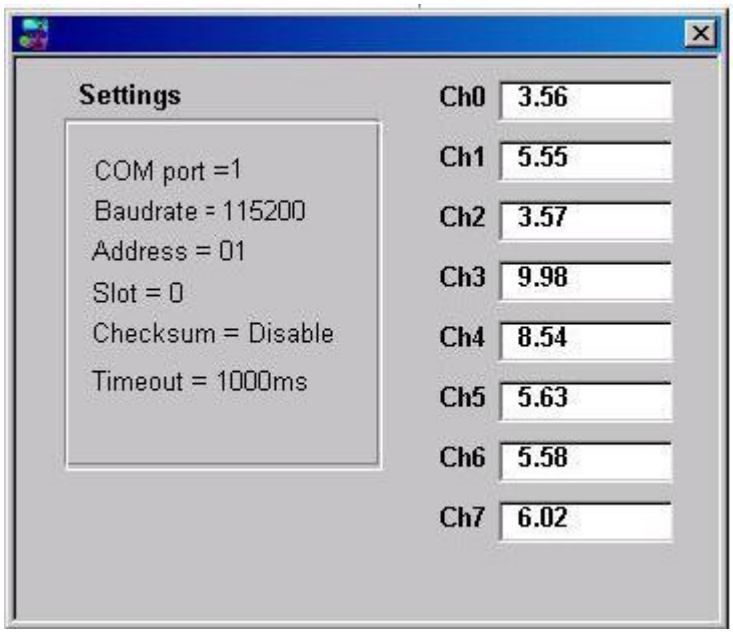
Step 6 : Arrange all the components on the form



Step 7: Double click the text box to assign a tag to it.



Step 8 : Run the project



4.4 NAP OPC Server

NAP OPC Server

OPC Server

Supported Module:

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

Modbus embedded controller

ISaGRAF embedded controller

Supported OS:

Windows 98/NT/2K/XP/CE

File Location::

CD:\Napdos\NapOPCSvr

OPC (OLE for Process Control) is the first standard resulting from the collaboration of a number of leading worldwide automation suppliers working in cooperation with Microsoft. Originally based on Microsoft's OLE COM (component object model) and DCOM (distributed component object model) technologies, the specification defined a standard set of objects, interfaces and methods for use in process control and manufacturing automation applications to facilitate interoperability. The COM/DCOM technologies provided the framework for software products to be developed. There are now hundreds of OPC Data.

4.4.1 Procedure for using the OPC Server

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 OPC Server by executing

CD:\Napdos\NapOPCSvr\NapOPCServer.exe

Note: If there is an older version of Nap OPC Server installed on the PC, It must be uninstalled before installing the new version.

Step 3: Read the manuals describing how to start

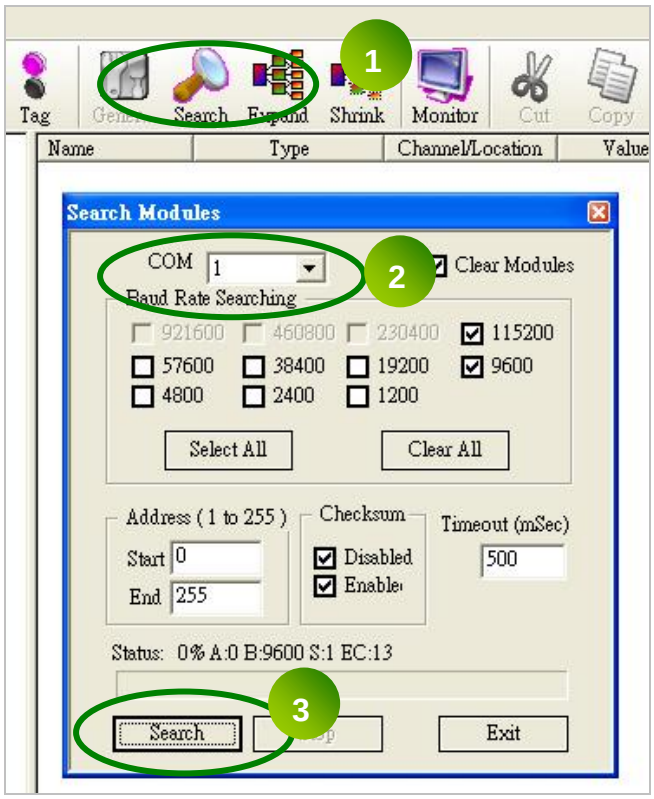
The NapOPCSvr.pdf is the user's manual describing how to use the OPC Server

