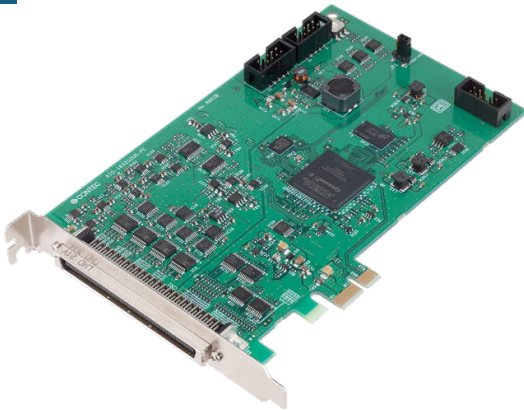


100KSPS 16-bit Analog I/O Board for PCI Express
AIO-163202G-PE



- * The photograph is a AIO-163202UG-PE.
- * 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 July, 2023.

Features

High-performance, multifunction single DAQ device with analog and digital input/output and counter functions

In addition to analog input, this high-performance multi-function device is equipped with 2 analog output channels, 16 digital inputs and outputs, and 2 counter channels (32-bit), enabling measurement control in a compact, reasonably priced package for systems requiring a variety of signal inputs and outputs.

| Model | Analog Input | | | Analog Output | | |
|-----------------|--------------------|------------|------------------|--------------------|------------|------------------|
| | Number of channels | Resolution | Conversion speed | Number of channels | Resolution | Conversion speed |
| AIO-163202UG-PE | Single-Ended: 32ch | 16bit | 1µsec/ch | 2ch | 16bit | 10µsec |
| AIO-163202G-PE | | | 10µsec/ch | | | |
| AIO-123202UG-PE | Differential: 16ch | 12bit | 1µsec/ch | | 12bit | 6µsec |
| AIO-123202G-PE | | | 10µsec/ch | | | |

Adopts and improves on the functions of the Analog E Series with compatibility for the Analog F Series

The Analog G Series was designed as a successor to the best-selling Analog E Series, long recognized as a mainstay of PC-based high-performance analog measurement devices. Using the conversion cable (DT-G2E-16/DT-G2E-32) also makes it possible to use the same connector pin assignments as the Analog E Series, allowing for the use of Analog E Series accessories and user design assets without any modifications.

The Analog G Series also shares the same connector pin assignments as the Analog F Series for use as upward-compatible devices.

This also makes it possible to use Analog F Series accessories and user design assets without any modifications.

DMA bus master transfer function for high-speed, continuous sampling

The DMA bus master transfer function, which allows data to be directly transferred to the PC memory, enables continuous sampling for long periods without affecting the device's maximum conversion speed.

When analog input data is transferred using the bus master transfer function, simultaneous transferring of various data is also possible, including analog output, digital input, digital output, and counter data synchronized with analog input clock signals.

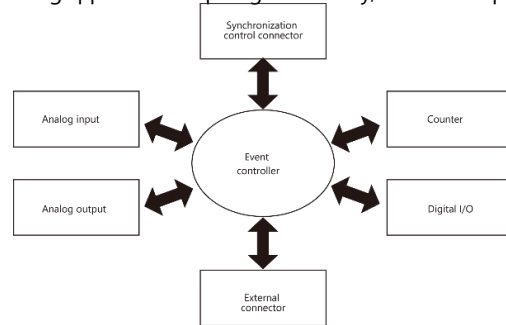
This makes the product ideal for component inspection equipment and measurement testing benches that require high-speed data acquisition over long periods.

The Analog G Series is a PCI Express-compliant data acquisition (DAQ) device with high-speed, high-precision, multi-channel analog input functionality. In addition to analog input, this multi-function device is equipped with analog output, digital input/output, and a counter, enabling measurement control in a compact, reasonably priced package for systems requiring a variety of signal inputs and outputs. The DMA bus master transfer function also enables continuous sampling for long periods without affecting the device's maximum conversion speed. This makes the product ideal for component inspection equipment and measurement testing benches that require high-speed data collection over long periods.

In addition, thanks to the event controller's ability to perform hardware-level integrated management of the trigger, clock, and status of each signal input/output, synchronous signal input/output control—difficult to achieve at the software level—is possible. As a result, the product is ideal for factory automation and mixed-signal testing applications requiring low-latency, real-time responsiveness.

Built-in event controller for advanced synchronization control

The built-in event controller enables integrated management of the triggers and statuses of each signal input and output, enabling hardware-level synchronization control of signal inputs and outputs. As a result, the product is ideal for factory automation and mixed-signal testing applications requiring low-latency, real-time responsiveness.



Scenario 1: Analog input and output synchronized with an external clock signal.
 Scenario 2: Analog input performed whenever the counter value reaches the set value.

Synchronized operation of up to 16 devices (connection via synchronization connector)

Synchronized operation of up to 16 devices is possible with no need for external wiring or clock synchronization.

Simply connect the devices via the synchronization connector and a dedicated cable to enable synchronized operation using the event controller. Synchronized operation is also possible with other Contec devices featuring a synchronization connector (such as the DIO-32DM3-PE and CNT-3208M-PE).

