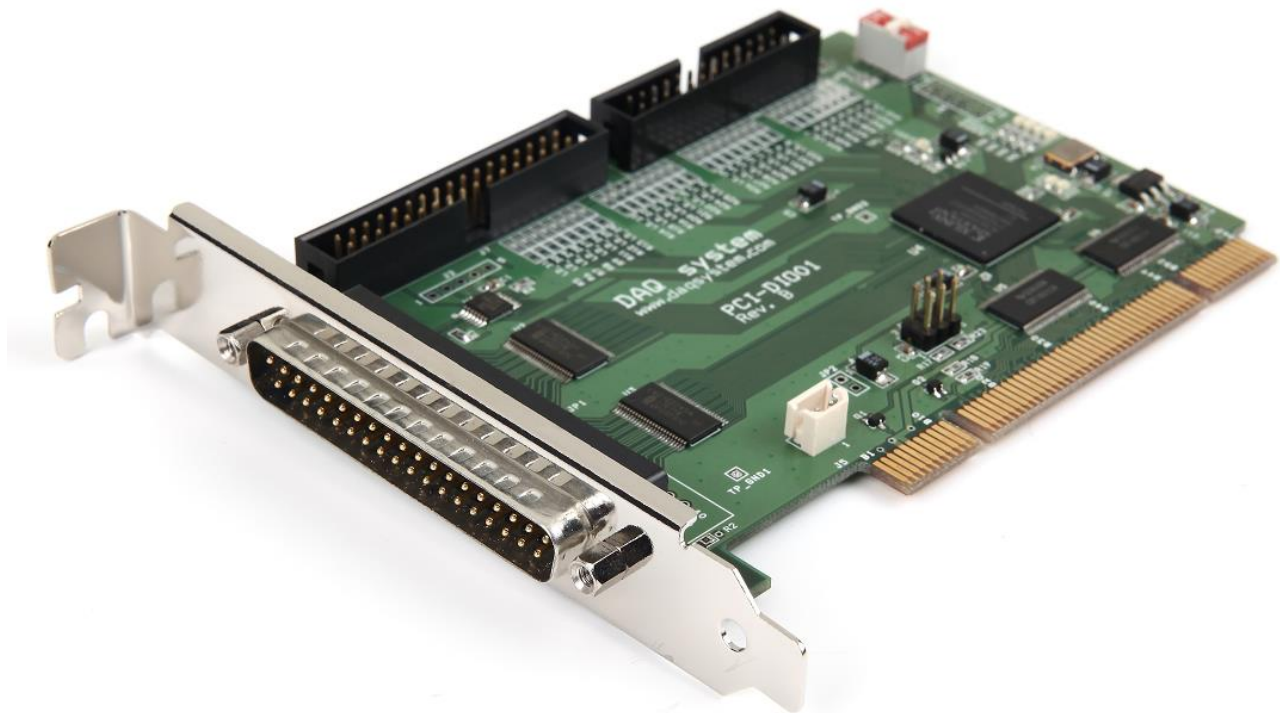


# PCI-DIO01

## User Manual

Version 0.7



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# Contents

|                                       |          |
|---------------------------------------|----------|
| <b>1. Introduction</b>                |          |
| 1-1 Product Features                  | 4        |
| 1-2 Product Applications              | 5        |
| <br>                                  |          |
| <b>2. PCI-DIO01 Block Diagram</b>     | <b>6</b> |
| <br>                                  |          |
| <b>3. PCI-DIO01 Board Description</b> |          |
| 3-1 Board Outline                     | 7        |
| 3-2 Device Features                   | 8        |
| <br>                                  |          |
| <b>4. Connector Pin Map</b>           |          |
| 4-1 J1 Connector                      | 9        |
| 4-2 JP1 Connector                     | 11       |
| 4-3 J3 Connector                      | 11       |
| 4-4 JP3 Connector                     | 12       |
| 4-5 SW1                               | 12       |
| <br>                                  |          |
| <b>5. Installation</b>                |          |
| 5-1 Hardware Installation             | 13       |
| 5-1-1 Product Contents                | 13       |
| 5-1-2 Installation Process            | 13       |
| 5-2 Driver Installation               | 14       |

**6. Sample Program** ..... **18**

    6-1 Device Function Description ..... **19**

    6-2 DIO Function Description ..... **19**

    6-3 Timer Function Description ..... **20**

    6-4 Counter Function Description ..... **21**

**Appendix**

    A-1 Repair Regulations ..... **22**

**Reference** ..... **23**

## UPDATE HISTORY

2011-07-04

2. Add interior layout
4. Add installation
5. Add sample program description

2012-09-21

1. Add Introduction
3. Changed appearance and added description

# 1. Introduction

PCI-DIO01 is a 32-bit digital input/output board that is perfectly compatible with industrial PCs and uses a 33bits, 33MHz PCI interface. All control of this board is designed with FPGA (Field Programmable Gate Array), so function enhancement or modification is free, and it can be easily upgraded according to the user's needs. In addition, 32-bit Counter/Timer can be used by coming out one port at a time. PCI-DIO01 board is suitable for industrial digital control such as power on/off, relay connection, and general-purpose counter/timer.

