

# 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<br>1 Analog<br>Inputs<br>6 Relay<br>Outputs  | 10 Digital<br>2 Analog<br>Inputs<br>6 Relay<br>Outputs | 6 Digital<br>6 Analog<br>Inputs<br>6 Relay<br>Outputs           | 20 Digital<br>2 D/A <sup>1</sup> Inputs<br>12 Relay<br>Outputs | 12 Digital<br>Inputs<br>12 Transistor<br>Outputs       | 22 Digital Inputs<br>16 Transistor<br>Outputs | 10 Digital<br>2 D/A <sup>1</sup> Inputs<br>12 Transistor<br>Outputs | 10 Digital<br>2 D/A/PT100/TC <sup>1</sup><br>Inputs<br>12 Transistor<br>Outputs | 10 Digital<br>2 D/A/TC <sup>1</sup> Inputs<br>10 Transistor<br>2 Analog Outputs | 8 Digital, 2 D/A<br>2 PT100/TC/<br>Digital <sup>1</sup> Inputs<br>8 Relay<br>2 Analog Outputs |
| <b>Inputs</b>  |   |  |   |  |  |   |   |   |   |   |
| Digital pnp/npn  | 10  | 10   | 6   | 22   | 12   | 22  | 12  | 12  | 12  | 12  |
| HSC/Shaft-Encoder/<br>Max. Freq. Measurer <sup>2</sup> | 3 10kHz<br>16-bit   | 3 10kHz<br>16-bit                                      | 1 10kHz<br>16-bit   | 3 30kHz <sup>3</sup><br>16-bit                                 | 2 10kHz<br>16-bit                                      | 2 30kHz <sup>3</sup><br>16-bit                | 3 10kHz<br>16-bit   | 2 10kHz<br>16-bit   | 1 30kHz <sup>3</sup><br>16-bit  | 1 30kHz <sup>3</sup><br>16-bit  |
| Analog   | 1 10-bit<br>0-10V,<br>0-20mA<br>4-20mA  | 2 10-bit<br>0-10V,<br>0-20mA<br>4-20mA                 | 6 10-bit<br>2 0-10V<br>0-20mA, 4-20mA<br>and 4 0-20mA<br>4-20mA | 2 10-bit<br>0-10V,<br>0-20mA<br>4-20mA                         | None   | None  | 2 10-bit<br>0-10V,<br>0-20mA<br>4-20mA                              | 2 14-bit<br>0-10V,<br>0-20mA<br>4-20mA  | 2 14-bit<br>0-10V,<br>0-20mA<br>4-20mA  | 2 14-bit<br>0-10V,<br>0-20mA<br>4-20mA  |
| Temperature<br>Measurement                             | None  | None   | None  | None   | None   | None  | None  | 2 PT100/TC<br>or<br>2 TC  | 2 TC<br>or<br>2 TC  | 2 PT100/TC<br>and<br>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/<br>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:<br>0-10V, 4-20mA  | 2 12-bit:<br>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<br>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*<br><b>8 Digital Inputs</b> ,<br>pnp/npn, including one<br>High-speed Counter<br><b>8 pnp Transistor Outputs</b> | 24VDC*<br><b>8 Digital Inputs</b> ,<br>pnp/npn, including one<br>High-speed Counter<br><b>4 Relay Outputs</b> | 24VDC*<br><b>8 Digital Inputs</b> ,<br>pnp/npn, including one<br>High-speed Counter<br><b>8 Relay Outputs</b> | 24VDC<br><b>8 Digital Inputs</b> ,<br>pnp, including one<br>High-speed Counter<br><b>8 Relay Outputs</b> | 24VDC*<br><b>16 Digital Inputs</b> ,<br>pnp/npn,<br>including one<br>High-speed Counter |
| IO-T016  | IO-R08  | IO-R016   | IO-DI8ACH  |   |
| 24VDC<br><b>16 pnp Transistor Outputs</b>  | 24VDC*<br>(power supply)<br><b>8 Relay Outputs</b>  | 24VDC*<br>(power supply)<br><b>16 Relay Outputs</b>   | 110/220 VAC<br><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<br><b>9 Digital Inputs</b> pnp/npn,<br>including <b>3</b> high-speed counter,<br><b>4 npn Transistor Outputs</b> ,<br>may function as high-speed<br>PWM/PTO,<br><b>2 relay outputs</b> |

