

PC-HELPER

High Speed Bi-Directional
Digital I/O Board for PCI

PIO-32DM(PCI)

User's Guide

CONTEC CO.,LTD.

Check Your Package

Thank you for purchasing the CONTEC product.

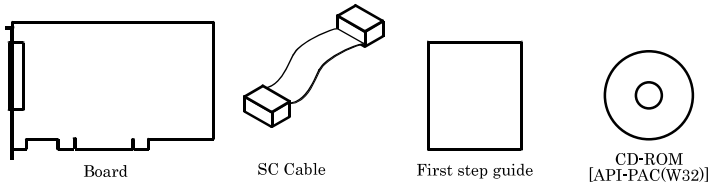
The product consists of the items listed below.

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

Product Configuration List

- Board [PIO-32DM(PCI)] ... 1
- First step guide ... 1
- SC Cable(10cm) ... 1
- CD-ROM *1 [API-PAC(W32)] ... 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

The PIO-32DM(PCI) is an interface board in compliance with the PCI bus specification and performs high-speed digital input and output application using bus mastering. This should be installed in a PCI bus slot.

The board can input and output a total of 32 TTL-level digital signals. Select input or output for each 16 signals.

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

Features

Since the board supports bus master, it is suited for fast-processing and controlling applications to control external devices with output of any digital pattern or to quickly sample digital input. The board is also equipped with synchronization control connectors to solve timing lag problems during channel expansion.

However, since the board is susceptible to electrical disturbances, it should be used for applications with a short wiring distance and in quiet environment.

- With bus master, the board transfers data between the PC and board at a speed of 80MB/sec. (133 MB/sec. at maximum) without any burden on the CPU.
- The board stores digital signals at a sampling rate of 20 MHz and can detect patterns (pattern input).
- The board can be used as a 20 MHz digital pattern generator (pattern output).
- A 1K-Word on-board FIFO memory is installed each for input and output.
- The 32-bit I/O lines can configure as either input or output, and 16-bit or 32-bit. The board can be set to 32-bit input lines, or 16-bit lines each for input and output, or 32-bit output lines.
- In addition to the digital I/O lines, control signals are available to start or stop pattern I/O. To achieve high-speed access to peripherals, the board also supports the REQ and ACK handshaking signals.
- The board is equipped with an SC connector to allow easy inter-board synchronization between the same or different boards.
- The board can be used not only for pattern I/O using bus mastering but also as a general-purpose digital I/O board. In general-purpose input mode, four input lines are available to interrupts (rising edge).
- Interrupts are set by the software, not by the hardware.
- The board is installed with a timer available to applications to accurately monitor time even when the board is used in Windows environment.

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) / 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 *1 useful for checking operation is provided.

< Operating environment >

OS Windows Vista, XP, Server 2003, 2000

Adaptation language Visual Basic, Visual C++, Visual C#, Delphi, C++ Builder

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

Linux version of digital I/O driver **API-DIO(LNX)**

[Stored on the bundled CD-ROM driver library API-PAC(W32)]

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

< Operating environment >

OS RedHatLinux, TurboLinux

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

Adaptation language gcc

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

*1 : For API-DIO(98/PC), test its operation using the sample program.

Cable & Connector (Option)

Shielded cable with double-ended connector for 96-pin half-pitch connector : PCB96PS-0.5P (0.5m)

: PCB96PS-1.5P (1.5m)

Flat cable with double-ended connector for 96-pin half-pitch connector : PCB96P-1.5 (1.5m)

Shielded cable with single-ended connector for 96-pin half-pitch connector : PCA96PS-0.5P (0.5m)

: PCA96PS-1.5P (1.5m)

Flat cable with single-ended connector for 96-pin half-pitch connector : PCA96P-1.5 (1.5m)

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

Accessories (Option)

Screw Terminal (M3 x 96) : EPD-96A *1*2

Screw Terminal (M3.5 x 96) : EPD-96 *1

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

*1 PCB96P or PCB96PS 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 products are warranted by CONTEC CO., LTD. to be free from defects in material and workmanship for up to three years from the date of purchase by the original purchaser.

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

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

How to Obtain Service

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

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

Liability

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

Safety Precautions

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

Safety Information

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

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

Handling Precautions

DANGER

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

CAUTION

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

Environment

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

Operating temperature

0 - 50°C

Operating humidity

10 - 90%RH (No condensation)

Corrosive gases

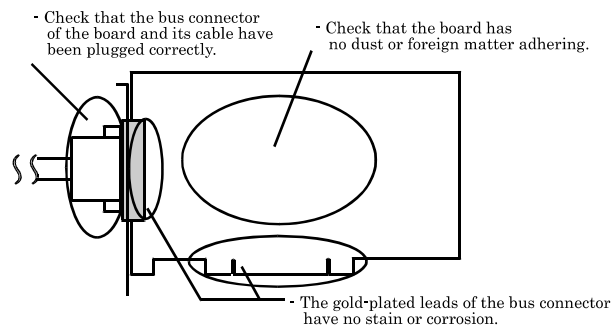
None

Floating dust particles

Not to be excessive

Inspection

Inspect the product periodically as follows to use it safely.



Storage

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

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

Disposal

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

2. Setup

This chapter explains how to set up the board.

What is Setup?

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

Different steps are required for software and hardware.

The setup procedure varies with the OS and software used.

Using the Board under Windows

Using the Driver Library API-PAC(W32)

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

Taking the following steps sets up the software and hardware. You can use the diagnosis program *1 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 Operation Checks

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

*1 : For API-DIO(98/PC), test its operation using the sample program.

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

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 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).

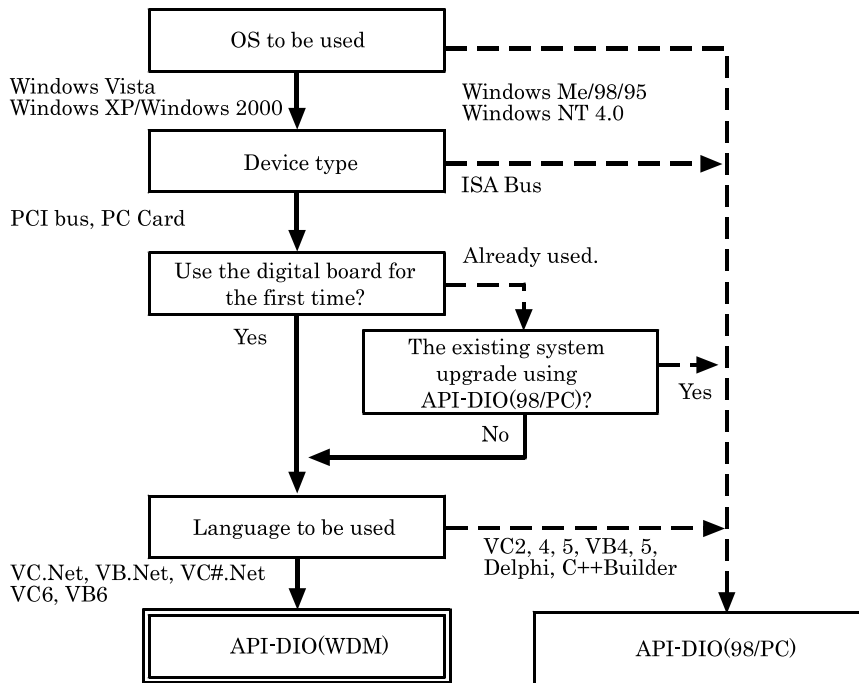
API-DIO(WDM) is a new driver to perform digital I/O under Windows.

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

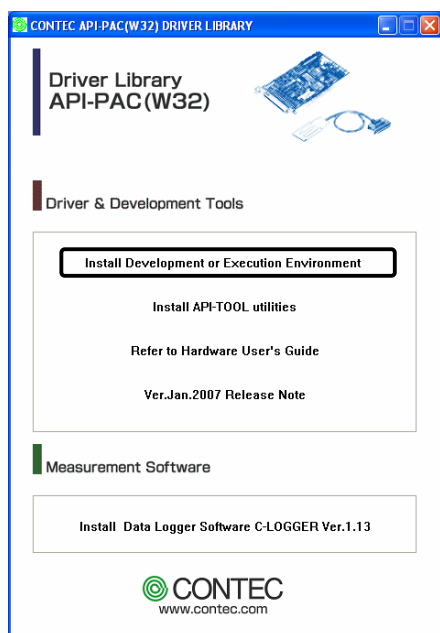
Use API-DIO(98/PC) if your operating environment contains such an unsupported piece of software or hardware.

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



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.

