

# Reference Manual of DAQ-Card for DASYLab

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Date : 20/June/2003

Version : 1.1

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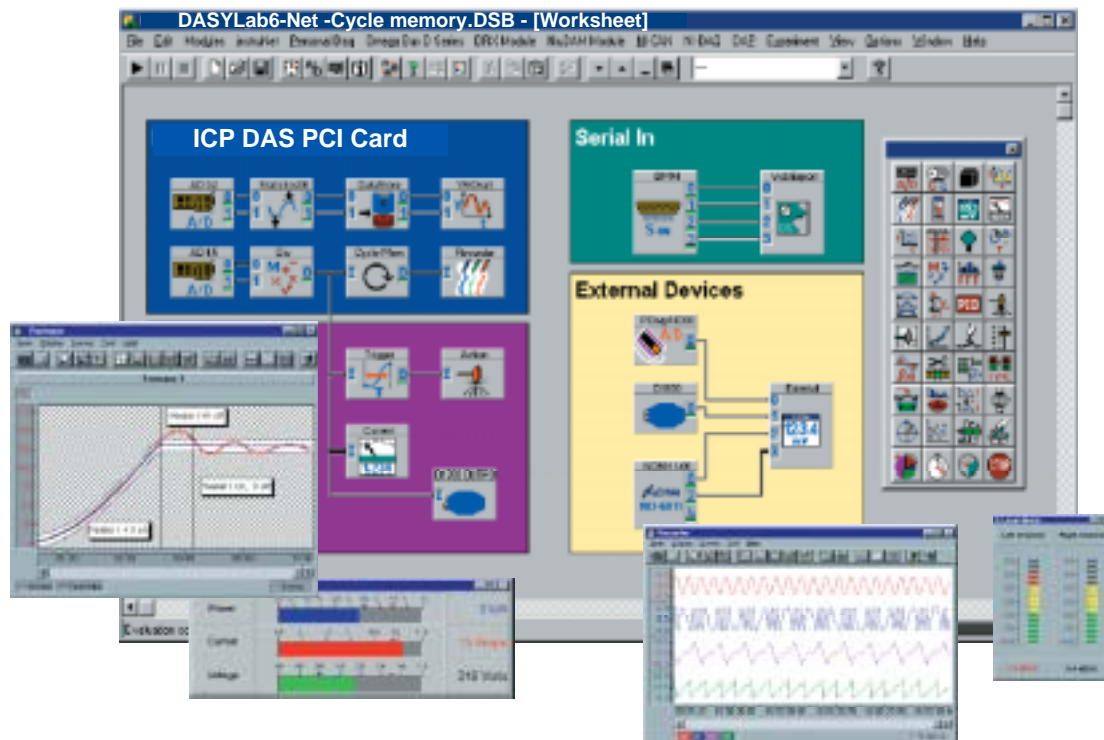
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# 1 DASYLab Introduction

**DASYLab** is a popular Easy-To-Use Software in Data Acquisition System with all kinds of interface connected to the hardware, such as RS232, RS485, RS422, USB, Parallel port, ISA bus and PCI bus, etc. Furthermore, various function modules for measurement and control are supplied by DASYLab. For DAQ card (in PCI and ISA bus) solution, user only needs to install corresponding drivers from ICP DAS. Thus DAQ interface cards can be applied to the environment of measurement and control using DASYLab. The following is a part of application interface by DasyLab and the bundled driver.



**DASYLab Software**

## 1.1 Product list for DASYLab

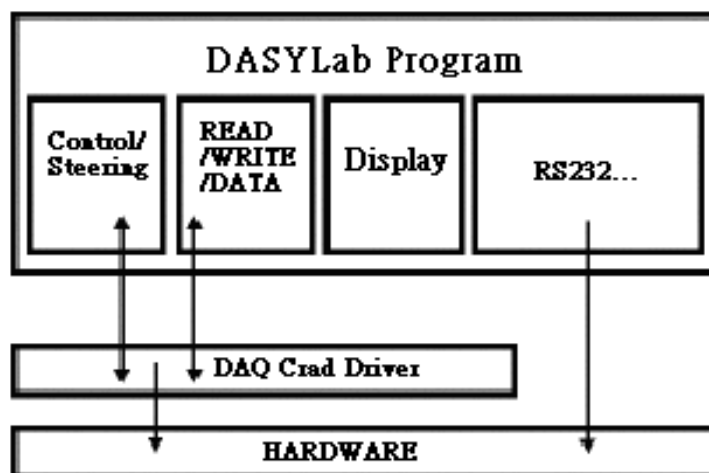
The following table shows the current supported products of PCI and ISA DAQ cards for DASYLab Software. It includes Multifunction boards, AD/DA boards, and digital I/O boards. Every board has its own specifications and functions. If user needs to know more information about DAQ cards, please go to the website ([www.icpdas.com](http://www.icpdas.com)) to download the related document to understand their full capability and specification.

Type	Input/Output	Card Model
PCI-BUS Multifunction Boards	Analog Input, Analog Output, Digital Input, and Digital Output	PCI-1602F/PCI-1602 PCI-1802L/H, PCI-1800L/H PCI-1202L/H PCI-1002L/H
PCI-BUS A/D, D/A Boards	Analog Input and Analog Output	PISO-813 /PIO-DA16/PIO-DA8/PIO-DA4
PCI-BUS Digital I/O Boards	Digital Input and Digital Output	PCI-P16R16/PCI-P8R8/ PIO-D144/PIO-D96/PIO-D64/PIO-D56/PIO-D48/PIO-D24/PISO-725/PISO-730/PISO-730A/PISO-C64/PISO-P64/PISO-P32C32/PISO-P32A32/PISO-P8R8/PIO-P8SSR8AC/PISO-P8SSR8DC
ISA-BUS Multifunction Boards	Analog Input, Analog Output, Digital Input, and Digital Output	A-8111, A-812PG, A-821PGH/L, A-822PGH/L, A-823PGH/L, A-826PG,
ISA-BUS A/D, D/A Boards	Analog Input and Analog Output	A-626/628, ISO-813, ISO-DA8/16, ISO-AD32H/L
ISA-BUS Digital I/O Boards	Digital Input and Digital Output	P16R16DIOI/P8R8DIO/ DIO-144/DIO-96/DIO-64/DIO-48/DIO-24/ISO-730/ISO-C64/ISO-P32C32/ISO-P64/P16R16DIO/P8R8DIO/

Note: DASYLab would not function properly, if the correct driver provided by hardware manufacturer is not installed.

## 1.2 DAQ driver & DASYLab

The architecture of a DASYLab application is shown below. The driver bridges the software program and the hardware.



Among other things, this structure, made possible by the simple adaptation to individual tasks, may be in the form of individual modules for different data acquisition boards. In this sense, the DAQ driver controls the equipment for measurement and data acquisition in an exchangeable component of the structure.

The user interface of DASYLab is symbol-oriented and makes a simple task definition by interconnecting modules in a worksheet. The hardware is represented by special modules such as other necessary system components, which are individually configurable as required. And the hardware module is a definitely required element in DASYLab applications.

## 1.3 DAQ-card driver installation

### 1.3.1 PCI-card driver installation

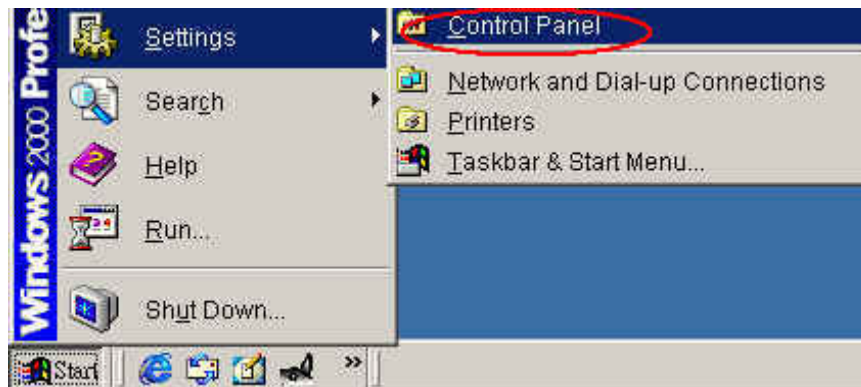
1. Firstly, you need to install the software driver onto your operation system.
2. PCI DAQ card normally support PnP function, but the Windows NT system don't support PnP function. So you only need to install the software driver for Windows NT system.
3. For Windows 95/98/2000 system, the system will automatically detect the device, and you need to select correct PnP information file(\*.inf) depending on your device. The detail procedure is demonstrated in the PnPInstall.pdf which can be downloaded from ICP DAS website: <http://www.icpdas.com/download/pci/index.htm> or product CD (For example : D:\NAPDOS\PCI\MANUAL).

### 1.3.2 ISA-card driver installation

1. Firstly, you need to install software driver onto your operation system.
2. For Windows 95/98/NT system, you only need to install the software driver due to ISA DAQ card normally do not support PnP function.
3. For Windows 2000 system, there are some ISA DAQ cards( Refer to the following table ) provide the PnP function by manual added device in the control panel. The detail procedure is demonstrated in the PnPInstall.pdf, which can be downloaded from ICP DAS website: <http://www.icpdas.com/download/pci/index.htm> or product CD (For example : D:\NAPDOS\PCI\MANUAL). You can also refer to the following steps to add device.

Driver	Win95/98	Wn2000	WinNT	Card Model
A8111				A-8111
DIO		PnP		DIO-24/48/64/144/P8R8DIO/P16R16DIO
ISO		PnP		ISO-P32C32/C64/P64/730
A626				A-626/628
A812				A-812PG
A821		PnP		A-821PGH/L
A822		PnP		A-822PGH/L
A823		PnP		A-823PGH/L
A826		PnP		A-826PG
ISO813				ISO-813
AD32				ISO-AD32H/L
ISODA				ISO-DA8/DA16

**Step 1 :** Click **“Start -> Settings -> Control Panel”** to open the control panel.



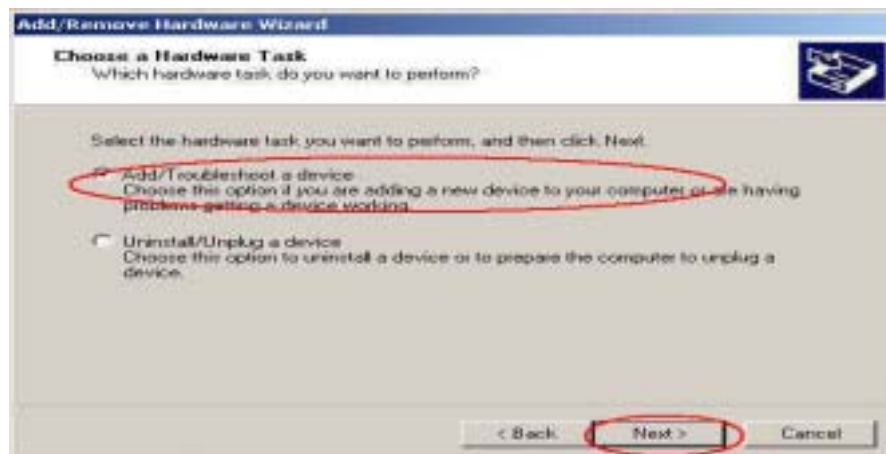
**Step 2:** Double-click the item **“Add/Remove Hardware”**.



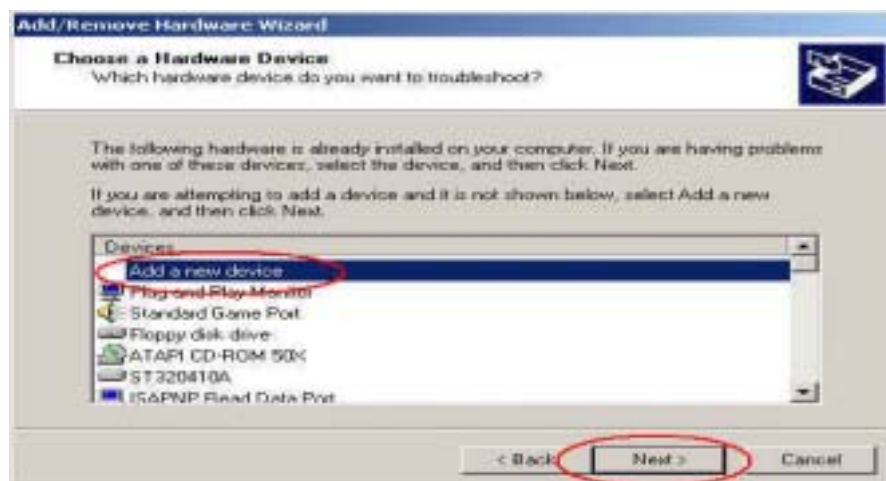
**Step 3:** Click the **“Next >”** button.



**Step 4:** Select the item **“Add/Troubleshoot a device”** and click the **“Next >”** button.



**Step 5:** Select the item **“Add a new device”** and click the **“Next >”** button.

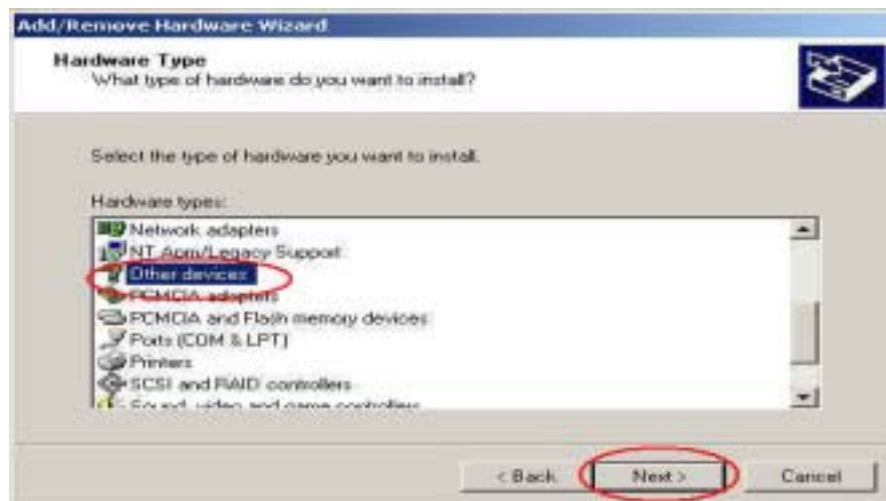


**Step 6:** Select the item **“No, I want to select the hardware from a list”** and click the **“Next >”** button.





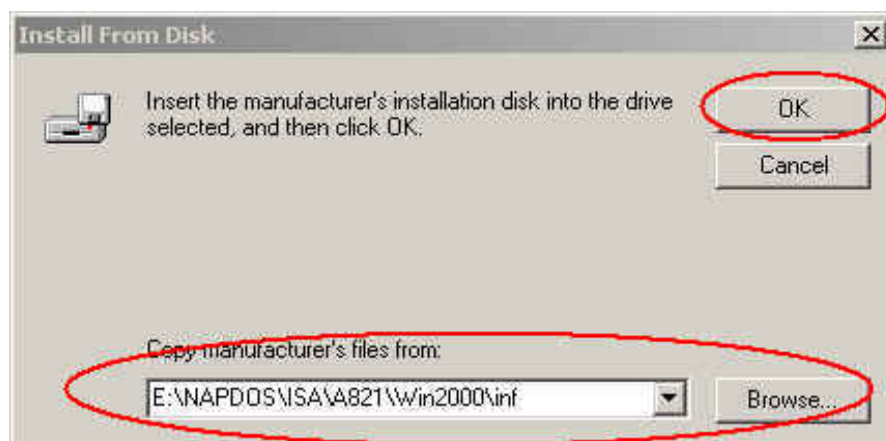
**Step 7:** Select the item “**Other device**” and click the “**Next >**” button.



**Step 8:** Click the “**Have Disk**” button.



**Step 9:** Click the “**Browse**” button to select correct PnP information file (\*.inf) depending on your device and click the “**OK**” button.



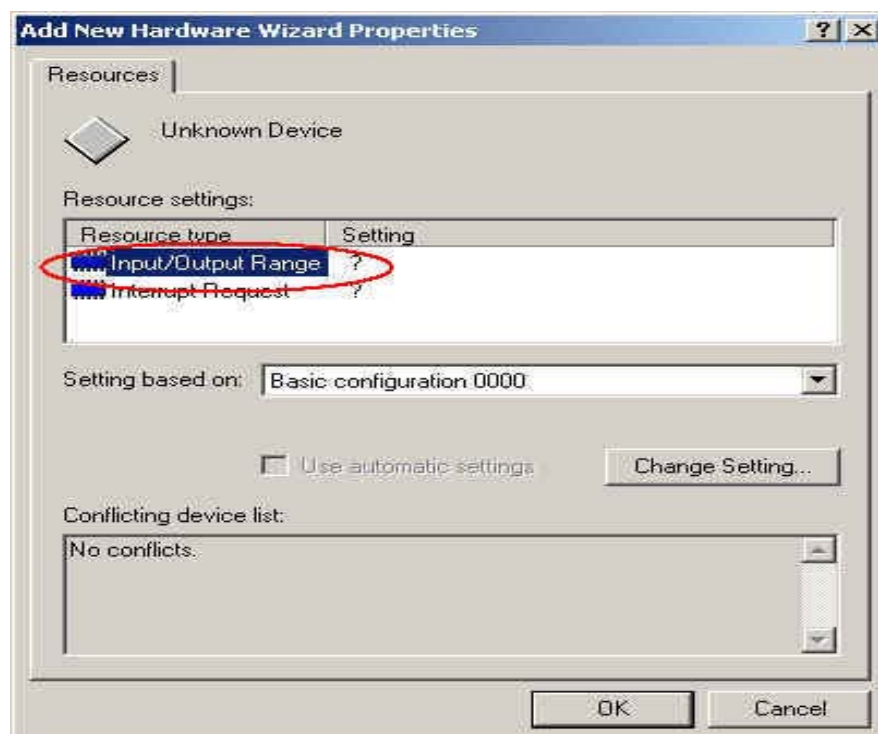
**Step 10:** Click the “Next >” button.



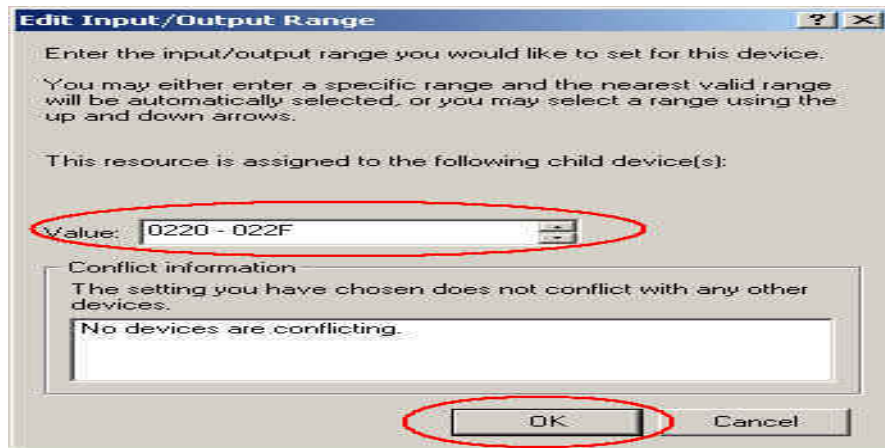
**Step 11:** Click the “OK” button to enter the device’s settings.



