PC-HELPER

Bi-Directional Digital I/O Card
for CardBus
PIO-48D(CB)H
User's Guide

CONTEC CO.,LTD.

Check Your Package
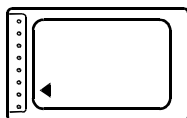
Thank you for purchasing the CONTEC product.

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.
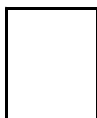
Product Configuration List

- PC Card [[PIO-48D(CB)H] …1

- First step guide …1

- CD-ROM [API-PAC(W32) *1] …1

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

PC card

First step guide

CD-ROM
[API-PAC(W32)]

Copyright

Trademarks

Table of Contents

1. Before Using the Product

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

About the PC Card

This board is a Type II size, CardBus, PC Card that complies with the PC Card Standard. The board performs input and output of LVTTL level signals.

PIO-48D(CB)H can input and output up to 48 channels.

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

Features

- This board can be used to input/output 48 points bi-directional digital corresponding to the i8255 mode 0.

- Uninsulated LVTTL-level input/output enabling fast response.

- Functionally equivalent to the PIO-48D(PCI) PCI bus board.

- The connector signal assignments when the DIO-68M/96F cable is used are the same as the cable connector signal assignments for the PCB96P-** series and the PCB96PS-**P series option cable on the PIO-48D(PCI).

- You can use all of the input signals as interrupt inputs.
  You can also select the interrupt trigger edge of the input signal.

- A digital filter function is included to prevent problems due to noise or chattering on input signals.

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 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, Me, 98, etc..
Adaptation language	Visual C/C++, Visual Basic, Delphi, Builder, etc..
Others	Each piece of library software requires 50 megabytes of free hard disk space.

Linux version of digital I/O driver API-DIO(LNX) (Supplied: Stored on the API-PAC(W32) CD-ROM)

This driver is used to control CONTEC digital I/O boards (PC cards) from within Linux.
You can control CONTEC I/O boards easily using the shared library used by gcc and Kylix, the device driver (module) for each kernel version, and the board (PC card) configuration program (config).
CONTEC provides download services 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, etc..
Others	Requires 3 megabytes of free hard disk space.

Base package of ActiveX components for measurement system development
ACX-PAC(W32)BP (Option)

This is a set of useful Windows development tools for measurement systems and consists of a software component library with ready-to-use samples which you can combine for easy programming.
The package contains components for controlling CONTEC I/O boards (PC cards). Features include interface control for analog I/O, digital I/O, GPIB communications, and counter inputs, as well as X-Y plotting and file storage support.
Check the CONTEC's Web site for more information on this soft.

Advanced package of ActiveX components for measurement system development
ACX-PAC(W32)AP (Option)

Complements the ACX-PAC(W32)BP functions with additional components including graphics (plotting, switches, and lamps, etc.) and mathematical and analysis tools.
Check the CONTEC's Web site for more information on this soft.

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.co.jp/vidaq/ for details and download of VI-DAQ.

Cable & Connector (Option)

Shielded Cable for CardBusDigital I/O Card   : DIO-68M/96F (0.5m)

Shield Cable with One 68-Pin Connector   : PCA68PS-0.5P (0.5m)

                                                  : PCA68PS-1.5P (1.5m)

Accessories (Option)

Relay Terminal Unit for Crimping   : EPD-96 *1

Terminal Unit for Cables   : DTP-64(PC) *1

*1 DIO-68M/96F optional cable 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 products 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 products. The warranty is not applicable if the device has been tampered with or damaged through abuse, mistreatment, neglect, or unreasonable use, or if the original invoice is not included, in which case repairs will be considered beyond the warranty policy.

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

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.

⚠ CAUTION

- Do not strike or bend the PC card.
  Otherwise, the PC card may malfunction, overheat, cause a failure or breakage.
- 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.
- Power saving mode (standby mode) is not supported.
- Restrictions apply to the current able to be supplied from PC card slots. Please check the ratings in the manual for your PC.

Environment

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

Operating temperature

0 to 50°C

Operating humidity

10 to 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 bus connector have no stain or corrosion.

- Check that the bus connector and its cable have been plugged correctly.
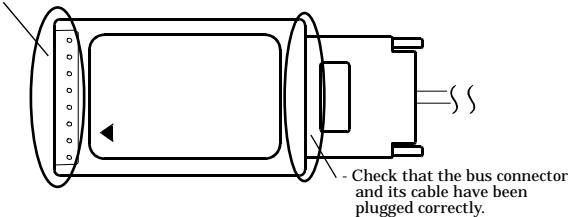
Storage

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

(1) Put the PC card 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 PC card.

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 PC card 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 PC card 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 PC card 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 manual 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 PC card under an OS other than Windows

For using the PC card under Linux, see the following parts of this manual.

This chapter Step 2 Setting the Hardware

Chapter 3 External Connection

Chapter 5 About Software

Chapter 6 About Hardware

For using the PC card under an OS other than Windows and Linux, see the following parts of this manual.

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.**
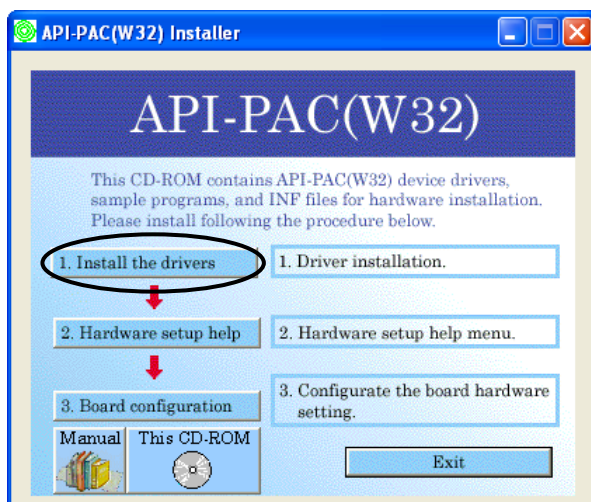
⚠ **CAUTION**

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

(1) **The following dialog box appears to select "Driver Type" and "Install Type".**

(2) **Select "Digital I/O".**

(3) **Select "Driver, Help, etc… (Full install)".**

(4) **Click on the [Install] button.**
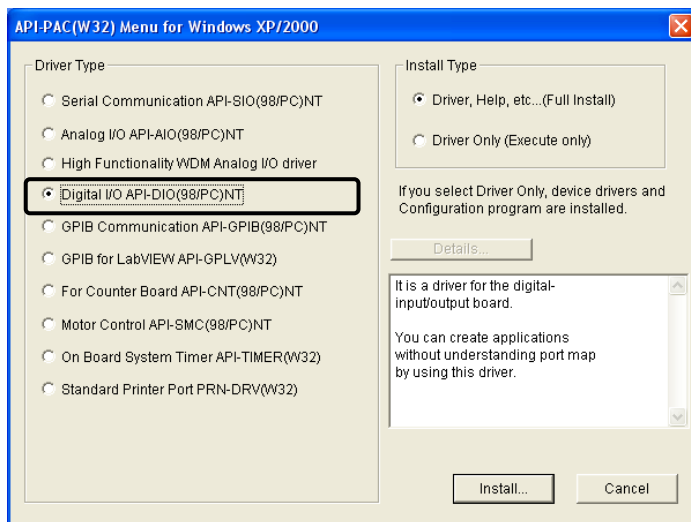
Executing the Installation

