500KSPS 16-bit
Analog I/O Unit for USB
AIO-163202FX-USB

* Specifications, color and design of the products are subject to change without notice.
* 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 2021.

This product is a USB2.0-compliant analog I/O unit that extends the analog I/O function of USB port of PCs. This product features high-precision 16bit analog inputs (32channels), high-precision 16bit analog outputs (2channels), digital I/O (LVTTL level each 8channels), and a counter (32bit binary, LVTTL level 2channels) function.

This product includes an event controller for integrated management of control signals by hardware and buffer memory (128K data). Together, these features provide all you need to build a high-performance PC-based measurement and control system.

As there is compatible with PCI bus-compatible board ADA16-32/2(PCI)F and PCI Express bus-compatible board AIO-163202F-PE in terms of connector shape and pin assignments, it is easy to migrate from the existing system.

Using the bundled API function library package [API-USBP(WDM)], 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/C++.

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, this product also supports MATLAB and LabVIEW.

Features

Multi-function
The unit contains analog inputs (16bit, 32channels), analog outputs (16bit, 2channels), digital inputs (LVTTL level 8channels), digital outputs (LVTTL level 8channels), and counters (32bit binary, LVTTL level 2channels). Combining all these features on one unit allows complex systems to be implemented even on PCs with USB port only.
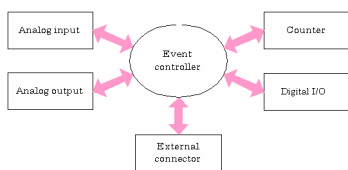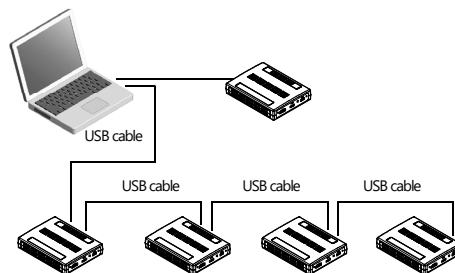
Compatible to USB1.1/USB2.0
Compatible to USB1.1/USB2.0 and capable to achieve high speed transfer at HighSpeed (480 Mbps).

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

Overview of event controller

Each I/O function can be synchronized by the operation starting/stopping signal and the clock signal etc. of each I/O function.

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 value reaches a constant one.

Buffer memory for 128K of data available for background processing
The analog inputs and outputs each have their own buffer memory (128K data) which can be used. The buffer memory can be used as FIFO or RING form. You can also perform analog input and output in the background, independent of software and the current status of the PC.

USB HUB function, the CONTEC's USB supported products (Max. 4) can be used.
This product has the USB HUB function. Max. 4 AIO-163202FX-USB can be used in 1 USB port of PC.*5   When you use 4 or more AIO-163202FX-USB, you can do by connecting AIO-163202FX-USB to the

another USB port of PC side.

Also, you can connect the CONTEC's USB supported products other than AIO-163202FX-USB to the USB port of AIO-163202FX-USB. *1*2

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.

Compatible with PCI / PCI Express bus board and Card Bus PC card in it's design. Common connector shape and pin assignment with PCI / PCI Express bus board and Card Bus PC card.
This product has the common connector shape and pin assignment with PCI bus board ADA16-32/2(PCI)F, PCI Express bus board AIO-163202F-PE and Card Bus PC card ADA16-32/2(CB)F *3 so you can use the common cables and accessories, it is easy to migrate from the existing system *4.

⚠ CAUTION
AIO-163202FX-USB has neither the bus master transfer function nor a synchronous control connectors that exist in the PCI bus-compatible board ADA16-32/2(PCI)F and the PCI Express bus-compatible board AIO-163202F-PE. In the system that uses the bus master transfer function and the synchronous control connector, it is not likely to be able to shift.

Data logger software, Windows compatible driver libraries are attached.
The attached data logger software [C-LOGGER] enables the graph display of recorded signal data and file saving without a program. Also, driver library API-USBP(WDM) that makes it possible to create applications of Windows is attached.

