Getting Started of µPAC-5007/5107/5207/5307

This manual is intended for integrators, programmers, and maintenance personnel who will be installing and maintaining a µPAC-5x07 controller system.

ISaGRAF PAC Series of ICP DAS includes:

µPAC: µPAC-7186EG, µPAC-7186PEG, I-7188EG, I-7188XG, µPAC-5007/5107/5207/5307
iPAC: iP-8447, iP-8847, I-8437-80, I-8837-80, I-8417, I-8817,
WinPAC: WP-8147, WP-8447, WP-8847 (WinCon: W-8347, W-8747)
ViewPAC: VP-25W7, VP-23W7, VP-2117
XPAC: XP-8047-CE6, XP-8347-CE6, XP-8747-CE6

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Reference Guide

ISaGRAF User's Manual (English Manual):

CD-ROM: \napdos\isagraf\8000\english_manu\ "user_manual_i_8xx7.pdf" & "user_manual_i_8xx7_appendix.pdf" or
http://www.icpdas.com/products/PAC/i-8000/getting_started_manual.htm

ISaGRAF 進階使用手冊 (Chinese Manual):

CD-ROM: \napdos\isagraf\8000\chinese_manu\ "chinese_user_manual_i_8xx7.pdf" & "chinese_user_manual_i_8xx7_appendix.pdf" or
http://www.icpdas.com/products/PAC/i-8000/getting_started_manual.htm

Hardware Manual:

µPAC-5x07: CD\NAPDOS\uPAC-5000\document\ or
ftp://ftp.icpdas.com.tw/pub/cd/8000cd/napdos/upac-5000/document/

ISaGRAF Resource on the Internet:

Newly updated ISaGRAF IO libraries, drivers, demo, and manuals can be found at
http://www.icpdas.com/products/PAC/i-8000/isagraf.htm

Industrial Ethernet Switch: NS-205 / NS-208 / NS-205PSE

Best choice for Industrial Ethernet Communication.
http://www.icpdas.com/products/Switch/switch_list.htm

Model:NS-205

Model:NS-208

Model: NS-205PSE

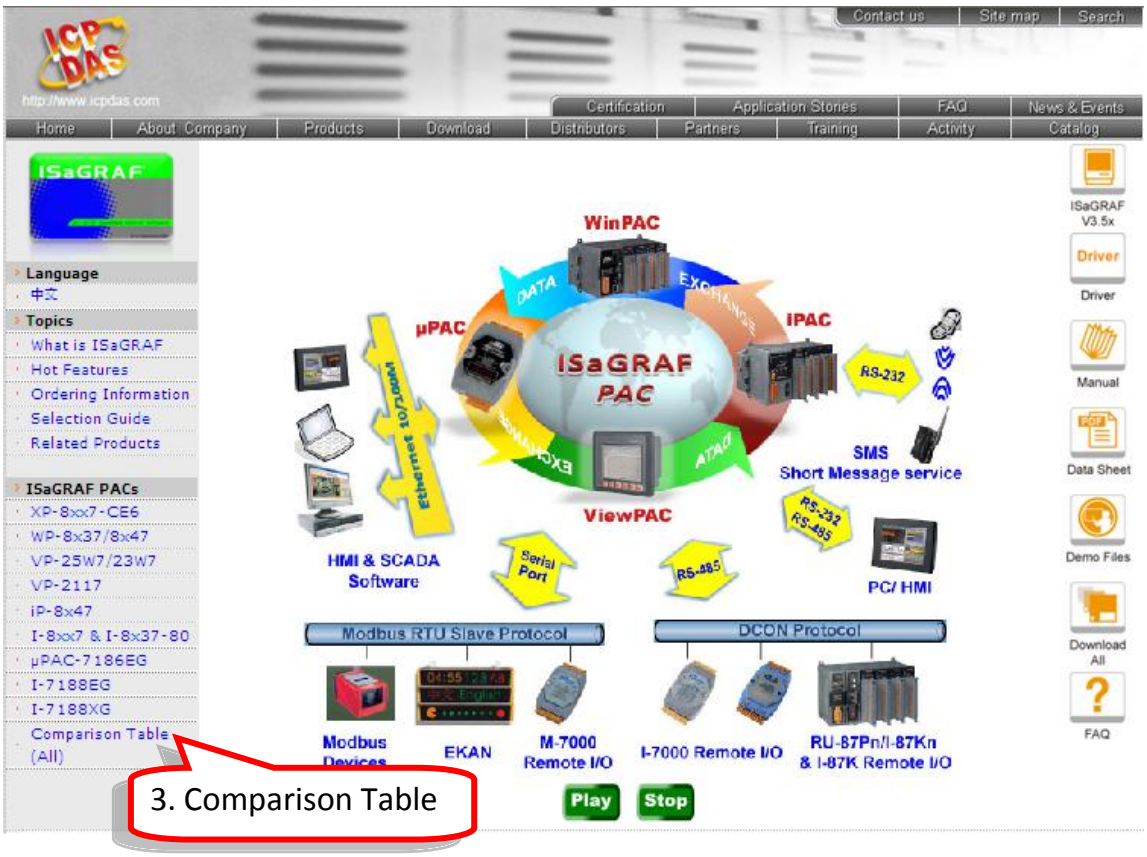
Note: The NS-205PSE is a PoE Switch.

FAQ:

Please refer to our website www.icpdas.com > FAQ > Software > ISaGRAF for Frequently Asked Question, or click directly on web http://www.icpdas.com/faq/isagraf.htm

Performance Comparison Table of ISaGRAF PACs

Please click on the link ISaGRAF Comparison Table or follow the below steps:



Specifications: µPAC-5x07(D)

Models		µPAC-5007(D)	µPAC-5107(D)	µPAC-5207(D)	µPAC-5307(D)
System Software					
OS		MiniOS7			
Development Software					
ISaGRAF Software	ISaGRAF Ver. 3	IEC61131-3 standard			
	Languages	LD, ST, FBD, SFC, IL & FC			
	Max. Code Size	64 KB			
	Scan Time	2 ~ 25 ms for normal program 10 ~ 125 ms (or more) for complex or large program			
CPU Module					
CPU		**80186** or compatible **(16-bit and 80 MHz)**			
SRAM		**768 KB**			
microSD Expansion		Yes (but the ISaGRAF doesn't support).			
FLASH		512 KB			
		100,000 erase/write cycles			
Battery Backup SRAM		512 KB			
		Data Retention: 5 years.			
EEPROM		16 KB			
		1,000,000 erase/write cycles ; Data Retention: 40 years.			
NVRAM		31 bytes			
		Battery backup, data valid up to 5 years.			
RTC (Real Time Clock)		Provide second, minute, hour, date, day of week, month, year			
64-bit Hardware Serial Number		Yes, for Software Copy Protection			
Watchdog Timer		Yes (0.8 second)			
Communication Ports					
Ethernet		RJ-45 x 1, 10/100 Base-TX, Program downloads port. (Auto-negotiating, Auto MDI/MDI-X, LED indicator)			
COM1		RS-232: TxD, RxD, RTS, CTS, GND, Non-isolated. Baudrate: Max. 115200 bps, Program downloads port.			
COM2		RS-485: D2+, D2-, Non-isolated, self-tuner ASIC inside. Baudrate: Max. 115200 bps.			
LED Indicator					
Programmable LED		2 (for User-Defined)			
LED Display		5-digit 7-segment LED display for (D) versions			
Hardware Expansion					
I/O Expansion Bus		Yes (for one XW-board).			

GPS	
* For µPAC-5**1**07(D)/5**3**07(D)	
Channels	16 channels all-in-view tracking
Sensitivity	159 dBm
Acquisition Rate	Cold start: 42 sec.; warm start: 35 sec.; reacquisition rate: 0.1 sec.
Accuracy	Position: 25 m CEP (S/A off); Velocity: 0.1 sec. (S/A off); Time: ±1 ms
Protocol	NMEA
GSM/GPRS	
* For µPAC-5**2**07(D)/5**3**07(D)	
BandC	850/900/1800/1900 MHz
GPRS Multi-slot	Class 10/8
GPRS Mobile Station	Class B
GPRS Class 10	Max. 85.6 kbps
CSD	Up to 14.4 kbps
Compliant to GSM phase 2/2+	Class 4 (2 W @ 850/900 MHz); Class 1 (1W @ 1800/1900 MHz)
Coding Schemes	CS 1, CS 2, CS 3, CS 4
SMS	Text and PDU mode
Mechanical	
Dimensions (W x L x H)	91 mm x 123 mm x 52 mm
Installation	DIN-Rail
Environmental	
Operating Temperature	-25 ~ +75 °C
Storage Temperature	-30 ~ +80 °C
Ambient Relative Humidity	10 ~ 90% RH (non-condensing)
Power	
Input Range	+12 ~ +48 V_{DC}
Redundant Power Inputs	Yes
Protection	Power reverse polarity protection
Frame Ground	Yes (for ESD Protection)
Power Consumption	2 W; 2.5 W for (D) version
Protocols (some protocols need optional devices)	
NET ID	User-assigned by software, 1 ~ 255

Modbus RTU/ASCII Master Protocol	**Max. 2 COM Ports**: COM1, COM2 and COM3 (*). (To connect to other Modbus Slave devices) Max. Modbus_xxx Function Block amount for 2 ports: 128.
Modbus RTU Slave Protocol	**Max. 2 COM Ports**, COM1 and one of (COM2, COM3) (*). For connecting ISaGRAF, PC/HMI/OPC Server & MMI panels.
Modbus TCP/IP Protocol	**Max. 6 connections**, Ethernet ports support Modbus TCP/IP Slave Protocol for connecting ISaGRAF & PC/HMI.
Remote I/O	One of COM2 or COM3 (RS-485) (*) supports I-7000 I/O modules & (I-87Kn or RU-87Pn + I-87K High Profile I/O boards) as Remote I/O. Max. **64** I/O modules for one PAC.
Fbus	Built-in COM2 Port to exchange data between ICP DAS's ISaGRAF PACs.
Ebus	To exchange data between ICP DAS's ISaGRAF Ethernet PACs via Ethernet port.
Send Email	Actively or passively sending E-mail via Ethernet port through internet. Max.10 receivers for each sending and can send E-mail with an attached file. (Max. file size is about 488 KB)
SMS: Short Message Service	One of COM1 or COM3 (RS-232) (*) can link to a GSM modem to support SMS. User can request data/control the controller by cellular phone. The controller can also send data & alarms to user's cellular phone. **Optional GSM modem**: GTM-201-RS232 (GSM/GPRS 850/900/1800/1900) Note: µPAC-5207, 5307 has built-in GPRS, no external GSM/GPRS modem required.
Redundancy Solution	Two PACs plug with **XW107** in slot0. One is Master, one is Slave. Master handles all inputs & outputs at run time. If Master is damaged (or power off), Slave will take over the control of Bus7000b. If Master is alive from damaged (or power up again), it takes the control of Bus7000b again. The change over time is about 5 seconds. Control data is exchanging via Ebus (if using a cross cable, no require any Ethernet Switch). All I/O should be RS-485 I/O except the status I/O in the slot 0: XW107.
CAN/CANopen	Use COM1 or COM3 ~ COM8 (*) to connect one I-7530 (RS-232 to CAN converter) to support CAN/CANopen devices and sensors. One PAC supports max. **3** RS-232 ports to connect max. **3 I-7530** modules. Please refer to: www.icpdas.com > FAQ > Software > ISaGRAF Ver.3 (English) - 086
Optional I/O Functions	
PWM Output	
Pulse Width Modulation Output	All XW-board series support PWM output. Max. 8 channels for one controller. 500 Hz max. for Off = 1 & On = 1 ms Output square wave: Off: 1 ~ 32767 ms, On: 1 ~ 32767 ms
Counters	
Parallel DI Counter	All XW-board series support DI counter. Max. 8 channels for one controller. Counter value: 32-bit 500 Hz max. Min. ON & OFF width must > 1 ms
Remote DI Counter	All remote I-7000 & I-87K DI modules support counters. 100 Hz max. value: 0 ~ 65535
Remote High Speed Counter	Optional I-87082: 100 kHz max. ,32-bit
*Note: COM3 ~ COM8 are resided at the optional XW-board series if it is plugged inside the µPAC-5x07.	

Chapter 1. Typical Application

1.1 µPAC-5007/5107/5207/5307 Comparison Table

Model	CPU	Flash	SRAM	Memory Expansion	Ethernet	GPS	GPRS	RS-232/RS-485
µPAC-5007	80186 80M	512 KB	768 KB	512 KB Battery-backup SRAM	10/100 Base TX	-	-	1/1
µPAC-5107						Yes	-	
µPAC-5207						-	Yes	
µPAC-5307						Yes	Yes	

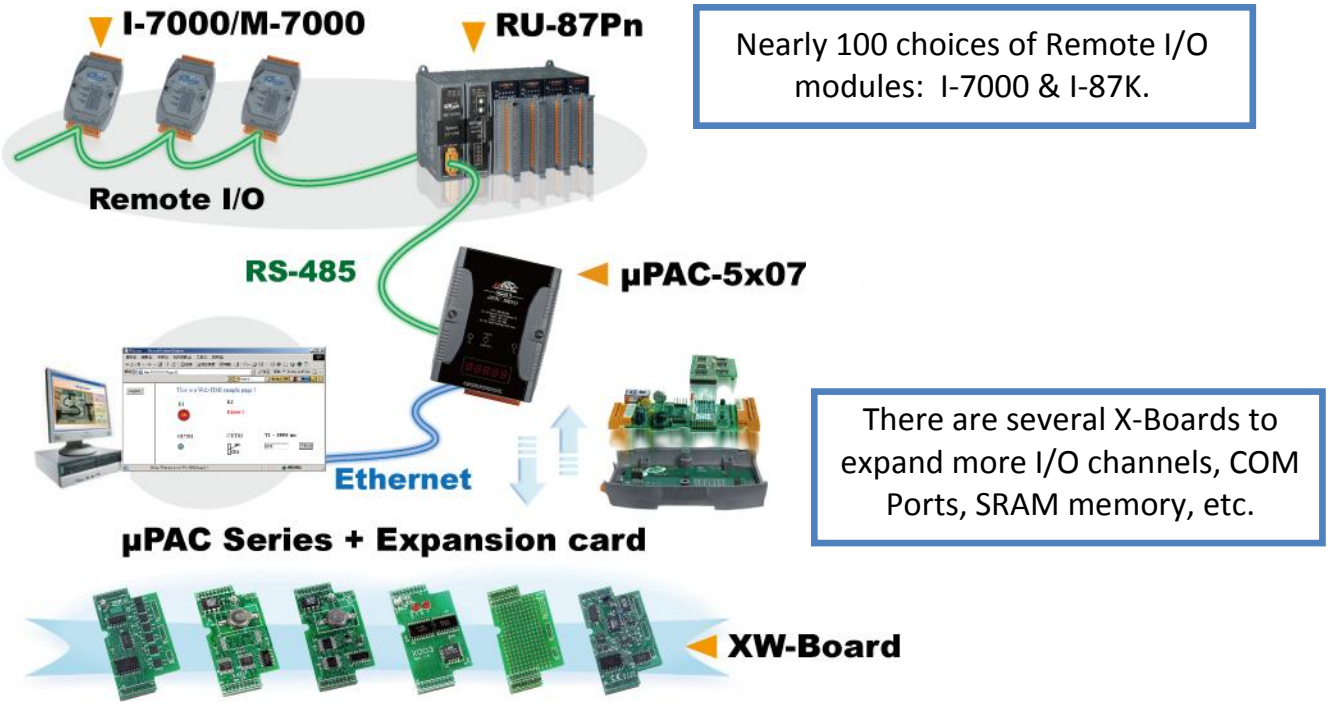
★ **All of the following applications are applicable to µPAC-5x07(D) PAC. The µPAC-5007D is used in following diagram.**

1.2 Local & Remote I/O Application

Advantage of using RU-87P4/P8 + I-87K I/O modules:

- Hot-Swap
- Auto-Configuration at Run Time
- Plug & Play at Run Time

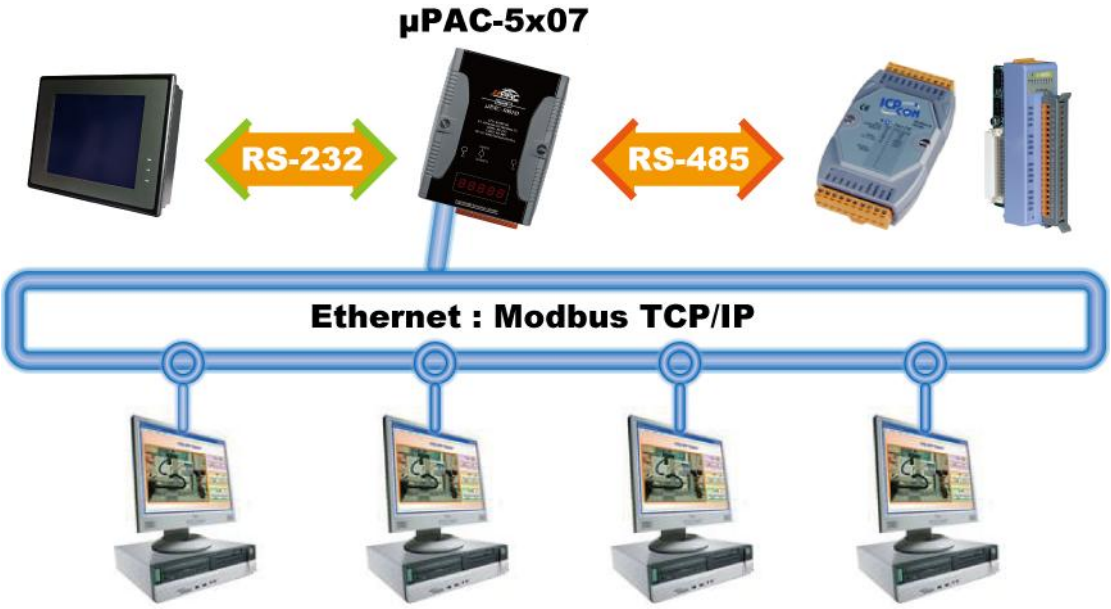
NOTE: RU-87Pn support only High profile I-87K I/O module.



Nearly 100 choices of Remote I/O modules: I-7000 & I-87K.

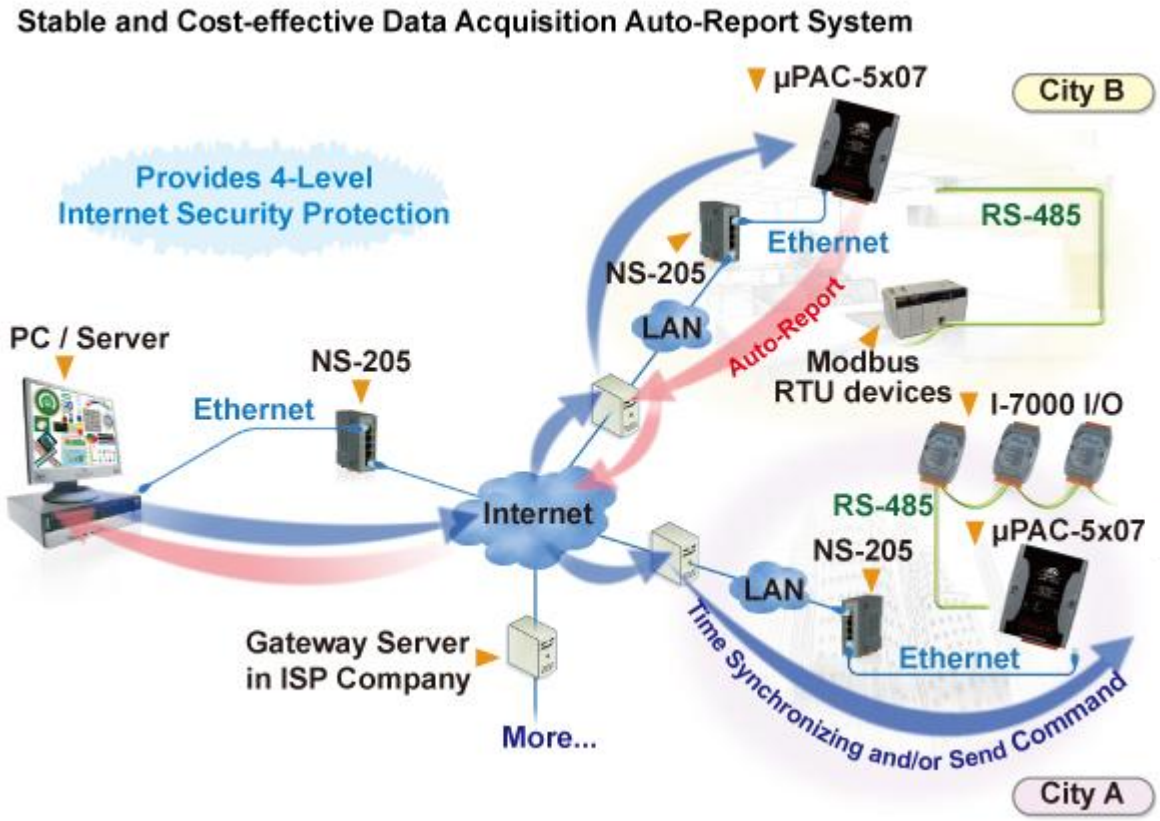
There are several X-Boards to expand more I/O channels, COM Ports, SRAM memory, etc.

1.3 Multi-HMI Application



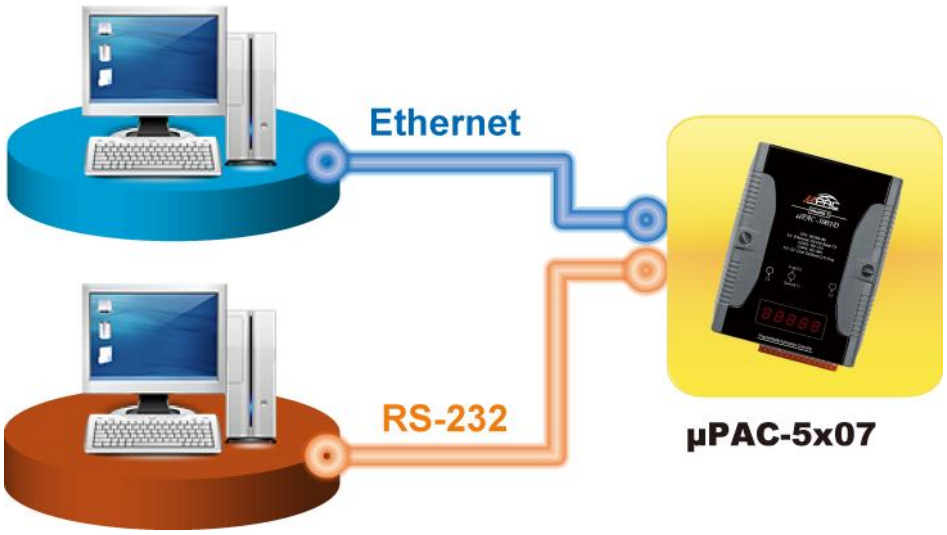
1.4 Active Data Acquisition & Auto-Report System

- µPAC-5x07 can use UDP/IP Client protocol to auto-report acquisition data & control data to local or to remote internet PC/Server.
- Advantage: Each PAC in the different location doesn't require a fixed Internet IP.
- Please refer to www.icpdas.com > FAQ > Software > ISaGRAF Ver.3 (English) - 065



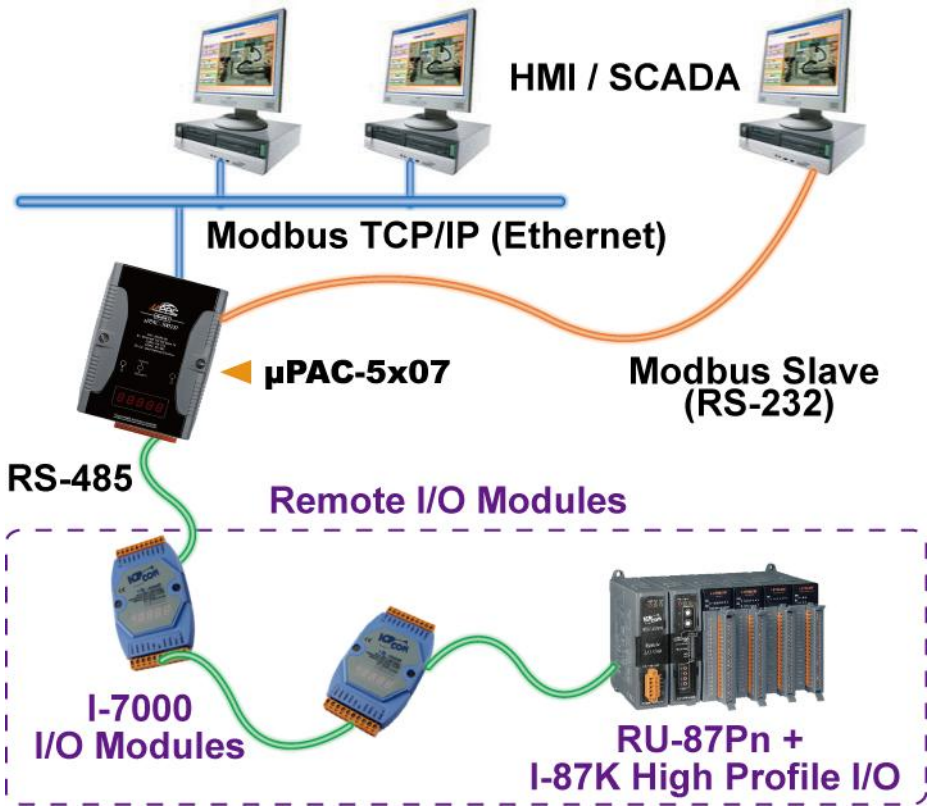
1.5 Data Logger

- ICP DAS provides a freeware “UDLoader.exe” to load the data stored in battery-backup SRAM via RS-232 or Ethernet port.



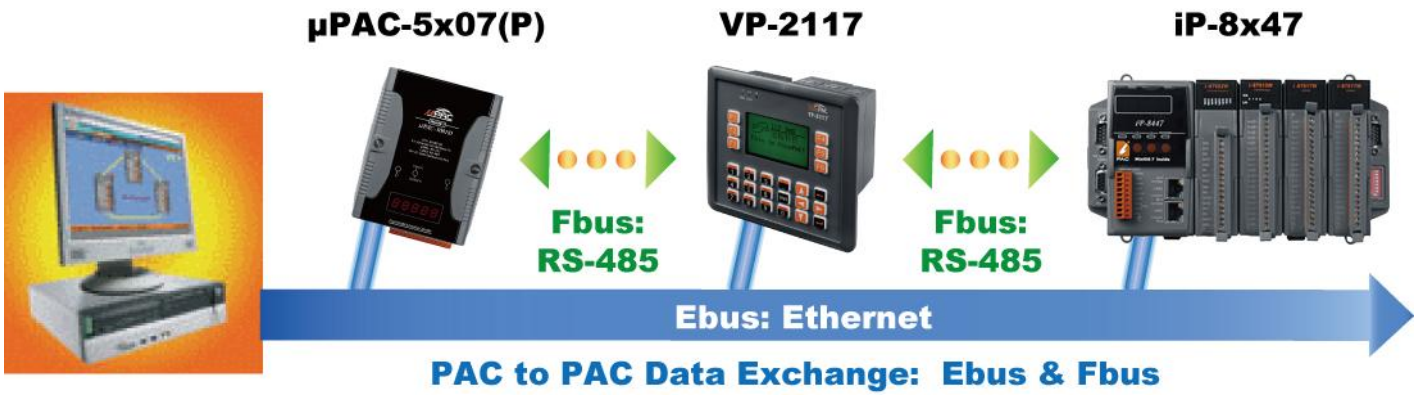
1.6 Modbus Converter of Remote I/O Modules

- µPAC-5x07 can be a Modbus RTU Serial and TCP/IP converter of I-7000 & I-87K series I/O modules.



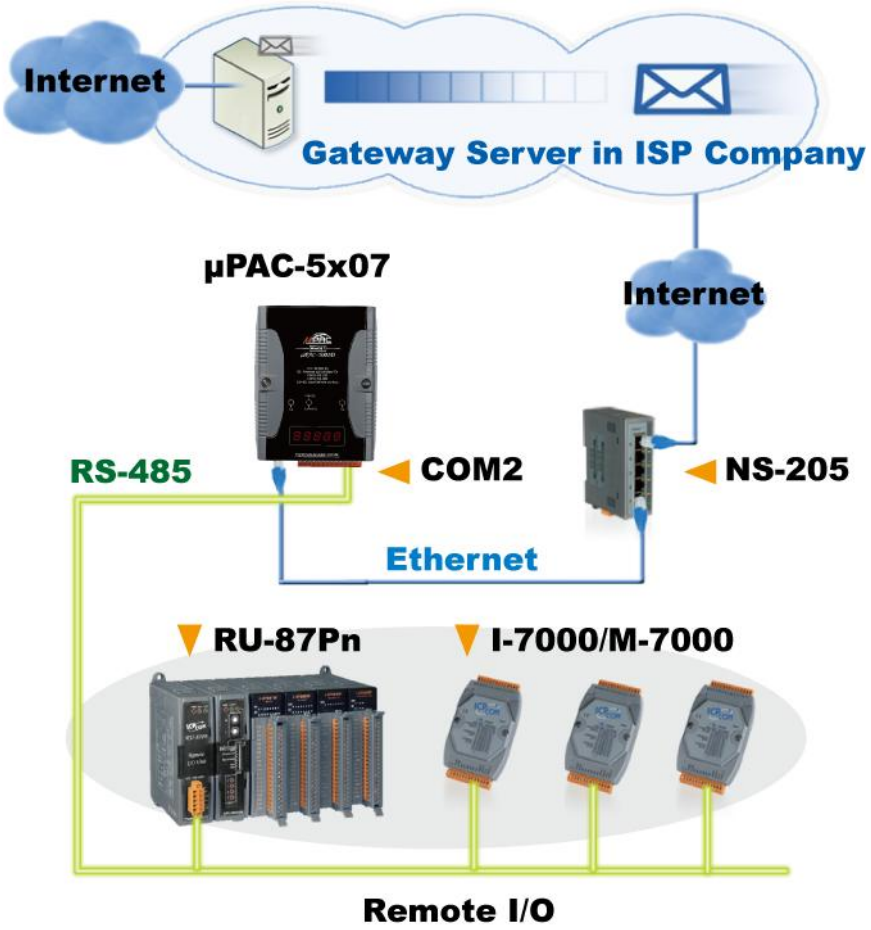
1.7 Data Exchange through Ethernet or RS-485

- Each µPAC-5x07 can send or receive data to each other via the Ebus (Ethernet) or Fbus (RS-485) communication mechanism on the same network.



