PC-HELPER

Bi-Directional Digital I/O
Board for PCI Express
Low Profile

DIO-96D-LPE
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 [DIO-96D-LPE] …1
- First step guide …1
- CD-ROM *1 [API-PAC(W32)] …1
- Standard size bracket …1

*1 The CD-ROM contains the driver software and User’s Guide (this guide)
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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 Express bus-compliant interface board that extends the input/output function of bi-directional digital signal. This board has up to 96 unisolated LVTTL-level input/output channels that is powered by the equivalence to the mode 0 of i8255 chips, and you can use up to 96 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 96 points bi-directional digital corresponding to the equivalence to the i8255 mode 0.
  This board has up to 96 unisolated LVTTL-level input/output channels whose response speed is 200μsec that is powered by to 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 96 channels of the input signals as interrupt events.
  You can use up to 96 channels of the input signals as interrupt events and also disable or enable the interrupt in bit units and select the edge of 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.

- Support for both of Low Profile and standard size slots
  Support for both of Low Profile and standard size slots (interchangeable with a bundled bracket).

- Functions and connectors are compatible with PCI compatible board DIO-96D2-LPCI.
  The functions same with PCI compatible board DIO-96D2-LPCI are provided. In addition, as there is compatibility in terms of connector shape and pin assignments, 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.
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 >*

<table>
<thead>
<tr>
<th>OS</th>
<th>Windows Vista, XP, Server 2003, 2000</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adaptation language</td>
<td>Visual Basic, Visual C++, Visual C#, Delphi, C++ Builder</td>
</tr>
</tbody>
</table>

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 >*

<table>
<thead>
<tr>
<th>OS</th>
<th>RedHatLinux, TurboLinux</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adaptation language</td>
<td>gcc</td>
</tr>
</tbody>
</table>

(For details on supported distributions, refer to Help available after installation.)

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.
1. Before Using the Product

**Cable & Connector (Option)**

Cable with 68-Pin D-sub Connector at either Ends (Mold Type)
- PCB68PS-0.5P (0.5m)
- PCB68PS-1.5P (1.5m)

Shield Cable with One 68-Pin Connector
- PCA68PS-0.5P (0.5m)
- PCA68PS-1.5P (1.5m)

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

* If using both the CNA and CNB connectors, two cable sets are required.

**Accessories (Option)**

Screw Terminal Unit (M3 x 68P)
- EPD-68A *1*3

Screw Terminal Unit (M3 x 96P)
- EPD-96A *2*3

Screw Terminal Unit (M3.5 x 96P)
- EPD-96 *2

Terminal Unit for Cables (M3 x 96P)
- DTP-64A *2

*1 PCB68PS-0.5P or PCB68PS-1.5P optional cable is required separately.
*2 DIO-68M/96F optional cable is required separately.
*3 “Spring-up” type terminal is used to prevent terminal screws from falling off.
*4 If using both the CNA and CNB connectors, two each of the accessories and cable sets are required.

* Check the CONTEC’s Web site for more information on these options.
1. Before Using the Product

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 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 is a switch on the board that needs 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.
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.

- 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.
- The gold-plated leads of the bus connector have no stain or corrosion.

Storage

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

(1) Put the board in the storage bag.
(2) Wrap it in the packing material, then put it in the box.
(3) Store the package at room temperature at a place free from direct sunlight, moisture, shock, vibration, magnetism, and static electricity.

Disposal

When disposing of the product, follow the disposal procedures stipulated under the relevant laws and municipal ordinances.
2. Setup

This chapter explains how to set up the board.

What is Setup?

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

Using the Board under Windows

Using the Driver Library API-PAC(W32)

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

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

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

Using the Board under Windows

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

For setting up software other than API-PAC(W32), refer to the 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
2. Setup

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
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 a 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.
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 Vista, driver is automatically installed.

⚠️ CAUTION
Before installing the software in Windows Vista, XP, Server 2003, 2000 and NT, log in as a user with administrator privileges.
2. Setup

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.

![Dialog box for selecting API-DIO(WDM)](image)

* 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.
2. Setup

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).
2. Setup

DIO-96D-LPE

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”.

![CONTEC API-DIO-96D-LPE - InstallShield Wizard](image)

**InstallShield Wizard Complete**

The InstallShield Wizard has successfully installed CONTEC API-DIO-96D-LPE. Click Finish to exit the wizard.

