Features

Integrates the analog signal I/O and digital signal I/O features into one board.

With this one board, following features can be added: analog inputs (10μsec [100KSPS]/ch, 12bit, 16channels), analog outputs (10μsec [100KSPS], 12bit, 1channel), counter (32bit, TTL level 2channels), and digital I/Os (8channels for TTL level). A feature-rich system is possible even with a PC that has relatively fewer expansion slot(s).

Supports the SC series signal conditioners.
The SC series signal conditioner that provides various signal conversion features are supported. Using this product with the SC series, by unifying I/O ranges through conversion for each channel, it can support diverse testing applications that require different I/O specifications for testing purposes.

Analog I/O features that supports numerous sampling and counter features.

Buffer memory (256K data) can be used as FIFO or RING for analog input or output, supporting several start/stop condition settings. Many types of sampling operation are possible with matching the counters, internal timer and/or external clock. Trimmer-less design that enables calibration of conversion accuracy via software.

Counter features that supports both of the single-phase and two-phase modes.

Single-phase mode (up count) and two-phase (up-down count) mode are supported. Various applications such as pulse-signal adder, rotary encoder, linear-scale position detection can be supported. A digital filter feature that suppresses malfunction caused by a noise.

Synchronized operation of multiple interface boards is supported.

On-board synchronization control connector. Enables synchronized operation with the other boards that have synchronization connectors (Max. 16 boards).

Supports data logger software C-LOGGER

Without requiring any programming, supports C-LOGGER, our data logger software that enables graphical view of the measurement data, observation with zooming, file save and dynamic transmission to Excel (a spreadsheet software) (Stored on the bundled CD-ROM).

This product is a PCI bus-compliant interface board that integrates the analog I/O and digital I/O features into one board. It has 12bit analog inputs (16channels), 12bit analog outputs (1channel), 8 digital I/Os, and 2 channels of counter that supports encoder inputs (2-phase signals). Using it with a signal conditioner (separately available) that converts and integrates relevant I/Os that may differ according to what to be measured and/or controlled, it can support diverse testing applications that require complex and various I/O features. As a support for application development environments, a lot of driver software and middleware is provided such as Windows / Linux APIs and MATLAB / LabVIEW libraries.

Specification

<table>
<thead>
<tr>
<th>Item</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Analog input</td>
<td></td>
</tr>
<tr>
<td>Isolated specification</td>
<td>Non-isolated</td>
</tr>
<tr>
<td>Input type</td>
<td>Single-Ended Input</td>
</tr>
<tr>
<td>Number of input channels</td>
<td>16channels</td>
</tr>
<tr>
<td>Input range</td>
<td>Bipolar ±10V</td>
</tr>
<tr>
<td>Absolute max. input voltage</td>
<td>±15V</td>
</tr>
<tr>
<td>Input impedance</td>
<td>1MΩ or more</td>
</tr>
<tr>
<td>Resolution</td>
<td>12bit</td>
</tr>
<tr>
<td>Non-Linearity error *1</td>
<td>±2LSB</td>
</tr>
<tr>
<td>Conversion speed</td>
<td>10μsec [100KSPS]/ch (Max.)</td>
</tr>
<tr>
<td>Buffer memory</td>
<td>256K data FIFO or 256K data RING</td>
</tr>
<tr>
<td>Conversion start trigger</td>
<td>Software, conversion data compare, external trigger, count compare match for counter, count clear, carry / borrow, timer</td>
</tr>
<tr>
<td>Conversion stop trigger</td>
<td>Settings include data save complete, conversion data compare, external trigger, software, count compare match for counter, count clear, digital filter error, abnormal input error, carry / borrow, timer</td>
</tr>
<tr>
<td>External start signal</td>
<td>TTL (Rising or falling edge can be selected by software)</td>
</tr>
<tr>
<td>External stop signal</td>
<td>TTL (Rising or falling edge can be selected by software)</td>
</tr>
<tr>
<td>External clock signal</td>
<td></td>
</tr>
<tr>
<td>External status output signal</td>
<td>2 TTL</td>
</tr>
</tbody>
</table>