Plug-ins for the dedicated libraries, this product 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 by National Instruments. These dedicated libraries are available, free of charge (downloadable), on our web site.

*1 Do not connect the device other than that of CONTEC's USB to the USB port included on the AIO-163202FX-USB. Otherwise, this may cause a failure or malfunction.
*2 When connecting multiple units with USB HUB function and set up them, do one at a time and complete setup for the previous unit before starting to do the next unit.
*3 When using the optional connector conversion cable ADC-68M/96F.
*4 There are some differences of the specifications between this product and AIO-163202F-PE, ADA16-32/2(PCI)F and ADA16-32/2(CB)F. For more details on this, refer to "Chapter7, Difference from AIO-163202F-PE, ADA16-32/2(PCI)F and ADA16-32/2(CB)F"
*4 This product cannot be stacked up for installation.

Specifications

Hardware specification

Item		Specification
Analog input		
	Isolated specification	Non-isolated
	Input type	Single-Ended Input or Differential Input
	Number of input channels	32channels (Single-Ended Input) 16channels (Differential Input)
	Input range	Bipolar ±10V, ±5V, ±2.5V or Unipolar 0 - +10V, 0 - +5V, 0 - +2.5V
	Absolute max. input voltage	±15V
	Input impedance	1MΩ or more
	Resolution	16bit
	Non-Linearity error *1*2	±5LSB
	Conversion speed	2μsec/ch (Max.) *3 [500KSPS]*4
	Buffer memory	128K data FIFO or 128K data RING
	Conversion start trigger	Software, conversion data compare, external trigger, and event controller output etc.,
	Conversion stop trigger	Settings include data save complete, conversion data compare, external trigger, event controller output, and software etc.,
	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	LVTTL level : 2 Sampling clock output
Analog output		
	Isolated specification	Non-isolated
	Number of output channels	2channels
	Output range	Bipolar ±10V, ±5V, ±2.5V, ±1.25V or Unipolar 0 - +10V, 0 - +5V, 0 - +2.5V
	Absolute max. output current	±5mA
	Output impedance	1Ω or less
	Resolution	16bit
	Non-Linearity error *1	±3LSB
	Conversion speed	10μsec (Max.) [100KSPS]*4
	Buffer memory	128K data FIFO or 128K data RING
	Conversion start trigger	Software, external trigger, and event controller output etc.,
	Conversion stop trigger	Settings include data save complete, external trigger, event controller output, and software etc.,
	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	LVTTL level : 2 Sampling clock output
Digital I/O		
	Number of input channels	Non-isolated input 8channels (LVTTL level positive logic)
	Number of output channels	Non-isolated output 8channels (LVTTL level positive logic)
Counter		
	Number of channels	2channels
	Counting system	Up count
	Max. count	FFFFFFFFh (Binary data, 32bit)
	Number of external inputs	LVTTL level : 2 (Gate/Up)/ch, Gate (High level), Up (Rising edge)
	Number of external outputs	LVTTL level : 1/ch, Count match output (positive logic, pulse output)
	Frequency response	10MHz (Max.)
USB		
	Bus specification	USB Specification 2.0/1.1 standard
	USB transfer rate	12Mbps (Full-speed), 480Mbps (High-speed) *5
	Power supply	Self power *6
	Attached AC adapter (POA200-20-2)	90 - 264VAC 5.0VDC±5% 2.0A (Max.) Cable length : about 1.5m, AC Cable length : about 1.5m
Common section		
	Connector	96-pin half pitch connector [M(male)type] PCR-96LMD+ [HONDA TSUSHIN KOGYO CO., LTD.] or equivalence to it

Item		Specification
	Number of terminals used at the same time	127 terminals (Max.) *7
	Power consumption (Max.)	5VDC 1300mA
	Operating condition *8	0 - 50℃, 10 - 90%RH (No condensation) * When using the attached AC adapter POA200-20-2, it is 0 - 40℃
	Physical dimensions (mm)	180(L) x 140(D) x 34(H) (No protrusions)
	Weight	400g
	Attached cable length	USB Cable 1.8m
Standard		VCCI Class A, CE Marking (EMC Directive Class A, RoHS Directive)

