

# PCI-DIO12

## User Manual

Version 1.2



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# 1. Introduction

PCI-DIO12 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, it has 128MBytes DDR SDRAM as data storage space and is suitable for industrial digital control that performs 400Mbytes/s high-speed data transfer.

## 1-1 Product Features

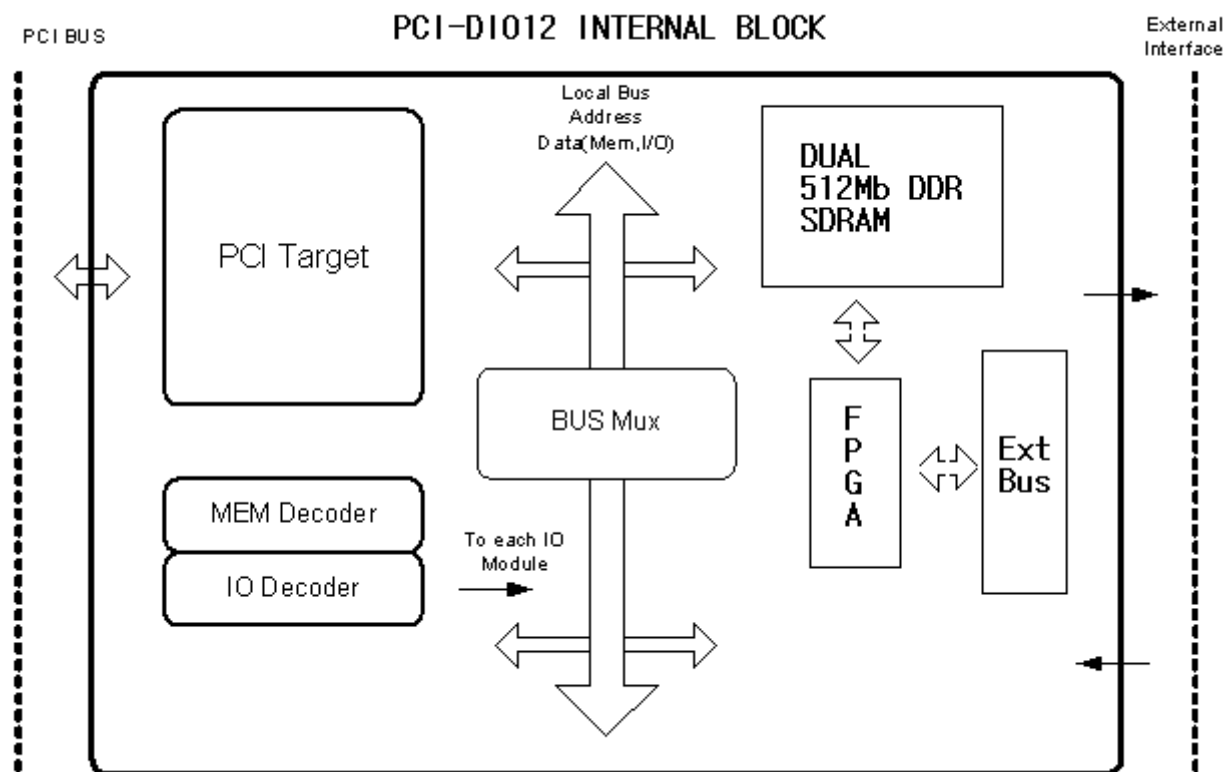
Items	Description	Remark
<b>Hardware</b>		
PC Interface	PCI 32bit/33Mhz	
Operation Power	+5VDC/ Max 1A	
I/O Port	VHDCI68 x2	MINI MDR Type
Feature	16/16 or 32/32	128MB DDR SDRAM Data transfer rate up to 400Mbytes/sec
Vout level	1.25 ~ 3.6V (Max 500mA)	
Output Port Current	Max 12mA each port	
Simultaneous 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	160mm X 100mm	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 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 Data transfer rate up to 400Mb/s
PCI-MOT01	24/24 (Isolated)		1 Channel PWM, 2 Channel Encoder, 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 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 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 12Mbps
USB-MULTI	2/None		Isolated Input/Output 16bit Counter In & Timer Out
USB-PWM10	6/8(Isolated)		4 Channel Triggered PWM outputs

## 2. PCI-DIO12 Block Diagram

PCI-DIO12 has a digital 32 channel port and 128MByte of memory and is configured to interface with the outside quickly (400MBytes/sec). All control of the PCI-DIO12 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.



