
The EN-4000™ Chassis

Hardware Description and Specifications

This chapter provides information on the EN-4000™ chassis hardware and specifications.

The EN-4000™ 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.

Highlights of the EN-4000™ include:

- Industrial-hardened cybersecurity appliance and router
- IP security (IPsec) VPNs with DES, 3DES, and AES (256-bit), to maintain private transmissions over a public network
- SSL/TLS encrypted link to the wide-area network (WAN)
- Connectivity over any IP/MPLS, Frame Relay, circuit-switched, or cellular wireless network
- Choice of WAN interface via cellular data, T1/E1 CSU, serial, or Ethernet, optical fiber, modem
- Cellular, Wi-Fi, and Bluetooth connectivity
- Up to four serial ports for legacy traffic support
- Alarm ports (dry contact sensing, voltage sensing, dry contact closure outputs)
- Legacy protocol support via serial or IP conversion/interworking

Note: The EN-4000™ chassis and the EN4000-IE™ chassis differ in a few respects. For comparison, see the document [The EN4000-IE™ Chassis for North America](#) or the document [The EN4000-IE™ Chassis for Europe](#).

See the following:

- [Section 1.1, EN-4000™ Hardware Overview](#), on page 2
- [Section 1.2, EN-4000™ Technical Specifications](#), on page 9

1.1 EN-4000™ Hardware Overview

The EN-4000™ router adds more speed, capacity, and flexibility to Encore Networks' series of wireless routers. This IP router continues and advances Encore's record for wired, optical fiber, and cellular uplinks, complete remote management, and support for current and legacy data protocols.

The EN-4000™ chassis is designed to operate in industrial environments with a wide range of ambient temperatures. Its tight all-metal enclosure resists dust, moisture, and electromagnetic interference (EMI).

The EN-4000™ has expanded memory and a high-speed processor that allow it to handle multiple ports and high-speed network connections while converting protocols, routing packets, and applying firewall rules and other security measures.

One internal module for WiFi and Bluetooth communications and one internal cellular wireless module are standard on selected models. Because the modules are internal, they leave the chassis's expansion slots open for other modules. Up to four antennas handle 3G/4G/LTE cellular wireless and 802.11 wireless (wifi) connections.

There is no cooling fan or other moving part. All models are built on the same hardware platform. Expansion slots for optional modules enhance flexibility and let the EN-4000™ router adapt to specific user needs. You can add Ethernet ports, a modem, wireless ports, encryption hardware, a digital signal processor (DSP), serial ports, fiber-optic links, and T1/E1 CSU interfaces.

Slots allow installation of serial data ports, a modem behind an FXS analog telephone interface, and up to five additional Ethernet ports. An internal switch allows any port to handle upstream connections and locally attached equipment. You can select a model that uses a fixed configuration of a cellular wireless port and one Ethernet port. Another model contains three expansion slots—two in the front and one internal—for optional hardware modules.

Technicians with modest skills, using only a screwdriver, can install and change most modules in the field.

The EN-4000™ requires minimal power. Typical configurations draw less than 13 watts. The power source options are:

- A 12V–48V DC input line, at several voltages
- An AC power supply unit, supplying 5 V DC to the chassis

A DC power input can form a redundant pair with an AC power input: One is the chassis's primary input power source, and the other source provides power if the primary source is down.

See the following:

- [Section 1.1.1, EN-4000™ Front Panel](#), on page 3
- [Section 1.1.2, EN-4000™ Back Panel](#), on page 4
- [Section 1.1.3, RJ45 Serial Port](#), on page 4
- [Section 1.1.4, RJ45 10-Base-T/100-Base-T Ethernet Port](#), on page 5

- [Section 1.1.5, Power Supply Ports](#), on page 6
- [Section 1.1.6, Modules for Expansion Slots](#), on page 6
- [Section 1.1.7, LEDs](#), on page 8