## 1-1 Product Features

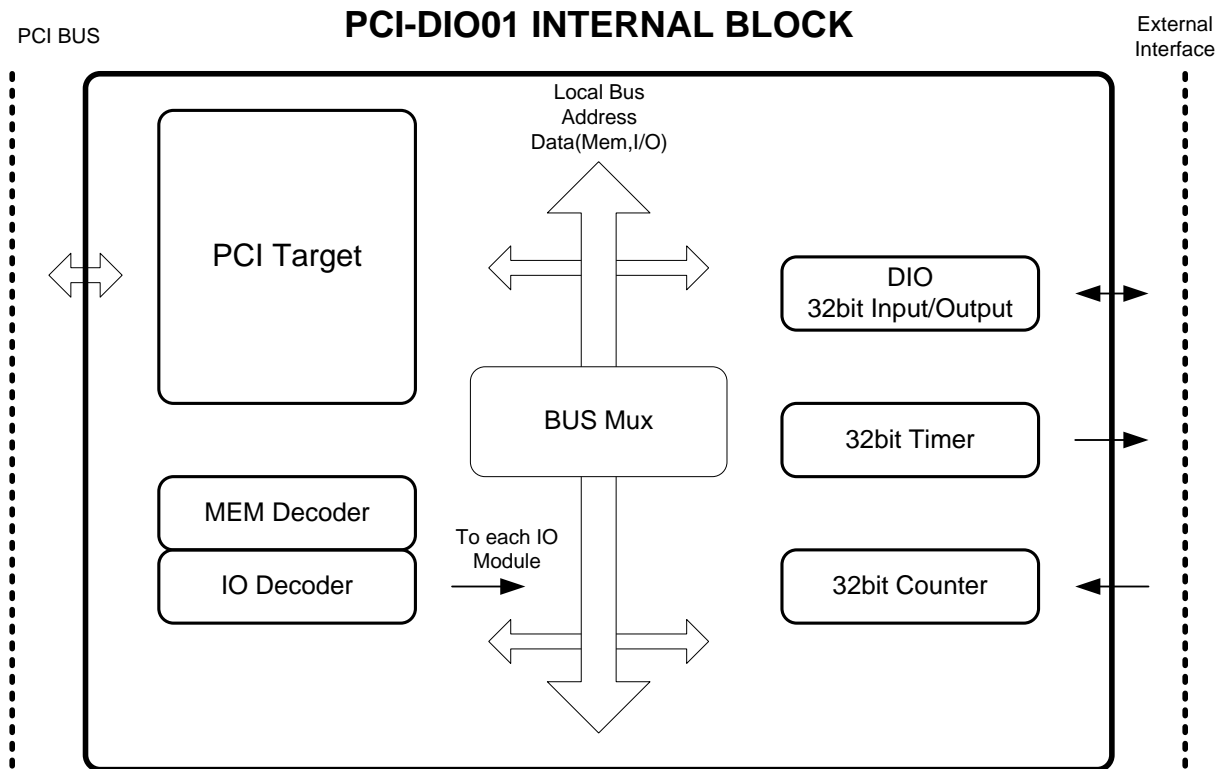
| Items                       | Description                       | Remark  |
|-----------------------------|-----------------------------------|---|
| <b>Hardware</b>             |                                   |   |
| PC Interface                | PCI 32bit/33Mhz                   |   |
| Operation Power             | +5VDC/ Max 1A                     |   |
| I/O Port                    | D-Sub37                           |   |
| Feature                     | 32bit Digital I/O                 | 3.3V COMOS and TTL Logic Input,<br>3.3V CMOS Logic Output Level |
| Timer                       | 32bit resolution<br>1 Port        |   |
| Counter                     | 32bit resolution<br>1 Port        |   |
| Simultaneous use of boards  | Max. 4                            |   |
| Operating temperature range | 0 ~ 60°C                          |   |
| Storage temperature range   | -20 ~ 80°C                        |   |
| Humidity range              | 5 ~ 95%                           | Non-condensing  |
| Board size                  | 125mm X 76mm                      | PCB Board Size  |
| <b>Software</b>             |                                   |   |
| OS                          | Windows 2000/XP/7/8/10 (32/64bit) |   |
| API                         | Windows Client DLL API            |   |
| Support                     | Sample Program                    | VC++  |

➤ DAQ System Digital I/O Products

| Product        | No. In/Out                           | Timer/Counter | Specification   |
|----------------|--------------------------------------|---------------|---|
| cPCI-DIO6400   | 32/32                                |               | Isolated Input/Output                                       |
| cPCI-DIO02     | 128 channels Software Configurable   |               | Read/Write in 8 Groups in 16-bit Units                      |
| PCI(e)-DIO6400 | 32/32                                |               | Isolated Input/Output                                       |
| PCI-DIO6401    | 64/None                              |               | Isolated Input  |
| PCI-DIO6402    | None/64                              |               | Isolated Output   |
| PCI-DIO01      | 32/32 Software Configurable          | 1/1           | TTL Level Input/Output<br>32bit Counter/Timer               |
| PCI-DIO02      | 128 channels Software Configurable   | 1/1           | Read/Write in 8 Groups in 16-bit Units                      |
| PCI-DIO12      | 16/16 or 32/32 Software Configurable |               | 128Mbyte DDR SDRAM<br>Data transfer rate up to 400Mb/s      |
| PCI-MOT01      | 24/24 (Isolated)                     |               | 1 Channel PWM, 2 Channel Encoder,<br>1 Channel ADC          |
| PCI-PWM02      | 6/12(Isolated)                       |               | 4 Channel Triggered PWM outputs                             |
| PCI(e)-TC03    | 16/16                                | 8/8           | 32bit resolution Differential Counter/Timer                 |
| PCI-EK01       | 24(shared)                           | 1/1(32bit)    | 12bit 8 Channel A/D Input<br>12bit 8 Channel D/A Output     |
| PCIe-DIO05     | 32/32                                |               | TTL Level Input/Output                                      |
| USB-AIO10      | 24/24(Isolated)                      |               | 4-Ch Analog Input and Output<br>RS-232 115,200bps Interface |
| USB-DIO12800   | 128 channels Software Configurable   |               | Read/Write in 8 Groups in 16-bit Units                      |
| USB-DIO6400    | 32/32                                |               | Isolated Input/Output<br>12Mbps                             |
| USB-MULTI      | 2/None                               |               | Isolated Input/Output<br>16bit Counter In & Timer Out       |
| USB-PWM10      | 6/8(Isolated)                        |               | 4 Channel Triggered PWM outputs                             |