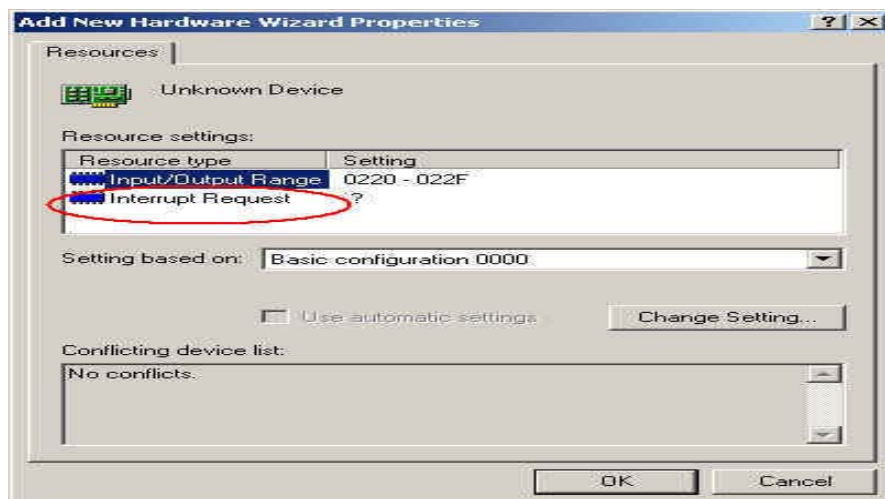
**Step 12:** Double-click on the “Input/Output Range” item to set device’s resource.



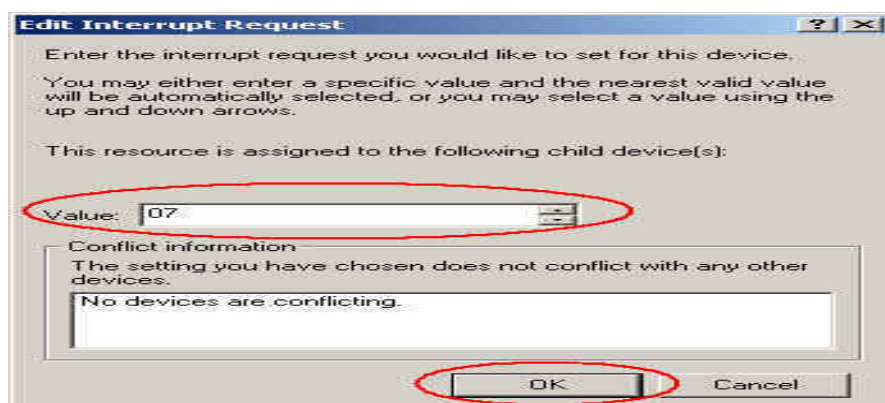
**Step 13:** Select the input/output range value, and the value must match the setting of hardware device.



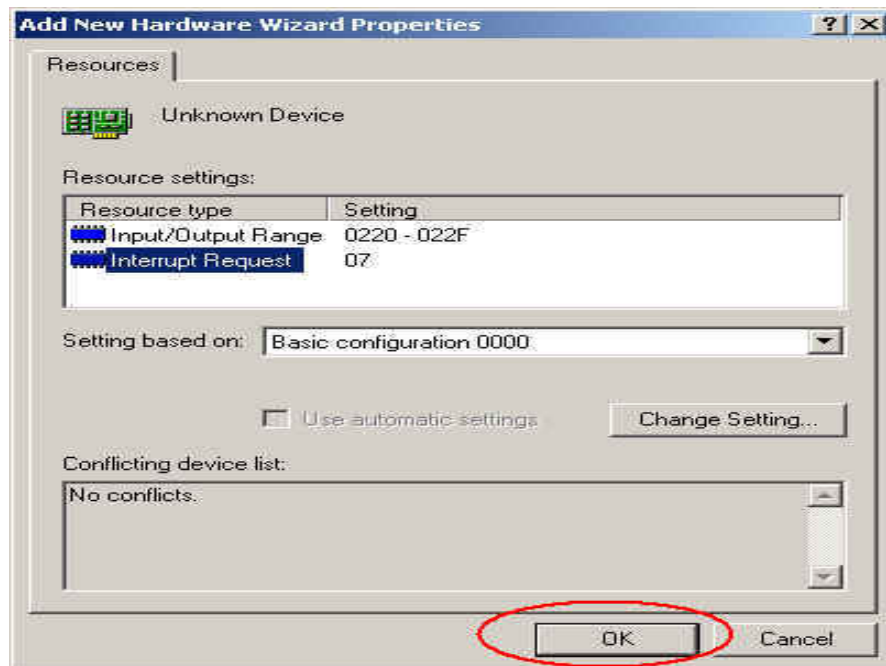
**Step 14:** Double-click on the "Interrupt Request" item to set IRQ number.



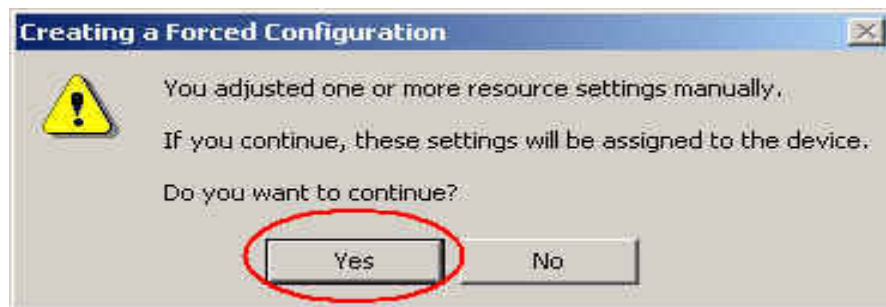
**Step 15:** Select the IRQ value and the value must match the setting of hardware device.



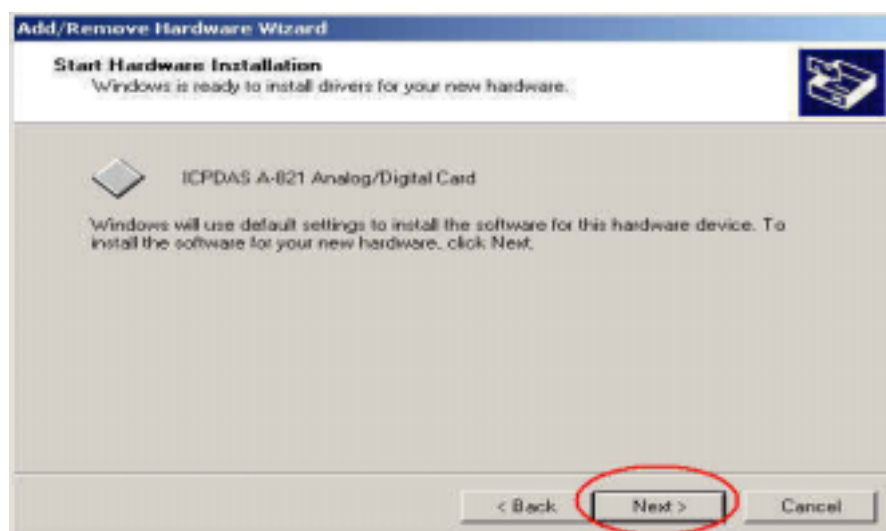
**Step 16:** Click the “OK” button to finish the settings of hardware.



**Step 17:** Click the “Yes” button to assign the settings to the device.



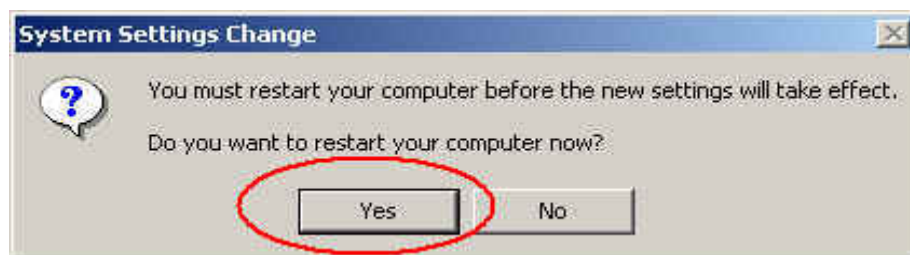
**Step 18:** Click the “Next >” button to install the driver.



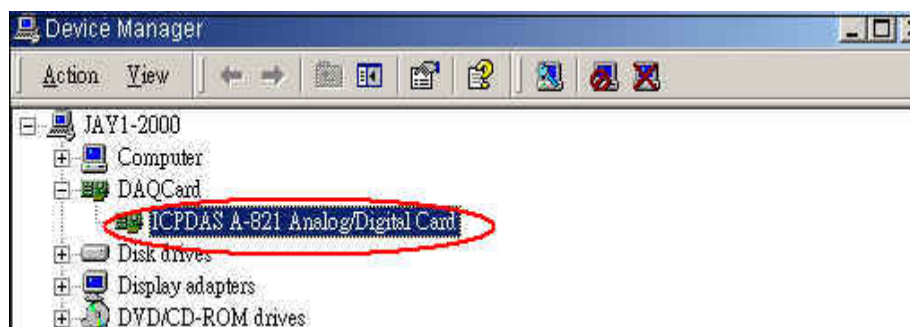
**Step 19:** Click the **“Finish”** button and the hardware has been installed.



**Step 20:** Click the **“Yes”** button to restart your computer now.



**Step 21:** Open the **“Hardware -> Device Manager”** and check if the device had been added.



## 2 Driver installation and setup

DASYLab supports a wide range of data acquisition hardware from different vendors. You will typically need a different hardware driver for each data acquisition device. If you have more than one hardware driver installed on your system, for example, two different drivers are installed; you can only use one driver at a time. And that means you may switch among them using the select driver function when more than one hardware are needed. However, currently DASYLab only support one standard driver at a time. The driver of PCI type DAQ-card of ICPDAS product is MICPDAS.dll. **Before using this driver, user needs to install the DAQ-card driver into operation system and this corresponding MICPDAS.dll driver will be established in the DASYLab software environment.** The following section will demonstrate the installation procedure and how to use it at the first time.

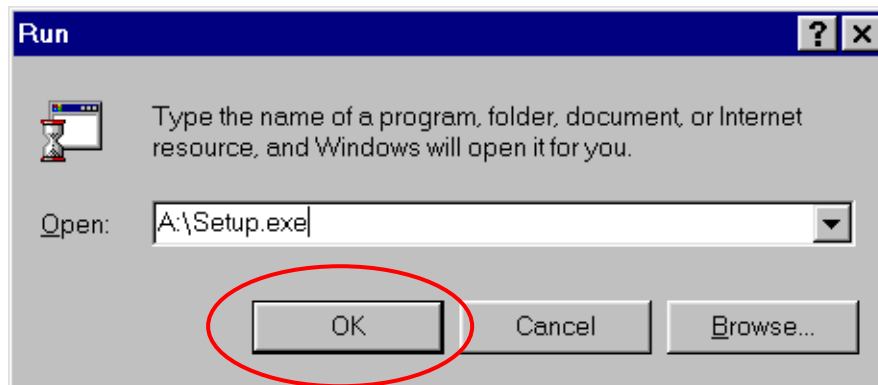


## 2.1 DASYLab Driver installation

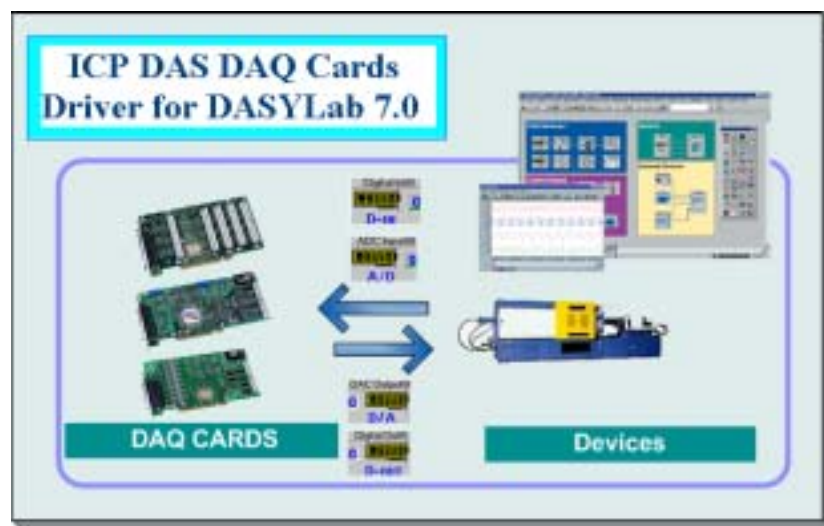
**Step 1:** Insert the driver setup disk into floppy or CD-ROM disk drive.

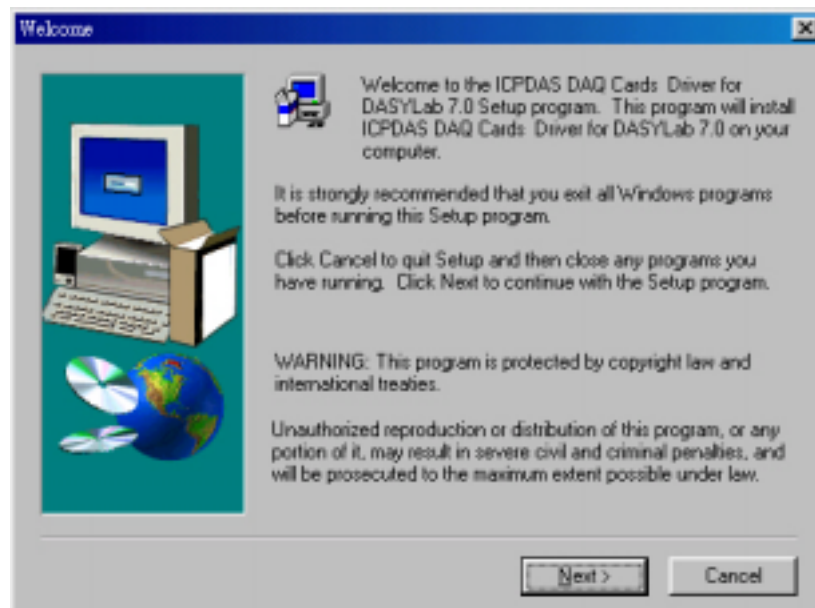
**Step 2:** Then click “Start” button in the task bar, and click “Run”.

**Step 3:** Enter “A:\setup.exe” (the path depends on where the setup.exe is located, or E:\setup.exe).

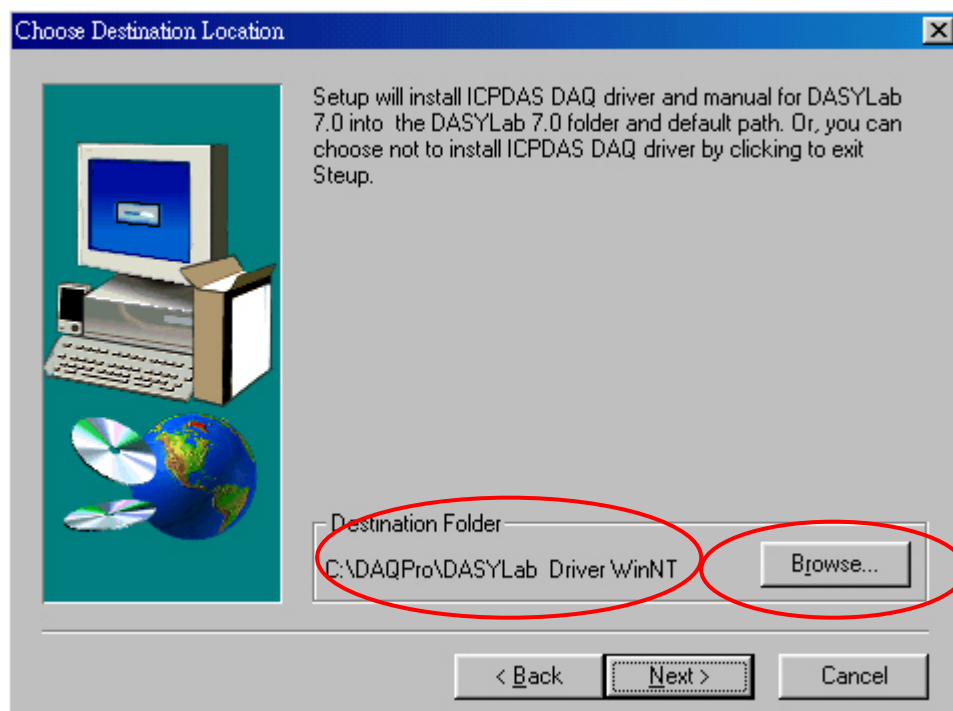


**Step 4:** Click “OK” to start the installation process. Then, an ICPDAS application logo will be shown for about three seconds. After that, a “Welcome” window pops up to prompt user to follow the installing steps.





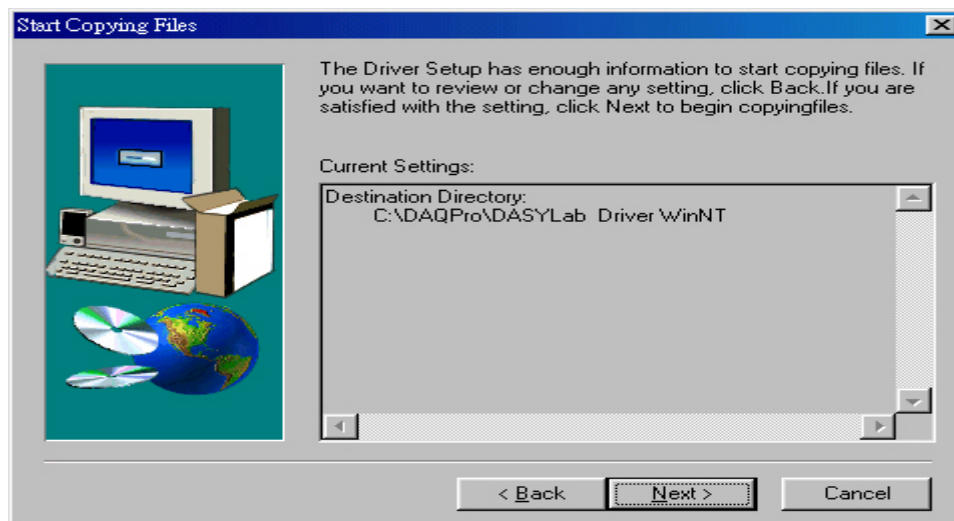
**Step 5:** Please click “Next>” button to go to the next step. Information will be displayed to help user to select a destination directory for installing ICPDAS driver into DASYLab software.



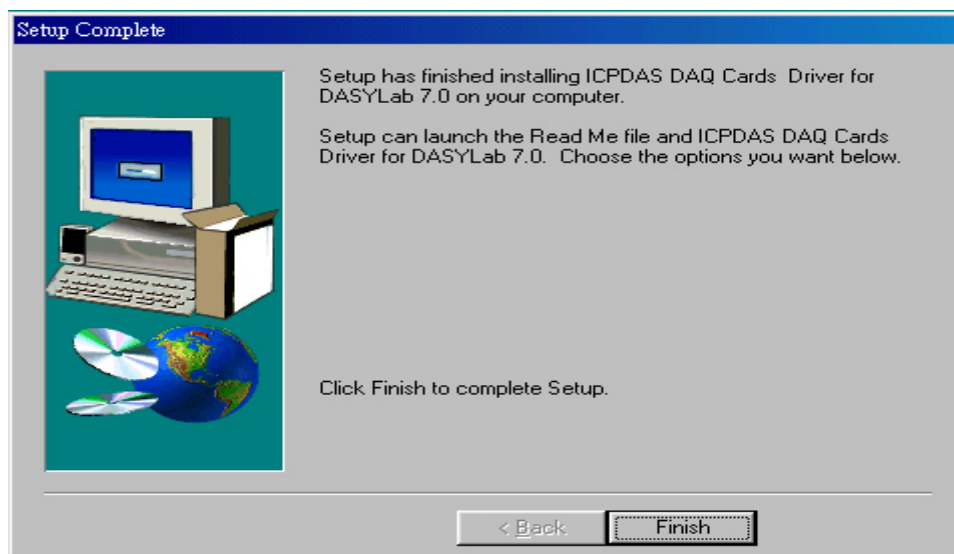


**Step 6:** Choose the DASYLab path installed in your computer. The default path is “C:\DAQPro\DASYLab Driver Win2K”, “C:\DAQPro\DASYLab Driver WinNT” or “C:\DAQPro\DASYLab Driver Win98”. Users can use “Browser” button to select the other path.

