DIO-24
DIO-96/144

User Manual

Version 2.4
Nov. 2011

Warranty

All products manufactured by ICP DAS are warranted against defective materials for a period of one year from the date of delivery to the original purchaser.

Warning

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DIO-24

24-bit Compatible DIO OPTO-22 Board

1. Introduction

The DIO-24 provides 24 TTL digital I/O lines. The DIO-24 emulates 8255 mode 0 and has an increased output current of 15 mA (source) and 64 mA (sink) , allowing it to control LED, relay, etc. The DIO-24 consists of three 8 bit bi-directional ports and 2 input lines for interrupt enable and interrupt. The 8 bit ports are named port A(PA),port B(PB) and port C(PC). The port C can be split into two four bit. All ports are configured as inputs upon power-up or reset. The DIO-24 uses 4 consecutive I/O locations in I/O addressing space. The base address is selectable from 200 to 3FF hex. The interrupt signal can be connected to any of the interrupt levels 2 through 7.

1.1 Features

- 24 digital I/O lines
- Emulate 8255 mode (Basic input/output mode)
- Buffer output for higher driving capability than 8255
- Register compatible to 724 series
- Programmable interrupt handling
- Output status readback

1.2 Applications

- Interfacing with any OPTO-22 compatible I/O module
- Digital I/O control
- Contact closure monitoring and alarm monitoring
- Useful with parallel interface devices

1.3 Specifications

Model Name	DIO-24
Digital Input	
Channels	24 (OPTO-22 compatible)
Compatibility	5 V/TTL
Input Voltage	Logic 0: 0.8 V max. Logic 1: 2.0 V min.
Response Speed	1.0 MHz (Typical)
Digital Output	
Channels	24 (OPTO-22 compatible)
Compatibility	5 V/TTL
Output Voltage	Logic 0: 0.4 V max. Logic 1: 2.4 V min.
Output Capability	Sink: 0.8 mA @ 0.8 V Source: -2.4 mA @ 2.0 V
Response Speed	1.0 MHz (Typical)
General	
Bus Type	ISA
I/O Connector	20-pin box header x 2 50-pin box header x 1
Dimensions (L x W x D)	182 mm x 110 mm x 22 mm
Power Consumption	900 mA @ +5 V (typical)
Operating Temperature	0 ~ 60 °C
Storage Temperature	-20 ~ 70 °C
Humidity	5 ~ 85% RH, non-condensing

1.4 Product Check List

The shipping package includes the following items:

- One DIO-24 card
- One software utility PCI CD.
- One Quick Start Guide

It is recommended that you read the Quick Start Guide first. All the necessary and essential information is given in the Quick Start Guide, including:

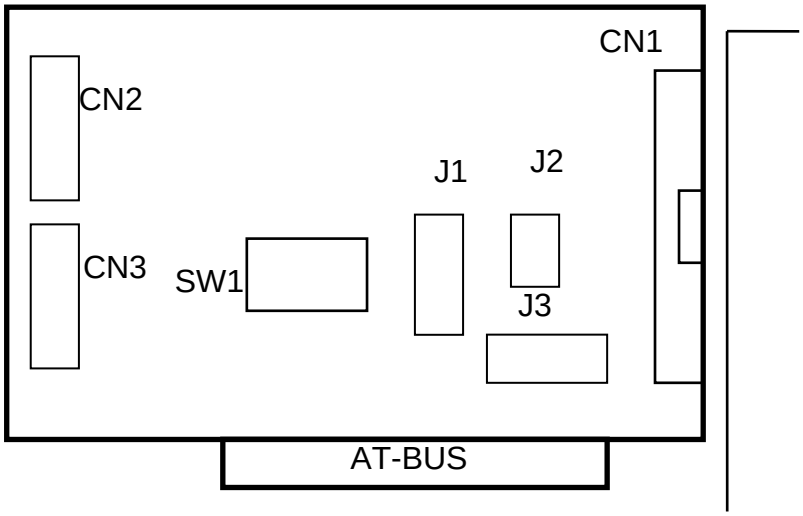
- Where to get the software driver, demo programs and other resources.
- How to install the software.
- How to test the card.

Attention!

If any of these items is missing or damaged, contact the dealer from whom you purchased the product. Please save the shipping materials and carton in case you need to ship or store the product in the future.

2. Hardware Configuration

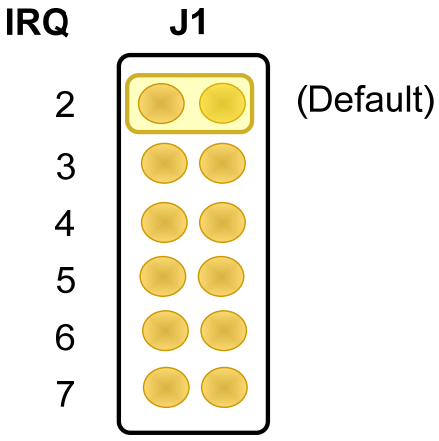
2.1 Board Layout



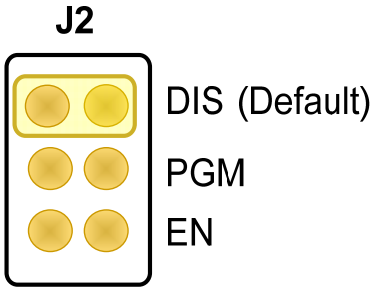
CN1	24-channel digital input/output (50-pin header, PA, PB, PC)
CN2	16-channel digital input/output (20-pin header, PA, PB)
CN3	8-channel digital input/output (20-pin header, PC)
J1	Interrupt jumper setting
J2	Interrupt status setting
J3	Interrupt trigger edge setting
SW1	Base address setting

2.2 Jumper Setting

2.2.1 Interrupt Jumper Setting

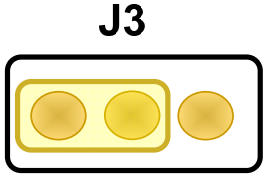


2.2.2 Interrupt Status Setting

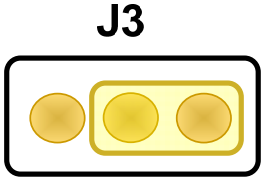


- **DIS:** Interrupt disable (Default)
- **PGM:** Programmable interrupt enable, when PC-4 is low
- **EN:** Interrupt enable

2.2.3 Interrupt Trigger Edge Setting

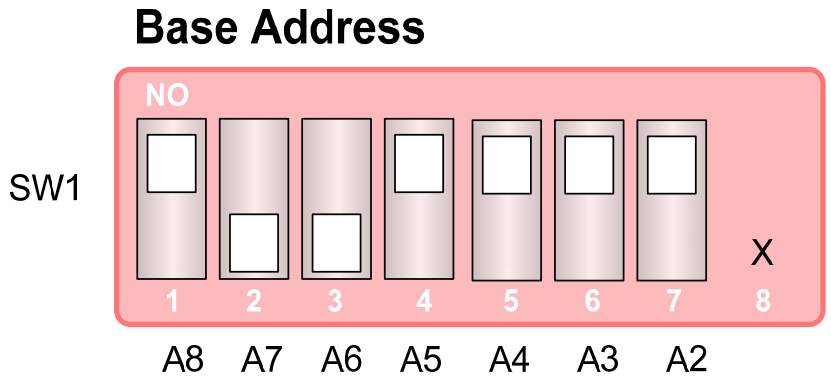


Rising Edge Trigger
(Default)



Falling Edge Trigger

2.3 Base address Setting



For Example

How to select 2 C 0 (Hex)

OFF → 1
ON → 0
X → 0

2		C				0			
1	ON	OFF	OFF	ON	ON	ON	ON	X	0
	→ 0	1	1	0	0	0	0	0	
	A8	A7	A6	A5	A4	A3	A2	X	

The detail SW1 base addresses setting. Please refer to 24-bit Address Table, as follows:

24-Bit Address Table:

(*): Default Setting ; X = don't care

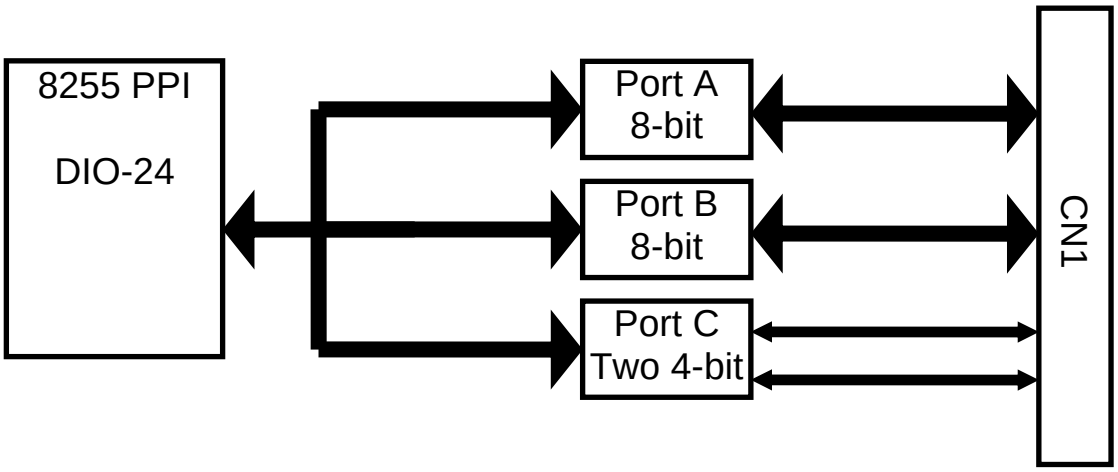
I/O Address (Hex)	1 A8	2 A7	3 A6	4 A5	5 A4	6 A3	7 A2	8
200-203	ON	ON	ON	ON	ON	ON	ON	X
204-207	ON	ON	ON	ON	ON	ON	OFF	X
208-20B	ON	ON	ON	ON	ON	OFF	ON	X
20C-20F	ON	ON	ON	ON	ON	OFF	OFF	X
210-213	ON	ON	ON	ON	OFF	ON	ON	X
214-217	ON	ON	ON	ON	OFF	ON	OFF	X
218-21B	ON	ON	ON	ON	OFF	OFF	ON	X
21C-21F	ON	ON	ON	ON	OFF	OFF	OFF	X
220-223	ON	ON	ON	OFF	ON	ON	ON	X
224-227	ON	ON	ON	OFF	ON	ON	OFF	X
228-22B	ON	ON	ON	OFF	ON	OFF	ON	X
22C-22F	ON	ON	ON	OFF	ON	OFF	OFF	X
230-233	ON	ON	ON	OFF	OFF	ON	ON	X
234-237	ON	ON	ON	OFF	OFF	ON	OFF	X
238-23B	ON	ON	ON	OFF	OFF	OFF	ON	X
23C-23F	ON	ON	ON	OFF	OFF	OFF	OFF	X
240-243	ON	ON	OFF	ON	ON	ON	ON	X
244-247	ON	ON	OFF	ON	ON	ON	OFF	X
248-24B	ON	ON	OFF	ON	ON	OFF	ON	X
24C-24F	ON	ON	OFF	ON	ON	OFF	OFF	X
250-253	ON	ON	OFF	ON	OFF	ON	ON	X
254-257	ON	ON	OFF	ON	OFF	ON	OFF	X
258-25B	ON	ON	OFF	ON	OFF	OFF	ON	X
25C-25F	ON	ON	OFF	ON	OFF	OFF	OFF	X
260-263	ON	ON	OFF	OFF	ON	ON	ON	X
264-267	ON	ON	OFF	OFF	ON	ON	OFF	X
268-26B	ON	ON	OFF	OFF	ON	OFF	ON	X
26C-26F	ON	ON	OFF	OFF	ON	OFF	OFF	X
270-273	ON	ON	OFF	OFF	OFF	ON	ON	X
274-277	ON	ON	OFF	OFF	OFF	ON	OFF	X
278-27B	ON	ON	OFF	OFF	OFF	OFF	ON	X
27C-27F	ON	ON	OFF	OFF	OFF	OFF	OFF	X
280-283	ON	OFF	ON	ON	ON	ON	ON	X
284-287	ON	OFF	ON	ON	ON	ON	OFF	X
288-28B	ON	OFF	ON	ON	ON	OFF	ON	X
28C-28F	ON	OFF	ON	ON	ON	OFF	OFF	X
290-293	ON	OFF	ON	ON	OFF	ON	ON	X
294-297	ON	OFF	ON	ON	OFF	ON	OFF	X
298-29B	ON	OFF	ON	ON	OFF	OFF	ON	X
29C-29F	ON	OFF	ON	ON	OFF	OFF	OFF	X
2A0-2A3	ON	OFF	ON	OFF	ON	ON	ON	X

