PC-HELPER

Pt100 Thermo-sensor Input Module
for USB2.0
PTI-4(USB)
User's Guide

CONTEC CO.,LTD.

Check Your Package

Thank you for purchasing the CONTEC product.

The product consists of the items listed below.

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Product Configuration List

- USB module [PTI-4(USB)]…1

- First step guide …1

- CD-ROM *1 [API-USBP(WDM)]…1

- Interface connector (plugs) FK-MC0.5/9-ST-2.5 (mounted on the module)…2

- AC adapter (1.4m)…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)

CD-ROM [API-USBP(WDM)]

AC adapter

USB module

USB cable

ProtectiveRubber   Magnet

First step guide
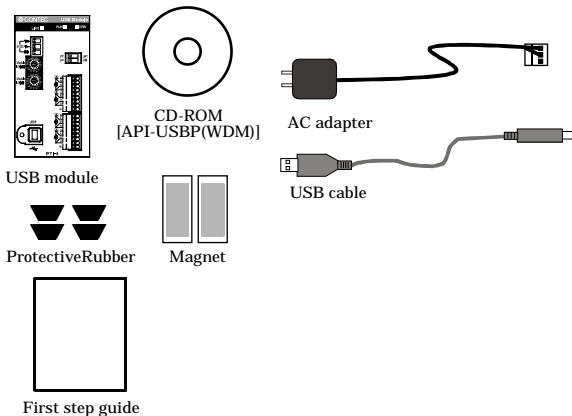
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1. Before Using the Product

1.1. About the Module

Before, the measurement and control was realized by way of inserting PCI interface boards into expansion slots of a desktop computer in case of configuring system using computers. However, because of the limit on number of expansion slots, it is difficult to configure system sometimes, or it is difficult to perform the same measure and control as PCI interface boards for a note PC. The USB module can be used to resolve that kind of problems.

The PTI-4(USB) is a compact, ready-to-use module for collecting resistance and temperature data from a USB-compatible platinum resistance temperature detector, Pt100 or JPt100.
This module can be used in various operating environments as it provides discontinuity detection and digital filtering features.

Desktop Computer   Note PC

Corresponding to USB

It can be used by PC with USB interface and is for note PC best.
When using it on a desktop computer, you can perform simple connection without the need for opening the host cover.

Easy to setup
Simple on utilization

Being connected with USB port, the USB module can be setup simply. In addition, it can be used immediately owing to the supplied Windows development environment and Utility. The communication in Full Speed (12Mbps) is added to this USB module, and which is compatible with High Speed (480Mbps).   High Speed is namely High-Speed data communication which is additional definition in the specification of USB2.0. The host controller performs communication in 480Mbps when corresponding to High Speed of USB2.0. Comparing with communication in Full Speed, the response for module access as communication in High Speed improves.

1.1.1. Features

➢ **Supporting a variety of temperature measurement applications**

Providing the averaging and alarm output functions as well as resistance/temperature data acquisition for temperature measurement, thereby supporting various application.

Serviceable with either a three-wire or four-wire platinum resistance temperature detector.

- Resistance/temperature data acquisition

Capable of acquiring resistance data from a platinum resistance temperature detector connected. While the output from the platinum resistance temperature detector is nonlinear with respect to temperature changes, the module internally linearizes the input to obtain data as temperature values.

- Averaging by count

Capable of averaging data input after input data by sampling count.

- Averaging by time

Capable of averaging input data by

- Alarm output

Capable of sensing an alarm output upon detection of a temperature outside the set temperature range. The module can be programmed to take action only when the alarm output changes. The alarm output can be set for each channel.
The alarm output range can be set with four levels: higher high limit, high lower limit, lower high limit, and lower low limit.
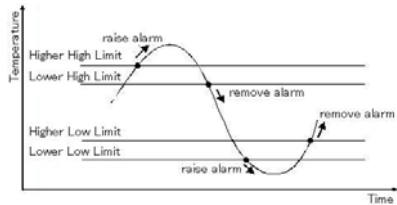
➢ **Digital Filter**

Incorporating a digital filter for eliminating noise from the commercial power supply (50/60 Hz). Note that the digital filter can be used only at a conversion speed of 150 ms.

➢ **Discontinuity detection**

Capable of detecting the discontinuity in a resistance temperature detector or conductor per channel.

➢ **Isolated from external device**

Using an opto-coupler to isolate the CPU in the module from the external device, preventing the external device from electrically affecting the host computer directly via the USB port.

> **Easy to wire**

The system incorporates a scrawls connector plug that allows you to easily attach and detach wires without using any special tools.

Press this section to insert the wire
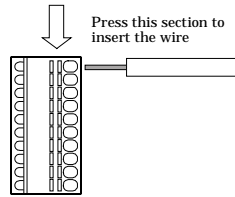
> **Easy-to-install design**

The system, in the module itself, incorporates a 35mm DIN rail mounting mechanism as a standard item, so it can be attached and detached easily.
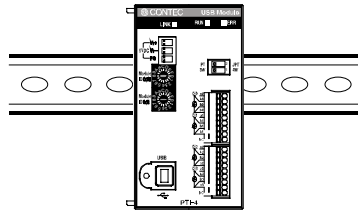
> **Easy to extend input channel**

By adding expansion modules Option, the number of input channels can be increased.

It adopts the unique configuration of stack connecting which permits a simple, compact system configuration.

PTI-4(USB) + PTI-4(FIT)GY x 5
(Up to 24 input channels can be extended)
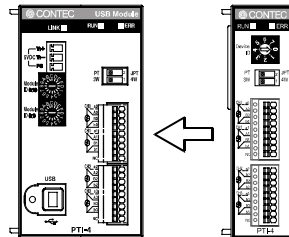
> **Easy-to-develop-application Sample Program**

Visual Basic, Visual C++, Delphi and C++ Builder sample programs have been prepared.
Functions convenient for developing generic applications, such as the functions that acquire the list of the current available USB modules, are prepared.
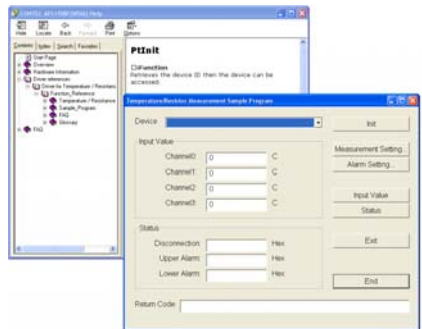
➢ **Convenient utility for debugging**

- **Diagnostic Program**

    When the problem occurred, it will be helpful to solving the problem.
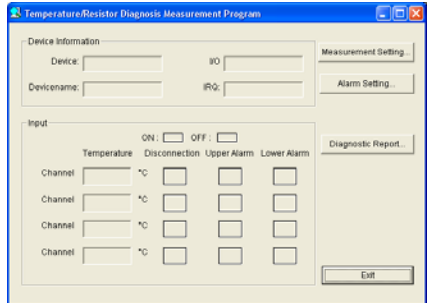
1.1.2. Support Software

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

API Functions 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/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.

