ECHELON®

Edge Control Node 7000 Series Hardware and Installation Guide

078-0455-01A

Echelon Corporation
www.echelon.com

Welcome

To improve both reliability and efficiency, national and regional power distribution grids must become smarter. They must also be able to manage themselves using intelligent distributed control and be able to communicate with any device, over any network or protocol, to optimize grid operations and anticipate problems before they occur.

The Echelon® Edge Control Node (ECN) 7000 Series of open and extensible hardware products enable power distribution grids to become smarter. The ECN 7000 Series distributes the intelligence that public and private electrical power utilities need to monitor and control devices at the edge of the grid. The edge of the grid is the critical point where the distribution network connects to customers and where energy supply and demand are becoming increasingly unpredictable and complex.

The ECN 7000 Series is powered by the Echelon Control Operating System (COS) software platform, which is part of the Echelon Networked Energy Services (NES) system. COS software provides an open, secure, and modular software framework that allows you to host hundreds of new applications that are needed for a smarter grid. This powerful hardware and software combination brings intelligent distributed control to the edge of the grid for maximum reliability, survivability, and responsiveness.

This manual describes the hardware within for the ECN 7650 device. It also describes how a utility worker installs an ECN 7650 device on a utility power pole or a transformer pad.

Audience

This document assumes that you have a good understanding of medium (<50 kV) and low (<1 kV) voltage electrical power distribution grids. You should also understand the communications requirements for your grid applications, and be comfortable working with printed circuit board (PCB) cards.

For the installation information, you should be able to make electrical connections to medium and low power distribution transformers, and be able to make physical connections for electrical devices within the medium and low power electrical distribution grid. You must also understand the safety requirements for working within this environment.

Related Documentation

The following manuals are available from the Echelon Web site (www.echelon.com) and provide additional information that can help you deploy Edge Control Node devices and develop applications for them:

- *Edge Control Node 7000 Series Expansion Card Development Guide* (078-0448-01A). This manual describes the functional requirements for third-party development of expansion cards that plug into the ECN 7000 Series of products.
- *Getting Started with the Edge Control Node (ECN)* (078-0452-01A). This document guides you through general activities for the ECN, such as

connecting the ECN hardware, installing the COS software, configuring an ECN, creating and deploying a custom COS app, creating an ECN component, and deploying that component to multiple ECNs.

- *COS User's Guide* (078-0456-01A). This document describes how to configure the COS software and use its applications to manage grid control networks.
- *COS App Developer's Guide* (078-0453-01A). This guide describes how to create and use apps on your ECN, and how to localize the language of the COS Web interface.
- *COS Programmer's Reference* (078-0462-01A). This guide provides the application programming interface (API) reference information for COS app development.

All of the Echelon documentation is available in Adobe® PDF format. To view the PDF files, you must have a current version of the Adobe Reader®, which you can download from Adobe at: get.adobe.com/reader.

FCC Notice

Federal Communications Commission Radio Frequency Interference Statement

This equipment has been tested and found to comply with the limits for a Class B digital device pursuant to Part 15 of the FCC Rules, per sections 15.107 and 15.109. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the manufacturer's instruction manual, may cause interference with radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, you are encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and the receiver.
- Connect the equipment into an outlet on a circuit different from that which the receiver is connected.
- Consult the dealer or an experienced radio/television technician for help.

Changes or modifications not expressly approved by Echelon Corporation could void the user's authority to operate the equipment.

RF Statements

This equipment also complies with the limits for wireless devices per FCC sections 15.203, 15.205, 15.207, 15.209, 15.247, and 15.407. It uses frequency 2.4 GHz per Institute of Electrical and Electronics Engineers (IEEE) standard 802.15.4-2006, and uses a frequency bandwidth from 2400 MHz to 2483.5 MHz. **Table 1** on page v lists the RF configurations for the ECN 7650 device.

Table 1. RF Transmitter Options

FCC ID Number	Model Numbers	Radio Transmitter Options
IZP70101-R000	TBD	No radio transmitters
IZP70101-R001	TBD	Dual Band CDMA2000/EV-DO cellular data communications module operating in the 800 MHz cellular band and 1800/1900 MHz PCS band
IZP70101-R002	TBD	Dual band (2.4 and 5.8 GHz) Wi-Fi™ access point module
IZP70101-R003	70101-0021 70101-0020 70101-0022 70101-0023 70101-0025	Dual Band CDMA2000/EV-DO cellular data communications module operating in the 800 MHz cellular band and 1800/1900 MHz PCS band Dual band (2.4 and 5.8 GHz) Wi-Fi access point module

This equipment complies with the FCC RF radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with a minimum distance of 28 centimeters between the radiator and your body.

This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.

Important: Any changes or modifications not expressly approved by Echelon Corporation to the RF communications capabilities of the ECN unit could void FCC compliance of the device. Retesting of the ECN with the modifications to comply with FCC regulations is the customer's responsibility.

EMC and Safety Statements

TÜV	Certified per EN 60950: 2000, IEC60950: 2000, and UL60950 by TÜV under NRTL

Table of Contents

1

Introduction

This chapter introduces the ECN 7000 Series of products, and describes the ECN hardware architecture.

Overview of the ECN 7000 Series

Residential and commercial energy customers are increasingly focused energy efficiency and reliability, while also reducing the environmental impact of electricity use. National and regional power distribution grids in the 21st century must address these customer concerns, while at the same time monitoring electricity as it flows through many types of devices and transmission media (substation elements, high, medium, and low voltage power lines, capacitor banks, transformers, meters, communicating thermostats, load-control devices, and so on).

A modern smart power grid network must be able to manage itself using intelligent distributed control and be able to communicate with any device, over any network or protocol, to optimize grid operations and anticipate problems before they occur.

The Echelon Edge Control Node (ECN) 7000 Series of open and extensible hardware products enable power distribution grids to become smarter. The ECN 7000 Series distributes the intelligence that public and private electrical power utilities need to monitor and control devices at the edge of the grid. The edge of the grid is the critical point where the distribution network connects to customers and where energy supply and demand are becoming increasingly unpredictable and complex.

The ECN 7000 Series of products use the Echelon Control Operating System (COS) software platform, which provides the open, secure and modular software framework needed to host hundreds of new applications needed for a smarter grid. This powerful combination of hardware and software brings intelligent distributed control to the edge of the grid for maximum reliability, survivability, and responsiveness.

The ECN 7650 is the first member of the ECN 7000 Series of products. The ECN 7650 supports a variety of local, wide-area, and radio frequency (RF) networks, with up to nine antennas, all contained within the ECN 7650 enclosure to protect them from the weather and to reduce vandalism and security risks.

An ECN 7650 device can accommodate a variety of expansion cards depending on form factor, power requirements, and communications technology. For example, you might design one card for RF communications and another for wired communications.

Third-party vendors can develop ECN expansion cards for the following example applications:

- Wide-area network (WAN) communications, for example for 2G, 3G, or 4G networks
- Metering applications, such as 868 MHz or 900 MHz transceivers for gas, water, heat, and other metering and communications systems
- Analog or digital I/O
- Local device or network interfaces

By combining an extensible hardware architecture with the COS software platform, the ECN 7000 Series of products provides 21st century management for the smart grid.

The cover of the ECN 7650 is secured with one-way screws, which virtually eliminates unauthorized access. When the ECN 7650 is pad mounted, you secure the power and network connections inside a metal housing with a padlock. The ECN 7650 is also rugged and sturdy enough to allow a person (for example, a utility working gaffing a utility pole) to step on it.

The ECN 7650 is designed for quick and secure installation using a rapid-mount bracket on either a utility pole or a pad-mounted distribution transformer. Because the ECN 7650 is small enough and light enough to hand carry, installation is simple and easy.

ECN Hardware Architecture

The ECN 7650 is a small, lightweight box that contains all of the hardware to support the COS software platform and third-party applications. The hardware architecture includes the following elements:

- Main board
- Measurement processor and internal sensors
- Real-time clock
- System cards
- Expansion cards
- Optional backup battery

These hardware elements are housed in a rigid plastic enclosure that provides protection for the electronics. **Figure 1** on page 4 shows a high-level view of the ECN architecture.

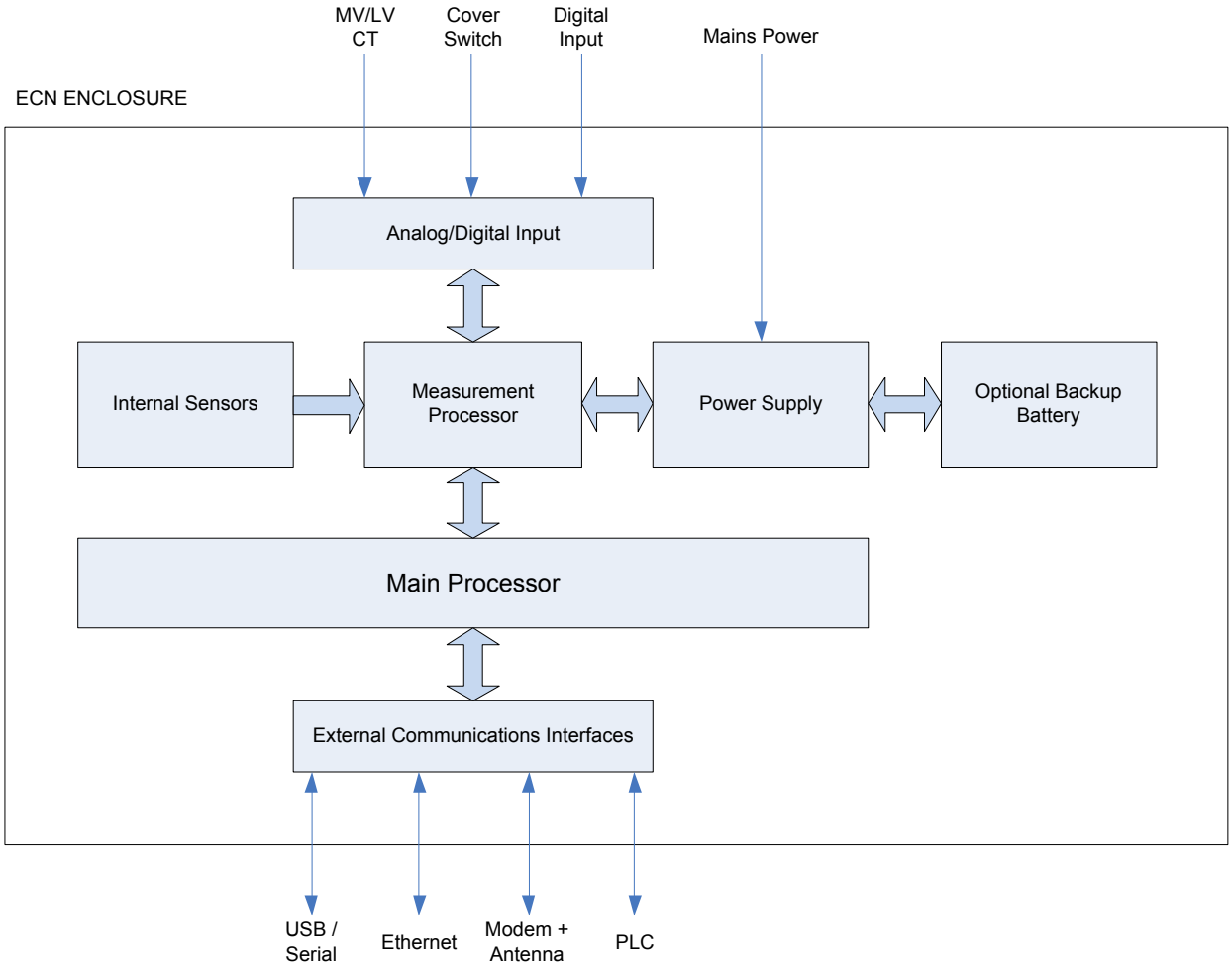

Figure 1. ECN Hardware Architecture

The ECN main processor manages the other hardware components within the ECN and runs the COS system software and related applications. The main processor communicates with a measurement processor that monitors the overall health of the ECN unit, including internal sensors and certain input data. The measurement processor also provides a hardware watchdog function to ensure that the main processor remains responsive.

The ECN main processor also communicates with system cards and expansion cards that provide the communications interfaces for the ECN. It is these cards that allow the ECN to communicate with smart meters, home area networks, wide area networks, and the Internet.

Inside the ECN enclosure, all of the hardware is further enclosed in an inner card cage that protects the main processor, the system cards, and the expansion cards from exposure to the communications frequencies emitted from the antennas located at the periphery of the ECN unit. **Figure 2** on page 5 shows the ECN with its external cover removed so that the inner card cage is visible. Also visible in the figure are the antenna holders at the edges of the enclosure.