2A4-2A7	ON	OFF	ON	OFF	ON	ON	OFF	X
2A8-2AB	ON	OFF	ON	OFF	ON	OFF	ON	X
2AC-2AF	ON	OFF	ON	OFF	ON	OFF	OFF	X
2B0-2B3	ON	OFF	ON	OFF	OFF	ON	ON	X
2B4-2B7	ON	OFF	ON	OFF	OFF	ON	OFF	X
2B8-2BB	ON	OFF	ON	OFF	OFF	OFF	ON	X
2BC-2BF	ON	OFF	ON	OFF	OFF	OFF	OFF	X
2C0-2C3(*)	**ON**	**OFF**	**OFF**	**ON**	**ON**	**ON**	**ON**	**X**
2C4-2C7	ON	OFF	OFF	ON	ON	ON	OFF	X
2C8-2CB	ON	OFF	OFF	ON	ON	OFF	ON	X
2CC-2CF	ON	OFF	OFF	ON	ON	OFF	OFF	X
2D0-2D3	ON	OFF	OFF	ON	OFF	ON	ON	X
2D4-2D7	ON	OFF	OFF	ON	OFF	ON	OFF	X
2D8-2DB	ON	OFF	OFF	ON	OFF	OFF	ON	X
2DC-2DF	ON	OFF	OFF	ON	OFF	OFF	OFF	X
2E0-2E3	ON	OFF	OFF	OFF	ON	ON	ON	X
2E4-2E7	ON	OFF	OFF	OFF	ON	ON	OFF	X
2E8-2EB	ON	OFF	OFF	OFF	ON	OFF	ON	X
2EC-2EF	ON	OFF	OFF	OFF	ON	OFF	OFF	X
2F0-2F3	ON	OFF	OFF	OFF	OFF	ON	ON	X
2F4-2F7	ON	OFF	OFF	OFF	OFF	ON	OFF	X
2F8-2FB	ON	OFF	OFF	OFF	OFF	OFF	ON	X
2FC-2FF	ON	OFF	OFF	OFF	OFF	OFF	OFF	X
300-303	OFF	ON	ON	ON	ON	ON	ON	X
304-307	OFF	ON	ON	ON	ON	ON	OFF	X
308-30B	OFF	ON	ON	ON	ON	OFF	ON	X
30C-30F	OFF	ON	ON	ON	ON	OFF	OFF	X
310-313	OFF	ON	ON	ON	OFF	ON	ON	X
314-317	OFF	ON	ON	ON	OFF	ON	OFF	X
318-31B	OFF	ON	ON	ON	OFF	OFF	ON	X
31C-31F	OFF	ON	ON	ON	OFF	OFF	OFF	X
320-323	OFF	ON	ON	OFF	ON	ON	ON	X
324-327	OFF	ON	ON	OFF	ON	ON	OFF	X
328-32B	OFF	ON	ON	OFF	ON	OFF	ON	X
32C-32F	OFF	ON	ON	OFF	ON	OFF	OFF	X
330-333	OFF	ON	ON	OFF	OFF	ON	ON	X
334-337	OFF	ON	ON	OFF	OFF	ON	OFF	X
338-33B	OFF	ON	ON	OFF	OFF	OFF	ON	X
33C-33F	OFF	ON	ON	OFF	OFF	OFF	OFF	X
340-343	OFF	ON	OFF	ON	ON	ON	ON	X
344-347	OFF	ON	OFF	ON	ON	ON	OFF	X
348-34B	OFF	ON	OFF	ON	ON	OFF	ON	X
34C-34F	OFF	ON	OFF	ON	ON	OFF	OFF	X
350-353	OFF	ON	OFF	ON	OFF	ON	ON	X
354-357	OFF	ON	OFF	ON	OFF	ON	OFF	X
358-35B	OFF	ON	OFF	ON	OFF	OFF	ON	X
35C-35F	OFF	ON	OFF	ON	OFF	OFF	OFF	X

360-363	OFF	ON	OFF	OFF	ON	ON	ON	X
364-367	OFF	ON	OFF	OFF	ON	ON	OFF	X
368-36B	OFF	ON	OFF	OFF	ON	OFF	ON	X
36C-36F	OFF	ON	OFF	OFF	ON	OFF	OFF	X
370-373	OFF	ON	OFF	OFF	OFF	ON	ON	X
374-377	OFF	ON	OFF	OFF	OFF	ON	OFF	X
378-37B	OFF	ON	OFF	OFF	OFF	OFF	ON	X
37C-37F	OFF	ON	OFF	OFF	OFF	OFF	OFF	X
380-383	OFF	OFF	ON	ON	ON	ON	ON	X
384-387	OFF	OFF	ON	ON	ON	ON	OFF	X
388-38B	OFF	OFF	ON	ON	ON	OFF	ON	X
38C-38F	OFF	OFF	ON	ON	ON	OFF	OFF	X
390-393	OFF	OFF	ON	ON	OFF	ON	ON	X
394-397	OFF	OFF	ON	ON	OFF	ON	OFF	X
398-39B	OFF	OFF	ON	ON	OFF	OFF	ON	X
39C-39F	OFF	OFF	ON	ON	OFF	OFF	OFF	X
3A0-3A3	OFF	OFF	ON	OFF	ON	ON	ON	X
3A4-3A7	OFF	OFF	ON	OFF	ON	ON	OFF	X
3A8-3AB	OFF	OFF	ON	OFF	ON	OFF	ON	X
3AC-3AF	OFF	OFF	ON	OFF	ON	OFF	OFF	X
3B0-3B3	OFF	OFF	ON	OFF	OFF	ON	ON	X
3B4-3B7	OFF	OFF	ON	OFF	OFF	ON	OFF	X
3B8-3BB	OFF	OFF	ON	OFF	OFF	OFF	ON	X
3BC-3BF	OFF	OFF	ON	OFF	OFF	OFF	OFF	X
3C0-3C3	OFF	OFF	OFF	ON	ON	ON	ON	X
3C4-3C7	OFF	OFF	OFF	ON	ON	ON	OFF	X
3C8-3CB	OFF	OFF	OFF	ON	ON	OFF	ON	X
3CC-3CF	OFF	OFF	OFF	ON	ON	OFF	OFF	X
3D0-3D3	OFF	OFF	OFF	ON	OFF	ON	ON	X
3D4-3D7	OFF	OFF	OFF	ON	OFF	ON	OFF	X
3D8-3DB	OFF	OFF	OFF	ON	OFF	OFF	ON	X
3DC-3DF	OFF	OFF	OFF	ON	OFF	OFF	OFF	X
3E0-3E3	OFF	OFF	OFF	OFF	ON	ON	ON	X
3E4-3E7	OFF	OFF	OFF	OFF	ON	ON	OFF	X
3E8-3EB	OFF	OFF	OFF	OFF	ON	OFF	ON	X
3EC-3EF	OFF	OFF	OFF	OFF	ON	OFF	OFF	X
3F0-3F3	OFF	OFF	OFF	OFF	OFF	ON	ON	X
3F4-3F7	OFF	OFF	OFF	OFF	OFF	ON	OFF	X
3F8-3FB	OFF	OFF	OFF	OFF	OFF	OFF	ON	X
3FC-3FF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	X

2.4 Pin Assignments

The CN1 of DIO-24 emulate as Intel 8255 general purpose programmable peripheral interface. Figure shows DIO-24 I/O port equally block diagram.

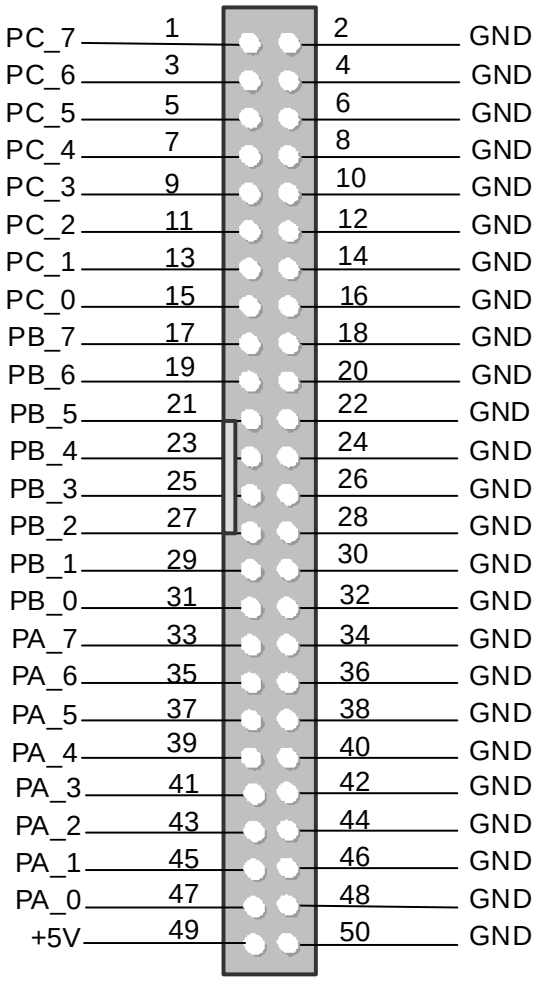


DIO-24 Block diagram

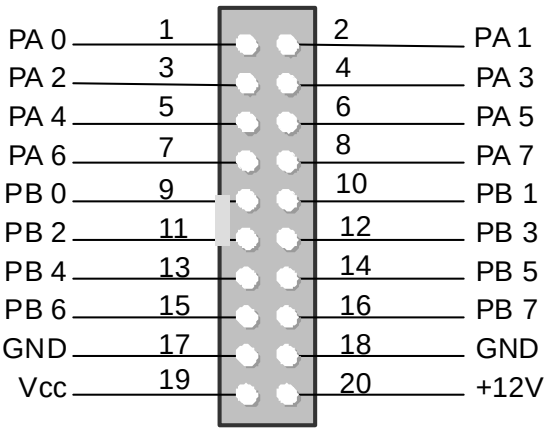
Note:

When computer is powered on, the DIO-24 default status is input mode.

