

PCI Express-compliant  
Multi-function Analog I/O (Low profile)

**AIO-160802L-LPE**



PCI Express-compliant  
Multi-function Analog I/O (Low profile)

**AO-1604L-LPE**



PCI Express-compliant  
Multi-function Analog I/O

**AI-1616L-LPE**



These products are multi-function, PCI Express bus-compliant interface boards that include high-precision 16-bit analog inputs, high-precision 16-bit analog outputs, digital inputs/outputs (LVTTTL each 4ch), and a counter (32-bit, 1ch) function.

These products support a Low Profile size slot and, if replaced with the supplied bracket, support 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.

These products 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 boards also support MATLAB and LabVIEW.

## Features

### Multi-function

CONTEC analog I/O device L series support a compact and high precision system and now offer three products:

AIO-160802L-LPE: analog input (16bit, 8ch), analog output (16bit, 2ch).

AI-1616L-LPE: analog input (16bit, 16ch).

AO-1604L-LPE: the analog output (16bit, 4ch).

All the three models include digital inputs and outputs (4 each, LVTTTL) and a counter (32-bit 1ch).

### Synchronization analog I/O

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

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

1k word FIFO or RING buffers for send/receive, allowing both small and large volumes of data to be transferred at high speed

### Software-based calibration

Adjustment can be done via software, requires no trimmer setting, capable of recognizing any adjustment information that is different from that set at the factory. This allows for optimum settings for individual applications.

### 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 either Low Profile slots or standard slots

This boards support both low-profile and standard PCI-Express slots by using the interchangeable brackets.

### Support data logging software "C-LOGGER"

C-LOGGER helps you to easily configure graph display, saving the file and then export it to Microsoft Excel.

### MATLAB and LabVIEW-compliant with the plug-in library

CONTEC provide you with ML-DAQ library for The MathWork's MATLAB and VI-DAQ for National Instrument's LabVIEW. ( Available for free download from our website.)

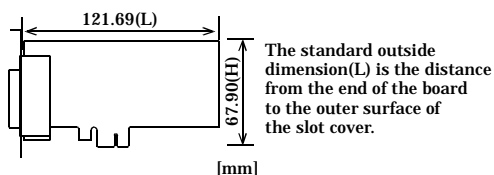
Specification <AIO-160802L-LPE>

Item	Specification
<b>Analog input</b>	
Isolated specification	Un-Isolated
Input type	Single-Ended Input
Number of input channels	8ch
Input range	Bipolar $\pm 10V$
Absolute max. input voltage	$\pm 20V$
Input impedance	1M $\Omega$ or more
Resolution	16bit
Non-Linearity error *1 *2	$\pm 5LSB$
Conversion speed	10 $\mu$ sec/channel (Max.)
Buffer memory	1k Word
Conversion start trigger	Software / external trigger
Conversion stop trigger	Number of sampling times / external trigger/software
External start signal	LVTTL (Rising or falling edge can be selected by software) Digital filter (1 $\mu$ sec can be selected by software)
External stop signal	LVTTL (Rising or falling edge can be selected by software) Digital filter (1 $\mu$ sec can be selected by software)
External clock signal	LVTTL (Rising or falling edge can be selected by software)
<b>Analog output</b>	
Isolated specification	Un-Isolated
Number of output channels	2ch
Output range	Bipolar $\pm 10V$
Output current ability	$\pm 3mA$
Output impedance	1 $\Omega$ or more
Resolution	16bit
Non-Linearity error *1	$\pm 5LSB$
Conversion speed	10 $\mu$ sec (Max.)
Buffer memory	1k Word
Conversion start trigger	Software / external trigger
Conversion stop trigger	Number of sampling times / external trigger/software
External start signal	LVTTL (Rising or falling edge can be selected by software) Digital filter (1 $\mu$ sec can be selected by software)
External stop signal	LVTTL (Rising or falling edge can be selected by software) Digital filter (1 $\mu$ sec can be selected by software)
External clock signal	LVTTL (Rising or falling edge can be selected by software)
<b>Digital I/O</b>	
Number of input channels	Un-Isolated input 4ch (TTL positive logic)
Number of output channels	Un-Isolated output 4ch (TTL positive logic)
<b>Counter</b>	
Number of channels	1ch
Counting system	Up count
Max. count	FFFFFFFFh (Binary data,32bit)
Number of external inputs	2 LVTTL (Gate/Up)/ch Gate (High level), Up (Rising edge)
Number of external outputs	1 LVTTL, 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 200mA
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: At the time of the source use of a signal which built in the high-speed operational amplifier.