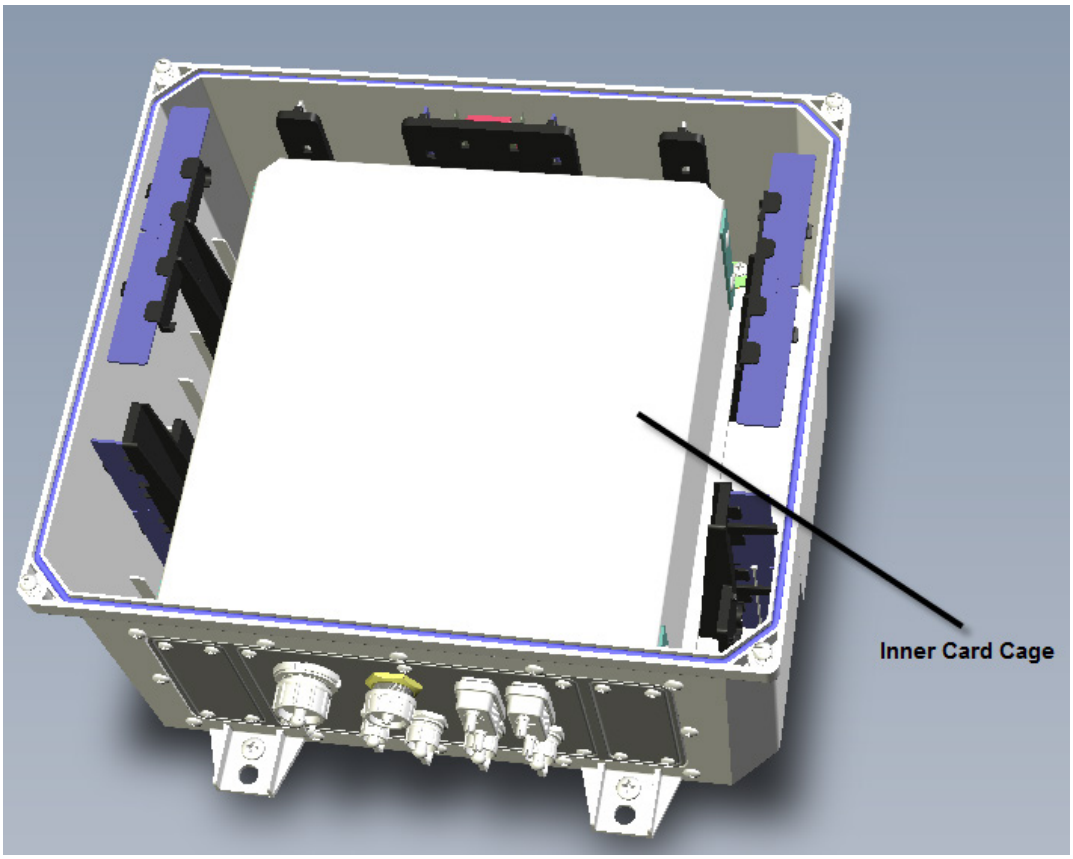

Figure 2. The ECN Inner Card Cage

Figure 3 on page 6 shows the ECN removed from its enclosure and with the inner card cage removed. The figure highlights the locations of the expansion slots. Also visible are the ECN system slots and the main board. The antenna holders are more visible as well.

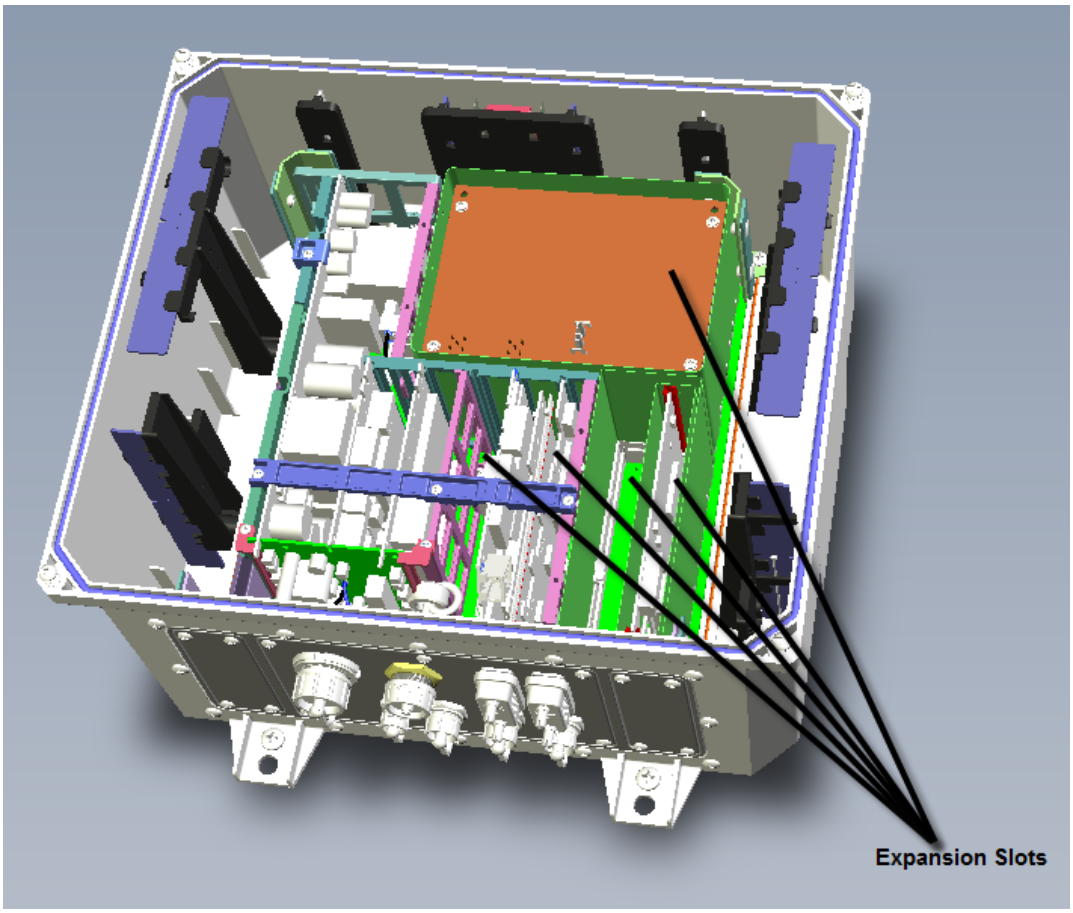

Figure 3. ECN Expansion Slots

The expansion slots allow you to customize the functionality provided by the ECN to suit your application's needs. Typically, an expansion card provides additional communications interfaces for the ECN, but it can also provide additional software applications to complement the COS system software.

Main Board

The ECN main board includes the power supply back end, USB hubs with power control, and high bandwidth interconnects for the system cards and expansion cards. There are six expansion slots available on the backplane, each allocated with its own backplane communications interface. See the *Edge Control Node 7000 Series Expansion Card Developer's Guide* for more information about the expansion cards. You can access all expansion by removing the enclosure front cover and the inner card cage.

The ECN system processor has four high bandwidth interfaces available for use by external peripherals: two USB hosts and two SPI ports for Ethernet connectivity. The SPI interfaces are only used for direct connectivity to Ethernet devices, but the USB interfaces are available on the backplane for the expansion slots. These system resources are optimized for high performance communications between devices with higher bandwidth requirements, such as EV-DO modems and Wi-Fi™ devices.

Figure 4 shows the relationships between the main processor and the backplane. Some of the functionality is provided by system cards, and the rest is provided by expansion cards.

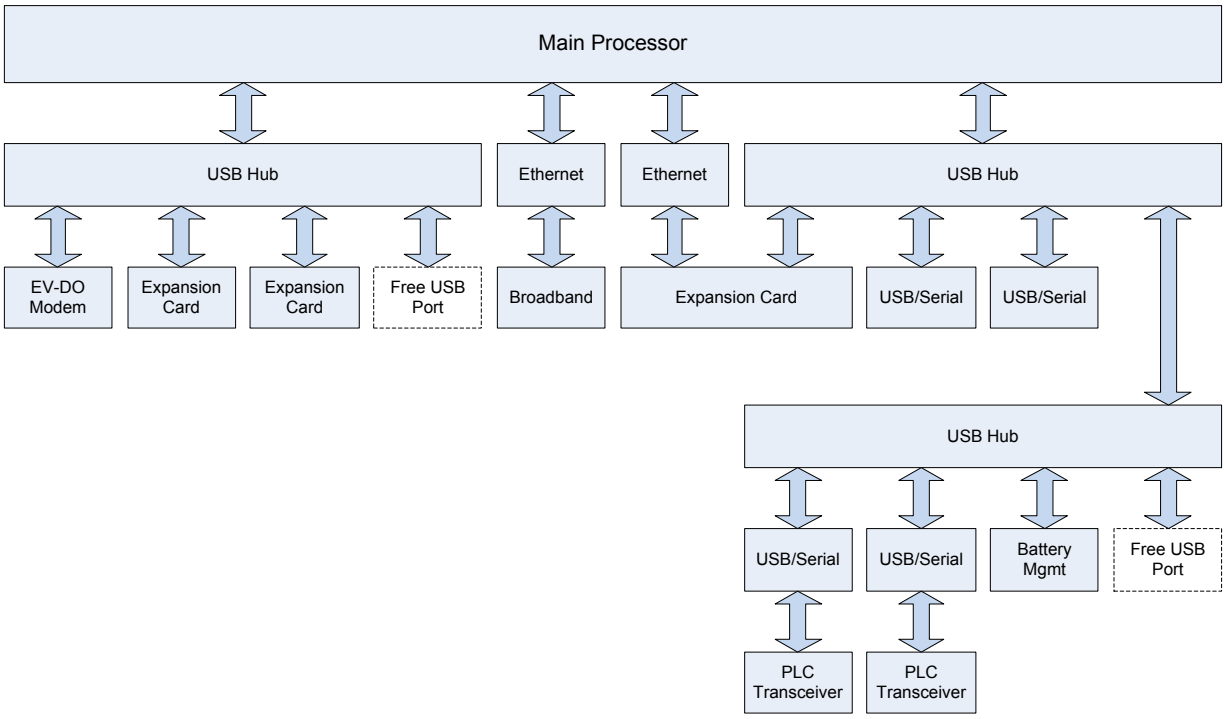

Figure 4. ECN Main Board Architecture

Power Management

The ECN main board includes the power supply for the ECN unit, as well as for the system cards and expansion cards. To maintain data integrity, the ECN includes several watchdog and reset functions.

Main Power Supply

The ECN power supply is capable of operating on any phase of a 3-wire 120/240 V_{AC} or 120/208 V_{AC} network, making it compatible with network and non-network transformers. The power can provide up to 30 W of continuous power, which is ideal for RF applications where low radiated emissions are critical.

The main component of the power supply is located at the top of the ECN main board, where the Faraday cage can provide adequate ventilation to prevent excessive heating of the expansion cards.

Power-Up Function

On power-up, the ECN unit is held in reset by hardware watchdog circuitry until the power supply stabilizes at its operating threshold. This function provides a

soft-start mechanism for the ECN system processor and expansion cards, and prevents heavy loading on the power supply while line voltages are settling.

When the power supply is stable, reset is released and a "wake-up" interrupt is issued to the measurement processor, which has been operating in watch mode while power was off. During initialization, the measurement processor starts to monitor the AC line voltage and begins its other measurement tasks.

Power-Down Function

While the ECN is operational, the measurement processor continually monitors line voltages. When the line voltage drops below 50% of nominal for longer than one minute, the system performs its power-down procedure:

- The system processor completes housekeeping tasks.
- If the ECN unit includes backup batteries, the ECN switches to battery power.
- If the ECN unit does not include backup batteries, the main system processor and all expansion cards are held in reset and the measurement processor enters watch mode. In this mode, the real-time clock and tamper functions are maintained.

For line voltage drops of less than one minute, the ECN operates in brown-out mode, with internal capacitance providing temporary power to the ECN unit.

WARNING: Wait at least one minute after removing mains power from an ECN unit before opening the cover and handling internal components, including expansion cards.

Brown-Out Function

If the line voltage sags for longer than one second, but remains 50% to 80% of nominal, the ECN runs in a reduced state of operation known as brown-out. In this state, the ECN effectively operates as if it was in battery back-up mode, but power continues to be taken from the line voltage, not the battery. The measurement processor continues to monitor line voltage and hold the system in brown-out state until power is either restored or removed.

Line voltage sags of less than one second are ignored and do not trigger a brown-out event.

Energy Saving Mode

The ECN also provides a "Burst Mode Control" option. When in burst mode, the power supply runs more efficiently. The burst mode circuit operates as a type of relaxation oscillator where the output voltage from the power supply switches between 11.8 V_{DC} and 14.0 V_{DC}. The burst mode operates when the temperature is greater than 60 °C, thereby reducing the power dissipation inside the ECN enclosure.

Peripheral Power Control

Power for the USB hubs and expansion cards is derived from the main power supply on the ECN main system board. The hubs are powered by a single +5 V

convertor, whereas each expansion slot has its own convertor. Thus, the expansion cards can be designed to use a different voltage value, as needed. See the *Edge Control Node 7000 Series Expansion Card Developer's Guide* for more information.

The ECN main system processor can control power management for each of the USB hubs and expansion slots. When the main processor is held in reset (because of a watchdog or brown-out event), the expansion slots are automatically turned off.