(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 the "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", then go to Step 4 "Initializing the Software".
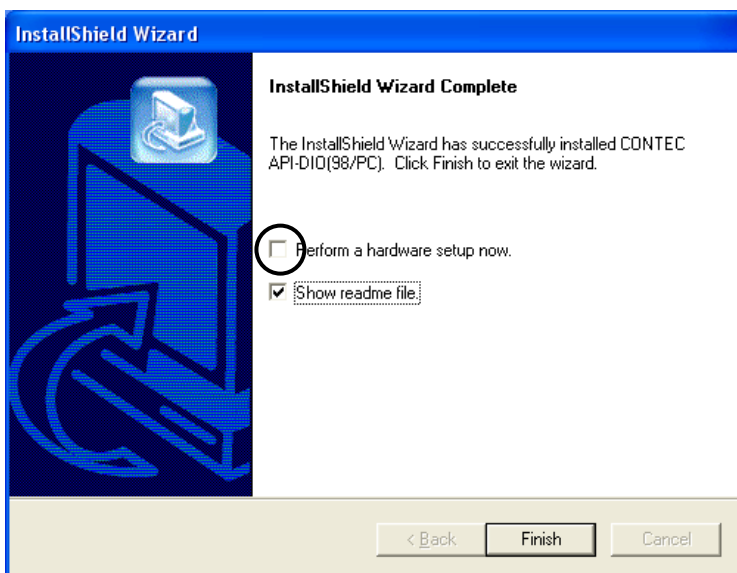
You have now finished installing the software.

Step 2 Setting the Hardware

The following explains how to insert the PC card into the PC.

Connecting the PC Card to the Connection Cable

Plug the PC card connecter of the optional cable DIO-68M/96F or PCA68PS-** P into the PIO-48D(CB)H PC card. The flat side of the connecter should face the same way as the topside of the card as shown in Figure 2.1.

⚠ CAUTION

- When plugging in the cable, align the cable connector with the PC card socket and push firmly into place. Do not apply any excessive force to the socket on the PC card as this may damage the socket or result in a bad connection.

- Do not insert or remove connectors or the PC card while the PC power is turned on.
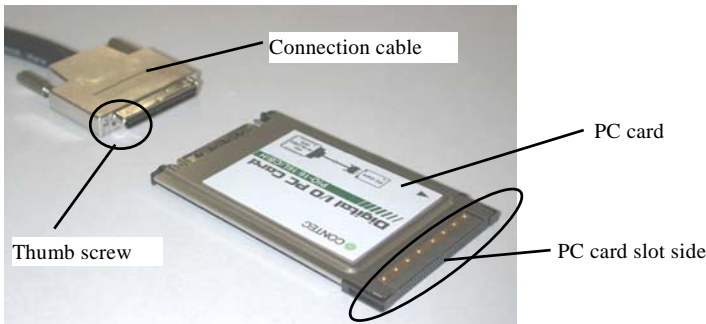
Figure 2.1. Connecting the PC Card to the Connection Cable

Insert the PC Card

Check that the power to the PC is turned off and insert the PC card into the PC card slot on the PC.

Firmly insert the PC card into the slot with the orientation indicated by the arrow symbol on the PC card, as shown in Figure 2.2.
The PC card has a key to prevent it from being inserted incorrectly. Do not try to force the PC card into the slot the wrong way around as this may damage the PC card or the slot on the PC. Also, check the PC card slot on your PC as the slots on some PCs are oriented so that PC cards is inserted with the topside facing down.

Refer to the manual for your PC for instructions on how to remove the PC card.
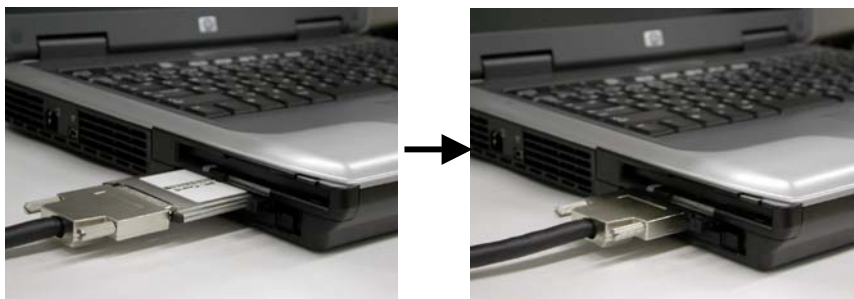
Figure 2.2. Insert the PC Card

⚠ CAUTION

Take note of the following points as inappropriate handling of the PC card may damage the PC card or connector socket and may result in a bad connection.

- Always insert the PC card with the correct orientation and in accordance with the instructions.

- Do not hold the PC card by the cable or connector when inserting the PC card into the slot

- Do not move the PC with the cable still plugged in.

- Do not apply any excessive force to the cable socket on the PC card such as by pulling on the cable connector.

- Do not place any objects on top of the cable connector.

Cautions When Using Two or More PIO-48D(CB)H PC Cards

If your PC has two TYPE II size PC card slots one on top of the other, you cannot use PIO-48D(CB)H PC cards in both slots at the same time. This is because of the shape of the cable connector.

However, you can use the PIO-48D(CB)H together with another PC card that does not require an external connector such as a memory PC card.
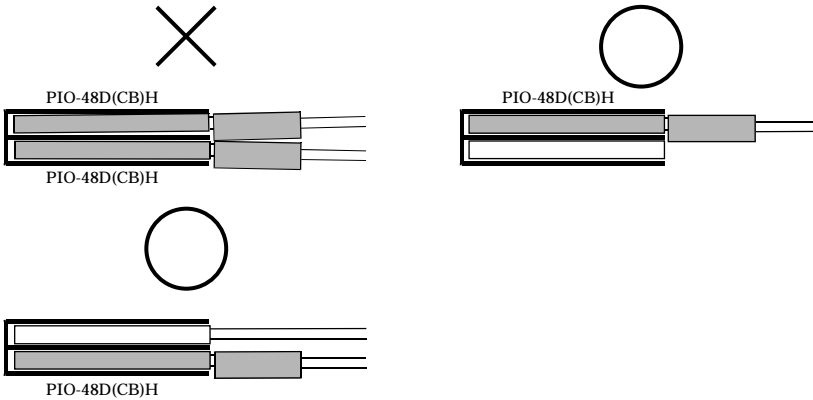
Figure 2.3. Cautions When Using Two or More PIO-48D(CB)H PC Cards

⚠ CAUTION

Using two or more cards at the same time may not be possible depending on the number and arrangement of PC card slots and on the driver specifications. Refer to the driver help file for details of the driver specifications.

Step 3 Installing the Hardware

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

When using more than one PC card, install the PC cards one at a time and do not install the next PC card until setup is complete for the previous PC card.

Turning on the PC

Turn on the power to your PC.

⚠ CAUTION ───

The PC card cannot be properly installed unless the resources (I/O addresses and interrupt level) for the PC card can be allocated. Before attempting to install the PC card, first determine what PC resources are free to use.

Setting with the Found New Hardware Wizard

(1) The "Found New Hardware Wizard" appears.
Select "Install from a list or specific location [Advanced]" and click the "Next" button.