## 2. PCI-DIO01 Block Diagram

As shown in [Figure 2-1], PCI-DIO01 is a board with 32-bit TTL digital input/output ports that can be set in 8-bit units, and consists of a 32-bit timer and a 32-bit counter. 32 LED status indicators (indicators) to check the digital output make it easy for users to use.



[Figure 2-1. PCI-DIO01 Internal Block Diagram]

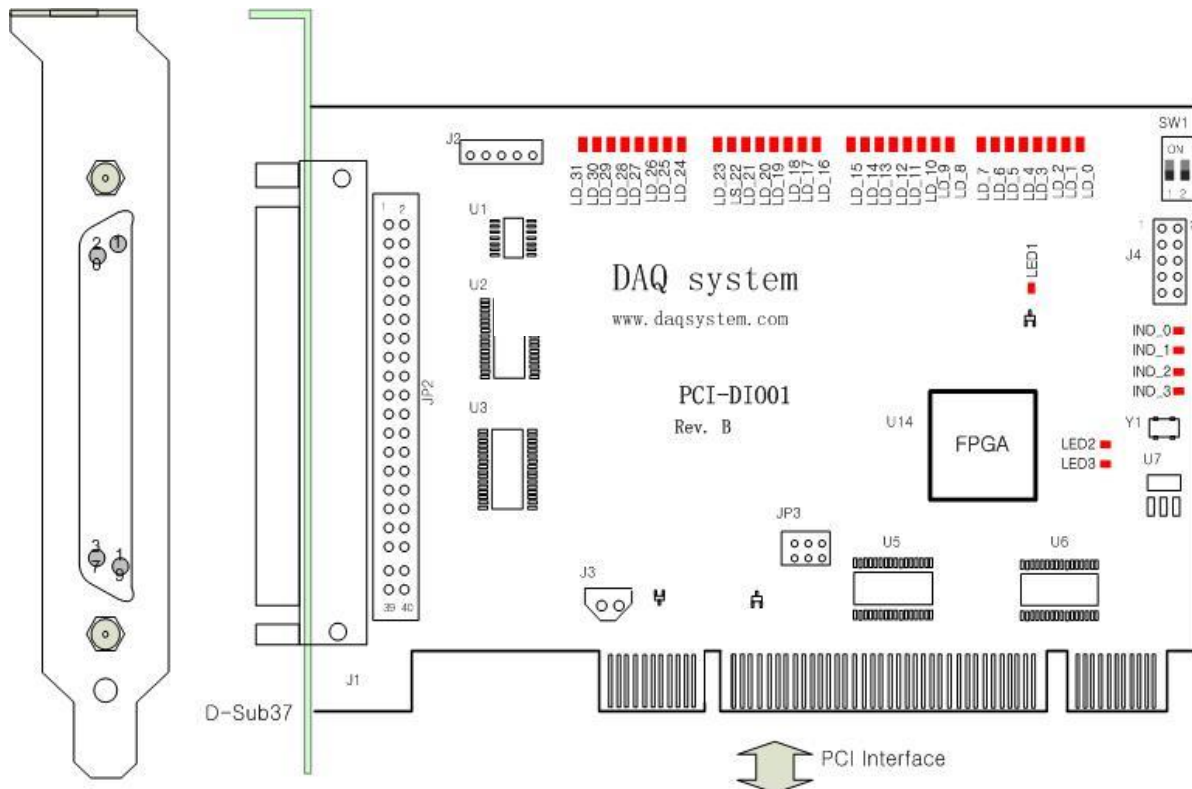
### GENERAL DESCRIPTION

- ◆ PCI 32-bit, 33MHz 5/3.3V Compatible Target Board
- ◆ 32-bit Digital Input Output Board
- ◆ 1 Port 32-bit Timer
- ◆ 1 Port 32-bit Counter
- ◆ 3.3V COMOS and TTL Logic Input, 3.3V CMOS Logic Level Output

### 3. PCI-DIO01 Board Description

Each important board function is briefly described. For detailed function information, please refer to the parts specification.

#### 3-1 Board Layout



[Figure 3-1. PCI-DIO01 Layout]

There are 38 LEDs on the board, each of which is described below.

LED1 : Lights up when the board finishes configuration and ready for operation.

LED2: Not applied

LED3 : Not applied

**IND\_0 ~ IND3** : For testing (currently always lit)

**LD\_0 ~ LD\_31** : When the digital transmission direction is Out, the corresponding bit is lit.



## 3-2 Device Features

**(1) D-Sub 37 Pin : J1**

Digital 32 channels Input/Output Pin  
Pin for Counter/Timer

**(2) FPGA : U14**

All functions of the board are controlled through this FPGA Logic.