Software applications that run on the main processor can also control the USB power. For example, if a particular application senses a problem with a specific communications card, it can cycle power to that card to reset it. Alternatively, applications can turn off individual communications cards to reduce overall power consumption (for example, when the ECN is operating from battery back-up power).

Watchdog and Reset

The ECN includes a number of watchdog and reset functions:

- System watchdog and reset (hardware only)
- Measurement processor watchdog (software only)
- Main system processor watchdog (software only)
- Expansion card watchdog and power control (hardware and software)

Figure 5 on page 10 shows the relationships between the various watchdog and reset functions. The following sections describe the functions.

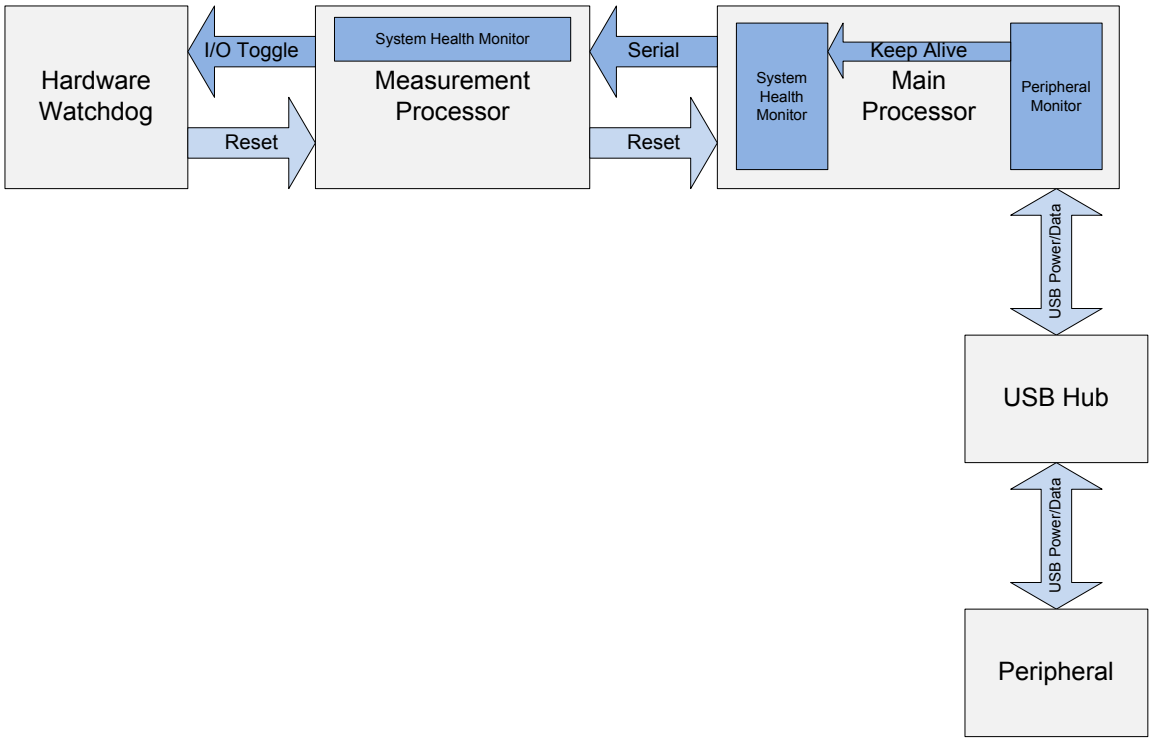

Figure 5. Watchdog Functions

System Watchdog and Reset

A dedicated processor provides hardware watchdog functionality for the entire ECN system. The watchdog has master reset control over both the ECN main system processor and the measurement processor.

The measurement processor maintains the watchdog with a 1.6 second refresh signal. If the measurement processor fails to provide this signal, the hardware watchdog automatically initiates a system reset. A system reset all processors, USB hubs, communications devices, and expansion cards to causes reinitialize.

Measurement Processor Watchdog

The ECN measurement processor runs a software process to maintain a software watchdog for the processor. If there is a malfunction of the measurement scheduler, the software watchdog initiates a reset or a power cycle of the processor, which causes a full system reset or power cycle for the ECN unit.

System Processor Watchdog

The ECN main system processor runs a process to maintain a software watchdog for the processor. If there is a malfunction, the software watchdog initiates a reset or a power cycle of the processor, which also causes all expansion cards to be reset or power cycled.

Expansion Card Watchdog and Power Control

The ECN main system processor has power control over all peripherals, including USB hubs and expansion slots. Applications running on the main system

processor can monitor the health of each of the expansion cards through the USB interface.

Internal Sensors

The ECN includes internal sensors to detect removal of the external cover, change in the title angle of the unit, internal temperature, secondary voltage, and current.

Enclosure Cover Removal Sensor

The ECN includes a reed switch that is mounted in the enclosure cover for sensing removal of the enclosure cover. When the enclosure cover is removed, the measurement processor raises an alarm that you can monitor remotely.

Cover switch sensing continues to operate when power is removed.

Tilt Sensor

The ECN includes a ball bearing tilt sensor that is mounted on the ECN main processor card for sensing changes in tilt angle of the unit. This sensor allows you to determine remotely if the ECN has fallen from or been removed from its pole or pad mounting. When the tilt angle exceeds 30º, the sensor triggers an alarm.

The detection circuitry is monitored by the measurement processor after power is removed.

The tilt sensor is available as a factory option.

Temperature Sensor

The ECN includes an internal temperature sensor that provides a linear output voltage proportional to local temperature, from –55 ºC to +130 ºC. This sensor is monitored directly by the measurement processor.

Temperature measurements are used to compensate the real-time clock and power supply voltages. They can also be used to generate alarms in the event that the internal temperature approaches maximum permissible levels.

If the internal temperature of the ECN enclosure exceeds the maximum operating limits (105 ºC), a protection circuit turns off the main power. This shutdown protects the electronics within the enclosure and also prevents the ECN from reaching unsafe temperature levels.

Secondary Voltage Sensing

The ECN power supply system card includes isolated voltage transformers that card are connected to the ECN line inputs. Each transformer provides a low voltage signal that is proportional to the line voltage, with signal amplitude of 5 $V_{p\text{-}p}$ at 300 V_{AC}. Voltages above and below the power supply rail limits are clamped by protection devices on the power supply card.

The motherboard backplane connects the low voltage signals to the ECN power supply system card and the ECN main processor system card. The measurement

processor processes the signals in real time. If you connect secondary current transformers (CTs), the measurement processor can calculate V_{RMS} and monitor power quality events (such as sag, swell, line frequency, harmonic content, and energy).

The voltage measurement circuitry can be calibrated at the factory to provide increased accuracy. With calibration it is possible to achieve better than 2% accuracy for V_{RMS} readings.

The secondary voltage sensor is available as a factory option.

Primary and Secondary Current Sensing

You can connect the ECN main processor system card to up to three external current transformers or Rogowski coils. Because the type of sensor technology determines the signal conditioning circuitry needed, the analog conditioning circuit is located on an adaptor board that is fitted to the ECN processor system card. Thus, a change in this circuit does not require a new processor system card, but only the replacement of the conditioning circuit.

The external sensors provide isolated voltages proportional to the current waveform to the ECN processor system card through connectors mounted in the ECN's external connection panel. The sensor inputs can be connected to either the primary or secondary lines of the transformer.

The typical supported current sensors provide either the standard 0.333 V_{AC} full scale output or di/dt output. In the case of the 0.333 V standard, the signal conditioning circuit consists of three differential amplifiers. In the case of the Rogowski coils, it consists of three voltage integrators.

The 0.333 V standard is supported by multiple vendors with clamp-on current transformers covering primary currents from 200 A to 2 kA. The di/dt sensors or Rogowski sensors are more flexible than CTs and are available in various forms that can be wrapped around awkwardly shaped bus bars.

The signals from the conditioning circuit are fed to the measurement processor so that I_{RMS} can be calculated in real time. If the current sensors are on the secondary of the transformer, then I_{RMS} and V_{RMS} measurements can be combined to calculate total power, reactive energy, and active energy.

The current measurement circuitry can be calibrated at the factory to provide increased accuracy. With calibration it is possible to achieve better than 2% accuracy for I_{RMS} readings.

Real-Time Clock

The ECN measurement processor provides real-time clock function for the ECN unit. The real-time clock is accurate to at least +/- 6 ppm (6 µs drift). This tight accuracy is achieved by calibrating the clock during manufacturing.

The ECN measurement processor adjusts the real-time clock, as needed, based on internal temperature measurements to maintain clock accuracy over the operating temperature range of the ECN. The COS system software can also adjust the real-time clock in the field, as needed.

When mains power is removed from ECN, the measurement processor switches to battery backup power to maintain the real-time clock. In this mode, the

processor is powered from a non-replaceable 3 V_{DC} lithium battery located on the processor card. Tamper functions are also maintained during this period. This battery provides at least 10 years of functionality for the real-time clock. If you plan to store the ECN for significant periods of time, the measurement processor can be placed in stop mode to further extend the effective life (up to 20 years). When power is first applied to an ECN in this state, the COS system software enables watch mode and updates the date and time.

When mains power is restored, the real-time clock time and date registers are updated along with the tamper status.

Communications Interfaces

The ECN supports many communications interfaces. Some, such as power line communications, are supported by system cards that are included with the ECN or are available as orderable options. Others, such as wireless modems, are supported by expansion cards provided by third-party manufacturers.

This section describes the many communications interfaces supported by the ECN. Some communications interfaces are available as factory options, as shown in **Figure 6** on page 14. In the figure, options are shown with dashed lines. The following sections describe each of the communications interfaces available for the ECN.

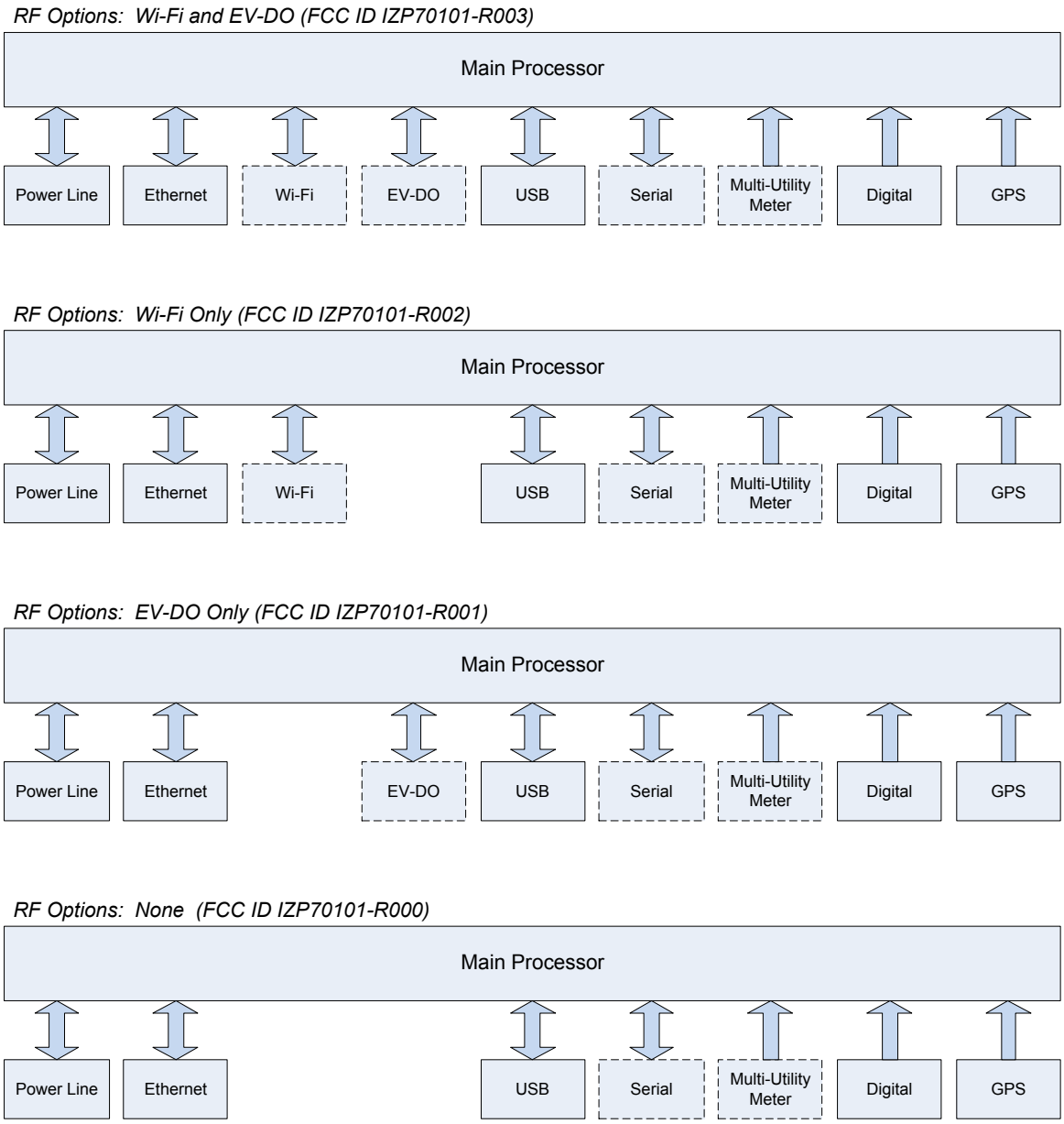

Figure 6. RF Communications Options for the ECN

Power Line Communications

Two of the ECN system cards provide support for Echelon's Power Line technology within the communications frequencies defined by the comité européen de normalization electrotechnique[1] (CENELEC) EN 50065-1 media access protocol standard. One card supports the CENELEC A Band (3 kHz to 95 kHz) and the other card supports the CENELEC C Band (125 kHz to 140 kHz). The A Band is typically restricted to electricity suppliers and their licensees; it is also used by Echelon's NES System, the advanced metering infrastructure (AMI)

[1] European Committee for Electrotechnical Standardization

within the COS software platform. The C Band is typically used for commercial and residential applications, such as those that use LONWORKS communications channels.