**Step 7:** When the working path of DASYLab is selected, please click “Next>” button and a driver installation confirmation window will be shown to allow user to check it again.



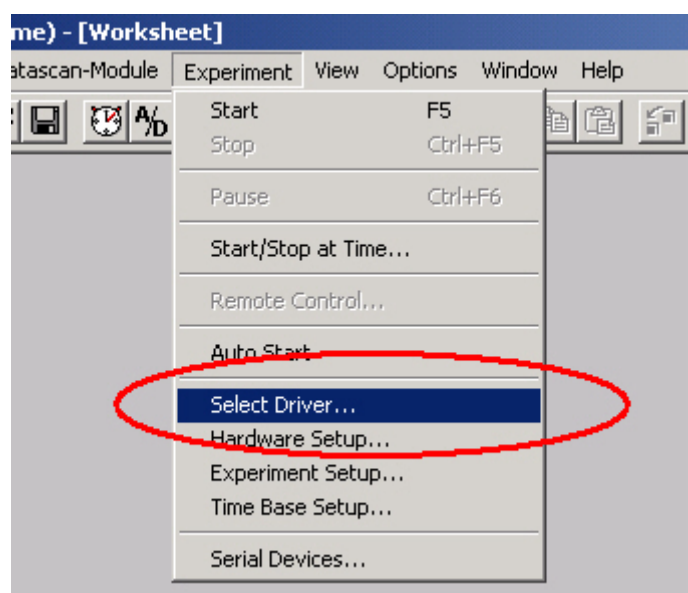
**Step 8:** If everything is correct, please click “Next>” button to start the driver installation procedure. When the driver is installed successfully into the system, a setup complete window pops up and wait for user to click “Finish” button to complete the setup process.



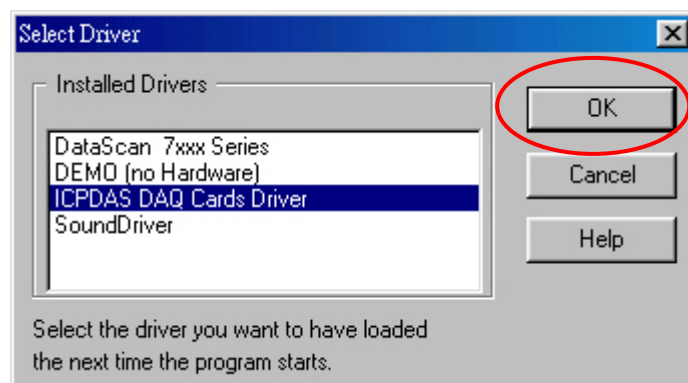
## 2.2 Driver selection

When user has installed ICPDAS driver into DASYLab, the next step is to import driver into your system, which is called “Select Driver”. Here, a step-by-step procedure is demonstrated regarding how to setup ICPDAS driver in DASYLab software environment.

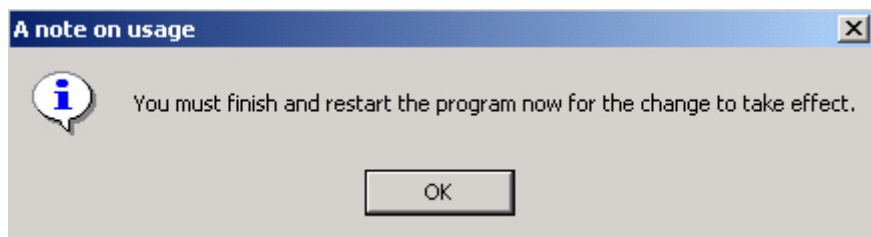
**Step 1:** At the beginning, user needs to open DASYLab software. Choose “Select Driver” from the “Experiment menu”.



**Step 2:** All installed drivers are presented in the Select Driver Window. Please choose “ICPDAS DAQ Cards Driver”, which is the DASYLab driver for ICPDAS DAQ cards. Then Click “OK” button in the dialog to confirm the selection.



**Step 3:** Then, a note on usage window is displayed to hint user to restart DASYLab software to take effect the changing configuration. Please click “OK” button to exit and restart DASYLab. DASYLab will load the driver after restart the DASYLab program. Then, user can apply this driver as a general DASYLab DAQ interface to communicate with the hardware system.

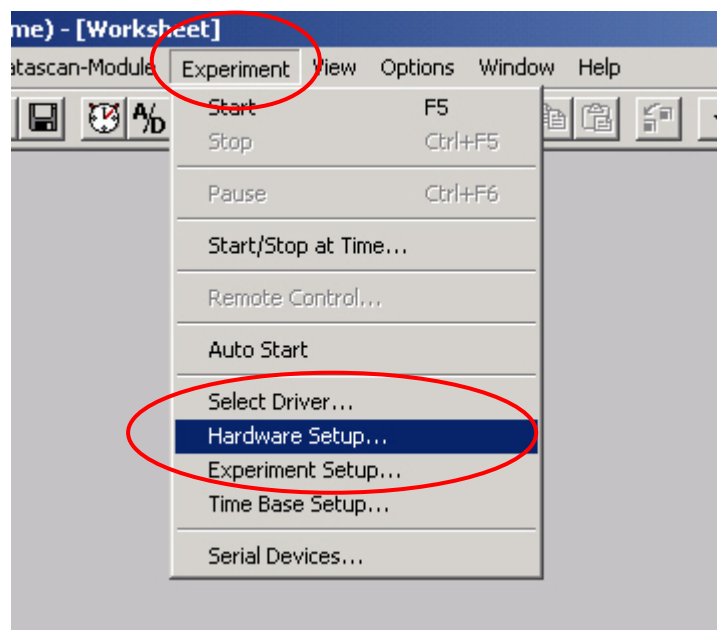


## 2.3 Hardware setup

### 2.3.1 Auto Searching the PnP cards

When driver is successfully imported to the development environment, the next step is to search the hardware DAQ card installed in your computer system.

**Step 1:** Open “**Hardware Setup...**” dialog in the “**Experiment**” menu, as shown below.

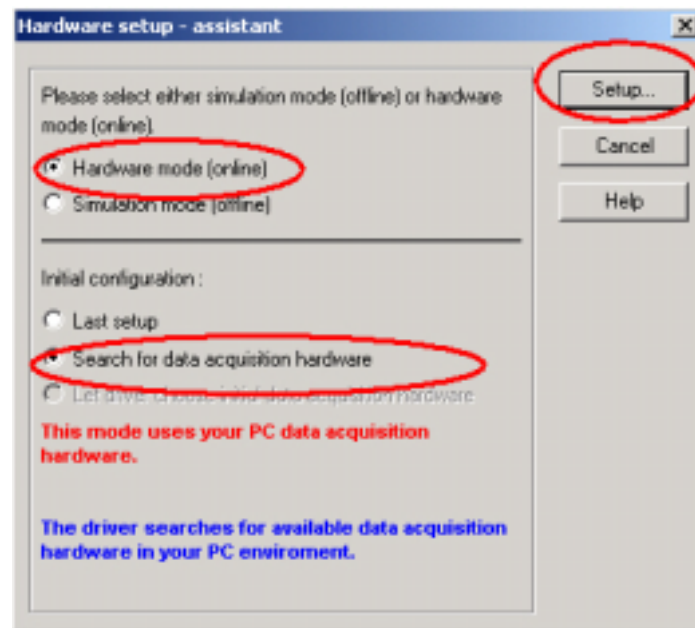


**Step 2:** Then, a hardware setup assistant window is shown. This will help users to select “Hardware mode (online)” or “Simulation mode (offline)”. Choose “Hardware mode” and select the option of “search for data acquisition hardware”. Then click “Setup” button to start searching ICPDAS DAQ cards installed in your PC.

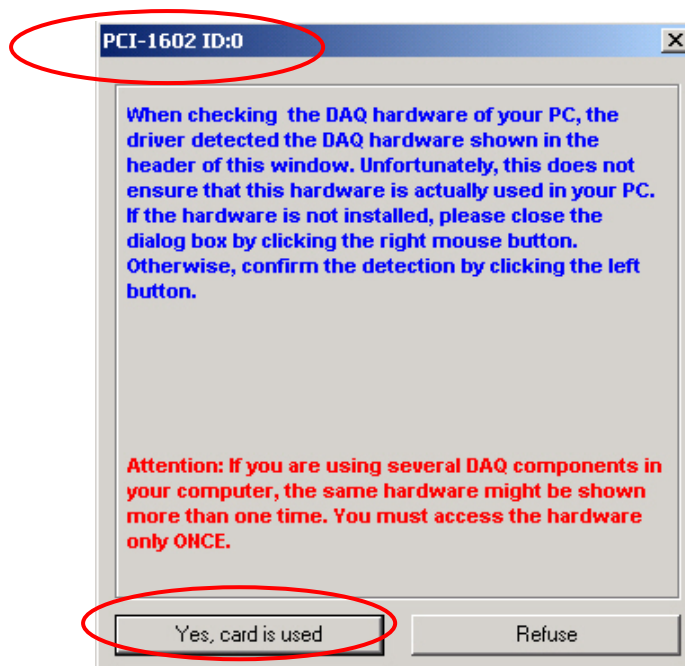
**Note:**

However, DASYLab provides two measurement modes for application, which are the hardware mode and the simulation mode. The former is only available if all needed components of ICPDAS driver and the corresponding driver are properly installed. Otherwise, the following error message will be shown, “The required driver DLL named MICPDAS.dll was not found or invalid”. It means you can only use the DASYLab driver in simulation (offline) mode”. The second one is the simulation mode, where DASYLab is working

on measurement and control for simulated DAQ cards. In this mode, the received data are generated by the PC without accessing the actual hardware system. All of available functions in DASYLab can be used to process and control these generated data. It is very useful for testing between software and hardware system. When user selects the simulation mode, DASYLab will display a hint message, “You are using the Simulation Mode (offline)”, for confirming your working mode.

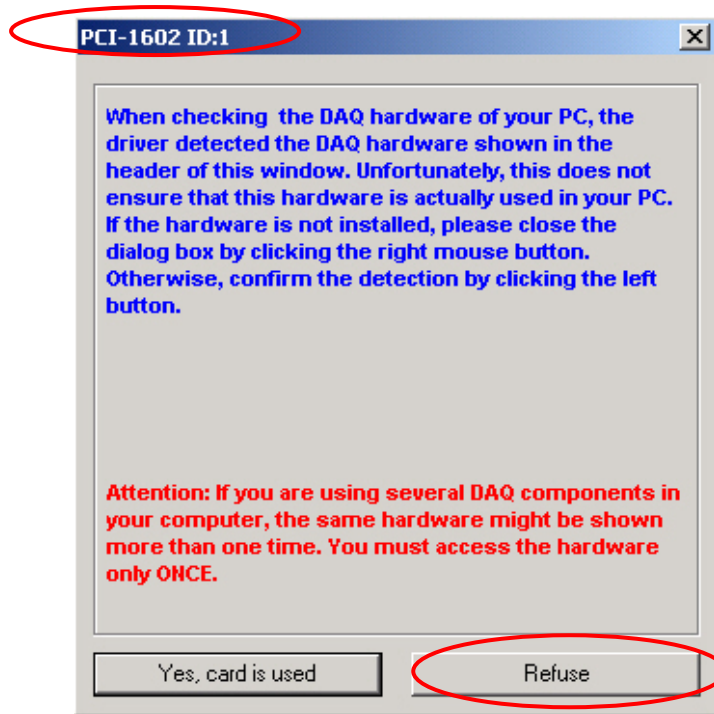


**Step 3:** If you select the hardware mode, the program starts to search cards plugged in the PC after clicking “**setup**” button. For example, in the demo there are two boards, which are PCI-1602 and PCI-1602F. The first board is PCI-1602 with ID:0 and the second one is PCI-1602F with ID:1. According to this, DASYLab firstly finds the PCI-1602 ID:0 card (ID Number is 0) and shows the information in the window. At this time, user must make sure if the current board detected is the first board in the PC or not. In the demo, PCI-1602 card is the first board in the system. Therefore, please click “**Yes, card is used**” button to confirm and save setting into DASYLab. If the message shown in the window is not the current board installed in the system, please click “**Refuse**” button to decline the setup process and continue to find the next board.

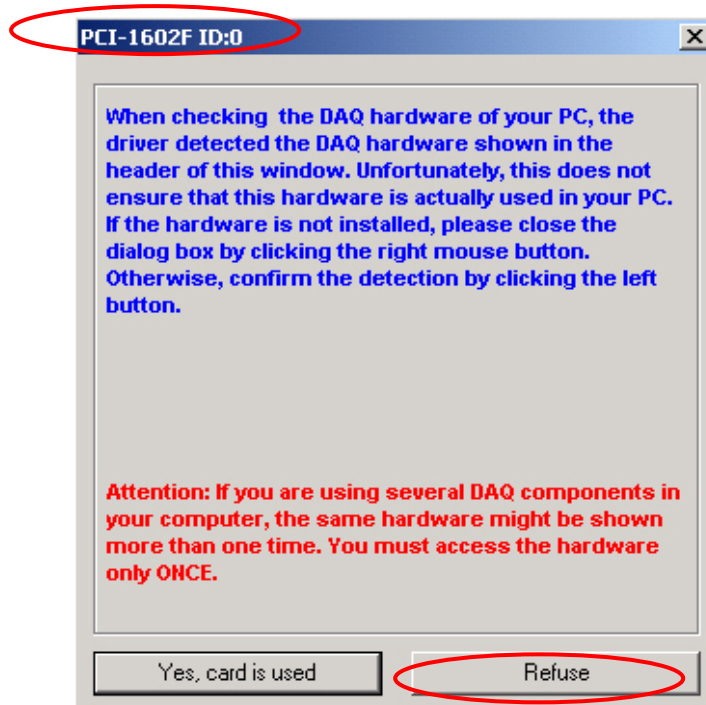
**Attention:**

The programming interface for the hardware relies on a unique Identification number, called ID Number. In the hardware mode, the driver detects all DAQ hardware boards automatically. To ensure the search process will work properly for each type of hardware board. Hardware manufacturer must give every product with a unique identification number. Unfortunately not all manufacturers do so and sometimes different hardware components may have the same number. The result is a driver error message: The hardware named in the window header was found, but the driver can not verify that the named hardware is used in your system or not. To cancel the result of search please leave the dialog using the right button, or to confirm the result using the left button.

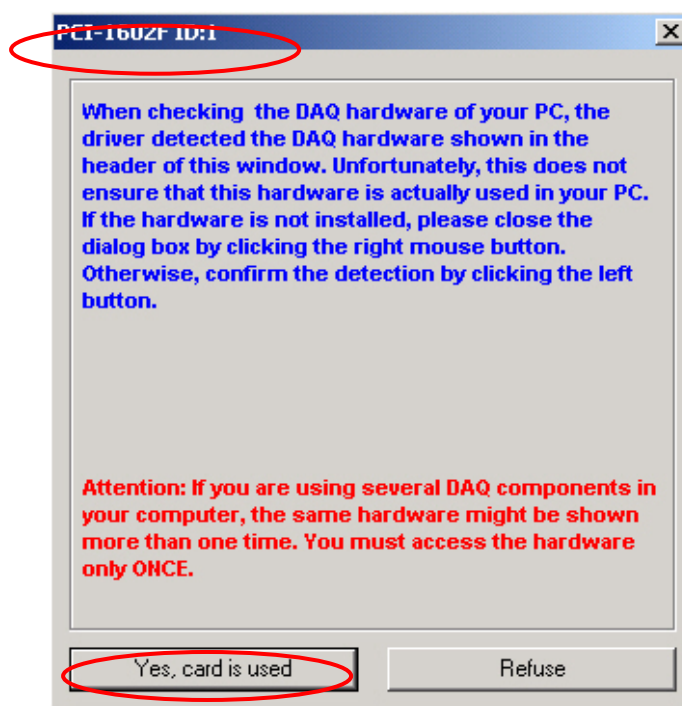
**Step 4:** The next board searched is PCI-1602 ID:1. Because the second board in the demo is PCI-1602F, this result is wrong. Since PCI-1602 and PCI-1602F have the same ID, please click “Refuse” to decline the currently detected setting.



**Step 5:** The next board detected is PCI-1602F ID:0. Because the first board plugged in the system is PCI-1602, therefore, this result is also wrong. Please click “Refuse” again.



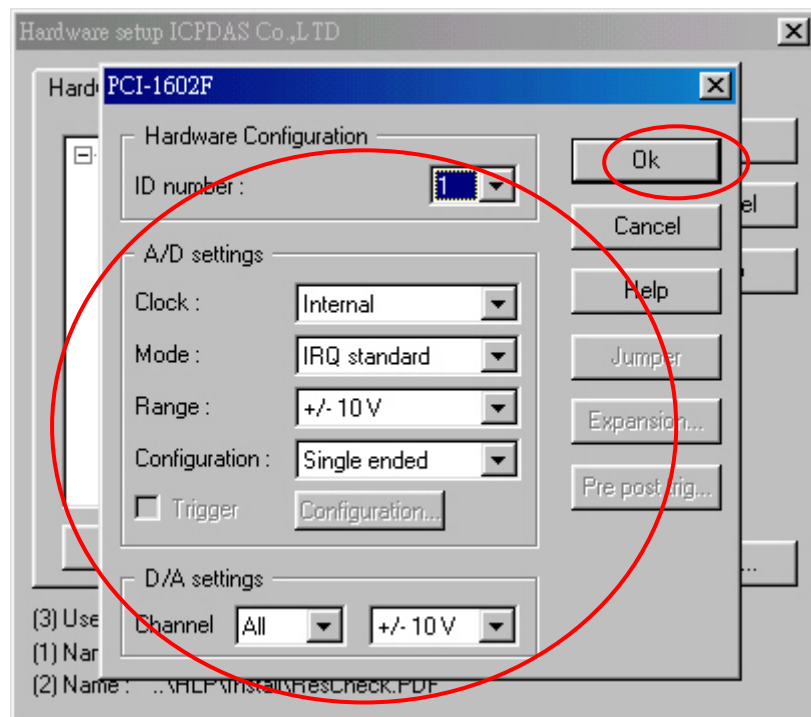
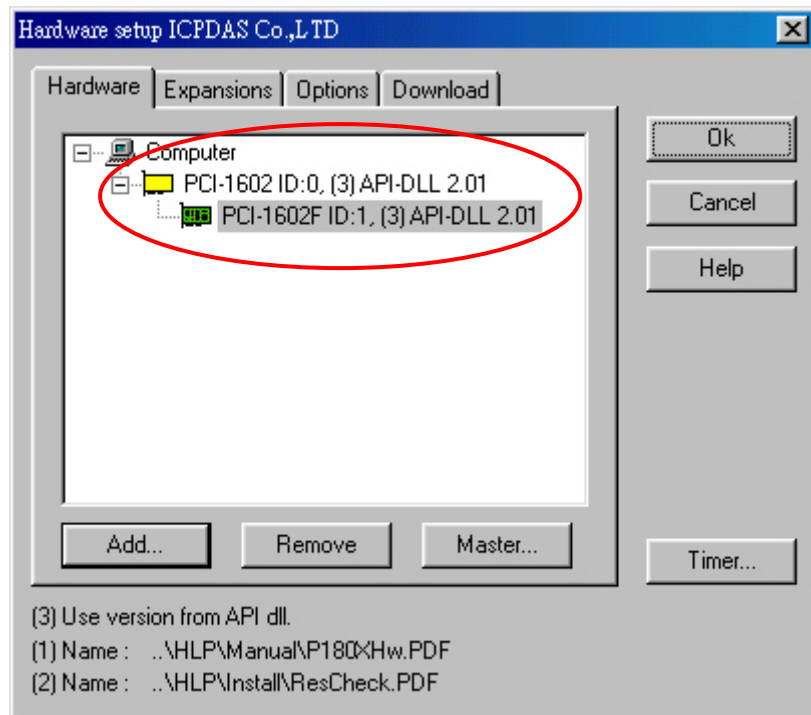
**Step 6:** The next board found is PCI-1602F ID:1. This is the correct second board information, PCI-1602F, installed in the computer. Please click “Yes, card is used” to accept this detection.



