PC-HELPER

Isolated 24-bit Up/Down Counter Module for USB

CNT24-2(USB)GY

User’s Guide

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Trademarks

All company and product names that are referred to in this manual are generally trademarks or registered trade.
Product Configuration

- Module (one of the following products)
  [CNT24-2(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
- AC adapter (1.5m)…1
- AC cable (1.5m)…1
- USB cable (1.8m)…1
- Rubber feet…4
- Magnet…2
- Manual (this book)…1

*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

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.

CNT24-2(USB)GY is compact isolated up-down counter module which is applied to USB and can be used easily.

It not only counts high-speed pulses but also can be used for position alignment control in combination with an encoder. In addition, external electric do not have direct effect on the host computer because of the isolation between control external signals and the CPU of the controller module by Optocoupler.

Now serviceable with USB-compatible PCs, this module is best suited for use with notebook PCs with no PCI bus expansion slot. When using it on a desktop computer, you can perform simple connection without the need for opening the host cover.
1. Introduction

Being connected with USB port, the 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.

**Features**

**Support various kinds of counter modes**

The count method supports single-phase input, 2-phase input and single-phase input with gate control. Because it can be connected with a rotary encoder, using it can easily perform the position detection and revolution speed measurement.

- **Single-phase input**
  
  It can be used to keep track of the number of good products and inferior products on a product examination line.

- **2-phase input**
  
  It can be used to measure moving distance and to detect position. Detailed control can be effected by setting the count input multiplier to 2 or 4.

- **Single-phase input with gate control**
  
  Because the pulse count time can be controlled via external signal, it is very convenient to use the module to measure the revolution speed.

**Digital filter**

The digital filter which is designed to cut the chattering of input pulse signal has been installed. The allowable range of the sampling cycle is 0.1 - 1056.1µsec.
1. Introduction

**Count-match output**

Once the count comparison value has been set, the module will output a signal to external when there is a match between a count value and a count comparison value. The allowable setting range of the output signal width is 0 - 104.5ms.

**Isolated from external device**

Because the isolation between the CPU and the external device is made by Optocoupler, the change of external circuit will not affect the computer by USB port.

(There is not external electric effect on the host computer by way of USB ports because of the isolation between the CPU of the module and external device by Optocoupler.)

**Easy to wire**

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

**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 sold separately, the number of input/output channels can be increased. It adopts the unique configuration of stack connecting which permits a simple, compact system configuration.
CNT24-2(USB)GY + CNT24-2(FIT)GY x 3
(Up to 8 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 modules, are prepared.

Easy-to-debug utility

- Counter monitor

Without programming, the user can easily operate the module. The current status can be verified by the indicator. The output value can be set by mouse-clicking on a switch only.

- Diagnostic program

When the problem occurred, it will be helpful to solving the problem.
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++ etc., you can develop high-speed application software with feature of hardware produced by our company.

In addition, you can verify the operation of hardware using Diagnostic programs.

< Operating environment >


Primary corresponding language: Visual Basic, Visual C++, Visual C#, Delphi, C++ Builder

CONTEC provides download services (at http://www.contec.com/apiusbp/) to supply the updated drivers and differential files.

Accessories (Option)

Isolation counter module (Expansion module for CNT24-2(USB)GY)
: CNT24-2(FIT)GY

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

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

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

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

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

* 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 product is 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.

<table>
<thead>
<tr>
<th>⚠️ DANGER</th>
<th>DANGER indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury.</th>
</tr>
</thead>
<tbody>
<tr>
<td>⚠️ WARNING</td>
<td>WARNING indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.</td>
</tr>
<tr>
<td>⚠️ CAUTION</td>
<td>CAUTION indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury or in property damage.</td>
</tr>
</tbody>
</table>
1. Introduction

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 this product that need to be set in advance. Be sure to check its switch settings before using this product.
- Please do not change this product switch settings in an unauthorized manner. Otherwise, it can bring about malfunction, heating and trouble.
- Please do not subject this product 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 this product is turned on. Otherwise, it can bring about malfunction, heating and trouble.
- Please do not touch this product with a wet hand when the power for this product is turned on. It is danger of electric shock. Be sure to turn off the power for this product.
- Please do not touch this product with a wet hand when the power for this product is turned on. It is danger of electric shock. Be sure to turn off the power for this product.
- When you use this product 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 connector of the AC adapter (bundled) to the ground so that the FG pin in the +5 VDC input terminal is connected to the ground.
- 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 this product and perform quality improvement, this product specification is subject to change without notice. Even if you use this product again, please be sure to read the manual to confirm the content.
- Please do not modify this product. CONTEC will bear no responsibility for any problems, etc., resulting from modifying this product.
- Please do not open this 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 or for results obtained by the user as a result of using this product.
- It may cause a trouble in recognizing and operating the device according to the kind of USB hub. If you use the USB hub, we encourage you to take advantage of the CONTEC’s product loan service to confirm operation before purchasing.
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

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

(1) Put this product 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.

Disposal

When disposing of the product, follow the disposal procedures stipulated under the relevant laws and municipal ordinances.
1. Introduction
2. Module Nomenclature

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

**CNT24-2(USB)GY**

![Diagram of module components](image)

*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 AC adapter (accessory).)