**(3) PCI Chipset : U5, U6**

PCI Signal Control

**(4) 5V Input/Output Tolerant : U2, U3**

5V Tolerant In/Outs for interfacing with 5V Logic

**(5) Regulator : U7**

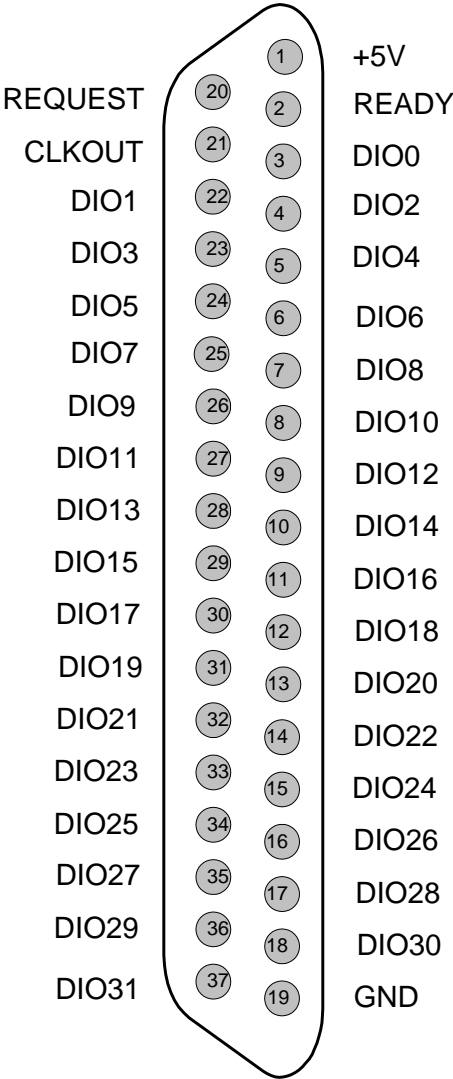
It supplies the power used by the board.

## 4. Connector Pin Map

This section describes connectors and jumpers used in PCI-DIO01. The main connectors are D-Sub 37pin connector J1 for external digital input/output connection and 40pin Box Header connector to check the signal of D-SUB 37pin connector.

[Figure 4-1] shows the bracket that interfaces with the board and the connection connector.

### 4-1 J1 Connector



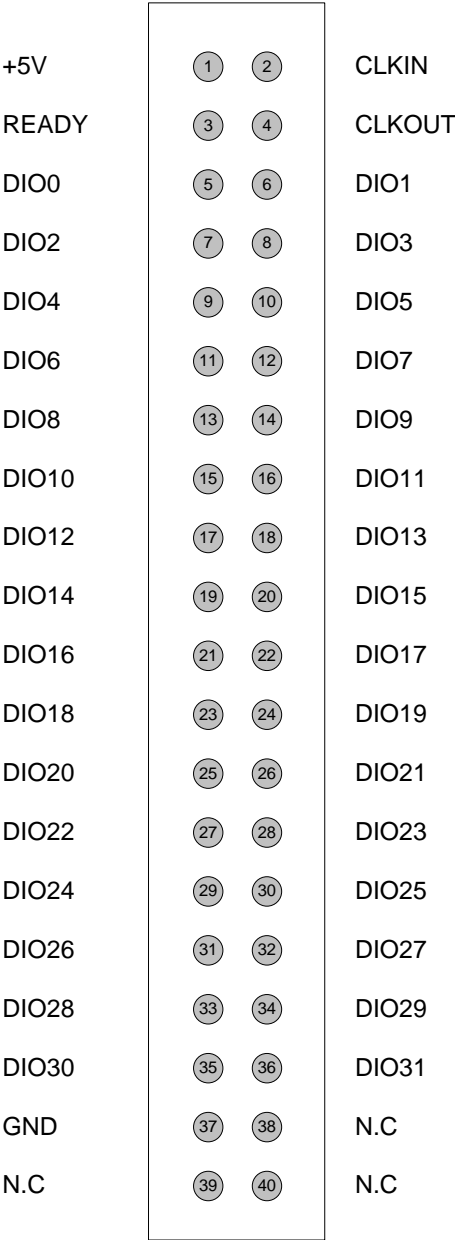
[Figure 4-1. PCI-DIO01 D-Sub37 Connector]

The 37-pin D-SUB connector fixed to the standard PCI bracket is used to connect the external interface for DIO, timer, and counter input/output, and the signals assigned to each pin are as follows [Table 1].

[Table 1. PCI-DIO01 D-SUB 37 Pin Connector]

