

# DATENBLATT

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## AI-1608-USB-Serie

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### **ADRESSE**

Am Sonnenlicht 5

D-82239 Alling bei München



N Series for USB  
Isolated Analog Input Unit  
(±10V Voltage Input)  
**AI-1608VIN-USB**  
(0 - 20mA Current Input)  
**AI-1608AIN-USB**



- \* The photograph is a AI-1608AIN-USB.
- \* Specifications, color and design of the products are subject to change without notice.

## Features

### <AI-1608VIN-USB>

**8 channels of analog input (voltage input) with high accuracy, and 4 channels of digital input and output respectively are contained**  
Analog input (10μsec/ch, 16bit, 8ch), and digital input and output (Input: TTL level 4 channels, Output: Open-collector 4 channels) are equipped. The analog input supports differential input and the ±10V voltage input bipolar.

### <AI-1608AIN-USB>

**8 channels of analog input (current input) with high accuracy, and 4 channels of digital input and output respectively are contained**  
Analog input (20μsec/ch, 16bit, 8ch), digital input and output (Input: TTL level 4 channels, Output: Open-collector 4 channels) are equipped. The analog input supports differential input and the 0-20mA current input.

### <Common>

#### Buffer memory available in FIFO format

This product contains buffer memory (8K data) which can be used in FIFO format. You can perform analog input in the background, independent of software and the current status of the PC.

#### Sampling can be driven by a clock or by various triggers

Sampling can be started and stopped by software and external (timing of control signals input from external) triggers. The sampling period can be controlled by the internal clock (high-precision timer included in the product).

#### Isolated from the bus by a digital isolator

This product isolates the PC from analog input as well as digital I/O by a digital isolator, which improves the noise performance.

#### Open collector output for digital output

The use of open collector output ensures digital outputting with TTL or 12-24 V power by the power of the external device.

#### Compact design not restricting installation location

**(188.0(W)×78.0(D)×30.5(H))**

Compact design of 188.0(W) × 78.0(D) × 30.5(H) does not require special installation location.

This product is an analog input unit supporting USB2.0 to provide the input function of analog signal from USB port on the computer. Compact design, (188.0(W)×78.0(D)×30.5(H)mm), features flexibility in installation. The product can be set on the floor, wall, and inside the console or equipment with the DIN rail.

For AI-1608VIN-USB, 8 channels of 16-bit analog input, and digital input and output (4 channels respectively) are equipped, and these circuits are isolated from the computer. As the analog input supports differential input, accurate measurement can be performed even when potential differences with the signal source occur. The input range supports ±10V voltage input bipolar.

As for AI-1608AIN-USB, 8 channels of 16-bit analog input, and digital input and output (4 channels respectively) are equipped, and these circuits are isolated from the computer. As the analog input supports differential input, accurate measurement can be performed even when potential differences with the signal source occur. The input range supports 0-20mA current input.

- \* 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 May 2019.

### Compatible to USB1.1/USB2.0

Compatible to USB1.1/USB2.0 and capable to achieve high speed transfer at High Speed (480 Mbps)

### Diverse installations such as screw fastening, magnet, DIN rail are possible

Installation on the floor / wall / ceiling is possible by screw fastening, magnet, rubber feet, etc. In addition, DIN rail mounting mechanism is equipped as standard with the product, making it easy to install the product within the panel or the device.

### Easy-to-wire terminal connector adopted

Adoption of terminal connector (with screws) enables to achieve easy wiring.

### Software-based calibration function

Calibration of analog input 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.

### Windows compatible driver software is provided

Using the provided driver software API-AIO(WDM) for USB makes it possible to create applications of Windows.

In addition, a Diagnostic Program to confirm the hardware operations is supplied as well.

### Data logger software [C-LOGGER] (Analog input only) compatible

Data logger software [C-LOGGER] program is compatible with our products and it displays the recorded signal data as a graph or saves them in a file, and dynamic forwards them to the spreadsheet software program "Excel".

### LabVIEW is supported by a plug-in of dedicated library

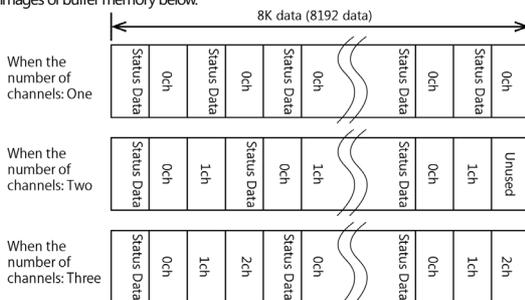
Using the dedicated library allows a user to create each application for LabVIEW.