[Figure 2-1. PCI-DIO12 Internal Block Diagram]

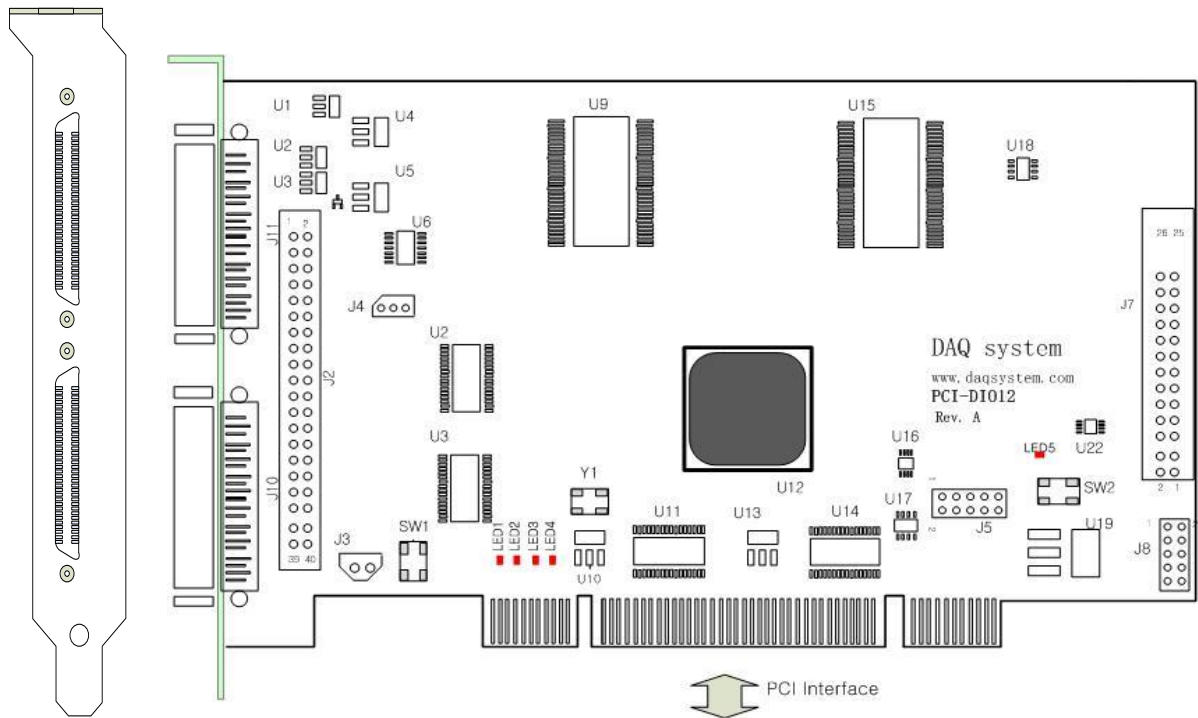
## GENERAL DESCRIPTION

- ◆ PCI Specification V2.2 32bit 33MHz 5V/3.3V Compatible
- ◆ Full 33Mhz burst read/write operation
- ◆ Data transfer rate up to 400Mbytes/sec
- ◆ Bus-mastering DMA with scatter-gather technology
- ◆ On board two 64Mbytes DDR SDRAM
- ◆ Programmable interface voltage level
- ◆ Compact, half-size PCB

### 3. PCI-DIO12 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-DIO12 Layout]

There are 5 LEDs on the board, and the description of each is as follows.

**LED1** : Lights up when there is a PCI bus request.

**LED2** : Lights when PCI bus request is acknowledged.

**LED3** : Lights up when DDR Memory is ready.

**LED4** : Lights up when data transmission starts.

**LED5** : Lights up when the board finishes configuration and ready for operation.

## 3-2 Device Features

**(1) VHDCI68 connector: J10, J11**

J10 --- DIO 28ch / Vio (Max 500mA)

J11 --- DIO 4ch / 1trigger In /1trigger Out

**(2) FPGA : U12**

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

**(3) PCI Chipset : U11, U13**

PCI Signal Control

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

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

Each port Max 12mA current out

**(5) DDR SDRAM : U9, U15**

Dual 64MByte Total 128Mbytes Data Memory

**(6) Regulator : U1, U2, U3, U4, U5, U13, U19**

It supplies the power used by the board.

