Digital I/O Board for PCI
DIO-0808L-PCI
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
- Board (One of the following)
  [DIO-0808L-PCI]
- First step guide … 1
- DVD-ROM *1 [API-PAC(W32)] … 1

*1 The DVD-ROM contains the driver software and User’s Guide (this guide)
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# About Hardware

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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 digital signal I/O functions of a PC. DIO-0808L-PCI is a 12 - 24VDC opto-coupler isolated type with opto-coupler isolated input 8ch and opto-coupler isolated open-collector output 8ch. You can use all of the input signals as interrupt inputs. Equipped with the digital filter function and output transistor protection circuit (surge voltage protection and overcurrent protection).

Windows driver is bundled with this product.

Features

- Opto-coupler isolated input (supporting current sink output) and opto-coupler isolated open-collector output (current sink type)

DIO-0808L-PCI has the opto-coupler isolated input 8ch (supporting current sink output) whose response speed is 200μsec and opto-coupler isolated open-collector output 8ch (current sink type).

Common terminal provided per 8ch, capable of supporting a different external power supply

Supporting driver voltages of 12 - 24 VDC for I/O

- Opto-coupler bus isolation

As the PCI bus (PC) is isolated from the input and output interfaces by opto-couplers, this product has excellent noise performance.

- You can use all of the input signals as interrupt events.

You can use all of the input signals as interrupt events and also disable or enable the interrupt in bit units and select the interrupt edge.

- Windows compatible driver libraries are attached.

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

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

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

- Output circuits include zener diodes for surge voltage protection and fuses for overcurrent protection.

Zener diodes are connected to the output circuits to protect against surge voltages. Similarly, fuses are fitted to each group of 8channels outputs for over-current protection. The output rating is max. 35VDC, 100mA per channel.
1. Before Using the Product

Support Software

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

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

The API-DIO(WDM) 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 >
Adaptation language Visual Basic, Visual C++, Visual C#

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.
Cable & Connector  (Option)

Flat Cable with a 37-Pin D-SUB Connectors at 2 Ends   : PCB37P-1.5 (1.5m)
              : PCB37P-3 (3m)
Shielded Cable with a 37-Pin D-SUB Connectors at 2 Ends : PCB37PS-0.5P (0.5m)
              : PCB37PS-1.5P (1.5m)
              : PCB37PS-3P (3m)
              : PCB37PS-5P (5m)
Flat Cable with a 37-Pin D-SUB Connector               : PCA37P-1.5 (1.5m)
              : PCA37P-3 (3m)
              : PCA37P-5 (5m)
Shielded Cable with a 37-Pin D-SUB Connector          : PCA37PS-0.5P (0.5m)
              : PCA37PS-1.5P (1.5m)
              : PCA37PS-3P (3m)
              : PCA37PS-5P (5m)

Accessories  (Option)

Screw Terminal (M3 x 37P)  : EPD-37A *1*2
Screw Terminal (M3.5 x 37P) : EPD-37 *1
General Purpose Terminal  (M3 x 37P) : DTP-3C *1
Screw Terminal (M2.5 x 37P) : DTP-4C *1

*1 A PCB37P or PCB37PS 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.
Customer Support

