

# IO-AI4-AO2 I/O Expansion Module 4 Analog Inputs, 2 Analog Outputs

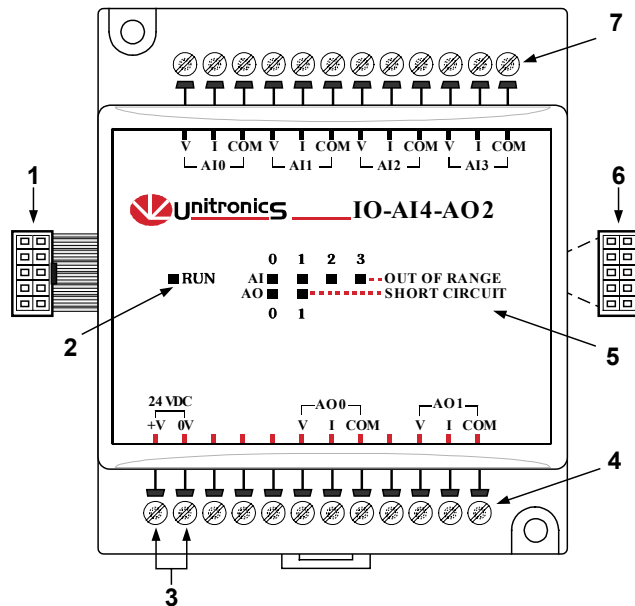
The IO-AI4-AO2 is an I/O expansion module that can be used in conjunction with specific Unitronics OPLC controllers.

The module offers 4 12-bit analog inputs; functioning at 0-10V, 0-20mA, 4-20mA; and 2 12-bit +sign analog outputs; functioning at  $\pm 10V$ , 0-20mA, 4-20mA.

The interface between the module and the OPLC is provided by an adapter.

The module may either be snap-mounted on a DIN rail, or screw-mounted onto a mounting plate.

Component identification	
1	Module-to-module connector
2	Communication status indicator
3	Connection points for power supply to analog unit
4	Output connection points
5	Input/Output status indicators
6	Module-to-module connector port
7	Input connection points



## User safety and equipment protection guidelines

This document is intended to aid trained and competent personnel in the installation of this equipment as defined by the European directives for machinery, low voltage and EMC. Only a technician or engineer trained in the local and national electrical standards should perform tasks associated with the electrical wiring of this device.

- Under no circumstances will Unitronics be liable or responsible for any consequential damage that may arise as a result of installation or use of this equipment, and is not responsible for problems resulting from improper or irresponsible use of this device.
- All examples and diagrams shown in the manual are intended to aid understanding. They do not guarantee operation.
- Unitronics accepts no responsibility for actual use of this product based on these examples.
- Only qualified service personnel should open this device or carry out repairs.
- Please dispose of this product in accordance with local and national standards and regulations.



- Check the user program before running it.
- Do not attempt to use this device with voltage exceeding permissible levels.
- Install an external circuit breaker and take appropriate safety measures against short-circuiting in external wiring.



- Failure to comply with appropriate safety guidelines can result in severe personal injury or property damage. Always exercise proper caution when working with electrical equipment.