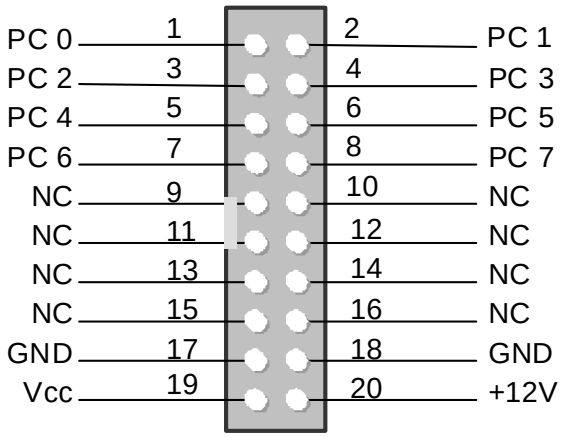
CN1: 50-Pin of box header



CN2: 20-Pin of box header



CN3 20-Pin of box header



All Signals are TTL Compatible	
High (1)	2.0 ~ 5.0 V(Voltage over 5.0V will damage the device)
None Define	2.0 V ~ 0.8 V
Low(0)	Under 0.8 V

3. Programming

The DIO-24 emulates MODE 0 of the 8255, and Mode 0 of the 8255 provides basic input and output operations through each of the ports A, B and C. Output data is latched and input data follows the peripheral.

Mode 0 of the 8255 PPI functions

- 16 different configurations
- Two 8-bit port and two 4 bit-ports
- Input are not latched
- Output are latched

3.1 Register

The DIO-24 each port can be defined to input or output mode.

- **Register Functions**

Address	Register	Read/Write
Base+0	Port A	R/W
Base+1	Port B	R/W
Base+2	Port C	R/W
Base+3	CFG	Write only

- **CFG Register Format**

D7	D6	D5	D4	D3	D2	D1	D0
1	0	0	?	?	0	?	?
1	X	X	Port A 1:Input 0:Output	Port C 1:Input 0:Output (High nibble)	X	Port B 1:Input 0:Output	Port C 1:Input 0:Output (Low nibble)

■ CFG Configurations Table

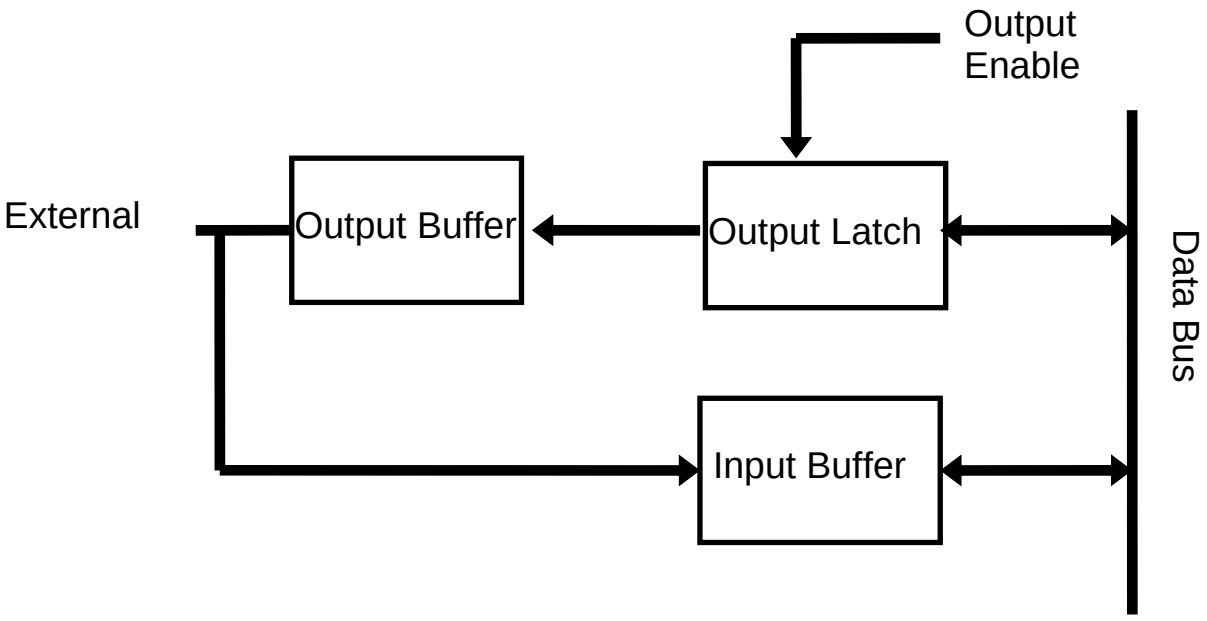
	D4	D3	D1	D0
CFG	PA0-PA7	PC4-PC7	PB0-PB7	PC0-PC3
80H	O	O	O	O
81H	O	O	O	I
82H	O	O	I	O
83H	O	O	I	I
88H	O	I	O	O
89H	O	I	O	I
8AH	O	I	I	O
8BH	O	I	I	I
90H	I	O	O	O
91H	I	O	O	I
92H	I	O	I	O
93H	I	O	I	I
98H	I	I	O	O
99H	I	I	O	I
9AH	I	I	I	O
9BH	I	I	I	I

3.2 Interrupt Handling

The Port C 0 can generate a hardware interrupt to computer. Use the interrupt you must set an IRQ level to be used. The J1 is used to select the IRQ level and the J2 is used to select the desired interrupt enable mode. Then the J3 is used to select rising edge trigger or falling edge trigger.

3.3 Output Latch

The signal direction of DIO-24 is software programmable. When user turns on or reset computer, all ports are configured as input mode. When the DIO-24 is programmed as output mode, it does not output until program execute the output instruction.



Signal Direction

3.4 Program Example

The DIO-24 I/O card is very easy to programming input/ output function.
Example (Quick Basic)

```
Bas=&H2C0
'====== Init DIO-24 Port A and Port B Input mode Port C output mode =====

OUT Bas+3,&H92          'Reference Configuration table

'================================================

PA = INP(Bas+0)         'Read Port A Data
PB = INP(Bas+1)         'Read Port B Data
OUT Bas+2 , &HFF        'Rrite Data to Port C , set Channel 0-7 is high

OUT Bas+3,&H80          ' Set Port A,B,C is Output Mode
OUT Bas+0, 0            ' Write Data to Port A
OUT Bas+1, 0            ' Write Data to port B
OUT Bas+2, 0            ' Write Data to Port C

OUT Base+3,&H9B         ' Set Port A,B,C is Input mode
PA=INP(Bas+0)           ' Read Port A Data
PB=INP(Bas+1)           ' Read Port B Data
PC=INP(Bas+2)           ' Read Port C Data
```

4. Software/Hardware Installation

The DIO-24 can be used in DOS and Windows 98/ME/NT/2K and 32-bit Windows XP/2003/Vista/7. The recommended installation procedure for windows is given in Sec. 4.1 ~ 4.2. Or refer to Quick Start Guide (CD:\NAPDOS\ISA\DIO\Manual\QuickStart\).
http://ftp.icpdas.com/pub/cd/iocard/isa/napdos/isa/dio/manual/quickstart/

4.1 Software Installing Procedure

DIO-24 Windows driver (Windows 98/NT/2K and 32-bit Windows XP/2003/ Vista/7):

Step 1: Insert the companion CD into the CD-ROM drive and after a few seconds the installation program should start automatically. If it doesn't start automatically for some reason, double-click the **AUTO32.EXE** file in the **NAPDOS** folder on this CD.

Step 2: Click the item: "**Install Toolkits (Softwares)/Manuals**".

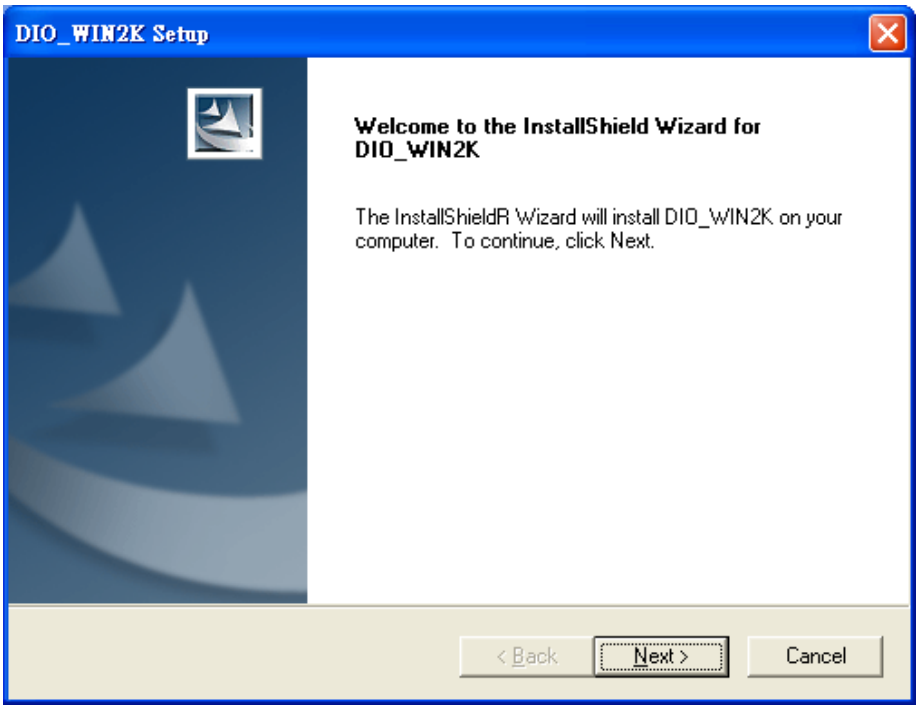
Step 3: Click the item: "**ISA Bus DAQ Card**".

Step 4: Click the item: "**DIO**".

Step 5: Choose the "**Install Toolkit for Windows 95/98、NT or 2000**" for setup according to your PC platform and then install driver.

Notes:

1. **The DIO-24 Windows driver site location:**
   http://ftp.icpdas.com/pub/cd/iocard/isa/napdos/isa/dio/dll/
2. **The Windows 2000 (Win2K) driver support Windows 2000 and 32-bit Windows XP/2003/Vista/7.**



Step 6: Click **"Next>"** button to start installation.
Step 7: Click **"Next>"** button to install driver into the default folder.
Step 8: Click **"Next>"** button to continue installation.
Step 9: Select **"No, I will restart my computer late"** and then click **"Finish"** button.

4.2 Hardware Installing Procedure

Please set the base address, interrupt IRQ and interrupt status on the DIO-24 card before insert DIO-24 card into the ISA slot in the computer. For detailed base address and interrupt settings information refer to Section 2.2 "Jumper Setting" and 2.3 "Base Address Setting".

For example: base address is 0x2C0, Interrupt IRQ is 7.

Step 1: Shout down and power off your computer.
Step 2: Remove all covers from the computer.
Step 3: Select an empty ISA slot.
Step 4: Care fully insert your DIO-24 card into the ISA slot.
Step 5: Replace the PC covers.
Step 6: Power on the computer.

Adding Hardware

Notes: adding hardware for working on Windows 2000 and 32-bit Windows XP/2003/Vista/7 only. Windows 95/98/Me/NT users should install correct version of the driver on the CD-ROM, and skip these “Adding Hardware” procedures.

Step 7: Open the “**Control Panel**” by click the item “**Start >> Settings >> Control Panel** ”.

Step 8: Double-click the item “**Add Hardware**” and click the **“Next>**” button.

Step 9: Select the item “**Yes, I have already connected the hardware**” and click the “**Next>**” button.

