

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.

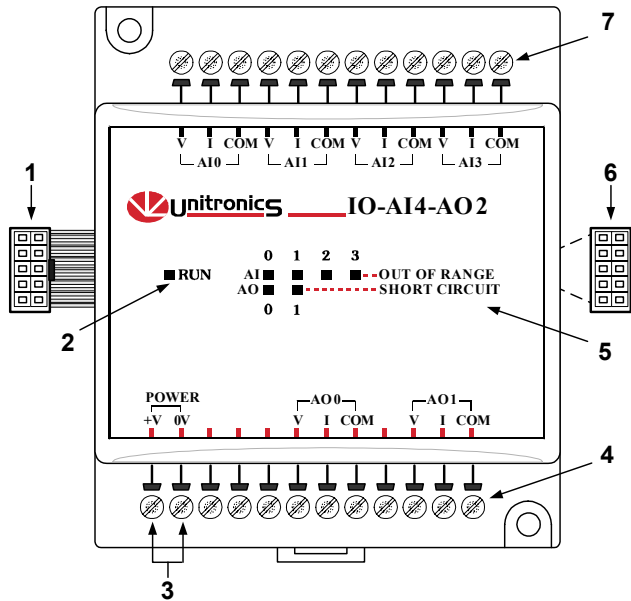
The module offers 4 12-bit analog inputs; functioning at 0-10V, 0-20mA, 4-20mA; and 2 12-bit +sign analog outputs; functioning at ±10V, 0-20mA, 4-20mA.

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



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- All examples and diagrams shown herein are intended to aid understanding, and do not guarantee operation. Unitronics accepts no responsibility for actual use of this product based on these examples.
- Please dispose of this product in accordance with local and national standards and regulations.
- Only qualified service personnel should open this device or carry out repairs.

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 device's electrical wiring.

Symbols are used to highlight information relating to the user's personal safety and equipment protection throughout this document. When these symbols appear, the associated information must be read carefully and understood fully.

Symbol	Meaning	Description
	Danger	The identified danger causes physical and property damage.
	Warning	The identified danger can cause physical and property damage.
Caution	Caution	Use caution.



- 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.



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

Environmental 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.

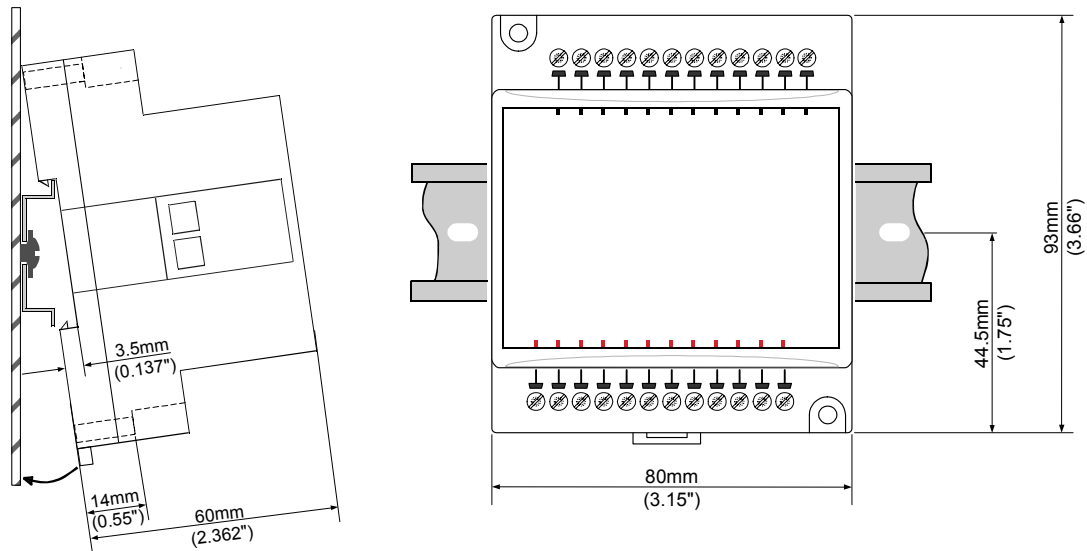


- Leave a minimum of 10mm space for ventilation between the top and bottom edges of the device and the enclosure walls.
- Do not place in water or let water leak onto the unit.
- Do not allow debris to fall inside the unit during installation.

Mounting the Module

DIN-rail mounting

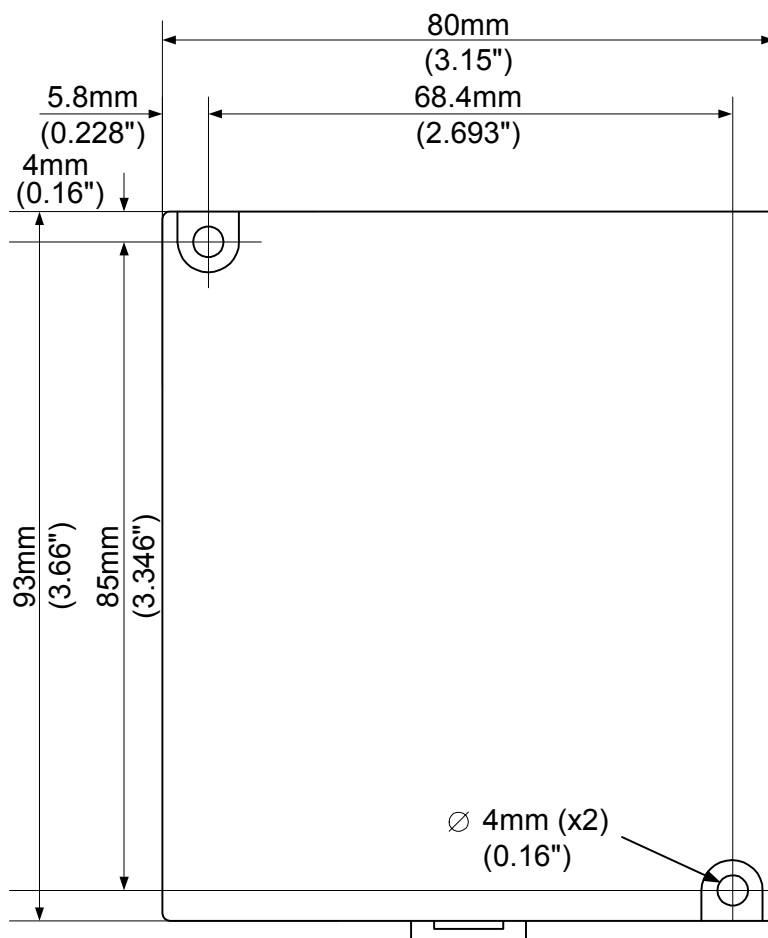
Snap the device onto the DIN rail as shown below; the module will be squarely situated on the DIN rail.



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.

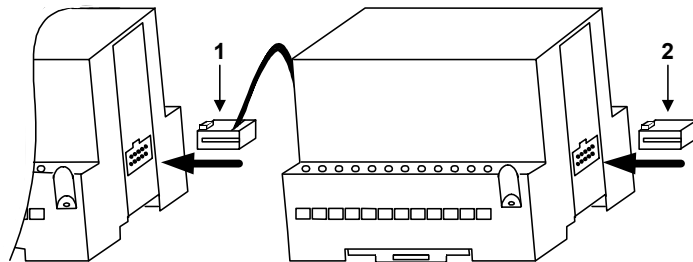
Note that there is a protective cap provided with the adapter. This cap covers the port of the **final** I/O module in the system.



- 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



- Do not touch live wires.



- Unused pins should not be connected. Ignoring this directive may damage the device.
- Do not connect the 'Neutral or 'Line' signal of the 110/220VAC to the device's 0V pin.
- Double-check all wiring before turning on the power supply.

Wiring Procedures

Use crimp terminals for wiring; use 26-12 AWG wire (0.13 mm²–3.31 mm²) for all wiring purposes.

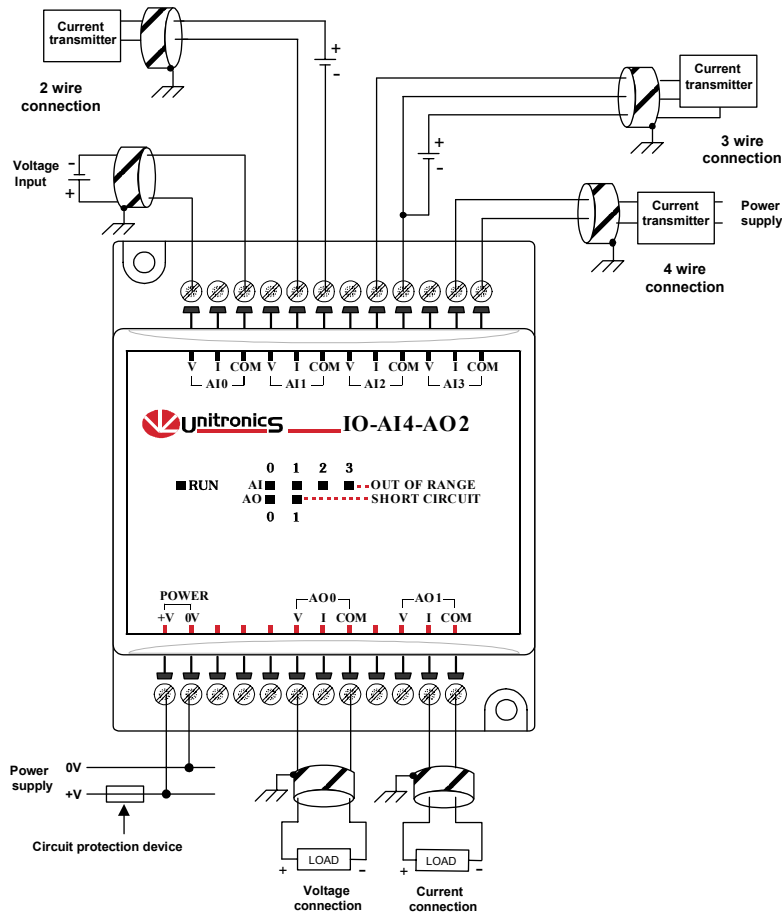
1. Strip the wire to a length of 7±0.5mm (0.250–0.300 inches).
 2. Unscrew the terminal to its widest position before inserting a wire.
 3. Insert the wire completely into the terminal to ensure that a proper connection can be made.
 4. Tighten enough to keep the wire from pulling free.
- To avoid damaging the wire, do not exceed a maximum torque of 0.5 N·m (5 kgf·m).
 - Do not use tin, solder, or any other substance on stripped wire that might cause the wire strand to break.
 - Install at maximum distance from high-voltage cables and power equipment.

I/O Wiring—General

- 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 lines used over an extended distance. Use wire that is properly sized for the load.
- The adapter, I/O signals, and module's power supply must be connected to the same 0V signal.
- The COM signals of each I/O are internally connected to the module's 0V.

Analog Inputs

- 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

1. Connect the "positive" cable to the "+V" terminal, and the "negative" to the "0V" terminal.
 - The analog 0V signal must be the same 0V used by the controller's power supply.
 - 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 controller'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 Ω —voltage 121.5 Ω —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 Ω minimum—voltage 500 Ω 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

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

Environmental

	IP20/NEMA1
Operating temperature	0° to 50°C (32 to 122° F)
Storage temperature	-20° to 60°C (-4 to 140° F)
Relative Humidity (RH)	5% to 95% (non-condensing)
Dimensions (WxHxD)	80mm x 93mm x 60mm (3.15 x 3.66 x 2.362")
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.

