## Digital I/O Board with Opto-Isolation for PCI
# PIO-16/16L(PCI)H



\* Specifications, color and design of the products are subject to change without notice.

This product is a PCI-compliant interface board used to provide a digital signal I/O function on a PC.

This product can input and output digital signals at 12 - 24VDC.

This product features 16 opto-coupler isolated inputs and 16 opto-coupler isolated open-collector outputs.   You can use 16 input signals as interrupt inputs.   In addition, the digital filter function to prevent wrong recognition of input signals is provided and output transistor protection circuit (surge voltage protection and overcurrent protection).
Windows/Linux driver is bundled with this product.
Possible to be used as a data recording device for LabVIEW, with dedicated libraries.

\* The contents in this document are subject to change without notice.

\* Visit the CONTEC website to check the latest details in the document.

\* The information in the data sheets is as of April, 2018.

## Features

**Opto-coupler isolated input (compatible with current sink output) and opto-coupler isolated open-collector output (current sink type)**
This product has the 16ch of opto-coupler isolated input (compatible with current sink output) and 16ch of opto-coupler isolated open-collector output (current sink type) whose response speed is 200μsec.   Common terminal provided per 16channels, capable of supporting a different external power supply.   Supporting driver voltages of 12 - 24 VDC for I/O.

**Opto-coupler bus isolation**
As the PC is isolated from the input and output interfaces by opto-couplers, this product has excellent noise performance.

**You can use all of the input signals as interrupt request signals.**
You can use all of the input signals as interrupt request signals and also disable or enable the interrupt in bit units and select the edge of the input signals, at which to generate an interrupt.

**Windows/Linux compatible driver libraries are attached.**
Using the attached driver library API-PAC(W32) makes it possible to create applications of Windows/Linux.   In addition, a diagnostic program by which the operations of hardware can be checked is provided.

**This product has a digital filter to prevent wrong recognition of input signals from carrying noise or a chattering.**
This product has a digital filter to prevent wrong recognition of input signals from carrying noise or a chattering.   All input terminals can be added a digital filter, and the setting can be performed by software.

**Output circuits include zener diodes for surge voltage protection and poly-switches for overcurrent protection.**
Zener diodes are connected to the output circuits to protect against surge voltages.   Similarly, polyswitches are fitted to each group of 8channels outputs for over-current protection. The output rating is max. 35VDC, 100mA per channel.

**LabVIEW is supported by a plug-in of dedicated library VI-DAQ.**
Using the dedicated library VI-DAQ makes it possible to make a LabVIEW application.

## Specification

| Item | | Specification |
|---|---|---|
| Input section | | |
| Input format | | Opto-coupler isolated input (Compatible with current sink output)(Negative logic *1) |
| Number of input signal channels | | 16 channels (all available for interrupts) (1 common ) |
| 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 | | 200μsec within |
| Output section | | |
| Output format | | Opto-coupler isolated open collector output (current sink type) (Negative logic*1) |
| Number of output signal channels | | 16 channels (1 common) |
| Output rating | Output voltage | 35VDC (Max.) |
| | Output current | 100mA (par channel) (Max. ) |
| Residual voltage with output on | | 0.5V or less (Output current≤50mA), 1.0V or less (Output current≤100mA) |
| Surge protector | | Zener diode RD47FM(NEC) or equivalent |
| Response time | | 200μsec within |
| Common section | | |
| I/O address | | Any 32-byte boundary |
| Interruption level | | 1 level use |
| Max. board count for connection | | 16 boards including the master board |
| Dielectric strength | | 1000Vrms |
| External circuit power supply | | 12 - 24VDC(±10%) |
| Power consumption | | 5VDC 200mA (Max.) |
| Operating condition | | 0 - 50°C, 10 - 90%RH (No condensation) |
| Allowable distance of signal extension | | Approx. 50m (depending on wiring environment) |
| PCI bus specification | | 33bit, 33MHz, Universal key shapes supported *2 |
| Dimension (mm) | | 121.69(L) x 105.68(H) |
| Weight | | 130g |
| Certification | | ROHS,CE,VCCI |

\*1    Data "0" and "1" correspond to the High and Low levels, respectively.
\*2    This board requires power supply at +5 V from an expansion slot (it does not work on a machine with a +3.3V power supply alone).

