## 64 Channel Analog to Digital Input Board for PCI
# AD12-64(PCI)



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

AD12-64(PCI) are PCI-compliant interface boards that convert analog input signals to digital equivalents (performing analog-to-digital conversion).

AD12-64(PCI) can perform A-D conversion at a conversion speed of 10μsec [100KSPS] per channel and a resolution of 12bit.

Windows/Linux device driver is supported with this product.

* 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 July, 2024.

## Features

- **Multi-channel analog input**
< AD12-64(PCI) > can perform an analog input of single-ended input 64 channels and differential input 32 channels.
Selection of single-ended input and differential input can be set up by the device driver function.

- **Input range setup by device driver function**
Input range can be selected for each channel from the following ranges and can be set up by the device driver function.
±10V, ±5V, ±2.5V, ±1.25V, 0 - +10V, 0 - +5V, 0 - +2.5V, 0 - +1.25V

- **Sampling control function**
The board can perform sampling either at arbitrary timings under control of software or periodically in synchronization with a sampling clock signal. The sampling clock signal can be selected between the internal one based on the on-board clock generator and the external one using a digital signal input from an external source.

- **Windows/Linux support device driver**
Using the device driver API-TOOL makes it possible to create applications of Windows/Linux. In addition, a diagnostic program by which the operations of hardware can be checked is provided.

- **Digital input/output function**
The board has four digital input and four digital output pins for TTL-level signals, allowing an external device to be monitored and controlled.

- **Optional units**
Using optional units facilitates connections.
For more details on the option, please refer to "Optional Products".

## Included Items

Product ...1
Please read the following...1

## Specifications

### Function specification

| Item | | Specification |
|---|---|---|
| Analog input | | |
| | Isolated specification | Un-Isolated |
| | Input type | Single-Ended Input or Differential Input |
| | Number of input channels | 64 channels (Single-Ended Input) <br> 32 channels (Differential Input) |
| | Input range | Bipolar ±10V, ±5V, ±2.5V, ±1.25V, <br> or Unipolar 0 - +10V, 0 - +5V, 0 - +2.5V, 0 - +1.25V <br> (Software setup per channel) |
| | Absolute max. input voltage | ±15V |
| | Input impedance | 1MΩ or more |
| | Resolution | 12bit |
| | Non-Linearity error *1 | ±2LSB(±10V, ±5V, 0 - 10V, 0 - 5V) <br> ±4LSB(±2.5V, ±1.25V, 0 - 2.5V) <br> ±8LSB(0 - 1.25V) |
| | Conversion speed | 10μsec [100KSPS]*2 /ch (Max.) |
| | Sampling clock | Internal sampling clock: 10,000 - 1,073,741,824,000nsec (Settable in 250 nsec) <br> External sampling clock: TTL level falling edge |
| Digital I/O | | |
| | Number of input channels | Un-Isolated input 4ch (TTL level, positive logic) |
| | Number of output channels | Un-Isolated output 4ch (TTL level, positive logic) |
| Programmable timer | | |
| | Setting period | 500 - 1,073,741,824,000nsec (Settable in 250 nsec) |
| | Status | Count up, Count up over run |
| | Timer output signal | TTL level 250nsec Low pulse |
| External trigger input | | |
| | External trigger input signal | Un-Isolated input 1ch (TTL level falling edge) |
| | Status | Trigger input, Trigger input overrun |
| Common section | | |
| | I/O address | 32 ports boundary |
| | Interrupt level | Errors and various factors, One interrupt request line as INTA |
| | Current consumption | +5VDC   700mA (Max.) *3 |
| | Operating condition | 0 - 50°C, 10 - 90%RH (No condensation) |
| | Bus specification | 32bit, 33MHz, Universal key shapes supported *4*5 |
| | Physical dimensions (mm) | 176.41(L) x 105.68(H) *6 |
| | Weight | 150g |

*1    A linearity error approximately 0.1% of full-range may occur when operated at 0ºC or 50ºC ambient temperature

*2    SPS = Samplings Per Second. The number of data that can be converted in one second is shown.

*3    If an external device requires this AD12-64(PCI) product to supply +5VDC from the CN1 or CN2 connectors, the power consumption of this product will be bigger than what this specification has defined.

