

High-precision Analog output board  
(Low Profile size) for PCI Express

**AO-1604L-LPE**



\* Specifications, color and design of the products are subject to change without notice.

**Features**

**Multi-function**

High-precision analog I/O can be implemented in a compact system. This product contains the analog output (16bit, 4ch). This product include digital inputs and outputs (4 each, LVTTTL level) and a counter (32-bit 1ch).

**Analog I/O can be synchronized with an internal timer or external clock**

Analog I/O can both be performed at fixed time intervals or synchronized with an external signal.

**Buffer memory available for background processing independent of software**

The boards include buffer memory (1K Word each for analog input and output) which can be used in either FIFO or ring format. This allows analog I/O to be performed independently of the operating state of the PC or software.

**Software-based calibration function**

Calibration of analog input/output can be all performed by software. Apart from the adjustment information prepared before shipment, additional adjustment information can be stored according to the use environment.

**Filter function for easy connection of external signals**

The digital input signals, counter input signals, and the external control signals for analog I/O incorporate a digital filter to prevent problems such as chattering.

**Support for both of Low Profile and standard size slots**

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

**Plug-ins for the dedicated libraries, the board also supports MATLAB and LabVIEW.**

We offer a dedicated library [ML-DAQ], which allows you to use this product on MATLAB by The MathWorks as well as another dedicated library [VI-DAQ], which allows you to use the product on LabVIEW.

These dedicated libraries are available, free of charge (downloadable), on our web site.

This product is a multi-function, PCI Express bus-compliant interface board that incorporates high-precision 16-bit analog outputs, digital inputs/outputs (LVTTTL level each 4ch), and a counter (32-bit, 1ch) function.

This product supports a Low Profile size slot and, if replaced with the supplied bracket, supports a standard size slot, too.

You can use the driver library (API-PAC(W32)) supplied with the board to write Windows application programs in any programming language (such as Visual Basic, Visual C++, etc.) that supports the calling of Win32 API functions.

It can also collect data easily without a program when the data logger software [C-LOGGER] stored on the attached CD-ROM is used.

With plug-ins for the dedicated libraries, the board also supports MATLAB and LabVIEW.

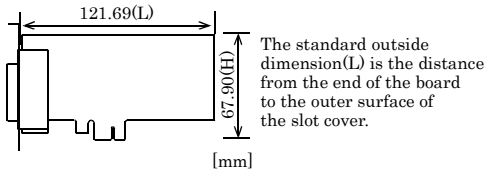
**Specification**

Item	Specification
<b>Analog output</b>	
Isolated specification	Non-isolated
Number of output channels	4ch
Output range	Bipolar ±10V
Absolute max. output voltage	±3mA
Output impedance	1Ω or less
Resolution	16bit
Non-Linearity error *1	±5LSB
Conversion speed	10μ sec [100KSPS]*2
Buffer memory	1k Word
Conversion start trigger	Software / external trigger
Conversion stop trigger	Number of sampling times / external trigger/software
External start signal	LVTTTL level (Rising or falling edge can be selected by software) Digital filter (1μ sec can be selected by software)
External stop signal	LVTTTL level (Rising or falling edge can be selected by software) Digital filter (1μ sec can be selected by software)
External clock signal	LVTTTL level (Rising or falling edge can be selected by software)
<b>Digital I/O</b>	
Number of input channels	Non-isolated input 4ch (TTL level positive logic)
Number of output channels	Non-isolated output 4ch (TTL level positive logic)
<b>Counter</b>	
Number of channels	1ch
Counting system	Up count
Max. count	FFFFFFFFh (Binary data,32bit)
Number of external inputs	2 LVTTTL level (Gate/Up)/ch Gate (High level), Up (Rising edge)
Number of external outputs	1 LVTTTL level, Count match output (positive logic, pulse output)
Response frequency	10MHz (Max.)
<b>Common section</b>	
I/O address	64 ports
Interruption level	Errors and various factors, One interrupt request line as INTA
Used Connector	10250-52A2JL[3M] or equivalent to it
Power consumption	3.3VDC 400mA 12VDC 250mA
Operating condition	0 - 50°C, 10 - 90%RH (No condensation)
Bus specification	PCI Express Base Specification Rev. 1.0a x1
External dimension (mm)	121.69 (L) x 67.90 (H)
Weight	60g

\*1: The non-linearity error means an error of approximately 0.1% occurs over the maximum range at 0°C and 50°C ambient temperature.