## Board Dimensions

121.69(L)

105.68(H)

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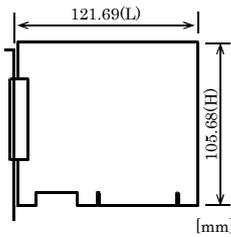
The standard outside dimension (L) is the distance from the end of the board to the outer surface of the slot cover.

## Support Software

**Windows version of digital I/O driver API-DIO(WDM)/ API-DIO(98/PC)**
**[Stored on the bundled disk driver library API-PAC(W32)]**
The API-DIO(WDM) is the Windows version driver library software that provides products in the form of Win32 API functions (DLL).   Various sample programs such as Visual Basic and Visual C++, etc and diagnostic program *1useful for checking operation is provided.
For more details on the supported OS, applicable language and new information, please visit the CONTEC's Web site.

**Linux version of digital I/O driver API-DIO(LNX)**
**[Stored on the bundled disk driver library API-PAC(W32)]**
The API-DIO(LNX) is the Linux version driver software which provides device drivers (modules) by shared library and kernel version.   Various sample programs of gcc are provided.
For more details on the supported OS, applicable language and new information, please visit the CONTEC's Web site.

**LabVIEW-support data acquisition library DAQfast for LabVIEW**
**(Available for downloading (free of charge) from the CONTEC web site.)**
This is a data collection library to use in the LabVIEW by National Instruments.   With Polymorphic VI, our design enables a LabVIEW user to operate seamlessly.   Our aim is that the customers to perform easily, promptly what they wish to do.
For more details on the library and download of DAQfast for LabVIEW, please visit the CONTEC's Web site.
**Data acquisition library for LabVIEW    VI-DAQ (Available for downloading (free of charge) from the CONTEC web site.)**
This is a VI library to use in National Instruments LabVIEW. VI-DAQ is created with a function form similar to that of LabVIEW's Data Acquisition VI, allowing you to use various devices without complicated settings.
For more details on the library and download of VI-DAQ, please visit the CONTEC's Web site.

## Packing List

Board [PIO-16/16L(PCI)H] …1
First step guide … 1
Disk *1 [API-PAC(W32)] …1
Warranty Certificate…1
Serial Number Label…1

*1    The Disk contains the driver software and User's Guide.

## Cable & Connector (Option )

Flat Cable with a 37-Pin D-type Connectors on 2Ends
                                  : PCB37P-1.5 (1.5m)
                                  : PCB37P-3 (3m)
                                  : PCB37P-5 (5m)

Shielded cable with two 37-pin D- Type connectors
                                  : PCB37PS-0.5P (0.5m)
                                  : PCB37PS-1.5P (1.5m)
                                  : PCB37PS-3P (3m)
                                  : PCB37PS-5P (5m)

Flat Cable with a 37-pin D-type Connector
                                  : PCA37P-1.5 (1.5m)
                                  : PCA37P-3 (3m)
                                  : PCA37P-5 (5m)
Shielded Cable with Two 37-pin D-Type Connectors
                                  : PCA37PS-0.5P (0.5m)
                                  : PCA37PS-1.5P (1.5m)
                                  : PCA37PS-3P (3m)
                                  : PCA37PS-5P (5m)

