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

* The photograph is an AI-1608AIN-ETH.

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

The product is an Ethernet-compatible unit with analog input function. 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. Windows/Linux device driver is supported with the product.

For AI-1608VIN-ETH, 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.

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* 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 February, 2024.

Features

8 channels of analog input (voltage input), and 4 channels of digital input and output respectively are contained with high accuracy (AI-1608VIN-ETH only)

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.

8 channels of analog input (current input), and 4 channels of digital input and output respectively are contained with high accuracy (AI-1608AIN-ETH only)

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.

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

The 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.

Operable in a wide range of 12 - 24VDC power

The product can be operated in the various environments with a wide range power supply of 12 - 24VDC. In addition, the FG terminal is equipped in the power supply connector.

Compact design not restricting installation location (188.0(W) x 78.0(D) x 30.5(H))

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

Usable as an Ethernet-based analog input

Analog input is controlled via Ethernet, making remote monitoring easy.

Diverse installations such as screw fastening, magnet (optional purchase), DIN rail are possible

Installation on the floor / wall /ceiling is possible by screw fastening, with magnets (optional purchase), 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.

Windows/Linux support device driver

Using the device driver API-TOOL makes it possible to create applications of Windows/Linux. In addition, a diagnostic program by which the operations of hardware can be checked is provided.

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.

Included Items

Product ...1
Interface connector...3
Power supply connector...1

Rubber feet...4
Please read the following...1

Support Software

| Name	Contents	How to get
Windows Version Analog I/O Driver software API-AIO(WDM)	The Windows device driver is provided as a form of Windows API functions. Various sample programs such as C# and Visual Basic .NET , Visual C++, Python etc. and diagnostic program useful for checking operation is provided.	Download from the CONTEC website *1
Linux Version Analog I/O Driver software API-AIO(LNX)	The Linux device driver is provided as a shared library. The software includes various sample programs such as gcc (C, C++) and Python programs, as well as a configuration tool to configure the device settings.	Download from the CONTEC website *1
Software Development Tool Kits (SDK) and Support Software	In addition to the device drivers, we offer many software programs for using CONTEC devices in an easier manner.	Download from the CONTEC website *2

*1 Download the files from the following URL
    https://www.contec.com/download/

*2 For supported software, search the CONTEC website for this product and view the product page.
    https://www.contec.com/

Specifications

Function specification

Item		AI-1608VIN-ETH	AI-1608AIN-ETH
Analog input			
	Isolated specification	Bus-Isolated	
	Input type	Differential Input	
	Number of input channels	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 (Max.)	20μsec/ch *3 (Max.)
	Buffer memory	8K data *4	
	Conversion start trigger	Software / external trigger	
	Conversion stop trigger	Number of sampling times / external trigger / software	
	External start signal	TTL level (Rising or falling edge can be selected to the DI00-pin by software)	
	External stop signal	TTL level (Rising or falling edge can be selected to the DI01-pin by software)	
	External clock signal	TTL level (Rising or falling edge can be selected to the DI02-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.)
LAN section *7			
	Transmission standard	10BASE-T/100BASE-TX	
	Connector	RJ-45 connector	
	LED	Speed(Orange), Link / Act(Green)	
Power supply			
	Input voltage range	12 - 24VDC±10%	
	Current consumption	12VDC 250mA(Max.), 24VDC 150mA(Max.)	
	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	

*1   The non-linearity error means an error of approximately ±0.1% occurs over the maximum range at -20℃ and 60℃ 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.
The 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.
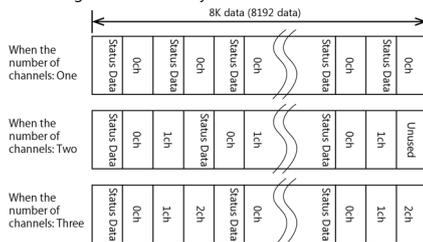
*5   Data "0" and "1" correspond to the High and Low levels, respectively.

*6   The DI00 / DI01 / DI02-pin of digital input cannot be used simultaneously with External start signal/ External stop signal/ External clock signal.