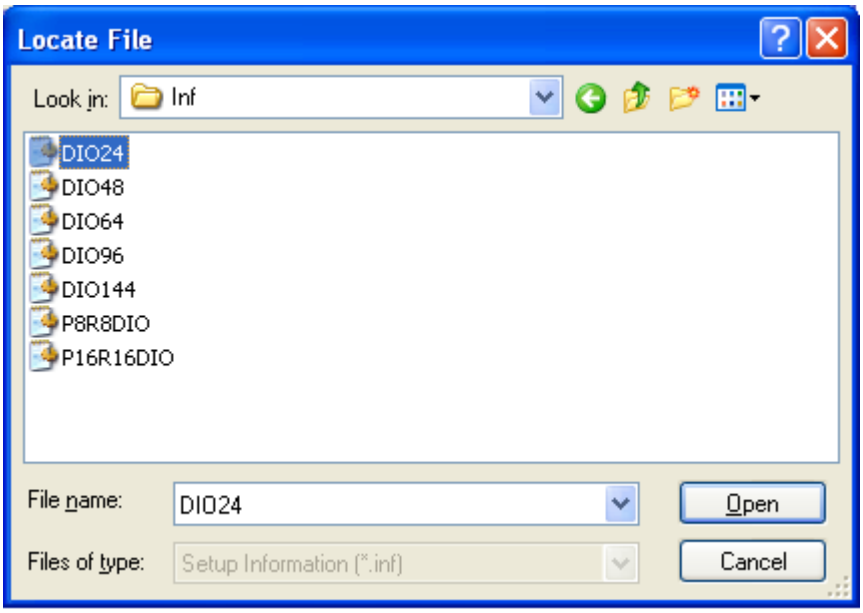
Step 10: Selection the item “**Add a new hardware device**” and click the “**Next>**” button.

Step 11: Selection the item “**Install the hardware that I manually select from a list [Advanced]**” and click the “**Next>**” button.

Step 12: Selection the item “**Show All Devices**” and click the “**Next>**” button.

Step 13: Click the “**Have Disk...**” button.

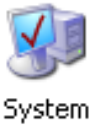
Step 14: Click the “**Browse...**” button to select the **.Inf** file default path is **C:\DAQPRO\DIO_Win2K\Inf** and click the “**Open**” and “**OK**” button.



Step 15: Selection then correct device from the "**Models:**" listbox and click the "**Next>**" button.

Step 16: Click the "**Next>**" button and then click the "**Finish**" button.

Modify the device properties

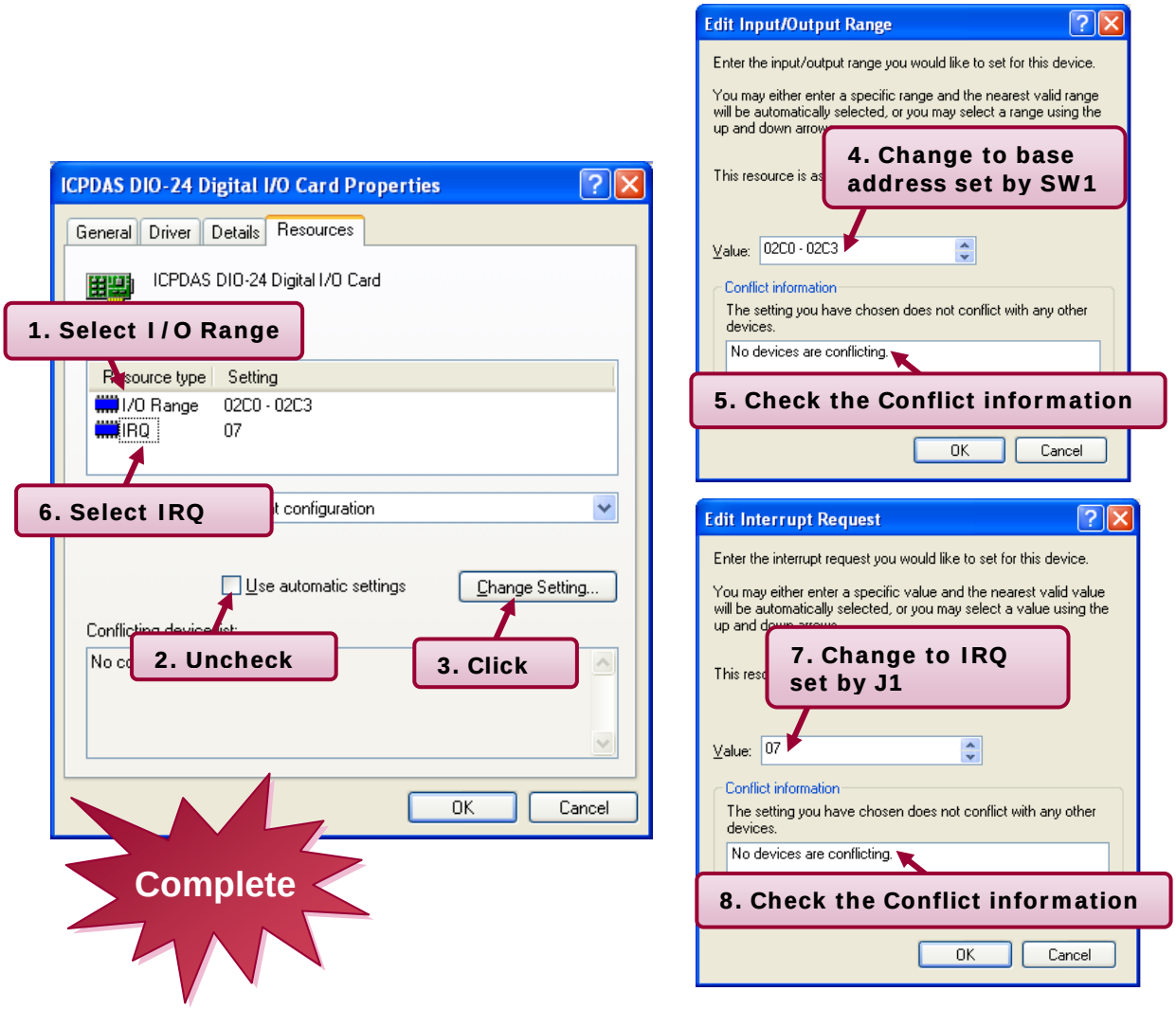


Step 17: Double-click the "**System**" icon in the "**Control Panel**".

Step 18: Click the "**Hardware**" tab and then click the "**Device Manager**" button.

Step 19: Click the "**DAQCard**" tab and then double-click "**ICPDAS DIO-24 Digital I/O Card**".

Step 20: Select the "**Resources**" tab and then setting as follows:



5. Software Installation

The DIO-144/96 provides 144/ 96 TTL digital I/O lines. It emulates six channel 8255 mode 0 (basic input /output mode) and has an increased output current of 15 mA (source) and 64 mA (sink) for controlling LED, relay, etc. The DIO-144/96 each connector consists of three 8-bit bi-directional ports and two input lines for interrupt enable and interrupt. The 8-bit ports are named port A (PA), port B (PB) and port C (PC). The port C can be split into two nibbles wide ports. All ports are configured as inputs upon power-up or reset. The DIO-144/96 uses 4 consecutive I/O locations in I/O addressing space. The base address is selectable by using an 8-position DIP switch from 200 to 3FF hex. The interrupt signal can be connected to any of the interrupt levels 2 through 15 available on the PC bus via a jumper.

5.1 Features

- 144/ 96 digital I/O lines
- OPTO-22 pin compatible
- Programmable interrupt handling
- Buffer output for higher driving capability than the 8255
- Register compatible to 722 series

5.2 Applications

- Interfacing with any OPTO-22 compatible I/O module
- Digital I/O control
- Contact closure monitoring and alarm monitoring
- Useful with parallel interface devices

5.3 Specifications

Model Name	DIO-96	DIO-144
Digital Input		
Channels	96 (OPTO-22 compatible)	144 (OPTO-22 compatible)
Compatibility	5 V/TTL	
Input Voltage	Logic 0: 0.8 V max. Logic 1: 2.0 V min.	
Response Speed	1.0 MHz (Typical)	
Digital Output		
Channels	96 (OPTO-22 compatible)	144 (OPTO-22 compatible)
Compatibility	5 V/TTL	
Output Voltage	Logic 0: 0.4 V max. Logic 1: 2.4 V min.	
Output Capability	Sink: 0.8 mA @ 0.8 V Source: -2.4 mA @ 2.0 V	
Response Speed	1.0 MHz (Typical)	
General		
Bus Type	ISA	
I/O Connector	50-pin box header x 4	50-pin box header x 6
Dimensions (L x W x D)	182 mm x 120 mm x 22 mm	
Power Consumption	800 mA @ +5 V	700 mA @ +5 V
Operating Temperature	0 ~ 60 °C	
Storage Temperature	-20 ~ 70 °C	
Humidity	5 ~ 85% RH, non-condensing	

5.4 Product Check List

The shipping package includes the following items:

- One DIO-144/96 card
- One software utility PCI CD.
- One Quick Start Guide

It is recommended that you read the Quick Start Guide first. All the necessary and essential information is given in the Quick Start Guide, including:

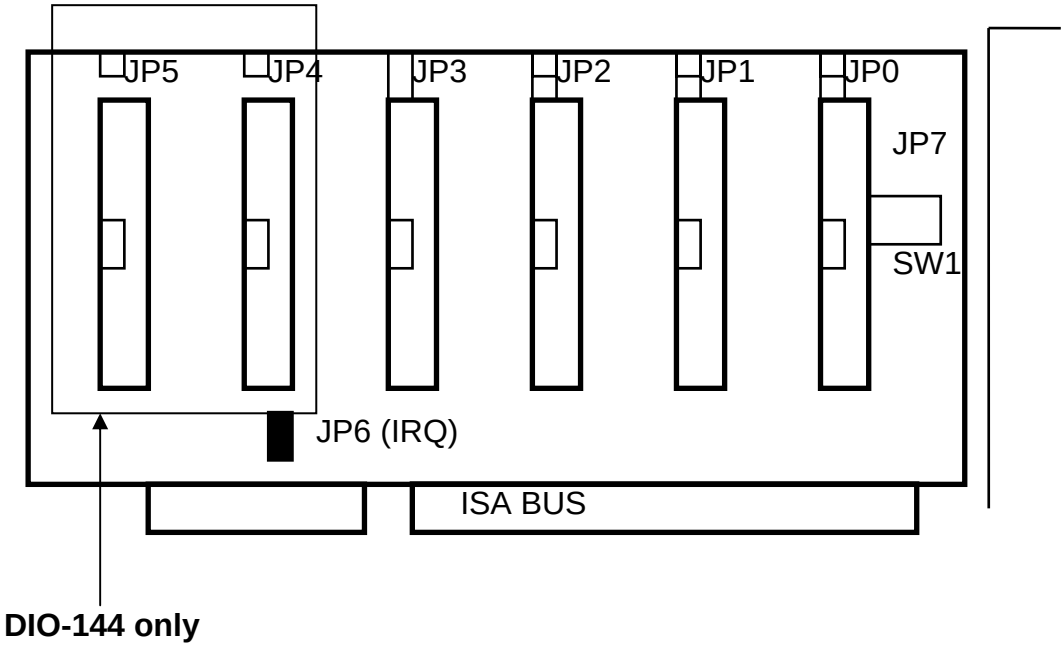
- Where to get the software driver, demo programs and other resources.
- How to install the software.
- How to test the card.

Attention!

If any of these items is missing or damaged, contact the dealer from whom you purchased the product. Please save the shipping materials and carton in case you need to ship or store the product in the future.

