Digital I/O Board
with Opto-Isolation for PCI Express
DIO-1616B-PE

This product is a PCI Express board used to provide a digital signal I/O function on a PC.   This product features 16 inputs and 16 open-collector outputs, and has 12 - 24VDC opto-coupler type isolation with an internal 12VDC power supply that does not require external power.   You can use all of the input signals as interrupt inputs.   Equipped with the digital filter function and output transistor protection circuit (surge voltage protection and overcurrent protection).   Windows/Linux driver is supported 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 October, 2022.

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

Features

Opto-coupler isolated input (supporting current sink output) and opto-coupler isolated open-collector output (current sink type)
This product has the opto-coupler isolated input 16channels (supporting current sink output) whose response speed is 200µsec and opto-coupler isolated open-collector output 16channels (current sink type).   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 PCI Express bus (PC) is isolated from the input and output interfaces by opto-couplers, this product has excellent noise performance.

Power supply (12VDC 240mA) for driving opto-coupler
Power supply (12VDC 240mA) for driving opto-coupler is equipped. Whether or not to use the internal power supply can be specified by jumpers in blocks of 16channels.

You can use all of the input signals as interrupt events.
You can use all of the input signals as interrupt events and also disable or enable the interrupt in bit units and select the interrupt edge.

Windows/Linux compatible driver libraries are supported.
Using the digital I/O driver 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 input signals from carrying noise or a chattering.
This product has a digital filter to prevent 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.

Functions and connectors are compatible with PCI compatible board PIO-16/16B(PCI)H.
The functions same with PCI compatible board PIO-16/16B(PCI)H are provided.   In addition, as there is compatibility in terms of connector shape and pin assignments, it is easy to migrate from the existing system.

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.

Included Items

Product [DIO-1616B-PE] ...1
Please read the following ... 1

Hardware 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 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 to it
Response time		Within 200μsec
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
Standard		VCCI Class A, CE Marking (EMC Directive Class A, RoHS Directive), UKCA

*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.

Physical Dimensions

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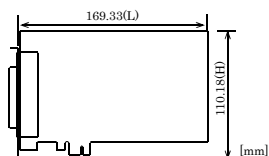
The standard outside dimension (L) is the distance from the end of the board to the outer surface of the slot cover.

Support Software

You can use CONTEC support software according to your purpose and development environment. For more details on the supported OS, applicable languages, or to download the latest version of software, visit the CONTEC Web site.

Name	Contents	How to get
Windows Version Digital I/O Driver software API-DIO(WDM)	The API-DIO(WDM) is the Windows version driver 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 useful for checking operation is provided.	Download from the CONTEC website
Linux Version Digital I/O Driver software API-DIO(LNX)	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.	Download from the CONTEC website
LabVIEW-support data acquisition library DAQfast for LabVIEW	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.	Download from the CONTEC website

Option

Product Name	Model type	Description
Flat Cable with Two 37-pin D- SUB Connectors	PCB37P-1.5	1.5m
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
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
Screw Terminal (M3 x 37P)	EPD-37A	*1*2
Screw Terminal (M3.5 x 37P)	EPD-37	*2
General Purpose Terminal (M3 x 37P)	DTP-3C	*2
Screw Terminal (M2.5 x 37P)	DTP-4C	*2
Signal Monitor for Digital I/O (32Bits)	CM-32L	*2

*1   "Spring-up" type terminal is used to prevent terminal screws from falling off.
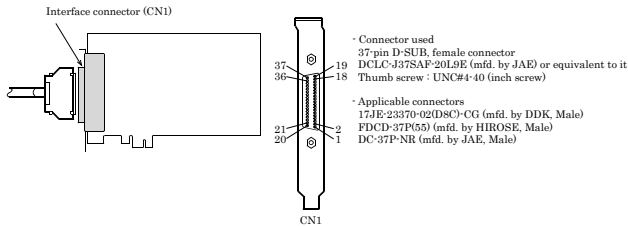*2   A PCB37P or PCB37PS optional cable is required separately.
* Check the CONTEC's Web site for more information on these options.
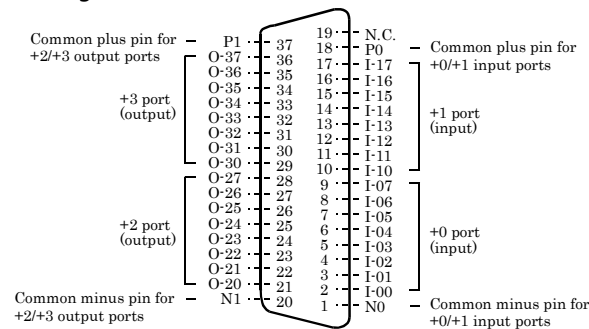
How to connect the connectors

Connector shape

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

Interface connector (CN1)

- 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)

CN1

Connector Pin Assignment
Pin Assignments of Interface Connector (CN1)

Common plus pin for +2/+3 output ports — P1

P1	37	19 · N.C.
O-37	36	18 · P0
O-36	35	17 · I-17
O-35	34	16 · I-16
O-34	33	15 · I-15
O-33	32	14 · I-14
O-32	31	13 · I-13
O-31	30	12 · I-12
O-30	29	11 · I-11
		10 · I-10
O-27	28	9 · I-07
O-26	27	8 · I-06
O-25	26	7 · I-05
O-24	25	6 · I-04
O-23	24	5 · I-03
O-22	23	4 · I-02
O-21	22	3 · I-01
O-20	21	2 · I-00
N1	20	1 · N0

Common plus pin for +0/+1 input ports — P0

+3 port (output) — O-37 to O-30
+1 port (input) — I-17 to I-10
+2 port (output) — O-27 to O-20
+0 port (input) — I-07 to I-00

Common minus pin for +2/+3 output ports — N1
Common minus pin for +0/+1 input ports — N0

I-00 - I-17 can be used as interrupt signal.

