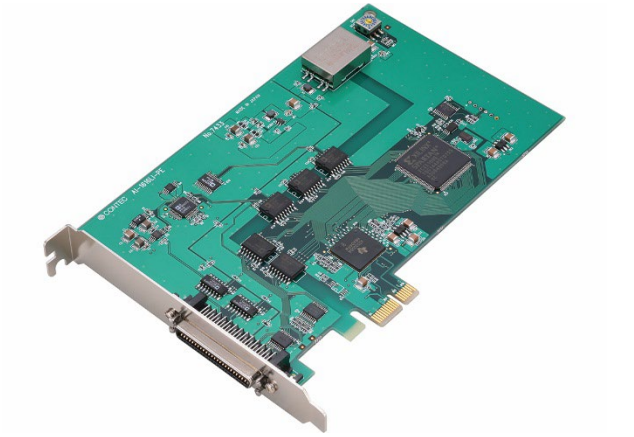
Isolated 16-bit Analog Input Board for PCI Express
AI-1616LI-PE



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

This product is a PCI Express bus-compliant interface board used to provide an analog signal input, input function on a PC.
AI-1616LI-PE features bus isolated 16-bit analog input 16 channels. Equipped with digital I/O and counter, this product is multifunction and bus isolated type that provides isolation between PC and external analog I/O circuit. This product carries buffer memory for 1K of data, allowing sampling to be performed in a variety of trigger / clock conditions.
Windows/Linux driver and full-fledged data logger software "C-LOGGER" is bundled with this product. Possible to be used as a data recording device for MATLAB and LabVIEW, with dedicated libraries.

* The contents in this document are subject to change without notice.
* Visit the CONTEC website to check the latest details in the document.
* The information in the data sheets is as of June, 2022.

Features

Bus isolated high precision analog input 16 channels, each 4 channels for digital I/O, counter 1 channel
This product has analog input (10μsec / channel [100KSPS], 16-bit, 16 channels), analog input control signal (Isolation TTL level 3 channels), digital I/O (4 channels each for Isolation TTL level), counter (32-bit, Isolation TTL level 1 channel).

Functions and connectors are compatible with PCI compatible board ADI16-16(LPCI)L
The functions same with PCI compatible board ADI16-16(LPCI)L are provided. In addition, as there is compatibility in terms of connector shape and pin assignments, it is easy to migrate from the existing system.

Bus isolation between PC and external I/O signals by a digital isolator
Isolation between PC and external I/O circuit by a digital isolator improves noise tolerance.

The start/end of sampling can be controlled by software, comparison of conversion data, an external trigger, etc.
You can select from software, comparison of conversion data or an external trigger to control the start of sampling. You can select from completion of sampling for a specified number of sessions, comparison of conversion data, an external trigger or software to control the end of sampling. The sampling cycle can be selected from the internal clock or an external clock.

Equipped with buffer memory (1K data) that can be used in the FIFO or RING format
The analog input block contains buffer memory (1K data) that can be used in the FIFO or RING format. This allows for background analog I/O 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)

Software-based calibration function
Calibration 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.

Data logger software, Windows/Linux compatible driver libraries are attached.
Using the bundled data logger software "C-LOGGER" allows you to display recorded signal data in graphs, save files without any special program. In addition, the driver library API-PAC(W32) which makes it possible to create applications of Windows/Linux 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.

