

High-Resolution & High-Speed Analog I/O Board for PCI

ADA16-32/2(PCI)F

with Driver Library [API-PAC(W32)]



ADA16-32/2(PCI)F is a multi functional interface board for PCI that contains high-resolution analog I/O and counter function. This board includes an event controller that provides central management (via hardware) for control and a bus master data transfer function for transferring large volumes of data at high speed. The included driver library (API-PAC(W32)) allows you to write Windows application programs in any programming language (such as Visual Basic, Visual C/C++, etc.) that supports the calling of Win32 API functions.

Features

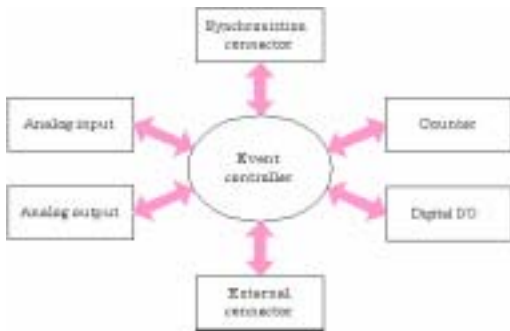
- Multi-function

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

Setting and calibrating the analog input and output ranges can be performed completely by software.

No tricky jumper settings are required. You can also set your own calibration data in place of the default data set at the factory and use different calibration data depending on the operating conditions. Software-based calibration

- 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.

Hardware specification

Specification (1/2)

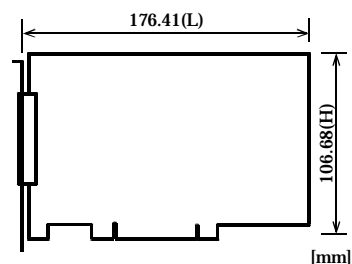
Item	Specification
Analog input	
Isolated specification	Un-Isolated
Input type	Single-Ended Input or Differential Input
Number of input channels	32 channels (Single-Ended Input) 16 channels (Differential Input)
Input range	Bipolar $\pm 10V$
Absolute max. input voltage	$\pm 13V$
Input impedance	1M Ω or more
Resolution	16bit
Non-Linearity error *1*2	$\pm 5LSB$
Conversion speed	2 μ sec/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 levels Sampling clock output
Analog output	
Isolated specification	Un-Isolated
Number of output channels	2ch
Output impedance	Bipolar $\pm 10V$
Output current ability	$\pm 5mA$
Output impedance	1 Ω or less
Resolution	16bit
Non-Linearity error *1	$\pm 3LSB$
Conversion speed	10 μ sec (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)

*1: The non-linearity error means an error of approximately 0.1% occurs over the maximum range at 0 and 50 degrees centigrade ambient temperature. The error can be reduced by calibrating under the actual temperature conditions.

Specification (2/2)

Item	Specification
Digital I/O	
Number of input channels	8 TTL levels (positive logic)
Number of output channels	8 TTL levels (positive logic)
Counter	
Number of channels	2ch
Counting system	Up count
Max. count	FFFFFFFFh (Binary data,32bit)
Number of external inputs	2 TTL levels (Gate/Up)/ch Gate (High level), Up (Rising edge)
Number of external outputs	TTL level 1 output/ch Count match output (positive logic, pulse output)
Bus master section	
DMA channels	2 channels (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
Synchronization bus section	
Control output signal	Selection of output signal with the software when specifying a sync master board.
Control input signal	Selection of sync factor with the software when specifying sync slave boards.
Max. board count for connection	16 boards including the master board
Connector	2 connectors equivalent to the PS-10PE-D4L1-B1 (JAE)
Common section	
I/O address	64 ports x 1,256 ports x 1 region
Interrupt level	Errors and various factors, One interrupt request line as INTA
Connector	PCR-96LMD [HONDA]
Power consumption	5VDC 1100mA (Max.)
Operating condition	0 - 50°C, 10 - 90%RH (No condensation)
PCI bus specification	32bit, 33MHz, Universal key shapes supported *2
Dimension (mm)	176.41(L) x 105.68(H)
Weight	130g

Board Dimensions



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

Supported Software

You are recommended use CONTEC support software depending on your purpose and development environment.

Driver Library API-PAC(W32) (Included)

API-PAC(W32) is the library software that provides the commands for CONTEC hardware products in the form of Windows standard Win32 API functions (DLL). It makes it easy to create high-speed application software taking advantage of the CONTEC hardware using various programming languages that support Win32 API functions, such as Visual Basic and Visual C/C++.

It can also be used by the installed diagnosis program to check hardware operations.