6. Hardware Configuration

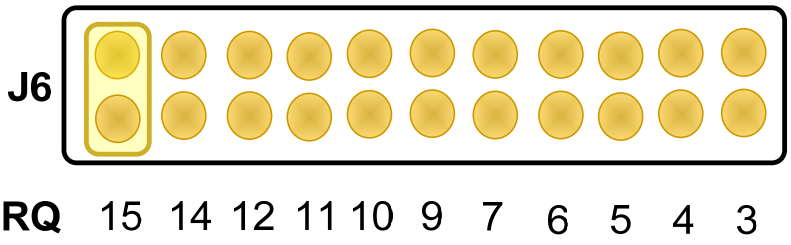
6.1 Board Layout



JP0	Interrupt status setting for CH0
JP1	Interrupt status setting for CH1
JP2	Interrupt status setting for CH2
JP3	Interrupt status setting for CH3
JP4	Interrupt status setting for CH4
JP5	Interrupt status setting for CH5
JP7	96-bit or 144-bit setting
JP6	Interrupt jumper setting
SW1	Base address setting

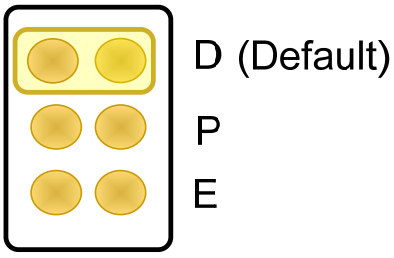
6.2 Jumper Setting

6.2.1 Interrupt Jumper Setting



6.2.2 Interrupt Status Setting

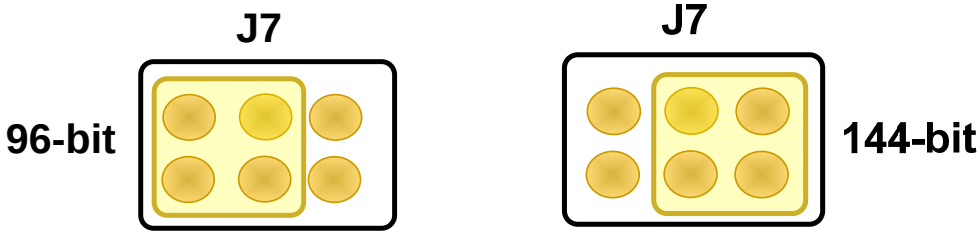
JP0, JP1, JP2, JP3, JP4, JP5



D: Interrupt disable (Default)
P: Programmable Interrupt enable, when PC-4 is low
E: Interrupt enable

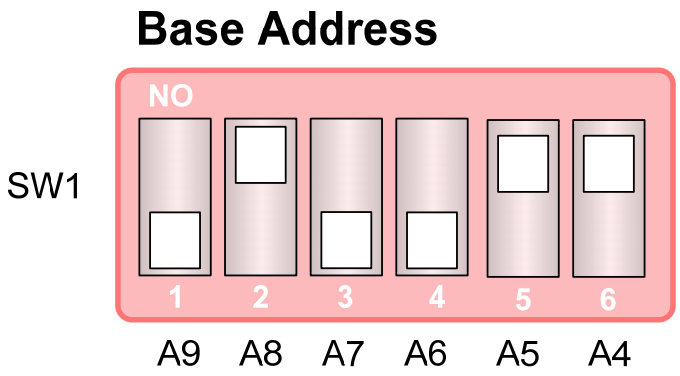
6.2.3 96-bit/144-bit Jumper Setting

The DIO-144/96 provides 144/96 bit mode. The 144 bit mode (Channel 0-5) requires 24 consecutive locations in I/O address space, the 96 bit mode (Channel 0-3) requires 16 consecutive locations in I/O address space.



6.3 Base Address Setting

6.3.1 96-bit Mode



For Example

How to select 2 C 0 (Hex)

OFF → 1
ON → 0

	2		C				0
	OFF	ON	OFF	OFF	ON	ON	
→	1	0	1	1	0	0	
	A9	A8	A7	A6	A5	A4	

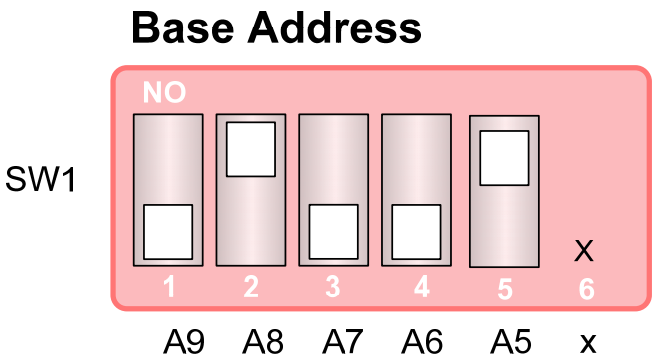
The detail SW1 base addresses setting. Please refer to 96-Bit Address Table, as follows.

96-Bit Address Table:

(*): Default Setting

I/O Address	1 A9	2 A8	3 A7	4 A6	5 A5	6 A4
200	OFF	ON	ON	ON	ON	ON
210	OFF	ON	ON	ON	ON	OFF
220	OFF	ON	ON	ON	OFF	ON
230	OFF	ON	ON	ON	OFF	OFF
240	OFF	ON	ON	OFF	ON	ON
250	OFF	ON	ON	OFF	ON	OFF
260	OFF	ON	ON	OFF	OFF	ON
270	OFF	ON	ON	OFF	OFF	OFF
280	OFF	ON	OFF	ON	ON	ON
290	OFF	ON	OFF	ON	ON	OFF
2A0	OFF	ON	OFF	ON	OFF	ON
2B0	OFF	ON	OFF	ON	OFF	OFF
2C0 (*)	**OFF**	**ON**	**OFF**	**OFF**	**ON**	**ON**
2D0	OFF	ON	OFF	OFF	ON	OFF
2E0	OFF	ON	OFF	OFF	OFF	ON
2F0	OFF	ON	OFF	OFF	OFF	OFF
300	OFF	OFF	ON	ON	ON	ON
310	OFF	OFF	ON	ON	ON	OFF
320	OFF	OFF	ON	ON	OFF	ON
330	OFF	OFF	ON	ON	OFF	OFF
340	OFF	OFF	ON	OFF	ON	ON
350	OFF	OFF	ON	OFF	ON	OFF
360	OFF	OFF	ON	OFF	OFF	ON
370	OFF	OFF	ON	OFF	OFF	OFF
380	OFF	OFF	OFF	ON	ON	ON
390	OFF	OFF	OFF	ON	ON	OFF
3A0	OFF	OFF	OFF	ON	OFF	ON
3B0	OFF	OFF	OFF	ON	OFF	OFF
3C0	OFF	OFF	OFF	OFF	ON	ON
3D0	OFF	OFF	OFF	OFF	ON	OFF
3E0	OFF	OFF	OFF	OFF	OFF	ON
3F0	OFF	OFF	OFF	OFF	OFF	OFF

6.3.2 144-bit Mode



For Example

How to select 2 C 0 (Hex)

OFF → 1
ON → 0
X → 0

	2		C				0
	OFF	ON	OFF	OFF	ON	X	
→	1	0	1	1	0	0	
	A9	A8	A7	A6	A5	X	

The detail SW1 base addresses setting. Please refer to 144-Bit Address Table, as follows.

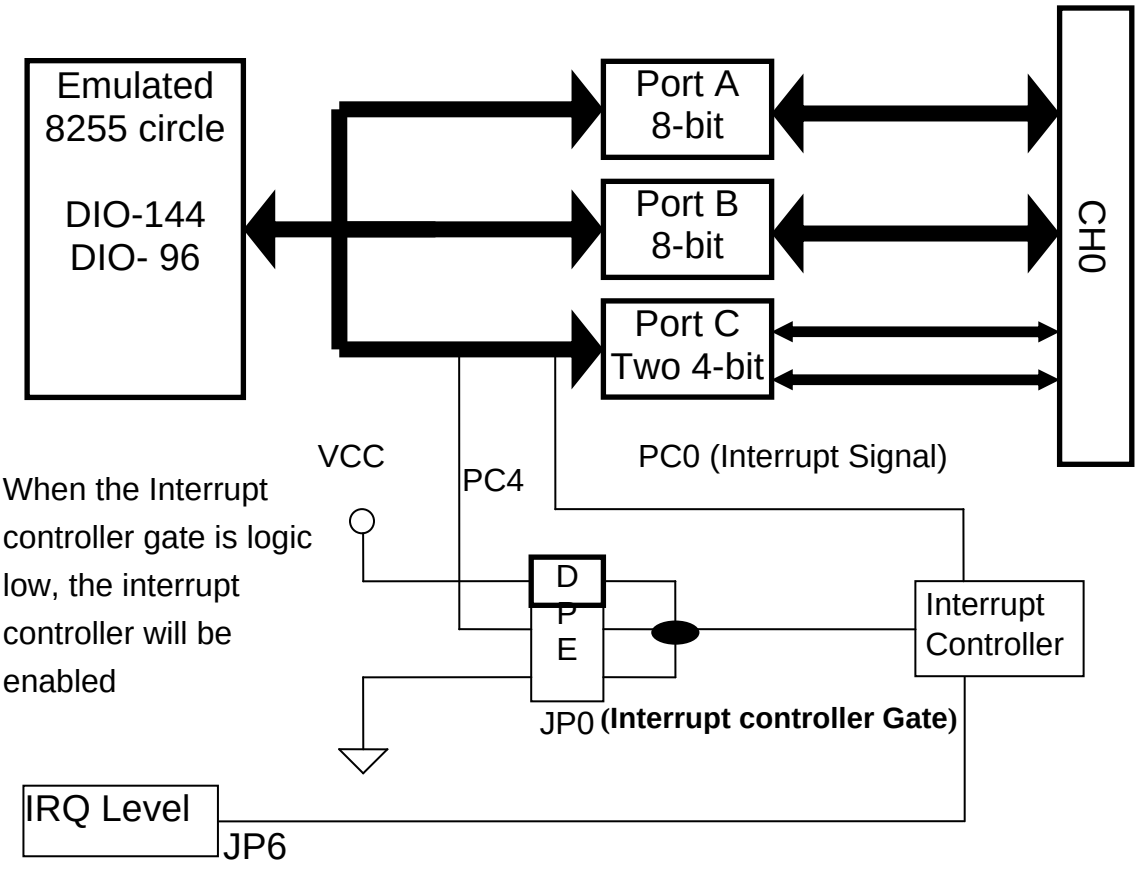
144-Bit Address Table:

(*): Default setting

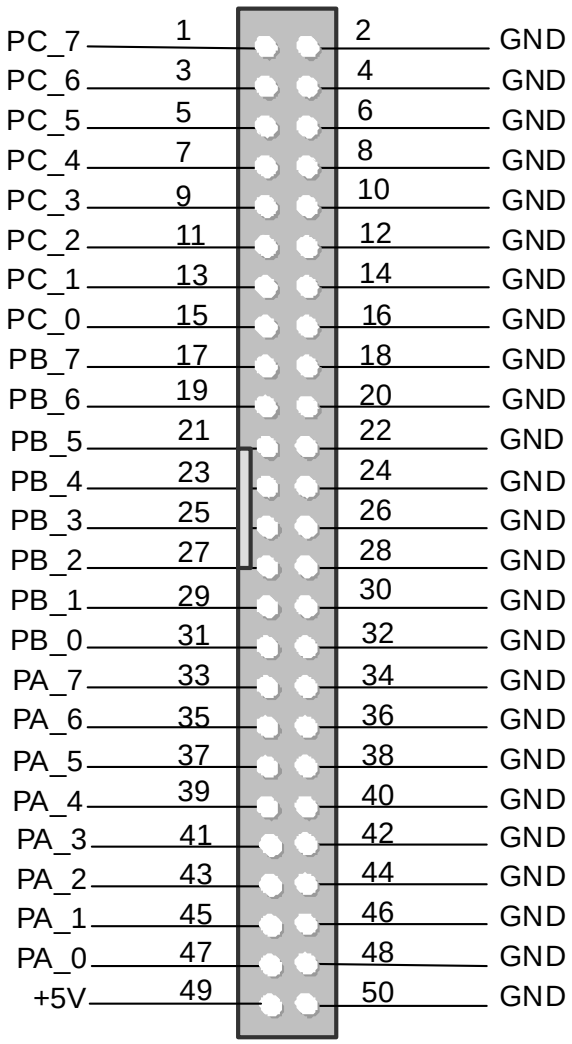
I/O Address	1 A9	2 A8	3 A7	4 A6	5 A5	6 X
200	OFF	ON	ON	ON	ON	X
220	OFF	ON	ON	ON	OFF	X
240	OFF	ON	ON	OFF	ON	X
260	OFF	ON	ON	OFF	OFF	X
280	OFF	ON	OFF	ON	ON	X
2A0	OFF	ON	OFF	ON	OFF	X
2C0 (*)	**OFF**	**ON**	**OFF**	**OFF**	**ON**	**X**
2E0	OFF	ON	OFF	OFF	OFF	X
300	OFF	OFF	ON	ON	ON	X
320	OFF	OFF	ON	ON	OFF	X
340	OFF	OFF	ON	OFF	ON	X
360	OFF	OFF	ON	OFF	OFF	X
380	OFF	OFF	OFF	ON	ON	X
3A0	OFF	OFF	OFF	ON	OFF	X
3C0	OFF	OFF	OFF	OFF	ON	X
3E0	OFF	OFF	OFF	OFF	OFF	X

6.4 Pin Assignments

The CN0 of DIO-144/96 emulates as Intel 8255 general purposes programmable peripheral interface. Figure shows DIO-144/96 I/O port equally block diagram.