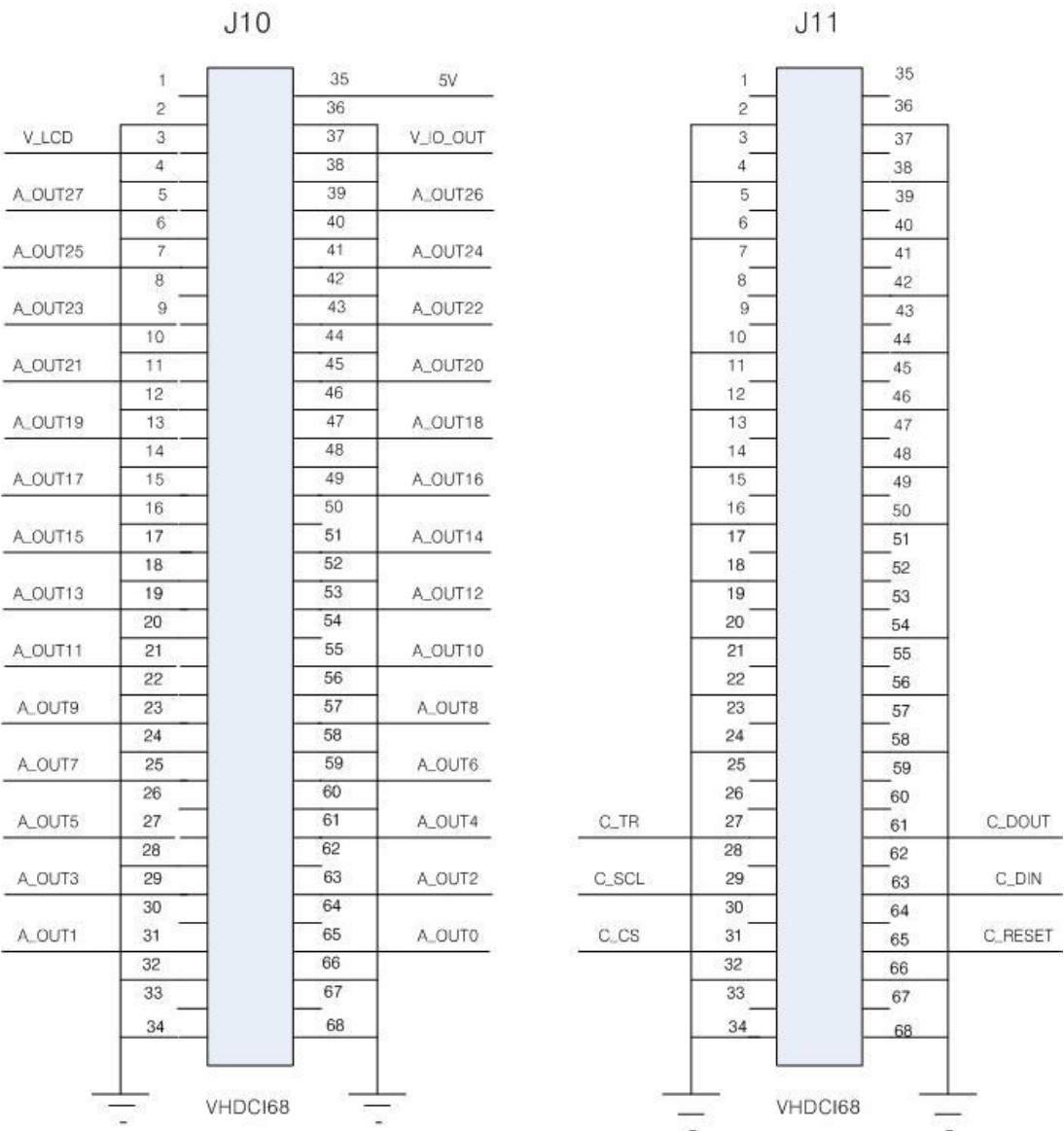


4. Connector Pin Map

This section describes connectors and jumpers used in PCI-DIO12. The main connectors are the VHDCI (Very High Density Cable Interconnect) 68pin connector J10 and J11 for external digital input/output connection, and the 40pin Box Header J2 connector for checking the signal of the VHDCI connector.

4-1 VHDCI68 Connector (J10, J11)

The 68-pin VHDCI connector fixed to the standard PCI bracket is used for digital input/output signal line and trigger in/out connection, and the signals assigned to each pin are as follows [Table 1].



[Figure 4-1. PCI-DIO12 VHDCI68 J10, J11 Connector]

[Table 1. PCI-DIO12 J10 Connector]

Pin No.	Name	Description	Remark
35	+5V	5V DC PCI Power	Power
3	V_LCD	LCD Power	2.8V Output
65	A_OUT0	A-port Digital IO Signal 0	
31	A_OUT1	A-port Digital IO Signal 1	
63	A_OUT2	A-port Digital IO Signal 2	
29	A_OUT3	A-port Digital IO Signal 3	
61	A_OUT4	A-port Digital IO Signal 4	
27	A_OUT5	A-port Digital IO Signal 5	
59	A_OUT6	A-port Digital IO Signal 6	
25	A_OUT7	A-port Digital IO Signal 7	
57	A_OUT8	A-port Digital IO Signal 8	
23	A_OUT9	A-port Digital IO Signal 9	
55	A_OUT10	A-port Digital IO Signal 10	
21	A_OUT11	A-port Digital IO Signal 11	
53	A_OUT12	A-port Digital IO Signal 12	
19	A_OUT13	A-port Digital IO Signal 13	
51	A_OUT14	A-port Digital IO Signal 14	
17	A_OUT15	A-port Digital IO Signal 15	
49	A_OUT16	A-port Digital IO Signal 16	
15	A_OUT17	A-port Digital IO Signal 17	
47	A_OUT18	A-port Digital IO 신호 18	
13	A_OUT19	A-port Digital IO Signal 19	
45	A_OUT20	A-port Digital IO Signal 20	
11	A_OUT21	A-port Digital IO Signal 21	
43	A_OUT22	A-port Digital IO Signal 22	
9	A_OUT23	A-port Digital IO Signal 23	
41	A_OUT24	A-port Digital IO Signal 24	
7	A_OUT25	A-port Digital IO Signal 25	
39	A_OUT26	A-port Digital IO Signal 26	
5	A_OUT27	A-port Digital IO Signal 27	
37	V_IO	IO Power	1.8V Output
	GND	2,4,6,10,12,14,16,18,20,22,24,28,32,34,36,38,40, 42,44,46,48,50,54,56,58,62,66,68	Ground
	N.C	1,8,26,30,33,52,60,64,67	No Connection