---

© CONTEC
CNT24-2(USB)GY 11
### Table 2.1. The List of Status LED Functions

*< CNT24-2(USB)GY >*

<table>
<thead>
<tr>
<th>Name</th>
<th>Function</th>
<th>Indicator color</th>
<th>LED indicator</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>LINK status</strong></td>
<td>USB communication status</td>
<td>GREEN</td>
<td><strong>ON</strong>: Communication is established.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td><strong>OFF</strong>: Communication is not established.</td>
</tr>
<tr>
<td><strong>Phase-A status</strong></td>
<td>Phase-A input status</td>
<td>GREEN</td>
<td><strong>ON</strong>: when a current flows from pin PA (low level, negative logic)</td>
</tr>
<tr>
<td><strong>Phase-B status</strong></td>
<td>Phase-B input status</td>
<td>GREEN</td>
<td><strong>ON</strong>: when a current flows from pin PB (low level, negative logic)</td>
</tr>
<tr>
<td><strong>Phase-Z status</strong></td>
<td>Phase-Z input status</td>
<td>GREEN</td>
<td><strong>Positive logic</strong>&lt;br&gt;<strong>ON</strong>: when pin PZ is open (high level, positive logic)&lt;br&gt;<strong>Negative logic</strong>&lt;br&gt;<strong>ON</strong>: when a current flows from pin PZ (low level, negative logic)</td>
</tr>
<tr>
<td><strong>Counter input status</strong></td>
<td>Counter input status</td>
<td>GREEN</td>
<td><strong>ON</strong>: when a current flows from pin PDI (low level, negative logic)</td>
</tr>
</tbody>
</table>
3. Setup

Connection-Overall Diagram

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

Setting a Module ID

The host computer distinguishes and keeps track of the products 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
3. Setup

Setup Flow

The following shows the basic flow for installing module.

Software Installation

Install software.

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.
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.

1. Clicking on “Install Development or Execution Environment”.
   [API-USBP(WDM) Installer] dialog box displays.

2. Selecting “Advanced Counter input driver”.

3. Clicking on “Install” Button.
   Please perform installation following the directions on the screen. And thus the installation is completed.
   * The screen design may be different.
3. Setup

Installing the Utility

The utility is an application with which you can verify device operation easily.
Run the X:\USBP_UTILITY\ENG\CntMnt\setup.exe (X : CD-ROM drive) from the [Run] of start menu.

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

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”.

⚠️ CAUTION
It may cause a trouble in recognizing and operating the device according to the kind of USB hub. If you use the USB hub, we encourage you to take advantage of the CONTEC’s product loan service to confirm operation before purchasing.

---

**Step1 Setting supplied CD-ROM “API-USBP(WDM)”**
The menu screen is displayed. The menu will be used in “Software Installation” on page 15. (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 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.
3. Setup

**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. In Windows Vista, Because the driver's installation is completed by "Installing the Software", it is not necessary to operate it about the Hardware Wizard.

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)

**Points**

Please specify the path for supplied CD as follows in the case of failure in detecting automatically.

X:\INF\WDM\CNT  

(X: CD-ROM drive)

**Step4 Clicking on [Finish] button**

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

Setting Properties Using Device Manager

After connecting module with a PC and completing driver installation, open device manager and set properties.

Step1 Starting Device Manager
Right-click on [My Computer] and select [Properties] to start device manager.

[XXXXX] within CONTEC Devices expresses the name from getting rid of GY from the model of module.

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.

Step2 Setting the Device Name
Right-clicking on module name and selecting [Properties] displays [Module Properties].
Open [Common Settings] tab and enter arbitrary name in the editing box for device name.
(Default name also can be used.)

[XXXXX] will appear as CNT000

⚠️ CAUTION

USB driver can not be used without settings. Settings must be performed.
Step 3 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.

### Connecting to an External Device

#### Signal Layout

This product can be connected to an external device using a 9-pin connector that is provided on this product’s face.

![Connectors Diagram]

**Figure 3.3. Signal Layout on the Interface Connector**

< CNT24-2(USB)GY >
3. Setup

**Connection Method**

When connecting this product 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.

Press this section to insert the wire.

**7 - 8mm**

**Compatible plug:**

FK-MC0,5/9-ST-2,5 [made by Phoenix Contact]

Compatible cable: AWG28 - 20

---

**Figure 3.4. Connecting an Interface Connector and Connectors That Can Be Used**
3. Setup

Connecting to a rotary encoder

When the module is used with an external 5-V power supply, a current limiting resistor do not have to be inserted. When it is used with an external 12-V power supply, however, a resistor of about 400 ohms is required.

![Figure 3.5. Connecting to a Rotary Encoder](image1)

Connecting to count-match output

The count-match output section has an open collector configuration based on Optocoupler isolation. Driving the output of this product requires an external power supply 5 – 12V.
Nominal output: 35VDC 50mA(Max.)

![Figure 3.6. Connecting to Count-match Output](image2)

Point

A surge voltage protection circuit is not provided on the output transistors for this product. Therefore, when driving relays, lamps, and other induction loads using this product, a surge voltage countermeasure should be provided on the load side. For a description of how to deal with surge voltages, see "Surge Voltage Countermeasures".
Counting Function

The functions supported by this product is listed below. Because the count input multiplier and clear method can be set separately, the supported modes are as follows: single-phase input is of 1 mode, 2-phase input is of 6 modes, single-phase input with gate control is of 2 modes.

<table>
<thead>
<tr>
<th>Input format</th>
<th>Count input multiplier</th>
<th>Clear Method</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1 Multiplier</td>
<td>2 Multiplier</td>
</tr>
<tr>
<td>Single-phase input</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>2-phase input</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Single-phase input with gate control</td>
<td>Yes</td>
<td>Yes</td>
</tr>
</tbody>
</table>

Counter Operating Modes

Single-phase input

During single-phase input, the system counts up upon the input of an UP pulse, and counts down upon the input of a DOWN pulse. A count fails if UP and DOWN pulses occur simultaneously or both pulses happen to be LOW. In the application that the pulses can be LOW simultaneously, we recommend you to count them separately.