Physical dimension



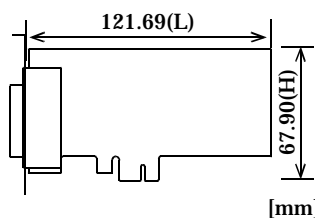
Specification <AI-1616L-LPE>

Item	Specification
Analog input	
Isolated specification	Un-Isolated
Input type	Single-Ended Input
Number of input channels	16ch
Input range	Bipolar ±10V
Absolute max. input voltage	±20V
Input impedance	1MΩ or more
Resolution	16bit
Non-Linearity error *1 *2	±5LSB
Conversion speed	10μ sec/ch (Max.)
Buffer memory	1k Word
Conversion start trigger	Software / external trigger
Conversion stop trigger	Number of sampling times / external trigger/software
External start signal	LVTTL (Rising or falling edge can be selected by software) Digital filter (1μ sec can be selected by software)
External stop signal	LVTTL (Rising or falling edge can be selected by software) Digital filter (1μ sec can be selected by software)
External clock signal	LVTTL (Rising or falling edge can be selected by software)
Digital I/O	
Number of input channels	Un-Isolated input 4ch (TTL positive logic)
Number of output channels	Un-Isolated output 4ch (TTL positive logic)
Counter	
Number of channels	1ch
Counting system	Up count
Max. count	FFFFFFFFh (Binary data,32bit)
Number of external inputs	2 LVTTL (Gate/Up)/ch Gate (High level), Up (Rising edge)
Number of external outputs	1 LVTTL, 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 120mA
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: At the time of the source use of a signal which built in the high-speed operational amplifier.

Physical dimension



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

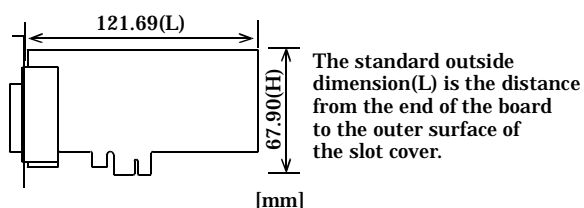
[mm]

Specification <AO-1604I-LPE>

Item	Specification
<b>Analog output</b>	
Isolated specification	Un-Isolated
Number of output channels	4ch
Output range	Bipolar $\pm 10V$
Absolute max. output voltage	$\pm 3mA$
Output impedance	$1\Omega$ or less
Resolution	16bit
Non-Linearity error *1	$\pm 5LSB$
Conversion speed	$10\mu$ sec
Buffer memory	1k Word
Conversion start trigger	Software / external trigger
Conversion stop trigger	Number of sampling times / external trigger/software
External start signal	LVTTL (Rising or falling edge can be selected by software) Digital filter ( $1\mu$ sec can be selected by software)
External stop signal	LVTTL (Rising or falling edge can be selected by software) Digital filter ( $1\mu$ sec can be selected by software)
External clock signal	LVTTL (Rising or falling edge can be selected by software)
<b>Digital I/O</b>	
Number of input channels	Un-Isolated input 4ch (TTL positive logic)
Number of output channels	Un-Isolated output 4ch (TTL 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 (Gate/Up)/ch Gate (High level), Up (Rising edge)
Number of external outputs	1 LVTTTL, 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 temperatures.

Physical dimension



## Support Software

### Driver Software Package API-PAC(W32) (Included)

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++.

It can also be used by the installed diagnosis program to check hardware operations. CONTEC provides download services (at <http://www.contec.com/apipac/>) to supply the updated drivers and differential files.

For details, read Help on the bundled CD-ROM or visit the CONTEC Web site.

< Operating environment >

OS: Windows XP, Server 2003, 2000, Me, 98, etc..

Language: Visual C++ .NET, Visual C# .NET, Visual Basic .NET, Visual Basic

### 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 (cards) from within Linux. Users can control CONTEC I/O boards easily using the shared library called from the user application, the device driver (module) for kernel version, and the board (card) configuration program(config). CONTEC provides download services (at <http://www.contec.com/apipac/>) 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, etc..

### Data Logger Software C-LOGGER (Supplied: Stored on the API-PAC(W32) CD-ROM)

C-LOGGER is a data logger software program compatible with our analog I/O products. This program enables the graph display of recorded signal data, zoom observation, file saving, and dynamic transfer to the spreadsheet software "Excel". No troublesome programming is required. CONTEC provides download services (at <http://www.contec.com/clogger/>) to supply the updated drivers.

