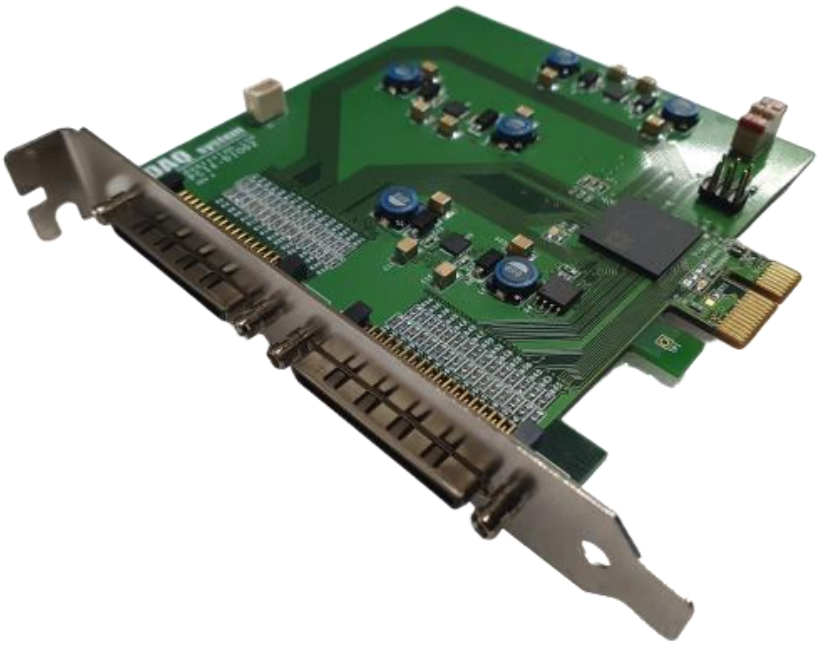
PCIe-DIO02

User Manual

Version 1.0



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1. Introduction

PCIe-DIO02 is a 128-bit digital input/output board that is perfectly compatible with industrial PCs and uses a PCI Express x1 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.

1-1 Product Features

Items	Description	Remark
Hardware		
PC Interface	PCI Express x1	
Operation Power	+5VDC/ Max 1A	
I/O Port	3.3 / 12V	PC PCI Express Slot Power
Feature	128bit Digital I/O	Programmed I/O : Direction control grouped by 16bit Maximum Transfer Speed : 8Mbytes/sec
I/O level	CMOS level	
Output Type	CMOS level	
Simultaneous use of boards	Max. 4	
Operating temperature range	0 ~ 60℃	
Storage temperature range	-20 ~ 80℃	
Humidity range	5 ~ 95%	Non-condensing
Board size	100mm X 100mm	PCB Board Size
Software		
OS	Windows 2000/XP/7/8/10 (32/64bit)	
API	Windows Client DLL API	
Support	Sample Program	VC++

➢ DAQ System Digital I/O Products

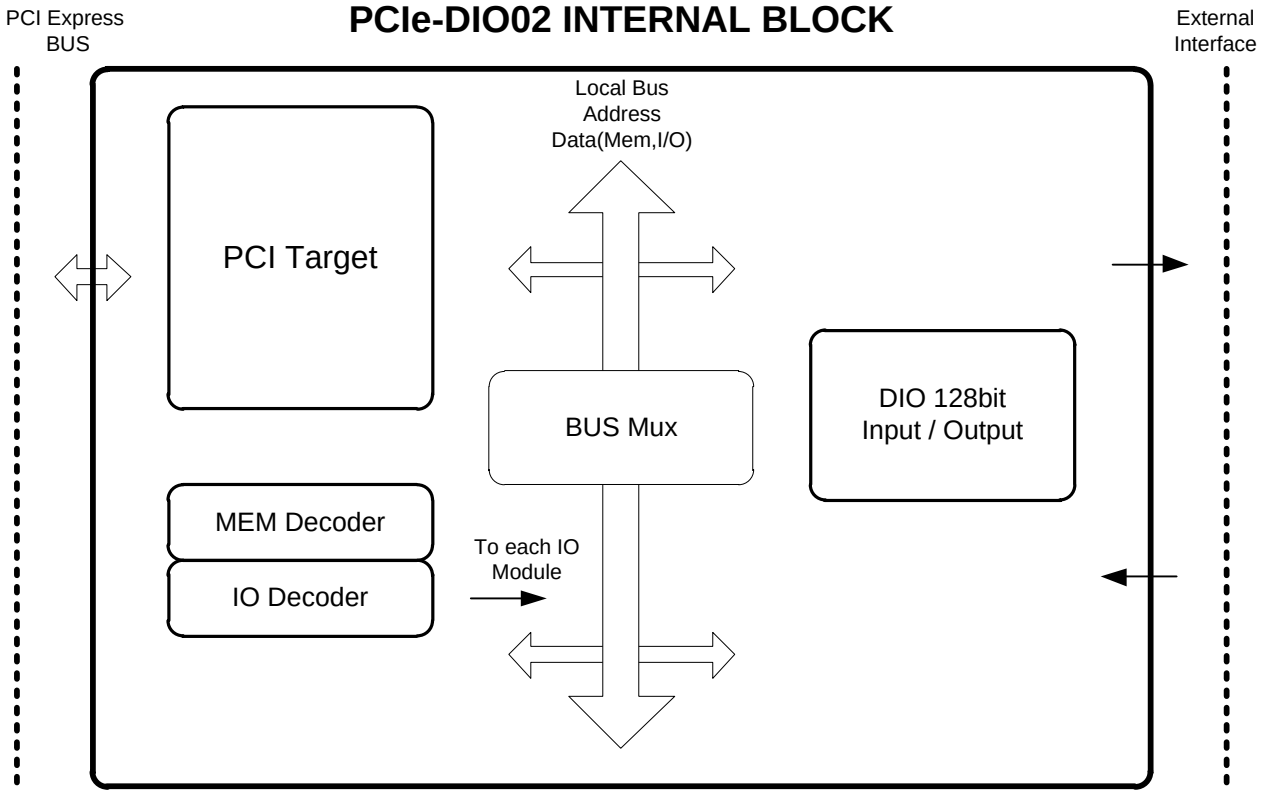
Product	No. In/Out	Timer/Counter	Specification
cPCI-DIO6400	32/32		Isolated Input/Output
cPCI-DIO02	128 channels Software Configurable		Read/Write in 8 Groups in 16-bit Units
PCI(e)-DIO6400	32/32		Isolated Input/Output
PCI-DIO6401	64/None		Isolated Input
PCI-DIO6402	None/64		Isolated Output
PCI-DIO01	32/32 Software Configurable	1/1	TTL Level Input/Output 32bit Counter/Timer
PCIe-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. PCIe-DIO02 Block Diagram

In the case of PCIe-DIO02, as shown in [Figure 2-1], it has 128 IO ports and is configured to interface with the outside. (Input/Output can be selected and used in the program)

It is possible to select Read / Write in 8 groups of 16 bits.

- - I/O level is compatible with Input CMOS / TTL level / Output is output with CMOS level.



[Figure 2-1. PCIe-DIO02 Internal Block Diagram]

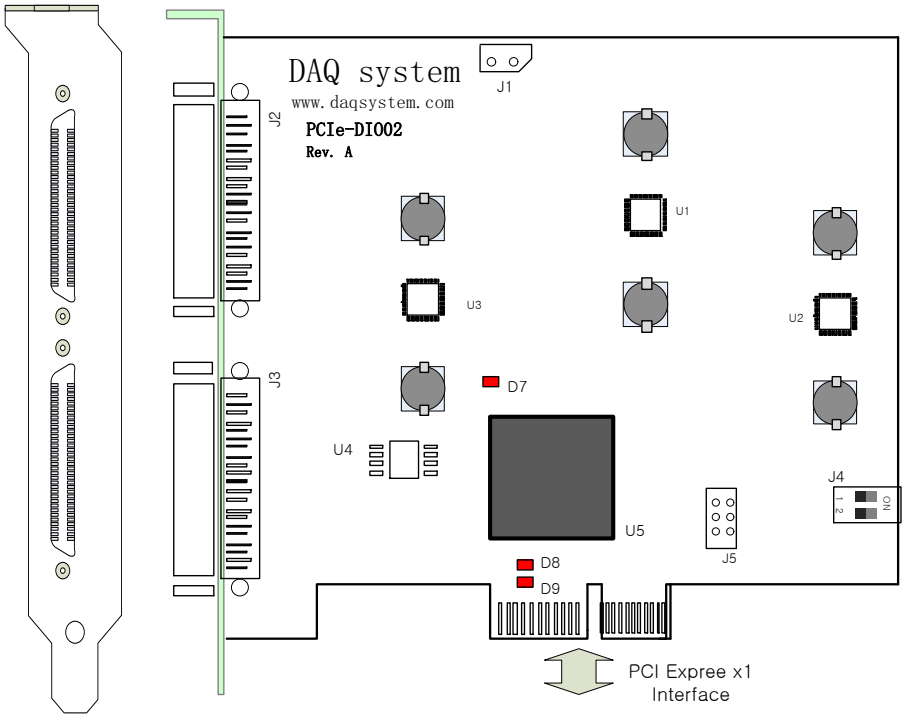
GENERAL DESCRIPTION

- PCI Express x1
- 128bit general purpose I/O, Direction control grouped by 16bit.
- Average data rate is 30Mb data to, 8Mb data from the board without DMA
- Very flexible to upgrade because FPGA.
- Compact PCB

3. PCIe-DIO02 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. PCIe-DIO02 Layout]

There are 3 LEDs on the board, and the description of each is as follows.

D7 : Lights up when the board finishes configuration and ready for operation.

D8 : Lights when the PCI Express connection is active. (wakes up from standby)

D9 : Lights up when the board is mounted.

3-2 Device Features

(1) VHDCI68 connector: J2, J3

J2 --- External interface (I/O 0~63)

J3 --- External interface (I/O 64~127)

(2) FPGA : U5

PCI Express signal control and digital I/O functions of the board are controlled through this FPGA Logic.

(3) Regulator : U1, U2, U3

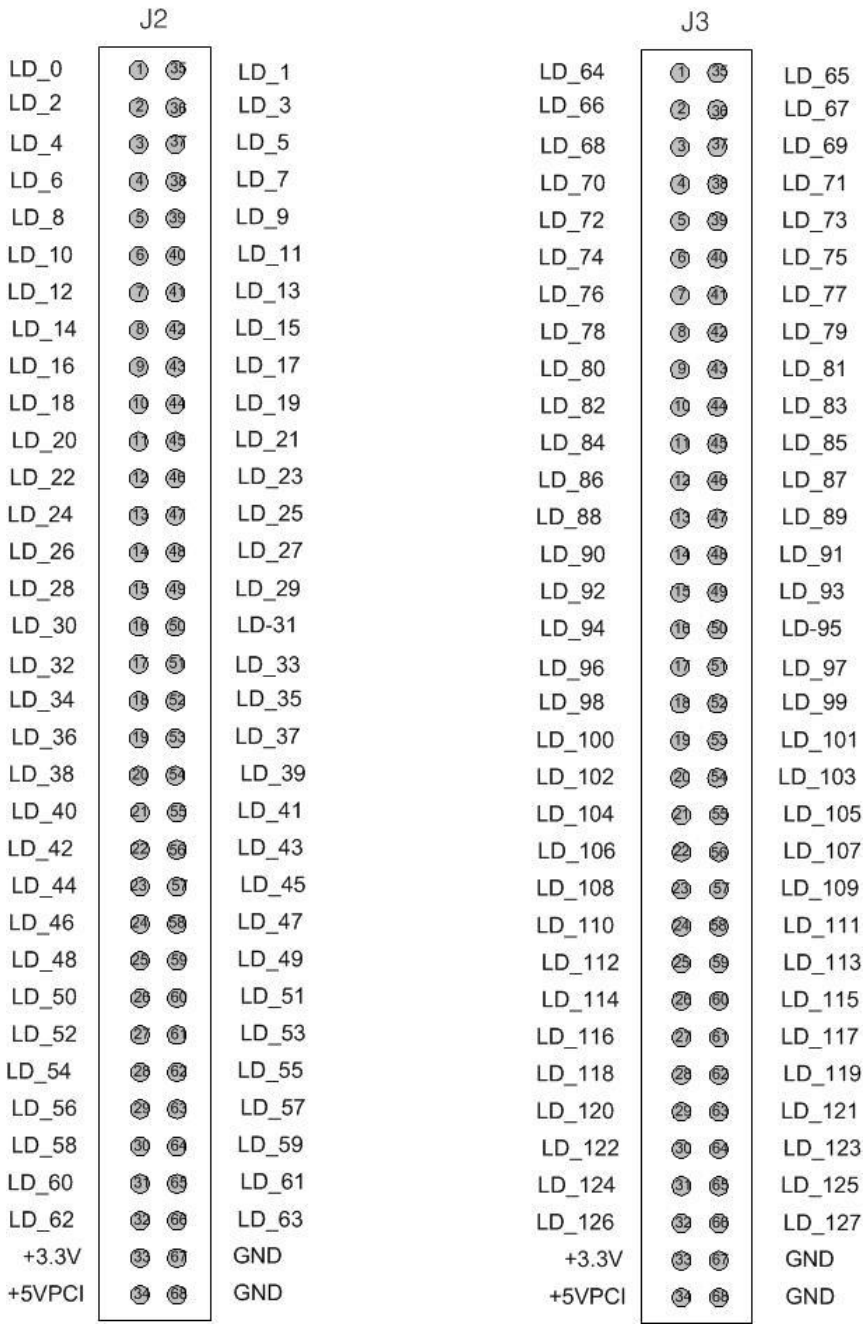
It supplies the power used by the board.