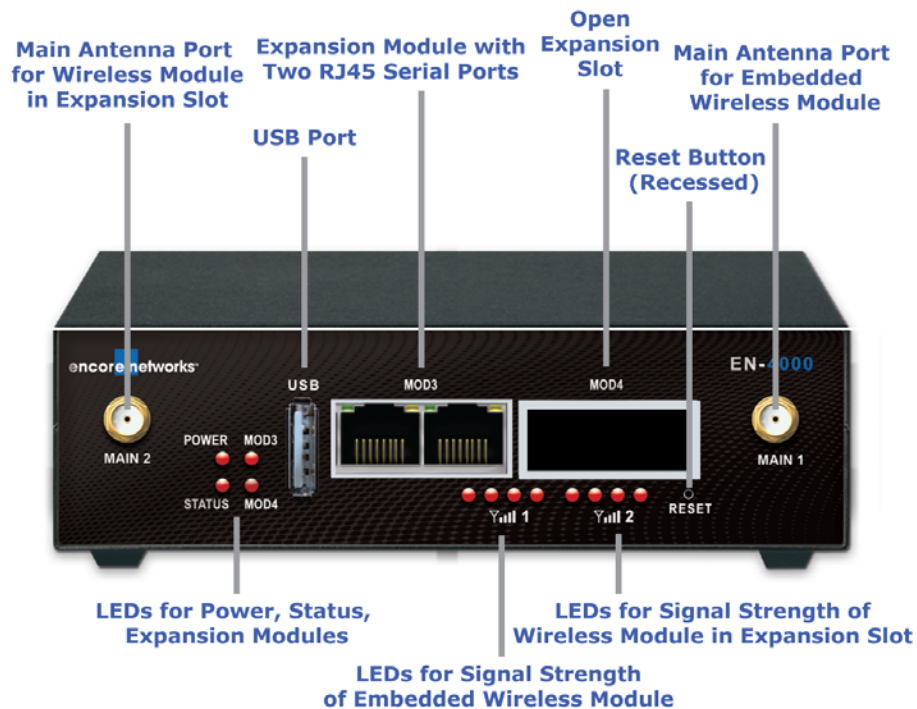
1.1.1 EN-4000™ Front Panel

Figure 1-1 shows the front of the EN-4000™ chassis with a dual serial-port module installed in one expansion slot. (The other expansion slot remains open.)

The front of the EN-4000™ chassis has:

- One LED for power status
- One LED for system status
- Two LEDs for status of expansion modules
- One USB port
- One dual RJ45 serial-port module in an expansion slot
- One open expansion slot
- Two external antenna connectors for wireless modules
- Two groups of 4 LEDs to indicate cellular wireless signal strength
- One reset switch (for default software/configuration load)

Figure 1-1. EN-4000™ Front Panel with a Dual Serial-Port Module in an Expansion Slot

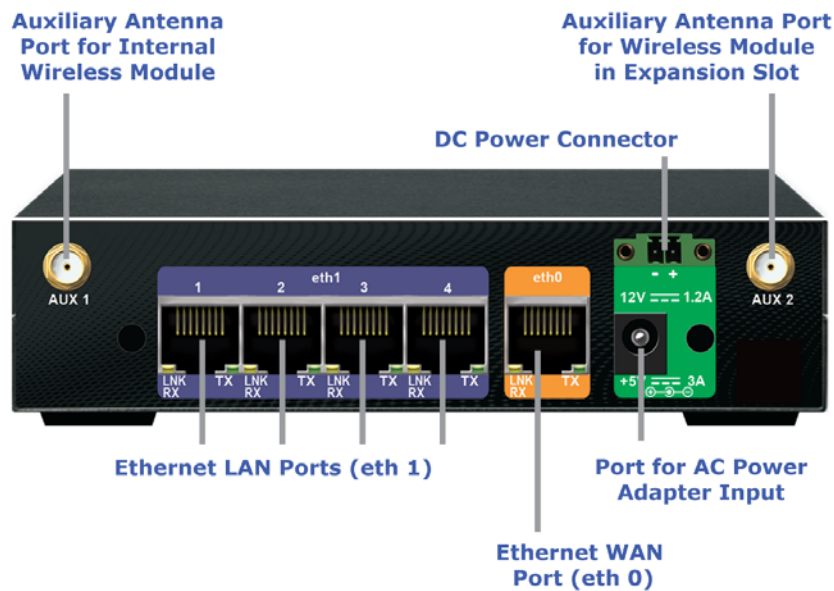


1.1.2 EN-4000™ Back Panel

Figure 1-2 shows the back of the EN-4000™ chassis. The back of the EN-4000™ chassis has:

- Two external auxiliary antenna connectors to support WiFi module; Bluetooth module; or wireless modules
- One 10/100 Ethernet RJ45 WAN port
- Four 10/100 switched Ethernet RJ45 LAN ports
- One 12V–48V DC input port
- One 5 V DC input port (from AC power adapter)

Figure 1-2. EN-4000™ Rear Panel

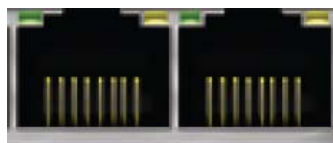


1.1.3 RJ45 Serial Port

Figure 1-3 shows the dual serial-port module for the EN-4000™. The module is installed in one of the expansion slots on the front of the chassis. (The module can be installed in either expansion slot.)