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

* The name of the PC card you have just added is displayed.
- PIO-48D(CB)H

Source folder

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

Windows XP, 2000   \INF\Win2000\Dio\PCCard
Windows Me, 98   \INF\Win95\Dio\PCCard

Example of specifying the folder for use under Windows XP

\INF\Win2000\Dio\ PCCard
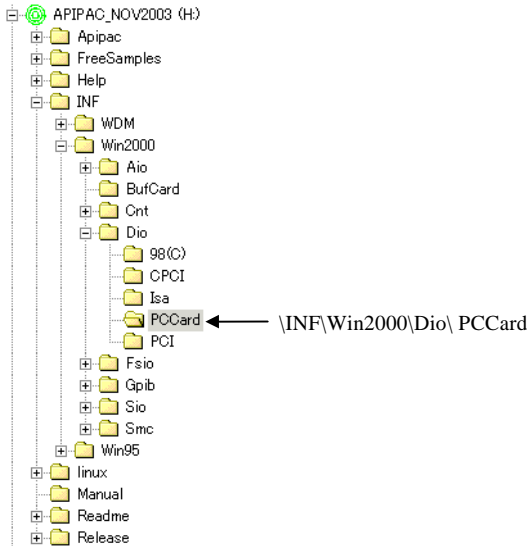
⚠ CAUTION

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 PC card.

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

* The name of the PC card you have just added is displayed.
- PIO-48D(CB)H
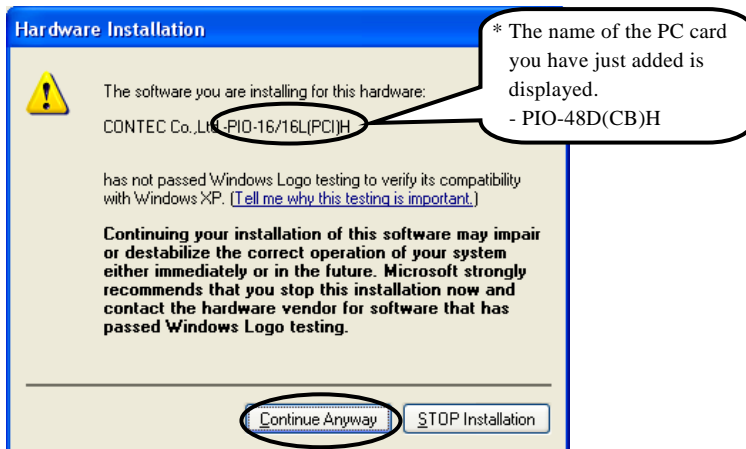
You have now finished installing the software.

Step 4 Initializing the Software

The Driver 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".
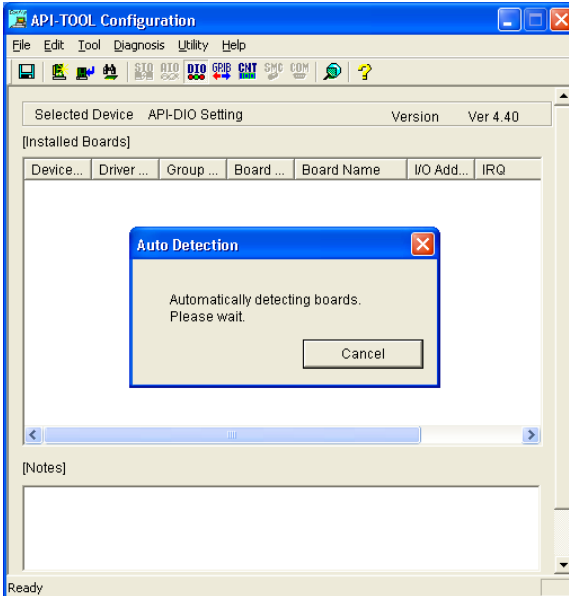
(2) API-TOOL Configuration detects the hardware automatically.
The detected the PC cards are listed.

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 PC card 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 PC card 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 PC card, I/O status, and interrupt status.

Check Method

Connect the PC card to a remote device to test the input/output and check the execution environment.
To connect the external device, see Chapter 3 "External Connection".

Using the Diagnosis Program

Starting the Diagnosis Program

Select the PC card in the API-TOOL Configuration windows, then run the Diagnosis Program. Run as the following screen.

* The name of the PC card you have just added is displayed.

* The name of the PC card you have just added is displayed.
- PIO-48D(CB)H
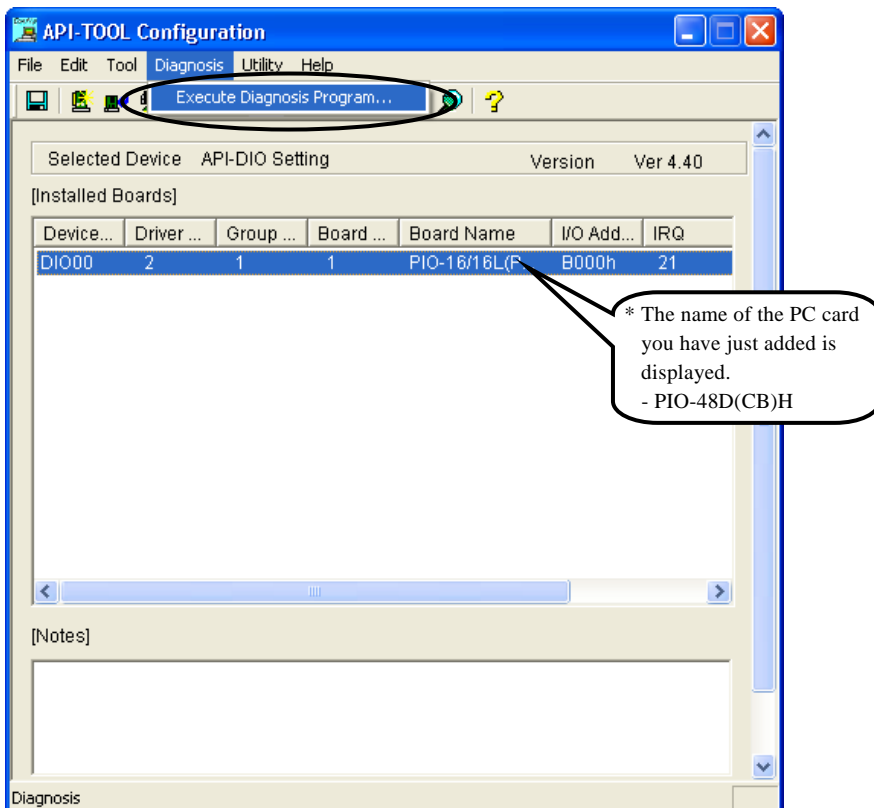
Checking Digital Inputs and Outputs

The main panel of the Diagnosis Program appears.

You can check the current operation states of the PC card in the following boxes:

"Input Port" : Displays input values bit by bit at fixed time intervals.

"Output Port" : Mouse operation allows the data to output or display.

"Interrupt" : Displays the number of interrupts detected bit by bit.

