

# M91™

An affordable All-in-One: a smart PLC with a textual HMI and keyboard, plus an onboard I/O configuration; expand up to 150 I/Os

## Features:

### HMI

- Up to 80 user-designed screens
- Multilingual: supports over 15 languages and 20 graphic symbols
- Scroll between pre-programmed recipes/menus
- Memory and communication monitoring via HMI - No PC needed

### PLC

- Shaft-encoder inputs and PWM outputs
- Direct temperature inputs
- Auto-tune PID, up to 4 loops
- Date & Time-based control
- Database
- Print utilities
- Full source upload

### Communication

- SMS messaging via GSM
- Remote access utilities
- PC access via MODBUS or OPC server
- Supports MODBUS protocol
- CANBus (in C models only)
- User-defined ASCII strings, enable communication with external devices
- RS232/RS485 built-in port



M91

<b>M91</b>										
Article Number	M91-2-R1	M91-2-R2C	M91-2-R6C	M91-2-R34	M91-2-T1	M91-2-T38	M91-2-T2C	M91-2-UN2	M91-2-UA2	M91-2-RA22
	10 Digital 1 Analog Inputs 6 Relay Outputs	10 Digital 2 Analog Inputs 6 Relay Outputs	6 Digital 6 Analog Inputs 6 Relay Outputs	20 Digital 2 D/A <sup>1</sup> Inputs 12 Relay Outputs	12 Digital Inputs 12 Transistor Outputs	22 Digital Inputs 16 Transistor Outputs	10 Digital 2 D/A <sup>1</sup> Inputs 12 Transistor Outputs	10 Digital 2 D/A/PT100/TC <sup>1</sup> Inputs 12 Transistor Outputs	10 Digital 2 D/A/TC <sup>1</sup> Inputs 10 Transistor 2 Analog Outputs	8 Digital, 2 D/A 2 PT100/TC/ Digital <sup>1</sup> Inputs 8 Relay 2 Analog Outputs
<b>Inputs</b>										
Digital pnp/npn	10	10	6	22	12	22	12	12	12	12
HSC/Shaft-Encoder/ Max. Freq. Measurer <sup>2</sup>	3 10kHz 16-bit	3 10kHz 16-bit	1 10kHz 16-bit	3 30kHz <sup>3</sup> 16-bit	2 10kHz 16-bit	2 30kHz <sup>3</sup> 16-bit	3 10kHz 16-bit	2 10kHz 16-bit	1 30kHz <sup>3</sup> 16-bit	1 30kHz <sup>3</sup> 16-bit
Analog	1 10-bit 0-10V, 0-20mA 4-20mA	2 10-bit 0-10V, 0-20mA 4-20mA	6 10-bit 2 0-10V 0-20mA, 4-20mA and 4 0-20mA 4-20mA	2 10-bit 0-10V, 0-20mA 4-20mA	None	None	2 10-bit 0-10V, 0-20mA 4-20mA	2 14-bit 0-10V, 0-20mA 4-20mA	2 14-bit 0-10V, 0-20mA 4-20mA	2 14-bit 0-10V, 0-20mA 4-20mA
Temperature Measurement	None	None	None	None	None	None	None	2 PT100/TC or 2 TC	2 TC or 2 TC	2 PT100/TC and 2 PT100/TC
<b>Outputs</b>										
Digital	6 relay	6 relay	6 relay	12 relay	12 pnp	16 pnp	12 pnp	12 pnp	10 pnp	8 relay
High-Speed Outputs/ PWM <sup>4</sup>	None	None	None	None	2, first 2 outputs can function as HSO, 0.5kHz maximum					None
Analog	None	None	None	None	None	None	None	None	2 12-bit: 0-10V, 4-20mA	2 12-bit: 0-10V, 4-20mA
<b>I/O Expansion</b>	I/Os may be added via expansion port									
<b>Program</b>										
Application Memory	36K (virtual) Ladder code capacity									
Memory Operands	256 coils, 256 registers, 64 timers									
Database	1024 integers, (indirect access)									
<b>Operator Panel</b>										
Type	STN LCD									
Display Size	2 lines x 16 characters									
Keys	15 keys									
<b>General</b>										
Power Supply	12/24VDC	12/24VDC	24VDC	24VDC	12/24VDC	24VDC	12/24VDC	12/24VDC	24VDC	24VDC
Battery	7 years typical at 25°C, battery back-up for all memory sections and RTC									
Clock (RTC)	Real-time clock functions (date and time)									
Environment	IP65/NEMA4X (when panel mounted)									
Standard	CE, UL Many of our products are also UL Class 1 Div 2 and GOST certified - please contact Unitronics									

