

# MAR-2000 Series

## Industrial multi-radio mobile access and applications router



- > Multiple WAN dynamic routing
- > Policy-based routing management
- > Simple web management user interface
- > IEEE 802.11a/b/g/n wireless AP/bridge/client
- > Five-band UMTS/HSPA+ and quad-band GSM/GPRS/EDGE industrial IP-modems
- > Complies with a portion of EN 50155 specifications
- > Built-in 50-channel GPS for location-based applications
- > -25 to 70°C wide temperature range (EN 50155 Class T3)



### Overview

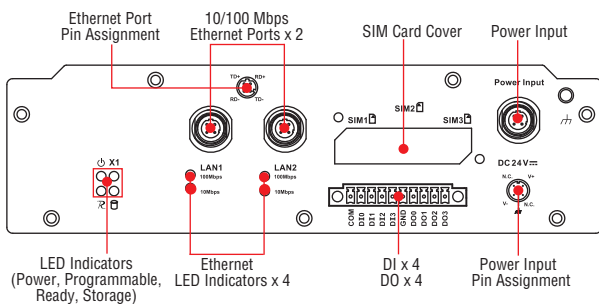
The MAR-2000 is a compact, simple, and programmable RISC-based wireless mobile router with strong wireless routing capabilities. With a built-in GPS module, HSPA+ cellular and 802.11a/b/g/n wireless capabilities, independent power switches on its cellular module connectors, and high thermal tolerance, the MAR-2000 is compliant with a portion of EN 50155 specifications. The built-in 32 MB NOR Flash ROM and 512 MB SDRAM give you enough memory for installing your own application software, the 512 MB NAND Flash can be used to provide additional data storage, and the CompactFlash socket is available for adding more memory when needed. The built-in GPS module supports geo-fencing functionality, making it ideal for managing wireless connections in the cross-WAN environments often associated with rolling stock and other vehicular applications.

When a train travels to a different region, it often encounters switches that support different wireless interfaces, such as WiFi, UMTS, and HSPA+. The MAR-2000 uses multiple-WAN support and backup functionality to ensure that your wireless connections are always available, stable, and reliable.

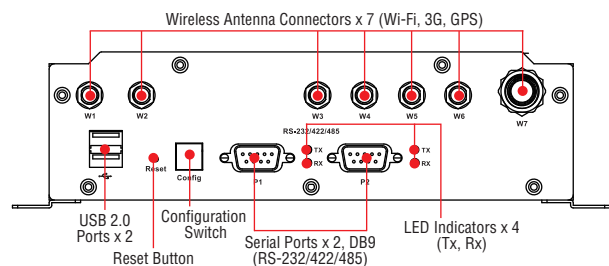
As an added bonus, the MAR-2000 series includes wide temperature models designed to operate reliably in extreme environments with temperatures ranging from -25 to 70°C.

### Appearance

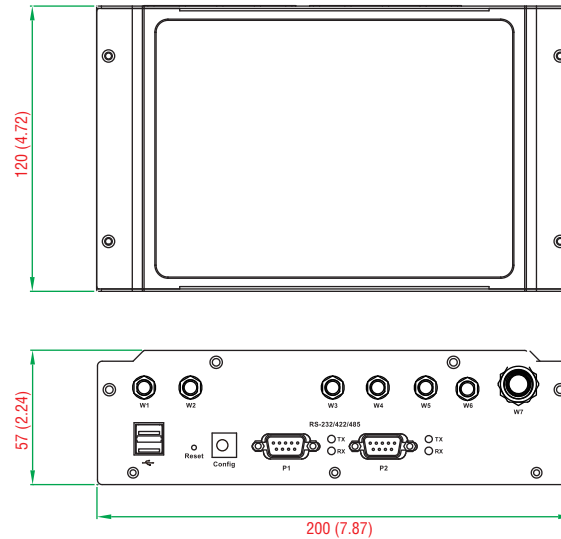
#### Front View



#### Rear View



## Dimensions



Unit: mm (inch)

## Hardware Specifications

### Computer

**CPU:** Intel XScale IXP435, 533 MHz

**USB:** USB 2.0 hosts x 2

**DRAM:** 512 MB DDR2 SDRAM onboard

#### Flash:

- 32 MB NOR Flash onboard to store OS
- 512 MB NAND Flash, up to 1 GB for OS file system, caching storage, and data logger