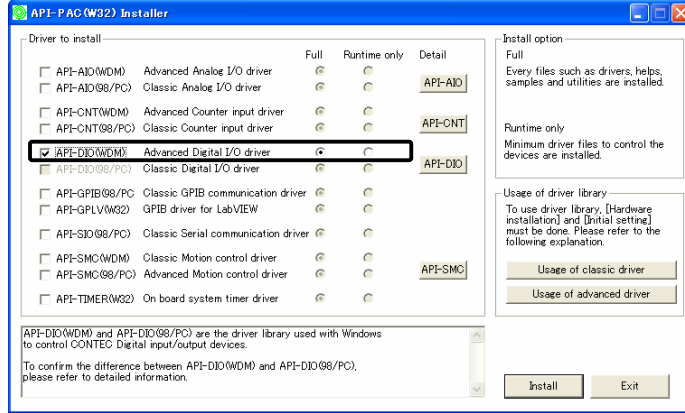
CAUTION

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

When Using API-DIO(WDM)

Selecting API-DIO(WDM)

- (1) The following dialog box appears to select “Driver to install” and “Install option”, “Usage of driver library”.
- (2) Select the "Advanced Digital I/O driver".
- (3) Click on the [Install] button.



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

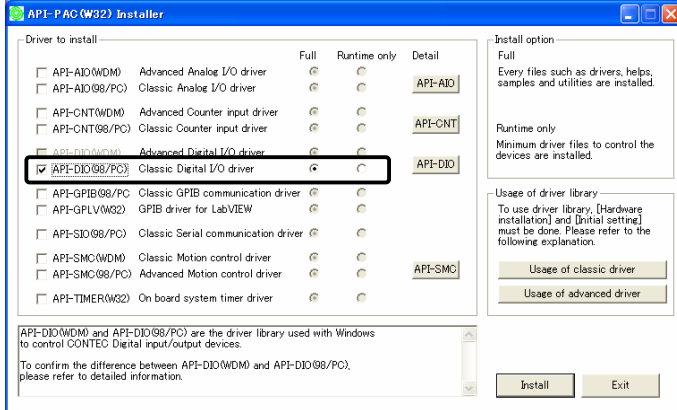
Run the installation

- (1) Complete the installation by following the instructions on the screen.
- (2) The Readme file appears when the installation is complete.

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).

Executing the Installation

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

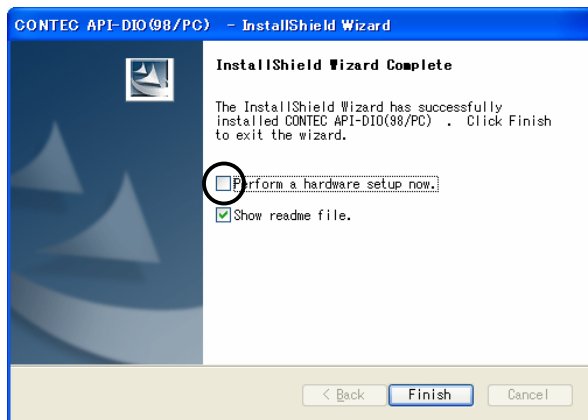
When you are installing the software or hardware for the first time:

- 1) **Uncheck “Perform a hardware setup now”.**
- 2) **Click on the [Finish] button.**

Go to Step 2 to set and plug the hardware.

* When the hardware has already been installed:

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



You have now finished installing the software.

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.

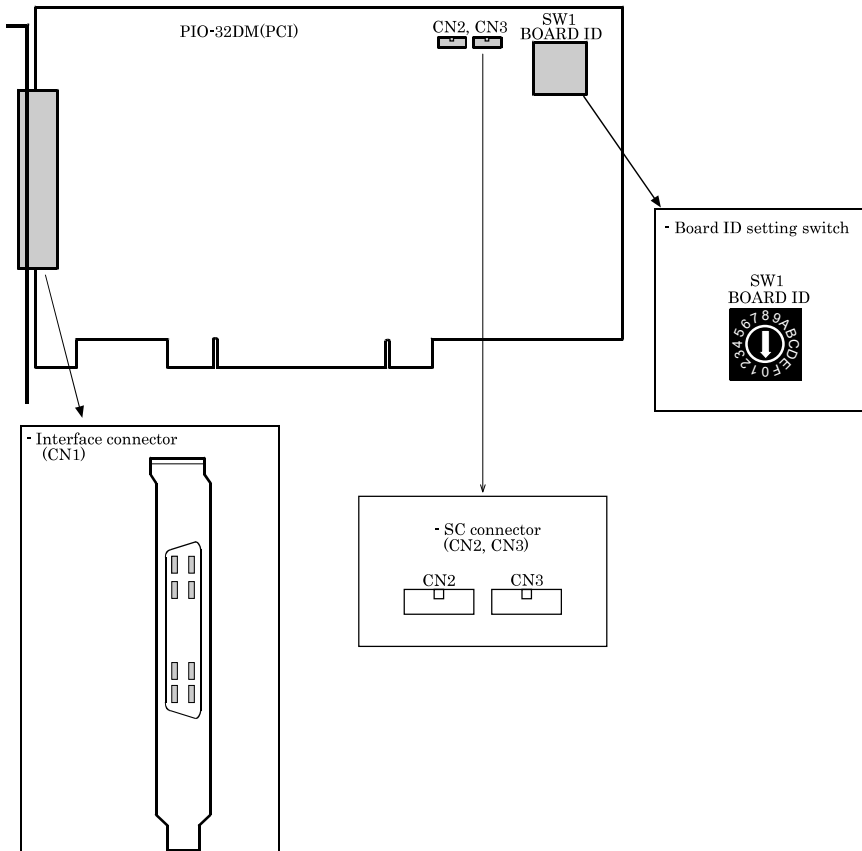


Figure 2.1. Component Locations

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.

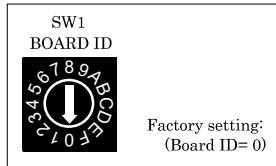


Figure 2.2. Board ID Settings (SW1)

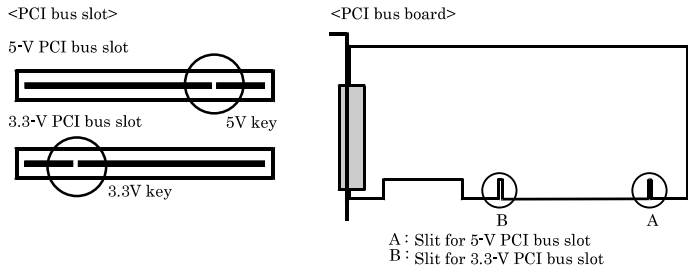
Plugging the Board

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



Applicable PCI bus slots

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



CAUTION

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

Step 3 Installing the Hardware

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

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

Turning on the PC

Turn on the power to your PC.

⚠ CAUTION

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

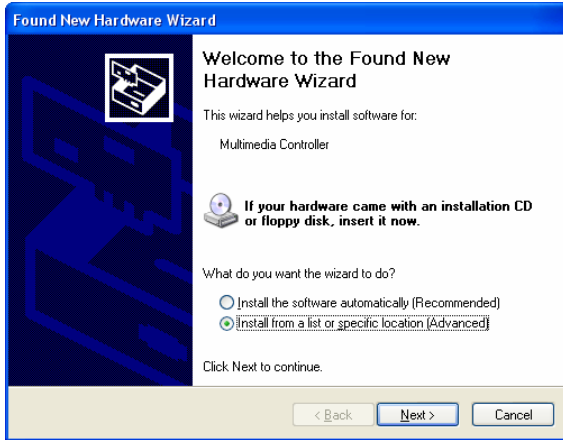
When Using API-DIO(WDM)

- (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.

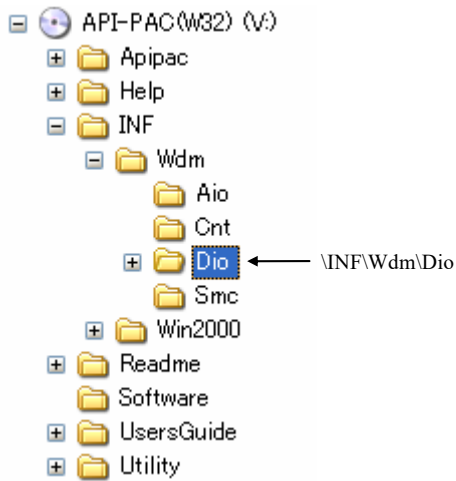


When the model name of hardware is displayed, select “Install the software automatically [Recommended]” and then click on the “Next” button.

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.

When Using API-DIO(98/PC)

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

If you are using Windows NT 4.0, the “Add New Hardware Wizard” is not started.

Go to Step 4 “Initializing the Software”.



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.