1.8 Send Email with an Attached File

- µPAC-5x07 can send Email with one attached file via Ethernet Port. The maximum file size is about 488K bytes and one Email can send to 10 receivers at one sending.

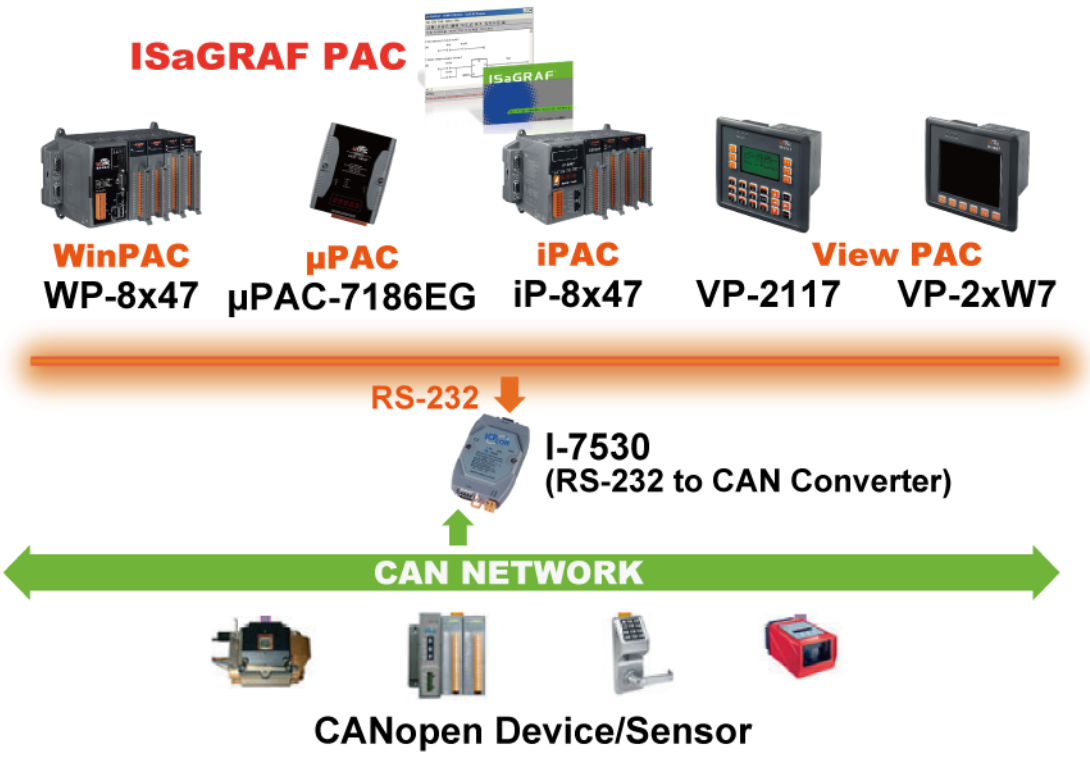


1.9 SMS: Short Message Service

- Short message can be sent in multiple language format (such as Chinese, English... others)
- Please refer to www.icpdas.com > FAQ > Software > ISaGRAF Ver.3 (English) - 111
- µPAC-5207/5307 has built-in GPRS, no external GSM/GPRS modem required.

1.10 Integrate with CAN/CANopen Devices and Sensors

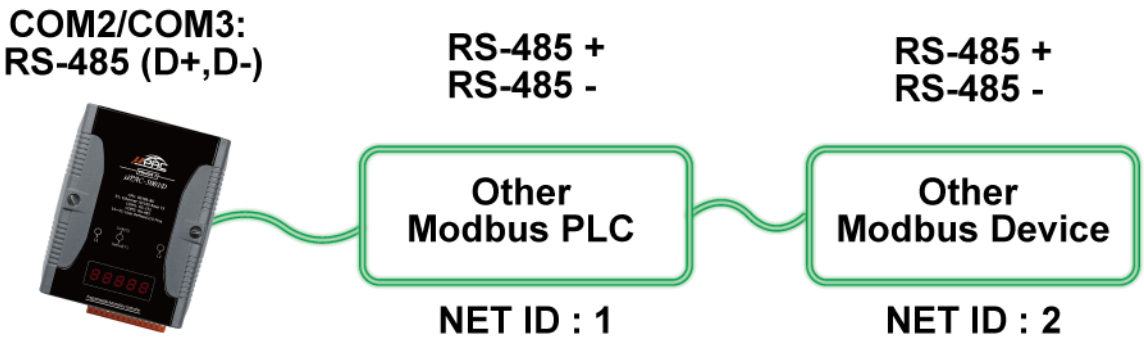
- µPAC-5x07 supports max. 3 I-7530 (RS-232 to CAN) converters.
- Please refer to www.icpdas.com > FAQ > Software > ISaGRAF Ver.3 (English) - 86



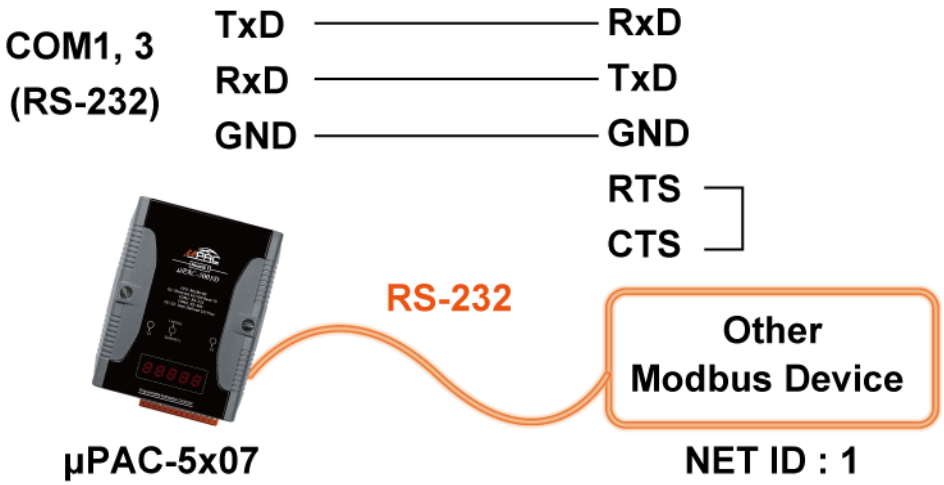
1.11 Connecting other Device via Modbus Master

- µPAC-5x07 supports up to 2 COM ports of Modbus RTU/ASCII Master protocol to integrate with other Modbus devices.

RS-485:



RS-232:



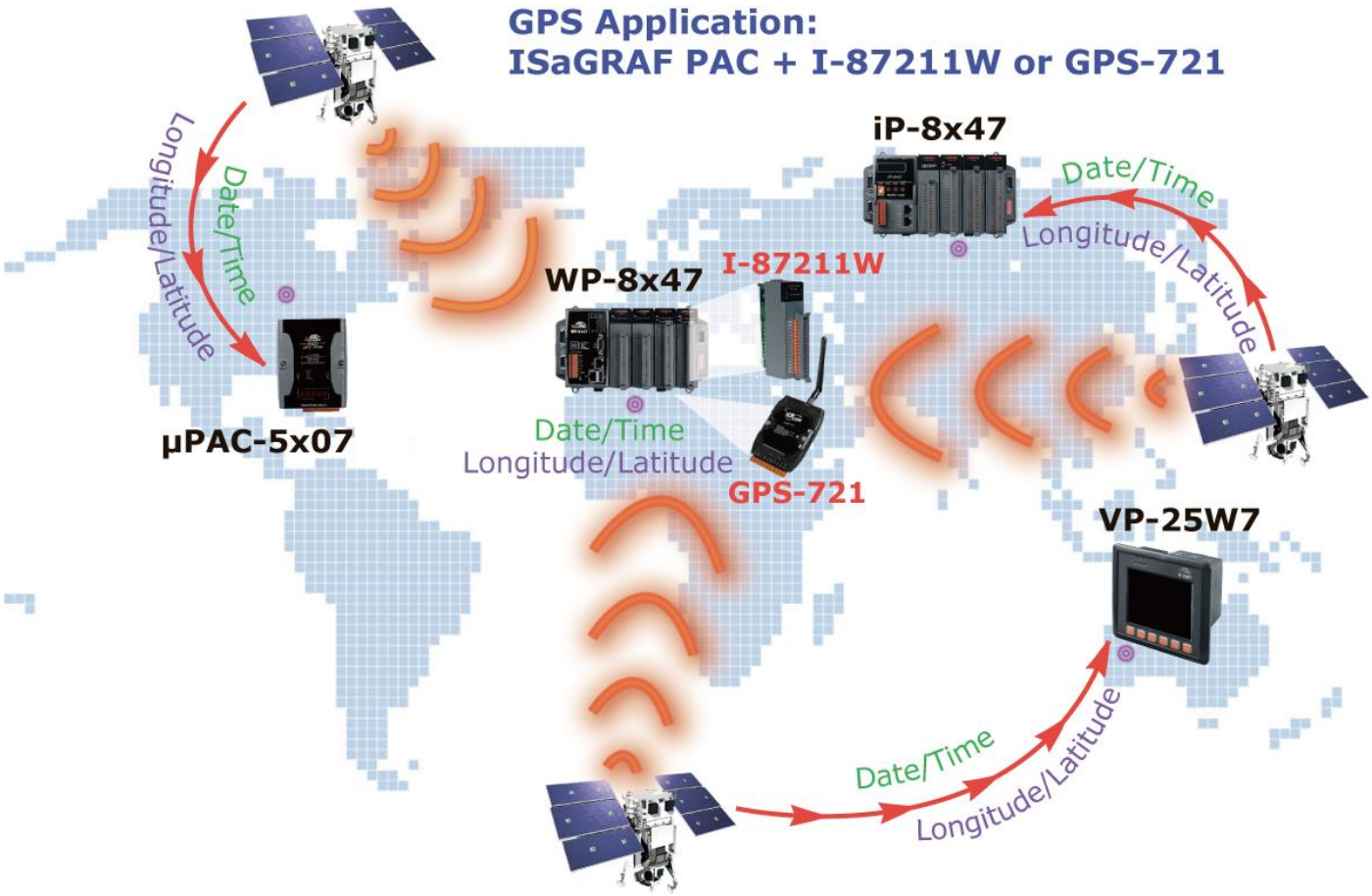
Note: COM3 ~ COM8 is optional from XW-Board (XW5xx), RS-232/RS-422/RS-485 expansion board.

µPAC-5x07 can plug one I/O Expansion board inside the main box. To install it, user has to loosen the screw, remove the shell of µPAC-5x07 and then plug in the XW-board. Please refer to below web for new products:
http://www.icpdas.com.tw/product/solutions/pac/upac/xw-board_selection.html.

1.12 GPS Applications: ISaGRAF PAC plus I-87211W or GPS-721

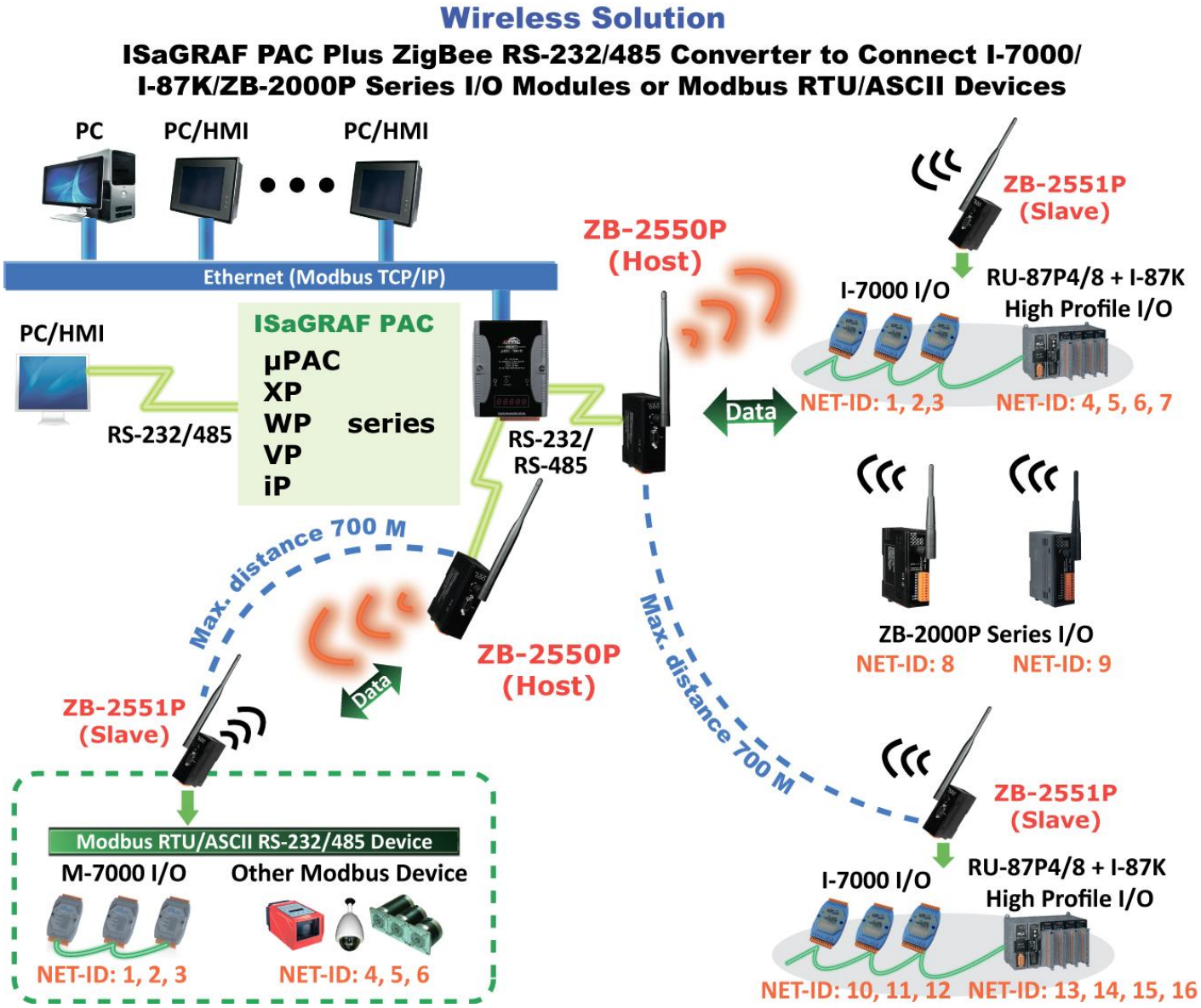
- µPAC-5007/5207 can support one I-87211W card or GPS-721 as GPS I/O.
  (The PAC can communicate with the GPS-721 by RS-485/232; the I-87211W can plug into Remote I/O Expansion units)
- For doing auto-time-synchronization and getting local longitude and latitude.
- Please refer to www.icpdas.com > FAQ > Software > ISaGRAF Ver.3 (English) - 107
- GPS Receiver: www.icpdas.com > Products > Wireless... > Selection Guide > GPS Solution

  Note: µPAC-5107, µPAC-5307 has built-in GPS function.



1.13 ZigBee Wireless Solution

- ISaGRAF PAC plus ZB-2550P and ZB-2551P (ZigBee to RS-232/485 Converters) can apply wireless communication, reduce the wiring cost, and achieve the mission of remote I/O control and data acquisition.
- Please refer to [www.icpdas.com > FAQ > Software > ISaGRAF Ver.3 (English)](www.icpdas.com) - 110



Chapter 2. Software Programming

2.1 Step 1 – Installing ISaGRAF Software

There are two kinds of software to be installed in PC before user can program on the µPAC-5x07 PAC system. They are:

A. ISaGRAF Workbench and
B. ICP DAS Utilities for ISaGRAF

User has to purchase at least one pcs. of ISaGRAF workbench Version 3 (ISaGRAF-256) to install on his PC to edit, download, monitor & debug the controller system. Item (B) is free and it is burned inside the CD-ROM which is delivered with the µPAC-5x07.

Operating System Requirements:

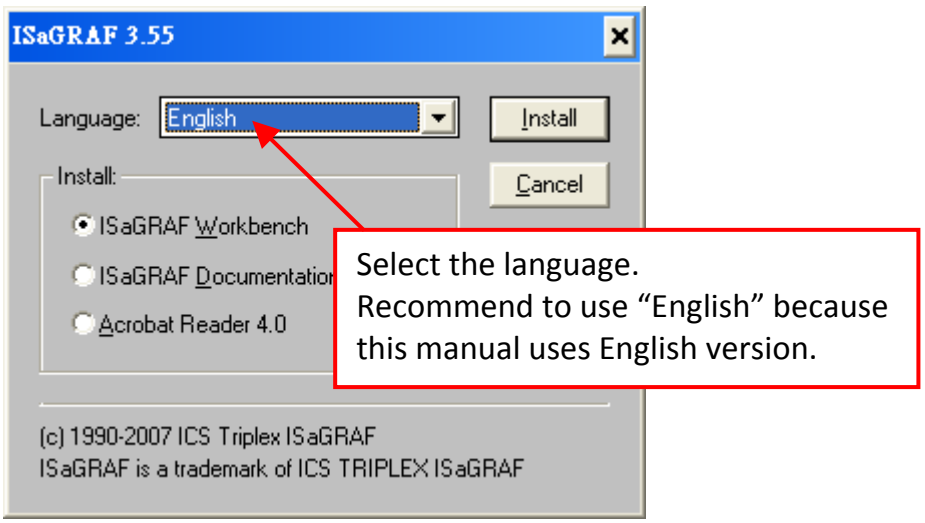
Before you install the "ISaGRAF Workbench" software, you must install one of the following operating system:

- Windows 95 / Windows 98 / Windows 2000
- Windows NT Version 3.51 or Windows NT Version 4.0
- Windows XP, Vista or Windows 7
  (Please refer to www.icpdas.com > FAQ > Software > ISaGRAF Ver.3 (Chinese) - 117)

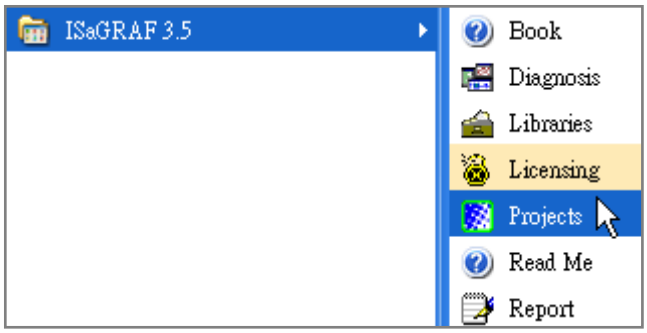
Steps to Install the ISaGRAF Workbench:

1. Insert the ISaGRAF Workbench CD into your CD-ROM drive.
   If your computer does not auto-start the installation, use the Windows Explorer and go to the CD-ROM drive where the Workbench CD is installed.

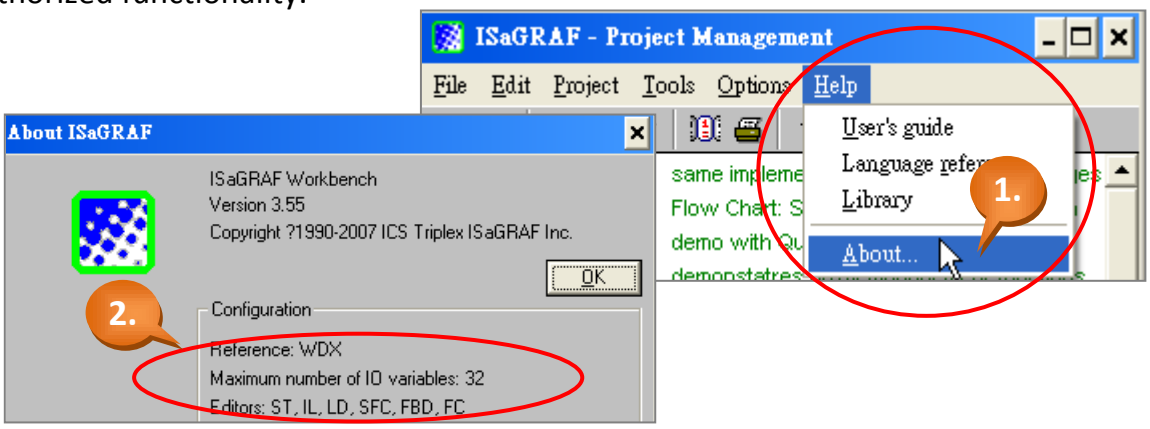
2. Double-click on the "install.bat" file listed on the ISaGRAF CD.
   If the "install.bat" file is not found on your ISaGRAF CD, then double-click on the "ISaGRAF.exe" file to start the installation process.



3. Click on the windows [Start] > [All Programs] > [ISaGRAF 3.x] > [Projects] to start the ISaGRAF software.



Note1: You must install the hardware protection device (dongle) provided with the ISaGRAF software on your computer parallel port for ISaGRAF program to achieve fully authorized functionality.



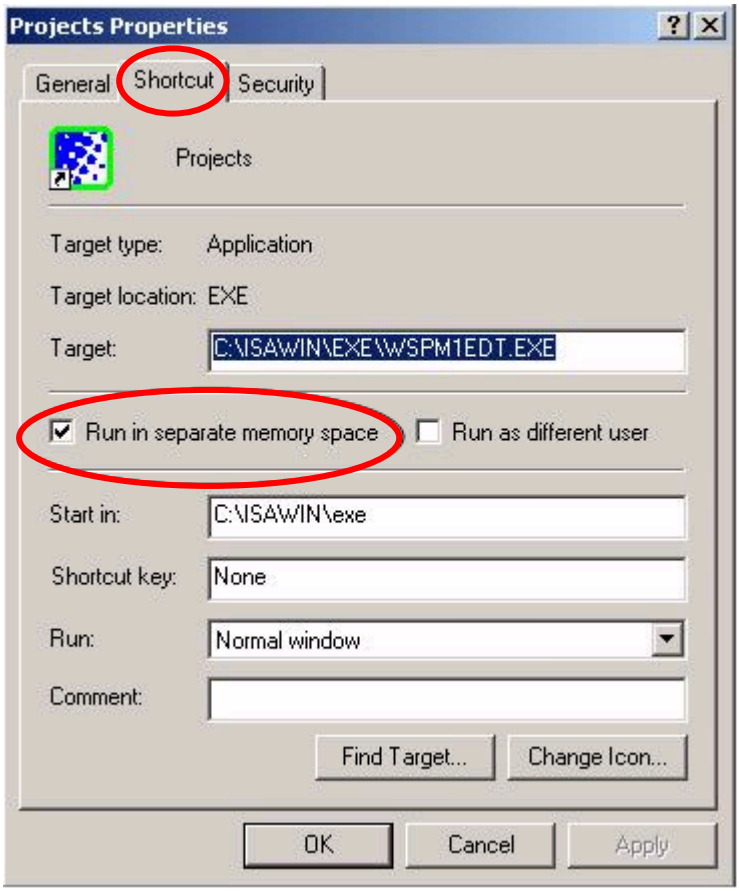
While using ISaGRAF and the dongle is plugged, if the menu [Help] > [About] says "Maximum number of IO variables: 32", it means ISaGRAF workbench cannot find the dongle. Please reset your PC and then verify the [Help] > [About] again.

Note2: If it still displays "Maximum number of IO variables: 32", the dongle driver may not be installed well. Please execute the ISaGRAF CD_ROM \Sentinel5382\setup.exe for ISaGRAF-80, while \Sentinel\setup.exe for other ISaGRAF version and then reset the PC again.

Note3: Since **ISaGRAF 3.51**, it is using USB protection-key. To make your PC recognize the ISaGRAF USB protection-key, please **un-plug** the USB key from your USB port first, then run **"\Sentinel\SSD5411-32bit.exe"** in the ISaGRAF 3.51 ~ 3.55 CD-ROM after you have installed the ISaGRAF. Then you have to plug on the USB protection-key before you executing ISaGRAF Projects every time.

Important Notice for Windows 2000 Users:

If you close some ISaGRAF windows, it holds about 20 ~ 40 seconds (No response). This may caused by the procedure "CTFMON.EXE" of Windows 2000. To avoid this problem, you may create a short cut for the "ISaGRAF project manager". And then verify the "run in separate memory space" option in the shortcut property.



Important Notice for Windows NT Users:

If your computer is using the “Windows NT” OS, you will need to add one line to the file in the ISaGRAF Workbench folder. C:\isawin\exe\isa.ini

You can use any ASCII based text editor to open the "isa.ini" file. Locate the [WS001] header in the file (it should be at the top of the file). Anywhere within the [WS001] header portion of the file, add the entry shown below.

[WS001]
NT=1
Isa=C:\ISAWIN
IsaExe=C:\ISAWIN\EXE

Important setting for using variable arrays:

Please add two more lines on the top of the c:\isawin\exe\isa.ini file to enable the usage of variable arrays.

[DEBUG]
Arrays=1

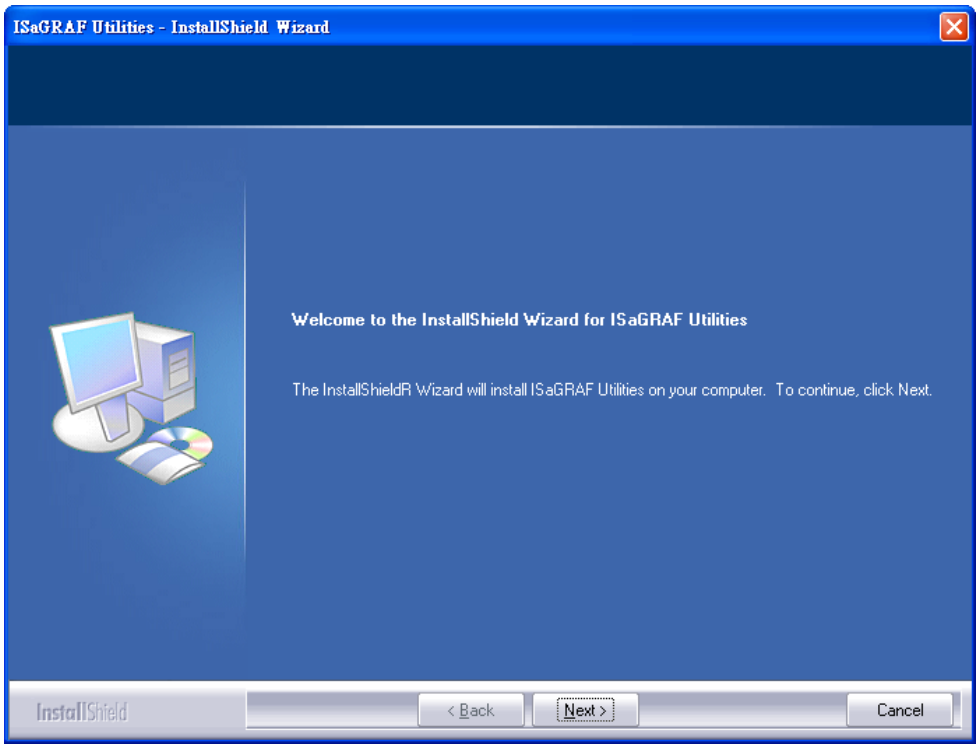
2.2 Step 2 – Installing ICP DAS Utilities for ISaGRAF

"ICP DAS Utilities for ISaGRAF" consists of 3 major functions:

- I/O libraries (for µPAC-5x07 and other ISaGRAF PAC)
- Modem_Link utility
- Auto-scan I/O utility

Note: Make sure you have installed the ISaGRAF Workbench program, IF NOT, please refer to Ch 2.1 Step 1 before continuing.

There is a CD-ROM supplied with each of the µPAC-5x07 PAC with the "ICP DAS Utilities for ISaGRAF". Please insert the CD-ROM into your CD-ROM drive. Then run **CD-ROM: \napdos\isagraf\setup.exe**. Follow the steps to install it.



If "ICP DAS Utilities for ISaGRAF" is not in your CD-ROM, please refer to website of http://www.icpdas.com/products/PAC/i-8000/isagraf-link.htm , then find "ICP DAS Utilities for ISaGRAF" to download "io_lib.zip".

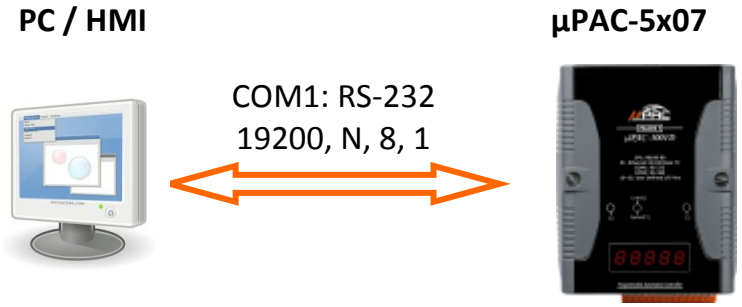
Chapter 3. Hardware System & Setting

3.1 Connect Your PC to COM1 Port

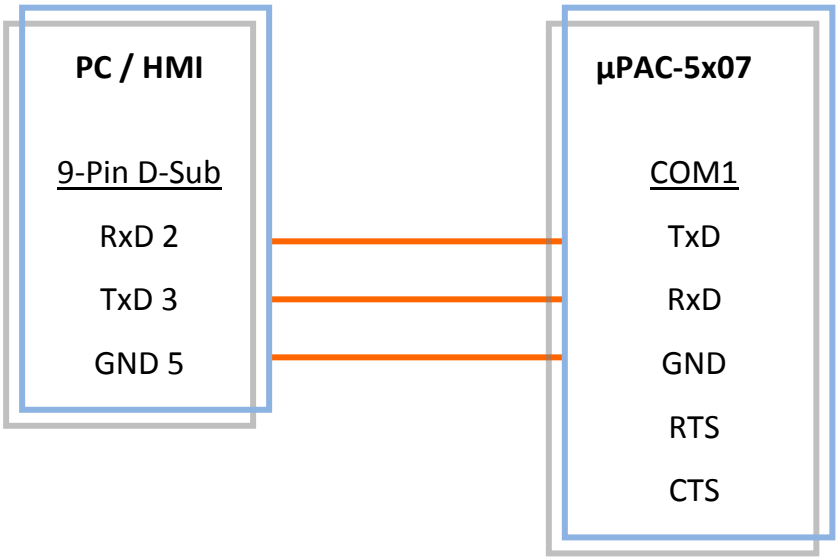
The COM1 port of the µPAC-5x07 is a Modbus Slave port which can talk with HMI software or for the ISaGRAF workbench to download the ISaGRAF project.

COM1: RS-232:

One PC/HMI can only link to COM1: RS-232 port of **one** µPAC-5x07.



