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UNITRONICS IO-LC1 I-O Expansion Modules User Guide

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

Contents [hide]

IO-LC1 I-O Expansion Modules

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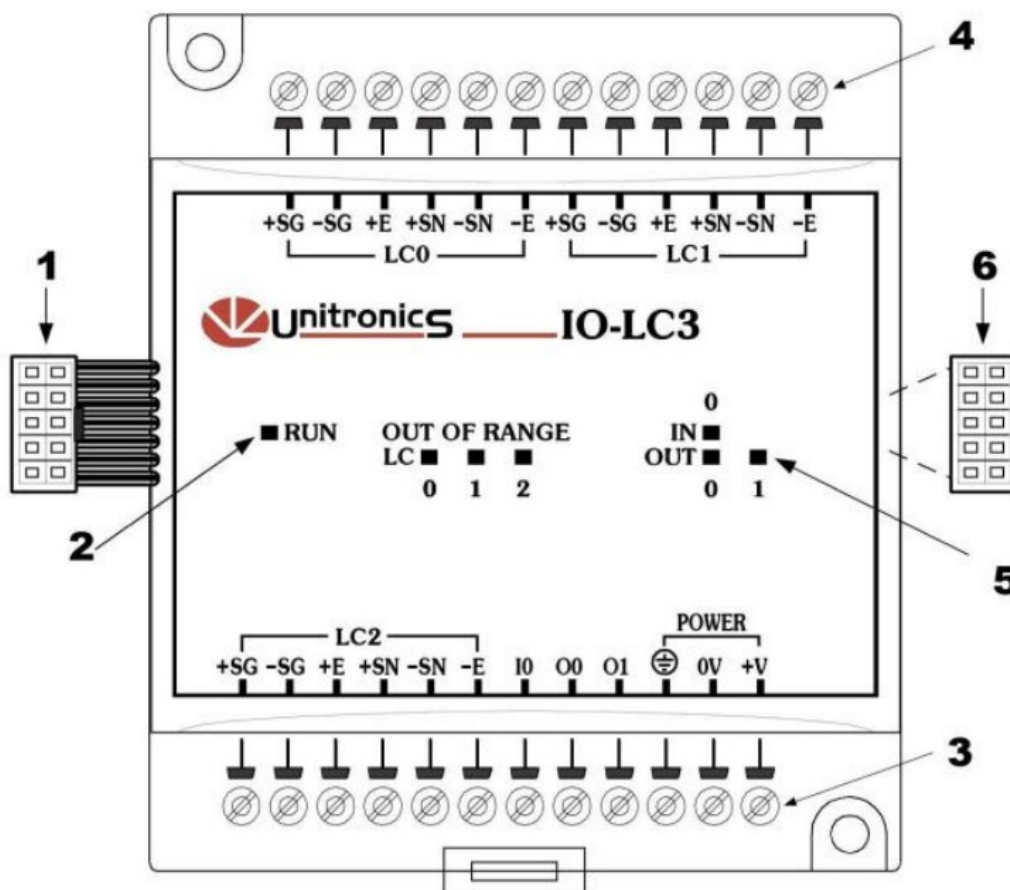
Note: The single Loadcell input offered by IO-LC1 is marked LC and is located where the input LC2 is shown above.

- 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.

93mm
(3.66")

44.5mm
(1.75")

80mm
(3.15")

3.
(5)
in3
(17

1
0)
r5
5
("