About Unitronics

Unitronics Industrial Automation Systems has been producing PLCs, automation software and accessory devices since 1989.

Unitronics' OPLC controllers combine full-function PLCs and HMI operating panels into single, compact units. These HMI + PLC devices are programmed in a single, user-friendly environment. Our clients save I/O points, wiring, space, and programming time; elements that translate directly into cost-efficiency.

Unitronics supports a global network of distributors and sales representatives, as well as a U.S. subsidiary.

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IO-AI8 I/O Expansion Module 8 Analog Inputs

The IO-AI8 is an I/O Expansion Module that can be used in conjunction with specific Unitronics OPLC controllers.

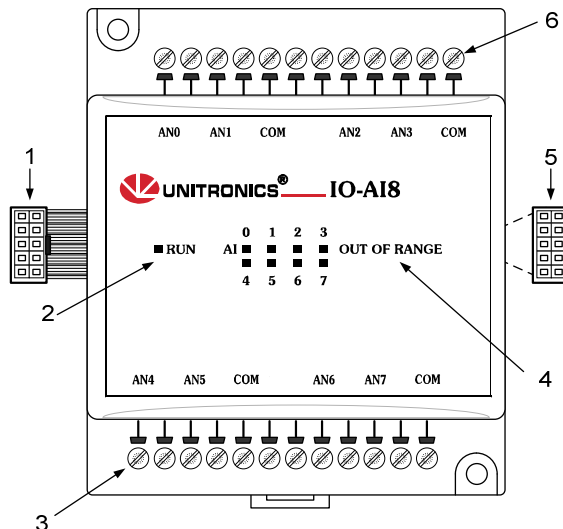
The module offers 8 analog inputs.

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	Input connection points, AN4 to AN7
4	Input status indicators
5	Module-to-module connector port
6	Input connection points, AN0 to AN3



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Caution	Caution	Use caution.



- 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.



- Check the user program before running it.
- Do not attempt to use this device with parameters that exceed permissible levels.
- To avoid damaging the system, do not connect / disconnect the device when the power is on.

Environmental 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.

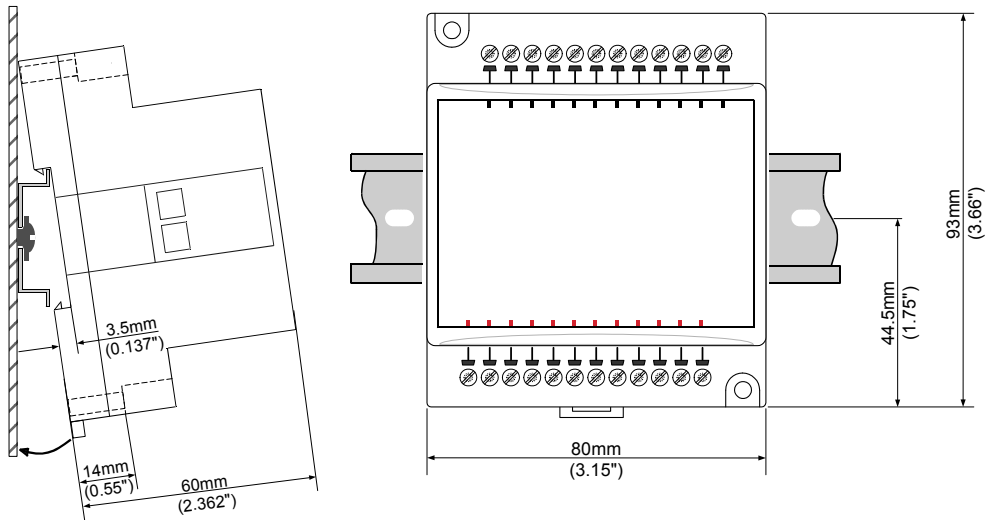


- Leave a minimum of 10mm space for ventilation between the top and bottom edges of the device and the enclosure walls.
- Do not place in water or let water leak onto the unit.
- Do not allow debris to fall inside the unit during installation.

Mounting the Module

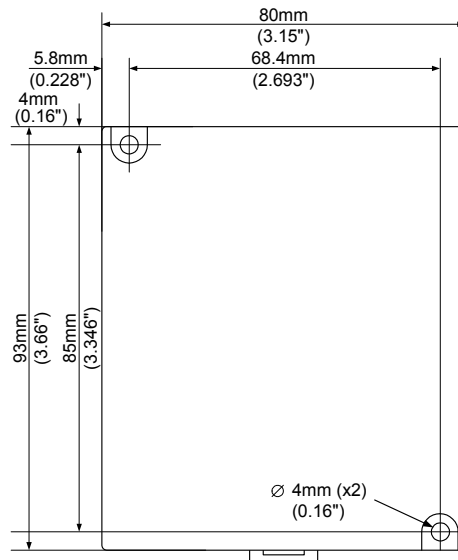
DIN-rail mounting

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



Screw-Mounting

The figure below is not 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:

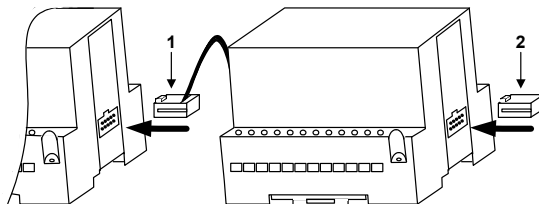
Push the module-to-module connector into the port located on the right side of the device.

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



- Do not touch live wires.



- Unused pins should not be connected. Ignoring this directive may damage the device.
- Do not connect the 'Neutral' or 'Line' signal of the 110/220VAC to the device's COM pins.
- Double-check all wiring before turning on the power supply.

Wiring Procedures

Use crimp terminals for wiring; use 26-12 AWG wire (0.13 mm^2 – 3.31 mm^2) for all wiring purposes.

- Strip the wire to a length of $7 \pm 0.5 \text{ mm}$ (0.250 – 0.300 ”).
 - Unscrew the terminal to its widest position before inserting a wire.
 - Insert the wire completely into the terminal to ensure that a proper connection can be made.
 - Tighten enough to keep the wire from pulling free.
- To avoid damaging the wire, do not exceed a maximum torque of $0.5 \text{ N}\cdot\text{m}$ ($5 \text{ kgf}\cdot\text{m}$).
 - Do not use tin, solder, or any substance on stripped wire that might cause the wire strand to break.
 - Install at maximum distance from high-voltage cables and power equipment.

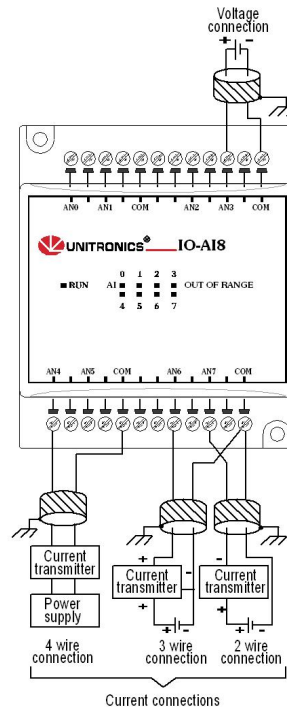
I/O Wiring—General

- 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 lines used over an extended distance. Use wire that is properly sized for the load.

Analog Inputs

- Shields should be connected at the signal source.
- Inputs may be set as either current, or voltage. To set an input
- Use the appropriate wiring as shown near.
- Open the device and set the jumpers according to the instructions beginning on page 5.
- The adapter and the COM signals of the analog inputs must be connected to the same 0V signal.
- The COM signals of each channel are internally shorted.

When set to current/voltage, each 2 inputs share a common COM signal.



Opening the Device



- Before opening the device, touch a grounded object to discharge any electrostatic charge.
- Avoid touching the PCB board directly.
- Turn power off and disconnect all leads before opening the device.

In order to change the jumper settings of a specific input, first open the device by prying off its back, using the blade of a flat-bladed screwdriver. The insertion points for the screwdriver are located on both sides of the module.

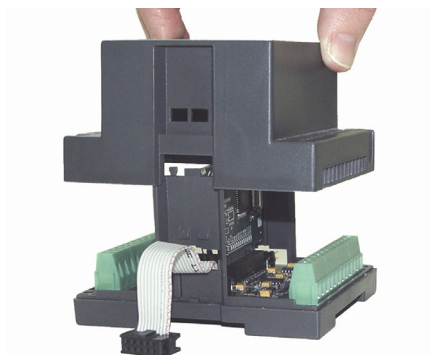
1. Open the first side of the device by inserting the blade between the 2 plastic moldings as shown below, then gently pushing up.



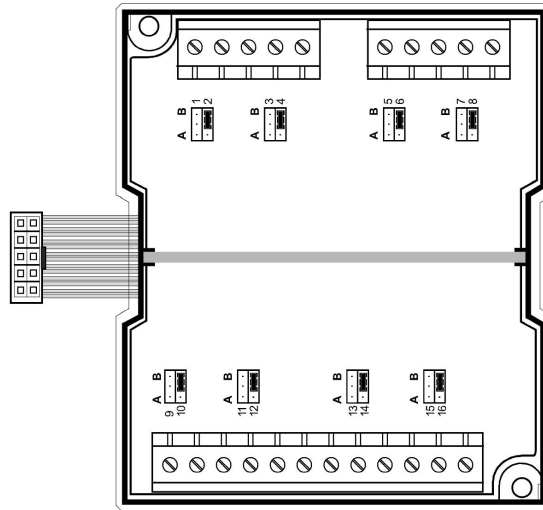
2. Taking care not to damage the cable, open the other side of the device by inserting the blade where shown below, then gently pushing up.



3. Gently remove the top of the device as shown.



4. The jumpers are shown at right. Change the jumper settings as required, in accordance with the tables shown on the next page.



Jumper Settings

The tables below show how to set a specific jumper to change the functionality of a specific input. To open the device and access the jumpers, refer to the instructions beginning on page 5.

Caution ■ Incompatible jumper settings and wiring may severely damage the device.

	Jumper #	Voltage*	Current
Input 0	2	A	B
Input 1	4	A	B
Input 2	6	A	B
Input 3	8	A	B
Input 4	10	A	B
Input 5	12	A	B
Input 6	14	A	B
Input 7	16	A	B

* Default factory setting.

IO-A18 Technical Specifications

Max. current consumption	40mA maximum from the adapter's 5VDC
Typical power consumption	0.2W@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	8 (single-ended) See Note 1.
Input range	0-10V, 0-20mA, 4-20mA. See Note 1.
Input type	Either Normal or Fast mode, according to the filter type selected in software settings
Conversion method	Voltage to frequency
Normal mode	
Resolution at 0-10V, 0-20mA	14-bit (16384 units)
Resolution at 4-20mA	3277 to 16383 (13107 units)
Conversion time	100mSec minimum per input
Fast mode	
Resolution at 0-10V, 0-20mA	12-bit (4096 units)
Resolution at 4-20mA	819 to 4095 (3277 units)
Conversion time	25mSec minimum per input
Input impedance	>400K Ω —voltage 500 Ω —current
Isolation	None
Absolute maximum rating	\pm 15V—voltage \pm 30mA—current
Linearity error	0.04% max of full scale
Error limits	0.4% of input value
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 5.

Environmental

Operating temperature	IP20/NEMA1
Storage temperature	0° to 50°C (32 to 122° F)
Relative Humidity (RH)	-20° to 60°C (-4 to 140° F)
Dimensions (WxHxD)	5% to 95% (non-condensing)
Weight	80mm x 93mm x 60mm (3.15 x 3.66 x 2.362")
Mounting	150g (5.3 oz)
	Either onto a 35mm DIN-rail or screw-mounted.

