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# EN-2000 Hardware Description and Specifications

This chapter provides information on the EN-2000™ chassis hardware and specifications.

Highlights of the EN-2000 include:

- Industrial-hardened cybersecurity
- SSL/TLS encrypted link to the wide-area network (WAN)
- IP security (IPsec) VPNs with DES, 3DES, and AES (256-bit)
- Cellular wireless connectivity over any IP or cellular wireless network
- Choice of WAN interface via cellular data Ethernet
- Optional use of vehicle input power (discussed in [The Automotive EN-2000™ Router](#))

See the following:

- [Section 1.1, Hardware Overview](#), on page 1
- [Section 1.2, Pin Configuration](#), on page 5
- [Section 1.3, RJ45 Signaling Conversion](#), on page 6
- [Section 1.4, EN-2000 Technical Specifications](#), on page 7

## 1.1 Hardware Overview

The EN-2000 is a cost-efficient router that supports 4G LTE cellular wireless service and optional 802.11 wireless (WiFi) service. All EN-2000 models are built on the same hardware platform. The EN-2000 has:

- One LAN Ethernet port
- One WAN Ethernet port
- One optional RS232 serial port
- One optional RS485 serial port

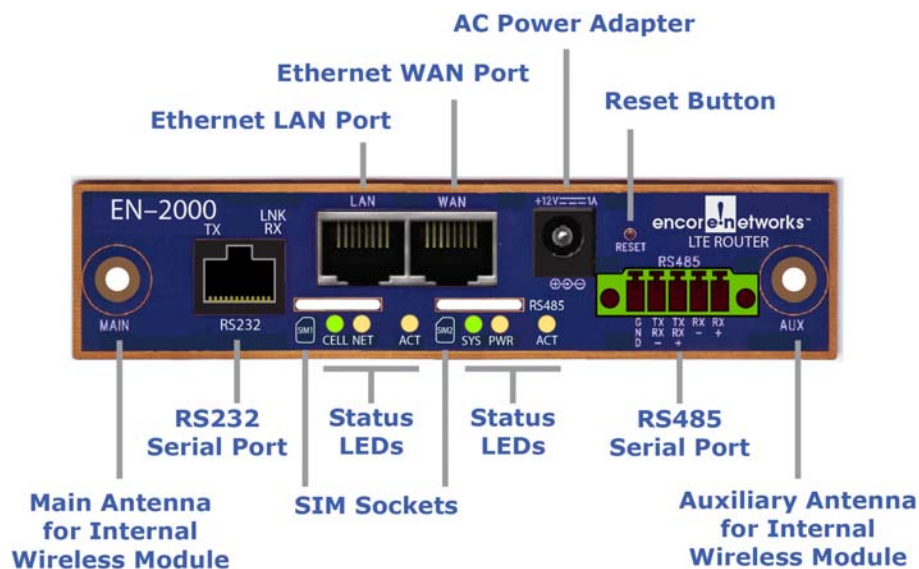
- One or two SIM sockets
- One LTE cellular wireless module
- One or two optional 802.11 wireless modules

The EN-2000's power source is an AC power supply unit, supplying 12 VDC to the chassis. The automotive EN-2000 uses vehicle input power voltage (range 9–32 volts), with ignition sensing.

### 1.1.1 EN-2000 Chassis Front Panel

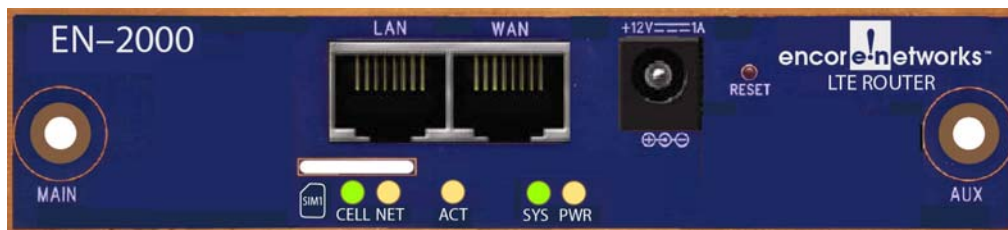
The front panel of the EN-2000 chassis has several versions. This section discusses chassis versions with one or two SIMs, and with or without serial ports. [Figure 1-1](#) identifies items on the front of the EN-2000 chassis.