COM1: RS-232 Pin Assignments

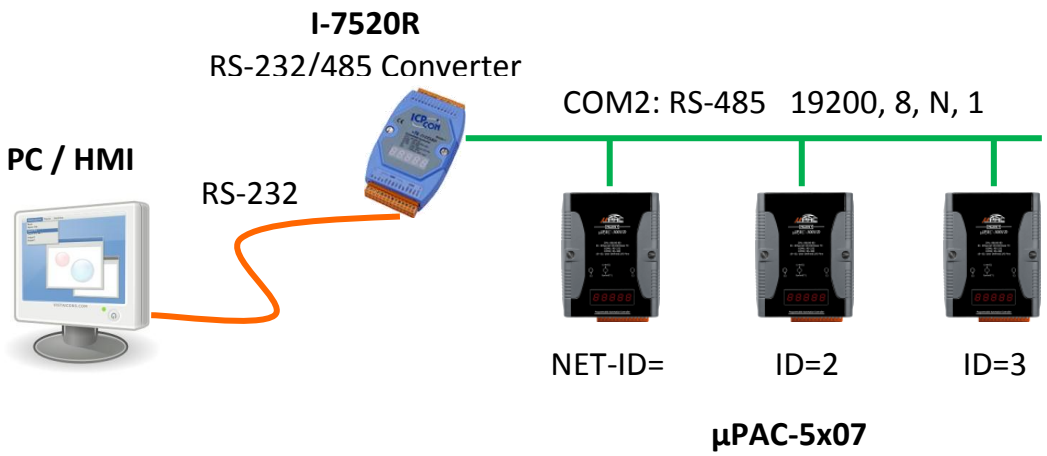


For the ISaGRAF Workbench RS-232 communications to operate properly, only the RXD, TXD, and the GND signals are used. If your PC is running a hardware device or software program that uses the RTS and CTS signals, then you will need to wire the RTS-CTS signals together.

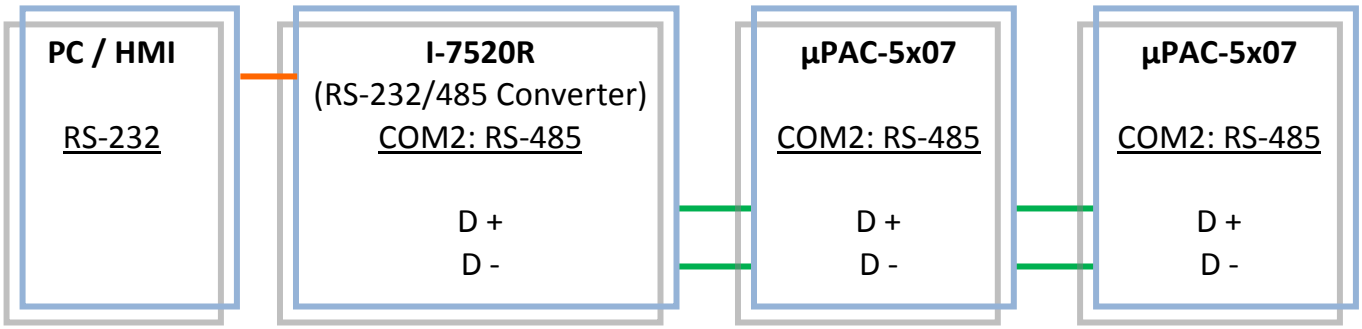
3.2 Connect Your PC to COM2 Port

One PC or HMI can link through COM2: RS-485 port to **MANY** µPAC-5x07 if each of them on the same RS-485 network has a unique NET-ID.

COM2: RS-485:



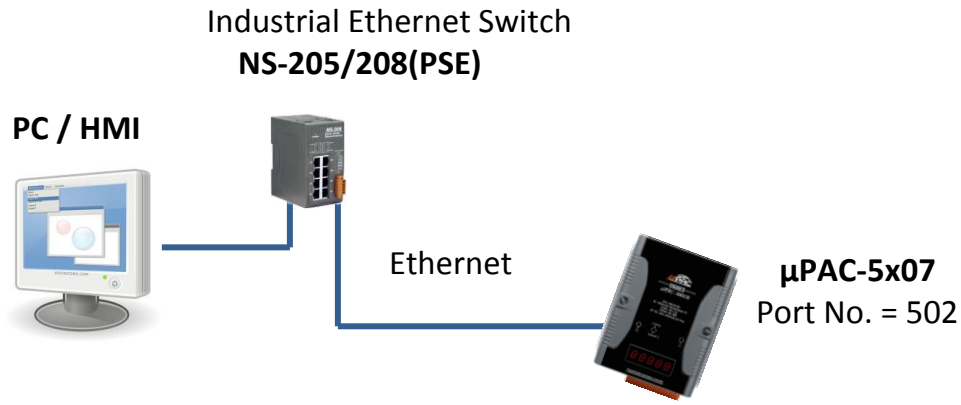
COM2: RS-485 Pin Assignments



Note: Please make sure each µPAC-5x07 on the same RS-485 network has distinct NET-ID. Refer to Section 3.4 to set the NET-ID.

3.3 Connect Your PC to Ethernet Port

The Ethernet port of the µPAC-5x07 PAC provides Modbus TCP/IP Slave protocol. It can be used to connect to the PC or HMI software. Up to **6** PC/HMI can talk to one µPAC-5x07 at the same time through the Ethernet port.



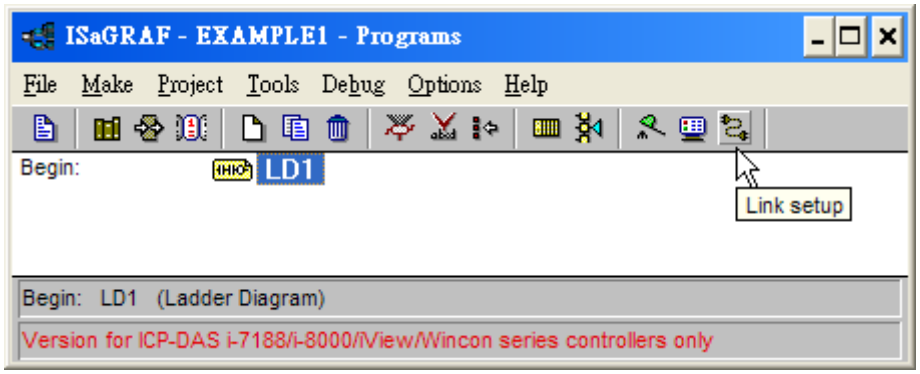
Before you can download an ISaGRAF application to the µPAC-5x07 PAC using the Ethernet port, you must first setup the Ethernet port to properly communicate with the host PC.

µPAC-5x07:

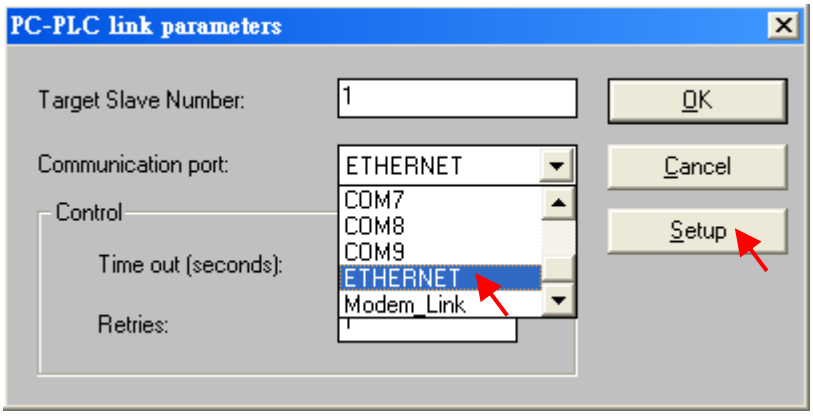
Set IP address, Mask and Gateway. Please refer to Section 3.9.

PC:

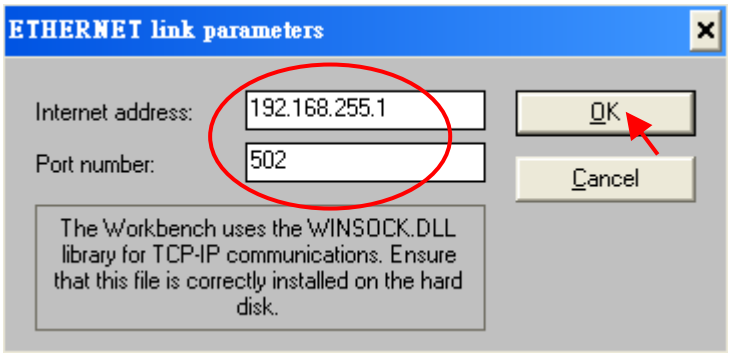
First open an ISaGRAF project and select a program you wish to communicate between your PC and the µPAC-5x07 PAC system. Next, click on "Link Setup" button in the project screen as shown below.



A "PC-PLC Link Parameters" dialog box will appear as shown below. Select the "Ethernet" communications option and click on "Setup" button.



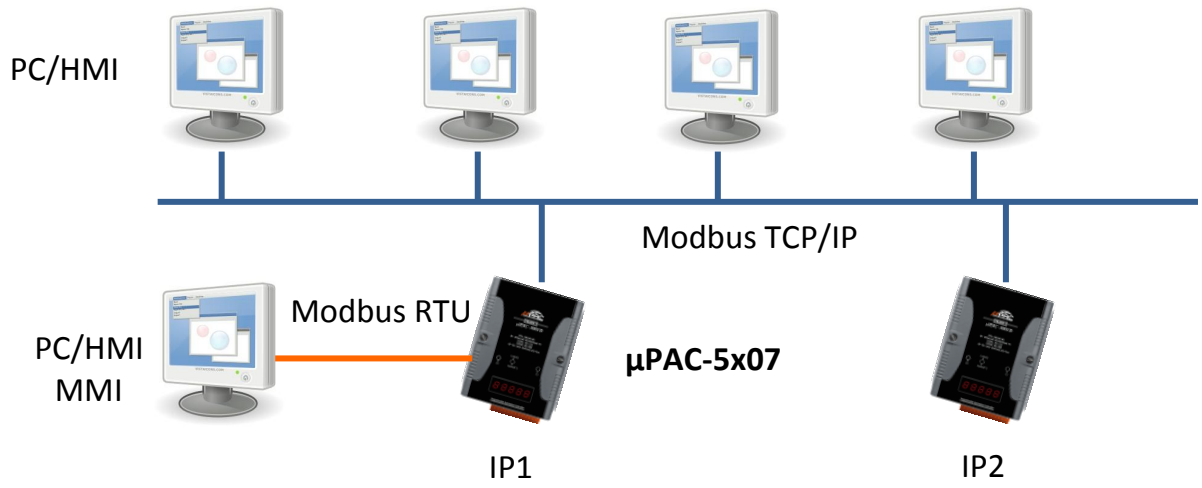
After you click on "Setup" button, an "Ethernet Link Parameters" dialog box will appear. Set the "Port Number" to "502" and enter the Internet address (IP) of your µPAC-5x07 PAC. (Please refer to Section 3.9)



Once you have entered the appropriate information, click on "OK" button, and now you have configured your PC to communicate with the µPAC-5x07 through the Ethernet port.

Multi-Clients Connection to µPAC-5x07

Each µPAC-5x07 has an IP address and with a fixed Ethernet port No. 502. Up to **6** PCs can link to one PAC throughout Ethernet (Modbus TCP/IP protocol). Another PC or MMI can link to COM1: RS-232 port (Modbus RTU protocol). Therefore the maximum number of clients can be linked is 7.



3.4 How to Update Hardware Driver

Our newly released driver can be obtained from the below website.
http://www.icpdas.com/products/PAC/i-8000/isagraf.htm

Steps: We use **ver. 1.00 of µPAC-5307's** driver as an example to show how to view and upgrade the driver.

Download the Driver:

1. Create a file folder named "µPAC-5307" in your hard drive. (Ex. "c:\ µPAC-5307")

2. Copy the following listed files under CD:
   \Napdos\ISaGRAF\µPAC-5000\Driver\5307\1.00 or download the zip file from website of http://www.icpdas.com/products/PAC/i-8000/isagraf-link.htm.
   (µPAC-5307 ver. 1.00, please extract the file.)

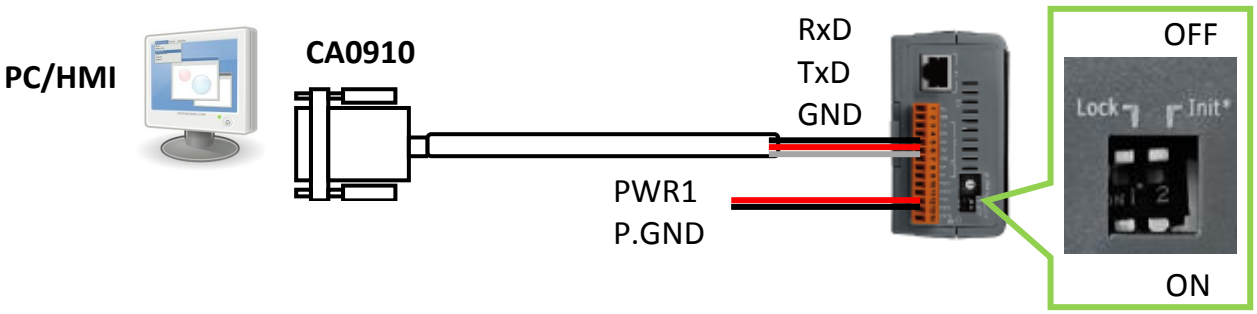
   1. 7188xw.exe
   2. 7188xw.f4
   3. 7188xw.ini
   4. autoexec.bat
   5. 5k090903.img
   6. isa5307.exe

   Future version may not use the same img file.

3. Run "7188xw.exe" in your hard drive. A "7188xw" screen will appear.
   (Press F1 if need help)

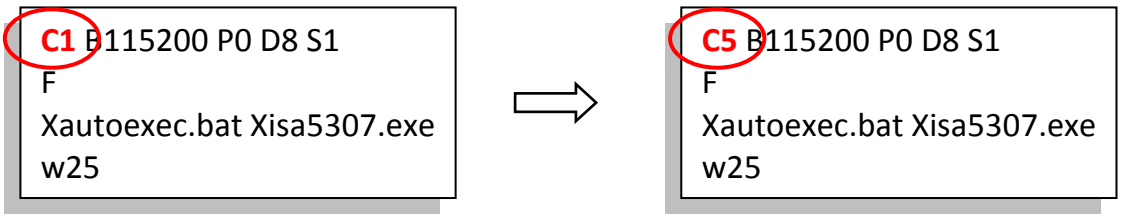
Hardware Connection & Setting:

4. Link COM1 or COM2 of your PC to COM1 of the PAC through a RS-232 cable.



Note: If your computer has no COM1/COM2 or you use other COM (like COM5) to link the µPAC-5307, you can change the "C number" in the first line of "7188xw.ini" file.

EX: Using computer's COM5 to link to µPAC-5307. As shown below:



5. Switch the "Init*" to "ON" then power it up.
6. If the connection is OK, "uPAC-5001>" messages will appear on the screen.

Upgrade ISaGRAF Embedded Driver:

7. Press "F4" to auto download the following files and reboot system.
   "autoexec.bat", " isa5307.exe ", "5k090903.img"

```
uPAC-5001>time 12:14:16
Current Time is 12:14:16

uPAC-5001>date 05/19/2010
Current DATE is 5/19/2010(3)

uPAC-5001>del /y
Total File number is 2, do you really want to delete(y/n)?

uPAC-5001>LOAD
File will save to 8000:0000
StartAddr-->7000:FFFF
Load file:autoexec.bat[crc=E265,0000]
Block 1
Transfer time is: 0.063000 seconds
```

🕐 Please Wait about **60** SEC. to update ISaGRAF system and
DO NOT Remove the Power. **

8. When the system automatically reboot, you have completed the update.
   Type "dir" to make sure "autoexec.bat" and "isa5307.exe" have been downloaded.

```
<<Write Finished>>OK
Wait WDT reset system...
ICP DAS MiniOS7_UDP for uPAC-5001 Ver. 2.04 build 007,Sep 03 2009 11:08:55
OS id=37
SRAM:768K, FLASH MEMORY:512K
[CPU=R2240]
CPU internal WDT is ENABLED(WDT timeout=0.8 sec)
Serial number= 01 86 58 81 12 00 00 9D

uPAC-5001>dir

 0)autoexec.bat 05/18/2010 11:14:11      22[00016]8002:0000-8003:0005
 1)isa5307.exe  05/19/2010 12:03:02  208194[32D42]8005:0006-B2D9:0007
Total File number is 2  Free space=250440 bytes
uPAC-5001>
```

View the OS Version & Date:

9. Type "ver" to see the current OS version and date.

View the Driver Version & PAC Settings:

10. Type "isa5307 *p=" to see the current driver version, PAC settings and instruction description.
    Note 1: Please depend on the PAC model to type the instruction. (Ex. isa5307 *p=)
    Note 2: After typing this instruction, you have to reboot to continue other step.

```
uPAC-5001>ver

ICP DAS MiniOS7_UDP for uPAC-5001 Ver. 2.04 build 007,Sep 03 2009 11:08:55
OS id=3
SRAM:768K, FLASH MEMORY:512K
[CPU=R2240]
CPU internal WDT is ENABLED(WDT timeout=0.8 sec)
Serial number= 01 86 58 81 12 00 00 9D

uPAC-5001>isa5307 *p=

Driver: uPAC-5307 : isa5307.exe - 1.00, March.28,2010
MiniOS7: Must use 5K090903.img
Licence is OK
NET-ID  : 2
COM1 is Modbus RTU slave port,9600,8,N,1
Use 'isa5307 *f=1' to free COM1, 'isa5307 *f=0' to set COM1 as Modbus RTU
Use 'isa5307 *s=1 to 255' to set NET-ID to 1 to 255
Use 'isa5307 *d=' to delete ISaGRAF program
Use 'isa5307 *b=0 to 9' to set baudrate of COM1 as 1200,2400...
Use 'isa5307 *x=PB' to set COM2/COM3 as Modbus RTU slave port
     P means port number, P: 2 or 3. B means baudrate, B:0 ~ 9
ex : isa5307 *x=24, set COM2 as Modbus RTU slave and baudrate is 19200
    'isa5307 *x=f' to free COM2/COM3 port
Baudrate are as follows : 1=2400,2=4800,3=9600,4=19200,5=38400,6=57600,7=1
,8=300,9=600,0=1200
Flash Memory is unprotected; refer to www.icpdas.com > FAQ > Software > IS
> 089 for more detail info.

(C)Copyright:ICP DAS  CO. , LTD.      Taiwan Id:84517297
```

11. Press “ALT_X” to exit the "7188xw" screen.
12. Switch the “Init*” to “OFF” then power it up.

3.5 Set NET-ID for Controller System

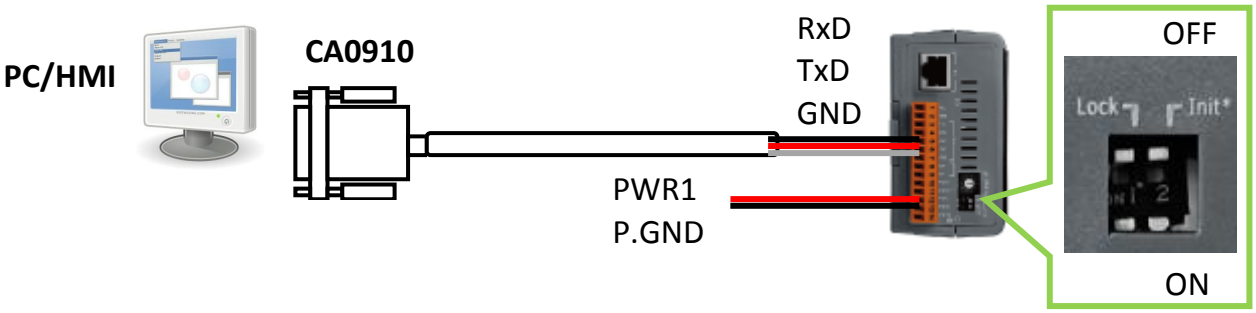
Each µPAC-5x07 has a NET-ID Number. The valid Number is from 1 to 255. The default No. is 1. Net-ID must be unique in the same RS-485 network. To set the NET-ID No., please follow below steps.

Related Files & Hardware Connection: (We use µPAC-5307 as an example)

1. Create a file folder named "µPAC-5307" in your hard drive. (Ex. "c:\ µPAC-5307")

2. Copy the following listed files under "µPAC-5307" folder:
   CD: **\Napdos\ISaGRAF\µPAC-5000\Driver\5307\1.00**

3. Run "7188xw.exe" in your "µPAC-5307" folder.
4. Link COM1 or COM2 of your PC to COM1 of the PAC through a RS-232 cable.



If your computer has no COM1/COM2 or you use other COM (like COM5) to link the µPAC-5307, you can change the "C number" in the first line of "7188xw.ini" file.

EX: Using computer's COM5 to link to µPAC-5307. You need to change C1 to C5.

```
C1 B115200 P0 D8 S1
F
Xautoexec.bat Xisa5307.exe
w25
```

⇨

```
C5 B115200 P0 D8 S1
F
Xautoexec.bat Xisa5307.exe
w25
```

5. Switch the "Init*" to "ON" then power it up.
6. If the connection is OK, "uPAC-5001>" messages will appear on the screen.

Set NET- ID:

7. Type **"isa5307 *s= 2"**, to set NET-ID to 2.

```
uPAC-5001>isa5307 *s=2

Set Net-ID to 2
```

Please type the instruction according to the controller model. (Ex. isa5307 *s=2)

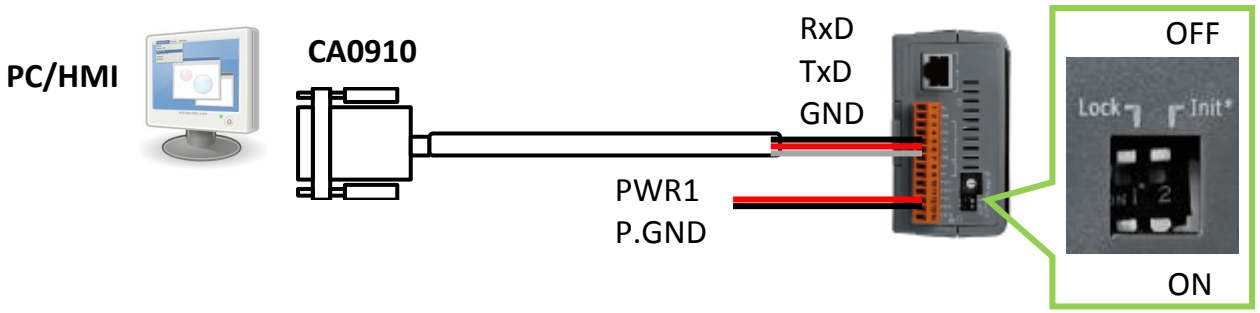
8. Switch the "Init*" to "OFF" then power it up.

3.6 Set Baud Rate for COM1

Related Files & Hardware Connection: (We use µPAC-5307 as an example)

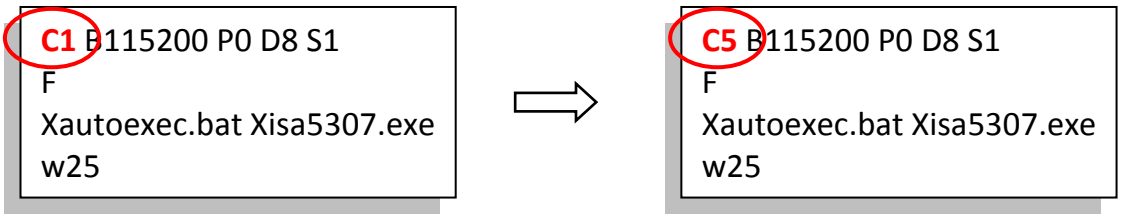
1. Create a file folder named "µPAC-5307" in your hard drive. (Ex. "c:\ µPAC-5307")
2. Copy the following listed files under "µPAC-5307" folder:
   CD: **\Napdos\ISaGRAF\µPAC-5000\Driver\5307\1.00**

3. Run "7188xw.exe" in your "µPAC-5307" folder.
4. Link COM1 or COM2 of your PC to COM1 of the PAC through a RS-232 cable.



If your computer has no COM1/COM2 or you use other COM (like COM5) to link the µPAC-5307, you can change the "C number" in the first line of "7188xw.ini" file.

EX: Using computer's COM5 to link to µPAC-5307. You need to change C1 to C5.



5. Switch the "Init*" to "ON" then power it up.
6. If the connection is OK, "uPAC-5001>" messages will appear on the screen.

Start the Baud Rate Setting:

7. Type **"isa5307 *b=n"** to set baud rate of COM1. "n" is the setting code, n = 0 ~ 9.

1=2400,	2=4800,	3=9600,	4=19200,	5=38400,	6=57600,
7=115200,	8=300,	9=600,	0=1200		

```
uPAC-5001>isa5307 *b=3
```

Please type the instruction according to the controller model. (Ex. isa5307 *b=3)

8. Switch the "Init*" to "OFF" then power it up.

3.7 Set COM1 to Non-Modbus-Slave for µPAC-5x07

The COM1 of µPAC-5x07 supports Modbus RTU Slave protocol by default. User can free it as a Non-Modbus-Slave port for other usage. For example, user may write his own defined protocol on COM1 or use COM1 as a Modbus Master port.

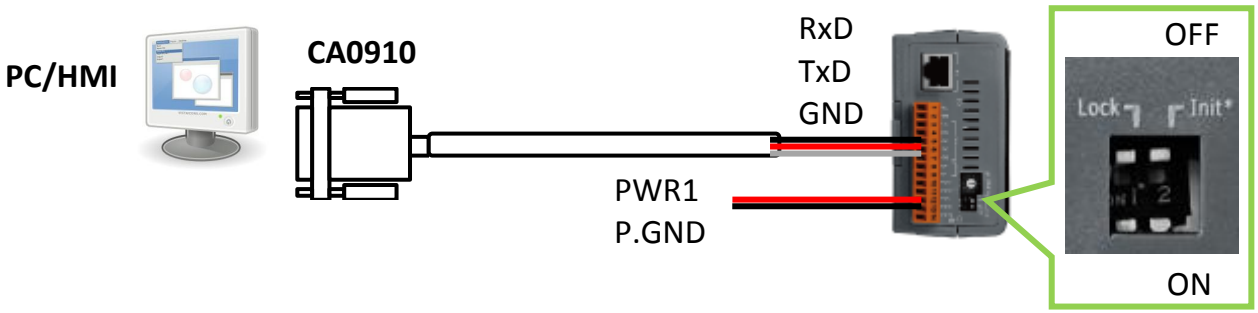
Related Files & Hardware Connection: (We use µPAC-5307 as an example)

1. Create a file folder named "µPAC-5307" in your hard drive. (Ex. "c:\ µPAC-5307")

2. Copy the following listed files under "µPAC-5307" folder:
   CD: **\Napdos\ISaGRAF\µPAC-5000\Driver\5307\1.00**

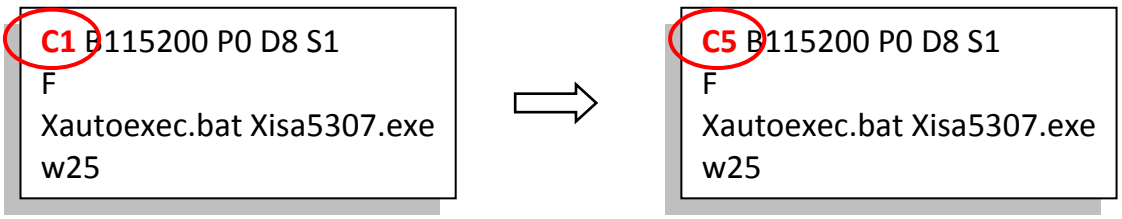
3. Run "7188xw.exe" in your "µPAC-5307" folder.

4. Link COM1 or COM2 of your PC to COM1 of the PAC through a RS-232 cable.



If your computer has no COM1/COM2 or you use other COM (like COM5) to link the µPAC-5307, you can change the "C number" in the first line of "7188xw.ini" file.

EX: Using computer's COM5 to link to µPAC-5307. You need to change C1 to C5.



5. Switch the "Init*" to "ON" then power it up.

6. If the connection is OK, "uPAC-5001>" messages will appear on the screen.

Free COM1:

7. Type **"isa5307 *f=1"** to free COM1 (free COM1 as Non-Modbus-Slave)

```
uPAC-5001>isa5307 *f=1

Com1 is free now
```

Please type the instruction according to the controller model. (Ex. isa5307 *f=1)

8. Exit the "7188xw" screen; else the COM1/COM2 is always in use.

9. Switch the “Init*” to “OFF” then power it up.

Important Notice:

If user wants to change COM1 back to a Modbus RTU Slave port again, follow the same steps as above and then type **"isa5307 *f=0"** as below.

```
uPAC-5001>isa5307 *f=0

Com1 is define as Modbus RTU
```

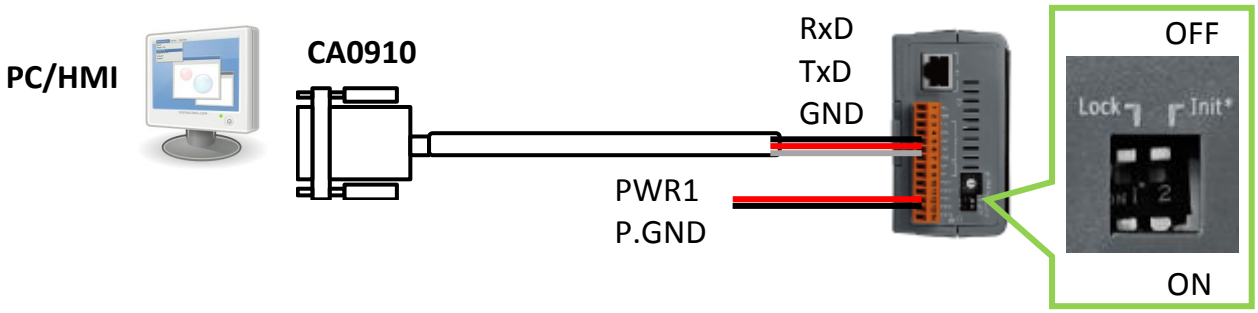
3.8 Set COM2 or COM3 as a Modbus RTU Slave Port

µPAC-5x07 can install XW5xx expansion board to have a COM3 or more COM Port. User can customize one of COM2/COM3 to supports Modbus RTU Slave protocol.

