

High-Resolution
Analog Output Unit for USB
AO-1604LX-USB



This product is a USB2.0-compliant analog output unit that extends the analog output function of USB port of PCs. This product features high-precision analog outputs, digital inputs, digital outputs, and a counter function.

As there is compatible with PCI bus-compatible board DA16-4(LPCI)L and PCI Express bus-compatible board AO-1604L-LPE in terms of connector shape and pin assignments, it is easy to migrate from the existing system.

Using the bundled API function library package [API-USBP(WDM)], 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++.

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

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

Features

Multi-function

The unit contains analog outputs (16bit, 4channels), control signal(3 points) of analog output, digital inputs (LVTTTL level 4channels), digital outputs (LVTTTL level 4channels), and counters (32bit binary, LVTTTL level 1channels). Combining all these features on one unit allows complex systems to be implemented even on PCs with USB port only.

Buffer memory

The analog outputs have their own buffer memory. You can also perform analog output in the background, independent of software and the current status of the PC.

Filter function for easy connection of external signals

The digital input signals, counter input signals, and the external control signals for analog output incorporate a digital filter to prevent wrong recognition of input signals from carrying noise or a chattering.

Compatible with PCI / PCI Express bus board in it's design. Common connector shape and pin assignment with PCI / PCI Express bus board

This product has the common connector shape and pin assignment with PCI bus board DA16-4(LPCI)L, PCI Express bus board AO-1604L-LPE so you can use the common cables and accessories, it is easy to migrate from the existing system *1.

Compatible to USB1.1/USB2.0

Compatible to USB1.1/USB2.0 and capable to achieve high speed transfer at HighSpeed (480 Mbps).

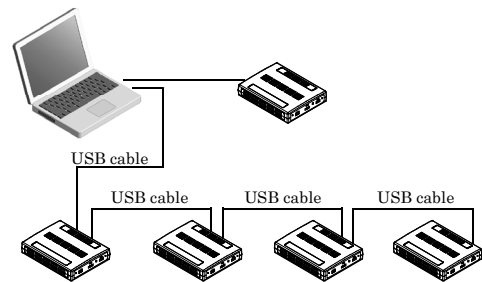
Software-based calibration function

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.

USB HUB function, the CONTEC's USB supported products (Max. 4) can be used.

This product has the USB HUB function. *2
Max. 4 AO-1604LX-USB can be used in 1 USB port of PC. When you use 4 or more AO-1604LX-USB, you can do by connecting AO-1604LX-USB to the another USB port of PC side.

Also, you can connect the CONTEC's USB supported products other than AO-1604LX-USB to the USB port of AO-1604LX-USB. *3*4



Windows compatible driver libraries are attached.

Also, driver library API-USBP(WDM) that makes it possible to create applications of Windows is attached.

Plug-ins for the dedicated libraries, this product 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 by National Instruments. These dedicated libraries are available, free of charge (downloadable), on our web site.

*1 There are some differences of the specifications between this product and AO-1604L-LPE, DA16-4L(LPCI)L. For more details on this, refer to "Chapter7, Difference from AO-1604L-LPE, DA16-4(LPCI)L"

*2 This product cannot be stacked up for installation.

*3 Do not connect the device other than that of CONTEC's USB to the USB port included on the AO-1604LX-USB. Otherwise, this may cause a failure or malfunction.

*4 When connecting multiple units with USB HUB function and set up them, do one at a time and complete setup for the previous unit before starting to do the next unit.

Specification

Item	Specification
Analog output	
Isolated specification	Non-isolated
Number of output channels	4channels
Output range	Bipolar ±10V
Absolute max. output current	±3mA
Output impedance	1Ω or less
Resolution	16bit
Non-Linearity error *1	±5LSB
Conversion speed	10μsec
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 (1μsec can be selected by software)
External stop signal	LVTTTL level (Rising or falling edge can be selected by software) Digital filter (1μsec can be selected by software)
External clock signal	LVTTTL level (Rising or falling edge can be selected by software) Digital filter (1μsec can be selected by software)
Digital I/O	
Number of input channels	Non-isolated input 4channels (LVTTTL level positive logic)
Number of output channels	Non-isolated output 4channels (LVTTTL level positive logic)
Counter	
Number of channels	1channel
Counting system	Up count
Max. count	FFFFFFFFh (Binary data, 32bit)
Number of external inputs	LVTTTL level : 2 (Gate/Up)/ch, Gate (High level), Up (Rising edge)
Number of external outputs	LVTTTL level : 1/ch, Count match output (positive logic, pulse output)
Frequency response	10MHz (Max.)
USB	
Bus specification	USB Specification 2.0/1.1 standard
USB transfer rate	12Mbps (Full-speed), 480Mbps (High-speed) *2
Power supply	Self power *3
Attached AC adaptor (POA200-20-2)	90 - 264VAC 5.0VDC±5% 2.0A (Max.) Cable length : about 1.5m, AC Cable length : about 1.5m
Common section	
Number of terminals used at the same time	127 terminals (Max.) *4
Power consumption (Max.)	5VDC 700mA
Operating condition*5	0 - 50°C, 10 - 90%RH (No condensation) * When using the attached AC adaptor POA200-20-2, it is 0 - 40°C
Physical dimensions (mm)	180(L) x 140(D) x 34(H) (No protrusions)
Weight	400g(Not including the USB cable, attachment)
Connector	10250-52A2JL[3M] or equivalent to it
Attached cable length	USB Cable 1.8m
Standard	FCC Class A, VCCI Class A, CE Marking (EMC Directive Class A, RoHS Directive), UKCA