It also supplies the up-to-date driver and download service for missing files.

Further details may be found in the help within supplied CD-ROM or the homepage of our company.

< Operating Environment >

Primary corresponding OS	Windows XP, 2000, Me, 98SE
Primary corresponding language	Visual C++.NET, Visual C#.NET, Visual Basic.NET, Visual C++, Visual Basic, Delphi, Builder

1.1.3. Accessories (Option)

Input Module for Pt100 Thermo-sensor (Expansion module for PTI-4(USB))	:	PTI-4(FIT)GY
AC adapter (input: 90 - 264VAC, output: 5VDC 2.0A)	:	POA-AD22
AC-DC power supply unit (input: 85 - 132VAC, output: 5VDC 3.0A):		POW-AD13GY
AC-DC power supply unit (input: 85 - 264VAC, output: 5VDC 2.0A):		POW-AD22GY
AC-DC power supply unit (input: 85 - 264VDC, output: 5VDC 4.6A (230VAC), 4.2A(115VAC))	:	POW-AD25GY
AC-DC power supply unit (input: 10 to 30VDC, output: 5VDC 3.0A):		POW-DD10GY
DC-DC power supply unit (input: 30 to 50VDC, output: 5VDC 3.0A):		POW-DD43GY

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

1.2. Customer Support

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

1.2.1. Web Site

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

Latest product information

CONTEC provides up-to-date information on products.
CONTEC also provides product manuals and various technical documents in the PDF.

Free download

You can download updated driver software and differential files as well as sample programs available in several languages.

Note! For product information

Contact your retailer if you have any technical question about a CONTEC product or need its price, delivery time, or estimate information.

1.3. Limited One-Year Warranty

CONTEC F&eIT 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 products. 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.

1.4. 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.

1.5. 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.

1.6. Safety Precautions

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

1.6.1. 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.

1.6.2. 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.

- When you use the module in a noisy environment or are nervous about noise, attach ferrite cores to the connection cable.

- 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.

- 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.

1.6.3. Environment

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

Operating temperature

0 - 50°C

Operating humidity

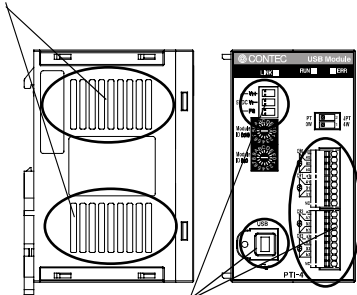10 - 90%RH (No condensation)

Corrosive gases

None

Floating dust particles

Not to be excessive

1.6.4. 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

1.6.5. Storage

When storing this product, keep it in its original packing form.

(1) Put the module in the storage bag.

(2) Wrap it in the packing material, then put it in the box.

(3) Store the package at room temperature at a place free from direct sunlight, moisture, shock, vibration, magnetism, and static electricity.

2. Module Nomenclature

Figures 2.1 shows the names of module components.
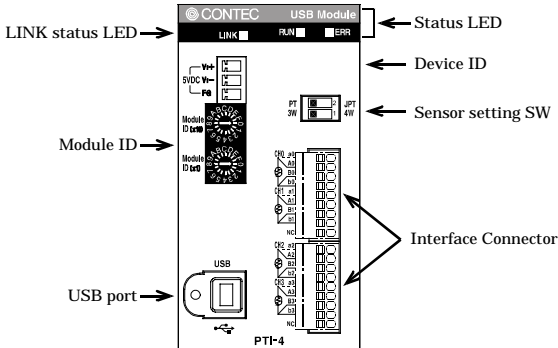In the figures, the indicated switch settings represent factory settings.

Figure 2.1. Nomenclature of Module Components

Table 2.1. List of Status LED Functions

Name	Function	Indicator color	LED indicator
LINK status	USB communication status	GREEN	ON: Communication established
			OFF: Communication unestablished
RUN status	Run status	GREEN	ON: Upon completion of startup after the power is turned on
ERR status	Error status	RED	OFF: Upon discontinuity detection or alarm output

Table 2.2. Settings of Sensor Setting Switches

SW setting	Wiring method	Platinum resistance temperature detector
PT 3W ... JPT 4W	Three-wire type	Pt100 *1
PT 3W ... JPT 4W		JPt100
PT 3W ... JPT 4W	Four-wire type	Pt100
PT 3W ... JPT 4W		JPt100

*1 Factory setting

3. Setup

3.1. Connection-Overall Diagram

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

**Connecting to a PC
(Page 14)**

**Connecting to an
External Device
(Page 20)**

**Software Installation
(Page 18)**

**Connecting with
Expansion
Accessories
(Page 39)**

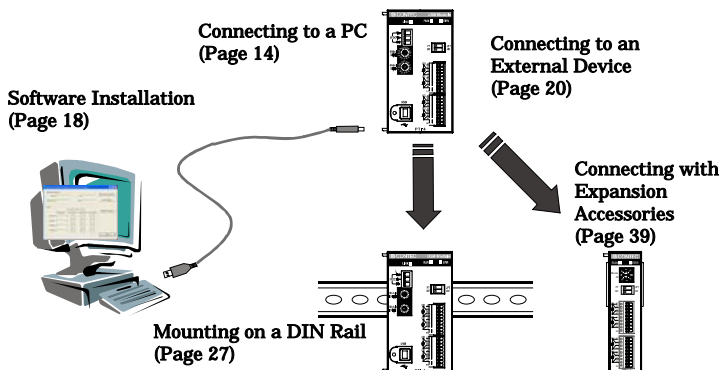**Mounting on a DIN Rail
(Page 27)**

Figure 3.1. Connection-Overall Diagram

3.2. 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 to 7Fh when several modules with the same model are being connected. When the module is connected along with the CPU-CA10(USB)GY, assign different module IDs to them.

There are two rotary switches, moreover, "x16" and "x1" represent high bits and low bits of Module ID respectively.
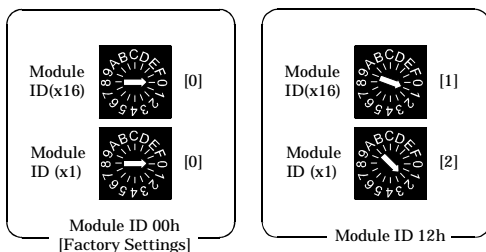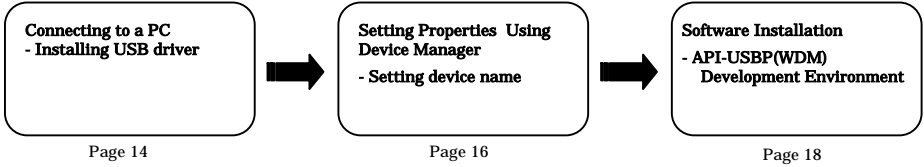
Module
ID(x16)   [0]

Module
ID (x1)   [0]

Module ID 00h
[Factory Settings]

Module
ID(x16)   [1]

Module
ID (x1)   [2]

Module ID 12h

Figure 3.2. Setting a Module ID

3.3. Setup Flow

The following shows the basic flow for installing USB module.