In the examination line for the product, it can be used to keep track of the number of the good products and the inferior products, and to get the statistics of the defective products.

![Single-phase Input Diagram]

Figure 3.7. Single-phase Input

Point

Phase-A counts up input, Phase-B counts down input.
2-phase input

2-phase pulse input refers to the input of two pulses, Phase-A (fast signal) and Phase-B (slow signal) that differ in phase by 90°. If phase-Z is provided (reference position signal), the counter can be cleared using 2-phase pulse input.

Using rotary encoders and linear gauges, you can measure the moving distance. Detailed control can be effected by setting the count input multiplier to 2 or 4. The subtler the resolution is divided, the shorter the moving distance can be measured.

Setting rotary direction of the encoder (DIR): count up in Clockwise.

The encoder is set to count up in clockwise, so the counter data count up when the encoder turning in clockwise.

Figure 3.8. 2-phase Input (count up)

If the synchronous clear and the input logic of phase-Z is set to positive logic, shown as Figure 3.8, the counter is zero-cleared when phase-A rises with the phase-Z input HIGH regardless of the setting of count input multiplier.
Setting rotary direction of the encoder DIR: count up in counterclockwise.

The encoder count up in counterclockwise, so the counter data count down when the encoder turn in counterclockwise.

![Diagram](image)

**Figure 3.9. 2-phase Input (count down)**

If the synchronous clear and the input logic of phase-Z is set to positive logic, shown as Figure 3.8, the counter is zero-cleared when phase-A falls with the phase-Z input HIGH regardless of the setting of count input multiplier.

**Points**

- The logic of phase-Z can be set with software.
- The data after being cleared is not the data set by the initial value.
3. Setup

**Single-phase input with gate control**

The counter can be started/stopped according to the gate control signal that is input together with a string of single-phase pulses. The clear signal zero-clears the counter value.

Because the pulses from an external signal can be measured in a segment of time, measuring the rotational velocity is practicable.

For example, in the following condition, the number of rotational velocity can be figured out according to the measured number of pulses.

Measure time (the time that the gate is effective): 0.3 sec

The number of the encoder’s pulses per round: 200 pulses

Measured pulses: 1800 pulses

Rotational velocity = 1800 ÷ (0.3 / 60) ÷ 200 = 1800 rpm

If the measure time can be set by the resolution of the encoder in advance, the input data will be the rotational Expansion velocity data.

![Diagram of Single-phase Input with Gate Control](image)

**Figure 3.10. Single-phase Input with Gate Control**
Clearing Count Value

Asynchronous clear

The counter is zero-cleared when phase-Z is input, irrespective of the input state of phase-A or B.

When phase-Z is set to positive logic, HIGH level is effective signal; When it is set to negative logic, LOW level is effective signal. The timing chart is shown below corresponding to the following settings.

Counter mode: 2-phase input, 1 multiplier

The setting of the phase-Z input logic: positive logic

The setting of the rotary direction (DIR): CW

Figure 3.11. Asynchronous Clear

Synchronous clear

Set the rotary direction of the encoder to clockwise, the counter is zero-cleared when phase-A rises. As same with asynchronous clear, when phase-Z is set to positive logic, HIGH level is effective signal; When it set to negative logic, LOW level is effective signal. The timing chart is shown below corresponding to the following settings.

Counter mode: 2-phase Input, 1 multiplier

The setting of the phase-Z input logic: positive logic

The setting of the rotary direction (DIR): CW

Figure 3.12. Synchronous Clear
Point

By the setting above, Phase-A and Phase-Z rise is detected within the module. First, check out phase-Z rise, clear the counter data at the next rise of phase-A. Even if the phase-Z input turns LOW before phase-A rises, the counter data will be cleared.

Setting the method of clearing
Phase-Z can also be set enabled/disabled besides the logic setting.

There are 3 methods of setting as follows:

(1) Phase-Z input disabled

(2) After the method of clearing is set to “one time” by using CntSetZMode(), the next phase-Z input is effective.

(3) Enabled for all phase-Z input

Points

- The initial setting is “Enabled for one time”.

- When “Enabled for one time” is set, use CntStopCount() stop counting. If execute CntStartCount() again, the “Phase-Z effective one time” setting is effective.

- When phase-Z/CLR input is not used, please set to “Phase-Z input Disabled”.

Digital Filter

According to the using environment, the Chattering Noise and Cross Talk may be presented in phase-A, B or Z of the counter. It would result in counting error. Use digital filter to avoid this abnormality.

Digital filter clock setting data determines the sampling clock cycle for the digital filter. When detecting 4 clocks of continuous HIGH (or LOW) signals by sampling the input signals with this sampling clock, the digital filter outputs a HIGH (or a LOW), and transmits the signal to the counter circuit. In other words, the signals that is shorter than the sampling clock × 4, they can be cancelled from the counter data.

Notice that because all external input signals (with the exception of general-purpose input signals) are directed into the internal counter through the digital filter, they are read with a delay of 4 sampling clock cycles.

In the initial condition, external input signals are read with a delay of 0.4μsec.