<sup>1</sup> In these models certain inputs are adaptable, and can function as either digital, analog, and in certain models also as thermocouple or PT100. Using adaptable inputs reduces the amount of free digital inputs. For example, M91-2-UA2 offers 12 digital inputs. Implementing 2 TC inputs requires 4 digital inputs, leaving 8 free.

<sup>2</sup> Certain inputs can function as high-speed counters, shaft-encoder inputs, or normal digital inputs.

<sup>3</sup> This specification depends on cable length.

<sup>4</sup> Certain outputs can function as high-speed or PWM outputs.

# I/O Expansion Modules

CE/UL

Expand your system with local or remote I/O expansion modules.

Vision series support both local & remote I/O modules. M91 supports local modules only.

## Digital Modules

IO-DI8-T08	IO-DI8-R04	IO-DI8-R08	EX90-DI8-R08 <sup>3</sup>	IO-DI16
24VDC* <b>8 Digital Inputs</b> , pnp/npn, including one High-speed Counter <b>8 pnp Transistor Outputs</b>	24VDC* <b>8 Digital Inputs</b> , pnp/npn, including one High-speed Counter <b>4 Relay Outputs</b>	24VDC* <b>8 Digital Inputs</b> , pnp/npn, including one High-speed Counter <b>8 Relay Outputs</b>	24VDC <b>8 Digital Inputs</b> , pnp, including one High-speed Counter <b>8 Relay Outputs</b>	24VDC* <b>16 Digital Inputs</b> , pnp/npn, including one High-speed Counter
IO-T016	IO-R08	IO-R016	IO-DI8ACH	
24VDC <b>16 pnp Transistor Outputs</b>	24VDC* (power supply) <b>8 Relay Outputs</b>	24VDC* (power supply) <b>16 Relay Outputs</b>	110/220 VAC <b>8 AC Inputs</b>	

\*Also available as 12VDC – contact us for part number

## High-speed Remote I/O Module

EXF-RC15 <sup>2,5</sup>
24VDC <b>9 Digital Inputs</b> pnp/npn, including <b>3</b> high-speed counter, <b>4 npn Transistor Outputs</b> , may function as high-speed PWM/PTO, <b>2 relay outputs</b>

## Analog, Temperature and Weight/Strain Measurements

IO-AI4-A02	IO-PT400	IO-PT4K
24VDC (power supply) <b>4 Analog Inputs</b> 12-bit, 0-10V, 0-20mA, 4-20mA, <b>2 Analog Outputs</b> , 12-bit+sign, ± 10V, 0-20mA, 4-20mA	<b>4 PT100/NI100/NI120 Inputs</b> Range PT100: -50°C ÷ 460°C (-58°F ÷ 860°F) Range NI100: -50°C ÷ 232°C (-58°F ÷ 449°F) Range NI120: -50°C ÷ 172°C (-58°F ÷ 341°F) 12-bit	<b>4 PT1000/NI1000 Inputs</b> Range PT1000: -50°C ÷ 460°C (-58°F ÷ 860°F) Range NI1000: -50°C ÷ 232°C (-58°F ÷ 449°F) 12-bit
IO-A06X	IO-LC1 <sup>4</sup>	IO-LC3 <sup>4</sup>
24VDC (power supply) <b>6 Isolated Analog Outputs</b> 0-10V, 0-20mA, 4-20mA 12-bit	12/24VDC (Power Supply) <b>1-3 Loadcell / Strain gauge Inputs</b> Input voltage ranges: ± 20mV, ± 80mV Excitation: AC/DC <b>1 Digital pnp Input</b> <b>2 pnp Outputs</b>  Not supported by all PLCs	<b>8 Thermocouple/ Analog Inputs</b> T/C J, K, T, B, E, N, R, S, 0.1 <sup>0</sup> Resolution, 0-10V, 0-20mA, 4-20mA, 12/14-bit

## I/O Expansion Module Adapters

EX-A2X <sup>1</sup>
Local I/O module adapter. Galvanic isolation. Up to <b>8</b> modules may be connected to a single PLC <sup>1</sup> . Supports both 12/24 VDC
EX-RC1 <sup>1,5</sup>
Remote I/O module adapter, via CANbus. Connect multiple adapters to a single PLC; connect up to <b>8</b> modules per adapter. Supports both 12/24 VDC.