Connecting to a PC - Installing USB driver	→	Setting Properties Using Device Manager - Setting device name	→	Software Installation - API-USBP(WDM) Development Environment
Page 14		Page 16		Page 18

3.4. 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.

Point
- You must be logged on as an administrator or a member of the Administrators group to work on Windows 2000 or Windows XP.

## Step1 Setting supplied CD-ROM "API-USBP(WDM)"

The menu screen is displayed. The menu will be used in "3.6 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 module to the USB port.
Check the orientation of the connector and plug it deep into the port.

Note!
When using the AC adapter, supply power to the module before connecting it to the PC.
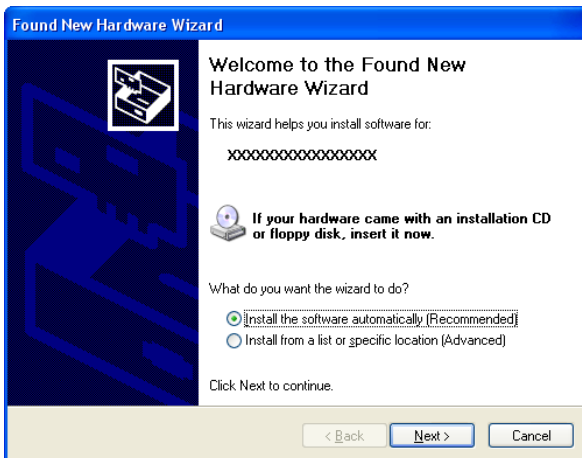
USB cable

USB port

USB port
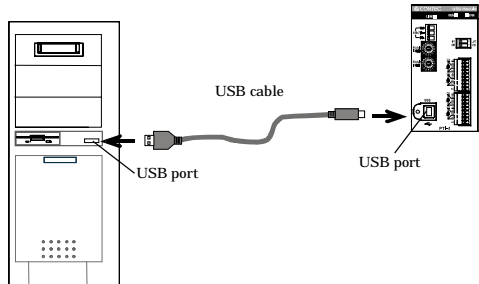
Step3 Starting "Add New Hardware Wizard"

Start "Add New Hardware Wizard", then select "Detect Proper Driver Automatically" item and finally click on "Next Step" button.

Detect setup information from supplied CD automatically for installing USB driver.
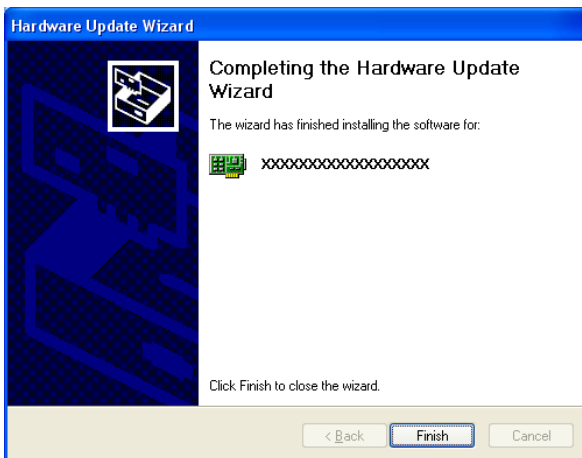
XXXXXX:
device name being searched out

Point

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

Step4 Clicking on [Finish] button

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

3.5. Setting Properties Using Device Manager

After connecting USB module with a PC and completing driver installation, open Device Manager and set properties.
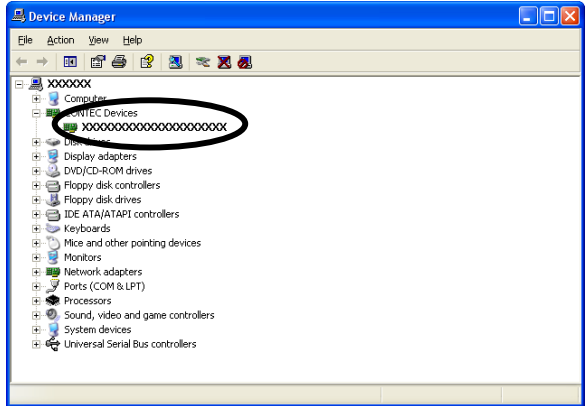
Step1 Starting Device Manager

- **In the case of Windows XP/2000**

From [Start] menu, click on [Settings]-[Control Panel]-[System] and then click on [Device Manager] button in [Hardware] tab.

- **In the case of Windows 98/Me**

Right-click on [My Computer] and select [Properties] to start device manager.

* model number of the USB module appears as [XXXXX] under "CONTEC Devices".

Step2 Setting the Device Name

Right-clicking on USB module name and selecting [Properties] displays [USB Module Properties].Open [Common Settings] tab and enter arbitrary name in the editing box for device name. (Default name also can be used.)
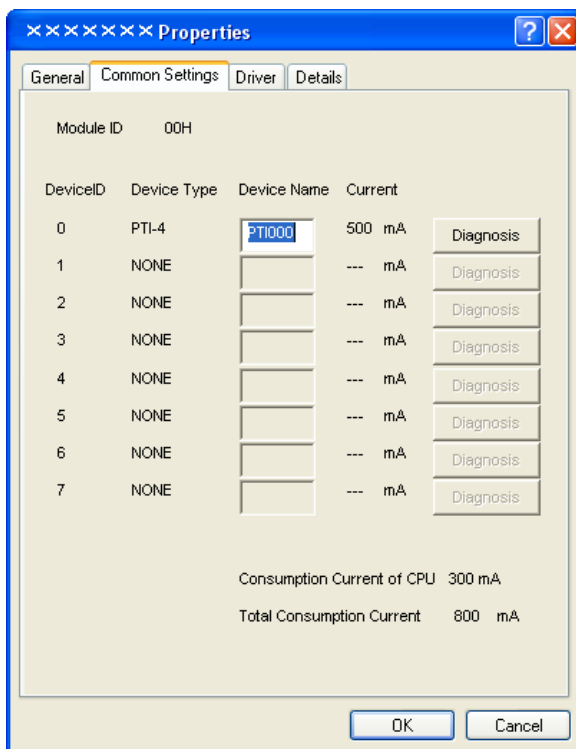
⚠ CAUTION

USB driver can not be used without settings. Settings must be performed.