**Step 7:** When the searching process is finished, the “**Hardware setup ICPDAS**” dialog window will pop up to confirm hardware settings you have just made. If the hardware information listed is correct, then user can go on to configure the advanced settings for every DAQ card. However, if the listed hardware has something missing, please use the “Add” and “Remove” button to modify the configuration of detected hardware board.

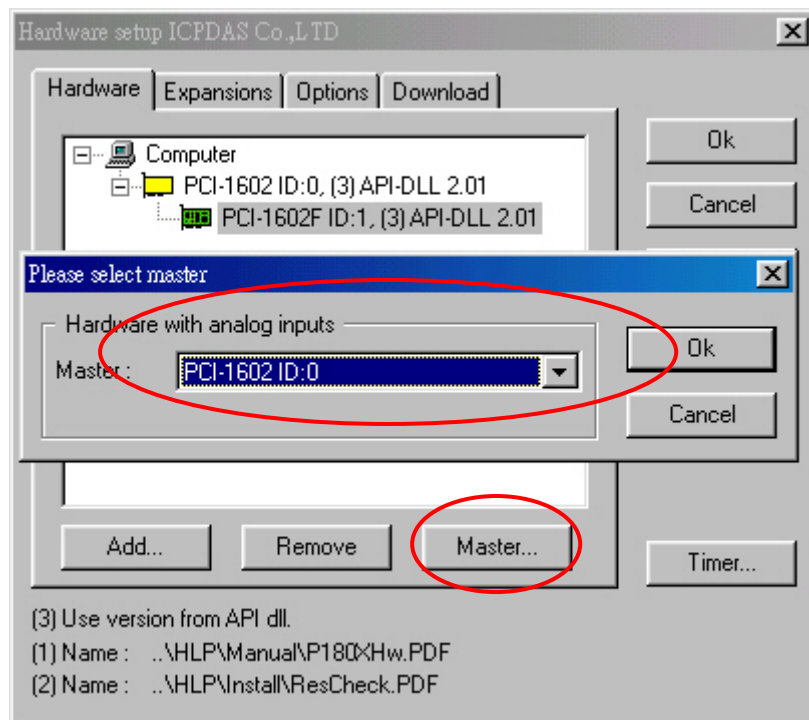
Since DASYLab needs to select a master DAQ card for implementation, users can use “**Master...**” button at the right corner to set up the master card. The first card in the PC is the default master card and the others are the slave cards. According to the Hardware setup for each card, users can double click on the selected board and then a setting window will pop up. Please input and set up the correct parameters, which exactly correspond to the board configuration, in order to ensure correct operation between DASYLab and hardware boards. If users need further information regarding the setting process, you may click “Help” button to open hardware manual in PDF format.



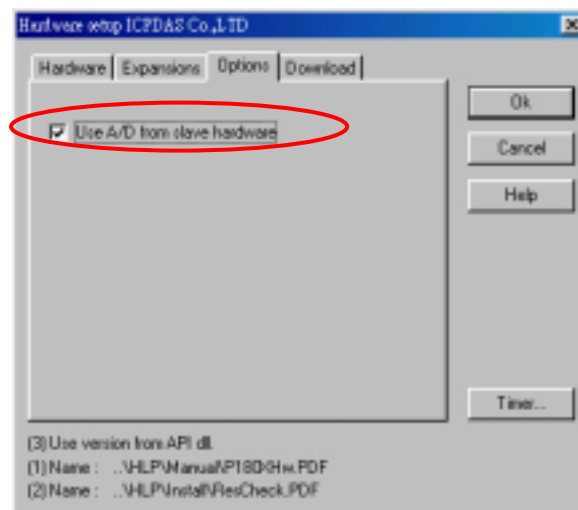


**Step 8:** The driver always uses the first DAQ card as the Master Hardware, which is shown on the top of the detected hardware tree under the PC symbol. If there is a need to select a different Master Hardware and exchange the positions in the hardware tree, user can click “**Master...**” button to change the setting from the window of “**Select Master Hardware**”. Then, a new Master-Hardware card will be

defined.



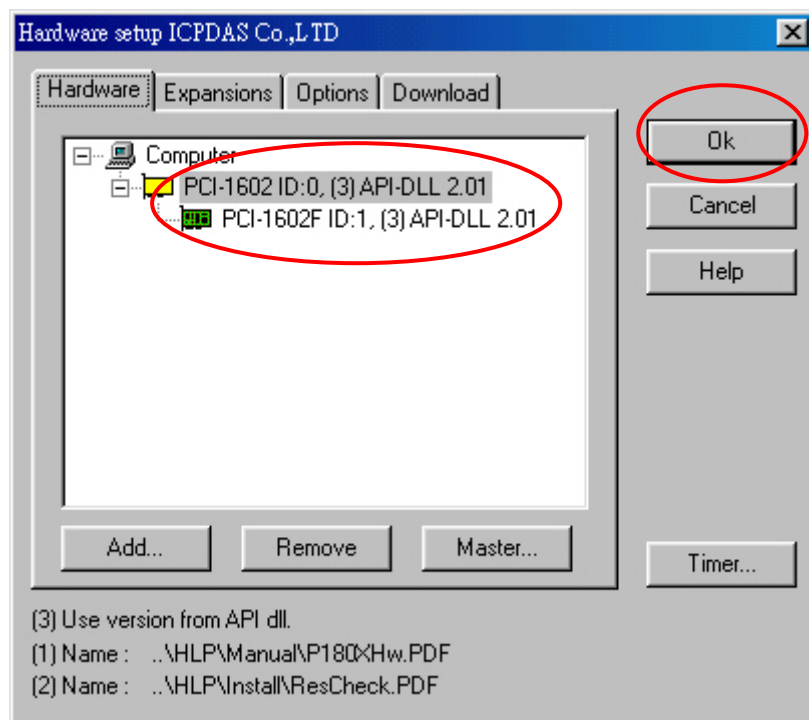
**Step 9:** If users have two or more than two A/D DAQ cards. DASYLab needs to start up the master-slave mechanism. Therefore, user needs to go to the “Options” page to check the option of “**Use A/D from slave hardware**”.



Besides, if the system has more than two A/D multifunction cards. All other cards, except the master card, will work as the slaves. To use each slave hardware with its own sampling rate and block size is not possible because of the internal structure of DASYLab. Hence the Slave hardware only can be applied in the polling mode. The sampling rate/ block size of the A/D converter mechanism of the Slave hardware is exactly the same as those of

the Master hardware. Because the build-in clocks of the DAQ hardware do not work on absolute synchronization, the time stamps of the measured data will drift and at the end would not fit.

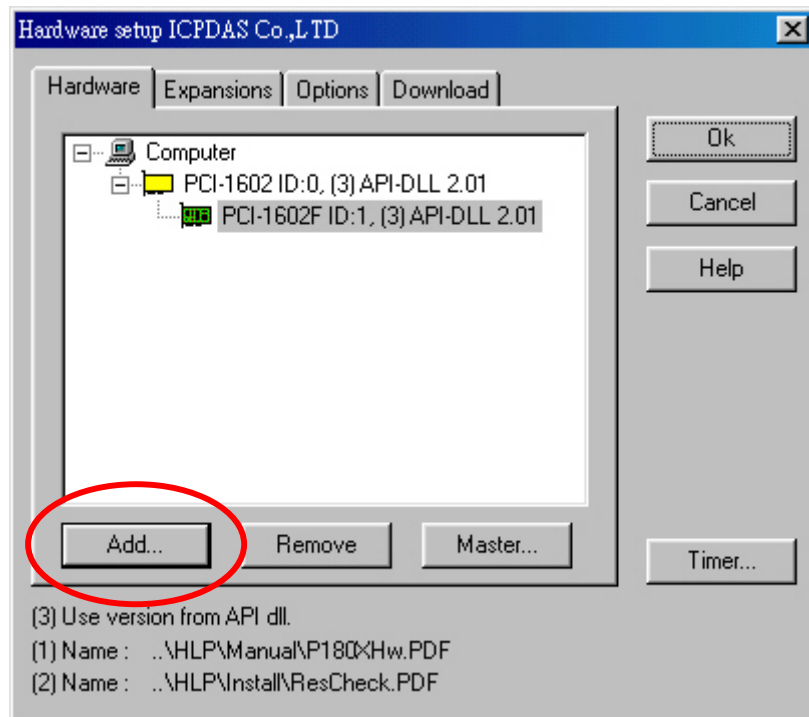
**Step 10:** Click “OK” to finish the hardware setting.



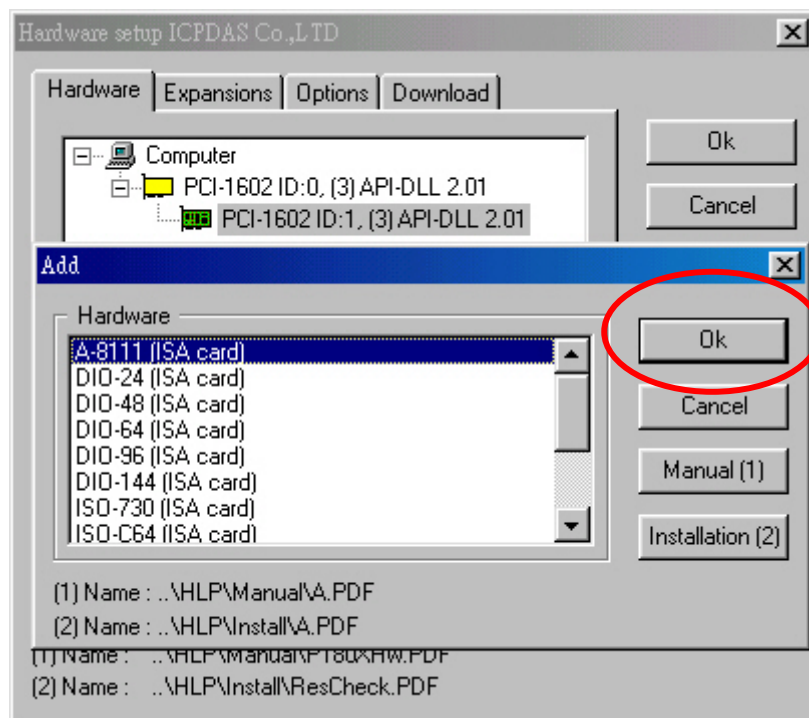
### 2.3.2 Setting the non-PnP cards

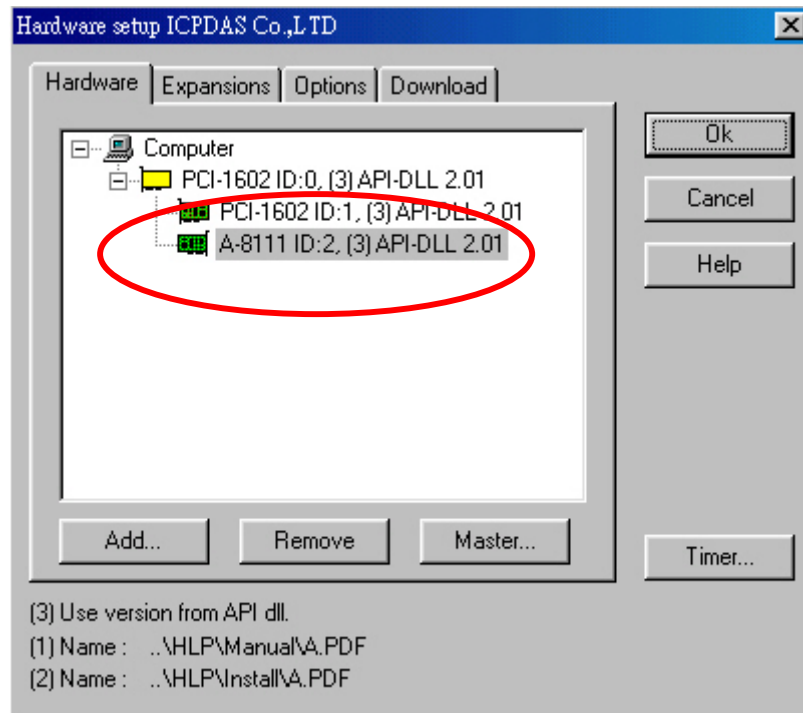
If users plug non-PnP cards in the PC, the DASYLab will not find the card. Users must add the cards into DASYLab manually.

**Step 1 :** When the searching process is finished, the “**Hardware setup ICPDAS**” dialog window will pop up to confirm hardware settings you have just made. You can use “Add” button to add the non-PnP cards into DASYLab.

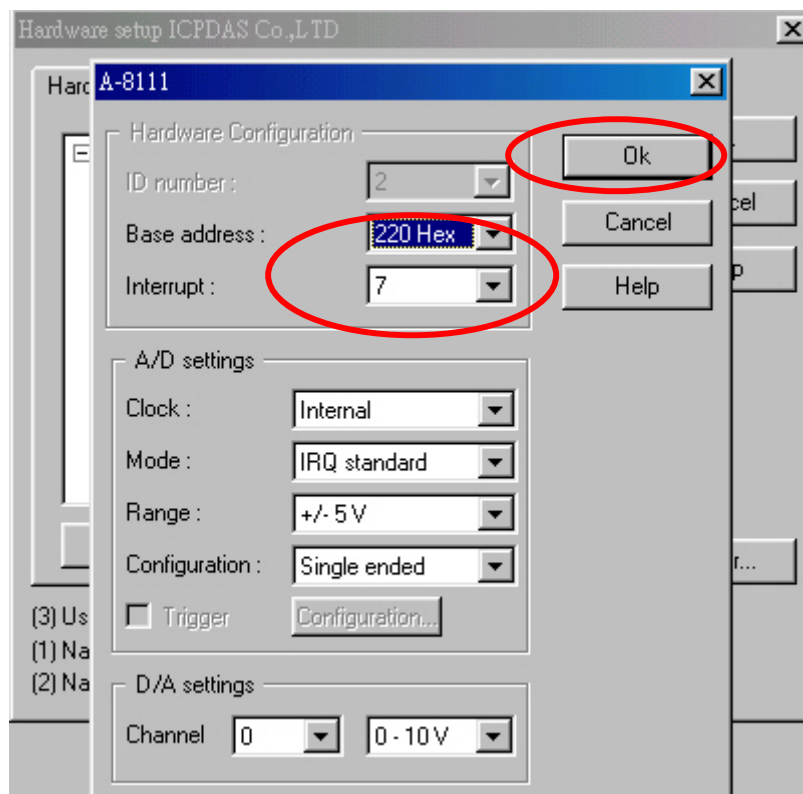


**Step 2 :** Select the non-PnP card plugged in the PC. Click “OK” to add the card in your Hardware list.

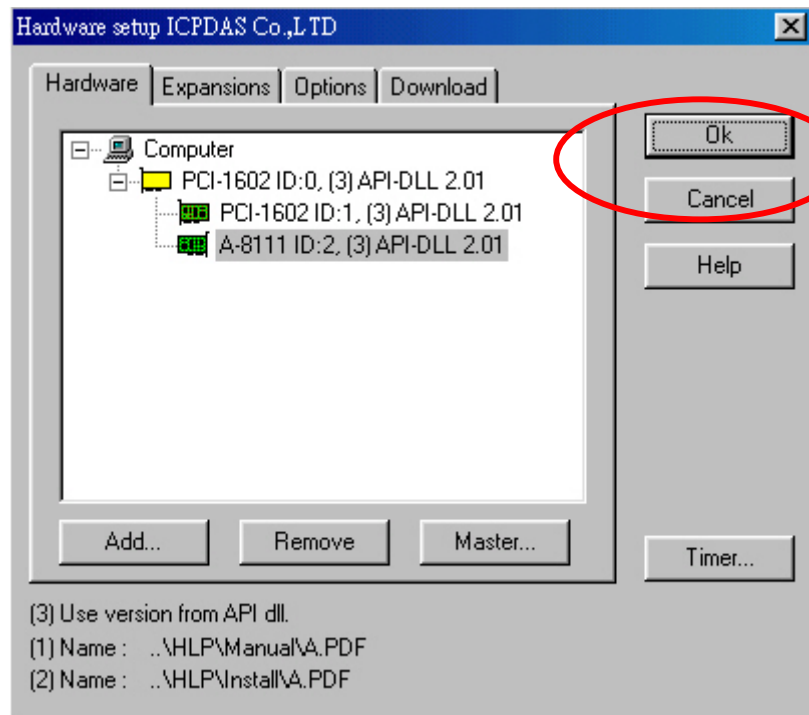




**Step 3:** Double click the selected card. Setting the non-PnP card's configuration fitted for your hardware. (base address, IRQ and etc..) If the incorrect configuration is set, DASYLab will not driver the card correctly.