Each Power Line Communications card contains the following components:

- An Echelon PL 3120® Power Line Smart Transceiver, configured for communications within the A Band or the C Band
- Appropriate Power Line coupling circuit
- Voltage transformer for secondary line-voltage monitoring
- Zero-crossing detector
- High-voltage rectifiers with surge protection
- A USB Hub and associated USB-to-serial converter for communicating with the ECN main system processor

The following features of the Echelon PL 3120 Power Line Smart Transceiver provide high performance communications over power lines:

- Unique dual-carrier frequency feature, which automatically selects an alternate secondary communications frequency if the primary frequency is blocked by noise.
- Highly efficient, patented, low-overhead forward error correction algorithm to overcome errors induced by noise.
- Sophisticated algorithms for digital signal processing, noise cancellation, and distortion correction. These features correct for a wide variety of signaling impediments, including impulsive noise, continuous-tone noise, and phase distortion.

A Power Line Smart Transceiver requires an isolated coupling circuit tuned to its specific transmission frequencies to be able to inject its signal into the low impedance power cables. The power amplifiers are capable of delivering a 10 V_{p-p} (2 A_{p-p}) signal into the power lines.

The coupling circuits are specially tuned transformers that provide isolation between the high-voltage power lines and the low-voltage Power Line Smart Transceiver.

Whenever line voltage is removed from the ECN, the main system processor holds the Smart Transceivers in reset or powers them off. See *Power Management* on page 7.

Ethernet

The ECN main system board provides two Media Access Control (MAC) physical layer (PHY) ports that provide support for the IEEE 802.3 standards for Ethernet-over-twisted-pair networking. The Ethernet 10/100 interfaces support two different speeds of Ethernet on the same port: 10BASE-T (10 Mbit/s) and 100BASE-TX (100 Mbit/s). The Ethernet MAC PHYs are connected to the SPI ports of the main system processor.

The ECN external connection panel includes two 8 Position 8 Contact (8P8C; also known as RJ45) modular connectors for connecting to the Ethernet network. You can use standard ANSI/TIA/EIA-568-A Category 5 cable in either the T568A or T568B wiring configuration. These Ethernet connectors have built-in transformers on the ECN main system board.

The external connector is included with the External Connections + Serial option.

Wi-Fi

The ECN can include a Wi-Fi access point that supports simultaneous dual-band Wi-Fi clients.

An option is also available that supports the draft IEEE 802.11s Wi-Fi meshing standard.

EV-DO

The ECN can include an Evolution-Data Optimized (EV-DO) modem that conforms to the TIA-856 Rev. B standard. For US models, the modem has been certified through the Verizon Wireless™ Open Development program to operate with the Verizon Wireless 3G network. Thus, the ECN can provide broadband Internet access to devices at the edge of the Smart Grid.

USB

The ECN main system board includes two Universal Serial Bus (USB) host controllers. These hosts allow connectivity to the three USB hubs that are included on the ECN main processor system card and to the six expansion slots. The USB hosts support the USB 1.1 specification at either 1.5 Mbit/s (Low-Bandwidth) or 12 Mbit/s (Full-Bandwidth).

All expansion slots support a USB power interconnect (+1.8 VDC to +12 VDC variable-voltage input determined by the expansion card) and USB data interconnect.

Serial

The ECN can include serial communications connectors that provide serial ports for communicating with serial devices. The serial ports use standard 5-wire EIA-232 interface with a standard 9-pin female DE-9 connectors.

There is also an optional Distributed Network Protocol (DNP3) driver available for process automation and distribution automation systems.

The serial connections are included with the External Connections + Serial option.

Multi-Utility Meters

The ECN expansion slots support several wired and wireless technologies that allow the ECN to monitor advanced multi-utility meters, such as water and gas meters. Thus, the ECN can gather information about many forms of energy and power being used at the edge of the Smart Grid. For example, you can install an expansion card with a modem to connect to a Badger® Meter ORION® system or

an Itron® Energy Gateway with an Itron Encoder-Receiver-Transmitter (ERT®) module.

The end points for such multi-utility meters typically transmit their register readings periodically (for example, every 8 seconds for a Badger meter), so the reader must be able to capture these readings and transmit them to the ECN, which forwards the information to the back end software.

Digital

The ECN external connection panel includes a digital input connector that connects the measurement processor to external devices. The measurement processor monitors changes in state of the input, and raises an alarm for state changes. You can monitor the alarms remotely.

GPS

The ECN has a built-in Global Positioning System (GPS) modem operating at 1575.42 MHz. The GPS antenna is an active 12-channel antenna, mounted near expansion slot 5 in the outer plastic enclosure.

Antenna Support

EV-DO modems operating in the 800 MHz and 1900 MHz bands, or modems that operate within 900 MHz industrial, scientific and medical (ISM) radio bands, typically require two dual-band antennas for diversity operation. If both antennas are mounted with the same polarization, the antennas must be separated by approximately 16.5 cm (6.5 in). However, if one antenna is mounted vertically and the other antenna is mounted horizontally (that is, they have polarization diversity), the two antennas can be located in close proximity to one another. The antenna for an EV-DO or ISM radio system is a ½ wave length antenna that does not require a ground plane or counterpoise. Thus, the antenna is approximately 12 cm (5 in) in length.

The antennas are mounted in the outer plastic enclosure and connect directly to the expansion card using coax cable.

Expansion Card Architecture

An ECN device can accommodate a variety of expansion cards depending on form factor, power requirements, and communications technology. Because each application has different requirements for its expansion card, the ECN provides six expansion slots, each of which can support one or more types of expansion card.

All expansion slots support a USB power interconnect (+1.8 VDC to +12 VDC variable-voltage input determined by the expansion card) and USB data interconnect. Expansion slot 6 also provides an Ethernet connection.

See the *Edge Control Node 7000 Series Expansion Card Developer's Guide* for more information about the requirements for each expansion card type. The guide also describes the requirements for each device's antennas.

Backup Battery

To provide power to the ECN unit during extended power outages, the ECN can optionally be fitted with a backup battery. The ECN enclosure includes a separate compartment for the battery module. Within this compartment, a blind-mate electrical connector allows easy installation for the battery module. This separate compartment is weather tight and provides shielding from sensitive electronics and radios. **Figure 7** shows the battery pack, after it is removed from the ECN.

The ECN uses intelligent battery charging techniques (similar to those found in laptop computers) to maximize the life of the battery. That is, the ECN constantly monitors the state of the Lithium Ion cells used in the module to ensure long life and reliable operation. A typical charge cycle can take up to 4 hours. Each battery pack has an operating life of approximately 10 years.

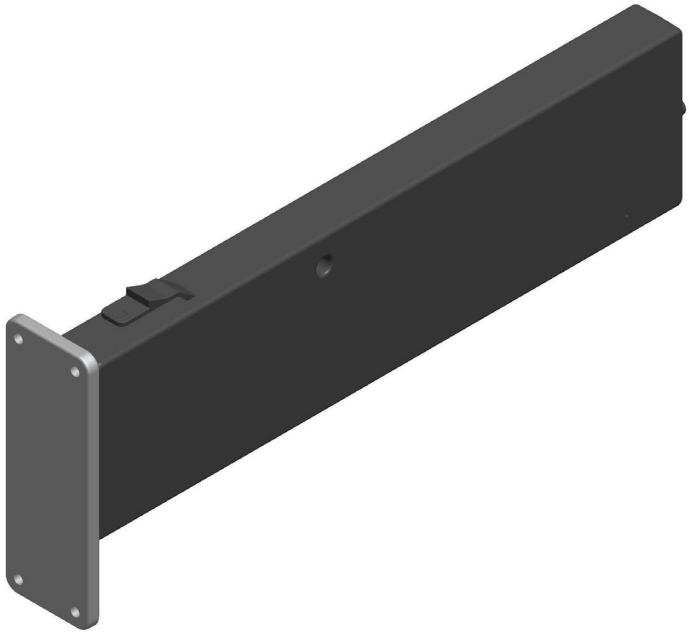

Figure 7. Battery Pack

The battery module is capable of providing up to 24 W of power for at least 15 minutes.

Table 2. Battery Pack Specifications

Specifications	**Dimensions and Weight**
Voltage (Output): 12.1 V ±3% Current: 2 A Run Time (Full Charge): >15 minutes Operating Temperature: -40°C to +50°C	Dimensions (including panel): H: 100 mm (3.9 in) W: 36 mm (1.4 in) D: 267.4 mm (10.5 in) Weight: 320 g (0.7 lb)

2

Installing Components and Troubleshooting

This chapter describes how to install components in an ECN unit before field deployment and how to perform basic troubleshooting for a unit returned from the field.

Installing Components

Because the ECN's cover is not designed to be removed in the field (the cover is secured with one-way screws), you generally cannot perform in-field service for an ECN. If an ECN becomes non-operational, you should replace it in the field with a similarly equipped model to maintain operational service for your customers; see Chapter 5, *Field Replacement for an ECN 7000 Series Device*, on page 49. You can return the non-operational ECN to your service center for maintenance.

The following sections describe how to install components in an ECN unit before field deployment.

Removing the Cover

The cover is secured to the ECN enclosure with four #10 (M5) one-way screws to prevent their unauthorized removal in the field. To remove these screws, use a one-way screw removal tool, which are available from vendors such as W.W. Grainger®, Inc. or Hudson Fasteners, Inc.

Important: Removing the cover compromises the factory seal. You must replace the gasket and sealing screws to reestablish a proper seal.

To remove the cover, remove the screws at the four corners of the ECN enclosure, as shown in **Figure 8**.

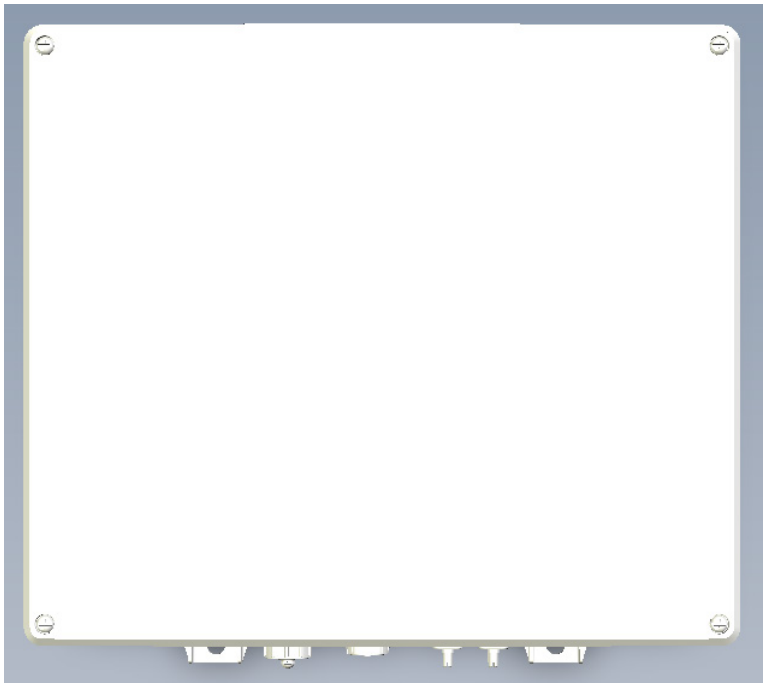

Figure 8. Top View of ECN with Cover Attached

Removing the Card Cage

The card cage is secured to the interior of the ECN enclosure with four #10 (M5) standard Phillips® screws.

To remove the card cage, remove the screws at the four corners of the card cage, as shown in **Figure 9**.