*4   This product requires +5V power supply from expansion slots (it does not operate in the environment of only +3.3V power supply).

*5   AD12-64(PCI): If the board No. is No.7149A, PCI bus specification is 32bit, 33MHz, 5V.

*6   Boards with different board numbers are different in these specifications.　See "Different in the specification " at the end of this document.

## Installation Environment Requirements

| Item | Description |
|---|---|
| Operating ambient temperature | 0 - 50℃ |
| Operating ambient humidity | 10 - 90%RH (No condensation) |
| Floating dust particles | Not to be excessive |
| Corrosive gases | None |
| Standard | VCCI Class A, CE Marking (EMC Directive Class A, RoHS Directive), UKCA, KC |

## Physical Dimensions

176.41(L)
105.68(H)
[mm]
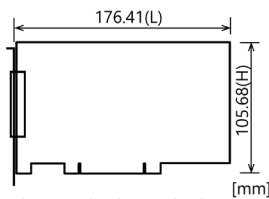
The standard outside dimension (L) is the distance from the end of the board to the outer surface of the slot cover.

## Support Software

| Name | Contents | How to get |
|---|---|---|
| Windows version High-efficiency Analog I/O Driver API-AIO(WDM) | The API-AIO(WDM) is the Windows version driver 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. | Download from the CONTEC website *1 |
| Analog I/O Driver for Linux API-AIO(LNX) | This is the Linux version driver software provided in API function formats. The software includes various sample programs such as gcc (C, C++) and Python programs. | Download from the CONTEC website *1 |
| Software Development Tool Kits (SDK) and Support Software | In addition to the device drivers, we offer many software programs for using CONTEC devices in an easier manner. | Download from the CONTEC website *2 |

*1 Download the files from the following URL.

   https://www.contec.com/download/

*2 For supported software, search the CONTEC website for this product and view the product page.

   https://www.contec.com/

## Optional Products

| Product Name | Model type | Description |
|---|---|---|
| Shielded Cable with Two 96-Pin Half-Pitch Connectors | PCB96PS-0.5P | 0.5m |
| | PCB96PS-1.5P | 1.5m |
| Flat Cable with 96-pin Half-Pitch Connectors at Both Ends | PCB96P-1.5 | 1.5m |
| Shielded Cable with One 96-pin Half-Pitch Connector | PCA96PS-0.5P | 0.5m |
| | PCA96PS-1.5P | 1.5m |
| Flat Cable with One 96-pin Half-Pitch Connector | PCA96P-1.5 | 1.5m |
| Screw Terminal (M3 * 96) | EPD-96A | *1*2 |
| Terminal Unit for Relay Terminal Banks | EPD-96 | *1 |
| Screw Terminal | DTP-64A | *1 |

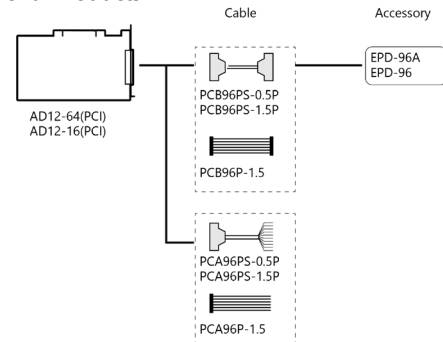*1   PCB96P-0.5P or PCB96PS-0.5P optional cable is required separately.

*2   "Spring-up" type terminal is used to prevent terminal screws from falling off.

Visit the CONTEC website for the latest optional products.

## Connecting an Interface Connector

Interface connector (CN1)

B48
B47
A48
A47
B02
B01
A02
A01

- Connector used
  PCR-E96LMD equivalent
  (mfd. by HONDA TSUSHIN KOGYO CO., LTD)
- Applicable connectors
  PCR-E96FA equivalent
  (mfd. by HONDA TSUSHIN KOGYO CO., LTD)
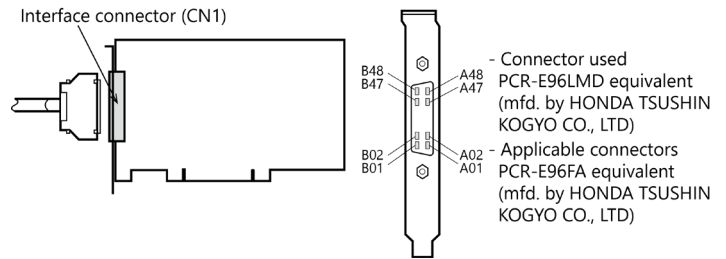
## Adding Optional Products