* The name of the PC card you have just added is displayed.
  - PIO-48D(CB)H
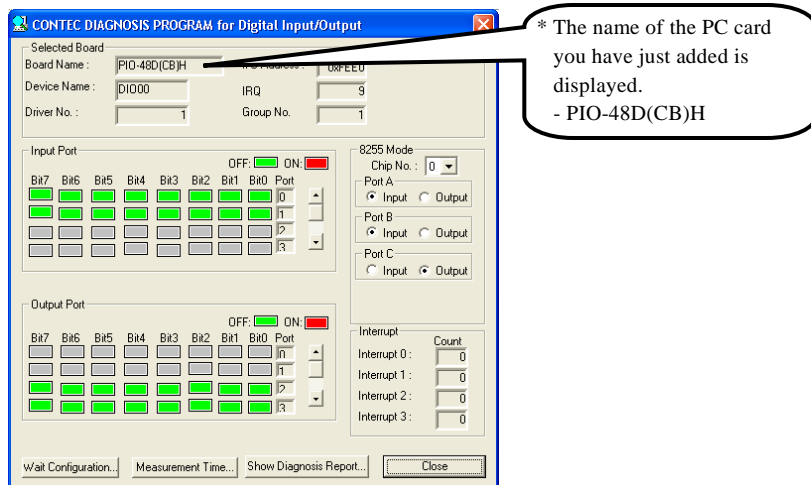
To use the wait time control feature, click on the [Wait Configuration] button. Use the feature when the wait time based on the DioWait or DioWaitEx function is not normal.

To use the function execution time measurement feature, click on the [Measurement Time] button. Enter the I/O start port and the number of ports, then press the measurement button. The time for each execution of a function will be measured.

Diagnosis Report

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

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

The Diagnosis Program performs "PC card presence/absence check", "driver file test", "PC card setting test", and so on.

⚠ CAUTION

Before executing diagnosis report output, unplug the cable from the PC card.

* The name of the PC card you have just added is displayed.
-PIO-48D(CB)H

Click on [Show Diagnosis Report].
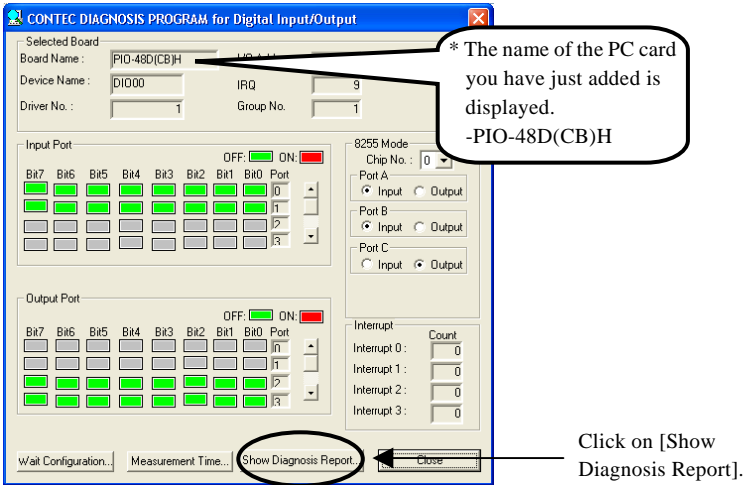
(2) A diagnosis report is displayed as shown below.

* The name of the PC card you have just added is displayed.
- PIO-48D(CB)H
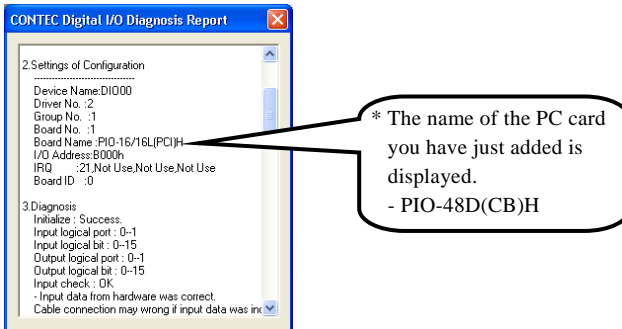
Setup Troubleshooting

Symptoms and Actions

No output can be obtained.

Use API-TOOL Configuration to check whether the PC card name setting is wrong.

The PC card works with the Diagnosis Program but not with an application.

The Diagnosis Program is coded with API-TOOL functions. As long as the PC card operates with the Diagnosis Program, it is to 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.

- When the PC card is an isolated type, it has a time lag for its response between the output by a function and the actual output. Consider the execution intervals between functions.

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

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

If your problem cannot be resolved

Contact your retailer.

3. External Connection

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

Using the On-board Connectors

Connecting a Device to a Connector

The optional connector cable (DIO-68M/96F or PCA68PS-**P) is used to connect the PC card to external devices. The cable is used together with a terminal block to connect external devices.

<DIO-68M/96F>
- Cable
  68conductor Shield cable
  Cable length : 500mm
  Conductor size : AWG#30

A48[1]   B48[49]

- Appricable connectors
  96-pin half-pitch, female connector
  PCR-E96FA[HONDA] or equivalent

- [ ]shows the pin No. of HONDA specification.

A01[48]   B01[96]

<PCA68PS> - Cable
  68conductor Shield cable
  Cable length : PCA68PS-0.5P 500mm
               PCA68PS-1.5P 1500mm
  Conductor size : AWG#30

Laminate side

150mm

1
35
2
36
:
33
67
34
68

Figure 3.1. Interface Connector and Applicable Cable Connector

Relay terminal stand

Optional cable

DIO-68M/96F

Relay Terminal Unit for Crimping
EPD-96

PIO-48D(CB)H

Optional cable

PCA68PS-**P

Terminal Unit for Cables
DTP-64(PC)
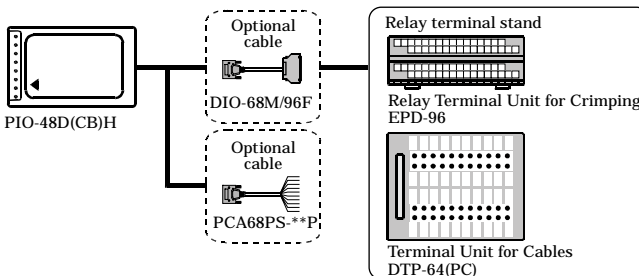
Figure 3.2. Examples of Connecting Options

Connector Pin Assignment

Pin Assignments of Interface Connector for PIO-48D(CB)H

```
                  ┌─ GND ─┤  1   35 ├─ GND ─┐
                  │  GND ─┤  2   36 ├─ GND   │
            ┌─    │  1-PA0 ┤  3   37 ├─ 2-PA0 │    ─┐
            │     │  1-PA1 ┤  4   38 ├─ 2-PA1 │     │
            │     │  1-PA2 ┤  5   39 ├─ 2-PA2 │     │
  1-A port  │     │  1-PA3 ┤  6   40 ├─ 2-PA3 │     │  2-A port
            │     │  1-PA4 ┤  7   41 ├─ 2-PA4 │     │
            │     │  1-PA5 ┤  8   42 ├─ 2-PA5 │     │
            │     │  1-PA6 ┤  9   43 ├─ 2-PA6 │     │
            └─    │  1-PA7 ┤ 10   44 ├─ 2-PA7 │    ─┘
                  │  GND ─┤ 11   45 ├─ GND    │
                  │  GND ─┤ 12   46 ├─ GND    │
            ┌─    │  1-PB0 ┤ 13   47 ├─ 2-PB0 │    ─┐
            │     │  1-PB1 ┤ 14   48 ├─ 2-PB1 │     │
            │     │  1-PB2 ┤ 15   49 ├─ 2-PB2 │     │
  1-B port  │     │  1-PB3 ┤ 16   50 ├─ 2-PB3 │     │  2-B port
            │     │  1-PB4 ┤ 17   51 ├─ 2-PB4 │     │
            │     │  1-PB5 ┤ 18   52 ├─ 2-PB5 │     │
            │     │  1-PB6 ┤ 19   53 ├─ 2-PB6 │     │
            └─    │  1-PB7 ┤ 20   54 ├─ 2-PB7 │    ─┘
                  │  GND ─┤ 21   55 ├─ GND    │
                  │  GND ─┤ 22   56 ├─ GND    │
  1-C port  ┌─    │  1-PC0 ┤ 23   57 ├─ 2-PC0 │    ─┐ 2-C port
  (Low)     │     │  1-PC1 ┤ 24   58 ├─ 2-PC1 │     │ (Low)
            │     │  1-PC2 ┤ 25   59 ├─ 2-PC2 │     │
            └─    │  1-PC3 ┤ 26   60 ├─ 2-PC3 │    ─┘
                  │  GND ─┤ 27   61 ├─ GND    │
                  │  GND ─┤ 28   62 ├─ GND    │
  1-C port  ┌─    │  1-PC4 ┤ 29   63 ├─ 2-PC4 │    ─┐ 2-C port
  (High)    │     │  1-PC5 ┤ 30   64 ├─ 2-PC5 │     │ (High)
            │     │  1-PC6 ┤ 31   65 ├─ 2-PC6 │     │
            └─    │  1-PC7 ┤ 32   66 ├─ 2-PC7 │    ─┘
                  │  GND ─┤ 33   67 ├─ GND    │
                  └─ GND ─┤ 34   68 ├─ GND ──┘
```