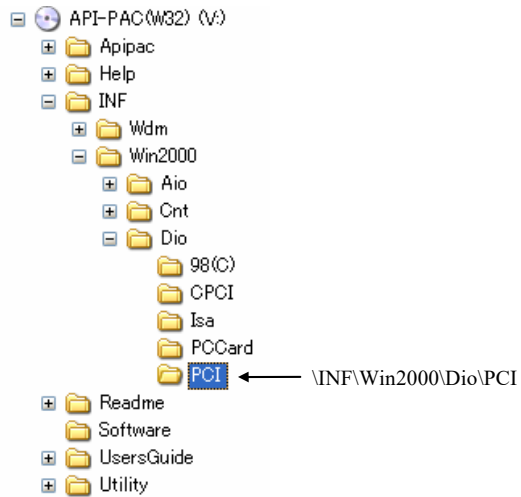


Source folder

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

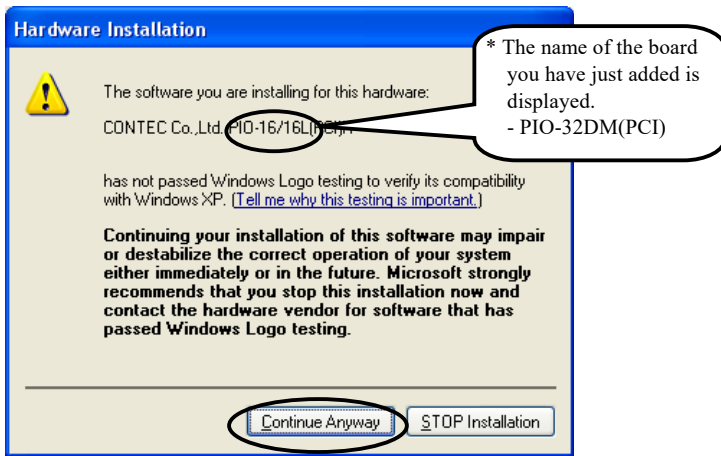
Example of specifying the folder for use under Windows XP



⚠ CAUTION

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

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



You have now finished installing the software.

Step 4 Initializing the Software

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

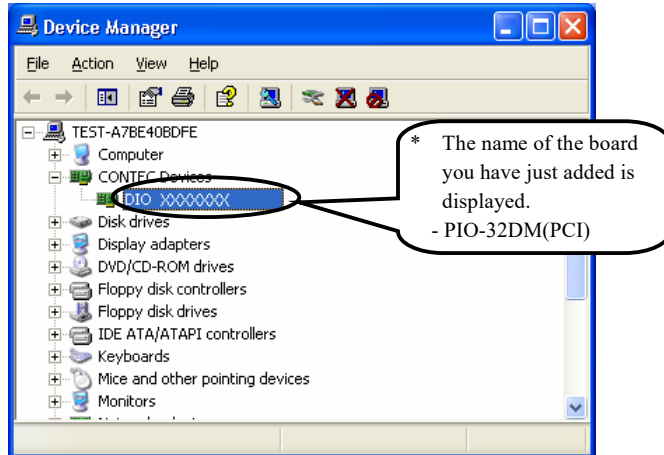
When Using API-DIO(WDM)

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.)

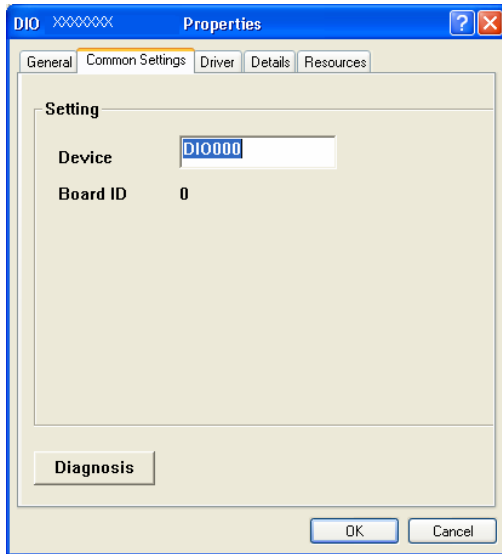


- (2) The installed hardware appears under the CONTEC Devices node. Open the CONTEC Devices node and select the device you want to setup (the device name should appear highlighted). Click [Properties].

(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.

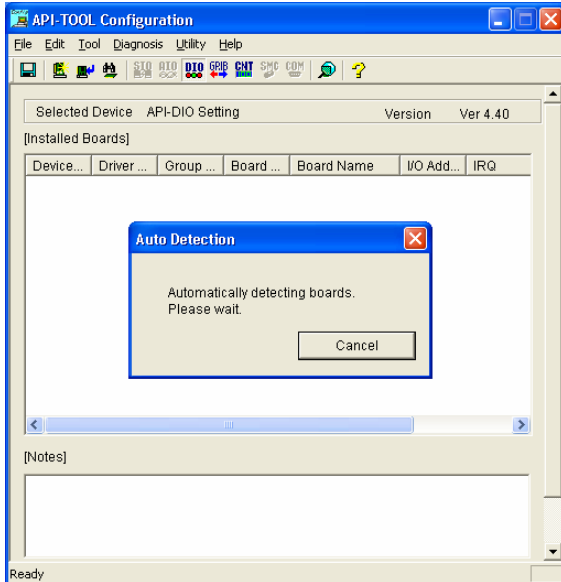


- * The initial device name that appears is a default value. You can use this default name if you wish.
- * Make sure that you do not use the same name for more than one device.

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 settings to registry...” from the “File” menu.

You have now finished installing the initial setting of Software.

Step 5 Operation Checks

You must make sure that the board and driver software operate normally. By taking this step, you can make sure that the board has been set up correctly.

Check Method

Connect the board to a remote device to test the input/output and check the execution environment.

Set the board in the default factory.

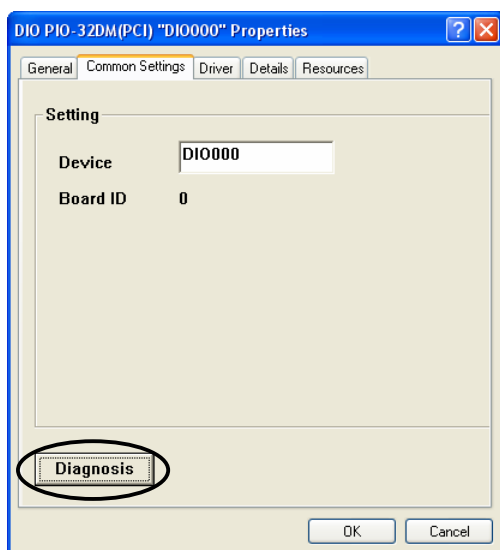
To connect a external device, see Chapter 3 “External Connection”.

When Using API-DIO(WDM)

Use the diagnostic program to check the operation.

Starting the Diagnosis Program

Open the “Properties” page of the device that was used for the software initialization, and press the [Diagnosis] button.



Checking Digital Inputs and Outputs

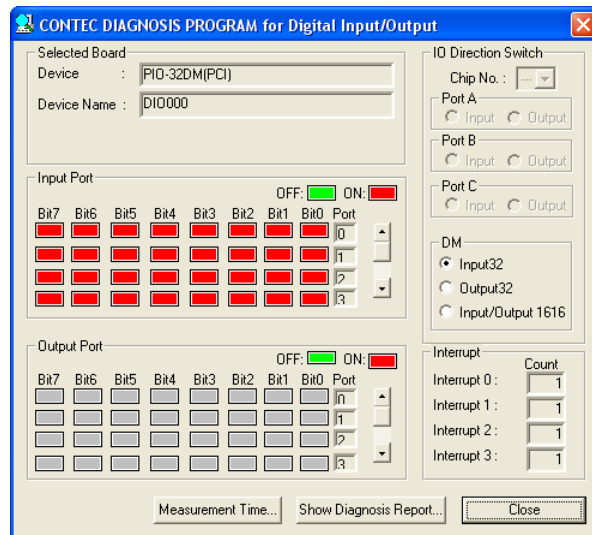
The main panel of the Diagnosis Program appears.

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 function execution time measurement feature, click on the [Measurement Time] button.

Enter the I/O start port and the number of ports, then press the measurement button. The time for each execution of a function will be measured.

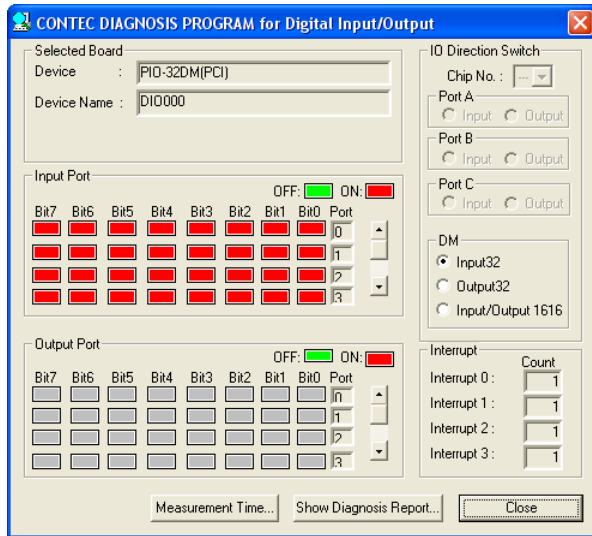
Diagnosis Report

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

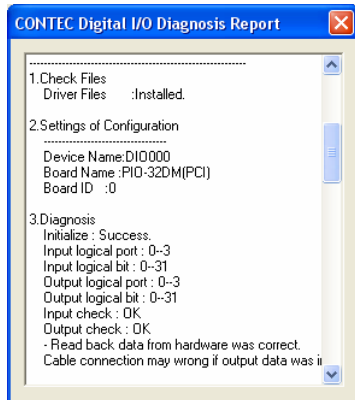
The Diagnosis Program performs “board presence/absence check”, “driver file test”, “board setting test”, and so on.