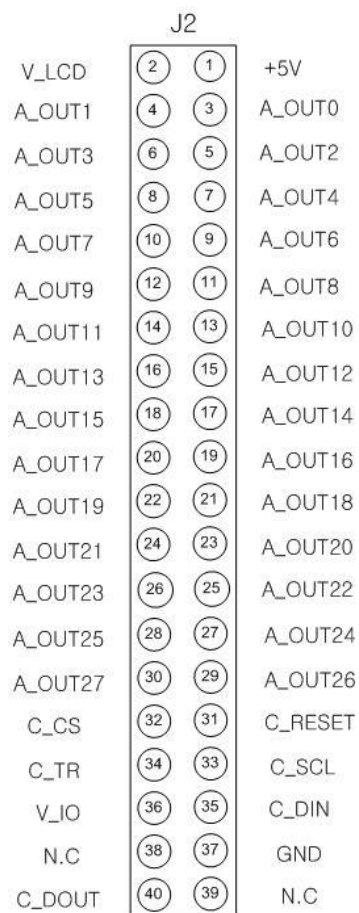
[Table 2. PCI-DIO12 J11 Connector]

Pin No.	Name	Description	Remark
65	C_RESET	A-port Digital IO Signal 28 / C-port Reset	

31	C_CS	A-port Digital IO Signal 29 / C-port Chip Select	
29	C_SCL	A-port Digital IO Signal 30 / C-port Serial Clock	
27	C_TR	A-port Digital IO Signal 31 / C-port Translation	
63	C_DIN	Trigger In	
61	C_DOUT	Trigger Out	
	GND	2,4,6,10,12,14,16,18,20,22,24,28,32,34,36,40, 42,44,46,48,50,54,56,58,62,66,68	Ground
	N.C	1,3,5,7,8,9,11,13,15,17,19,21,23,25,26,27,30, 33,35,37,39,41,43,45,47,48,51,52,53,55,57,59, 60,64,67	No Connection

## 4-2 J2 Connector

PCI-DIO12 allocated a TP pin array that can attach a 40-pin (20x2, 2.54mm pitch) header connector (JP1) on the PCB to check the signal of the J10/J11 connector. Refer to [Table 1] for signal characteristics.



[Figure 4-2. PCI-DIO12 J2 Connector]

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

This is a 3.3V external DC power connector. This is the power used when installing the FPGA and is not normally used.

### 4-4 J5 Connector

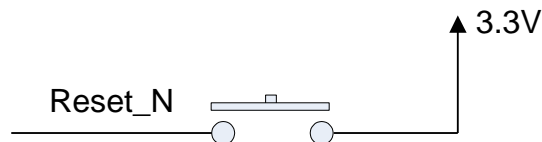
J5 is used when writing FPGA program on the board to U12 EPCS16 (16Mbit flash memory). Do not use when operating the board normally.

### 4-5 J8 Connector

J4 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.

### 4-6 SW1

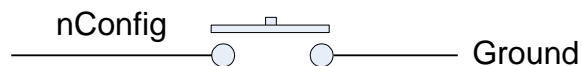
It is a system reset switch that is High Active (3.3V).



[Figure 4-3. SW1 Switch]

### 4-7 SW2

Low Active인 FPGA Restart Configuration Switch이다.



[Figure 4-4 SW2 Switch]

## 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-DIO12 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-DIO12 board in the PC to an empty PCI slot.
- When you turn on the power, a new hardware search window will appear.