*7   Use an STP cable.

Installation Environment Requirements

Item		AI-1608VIN-ETH	AI-1608AIN-ETH
Operating ambient temperature *1		-20 - +60℃ *2	
Operating ambient humidity		10 - 90%RH (No condensation)	
Floating dust particles		Not to be excessive	
Corrosive gases		None	
Line-noise resistance *3	Line noise	AC Line/±2kV, Signal Line/±1kV (IEC61000-4-4 Level 3, EN61000-4-4 Level 3)	
	Static electricity resistance	Contact discharge /±4kV (IEC61000-4-2 Level 2, EN61000-4-2 Level 2) Air discharge /±8kV (IEC61000-4-2 Level 3, EN61000-4-2 Level 3)	
Vibration resistance	Sweep resistance	10 - 57Hz /semi-amplitude vibration 0.15mm, 57 - 150Hz/2G 40minutes each in X, Y, and Z directions (JIS C60068-2-6-compliant, IEC60068-2-6-compliant)	
Shock resistance		147m/s²(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), UKCA	

*1   Secure a distance of at least 50mm between the top of the product (single use) and any surrounding objects.

*2   When using the supplied AC adaptor POA 201-10-2, it is 0 - 40℃.

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

Physical Dimensions

[mm]
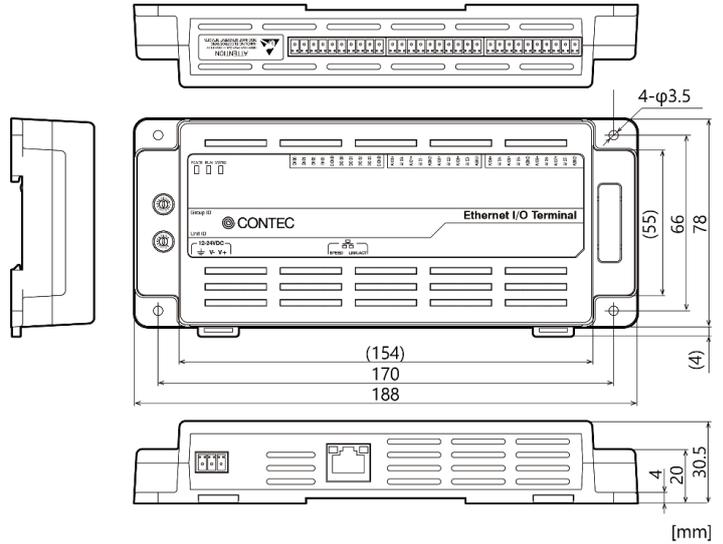
Optional Products

| Product Name	Model type	Note
AC-DC Power Adaptor (12VDC, 1A)	POA201-10-2	*1
CONPROSYS Series Magnet (Four Piece Set)	CPS-MAG01-4	
CONPROSYS Series 12VDC AC-DC Converter	CPS-PWD-15AW12-01	*2
CONPROSYS Series 12VDC AC-DC Converter	CPS-PWD-30AW24-01	*2
CONPROSYS Series 12VDC AC-DC Converter	CPS-PWD-90AW24-01	*2

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

*2   The operating ambient temperature is -20 to 70 ℃.

Component Name
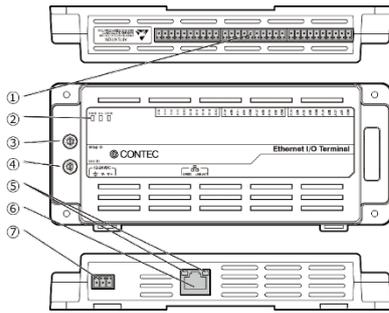
No.	Name	No.	Name
1	Interface Connector	5	LAN LED
2	LED Indicator	6	Ethernet Connector
3	Setting Switch: Group ID	7	Power Supply Connector (Attached connector)
4	Setting Switch: Unit ID		