Figure 1-1. EN-2000 Front Panel (All Potential Ports Shown)



[Figure 1-2](#) shows the faceplate for a single-SIM EN-2000 without serial ports.

Figure 1-2. Front Panel for Single-SIM EN-2000 without Serial Ports



The front of the EN-2000 router's chassis with one SIM and without serial ports has:

- One LED for power status (PWR)
- One LED for system status (SYS)
- One LED for data activity (ACT) on the LAN port or WAN port
- LEDs to indicate cellular wireless activity (CELL) and network status (NET)

- Two RJ45 Ethernet ports (LAN and WAN)
- A slot for a SIM
- Two SMA (subminiature version A) connectors for antennas to support cellular wireless modules
- One reset switch (for default software/configuration load)

Figure 1-3 shows the faceplate for a dual-SIM EN-2000 with two serial ports (an RS232 port and an RS485 port).

Figure 1-3. Front Panel for Dual-SIM EN-2000 with Serial Ports



The front of the EN-2000 router's chassis with two SIMs and two serial ports has all the ports that the chassis without serial ports has. This chassis also includes the following ports:

- One RS485 serial port (half duplex/full duplex)
- One RS232 serial port

**Note:** Figure 1-3 shows a slot for a second SIM.

### 1.1.2 EN-2000 Chassis Back Panel

The back of the EN-2000 chassis has connectors for two antennas that support the 2.4GHz and 5.1 GHz 802.11 wireless (WiFi) cards. In addition, the backplate of the EN-2000 has two forms: without serial port LEDs (Figure 1-4) or with serial port LEDs (Figure 1-5).

Figure 1-4. EN-2000 Back Panel without Serial Port LEDs



The back of the EN-2000 router without serial ports has:

- Two reverse-polarity SMA (subminiature version A) connectors for WiFi antennas
- LEDs for status and troubleshooting
- LEDs for transmission activity

**Note:** LEDs for power, system status, and network activity are on both the front and the back of the router, for the operator's monitoring convenience.

Figure 1-5. EN-2000 Back Panel with Serial Port LEDs



The back of the EN-2000 router with serial ports has:

- Two reverse-polarity SMA (subminiature version A) connectors for WiFi antennas
- An LED for serial RS485 activity
- An LED for serial RS232 activity

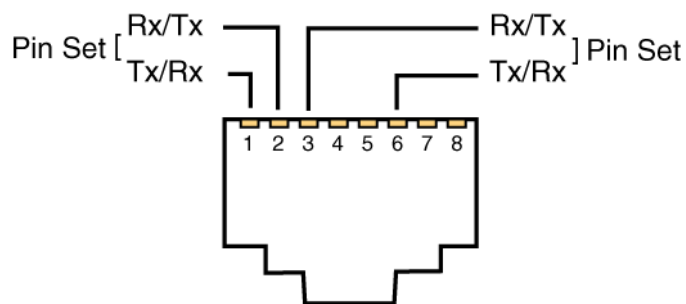
**Note:** LEDs for power, system status, and network activity are on both the front and the back of the router, for the operator's monitoring convenience.

### 1.1.3 RJ45 10-Base-T/100-Base-T Ethernet Port

Figure 1-6 shows the pin locations on an RJ45 Ethernet port. Table 1-1 lists the pin configuration for the EN-2000's 10/100-Base-T Ethernet ports.

**Note:** The EN-2000 router has Auto MDI-X; it automatically detects the required cable connection type and configures the connection appropriately, removing the need for crossover cables to interconnect network devices. If Auto MDI-X is enabled on either end of the connection, either type of cable (patch cable or crossover cable) can be used.