## Specifications

### Function Specifications

Item		AI-1608VIN-USB	AI-1608AIN-USB
Analog input	Isolated specification	Bus-Isolated	
	Input type	Differential Input	
	Input channel	8ch	
	Input range	Voltage: Bipolar ±10V	Current: 0 - 20mA
	Maximum input rating	±15V	30mA
	Input impedance	1MΩ or more	250Ω (Typ.)
	Resolution	16bit	
	Non-linear error *1*2	±8LSB	±20LSB
	Conversion speed	10μsec/ch *3	20μsec/ch *3
	Buffer memory	8K data *4	
	Conversion start trigger	Software / external trigger	
	Conversion stop trigger	Number of sampling times / external trigger / soft-ware	
	External start signal	TTL level (Rising or falling edge can be selected to the D100-pin by software)	
	External stop signal	TTL level (Rising or falling edge can be selected to the D101-pin by software)	
External dock signal	TTL level (Rising or falling edge can be selected to the D102-pin by software)		
Digital input	Number of input channels	4ch	
	Input type	Bus-isolated TTL level input (Negative logic) *5*6	
Digital output	Number of output channels	4ch	
	Output format	Bus-isolated open collector output (Negative logic) *5	
	Output rating	Output voltage	30VDC (Max.)
		Output current	40mA (par channel) (Max.)
USB	Bus specification	USB Specification 2.0/1.1-compliant	
	USB transfer rate *7	12Mbps (Full-speed), 480Mbps (High-speed)	
	USB connector	USB mini B connector	
	Power supply	Self-power	
Power supply	Input voltage range	12 - 24VDC±10%	
	Current consumption (Max.)	12VDC 250mA, 24VDC 150mA	
	Power supply connector	European type terminal 3.5mm pitch 3-pin jack connector	
Common section	Interface connector	European type terminal 3.5mm pitch 10-pin jack connector	
	Dielectric strength	500VAC	
	Physical dimensions (mm)	188.0(W)×78.0(D)×30.5(H) (No projection included)	
	Weight	250g (Not including the USB cable or attachment)	
	The length of cable (supplied)	USB cable(Type A - mini-B type) 1.8m	

- \*1 The non-linearity error means an error of approximately ±0.1% occurs over the maximum range at -20°C and 60°C ambient temperature.
- \*2 At the time of the source use of a signal which built in the high-speed operational amplifier.
- \*3 This numerical displays the conversion speed for A/D converter. The minimum executable sampling cycle depends on the operating condition of the terminal.
- \*4 Not only sampling data but also status data are stored in buffer memory. This product employs 8K (8192 data) data buffer memory. When the number of channels x the number of sampling are up to 8192 data (see below), sampling can be done at 10μsec/ch of the conversion speed of A/D converter.  
The number of channels x The number of sampling ≤ 8192 data  
However, the amount of data that can actually be stored in buffer memory will be decreased since the memory for one data at one sampling is used as internal status.  
See the images of buffer memory below.



- \*5 Data "0" and "1" correspond to the High and Low levels, respectively.
- \*6 The D100 / D101 / D102-pin of digital input cannot be used simultaneously with External start signal/ External stop signal/ External clock signal.
- \*7 The USB transfer rate depends on the host PC environment used (OS and USB host controller).

### Installation Environment Requirements

Item	AI-1608VIN-USB	AI-1608AIN-USB
Operating ambient temperature	-20 - +60°C *8	
Operating ambient humidity	10 - 90%RH (No condensation)	
Floating dust particles	Not to be excessive	
Corrosive gases	None	
Line-noise resistance *9	Line noise	AC Line/±2kV Signal Line /±1kV(IEC61000-4-4 Level 3, EN61000-4-4 Level 3)
	Static electricity resistance	Touch /±4kV(IEC61000-4-2 Level 2, EN61000-4-2 Level 2) Air /±8kV(IEC61000-4-2 Level 3, EN61000-4-2 Level 3)
Vibration resistance	Sweep resistance	10 - 57Hz /semi-amplitude vibration 0.15mm, 57 - 150Hz/2.0G 40minutes each in X, Y, and Z directions (JIS C60068-2-6-compliant, IEC 60068-2-6-compliant)
Shock resistance	147m/s <sup>2</sup> (15G)/11ms/half-sine shock (JIS C 60068-2-27 -compliant, IEC 60068-2-27 -compliant)	
Standard	VCCI Class A, FCC Class A, CE Marking (EMC Directive Class A, RoHS Directive)	

\*8 When using the supplied AC adaptor POA 201-10-2, it is 0 - 40°C.

