



### Main

|                           |                                                                          |
|---------------------------|--------------------------------------------------------------------------|
| Range of product          | Modicon M221                                                             |
| Product or component type | Logic controller                                                         |
| [Us] rated supply voltage | 24 V DC                                                                  |
| Discrete input number     | 8 discrete input conforming to IEC 61131-2 Type 1 including 4 fast input |
| Analogue input number     | 2 at input range: 0...10 V                                               |
| Discrete output type      | Relay normally open                                                      |
| Discrete output number    | 8 relay                                                                  |
| Discrete output voltage   | 5...250 V AC<br>5...125 V DC                                             |
| Discrete output current   | 2 A                                                                      |

### Complementary

|                                |                                                                                                                                                                                                                                                                                                                                                                                                |
|--------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Discrete I/O number            | 16                                                                                                                                                                                                                                                                                                                                                                                             |
| Number of I/O expansion module | <= 7 with <= 92 discrete output(s) for relay output                                                                                                                                                                                                                                                                                                                                            |
| Supply voltage limits          | 19.2...28.8 V                                                                                                                                                                                                                                                                                                                                                                                  |
| Inrush current                 | <= 35 A                                                                                                                                                                                                                                                                                                                                                                                        |
| Power consumption in W         | <= 22.5 W at 24 V                                                                                                                                                                                                                                                                                                                                                                              |
| Power supply output current    | 0.45 A at 24 V for expansion bus<br>0.52 A at 5 V for expansion bus                                                                                                                                                                                                                                                                                                                            |
| Discrete input logic           | Sink or source (positive/negative)                                                                                                                                                                                                                                                                                                                                                             |
| Discrete input voltage         | 24 V                                                                                                                                                                                                                                                                                                                                                                                           |
| Discrete input voltage type    | DC                                                                                                                                                                                                                                                                                                                                                                                             |
| Analogue input resolution      | 10 bits                                                                                                                                                                                                                                                                                                                                                                                        |
| LSB value                      | 10 mV                                                                                                                                                                                                                                                                                                                                                                                          |
| Conversion time                | 1 ms per channel + 1 controller cycle time for analog input                                                                                                                                                                                                                                                                                                                                    |
| Permitted overload on inputs   | +/- 15 V DC for analog input permanent<br>+/- 30 V DC for analog input with 5 min maximum                                                                                                                                                                                                                                                                                                      |
| Voltage state1 guaranteed      | >= 15 V for input                                                                                                                                                                                                                                                                                                                                                                              |
| Current state 1 guaranteed     | >= 2.5 mA for input                                                                                                                                                                                                                                                                                                                                                                            |
| Voltage state 0 guaranteed     | <= 5 V for input                                                                                                                                                                                                                                                                                                                                                                               |
| Current state 0 guaranteed     | <= 1 mA for input                                                                                                                                                                                                                                                                                                                                                                              |
| Discrete input current         | 4.5 mA for fast input<br>7 mA for input                                                                                                                                                                                                                                                                                                                                                        |
| Input impedance                | 4.9 kOhm for fast input<br>3.4 kOhm for input<br>100 kOhm for analog input                                                                                                                                                                                                                                                                                                                     |
| Response time                  | 10 ms turn-off operation for output<br>10 ms turn-on operation for output<br>5 µs turn-off operation for fast input<br>5 µs turn-on operation for fast input<br>100 µs turn-off operation for input; I8...I15 terminal<br>100 µs turn-on operation for input; I8...I15 terminal<br>35 µs turn-off operation for input; I2...I5 terminal<br>35 µs turn-on operation for input; I2...I5 terminal |
| Configurable filtering time    | 12 ms for input<br>3 ms for input<br>0 ms for input                                                                                                                                                                                                                                                                                                                                            |
| Output voltage limits          | 277 V AC<br>125 V DC                                                                                                                                                                                                                                                                                                                                                                           |
| Current per output common      | 8 A                                                                                                                                                                                                                                                                                                                                                                                            |

