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Find the *Contec DIO-48D2-PCI* at our website: ***Click HERE***

PC-HELPER

Bi-Directional Digital I/O Board for PCI

DIO-48D2-PCI

User's Guide

CONTEC CO.,LTD.

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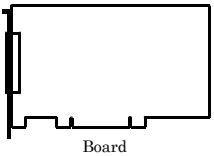
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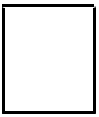
Product Configuration List

- Board [DIO-48D2-PCI] …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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1. Before Using the Product

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

About the Board

This product is a PCI bus-compliant interface board that extends the input/output function of bi-directional digital signal. This board has up to 48 unisolated TTL-level input/output channels that is powered by the equivalence to the mode 0 of i8255 chips, and you can use up to 48 channels of the input signals as interrupt inputs. You can select the input/output by the application software in eight signals units (in four signals unit for some inputs/outputs). Additionally, the digital filter function is equipped with this product. Windows/Linux driver is bundled with this product.

Using the dedicated library VI-DAQ makes it possible to create each application for LabVIEW.

Features

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

  This board has up to 48 unisolated TTL-level input/output channels whose response speed is 200µsec that is powered by the equivalence to the mode 0 of i8255 device for general-purpose. You can select the input/output by the application software in eight signals units (in four signals unit for some inputs/outputs).

- You can use up to 48channels of the input signals as interrupt events.

  You can use up to 48channels of the input signals as interrupt events and also disable or enable the interrupt in bit units and select the edge of input signals, at which to generate an interrupt.

- This product has a digital filter function to prevent wrong recognition of input signals from carrying noise or a chattering.

  This product has a digital filter function to prevent wrong recognition of input signals by noise or chattering is provided. All input terminals can be added a digital filter, and the setting can be performed by software.

- Windows/Linux compatible driver libraries are attached.

  Using the attached driver library API-PAC(W32) makes it possible to create applications of Windows/Linux. In addition, a diagnostic program by which the operations of hardware can be checked is provided.

- Connectors are compatible with PCI compatible board PIO-48D(PCI).

  There is compatibility in terms of connector shape and pin assignments with PCI compatible board PIO-48D(PCI), it is easy to migrate from the existing system.

- LabVIEW is supported by a plug-in of dedicated library VI-DAQ.

  Using the dedicated library VI-DAQ makes it possible to create each application for LabVIEW.

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Support Software

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

Windows version of digital I/O driver **API-DIO(98/PC) / API-DIO(WDM)**
[Stored on the bundled CD-ROM driver library API-PAC(W32)]

The API-DIO(98/PC) is the Windows version driver library software that provides products in the form of Win32 API functions (DLL). Various sample programs such as Visual Basic and Visual C++, etc and diagnostic program useful for checking operation is provided.

< Operating environment >

OS	Windows 7, Vista, XP, Server 2003, 2000
Adaptation language	Visual Basic, Visual C++, Visual C#, Delphi, C++ Builder

You can download the updated version from the CONTEC's Web site (http://www.contec.com/apipac/). For more details on the supported OS, applicable language and new information, please visit the CONTEC's Web site.

Linux version of digital I/O driver **API-DIO(LNX)**
[Stored on the bundled CD-ROM driver library API-PAC(W32)]

The API-DIO(LNX) is the Linux version driver software which provides device drivers (modules) by shared library and kernel version. Various sample programs of gcc are provided.

< Operating environment >

OS	RedHatLinux, TurboLinux (For details on supported distributions, refer to Help available after installation.)
Adaptation language	gcc

You can download the updated version from the CONTEC's Web site (http://www.contec.com/apipac/). For more details on the supported OS, applicable language and new information, please visit the CONTEC's Web site.

Data acquisition VI library for LabVIEW **VI-DAQ** (Available for downloading (free of charge) from the CONTEC web site.)

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.

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Cable & Connector (Option)

Shield Cable with 96-Pin Half-Pitch Connectors at Both Ends

: PCB96PS-0.5P (0.5m)

: PCB96PS-1.5P (1.5m)

Flat Cable with 96-Pin Half-Pitch Connectors at Both Ends

: PCB96P-1.5 (1.5m)

Shield Cable with 96-Pin Half-Pitch Connectors at One End

: PCA96PS-0.5P (0.5m)

: PCA96PS-1.5P (1.5m)

Flat Cable with 96-Pin Half-Pitch Connectors at One End

: PCA96P-1.5 (1.5m)

Flat cable with single-ended connector for 50-pin : PCA50J-1.5 (1.5m)

Half-pitch 96-pin Female Connector Set (5 Pieces) : CN5-H96F

Accessories (Option)

Screw Terminal (M3 x 96) : EPD-96A *1*2
Screw Terminal (M3.5 x 96) : EPD-96 *1
Terminal Unit for Cables (M3 x 96P) : DTP-64A *1

*1 PCB96P-1.5, PCB96PS-0.5 or PCB96PS-1.5 optional cable is required separately.

*2 “Spring-up” type terminal is used to prevent terminal screws from falling off.

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

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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 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.

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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.

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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

- There are switches and jumpers on this product that need to be set in advance.
  Be sure to check these before installing to the expansion slot.
- Only set the switches and jumpers on this product to the specified settings.
  Otherwise, this product may malfunction, overheat, or cause a failure.
- Do not strike or bend this product.
  Otherwise, this product may malfunction, overheat, cause a failure or breakage.
- Do not touch this product's metal plated terminals (edge connector) with your hands.
  Otherwise, this product 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 this product to or from the expansion slot while the computer's power or expansion unit is turned on.
  Otherwise, this product 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 this products installed.
  Insufficiently energized products 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 user’s guide 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.

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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

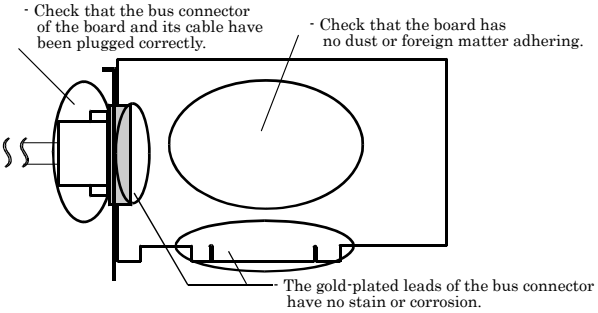
None

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.

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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 software 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 user’s guide for that software. See also the following parts of this user’s 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

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Using the Board under an OS Other than Windows

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

This chapter Step 2 Setting the Hardware

Chapter 3 External Connection

Chapter 6 About Hardware

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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.

About the driver to be used

Two digital I/O drivers are available: API-DIO(WDM) and API-DIO(98/PC).

