Digital I/O Unit with High Voltage Isolation for USB

# DIO-1616RYX-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 is compatible with the digital signal I/O with high voltage (input 12 - 24VDC, output 120VAC/DC) and features 16 optocoupler isolated inputs (compatible with current sink output/current source output) and 16 semiconductor-relay 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.

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

The input specification is fixation from 12 - 24VDC for this product.

Windows driver is bundled with this product. Possible to be used as a data recording device for LabVIEW, with dedicated libraries.

## Features

**Optocoupler isolated input (compatible with current sink output/current source output) and semiconductor-relay output**
This product has the 16 of optocoupler isolated input (compatible with current sink output/current source output) whose response speed is 200µsec and 16 of semiconductor-relay output whose response speed is 1.0msec. Supporting driver voltages of 12 - 24VDC for input and 120VAC/DC for output with high voltage.
(12 - 24VDC external circuit power supply is required separately.)

**Optocoupler and semiconductor-relay bus isolation**
As the USB (PC) is isolated from the input and output interfaces by optocoupler and semiconductor-relay, this product has excellent noise performance.

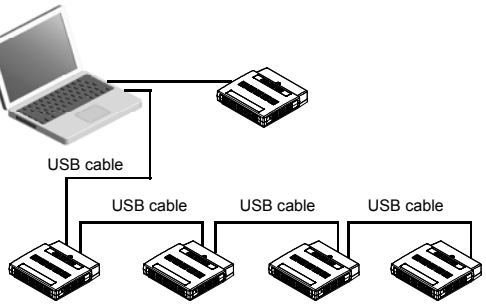
**You can use 16 input signals as interrupt request signals.**
You can use 16 input signals as interrupt request signals and also disable or enable the interrupt in bit units and select the edge of the input signals, at which to generate an interrupt.

**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.

**Connectors are compatible with PCI/PCI Express bus-compatible board**
As there is compatible with PIO-16/16RY(PCI) and DIO-1616RY-PE in terms of connector shape and pin assignments, it is easy to migrate from the existing system. The specification of the input part is from 12 - 24VDC fixation however.
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).

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




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

**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.

*1 When you use the USB port included on the DIO-1616RYX-USB, use 5VDC power supply for self-power. For more details on the connection with 5VDC power supply, refer to page 4, "Connection with 5VDC Power Supply for Self-power".
*2 Do not connect the device other than that of CONTEC's USB to the USB port included on the DIO-1616RYX-USB. Otherwise, this may cause a failure or malfunction.
*3 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.

## Specification

| Item | | Specification |
|---|---|---|
| Input section | | |
| Number of input signal channels | | 16 channels (all available for interrupts) (1 common pin) |
| Input format | | Optocoupler isolated input (Both of current sink and source outputs supported) |
| Input resistance | | 3kΩ |
| Input ON current | | 3.1mA or more |
| Input OFF current | | 1.0mA or less |
| Interrupt | | 16 interrupt input signals are arranged into a single output of interrupt signal INTA. An interrupt occurs at the High-to-Low or Low-to-High edge (software-selected) |
| Response time | | 200μsec within *1 |
| Output section | | |
| Number of output signal channels | | 16 channels (1 common) |
| Output format | | Semiconductor relay output |
| Output rating | Output voltage | 120VAC/DC (Max.) |
| | Output current | 100mA (par channel) (Max.) |
| Device used | | PS7221A-2A (NEC) |
| ON resistance | | 10.0Ω or less |
| OFF leakage current | | 1.0μA or less |
| Response time | | 1.0msec within |
| USB section | | |
| Bus specification | | USB Specification 2.0/1.1 standard |
| USB transfer rate | | 12Mbps (Full-speed), 480Mbps (High-speed) *2 |
| Power supply | | Bus power / Self-power *3 |
| Common section | | |
| Number of terminals used at the same time | | 127 terminals (Max.) *4 |
| Dielectric strength | | 1000Vrms |
| External circuit power supply*5 | | 12 - 24VDC (±10%) |
| Current consumption (Max.) | | 5VDC 500mA |
| Operating conditions | | 0 - 50ºC, 10 - 90%RH (No condensation) |
| 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]or equivalence to it |
| Attached cable | | USB cable 1.8m |

*1 The Optocoupler's response time comes.
*2 This depends on the PC environment used (OS and USB host controller).
*3 Use 5VDC power supply for sefl-power when you use the USB hub function.
*4 As a USB hub is also counted as one device, you cannot just connect 127 USB unit.
*5 External circuit power supply is required separately.