*1: A linearity error approximately 0.1% of full-range may occur when operated at 0℃ or 50℃ ambient temperature.
*2: At the time of the source use of a signal which built in the high-speed operational amplifier.
*3: The required time is indicated in the analog to digital translation of one channel. When AD of two or more channels is converted, time of the a few minutes of the channel is necessary. Conversion time = Number of conversion channelsx2μsec
*4: SPS = Samplings Per Second.   The number of data that can be converted in one second is shown.
*5: The USB transfer speed depends on the host PC environment used (OS and USB host controller).
*6: The supplied current is insufficient in the bus power.   Please use the attached AC adaptor (POA200-20-2).
*7: As a USB hub is also counted as one device, you cannot just connect 127 USB terminals.
*8: To suppress the heating, ensure that there are spaces for ventilation (about 5cm) around this product..

AC adapter environmental condition (environmental specification)

Item	Specification
Input voltage range	90 - 264VAC
Rated input current	300mA
Number of frequency	50 - 60Hz
Rated output voltage	5.0VDC
Rated output current	2.0A (Max.)
Dimension (mm)	47.5(W) x 75(D) x 27.3(H) (No protrusions)
Weight	175g
Operating temperature	0 - 40℃
Operating humidity	20 - 80%RH(No condensation)
Life expectancy	4 years at the ambient temperature 40 ℃ (When 100VAC is input and 1.3A is output)
Allowable time of short interruption	15ms (Max.) (When 100VAC is input and 1.3A is output) *1
Floating dust particles	Not to be excessive
Corrosive gases	None
Voltage corresponding to the attached AC cable	125VAC 7A

*1 When the short interruption occurs and the defective operation of the equipment is generated, please insert the power supply of the equipment after pulling out it.

Support Software

Driver Library API-AIO(WDM)
[Stored on the bundled disk driver library API-USBP(WDM)]

The API-AIO(WDM) is the Windows version driver library software that provides products in the form of Win32 API functions (DLL).   Various sample programs such as Visual Basic and Visual C++, etc and diagnostic program *1useful for checking operation is provided.

Data Logger Software C-LOGGER
[Stored on the bundled disk driver library API-USBP(WDM)]

C-LOGGER is a data logger software program compatible with our analog input products. This program enables the graph display of recorded signal data, zoom observation, file saving, and dynamic transfer to the spreadsheet software "Excel". No troublesome programming is required. For details on the supported operating systems and applicable languages and to download the latest version, see the services on the CONTEC website

LabVIEW VI Library for Data Acquisition DAQfast for LabVIEW (Available for downloading (free of charge) from the CONTEC web site.)

This is a data collection library to use our devices in the LabVIEW by National Instruments.   With Polymorphic VI, our design enables a LabVIEW user to operate seamlessly.   Our aim is for the customers to perform easily, promptly what they wish to do.
For more details on the library and download of DAQfast for LabVIEW, please visit the CONTEC's Web site.

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, please visit the CONTEC's Web site.

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. For more details on the library and download, please visit the CONTEC's Web site.

Cable & Connector

Cable (Option)
Shield Cable with 96-Pin Half-Pitch Connectors at One End
: PCA96PS-0.5P (0.5m)
: PCA96PS-1.5P (1.5m)

Shield Cable with 96-Pin Half-Pitch Connectors at Both Ends
: PCB96PS-0.5P (0.5m)
: PCB96PS-1.5P (1.5m)

Flat Cable with 96-Pin Half-Pitch Connectors at One End
: PCA96P-1.5 (1.5m)

Flat Cable with 96-Pin Half-Pitch Connectors at Both Ends
: PCB96P-1.5 (1.5m)