Wide selection of wiring accessories and expansion modules with various functions

Choose from a wide selection of expansion modules offering various functions such as buffer amplification (operational amplification), simultaneous sampling (sample/hold amplification), thermocouple input, gain amplification, and low-pass filtering. Various wiring accessories are also available, including BNC terminal blocks, screw terminal blocks, and noise-resistant cables.

Jumper-less, trim-less configuration (software configuration)

Software-based configuration of input range, output range, accuracy calibration, and digital filtering settings is possible while the product is installed on the computer.

- Analog output range settings: $\pm 10V, \pm 5V, \pm 2.5V, 0 - +10V, 0 - +5V, 0 - +2.5V$
- Analog output range settings: $\pm 10V, \pm 5V, \pm 2.5V, \pm 1.25V, 0 - +10V, 0 - +5V, 0 - +2.5V$
- Analog input/output calibration settings: Factory default or user preset
- Digital filtering setting (external trigger/clock, digital input, counter): 0 - 16000 μs

Extensive support software

Device driver for Windows / Linux API-TOOL (Free download)

The API-TOOL device driver/SDK for Windows and Linux, which includes programming API, online help, sample programs, and hardware diagnostic programs, is available to download for free.

Data Logger Software C-LOGGER (Free download)

The Analog G Series is compatible with Contec's C-LOGGER data logger software designed to bring out the best of Contec's analog measurement devices. Take advantage of graphical displays of acquired data, zoomed observation, file saving, and dynamic transferring of data to Excel (spreadsheet software) with no programming required.

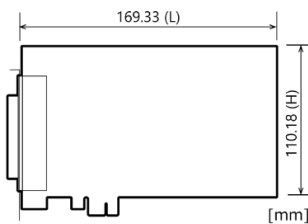
DAQfast LabVIEW data acquisition library DAQ-LV-WIN (Free download)

This data recording library makes it possible to use the product with LabVIEW from National Instruments. Polymorphic VIs make using the product simple for LabVIEW users, ensuring the desired operations can be performed quickly and effortlessly.

.NET component collection for DAQfast measurement system development DAQ-DNC-FE (Free download)

This measurement system development support tool is compatible with the Visual Studio integrated development environment. This makes it possible to configure device settings, acquire data, and link data between components with no coding necessary, enabling a highly productive low-code development environment.

Physical Dimensions



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

Included Items

- Product [AIO-163202G-PE] ...1
- Setup Guide ... 1
- Warranty Certificate ...1
- Serial Number Label ...1
- Sync Signal Cable ...1

Specifications

Function specification

| Item | | Description | |
|------------------------------|--------------------------------|---|--|
| 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 $\pm 10V, \pm 5V, \pm 2.5V$ or Unipolar 0 - +10V, 0 - +5V, 0 - +2.5V | |
| | Absolute max. input voltage *1 | $\pm 15V$ (Max.) | |
| | Input impedance | 1M Ω or more | |
| | Resolution | 16bit | |
| | Non-Linearity error *2*3*4 | Within $\pm 5LSB$ | |
| | Conversion speed | 10 $\mu sec/ch$ (Max.) | |
| | Buffer memory | 128M Word FIFO or 128M Word RING | |
| | Conversion start trigger | Software, conversion data compare, external trigger, and event controller output. | |
| | Conversion stop trigger | Data save complete, conversion data compare, external trigger, event controller output, and software. | |
| | Analog output | Isolated specification | Un-Isolated |
| Number of output channels *7 | | 2ch | |
| Output range | | Bipolar $\pm 10V, \pm 5V, \pm 2.5V, \pm 1.25V$ or Unipolar 0 - +10V, 0 - +5V, 0 - +2.5V | |
| Output current ability | | $\pm 5mA$ | |
| Output impedance | | 1 Ω or less | |
| Resolution | | 16bit | |
| Non-Linearity error *1 | | Within $\pm 3LSB$ | |
| Conversion speed | | 10 μsec (Max.) | |
| Buffer memory | | 256k Word FIFO or 256k Word RING | |
| Conversion start trigger | | Software, external trigger, and event controller output. | |
| Conversion stop trigger | | Last sampling count, external trigger, event controller output, and software. | |
| External start signal *5*7 | | LVTTTL level (Rising or falling edge can be selected by software) | |
| External stop signal *5*7 | | LVTTTL level (Rising or falling edge can be selected by software) | |
| Digital I/O section | Number of I/O channels *7*8 | 16 (The number of inputs and outputs can be set to either 16 inputs, 8 inputs and 8 outputs, or 16 outputs using the software.) | |
| | Response time | 200nsec (Max.) | |
| | I/O model *5*6 | Un-Isolated I/O (LVTTTL level positive logic) | |
| | Counter | Number of channels *7 | 2ch |
| | | Counting system | Up count |
| | | Max. count | FFFFFFFFh (Binary data, 32bit) |
| | | Number of external inputs *5*7 | 2 LVTTTL level (Gate/Up)/ch, Gate (High level), Up (Rising edge) |
| | | Number of external outputs *6*7 | LVTTTL level output/ch, Count match output (positive logic, pulse output) |
| | | Frequency response | 10MHz (Max.) |
| | Bus master section | DMA channels | 2ch |
| | | Transfer bus width | 64/32bit |
| | | Transfer data length | 360MByte/s |
| | | FIFO | 8k Word/ch |
| Scatter/Gather function | | 2G Byte/ch | |
| Synchronization bus section | Control output signal | Selection of output signal with the software when specifying a sync master product. | |
| | Control input signal | Selection of sync factor with the software when specifying sync slave products. | |

