Bus master transfer / multi functions AIO card for CardBus

ADA16-32/2(CB)F

With Driver Library [API-PAC(W32)]

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

This card is a multi-function PC Card containing analog inputs, analog outputs, digital inputs, digital outputs, and counters.
The card is a Type II size PC Card Standard CardBus card.
The PC Card includes an event controller for integrated management of control signals by hardware and a bus master data transfer function for transferring large volumes of data at high speed. Together, these features provide all you need to build a high-performance PC-based measurement and control system.
You can use the driver library (API-PAC(W32)) supplied with the PC Card to write Windows application programs in any programming language (such as Visual Basic, Visual C++, etc.) that supports the calling of Win32 API functions.
It 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 board also supports MATLAB and LabVIEW.

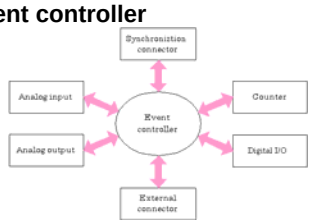
Limitations
If your PC has two TYPE II size PC Card slots one on top of the other, you cannot use ADA16-32/2(CB)F cards in both slots at the same time. This is because of the shape of the cable connector. However, you can use the ADA16-32/2(CB)F together with another PC Card that does not require an external connector such as a memory card.

Features

Multi-function
The PC Card contains analog inputs (16-bit, 32ch), analog outputs (16-bit, 2ch), digital inputs (4ch), digital outputs (4ch), and counters (32-bit binary, 1ch). Combining all these features on one PC Card allows complex systems to be implemented even on PCs with few spare expansion slots.

The event controller can be used to implement a wide range of different sampling control schemes
The PC Card incorporates an event controller for integrated hardware control. The event controller can use the external control signals and the events generated by the PC Card functions to start and stop analog input operation and perform clock control. This enables high-precision synchronization of the various PC Card functions without requiring software. Also, each function can be operated separately.

Overview of event controller



The arrows in the figure indicate the flow of control signals.
The main control signals included clock signals and the operation start and stop signals.
Example 1: Synchronize the timing of analog input and analog output based on an external clock signal.
Example 2 Start analog input operation each time the counter reaches a preset value.

Bus master transfer function and combined data I/O function
Bus master data transfer can be used for the analog inputs and outputs either separately or at the same time. This can be used to transfer large volumes of data between the PC Card and PC without placing a load on the CPU.
When using bus master data transfer for analog input data, you can also transfer the analog output, digital input, digital output, and counter data at the same time synchronized with the analog input clock signal.
This function ensures reliable data synchronization in the systems you implement.

Buffer memory available for background processing independent of software
The analog inputs and outputs each have their own buffer memory which can be used when not using bus master transfer. You can also perform analog input and output in the background, independent of software and the current status of the PC.

Software-based calibration function
Calibration of analog input/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.

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.

The same systems can be implemented on either desktop or notebook PCs
The "Analog F Series" PC Cards (ADA16-32/2(PCI)F and ADA16-32/2(CB)F) have equivalent functionality.
Systems developed on a desktop PC can be ported directly to a notebook PC with minimal changes.

Supported to the data logger software [C-LOGGER]
Supporting the data logger software [C-LOGGER] that enables the graph display of recorded signal data, file saving, and dynamic transfer to the spreadsheet software program “Excel”

Plug-ins for the dedicated libraries, the board 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.
These dedicated libraries are available, free of charge (downloadable), on our web site.