Step3 Clicking on [OK] button

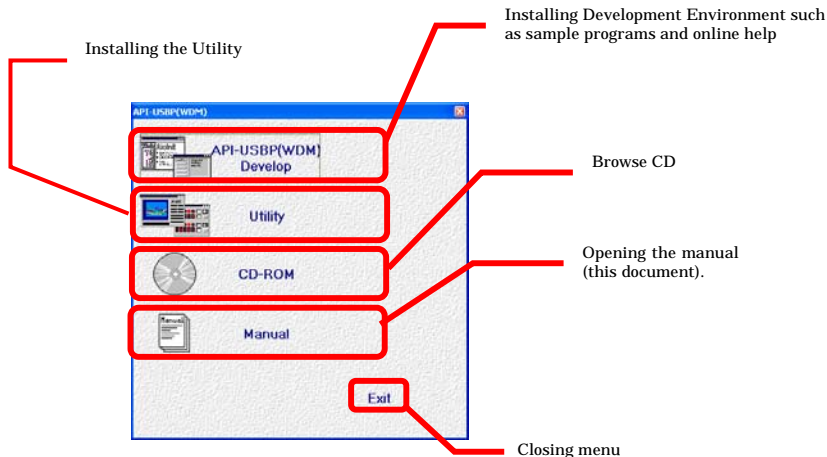Device name is set by clicking [OK] button.

Point
- When the application developed by users is running on another 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.

3.6. Software Installation

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

3.6.1. Illustration of Menu Screen

Installing Development Environment such as sample programs and online help

Installing the Utility

Browse CD

Opening the manual (this document).

Closing menu

Point

- 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.
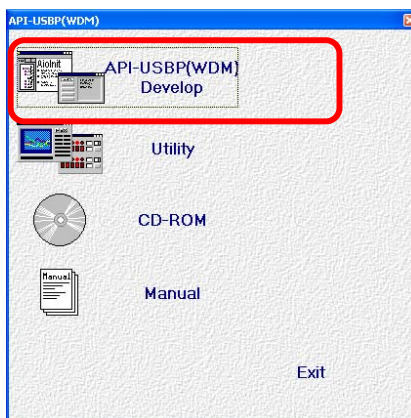
- The screen design may be different.

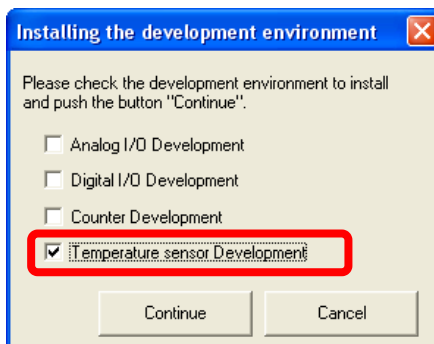## 3.6.2. Installation of API-USBP(WDM) Development

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 "Temperature sensor Developent"

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.

3.7. Connecting to an External Device

3.7.1. Signal Layout

The Module can be connected to an external device using a 9-pin connector that is provided on the Module face.
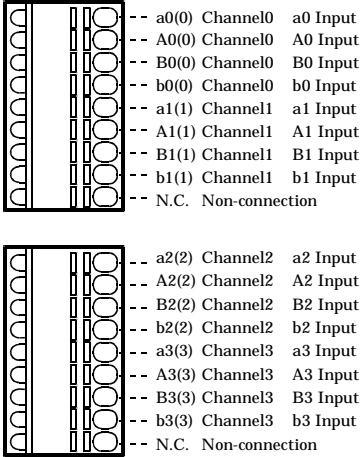
a0(0) Channel0   a0 Input
A0(0) Channel0   A0 Input
B0(0) Channel0   B0 Input
b0(0) Channel0   b0 Input
a1(1) Channel1   a1 Input
A1(1) Channel1   A1 Input
B1(1) Channel1   B1 Input
b1(1) Channel1   b1 Input
N.C.   Non-connection

a2(2) Channel2   a2 Input
A2(2) Channel2   A2 Input
B2(2) Channel2   B2 Input
b2(2) Channel2   b2 Input
a3(3) Channel3   a3 Input
A3(3) Channel3   A3 Input
B3(3) Channel3   B3 Input
b3(3) Channel3   b3 Input
N.C.   Non-connection

Figure 3.3. Signal Layout on the Interface Connector

3.7.2. Connection Method

When connecting the Module to an external device, use the attached 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. Applicable wire size is AWG 28 - 20.

⚠ CAUTION ──────────────────────────────────────

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

Press this section to insert the wire material.

7 - 8mm

- Connector used:
  2.5-mm pitch, 9-pin type, 4.0A nominal current MC0.5/9-0,2.5 connector (made by Phoenix Contact Corp.)

- Compatible plug:
  Front-operable spring gauge type FK-MC0.5/9-ST-2.5 plug (made by Phoenix Contact Corp.) Compatible cable: AWG 28 - 20
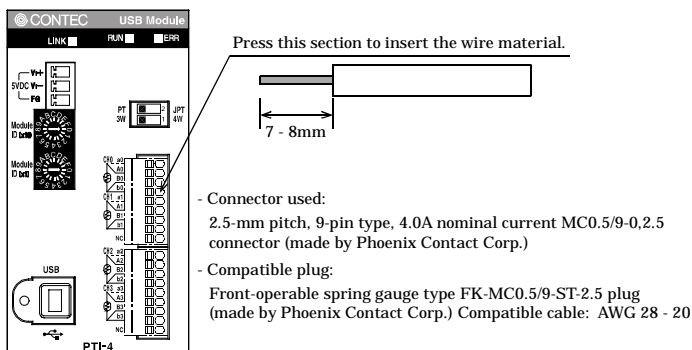
Figure 3.4. Connecting an Interface Connector and Connectors That Can Be Used

Connect a three-wire platinum resistance temperature detector.
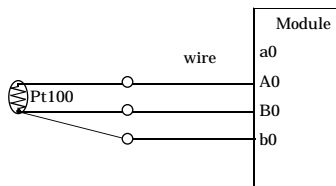

Figure 3.5. Connecting a Three-wire Platinum Resistance Temperature Detector

Point

As conductor resistance affects measured values in a three-wire connection, use three conductors of the same material, wire form, and length so that they have the same electrical resistance.

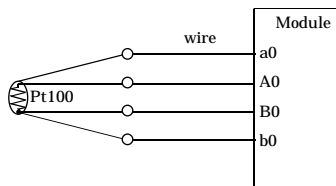Connect a four-wire platinum resistance temperature detector.

Figure 3.6. Connecting a four -wire Platinum Resistance Temperature Detector

Point

As conductor resistance has no effect on measured values in a four-wire connection, use four conductors for connection when precise measurement is required.

3.8. Connecting an External Power Supply

This module must be connected with an external power supply (in a self-powered state).

Connect the external power supply to the +5 VDC input terminal.

Vi+ ---- Power supply(5V)

Vi- ---- Power supply(GND)

FG ---- Frame ground

Figure 3.7. +5 VDC Input Terminal Pinouts

The bundled AC adapter POA-AD22 can be connected as it is because its connector is pin-compatible with the input terminal.
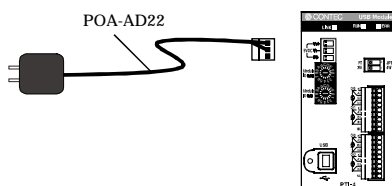

POA-AD22

Figure 3.8. Connecting the AC Adapter POA-AD22

In addition, besides the Ac adapter, the power supplies (Option) installable on DIN rail are provided.