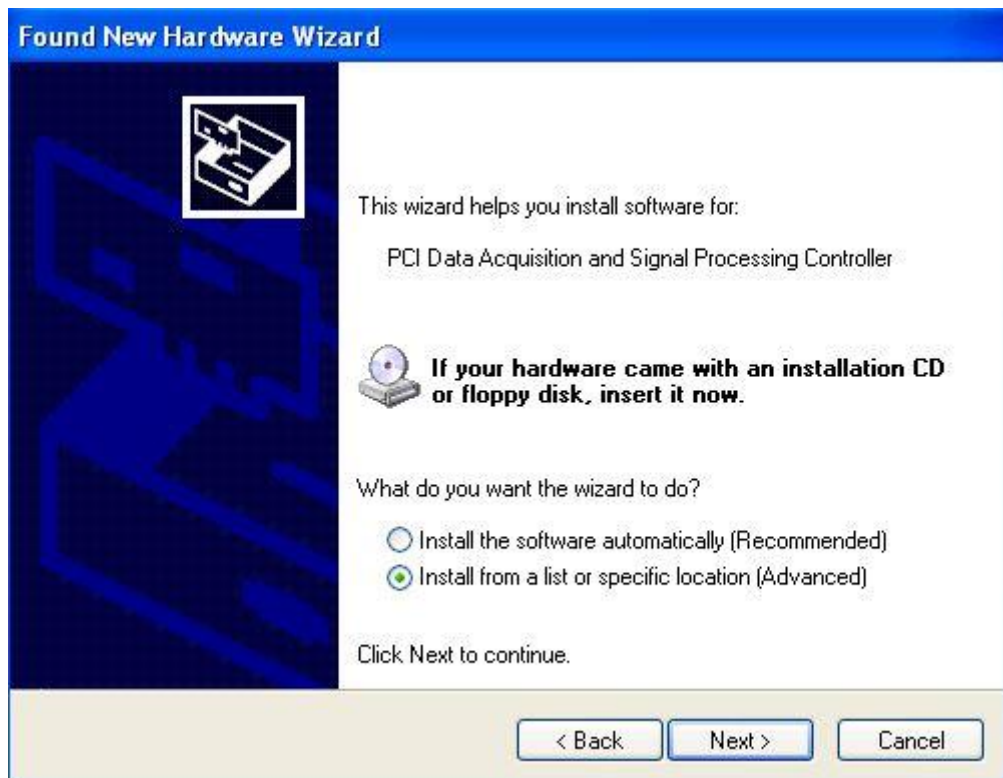
## 5-2 Driver Installation

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

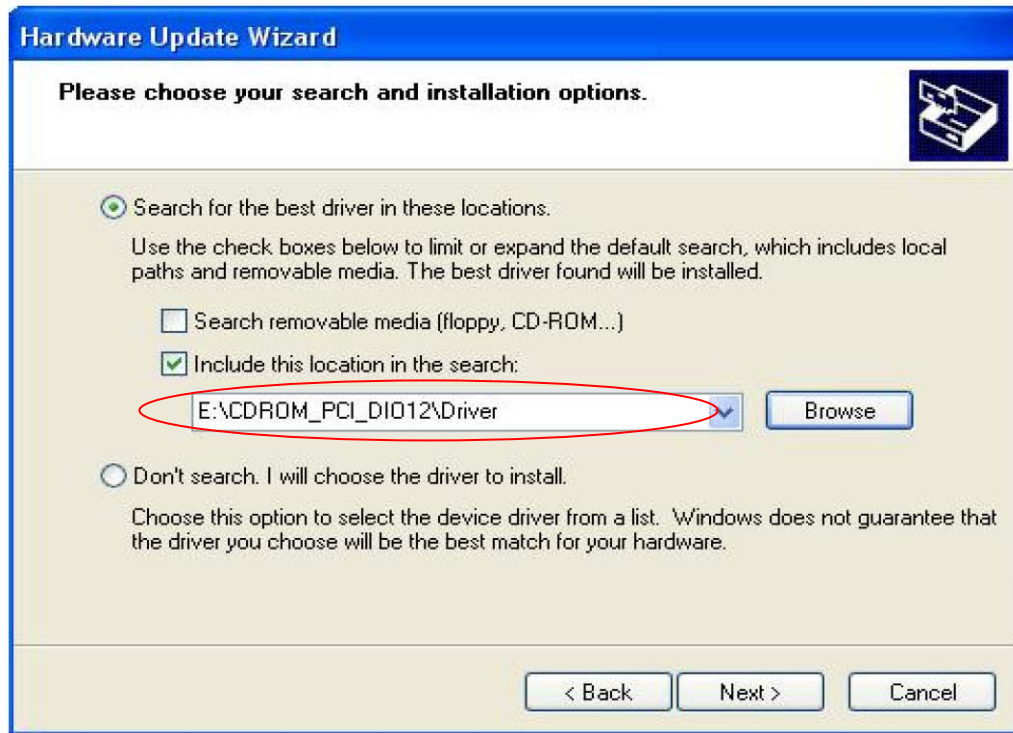
The installation procedure is as follows, and unless otherwise specified, it is explained based on Windows XP.

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-DIO12 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-DIO12 connects to PCI Card Port. After that you can show the below picture of "Found New Hardware Wizard" window.