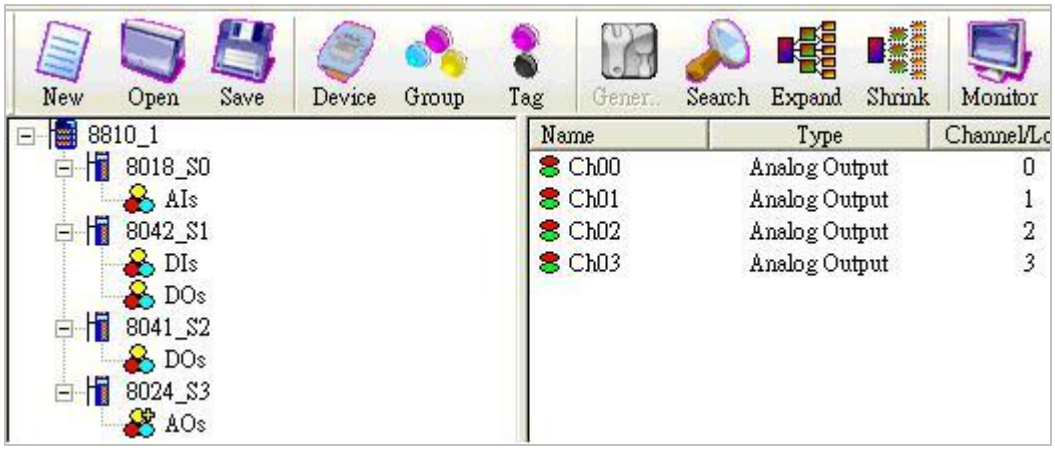
4.4.2 OPC Server Example (Reading an analog input value)

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:

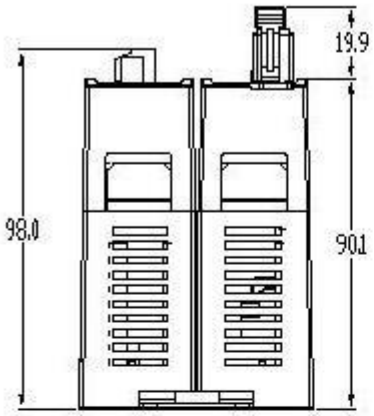
• **LabVIEW**	• **National**	• **WIZCON**
• **iFix**	• **InduSoft**	• **Citect**