You can choose by the environment and purpose.

Table 3.2. Power Supply

| Category	Model	Input	Output	External dimensions(mm)	DIN rail
AC adapter	POA-AD22 (Bundled)	90 - 264VAC	5.0VDC±5% 2.0A(Max.)	44.0(W)x55.0(D)x26.5(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
AC-DC power	POW-AD25GY	85 - 264VAC	5.0VDC±5% 230VAC :4.6A(Max.), 115VAC :4.2A(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
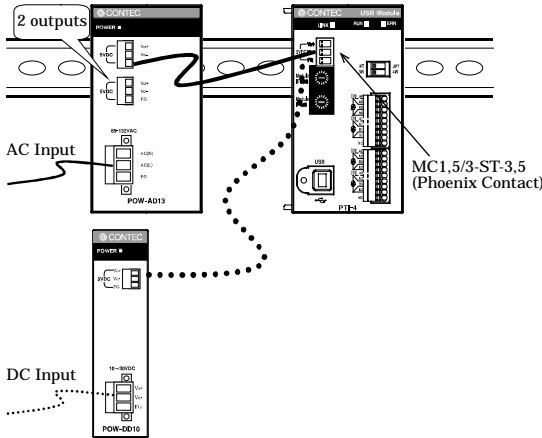
Figure 3.9. Power Supply

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) (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 POA-AD22).

3.9. Installing the Module

3.9.1. 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 rubber feet when setting on a desk or others as figure 3.10(A).

Correct Installation Orientation

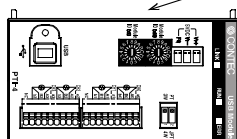(A) Vertical,Front
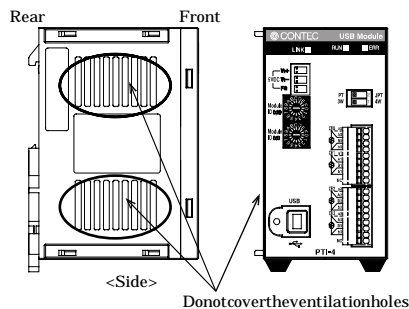
(B) Horizontal,Front
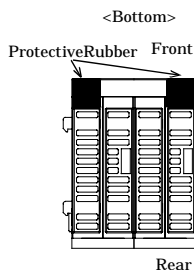

Figure 3.10. Installation Orientation

Figure 3.11. Attaching Rubber Pads

3.9.2. 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.
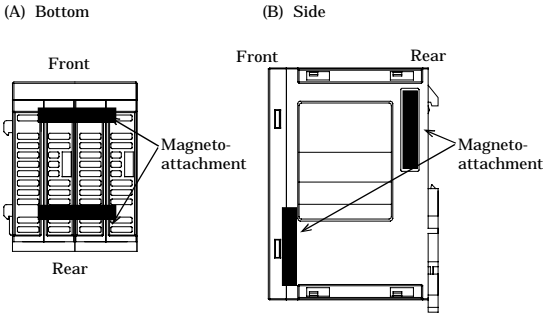
The example of magneto-attachment

Figure 3.12. 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.

3.9.3. Mounting on a DIN Rail

The following illustrates the installation with expansion module. Please reference to page 39 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).
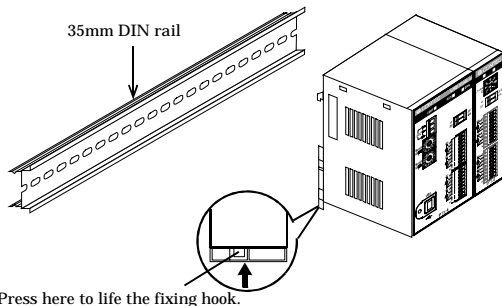

35mm DIN rail

Press here to life the fixing hook.

Figure 3.13. 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.
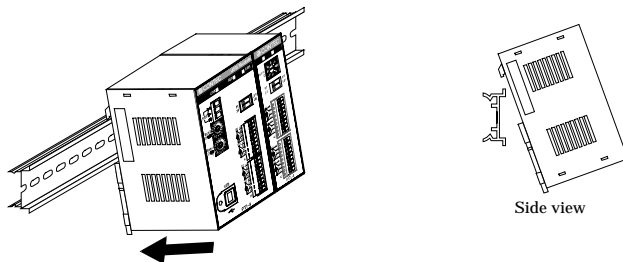

Side view

Figure 3.13. Mounting on a DIN Rail < 2 / 3 >

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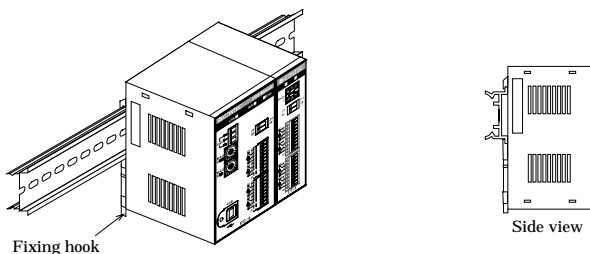

Fixing hook

Side view

Figure 3.13. Mounting on a DIN Rail < 3 / 3 >

Removal method

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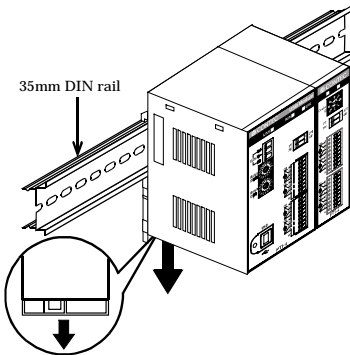

35mm DIN rail

Figure 3.14. Removing the Module from the DIN Rail < 1 / 3 >

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

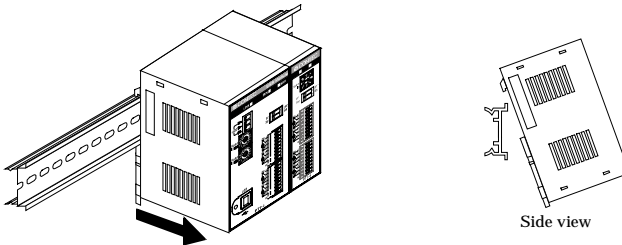Side view

Figure 3.14. Removing the Module from the DIN Rail < 2 / 3 >

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

Side view
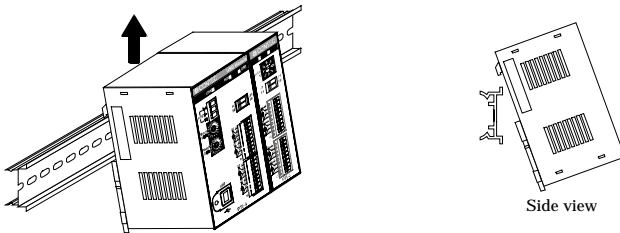
Figure 3.14. Removing the Module from the DIN Rail < 3 / 3 >

⚠ 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.

