Isolated high-functional Analog Input Card for PCI

AI-1216I2-PCI

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

AI-1216I2-PCI is PCI-compliant interface boards that convert analog input signals to digital equivalents (performing analog-to-digital conversion).
AI-1216I2-PCI can perform A-D conversion at a conversion speed of 20µsec per channel and a resolution of 12-bit.

Using the bundled driver library [API-PAC(W32)], 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++.

* 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 October 2022.

Features

- Bus-isolation by optocoupler and digital isolator

PC and external I/O circuit is isolated from each other by optocoupler and digital isolator, offering good noise immunity.

- Sixteen single-ended channels and eight differential channels (Analog input function)

Either board allows the single-ended or differential input mode to be selected with on-board jumpers. The order of channels subject to signal conversion can be preset in the dedicated register.

- On-board buffer memory (Analog input function)

The board has buffer memory available as a FIFO or ring buffer to hold 256 kilobytes of data. This enables sampling to be executed in the background independently of the processing power of the PC.

- Assorted sampling control functions (Analog input function)

The board can control the starting and stopping of sampling not only with software commands but also by detecting analog signal strength or digital signals. The board offers a choice of sampling clocks selectable to determine the sampling speed: the internal sampling clock using the on-board clock generator and the external sampling clock using the digital signal input from an external device.

- Digital input/output function

The board has optocoupler isolation open-collector output (sink type) digital output 4 channels, optocoupler isolation input (corresponding to sink output) digital input 4 channels and can monitor, control the external device.

- Abundant optional units

Optional units are available for enhancements.
Using optional units enhances board functions and facilitates connections.
For more details on the option, please refer to this chapter "Cable & Connector" or "Accessories (Option)".

Packing List

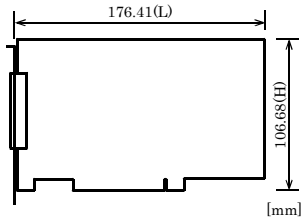
Board [AI-1216I2-PCI] ...1
Please read the following ...1

Specification

Item		Specification
Analog Input		
	Isolated specification	Bus-isolated
	Input Type	Single-Ended Input or Differential Input (Jumper setup)
	Number of input channels	16 channels (Single-Ended Input) 8 channels (Differential Input)
	Input range	Bipolar ±10V, ±5, ±2.5V, ±1.25V Unipolar 0 - +10V, 0 - +5V, 0 - +2.5V, 0 - +1.25V 4 - 20mA (Set the input range using both jumpers and software setting.)
	Absolute max. input voltage	±20V (Voltage input)
	Absolute max. input current	25mA (Current input)
	Input impedance	1MΩ or more (Voltage input)
	Resolution	12bit
	Non-Linearity error *1*2	±2LSB(±10V, ±5V, 0 - +10V, 0 - +5V) ±4LSB(±2.5V, ±1.25V, 0 - +2.5V, 0 - +1.25V) ±3LSB(4 - 20mA)
	Conversion speed	20µsec/ch (Max)
	Buffer memory	256K Word FIFO or 256K Word RING (Software setup)
	Conversion start trigger	Software/input data comparison/isolated external input digital signal
	Conversion stop trigger	Specified sampling data stored/input data comparison/isolated external input digital /software
Digital I/O		
	Number of output channels	Optocoupler isolated open collector output (sink type) 4 channels Response time : within 1msec
	Number of input channels	Optocoupler isolated open collector input (corresponding to sink output) 4 channels Response time : within 1msec
Interface connector		
	CN1	37pin D-SUB female thumb screw #4-40UNC
	CN2	16pin Pin-header
I/O address		16 ports boundary
Interrupt level		1 level use (Interrupts can be enabled or disabled.)
Operating condition		0 - 50°C, 10 - 90%RH (No condensation)
Current consumption		+5V 700mA (Max.)
PCI bus specification		32bit, 33MHz, 5V
Dimension (mm)		176.41(L) x 106.68(H)
Weight		150g
Standard		VCCI Class A, CE Marking (EMC Directive Class A, RoHS Directive), UKCA

*1 When the environment temperature is near 0ºC or 50ºC, the non-linearity error may become larger.
The error can be reduced by calibrating under the actual temperature conditions.
*2 At the time of the source use of a signal which built in the high-speed operational amplifier.