CONTEC provides download services (at <http://www.contec.com/apipac/>) to supply the updated drivers and differential files.

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

< Operating environment >

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

Adaptation language: Visual C/C++, Visual Basic, Delphi, Builder, etc..

Other: Each piece of library software requires 50 megabytes of free hard disk space.

Cable & Connector (Option)

Shielded Cable with One 96-Pin Half-Pitch Connector:

PCA96PS-0.5P (0.5m), PCA96PS-1.5P (1.5m)

Shielded Cable with 96-Pin Half-Pitch Connectors at Both Ends:

PCB96PS-0.5P (0.5m), PCB96PS-1.5P (1.5m)

Flat Cable with One 96-Pin Half-Pitch Connector:PCA96P-1.5 (1.5m)

Flat Cable with 96-Pin Half-Pitch Connectors at Both Ends:

PCB96P-1.5 (1.5m)

Half Pitch 96-Pin Female Connector Set(5Pieces): CN5-H96F

Accessories (Option)

Digital I/O 64CH Series Terminal Panel: DTP-64

Screw Terminal: EPD-96

Termination Panel with BNC connectors for Analog I/O Boards : ATP-32F *1

Termination Panel with BNC connectors for Analog I/O Boards : ATP-8 *1

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

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

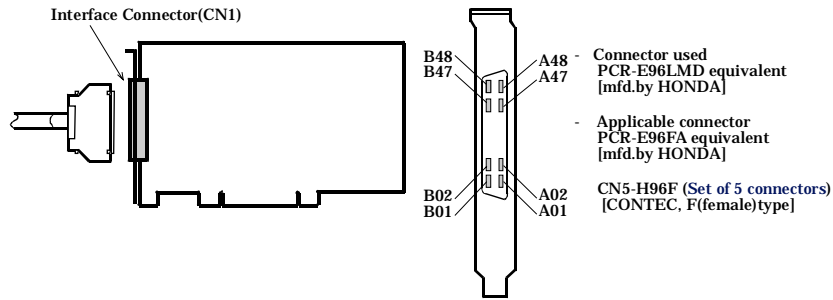
Product Configuration List

- Board [ADA16-32/2(PCI)F] ...1
 - First step guide ... 1
 - CD-ROM *1 [API-PAC(W32)] ...1
 - Synchronization Control Cable(10cm) ...1
- *1 The CD-ROM contains the driver software and User's Guide (this guide)

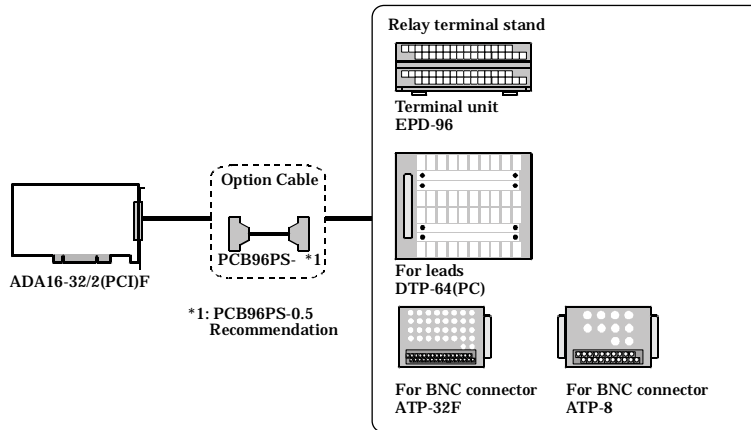
How To Connect to On-board Connector

◆ 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) shown below.