| Item | Description | |
|----------------|-----------------------------------|---|
| | Max. product count for connection | 16 products including the master product |
| Common section | Memory address | Occupies 2 locations 256MByte |
| | Connector | 96-pin half pitch connector [M(male)type] PCR-96LMD [HONDA TSUSHIN KOGYO CO., LTD.] or equivalent |
| | Current consumption (Max.) *9 | 3.3V 2500mA, 12V 500mA |
| | Operating condition | 0 - 50°C, 10 - 90%RH (No condensation) |
| | Bus specification | PCI Express Base Specification Rev.2.0 x1 |
| | Dimension (mm) | 169.33(L) x 110.18(H) |
| | Weight | 140g |

- *1 Do not input voltages in excess of the maximum input voltage. Similarly, do not input voltage exceeding 1.5 times the range being used, even if less than the maximum input voltage. Inputting too high a voltage may cause a fault.
- *2 The rated precision may not be achieved depending on the cable used.
- *3 The non-linearity error means an error of approximately 0.1% occurs over the maximum range at 0°C and 50°C ambient temperature.
- *4 When using a signal source with a built-in high-speed operational amp.
- *5 Inputting a 5 V TTL signal is possible.
- *6 Output to 5V TTL signal is possible. The signal will be output when H is 2.0 V or higher, and L is less than 0.8 V.
- *7 The number of analog outputs, control signals, digital inputs/outputs, counters, etc. will be limited when using a conversion cable (DT-G2E-16 or DT-G2E-32). Refer to the instruction manual of the conversion cable for details.
- *8 When JP1 is set to 2-3, the product will be fixed at 8 inputs and 8 outputs (with 1 output for Simultaneous Hold Output).
- *9 When JP1 is set to 1-2, because there is no external +5 V supply, the 12 V consumption becomes zero.

Installation Environment Requirements

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

Support Software

You can use CONTEC support software according to your purpose and development environment. For more details on the supported OS, applicable languages, or to download the latest version of software, visit the CONTEC Web site.

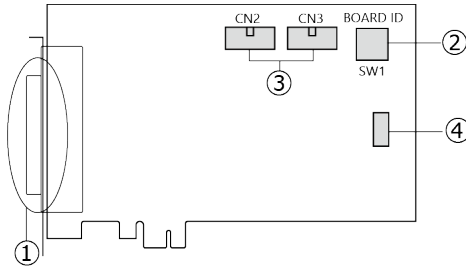
| Name | Contents | How to get |
|---|--|----------------------------------|
| Windows version High-efficiency Analog I/O Driver API-AIO(WDM) | The API-AIO(WDM) is the Windows version driver software that provides products in the form of Win32 API functions (DLL). Various sample programs such as Visual Basic and Visual C++, etc and diagnostic program useful for checking operation is provided. | Download from the CONTEC website |
| Analog I/O Driver for Linux API-AIO(LNX) | This is the Linux version driver software provided in API function formats. The software includes various sample programs such as gcc (C, C++) and Python programs. | Download from the CONTEC website |
| Data Logger Software C-LOGGER | 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. | Download from the CONTEC website |
| LabVIEW VI Library for Data Acquisition DAQ-LV-WIN | This is a data acquisition 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. | Download from the CONTEC website |
| .NET component collection for DAQfast measurement system development DAQ-DNC-FE | A GUI-based measurement system development support tool compatible with the Visual Studio low-code integrated development environment. It contains a collection of components that are very useful for developing applications using Contec's wealth of measurement control devices in the PC-HELPER series (PCIe/PCI, USB, Ethernet) and the industrial IoT CONPROSYS™ nano series. | Download from the CONTEC website |

