Digital I/O Unit with Opto-Isolation
for USB (On-board Power Supply)

DIO-1616BX-USB

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

This product is an USB2.0-compliant digital I/O unit used to provide a digital signal I/O function on a PC.

This product can input and output digital signals at 12VDC. This product features 16 channels of Optocoupler isolated inputs (compatible with current sink output) and 16 channels of Optocoupler isolated open-collector outputs (current sink type). You can use 16 input signals as interrupt inputs. Equipped with the digital filter function to prevent wrong recognition of input signals and output transistor protection circuit (surge voltage protection and over current protection).

As there is compatible with PCI bus-compatible board PIO-16/16B(PCI)H and PCI Express bus-compatible board DIO-1616B-PE in terms of connector shape and pin assignments, it is easy to migrate from the existing system.

Windows/Linux driver is supported with this product.

*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 November, 2022.

Features

- 16 channels of Optocoupler isolated inputs (compatible with current sink output) and 16 channels of Optocoupler isolated open-collector outputs (current sink type)

This product has the 16 channels of Optocoupler isolated inputs (compatible with current sink output) and the 16 channels of Optocoupler isolated open-collector outputs (current sink type) whose response speed is 200µsec. Supporting driver voltages of 12VDC for I/O.

- Power for opto-coupler operation (12VDC 240mA) supplied internally

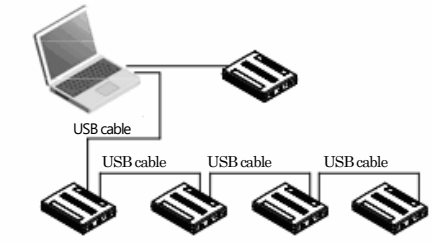
As the power to run the opto-couplers is supplied internally, no external power supply is required.

- Compatible to USB1.1/USB2.0

Compatible to USB1.1 / USB2.0 and capable to achieve high speed transfer at HighSpeed (480 Mbps).

- USB HUB function

This product has the USB HUB function. Max. 4 DIO-1616LX-USB can be used in 1 USB port of PC. When you use 4 or more DIO-1616LX-USB, you can do by connecting DIO-1616LX-USB to the another USB port of PC side. *1
Also, you can connect the CONTEC's USB device other than DIO-1616LX-USB to the USB port of DIO-1616LX-USB. *2*3



- Optocoupler bus isolation

As the USB (PC) is isolated from the input and output interfaces by Optocouplers, this product has excellent noise performance.

- You can use 16 input signals as interrupt request signals.

You can use 16 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.

- 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.

- Connectors are compatible with PCI/PCI Express bus-compatible board

As there is compatible with PIO-16/16B(PCI)H and DIO-1616B-PE in terms of connector shape and pin assignments, it is easy to migrate from the existing system. If the system of this product is created by the digital I/O driver API-DIO(98/PC), it is required to replace it with API-DIO(WDM).

- 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.

*1 Do not connect the device other than that of CONTEC's USB to the USB port included on the DIO-1616B-USB. Otherwise, this may cause a failure or malfunction.
*2 When connecting multiple units with USB HUB function and set up them, do one at a time and complete setup for the previous unit before starting to do the next unit.

Included Items

Unit [DIO-1616BX-USB] ... 1
Please read the following ... 1
AC adapter ...1
AC Cable (for 125VAC) ...1
USB cable (1.8m) ...
USB cable attachment on the main unit's side (For Mini B connector side) ...1
Clamps for prevention of cable on the main unit's side...1
Power connector MC1,5/3-ST-3,5 ...1
Ferrite core ...1

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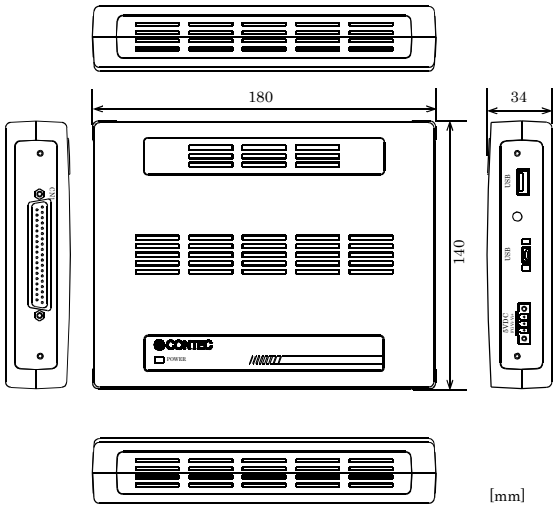
Hardware specifications