As the name indicates, this module provides two serial ports. The serial ports use RJ45 connections.

Figure 1-3. Dual Serial-Port Module for the EN-4000™



Each serial port has an RJ45 connector. Figure 1-4 shows the pin locations on an RJ45 serial port. Table 1-1 lists the pin configuration for the EN-4000™'s RJ45 serial ports.

Figure 1-4. Pin Locations for Female RJ45 Serial Port Connector

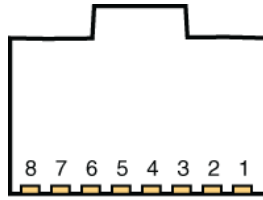


Table 1-1. RJ45 Serial Port Pin Configuration

RJ45 Pin No.	RS232	RS485HD	RS485FD
1	DSR/RI (O)	TX/RX+ (BI)	RXD+ (O)
2	DCD (O)	TX/RX- (BI)	RXD- (O)
3	DTR (I)	N/A	TXD- (I)
4	SGND	SGND	SGND
5	RD (O)	DSR (O)	DSR (O)
6	TD (I)	N/A	TXD+ (I)
7	CTS (O)	CTS (O)	CTS (O)
8	RTS (I)	RTS (I)	RTS (I)

(I): input
(O): output
(BI): bidirectional

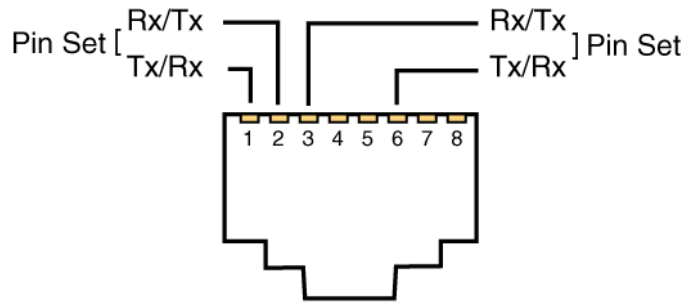
The serial port options are RS232 DCE, RS485 half duplex, and RS485 full duplex. The supported protocols (selectable in the software) are Asynchronous Encapsulation, Frame Relay over IP, Synchronous Frame Relay, and Telnet Terminal.

1.1.4 RJ45 10-Base-T/100-Base-T Ethernet Port

Figure 1-5 shows the pin locations on an RJ45 Ethernet port. Table 1-2 lists the pin configuration for the EN-4000™'s 10/100-Base-T Ethernet ports.

Note: The EN-4000™ senses the pin configuration at the remote end of the connection and sets its own pin configuration to correspond to that remote configuration.

Figure 1-5. 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 1-2. 10-Base-T/100-Base-T Ethernet Port Pin Configuration

Pin Set ¹	Description ²
1 and 2	Tx or Rx
3 and 6	Rx or Tx

1. Unused pins are not listed.

2. The EN-4000™ Ethernet connectors are autosensing and will adjust to the signals from the device at the remote end of the connection.

1.1.5 Power Supply Ports

The back of the chassis has a port for a 5 Volt AC Power Adapter.

The EN-4000™ chassis that uses DC power also has a DC 12V–48V DC port.

1.1.6 Modules for Expansion Slots

The EN-4000™ provides a choice of several modules in its expansion ports:

- Multi-mode or single-mode optical-fiber SFP, 10/100/1000 Ethernet port
- Single channelized/unchannelized/fractional T1/E1 CSU/DSU port
- 10/100/1000 Ethernet over copper
- 4-wire E&M (Types I and V)
- Dual high-speed serial ports (RS-232, RS-485, RS-422)
- Single V.35 serial port
- V.90/92 modem, FXS port, with PPP support (PAP/CHAP)
- Digital Signal Processor
- 3G or 4G cellular wireless port: CDMA (1xRTT), EVDO, GSM, GPRS, EDGE, UMTS, HSDPA, HSPA
- Wi-Fi/Bluetooth wireless port
- Commercial miniPCI modules, such as the latest Wi-Fi

- Hardware encryption module (offloads the algorithm from the main processor)
- Optical Ethernet: Small form-factor pluggable (SFP) interface for optical fiber, 1000 Mbit/sec (= 1 Gbit/sec)
- Four voltage-sensor inputs plus three contact closure outputs

Customers may select factory-installed WiFi/Bluetooth and cellular radios ([Table 1-3](#)).

