Isolated Digital I/O Module
for USB2.0

# DIO-16/16(USB)

RoHS Compliant

This product is a USB 2.0 compliant module that extends the digital signal I/O functions of a PC.
This product is an opto-coupler isolated type for input at 12 - 24VDC and output at 12 - 48VDC with input 16ch and open-collector output 16ch.
Using the expansion module available as an option can increase the number of I/O channels. In addition, this product has an attachment that allows this product to be directly attached onto 35-mm DIN rails useful for embedded applications. Windows driver is bundled with this product.
Possible to be used as a data recording device for LabVIEW, with dedicated libraries.

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

## Features

**Opto-coupler isolated input (supporting current sink output and current source output) and opto-coupler isolated open-collector output (current sink type)**
Equipped with opto-coupler isolated input 16ch (supporting current sink output and current source output) whose response speed is 1msec and opto-coupler isolated open-collector output 16ch (current sink type). Common terminal provided per 16ch, capable of supporting a different external power supply
Supporting driver voltages of 12 - 24VDC for input and 12 - 48VDC for output

**Conforming to the USB1.1 and USB2.0 Standards and supporting the internal and external power supplies**
Compatible to USB1.1/USB2.0 and capable to achieve high speed transfer at HighSpeed (480 Mbps).
Not necessary to power this product externally as the bus power of USB is used. Capable of accepting an external power supply (optional AC adapter) when lower power consumption is required, e.g., for use with a notebook PC

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

**Trigger monitor function integrated**
The CPU inside the module can report status changes (rise and fall) to the host in a minimum cycle of 1ms.

**Easy to increase the number of I/O channels using an expansion module**
Adding optional modules (up to 3 units) can easily increase the number of I/O channels.
The unique structure for connection by stacking enables easy and compact system configuration.

**Screw-less connector plug facilitating wiring and plugging/unplugging**
Wiring and plugging/unplugging are easy as the screw-less connector plug is used.

**Capable of being mounted on 35-mm DIN rails**
The module is equipped with an attachment for mounting on 35-mm DIN rails on the back, allowing the module to be attached onto and detached from DIN rails.

**Output circuit with a built-in zener diode for protection from surge voltage**
The output circuit is connected with a zener diode for protection from surge voltage.
The output rating is 150mA at a maximum of 24VDC or 50mA at a maximum of 48VDC per ch.

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

## Packing List

USB module [DIO-16/16(USB)] …1
First step guide … 1
CD-ROM *1 [API-USBP(WDM)]…1
Interface connector (plugs) FMC1,5/18-ST-3.5…2
Power connector MC1,5/3-ST-3,5 …1
USB cable (1.8m)…1
Rubber feet…4
Magnet…2

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

## Product Specification

### Hardware Specification

| Item | | | Specification |
|---|---|---|---|
| Input section | | | |
| | Input format | | opto-isolated input<br>Compatible with current sink output: negative logic *1,<br>Compatible with current source output: positive logic *2 |
| | Number of input signal points | | 16 points (16 points/common) |
| | Input resistance | | 3kΩ |
| | Input ON current | | 3.4mA(Min.) |
| | Input OFF current | | 0.16mA(Max.) |
| | Response time | | 1msec(Min.) *3 |
| | External power | | 12 - 24VDC (±15%) (per point 4mA/12V - 8mA/24V) |
| | Allowable distance of signal extension | | Approx. 50m (depending on wiring environment) |
| Output section | | | |
| | Output format | | Opto-isolated open collector output (current sink type) (negative *1) |
| | Output rating | Output voltage | 12 - 48VDC (±15%) |
| | | Output current | Max. 150mA(12 - 24V) (per point), 50mA(36 - 48V) (per point) |
| | Number of output signal points | | 16 points (16 points/common) |
| | Response time | | 1msec(Min.) |
| | External power | | 12 - 48VDC (±15%) |
| | Allowable distance of signal extension | | Approx. 50m (depending on wiring environment) |
| Communication | | | |
| | USB transmission speed | | 12Mbps (full speed), 480Mbps (high speed) *3 |
| | Current consumption | | +5VDC 450mA(Max.) |
| Others | | | |
| | Number of modules used at the same time | | 127 modules (Max.) *4 |
| | Use condition *5 | | 0 - 50℃ 10 - 90%RH (no condensation) |
| | Physical dimensions (mm) | | 50.4(W) x 64.7(D) x 94.0(H) (exclusive of protrusions) |
| | Weight of the module itself | | 160g |
| | Module installation method | | One-touch connection to 35mm DIN rails (standard connection mechanism provided in the system) |
| | Expansion module | | DIO-16/16(FIT)GY : 3 modules (Max.)<br>consumption current per module: +5VDC 150mA (Max.) |
| | Compatible plug | | FMC1,5/18-ST-3.5 (made by Phoenix Contact corp.)<br>3.5mm-pitch nominal current: 6A (Max.) |
| | Compatible wires | | AWG24 - 16 |