## Analog, Temperature and Weight/Strain Measurements

| IO-AI4-A02  | IO-PT400  | IO-PT4K   |
|---|---|---|
| 24VDC (power supply)<br><b>4 Analog Inputs</b><br>12-bit, 0-10V, 0-20mA,<br>4-20mA,<br><b>2 Analog Outputs</b> ,<br>12-bit+sign, ± 10V,<br>0-20mA, 4-20mA | <b>4 PT100/NI100/NI120 Inputs</b><br>Range PT100:<br>-50°C ÷ 460°C (-58°F ÷ 860°F)<br>Range NI100:<br>-50°C ÷ 232°C (-58°F ÷ 449°F)<br>Range NI120:<br>-50°C ÷ 172°C (-58°F ÷ 341°F)<br>12-bit                              | <b>4 PT1000/NI1000 Inputs</b><br>Range PT1000:<br>-50°C ÷ 460°C<br>(-58°F ÷ 860°F)<br>Range NI1000:<br>-50°C ÷ 232°C<br>(-58°F ÷ 449°F)<br>12-bit |
| IO-A06X   | IO-LC1 <sup>4</sup>   | IO-LC3 <sup>4</sup>   |
| 24VDC (power supply)<br><b>6 Isolated Analog Outputs</b><br>0-10V, 0-20mA,<br>4-20mA<br>12-bit  | 12/24VDC (Power Supply)<br><b>1-3 Loadcell / Strain gauge Inputs</b><br>Input voltage ranges:<br>± 20mV, ± 80mV<br>Excitation: AC/DC<br><b>1 Digital pnp Input</b><br><b>2 pnp Outputs</b><br><br>Not supported by all PLCs | <b>8 Thermocouple/ Analog Inputs</b><br>T/C J, K, T, B, E, N, R, S,<br>0.1 <sup>0</sup> Resolution,<br>0-10V, 0-20mA,<br>4-20mA,<br>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,<br><b>16 Digital Inputs</b><br>pnp/npn, including two<br>High-speed Counters,<br><b>3 Analog Inputs</b> ,<br>10-bit, 0-20mA, 4-20mA,<br><b>16 Relay Outputs</b> | 24VDC,<br><b>16 Digital Inputs</b> pnp/npn,<br>including one<br>High-speed Counter,<br><b>3 Analog Inputs</b> ,<br>10-bit, 0-20mA, 4-20mA,<br><b>15 pnp + 1 pnp/npn Transistor Outputs</b> including <b>1 HSO</b> | 24VDC,<br>built-in Expansion Module Adapter,<br><b>16 Digital Inputs</b> , pnp/npn,<br>including two<br>High-speed Counters,<br><b>3 Analog Inputs</b> 10-bit,<br>0-20mA, 4-20mA,<br><b>8 Relay Outputs</b> | 24VDC,<br>built-in Expansion Module Adapter,<br><b>16 Digital Inputs</b> , pnp/npn,<br>including one High-speed Counter,<br><b>3 Analog Inputs</b> 10-bit,<br>0-20mA, 4-20mA,<br><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

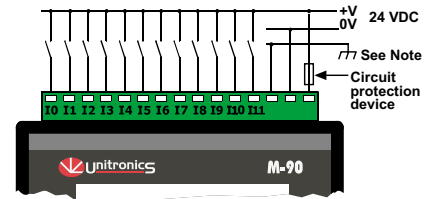
# M91-2-UA2

Art. No. 1\$, , &

24 VDC, 12 pnp/npn digital inputs, \*2 universal inputs, high-speed counter/shaft encoder input, 10 transistor outputs, 2 analog outputs, I/O expansion port, RS232/RS485 port