Item			Specification
Input section			
	Number of input signal channels		16 channels (all available for interrupts) (1 common in 16 channels unit)
	Input format		Optocoupler isolated input (Compatible with current sink output) (Negative logic *1)
	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 request signal INTA. An interrupt is generated at the rising edge (HIGH-to-LOW transition) or falling edge (LOW-to-HIGH transition) (set by software).
	Response time		200µsec within *2
Output section			
	Number of output signal channels		16 channels (1 common in 16 channels unit)
	Output format		Optocoupler isolated open collector output (current sink type) (Negative logic*1)
	Output rating	Output voltage	35VDC (Max.)
		Output current	100mA (per 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 *2
USB section			
	Bus specification		USB Specification 2.0/1.1 standard
	USB transfer rate		12Mbps (Full-speed), 480Mbps (High-speed) *3
	Power supply		Self-power
Common section			
	Number of terminals used at the same time		127 terminals (Max.) *4
	Dielectric strength		500Vrms
	Internal power supply		12VDC 240mA *5
	Current consumption (Max.)		5VDC 830mA
	Operating conditions *6		0 - 50°C, 10 - 90%RH (No condensation) * When using the attached AC adapter POA200-20-2, it is 0 - 40°C
	Allowable distance of signal extension		Approx. 50m (depending on wiring environment)
	Physical dimensions (mm)		180(W) x 140(D) x 34(H) (No protrusions)
	Weight		300g (Not including the USB cable, attachment)
	Connector		37 pin D-SUB connector [F (female) type] DCLC-J37SAF-20L9E [mfd. by JAE] equivalent to it
	Attached cable		USB cable 1.8m
	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 The Optocoupler's response time comes.
*3 This depends on the PC environment used (OS and USB host controller).
*4 As a USB hub is also counted as one device, you cannot just connect 127 USB unit.
*5 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.
*6 To suppress the heating, ensure that there are spaces for ventilation (about 5cm) around this product.

Physical Dimensions



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
USB I/O Unit Bracket for X Series	BRK-USB-X	
AC adaptor (input : 90 - 264VAC, output : 5VDC 2.0A)	POA200-20-2	*3

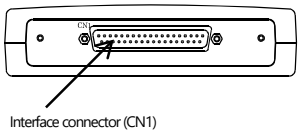
*1 "Spring-up" type terminal is used to prevent terminal screws from falling off.
*2 A PCB37P or PCB37PS optional cable is required separately.
*3 It is the same as the one appended to the product. Please buy it necessary for maintenance.

* Check the CONTEC's Web site for more information on these options.

Using the Connectors

Connecting to a Connector

To connect an external device to this product, plug the cable from the device into the interface connector (CN1) of unit shown below.



- Connector used
  37-pin D-SUB connector [F(female)type]
  DCLC-J37SAF-20L9E [mfd by JAE]+
  equivalence to it Lock nut UNC #4-40 (inch screw threads)

- Compatible connector
  17JE-23370-02(D8C) [mfd by DDK, M(male)type]
  FDCD-37P [mfd by HIROSE, M(male)type]
  DC-37P-N [mfd by JAE, M(male)type]

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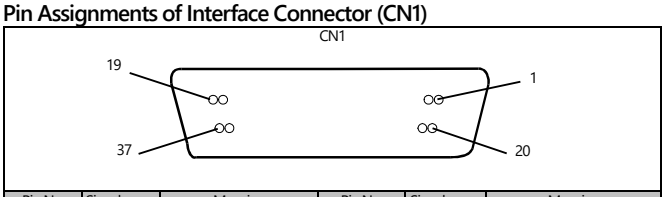
Connector Pin Assignment

Pin Assignments of Interface Connector (CN1)