*1 Data"0" corresponds to high-level and data"1"corresponds to low-level.
*2 Data"1"corresponds to high-level and data"0" corresponds to low-level.
*3 USB module executes API function by USB communication. The executing time of API function by
USB communication is about several msec in practice (Depending on the contents handled by API function, it may be longer than that). The responding speed of USB module is based on the environment of the host PC being used.
*4 The USB interface can accommodate up to 127 devices on the bus. As a USB hub itself is counted as one device, however, 127 USB modules cannot be connected.
*5 When using the attached AC adaptor POA200-20-2, it is 0 - 40℃

### Software Specification

| Item | Specification |
|---|---|
| Support OS | Microsoft Windows 98 or Second Edition<br>Microsoft Windows Me<br>Microsoft Windows XP Professional, Home Edition<br>Microsoft Windows 2000 Professional<br>Microsoft Windows Vista<br>Microsoft Windows Server 2008<br>Microsoft Windows 7 |
| Support language | Microsoft Visual C++ Ver 5.0, Ver 6.0<br>Microsoft Visual C++ .NET 2002, 2003<br>Microsoft Visual Basic Ver 5.0, Ver 6.0<br>Microsoft Visual Basic .NET 2002, 2003<br>Microsoft Visual C# .NET 2002, 2003<br>Borland Delphi Ver 5.0, 6.0<br>Borland C++ Builder Ver 5.0 |
| System requirement | - PC (IBM PC/AT compatibility, DOS/V) with USB port<br>- CD-ROM drive<br>- Recommend the environment on which the using language can run smoothly |

## Support Software

**Driver Library API-USBP(WDM) (Bundled)**

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.
CONTEC provides download services (at http://www.contec.com/apiusbp/) to supply the updated drivers and differential files.
Further details may be found in the help within supplied CD-ROM or the homepage of our company.

< Operating environment >

| | |
|---|---|
| OS | Windows 7, Server 2008, Vista, XP, Server 2003, 2000, Me, 98 |
| Adaptation language | Visual Basic, Visual C++, Visual C#, Delphi, C++ Builder |

