PCI Express-compliant
Opto-isolated Digital I/O Board with On-board power supply

DIO-1616B-PE

Includes API-PAC Driver Library

This PCI Express compliant interface board was designed to extend digital signal I/O functions using a standard PC.

DIO-1616B-PE is a 12 - 24VDC digital I/O board with 16ch opto-coupler isolated inputs and 16ch opto-coupler isolated open-collector outputs with a 12VDC on-board power. All input signals can be used as interrupts. It is equipped with a digital filter function and output transistor protection circuit (voltage surge and overcurrent protection).

Both Windows and Linux drivers are included with this board.

CONTEC provides drivers that enable these boards to be used with LabVIEW.

Packing List

- Board [DIO-1616B-PE] …1
- First step guide … 1
- CD-ROM *1 [API-PAC(W32)] …1
*1 The CD-ROM contains the driver software and User's Guide.

Features

Opto-coupler isolated input (support current sink output) and opto-coupler isolated open-collector output (current sink)
This board has 16ch of opto-coupler isolated input (supporting current sink output) with a 200μsec response speed and 16ch of opto-coupler isolated open-collector output (current sink).

16ch share a common terminal, each capable of supporting different external driver voltages of 12 - 24 VDC for I/O.

Opto-coupler bus isolation
The PCI Express bus (PC) is isolated from both the input and output interfaces by the use of opto-couplers, providing superior noise immunity.

12VDC 240mA on-board power supply
This board has a 12VDC 240mA on-board power supply. 16ch share a common terminal, each capable of supporting different external driver voltages of 12 - 24 VDC for I/O.

All input signals can be used as interrupts
All input signals can be used as interrupts. Disable or enable interrupts in bit units and select the interrupt edge via software.

Windows and Linux driver libraries are included
The included driver library [API-PAC(W32)] makes it possible to create applications in both Windows and Linux environments. A diagnostic program to check the hardware operation is also provided.

Digital filter prevents input signal errors from noise or chattering.
A digital filter is provided to prevent input signal errors from noise or chattering. This filter can be added to each input terminal, with settings performed via software.

Zener diodes on output circuits provide voltage surge protection with poly-switches for overcurrent protection.
Zener diodes are connected to the output circuits for protection against voltage surges. Similarly, poly-switches are provided for each group of 8ch outputs for over-current protection.
The output rating is 35 VDC (max), 100mA per channel.

Functions and connectors are compatible with PIO-16/16L(PCI)B series PCI-bus boards
Compatible connector shapes and pin assignments provide easy transition from PCI based to PCI-Express based systems.

LabVIEW support
LabVIEW is supported by using CONTEC's dedicated library VI-DAQ.

Specifications

Item	Specification
Input	
Input format	Opto-coupler isolated input (Compatible with current sink output) (Negative logic *1)
Number of input signal channels	16channels (all available for interrupts) (1 common in 16channels)
Input resistance	4.7kΩ
Input ON current	2.0mA or more
Input OFF current	0.16mA or less
Interrupt	16 interrupt input signals are arranged into a single output of interrupt signal INTA. An interrupt is generated at the rising edge (HIGH-to-LOW transition) or falling edge (LOW-to-HIGH transition).
Response time	Within 200μsec
Output	
Output format	Opto-coupler isolated open collector output (current sink type) (Negative logic *1)
Number of output signal channels	16channels (1 common per 16channels)
Output rating — Output voltage	35VDC (Max.)
Output rating — Output current	100mA (par channel) (Max.)
Residual voltage with output on	0.5V or less (Output current$\leq$50mA), 1.0V or less (Output current$\leq$100mA)
Surge protector	Zener diode RD47FM(NEC) or equivalent to it
Response time	Within 200μsec
Item	**Specification**
Common	
Built-in power	12VDC 240mA *2
Allowable distance of signal extension	Approx. 50m (depending on wiring environment)
I/O address	Any 32-byte boundary
Interruption level	1 level use
Max. board count for connection	16 boards including the master board
Isolated Power	500Vrms
External circuit power supply	12 - 24VDC(±10%)
Power consumption (Max.)	When using the internal power supply : 3.3VDC 350mA, 12VDC 350mA. When using the external power supply : 3.3VDC 350mA
Operating condition	0 - 50°C, 10 - 90%RH (No condensation)
Bus specification	PCI Express Base Specification Rev. 1.0a x1
Dimension (mm)	169.33(L) x 110.18(H)
Connector	37 pin D-SUB connector [F (female) type] DCLC-J37SAF-20L9E [mfd. by JAE] equivalent to it
Weight	140g