\*9 When using the supplied AC adaptor POA 201-10-2.

### AC adapter environmental condition (environmental specification)

Item	Specifications
Input voltage range	90 - 264VAC
Rated input current	300mA
Number of frequency	50 - 60Hz
Rated output voltage	12.0VDC
Rated output current	1.0A (Max.)
Physical dimensions (mm)	47.5(W)×75(D)×27.3(H) (No protrusions)
Weight	175g
Operating temperature	0 - 40°C
Operating humidity	20 - 80%RH (No condensation)
Life expectancy *10	1.5 years (at the ambient temperature 40 °C when 100VAC is input and 1.0A is output) 4 years (at the ambient temperature 40 °C when 100VAC is input and 0.5A is output)
Allowable time of short interruption	20ms (Max.) (When 100VAC is input and 0.55A is output) *11
Floating dust particles	Not to be excessive
Corrosive gases	None
Voltage compatible to the supplied AC cable	125VAC 7A

\*10 Life expectancy is four years when using this product.

\*11 When short interruption occurs and

## 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
Driver software API-AIO(WDM) for USB	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
Data Logger Software C-LOGGER	C-LOGGER is a data logger software program compatible with our analog I/O products. This program enables the recorded signal data to be displayed as a graph, zoom-observed, saved in a file, and dynamic forwarded to the spreadsheet software program "Excel". It eliminates the need for tedious programming.	
LabVIEW VI Library for the Data Acquisition DAQfast for LabVIEW	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.	

### Optional Products

Product Name	Model type	Description
AC adapter	POA201-10-2 *1	Input: 90 - 264VAC, Output: 12VDC 1.0A
DIN rail fitting power supply	CPS-PWD-90AW24-01 *2	90W (Input: 100-240VDC, Output: 12VDC 3.8A)
	CPS-PWD-30AW24-01 *2	30W (Input: 100-240VDC, Output: 12VDC 1.3A)
	CPS-PWD-15AW12-01 *2	15W (Input: 100-240VDC, Output: 12VDC 1.3A)
Magnet	CPS-MAG01-4	Magnet (Four Piece Set)

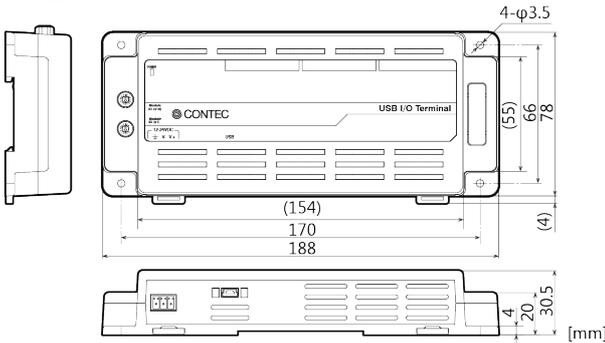
\*1 The operating ambient temperature is 0 to 40 °C. It is the same adapter included in this package.

\*2 The operating ambient temperature is -20 to 70 °C

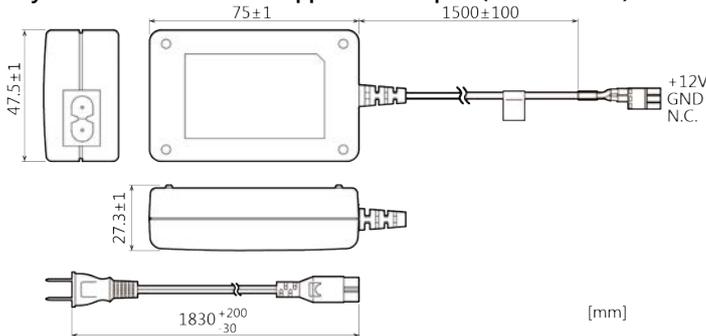
Visit the CONTEC website for the latest optional products.