3.10. 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.
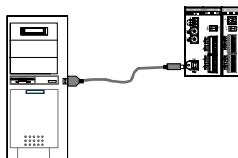
* This module can be self-powered to operate.

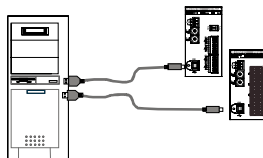Unnecessary to set Module ID

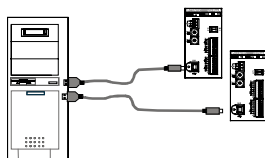Stand alone   Expansion module being used   Multiple modules with different model
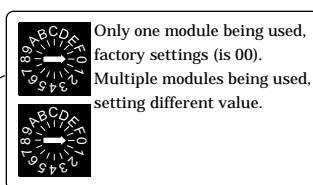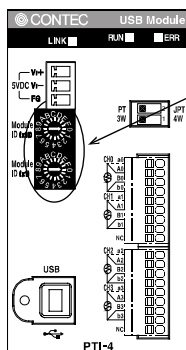

Necessary to set Module ID

Multiple modules with same model being used

Multiple modules with same model being used

3.10.1. 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.

4.1. 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.

4.2. 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.
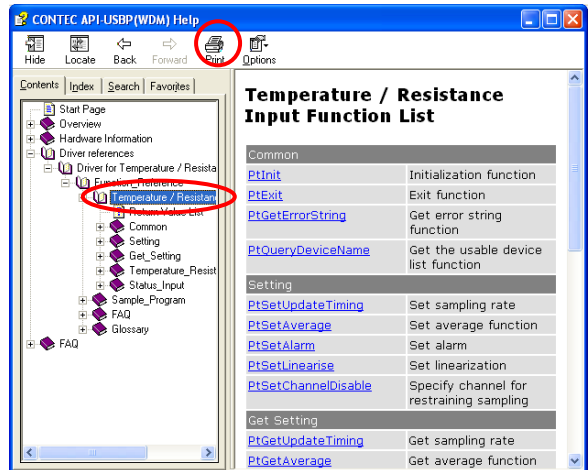
4.3. Sample Program

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)]-[Thermo-sensor Input Sample]-[Sample Name] from [Start] menu.

4.4. Distributing Developed Application

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

USB driver for Thermo-sensor Input

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

5. Troubleshooting

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

For the usage of [API Function Library], please reference to online help or the sample program.

5.1. 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.

5.2. 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	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 PTI-4(USB), PTI-4 (FIT) 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.
How to get the version of USB driver?	Run diagnostic program and [Diagnosis ...] 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?	Windows 2000: Start Start->Settings->Control Panel->System.Select Hardware and click on Device Manager.
Does it feature suspend/resume function?	No. Please set power management for a PC in order to avoid suspension in operation.

Question	Answer
Is the AC adapter necessary when the module is used with an intervening hub?	The AC adapter is necessary.
Want to perform the channels more than the points being appended by expansion modules.	The number of expansion modules is 5(6 including the USB module). when channels more than this number are wanted, please purchase the necessary USB module(s) and expansion accessories.
Is adding points by expansion modules different form adding USB modules?	Using expansion modules - Only one USB port is used. Adding main units - As many USB ports as the numbers of main units added are used.
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.

5.3. 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 [Common Settings] tab.
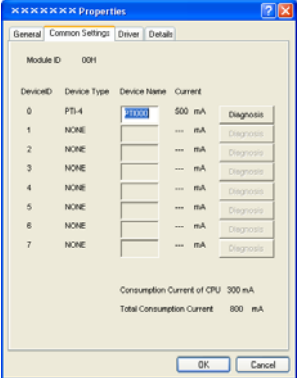
Using Diagnostic program, you can not only verify the status of current input but also perform further diagnosis by clicking on [Diagnosis…] button.
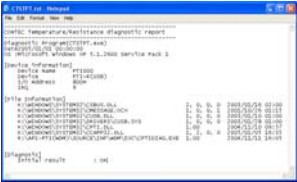
5.4. Version Upgrade

5.4.1. 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.

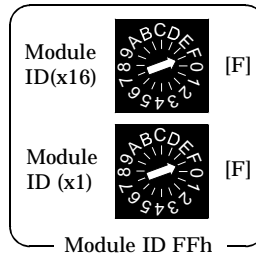### Step2 Set Module ID to FFh
Set Module ID to FFh
It is special setting for firmware upgrade.

Point

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

Module ID(x16)　　[F]

Module ID (x1)　　[F]

Module ID FFh

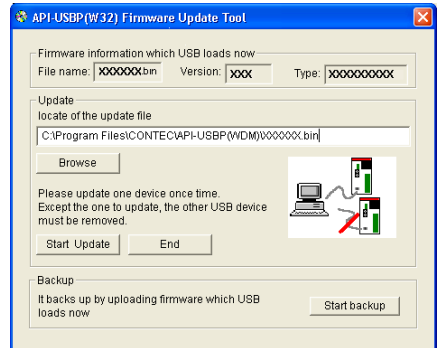### Step3 USB Connecting USB Module with USB Port
Please connect USB port after AC adapter has been connected when using self power.

Step4 Starting Firmware Upgrade Tools
Click on [Programs]-[CONTEC API-USBP(WDM)]-[Firmware upgrade tool] from [Start] menu.

Step5 Specifying Upgrade File
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 by referencing to "Setting Properties by Device Manager" on page 20.

5.4.2. Driver Upgrade

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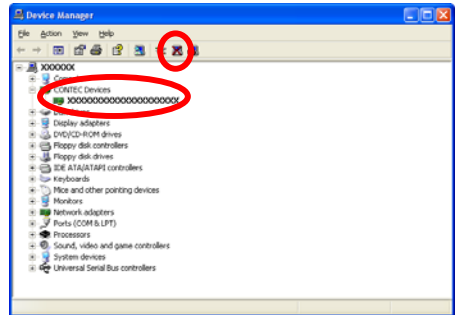
http://www.contec.com/download

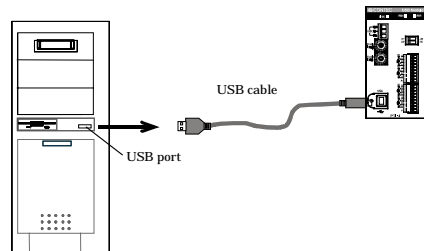# 5.5. Returning to Initial State

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
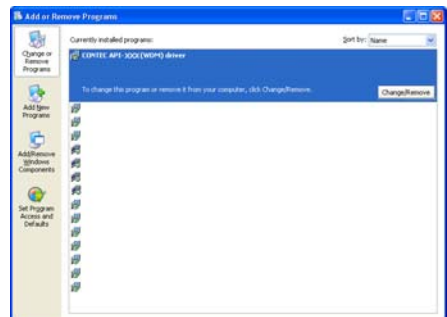Select the device to be deleted, then press the Delete button.