|                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
|-----------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Absolute accuracy error           | +/- 1 % of full scale for analog input                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| Electrical durability             | Inductive (L/R = 7 ms) DC-13, 24 V/ 7.2 W : 300000 cycles<br>Inductive (L/R = 7 ms) DC-13, 24 V/ 24 W : 100000 cycles<br>Resistive DC-12, 24 V/ 16 W : 300000 cycles<br>Resistive DC-12, 24 V / 48 W : 100000 cycles<br>Inductive AC-14, (cos phi = 0.7) 240 V/ 72 VA : 300000 cycles<br>Inductive AC-14, (cos phi = 0.7) 120 V/ 36 VA : 300000 cycles<br>Inductive AC-14, (cos phi = 0.7) 240 V/ 240 VA : 100000 cycles<br>Inductive AC-14, (cos phi = 0.7) 120 V/ 120 VA : 100000 cycles<br>Inductive AC-15, (cos phi = 0.35) 240 V / 36 VA : 300000 cycles<br>Inductive AC-15, (cos phi = 0.35) 120 V/ 18 VA : 300000 cycles<br>Inductive AC-15, (cos phi = 0.35) 240 V / 120 VA : 100000 cycles<br>Inductive AC-15, (cos phi = 0.35) 120 V/ 60 VA : 100000 cycles<br>Resistive AC-12, 240 V/ 160 VA : 300000 cycles<br>Resistive AC-12, 120 V / 80 VA : 300000 cycles<br>Resistive AC-12, 240 V/ 480 VA : 100000 cycles<br>Resistive AC-12, 120 V / 240 VA : 100000 cycles |
| Switching frequency               | 20 switching operations/minute with maximum load                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| Mechanical durability             | >= 20000000 cycles for relay output                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| Minimum load                      | 10 mA at 5 V DC for relay output                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| Reset time                        | 1 s                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| Memory capacity                   | 640 kB for system memory RAM<br>256 kB for program with 10000 instructions                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| Data backed up                    | 256 kB built-in flash memory for backup of programs                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| Data storage equipment            | 2 GB SD card optional                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| Battery type                      | BR2032 lithium non-rechargeable, battery life: 4 yr                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| Backup time                       | 1 year at 25 °C by interruption of power supply                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| Execution time for 1 KInstruction | 0.7 ms for other instruction<br>0.3 ms for event and periodic task                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| Execution time per instruction    | 0.2 µs Boolean                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| Exct time for event task          | 60 µs response time                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| Application structure             | 1 configurable freewheeling/cyclic master task<br>1 cyclic auxiliary task<br>8 interrupt tasks                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| Maximum size of object areas      | 512 %M memory bits<br>8000 %MW memory words<br>512 %KW constant words<br>255 %TM timers<br>255 %C counters                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| Realtime clock                    | With                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| Clock drift                       | <= 30 s/month at 25 °C                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| Regulation loop                   | Adjustable PID regulator up to 14 simultaneous loops                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| Control signal type               | Single phase signal at 100 kHz for fast input (HSC mode)<br>Pulse/Direction signal at 100 kHz for fast input (HSC mode)<br>A/B signal at 50 kHz for fast input (HSC mode)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| Counting input number             | 4 fast input (HSC mode) (counting frequency: 100 kHz), counting capacity: 32 bits                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| Integrated connection type        | Non isolated serial link "serial 2" with connector RJ45 and interface RS232/RS485<br>Non isolated serial link "serial 1" with connector RJ45 and interface RS485<br>USB port with connector mini B USB 2.0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| Supply                            | Serial 1 serial link supply at 5 V 200 mA                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| Transmission rate                 | 480 Mbit/s - communication protocol: USB<br>1.2...115.2 kbit/s (115.2 kbit/s by default) for bus length of 3 m - communication protocol: RS232<br>1.2...115.2 kbit/s (115.2 kbit/s by default) for bus length of 15 m - communication protocol: RS485                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| Communication port protocol       | Non isolated serial link : Modbus protocol master/slave - RTU/ASCII or SoMachine-Network<br>USB port : USB protocol - SoMachine-Network                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| Communication service             | Modbus master<br>Modbus slave                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |

|                       |                                                                                                                                                                                                                                                                                                                 |
|-----------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Local signalling      | 1 LED per channel green for I/O state<br>1 LED green for SL2<br>1 LED green for SL1<br>1 LED red for BAT<br>1 LED green for SD card access (SD)<br>1 LED red for module error (ERR)<br>1 LED green for RUN<br>1 LED green for PWR                                                                               |
| Electrical connection | Removable screw terminal block, 11 terminal(s) for outputs<br>Removable screw terminal block, 10 terminal(s) for inputs<br>Mini B USB 2.0 connector for a programming terminal<br>Connector, 4 terminal(s) for analogue inputs<br>Terminal block, 3 terminal(s) for connecting the 24 V DC power supply         |
| Cable length          | <= 30 m unshielded cable for output<br><= 10 m shielded cable for fast input<br><= 30 m unshielded cable for input                                                                                                                                                                                              |
| Insulation            | Non-insulated between analogue inputs<br>Non-insulated between analogue input and internal logic<br>500 V AC between output groups<br>500 V AC between output and internal logic<br>Non-insulated between inputs<br>500 V AC between fast input and internal logic<br>500 V AC between input and internal logic |
| Marking               | CE                                                                                                                                                                                                                                                                                                              |
| Mounting support      | Plate or panel with fixing kit<br>Top hat type TH35-7.5 rail conforming to IEC 60715<br>Top hat type TH35-15 rail conforming to IEC 60715                                                                                                                                                                       |
| Height                | 90 mm                                                                                                                                                                                                                                                                                                           |
| Depth                 | 70 mm                                                                                                                                                                                                                                                                                                           |
| Width                 | 70 mm                                                                                                                                                                                                                                                                                                           |
| Product weight        | 0.264 kg                                                                                                                                                                                                                                                                                                        |