- [ ] Perform a hardware setup now.
- [x] Show readme file.

[Back] [Finish] [Cancel]

You have now finished installing the software.
Step 2 Setting the Hardware

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

Replacing the Bracket

This product is shipped with a Low Profile size bracket mounted. To plug the product into a standard size slot, replace the bracket with the bundled standard-sized bracket. The replacing method is as follows:

- Remove the screws and replace it with the Standard-sized bracket.

Use a flathead screwdriver or hexagonal spanner to undo and tighten the screws.

Figure 2.1. Replacing the Bracket
Parts of the Board and Factory Defaults

Figure 2.2. shows the names of major parts on the board. Note that the switch setting shown below is the factory default.

Figure 2.2. 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 2.3. Board ID Settings (SW1)
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.

⚠️ 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.
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 Found New Hardware Wizard.

Turning on the PC

Turn on the power to your PC.

⚠️ CAUTION

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

- The resources used by each board do not depend on the location of the PCI Express 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.
(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 Vista, XP, Server 2003, 2000 \INF\Wdm\Dio
You have now finished installing the hardware.
2. Setup

**When Using API-DIO(98/PC)**

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

![Found New Hardware Wizard](image)

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.
(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 Vista, XP, Server 2003, 2000 \INF\Win2000\Dio\PCI

Example of specifying the folder for use under Windows XP

[Diagram showing file structure]

\INF\Win2000\Dio\PCI

* The name of the board you have just added is displayed.
  - DIO-96D-LPE
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.
### 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-96D-LPE
(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.
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.
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.

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

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

- DIO-96D-LPE
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.

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.

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

The on-board interface connector (CNA, CNB) is used when connecting this product and the external devices.

* Please refer to chapter 1 for more information on the supported cable and accessories.

Figure 3.1. Interface Connector (CNA, CNB) Shape
## Connector Pin Assignment

### Pin Assignments of DIO-96D-LPE Interface Connector (CNA, CNB)

<table>
<thead>
<tr>
<th>Pin Assignments of Interface Connector (CNA, CNB)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>2-A port</strong></td>
</tr>
<tr>
<td>GND 46</td>
</tr>
<tr>
<td>1-PA7 44</td>
</tr>
<tr>
<td>2-PA6 43</td>
</tr>
<tr>
<td>2-PA5 42</td>
</tr>
<tr>
<td>2-PA4 41</td>
</tr>
<tr>
<td>2-PA3 40</td>
</tr>
<tr>
<td>2-PA2 39</td>
</tr>
<tr>
<td>2-PA1 38</td>
</tr>
<tr>
<td>2-PA0 37</td>
</tr>
<tr>
<td>GND 36</td>
</tr>
<tr>
<td>GND 35</td>
</tr>
<tr>
<td><strong>1-A port</strong></td>
</tr>
<tr>
<td>3-PA7 32</td>
</tr>
<tr>
<td>3-PA6 33</td>
</tr>
<tr>
<td>3-PA5 34</td>
</tr>
<tr>
<td>3-PA4 35</td>
</tr>
<tr>
<td>3-PA3 36</td>
</tr>
<tr>
<td>3-PA2 37</td>
</tr>
<tr>
<td>3-PA1 38</td>
</tr>
<tr>
<td>3-PA0 39</td>
</tr>
<tr>
<td>GND 40</td>
</tr>
<tr>
<td>GND 41</td>
</tr>
<tr>
<td><strong>1-B port</strong></td>
</tr>
<tr>
<td>GND 46</td>
</tr>
<tr>
<td>2-PB7 54</td>
</tr>
<tr>
<td>2-PB6 53</td>
</tr>
<tr>
<td>2-PB5 52</td>
</tr>
<tr>
<td>2-PB4 51</td>
</tr>
<tr>
<td>2-PB3 50</td>
</tr>
<tr>
<td>2-PB2 49</td>
</tr>
<tr>
<td>2-PB1 48</td>
</tr>
<tr>
<td>2-PB0 47</td>
</tr>
<tr>
<td>GND 58</td>
</tr>
<tr>
<td>GND 59</td>
</tr>
<tr>
<td><strong>1-C port</strong></td>
</tr>
<tr>
<td>GND 48</td>
</tr>
<tr>
<td>2-PC7 66</td>
</tr>
<tr>
<td>2-PC6 65</td>
</tr>
<tr>
<td>2-PC5 64</td>
</tr>
<tr>
<td>2-PC4 63</td>
</tr>
<tr>
<td>GND 62</td>
</tr>
<tr>
<td>GND 61</td>
</tr>
<tr>
<td><strong>2-C port</strong></td>
</tr>
<tr>
<td>GND 56</td>
</tr>
<tr>
<td>2-PC3 60</td>
</tr>
<tr>
<td>2-PC2 59</td>
</tr>
<tr>
<td>2-PC1 58</td>
</tr>
<tr>
<td>2-PC0 57</td>
</tr>
<tr>
<td>GND 66</td>
</tr>
<tr>
<td><strong>1-G port</strong></td>
</tr>
<tr>
<td>GND 36</td>
</tr>
<tr>
<td>GND 35</td>
</tr>
</tbody>
</table>