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

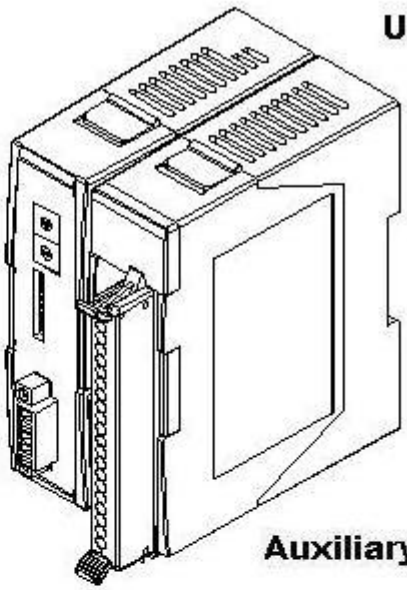
Appendix A : Dimension

A.1 – RU-87P1

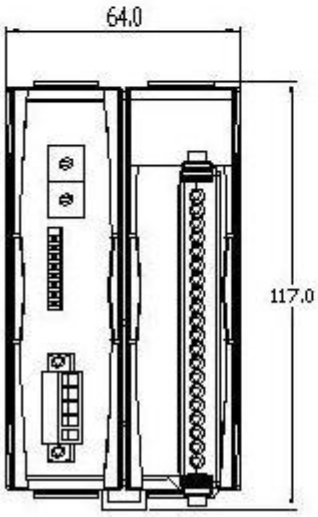
Unit: mm



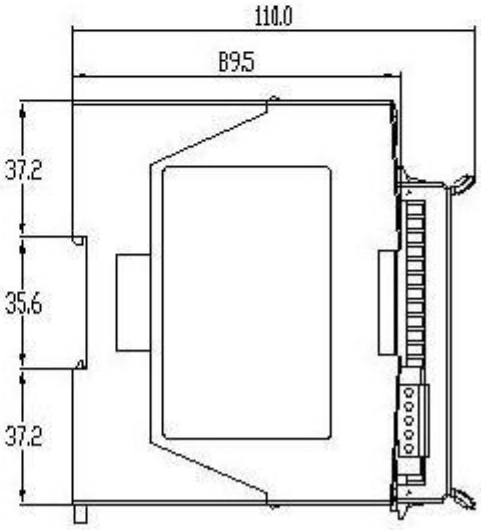
TOP View



Auxiliary View



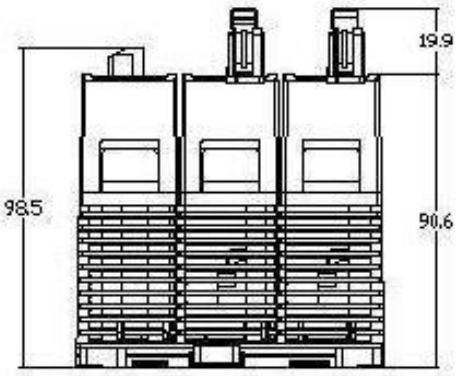
Front View



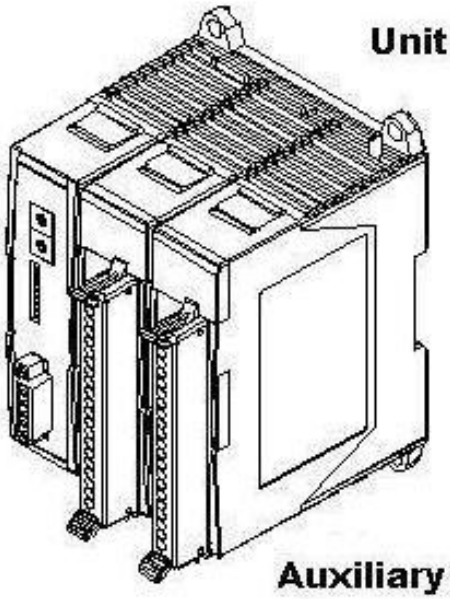
Right Side View

A.2 – RU-87P2

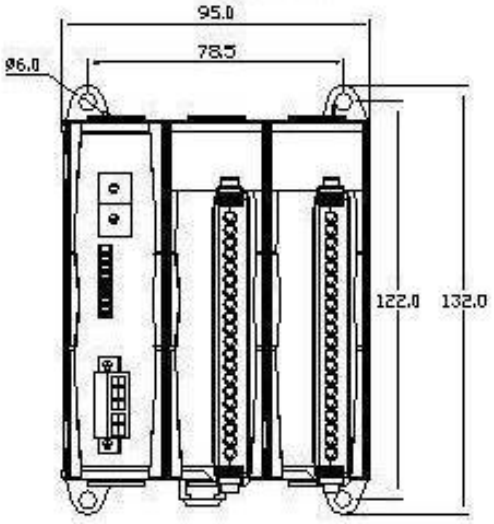
Unit: mm



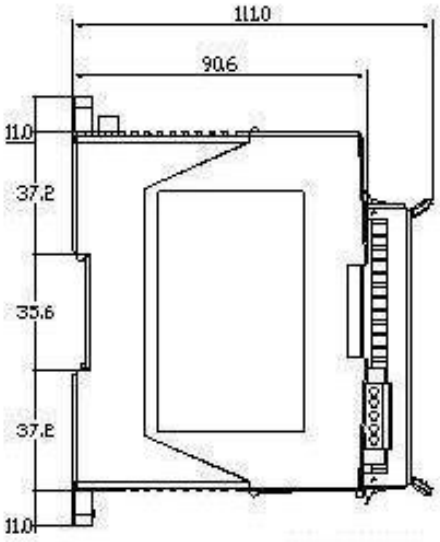
Top View



Auxiliary View

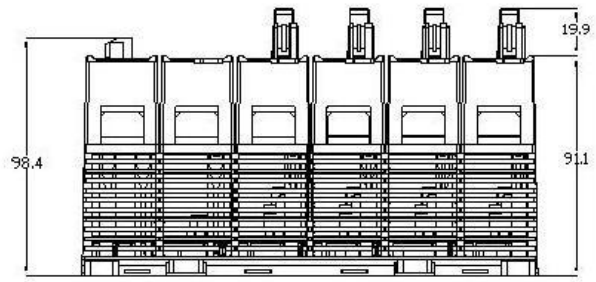


Front View



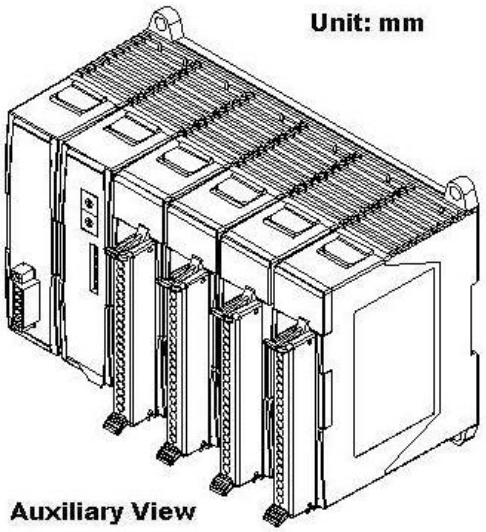
Right Side View

A.3 – RU-87P4