Accessories

Accessories (Option)
Buffer Amplifier Box for Analog Input Boards (32ch type)
: ATBA-32F *1*2*7
Buffer Amplifier Box for Analog Input Boards (8ch type)
: ATBA-8F *1*2*3*7
Terminal Unit for Cables (M2.5 x 96P) : DTP-64(PC) *1
Screw Terminal Unit (M3.5 x 96P)   : EPD-96 *1
Screw Terminal Unit (M3 x 96P)   : EPD-96A *1 *5
BNC Terminal Unit (for analog input 32ch)
: ATP-32F *1
BNC Terminal Unit (for analog input 8ch)
: ATP-8 1*3*4
USB I/O Unit Bracket for X Series   : BRK-USB-X
AC adapter (input : 90 - 264VAC, output : 5VDC 2.0A)
: POA200-20-2 *6
DC-DC power supply unit (input: 10 - 30VDC, output: 5VDC 3.0A)
: POW-DD10GY

1   PCB96PS- optional cable is required separately (0.5mm is recommended).
*2   An external power supply is necessary (optional AC adapter 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   "Spring-up" type terminal is used to prevent terminal screws from falling off.
*6   It is the same as the one appended to the product. Please buy it necessary for maintenance.
*7   When a buffer amp is connected, the pin assignments are different from those for the connector of this product. For the pin assignment, refer to the buffer amp's product manual.
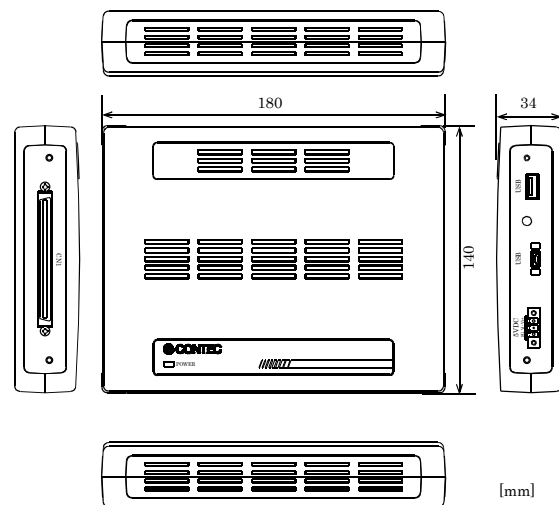*   Check the CONTEC's Web site for more information on these options.

Packing List

Unit [AIO-163202FX-USB] ...1
AC adapter ...1
AC Cable (for 125VAC) ...1
USB cable (1.8m) ...1
USB cable attachment on the main unit's side
(For Mini B connector side) ...1
Clamps for prevention of cable on the main unit's side ...1
Disk *1 [API-USBP(WDM)] ...1
First step guide ... 1
Warranty Certificate ...1
Ferrite core ...1
Power connector MC1,5/3-ST-3,5 ...1

*1 The CD-ROM contains the driver software and User's Guide (this guide)

Physical Dimensions

180
34
140
[mm]

Using the Connectors

Connecting to a Connector

To connect an external device to this product, plug the cable from the device into the interface connector (CN1) of unit shown below.

Interface connector (CN1)

- Connector used
  PCR-E96LMD+ [mfd. by HONDA TSUSHIN KOGYO CO., LTD.] or equivalence to it
- Compatible connectors
  PCR-E96FA+ [mfd. by HONDA TSUSHIN KOGYO CO., LTD.] or equivalence to it

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

Connector Pin Assignment
Pin Assignments of Interface Connector (CN1)
< Single-Ended Input >