Cable          Accessory

AD12-64(PCI)
AD12-16(PCI)

PCB96PS-0.5P
PCB96PS-1.5P

PCB96P-1.5

PCA96PS-0.5P
PCA96PS-1.5P

PCA96P-1.5

EPD-96A
EPD-96

## Layout on the Interface Connector(CN1)
## Single-Ended Input

| Signal | Pin | | | Pin | Signal |
|---|---|---|---|---|---|
| Analog Input 63 | B48 | | | A48 | Analog Input 59 |
| Analog Input 55 | B47 | | | A47 | Analog Input 51 |
| Analog Input 62 | B46 | | | A46 | Analog Input 58 |
| Analog Input 54 | B45 | | | A45 | Analog Input 50 |
| Analog Input 61 | B44 | | | A44 | Analog Input 57 |
| Analog Input 53 | B43 | | | A43 | Analog Input 49 |
| Analog Input 60 | B42 | | | A42 | Analog Input 56 |
| Analog Input 52 | B41 | | | A41 | Analog Input 48 |
| Analog Ground | B40 | | | A40 | Analog Ground |
| Analog Ground | B39 | | | A39 | Analog Ground |
| Analog Input 47 | B38 | [49] | [1] | A38 | Analog Input 43 |
| Analog Input 39 | B37 | B48 | A48 | A37 | Analog Input 35 |
| Analog Input 46 | B36 | | | A36 | Analog Input 42 |
| Analog Input 38 | B35 | | | A35 | Analog Input 34 |
| Analog Input 45 | B34 | | | A34 | Analog Input 41 |
| Analog Input 37 | B33 | | | A33 | Analog Input 33 |
| Analog Input 44 | B32 | | | A32 | Analog Input 40 |
| Analog Input 36 | B31 | | | A31 | Analog Input 32 |
| Analog Ground | B30 | | | A30 | Analog Ground |
| Analog Ground | B29 | | | A29 | Analog Ground |
| Analog Input 31 | B28 | | | A28 | Analog Input 27 |
| Analog Input 23 | B27 | | | A27 | Analog Input 19 |
| Analog Input 30 | B26 | | | A26 | Analog Input 26 |
| Analog Input 22 | B25 | | | A25 | Analog Input 18 |
| Analog Input 29 | B24 | | | A24 | Analog Input 25 |
| Analog Input 21 | B23 | | | A23 | Analog Input 17 |
| Analog Input 28 | B22 | | | A22 | Analog Input 24 |
| Analog Input 20 | B21 | | | A21 | Analog Input 16 |
| Analog Ground | B20 | | | A20 | Analog Ground |
| Analog Ground | B19 | | | A19 | Analog Ground |
| Analog Input 15 | B18 | | | A18 | Analog Input 11 |
| Analog Input 7 | B17 | | | A17 | Analog Input 3 |
| Analog Input 14 | B16 | | | A16 | Analog Input 10 |
| Analog Input 6 | B15 | | | A15 | Analog Input 2 |
| Analog Input 13 | B14 | | | A14 | Analog Input 9 |
| Analog Input 5 | B13 | | | A13 | Analog Input 1 |
| Analog Input 12 | B12 | | | A12 | Analog Input 8 |
| Analog Input 4 | B11 | B01 | A01 | A11 | Analog Input 0 |
| Analog Ground | B10 | [96] | [48] | A10 | Analog Ground |
| Analog Ground | B09 | | | A09 | Analog Ground |
| +5VDC from PC | B08 | | | A08 | External Sampling Clock Input |
| +5VDC from PC | B07 | | | A07 | Digital Ground |
| Sampling Busy Output | B06 | | | A06 | External Trigger Input |
| Timer Output | B05 | | | A05 | Digital Ground |
| Digital Output 3 | B04 | | | A04 | Digital Input 3 |
| Digital Output 2 | B03 | | | A03 | Digital Input 2 |
| Digital Output 1 | B02 | | | A02 | Digital Input 1 |
| Digital Output 0 | B01 | | | A01 | Digital Input 0 |

