# Product data sheet
## Characteristics

# TM221M16R
## logic controller, Modicon M221, 16 IO, relay



### Main

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| 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 |
| Analogue input number | 2 at 0...10 V |
| Discrete output type | Relay normally open |
| Discrete output number | 8 relay |
| Discrete output voltage | 5...125 V DC<br>5...250 V AC |
| Discrete output current | 2 A |

### Complementary

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| Discrete I/O number | 16 |
| Maximum number of I/O expansion module | 7 (local I/O-Architecture)<br>14 (remote I/O-Architecture) |
| Supply voltage limits | 20.4…28.8 V |
| Inrush current | 35 A |
| Maximum power consumption in W | 22.5 W at 24 V (with max number of I/O expansion module)<br>3.6 W at 24 V (without I/O expansion module) |
| Power supply output current | 0.52 A 5 V for expansion bus<br>0.46 A 24 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 analogue input analog input |
| Permitted overload on inputs | +/- 30 V DC for 5 min (maximum) for analog input<br>+/- 13 V DC (permanent) for analog input |
| Voltage state 1 guaranteed | >= 15 V for input |
| Voltage state 0 guaranteed | <= 5 V for input |
| Discrete input current | 7 MA for discrete input<br>5 MA for fast input |
| Input impedance | 100 kOhm for analog input<br>3.4 kOhm for input<br>4.9 kOhm for fast input |

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| Response time | 35 µs turn-off, I2...I5 terminal(s) for input<br>10 ms turn-on for output<br>10 ms turn-off for output<br>5 µs turn-on, I0, I1, I6, I7 terminal(s) for fast input<br>35 µs turn-on, other terminals terminal(s) for input<br>5 µs turn-off, I0, I1, I6, I7 terminal(s) for fast input<br>100 µs turn-off, other terminals terminal(s) for input |
| Configurable filtering time | 0 ms for input<br>3 ms for input<br>12 ms for input |
| Output voltage limits | 125 V DC<br>277 V AC |
| Maximum current per output common | 7 A |
| Absolute accuracy error | +/- 1 % of full scale for analog input |
| Electrical durability | 100000 Cycles AC-12, 120 V, 240 VA, resistive<br>100000 Cycles AC-12, 240 V, 480 VA, resistive<br>300000 Cycles AC-12, 120 V, 80 VA, resistive<br>300000 Cycles AC-12, 240 V, 160 VA, resistive<br>100000 Cycles AC-15, cos phi = 0.35, 120 V, 60 VA, inductive<br>100000 Cycles AC-15, cos phi = 0.35, 240 V, 120 VA, inductive<br>300000 Cycles AC-15, cos phi = 0.35, 120 V, 18 VA, inductive<br>300000 Cycles AC-15, cos phi = 0.35, 240 V, 36 VA, inductive<br>100000 Cycles AC-14, cos phi = 0.7, 120 V, 120 VA, inductive<br>100000 Cycles AC-14, cos phi = 0.7, 240 V, 240 VA, inductive<br>300000 Cycles AC-14, cos phi = 0.7, 120 V, 36 VA, inductive<br>300000 Cycles AC-14, cos phi = 0.7, 240 V, 72 VA, inductive<br>100000 Cycles DC-12, 24 V, 48 W, resistive<br>300000 Cycles DC-12, 24 V, 16 W, resistive<br>100000 Cycles DC-13, 24 V, 24 W, inductive (L/R = 7 ms)<br>300000 Cycles DC-13, 24 V, 7.2 W, inductive (L/R = 7 ms) |
| Switching frequency | 20 switching operations/minute with maximum load |
| Mechanical durability | 20000000 Cycles for relay output |
| Minimum load | 1 MA at 5 V DC for relay output |
| Protection type | Without protection at 5 A |
| Reset time | 1 S |
| Memory capacity | 256 kB for user application and data RAM with 10000 instructions<br>256 kB for internal variables RAM |
| Data backed up | 256 kB built-in flash memory for backup of application and data |
| Data storage equipment | 2 GB SD card (optional) |
| Battery type | BR2032 or CR2032X lithium non-rechargeable |
| Backup time | 1 year at 25 °C (by interruption of power supply) |
| Execution time for 1 KInstruction | 0.3 Ms for event and periodic task<br>0.7 Ms for other instruction |
| 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 | 255 %TM timers<br>8000 %MW memory words<br>255 %C counters<br>512 %M memory bits<br>512 %KW constant words |
| Realtime clock | With |
| Clock drift | <= 30 s/month at 25 °C |
| Regulation loop | Adjustable PID regulator up to 14 simultaneous loops |
| Counting input number | 4 fast input (HSC mode) at 100 kHz 32 bits |
| Control signal type | Pulse/Direction<br>A/B<br>Single phase |
| Integrated connection type | USB port with mini B USB 2.0 connector<br>Non isolated serial link serial 1 with RJ45 connector and RS485 interface<br>Non isolated serial link serial 2 with RJ45 connector and RS232/RS485 interface |
| Supply | (Serial 1)serial link supply: 5 V, <200 mA |
| Transmission rate | 1.2...115.2 kbit/s (115.2 kbit/s by default) for bus length of 15 m for RS485<br>1.2...115.2 kbit/s (115.2 kbit/s by default) for bus length of 3 m for RS232<br>480 Mbit/s for USB |