Step2 Drawing USB cable from a PC

Step3 Uninstalling Driver
Select [CONTEC API-PTI(WDM) driver] from [My Computer]-[Control Panel]-[Add/Remove Programs].

Step4 Restarting

6. Connecting with Expansion Accessories

Even though your system has run out of temperature measurement input channels to connect external devices, purchasing another PTI-4(USB) module doubles the cost and installation space.
At the same time, adding channels is considered when designing this module, and additional module can be connected by the connector on module side, so that not only the cost but also the installation space are controlled.

Up to 5 modules PTI-4(FIT)GY can be connected when adding channels.

Combining the main module "PTI-4(USB)" with five additional modules "PTI-4(FIT)GY" allows up to 24 input channels for temperature measurement to be controlled via a single USB port.

Table 6.1. Expansion Modules

Model	Output channel	Current consumption	Function
PTI-4(FIT)GY	4	+5VDC 500mA(Max.)	Expansion module for PTI-4(USB)

With the same name
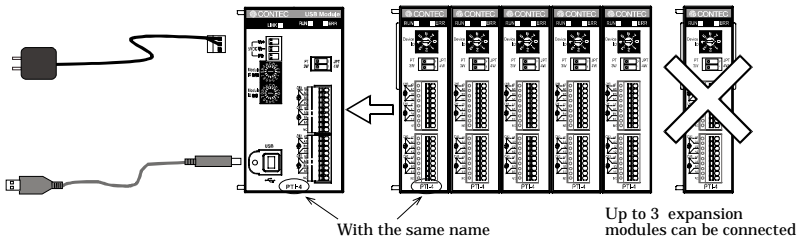
Up to 3 expansion modules can be connected

Figure 6.1. Expansion Modules

Point

- Up to 5 modules can be connected.

- If you add three or more expansion modules, the AC adapter cannot supply sufficient power. In that case, use another higher-capacity power supply instead.

- Modules with different function from the USB module can not be connected.

6.1. Setting a Device ID

Set Device ID by rotary switch on the front when adding modules.

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".
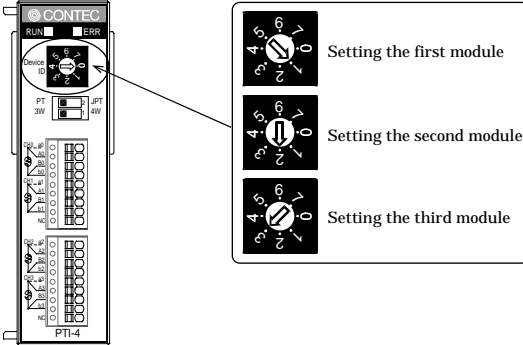

Figure 6.2. Setting a Device ID

6.2. Connection between Modules

6.2.1. Stack Connection Locking Devices

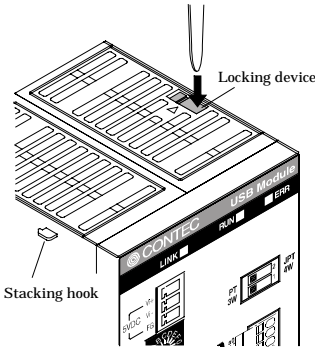The module contains connecting locking devices (mark, two units at the top and bottom).

Figure 6.3. Stack Connection Locking Devices

6.2.2. How the Stack Connection Locking Device Works

Locking

Push the pawl of the locking device with a tool that has a slender tip downward from above to open the spring for the locking device (the groove moves toward you).

Unlocking

Push the groove of the locking device with a tool that has a slender tip in the direction of the arrow until the device is locked.
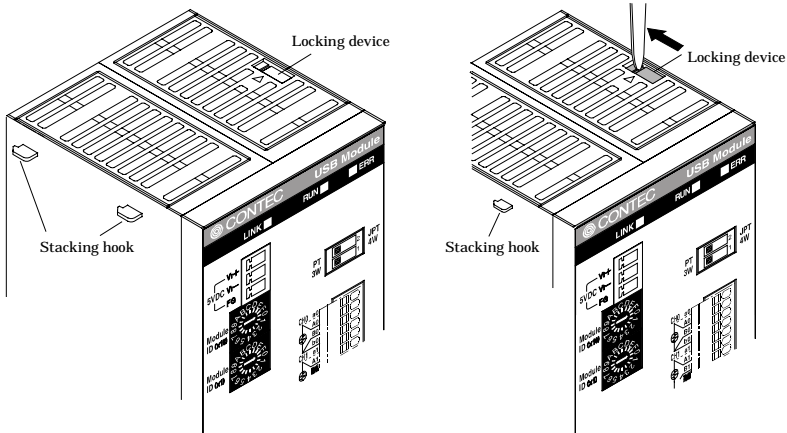

Figure 6.4. How the stack connection locking device works

6.2.3. Connecting the Module

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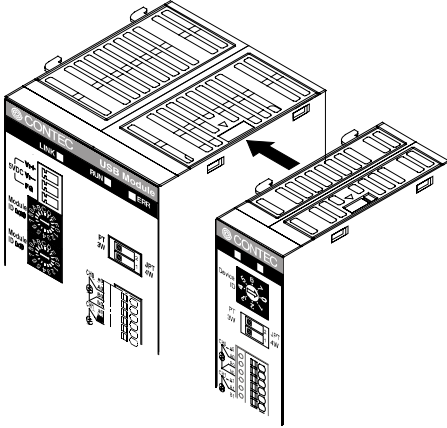

Figure 6.5. Connecting the Module

6.2.4. Removing the Module

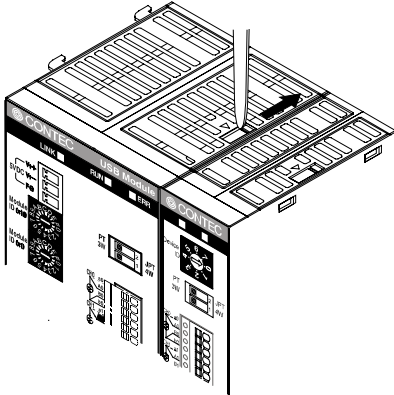Unlock the locking device at the top and the bottom. Remove the connected module from the hook.

Figure 6.6. Removing the Module

7. Product Specification

7.1. Hardware Specification

Table 7.1 lists the hardware specification of PTI-4(USB).

Table 7.1. Hardware Specification (1/2)

Item		Specification
Input section	Number of channel	4 channels
	Platinum resistance temperature detectors acceptable	Pt100(JIS C1604-1997, IEC 751 1983), JPt100(JIS C1604-1989)
	Wiring method	Three-wire or Four-wire
	Measurable temperature range	Pt100 : -200 - 850°C JPt100 : -200 - 510°C
	Precision — Operating temperature 0 - 50°C	±0.3ºC *1
	Precision — Operating temperature 15 - 35°C	±0.15ºC *1
	Resolution	0.01ºC
	Conversion rate	Select from 150ms / 40ms / 5ms per one channel
	Output current for temperature detection	1mA
	Isolation method	Between platinum resistance temperature detector input and power supply : Opto-coupler isolation Between platinum resistance temperature detector input channels : unisolation
Adjustment	Flash ROM writing count	100000 times (Max.)
Communication	USB transmission speed	2Mbps (full speed), 480Mbps (high speed) *2
	Current consumption	+5VDC 800mA(Max.) *3

*1 At a conversion speed of 150 ms

*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 Always use the supplied AC adapter or power supply unit (option).