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.

Connecting 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
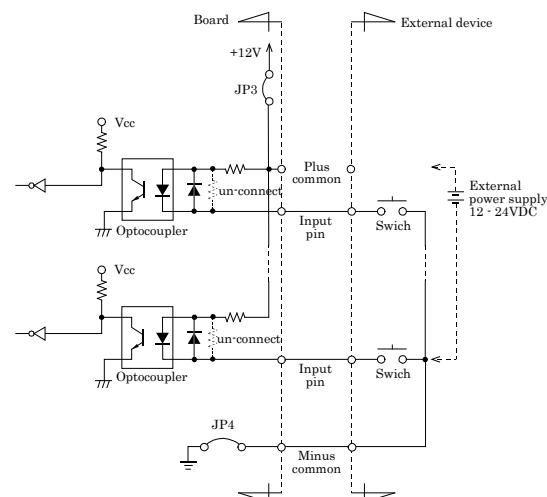
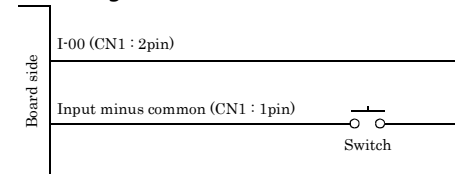

* Input pin represents I-xx.

The input circuits of interface blocks of this product are illustrated in Figure. 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

Board side
I-00 (CN1：2pin)
Input minus common (CN1：1pin)
Switch

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

Connecting Output Circuit

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
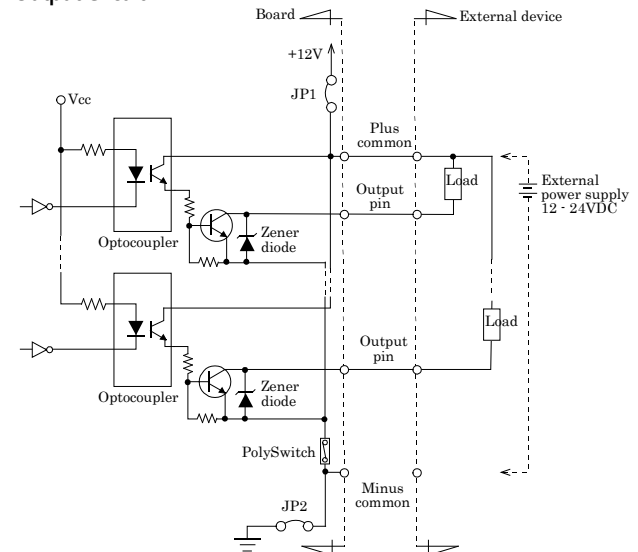
* Output pin represents O-xx.

The output circuits of interface blocks of this product are illustrated in Figure. 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 overcurrent protector is provided for every 8 output transistors.

When the overcurrent 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.
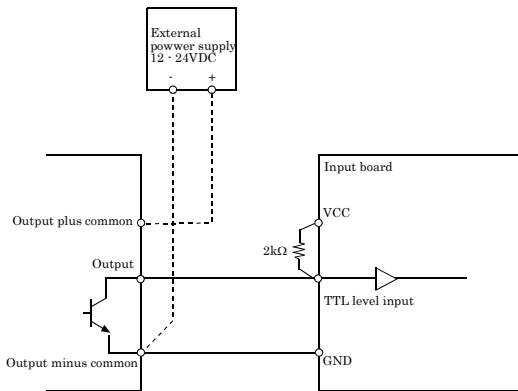
⚠ CAUTION
- When the PC is turned on, all output are reset to OFF.

  Please refer to "Selecting Power Supply" and then connecto the jumper in accordance with the power supply to be used.
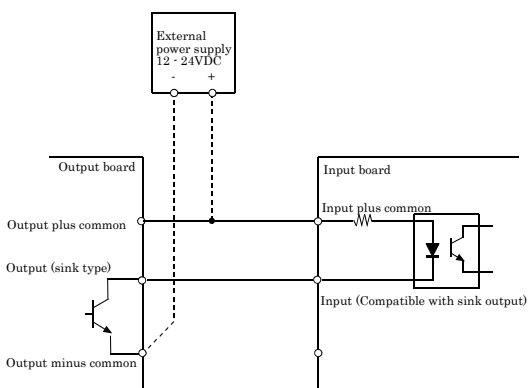
Connection to the LED
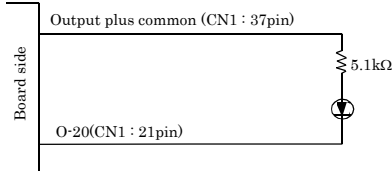
When "1" is output to a relevant bit, the corresponding LED comes on. When "0" is output to the bit, in contrast, the LED goes out.

Example of Connection to TTL Level Input

Connecting 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.