Specification

Item		Specification
Analog input		
	Isolated specification	Un-Isolated
	Input type	Single-Ended Input or Differential Input
	Number of input channels	32ch (Single-Ended Input) 16ch (Differential Input)
	Input range	Bipolar ±10V
	Absolute max. input voltage	±13V
	Input impedance	1MΩ or more
	Resolution	16bit
	Non-Linearity error *1*2	±5LSB
	Conversion speed	2μsec/ch (Max.)
	Buffer memory	64k Word FIFO or 64k Word RING
	Conversion start trigger	Software, conversion data compare, external trigger, and event controller output.
	Conversion stop trigger	Settings include data save complete, conversion data compare, external trigger, event controller output, and software.
	External start signal	LVTTL level (Rising or falling edge can be selected by software)
	External stop signal	LVTTL level (Rising or falling edge can be selected by software)
	External clock signal	LVTTL level (Rising or falling edge can be selected by software)
	External status output signal	2 LVTTL level Sampling clock output
Analog output		
	Isolated specification	Un-Isolated
	Number of output channels	2ch
	Output impedance	Bipolar ±10V
	Output current ability	±5mA
	Output impedance	1Ω or less
	Resolution	16bit
	Non-Linearity error *1	±3LSB
	Conversion speed	10μsec (Max.)
	Buffer memory	64k Word FIFO or 64k Word RING
	Conversion start trigger	Software, external trigger, and event controller output.
	Conversion stop trigger	Settings include data save complete, external trigger, event controller output, and software.
	External start signal	LVTTL level (Rising or falling edge can be selected by software)
	External stop signal	LVTTL level (Rising or falling edge can be selected by software)
	External clock signal	LVTTL level (Rising or falling edge can be selected by software)
	External status output signal	2 LVTTL level Sampling clock output
Digital I/O		
	Number of input channels	Un-Isolated input 4ch (LVTTL level positive logic)
	Number of output channels	Un-Isolated output 4ch (LVTTL level positive logic)
Counter		
	Number of channels	1ch
	Counting system	Up count
	Max. count	FFFFFFFFh(Binary data,32bit)
	Number of external inputs	2 LVTTL levels (Gate/Up)/ch Gate (High level), Up (Rising edge)
	Number of external outputs	LVTTL level 1 output/ch Count match output (positive logic, pulse output)
	Response speed *2	10MHz (Max.)
Bus master section		
	DMA channels	2ch (one each for input and output)
	Transfer bus width	32bit
	Transfer data length	8 PCI Words length (Max.)
	FIFO	1K-Word/ch
	Scatter/Gather function	64M-Byte/ch
Common section		
	I/O address	64 ports x 1, 256 ports x 1 Boundary
	Interruption level	1 level use
	Connector	96-pin half pitch connector [M (male) type] PCR-96LMD [HONDA TSUSHIN KOGYO CO., LTD.] or equivalent
	Power consumption	3.3VDC 600mA (Max.)
	Operating condition	0 - 50°C, 10 - 90%RH (No condensation)
	PC Card slot specifications	PC Card Standard CardBus
	Dimension (mm)	85.6(W) x 54.0(D) x 5.0(H) TYPE II
	Weight	80g

*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.
The error can be reduced by calibrating under the actual temperature conditions.

*2 However, it is the case that not use the digital filter.

Support Software

Windows version of analog I/O driver API-AIO(WDM) [Stored on the bundled CD-ROM driver library API-PAC(W32)]

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.

< Operating environment >

OS Windows 7, Server 2008, Vista, XP, Server 2003, 2000

Adaptation language Visual Basic, Visual C++, Visual C#, Delphi, C++ Builder

You can download the updated version from the CONTEC's Web site (http://www.contec.com/apipac/). 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) [Stored on the bundled CD-ROM 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.

< Operating environment >

OS RedHatLinux, TurboLinux
(For details on supported distributions, refer to Help available after installation.)

Adaptation language gcc

You can download the updated version from the CONTEC's Web site (http://www.contec.com/apipac/). For more details on the supported OS, applicable language and new information, please visit the CONTEC's Web site.

Data Logger Software C-LOGGER [Stored on the bundled CD-ROM driver library API-PAC(W32)]

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 7, Vista, XP, Server 2003, 2000

Data Acquisition library for MATLAB ML-DAQ (Available for downloading (free of charge) from 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 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.
See http://www.contec.com/vidaq/ for details and download of VI-DAQ.

Cable & Connector

Cable (Option)

Shielded cables with single-ended connector for 68-pin half-pitch connector
: PCA68PS-0.5P (0.5m)
: PCA68PS-1.5P (1.5m)

Shielded Cable with 68-Pin Half-Pitch Connectors at Both Ends
: PCB68PS-0.5P (0.5m)
: PCB68PS-1.5P (1.5m)

68/96-pin conversion shielded cable for analog input/output
: ADC-68M/96F (0.5m)

Accessories

Accessories (Option)

Buffer Amplifier Box
for Analog Input Boards (32ch type) : ATBA-32F *1*2
Buffer Amplifier Box
for Analog Input Boards (8ch type) : ATBA-8F *1*2*3
Terminal Unit for Cables (M3 x 96P) : DTP-64A *1
Terminal Unit for Cables (M2.5 x 96P) : DTP-64(PC) *1
Screw Terminal Unit (M3 x 68P) : EPD-68A *5*6
Screw Terminal Unit (M3 x 96P) : EPD-96A *1*6
Screw Terminal Unit (M3.5 x 96P) : EPD-96 *1
BNC Terminal Unit (for analog input 32ch) : ATP-32F *1
BNC Terminal Unit (for analog input 8ch): ATP-8 *1*3*4

*1 ADC-68M/96F optional cable is required separately.
*2 An external power supply is necessary (optional AC adaptor POA200-20 prepared.)
*3 The analog input could have 8 channels to be used.
*4 The digital input can be used up to four points, the digital output up to four points and the counter I/O up to 1 channel.
*5 PCB68PS-0.5P optional cable is required separately.
*6 "Spring-up" type terminal is used to prevent terminal screws from falling off.