<sup>1</sup> Number of supported I/Os & I/O modules varies according to PLC model.

<sup>2</sup> The EXF-RC15 functions as a CANbus node in a Vision UniCAN network. The EXF-RC15 is stand-alone and does not support I/O Expansion Modules.

<sup>3</sup> The EX90 is housed in an open casing. Only one EX90 can be connected per PLC, as a single expansion module; Expansion adapter not required.

<sup>4</sup> IO-LCx models are supported by the M91 & Vision series. Not supported by the M90 series.

<sup>5</sup> Supported by Vision series. Not supported by M91 series.

## Functions as both I/O module and adapter\*

IO-D16A3-R016	IO-D16A3-T016	EX-D16A3-R08	EX-D16A3-T016
24VDC, <b>16 Digital Inputs</b> pnp/npn, including two High-speed Counters, <b>3 Analog Inputs</b> , 10-bit, 0-20mA, 4-20mA, <b>16 Relay Outputs</b>	24VDC, <b>16 Digital Inputs</b> pnp/npn, including one High-speed Counter, <b>3 Analog Inputs</b> , 10-bit, 0-20mA, 4-20mA, <b>15 pnp + 1 pnp/npn Transistor Outputs</b> including <b>1 HSO</b>	24VDC, built-in Expansion Module Adapter, <b>16 Digital Inputs</b> , pnp/npn, including two High-speed Counters, <b>3 Analog Inputs</b> 10-bit, 0-20mA, 4-20mA, <b>8 Relay Outputs</b>	24VDC, built-in Expansion Module Adapter, <b>16 Digital Inputs</b> , pnp/npn, including one High-speed Counter, <b>3 Analog Inputs</b> 10-bit, 0-20mA, 4-20mA, <b>15 pnp + 1 pnp/npn Transistor Outputs</b> including <b>1 HSO</b>

\*Functions as local adapter. Can support up to 7 I/O modules

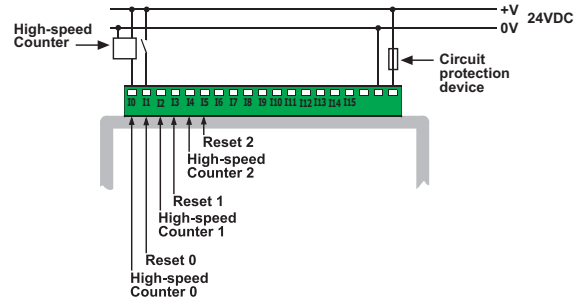
# M91-2-R34

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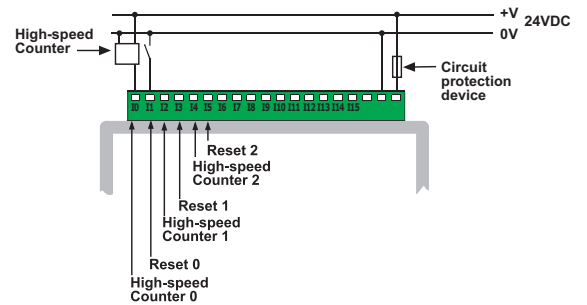
24 VDC, 22 pnp/npn digital inputs, including 2 analog inputs<sup>1</sup> and 3 high-speed counter/shaft encoder inputs, 12 relay outputs, I/O expansion port, RS232/RS485 port

<b>Power supply</b>	24VDC
Permissible range	20.4VDC to 28.8VDC with less than 10% ripple
Maximum current consumption	240mA@24VDC
<b>Digital inputs</b>	22 pnp (source) or npn (sink) inputs. See Notes 1 and 2.
Nominal input voltage	24VDC. See Note 3.
Input voltages for pnp (source):	0-5VDC for Logic '0' 17-28.8VDC for Logic '1'
Input voltages for npn (sink):	17-28.8VDC < 1mA for Logic '0' 0-5VDC > 3mA for Logic '1'
Input current	3.7mA@24VDC
Input impedance	6.5KΩ
Response time (except high-speed inputs)	10mS typical
Galvanic isolation	None
Input cable length	Up to 100 meters, unshielded
<b>High-speed counter</b>	Specifications below apply when inputs are wired for use as a high-speed counter input/shaft encoder. See Notes 4 and 5.
Resolution	16-bit
Input freq.	10kHz max.
Minimum pulse	40µs