Signal Layout on the Interface Connector
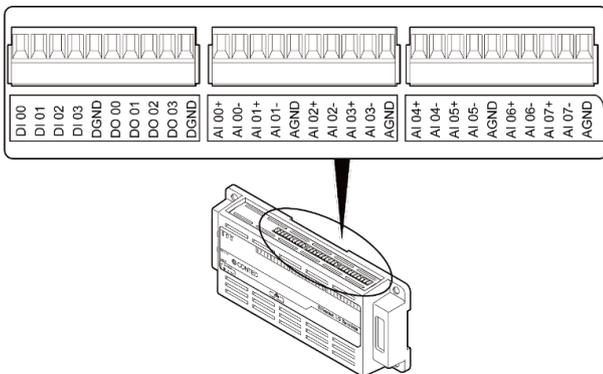
DI 00 -- DI 03	Digital input pins. The numbers correspond to input bits.
DO 00 -- DO 03	Digital output pins. The numbers correspond to output bits.
DGND	This is a digital ground and shares channels of I/O signals.
AI 00+ -- AI 07+	Analog input pins(+). The numbers correspond to channel numbers.
AI 00- -- AI 07-	Analog input pins (-). The numbers correspond to channel numbers.
AGND	Common pin for input signals or output signals.

Connecting Analog Input Signal (AI-1608VIN-ETH)

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.
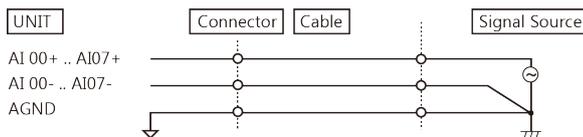
- Connection example with shield cable
The following figure shows an example of shielded cable connection. Use shielded cable if the distance between the signal source and product is long or if you want to provide better protection from noise. For each analog input channel on interface connector, connect 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.
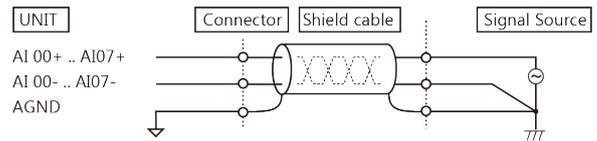
⚠ **CAUTION**

- 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". 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.
- The 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-ETH)

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

Connection Example of Current Input
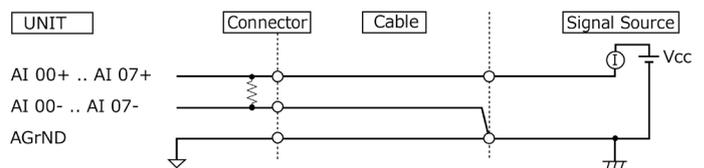**- Connecting with two-terminal current output (Flat Cable)**
The following shows an example of flat cable connection with two-terminal current output. Connect the [+] input of analog input channel of the interface connector to the positive side of signal source, and the [-] to the negative side of the signal source respectively. Also, connect the analog ground of the interface connector to the [-] input of the signal source.
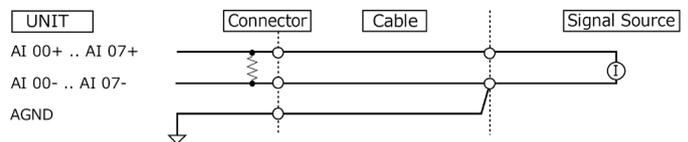
- Connecting with current source output (Flat Cable)
The following shows an example of flat cable connection with current source output. Connect the [+] input of analog input channel of the interface connector to the output terminal of the signal source, and the [-] input to negative side of the signal source respectively. Also, connect the analog ground of the interface connector to the ground of the signal source.
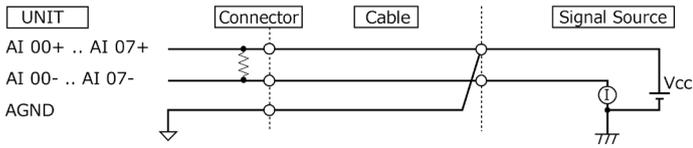
*   When connecting the [-] input of the product and the analog ground on the external device side, make sure the potential difference between the [-] input of the product and the analog ground is 0.5 V or less.