CN1

Pin No.	Meaning	Pin No.	Meaning
B48	N.C.	A48	Analog Output 00
B47	N.C.	A47	Analog Ground
B46	N.C.	A46	Analog Output 01
B45	N.C.	A45	Analog Ground
B44	Analog Input 08	A44	Analog Input 00
B43	Analog Input 24	A43	Analog Input 16
B42	Analog Input 09	A42	Analog Input 01
B41	Analog Input 25	A41	Analog Input 17
B40	Analog Ground (for AI)	A40	Analog Ground
B39	Analog Ground (for AI)	A39	Analog Ground
B38	Analog Input 10	A38	Analog Input 02
B37	Analog Input 26	A37	Analog Input 18
B36	Analog Input 11	A36	Analog Input 03
B35	Analog Input 27	A35	Analog Input 19
B34	Analog Ground (for AI)	A34	Analog Ground
B33	Analog Ground (for AI)	A33	Analog Ground
B32	Analog Input 12	A32	Analog Input 04
B31	Analog Input 28	A31	Analog Input 20
B30	Analog Input 13	A30	Analog Input 05
B29	Analog Input 29	A29	Analog Input 21
B28	Analog Ground (for AI)	A28	Analog Ground
B27	Analog Ground (for AI)	A27	Analog Ground
B26	Analog Input 14	A26	Analog Input 06
B25	Analog Input 30	A25	Analog Input 22
B24	Analog Input 15	A24	Analog Input 07
B23	Analog Input 31	A23	Analog Input 23
B22	Analog Ground (for AI)	A22	Analog Ground
B21	Analog Ground (for AI)	A21	Analog Ground
B20	Digital Ground	A20	Digital Ground
B19	N.C.	A19	N.C.
B18	Digital Output 00	A18	Digital Input 00
B17	Digital Output 01	A17	Digital Input 01
B16	Digital Output 02	A16	Digital Input 02
B15	Digital Output 03	A15	Digital Input 03
B14	Digital Output 04	A14	Digital Input 04
B13	Digital Output 05	A13	Digital Input 05
B12	Digital Output 06	A12	Digital Input 06
B11	Digital Output 07	A11	Digital Input 07
B10	AO Control Signal Output 00	A10	AI Control Signal Output 00
B09	AO Control Signal Output 01	A09	AI Control Signal Output 01
B08	Digital Ground	A08	Digital Ground
B07	AO External Sampling Clock Input	A07	AI External Sampling Clock Input
B06	AO External Stop Trigger Input	A06	AI External Stop Trigger Input
B05	AO External Start Trigger Input	A05	AI External Start Trigger Input
B04	Counter UP Clock Input 01	A04	Counter UP Clock Input 00
B03	Reserved	A03	Reserved
B02	Counter Gate Control Input 01	A02	Counter Gate Control Input 00
B01	Counter Output 01	A01	Counter Output 00

* [ ] shows pin numbers specified by HONDA TSUSHIN KOGYO CO., LTD.

Signal	Description
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.

⚠ CAUTION

- Leave "Reserved" pins unconnected.   Connecting these pins may cause a fault in the product.
- When the Buffer Amplifier Box is used, pin assignments are different.   Refer to the pin assignments for the connector on the Buffer Amplifier Box.

Pin Assignments of Interface Connector (CN1)
< Differential Input >

CN1

Pin No.	Meaning	Pin No.	Meaning
B48	N.C.	A48	Analog Output 00
B47	N.C.	A47	Analog Ground
B46	N.C.	A46	Analog Output 01
B45	N.C.	A45	Analog Ground
B44	Analog Input 08[+]	A44	Analog Input 00[+]
B43	Analog Input 08[-]	A43	Analog Input 00[-]
B42	Analog Input 09[+]	A42	Analog Input 01[+]
B41	Analog Input 09[-]	A41	Analog Input 01[-]
B40	Analog Ground	A40	Analog Ground
B39	Analog Ground	A39	Analog Ground
B38	Analog Input 10[+]	A38	Analog Input 02[+]
B37	Analog Input 10[-]	A37	Analog Input 02[-]
B36	Analog Input 11[+]	A36	Analog Input 03[+]
B35	Analog Input 11[-]	A35	Analog Input 03[-]
B34	Analog Ground	A34	Analog Ground
B33	Analog Ground	A33	Analog Ground
B32	Analog Input 12[+]	A32	Analog Input 04[+]
B31	Analog Input 12[-]	A31	Analog Input 04[-]
B30	Analog Input 13[+]	A30	Analog Input 05[+]
B29	Analog Input 13[-]	A29	Analog Input 05[-]
B28	Analog Ground	A28	Analog Ground
B27	Analog Ground	A27	Analog Ground
B26	Analog Input 14[+]	A26	Analog Input 06[+]
B25	Analog Input 14[-]	A25	Analog Input 06[-]
B24	Analog Input 15[+]	A24	Analog Input 07[+]
B23	Analog Input 15[-]	A23	Analog Input 07[-]
B22	Analog Ground	A22	Analog Ground
B21	Analog Ground	A21	Analog Ground
B20	Digital Ground	A20	Digital Ground
B19	N.C.	A19	N.C.
B18	Digital Output 00	A18	Digital Input 00
B17	Digital Output 01	A17	Digital Input 01
B16	Digital Output 02	A16	Digital Input 02
B15	Digital Output 03	A15	Digital Input 03
B14	Digital Output 04	A14	Digital Input 04
B13	Digital Output 05	A13	Digital Input 05
B12	Digital Output 06	A12	Digital Input 06
B11	Digital Output 07	A11	Digital Input 07
B10	AO Control Signal Output 00	A10	AI Control Signal Output 00
B09	AO Control Signal Output 01	A09	AI Control Signal Output 01
B08	Digital Ground	A08	Digital Ground
B07	AO External Sampling Clock Input	A07	AI External Sampling Clock Input
B06	AO External Stop Trigger Input	A06	AI External Stop Trigger Input
B05	AO External Start Trigger Input	A05	AI External Start Trigger Input
B04	Counter UP Clock Input 01	A04	Counter UP Clock Input 00
B03	Reserved	A03	Reserved
B02	Counter Gate Control Input 01	A02	Counter Gate Control Input 00
B01	Counter Output 01	A01	Counter Output 00