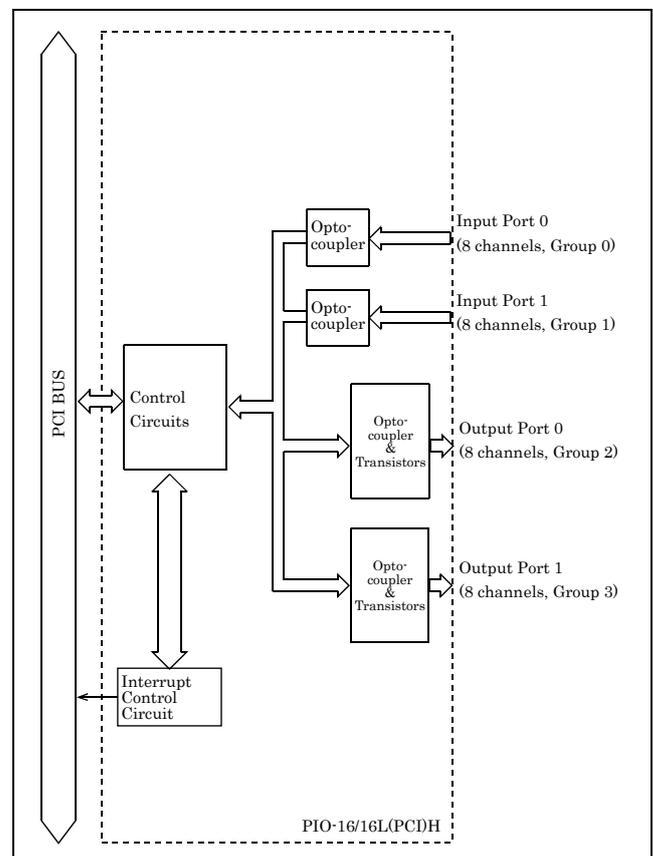## Accessories (Option)

Screw Terminal (M3 x 37P)               : EPD-37A *1*2
Screw Terminal (M3.5 x 37P)             : EPD-37 *1
General Purpose Terminal (M3 x 37P)     : DTP-3A *1
Screw Terminal (M2.5 x 37P)             : DTP-4C *1
Signal Monitor for Digital I/O (32Bits) : CM-32L *1

*1    A PCB37P or PCB37PS optional cable is required separately.
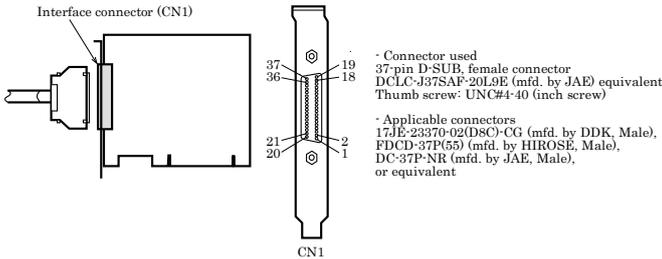*2 "Spring-up" type terminal is used to prevent terminal screws from falling off.

## Block Diagram



Input Port 0 (8 channels, Group 0)
Input Port 1 (8 channels, Group 1)
Output Port 0 (8 channels, Group 2)
Output Port 1 (8 channels, Group 3)
Opto-coupler
Opto-coupler & Transistors
Control Circuits
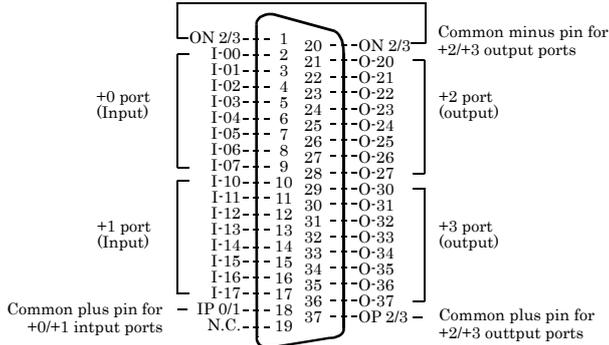Interrupt Control Circuit
PCI BUS
PIO-16/16L(PCI)H

## How to connect the connectors

### Connector shape

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

Interface connector (CN1)

CN1

- Connector used
37-pin D-SUB, female connector
DCLC-J37SAF-20L9E (mfd. by JAE) equivalent
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),
or equivalent

### Connector Pin Assignment

Pin Assignments of Interface Connector (CN1)



| | | |
|---|---|---|
| I-00 - I-17 | 16 input signal pins. Connect output signals from the external device to these pins. | |
| O20 - O37 | 16 output signal pins. Connect these pins to the input signal pins of the external device. | |
| IP 0/1 | Connect the positive side of the external power supply. These pins are common to 16 input signal pins. | |
| OP 2/3 | Connect the positive side of the external power supply. These pins are common to 16 output signal pins. | |
| ON 2/3 | Connect the negative side of the external power supply. These pins are common to 16 output signal pins. | |
| N.C. | This pin is left unconnected. | |

