

PC-HELPER

4ch 24Bit

Up/Down Counter Board for PCI

**CNT24-4(PCI)H**

User's Guide

CONTEC CO.,LTD.

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# Check Your Package

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Thank you for purchasing the CONTEC product.

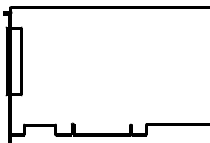
The product consists of the items listed below.

Check, with the following list, that your package is complete. If you discover damaged or missing items, contact your retailer.

## Product Configuration List

- CNT24-4(PCI)H ...1
- First step guide ...1
- CD-ROM\*1 [API-PAC(W32)] ...1

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



Board



First step guide



CD-ROM  
[API-PAC(W32)]

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# Copyright

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# 1. Before Using the Product

This chapter provides information you should know before using the product.

## About the Board

The CNT24-4(PCI)H is a PCI bus-compliant interface board that counts input pulse signals from external devices.

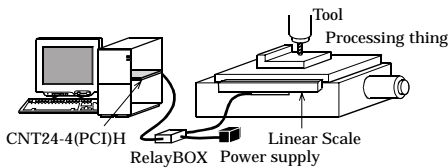
The CNT24-4(PCI)H has four channels of 24-bit up/down counters, allowing external devices such as a rotary encoder and a linear scale to be connected. Given below are examples of using the board for “detecting a position of the table of a machine tool” and “detecting a change in weight”.

The pulse signal inputting interface is photo coupler isolated or TTL-level input.

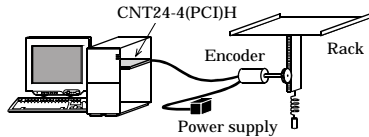
Using the bundled driver library [API-PAC(W32)], you can create Windows application software for this board in your favorite programming language supporting Win32 API functions, such as Visual Basic or Visual C/C++.

< Example >

- Detecting a position of the table of a machine tool



- Detecting a change in weight



## Features

- It is equipped with four channels of 24-bit up/down counters.
- The board can count two-phase signals, which can be outputs of some rotary encoders and linear scales
- You can select either a photo coupler isolated input or a TTL-level input for each channel by software command.
- Each channel can generate an interrupt request signal and a one-pulse output signal when the count data matches a pre-specified value.
- The board is equipped with a programmable timer to allow interrupts to be generated periodically according to a specified timer value.
- Each Channel is equipped with a general-purpose input signal (both photo coupler and TTL).



# Support Software

You should use CONTEC support software according to your purpose and development environment.

### Driver Library **API-PAC(W32)** (Bundled)

API-PAC(W32) is the library software that provides the commands for CONTEC hardware products in the form of Windows standard Win32 API functions (DLL). It makes it easy to create high-speed application software taking advantage of the CONTEC hardware using various programming languages that support Win32 API functions, such as Visual Basic and Visual C/C++.

It can also be used by the installed diagnosis program to check hardware operations.

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

For details, read Help on the bundled CD-ROM or visit the CONTEC's Web site.

#### < Operating environment >

OS	Windows XP, 2000, NT, Me, 98, etc..
Adaptation language	Visual C/C++, Visual Basic, Delphi, Builder, etc..
Others	Each piece of library software requires 50 MB of free hard disk space.

### Linux version of general-purpose COUNT driver: **API-CNT(LNX)** (Supplied within the same CD-ROM of API-PAC (W32))

This driver is used to control CONTEC counter boards (PC Cards).

You can control CONTEC counter boards easily using the shared library used by gcc, Kylix, the device driver (module) for each kernel version, and the board (PC Cards) configuration program (config).

CONTEC provides download services (at <http://www.contec.co.jp/enom/apipac/>) to supply the updated drivers and differential files.

For details, read Help on the bundled CD-ROM or visit the CONTEC's Web site.

#### < Operating environment >

OS	RedHatLinux, TurboLinux, etc.. (For details on supported distributions, refer to Help available after installation.)
Adaptation language	gcc, Kylix
Others	Each piece of library software requires 3 MB of free hard disk space.

### Data acquisition VI library for LabVIEW **VI-DAQ** (Free download)

This is a VI library to use in National Instruments LabVIEW.

VI-DAQ is created with a function form similar to that of LabVIEW's Data Acquisition VI, allowing you to use various devices without complicated settings.

See <http://www.contec.com/vidaq/> for details and download of VI-DAQ.

## Cable & Connector (Option)

Flat cable with both-ends 37-pin D-SUB connector	: PCB37P-1.5 (1.5m) : PCB37P-3 (3m) : PCB37P-5 (5m)
Shield cable with both-ends 37-pin D-SUB connector	: PCB37PS-0.5P (0.5m) : PCB37PS-1.5P (1.5m) : PCB37PS-3P (3m) : PCB37PS-5P (5m)
Flat cable with one-end 37-Pin D-SUB connector	: PCA37P-1.5 (1.5m) : PCA37P-3 (3m) : PCA37P-5 (5m)
Shield cable with one-end 37-pin D-SUB connector	: PCA37PS-0.5P (0.5m) : PCA37PS-1.5P (1.5m) : PCA37PS-3P (3m) : PCA37PS-5P (5m)
30-pin Pinhead Connector to 37-pin D-SUB Connector	: DT/B2 (0.5m)
Conversion Flat Cable	: DT/O (1.5m)
37-pin D-SUB(male) connector Five-piece set	: CN5-D37M

## Accessories (Option)

Screw terminal	: EPD-37A *1
Screw terminal (Screw Up type)	: EPD-37 *1
Terminal unit for solderless terminal (M3)	: DTP-3(PC)
Terminal unit for leads	: DTP-4(PC)

\*1 Option cable PCB37P or PCB37PS is required separately.

\* 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/>

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.

## Limited Three-Years Warranty

CONTEC Interface boards are warranted by CONTEC CO., LTD. to be free from defects in material and workmanship for up to three years from the date of purchase by the original purchaser.

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

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

## How to Obtain Service

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

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

## Liability




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

# Safety Precautions

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

## Safety Information

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

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

## Handling Precautions



### DANGER

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Do not use the product where it is exposed to flammable or corrosive gas. Doing so may result in an explosion, fire, electric shock, or failure.

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### CAUTION

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- There are switches and jumpers on the board that need to be set in advance.  
Be sure to check these before installing the board.
  - Only set the switches and jumpers on the board to the specified settings.  
Otherwise, the board may malfunction, overheat, or cause a failure.
  - Do not strike or bend the board.  
Otherwise, the board may malfunction, overheat, cause a failure or breakage.
  - Do not touch the board's metal plated terminals (edge connector) with your hands.  
Otherwise, the board may malfunction, overheat, or cause a failure.  
If the terminals are touched by someone's hands, clean the terminals with industrial alcohol.
  - Do not install or remove the board to or from the expansion slot while the computer's power is turned on.  
Otherwise, the board may malfunction, overheat, or cause a failure.  
Be sure that the personal computer's power is turned off.
  - Make sure that your PC or expansion unit can supply ample power to all the boards installed.  
Insufficiently energized boards could malfunction, overheat, or cause a failure.
  - The specifications of this product are subject to change without notice for enhancement and quality improvement.  
Even when using the product continuously, be sure to read the manual and understand the contents.
  - Do not modify the product.  
CONTEC will bear no responsibility for any problems, etc., resulting from modifying this product.
  - Regardless of the foregoing statements, CONTEC is not liable for any damages whatsoever (including damages for loss of business profits) arising out of the use or inability to use this CONTEC product or the information contained herein.
-

## 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

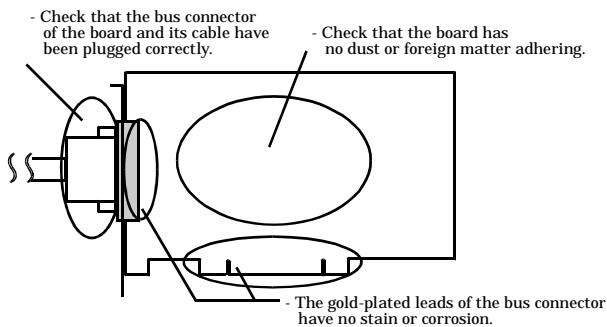
None

Floating dust particles

Not to be excessive

## Inspection

Inspect the product periodically as follows to use it safely.



## Storage

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

- (1) Put the board 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.



## 2. Setup

This chapter explains how to set up the board.

### What is Setup?

Setup means a series of steps to take before the product can be used.

Different steps are required for software and hardware.

The setup procedure varies with the OS and applications used.

### Using the Board under Windows

#### Using the Driver Library API-PAC(W32)

This section describes the setup procedure to be performed before you can start developing application programs for the board using the bundled CD-ROM “Driver Library API-PAC(W32)”.

Taking the following steps sets up the software and hardware. You can use the diagnosis program later to check whether the software and hardware function normally.

**Step 1 Installing the Software**

**Step 2 Setting the Hardware**

**Step 3 Installing the Hardware**

**Step 4 Initializing the Software**

**Step 5 Checking Operations with the Diagnosis Program**

If Setup fails to be performed normally, see the “Setup Troubleshooting” section at the end of this chapter.

### Using the Board under Windows

#### Using Software Other than the Driver Library

#### API-PAC(W32)

For setting up software other than API-PAC(W32), refer to the manual for that software. See also the following parts of this guide as required.

**This chapter Step 2 Setting the Hardware**

**This chapter Step 3 Installing the Hardware**

**Chapter 3 External Connection**

**Chapter 6 About Hardware**



## Using the Board under an OS Other than Windows

For using the board under Linux, see the following parts of this guide.

**This chapter Step 2 Setting the Hardware**

**Chapter 3 External Connection**

**Chapter 5 About Software**

**Chapter 6 About Hardware**

For using the board under an OS such as MS-DOS other than Windows, see the following parts of this guide.

**This chapter Step 2 Setting the Hardware**

**Chapter 3 External Connection**

**Chapter 6 About Hardware**

## Step 1 Installing the Software

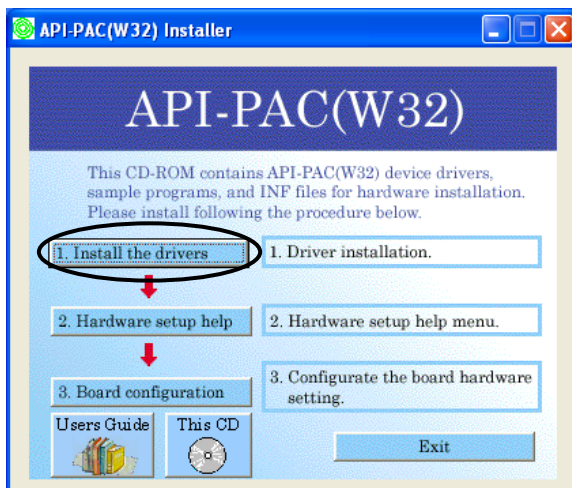
This section describes how to install the Driver libraries.