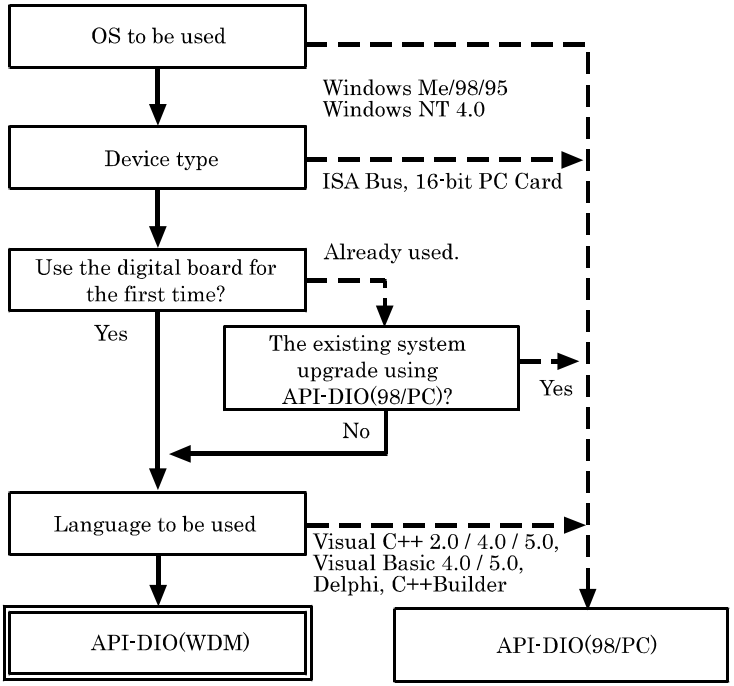
API-DIO(WDM) is a new driver to perform digital I/O under Windows.

API-DIO(WDM) was developed to improve the conventional product version of API-DIO(98/PC) in the ease of use and functionality.

It is advisable to use API-DIO(WDM) for you to use an digital I/O device. API-DIO(WDM) will support new OS and devices in the future but will not support Windows NT 4.0, Windows 95, ISA bus.

Use API-DIO(98/PC) if your operating environment contains such an unsupported piece of software or hardware.

Check the following selection guide to easily select the driver to be used.



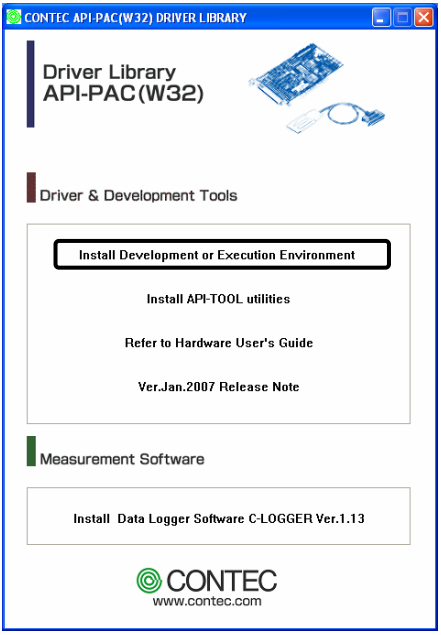
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Starting the Install Program

(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 Development or Execution Environment] button.**



* When using the Windows 7, Vista, driver is automatically installed.

⚠ CAUTION

Before installing the software in Windows 7, Vista, XP, Server 2003 and 2000, log in as a user with administrator privileges.

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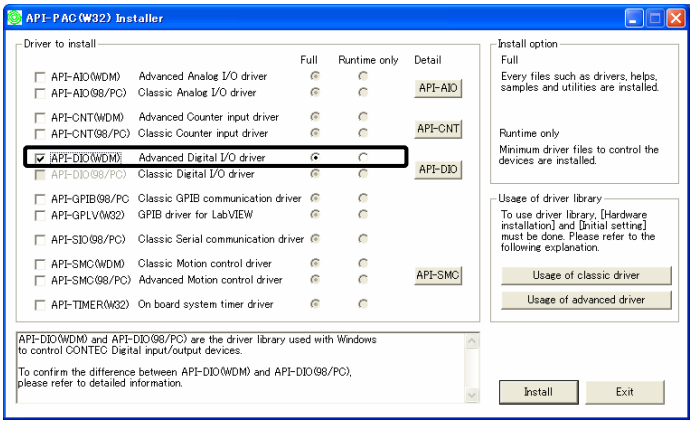
When Using API-DIO(WDM)

Selecting API-DIO(WDM)

(1) **The following dialog box appears to select “Driver to install” and “Install option”, “Usage of driver library”.**

(2) **Select the "Advanced Digital I/O driver".**

(3) **Click on the [Install] button.**



* Clicking the [API-DIO] button displays detailed information about API-DIO(WDM) and API-DIO(98/PC).

Run the installation

(1) **Complete the installation by following the instructions on the screen.**

(2) **The Readme file appears when the installation is complete.**

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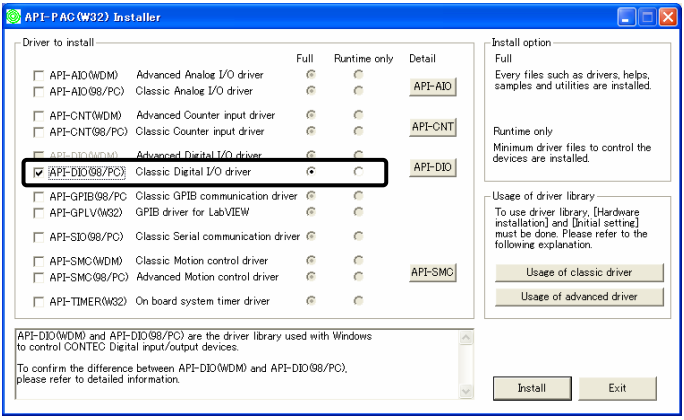
When Using API-DIO(98/PC)

Selecting API-DIO(98/PC)

(1) **The following dialog box appears to select “Driver to install” and “Install option”, “Usage of driver library”.**

(2) **Select “Classic Digital I/O driver”.**

(3) **Click on the [Install] button.**



* Clicking on the [API-DIO] button displays detailed information on API-DIO(WDM), API-DIO(98/PC).