Notes:

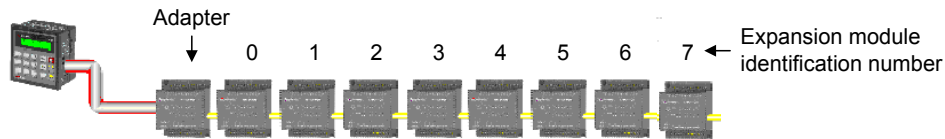
- Each input may be set as either voltage (0-10V), or current (0-20mA, 4-20mA) via wiring, jumper and software settings.
- The voltage or current value of analog inputs can also indicate faults, as shown in the table below.

Value: 12-bit (Fast mode)	Value: 14-bit (Normal mode)	Input Value Deviates:
-1	-1	Slightly below the input range.
4096	16384	Slightly above the input range.
32767	32767	Greatly above or below the input range.

Addressing I/Os on Expansion Modules

Inputs and outputs located on I/O expansion modules that are connected to an 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 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 OPLC will be addressed as I 149, $149 = 32 + 7 \cdot 16 + 5$

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DSP-EXP-AI8 01/11

IO-AO6X I/O Expansion Module 6 Isolated Analog Outputs

The IO-AO6X is an I/O Expansion Module that can be used in conjunction with specific Unitronics OPLC controllers.

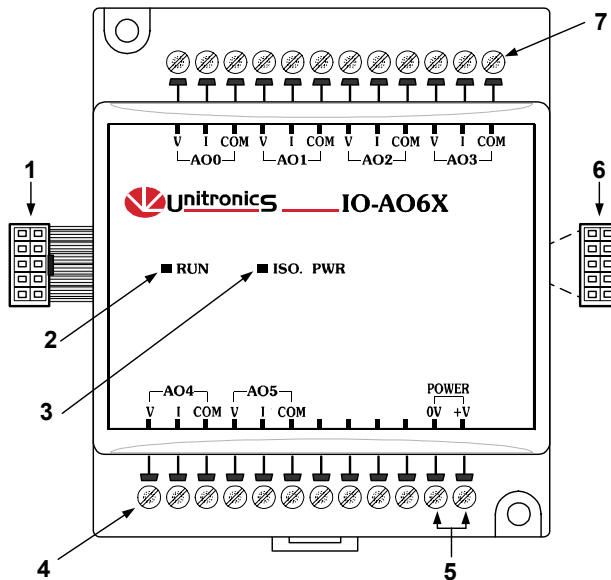
The module offers 6 12-bit isolated outputs; functioning at 0-10V, 0-20mA, and 4-20mA.

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	Isolated power supply indicator
4	Output connection points, AO4-AO5
5	Connection points for power supply to analog unit
6	Module-to-module connector port
7	Output connection points, AO0-AO3



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- Check the user program before running it.
- Do not attempt to use this device with parameters that exceed permissible levels.
- Install an external circuit breaker and take appropriate safety measures against short-circuiting in external wiring.
- To avoid damaging the system, do not connect / disconnect the device when the power is on.

Environmental 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.

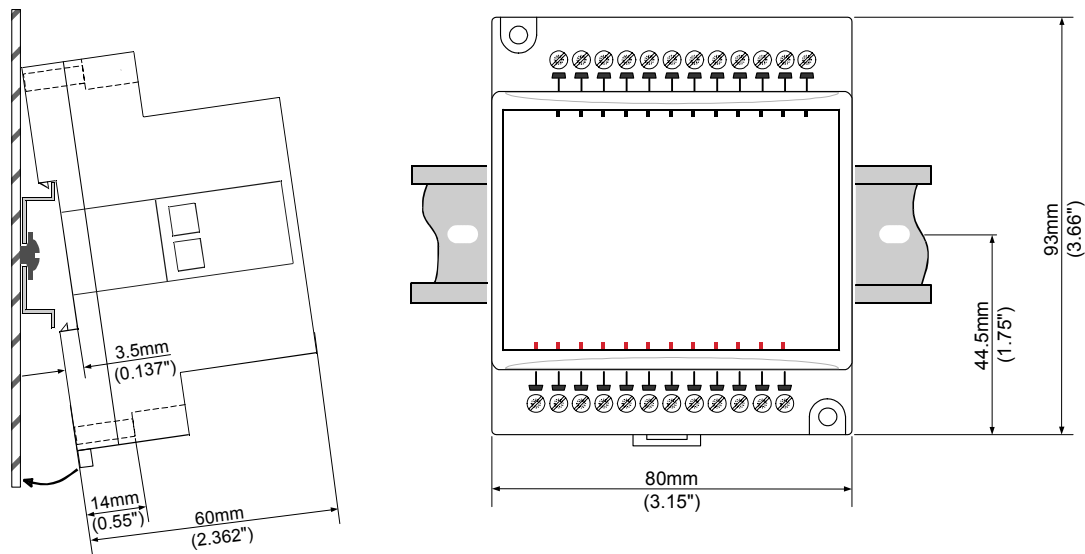


- Leave a minimum of 10mm space for ventilation between the top and bottom edges of the device and the enclosure walls.
- Do not place in water or let water leak onto the unit.
- Do not allow debris to fall inside the unit during installation.

Mounting the Module

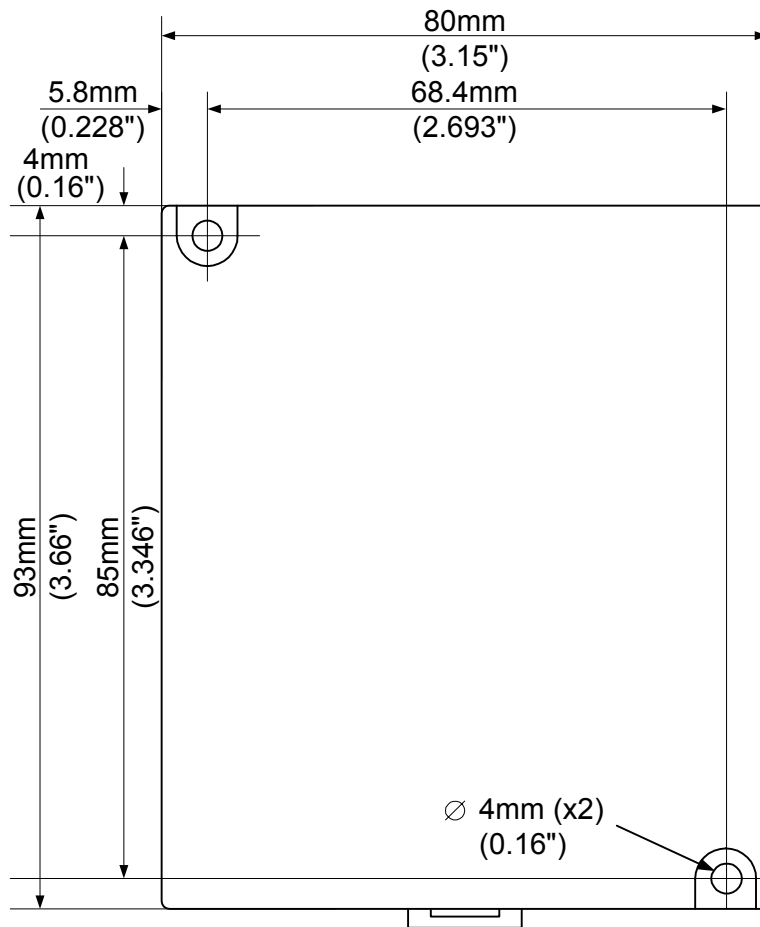
DIN-rail mounting

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:

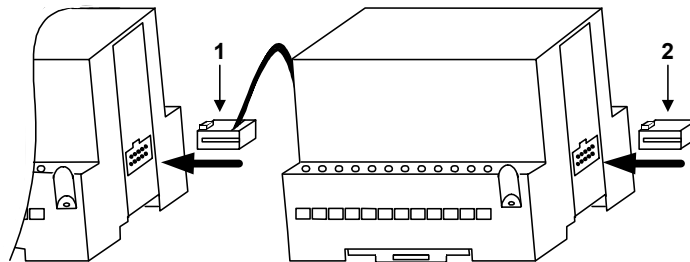
- 1 Push the module-to-module connector into the port located on the right side of the device.

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



- Do not touch live wires.



- Unused pins should not be connected. Ignoring this directive may damage the device.
- Do not connect the 'Neutral or 'Line' signal of the 110/220VAC to the device's 0V pin.
- Double-check all wiring before turning on the power supply.

Wiring Procedures

Use crimp terminals for wiring; use 26-12 AWG wire (0.13 mm²–3.31 mm²) for all wiring purposes.

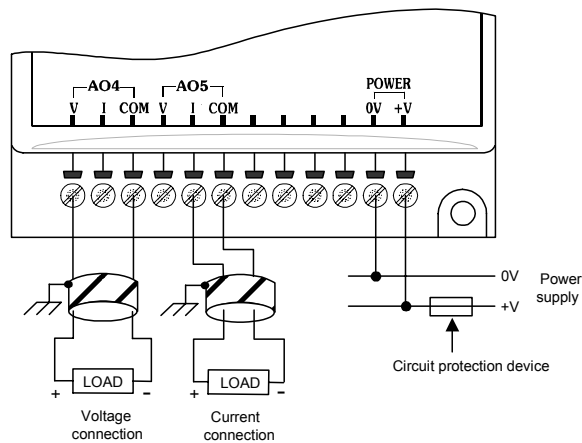
1. Strip the wire to a length of 7±0.5mm (0.250–0.300 inches).
 2. Unscrew the terminal to its widest position before inserting a wire.
 3. Insert the wire completely into the terminal to ensure that a proper connection can be made.
 4. Tighten enough to keep the wire from pulling free.
- To avoid damaging the wire, do not exceed a maximum torque of 0.5 N·m (5 kgf·m).
 - Do not use tin, solder, or any other substance on stripped wire that might cause the wire strand to break.
 - Install at maximum distance from high-voltage cables and power equipment.

I/O Wiring—General

- 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 lines used over an extended distance. Use wire that is properly sized for the load.

Analog Outputs

- 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.
- The outputs' COM signals are internally shorted.

**Wiring the Analog Outputs' Power 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.

IO-AO6X Technical Specifications

Max. current consumption	32mA maximum from the adapter's 5VDC
Typical power consumption	29mA @ 5VDC
Status indicator (RUN)	Green LED: —Lit when a communication link is established between module and OPLC. —Blinks when the communication link fails.
Isolated power indicator (ISO. PWR)	Green LED: —Lit when the isolated power supply is on.
Isolation	
Channel to bus	Yes
Channel to power supply	Yes
Channel to channel	No

Analog Outputs

Number of outputs	6 (single-ended)
Output range	0-10V, 0-20mA, 4-20mA. See Note 1.
Resolution (except at 4-20mA)	12-bit (4096 units)
Resolution at 4-20mA	819 to 4095 (3277 units)
Load impedance	1k Ω minimum—voltage 500 Ω maximum—current. See Note 2.
Conversion time	2 mSec, synchronized to expansion communication.
Linearity error	\pm 0.1%
Operational error limits	\pm 0.2%

Analog Power Supply

	24VDC
Permissible range	20.4 to 28.8VDC
Max. current consumption	170mA@24VDC

Environmental

	IP20 / NEMA1
Operating temperature	0° to 50°C (32 to 122° F)
Storage temperature	-20° to 60°C (-4 to 140° F)
Relative Humidity (RH)	5% to 95% (non-condensing)
Dimensions (WxHxD)	80mm x 93mm x 60mm (3.15 x 3.66 x 2.362")
Weight	159g (5.6oz.)
Mounting	Either onto a 35mm DIN-rail or screw- mounted.