Examples of Connecting Options



◆ Connector Pin Assignment < Single-Ended Input >

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

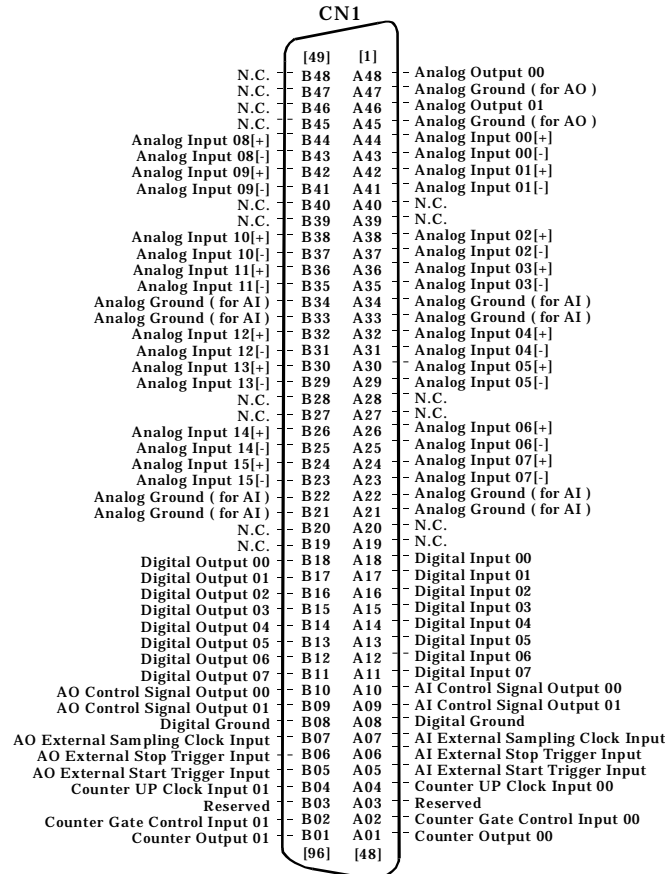
CN1

	[49]	[1]	
N.C.	B48	A48	Analog Output 00
N.C.	B47	A47	Analog Ground (for AO)
N.C.	B46	A46	Analog Output 01
N.C.	B45	A45	Analog Ground (for AO)
Analog Input 08	B44	A44	Analog Input 00
Analog Input 24	B43	A43	Analog Input 16
Analog Input 09	B42	A42	Analog Input 01
Analog Input 25	B41	A41	Analog Input 17
N.C.	B40	A40	N.C.
N.C.	B39	A39	N.C.
Analog Input 10	B38	A38	Analog Input 02
Analog Input 26	B37	A37	Analog Input 18
Analog Input 11	B36	A36	Analog Input 03
Analog Input 27	B35	A35	Analog Input 19
Analog Ground (for AI)	B34	A34	Analog Ground (for AI)
Analog Ground (for AI)	B33	A33	Analog Ground (for AI)
Analog Input 12	B32	A32	Analog Input 04
Analog Input 28	B31	A31	Analog Input 20
Analog Input 13	B30	A30	Analog Input 05
Analog Input 29	B29	A29	Analog Input 21
N.C.	B28	A28	N.C.
N.C.	B27	A27	N.C.
Analog Input 14	B26	A26	Analog Input 06
Analog Input 30	B25	A25	Analog Input 22
Analog Input 15	B24	A24	Analog Input 07
Analog Input 31	B23	A23	Analog Input 23
Analog Ground (for AI)	B22	A22	Analog Ground (for AI)
Analog Ground (for AI)	B21	A21	Analog Ground (for AI)
N.C.	B20	A20	N.C.
N.C.	B19	A19	N.C.
Digital Output 00	B18	A18	Digital Input 00
Digital Output 01	B17	A17	Digital Input 01
Digital Output 02	B16	A16	Digital Input 02
Digital Output 03	B15	A15	Digital Input 03
Digital Output 04	B14	A14	Digital Input 04
Digital Output 05	B13	A13	Digital Input 05
Digital Output 06	B12	A12	Digital Input 06
Digital Output 07	B11	A11	Digital Input 07
AO Control Signal Output 00	B10	A10	AI Control Signal Output 00
AO Control Signal Output 01	B09	A09	AI Control Signal Output 01
Digital Ground	B08	A08	Digital Ground
AO External Sampling Clock Input	B07	A07	AI External Sampling Clock Input
AO External Stop Trigger Input	B06	A06	AI External Stop Trigger Input
AO External Start Trigger Input	B05	A05	AI External Start Trigger Input
Counter UP Clock Input 01	B04	A04	Counter UP Clock Input 00
Reserved	B03	A03	Reserved
Counter Gate Control Input 01	B02	A02	Counter Gate Control Input 00
Control Output 01	B01	A01	Counter Output 00
	[96]	[48]	

- The numbers in square brackets [] are pin numbers designated 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 Input07	Digital input signal.
Digital Output00 - Digital Output07	Digital output signal.
Counter Gate Control Input00 - Counter Gate Control Input01	Gate control input signal for counter.
Counter Up Clock Input00 - Counter Up Clock Input01	Count-up clock input signal for counter.
Counter Output00 - Counter Output01	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.