![Digital Filter Diagram]

**Points**

- In the initial condition, the clock is set at 0.1μsec (which is the default).
- Some noise signals can cause a delay greater than 4 clock cycles.
- Any change in level occurring at a frequency faster than a set sampling clock cycle is invalidated and the level is not correctly counted. Therefore, signals less than the input frequency must be entered.
Count-match Output

When there is a match between a count value on a channel and a count compare value, the pulse output is prepared to notify external device. The pulses width can be changed in the allowable range 0 - 104.45msec. The pulses output to the channels separately.

The pulse width is common to all channels, and is determined by setup data. The initial pulse width is 0, so even if there is a match between count value and count compare value, the pulse will not output. When you use it you must set the pulse width.

The signal output section has an open collector configuration based on Optocoupler isolation. It can drive 35VDC 50mA load too. The equivalent circuit is described in [External Input and Output].

![Count-match Output Diagram](image)

Figure 3.14. Count-match Output

Points

- Initial state is pulses width=0 (not output)(00h).
- The pulse width is subject to some variable depending upon connection load specifications.
3. Setup

Connecting an External Power Supply Such as the AC Adapter in Self-powered Mode

This product must be self-powered for use.

For use in self-powered mode, use the +5-VDC input terminal.

![Pinouts Diagram]

**Figure 3.15. +5 VDC Input Terminal Pinouts**

When using the supplied AC adapter [POA200-20-2], please connect directly to the input terminals.

![Connection Diagram]

**Figure 3.16. Connecting the AC Adapter POA200-20-2**

Beside the AC adapter, a power supply for installation on a DIN rail is also available (as an option). Use the appropriate power supply depending on the operating environment and application.

*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 AC adapter's connector plug to the ground.
### Table 3.2. Optional power supply

<table>
<thead>
<tr>
<th>Type</th>
<th>Model</th>
<th>Input</th>
<th>Output</th>
<th>Physical dimension (mm)</th>
<th>DIN rail</th>
</tr>
</thead>
<tbody>
<tr>
<td>AC adapter</td>
<td>POA200-20-2</td>
<td>90 - 264VAC</td>
<td>5.0VDC ± 5%</td>
<td>47.5(W) x 75(D) x 27.3(H)</td>
<td>·</td>
</tr>
<tr>
<td>(Bundled)</td>
<td></td>
<td></td>
<td>± 2.0A(Max.)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>AC-DC power supply</td>
<td>POW-AD13GY</td>
<td>85 - 132VAC</td>
<td>5.0VDC ± 5%</td>
<td>52.4(W) x 64.7(D) x 94.0(H)</td>
<td>Corresponding</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>± 3.0A(Max.)</td>
<td>(No protrusions)</td>
<td></td>
</tr>
<tr>
<td>AC-DC power supply</td>
<td>POW-AD22GY</td>
<td>85 - 265VAC</td>
<td>5.0VDC ± 5%</td>
<td>52.4(W) x 64.7(D) x 94.0(H)</td>
<td>Corresponding</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>± 2.0A(Max.)</td>
<td>(No protrusions)</td>
<td></td>
</tr>
<tr>
<td>DC-DC power supply</td>
<td>POW-DD10GY</td>
<td>10 - 30VDC</td>
<td>5.0VDC ± 5%</td>
<td>25.2(W) x 64.7(D) x 94.0(H)</td>
<td>Corresponding</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>± 3.0A(Max.)</td>
<td>(No protrusions)</td>
<td></td>
</tr>
<tr>
<td>DC-DC power supply</td>
<td>POW-DD43GY</td>
<td>30 - 50VDC</td>
<td>5.0VDC ± 5%</td>
<td>25.2(W) x 64.7(D) x 94.0(H)</td>
<td>Corresponding</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>± 3.0A(Max.)</td>
<td>(No protrusions)</td>
<td></td>
</tr>
</tbody>
</table>

*When you use the module in a noisy environment or are nervous about noise, connect the power plug MC1,5/3-ST-3,5 to the ground.*
3. Setup

For the power supply for installation on a DIN rail, use the connector MC 1,5/3-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 supply connector to supply power to the module.
  2. Use the USB cable to connect the 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 module.

⚠️ **CAUTION**

- To use the AC adapter, connect it to the module first, then plug the AC adapter's connector into a wall outlet.
- When the module is not used, leave the AC adapter unplugged.
- Continuously using the AC adapter heated affects its life.
- Use the AC adapter not in a closed place but in a well-ventilated place not to be heated. The AC adapter heats up itself when loaded heavily. If the AC adapter is exposed to high temperature or used continuously, you should keep the load at about 80% of the maximum load (at 1.6 A for the POA200-20-2).
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 rubber feet when setting on a desk or others as figure 3.18(A).

Correct installation orientation

Figure 3.18. Installation Orientation
3. Setup

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 module.

The example of magneto-attachment

Notes!

- Please attach in a DIN rail on the wall and use 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. Setup

Mounting on a DIN Rail

The following illustrates the installation with expansion module. Please reference to page 51, “6. Connecting with Expansion Accessories”.

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).

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

Figure 3.19. Mounting on a DIN Rail < 1 / 3 >

Figure 3.19. Mounting on a DIN Rail < 2 / 3 >
(3) The fixing hook is automatically locked, and the module can be mounted in one-touch.

Figure 3.19. 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).

Figure 3.20. 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 3.20. Removing the Module from the DIN Rail < 2 / 3 >

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

Figure 3.20. 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.
Using Several Products of the same Model

Each module should be assigned a unique Module ID in order to let USB driver recognize them when several products 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**

![Diagram showing modules connected without setting Module ID](image)

**Necessary to set Module ID**

Multiple modules same model being used

![Diagram showing multiple modules connected with different settings](image)

**Setting a Module ID**

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

multiple modules being used, setting different value

![Diagram showing module ID setting](image)
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(W32) Help] from [Start] menu.

