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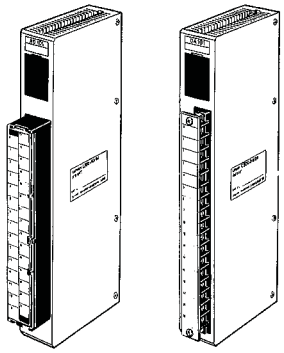
C120/C500/C1000H/C2000H

Analog I/O Modules

Cat. No. W121-E3-1



Notice:

OMRON products are manufactured for use according to proper procedures by a qualified operator and only for the purposes described in this manual.

The following conventions are used to indicate and classify precautions in this manual. Always heed the information provided with them. Failure to heed precautions can result in injury to people or damage to the product.

⚠ DANGER! Indicates information that, if not heeded, is likely to result in loss of life or serious injury.

⚠ WARNING Indicates information that, if not heeded, could possibly result in loss of life or serious injury.

⚠ Caution Indicates information that, if not heeded, could result in relatively serious or minor injury, damage to the product, or faulty operation.

OMRON Product References

All OMRON products are capitalized in this manual. The terms *Unit* and *Module* are capitalized when refering to an OMRON product.

The abbreviation “Ch,” which appears in some displays and on some OMRON products, often means “word” and is abbreviated “Wd” in documentation in this sense.

The abbreviation “PLC” means Programmable Controller and is not used as an abbreviation for anything else.

Visual Aids

The following headings appear in the left column of the manual to help you locate different types of information.

Note Indicates information of particular interest for efficient and convenient operation of the product.

1, 2, 3... 1. Indicates lists of one sort or another, such as procedures, checklists, etc.

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About this Manual:

This manual describes the installation and operation of Analog Input Modules and Analog Output Modules for the C120, C500, C1000H, and C2000H SYSMAC C-series PLCs. These Modules are classified as Special I/O Modules and include the following:

Analog Input Modules

The Analog Input Modules convert analog inputs to digital (binary) form. The type and range of input as well as the digital format depend on the model. Some models provide additional features such as peak values, means, or scaling.

PLC	Applicable models
C120	3G2A6-AD001 3G2A6-AD002 3G2A6-AD003 3G2A6-AD004 3G2A6-AD005 3G2A6-AD006 3G2A6-AD007
C500 C1000H C2000H	C500-AD101 3G2A5-AD001 3G2A5-AD002 3G2A5-AD003 3G2A5-AD004 3G2A5-AD005 3G2A5-AD006 3G2A5-AD007

Analog Output Modules

Analog Output Modules convert digital (binary) data to analog outputs. The type and range of output as well as the digital format depend on the model.

PLC	Applicable models
C120	3G2A6-DA001 3G2A6-DA002 3G2A6-DA003 3G2A6-DA004 3G2A6-DA005
C500 C1000H C2000H	C500-DA101 3G2A5-DA001 3G2A5-DA002 3G2A5-DA003 3G2A5-DA004 3G2A5-DA005

Be sure to familiarize yourself with the information in this manual and your PLC's *Operation Manual* before you try to install or use an Analog I/O Module.

Model References

If an Analog I/O Module is referred to using only the last half of the model number (i.e., 3G2A5 or 3G2A6 is omitted), the information being provided applies to all Modules whose model number ends with the number given.

SECTION 1
System Design

This section describes the basic use of Analog I/O Modules in a Control System and illustrates the type of applications in which they might be found.