Table 1-3. Factory Installation Options

Factory-Installed Options ¹	Comment
3G/4G/LTE wireless module	Antenna connection required.
802.11 wifi wireless module	Antenna connection required.
Wi-Fi/Bluetooth wireless module	Antenna connection required.

1. These options are soldered onto the EN-4000™'s main board. The front and back panels have connectors attached to these options.

Users may also install modules in the field ([Table 1-4](#)).

Table 1-4. Field-Installable Modules (Sheet 1 of 2)

Optional Modules	Compatible Option Slots		
	Slot 1 miniPCIe ¹	Slot 2 Custom	Slot 3 miniPCI/Custom
3G/4G/LTE wireless module	•		•
802.11 wifi wireless module	•		•
Wi-Fi/Bluetooth wireless module	•		•
900 MHz wireless module	•	•	•
One 10/100/1000T wired Ethernet		•	•
One 100FX fiber-optic port		•	•
One fiber-optic Gigabit Ethernet (GigE) port		•	•
Two async serial ports; RS-485, RS-232, RS-422		•	•
One 4-wire E&M port		•	
One V.35 serial port		•	•
High-speed DSL modem		•	•
One T1/E1 CSU/DSU ²		•	•
V.29 modem/FXS		•	•
Two FXS analog ports		•	

Table 1-4. Field-Installable Modules (Sheet 2 of 2)

Optional Modules	Compatible Option Slots		
	Slot 1 miniPCIe ¹	Slot 2 Custom	Slot 3 miniPCI/Custom
4 V sensors in, 3 contact closures out		•	•
Hardware encryption	•	•	•

1. This expansion slot is inside the EN-4000™ chassis.

2. Provides both channelized and unchannelized services.

1.1.7 LEDs

Table 1-5 describes the LEDs on the EN-4000™ chassis.

Table 1-5. General Status LED Definitions

LED	Color	Description
Power	Green	The unit is receiving power.
	Green (blinking)	A port has an alarm or the system needs attention.
	Off	The unit is not receiving power.
Status	Green	Connection has been made to a management terminal (or to the carrier, if the port is used for data).
	Off	There is no connection.
Mod3 (expansion port)	Green	Connection to the remote device has been made.
	Off	The connection has failed.
Mod4 (expansion port)	Green	Connection to the remote device has been made.
	Off	The connection has failed.
Signal strength 1 and 2	Green	Each group of 4 LEDs indicates the status of a connection to a cellular wireless network and the strength of signals from that network:
	• Number of lights	• The number of signal-strength LEDs that light up (1 to 4 lights) indicates the strength of the signal from the cellular wireless carrier.
	• Steady	• 1 to 4 steady (unblinking) LEDs indicate that the port is connected to a cellular wireless network.
	• Blinking	• 1 to 4 blinking LEDs indicate one or both of the following: <ul style="list-style-type: none"> - that a cellular wireless network is available but that the port does not have an IP address. - that the cellular wireless module has not been activated on the cellular wireless network. In either case, configure an IP address for the port, so that the port can connect to the network. See the document Configuring General Settings for the EN-4000™ .

[Table 1-6](#) describes the LEDs above the 1 Gbps fiber-optic Ethernet module.

Table 1-6. LED Definitions for the GigE Module

LED Color	Description
Green (solid)	The 1 Gbps Ethernet link has been established.
Yellow (blinking)	Rx/Tx traffic is passing through the link.

1.2 EN-4000™ Technical Specifications

This section lists specifications for the EN-4000™ ([Figure 1-6](#)).

