

MAR-2000 Series

Industrial multi-radio mobile access and applications router



- > Dynamic routing across multiple WANs
- > 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

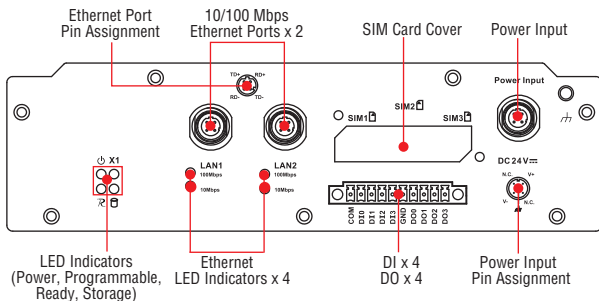
The MAR-2000 is a compact, simple, and programmable RISC-based wireless mobile router with strong wireless routing capabilities. With a built-in GPS module, HSPA+ cellular and 802.11a/b/g/n wireless capabilities, independent power switches on its cellular module connectors, and high thermal tolerance, 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 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 Wi-Fi, 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.

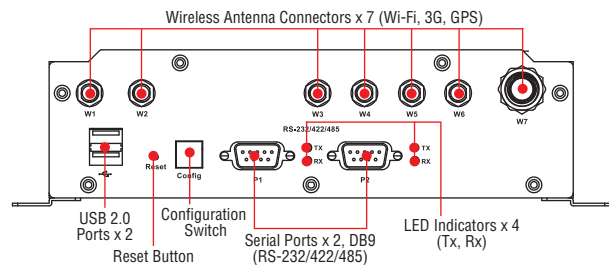
As an added bonus, the MAR-2000 series includes wide temperature models designed to operate reliably in extreme environments with temperatures ranging from -25 to 70°C.

Appearance

Front View

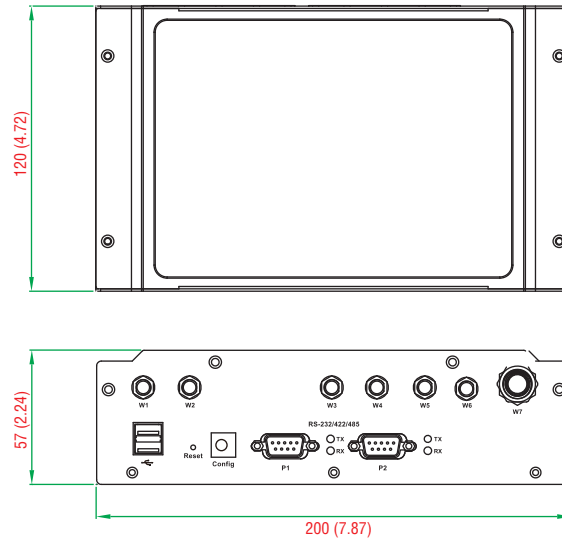


Rear View



Dimensions

Unit: mm (inch)



Hardware Specifications

Computer

CPU: Intel XScale IXP435, 533 MHz

USB: USB 2.0 hosts x 2, type A connector

DRAM: DDR2 SDRAM, 512 MB

Flash:

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

OS (pre-installed): Linux 3.8.13

Storage

Storage Expansion: CompactFlash (Type I/II) sockets x 1, up to 8 GB

Ethernet Interface

LAN: Auto-sensing 10/100 Mbps ports (M12) x 2

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: 384 kbps (max.); UL: 384 kbps (max.)

EDGE Class 12:

DL: 237 kbps (max.); UL: 237 kbps (max.)

GPRS Class 12:

DL: 85.6 kbps (max.); UL: 85.6 kbps (max.)

Connector Type: QMA connector (female type)

Serial Interface

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

Console Port: RS-232 (Tx, Rx, 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, ADDC® (Automatic Data Direction Control) for RS-485

Baudrate: 50 bps to 921.6 kbps (supports nonstandard baudrates; see user's manual for details)

Serial Signals

RS-232: Tx, Rx, DTR, DSR, RTS, CTS, DCD, GND

RS-422: Tx+, Tx-, Rx+, Rx-, GND

RS-485-4w: Tx+, Tx-, Rx+, Rx-, GND

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

Digital Input

Input Channels: DI x 4

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-fastened terminal block (4 points, COM, GND)

Isolation: 2 kV optical isolation

Digital Output

Output Channels: DO x 4, sink type

Output Current: 200 mA (max.) per channel

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

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

LEDs

System: Power, Ready, Storage, Programmable

LAN: 10M x 2, 100M 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 (2.67 lb)

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

Mounting: DIN rail, wall

Environmental Limits

Operating Temperature: -25 to 70°C (-13 to 158°F)

Storage Temperature: -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

Input Current: 833 mA @ 24 VDC

Power Consumption: 20 W

Standards and Certifications

Safety: UL 60950-1

EMC: EN 55032 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 50121-4, IEC 61373

*Complies with a portion of EN 50155 specifications.

Reliability

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

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

MTBF (mean time between failures)

Time:

MAR-2002-T: 280,129 hrs

MAR-2001-T: 350,609 hrs

Standard: Telcordia (Bellcore) Standard TR/SR

Warranty

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

Details: See 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

Terminal Server (SSH): Provides secure encrypted communications between two untrusted hosts over an unsecure network

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

GPS: Uses gpsd, which 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	Models	
Model Name	MAR-2001-T	MAR-2002-T
Management Service		
MAR-2000 Web Management Utility	Available	
MAR-2000 Dynamic Routing	Available	
Storage		
CF Sockets	1	
Wireless		
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
Wi-Fi	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	
Interface		
Ethernet Ports	2	
Serial Ports	2	
DI/DO	4 DIs, 4 DOs	
USB	2.0 host	
Environmental Limits		
Operating Temperature	-25 to 70°C (-13 to 158°F), (EN 50155 Class T3)	
Conformal Coating	Available by Request	

M12 Connectors (can be purchased separately)

M12A-5P-IP68: Field-installable A-coded screw-fastened power connector, 5-pin female M12 connector, IP68-rated

M12D-4P-IP68: Field-installable D-coded screw-fastened 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 omnidirectional 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)