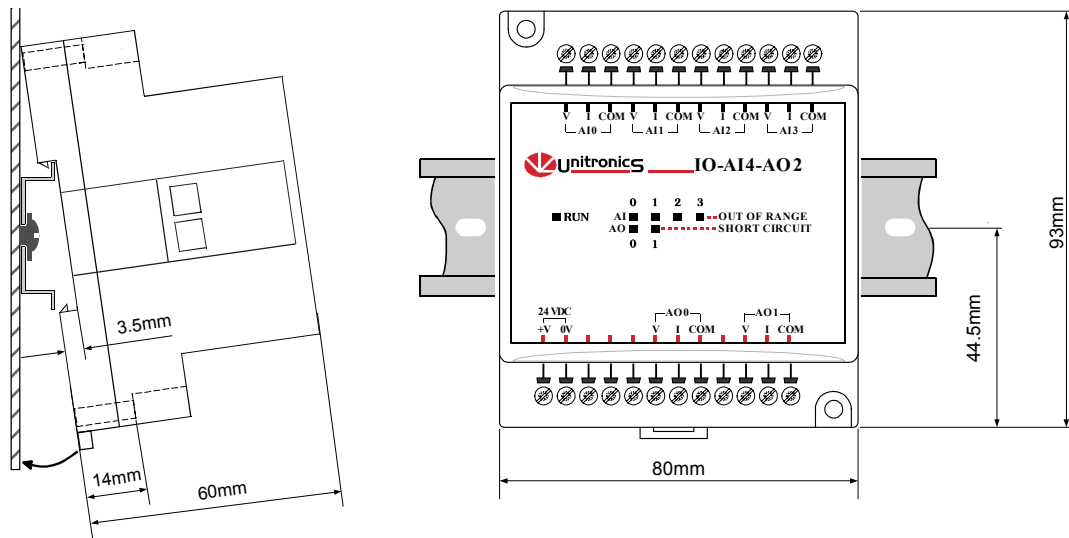
**Mounting the Module**

**Mounting Considerations**

- Do not install in areas with: excessive or conductive dust, corrosive or flammable gas, moisture or rain, excessive heat, regular impact shocks or excessive vibration.
- Provide proper ventilation by leaving a minimum space of 10mm between the top and bottom edges of the device and the enclosure walls.
- Do not place in water or let water leak onto the unit.
- Do not allow debris to fall inside the unit during installation.

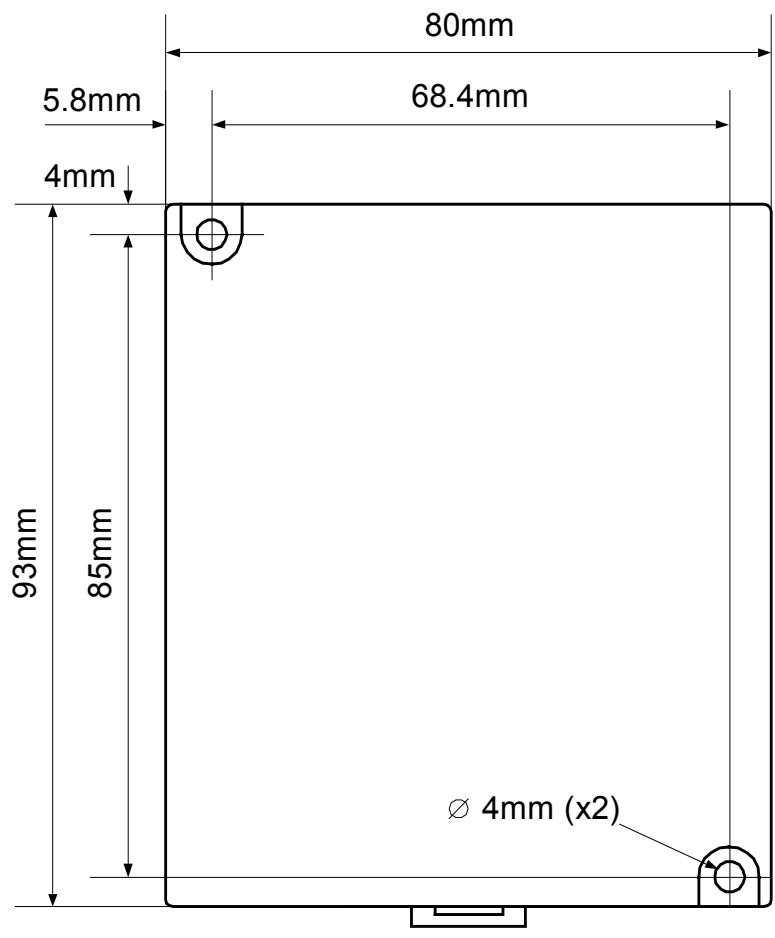
**DIN-rail mounting**

Snap the device onto the DIN rail as shown below; the module will be squarely situated on the DIN rail.