## Support Software

**Windows version of digital I/O driver API-DIO(WDM) [Stored on the bundled CD-ROM driver library API-USBP(WDM)]**

It is the library software, and which supplies command of hardware produced by our company in the form of standard Win32 API function (DLL). Using programming languages supporting Win32API functions, such as Visual Basic and Visual C++ etc., you can develop high-speed application software with feature of hardware produced by our company. In addition, you can verify the operation of hardware using Diagnostic programs.

< Operating environment >

| | |
|---|---|
| OS | Windows 7, Vista, XP, Server 2003, 2000, Me, 98 |
| Adaptation language | Visual Basic, Visual C++, Visual C#, Delphi, C++ Builder |

For more details on the supported OS, applicable language and how to download the updated version, please visit the CONTEC's Web site (http://www.contec.com/apiusbp/).

**Data acquisition VI 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.
See http://www.contec.com/vidaq/ for details and download of VI-DAQ.

## Cable & Connector

### Cable (Option)

Flat Cable with 37-Pin D-SUB Connectors at either Ends
: PCB37P-1.5 (1.5m), PCB37P-3 (3m), PCB37P-5 (5m)

Shielded Cable with 37-pin D-SUB connectors at either ends
: PCB37PS-0.5P (0.5m), PCB37PS-1.5P (1.5m), PCB37PS-3P (3m), PCB37PS-5P (5m)

Flat Cable with 37-Pin D-SUB Connector at One End
: PCA37P-1.5 (1.5m), PCA37P-3 (3m), PCA37P-5 (5m)

Shield Cable with 37-Pin D-SUB Connector at One End
: PCA37PS-0.5P (0.5m), PCA37PS-1.5P (1.5m) PCA37PS-3P (3m), PCA37PS-5P (5m)

### Connector (Option)

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

## Accessories

### Accessories (Option)

Screw Terminal Unit (M3 x 37P) : EPD-37A *1 *2
Screw Terminal Unit (M3.5 x 37P) : EPD-37 *1
General Purpose Terminal (M3 x 37P) : DTP-3A *1
Screw Terminal (M2.6 x 37P) : DTP-4A *1
Signal Monitor / Output Accessory for Digital I/O (32P) : CM-32(PC)E *1
AC adapter (input : 90 - 264VAC, output : 5VDC 2.0A) : POA200-20
USB I/O Unit Bracket for X Series : BRK-USB-X

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

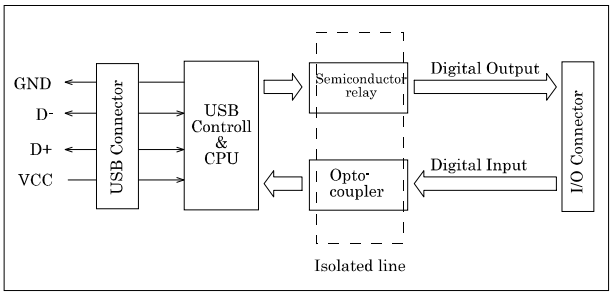
* Check the CONTEC's Web site for more information on these options.

## Packing List

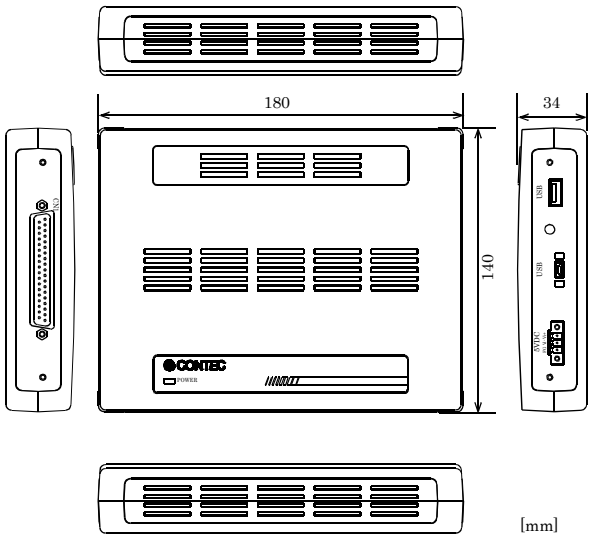
Unit [DIO-1616RYX-USB] …1
USB cable (1.8m) …1
USB cable attachment on the main unit's side (For Mini B connector side) …1
Clamps for prevention of cable on the main unit's side…1
CD-ROM *1 [API-USBP(WDM)] …1
Power connector MC1,5/3-ST-3,5 …1
First step guide …1
Ferrite core …1

*1 The CD-ROM contains the driver software and User's Guide.