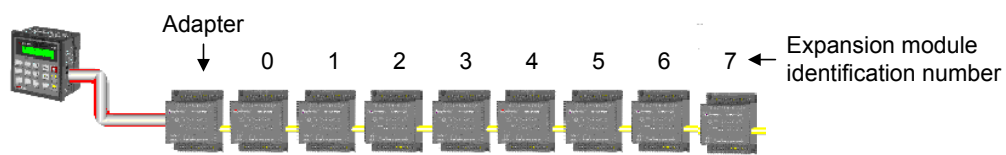
Notes:

- Note that the range of each I/O is defined both by wiring and within the controller's software.
- When an analog output is set to use current, the output must be connected **before** the power is turned on.

Addressing I/Os on Expansion Modules

Inputs and outputs located on I/O expansion modules that are connected to an 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, $149 = 32 + 7 \cdot 16 + 5$

About Unitronics

Unitronics Industrial Automation Systems has been producing PLCs, automation software and accessory devices since 1989.

Unitronics' OPLC controllers combine full-function PLCs and HMI operating panels into single, compact units. These HMI + PLC devices are programmed in a single, user-friendly environment. Our clients save I/O points, wiring, space, and programming time; elements that translate directly into cost-efficiency.

Unitronics supports a global network of distributors and sales representatives, as well as a U.S. subsidiary.

For more information regarding Unitronics products, contact your distributor, Unitronics headquarters via email: export@unitronics.com, or visit the Unitronics website at <http://www.unitronics.com/>.



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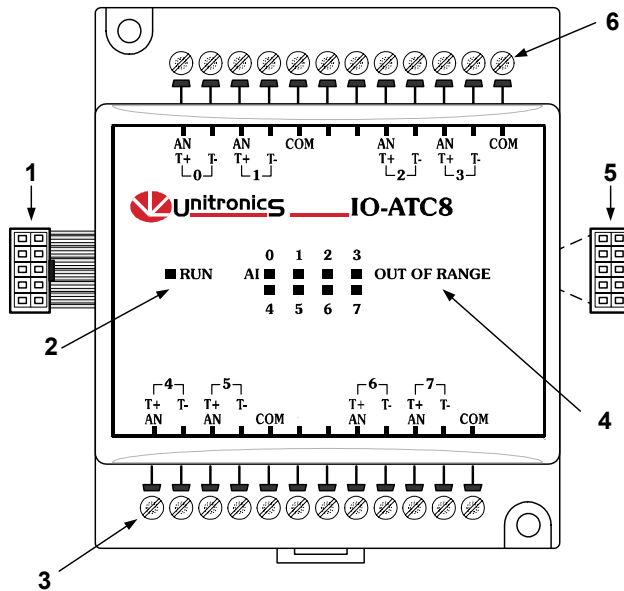
Unitronics product sold hereunder can be used with certain products of other manufacturers at the user's sole responsibility.

IO-ATC8 I/O Expansion Module 8 Analog/Thermocouple Inputs

The IO-ATC8 is an I/O Expansion Module that can be used in conjunction with specific Unitronics OPLC controllers. The module offers 8 inputs that may be set as either analog or thermocouple inputs via wiring, jumper and software settings. 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	Input connection points, I4 to I7
4	Input status indicators
5	Module-to-module connector port
6	Input connection points, I0 to I3



- Before using this product, it is the responsibility of the user to read and understand this document and any accompanying documentation.
- All examples and diagrams shown herein are intended to aid understanding, and do not guarantee operation. Unitronics accepts no responsibility for actual use of this product based on these examples.
- Please dispose of this product in accordance with local and national standards and regulations.
- Only qualified service personnel should open this device or carry out repairs.

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 device's electrical wiring.

Symbols are used to highlight information relating to the user's personal safety and equipment protection throughout this document. When these symbols appear, the associated information must be read carefully and understood fully.

Symbol	Meaning	Description
	Danger	The identified danger causes physical and property damage.
	Warning	The identified danger can cause physical and property damage.
Caution	Caution	Use caution.



- 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.



- Check the user program before running it.
- Do not attempt to use this device with parameters that exceed permissible levels.
- To avoid damaging the system, do not connect / disconnect the device when the power is on.

Environmental 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.

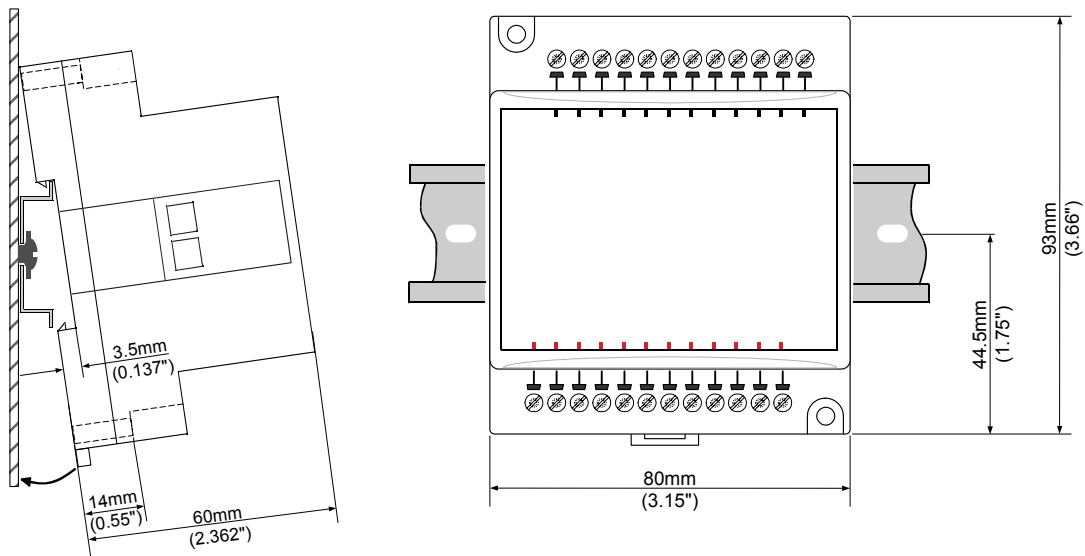


- Leave a minimum of 10mm space for ventilation between the top and bottom edges of the device and the enclosure walls.
- Do not place in water or let water leak onto the unit.
- Do not allow debris to fall inside the unit during installation.

Mounting the Module

DIN-rail mounting

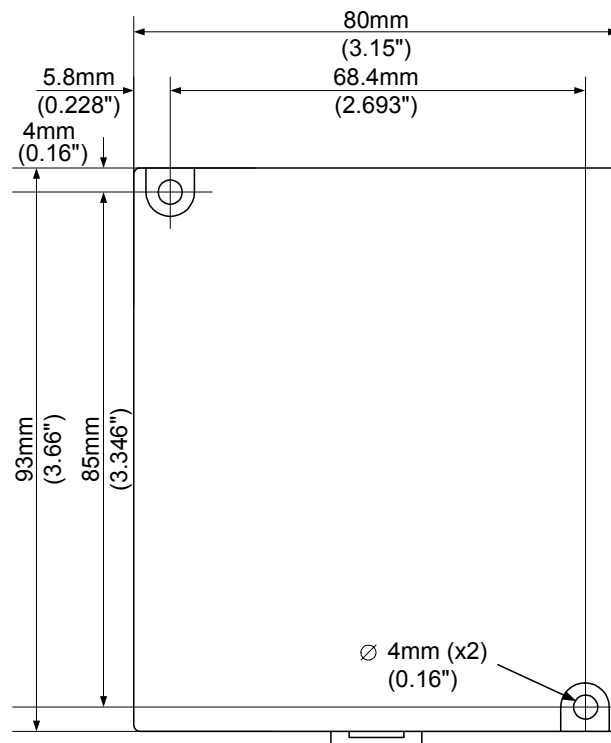
Snap the device onto the DIN rail as shown below; the module will be squarely situated on the DIN rail.



Screw-Mounting

The figure below is not 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.

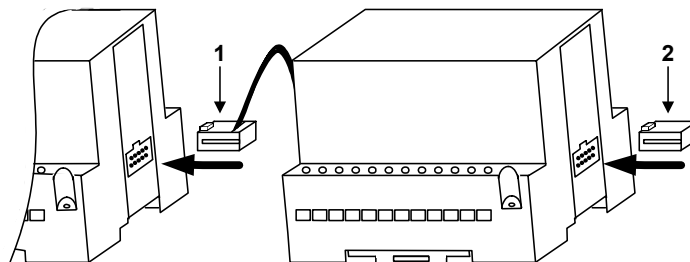
Note that there is a protective cap provided with the adapter. This cap covers the port of the **final** I/O module in the system.



- 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



- Do not touch live wires.



- Unused pins should not be connected. Ignoring this directive may damage the device.
- Do not connect the 'Neutral' or 'Line' signal of the 110/220VAC to the device's COM pins.
- Double-check all wiring before turning on the power supply.

Wiring Procedures

Use crimp terminals for wiring; use 26-12 AWG wire (0.13 mm^2 – 3.31 mm^2) for all wiring purposes.

1. Strip the wire to a length of $7 \pm 0.5 \text{ mm}$ (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.

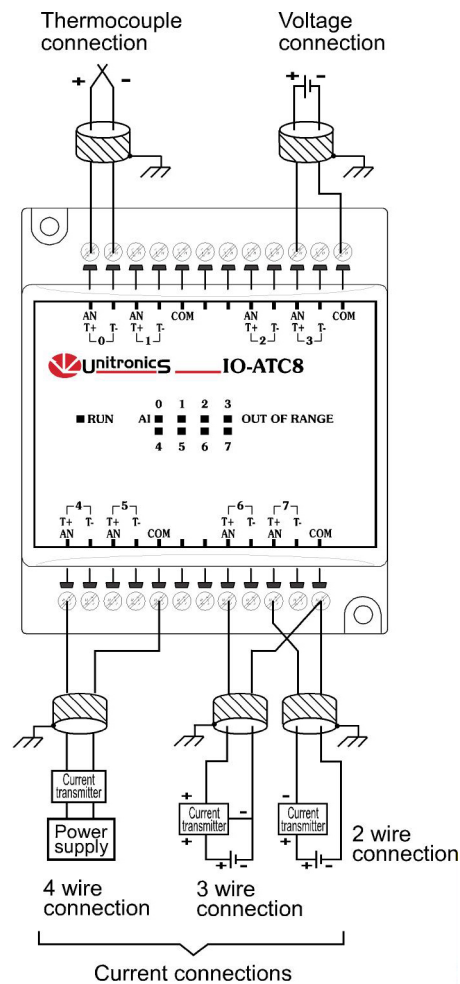
- To avoid damaging the wire, do not exceed a maximum torque of 0.5 N·m (5 kgf·m).
- Do not use tin, solder, or any other substance on stripped wire that might cause the wire strand to break.
- Install at maximum distance from high-voltage cables and power equipment.

I/O Wiring—General

- 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 lines used over an extended distance. Use wire that is properly sized for the load.

Analog Inputs

- Shields should be connected at the signal source.
- Inputs may be set as either thermocouple, current, or voltage. To set an input:
 - Use the appropriate wiring as shown below.
 - Open the device and set the jumpers according to the instructions beginning on page 6.
- The adapter and the COM signals of the analog inputs must be connected to the same 0V signal.
- The COM signals of each channel are internally shorted.
- When set to current/voltage, each 2 inputs share a common COM signal.



