

PCI-PWM02

User Manual

Version 1.4



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1. Introduction

PCI-PWM02 is a board with 4 channels of PWM (Pulse Width Modulation), isolated 6-bit digital input, and 12-bit digital output, which is perfectly compatible with industrial PCs and uses a 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.

➤ 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

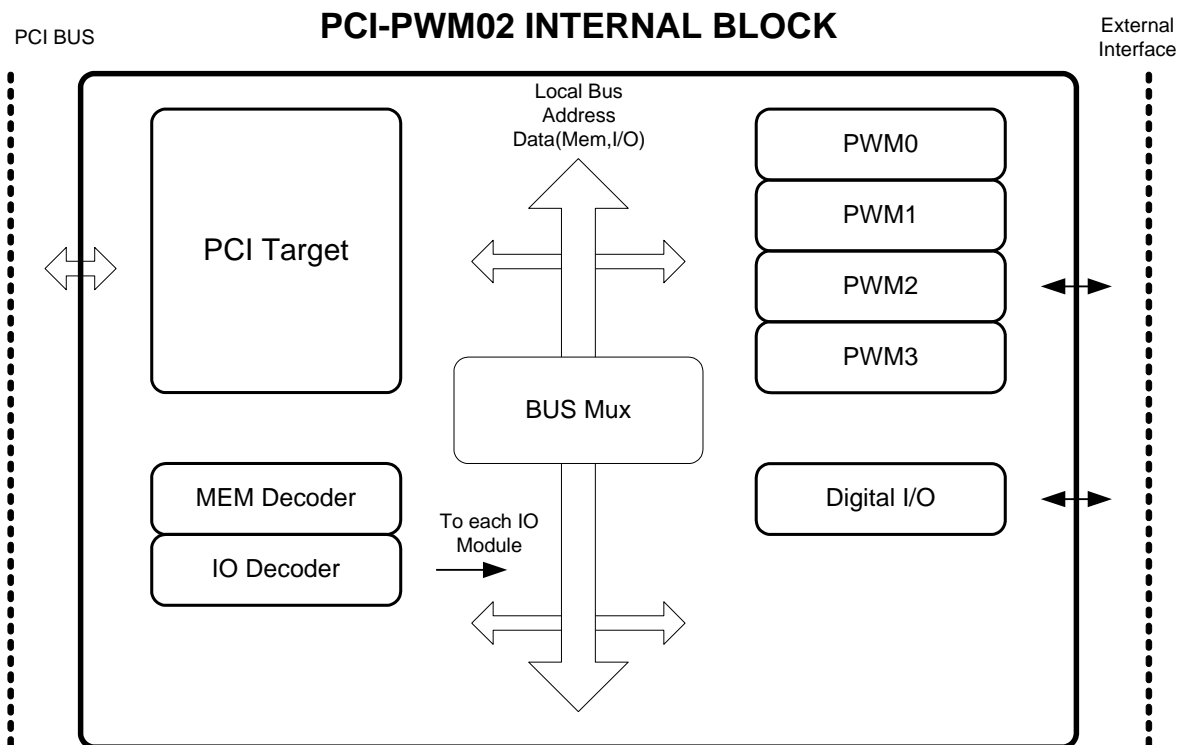
1-1 Product Features

Items	Description	Remark
Hardware		
PC Interface	PCI 32bit/33Mhz	
Operation Power	+5VDC at 250mA typical	
I/O Port	D-Sub37	Plug Type
Feature	4CH PWM, 6/12bit Digital I/O	
PWM Output	Number of Channels : 4 Number of Trigger Input : 4 Resolution : 1us Timer : 22bit Output Level : 12V(External)	
Isolated Digital Input	Number of Channels : 6 Number of Common Input : 1 Maximum Input Range(Non-polarity) : 24V Digital Logic Levels : Input High level 5 ~ 24V Input Low voltage 0 ~ 1.5V Input Resistance : 4.7Kohm@1.2W Isolation Voltage : 2500Vrms Isolated input voltage up to 24V Interrupt Sources : Programmed I/O	
Isolated Digital Output	Number of Channels : 12 Output type : Open collector Supply Voltage : 5V PCI or Isolated 5V(inside equipped) Isolation Voltage : 5000Vrms Data Transfer : Programmed I/O	
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
Software		
OS	Windows 2000/XP/7/8/10 (32/64bit)	
API	Windows Client DLL API	
Development	Windows Application by User	
Support	Sample Program	VC++

2. PCI-PWM02 Block Diagram

In the case of PCI-PWM02, as shown in [Figure 1-1], it is composed of 4 digital PWM (Pulse Width Modulation) control blocks to interface with the outside.

PWM is widely used to control the average voltage by changing the duty ratio within a certain period to control the speed of DC motors or to control the amount of light of lighting products such as LEDs.



[Figure 2-1. PCI-PWM02 Internal Block Diagram]