4. Connector Pin Map

This section describes connectors and jumpers used in PCIe-DIO02. As the main connectors, there are VHDCI (Very High Density Cable Interconnect) 68pin connectors J2 and J3 connectors for external digital input/output connection.

4-1 VHDCI68 Connecter (J2, J3)

PCIe-DIO02 uses two VHDCI68 connectors for external I/O interface.



[Figure 4-1. J2 & J3 Pin Map]

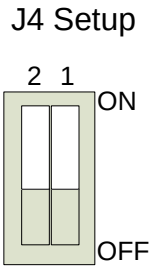
4-2 J1 Connector (2Pin Header, 2.54mm)

This is a 12V external DC power connector. Power used when installing CPLD or FPGA, not normally used.

4-3 J4 Connector

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 (J4) on the board.

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



1	2	Board No.
OFF	OFF	0
ON	OFF	1
OFF	ON	2
ON	ON	3

[Figure 4-2. 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. PCIe-DIO02 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 Express 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 PCIe-DIO02 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

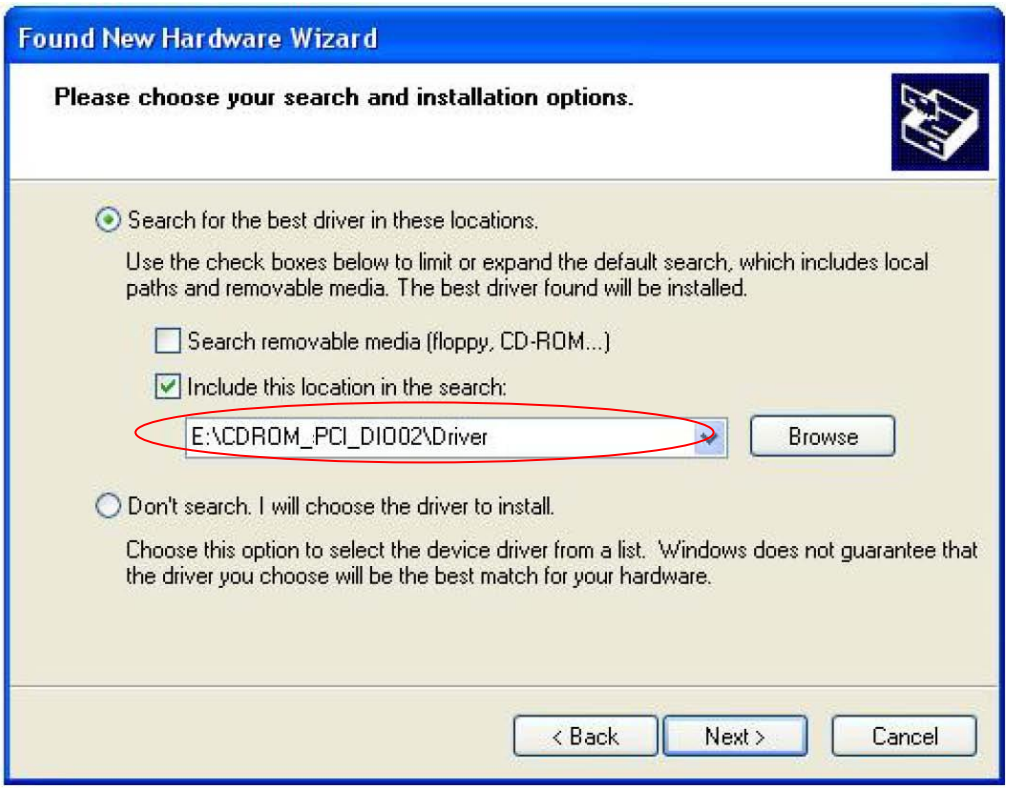
After installing the board, install the driver and sample application to run the board on your PC. For installation, use the supplied CD.

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-DIO02 board into the PCI Slot, and turn on the PC's power. When the "Start New Hardware Wizard" window opens as shown below, selects it as shown below and click the Next button.

The PCI-DIO02 connects to PCI Card Port. After that you can show the below picture of "Found New Hardware Wizard" window.

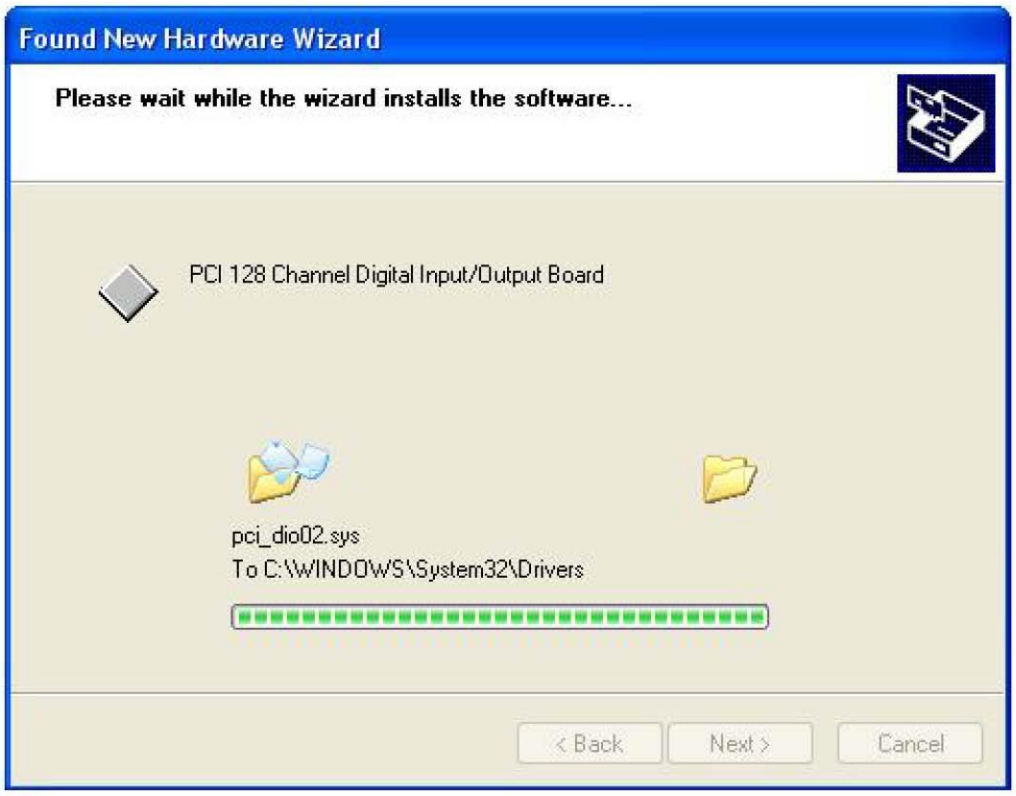
If new hardware is found, Wizard will ask you to install the corresponding driver. For installation of the driver, select the item "Install from a list or specific location (Advanced)" and click "Next" as in the figure.



The driver folder includes a file of **"pci_dio02.inf"** and **"pci_dio02.sys"** that it is necessary for driver installation.

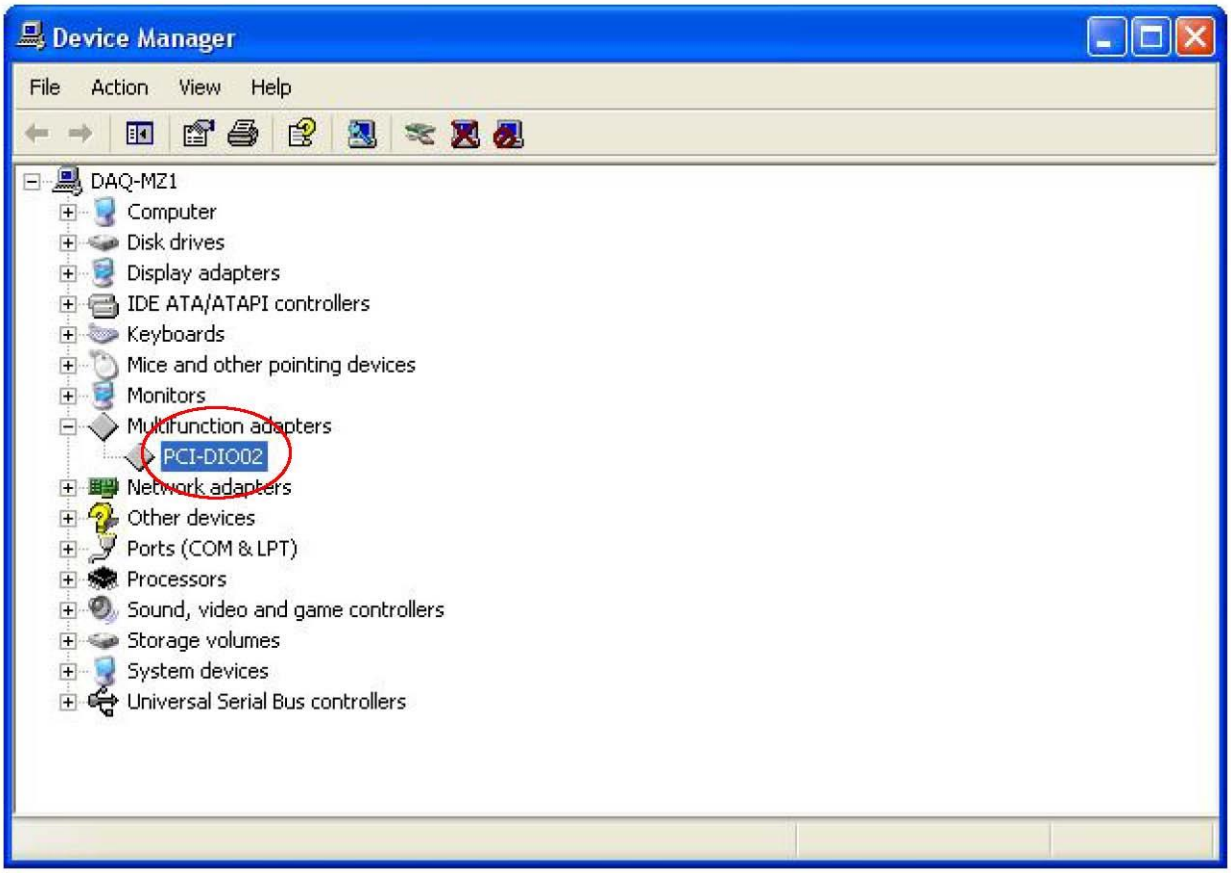
A warning message appears during installation here, press "Continue Anyway" button.