Note: **COM2/COM3 is "Non-Modbus RTU Slave Port" by default.**

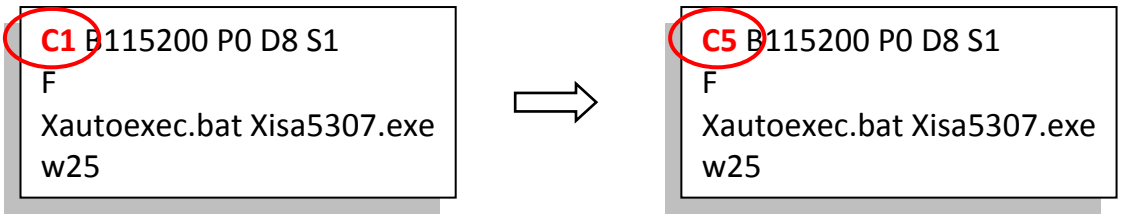
Related Files & Hardware Connection: (We use µPAC-5307 as an example)

1. Create a file folder named "µPAC-5307" in your hard drive. (Ex. "c:\ µPAC-5307")
2. Copy the following listed files under "µPAC-5307" folder:
   CD: **\Napdos\ISaGRAF\µPAC-5000\Driver\5307\1.00**
3. Run "7188xw.exe" in your "µPAC-5307" folder.
4. Link COM1 or COM2 of your PC to COM1 of the PAC through a RS-232 cable.



If your computer has no COM1/COM2 or you use other COM (like COM5) to link the µPAC-5307, you can change the "C number" in the first line of "7188xw.ini" file.

EX: Using computer's COM5 to link to µPAC-5307. You need to change C1 to C5.



5. Switch the "Init*" to "ON" then power it up.
6. If the connection is OK, "uPAC-5001>" messages will appear on the screen.

Set COM2 or COM3 as Modbus RTU Slave:

7. Type "isa5307 *x=PB" to set the baud rate of COM2/3 and as a Modbus RTU Slave port.

   "P" means the COM Port number. (P = 2 or 3)
   "B" means the baud rate. (B = 0 ~ 9)

   1=2400, 2=4800, 3=9600, 4=19200, 5=38400, 6=57600,
   7=115200, 8=300, 9=600, 0=1200

   Set COM2/3 baud rate and define it as a Modbus RTU
   "PB" = 20 ~ 29, set COM2 to Modbus Slave Port
   "PB" = 30 ~ 39, set COM3 to Modbus Slave Port

Ex: Set COM2 as Modbus RTU Slave Port, baud rate is 19200.

```
uPAC-5001>isa5307 *x=24

Com2 is defined as Modbus RTU
```

Please type the instruction according to the controller model. (Ex. isa5307 *x=24)

8. Exit the "7188xw" screen; else the COM1/COM2 is always in use.

9. Switch the “Init*” to “OFF” then power it up.

Recovery the COM2/COM3 Setting:

If you want to set COM2/COM3 as Non-Modbus RTU Slave Port, please type "isa5307 *x=f" to release it.

```
uPAC-5001>isa5307 *x=f

COM2/COM3 port is not as Modbus Slave port
```

3.9 Set IP & MASK & Gateway for µPAC-5x07

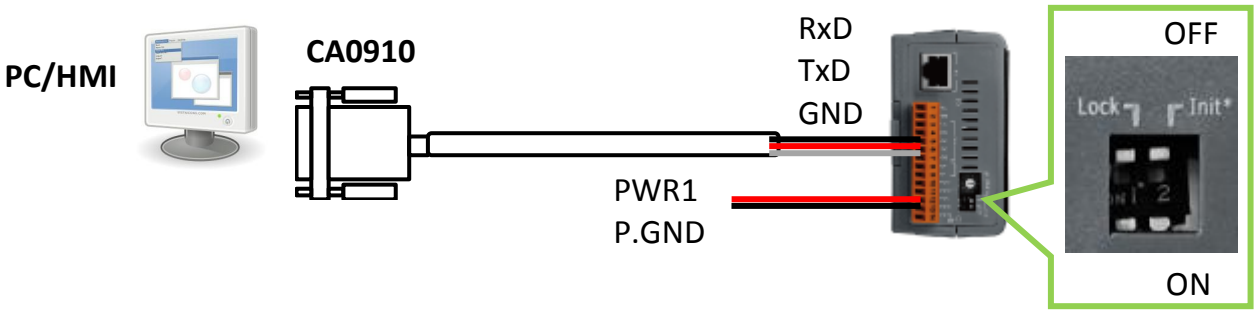
Related Files & Hardware Connection: (We use µPAC-5307 as an example)

1. Create a file folder named "µPAC-5307" in your hard drive. (Ex. "c:\ µPAC-5307")

2. Copy the following listed files under "µPAC-5307" folder:
   CD: **\Napdos\ISaGRAF\µPAC-5000\Driver\5307\1.00**

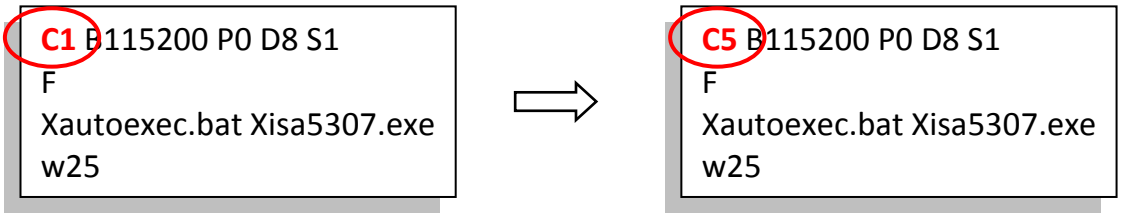
3. Run "7188xw.exe" in your "µPAC-5307" folder.

4. Link COM1 or COM2 of your PC to COM1 of the PAC through a RS-232 cable.



If your computer has no COM1/COM2 or you use other COM (like COM5) to link the µPAC-5307, you can change the "C number" in the first line of "7188xw.ini" file.

EX: Using computer's COM5 to link to µPAC-5307. You need to change C1 to C5.



5. Switch the "Init*" to "ON" then power it up.

6. If the connection is OK, "uPAC-5001>" messages will appear on the screen.

Set IP & Mask & Gateway:

7. Type **"ip"** to see the current IP address of µPAC-5307.
   Type **"ip xxx.xxx.xxx.xxx"** to set a new IP.
   Ex. > ip 192.168.1.205

```
uPAC-5001>ip
IP=192.168.1.233
uPAC-5001>ip 192.168.1.205
Set IP=192.168.1.205
[ReadBack]IP=192.168.1.205
```

8. Type **"mask"** to see the current address mask.
   Type **"mask xxx.xxx.xxx.xxx"** to set a new address mask.
   Ex. > mask 255.255.0.0

```
uPAC-5001>mask
MASK=255.255.255.0
uPAC-5001>mask 255.255.0.0
Set MASK=255.255.0.0
[ReadBack]MASK=255.255.0.0
```

9. Type **"gateway"** to see the current gateway address.
   Type **"gateway xxx.xxx.xxx.xxx"** to set a new gateway address.
   Ex. > gateway 192.168.0.254

```
uPAC-5001>gateway
Gateway=192.168.1.1
uPAC-5001>gateway 192.168.0.254
Set GATEWAY=192.168.0.254
[ReadBack]Gateway=192.168.0.254
```

10. Exit the "7188xw" screen; else the COM1/COM2 is always in use.

11. Switch the “Init*” to “OFF” then power it up.

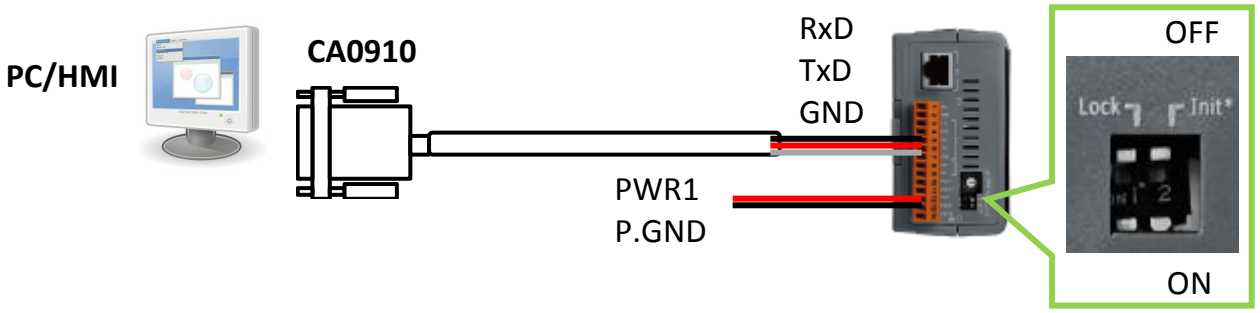
3.10 Delete an ISaGRAF Project from the PAC

If there is a project exists in the PAC, user may use ISaGRAF Workbench to download a new one to replace it. By some reasons, user may want to delete the ISaGRAF project from the µPAC-5x07 PAC, please follow the steps below.

Related Files & Hardware Connection: (We use µPAC-5307 as an example)

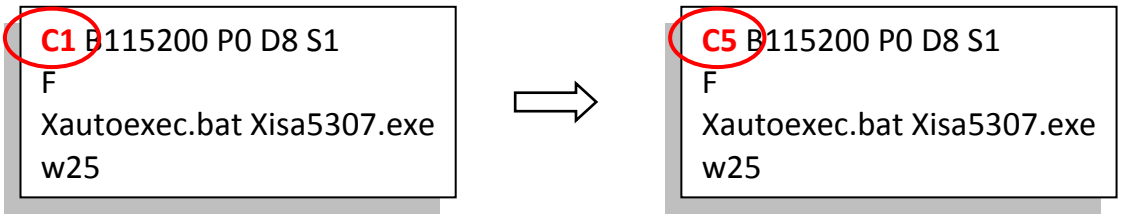
1. Create a file folder named "µPAC-5307" in your hard drive. (Ex. "c:\ µPAC-5307")
2. Copy the following listed files under "µPAC-5307" folder:
   CD: **\Napdos\ISaGRAF\µPAC-5000\Driver\5307\1.00**

3. Run "7188xw.exe" in your "µPAC-5307" folder.
4. Link COM1 or COM2 of your PC to COM1 of the PAC through a RS-232 cable.



If your computer has no COM1/COM2 or you use other COM (like COM5) to link the µPAC-5307, you can change the "C number" in the first line of "7188xw.ini" file.

EX: Using computer's COM5 to link to µPAC-5307. You need to change C1 to C5.



5. Switch the "Init*" to "ON" then power it up.
6. If the connection is OK, "uPAC-5001>" messages will appear on the screen.

Delete ISaGRAF Project:

7. Type "isa5307 *d=" to delete the project.

```
uPAC-5001>isa5307 *d=

ISaGRAF Project Deleted.
```

Please type the instruction according to the controller model. (Ex. isa5307 *d=)

8. Exit the "7188xw" screen and switch the "Init*" to "OFF" then power it up.

3.11 Set I-7000 and I-87K Remote I/O by DCON Utility

µPAC-5x07 can link up to 128 pcs ICP DAS's remote I/O modules - "I-7000" and “I-87K” series remote I/O modules.

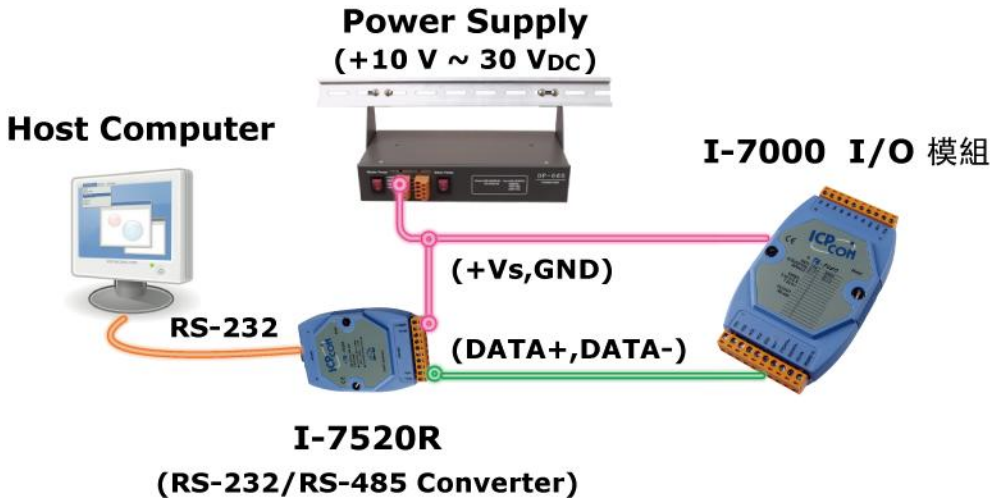
Pre-set : Before linking I-7000 and I-87K modules, user must use DCON Utility to pre-set each I-7000 and I-87K remote module to has a unique address (NET-ID) and the same Baud rate (included the PAC) in this µPAC-5x07 PAC system.

The DCON Utility is a toolkit that helps user to search the I/O network, easily to configure and test the I/O modules. For DCON Utility program and manual please reach to ftp://ftp.icpdas.com.tw/pub/cd/8000cd/napdos/driver/dcon_utility/.

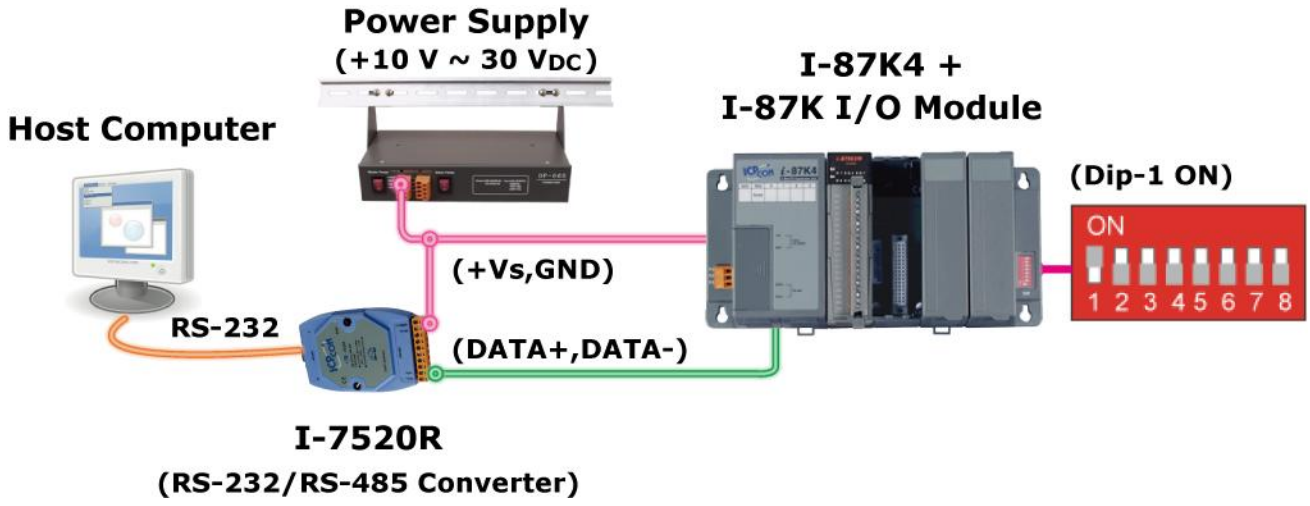
Step 1: Hardware Connection

Note: The power supply must be DC power between +10V ~ +30V.
Search and configure the modules one by one.

- Wire Connection for I-7000 : (Configure one module at once)



- Wire Connection for I-87K : (Configure one module at once)



Step 2: Set I/O module to the initial state

Every new module has the factory default settings (as figure 1) for user's convenient use. If you use an old one and you don't know the configuration of the module, please set the I/O module to the initial state (as figure 2).

The Factory Default Settings :

I/O Module	I-7000	M-7000	I-87K
Address	1	1	1
Baud rate	9600	9600	115200
Checksum	Disabled	Not defined	Disabled
Protocol	DCON Protocol	Modbus Protocol	DCON Protocol

The Initial Settings:

I/O Module	7000 Series (I-7000 & M-7000)	I-87K Series
Address	0	0
Baud rate	9600	115200
Checksum	Disabled	Disabled
Protocol	DCON Protocol	DCON Protocol

HOWTO: Initialize the I/O module

***I-7000:** To set I-7000 module to the initial state, please wire the INIT* to GND (if there is a DIP switch on the back of it, just set the switch to "INIT" position) and power on the module. Then the module will become initial state.

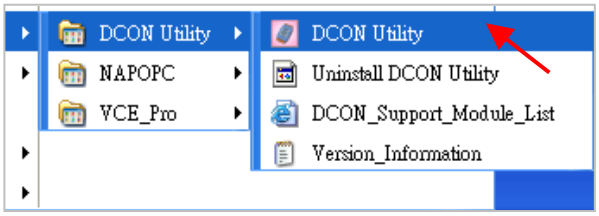
***I-87K:** To set I-87K module to the initial state, please set the related DIP Switch on the I-87K4/5/8/9 I/O expansion unit. For example, change DIP-1 to "ON" and restart the power, the I/O module in the first slot will become initial state.

Note: If you use I-87K**9** or I-87K**5** I/O expansion unit, the DIP-1 is corresponding to the second slot, so do not use the first slot.

Following, we would like to use I-87K I/O module as an example to show how to serch and configure with DCON Utility.

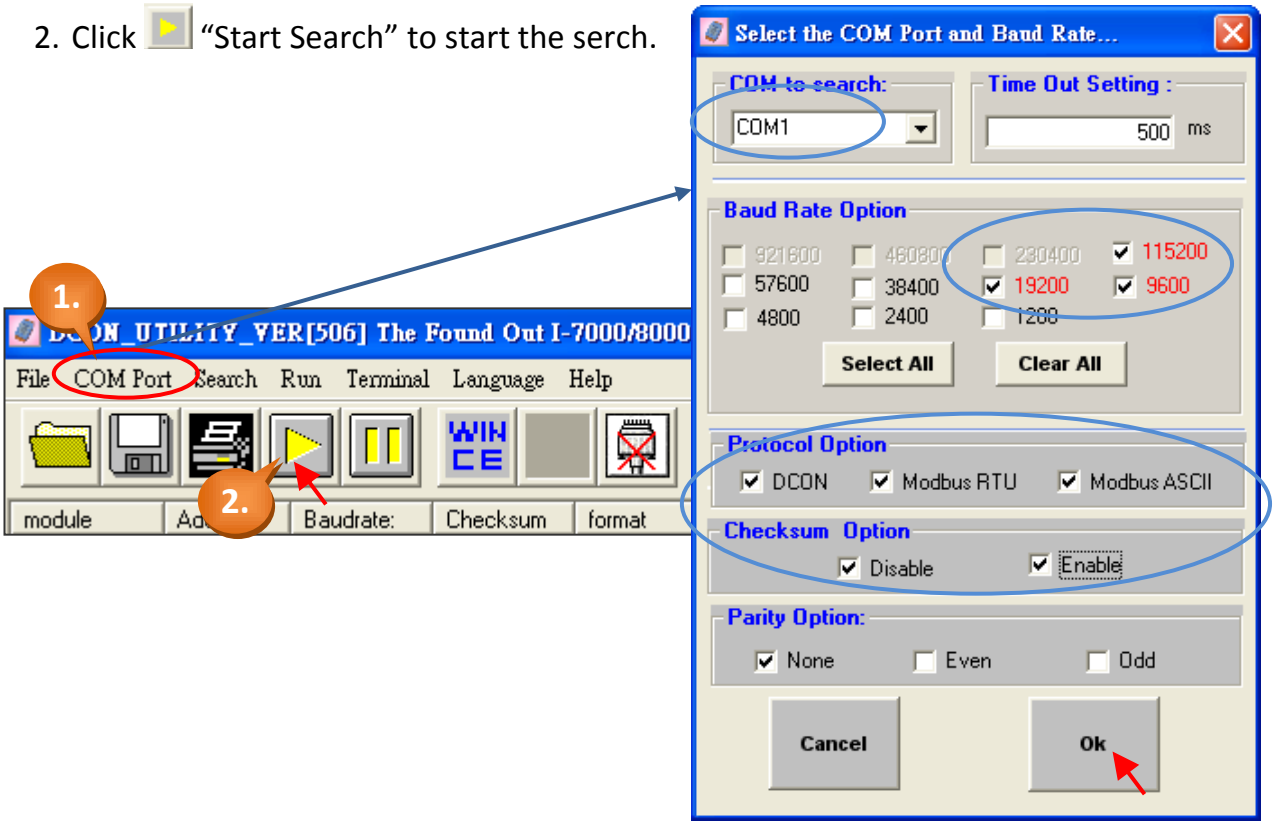
Step 3: Select COM Port & Baud Rate to Search

Execute the [DCON Utility] :



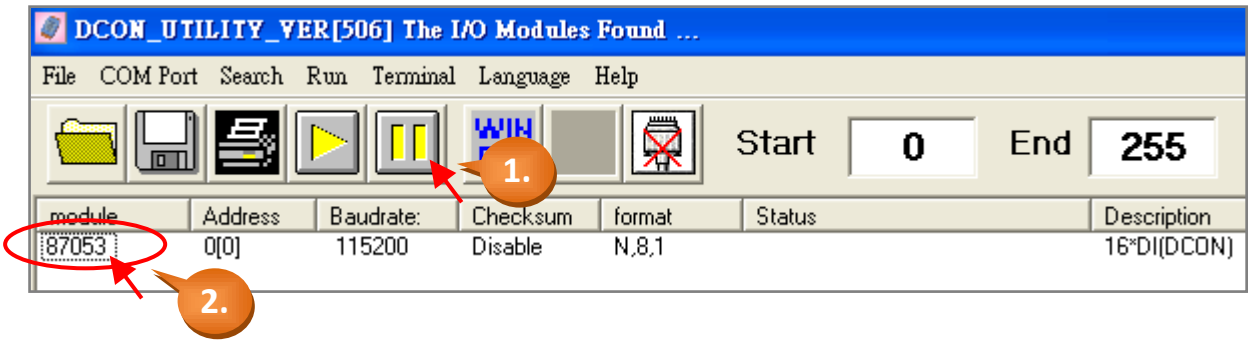
1. Click “COM Port” menu to select the COM port and Baud rate to search. Select multiple baud rate, protocol or checksum options if you do not know the module’s setting, but it will take more serch time. After selection, click “OK”.

2. Click “Start Search” to start the serch.

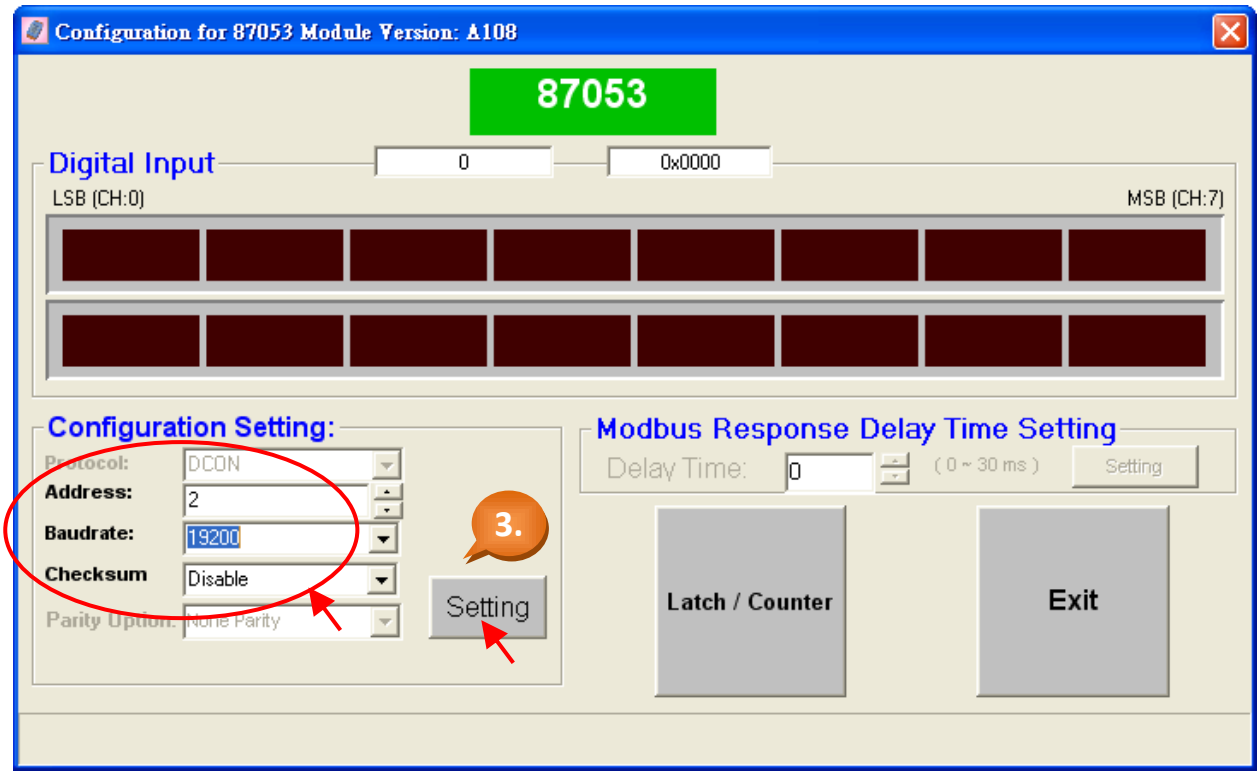


Step 4: Click the Module Name to Configure it

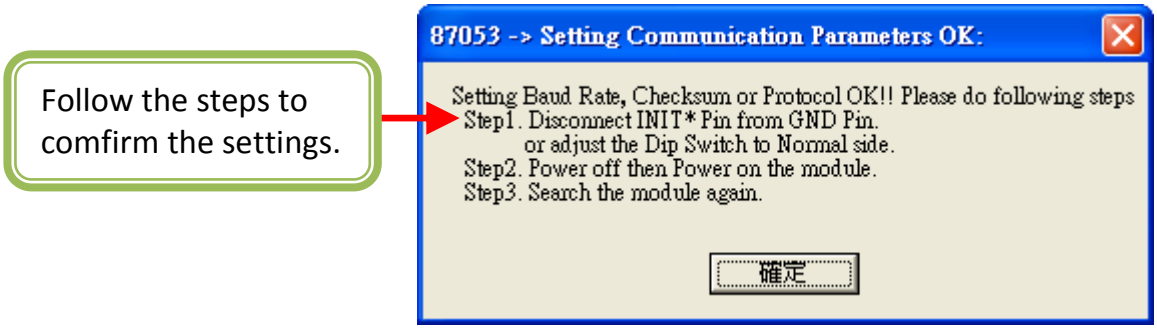
1. When you see the module name on screen, please click button to stop serch.
2. Double-click the module name to enter the configure screen.



3. Now, you can set the Address, Baud rate and Checksum. After configuration, you **must** click “Setting” to save the settings.



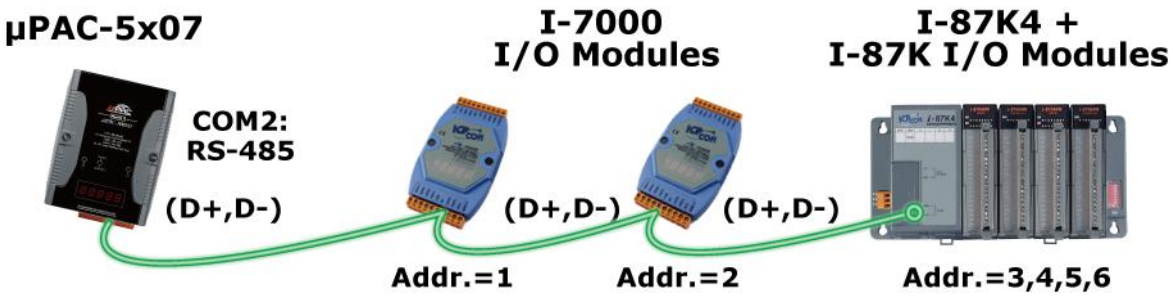
4. You have completed the setting; please adjust the DIP Switch to “OFF” position and restart the power. Finally, you can serch the module again to comfirm settings.



Note: Remember to remove the wire between INIT* and GND, then restart the power if you use the I-7000 I/O module.

3.12 Link to I-7000 and I-87K Remote I/O Modules

µPAC-5x07 PAC system can use its COM2: RS-485 port to link to ICP DAS's "I-7000" and "I-87K" series Remote I/O modules. This configuration can be very useful in applications that require distributed Remote I/O throughout the system.



Note: You can link up to **64** pcs of I-7000 or I-87K series Remote I/O modules to one µPAC-5x07 PAC.

You must remember to set each I-7000 and I-87K Remote I/O module a unique address (NET-ID), and set them and the µPAC-5x07 PAC all have the same Baud rate & checksum (Default: Disable).

For more information regarding setting up and programming an I-7000 / I-87K remote module, please refer to "Chapter 6: Link I-7000 and I-87XX Modules" of "User's Manual of ISaFRAF PACs".

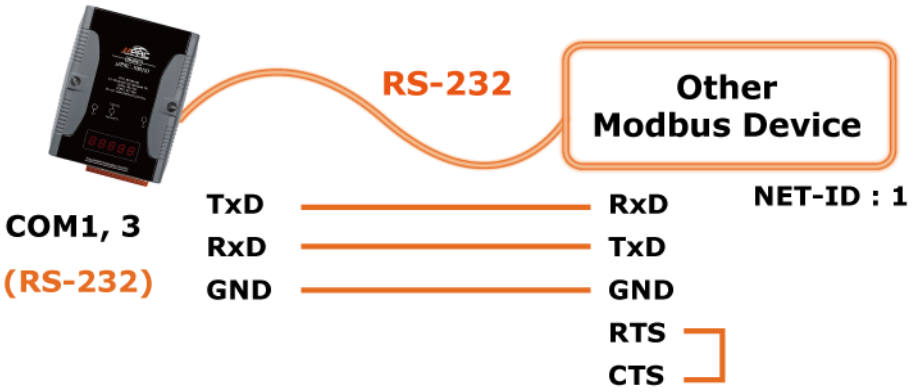
3.13 Create Two Modbus Master/Slave Links

µPAC-5x07 can support max. two Modbus "Slave" (COM1, 2, 3) or two Modbus "Master" (COM1 or 2/3) ports at the same time for various kinds of application.