Opening the Device

- Before opening the device, touch a grounded object to discharge any electrostatic charge.
- Avoid touching the PCB board directly.
- Turn power off and disconnect all leads before opening the device.

In order to change the jumper settings of a specific input, first open the device by prying off its back, using the blade of a flat-bladed screwdriver. The insertion points for the screwdriver are located on both sides of the module.

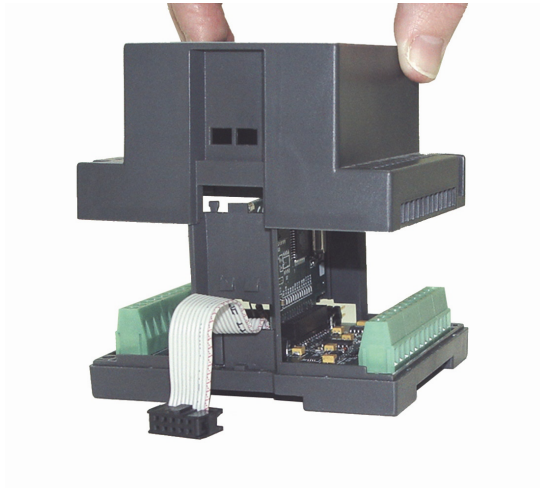
1. Open the first side of the device by inserting the blade between the 2 plastic moldings as shown below, then gently pushing up.



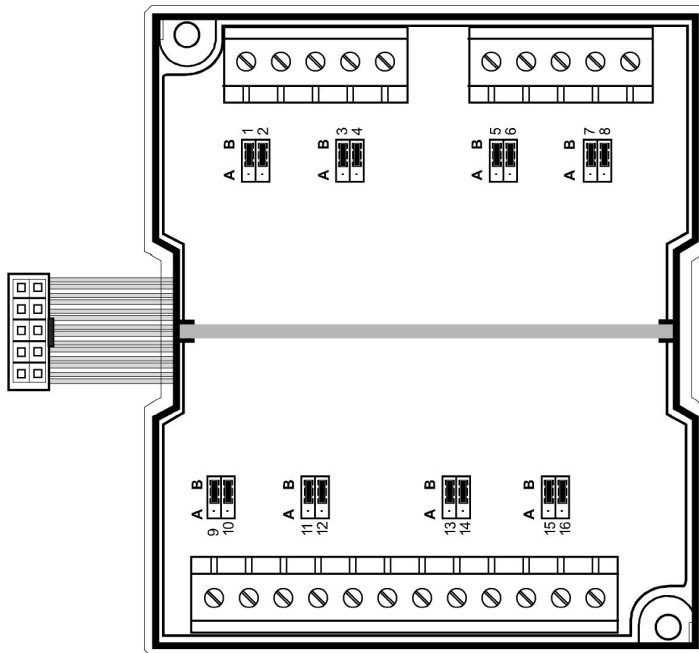
2. Taking care not to damage the cable, open the other side of the device by inserting the blade where shown below, then gently pushing up.



- 3. Gently remove the top of the device as shown.



- 4. The jumpers are shown at right. Change the jumper settings as required, in accordance with the tables shown on the next page.



Jumper Settings

The tables below show how to set a specific jumper to change the functionality of a specific input. To open the device and access the jumpers, refer to the instructions beginning on page 6.

Caution ■ Incompatible jumper settings and wiring may severely damage the device.

	Jumper #	Thermocouple*	Voltage	Current
Input 0	1	B	A	A
	2	B	A	B
Input 1	3	B	A	A
	4	B	A	B
Input 2	5	B	A	A
	6	B	A	B
Input 3	7	B	A	A
	8	B	A	B
Input 4	9	B	A	A
	10	B	A	B
Input 5	11	B	A	A
	12	B	A	B
Input 6	13	B	A	A
	14	B	A	B
Input 7	15	B	A	A
	16	B	A	B

* Default factory setting.

IO-ATC8 Technical Specifications

Max. current consumption	40mA maximum from the adapter's 5VDC
Typical power consumption	0.2W@5VDC
Status indicator (RUN)	Green LED: —Lit when a communication link is established between module and OPLC. —Blinks when the communication link fails.

Thermocouple Inputs

Number of inputs	8. See Note 1.
Input type	Thermocouple, differential inputs. See Note 2.
Input range	As shown in table below.
Isolation	None
Conversion method	Voltage to frequency
Resolution	0.1°C (0.1°F) See Note 3.
Conversion time	100mSec minimum, according to the filter type selected in software settings
Input impedance	>10MΩ
Cold junction compensation	Local, automatic
Cold junction compensation error	±1.5°C (±2.7°F) maximum
Absolute maximum rating	±0.6VDC
Linearity error	0.04% maximum of full scale
Error limit	0.4% of input value
Warm-up time	Typically ½ hour, ±1°C (±1.8°F) repeatability
Status indicators (OUT OF RANGE)	Red LEDs—Lit when the corresponding input measures an analog value in excess of the input range. See Note 4.

Thermocouple input ranges

Type	Temperature range	Wire color	
		ANSI (USA)	BS 1843 (UK)
mV	-5 to 56mV	-	-
B	200 to 1820°C (300 to 3276°F)	+ Grey - Red	+ None - Blue
E	-200 to 750°C (-328 to 1382°F)	+ Violet - Red	+ Brown - Blue
J	-200 to 760°C (-328 to 1400°F)	+ White - Red	+ Yellow - Blue
K	-200 to 1250°C (-328 to 2282°F)	+ Yellow - Red	+ Brown - Blue
N	-200 to 1300°C (-328 to 2372°F)	+ Orange - Red	+ Orange - Blue
R	0 to 1768°C (32 to 3214°F)	+ Black - Red	+ White - Blue
S	0 to 1768°C (32 to 3214°F)	+ Black - Red	+ White - Blue
T	-200 to 400°C (-328 to 752°F)	+ Blue - Red	+ White - Blue

Analog Inputs

Number of inputs	8 (single-ended) See Note 1.
Input range	0-10V, 0-20mA, 4-20mA. See Note 1.
Input type	Either Normal or Fast mode, according to the filter type selected in software settings
Conversion method	Voltage to frequency
Normal mode	
Resolution at 0-10V, 0-20mA	14-bit (16384 units)
Resolution at 4-20mA	3277 to 16383 (13107 units)
Conversion time	100mSec minimum per input
Fast mode	
Resolution at 0-10V, 0-20mA	12-bit (4096 units)
Resolution at 4-20mA	819 to 4095 (3277 units)
Conversion time	25mSec minimum per input
Input impedance	>400K Ω —voltage 500 Ω —current
Isolation	None
Absolute maximum rating	$\pm 15V$ —voltage $\pm 30mA$ —current
Linearity error	0.04% max of full scale
Error limits	0.4% of input value
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 5.

Environmental	IP20/NEMA1
Operating temperature	0° to 50°C (32 to 122° F)
Storage temperature	-20° to 60°C (-4 to 140° F)
Relative Humidity (RH)	5% to 95% (non-condensing)
Dimensions (WxHxD)	80mm x 93mm x 60mm (3.15 x 3.66 x 2.362")
Weight	150g (5.3 oz)
Mounting	Either onto a 35mm DIN-rail or screw-mounted.

Notes:

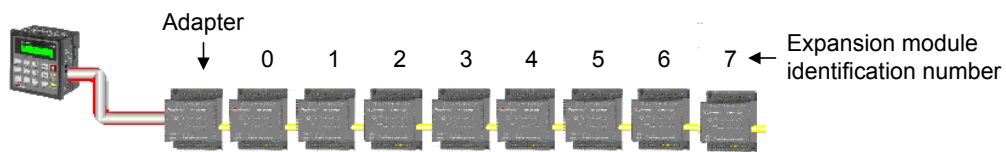
- Each input may be set as either thermocouple, voltage (0-10V), or current (0-20mA, 4-20mA) via wiring, jumper and software settings.
- The device can also measure voltage within the range of -5 to 56mV, at a resolution of 0.01mV. The device can also measure raw value frequency at a resolution of 14-bits(16384).
- The input analog value represents the measured value as shown in the following examples:
 - Thermocouple: a value of 262 is represented as 26.2°C.
 - mV: value of 262 is represented as 2.62mV.
- The value of a thermocouple may also indicate when the sensor is not connected to the input, or when the analog value exceeds the permissible range. If such is the case, the value will be 32767.
- The voltage or current value of analog inputs can also indicate faults, as shown in the table below.

Value: 12-bit (Fast mode)	Value: 14-bit (Normal mode)	Input Value Deviates:
-1	-1	Slightly below the input range.
4096	16384	Slightly above the input range.
32767	32767	Greatly above or below the input range.

Addressing I/Os on Expansion Modules

Inputs and outputs located on I/O expansion modules that are connected to an 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 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 OPLC will be addressed as I 149, $149 = 32 + 7 \cdot 16 + 5$

About Unitronics

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IO-LC1, IO-LC3 I/O Expansion Modules 1-3 Loadcell Inputs, 1 Digital In, 2 Out

The IO-LC1 and IO-LC3 are I/O Expansion Modules that can be used in conjunction with specific Unitronics OPLC controllers.

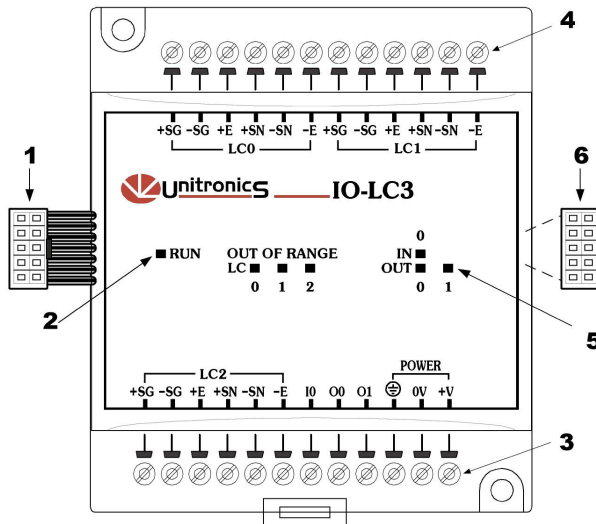
IO-LC1 offers 1 Loadcell input; IO-LC3 module offers 3 Loadcell inputs. Both modules offer 1 PNP (source) input and 2 short-circuit protected PNP (source) outputs with optional setpoint action that is defined via software settings.

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	Power and I/O connection points
4	I/O connection points (IO-LC3 only)
5	Power and I/O status indicators
6	Module-to-module connector port



Note: The single Loadcell input offered by IO-LC1 is marked LC and is located where the input LC2 is shown above.

- Before using this product, it is the responsibility of the user to read and understand this document and any accompanying documentation.
- All examples and diagrams shown herein are intended to aid understanding, and do not guarantee operation. Unitronics accepts no responsibility for actual use of this product based on these examples.
- Please dispose of this product in accordance with local and national standards and regulations.
- Only qualified service personnel should open this device or carry out repairs.

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 device's electrical wiring.

Symbols are used to highlight information relating to the user's personal safety and equipment protection throughout this document. When these symbols appear, the associated information must be read carefully and understood fully.

Symbol	Meaning	Description
	Danger	The identified danger causes physical and property damage.
	Warning	The identified danger can cause physical and property damage.
Caution	Caution	Use caution.



- 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.



- Check the user program before running it.
- Do not attempt to use this device with parameters that exceed permissible levels.
- To avoid damaging the system, do not connect / disconnect the device when the power is on.

Environmental 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.