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-DIO02**]



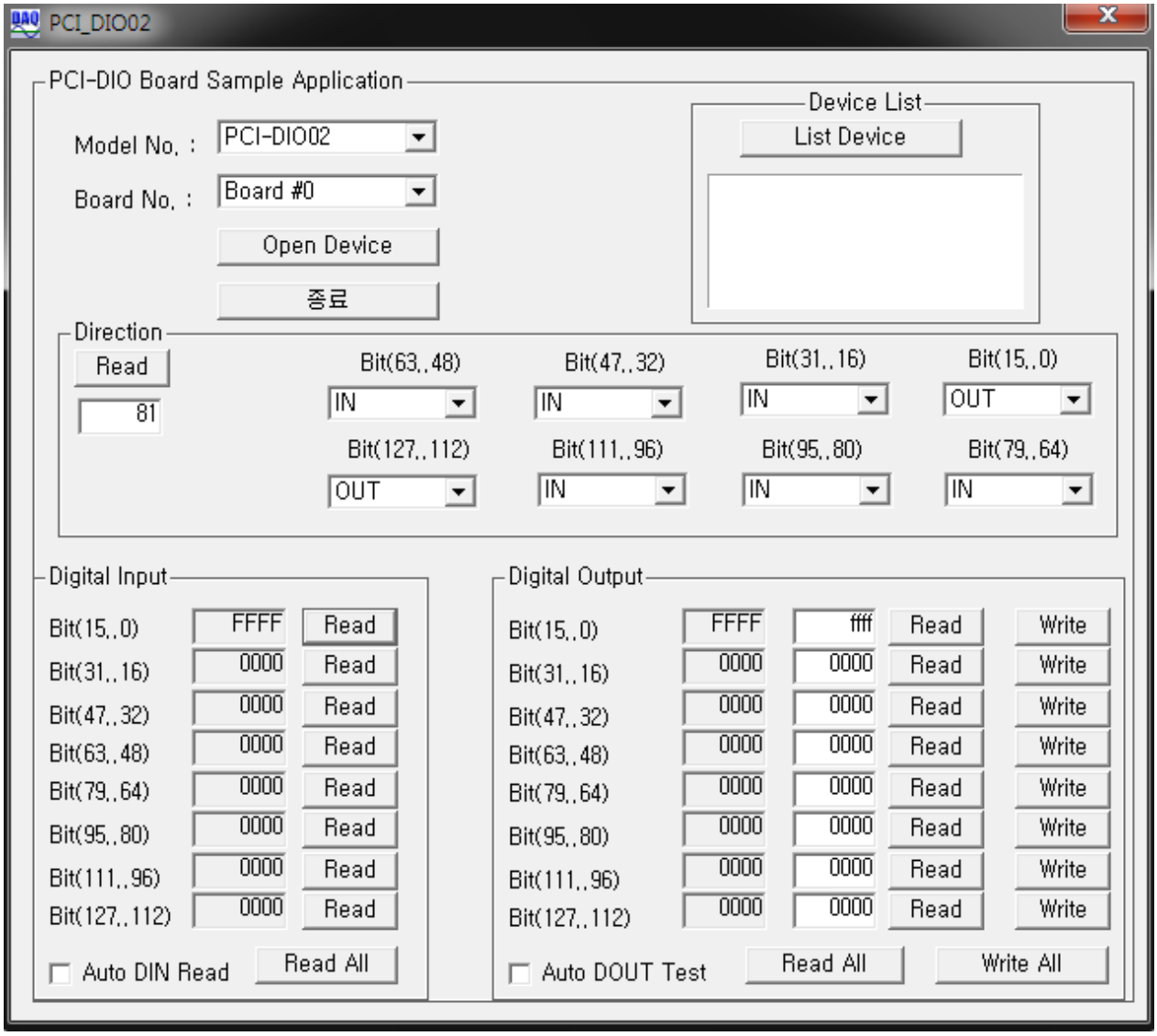
If you can see the "PCI-DIO02" at Multifunction Adaptors, the driver installation is to have been over. The PCIe-DIO02 board is compatible with the PCI-DIO02 board driver and is expressed as PCI-DIO02 using the same driver. (Check the red circle)

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_DIO02.exe"** is provided for easy use of the board. In order to test the sample program, the board driver 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_DIO02.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 to compile. In order to run the sample program normally, the API DLL (PCI_DIO02.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) **'Model No' Button**

It selects the motel name PCI-DIO02.

(2) **'Board No' Button**

It selects the selected board number (Board # 0 ~ Board # 3) when clicked. The board number can be set to SW1 in the board and connect up to 4 units.

(3) **'Open Device' Button**

It opens the selected board.

(4) **'Exit' Button**

Exit the program. The set values are initialized and terminated.

Window exit is not initialized.

(5) **'List Device' Button**

It displays the board numbers installed in the System. (Unused state)

(6) **'Direction' Button**

It selects Read / Write mode. 16bit units can be selected in one group.

Each group **'IN' : Read**

'OUT' : Write

For example)

When [Bit0..15] is set to OUT as shown in [Figure 6-1], group 0 is set to write mode.

When [Bit127..112] is set to OUT as shown in [Figure 6-1], group 7 is set to write mode.

When you read "Read" in this state, you can see that it is set to **"81".**

"FF" [Bit127..0] All 7 groups are set to write mode.

(7) **'Digital Input' Window**

It check the corresponding bit (16bit) value for each group. It displays the input value of the group when Read button is clicked.

'Auto DIN Read' check can be checked immediately when input is picked up.

'Read All' checks the input of all groups.

(8) **'Digital Output' Window**

Check the corresponding bit (16bit) output value for each group.

When the **'Read'** button is clicked, the value set to 'Write' is displayed.

When the **'Write'** button is clicked, the corresponding bit of the port is set to the write mode.

You can use 16 output ports by writing "FFFF" bit (15..0) in Digital Output window in [Figure 6-1] above.

When **'Auto DOUT Test'** is checked, "0" is written while shifting data one bit to the left sequentially for the group set as Output.

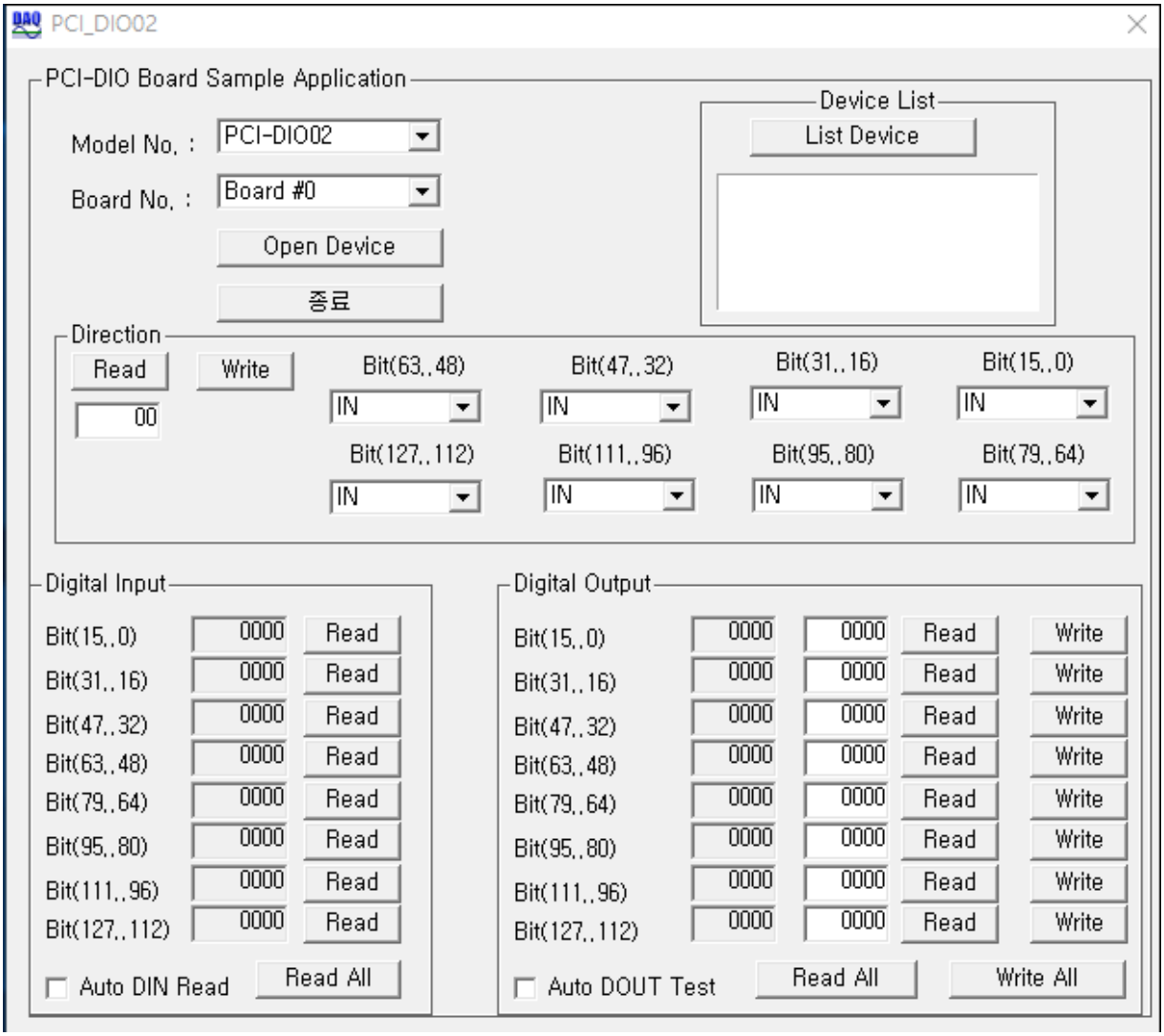
1111 1111 1111 1111
1111 1111 1111 1110 (FFFE)
1111 1111 1111 1101 (FFFD)
1111 1111 1111 1011 (FFFB)
1111 1111 1111 0111 (FFF7)
..
..
1011 1111 1111 1111 (BFFF)
0111 1111 1111 1111 (7FFF) .

Check with **'Read All'** or **'Auto DIN Read'** check. Check with 'Read All' or 'Auto DIN Read' check. To test the output ports of all ports, Direction must be set to OUT in direction setting.

Caution) After 'Auto DOUT Test', Write All is returned to the previous setting value.
'Read / Write All' checks the input / output of all groups.

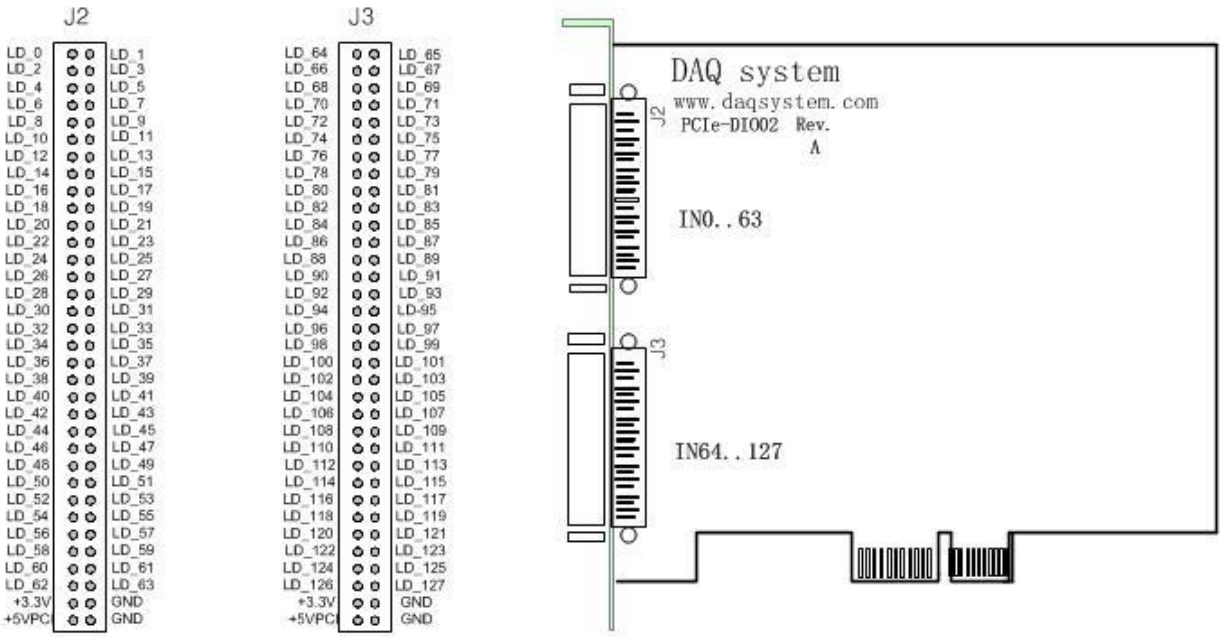
6-1 128bit Digital In Setup

When using all 128 bits as input, the sample program settings are as follows.

