100KSPS 16-bit 4ch Analog Output Board for PCI Express (Low Profile)

AO-1604L-LPE

This product is a Low Profile PCI Express bus-compliant interface board used to provide an analog signal output function on a PC.

This product is multifunction type with 16-bit analog output 4 channels, digital I/O and counter function.

This product carries buffer memory for 1K of data, allowing sampling to be performed in a variety of trigger / clock conditions.

Windows/Linux driver is bundled with this product.

Possible to be used as a data recording device for MATLAB and LabVIEW, with dedicated libraries.

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

Features

High precision analog output 4 channels, each 4 channels for digital I/O, counter 1 channel

This product has analog output (10μsec, 16-bit, 4 channels), analog output control signal (LVTTL level 3 channels), digital I/O (each 4 channels for LVTTL level), counter (32-bit, LVTTL level 1 channel).

The start/end of sampling can be controlled by software, an external trigger, etc.

You can select from software, an external trigger to control the start of sampling. You can select from completion of sampling for a specified number of sessions, an external trigger or software to control forcibly the end of sampling. The sampling cycle can be selected from the internal clock or an external clock.

Safety design to adjust output voltage to 0V when power supply is turned on

To prevent the unstable voltage and the connected device of D/A converter from fault and malfunctions when the power supply is turned on, the circuit is designed to adjust output voltage of the analog output to 0V.

Equipped with buffer memory (1K data) that can be used in the FIFO or RING format

The block contains buffer memory (1K data) that can be used in the FIFO or RING format. This allows for background analog output that does not depend on the operation status of the software or PC.

Digital filter function included to prevent misdetection due to chattering on external signals

A digital filter is included to prevent misdetection due to chattering on the control signal (external trigger input signal, sampling clock input signal, etc.), digital input signal and counter input signal. (Except from external clock input signal and counter gate signal)

Support for both of low-profile and standard PCI slots (interchangeable with a bundled bracket)

This product has each bracket for both low-profile size slot and standard size slot. If you wish to mount this product in a standard size slot, replace this with the standard size bracket.

Software-based calibration function

Calibration of analog 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.

Windows/Linux compatible driver libraries are attached.

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

MATLAB and LabVIEW is supported by a plug-in of dedicated library VI-DAQ.

Using the dedicated library MATLAB and VI-DAQ makes it possible to make a LabVIEW application.
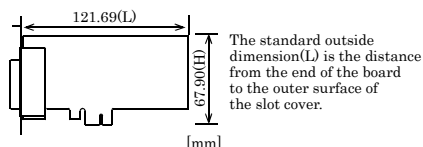
Specification

Item	Specification
Analog output	
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	LVTTL level (Rising or falling edge can be selected by software) Digital filter (1μ sec can be selected by software)
External stop signal	LVTTL level (Rising or falling edge can be selected by software) Digital filter (1μ sec can be selected by software)
External clock signal	LVTTL level (Rising or falling edge can be selected by software) Digital filter (1μ sec can be selected by software)
Digital I/O	
Number of input channels	Non-isolated input 4ch (TTL level positive logic)
Number of output channels	Non-isolated output 4ch (TTL level positive logic)
Counter	
Number of channels	1ch
Counting system	Up count
Max. count	FFFFFFFFh (Binary data,32bit)
Number of external inputs	2 LVTTL level (Gate/Up)/ch Gate (High level), Up (Rising edge)
Number of external outputs	1 LVTTL level, Count match output (positive logic, pulse output)
Response frequency	10MHz (Max.)
Common section	
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
Standard	VCCI Class A, CE Marking (EMC Directive Class A, RoHS Directive), UKCA

*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

121.69(L)
67.90(H)

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

[mm]

Support Software

Windows version of analog I/O driver API-AIO(WDM)
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 *1useful for checking operation is provided.
For more details on the supported OS, applicable language and new information, please visit the CONTEC's Web site.

Linux version of analog I/O driver   API-AIO(LNX)
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.
For more details on the supported OS, applicable language and new information, please visit the CONTEC's Web site.

Data Acquisition library for MATLAB ML-DAQ
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.
For more details on the supported OS, applicable language and new information, please visit the CONTEC's Web site.

Data acquisition VI library for LabVIEW   VI-DAQ
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.
For more details on the library and download of VI-DAQ, please visit the CONTEC's Web site.

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*2

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

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

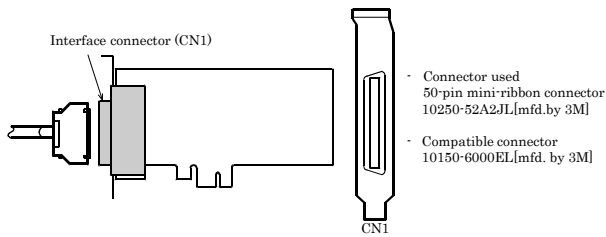* Check the CONTEC's Web site for more information on these options.

Packing List

Board [AO-1604L-LPE] …1
First step guide …1
Disk *1 [API-PAC(W32)] …1
Standard size bracket …1
Serial number label…1
Warranty Certificate…1

*1   The Disk 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.

- Connector used
  50-pin mini-ribbon connector
  10250-52A2JL[mfd.by 3M]
- Compatible connector
  10150-6000EL[mfd. by 3M]

CN1

* 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 Inpu	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

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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.
- 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 product.

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.

BOARD		CN1	Cable		Target
Analog Output 0..3*2					
Analog Ground					
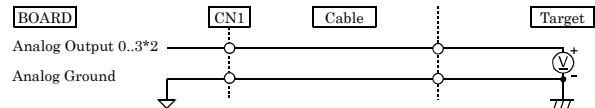
The following figure shows an example of shield cable connection. Use shielded cable if the distance between the signal source and product is long or if you want to provide better protection from noise. For each analog input channel on CN1, connect the core wire to the signal line and connect the shielding to ground.

BOARD		CN1	Shield cable		Target
Analog Output 0..3*2					
Analog Ground					
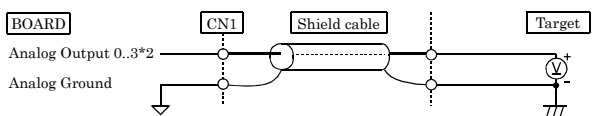
*2　The number of channels depends on each product. The AO-1604L-LPE has four channels.

⚠ CAUTION
- When the power supply is turned on, the output voltage of all channels becomes 0 V.
- 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 ±3mA (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 LVTTL level signals.

Digital Input Connection
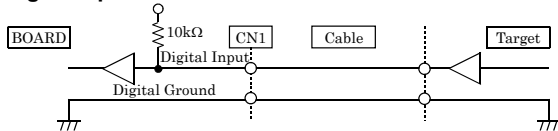
Digital Output Connection
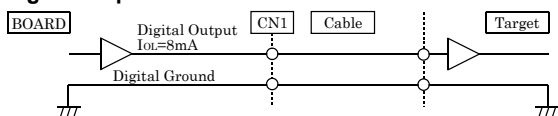
About the counter input control signal

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.

- Each input accepts 5V TTL signals.

Block Diagram