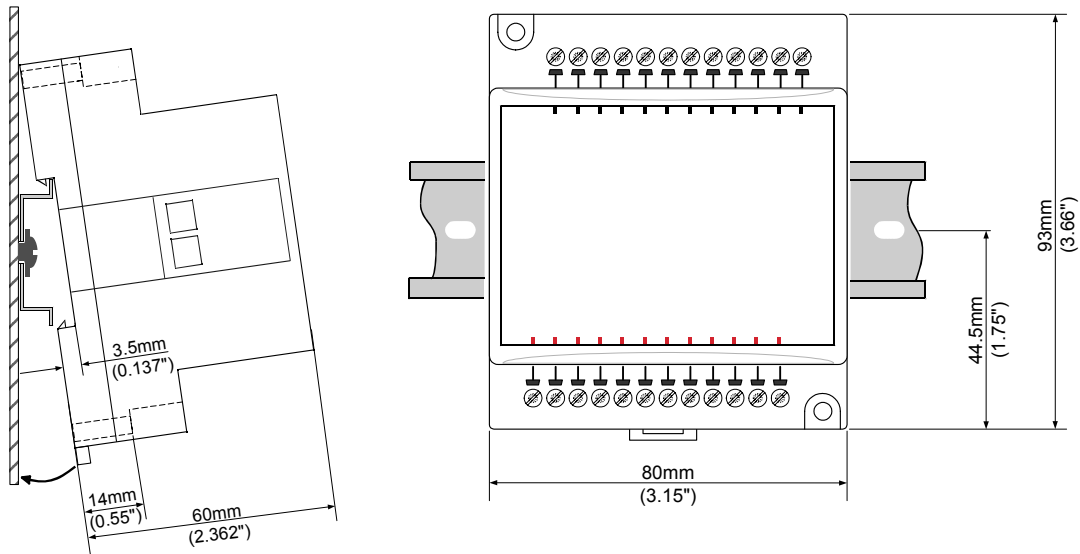


- Leave a minimum of 10mm space for ventilation between the top and bottom edges of the device and the enclosure walls.
- Do not place in water or let water leak onto the unit.
- Do not allow debris to fall inside the unit during installation.

Mounting the Module

DIN-rail mounting

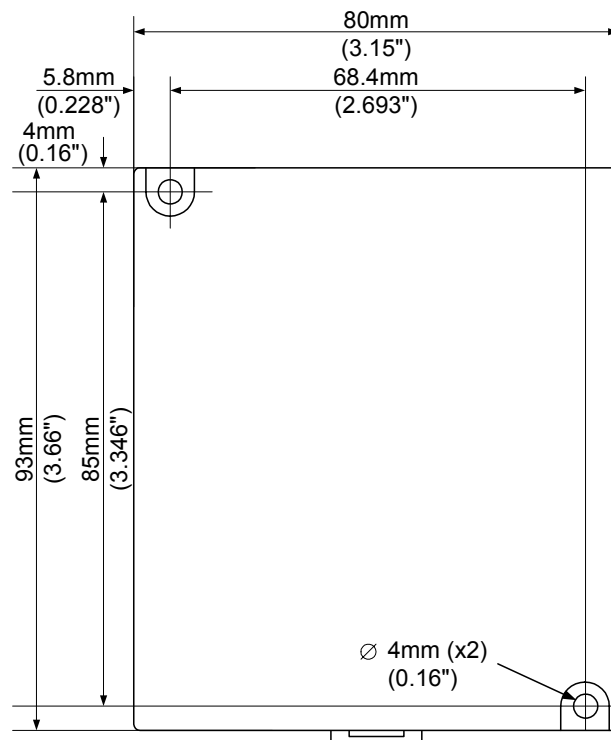
Snap the device onto the DIN rail as shown below; the module will be squarely situated on the DIN rail.



Screw-Mounting

The figure below is not 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:

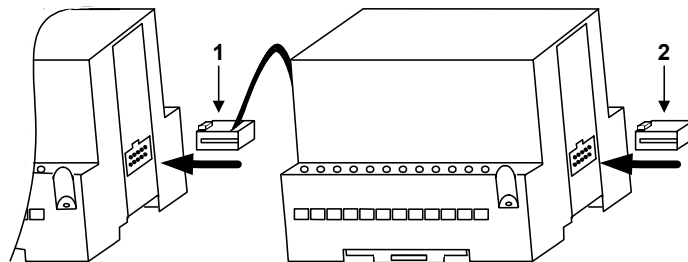
1. Push the module-to-module connector into the port located on the right side of the device.

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



- Do not touch live wires.



- Unused pins should not be connected. Ignoring this directive may damage the device.
- Do not connect the 'Neutral' or 'Line' signal of the 110/220VAC to the device's COM pins.
- Double-check all wiring before turning on the power supply.

Wiring Procedures

Use crimp terminals for wiring; use 26-12 AWG wire (0.13 mm^2 – 3.31 mm^2) for all wiring purposes.

1. Strip the wire to a length of $7 \pm 0.5 \text{ mm}$ (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 use tin, solder, or any other substance on stripped wire that might cause the wire strand to break.
- Install at maximum distance from high-voltage cables and power equipment.

I/O Wiring—General

- 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 lines used over an extended distance. Use wire that is properly sized for the load.

External Power Supply

All of the IO-LC1, IO-LC3 I/O signals are isolated from the controller bus, but are not isolated from the power supply input. If required, you can provide full isolation by using a separate isolated power-supply.

1. Connect the "positive" cable to the "+V" terminal, and the "negative" cable to the "0V" terminal.



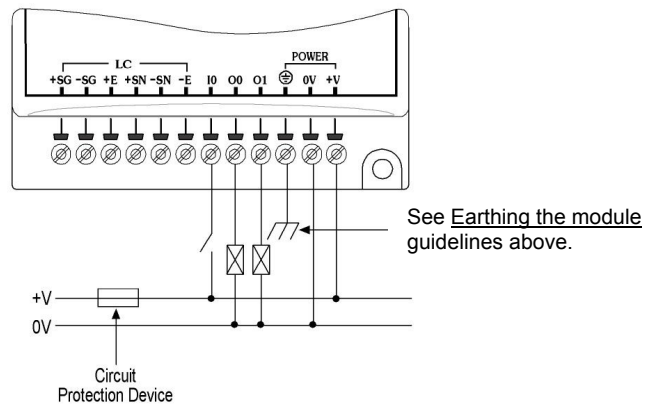
- Do not connect the 'Neutral' or 'Line' signal of the 110/220VAC to any of the module's terminals.
- In case of voltage fluctuations or non-conformity to voltage power supply specifications, connect the module to a regulated power supply.

Earthing the module

To maximize system performance, avoid electromagnetic interference by earthing the module.

1. Connect one end of a wire, 14 AWG, to the chassis signal; connect the other end to the cabinet chassis. This assumes that the cabinet is properly earthed. If this is not the case, do not earth the module.
- Caution*
- The wire used to earth the module must not exceed 8 cm in length. If your conditions do not permit this, do not earth the module.
 - Do not earth the module via the Loadcell cable shield.

External power supply and Digital I/O wiring



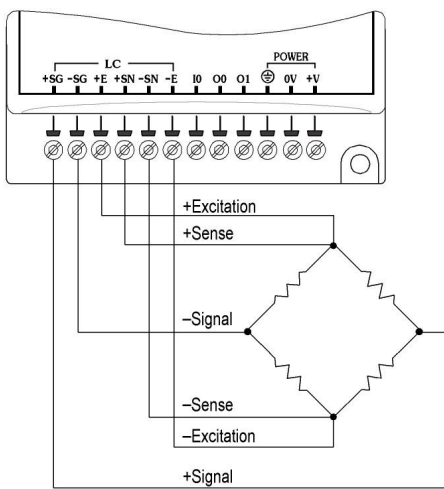
Digital I/Os

- Refer to External power supply and Digital I/O wiring above for wiring guidelines.

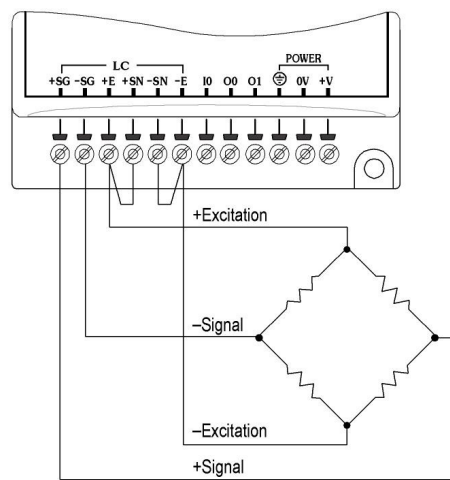
Loadcell Inputs

- Use 6 or 4 wire shielded cable (6 wire is recommended).
- The cable shield should be connected ONLY to the Loadcell chassis. The shield at the other end of the cable should be left unconnected.
- Refer to the figures below for wiring guidelines.

6 wire Loadcell wiring



4 wire Loadcell wiring



IO-LC1, IO-LC3 Technical Specifications

External Power-Supply

Nominal operating voltage	12 / 24VDC
Operating voltage range	10.2 to 28.8VDC

Power Consumption

Max. current consumption			
From the adapter's 5VDC	60mA		
From external power-supply		At 12V	At 24V
	One 350Ω Loadcell	45mA	30mA
	4 x 350Ω Loadcells	70mA	45mA
	12 x 350Ω Loadcells	140mA	80mA
		See Note 1 for details	
Max. total internal power dissipation	At 12V	At 24V	
	1.0W	1.2W	

Status Indicator

(RUN)	Green LED:
	—Lit when a communication link is established between module and OPLC.
	—Blinks when the communication link fails.

Loadcell Inputs

Number of inputs	3 for IO-LC3, 1 for IO-LC1
Galvanic isolation	
Loadcell to ext. pwr supply	No
Loadcell to bus	Yes
Loadcell to digital input	No
Loadcell to digital outputs	No
Input voltage ranges	
Signal (+SG & -SG)	
Differential	Gain Setting (S.W. selectable) Nominal Span
	0 -20mV to +20mV
	1 -80mV to +80mV
	*Offset compensation (S.W. selectable) can shift span by approx. -77.5mV to +77.5mV (2.5mV steps).
Common-Mode	1.5Vmin to 3.5Vmax (relative to the 0V terminal voltage)
Sense (+SN & -SN)	
Differential	-5V to +5V nominal
Common-Mode	0Vmin to 5Vmax (relative to the 0V terminal voltage)
Excitation output (+E & -E)	
Excitation type	Software selectable: DC or AC (Alternating polarity square wave, see Note 6)
Differential output voltage	5V nominal
	4.70Vmin to 5.20Vmax
Output current	
Per Loadcell input	200mA maximum (up to 12 x 350Ω Loadcells)
Total	200mA maximum (up to 12 x 350Ω Loadcells)
Short circuit protection	Yes, up to 1 minute
A/D Converter	
Conversion method	Sigma-Delta
Resolution	24 bits
Conversion period	12.5msec (80Hz)

Linearity error	0.01% maximum of full scale
Common-mode rejection	>100dB @ DC, 50Hz, 60Hz
Offset drift	100nV / °C typ.
Gain drift	3ppm / °C typ.
Calibration and Zero	—2 to 12 calibration-points (zero-point not required), direct/indirect point addressing for editing and deleting calibrated points. —Zero and tare acquisition and/or editing. —Auto zero tracking
Filter	Adjustable settling time up to 24 sec. See Note 2 for details.
Loadcell input values	Either one or two independent values, signed 16 or 24 bit. Each weight/strain value may be represented in a different mode; representation modes are selected via software.
Polarity	Fully bipolar operation – weight/strain values can be either positive or negative.
Representation modes	Net, Gross, Net Min, Net Max, uV/V or A/D Raw Value. *When uV/V is selected for one value, both values will be represented in uV/V. **The Net and Gross values may also indicate connection problems. See Note 3 for details.
Rounding	The Net, Gross, Net Min and Net Max values may be rounded by 1, 2, 5, 10, 20, 50 or 100.
Effective resolution	See Effective Resolution, page 10.
Status indicators (OUT OF RANGE)	Red LEDs: —Lit when the corresponding Loadcell is not connected to the input, or when the input analog value exceeds the permissible range. See Note 3 for details. —Blinks when the external power-supply is not detected. See Note 4 for details.