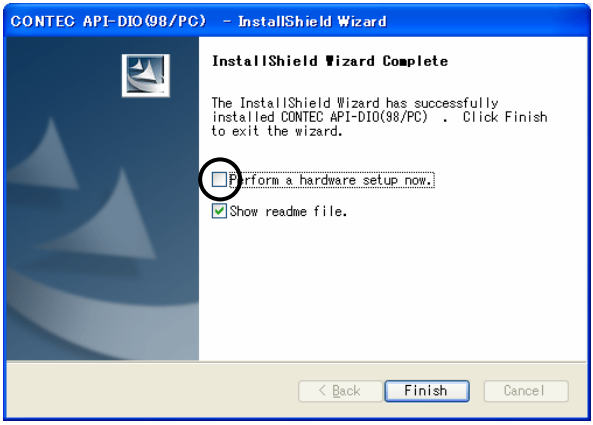
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Executing the Installation

(1) **Follow the on-screen instructions to proceed to install.**

(2) When the required files have been copied, the “Perform a hardware setup now (API-TOOL Configuration)” 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.

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Step 2 Setting the Hardware

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

The board has some switches and jumper 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.

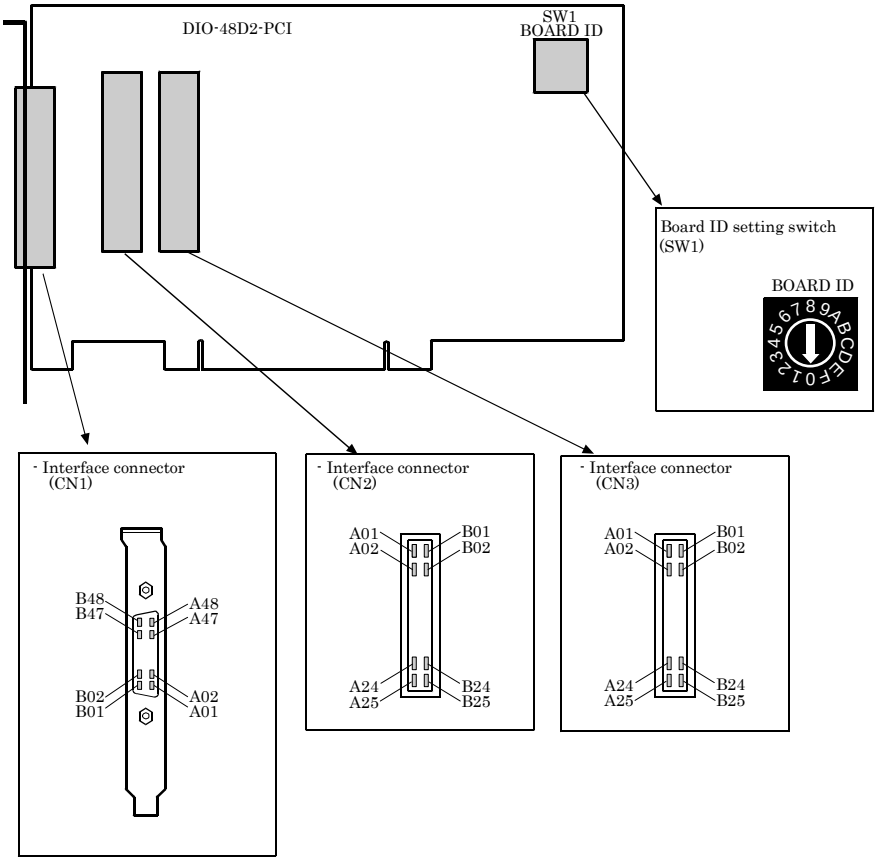


Figure 2.1. Component Locations

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Setting the Board ID

If you install two or more 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.

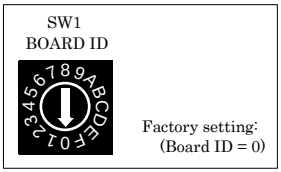


Figure 2.2. Board ID Settings (SW1)

⚠ CAUTION

The PC detects the DIO-48D2-PCI and PIO-48D(PCI) boards as the same board. If using both boards on the same PC, set different board IDs on each board.

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Plugging the Board

(1) Before plugging the board, shut down the system, unplug the power code 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.

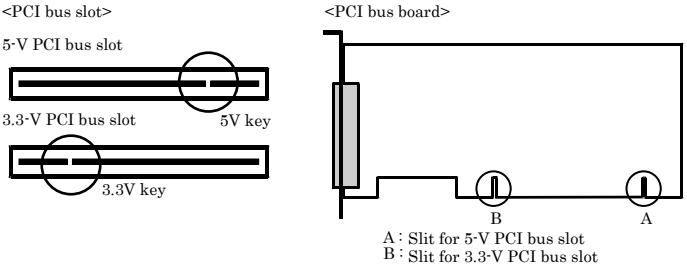
(4) Attach the board bracket to the PC with a screw.

(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.



⚠ 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 power or expansion unit 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.
- Power supply from the PCI bus slot at +5V is required.

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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 Add 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 to be used does 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.

When Using API-DIO(WDM)

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



Select “No, not this time” and then click the “Next” button.

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(2) When “Multimedia Controller” is displayed, select “Install from a list or specific location [Advanced]” and then specify that folder on the CD-ROM which contains the setup information (INF) file to register the board.

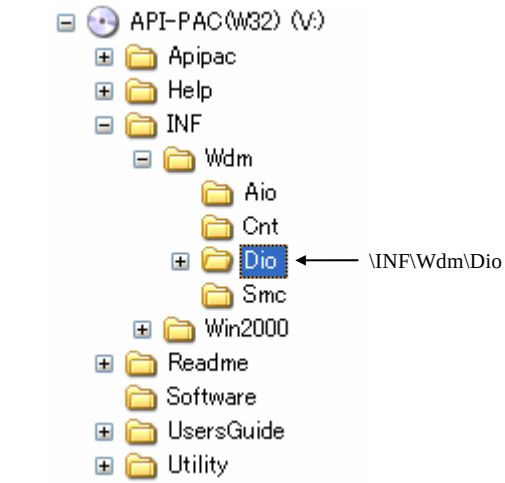


When the model name of hardware is displayed, select “Install the software automatically [Recommended]” and then click on the “Next” button.

Source folder

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

Windows 7 [64, 32bit], Vista [64, 32bit], XP [64, 32bit],
Server 2003 [64, 32bit], 2000 \INF\Wdm\Dio



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You have now finished installing the hardware.

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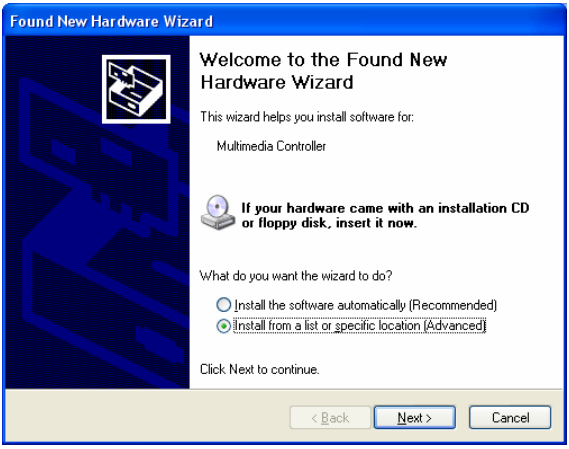
When Using API-DIO(98/PC)

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



Select “No, not this time” and then click the “Next” button.

