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Find the *Contec AD12-16U(PCI)E* at our website: ***Click HERE***

PC-HELPER

Analog Input Board for PCI

AD12-16(PCI)E
AD12-16U(PCI)E
AD16-16(PCI)E

User's Guide

CONTEC CO.,LTD.

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Check Your Package

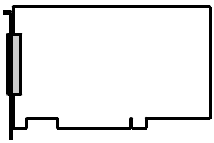
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The product consists of the items listed below.

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

Product Configuration List

- Board (One of the following) …1
  [AD12-16(PCI)E, AD12-16U(PCI)E or AD16-16(PCI)E] …1
- User's Guide (this booklet) …1
- CD-ROM [API-PAC(W32)] …1



Board



User's Guide



CD-ROM
[API-PAC(W32)]

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1. Before Using the Product

About the Board

AD12-16(PCI)E, AD12-16U(PCI)E and AD16-16(PCI)E are PCI-compliant interface boards that convert analog input signals to digital equivalents (performing analog-to-digital conversion).

< AD12-16(PCI)E > is the general-purpose type that can perform A-D conversion at a conversion speed of 10μsec per channel and a resolution of 12-bit.
< AD12-16U(PCI)E > is the high-speed type that can perform A-D conversion at a conversion speed of 1μsec per channel and a resolution of 12-bit.
< AD16-16(PCI)E > is the high-precision type that can perform A-D conversion at a conversion speed of 10μsec per channel and a resolution of 16-bit.

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

Sixteen single-ended channels and eight differential channels (Analog input function)

Either board allows the single-ended or differential input mode to be selected with on-board jumpers. The order of channels subject to signal conversion can be preset in the dedicated register. Using an optional unit, the board can increase the maximum number of input channels (up to 32 channels) and perform simultaneous sampling.

On-board buffer memory (Analog input function)

The board has buffer memory available as a FIFO or ring buffer to hold 256 kilobytes of data. This enables sampling to be executed in the background independently of the processing power of the PC.

Assorted sampling control functions (Analog input function)

The board can control the starting and stopping of sampling not only with software commands but also by detecting analog signal strength or TTL-level signals. The board offers a choice of sampling clocks selectable to determine the sampling speed: the internal sampling clock using the on-board clock generator and the external sampling clock using the digital signal input from an external device.

Analog output function

The board has one channel of analog output function.

Digital input/output function

The board has four digital input and four digital output pins for TTL-level signals, allowing an external device to be monitored and controlled.

Abundant optional units

Optional units are available for enhancements.
Using optional units enhances board functions and facilitates connections.
For more details on the option, please refer to this chapter “Cable & Connector” or “Accessories (Option)”.

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Support Software

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

Driver Library **API-PAC(W32)** (Bundled)

API-PAC(W32) is the library software that provides the commands for CONTEC hardware products in the form of Windows standard Win32 API functions (DLL). It makes it easy to create high-speed application software taking advantage of the CONTEC hardware using various programming languages that support Win32 API functions, such as Visual Basic and Visual C/C++.
It can also be used by the installed diagnosis program to check hardware operations.
CONTEC provides download services to supply the updated drivers and differential files.
For details, read Help on the bundled CD-ROM or visit the CONTEC's Web site.

< Operating environment >

OS	Windows XP, 2000, NT, Me, 98, etc..
Adaptation language	Visual C/C++, Visual Basic, Delphi, Builder, etc..
Others	Each piece of library software requires 50 megabytes of free hard disk space.

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

This driver is used to control CONTEC analog I/O boards (PC Cards) from within Linux.
You can control CONTEC I/O boards easily using the shared library used by gcc and Kylix, the device driver (module) for each kernel version, and the board (PC Card) configuration program (config).
CONTEC provides download services to supply the updated drivers and differential files.
For details, read Help on the bundled CD-ROM or visit the CONTEC's Web site.

< Operating environment >

OS	RedHatLinux, TurboLinux, etc.. (For details on supported distributions, refer to Help available after installation.)
Adaptation language	gcc, Kylix, etc..
Others	Requires 3 megabytes of free hard disk space.

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

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

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

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

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Cable & Connector (Option)

Flat Cable with One 37-pin D-Type Connector	:	PCA37P-1.5 (1.5m)
Shielded Cable with One 37-pin D-Type Connector	:	PCA37PS-0.5P (0.5m)
	:	PCA37PS-1.5P (1.5m)
Shielded Cable with Two 37-pin D-Type Connectors	:	PCB37PS-0.5P (0.5m)
	:	PCB37PS-1.5P (1.5m)
Flat Cable with One 15-pin D-Type Connector	:	PCA15P-1.5 (1.5m)
Flat Cable with Two 15-pin D-Type Connectors	:	PCB15P-1.5 (1.5m)*1
Coaxial Cable for Single-ended Inputs (16 channels)	:	PCC16PS-1.5 (1.5m)
	:	PCC16PS-3 (3m)
2 Wires Shielded Cable for Differential Inputs (8 channels)	:	PCD8PS-1.5 (1.5m)
	:	PCD8PS-3 (3m)
Flat Cable with 1 Sided 16-Pin Header Connector (1.5m)	:	DT/E1
Conversion Cable (16Pin to 15Pin) with Bracket	:	DT/E2

*1 For FTP-15 only

Accessories (Option)

Termination panel with Screw Terminals for Spade Lugs	: DTP-3(PC)
Termination panel with Screw Terminals	: DTP-4(PC)
Termination panel with BNC connectors for Analog Multi-function Boards	: ATP-16 *2
Termination panel for Digital I/O on Analog Multi-function Boards	: FTP-15 *3
Screw Terminal	: EPD-37A *2
Screw Terminal	: EPD-37 *2
16 Channel Simultaneous Sample & Hold Accessory	: ATSS-16 *2
8ch-Isolation Accessory Board for Analog Inputs	: ATII-8A *2
Low pass filter expansion board	: ATLF-8 *2
16CH Multiplexer Sub-Board	: ATCH-16(PCI) <When using the AD12-16(PCI)E, AD16-16(PCI)E>
16CH Multiplexer Sub-Board	: ATUH-16(PCI) <When using the AD12-16U(PCI)E>

*2 A PCB37PS -*P optional cable is required separately. (0.5m is recommended.)

*3 A DT/E2 and PCB15P-1.5 optional cable is required separately.

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

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Customer Support

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

Web Site

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

Latest product information

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

Free download

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

Note! For product information

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

Limited Three-Years Warranty

CONTEC 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.

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Safety Precautions

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

Safety Information

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

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

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Handling Precautions

⚠ DANGER

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

⚠ CAUTION

- There are switches and jumpers on 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.

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Environment

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

Operating temperature

0 to 50°C

Operating humidity

10 to 90%RH (No condensation)

Corrosive gases

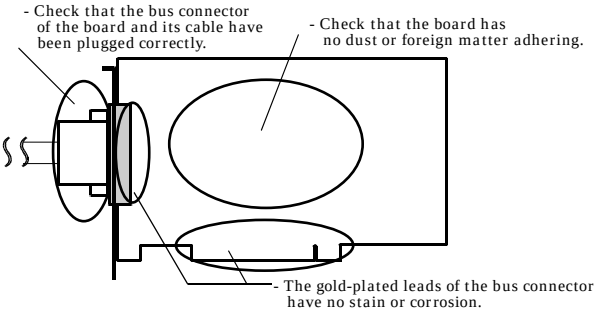
None

Floating dust particles

Not to be excessive

Inspection

Inspect the product periodically as follows to use it safely.



Storage

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

(1) Put the board in the storage bag.

(2) Wrap it in the packing material, then put it in the box.

(3) Store the package at room temperature at a place free from direct sunlight, moisture, shock, vibration, magnetism, and static electricity.

Disposal

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

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2. Setup

This chapter explains how to set up the board.

What is Setup?

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

Using the Board under Windows

Using the Driver Library API-PAC(W32)

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

Taking the following steps sets up the software and hardware. You can use the diagnosis program later to check whether the software and hardware function normally.

Step 1 Installing the Software

Step 2 Setting the Hardware

Step 3 Installing the Hardware

Step 4 Initializing the Software

Step 5 Checking Operations with the Diagnosis Program

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

Using the Board under Windows

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

For setting up software other than API-PAC(W32), refer to the user’s guide for that software. See also the following parts of this user’s guide as required.

This chapter Step 2 Setting the Hardware

This chapter Step 3 Installing the Hardware

Chapter 3 External Connection

Chapter 6 About Hardware

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Using the Board under an OS Other than Windows

For using the board under 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

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Step 1 Installing the Software

This section describes how to install the Driver libraries.

Before installing the hardware on your PC, install the Driver libraries from the bundled API-PAC(W32) CD-ROM.

The following description assumes the operating system as Windows Me. Although some user interfaces are different depending on the OS used, the basic procedure is the same.

About the driver to be used

Two analog I/O drivers are available: API-AIO(WDM) and API-AIO(98/PC)W95/NT.

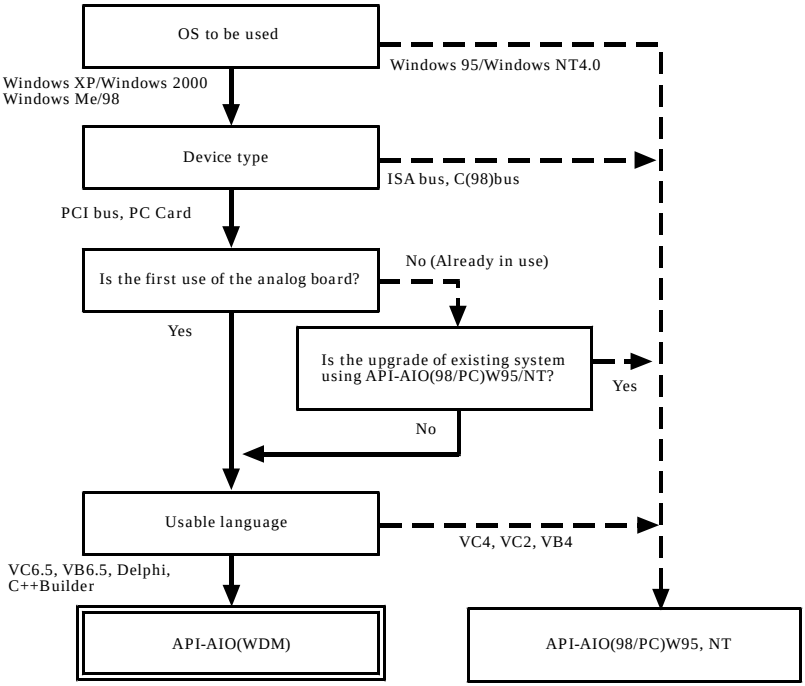
API-AIO(WDM) is a new driver to perform analog input/output under Windows.

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

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

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

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



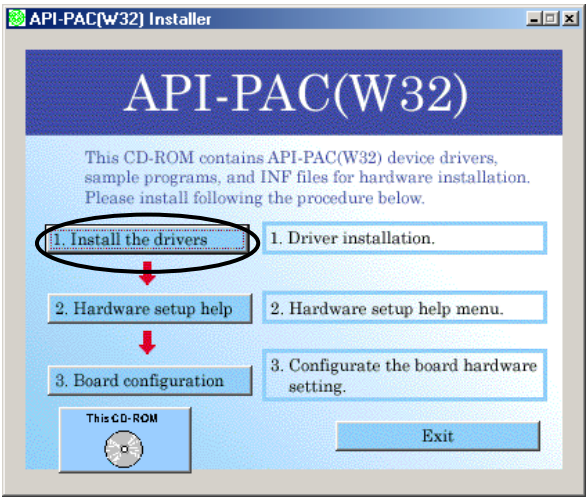
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Starting the Install Program

(1) **Load the CD-ROM [API-PAC(W32)] on your PC.**

(2) **The API-PAC(W32) Installer window appears automatically.**
If the panel does not appear, run (CD-ROM drive letter):\AUTORUN.exe.

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



⚠ CAUTION

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

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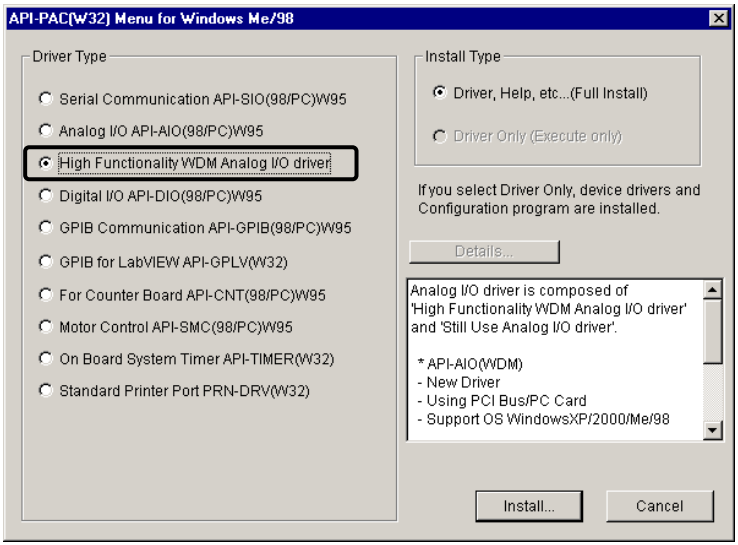
Select API-AIO(WDM)

Selecting API-AIO(WDM)

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

(2) **Select the "High Functionality WDM Analog I/O driver".**

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



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

Run the installation

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

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

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Select API-AIO(98/PC)

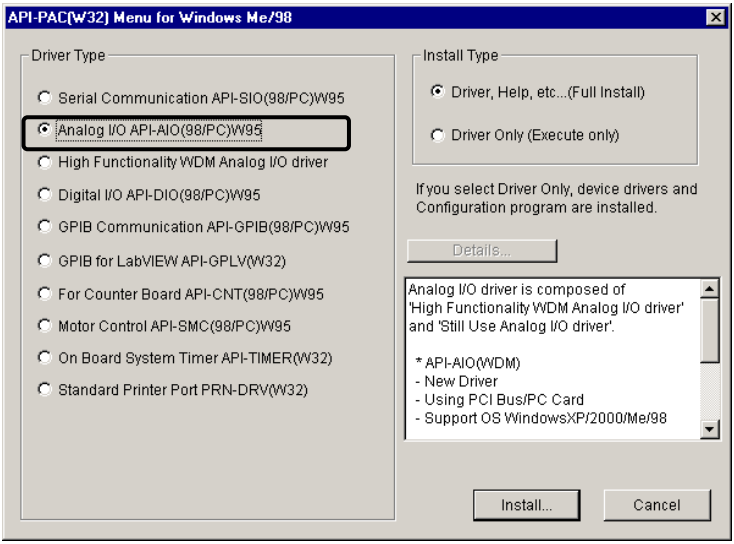
Selecting API-AIO(98/PC)

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

(2) **Select “Analog I/O API-AIO(98/PC)W95”.**

(3) **Select “Driver, Help, etc..(Full Install)”.**

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



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

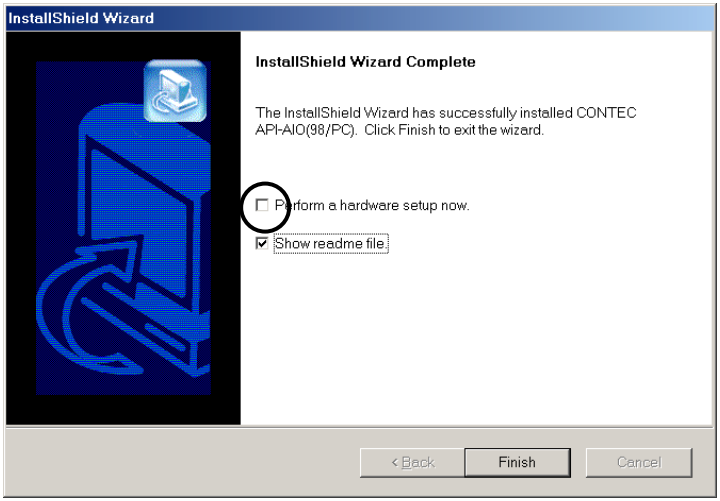
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Executing the Installation

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

(2) When the required files have been copied, the “Perform a hardware setup now(API-TOOL Configuration)” and “Show readme file” check boxes are displayed.
When you are installing the software or hardware for the first time:
1) Uncheck “Perform a hardware setup now”.
2) Click on the [Finish] button.
Go to Step 2 to set and plug the hardware.

* When the hardware has already been installed:
Check “Perform a hardware setup now(API-TOOL Configuration)”, then go to Step 4 “Initializing the Software”.



You have now finished installing the software.

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Step 2 Setting the Hardware

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

The board has some switches and jumper to be preset.
Check the on-board switches and jumpers before plugging the board into an expansion slot.

The board can be set up even with the factory defaults untouched. You can change board settings later.

Parts of the Board and Factory Defaults

Figure 2.1. to Figure 2.3. show the names of major parts on the board.