| Pin No. | Name    | Description                                    | Remark                              |
|---------|---------|--|-------------------------------------|
| 1       | +5V     | 5Vdc PCI Power                                 | Power                               |
| 2       | READY   | DIO Output ready signal,<br>DOOUT state change | Change the output<br>value from '1' |
| 3       | DIO0    | Digital IO Signal 0                            |                                     |
| 4       | DIO2    | Digital IO Signal 2                            |                                     |
| 5       | DIO4    | Digital IO Signal 4                            |                                     |
| 6       | DIO6    | Digital IO Signal 6                            |                                     |
| 7       | DIO8    | Digital IO Signal 8                            |                                     |
| 8       | DIO10   | Digital IO Signal 10                           |                                     |
| 9       | DIO12   | Digital IO Signal 12                           |                                     |
| 10      | DIO14   | Digital IO Signal 14                           |                                     |
| 11      | DIO16   | Digital IO Signal 16                           |                                     |
| 12      | DIO18   | Digital IO Signal 18                           |                                     |
| 13      | DIO20   | Digital IO Signal 20                           |                                     |
| 14      | DIO22   | Digital IO Signal 22                           |                                     |
| 15      | DIO24   | Digital IO Signal 24                           |                                     |
| 16      | DIO26   | Digital IO Signal 26                           |                                     |
| 17      | DIO28   | Digital IO Signal 28                           |                                     |
| 18      | DIO30   | Digital IO Signal 30                           |                                     |
| 19      | GND     | Digital IO Ground                              | Ground                              |
| 20      | REQUEST | Counter Input                                  |                                     |
| 21      | CLKOUT  | Timer Output                                   |                                     |
| 22      | DIO1    | Digital IO Signal 1                            |                                     |
| 23      | DIO3    | Digital IO Signal 3                            |                                     |
| 24      | DIO5    | Digital IO Signal 5                            |                                     |
| 25      | DIO7    | Digital IO Signal 7                            |                                     |
| 26      | DIO9    | Digital IO Signal 9                            |                                     |
| 27      | DIO11   | Digital IO Signal 11                           |                                     |
| 28      | DIO13   | Digital IO Signal 13                           |                                     |
| 29      | DIO15   | Digital IO Signal 15                           |                                     |
| 30      | DIO17   | Digital IO Signal 17                           |                                     |
| 31      | DIO19   | Digital IO Signal 19                           |                                     |
| 32      | DIO21   | Digital IO Signal 21                           |                                     |
| 33      | DIO23   | Digital IO Signal 23                           |                                     |
| 34      | DIO25   | Digital IO Signal 25                           |                                     |
| 35      | DIO27   | Digital IO Signal 27                           |                                     |
| 36      | DIO29   | Digital IO Signal 29                           |                                     |
| 37      | DIO31   | Digital IO Signal 31                           |                                     |

4-2 JP1 Connecter



[Figure 4-2. PCI-DIO01 On-Board Test Pin]

To check the signal of the D-SUB 37-pin connector, a TP pin array for attaching a 40-pin (20x2, 2.54mm pitch) header connector (JP1) on the PCB was allocated. Refer to [Table 1] for signal characteristics.

4-3 J3 Connector (2Pin Header, 2.54mm)

It is a 3.3V external DC power connector (2Pin Header, 2.54mm). Power used when installing CPLD or FPGA, not normally used.

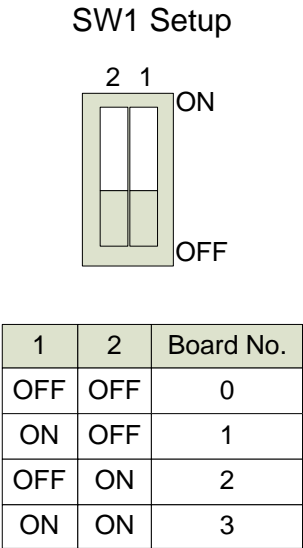
4-4 JP3 Connector

JP3 is a JTAG (Joint Test Action Group) connector and is used to update the FPGA program on the board. Do not use when operating the board normally.

4-5 SW1

In a system that requires many I/O ports, if several DIO02 series boards are installed in one system, each board address must be used separately. At this time, each board classification uses the dip switch (SW1) on the board.

The total number of boards installed in one system is four.



[Figure 4-3. Board Address Setup]

## 5. Installation

Before installing the board, check that the contents of the package are intact.

### 5-1 Hardware Installation

#### 5-1-1 Product Contents

1. PCI-DIO01 Board
2. CD (Driver/Manual/API/Sample Source etc.)

#### 5-1-2 Installation Process

- ① Turn off the computer.
- ② Remove the computer cover according to the computer manual.
- ③ Insert the product into an empty PCI slot. If possible, insert the boards in the order closest to the CPU.
- ④ Remove the blocked part at the back of the computer case of the slot where the board is inserted. Tighten the screws between the bracket of the board and the connection part of the case.
- ⑤ In case of multi-board, repeat from step 3.

Connect the PCI-DIO01 board in the PC to an empty PCI slot.

When you turn on the power, a new hardware search window will appear.

## 5-2 Driver Installation

After installing the board, install the driver and sample application to run the board on your PC. For installation, use the supplied CD.