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

Web Site

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

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

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

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

Limited Three-Years Warranty

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

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

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

How to Obtain Service

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

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

Liability

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

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

Safety Information

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

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>! DANGER</td>
<td>DANGER indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury.</td>
</tr>
<tr>
<td>! WARNING</td>
<td>WARNING indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.</td>
</tr>
<tr>
<td>! CAUTION</td>
<td>CAUTION indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury or in property damage.</td>
</tr>
</tbody>
</table>
### 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 on the board that need to be set in advance. Be sure to check these before installing the board.
- Only set the switches and jumpers on the board to the specified settings. Otherwise, the board may malfunction, overheat, or cause a failure.
- Do not strike or bend the board. Doing so could damage the board. Otherwise, the board may malfunction, overheat, cause a failure or breakage.
- Do not touch the board's metal plated terminals (edge connector) with your hands. Otherwise, the board may malfunction, overheat, or cause a failure. If the terminals are touched by someone's hands, clean the terminals with industrial alcohol.
- Do not install or remove the board to or from the slot while the computer's power is turned on. Otherwise, the board may malfunction, overheat, or cause a failure. Doing so could cause trouble. Be sure that the personal computer or the I/O expansion unit power is turned off.
- Make sure that your PC or expansion unit can supply ample power to all the boards installed. Insufficiently energized boards could malfunction, overheat, or cause a failure.
- The specifications of this product are subject to change without notice for enhancement and quality improvement. Even when using the product continuously, be sure to read the manual and understand the contents.
- Do not modify the product. CONTEC will bear no responsibility for any problems, etc., resulting from modifying this product.
- Regardless of the foregoing statements, CONTEC is not liable for any damages whatsoever (including damages for loss of business profits) arising out of the use or inability to use this CONTEC product or the information contained herein.
1. Before Using the Product

**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

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.

- Check that the bus connector of the board and its cable have been plugged correctly.
- Check that the board has no dust or foreign matter adhering.

**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.
1. Before Using the Product
2. Setup

This chapter explains how to set up the board.

What is Setup?

Setup means a series of steps to take before the product can be used. Different steps are required for software and hardware. The setup procedure varies with the OS and applications used.

Using the Board under Windows

Using the Driver Library API-PAC(W32)

This section describes the setup procedure to be performed before you can start developing application programs for the board using the bundled DVD-ROM “Driver Library API-PAC(W32)”. Taking the following steps sets up the software and hardware. You can use the diagnosis program later to check whether the software and hardware function normally.

- Step 1 Installing the Software
- Step 2 Setting the Hardware
- Step 3 Installing the Hardware
- Step 4 Initializing the Software
- Step 5 Checking Operations with the Diagnosis Program

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

Using the Board under Windows

Using Software Other than the Driver Library API-PAC(W32)

For setting up software other than API-PAC(W32), refer to the manual for that software. See also the following parts of this 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 Board under an OS Other than Windows

For using the board under an OS other than Windows, 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) DVD-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 DVD-ROM [API-PAC(W32)] on your PC.**
2. **The API-PAC(W32) Installer window appears automatically.**
   - If the panel does not appear, run (DVD-ROM drive letter):\AUTORUN.exe.
3. **Click on the [Install Development or Execution Environment] button.**

* When using the Windows 8, 7, Vista, driver is automatically installed.

⚠️ **CAUTION**

Before installing the software in Windows 8, 7, Vista, Server 2008, Server 2003, XP, and 2000, log in as a user with administrator privileges.
2. Setup

Select 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 under the “Detail” 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.
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
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 - 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)](image)

---

2. Setup
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 or expansion unit’s power is turned on.
  Otherwise, the board may malfunction, overheat, or cause a failure.
  Be sure that the personal computer power is turned off.
- Make sure that your PC or expansion unit can supply ample power to all the boards installed.
  Insufficiently energized boards could malfunction, overheat, or cause a failure.
- Power supply from the PCI bus slot at +5V is required.
Step 3 Installing the Hardware

For using an expansion board under Windows, you have to let the OS detect the I/O addresses and IRQ 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 used by each board do not depend on the location of the PCI bus slot or the board itself. If you remove two or more boards that have already been installed and then remount one of them on the computer, it is unknown which one of the sets of resources previously assigned to the two boards is assigned to the remounted board. In this case, you must check the resource settings.

Setting with the Found New Hardware Wizard

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

Select “No, not this time” and then click the “Next” button.
(2) When “Multimedia Controller” is displayed, select “Install from a list or specific location[Advanced]” and then specify that folder on the DVD-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 DVD-ROM.
\INF\Wdm\Dio

![Found New Hardware Wizard]

If your hardware came with an installation CD or floppy disk, insert it now.

What do you want the wizard to do?