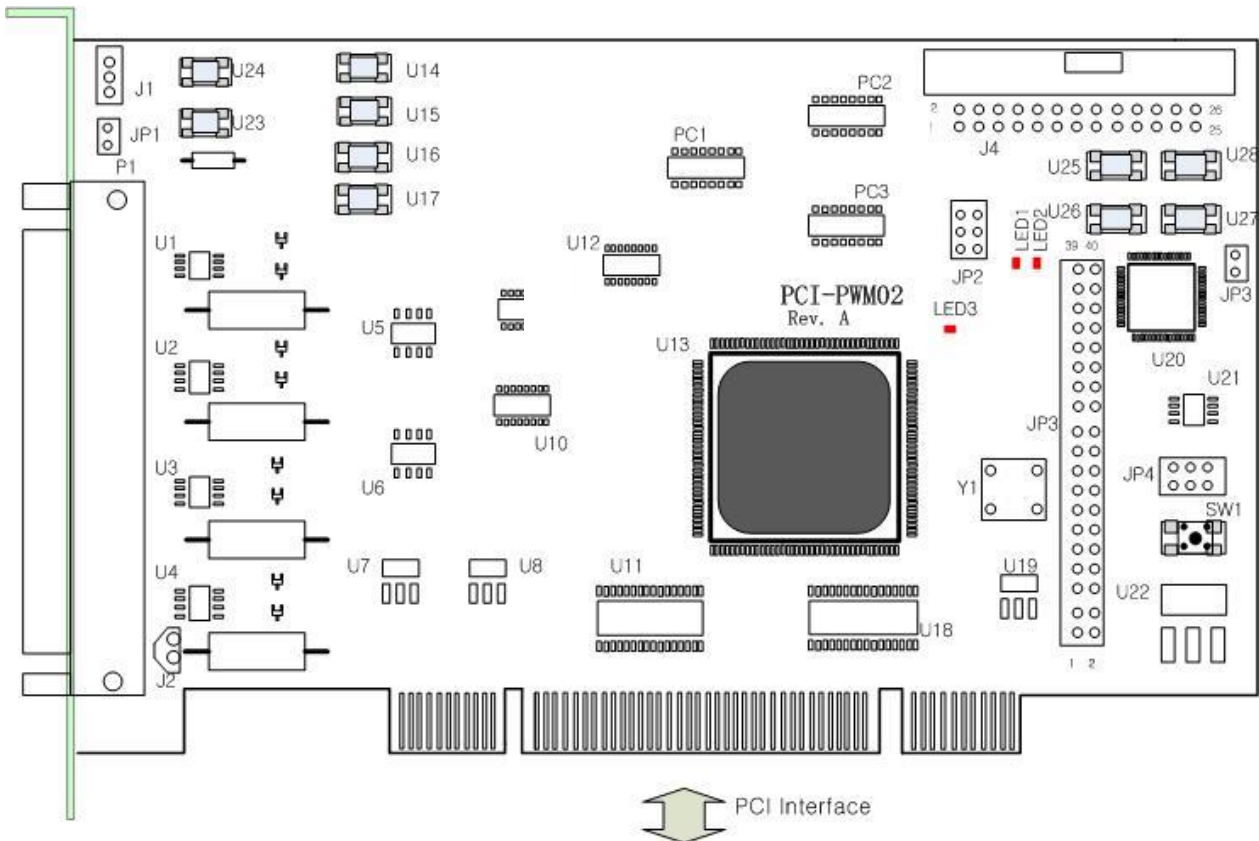
GENERAL DESCRIPTION

- ◆ PCI 32-bit, 33MHz 5/3.3V compatible target board
- ◆ 6-bit digital input port
- ◆ 12-bit digital output
- ◆ 4-port Triggered PWM Output
- ◆ 3.3V COMOS and TTL logic input, 3.3V CMOS logic output level

3. PCI-PWM02 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-PWM02 Layout]

3-2 Device Features

(1) **FPGA : U13**

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

(2) **Photo-coupler : PC1 ~ PC3, U14 ~ U17, U23 ~ U28**

Photo-coupler chipset.

(3) **Regulator : U7, U8, U9, U22**

It supplies the power used by the board.

(4) **PCI Chipset : U11, U18**

PCI Signal Control

(5) **CPLD : U20**

In-system programming for general purpose logic integration is provided.

(6) **Oscillator : Y1**

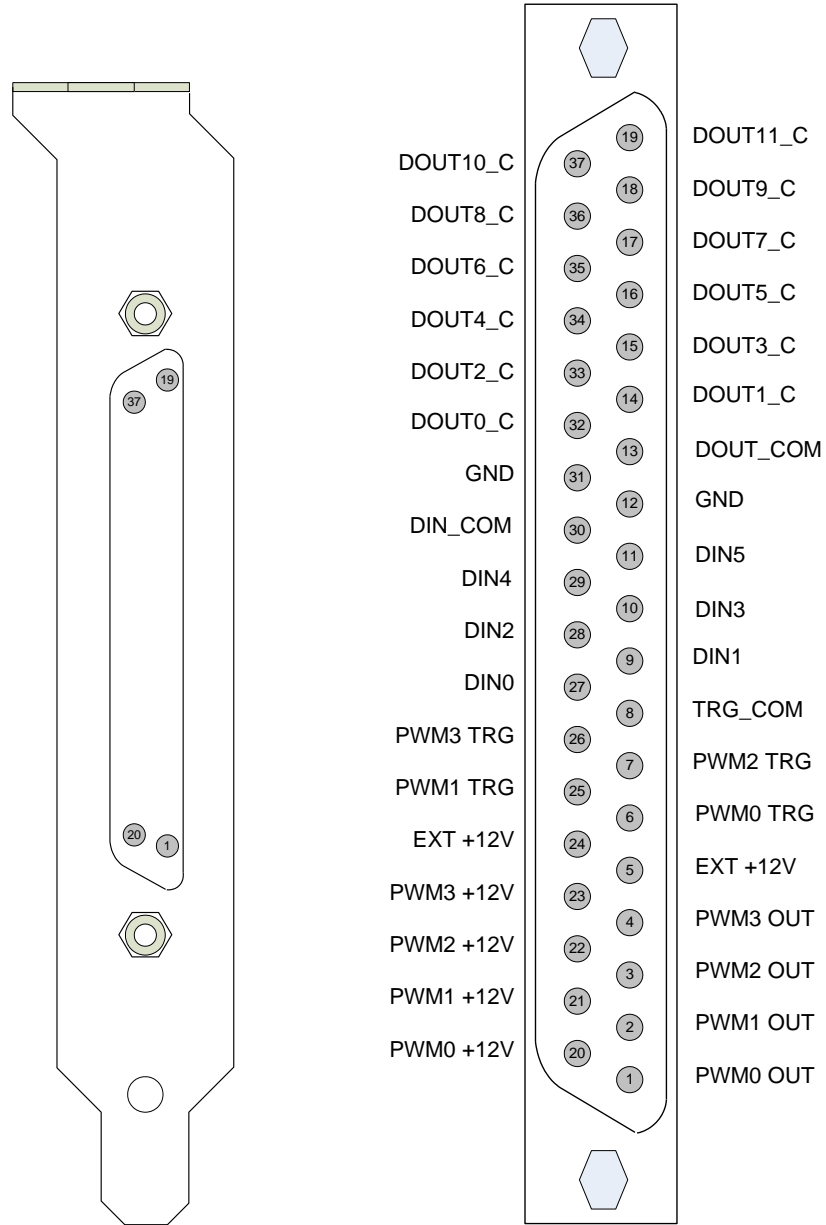
It supplies 40MHz to the board.

(7) **N-Channel Field Effect Transistor : U1 ~ U4**

PWM Output Stage.