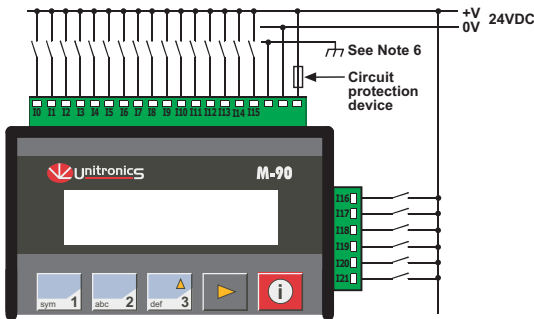
## pnp (source) high-speed counter



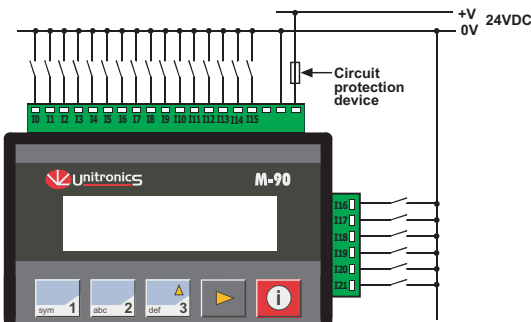
## npn (sink) high-speed counter



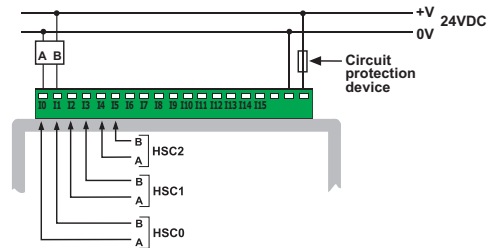
## Power supply, pnp (source) inputs



## npn (sink) inputs



## Shaft encoder



### Notes:

- The total number of inputs is 22. All of these may be used as normal digital inputs. Via jumper settings and wiring, certain of these inputs may be adapted to analog inputs.
- All 22 inputs can be set to pnp (source) or npn (sink) via a single jumper and appropriate wiring.
- nnp (sink) inputs use voltage supplied from the controller's power supply.
- Inputs #0, #2 and #4 can each function as either high-speed counter or as part of a shaft encoder. In each case, high-speed input specifications apply. When used as a normal digital input, normal input specifications apply.
- Inputs #1, #3 and #5 can each function as either counter reset, or as a normal digital input; in either case, specifications are those of a normal digital input. These inputs may also be used as part of a shaft encoder. In this case, high-speed input specifications apply.
- To avoid electromagnetic interference, mount the controller in a metal panel/cabinet and earth the power supply. Earth the power supply signal to the metal using a wire whose length does not exceed 10cm. If your conditions do not permit this, do not earth the power supply.

### Warnings

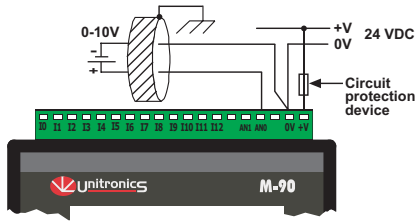
- Unused pins should not be connected. Ignoring this directive may damage the controller.
- Improper use of this product may severely damage the controller.
- Refer to the controller's User Guide regarding wiring considerations.
- Before using this product, it is the responsibility of the user to read the product's User Guide and all accompanying documentation.

Analog Inputs	Two 10-bit, multi-range inputs: 0-10V, 0-20mA, 4-20mA See Note 1 on page 1
Conversion method	Successive approximation
Input impedance	>150K $\Omega$ for voltage 243 $\Omega$ for current
Galvanic isolation	None
Resolution (except 4-20mA)	10-bit (1024 units)
Resolution at 4-20mA	204 to 1023 (820 units)
Conversion time	Synchronized to scan time
Absolute max. rating	$\pm 15V/30mA$
Full scale error	$\pm 2$ LSB
Linearity error	$\pm 2$ LSB
Status indication	Yes, See Note

Note:

The analog value can also indicate when the input is functioning out of range.  
If an analog input deviates above the permissible range, its value will be 1024.