6
2.)
36
(H2
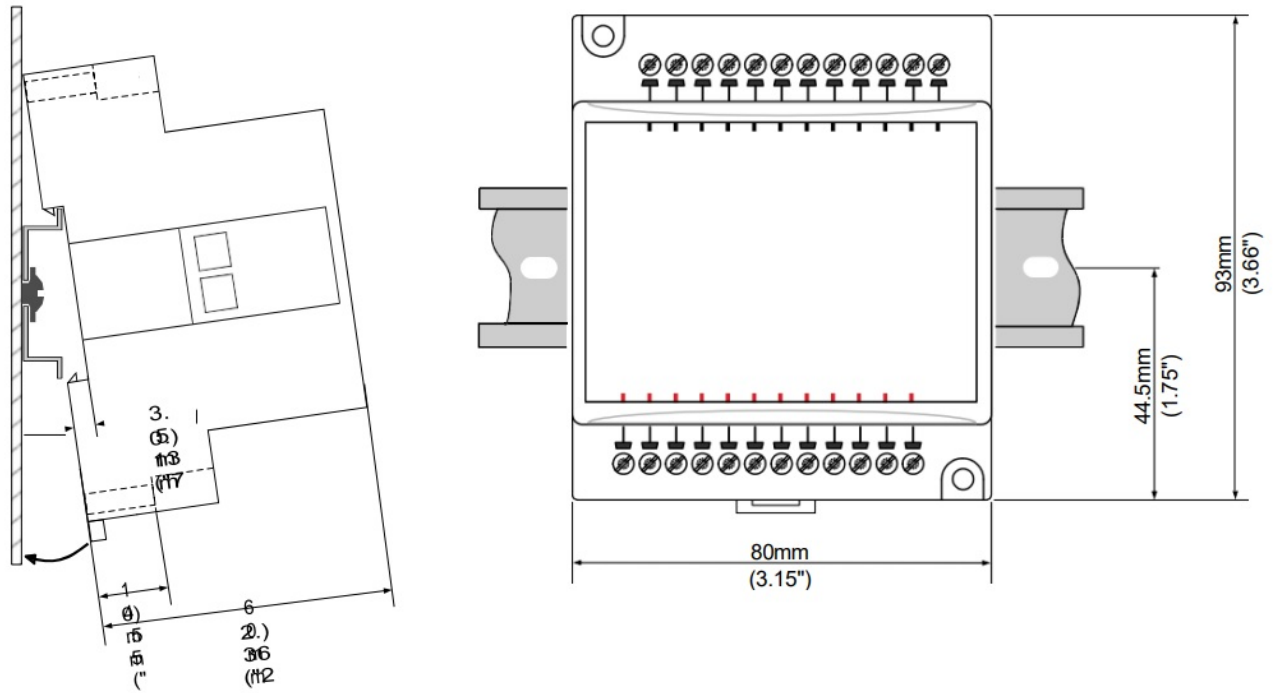
Screw-Mounting

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.

80mm
(3.15")

68.4mm
(2.693")

5.8mm
(0.228")

4mm
(0.16")

93mm
(3.66")

85mm
(3.346")

Ø 4mm (x2)
(0.16")
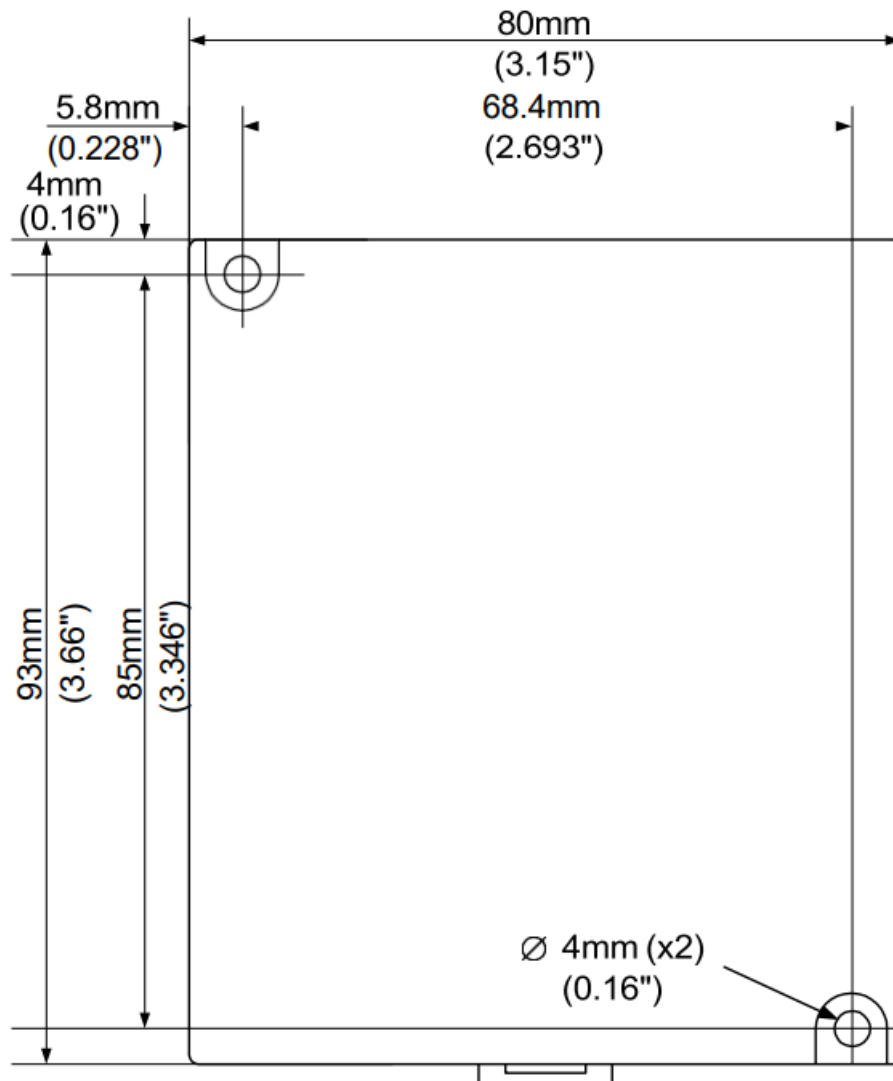
Connecting Expansion Modules