Optional Products

| Product Name | Model type | Description |
|---|-------------------|----------------------------|
| Buffer Amplifier Box for Analog Input Boards | ATBA-32F *1*2 | 32ch type |
| | ATBA-16E *3 | 16ch type |
| | ATBA-8F *1*2*4 | 8ch type |
| Terminal Unit for Relay Terminal Banks | EPD-96 *1 | M3.5 x 96P |
| | EPD-37 *3 | M3.5 x 37P |
| Screw Terminal | EPD-96A *1*5 | M3 x 96P |
| | EPD-37A *3*5 | M3 x 37P |
| | DTP-64A *1 | M3 x 96P |
| | DTP-4C | M2.5 x 37P |
| General Purpose Terminal | DTP-3C | M3 x 37P |
| | FTP-15 *6 | M3 x 15P |
| Termination Panel with BNC connectors for Analog I/O Boards | ATP-32F *1 | for analog input 32ch |
| | ATP-16E *3 | for analog input 16ch |
| | ATP-8 *1*4*7 | for analog input 8ch |
| Simultaneous Sample & Hold Accessory for Analog Input | ATSS-16A *3*8 | |
| Isolated Expansion Accessory for Analog Input | ATII-8C *3 | |
| Low Pass Filter Accessory for Analog Input | ATLF-8A *3 | |
| Connection Conversion Shield Cable | DT-G2E-16 *9 | 16ch (96p → 37p & 15p) |
| | DT-G2E-32 *9 | 32ch (96p → 37p x 2 & 15P) |
| Shielded Cable with One 96-Pin Half-Pitch Connector | PCA96PS-0.5P | 0.5m |
| | PCA96PS-1.5P | 1.5m |
| Shielded Cable with Two 96-Pin Half-Pitch Connectors | PCB96PS-0.5P | 0.5m |
| | PCB96PS-1.5P | 1.5m |
| Shielded Cable with One 37-pin D-type Connector | PCA37PS-0.5P *10 | 0.5m |
| | PCA37PS-1.5P *10 | 1.5m |
| Shielded Cable with two 37-pin D-type Connectors | PCB37PS-0.5P *10 | 0.5m |
| | PCB37PS-1.5P *10 | 1.5m |
| Flat Cable with One 96-Pin Half-Pitch Connector | PCA96P-1.5 *11 | 1.5m |
| Flat Cable with 96-Pin Half-Pitch Connectors at Both Ends | PCB96P-1.5 *11 | 1.5m |
| Flat Cable with a 37-pin D-type Connector | PCA37P-1.5 *10*11 | 1.5m |
| Flat Cable with Two 37-pin D-SUB Connectors | PCB37P-1.5 *10*11 | 1.5m |
| Coaxial Cable for Single-ended Inputs | PCC16PS-1.5 | 1.5m |
| | PCC16PS-3 | 3m |
| 2 Wires Shielded Cable for Differential Inputs | PCD8PS-1.5 *10 | 1.5m |
| | PCD8PS-3 *11 | 3m |
| Shielded Cable with Two 15-pin D-Type Connectors | PCB15PS-1.5P *10 | 1.5m |

- *1 A PCB96PS-* optional cable is required separately. (0.5m is recommended)
- *2 An external power supply is necessary (optional AC adaptor POA200-20-2 prepared)
- *3 A conversion cable (DT-G2E-16 or DT-G2E-32) and a PCB37PS-*P cable are required separately. (0.5m is recommended.)
- *4 The analog input could have 8 channels to be used.
- *5 "Screw upright terminal panel" is used to prevent terminal screws from falling off.
- *6 A conversion cable (DT-G2E-16 or DT-G2E-32) and a PCB15PS-1.5P cable are required separately.
- *7 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.
- *8 An external power supply is necessary.
- *9 A conversion cable (DT-G2E-16 or DT-G2E-32) and a PCB15PS-1.5P cable are required separately. The length of the conversion cable (DT-G2E-16 or DT-G2E-32) is short, therefore, in order to install the FTP-15 securely, we recommend the use of the PCB15PS-1.5P cable.
- *10 A conversion cable (DT-G2E-16 or DT-G2E-32) is required separately.
- *11 Flat cables are not compliant with CE EMC Directive. Use shielded cables to ensure compliance with these standards.
- * Information about the option products, see the Contec's website.

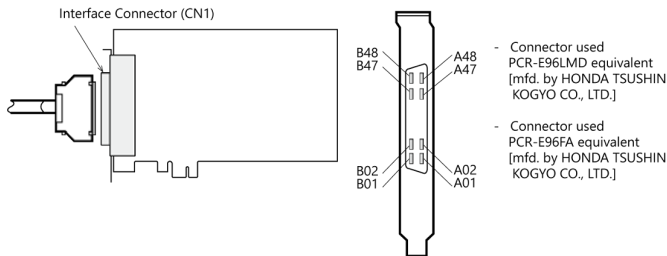
Component Name



| No. | Name | No. | Name |
|-----|-------------------------|-----|---------------------------------------|
| 1 | Interface Connector | 3 | Connector for Synchronization control |
| 2 | Board ID Setting Switch | 4 | E Series Setting Jumper (JP1) |

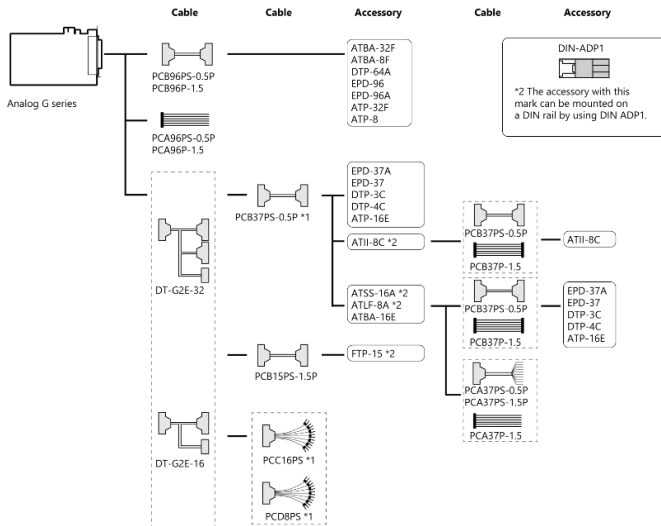
Connecting an Interface Connector

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



Adding Optional Products

Functions can be expanded by adding various dedicated optional products.



*1 Two sets of cables are necessary to use the DT-G2E-32.
 *2 The optional products with this mark can be mounted on a DIN rail by using [DIN-ADP1] accessory.
 * Please refer to "List of Option" for more information on the supported cable and accessories.