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1−2 Basic Configuration 2
1−3 Example Configurations 3
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1−4−1 AD001 through AD005 Analog Input Modules 4
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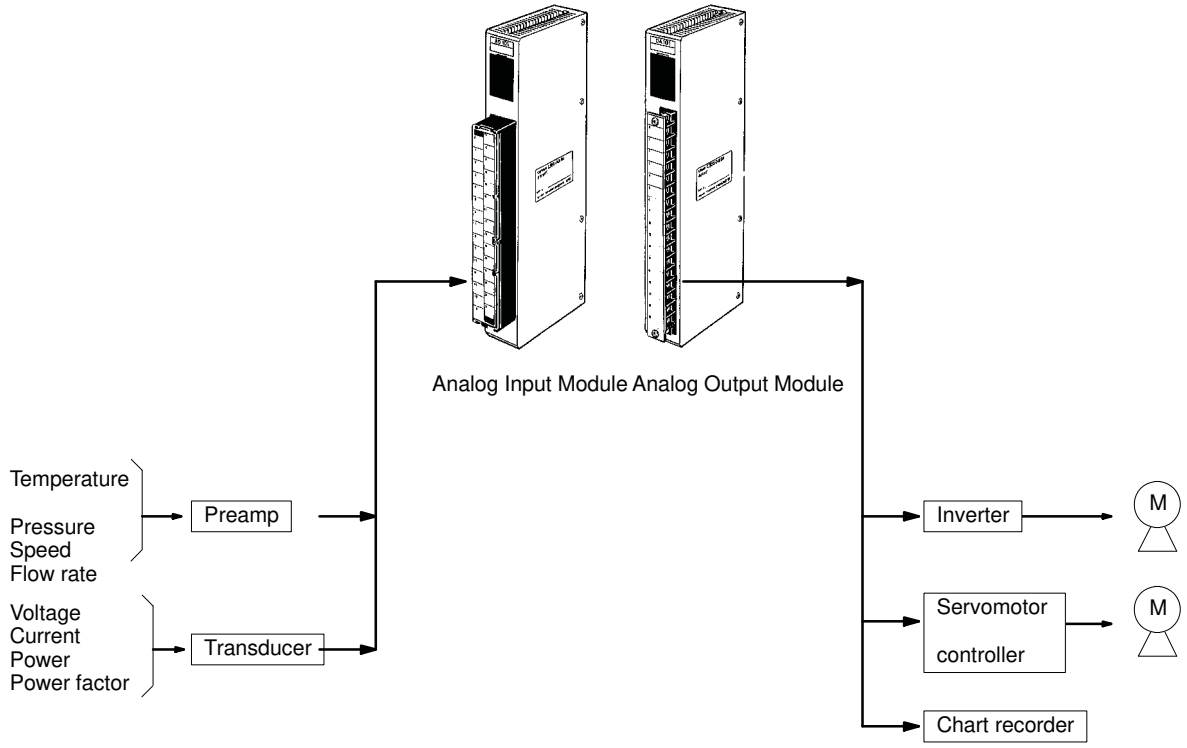
1–1 Introduction

Analog I/O Modules are used to interface the digital operation of the PLC with analog I/O field devices. Analog Input Modules convert analog signal from input devices to digital PLC data. Analog Output Modules convert digital PLC data to analog signals for output devices.

1–2 Basic Configuration

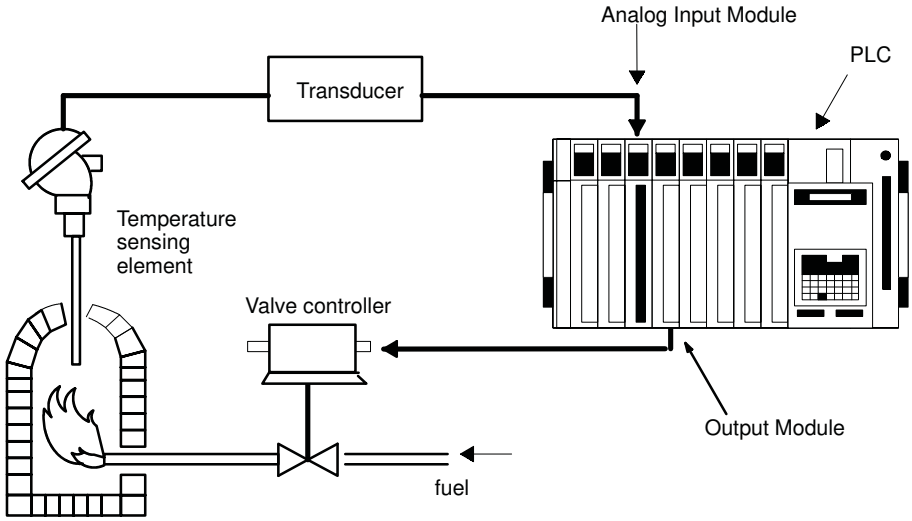
This diagram shows some of the possible field devices for the Analog I/O Modules. Any I/O device may be used as long as its voltage/current requirements fall within the specified ranges (see *Appendix B*).