For details, refer to the C-LOGGER Users Guide or our website.

< Operating Environment >

OS: Windows XP, Server 2003, 2000

### Data Acquisition library for MATLAB ML-DAQ -Available at 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 at 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.

## Optional Cable & Connector

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

Screw Terminal Unit(M3 terminal block, 50 points)

:EPD-50A \*1

Buffer Amplifier Box for Analog Input Boards

:ATBA-8L \*1\*2\*3\*4

Buffer Amplifier Box for Analog Input Boards

:ATBA-16L \*1\*2\*3

BNC Connector Screw Terminal Unit

:ATP-8L \*1\*5

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

\*2 Only AIO-160802L-LPE, AI-1616L-LPE can be used.

\*3 An external power supply is necessary (optional AC adaptor POA200-20 prepared.)

\*4 As for the AI-1616L-LPE, capable of using the analog input of up to 8ch.

\*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.

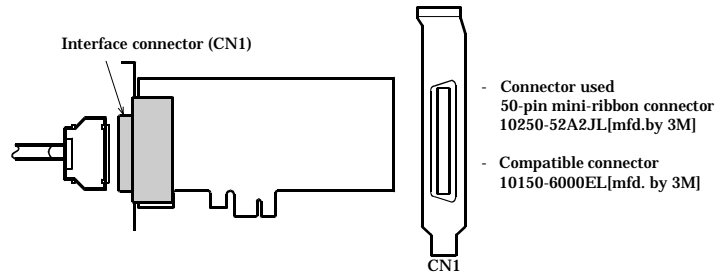
## Packing List

- Board (One of the following) ...1  
[AIO-160802L-LPE, AI-1616L-LPE or AO-1604L-LPE]
- 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.

## Connector shape

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



## Connector pin assignment <AIO-160802L-LPE>

Non Connect	N.C.	50	25	- AO 00	Analog Output 00
Analog Ground ( for AO )	AGND	49	24	- AGND	Analog Ground ( for AO )
Non Connect	N.C.	48	23	- AO 01	Analog Output 01
Analog Ground ( for AO )	AGND	47	22	- AGND	Analog Ground ( for AO )
Analog Input 04	AI 04	46	21	- AI 00	Analog Input 00
Non Connect	N.C.	45	20	- N.C.	Non Connect
Analog Input 05	AI 05	44	19	- AI 01	Analog Input 01
Non Connect	N.C.	43	18	- N.C.	Non Connect
Analog Ground ( for AI )	AGND	42	17	- AGND	Analog Ground ( for AI )
Analog Ground ( for AI )	AGND	41	16	- AGND	Analog Ground ( for AI )
Analog Input 06	AI 06	40	15	- AI 02	Analog Input 02
Non Connect	N.C.	39	14	- N.C.	Non Connect
Analog Input 07	AI 07	38	13	- AI 03	Analog Input 03
Non Connect	N.C.	37	12	- N.C.	Non Connect
AO External Start Trigger Input	AO START	36	11	- AI START	AI External Start Trigger Input
AO External Stop Trigger Input	AO STOP	35	10	- AI STOP	AI External Stop Trigger Input
AO External Sampling Clock Input	AO EXCLK	34	9	- AI EXCLK	AI External Sampling Clock Input
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 Input00 - Analog Input07	Analog input signal. The numbers correspond to channel numbers.
Analog Output00 - Analog Output01	Analog output signal. The numbers correspond to channel numbers.
Analog Ground	Common analog ground for analog I/O signals.
AI External Start Trigger Input	External trigger input for starting analog input sampling.
AI External Stop Trigger Input	External trigger input for stopping analog input sampling.
AI External Sampling Clock Input	External sampling clock input for analog input.
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 product.