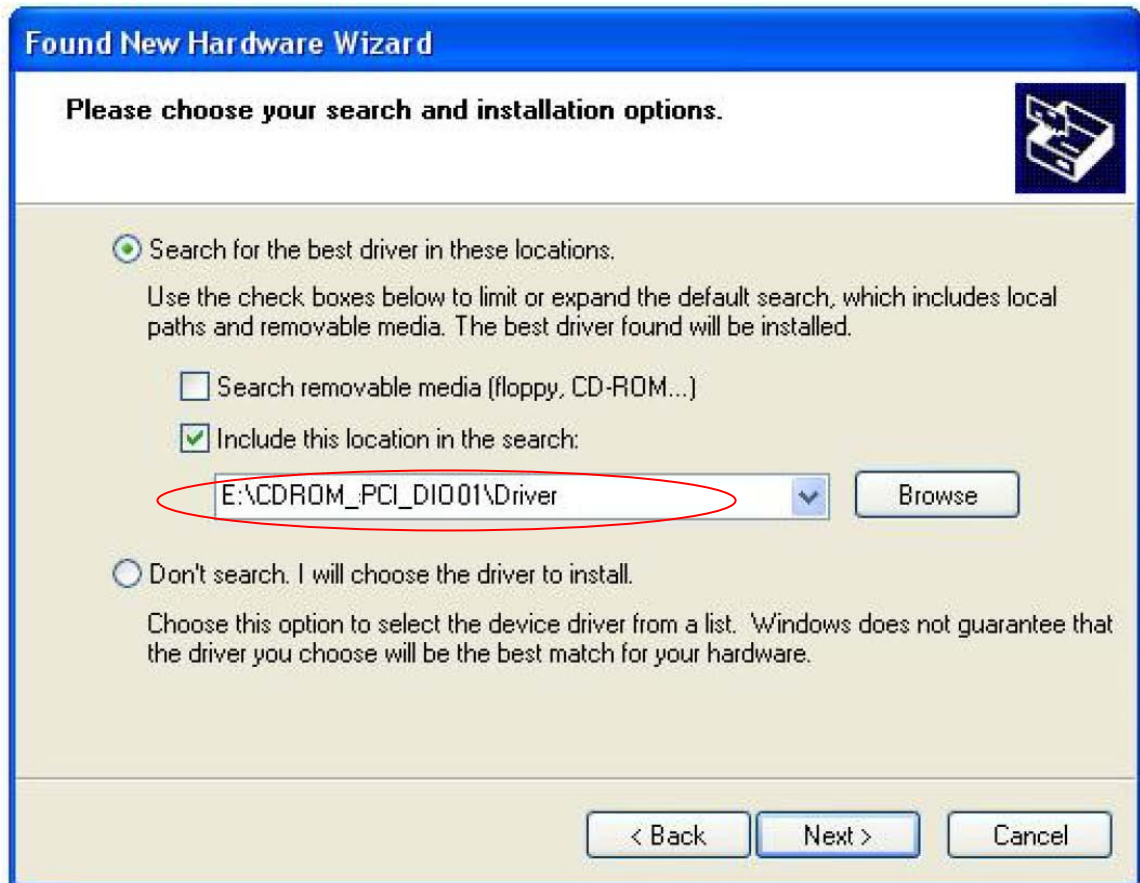
The installation procedure is as follows, and unless otherwise specified, it is explained based on Windows XP.

The board environment must be Windows 2000 SP4 or higher and Windows XP SP1 or higher. First, turn off the PC's power, plug the PCI-DIO01 board into the PCI Slot, and turn on the PC's power. When the "Start New Hardware Wizard" window opens as shown below, select it as shown below and click the Next button.

The PCI-DIO01 connects to PCI Card Port. After that you can show the below picture of "Found New Hardware Wizard" window.



If new hardware is found, Wizard will ask you to install the corresponding driver. For installation of the driver, select the item "Install from a list or specific location (Advanced)" and click "Next" as in the figure.



The driver folder includes a file of "**pci\_dio01.inf**" and "**pci\_dio01.sys**" that it is necessary for driver installation.

A warning message appears during installation here, press "Continue Anyway" button.

You can show below message window. The process progress as follows.