* I-00 · I-17 can be used as interrupt signal.

**Figure 3.2. Pin Assignments of Interface Connector (CNA, CNB) < DIO-96D-LPE >**
Pin assignments for connecting to the DIO-68M/96F used

The figure below shows the correspondence between the option cable pins and signals.

![Figure 3.3. Signal assignment with the DIO-68M/96F used](image)

<table>
<thead>
<tr>
<th>1-C port (High)</th>
<th>2-C port (High)</th>
<th>3-C port (High)</th>
<th>4-C port (High)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-PC7 A48</td>
<td>B48 2-PC7</td>
<td>3-PC7 A48</td>
<td>B48 1-PC7</td>
</tr>
<tr>
<td>GND A47</td>
<td>B47 GND</td>
<td>GND A47</td>
<td>B47 GND</td>
</tr>
<tr>
<td>1-PC6 A46</td>
<td>B46 2-PC6</td>
<td>3-PC6 A46</td>
<td>B46 1-PC6</td>
</tr>
<tr>
<td>GND A45</td>
<td>B45 GND</td>
<td>GND A45</td>
<td>B45 GND</td>
</tr>
<tr>
<td>1-PC5 A44</td>
<td>B44 2-PC5</td>
<td>3-PC5 A44</td>
<td>B44 1-PC5</td>
</tr>
<tr>
<td>GND A43</td>
<td>B43 GND</td>
<td>GND A43</td>
<td>B43 GND</td>
</tr>
<tr>
<td>1-PC4 A42</td>
<td>B42 2-PC4</td>
<td>3-PC4 A42</td>
<td>B42 1-PC4</td>
</tr>
<tr>
<td>GND A41</td>
<td>B41 GND</td>
<td>GND A41</td>
<td>B41 GND</td>
</tr>
<tr>
<td>1-PC3 A40</td>
<td>B40 2-PC3</td>
<td>3-PC3 A40</td>
<td>B40 1-PC3</td>
</tr>
<tr>
<td>GND A39</td>
<td>B39 GND</td>
<td>GND A39</td>
<td>B39 GND</td>
</tr>
<tr>
<td>1-PC2 A38</td>
<td>B38 2-PC2</td>
<td>3-PC2 A38</td>
<td>B38 1-PC2</td>
</tr>
<tr>
<td>GND A37</td>
<td>B37 GND</td>
<td>GND A37</td>
<td>B37 GND</td>
</tr>
<tr>
<td>1-PC1 A36</td>
<td>B36 2-PC1</td>
<td>3-PC1 A36</td>
<td>B36 1-PC1</td>
</tr>
<tr>
<td>GND A35</td>
<td>B35 GND</td>
<td>GND A35</td>
<td>B35 GND</td>
</tr>
<tr>
<td>1-PC0 A34</td>
<td>B34 2-PC0</td>
<td>3-PC0 A34</td>
<td>B34 1-PC0</td>
</tr>
<tr>
<td>GND A33</td>
<td>B33 GND</td>
<td>GND A33</td>
<td>B33 GND</td>
</tr>
<tr>
<td>1-PA7 A32</td>
<td>B32 2-PA7</td>
<td>3-PA7 A32</td>
<td>B32 1-PA7</td>
</tr>
<tr>
<td>GND A31</td>
<td>B31 GND</td>
<td>GND A31</td>
<td>B31 GND</td>
</tr>
<tr>
<td>1-PA6 A30</td>
<td>B30 2-PA6</td>
<td>3-PA6 A30</td>
<td>B30 1-PA6</td>
</tr>
<tr>
<td>GND A29</td>
<td>B29 GND</td>
<td>GND A29</td>
<td>B29 GND</td>
</tr>
<tr>
<td>1-PA5 A28</td>
<td>B28 2-PA5</td>
<td>3-PA5 A28</td>
<td>B28 1-PA5</td>
</tr>
<tr>
<td>GND A27</td>
<td>B27 GND</td>
<td>GND A27</td>
<td>B27 GND</td>
</tr>
<tr>
<td>1-PA4 A26</td>
<td>B26 2-PA4</td>
<td>3-PA4 A26</td>
<td>B26 1-PA4</td>
</tr>
<tr>
<td>GND A25</td>
<td>B25 GND</td>
<td>GND A25</td>
<td>B25 GND</td>
</tr>
<tr>