**Screw-Mounting**

The figure on the next page is drawn to scale. It may be used as a guide for screw-mounting the module. Mounting screw type: either M3 or NC6-32.



## Connecting Expansion Modules

An adapter provides the interface between the OPLC and an expansion module. To connect the I/O module to the adapter or to another module:

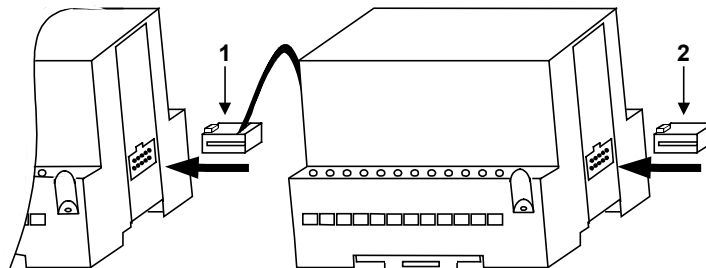
- 1 Push the module-to-module connector into the port located on the right side of the device.

Note that there is a protective cap provided with the adapter. This cap covers the port of the **final** I/O module in the system.



- To avoid damaging the system, do not connect or disconnect the device when the power is on.

Component identification	
1	Module-to-module connector
2	Protective cap



## Wiring

### Wire Size

Use 26-12 AWG wire (0.13 mm<sup>2</sup>–3.31 mm<sup>2</sup>) for all wiring purposes.

### Wiring Considerations

- Note that the adapter, I/O signals, and analog outputs' power supply must be connected to the same 0V signal.
- Note that the COM signals of each I/O are internally connected to the module's 0V.
- Do not use tin, solder or any other substance on the stripped wire that might cause the wire strand to break.
- We recommend that you use crimp terminals for wiring.
- Install at maximum distance from high-voltage cables and power equipment.

### General Wiring Procedures

- 1 Strip the wire to a length of 7±0.5mm (0.250–0.300 inches).
- 2 Unscrew the terminal to its widest position before inserting a wire.
- 3 Insert the wire completely into the terminal to ensure that a proper connection can be made.
- 4 Tighten enough to keep the wire from pulling free.

To avoid damaging the wire, do not exceed a maximum torque of 0.5 N·m (5 kgf·m).



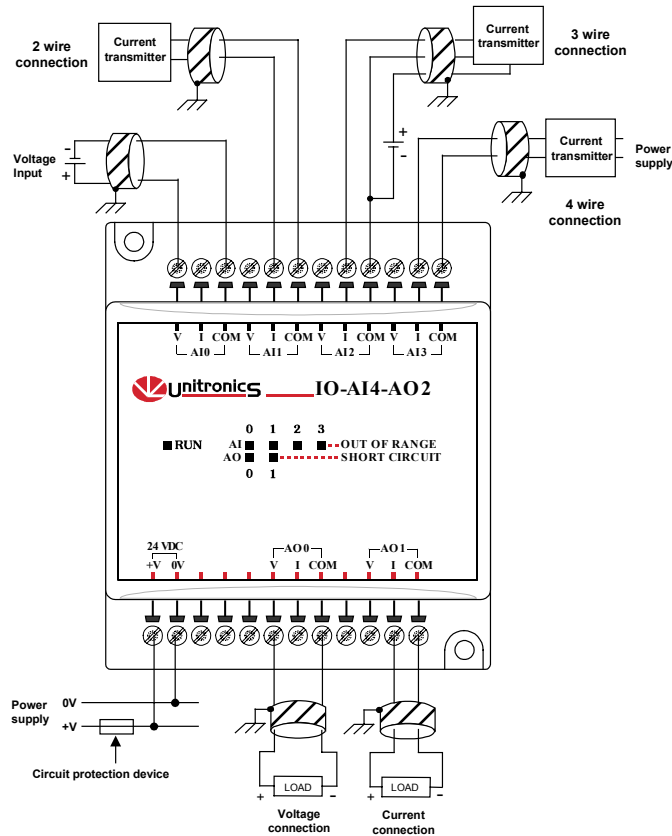
- Do not touch live wires.
- Double-check all the wiring before turning on the power supply.