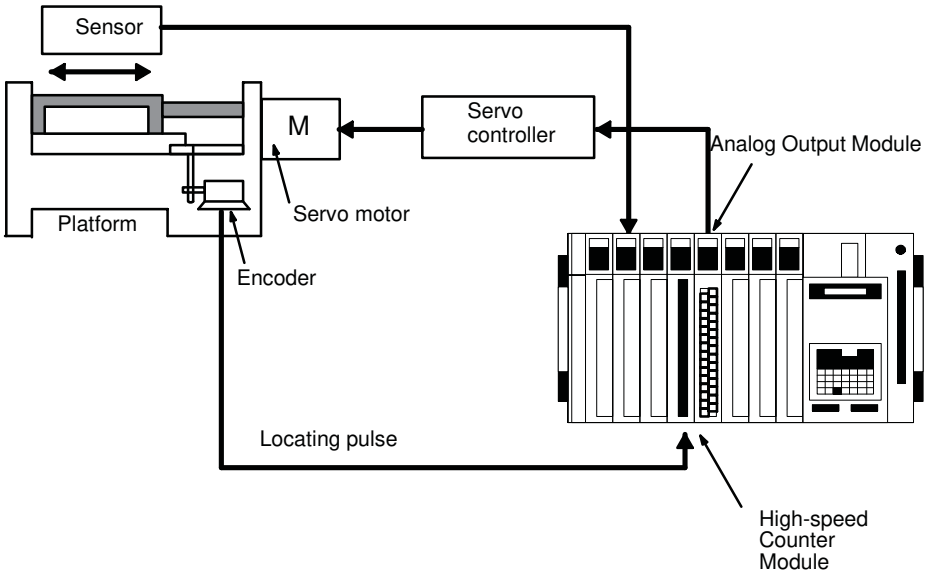
The I/O device connected to the Analog I/O Module will often serve as an interface for another device, e.g., a preamplifier may interface a pressure gauge to increase the signal level to Analog Input Module requirements; a regulator may interface a heating system to control temperature.



1–3 Example Configurations

Below are two examples of how the Analog I/O Modules can be employed in control systems. The first diagram shows a temperature regulating system and the second shows a servomotor positioning system.





1–4 Allocated Words

Each Analog I/O Module is allocated either two or four words. This section specifies only the actual number of words allocated to the Modules; use of these words is dealt with in *Section 4 Operation*.

The first word allocated to the Module is designated as “n” in this manual. Remaining words, which are always consecutive, are designated as n+1, n+2, etc. Refer to you PLC’s *Operation Manual* for details on how words are allocated to Modules.

1–4–1 AD001 through AD005 Analog Input Modules

Each of these Analog Input Modules is allocated two words, one for each analog input point. Word n is for point 1, and word n+1 is for point 2. Each of these words contains the decimal-converted value for the analog input point.

1–4–2 AD006 and AD007 Analog Input Modules

Each of these Analog Input Modules is allocated four words, one for each analog input point. Word n is for point 1, word n+1 is for point 2, word n+2 is for point 3, and word n+3 is for point 4. Each of these words contains the decimal-converted value for the analog input point.

1–4–3 AD101 Analog Input Modules

Each of these Analog Input Modules is allocated either two or four words, depending on the switch settings. The operation of the Module is completely different depending on this switch setting. Refer to later sections of this manual for details.

1–4–4 DA001 through DA005 Analog Output Modules

Each of these Analog Output Modules is allocated two words, one for each analog output point. Word n is for point 1; word n+1 is for point 2. Each of these words contains the digital-converted value for the analog output point.

1–4–5 DA101 Analog Output Modules

Each of these Analog Output Modules is allocated four words, one for each analog output point. Word n is for point 1, word n+1 is for point 2, word n+2 is for point 3, and word n+3 is for point 4. Each of these words contains the digital-converted value for the analog output point.