3-3 Connector Pin Map

3-3-1 DSub-37Pin (P1)



[Figure 3-1. P1 Connector

[Table 1. PCI-PWM02 P1 Connector]

Pin No.	Pin Name	Description	Remark
1	PWM0 OUT	PWM Channel 0 Output	
2	PWM1 OUT	PWM Channel 1 Output	
3	PWM2 OUT	PWM Channel 2 Output	
4	PWM3 OUT	PWM Channel 3 Output	
5	EXT +12V	External Power +12V Input	
6	PWM0 TRG	PWM Channel 0 Trigger Input	
7	PWM2 TRG	PWM Channel 2 Trigger Input	
8	TRG_COM	Trigger Input Common	
9	DIN1	Digital Input 1	
10	DIN3	Digital input 3	
11	DIN5	Digital input 5	
12	GND	Power GROUND	
13	DOUT_COM	Digital Output Common	
14	DOUT1_C	Digital Output 1 Collector	
15	DOUT3_C	Digital Output 3 Collector	
16	DOUT5_C	Digital Output 5 Collector	
17	DOUT7_C	Digital Output 7 Collector	
18	DOUT9_C	Digital Output 9 Collector	
19	DOUT11_C	Digital Output 11 Collector	
20	PWM0 +12V	PWM Channel 0 Output +12V	
21	PWM1 +12V	PWM Channel 1 Output +12V	
22	PWM2 +12V	PWM Channel 2 Output +12V	
23	PWM3 +12V	PWM Channel 3 Output +12V	
24	EXT +12V	External Power +12V Input	
25	PWM1 TRG	PWM Channel 1 Trigger Input	
26	PWM3 TRG	PWM Channel 3 Trigger Input	
27	DIN0	Digital input 0	
28	DIN2	Digital input 2	
29	DIN4	Digital input 4	
30	DIN_COM	Digital input Common	
31	GND	Power GROUND	
32	DOUT0_C	Digital Output 0 Collector	
33	DOUT2_C	Digital Output 2 Collector	
34	DOUT4_C	Digital Output 4 Collector	
35	DOUT6_C	Digital Output 6 Collector	
36	DOUT8_C	Digital Output 8 Collector	
37	DOUT10_C	Digital Output 10 Collector	

3-3-2 Multi Board Setup

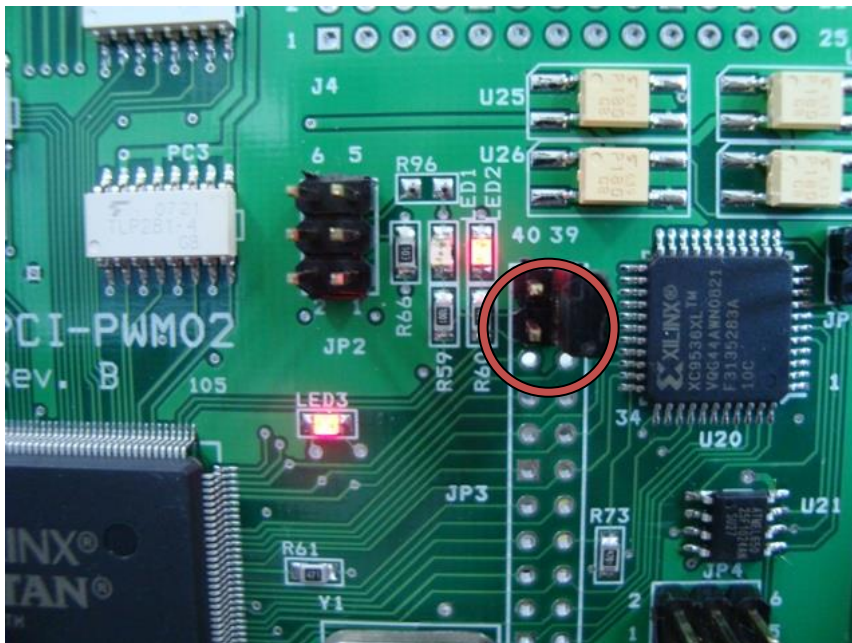
PCI_PWM02 board can use a total of 4 boards together in one system. Each board installed in the system is assigned a number and can be used by selecting a board from the API.

However, the board number is determined by the jumper setting of JP3.

Board No.	JP3 Setup	
	PIN38 <-> PIN40	PIN37 <-> PIN39
0	OPEN	OPEN
1	OPEN	SHORT
2	SHORT	OPEN
3	SHORT	SHORT

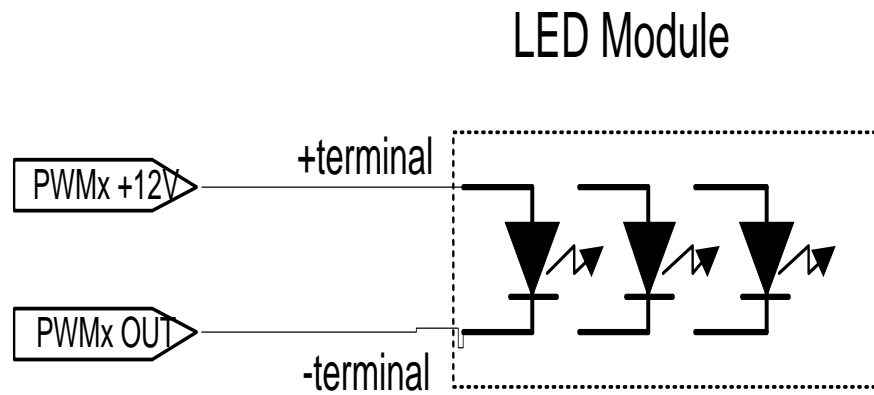
The figure below shows an example of setting the board number to 1.

