

PC-HELPER

Digital I/O Module with Opto-Isolation
for USB

DIO-8/8(USB)GY

Digital Input Module with Opto-Isolation
for USB

DI-16(USB)GY

Digital Output Module with Opto-Isolation
for USB

DO-16(USB)GY

User's Manual

CONTEC CO.,LTD.

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Trademarks

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Product Configuration

-USB module (one of the following products)

[DIO-8/8(USB)GY, DI-16(USB)GY, DO-16(USB)GY]...1

- First step guide ...1

- CD-ROM *1 [API-USBP(WDM)]...1

-Interface connector (plugs) FK-MC0,5/9-ST-2.5...2

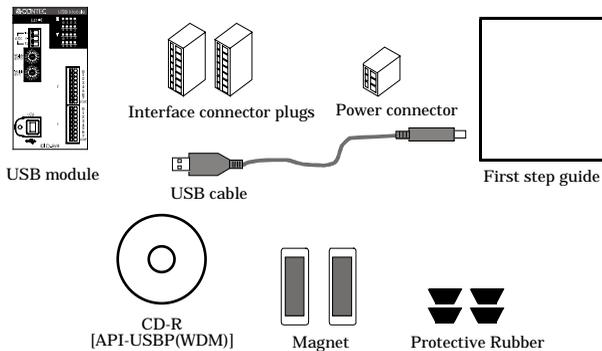
-Power connector MC1,5/3-ST-3,5 ...1

-USB cable (1.8m)...1

-Protective Rubber...4

-Magnet...2

*1 The CD-ROM contains the driver software and User's Guide (this guide)



Check the contents to make sure that you have everything listed below. If you do not have all the items or have any damage, contact your distributor or CONTEC group office where you purchased.

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1. Introduction

Summary

This product is a USB 2.0 compliant module that extends the digital signal I/O functions of a PC.

The DIO-8/8(USB)GY is a 12 - 24VDC opto-coupler isolated type with input 8ch and open-collector output 8ch.

The DI-16(USB)GY is a 12 - 24VDC opto-coupler isolated type with input 16ch.

The DO-16(USB)GY is a 12 - 24VDC opto-coupler isolated type with 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.

Features

Opto-coupler isolated input (supporting current sink output and current source output) and opto-coupler isolated open-collector output (current sink type)

DIO-8/8(USB)GY has the opto-coupler isolated input 8ch (supporting current sink output and current source output) whose response speed is 1msec and opto-coupler isolated open-collector output 8ch (current sink type).

DI-16(USB)GY has the opto-coupler isolated input 16ch (supporting current sink output and current source output) whose response speed is 1msec.

DO-16(USB)GY has the opto-coupler isolated open-collector output 16ch (current sink type) whose response speed is 1msec.

Common terminal provided per 8ch, capable of supporting a different external power supply

Supporting driver voltages of 12 - 24 VDC for I/O

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 1msec.

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.

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.

Support Software

It is suggested that support software produced by our company should be used according to the goal and development environment.

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 XP, Server 2003, 2000, Me, 98, etc..
Adaptation language	Visual C++ .NET, Visual C# .NET, Visual Basic .NET, Visual C++, Visual Basic, Delphi, C++Builder, etc..

Accessories (Option)

Isolated digital I/O module (Expansion module for DIO-8/8(USB)GY)	: DIO-8/8(FIT)GY
Isolated input module (Expansion module for DI-16(USB)GY)	: DI-16(FIT)GY
Isolated output module (Expansion module for DI-16(USB)GY)	: DO-16(FIT)GY
AC adapter (input: 90 - 264VAC, output : 5VDC 2.0A)	: POA200-20
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

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

Customer Support

CONTEC provides the following support services for you to use CONTEC products more efficiently and comfortably.

Web Site

Japanese	http://www.contec.co.jp/
English	http://www.contec.com/
Chinese	http://www.contec.com.cn/

The latest product information

Up-to-date information of the product is supplied.

In addition, the product manual with the form of PDF file and various technical data are supplied.

Free download

You can download the up-to-date driver and missing files.

In addition, you can also download sample programs in various languages.

Limited One-Year Warranty

CONTEC products are warranted by CONTEC CO., LTD. to be free from defects in material and workmanship for up to one year from the date of purchase by the original purchaser.

Repair will be free of charge only when this device is returned freight prepaid with a copy of the original invoice and a Return Merchandise Authorization to the distributor or the CONTEC group office, from which it was purchased.

This warranty is not applicable for scratches or normal wear, but only for the electronic circuitry and original boards. The warranty is not applicable if the device has been tampered with or damaged through abuse, mistreatment, neglect, or unreasonable use, or if the original invoice is not included, in which case repairs will be considered beyond the warranty policy.

How to Obtain Service

For replacement or repair, return the device freight prepaid, with a copy of the original invoice. Please obtain a Return Merchandise Authorization number (RMA) from the CONTEC group office where you purchased before returning any product.

*** No product will be accepted by CONTEC group without the RMA number.**

Liability

The obligation of the warrantor is solely to repair or replace the product. In no event will the warrantor be liable for any incidental or consequential damages due to such defect or consequences that arise from inexperienced usage, misuse, or malfunction of this device.

Safety Precautions

Understand the following definitions and precautions to use the product safely.

Safety Information

This document provides safety information using the following symbols to prevent accidents resulting in injury or death and the destruction of equipment and resources. Understand the meanings of these labels to operate the equipment safely.

 DANGER	DANGER indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury.
 WARNING	WARNING indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.
 CAUTION	CAUTION indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury or in property damage.

Handling Precautions

DANGER

Please do not use the product in environments subject to flammable and corrosive gas. Otherwise, it can bring on exploding, fire, electric shock and trouble.

CAUTION

- There are switches on the module that need to be set in advance.
Be sure to check its switch settings before using the module.
- Please do not change the module switch settings in an unauthorized manner.
Otherwise, it can bring about malfunction, heating and trouble.
- Please do not subject the module to impact or bend it.
Otherwise, it can bring about malfunction, heating, trouble and damage.
- Please do not touch the metallic pins on the external module connector.
Otherwise, it can bring about malfunction, heating and trouble.
- Please do not connect expansion module when the power for the module is turned on.
Otherwise, it can bring about malfunction, heating and trouble.
Be sure to turn off the power for the USB module.
- When you use the module in a noisy environment or are nervous about noise, attach ferrite cores to the connection cable.
- Attach ferrite cores to the cable connected to the interface connector.
- Connect the USB connector plug to the ground.
- Attach ferrite cores to the USB cable.
- When using the AC adapter, attach ferrite cores to its power cable.
- Connect the power-supply connector plug MC1,5/3-ST-3,5 (accessory) or AC adapter (option) connector to the ground so that the FG pin in the +5-VDC input terminal is grounded.
- When you use the module in a noisy environment or are nervous about noise, attach ferrite cores to the connection cable.
- Please do not touch the module with a wet hand when the power for the module is turned on.
It is danger of electric shock.
Be sure to turn off the power for the USB module.
- If you notice any strange odor or overheating, please unplug the power cord and USB cable immediately.
Otherwise, it can bring about malfunction, heating and trouble.
In the event of an abnormal condition or malfunction, please consult the dealer from whom the product was purchased.
- In order to add functions to the product and perform quality improvement, the product specification is subject to change without notice.
Even if you use the product again, please be sure to read the manual to confirm the content.
- Please do not modify the product.
CONTEC will bear no responsibility for any problems, etc., resulting from modifying the product.

- Please do not open the product casing.
CONTEC will disclaim any responsibility for products whose casing has been opened.
 - Regardless of the foregoing statement, CONTEC assumes no responsibility for any errors that may appear in this document nor for results obtained by the user as a result of using this product.
-

Environment

Use this product in the following environment. If used in an unauthorized environment, the board may overheat, malfunction, or cause a failure.

Operating temperature

0 - 50°C

Operating humidity

10 - 90%RH (No condensation)

Corrosive gases

None

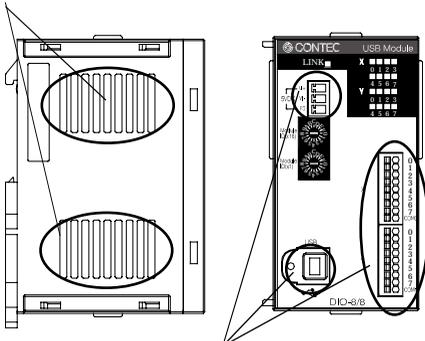
Floating dust particles

Not to be excessive

Inspection

Inspect the product periodically as follows to use it safely.

*The ventilation slits are not covered,
and neither dust nor alien substance is attached to the ventilation slits



*Make sure that the connectors
on the module side are correctly
connected with the cables

Storage

Please store the product according to the state in which you purchased.

- (1) Store the module into a storage bag.
- (2) Store the module into a box with wrapper.
- (3) Please store the module in normal temperature avoiding direct sunlight, shock and vibration, magnetic field and static electricity.

Disposal

When disposing of the product, follow the disposal procedures stipulated under the relevant laws and municipal ordinances.

2. Module Nomenclature

Figures 2.1 to 2.3 show the names of module components.

In the figures, the indicated switch settings represent factory settings.

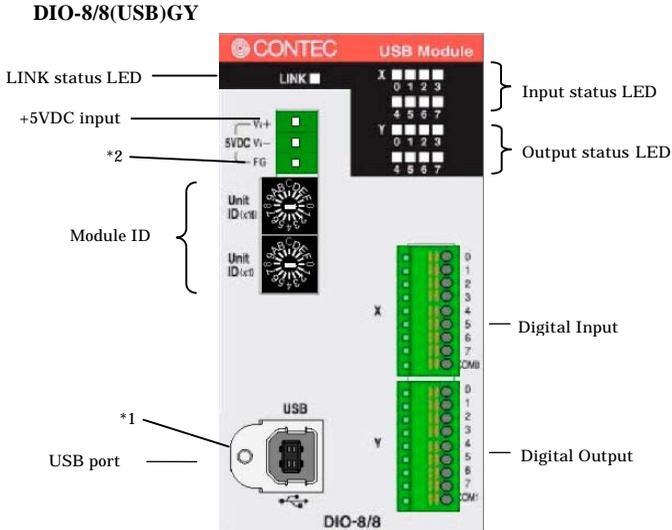


Figure 2.1. Nomenclature of Module Components
<DIO-8/8(USB)GY>

- *1 When you use the module in a noisy environment or are nervous about noise, ground the module(using a M3 screw).
- *2 When you use the module in a noisy environment or are nervous about noise, connect the FG pin in the +5 VDC input terminal to the ground. (To ground the FG pin, use the power-supply connector plug (MC1,5/3-ST-3,5 (accessory) or AC adapter (option).)