The information for application development, such as function reference is provided in [API-USBP(W32) 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)]-[CNT]-[Sample Name] from [Start] menu.

Distributing Developed Application

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

USB driver for counter

X:\INF\WDM\CNT  (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

<table>
<thead>
<tr>
<th>Condition</th>
<th>Cause and measure</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>USB port of a PC is unusable</strong></td>
<td>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.</td>
</tr>
<tr>
<td><strong>“Unknown Device” is registered with device manager (Win98/Me)</strong></td>
<td>The cause is incorrect operation such as canceling the wizard by mistake when connecting with a module. Follow the following procedure to delete unknown device. Start device manager, select [Unknown Device] and then click on [Delete] button.</td>
</tr>
<tr>
<td><strong>&quot;USB Device&quot; is registered with device manager (Windows 2000)</strong></td>
<td>The cause is incorrect operation such as canceling the wizard by mistake when connecting with a module. Follow the following procedure to delete unknown device. Start device manager, select [USB Device] and then right-click [Delete].</td>
</tr>
<tr>
<td><strong>The menu can not be displayed when a PC CD-ROM is being set.</strong></td>
<td>Select “Run...” from Start menu, and then type X: AUTORUN.EXE (X: CD ROM drive), finally, click on OK button.</td>
</tr>
<tr>
<td><strong>The message of &quot;HI-SPEED USB Device Plugged into non-HI-SPEED USB HUB&quot; is displayed on Windows XP.</strong></td>
<td>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.</td>
</tr>
</tbody>
</table>
## 5. Troubleshooting

### Q & A

<table>
<thead>
<tr>
<th>Question</th>
<th>Answer</th>
</tr>
</thead>
<tbody>
<tr>
<td>Can it run on Windows NT4.0 or Windows 95?</td>
<td>No. In addition, it can not run on Windows 3.1, Windows NT3.51 and so on.</td>
</tr>
<tr>
<td>Can it run on OS different from Windows?</td>
<td>It can not run on non-Window OS such as Linux, MS-DOS etc.</td>
</tr>
<tr>
<td>Can you make an USB connection with PC-9821 series?</td>
<td>Not support.</td>
</tr>
<tr>
<td>How many modules can be connected to one PC?</td>
<td>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 HUB.</td>
</tr>
<tr>
<td>Can the developed applications run on other PC?</td>
<td>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.</td>
</tr>
<tr>
<td>Does it have license in distributing developed applications?</td>
<td>It is free to distribute developed applications.</td>
</tr>
<tr>
<td>Can applications be developed in language different from corresponding language?</td>
<td>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.</td>
</tr>
<tr>
<td>Can it be used without programming knowledge?</td>
<td>There are supplied software (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.</td>
</tr>
<tr>
<td>Can run with other applications together simultaneously?</td>
<td>It is possible because of multiple-thread processing in Windows. Reply from an application may be very slow because of the high load.</td>
</tr>
<tr>
<td>Can expansion modules with different type be connected?</td>
<td>No. In the case of using this product, CNT24-2(FIT)GY is the only module to be connected.</td>
</tr>
<tr>
<td>What about the maximum length of USB cable?</td>
<td>The maximum length is less than 5m according to USB specification. But it can expand to 6 tiers with 30m long when using USB HUB.</td>
</tr>
<tr>
<td>How to get the version of USB driver?</td>
<td>Run diagnostic program and [Diagnosis …] to get the version of the driver.</td>
</tr>
<tr>
<td>How to upgrade USB driver to latest edition?</td>
<td>You can download it from following homepage when there is latest edition. <a href="http://contec.com/download">http://contec.com/download</a></td>
</tr>
<tr>
<td>How to start the device manager?</td>
<td>Windows 2000 : Start &gt; Settings &gt; Control Panel &gt; System. Select Hardware and click on Device Manager.</td>
</tr>
<tr>
<td>Does it feature suspend/resume function?</td>
<td>No. Please set power management for a PC in order to avoid suspension in operation.</td>
</tr>
<tr>
<td>Is AC adapter necessary when HUB is being used?</td>
<td>It is unnecessary to connect with AC adapter when connecting with a HUB of self power. (It is necessary when using expansion modules.)</td>
</tr>
</tbody>
</table>
## 5. Troubleshooting

<table>
<thead>
<tr>
<th>Question</th>
<th>Answer</th>
</tr>
</thead>
<tbody>
<tr>
<td>Want to perform the channels more than the points being appended by expansion modules.</td>
<td>The number of expansion modules is 3(4 including the module). When channels more than this number are wanted, please purchase the necessary module(s) and expansion accessories.</td>
</tr>
<tr>
<td>Is adding points by expansion modules different from adding modules?</td>
<td>When modules are added, the USB ports corresponding to those modules will be used. For example, channel 0 input of module A, channel 0 input of module B. When the expansion modules are added, they can be used in the image based on the number of points in the USB modules. For example, in the case of the number of input channels of USB module is 8, channel 0 input of USB module A, channel 8 input of expansion module B. Therefore, they can be treated as consecutive points.</td>
</tr>
<tr>
<td>In what order should the USB cable and power cable be unplugged?</td>
<td>When the module is externally powered, for example, via the AC adapter, unplug the USB cable first, then unplug the power cable.</td>
</tr>
</tbody>
</table>
5. Troubleshooting

Diagnostic Program

Running diagnostic program may identify that if abnormality exists in hardware or software.
Run diagnostic program, open Properties for 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 output but also perform further diagnosis by clicking on [Diagnosis Report...] button.
Version Upgrade

How to Upgrade the Firmware

Firmware is namely software which is embedded in 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 module.