**Before installing the hardware on your PC, install the Driver libraries from the bundled API-PAC(W32) CD-ROM.**

The following description assumes the operating system as Windows XP. Although some user interfaces are different depending on the OS used, the basic procedure is the same.

### Starting the Install Program

- (1) Load the CD-ROM [API-PAC(W32)] on your PC.
- (2) The API-PAC(W32) Installer window appears automatically.  
If the panel does not appear, run (CD-ROM drive letter):\AUTORUN.exe.
- (3) Click on the [Install the drivers] button.

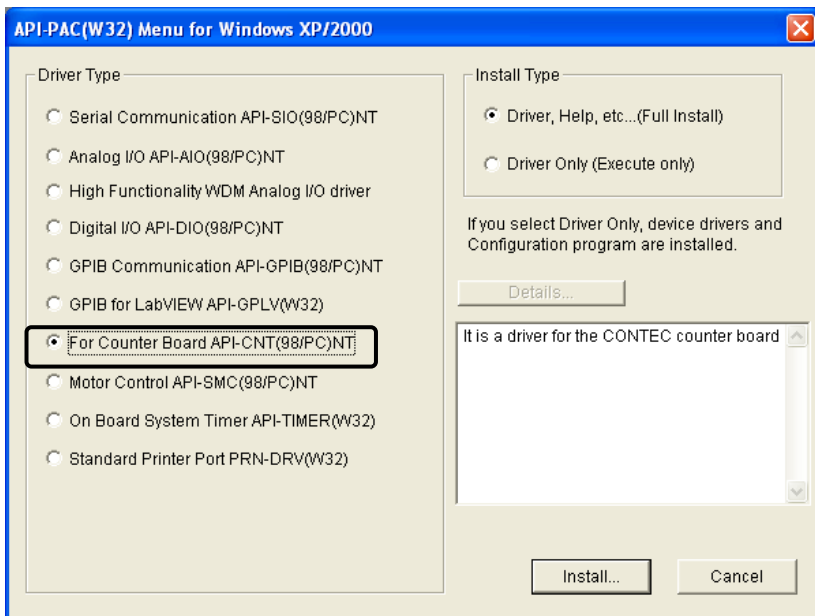


### CAUTION

Before installing the software in Windows XP, 2000, or NT, log in as a user with administrator privileges.

## Selecting the Counter Board Driver

- (1) The following dialog box appears to select “Driver Type” and “Install Type”.
- (2) Select “For Counter Board API-CNT(98/PC)NT”.
- (3) Select “Driver, Help, etc... (Full install)”.
- (4) Click on the [Install] button.



## Executing the Installation

- (1) **Follow the on-screen instructions to proceed to install.**
- (2) When the required files have been copied, the “Perform a hardware setup now” and “Show readme file” check boxes are displayed.

**When you are installing the software or hardware for the first time:**

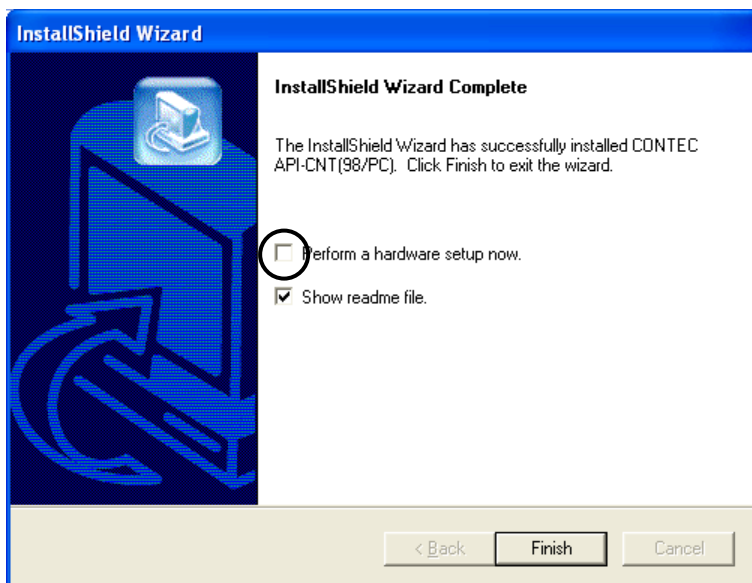
**1) Uncheck “Perform a hardware setup now”.**

**2) Click on the [Finish] button.**

**Go to Step 2 to set and plug the hardware.**

\* When the hardware has already been installed:

Check “Perform a hardware setup now(API-TOOL Configuration)”, then go to Step 4 “Initializing the Software”.



**You have now finished installing the software.**

# Step 2 Setting the Hardware

This section describes how to set the board and plug it on your PC.

The board may have some switches and jumpers that need to be preset.

Check the on-board switches and jumpers before plugging the board into an expansion slot.

The board can be set up even with the factory defaults untouched. You can change board settings later.

## Parts of the Board and Factory Defaults

Figure 2.1. shows the names of major parts on the board.

Note that the switch setting shown below is the factory default.

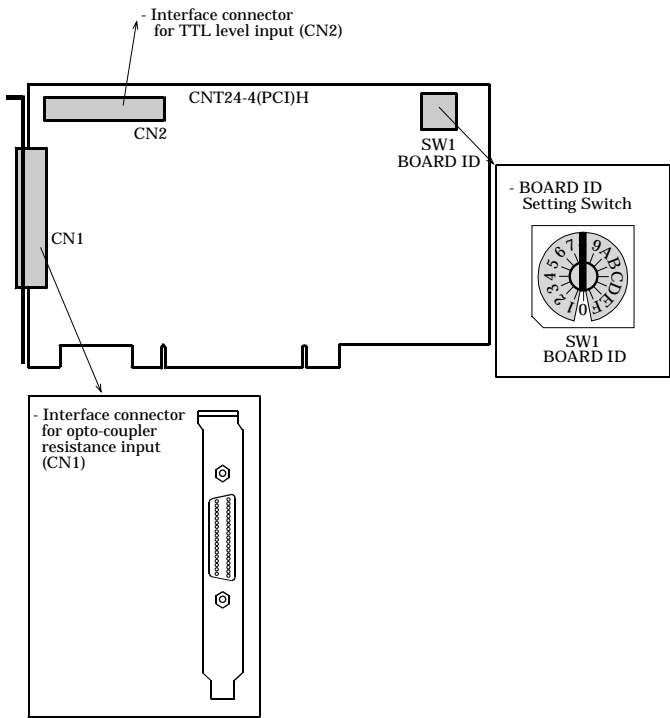


Figure 2.1. Component Locations

## Setting the Board ID

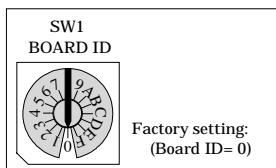
If you install two or more CNT24-4(PCI)H boards on one personal computer, assign a different ID value to each of the boards to distinguish them.

The board IDs can be set from 0 to Fh to identify up to sixteen boards.

If only one board is used, the original factory setting (Board ID = 0) should be used.

### Setting Procedure

To set the board ID, use the rotary switch on the board. Turn the SW1 knob to set the board ID as shown below.



**Figure 2.2. Board ID Settings (SW1)**

## Plugging the Board

- (1) Before plugging the board, shut down the system, unplug the power cord of your PC.
- (2) Remove the cover from the PC so that the board can be mounted.
- (3) Plug the board into an expansion slot.
- (4) Attach the board bracket to the PC with a screw.
- (5) Put the cover back into place.



### Applicable PCI bus slots

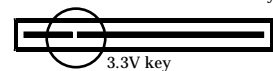
PCI bus slots used in PCs have keys to prevent 5V and 3.3V PCI bus boards from being accidentally plugged into wrong bus slots. This board can be plugged into both of the 5V and 3.3V PCI bus slots.

<PCI bus slot>

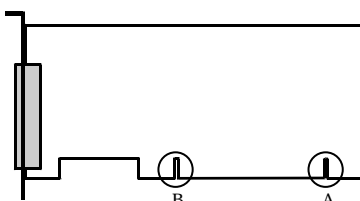
5-V PCI bus slot



3.3-V PCI bus slot



<PCI bus board>



A : Slit for 5-V PCI bus slot  
B : Slit for 3.3-V PCI bus slot

## ⚠ CAUTION

- Do not touch the board's metal plated terminals (edge connector) with your hands. Otherwise, the board may malfunction, overheat, or cause a failure.  
If the terminals are touched by someone's hands, clean the terminals with industrial alcohol.
- Do not install or remove the board to or from the slot while the computer's or expansion unit's power is turned on. Otherwise, the board may malfunction, overheat, or cause a failure.  
Be sure that the personal computer power is turned off.
- Make sure that your PC or expansion unit can supply ample power to all the boards installed. Insufficiently energized boards could malfunction, overheat, or cause a failure.
- A +5VDC Power supply from the PCI bus slot is required.

## Step 3 Installing the Hardware

For using an expansion board under Windows, you have to let the OS detect the I/O addresses and interrupt level to be used by the board. The process is referred to as installing the hardware.

In the case of using two or more boards, make sure you install one by one with the Found New Hardware Wizard.

### Turning on the PC

Turn on the power to your PC.



#### CAUTION

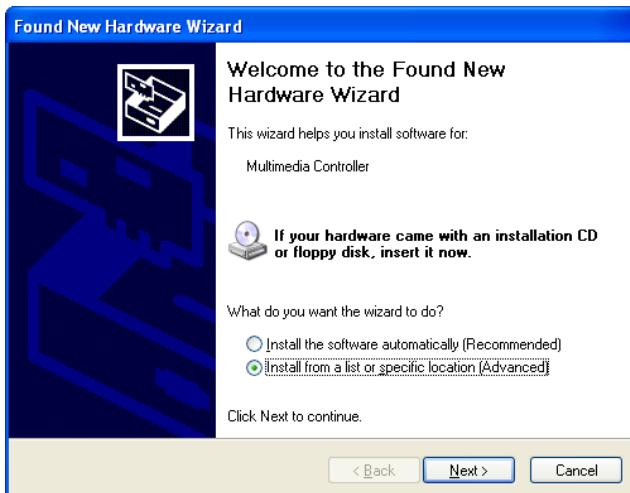
- The board cannot be properly installed unless the resources (I/O addresses and interrupt level) for the board can be allocated. Before attempting to install the board, first determine what PC resources are free to use.
- The resources used by each PCI bus board do not depend on the location of the PCI bus slot or the board itself. If you remove two or more boards that have already been installed and then remount one of them on the computer, it is unknown that which one of the sets of resources previously assigned to the two boards is assigned to the remounted board. In this case, you must check the resource settings.