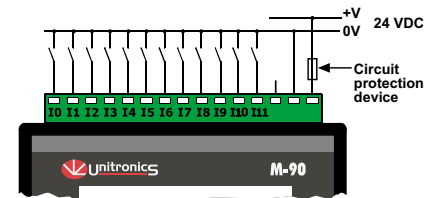
|  |  |
|--|--|
| <b>Power supply</b>                      | 24VDC  |
| Permissible range                        | 20.4VDC to 28.8VDC with less than 10% ripple   |
| Maximum current consumption              | 145mA@24VDC (pnp inputs)<br>250mA@24VDC (npn inputs)   |
| <b>Digital inputs</b>                    | 12 pnp (source) or npn (sink) inputs. See Note 1.  |
| Nominal input voltage                    | 24VDC.<br>See Note 2   |
| Input voltages for pnp (source)          | 0-5VDC for Logic '0'<br>17-28.8VDC for Logic '1'   |
| Input voltages for npn (sink)            | 17-28.8VDC/<2mA for Logic '0'<br>0-5VDC/>6mA for Logic '1'   |
| Input current                            | 8mA@24VDC  |
| Input impedance                          | 3KΩ  |
| 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 3 and 4. |
| Resolution                               | 16-bit   |
| Input freq.                              | 10kHz max.   |
| Minimum pulse                            | 40μs   |

## Power supply, pnp (source) inputs

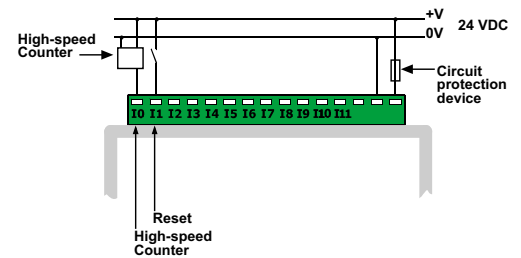


Note:  
To avoid electromagnetic interference, mount the controller in a metal panel/cabinet and earth the power supply. Earth the power supply signal to the metal using a wire whose length does not exceed 10cm. If your conditions do not permit this, do not earth the power supply.

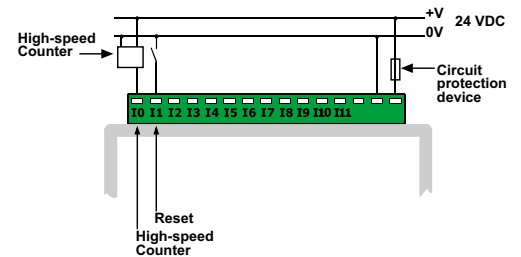
## nnp (sink) inputs



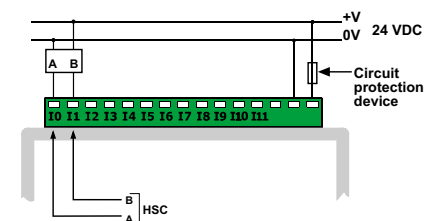
## pnp (source) high-speed counter



## nnp (sink) high-speed counter



## Shaft encoder



### Notes:

- All 12 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.
- Input #0 can 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.
- Input #1 can function as either counter reset, or as a normal digital input; in either case, specifications are those of a normal digital input.  
This input may also be used as part of a shaft encoder.  
In this case, high-speed input specifications apply.

\* Certain inputs can function as normal digital inputs, analog inputs or thermocouple inputs, in accordance with jumper settings and wiring connections.