### Physical Dimensions

#### Product



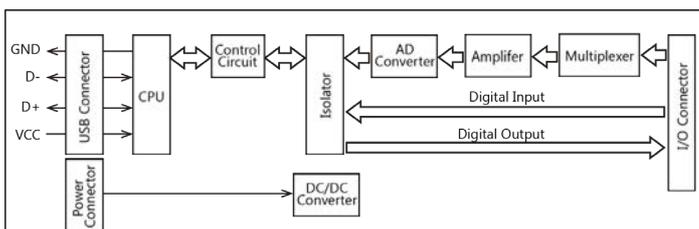
#### Physical dimensions of the supplied AC adapter (POA201-10-2)



### Packing List

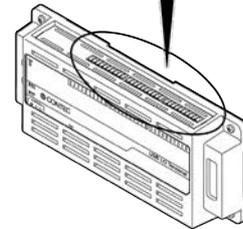
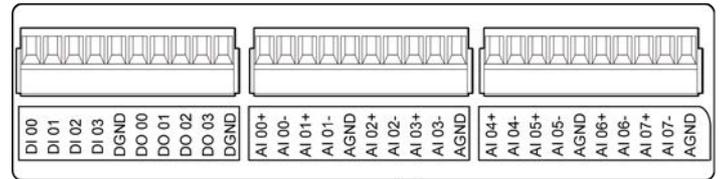
- Product...1
- Setup Guide...1
- Warranty Certificate...1
- Serial Number Label...1
- Interface Connector...3
- USB Cable (1.8m)...1
- USB Cable Attachment on the main unit's side)...1
- Rubber feet...4
- AC Adapter...1
- AC Cable...1

### Circuit Block Diagram



### Signal Layout on the Interface Connector

The product can be connected to an external device using three 10-pin connectors included in the package.



DI 00 -- DI 03	Digital input pins. The numbers correspond to input bits.
DO 00 -- DO 03	Digital output pins. The numbers correspond to output bits.
DGND	This is a digital ground and shares channels of I/O signals.
AI 00+ -- AI 07+	Analog input pins(+). The numbers correspond to channel numbers.
AI 00- -- AI 07-	Analog input pins(-). The numbers correspond to channel numbers.
AGND	This is an analog ground and shares channels of analog input signals.

### Connecting Cable

#### Analog Input Cable

Use the analog input cable listed below.

Applicable wire	AWG28 - 16
Cable Length	For AI-1608VIN-USB : Within 1.5 meters * If higher accuracy is required, the cable length should be 0.5 meters or shorter. For AI-1608AIN-USB : Within 20 meters

#### Digital I/O Cable

Use the digital I/O cable listed below.

Applicable wire	AWG28 - 16
Cable Length	Within 1.5 meters

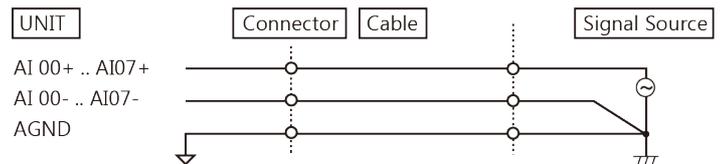
### Connecting Analog Input Signal (AI-1608VIN-USB)

Here are examples on how to connect analog input signals of interface connector with flat cable or shield cable.

#### Differential Input Connection

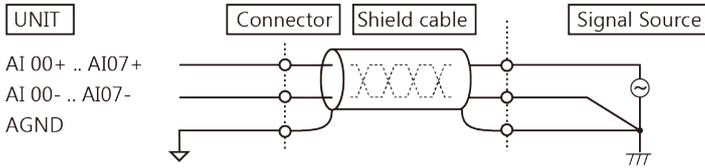
##### - Connection example with flat cable

The following figure shows an example of flat cable connection. For each analog input channel on interface connector, connect the "+" input to the signal and connect the "-" input to the signal source ground. Also connect the analog ground on the product to the signal source ground.



##### - Connection example with shield 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 each analog input channel on interface connector, connect the "+" input to the signal and connect the "-" input to the signal source ground. Also connect the analog ground on the product and the signal source ground to the shielding.



**CAUTION**

- If the signal source contains over 1 MHz signals, the signal may affect the cross-talk noise between channels.
- When the analog ground is not connected, the conversion data is not determined.
- 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 that inputs to the [+] input or the [-] input should not exceed the maximum input voltage and current listed in the "Function Specifications (Page 2)". The product may be damaged if the maximum voltage or current is exceeded.
- When the [+] input or the [-] input is not connected, the conversion data is not determined. Connect all the unused [+] input pins and the [-] input pins of channels to analog ground.
- This product measures multiple channels with the multiplexer. 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 properly 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 as a buffer between the signal source and the analog input pin to reduce the effect.