**Step1 Removing 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 - 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 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.
**Step 5 Specifying upgrade files**
Clicking on [Reference] button specifies the file which has been downloaded.

**Step 6 Clicking [Start Upgrade] button**
Upgrade is completed automatically.

**Step 7 Setting properties using Device Manager once more**
After completing upgrade, perform settings again by referencing to “Setting Properties Using Device Manager” on page 18.

**Point**
Use the firmware upload function if you wish to backup the old firmware before downloading the new firmware.

1. Click the [Start backup] button and specify where to save the uploaded file.
2. Click the [OK] button to start the upload.

**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. Moreover, the method of returning to the initial state is different depending on OS. Please initialize it by the method of suitable for OS used.


< Uninstall the device driver >
Use [My Computer] - [Control Panel] - [Programs and Features] to uninstall the device driver.
Select [Windows driver package - CONTEC (****)] and then click [Uninstall].
* "****" contains the driver category name (caio, ccnt, cdio, csmc, etc.).

⚠️ CAUTION
Uninstall procedure for XP and Server 2003, use [My Computer] - [Control Panel] - [Add and Remove Programs] to uninstall the device driver.

< Uninstall the development environment >
Use [My Computer] - [Control Panel] - [Programs and Features] to uninstall the development environment.
Select [CONTEC API-****(WDM) VerX.XX (development environment)] and then click [Uninstall].
* "****" contains the driver category name (AIO, CNT, DIO, SMC, etc.).
5. Troubleshooting

⚠️ CAUTION

Uninstall procedure for Windows Me

< Uninstalling the device driver >
Use [My Computer] - [Control Panel] - [Add or Remove Programs] to uninstall the device driver.
Select [CONTEC API-***(WDM) driver] and then click [Change/Remove].

* "***" contains the driver category name (caio, ccnt, cdio, csmc, etc.).

< Uninstall the development environment >
Use [My Computer] - [Control Panel] - [Add or Remove Programs] to uninstall the development environment.
Select [CONTEC API-***(WDM) VerX.XX (development environment)] and then click [Change/Remove].

* "***" contains the driver category name (AIO, CNT, DIO, SMC, etc.).

Uninstall procedure for Windows 98, 98SecondEdition

< Uninstalling the device driver >
Use [My Computer] - [Control Panel] - [Add or Remove Programs] to uninstall the device driver.
Select [CONTEC API-***(WDM) driver] and then click [Change/Remove].

* "***" contains the driver category name (caio, ccnt, cdio, csmc, etc.).

< Uninstall the development environment >
Use [My Computer] - [Control Panel] - [Add or Remove Programs] to uninstall the development environment.
Select [CONTEC API-***(WDM) VerX.XX (development environment)] and then click [Change/Remove].

* "***" contains the driver category name (AIO, CNT, DIO, SMC, etc.).
6. Connecting with Expansion Accessories

When lacking of counter input channel 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 channels is considered when designing this product, 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 3 modules CNT24-2(FIT)GY can be connected when adding channels.

In the case of combination of this product and three expansion modules “CNT24-2(FIT)GY”, it is possible to control 16 channels output by way of one USB port.

**Table 6.1. Expansion Module**

<table>
<thead>
<tr>
<th>Model</th>
<th>Output channel</th>
<th>Current consumption</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>CNT24-2(FIT)GY</td>
<td>2</td>
<td>+5VDC 180mA (Max.)</td>
<td>Expansion module for CNT24-2(USB)GY</td>
</tr>
</tbody>
</table>

**Figure 6.1. Expansion Module**

Points

- Up to 3 modules can be connected.
- Please use the supplied AC adapter when adding modules.
- Modules with different function from this product can not be connected.
6. Connecting with Expansion Accessories

## 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”.

⚠️ **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](image)

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CNT24-2(USB)GY

50
Connection between Modules

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
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](image_url)
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
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

### Hardware Specification

Table 7.1 lists the hardware specification of this product.