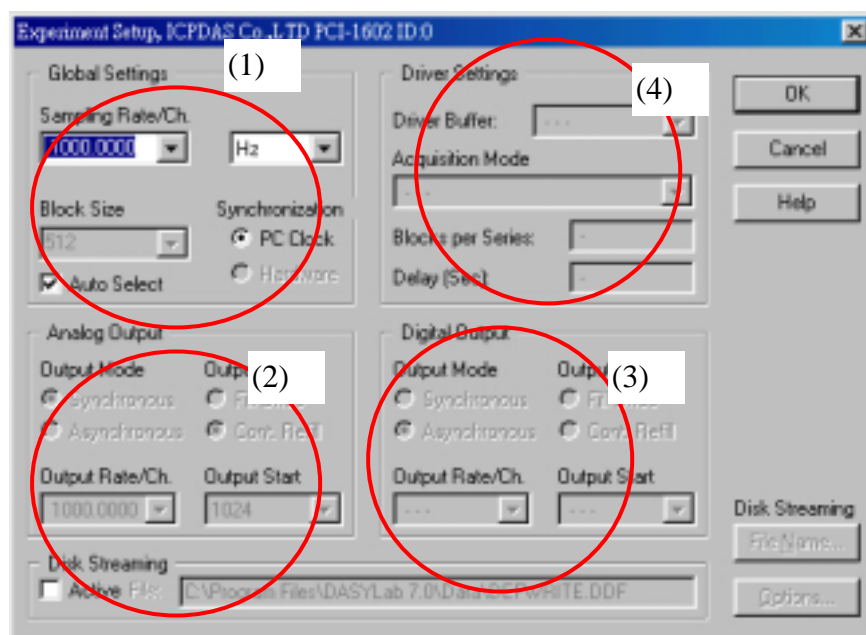
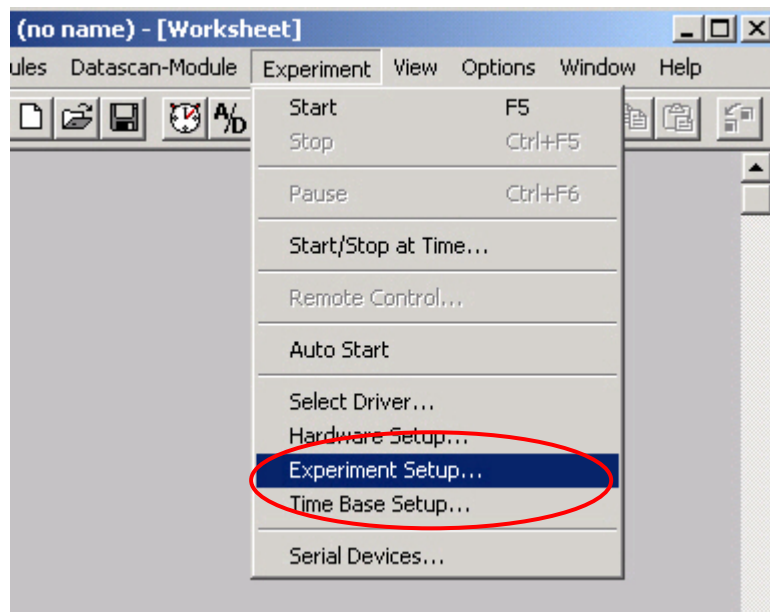


**Setp 4:** Click “OK” to finish the Hardware setting.



## 2.4 Experiment Setup

After the hardware setup, users need to go to “**Experiment Setup**” dialog, which is in the “Experiment” menu. Experiment Setup is for the general parameters setting of data acquisition and measurement. According to the resources provided by your computer system and the size of the worksheet you have designed, these settings have decisive influence on the overall data processing performance as well as on the response time of individual functions.



(1) **Global Setting:** You can use global variables to define the sampling rate

and block size settings. These variables are read once at the start of the application program. The global settings are related to all functions for signal data acquisition.

- (2) **Analog Output:** These settings are interrelated to the output mode, buffer and rate of analog output
- (3) **Digital Output:** These settings are interrelated to the output mode, buffer and rate of digital output.
- (4) **Driver Setting:** The variables depend on the installed hardware.

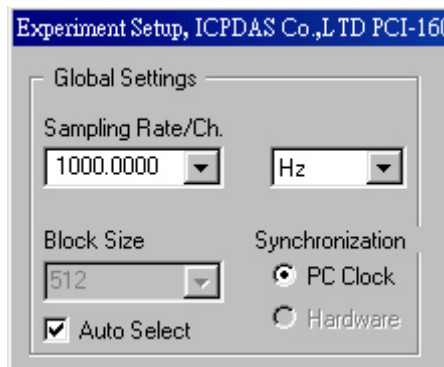


### 3 Analog Input module

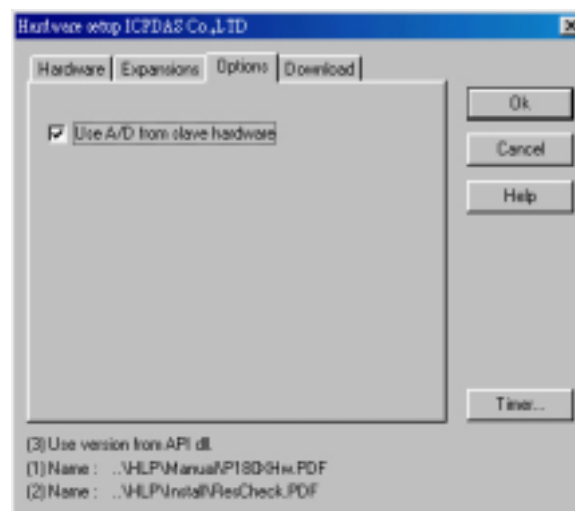
In this section, we will describe how to set analog input module. And a demo program will be also built for testing.

#### 3.1 Master Slave Mode

To set up an A/D data acquisition setting of the driver, user needs to use the dialog of “**Experiment Setup**”, which is in the “**Experiment**” menu. Please refer to the following figure to configure the Global Settings of Analog input. Here, you have to define Sampling Rate, Block Size (driver buffer) and synchronization setting, which depend on PC clock or hardware setting. Note that Global Setting only accepts the setup of ONE DAQ hardware component, i.e., the master hardware.



If users have more than one DAQ cards in the system, all other hardware is designed to work as the slave mode. Therefore, according to the hardware settings, users need to check the option setting of “**Use A/D from slave hardware**”. In other words, only the master hardware can work at the given sampling rate. And all other hardware used as Slaves can only be used in a reduced mode.



To use a slave board with its own sampling rate and block size is not possible because of internal structure of DASYLab. To use the A/D input channels, you can use the Slave hardware exactly with the same sampling rate/ block size as the Master hardware has. Because the build-in clock of the DAQ hardware work is not absolute synchronized, the time stamps of the measured data will drift and at the end would not fit.

Besides, to use the Master-Slave mode, you do not need to make special settings for the slave hardware. All Slave hardware is automatically set to the Polling mode. Depending on the usage as Master- and/or Slave-Hardware in the worksheet, some types of I/O hardware may have some restrictions in this application structure. In the table below, several possible error messages are listed for reference to help users tackling practical application problems.

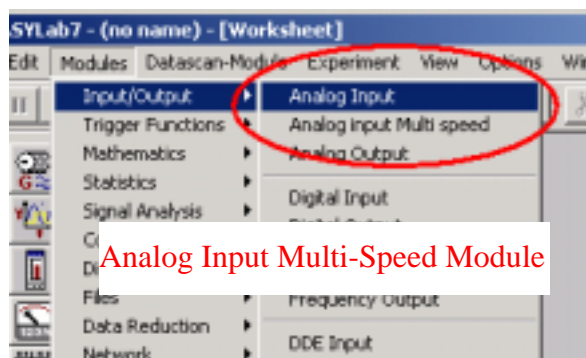
Table 1

I/O-Type	Only Master Hardware	Only Slave Hardware	Master and Slave-Hardware
Analog Inputs	available (possible Error 24)	As stand-alone not available, in worksheet at least one A/D input of the Master has to be used(possible Errors 33, 39)	See last text passage (possible Errors 24, 49)Setting 1 needed
Analog Outputs	available(possible Error 27, without error No.)Setting 2 needed	available(possible Error 27, without error No.)Setting 2 needed	If you use A/D inputs of Master AND Slave NOT available(possible error 48)
Digital Inputs	available (possible Error 22)	available (possible Error 22)	If you use A/D inputs of Master AND Slave NOT available(possible error 43)
Digital Outputs	available(possible Error 27, without error No.) Setting 2 needed	available(possible Error 27, without error No.)Setting 2 needed	If you use A/D inputs of Master AND Slave NOT available(possible error 46)
Counter Inputs	available	available	If you use A/D inputs of Master AND Slave NOT available(possible error 44)

<b>Error Code</b>	<b>Description</b>
Error 022	Attention! If you use A/D inputs Digital, inputs are only available as "High-Speed Digital inputs". Reconfigure the DAQ hardware in the Hardware Dialog and modify your worksheet.
Error 024	Too much Analog inputs are used in the worksheet. Please reduce the number.
Error 027	The synchronous Analog or Digital output is not valid in the selected "Polling" mode. Please modify your settings.
Error 033	You must use at least one Analog input of the Master hardware in the worksheet.
Error 034	Please select hardware a hardware with Analog Inputs as Master. The driver will only accept such master hardware.
Error 039	A stand-alone usage of a Slave board is not allowed. Please change the Master-Slave order in the Hardware settings.
Error 042	A DAQ hardware to acquire temperature is not valid as Master. Please select a hardware with Analog Inputs as Master hardware. The driver will only accept such master hardware.
Error 043, 044, 046, 048	You are using Analog inputs of Master and Slave hardware. The simultaneous usage is not allowed with the actual driver build.
Error 049	First you have to announce the usage of A/D channels of the Slave hardware in the hardware setup dialog.

### 3.2 Multi-Speed Module

With the driver, the A/D channels of the ICPDAS DAQ cards can also be addressed for data acquisition using the DASYLab Module of Analog Input Multi-Speed.



In contrast to the Master/Slave operation mode, using this module, you define individual scanning rate and block size of each measuring hardware for A/D data acquisition. That is, the measuring hardware performs the A/D data acquisition with an independent worksheet. You can use this Module for A/D data acquisition for all remaining I/O types of the hardware at the same time in the worksheet. However, to have this capability, it is necessary that at least one I/O module of the driver (analog output, digital input, digital output, and counter input) has been applied in the worksheet. For A/D applications using the Analog Input Multi-Speed Module, possible error messages are summarized as follows.

Table 2: Error messages for A/D mode with analog Input Multi-Speed

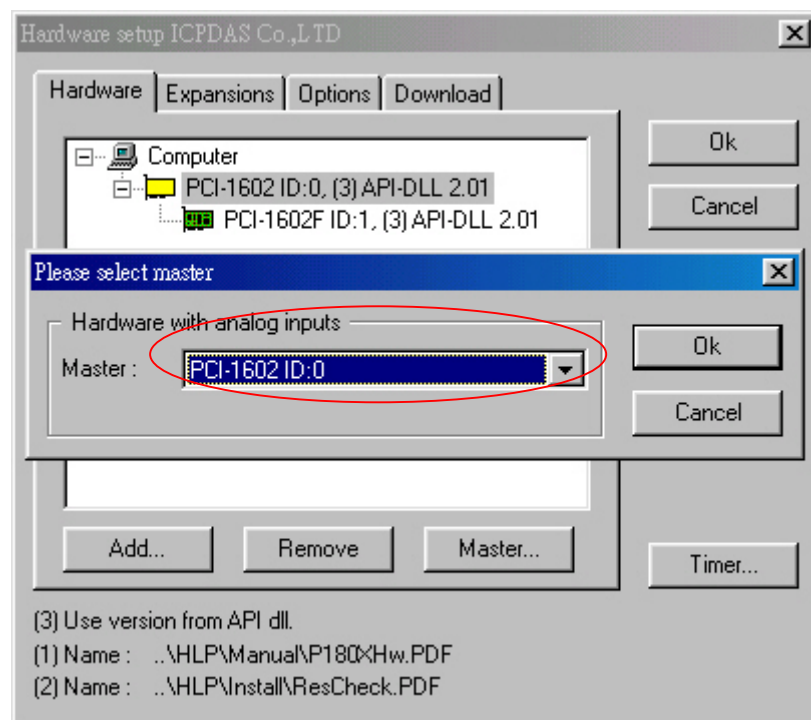
Error Code	Description
Error 052	The DLL "LibMS" is not found or valid. Please check the steps for the driver installation.
Error 053	The A/D channels can not be used simultaneously via driver interface and module interface. Please modify your worksheet.
Error 054	To use the A/D channels at least one I/O module of the driver (analog output, digital input, digital exit, counter input) must be inserted into the worksheet.
Error 057	In all modules Analog Input Multi-Speed, which have to address the same hardware, you must use identical values for sampling rate, block size, and buffer in the dialog box.

### 3.3 Demonstration

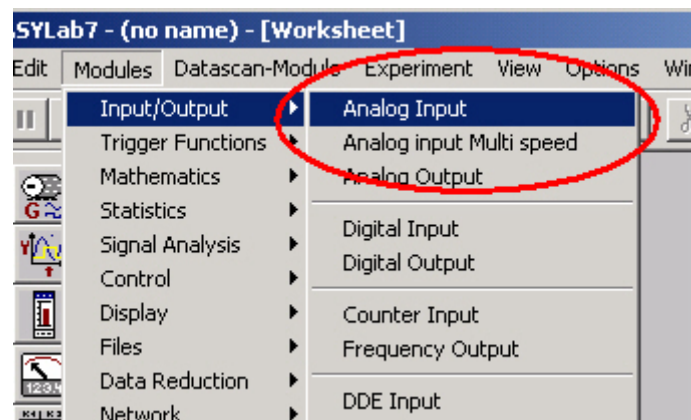
The following example demonstrates the condition with a PCI-1602 card and a PCI-1602F card. Here, we try to guide users how to use A/D DAQ boards provided by ICP DAS.

#### (1) One Analog Input board

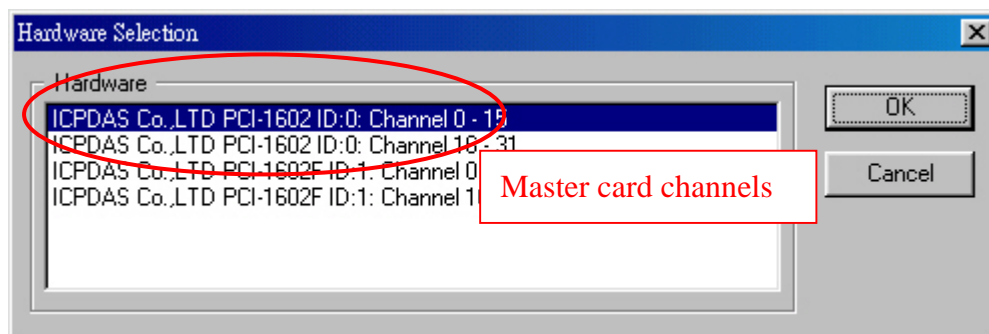
**Step 1:** Setup the PCI-1602 ID:0 as the master card in “**Hardware Setup**” dialog of menu “**Experiment**”, as shown below.



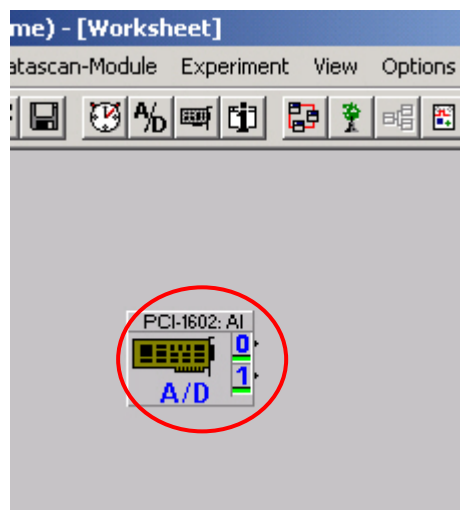
**Step 2:** Open a new Worksheet in DASYLab and create an AI module from “**Modules**” menu.




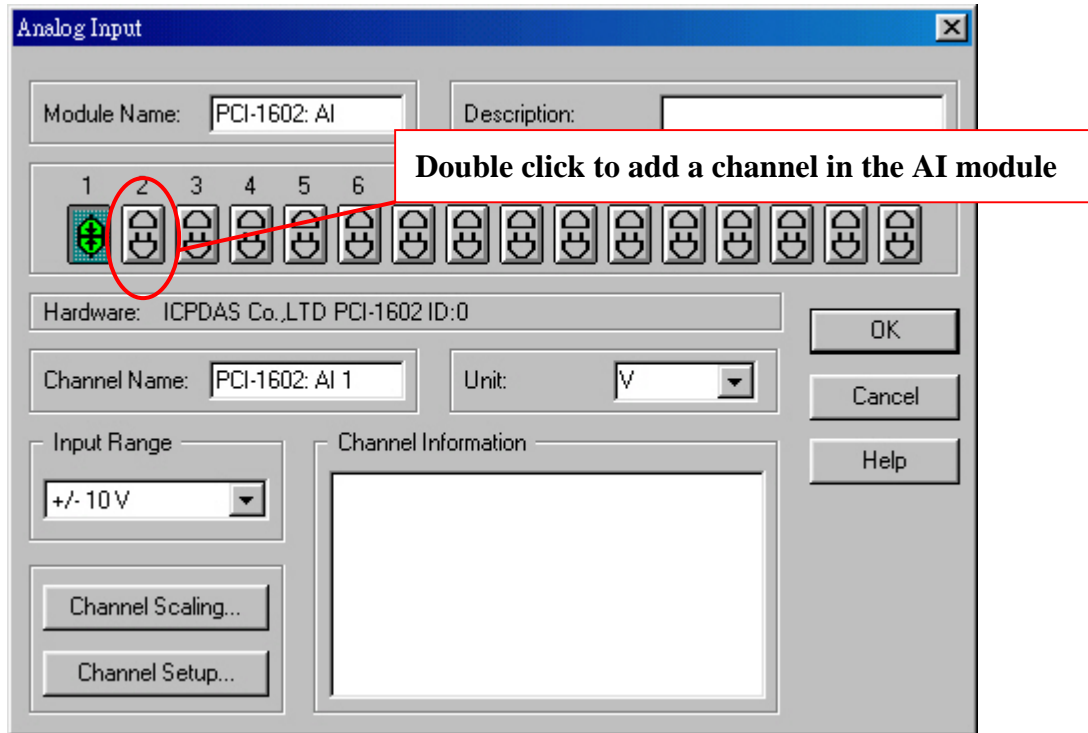
**Step 3:** When an AI module is selected, a dialog “**Hardware Selection**” pops up. Users must select the master card, which is PCI-1602 ID:0 with channel 0~15. The first 16 channels are supported for testing.




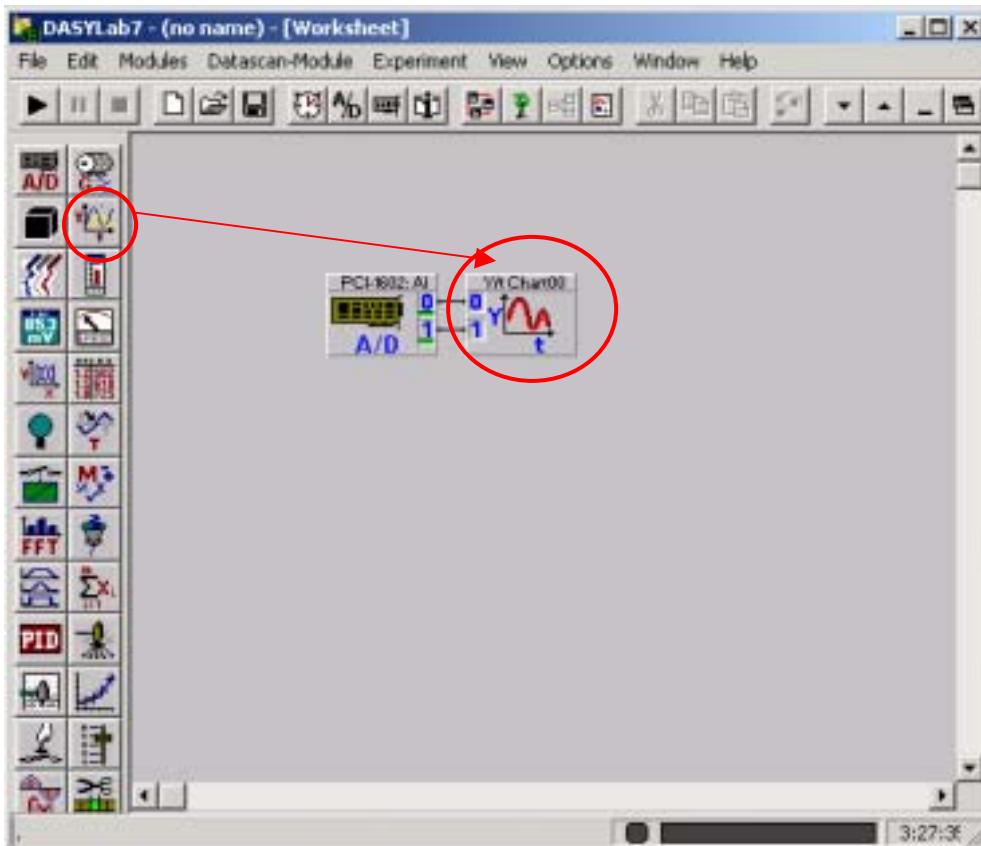
**Step 4:** Double click an AI module, locating in the module bar, to add one analog input module into the worksheet.