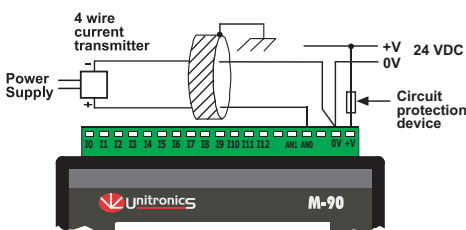
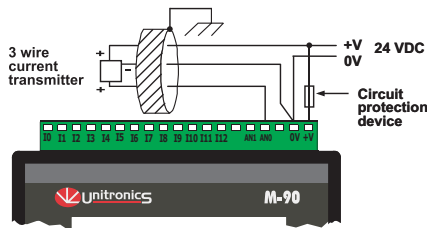
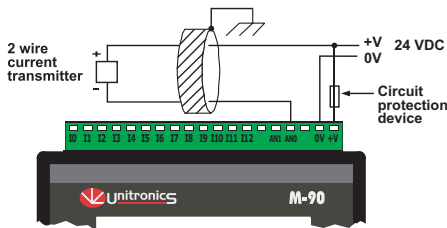
### Voltage connection



Notes:

- Shields should be connected at the signals' source.
- The 0V signal of the analog input must be connected to the controller's 0V.

### Current connections



Notes:

- Shields should be connected at the signals' source.
- The 0V signal of the analog input must be connected to the controller's 0V.

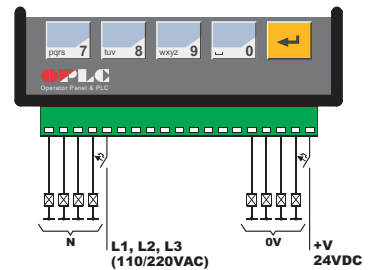
Relay outputs	12 relay (in 3 groups) See Note
Output type	SPST-NO (Form A)
Type of relay	Tyco PCN-124D3MHZ or compatible
Isolation	by relay
Output current (resistive load)	3A max per output 8A max total for common
Rate voltage	250VAC / 30VDC
Minimum load	1mA@5VDC
Life expectancy	100k operations at maximum load
Response time	10mS (typical)
Contact protection	External precautions required (see below)

Note:

Outputs #0, #1, #2 and #3 share a common signal.  
Outputs #4, #5, #6 and #7 share a common signal.  
Outputs #8, #9, #10 and #11 share a common signal.

### Relay Outputs

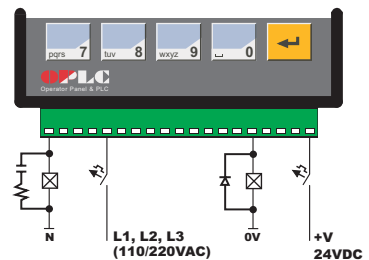
- Each Output can be wired separately to either AC or DC as shown below.
- The 0V signal of the relay outputs is isolated from the controller's 0V signal.



### Increasing Contact Life Span

To increase the life span of the relay output contacts and protect the device from potential damage by reverse EMF, connect:

- a clamping diode in parallel to each inductive DC load.
- an RC snubber circuit in parallel with each inductive AC load.



<b>Display</b>	STN, LCD display
Illumination	LED yellow-green backlight
Display size	2 lines, 16 characters long
Character size	5 x 8 matrix, 2.95 x 5.55mm

<b>Keypad</b>	Sealed membrane
Number of keys	15

<b>PLC program</b>	
Ladder Code Memory (virtual)	36K
Memory Bits (coils)	256
Memory Integers (Registers)	256
Timers	64
Execution time	12µsec. for bit operations
Database	1024 integers (indirect access)
HMI displays	80 user-designed displays
HMI variables	64 HMI variables are available to conditionally display and modify text, numbers, dates, times & timer values. The user can also create a list of up to 120 variable text displays, totaling up to 2K.