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

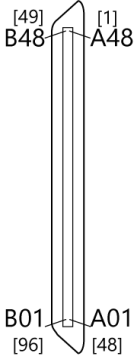
| | | | |
|---|-----|-----|----------------------------------|
| N.C. | B48 | A48 | Analog Output 00 |
| N.C. | B47 | A47 | Analog Ground (for AO) |
| N.C. | B46 | A46 | Analog Output 01 |
| N.C. | B45 | A45 | Analog Ground (for AO) |
| Analog Input 08 | B44 | A44 | Analog Input 00 |
| Analog Input 24 | B43 | A43 | Analog Input 16 |
| Analog Input 09 | B42 | A42 | Analog Input 01 |
| Analog Input 25 | B41 | A41 | Analog Input 17 |
| Analog Ground (for AI) | B40 | A40 | Analog Ground (for AI) |
| Analog Ground (for AI) | B39 | A39 | Analog Ground (for AI) |
| 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 |
| Analog Ground (for AI) | B28 | A28 | Analog Ground (for AI) |
| Analog Ground (for AI) | B27 | A27 | Analog Ground (for AI) |
| 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) |
| Digital Ground | B20 | A20 | Digital Ground |
| *1 +5V DC from PC | B19 | A19 | +5V DC from PC *1 |
| *2 Digital Input/Output 08 | B18 | A18 | Digital Input/Output 00 *3 |
| *2 Digital Input/Output 09 | B17 | A17 | Digital Input/Output 01 *3 |
| *2 Digital Input/Output 10 | B16 | A16 | Digital Input/Output 02 *3 |
| *2 Digital Input/Output 11 | B15 | A15 | Digital Input/Output 03 *3 |
| *2 Digital Input/Output 12 | B14 | A14 | Digital Input/Output 04 *3 |
| *2 Digital Input/Output 13 | B13 | A13 | Digital Input/Output 05 *3 |
| *2 Digital Input/Output 14 | B12 | A12 | Digital Input/Output 06 *3 |
| *2*4 (Simultaneous Hold Output) Digital Input/Output 15 | B11 | A11 | Digital Input/Output 07 *3 |
| 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 |

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

- *1 This becomes enabled when JP1 is set to 2-3.
- *2 Only Digital Output is available when JP1 is set to 2-3.
- *3 Only Digital Input is available when JP1 is set to 2-3.
- *4 Simultaneous Hold Output becomes enabled when JP1 is set to 2-3.

Differential Input

| | | | |
|---|-----|-----|----------------------------------|
| 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 08[-] | B43 | A43 | Analog Input 00[-] |
| Analog Input 09[+] | B42 | A42 | Analog Input 01[+] |
| Analog Input 09[-] | B41 | A41 | Analog Input 01[-] |
| Analog Ground (for AI) | B40 | A40 | Analog Ground (for AI) |
| Analog Ground (for AI) | B39 | A39 | Analog Ground (for AI) |
| Analog Input 10[+] | B38 | A38 | Analog Input 02[+] |
| Analog Input 10[-] | B37 | A37 | Analog Input 02[-] |
| Analog Input 11[+] | B36 | A36 | Analog Input 03[+] |
| Analog Input 11[-] | B35 | A35 | Analog Input 03[-] |
| 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 12[-] | B31 | A31 | Analog Input 04[-] |
| Analog Input 13[+] | B30 | A30 | Analog Input 05[+] |
| Analog Input 13[-] | B29 | A29 | Analog Input 05[-] |
| Analog Ground (for AI) | B28 | A28 | Analog Ground (for AI) |
| Analog Ground (for AI) | B27 | A27 | Analog Ground (for AI) |
| Analog Input 14[+] | B26 | A26 | Analog Input 06[+] |
| Analog Input 14[-] | B25 | A25 | Analog Input 06[-] |
| Analog Input 15[+] | B24 | A24 | Analog Input 07[+] |
| Analog Input 15[-] | B23 | A23 | Analog Input 07[-] |
| Analog Ground (for AI) | B22 | A22 | Analog Ground (for AI) |
| Analog Ground (for AI) | B21 | A21 | Analog Ground (for AI) |
| Digital Ground | B20 | A20 | Digital Ground |
| *1 +5V DC from PC | B19 | A19 | +5V DC from PC *1 |
| *2 Digital Input/Output 08 | B18 | A18 | Digital Input/Output 00 *3 |
| *2 Digital Input/Output 09 | B17 | A17 | Digital Input/Output 01 *3 |
| *2 Digital Input/Output 10 | B16 | A16 | Digital Input/Output 02 *3 |
| *2 Digital Input/Output 11 | B15 | A15 | Digital Input/Output 03 *3 |
| *2 Digital Input/Output 12 | B14 | A14 | Digital Input/Output 04 *3 |
| *2 Digital Input/Output 13 | B13 | A13 | Digital Input/Output 05 *3 |
| *2 Digital Input/Output 14 | B12 | A12 | Digital Input/Output 06 *3 |
| *2*4 (Simultaneous Hold Output) Digital Input/Output 15 | B11 | A11 | Digital Input/Output 07 *3 |
| 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 |
| Counter Output 01 | B01 | A01 | Counter Output 00 |