Figure 3.3. Pin Assignments of Interface Connector

Signal assignment with the DIO-68/96F used

	[1]	[49]	
1-C port (High)	1-PC7 A48 / GND A47 / 1-PC6 A46 / GND A45 / 1-PC5 A44 / GND A43 / 1-PC4 A42	B48 2-PC7 / B47 GND / B46 2-PC6 / B45 GND / B44 2-PC5 / B43 GND / B42 2-PC4	2-C port (High)

Figure described below:

1-C port (High)
- 1-PC7 — A48 — B48 — 2-PC7
- GND — A47 — B47 — GND
- 1-PC6 — A46 — B46 — 2-PC6
- GND — A45 — B45 — GND
- 1-PC5 — A44 — B44 — 2-PC5
- GND — A43 — B43 — GND
- 1-PC4 — A42 — B42 — 2-PC4
— 2-C port (High)

- GND — A41 — B41 — GND

1-C port (Low)
- 1-PC3 — A40 — B40 — 2-PC3
- GND — A39 — B39 — GND
- 1-PC2 — A38 — B38 — 2-PC2
- GND — A37 — B37 — GND
- 1-PC1 — A36 — B36 — 2-PC1
- GND — A35 — B35 — GND
- 1-PC0 — A34 — B34 — 2-PC0
— 2-C port (Low)

- GND — A33 — B33 — GND

1-B port
- 1-PB7 — A32 — B32 — 2-PB7
- GND — A31 — B31 — GND
- 1-PB6 — A30 — B30 — 2-PB6
- GND — A29 — B29 — GND
- 1-PB5 — A28 — B28 — 2-PB5
- GND — A27 — B27 — GND
- 1-PB4 — A26 — B26 — 2-PB4
- GND — A25 — B25 — GND
- 1-PB3 — A24 — B24 — 2-PB3
- GND — A23 — B23 — GND
- 1-PB2 — A22 — B22 — 2-PB2
- GND — A21 — B21 — GND
- 1-PB1 — A20 — B20 — 2-PB1
- GND — A19 — B19 — GND
- 1-PB0 — A18 — B18 — 2-PB0
— 2-B port

- GND — A17 — B17 — GND

1-A port
- 1-PA7 — A16 — B16 — 2-PA7
- GND — A15 — B15 — GND
- 1-PA6 — A14 — B14 — 2-PA6
- GND — A13 — B13 — GND
- 1-PA5 — A12 — B12 — 2-PA5
- GND — A11 — B11 — GND
- 1-PA4 — A10 — B10 — 2-PA4
- GND — A09 — B09 — GND
- 1-PA3 — A08 — B08 — 2-PA3
- GND — A07 — B07 — GND
- 1-PA2 — A06 — B06 — 2-PA2
- GND — A05 — B05 — GND
- 1-PA1 — A04 — B04 — 2-PA1
- GND — A03 — B03 — GND
- 1-PA0 — A02 — B02 — 2-PA0
- GND — A01 — B01 — GND
— 2-A port

[48] [96]

- [ ] shows the pin No. of HONDA TSUSHIN KOGYO CO., LTD. specification.

Figure 3.4. Pin Assignments of Interface Connector

Relationships between API-PAC(W32) Logical Ports/Bits and Connector Signal Pins

The following table lists the relationships between the connector signal pins and the logical port/bit numbers used for I/O functions when applications are written with API-PAC(W32).

Table 3.1. Logical Ports, Logical Bits, and Connector Signal Pins

	D7	D6	D5	D4	D3	D2	D1	D0
I/O Logical Ports0	1-PA7 [7]	1-PA6 [6]	1-PA5 [5]	1-PA4 [4]	1-PA3 [3]	1-PA2 [2]	1-PA1 [1]	1-PA0 [0]
I/O Logical Ports 1	1-PB7 [15]	1-PB6 [14]	1-PB5 [13]	1-PB4 [12]	1-PB3 [11]	1-PB2 [10]	1-PB1 [9]	1-PB0 [8]
I/O Logical Ports 2	1-PC7 [23]	1-PC6 [22]	1-PC5 [21]	1-PC4 [20]	1-PC3 [19]	1-PC2 [18]	1-PC1 [17]	1-PC0 [16]
I/O Logical Ports 3	2-PA7 [31]	2-PA6 [30]	2-PA5 [29]	2-PA4 [28]	2-PA3 [27]	2-PA2 [26]	2-PA1 [25]	2-PA0 [24]
I/O Logical Ports 4	2-PB7 [39]	2-PB6 [38]	2-PB5 [37]	2-PB4 [36]	2-PB3 [35]	2-PB2 [34]	2-PB1 [33]	2-PB0 [32]
I/O Logical Ports 5	2-PC7 [47]	2-PC6 [46]	2-PC5 [45]	2-PC4 [44]	2-PC3 [43]	2-PC2 [42]	2-PC1 [41]	2-PC0 [40]

Note : 1-PAx, 1-PBx, 1-PCx, 2-PAx, 2-PBx, 2-PCx represents an I/O signal of CN1
[xx] represents a logical bits

⚠ CAUTION

The logical port and logical bit numbers are virtual port and bit numbers that enable programming independent of board I/O addresses or board types.
For details, refer to API-DIO HELP available after installing API-PAC(W32).

Connecting I/O Signals

The I/O circuits of interface blocks of the PIO-48D(CB)H are illustrated in Figure 3.5. Signals are LVTTL levels and positive logic. Each of the signal is pulled up.
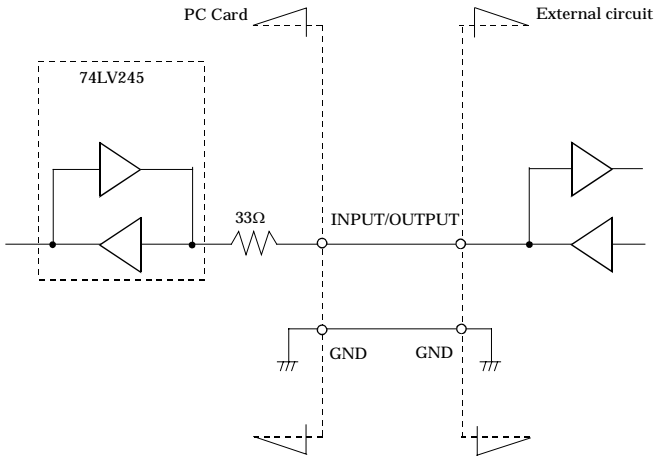
I/O Circuit

Figure 3.5. I/O Circuit

⚠ CAUTION

- Take care not to short the outputs to digital ground as this may cause a fault.