## Setting with the Found New Hardware Wizard

- (1) The “Found New Hardware Wizard” will be started.

Select “Install from a list or specific location [Advanced]”, then click on the [Next] button.

**If you are using Windows NT 4.0, the “Found New Hardware Wizard” is not started.  
Go to Step 4 “Initializing the Software”.**





- (2) Specify that folder on the CD-ROM which contains the setup information (INF) file to register the board.

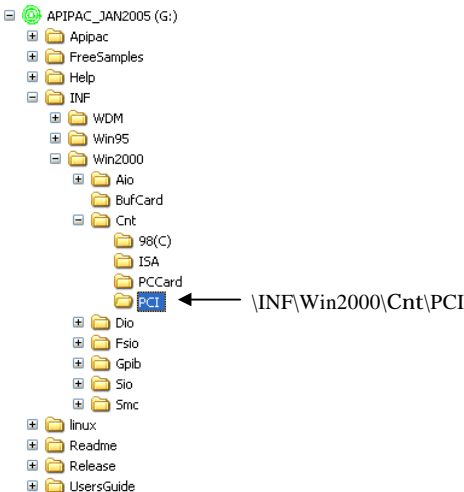


Source folder

The setup information (INF) file is contained in the following folder on the bundled CD-ROM.

Windows XP, 2000     \INF\Win2000\Cnt\PCI  
Windows Me, 98, 95   \INF\Win95\Cnt\PCI

### Example of specifying the folder for use under Windows XP

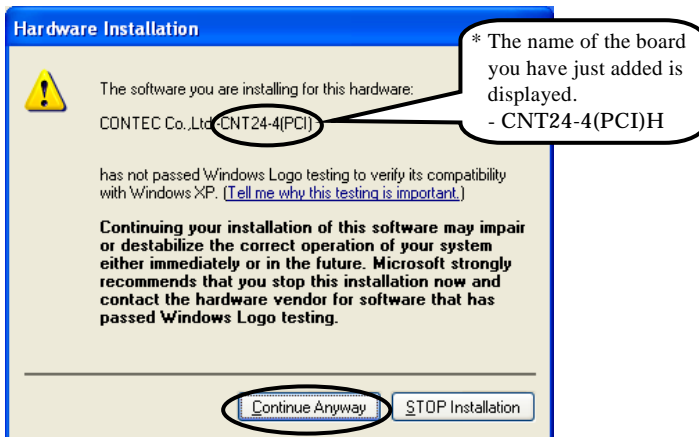




## CAUTION

- In Windows XP, the Hardware Wizard displays the following alert dialog box when you have located the INF file. This dialog box appears, only indicating that the relevant driver has not passed Windows Logo testing, and it can be ignored without developing any problem with the operation of the board.

**In this case, click on the [Continue Anyway] button.**



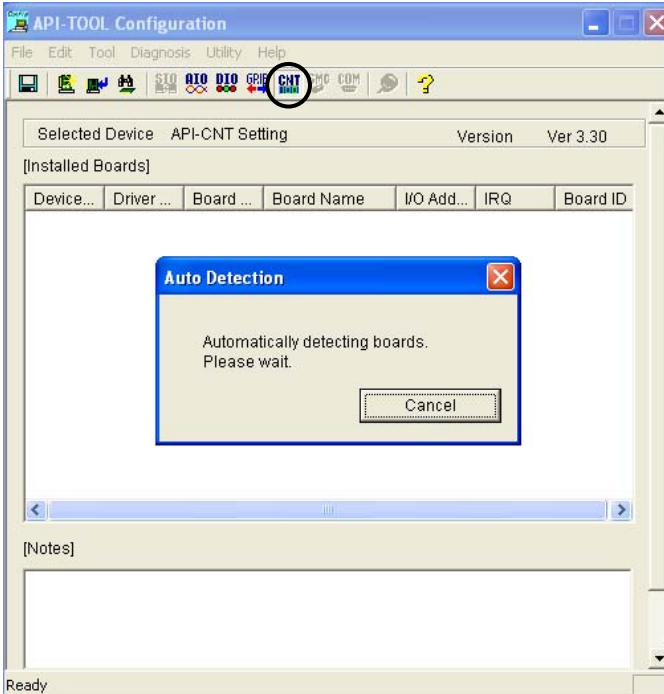
**You have now finished installing the software.**

# Step 4 Initializing the Software

The API function library requires the initial setting to recognize the execution environment. It is called the initialization of the Driver library.

## Invoking API-TOOL Configuration

- (1) Open the Start Menu, then select “Programs” – “CONTEC API-PAC(W32)” – “API-TOOL Configuration”.



- (2) Click on the [CNT] icon.  
API-TOOL Configuration detects hardware automatically.  
The detected boards are listed.

## Updating the Settings

- (1) Select “Save settings to registry...” from the “File” menu.

**You have now finished installing the initial setting of Software.**

## Step 5 Checking Operations with the Diagnosis Program

Use the diagnosis program to check that the board and driver software work normally, thereby you can confirm that they have been set up correctly.

### What is the Diagnosis Program?

The diagnosis program diagnoses the states of the board and driver software.

It can also be used as a simple checker when an external device is actually connected.

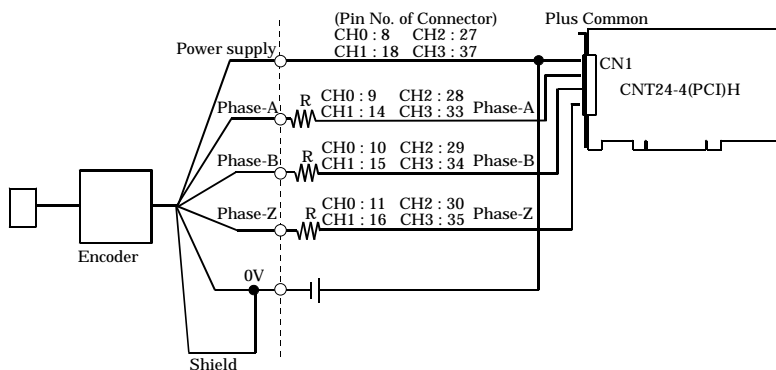
Using the “Diagnosis Report” feature reports the driver settings, the presence or absence of the board, I/O status, and interrupt status.

### Check Method

The diagnosis program tests the board actually connected to an external device to check whether count values are displayed correctly and whether signals are successfully turned on/off. See the following section about how they are connected.

Connection diagram

Use the following connection to connect the rotary encoder to the photo coupler isolated input. For the details on the example connection of input and signal position, see Chapter 3 "External Connection".



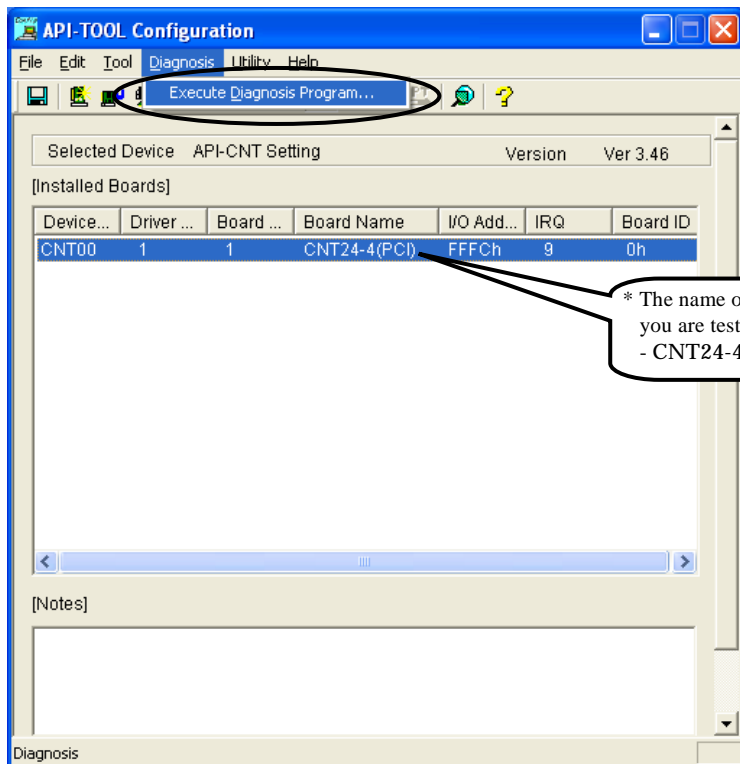
\* If you apply a 12V external power supply for this test, the resistor R should be about 400Ω. However in case of 5V power supply, the R is not required.

**Figure 2.3. Connection diagram**

## Using the Diagnosis Program

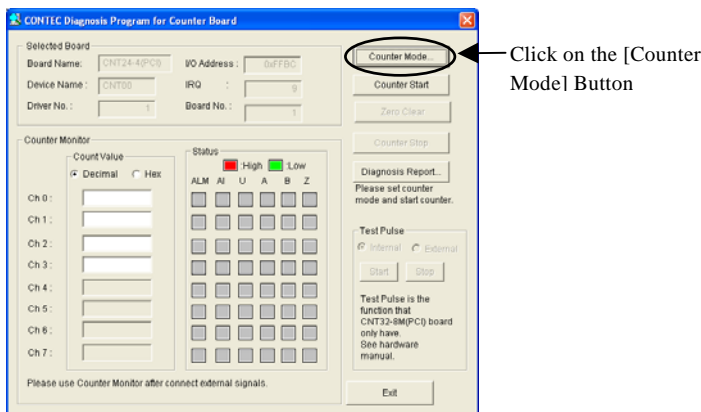
### Starting the Diagnosis Program

Select the board in the API-TOOL Configuration Windows, then run the Diagnosis Program. Follow the instructions on screen.