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:

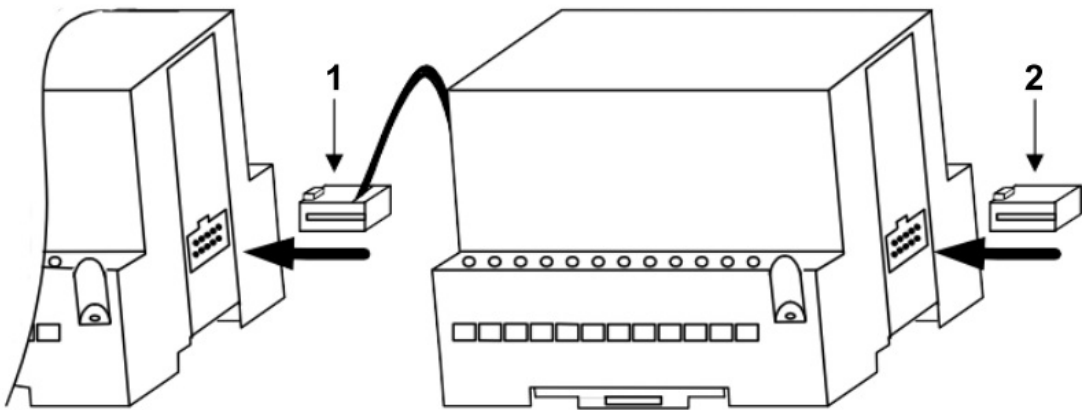1. Push the module-to-module connector into the port located on the right side of the device.

   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 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.

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.

- ⚠️ 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
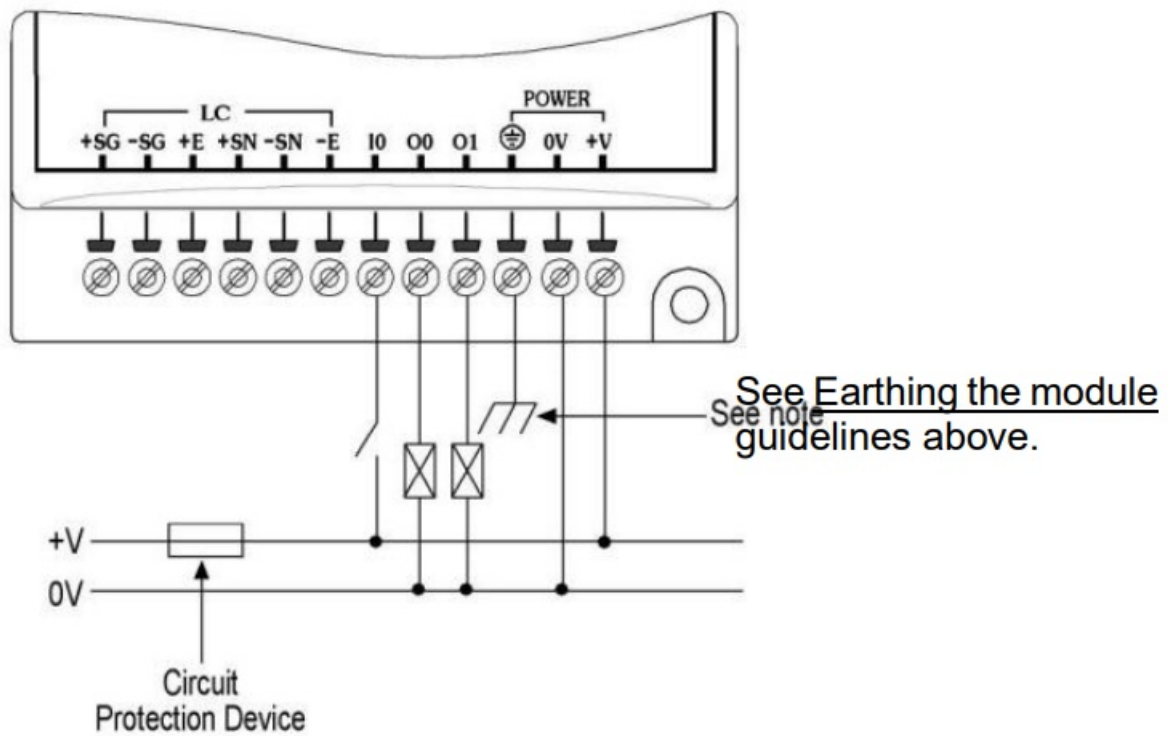
Digital I/Os