Part Names < AD12-16(PCI)E >

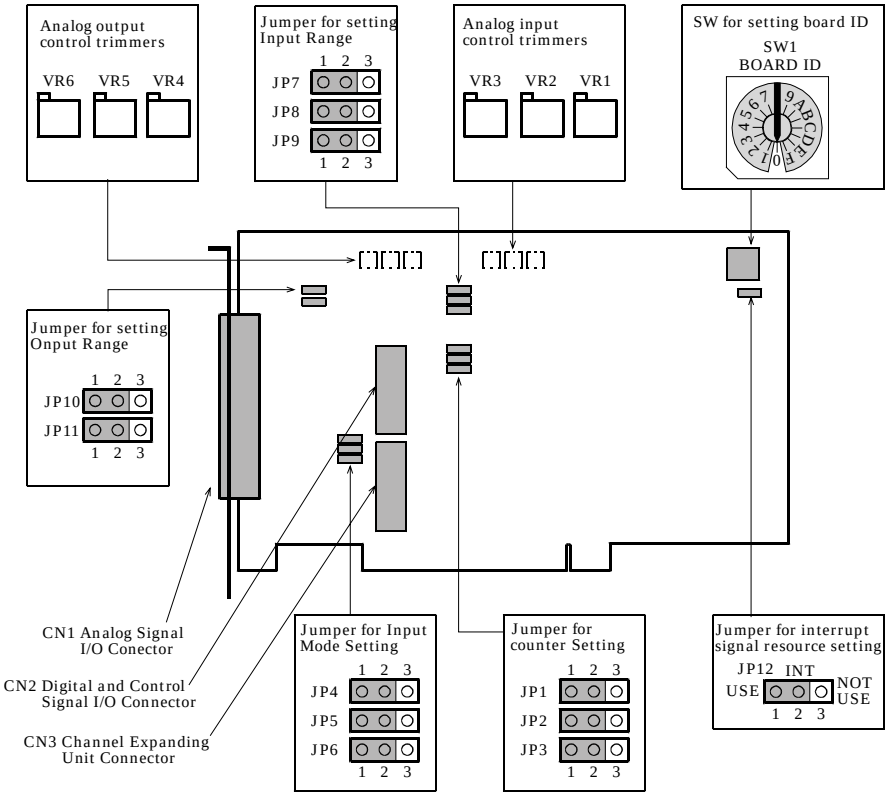


Figure 2.1. Part Names

Note that the switch and jumper setting shown below is the factory default.

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Part Names < AD12-16U(PCI)E >

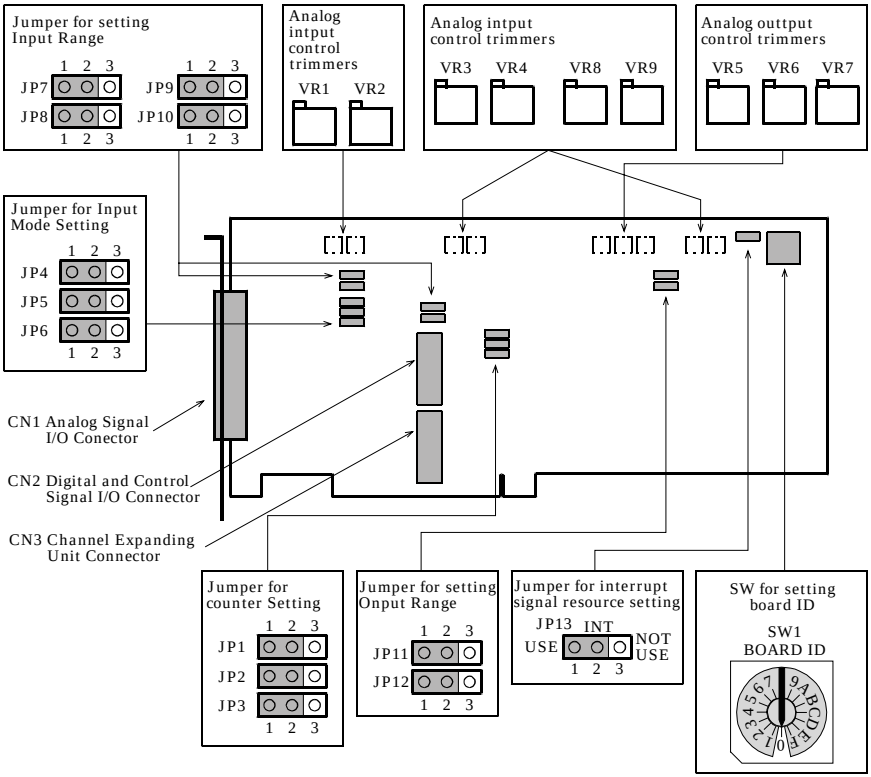


Figure 2.2. Part Names

Note that the switch and jumper setting shown below is the factory default.

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Part Names < AD16-16(PCI)E >

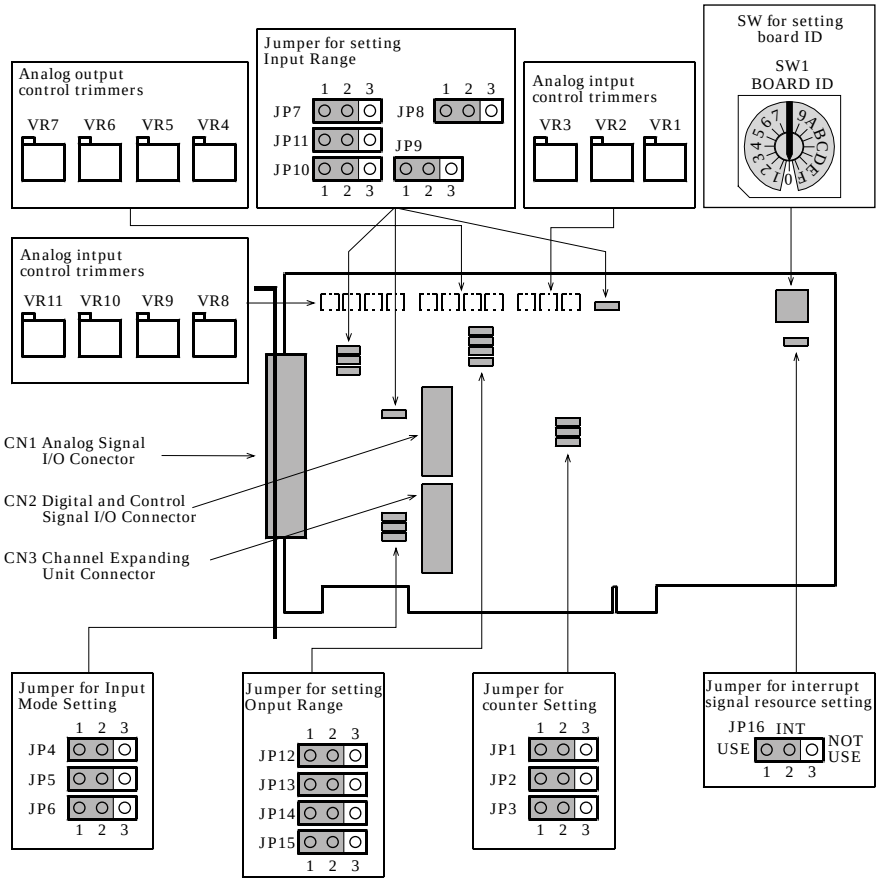


Figure 2.3. Part Names

Note that the switch and jumper setting shown below is the factory default.

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Setting the Board ID

If you install two or more boards on one personal computer, assign a different ID value to each of the boards to distinguish them.

The board IDs can be set from 0 to Fh to identify up to sixteen boards.

If only one board is used, the original factory setting (Board ID = 0) should be used.

Setting Procedure

To set the board ID, use the rotary switch on the board. Turn the SW1 knob to set the board ID as shown below.

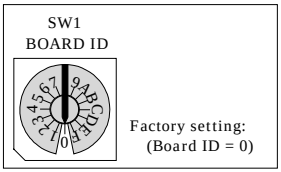


Figure 2.4. Board ID Settings (SW1)

Setting the interrupt signal resource

If you set up the board not to use interrupts, you can make your PC recognize the board as using no interrupts to save the PC's interrupt signal resources.

Setup method

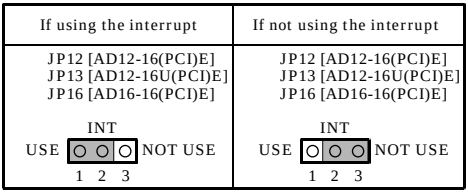


Figure 2.5. Setting the interrupt signal resource

When the board uses interrupts, it is assigned an interrupt level by the PC.

⚠ CAUTION

API-AIO(WDM) is designed to use interrupts. Set the jumper to use interrupts.

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Setting the Analog Input

The analog input is set by specifying the input mode and input range.
For the input mode setting function, see Chapter 4 “Functions”.

Setting the Input Mode

The input mode is the method of connecting analog input signals. The single-ended and differential input modes are available.
The jumper settings for these modes are common to the AD12-16(PCI)E, AD12-16U(PCI)E and AD16-16(PCI)E.
Use JP4 to JP6 to set the desired input mode.

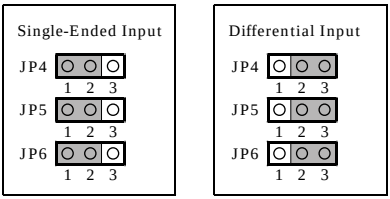


Figure 2.6. Setting the Input Mode

⚠ CAUTION

Do not set the jumpers to any strapping pattern other than those specified above. Doing so can result in a fault in the board.

Setting the Input Range

The input range indicates the range of voltages of analog input signals.
The board converts the voltages in the preset input range into digital signals according to the resolution.
The input range is common to all channels; it is not possible to set a different input range for each channel. Figures 2.7, 2.8 and 2.9 illustrates the jumper settings on each board.
Set the input range using both of jumpers and software.

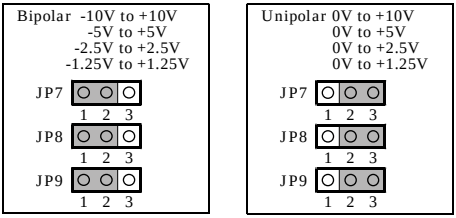


Figure 2.7. Setting the Input Range < AD12-16(PCI)E >

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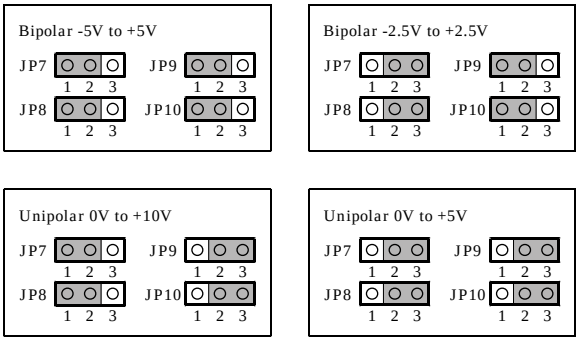


Figure 2.8. Setting the Input Range < AD12-16U(PCI)E >

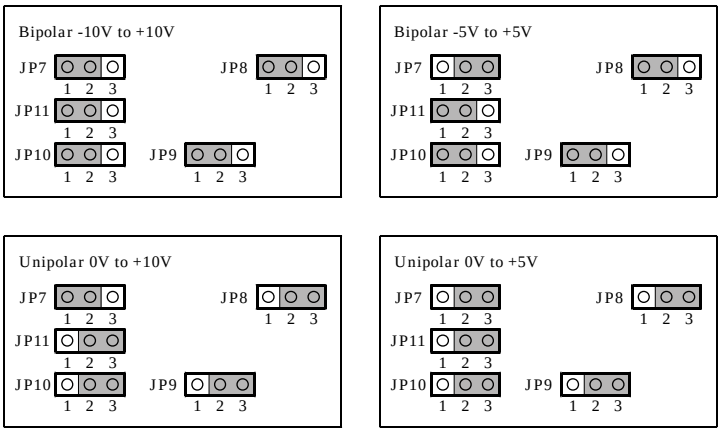


Figure 2.9. Setting the Input Range < AD16-16(PCI)E >

⚠ CAUTION

Do not set the jumpers to any strapping pattern other than those specified above. Doing so can result in a fault in the board.

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Setting the Analog Output

The analog output is set by specifying the output range.
The output range indicates the range of voltages of analog output signals.
The board converts digital signals into voltages in the preset output range according to the resolution.
Figures 2.10, 2.11 and 2.12 illustrates the jumper settings on each board.

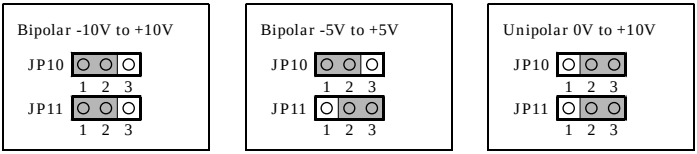


Figure 2.10. Setting the Output Range < AD12-16(PCI)E >

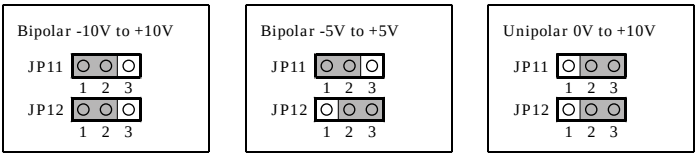


Figure 2.11. Setting the Output Range < AD12-16U(PCI)E >

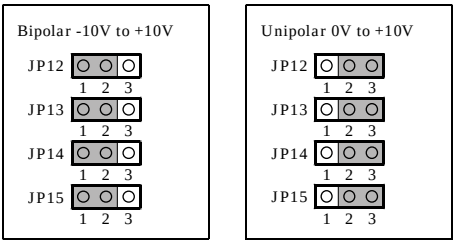


Figure 2.12. Setting the Output Range < AD16-16(PCI)E >

⚠ CAUTION

Do not set the jumpers to any strapping pattern other than those specified above. Doing so can result in a fault in the board.

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Setting the Counter Control and Digital I/O Signals

The board has a component equivalent to the i8254, which contains three 16-bit counters. You can set the connections of counter control signals (counter output signal, gate signal, and clock input signal). Some of the counter control signals and digital I/O signals are shared, which are set altogether.
For the digital input, digital output, and counter functions, see Chapter 4 “Functions”.

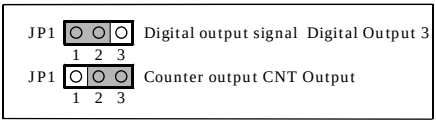


Figure 2.13. Settings the Signals to Be Connected to CN2[10pin] Digital Output3 and CNT Output

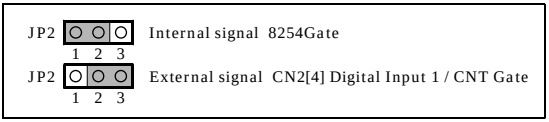


Figure 2.14. Settings the Signals to Be Connected to gate of COUNTER1/COUNTER2

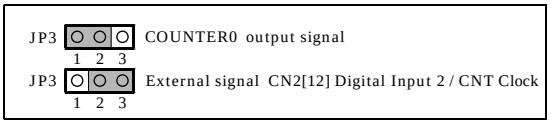


Figure 2.15. Settings the Signals to Be Connected to Clock of COUNTER1

⚠ CAUTION

- External signals for counter control must be TTL-level signals.
- CNTCLK and CNTGATE serve also as DI2 and DI1, respectively.
- Only one of the CNTOUT and DO3, which is selected by JP1, is output from CN2.
- API-AIO(WDM) does not support the counter functions. Leave the jumpers factory-set.

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Plugging the Board

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

(2) Remove the cover from the PC so that the board can be mounted.

(3) Plug the board into an expansion slot.

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

(5) Put the cover back into place.



⚠ 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 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.

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Step 3 Installing the Hardware

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

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

Turning on the PC

Turn on the power to your PC.

⚠ CAUTION

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

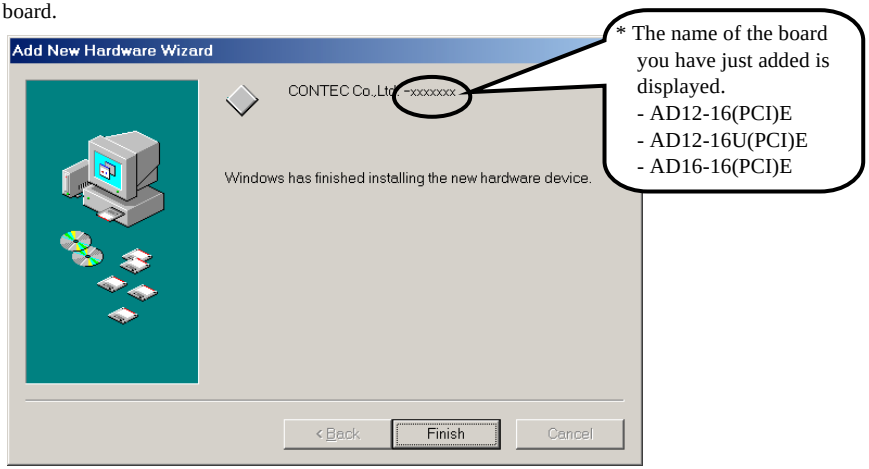
When Using API-AIO(WDM)

(1) The “Add New Hardware Wizard” will be started.
Select “Specify the location of the driver”, then click on the [Next] button.