Table 2.1. List of Status LED Functions <DIO-8/8(USB)GY>

Name	Function	Indicator color	LED indicator
LINK status	USB communication status	GREEN	ON: Communication established
			OFF: Communication unestablished
Input status	Input indicator X00 - X07	GREEN	ON: Input ON
			OFF: Input OFF
Output status	Output indicator Y00 - Y07	RED	ON: Output ON
			OFF: Output OFF

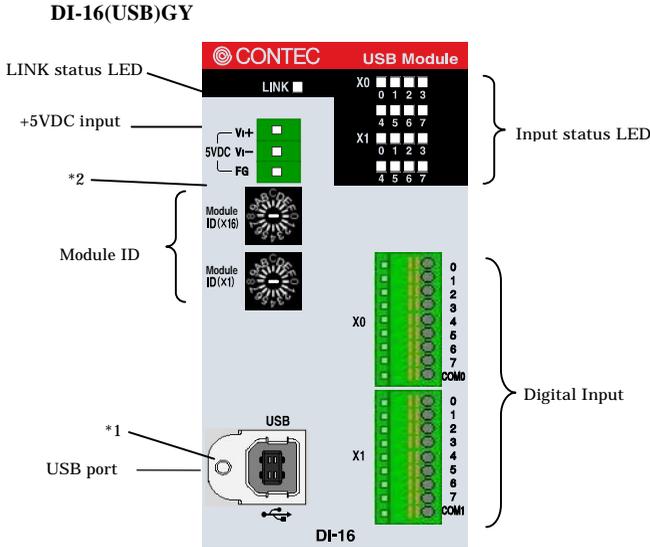
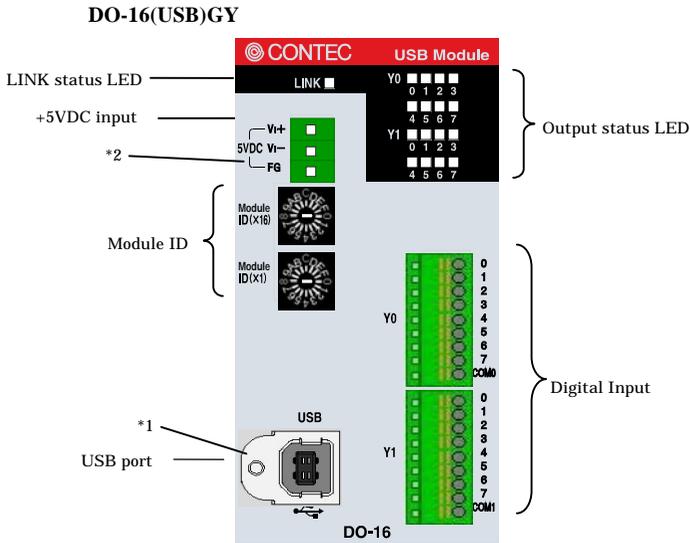


Figure 2.2 Nomenclature of Module Components <DI-16(USB)GY>

- *1 When you use the module in a noisy environment or are nervous about noise, ground the module(using a M3 screw).
- *2 When you use the module in a noisy environment or are nervous about noise, connect the FG pin in the +5 VDC input terminal to the ground. (To ground the FG pin, use the power-supply connector plug (MC1,5/3-ST-3,5 (accessory) or AC adapter (option).)

Table 2.2. List of Status LED Functions <DI-16(USB)GY>

Name	Function	Indicator color	LED indicator
LINK status	USB communication status	GREEN	ON: Communication established
			OFF: Communication unestablished
Input status	Input indicator X00 - X07 Input indicator X10 - X17	GREEN	ON: Input ON
			OFF: Input OFF



**Figure 2.3. Nomenclature of Module Components
<DO-16(USB)GY>**

- *1 When you use the module in a noisy environment or are nervous about noise, ground the module (using a M3 screw).
- *2 When you use the module in a noisy environment or are nervous about noise, connect the FG pin in the +5 VDC input terminal to the ground. (To ground the FG pin, use the power-supply connector plug (MC1,5/3-ST-3,5 (accessory) or AC adapter (option).)

Table 2.3. List of Status LED Functions <DO-16(USB)GY>

Name	Function	Indicator color	LED indicator
LINK status	USB communication status	GREEN	ON: Communication established
			OFF: Communication unestablished
Output status	Output indicator Y00 - Y07 Output indicator Y01 - Y17	RED	ON: Output ON
			OFF: Output OFF

3. Setup

Connection-Overall Diagram

This is connection-overall diagram. Please reference to this page for actual connection.

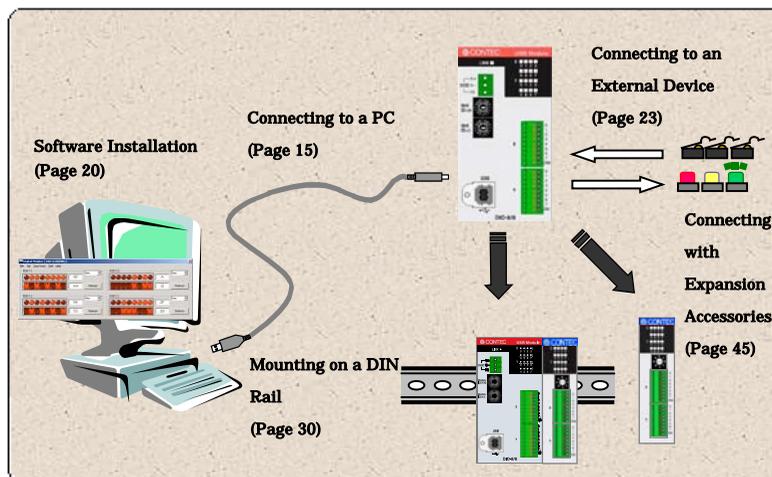


Figure 3.1. Connection-Overall Diagram

Setting a Module ID

The host computer distinguishes and keeps track of the modules of same model by assigning Module IDs to them. Factory settings “00” can be used when only one module per model is connected to one computer.

Each module should be assigned a unique Module ID in the range of 00 - 7Fh when several modules with the same model are being connected.

There are two rotary switches, moreover, “x16” and “x1” represent high bits and low bits of Module ID respectively.

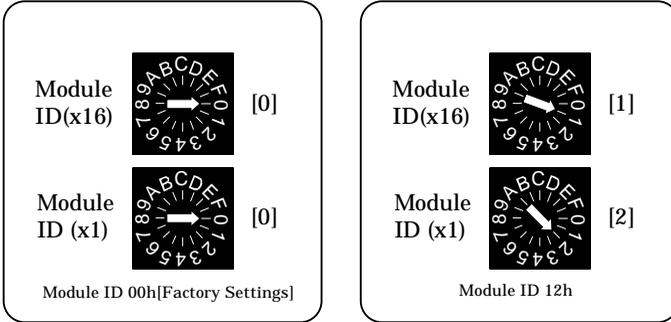
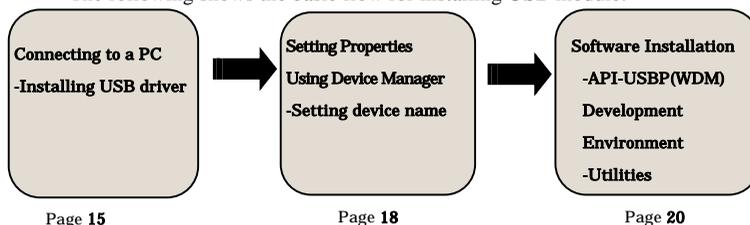


Figure 3.2. Setting a Module ID

Setup Flow

The following shows the basic flow for installing USB module.



Connecting to a PC

Connect the USB device to a PC and install the driver.

It is illustrated by taking example for Windows XP. Displaying screen may be different according to different OS, but basic settings are the same.

Points

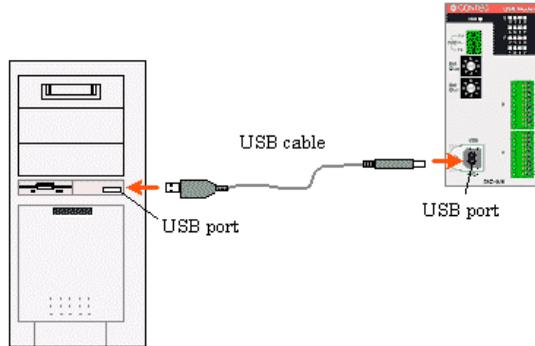
- You must be logged on as an administrator or a member of the Administrators group to work on Windows 2000 or Windows XP.
- The name detected by Windows and displayed by software is the model removing the “GY”.

Step1 Setting Supplied CD-ROM “API-USBP(WDM)”

The menu screen is displayed. The menu will be used in “Software Installation”. (If the menu screen is not displayed for PC settings, please jump to Step2.)

Step2.Connecting USB Port with a PC

Use the bundled USB cable to connect the USB port of the USB module to the USB port on the PC. Check the orientation of the connector and plug it deep into the port.



Note!

Make sure that the power is turned on before a PC is connected when using AC adapter (Option) or external power supply.

Step3 Starting “Found New Hardware Wizard”

Start “Found New Hardware Wizard”, then select “Install from a list or specific location[Advanced]” item and finally click on “Next” button.

Detect setup information from supplied CD automatically for installing USB driver.
XXXXXX: device name being searched out(the name from getting rid of GY from the model)



Point

Please specify the path for supplied CD as follows in the case of failure in detecting automatically.
X:\INF\WDM\DIO (X: CD-ROM drive)

Step4 Clicking on [Finish] Button

Click on [Finish] button to complete the installation of USB driver.



Step3 Clicking on [OK] button

Device name is set by clicking [OK] button.

Points

- When the application developed by users is running on an other PC, please perform foregoing operation on the target computer.(no need to install software introduced on next page)
- Please use the device name specified in last step for initialization function when initialization is performed using API function. When running on other PC, it can run without changing the application for the same device name being specified.