#### Table 7.1. Hardware Specification

<table>
<thead>
<tr>
<th>Item</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Counter</strong></td>
<td></td>
</tr>
<tr>
<td>Channel count</td>
<td>2 channels</td>
</tr>
<tr>
<td>Counting system</td>
<td>Up/down counting</td>
</tr>
<tr>
<td>Max. count</td>
<td>FFFFFFH (binary data)</td>
</tr>
<tr>
<td>Input format</td>
<td>Optocoupler isolated input (for current sinking output)</td>
</tr>
<tr>
<td>Input signal</td>
<td>Phase-A/UP One x 2 channels</td>
</tr>
<tr>
<td></td>
<td>Phase-B/DOWN One x 2 channels</td>
</tr>
<tr>
<td></td>
<td>Phase-Z/CLR One x 2 channels</td>
</tr>
<tr>
<td></td>
<td>General-purpose input One x 2 channels</td>
</tr>
<tr>
<td>Input resistance</td>
<td>220Ω and above</td>
</tr>
<tr>
<td>Input ON current</td>
<td>15 ÷ 25mA</td>
</tr>
<tr>
<td>Input protection circuit</td>
<td>Not available</td>
</tr>
<tr>
<td>Response frequency</td>
<td>500kHz 50% (Max.) duty *1</td>
</tr>
<tr>
<td>External power</td>
<td>5 ÷ 12VDC ±10% 400mA (Min.)</td>
</tr>
<tr>
<td>Digital filter</td>
<td>0.1 ÷ 105.6µsec</td>
</tr>
<tr>
<td><strong>Count-match Output</strong></td>
<td></td>
</tr>
<tr>
<td>Output count</td>
<td>One x 2 channels</td>
</tr>
<tr>
<td>Output format</td>
<td>Optocoupler isolated open collector output</td>
</tr>
<tr>
<td>Rated output</td>
<td>35VDC 50mA (Max.)</td>
</tr>
<tr>
<td>Pulse width</td>
<td>0 ÷ 104.45msec</td>
</tr>
<tr>
<td>Output protected circuit</td>
<td>Not available</td>
</tr>
<tr>
<td>External power</td>
<td>5 ÷ 12VDC ±10%</td>
</tr>
<tr>
<td><strong>Communication</strong></td>
<td></td>
</tr>
<tr>
<td>USB transmission speed</td>
<td>12Mbps (full speed), 480Mbps (high speed) *1</td>
</tr>
<tr>
<td>Current consumption</td>
<td>+5VDC 510mA (Max.) *2</td>
</tr>
</tbody>
</table>
### Table 7.1. Hardware Specification

<table>
<thead>
<tr>
<th>Item</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of modules used at the same time</td>
<td>127 modules (Max.) *3</td>
</tr>
<tr>
<td>Maximum distance of signal extension</td>
<td>30m</td>
</tr>
<tr>
<td>Use condition*4</td>
<td>0 · 50°C 10 · 90%RH (No condensation)</td>
</tr>
<tr>
<td>Physical dimensions (mm)</td>
<td>50.4(W) x 64.7(D) x 94.0(H) (No protrusions)</td>
</tr>
<tr>
<td>Weight</td>
<td>150g</td>
</tr>
<tr>
<td>Installation method</td>
<td>One-touch connection to 35mm DIN rails</td>
</tr>
<tr>
<td></td>
<td>(standard connection mechanism provided in the system)</td>
</tr>
<tr>
<td>Expansion module</td>
<td>CNT24-2(FIT)GY : 3 modules (Max.)</td>
</tr>
<tr>
<td></td>
<td>Current consumption/module : +5VDC 180mA(Max.)</td>
</tr>
<tr>
<td>Compatible plug</td>
<td>FK-MC0,5/9-ST-2,5 (made by Phoenix Contact)</td>
</tr>
<tr>
<td></td>
<td>2.5mm-pitch nominal current : 4A (Max.)</td>
</tr>
<tr>
<td>Compatible wires</td>
<td>AWG28 · 20</td>
</tr>
<tr>
<td>Bundled AC adapter (POA-AD22)</td>
<td>90 · 264VAC 5.0VDC ±5% 2.0A (Max.)</td>
</tr>
<tr>
<td></td>
<td>Length of cable is about 1.4m</td>
</tr>
</tbody>
</table>

*1 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 module is based on the environment of the PC being used (OS, USB host controller).

*2 When over 500mA, a bundled AC adapter should be 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 modules cannot be connected together.

*4 When using the attached AC adapter POA200-20-2, it is 0 · 40°C
### Table 7.2. AC adapter environmental condition (environmental specification)

<table>
<thead>
<tr>
<th>Item</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Input voltage range</td>
<td>90 - 264VAC</td>
</tr>
<tr>
<td>Rated input current</td>
<td>300mA</td>
</tr>
<tr>
<td>Number of frequency</td>
<td>50 - 60Hz</td>
</tr>
<tr>
<td>Rated output voltage</td>
<td>5.0VDC</td>
</tr>
<tr>
<td>Rated output current</td>
<td>2.0A (Max.)</td>
</tr>
<tr>
<td>Dimension (mm)</td>
<td>47.5(W) x 75(D) x 27.3(H) (No protrusions)</td>
</tr>
<tr>
<td>Weight</td>
<td>175g</td>
</tr>
<tr>
<td>Operating temperature</td>
<td>0 - 40°C</td>
</tr>
<tr>
<td>Operating humidity</td>
<td>20 - 80%RH (No condensation)</td>
</tr>
<tr>
<td>Life expectancy</td>
<td>4 years at the ambient temperature 40 °C</td>
</tr>
<tr>
<td></td>
<td>(When 100VAC is input and 1.3A is output)</td>
</tr>
<tr>
<td>Allowable time of short interruption</td>
<td>15ms (Max.) (When 100VAC is input and 1.3A is output) *1</td>
</tr>
<tr>
<td>Floating dust particles</td>
<td>Not to be excessive</td>
</tr>
<tr>
<td>Corrosive gases</td>
<td>None</td>
</tr>
<tr>
<td>Voltage corresponding to the attached AC cable</td>
<td>125VAC 7A</td>
</tr>
</tbody>
</table>

*1 When the short interruption occurs and the defective operation of the equipment is generated, please insert the power supply of the equipment after pulling out it.
## Software Specification