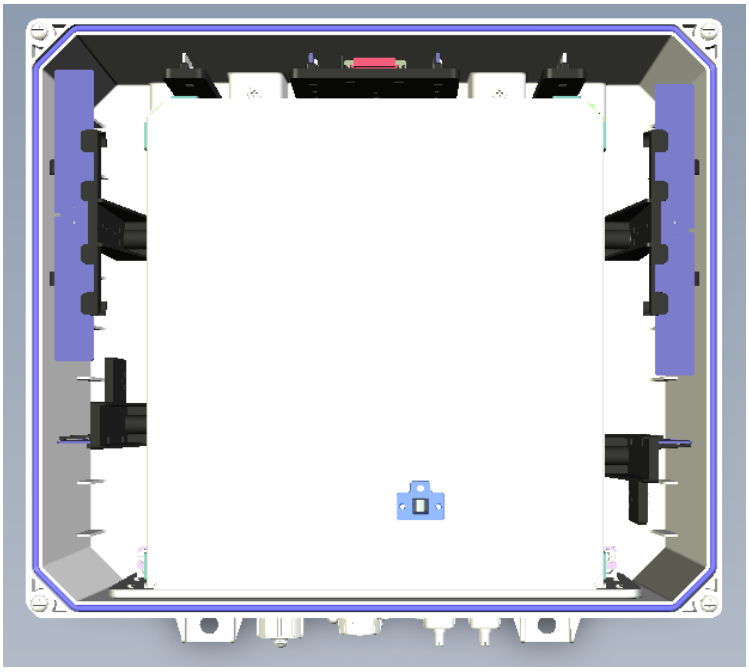

Figure 9. Top View of ECN with Cover Removed

Removing RF Shields

Prior to installing an expansion card in expansion slots 3, 4, or 5, you must remove the factory-installed RF shielding for these slots. This shielding protects the rest of the ECN electronics from unintended emissions from the wireless or cellular modems installed in these slots.

Figure 10 on page 22 shows these slots with and without their RF shielding.

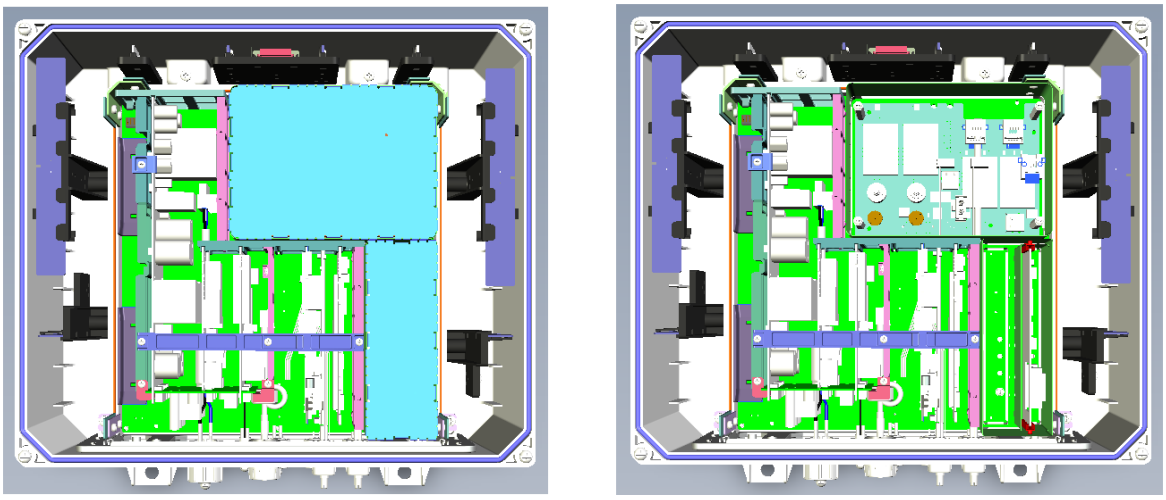

Figure 10. RF Shielding for Expansion Slots 3, 4, and 5

Installing an Expansion Card

The ECN main board includes two types of slots: system slots and expansion slots. *System slots* contain *system cards* that are installed in the factory and provide basic or pre-installed optional functionality for the ECN. *Expansion slots* contain *expansion cards* that are generally installed before field deployment (although some expansion cards can be factory installed) and provide additional functionality for the ECN. For example, an expansion card can add a modem for additional communications functionality.

There are six expansion slots (numbered 1 to 6), and five types of expansion card, types A, B, C, D, and E. Each of these types has different electrical and mechanical characteristics based on the type of functionality it is designed to provide. See *the Edge Control Node 7000 Series Expansion Card Developer's Guide* for more information about each of the card types.

Important: The ECN hardware, operating system, and communications software does not support plug and play or hot plug of expansion cards. Power must be removed from the ECN before installing, or uninstalling, an expansion card.

Installation for Card Types A and B

Access to expansion slots 1 and 2 can be made while the card cage is installed in the outer enclosure:

1. Remove the enclosure cover
2. Remove the inner card cage cover
3. Remove the card retainer

Card guides are made available for each slot, which (along with the alignment holes in the ECN main board) prevent expansion cards from being misaligned on

installation. After a card is installed, you must screw the card retainer back in place to prevent the card from becoming dislodged during transportation.

If the expansion card requires electrical connections to external devices, those electrical connections must be positioned as close as possible to the edge of the card facing the external connection plate. Connection between the card and the IP66 connector on the ECN external connection panel must use a short cable.

Installation for Card Type C

Access to expansion slots 3 and 4 can be made while the card cage is installed in the outer enclosure:

1. Remove the enclosure cover
2. Remove the inner card cage cover
3. Remove the individual RF shields

Card guides are made available for each slot, which (along with the alignment holes in the ECN main board) prevent expansion cards from being misaligned on installation. After a card is installed, you must reinstall the RF shielding.

Make antenna connections using a suitable coaxial cable, and exit the shielding as recommended. Routing for antenna cables must follow the requirements described in your compliance approvals. The antennas must be installed as directed using the mounting points provided.

Installation for Card Type D

Access to expansion slot 5 can be made while the card cage is installed in the outer enclosure:

1. Remove the enclosure cover
2. Remove the inner card cage cover
3. Remove the RF shield that protects the slot

Mount the card to the four PCB standoffs located inside the shielded enclosure using four retaining screws. You must provide an interface for the card that is compatible with expansion slot 5's mechanical and electrical requirements. You can install multiple cards at this location.

Make antenna connections using a suitable coaxial cable, and exit the shielding as recommended. Routing for antenna cables must follow the requirements described in your compliance approvals. The antennas must be installed as directed using the mounting points provided.

Installation for Card Type E

Access to expansion slot 6 can only be made when the inner card cage is removed from the outer enclosure. Gain access to the slot by removing the slot cover plate.

Mount the card using five PCB standoffs that you screw to the cover plate. Reinstall the cover plate and card into the card cage as a single assembly. You must provide an interface for the card that is compatible with expansion slot 6's mechanical and electrical requirements. You can install multiple cards at this location.

Make antenna connections using a suitable coaxial cable, and exit the shielding as recommended. Routing for antenna cables must follow the requirements described in your compliance approvals. The antennas must be installed as directed using the mounting points provided.

Installing an Antenna

You can use the internal antenna holders for your own PCB antennas. **Figure 11** shows the various antenna holders attached to the ECN inner card cage. The holders are extremely flexible and allow antennas of various sizes to be mounted on multiple planes.

Recommendations:

- Use the holders along each side for EV-DO, GPRS and ISM type applications. In particular one holder can be used on each side for diversity.
- Use the holders along the top of the card cage for Wi-Fi and Wi-Max applications.

The holders also have built in clips that can be used for locating cabling and holding protective ferrite beads.

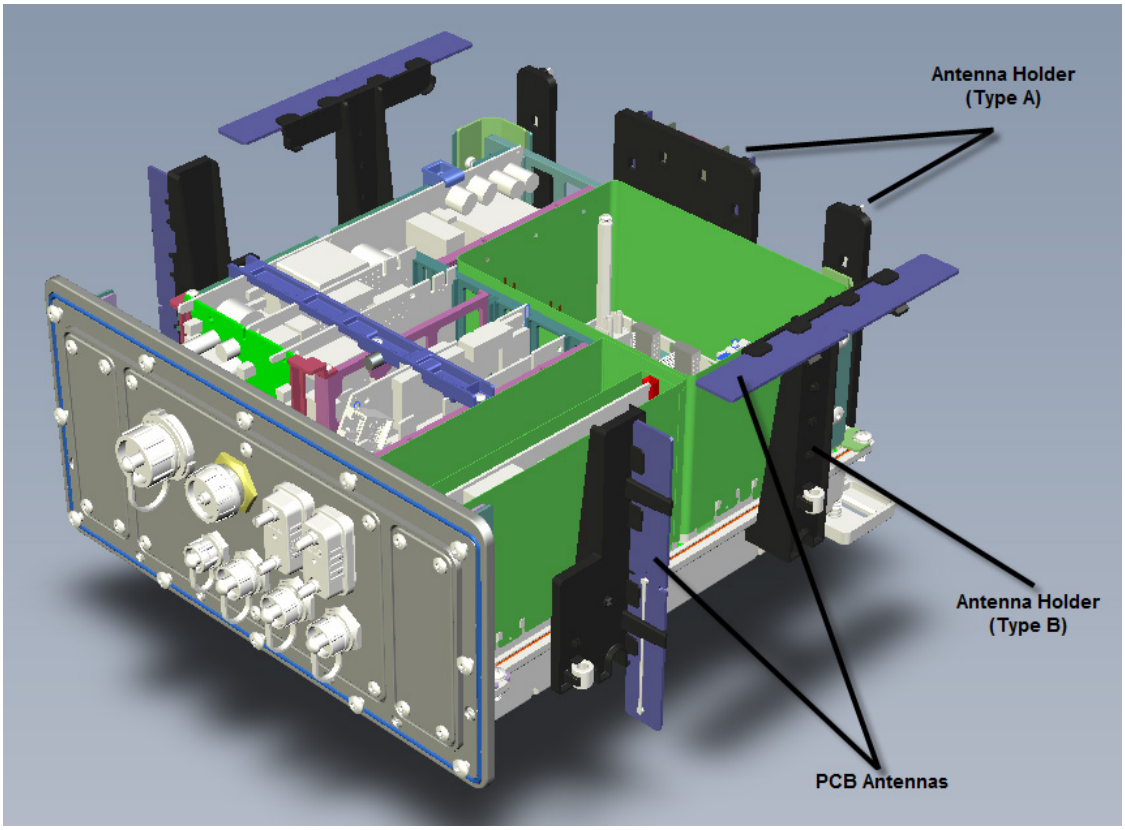

Figure 11. Antenna Holder Locations

Troubleshooting

The ECN is designed to perform without malfunctioning for a period of at least 10 years in harsh environmental conditions. In addition, the ECN outer enclosure is designed to provide IP66 protection, as defined by International Electrotechnical Commission (IEC) standard 60529. All Echelon supplied connectors are IP67 rated, and each connector has a cap designed to maintain its long-term reliability.

The main symptom of a problem with an ECN unit would be a communications problem on one or more of the communications channels. You perform different troubleshooting tasks, depending on whether the unit is already field installed or is not yet deployed.

For field-installed units, you can perform the following tasks to troubleshoot communications problems:

- Verify that the cables are correctly plugged into their connectors on the ECN bottom panel. Check that the lock nut for each connector is secure. As necessary, ensure that no pins on any of the connectors are bent or damaged.
- Attempt to communicate with the ECN unit with the COS system software. If possible, reboot the unit.
- If you cannot connect to the ECN unit from the COS system software, remove power from the unit, wait at least two minutes, and reconnect power. Verify that the unit is operational, as described in *Verifying Successful Installation* on page 33.
- If you still cannot establish communications, replace the unit, as described in Chapter 5, *Field Replacement for an ECN 7000 Series Device*, on page 49. Return the failed unit to your deployment station, or contact Echelon Support for service.

For units not yet deployed, you can perform the following tasks to troubleshoot communications problems:

- Perform the same set of tasks described above for field-installed ECN units.
- Ensure that power is **not** connected to the unit. Remove the ECN cover, as described in *Removing the Cover* on page 20. Look for any obvious problems. Ensure that each antenna (if any) is seated correctly, and that any connector cables for the antennas are secure.
- Remove the card cage, as described in *Removing the Card Cage* on page 20. Look for any obvious problems. Ensure that each card, both system and expansion, is seated correctly. Ensure that any connector cables are secure.
- Connect power to the ECN unit, and attempt to reestablish communications. **Be sure to follow proper safety protocols when supplying power with the cover removed.**
- If you still cannot establish communications, contact Echelon Support for service.

3

Pole Mount Installation

This chapter describes how to install the ECN on a utility pole.

Introduction

You can install an ECN on any standard utility pole, in either the supply space or the common area. The ECN provides a carrying loop for a carabiner hook to allow you to easily carry the ECN while climbing the pole. The ECN is also small and light enough that you can carry it while working from a boom lift.

After installation, the ECN can withstand a 115 kg (250 lb) load, for example, of a utility worker stepping on the unit. The ECN is designed to be small enough that a utility worker can gaff up the pole and around the unit with minimal difficulty.

The installation includes a bracket that you attach to the utility pole. You then attach the ECN to the installed bracket. Subsequent replacement or installation of an ECN can reuse the installed bracket, thus substantially reducing replacement installation time and effort. In addition, you can connect or disconnect the ECN from either power or the communications network easily, without having to uninstall the entire unit.