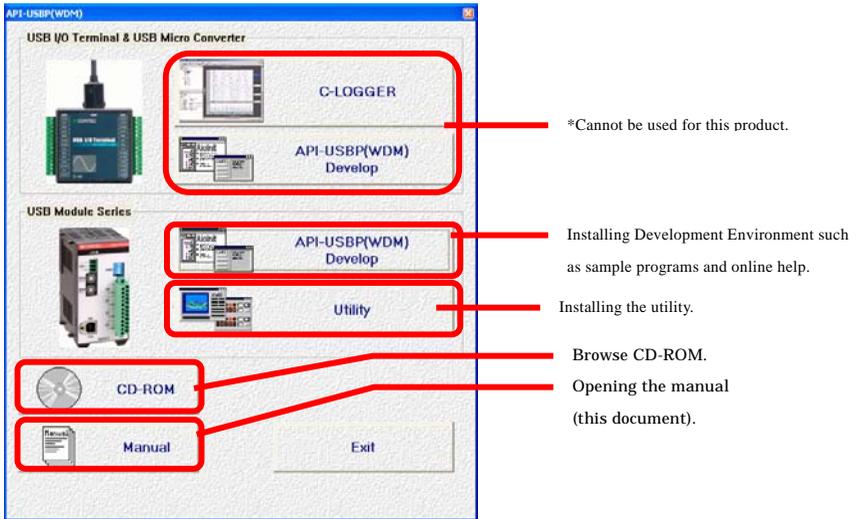
Software Installation

Connect with USB module, and install following software if USB driver has been installed.

Illustration of Menu Screen

Points

- Please set up the supplied CD-ROM if it has not been set up. The menu starts automatically.
- If the menu do not start, launch X:AUTORUN.EXE(X:CD-ROM drive) from [Run...] in Start menu.
- The screen design may be different.



Points

- Please set up the supplied CD-ROM if it has not been set up. The menu starts automatically.
- If the menu do not start, launch X:AUTORUN.EXE(X:CD-ROM drive) from [Run...] in Start menu.
- The screen design may be different.

Installation of API-USBP(WDM) Development Environment

Installation of development environment is namely installing supplied online help and sample program in all language in order to use API function.

Step1 Clicking on “API-USBP(WDM) Develop”

[Installing the development environment] dialog box displays.



Step2 Selecting “Digital I/O”



Step3 Clicking on “Continue” Button

Please perform installation following the directions on the screen. And thus the installation is completed.

The screen design may be different.

Installing the Utility

The utility is application with which you can verify device operation easily.

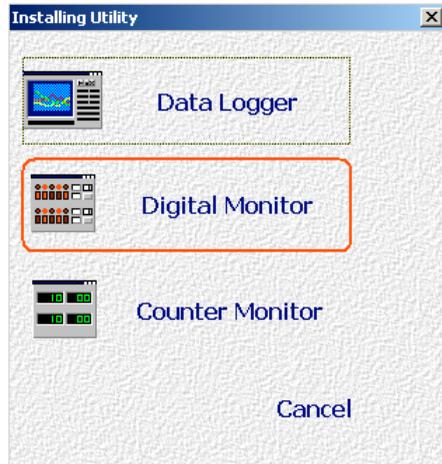
Step1 Clicking on “Utility”



Step2 Clicking on “Digital Monitor”

Please perform installation following the directions on the screen. And thus the installation is completed.

The screen design may be different.



Connecting to an External Device

Signal Layout

The Module can be connected to an external device using a 9-pin connector that is provided on the Module face.

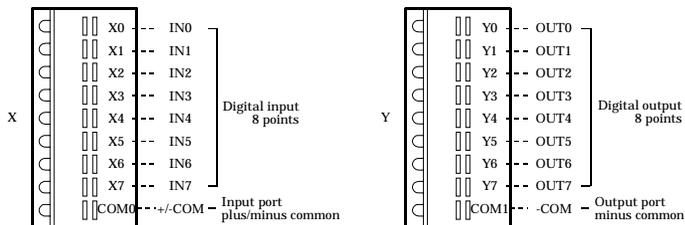


Figure 3.3. Signal Layout on the Interface Connector

<DIO-8/(USB)GY>

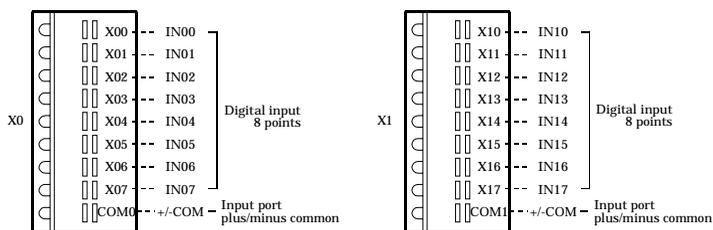


Figure 3.4. Signal Layout on the Interface Connector

<DI-16/(USB)GY>

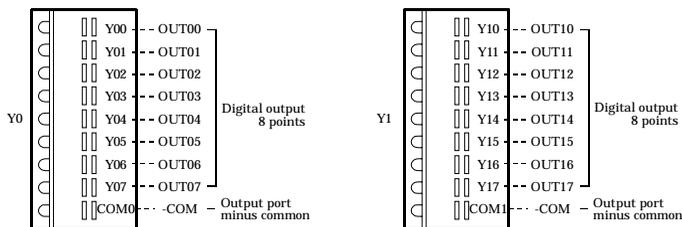


Figure 3.5. Signal Layout on the Interface Connector

<DO-16/(USB)GY>

Connection Method

When connecting the Module to an external device, you can use the supplied connector plug. When wiring the Module, strip off approximately 7 - 8 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 28 - 20.

⚠ CAUTION

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

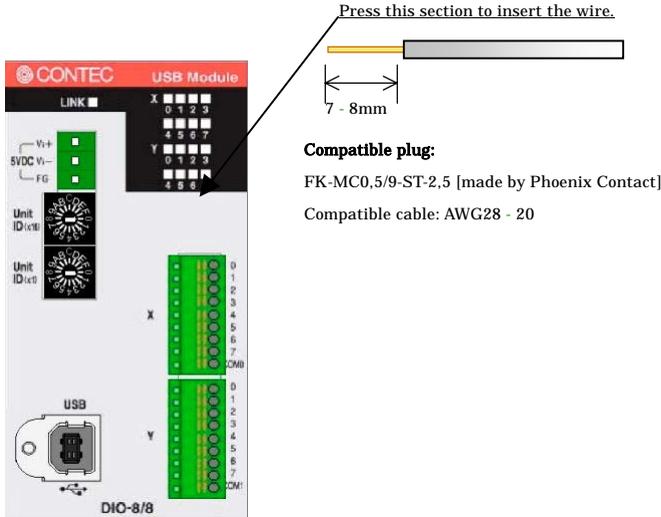
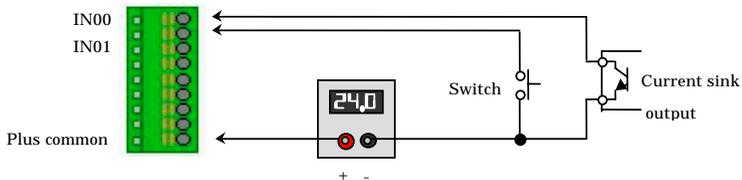


Figure 3.6. Connecting an Interface Connector and Connectors That Can Be Used

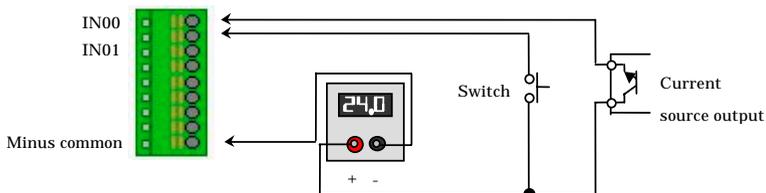
Input the signal to the module from the device

When the status of contact of a current sink output device or a switch is monitored, the COMMON terminal can be used as “Plus common”. 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.

About the details of internal circuit, please refer to [External Input and Output Circuit].



When connecting with the current source output device, using the common terminal as the “Minus common”.

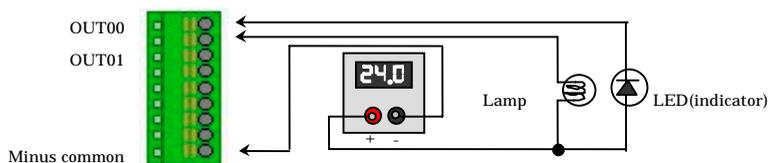


Output the signal to the device from the module

The signal output section consists of an opto-isolated open collector method (current sink type).

Therefore, driving the output section for the Module requires an external power supply with 12 - 24VDC. The nominal output current maximum per point is 150mA. The module can be connected with relays and indicators.

About the details of internal circuit and protected circuit, please refer to [Protection Circuit Introduction].



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.

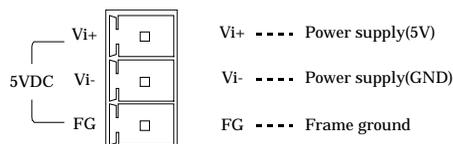


Figure 3.7. +5VDC Input Plug

Input plug is 5VDC $\pm 5\%$ input, Laterally operable screw-in type connector is supplied as a standard item. (MC1,5/3-ST-3,5 Phoenix Contact compatible cable: AWG28 - 18)

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.

Table 3.1. Power Supply

Category	Model	Input	Output	External dimensions(mm)	DIN rail
AC adapter	POA200-20	90 - 264VAC	5.0VDC $\pm 5\%$ 2.0A (Max.)	40.0(W) x 105.0(D) x 30.0(H) (exclusive of protrusions)	No
AC-DC power	POW-AD13GY	85 - 132VAC	5.0VDC $\pm 5\%$ 3.0A (Max.)	52.4(W) x 64.7(D) x 94.0(H) (exclusive of protrusions)	Yes
AC-DC power	POW-AD22GY	85 - 265VAC	5.0VDC $\pm 5\%$ 2.0A (Max.)	52.4(W) x 64.7(D) x 94.0(H) (exclusive of protrusions)	Yes
DC-DC power	POW-DD10GY	10 - 30VDC	5.0VDC $\pm 5\%$ 3.0A (Max.)	25.2(W) x 64.7(D) x 94.0(H) (exclusive of protrusions)	Yes
DC-DC power	POW-DD43GY	30 - 50VDC	5.0VDC $\pm 5\%$ 3.0A (Max.)	25.2(W) x 64.7(D) x 94.0(H) (exclusive of protrusions)	Yes

* The consumed current of DIO-8/8(USB)GY, DI-16(USB)GY or DO-16(USB)GY is +5VDC 450mA(Max.) individually.

The consumed current of DIO-8/8(FIT)GY, DI-16(FIT)GY or DO-16(FIT)GY is +5VDC 150mA(Max.) individually.