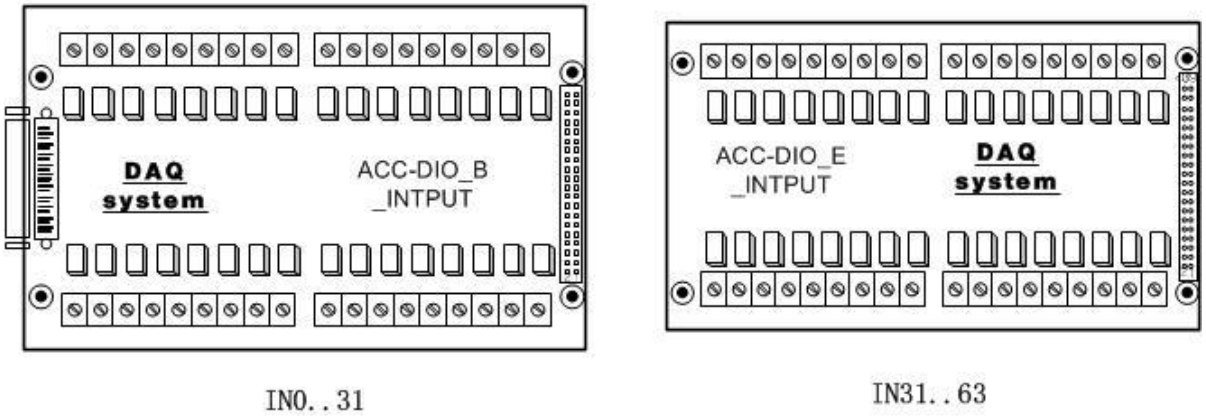


[Figure 6-2. Sample Program 128bit Digital In]

[Figure 6-3] shows the connection method using the ACC-DIO_B_INPUT terminal board and the ACC-DIO_E_INPUT terminal board.

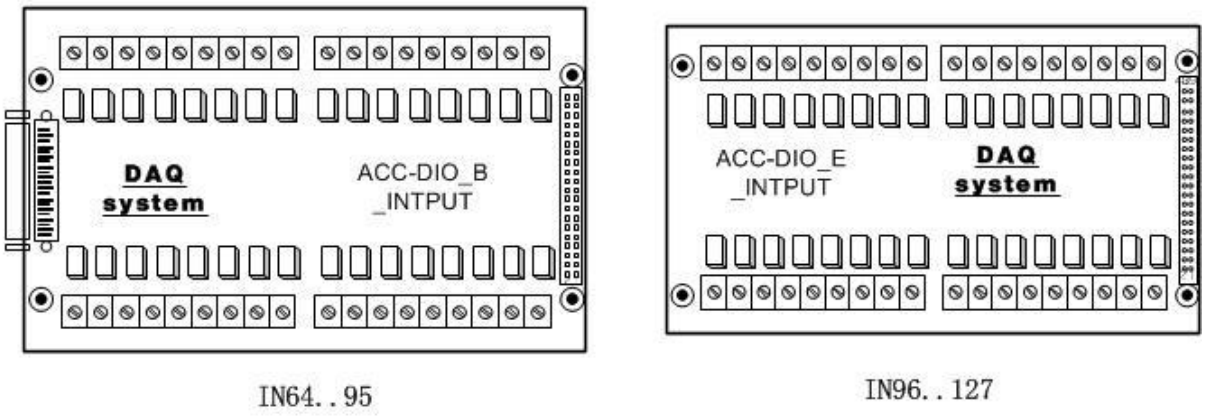


J2 Connection



IN0..31 IN31..63

J3 Connection

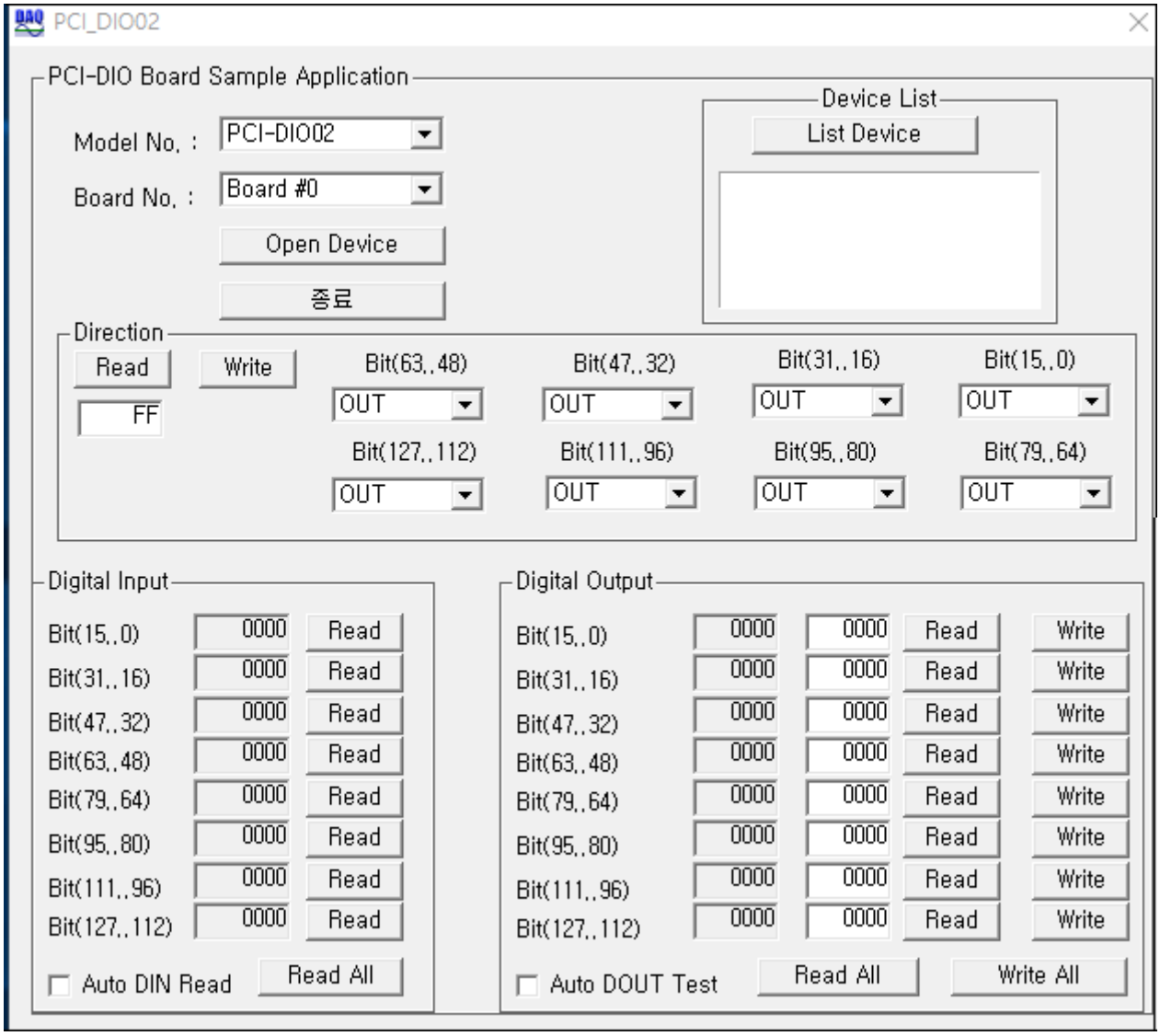


IN64..95 IN96..127

[Figure 6-3. 128bit Digital In Connection]

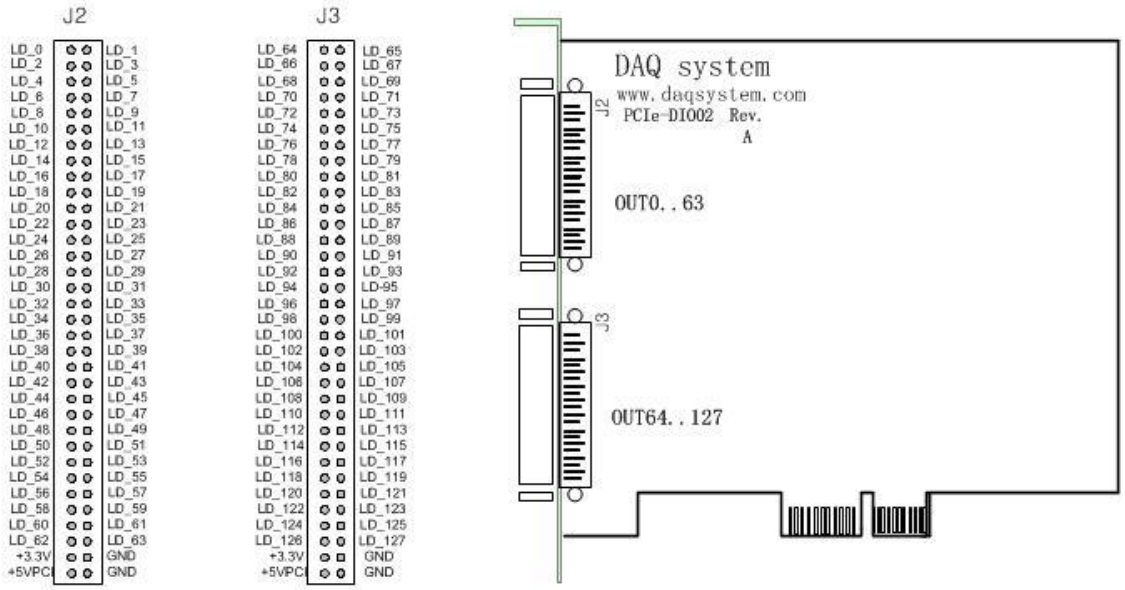
6-2 128bit Digital Out Setup

When using all 128 bits as output, the sample program settings are as follows.

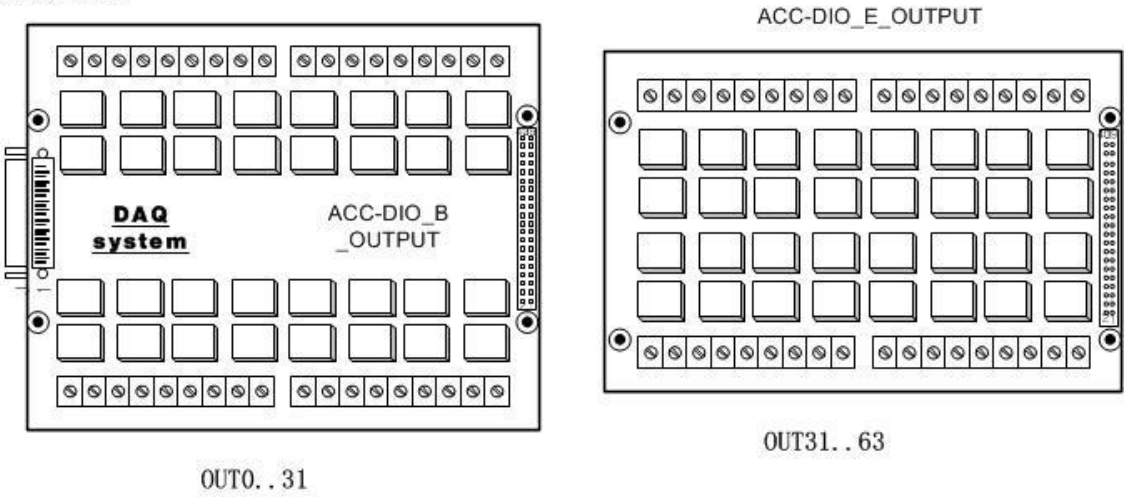


[Figure 6-4. Sample Program 128bit Digital Out Screen]

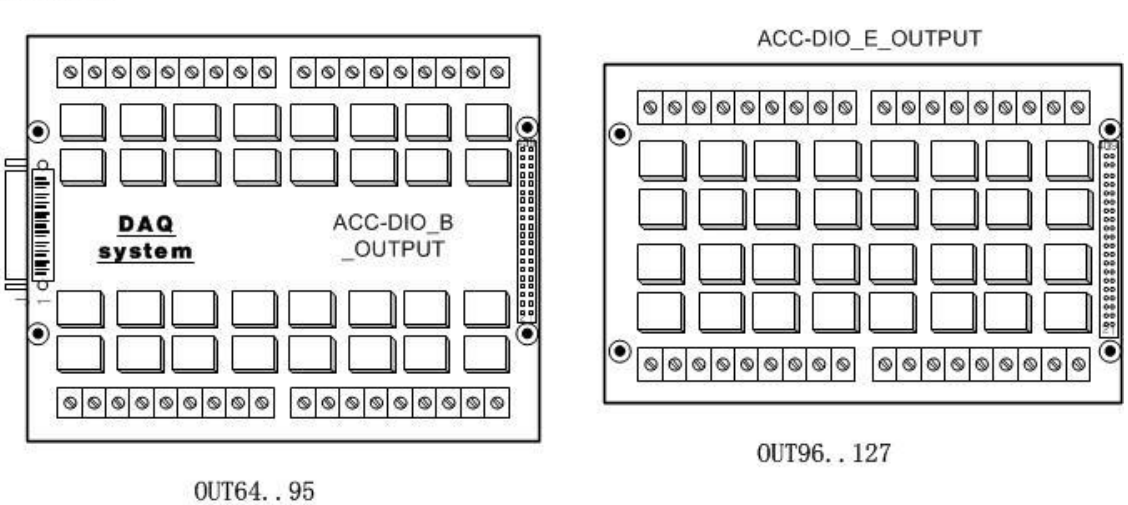
[Figure 6-5] shows the connection method using the ACC-DIO_B_OUTPUT terminal board and the ACC-DIO_E_OUTPUT terminal board.