- 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 shield 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.
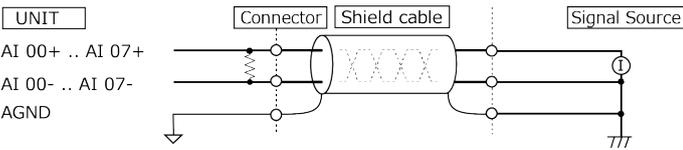
- Connecting with current input (Shielded two-conductor cable)

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.
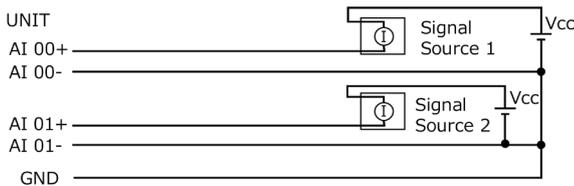

⚠ CAUTION

- 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 "Hardware Specification". 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.

Connecting Digital I/O Signals

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 the product, therefore, outputs of relay contacts or semiconductor switch can be connected directly between this signal input and signal common.
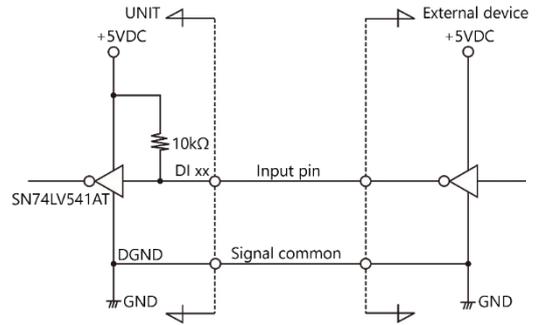

*Input pins are indicated as DI xx. xx corresponds to input bits.

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 (External Sampling Start Trigger Input)

    DI 01: External Stop Signal Input (External Sampling Stop Trigger Input)

    DI 02: External Clock Signal Input (External Sampling Input)
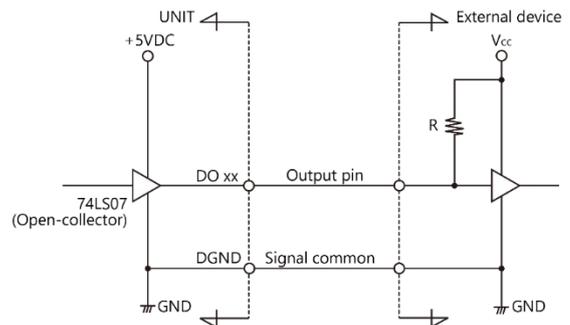
Example Connection with switch
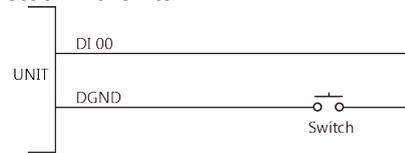
When switch is "ON", the corresponding bit is "1".

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 the product, therefore, pull up at the external device side.
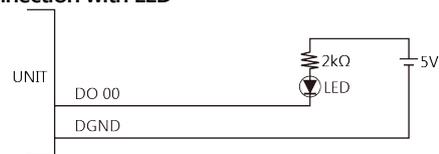
⚠ CAUTION

- 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.
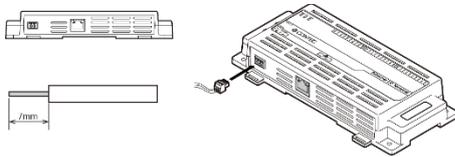
Power Supply Connector

Connect this product to the external power supply with the supplied power input connector.

When using a commercially available DC output power supply, follow the same procedure described here.
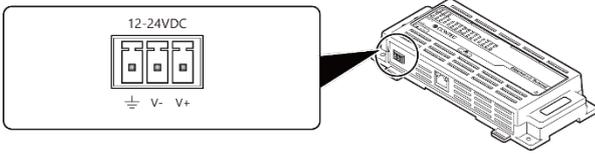
Mark	Signal Name
⏚	Frame ground (FG)
V-	Power supply (GND)
V+	Power supply (12 − 24VDC)

Connecting to an External Power Supply for Driving the Product

When supplying power using the supplied power supply connector or the compatible connector, strip off approximately 7mm (±0.5mm) of the covered part of the cable and insert it into the connector and securely screw it in place.