In the figure below, LED1 turns on when PIN38 and PIN40 are shorted, and LED2 turns on when PIN37 and PIN39 are shorted, it lights up to indicate the selected board number. (See red circle)



4. Circuit Connection

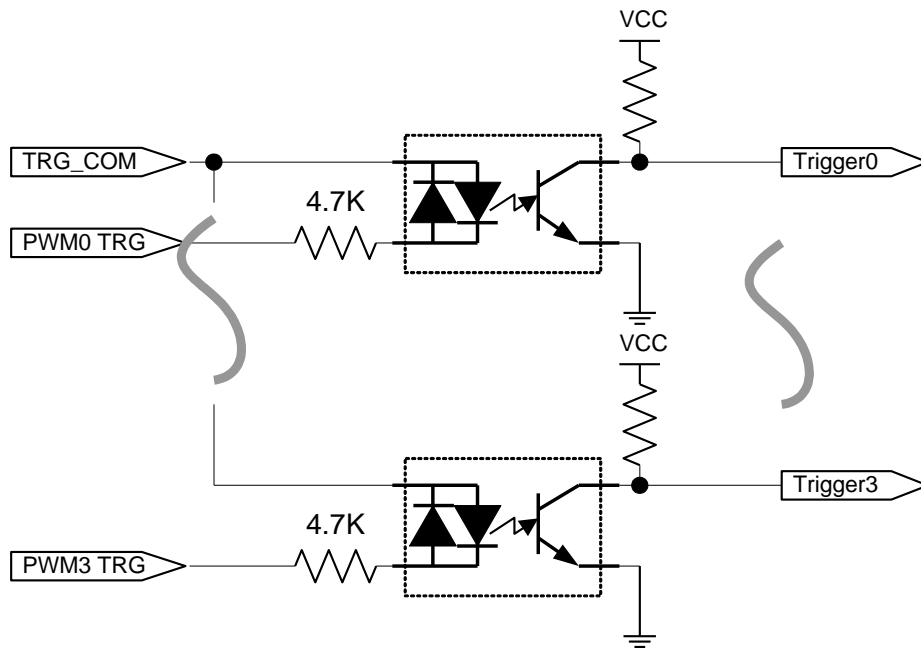
4-1 PWM Output Circuit Connection



[Figure 4-1. PWM Output Connection Circuit]

The above figure shows the figure where the PWM output is connected to the LED module. Connect +12V of PWM0-4 to the "+" side of the LED module, and connect PWM0-4 OUT to the "-" side of the LED module.

4-2 Trigger Input Circuit



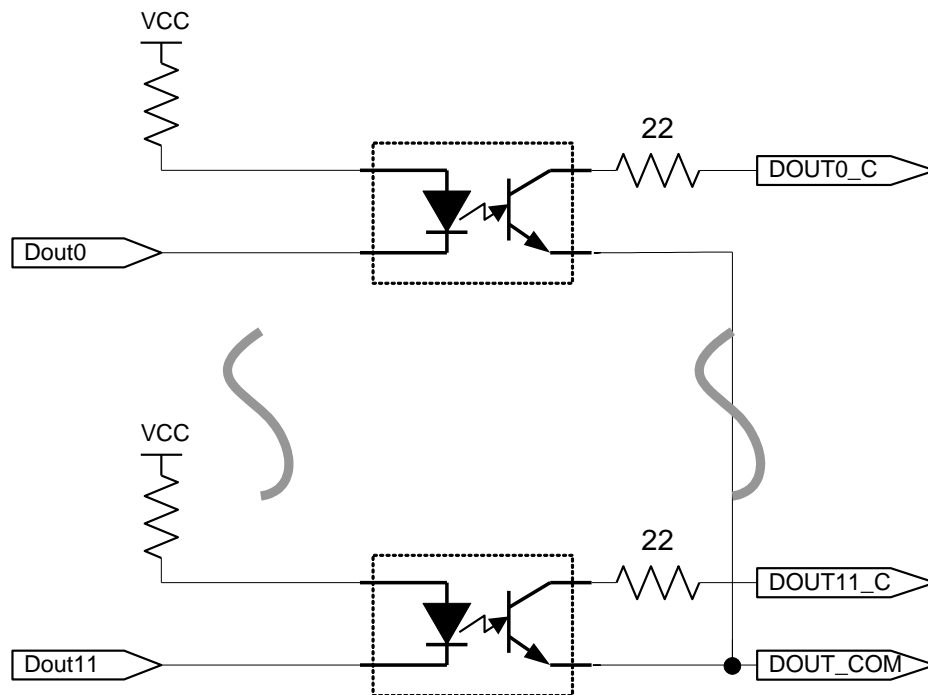
[Figure 4-2. Trigger Input Circuit]

The above figure shows a circuit that receives a trigger input when the output of each PWM is operated in trigger mode.

There are A/B trigger inputs, and if input 12V to 24V is input to each pin, trigger operation is made.

There is no power polarity of the input, so there is no need to distinguish +/-.

4-3 Digital Output Circuit

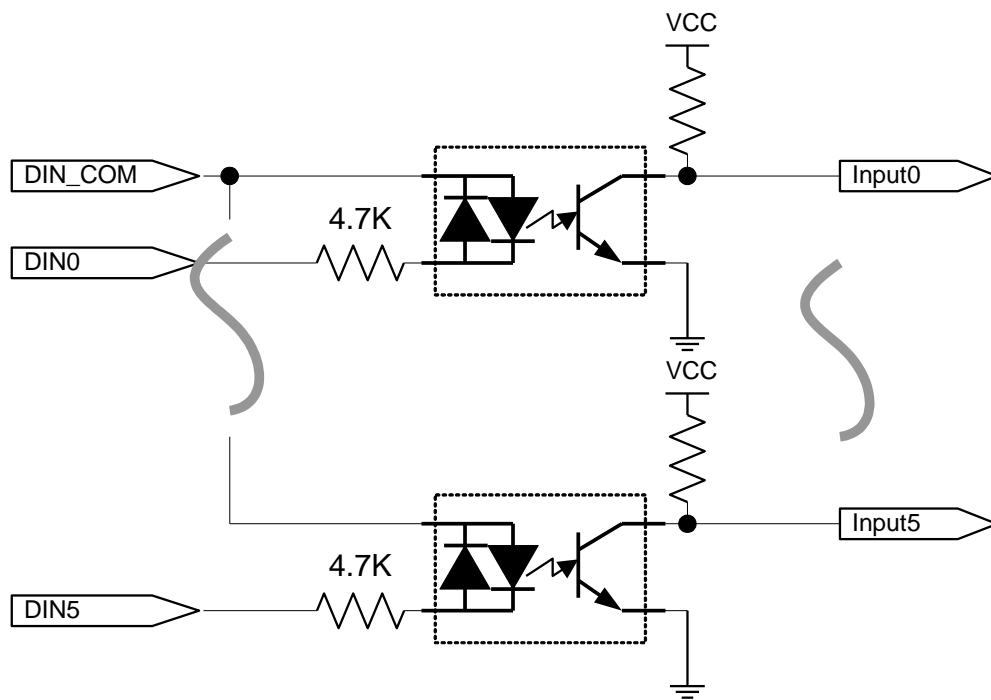


[Figure 4-3. Isolated Digital Output Circuit]

As shown in the figure, each digital output is output insulated by a photo coupler. Each output has overcurrent protection with a resistance of 22 ohms, and a common output terminal is used.