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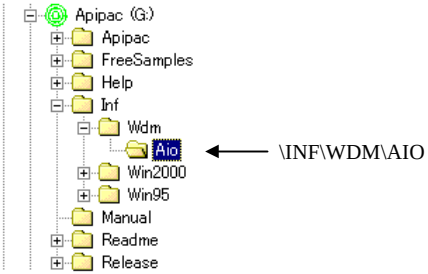
(2) Specify that folder on the CD-ROM which contains the setup information (INF) file to register the board.



Source folder

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

\INF\WDM\AIO



You have now finished installing the hardware.

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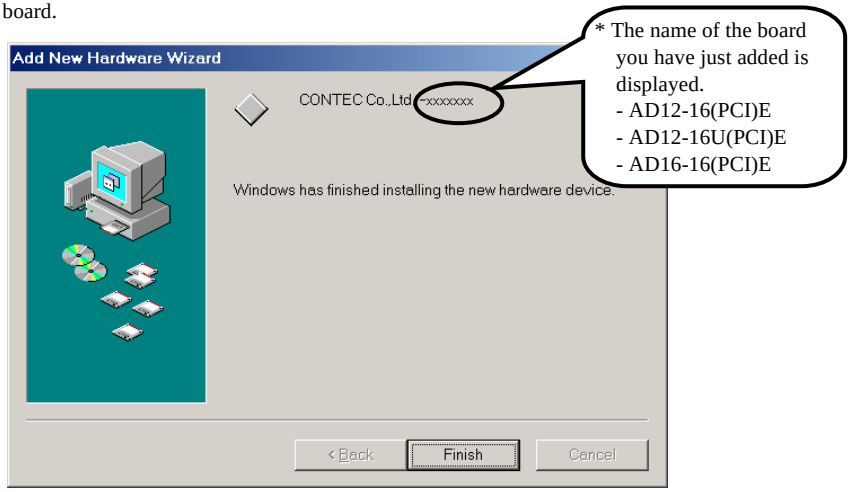
When Using API-AIO(98/PC)

(1) The “Add New Hardware Wizard” will be started.
Select “Specify the location of the driver”, then click on the [Next] button.
If you are using Windows NT 4.0, the “Add New Hardware Wizard” is not started. Go to Step 4 “Initializing the Software”.



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

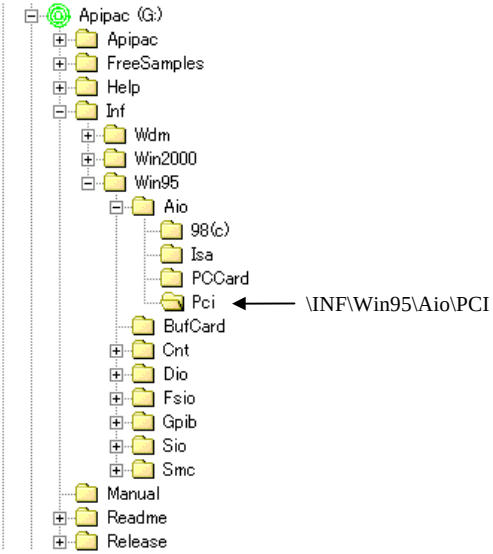


Source folder

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

Windows XP, 2000	\INF\Win2000\Aio\PCI
Windows Me, 98, 95	\INF\Win95\Aio\PCI

Example of specifying the folder for use under Windows Me

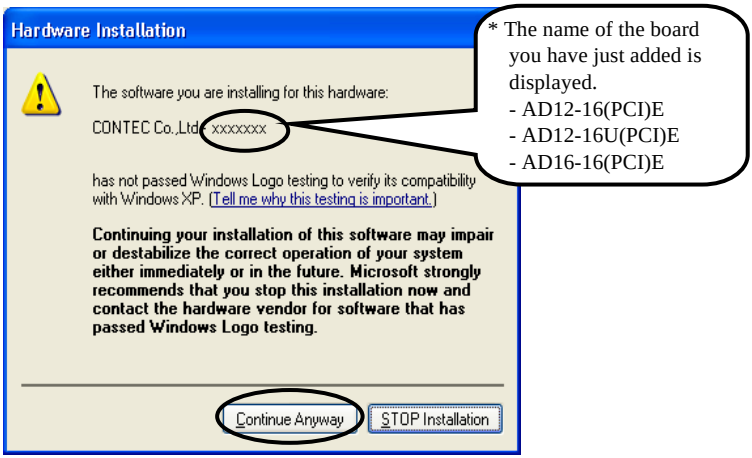


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⚠ CAUTION

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

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



You have now finished installing the hardware.

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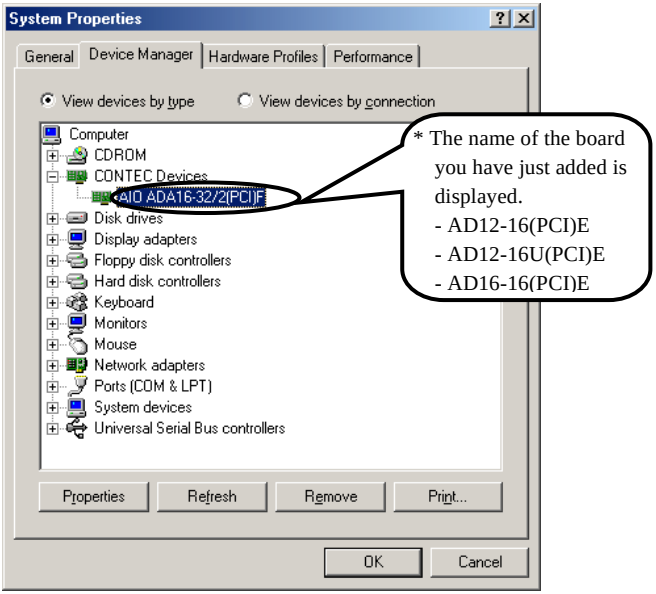
Step 4 Initializing the Software

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

When Using API-AIO(WDM)

Setting the device name

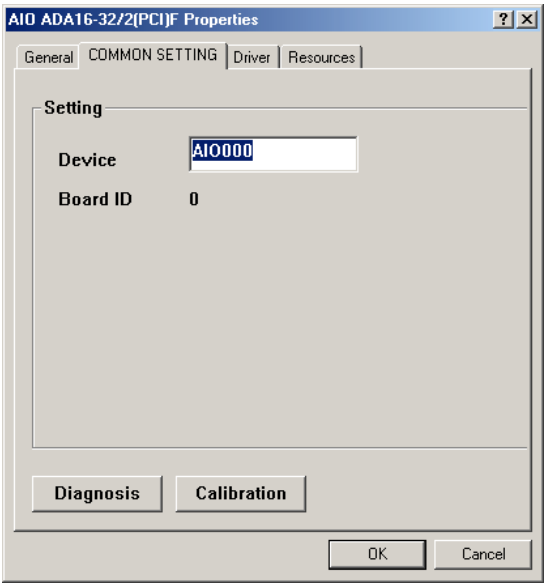
(1) Run Device Manager. From [My Computer] - [Control Panel], select [System] and then select the [Device Manager] tab.
(You can also open Device Manager by right clicking on My Computer and selecting Properties.)



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

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



* The initial device name that appears is a default value. You can use this default name if you wish.

* Make sure that you do not use the same name for more than one device.

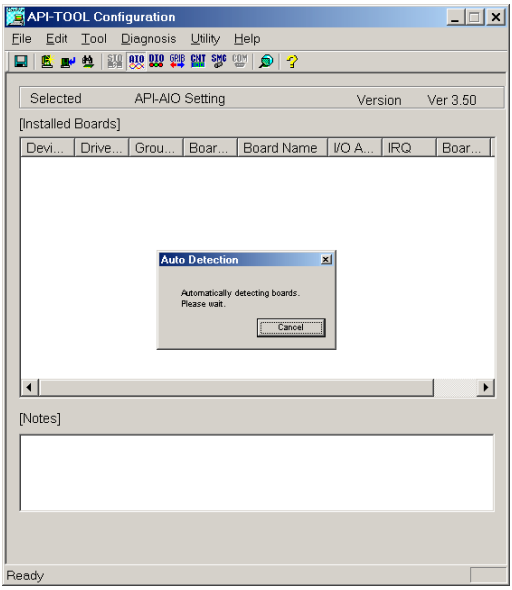
You have now finished installing the initial setting of Software.

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When Using API-AIO(98/PC)

Invoking API-TOOL Configuration

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



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

Updating the Settings

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

You have now finished installing the initial setting of Software.

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Step 5 Checking Operations with the Diagnosis Program

Use the diagnosis program to check that the board and driver software work normally, thereby you can confirm that they have been set up correctly.

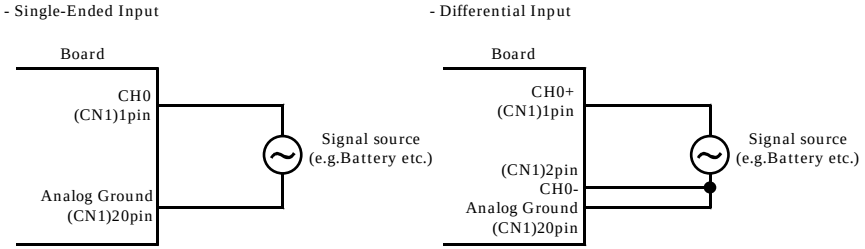
What is the Diagnosis Program?

The diagnosis program diagnoses the states of the board and driver software.
It can also be used as a simple checker when an external device is actually connected.
Using the “Diagnosis Report” feature reports the driver settings, the presence or absence of the board, I/O status, and interrupt status.

Check Method

To check analog I/O data, connect the signal.
The diagrams below show examples of using channel 0 on the AD12-16(PCI)E. For details on the connections, see Chapter 3 “External Connection”. Check the board with the factory defaults untouched.
Wiring Diagram

<Analog input>



⚠ CAUTION

- To check the analog input in differential input mode, set the jumpers to change the input mode setting in advance. For details, see “Setting the Analog Input” in this chapter.
- Input data remains indeterminate when no input pin is connected. The input pin for the channel not connected to the signal source must be connected to the analog ground. For details, see “Chapter 3 External Connection”.

<Analog output>

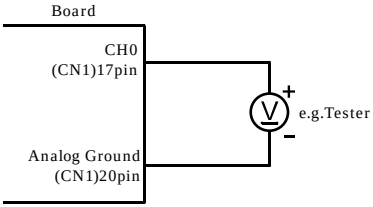


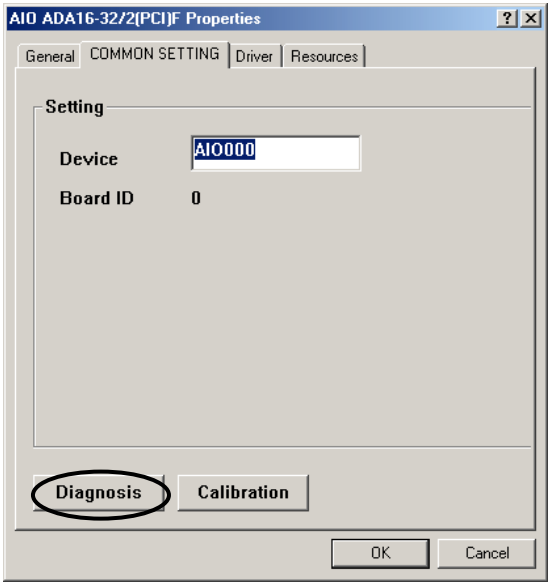
Figure 2.16. Wiring Diagram

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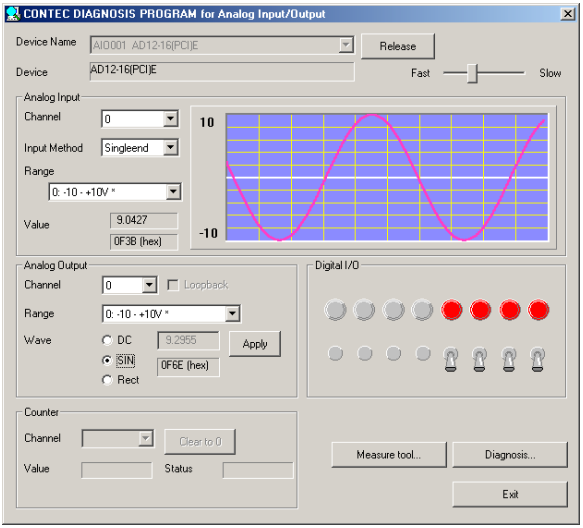
Using the Diagnosis Program for Use of API-AIO(WDM)

Starting the Diagnosis Program

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



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Analog input

You can select the desired input channel, input mode and input range from the lists.

Input data is plotted on a graph.

Analog output

You can select the desired output channel and output range from the lists.

You can set the output data to DC (constant voltage), sine wave, or square wave.

Digital input / output

The upper row of circular lamps indicates the digital input states. Red indicates the bit is ON and brown indicates OFF.

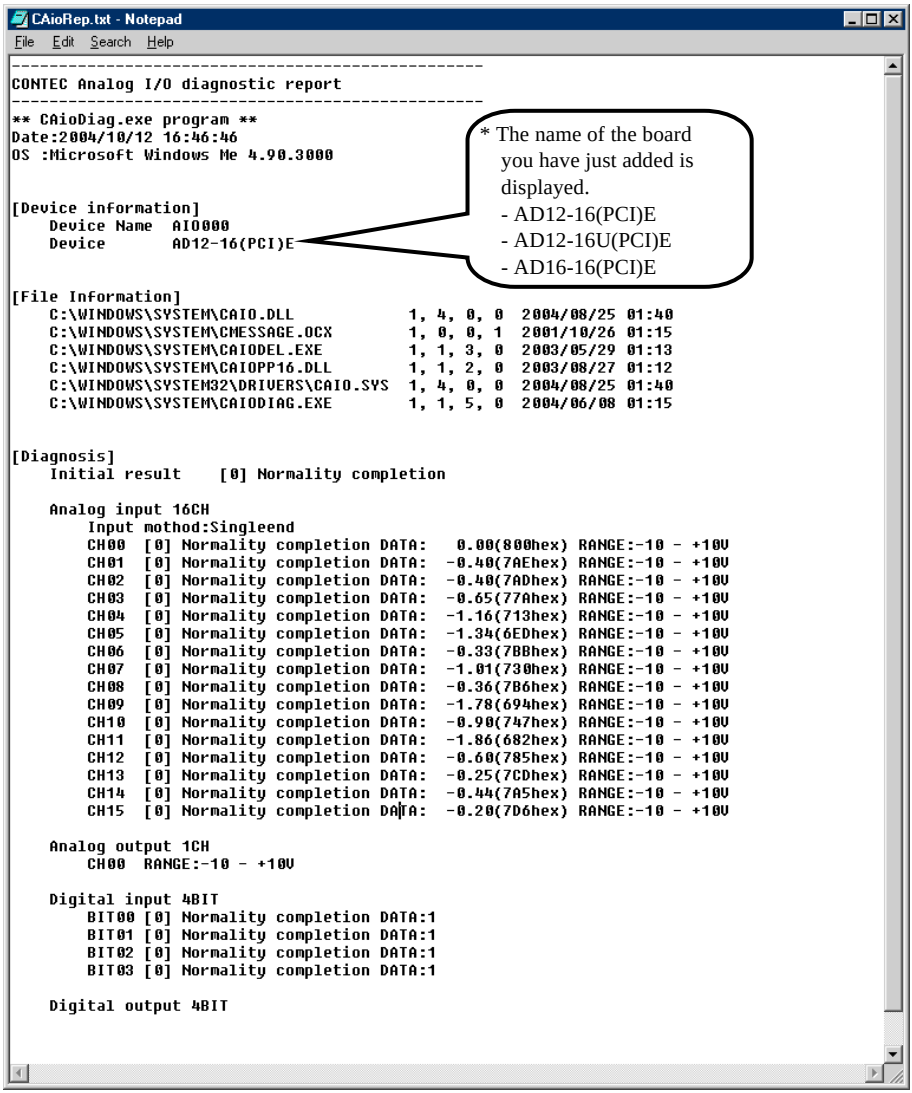
Clicking the lower row of switches turns the digital output bits ON or OFF.

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Diagnosis Report

(1) The diagnosis report saves detailed data, including the device settings and settings for each channel, to a text file and displays the file for you to view.