- *1 : A linearity error approximately 0.1% of full-range may occur when operated at 0°C or 50°C ambient temperature.
 *2 : The USB transfer speed depends on the host PC environment used (OS and USB host controller).
 *3 : The supplied current is insufficient in the bus power. Please use the attached AC adaptor (POA200-20-2).
 *4 : As a USB hub is also counted as one device, you cannot just connect 127 USB terminals.
 *5 : To suppress the heating, ensure that there are spaces for ventilation (about 5cm) around this product.

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 useful for checking operation is provided.

For more details on the supported OS, applicable language and how to download the updated version, 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 information, please visit CONTEC's website.

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.

For more information, please visit CONTEC's website.

Cable & Connector

Cable (Option)

Shield Cable with 50-Pin Mini-Ribbon Connectors at either Ends
 : PCB50PS-0.5P (0.5m)
 : PCB50PS-1.5P (1.5m)

Shield Cable with 50-Pin Mini-Ribbon Connector at one End
 : PCA50PS-0.5P (0.5m)
 : PCA50PS-1.5P (1.5m)

Accessories

Accessories (Option)

S Screw Terminal Unit (M3 x 50P) : EPD-50A *1*2
 BNC Terminal Unit (for analog input 8ch) : ATP-8L *1*3
 USB I/O Unit Bracket for X Series : BRK-USB-X
 AC adaptor (input : 90 - 264VAC, output : 5VDC 2.0A)
 : POA200-20-2 *4
 DC-DC power supply unit (input: 10 - 30VDC, output: 5VDC 3.0A)
 : POW-DD10GY

- *1 PCB50PS-0.5P or PCB50PS-1.5P optional cable is required separately.
 *2 "Spring-up" type terminal is used to prevent terminal screws from falling off.
 *3 Capable of using the analog output of up to 2ch.
 *4 It is the same as the one appended to the product. Please buy it necessary for maintenance.
 * Check the CONTEC's Web site for more information on these options.