<td>1-PA3 A24</td>
<td>B24 2-PA3</td>
<td>3-PA3 A24</td>
<td>B24 1-PA3</td>
</tr>
<tr>
<td>GND A23</td>
<td>B23 GND</td>
<td>GND A23</td>
<td>B23 GND</td>
</tr>
<tr>
<td>1-PA2 A22</td>
<td>B22 2-PA2</td>
<td>3-PA2 A22</td>
<td>B22 1-PA2</td>
</tr>
<tr>
<td>GND A21</td>
<td>B21 GND</td>
<td>GND A21</td>
<td>B21 GND</td>
</tr>
<tr>
<td>1-PA1 A20</td>
<td>B20 2-PA1</td>
<td>3-PA1 A20</td>
<td>B20 1-PA1</td>
</tr>
<tr>
<td>GND A19</td>
<td>B19 GND</td>
<td>GND A19</td>
<td>B19 GND</td>
</tr>
<tr>
<td>1-PA0 A18</td>
<td>B18 2-PA0</td>
<td>3-PA0 A18</td>
<td>B18 1-PA0</td>
</tr>
<tr>
<td>GND A17</td>
<td>B17 GND</td>
<td>GND A17</td>
<td>B17 GND</td>
</tr>
<tr>
<td>1-PB7 A16</td>
<td>B16 2-PB7</td>
<td>3-PB7 A16</td>
<td>B16 1-PB7</td>
</tr>
<tr>
<td>GND A15</td>
<td>B15 GND</td>
<td>GND A15</td>
<td>B15 GND</td>
</tr>
<tr>
<td>1-PB6 A14</td>
<td>B14 2-PB6</td>
<td>3-PB6 A14</td>
<td>B14 1-PB6</td>
</tr>
<tr>
<td>GND A13</td>
<td>B13 GND</td>
<td>GND A13</td>
<td>B13 GND</td>
</tr>
<tr>
<td>1-PB5 A12</td>
<td>B12 2-PB5</td>
<td>3-PB5 A12</td>
<td>B12 1-PB5</td>
</tr>
<tr>
<td>GND A11</td>
<td>B11 GND</td>
<td>GND A11</td>
<td>B11 GND</td>
</tr>
<tr>
<td>1-PB4 A10</td>
<td>B10 2-PB4</td>
<td>3-PB4 A10</td>
<td>B10 1-PB4</td>
</tr>
<tr>
<td>GND A09</td>
<td>B09 GND</td>
<td>GND A09</td>
<td>B09 GND</td>
</tr>
<tr>
<td>1-PB3 A08</td>
<td>B08 2-PB3</td>
<td>3-PB3 A08</td>
<td>B08 1-PB3</td>
</tr>
<tr>
<td>GND A07</td>
<td>B07 GND</td>
<td>GND A07</td>
<td>B07 GND</td>
</tr>
<tr>
<td>1-PB2 A06</td>
<td>B06 2-PB2</td>
<td>3-PB2 A06</td>
<td>B06 1-PB2</td>
</tr>
<tr>
<td>GND A06</td>
<td>B06 GND</td>
<td>GND A06</td>
<td>B06 GND</td>
</tr>
<tr>
<td>1-PB1 A05</td>
<td>B05 2-PB1</td>
<td>3-PB1 A05</td>
<td>B05 1-PB1</td>
</tr>
<tr>
<td>GND A05</td>
<td>B05 GND</td>
<td>GND A05</td>
<td>B05 GND</td>
</tr>
<tr>
<td>1-PA7 A04</td>
<td>B04 2-PA7</td>
<td>3-PA7 A04</td>
<td>B04 1-PA7</td>
</tr>
<tr>
<td>GND A04</td>
<td>B04 GND</td>
<td>GND A04</td>
<td>B04 GND</td>
</tr>
<tr>
<td>1-PA6 A03</td>
<td>B03 2-PA6</td>
<td>3-PA6 A03</td>
<td>B03 1-PA6</td>
</tr>
<tr>
<td>GND A03</td>
<td>B03 GND</td>
<td>GND A03</td>
<td>B03 GND</td>
</tr>
<tr>
<td>1-PA5 A02</td>
<td>B02 2-PA5</td>
<td>3-PA5 A02</td>
<td>B02 1-PA5</td>
</tr>
<tr>
<td>GND A02</td>
<td>B02 GND</td>
<td>GND A02</td>
<td>B02 GND</td>
</tr>
<tr>
<td>1-PA4 A01</td>
<td>B01 2-PA4</td>
<td>3-PA4 A01</td>
<td>B01 1-PA4</td>
</tr>
<tr>
<td>GND A01</td>
<td>B01 GND</td>
<td>GND A01</td>
<td>B01 GND</td>
</tr>
</tbody>
</table>