Analog output

<table>
<thead>
<tr>
<th>Item</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Isolated specification</td>
<td>Non-isolated</td>
</tr>
<tr>
<td>Number of output channels</td>
<td>1channel</td>
</tr>
<tr>
<td>Output range</td>
<td>Bipolar ±10V</td>
</tr>
<tr>
<td>Absolute max. input current</td>
<td>±5mA</td>
</tr>
<tr>
<td>Input impedance</td>
<td>1MΩ or less</td>
</tr>
<tr>
<td>Resolution</td>
<td>12bit</td>
</tr>
<tr>
<td>Non-Linearity error *1</td>
<td>±1LSB</td>
</tr>
<tr>
<td>Conversion speed</td>
<td>10μsec [100KSPS]/ch (Max.)</td>
</tr>
<tr>
<td>Buffer memory</td>
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<tr>
<td>External status output signal</td>
<td>2 TTL</td>
</tr>
</tbody>
</table>

* Specifications, color and design of the products are subject to change without notice.
**OS**
Windows Vista, XP, Server 2003, 2000

**Operating environment**
- Basic and Visual C++, etc and diagnostic program useful for functions (DLL).
- Various sample programs such as Visual Basic and Visual C++.

**API-AIO(WDM)**
- The API-AIO(WDM) is the Windows version driver software which provides device drivers (modules) by shared library and kernel version.
- Various sample programs of gcc are provided.

**API-AIO(LNX)**
- The API-AIO(LNX) is the Linux version driver software which provides device drivers (modules) by shared library and kernel version.

**Support Software**

**Windows version of analog I/O driver API-AIO(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 useful for checking operation is provided.

**Cable & Connector**

**Cable (Option)**
- Shield Cable with 96-Pin
  - D-SUB Connector at One End: PCA96PS-0.5P (0.5m)
  - PCA96PS-1.5P (1.5m)
- Half-Pitch Connectors at Both Ends: PCB96PS-0.5P (0.5m)
  - PCB96PS-1.5P (1.5m)
- Flat Cable with 96-Pin
  - PCA96P-1.5 (1.5m)
  - PCB96P-1.5 (1.5m)
**Data acquisition library for MATLAB ML-DAQ**
- (Available for downloading (free of charge) from the CONTEC web site.)

This is the library software which allows you to use our analog I/O device products on MATLAB by the MathWorks. Each function is offered in accordance with the interface which is integrated in MATLAB’s Data Acquisition Toolbox. See http://www.contec.com/mldaq/ for details and download of ML-DAQ.

**Data acquisition VI library for LabVIEW VI-DAQ**
- (Available for downloading (free of charge) from the CONTEC web site.)

This is a VI library to use in National Instruments LabVIEW. VI-DAQ is created with a function form similar to that of LabVIEW’s Data Acquisition VI, allowing you to use various devices without complicated settings. See http://www.contec.com/vidaq/ for details and download of VI-DAQ.
Connector (Option)
Half Pitch 96P Female Connector Set (5 Pieces): PCB96P-1.5 (1.5m) *1

*1 Flat cable is not VCCI Class A compliant. For VCCI ClassA compliance, use the shielded cable (CPA96PS/PCB96PS).

Accessories (Option)
- Screw Terminal Unit (M3 x 96P): EPD-96A *1 *3
- Screw Terminal Unit (M3.5 x 96P): EPD-96 *1
- Signal conversion board for analog I/O: SC-AIO1604G *1 *2
- Box for signal conversion board (4-Slots): ESC-4

*1 PCB96PS. *2 Optional ESC-4 is required separately.
*3 "Spring-up" type terminal is used to prevent terminal screws from falling off.
* Check the CONTEC’s Web site for more information on these options.