- If connecting pull-up resistors to the outputs, use a resistor of approximately 10kΩ and pull-up to the 3.3V power supply.

- The inputs support input of 5V TTL signals.
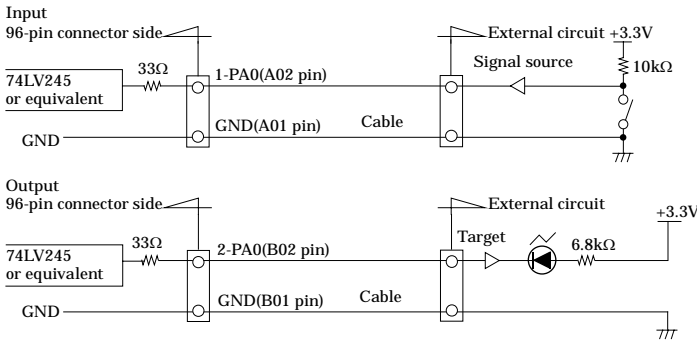
Example Connection 1 (Using DIO-68M/96F)

Input
96-pin connector side

74LV245 or equivalent — 33Ω — 1-PA0(A02 pin)

GND — GND(A01 pin) — Cable

External circuit +3.3V

Signal source — 10kΩ

Output
96-pin connector side

74LV245 or equivalent — 33Ω — 2-PA0(B02 pin)

GND — GND(B01 pin) — Cable

External circuit +3.3V

Target — 6.8kΩ

Figure 3.6. Connection Example Using 1-PA0 for Input and 2-PA0 for Output (Using DIO-68M/96F)

Example Connection 2 (Using PCA68PS-**P)

Input
Laminate side

74LV245 or equivalent — 33Ω — 1-PA0(3 pin)

GND — GND(2 pin) — Cable

External circuit +3.3V

Signal source — 10kΩ

Output
Laminate side

74LV245 or equivalent — 33Ω — 2-PA0(37 pin)

GND — GND(36 pin) — Cable

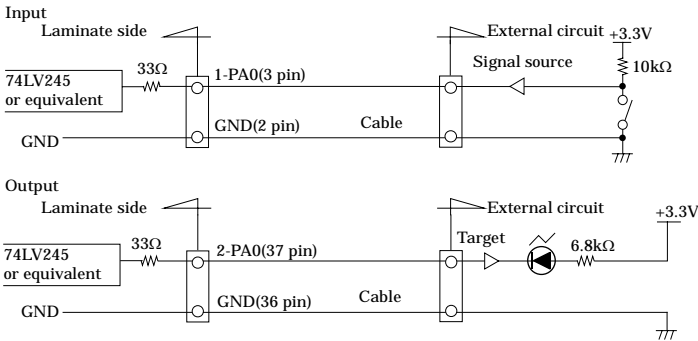External circuit +3.3V

Target — 6.8kΩ

Figure 3.7. Connection Example Using 1-PA0 for Input and 2-PA0 for Output (Using PCA68PS-P)**

4. Function

This section describes the features of the PC card.

Each function described here can be easily set and executed by using the bundled API driver library. For details, refer to API-DIO HELP available after installation.

Data I/O Function

This board supports mode 0 of two i8255 chips, capable of input/output of up to 48 LVTTL-level active high signals.

I/O setup of the port

The I/O function of the port must be set properly before the board can input/output data correctly. Writing a control word sets each port for either input or output.

⚠ CAUTION ───────────────────────

Each port is assigned as an input port when the power is turned on.

```
        ┌──────────┐
        (  Start   )
        └────┬─────┘
             │
     ╱───────────────╱
    ╱ set i8255 function ╱
   ╱───────────────╱
             │
     ╱───────────────╱
    ╱ input/output data ╱
   ╱───────────────╱
        ┌────┴─────┐
        (   end    )
        └──────────┘
```
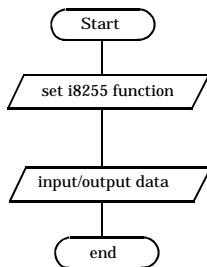
Figure 4.1. I/O setup

Each bit of control word is as follows.
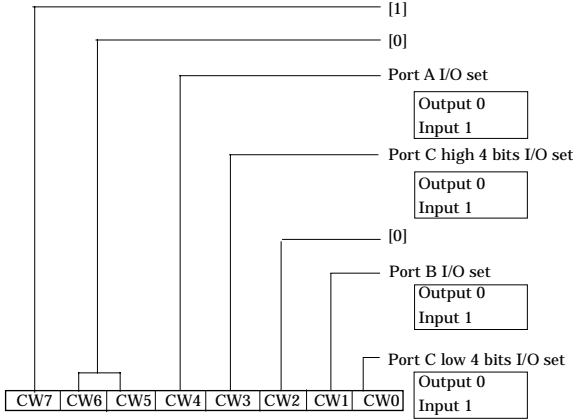
Figure 4.2. I/O setup control word

Table 4.1. Setup value of the control word

			Contorol Ward									
D7	D6	D5	D4	D3	D2	D1	D0	hexadecimal	Port A	Port C (High 4bit)	Port B	Port C (Low 4bit)
1	0	0	0	0	0	0	0	80	OUTPUT	OUTPUT	OUTPUT	OUTPUT
1	0	0	0	0	0	0	1	81	OUTPUT	OUTPUT	OUTPUT	INPUT
1	0	0	0	0	0	1	0	82	OUTPUT	OUTPUT	INPUT	OUTPUT
1	0	0	0	0	0	1	1	83	OUTPUT	OUTPUT	INPUT	INPUT
1	0	0	0	1	0	0	0	88	OUTPUT	INPUT	OUTPUT	OUTPUT
1	0	0	0	1	0	0	1	89	OUTPUT	INPUT	OUTPUT	INPUT
1	0	0	0	1	0	1	0	8A	OUTPUT	INPUT	INPUT	OUTPUT
1	0	0	0	1	0	1	1	8B	OUTPUT	INPUT	INPUT	INPUT
1	0	0	1	0	0	0	0	90	INPUT	OUTPUT	OUTPUT	OUTPUT
1	0	0	1	0	0	0	1	91	INPUT	OUTPUT	OUTPUT	INPUT
1	0	0	1	0	0	1	0	92	INPUT	OUTPUT	INPUT	OUTPUT
1	0	0	1	0	0	1	1	93	INPUT	OUTPUT	INPUT	INPUT
1	0	0	1	1	0	0	0	98	INPUT	INPUT	OUTPUT	OUTPUT
1	0	0	1	1	0	0	1	99	INPUT	INPUT	OUTPUT	INPUT
1	0	0	1	1	0	1	0	9A	INPUT	INPUT	INPUT	OUTPUT
1	0	0	1	1	0	1	1	9B	INPUT	INPUT	INPUT	INPUT

Data I/O

I/O signals are LVTTL levels and positive logic.

Input

When input data is low level, [0] is input to the corresponding bit.
When input data is high level, [1] is input to the corresponding bit.