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

Figure 3.3. Signal assignment with the DIO-68M/96F used
## Relationships between API-PAC(W32) Logical Ports/Bits and Connector Signal Pins

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

<table>
<thead>
<tr>
<th>I/O Logical Ports</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>0</td>
<td>1-PA7</td>
<td>1-PA6</td>
<td>1-PA5</td>
<td>1-PA4</td>
<td>1-PA3</td>
<td>1-PA2</td>
<td>1-PA1</td>
<td>1-PA0</td>
</tr>
<tr>
<td>1</td>
<td>1-PB7</td>
<td>1-PB6</td>
<td>1-PB5</td>
<td>1-PB4</td>
<td>1-PB3</td>
<td>1-PB2</td>
<td>1-PB1</td>
<td>1-PB0</td>
</tr>
<tr>
<td>2</td>
<td>1-PC7</td>
<td>1-PC6</td>
<td>1-PC5</td>
<td>1-PC4</td>
<td>1-PC3</td>
<td>1-PC2</td>
<td>1-PC1</td>
<td>1-PC0</td>
</tr>
<tr>
<td>3</td>
<td>2-PA7</td>
<td>2-PA6</td>
<td>2-PA5</td>
<td>2-PA4</td>
<td>2-PA3</td>
<td>2-PA2</td>
<td>2-PA1</td>
<td>2-PA0</td>
</tr>
<tr>
<td>4</td>
<td>2-PB7</td>
<td>2-PB6</td>
<td>2-PB5</td>
<td>2-PB4</td>
<td>2-PB3</td>
<td>2-PB2</td>
<td>2-PB1</td>
<td>2-PB0</td>
</tr>
<tr>
<td>5</td>
<td>2-PC7</td>
<td>2-PC6</td>
<td>2-PC5</td>
<td>2-PC4</td>
<td>2-PC3</td>
<td>2-PC2</td>
<td>2-PC1</td>
<td>2-PC0</td>
</tr>
<tr>
<td>6</td>
<td>3-PA7</td>
<td>3-PA6</td>
<td>3-PA5</td>
<td>3-PA4</td>
<td>3-PA3</td>
<td>3-PA2</td>
<td>3-PA1</td>
<td>3-PA0</td>
</tr>
<tr>
<td>7</td>
<td>3-PB7</td>
<td>3-PB6</td>
<td>3-PB5</td>
<td>3-PB4</td>
<td>3-PB3</td>
<td>3-PB2</td>
<td>3-PB1</td>
<td>3-PB0</td>
</tr>
<tr>
<td>8</td>
<td>3-PC7</td>
<td>3-PC6</td>
<td>3-PC5</td>
<td>3-PC4</td>
<td>3-PC3</td>
<td>3-PC2</td>
<td>3-PC1</td>
<td>3-PC0</td>
</tr>
<tr>
<td>9</td>
<td>4-PA7</td>
<td>4-PA6</td>
<td>4-PA5</td>
<td>4-PA4</td>
<td>4-PA3</td>
<td>4-PA2</td>
<td>4-PA1</td>
<td>4-PA0</td>
</tr>
<tr>
<td>A</td>
<td>4-PB7</td>
<td>4-PB6</td>
<td>4-PB5</td>
<td>4-PB4</td>
<td>4-PB3</td>
<td>4-PB2</td>
<td>4-PB1</td>
<td>4-PB0</td>
</tr>
<tr>
<td>B</td>
<td>4-PC7</td>
<td>4-PC6</td>
<td>4-PC5</td>
<td>4-PC4</td>
<td>4-PC3</td>
<td>4-PC2</td>
<td>4-PC1</td>
<td>4-PC0</td>
</tr>
</tbody>
</table>