(2) Select “Install from a list or specific location [Advanced]” and then click the “Next” button.



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

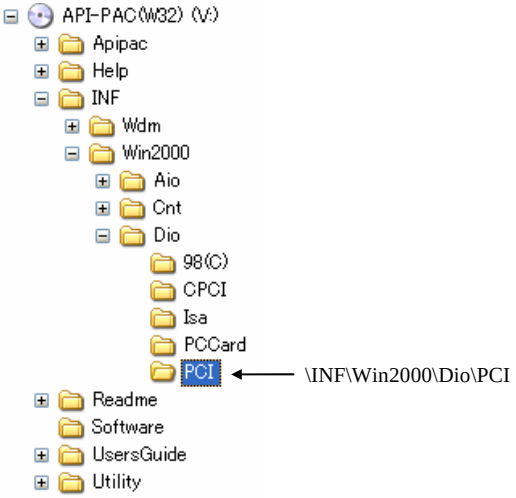


Source folder

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

Windows 7 [32bit], Vista [32bit], XP [32bit],
Server 2003 [32bit], 2000 \INF\Win2000\Dio\PCI

Example of specifying the folder for use under Windows XP

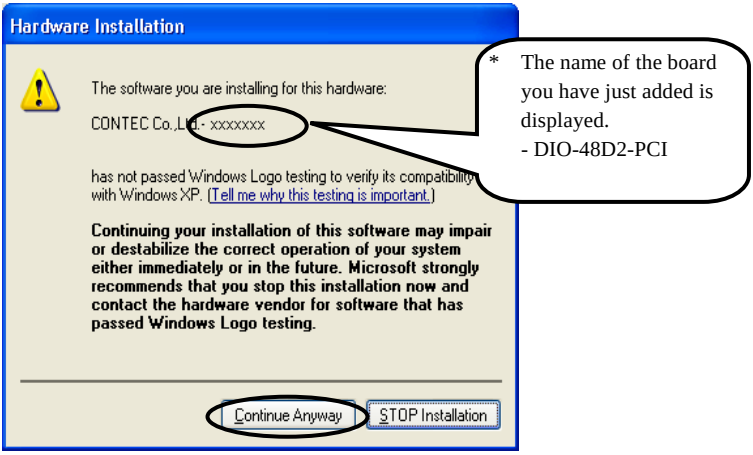


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⚠ CAUTION

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 hardware.

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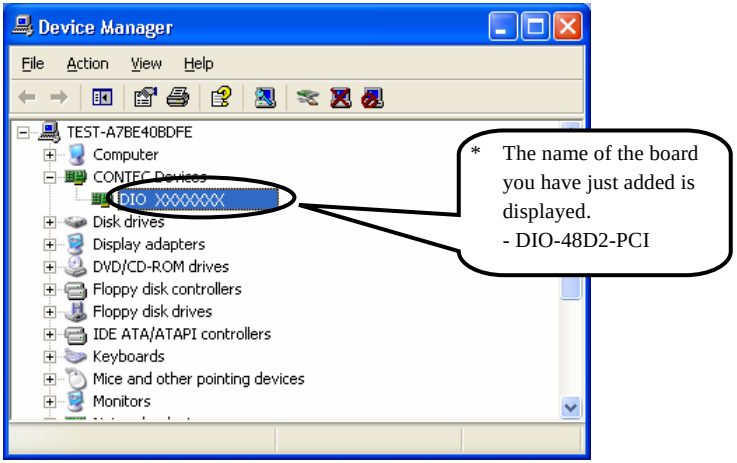
Step 4 Initializing the Software

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

When Using API-DIO(WDM)

Setting the device name

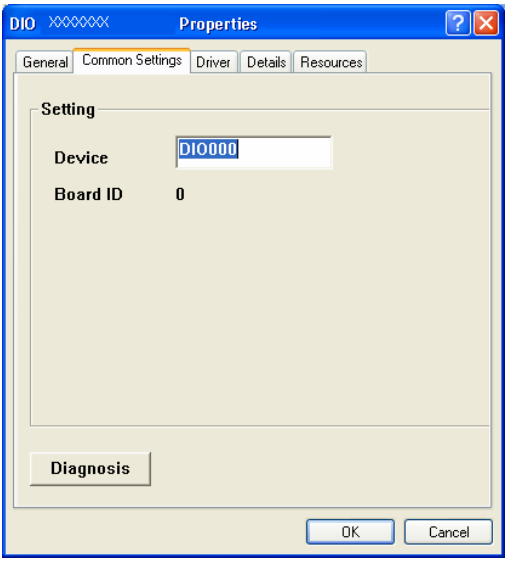
(1) Run Device Manager. From [My Computer] - [Control Panel], select [System] and then select the [Device Manager] tab.
(You can also open Device Manager by right clicking on My Computer and selecting Properties.)



(2) The installed hardware appears under the CONTEC Devices node. Open the CONTEC Devices node and select the device you want to setup (the device name should appear highlighted). Click [Properties].

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(3) The property page for the device opens.
Enter the device name in the common settings tab page and then click [OK].
The device name you set here is used later when programming.



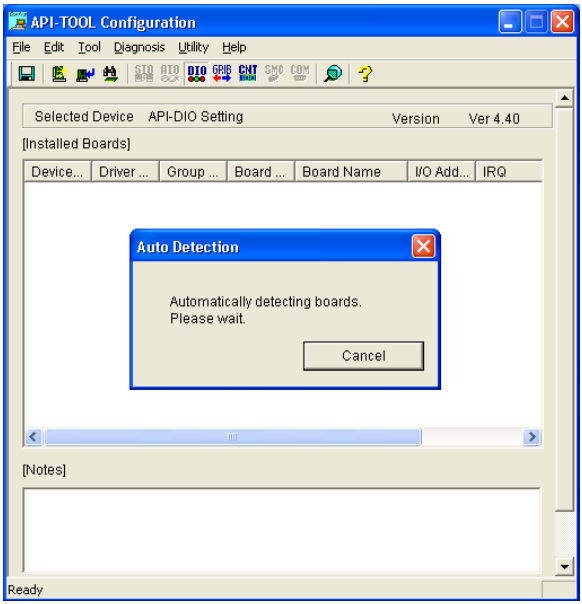
* The initial device name that appears is a default value. You can use this default name if you wish.
* Make sure that you do not use the same name for more than one device.