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| Communication port protocol | USB port: USB - SoMachine-Network<br>Non isolated serial link: Modbus master/slave - RTU/ASCII or SoMachine-Network |
| Communication service | Modbus slave<br>Modbus master |
| Local signalling | 1 LED (green) for PWR<br>1 LED (green) for RUN<br>1 LED (red) for module error (ERR)<br>1 LED (green) for SD card access (SD)<br>1 LED (red) for BAT<br>1 LED (green) for SL1<br>1 LED (green) for SL2<br>1 LED per channel (green) for I/O state |
| Electrical connection | Terminal block, 3 terminal(s) for connecting the 24 V DC power supply<br>Connector, 4 terminal(s) for analogue inputs<br>Mini B USB 2.0 connector for a programming terminal<br>Removable screw terminal block, 10 terminal(s) for inputs<br>removable screw terminal block, 11 terminal(s) for outputs |
| Maximum cable distance between devices | Shielded cable: <10 m for fast input<br>Unshielded cable: <30 m for output<br>Unshielded cable: <30 m for digital input<br>Unshielded cable: <1 m for analog input |
| Insulation | Between input and internal logic at 500 V AC<br>Between fast input and internal logic at 500 V AC<br>Non-insulated between inputs<br>Between output and internal logic at 500 V AC<br>Between output groups at 500 V AC<br>Non-insulated between analogue input and internal logic<br>Non-insulated between analogue inputs |
| Marking | CE |
| Mounting support | Top hat type TH35-15 rail conforming to IEC 60715<br>Top hat type TH35-7.5 rail conforming to IEC 60715<br>plate or panel with fixing kit |
| Height | 90 Mm |
| Depth | 70 Mm |
| Width | 70 Mm |
| Net weight | 0.264 Kg |

## Environment

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| Standards | IEC 61131-2<br>UL 508<br>CAN/CSA C22.2 No. 213<br>IACS E10<br>ANSI/ISA 12-12-01 |
| Product certifications | DNV-GL[RETURN]ABS[RETURN]LR[RETURN]cULus[RETURN]RCM[RETURN]EAC[RETURN |
| Environmental characteristic | Ordinary and hazardous location |
| Resistance to electrostatic discharge | 8 KV in air conforming to IEC 61000-4-2<br>4 KV on contact conforming to IEC 61000-4-2 |
| Resistance to electromagnetic fields | 10 V/M 80 MHz...1 GHz conforming to IEC 61000-4-3<br>3 V/M 1.4 GHz...2 GHz conforming to IEC 61000-4-3<br>1 V/M 2...2.7 GHz conforming to IEC 61000-4-3 |
| Resistance to magnetic fields | 30 A/M 50/60 Hz conforming to IEC 61000-4-8 |
| Resistance to fast transients | 2 KV (power lines) conforming to IEC 61000-4-4<br>2 KV (relay output) conforming to IEC 61000-4-4<br>1 KV (I/O) conforming to IEC 61000-4-4<br>1 KV (Ethernet line) conforming to IEC 61000-4-4<br>1 KV (serial link) conforming to IEC 61000-4-4 |
| Surge withstand | 2 KV power lines (AC) common mode conforming to IEC 61000-4-5<br>2 KV relay output common mode conforming to IEC 61000-4-5<br>1 KV I/O common mode conforming to IEC 61000-4-5<br>1 KV shielded cable common mode conforming to IEC 61000-4-5<br>0.5 KV power lines (DC) differential mode conforming to IEC 61000-4-5<br>1 KV power lines (AC) differential mode conforming to IEC 61000-4-5<br>1 KV relay output differential mode conforming to IEC 61000-4-5<br>0.5 KV power lines (DC) common mode conforming to IEC 61000-4-5 |
| Resistance to conducted disturbances | 10 V 0.15...80 MHz conforming to IEC 61000-4-6<br>3 V 0.1...80 MHz conforming to Marine specification (LR, ABS, DNV, GL)<br>10 V spot frequency (2, 3, 4, 6.2, 8.2, 12.6, 16.5, 18.8, 22, 25 MHz) conforming to Marine spec |