## Environment

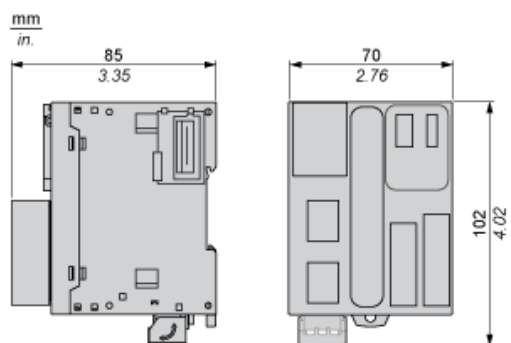
|                                                                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
|-------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Standards                                                               | EN/IEC 61131-2<br>EN/IEC 61010-2-201                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| Product certifications                                                  | CSA<br>CULus<br>IACS E10<br>RCM                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| Resistance to electrostatic discharge                                   | 4 kV on contact conforming to EN/IEC 61000-4-2<br>8 kV in air conforming to EN/IEC 61000-4-2                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| Resistance to electromagnetic fields                                    | 1 V/m ( 2 GHz...3 GHz) conforming to EN/IEC 61000-4-3<br>3 V/m ( 1.4 GHz...2 GHz) conforming to EN/IEC 61000-4-3<br>10 V/m ( 80 MHz...1 GHz) conforming to EN/IEC 61000-4-3                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| Resistance to magnetic fields                                           | 30 A/m at 50...60 Hz conforming to EN/IEC 61000-4-8                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| Resistance to fast transients                                           | 1 kV for serial link conforming to EN/IEC 61000-4-4<br>1 kV for Ethernet line conforming to EN/IEC 61000-4-4<br>1 kV for I/O conforming to EN/IEC 61000-4-4<br>2 kV for relay output conforming to EN/IEC 61000-4-4<br>2 kV for power lines conforming to EN/IEC 61000-4-4                                                                                                                                                                                                                                                                                                                                        |
| Surge withstand                                                         | 1 kV for relay output in differential mode conforming to EN/IEC 61000-4-5<br>1 kV for power lines (AC) in differential mode conforming to EN/IEC 61000-4-5<br>0.5 kV for power lines (DC) in differential mode conforming to EN/IEC 61000-4-5<br>1 kV for shielded cable in common mode conforming to EN/IEC 61000-4-5<br>1 kV for I/O in common mode conforming to EN/IEC 61000-4-5<br>2 kV for relay output in common mode conforming to EN/IEC 61000-4-5<br>2 kV for power lines (AC) in common mode conforming to EN/IEC 61000-4-5<br>1 kV for power lines (DC) in common mode conforming to EN/IEC 61000-4-5 |
| Resistance to conducted disturbances, induced by radio frequency fields | 10 Vrms (spot frequency (2, 3, 4, 6.2, 8.2, 12.6, 16.5, 18.8, 22, 25 MHz)) conforming to Marine specification (LR, ABS, DNV, GL)<br>3 Vrms (0.1...80 MHz) conforming to Marine specification (LR, ABS, DNV, GL)<br>10 Vrms (0.15...80 MHz) conforming to EN/IEC 61000-4-6                                                                                                                                                                                                                                                                                                                                         |