CN1: 50-Pin of box header for CH0~CH5



All Signals are TTL Compatible	
High (1)	2.0 ~ 5.0 V(Voltage over 5.0V will damage the device)
None Define	2.0 V ~ 0.8 V
Low(0)	Under 0.8 V

7. Programming

The DIO-144/96 offers six/four OPTO-22 connectors, which are emulated MODE 0 of the 8255. Mode 0 of the 8255 provides basic input and output operations through each of the ports A, B and C. Output data is latched and input data follows the peripheral.

Mode 0 of the 8255 PPI Functions

- 16 different configurations
- Two 8-bit port and two 4-bit-ports
- Input are not latched
- Output are latched

7.1 Register

	I/O Address	Channel
144 Bit Mode	2C0 ~ 2DF	CH0 ~ CH 5
96 Bit Mode	2C0 ~2CF	CH0 ~CH3

- **144 Bit Mode I/O Register Default I/O Address: 0x2C0 (Hex)**

Address (Hex.)	Register	Read/Write
Base+0x00	CH0_Port A	R/W
Base+0x01	CH0_Port B	R/W
Base+0x02	CH0_Port C	R/W
Base+0x03	CH0_CFG	Write only
Base+0x04	CH1_Port A	R/W
Base+0x05	CH1_Port B	R/W
Base+0x06	CH1_Port C	R/W
Base+0x07	CH1_CFG	Write only
Base+0x08	CH2_Port A	R/W
Base+0x09	CH2_Port B	R/W
Base+0x0A	CH2_Port C	R/W

Base+0x0B	CH2_CFG	Write only
Base+0x0C	CH3_Port A	R/W
Base+0x0D	CH3_Port B	R/W
Base+0x0E	CH3_Port C	R/W
Base+0x0F	CH3_CFG	Write only
Base+0x10	CH4_Port A	R/W
Base+0x11	CH4_Port B	R/W
Base+0x12	CH4_Port C	R/W
Base+0x13	CH4_CFG	Write only
Base+0x14	CH5_Port A	R/W
Base+0x15	CH5_Port B	R/W
Base+0x16	CH5_Port C	R/W
Base+0x17	CH5_CFG	Write only

■ **96 Bit Mode I/O Register Default I/O Address : 0x2C0(Hex)**

Address (Hex.)	Register	Read/Write
Base+0x00	CH0_Port A	R/W
Base+0x01	CH0_Port B	R/W
Base+0x02	CH0_Port C	R/W
Base+0x03	CH0_CFG	Write only
Base+0x04	CH1_Port A	R/W
Base+0x05	CH1_Port B	R/W
Base+0x06	CH1_Port C	R/W
Base+0x07	CH1_CFG	Write only
Base+0x08	CH2_Port A	R/W
Base+0x09	CH2_Port B	R/W
Base+0x0A	CH2_Port C	R/W
Base+0x0B	CH2_CFG	Write only
Base+0x0C	CH3_Port A	R/W
Base+0x0D	CH3_Port B	R/W
Base+0x0E	CH3_Port C	R/W
Base+0x0F	CH3_CFG	Write only

7.2 Data Format

The DIO-144/96 provides 6/4 channel opto-22 connectors and each channel have 3 digital input/output port. Each port could be programmed as input or output mode by CFG register.

- **CFG Register Format**

D7	D6	D5	D4	D3	D2	D1	D0
1	0	0	?	?	0	?	?
1	X	X	Port A 1:Input 0:Output	Port C 1:Input 0:Output (High nibble)	X	Port B 1:Input 0:Output	Port C 1:Input 0:Output (Low nibble)

- **CFG Configurations Table**

	D4	D3	D1	D0
CFG	**PA0-PA7**	**PC4-PC7**	**PB0-PB7**	**PC0-PC3**
80H	O	O	O	O
81H	O	O	O	I
82H	O	O	I	O
83H	O	O	I	I
88H	O	I	O	O
89H	O	I	O	I
8AH	O	I	I	O
8BH	O	I	I	I
90H	I	O	O	O
91H	I	O	O	I
92H	I	O	I	O
93H	I	O	I	I
98H	I	I	O	O
99H	I	I	O	I
9AH	I	I	I	O
9BH	I	I	I	I

The DIO-144/96 each port can be CFG register initial to input port or output port. The port A and port B is 1 byte (1 byte = 8 bits) and the port C is 2 nibble byte (nibble byte = 4 bits).

Input / Output Port Data Format

Port_A

Port_A_7	Port_A_6	Port_A_5	Port_A_4	Port_A_3	Port_A_2	Port_A_1	Port_A_0
D7	D6	D5	D4	D3	D2	D1	D0

Port_B

Port_B_7	Port_B_6	Port_B_5	Port_B_4	Port_B_3	Port_B_2	Port_B_1	Port_B_0
D7	D6	D5	D4	D3	D2	D1	D0

Port_C

Port_C_7	Port_ C _6	Port_ C _5	Port_ C _4	Port_ C _3	Port_ C _2	Port_ C _1	Port_ C _0
High nibble3	High nibble2	High nibble1	High nibble0	Low nibble3	Low nibble2	Low nibble1	Low nibble0
D7	D6	D5	D4	D3	D2	D1	D0

Example: Initialize

1. Initial channel 0 Port A input mode, Port B input mode, Port C output mode
   - 1-1: Reference I/O register table: channel 0 CFG = Base + 0x03
   - 1-2: Reference CFG format table: Port_A_I, Port_B_I, Port_C_O = 0x92

     Note :

     Port_A_I means: Port A Input mode

     Port_C_O means: Port C Output mode
   - 1-3: Output initial data to CFG register: outportb (Base + 0x03 , 0x92);
   - 1-4: Then you can reading data from Port A and Port B and output data to Port C of channel 0

2. Initial channel 1 port A output mode , port B output mode , port C input mode
   - 2-1: Reference I/O register table: channel CFG = Base + 0x07
   - 2-2: Reference CFG format table: Port_A_O, Port_B_O, Port_C_I = 0x89
   - 2-3: Output initial data to CFG register: outputb (Base +0x07 , 0x89);
   - 2-4: Then you can output data to port A and port B and reading data from port C

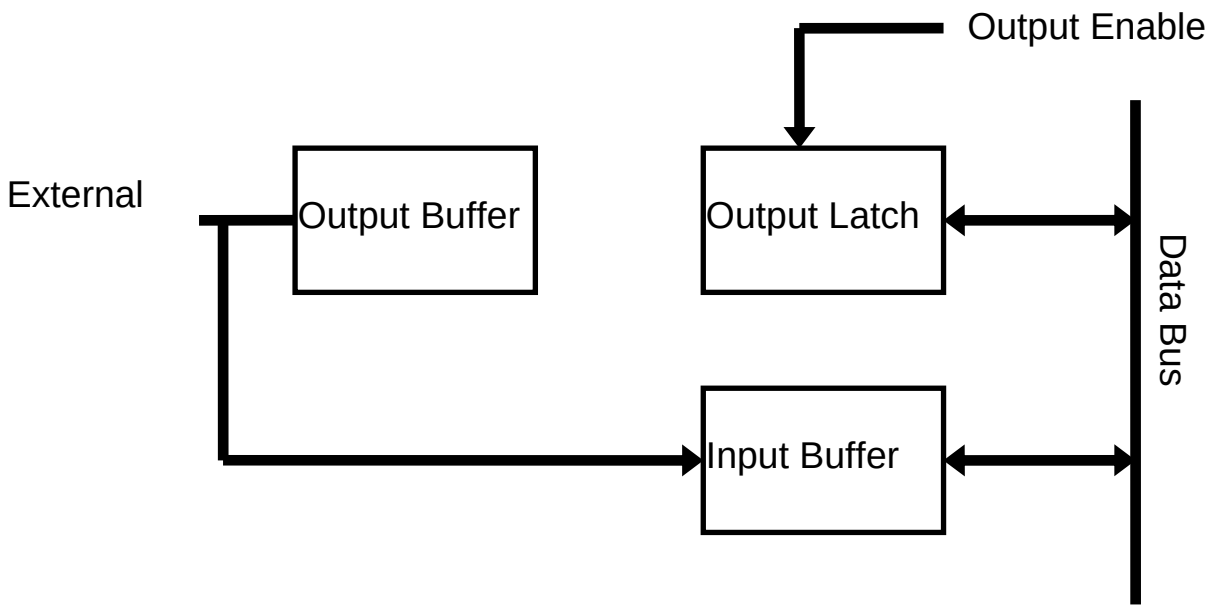
3. Other channel initialize as same as step 1 and step2.

7.3 Interrupt Handling

The Port C_0 of each connector can generate a hardware interrupt to computer. Use the interrupt you must set the IRQ level to be used. The JP6 is used to select IRQ level and the JP0 ~ JP6 is used to select the desired interrupt enable mode.

7.4 Output Latch

The DIO-144/96 signal direction is software programmable. When users turn on or reset computer, all ports are configured as input mode.
When the DIO-144/96 is programmed as output mode, it does not output until program execute the output instruction.



Signal Direction

7.5 Program Example

The DIO-144/96 I/O card is very easy to programming input/Output function.
Example (Quick Basic)

```
Bas=&H2C0
'==== Init DIO-144/96 Port A and Port B Input mode Port C output mode ====
OUT Bas+3,&H92              ' Reference Configuration table

'================================================

PA = INP(Bas+0)             'Read Port A Data
PB = INP(Bas+1)             'Read Port B Data
OUT Bas+2 , &HFF            'Write Data to Port C , set Channel 0 ~ 7 is high

'================= initial channel 1 ====================

OUT Bas+7,&H80          ' Set Port A,B,C is Output Mode
OUT Bas+4, 0            ' Write Data to Port A
OUT Bas+5, 0            ' Write Data to port B
OUT Bas+6, 0            ' Write Data to Port C

'====================initial channel 2 ====================

OUT Base+&HB,&H9B       ' Set Port A,B,C is Input mode
PA=INP(Bas+&H8)         ' Read Port A Data
PB=INP(Bas+&H9)         ' Read Port B Data
PC=INP(Bas+&HA)         ' Read Port C Data
```

8. Software/Hardware Installation

The DIO-144/96 can be used in DOS and Windows 98/ME/NT/2K and 32-bit Windows XP/2003/Vista/7. The recommended installation procedure for windows is given in Sec. 8.1 ~ 8.2. Or refer to Quick Start Guide (CD:\NAPDOS\ISA\DIO\Manual\QuickStart\).
http://ftp.icpdas.com/pub/cd/iocard/isa/napdos/isa/dio/manual/quickstart/

8.1 Software Installing Procedure

DIO-144/96 Windows driver (Windows 98/NT/2K and 32-bit Windows XP/2003/ Vista/7):

Step 1: Insert the companion CD into the CD-ROM drive and after a few seconds the installation program should start automatically. If it doesn't start automatically for some reason, double-click the **AUTO32.EXE** file in the **NAPDOS** folder on this CD.