*1　Data "0" and "1" correspond to the High and Low levels, respectively.

*2　When using the internal power supply, the input section consumes up to 40mA and the SW section of output channel consumes up to 30mA, so the output current that can be supplied to the external device is 170mA.

Board Dimensions

169.33(L)

110.18(H)

[mm]
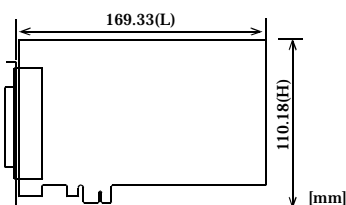
The standard outside dimension (L) is the distance from the end of the board to the outer surface of the slot cover.

Support Software

API-DIO(WDM)/API-DIO(98/PC)
Digital I/O driver for Windows®

[Found on the included CD-ROM driver library API-PAC(W32)]

For use in Windows® environments, API-DIO(98/PC) is driver library software that provides basic Win32 API functions (DLL).

Various sample programs using Visual Basic and Visual C++ and a diagnostic program used to check the hardware operation are also provided.

< Operating Environments >

Operating Systems: Windows Vista, Windows XP, Server 2003, 2000

Programming languages: Visual Basic, Visual C++, Visual C#, Delphi, C++ Builder

Upgraded software versions can be downloaded from CONTEC's document site (http://www.contec.com/apipac/).

For more details on supported OS, programming languages and for updated information, please visit CONTEC's Web site.

API-DIO(LNX)
Digital I/O driver for Linux

[Found on the included CD-ROM driver library API-PAC(W32)]

API-DIO(LNX) is driver software for Linux which provides device drivers (modules) by shared library and kernel versions. Various sample gcc programs are provided.

< Operating Environments >

Operating Systems: RedHatLinux, TurboLinux
(For details on supported distributions, refer to Help files that are available after installation.)

Programming language: gcc

Upgraded software versions can be downloaded from CONTEC's document site (http://www.contec.com/apipac/).

For more details on supported OS, programming languages and for updated information, please visit CONTEC's Web site.

VI-DAQ
Data acquisition VI library for LabVIEW

[Available for free download from CONTEC's web site]

CONTEC's VI library is for use with National Instruments' LabVIEW.
VI-DAQ is designed with functions similar to that of LabVIEW's Data Acquisition VI, allowing various devices to be used without complicated settings.
For more details and to download VI-DAQ go to http://www.contec.com/vidaq/.

Optional Cables and Connectors

Shielded Cable with Two 37-pin D- SUB Connectors
:PCB37PS-0.5P (0.5m)
:PCB37PS-1.5P (1.5m)
:PCB37PS-3P (3m)
:PCB37PS-5P (5m)

Flat Cable with One 37-pin D- SUB Connector
:PCA37P-1.5 (1.5m)
:PCA37P-3 (3m)
:PCA37P-5 (5m)

Shielded Cable with One 37-pin D- SUB Connector
: PCA37PS-0.5P (0.5m)
: PCA37PS-1.5P (1.5m)
: PCA37PS-3P (3m)
: PCA37PS-5P (5m)

37-pin D-SUB Male Connector Set (5 Pieces)
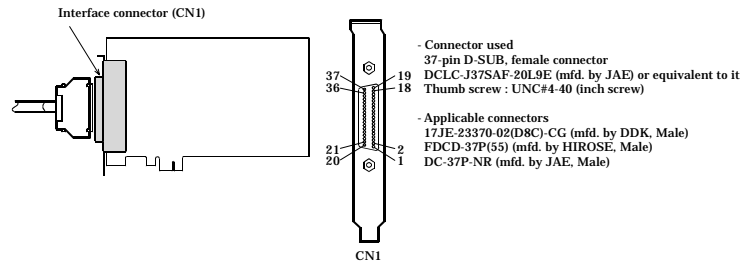: CN5-D37M