### 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.

## Universal Inputs

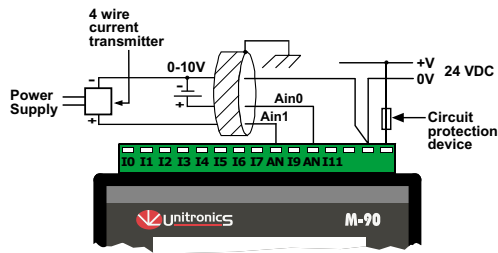
|                            |  |
|----------------------------|--|
| <b>Analog Inputs</b>       | Two 14-bit, multi-range inputs:<br>0-10V, 0-20mA, 4-20mA<br>See Note 1 |
| Conversion method          | Voltage to Frequency   |
| Input impedance            | >400K $\Omega$ for voltage<br>500 $\Omega$ for current                 |
| Isolation                  | None   |
| Resolution (except 4-20mA) | 14-bit (16384 units)   |
| Resolution at 4-20mA       | 3277 to 16383 (13557 units)  |
| Conversion time            | 100mSec minimum<br>(according to filter type)                          |
| Absolute max. rating       | $\pm 15V$ for voltage<br>$\pm 30mA$ for current                        |
| Linearity error            | 0.04% max. of full scale   |
| Error limit                | 0.4% of input value  |
| Status indication          | Yes, see Note 2  |

Notes:

- Input#8 and input#10 can be used as analog inputs, related to signal 0V, in accordance with jumper settings and wiring connections.
- The analog value can also indicate faults, as shown below:

| Value | Possible Cause  |
|-------|---|
| -1    | Input value deviates <b>slightly below</b> the input range.         |
| 16384 | Input value deviates <b>slightly above</b> the input range          |
| 32767 | Input value deviates <b>greatly above or below</b> the input range. |

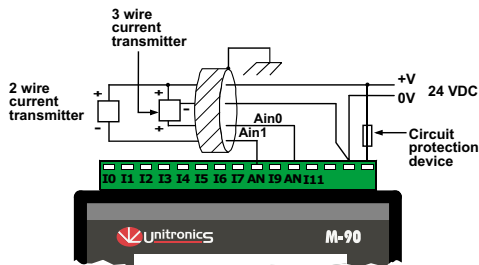
### Voltage / Current connection



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 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.

|                                  |  |
|----------------------------------|--|
| <b>Thermocouple inputs</b>       | 2 differential inputs.<br>See Note 1.  |
| Input type                       | Thermocouple   |
| Input ranges                     | As shown in the table below  |
| Isolation                        | None   |
| Conversion method                | Voltage to Frequency   |
| Resolution                       | 0.1°C / 0.1°F  |
| Conversion time                  | 100mSec minimum<br>(according to filter type)                                    |
| Input impedance                  | >10M $\Omega$  |
| Cold junction compensation       | local, automatic   |
| Cold junction compensation error | $\pm 1.5^\circ C / \pm 2.7^\circ F$ maximum                                      |
| Absolute maximum rating          | $\pm 0.6$ VDC  |
| Linearity error                  | 0.04% max. of full scale   |
| Error limit                      | 0.4% of input value  |
| Status indication                | None   |
| Warm-up time                     | $\frac{1}{2}$ hour typically,<br>$\pm 1^\circ C / \pm 1.8^\circ F$ repeatability |

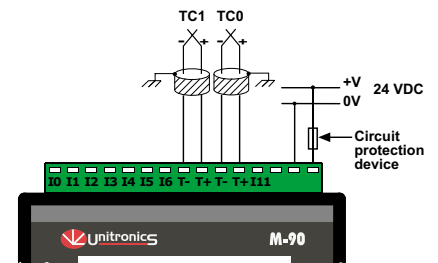
Notes:

- Thermocouple #0: use Input#10 as positive input & Input #9 as negative input.  
Thermocouple #1: use Input#8 as positive input & Input #7 as negative input.  
To use inputs as thermocouple, set the relevant jumpers and use appropriate wiring.