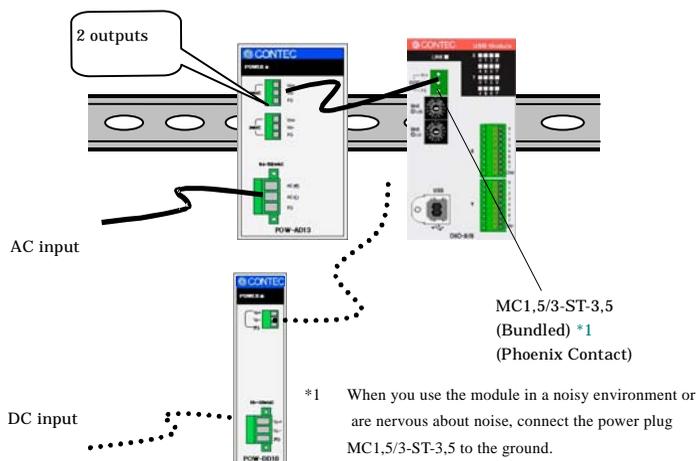


Figure 3.8. Optional power supply

Connecting method

- To connect the external power supply and USB cable to the unit, take the steps below:
 - (1) Connect the external power supply connector to supply power to the USB module.
 - (2) Use the USB cable to connect the USB module to the PC.
- To remove the external power supply and USB cable from the unit, take the steps below:
 - (1) Unplug the USB cable.
 - (2) Remove the external power supply connector to stop power supply 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).

Installing the Module

Installation Orientation

Please use the module following orientation illustrated in the graph when the module is mounting on a DIN rail and being used on a desk. It should be noted that lateral slit of the module being covered brings about malfunction.

In addition, please use the supplied two protective rubbers when setting on a desk or others as figure 3.9(A).

Correct Installation Orientation

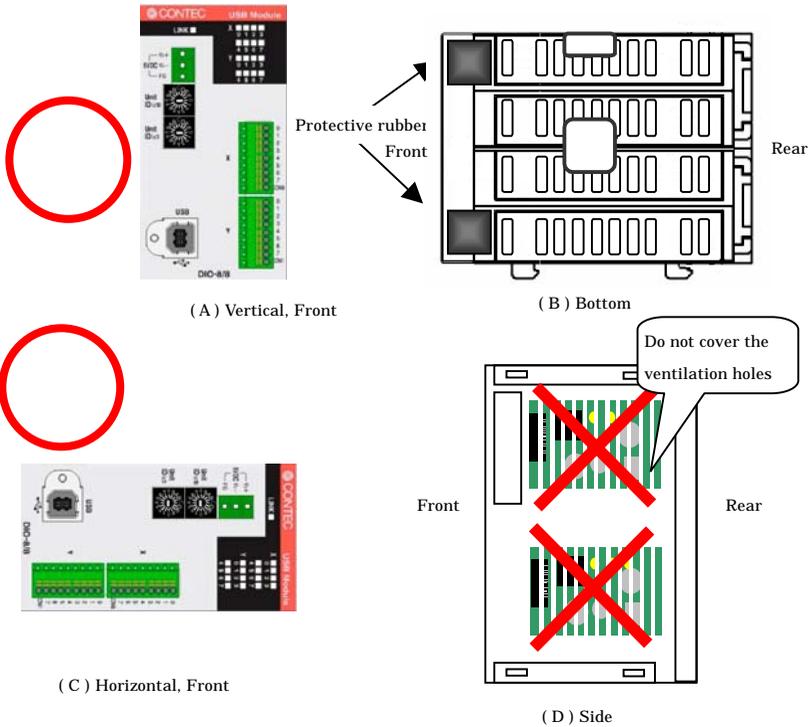


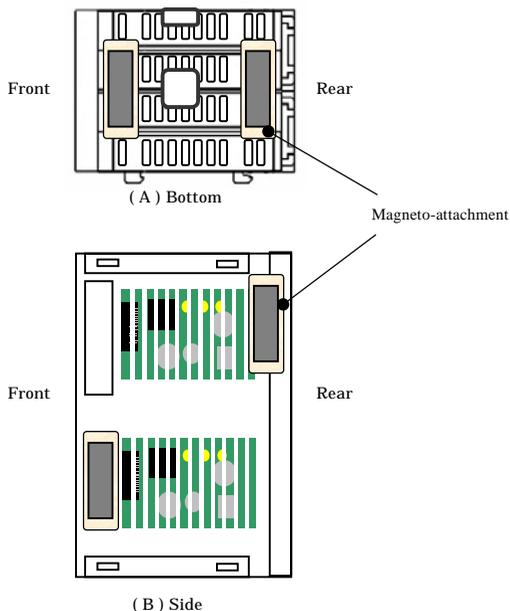
Figure 3.9. Installation Orientation

Mounting with magnets

Two magnets are appended to this product. It is easy of attachment and removal of the module to metal sides, such as a desk, partition panel and so on.

Initial adhesion strength of seal is high, but adhesion strength decreases an ability of peeling strength if once removing a magnet from the enclosure of USB module.

The example of magneto-attachment



⚠ CAUTION

- Please attach in a DIN rail on the wall and use USB Module, if connecting expansion modules.
- Please do not close ventilation holes due to prevention of the temperature rise inside a product. Otherwise, it can bring about malfunction, heating and trouble.

Mounting on a DIN Rail

The following illustrates the installation with expansion module. Please reference to page 52 for expanding a module.

Installation Method

- (1) Pushing the fixing hook with a flat-head screwdriver renders it into a lock-enabled condition (this should be done on all connected modules).

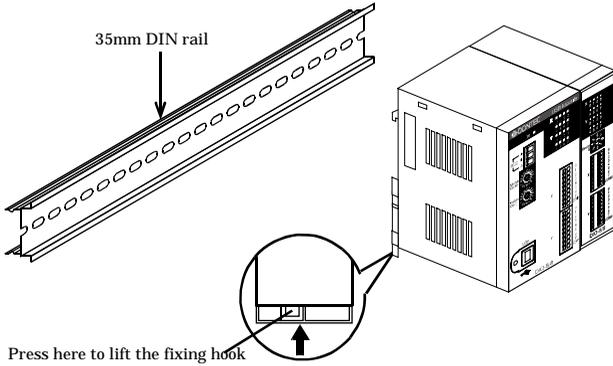


Figure 3.10. Mounting on a DIN Rail < 1 / 3 >

- (2) Hook the unit (an object consisting of a controller and a module) from the upper part of the DIN rail, and press the lower part of the unit onto the DIN rail.

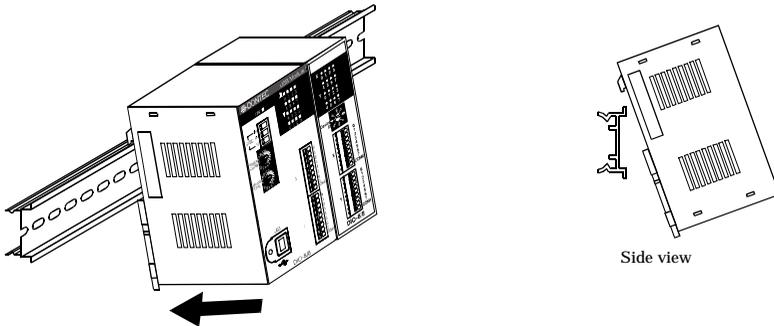


Figure 3.10. Mounting on a DIN Rail < 2 / 3 >

- (3) The fixing hook is automatically locked, and the module can be mounted in one-touch.

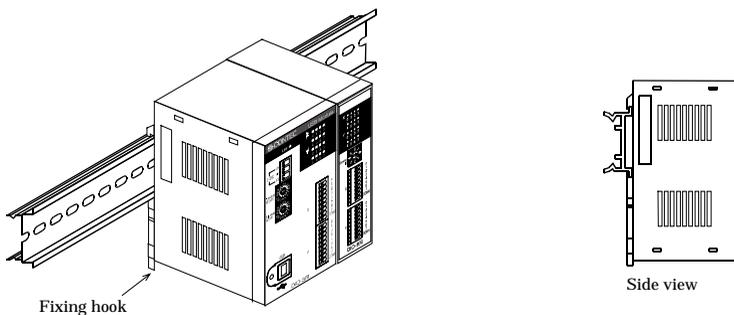


Figure 3.10. Mounting on a DIN Rail < 3 / 3 >

Removal method

⚠ CAUTION

Any operation involving the disconnection of modules in a unit (in which multiple modules are connected) that is attached to a DIN rail should be performed after the unit is removed from the DIN rail.

- (1) Lower the fixing hook for the unit to unlock it (this operation should be performed on all connected modules).

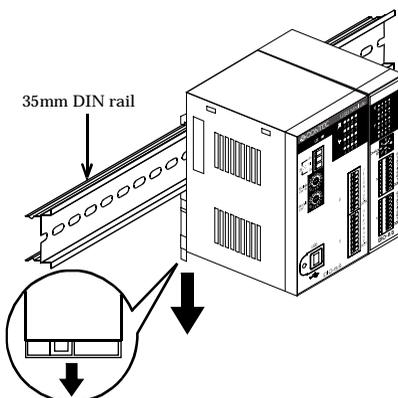


Figure 3.11. Removing the Module from the DIN Rail < 1 / 3 >

- (2) With the fixing hook unlocked, pull the lower part of the unit toward you.

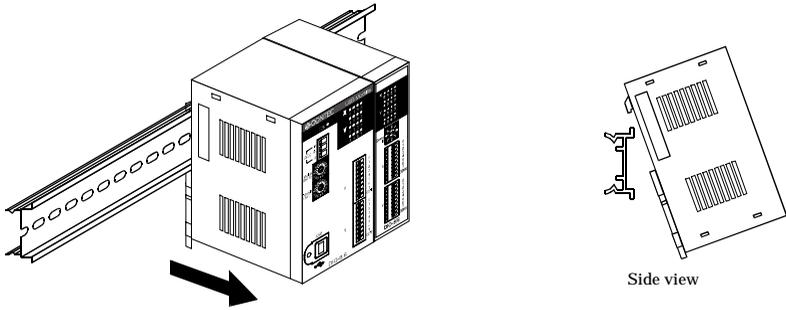


Figure 3.11. Removing the Module from the DIN Rail < 2 / 3 >

- (3) By lifting the unit, you can easily remove it from the DIN rail.

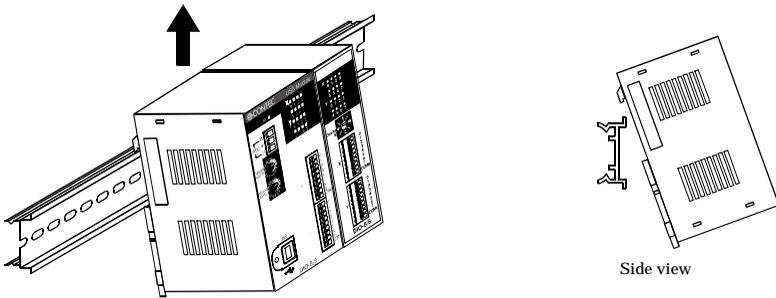


Figure 3.11. Removing the Module from the DIN Rail < 3 / 3 >

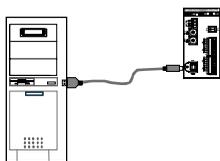
Using Several Modules with the same Model

Each module should be assigned a unique Module ID in order to let USB driver recognize them when several modules of the same model are being used.