Packing List

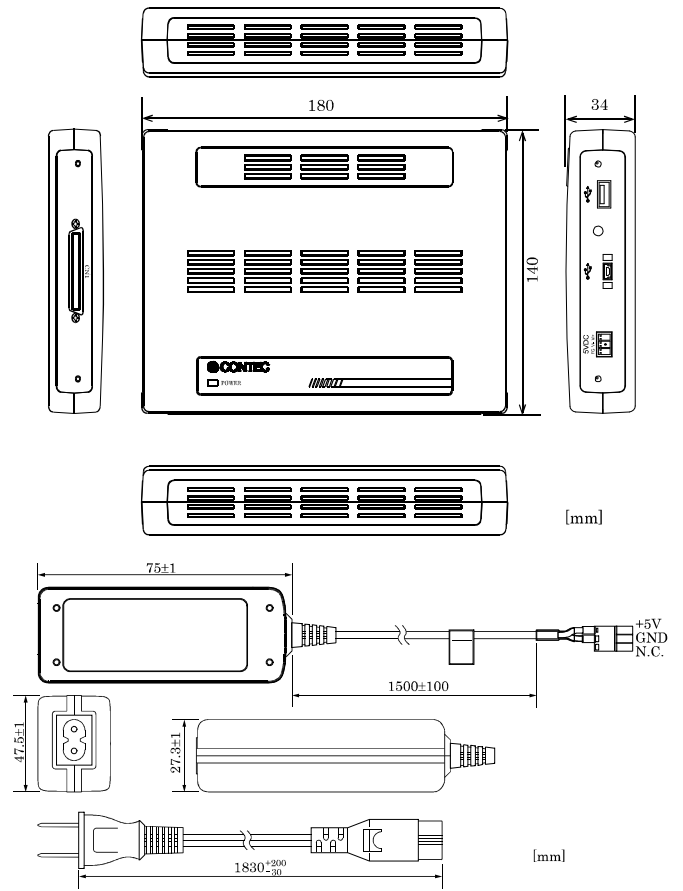
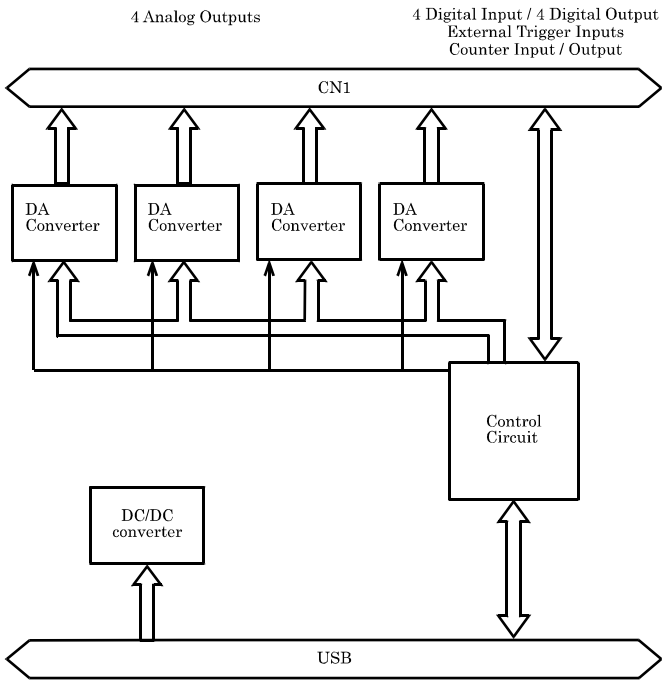
- Unit [AO-1604LX-USB] ...1
- AC adaptor ...1
- AC Cable (for 125VAC)...1
- USB cable (1.8m) ...1
- USB cable attachment on the main unit's side (For Mini B connector side) ...1
- Clamps for prevention of cable on the main unit's side ...1
- Disk *1 [API-USBP(WDM)] ...1
- First step guide ... 1

- Power connector MC1,5/3-ST-3,5 ...1
- Ferrite core ...1
- Warranty Certificate ...1
- Serial Number Label ...1

*1 The bundled disk contains the driver software and User's Guide

Physical Dimensions

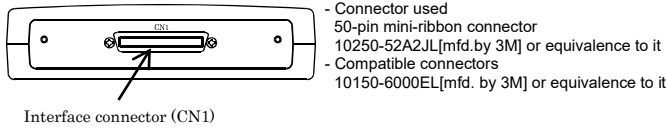
Block Diagram



How to Connect the Connectors

Connector Shape

To connect an external device to this product, plug the cable from the device into the interface connector (CN1) of unit shown below.



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

* Please refer to page 3 for more information on the supported cable and accessories.

Connector Pin Assignment

Pin Assignments of Interface Connector(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
Non Connect	N.C.	42	17	N.C.	Non Connect
Non Connect	N.C.	41	16	N.C.	Non Connect
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	Common analog ground for analog output signals.
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	External 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.

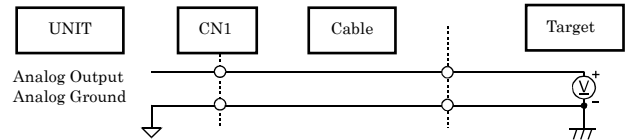
CAUTION

- 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

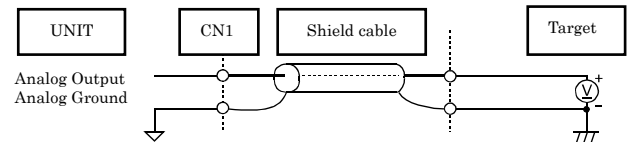
Analog Output Connection (Flat Cable)

This section shows how to connect the analog output signal by using a flat cable or a shield 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 (Shielded Cable)

The following figure shows an example of shield cable connection. Use shield cable if the distance between the signal source and this product 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.