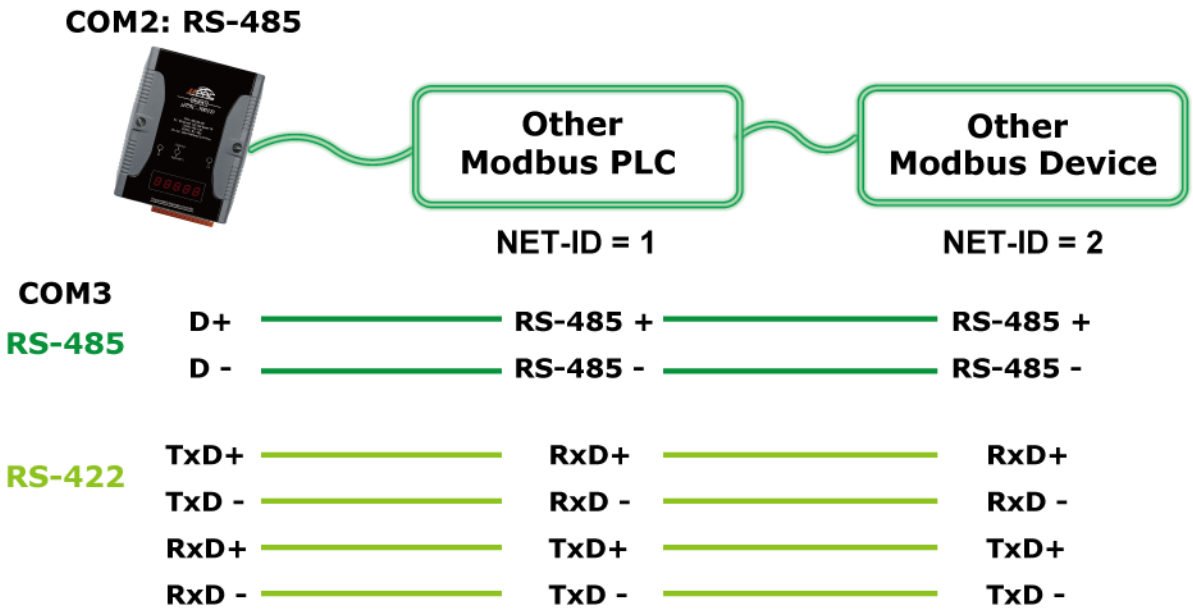
COM3: The COM3 of µPAC-5x07 is on the plugged XW-Board XW5xx.
RS-232 (with one XW503, XW504...XW-board) or
RS-485 (with one XW511... XW-board) or
RS-422 (with one XW507... XW-board)

Multi-Link: One µPAC-5x07 PAC can link multi Modbus devices via RS-485 or RS-422. Every linked device must have one unique NET ID (1 ~ 255). Their Baud rate and the Checksum must be the same as the PAC's.

Wire Connection (RS-232):



Wire Connection (RS-485/RS-422):

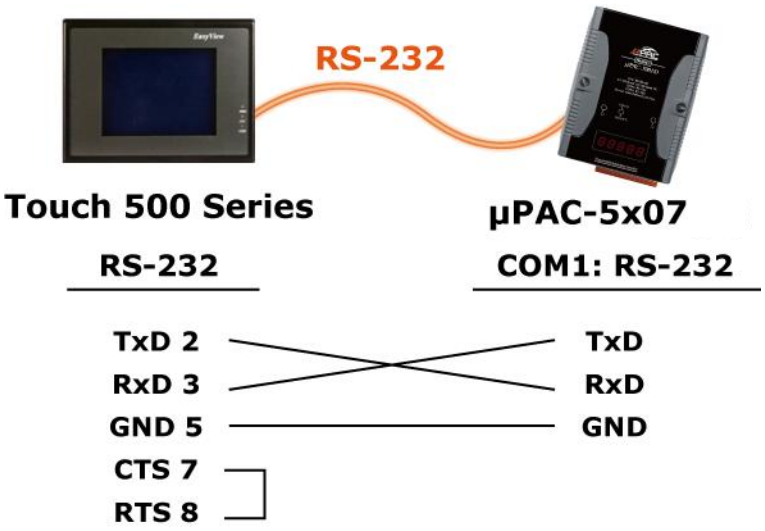


3.14 Link to HMI Interface Device

The COM1: RS-232 port of the µPAC-5x07 can be used to interface with additional Human Machine Interface (HMI) devices such as touch screen displays.

ICP DAS provides a series of touch screen displays, such as the "Touch" series. This product comes in various size and model.

For new & detail information please visit web site:
http://www.icpdas.com/products/Products-list_c.htm#P8.

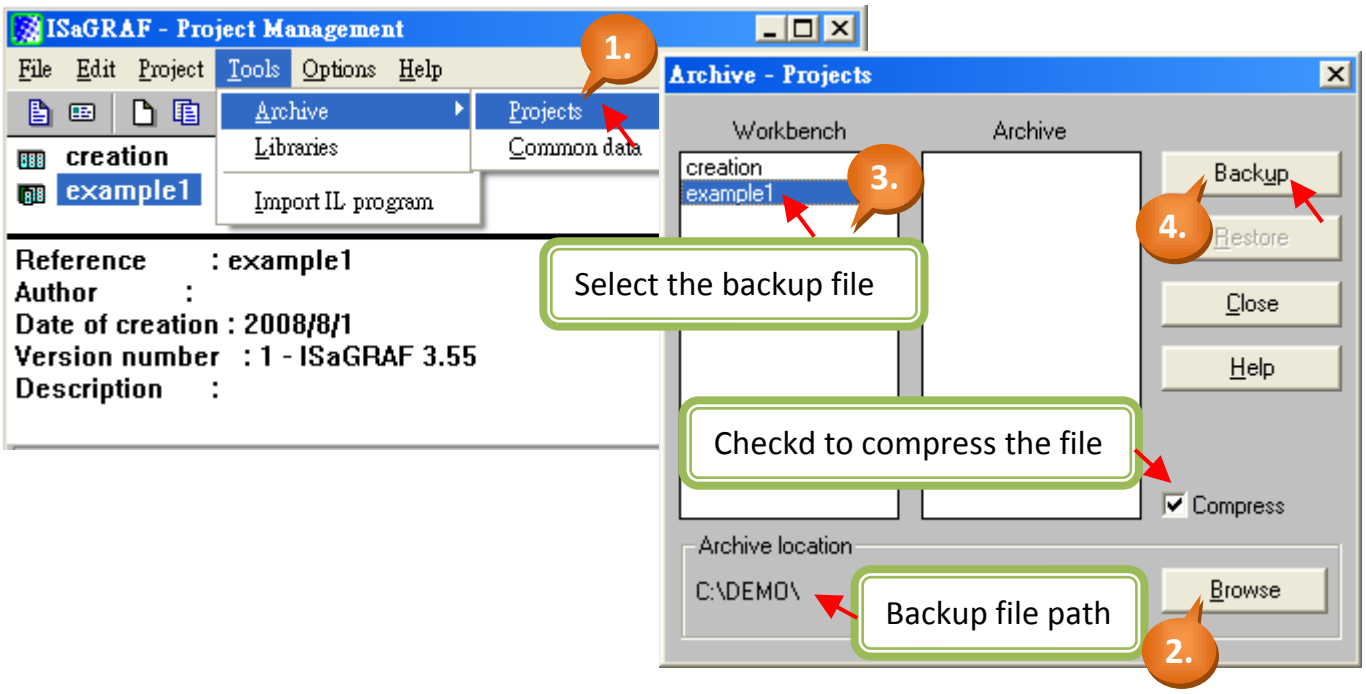


3.15 Backup & Restore an ISaGRAF Project

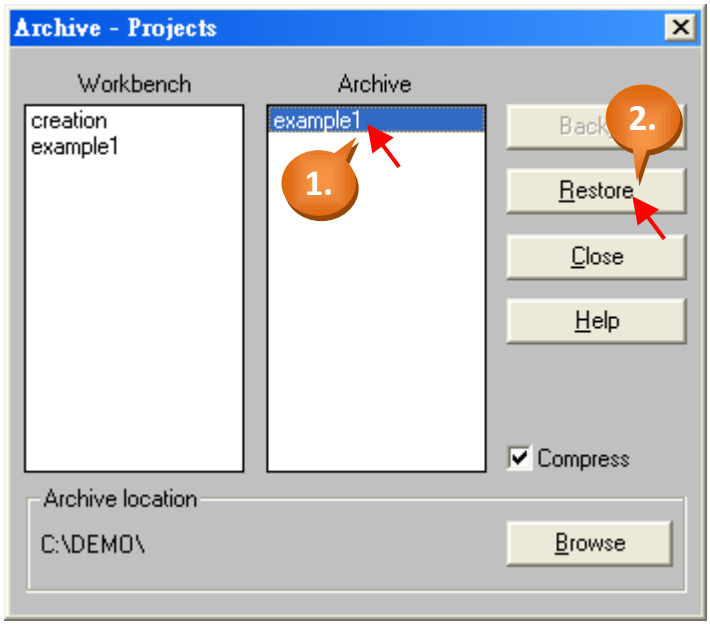
For user's archiving purposes, ISaGRAF Workbench provides the backup and restore functions. Sometimes, you would like to compress your projects to someone, such as e-mail to: service@icpdas.com for technical support.

Backup an ISaGRAF Project

1. Click "Tools" > "Archive" > "Projects" in "ISaGRAF Project Management" window.
2. Click "Browse" to select the path of the backup file in "Archiev – Projects" window.
3. Select the project name you want to backup in "Workbench" field.
   (You can click "Compress" checkbox to compress the file.)
4. Click "Backup" to backup the file to the folder.



Restore an ISaGRAF Project



To restore an ISaGRAF project from a backup folder, use the same method as above:

Select the project name you want to restore from the "Archive" field.

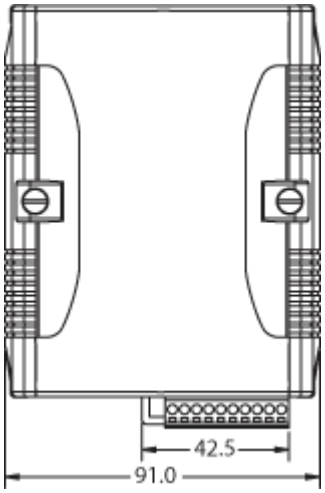
1. Click on the "Restore" button, the project will be restored to the "Workbench" field.

Now, you can open, edit and download the restored ISaGRAF project file.

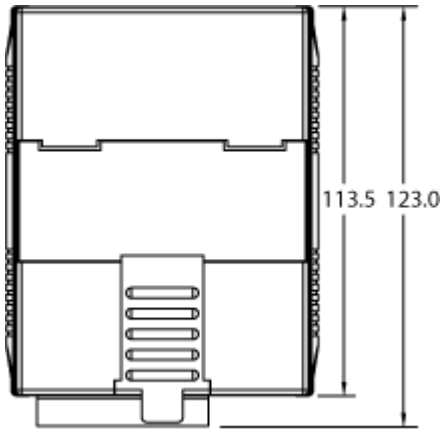
3.16 Dimension & Mounting for µPAC-5x07

Unit: mm

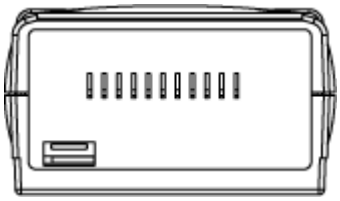
Front View



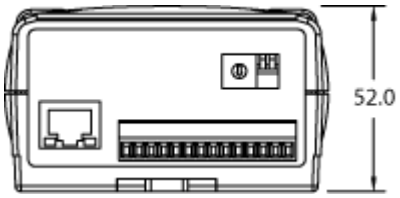
Back View



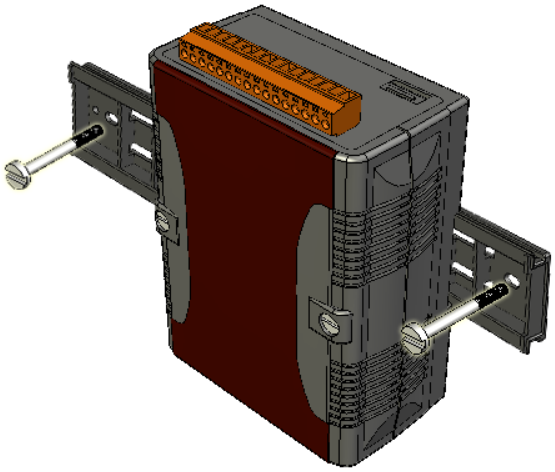
Top View



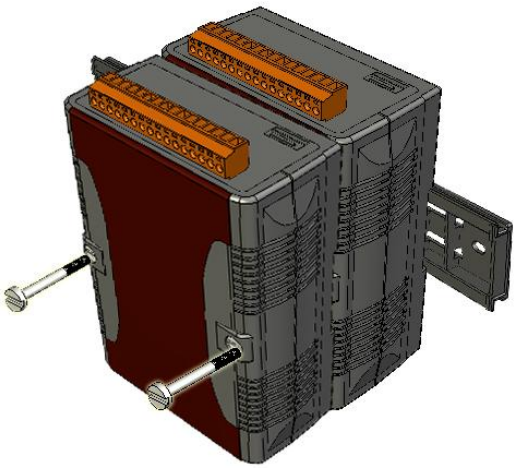
Bottom View



DIN-Rail Mounting



Piggyback Mounting



Chapter 4. ISaGRAF Demo

4.1 Writing a Simple ISaGRAF Program

Note: The following is a step-by-step example on how to create a ladder logic (henceforth referred as "LD") program and download it to µPAC-5x07 PAC. If you do not install the "ISaGRAF Workbench" and "ICP DAS Utilities for ISaGRAF" software, please refer to Section 2.1: Step1 & 2 .

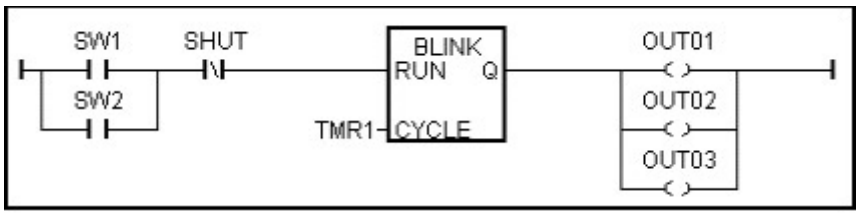
Example of LD Program:

The following is a step-by-step example on how to create a ladder logic (henceforth referred as "LD") program, we use µPAC-5307 PAC (plugged XW-board: XW107).

Variable Declaration:

Name	Type	Attribute	Description
SW1	Boolean	Input	Input Switch 1
SW2	Boolean	Input	Input Switch 2
SHUT	Boolean	Input	Input Shutdown button
OUT01	Boolean	Output	Output 1
OUT02	Boolean	Output	Output 2
OUT03	Boolean	Output	Output 3
TMR1	Timer	Internal	Time Period of blinking, initial value is set at "T#1s"

LD Program:

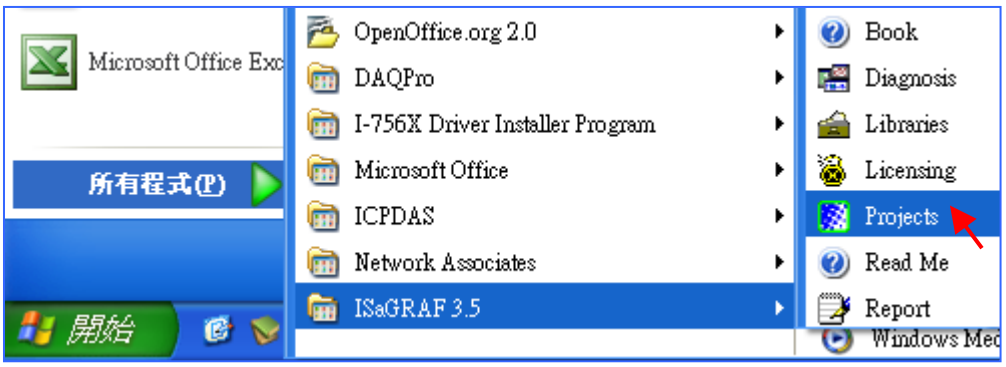


Action Procedure:

1. Monitors the "SW1" (Default: OFF) and "SW2" (Default: OFF).
2. Monitors the "SHUT" button (Default: OFF, Normal Close)
3. If either "SW1" or "SW2" is ON and the "SHUT" is OFF, start the (blinking) timer "TMR1".
4. OUT01 ~ 03 will switch to ON and OFF per second.
5. Press "SHUT" to stop the bliking of OUT01 ~ 03.

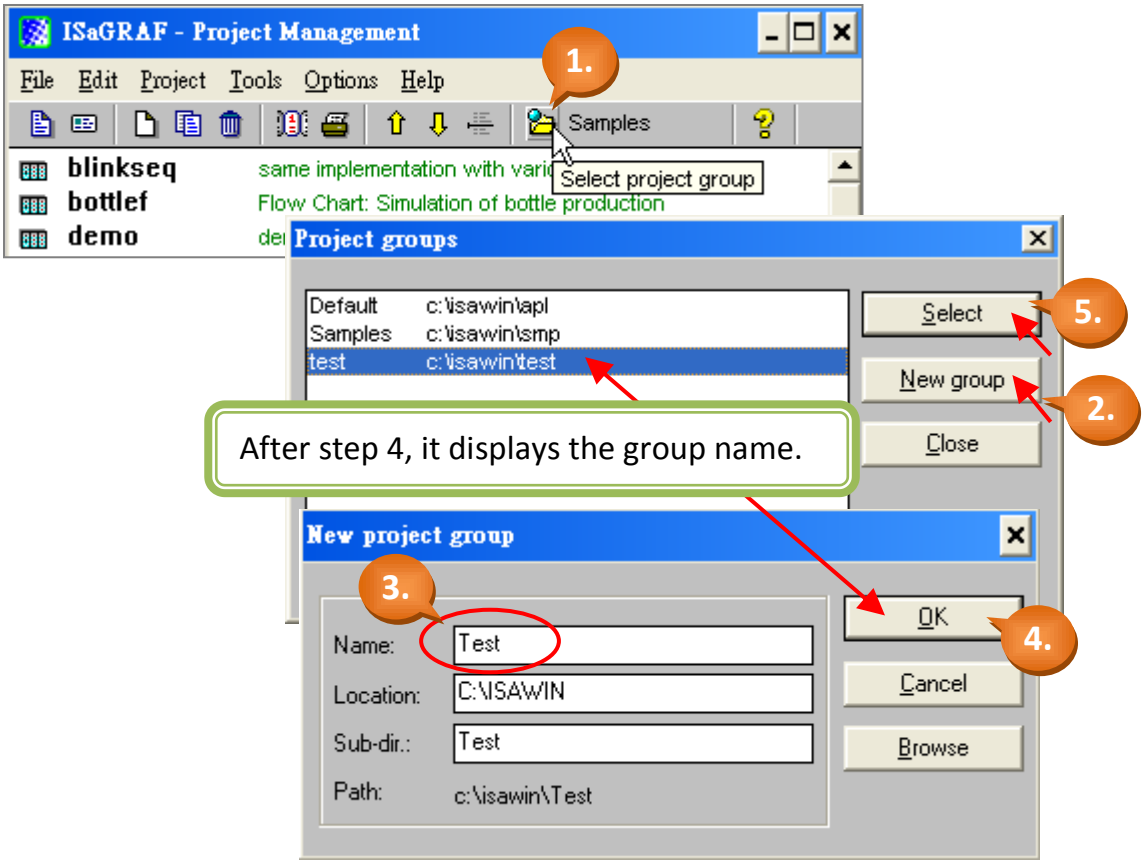
4.1.1: Start ISaGRAF – Project Management

First, start the ISaGRAF Workbench software, please click on the Windows [Start] > [All Programs] > [ISaGRAF 3.x] > [Projects], as shown below.



4.1.2: Creating an ISaGRAF Project Group

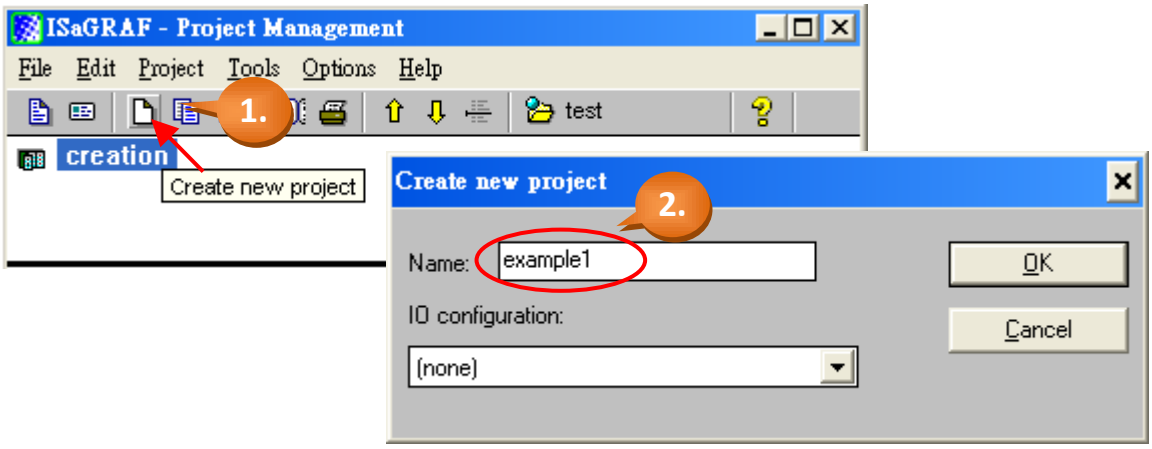
Click the "Select Program Group" tool button then click "New Group" button. Key in the name for the new group you wish to create then click on "OK".



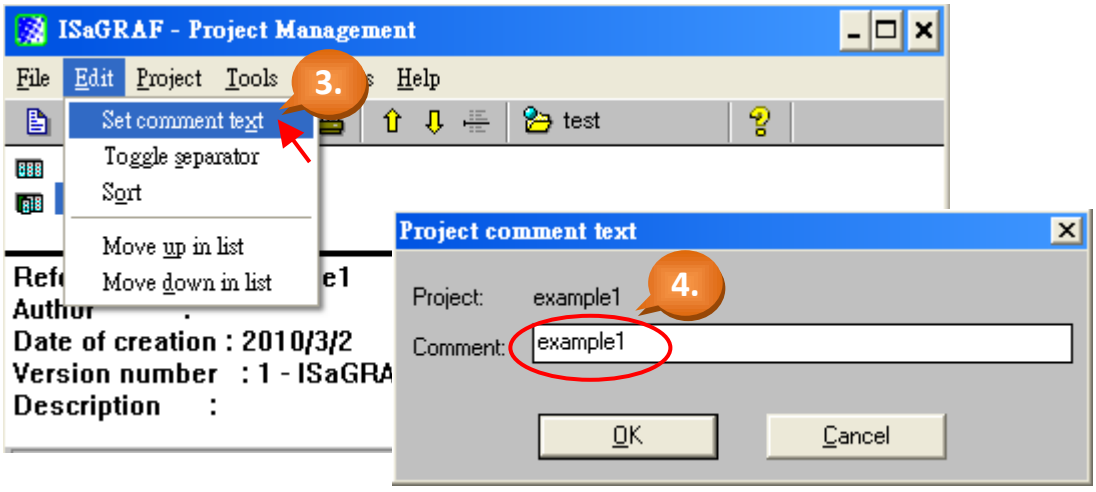
After press “OK”, it will create a new folder under the "c:\isawin" and show the group name and file path in “Project Groups” window. Now, you can click "Select" button or Double-click the group name to open it.

4.1.3: Creating a New ISaGRAF Project

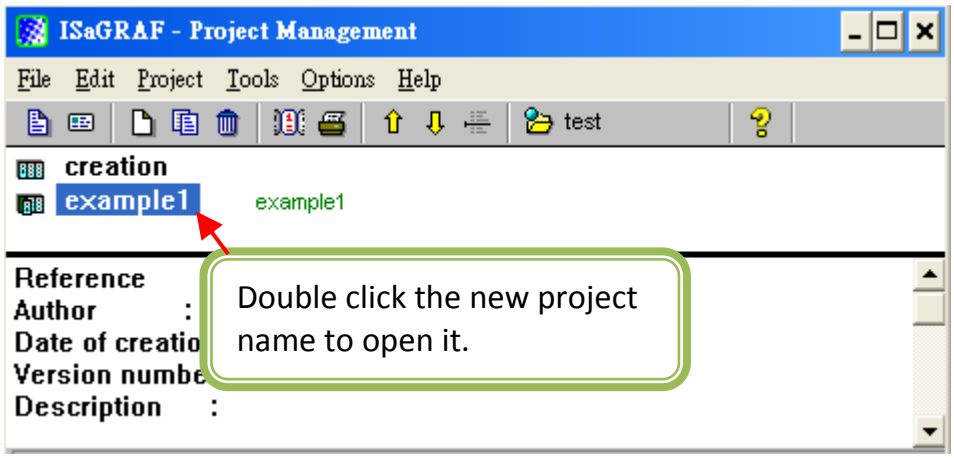
To create a new ISaGRAF project, click the "Create New Project" then enter the name for the new project.



You can enter additional information for your project by clicking on the [Edit] > [Set Comment Text].



You will now see the name of the new project in the "Project Management" window. Double-click the new project name to open the new project

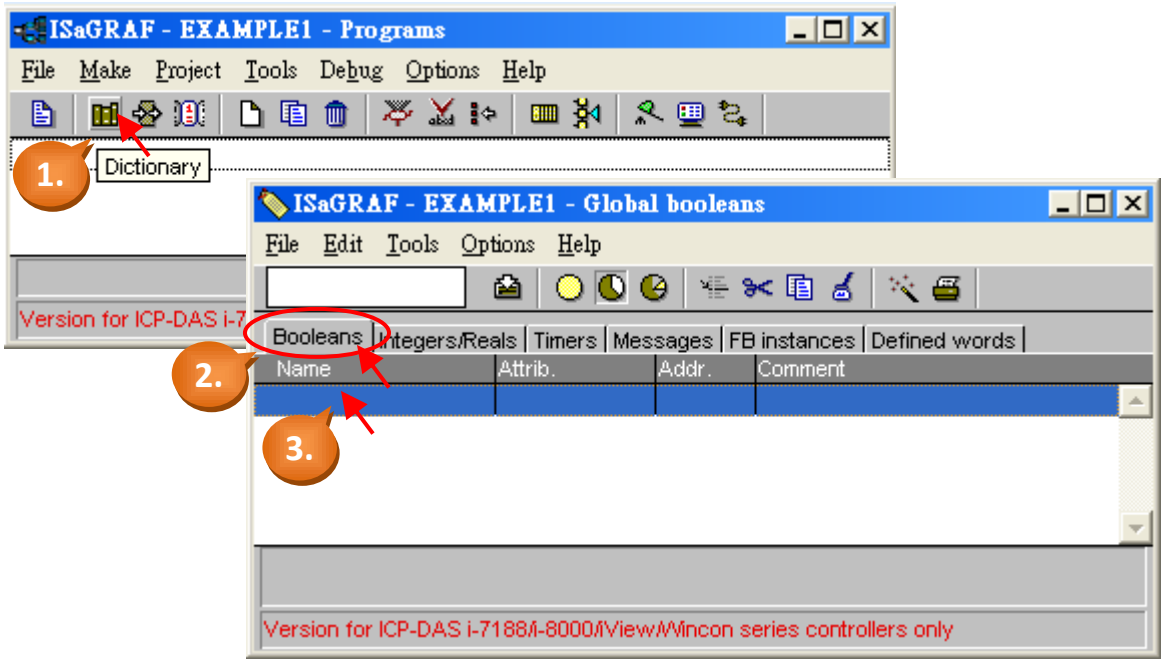


4.1.4: Declaring the ISaGRAF Project Variables

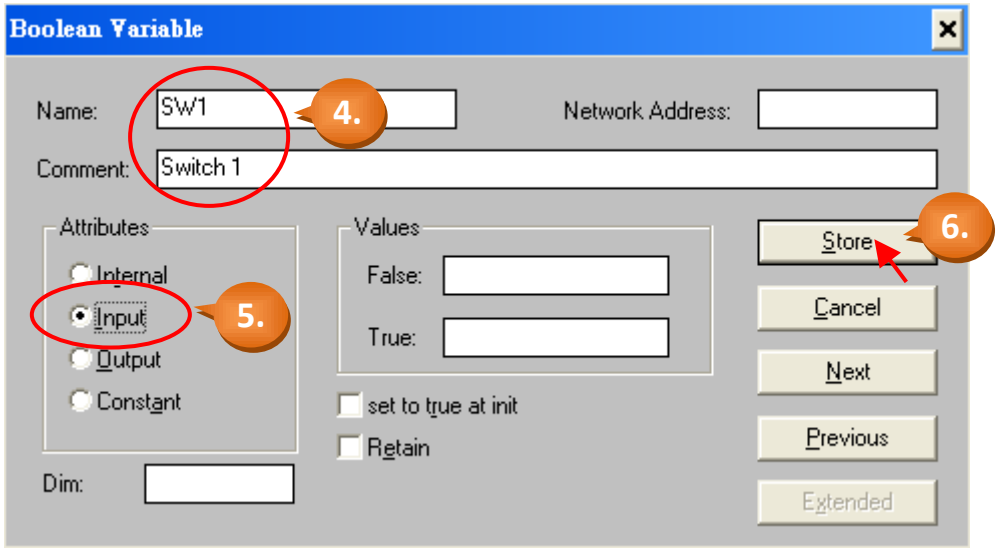
Before you start creating an ISaGRAF program, you must first declare the variables that will be used in the ISaGRAF program.

Declaring Boolean:

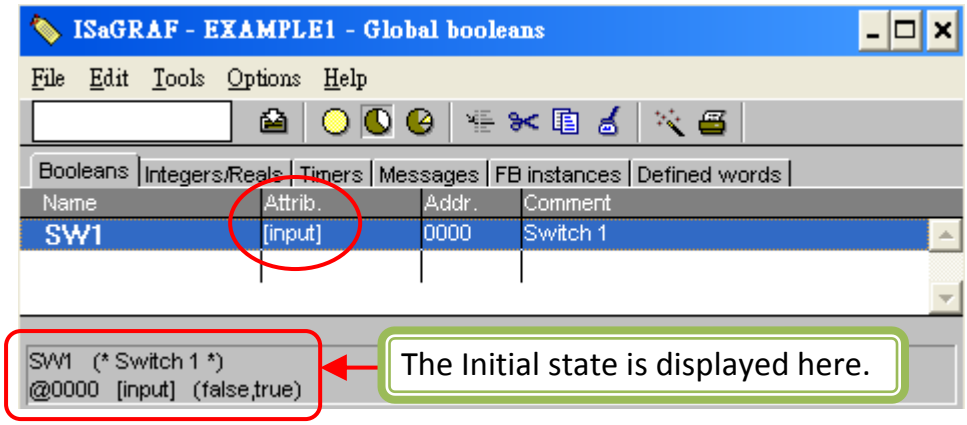
1. Click "Dictionary" tool button.
2. Click "Booleans" tab to declare the Boolean variable which required in program.
3. Double-click on the colored area below the "Booleans" tab to go into "Boolean Variable" window.



4. In this example, type "SW1" as the name and type "Switch 1" as the comment.
5. Set the attribute as "Input".
6. Finally, click "Store" button to save.



In this screen, you have declared the Boolean variable.