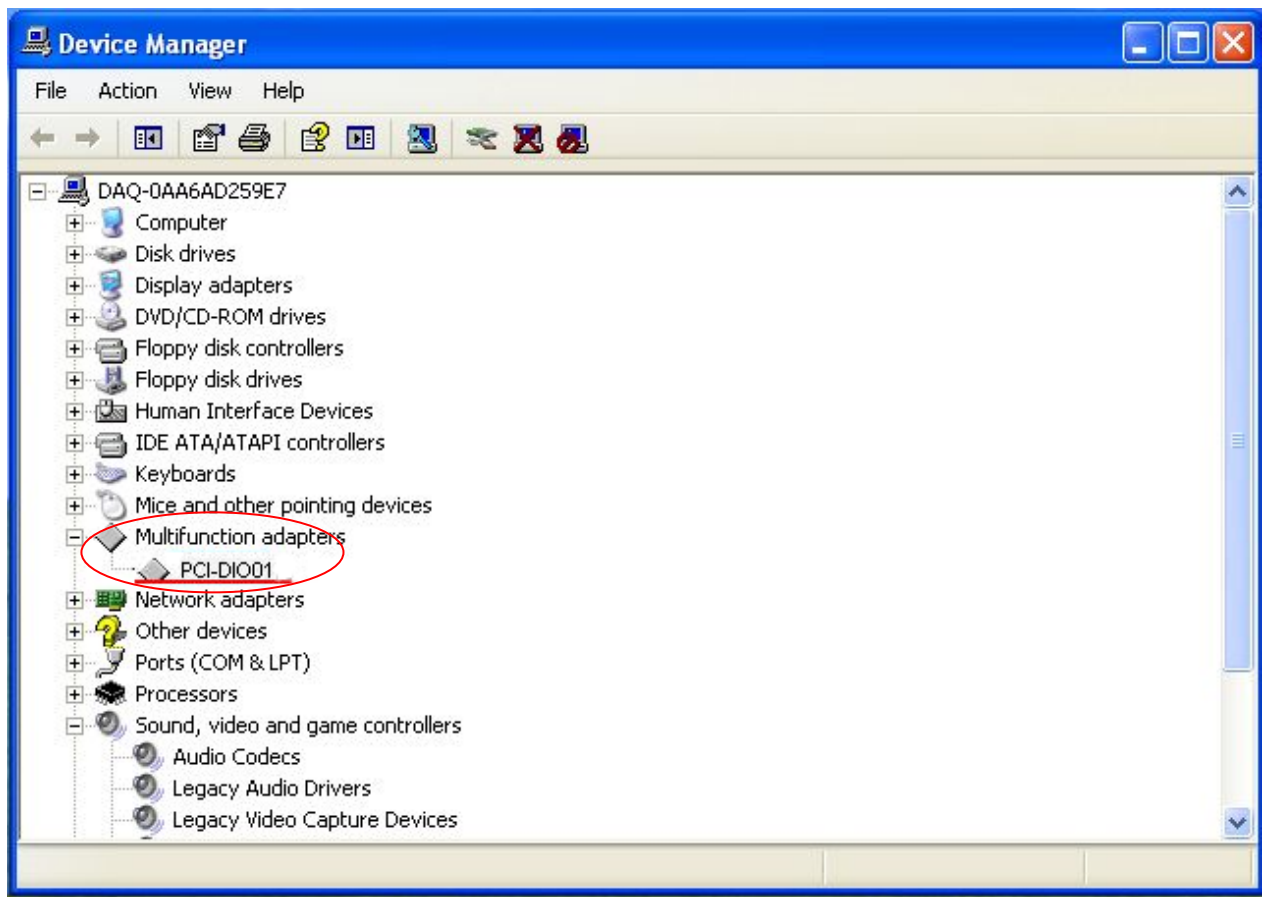




If the installation is completely finished, you can show below message window.



If the installation is completely finished, you confirm it in the following ways. Do the following steps to show up the "Device Manager" window. [My Computer -> properties -> Hardware -> Device Manager -> **Multifunction Adaptors** -> **PCI-DIO01**]



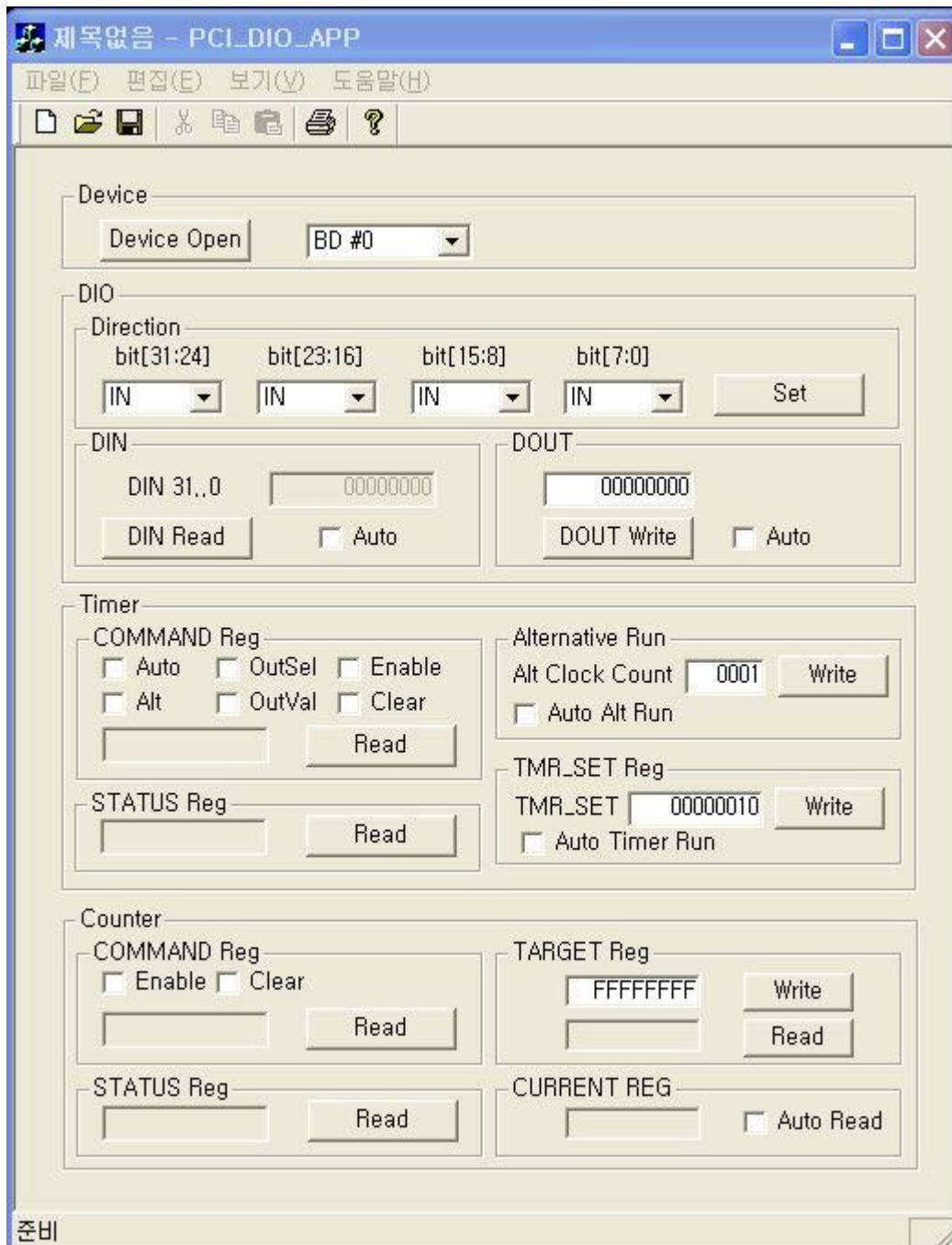
If you can see the "PCI-DIO01" at Multifunction Adaptors, the driver installation is to have been over. (Check the red circle)

**Notice : After installation, you should re-boot the system for the proper operation.**

## 6. Sample Program

In the APP folder of the CDROM provided with the board, a sample program "PCI\_DIO\_APP.exe" is provided for easy use of the board. In order to test the sample program, the driver of the board must be installed first.