## Accessories

**Accessories (Option)**

Isolated digital I/O module (Expansion module) : DIO-16/16(FIT)GY

AC adapter
(input: 90 - 264VAC, output : 5VDC 2.0A) : POA200-20-2

AC-DC power supply unit
(input: 85 - 132VAC, output: 5VDC 3.0A) : POW-AC13GY

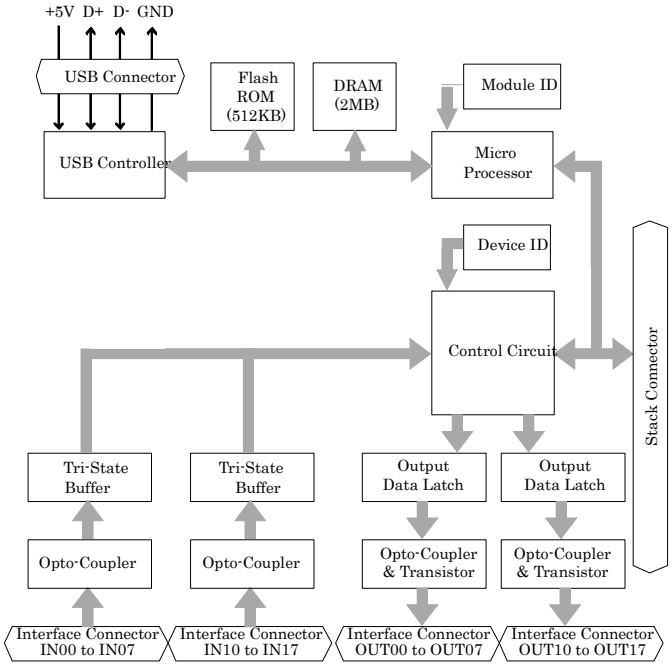
AC-DC power supply unit
(input: 85 - 264VAC, output: 5VDC 2.0A) : POW-AD22GY

DC-DC power supply unit
(input: 10 - 30VDC, output: 5VDC 3.0A) : POW-DD10GY

DC-DC power supply unit
(input: 30 - 50VDC, output: 5VDC 3.0A) : POW-DD43GY

* Further details of the accessories may be verified in the Web site of our company.

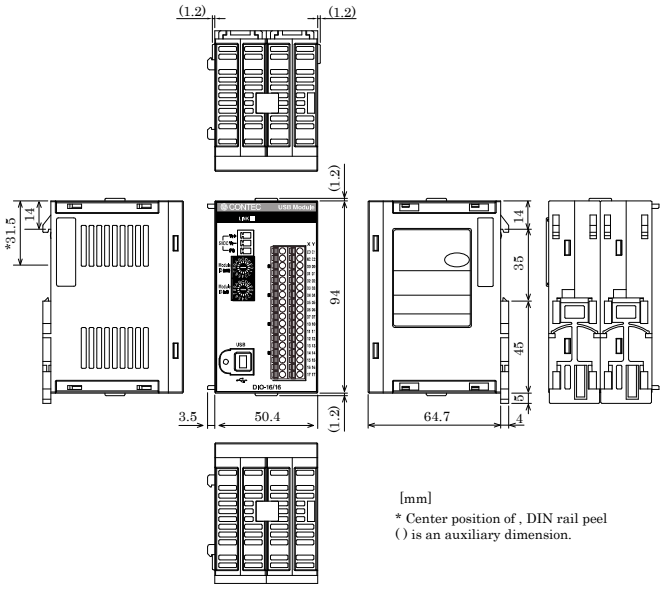
## Block Diagram




*Points*

The Device ID is fixed at “0”.

## Physical Dimensions

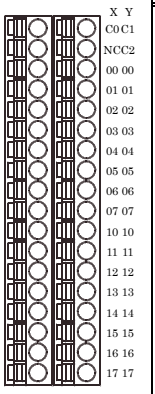



[mm]
* Center position of , DIN rail peel
( ) is an auxiliary dimension.

## Signal Layout

For connection of this module to an external device, use a pair of 18-pin connectors on the module.

| Pin No. | Signal name | Meaning |
|---|---|---|
| X | | |
| C0 | COM | Common for Input+0, +1 group |
| NC | N.C. | Unconnected |
| 0 | IN00 | Input+0 group |
| 1 | IN01 | |
| 2 | IN02 | |
| 3 | IN03 | |
| 4 | IN04 | |
| 5 | IN05 | |
| 6 | IN06 | |
| 7 | IN07 | |
| 10 | IN10 | Input+1 group |
| 11 | IN11 | |
| 12 | IN12 | |
| 13 | IN13 | |
| 14 | IN14 | |
| 15 | IN15 | |
| 16 | IN16 | |
| 17 | IN17 | |