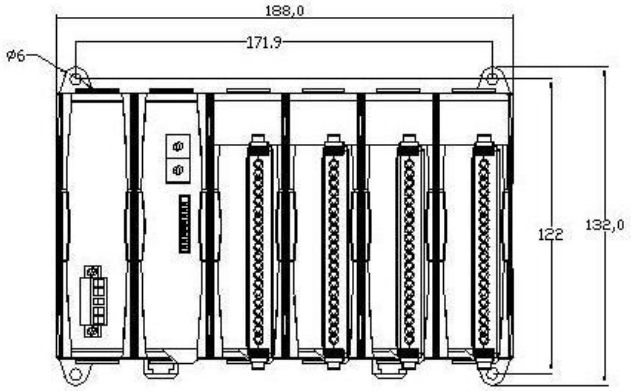


Top View

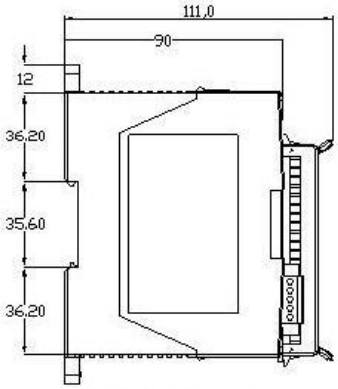
Unit: mm



Auxiliary View



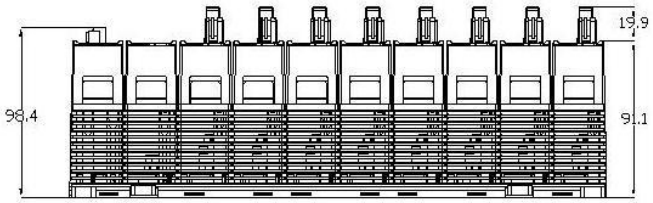
Front View



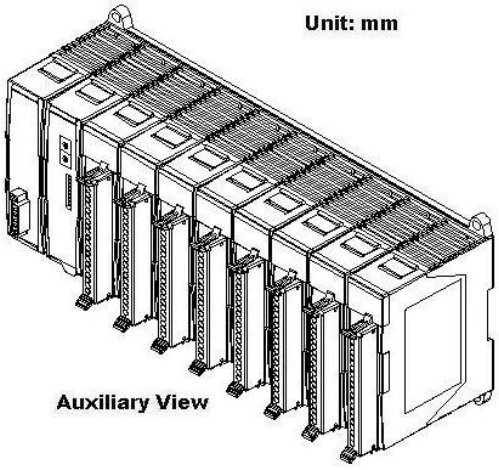
Right Side View

A.4 – RU-87P8

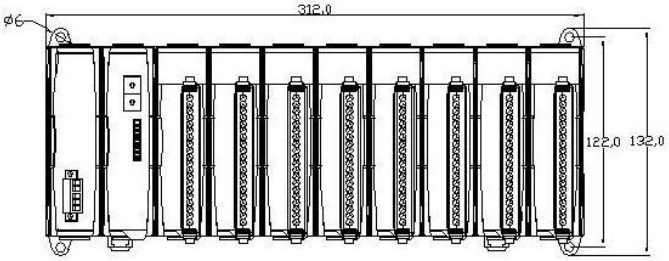
Unit: mm



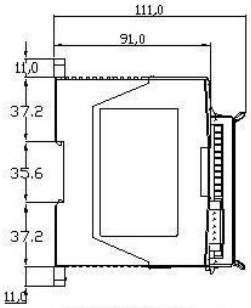
Top View



Auxiliary View



Front View



Right Side View

Appendix B : Compare RU-87Pn with I-87Kn

Note: I-87K I/O module has divides into the high profile (new version) and the low profile (old version) two kinds, only I-87K high profile series I/O modules can support Hot Swap and Auto-Configuration function correctly.