- Install the software automatically (Recommended)
- Install from a list or specific location[Advanced]

Click Next to continue
You have now finished installing the hardware.
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)

API-DIO(WDM) is initialized automatically during hardware installation. Therefore, if you want to use it with its initial settings, you can skip the setting procedure described in Step 4. To change the device name, follow the setting procedure shown below.

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].

* The name of the board you have just added is displayed.
  - DIO-0808L-PCI
2. Setup

(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.
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 test the input/output and check the execution environment.
For this board, prepare an external power supply (12 - 24VDC).
Set the board in the default factory.
To connect the external device, see Chapter 3 “External Connection”.

© CONTEC
DIO-0808L-PCI
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.
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.
2. Setup

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.

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 “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.

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

* The name of the board you have just added is displayed.
  - DIO-0808L-PCI

* The name of the board you have tested is displayed.
  - DIO-0808L-PCI
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.


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.
2. Setup
3. External Connection

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

Using the On-board Connectors

Connecting a Device to a Connector

To connect an external device to this board, plug the cable from the device into the interface connector shown below.

![Interface connector (CN1)](image)

- Connector used
  - 37-pin D-SUB, female connector
  - DCLC-J37SAP-20L9(mfd. by JAE)
  - Thumb screw : UNC#4-40(inch screw)
- Applicable connectors
  - 17JE-23370-02(D8C) (mfd. by DDK, Male)
  - FDCD-37P (mfd. by HIROSE, Male)
  - DC-37P-N (mfd. by JAE, Male)

Figure 3.1. Interface Connector and Applicable Cable Connector
## Connector Pin Assignment

### Pin Assignments of Interface Connector (CN1)

<table>
<thead>
<tr>
<th>Port</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>O-00 – O-07</td>
<td>8 input signal pins. Connect output signals from the external device to these pins.</td>
</tr>
<tr>
<td>O-00 – O-07</td>
<td>8 output signal pins. Connect these pins to the input signal pins of the external device.</td>
</tr>
<tr>
<td>IP</td>
<td>Connect the positive side of the external power supply. These pins are common to 8 input signal pins.</td>
</tr>
<tr>
<td>OP</td>
<td>Connect the positive side of the external power supply. These pins are common to 8 output signal pins.</td>
</tr>
<tr>
<td>ON</td>
<td>Connect the negative side of the external power supply. These pins are common to 8 output signal pins.</td>
</tr>
<tr>
<td>Others</td>
<td>This pin is left unconnected.</td>
</tr>
</tbody>
</table>

**Figure 3.2. Pin Assignments of Interface Connector (CN1)**
Relationships between Logical Ports/Bits and Connector Signal Pins

The following table lists the relationships between the connector signal pins and the logical port/bit numbers.

⚠️ 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.

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

<table>
<thead>
<tr>
<th>Input logical port</th>
<th>D7</th>
<th>D6</th>
<th>D5</th>
<th>D4</th>
<th>D3</th>
<th>D2</th>
<th>D1</th>
<th>D0</th>
</tr>
</thead>
<tbody>
<tr>
<td>I-07</td>
<td>I-06</td>
<td>I-05</td>
<td>I-04</td>
<td>I-03</td>
<td>I-02</td>
<td>I-01</td>
<td>I-00</td>
<td></td>
</tr>
<tr>
<td>[7]</td>
<td>[6]</td>
<td>[5]</td>
<td>[4]</td>
<td>[3]</td>
<td>[2]</td>
<td>[1]</td>
<td>[0]</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Output logical port</th>
<th>D7</th>
<th>D6</th>
<th>D5</th>
<th>D4</th>
<th>D3</th>
<th>D2</th>
<th>D1</th>
<th>D0</th>
</tr>
</thead>
<tbody>
<tr>
<td>O-07</td>
<td>O-06</td>
<td>O-05</td>
<td>O-04</td>
<td>O-03</td>
<td>O-02</td>
<td>O-01</td>
<td>O-00</td>
<td></td>
</tr>
<tr>
<td>[7]</td>
<td>[6]</td>
<td>[5]</td>
<td>[4]</td>
<td>[3]</td>
<td>[2]</td>
<td>[1]</td>
<td>[0]</td>
<td></td>
</tr>
</tbody>
</table>

Notes: I-xx represents the input signal. O-xx represents the output signal. [xx] represents the logical bit.
Connecting Input Signals

Connect the input signals to a device which can be current-driven, such as a switch or transistor output device. The connection requires an external power supply to feed currents. The board inputs the ON/OFF state of the current-driven device as a digital value.