## Connecting Input Signals

Connect the input signals to a device which can be current-driven, such as a switch or transistor output device.
The connection requires an external power supply to feed currents.
The board inputs the ON/OFF state of the current-driven device as a digital value.
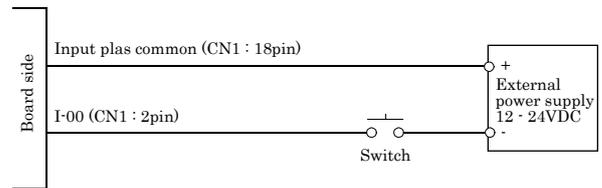
### Input Circuit



* Input pin represent input signals.
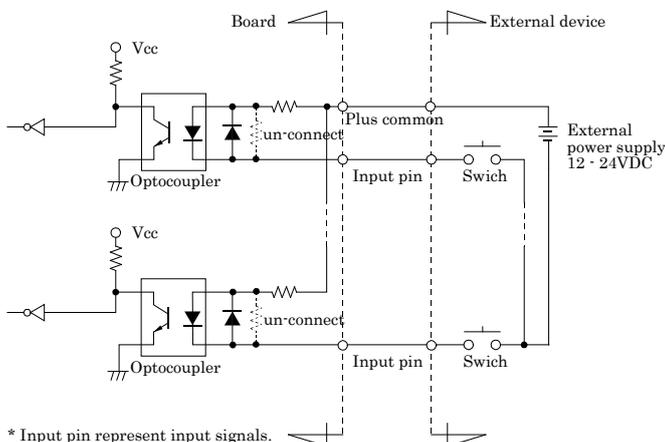
The input circuits of interface blocks of this product is illustrated in the bottom-left diagram.   The signal inputs are isolated by opto-couplers (ready to accept current sinking

output signals).   The board therefore requires an external power supply to drive the inputs.   The power requirement for each input pin is about 5.1 mA at 24 VDC (about 2.6 mA at 12 VDC).

### Connecting a Switch



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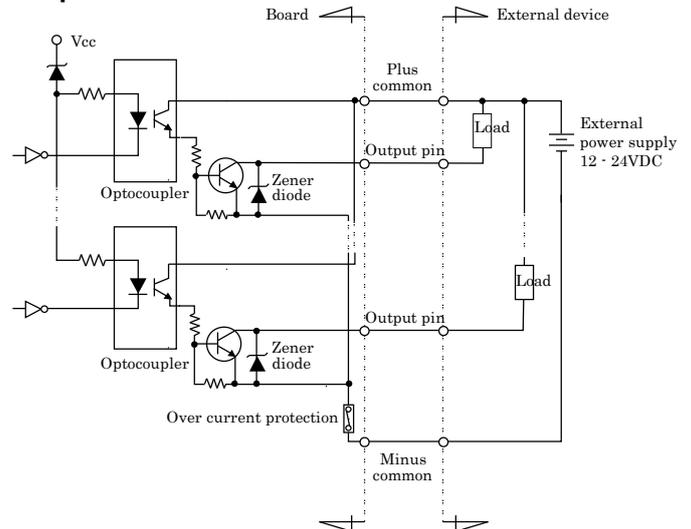When the switch is OFF, by contrast, the bit contains 0.

## Connecting Output Signals

Connect the output signals to a current-driven controlled device such as a relay or LED.
The connection requires an external power supply to feed currents.
The board controls turning on/off the current-driven controlled device using a digital value.

### Output Circuit



* Output pin represent output signals.