⚠ CAUTION

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



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



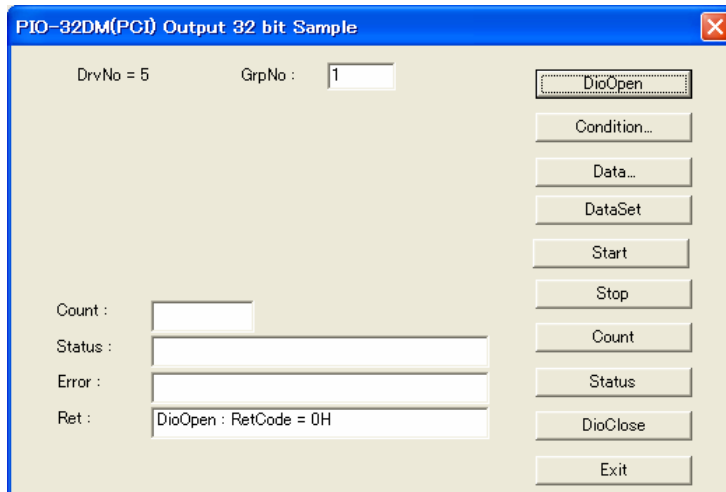
When Using API-DIO(98/PC)

Use the sample program to check the operation.

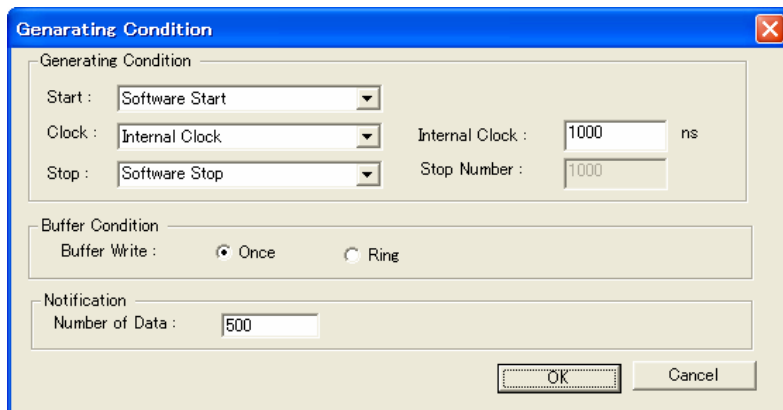
Starting the Sample Program

From the “Start” menu, select [Programs] – [CONTEC API-PAC(W32)] – [Dio] – [PIO-32DM] – [SAMPLE Output 32bit].

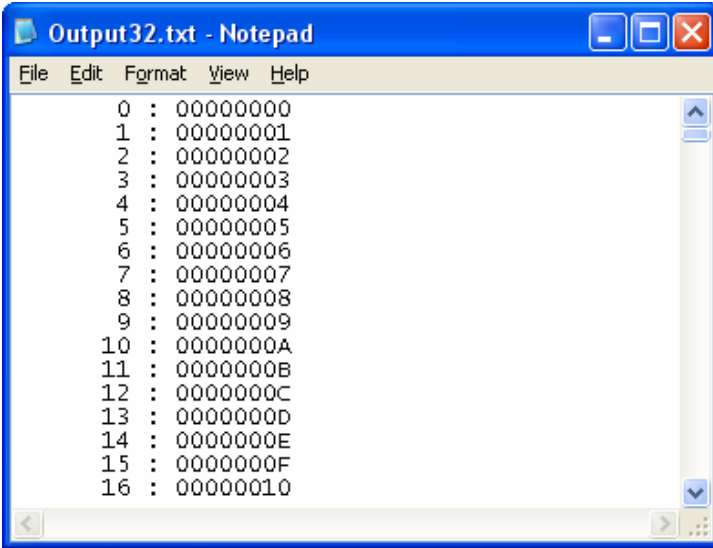
- (1) Enter in [GrpNo:] the “Group No.” which you set in “API-TOOL Configuration”, and then press the [DioOpen] button. Make sure that the [Ret:] field displays the following information.



- (2) Press the [Condition...] button to display the “Generating Condition” window, and then press the [OK] button.

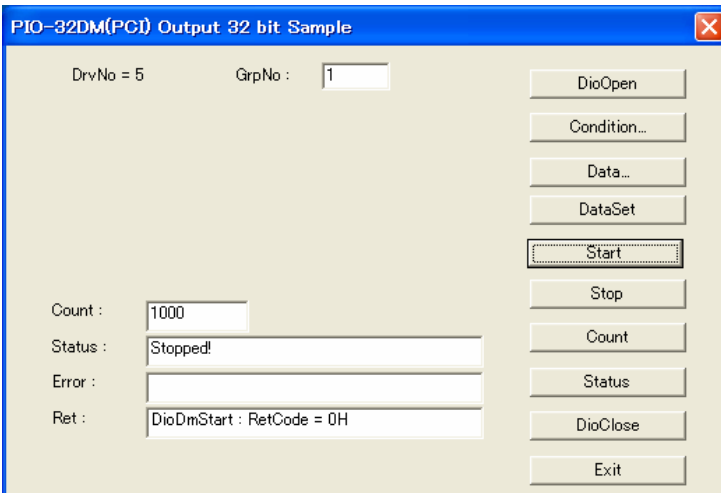


(3) Press the [Data...] button to create output data.



(4) Press the [DataSet] button to set the output data in the buffer for the bus master.

(5) Pressing the [Start] button starts bus master transfer, and once the output is completed, the following information appears.



Setup Troubleshooting

Symptoms and Actions

The board cannot be initialized [Windows NT 4.0]

The driver may not yet be activated.

When using the board under an OS not compliant with Plug and Play, such as Windows NT 4.0, make sure that the [PnP OS] BIOS option has been set to [NO], [disable], or [Do not use]. If the option has been set to [Windows 95], for example, the board may not be detected normally. For details on BIOS settings, refer to the user's guide for your PC.

No output can be obtained.

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

The board works with the utility program but not with an application.

The utility program is created by using API-TOOL functions. When the utility program runs, other applications should run as well. In this case, check the following point to review your program.

- Check the arguments for functions and their return values.

The OS won't normally get started or detect the board. [Windows Vista, XP, Server 2003, 2000]

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

If your problem cannot be resolved

Contact your retailer.

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 (CN1) shown below.