## Block Diagram



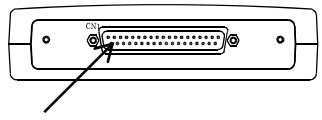
## Physical Dimensions




## 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.




Interface connector (CN1)

- 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]

* Please refer to page 2 for more information on the supported cable and accessories.

### Connector Pin Assignment

#### Pin Assignments of Interface Connector (CN1)

CN1



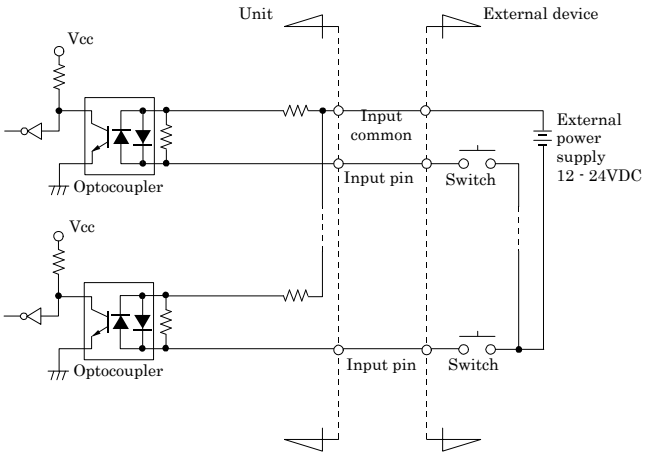

| Pin No. | Signal name | Meaning | Pin No. | Signal name | Meaning |
|---|---|---|---|---|---|
| | | | 19 | N.C. | |
| 37 | N.C. | | 18 | ICOM 0/1 | Common pin for +0/+1 input port |
| 36 | O-37 | +3 port (output) | 17 | I-17 | +1 port (input) |
| 35 | O-36 | | 16 | I-16 | |
| 34 | O-35 | | 15 | I-15 | |
| 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 | OCOM 2/3 | Common pin for +2/+3 output port | 1 | N.C. | |

| | |
|---|---|
| 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. |
| ICOM 0/1 | Common pin for input signals. These pins are common to 16 input signal pins. |
| OCOM 2/3 | Connect the positive 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. This product inputs the ON/OFF state of the current-driven device as a digital value.

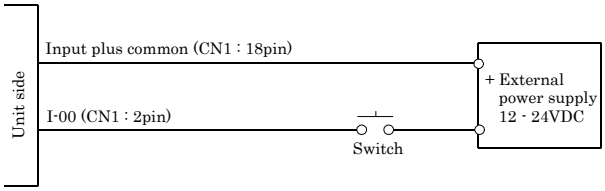
### Input Circuit




* I-xx represents the input pin.

The input circuits of interface blocks of this product is illustrated in the image above. The input specification is fixation from 12 - 24VDC for this product.
The signal inputs are isolated by opto-couplers (Both of current sink and source outputs supported). The board therefore requires an external power supply to drive the inputs. The power capacity required for driving each input channel is about 4 mA when the signal voltage is 12VDC.

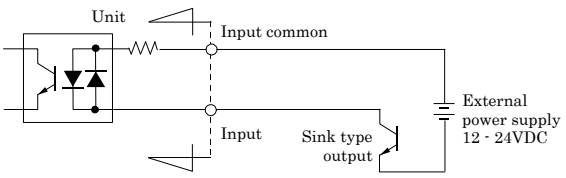
### Connecting a Switch



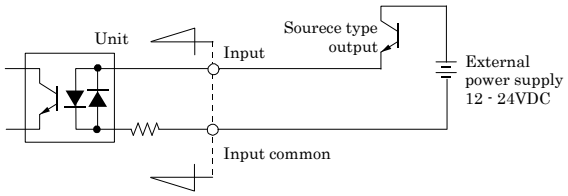

When the switch is ON, the corresponding bit contains 1.
When the switch is OFF, by contrast, the bit contains 0.