Step 2: Click the item: "**Install Toolkits (Softwares)/Manuals**".

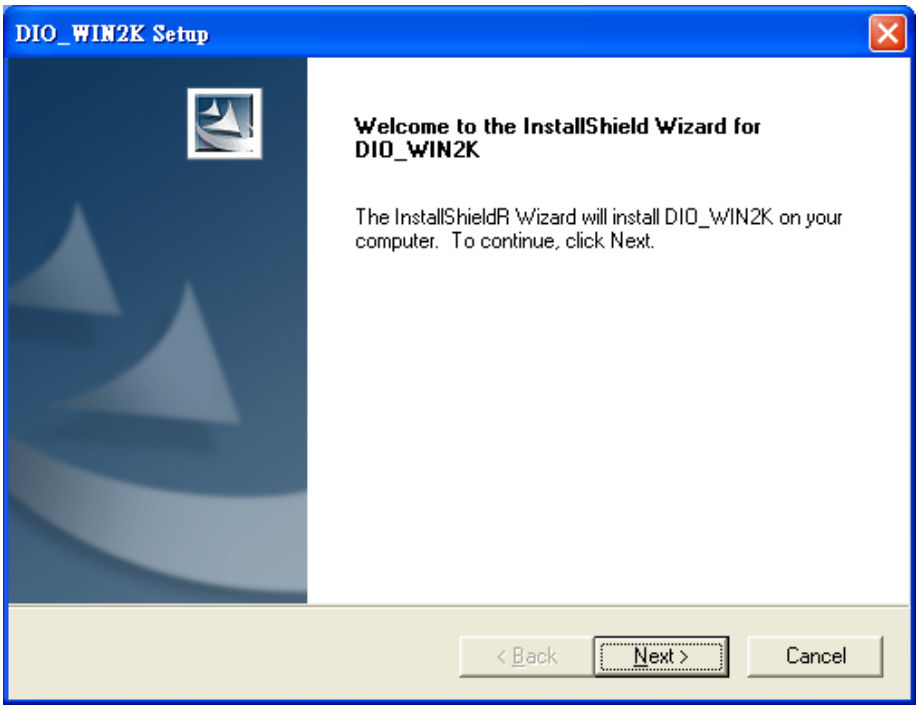
Step 3: Click the item: "**ISA Bus DAQ Card**".

Step 4: Click the item: "**DIO**".

Step 5: Choose the "**Install Toolkit for Windows 95/98、NT or 2000**" for setup according to your PC platform and then install driver.

Notes:

3. **The DIO-144/96 Windows driver site location:**
   http://ftp.icpdas.com/pub/cd/iocard/isa/napdos/isa/dio/dll/
4. **The Windows 2000 (Win2K) driver support Windows 2000 and 32-bit Windows XP/2003/Vista/7.**



Step 6: Click **"Next>"** button to start installation.
Step 7: Click **"Next>"** button to install driver into the default folder.
Step 8: Click **"Next>"** button to continue installation.
Step 9: Select **"No, I will restart my computer late"** and then click **"Finish"** button.

8.2 Hardware Installing Procedure

Please set the base address, interrupt IRQ and interrupt status on the DIO-144/96 card before insert DIO-144/96 card into the ISA slot in the computer. For detailed base address and interrupt settings information refer to Section 6.2 "Jumper Setting" and 6.3 "Base Address Setting".

For example: base address is 0x2C0, Interrupt IRQ is 7.

Step 1: Shout down and power off your computer.
Step 2: Remove all covers from the computer.
Step 3: Select an empty ISA slot.
Step 4: Care fully insert your DIO-144/96 card into the ISA slot.
Step 5: Replace the PC covers.
Step 6: Power on the computer.

Adding Hardware

Notes: adding hardware for working on Windows 2000 and 32-bit Windows XP/2003/Vista/7 only. Windows 95/98/Me/NT users should install correct version of the driver on the CD-ROM, and skip these “Adding Hardware” procedures.

Step 7: Open the “**Control Panel**” by click the item “**Start >> Settings >> Control Panel** ”.

Step 8: Double-click the item “**Add Hardware**” and click the **“Next>**” button.

Step 9: Select the item “**Yes, I have already connected the hardware**” and click the “**Next>**” button.

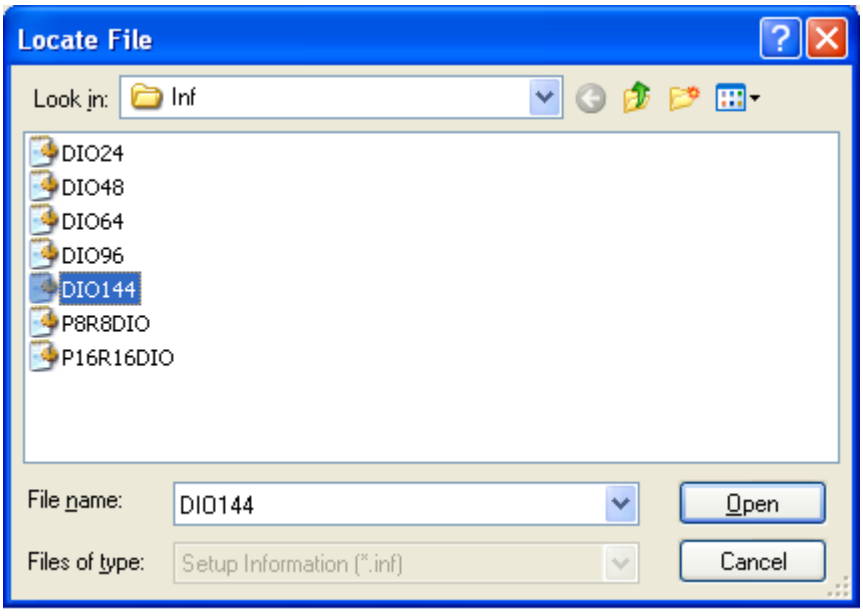
Step 10: Selection the item “**Add a new hardware device**” and click the “**Next>**” button.

Step 11: Selection the item “**Install the hardware that I manually select from a list [Advanced]**” and click the “**Next>**” button.

Step 12: Selection the item “**Show All Devices**” and click the “**Next>**” button.

Step 13: Click the “**Have Disk...**” button.

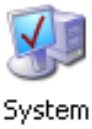
Step 14: Click the “**Browse...**” button to select the **.Inf** file default path is **C:\DAQPRO\DIO_Win2K\Inf** and click the “**Open**” and “**OK**” button.



Step 15: Selection then correct device from the "**Models:**" listbox and click the "**Next>**" button.

Step 16: Click the "**Next>**" button and then click the "**Finish**" button.

Modify the device properties

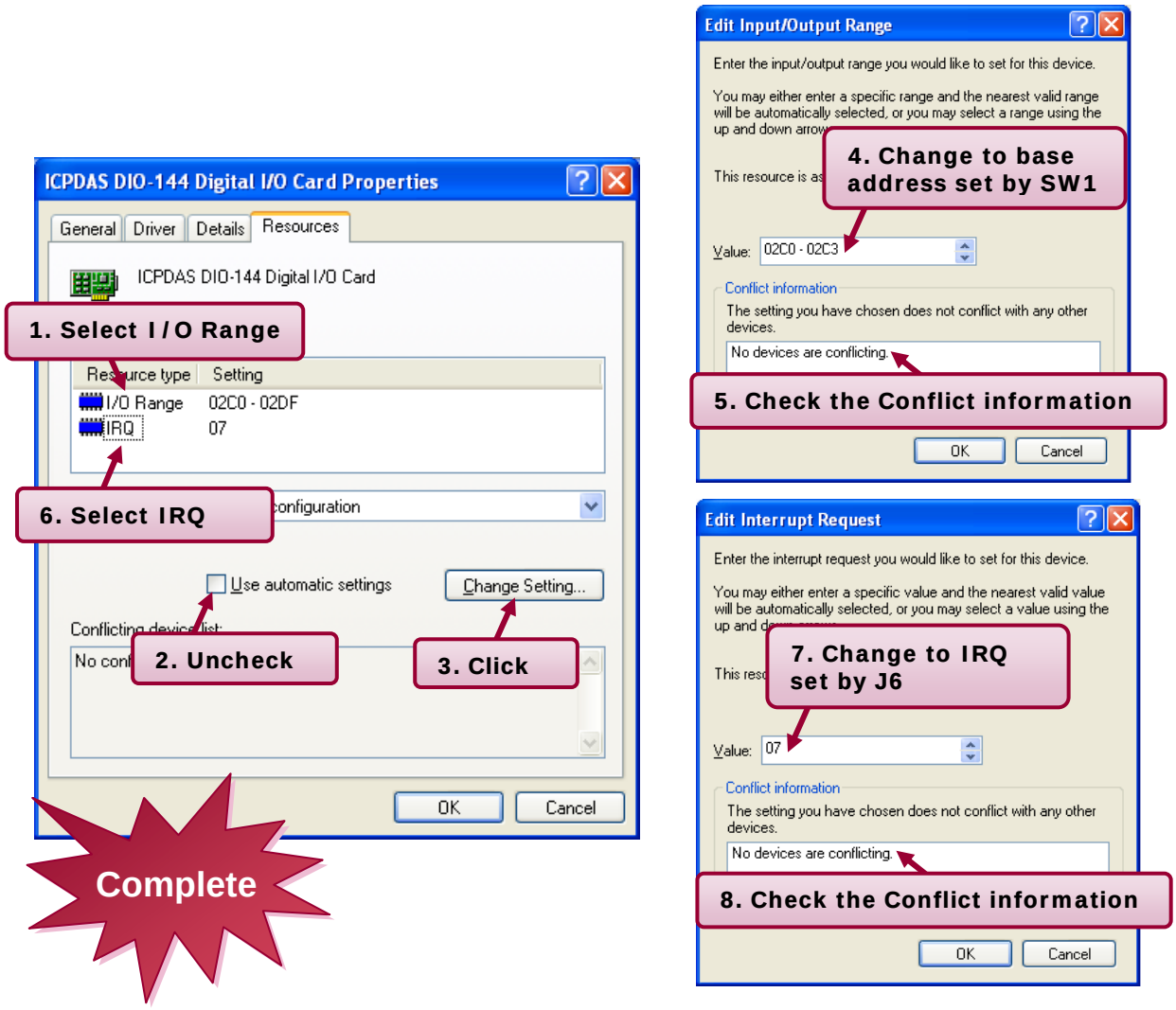


Step 17: Double-click the "**System**" icon in the "**Control Panel**".

Step 18: Click the "**Hardware**" tab and then click the "**Device Manager**" button.

Step 19: Click the "**DAQCard**" tab and then double-click "**ICPDAS DIO-144 Digital I/O Card**".