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
- Leave "Reserved" pins unconnected. Connecting these pins may cause a fault in the product.
- When the Buffer Amplifier Box is used, pin assignments are different. Refer to the pin assignments for the connector on the Buffer Amplifier Box.
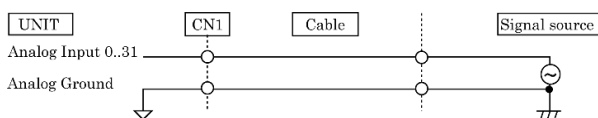
Analog Input Signal Connection

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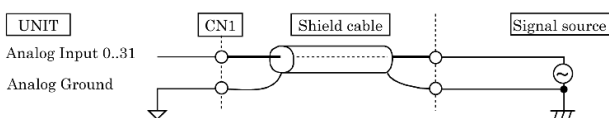
Single-ended Input
The following figure shows an example of flat cable connection. Connect separate signal and ground wires for each analog input channel on CN1.

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 unit 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.

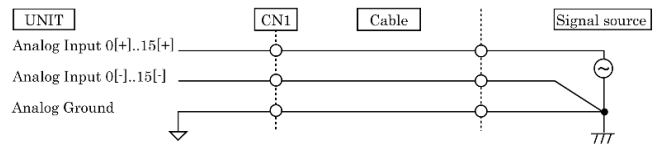Single-ended Input Connection (Shielded Cable)

⚠ CAUTION
- If the signal source contains over 1MHz signals, the signal may effect the cross-talk noise between channels.
- If the unit and the signal source receive noise or the distance between the unit 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 unit 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..
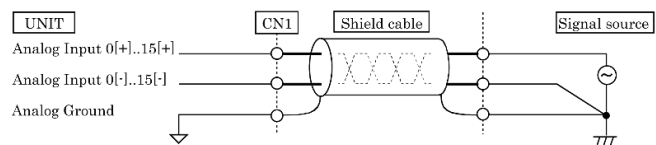
Differential Input
The following figure shows an example of flat cable connection. For each analog input channel on CN1, connect the "+" input to the signal and connect the "-" input to the signal source ground.   Also connect the analog ground on the unit to the signal source ground.

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 unit 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 unit and the signal source ground to the shielding.