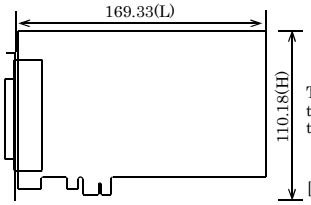
Specification

Item		Specifications
Analog input		
	Isolated specification	Bus-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	±16LSB
	Conversion speed	10μsec/ch*3 [100KSPS]*4
	Buffer memory	1k Word
	Conversion start trigger	Software / external trigger
	Conversion stop trigger	Number of sampling times / external trigger/software
	External start signal	Isolation TTL-level (Rising or falling edge can be selected by software) Digital filter (1μsec can be selected by software)
	External stop signal	Isolation TTL-level (Rising or falling edge can be selected by software) Digital filter (1μsec can be selected by software)
	External clock signal	Isolation TTL-level (Rising or falling edge can be selected by software)
Digital I/O		
	Number of input channels	Isolated input 4ch (TTL-level positive logic)
	Number of output channels	Isolated input 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 Isolation TTL-level (Gate/Up) Gate (positive logic/level), Up (Rising edge)
	Number of external outputs	1 Isolation TTL-level Count match output (positive logic, pulse output)
	Response frequency	1MHz (Max.)
Common section		
	I/O address	64 ports
	Interruption level	Errors and various factors, One interrupt request line as INTA
	Connector	10250-52A2JL[3M]
	Power consumption	3.3VDC 850mA (Max.)
	Operating condition	0 - 50℃, 10 - 90%RH (No condensation)
	Bus specification	PCI Express Base Specification Rev. 1.0a x1
	Dimension (mm)	169.33 (L) x 110.18(H)
	Weight	125g
	Standard	VCCI Class A, FCC 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℃ and 50℃ ambient temperature.
*2 At the time of the source use of a signal which built in the high-speed operational amplifier.

*3 The required time is indicated in the analog to digital translation of one channel. When AD of two or more channels is converted, time of the a few minutes of the channel is necessary. Conversion time = Number of conversion channelsx10μsec
*4 SPS = Samplings Per Second. The number of data that can be converted in one second is shown.

Dimensions



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 Logger Software C-LOGGER
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.

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.

Packing List

Board [AI-1616LI-PE] ...1
First step guide ... 1
Disk *1 [API-PAC(W32)] ...1
Warranty Certificate ...1
Serial Number Label ...1

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

List of Options

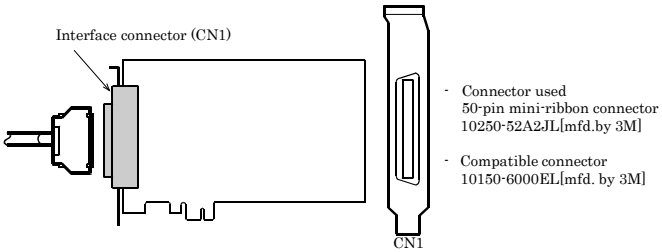
Shield Cable with 50-Pin Mini-Ribbon Connectors
at either Ends :PCB50PS-0.5P (0.5m)
:PCB50PS-1.5P (1.5m)
Shield Cable with 50-Pin Mini-Ribbon Connector
at one End :PCA50PS-0.5P (0.5m)
:PCA50PS-1.5P (1.5m)
Screw Terminal Unit (M3 x 50P) :EPD-50A *1*2
Buffer Amplifier Box for Analog Input Boards
(8ch type) :ATBA-8L *1*3
Buffer Amplifier Box for Analog Input Boards
(16ch type) :ATBA-16L *1*3
BNC Terminal Unit
(for analog input 8ch) :ATP-8L *1*4

*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 An external power supply is necessary (optional AC adaptor POA200-20 prepared.)
*4 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.

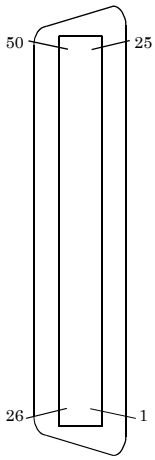
How to connect the connectors

Connector shape
To connect an external device to this board, plug the cable from the device into the interface connector (CN1) shown below.



Connector Pin Assignment
Pin Assignments of AI-1616LI-PE Interface Connector (CN1)

Non Connect	N.C.	50		25	N.C.	Non Connect
Reserved	Reserved	49		24	Reserved	Reserved
Non Connect	N.C.	48		23	N.C.	Non Connect
Reserved	Reserved	47		22	Reserved	Reserved
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 Input10
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	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.
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.