Required Tools

To perform the installation for the Pole Mounting Bracket, you will need the following tools:

- Support bolt: 12 to 70 cm (4.5 to 27.5 inches) in length (depends on the pole class and the planned installation height for the ECN), 1.6 cm (5/8 inch) in diameter
- One or two 1.6 cm (5/8 inch) washers, combined thickness 5.72 cm (2-1/4 inch)
- One 1.6 cm (5/8 inch) square-head or hex-head nut
- A drill, with drill bit appropriate for a 1.6 cm (5/8 inch) diameter bolt that is 12 to 70 cm (4.5 to 27.5 inches) in length
- A wrench suitable for 1.6 cm (5/8 inch) bolts
- A wire stripping tool
- A fiberglass or plastic cable puller tool
- A standard Phillips® screwdriver, Point Size 2

In addition to the tools listed above, you need an ECN Pole Mount Kit and the appropriate ECN input power cable accessory:

- The input power cable accessory is available in three lengths: 3 m, 9 m, and 12 m (10 ft, 30 ft, and 40 ft).
- The cable type conforms to the specifications for 1.29 mm (16 AWG) stranded copper conductors. The outer jacket for the cable is insulated (600 V rating). The cable includes four conductors:
    - Black: Phase 1
    - Blue: Phase 2
    - Red: Phase 3

- White: Neutral

The ECN does not use the blue connector (phase 2).

- The end of the cable that connects to the ECN input power connector is fitted. The other end of the cable is not fitted.

Installation Location

Typically, you install the ECN on a utility pole either in the supply space (near the service distribution transformer) or in the common area (3-½ to 4-½ meters or 12 to 15 feet above ground level).

Important: Do not install the ECN in the communication space; that space is reserved for cable, telephone, and other companies to install their equipment.

For optimal antenna performance, you should place the ECN as high on the utility pole as possible, in the supply space. However, many installations will install the ECN common area: installation in the common area is typically easier to perform, less expensive, and involves less risk for the installer.

Preparing for Installation

After you have selected the installation location on the utility pole (within the supply space or in the common area), determine the distance from the low-voltage (LV) attachment point (typically at or near the service distribution transformer) and the proposed installation point for the ECN. If the ECN input power cable is shorter than this distance, splice an additional length of cable and weather seal that splice.

When the ECN is installed in the common area, the input power cable must be shielded in a protective conduit to protect the input power cable from communications workers and other personnel who climb the pole. When the ECN is installed in the supply space, this protective conduit is not necessary. You can use a simple vertical wire guard, but generally you should use Schedule 40 conduit.[2] Leave both the top and bottom of the conduit open so that water can flow freely through the conduit. The bottom end of the conduit should terminate near the ECN, but should not be attached to it. Feed the input power cable through the conduit and connect it to an available power source.

Drill a hole through the utility pole. The diameter of this hole should be able to fit a 1.6 cm (5/8 inch) diameter bolt securely. The hole should be centered horizontally with respect to the pole diameter, and should be centered vertically with respect to the planned location of the ECN.

Performing the Installation

To install the ECN using the pole mount method, perform the following tasks:

1. Attach the Pole Mounting Bracket to the pole
2. Attach the ECN to the Pole Mounting Bracket
3. Secure the ECN to the Pole Mounting Bracket

[2] See UL 651, NEMA TC-2, or NEC-Article 352 for Schedule 40 specifications.

4. Connect the ECN to power and to the network
5. Complete the installation

Each of these tasks is described in the following sections.

Attach Pole Mounting Bracket

You connect the ECN to the utility pole using the hole that you drilled into the pole to prepare for installation; see *Preparing for Installation* on page 29. Place the bracket against the pole, insert the support bolt, and secure the bolt with a washer and nut, as shown in **Figure 12**. The Pole Mounting Bracket is designed to fit any standard utility pole.

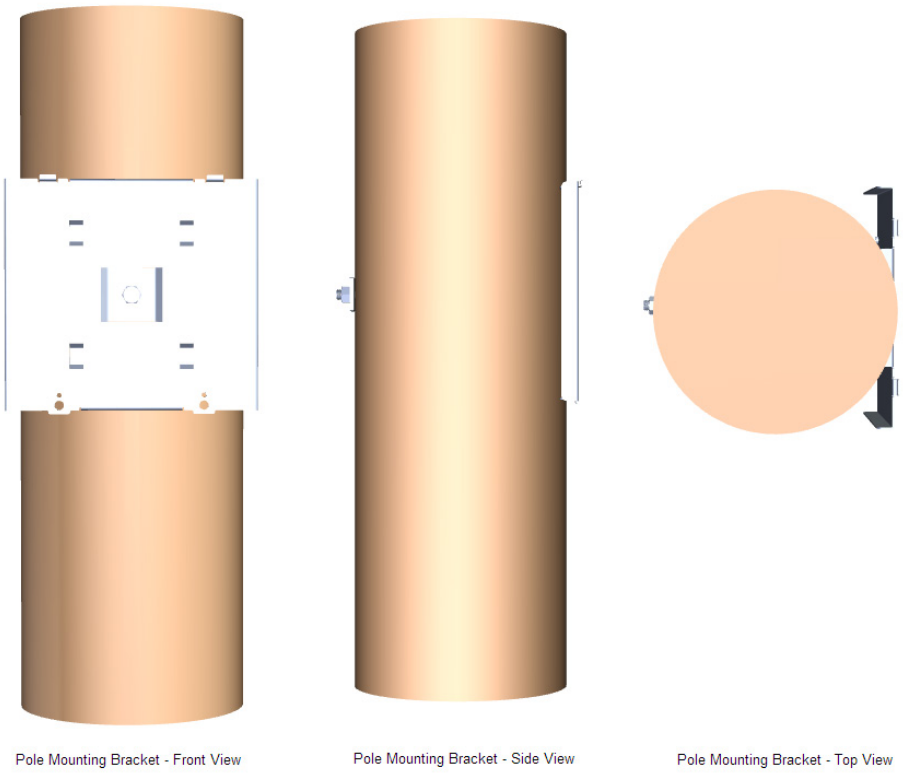

Figure 12. Attach Pole Mounting Bracket

Attach ECN to Pole Mounting Bracket

After the Pole Mounting Bracket is securely attached to the utility pole, you can attach the ECN to the Pole Mounting Bracket. The top of the back side of the ECN includes two tabs that slide into the top of the Pole Mounting Bracket. **Figure 13** on page 31 shows the ECN attached to the Pole Mounting Bracket.

Note that if you should need to replace an ECN, you need replace only the ECN and not the Pole Mounting Bracket.

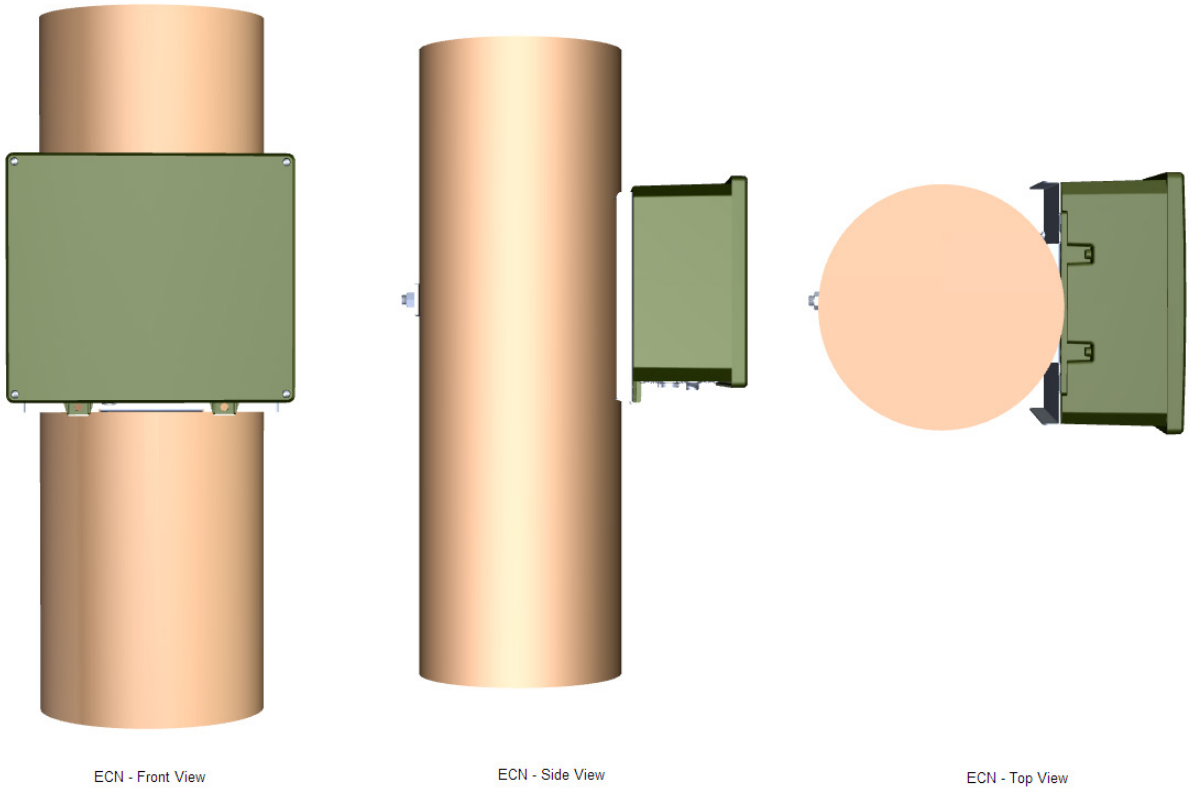

Figure 13. Attach the ECN to the Pole Mounting Bracket

Secure ECN to Pole Mounting Bracket

To secure the ECN to the Pole Mounting Bracket, secure the two captive ¼-20 screws to the bottom of the ECN to attach it to the Pole Mounting Bracket. These screws are already connected to the ECN, and are designed not to make contact with the pole. **Figure 14** on page 32 shows a front view of the ECN attached to the Pole Mounting Bracket, with the bottom screws visible.

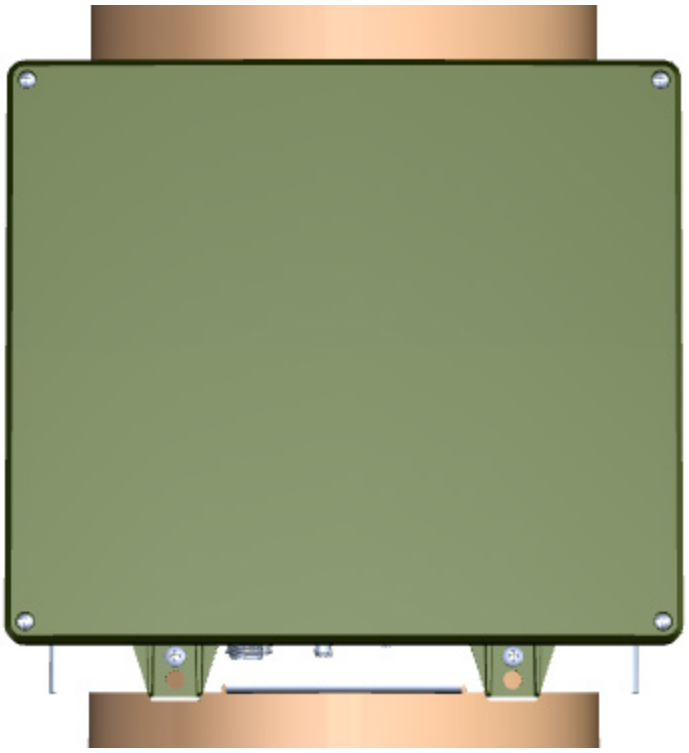

Figure 14. Secure the ECN to the Pole Mounting Bracket

Connect the ECN to Power and the Network

You make the connections to power and to the communications network at the bottom of the ECN. All Echelon supplied connectors are IP67 rated. Each connector has a cap designed to maintain its long-term reliability. **Figure 15** on page 33 shows the bottom of a typical ECN, before installation.

You can connect the ECN to either low voltage, or with the CT option, medium voltage.

The exact configuration of the ECN bottom panel depends on the options that you have installed in the ECN, but at a minimum, the bottom panel has a connection for power. In the figure, the upper left connection is for power.

To make the power connection, remove the cap, insert the power cable, and twist the cable ¼ turn to lock it in place.