■ Pin assignment of ADA16-32/2(PCI)F interface connector < Differential Input >



- The numbers in square brackets [] are pin numbers designated 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.
Digital Input00 - Digital Input07	Digital input signal.
Digital Output00 - Digital Output07	Digital output signal.
Counter Gate Control Input00 - Counter Gate Control Input01	Gate control input signal for counter.
Counter Up Clock Input00 - Counter Up Clock Input01	Count-up clock input signal for counter.
Counter Output00 - Counter Output01	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 Signal Connection

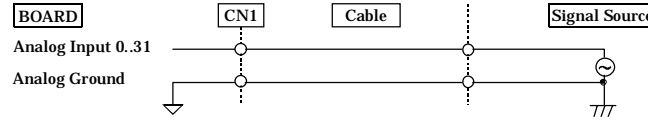
The procedure for connecting analog signals depends on whether the analog input signals are single-ended or differential. The sections below describe how to connect the signals using flat cable and shielded cable.

◆ Single-ended Input

The following figure shows an example of flat cable connection.

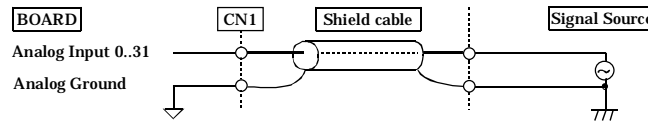
Connect separate signal and ground wires for each analog input channel on CN1.

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 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.

Single-ended Input Connection (Shield Cable)



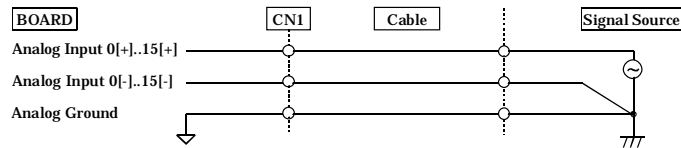
• CAUTION

- 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.

◆ Differential Input

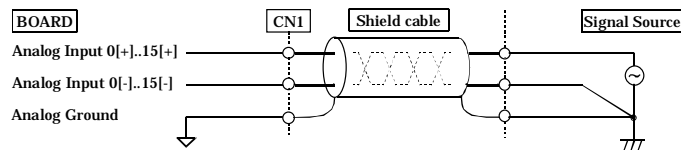
The following figure shows an example of flat cable connection.

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.



Differential Input Connection (Flat Cable)

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.



Differential Input Connection (Shield Cable)

▼ CAUTION

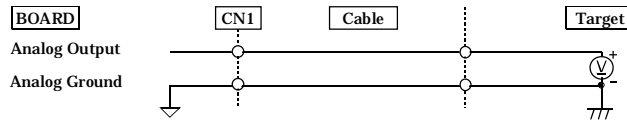
- If the signal source contains over 1MHz signals, the signal may effect the cross-talk noise between channels.
- When the analog ground is not connected, the conversion data is not determined.
- If the board and the signal source receive noise or the distance between the board and the signal source 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.

Analog Output Connection

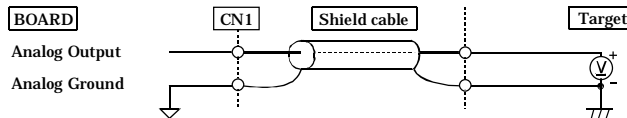
This section shows how to connect the analog output signal by using a flat cable or a shielded cable.

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

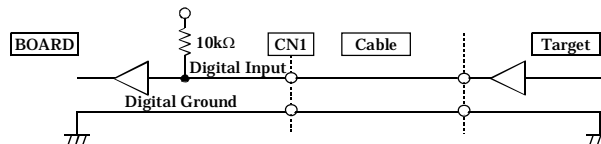
- If the board or the connected wire receives noise, or the distance between the board and the target is long, data may not be outputted properly.
- For analog output signal, the current capacity is $\pm 5\text{mA}$ (Max.). Check the specification of the connected device before connecting the board.
- Do not short the analog output signal to analog ground, digital ground, and/or power line. Doing so may damage the board.
- Do not connect an analog output signal to any other analog output, either on the board or on an external device, as this may cause a fault on the board.

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

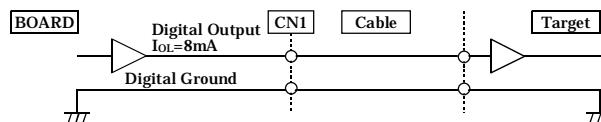
The following sections show examples of how to connect digital I/O signals, counter I/O signals, and other control I/O signals (external trigger input signals, sampling clock input signals, etc.).

All the digital I/O signals and control signals are LVTTTL level signals.