Connector pin assignment <AI-1616L-LPE>

Non Connect	N.C.	50	25	- N.C.	Non Connect
Non Connect	N.C.	49	24	- N.C.	Non Connect
Non Connect	N.C.	48	23	- N.C.	Non Connect
Non Connect	N.C.	47	22	- N.C.	Non Connect
Analog Input 04	AI 04	46	21	- AI 00	Analog Input 00
Analog Input 12	AI 12	45	20	- AI 08	Analog Input 08
Analog Input 05	AI 05	44	19	- AI 01	Analog Input 01
Analog Input 13	AI 13	43	18	- AI 09	Analog Input 09
Analog Ground ( for AI )	AGND	42	17	- AGND	Analog Ground ( for AI )
Analog Ground ( for AI )	AGND	41	16	- AGND	Analog Ground ( for AI )
Analog Input 06	AI 06	40	15	- AI 02	Analog Input 02
Analog Input 14	AI 14	39	14	- AI 10	Analog Input 10
Analog Input 07	AI 07	38	13	- AI 03	Analog Input 03
Analog Input 15	AI 15	37	12	- AI 11	Analog Input 11
Non Connect	N.C.	36	11	- AI START	AI External Start Trigger Input
Non Connect	N.C.	35	10	- AI STOP	AI External Stop Trigger Input
Non Connect	N.C.	34	9	- AI EXCLK	AI External Sampling Clock Input
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 Input00 - Analog Input15	Analog input signal. The numbers correspond to channel numbers.
Analog Ground	Analog ground.
AI External Start Trigger Input	External trigger input for starting analog input sampling.
AI External Stop Trigger Input	External trigger input for stopping analog input sampling.
AI External Sampling Clock Input	External sampling clock input for analog input.
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 product.

Connector pin assignment <AO-1604L-LPE>

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	Reseved	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**

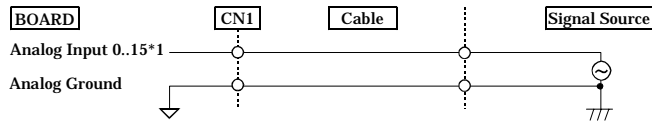
- Do not connect any of the outputs and power outputs to the analog or digital ground. Neither connect outputs to each other. Doing either can result in a fault.
- If analog and digital ground are shorted together, noise on the digital signals may affect the analog signals. Accordingly, analog and digital ground should be separated.
- Leave "Reserved" pins unconnected. Connecting these pins may cause a fault in the product.



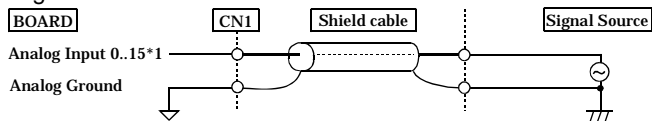
## Analog Input Signal Connection

### Single-ended Input

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



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.



\*1The number of channels depends on each product. The AIO-160802L-LPE has eight channels; the AI-1616L-LPE has 16 channels; the AO-1604L-LPE has no channel.

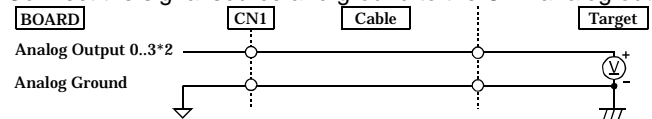
### CAUTION

- If the signal source contains over 1MHz signals, the signal may effect the cross-talk noise between channels.
- If the product and the signal source receive noise or the distance between the product 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 product analog ground). If it exceeds the maximum voltage, the product may be damaged.
- Connect all the unused analog input channels to analog ground.
- The signal connected to an input pin may fluctuate after switching of the multiplexer. If this occurs, shorten the cable between the signal source and the analog input pin or insert a high-speed amplifier as a buffer between the two to reduce the fluctuation.

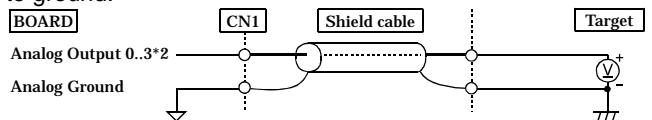
## Analog Output Signal Connection

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.



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.



\*2 The number of channels depends on each product. The AIO-160802L-LPE has two channels; the AI-1616L-LPE has no channel; the AO-1604L-LPE has four channels.

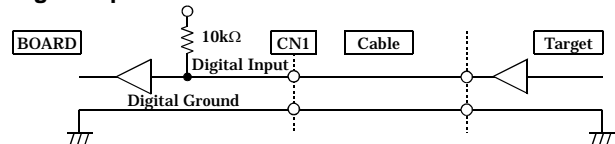
### CAUTION

- 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.

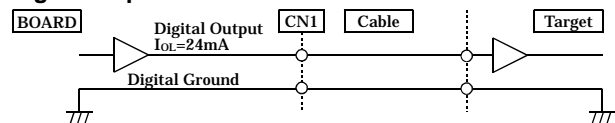
## Digital I/O, Counter and Control Signal Connection

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 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.