In general, in the case of the common output terminal DOUT_COM, it is connected to the external GROUND and used as an open-collector output.

4-4 Digital Input Circuit



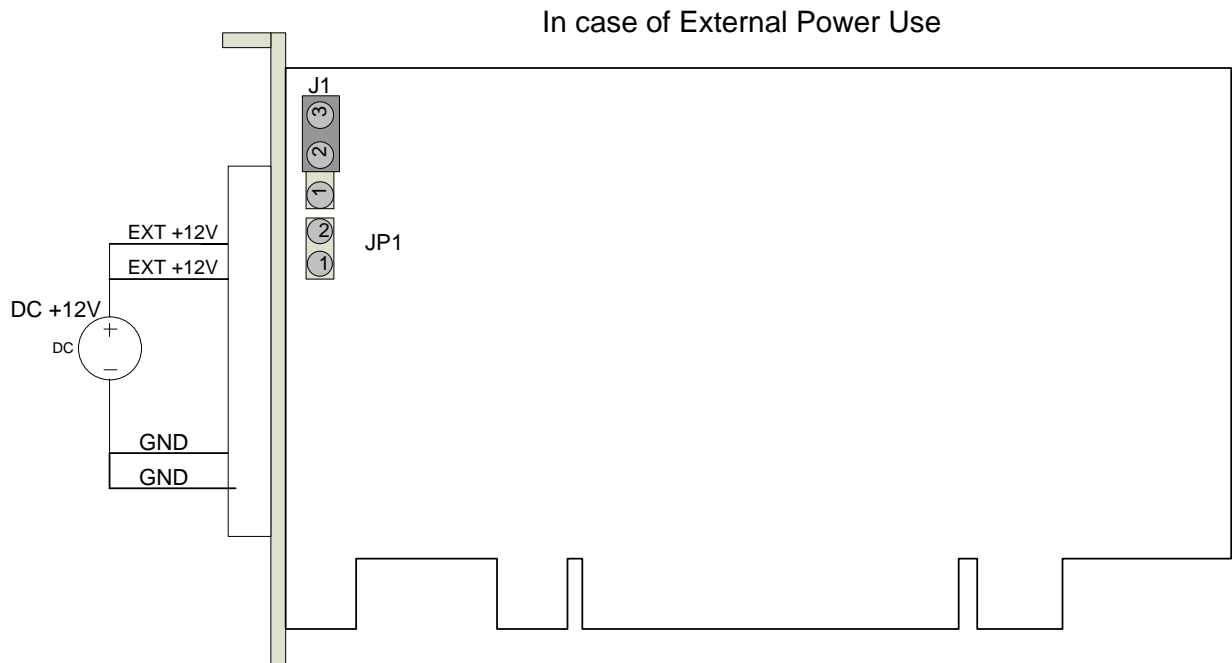
[Figure 4-4. Isolated Digital Input Circuit]

In the figure, each digital input is insulated by a photo coupler, and the input has a common input terminal and each input terminal. Each input has a 4.7K ohm resistor connected in series to accept 12V and 24V inputs.

Since there is no input polarity, "+" voltage or "-" voltage can be applied to the common terminal, and the opposite polarity to the common terminal must be input to each input.

4-5 External Connection

4-5-1 In case of External Power Use

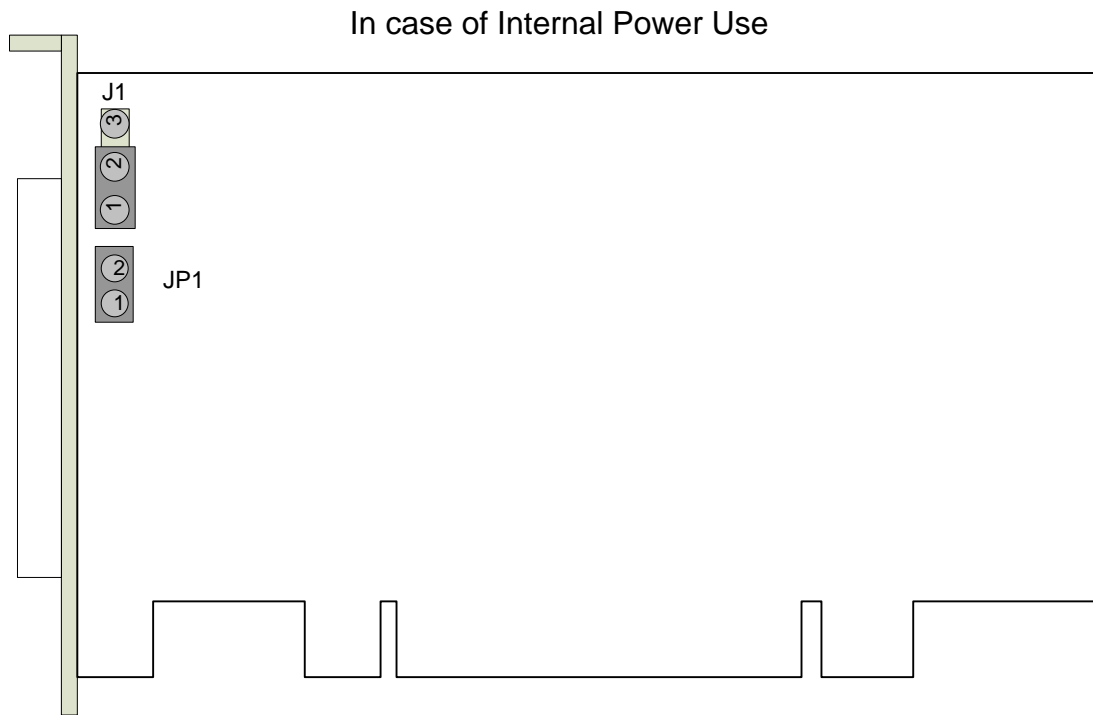


[Figure 4-5. External Connection (External Power Use)]

If the +12 power of the PC is insufficient to operate the LED module, an external power source must be used. [Figure 9] shows the wiring when using an external power source at this time. Connect external power to the connector pins "EXT +12" and "GND" pins and connect the J1 jumper on the board to 2-3.

In case of J1 jumper, 1-2 should be connected when using internal power.

4-5-2 In case of Internal Power Use



[Figure 4-6. Internal Power Use]

In case of using internal PC power (+12) use, connection shall work 1-2 jumper (J1) like [Figure 4-6]. At this time +12V gets from supply in PCI slot.