You have now finished installing the initial setting of Software.

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When Using API-DIO(98/PC)

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



(2) API-TOOL Configuration detects boards automatically.
The detected boards are listed.

Updating the Settings

(1) Select “Save setting to registry…” from the “File” menu.

You have now finished installing the initial setting of Software.

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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

Connect the board to a remote device to text the input/output and check the execution environment.
Set the board in the default factory.

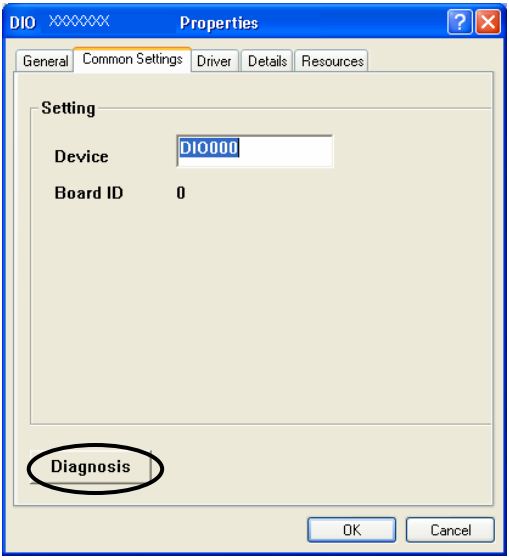
To connect the external device, see Chapter 3 “External Connection”.

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Using the Diagnosis Program

Starting the Diagnosis Program for Use of API-DIO(WDM)

Click the [Diagnosis] button on the device property page to start the diagnosis program.

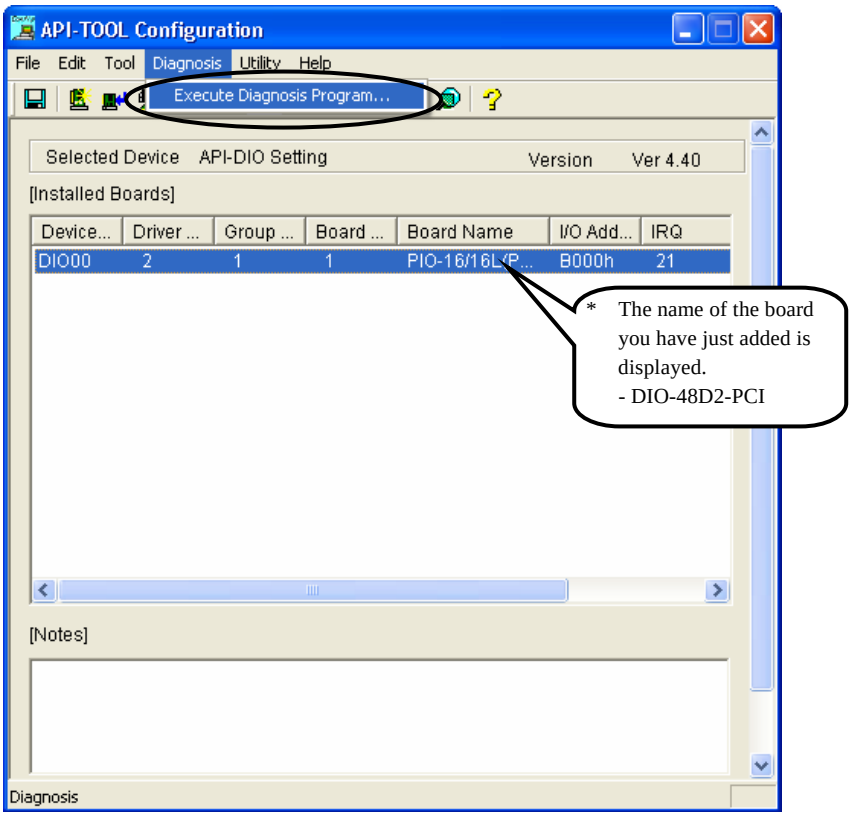


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Starting the Diagnosis Program for Use of API-DIO(98/PC)

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

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



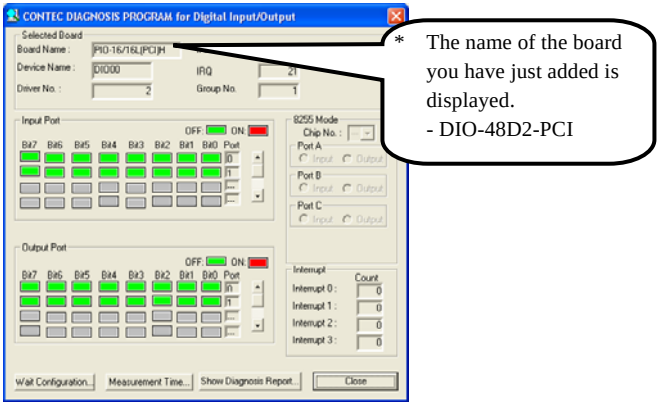
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Checking Digital Inputs and Outputs

The main panel of the Diagnosis Program appears.

You can check the current operation states of the board 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.



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.

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Diagnosis Report

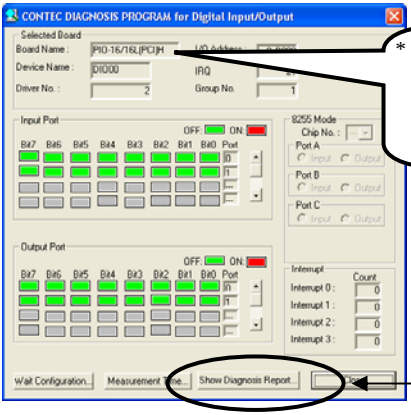
(1) Clicking on the [Show Diagnosis Report] button displays detailed data such as board settings and the diagnosis results while saving them in text format.

When it is API-DIO(WDM), file name to save the result is displayed.
When it is API-DIO(98/PC), the result is saved to the folder in which to install (Program Files\CONTEC\API-PAC(W32)) by the text file (DioRep.txt) and then displayed.

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

⚠ CAUTION

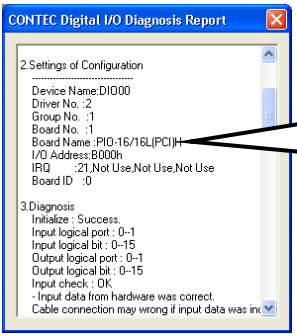
Before executing diagnosis report output, unplug the cable from the board.



* The name of the board you have just added is displayed.
- DIO-48D2-PCI

Click on [Show Diagnosis Report].