Step 20: Select the "**Resources**" tab and then setting as follows:



Appendix: Daughter Board

A1. Daughter Board Comparison Table

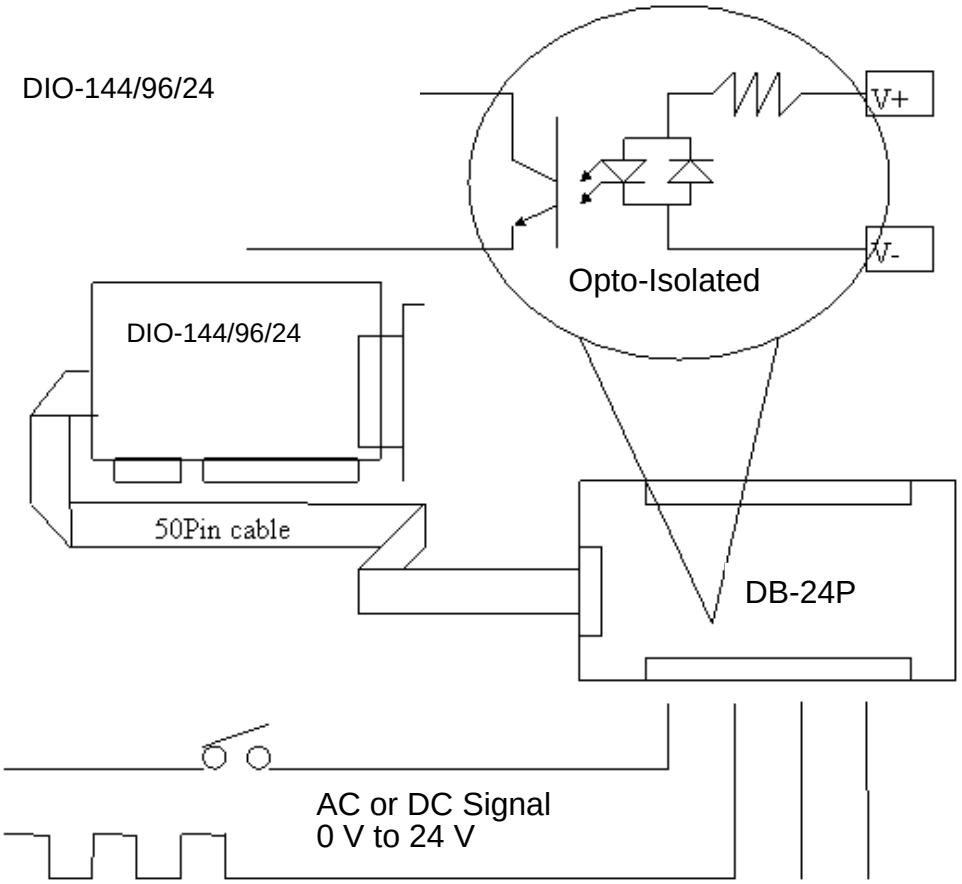
	20-pin flat-cable	50-pin flat-cable	D-sub 37-pin
DB-37	No	No	Yes
DN-37	No	No	Yes
ADP-37/PCI	No	Yes	Yes
ADP-50/PCI	No	Yes	No
DB-24P	No	Yes	No
DB-24PD	No	Yes	Yes
DB-16P8R	No	Yes	Yes
DB-24R	No	Yes	No
DB-24RD	No	Yes	Yes
DB-24C	Yes	Yes	Yes
DB-24PR	Yes	Yes	No
Db-24PRD	No	Yes	Yes
DB-24POR	Yes	Yes	Yes
DB-24SSR	No	Yes	Yes

The DIO-24 and DIO-144/96 offers 50 pin Opto-22 connector which could be connected to daughter board, such as:

1. DB-24PD: 24 OPTO-isolated Digital Input Terminal Board.
2. DB-24RD: 24 Relay Output Board
3. DB-24PRD: 24 Power Relay Output Board

A2. DB-24P/24PD Isolated Input Board

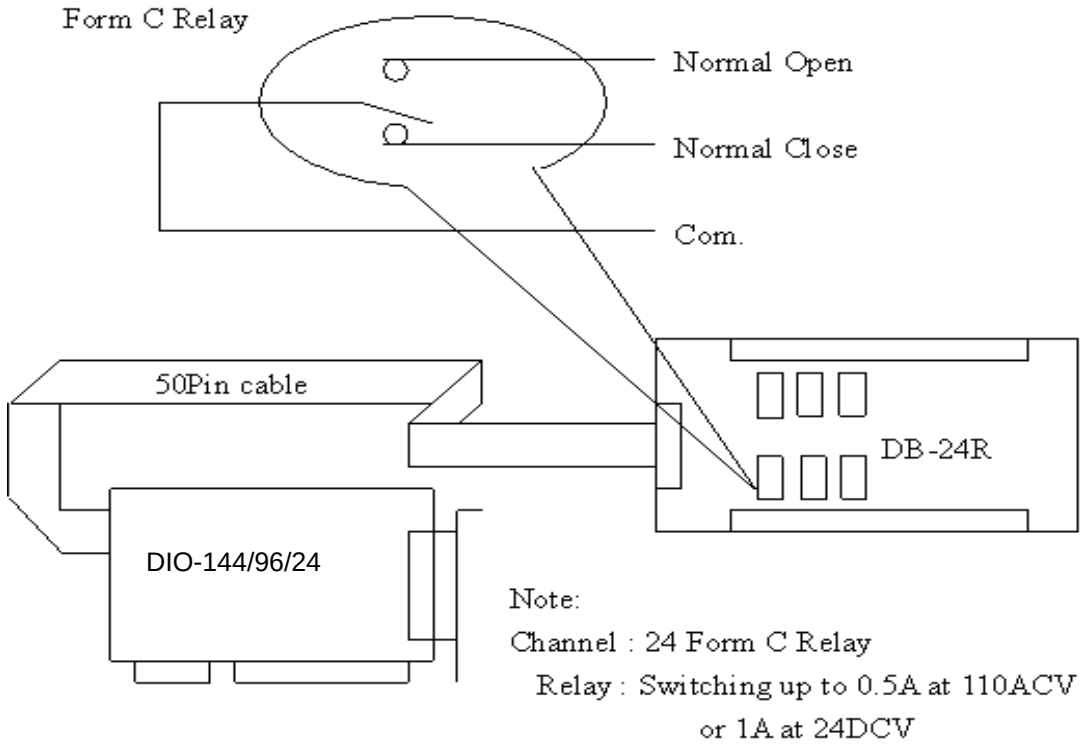
The DB-24P/24PD is a 24-channel isolated digital input daughter board. The optically isolated inputs of the DB-24P/24PD consist of a bi-directional optocoupler with a resistor for current sensing. You can use the DB-24P/24PD to sense DC signal from TTL levels up to 24 V or use the DB-24P to sense a wide range of AC signals. You can use this board to isolate the computer from large common-mode voltage, ground loops and transient voltage spike that often occur in industrial environments.



	DB-24P	DB-24PD
50-pin flat-cable header	Yes	Yes
D-sub 37-pin header	No	Yes
Other specifications	Same	

A3. DB-24R/24RD Relay Board

The DB-24R/DB-24RD, 24-channel relay output board, consists of 24 form C relays for efficient switch of load by programmed control. The relay are energized by apply 12 V/24 V voltage signal to the appropriated relay channel on the 50-pin flat connector. There are 24 enunciator LEDs for each relay, light when their associated relay is activated.



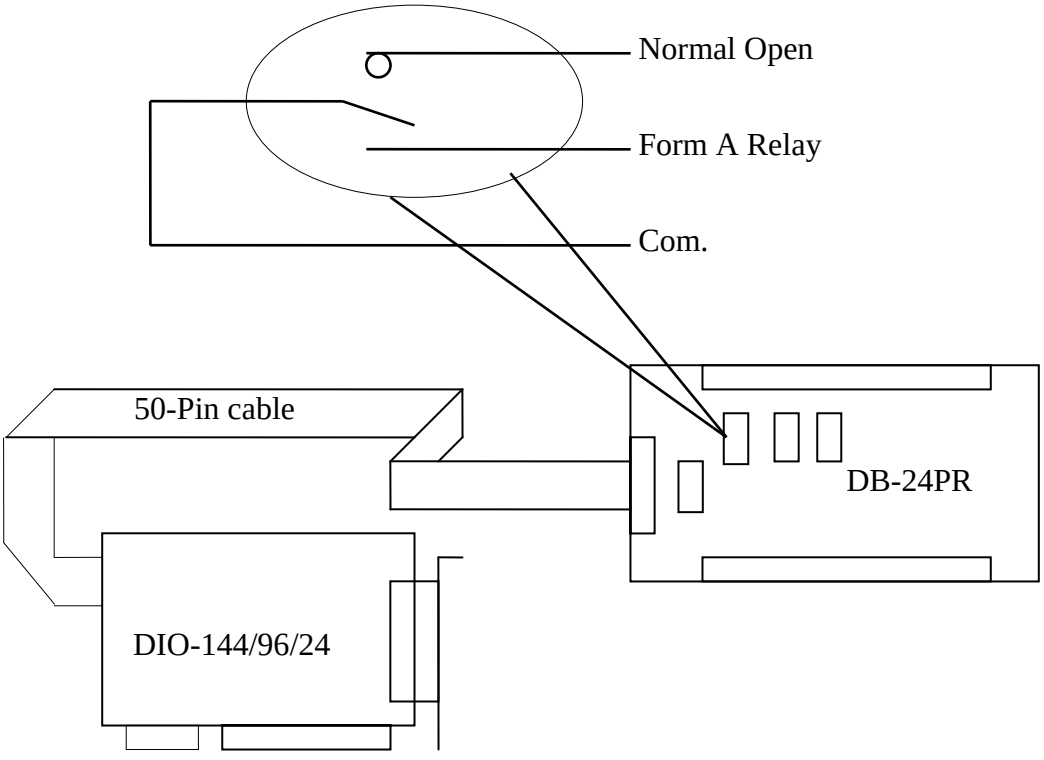
	DB-24R	DB-24RD
50-pin flat-cable header	Yes	Yes
D-sub 37-pin header	No	Yes
Other specifications	Same	

DB-24R, DB-24RD	24 × Relay (120 V, 0.5 A)
DB-24PR,DB-24PRD	24 × Power Relay (250 V, 5 A)
DB-24POR	24 × Photo MOS Relay (350 V, 01 A)
DB-24SSR	24 × SSR (250 V_{AC}, 4 A)
DB-24C	24 × O.C. (30 V, 100 mA)
DB-16P8R	16 × Relay (120 V, 0.5 A) + 8 × isolated input

A4. DB-24PR/24PRD

DB-24PR	24 × Power relay, 5 A/250 V
DB-24POR	24 × Photo MOS relay, 0.1 A/350 V_{AC}
DB-24C	24 × Open Collector, 100 mA per channel, 30 V max.

The DB-24PR, 24-channel power relay output board, consists of 8 form C and 16 form A electromechanical relays for efficient switching of load programmed control. The contact of each relay can control a 5 A load at 250 V_{AC} /30 V_{DC}. The relay is energized by applying 5 V signal to the appropriate relay channel on the 20-pin flat cable connector (just used 16 relays) or 50-pin flat cable connector (OPTO-22 compatible, for DIO-24 series). Twenty-four enunciator LEDs, one of each relay, light when their associated relay is activated. To avoid overloading your PC power supply, this board needs a +12 V_{DC} or +24 V_{AC} external power supply.



Notes:
Channel : 8 form C relays (SPDT) and 16 form A relay
Relay: Switch up to 5 A at 250 V_{AC} / 5 A at 30 V_{DC}