\*2: SPS = Samplings Per Second. The number of data that can be converted in one second is shown.

## Board Dimensions



## Support Software

### Windows version of analog I/O driver API-AIO(WDM) [Stored on the bundled CD-ROM driver library API-PAC(W32)]

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

#### < Operating environment >

OS: Windows Vista, XP, Server 2003, 2000  
Adaptation language: Visual Basic, Visual C++, Visual C#, Delphi, C++ Builder  
For more details on the supported OS, applicable language and how to download the updated version, please visit the CONTEC's Web site (<http://www.contec.com/apipac/>)

### Linux version of analog I/O driver API-AIO(LNX) [Stored on the bundled CD-ROM driver library API-PAC(W32)]

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

#### < Operating environment >

OS: RedHatLinux, TurboLinux (For details on supported distributions, refer to Help available after installation.)  
Adaptation language: gcc  
For more details on the supported OS, applicable language and how to download the updated version, please visit the CONTEC's Web site (<http://www.contec.com/apipac/>).

### Data Acquisition library for MATLAB ML-DAQ (Available for downloading (free of charge) from the CONTEC web site.)

This is the library software which allows you to use our analog I/O device products on MATLAB by the MathWorks. Each function is offered in accordance with the interface which is integrated in MATLAB's Data Acquisition Toolbox. See <http://www.contec.com/mldaq/> for details and download of ML-DAQ.

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

This is a VI library to use in National Instruments LabVIEW. VI-DAQ is created with a function form similar to that of LabVIEW's Data Acquisition VI, allowing you to use various devices without complicated settings. See <http://www.contec.com/vidaq/> for details and download of VI-DAQ.

## Cable & Connector (Option)

Shield Cable with Two 50-Pin Mini-Ribbon Connector  
:PCB50PS-0.5P (0.5m) , PCB50PS-1.5P (1.5m)

Shield Cable with One 50-Pin Mini-Ribbon Connector  
:PCA50PS-0.5P (0.5m) , PCA50PS-1.5P (1.5m)

## Accessories (Option)

Screw Terminal Unit (M3 terminal block, 50 points)  
: EPD-50A \*1

BNC Connector Screw Terminal Unit  
: ATP-8L \*1\*5

\*1 PCB50PS-0.5P or PCB50PS-1.5P optional cable is required separately.

\*5 Capable of using the analog input of up to 8ch, and analog output of up to 2ch.

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

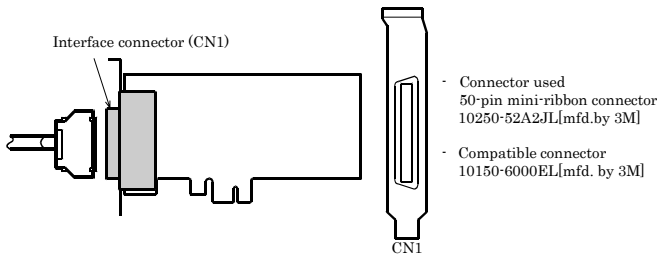
## Packing List

Board [AO-1604L-LPE] ...1  
First step guide ...1  
CD-ROM \*1 [API-PAC(W32)] ...1  
Standard size bracket ...1

\*1 The CD-ROM contains the driver software and User's Guide.

## How to connect the connectors

The on-product interface connector (CN1) is used when connecting this product and the external devices.



\* Please refer to page 2 for more information on the supported cable and accessories.