### I/O Wiring

- Input or output cables should not be run through the same multi-core cable or share the same wire.
- Allow for voltage drop and noise interference with input/output lines used over an extended distance. Use wire that is properly sized for the load.

### Input Wiring

- Shields should be connected at the signal source.
- Inputs may be wired to work with either current or voltage.



### Output Wiring

- Shields should be earthed, connected to the earth of the cabinet.
- Do not connect unused outputs.
- An output can be wired to either current or voltage.
- Do not use current and voltage from the same source channel.

### Wiring the Analog Power Supply

#### Wiring DC supply

- 1 Connect the "positive" cable to the "+V" terminal, and the "negative" to the "0V" terminal.
  - A non-isolated power supply can be used provided that a 0V signal is connected to the chassis.
  - Do not connect the 'Neutral' or 'Line' signal of the 110/220VAC to the device's 0V pin.
  - In the event of voltage fluctuations or non-conformity to voltage power supply specifications, connect the device to a regulated power supply.



- The 24VDC power supply must be turned on and off simultaneously with the module's power supply.

**IO-AI4-AO2 Technical Specifications**

Max. current consumption	30mA maximum from the adapter's 5VDC
Typical power consumption	0.1W @ 5VDC
Status indicator (RUN)	Green LED: —Lit when a communication link is established between module and OPLC. —Blinks when the communication link fails.

**Analog Inputs**

Number of inputs	4 (single-ended)
Input range	0-10V, 0-20mA, 4-20mA. See Note 1.
Conversion method	Successive approximation
Resolution (except at 4-20mA)	12-bit (4096 units)
Resolution at 4-20mA	819 to 4095 (3277 units)
Conversion time	20msec
Input impedance	1M $\Omega$ —voltage 121.5 $\Omega$ —current
Galvanic isolation	None
Absolute maximum rating	$\pm$ 20V—voltage $\pm$ 40mA—current
Full-scale error	$\pm$ 4 LSB (0.1%)
Linearity error	$\pm$ 1 LSB (0.025%)
Operational error limits	$\pm$ 0.4%
Status indicators (OUT OF RANGE)	Red LEDs—Lit when the corresponding input is receiving current or voltage in excess of the input range. See Note 2.

**Analog Outputs**

Number of outputs	2 (single-ended)
Output range	$\pm$ 10V, 0-20mA, 4-20mA. See Note 1.
Resolution (except at 4-20mA)	12-bit (4096 units) + sign
Resolution at 4-20mA	819 to 4095 (3277 units)
Load impedance	1k $\Omega$ minimum—voltage 500 $\Omega$ maximum—current
Galvanic isolation	None
Conversion time	5msec
Linearity error	$\pm$ 0.1%
Operational error limits	$\pm$ 0.2%
Status Indicators (SHORT CIRCUIT)	Red LED—Lit when an output wired to deliver a positive voltage is short-circuited. See Note 3.

**Analog Power Supply**

Permissible range	24VDC
Max. current consumption	20.4 to 28.8VDC 75mA@24VDC

**Environmental**

Operating temperature	IP20 0° to 50° C
Storage temperature	-20° to 60° C
Relative Humidity (RH)	5% to 95% (non-condensing)
Dimensions (WxHxD)	80mm x 93mm x 60mm
Weight	146.3g (5.15oz.)
Mounting	Either onto a 35mm DIN-rail or screw-mounted.