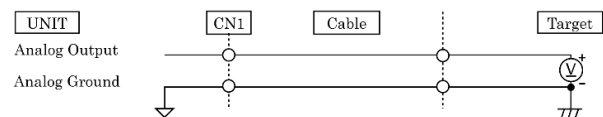Differential Input Connection (Shielded Cable)

⚠ 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 unit and the signal source receive noise or the distance between the unit 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 unit analog ground).   If it exceeds the maximum voltage, the unit 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.
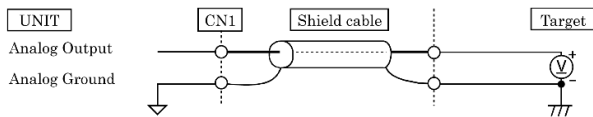
Analog Output Signal Connection

This section shows how to connect the analog output signal by using a flat cable or a shield cable. The following figure shows an example of flat cable connection. Connect the signal source and ground to the CN1 analog output.

Analog Output Connection (Flat Cable)

The following figure shows an example of shield cable connection.   Use shield cable if the distance between the signal source and this product 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.
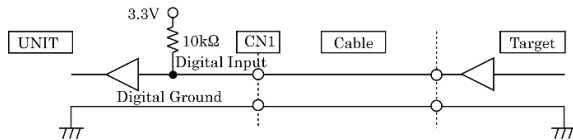
Analog Output Connection (Shielded Cable)

⚠ CAUTION
- If this product or the connected wire receives noise, or the distance between this product 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 this product.
- Do not short the analog output signal to analog ground, digital ground, and/or power line.   Doing so may damage this product.
- Do not connect an analog output signal to any other analog output, either on this product or on an external device, as this may cause a fault on this product.
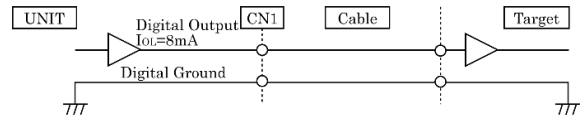- Analog output signal outputs hundreds of □ voltages when USB cable is inserted.

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 this product 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 product.
- If connected to each output, a pull-up resistor must be about 10k□ to pull up with a 3.3V power source.
- Each input accepts 5V TTL signals.

Difference from AIO-163202F-PE, ADA16-32/2(PCI)F and ADA16-32/2(CB)F

Item	AIO-163202FX-USB	AIO-163202F-PE	ADA16-32/2(CB)F	ADA16-32/2(PCI)F
Analog input				
Buffer memory	128K data FIFO or 128K data RING	64K data FIFO or 64K data RING		
External start signal, External stop signal, External clock signal	LVTTL level			TTL level
External status output signal	LVTTL level			TTL level
Analog output				
Buffer memory	128K data FIFO or 128K data RING	64K data FIFO or 64K data RING		
External start signal, External stop signal, External clock signal	LVTTL level			TTL level
External status output signal	LVTTL level			TTL level
Digital I/O				
Number of input channels	Non-isolated input 8 channels (LVTTL level positive logic)		Non-isolated input 4 channels (LVTTL level positive logic)	Non-isolated input 8 channels (TTL level positive logic)
Number of output channels	Non-isolated output 8 channels (LVTTL level positive logic)		Non-isolated output 4 channels (LVTTL level positive logic)	Non-isolated output 8 channels (TTL level positive logic)
Counter				
Number of channels	2 channels		1 channel	2 channels
Number of external inputs	LVTTL level			TTL level
Number of external outputs	LVTTL level			TTL level
Bus master transfer function	None	Have		
Sync signal control connectors	None	Have		None
Connector	96-pin half pitch connector [M (male) type]		68-pin 0.8mm-pitch connector [F (female) type] *1	96-pin half pitch connector [M(male) type]
Power consumption (Max.)	5VDC 1300mA	3.3VDC 500mA, 12VDC 300mA	3.3VDC 600mA	5VDC 1100mA
Bus specification	USB Specification 2.0/1.1 standard	PCI Express Base Specification Rev. 1.0a x1	PC Card Standard Card Bus	PCI(32bit, 33MHz, Universal key shapes supported)
Physical dimensions (mm)	180(L) x 140(D) x 34(H) (No protrusions)	169.33(L) x 110.18(H)	85.6(W) x 54.0(D) x 5.0(H) TYPE II	176.41(L) x 105.68(H)
Weight	400g	140g	80g	130g

*1: When you use the optional connector conversion cable ADC-68M/96F, connector is 96-pin half pitch connector [M (male) type].