# 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.

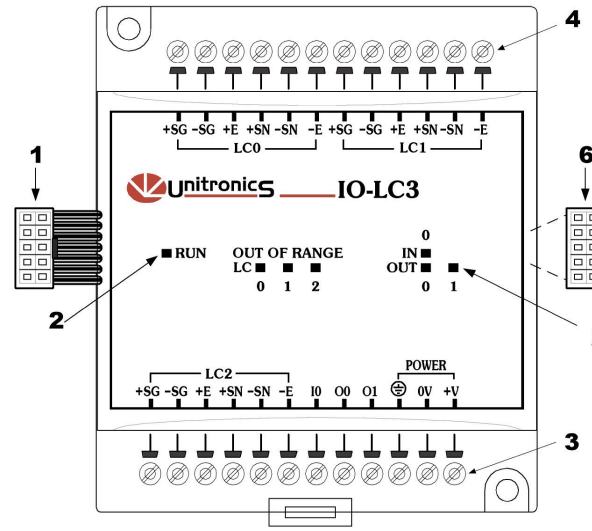
IO-LC1 offers 1 Loadcell input; IO-LC3 module offers 3 Loadcell inputs. Both modules offer 1 PNP (source) input and 2 short-circuit protected PNP (source) outputs with optional setpoint action that is defined via software settings.

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

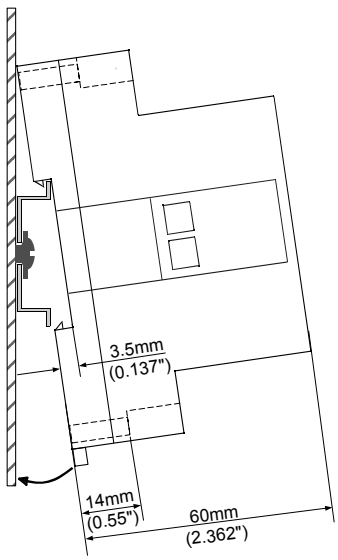
- Do not install in areas with: excessive or conductive dust, corrosive or flammable gas, moisture or rain, excessive heat, regular impact shocks or excessive vibration.

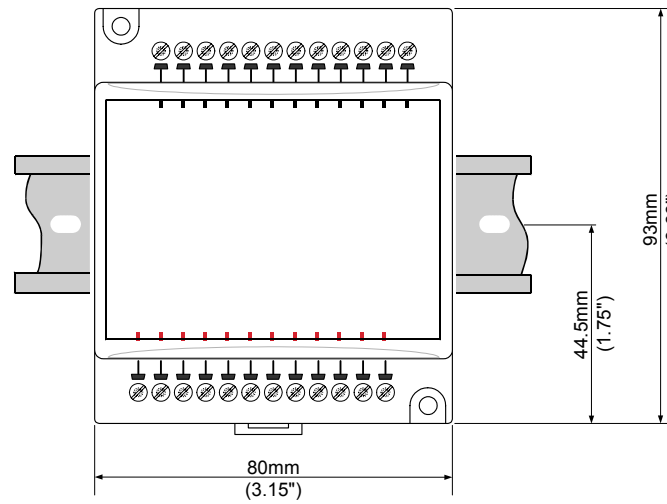
- Leave a minimum of 10mm space for ventilation between the top and bottom edges of the device and the enclosure walls.
- Do not place in water or let water leak onto the unit.
- Do not allow debris to fall inside the unit during installation.

## Mounting the Module

### DIN-rail mounting

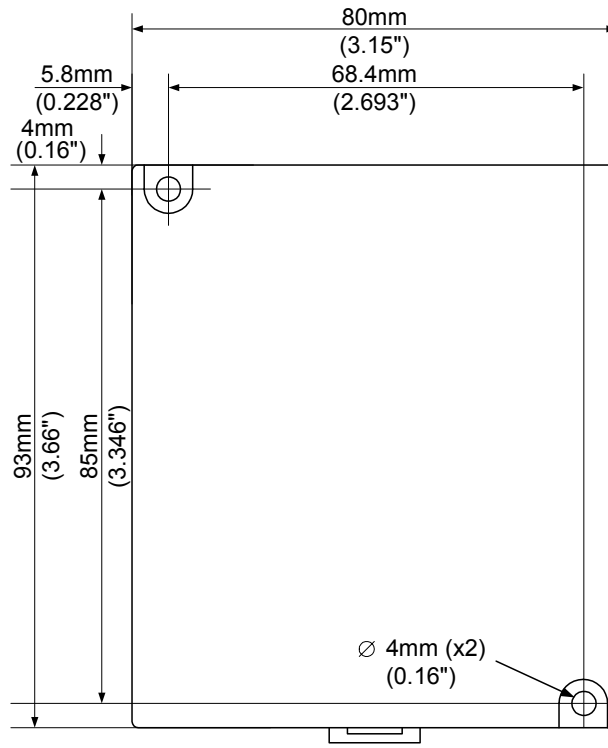
Snap the device onto the DIN rail as shown below; the module will be squarely situated on the DIN rail.