**OS (pre-installed):** Linux 3.8.13

### Storage

**Storage Expansion:** CompactFlash (Type I/II) socket, up to 8 GB

### Ethernet Interface

**LAN:** 2 auto-sensing 10/100 Mbps ports (M12)

**Magnetic Isolation Protection:** 1.5 kV built in

### GPS Module (U-Blox LEA-6S)

#### Receiver Types:

- 50-channel U-blox 6 engine
- GPS L1 C/A code
- SBAS: WAAS, EGNOS, MSAS, GAGAN

#### Acquisition:

- Cold starts: 28 s
- Warm starts: 28 s
- Aided starts: 1 s
- Hot starts: 1 s

#### Sensitivity:

- Tracking: -160 dBm
- Reacquisition: -160 dBm
- Cold starts: -147 dBm

#### Timing Accuracy:

- RMS: 30 ns
- 99%: < 60 ns
- Granularity: 21 ns

#### Accuracy:

- Position: 2.5 m CEP
- SBAS: 2.0 m CEP

**Protocols:** NMEA, UBX binary, 5 Hz max. update rate (ROM version)

**Time Pulse:** 0.25 Hz to 1 kHz

**Velocity Accuracy:** 0.1 m/s

**Heading Accuracy:** 0.5 degrees

**A-GPS:** Supports AssistNow Online and AssistNow Offline, OMA SUPL compliant

**Operational Limits:** Velocity: 500 m/s (972 knots)

**Connector Type:** TNC

### WLAN Module (Atheros AR9220)

**WAPN001:** IEEE 802.11a/b/g/n wireless LAN module with TNC antenna connector

**Standards:** IEEE 802.11a/b/g/n for wireless LAN

**Connector Type:** QMA connectors (female type) x 2

**Mode:** Client/AP

### Cellular Module (Cinterion PH8)

**Frequency Bands:** GSM/GPRS/EDGE/UMTS/HSPA+

#### Band Options:

- Five-band UMTS (WCDMA/FDD)
- 800/850/1900 AWS and 2100 MHz
- Quad-band GSM: 850/900/1800/1900 MHz

#### HSDPA/HSUPA Data Rates:

DL: 3.6/7.2/14.4 Mbps; UL: 2.0/5.76 Mbps

#### UMTS Data Rates:

DL: max 384 kbps; UL: max 384 kbps

#### EDGE Class 12:

DL: max 237 kbps; UL: max 237 kbps

#### GPRS Class 12:

DL: max 85.6 kbps; UL: max 85.6 kbps

**Connector Type:** QMA connector (female type)

### Serial Interface

**Serial Standards:** 2 RS-232/422/485 ports, software-selectable (DB9)

**Console Port:** RS-232 (TxD, RxD, GND), 4-pin pin header output (115200, n, 8, 1)

### Serial Communication Parameters

**Data Bits:** 5, 6, 7, 8

**Stop Bits:** 1, 1.5, 2

**Parity:** None, Even, Odd, Space, Mark

**Flow Control:** RTS/CTS, XON/XOFF, ADCC® (automatic data direction control) for RS-485

**Baudrate:** 50 bps to 921.6 kbps (supports non-standard baudrates; see user's manual for details)

### Serial Signals

**RS-232:** TxD, RxD, DTR, DSR, RTS, CTS, DCD, GND

**RS-422:** TxD+, TxD-, RxD+, RxD-, GND

**RS-485-4w:** TxD+, TxD-, RxD+, RxD-, GND

**RS-485-2w:** Data+, Data-, GND

## Digital Input

**Input Channels:** 4, source type

**Input Voltage:** 0 to 30 VDC

**Digital Input Levels for Dry Contacts:**

- Logic level 0: Close to GND
- Logic level 1: Open

**Digital Input Levels for Wet Contacts:**

- Logic level 0: +3 V max.
- Logic level 1: +10 V to +30 V (COM to DI)

**Connector Type:** 10-pin screw-type terminal block (4 points, COM, GND)

**Isolation:** 2 kV optical isolation

## Digital Output

**Output Channels:** 4, sink type

**Output Current:** Max. 200 mA per channel

**On-state Voltage:** 24 VDC nominal, open collector to 30 V

**Connector Type:** 10-pin screw terminal block (4 points, GND)

## LEDs

**System:** Power, Ready, Storage, Programmable

**LAN:** 10M/Link x 2, 100M/Link x 2 (on connector)

**Serial:** Tx/D x 2, Rx/D x 2

**Reset Button:** Supports "Reset to Factory Default"

## Physical Characteristics

**Housing:** SECC sheet metal (1 mm)

**Weight:** 1.2 kg

**Dimensions:** 200 x 57 x 120 mm (7.87 x 2.24 x 4.72 in)

**Mounting:** DIN rail, wall

## Environmental Limits

**Operating Temperature:** Wide Temp. Models: -25 to 70°C (-13 to 158°F)

**Storage Temperature:**

Wide Temp. Models: -40 to 80°C (-40 to 176°F)

**Ambient Relative Humidity:** 5 to 95% (non-condensing)

**Anti-Vibration:** IEC 61373 standard

**Anti-Shock:** IEC 61373 standard

## Power Requirements

**Input Voltage:** 24 VDC (9 to 48 V), M12 connector

**Power Consumption:** 20 W, 833 mA @ 24 VDC

## Standards and Certifications

**Safety:** UL 60950-1

**EMC:** EN 55022 Class A, EN 61000-4-2, EN 61000-4-3, EN 61000-4-4, FCC Part 15 Subpart B Class A

**Rail Traffic:** EN 50155\*, EN 50121-3-2, EN 50121-4, IEC 61373

\*Complies with a portion of EN 50155 specifications. Please contact Moxa or a Moxa distributor for details.