(2) A diagnosis report is displayed as shown below.



* The name of the board you have just added is displayed.
- DIO-48D2-PCI

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Setup Troubleshooting

Symptoms and Actions

No output can be obtained.

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

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 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 board 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 board.
[Windows 7, Vista, Windows XP, Server 2003, 2000**]**

Turn off the power to 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.

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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.

How to connect the connectors

Connector shape

To connect an external device to this board, plug the cable from the device into the interface connector (CN1 or CN2 and CN3) shown below.

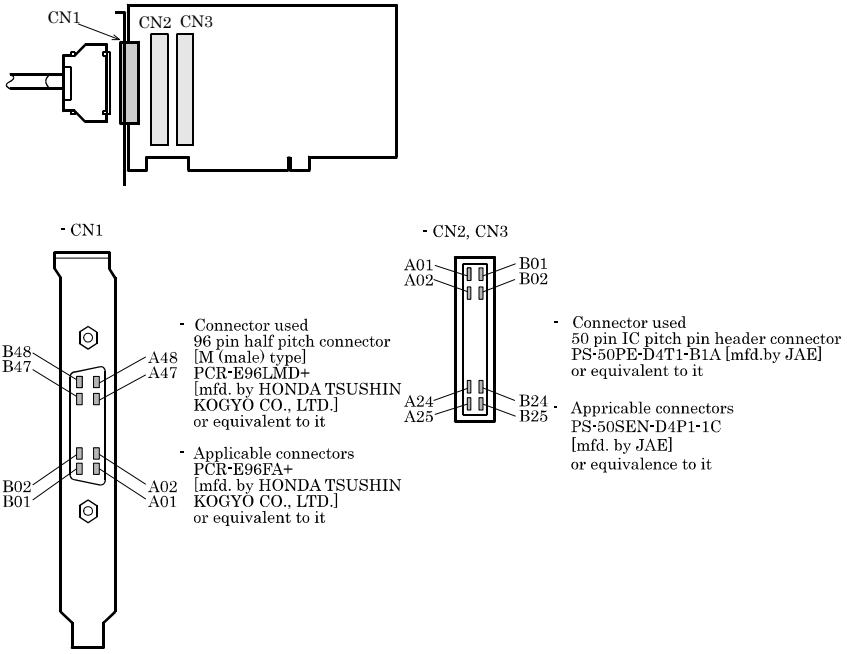


Figure 3.1. Interface Connector Shape

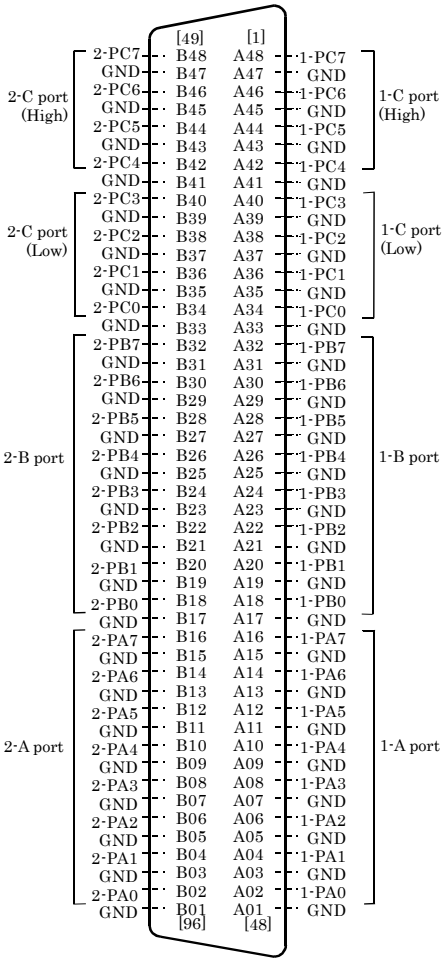
⚠ CAUTION

- CN2 and CN3 are designed assuming the connection to any other board or device in the same PC (system).
- For connecting CN2 or CN3 to a device outside the PC, use an adjacent expansion slot as required.
- The 96-pin connector (CN1) and 50-pin connectors (CN2 and CN3) are mutually exclusive. Use either of them at a time.

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Connector Pin Assignment

Pin Assignments of Interface Connector



* The numbers in square brackets [ ] are pin numbers designated by HONDA TSUSHIN KOGYO CO., LTD.

Figure 3.2. Pin Assignments of Interface Connector (CN1)

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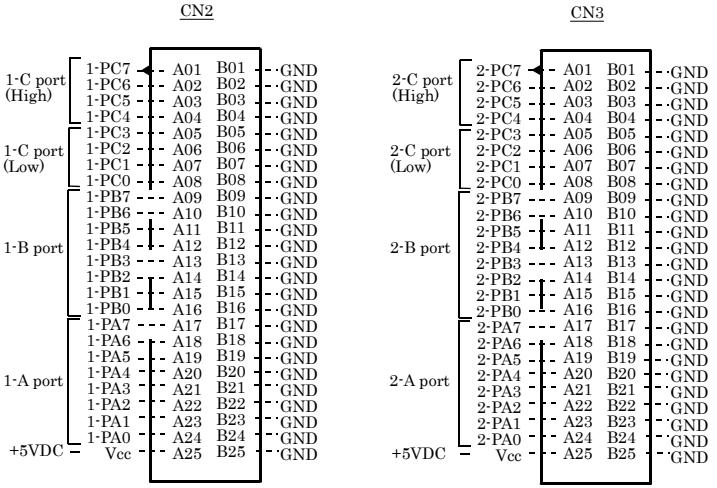


Figure 3.3. Pin Assignments of Interface Connector (CN2, CN3)

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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).

⚠ 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).

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 Ports1	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 Ports2	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 Ports3	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 Ports4	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 Ports5	2-PC7 [47]	2-PC6 [46]	2-PC5 [45]	2-PC4 [44]	2-PC3 [43]	2-PC2 [42]	2-PC1 [41]	2-PC0 [40]

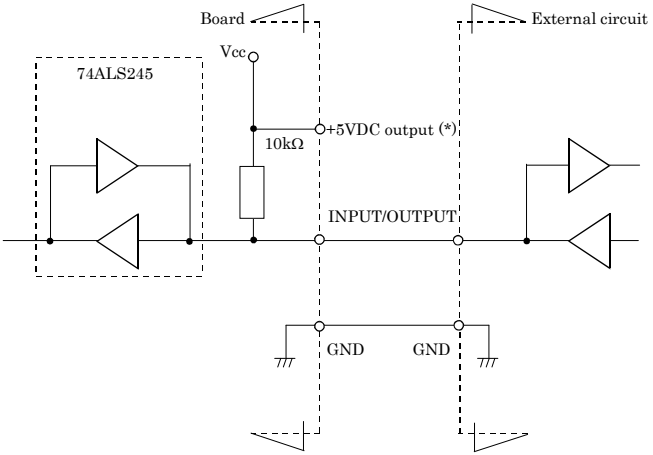
Note : 1-PAx, 1-PBx, 1-PCx, 2-PAx, 2-PBx, 3-PCx represents an I/O signal of CN1, CN2, CN3.
[xx] represents a logical bits

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Connecting I/O Signals

The I/O circuits of interface blocks of the DIO-48D2-PCI are illustrated in Figure 3.4. Signals are TTL levels and positive logic. Each of the signal is pulled up.