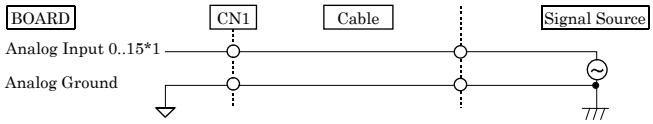
CAUTION
- Do not connect any of the outputs and power outputs to the analog or digital ground. Neither connect outputs to each other. Doing either can result in a fault.
- If analog and digital ground are shorted together, noise on the digital signals may affect the analog signals. Accordingly, analog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

Analog Input Signal Connection

Single-ended Input

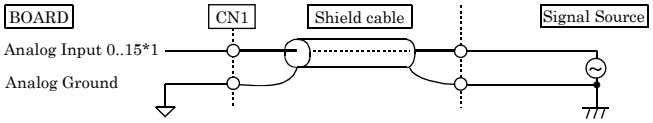
The following figure shows an example of flat cable connection. Connect separate signal and ground wires for each analog input channel on CN1.

Single-ended Input Connection (Flat Cable)



The following figure shows an example of shield cable connection. 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.

Single-ended Input Connection (Shield Cable)



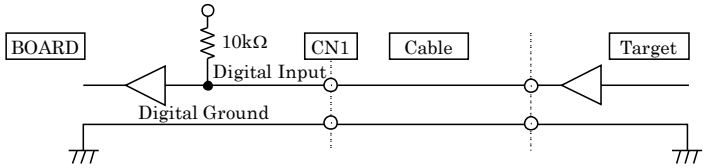
*1 The number of channels depends on each board. The AI-1616LI-PE has 16 channels.

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.
- 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.
- Digital ground of CN1 is isolated from the ground in the PC.

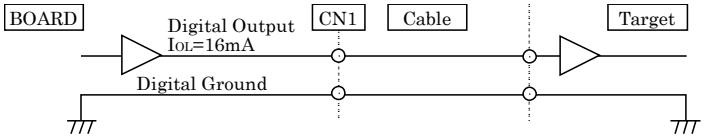
Digital I/O signals, Counter signals and Control signals Connection

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 TTL level signals.

Digital Input Connection



Digital Output Connection

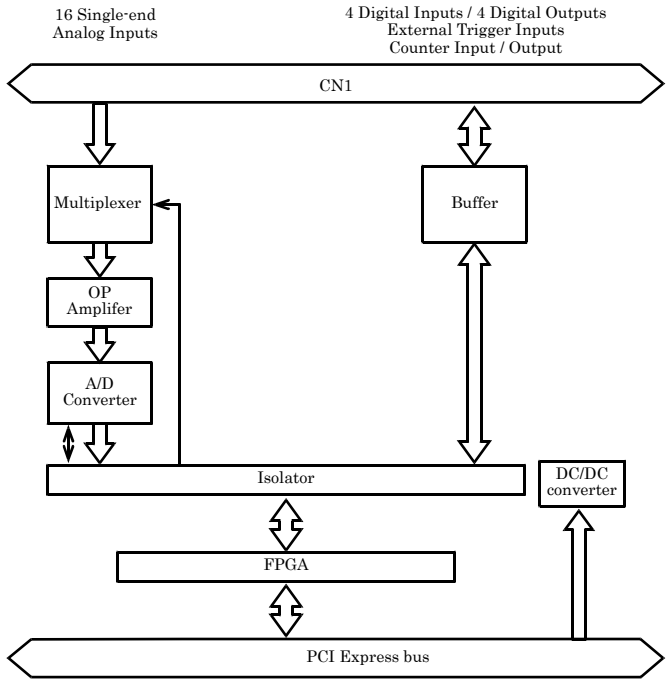


About the counter input control signal

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.
- Digital ground of CN1 is isolated from the ground in the PC.

Block Diagram



Difference from ADI16-16(LPCI)L

The functions same with conventional product of ADI16-16(LPCI)L are provided with the AI-1616LI-PE. In addition, as there is compatibility in terms of connector shape and pin assignments, it is easy to migrate from the existing system. So you can use the same operating procedures as ADI16-16(LPCI)L.

There are some differences in specifications as shown below.

	AI-1616LI-PE	ADI16-16(LPCI)L
Power consumption	+3.3VDC 850mA (Max.)	+5VDC 400mA (Max.)
Bus specification	PCI Express Base Specification Rev. 1.0a x1	PCI (32-bit, 33MHz, Universal key shapes supported)
Dimension (mm)	169.33(L) x 110.18(H)	121.69(L) x 63.41(H)
Weight	125g	65g