- 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).
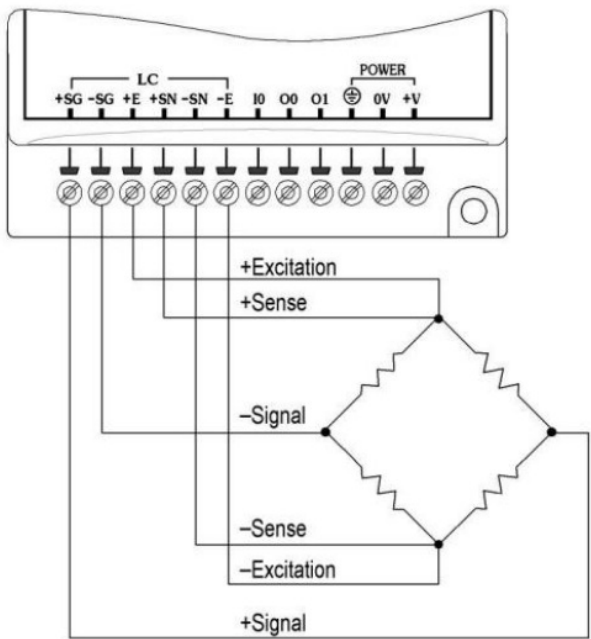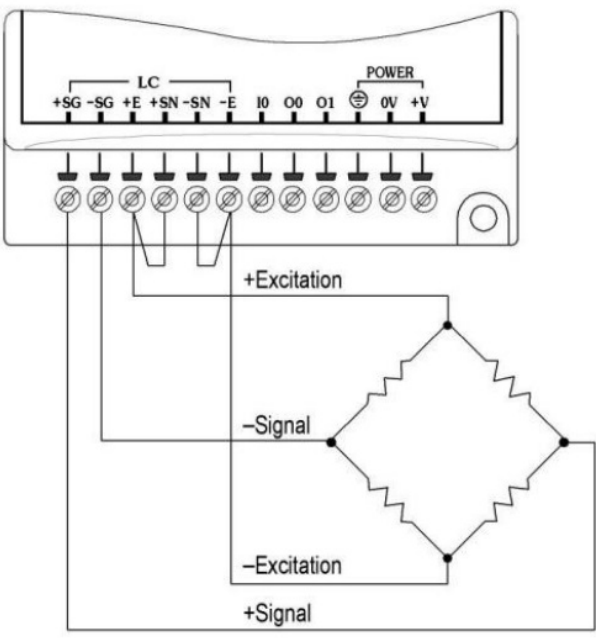- The cable shield should be connected ONLY to the Loadcell chassis. The shield at the other end of the cable should be left unconnected.
- Refer to the figures below for wiring guidelines.