Input Circuit

![Input Circuit Diagram]

* I-xx represents the input pin.

Figure 3.3. Input Circuit

The signal inputs are isolated by opto-couplers (ready to accept current sinking output signals). The board therefore requires an external power supply to drive the inputs. The power requirement for each input pin is about 5.1mA at 24VDC (about 2.6mA at 12VDC).

Connecting a Switch

![Connecting a Switch Diagram]

When the switch is ON, the corresponding bit contains 1. When the switch is OFF, by contrast, the bit contains 0.

Figure 3.4. An Example to use Input I-00
Connecting Output Signals

Connect the output signals to a current-driven controlled device such as a relay or LED. The connection requires an external power supply to feed currents. The board controls turning on/off the current-driven controlled device using a digital value.

Output Circuit

![Output Circuit Diagram]

* O-xx represents the output pin.

**Figure 3.5. Output Circuit**

The signal output section is an opto-coupler isolated, open-collector output (current sink type). Driving the output section requires an external power supply.

The rated output current per channel is 100mA at maximum.

The output section can also be connected to a TTL level input as it uses a low-saturated transistor for output. The residual voltage (low-level voltage) between the collector and emitter with the output on is 0.5V or less at an output current within 50mA or at most 1.0V at an output current within 100mA.

A zener diode is connected to the output transistor for protection from surge voltages. A Fuse-based overcurrent protector is provided for every 8 output transistors. When the overcurrent protector works, the output section of the board is temporarily disabled. If this is the case, turn off the power to the PC and the external power supply and wait for a few minutes, then turn them on back.

⚠️ CAUTION

When the PC is turned on, all output are reset to OFF.
3. External Connection

**Connection to the LED**

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 3.6. An Example to use Output O-00**

**Example of Connection to TTL Level Input**

**Figure 3.7. Connection Example of Output and TTL level Input Signal**
Connecting the Sink Type Output and Sink Output Support Input

The following example shows a connection between a sink type output (output board) and a sink output support input (input board). Refer to this connection example when you connect such boards to each other.

![Diagram](image)

**Figure 3.8. Example of Connecting the Sink Type Output and Sink Output Support Input**
3. External Connection
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 function library. For details, refer to API-DIO HELP available after installation.

Data I/O Function

Data Input

When input data is “ON”, “1” is input to the relevant bit.
When the input data is “OFF”, in contrast, “0” is input to the relevant bit

Data Output

When “1” is output to the relevant bit, the corresponding transistor is set to “ON”.
When “0” is output to the relevant bit, in contrast, the corresponding transistor is set to “OFF”.

⚠️ CAUTION
When the PC is turned on, all output are reset to 0 (OFF).

Monitoring Output Data

The <DIO-0808L-PCI> can read the state of the data currently being output without affecting the output data.
Digital Filter

Using this feature, the <DIO-0808L-PCI> 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.

![Diagram of Digital Filter Function Principle](image)

Figure 4.1. 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.] = $2^n / (8 \times 10^6)$

\[ n = \text{setting data}(0 \text{ - } 20) \]

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

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.
Interrupt Control Function

The <DIO-0808L-PCI> can use all of the input signals as interrupt request signals.

This product 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 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 fall of the input signal from High to Low).

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 rise of the input signal from Low to High).

⚠️ 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

DVD-ROM Directory Structure

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

The bundled DVD-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) Using the API-DIO(WDM), from the Start Menu, select “Programs” – “CONTEC API-PAC(W32)” - “DIOWDM” - “API-DIO(WDM) 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.