Digital Input Connection



Digital Output Connection



▼ CAUTION

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

Synchronization Control Connectors

◆ SC Connectors

Controlling simultaneous operations between boards or controlling in sync with events is in part dependent on software performance. In order to enhance the reliability of the entire system and to solve these problems, the board is equipped with SC (Synchronization Control) connectors.

Connecting the SC connectors allows boards of the same or different models to operate in sync with one another.

From the boards connected with the SC cable, select one master board and use others as slaves. On the master board, set the signal to be supplied to the slave boards with the software. On the slave boards, the signal from the master board can be set to either the pacer clock operation start or stop factor.

All board operations can also be stopped with a stop request from the master in case of an error, for example, or when requested from a slave board. A maximum of 16 boards can be connected including the master.

For more information on the setup procedure, see the driver software online help. When the SC is not connected, use the board with stand-alone settings.

Example 1: When clock start and stop requirements are set the same for multiple boards

In order to synchronize master clock start and stop with slave boards you can build a synchronous system which does not depend on software processing capabilities.

If the board model is the same, data remains synchronized among boards even when channels are expanded. When board models are different, data still remains compatible since operating clock start and stop are dependent on the master.

- (1) Connect the SC cable.
- (2) Designate master/slave with the software.
- (3) Assign to the connectors the clock start and stop signals to be output from the master.
- (4) Set up slave boards so they can utilize all signals.
- (5) Start in order of slave to master boards.

▼ CAUTION

- When clock signals are assigned to the synchronization control connector, the maximum clock frequency is restricted to 5MHz.
- When signals are assigned to the synchronization control connector, a delay of approximately 100ns occurs at the slave board.

Example 2: When controlling slave operations with master's internal events

By outputting an internal event (interrupt) occurring on the master board, the slaves can start operating in sync with that signal.

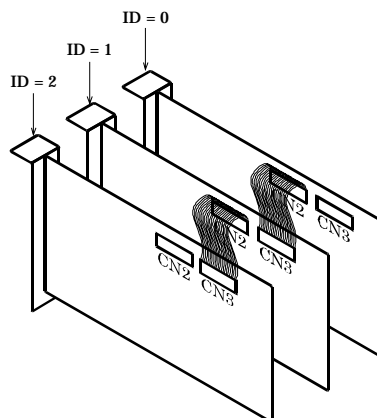
- (1) Connect the SC cable.
- (2) Designate master/slave with the software.
- (3) Assign to the connector the event signal to be output from the master.
- (4) Set signals from the master to the start requirements on the slave boards.
- (5) Start in order of slave to master boards.

Connecting the SC Connectors (CN2 and CN3)

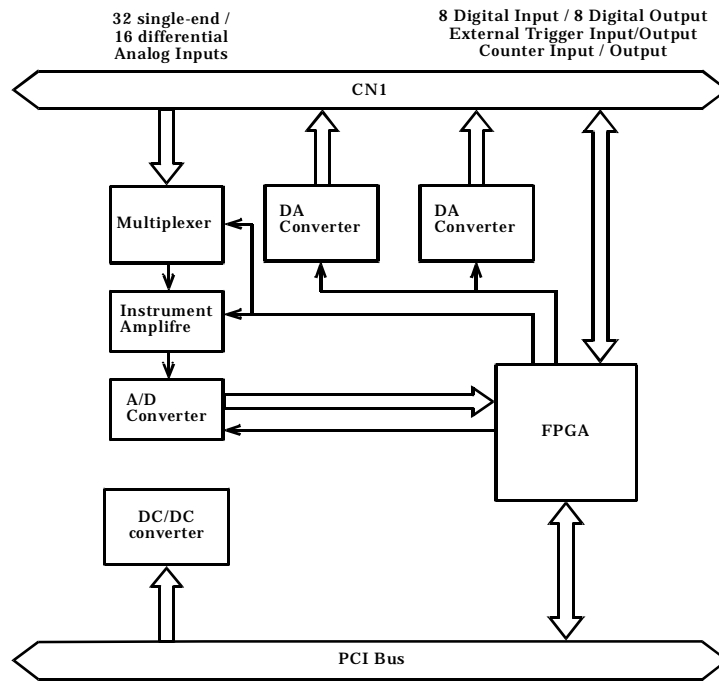
This board is equipped with sync signal control connectors (CN2 and CN3) for connecting a sync signal cable. When the cable is connected, multiple boards can operate in sync with one another.

Connection Procedure

Connect the sync signal cable when two or more boards need to operate in sync with one another. Connect CN2 with a smaller ID number to CN3 with a greater ID number with the cable. You should only use the cable that came with the board.



Block Diagram



The specification, color, and design of a product may be changed without a preliminary announcement.