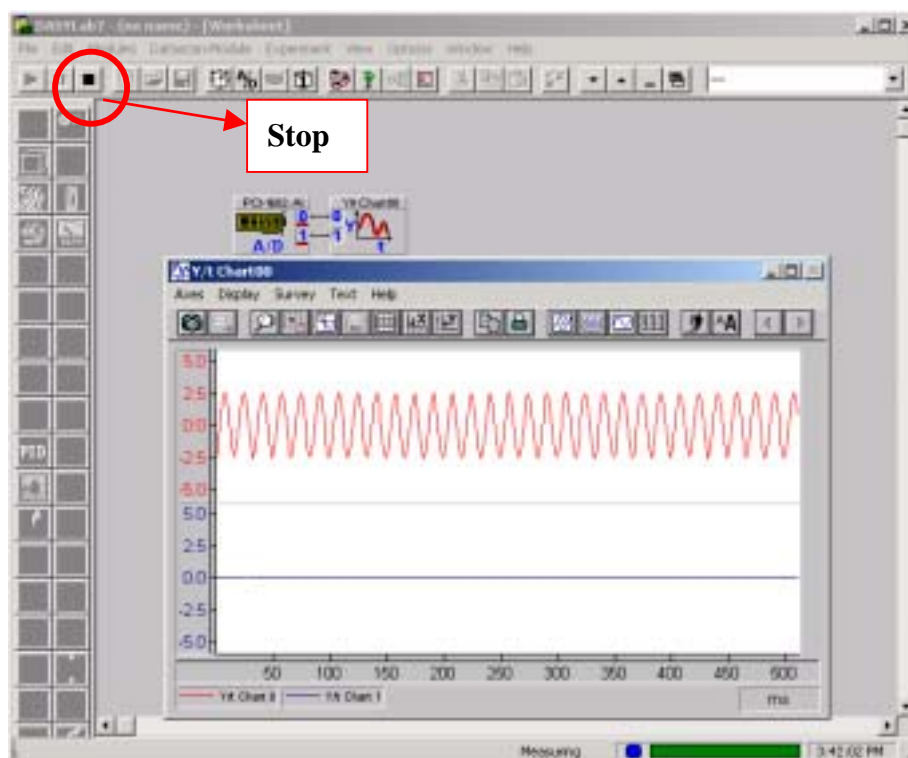
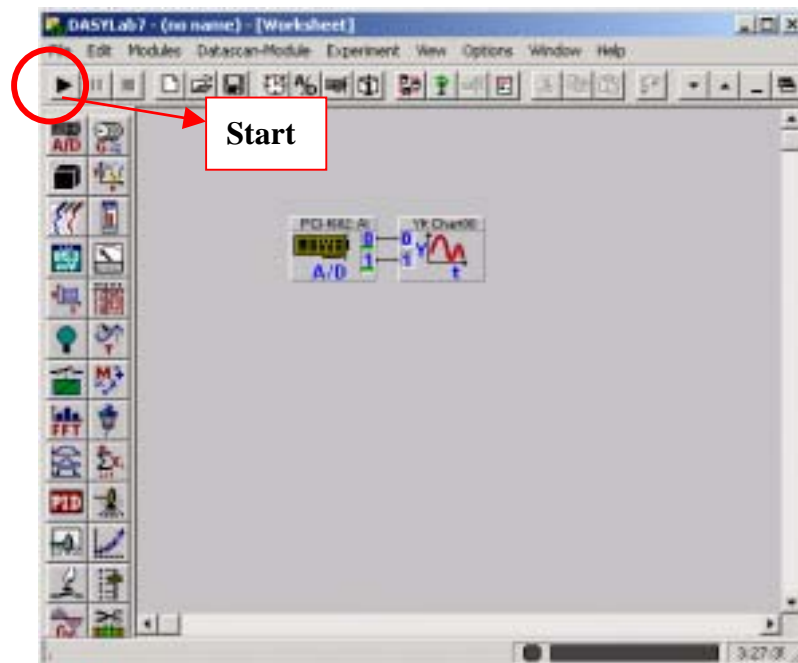
**Step 5:** Double click on the icon, , to set general settings for AI modules. Please follow the information shown in the figure to add more channels or change the setting of each channel.



**Step 6:** Add a Y/t chart module  from the module bar. Then connect the AI modules with the Y/t chart.



**Step 7:** Click  to start, or  to pause, or  to completely stop the measurement.

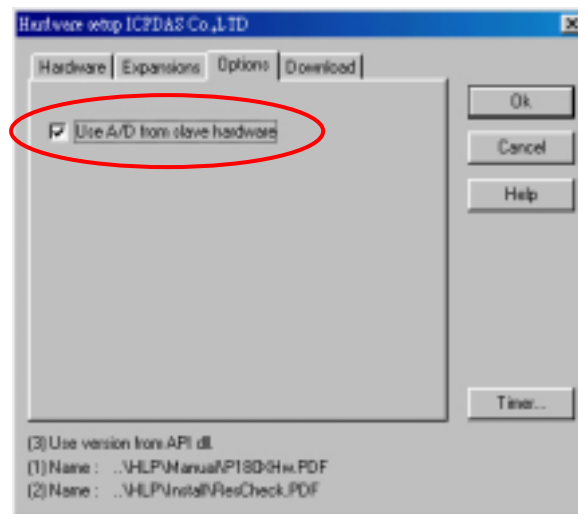


## (2) Two Analog input boards.

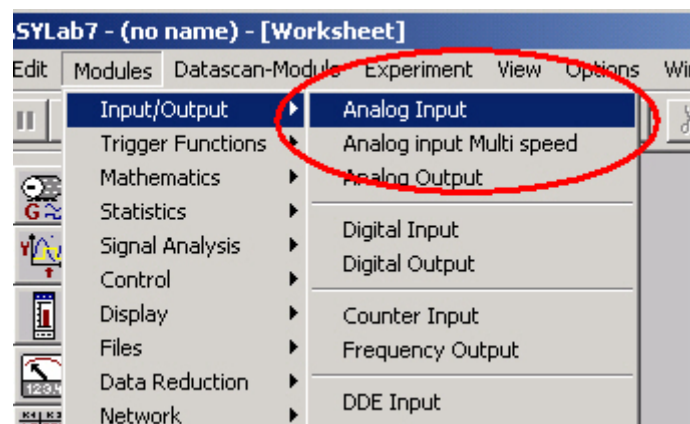
Before start the measurement, you must setup the slave hardware in the



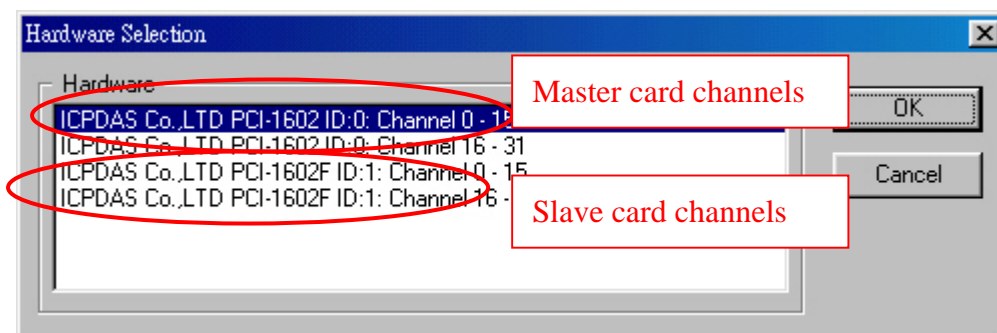
dialog of “**Hardware Setup**” in the “**Experiment**” menu.

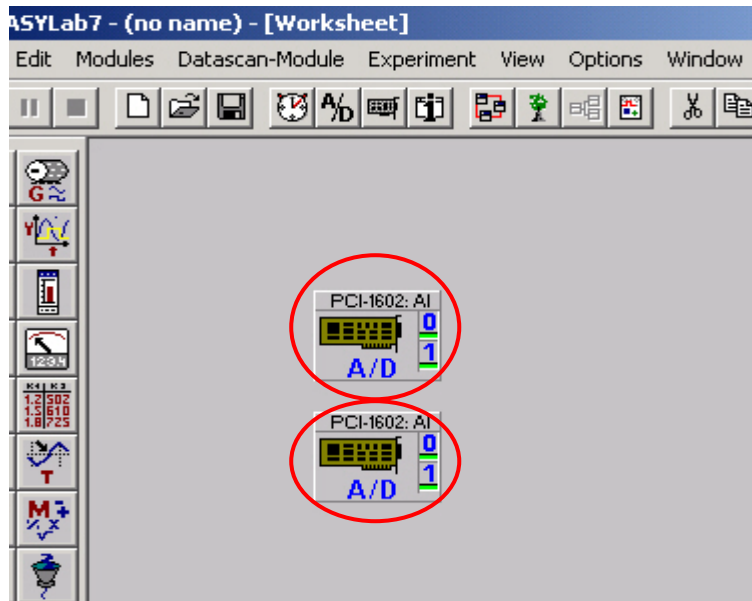



**Step 1:** Open a new Worksheet in DASYLab and create two AI modules from “**Modules**” menu.

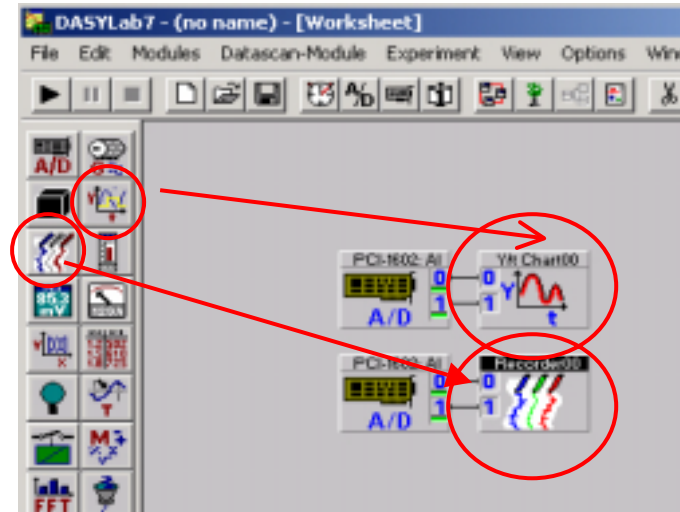





**Step 2:** Double click “**ICPDAS PCI-1602 ID:0: Channel0-15**” and “**ICPDAS PCI-1602F ID:1: Channel0-15**” to add these modules to the worksheet.

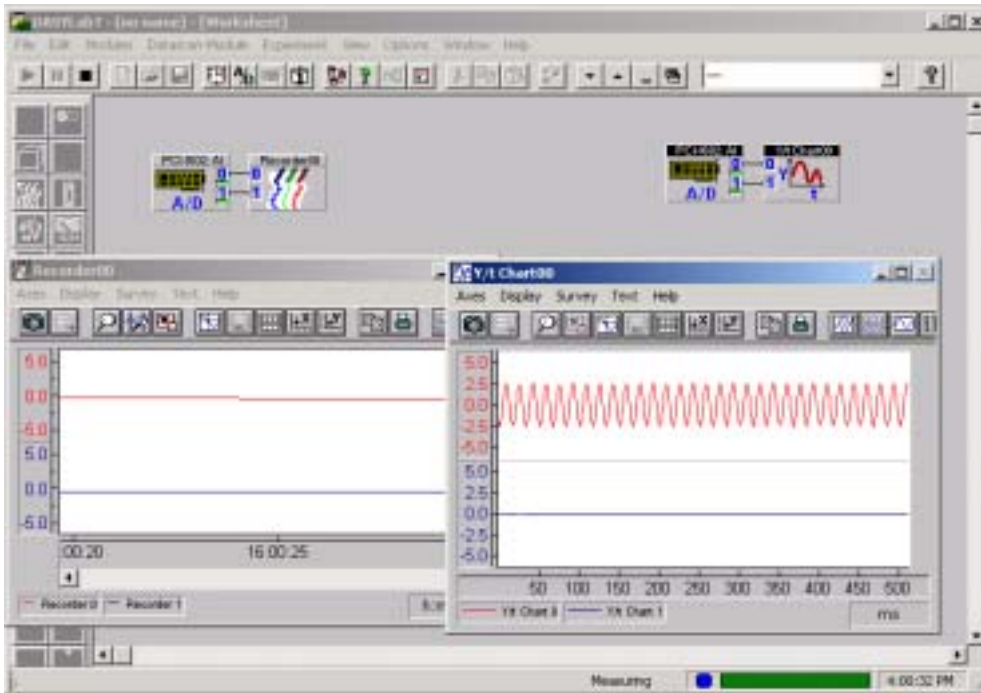




**Step 3:** For the AI mode of slave hardware, the AI signals are acquired with polling mode. So we can use recorder module  to store AI values. The master hardware is the same as the last demo. And a Y/t chart is imported and connected to the master hardware.



**Step 4:** Click  to start, or  to pause, or  to completely stop the measurement. The final result is shown in the following figure.

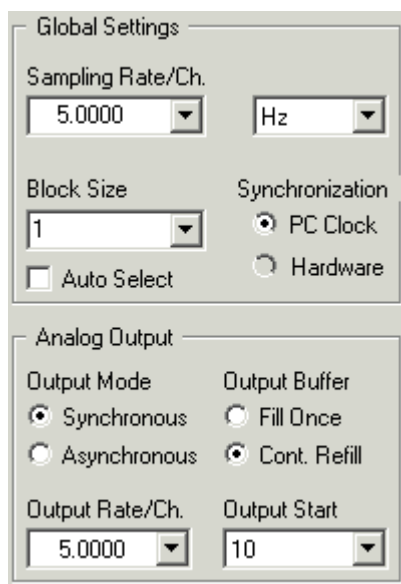


## 4 Analog Output module

In this section, we demonstrate how to use the analog output module.

### 4.1 Analog Output Introduction

In the dialog of “**Experiment Setup**” in the “**Experiment**” menu, you can select the data, which is acquired either synchronously or asynchronously, with the measuring frequency and define the output buffer.



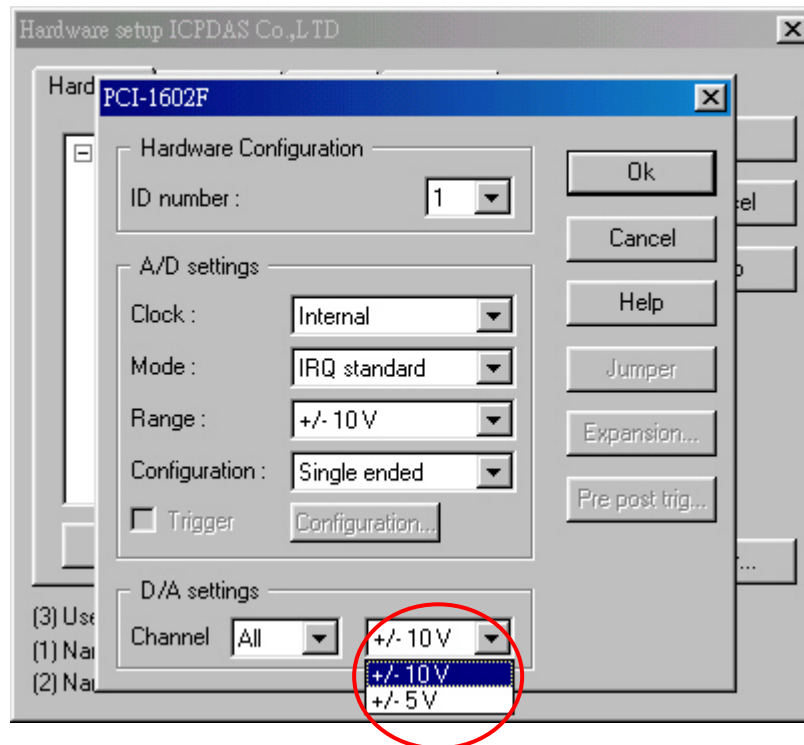
In the synchronous mode, the data is sent to the D/A output channel with the adjusted output rate. The output buffer in the dialog “**Experiment Setup**” has two options, “Fill Once” and “Cont. Refill”. “Fill once” specifies that the values of the first data block can be sent continuously (repeatedly). If “Cont. Refill” is selected, the values are put out because they arrive over the appropriate data channel. As the output rate only depends on the global scanning rate, it can be selected for each channel. According to the selected number of channels, you can only use the global sampling rate or integer divisors of it, which are slower rates.

In the dialog of “**Experiment Setup**”, the setting of “**Output Start**” specifies the number of values, which have to be collected before the data output process is started. This value is at least equal to the global block size. On one hand, this input permits an adjustable delay. On the other hand, it also offers a buffer space and irregularly arriving values can be synchronized.

With the asynchronous operation, only the last value of a data block is sent as fast as it could be. No speed estimation can be made, because this depends on many factors, for example, the computer performance, the

number of modules in the diagram, etc.

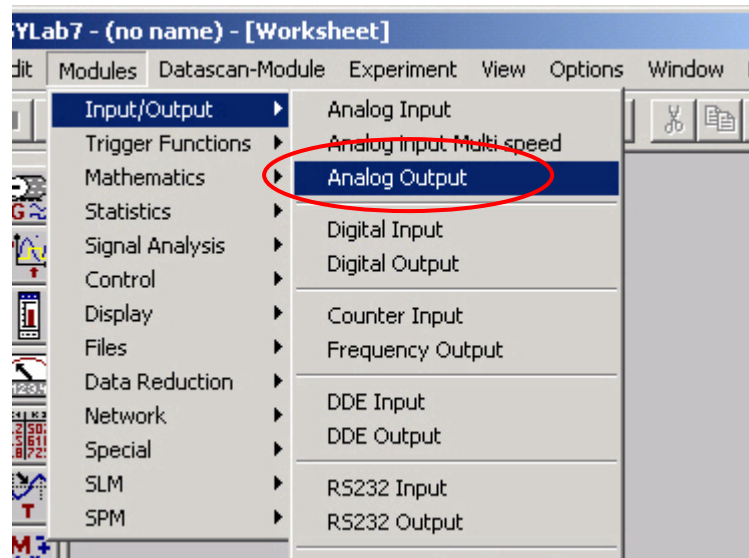
You can check the settings of AO modules in the dialog of “**Hardware Setup**” from the menu “**Experiment**”. Modify the parameters to fit your needs.



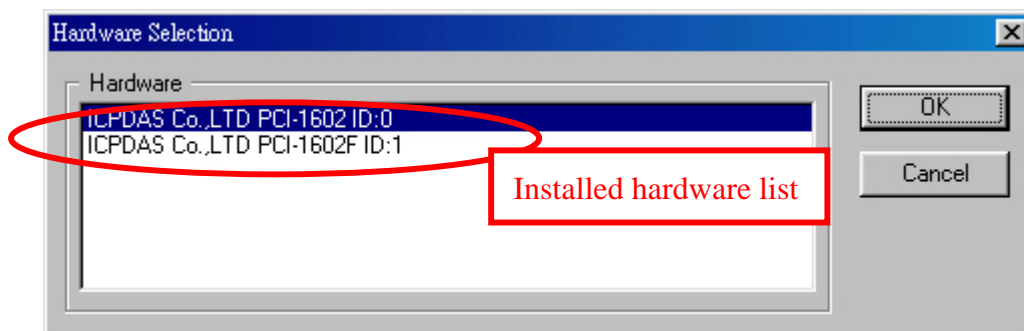
## 4.2 Demonstration


This demo uses two AO and two AI channels of the PCI-1602 board. And the analog output channels are connected to analog input channels. The Sampling Rate/Ch is 10kHz. The model of Analog Output is asynchronous. The following procedures describe how to create and implement the analog output modules.