Output

When [0] is output to the corresponding bit, low level is output to the external part.
When [1] is output to the corresponding bit, high level is output to the external part.

Digital Filter

Using this feature, the PIO-48D(CB)H can apply a digital filter to every input pin, thereby preventing the input signal from being affected by noise or chattering.

Digital Filter Function Principle

The digital filter checks the input signal level during the sampling time of the clock signal. When the signal level remains the same for the digital filter set time, the digital filter recognizes that signal as the input signal and changes the signal level of the PC

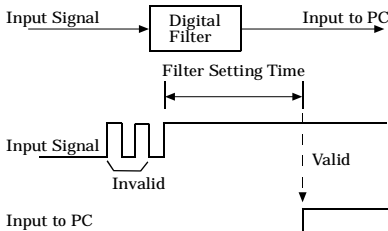If the signal level changes at a frequency shorter than the set time, therefore, the level change is ignored.

Figure 4.3. Digital Filter Function Principle

Set Digital Filter Time

Set the digital filter time to 0 to 20 (14h).

Setting the digital filter time to 0 disables digital filtering. It is set to 0 when the power is turned on.

Figure 4.4 shows the relationships between digital filter time settings and the actual digital filter times.

Digital Filter Time[sec.] = $2^n / (8 \times 10^6)$

n: setting data (0 to 20)

Setting Data(n)	Digital Filter Time	Setting Data(n)	Digital Filter Time	Setting Data(n)	Digital FilterTime
0 (00h)	The filter function is not used.	7 (07h)	16μsec	14 (0Eh)	2.048msec
1 (01h)	0.25μsec	8 (08h)	32μsec	15 (0Fh)	4.096msec
2 (02h)	0.5μsec	9 (09h)	64μsec	16 (10h)	8.192msec
3 (03h)	1μsec	10 (0Ah)	128μsec	17 (11h)	16.384msec
4 (04h)	2μsec	11 (0Bh)	256μsec	18 (12h)	32.768msec
5 (05h)	4μsec	12 (0Ch)	512μsec	19 (13h)	65.536msec
6 (06h)	8μsec	13 (0Dh)	1.024msec	20 (14h)	131.072msec

Figure 4.4. Digital Filter Time and Setting Data

⚠ CAUTION

- If you set the digital filter time, the filter applies to all input pins. You cannot apply the filter only to a specific filter.
- Do not set Setting Data to a value outside the above range as doing so can cause the PC card to malfunction.

Interrupt Control Function

The PIO-48D(CB)H can use all of the input signals as interrupt request signals.

The PC card can generate an interrupt request signal to the PC when the input signal changes from High to Low or from Low to High.

When the digital filter (described above) is used, interrupt requests are generated by input signals that have passed through the filter.

Disabling/Enabling Interrupts

Interrupt mask bits can be used to disable or enable the individual bits for interruptions.
Once a certain bit has been interrupt-disabled, no interrupt occurs even when the corresponding input signal changes its level.
To let interrupts occur, enable the corresponding interrupt mask bit for interruptions.

⚠ CAUTION
All of the interrupt mask bits are interrupt-disabled when the power is turned on.

Selecting the Interrupt Edge

Interrupt edge select bits can be used to set the input logic for interruption bit by bit.
If you set an interrupt edge select bit to 0, an interrupt occurs when the input value to the corresponding bit changes from 0 to 1 (at the rise of the input signal from Low to High).
If you set an interrupt edge select bit to 1, an interrupt occurs when the input value to the corresponding bit changes from 1 to 0 (at the fall of the input signal from High to Low).

⚠ CAUTION
When the power is turned on, all of the interrupt edge select bits are set to 0 so that an interrupt occurs when the input value changes from 0 to 1 (at the fall of the input signal from High to Low).

Clearing the Interrupt Status and Interrupt Signal

Interrupt status bits are used to identify the input signal bit being used for requesting an interrupt.
When an interrupt status is input, the interrupt request signal and the interrupt status are cleared automatically.

⚠ CAUTION
- All of the interrupt status bits are set to 0 when the power is turned on.

- If an interrupt mask bit has been set to disable interrupts, the interrupt status bit is not set even when the input signal changes its level.