SECTION 2
Components and Switch Settings

This section describes the switch settings for the AD101 Analog Input Module and the DA101 Analog Output Module. There are no switch settings required on the other Analog I/O Modules.

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2–1 AD101 Analog Input Modules

There are two settings necessary for this Module: the operation mode and the input ranges (offset and gain) for each input point

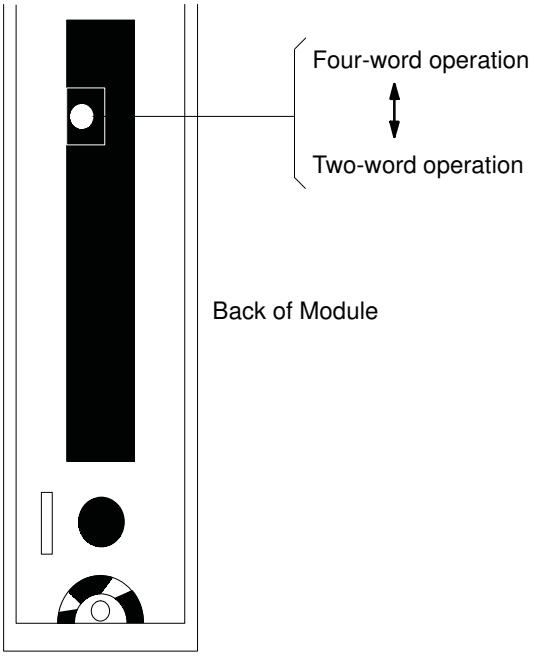
Operation Mode

Select either two-word or four-word operation. If you select two-word operation, data is transferred between the Analog Input Module and PLC using the I/O READ and I/O WRITE instructions, WRIT(87) and READ(88). If you select four-word operation, data is transferred between the Analog Input Module and PLC via the MOVE instruction, MOV(21).

Use of WRIT(87) and READ(88) will simplify programming and shorten the time required to access analog input data.

The switch for this setting is on the back of the Module and will not be accessible while the Module is mounted to a Rack. Be sure to set this switch before mounting the Module to the PLC. The setting of the switch is read when the PLC power is turned ON.

Caution Only the following C120 and C500 CPUs are equipped with WRIT(87) and READ(88), which are required for two-word operation: 3G2C4-SC023-E and 3G2C3-CPU11-EV1 With all other C120 and C500 CPUs, you must use four-word operation. These instructions are supported by all C1000H and C2000H CPUs. Two-word operation is not possible if the Analog I/O Module is mounted to a Slave Rack in a Remote I/O System, regardless of the CPU.



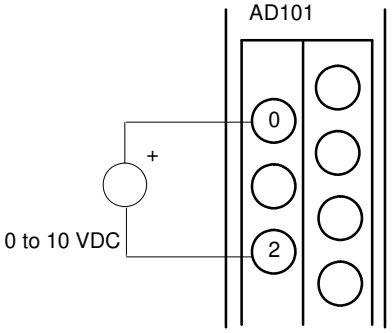
Input Ranges

Each input point is set with an offset (minimum) of 1 V (4 mA) and a gain (maximum) of 5 V (20 mA) at the factory. Use the following procedure to change these settings if necessary. The offset and gain can be set to anywhere between 0 and 10 V (0 and 20 mA) as long as the gain is greater than the offset. (Refer to *Section 3 Operation* for details on AD conversion.)

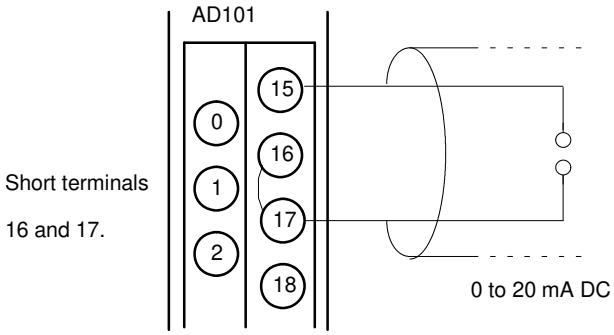
Caution If an offset is set below 0 V (0 mA), the binary-converted value will be locked at 000_{hex}; if a gain is set above 10 V (20 mA), the binary-converted value will be locked at FFF_{hex} for voltage inputs, but not for current inputs.