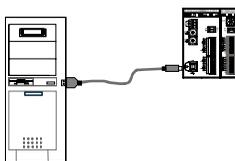
Factory settings (=00) can be used when only one module is connected to one computer.

Unnecessary to set Module ID

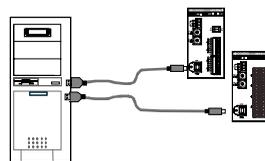
Stand alone



Expansion module being used

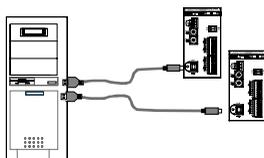


Multiple modules with different model

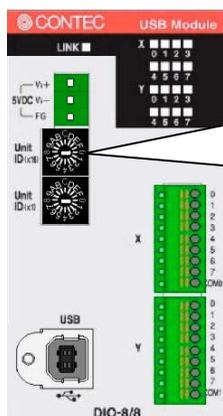


Necessary to set Module ID

Multiple modules with same model being used



Setting a Module ID



Only one module being used,
factory settings (is 00)

Multiple modules being used,
setting different value

4. Application Development

Please reference to online help and sample program when developing applications.

Reference to Online Help

Click on [Programs]-[CONTEC API-USBP(WDM)]-[API-USBP(WDM) Help] from [Start] menu.

The information for application development, such as function reference is provided in [API-USBP(WDM) Help].

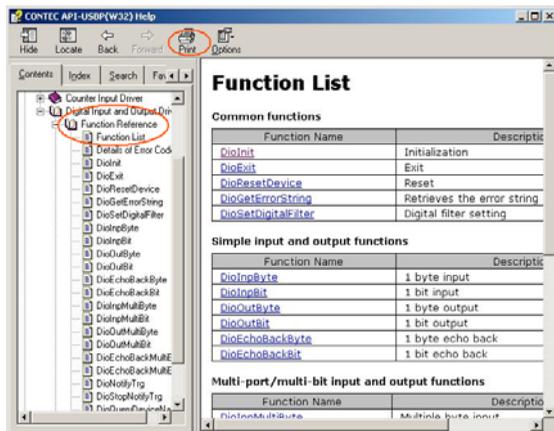
Detailed introduction to search method for help should be found from [How to navigate Help] in the help.

For basic usage, please reference to “Tutorial” for help.

Printing Function Reference

Clicking on Print button from online help prints the page being displayed. It can be printed entirely as follows in the case of referencing to printing function.

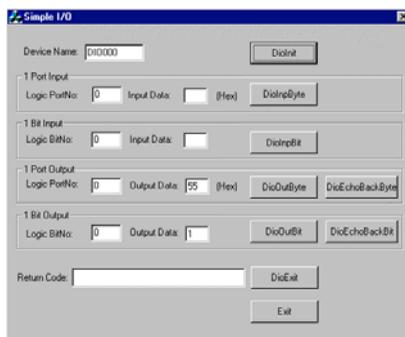
As figure shown on the right, selecting  mark and clicking on Print button prints all the topics under the mark selected at a time.



Sample Program

Sample programs are copied in installation path. (The default path is Program Files\CONTEC~) Sample programs in all language are provided here.

To run a sample program, click on [Programs]- [CONTEC API-USBP(WDM)]-[Samples for Data I/O]-[Sample Name] from [Start] menu.



Distributing Developed Application

Please distribute the developed application with USB driver in supplied CD.

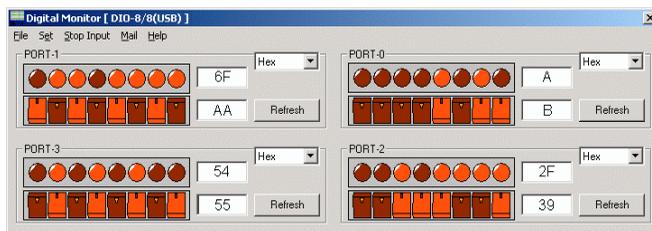
USB driver for Digital I/O

X:\INF\WDM\DIO (X: CD-ROM drive)

Utility

You can verify the operation of USB device simply by using utility programs.

Please run the help from menu for usage.



5. Troubleshooting

When encountering trouble or question, you should reference to this section first.

If you cannot find any piece of applicable information here or taking a suggested action does not solve the problem, contact your retailer.

Troubleshooting

Condition	Cause and measure
USB port of a PC is unusable	There is no [Universal Serial Bus Controllers] in the category of [Control Panel]-[System]-[Device Manager]. It may be unusable for USB port without BIOS settings. BIOS settings is different according to different PC and so that you should reference to the manual of the PC being used.
"Unknown Device" is registered with device manager (Win98/Me)	The cause is incorrect operation such as canceling the wizard by mistake when connecting with a USB module. Follow the following procedure to delete unknown device. Start device manager, select [Unknown Device] and then click on [Delete] button.
"USB Device" is registered with device manager (Windows 2000)	The cause is incorrect operation such as canceling the wizard by mistake when connecting with a USB module. Follow the following procedure to delete unknown device. Start device manager, select [USB Device] and then right-click [Delete].
The menu can not be displayed when a PC CD-ROM is being set.	Select "Run..." form Start menu, and then type X: AUTORUN.EXE (X: CD ROM drive), finally, click on OK button.
The message of "HI-SPEED USB Device Plugged into non-HI-SPEED USB Hub" is displayed on Windows XP.	This USB module corresponds to communication with HighSpeed (480Mbps), and Full Speed (12Mbps) is used to communicate when host controller and HUT device do not correspond to HighSpeed. Warning message will be displayed on Windows XP and it does not disturb the operation.

Q & A

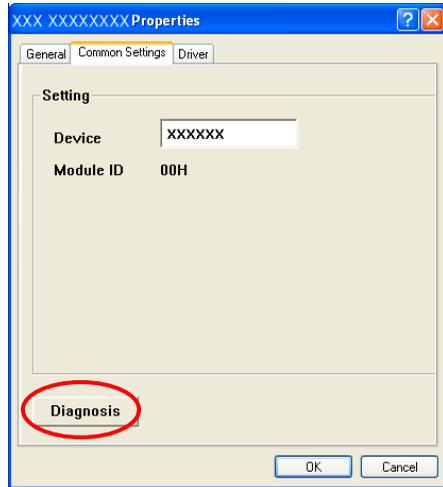
Question	Answer
Can it run on Windows NT4.0 or Windows 95?	No. In addition, it can not run on Windows 3.1, Windows NT3.51 and so on.
Can it run on OS different from Windows?	It can not run on non-Windows OS such as Linux, MS-DOS etc.
Can you make an USB connection with PC-9821 series?	Not support.
How many USB modules can be connected to one PC?	The number for connection is namely the number of USB ports available on a PC. Please supply the power by AC adapter when expending ports by USB HUT.
Can the developed applications run on other PC?	Please install USB driver and set device name for developed applications with which the files necessary to distribute are supplied. USB driver is in the INF folder on CD-ROM drive.
Does it have license in distributing developed applications?	It is free to distribute developed applications.
Can applications be developed in language different from corresponding language?	The languages in which the supplied sample programs are written are the supported languages. USB driver is supplied in the form of Win32API DLL and so that it can be used by language and applications supporting this form (It can not be used by language which do not support corresponding argument type). The integrity of the operation cannot be guaranteed because we do not verify the operation.
Can it be used without programming knowledge?	There are supplied softwares (Development Environment) for application development on the CD-ROM. Applications are basically developed in corresponding language, and utility programs can be used to check status if you only want to monitor I/O status.
Can run with other applications together simultaneously?	It is possible because of multiple-thread processing in Windows. Reply from an application may be very slow because of the high load.
Can expansion modules with different type be connected?	No. In the case of using DIO-8/8(USB)GY, DIO-8/8(FIT)GY is the only module to be connected.
What about the maximum length of USB cable?	The maximum length is less than 5m according to USB specification. But it can expand to 6 tiers with 30m long when using USB HUT.

Question	Answer
How to get the version of USB driver?	Run diagnostic program and [Show Diagnosis Report...] to get the version of the driver.
How to upgrade USB driver to latest edition?	You can download it from following homepage when there is latest edition. http://www.contec.com/download
How to start the device manager?	Windows2000: Start Start->Settings->Control Panel->System.Select Hardware and click on Device Manager.
How about trigger monitoring?	Monitor ON/OFF of input value by the firmware of USB module. The application is given notice of change.
Does it fail in monitoring trigger when other application is running at the same time?	Monitor is performed by firmware of USB module itself and so that it has no influence on Windows processing. But the notification to application may be delayed.
How about pulling out USB connector in operation?	All of the output will be OFF. Please restart the application when reconnecting.
Does it feature suspend/resume function?	No. Please set power management for a PC in order to avoid suspension in operation.
Is AC adapter necessary when HUB is being used?	It is unnecessary to connect with AC adapter when connecting with a HUB of self power. (It is necessary when using expansion modules.)
What value will the output be if the application is terminated?	Output is hold.
Want to perform the points more than the points being appended by expansion modules.	The number of expansion modules is 3(4 including the host). Please purchase necessary USB modules and expansion accessories when points more than these are wanted.
Is adding points by expansion modules different form adding USB modules?	Using expansion modules - Only one USB port is used. - When a function is used, it is executed for one device with the number of channels increased. Adding main units - As many USB ports as the number of main units added are used. - When a function is used, it is executed for the separate devices.
In what order should the USB cable and power cable be unplugged?	When the module is externally powered, for example, via the AC adapter, unplug the USB cable first, then unplug the power cable.

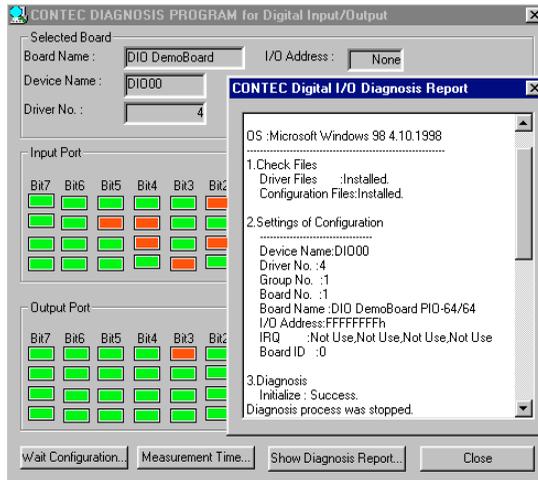
Diagnostic Program

Running diagnostic program may identify that if abnormality exists in hardware or software.