- The numbers in square brackets [] are pin numbers designated by HONDA TSUSHIN KOGYO CO.
- *1 This becomes enabled when JP1 is set to 2-3.
- *2 Only Digital Output is available when JP1 is set to 2-3.
- *3 Only Digital Input is available when JP1 is set to 2-3.
- *4 Simultaneous Hold Output becomes enabled when JP1 is set to 2-3.

| Signal name | Description |
|---|---|
| Analog Input00 - Analog Input31 | Analog input signal with single-ended input. The numbers correspond to channel numbers. |
| Analog Input 0[+] - Analog Input 15[+] | Analog input signal with differential input. The numbers correspond to channel numbers. |
| Analog Input 0[-] - Analog Input 15[-] | Analog input signal with differential input. 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 Input/Output 00 - Digital Input/Output 15 | Digital I/O 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. |
| +5V DC from PC | Outputs +5V. The total current-carrying capacity that can be supplied is 0.9. Mainly used for supplying power to expansion accessories. |
| Simultaneous Hold Output | Control signal for simultaneous sampling unit ATSS-16A available as an option. |
| Reserved | Reserved pin |
| N.C. | No connection to this pin |

CAUTION

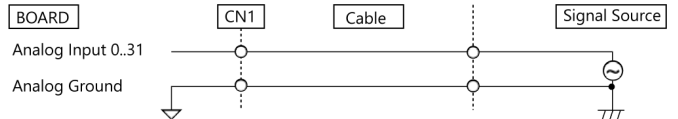
- Do not connect any of the outputs and power outputs to the analog or digital ground. Neither connect outputs to each other. Doing either can result in a fault.
- If analog and digital ground are shorted together, noise on the digital signals may affect the analog signals. Accordingly, analog and digital ground should be separated.
- Leave "Reserved" pins unconnected. Connecting these pins may cause a fault in the product.

Connecting Analog Input Signal

Single-ended Input

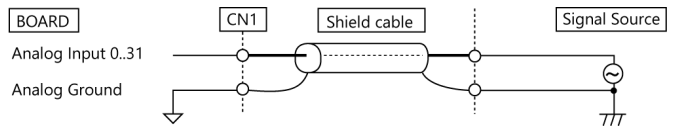
Single-ended Input Connection (Flat Cable)

The following figure shows an example of flat cable connection. Each signal source is connected to one analog input channel and the signal common to analog ground pin of CN1.



Single-ended Input Connection (Shielded Cable)

The following figure shows an example of shielded cable connection. When the distance between the signal source and the product is long or you want to increase the noise tolerance, a shield cable is suggested. Connect the signal by the core wire and common signal by the shield braids.



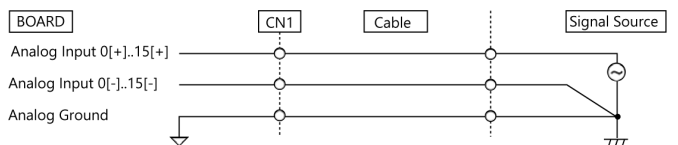
CAUTION

- When a frequency of 1MHz or higher is contained in the source signal, the cross talk between channels may occur.
- If the product and the signal source receive noise or the distance between the product and the signal source is too long, data may not be input properly.
- An input analog signal should not exceed the maximum input voltage (relate to the product analog ground). If it exceeds the maximum voltage, the product may be damaged.
- Connect all the unused analog input channels to analog ground.
- 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

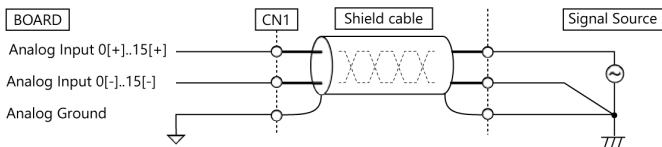
Differential Input Connection (Flat Cable)

The following figure shows an example of flat cable connection. Each signal source is connected to a [+] pin of analog input channel and the signal common of this source to the [-] pin of this input channel of CN1. In addition, the signal common must be connected to the pin of the analog ground of CN1 by a third wire.



Differential Input Connection (Shielded Cable)

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



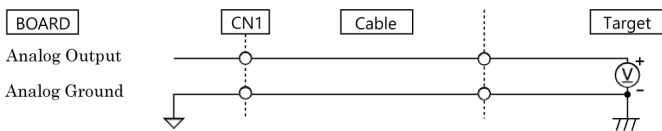
▼CAUTION

- When a frequency of 1MHz or higher is contained in the source signal, the cross talk between channels may occur.
- The input data would be uncertain if the analog ground is not connected.
- If the product and the signal source receive noise or the distance between the product and the signal source is too long, data may not be input properly.
- The input voltage from the [+] input or [-] input should not exceed the maximum input voltage (based on the product analog ground). If it exceeds the maximum voltage, the product may be damaged.
- Because the input data will be uncertain if the [+] pin or the [-] pin of CN1 is not connected, all the unused input pins of CN1 should be connected to the analog ground, AGND.
- 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

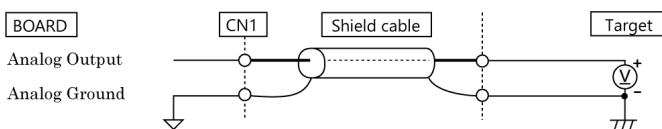
Analog Output Connection (Flat Cable)

The following figure shows an example of flat cable connection. Connect the signal source and ground to the CN1 analog output.