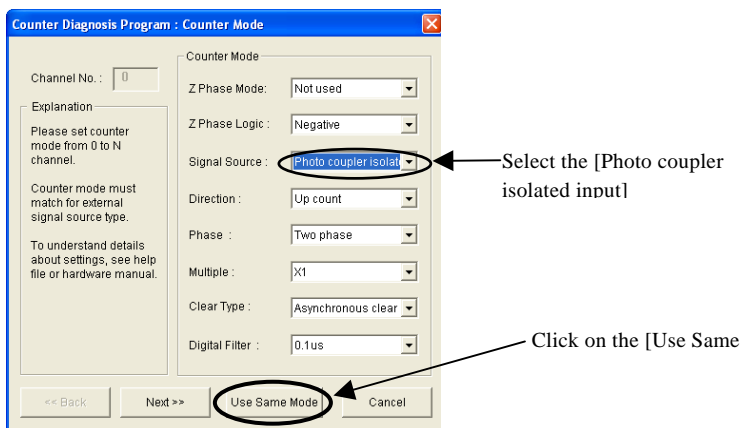


## Setting count conditions

- (1) Change counter mode settings. Click on the [Counter Mode...].  
The Counter Mode setting dialog box appears.



- (2) Setting the channel 0. Select Photo coupler isolated input for Signal Source. Use default data for other settings. Because other three channels should be the same settings, click [Use Same Mode] then.



(3) Click on the [End] button to finish condition setting.

Counter Diagnosis Program : Counter Mode

Channel No. : 3

Explanation

Please set counter mode from 0 to N channel.

Counter mode must match for external signal source type.

To understand details about settings, see help file or hardware manual.

Counter Mode

Z Phase Mode : Not used

Z Phase Logic : Negative

Signal Source : Photo coupler isolat

Direction : Up count

Phase : Two phase

Multiple : X1

Clear Type : Asynchronous clear

Digital Filter : 0.1us

<< Back   Next >>   **End**   Cancel

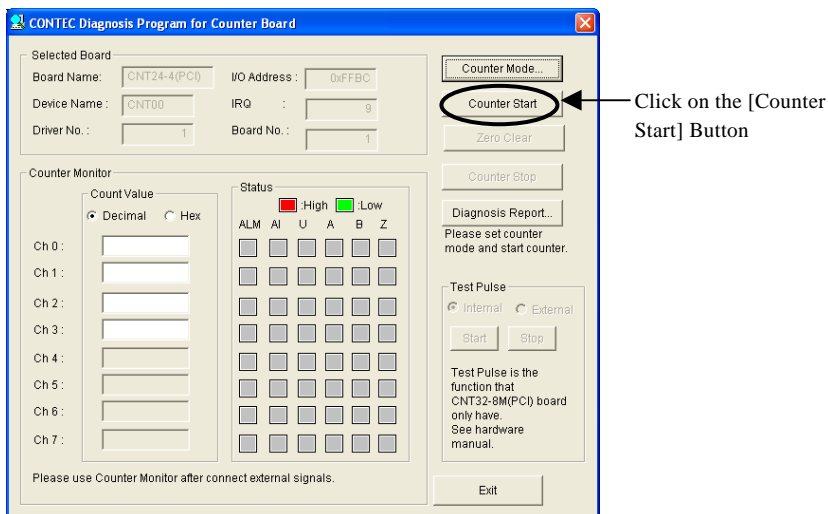
Click on the [End]  
Button.

## Checking counter operations

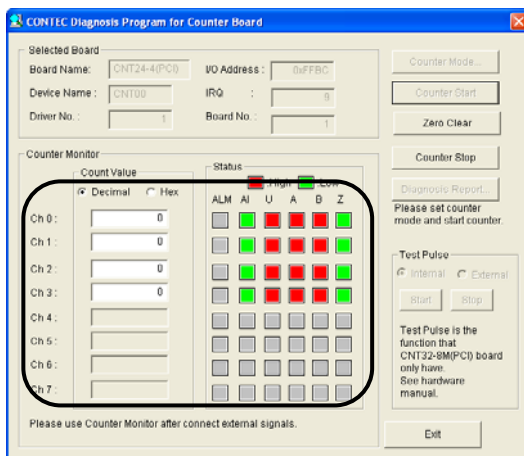
The following commands can be used to check the basic operations of the counter.

- [Counter Start] : Starts the counter.  
 [Zero Clear] : Clears the counter to zero.  
 [Counter Stop] : Stops the counter.

- (1) Click on the [Counter Start].



- (2) The count value of each counter and their status (AI, U, A, B, and Z) will be displayed.



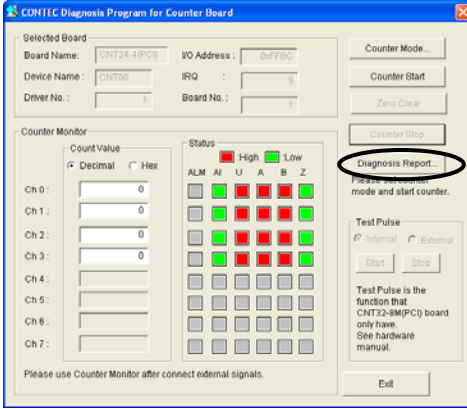


## Diagnosis Report

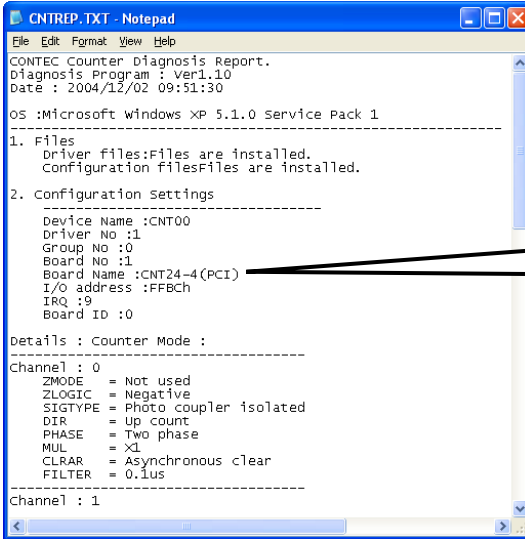
- (1) Clicking on the [Diagnosis Report] button displays detailed data such as board settings and the diagnosis results while saving them in text format.

The results are saved and displayed as a text file (CntRep.txt) in the install folder (Program Files\CONTEC\API-PAC(W32)).

The Diagnosis Program performs “board presence/absence check”, “interrupt test”, “driver file test”, “board setting test”, and so on.



- (2) A diagnosis report is shown below.



## ⚠ CAUTION

Before executing diagnosis report output, unplug the cable from the board.

# Setup Troubleshooting

## Symptoms and Actions

The board cannot be initialized [Windows NT 4.0]

The driver may not yet be activated. When using the board under an OS not compliant with Plug and Play, such as Windows NT 4.0, make sure that the [PnP OS] BIOS option has been set to [NO].

For details on BIOS settings, refer to the user's guide for your PC.

Could not read counter data

- Confirm if the I/O address has been set correctly.
- The counter mode setting may be incorrect.  
The counter mode must be set according to the input signal format before the board can operate normally. Read the function description in API-CNT HELP or this manual to set an appropriate mode.

The board works with the Diagnosis Program but not with an application.

The Diagnosis Program is coded with API-TOOL functions. As long as the board operates with the Diagnosis Program, it should operate with other applications as well. In such cases, review your program while paying attention to the following points:

- Check the arguments to functions and their return values.
- Confirm whether the counter mode has been set correctly or not.

The OS won't normally get started or detect the board. [Windows XP, 2000]

Turn off the power of your PC, then unplug the board. Restart the OS and delete the board settings of API-TOOL Configuration. Turn off the PC again, plug the board, and restart the OS. Let the OS detect the board and use API-TOOL Configuration to register board settings.

## If your problem cannot be resolved

Contact your retailer.



## 3. External Connection

This chapter describes the interface connectors on the board and the external I/O circuits. Check the information available here when connecting an external device.

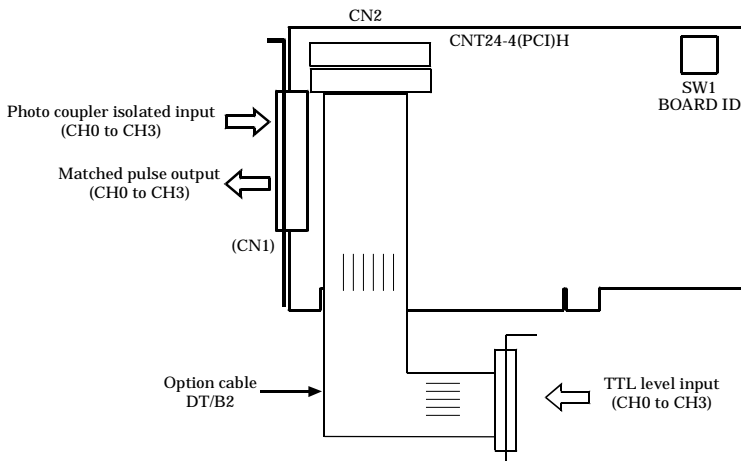
### Using the On-Board Connectors

#### Connecting a Board to a Connector

To input external pulse signals, use the interface connector on the board.

Use CN1 for the photo coupler isolated input. For TTL level input, connect CN2 to an external device by connecting the optional cable CN2.

Matched pulse output is output from CN1. (Photo coupler isolated open collector output)

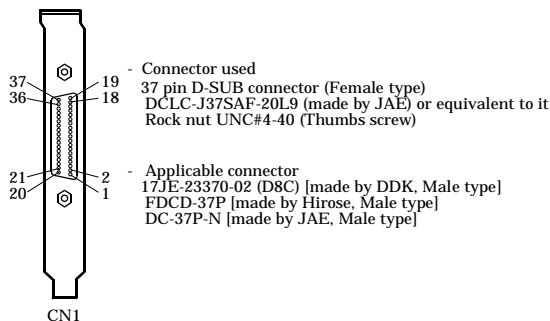


**Figure 3.1. Connecting the Interface Connector**

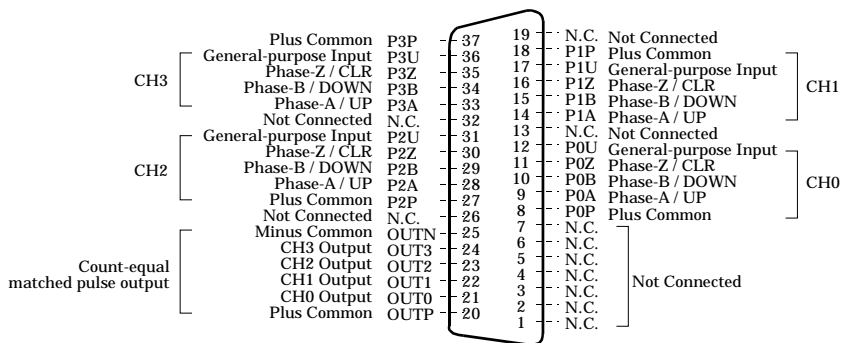
## Interface Connector Signal Assignment

Use the on-board connector to connect the interface board to an external device.