## Pin Assignment of CN1

Analog Output 02	AO 02	50	25	-	AO 00	Analog Output 00
Analog Ground ( for AO )	AGND	49	24	-	AGND	Analog Ground ( for AO )
Analog Output 03	AO 03	48	23	-	AO 01	Analog Output 01
Analog Ground ( for AO )	AGND	47	22	-	AGND	Analog Ground ( for AO )
Non Connect	N.C.	46	21	-	N.C.	Non Connect
Non Connect	N.C.	45	20	-	N.C.	Non Connect
Non Connect	N.C.	44	19	-	N.C.	Non Connect
Non Connect	N.C.	43	18	-	N.C.	Non Connect
Reserved	Reserved	42	17	-	Reserved	Reserved
Reserved	Reserved	41	16	-	Reserved	Reserved
Non Connect	N.C.	40	15	-	N.C.	Non Connect
Non Connect	N.C.	39	14	-	N.C.	Non Connect
Non Connect	N.C.	38	13	-	N.C.	Non Connect
Non Connect	N.C.	37	12	-	N.C.	Non Connect
AO External Start Trigger Input	AO START	36	11	-	N.C.	Non Connect
AO External Stop Trigger Input	AO STOP	35	10	-	N.C.	Non Connect
AO External Sampling Clock Input	AO EXCLK	34	9	-	N.C.	Non Connect
Digital Ground	DGND	33	8	-	DGND	Digital Ground
Digital Output 00	DO 00	32	7	-	DI 00	Digital Input 00
Digital Output 01	DO 01	31	6	-	DI 01	Digital Input 01
Digital Output 02	DO 02	30	5	-	DI 02	Digital Input 02
Digital Output 03	DO 03	29	4	-	DI 03	Digital Input 03
Digital Ground	DGND	28	3	-	DGND	Digital Ground
Counter UP Clock Input	CNT UPCLK	27	2	-	CNT GATE	Counter Gate Control Input
Reserved	Reserved	26	1	-	CNT OUT	Counter Output

Analog Output00 - Analog Output03	Analog output signal. The numbers correspond to channel numbers.
Analog Ground	Analog ground.
AO External Start Trigger Input	External trigger input for starting analog output sampling.
AO External Stop Trigger Input	External trigger input for stopping analog output sampling.
AO External Sampling Clock Input	External sampling clock input for analog output.
Digital Input00 - Digital Input03	Digital input signal.
Digital Output00 - Digital Output03	Digital output signal.
Counter Gate Control Input	Gate control input signal for counter.
Counter Up Clock Input	Count-up clock input signal for counter.
Counter Output	Counter output signal.
Digital Ground	Common digital ground for digital I/O signals, external trigger inputs, external sampling clock inputs, and counter I/O signals.
Reserved	Reserved pin.
N.C.	No connection to this pin.

## 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.

If analog and digital ground are shorted together, noise on the digital signals may affect the analog signals. Accordingly, analog and digital ground should be separated.

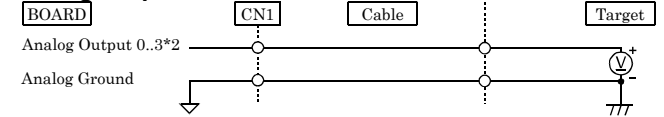
Leave "Reserved" pins unconnected. Connecting these pins may cause a fault in the board.

## 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 flat cable connection. Connect the signal source and ground to the CN1 analog output.

### Analog Output Connection



\*2 The number of channels depends on each product. The AO-1604L-LPE has four channels.

## CAUTION

If the product or the connected wire receives noise, or the distance between the product and the target is long, data may not be outputted properly.

For analog output signal, the current capacity is  $\pm 3\text{mA}$  (Max.). Check the specification of the connected device before connecting the product.

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

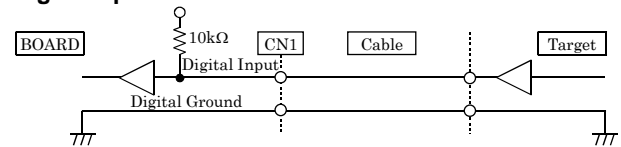
Do not connect an analog output signal to any other analog output, either on the product or on an external device, as this may cause a fault on the product.

## Digital I/O signals, Counter signals and Control signals Connection

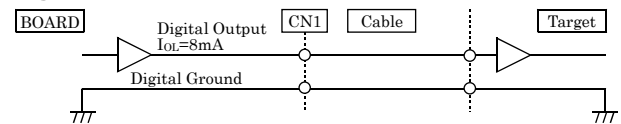
The following sections show examples of how to connect digital I/O signals, counter I/O signals, and other control I/O signals (external trigger input signals, sampling clock input signals, etc.).

All the digital I/O signals and control signals are LVTTTL level signals.

### Digital Input Connection



### Digital Output Connection



### About the counter input control signal

Counter Gate Control Input (refer to the chapter 3 Connector Pin Assignment) acts as an input that validate or invalidate the input of an external clock for the counter. This function enables the control of an external clock input for the counter. The external clock for the counter is effective when input is "High", and invalid when input is "Low". If unconnected, it is a pull-up in the board (card) and remains "High". Therefore the external clock for the counter is effective when the counter gate control input is not connected.

**⚠ CAUTION**

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

Do not connect a digital output signal to any other digital output, either on the board or on an external device, as this may cause a fault on the board.