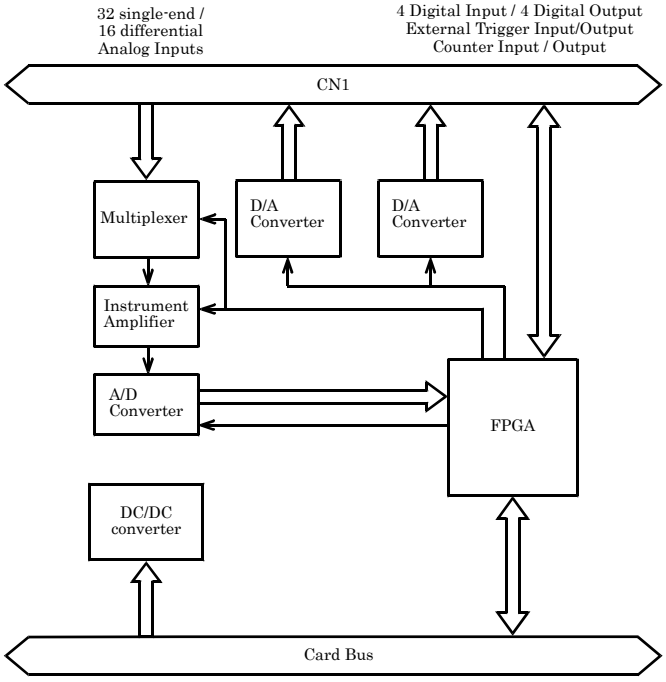
* Check the CONTEC's Web site for more information on these options.

Packing List

PC Card [ADA16-32/2(CB)F] …1
First step guide … 1
CD-ROM *1 [API-PAC(W32)]…1

*1 The CD-ROM contains the driver software and User's Guide.

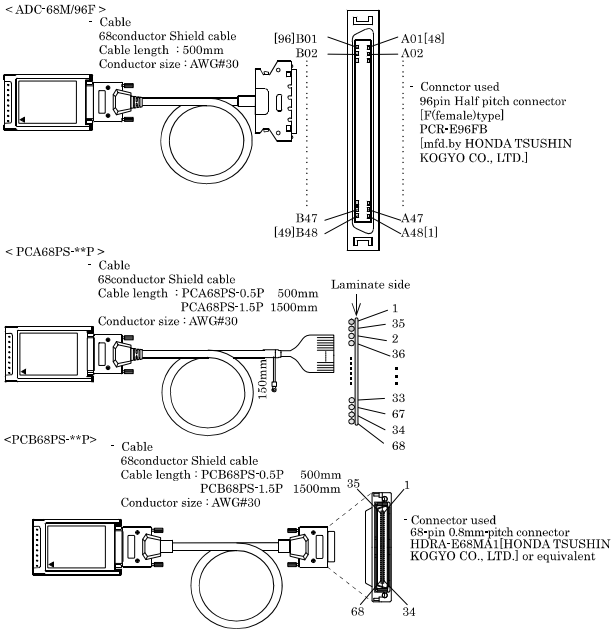
Block Diagram



How to connect the connectors

Connector shape

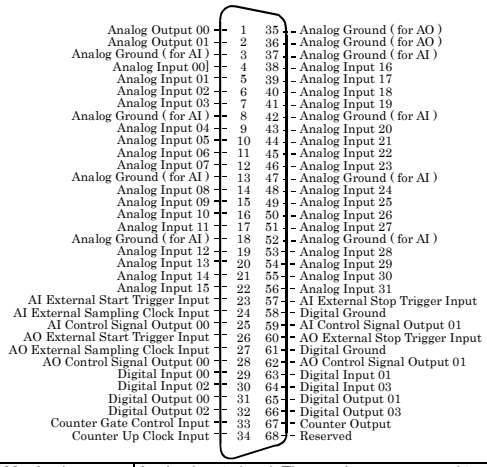
An optional connection cable (ADC-68M/96F or PCA68PS-**P) is used to connect the PC Card to external devices. Use these cables in conjunction with a terminal block and so on to connect external devices.