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| Electromagnetic emission | Conducted emissions - test level: 79 dBµV/m QP/66 dBµV/m AV ( power lines (AC)) at 0.15…0.5 M<br>Conducted emissions - test level: 73 dBµV/m QP/60 dBµV/m AV ( power lines (AC)) at 0.5…300 M<br>Conducted emissions - test level: 120...69 dBµV/m QP ( power lines) at 10…150 kHz conforming<br>Conducted emissions - test level: 63 dBµV/m QP ( power lines) at 1.5…30 MHz conforming to IEC<br>Radiated emissions - test level: 40 dBµV/m QP class A ( 10 m) at 30…230 MHz conforming to IEC<br>Conducted emissions - test level: 79...63 dBµV/m QP ( power lines) at 150…1500 kHz conforming<br>Radiated emissions - test level: 47 dBµV/m QP class A ( 10 m) at 200…1000 MHz conforming to I |
| Immunity to microbreaks | 10 Ms |
| Ambient air temperature for operation | -10…55 °C (horizontal installation)<br>-10…35 °C (vertical installation) |
| Ambient air temperature for storage | -25…70 °C |
| Relative humidity | 10…95 %, without condensation (in operation)<br>10…95 %, without condensation (in storage) |
| IP degree of protection | IP20 with protective cover in place |
| Pollution degree | <= 2 |
| Operating altitude | 0...2000 m |
| Storage altitude | 0…3000 M |
| Vibration resistance | 3.5 mm at 5…8.4 Hz on symmetrical rail<br>3.5 mm at 5…8.4 Hz on panel mounting<br>1 gn at 8.4…150 Hz on symmetrical rail<br>1 gn at 8.4…150 Hz on panel mounting |
| Shock resistance | 98 m/s² for 11 ms |

## Packing Units

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|---|---|
| Unit Type of Package 1 | PCE |
| Number of Units in Package 1 | 1 |
| Package 1 Height | 11.000 Cm |
| Package 1 Width | 10.000 Cm |
| Package 1 Length | 13.000 Cm |
| Package 1 Weight | 460.000 G |
| Unit Type of Package 2 | S04 |
| Number of Units in Package 2 | 24 |
| Package 2 Height | 30.000 Cm |
| Package 2 Width | 40.000 Cm |
| Package 2 Length | 60.000 Cm |
| Package 2 Weight | 11.500 Kg |
| Unit Type of Package 3 | P12 |
| Number of Units in Package 3 | 288 |
| Package 3 Height | 105.000 Cm |
| Package 3 Width | 80.000 Cm |
| Package 3 Length | 120.000 Cm |
| Package 3 Weight | 148.000 Kg |

## Offer Sustainability

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| Total lifecycle Carbon footprint | 97 kg CO2 eq. |
| Carbon footprint of the manufacturing phase [A1 to A3] | 8.386935828 |
| Carbon footprint of the manufacturing phase [A1 to A3] | 8 kg CO2 eq. |
| Carbon footprint of the distribution phase [A4] | 0.0567696045 |
| Carbon footprint of the distribution phase [A4] | 0.1 kg CO2 eq. |
| Carbon footprint of the installation phase [A5] | 0.0090520269 |
| Carbon footprint of the installation phase [A5] | 0 kg CO2 eq. |
| Carbon footprint of the use phase [B2, B3, B4, B6] | 88.3770994987 |
| Carbon footprint of the use phase [B2, B3, B4, B6] | 88 kg CO2 eq. |
| Mercury free | Yes |
| Sustainable packaging | No |
| Carbon footprint of the end-of-life phase [C1 to C4] | 0.2180357788 |
| Carbon footprint of the end-of-life phase [C1 to C4] | 0.2 kg CO2 eq. |
| Environmental Disclosure | Product Environmental Profile |
| Total lifecycle Carbon footprint | 97 |

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| Packaging made with recycled cardboard | Yes |
| Packaging without single use plastic | No |
| REACh Regulation | Reference contains Substances of Very High Concern above the threshold |
| EU RoHS Directive | Compliant By Exemption |
| California proposition 65 | WARNING: This product can expose you to chemicals including: Lead and lead compounds, wh |
| PVC free | Yes |
| End of life manual availability | End Of Life Information |
| Take-back | No |
| WEEE Label | The product must be disposed on European Union markets following specific waste collection a |

## Contractual warranty

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| Warranty (in months) | 18 |

Product Life Status : Commercialised