Clicking [Diagnosis Report] prompts you to specify where to save the report text file.




```
------------------------------------------------
CONTEC Analog I/O diagnostic report
------------------------------------------------
** CAioDiag.exe program **
Date:2004/10/12 16:46:46
OS :Microsoft Windows Me 4.90.3000


[Device information]
    Device Name  AIO000
    Device       AD12-16(PCI)E


[File Information]
    C:\WINDOWS\SYSTEM\CAIO.DLL             1, 4, 0, 0  2004/08/25 01:40
    C:\WINDOWS\SYSTEM\CMESSAGE.OCX         1, 0, 0, 1  2001/10/26 01:15
    C:\WINDOWS\SYSTEM\CAIODEL.EXE          1, 1, 3, 0  2003/05/29 01:13
    C:\WINDOWS\SYSTEM\CAIOPP16.DLL         1, 1, 2, 0  2003/08/27 01:12
    C:\WINDOWS\SYSTEM32\DRIVERS\CAIO.SYS   1, 4, 0, 0  2004/08/25 01:40
    C:\WINDOWS\SYSTEM\CAIODIAG.EXE         1, 1, 5, 0  2004/06/08 01:15


[Diagnosis]
    Initial result    [0] Normality completion

    Analog input 16CH
        Input mothod:Singleend
        CH00  [0] Normality completion DATA:   0.00(800hex) RANGE:-10 - +10V
        CH01  [0] Normality completion DATA:  -0.40(7AEhex) RANGE:-10 - +10V
        CH02  [0] Normality completion DATA:  -0.40(7ADhex) RANGE:-10 - +10V
        CH03  [0] Normality completion DATA:  -0.65(77Ahex) RANGE:-10 - +10V
        CH04  [0] Normality completion DATA:  -1.16(713hex) RANGE:-10 - +10V
        CH05  [0] Normality completion DATA:  -1.34(6EDhex) RANGE:-10 - +10V
        CH06  [0] Normality completion DATA:  -0.33(7BBhex) RANGE:-10 - +10V
        CH07  [0] Normality completion DATA:  -1.01(730hex) RANGE:-10 - +10V
        CH08  [0] Normality completion DATA:  -0.36(7B6hex) RANGE:-10 - +10V
        CH09  [0] Normality completion DATA:  -1.78(694hex) RANGE:-10 - +10V
        CH10  [0] Normality completion DATA:  -0.90(747hex) RANGE:-10 - +10V
        CH11  [0] Normality completion DATA:  -1.86(682hex) RANGE:-10 - +10V
        CH12  [0] Normality completion DATA:  -0.60(785hex) RANGE:-10 - +10V
        CH13  [0] Normality completion DATA:  -0.25(7CDhex) RANGE:-10 - +10V
        CH14  [0] Normality completion DATA:  -0.44(7A5hex) RANGE:-10 - +10V
        CH15  [0] Normality completion DATA:  -0.20(7D6hex) RANGE:-10 - +10V

    Analog output 1CH
        CH00  RANGE:-10 - +10V

    Digital input 4BIT
        BIT00 [0] Normality completion DATA:1
        BIT01 [0] Normality completion DATA:1
        BIT02 [0] Normality completion DATA:1
        BIT03 [0] Normality completion DATA:1

    Digital output 4BIT
```


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(2) The diagnosis report contains the following data.

- Version of OS
- Device Information
- File Information
- Diagnosis results for each I/O channel

Execution time measurement

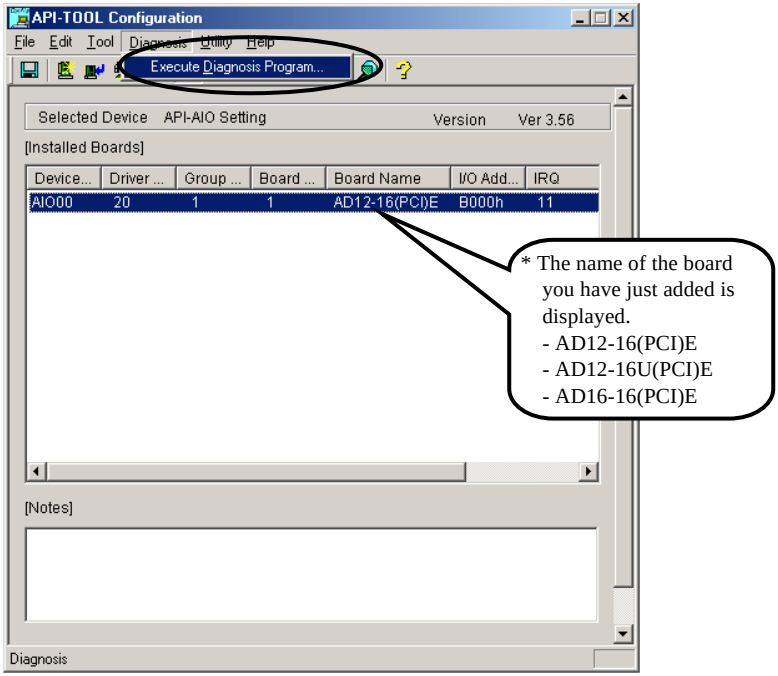
Clicking [Execution Time Measurement] runs the program to measure API function execution speed. The operation of this program is explained in "API function Execution Speed Measurement Program" in Chapter 5.

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Using the Diagnosis Program for Use of API-AIO(98/PC)

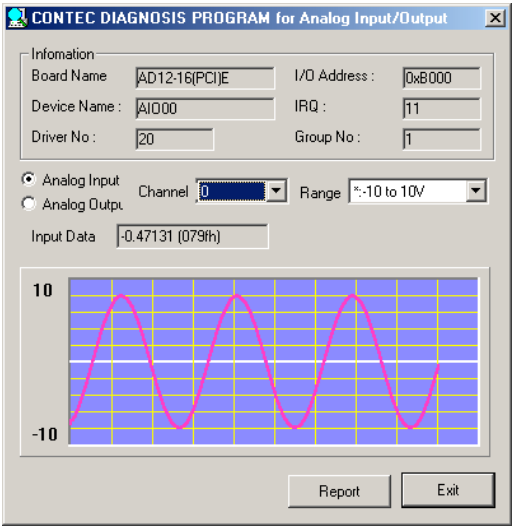
Starting the Diagnosis Program

After selecting the board in [API-TOOL Configuration], run the diagnosis program. Follow the on-screen instructions.



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Checking the Analog Input/Output



Analog input

You can select the input channel and input range from the lists.
Input data is plotted on a graph.

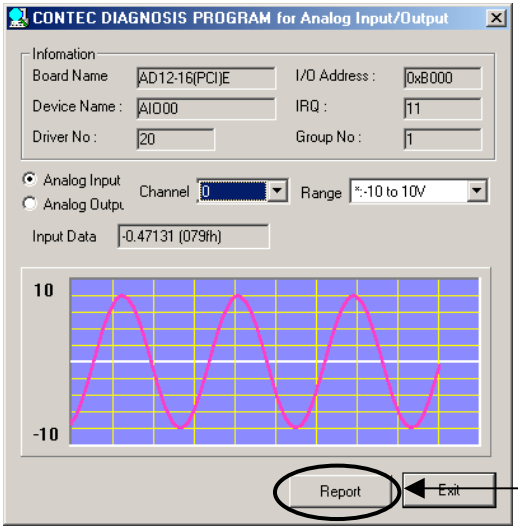
Analog output

You can select the desired output channel and output range from the lists.

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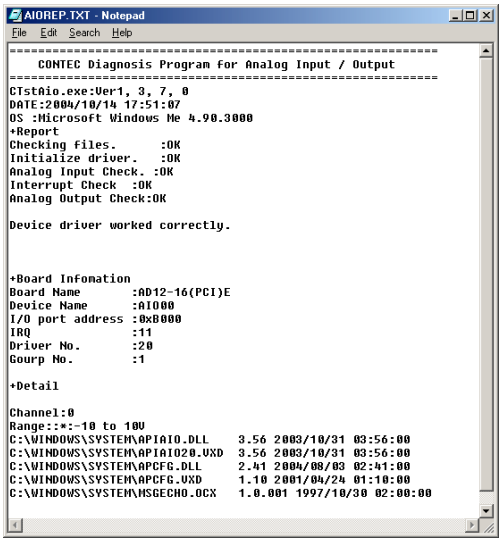
Diagnosis Report

(1) Clicking on the [Report] button displays detailed data such as a board, channel settings and the diagnosis results while saving them in text format.
The results are saved and displayed as a text file (AioRep.txt) in the install folder (CONTEC/CONTECW95).
The Diagnosis Program performs “board presence/absence check”, “interrupt test”, “driver file test”, “board setting test”, and so on.



Click on [Report].

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



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Setup Troubleshooting

Symptoms and Actions

The board cannot be initialized. [Windows NT4.0]

The driver may not yet be activated. When your PC is running under Windows NT 4.0, set the PnP OS option in the BIOS Setup menu to “NO”.

For details on BIOS settings, refer to the user’s guide for your PC.

The board cannot input or output data normally

- Run the Diagnosis Program to check whether the board has been registered correctly and whether any initialization error has occurred.
- Check the settings and connections of the board. Also check the input and output ranges. When your board uses jumpers to set the input/output ranges, correct data cannot be obtained unless the ranges have been adjusted. When no connection has been made, input data remains indeterminate. The channel to be used must be wired. The channels not to be used must be connected to the analog ground.
- If there is no appropriate signal source available at voltage input, either connect a cell or connect the channel to the analog ground to check for 0V.

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 return values of functions.
- Check the Driver No. and Board No.

The OS won't normally get started or detect the board. [Windows 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

Refer to the troubleshooting section of API-AIO HELP. If there is no answer in it, please contact your retailer.

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3. External Connection

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

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, CN2) shown below.

The board has two interface connectors: the analog I/O connector (CN1: 37-pin female D-SUB connector) and the control signal connector (CN2: 16-pin pin-header) for digital input/output and counter control.

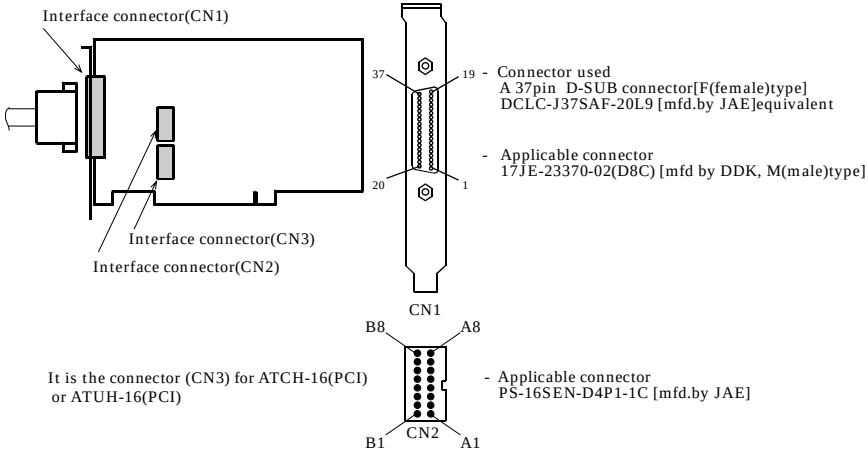


Figure 3.1. Interface Connectors and Mating Connectors

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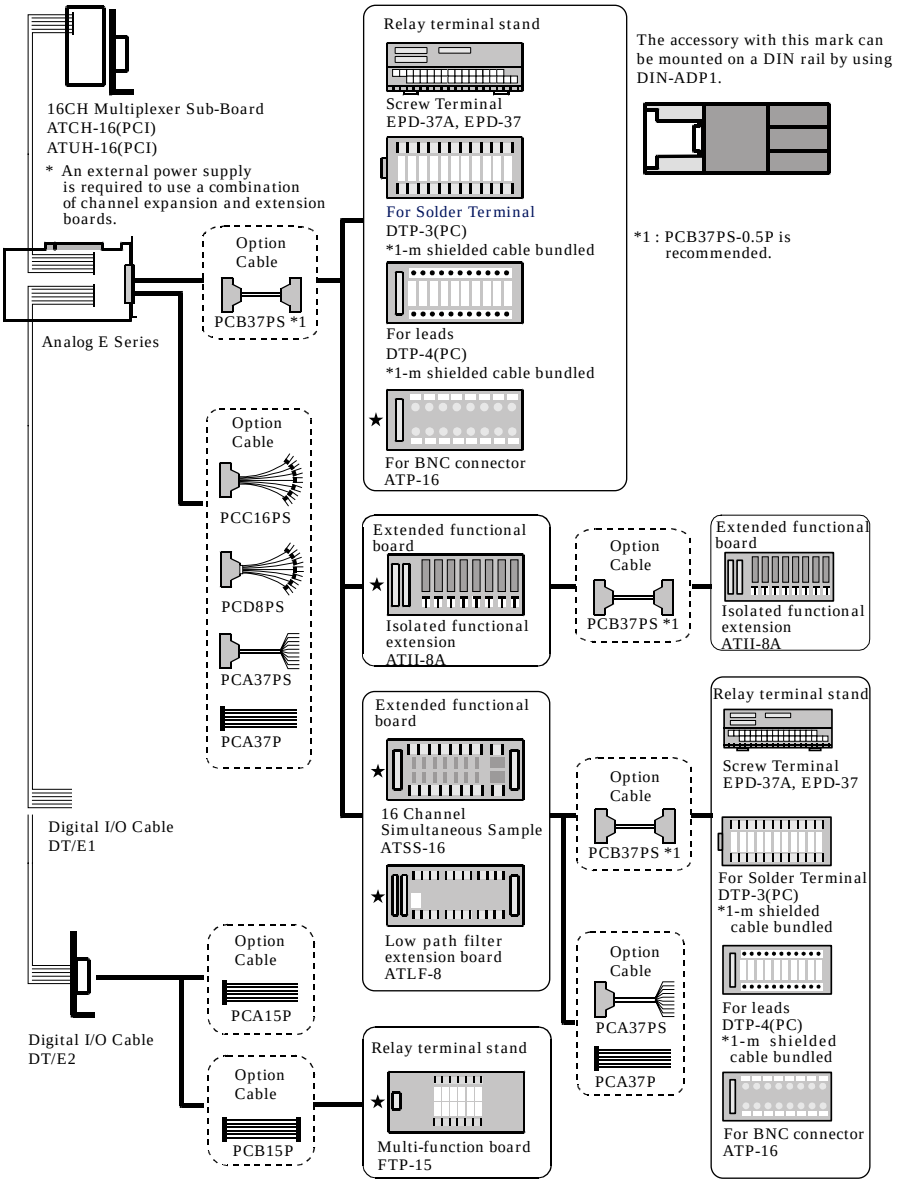
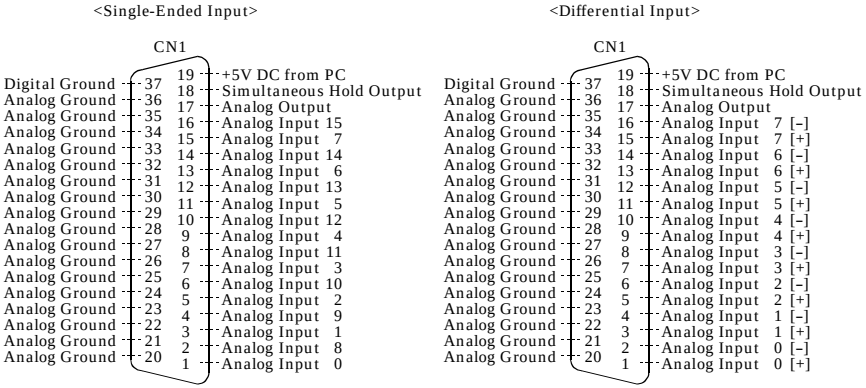


Figure 3.2. Examples of Connecting Options

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Connector Pin Assignment

Pin Assignment of CN1



Analog Input0 to Analog Input15	Analog input signal at the time of Single-Ended Input. The numbers correspond to channel numbers.
Analog Input0[+] to Analog Input15[+]	Analog input signal at the time of Differential Input. The numbers correspond to channel numbers.
Analog Input0[-] to Analog Input15[-]	Analog input signal at the time of Differential Input. The numbers correspond to channel numbers
Analog Output	Analog output signal.
Analog Ground	Common analog ground for analog I/O signals.
Simultaneous Hold Output	Control signal for simultaneous sampling unit ATSS-16 available as an option.
+5V DC from PC	Output +5V. Supportable current is 3A.
Digital Ground	Common digital ground for “Simultaneous Hold Output” and “+5V DC from PC”.

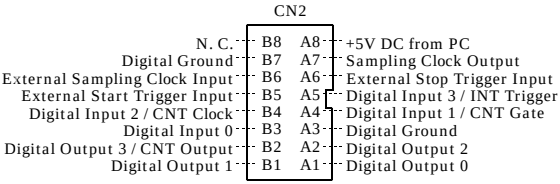
Figure 3.3. Pin Assignment of CN1

⚠ CAUTION

Do not connect any of the outputs and power outputs to the analog or digital ground. Neither connect outputs to each other. Doing either can result in a fault.