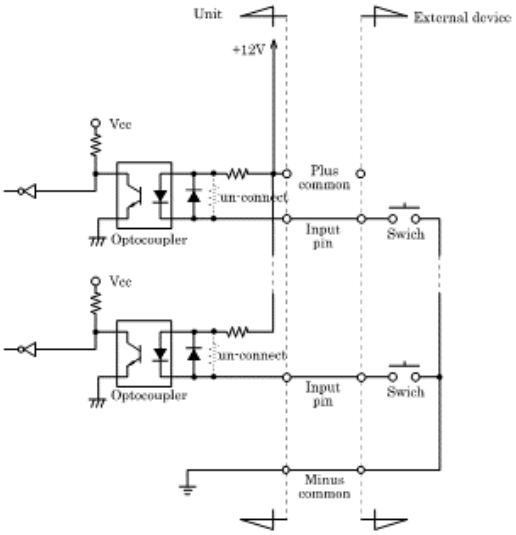
Pin No.	Signal name	Meaning	Pin No.	Signal name	Meaning
			19	N.C.	
37	P1	Common plus pin for +2/+3 output port	18	P0	Common plus pin for +0/+1 input port
36	O-37	+3 port (output)	17	I-17	+1 port (input)
35	O-36		16	I-16	
34	O-35		15	I-15	
33	O-34		14	I-14	
32	O-33		13	I-13	
31	O-32		12	I-12	
30	O-31		11	I-11	
29	O-30		10	I-10	
28	O-27	+2 port (output)	9	I-07	+0 port (input)
27	O-26		8	I-06	
26	O-25		7	I-05	
25	O-24		6	I-04	
24	O-23		5	I-03	
23	O-22		4	I-02	
22	O-21		3	I-01	
21	O-20		2	I-00	
20	N1	Common minus pin for +2/+3 output port	1	N0	Common minus pin for +0/+1 input port

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	The output of this pin is +12V. These pins are common to 16 input signal pins.
P1	The output of this pin is +12V. These pins are common to 16 output signal pins.
N0	This pin is GND. These pins are common to 16 input signal pins.
N1	This pin is GND. 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. This product inputs the ON/OFF state of the current-driven device as a digital value.

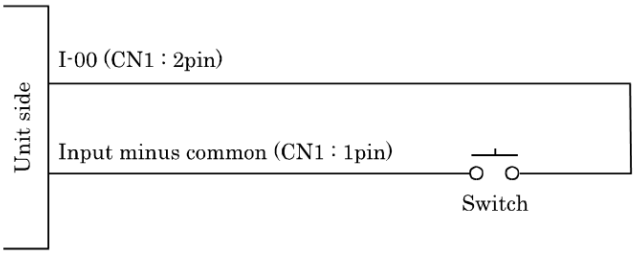
Input Circuit



* I-xx represents the input pin.

The input circuits of interface blocks of this product is illustrated in the image above. The signal inputs are isolated by Optocouplers (compatible with current sink output).

Connecting a Switch

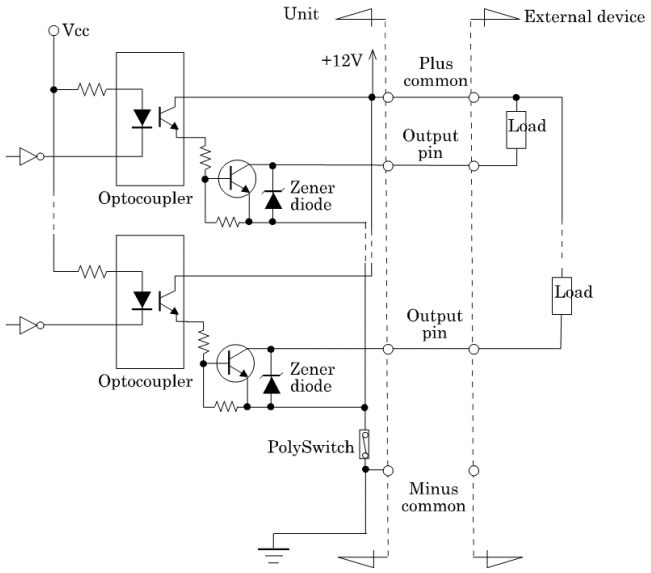


When the switch is ON, the corresponding bit contains 1.
When the switch is OFF, by contrast, the bit contains 0.

Connecting Output Signals

Connect the output signals to a current-driven controlled device such as a relay or LED. This product controls turning on/off the current-driven controlled device using a digital value.

Output Circuit



* O-xx represents the output pin.

The output circuits of interface blocks of this product is illustrated in the image above. The signal output section is an optocoupler isolated, open-collector output (current sink type). This product therefore requires the on-board internal power supply to drive the output section of this product.
The rated output current per channel is 100mA 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 50mA or at most 1.0 V at an output current within 100mA.
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.