- The numbers in square brackets [ ] are pin numbers designated by HONDA TSUSHIN KOGYO CO.

| Signal name | Description |
|---|---|
| Analog Input 0 - Analog Input 63 | Analog input signal at the time of single-ended input. The numbers correspond to channel numbers. |
| Analog Ground | Common analog ground for analog input signals. |
| Digital Input 0 - Digital Input 3 | Digital input signal. |
| Digital Output 0 - Digital Output 3 | Digital output signal. |
| External Trigger Input | External trigger input signal. |
| External Sampling Clock Input | External sampling clock input signal. |
| Timer Output | Programmable timer output signal. |
| Sampling Busy Output | Output signal indicating that the board is performing AD conversion. |
| +5VDC from PC | Output +5V. The total current-carrying capacity that can be supplied from two pins is 1A. |
| Digital Ground | Digital ground common to those signals other than analog input signals, such as digital I/O signals and external sampling clock input signals, and "+5V DC from PC". |

| Sampling Busy Output | Output signal indicating that the board is performing AD conversion. |
|---|---|
| +5VDC from PC | Output +5V.　The total current-carrying capacity that can be supplied from two pins is 1A |
| Digital Ground | Digital ground common to those signals other than analog input signals, such as digital I/O signals and external sampling clock input signals, and "+5V DC from PC". |

⚠ 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.

⚠ 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.

## Differential Input

| Signal name (B) | Pin | Pin | Signal name (A) |
|---|---|---|---|
| Analog Input 31 [-] | B48 | A48 | Analog Input 27 [-] |
| Analog Input 31[+] | B47 | A47 | Analog Input 27 [+] |
| Analog Input 30 [-] | B46 | A46 | Analog Input 26 [-] |
| Analog Input 30[+] | B45 | A45 | Analog Input 26 [+] |
| Analog Input 29 [-] | B44 | A44 | Analog Input 25 [-] |
| Analog Input 29[+] | B43 | A43 | Analog Input 25 [+] |
| Analog Input 28 [-] | B42 | A42 | Analog Input 24 [-] |
| Analog Input 28[+] | B41 | A41 | Analog Input 24 [+] |
| Analog Ground | B40 | A40 | Analog Ground |
| Analog Ground | B39 | A39 | Analog Ground |
| Analog Input 23 [-] | B38 | A38 | Analog Input 19 [-] |
| Analog Input 23[+] | B37 | A37 | Analog Input 19 [+] |
| Analog Input 22 [-] | B36 | A36 | Analog Input 18 [-] |
| Analog Input 22[+] | B35 | A35 | Analog Input 18 [+] |
| Analog Input 21 [-] | B34 | A34 | Analog Input 17 [-] |
| Analog Input 21[+] | B33 | A33 | Analog Input 17 [+] |
| Analog Input 20 [-] | B32 | A32 | Analog Input 16 [-] |
| Analog Input 20[+] | B31 | A31 | Analog Input 16 [+] |
| Analog Ground | B30 | A30 | Analog Ground |
| Analog Ground | B29 | A29 | Analog Ground |
| Analog Input 15 [-] | B28 | A28 | Analog Input 11 [-] |
| Analog Input 15[+] | B27 | A27 | Analog Input 11 [+] |
| Analog Input 14 [-] | B26 | A26 | Analog Input 10 [-] |
| Analog Input 14[+] | B25 | A25 | Analog Input 10 [+] |
| Analog Input 13 [-] | B24 | A24 | Analog Input 9 [-] |
| Analog Input 13[+] | B23 | A23 | Analog Input 9 [+] |
| Analog Input 12 [-] | B22 | A22 | Analog Input 8 [-] |
| Analog Input 12[+] | B21 | A21 | Analog Input 8 [+] |
| Analog Ground | B20 | A20 | Analog Ground |
| Analog Ground | B19 | A19 | Analog Ground |
| Analog Input 7 [-] | B18 | A18 | Analog Input 3 [-] |
| Analog Input 7[+] | B17 | A17 | Analog Input 3 [+] |
| Analog Input 6 [-] | B16 | A16 | Analog Input 2 [-] |
| Analog Input 6[+] | B15 | A15 | Analog Input 2 [+] |
| Analog Input 5 [-] | B14 | A14 | Analog Input 1 [-] |
| Analog Input 5[+] | B13 | A13 | Analog Input 1 [+] |
| Analog Input 4 [-] | B12 | A12 | Analog Input 0 [-] |
| Analog Input 4[+] | B11 | A11 | Analog Input 0 [+] |
| Analog Ground | B10 | A10 | Analog Ground |
| Analog Ground | B09 | A09 | Analog Ground |
| +5VDC from PC | B08 | A08 | External Sampling Clock Input |
| +5VDC from PC | B07 | A07 | Digital Ground |
| Sampling Busy Output | B06 | A06 | External Trigger Input |
| Timer Output | B05 | A05 | Digital Ground |
| Digital Output 3 | B04 | A04 | Digital Input 3 |
| Digital Output 2 | B03 | A03 | Digital Input 2 |
| Digital Output 1 | B02 | A02 | Digital Input 1 |
| Digital Output 0 | B01 | A01 | Digital Input 0 |