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Pin Assignment of CN2



Digital Input0	Digital input signal.
Digital Input1/CNT Gate	Digital input signal. Common for Gate control input signal for counter.
Digital Input2/CNT Clock	Digital input signal. Common for counter clock input signal.
Digital Input3/INT Trigger	Digital input signal. Common for interrupt trigger input signal.
Digital Output0 to Digital Out 2	Digital output signal.
Digital Output3 to CNT Output	Digital output signal. Capable of being jumper-switched to serve as the counter output signal.
External Start Trigger Input	External trigger input signal for starting sampling.
External Stop Trigger Input	External trigger input signal for stopping sampling.
External Sampling Clock Input	External sampling clock input
Sampling Clock Output	Sampling clock output signal
+5V DC from PC	Output +5V. Supportable current is 1A.
Digital Ground	Common digital ground for each signal and “+5V DC from PC”.
N.C.	No connection to this pin.

Figure 3.4. Pin Assignment of CN2

⚠ CAUTION

Do not connect any of the outputs and power outputs to the analog or digital ground.
Neither connect outputs to each other. Doing either can result in a fault.

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Analog Input Signal Connection

The procedure for connecting analog signals depends on whether the analog input signals are single-ended or differential. The sections below describe how to connect the signals using flat cable and shielded cable.

Single-ended Input

The following figure shows an example of optional flat cable (PCA37P) connection.
Connect separate signal and ground wires for each analog input channel on CN1.

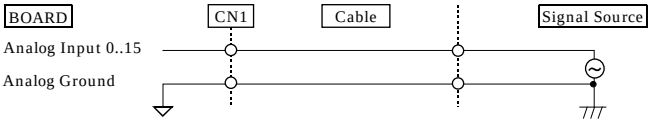


Figure 3.5. Single-ended Input Connection (Flat Cable)

The following example connects a signal source to the board using a shielded cable such as a coaxial cable (PCC16PS) available as an option. Use shielded cable if the distance between the signal source and board is long or if you want to provide better protection from noise. For each analog input channel on CN1, connect the core wire to the signal line and connect the shielding to ground.

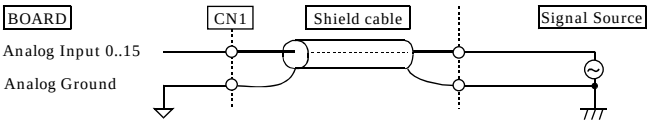


Figure 3.6. Single-ended Input Connection (Shield Cable)

⚠ CAUTION

- If the signal source contains over 1MHz signals, the signal may effect the cross-talk noise between channels.
- If the board and the signal source receive noise or the distance between the board and the signal source is too long, data may not be input properly.
- An input analog signal should not exceed the maximum input voltage (relate to the board analog ground). If it exceeds the maximum voltage, the board may be damaged.
- Connect all the unused analog input channels to analog ground.

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Differential Input

The following figure shows an example of optional flat cable (PCA37P) connection.
For each analog input channel on CN1, connect the "+" input to the signal and connect the "-" input to the signal source ground. Also connect the analog ground on the board to the signal source ground.

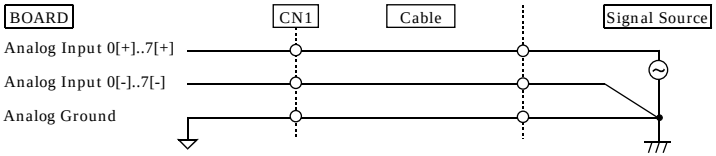


Figure 3.7. Differential Input Connection (Flat Cable)

The following example connects a signal source to the board using a shielded cable such as a two-conductor shielded cable (PCD8PS) available as an option. Use shielded cable if the distance between the signal source and board is long or if you want to provide better protection from noise. For each analog input channel on CN1, connect the "+" input to the signal and connect the "-" input to the signal source ground. Also connect the analog ground on the board and the signal source ground to the shielding.

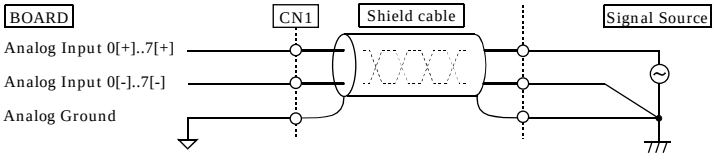


Figure 3.8. Differential Input Connection (Shield Cable)

⚠ CAUTION

- If the signal source contains over 1MHz signals, the signal may effect the cross-talk noise between channels.
- When the analog ground is not connected, input data comes to be undetermined.
- If the board and the signal source receive noise or the distance between the board and the signal source is too long, data may not be input properly.
- An input analog signal should not exceed the maximum input voltage (relate to the board analog ground). If it exceeds the maximum voltage, the board may be damaged.
- Connect all the unused analog input channels to analog ground.

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Analog Output Signal Connection

This section shows how to connect the analog output signal by using a flat cable or a shielded cable.

The following figure shows an example of optional flat cable (PCA37P) connection.

Connect the CN1's analog output and analog ground to the input to the external device and its ground, respectively.

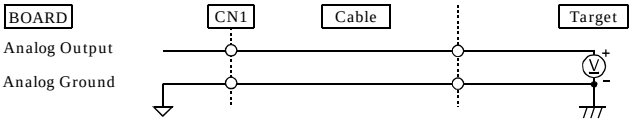


Figure 3.9. Analog Output Connection (Flat Cable)

The following figure shows an example of shielded cable connection. Use shielded cable if the distance between the board and external device is long or if you want to provide better protection from noise. For the CN1 analog output, connect the core wire to the signal line and connect the shielding to ground.

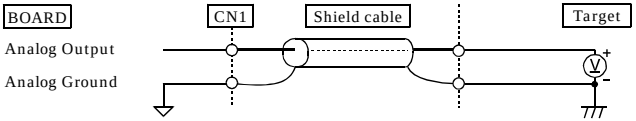


Figure 3.10. Analog Output Connection (Shield Cable)

⚠ CAUTION

- If the board or the connected wire receives noise, or the distance between the board and the target is long, data may not be outputted properly.
- For analog output signal, the current capacity is ±5mA (Max.). Check the specification of the connected device before connecting the board.
- Do not short the analog output signal to analog ground, digital ground, and/or power line. Doing so may damage the board.

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Digital I/O signals and Control signals Connection

The digital I/O signals and the control signals (external trigger input signal, sampling clock output signal and so on) are interfaced through the connector CN2. User can use an optional flat cable DT/E1 or DT/E2 (with bracket and a 15-pin D-SUB female connector) to connect these signals to your external devices.
All the digital I/O signals and control signals are TTL level signals.

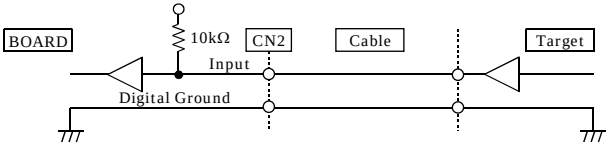


Figure 3.11. Digital Input Connection

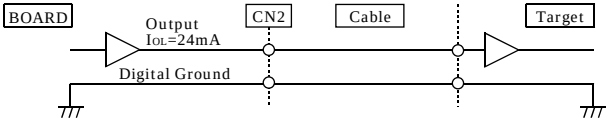


Figure 3.12. Digital Output Connection

⚠ CAUTION

Do not short the output signals to analog ground, digital ground, and/or power line. Doing so may damage the board.

Reference

For the operation timings for control signal input, see ”Timing of External Control Signals” in Chapter 6 “Hardware”.

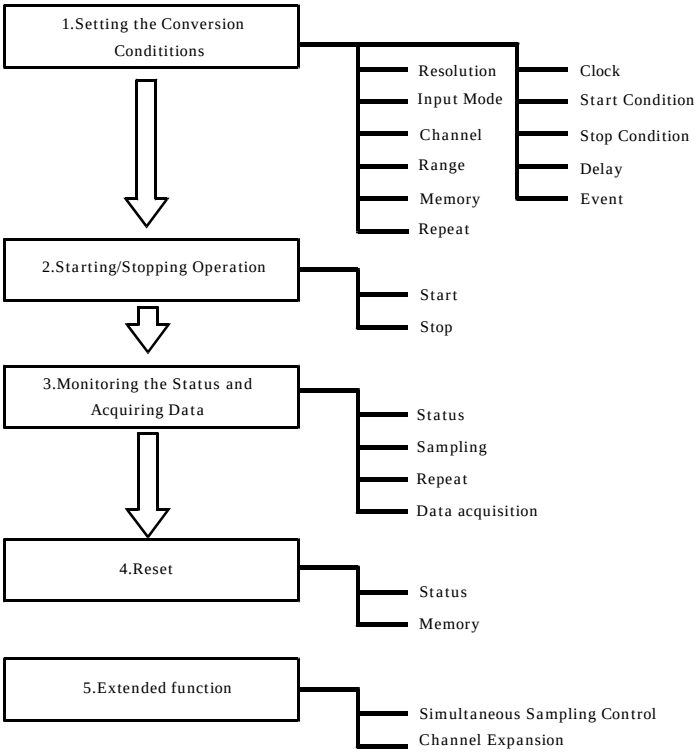
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4. Functions

This chapter describes the different functions that can be implemented using the hardware and driver together. Unless stated otherwise, the driver is assumed to be API-AIO(WDM).

Analog Input Function

The board converts analog signals to digital data according to the resolution and stores it in memory. You can set a variety of conditions for analog input, including the input channel, sampling period, and sampling start/stop conditions.
Analog input processes are classified as follows:



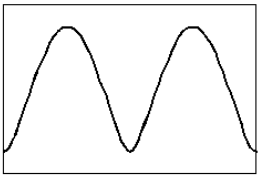
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1. Setting the Conversion Conditions

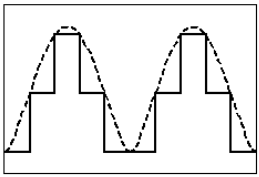
First, set the conditions for executing analog input.

Resolution

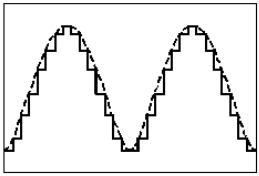
“Resolution” signifies the number of bits used by an analog input device to represent analog signals.
The higher the resolution, the more finely the voltage range is segmented, allowing the device to convert analog values to digital equivalents more precisely.
A device with a resolution of 12-bit divides the range width into 4096 segments.
When the device covers the range of 0 to 10V, the minimum unit of converted voltages is 10÷4096=2.44mV.
If the device has a resolution of 16-bit, it is 10÷65536 = 0.153mV instead.



Analog Voltage before Conversion



Low Resolution Board



High Resolution Board

AD12-16(PCI)E : The resolution is 12-bit.
AD12-16U(PCI)E : The resolution is 12-bit.
AD16-16(PCI)E : The resolution is 16-bit.

Input Mode

“Input Mode” indicates the method of connecting analog input signals.
The input modes available are single-ended input and differential input.
The single-ended input mode is suitable for the environment in which the potential difference between the signal source and ground and noise components can be ignored. For the environment in which they cannot be ignored, the differential input mode is suitable.
The number of channels available in differential input mode is half that in single-ended input mode.
This board uses on-board jumpers to set the input mode.
Please refer to the “Chapter2 Setup - Setting the Hardware - Setting the Analog Input”.

Channel

“Channel” represents each point of analog input.
For individual channel numbers, see “Using the On-board Connectors” to “Connector Pin Assignment” in Chapter 3 "External Connection".
You can specify an arbitrary number of points of analog input by setting the channels by means of software.

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Range

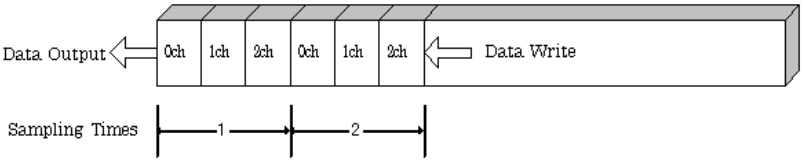
"Range" means the range of voltages at which analog input can be performed.
The input range can be selected by setting the upper and lower input signals.

AD12-16(PCI)E : The range is specified by setting both the jumpers and software.
AD12-16U(PCI)E : The range is specified by setting the jumpers.
AD16-16(PCI)E : The range is specified by setting the jumpers.
Please refer to the "Chapter2 Setup - Setting the Hardware - Setting the Analog Input".

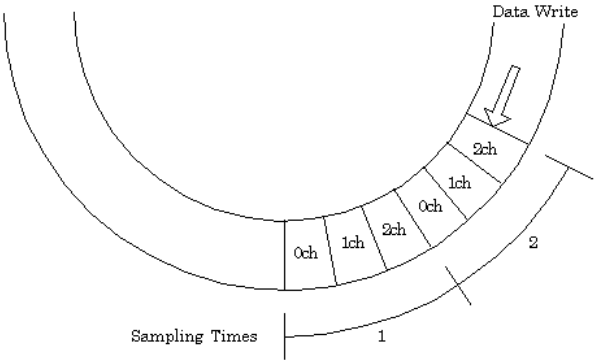
Memory

Board's or driver's input data storage memory is used to enable advanced analog input processing at high speed. For the memory, the FIFO or ring format can be selected by means of software.

- FIFO format
  In the FIFO (First In First Out) format, input data items are read from memory in the same order in which they were written to the memory. Input data items are fed out of the memory sequentially, where the oldest one is always read from the memory. The status monitor and application notification functions are provided, which check and report the state in which the memory has stored a fixed amount of data or in which the memory has become full.
  The FIFO memory is used to obtain all input data from analog input in a short or infinite period of time.



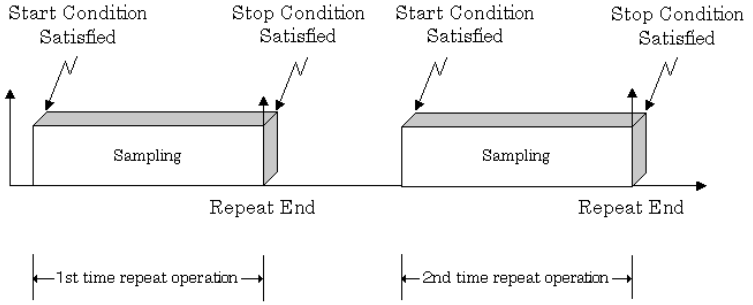
- Ring format
  In the ring format, the memory contains storage areas arranged in a ring. Input data items are written to the memory sequentially. When it stores data exceeding the limit, it overwrites the area storing the previous item of input data. The status monitor and application notification functions are provided, which check and report the state in which data has been written to certain areas of memory.
  The ring memory is used to obtain data where conversion has stopped due to some event, usually without obtaining data in the normal state.



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Repeat

“Repeat” indicates the number of repetitions of sampling to be executed, from when the sampling start condition is satisfied until the end of sampling, including delayed sampling.
The number of repetitions is set by means of software, for which conversion is repeated. You can set an infinite number of repetitions, in which case the conversion is terminated by the software abort command.
Input data items are stored to the memory sequentially. The repetition state can be subject to status monitoring and application notification.



This board does not support the Repeat feature when the sampling start condition is "software".

Clock

The sampling clock controls the sampling frequency. You can select both the internal sampling clock and the external sampling clock. The sampling clock is selected by means of software.

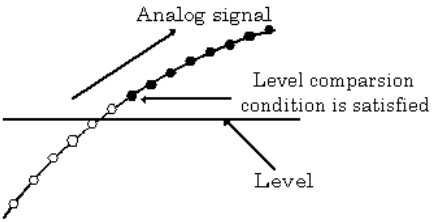
- Internal sampling clock
  The clock signal from the on-board clock generator is used.
- External sampling clock
  The edge of the digital signal input from an external device is used for the sampling clock.

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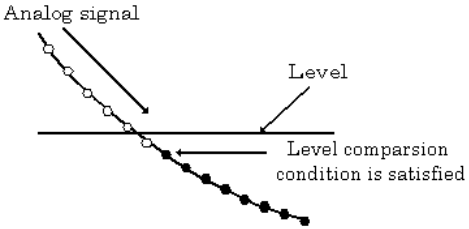
Start Condition

The condition for controlling the start of sampling can be selected from among software, input data comparison and an external trigger. The conditions for controlling the start and stop of sampling are completely independent of each other; they can be set separately.

- Software
  The board starts sampling and storing input data to memory immediately after the operation start command is issued.
- Input data comparison
  When the operation start command is issued, the board compares the analog signal input through a specified channel to the value of the preset comparison level. If the analog signal satisfies the condition, the board starts storing input data.
  Level comparison conditions are set as two conditions: level and direction.



The above sketch shows that the level comparison condition is satisfied in the rising direction. The start condition is satisfied when the analog signal at the specified channel passes the comparison level in the rising direction. Input data items are stored to memory, starting with those at solid dots.



The above sketch shows that the level comparison condition is satisfied in the falling direction. The start condition is satisfied when the analog signal at the specified channel passes the comparison level in the falling direction. Input data items are stored to memory, starting with those at solid dots.