6 wire Loadcell wiring

LC
+SG −SG +E +SN −SN −E   I0 O0 O1 ⏚ 0V +V

POWER

+Excitation
+Sense
−Signal
−Sense
−Excitation
+Signal

4 wire Loadcell wiring

LC
+SG −SG +E +SN −SN −E   I0 O0 O1 ⏚ 0V +V

POWER

+Excitation
−Signal
−Excitation
+Signal

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 From external power-supply

60mA	At 12V	At 24V
One 350Ω Loadcell	45mA	30mA
4 x 350Ω Loadcells	70mA	45mA
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. —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:

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:	15-2 = -32,768 = 8000 Hex	23-2 = -8,388,608 = FF80 0000 Hex
Over-Range:	215 – 1 = 32,767 = 7FFF Hex	2 – 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)
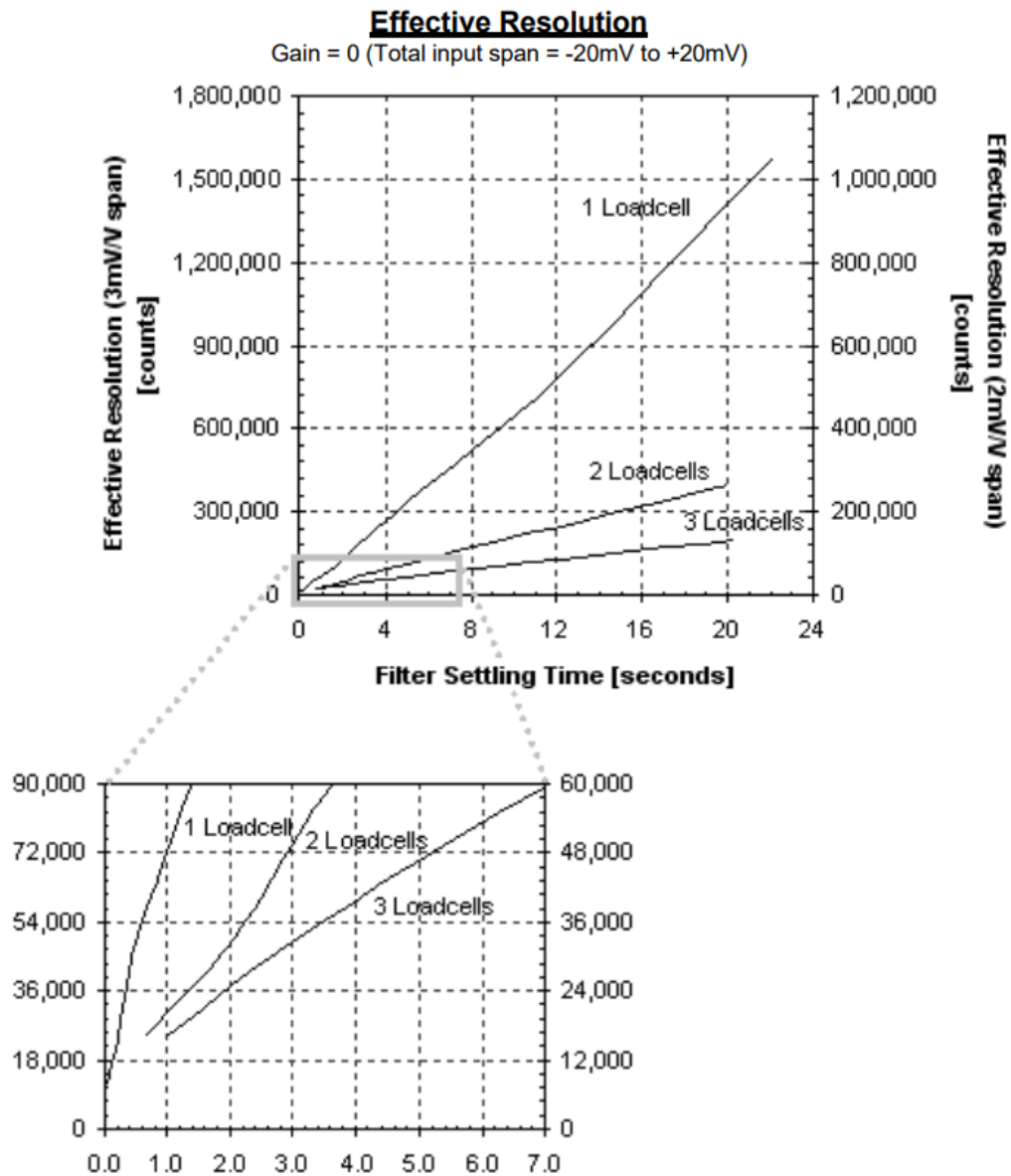
- The effective resolution depends on several electrical parameters including the gain setting, the input span that is used (usually 10mV for 2mV/V Loadcells or 15mV for 3mV/V Loadcells), the amount of uncompensated differential offset, and the applied input noise.
- The number of Loadcell inputs used 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.
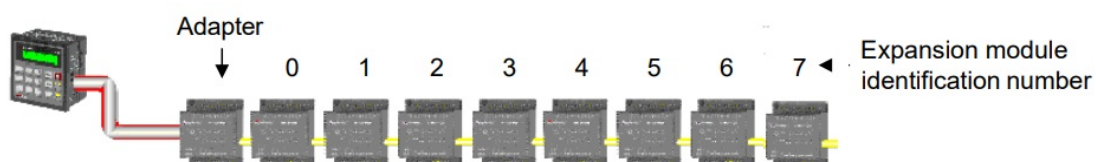
The formula below is used to assign addresses for I/O modules used in conjunction with the OPLC.
X is the number representing a specific module's location (0-7). Y is the number of the input or output on that specific module (0-15).
The number that represents the I/O's location is equal to: $32 + x \cdot 16 + y$