RU-87Pn & I-87Kn I/O unit comparison

Supported	RU-87Pn with Auto Config. Enable	RU-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	√	--	--

Fig. 29：I-87K high/low profile series I/O modules

Please refer to web page :
http://www.icpdas.com/products/PAC/I-8000/8000_IO_modules.htm

Appendix C : Solution for 87K I/O module on the slot

When insert the module on the expansion slot of 87Pn, the same time 87Pn CPU will detect the module name and respond the status of interacting between 87Pn and module. As following diagram, the search result only find out the RU-87P4 and a 87019R which on slot 0, the Status column shows Auto Config. Enable [O,O,X,O]

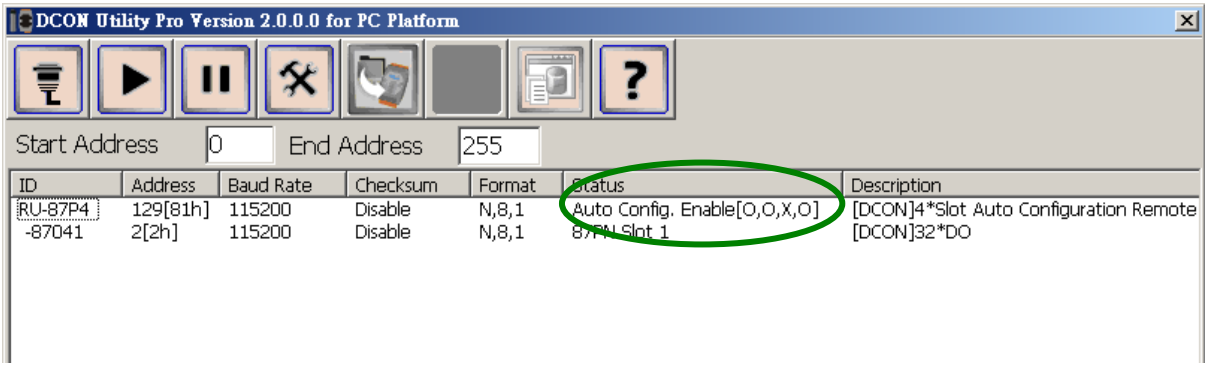


Fig. 30：The search result between 87Pn and modules

Click the name “RU-87P4” entering the operation screen to know the settings of 87Pn and the status detected by 87Pn CPU, the module status code in "Slot Configuration Slot" column means the different error message.

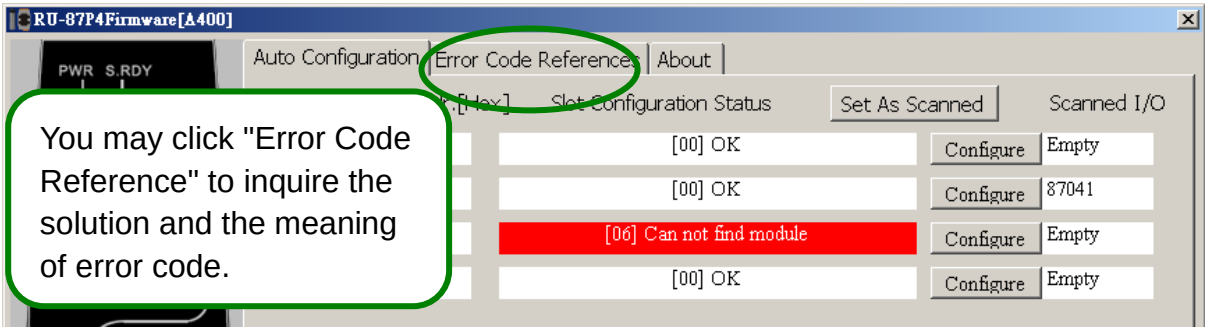


Fig. 31：DCON Utility shows the status of 87Pn expansion slot

As following table, you can accord the error code and LED lamp status to find out the problem solution.

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

Error Code	Slot LED (Red)	Status	Description	Solution
00H	Dark (ok)	OK	OK	None
01H	Flashing (Warning)	Module scanned in Empty Slot	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.
02H	Flashing (Warning)	Commands not comparable	**Configure failure:** 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.	1. Check the I-87K I/O module's firmware. * 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.
03H	Bright (Error)	Configuration Failed	**Configure failure:** Some commands are not supported by this 87K I/O module and this error will be serious for system operation.	1. Check the 87K I/O module firmware 2. Update the 87K I/O module with a new firmware version.
04H	Bright	wrong	**Configure failure:**	1. Run DCON Utility.