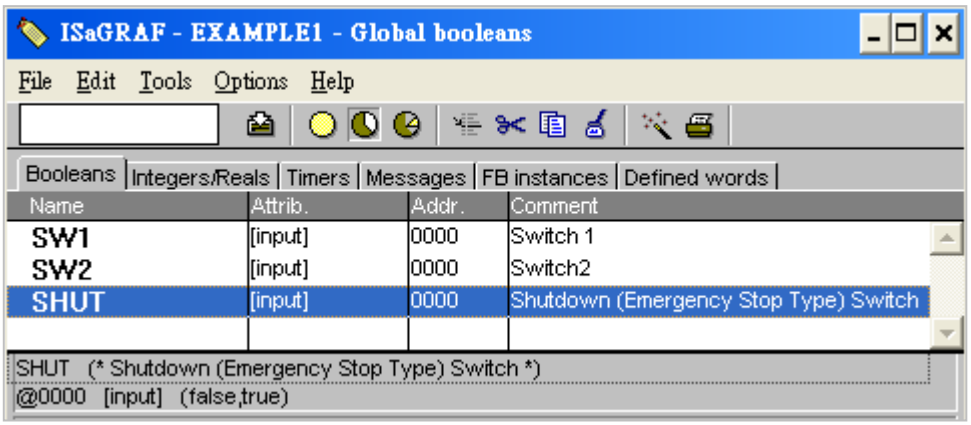


Note: The other fields behind the "Name" provide the programmer with detail information for this variable.

Note: Ensure that you have declared the proper attribute of the variable. If you need to change the attribute, just double click on the variable name to reassign it.

Using the same method described above, declare the other Boolean variables for this example program, "SW2" and "SHUT".

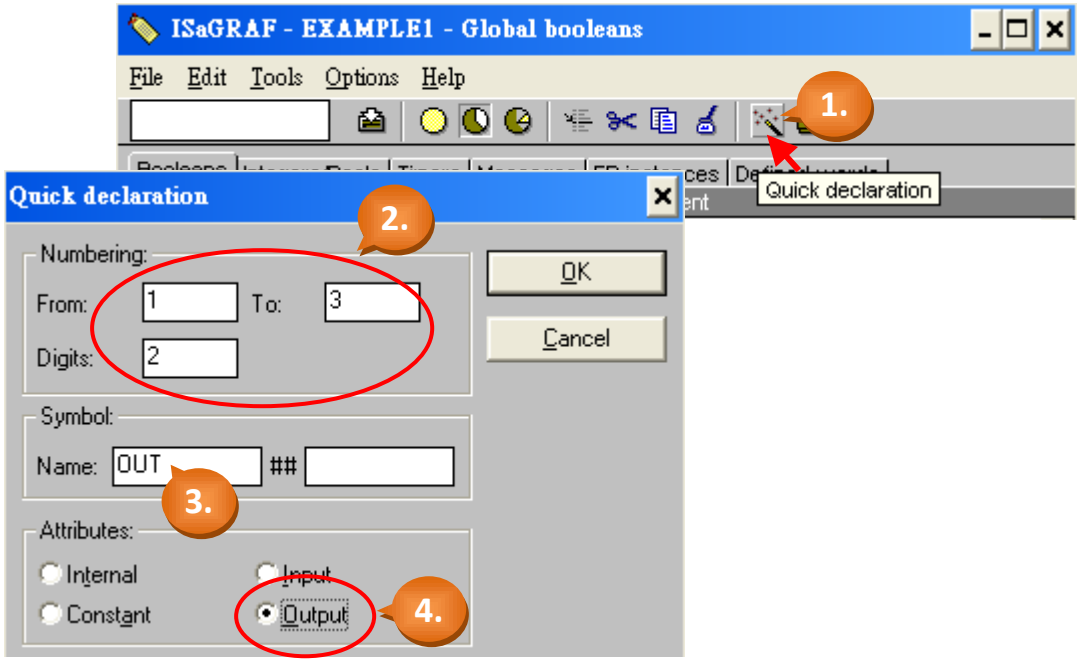
When you have completed the Boolean variable assignments, the Global Boolean window should be looked like below.



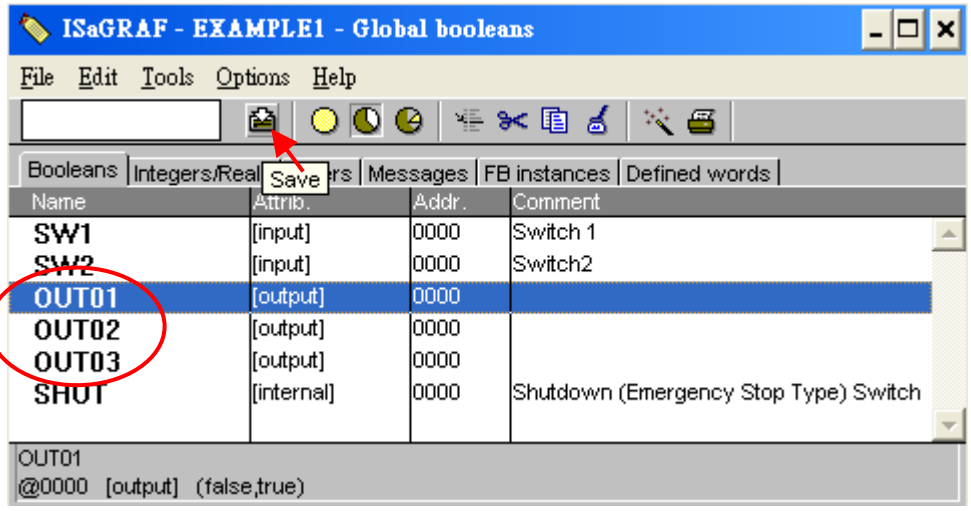
Quick Declaration:

There are three outputs used in this example named “OUT01”, “OUT02”, and “OUT03”. For these sequentially ordered variables, ISaGRAF provides a quick and easy way to declare them.

1. Click "Quick Declaration" tool button.
2. In the "Numbering" area,
   “From” and "To" indicates the ordinal number of the variable (Ex. From 1 To 3).
   “Digits” indicates the number of digits to display. (Ex. input 2, means 01 ~ 03).
3. In the “Name” field of "Symbol" area, type “OUT” as the variable name.
4. Finally, set the attribute as "Output".



After you press "OK", all three outputs will be immediately added to the "Global Booleans" window. Remember to press “Save” to store the settings.

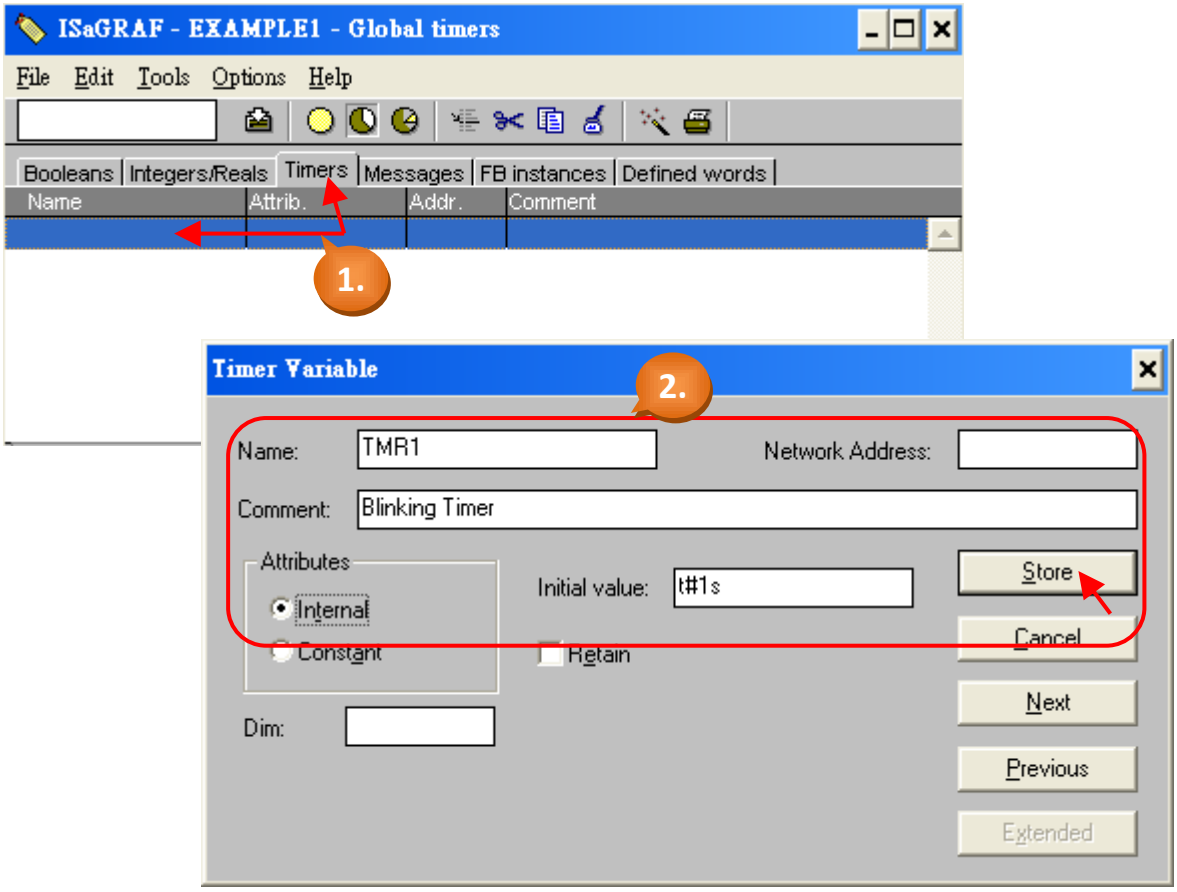


Declaring Timer:

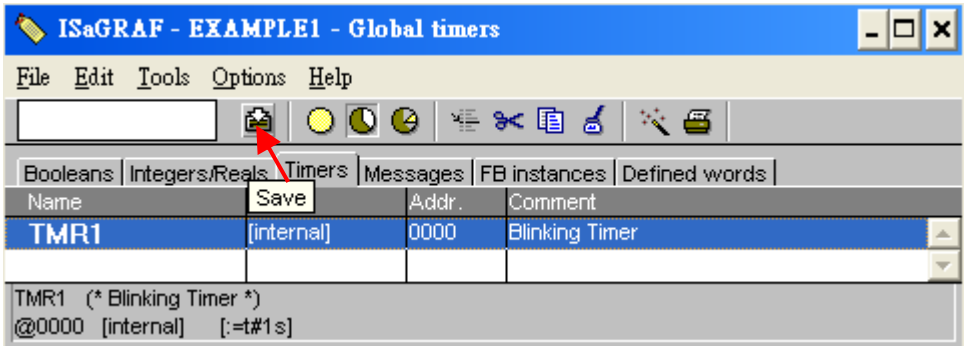
Please follow the similar way to declare the timer variable (TMR1).

1. Click "Timers" tab in the “Global…” window and double-click the colored area to open the "Timer Variable" window.

2. Type "TMR1" as the name, “Blinking Timer" as the comment and set the attribute as "Internal", and Initial Value as “T #1s". Finally, press "Store" to save them.



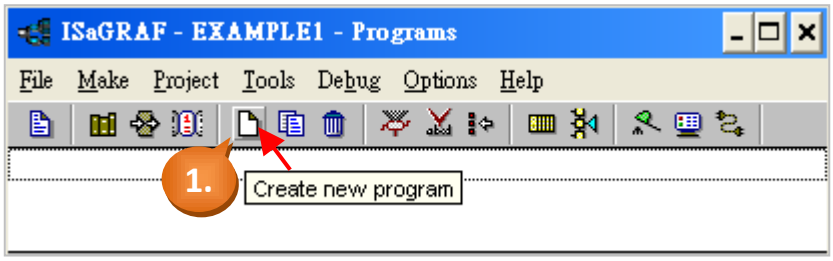
Now, you have completed the declaration of Timer variable (as diagram below). Please press the “Save” to store settings, and then click the top-right corner of the “X” to close the window.



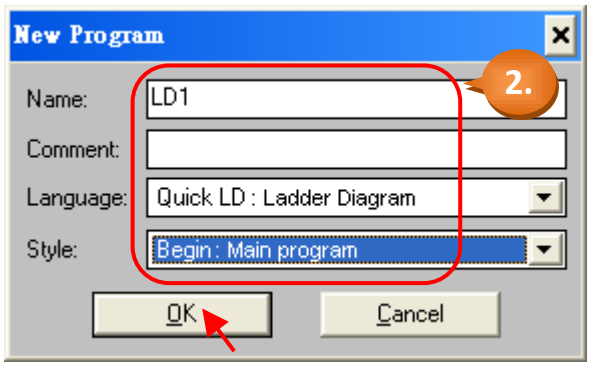
4.1.5: Creating the Example LD Program

Once all of the variables have been properly declared, you are now ready to create the example LD program. Please follow the steps to start this process.

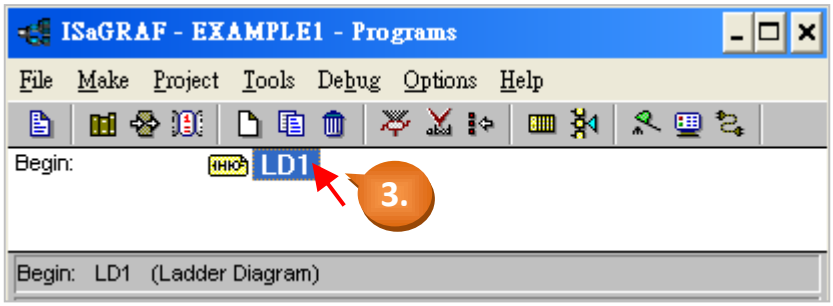
1. Click the "Create New Program" button and the "New Program" window will appear.



2. Type "LD1" as the name. (The program name in this example).
   Select the "Quick LD: Ladder Diagram" in "Language" field.
   Select the "Begin: Main Program" in "Style" field.
   (You could add the notes in "Comment" field but it is not required.)

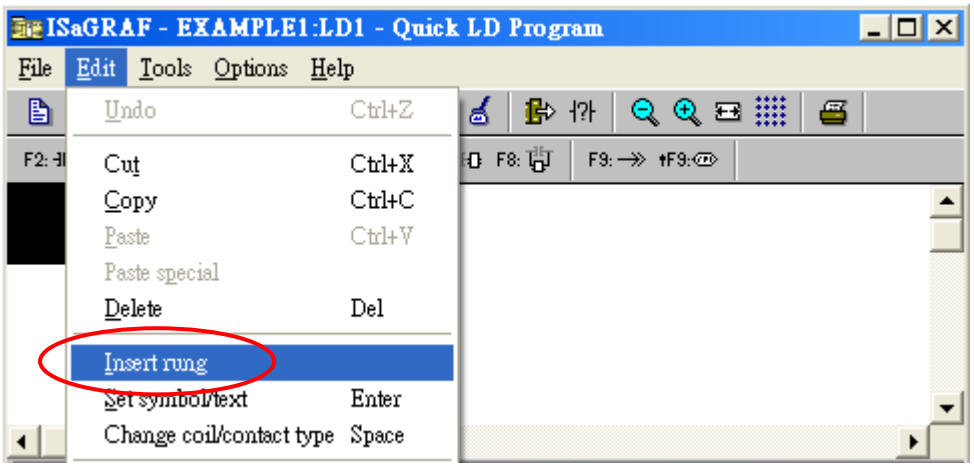


3. Double-click the “LD1” to begin programming.

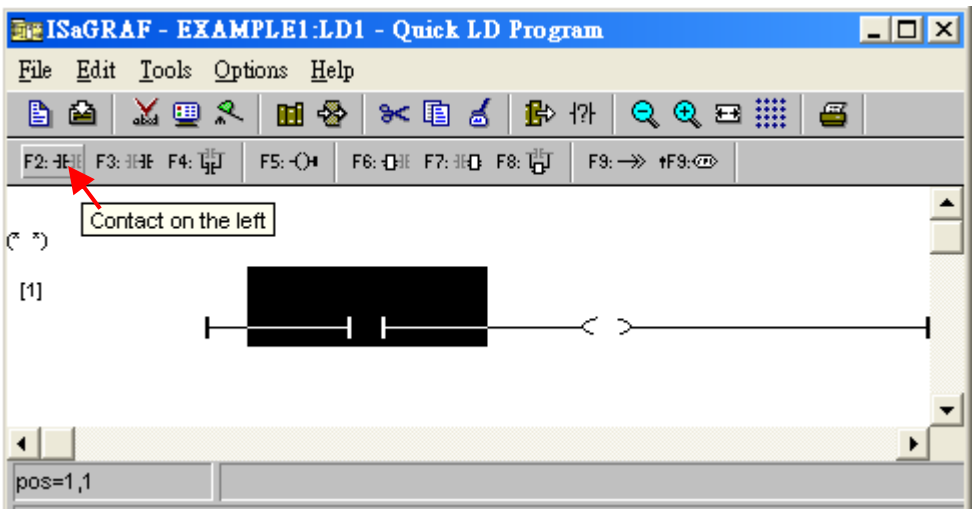


4.1.6: Editing the Example "LD1" Program

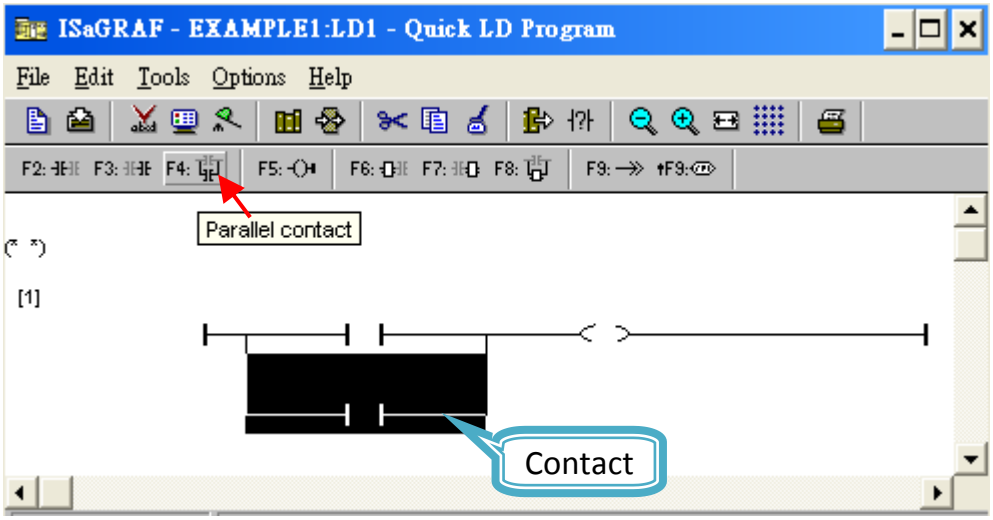
When you double click on the "LD1", the "Quick LD Program" window will appear. Please click [Edit] > [Insert Rung] (as shown below) to insert a basic LD rung.



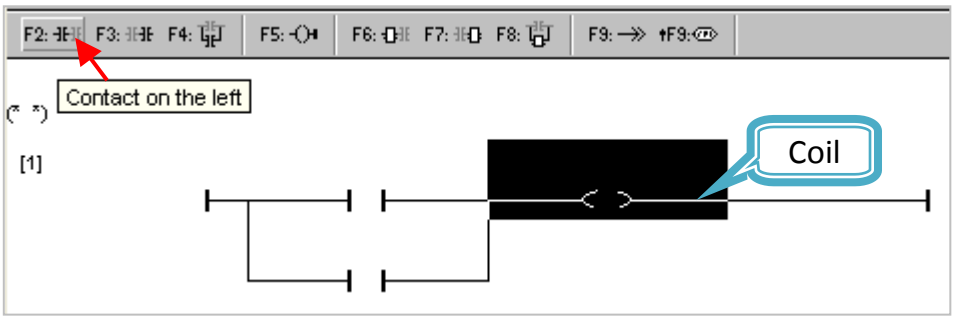
Or you could click the "F2 (Contact on the left)" tool button to insert a rung quickly.



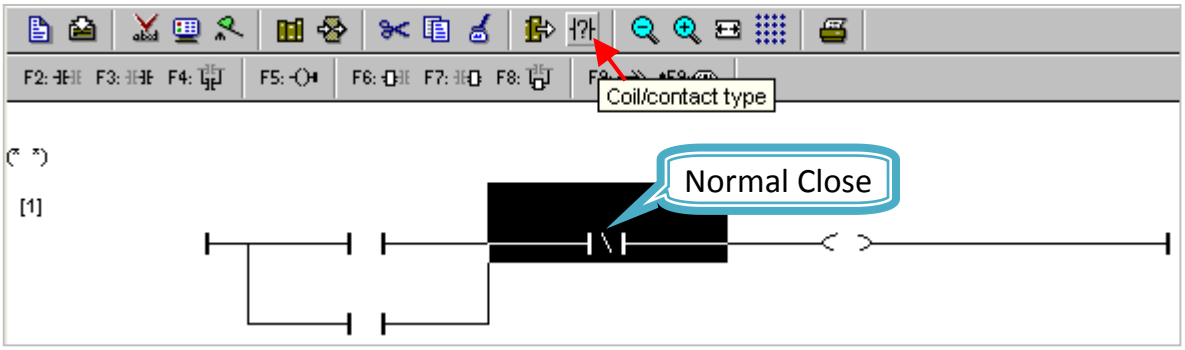
Click the "F4 (Parallel contact)" tool button to insert a parallel “Contact”.



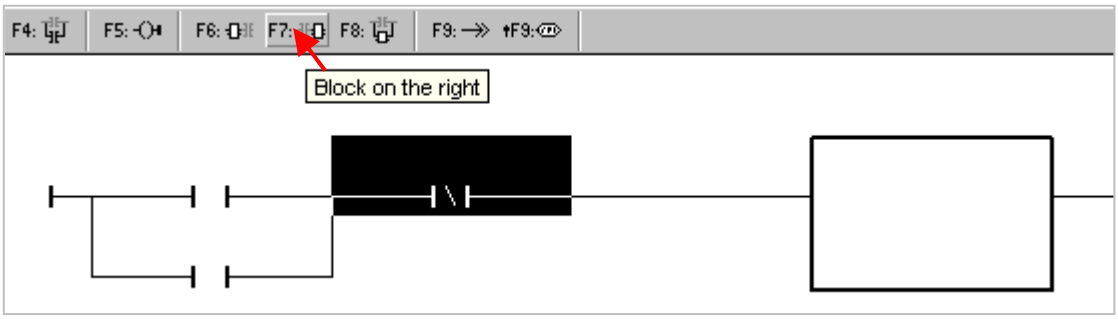
Next, click the “Coil” (as diagram below) and click the "F2 (Contact on the left)" tool button to insert a new “Contact”.



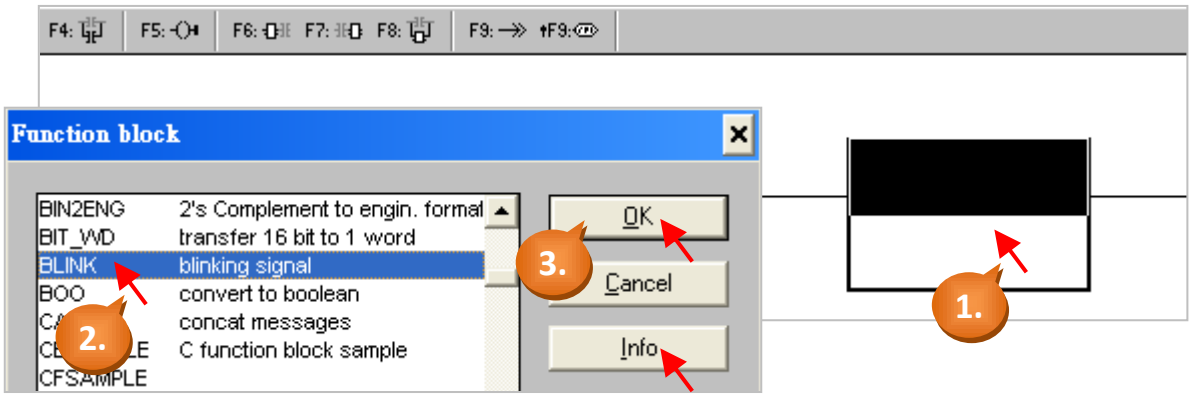
Then, click the “Contact” (as diagram below) and click the "Coil/contact type" tool button to set the attribute as “Normal Close”.



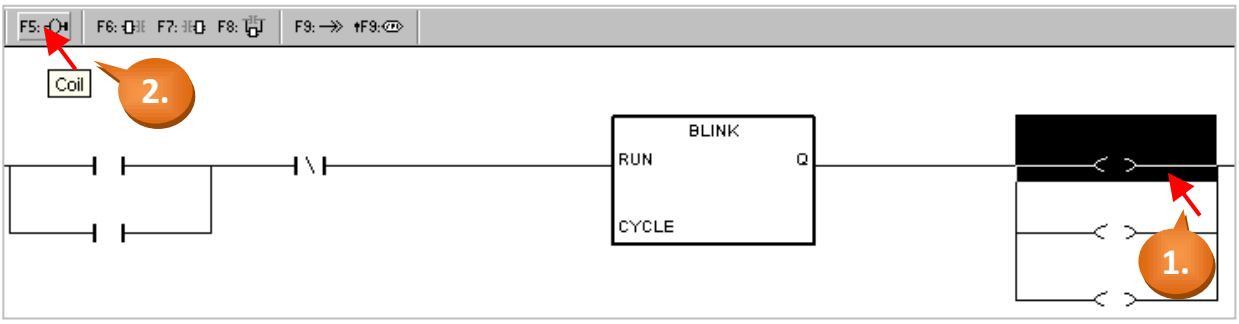
Click "F7 (Block on the right)" button to add a function block (for timer) on the right.



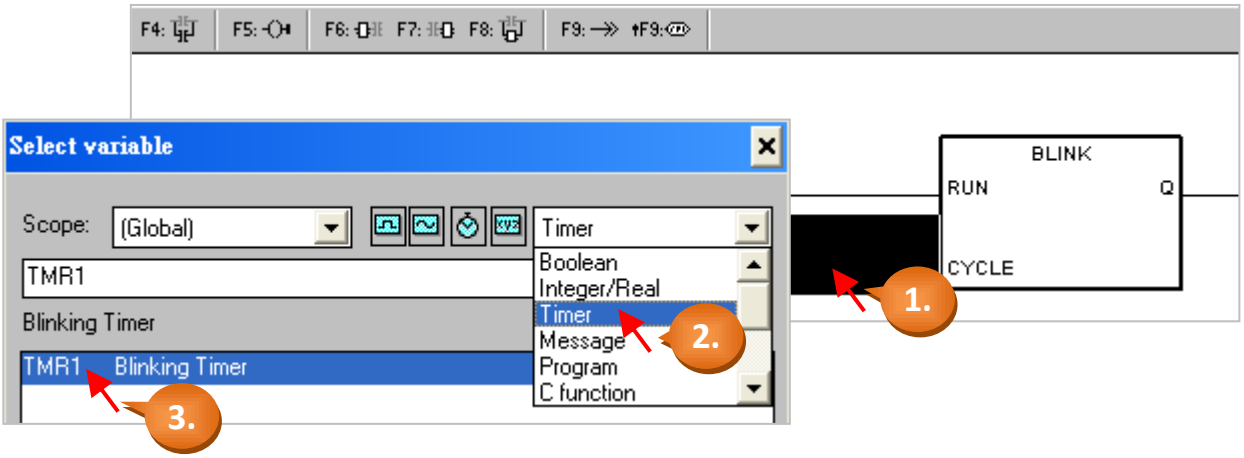
Double-click the function block and then the "Function Block" window will appear. Select "BLINK" function block and click “OK”. You can also click “Info” to get more information about the function block.



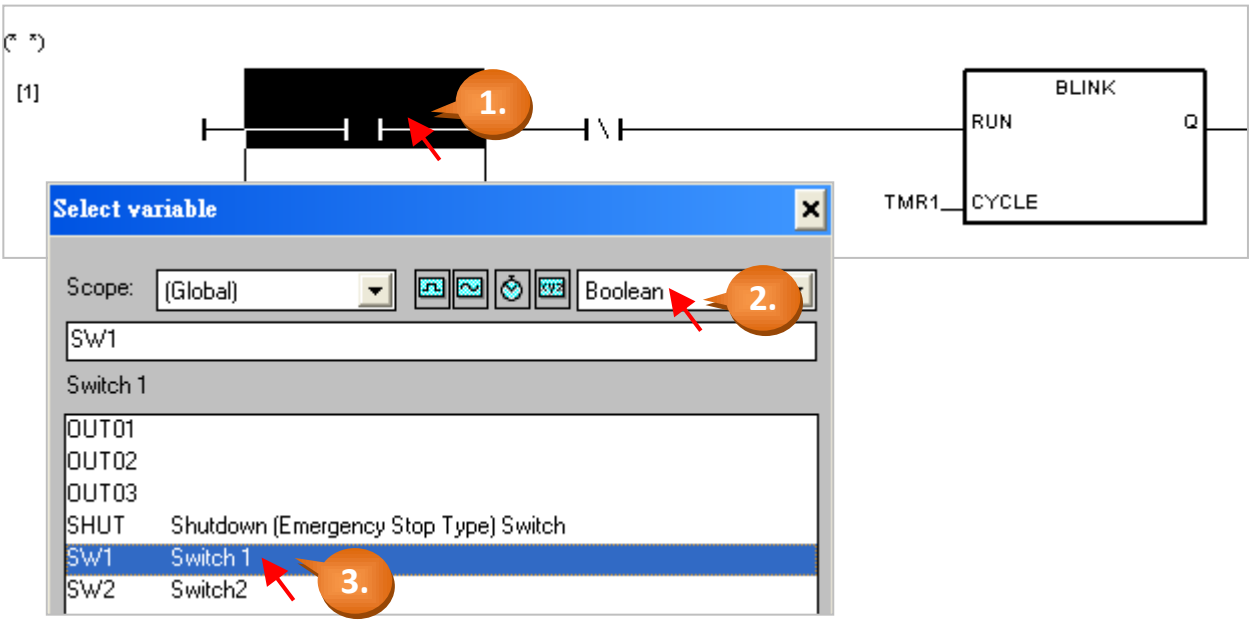
Finally, click the “output coil” to the right side of LD program and click the “F5 (Coil)” twice to add two “coil” under the first one.