Table 1: input ranges

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

### Thermocouple connection



Note:

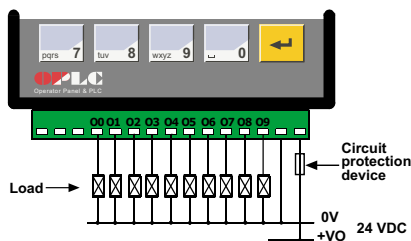
Shields should be connected at the signals' source.

|                                     |   |
|-------------------------------------|---|
| <b>Digital outputs</b>              | 10 pnp (source) outputs<br>24VDC                |
| Output type                         | P-MOSFET (open drain)                           |
| Isolation                           | None  |
| Output current                      | 0.5A max.<br>Total current: 3A max.             |
| Max. frequency for normal outputs   | 50Hz (resistive load)<br>0.5Hz (inductive load) |
| High speed output maximum frequency | 2kHz (resistive load)<br>See Note 1.            |
| Short circuit protection            | Yes   |
| Short indication                    | by software                                     |
| On voltage drop                     | 0.5VDC maximum                                  |
| <b>Power supply for outputs</b>     |   |
| Operating voltage                   | 20.4 to 28.8VDC                                 |
| Nominal operating voltage           | 24VDC   |

Note:

1. Output #0 and Output #1 may be used as high-speed outputs.

### Digital outputs connection

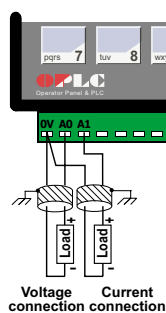


|                          |   |
|--------------------------|---|
| <b>Analog outputs</b>    | Two 12-bit analog outputs:<br>0-10V, 4-20mA, See note 1.    |
| Load impedance           | 1k $\Omega$ minimum—voltage<br>500 $\Omega$ maximum—current |
| Galvanic isolation       | None  |
| Resolution               | 12-bit (4096 units)   |
| Conversion time          | Synchronized to scan time                                   |
| Linearity error          | $\pm 0.1\%$   |
| Operational error limits | $\pm 0.2\%$   |

Note :

1. Each analog output range is defined by wiring, jumpers and within the controller's software.

### Analog outputs connection



Notes:

- a. Shields should be earthed, connected to the earth of the cabinet.
- b. The 0V signal of the analog outputs must be the same 0V used by the controller's power supply.

|                |                             |
|----------------|-----------------------------|
| <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               | 12 $\mu$ sec. 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> |
|--------------------------------|---|

|                         |   |
|-------------------------|---|
| <b>RS232</b> (see note) | 1 port  |
| Galvanic isolation      | None  |
| Voltage limits          | $\pm 20V$   |
| <b>RS485</b> (see note) | 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 96 additional I/Os, including digital & analog I/Os, RTD and more. |
|---------------------------|--|

|                         |  |
|-------------------------|--|
| <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                  | 270g. (9.82oz)   |
| 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)<br>Panel mounted (IP65/NEMA4X) |

The tables below show how to set a specific jumper to change the functionality of a specific input, or analog output. 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.

**JP2, JP3, JP6, JP8  
Input#9 and Input#10 (universal input no. 0)**

| To use as                              | JP2<br>for Input#10 | JP3<br>for Input#9 | JP6<br>for Input#10 | JP8<br>for Input#10 |
|--|---------------------|--------------------|---------------------|---------------------|
| Normal digital inputs                  | A                   | A                  | A                   | B                   |
| Thermocouple input*<br>(See Note 1)    | B                   | B                  | A                   | B                   |
| Analog input - voltage<br>(see Note 3) | B                   | A<br>See Note 2    | B                   | A                   |
| Analog input - current<br>(see Note 3) | B                   | A<br>See Note 2    | B                   | B                   |

Notes:

1. Thermocouple input is between Input#10 (T+) and Input#9 (T-).
2. When using Input#10 as analog input, Input#9 can be used as normal digital input.
3. Analog inputs are related to signal 0V.