J2 Connection



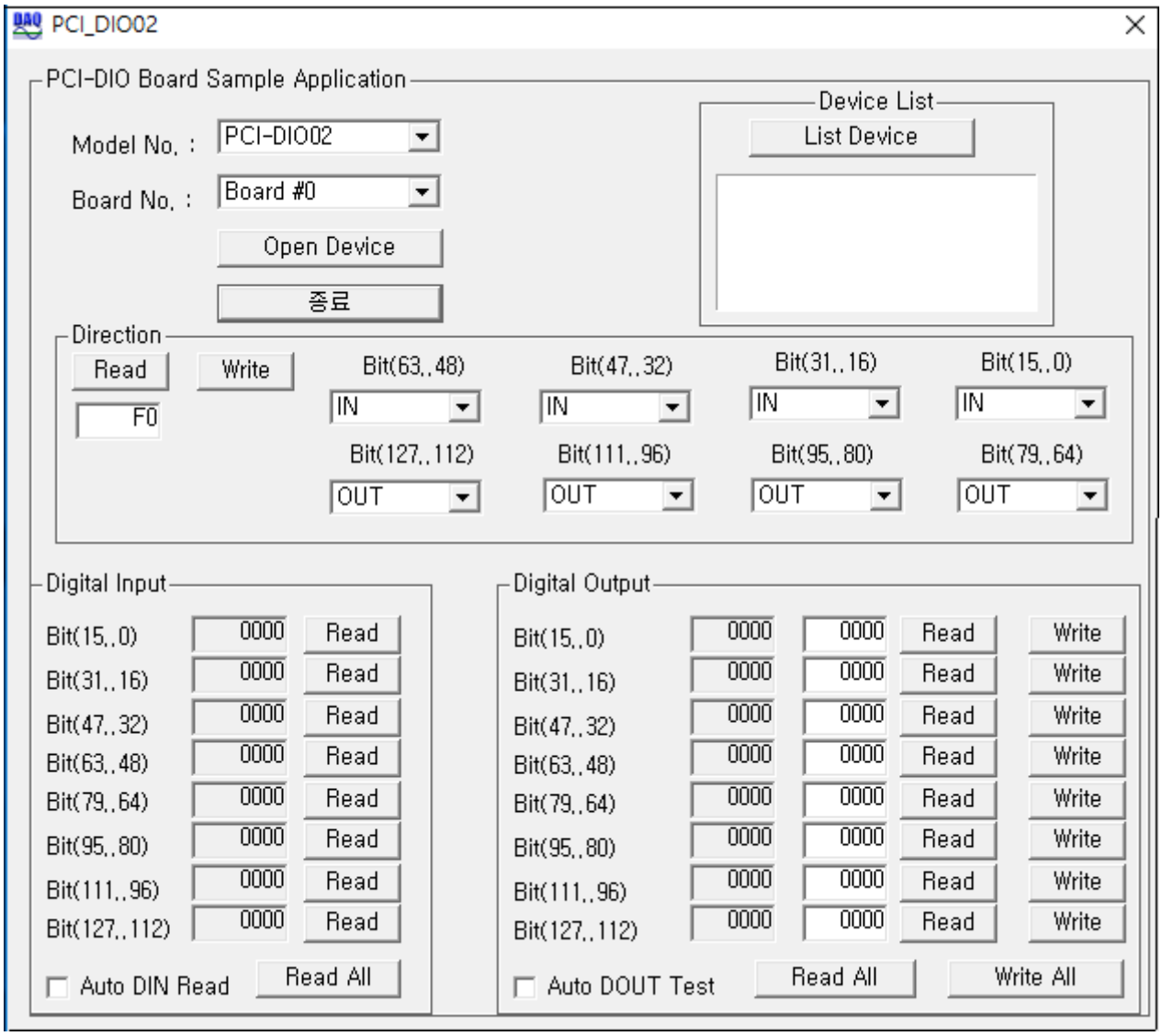
J3 Connection



[Figure 6-5. 128bit Digital Out Connection]

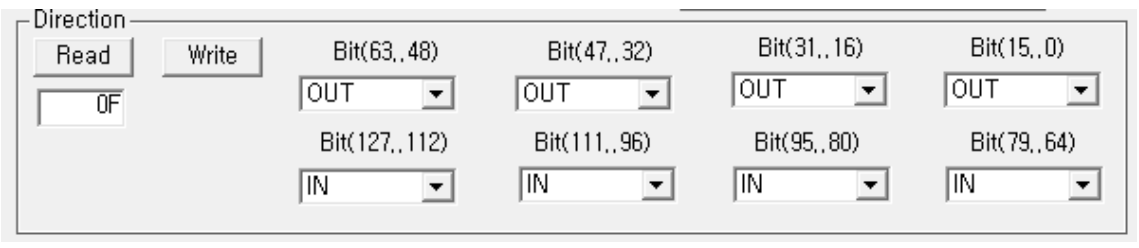
6.3 128bit Digital In/Out Setup

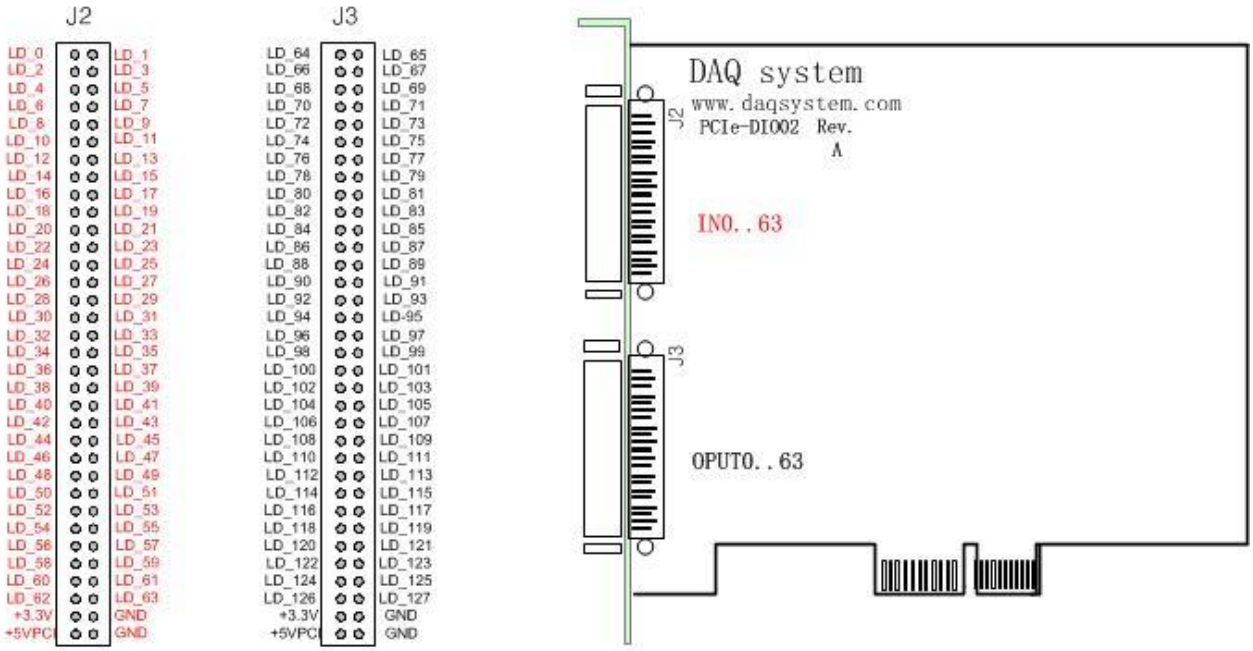
When 128 bits are used as 64 bits of input and output, the sample program settings are as follows.



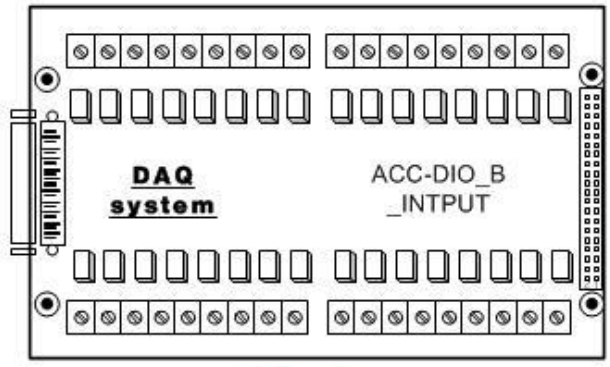
[Figure 6-6. Sample Program 128bit Digital In/Out Screen]

[Figure 6-7] shows the connection method using the ACC-DIO_B_INPUT and ACC-DIO_E_INPUT boards and the ACC-DIO_B_OUTPUT and ACC-DIO_E_OUTPUT boards. In the connection below, you can use the input/output of J1 and J2 interchangeably. In this case, the settings are as follows.