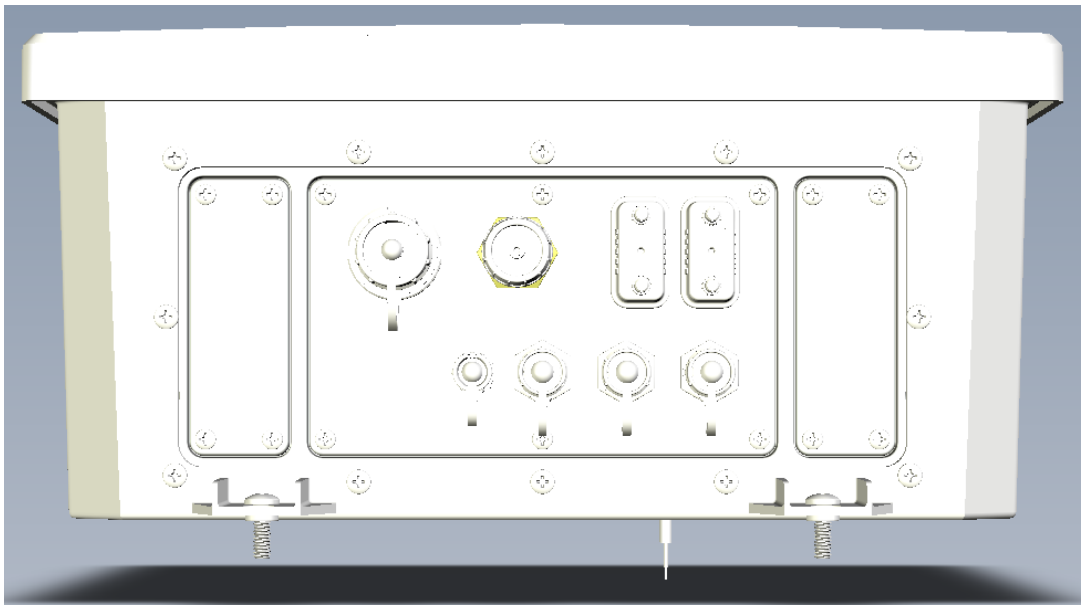

Figure 15. Connect the ECN to Power and the Network

Complete the Installation

After the installation is complete, perform the following tasks:

1. Inspect the connection of the ECN to the Pole Mounting Bracket.
2. Inspect the connection of the Pole Mounting Bracket to the utility pole.
3. Inspect the cabling connections to the ECN.

The completed installation should look similar to the views depicted in **Figure 13** on page 31. Note that the figure does not show the cabling connections to the ECN.

Verifying Successful Installation

Because the ECN has no external lights or displays, it uses an internal audio buzzer to provide indications of important installation-related states. The buzzer's audio frequency is 2.4 kHz (as a 1/2 duty cycle square wave) and outputs 85 to 92 dBA of sound pressure,[3] which should be audible from at least 10 m (30 ft). **Table 3** on page 34 lists the sound patterns for the audio indicator. The audio indicator outputs its audio indicator patterns only during ECN startup.

[3] dBA measures sound pressure levels relative to 20 µPa (rms) at 1 m.

Table 3. Internal Audio Indicator Sound Patterns

Sound Pattern			
On (ms)	**Off (ms)**	**Repeat**	**Description**
1000	0	1	ECN boot process successful System Manager is now running
4000	0	1	ECN boot process failed
1000	500	2	WAN connection to cell tower successful
4000	200	2	WAN connection to cell tower failed
1000	500	3	Connection to System Software successfully established
4000	200	3	Connection to System Software failed

As the table shows, a successful installation should include several 1 second sound bursts, some with a repeated pattern (1 s on, 0.5 s off) to indicate successful network connections. If you receive a 4 s sound burst, the ECN boot process failed. If you receive the repeated pattern (4 s on, 0.2 s off), a network connection failed; check the network cable connection and verify that the network is operational.

After installation is verified successful, use the COS Web page interface for the ECN to verify additional functionality. You might also want use the command-line interface to disable the internal audio indicator so that subsequent resets or power events do not cause the audio indicator to output its audio indicator patterns. You can also change the audio indicator patterns by modifying the controller configurable file (CCF); see the *COS User's Guide* for information about modifying the audio indicator patterns.

4

Pad Mount Installation

This chapter describes how to install the ECN on a service distribution transformer that is mounted on a transformer pad.

Introduction

You can install an ECN on the same transformer pad as a service distribution transformer, and secure it to the transformer without drilling holes into or otherwise damaging the transformer housing. After installation, the ECN is resistant to manual removal, and none of the electrical or communications network connections can be accessed by unauthorized personnel.

The installation includes a bracket that you attach to the transformer housing and transformer pad. You then attach the ECN to the installed bracket. Subsequent replacement or installation of an ECN can reuse the installed bracket, thus substantially reducing replacement installation time and effort. In addition, you can connect or disconnect the ECN from either power or the communications network easily, without having to uninstall the entire unit.

Required Tools

To perform the installation for the Pad Mounting Bracket, you will need the following tools:

- Connection bolt: 5 cm (2 inches) in length, 1.6 cm (5/8 inch) in diameter
- A 1.6 cm (5/8 inch) washer
- Two 1.6 cm (5/8 inch) concrete-compatible bolt kits
- Conduit housing
- A wrench suitable for 1.6 cm (5/8 inch) bolts
- A wire stripping tool
- A fiberglass or plastic cable puller tool
- A standard Phillips screwdriver, Point Size 2
- A shovel (hand or power) or similar digging tool
- Standard conduit sealing putty or foam

In addition to the tools listed above, you need an ECN Pad Mount Kit and the appropriate ECN input power cable accessory:

- The input power cable accessory is available in three lengths: 3 m, 9 m, and 12 m (10 ft, 30 ft, and 40 ft).
- The cable type conforms to the specifications for 1.29 mm (16 AWG) stranded copper conductors. The outer jacket for the cable is insulated (600 V rating). The cable includes four conductors:
    - Black: Phase 1
    - Blue: Phase 2
    - Red: Phase 3
    - White: Neutral

  The ECN does not use the blue connector (phase 2).
- The end of the cable that connects to the ECN input power connector is fitted. The other end of the cable is not fitted.

Installation Location

For optimal antenna performance, you should place the ECN as high on the distribution transformer as possible. However, most installations will require that the top of the ECN after installation extend no higher than the top of the transformer. A typical residential transformer measures between 46 cm (18 inches) and 74 cm (29 inches) in height. If you place the ECN exactly even with the top of the transformer, you have between 15 cm (6 inches) and 43 cm (17 inches) clearance from the transformer pad to the bottom of the ECN. For most installations, this clearance is sufficient to connect the installed ECN to external power and the communication network.

Installation rules also typically require that the top of the 1.9 cm or 3.2 cm (¾" or 1-1/4") flexible conduit should be at least 7.6 cm (3 inches) above grade level to prevent water ingress into the conduit. That is, there must be at least 7.6 cm (3 inches) of clearance from the bottom locking nut on the outside of the 1.9 cm or 3.2 cm (¾" or 1-1/4") flexible conduit.

Preparing the Transformer Pad

To prepare to connect the ECN to the power mains at the transformer, perform the following tasks:

1. Open the transformer cover to determine the location of an unused pre-cored hole in the transformer pad. This hole must be large enough to accommodate the 1.9 cm or 3.2 cm (¾" or 1-1/4") flexible conduit for the ECN.
2. Use a shovel or similar tool to dig under the transformer pad to clear space for the conduit.
3. Fit the conduit up and into the hole.
4. Position the conduit as near to the lifting nut on the side of the transformer as possible. Ideally, the conduit should be positioned vertically under the lifting nut.
5. Cut to the conduit to the approved length.
6. Replace the dirt below the transformer pad.
7. Close the transformer cover.

Preparing for Installation

After you prepare the transformer pad, you can complete installation preparation by performing the following steps:

1. Use a cable stripping tool to strip approximately 45 cm (18 inches) of the insulating jacket from the conductors of the non-fitted end of the power cable.
2. Use a fiberglass or plastic cable puller tool to thread the power cable though the conduit that you prepared in the previous section, *Preparing the Transformer Pad*.
3. On the transformer side, attach the cables to the transformer so that they can provide power to the ECN.

4. Seal the top of the conduit inside the transformer cover with sealing putty or foam. This seal ensures that water and foreign objects cannot enter the transformer housing.
5. Seal the end of the conduit that is external to the transformer cover with sealing putty or foam.

After the conduit and cabling are ready, you can install the ECN. See the next section, *Performing the Installation*.

Performing the Installation

To install the ECN using the pad mount method, perform the following tasks:

1. Extend the Pad Mounting Bracket
2. Attach the Pad Mounting Bracket to the transformer's lifting nut
3. Attach the Conduit Housing to the Pad Mounting Bracket
4. Insert a Conduit Thread into the Conduit Housing
5. Attach the ECN to the Pad Mounting Bracket
6. Secure the ECN to the Pad Mounting Bracket
7. Connect the ECN to power and to the network
8. Close and lock the Conduit Housing
9. Complete the installation

Each of these tasks is described in the following sections.

Extend Pad Mounting Bracket

You connect the ECN to the transformer using the transformer's lifting nut, as described in *Attach Pad Mounting Bracket to Lifting Nut* on page 39. The Pad Mounting Bracket is designed to secure the ECN to the transformer's lifting nut, regardless of the location of the lifting nut.

The Pad Mounting Bracket is vertically adjustable (from approximately 46 cm [18 inches] to 92 cm [36 inches]) so that you can match the 1.9 cm (3/4 inch) horizontal slots with the position of the transformer lifting nut. **Figure 16** on page 39 shows the Pad Mounting Bracket fully extended.

Figure 16. Extend the Pad Mounting Bracket

Attach Pad Mounting Bracket to Lifting Nut

Because it is generally inadvisable to drill holes into the transformer housing, you use one of the 1.6 cm (5/8 inch) welded lifting nuts (inside the transformer cabinet and exposed through a hole in the transformer casing) as the installation point.

Locate one of the transformer's lifting nuts. There is no standard for the location of the lifting nuts, but typically one is within a few centimeters (an inch or two) of the top of the transformer.

Measure the distance from the lifting nut to the top of the transformer, and extend the Pad Mounting Bracket to ensure that after the bracket is attached to the lifting nut, the top of the bracket is as close to the top of the transformer as possible.

To secure the ECN to the transformer's lifting nut, temporarily remove the nut. Position the Pad Mounting Bracket so that one of the horizontal slots matches the position of the lifting nut. Attach the Pad Mounting Bracket to the lifting nut. **Figure 17** on page 40 shows the Pad Mounting Bracket attached to the lifting nut.

After you secure the Pad Mounting Bracket to the lifting nut, secure the bracket to the transformer pad using the two 1.6 mm (5/8 inch) slots at the bottom of the bracket.

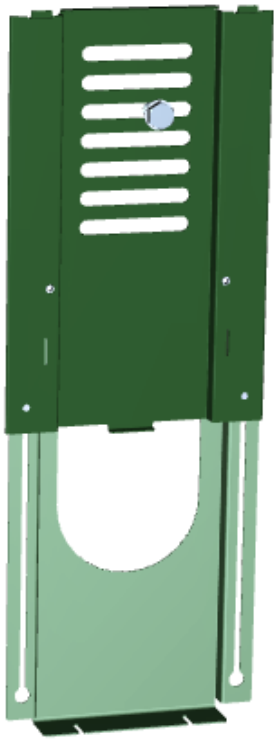

Figure 17. Attach the Mounting Bracket to the Transformer's Lifting Nut

Attach Conduit Housing to Pad Mounting Bracket

To protect the electrical and network connections to the ECN, the Pad Mounting Bracket includes a Conduit Housing. The Conduit Housing is approximately 13 cm (5 inches) high and 30 cm (12 inches) wide. Attach the Conduit Housing to the bottom of the upper extension of the Pad Mounting Bracket, as shown in **Figure 18** on page 41. You can perform this step prior to field installation.

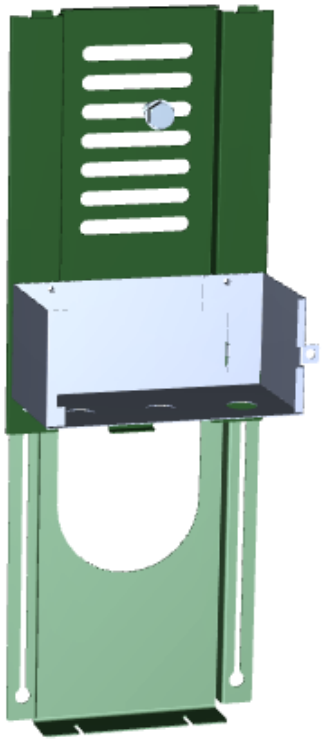

Figure 18. Attach the Conduit Housing to the Pad Mounting Bracket

Insert Conduit Thread into Conduit Housing

To protect the electrical and network cabling as it enters the Pad Mounting Bracket Conduit Housing, insert a Conduit Thread unit into one of the available holes in the bottom of the Conduit Housing. The Conduit Thread should accommodate the locking nut for the conduit and the radius of one or more cable bundles. The Conduit Housing provides three cutouts for conduits; at least one of these should be precut to allow for insertion of the electrical and network cabling.

Insert the Conduit Thread into the Conduit Housing, as shown in **Figure 19** on page 42. You can perform this step prior to field installation.