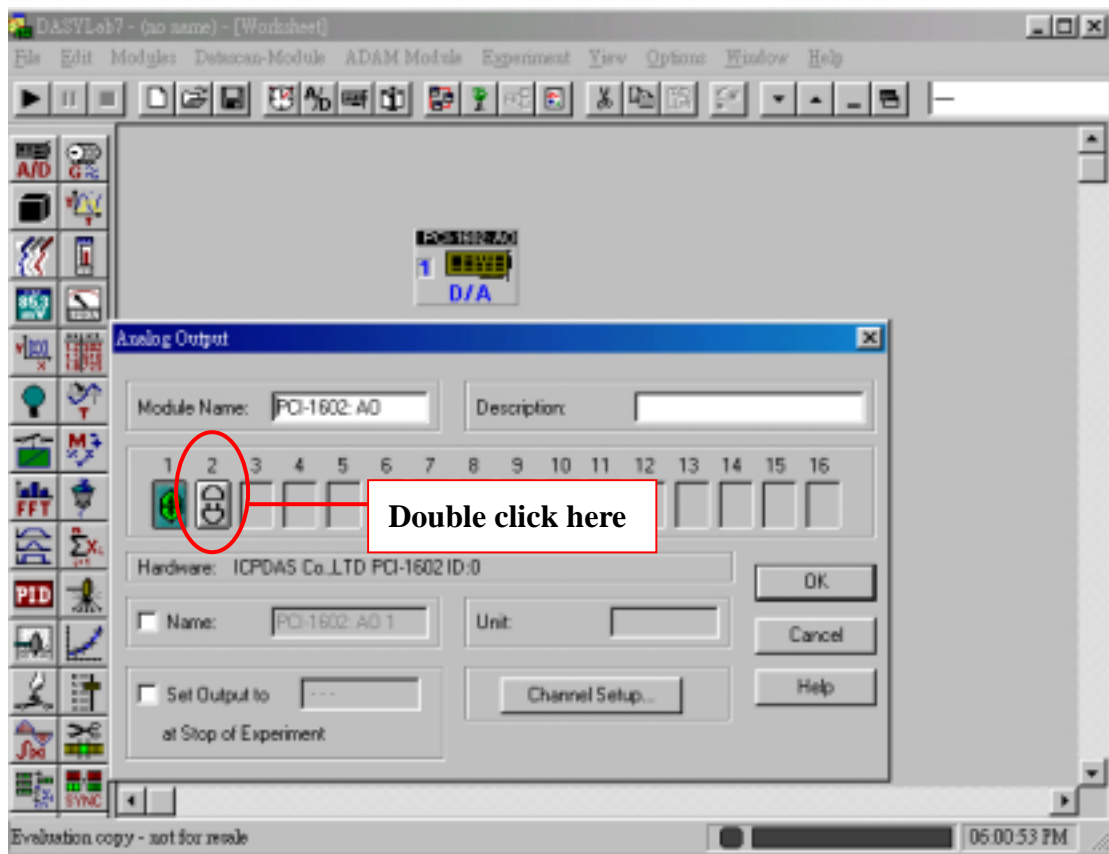
**Step 1:** Open a new Worksheet in DASYLab and add an AO module from the “**Modules**” menu.





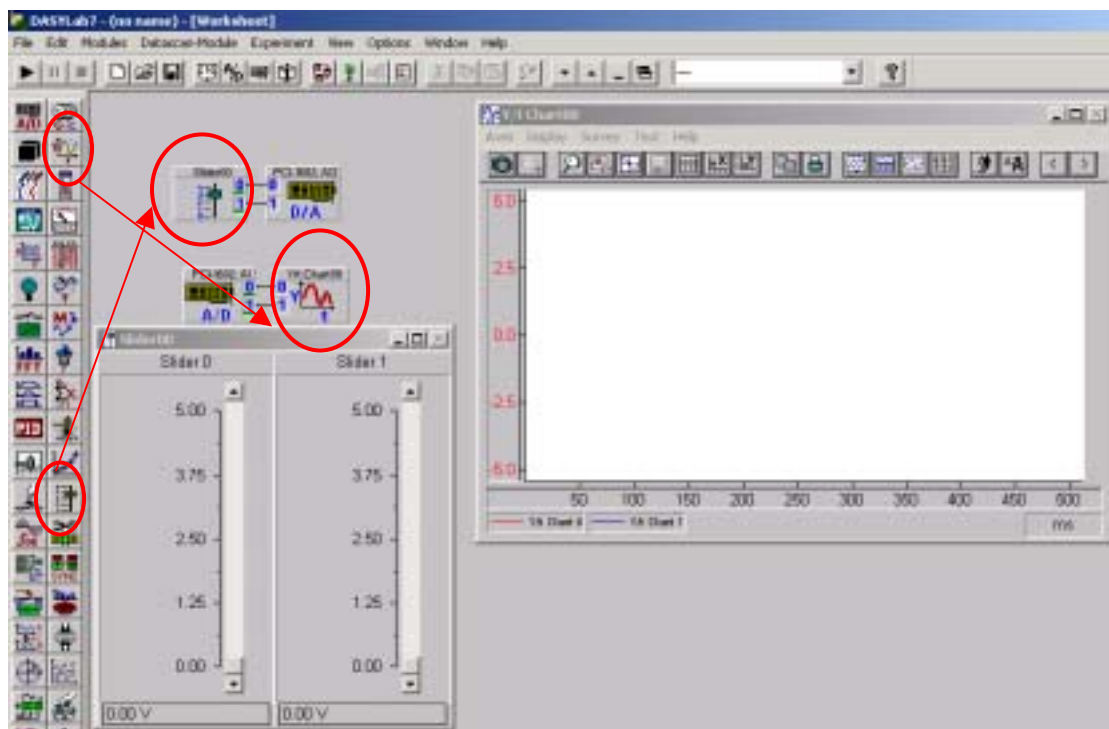
**Step 2:** This module represents analog output channels if they are available on the installed data acquisition hardware. If the selected driver supports more than one hardware component, a “Hardware Selection” window appears and displays the available hardware. Please choose the hardware from the list and assign it to the new module.






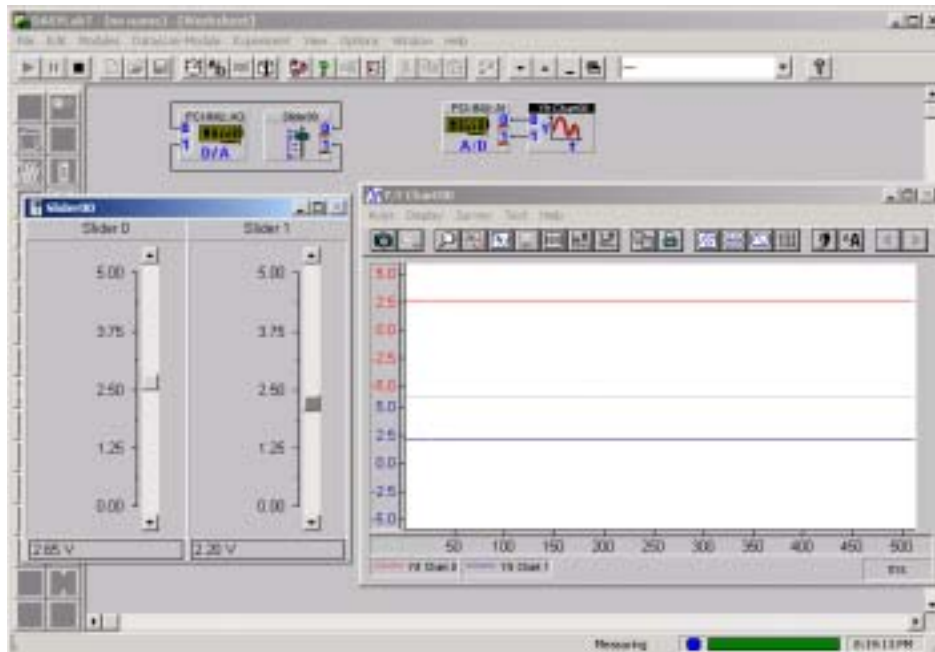
**Step 3:** Double click the icon  to add/remove a channel connected with hardware in the AO module.



**Step 4:** Add a slide module  to output AO values and a Y/t chart module  to measure A/D values from the AI module.



**Step 5:** Click  to start, or  to pause, or  to completely stop the experiment. The result is illustrated below.



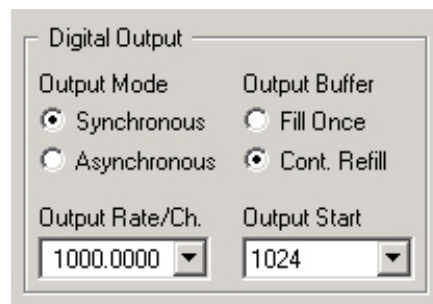
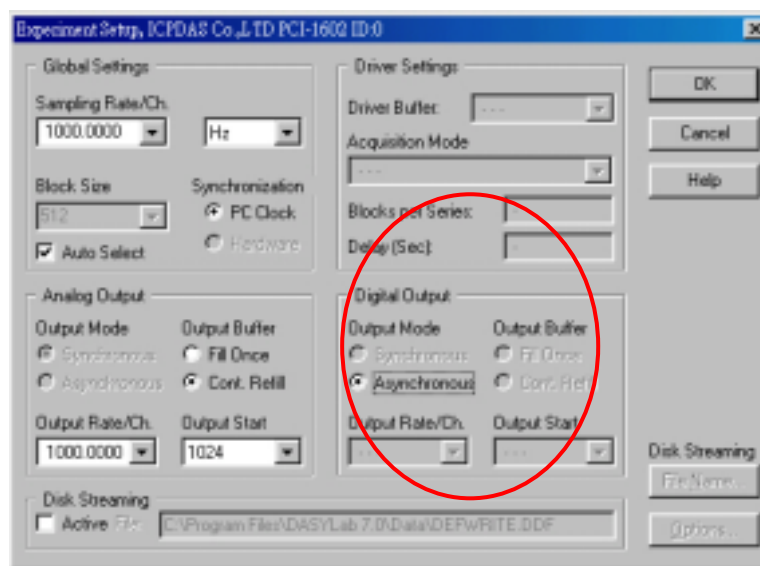


## 5 Digital Input/Output module

### 5.1 Digital I/O Introduction

Digital I/O interfaces are frequently used for the sequence and process control, especially to communicate with peripheral devices. Digital I/O components need to produce or accept binary Input/output signals.

In the dialog of “**Experiment Setup**”, you select whether the data are output synchronously with the measuring frequency or asynchronously at indefinite times.



In the synchronous mode, the data are sent to the digital output channel with the adjusted output rate. The output buffer in the dialog of “**Experiment Setup**” can be “Fill Once” or “Cont. Refill”. The setting “Fill once” specifies that the values of the first data block is sent continuously (repeatedly). Otherwise, if “Cont. refill” is selected, the values are put out, as they arrive over the appropriate data channel. As the frequency of output rate only depends on the global scanning rate, it can be selected for each channel. According to the selected number of channels, you can only use the global sampling rate or integer divisors of it, which are slower rates. In the dialog of “**Experiment**

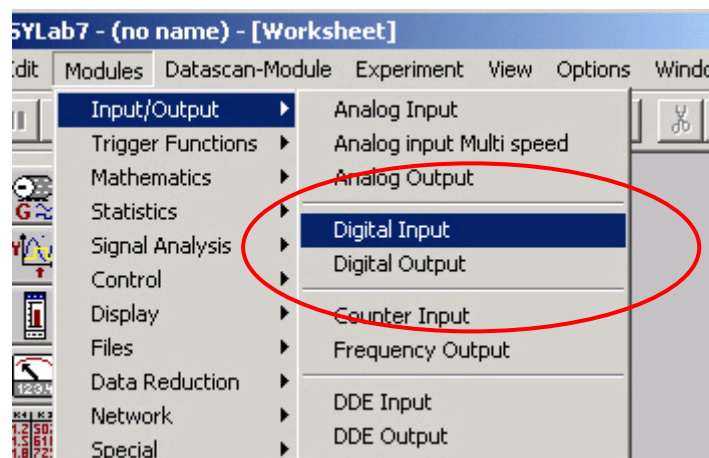
**Setup**, the setting of “Output Start” specifies the number of values, which have to be collected at one time, before the data output starts. This value is at least equal to the global block size. On one hand, this input permits an adjustable delay; on the other hand, it offers a buffer space for synchronization of irregularly arriving values.

With the asynchronous operation, only the last value of a data block is sent as fast as it could be. Besides, no speed estimation can be made, because this depends on many factors, for example, the computer performance, the number of modules in the diagram, etc.

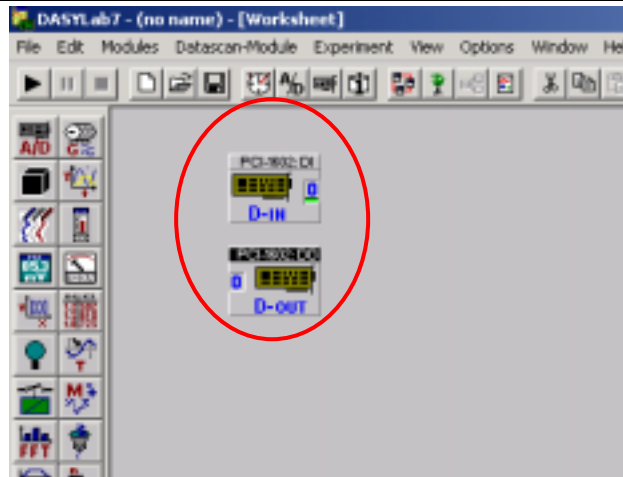
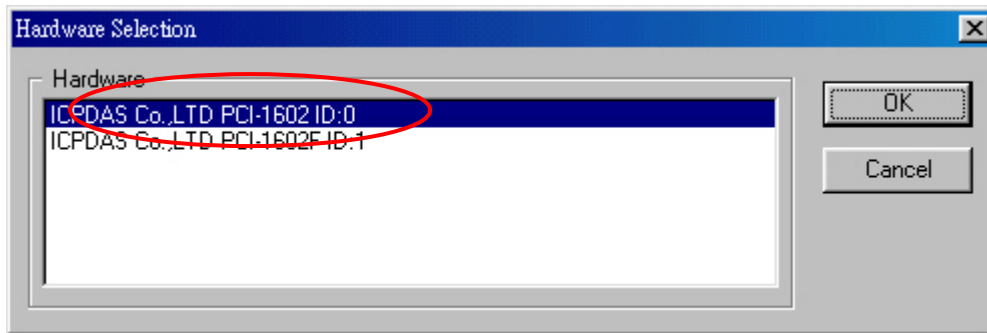
## 5.2 Demonstration


This demo uses 3 DO and 3 DI channels of PCI-1602 board to test Digital Input Modules and Digital Output Modules. And the digital output channels are connected to digital input channels. The following steps describe how to create and implement the experiment of digital input/output modules.

**Step 1:** Open a new Worksheet in DASYLab and insert DO and DI modules from the “**Modules**” menu.

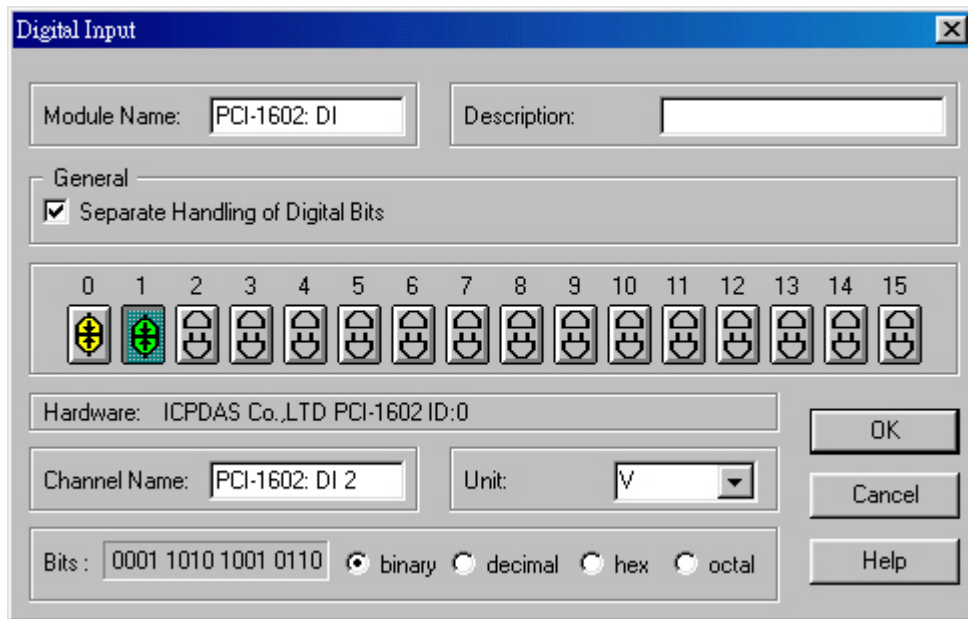



**Step 2:** This module represents digital output/input channels if they are available in the installed data acquisition hardware. If the selected driver supports more than one hardware component, a “Hardware Selection” window is opened to display the available hardware. Select the hardware from the list and assign it to the new module.

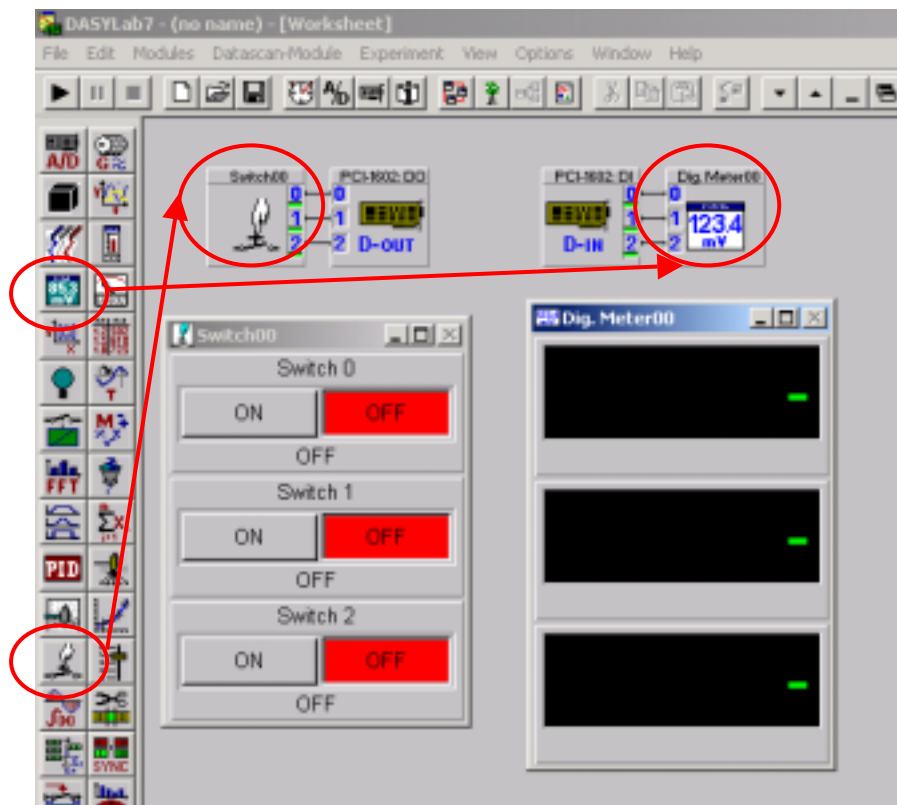





**Step 3:** Double click the icon  to add/remove digital output/input channels. And then connect digital input channel with digital output channel through the Digital Output/Input modules.