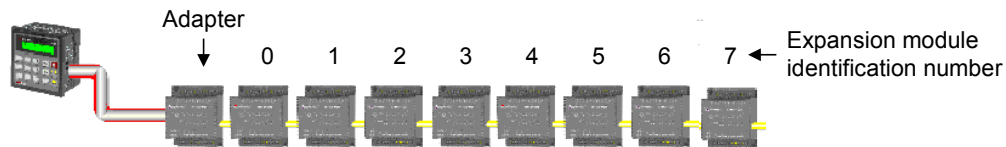
**Notes:**

1. Note that the range of each I/O is defined both by wiring and within the controller's software.
2. The analog value of an input may also indicate when the input is functioning out of range. If an analog input exceeds the permissible range, its value will be 4096.
3. When an output that is delivering positive output voltage is connected to a load that short-circuits, the SHORT CIRCUIT LED lights up on the module. The short circuit is also identified by the software program within the controller connected to the module.  
Within the M90 OPLC, for example, SB 5 turns ON. SI 5 contains a bitmap indicating the module containing the affected output.  
For more information, refer to the on-line help supplied with the programming package of your controller.

## Addressing I/Os on M90 Expansion Modules

Inputs and outputs located on I/O expansion modules that are connected into an M90 OPLC are assigned addresses that comprise a letter and a number. The letter indicates whether the I/O is an input (I) or an output (O). The number indicates the I/O's location in the system. This number relates to both the position of the expansion module in the system, and to the position of the I/O on that module.

Expansion modules are numbered from 0-7 as shown in the figure below.



The formula below is used to assign addresses for I/O modules used in conjunction with the M90 OPLC. X is the number representing a specific module's location (0-7). Y is the number of the input or output on that specific module (0-15).

The number that represents the I/O's location is equal to:

$$32 + x \cdot 16 + y$$

**Examples**

- Input #3, located on expansion module #2 in the system, will be addressed as I 67,  
 $67 = 32 + 2 \cdot 16 + 3$
- Output #4, located on expansion module #3 in the system, will be addressed as O 84,  
 $84 = 32 + 3 \cdot 16 + 4$ .

EX90-DI8-RO8 is a stand-alone I/O module. Even if it is the only module in the configuration, the EX90-DI8-RO8 is always assigned the number 7.

Its I/Os are addressed accordingly.

**Example**

- Input #5, located on an EX90-DI8-RO8 connected to an M90 OPLC will be addressed as I 149,  $149 = 32 + 7 \cdot 16 + 5$

# 8 Convenient I/O Modules

	Digital I/O (transistor)			Digital I/O (relay)			Analog I/O	PT 100
	IO-D18-T08	IO-D16	IO-T016	IO-D18-RO4	IO-RO8	EX90-D18-RO8*		
Digital inputs (24VDC)	8 pnp/npn (source/sink)	16 pnp/npn (source/sink)	—	8 pnp/npn (source/sink)	—	8 pnp (source)	—	—
Analog inputs	—	—	—	—	—	—	4 inputs 0-10V/ 0-20mA, 4-20mA	4 PT100 -50° to 460°C
Analog input resolution	—	—	—	—	—	—	12 bit	12 bit
Digital outputs	8 pnp (source)	—	16 pnp (source)	4 relay outputs	8 relay outputs	8 relay outputs	—	—
Analog outputs	—	—	—	—	—	—	2 outputs ±10V, 0-20mA, 4-20mA	—
Analog output resolution	—	—	—	—	—	—	12 bit + sign	—
High-speed counter/ Frequency measurement	One	One	—	One	—	One	—	—

\* Stand-alone module. Other modules are used in conjunction with the EX-A1 adapter

*To order the expansion module that best fits your system, contact your local distributor.  
For a list of Unitronics distributors, check our website: <http://www.unitronic.com/contact.htm>*