The output circuits of interface blocks of this product is illustrated in the above diagram.   The signal output section is an opto-coupler isolated, open-collector output (current sink type).   Driving the output section requires an external power supply.
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.
To protect against surge voltage, a Zener diode is connected to the output transistor. Also, an overcurrent protection circuit is attached to a unit of eight output channels.
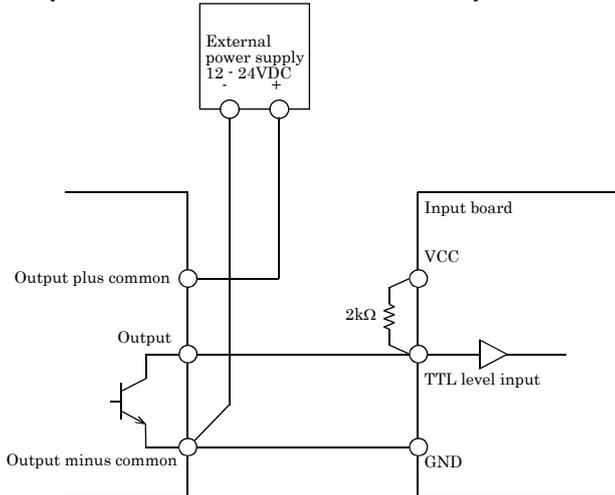
⚠ CAUTION
When the PC is turned on, all output are reset to OFF.

## Connection to the LED
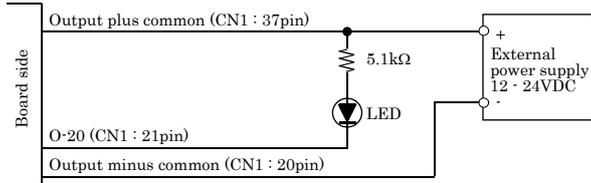


When "1" is output to a relevant bit, the corresponding LED comes on.
When "0" is output to the bit, in contrast, the LED goes out.

## Example of Connection to TTL Level Input



### Connecting the Sink Type Output and Sink Output Support 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.
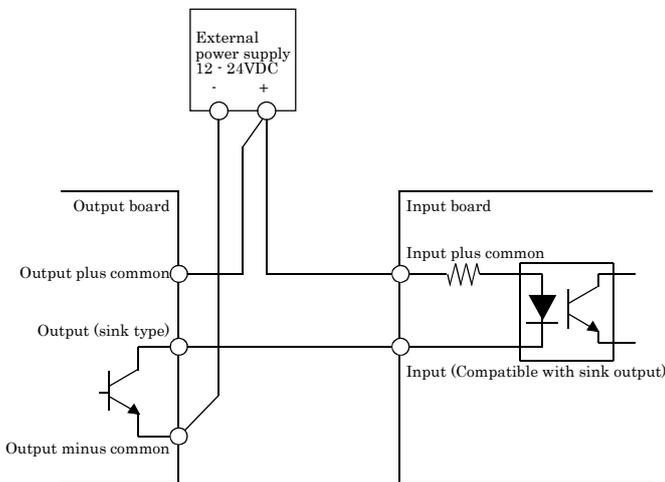


### Differences between the PIO-16/16L(PCI)H and PIO-16/16L(PCI)

The PIO-16/16L(PCI)H is connector-pin compatible with the conventional PIO-16/16L(PCI) but has the following differences from it:

(1) Different in the number of input signals available to interrupt requests
PIO-16/16L(PCI)H  : All of 16 channels
PIO-16/16L(PCI)     : 4 channels

(2) Different in the expression to calculate the digital filter time (n: setting value)
PIO-16/16L(PCI)H  : $2^n / (8 \times 10^6)$
PIO-16/16L(PCI)     : $2^n / (16 \times 10^6)$

(3) Protective elements provided for outputs
PIO-16/16L(PCI)H  : Surge protector: Zener diode
PIO-16/16L(PCI)     : Nothing

(4) Different in interrupt level resource allocation
PIO-16/16L(PCI)H  : Automatically allocates on interrupt level.
PIO-16/16L(PCI)     : Uses a jumper switch to select whether to allocate interrupt levels.

(5) Different in board dimensions
PIO-16/16L(PCI)H  : 121.69(L) x 105.68(H) mm
PIO-16/16L(PCI)     : 176.41(L) x 106.68(H) mm