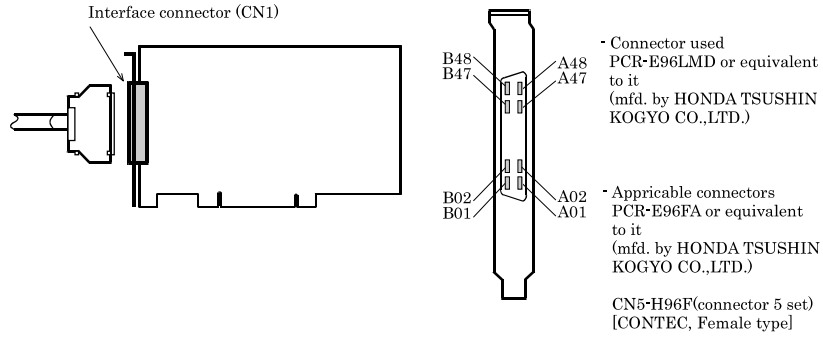


Figure 3.1. Interface Connector and Applicable Cable Connector

Connector Pin Assignment

		[49]	[1]				
Ground	GND	---B48	A48	---	GND	Ground	
Ground	GND	---B47	A47	---	GND	Ground	
Ground	GND	---B46	A46	---	GND	Ground	
External clock input	EXTCLK1	---B45	A45	---	EXTCLK0	External clock input	
Ground	GND	---B44	A44	---	GND	Ground	
External start signal	EXTSTART1	---B43	A43	---	EXTSTART0	External start signal	
Ground	GND	---B42	A42	---	GND	Ground	
External stop signal	EXTSTOP1	---B41	A41	---	EXTSTOP0	External stop signal	
Ground	GND	---B40	A40	---	GND	Ground	
REQ signal	EXTREQ1	---B39	A39	---	EXTREQ0	REQ signal	
Ground	GND	---B38	A38	---	GND	Ground	
ACK signal	EXTACK1	---B37	A37	---	EXTACK0	ACK signal	
Ground	GND	---B36	A36	---	GND	Ground	
Ground	GND	---B35	A35	---	GND	Ground	
Ground	GND	---B34	A34	---	GND	Ground	
I/O signal D07	DIOD07	---B33	A33	---	DIOB07	I/O signal B07	
Ground	GND	---B32	A32	---	GND	Ground	
I/O signal D06	DIOD06	---B31	A31	---	DIOB06	I/O signal B06	
Ground	GND	---B30	A30	---	GND	Ground	
I/O signal D05	DIOD05	---B29	A29	---	DIOB05	I/O signal B05	
Ground	GND	---B28	A28	---	GND	Ground	
I/O signal D04	DIOD04	---B27	A27	---	DIOB04	I/O signal B04	
Ground	GND	---B26	A26	---	GND	Ground	
I/O signal D03	DIOD03	---B25	A25	---	DIOB03	I/O signal B03	
Ground	GND	---B24	A24	---	GND	Ground	
I/O signal D02	DIOD02	---B23	A23	---	DIOB02	I/O signal B02	
Ground	GND	---B22	A22	---	GND	Ground	
I/O signal D01	DIOD01	---B21	A21	---	DIOB01	I/O signal B01	
Ground	GND	---B20	A20	---	GND	Ground	
I/O signal D00	DIOD00	---B19	A19	---	DIOB00	I/O signal B00	
Ground	GND	---B18	A18	---	GND	Ground	
I/O signal C07	DIOC07	---B17	A17	---	DIOA07	I/O signal A07	
Ground	GND	---B16	A16	---	GND	Ground	
I/O signal C06	DIOC06	---B15	A15	---	DIOA06	I/O signal A06	
Ground	GND	---B14	A14	---	GND	Ground	
I/O signal C05	DIOC05	---B13	A13	---	DIOA05	I/O signal A05	
Ground	GND	---B12	A12	---	GND	Ground	
I/O signal C04	DIOC04	---B11	A11	---	DIOA04	I/O signal A04	
Ground	GND	---B10	A10	---	GND	Ground	
I/O signal C03	DIOC03	---B09	A09	---	DIOA03	I/O signal A03 / interrupt signal In03*	
Ground	GND	---B08	A08	---	GND	Ground	
I/O signal C02	DIOC02	---B07	A07	---	DIOA02	I/O signal A02 / interrupt signal In02*	
Ground	GND	---B06	A06	---	GND	Ground	
I/O signal C01	DIOC01	---B05	A05	---	DIOA01	I/O signal A01 / interrupt signal In01*	
Ground	GND	---B04	A04	---	GND	Ground	
I/O signal C00	DIOC00	---B03	A03	---	DIOA00	I/O signal A00 / interrupt signal In00*	
Unconnection	N.C.	---B02	A02	---	N.C.	Unconnection	
Unconnection	N.C.	---B01	A01	---	N.C.	Unconnection	
		[96]	[48]				

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

* Can be used as an interrupt signal when used as general-purpose I/O.

Figure 3.2. Pin Assignments of Interface Connector

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

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

Setup1

Table 3.1. Logical Ports, Logical Bits, and Connector Signal Pins < Setup1 >

	D7	D6	D5	D4	D3	D2	D1	D0
Input Logical Ports0	DIOA07 [7]	DIOA06 [6]	DIOA05 [5]	DIOA04 [4]	DIOA03 [3]	DIOA02 [2]	DIOA01 [1]	DIOA00 [0]
Input Logical Ports1	DIOB07 [15]	DIOB06 [14]	DIOB05 [13]	DIOB04 [12]	DIOB03 [11]	DIOB02 [10]	DIOB01 [9]	DIOB00 [8]
Input Logical Ports2	DIOC07 [23]	DIOC06 [22]	DIOC05 [21]	DIOC04 [20]	DIOC03 [19]	DIOC02 [18]	DIOC01 [17]	DIOC00 [16]
Input Logical Ports3	DIOD07 [31]	DIOD06 [30]	DIOD05 [29]	DIOD04 [28]	DIOD03 [27]	DIOD02 [26]	DIOD01 [25]	DIOD00 [24]

Note : DIOAxx, DIOBxx, DIOCxx and DIODxx represents the CN1 input signal.
[xx] represents the logical bit.

Setup2

Table 3.2. Logical Ports, Logical Bits, and Connector Signal Pins < Setup2 >

	D7	D6	D5	D4	D3	D2	D1	D0
Input Logical Ports0	DIOA07 [7]	DIOA06 [6]	DIOA05 [5]	DIOA04 [4]	DIOA03 [3]	DIOA02 [2]	DIOA01 [1]	DIOA00 [0]
Input Logical Ports1	DIOB07 [15]	DIOB06 [14]	DIOB05 [13]	DIOB04 [12]	DIOB03 [11]	DIOB02 [10]	DIOB01 [9]	DIOB00 [8]
Output Logical Ports2	DIOC07 [23]	DIOC06 [22]	DIOC05 [21]	DIOC04 [20]	DIOC03 [19]	DIOC02 [18]	DIOC01 [17]	DIOC00 [16]
Output Logical Ports3	DIOD07 [31]	DIOD06 [30]	DIOD05 [29]	DIOD04 [28]	DIOD03 [27]	DIOD02 [26]	DIOD01 [25]	DIOD00 [24]

Note : DIOAxx and DIOBxx represents the CN1 input signal and DIOCxx and DIODxx represents the CN1 output signal.
[xx] represents the logical bit.

Setup3

Table 3.3. Logical Ports, Logical Bits, and Connector Signal Pins < Setup3 >

	D7	D6	D5	D4	D3	D2	D1	D0
Output Logical Ports0	DIOA07 [7]	DIOA06 [6]	DIOA05 [5]	DIOA04 [4]	DIOA03 [3]	DIOA02 [2]	DIOA01 [1]	DIOA00 [0]
Output Logical Ports1	DIOB07 [15]	DIOB06 [14]	DIOB05 [13]	DIOB04 [12]	DIOB03 [11]	DIOB02 [10]	DIOB01 [9]	DIOB00 [8]
Output Logical Ports2	DIOC07 [23]	DIOC06 [22]	DIOC05 [21]	DIOC04 [20]	DIOC03 [19]	DIOC02 [18]	DIOC01 [17]	DIOC00 [16]
Output Logical Ports3	DIOD07 [31]	DIOD06 [30]	DIOD05 [29]	DIOD04 [28]	DIOD03 [27]	DIOD02 [26]	DIOD01 [25]	DIOD00 [24]

Note : DIOAxx, DIOBxx, DIOCxx and DIODxx represents the CN1 output signal.
[xx] represents the logical bit.

⚠ 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).

Connection method to the external device

-Data I/O-

Connecting the data I/O signal(DIOA0* - DIOD0*)

These lines input from and output to external devices and can be configured in 16-bit with the software.

Input and output and setting procedures are the same whether these lines are used for general-purpose digital I/O or bus master transferring and they can be configured in three different settings as shown below:

Table 3.4. I/O signal

Signal name	Setup1	Setup2	Setup3
DIOA00 - DIOA07	Digital input	Digital input	Digital output
DIOB00 - DIOB07	Digital input	Digital input	Digital output
DIOC00 - DIOC07	Digital input	Digital output	Digital output
DIOD00 - DIOD07	Digital input	Digital output	Digital output

When settings 1 and 2 are used for general-purpose digital I/O, DIOA00 through DIOA03 can be used as interrupts (rising edge).

Detailed Data I/O Signal Circuit

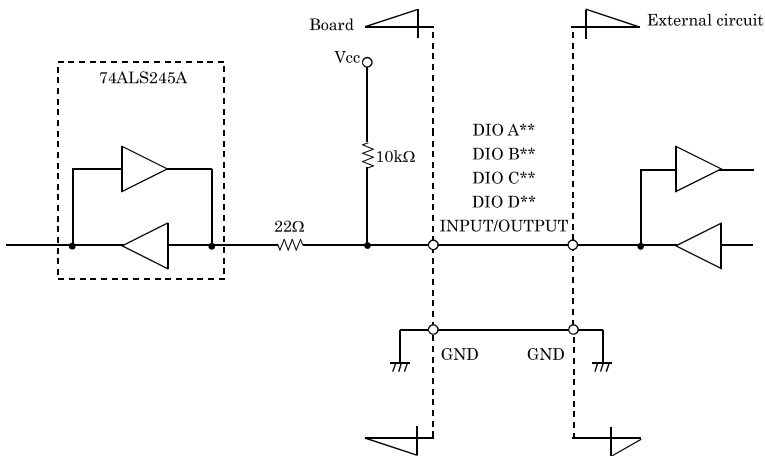


Figure 3.3. Data I/O Signal Circuit

Connection method to the external device

-Control I/O-

Connection to the control signal (EXT**)

In order to control bus mastering from outside, five signals are provided each for pattern I/O. Before using the signals to be input as control signals please verify their pulse widths.

"0" at the end of a signal name indicates a pattern input signal and "1" a pattern output signal.

Table 3.5. Control signal

Signal name	Direction	Usage	Signal name	Direction	Usage
EXTCLK0	In	Pattern input clock	EXTCLK1	In	Pattern output clock
EXTSTART0	In	Pattern input start signal	EXTSTART1	In	Pattern output start signal
EXTSTOP0	In	Pattern input stop signal	EXTSTOP1	In	Pattern output stop signal
EXTREQ0	In	Pattern input REQ signal	EXTREQ1	Out	Pattern output REQ signal
EXTACK0	Out	Pattern input ACK signal	EXTACK1	In	Pattern output ACK signal

Detailed Control Input Signal Circuit

Control signals to be input include clock, start, stop, and handshake input signals.