When connecting the FG pin of the product to ground (earth), follow the same procedure.

Use the power cable described below.

Cable	Twisted pair cable (when using a single wire, twist V+ wire and V- wire)
Cable Diameter	AWG24 - 16(0.2mm^2 - 1.25mm^2)
Cable Length	Within 3 meters

Use the FG cable described below.

Cable Diameter	AWG18 - 16(0.75mm^2 - 1.25mm^2)

About a power rise

When using a commercially available DC output power supply, use a power supply with an input voltage that rises to above 11.4VDC and below 12 to 24VDC (+10%) within 20ms. A power supply that does not rise to this level may not operate the product properly or may cause a product failure or accident.
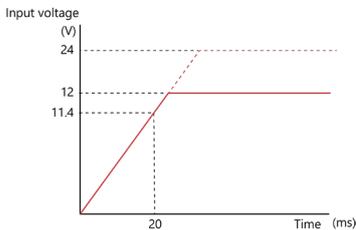

### Connecting an external power supply

Use an external power supply as necessary for the environment and application.

When using the separately sold AC adapter POA201-10-2 or DIN rail fitting power supply, connect the connector included with that product to the power supply connector, and do not use the supplied power supply connector. Use an external power supply as necessary for the environment and application.

Connecting the AC Adapter POA201-10-2 (Option)
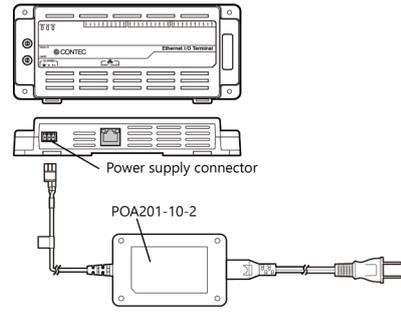
Connecting DIN rail fitting power supply (Option)
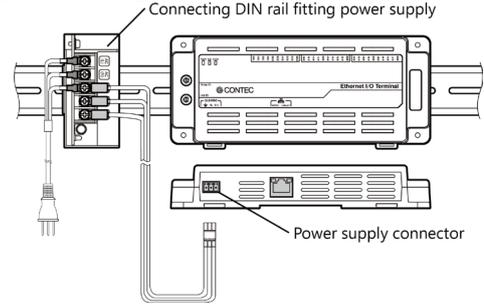
⚠ CAUTION

- Refer to the specifications in "Function Specifications" for the required input power specifications per unit of the product.
- The tightening torque for the supplied power supply connector is 0.19N·m.
- If the maximum output current of the external power supply does not include a sufficient margin compared with the maximum current consumption of the product, abnormal operation may occur due to the inrush current at startup or load fluctuations, or a start failure may occur due to degradation of the power supply over time.
- When the product is not used, leave the 12 - 24VDC power supply (such as the separately sold AC adapter) unplugged.
- Connect the 12-24VDC power supply (such as the separately sold AC adapter) to the power supply connector of the product first. When unplugging, unplug it from the power outlet side of the AC adapter first.
- Grasping the cable to remove the power supply connector of the 12-24VDC can break the wire. Always grasp the connector to remove it.
- When the 12-24VDC power supply in supplied, do not disconnect the 12-24VDC power supply from the power supply connector.
- If you use the product in a noisy environment, connect the FG pin of the product to the ground (earth) to stabilize the operation.
- Using the separately sold AC adapter in a heated state continuously affects its life.
- Use the separately sold AC adapter not in a closed place but in a well-ventilated place to prevent the product from being overheated.
- Do not remove the power supply connector [MC1,5/3-ST-3,5] that is attached to the separately sold AC adapter.

Circuit Block Diagram