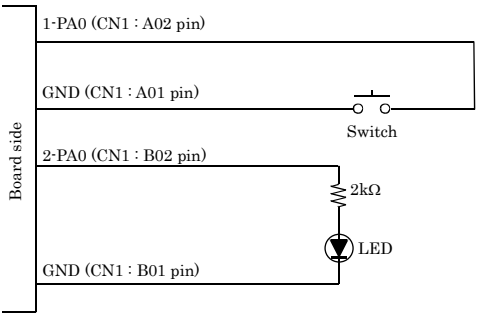
I/O Circuit



(*) Only CN2 and CN3 has +5VDC output pin. Current to be able to supplied is within 1A (total).

Figure 3.4. I/O Circuit

Example of Connection



When switch is "ON", the corresponding bit is "0".

When switch is "OFF" in contrast, the corresponding bit is "1".

When "1" is output to a relevant bit, the corresponding LED comes on.

When "0" is output to the bit, in contrast, the LED goes out.

Figure 3.5. Connection Example Using 1-PA0 for Input and 2-PA0 for Output

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About the Protection Feature

The +5VDC output of the board is provided with a PolySwitch-based protection feature. If the +5VDC output is accidentally connected to GND, the protection feature works and it may disable the board temporarily. In that case, turn the PC off, wait for a few minutes, then turn the PC back on.

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4. Function

This section describes the features of the board.

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 the equivalence to the mode 0 of two i8255 chips, capable of input/output of up to 48 TTL-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.

The input/output setting can be achieved in eight signals unit for ports A and B and in four signals unit (upper 4 bits and lower 4 bits) for port C.

⚠ CAUTION

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

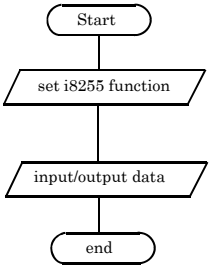


Figure 4.1. I/O setup

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Each bit of control word is as follows.

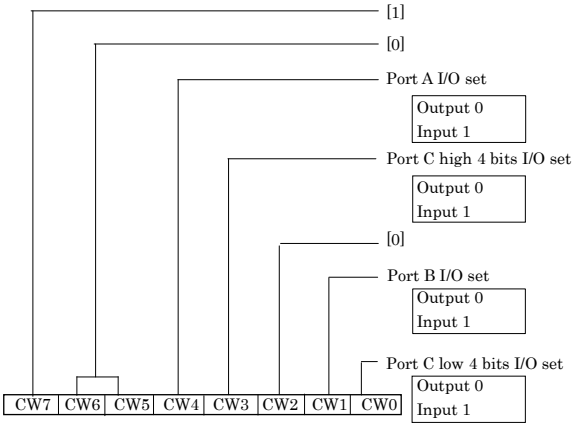


Figure 4.2. I/O setup control word

Table 4.1. Setup value of the control word

Control 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

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Data I/O

I/O signals are TTL 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.

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Digital Filter Function

Using this feature, The DIO-48D2-PCI can apply a digital filter to every input pin, thereby preventing wrong recognition of input signals from carrying noise or a 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.

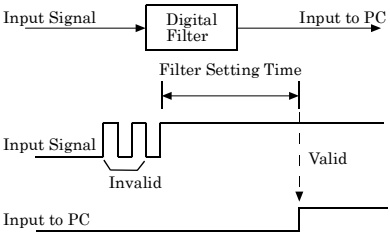


Figure 4.3. Digital Filter Function Principle

Set Digital Filter Time

Set the digital filter time to 0 - 20 (14h).
Setting the digital filter time to 0 disables digital filtering. It is set to 0 when the power is turned on.
Figure 4.2 shows the relationships between digital filter time settings and the actual digital filter times.

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

n: = setting data(0 - 20)

Setting Data (n)	Digital Filter Time	Setting Data (n)	Digital Filter Time	Setting Data (n)	Digital Filter Time
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 4.2. 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 board to malfunction.

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Interrupt Control Function

The DIO-48D2-PCI can use all of the input signals as interrupt request signals.
The board can generate an interrupt request signal to the PC when the input signal change 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 edge of input signals, at which to generate an interrupt

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

⚠ CAUTION

When the power is turned on, all of the input signal edge selection bit are set to 0.

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.
- The interrupt status bits are set regardless of the state of the interrupt mask bit.