### Examples of Connecting the Board to an External Device

#### Connecting the input to the sink type output



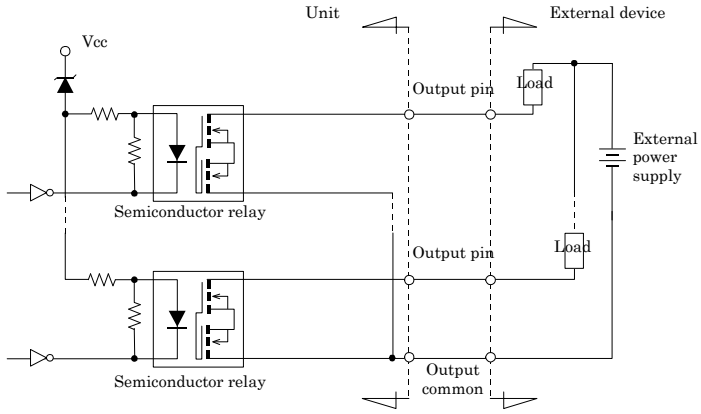
### Connecting the input to the source type output




## 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. This product controls turning on/off the current-driven controlled device using a digital value.

### Output Circuit

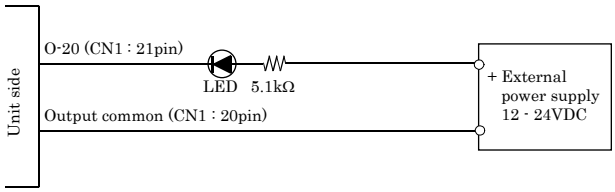



* O-xx represents the output pin.

The output circuits of interface blocks of the board are illustrated in the image above. The signal outputs are semiconductor relay outputs using a rated output current of up to 100 mA per channel.

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

### Connection to the LED

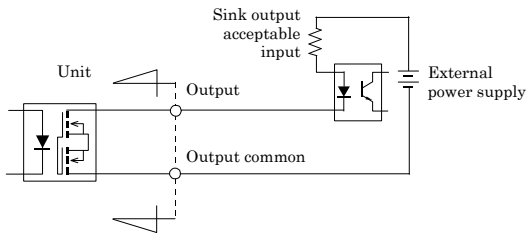



When "1" is output to a relevant bit, the corresponding LED comes on.
When "0" is output to the bit, in contrast, the LED goes out.

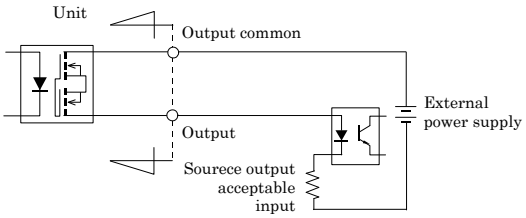
### Examples of Connecting the Board to an External Device

#### Connecting the Output to the Sink Output Acceptable Input

Connecting the Output to the Sink Output Acceptable Input

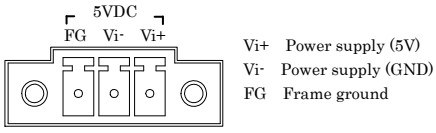



Connecting the Output to the Source Output Acceptable Input



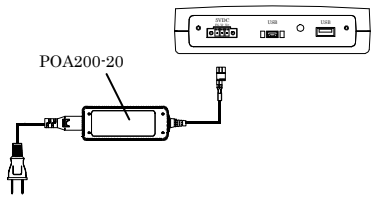

## Connection with 5VDC Power Supply for Self-power

When you use the HUB function (USB Type A connector) included on the DIO-1616RYX-USB, this product must be connected with 5VDC power supply (in a self-powered state). Connect with 5VDC power supply by using +5VDC input pin.




To supply power using the bundled power connector (MC1,5/3-ST-3,5, compatible cable
: AWG28 - 16), strip the end of the compatible cable, insert it into the power connector, then securely screw it.

When using the optional AC adapter [POA200-20], please connect directly to the input terminals.




⚠ 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.

## Difference from DIO-1616RY-PE and PIO-1616RY(PCI)

| Item | DIO-1616RYX-USB | DIO-1616RY-PE | PIO-1616RY(PCI) |
|---|---|---|---|
| Input section | | | |
| Input resistance | 3kΩ | 3 kΩ (with 12 - 24 V selected) or 6 kΩ (with 24 - 48 V selected) | |
| External circuit power supply | 12 - 24VDC (±10%) | 12 - 24 VDC (±10%) or 24 - 48 VDC (±10%) (selected by jumper switch) | |
| Current consumption (Max.) | 5VDC 500mA | 3.3VDC 550mA | 5VDC 400mA |
| Bus specification | USB Specification 2.0/1.1 standard | PCI Express Base Specification Rev. 1.0a x 1 | 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 105.68(H) |
| Weight | 300g (Not including the USB cable, attachment) | 120g | 130g |