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
|   |—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
```

About Software for Windows

The bundled CD-ROM "Driver Library API-PAC(W32)" contains the functions that provide the following features:

- Digital input/output of specified ports

- Hardware digital input/output of specified bits

- Hardware digital filtering that prevents chattering

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)" – "Dio" – "API-DIO HELP" to display help information.
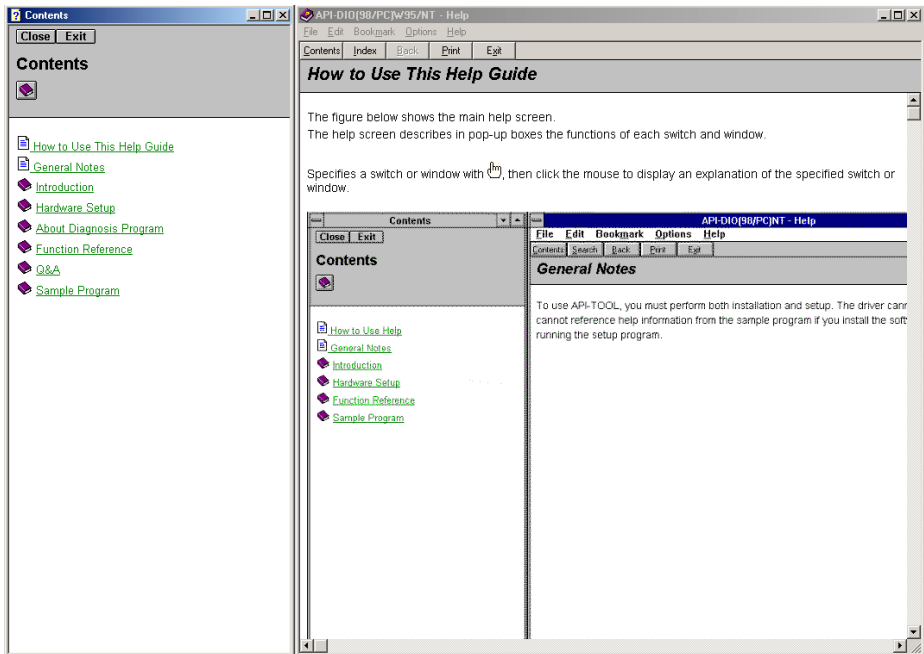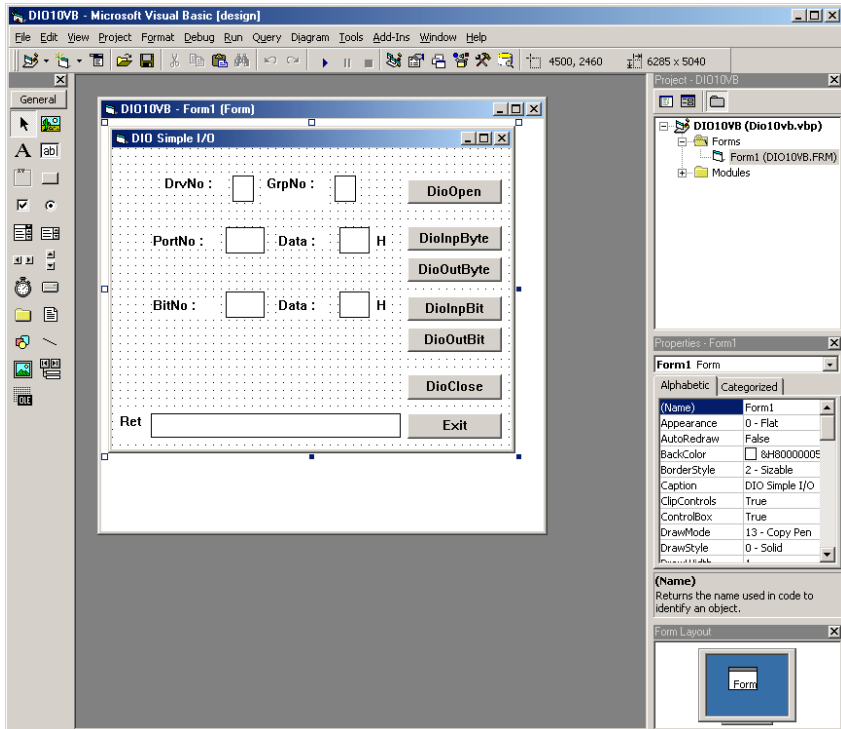
Using Sample Programs

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)\Dio\Samples.

Running a Sample Program

(1) Click on the [Start] button on the Windows taskbar.

(2) From the Start Menu, select "Programs" – "CONTEC API-PAC(W32)" – "Dio" – "SAMPLE…".

(3) A sample program is invoked.

Sample Programs - Examples

|		
-Sample program 1	:	Inputs digital data through a specified port.
-Sample program 2	:	Outputs digital data through a specified port.
-Sample program 3	:	Inputs/outputs digital data from/to a programmable PC card.
-Sample program 4	:	Inputs digital data from a specified port in the background.

-Sample program 5   :   Inputs/outputs digital data from/to a specified bit.

-Sample program 6   :   Services interrupts of a specified PC card.

-Sample program 7   :   Provides process control of a specified PC card.

-Sample program 8   :   Performs trigger monitoring of a specified PC card.

-Sample program 9   :   Inputs digital data through a specified port using BCD data.

-Sample program 10   :   Executes digital input (simple functions) at specified bits through a specified port.

-Sample program 11   :   Services interrupts of a specified PC card (using an extended function).

-Sample program (Console):   Inputs/outputs digital data through a specified port.

[Sample program 1]

[Sample program 2]

[Sample program 5]

[Sample program 9]

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 "Settings" – "Control Panel".

(2) Double-click on "Add/Remove Programs" in the Control Panel.

(3) Select "CONTEC API-DIO(98/PC)xx" from the application list displayed, then click on the [Add/Remove] button. Follow the on-screen instructions to uninstall the function libraries.
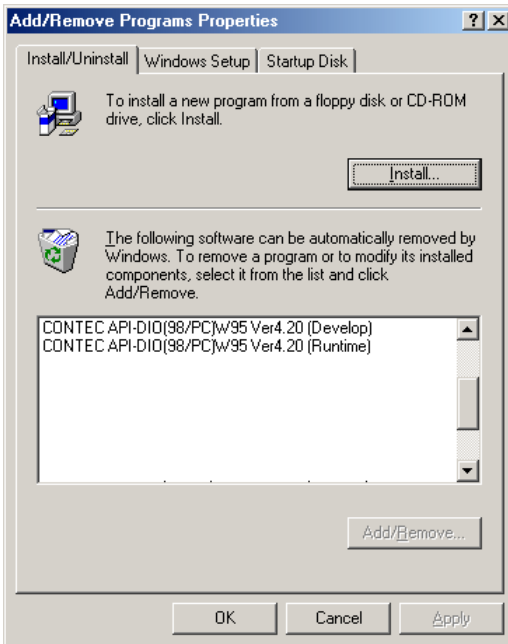
About Software for Linux

The Linux version of digital I/O function driver, API-DIO(LNX), provides functions that execute the following features:

- Digital input/output of specified ports
- Digital input/output of specified bits
- Hardware digital filtering that prevents chattering

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 for digital I/O driver, API-DIO(LNX), is supplied as a compressed file /linux/dio/cdioXXX.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 superuser.

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 PC card 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 diohelp.htm in the contec/cdio/help directory.

Using Sample Programs

Sample programs have been prepared for specific basic applications.

Sample programs for each language are contained in the contec/cdio/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/cdio directory. For details, check the contents of the script.

6. About Hardware

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

Hardware specification

Table 6.1. Specification

Item		Specification
I/O		
	I/O format	LVTTL-level input (Positive logic)
	Number of I/O channels	48 channels (all available for interrupts)
	Interrupt	48 interrupt input signals are arranged into a single output of interrupt signal INT. An interrupt is generated at the falling edge (HIGH-to-LOW transition) or rising edge (LOW-to-HIGH transition).
	Response time	200nsec within
	Rated output current	I_{OL}=8mA(Max.) I_{OH}=-8mA(Max.)
Common		
	I/O address	8 bit x 32 port boundary(Common to I/O part)
	Power consumption	3.3VDC 120 mA(Max.)
	Operating condition	0 to 50°C, 10 to 90%RH (No condensation)
	Allowable distance of signal extension	Approx. 1.5m (depending on wiring environment)
	Compatible PC card slot	PC card Standard compliant CardBus
	Dimension (mm)	85.6(W) x 54.0(D) x 5.0(H) TYPE II *2
	Weight	60g

*1 Data "1" and "0" correspond to the High and Low levels, respectively.

*2 On PCs with two TYPE II size PC card slots arranged vertically, two PIO-48D (CB)H cards cannot be used in the two slots at the same time. This is due to the shape of the option cable connectors.
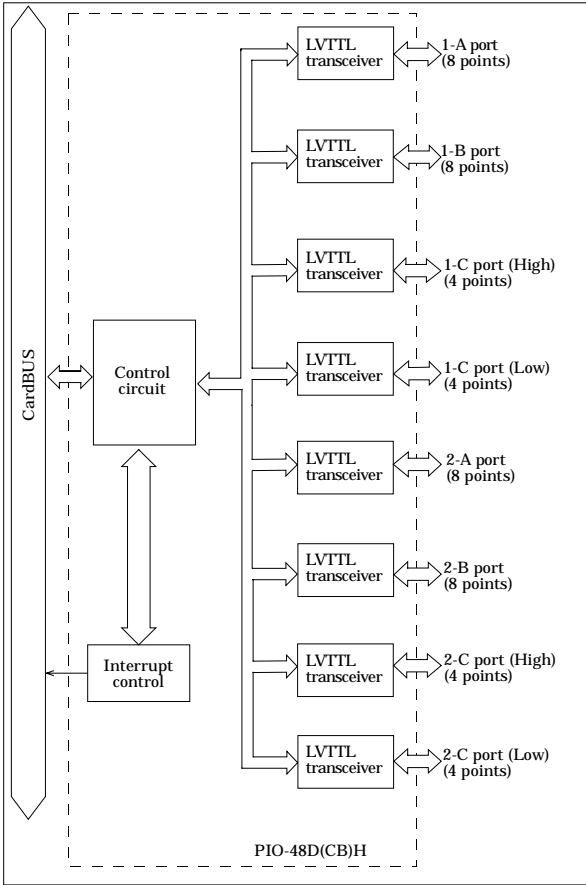
Block Diagram

Figure 6.1. Block Diagram

PIO-48D(CB)H
User's Guide

CONTEC CO., LTD.   November 2004 Edition

[11082004]   Management No. A-46-948
                                              Parts No.   LYEH421