Table 7.1. Hardware Specification (2/2)

Item		Specification
Others	Number of modules used at the same time	127 modules (Max.) *4
	Use condition	0 - 50ºC, 10 - 90%RH (no condensation)
	External dimensions (mm)	50.4(W)x64.7(D)x94.0(H) (exclusive of protrusions)
	Weight of the module itself	200g
	Module installation method	One-touch connection to 35mm DIN rails (standard connection mechanism provided in the system)
	Expansion module	PTI-4(FIT)GY : 5modules (Max.) , Current consumption/module: +5VDC 500mA(Max.)
	Compatible plug	FK-MC0.5/9-ST-2.5(made by Phoenix Contact) 2.5mm-pitch nominal current: 4A (Max.)
	Applicable wire	AWG28 - 20
	Bundled AC adapter (POA-AD22)	90 - 264VAC 5.0VDC±5% 2.0A(Max.) Length of cable is about1.4m

*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.

7.2. Software Specification

Table 7.2. Windows Driver 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, Ver6.0 Microsoft Visual C++ .NET 2002, 2003 Microsoft Visual Basic Ver 5.0, Ver6.0 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, 6.0
System requirement	- PC (IBM PC/AT compatibility, DOS/V) with USB port - CD-ROM drive - Recommend the environment on which the using language can run smoothly

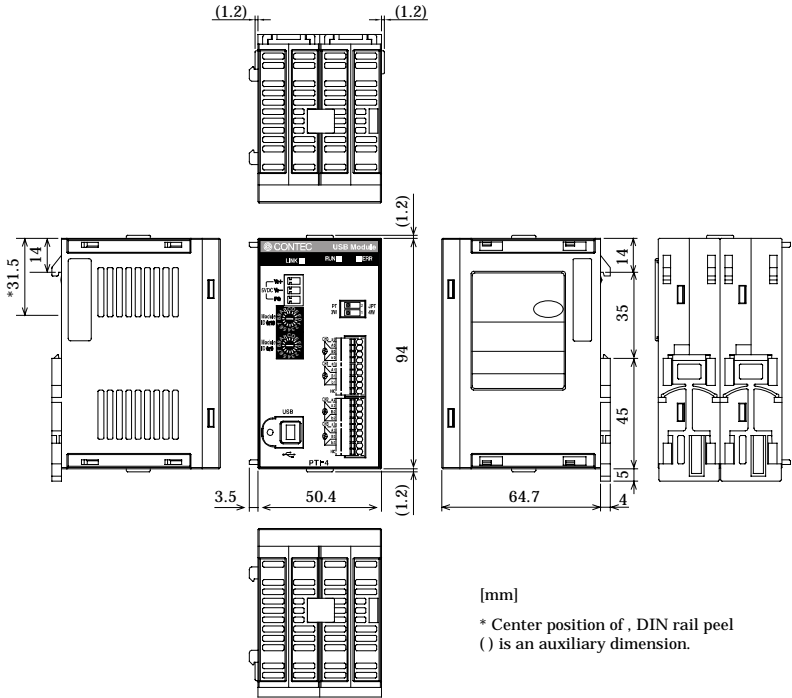# 7.3. Circuit Block Diagram
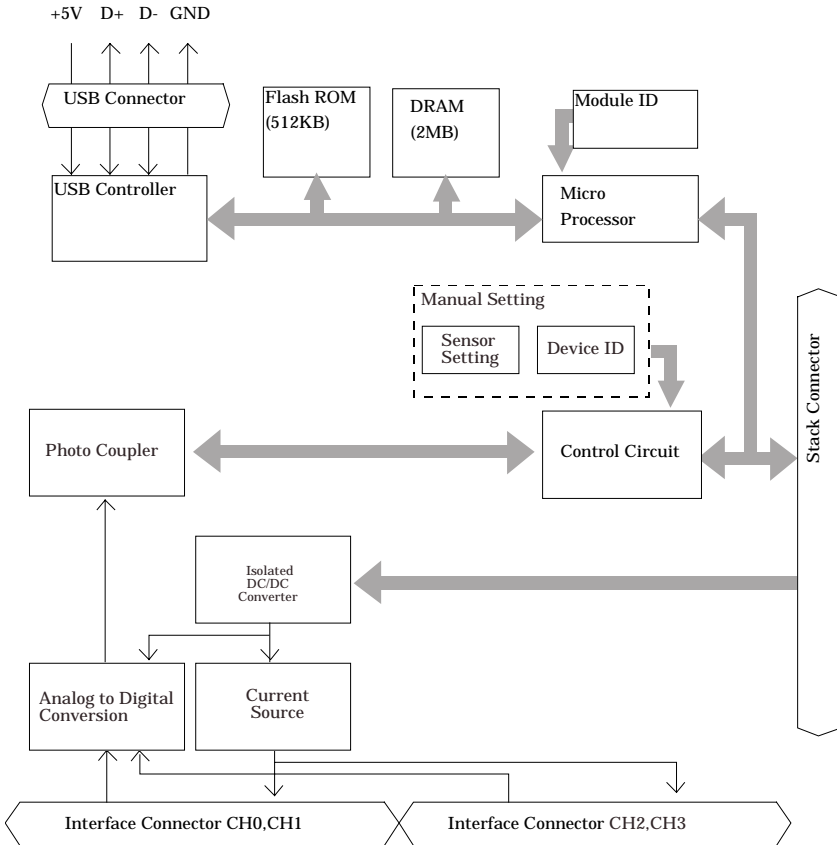
Figure 7.1. Circuit Block Diagram

Point
    The Device ID of the USB module PTI-4(USB) is fixed at "0".

7.4. External Dimensions

[mm]

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

Figure 7.2. External Dimensions of the USB module

8. Appendix

8.1. 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 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 not only a specification for the connection between a PC and a peripheral equipment but also a kind of terminal. It can connect a wide range of devices and can be plugged/unplugged with the power being
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 channel number is 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.
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 and so on.
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	User aid program designed for PC novices to add peripheral devices. It is started automatically, for example, when a USB device is connected. It gives instructions to install the driver, facilitating hardware expansion.
Bus power	Power is supplied by a host when USB cable is being connected without connecting a AC adapter.
Firmware	It is the software incorporated into a equipment to perform basic control on hardware.
Properties	Select USB Modules from Device Manager, right-click and select [Properties] dialog box from pop-up menu to set the device name.
Module ID	About the ID of the USB module. Set unique ID value individually for the modules in order to distinguish the driver when using multiple modules. Use the factory setting(=0) when using one module.

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