|                                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
|---------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Electromagnetic emission              | <p>Radiated emissions conforming to EN/IEC 55011 class A 10 m, 230 MHz...1 GHz : 47 dB<math>\mu</math>V/m QP</p> <p>Radiated emissions conforming to EN/IEC 55011 class A 10 m, 30...230 MHz : 40 dB<math>\mu</math>V/m QP</p> <p>Conducted emissions conforming to EN/IEC 55011 power lines, 1.5...30 MHz : 63 dB<math>\mu</math>V/m QP</p> <p>Conducted emissions conforming to EN/IEC 55011 power lines, 150 kHz...1.5 MHz : 79...63 dB<math>\mu</math>V/m QP</p> <p>Conducted emissions conforming to EN/IEC 55011 power lines, 10...150 kHz : 120...69 dB<math>\mu</math>V/m QP</p> <p>Conducted emissions conforming to EN/IEC 55011 power lines (AC), 0.5...300 MHz : 73 dB<math>\mu</math>V/m QP/60 dB<math>\mu</math>V/m AV</p> <p>Conducted emissions conforming to EN/IEC 55011 power lines (AC), 0.15...0.5 MHz : 79 dB<math>\mu</math>V/m QP/66 dB<math>\mu</math>V/m AV</p> |
| Immunity to microbreaks               | 10 ms                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| Ambient air temperature for operation | <p>-10...35 °C for vertical installation</p> <p>-10...55 °C for horizontal installation</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| Ambient air temperature for storage   | -25...70 °C                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| Relative humidity                     | <p>10...95 % without condensation in storage</p> <p>10...95 % without condensation in operation</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| IP degree of protection               | IP20 with protective cover in place                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| Pollution degree                      | $\leq 2$                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| Operating altitude                    | 0...2000 m                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| Storage altitude                      | 0...3000 m                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| Vibration resistance                  | <p>3 gn (vibration frequency: 8.4...150 Hz) on panel mounting</p> <p>3.5 mm (vibration frequency: 5...8.4 Hz) on panel mounting</p> <p>3 gn (vibration frequency: 8.4...150 Hz) on symmetrical rail</p> <p>3.5 mm (vibration frequency: 5...8.4 Hz) on symmetrical rail</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| Shock resistance                      | 10 gn (test wave duration:11 ms)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |

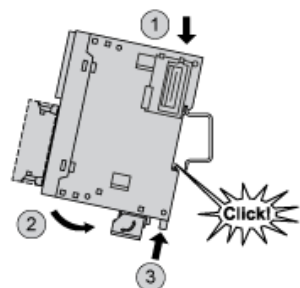
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Dimensions

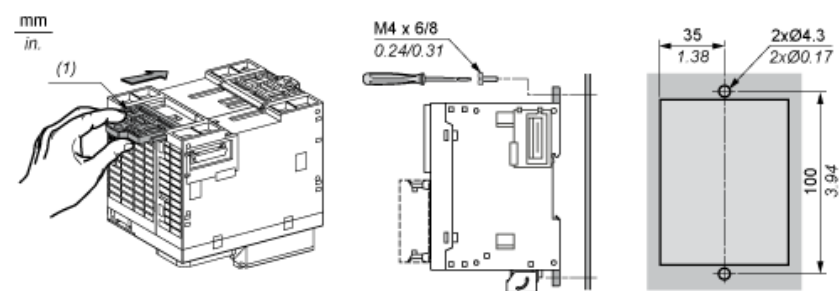
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## Mounting on a Rail