CAUTION

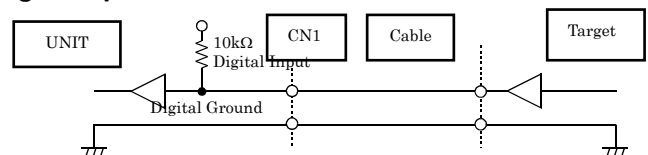
- If this product or the connected wire receives noise, or the distance between this product and the target is long, data may not be outputted properly.
- For analog output signal, the current capacity is $\pm 3\text{mA}$ (Max.). Check the specification of the connected device before connecting this product.
- Do not short the analog output signal to analog ground, digital ground, and/or power line. Doing so may damage this product.
- Do not connect an analog output signal to any other analog output, either on this product or on an external device, as this may cause a fault on this product.
- Analog output signal outputs hundreds of μ voltages when USB cable is inserted.

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

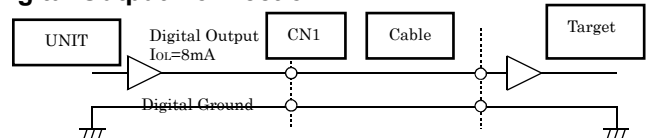
The following sections show examples of how to connect digital I/O signals, counter I/O signals, and other control I/O signals (external trigger input signals, sampling clock input signals, etc.).

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 acts as an input that validate or invalidate the input of an external up-clock for counter. This function enables the control of an external up-clock for counter. The external up-clock for counter is valid when input is "High", and invalid when input is "Low". If unconnected, it is a pull-up in the product and remains "High". Therefore the external up-clock for counter is valid when the counter gate control input is not connected.

⚠ CAUTION

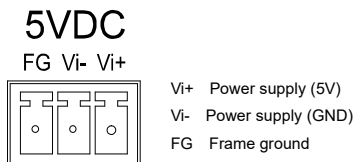
- Do not short the output signals to analog ground, digital ground, and/or power line. Doing so may damage the product.
- If connected to each output, a pull-up resistor must be about 10kΩ to pull up with a 3.3V power source.
- Each input accepts 5V TTL signals.

Connection with 5VDC Power Supply for Self-power

+5 VDC Input Terminal Pinouts

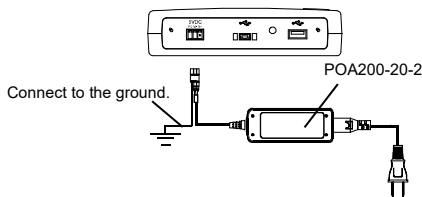
This product must be connected with 5VDC power supply (in a self-powered state).

Connect with 5VDC power supply by using +5VDC input pin.



Connecting the AC Adapter POA200-20-2

When using the attached AC adaptor [POA200-20-2], please connect directly to the input terminals. When the accompanying power connector (MC1,5/3-ST-3,5, suitable cable: AWG28 - 16) is used to supply power to this unit, strip the end of the suitable cable and insert it to the power connector before firmly securing it using a screw.



⚠ CAUTION

- Connect 5VDC power supply to the main unit. Next, connect the USB cable to the PC. Do not turn it on or off when using. If you remove, USB cable is first and then 5VDC power supply.
- When the USB module is not used, leave the AC adaptor unplugged.
- Continuously using the AC adaptor heated affects its life.
- Use the AC adaptor not in a closed place but in a well-ventilated place not to be heated.
- Do not remove the power connector [MC1,5/3-ST-3,5] attached to the AC adapter.

Difference from AO-1604L-LPE and DA16-4(LPCI)L

Item	AO-1604LX-USB	AO-1604L-LPE	DA16-4(LPCI)L
Analog output			
External start signal, External stop signal, External clock signal	LVTTTL level		TTL level
External status output signal	LVTTTL level		TTL level
Digital I/O			
Number of input channels	Non-isolated input 4 channels (LVTTTL level positive logic)		Non-isolated input 4 channels (TTL level positive logic)
Number of output channels	Non-isolated output 4 channels (LVTTTL level positive logic)		Non-isolated output 4 channels (TTL level positive logic)
Counter			
Number of external inputs	LVTTTL level		TTL level
Number of external outputs	LVTTTL level		TTL level
Power consumption (Max.)	5VDC 700mA	3.3VDC 400mA, 12VDC 250mA	5VDC 440mA (Max.)
Bus specification	USB Specification 2.0/1.1 standard	PCI Express Base Specification Rev. 1.0a x1	PCI(32bit, 33MHz, Universal key shapes supported)
Physical dimensions (mm)	180(L) x 140(D) x 34(H) (No protrusions)	121.69(L) x 67.90(H)	121.69(L) x 63.41(H)
Weight	400g (Not including the USB cable, attachment)	60g	130g