	(Error)	**Configuration format**	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.
05H	Bright (Error)	**Read Configuration failed**	**The memory data is failed:** The configured commands are wrong for DCON Protocol.	1. Run DCON Utility. 2. Click the "Write To 87Pn" button to write the settings to 87Pn CPU again.
06H	Bright (Error)	**Can not find module**	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.
07H	Bright (Error)	**Incorrect module name**	**Configure failure:** The module inserted in this slot is not the same as previous configured.	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.
08H	Bright (Error)	**Internal INIT* pin failed**	**Configure failure:** The INIT Pin is failed to connect with the GND and module failed to initialize.	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: RU-87Pn only supports high profile 87K I/O modules.
09H	Bright (Error)	**Module address over 255 (FFh)**	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)

0AH	Bright (Error)	The command count saved to 87Pn is not the same as DCON Utility	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.
0BH	Bright (Error)	Module response failed	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" This function only support at 87Pn firmware A300 or later version.
0CH	Bright (Error)	Module name invalid	This error might be caused by invalid module name format	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 This function only support at 87Pn firmware A300 or later version.

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

Error Code	Slot LED (Red)	Status	Description	Solution
80H	Dark (ok)	Initialize ok	setup success	None

81H	Bright (Error)	**Internal INIT* pin failed**	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.
82H	Bright (Error)	**Module address over 255 (FFh)**	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.

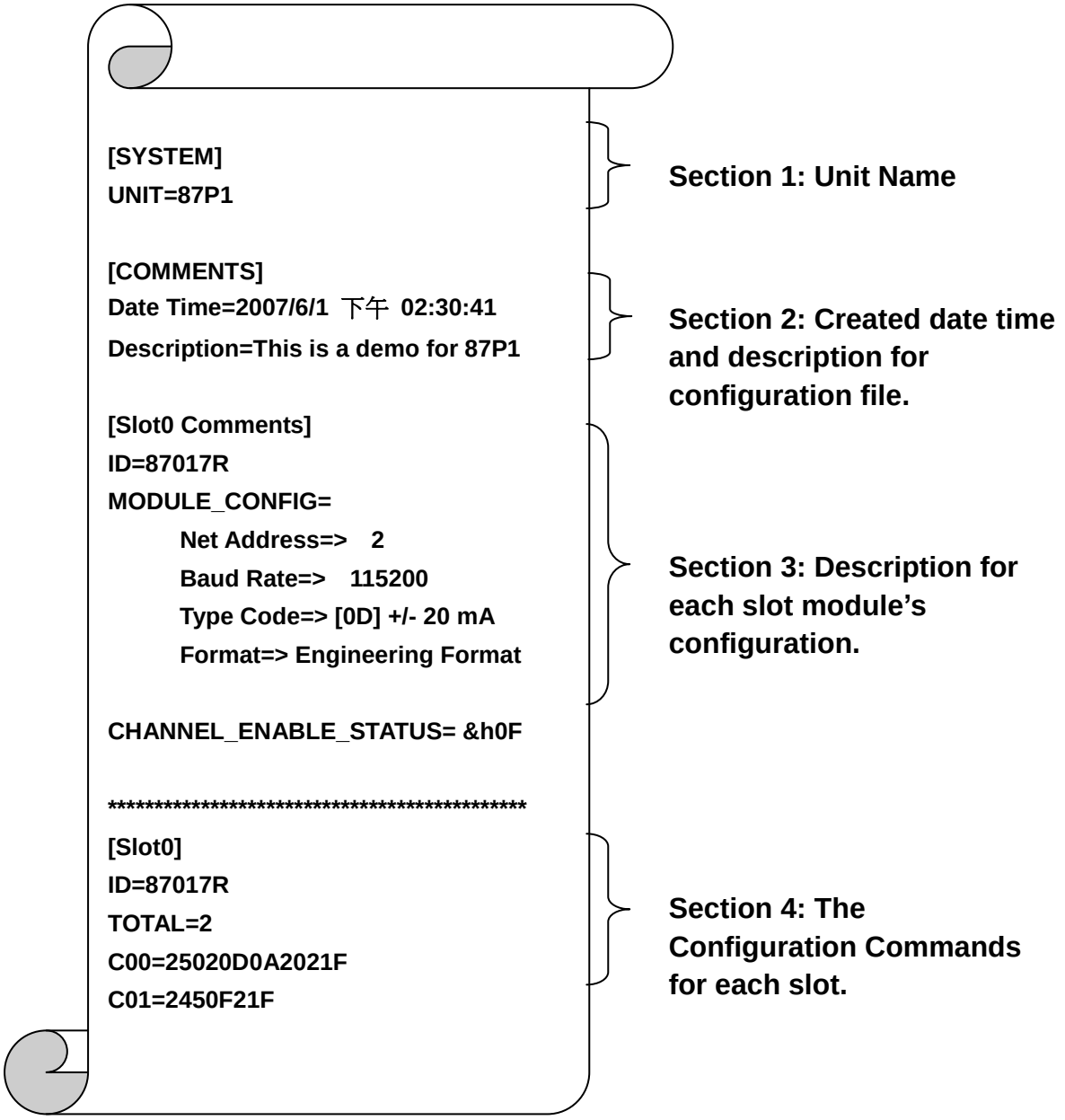
	Auto Config. LED (Green)	**S.RDY LED (Green)**	**Slot Status LED (Red)**
Auto Config. Enable			
No Error	Always ON	Always ON	Always OFF
Warning		Always ON	Flash
Failed		Flash	Always ON
Auto Config. Disable			
No Error	Always OFF	Always ON	Always OFF
Failed		Flash	Always ON