Accessories

Screw Terminal (M3 x 37P)	:EPD-37A *1
Screw Terminal (M3.5 x 37P)	:EPD-37 *1
General Purpose Terminal	:DTP-3A *1
Screw Terminal	:DTP-4A *1
Signal Monitor for Digital I/O	:CM-32(PC)E *1

*1 A PCB37P or PCB37PS optional cable is required separately.
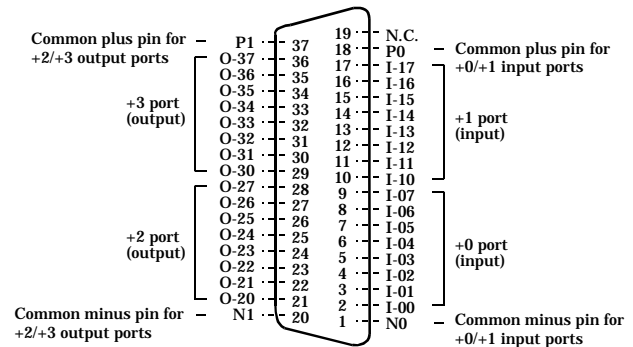
On-board connector wiring

: PCB3
: PCB3

Connector shape
The on-board interface connector (CN1) is used when connecting this product and the external devices.

- Connector used
  37-pin D-SUB, female connector
  DCLC-J37SAF-20L9E (mfd. by JAE) or equivalent to it
  Thumb screw : UNC#4-40 (inch screw)
- Applicable connectors
  17JE-23370-02(D8C)-CG (mfd. by DDK, Male)
  FDCD-37P(55) (mfd. by HIROSE, Male)
  DC-37P-NR (mfd. by JAE, Male)

Interface connector (CN1)

CN1

Connector Pin Assignment
Pin Assignments of Interface Connector (CN1)

Common plus pin for +2/+3 output ports — P1
O-37, O-36, O-35, O-34, O-33, O-32, O-31, O-30 — +3 port (output)
O-27, O-26, O-25, O-24, O-23, O-22, O-21, O-20 — +2 port (output)
Common minus pin for +2/+3 output ports — N1

N.C., P0 — Common plus pin for +0/+1 input ports
I-17, I-16, I-15, I-14, I-13, I-12, I-11, I-10 — +1 port (input)
I-07, I-06, I-05, I-04, I-03, I-02, I-01, I-00 — +0 port (input)
N0 — Common minus pin for +0/+1 input ports

I-00 - I-17 can be used as interrupt signal.
* The numbers in square brackets [ ] are pin numbers designated by HONDA TSUSHIN KOGYO CO., LTD.

I-00 - I-17	16 input signal pins. Connect output signals from the external device to these pins.
O-20 - O-37	16 output signal pins. Connect these pins to the input signal pins of the external device.
P0	When the external power supply is selected, its positive side is connected to these pins. When the internal power supply is used, these pins output power at +12 V. These pins are common to 16 input signal pins.
P1	When the external power supply is selected, its negative side is connected to this pin. When the internal power supply is selected, this pin serves as the ground. These pins are common to 16 input signal pins.
N0	When the external power supply is selected, its positive side is connected to these pins. When the internal power supply is used, these pins output power at +12 V. These pins are common to 16 input signal pins.
N1	When the external power supply is selected, its negative side is connected to this pin. When the internal power supply is selected, this pin serves as the ground. These pins are common to 16 input signal pins.
N.C.	This pin is left unconnected.