**Connecting Analog Input Signal (AI-1608AIN-USB)**

Here are examples on how to connect analog input signals of interface connector with flat cable or shield cable.

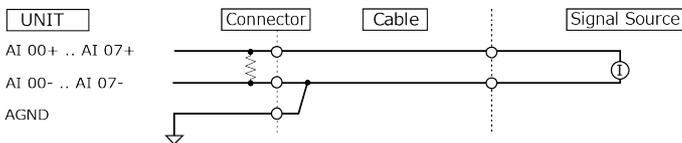
**Connection Example of Current Input**

**- Connecting with two-terminal current output (Flat Cable)**

The following shows an example of flat cable connection with two-terminal current output.

Connect the [+] input of analog input channel of the interface connector to the positive side of signal source, and the [-] to the negative side of the signal source respectively.

Also, connect the analog ground of the interface connector to the [-] input of the signal source.



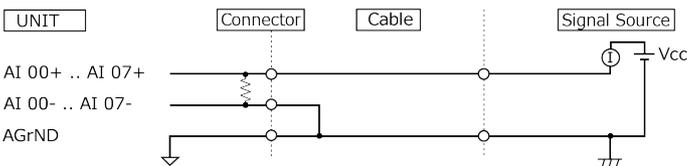
**- Connecting with current source output (Flat Cable)**

The following shows an example of flat cable connection with current source output.

Connect the [+] input of analog input channel of the interface connector to the output terminal of the signal source, and the [-] input to negative side of the signal source respectively.

Also, connect the analog ground of the interface connector to the ground of the signal source.

\* When connecting the [-] input of the product and the analog ground on the external device side, make sure the potential difference between the [-] input of the product and the analog ground is 0.5 V or less.



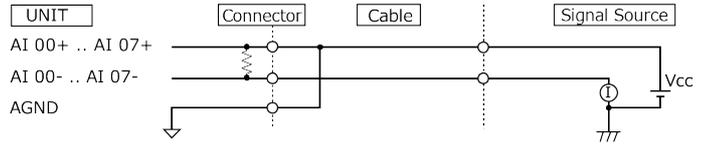
**- Connecting with current sink output (Flat Cable)**

The following shows an example of flat cable connection with current sink output.

Connect the [+] input of analog input channel of the interface connector to the positive side of the current source, and the [-] input to the output terminal of the current source respectively.

Also, connect the analog ground to the [+] input of signal source.

\* When connecting the [+] input of the product and the analog ground on the external device side, make sure the potential difference between the [+] input of the product and the analog ground is 0.5 V or less.



**- Connecting with current input (Shielded two-conductor cable)**

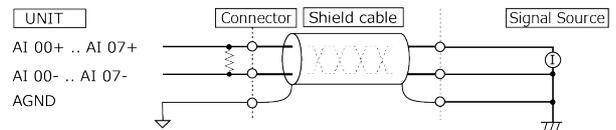
The following shows an example of shielded cable connection with current input.

Use this type of cable if the signal source is located at a distance from the product or if the connection requires higher noise immunity.

Connect the [+] input of analog input channel of the interface connector to the positive side of the current source, and the [-] input to the negative side of the current source respectively.

Also, connect the analog ground of the product to the ground of signal source using the shield braid.

\* At this time, make sure the potential difference between the [-] input of the module and the analog ground is 0.5 V or less.

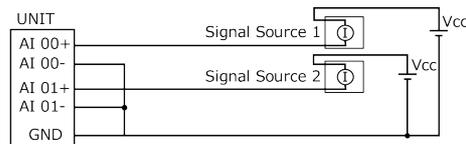


**- Connecting with several current source output (Flat Cable)**

The following shows an example of flat cable connection with current source output.

Connect the [+] input of analog input channel of the interface connector to the output terminal of the current source, and the [-] input to the negative side of the current source respectively.

Also, connect the analog ground to the ground of signal source.