Run diagnostic program, open Properties for USB module of device manager and then click on [Diagnosis] button in [Diagnosis] button in [Common Settings] tab.



Diagnostic program can not only verify the status of current input and output but also save diagnostic result in a file by clicking on [Show Diagnosis Report...] button.



Version Upgrade

How to Upgrade the Firmware

Firmware is namely software which is embedded in USB module. Up-to-date firmware(update file) will be supplied in the homepage of our company in the case of function upgrade and so on.

The following presents how to update the update file downloaded from homepage to USB module.

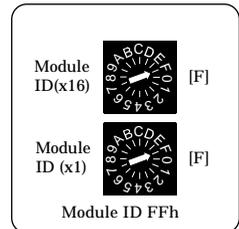
Step1 Removing USB Module

Please make disconnection when USB port is being connected. When using self-power, remove AC adapter in order to reset status.

Step2 Set Module ID to FFh

Set Module ID to FFh.

It is special setting for firmware upgrade.



Point

Modules should be performed firmware version upgrade one by one.
Upgrade for multiple modules can not be performed at the same time.

Step3 Connecting USB Module with USB Port

Please connect USB port after AC adapter has been connected when using self-power.

Step4 Starting Firmware Upgrade Tools

Click on [Programs]-[CONTEC API-USBP(WDM)]-[Firmware Upgrade Tools] from [Start] menu.

Step5 Specifying Upgrade Files

Clicking on [Browse] button specifies the file which has been downloaded.



Step6 Clicking [Start Upgrade] Button

Upgrade is completed automatically.

Step7 Setting Properties by Device Manager once more

After completing upgrade, perform settings again also referencing to Setting Properties by Device Manager in page 22.

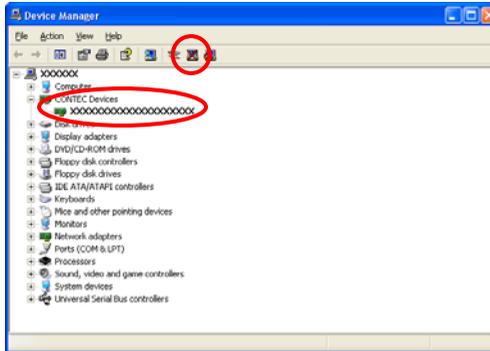
Driver Upgrade

If there is up-to-date driver, it is supplied in the homepage of our company.
<http://www.contec.com/download>

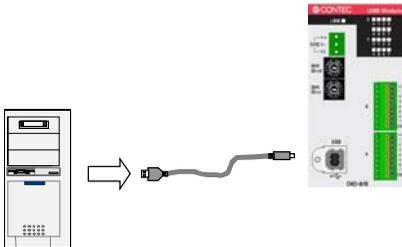
Returning to Initial State

This is the method of returning to initial state. It is suggested that you should return to initial state and perform installation again when the operation is losing stabilization.

Step1 Deleting Device form Device Manager



Step2 Drawing USB Cable from a PC



Step3 Uninstalling Driver

Select [CONTEC API-DIO(WDM) driver] from [My Computer]-[Control Panel]-[Add/Remove Programs].

Step4 Restarting

6. 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. At the same time, adding I/O point is considered when designing this module, and additional module can be connected by the connector on the side of the module, so that not only the cost but also the installation space are controlled.

The various modules (Option) are prepared for each USB module.

Table 6.1. Expansion Modules

Model	Input point	Output point	Current consumption	Function
DIO-8/8(FIT)GY	8	8	+5VDC 150mA(Max.)	Expansion module for DIO-8/8(USB)GY
DI-16(FIT)GY	16	None	+5VDC 150mA(Max.)	Expansion module for DI-16(USB)GY
DO-16(FIT)GY	None	16	+5VDC 150mA(Max.)	Expansion module for DO-16(USB)GY

Since the maximum number of modules to be connected is 3, in the case of combination of the USB module “DIO-8/8(USB)GY” and three expansion modules “DIO-8/8(FIT)GY”, it is possible to control 32 points input and 32 points output by way of one USB port.

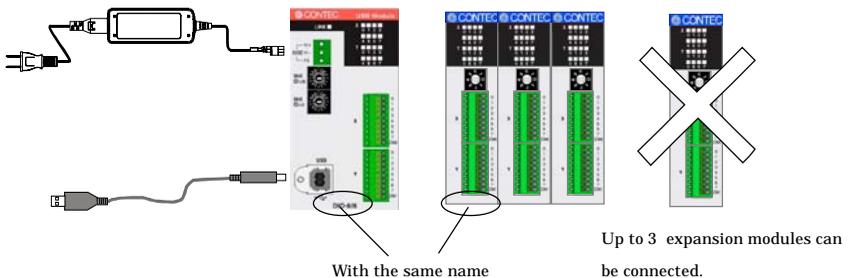


Figure 6.1. Expansion Modules

Points

- Up to 3 modules can be connected.
- You need for external power supply such as AC adapter(Option) when adding modules.
- Modules with different function from the USB module can not be connected. Please use private modules.

Setting a Device ID

Set Device ID by rotary switch on the front when adding I/O point.

The ID for the first module being added must be 1 and values 2 and 3 are for the following two modules respectively. Furthermore, the factory setting for the Device ID is “0”.

⚠ CAUTION

To avoid malfunction, please do not set the Device ID to one other than 1, 2 and 3.

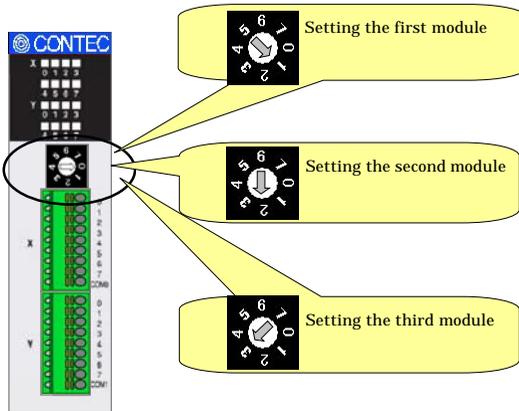


Figure 6.2. Setting a Device ID

Connecting the Module

Inserting the stack hook by aligning it with the hook insertion inlet for the other devices automatically locks the module. (If a stack connector protective cover is attached, the connection operation should be performed after the cover is removed.)

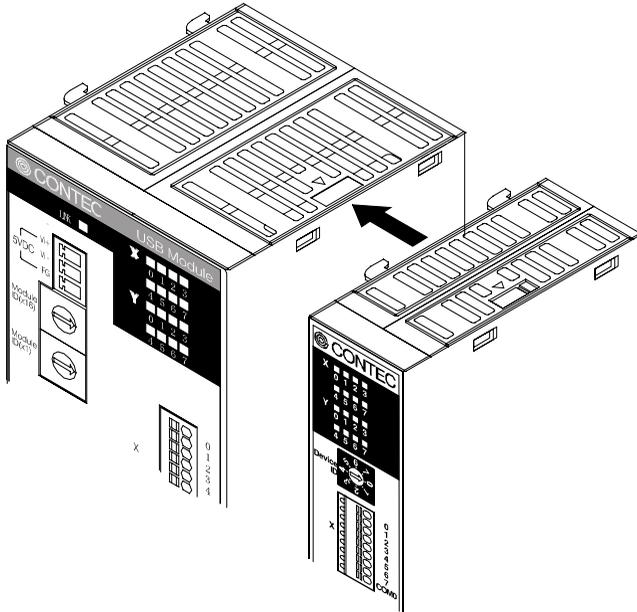


Figure 6.5. Connecting the Module

7. Product Specification

Hardware Specification

Table 7.1 - 7.3 list the hardware specification of DIO-8/8(USB)GY, DI-16(USB)GY and DO-16(USB)GY.

Table 7.1. Hardware Specification < DIO-8/8(USB)GY >

Item		Specification
Input section		
Input format		opto-isolated input Compatible with current sink output: negative logic *1 Compatible with current source output: positive logic *2
Number of input signal points		8 points (8 points/common)
Input resistance		3kΩ
Input ON current		3.4mA (Min.)
Input OFF current		0.16mA (Max.)
Response time		1msec (Max.) *3
External power		12V - 24VDC (±15%)
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	12V - 24VDC (±15%)
	Output current	Max. 150mA (per point)
Number of output signal points		8 points (8 points/common)
Response time		1msec (Max.) *3
External power		12V - 24VDC (±5%)
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		0 - 50°C 10 - 90%RH (no condensation)
External dimensions (mm)		50.4(W) x 64.7(D) x 94.0(H) (exclusive of protrusions)
Weight of the module itself		100g
Module installation method		One-touch connection to 35mm DIN rails (standard connection mechanism provided in the system)
Expansion module		DIO-8/8(FIT)GY: 3 modules (Max.) consumption current per module: +5VDC 150mA (Max.)
Compatible plug		FK-MC0,5/9-ST-2,5 (made by Phoenix Contact corp.) 2.5mm-pitch nominal current: 4A (Max.)
Compatible wires		AWG28 - 20

*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 together.

Table 7.2. Hardware Specification < DI-16(USB)GY >

Item	Specification
Input section	
Input format	Opto-isolated input Compatible with current sink output: negative logic *1 Compatible with current source output: positive logic *2
Number of input signal points	16 points (8 points/common)
Input resistance	3kΩ
Input ON current	3.4mA (Min.)
Input OFF current	0.16mA (Max.)
Response time	1msec (Max.) *3
External power	12V - 24VDC (±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	0 - 50°C 10 - 90%RH (no condensation)
External dimensions (mm)	50.4(W) x 64.7(D) x 94.0(H) (exclusive of protrusions)
Weight of the module itself	100g
Module installation method	One-touch connection to 35mm DIN rails (standard connection mechanism provided in the system)
Expansion module	DI-16(FIT)GY: 3 modules (Max.) , Consumption current per module: +5VDC 150mA (Max.)
Compatible plug	FK-MC0,5/9-ST-2,5 (made by Phoenix Contact corp.) 2.5mm-pitch nominal current: 4A (Max.)
Compatible wires	AWG28 - 20

*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 together.