Connection of Input Signals

Connect the input signals to a device which can be current-driven, such as a switch or transistor output device.
The board inputs the ON/OFF state of the current-driven device as a digital value.
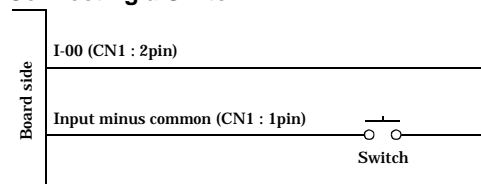
Input Circuit
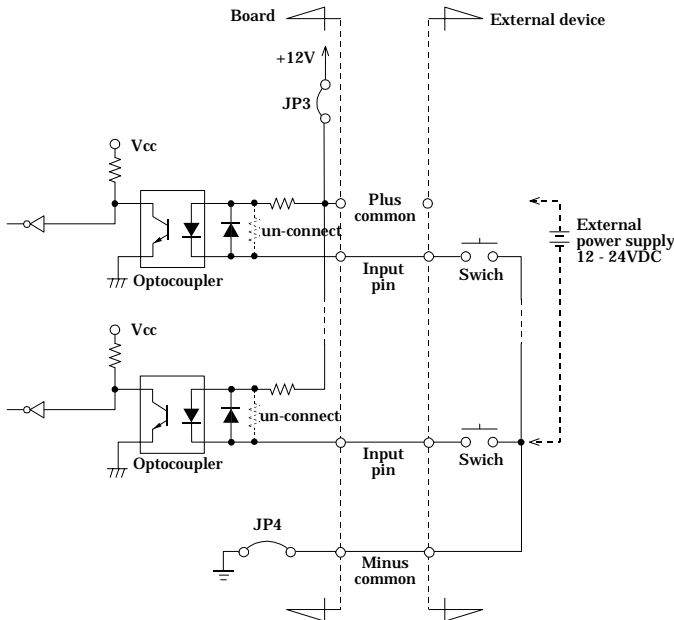
* Input pin represents I-xx.

The input circuits of interface blocks of this product are illustrated above. Connect the input signals to a device which can be current-driven, such as a switch or transistor output device.
This product inputs the ON/OFF state of the current-driven device as a digital value. The signal inputs are isolated by opto-couplers (ready to accept current sinking output signals). This product therefore requires the on-board internal power supply or the external power supply to drive the input section of this product. In this case, 5.1mA current is requested each channel on 24VDC (2.6mA on 12VDC).

⚠ CAUTION
Please refer to Selecting Power Supply, and choose the proper supply by jumps.
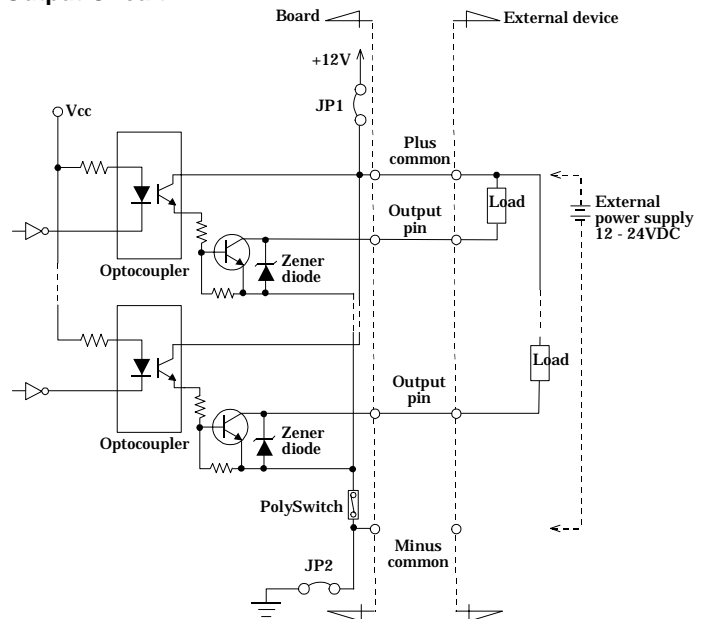
Connecting a Switch

When the switch is ON, the corresponding bit contains 1.
When the switch is OFF, by contrast, the bit contains 0.