If you set the level comparison directions to both directions, the start condition is satisfied when the analog signal passes the level both in the rising and falling directions.

- External trigger
  The board starts waiting for an external control signal as soon as the operation start command is output.
  Sampling and data transfer to memory start when the specified edge (rising edge or falling edge) is input from the external control signal.

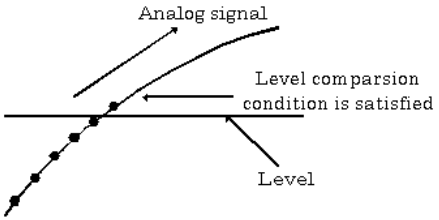
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Stop Condition

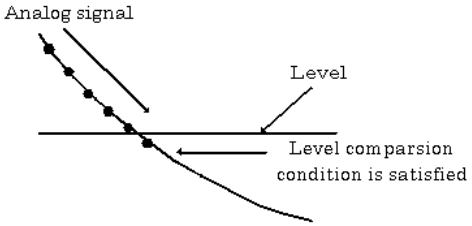
The condition for controlling the stop of sampling can be selected from among the last sampling count, input data comparison, an external trigger, and software abort.

The board stops sampling whenever an error occurs irrespective of the stop condition setting.

- Last sampling count
  The board stops sampling after storing input data to memory for the specified number of times of sampling.
- Input data comparison
  Once the board has started sampling, it compares the analog signal input through a specified channel to the value of the preset comparison level. If the analog signal satisfies the condition, the board stops sampling.
  Level comparison conditions are set as two conditions: level and direction.



The above sketch shows that the level comparison condition is satisfied in the rising direction. The stop condition is satisfied when the analog signal at the specified channel passes the comparison level in the rising direction. Input data items are stored to memory, ending until those at solid dots.



The above sketch shows that the level comparison condition is satisfied in the falling direction. The stop condition is satisfied when the analog signal at the specified channel passes the comparison level in the falling direction. Input data items are stored to memory, ending until those at solid dots

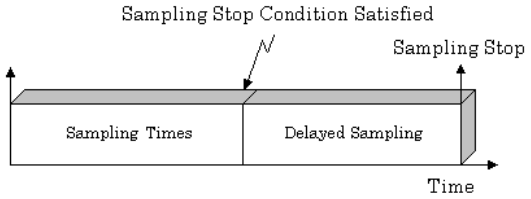
If you set the level comparison directions to both directions, the start condition is satisfied when the analog signal passes the level both in the rising and falling directions.

- External trigger
  The board starts waiting for an external control signal after the specified number of samples have been performed. Sampling stops when the specified edge (rising edge or falling edge) is input from the external control signal.
- Software
  Sampling continues indefinitely in this mode. Sampling only stops in response to a software command or an error.

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Delay

Delayed sampling is performed after the sampling stop condition is satisfied.
When a sampling stop condition other than the software abort command is satisfied, the board performs sampling for the specified number of times of delayed sampling to store input data to memory.
If you set the number of times of delayed sampling to 0, the board stops sampling the moment the sampling stop condition is satisfied.



Event

"Event" works as a function for reporting the occurrence of a certain board state to the application.
The following events can be used in combination depending on the specifications and purpose of the application.

- "AD conversion start condition satisfied" event
  This event occurs when the AD conversion start condition is satisfied. The event is nullified when the conversion start condition is "software".
- "Repeat end" event
  This even occurs whenever a repetition is completed.
- "End of device operation" event
  This event occurs when the entire operation including repetitions is completed.
- "Stored specified sampling times" event
  This event occurs when sampling has been performed for the number of times set by software.
- Overflow event
  This event occurs at an attempt to store input data with the memory full.
- Sampling clock error event
  This event occurs when conversion stops as an error occurs due to a sampling clock period that is too short.
- AD conversion error event
  This event occurs when conversion stops due to an AD conversion error.

2. Starting/Stopping Operation

Sampling is started by the software command.
Once started, sampling can be stopped by the software command at any timing.

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3. Monitoring the Status and Acquiring Data

Software commands are used to monitor the operation status of the device and to acquire input data from memory. Status monitoring and data acquisition can be performed even during sampling.

Status

The current state of the device can be checked by obtaining the device status.
The following types of device status are available:

- Device operating
  The “device operating” status remains ON, after the execution of the sampling start command until the board completes conversion, aborts operation due to an error, or stops sampling in response to the command.
- Waiting for start trigger
  This status remains ON, after the board starts sampling until the start trigger is input, if the conversion start condition is an external trigger or level comparison. The status is set to OFF when the input trigger is input to start conversion.
  The status is set to ON whenever the board enters the conversion start wait status even when repeated operation has been set.
- Specified sampling data stored
  This status is set to ON when input data stored in memory has reached the amount corresponding to the preset number of times of sampling.
  If the memory format is FIFO, the status is set to OFF when the amount of input data in the memory falls below the value corresponding to the preset number of times of sampling as data is acquired.
  Once the status is set to ON when the memory format is ring, it remains ON until it is reset.
- Overflow
  An overflow error occurs when an attempt is made to store input data to memory while it has been full of input data.
  When the memory format is FIFO, the board stops conversion.
  When the memory format is ring, the board continues conversion while overwriting existing data with new one.
- Sampling clock error
  This error occurs when the sampling clock period is too short.
- AD conversion error
  If the “device operating” status remains ON (without terminating conversion) for an extended period of time, the driver regards that state as an operation error and sets this status to ON. This error stops sampling.

Sampling

The number of sampled items of input data stored in memory can be obtained by the software command.

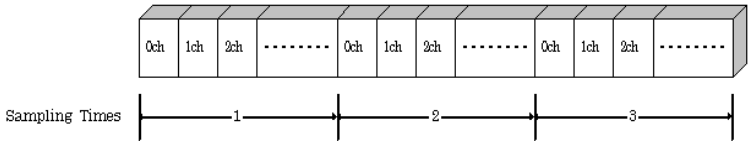
Repeat

The current repeat count can be obtained by the software command.

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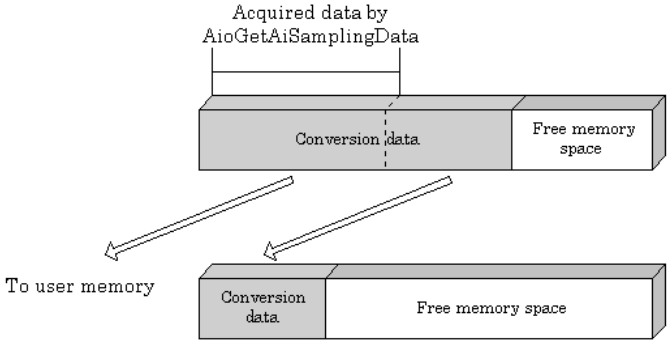
Data acquisition

The conversion data stored in memory can be retrieved using a software command.
The figure below shows the correspondence between the sampling count and the conversion channel for the conversion data stored in memory.



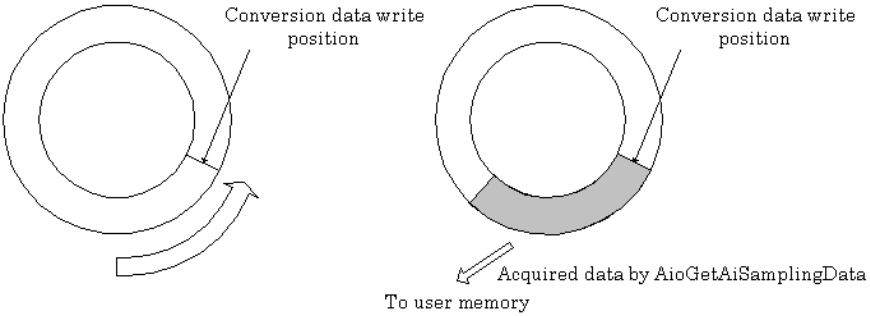
Input data is acquired differently depending on the memory format used.

- Data acquisition in FIFO format
  When FIFO memory is used, the oldest data is always read first.
  The following sketch shows an image of data acquisition in FIFO format.
  When data is acquired from the memory, the free memory space increases by that data size. When data is acquired next, the oldest one of the existing data items is taken from the memory in the same way.
  The FIFO memory deletes data once that data is acquired.



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- Data acquisition in ring format
  When ring memory is used, data is read always with respect to the current input data write position.
  The following sketch shows an image of data acquisition in ring format.
  The sampling count obtained is always the number of times of sampling for up to the latest data (shaded portion below).
  The larger the number of samples taken, the older the data item acquired first.
  As the ring memory retains data even after that data is acquired, you can fetch the same data any number of times.



Conversion data

The following equation represents the relationship between input data and voltage.

Voltage = Input data x (Max. range value – Min. range value) ÷ Resolution + Min. range value

The value of resolution for the 12-bit device is 4096; that for the 16-bit device is 65536.
The table below shows the relationship between input data and voltage in the ±10-V range.

Voltage	Conversion data (12-bit)
+9.995V	4095
:	:
0.005V	2049
0V	2048
-0.005V	2047
:	:
-10.000V	0

Voltage	Conversion data (16-bit)
+9.99970V	65535
:	:
0.00030V	32769
0V	32768
-0.00030V	32767
:	:
-10.000V	0

Ex.: When input data 3072 is input at a resolution of 12-bit in the ± 10-V range
Voltage = 3072 x (10 - (-10)) ÷ 4096 + (-10)
= 5.0

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4. Reset

Various states can be reset by executing the following reset commands:

All reset

This command resets the entire device, thereby initializing the device.

Status

This command resets the sampling clock error status and AD conversion error status.

Memory

This command resets the following memory related states.

- Resets the sampling count to 0.
- Resets the status for the specified sampling count to OFF.
- Resets the buffer overflow status to OFF.
- Resets the repeat count to 0.

5. Extended function

Simultaneous Sampling Control

Simultaneous sampling is executing AD conversion on multiple channels at the sampling clock timing. The simultaneous sampling unit ATSS-16 available as an option provides this board with the 16-channel simultaneous sampling feature.

Channel Expansion

Using the channel expansion sub-board ATCH-16(PCI) or ATUH-16(PCI) available as an option increases the maximum number of input channels to 32 (16 channels in differential input mode).

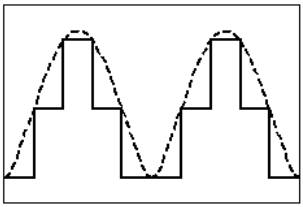
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Analog Output Function

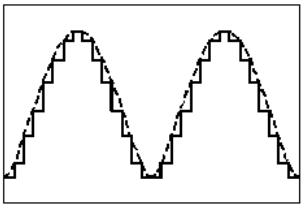
The board converts digital data to analog signals according to the resolution.

Resolution

"Resolution" signifies the number of bits used by an analog output device to represent analog signals. The higher the resolution, the more finely the voltage range is segmented, allowing the device to convert digital values to analog equivalents more precisely.
A device with a resolution of 12-bit divides the range width into 4096 segments.
When the device covers the range of 0 to 10V, the minimum unit of converted voltages is 10÷4096 = 2.44mV.
If the device has a resolution of 16-bit, it is 10 ÷ 65536 = 0.153mV instead.



Low Resolution Board



High Resolution Board

AD12-16(PCI)E : The resolution is 12-bit.
AD12-16U(PCI)E : The resolution is 12-bit.
AD16-16(PCI)E : The resolution is 16-bit.

Channel

"Channel" represents each point of analog output.
For individual channel numbers, see "Using the On-board Connectors" to "Connector Pin Assignment" in Chapter 3 "External Connection".
You can specify an arbitrary number of points of analog output by setting the channels by means of software.

Range

"Range" means the range of voltages at which analog output can be performed.
The output range can be selected by setting the upper and lower output signals.

AD12-16(PCI)E : The range is specified by setting the jumpers.
AD12-16U(PCI)E : The range is specified by setting the jumpers.
AD16-16(PCI)E : The range is specified by setting the jumpers.
Please refer to the “Chapter2 Setup - Setting the Hardware - Setting the Analog Output”.

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Output data

Set output data to output analog signals. You can output analog signals to the specified channel or channels (from 0 to an arbitrary number of channels) by executing the software command.
The following equation represents the relationship between output data and voltage.

Output data = ((Voltage – Min. range value) x Resolution) ÷ (Max. range value – Min. range value)

The value of resolution for the 12-bit device is 4096; that for the 16-bit device is 65536.
The table below shows the relationship between output data and voltage in the ±10-V range.

Voltage	Output data(12-bit)
+9.995V	4095
:	:
0.005V	2049
0V	2048
-0.005V	2047
:	:
-10.000V	0

Voltage	Output data(16-bit)
+9.99970V	65535
:	:
0.00030V	32769
0V	32768
-0.00030V	32767
:	:
-10.000V	0

Ex.: When 3V is output at a resolution of 12-bit in the ±10-V range

Output data = (3 - (-10)) x 4096 ÷ (10 - (-10))
= 2662.4 *

* The value that can be set as output data at this time is an integer. Select "2662" or "2663" as the output data.
The analog signal corresponding to the output data contains an error as follows:
- Output data "2662" converted to: 2.9998 V
- Output data "2663" converted to: 3.0029 V
This error is a consequential error occurring when output data is obtained from an expected analog value.

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Digital Input Function

Input bit

Individual digital input points are called input bits.
When the number of input points of a device is 4, the bits are determined as bit 0 to bit 3.



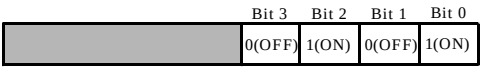
Input in Bits

The state 1 (ON) or 0 (OFF) of each input bit can be obtained by specifying the bit.

Input in Bytes

Individual input bits can be input in byte units.
When the number of input points of the device is 4, the individual input bits are arranged as shown below and the byte data to be input is a value between 0 and 15 depending on the states of the bits.

EX. Input of bit 3 (OFF), bit 2 (ON), bit 1 (OFF) and bit 0 (ON)
Byte data = 5(5H)



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Digital Output Function

Output bit

Individual digital output points are called output bits.
When the number of output points of a device is 4, the bits are determined as bit 0 to bit 3.



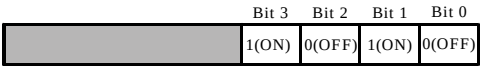
Output in Bits

The state of each output bit can be changed to ON or OFF by specifying the bit and setting it to 1 or 0.

Output in Bytes

Individual output bits can be output in byte units. When the number of output points of the device is 4, the individual output bits are arranged as shown below and byte data to be output is a value between 0 and 15.

Ex. Output of bit 3 (ON), bit 2 (OFF), bit 1 (ON) and bit 0 (OFF)
Byte data = 10(AH)



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5. About Software

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

- Analog input or output through arbitrary channels
- Analog input at arbitrary intervals using the internal or external sampling clock
- Simultaneous monitoring of the termination of analog input sampling, buffer memory usage, and interrupt events such as occurrences of errors
- Driver option check using a demo driver even without the board installed

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

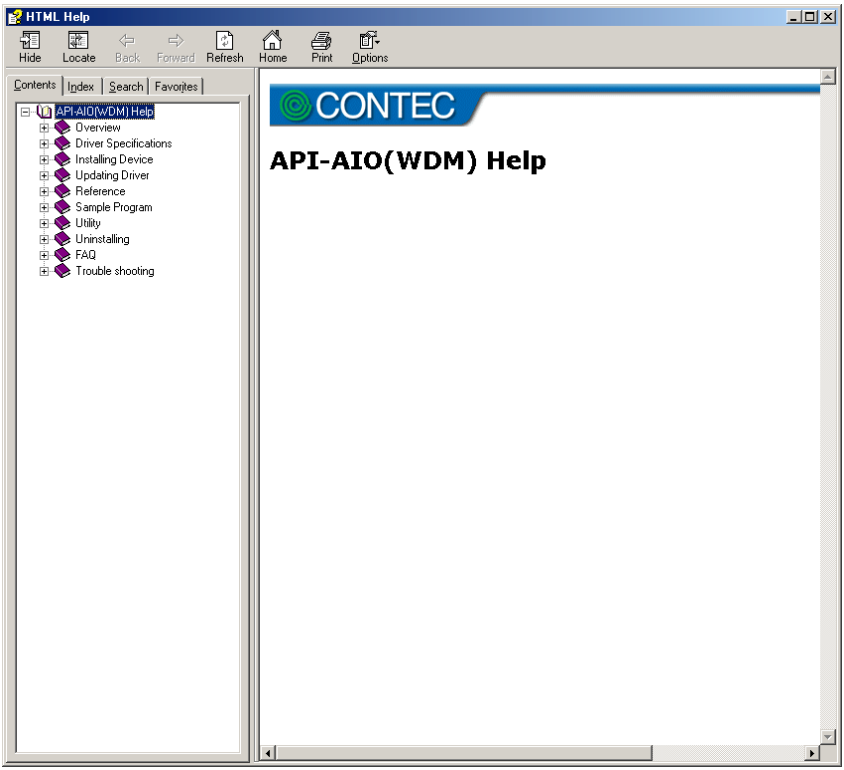
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When using the API-AIO(WDM)

Accessing the Help File

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

(2) From the Start Menu, select “Programs” – “CONTEC API-PAC(W32)” – “AIOWDM” – “API-AIO(WDM) HELP” to display help information.