Interface connector for the photo coupler isolated input(CN1)



**Figure 3.2. Connector used(CN1)**



Each channel has an independent plus common. (Same for match output)

**Figure 3.3. Pin Assignment of an interface connector(CN1)**

Interface connector for the TTL-level input(CN2)

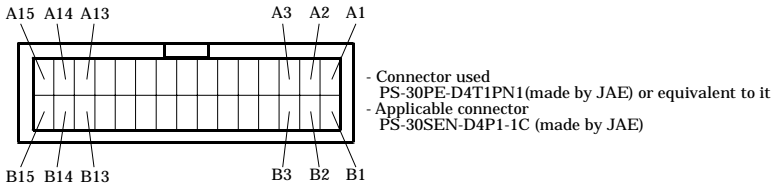
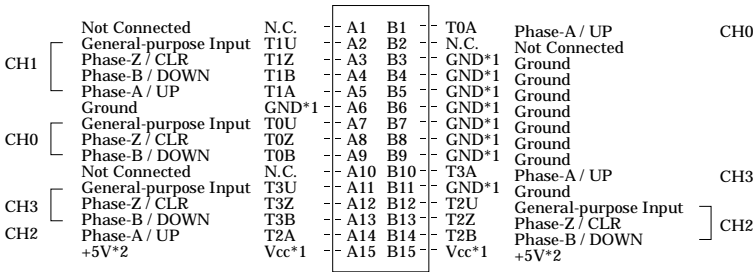


Figure 3.4. Connector used(CN2)



\*1: The VCC and GND signals are all common.  
\*2: Outputs +5V power supplied from the +5V pin in the PC to the external device.  
The maximum current flowing through these two Vcc pins together is 500mA.  
Use this pin to supply +5V power to an external device (such as an encoder) for simple checking.

Figure 3.5. Pin Assignment of an interface connector(CN2)

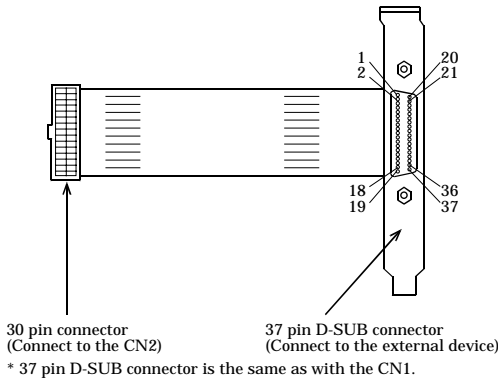
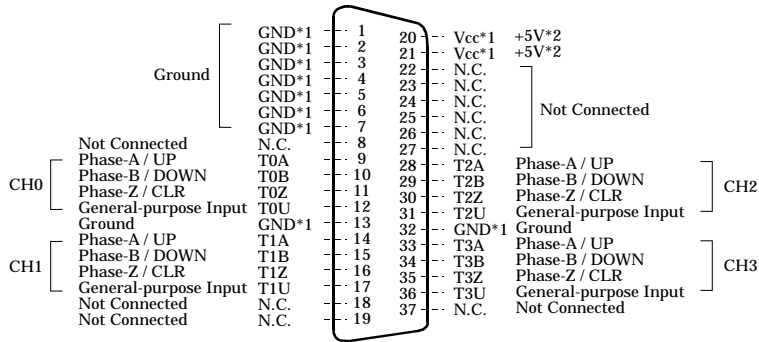


Figure 3.6. Optional Cable DT/B2



\*1: The VCC and GND signals are all common.  
\*2: Outputs +5V power supplied from the +5V pin in the PC to the external device.  
The maximum current flowing through these two Vcc pins together is 500mA.  
Use this pin as +5V power supply to an external device (such as an encoder) for simple checking.

Figure 3.7. Pin Assignments of an optional cable 37-Pin D-SUB

# Connection Method to the External device 1

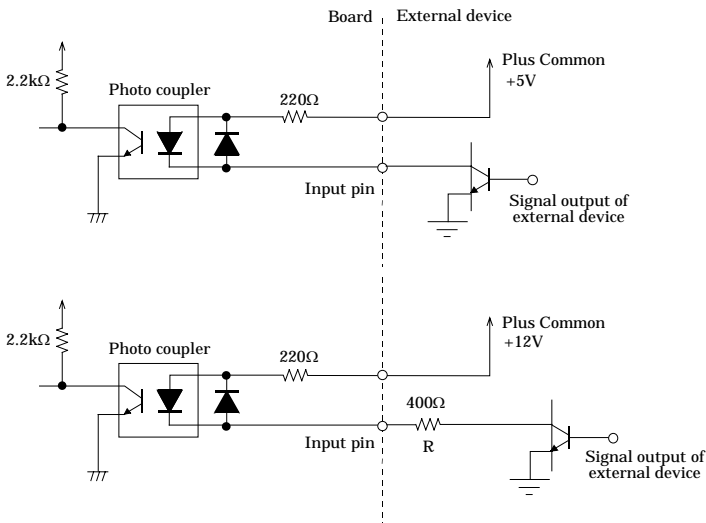
## -Photo coupler isolated Input-

### Photo coupler isolated Input Connection

Photo coupler isolated input connection with a rotary encoder or a linear scale open collector output circuit is shown in the Figure. The maximum input frequency is 500KHz.

For a two-phase input, connect both phase A and phase B. For a single phase input, connect to either phase A or phase B. If not using the Z phase, this does not need to be connected.

### Photo coupler Isolated Input Circuit



**Figure 3.8. Example Connection with the Photo Coupler Isolated Input Circuit**



### CAUTION

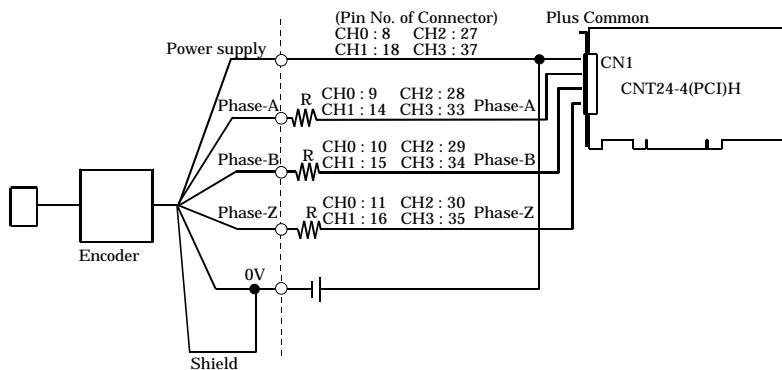
- The general input signal uses the same circuit structure.
- To use external power (other than 5V); insert a current limiting resistor at the R position. The following expression is used to calculate current limiting resistance R with the external power supply as PV:

$$\frac{P-5}{20} < Rk\Omega < \frac{P-5}{15}$$

If P=12, use a  $350\Omega < R < 470\Omega$  resistor.



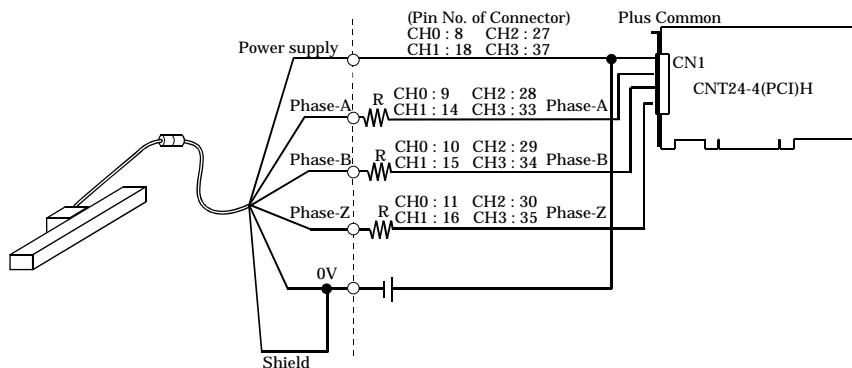
### Example Connection with a Rotary Encoder



\* If using 12V, 400Ω register is required in the position of R.  
If using 5V, it is not required.

**Figure 3.9. Example Connection with a Rotary Encoder (photo coupler isolated input)**

### Example Connection with a Linear Scale



\* If using 12V, 400Ω register is required in the position of R.  
If using 5V, it is not required.

**Figure 3.10. Example Connection with a Linear Scale (photo coupler isolated input)**

# Connection Method to the External device 2

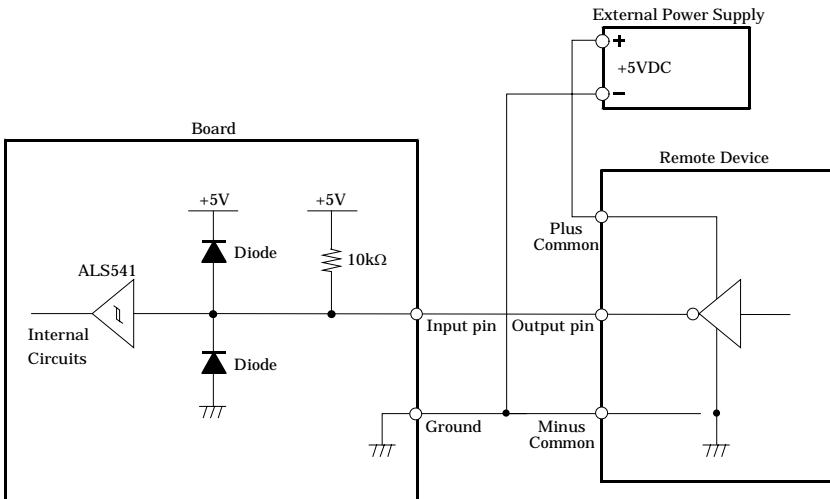
## -TTL-Level Input-

### TTL-Level Input Connection

Use the TTL-Level Input for the connection with a rotary encoder or a linear scale TTL-level output circuit. The maximum input frequency is 1MHz.

For a two-phase input, connect both phase A and phase B. For a single phase input, connect to either phase A or phase B. If not using the phase Z, this does not need to be connected.

### TTL-Level Input Circuit



**Figure 3.11. TTL-Level Input Circuit and Connection Example**



### CAUTION

- The general input signal uses the same circuit structure.
- The cable should be 1.5m or less.
- To prevent malfunction caused by noise, separate the circuit as much as possible from other signal cables and noise sources.