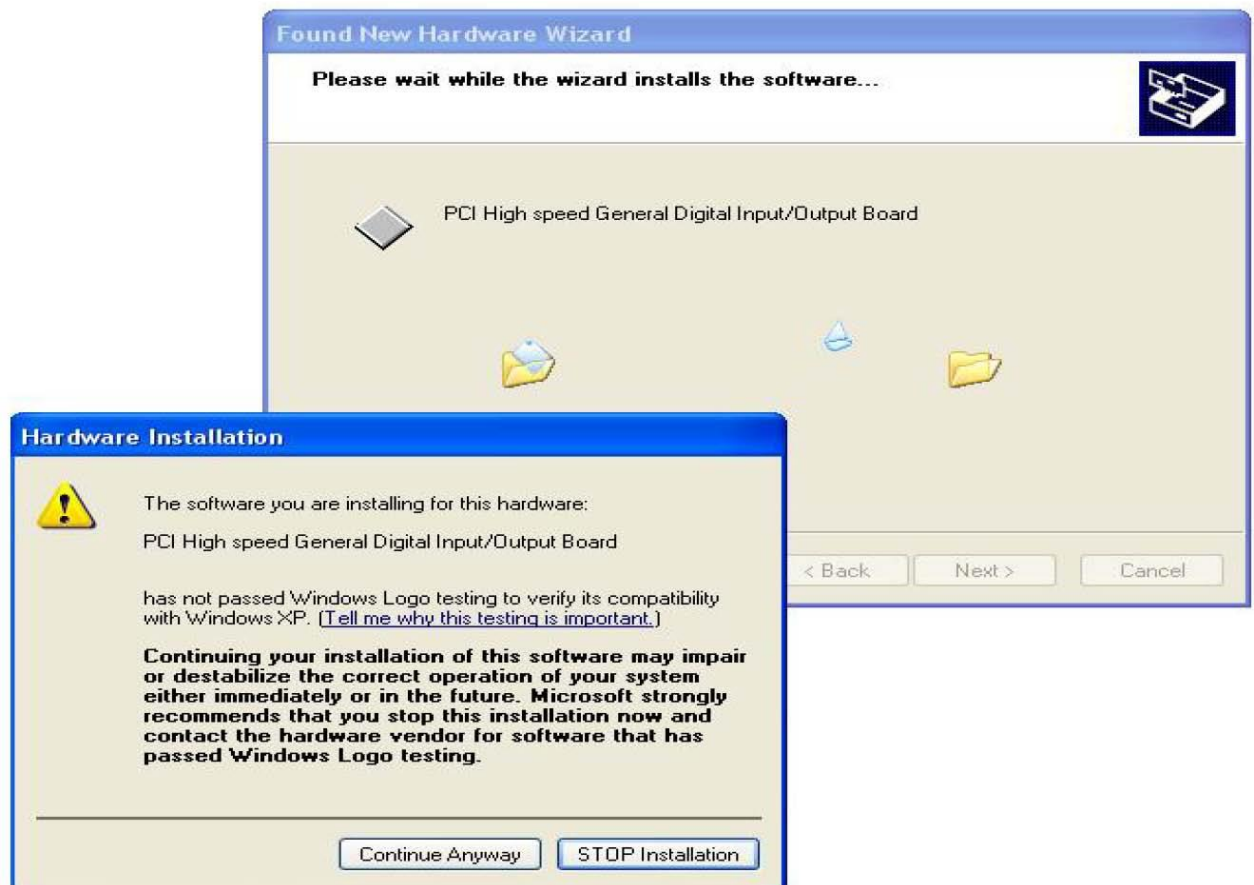


If new hardware is found, Wizard will ask you to install the corresponding driver. For installation of the driver, select the item "Install from a list or specific location (Advanced)" and click "Next" as in the figure.



The driver folder includes a file of "**pci\_dio11.inf**" and "**pci\_dio11.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.