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

Connector Pin Assignment < Single-Ended Input >

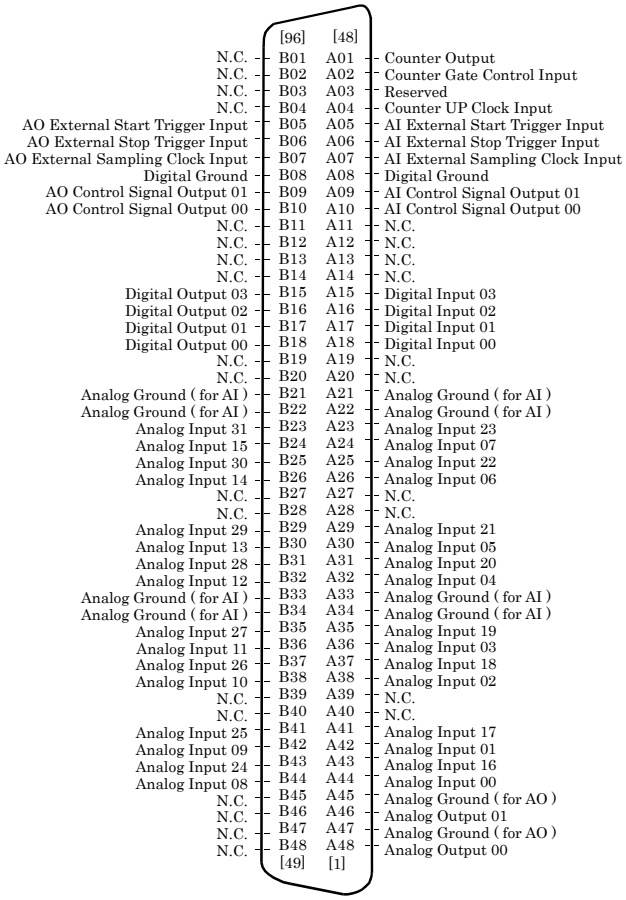
Pin assignment of ADA16-32/2(CB)F interface connector < Single-Ended Input >



Analog Input00 - Analog Input31	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.
AI Control Signal Output 00	External sampling clock output signal for analog input.
AI Control Signal Output 01	External output signal for analog input status. Not currently connected.
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.
AO Control Signal Output 00	External sampling clock output signal for analog output.
AO Control Signal Output 01	External output signal for analog output status. Not currently connected.
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	Count match output signal for counter.
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

Pin assignment of ADC-68M/96F < Single-Ended Input >

CN1



- [ ] shows the pin No. specified by HONDA TSUSHIN KOGYO Co., Ltd.

Analog Input00 - Analog Input31	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.
AI Control Signal Output 00	External sampling clock output signal for analog input.
AI Control Signal Output 01	External output signal for analog input status. Not currently connected.
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.
AO Control Signal Output 00	External sampling clock output signal for analog output.
AO Control Signal Output 01	External output signal for analog output status. Not currently connected.
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	Count match output signal for counter.
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

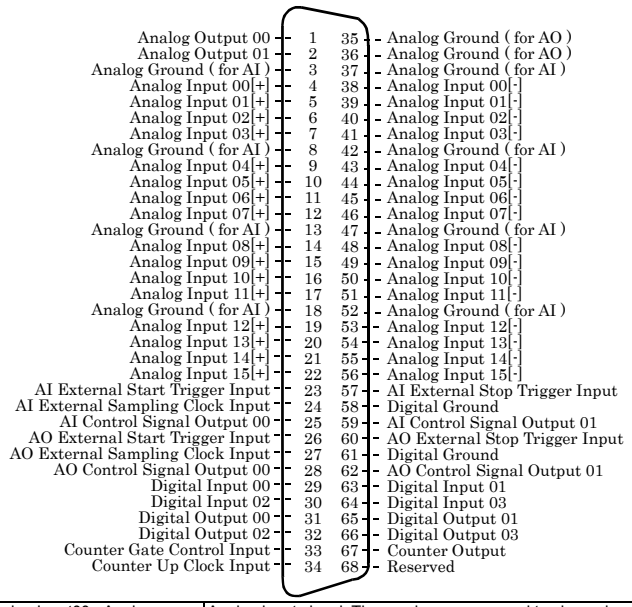
Do not connect any of the outputs and power outputs to the analog or digital ground.
Neither connect outputs to each other. Doing either can result in a fault.