### Table 7.3. Windows Drivers Specification

<table>
<thead>
<tr>
<th>Item</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Support OS</strong></td>
<td>&lt;64 bit OS&gt;</td>
</tr>
<tr>
<td></td>
<td>Microsoft Windows 7 x64 Edition</td>
</tr>
<tr>
<td></td>
<td>Microsoft Windows Server 2008 x64 Edition</td>
</tr>
<tr>
<td></td>
<td>Microsoft Windows Vista x64 Edition</td>
</tr>
<tr>
<td></td>
<td>Microsoft Windows Server 2003 x64 Edition</td>
</tr>
<tr>
<td></td>
<td>Microsoft Windows XP Professional x64 Edition</td>
</tr>
<tr>
<td></td>
<td>&lt;32 bit OS&gt;</td>
</tr>
<tr>
<td></td>
<td>Microsoft Windows 7</td>
</tr>
<tr>
<td></td>
<td>Microsoft Windows Server 2008</td>
</tr>
<tr>
<td></td>
<td>Microsoft Windows Vista</td>
</tr>
<tr>
<td></td>
<td>Microsoft Windows Server 2003</td>
</tr>
<tr>
<td></td>
<td>Microsoft Windows 2000 Professional Edition</td>
</tr>
<tr>
<td></td>
<td>Microsoft Windows Me</td>
</tr>
<tr>
<td></td>
<td>Microsoft Windows 98 and Second Edition</td>
</tr>
<tr>
<td></td>
<td>Microsoft Windows Embedded Standard</td>
</tr>
<tr>
<td><strong>Support language</strong></td>
<td>Microsoft Visual C++ Ver5.0, Ver6.0</td>
</tr>
<tr>
<td></td>
<td>Microsoft Visual Basic Ver5.0, Ver6.0</td>
</tr>
<tr>
<td></td>
<td>Borland Delphi Ver 5.0, 6.0</td>
</tr>
<tr>
<td></td>
<td>Borland C++ Builder Ver 5.0, 6.0</td>
</tr>
<tr>
<td><strong>System requirement</strong></td>
<td>-PC (IBM PC/AT compatibility, DOS/V) with USB port</td>
</tr>
<tr>
<td></td>
<td>-CD-ROM drive</td>
</tr>
<tr>
<td></td>
<td>-Recommend the environment on which the using language can run smoothly</td>
</tr>
</tbody>
</table>

*1 Supported Express Edition.

*2 Supported only MFC
Point

The Device ID of this product is fixed at “0”.

Figure 7.1. Circuit Block Diagram < CNT24-2(USB)GY >
Physical Dimensions

Figure 7.2. Physical Dimensions

Figure 7.3. Physical dimensions of attached AC adapter (POA200-20-2)
External Input and Output Circuit

Input section

Figure 7.4. Isolated Input Circuit and an Example of a Connection

The signal input section consists of an Optocoupler isolated input (compatible with current sink output). Therefore, driving the input section for the module requires an external power supply.

When an external power supply other than 5V is used, insert a current-limiting resistor at position R. If PV denotes an external power supply, the current-limiting resistor R can be calculated as follows:

\[
\frac{P-5}{20} < R \Omega < \frac{P-5}{15}
\]

For example, \( P = 12 \text{V} \) will require the following resistance:

\( 350 \Omega < R < 470 \Omega \).

In addition, the general-purpose input signal also has a similar circuit configuration.
Output section

When there is a match between a channel count and a specified value, a one-shot (one pulse) match signal is output to the outside. The signal output section has an open collector configuration based on Optocoupler isolation. Driving the output of this module requires an external power supply.

Figure 7.5. Output Circuit and an Example of a Connection
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

![Diagram of relay coil countermeasure with diode and Zener diode]

*Examples of use of lamp

![Diagram of lamp countermeasure with inrush current prevention resistance and dark point-lighting bypass]

Figure 7.6. Surge Voltage Countermeasures

⚠️ CAUTION

In order for a protection circuit to operate effectively, it must be connected within 50 cm of a load and a contact point.
# 8. Appendix

## Glossary

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

<table>
<thead>
<tr>
<th>Terms</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>API [Application Program Interface]</td>
<td>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 hardware by calling device driver.</td>
</tr>
<tr>
<td>PDF file</td>
<td>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.</td>
</tr>
<tr>
<td>USB [Universal Serial Bus]</td>
<td>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 ON (Hot Plug).</td>
</tr>
<tr>
<td>USB 2.0 [Universal Serial Bus 2.0]</td>
<td>The latest USB specification that keeps up the low-compatibility with previous USB and promotes the data transfer speed to 480Mbps (60MB/sec).</td>
</tr>
<tr>
<td>Device ID [Device Identifier]</td>
<td>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.</td>
</tr>
<tr>
<td>Self power</td>
<td>Supplying power by using AC adapter is called Self-Power.  Please make use of AC adapter when using expansion modules.</td>
</tr>
<tr>
<td>Device driver</td>
<td>It is software to operate and set peripheral equipment by a PC, and the peripheral equipment is installed on the PC.  It is simply called Driver.</td>
</tr>
<tr>
<td>Device manager</td>
<td>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.</td>
</tr>
<tr>
<td>Device name</td>
<td>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.</td>
</tr>
<tr>
<td>Hardware wizard</td>
<td>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.</td>
</tr>
<tr>
<td>Bus power</td>
<td>Power is supplied by a host when USB cable is being connected without connecting an AC adapter.</td>
</tr>
<tr>
<td>Firmware</td>
<td>It is the software incorporated into a equipment to perform basic control on hardware.</td>
</tr>
<tr>
<td>Properties</td>
<td>Select modules from Device Manager, right-click and select [Properties] dialog box from pop-up menu to set the device name.</td>
</tr>
<tr>
<td>Module ID</td>
<td>About the ID of the 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.</td>
</tr>
</tbody>
</table>