1, 2, 3... 1. First set up a power source and meter. For voltage inputs, you will need a 0 to 10 VDC supply and a DC voltmeter. For current input, you will need a 0 to 20 mA DC supply and a DC ammeter. Mount the Module to the PLC and connect the power source and meter. Voltage and current specifications can be set independently for each input point. The following examples illustrate how to wire the input points

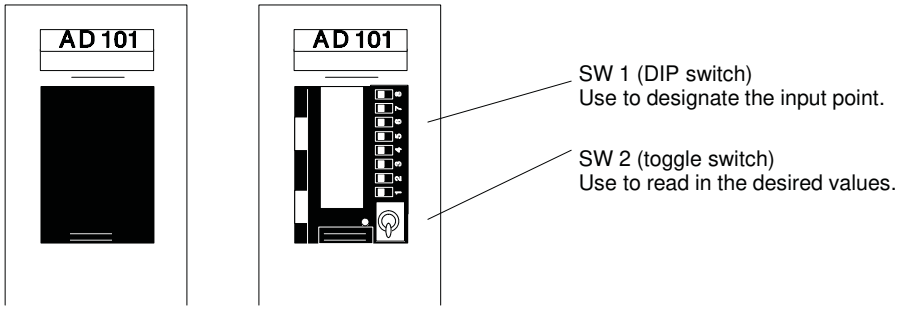
Wiring when input 1 is set at 0 to 10 V:



Wiring when input 5 is set at 0 to 20 mA:

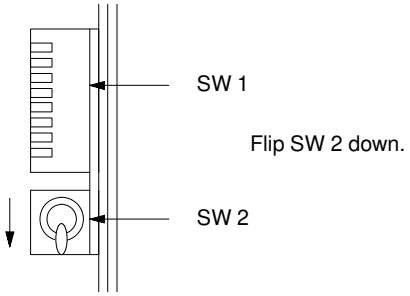


2. Turn the PLC power supply and confirm that power is being supplied to the PLC.

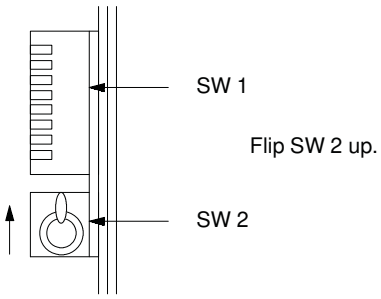


3. Remove the front panel of the Module with flat-blade screwdriver. Pins 1 through 8 on SW 1 represent input points 1 through 8 respectively. Turn ON the pin for the input point to be set and make sure all the other pins are OFF. First we will set input point 1.

4. The offset is the lowest voltage or current that will be input. The Module will convert this value to 000 hexadecimal. Apply the desired offset to the terminals of input point 1. Flip SW 2 down to read in as O V or mA the current or voltage currently being applied to the input terminals. This input value will be stored as the offset, i.e., as zero.



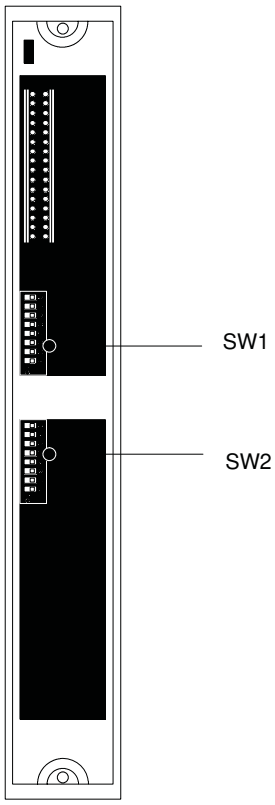
5. The gain is the highest voltage or current that will be input. The Module will convert this value to FFF hexadecimal. Apply the desired gain) to the terminals of input point 1. Flip SW 2 to down to read in as10 V or 20 mA current or voltage currently being applied to the input terminals. The input value will be stored as the gain, i.e., as 10 V or 20 mA.