## Example Connection with a Rotary Encoder

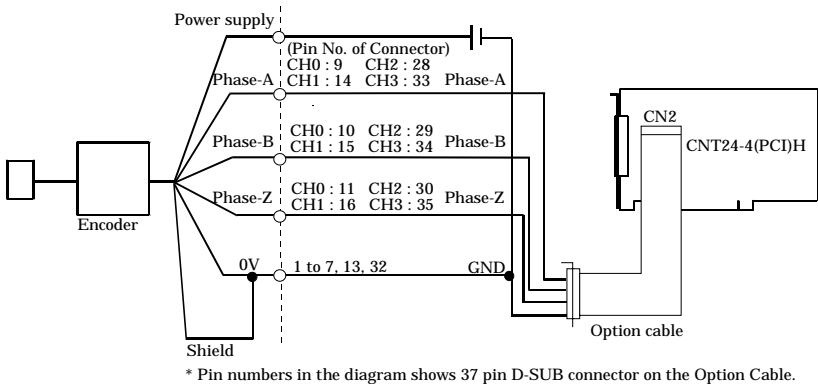


Figure 3.12. Example Connection with a Rotary Encoder (TTL Input)

## Example Connection with a Linear Scale

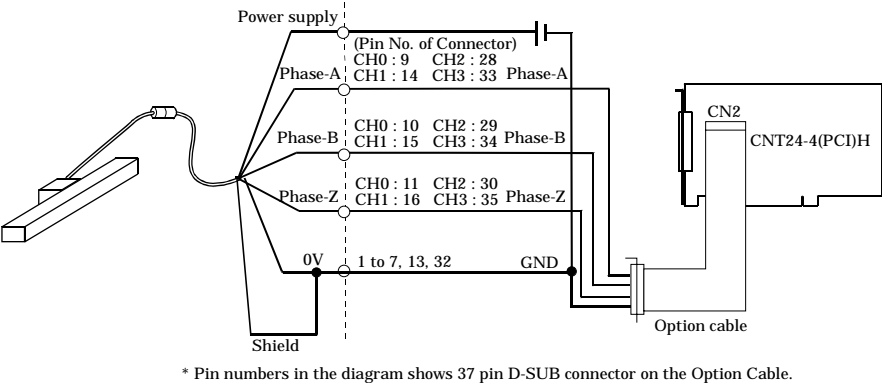


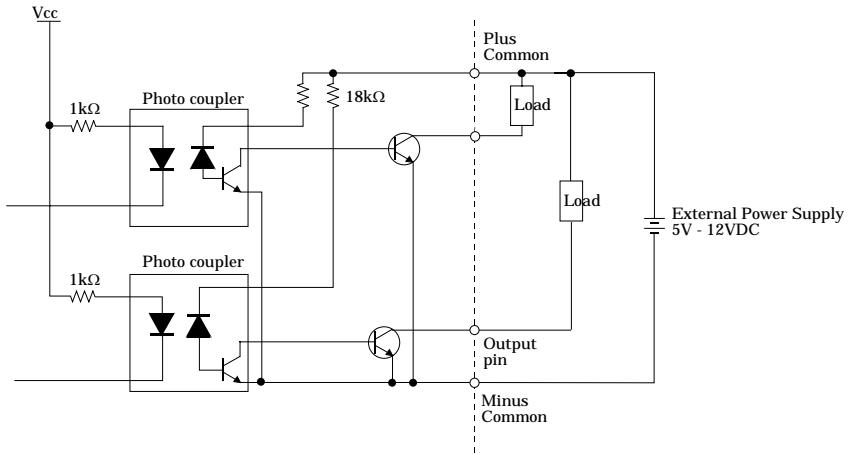
Figure 3.13. Example Connection with a Linear Scale (TTL Input)

# One-shot Pulse Output Connection

## One-shot Pulse Output Connection

When the count value of each channel and the user set value match, the circuit outputs a matched signal for one shot (1 pulse). The signal output part uses the open collector method by photo coupler insulation. As a result, an external power supply is needed to run the board output.

## Output Circuit and an Example Connection



**Figure 3.14. Output Circuit and an Example Connection**



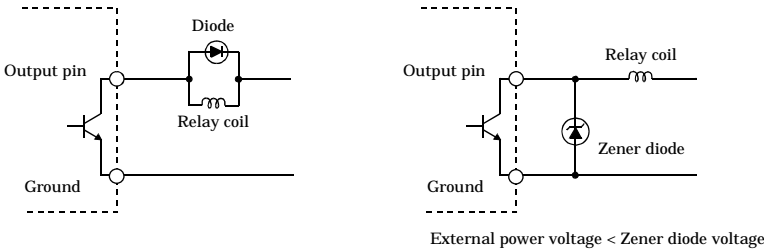
### CAUTION

The output of this board has no surge voltage protector. To drive an inductive load such as a relay or lamp using this board, apply surge voltage protection to the load side. For surge voltage protection, see “Surge Voltage Countermeasures” in the next section.

# 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 control output signal, 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



Examples of use of lump

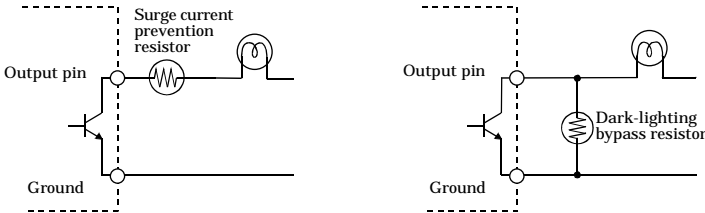


Figure 3.15. Samples of Surge Voltage Protection



## CAUTION

The protection circuit will not be effective unless it is installed less than 50cm from the load and contact.

## 4. Function

This section describes the features of the board.

### Types and Operations of Pulse Signals

#### Types of pulse signals

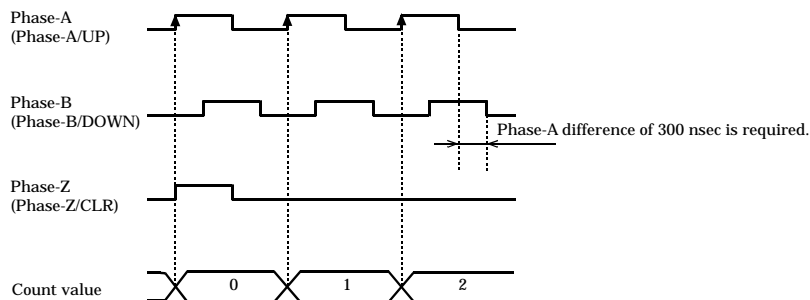
The following types of pulse signals (operation modes) can be set.

- 2-phase Input, Synchronous Clear, Multiply by 1
- 2-phase Input, Synchronous Clear, Multiply by 2
- 2-phase Input, Synchronous Clear, Multiply by 4
- 2-phase Input, Asynchronous Clear, Multiply by 1
- 2-phase Input, Asynchronous Clear, Multiply by 2
- 2-phase Input, Asynchronous Clear, Multiply by 4
- Single-phase Input, Asynchronous Clear, Multiply by 1
- Single-phase Input with Gate Control, Asynchronous Clear, Multiply by 1
- Single-phase Input with Gate Control, Asynchronous Clear, Multiply by 2

#### 2-phase Input

Two-phase pulse input consists of a phase A pulse (advanced signal) and a phase B (delayed signal) pulse that have 90 degrees of phase difference.

If the phase Z (reference position signal) is used, a Z pulse will reset count value of the two-phase pulse input to zero.

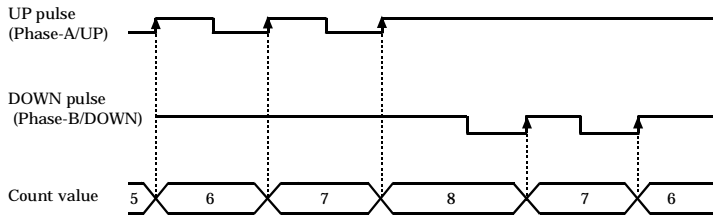


- \* Count operation for incremental counting in the CW direction. When decremental counting in the CW direction is set, the PC Card performs decremental counting at the rising edge of the phase-A signal.
- \* The minimum phase difference between phases-A and B is 300 nsec. Counting is not performed normally if the phase difference is less than 300 nsec.

**Figure 4.1. Example counting during 2-phase input**

## Single-phase Input

For a single-phase input, the count increments when an UP pulse is inputted and decremented when a DOWN pulse is inputted. The count remains unchanged if UP and DOWN pulses are inputted simultaneously.

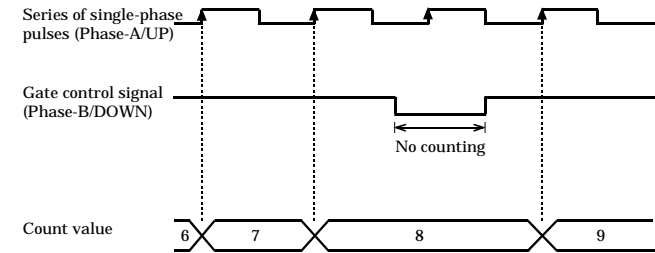


\* Count operation for incremental counting in the CW direction.  
When decremental counting in the CW direction is set, the PC Card performs decremental counting at the rising edges of positive pulse and incremental counting at the rising edges of negative pulses.

Figure 4.2. Example counting during single-phase input

## Single-phase Input with Gate Control

The counter can be started and stopped by using a gate control signal along with the single-phase pulse stream.



\* Count operation for incremental counting in the CW direction.  
When decremental counting in the CW direction is set, the PC Card performs decremental counting at the rising edges of the single-phase pulse train (phase-A/UP) while the gate control signal (phase-B/DOWN) goes high and stops counting while the gate control signal goes low.

Figure 4.3. Example counting during single-phase input with gate control

# Multiplication of Count Input

Setting the count input multiplication setting to two or four times enables you to fine-tune controlling.