## 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

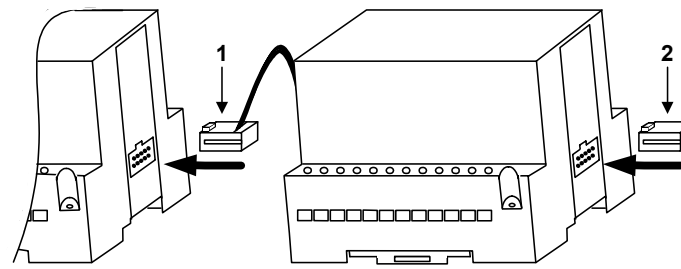
An adapter provides the interface between the OPLC and an expansion module. To connect the I/O module to the adapter or to another module:

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±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.

## 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

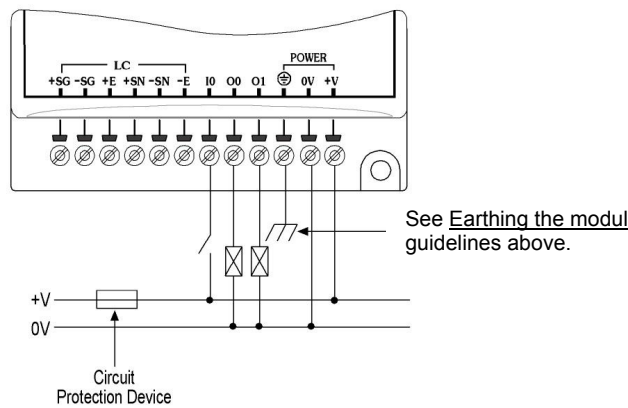
To maximize system performance, avoid electromagnetic interference by earthing the module.

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



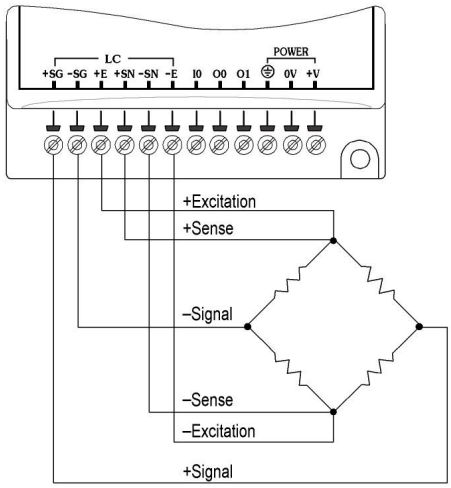

## Digital I/Os

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

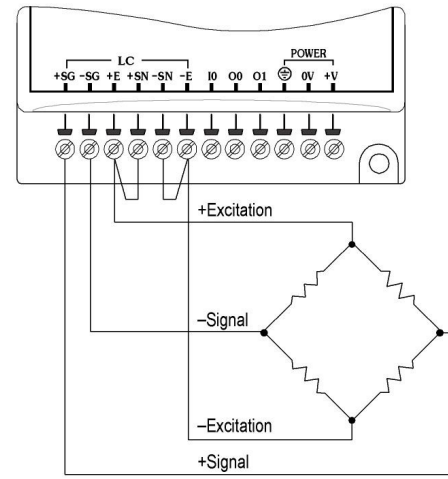
## Loadcell Inputs

- 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 | See Note 1 for details |
| 12 x 350Ω Loadcells | 140mA | 80mA | |

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.<br>—Zero and tare acquisition and/or editing.<br>—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.<br>*When uV/V is selected for one value, both values will be represented in uV/V.<br>**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:<br>—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.<br>—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'<br>9-28.8VDC for Logic '1' |
| Input current | 5.5mA @ 12VDC,<br>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)<br>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:**