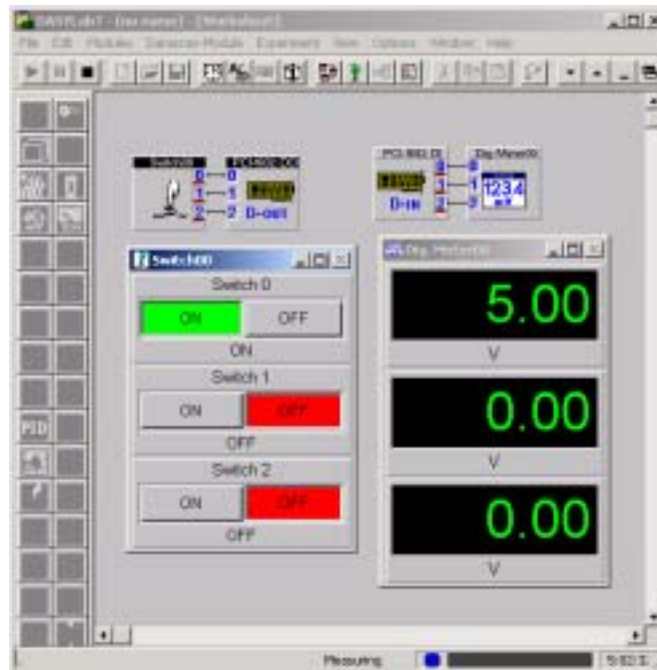




**Step 4:** Add a switch modules  and Digital Meter module  from the module bar to set Digital Output value and display Digital Input value.



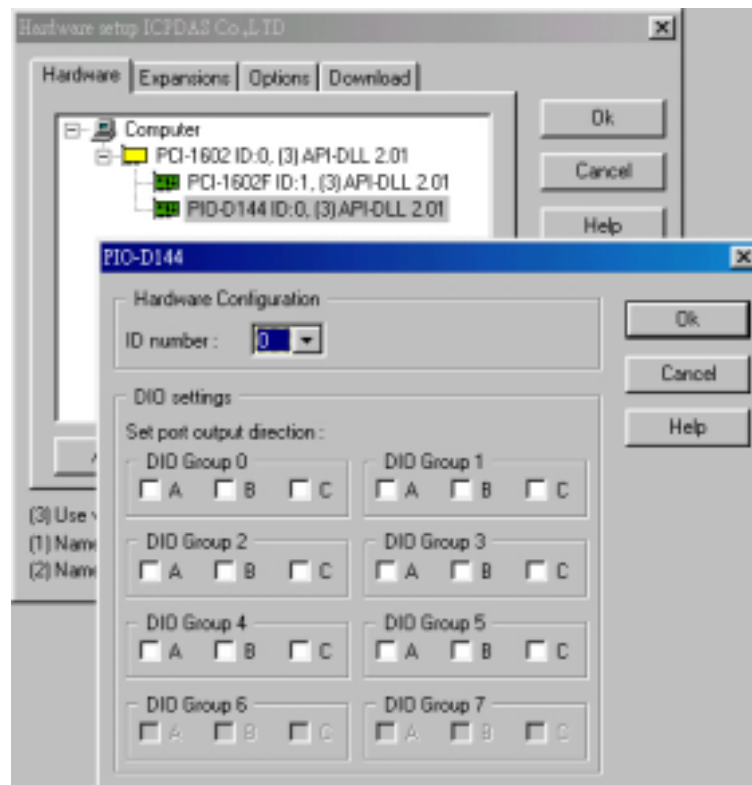
**Step 5:** Click  to start, or  to pause, or  to completely stop the measurement. The result is shown below.



## 6 Programmable Digital Output/Input

### 6.1 Programmable digital Output/Input

According to the existing programmable digital I/O component, you can switch the ports of eight digital channels in groups to be output and/or input. Possible designations of the programmable digital port are A, B, and C. Users can use mouse to check and set those ports working in digital output mode. Otherwise, they will work in digital input mode.



Every digital component has 8 digital channels. If your measuring hardware offers digital components with programmable direction, then the following issues need to be carefully considered. The information about the number of the existing digital input and output channels affect your settings in the worksheet. For example, the DAQ card of ICPDAS provides those programmable digital input/output products, which are PIO-DIO series digital I/O cards.

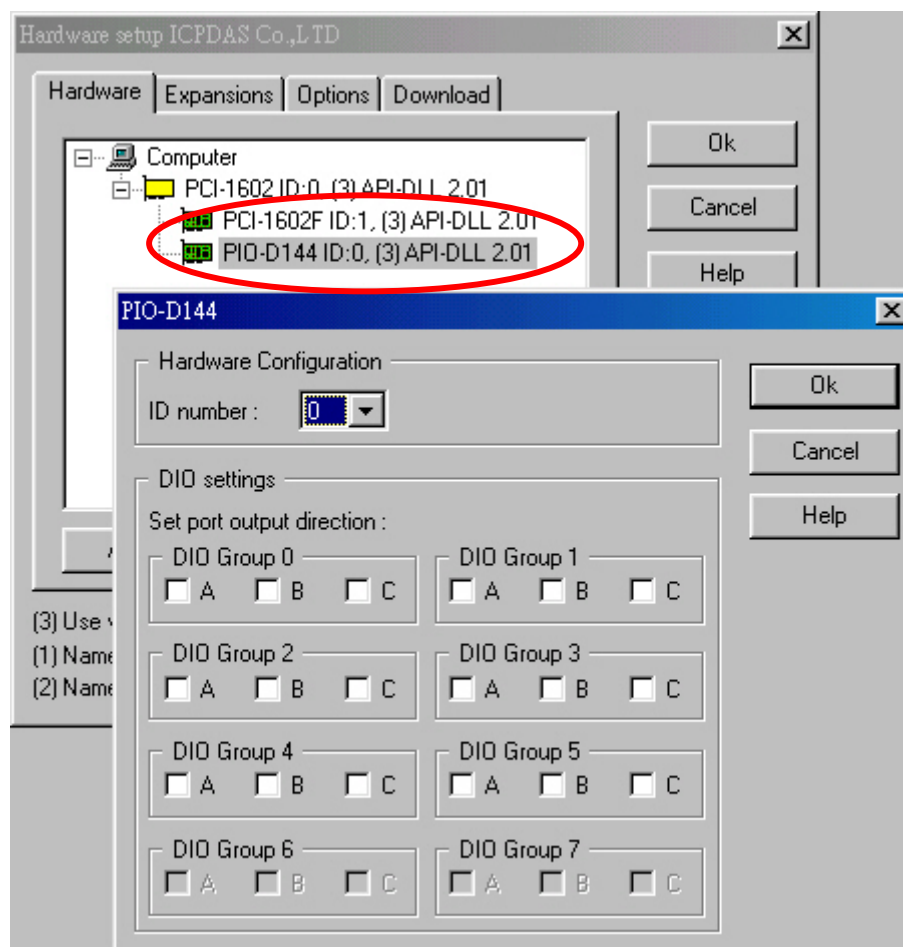
After setting the programmable digital I/O, users can start to apply digital modules into worksheet, which depends on the configuration you made in the setting process. However, if you want to change the programmable direction of the digital input and output port after you have added some digital modules

into the worksheet, those configurations will NOT fit the current settings and sometimes it is NOT valid to be used in DASYLab. Furthermore, when you leave the configuration dialog, the Hint 028 will be displayed for these circumstances. Hint 28 provides the message of “The Worksheets with another configuration of the DIO settings cannot be implemented”.

## 6.2 Demonstration

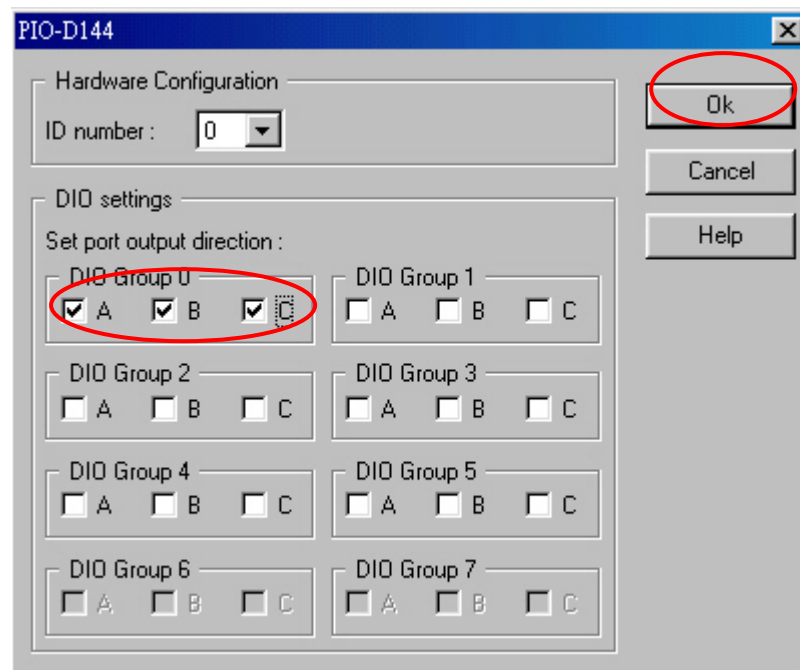
This demo applies three DO and three DI channels of the PIO-D144 board, which consists of six groups and each group has 3 ports and provides 24-bit bi-directional channels. And the digital input channels are designed to be connected to digital output channels. The following procedures describe how to create and implement the experiment of digital input/output modules.

**Step 1:** After plugging a PIO-D144 board and installing corresponding driver in the PC, DASYLab can detect the PIO-D144 card. If the PIO-D144 board is found, it will be shown in the dialog of **Hardware Setup** in the menu “**Experiment**”.

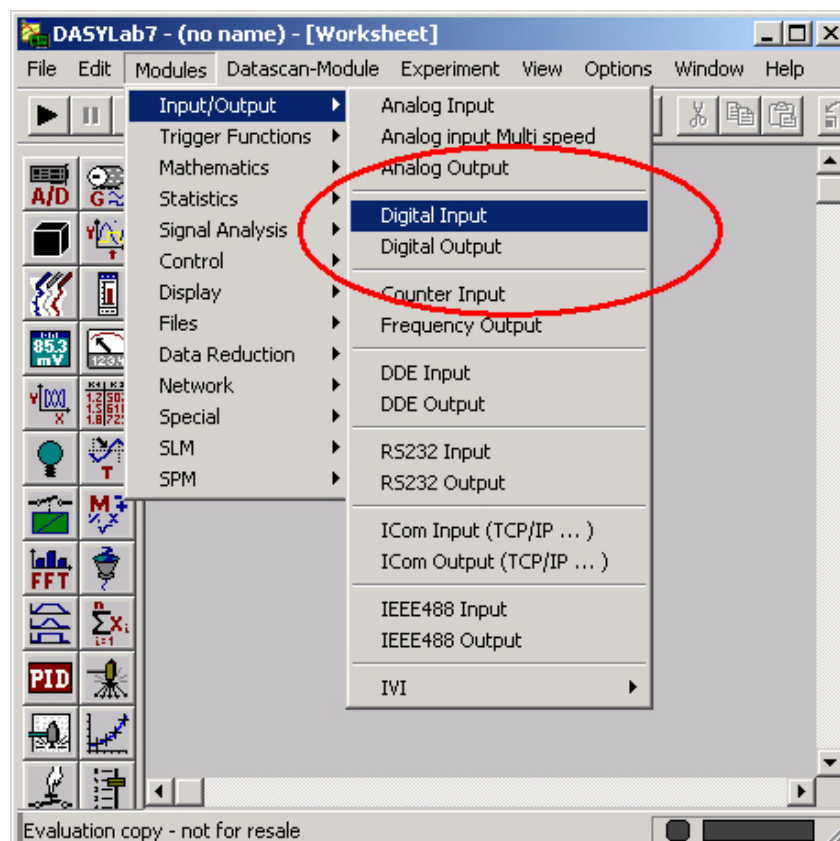


**Step 2:** Set up the number of digital output/input of the PIO-D144 board in the

dialog “PIO-D144” by double clicking the “PIO-D144” icon. And then user can set up the DIO Groups 0~5 to be the digital output or input ports. Each port consists of 8 digital channels. Then click “OK” button to store the settings.

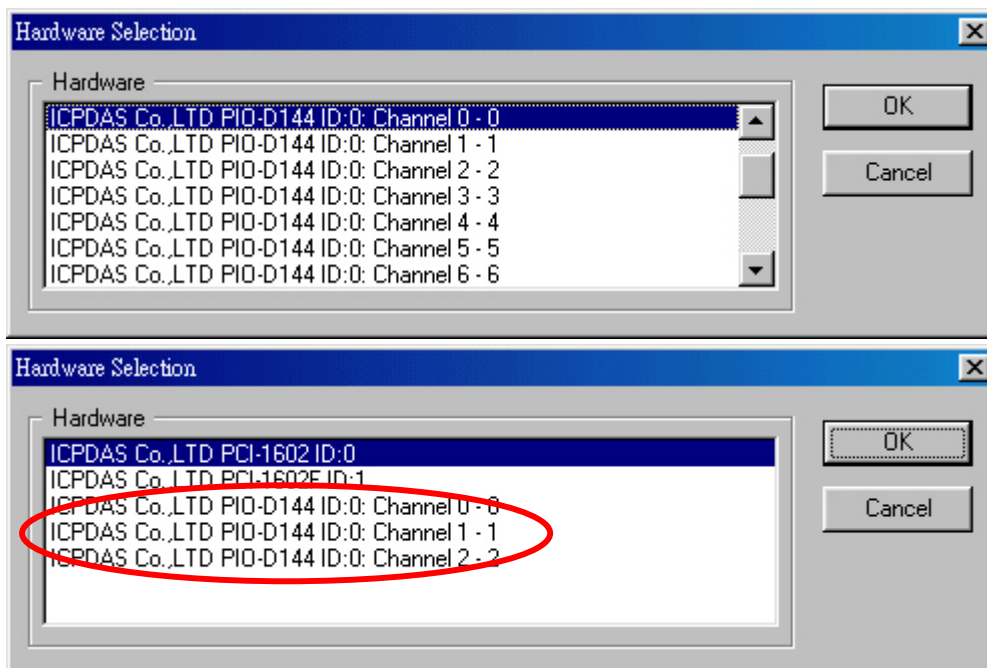



**Step 3:** Open a new Worksheet in DASYLab and insert DO and DI modules from the “modules” menu.

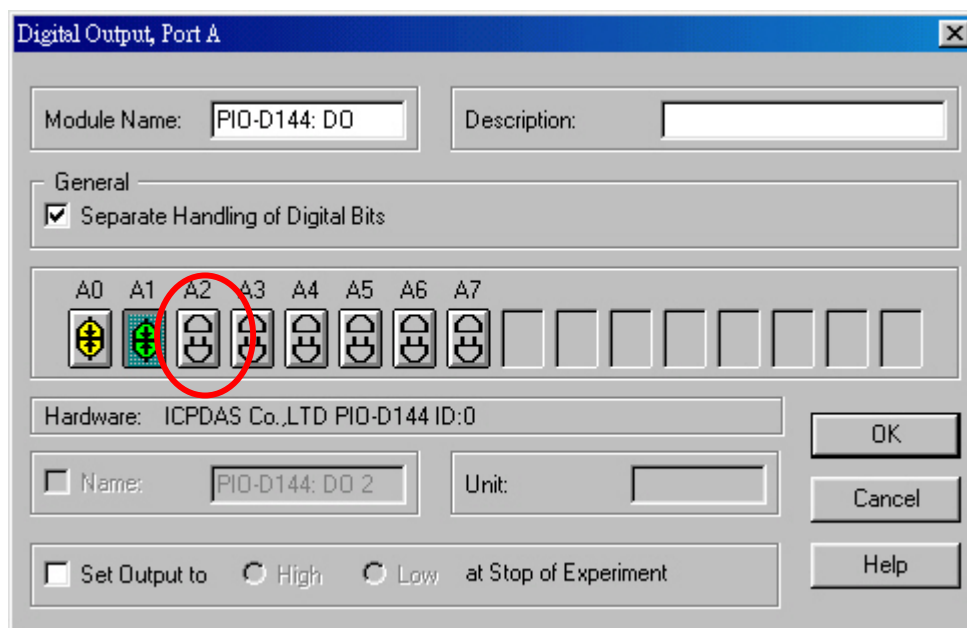


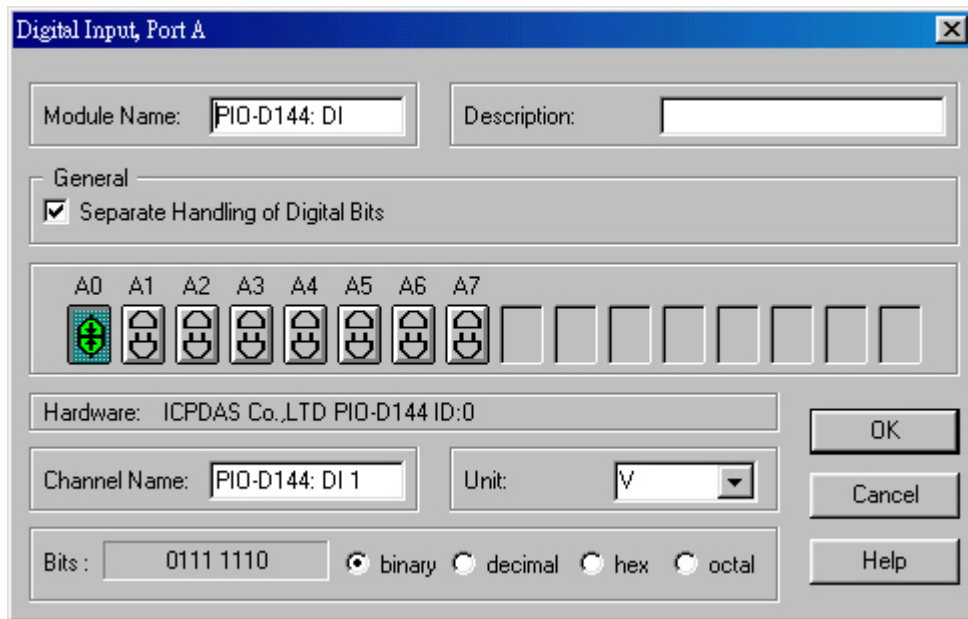


**Step 4:** This module represents digital output/input channels, if they are available on the installed data acquisition hardware. Select the hardware from the list and assign it to the new module.






**Step 5:** Double click the icon  to add/remove Digital Output/Input channels. And then connect digital input from digital output by the digital Output/Input modules.





**Step 6:** Add a switch modules  and Digital Meter module  from the module bar to set Digital Output value and display Digital Input value.

**Step7:** Click  to start, or  to pause, or  to completely stop the experiment. The result is shown in the following figure.