(Connector diagram: [49] B48 / [1] A48 — B01 [96] / A01 [48])

- The numbers in square brackets [ ] are pin numbers designated by HONDA TSUSHIN KOGYO CO.

| Signal name | Description |
|---|---|
| Analog Input 0[+] - Analog Input 31[+] | Analog input signal at the time of differential input. The numbers correspond to channel numbers. |
| Analog Input 0[-] - Analog Input 31[-] | Analog input signal at the time of differential input. The numbers correspond to channel numbers. |
| Analog Ground | Common analog ground for analog input signals. |
| Digital Input 0 - Digital Input 3 | Digital input signal. |
| Digital Output 0 - Digital Output 3 | Digital output signal. |
| External Trigger Input | External trigger input signal. |
| External Sampling Clock Input | External sampling clock input signal. |
| Timer Output | Programmable timer output signal. |

## Connecting Analog Input Signal

### Single-ended Input
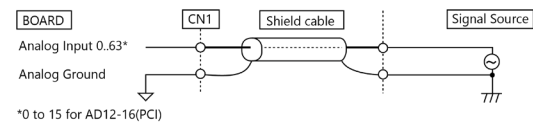**Single-ended Input Connection (Flat Cable)**
The following figure shows an example of flat cable connection. Each signal source is connected to one analog input channel and the signal common to analog ground pin of CN1.
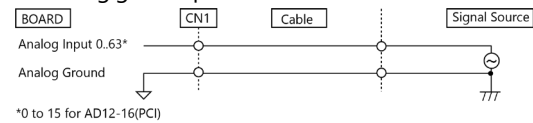


*0 to 15 for AD12-16(PCI)

### Single-ended Input Connection (Shielded Cable)
The following figure shows an example of shielded cable connection. When the distance between the signal source and the product is long or you want to increase the noise tolerance, a shield cable is suggested.

Connect the signal by the core wire and common signal by the shield braids.


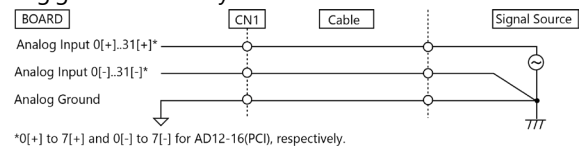
*0 to 15 for AD12-16(PCI)

⚠ CAUTION

- When a frequency of 1MHz or higher is contained in the source signal, the cross talk between channels may occur.
- 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.

### Differential Input
**Differential Input Connection (Flat Cable)**
The following figure shows an example of flat cable connection.

Each signal source is connected to a [+] pin of analog input channel and the signal common of this source to the [-] pin of this input channel of CN1. In addition, the signal common must be connected to the pin of the analog ground of CN1 by a third wire.



*0[+] to 7[+] and 0[-] to 7[-] for AD12-16(PCI), respectively.

### Differential Input Connection (Shielded Cable)
The following figure shows an example of shielded cable connection. When the distance between the signal source and the product is long or you want to increase the noise tolerance, a shield cable connection is preferred.　Each signal source is connected to a [+] pin of analog input channel and the signal common of this source to the [-] pin of this input channel of CN1.　In addition, the signal common must be connected to the pin of the analog ground of CN1 by the shielded braids.
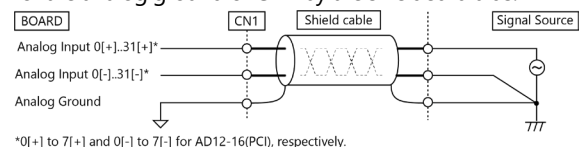


*0[+] to 7[+] and 0[-] to 7[-] for AD12-16(PCI), respectively.