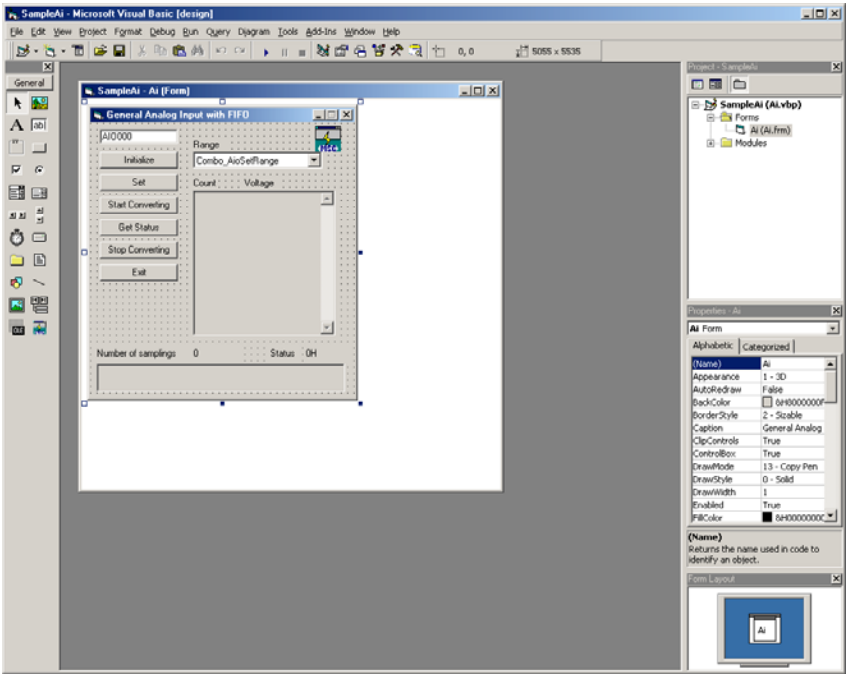
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Using Sample Programs

Sample programs are provided for each of the basic operations. You can use these to check the operation of the board and as a reference when writing your own programs.

To use the sample programs, specify the device name in the property page for the program.

The sample programs are stored in \Program Files\CONTEC\API-PAC(W32)\AIOWDM\Samples.



Running a Sample Program

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

(2) From the Start Menu, select “Programs” – “CONTEC API-PAC(W32)” – “AIOWDM” – “SAMPLE…”.

(3) A sample program is invoked.

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Sample Programs - Examples

Analog input

- SingleAi	Perform single analog input from specified channel
- MultiAi	Perform single analog input from multiple channels
- Ai	Perform standard analog input using a FIFO buffer
- AiPoll	Perform standard analog input by polling
- AiEx	Perform analog input for multiple channels using a FIFO buffer
- AiLong	Perform long-duration analog input using a FIFO buffer
- AiExt	Perform analog input using an external clock
- AiTrg	Perform analog input using an external trigger to start and stop operation
- AiLevel1	Use a level trigger to start analog input
- AiLevel2	Use a level trigger to stop analog input
- Ai2	Perform standard analog input using more than one device

Analog output

- SingleAo	Perform single analog output from specified channel
- MultiAo	Perform single analog output from multiple channels
- Ao	Perform standard analog output using a FIFO buffer
- AoPoll	Perform standard analog output by polling
- AoEx	Perform analog output for multiple channels using a FIFO buffer
- AoLong	Perform long-duration analog output using a FIFO buffer
- AoExt	Perform analog output using an external clock
- AoRing	Perform continuous analog output using a ring buffer
- AoTrg	Perform analog output using an external trigger to start and stop operation
- Ao2	Perform standard analog output using more than one device

Digital input/output

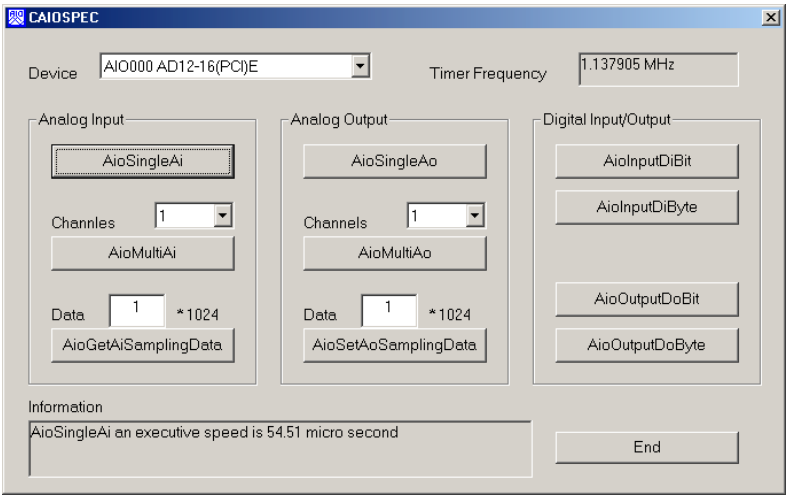
- DioBit	Perform digital I/O using bit values
- DioByte	Perform digital I/O using port values

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Using Utility Programs

Function execution speed measurement program

The function execution speed measurement program can be used to measure the execution times of some major functions.
To use the function execution speed measurement program, click the [Execution Time Measurement] button in the diagnosis program's dialog box.



Using procedure

(1) From the device list, select the device subject to measurement.

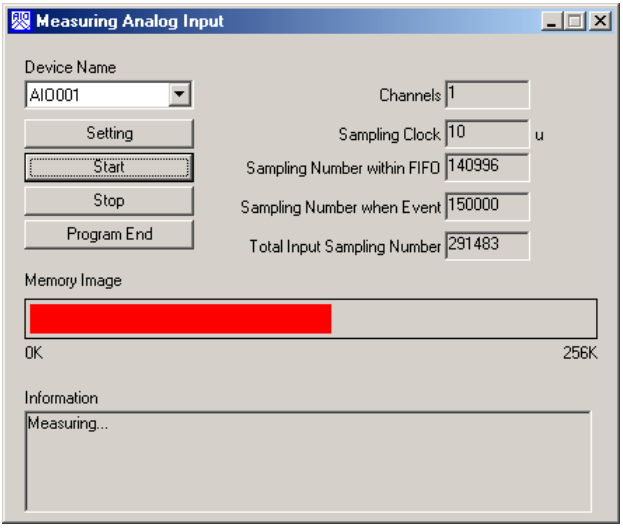
(2) Click the button labeled with a function key to measure the execution speed of that function.
For the AioMultiAi and AioMultiAo functions, select the number of channels to be used for conversion from the list. For the AioGetAiSamplingData and AioSetAoSamplingData functions, enter the size of data to be transferred.
Set the data size in kilobytes.

(3) Use the [End] button to quit the application.

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Analog input measurement tool

This tool is an analog input measurement utility for infinite sampling using FIFO memory. When a certain number of data items are collected in memory, an event occurs, causing the tool to obtain the data in memory. With this took, you can visually check data in the FIFO memory.



The dialog box can be used to set the number of channels to be used, internal/external clock, conversion speed, and the number of times sampling is performed before causing the event. Use this tool for measurement of conversion specifications under various sets of conversion conditions as it also reports a sampling clock error event.

⚠ CAUTION

This program is a Visual Basic application. It cannot be run without the Visual Basic runtime library installed. It can be used after executing the following setup program in the API-AIO(WDM) install folder.

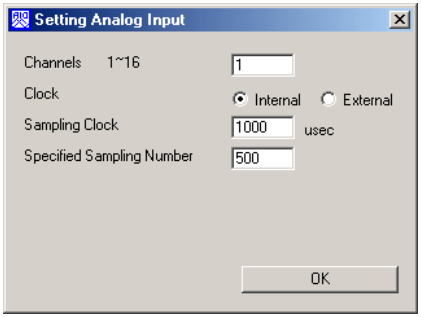
AIOWDM\Utility\AiSpec\setup.exe

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Using procedure

(1) In the combobox in the upper left corner, select the name of the device to be used. Then click the [Set] button.

(2) Set the conversion conditions in the analog input setup dialog box.
When the input reaches the sampling count specified as the number of data sampling times, an event occurs and the tool obtains data. Click the OK button to set the conditions and return to the previous dialog box.



(3) Click the [Start Measurement] button to start measurement. Various states will be displayed during conversion.

FIFO sampling count:
Conversion data loaded in memory. You can check this visually with the "memory image."

Event trigger sampling count:
An event occurs when the FIFO input sampling count reaches this value.

Total input sampling count:
Total number of times the application sampled data into memory.

The following errors may stop measurement.

Sampling clock error:
When the internal clock is used for conversion, this error indicates that the conversion speed is too high for the driver to keep up with conversion.
When the external clock is used for conversion, the error indicates too fast a clock cycle or noise.

Buffer overflow:
This error indicates that the conversion speed is too high relative to the speed of data input, causing memory overflow.

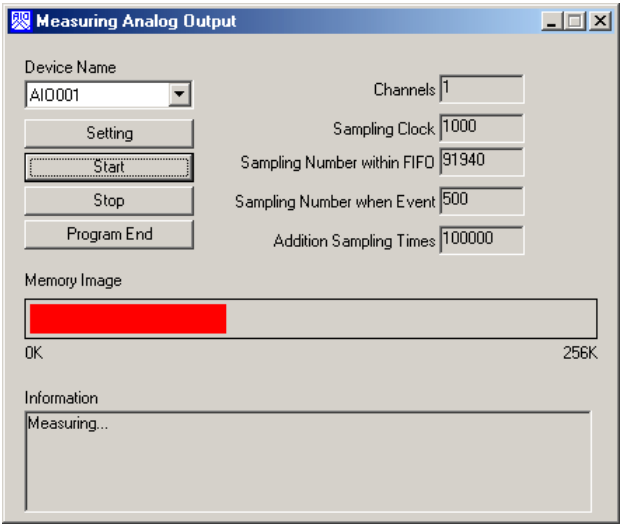
(4) Clicking the [End measurement] button terminates measurement.

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Analog output measurement tool

This tool is an analog output measurement utility for infinite sampling using FIFO memory. When a certain number of data items are collected in memory, an event occurs, adding the new output data. With this took, you can visually check data in the FIFO memory.

The dialog box can be used to set the number of channels to be used, internal/external clock, conversion speed, and the number of times sampling to be caused the event and to be added. Use this tool for measurement of conversion specifications under various sets of conversion conditions as it also reports a sampling clock error event.



⚠ CAUTION

This program is a Visual Basic application. It cannot be run without the Visual Basic runtime library installed. It can be used after executing the following setup program in the API-AIO-WDM) install folder.

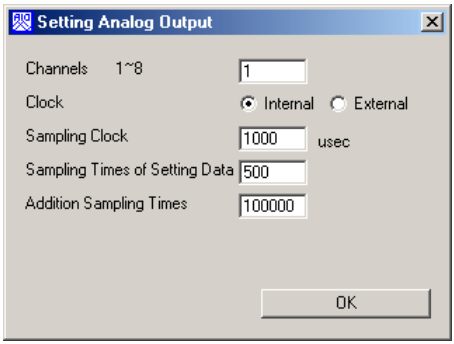
AIOWDM\Utility\AoSpec\setup.exe

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Using procedure

(1) In the combobox in the upper left corner, select the name of the device to be used. Then click the [Set] button.

(2) Set the conversion conditions in the analog output setup dialog box.



When the output reaches the sampling count specified as the number of data setup sampling times, an event occurs and the tool adds data. Click the OK button to set the conditions and return to the previous dialog box.

(3) Click the [Start Measurement] button to start measurement. Various states will be displayed during conversion.

FIFO sampling count:
Not-output conversion data loaded in memory. You can check this visually with the "memory image."

Event trigger sampling count:
An event occurs when the FIFO not-output sampling count reaches this value.

Adding sampling count:
Output data sampling count to be added in the event

The following errors may stop measurement.

Sampling clock error:
When the internal clock is used for conversion, this error indicates that the conversion speed is too high for the driver to keep up with conversion.
When the external clock is used for conversion, the error indicates too fast a clock cycle or noise.

(4) Clicking the [End measurement] button terminates measurement.

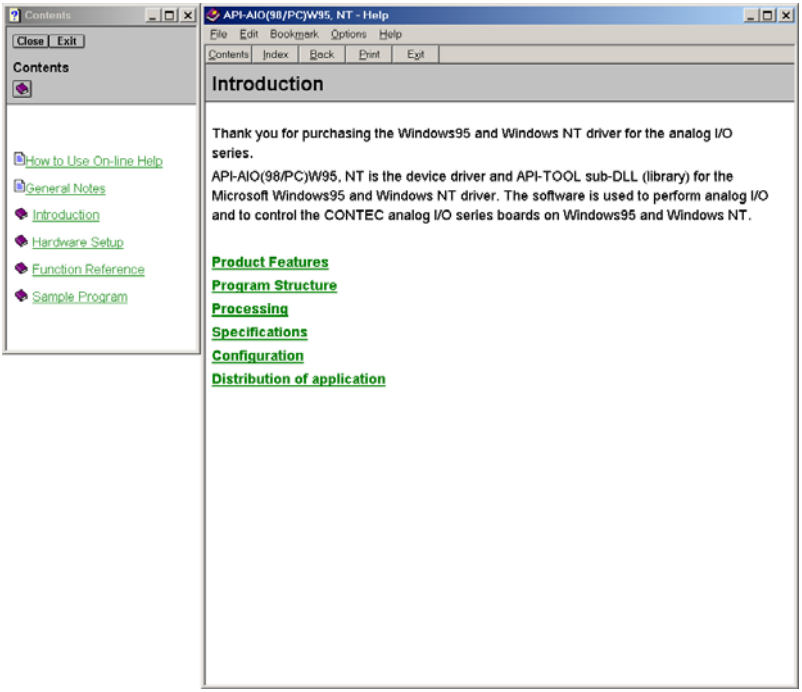
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When using the API-AIO(98/PC)

Accessing the Help File

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

(2) From the Start Menu, select “Programs” – “CONTEC API-PAC(W32)” – “Aio” – “API-AIO HELP” to display help information.

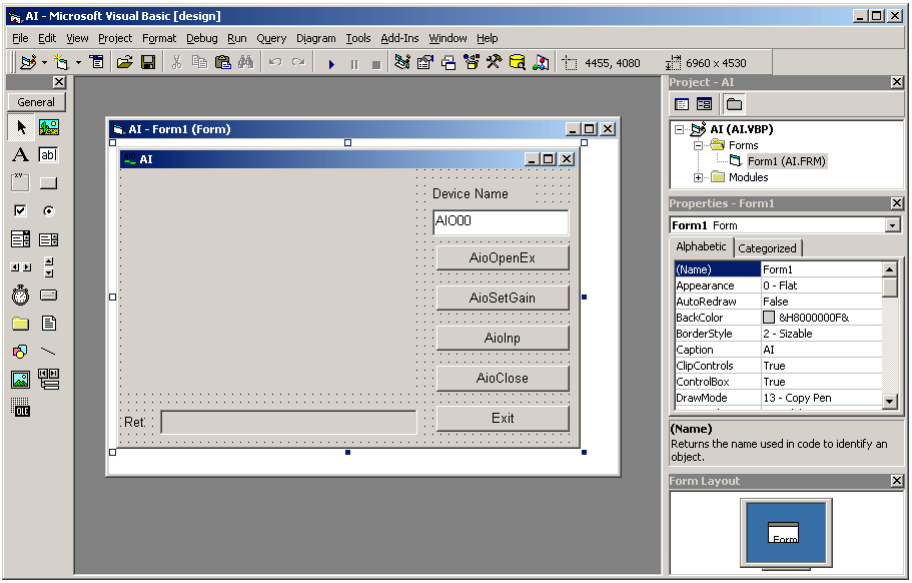


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Using Sample Programs

Sample programs have been prepared for specific basic applications.
To use each sample program, enter its device name set by API-TOOL Configuration.

Use these sample programs as references for program development and operation check.
The sample programs are stored in \Program Files\CONTEC\API-PAC(W32)\Aio\Samples.



Running a Sample Program

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

(2) From the Start Menu, select “Programs” – “CONTEC API-PAC(W32)” – “Aio” – “SAMPLE…”.

(3) A sample program is invoked.