Board dimension



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

Support Software

Windows version of analog I/O driver **API-AIO(WDM) / API-AIO(98/PC)**
[Stored on the bundled disk driver library API-PAC(W32)]
The API-AIO(WDM) / API-AIO(98/PC) 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.

Linux version of analog I/O driver **API-AIO(LNX)**
[Stored on the bundled disk 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.

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 details on the library and download of VI-DAQ, please visit the CONTEC's Web site.

Driver software can be download from the CONTEC's Web site.
For more details on the supported OS, applicable language and new information, please visit the CONTEC's Web site.

List of Options

Cable
Flat Cable with One 37-pin D-SUB Connector : PCA37P-1.5 (1.5m)

Shielded Cable with One 37-pin D-SUB Connector
: CA37PS-0.5P (0.5m)
: PCA37PS-1.5P (1.5m)

Flat Cable with Two 37-pin D-SUB Connectors : PCB37PS-1.5(1.5m)

Shielded Cable with Two 37-pin D-SUB Connectors
: PCB37PS-0.5P (0.5m)
: PCB37PS-1.5P (1.5m)

Flat Cable with Two 15-pin D-SUB Connectors : PCB15P-1.5 (1.5m) *1

Coaxial Cable for Single-ended Inputs (16 channels)
: PCC16PS-1.5 (1.5m)
: PCC16PS-3 (3m)

2 Wires Shielded Cable for Differential Inputs (8 channels)
: PCD8PS-1.5 (1.5m)
: PCD8PS-3 (3m)

Flat Cable with 1 Sided 16-Pin Header Connector (1.5m)
: DT/E1

Conversion Cable (16Pin to 15Pin) with Bracket : DT-E3

*1 For FTP-15 only

Accessories
Termination panel with Screw Terminals for Spade Lugs(M3 screw, 37points) : DTP-3C *2

Termination panel with Screw Terminals(M2.6 screw, 37points)
: DTP-4C *2

Screw Terminal(M3 screw, 37points) : EPD-37A *2*3

Screw Terminal(M3.5 screw, 37points) : EPD-37 *2

Termination panel for Digital I/O on Analog Multi-function Boards
: FTP-15 *4

Termination panel with BNC connectors for Analog Multi-function Boards(Analog Input 16ch) : ATP-16E *2

8ch-Isolation Accessory Board for Analog Inputs : ATII-8C *2*5

Low pass filter expansion board : ATLF-8A *2*5

Buffer amplifier termination panel for analog multi-function box(16ch type) : ATBA-16E *2

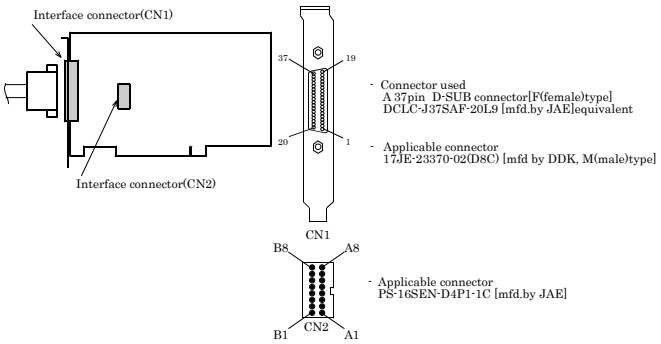
*2 A PCB37P or PCB37PS optional cable is required separately.
*3 "Spring-up" type terminal is used to prevent terminal screws from falling off.
*4 A DT-E3 and PCB15P-1.5 optional cable is required separately.
*5 External Power supply is required separately.