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-PWM02 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-PWM02 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-PWM02 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.

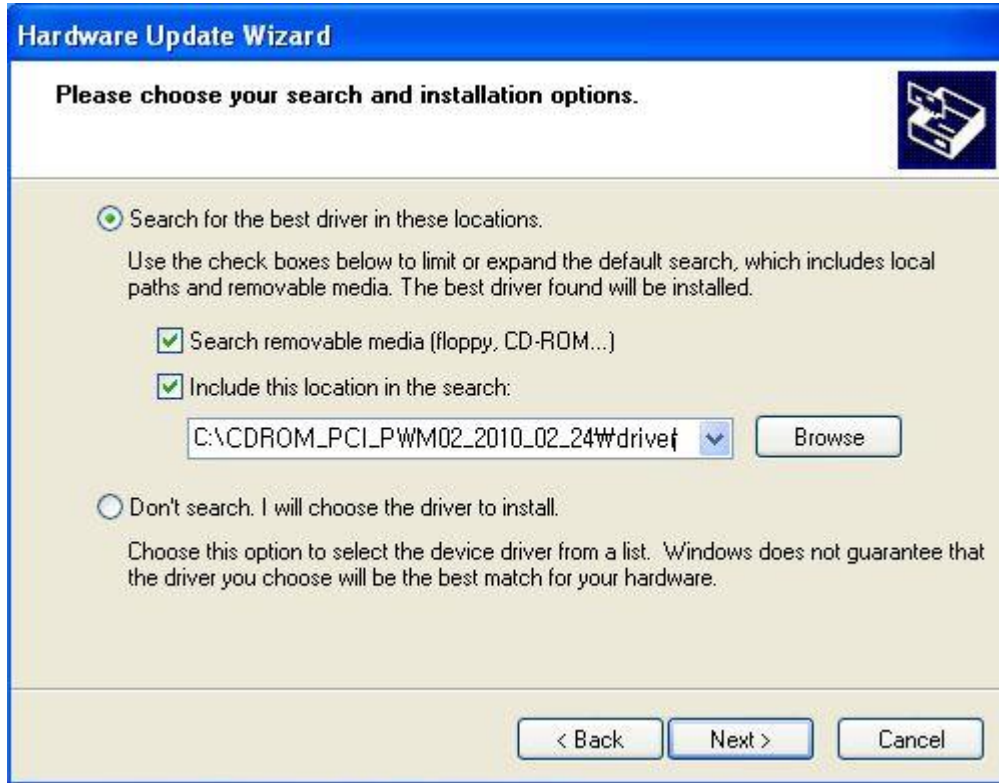
- (1) If new hardware is found, Wizard will ask you to install the corresponding driver. For installation of the driver, select the item "Install from a list or specific location (Advanced)" and click "Next" as in the below figure.



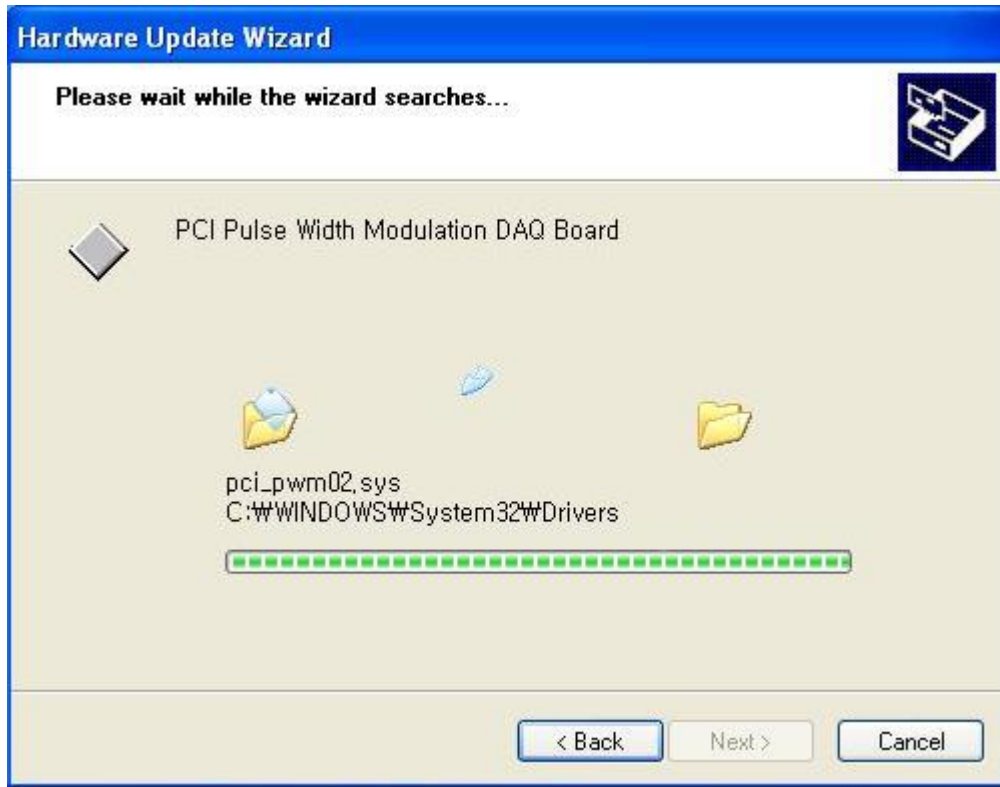
(2) After find a driver folder of the CD, press "next" button.

ex F:\CDROM_PCI_TC03\Driver

The driver folder includes a file of "**pci_pwm02.inf**" and "**pci_pwm02.sys**" that it is necessary for driver installation.