Appendix D : Description For ini Files

While you save the configuration file, the DCON Utility will save as .ini file. The default path of file as below:

C:\ICPDAS\DCON_Utility\for_users

The INI file explains as follows:



Appendix E : 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 RU-87Pn controller has a metallic board attached to the back of the plastic basket as shown in the Figure 36 below. When mounted to the DIN rail, connect the DIN rail to the earth ground because the DIN rail is in contact with the upper frame ground as shown in the Figure 36 below

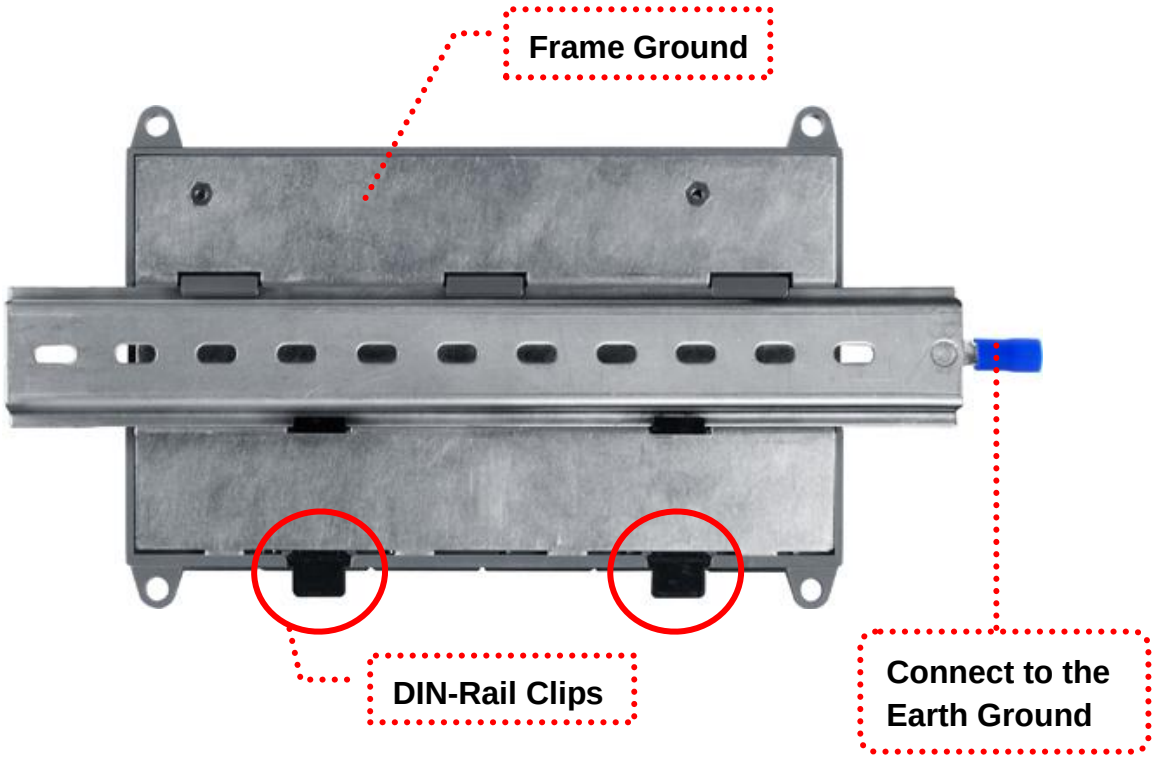


Fig. 32：Frame Ground & Earth Ground

Appendix F : Application of RS-485 Network

The RS-485 length can be up to 4000 ft or 1.2 km over a single set of twisted –pair cables, if the RS-485 network is over 4000 ft or 1.2Km, the RS-485 repeater must be added to extend the RS-485 network.