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 PC Card.

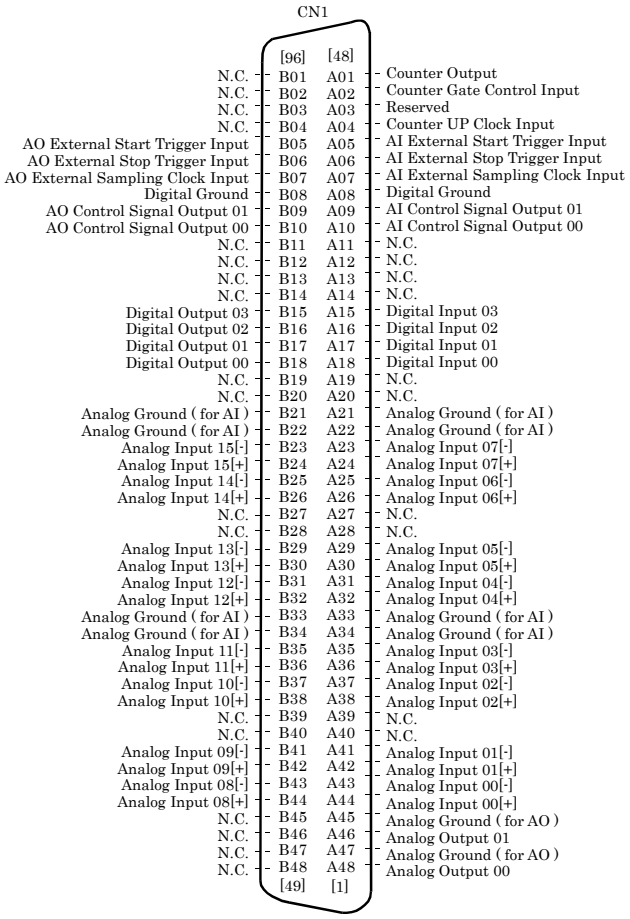
Connector Pin Assignment < Differential Input >

Pin Assignment of ADA16-32/2(CB)F interface connector < Differential Input >



Analog Input00 - Analog Input15	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.
AI Control Signal Output 00	External sampling clock output signal for analog input.
AI Control Signal Output 01	External output signal for analog input status. Not currently connected.
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.
AO Control Signal Output 00	External sampling clock output signal for analog output.
AO Control Signal Output 01	External output signal for analog output status. Not currently connected.
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	Count match output signal for counter.
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

Pin Assignment of ADC-68M/96F < Differential Input >



- [ ] shows the pin No. specified by HONDA TSUSHIN KOGYO Co., Ltd.

Analog Input00 - Analog Input15	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.
AI Control Signal Output 00	External sampling clock output signal for analog input.
AI Control Signal Output 01	External output signal for analog input status. Not currently connected.
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.
AO Control Signal Output 00	External sampling clock output signal for analog output.
AO Control Signal Output 01	External output signal for analog output status. Not currently connected.
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Digital Output00 - Digital Output03	Digital output signal.
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Counter Up Clock Input	Count-up clock input signal for counter.
Counter Output	Count match output signal for counter.
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.

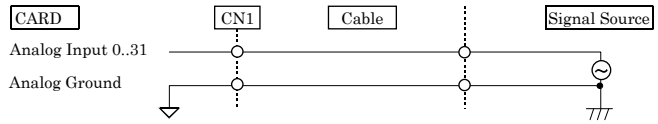
Leave "Reserved" pins unconnected. Connecting these pins may cause a fault in the PC Card.

Analog Input Signal Connection

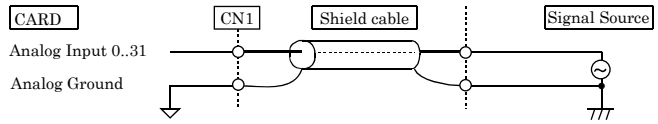
The procedure for connecting analog signals depends on whether the analog input signals are single-ended or differential. The sections below describe how to connect the signals using flat cable and shielded cable.

Single-ended Input

The following figure shows an example of 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 PC Card 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.



⚠ CAUTION

If the signal source contains over 1MHz signals, the signal may effect the cross-talk noise between channels.

If the PC Card and the signal source receive noise or the distance between the PC Card 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 PC Card analog ground). If it exceeds the maximum voltage, the PC Card may be damaged.