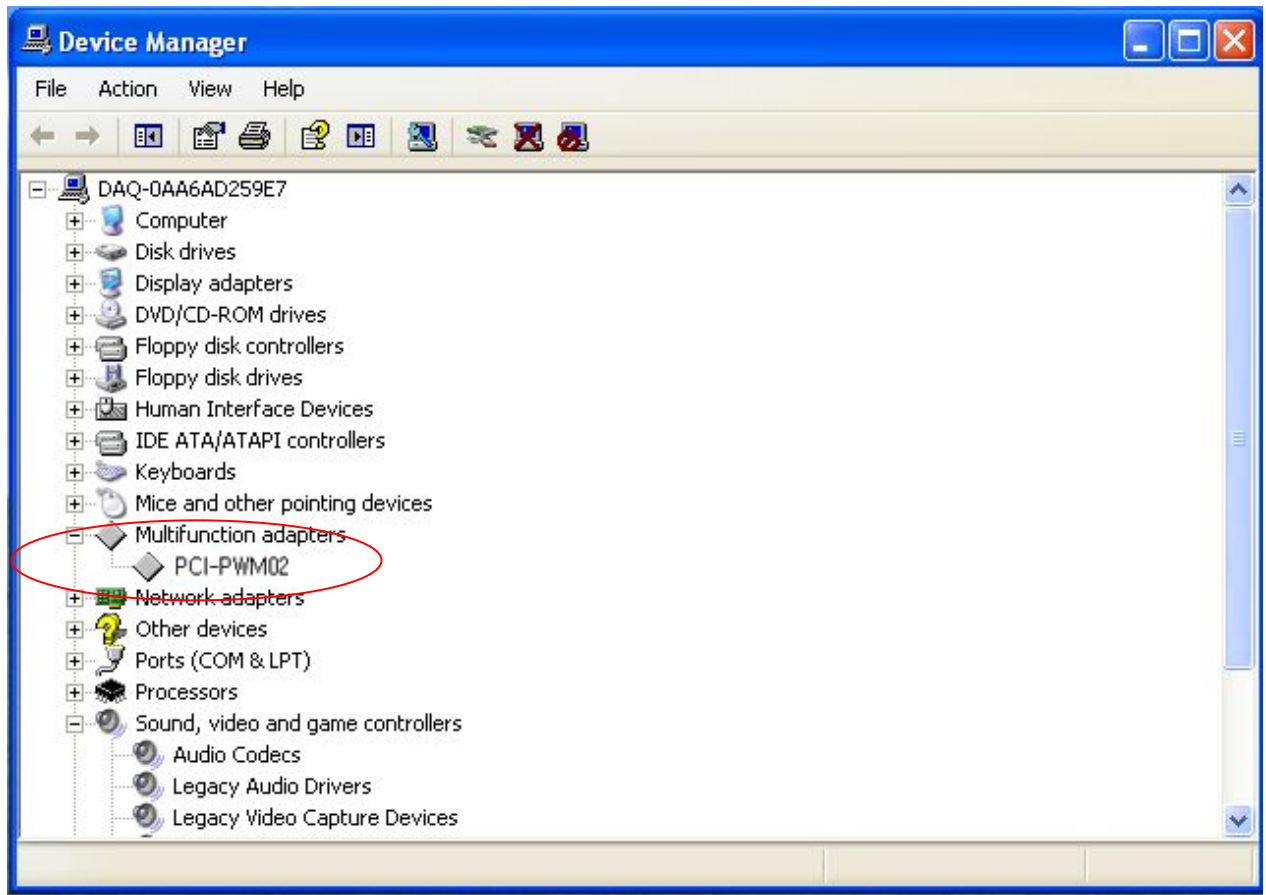
(3) A warning message appears during installation here, press "Continue Anyway" button. You can show below message window. The process progress as follows.



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



(5) 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-PWM02**]



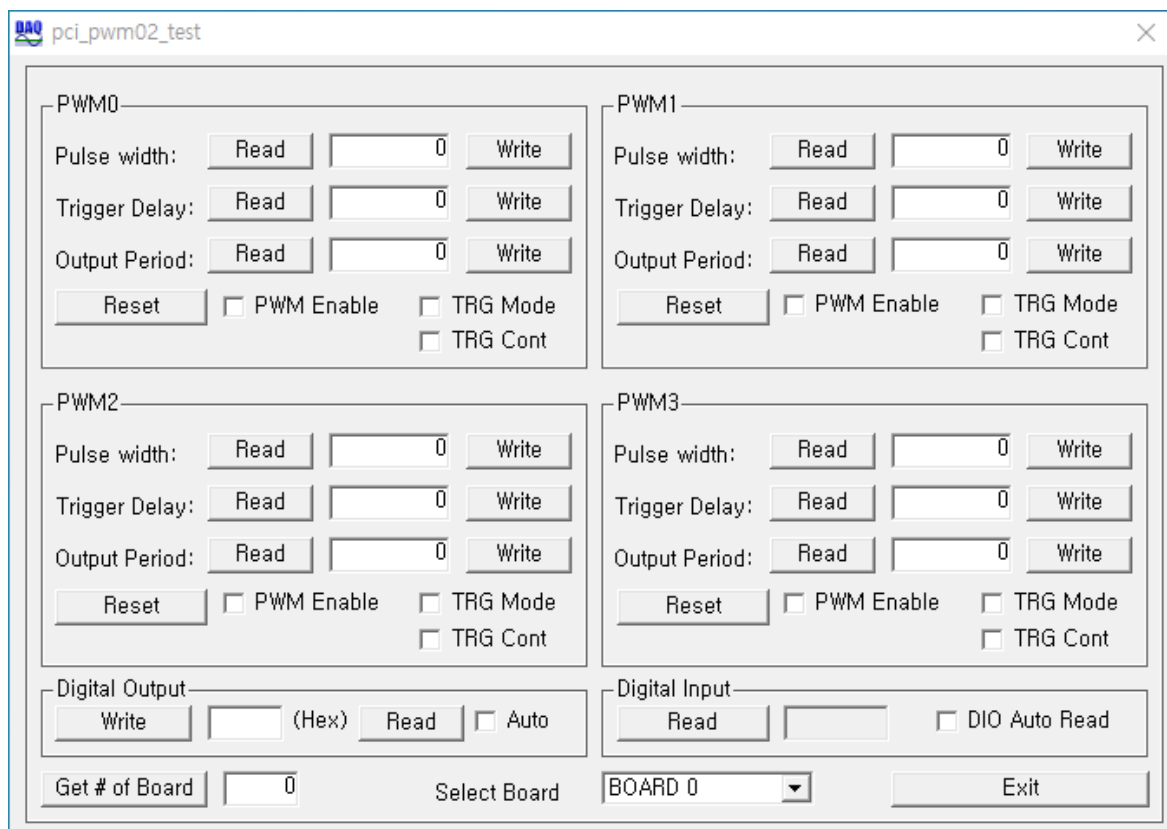
If you can see the "PCI-PWM02" at Multifunction Adaptors, the driver installation is to have been over. (Check the red circle)

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

6. Sample Program

DAQ system provides a sample program to make the user be familiar with the board operation and to make the program development easier. You can find the sample program in the CDROM accompanying with the board. One of the execution file is **"PCI_PWM02_SINGLE.exe"** and **"PCI_PWM02_MULTI.exe"**.