6. Continue on in this way to set the offset and gain for input points 2 through 8. Make sure you turn OFF each pin of SW 1 before you turn ON the next pin. Never allow more than one pin of SW 1 to be ON simultaneously. After you are finished setting all the input points, re-attach the front panel to the Module.

2–2 DA101 Analog Output Modules

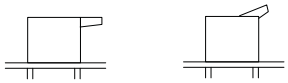
The output range must be set for each input point using the DIP switches on the back of the Module. Each input point is set to 1 to 5 V at the factory, but double check the settings before use. Be sure to set these switches before mounting the Module, as they will not be accessible while the Module is mounted.



Back of Module

DIP switch	Port	Pin	Output range		
			0 to 10 V	1 to 5 V	4 to 20 mA
SW1	1	1	OFF	ON	ON
		2	OFF	ON	ON
		3	OFF	OFF	ON
		4	ON	OFF	OFF
	2	5	OFF	ON	ON
		6	OFF	ON	ON
		7	OFF	OFF	ON
		8	ON	OFF	OFF
SW2	3	1	OFF	ON	ON
		2	OFF	ON	ON
		3	OFF	OFF	ON
		4	ON	OFF	OFF
	4	5	OFF	ON	ON
		6	OFF	ON	ON
		7	OFF	OFF	ON
		8	ON	OFF	OFF

Set the pins to the appropriate positions for the output range you are going to use. The pins are set as shown below.



ON OFF

SECTION 3
Installation

This section provides the dimensions, wiring diagrams, and other information required to install the Analog I/O Modules. Be sure to set back-panel switches as required before mounting the Modules to the Racks.

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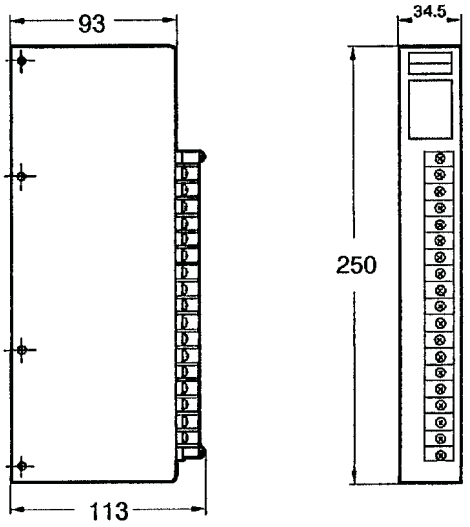
3−5−2 Wiring 24

3–1 AD001 through AD005 Analog Input Modules

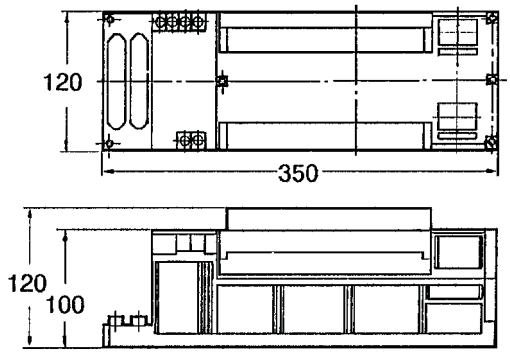
3–1–1 Dimensions

All dimensions given below are in millimeters.

3G2A5-AD001 through 3G2A5-AD005



3G2A6-AD001 through 3G2A6-AD005
(Mounted to 3G2C4-SIO25/SIO26)



3–1–2 Wiring

Use shielded twisted-pair cable for external connections.

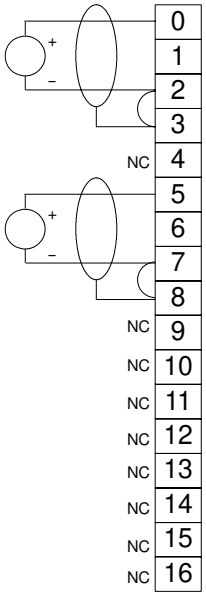
Connect the positive and negative terminals of any unused input points to the shield terminal.

Use separate power supplies for input points 1 and 2 whenever possible. When using separate power supplies, always connect the negative input terminal to the shield line; failure to do so will produce several percent of error in the converted data.