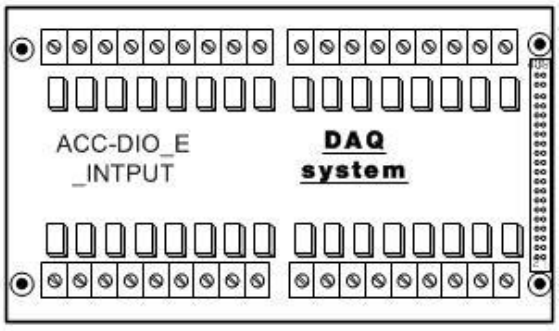




J2 Connection

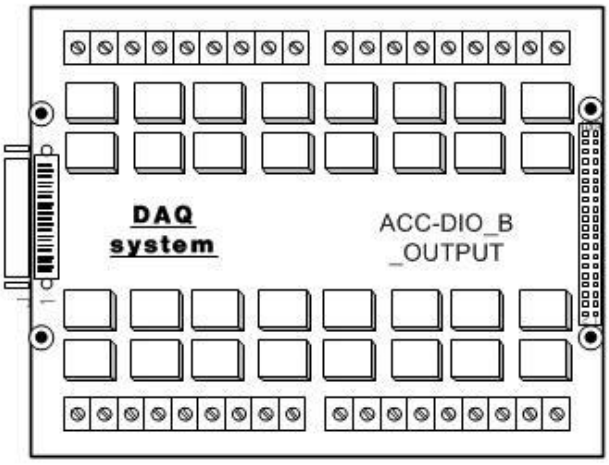


IN0..31

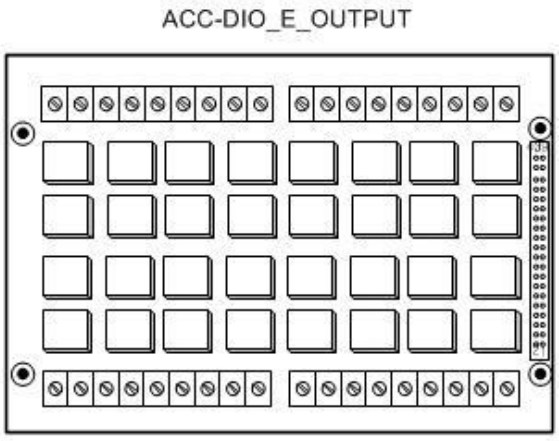


IN31..63

J3 Connection



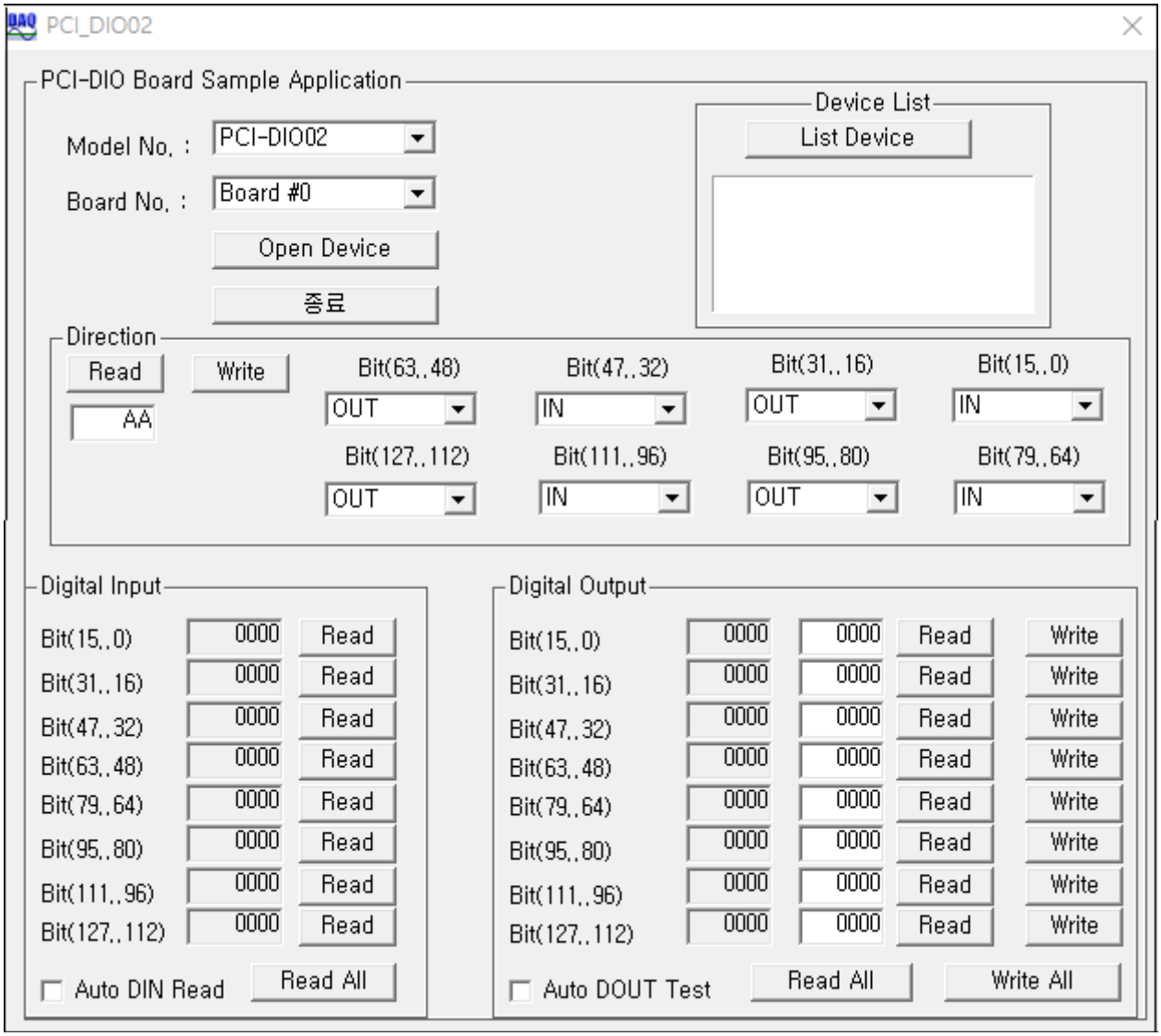
OUT0..31



OUT32..63

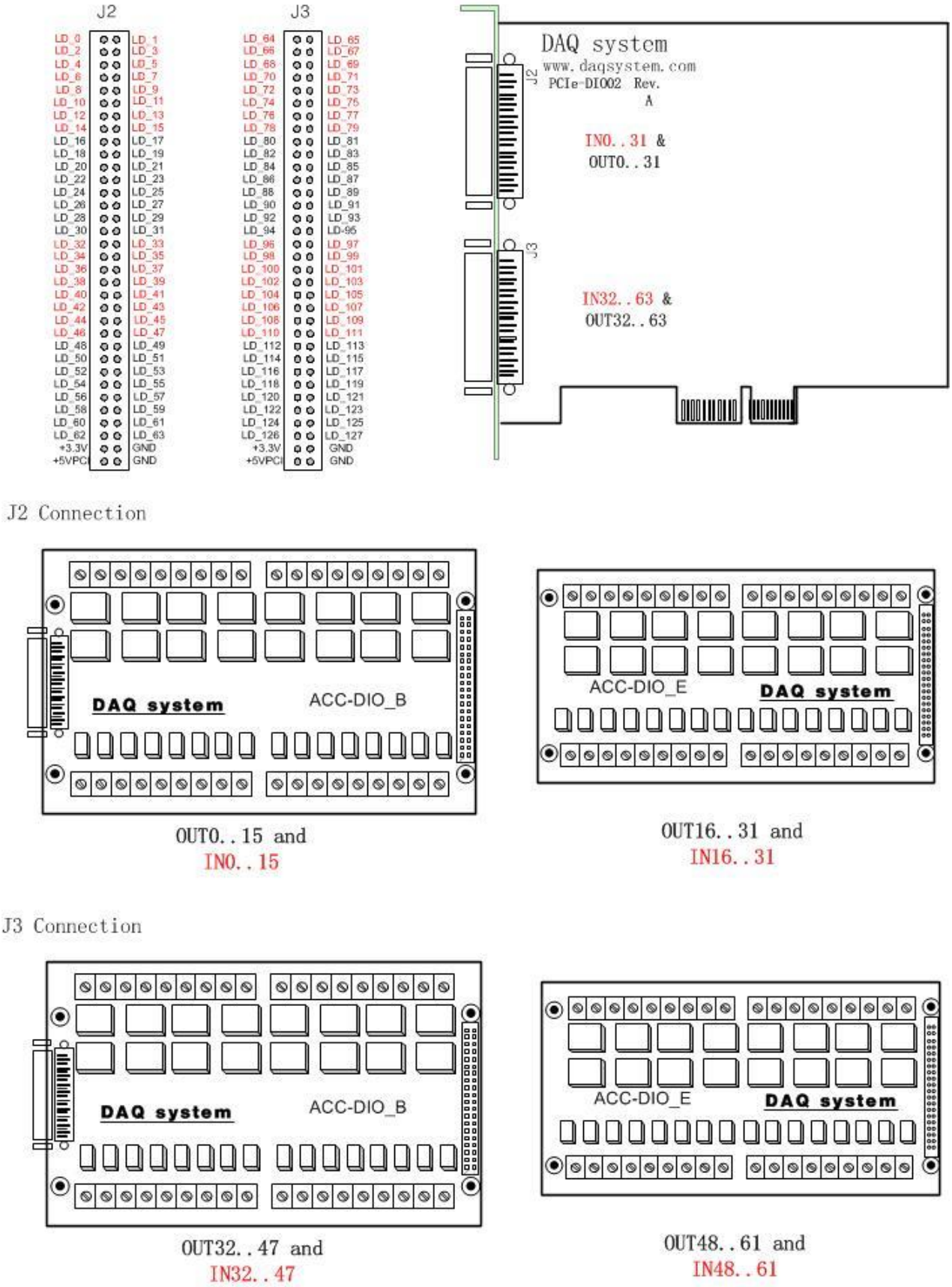
[Figure 6-7. 128bit Digital In/Out Connection]

In case of using ACC-DIO_B board and ACC-DIO_E board that have 16-bit input/output board together, the sample program setting is as follows.



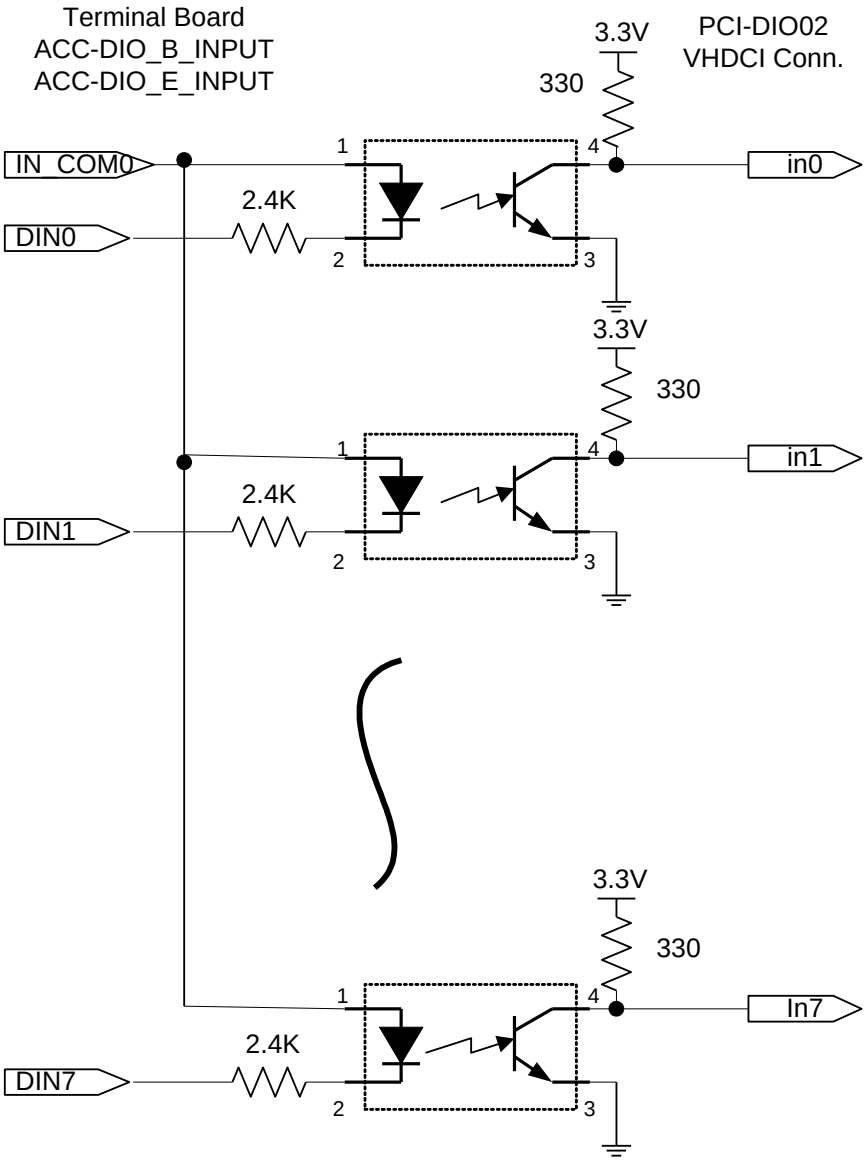
[Figure 6-8. Sample Program 128bit Digital In/Out Screen]

[Figure 6-9] shows the connection method using the ACC-DIO_B terminal board and the ACC-DIO_E terminal board.