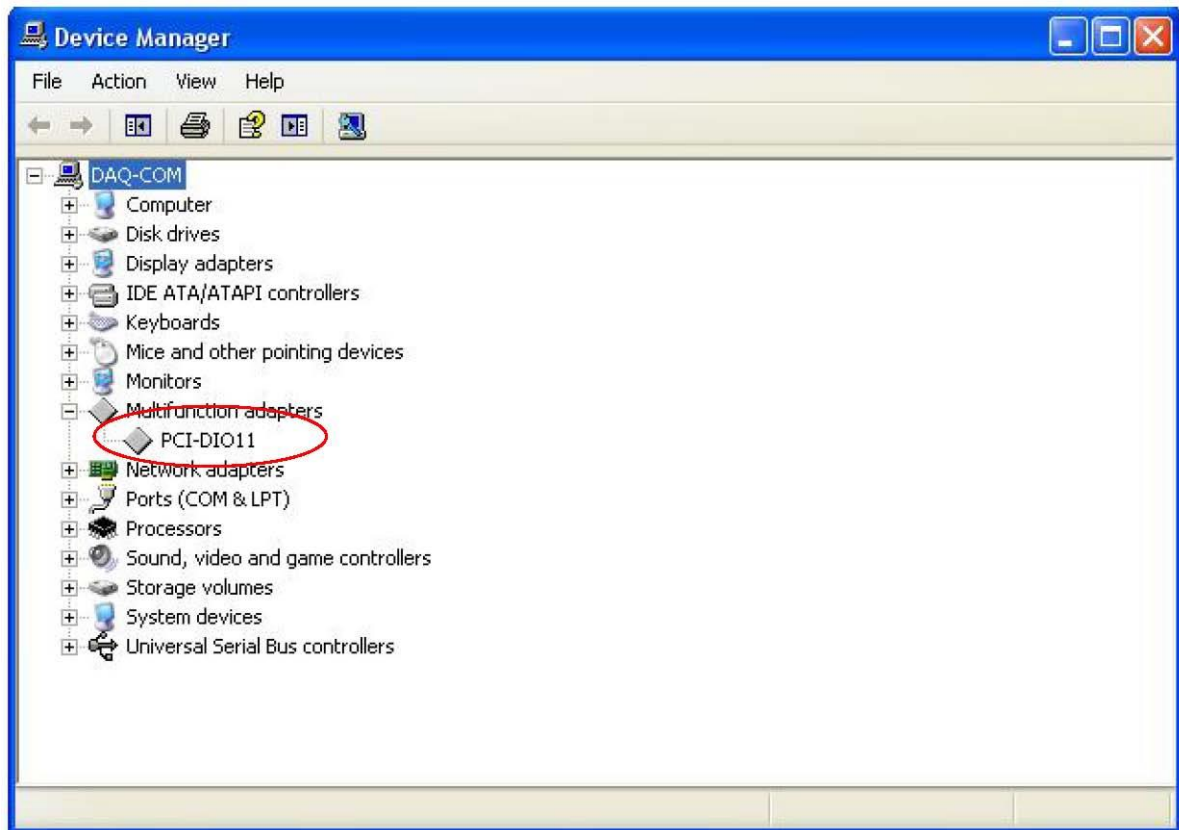


If the installation is completely finished, you can show below message window.





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-DIO11**]



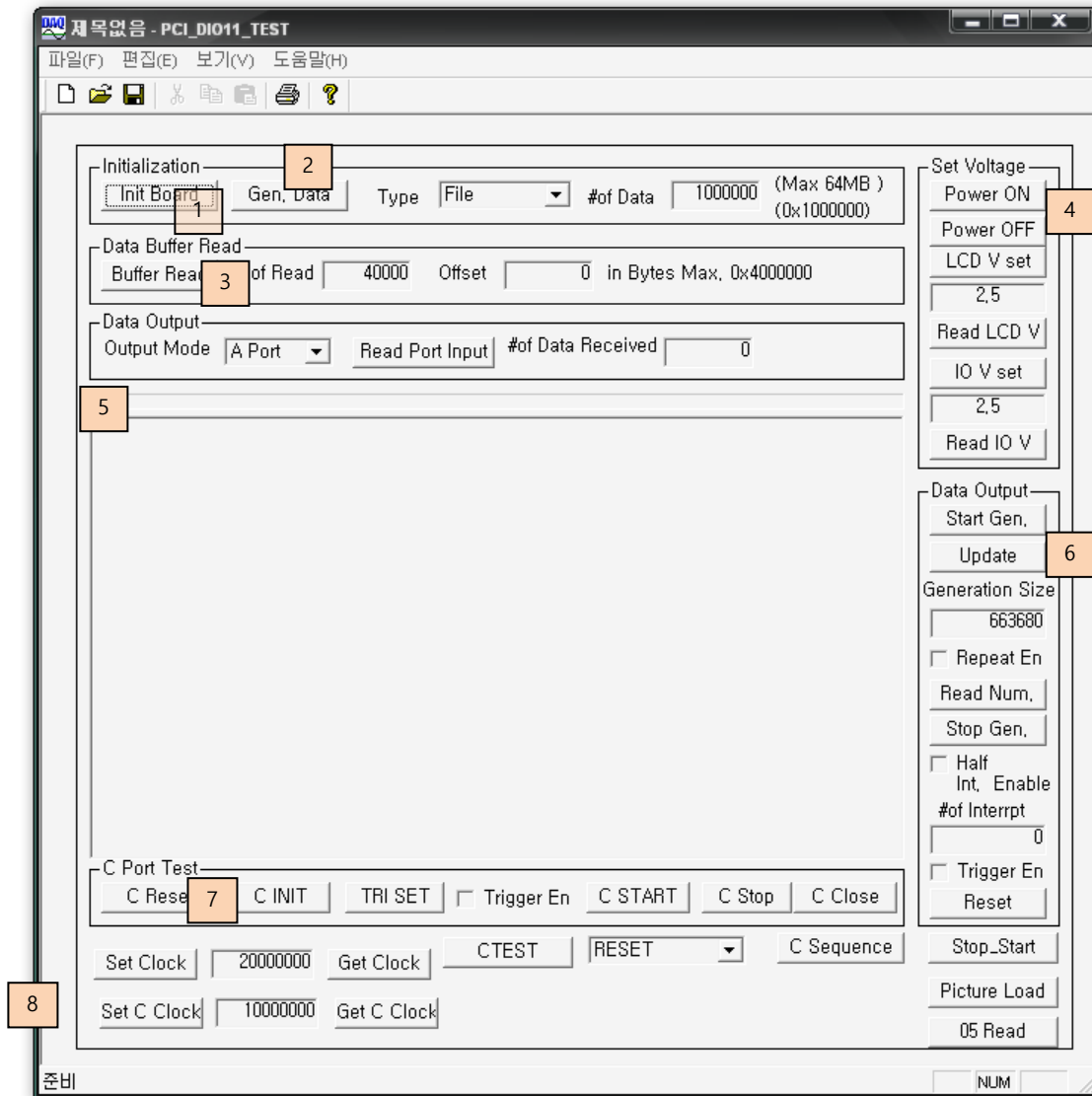
If you can see the "PCI-DIO11" (*The PCI-DIO12 uses a same driver with PCI-DIO11 because of compatibility*) at Multifunction Adaptors, the driver installation is to have been over.  
(Check the red circle)