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) A sample program is invoked.

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.
Uninstalling the Driver Libraries

The method used to uninstall API-PAC(W32) differs depending on which OS you are using. Follow the procedure given below.

Uninstall procedure for Windows 7 and Windows Vista

< Uninstalling the device driver >

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. All of the hardware that uses the API-TOOL(WDM) driver is registered under the CONTEC Devices tree. Open the device tree, select the hardware to uninstall, and then right-click the hardware. From the popup menu, select [Uninstall].

3. A dialog box opens asking you to confirm whether to uninstall. Select the [Delete the driver software for this device] checkbox, and then click [OK].
< Uninstall the development environment >

Select [CONTEC API-***(WDM) VerX.XX (development environment)] and then click [Uninstall].

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

< Uninstall the device driver >

Use [My Computer] - [Control Panel] - [Add and Remove Applications] to uninstall the device driver.
Select [Windows driver package - CONTEC (****)] and then click [Change/Remove].

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

< Uninstall the development environment >

Select [CONTEC API-***(WDM) VerX.XX (development environment)] and then click [Change/Remove].

* ”***” contains the driver category name (AIO, CNT, DIO, SMC, etc.).
6. About Hardware

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

Hardware specification

Table 6.1. Specification < 1 / 2 >

<table>
<thead>
<tr>
<th>Item</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Input</strong></td>
<td></td>
</tr>
<tr>
<td>Input format</td>
<td>Opto-coupler isolated input (Compatible with current sink output) (Negative logic *1)</td>
</tr>
<tr>
<td>Number of input signal</td>
<td>8ch (all available for interrupts) (1 common in 8ch)</td>
</tr>
<tr>
<td>Resistance</td>
<td>4.7kΩ</td>
</tr>
<tr>
<td>ON current</td>
<td>2.0mA or more</td>
</tr>
<tr>
<td>OFF current</td>
<td>0.16mA or less</td>
</tr>
<tr>
<td>Interrupt</td>
<td>8 interrupt input signals are arranged into a single output of interrupt signal INTA. An interrupt is generated at the rising edge (HIGH-to-LOW transition) or falling edge (LOW-to-HIGH transition).</td>
</tr>
<tr>
<td>Response time</td>
<td>Within 200μsec</td>
</tr>
<tr>
<td><strong>Output</strong></td>
<td></td>
</tr>
<tr>
<td>Output format</td>
<td>Opto-coupler isolated open collector output (current sink type) (Negative logic *1)</td>
</tr>
<tr>
<td>Number of output signal</td>
<td>8ch (1 common)</td>
</tr>
<tr>
<td>rating</td>
<td></td>
</tr>
<tr>
<td>Voltage</td>
<td>35VDC (Max.)</td>
</tr>
<tr>
<td>Current</td>
<td>100mA (par channel) (Max.)</td>
</tr>
<tr>
<td>Residual voltage with</td>
<td>0.5V or less (Output current≤50mA), 1.0V or less (Output current≤100mA)</td>
</tr>
<tr>
<td>output on</td>
<td></td>
</tr>
<tr>
<td>Surge protector</td>
<td>Zener diode RD47FM(NEC) or equivalent to it</td>
</tr>
<tr>
<td>Response time</td>
<td>Within 200μsec</td>
</tr>
</tbody>
</table>

*1 Data “0” and “1” correspond to the High and Low levels, respectively.
### Table 6.1. Specification < 2 / 2 >