**Note:** 1-PAx, 1-PBx, 1-PCx, 2-PAx, 2-PBx, 2-PCx, 3-PAx, 3-PBx, 3-PCx, 4-PAx, 4-PBx, 4-PCx represents an I/O signal of CN1

[xx] represents a logical bits

⚠️ **CAUTION**

The logical port and logical bit numbers are virtual port and bit numbers that enable programming independent of board I/O addresses or board types.

For details, refer to API-DIO HELP available after installing API-PAC(W32).
Connecting I/O Signals

The I/O circuits of interface blocks of the DIO-96D-LPE are illustrated in Figure 3.4. Signals are LVTTL-levels and positive logic.

I/O Circuit

Figure 3.4. I/O Circuit

⚠️ CAUTION
- Take care not to short the outputs to digital ground as this may cause a fault.
- If connecting pull-up resistors to the outputs, use a resistor of approximately 10kΩ and pull-up to the 3.3V power supply.
- The inputs support input of TTL level (5VDC) signals.
Example Connection 1 (Using PCA68PS-**P)

![Diagram of Example Connection 1](image1)

Figure 3.5. Connection Example Using 1-PA0 for Input and 2-PA0 for Output (Using PCA68PS-**P)

Example Connection 2 (Using DIO-68M/96F)

![Diagram of Example Connection 2](image2)

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

When connecting to digital outputs a load that may generate a voltage surge or current, for example an inductive load such as a relay coil or incandescent lamp, suitable protection measures are required to prevent damage to the output stage or malfunction owing to noise. The instantaneous interruption of current flowing through a coil, including a relay, results in the sudden generation of a high-voltage pulse. If the voltage exceeds the withstand voltage of the transistor, the transistor performance may be degraded or the transistor may be damaged. To prevent this, be sure to connect a surge absorption element when driving an inductive load including a relay coil. Examples of measures against voltage surge are shown in Figure 3.7. below.

**Figure 3.7. Samples of Voltage Surge Protection**

⚠️ **CAUTION**

The protection circuit must be installed less than 50 cm from the load and contact to provide effective protection.
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 driver library. For details, refer to API-DIO HELP available after installation.

Data I/O Function

This board supports the equivalence to mode 0 of four i8255 chips, capable of input/output of up to 96 LVTTL-level active high signals.

I/O setup of the port

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

![Control Word Diagram]