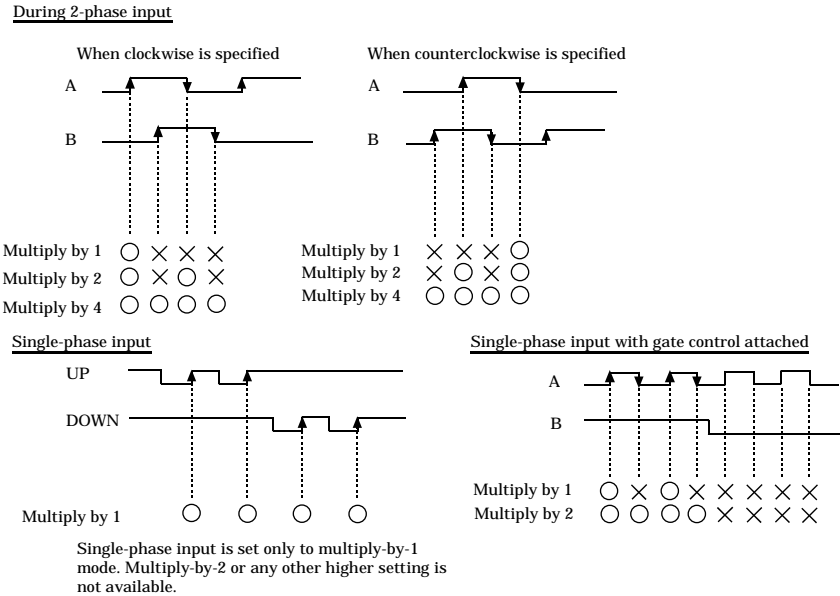


Figure 4.4. Example counting when count input multiplication is set

## Synchronous Clear

If a counter is set for CW (clockwise) direction Up-count and phase-Z positive logic, within a low level input of phase-B, a high level signal of phase-Z input will reset the count value of this counter; after this phase-Z input signal goes to low level, the following rising edge of the phase-A signal will start the counting operation..

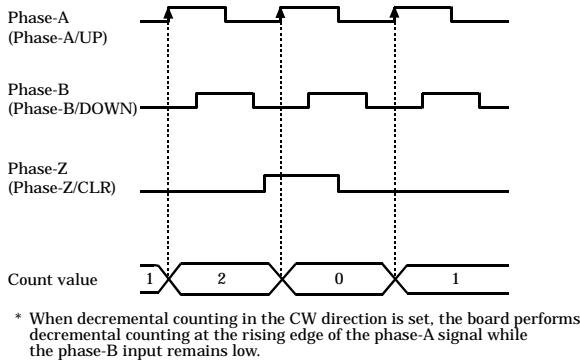


Figure 4.5. Example counting during synchronous clear





# Other Function

## Compare Register

Compare the count value of a corresponding channel with the compare register value. If these two values match, set status bit "EQ" to "0" (remains 0 as long as they are in agreement). This register can be set to any value from 0h to FFFFFFFh. It is possible either to cause an interrupt or to output a one-shot pulse to an external device when the two values match.

## Digital Filter

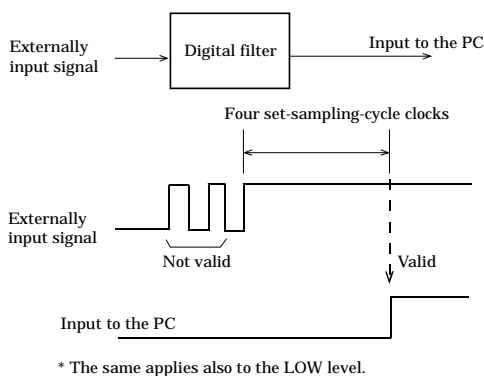
The digital filter allows the counter to operate normally even when noise enters into pulses input to the counter and/or into A-, B-, and Z-phase signals. The sampling clock cycle of the digital filter is determined by clock setting data for the digital filter.

When the input signal is sampled with this sampling clock and if HIGH (or LOW) is detected for duration of four continuous clocks, the digital filter outputs HIGH (or LOW) and communicates it to the counter circuit.

The cycle can be set in a range of 0.1μsec through 1,056.1μsec.

All externally input signals (except for general-purpose input signals) are fetched through the digital filter into the internal counter. They are fetched after a delay of four set-sampling-cycle clocks.

When initialized, externally input signals are fetched after a delay of 0.4μsec.



**Figure 4.8. Digital filter**



### CAUTION

- The initial state is set to 0.1μsec. (When the cycle is not specified, the cycle also defaults to 0.1μsec.)
- A delay of more than four set-cycle clocks may occur depending on noise.
- If a level changes at a frequency faster than the set-sampling-clock cycle, that level change is invalidated and not correctly counted. Be sure to input signals which are less than the input frequency.

## Programmable Timer

The programmable timer can generate interrupts at cycles according to a 32-bit setting data. The timer can be set in a range of 1msec through 200sec.

## One-shot Pulse

When the count value of a channel matches a preset compare value, this channel will generate a one-shot pulse. The width of this pulse is the same for all channels and is determined by set data. The width can be set in a range of 0 through 104.45msec.



### CAUTION

---

- The default state is set to "pulse width=0 (do not output).
  - Pulse widths may slightly vary depending on the specifications of a connected load.
-

## Status Data

You can monitor each signal input, counting direction, count matching and abnormal input statuses.

AI.....This bit is set to "1" to indicate an abnormal pulse input if a simultaneous change of phases A and B is detected during 2-phase input or a simultaneous change of UP and DOWN pulses is detected during up/down input.

- 1 : Detect abnormal input.
- 0 : Do not detect abnormal input.

Z.....Indicates phase Z input status.

< When set to positive logic >

- 1 : Phase Z input status[1]
- 0 : Phase Z input status[0]

< When set to negative logic >

- 1 : Phase Z input status[0]
- 0 : Phase Z input status[1]

A.....Indicates phase A input status.

- 1 : Phase A input status[1]
- 0 : Phase A input status[0]

B.....Indicates phase B input status.

- 1 : Phase B input status[1]
- 0 : Phase B input status[0]

U/D.....Count-direction operating status

This status bit indicates the direction in which the current up/down counter is operating.

- 0 : Engaged in counting up.
- 1 : Engaged in counting down.

EQ.....Detects and outputs match or mismatch.

- 0 : The count value matches compare register's contents.
- 1 : The count value does not match compare register's contents.

U.....Indicates the general-purpose input status.

- 1 : General-purpose input status[1]
- 0 : General-purpose input status[0]



### CAUTION

---

- The initial state varies with external connection states.
  - A, B, and Z phase statuses lag by four cyclical clocks since the status data is available after the filter function is processed. The general-purpose input status indicates the external input status as it is.
-



## 5. About Software

### CD-ROM Directory Structure

\	
— Autorun.exe	Installer Main Window
Readmej.html	Version information on each API-TOOL (Japanese)
Readmeu.html	Version information on each API-TOOL (English)
.	
— APIPAC	Each installer
— AIO	
— DISK1	
— DISK2	
— .....	
— DISKN	
— AioWdm	
— CNT	
— DIO	
— .....	
.	
— HELP	HELP file
— Aio	
— Cnt	
— .....	
.	
— INF	Each INF file for OS
— WDM	
— Win2000	
— Win95	
.	
— linux	Linux driver file
— cnt	
— dio	
— .....	
.	
— Readme	Readme file for each driver
.	
— Release	Driver file on each API-TOOL
— API_NT	(For creation of a user-specific install program)
— API_W95	
.	
— UsersGuide	Hardware User's Guide(PDF files)

## About Software for Windows

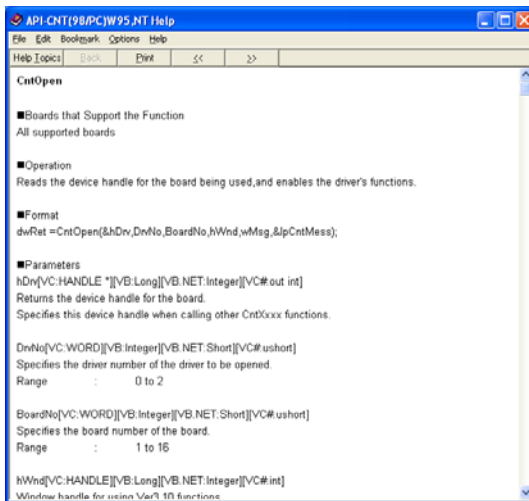
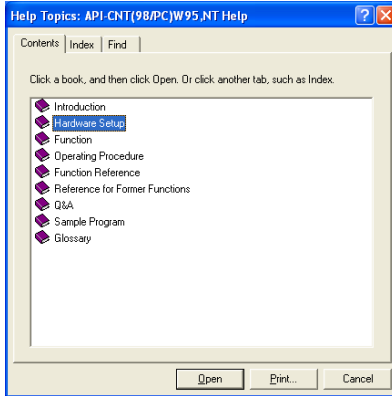
The bundled CD-ROM “Driver library API-PAC(W32)” contains the functions that provide the following features:

- Read current count value of a specified channel
- Read current status register of a specified channel
- Set for using hardware digital filter function to prevent signal chattering
- Pre-set a target data and to allow the counter to output a one-shot pulse when the count data of this specified channel matched this target data.

For details, refer to the help file. The help file provides various items of information such as “Function Reference”, “Sample Programs”, and “FAQs”. Use them for program development and troubleshooting.

## Accessing the Help File

- (1) Click on the [Start] button on the Windows taskbar.
- (2) From the Start Menu, select “Programs” – “CONTEC API-PAC (W32)” – “Cnt” – “API-CNT HELP” to display help information.





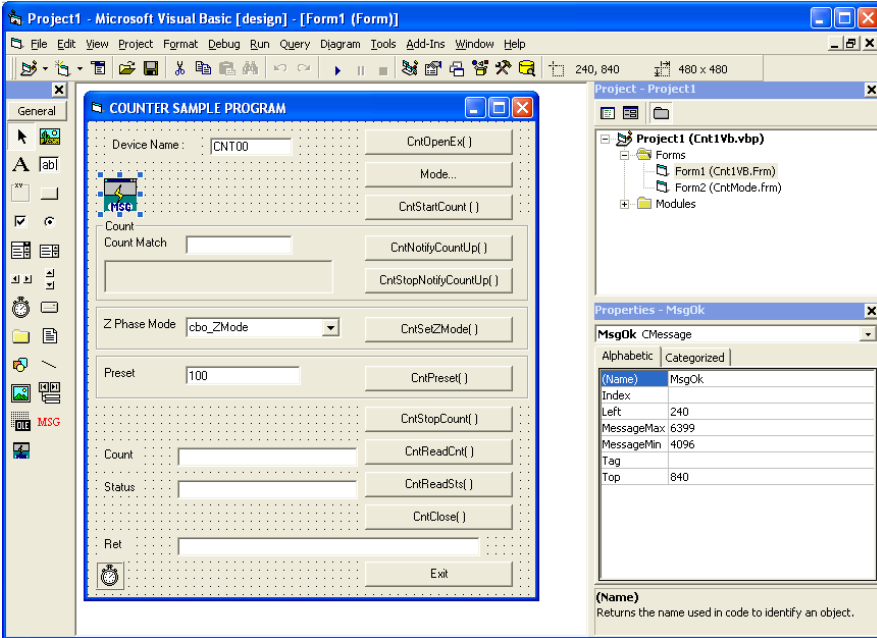
## Using Sample Programs

Sample programs have been prepared for specific basic applications.