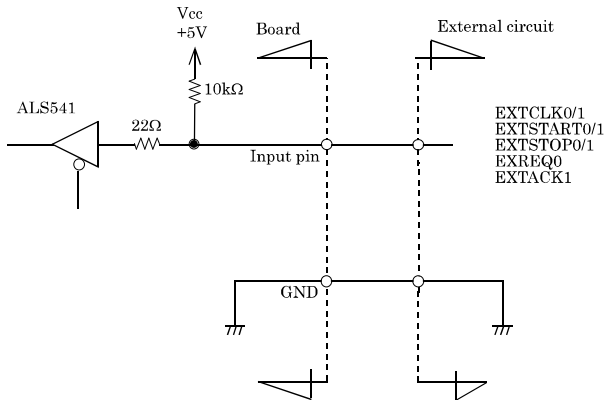


Figure 3.4. Control signal input circuit

Detailed Control Output Signal Circuit

Control signals to be output include handshake output signals.

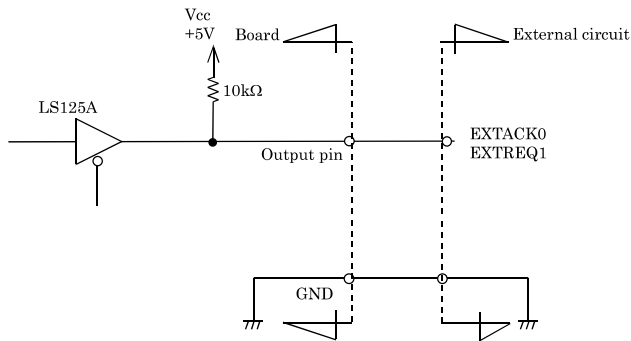


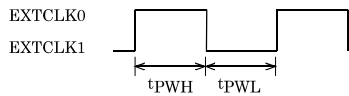
Figure 3.5. Control signal output circuit

What is the Control Signal?

External clock signal (EXTCLK0/EXTCLK1)

These signals input external pacer clocks. The maximum frequency is 10MHz.

When the external clock input is set as the clock source, pattern input or output occurs at the falling edge of this signal.

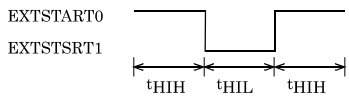


tPWH: Clock pulse high width 50ns (Min.)
tPWL: Clock pulse low width 50ns (Min.)

Figure 3.6. External clock signal

External start signal (EXTSTART0/EXTSTART1)

These input signals start bus mastering with an external signal. The signal level is TTL and you can select and enable the rising or falling edge with the software. In order to detect the signal edge, a high- and low-level hold time of 50ns is needed at minimum.



tHIH: High level hold time 50ns (Min.)
tHIL: Low level hold time 50ns (Min.)

Figure 3.7. External start signal

External stop signal (EXTSTOP0/EXTSTOP1)

These input signals stop bus mastering with an external signal. The signal is TTL level and you can select and enable the rising or falling edge with the software. In order to detect the signal edge, a high- and low-level hold time of 50ns is needed at minimum.

Handshake Signal (EXTREQ0/EXTACK0/ EXTREQ1/EXTACK1)

These signals handshake with external devices. The signal is TTL level and controlled with negative logic.

Input

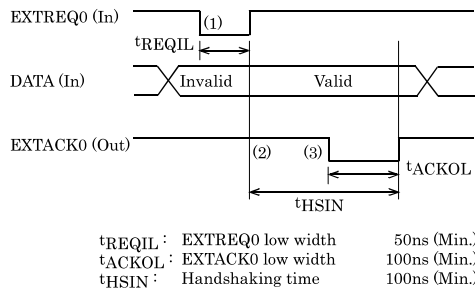


Figure 3.8. Handshake Signals at the Time of Input

- (1) After setting the handshaking operation, the PIO-32DM(PCI) samples the EXTREQ0 signal and starts pattern input when it recognizes a low pulse of more than 50ns. Pattern data prior to that time is disabled.
- (2) The board generates a cycle to write data input from an external device to the PC memory by bus mastering.
- (3) At the end of writing data, the board outputs acknowledge signal EXTRACK0 to notify the external device.

Output

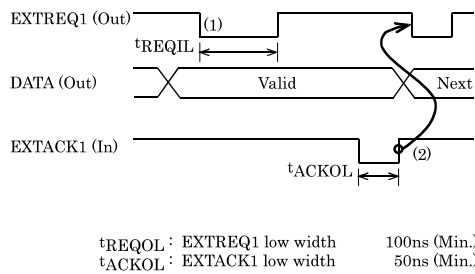


Figure 3.9. Handshake Signals at the Time of Output

- (1) After setting the handshaking operation, the PIO-32DM(PCI) outputs the EXTREQ1 signal.
- (2) The board begins sampling acknowledge signals from external devices. The board recognizes the end with a low pulse of more than 100ns and, at the leading edge, starts preparing to output the next data.

Synchronization Control Connectors

SC Connectors

Controlling simultaneous operations between boards or controlling in sync with events is in part dependent on software performance. In order to enhance the reliability of the entire system and to solve these problems, the board is equipped with SC (Synchronization Control) connectors.

Connecting the SC connectors allows boards of the same or different models to operate in sync with one another.

From the boards connected with the SC cable, select one master board and use others as slaves. On the master board, set the signal to be supplied to the slave boards with the software. On the slave boards, the signal from the master board can be set to either the pacer clock operation start or stop factor.

All board operations can also be stopped with a stop request from the master in case of an error, for example, or when requested from a slave board. A maximum of 16 boards can be connected including the master.

For more information on the setup procedure, see the driver software online help. When the SC is not connected, use the board with stand-alone settings.

Example 1: When clock start and stop requirements are set the same for multiple boards

In order to synchronize master clock start and stop with slave boards you can build a synchronous system which does not depend on software processing capabilities.

If the board model is the same, data remains synchronized among boards even when channels are expanded. When board models are different, data still remains compatible since operating clock start and stop are dependent on the master.

- (1) Connect the SC cable.
- (2) Designate master/slave with the software.
- (3) Assign to the connectors the clock start and stop signals to be output from the master.
- (4) Set up slave boards so they can utilize all signals.
- (5) Start in order of slave to master boards.



CAUTION

- When the clock signal is assigned to a synchronization control connector, the maximum clock frequency available is 5 MHz.
 - When each signal is assigned to a synchronization control connector, the slave board causes a delay of about 100nsec.
-

Example 2: When controlling slave operations with master's internal events

By outputting an internal event (interrupt) occurring on the master board, the slaves can start operating in sync with that signal.

- (1) Connect the SC cable.
- (2) Designate master/slave with the software.
- (3) Assign to the connector the event signal to be output from the master.
- (4) Set signals from the master to the start requirements on the slave boards.
- (5) Start in order of slave to master boards.

Connecting the SC Connectors (CN2,CN3)

This board is equipped with sync signal control connectors (CN2 and CN3) for connecting a sync signal cable. When the cable is connected, multiple boards can operate in sync with one another.

Connection Procedure

Connect the sync signal cable when two or more boards need to operate in sync with one another.

Connect CN2 with a smaller ID number to CN3 with a greater ID number with the cable. You should only use the cable that came with the board.

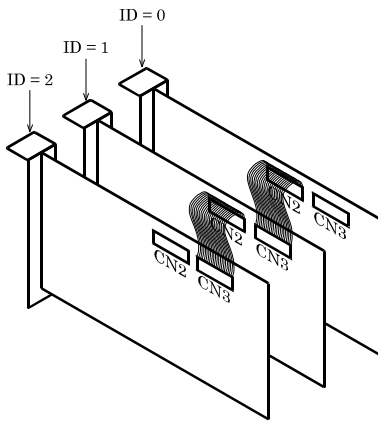


Figure 3.10. Connecting Cables

4. Function

This section describes the features of the board.

Function Outline

Overview

As the PIO-32DM(PCI) supports transfer by bus mastering, it can be used as a pattern generator that samples digital input signals or outputs arbitrary digital patterns at high speed. It can also be used as a general-purpose I/O board when bus mastering is not used.

Sampling function / generating function

The PIO-32DM(PCI) can be used in three I/O modes: 32-channel input, 16-channel input/output, 32-channel output. As the sampling and generating features have their own bus mastering blocks each made up of two independent channels, the board can generate 16 signals while sampling 16 signals. For sampling and generating, the PIO-32DM(PCI) can input and output patterns at up to 20 MHz using the internal clock. If it is too late for transfer because of failing to seize a bus, it causes an error and stops transfer because it uses bus mastering. Note that it depends, for example, on the operating status of applications on the PC whether the board can perform continuous transfer at 20 MHz. For sampling and generating, the PIO-32DM(PCI) can input/output data in various combinations of the start, clock, and stop conditions.

Bus Master Transfer

Bus mastering by the PIO-32DM(PCI) enables DMA for direct transfer between the board and the memory space allocated for the application when the PCI bus is free. For the application's memory space, a static area is specified, which is allocated by normal definition of a variable. Under the Windows operating system, memory space for applications is represented by logical addresses and physical addresses make up noncontiguous address spaces. The PIO-32DM(PCI) transfers data continuously to the noncontiguous address space. Bus mastering enables transfer to up to 64 megabytes of physical memory space. When the area for an application to transfer data to is set, the amount of allocatable memory depends on the type of the OS and on the actual memory size of the PC.