**JP4, JP5, JP7, JP9  
Input#7 and Input#8 (universal input no. 1)**

| To use as                              | JP4<br>for Input#8 | JP5<br>for Input#7 | JP7<br>for Input#8 | JP9<br>for Input#8 |
|--|--------------------|--------------------|--------------------|--------------------|
| Normal digital inputs                  | A                  | A                  | A                  | B                  |
| Thermocouple input*<br>(See Note 1)    | B                  | B                  | A                  | B                  |
| Analog input - voltage<br>(see Note 3) | B                  | A<br>See Note 2    | B                  | A                  |
| Analog input - current<br>(see Note 3) | B                  | A<br>See Note 2    | B                  | B                  |

Notes:

1. Thermocouple input is between Input#8 (T+) and Input#7 (T-).
2. When using Input#8 as analog input, Input#7 can be used as normal digital input.
3. Analog inputs are related to signal 0V.

**JP10  
Input type (for all digital inputs) -  
see Note 1**

| To use as     | JP10 |
|---------------|------|
| nnp (sink)    | A    |
| pnp (source)* | B    |

Note:

1. Inputs# 0-6, input #11 and #7-10 when these are set as normal digital inputs.

\*Default factory setting

# M91-2-UA2

## Jumpers Settings

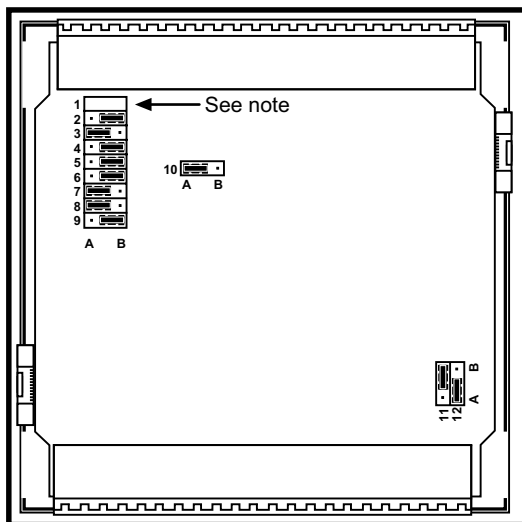
### JP12 Analog output #0

| To use as | JP12 |
|-----------|------|
| Voltage*  | A    |
| Current   | B    |

### JP11 Analog output #1

| To use as | JP11 |
|-----------|------|
| Voltage*  | A    |
| Current   | B    |

\*Default factory setting



### In this figure, the jumper settings will cause the inputs and the analog outputs to function as follows:

- Universal Input #0 (Input #10): Voltage input, related to 0V
- Universal Input #1 (Input #7 and Input #8): Termocouple input
- Input#9: Normal npn, 24VDC digital input
- Input#0 to Input #6 and input #11: npn, 24VDC digital inputs.

(Note that these inputs can only function as normal digital inputs.)

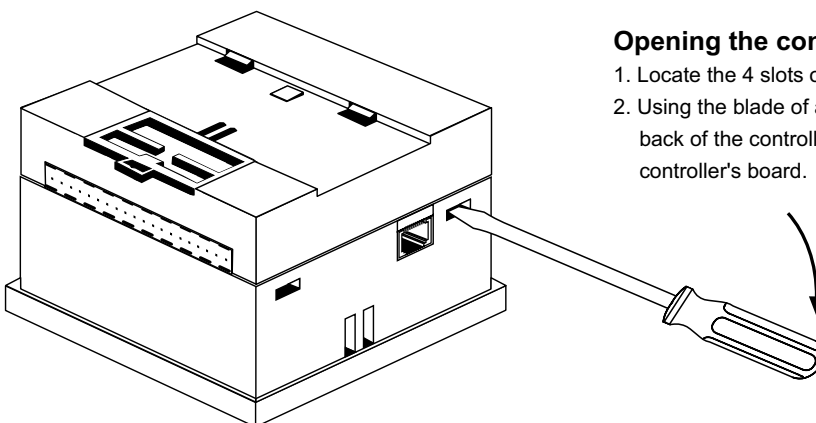
Analog output #0: Voltage output

Analog output #1: Current output

Note:  
Jumper #1 is reserved - do not use.

### 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.



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