Figure 1-6. EN-4000™ Chassis



See the following:

- [Section 1.2.1, General Features](#), on page 9
- [Section 1.2.2, Security Features](#), on page 10
- [Section 1.2.3, Transport Protocols](#), on page 11
- [Section 1.2.4, EN-4000™ Physical Specifications](#), on page 11
- [Section 1.2.5, Environmental Specifications](#), on page 12
- [Section 1.2.6, GigE Specifications](#), on page 12
- [Section 1.2.7, Standards Compliance](#), on page 13
- [Section 1.2.8, SIMs](#), on page 13

1.2.1 General Features

- Redundant power sources
- NERC CIP (003, 005, 007, 009) compliant firewall security
- Three slots for optional modules
- 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
- SNMP manageability for configuration and monitoring
- QoS enforcement to prioritize critical traffic
- Protocol management and translation (spoofing) for dozens of protocols
- Generic Route Encapsulation (RFC 1701)

Also see the following:

- [Section 1.2.1.1, IP](#), on page 10
- [Section 1.2.1.2, Legacy Protocol Support](#), on page 10

1.2.1.1 IP

- 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

1.2.1.2 Legacy Protocol Support

- Support for any asynchronous traffic from local equipment, over IP on any Ethernet interface
- Up to four serial ports (on two optional modules) supporting EIA/TIA RS485, RS232, or RS422 transmission
- Protocol support for DNP3, IEC 60870-5-101/103/104 MODBUS, CDC, S/NET, CONITEL, ABB, X.25, ALC, and most industry protocols

1.2.2 Security Features

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

1.2.3 Transport Protocols

Review the following:

- [Section 1.2.3.1, *WAN and LAN*](#), on page 11
- [Section 1.2.3.2, *Serial*](#), on page 11

1.2.3.1 WAN and LAN

- IP over Ethernet
- Frame Relay (RFC 1490, IP over FR)
- T1 or E1 (full or fractional)
- Asynchronous PPP
- Synchronous PPP
- X.25
- MLPPP
- PPPoE

1.2.3.2 Serial

- Asynchronous Encapsulation
- Synchronous Frame Relay
- Frame Relay over IP
- Telnet Terminal

1.2.4 EN-4000™ Physical Specifications

Review the following:

- [Section 1.2.4.1, *Chassis Dimensions*](#), on page 11
- [Section 1.2.4.2, *Power Supply Options*](#), on page 12
- [Section 1.2.4.3, *Alarm Port*](#), on page 12

1.2.4.1 Chassis Dimensions

[Table 1-7](#) lists the physical specifications for the EN-4000™.

Table 1-7. Physical Specifications for the EN-4000™ Chassis

Item	Measurement
Height ¹	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	Desktop

1. When the height of the chassis feet (0.03 in., or 0.08 cm) is included, the chassis stands 1.53 inches (3.89 cm) high.

1.2.4.2 Power Supply Options

The chassis draws 13 watts maximum. Use of a DC power source and an AC power supply provides a redundant pair for power backup with automatic failover.

- DC: 12V–48V
- AC: 100V–240V, 50–60 Hz (with external adapter)

1.2.4.3 Alarm Port

The alarm port on a serial port module is dry contact sensing.

1.2.5 Environmental Specifications

[Table 1-8](#) lists the environmental specifications for the EN-4000™.

Table 1-8. EN-4000™ Environmental Specifications

Measurement	Specification
Temperature	Operating Temperature: -40°C to 85°C (-40°F to 185°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)

1.2.6 GigE Specifications

The 1 GigE small form-factor pluggable (SFP) module must meet the following criteria:

- 3.3V
- Must be within industrial temperature guidelines (recall [Table 1-8](#)).
- Must comply with multi-source agreement (MSA) specifications for SFP modules.

1.2.7 Standards Compliance

The EN-4000™ complies with the agency standards listed in [Table 1-9](#).

Table 1-9. EN-4000™ Standards Compliance

Compliance	Agency
Environmental	ROHS-compliant
Electromagnetic Compatibility (EMC)	FCC Part 15 EN 55011/CISPR 11 IEC 61850-3 IEEE 1613
Product Safety	UL/CSA 60950-1 CAN/CSA-C22.2 No. 60950-1-03 EN 60950-1

1.2.8 SIMs

[Table 1-10](#) lists the recommended specifications for Subscriber Identity Modules (SIMs) used in the EN-4000™.

Note: SIMs are not shipped with the EN-4000™. Order SIMs from your cellular wireless carrier.

Table 1-10. Recommended Specifications for SIMs in the EN-4000™

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