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

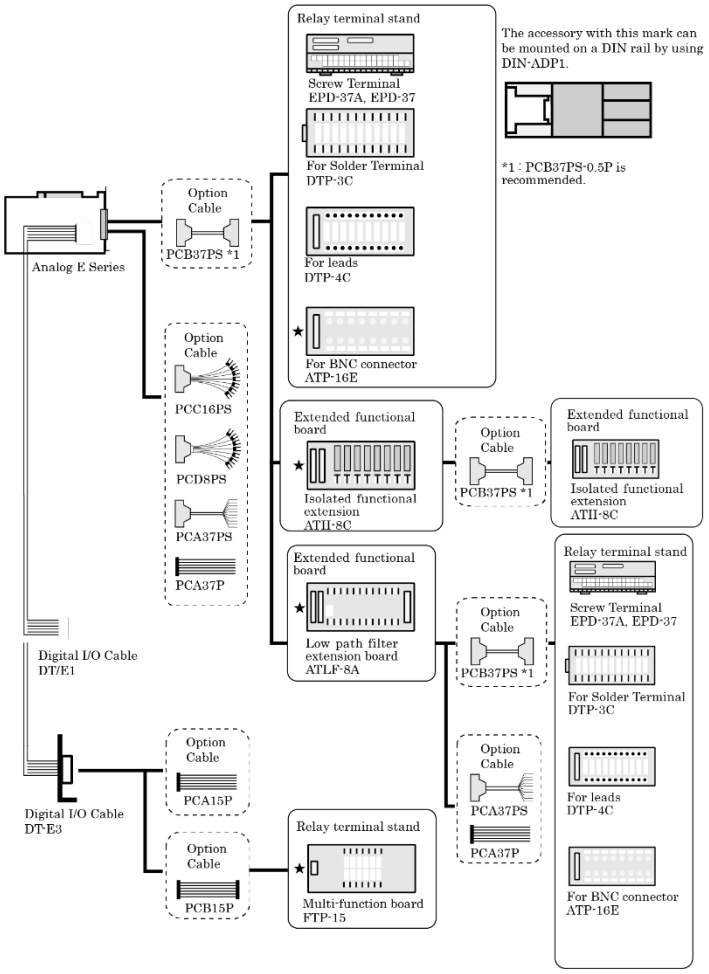
Using the On-board Connectors

Connecting a Device to a Connector
To connect an external device to this board, plug the cable from the device into the interface connector (CN1, CN2) shown below.

The board has two interface connectors: the analog I/O connector (CN1: 37-pin female D-SUB connector) and the control signal connector (CN2: 16-pin pin-header) for digital input/output and counter control.

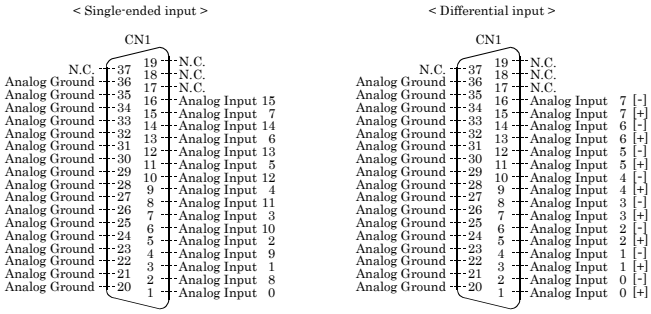


Examples of Connecting Options



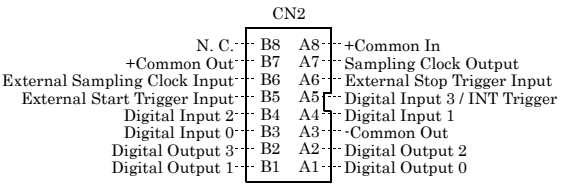
Connector Pin Assignment

Pin Assignment of CN1



Analog Input0 to Analog Input15	Analog input signal at the time of Single-Ended Input. The numbers correspond to channel numbers.
Analog Input0[+] to Analog Input15[+]	Analog input signal at the time of Differential Input. The numbers correspond to channel numbers.
Analog Input0[-] to Analog Input15[-]	Analog input signal at the time of Differential Input. The numbers correspond to channel numbers
Analog Ground	Common analog ground for analog input signals.
N.C.	No connection to this pin.

Pin Assignment of CN2



Digital Input0 to Digital Input2	Digital input signal.
Digital Input3/INT Trigger	Digital input signal. Common for interrupt trigger input signal.
Digital Output0 to Digital Out3	Digital output signal.
External Start Trigger Input	External trigger input signal for starting sampling.
External Stop Trigger Input	External trigger input signal for stopping sampling.
External Sampling Clock Input	External sampling clock input signal.
Sampling Clock Output	Sampling clock output signal
+Common In	Connect the plus side of external power supply. Common for each input channel.
+Common Out	Connect the plus side of external power supply. Common for each output channel.
-Common Out	Connect the minus side of external power supply. Common for each output channel.
N.C.	No connection to this pin.