Table 7.3. Hardware Specification < DO-16(USB)GY >

Item		Specification
Output section		
Output format		Opto-isolated open collector output (Current sink type) (negative logic *1)
Output rating	Output voltage	12V - 24VDC ($\pm 15\%$)
	Output current	Max. 150mA (per point)
Number of input signal points		16 points (8 points/common)
Response time		1msec (Max.) *2
External power		12V - 24VDC ($\pm 15\%$)
Allowable distance of signal extension		Approx. 50m (depending on wiring environment)
Communication		
USB transmission speed		12Mbps (full speed), 480Mbps (high speed) *2
Current consumption		+5VDC 450mA (Max.)
Others		
Number of modules used at the same time		127 modules (Max.) *3
Use condition		0 - 50°C 10 - 90%RH (no condensation)
External dimensions (mm)		50.4(W) x 64.7(D) x 94.0(H) (exclusive of protrusions)
Weight of the module itself		100g
Module installation method		One-touch connection to 35mm DIN rails (standard connection mechanism provided in the system)
Expansion module		DO-16(FIT)GY: 3 modules (Max.) . Consumption current per module: +5VDC 150mA (Max.)
Compatible plug		FK-MC0,5/9-ST-2,5 (made by Phoenix Contact corp.) 2.5mm-pitch nominal current: 4A (Max.)
Compatible wires		AWG28 - 20

*1 Data"0" corresponds to high-level and data"1" corresponds to low-level.

*2 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.

*3 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 together.

Software Specification

Table 7.4. Windows Drivers Specification

Item	Specification
Support OS	Microsoft Windows 98 or Second Edition Microsoft Windows Me Microsoft Windows 2000 Professional Microsoft Windows XP Professional, Home Edition
Support language	Microsoft Visual C++ Ver 5.0, Ver 6.0 Microsoft Visual C++ .NET 2002, 2003 Microsoft Visual Basic Ver 5.0, Ver 6.0 Microsoft Visual Basic .NET 2002, 2003 Microsoft Visual C# .NET 2002, 2003 Borland Delphi Ver 5.0, 6.0 Borland C++ Builder Ver 5.0
System requirement	<ul style="list-style-type: none"> - PC (IBM PC/AT compatibility, DOS/V) with USB port - CD-ROM drive - Recommend the environment on which the using language can run smoothly

Circuit Block Diagram

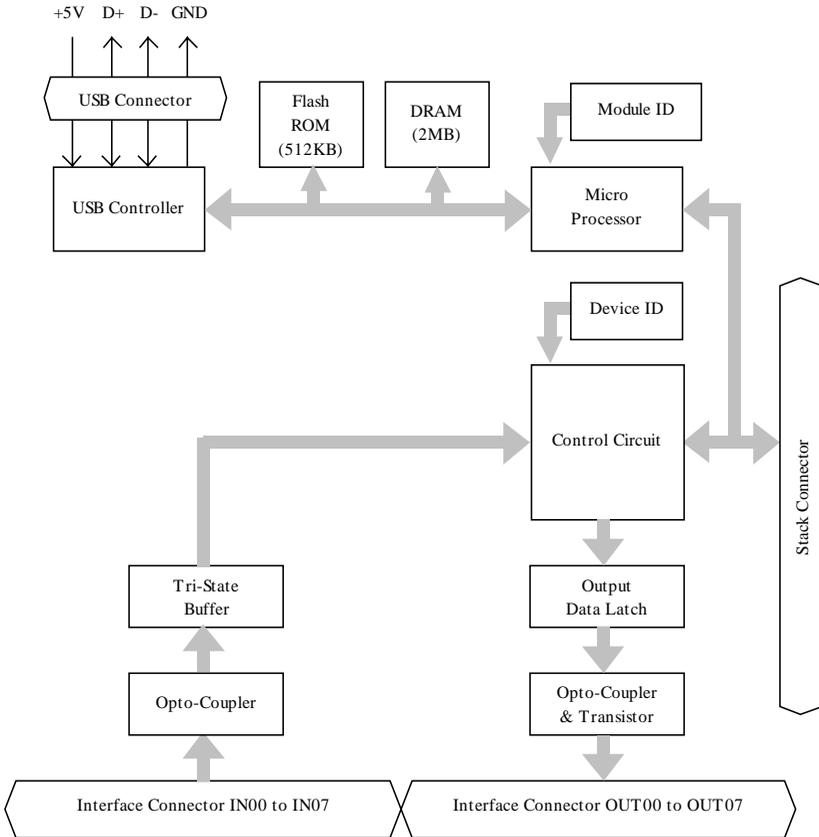


Figure 7.1. Circuit Block Diagram
< DIO-8/8(USB)GY >

Point

The Device ID of the system module DIO-8/8(USB)GY is fixed at “0”.

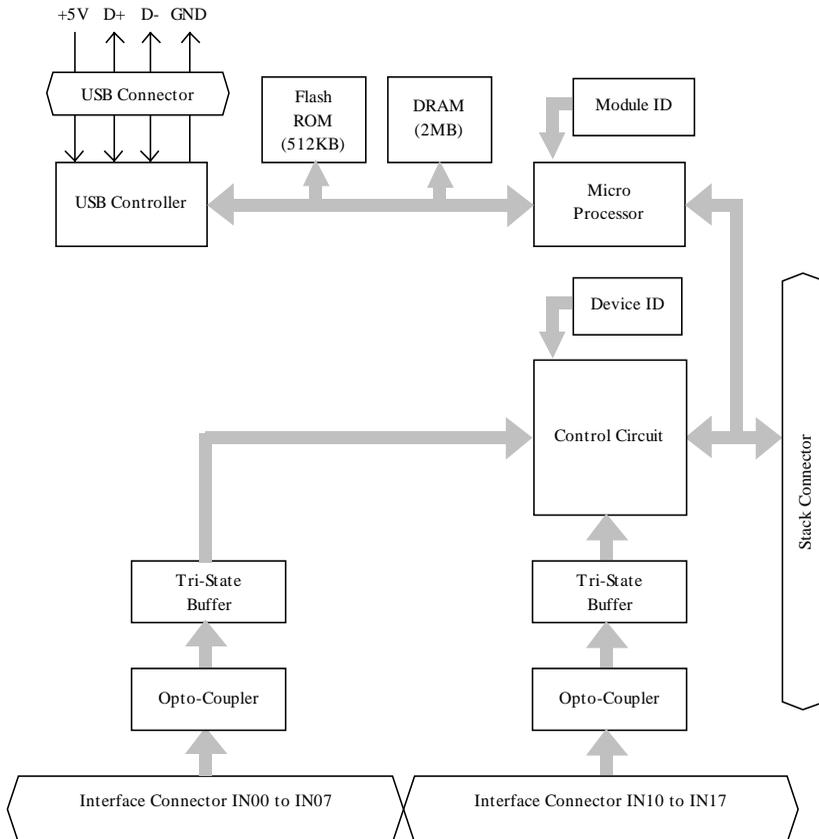


Figure 7.2. Circuit Block Diagram
< DI-16(USB)GY >

Point

The Device ID of the USB module DI-16(USB)GY is fixed at "0".

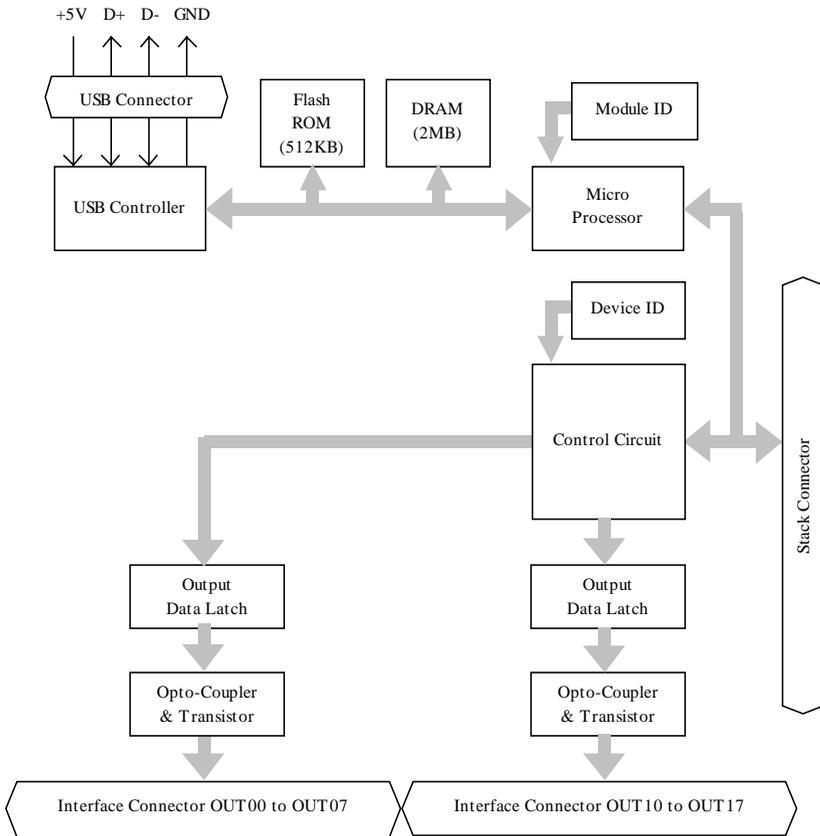


Figure 7.3. Circuit Block Diagram
< DO-16(USB)GY >

Point

The Device ID of the USB module DO-16(USB)GY is fixed at “0”.

External Dimensions

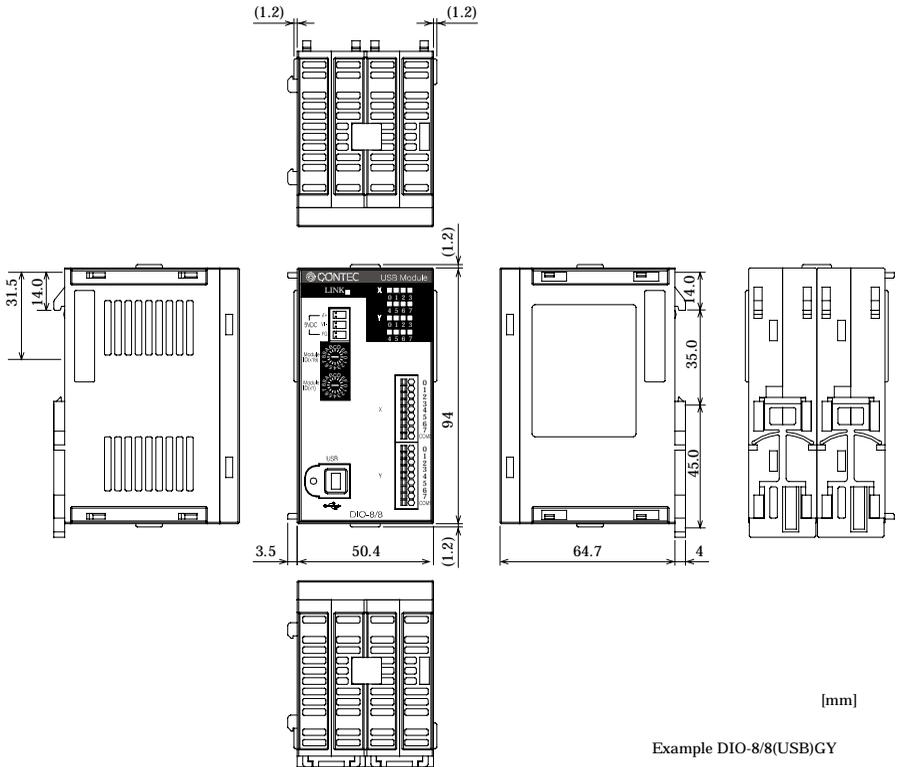


Figure 7.4. External Dimensions of the USB module

External Input and Output Circuit

Input Section

Figure 7.5 shows the input equivalent circuit for the interface section of the <DIO-8/8(USB)GY> and <DI-16(USB)GY>.