<b>RS232/RS485 serial port</b>	Used for: <ul style="list-style-type: none"> <li>● Application Download/Upload</li> <li>● Application Testing (Debug)</li> <li>● Connect to GSM or standard telephone modem: <ul style="list-style-type: none"> <li>- Send/receive SMS messages</li> <li>- Remote access programming</li> </ul> </li> <li>● RS485 Networking</li> </ul>
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<b>RS232 (see note)</b>	1 port
Galvanic isolation	None
Voltage limits	±20V

<b>RS485 (see note)</b>	1 port
Input voltage	-7 to +12V differential max.
Cable type	Shielded twisted pair, in compliance with EIA RS485
Galvanic isolation	None
Baud rate	110 – 57600 bps
Nodes	Up to 32

Note:  
RS232/RS485 is determined by jumper settings and wiring, as described in the document "M91 RS485 Port Settings" packaged with the controller.

<b>I/O expansion port</b>	Up to 64 additional I/Os, including digital & analog I/Os, RTD & more.
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<b>Miscellaneous</b>	
Clock (RTC)	Real-time clock functions (Date and Time).
Battery back-up	7 years typical battery back-up for RTC and system data.
Weight	310g (10.9 oz.)
Operational 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)
Mounting method	DIN-rail mounted (IP20/NEMA1) Panel mounted (IP65/NEMA4X)

# M 91-2-R34

## Jumper Settings

The tables below show how to set a specific jumper to change the functionality of the controller. To open the controller and access the jumpers, refer to the directions at the end of these specifications.

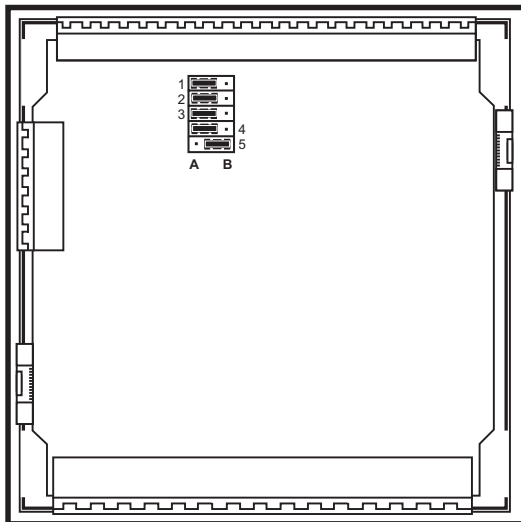
**Important:**

Incompatible jumper settings and wiring connections may severely damage the controller.

	Jumper #	NPN	PNP*
Digital Inputs	JP3	A	B

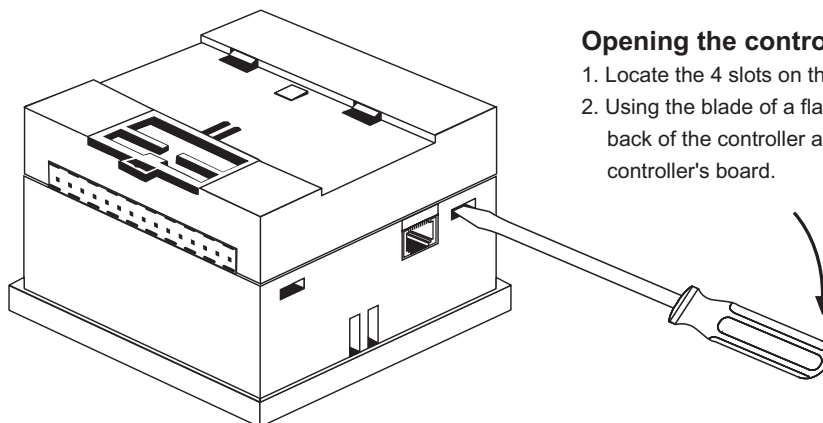
	Jumper #	Voltage	Current	Digital*
Analog 1 / I14	JP1	A	A	B
	JP4	A	B	B
Analog 0 / I15	JP2	A	A	B
	JP5	A	B	B

\*Default factory setting



**In this figure, the jumper settings will cause the controller to function as follows:**

- Digital inputs: npn, 24VDC inputs
- Analog input 1: Voltage input
- Analog input 0: Current input



**Opening the controller enclosure**

1. Locate the 4 slots on the sides of the enclosure
2. Using the blade of a flat-bladed screwdriver, gently pry off the back of the controller as shown in the figure below, exposing the controller's board.

Unitronics reserves the right to revise this publication from time to time and to amend its contents and related hardware and software at any time.

Technical updates (if any) may be included in subsequent editions (if any).

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