<table>
<thead>
<tr>
<th>Item</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Common</td>
<td></td>
</tr>
<tr>
<td>Built-in power</td>
<td>None</td>
</tr>
<tr>
<td>Allowable distance of signal extension</td>
<td>Approx. 50m (depending on wiring environment)</td>
</tr>
<tr>
<td>I/O address</td>
<td>Any 32-byte boundary</td>
</tr>
<tr>
<td>Interruption level</td>
<td>1 level use</td>
</tr>
<tr>
<td>Max. board count for connection</td>
<td>16 boards including the master board</td>
</tr>
<tr>
<td>Isolated Power</td>
<td>1000Vrms</td>
</tr>
<tr>
<td>External circuit power supply</td>
<td>12 · 24VDC(±10%)</td>
</tr>
<tr>
<td>Power consumption</td>
<td>5VDC 90.5mA</td>
</tr>
<tr>
<td>Operating condition</td>
<td>0 · 50°C, 10 · 90%RH (No condensation)</td>
</tr>
<tr>
<td>Bus specification</td>
<td>PCI Base Specification</td>
</tr>
<tr>
<td>Dimension (mm)</td>
<td>121.69(L) x 105.68(H)</td>
</tr>
<tr>
<td>Connector</td>
<td>37 pin D-SUB connector [F (female) type]</td>
</tr>
<tr>
<td></td>
<td>DCLC-J37SAF-20L9E [mfd by JAE] or equivalent to it</td>
</tr>
<tr>
<td>Weight</td>
<td>84.4g</td>
</tr>
</tbody>
</table>

### Board Dimensions

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

Figure 6.1. Block Diagram
부 록

DIO-0808L-PCI
Terminal (XTB-20H) 사용자 메뉴얼

※ Terminal 및 Cable은 옵션 품목입니다.
Board to Terminal  Cable Connection (Option)

DIO-0808L-PCI

INPUT PORT
1 [ON]
2 [I-00]
3 [I-01]
4 [I-02]
5 [I-03]
6 [I-04]
7 [I-05]
8 [I-06]
9 [I-07]
10 [IP]

OUTPUT PORT
20 [ON]
21 [O-00]
22 [O-01]
23 [O-02]
24 [O-03]
25 [O-04]
26 [O-05]
27 [O-06]
28 [O-07]
37 [OP]

XTB-20H

INPUT PORT
IN-1
100
101
102
103
104
105
106
107

OUTPUT PORT
ON-1
O 00
O 01
O 02
O 03
O 04
O 05
O 06
O 07
OP+1

Common plus pin for output Port
Common plus pin for input Port
Common plus pin for output Port

Board to Terminal  Cable Connection (Option)
About Terminal

**XTB - 20H**

- **Dimension**
- **Wiring diagram**

### Features
- **Terminal Pitch 7.0 ㎜**
- **Easy for working and Maintenance**
  - As it uses hinge-typed transparent T/B cover, it is easy to work and maintain.
  - As it is designed to have a DIN Rail mounting structure and has a hole for securing on the mounting plate, it is very easy to install it.
- **Workability under any working environment and Excellent Stability**
  - As this is an integration type in which PCB is not exposed to outside, it is an electrically safe structure for dust, moisture etc, and fire retardant material is used for outer case.

### Characteristics

<table>
<thead>
<tr>
<th></th>
<th>Rated Voltage 125V AC / 24V DC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rated current</td>
<td>1A</td>
</tr>
<tr>
<td>Insulation resistance</td>
<td>100 Ohm (DC 500V)</td>
</tr>
<tr>
<td>Withstand Voltage</td>
<td>AC500V 1min</td>
</tr>
<tr>
<td>Applicable Wire</td>
<td>1.25mm / MAX</td>
</tr>
<tr>
<td>Terminal Screw</td>
<td>M3 X 7L</td>
</tr>
<tr>
<td>Screw torque</td>
<td>1.2N·m (12Kgf·cm)</td>
</tr>
<tr>
<td>Ambient Temperature</td>
<td>-10 °C ~ +50 °C (No Condensation)</td>
</tr>
</tbody>
</table>

### Materials

<table>
<thead>
<tr>
<th></th>
<th>Case</th>
<th>Modified PPD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cover</td>
<td>Polycarbonate</td>
<td></td>
</tr>
<tr>
<td>P.C.B</td>
<td>Epoxy 1.6t</td>
<td></td>
</tr>
</tbody>
</table>

### Applicable Crimp terminal

- **MIN5.8 MAX4.2**
- **MIN6.2 MAX6.2**
About Terminal

Picture