Digital Input

Number of inputs	1
Input type	pnP (source)
Galvanic isolation	
Dig. input to ext. supply	No
Dig. input to bus	Yes
Dig. input to Loadcell	No
Dig. input to digital outputs	No
Nominal input voltage	12 / 24VDC
Input voltage	0-5VDC for Logic '0' 9-28.8VDC for Logic '1'
Input current	5.5mA @ 12VDC, 11.5mA @ 24VDC
Response time	10mSec typical
Status indicator (IN)	Green LED—Lit when the input is active. See Note 5.

Digital Outputs

Number of outputs	2 pnp (source)
Output type	P-MOSFET (open drain)
Galvanic isolation	
Dig. output to ext. pwr supply	No
Dig. output to bus	Yes
Dig. output to Loadcell	No
Dig. output to digital input	No

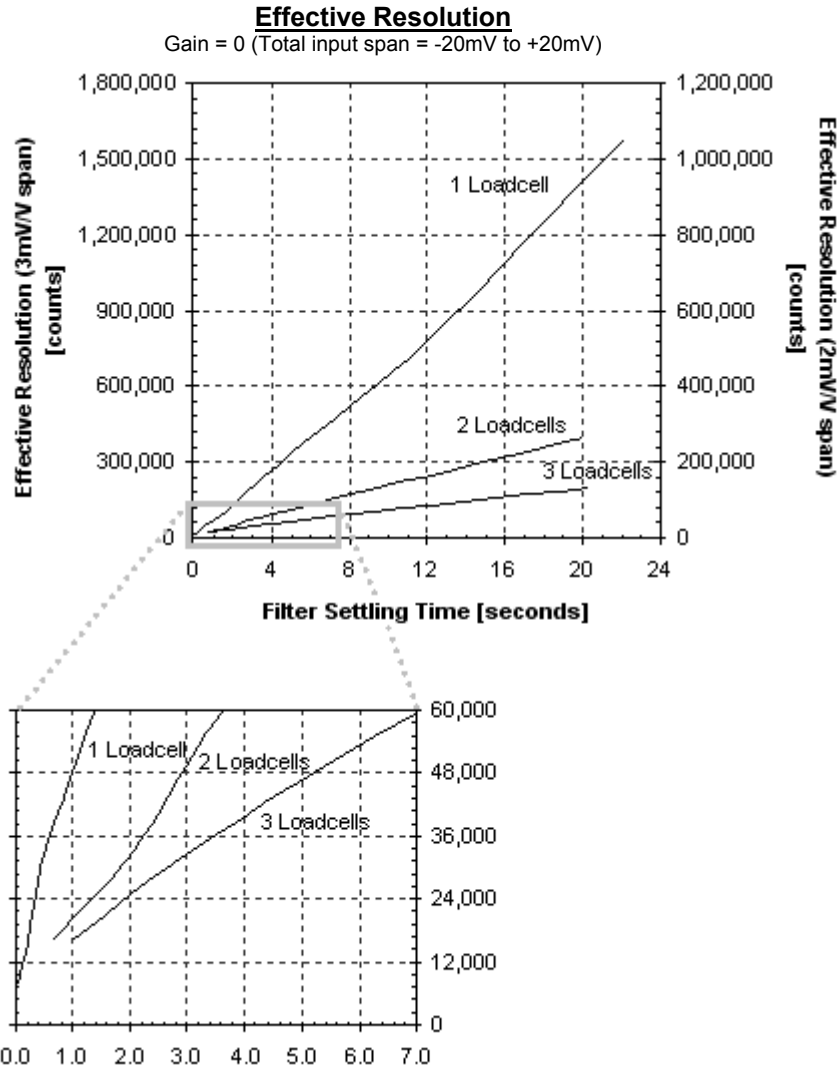
Output current	0.3A maximum per output
Maximum frequency	20Hz (resistive load) 0.5Hz (inductive load)
ON voltage drop	0.5V maximum
Short circuit protection	Yes
Response time	10mSec typical
Operating modes	Both outputs can be independently configured, via the software, to operate in one of the following modes:
Direct ladder control	The output functions like a standard digital output, and is directly controlled via ladder software. This is the default mode at power-up.
Setpoint	The output is linked to one of the active Loadcell input values and operates according to parameters set by the application software.
Status indicators (OUT)	Red LEDs—Lit when the corresponding output is active.
Environmental	IP20/NEMA1
Operating temperature	0° to 50°C (32 to 122° F)
Storage temperature	-20° to 60°C (-4 to 140° F)
Relative Humidity (RH)	5% to 95% (non-condensing)
Mechanical	
Dimensions (WxHxD)	80mm x 93mm x 60mm (3.15 x 3.66 x 2.362")
Weight	170g (6oz)
Mounting	Either onto a 35mm DIN-rail or screw- mounted.

Notes:

- The maximum current consumption does not provide for output requirements. The additional current requirement of the outputs must be added.
- The minimum settling times and settling time resolutions are: 12.5ms for one active channel, 675ms for two active channels and 1,012.5ms for three active channels
- The following connection-problems will cause the corresponding OUT OF RANGE LED to light up:
 - Disconnection of one of the signal (\pm SG) lines
 - Disconnection of one or both of the sense (\pm SN) lines
 When the Out Of Range LED is lit, the Out Of Range bit of the corresponding Loadcell Status Message turns ON, and the Loadcell's Net and Gross values will be set according as follows:

	Normal Resolution	High Resolution
Under-Range:	$-2^{15} = -32,768 = 8000$ Hex	$-2^{23} = -8,388,608 = FF80 0000$ Hex
Over-Range:	$2^{15} - 1 = 32,767 = 7FFF$ Hex	$2^{23} - 1 = 8,388,607 = 007F FFFF$ Hex

- When the external power-supply cannot be detected, the No Power Bit in all of the Loadcell Status Messages turns ON.
- The input's LED light up only when a communication link is established between module and OPLC.
- AC excitation has the advantage of lower offset drift errors, improving performance over time and in the presence of ambient temperature changes. To minimize the impact of offset drift errors in your loadcell application, the use of AC excitation is recommended.

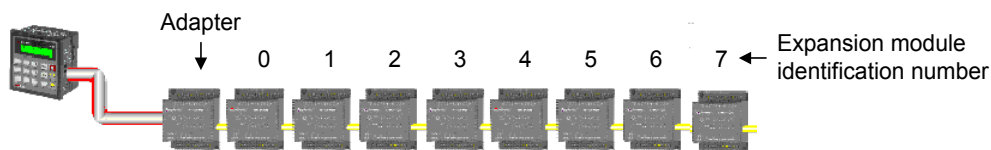


- The effective resolution depends on several electrical parameters including the gain setting, the input span that is used (usually 10mV for 2mV/V Loadcells or 15mV for 3mV/V Loadcells), the amount of uncompensated differential offset, and the applied input noise.
- The number of Loadcell inputs used per expansion module affects the sampling rate for each of them, resulting in lower filter depth and effective resolution.
- The filter settling time can be programmed separately for each Loadcell input without affecting the other(s).

Addressing I/Os on Expansion Modules

Inputs and outputs located on I/O expansion modules that are connected to an 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 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 • 16 + 3
- Output #4, located on expansion module #3 in the system, will be addressed as O 84,
84 = 32 + 3 • 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 OPLC will be addressed as I 149, 149 = 32 + 7 • 16 + 5

About Unitronics

Unitronics Industrial Automation Systems has been producing PLCs, automation software and accessory devices since 1989.

Unitronics' OPLC controllers combine full-function PLCs and HMI operating panels into single, compact units. These HMI + PLC devices are programmed in a single, user-friendly environment. Our clients save I/O points, wiring, space, and programming time; elements that translate directly into cost-efficiency.

Unitronics supports a global network of distributors and sales representatives, as well as a U.S. subsidiary.

For more information regarding Unitronics products, contact your distributor, Unitronics headquarters via email: export@unitronics.com, or visit the Unitronics website at <http://www.unitronics.com/>.



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IO-PT400, IO-PT4K I/O Expansion Modules 4 RTD Inputs

IO-PT400 and IO-PT4K are I/O Expansion Modules that can be used in conjunction with specific Unitronics OPLC controllers.

This module is offered in two models.

Each module offers 4 RTD inputs for temperature measurement:

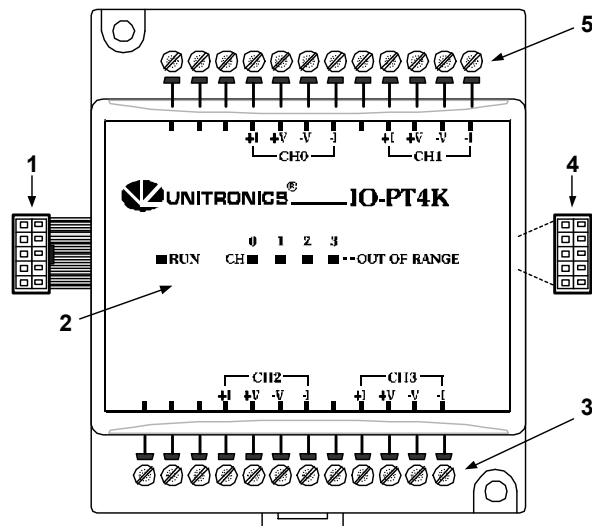
Part No.	RTD Type
I/O-PT400	PT100, NI100, NI120 ¹
I/O-PT4K	PT1000, NI1000

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	Status indicators
3	Input connection points, CH2 & CH3
4	Module-to-module connector port
5	Input connection points, CH0 & CH1





*Note that the model shown represents all models.

- Before using this product, it is the responsibility of the user to read and understand this document and any accompanying documentation.
- All examples and diagrams shown herein are intended to aid understanding, and do not guarantee operation. Unitronics accepts no responsibility for actual use of this product based on these examples.
- Please dispose of this product in accordance with local and national standards and regulations.
- Only qualified service personnel should open this device or carry out repairs.

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 device's electrical wiring.

Symbols are used to highlight information relating to the user's personal safety and equipment protection throughout this document. When these symbols appear, the associated information must be read carefully and understood fully.

Symbol	Meaning	Description
	Danger	The identified danger causes physical and property damage.
	Warning	The identified danger can cause physical and property damage.
Caution	Caution	Use caution.



- 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.

¹ Note that the temperature range for NI120 is not standard: -50° to 172°C (-58° to 341°F).

IO-PT400, IO-PT4K I/O Expansion Modules



- Check the user program before running it.
- Do not attempt to use this device with parameters that exceed permissible levels.
- Install an external circuit breaker and take appropriate safety measures against short-circuiting in external wiring.
- To avoid damaging the system, do not connect / disconnect the device when the power is on.

Environmental 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.