Sample program is provided in source form in order to show the usage of API(Application Programming Interface) of the board and may be modified for customer's own usage.



[Figure 6-1. Sample Program "pci_pwm02_test(x64).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_PWM02.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.

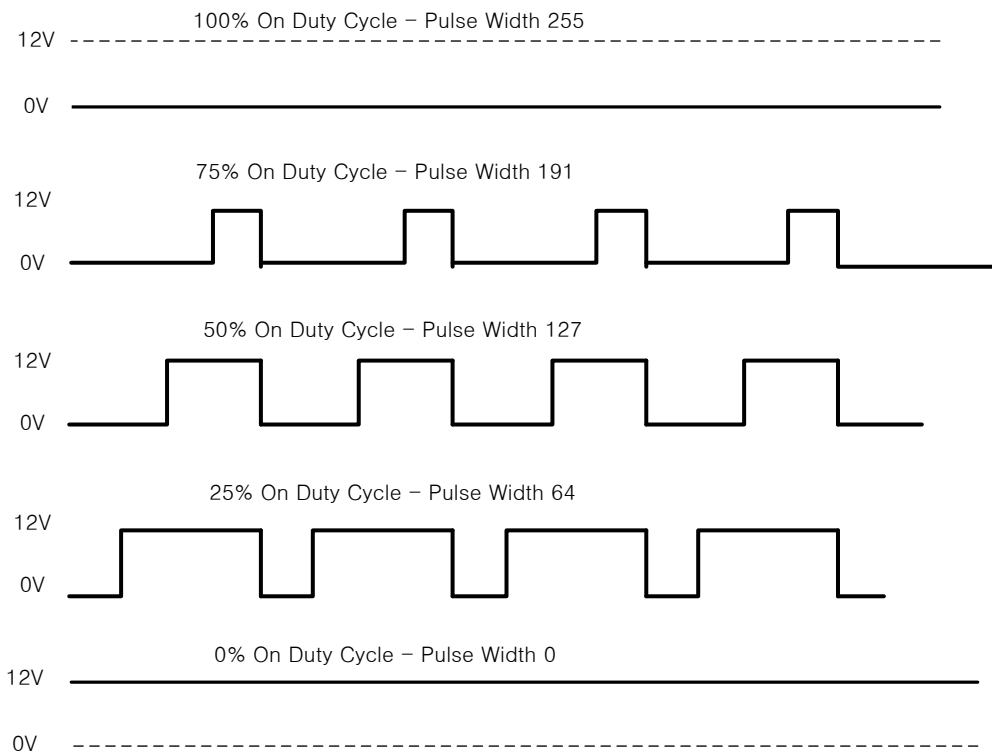
6-1 PWM0 ~ PWM3 Related Function

(1) Pulse width **'Read'** Button

Reads the currently set PWM operation value.

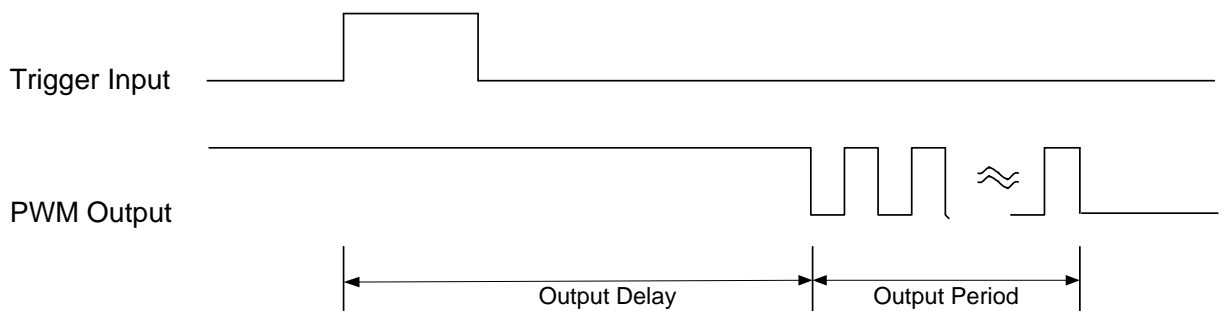
(2) Pulse width **'Write'** Button

It controls the output operation of each PWM. The setting value range is 0 to 255. One time change of the set value is 25 ns (40 MHz).



(3) Trigger Delay **'Read'** Button

Find out the currently set PWM output delay value.



The figure shows the trigger operation mode to control the PWM output by an external

trigger. In trigger operation, output delay and output period can be set. Each time uses a 22-bit timer in units of 1uSEC, so up to 4,194,303uSEC can be set.

(4) Trigger Delay **'Write'** Button

Controls the output delay operation of each PWM. The setting value range is from 0 to 4194303, and the resolution is in 1uSEC units and up to 4194303uSEC.

(5) Output Period **'Read'** Button

Find out the currently set PWM output period value. Default is 1000000.

(6) Output Period **'Write'** Button

Controls the output period of each PWM. The setting value range is from 0 to 4194303, and the resolution is in 1uSEC units and up to 4194303uSEC.

(7) **'Reset'** Button

Initialize each PWM. After initialization, PWM value becomes 0, PWM Disable, Normal Mode, Delay time are 0, and Period time is 1000mSEC.

6-2 Digital Output Function

(1) **'Write'** Button

Set digital output value. When each bit is 1, the output is ON. The total output is bits 0 to 11.

(2) **'Read'** Button

Reads the currently set digital output value.

6-3 Digital Input Function

(1) **'Read Time'** Button

Reads the currently set digital input value. There are a total of 6 digital inputs.

6.4 System Related Function

(1) **'Get # of Board'** Button

You can check how many PCI-PWM02 boards are currently installed in your PC.

(2) **Select Board**

Select the board number. Up to 4 (0 ~ 3) can be selected (refer to Section 3.3.2 Multi Board Setting)

(3) **'Exit'** Button

Close all open PCI-PWM02 devices.

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. General information on PCI board API -- DAQ system
4. AN201 How to build application using APIs -- DAQ system
5. AN242 PCI-PWM02 API Programming -- DAQ system

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Contact Point

Web sit : <https://www.daqsystem.com>

Email : postmaster@daqsystem.com