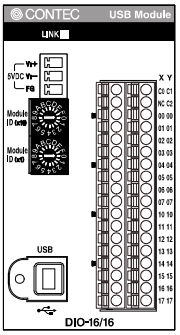


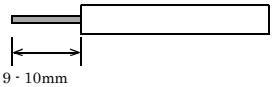

| Pin No. | Signal name | Meaning |
|---|---|---|
| Y | | |
| C1 | COM(+) | Plus common forOutput+0, +1group |
| C2 | COM(-) | Minus common for Output+0, +1 group |
| 0 | OUT00 | Output+0 group |
| 1 | OUT01 | |
| 2 | OUT02 | |
| 3 | OUT03 | |
| 4 | OUT04 | |
| 5 | OUT05 | |
| 6 | OUT06 | |
| 7 | OUT07 | |
| 10 | OUT10 | Output+1 group |
| 11 | OUT11 | |
| 12 | OUT12 | |
| 13 | OUT13 | |
| 14 | OUT14 | |
| 15 | OUT15 | |
| 16 | OUT16 | |
| 17 | OUT17 | |

## Connection Method

When connecting the Module to an external device, you can use the supplied connector plug. When wiring the Module, strip off approximately 9 - 10 mm of the covering for the cable, and insert the bare wire by pressing the orange button on the connector plug. Releasing the orange button after the wire is inserted fixes the cable. Compatible wires are AWG 24 - 16.

⚠ CAUTION
Removing the connector plug by grasping the cable can break the wire.



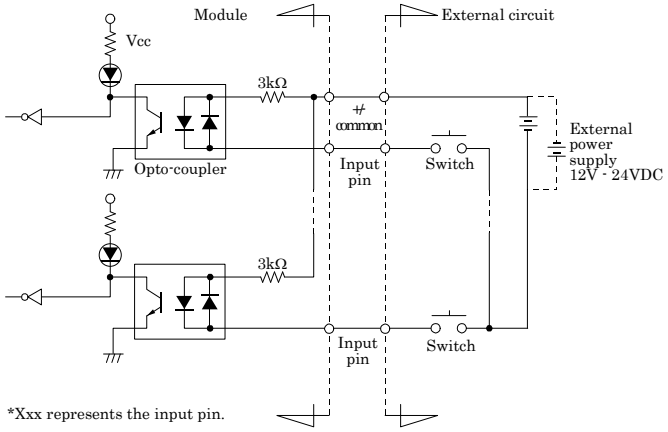

- Compatible plug:
FMC1,5/18-ST-3.5 (made by Phoenix Contact Corp.)
Compatible cable: AWG24 - 16

## External Input and Output Circuit

### Input Section

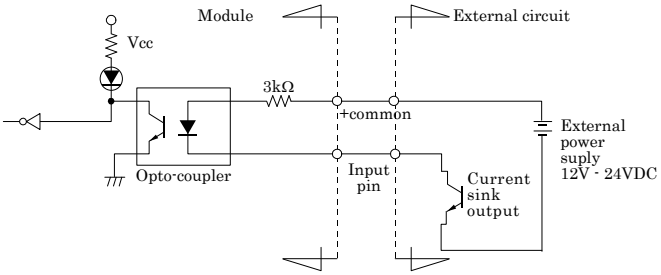
Figure below shows the input equivalent circuit for the interface section.
The signal input section consists of an opto-isolated input (compatible with both current sink output and current source output). Therefore, driving the input section for the Module requires an external power supply with a minimum capacity of approximately 8mA (or 4mA for 12VDC) per input point for 24VDC.