The sample program is provided in source form so that the API provided to use the board can be tested briefly, so the user can modify it and use it.



[Figure 6-1. Sample program "PCI\_DIO\_APP.exe" execution screen]

API (Application Programming Interface) is required to use the above sample program. API is provided in the form of "DLL", and import library and header file are required for compilation. In order to run the sample program normally, the API DLL (**PCI\_DIO01.DLL**) must be in the folder of the executable file, or in the Windows system folder or the folder specified by the Path environment variable.

## 6-1 Device Function Description

### (1) 'Device Open' Button

Click to open the selected board (BD #0 ~ BD #3).

## 6-2 DIO Function Description

### (1) Direction

It can be set as IN/OUT by dividing 32 bits by 8 bits.

### (2) 'Set' Button

It applies the selected Direction value.

### (3) 'DIN Read' Button

Reads digital input value according to the selected direction.

### (4) Auto

Not Used.

### (5) 'DOUT Write' Button

Outputs to the output port according to the selected Direction. If you write ff00ff00, LD\_31 ~ LD\_24 and LD\_15 ~ LD\_8 are turned on. At this time, Direction should be set to OUT.

### (6) Auto

DIO[31..0] Outputs 32bit digital value one bit at a time to the output port.

## 6-3 Timer Function Description

### (1) Command Reg

When "Read" button click, it set up the COMMAND register for Timer action.

**AUTO** : If it is '0', It will occur One-Shot output. If it is '1', it will be occurred time-out.

If it is Auto = '1', Alt='0', the frequency outputs frequency =  $5M/(TMR\_SET+1)$ .

If it is Auto = '1', Alt='1', the frequency outputs frequency =  $10M/(TMR\_SET+1)$  .

**ALT** : It is a bit of Alternative action. If it is '0', it put an output value into reverse whenever time-out occurs. If it is '1', it outputs '1' like numbers to have been set up to ALT\_CNT, and it outputs '0' until time-out occurrence

**OutSel** : If it is '1', the Timer output through IO outputs a value of "OutVal".

If it is '0', it outputs by the Timer actions

**OutVal** : It is an output value when the Timer output is IO.

**Enable** : If it is '1', a Timer operates. (Up-Counter)

**Clear** : If it is '1', it initialize current (TMR\_CUR) value to "0x00000000".

### (2) Alternative Run

It set the 16-bit timer value in Alternative operation.

When "Auto Alt Run" is set, the COMMAND register for timer operation is automatically set.

### (3) Status Reg

It gets the register value that shows the operation status.

If Bit0 is "1", a beep sounds when a timeout occurs ( $TMR\_CUR \geq TMR\_SET$ ).

### (4) TMR\_SET Reg

It set up 32-bit Timer value.

When "Auto Alt Run" set, it automatically set up the COMMAND register for the Timer action.

## 6-4 Counter Function Description

(1) **Command Reg**

When "**Read**" button click,

**Enable** : If it is '1', a Counter operates. (Up-Counter)

**Clear** : If it is '1', it initialize current Counter value to "0x00000000".

(2) **Target Reg**

When "**Write**" button click, it set up 32-bit Counter value

When "**Read**" button click, it read 32-bit Counter value.

(3) **STATUS Reg**

It gets the register value that shows the operation status.

(4) **CURRENT REG**

When the "**Auto Read**" button is clicked, the currently set register value is read.

## Appendix

### A-1 Repair Regulations

Thank you for purchasing DAQ SYSTEM's product. Please refer to the following regarding Customer Service stipulated by DAQ SYSTEM.

- (1) Please read the user's manual and follow the instructions before using the DAQ SYSTEM product.
- (2) When returning the product to be repaired, please send it to the head office with the symptoms of the malfunction as well.
- (3) All DAQ SYSTEM products have a one-year warranty.
  - The warranty period is counted from the date the product is shipped from DAQ SYSTEM.
  - Peripherals and third-party products not manufactured by DAQ SYSTEM are covered by the manufacturer's warranty.
  - If repair is required, please contact the contact points below.
- (4) Even during the free repair warranty period, paid repairs are made in the following cases.
  - ① Failure or damage caused by not following the user's manual
  - ② Failure or damage caused by customer negligence during product transportation after purchase
  - ③ Natural phenomena such as fire, earthquake, flood, lightning, pollution, etc. or power supply exceeding the recommended range malfunction or damage
  - ④ Failures caused by inappropriate storage environment (eg, high temperature, high humidity, volatile chemicals, etc.) damaged
  - ⑤ Failure or damage due to unreasonable repair or modification
  - ⑥ Products whose serial number has been changed or intentionally removed
  - ⑦ In the event that DAQ SYSTEM determines that it is the customer's negligence for other reasons
- (5) The customer must bear the shipping cost of returning the repaired product to DAQ SYSTEM.
- (6) The manufacturer is not responsible for any problems caused by incorrect use regardless of our Warranty provisions.

## References

1. PCI System Architecture -- MindShare Inc.
2. PCI Local Bus Specification -- PCI-SIG
3. AN201 How to build application using APIs -- DAQ system
4. AN242 PCI-DIO01 API Programming -- DAQ system



# MEMO

## Contact Point

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