For bus mastering, the board supports one-time transfer and ring transfer different in how it uses memory. During one-time transfer, the board completes transfer when it reaches the end of the allocated memory area. During ring transfer, the board starts transfer over again from the beginning of the allocated memory area when it reaches its end. Ring transfer continues until a stop condition is satisfied or until it is terminated by software.

Interrupt (at the time of bus master transfer)

The board provides the following two interrupt functions during bus mastering:

- Causes an interrupt each time the specified number of items are transferred.
- Causes an interrupt upon completion of transfer.

These interrupts can be posted to applications by using the relevant API-DIO(98/PC) function in API-PAC(W32).

If transfer is completed with an error when no bus can be seized or when it is missed, for example, the PIO-32DM(PCI) stops the transfer and generates a transfer completion interrupt. You can tell whether a transfer error has occurred by checking the status.

Status, count

The following types of bus mastering status (error) are provided.

Status	Contents
BUS MASTER STOP	Indicates that bus master transfer has been completed.
PIO START	Indicates that PIO input/output has been started.
PIO STOP	Indicates that PIO input/output has been stopped.
TRIGGER IN	Indicates that a start signal has been input in external start mode.
OVER RUN	Indicates that a start signal has been input twice or more in external start mode. Transfer can continue with no problem.

Error	Contents
FIFO EMPTY	Indicates that output has made the FIFO buffer empty. This is mainly because of a heavy load on the system that makes it late for bus master transfer. Take action such as decreasing the transfer rate or system load.
FIFO FULL	Indicates that input has made the FIFO buffer full. This is mainly because of a heavy load on the system that makes it late for bus master transfer. Take action such as decreasing the transfer rate or system load.
S/G OVER IN	Indicates a buffer overflow. The number of data items to be transferred exceeds the buffer size. Increase the buffer size.
TRG ERROR	Indicates that the start and stop signals have been input at the same time in external start mode. No transfer is performed with this status set. Check how the external start and stop signals are input.
CLOCK ERROR	Indicates that the next clock signal is input during data input/output during external clock mode. This status is merely set due to the operating speed of the board. If the status is set, consider decreasing the external clock speed.
SLAVE HALT	Indicates that a stop trigger from the slave has caused forced termination. Check for any error on the slave side.
MASTER HALT	Indicates that a stop trigger from the master has caused forced termination. Check for any error on the master side.

These types of status can be obtained by using the relevant API-DIO(98/PC) function of API-PAC(W32).

The 32-bit or 64-bit transfer count can be obtained by using the relevant API-DIO(98/PC) function of API-PAC(W32). The transfer count is obtained as the number of data items already transferred to user application memory in input mode or as the number of data items already output to an external device in output mode.

Sampling function

Sampling control

The PIO-32DM(PCI) can obtain sampling data at fixed intervals using a sampling clock. The table below lists the sampling clock, sampling start trigger, and sampling stop trigger factors.

Table 4.1. Sampling clock, starting trigger, stopping trigger

Item	Factor	Contents
Sampling clock	Internal clock	Internal clock (50ns to 107s) 25ns unit
	External clock	Fall of external clock input (EXTCLK0) (Maximum frequency response: 10 MHz)
	Handshake	Fall of handshake signal (EXTREQ0)
	SC connector	Clock input from synchronization control connector (Maximum frequency response: 5 MHz)
Sampling starting trigger	Software	Software command
	Rise of external signal	Rise of external start signal (EXTSTART0)
	Fall of external signal	Fall of external start signal (EXTSTART0)
	Pattern match	When matched with the specified input pattern
	SC connector	Start signal from synchronization control connector
Sampling stopping trigger	Software	Software command
	Rise of external signal	Rise of external stop signal (EXTSTOP0)
	Fall of external signal	Fall of external stop signal (EXTSTOP0)
	Specified number of items	Termination when the specified number of items is reached
	SC connector	Stop signal from synchronization control connector
	Bus master transfer error	When FIFO buffer becomes full

- The board obtains the first sampling data at the falling edge of the sampling clock signal after input of the sampling start trigger. From then on, the board obtains sampling data in synchronization with the sampling clock signal.
- The board stops sampling upon input of the sampling stop trigger. The board does not obtain sampling data when and after sampling is stopped.

Generating function

Generating control

The PIO-32DM(PCI) can output (generate) pattern data at fixed intervals using a generating clock. The table below lists the generating clock, generating start trigger, and generating stop trigger factors.

Table 4.2. generating clock, start trigger, stop trigger

Item	Factor	Contents
Generating clock	Internal clock	Internal clock (50ns to 107s) 25nsec unit
	External clock	Fall of external clock input (EXTCLK1) (Maximum frequency response: 10 MHz)
	Handshake	Rise of handshake signal (EXTACK1)
	SC connector	Clock input from synchronization control connector (Maximum frequency response: 5 MHz)
Generating start trigger	Software	Software command
	Rise of external signal	Rise of external start signal (EXTSTART1)
	Fall of external signal	Fall of external start signal (EXTSTART1)
	SC connector	Start signal from synchronization control connector
Generating stop trigger	Software	Software command
	Rise of external signal	Rise of external stop signal (EXTSTOP1)
	Fall of external signal	Fall of external stop signal (EXTSTOP1)
	Specified number of times	Termination when the specified number of items is reached
	SC connector	Stop signal from synchronization control connector
	Bus master transfer error	When FIFO buffer becomes empty

- The board outputs the first pattern data at the falling edge of the generating clock signal after input of the generating start trigger. From then on, the board outputs pattern data in synchronization with the generating clock signal.
- The board stops pattern data output upon input of the generating stop trigger.

General-purpose I/O function

Data input

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

When input data is low level, in contrast, [0] is input to the corresponding bit.

Data output

When [1] is output to the corresponding bit, [High level] is output.

When [0] is output to the corresponding bit, in contrast, [Low level] is output.

CAUTION

The entire board is set for input immediately after the power is turned on.

Monitoring the output data

The board can read the status of the current output data without affecting the output data.

Interrupt Control Function

The board can use up to four input signals as interrupt request signals. DIOA00 to DIOA03 can be used as interrupt request signals.

The board can generate an interrupt request signal to the PC when the input signal change from Low to High.

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.

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.
 - As long as the interrupt mask bit is set to disable interrupts, no interrupt status bit can be set even when the input signal changes.
-

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:

- The board can store digital signals and detects patterns at a sampling rate of 20 MHz. (pattern input)
- The board can be used as a 20-MHz digital pattern generator. (pattern output)
- As 32-bit I/O pins are set by software in 16 bit units, they can be used for 32-bit input, 16-bit input plus 16-bit output, or for 32-bit output.

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

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)” - “DIO(WDM)” - “API-DIO(WDM) HELP” to display help information.
- (3) Using the API-DIO(98/PC), from the Start Menu, select “Programs” – “CONTEC API-PAC(W32)” – “DIO” – “PIO-32DM” – “API-DIO HELP for PIO-32DM” 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)\DIO\WDM\Sample.

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

\Program Files\CONTEC\API-PAC(W32)\Dio\Samples\Pio32DM

To use each sample program of API-DIO(98/PC), 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.

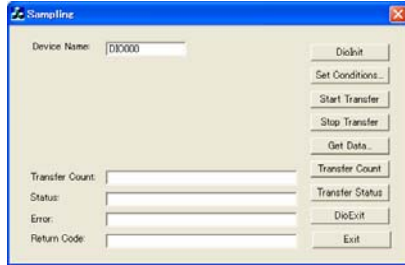
Running a Sample Program

- (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)” – “DIO\WDM” – “SAMPLE...”.
- (3) For the API-DIO(98/PC), from the Start Menu, select “Programs” – “CONTEC API-PAC(W32)” – “Dio” – “PIO-32DM” – “SAMPLE...”.
- (4) A sample program is invoked.

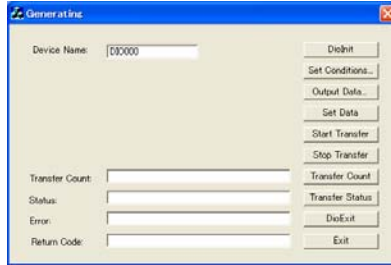
API-DIO(WDM) Sample

- Sample Programs Sampling : Executes pattern input (sampling) in 32 bits.
Saves sampling data to a file.
- Sample Programs Infinite Sampling : Executes pattern input (sampling) in 32 bits infinitely.
Saves sampling data to a file.
- Sample Programs Generating : Executes pattern output (generating) in 32 bits.
- Sample Programs Sync Samplin : Executes synchronous operation of the two boards
connected to each other via a synchronization control
connector.