## Reliability

**Alert Tools:** Built-in buzzer and RTC (real-time clock)

**Automatic Reboot Trigger:** Built-in WDT (watchdog timer)

## Warranty

**Warranty Period:** 5 years (does not apply to cellular module)

**Details:** See [www.moxa.com/warranty](http://www.moxa.com/warranty)

**Note:** These hardware specifications describe the embedded computer unit itself, but not its official accessories. In particular, the wide temperature specification does not apply to accessories such as power adapters and cables.

## Software Specifications

### Linux

**OS:** Linux 3.8.13

**File System:** JFFS2, NFS, Ext2, Ext3, Ext4, UBIFS

**Internet Protocol Suite:** TCP, UDP, IPv4, SNMPv2, ICMP, ARP, HTTP, CHAP, PAP, DHCP, NTP, PPP

**Internet Security:** OpenVPN, iptables firewall, OpenSSL

**Network Service:** Moxa's Dynamic Routing and network management Web UI

**Terminal Server (SSH):** Provides secure encrypted communications between two un-trusted hosts over an insecure network

**GPS:** gpsd is a daemon that receives data from a GPS receiver, and provides the data back to multiple applications such as Kismet or GPS navigation software

**Application Development Software:**

- Moxa API Library (Moxa serial I/O control, Moxa DI/DO API)
- GNU C/C++ cross-compiler, supports EABI
- GNU C library
- GDB source-level debugging server

**Software Protection:** Encryption tool for user executable files (based on patented Moxa technology)

## Ordering Information

Type	Standard Models	
Model Name	MAR-2001-T	MAR-2002-T
<b>Management Service</b>		
MAR-2000 Web Management Utility	Available	
MAR-2000 Dynamic Routing	Available	
<b>Storage</b>		
CF Sockets	1	
<b>Wireless</b>		
Cellular 3G (WCDMA)	2 quad-band GSM/GPRS, EDGE, five-band UMTS/HSPA+ industrial IP-modems	3 quad-band GSM/GPRS, EDGE, five-band UMTS/HSPA+ industrial IP-modems
WiFi	2 IEEE 802.11a/b/g/n dual-RF wireless AP/bridge/client	1 IEEE 802.11a/b/g/n dual-RF wireless AP/bridge/client
GPS	50-channel GPS module	
<b>Interface</b>		
Ethernet Ports	2	
Serial Ports	2	
DI/DO	4 DIs, 4 DOs	
USB	2.0 host	
<b>Environmental Limits</b>		
Operating Temperature	-25 to 70°C (EN 50155 Class T3)	
Conformal Coating	Available by Request	

### M12 Connectors (can be purchased separately)

**M12A-5P-IP68:** Field-installation A-coded screw-in power connector, 5-pin female M12 connector, IP68-rated

**M12D-4P-IP68:** Field-installation D-coded screw-in Ethernet connector, 4-pin male M12 connector, IP68-rated

### M12 Cables (can be purchased separately)

**CBL-M12(FF5P)/Open-100 IP67:** 1-meter A-coded M12-to-5-pin power cable, 5-pin female M12 connector, IP67-rated

**CBL-M12D(MM4P)/RJ45-100 IP67:** 1-meter D-coded M12-to-RJ45 Cat-5C UTP Ethernet cable, 4-pin male M12 connector, IP67-rated

### WLAN Cable and Antenna

**Cable:** QMA (male) to SMA (male) adapter with 50 cm cable

**Antenna:** 2 dual-band omni-directional antennas (2 dBi, RP-SMA, 2.4/5 GHz)

### Cellular Cable and Antenna

**Cable:** QMA (male) to SMA (female) adapter with 50 cm cable

**Antenna:** Omni 1 dBi rubber SMA antenna

### GPS Cable and Antenna

**Cable:** TNC to SMA (female) adapter with 50 cm cable

**Antenna:** 26 dBi, 1572 MHz, L1 band antenna

### Package Checklist

- MAR-2000 programmable router
- Wall mounting kit
- DIN-rail mounting kit
- CBL-4PINDB9F-100: 100 cm console port cable; 4 pin header connector to female DB9 connector
- Documentation and software CD or DVD
- Quick installation guide (printed)