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Sample Programs - Examples

Analog input

- AI	:	Uses AioInp to convert an analog signal only once and display the data.
- AIBack	:	Uses AioInpBack to perform memory-less board analog input.
- AIMemory	:	Uses AioInpBdMem to perform continuous conversion and AioReadBuf to acquire data from board memory (an example of using an external clock).
- AIInt	:	Infinite sampling example that uses AioInpBdMem for half/full interrupts and AioReadBuf to acquire data at interrupt events.
- AITimer	:	Infinite sampling example that uses AioInpBdMem to perform continuous conversion and AioReadBuf to acquire data at system timer events.
- AISync	:	Sample that uses AioInpBdMem and AioDO to perform simultaneous sampling of two memory-mounted boards.
- AioInp	:	Sample console application that uses AioOpenEx and AioInp.

Analog output

- AO	:	Uses AioOut to perform analog output once.
- AOBack	:	Uses AioOutBack to perform analog output at fixed intervals.
- AioOut	:	Sample console application that uses AioOpenEx and AioOut.

Digital input and output

- DIO	:	Uses AioDO and AioDI to perform digital input/output.

Counter

- Timer	:	Sample program using a timer. It uses the counter function to measure the lapse of time.
- Counter	:	Sample program using a counter. It uses the counter function to count external pulses.

The following sample program in Visual Basic is available.

- ANALOG	:	Versatile sample program using AioInp, AioInpBack, AioInpBdMem, AioOut, AioOutBack, AioDO, and AioDI

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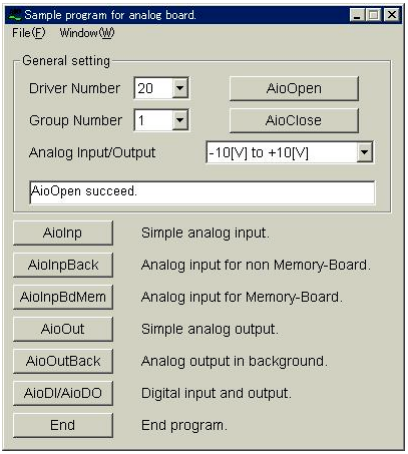
Using the Utility Program

Operation Check Tool

This program is a comprehensive operation check tool that can use all the features of the AioOpen, AioClose, AioSetRangeAioInp, AioInpBack, AioInpBdMem, AioOut, AioOutBack, AioDo, and AioDi functions.

Invoke the tool by selecting the Start Menu – “CONTEC API-PAC(W32)” – “AIO” – “SAMPLE Analog”.

[Main screen]



AioInp : Simple analog input

AioInpBack : Analog input for non Memory-Board

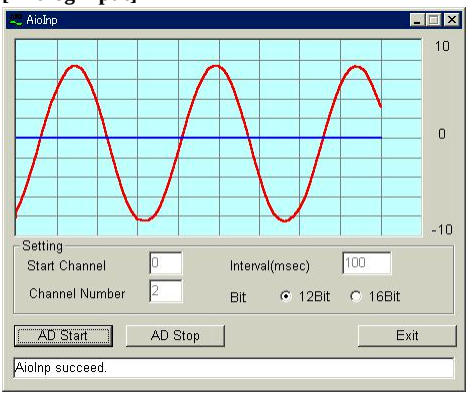
AioInpBdMem: Analog input for Memory-Board

AioOut : Simple analog output

AioOutBack : Analog output in background

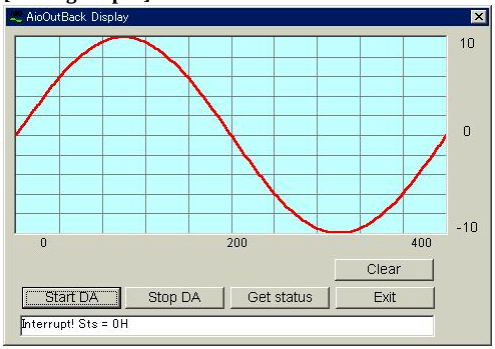
AioDi/AioDo : Digital input and output

[Analog input]

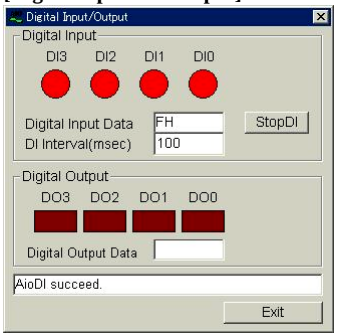


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[Analog output]



[Digital input and output]



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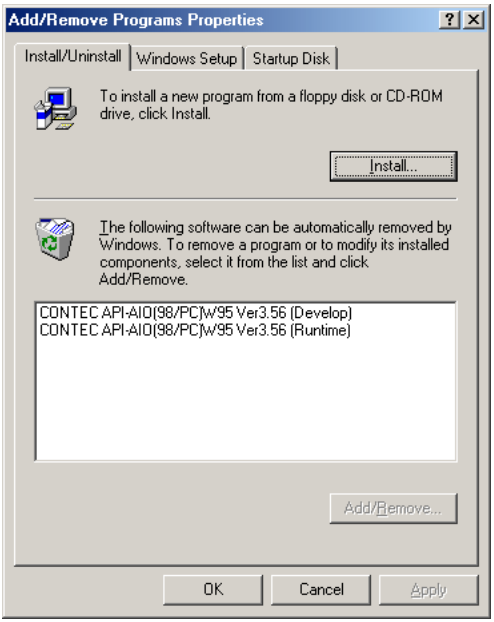
Uninstalling the Driver Libraries

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

(1) Click on the [Start] button on the Windows taskbar. From the Start Menu, select “Settings” – “Control Panel”.

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

(3) If the API-AIO(WDM), select “CONTEC API-AIO(WDM) driver” and “CONTEC API-AIO(WDM) VerX.XX (Development)” from the displayed application.
If the API-AIO(98/PC), select “CONTEC API-AIO(98/PC)xx VerX.XX (Development) and “CONTEC API-AIO(98/PC)xx VerX.XX (Runtime)”
Click on the [Add/Remove] button. Follow the on-screen instructions to uninstall the function libraries.



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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                  OS-specific INF file
|      ├─WDM
|      ├─Win2000
|      ├─Win95
  .
  .
| ─Readme               Readme file for each driver
  .
  .
| ─Release              Driver file for each API-TOOL
|      ├─API_NT         (For creation of a user-specific install program)
|      ├─API_W95
```


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6. About Hardware

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

Hardware specification

Common specification

Table 6.1. Common specification

Item		Specification
Digital I/O		
	Number of output channels	4 TTL levels (Selection of a counter output is possible at a jumper.)
	Number of input channels	4 TTL levels (A counter control input and common use are possible at a jumper.)
Counter		
	Counter device	i8254 equivalent
	Counter clock	Internal (4MHz) or External signal
Interface connector		
	CN1	D-SUB 37-Pin female thumb screw #4-40UNC
	CN2	16-pin Pin-header
I/O address		16 ports boundary
Interrupt level		1 level use (Interrupts can be enabled or disabled.)
PCI bus specification		32-bit, 33MHz, 5V
Operating condition		0 to 50°C, 10 to 90%RH (No condensation)

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AD12-16(PCI)E

Table 6.2. Specification

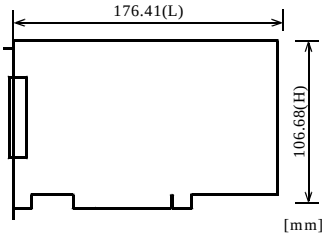
Item		Specification
Analog input		
	Isolated specification	Un-Isolated
	Input Type	Single-Ended Input or Differential Input (Jumper setup)
	Number of input channels	16 channels (Single-Ended Input) 8 channels (Differential Input)
	Input range	Bipolar ±10V, ±5V, ±2.5V, ±1.25V, or Unipolar 0 to +10V, 0 to +5V, 0 to +2.5V, 0 to +1.25V (Set the input range using both of jumpers and software.)
	Absolute max. input voltage	±20V
	Input impedance	1MΩ or more
	Resolution	12bit
	Non-Linearity error *1*2	±2LSB(±10V, ±5V, 0 to +10V, 0 to +5V) at the time of power voltage input ±4LSB(±2.5V, ±1.25V, 0 to +2.5V, 0 to +1.25V) at the time of power voltage input
	Conversion speed	10µsec/ch (Max.)
	Buffer memory	256K Word FIFO or 256K Word RING (Software setup)
	Conversion start trigger	Software/Input data comparison/TTL level external signal
	Conversion stop trigger	Specified sampling data stored /Input data comparison/ TTL level external signal/Software
Analog output		
	Isolated specification	Un-Isolated
	Number of output channel	1ch
	Output range	Bipolar ±10V/Bipolar ±5V/Unipolar 0 to +10V (Jumper setup)
	Output current ability	±5mA
	Output impedance	1Ω or less
	Resolution	12-bit
	Non- Linearity error *1	±1/2LSB
	Conversion speed	6µsec (Max.)
Current consumption *3		+5V 1100mA (Max.)
Dimension (mm)		176.41(L) x 106.68(H)
Weight		150g

*1: When the environment temperature is near 0ºC or 50ºC, the non-linearity error may become larger.

*2: At the time of the source use of a signal which built in the high-speed operational amplifier.

*3: If an external device requires this AD12-16(PCI)E board to supply +5VDC from the CN1 or CN2 connectors, the power consumption of this board will be bigger than what this specification has defined.

Board dimension



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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AD12-16U(PCI)E

Table 6.3. Specification

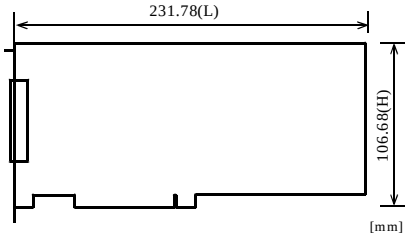
Item		Specification
Analog input		
	Isolated specification	Un-Isolated
	Input Type	Single-Ended Input or Differential Input (Jumper setup)
	Number of input channels	16 channels (Single-Ended Input) 8 channels (Differential Input)
	Input range	Bipolar ±5V, ±2.5V or Unipolar 0 to +5V, 0 to +10V (Jumper setup)
	Absolute max. input voltage	±15V
	Input impedance	1MΩ or more
	Resolution	12bit
	Non-Linearity error *1*2	±3LSB
	Conversion speed	1μsec/ch (Max.)
	Buffer memory	256K Word FIFO or 256K Word RING (Software setup)
	Conversion start trigger	Software/Input data comparison/TTL level external signal
	Conversion stop trigger	Specified sampling data stored /Input data comparison/ TTL level external signal/Software
Analog output		
	Isolated specification	Un-Isolated
	Number of output channel	1ch
	Output range	Bipolar ±10V/Bipolar ±5V/Unipolar 0 to +10V (Jumper setup)
	Output current ability	±5mA
	Output impedance	1Ω or less
	Resolution	12-bit
	Non- Linearity error *1	±1/2 LSB
	Conversion speed	6μsec (Max.)
Current consumption *3		+5V 1800mA (Max.)
Dimension (mm)		231.78(L) x 106.68(H)
Weight		250g

*1: When the environment temperature is near 0ºC or 50ºC, the non-linearity error may become larger.

*2: At the time of the source use of a signal which built in the high-speed operational amplifier.

*3: If an external device requires this AD12-16U(PCI)E board to supply +5VDC from the CN1 or CN2 connectors, the power consumption of this board will be bigger than what this specification has defined.

Board dimension



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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AD16-16(PCI)E

Table 6.4. Specification

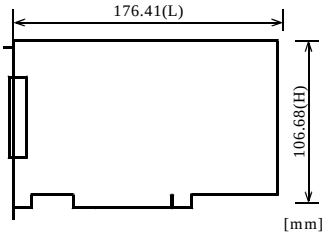
Item		Specification
Analog input		
	Isolated specification	Un-Isolated
	Input Type	Single-Ended Input or Differential Input (Jumper setup)
	Number of input channels	16 channels (Single-Ended Input) 8 channels (Differential Input)
	Input range	Bipolar ±10V, ±5V or Unipolar 0 to +10V, 0 to +5V (Jumper setup)
	Absolute max. input voltage	±20V
	Input impedance	1MΩ or more
	Resolution	16bit
	Non-Linearity error *1*2	±5LSB
	Conversion speed	10µsec/ch (Max.)
	Buffer memory	256K Word FIFO or 256K Word RING (Software setup)
	Conversion start trigger	Software/Input data comparison/TTL level external signal
	Conversion stop trigger	Specified sampling data stored /Input data comparison/ TTL level external signal/Software
Analog output		
	Isolated specification	Un-Isolated
	Number of output channel	1ch
	Output range	Bipolar ±10V/Unipolar 0 to +10V (Jumper setup)
	Output current ability	±5mA
	Resolution	16-bit
	Non- Linearity error *1	±2 LSB
	Conversion speed	13µsec (Max.)
Current consumption *3		+5V 1300mA (Max.)
Dimension (mm)		176.41(L) x 106.68(H)
Weight		150g

*1: When the environment temperature is near 0ºC or 50ºC, the non-linearity error may become larger.

*2: At the time of the source use of a signal which built in the high-speed operational amplifier.

*3: If an external device requires this AD16-16(PCI)E board to supply +5VDC from the CN1 or CN2 connectors, the power consumption of this board will be bigger than what this specification has defined.

Board dimension



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

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Block Diagram

Figure 6.1 is a circuit block diagram of this board.

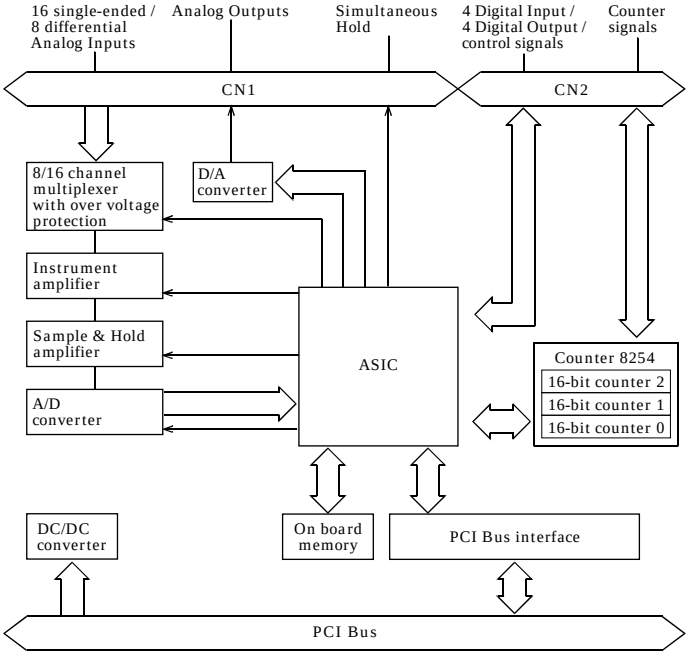


Figure 6.1. Block Diagram

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Timing of Sampling Control Signals

There are timing chart diagrams and a table about sampling control signals as shown Fig.6.2, 6.3, 6.4 and Table 6.5.

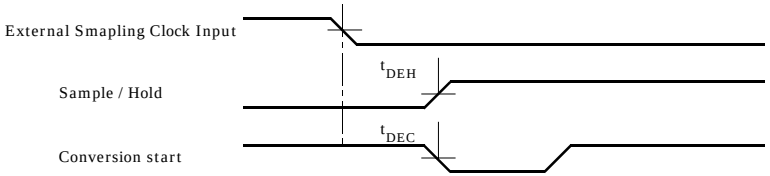


Figure 6.2. Timing Chart of External Sampling Clock

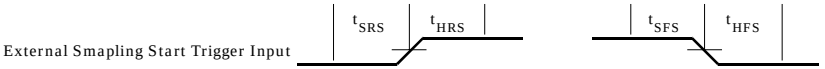


Figure 6.3. Timing Chart of External Sampling Start Control Signal

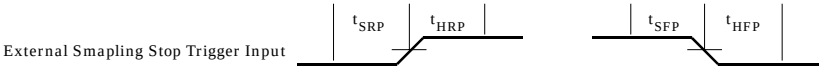


Figure 6.4. Timing Chart of External Sampling Stop Control Signal

Table 6.5. Timing Table of Operation Control Signals

Parameter	Symbol	Time	Unit
Delay time from external sampling clock to first hold action	tDEH	100	nsec
Delay time from external sampling clock to first A/D start pulse	tDEC	100	nsec
Set up time of sampling start (Rising edge)	tSRS	100	nsec
Hold time of sampling start (Rising edge)	tHRS	100	nsec
Set up time of sampling start (Rising edge)	tSFS	100	nsec
Hold time of sampling start (Rising edge)	tHFS	100	nsec
Set up time of sampling stop (Rising edge)	tSRP	100	nsec
Hold time of sampling stop (Rising edge)	tHRP	100	nsec
Set up time of sampling stop (Rising edge)	tSFP	100	nsec
Hold time of sampling stop (Rising edge)	tHFP	100	nsec

⚠ CAUTION

All of the times in Table 6.5 are typical values.

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About Calibration

This board is calibrated before shipment.

Contact your retailer if the board does not provide its prescribed performance.

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AD12-16(PCI)E
AD12-16U(PCI)E
AD16-16(PCI)E
User's Guide

CONTEC CO., LTD.
November 2004 Edition

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