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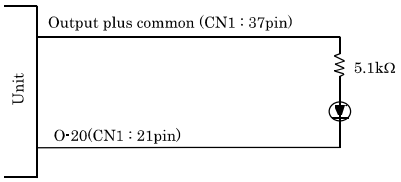
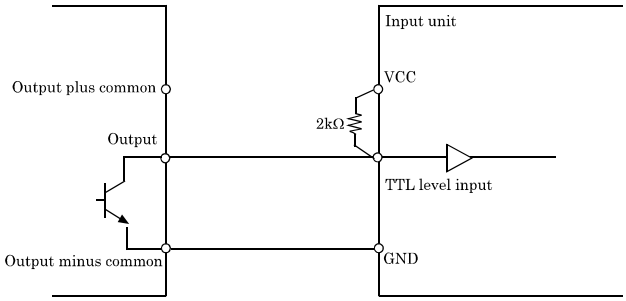
Connection to the LED



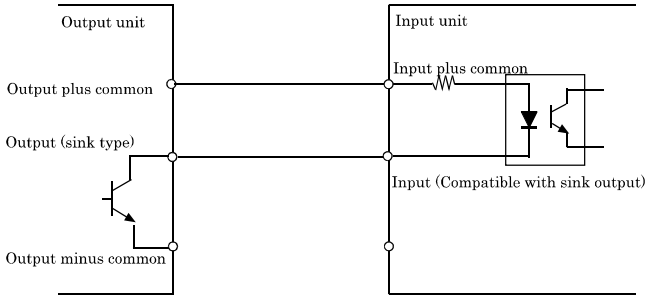
When "1" is output to a relevant bit, the corresponding LED comes on.
When "0" is output to the bit, in contrast, the LED goes out.

Example of Connection to TTL Level Input



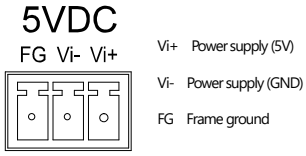
Connecting the Sink Type Output and Sink Output Support Input

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

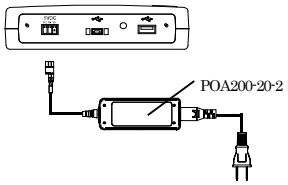


Connection with 5VDC Power Supply for Self-power

This product must be connected with 5VDC power supply (in a self-powered state).
Connect with 5VDC power supply by using +5VDC input pin.



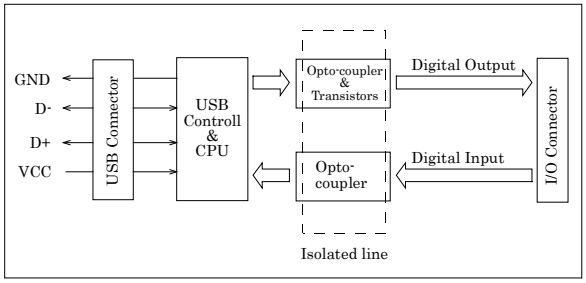
When using the attached AC adapter [POA200-20-2], please connect directly to the input terminals.
When the accompanying power connector (MC1,5/3-ST-3,5, suitable cable: AWG28 - 16) is used to supply power to this unit, strip the end of the suitable cable and insert it to the power connector before firmly securing it using a screw.



⚠CAUTION

- Connect 5VDC power supply to the main unit. Next, connect the USB cable to the PC. Do not turn it on or off when using. If you remove, USB cable is first and then 5VDC power supply.
- When the USB module is not used, leave the AC adapter unplugged.
- Continuously using the AC adapter heated affects its life.
- Use the AC adapter not in a closed place but in a well-ventilated place not to be heated.
- Do not remove the power connector [MC1,5/3-ST-3,5] attached to the AC adapter.

Block Diagram



Connecting the Sink Type Output and Sink Output Support Input

Item	DIO-1616BX-USB	DIO-1616B-PE	PIO-16/16B(PCI)H
Selecting Power Supply	It is impossible. (Only using the internal power supply)	It selects it with the jumper.	
Current consumption (Max.)	5VDC 830mA	When using the internal power supply : 3.3VDC 350mA, 12VDC 350mA When using the external power supply : 3.3VDC 350mA	When using the internal power supply : 5VDC 1200mA When using the external power supply : 5VDC 300mA
Bus specification	USB Specification 2.0/1.1 standard	PCI Express Base Specification Rev. 1.0a x1	PCI(32bit, 33MHz, Universal key shapes supported)
Physical dimensions (mm)	180(L) x 140(D) x 34(H) (No protrusions)	169.33(L) x 110.18(H)	176.41(L) x 106.68(H)
Weight	300g (Not including the USB cable, attachment)	140g	215g

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