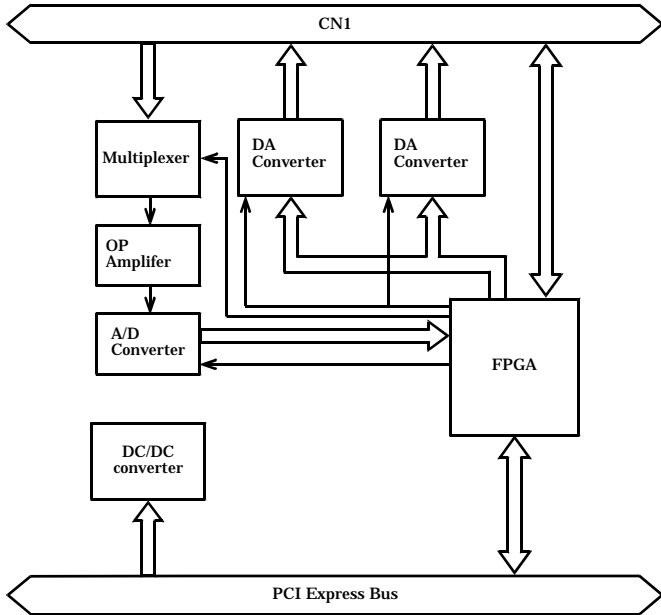
### CAUTION

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

Block Diagram

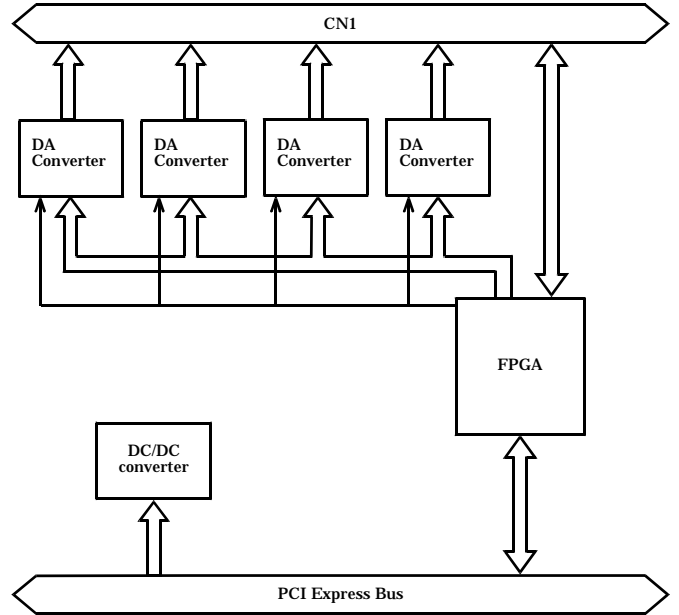
AI-160802L-LPE

8 single-end Analog Inputs      2 Analog Outputs      4 Digital Input / 4 Digital Output  
External Trigger Inputs  
Counter Input / Output



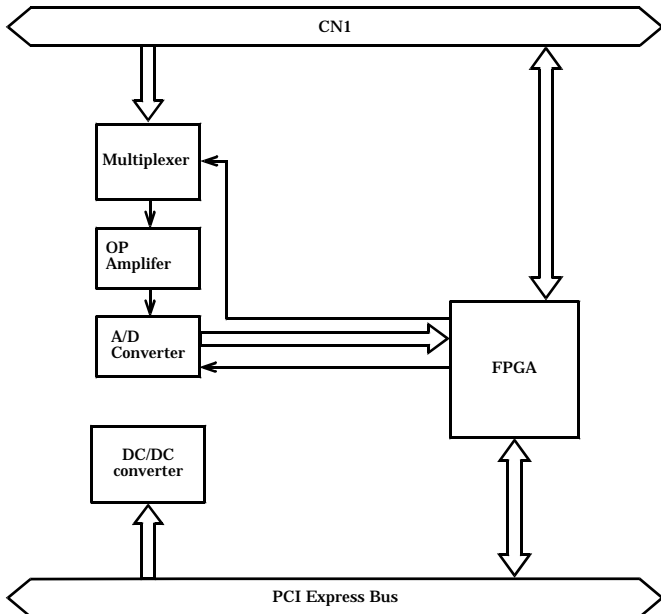
AO-1604L-LPE

4 Analog Outputs      4 Digital Input / 4 Digital Output  
External Trigger Inputs  
Counter Input / Output



AI-1616L-LPE

16 single-end Analog Inputs      4 Digital Input / 4 Digital Output  
External Trigger Inputs  
Counter Input / Output



\*Specifications, colors and design might be changed without notice.