Examples

- Input #3, located on expansion module #2 in the system, will be addressed as I 67, $67 = 32 + 2 \cdot 16 + 3$
- 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, $149 = 32 + 7 \cdot 16 + 5$

UL Compliance
The following section is relevant to Unitronics' products that are listed with the UL.
The following models: IO-AI4-AO2, IO-AO6X, IO-ATC8, IO-DI16, IO-DI16-L, IO-DI8-RO4, IO-DI8-RO4-L, IO-DI8-TO8, IO-DI8-TO8-L, IO-RO16, IO-RO16-L, IO-RO8, IO-RO8L, IO-TO16, EX-A2X are UL listed for Hazardous Locations.
The following models: EX-D16A3-RO8, EX-D16A3-RO8L, EX-D16A3-TO16, EX-D16A3-TO16L, IO-AI1X-AO3X, IO-AI4-AO2, IO-AI4-AO2-B, IO-AI8, IO-AI8Y, IO-AO6X, IO-ATC8, IO-D16A3-RO16, IO-D16A3-RO16L, IO-D16A3-TO16, IO-D16A3-TO16L, IO-DI16, IO-DI16-L, IO-DI8-RO4, IO-DI8-RO4-L, IO-DI8-RO8, IO-DI8-RO8-L, IO-DI8-TO8, IO-DI8-TO8-L, IO-DI8ACH, IO-LC1, IO-LC3, IO-PT4, IO-PT400, IO-PT4K, IO-RO16, IO-RO16-L, IO-RO8, IO-RO8L, IO-TO16, EX-A2X, EX-RC1 are UL listed for Ordinary Location.

UL Ratings, Programmable Controllers for Use in Hazardous Locations, Class I, Division 2, Groups A, B, C and D
These Release Notes relate to all Unitronics products that bear the UL symbols used to mark products that have been approved for use in hazardous locations, Class I, Division 2, Groups A, B, C and D.

 Caution

- This equipment is suitable for use in Class I, Division 2, Groups A, B, C and D, or Non-hazardous locations only.
- Input and output wiring must be in accordance with Class I, Division 2 wiring methods and in accordance with the authority having jurisdiction.
- WARNING—Explosion Hazard—substitution of components may impair suitability for Class I, Division 2.
- WARNING – EXPLOSION HAZARD – Do not connect or disconnect equipment unless power has been switched off or the area is known to be non-hazardous.
- WARNING – Exposure to some chemicals may degrade the sealing properties of material used in Relays.
- This equipment must be installed using wiring methods as required for Class I, Division 2 as per the NEC and/or CEC.

Relay Output Resistance Ratings
The products listed below contain relay outputs:

Input/Output expansion modules, Models: IO-DI8-RO4, IO-DI8-RO4-L, IO-RO8, IO-RO8L

- When these specific products are used in hazardous locations, they are rated at 3A res, when these specific products are used in non-hazardous environmental conditions, they are rated at 5A res, as given in the product's specifications.
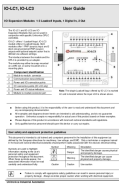
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Documents / Resources

	UNITRONICS IO-LC1 I-O Expansion Modules [pdf] User Guide IO-LC1, IO-LC3, IO-LC1 I-O Expansion Modules, IO-LC1, I-O Expansion Modules, Expansion Modules, Modules