Power supply

**Permissible range**: 10.2VDC to 28.8VDC with less than 10% ripple

**Maximum current consumption**:
- 180mA@24VDC (pnp inputs)
- 250mA@24VDC (npp inputs)
- 220mA@12VDC (pnp inputs)
- 330mA@12VDC (npp inputs)

**Digital inputs**: 10 pnp (source) or npp (sink) inputs. See Note 1.

**Nominal input voltage**: 12VDC or 24VDC. See Notes 2 and 3.

**Input voltages for pnp (source)**:
- **For 12VDC**: 0-3VDC for Logic ‘0’, 8-15.6VDC for Logic ‘1’
- **For 24VDC**: 0-5VDC for Logic ‘0’, 17-28.8VDC for Logic ‘1’

**Input voltages for npp (sink)**:
- **For 12VDC**: 8-15.6VDC<1.2mA for Logic ‘0’, 0-3VDC<3mA for Logic ‘1’
- **For 24VDC**: 0-5VDC<2mA for Logic ‘0’, 17-28.8VDC<8mA for Logic ‘1’

**Input current**: 4mA@12VDC, 8mA@24VDC

**Input impedance**: 3KΩ

**Response time (except high-speed inputs)**: 10mS typical

**Galvanic isolation**: None

**Input cable length**: Up to 100 meters, unshielded

**High-speed counter**

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

Notes:
1. All 10 inputs can be set to pnp (source) or npp (sink) via a single jumper and appropriate wiring.
2. All 10 inputs can function in 12 VDC or 24 VDC, set via a single jumper and appropriate wiring.
3. npp (sink) inputs use voltage supplied from the controller’s power supply.
4. 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.
5. 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.

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**Warning**:
- 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 accompanying documentation.
### Analog Input
- 10-bit, multi-range input: 0-10V, 0-20mA, 4-20mA
- Conversion method: Successive approximation
- Input impedance: >100KΩ for voltage, 500Ω 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: ±15V
- Full scale error: ±2 LSB
- Linearity error: ±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

![Voltage connection diagram](image)

**Notes:**
a. Shields should be connected at the signals’ source.
b. The 0V signal of the analog input must be connected to the controller’s 0V.

### Current connections

![Current connections diagram](image)

**Notes:**
a. Shields should be connected at the signals’ source.
b. The 0V signal of the analog input must be connected to the controller’s 0V.

### Digital outputs
- 6 relay outputs, 230VAC/12VDC
- Output type: SPST-NO relay
- Type of relay: Takamisawa (Fujitsu) JY-12H-K, or NAIS (Matsushita) JQ1A-12V or OMRON G6B-1114P-12VDC
- Isolation: by relay
- Output current: 5A max. (resistive load)
- Max. frequency: 10Hz
- Contact protection: External precautions required

### Relay Outputs
![Relay Outputs diagram](image)

### Display
- 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

### Keypad
- Sealed membrane
- Number of keys: 15

### PLC program
- 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.

### RS232/RS485 serial port
- Used for:
  - Application Download/Upload
  - Application Testing (Debug)
  - Connect to GSM or standard telephone modem: - Send/receive SMS messages - Remote access programming
  - RS485 Networking
- RS232 (see note)
  - 1 port
  - Galvanic isolation: None
  - Voltage limits: ±20V
- RS485 (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.

### I/O expansion port
- Up to 64 additional I/Os, including digital & analog I/Os, RTD & more.

### Miscellaneous
- 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)
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.

### JP1 Digital inputs type

<table>
<thead>
<tr>
<th>To use as</th>
<th>JP1</th>
</tr>
</thead>
<tbody>
<tr>
<td>npn (sink)</td>
<td>A</td>
</tr>
<tr>
<td>pnp (source)*</td>
<td>B</td>
</tr>
</tbody>
</table>

### JP5, JP6 Power supply voltage

<table>
<thead>
<tr>
<th>Range</th>
<th>JP5</th>
<th>JP6</th>
</tr>
</thead>
<tbody>
<tr>
<td>10.2 to 15.6VDC</td>
<td>A</td>
<td>A</td>
</tr>
<tr>
<td>15.6 to 28.8VDC*</td>
<td>B</td>
<td>B</td>
</tr>
</tbody>
</table>

### JP2 Digital inputs voltage

<table>
<thead>
<tr>
<th>To use as</th>
<th>JP2</th>
</tr>
</thead>
<tbody>
<tr>
<td>12VDC</td>
<td>A</td>
</tr>
<tr>
<td>24VDC*</td>
<td>B</td>
</tr>
</tbody>
</table>

*Default factory setting

### JP3 Analog input type

<table>
<thead>
<tr>
<th>To use as</th>
<th>JP3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Voltage input*</td>
<td>A</td>
</tr>
<tr>
<td>Current input</td>
<td>B</td>
</tr>
</tbody>
</table>

In this figure, the jumper settings will cause the controller to function as follows:
- Digital inputs: npn, 24VDC inputs
- Analog input: Voltage input
- Power supply: 24VDC

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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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