Figure 1-6. Pin Locations for Female RJ45 Ethernet Connector



Each pin set autosenses and adjusts to signals from the device at the remote end of the connection.

Table 1-1. 10-Base-T/100-Base-T Ethernet Port Pin Configuration

Pin Set <sup>1</sup>	Description <sup>2</sup>
1 and 2	Tx or Rx
3 and 6	Rx or Tx

1. Unused pins are not listed.

2. The EN-2000 Ethernet connectors are autosensing and will adjust to the signals from the device at the remote end of the connection.

## 1.1.4 LED Codes

See the *Quick Guide to EN-2000™ LED Codes* to interpret LED signals in the EN-2000 chassis.

## 1.2 Pin Configuration

[Table 1-2](#) through [Table 1-4](#) list the pin configurations for the EN-2000's signaling ports.

Table 1-2. Pin Configuration for EN-2000's RS232 Port, DCE

Pin	Signal	Direction
1	DSR	Out
2	DCD	Out
3	DTR	In
4	GND	
5	RXD	Out
6	TXD	In
7	CTS	Out
8	RTS	In

The RS232 signaling port is a physical RJ45 port.

Table 1-3. Pin Configuration for EN-2000's RS485 Port, Full Duplex

Pin	Signal	Direction
1	GND	
2	TX-	Out -
3	TX+	Out +
4	RX-	In -
5	RX+	In +

Table 1-4. Pin Configuration for EN-2000's RS485 Port, Half Duplex

Pin	Signal	Direction
1	GND	
2	TX/RX-	Out/In -
3	TX/RX+	Out/In +
4		Do not use.
5		Do not use.

## 1.3 RJ45 Signaling Conversion

Table 1-5 through Table 1-8 indicate signaling conversion for the EN-2000's RJ45 port.

Table 1-5. Signaling Conversion from EN-2000 RJ45 to DCE DB9

RJ45	Signal	DB9
1	DSR	6
2	DCD	1
3	DTR	4
4	GND	5
5	RXD	2
6	TXD	3
7	CTS	8
8	RTS	7

Table 1-6. Signaling Conversion from EN-2000 RJ45 to DCE DB25

RJ45	Signal	DB25
1	DSR	6
2	DCD	8
3	DTR	20
4	GND	7
5	RXD	3
6	TXD	2
7	CTS	5
8	RTS	4

Table 1-7. Signaling Conversion from EN-2000 RJ45 to DTE DB9

RJ45	Signal	Signal	DB9
1	DSR	DTR	4
2	DCD	RTS	7
3	DTR	DSR	6
4	GND	GND	5
5	RXD	TXD	3
6	TXD	RXD	2
7	CTS	OPEN	
8	RTS	DCD	1

Table 1-8. Signaling Conversion from EN-2000 RJ45 to DTE DB25

RJ45	Signal	Signal	DB25
1	DSR	DTR	20
2	DCD	RTS	4
3	DTR	DSR	6
4	GND	GND	7
5	RXD	TXD	2
6	TXD	RXD	3
7	CTS	OPEN	
8	RTS	DCD	8

## 1.4 EN-2000 Technical Specifications

See the following:

- [Section 1.4.1, General Features](#), on page 7
- [Section 1.4.2, Security Features](#), on page 8
- [Section 1.4.3, Transport Protocols](#), on page 8
- [Section 1.4.4, EN-2000 Physical Specifications](#), on page 8
- [Section 1.4.5, SIMs](#), on page 9
- [Section 1.4.6, Environmental Specifications](#), on page 9
- [Section 1.4.7, Standards Compliance](#), on page 10

### 1.4.1 General Features

- Firewall security compliant with NERC CIP (003, 005, 007, 009)
- Secure encrypted wireless connection over public or private cellular network
- Configuration servers to manage and update routers centrally
- Disaster recovery and loadsharing over WAN connections
- A hardened Linux operating system
- A graphical user interface (GUI) managed through any web browser
- QoS enforcement to prioritize critical traffic
- Protocol management and translation (spoofing) for dozens of protocols
- Generic Route Encapsulation (RFC 1701)