Figure 4.2. I/O setup control word

Table 4.1. Setup value of the control word

<table>
<thead>
<tr>
<th>D7</th>
<th>D6</th>
<th>D5</th>
<th>D4</th>
<th>D3</th>
<th>D2</th>
<th>D1</th>
<th>D0</th>
<th>hexadecimal</th>
<th>Port A</th>
<th>Port C (High 4bit)</th>
<th>Port B</th>
<th>Port C (Low 4bit)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>80</td>
<td>OUTPUT</td>
<td>OUTPUT</td>
<td>OUTPUT</td>
<td>OUTPUT</td>
</tr>
<tr>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>81</td>
<td>OUTPUT</td>
<td>OUTPUT</td>
<td>OUTPUT</td>
<td>INPUT</td>
</tr>
<tr>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>82</td>
<td>OUTPUT</td>
<td>OUTPUT</td>
<td>INPUT</td>
<td>OUTPUT</td>
</tr>
<tr>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>83</td>
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<td>INPUT</td>
<td>INPUT</td>
<td>INPUT</td>
</tr>
<tr>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>88</td>
<td>OUTPUT</td>
<td>INPUT</td>
<td>OUTPUT</td>
<td>OUTPUT</td>
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<tr>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
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<td>1</td>
<td>89</td>
<td>OUTPUT</td>
<td>INPUT</td>
<td>OUTPUT</td>
<td>INPUT</td>
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<tr>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>8A</td>
<td>OUTPUT</td>
<td>INPUT</td>
<td>INPUT</td>
<td>OUTPUT</td>
</tr>
<tr>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>8B</td>
<td>OUTPUT</td>
<td>INPUT</td>
<td>INPUT</td>
<td>INPUT</td>
</tr>
<tr>
<td>1</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>90</td>
<td>INPUT</td>
<td>OUTPUT</td>
<td>OUTPUT</td>
<td>OUTPUT</td>
</tr>
<tr>
<td>1</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>91</td>
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<td>OUTPUT</td>
<td>OUTPUT</td>
<td>INPUT</td>
</tr>
<tr>
<td>1</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>92</td>
<td>INPUT</td>
<td>OUTPUT</td>
<td>OUTPUT</td>
<td>INPUT</td>
</tr>
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<td>0</td>
<td>1</td>
<td>0</td>
<td>1</td>
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<td>1</td>
<td>93</td>
<td>INPUT</td>
<td>OUTPUT</td>
<td>OUTPUT</td>
<td>INPUT</td>
</tr>
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<td>1</td>
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<td>0</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>98</td>
<td>INPUT</td>
<td>INPUT</td>
<td>OUTPUT</td>
<td>OUTPUT</td>
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<tr>
<td>1</td>
<td>0</td>
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<td>1</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>99</td>
<td>INPUT</td>
<td>INPUT</td>
<td>OUTPUT</td>
<td>INPUT</td>
</tr>
<tr>
<td>1</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>9A</td>
<td>INPUT</td>
<td>INPUT</td>
<td>INPUT</td>
<td>OUTPUT</td>
</tr>
<tr>
<td>1</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>9B</td>
<td>INPUT</td>
<td>INPUT</td>
<td>INPUT</td>
<td>INPUT</td>
</tr>
</tbody>
</table>
Data I/O

I/O signals are LV 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.
Digital Filter Function

Using this feature, the <DIO-96D-LPE> 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.

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 4.4 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)

<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>

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-96D-LPE> 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.
- 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.
4. Function
5. About Software

CD-ROM Directory Structure

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

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

- 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.

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.
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: Executes inputs/outputs digital (simple functions) at specified bits through a specified port.
- Sample program 10: Services interrupts of a specified board (using an extended function).
- Sample program (Console): Inputs/outputs digital data through a specified port.
5. About Software

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 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].
5. About Software

< Uninstall the development environment >
Use [My Computer] - [Control Panel] - [Programs and Features] to uninstall the development environment.
In case of API-*** (WDM), select [CONTEC API-*** (WDM) VerX.XX (development environment)] and then click [Uninstall].
In case of API-*** (98/PC), select [CONTEC API-*** (98/PC)xx VerX.XX] and then click [Uninstall].
* *** contains the driver category name (AIO, CNT, DIO, SMC, etc.).

Uninstall procedure for Windows XP and Windows 2003 Server

< Uninstall the device driver >
Use [My Computer] - [Control Panel] - [Add and Remove Programs] to uninstall the device driver.
In case of API-*** (WDM), select [Windows driver package - CONTEC (***)] and then click [Change/Remove].
In case of API-*** (98/PC), select [CONTEC API-*** (98/PC)xx VerX.XX (development environment)] and then click [Change/Remove].
* *** contains the driver category name (caio, ccnt, cdio, csmc, etc.).
5. About Software

< Uninstall the development environment >

Use [My Computer] - [Control Panel] - [Add and Remove Programs] to uninstall the development environment.

In case of API-*** (WDM), select [CONTEC API-*** (WDM) Ver.X.XX (development environment)] and then click [Change/Remove].