#### Input Circuit

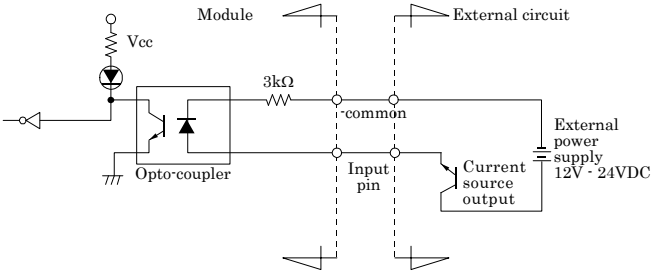



*Xxx represents the input pin.

#### Example of a Connection to Current Sink Output




#### Example of a Connection to Current Source Output

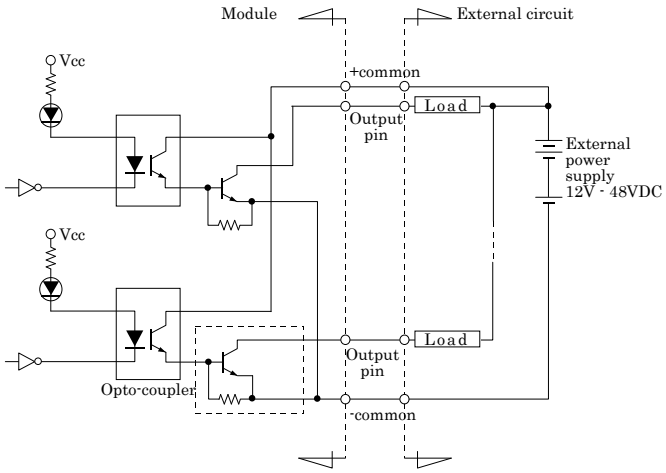



### Output Section

Figure shows the output circuit for the interface section.
The signal output section consists of an opto-isolated open collector method (current sink type). An external power supply is therefore required for driving the output block of this module. The maximum rated output current is 150 mA (at 12-24 VDC) or 50 mA (at 36-48 VDC) per channel. Although the output transistor of this module is provided with a surge voltage protection circuit (zener diode), it is advisable to apply surge voltage protection to the load side when this module drives an inductive load such as a relay or lamp.

⚠ DANGER
When the power is turned on, all output will be OFF.

**Output Circuit**

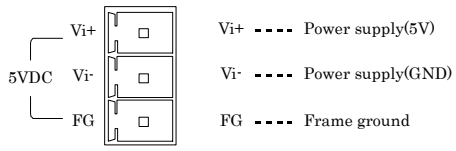



*Point*

When the power is turned on, all output will be OFF.

## Connecting an External Power Supply

The module can be used via only USB cable if it uses bus power. In this situation, the external power supply is not required.
If you want to control the power consumption of the computer with battery, such as Note PC, you can use self-power to provide power for the module. In addition, if you use expansion modules, the self-power is required.
When you use self-power, please use +5VDC input terminal.

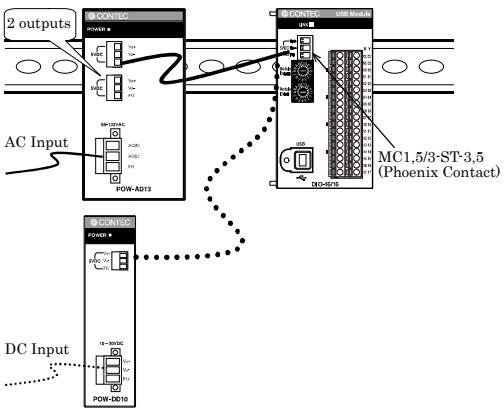



Input plug is 5VDC ±5% input, Laterally operable screw-in type connector is supplied as a standard item. (MC1,5/3-ST-3,5 Phoenix Contact compatible cable:AWG28 - 16)
To supply power using the bundled connector plug (MC1,5/3-ST-3,5), strip the end of the corresponding cable, insert it into the connector plug, then securely screw the plug.