Analog Output Connection (Shielded Cable)

The following figure shows an example of shielded cable connection. Use shielded cable if the distance between the signal source and 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.



▼CAUTION

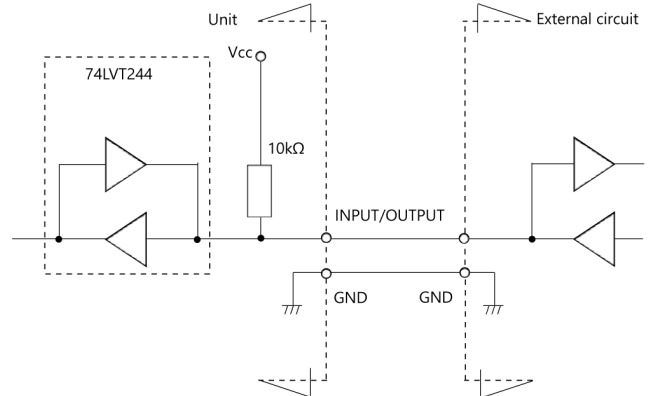
- If the product or the connected wire receives noise, or the distance between the product and the target is long, data may not be outputted properly.
- For analog output signal, the current capacity is $\pm 5\text{mA}$ (Max). Check the specification of the connected device before connecting the product.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

Connecting I/O Signals

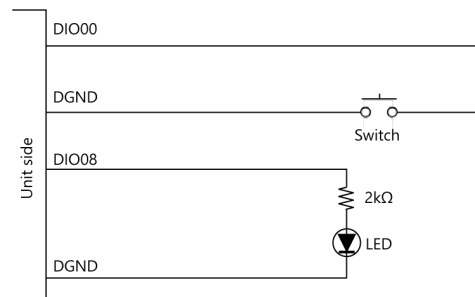
The following sections show examples of how to connect digital I/O signals.

All the I/O signals are TTL level, and input or output can be set in 8-bit units by software.

Digital I/O Circuit



Example of Connection



When switch is "ON", the corresponding bit is "0". When switch is "OFF" in contrast, the corresponding bit is "1". When "1" is output to a relevant bit, the corresponding LED comes on. When "0" is output to the bit, in contrast, the LED goes out.

These input/output signals are changed according to the software configuration when JP1 is set to 1-2. When JP1 is set to 2-3, the product will be fixed at 8 inputs and 8 outputs (with 1 output for Simultaneous Hold Output).

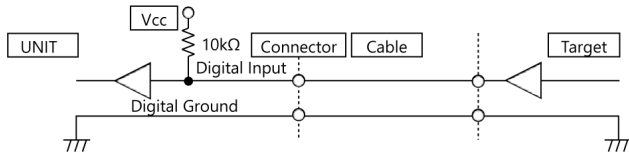
▼CAUTION

- Do not short the outputs to analog or digital ground. In addition, do not connect two outputs together. Doing either can result in a fault.
- If JP1 is set to 1-2 when the product power is turned on, only inputs will be used.
- When JP1 is set to 2-3, the product will be fixed at 8 inputs and 8 outputs (with 1 output for Simultaneous Hold Output).

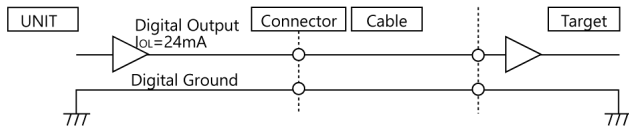
Counter signals and Control signals Connection

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

Counter input and Control input Connection



Counter output and Control output Connection



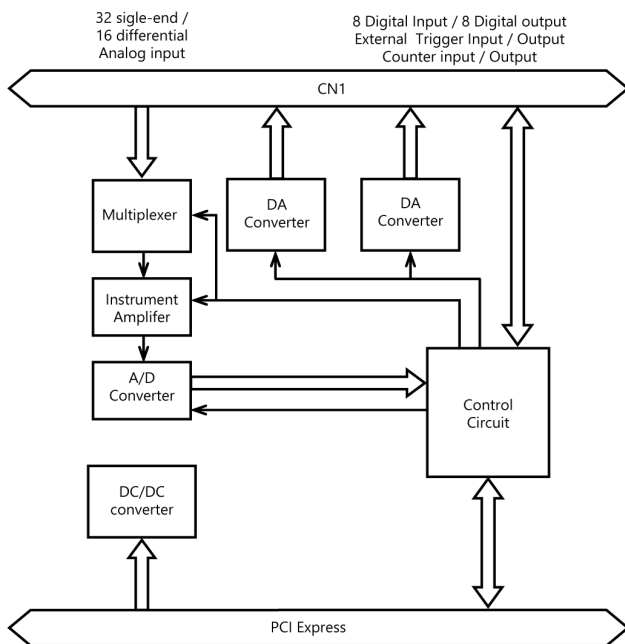
About the counter input control signal

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 10kΩ to pull up with a 5V power source. Each input accepts 5V TTL signals.

Block Diagram



Differences between this product and our earlier models.