In case of API-*** (98/PC), select [CONTEC API-*** (98/PC)x Ver.X.XX (development environment)] and then click [Change/Remove].

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

# make install Install.

# cd config
# ./config Set up the board to be used.

...... Set as follows........
# ./contec_dio_start.sh Start the driver.
# cd
Accessing the Help File

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

Using Sample Programs

Sample programs have been prepared for specific basic applications. Sample programs for each language are contained in the contec/cdio/samples directory. For compiling them, refer to the manual for the desired language.

Uninstalling the driver

To uninstall the driver, use the uninstall shell script contained in the contec/cdio directory. For details, check the contents of the script.
6. About Hardware

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

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.

Hardware specification

Table 6.1. Specification

<table>
<thead>
<tr>
<th>Item</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>I/O format</td>
<td>Unisolated LVTTL-level I/O (Positive logic)</td>
</tr>
<tr>
<td>Number of I/O channels</td>
<td>96 channels (all available for interrupts)</td>
</tr>
<tr>
<td>Interrupt</td>
<td>96 interrupt input signals are arranged into a single output of interrupt signal INT. An interrupt is generated at the falling edge (HIGH-to-LOW transition) or rising edge (LOW-to-HIGH transition).</td>
</tr>
<tr>
<td>Response time</td>
<td>200nsec within</td>
</tr>
<tr>
<td>Rated output current</td>
<td>$I_{OL}=8mA$ (Max.) $I_{OH}=-8mA$ (Max.)</td>
</tr>
</tbody>
</table>

Common

<table>
<thead>
<tr>
<th>I/O address</th>
<th>Any 32-byte boundary (Common to I/O part)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Power consumption</td>
<td>3.3VDC 300mA</td>
</tr>
<tr>
<td>Operating condition</td>
<td>0 °C to 50°C, 10% to 90%RH (No condensation)</td>
</tr>
<tr>
<td>Allowable distance of signal extension</td>
<td>Approx. 1.5m (depending on wiring environment)</td>
</tr>
<tr>
<td>Bus specification</td>
<td>PCI Express Base Specification Rev. 1.0a *1 x1</td>
</tr>
<tr>
<td>Dimension (mm)</td>
<td>121.69(L) x 67.90(H)</td>
</tr>
<tr>
<td>Connector</td>
<td>68 pin 0.8mm pitch connector HDRA-E66W1LFDT+ [mfd. by HONDA TSUSHIN KOGYO CO., LTD.] or equivalent to it</td>
</tr>
<tr>
<td>Weight</td>
<td>60g</td>
</tr>
</tbody>
</table>

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

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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DIO-96D-LPE 57
6. About Hardware

Block Diagram

Figure 6.1. Block Diagram
## Difference from DIO-96D2-LPCI

DIO-96D-LPE

The functions same with conventional product of DIO-96D2-LPCI are provided with the DIO-96D-LPE. In addition, as there is compatibility in terms of connector shape and pin assignments, it is easy to migrate from the existing system. So you can use the same operating procedures as DIO-96D2-LPCI.

There are some differences in specifications as shown below.

<table>
<thead>
<tr>
<th></th>
<th>DIO-96D2-LPCI</th>
<th>DIO-96D-LPE</th>
</tr>
</thead>
<tbody>
<tr>
<td>I/O</td>
<td>Unisolated TTL-level I/O (Positive logic)</td>
<td>Unisolated LVTTL-level I/O (Positive logic)</td>
</tr>
<tr>
<td>Rated output current</td>
<td>$I_{OL}=24mA$(Max.) $I_{OH}=-15mA$(Max.)</td>
<td>$I_{OL}=8mA$(Max.) $I_{OH}=-8mA$(Max.)</td>
</tr>
<tr>
<td>Power consumption</td>
<td>5VDC 950mA(Max.)</td>
<td>3.3VDC 300mA(Max.)</td>
</tr>
<tr>
<td>Bus specification</td>
<td>32-bit, 33MHz, Universal key shapes supported (The 5V pin on the bus must supply 5V.)</td>
<td>PCI Express Base Specification Rev. 1.0a x1</td>
</tr>
<tr>
<td>Dimension (mm)</td>
<td>121.69(L) x 63.41(H)</td>
<td>121.69(L) x 67.90(H)</td>
</tr>
</tbody>
</table>