Incorrect wiring will produce inaccuracy in converted data. Use the proper wiring diagram and wire with care.

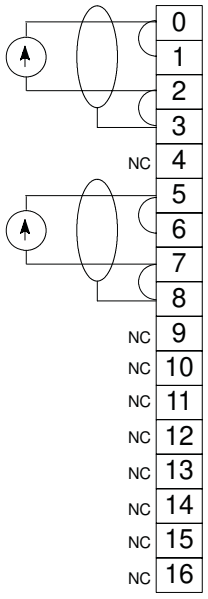
Voltage Inputs

VOLTAGE ONLY	
AD001	+1 ∼ +5VDC
AD002	0 ∼ +10VDC
AD003	0 ∼ +5VDC
AD004	−10 ∼ +10VDC
AD005	−5 ∼ +5VDC



Current Inputs

AD001	+4 ∼ +20mA

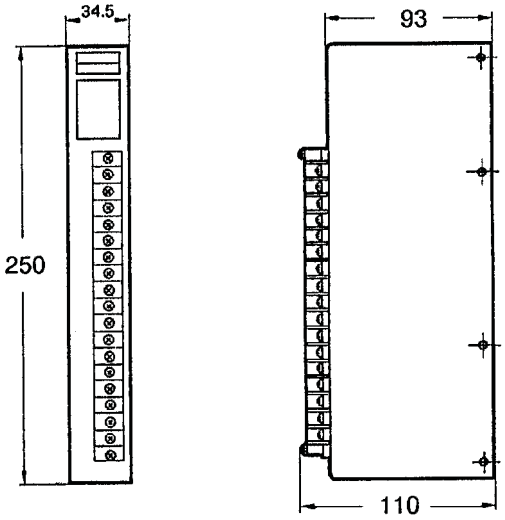


3–2 AD006 and AD007 Analog Input Modules

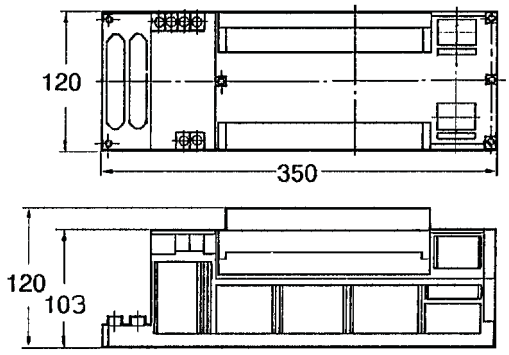
3–2–1 Dimensions

All dimensions given below are in millimeters.

3G2A5-AD006/AD007



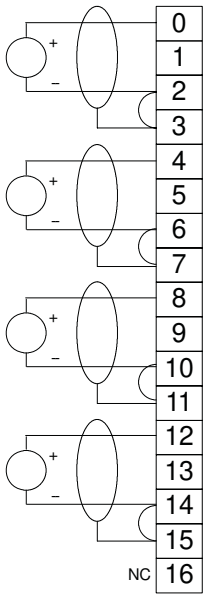
3G2A6-AD006/AD007
(Mounted to 3G2C4-SIO25/SIO26)



3–2–2 Wiring

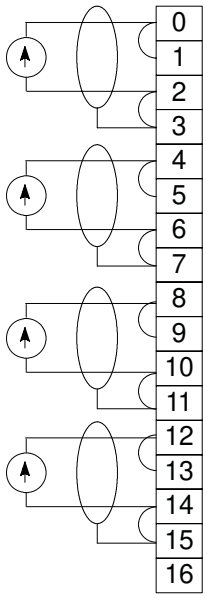
Voltage Inputs

VOLTAGE ONLY	
AD006	+1 ∼ +5VDC
AD007	0 ∼ +10VDC



Current Inputs

CURRENT ONLY	
AD006	4 ∼ +20mA

Wiring Notes

1. Use twisted-pair cable for external connections.
2. Connect the positive and negative terminals of any unused input points to the shield terminal.
3. For voltage inputs, connect the negative terminal to the shield terminal. Failure to do so may cause an error of several percent in the data.
4. For current inputs, Omron recommends that you use a separate power supply for each input point.