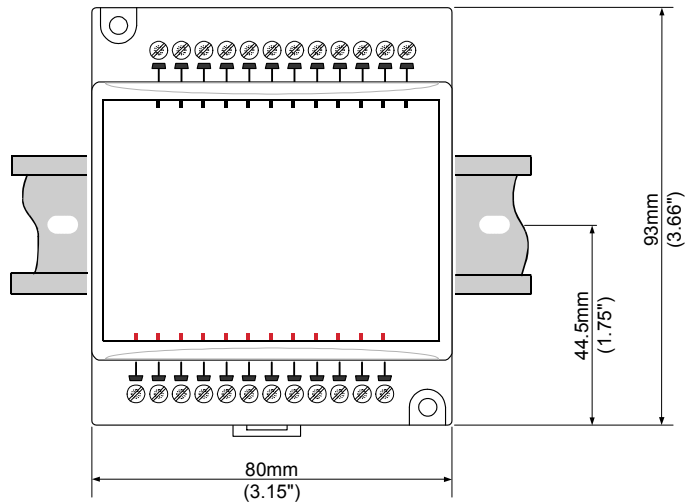
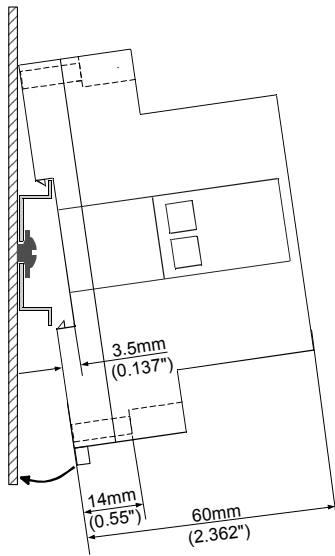


- Leave a minimum of 10mm space for ventilation between the top and bottom edges of the device and the enclosure walls.
- Do not place in water or let water leak onto the unit.
- Do not allow debris to fall inside the unit during installation.

Mounting the Module

DIN-rail mounting

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

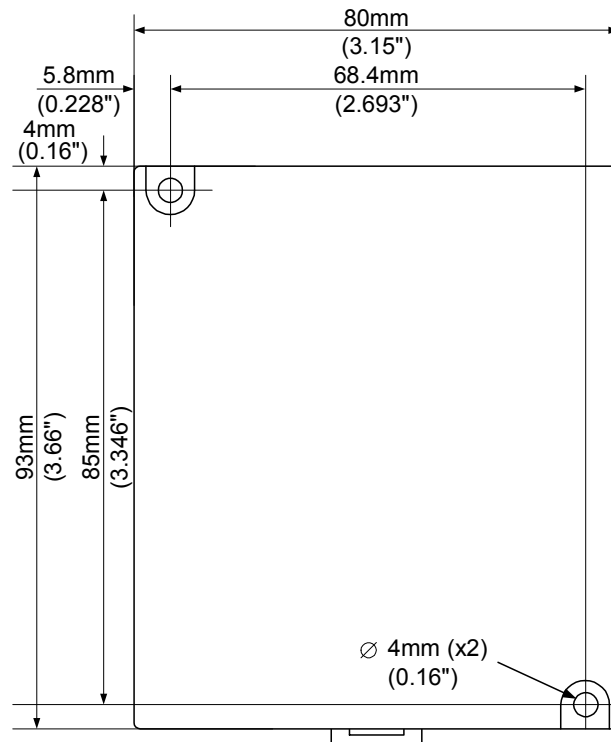


IO-PT400, IO-PT4K I/O Expansion Modules

Screw-Mounting

The figure below is not drawn to scale. It may be used as a guide for screw-mounting the module.

Mounting screw type: either M3 or NC6-32.



IO-PT400, IO-PT4K I/O Expansion Modules

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.

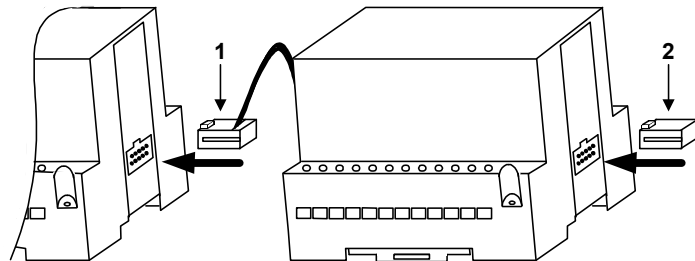
Note that there is a protective cap provided with the adapter. This cap covers the port of the **final** I/O module in the system.



- 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



- Do not touch live wires.



- Unused pins should not be connected. Ignoring this directive may damage the device.
- Double-check all wiring before turning on the power supply.

Wiring Procedures

Use crimp terminals for wiring; use 26-14 AWG wire (0.13 mm²–3.31 mm²) for all wiring purposes.

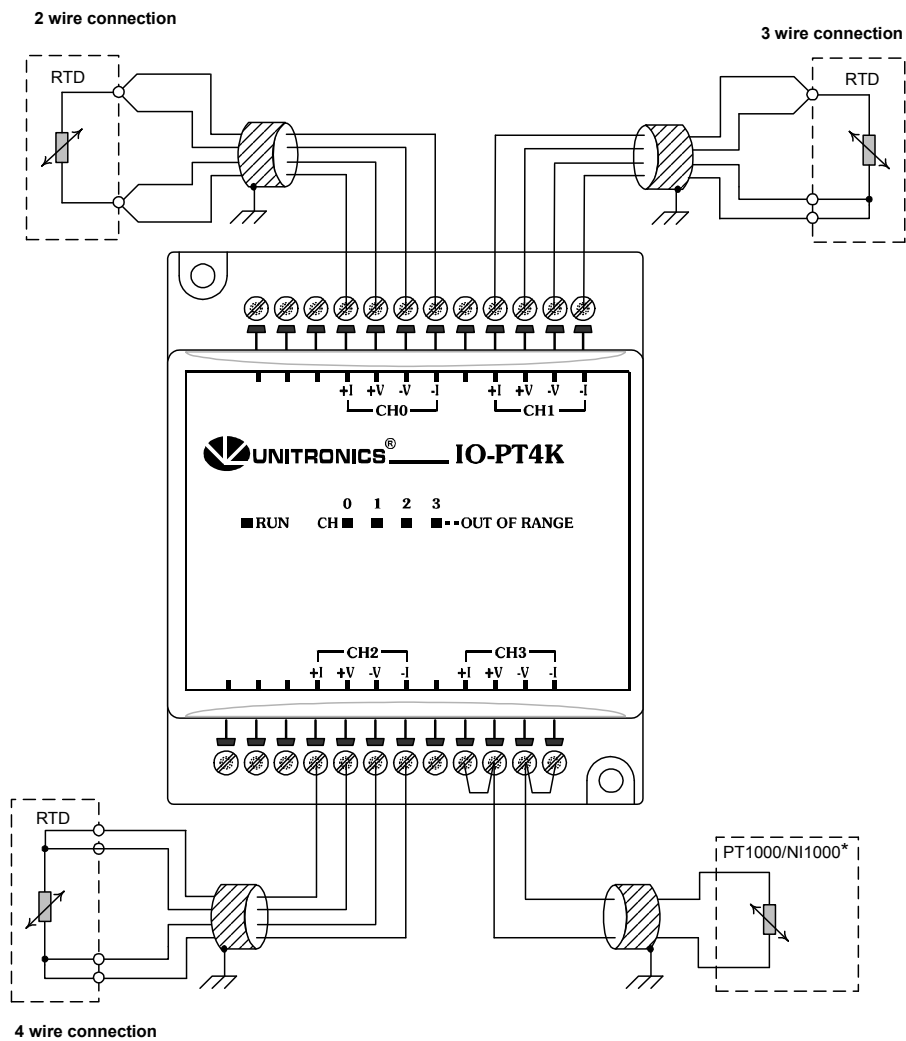
1. Strip the wire to a length of 7±0.5mm (0.250–0.300 inches).
 2. Unscrew the terminal to its widest position before inserting a wire.
 3. Insert the wire completely into the terminal to ensure that a proper connection can be made.
 4. Tighten enough to keep the wire from pulling free.
- To avoid damaging the wire, do not exceed a maximum torque of 0.5 N·m (5 kgf·cm).
 - Do not use tin, solder, or any other substance on stripped wire that might cause the wire strand to break.
 - Install at maximum distance from high-voltage cables and power equipment.

I/O Wiring—General

- 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 lines used over an extended distance. Use wire that is properly sized for the load.

Analog Inputs

- Shields should be connected at the signal source.



* RTD input types PT1000/Ni1000 support a two-wire connection, because the high resistance (1000 ohm) of the sensor element compensates for voltage drop.

IO-PT400, IO-PT4K I/O Expansion Modules

IO-PT400, IO-PT4K Technical Specifications

Max. current consumption	35mA maximum from the adapter's 5VDC
Typical power consumption	0.09W @ 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		
Model number	I/O-PT400	I/O-PT4K	
RTD type	PT100, NI100, NI120	PT1000, NI1000	
Temperature coefficient α	PT: 385/392, NI100: 618, NI120: 672	PT: 385/392, NI: 618	See Note 1
Temperature unit	°C and °F		
Temperature range			
PT100/1000	-50° to 460°C (-58° to 860°F)		
NI100/1000	-50° to 232°C (-58° to 449°F)		
NI120	-50° to 172°C (-58° to 341°F)		
Isolation	None		
Resolution	12-bit (4096 units)		
Measurement resolution	±0.1°C (0.1°F). See Note 2.		
Conversion method	Successive approximation		
Conversion time	40msec		
Input impedance	10M Ω minimum		
Auxiliary current			
PT100/NI100/NI120	1.9mA		
PT1000/NI1000	0.19mA		
Linearity error	I/O-PT400	I/O-PT4K	
	±0.3°C (0.6°F) (±0.05%)	±0.4°C (0.8°F) (±0.06%)	
Temperature accuracy	±0.4°C (0.8°F)		
Status indicators (OUT OF RANGE)	Red LEDs—Lit when the corresponding input measures an analog value (temperature) outside of the permissible range. See Note 3.		
Connection options	2, 3 or 4 wires		
Environmental	IP20 / NEMA1		
Operating temperature	0° to 50°C (32 to 122° F)		
Storage temperature	-20° to 60°C (-4 to 140° F)		
Relative Humidity (RH)	10% to 95% (non-condensing)		
Dimensions (WxHxD)	80 x 93 x 60mm (3.15 x 3.66 x 2.362")		
Weight	140.3g (4.94oz.)		
Mounting	Either onto a 35mm DIN-rail or screw-mounted.		

IO-PT400, IO-PT4K I/O Expansion Modules

Notes:

1. Alpha (α) type is selected in software. The PT default setting is 385.
2. The input analog value represents the temperature value as follows:
Analog value-262 Actual measured temperature: 26.2°C
3. The temperature values can also indicate certain faults as shown in the following table.

Value	Possible Cause
-10000 (-1000°)	<ul style="list-style-type: none">■ Input temperature is out of the permissible range (under -50°C)■ -I signal is not connected■ Sensor is short-circuited
10000 (1000°)	<ul style="list-style-type: none">■ Input temperature is out of the permissible range (PT: over 460°C) (NI: over 232° C) (NI120: over 172°C)■ Sensor is not connected to input■ +I or +V signals are not connected■ -I and -V signals are not connected

IO-PT400, IO-PT4K I/O Expansion Modules

Addressing I/Os on Expansion Modules

Inputs and outputs located on I/O expansion modules that are connected to an 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 0-7² as shown in the figure below.



The formula below is used to assign addresses for I/O modules used in conjunction with the 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,
 $84 = 32 + 3 \cdot 16 + 4$.

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² The maximum number of I/Os varies according to the types of I/O modules linked to the PLC.