Connection of Output Signals

Connect the output signals to a current-driven controlled device such as a relay or LED.
The board controls turning ON/OFF the current-driven controlled device using a digital value.

Output Circuit

* Output pin represents O-xx.

The output circuits of interface blocks of this product are illustrated above. The signal output section is an opto-coupler isolated, open-collector output (current sink type). This product therefore requires the on-board internal power supply or the external power supply to drive the output section of this product.
The rated output current per channel is 100 mA at maximum.
The output section can also be connected to a TTL level input as it uses a low-saturated transistor for output. The residual voltage (low-level voltage) between the collector and emitter with the output on is 0.5 V or less at an output current within 50 mA or at most 1.0 V at an output current within 100 mA.
A zener diode is connected to the output transistor for protection from surge voltages.
A PolySwitch-based over-current protector is provided for every 8 output transistors.
When the over-current protector works, the output section of this product is temporarily disabled. If this is the case, turn of the power to the PC and the external power supply and wait for a few minutes, then turn them on back.

⚠ CAUTION
When the PC is turned on, all outputs are reset to OFF.
Please refer to "Selecting Power Supply" and then connect to the jumper in accordance with the power supply to be used.
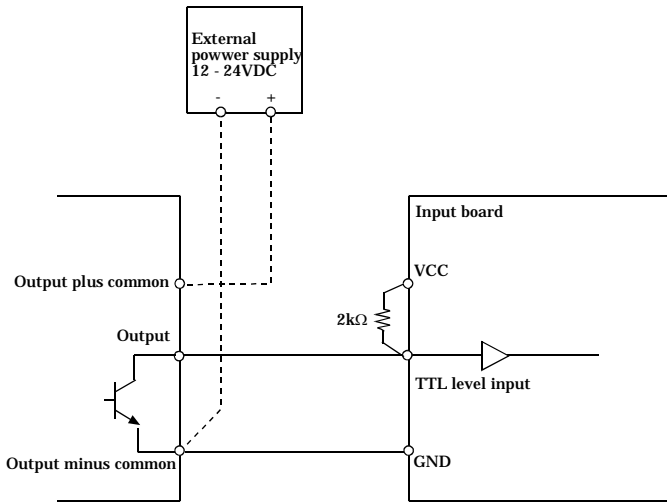
Connection to the LED
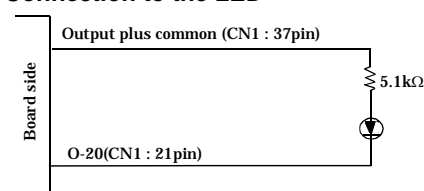
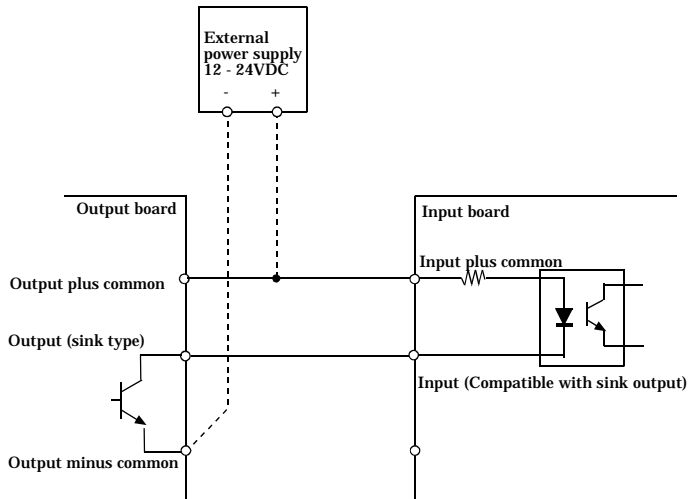When "1" is output to a relevant bit, the corresponding LED comes on.
When "0" is output to the bit, in contrast, the LED goes out.

Example of Connection to TTL Level Input

Connecting a Current Sink Output and Current Sink Output-Supported Input

The following example shows a connection between a sink type output (output board) and a sink output support input (input board). Refer to this connection example when you connect such boards to each other.

Block Diagrams