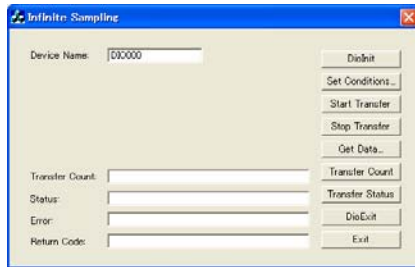
[Sample Sampling]



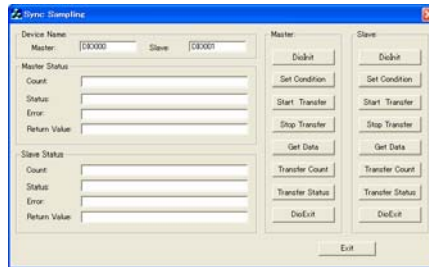
[Sample Generating]



[Sample Infinite Sampling]



[Sample Sync Samplin]



API-DIO(98/PC) Sample

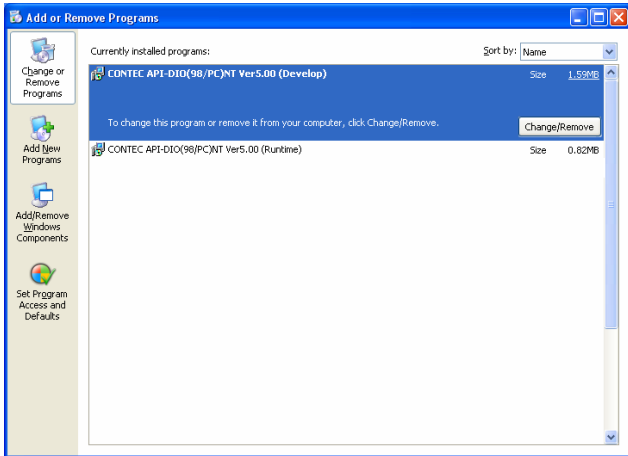
- Sample Programs INPUT 32 : Executes pattern input (sampling) in 32 bits.
Saves sampling data to a file.
- Sample Programs INFINITE : Executes pattern input (sampling) in 32 bits infinitely.
Saves sampling data to a file.
- Sample Programs OUTPUT 32 : Executes pattern output (generating) in 32 bits.
- Sample Programs SYNC : Executes synchronous operation of the two boards connected to each other via a synchronization control connector.

[Sample INPUT32]
[Sample INFINITE]
[Sample OUTPUT32]
[Sample SYNC]

Uninstalling the Driver Libraries

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

- (1) Click on the [Start] button on the Windows taskbar. From the Start Menu, select “Settings” – “Control Panel”.
- (2) Double-click on “Add/Remove Programs” in the Control Panel.
- (3) For use of API-DIO(WDM), select “CONTEC API-DIO(WDM) driver” and “CONTEC API-DIO(WDM) VerX.XX (Develop)” from the application list displayed.
For use of API-DIO(98/PC), select “CONTEC API-DIO(98/PC)xx VerX.XX (Develop)” and “CONTEC API-DIO(98/PC)xx VerX.XX (Runtime)” from the application list displayed.
Click on the [Change/Remove] button. Follow the on-screen instructions to uninstall the function libraries.



About Software for Linux

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

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

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

Driver Software Install Procedure

The Linux version for digital I/O driver, API-DIO(LNX), is supplied as a compressed file /linux/dio/cdioXXX.tgz on the bundled API-PAC(W32)CD-ROM. (Note: XXX represents the driver version.)

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

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

To install the driver, log in as a superuser.

Decompression and setup procedure

```
# cd
# mount /dev/cdrom /mnt/cdrom           Mount the CD-ROM.
# cp /mnt/cdrom/linux/dio/cdioXXX.tgz ./ Copy the compressed file.
# tar xvfz cdioXXX.tgz                 Decompress the compressed file.
.....
# cd contec/cdio
# make
                                     Compile the file.
.....
# make install                         Install.
.....
# cd config
# ./config                             Set up the 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.

Hardware specification

Table 6.1. Specification <1/2>

Item		Specification
Digital section		
Number of I/O Channels		32-bit input lines, 16-bit input/output lines, 32-bit output lines (programmable)
I/O signal level		TTL level (Equivalent to ALS245A)
Data access method		General-purpose digital I/O or pattern I/O with bus mastering DMA
Echo-back function		Available (at general-purpose output)
Connector		Equivalent to PCR-96LMD (HONDA)
Signal extension distance		1.5m (dependent on wiring environment)
Pattern input	Sampling start trigger	Software start/External start/Pattern detection
	Sampling stop trigger	Software stop/External stop/End of transfer/Transfer error
	Sampling clock	Sampling timer/External clock input/handshake/SC connector
	Sampling timer	50ns - 107s 25ns unit
Pattern output	Generating start trigger	Software start/External start/SC connector
	Generating stop trigger	Software stop/External stop/End of transfer/Transfer error/Specified number of items/SC connector
	Generating clock	Output timer/External clock input/Handshake/SC connector
	Generating timer	50ns - 107s 25ns unit
Control signal	I/O signal level	TTL level (Input: equivalent to ALS541; Output: equivalent to LS125A)
	REQ signal (handshake)	Negative logic tL=50ns (Min.)
	ACK signal (handshake)	Negative logic tL=50ns (Min.)
	External start signal	Selection of rising/falling edge with the software
	External stop signal	Selection of rising/falling edge with the software
	External clock input	f=10 MHz (Max.)
Bus master section		
DMA channels		2 channels (one each for input and output)
Transfer bus width		32-/16-bit width
Transfer data length		8 PCI Words length (Max.)
Transfer rate		80 MB/sec.
FIFO		1K Word/ch.
Scatter/Gather function		64 MB/ch.

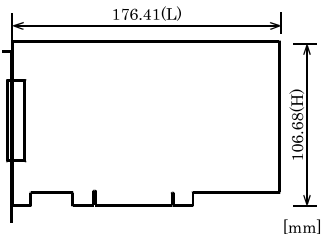
Table 6.1. Specification < 2 / 2 >

Item	Specification
Synchronization section	
Control output signal	Selection of output signal with the software when specifying a sync master board.
Control input signal	Selection of sync factor with the software when specifying sync slave boards.
Max. board count for connection	16 boards including the master board
Connector	PS-10PE-D4T1-B1 (JAE) or equivalent x 2
Common section	
I/O addresses	Occupies 2 locations, any 32-ports and 64-ports boundary
Interrupt	Errors and various factors, One interrupt request line as INTA
Current consumption	5 VDC, 700 mA (Max.)
Operating conditions	0 - 50°C, 10 - 90%RH (No condensation)
PCI bus specification	32bit, 33MHz, Universal key shapes supported *1*2
External dimensions (mm)	176.41(L) x 106.68(H)
Weight	130g

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

*2 When the board No. is 7166, PCI bus specification is 32bit, 33MHz, 5V.

External Board Dimensions



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

Differences in Bus Master Transfer Rate by System Configuration

Table 6.2. When Fitted in the PC Expansion Slot

	Limited		Unlimited	
	In	Out	In	Out
430TX/Pentium233MHz	20	20	13.4	8
440BX/PentiumII450MHz	20	20	13.4	8
i820/PentiumIII800MHz	20	20	13.4	8

Unit [MHz]

"Limited" indicates that the number of transfers is designated and "unlimited" indicates the number of transfers is not designated. However, these values may not be satisfied depending on the system configuration, such as other boards and applications.

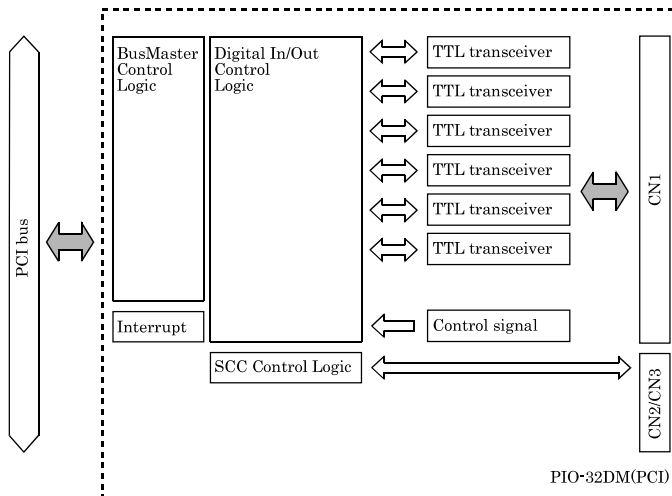
Table 6.3. When CONTEC's Expansion Unit FA-PAC (PCI) Series Is Used

	Limited		Unlimited	
	In	Out	In	Out
430TX/Pentium233MHz	20	20	13.4	2.5
440BX/PentiumII450MHz	20	20	13.4	2.5
i820/PentiumIII800MHz	20	20	13.4	2.5

Unit [MHz]

"Limited" indicates that the number of transfers is designated and "unlimited" indicates the number of transfers is not designated. However, these values may not be satisfied depending on the system configuration, such as other boards and applications.

Block Diagram

**Figure 6.1. Block Diagram**

PIO-32DM(PCI)

User's Guide

CONTEC CO., LTD.

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Japanese <http://www.contec.co.jp/>

English <http://www.contec.com/>

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Management No. A-46-414

[07102009_rev6]

Parts No. LZR5453