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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)
```


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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 wrong recognition of input signals from being affected by noise or 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) Using the API-DIO(WDM), from the Start Menu, select “Programs” – “CONTEC API-PAC(W32)” - “DIOWDM” - “API-DIO(WDM) HELP” to display help information.

(3) Using the API-DIO(98/PC), 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.

For the API-DIO(WDM), The sample programs are stored in

\Program Files\CONTEC\API-PAC(W32)\DIOWDM\Sample.

For the API-DIO(98/PC), The sample programs are stored in

\Program Files\CONTEC\API-PAC(W32)\Dio\Samples.

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.

Running a Sample Program

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

(2) For the API-DIO(WDM), from the Start Menu, select “Programs” – “CONTEC API-PAC(W32)” – “DIOWDM” – “SAMPLE…”.

(3) For the API-DIO(98/PC), from the Start Menu, select “Programs” – “CONTEC API-PAC(W32)” – “Dio” – “SAMPLE…”.

(4) A sample program is invoked.

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Sample Programs – Examples

API-DIO(WDM) sample program

- Simple I/O sample program : Input digital data through a specified port.
- Multi ports/bits I/O sample program : Input digital data through a specified multi ports/bits.
- Trigger monitoring sample program : Monitoring rising/falling trigger through a specified board.
- Interrupt sample program : Services interrupts of a specified board.

API-DIO(98/PC) sample program

-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 board.
-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 board.
-Sample program 7 : Provides process control of a specified board.
-Sample program 8 : Performs trigger monitoring of a specified board.
-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 board (using an extended function).
-Sample program (Console) : Inputs/outputs digital data through a specified port.

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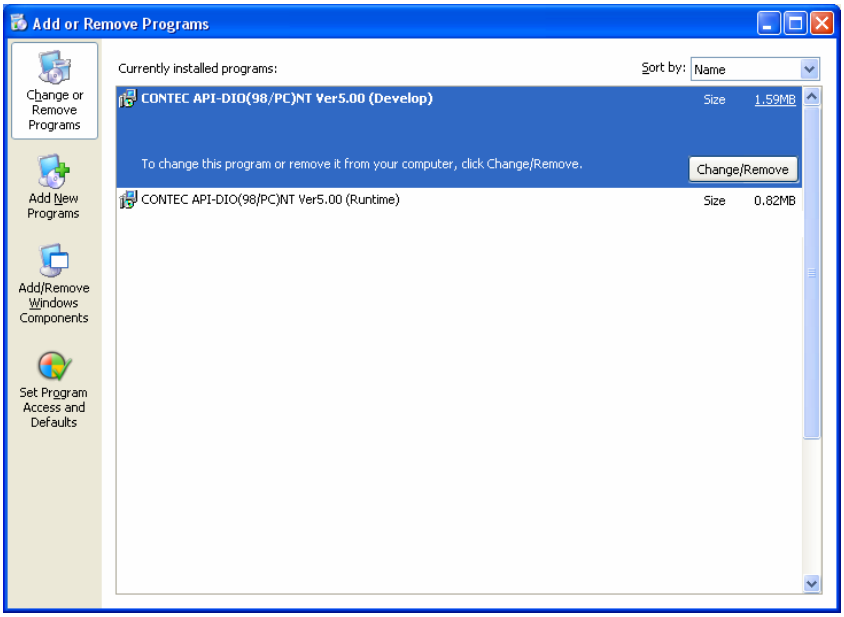
Uninstalling the Driver Libraries

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 “Add or Remove Programs” in the Control Panel.

(3) For use of API-DIO(WDM), select “CONTEC API-DIO(WDM) driver” and “CONTEC API-DIO(WDM) VerX.XX (Develop)” from the application list displayed.
For use of API-DIO(98/PC), select “CONTEC API-DIO(98/PC)xx VerX.XX (Develop)” and “CONTEC API-DIO(98/PC)xx VerX.XX (Runtime)” from the application list displayed.
Click on the [Change/Remove] button. Follow the on-screen instructions to uninstall the function libraries.



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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 wrong recognition of input signals from being affected by noise or 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 board to be used.
 ..... Set as follows .........
 # ./contec_dio_start.sh                      Start the driver.
# cd
```


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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 user's guide 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.

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6. About Hardware

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

For detailed technical information

For further detailed technical information (“Technical Reference” including the information such as an I/O map, configuration register, etc.), visit the Contec's web site (http://www.contec.com/support/) to call for it.

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Hardware specification

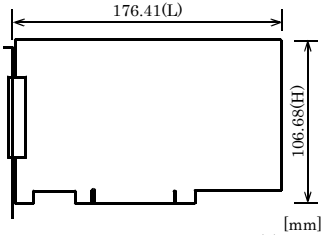
Table 6.1. Specification

Item			Specification
I/O			
	I/O format		Unisolated TTL-level input (Positive logic)
	Number of I/O channels		48 channels (all available for interrupts)
	Pull-up registance		10kΩ
	Interrupt		48 interrupt input signals are arranged into a single output of interrupt signal INTA. An interrupt is generated at the rising edge (LOW-to-HIGH transition).
	Response time		Within 200nsec
	Rated output current		I_{OL}=24mA (Max.) I_{OH}=-15mA (Max.)
Common			
	I/O address		Any 32-byte boundary (Common to I/O part)
	Power consumption (Max)		5VDC 600mA
	Operating condition		0 - 50°C, 10 - 90%RH (No condensation)
	Allowable distance of signal extension		Approx. 1.5m (depending on wiring environment)
	Bus specification		PCI (32bit, 33MHz, Universal key shapes supported *2)
	Dimension (mm)		176.41(L) x 106.68(H)
	Connector		
		CN1	96 pin half pitch connector [M (male) type] PCR-E96LMD+ [mfd. by HONDA TSUSHIN KOGYO CO., LTD.] or equivalent to it
		CN2,3	50 pin IC pitch pin header connector PS-50PE-D4T1-B1A [mfd.by JAE] or equivalent to it
	Weight		130g

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

*2 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.

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Block Diagram

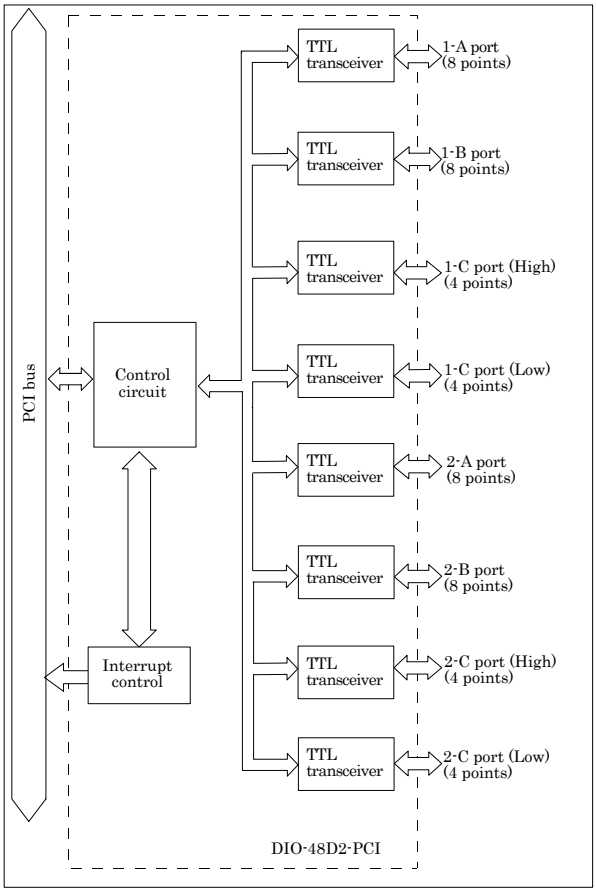


Figure 6.1. Block Diagram

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Differences between DIO-48D2-PCI and PIO-48D(PCI)

The DIO-48D2-PCI is connector-pin compatible with the conventional PIO-48D(PCI) but has the following differences from it:

	PIO-48D(PCI)	DIO-48D2-PCI
Digital filter function	None	Have
Selecting the Interrupt Edge	None	Have

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DIO-48D2-PCI

User's Guide

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