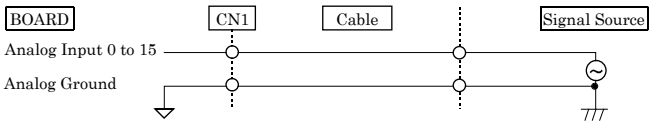
Analog Input Signal Connection

The procedure for connecting analog signals depends on whether the analog input signals are single-ended or differential. The sections below describe how to connect the signals using flat cable and shielded cable.

Single-ended Input

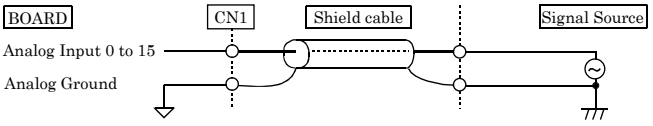
The following figure shows an example of optional flat cable (PCA37P) connection.
Connect separate signal and ground wires for each analog input channel on CN1.

Single-ended Input Connection (Flat Cable)



The following example connects a signal source to the board using a shielded cable such as a coaxial cable (PCC16PS) available as an option. 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)



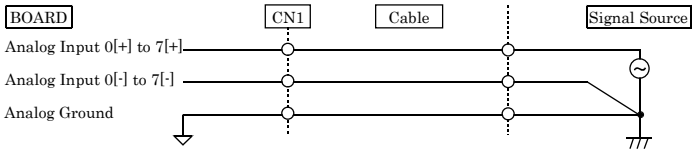
CAUTION

- If the signal source contains over 1MHz signals, the signal may affect 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.

Differential Input

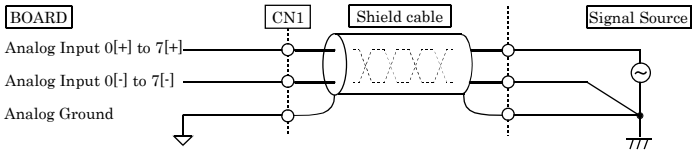
The following figure shows an example of optional flat cable (PCA37P) connection.
For each analog input channel on CN1, connect the "+" input to the signal and connect the "-" input to the signal source ground. Also connect the analog ground on the board to the signal source ground.

Differential Input Connection (Flat Cable)



The following example connects a signal source to the board using a shielded cable such as a two-conductor shielded cable (PCD8PS) available as an option. 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 "+" input to the signal and connect the "-" input to the signal source ground. Also connect the analog ground on the board and the signal source ground to the shielding.

Differential Input Connection (Shield Cable)



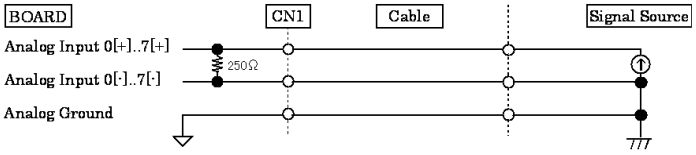
CAUTION

- If the signal source contains over 1MHz signals, the signal may affect the cross-talk noise between channels.
- When the analog ground is not connected, input data comes to be undetermined.
- 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 to both [+] and [-] input 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 [+] and [-] input channels to analog ground.

Current Input

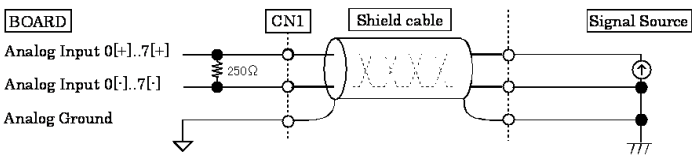
The following figure shows an example of optional flat cable (PCA37P) connection.
For each analog input channel on CN1, connect the "+" input to the signal and connect the "-" input to the signal source ground. Also connect the analog ground on the board to the signal source ground.

Current Input Connection (Flat Cable)



The following example connects a signal source to the board using a shielded cable such as a two-conductor shielded cable (PCD8PS) available as an option. 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 "+" input to the signal and connect the "-" input to the signal source ground. Also connect the analog ground on the board and the signal source ground to the shielding.