Packing List
Board [AIO-121601M-PCI] ...1
First step guide ...1
CD-ROM *1 [API-PAC(W32)] ...1
SC Cable (10cm) ...1

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

Block Diagram
16 single-end / Analog Inputs
8 Digital Input / 8 Digital Output
External Trigger Input/Output
Counter Input / Output

Digital Ground
Digital Input 00 - Digital Input 07
Digital Output 00 - Digital Output 07

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

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

Pin Assignment of CN1

Pin Assignment of CN1

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

Pin Assignment of CN1

Analog Input 00 - Analog Input 15
Analog output signal. The numbers correspond to channel numbers.
Analog Output
Analog output signal. The numbers correspond to channel numbers.
Analog Ground (for AI)
Common analog ground for analog input signals.
Analog Ground (for AO)
Common analog ground for analog output signals.
Digital Input 00 - Digital Input 07
Digital input signal. The numbers correspond to channel numbers.
CNT0/CNT1 Control Input*
External control signal for counter input.
Digital Output 00 - Digital Output 07
Digital output signal. The numbers correspond to channel numbers.
Digital Ground
Common digital ground for digital I/O signals, external trigger inputs, external sampling clock inputs, and counter I/O signals.
AI External Sampling Clock Input
External sampling clock input for analog input.
AI External Stop Trigger Input
External trigger input for stopping analog input sampling.
AO External Start Trigger Input
External trigger input for starting analog input sampling.
AO External Sampling Clock Input
External sampling clock input for analog output.
AO External Stop Trigger Input
External trigger input for stopping analog output sampling.
AO External Start Trigger Input
External trigger input for starting analog output sampling.
CNT Input A0 - CNT Input A1
Phase-A input signal of counter. The numbers correspond to channel numbers.
CNT Input B0 - CNT Input B1
Phase-B input signal of counter. The numbers correspond to channel numbers.
CNT Input Z0 - CNT Input Z1
Phase-Z signal of counter. The numbers correspond to channel numbers.
CNT Output 0 - CNT Output 1
Output signal of counter. The numbers correspond to channel numbers.

* The digital input 00/01 or CNT0/CNT1 Control Input is selected by software.

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.

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

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

Interface Connector (CN1)

* Please refer to page 2 for more information on the supported cable and accessories.
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 product 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 affect the cross-talk noise between channels.
- 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.

**Analog Output Signal Connection**

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

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

**Analog Output Connection (Flat 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.

**Analog Output Connection (Shield Cable)**

**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 ±5mA (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.

**Control Signal of Analog I/O**

**External sampling clock signal**

(AI External Sampling Clock Input, AO External Sampling Clock Input)

Pin used to input the external pacer clock. The maximum frequency is 10MHz.

If the external clock input is selected as the sampling clock, sampling occurs on the falling edge of the signal.

**Other control input signals**

(AI External Start Trigger Input, AI External Stop Trigger Input, AO External Start Trigger Input, AO External Stop Trigger Input)

These signals are TTL-level compatible and the trigger edge is software-programmable at either the rising or falling edge. High- and low-level hold times of at least 50 nsec are required to detect an edge of the signal.

**Digital I/O signals Connection**

The following figure shows examples of how to connect digital I/O signals.

All the digital I/O signals are TTL level signals.

**Digital Input Connection**
Digital Output Connection

Connection of the Counter Input Signal

You can connect to a rotary encoder or linear scale with a TTL level output circuit, or to an open-collector output circuit. The signal must be a TTL level input and can be up to 10MHz. For a two-phase input, connect both phase A and phase B. For a single phase input, connect to either phase A or phase B. If not using the Z phase, this does not need to be connected.

Example Connection for Counter Input Circuit

Digital Output Connection

Connection with counter input circuit (counter input)

Control input circuit and its sample connection

Connection of Control Signal for the Counter

Connection of a control input

The control input signals consist of one pin per channel that can be selected as the channel's counter start/stop or preset. The signals are TTL-level inputs. As pull-up resistors (10kΩ) are provided on the product.

Control output circuit and its sample connection

Example Connection with a Rotary Encoder

Example Connection with a Linear Scale