**CAUTION**

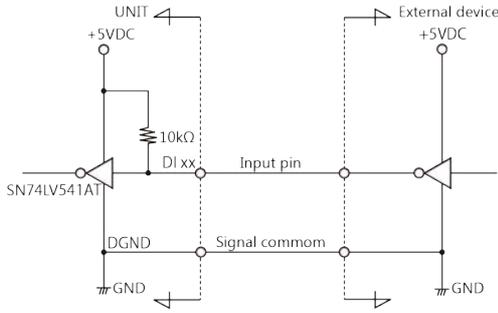
- If the signal source contains over 1 MHz signals, the signal may affect the cross-talk noise between channels.
- When the analog ground is not connected, the conversion data is not determined.
- If the connecting cable is affected by noise, accurate analog input may not be made. To secure the accuracy, place the connecting cable far from the source of the noise and put a laminated ceramic capacitor on the interface connector of the product (when using a ceramic capacitor, make the lead as short as possible).
- The analog ground is shared since analog input channels are not isolated among all. If inter-channels suffer from potential differences, isolate them with such as an isolated converter.
- An input analog signal that inputs to the [+] input or the [-] input should not exceed the maximum input voltage and current listed in the "Function Specifications(Page 2)". The product may be damaged if the maximum voltage or current is exceeded.
- Converted data is undefined when either of the [+] and [-] input terminals is left unconnected.
- Connect both of the [+] and [-] input terminals of the channel that are not connected to the signal source to the analog ground.

**Digital I/O signals Connection**

Digital I/O signals can be used as control I/O signals (external trigger input signals, sampling clock input signals, etc.). The following section shows examples of how to connect signals.

**Input Circuit**

The following is a digital I/O circuit of the interface (connector) part. External digital signals given to signal input section are TTL level, and each signal is taken to a PC using negative logic. Each signal input section is pulled-up in this product, therefore, outputs of relay contacts or semiconductor switch can be connected directly between this signal input and signal common.

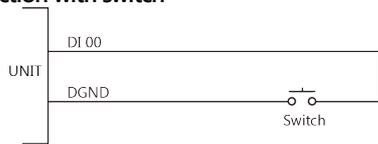


\*Input pins are indicated as DI xx. xx corresponds to input bits

DI 00 - DI02 can be used as control signals listed below. However, when using them as control signals, they cannot be used as general-purpose digital inputs.

- DI 00: External Start Signal Input
- DI 01: External Stop Signal Input
- DI 02: External Clock Signal Input

**Example Connection with switch**



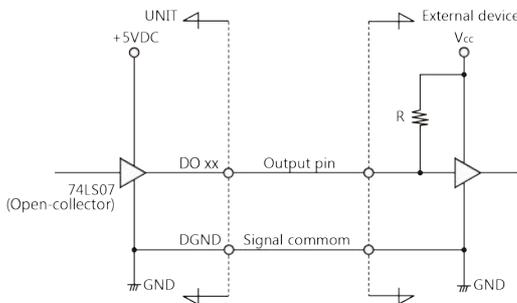
When switch is "ON", the corresponding bit is "1".  
When switch is "OFF" in contrast, the corresponding bit is "0".

**Output Circuit**

The following is an output circuit of the interface (connector) part. Signal output section is an open-collector, and each signal is sent to external devices using negative logic. Outputting by open-collector makes outputting in accordance with the power of the external devices. Note that each signal output section is not pulled-up in this product, therefore, pull up at the external device side.

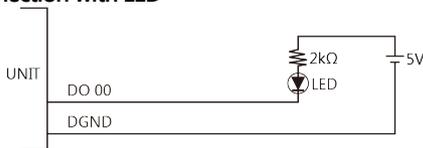
**CAUTION**

- Do not short the output signals to analog ground, and/or digital ground. Doing so may damage the product.
- When supplying power of 12-24VDC power (such as the AC adapter), all output will be OFF.



\*Output pins are indicated as DO xx. xx corresponds to output bits.

**Example Connection with LED**

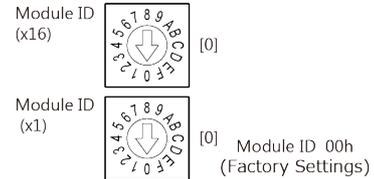


When "1" is output to a relevant bit, the corresponding LED comes on.  
When "0" is output to the bit, in contrast, the LED goes out.

**Setting Switches**

With the two setting switches, the host computer distinguishes and keeps track of the devices of same model by assigning Module IDs to them. Factory setting "00" can be used when only one device per model is connected to one computer. Each device should be assigned a unique Module ID in the range of 00 - 7Fh when several devices with the same model are being connected.

"x16" and "x1" represent upper four bits and lower four bits of Module ID respectively.



Module ID	Description
00 - 7Fh	It is a setting range for module IDs.
FFh	This is used only when upgrading the firmware.

**CAUTION**

When setting with Module ID(x1) = F, Module ID(x16) = F, Module ID is only used for upgrading the firmware. This setting cannot be used to distinguish or keep tracks of the devices.