## ⚠ CAUTION

- When a frequency of 1MHz or higher is contained in the source signal, the cross talk between channels may occur.

- The input data would be uncertain if the analog ground is not connected.

- 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.

- The input voltage from the [+] input or [-] input should not exceed the maximum input voltage (based on the product analog ground). If it exceeds the maximum voltage, the product may be damaged.

- Because the input data will be uncertain if the [+] pin or the [-] pin of CN1 is not connected, all the unused input pins of CN1 should be connected to the analog ground, AGND.

## Connecting Digital I/O Signals

This section shows how to connect the digital I/O signal and control signal ("External Sampling Clock Input", "External Trigger Input" and so on) by using a flat cable. Connect CN1 to the external device by using the optional flat cable (PCA96P-1.5).

All the digital I/O signals and control signals are TTL level signals.
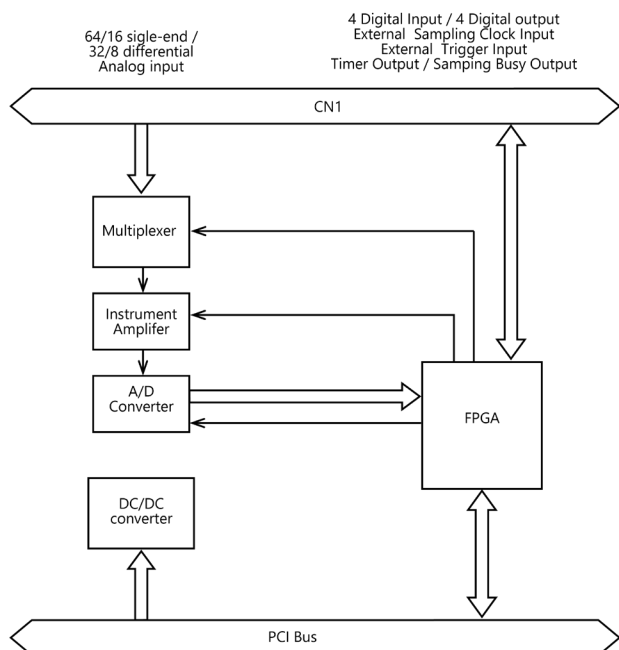
### Connecting the Digital Input

### Connecting the Digital Output

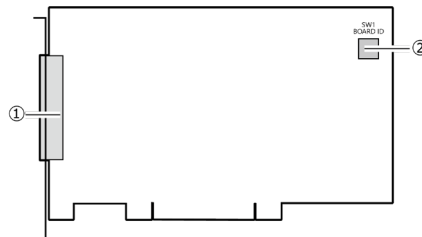| BOARD | | CN1 | Cable | | Target |

Digital Output — $I_{OL}$ = 24mA
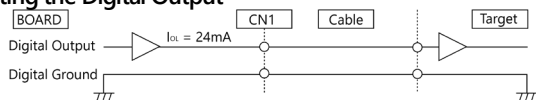
Digital Ground

## ⚠ CAUTION

Do not short the outputs to analog or digital ground. In addition, do not connect two outputs together. Doing either can result in a fault.

## Circuit Block Diagram

64/16 sigle-end /
32/8 differential
Analog input

4 Digital Input / 4 Digital output
External Sampling Clock Input
External Trigger Input
Timer Output / Samping Busy Output

CN1

Multiplexer

Instrument Amplifer

A/D Converter

FPGA

DC/DC converter

PCI Bus

## Component Name

| No. | Name |
|-----|------|
| 1 | Interface Connector (page) |
| 2 | Board ID Setting Switch |

## Different by board number

The AD12-64(PCI) are different in specifications, depending on the board number as listed below.

### Different in the specification

| Board No. | No.7149A | No.7149B | No.7149D |
|-----------|----------|----------|----------|
| Physical dimensions (mm) | 176.41(L) x 106.68(H) | 176.41(L) x 106.68(H) | 176.41(L) x 105.68(H) |