AIO-163202G-PE and E-series

| Item | AIO-163202G-PE *1 | AIO-161601E3-PE | AD16-16(PCI)EV |
|--|--|---|---|
| Analog input Number of channels | 32ch (Single-Ended Input), 16ch (Differential Input) *2 | 16ch (Single-Ended Input), 8ch (Differential Input) | 16ch (Single-Ended Input), 8ch (Differential Input) |
| Analog input Input range | Bipolar ±10V, ±5V, ±2.5V or Unipolar 0 - +10V, 0 - +5V, 0 - +2.5V | Bipolar ±10V, ±5V or Unipolar 0 - +10V, 0 - +5V | Bipolar ±10V, ±5V or Unipolar 0 - +10V, 0 - +5V |
| Analog input Range setting | Software | Jumper | Jumper |
| Absolute max. input voltage | ±15V | ±20V | ±20V |
| Analog input Buffer memory | 128M Word FIFO or 128M Word RING | 32M Word FIFO or 32M Word RING (16M data) *3 | 32M Word FIFO or 32M Word RING (16M data) *3 |
| Analog input Control signal | LVTTTL level 3ch *4 | TTL level 3ch | TTL level 3ch |
| Analog input External status output | LVTTTL level 2ch *5 | TTL level 1ch | TTL level 1ch |
| Analog output Number of channels | 2ch *6 | 1ch | 1ch |
| Analog output range | Bipolar ±10V, ±5V, ±2.5V, ±1.25V or Unipolar 0 - +10V, 0 - +5V, 0 - +2.5V | Bipolar ±10V or Unipolar 0 - +10V | Bipolar ±10V or Unipolar 0 - +10V |
| Analog output Range setting | Software | Jumper | Jumper |
| Analog output Buffer memory | 256k Word FIFO or 256k Word RING | --- | --- |
| Analog output Conversion start trigger | Software, conversion data compare, external trigger *6, and event controller output. | --- | --- |
| Analog output Conversion stop trigger | Data save complete, conversion data compare, external trigger *6, event controller output, and software. | --- | --- |
| Analog output Control signal | LVTTTL level 3c *6 | --- | --- |
| Analog output External status output | LVTTTL level 2ch *6 | --- | --- |
| Digital input | LVTTTL level 8ch *4*6 | TTL level 4ch | TTL level 4ch |
| Digital output | LVTTTL level 8ch *5*6 | TTL level 4ch | TTL level 4ch |
| Counter channel | 2ch *6 | 1ch | 1ch |
| Counter Device | --- *7 | i8254 equivalent | i8254 equivalent |
| Counter Clock | Internal signal (10MHz) or External Signal | Internal signal (4MHz) or External Signal | Internal signal (4MHz) or External Signal |
| Max. count | FFFFFFFFh (Binary data, 32bit) | FFFFFFFFFh (Binary data, 48bit) *8 | FFFFFFFFFh (Binary data, 48bit) *8 |
| Counter External Input Input level | LVTTTL level *4 | TTL level | TTL level |
| Counter External Output Output level | LVTTTL level *5 | TTL level | TTL level |
| Bus master | Installed | --- | --- |
| Synchronization bus | Installed | --- | --- |
| Occupied address | Memory address 256MByte*2 | I/O address 32 ports | I/O address 32 ports |
| Connector | 96-pin half pitch connector [M(male)type] PCR-96LMD [HONDA TSUSHIN KOGYO CO., LTD.] or equivalent *9 | 37 pin D-SUB connector [F (female) type] Screw lock #4-40UNC DCLC-J37SAF-20L9E [mfd. by JAE] equivalent to it | 37 pin D-SUB connector [F (female) type] Screw lock #4-40UNC DCLC-J37SAF-20L9E [mfd. by JAE] equivalent to it |
| | | 16-pin Pin-header PS-16SEN-D4P1-1C [mfd. by JAE] equivalent to it | 16-pin Pin-header PS-16SEN-D4P1-1C [mfd. by JAE] equivalent to it |
| Current consumption | 3.3VDC 2500mA 12VDC 500mA *10 | 3.3VDC 1500mA *11 | 5VDC 1000mA *11 |
| Bus specification | PCI Express Base Specification Rev.2.0 x1 | PCI Express Base Specification Rev. 1.0a x1 | PCI (32bit, 33MHz, Universal key shapes supported) |
| Dimension (mm) | 169.33(L) x 110.18(H) | 169.33(L) x 110.18(H) | 176.41(L) x 105.68(H) |
| Weight | 140g | 160g | 150g |

*1 When JP1 is set to 2-3.

- *2 When using the DT-G2E-16, either 16 channels (single-ended input) or 8 channels (differential input) will be used.
- *3 1 data bit = 2 words
- *4 Inputting a 5 V TTL signal is possible.
- *5 Output to 5V TTL signal is possible. The signal will be output when H is 2.0 V or higher, and L is less than 0.8 V.
- *6 The number of analog outputs, control signals, digital inputs/outputs, counters, etc. will be limited when using a conversion cable (DT-G2E-16 or DT-G2E-32).
Refer to the instruction manual of the conversion cable for details.
- *7 A separate counter function is installed.
- *8 It is the case above listed according to the setting of the installed jumper.
It could be 32bit depending on the settings.
- *9 Conversion to a connector equivalent to the AIO-161601UE3-PE or AD16-16U(PC)EV is possible by using a conversion cable.
- *10 The 12 V consumption becomes zero when no external +5 V supply is used.
- *11 The current consumption increases when +5 V is supplied externally from the connector.