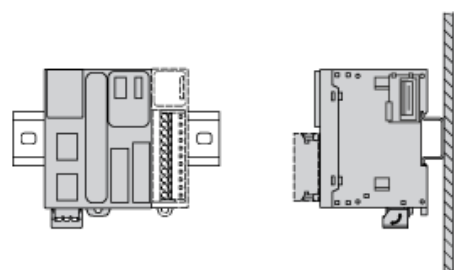
## Direct Mounting on a Panel Surface



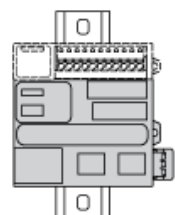
(1) Install a mounting strip

## Mounting

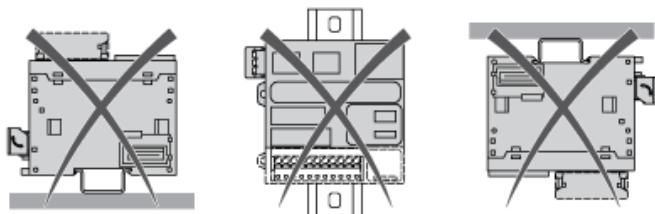
### Correct Mounting Position



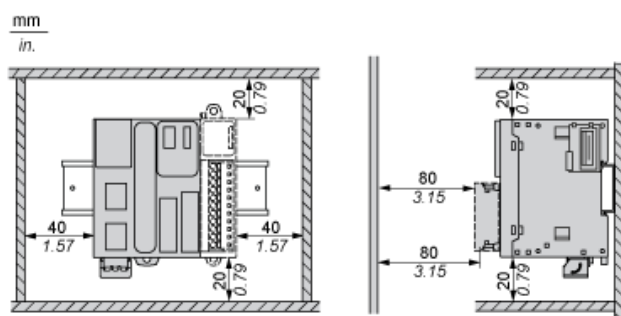
### Acceptable Mounting Position



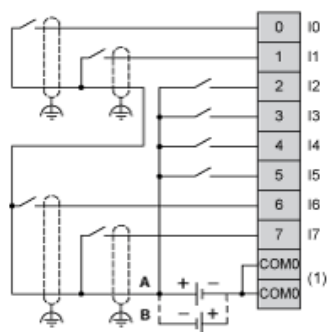
## Incorrect Mounting Position



## Clearance



## Digital Inputs

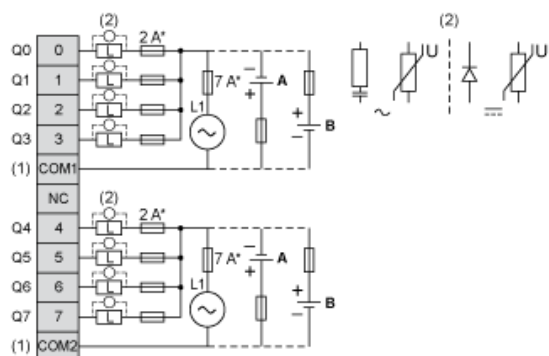


(1) The COM0 terminals are connected internally.

A : Sink wiring (positive logic).

B : Source wiring (negative logic).

## Digital Outputs



\* Type T fuse

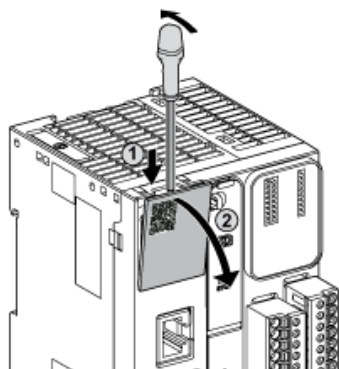
(1) The COM1 and COM2 terminals are not connected internally.

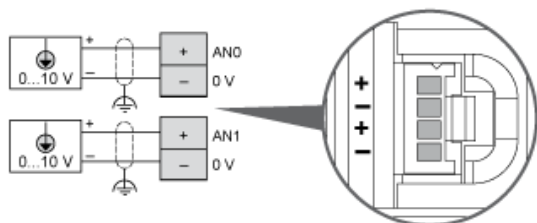
(2) To improve the life time of the contacts, and to protect from potential inductive load damage, you must connect a free wheeling diode in parallel to each inductive DC load or an RC snubber in parallel of each inductive AC load

A : Source wiring (negative logic).

B : Sink wiring (positive logic).

## Analog Inputs





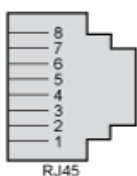
The (-) poles are connected internally.

| Pin       | Wire Color |
|-----------|------------|
| AN0 / AN1 | Red        |
| 0 V       | Black      |

## USB Mini-B Connection



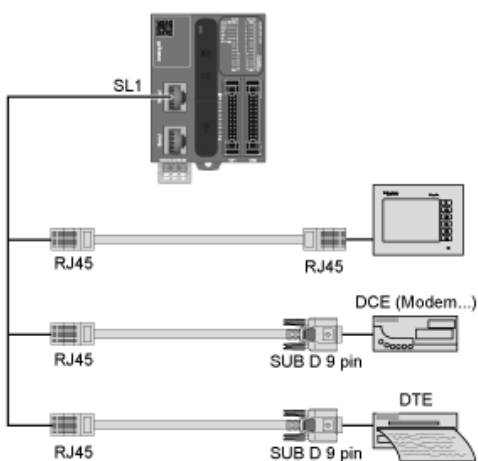
## SL1 Connection



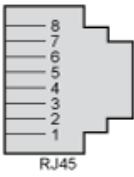
SL1

| N ° | RS 232 | RS 485  |
|-----|--------|---------|
| 1   | RxD    | N.C.    |
| 2   | TxD    | N.C.    |
| 3   | RTS    | N.C.    |
| 4   | N.C.   | D1 (A+) |
| 5   | N.C.   | D0 (B-) |
| 6   | CTS    | N.C.    |
| 7   | N.C.   | 5 Vdc   |
| 8   | Common | Common  |

N.C.: not connected



SL2 Connection



| N ° | RS 485  |
|-----|---------|
| 1   | N.C.    |
| 2   | N.C.    |
| 3   | N.C.    |
| 4   | D1 (A+) |
| 5   | D0 (B-) |
| 6   | N.C.    |
| 7   | N.C.    |
| 8   | Common  |

N.C.: not connected