[Figure 6-9. 128bit Digital In/Out Connection]

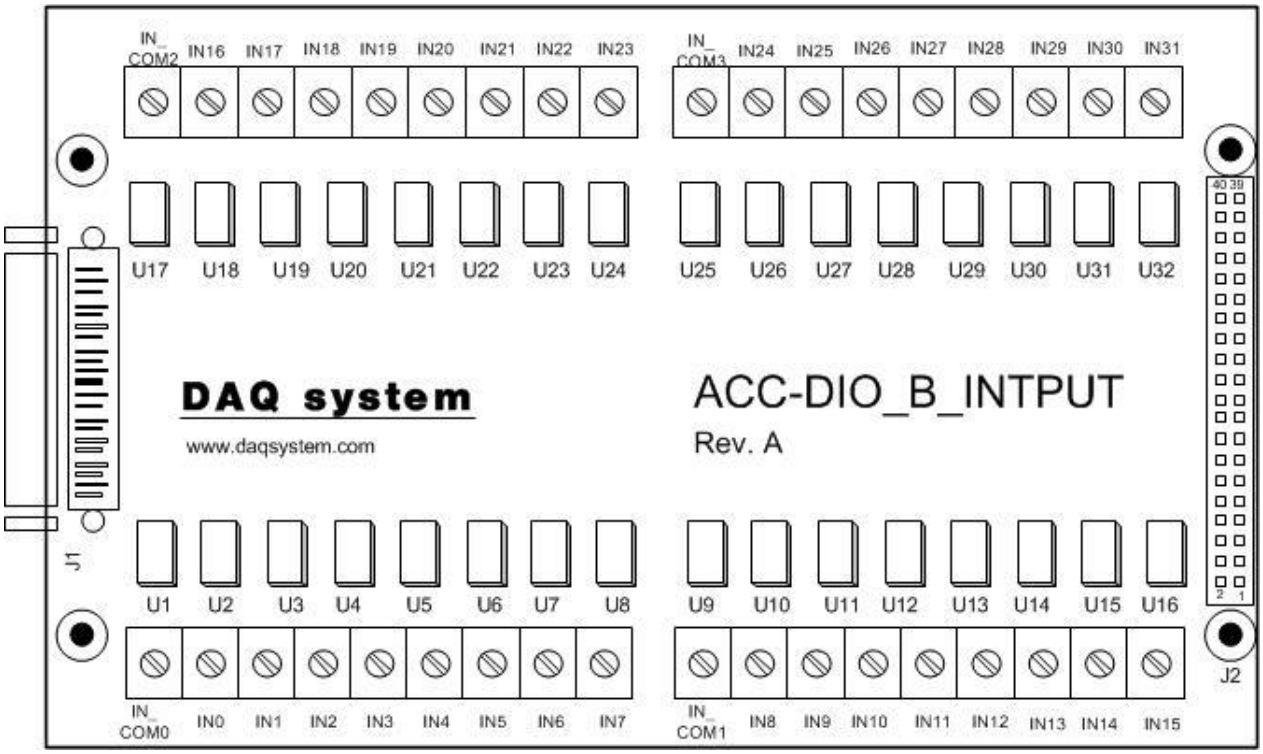
< Digital Input Terminal Board Circuit Configuration >

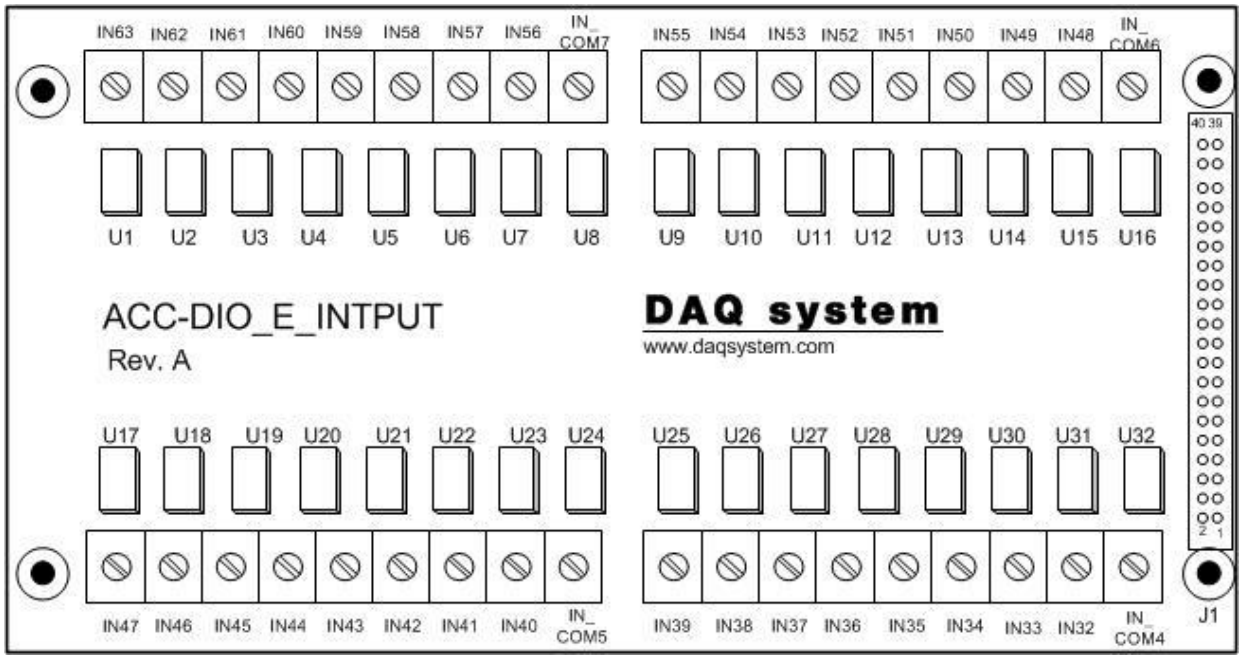


In the figure above, the digital input circuit is isolated by a port coupler. When a positive voltage is applied to the "IN_COM" side and a negative voltage is applied to the digital input, a current flows through the diode inside the photo coupler and the output side transistor is energized in accordance with the flowing current.

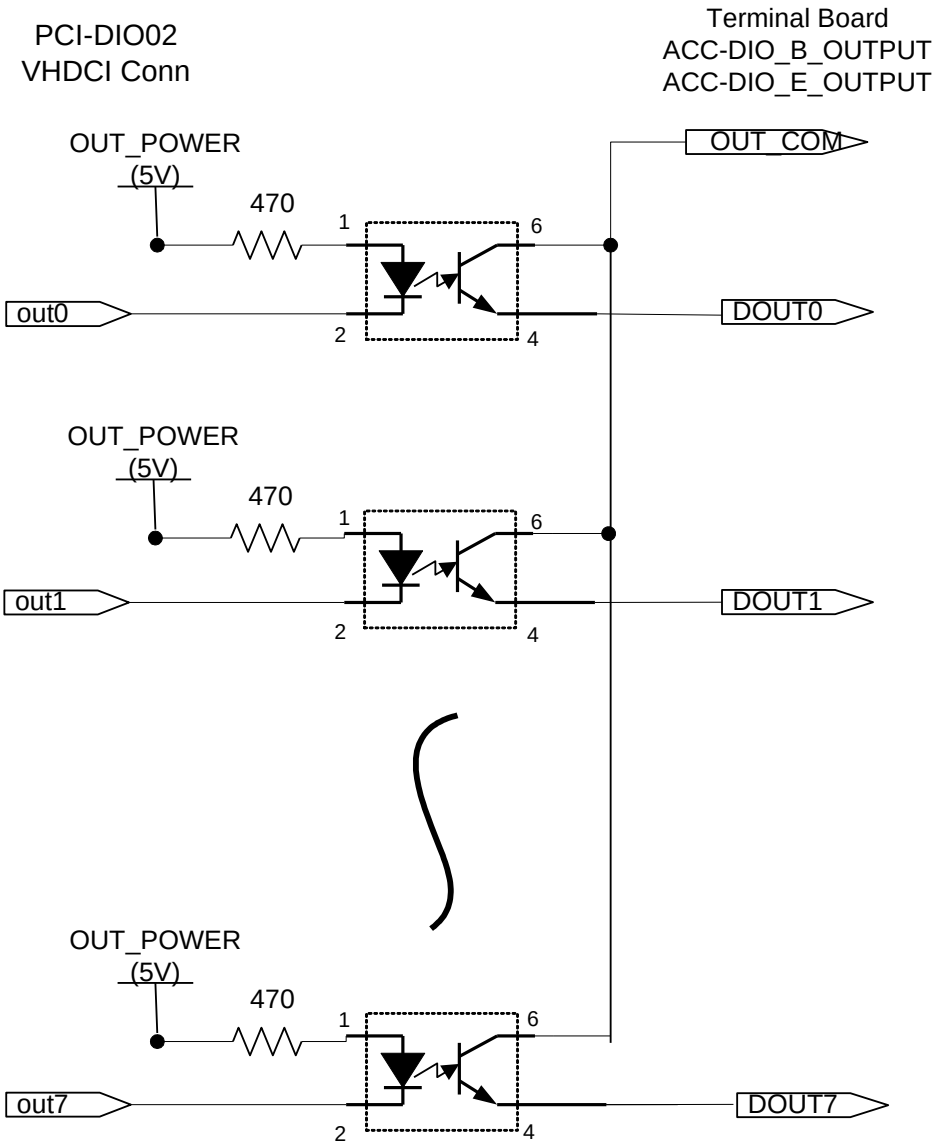
The terminal board **ACC-DIO_B_INPUT** is equipped with four circuits as described above. That is, there are four IN-COMs for every eight photo couplers. In addition, the extended terminal board **ACC-DIO_E_INPUT** is equipped with four circuits as described above. That is, there are four IN-COMs for every eight photo couplers.

In addition, **ACC-DIO_B_INPUT** and **ACC-DIO_E_INPUT** can be connected to the remaining ports (J1 connection) to be used as a total 128-bit input board.


IN_ COM2
IN16 IN17 IN18 IN19 IN20 IN21 IN22 IN23
IN_ COM3
IN24 IN25 IN26 IN27 IN28 IN29 IN30 IN31
U17 U18 U19 U20 U21 U22 U23 U24
U25 U26 U27 U28 U29 U30 U31 U32
DAQ system
www.daqsystem.com
ACC-DIO_B_INTPUT
Rev. A
J1
U1 U2 U3 U4 U5 U6 U7 U8
U9 U10 U11 U12 U13 U14 U15 U16
IN_ COM0
IN0 IN1 IN2 IN3 IN4 IN5 IN6 IN7
IN_ COM1
IN8 IN9 IN10 IN11 IN12 IN13 IN14 IN15
40 39
2 1
J2


IN63 IN62 IN61 IN60 IN59 IN58 IN57 IN56 IN_ COM7
IN55 IN54 IN53 IN52 IN51 IN50 IN49 IN48 IN_ COM6
U1 U2 U3 U4 U5 U6 U7 U8
U9 U10 U11 U12 U13 U14 U15 U16
ACC-DIO_E_INTPUT
Rev. A
DAQ system
www.daqsystem.com
U17 U18 U19 U20 U21 U22 U23 U24
U25 U26 U27 U28 U29 U30 U31 U32
IN47 IN46 IN45 IN44 IN43 IN42 IN41 IN40 IN_ COM5
IN39 IN38 IN37 IN36 IN35 IN34 IN33 IN32 IN_ COM4
40 39
2 1
J1

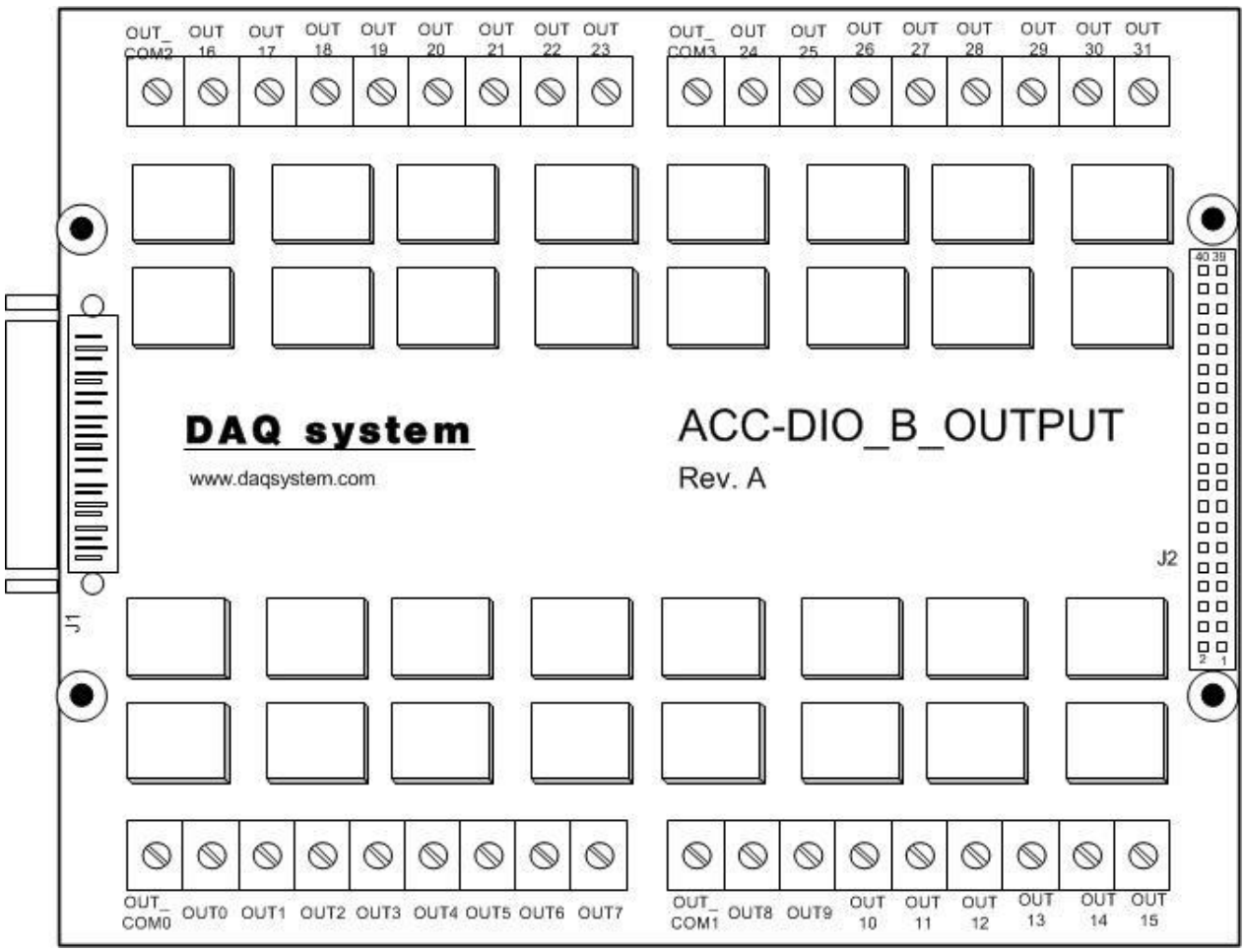
< Digital Output Terminal Board Circuit Configuration >