To use each sample program, enter its driver number and group number set by API-TOOL Configuration in the DrvNo and GrpNo fields.

Use these sample programs as references for program development and operation check.

The sample programs are stored in \Program Files\CONTEC\API-PAC(W32)\Cnt\Samples.



## Sample Programs – Examples

- Counter Sample CNT1 : Basic actions of counting input signals.
- Timer Sample CNT2 : Using programmable timer to generate interrupt requests periodically.

**[Sample program 1]**

**COUNTER SAMPLE PROGRAM**

Device Name :

Count

Count Match

Z Phase Mode

Preset

Count

Status

Ret

**[Sample program 2]**

**TIMER TEST PROGRAM**

Device Name :

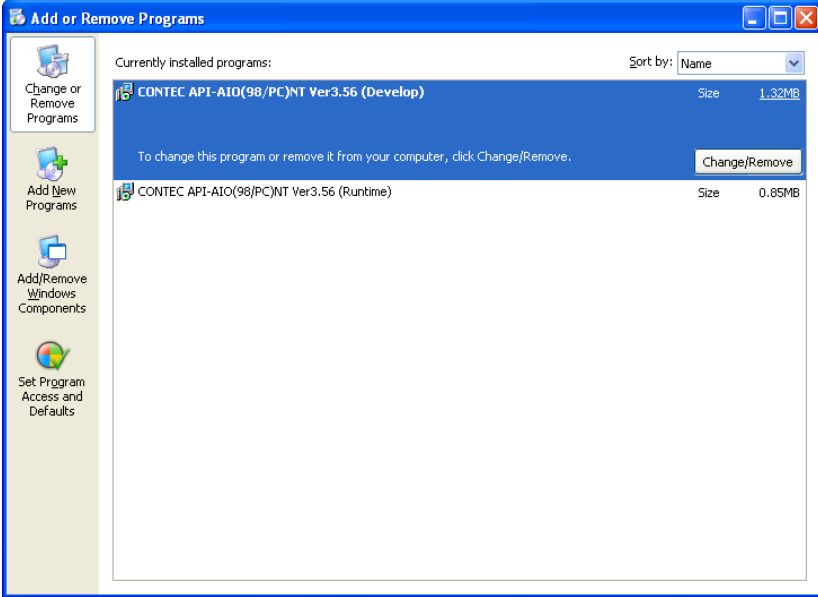
Time Match  ms

Ret

## Uninstalling the Driver Libraries

To uninstall API-PAC(W32), follow the procedure below.

- (1) Click on the [Start] button on the Windows taskbar. From the Start Menu, select “Control Panel”.
- (2) Double-click on the “Add or Remove Programs” in the Control Panel.
- (3) Select “CONTEC API-CNT(98/PC)xx” and then click on the [Change/Remove] button. Follow the on-screen instructions to uninstall the function libraries.



# About Software for Linux

The Linux version of counter driver, API-CNT(LNX), provides functions that execute the following features:

- Pulse input mode setting
- Count value acquisition
- Count-match or time-based interrupt response

For details, refer to the help file. The help file provides various items of information such as “Function Reference”, “Sample Programs”, and “FAQs”. Use them for program development and troubleshooting.

## Driver Software Install Procedure

The Linux version of counter driver, API-CNT(LNX), is supplied as a compressed file /linux/cnt/ccntXXX.tgz on the bundled API-PAC(W32)CD-ROM. (Note: XXX represents the driver version.)

Mount the CD-ROM as shown below, copy the file to an arbitrary directory, and decompress the file to install the driver.

For details on using the driver, refer to readme.txt and the help file in HTML format extracted by installation.

To install the driver, log in as a super user.

Decompression and setup procedure

```
# cd
# mount /dev/cdrom /mnt/cdrom           Mount the CD-ROM.
# cp /mnt/cdrom/linux/dio/cdioXXX.tgz ./ Copy the compressed file.
# tar xvfz cdioXXX.tgz                 Decompress the compressed file.
.....
# cd contec/cdio
# make                                Compile the file.
.....
# make install                        Install.
.....
# cd config
# ./config                           Set up the board to be used.
..... Set as follows.....
# ./contec_dio_start.sh              Start the driver.
# cd
```

## Accessing the Help File

- (1) Invoke a web browser in your X-Window environment.
- (2) In the browser, open cnthelp.htm in the contec/ccnt/help directory.

## Using Sample Programs

Sample programs have been prepared for specific basic applications.

Sample programs for each language are contained in the contec/ccnt/samples directory. For compiling them, refer to the manual for the desired language.

## Uninstalling the driver

To uninstall the driver, use the uninstall shell script contained in the contec/ccnt directory. For details, check the contents of the script.

## 6. About Hardware

This chapter provides hardware specifications and hardware-related supplementary information.

### Hardware specification

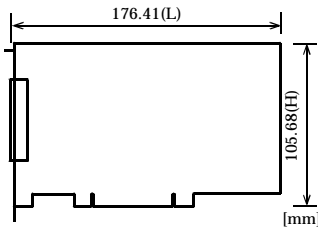
Tables 6.1 list the hardware specifications of the board.

**Table 6.1. Specification**

Item	Specification
<b>Counter Input</b>	
Number of Channels	4 Channels
Count system	Up/down counting
Max. count	FFFFFFH (binary data)
Counter input type	Photo coupler isolated input or TTL-level input
Counter input signal	Phase-A/UP 1 x 4 channels Phase-B/DOWN 1 x 4 channels Phase-Z/CLR 1 x 4 channels General-purpose input 1 x 4 channels
Input register	220Ω (photo coupler insulation) or more, 1TTL loading (TTL-level)
Input protection circuit	None
Response frequency	Photo coupler isolated input 500KHz duty 50% (Max.) TTL-level input 1MHz duty 50% (Max.)
Interrupt level	One interrupt caused upon channel count match or timer time-out
External power	5V - 12VDC ±10% Min. 400mA (Required for photo coupler isolated input)
Photo coupler input current	Photo coupler primary current 15 - 25mA
Digital filter	0.1μsec - 1056.1μsec (can be independently set for each channel.)
Timer	1msec - 200sec
<b>Match signal output</b>	
Output point	1 x 4 channels
Output type	Photo coupler isolated open collector output
Output rating	35VDC, 50mA(Max.) (per 1 point)
Output signal width	0 - 104.45msec (All channels)
Output protection circuit	None
External power	5V - 12VDC±10%
<b>Common</b>	
I/O address	8 bits x 32 ports boundary
Power consumption	5VDC 250mA Max.
Operating condition	0 - 50°C, 10 - 90%RH (No condensation)
PCI bus specification	32bit, 33MHz, Universal key shapes supported *1
Dimension (mm)	176.41(L) x 105.68(H)
Weight	130g

\*1 This board requires power supply at +5V from an expansion slot (it does not work on a machine with a +3.3V power supply alone).

Board Dimensions



The standard outside dimension (L) is the distance from the end of the board to the outer surface of the slot cover.

Block Diagram

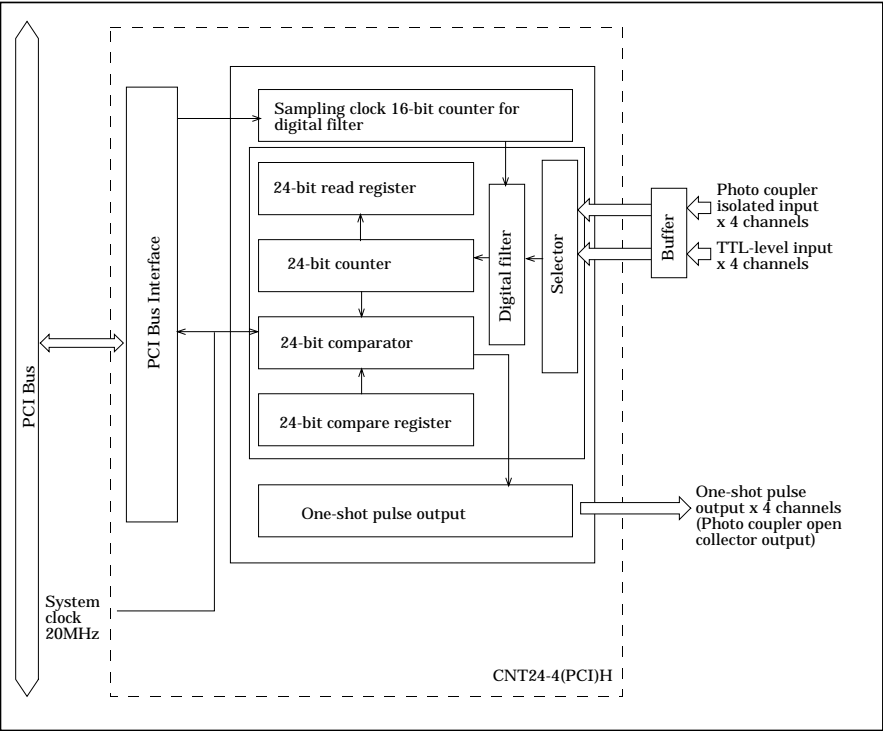


Figure 6.1. Block Diagram

## Differences between the CNT24-4(PCI)H and CNT24-4(PCI)

The CNT24-4(PCI)H partially enhanced version of the conventional products of CNT24-4(PCI) and it is upper compatible with CNT24-4(PCI).

There are some differences in specifications as shown below.

	CNT24-4(PCI)	CNT24-4(PCI)H
I/O address	8 bits x 4 ports boundary	8 bits x 32 ports boundary
Power consumption	5VDC 400mA (Max.)	5VDC 250mA (Max.)
PCI bus specification	32bit, 33MHz, 5V	32bit, 33MHz, Universal key shapes supported (Supply 5V to the 5V pin)
Interrupt signal resource setting	Set to select whether to use jumper JP1	Automatically set by PC
Dimension (mm)	121.69(L) x 106.68(H)	121.69(L) x 105.68(H)



# CNT24-4(PCI)H

## User's Guide

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February 2005 Edition

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[02082005]

Management No. A-51-004

Parts No. LYES101