1. The maximum current consumption does not provide for output requirements. The additional current requirement of the outputs must be added.
2. 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
3. The following connection-problems will cause the corresponding OUT OF RANGE LED to light up:
   - Disconnection of one of the signal (±SG) lines
   - Disconnection of one or both of the sense (±SN) lines

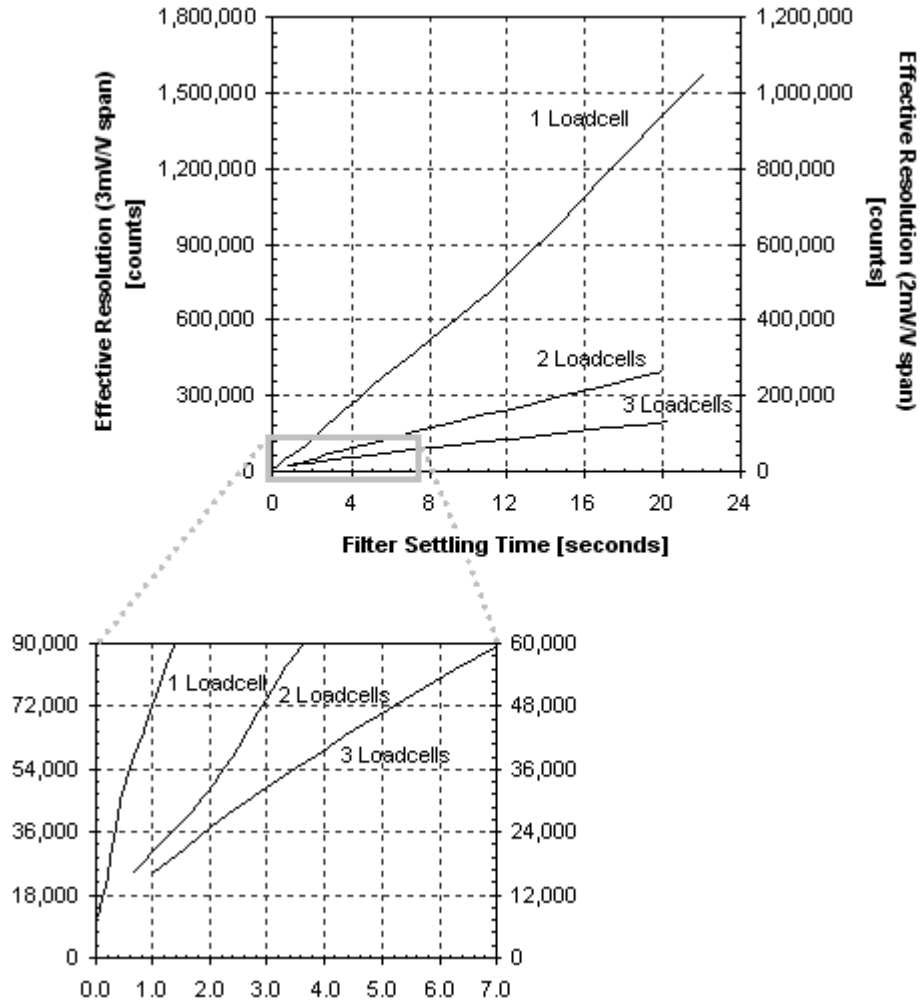
   When the Out Of Range LED is lit, the Out Of Range bit of the corresponding Loadcell Status Message turns ON, and the Loadcell's Net and Gross values will be set according as follows:

| | 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 |

4. When the external power-supply cannot be detected, the No Power Bit in all of the Loadcell Status Messages turns ON.
5. The input's LED light up only when a communication link is established between module and OPLC.
6. 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.

## Effective Resolution

Gain = 0 (Total input span = -20mV to +20mV)

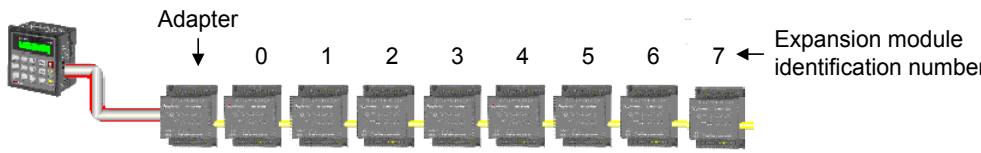



- The effective resolution depends on several electrical parameters including the gain setting, the input span that is used (usually 10mV for 2mV/V Loadcells or 15mV for 3mV/V Loadcells), the amount of uncompensated differential offset, and the applied input noise.
- The number of Loadcell inputs used 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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