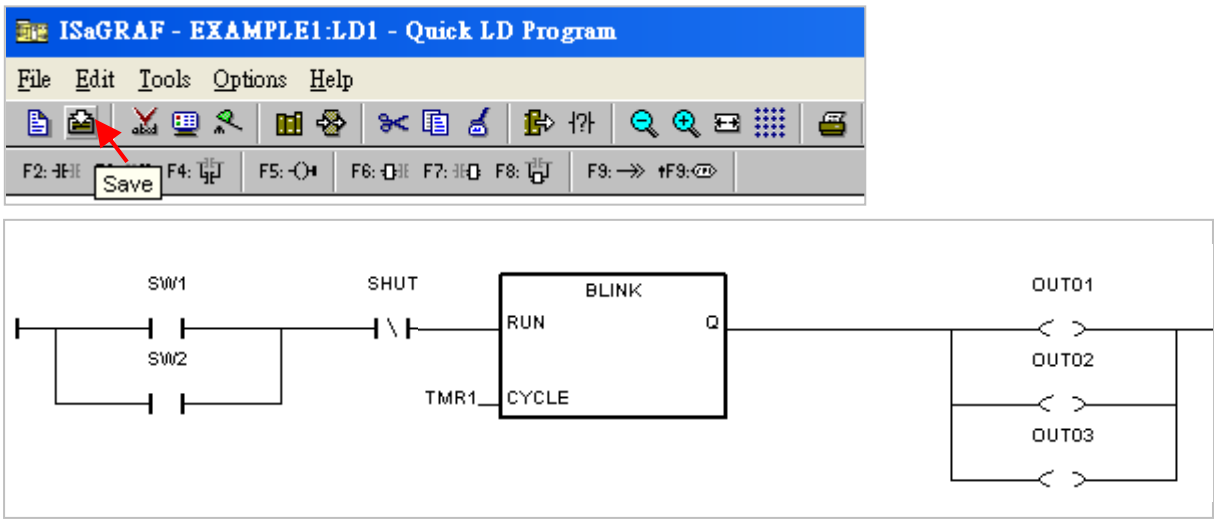
Now we are ready to specify the variables. Double-click the outside of "CYCLE" and the “Select variable” window appears. Select the "Timer" and then specify the variable as "TMR1".



Double-click the first “Contact” (Normal Open, as shown below). In "Select Variable" window, select “Boolean” and then specify the variable as “SW1”.



Please follow the same way to specify all variables to the “Contact” and “Coil”. Later, remember to click the "Save" button to store the settings (As diagram below).



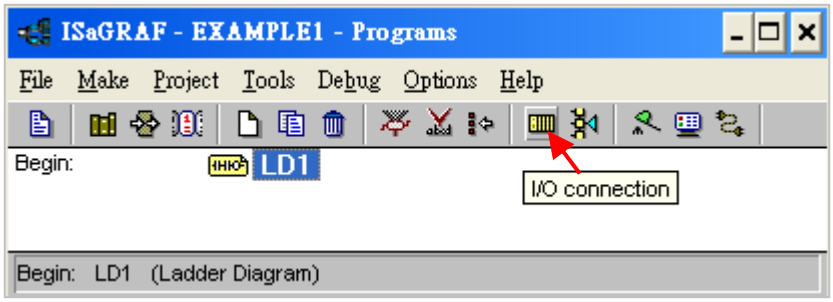
4.1.7: Connecting the I/O

The ISaGRAF Workbench is an open programming system. This allows user to create their ISaGRAF program to control a large number of variant PLC controller systems. The PLC hardware manufacturer should be responsible to embed the “ISaGRAF kernel” in their respective controller so that the ISaGRAF program operates properly.
The ICP DAS ISaGRAF PAC Series, programmable automatic controller, provides a powerful and flexible industrial controller system.

Connecting I/O Equipment:

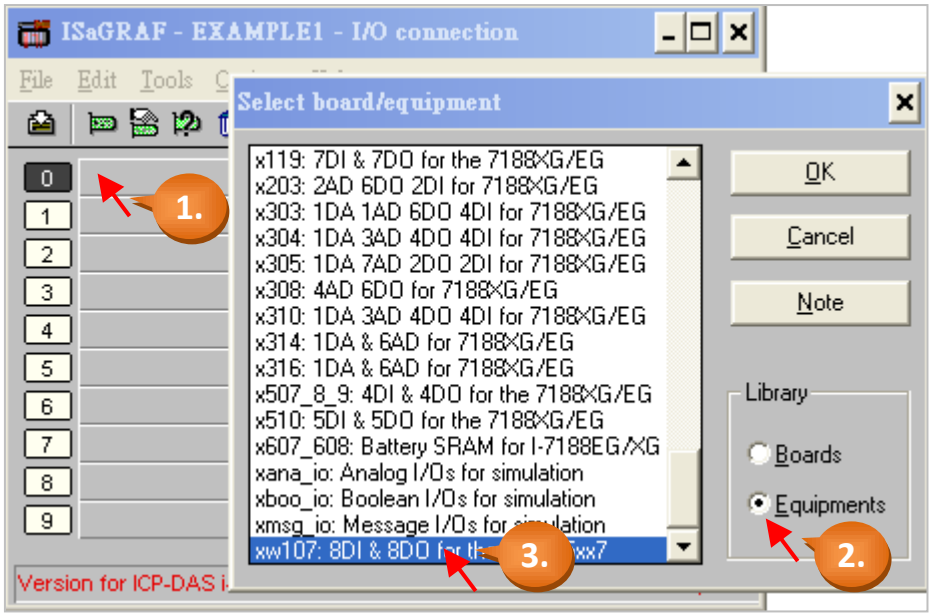
You have created the ISaGRAF example program. Now, the I/O variable we created before should be map to the µPAC-5x07's real I/O. In this example, we use µPAC-5307 PAC with an “XW107” I/O expansion board to add digital input and output channel (Please refer to Appendix D).

Click the "I/O Connection" tool button and the "I/O Connection" window will appear.



As diagram below,
1. Double-click "0" slot, the "Select Board/ Equipment" window will appear.

2. Click the “Equipments” and double-click “xw107” to select it. (If you have no XW-107, click any slot and select “xboo_io: Boolean I/O for simulation”)

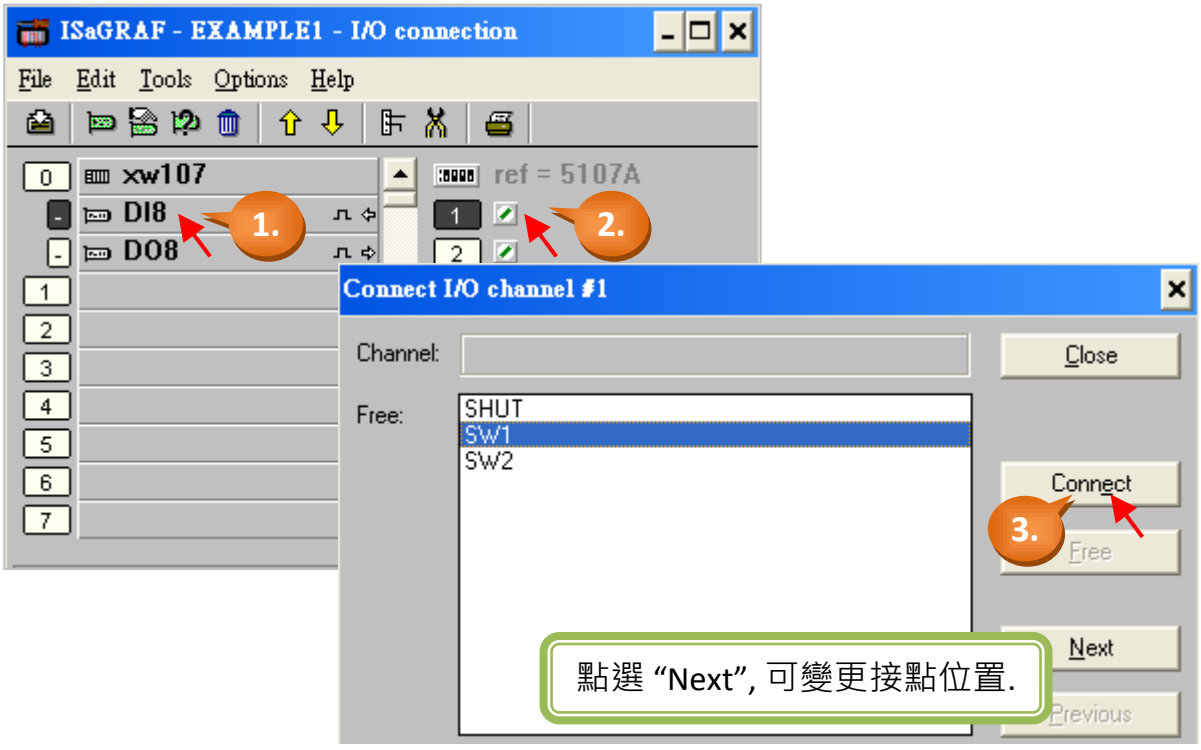


Important Notice:

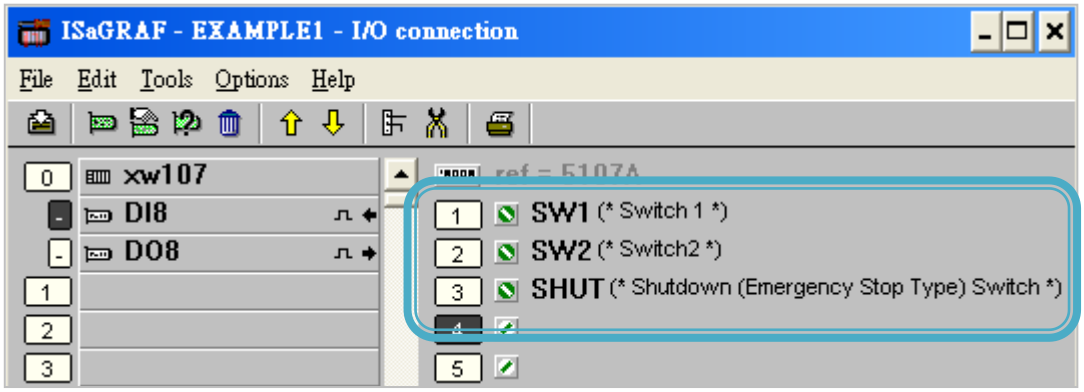
1. “0” slot is reserved for I/O expansion boards (XW-board) inside the controller.
2. For Remote I/O modules, you can use any slot and select the “Equipments” as “bus7000”.

Connecting Input:

To connect the Input attributed variables to “XW107”, please click “DI8” and double click the right side of channel “1”. Then select the variable name that corresponds to the channel, and click “Connect” button.

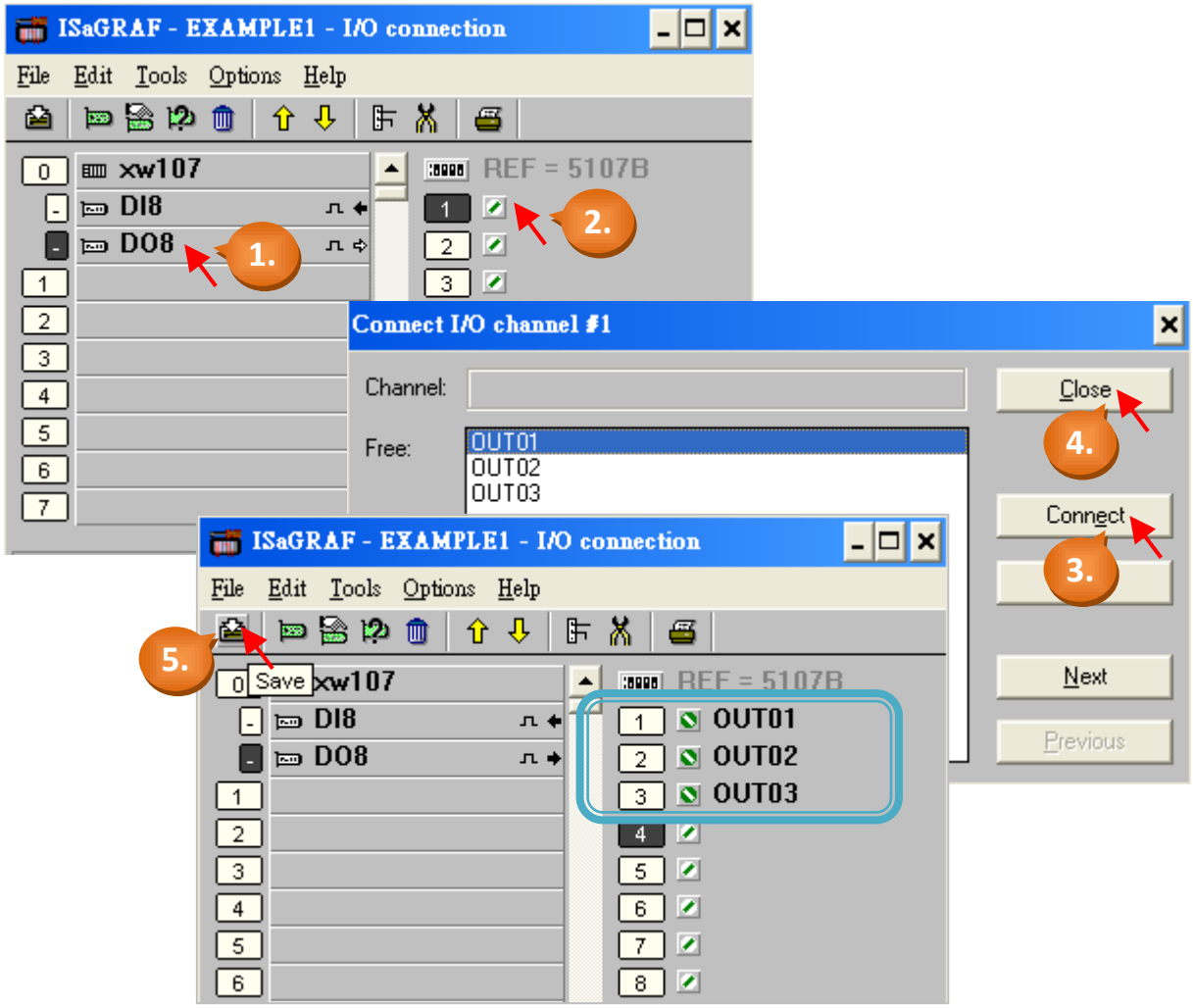


As diagram below, you have completed it.



Connecting Output:

To connect the output attributed variables to “XW107”, please click “DO8” and double click on the right side of channel “1”. Select the variable name that corresponds to the channel, and click “Connect” button. Finally, click “Close” to close the window. Remember to click the "Save" button after you completed the I/O connection.



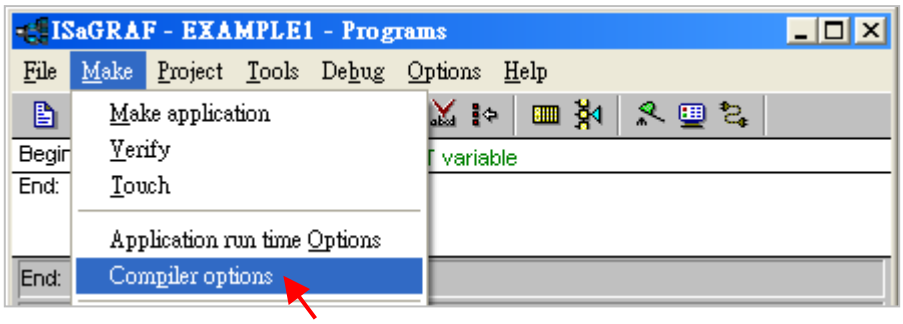
Important Notice:

All of the Input and Output variables MUST be connected through the I/O connection as described above for any program to be successfully compiled. Only the Input and Output variables will appear in the "I/O Connections" window.

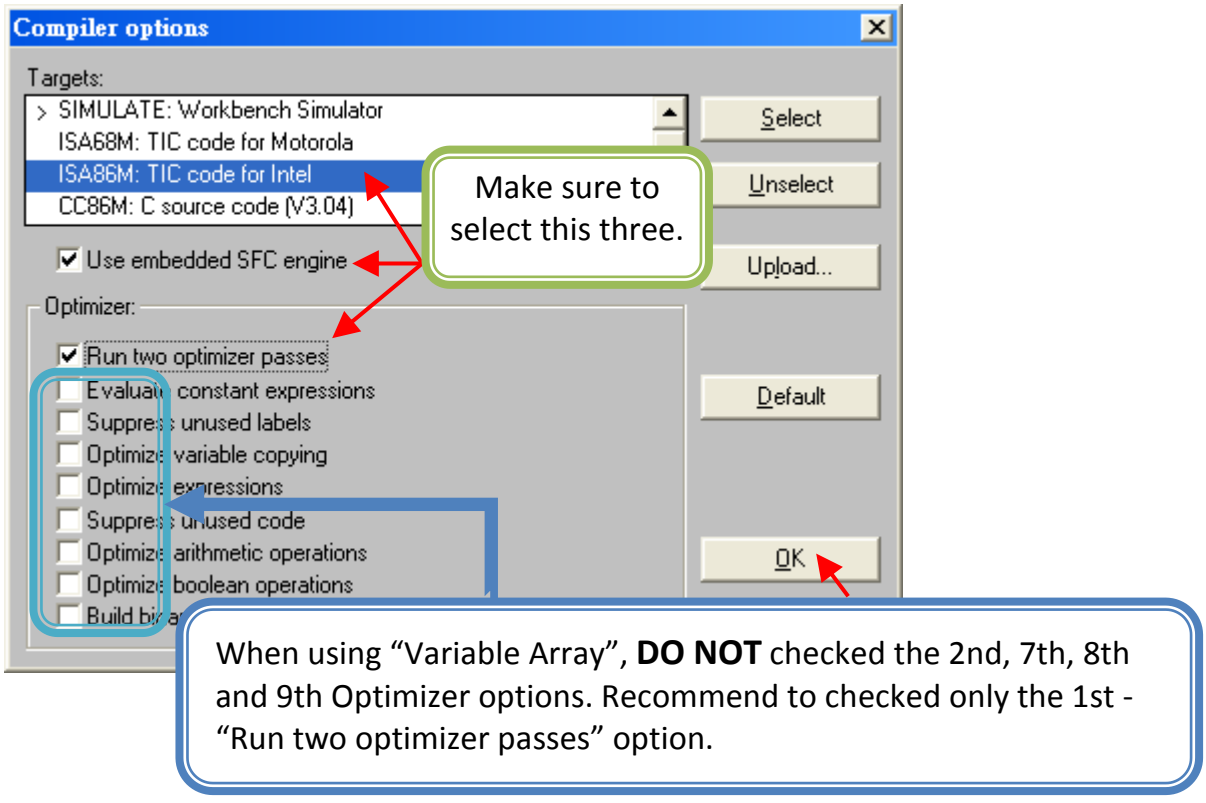
4.2 Compiling & Simulating the Example Project

Note: In order to ANY and EVERY ISaGRAF program to work properly inside the ISaGRAF PAC Series systems, the programmer should be responsible for selecting the correct "Compiler Options". You MUST select the "ISA86M: TIC Code For Intel" option as described below.

First, click the main menu [Make] > [Compiler Options].

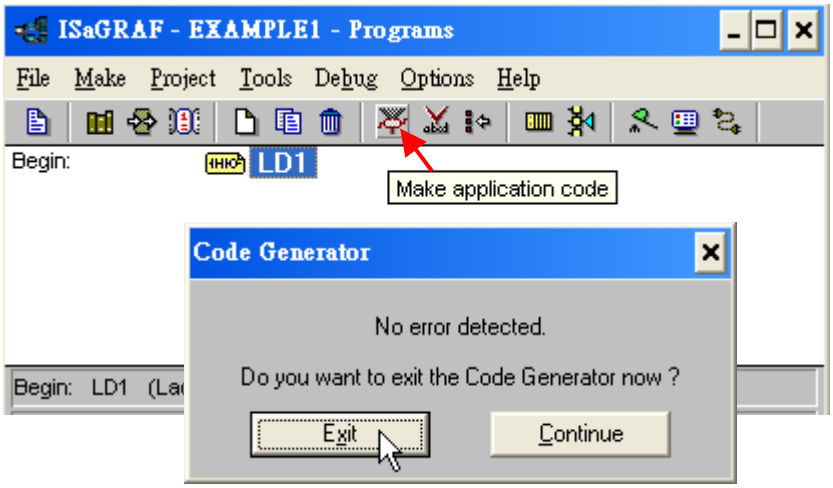


Make sure you have selected the following three necessary options in the "Compiler Options" window, and press "OK" button to complete the setting.



4.2.1: Compiling the LD Project!

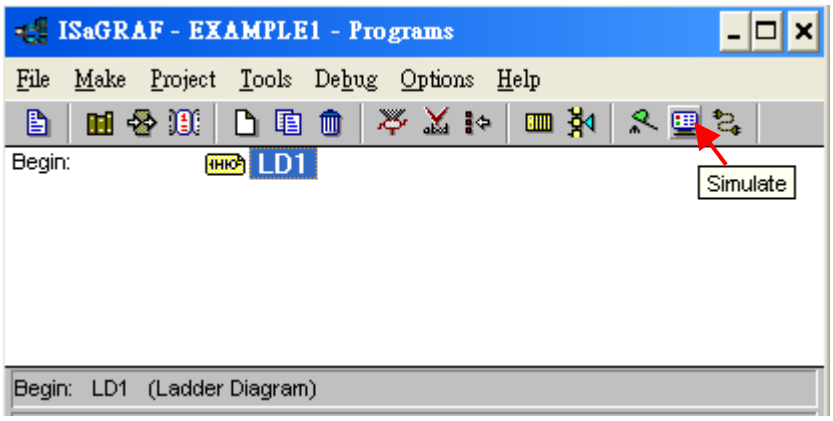
Now, you have selected the proper compiler options, please click on the "Make Application Code" button to compile the example LD project. If there is no compiler errors detected during the compilation process, CONGRATULATIONS, you have successfully created our example LD program.



If some red error message listed in the “Code Generator” window, please double-click the message to go into the LD1 program to modify it. Finally, re-compile it again.

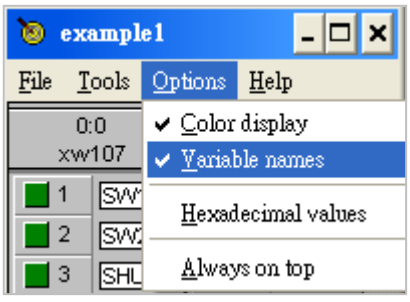
4.2.2: Simulating the LD Project

A powerful program debug feature of the ISaGRAF software is able to simulate the program. You can preview the operation result before downloading the program to the µPAC-5307 PAC system. After successfully compiling the example LD program, click the "Simulate" tool button as shown below.

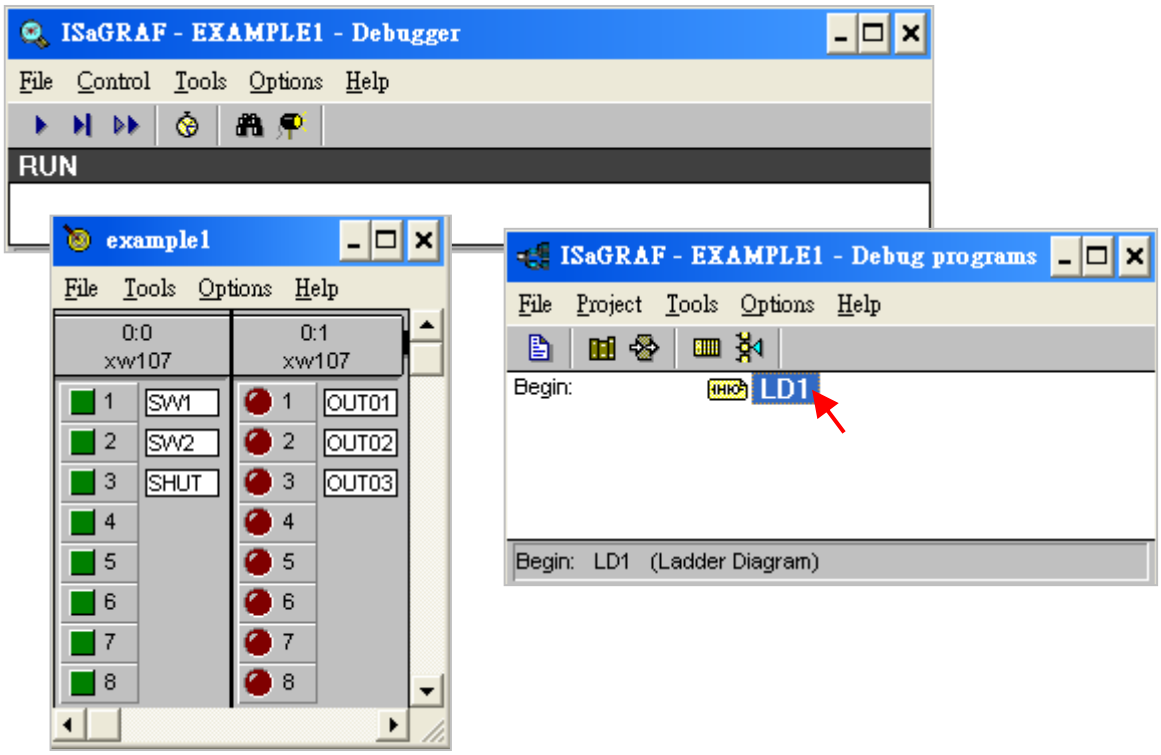


When you click the "Simulate" button three windows will appear. The windows are the "ISaGRAF Debugger", the "ISaGRAF Debug Programs", and the "I/O Simulator" windows.

If the I/O variable names you have created DO NOT appear in the I/O simulator window, just click the [Options] > [Variable Names] and the variable names will now appear.

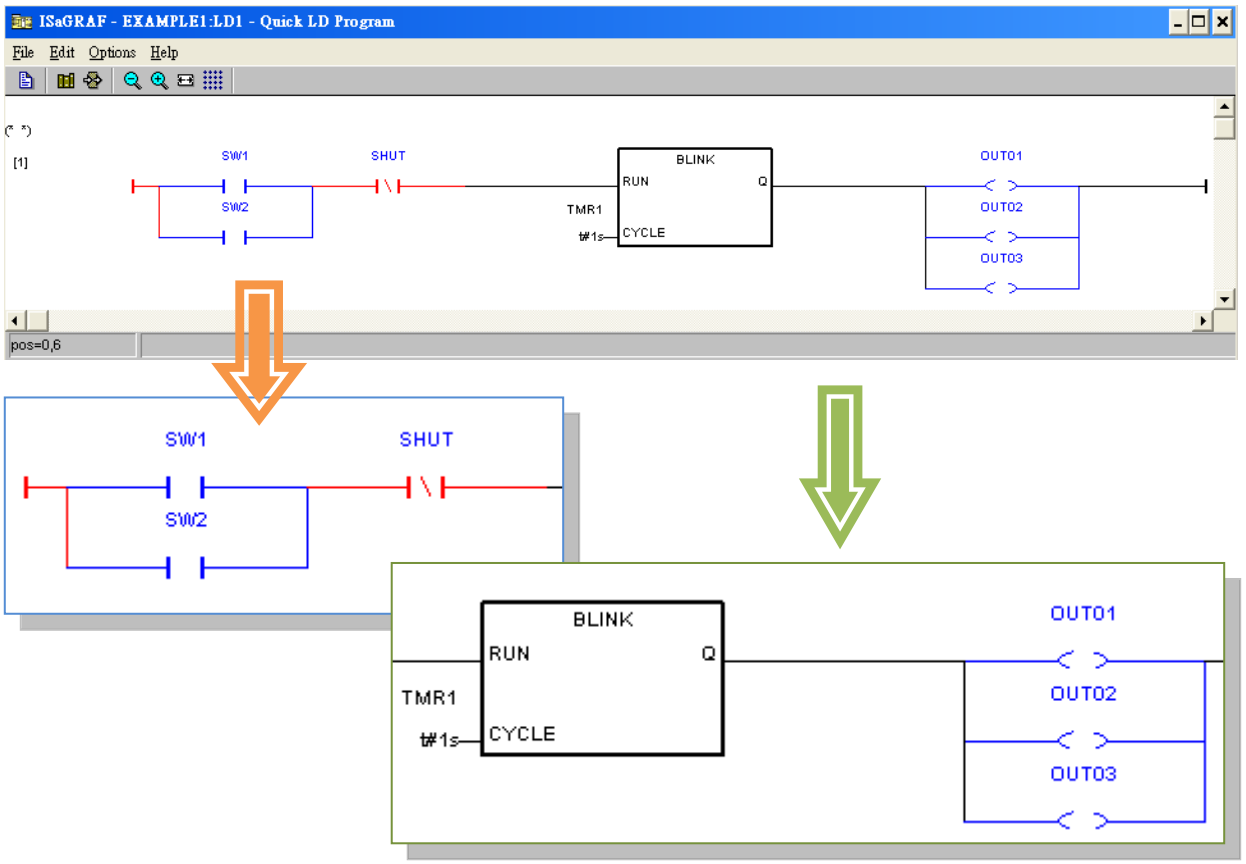


In the "Debug Programs" window, double-click "LD1" to open the “Quick LD Program” window. You can see the LD program you have created.



4.2.3: Running the Simulation Program:

When you open the “Quick LD Program” window, you will see the LD1 Program.



States of the Program:

As diagram above, "SW1" and "SW2" are the Normal Open switches that have not been energized so their color is blue. The "SHUT" is a Normal Close switch and its color is red because it is energized. Now, the light statuses in the I/O simulator window are OFF.

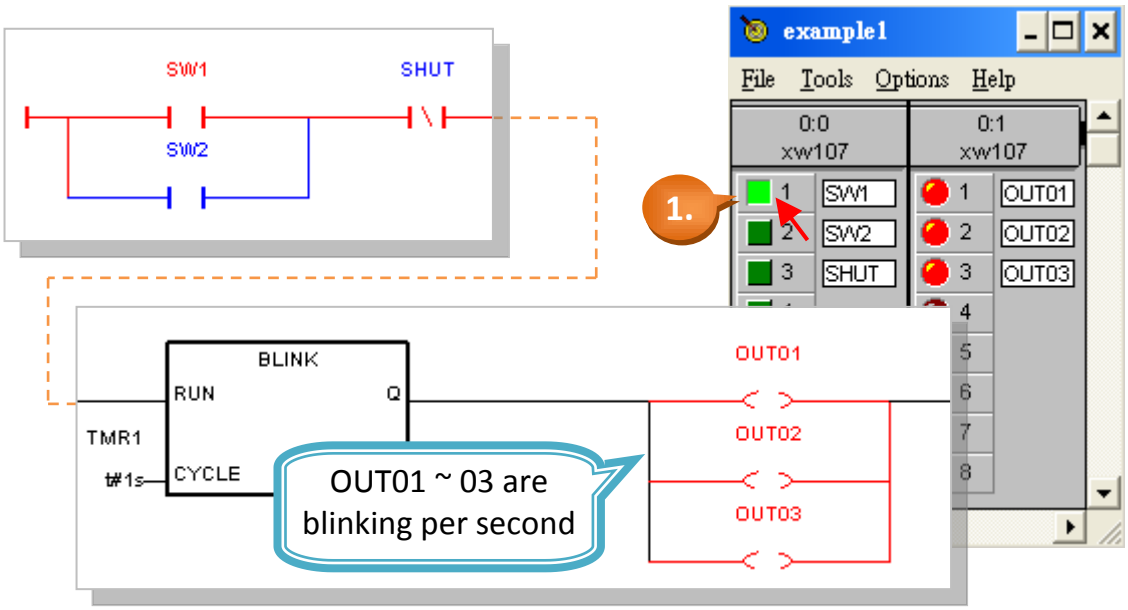
Description of the Simulation:

In the example, if either “SW1” or “SW2” is ON and the “SHUT” is OFF, then the OUT01 ~ 03 will start blinking every one second (according to the time of “TMR1”).