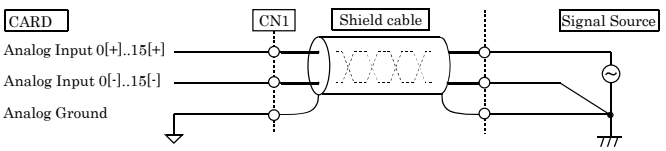
Connect all the unused analog input channels to analog ground.

In the channel switching, the multiplexer does the electrical charge and discharge on the internal capacitor according to the signal voltage. Therefore, the voltage from the previous switching state may go into the next channel. It might cause the error of the signal source action. If this occurs, insert a high-speed amplifier as a buffer between the signal source and the analog input pin to reduce the fluctuation.

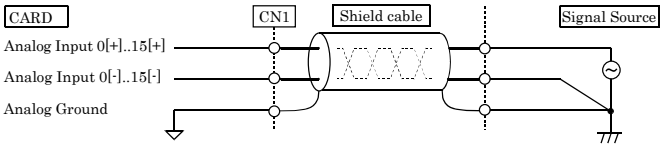
An input pin may fail to obtain input data normally when the signal source connected to the pin has high impedance. If this is the case, change the signal source to one with lower output impedance or insert a high-speed amplifier buffer between the signal source and the analog input pin to reduce the effect.

Differential Input

The following figure shows an example of flat cable 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 PC Card to the signal source ground.



The following figure shows an example of shielded cable connection. Use shielded cable if the distance between the signal source and PC Card 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 PC Card and the signal source ground to the shielding.



⚠ CAUTION

If the signal source contains over 1MHz signals, the signal may effect the cross-talk noise between channels.

If the PC Card and the signal source receive noise or the distance between the PC Card 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 PC Card analog ground). If it exceeds the maximum voltage, the PC Card may be damaged.

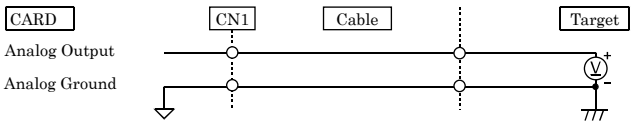
Connect all the unused analog input channels to analog ground.

In the channel switching, the multiplexer does the electrical charge and discharge on the internal capacitor according to the signal voltage. Therefore, the voltage from the previous switching state may go into the next channel. It might cause the error of the signal source action. If this occurs, insert a high-speed amplifier as a buffer between the signal source and the analog input pin to reduce the fluctuation.

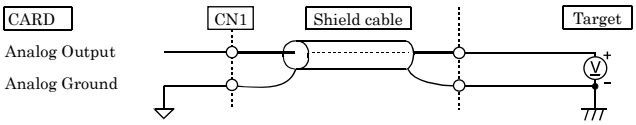
An input pin may fail to obtain input data normally when the signal source connected to the pin has high impedance. If this is the case, change the signal source to one with lower output impedance or insert a high-speed amplifier buffer between the signal source and the analog input pin to reduce the effect.

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 shielded cable connection. Use shielded cable if the distance between the signal source and PC Card 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 the PC Card or the connected wire receives noise, or the distance between the PC Card and the target is long, data may not be outputted properly.

For analog output signal, the current capacity is ±5mA (Max.). Check the specification of the connected device before connecting the PC Card.

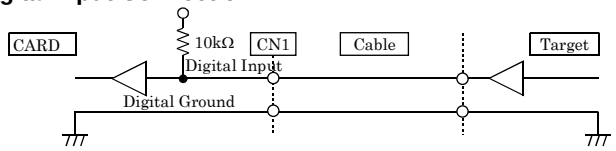
Do not short the analog output signal to analog ground, digital ground, and/or power line. Doing so may damage the PC Card.

Do not connect an analog output signal to any other analog output, either on the PC Card or on an external device, as this may cause a fault on the PC Card.

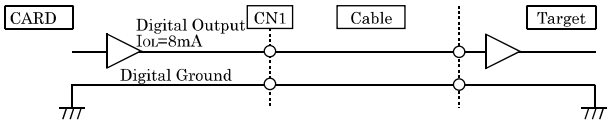
Digital I/O signals, Counter signals and Control signals Connection

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 LVTTL 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 PC Card.

If connected to each output, a pull-up resistor must be about 10 kΩ to pull up with a 3.3V power source.

Each input accepts 5V TTL signals.