#### 1.4.1.1 Internet Protocol

- IP Version 4
- IP Routing (RIP v1/v2) or static routing

- DHCP client/server/BootP/Relay
- IP QoS and traffic prioritization
- IP fragmentation/reassembly
- IP routing over VPN; TCP and UDP
- 802.1q VLAN tagging
- Virtual Redundant Routing Protocol (VRRP) between two routers

## 1.4.2 Security Features

- Integrated router/firewall with encryption and VLAN tagging
- Network Address Translation
- IPsec (RFC 2401) VPN tunnels with DES, 3DES, and AES (256) encryption and Internet Key Exchange (IKE, RFC 2409)

## 1.4.3 Transport Protocols

### 1.4.3.1 WAN and LAN

- IP over Ethernet
- Synchronous PPP
- MLPPP
- PPPoE

## 1.4.4 EN-2000 Physical Specifications

### 1.4.4.1 Chassis Dimensions

[Table 1-9](#) and [Table 1-10](#) list the physical specifications for the respective metal and plastic EN-2000 chassis.

Table 1-9. Physical Specifications for the EN-2000 Metal Chassis

Item	Measurement
Height <sup>1</sup>	1.448 in. (3.68 cm)
Width	6.0 in. (15.24 cm)
Depth	4.4 in. (11.18 cm)
Weight	Less than 1 lb. (Less than 0.45 kg)
Installation Type	Rack or Desktop

1. When the height of the feet (0.225 in., or 0.57 cm) for the metal chassis is included, the chassis stands 1.673 inches (4.25 cm) high.



Table 1-10. Physical Specifications for the EN-2000 Plastic Chassis

Item	Measurement
Height <sup>1</sup>	1.5 in. (3.81 cm)
Width	6.0 in. (15.24 cm)
Depth	4.4 in. (11.18 cm)
Weight	Less than 1 lb. (Less than 0.45 kg)
Installation Type	Rack or Desktop

1. When the height of the feet (0.135 in., or 0.34 cm) for the plastic chassis is included, the chassis stands 1.635 inches (4.15 cm) high.

#### 1.4.4.2 Power Supply Options

The chassis draws less than 13 watts, AC 100V–240V, 50–60 Hz (with external adapter).

#### 1.4.5 SIMs

The EN-2000 can hold one or two SIMs. [Table 1-11](#) lists the recommended specifications for Subscriber Identity Modules (SIMs) used in the EN-2000.

**Note:** SIMs are not shipped with the EN-2000. Order SIMs from your cellular wireless carrier.

Table 1-11. Recommended Specifications for SIMs in the EN-2000

Item	Specification
ID	Type 1 Mini SIM
Form factor	2FF
Dimensions	25 mm x 15 mm
Operating Temperature	-25°C to 85°C

#### 1.4.6 Environmental Specifications

[Table 1-12](#) provides the environmental specifications for the EN-2000.

Table 1-12. EN-2000 Environmental Specifications

Measurement	Specification
Temperature	Operating Temperature: 0°C to 50°C (32°F to 122°F) Non-Operating (Storage) Temperature: -40°C to 85°C (-40°F to 185°F)
Humidity	5% to 95% non-condensing
Altitude	Up to 10,000 ft. (Up to 3,048 m)

## 1.4.7 Standards Compliance

The EN-2000 complies with the European Union's directive on restriction of hazardous substances (RoHS). This directive places strict controls on pollutants, including the elimination of lead in the manufacturing process.

[Table 1-13](#) lists the EN-2000's compliance with agency standards.

Table 1-13. EN-2000 Standards Compliance

Compliance	Agency Specification
Environmental	RoHS-compliant
Electromagnetic Compatibility (EMC)	FCC Part 15: 2013 IC ICES-003 Issue 5 EN 301 489-1 V1.9.2 (2011-09) EN 301 489-17 V2.2.1 (2012-09)