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.

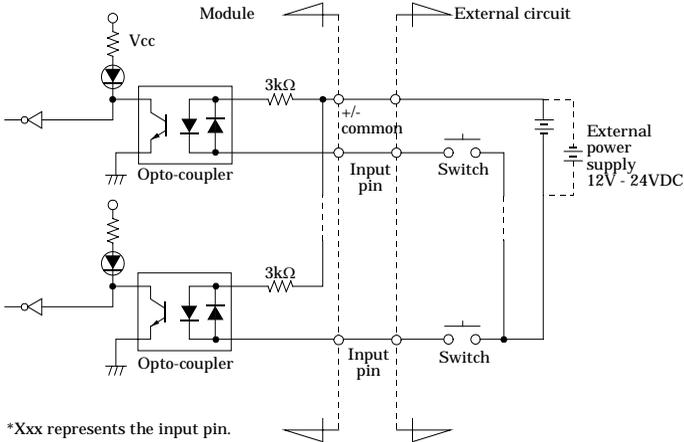


Figure 7.5. Input Circuit
 <DIO-8/8(USB)GY >, <DI-16(USB)GY >

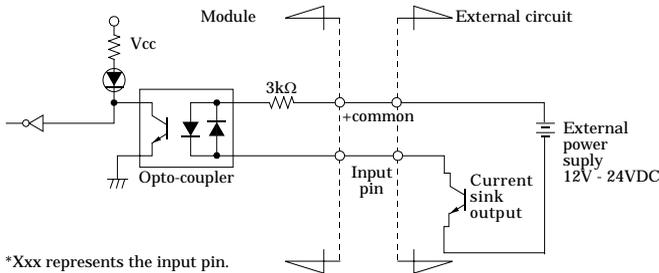


Figure 7.6. Example of a Connection to Current Sink Output
 <DIO-8/8(USB)GY >, <DI-16(USB)GY >

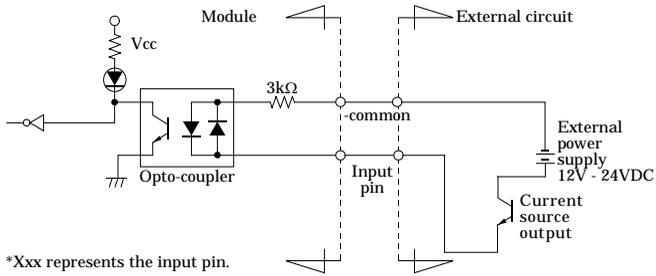


Figure 7.7. Example of a Connection to Current Source Output
< DIO-8/8(USB)GY >, < DI-16(USB)GY >

Output Section

Figure 7.8 shows the output circuit for the interface section of the DIO-8/8(USB)GY> and <DO-16(USB)GY>. The signal output section consists of an opto-isolated open collector method (current sink type). Therefore, driving the output section for the Module requires an external power supply with a nominal output current of 150mA maximum per point. A surge voltage protection circuit is not provided on the output transistors. Therefore, when driving relays, lamps, and other induction loads using this Module, a surge voltage countermeasure should be provided on the load side.

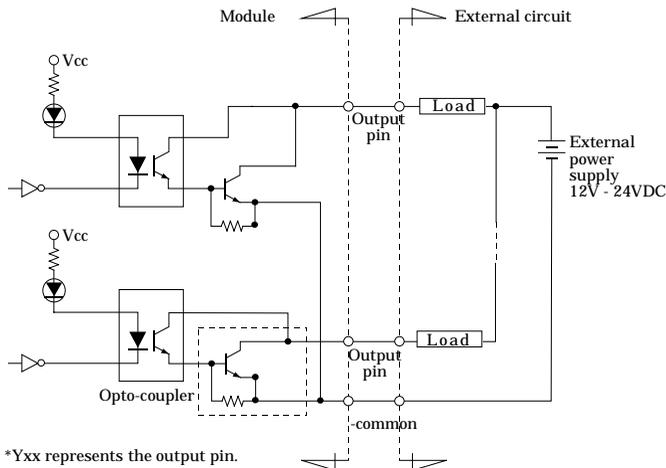


Figure 7.8. Output Circuit
 <DIO-8/8(USB)GY>, <DO-16(USB)GY>

Point

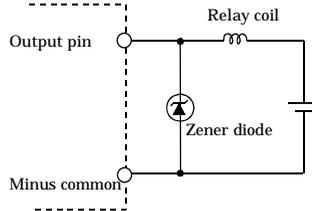
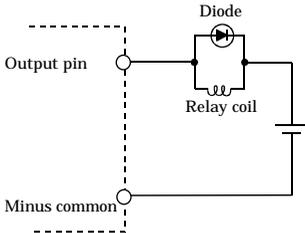
When the power is turned on, all output will be OFF.

Protection Circuit Introduction

Surge Voltage Countermeasures

When connecting a load that generates surge voltages and inrush currents, such as an induction load (relay coil) or an incandescent light bulb, to the digital output, appropriate protection must be provided in order to prevent damage to the output stage or a malfunction due to noise. The rapid shutoff of a coil, such as a relay, generates a sudden high-voltage pulse. If this voltage exceeds the voltage tolerance level of the output transistor, it can cause the transistor to gradually deteriorate, or even completely damage the transistor. Therefore, when driving an induction load, such as a relay coil, you should always connect a surge-absorbing device. The following illustrates a surge voltage countermeasure that can be employed:

*Examples of use of relay coil



External power voltage < Zener diode voltage

*Examples of use of lamp

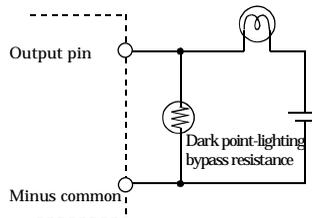
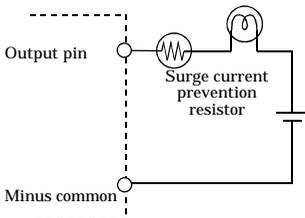


Figure 7.9. Surge Voltage Countermeasures

8. Appendix

Glossary

The glossary contains a brief description of terms used in this manual.

Terms	Explanation
API [Application Program Interface]	It is abbreviation for Application Program Interface. It is the open program interface for OS corresponding to applications, and all application processing are basically performed through the API. The API provided by our company can control hardwares by calling device driver.
PDF file	It is abbreviation for Portable Document Format. It is the document format developed in order to display files not depending on specified platform. It is developed by Adobe Co.
USB [Universal Serial Bus]	It is abbreviation for Universal Serial Bus. It is for the specification of the connection between a PC and peripheral equipment. It can connect a wide range of devices and can be plugged/unplugged with the power being ON(Hot Plug).
USB 2.0 [Universal Serial Bus 2.0]	The latest USB specification that keeps up the low-compatibility with previous USB and promotes the data transfer speed to 480Mbps (60MB/sec).
Device ID [Device Identifier]	It is the ID being set when connecting expansion modules and specifying connection order. It is only for expansion modules. The bit number and port number are decided by the setting.
Self power	Supplying power by using AC adapter is called Self-Power. Please make use of AC adapter when using expansion modules.
Expansion modules	Modules (sold separately) used to adding channels are showed as follows. Channel Expansion module for DIO-8/8(USB)GY: DIO-8/8(FIT)GY Channel Expansion module for DI-16(USB)GY: DI-16(FIT)GY Channel Expansion module for DO-16(USB)GY: DO-16(FIT)GY
Device driver	It is softwares to operate and set peripheral equipment by a PC, and the peripheral equipment is installed on the PC. It is simply called Driver.
Device manager	It is a Windows tool which can confirm the behavior of the peripheral equipment installed on a PC, and the state being identified by Windows
Device name	The name is set by USB driver to specify modules. It is set in Properties of Device Manager and specified in the course of API function initialization and so on.
Hardware wizard	It is support program for user without technical knowledge to add peripheral equipment to a PC. It runs automatically after the device such as USB device has been connected.
Bus power	Power is supplied by a host when USB cable is being connected without connecting a AC adapter.

Terms	Explanation
Bit number	<p>It is the number specified for inputting and outputting individual signal. The I/O value corresponding to the bit number is 0 or 1. The bit number is decided by the order of Device ID when multiple modules are used.</p> <p>For example: in the case of using one DI-16(USB)GY and two DI-16(FIT)GY expansion modules</p> <p>DI-16(USB)GY bit 0 to bit 15 DI-16(FIT)GY (ID=1) bit 16 to bit 31 DI-16(FIT)GY (ID=2) bit 32 to bit 47</p>
Firmware	<p>It is the software incorporated into a equipment to perform basic control on hardwares.</p>
Properties	<p>Select USB Modules from Device Manager, right-click and select [Properties] dialog box from pop-up menu to set the device name.</p>
Port number	<p>It is I/O port number specified in inputting and outputting the signal by treating 8-point as a group.</p> <p>The value of I/O port number is 0 to 255.</p> <p>The I/O port number is decided by the order of Device ID when multiple modules are being used.</p> <p>For example: in the case of using one DI-16(USB)GY and two expansion modules for DI-16(FIT)GY</p> <p>DI-16(USB)GY port 0 to port 1 DI-16(FIT)GY (ID=1) port 2 to port 3 DI-16(FIT)GY (ID=2) port 4 to port 5</p>
Module ID	<p>About the ID of the USB module.</p> <p>Set unique ID value individually for the modules in order to recognize the driver when using multiple modules. Use the factory setting(=0) when using one module.</p>

DIO-8/8(USB)GY, DI-16(USB)GY, DO-16(USB)GY User's Manual

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December 2006 Edition

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[09202002]

Management No. A-46-654

[12082006_rev4]

Parts No. LYBQ462