F.1: Basic RS-485 network

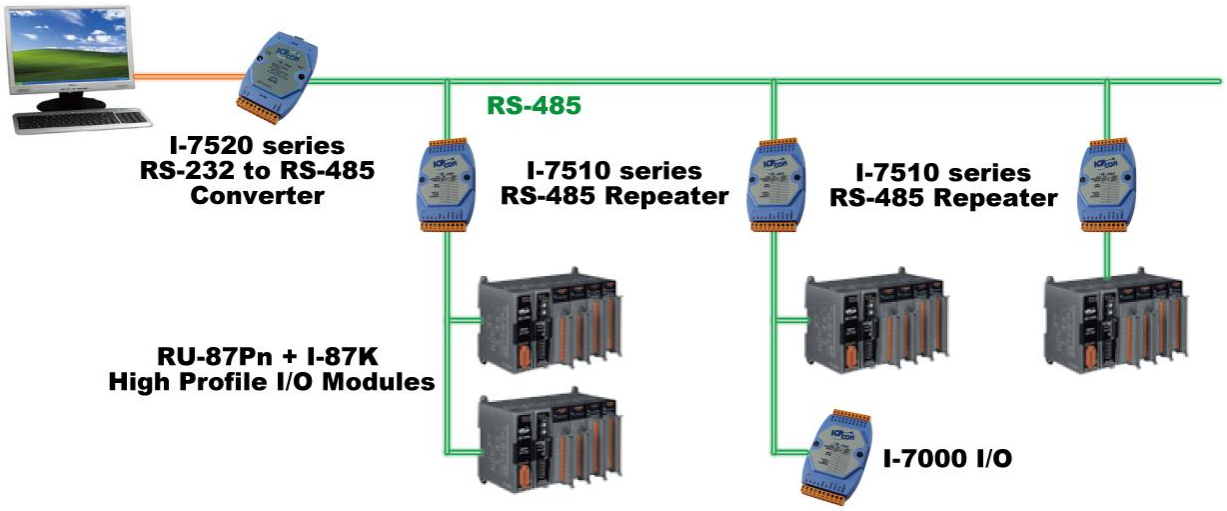
The basic component of the RS-485 network consist of a Master Controller (or using a PC as Host controller), and some RS-485 devices.

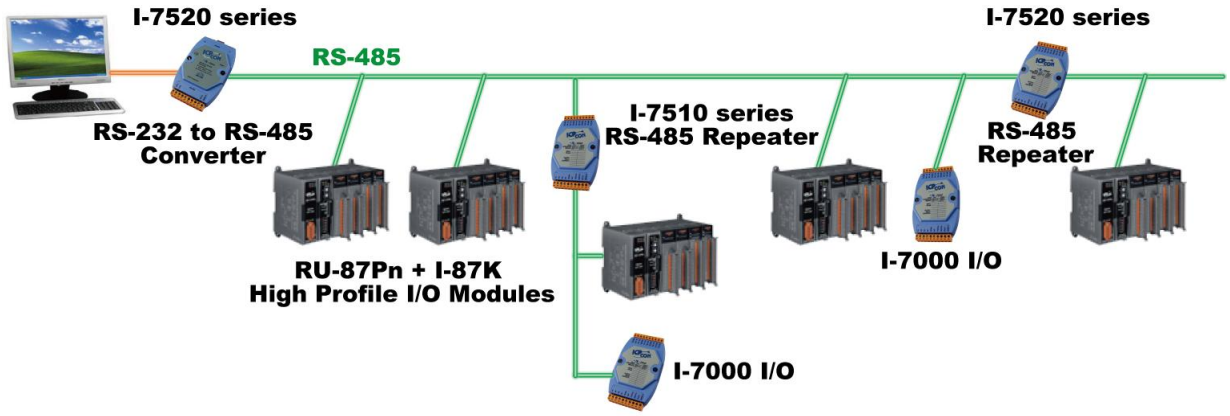
F.2: Daisy chain RS-485 network

All RS-485 devices are wired directly to the main wire, If the network is up to 1.2 Km, it will need a repeater (I-7510) to extend the network.

F.3: Star type RS-485 network

There are branches along the main wire. In this case, it is better to have a repeater to isolate or filter the noise that is made by devices



There is a better choice to use 7513 as a RS-485 hub on start type network

F.4: Random RS-485 network