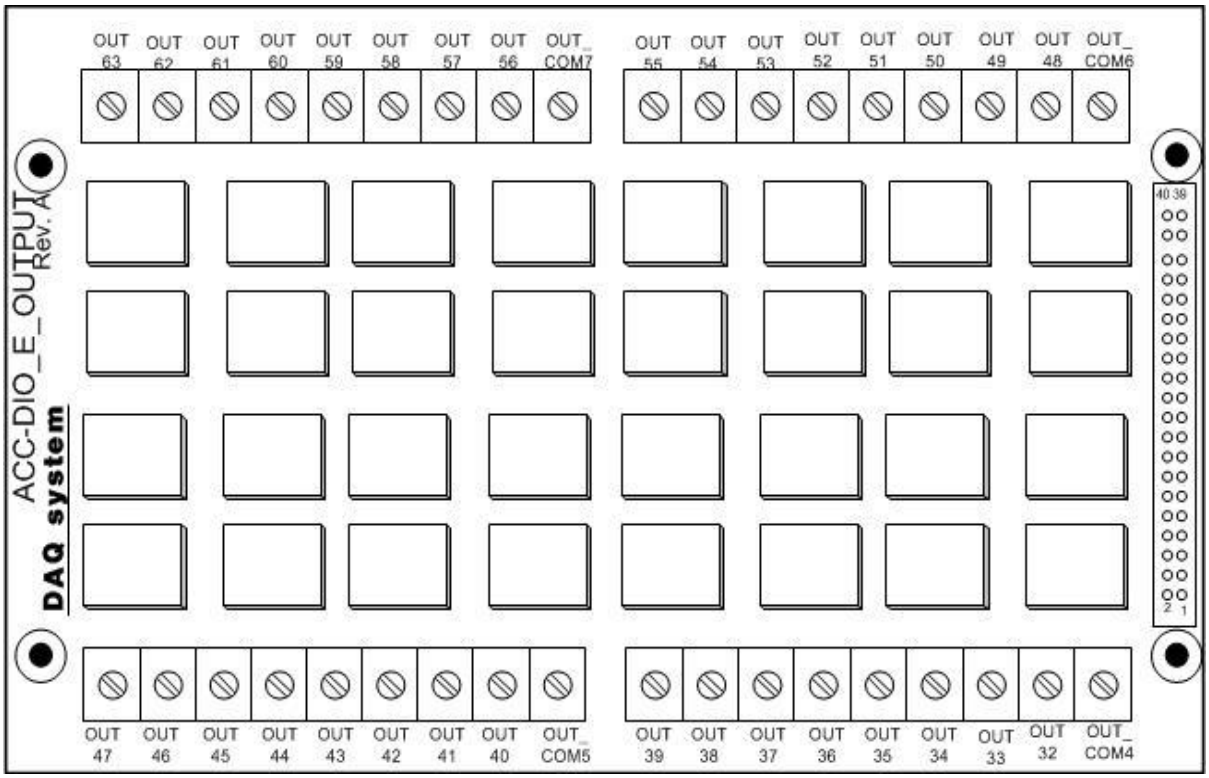


In the figure, the digital output circuit is isolated by a port coupler. "OUT_POWER" and "OUT_VDD" are commonly connected to the output circuit.

The terminal board **ACC-DIO_B_OUTPUT** is equipped with four circuits as described above, ie there are four OUT-COMs in each of the eight photo couplers. The extension terminal board ACC-DIO_E_OUTPUT is also provided with four circuits as described above. In other words, there are 4 OUT-COMs for every 8 photo couplers.

Combining **ACC-DIO_B_OUTPUT** and **ACC-DIO_E_OUTPUT** board result in a 64-bit output board. In addition, **ACC-DIO_B_OUTPUT** and **ACC-DIO_E_OUTPUT** can be connected to the remaining ports (J1 connection) to be used as a total 128-bit output board.

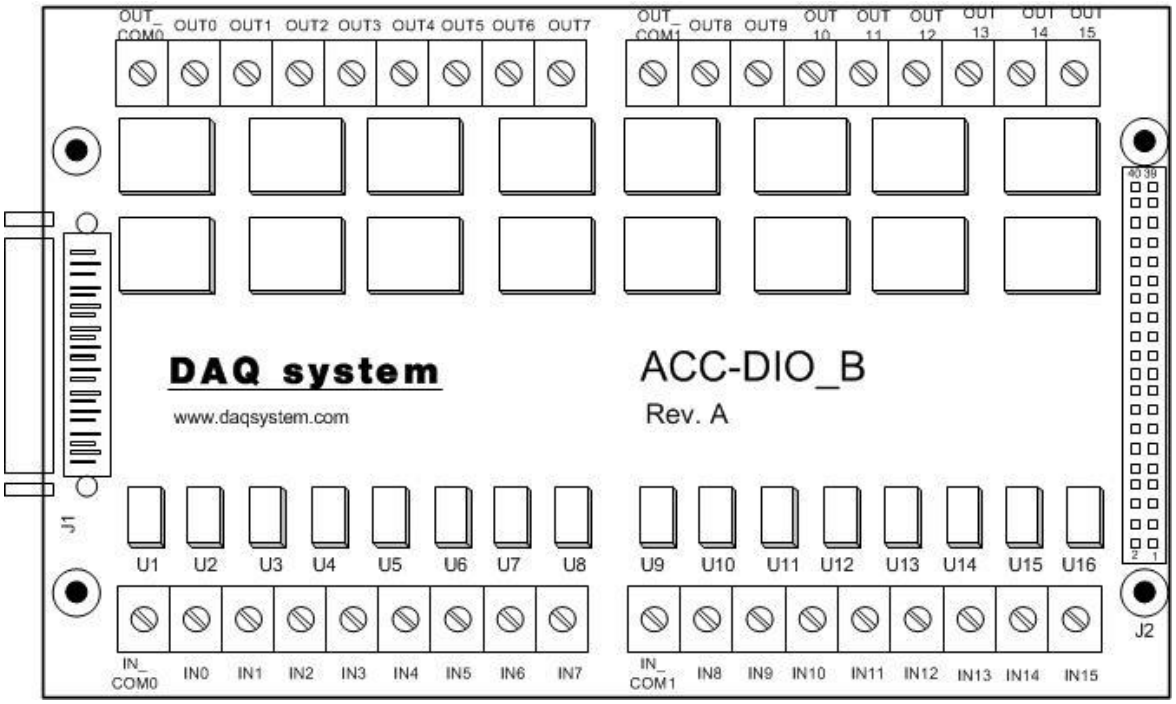

OUT_ COM2
OUT 16
OUT 17
OUT 18
OUT 19
OUT 20
OUT 21
OUT 22
OUT 23
OUT_ COM3
OUT 24
OUT 25
OUT 26
OUT 27
OUT 28
OUT 29
OUT 30
OUT 31
DAQ system
www.daqsystem.com
ACC-DIO_B_OUTPUT
Rev. A
J1
J2
OUT_ COM0
OUT0
OUT1
OUT2
OUT3
OUT4
OUT5
OUT6
OUT7
OUT_ COM1
OUT8
OUT9
OUT 10
OUT 11
OUT 12
OUT 13
OUT 14
OUT 15

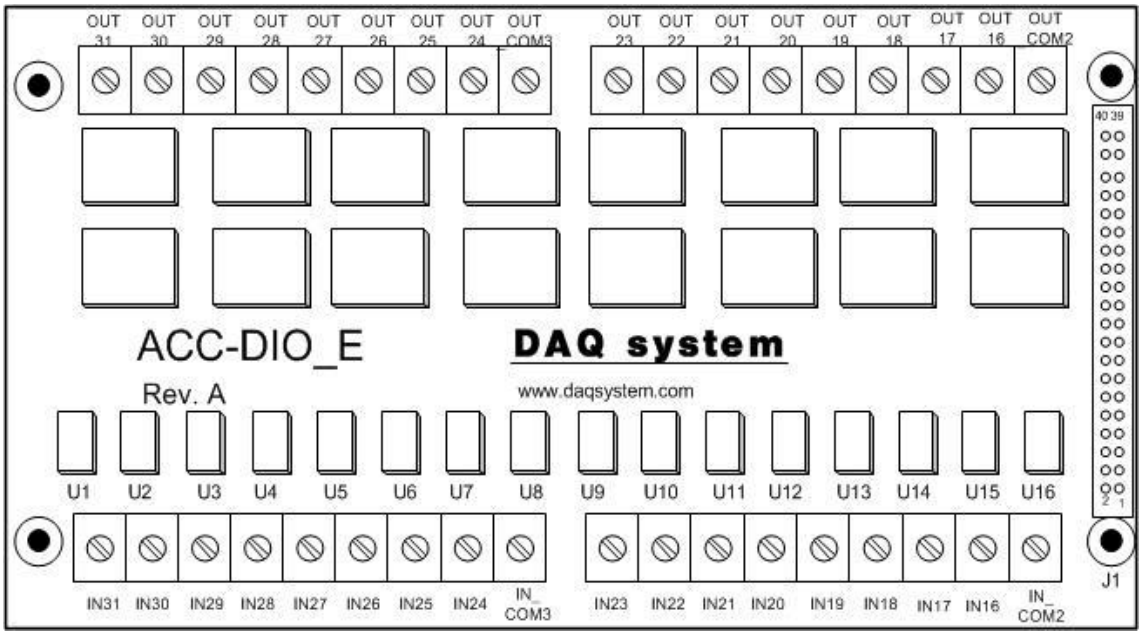

OUT 63
OUT 62
OUT 61
OUT 60
OUT 59
OUT 58
OUT 57
OUT 56
OUT_ COM7
OUT 55
OUT 54
OUT 53
OUT 52
OUT 51
OUT 50
OUT 49
OUT 48
OUT_ COM6
ACC-DIO_E_OUTPUT
Rev. A
DAQ system
OUT 47
OUT 46
OUT 45
OUT 44
OUT 43
OUT 42
OUT 41
OUT 40
OUT_ COM5
OUT 39
OUT 38
OUT 37
OUT 36
OUT 35
OUT 34
OUT 33
OUT 32
OUT_ COM4

< Digital Input/Output Terminal Board Circuit Configuration >

There are two IN-COMs on the terminal board **ACC-DIO_B** for every eight photocouplers. In addition, there are OUT-COM for every 8 photo couplers, and there are 2 OUT-COM. That is, you can use a 16-bit input/output board with one board. Also, the extended terminal board **ACC-DIO_E** is provided with four circuits as described above.

Combining **ACC-DIO_B** and **ACC-DIO_E** results in a 32-bit input/output board. (J2 connection). In addition, **ACC-DIO_B** and **ACC-DIO_E** can be connected to the remaining ports (J1 connection) to be used as a total 64-bit input/output board.





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-DIO02 API Programming

-- DAQ system

MEMO

Contact Point

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Measurement & Automation