You may click either the "SW1" or "SW2" button in the "I/O Simulator" window to observe the simulation of the program.

1. Click "SW1" (green button) to set it as ON. (As diagram below)

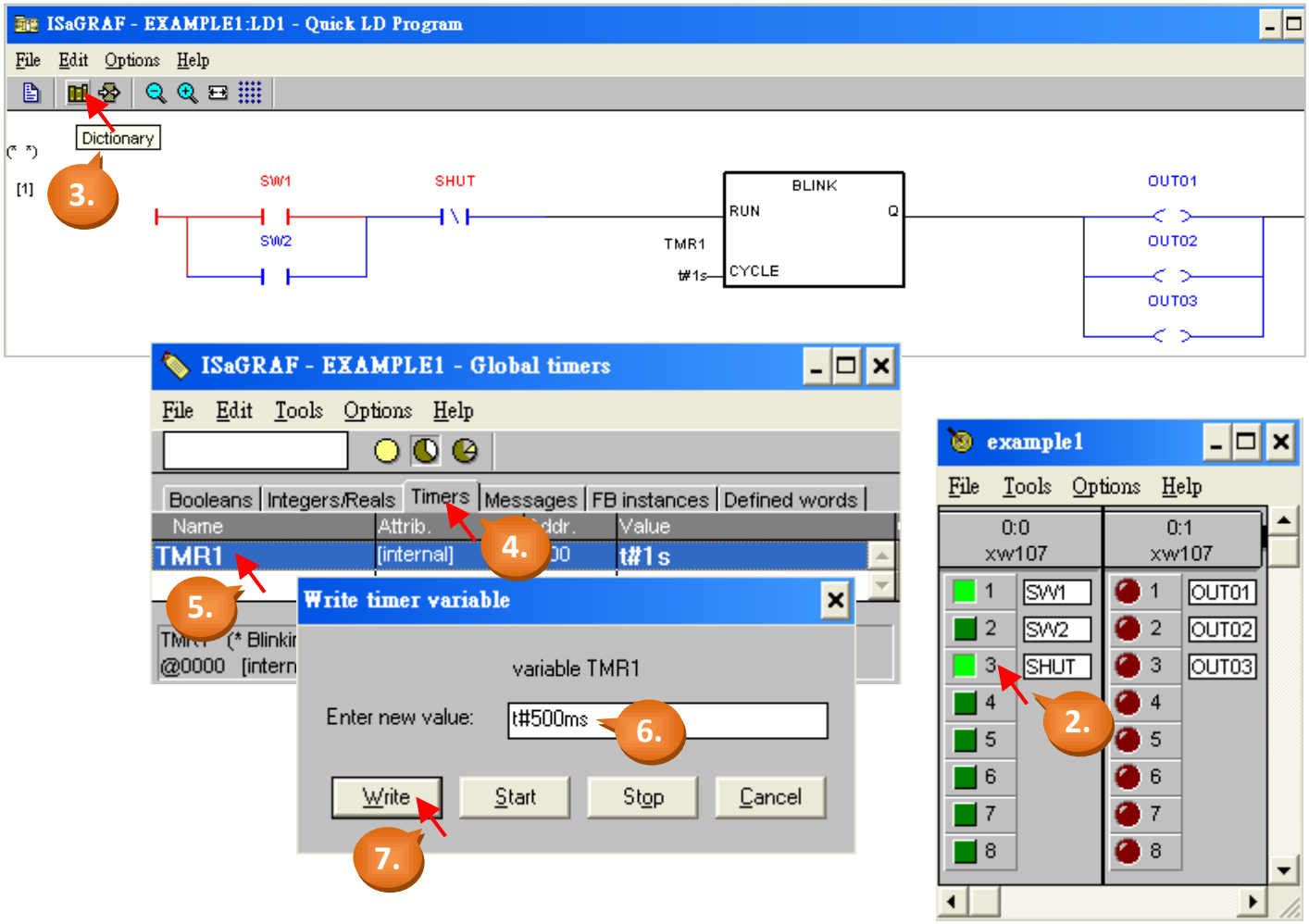
   For now, the current can flow through the circuit from “SW1” to “SHUT”. It means the logic of the LD program would become “True”. Therefore, the "OUT1", "OUT2" and "OUT3" will start blinking (according to the time of “TMR1”).



2. Click "SHUT" (green button) to set it as ON. (as diagram below)

   The "OUT1", "OUT2" and "OUT3" will stop blinking. (The logic of the LD program would become “False” because the circuit has been interrupted.)

3. You can modify the "TMR1" variable while the program is running. To accomplish this, click on the "Dictionary" button in the "ISaGRAF Quick LD Program" window which will open the "ISaGRAF Global Variables" window as shown below.



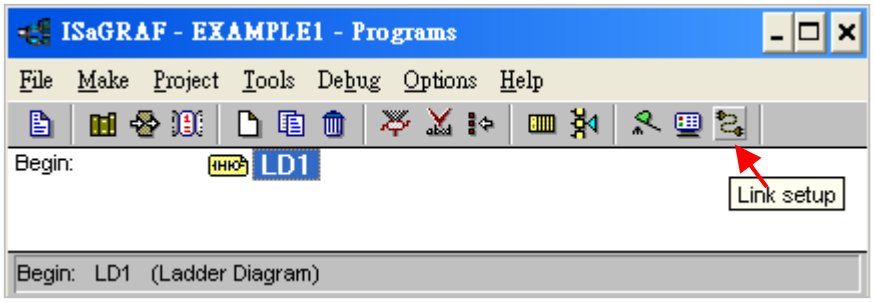
4. Click "Timers" tab in the "ISaGRAF Global Variables" window.
5. Double-click "TMR1" to open "Write Timer Variable" window.
6. Change "t#1s" to “t#500ms" in the "Enter New Value:" field.
7. Finally, click "Write" button.

Now when you click on “SHUT” button (green button) in the I/O simulator the “OUT01 ~ 03” will start blinking (turned on and off) every 500 milliseconds (0.5 second).

4.3 Debug & Download the Example Project

The last step required to run the LD example program on the µPAC-5x07 PAC systems is to download the project to the controller (frequently referred to as the "Target" platform). Before this download can be accomplished you must first establish communications between your development PC and µPAC-5x07 controller.

First, click the "Link Setup" button in the "ISaGRAF Programs" window.



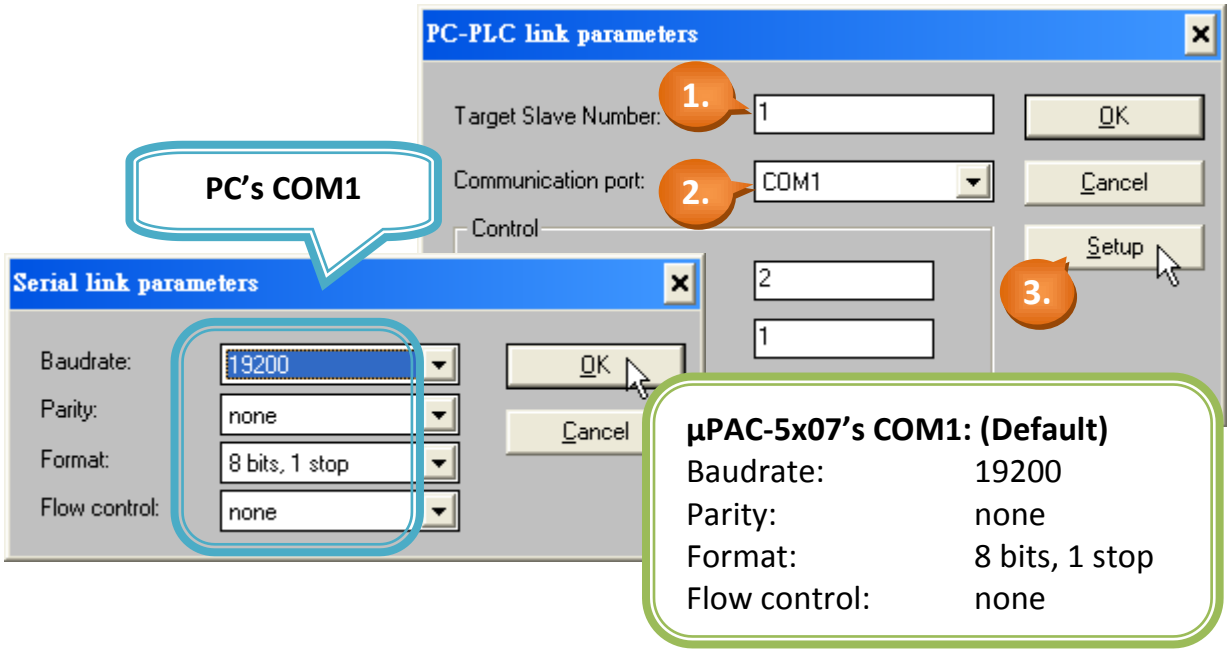
1. Set the "Target Slave Number" (NET-ID of the controller) as "1". (Default = 1)
   If you connected multiple controllers in the same RS-485 network, you must change the NET-ID to be unique. To change the NET-ID, please refer to section 3.5.

2. The "Communication Port" field means the COM Port on your PC, please select COM1 or COM2.

Important Notice:

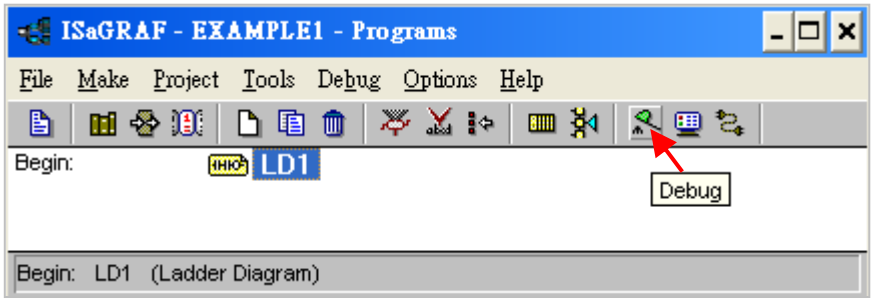
If there is no COM Port number to select, you can view and modify the current COM Port number in "Device Manager" on your computer. (Such as Notebook)

3. Click "Setup" to set the parameters of COM Port.
   The communication parameters between target PAC and the PC must be the same.



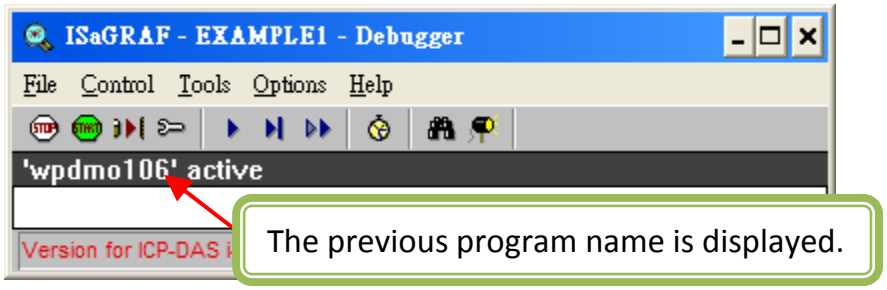
Debugging the Example LD Project

Before you download the LD project to the µPAC-5x07 controller system, you must first verify that your development PC and the µPAC-5x07 PAC system are communicating with each other. To verify proper communication, click on the "Debug" button in the "ISaGRAF Programs" window as shown below.

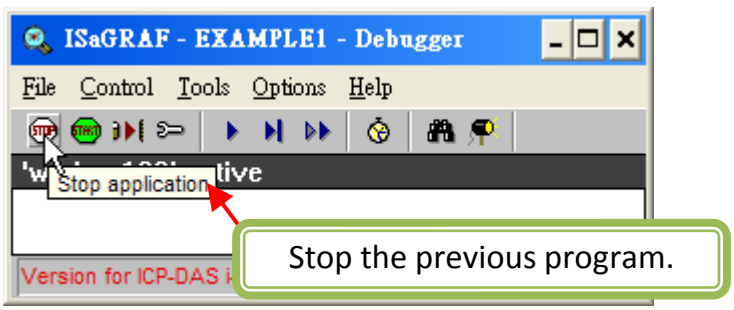


OK If the connection between PC and µPAC-5x07 is all right, you will see the following window.

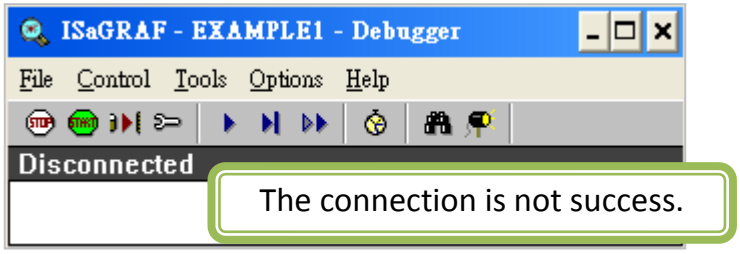
OK Or, If there is a previous program running in the µPAC-5x07 PAC, the program name will show on the window.



If there is a previous program running in the µPAC-5x07 PAC, you must click "STOP" to stop that program and then you can download a new one in it.



NG If the message in the "ISaGRAF Debugger" says "Disconnected", it means the connection between PC and µPAC-5x07 is failed.



The most common causes of connection failure are the COM Port between each other is not plugged in or the settings of communication parameters are not correct. When this occurs, please follow the following steps to troubleshoot the problem:

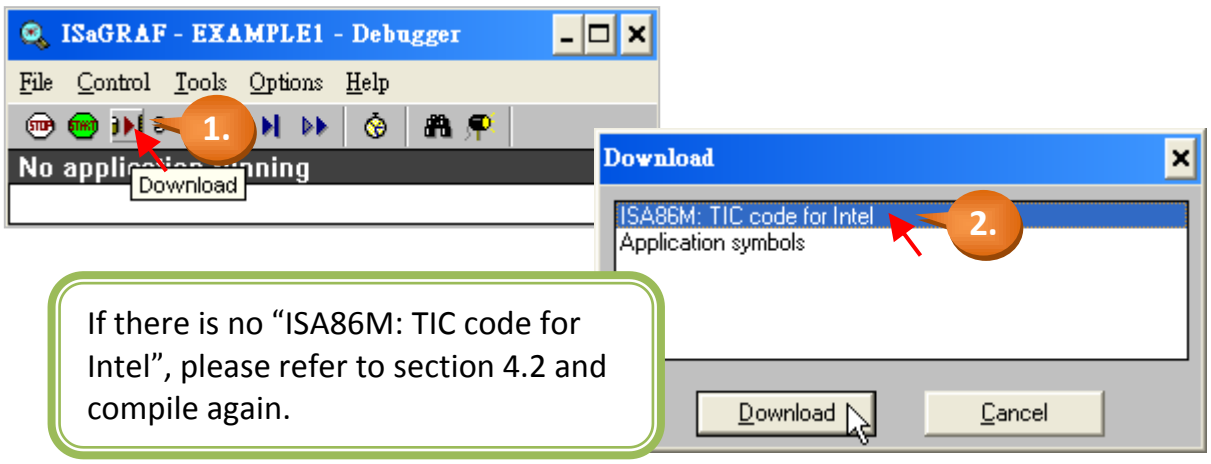
1. Ensure that the communication cable between PC and µPAC-5x07 is plugged well.
2. Refer to section 4.3, verify the COM Port settings.
3. Refer to section 3.4 step 10; verify the NET-ID, Baud rate settings.

If the NET-ID or Baud rate of PAC does not match the PC settings, recommand you to refer the section 4.3 to modify the link setup.

If you want to modify the NET-ID or Baud rate of PAC, please refer to section 3.5 and section 3.6.

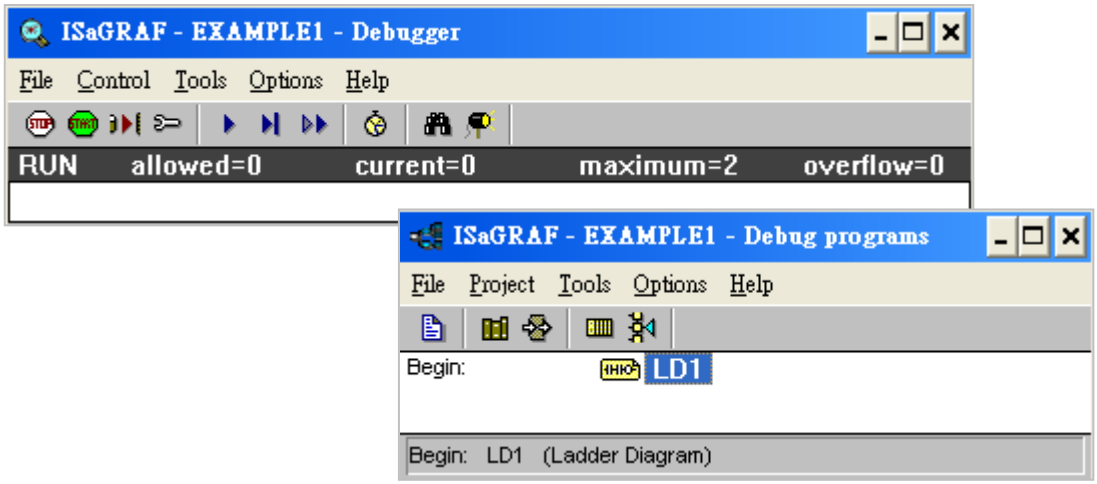
Downloading the Example LD Program:

Click "Download" button in the "ISaGRAF Debugger" window, then click on "ISA86M: TIC Code for Intel" and then click "Download" button. (As diagram below)



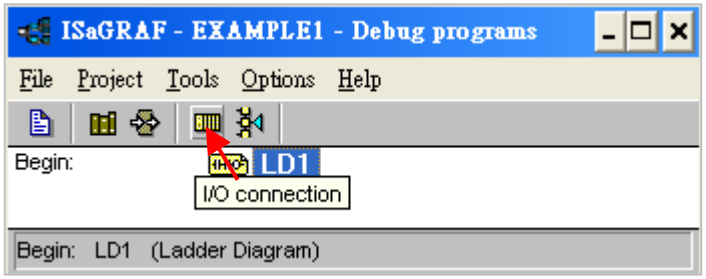
Now, the program is downloading to the controller and you will see the download progress in the "ISaGRAF Debugger" window.

When the program is downloaded successfully, the following window will appear.

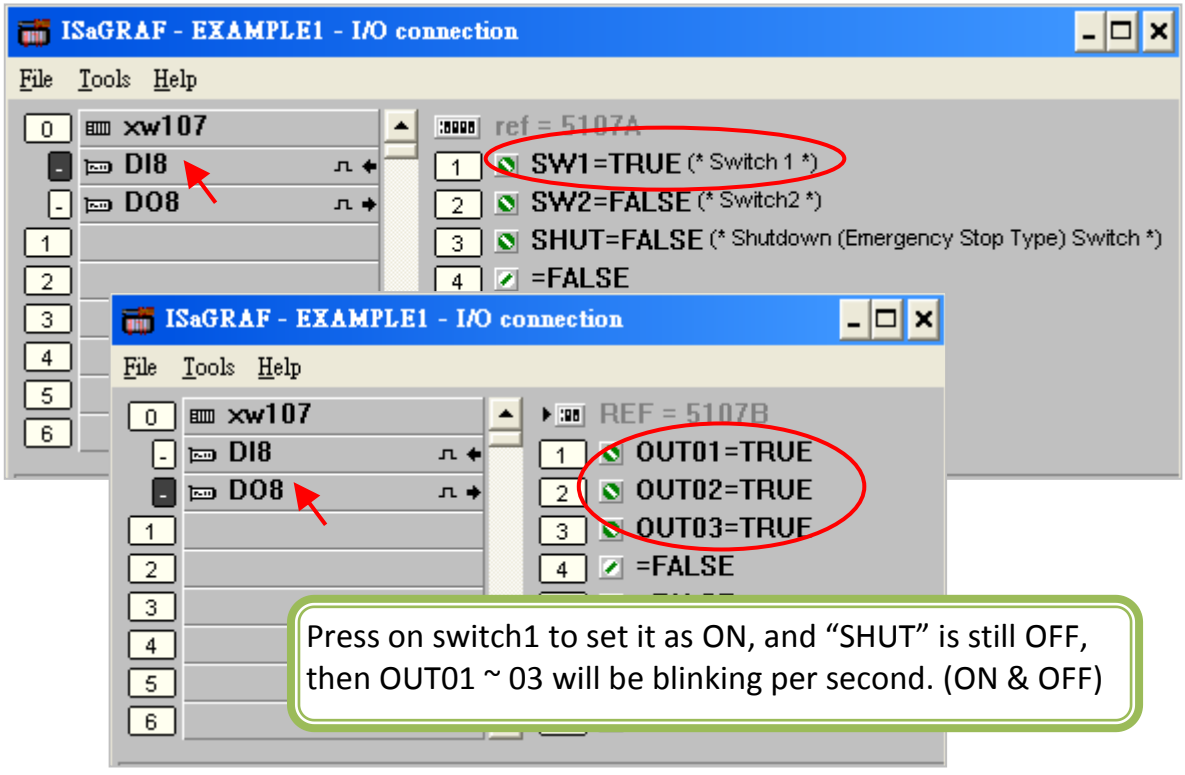


Running the Example LD Program:

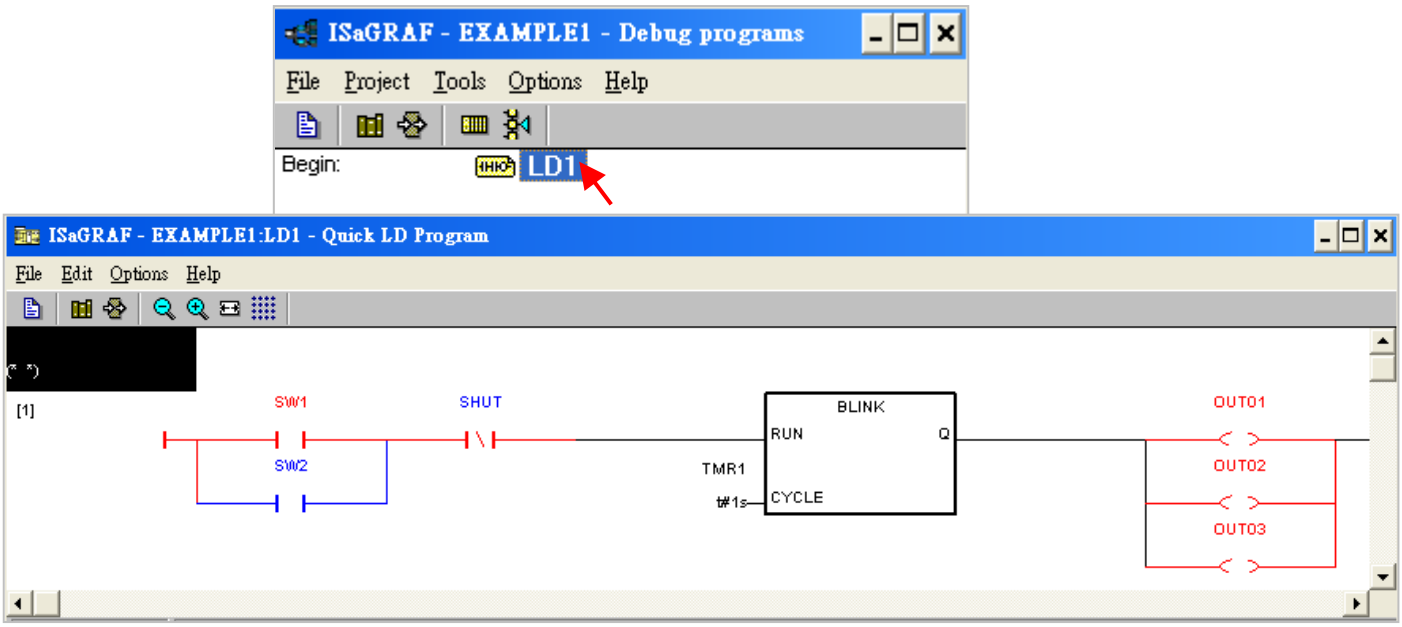
You can observe the real time I/O status from the ISaGRAF windows while you are running the example LD program. First, click on the "I/O Connection" button in the “Debugger programs” window



You can click the left of the “DI8” or “DO8” to view the current I/O status in the “I/O connection” window.



Another way to view the real-time operation status is from “Quick LD program” window. At present, the switch 1 ("SW1") is “ON” and the “SHUT” is “OFF”, so the “OUT01 ~ 03” will be blinking per second. (Turn on and turn off)



Note: The "SHUT" is a Normal Close switch that has been energized so its color is red. It is used in a concept of inverted phase, so the logic is “OFF”, but not “ON”.

The "Quick LD Program" window can show the entire ladder logic program in real-time and is also an excellent diagnostic tool for development and troubleshooting. Though there are numerous steps involved in creating and downloading an ISaGRAF program, each step is quick and easy to accomplish, and the end result is a powerful and flexible control development environment for the µPAC-5x07 PAC systems.

Practice, Practice, Practice!

Now you have successfully created and ran your first ISaGRAF program with the µPAC-5x07 PAC system, you should practice creating more powerful and elaborate programs. Such as any other computer development environment, it is only through constant practice and experiment to make you to be more proficient, GOOD LUCK!

Appendix

A. ISaGRAF User Manual & Demo Program & FAQ

The related ISaGRAF manuals and demo programs are all in your µPAC-5X07 CD. You can also follow the steps below to view the latest information and FAQ in ISaGRAF website.

A.1 The Download Page for ISaGRAF Resource

1. First, type the ICP DAS's web address http://www.icpdas.com in the browser.

2. Click the "ISaGRAF SoftLogic PAC" icon to get into the ISaGRAF website.

Manual:

3. Click the "Manual" icon to download the related ISaGRAF manual. (As diagram below)

"ISaGRAF User's Manual" is an advanced manual for using ISaGRAF as the embedded controller software. Please refer to this manual for more and detail information about how to use the ISaGRAF PACs.

Demo Files:

4. Click the “Demo Files” icon to download the ISaGRAF demo program.
   You can download all the files in CD or FTP:
   µPAC-5X07 CD-ROM: \napdos\ISaGRAF\upac5000\demo or
   ftp://ftp.icpdas.com.tw/pub/cd/8000cd/napdos/isagraf/upac-5000/demo/

FAQ

5. Click the “FAQ” icon to view the latest ISaGRAF frequently asked questions.
   You can also refer to: www.icpdas.com > FAQ > Software > ISaGRAF

A.2 Using Modbus TCP/IP protocol to control ISaGRAF controllers with VB?

1. VB.net 2005 Demo program using Modbus TCP/IP protocol to control ISaGRAF controllers. Please refer to below website:
   www.icpdas.com > FAQ > Software > ISaGRAF Ver.3 (English) - 051

2. VB 6.0 Demo program using Modbus TCP/IP protocol to control ISaGRAF controllers. Please refer to below website:
   www.icpdas.com > FAQ > Software > ISaGRAF Ver.3 (English) - 052

B. 10-ch Thermocouple Input Module

10-ch thermocouple input module is a brand new designed module different from the 8-ch normal module in the industrial area. ICP DAS supply I-7018Z and I-87018Z of **10-ch** Thermocouple Input Module and they all meet the RoHS Standard. They are the best Thermocouple Input Module choices for ISaGRAF PACs.

B.1 I-7018Z

B.2 I-87018Z

Advantages:

1. It is special designed for thermocouple inputs. The innovative design makes the thermocouple measurement more accurate than the previous design.
2. It supports voltage and current inputs. The voltage input ranges can be ±15mV to ±2.5V. The current input ranges can be 4 to 20mA, 0 to 20mA, and ± 20mA.
3. Up to 10 analog inputs of different types can connected to one module.
4. Up to 240 V_{rms} over voltage protection is provided.
5. It features per-channel open wire detection for thermocouple and 4 to 20mA inputs

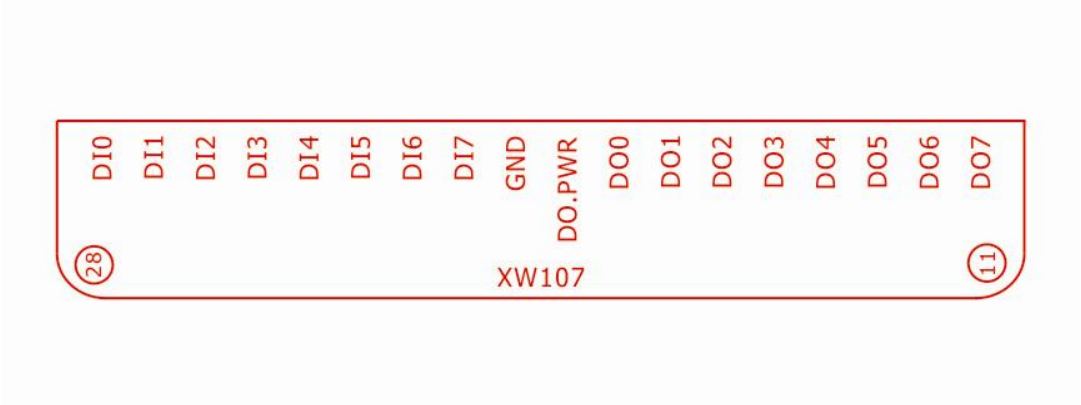
For more details, please visit the web site listed below:
I-7018Z: http://www.icpdas.com/products/Remote_IO/i-7000/i-7018z.htm
I-87018Z: http://www.icpdas.com/products/Remote_IO/i-87k/i-87018z.htm

C. XW-107 (I/O Expansion Board)

Each µPAC-5x07 PAC can plug an XW-board inside it to add I/O channel or RS-232/422/485 COM Port. In Section 4.1, we use XW107 to add digtal input and ouput channel. The following describes its specifications and PIN assignment.

Please refer to website for more information.
http://www.icpdas.com > Products > PAC > µPAC-5000 > XW-board or
http://www.icpdas.com.tw/product/solutions/pac/upac/xw-board_selection.html

Specifications: XW107

Digital Output	
Channel	8
Output Type	Sink, Open Collector
Output Voltage	+ 10 V_{DC} ~ 40 V_{DC}
Max. Load Current	200 mA/channel at 25 °C
Isolation	Non-Isolated
Digital Input	
Channel	8
Input Type	Dry, Source
Off Voltage Level	+ 1 V_{DC} max (Connect to GND)
On Voltage Level	+ 3.5 ~ 30 V_{DC} (Open)
Isolation	Non-Isolated

Pin Assignment: XW107