Differential Input Connection (Shield Cable)



CAUTION

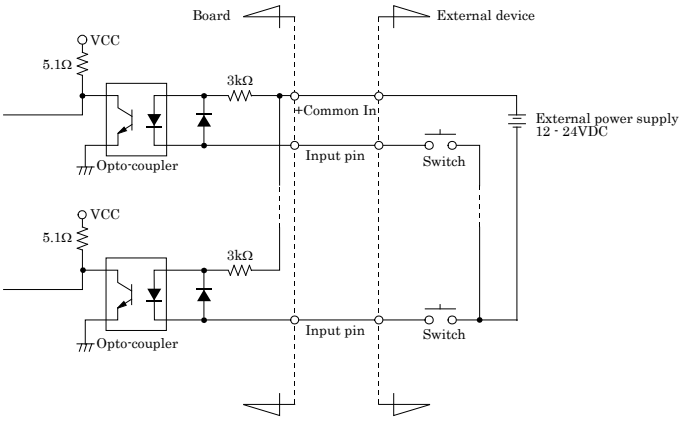
- If the signal source contains over 1MHz signals, the signal may affect the cross-talk noise between channels.
- When the analog ground is not connected, input data comes to be undetermined.
- If the board and the signal source receive noise or the distance between the board and the signal source is too long, data may not be input properly.
- Voltage of an input analog signal to both [+] and [-] input should not exceed the 1-5V (relate to the board analog ground). If it exceeds the maximum voltage, Even within the range scope, correct data input may not be possible.
- An input analog signal to both [+] and [-] input 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 [+] and [-] input channels to analog ground.

Digital I/O signals and Control signals Connection

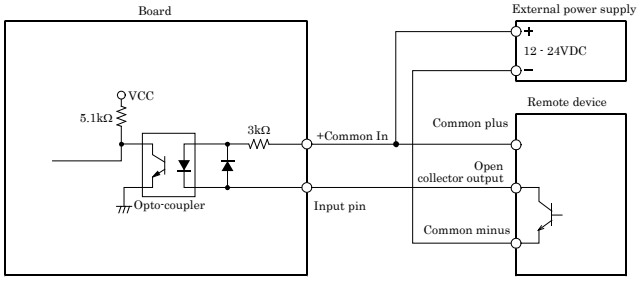
The digital I/O signals and the control signals (external trigger input signal, sampling clock output signal and so on) are interfaced through the connector CN2.
User can use an optional flat cable DT/E1 or DT-E3 (with bracket and a 15-pin D-SUB female connector) to connect these signals to your external devices.

Connecting the input signal

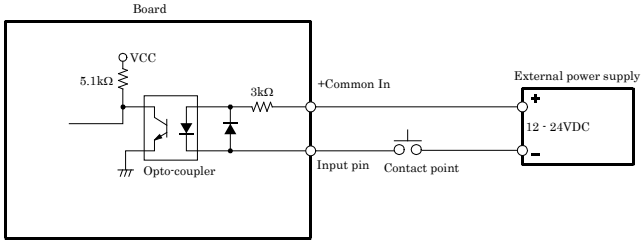
To the digital input signal and control signal (External Start Trigger Input, External Stop Trigger Input, External Sampling Clock Input) pins, connect current driven devices such as a switch and a transistor output device. Input circuit is as follows. +Common In is common to individual input signals. An external power supply is required to drive the input circuit. The power capacity required at this time is about 8 mA per input channel at 24 VDC (or about 4 mA at 12 VDC).



Example of connection of open collector output (current sink type)



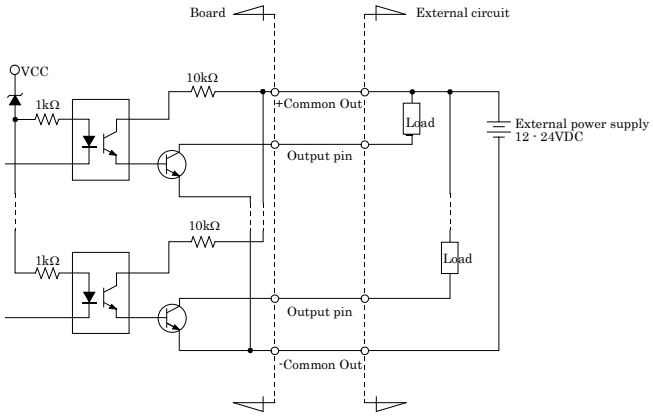
Example of connection to mechanical contact



In the above example, the input signal and data (internal logic) on the PC have the following relationships.