Use an external power supply (available as an option) depending on the operating environment and application.

| Category | Model | Input | Output | Physical dimensions(mm) | DIN rail |
|---|---|---|---|---|---|
| AC adapter | POA200-20-2 | 90 - 264VAC | 5.0VDC±5% 2.0A(Max.) | 47.5(W) x 75(D) x 27.3(H) (exclusive of protrusions) | No |
| AC-DC power | POW-AD13GY | 85 - 132VAC | 5.0VDC±5% 3.0A(Max.) | 52.4(W)x64.7(D)x94.0(H) (exclusive of protrusions) | Yes |
| AC-DC power | POW-AD22GY | 85 - 265VAC | 5.0VDC±5% 2.0A(Max.) | 52.4(W)x64.7(D)x94.0(H) (exclusive of protrusions) | Yes |
| DC-DC power | POW-DD10GY | 10 - 30VDC | 5.0VDC±5% 3.0A(Max.) | 25.2(W)x64.7(D)x94.0(H) (exclusive of protrusions) | Yes |
| DC-DC power | POW-DD43GY | 30 - 50VDC | 5.0VDC±5% 3.0A(Max.) | 25.2(W)x64.7(D)x94.0(H) (exclusive of protrusions) | Yes |

* The consumed current of DIO-16/16(USB) is +5VDC 450mA(Max.) individually.
The consumed current of DIO-16/16(FIT)GY is +5VDC 150mA(Max.) individually.




When using the power supply installable on DIN rail, please use the connector MC1,5/3-ST-3,5 (Phoenix Contact).

Connecting method

To connect the external power supply and USB cable to the unit, take the steps below:
(1) Connect the external power connector to supply power for the USB module.
(2) Connect the USB module with computer using USB cable.

To remove the external power supply and USB cable from the unit, take the steps below:
(1) Remove USB cable.
(2) Remove external power connector, stop power supplying to the USB module.

⚠ CAUTION

To use the AC adapter, connect it to the USB module first, then plug the AC adapter's connector into a wall outlet.

When the USB module is not used, leave the AC adapter unplugged

Continuously using the AC adapter heated affects its life.

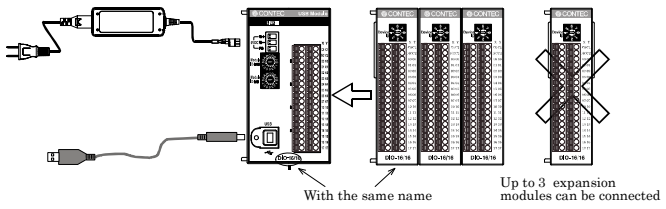
Use the AC adapter not in a closed place but in a well-ventilated place not to be heated. The AC adapter heats up itself when loaded heavily. If the AC adapter is exposed to high temperature or used continuously, you should keep the load at about 80% of the maximum load (at 1.6 A for the POA200-20-2).

## Connecting with Expansion Accessories

When lacking of digital I/O point used to connecting external device, you have to purchase a new same module, and thus it not only increases cost but also doubles installation space. As this module is designed considering the growth in the number of I/O channels, the connectors on the side face can accept additional modules to save the cost and installation space for expansion.
Expansion modules (options) are available to each type of USB module.

| Model | Input point | Output channel | Current consumption | Function |
|---|---|---|---|---|
| DIO-16/16(FIT)GY | 16 | 16 | +5VDC 150mA(Max.) | Expansion module for DIO-16/16(USB) |
| DI-32(FIT)GY | 32 | None | +5VDC 150mA(Max.) | Expansion module for DI-32(USB) |
| DO-32 (FIT)GY | None | 32 | +5VDC 150mA(Max.) | Expansion module for DO-32(USB) |

Up to three expansion modules can be connected. For example, the combination of the USB module "DIO-16/16(USB)" and three expansion modules "DIO-16/16(FIT)GY" can be used to control up to 64 inputs and 64 outputs through a single USB port.




*Points*

Up to 3 modules can be connected.

Adding an expansion module requires an external power supply such as the AC adapter (option).

Modules functionally incompatible with the USB module cannot be connected. Use dedicated modules.