**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\_DIO11\_TEST.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 simply, so the user can modify it and use it.



[Figure 6-1. Sample Program "PCI\_DIO11\_TEST.exe"]

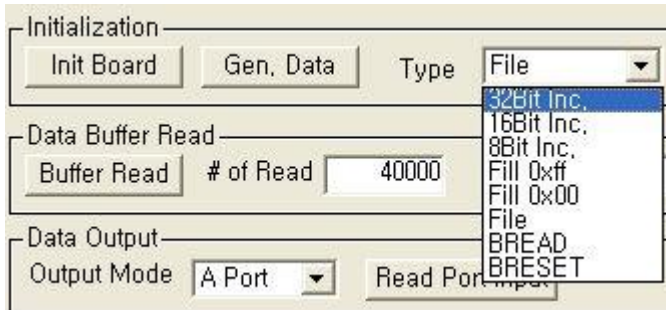
API (Application Programming Interface) is required to use the above sample program. API is provided in the form of "DLL", and import library and header file are required for compilation. In order to run the sample program normally, the API DLL (PCI\_DIO11.DLL) must be in the folder of the executable file, or in the Windows system folder or the folder specified by the Path environment variable.

**(1) 'Init Board' Button**

When executing a program with the board initialization button, it should be done first.

**(2) 'Get data' Button**

Data is loaded into the PC according to the value set in the '**Type**' box.



32Bit Inc. --- Write the value incremented by 1 for every 32 bits to 0x0 ~ 0x1000000.

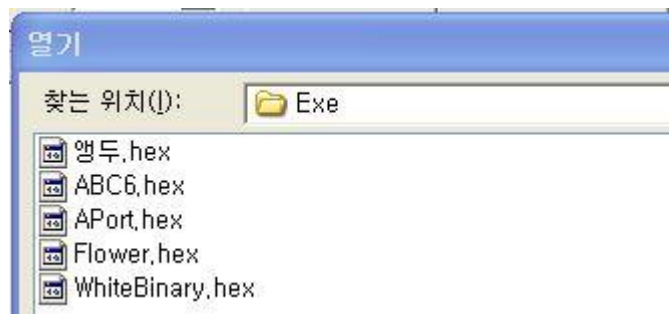
16Bit Inc --- Writes a value incremented by 1 for every 16bit to 0x0 ~ 0x1000000.

8Bit Inc --- Writes a value incremented by 1 for every 8bit to 0x0 ~ 0x1000000.

Full 0xff --- Write 'ff' value to all buffers.

Full 0x00 --- Write '00' to all buffers.

File --- Write the following \*.hex file in the provided CDROM\WExe folder.



BREAD --- Writes the set value up to 0xf7.

BRESET --- Writes the set value up to 0x5f.

**(3) 'Buffer Read' Button**

Read data buffer value.

**(4) 'Power On/Off' Button**

You can set the power according to the value of the 'LCD V set' or 'IO V set' box below and read the set power value.

The initial value is 2.8V for 'LCD V set'.

'IO V set' is 1.8V.

(5) '**Output Mode**'

Select of A, B, C, reserved Output mode.

(6) '**Data Output**'

Data Output or update

(7) '**C Port Test**'

Test a specific mode (C port) with special specifications.

(8) '**Clock Setting**'

Out clock setting with special specifications.

## 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-DIO12 API Programming -- DAQ system

# MEMO

## Contact Point

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