Internal logic	Contact point	Input pin voltage level
0	OFF	High
1	ON	Low

Connecting the output signal
To the digital output signal and control signal (Sampling Clock Output) pins, connect a relay controller or a current driven control device such as a LED. Output circuit is as follows. +Common Out / -Common Out is common to individual output signals. Output current rating is 100 mA (Max.) per 1 point and 2 A per 1 common.
The output transistor is not associated with a surge voltage protection circuit. When the output signal is used to drive the inductive load to a relay or lamp, apply surge protection to the load side.



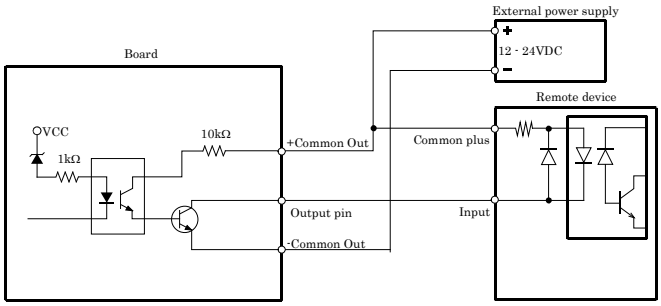
Internal logic and output signal

Internal logic	Output transistor	Output signal
0	OFF	High
1	ON	Low

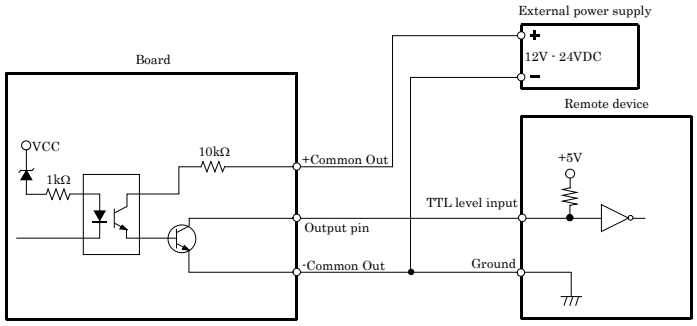
CAUTION

- For using the sampling clock output signal, set the sampling clock to at least 4 milliseconds, or normal output may not be obtained.

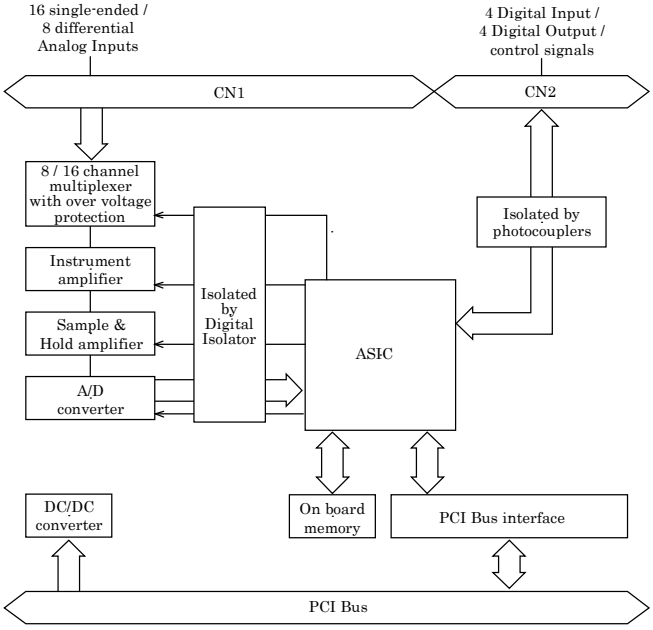
Example connection to current sink input



Example of connection to TTL level input (with pull-up resistor)



Block Diagram



Differences between AI-1216I2-PCI and ADI12-16(PCI)

This product supersedes the ADI 12-16 (PCI) but it can be used basically in the same way as the existing product.
The differences in the specifications are listed below.

	AI-1216I2-PCI	ADI12-16(PCI)
About the board name to be displayed	ADI12-16(PCI) *1	ADI12-16(PCI)
Supportive environment	RoHS Directive compliant product	Lead reduced product
Current consumption.	5V 700mA	5V 1200mA
Board body weight	150g	160g

*1 The board name "ADI12-16 (PCI)" will be displayed even after installing this product.
The product runs without problems even with the displayed board name "ADI12-16 (PCI)".