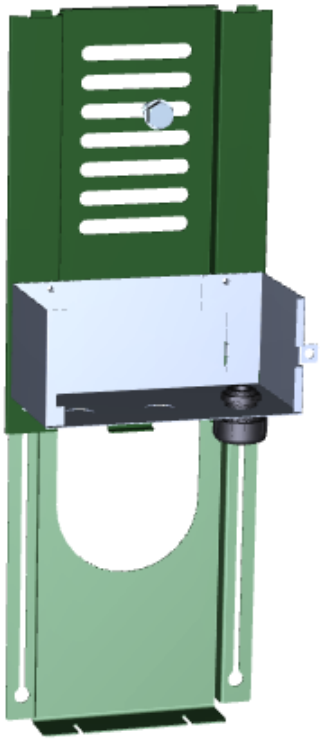

Figure 19. Insert a Conduit Thread into the Conduit Housing

Attach ECN to Pad Mounting Bracket

After the Pad Mounting Bracket is securely attached to the transformer, and the Conduit Housing is securely in place, you can attach the ECN to the Pad Mounting Bracket. The top of the back side of the ECN includes two tabs that slide into the top of the Pad Mounting Bracket. **Figure 20** on page 43 shows the ECN attached to the Pad Mounting Bracket.

Note that if you should need to replace an ECN, you need replace only the ECN and not the Pad Mounting Bracket.

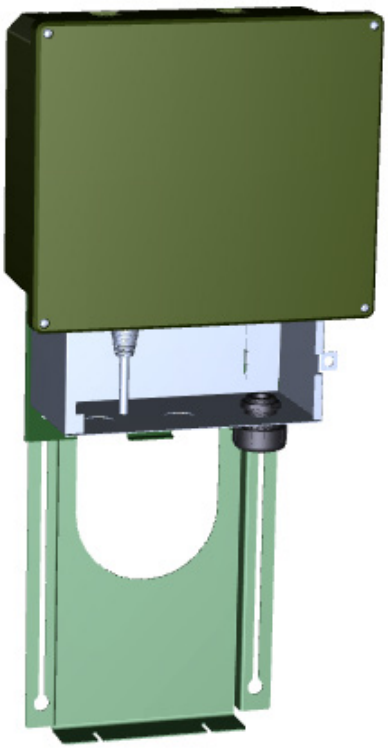

Figure 20. Attach the ECN to the Pad Mounting Bracket

Secure ECN to Pad Mounting Bracket

To secure the ECN to the Pad Mounting Bracket, secure the two captive ¼-20 screws to the bottom of the ECN to attach it to the Pad Mounting Bracket. These screws are designed not to make contact with the transformer. **Figure 21** on page 44 shows a front view of the ECN attached to the Pad Mounting Bracket, with the bottom screws visible.

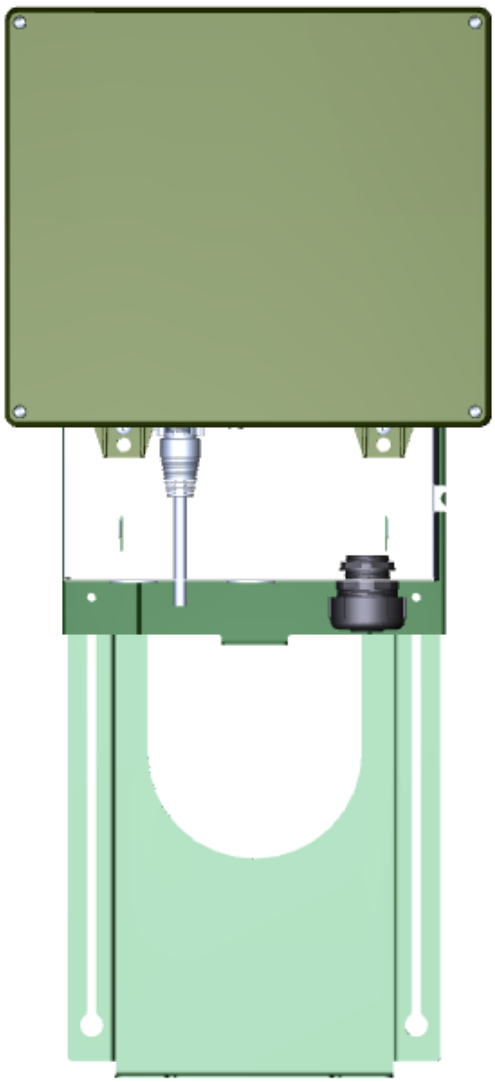

Figure 21. Secure the ECN to the Pad Mounting Bracket

Connect the ECN to Power and the Network

You make the connections to power and to the communications network at the bottom of the ECN, which is inside the Conduit Housing. All Echelon supplied connectors are IP67 rated. Each connector has a cap designed to maintain its long-term reliability. **Figure 22** on page 45 shows the bottom of a typical ECN, before installation.

You can connect the ECN to either low voltage, or with the CT option, medium voltage.

The exact configuration of the ECN bottom panel depends on the options that you have installed in the ECN, but at a minimum, the bottom panel has a connection for power. In the figure, the upper left connection is for power.

To make the power connection, remove the cap, insert the power cable, and twist the cable ¼ turn to lock it in place.

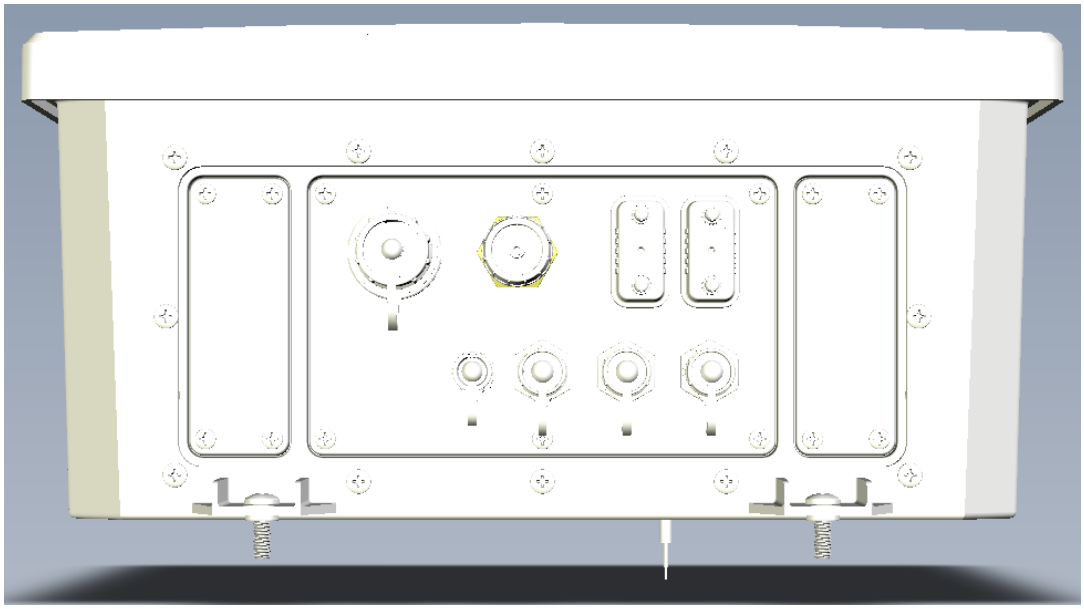

Figure 22. Connect the ECN to Power and the Network

Because the transformer's lifting nut is not necessarily centered vertically with where you placed the 1.9 cm or 3.2 cm (¾" or 1-1/4") flexible conduit relative to the transformer pad, ensure that the flexible conduit is long enough to reach both the Conduit Housing and the connections on the ECN.

Close and Lock the Conduit Housing

After you have completed all cabling connections and are ready to complete ECN installation, close the Conduit Housing door and secure it with a lock, as shown in **Figure 23** on page 46. The Conduit Housing includes a 1.3 cm (½ inch) hasp hole for the lock.

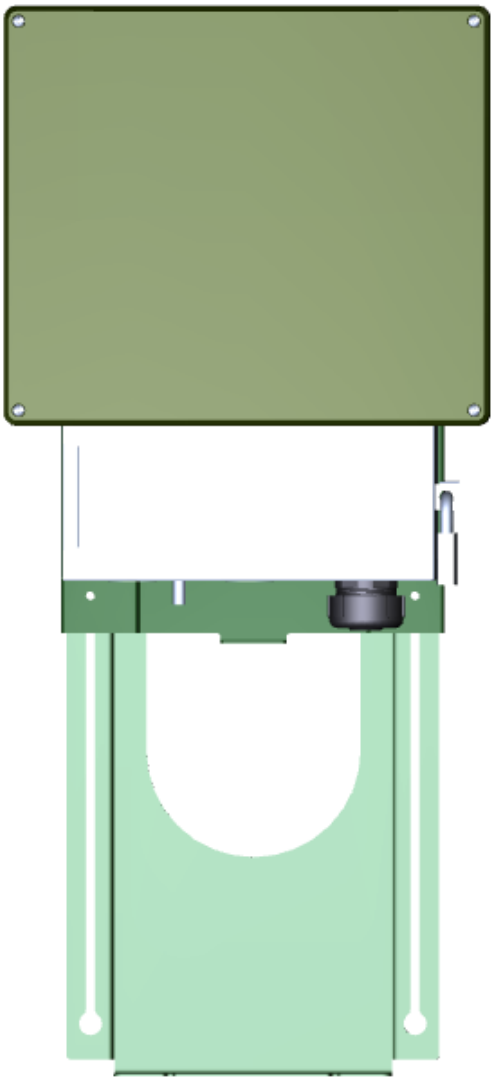

Figure 23. Close and Lock the Conduit Housing

Complete the Installation

After the installation is complete, perform the following tasks:

1. Inspect the connection of the ECN to the Pad Mounting Bracket.
2. Inspect the connection of the Pad Mounting Bracket to the transformer.
3. Inspect the cabling connections to the ECN.
4. Inspect the transformer pad.

The completed installation should look similar to the views depicted in **Figure 24** and **Figure 25** on page 47. Note that the figures do not show the cabling connections to the ECN.

Figure 24. Complete ECN Installation, Viewed from the Left

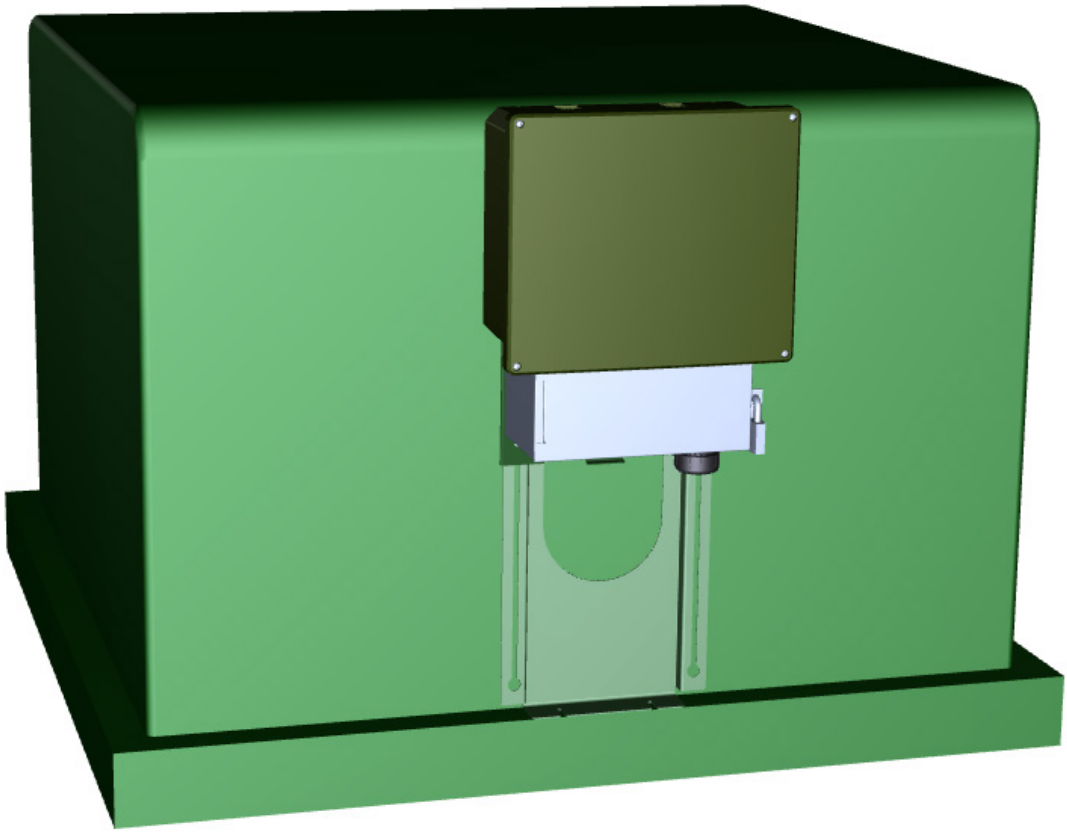

Figure 25. Complete ECN Installation, Viewed from the Front

Verifying Successful Installation

Because the ECN has no external lights or displays, it uses an internal audio buzzer to provide indications of important installation-related states. The buzzer's audio frequency is 2.4 kHz (as a 1/2 duty cycle square wave) and outputs 85 to 92 dBA of sound pressure,[4] which should be audible from at least 10 m (30 ft). **Table 4** lists the sound patterns for the audio indicator. The audio indicator outputs its audio indicator patterns only during ECN startup.

Table 4. Internal Audio Indicator Sound Patterns

Sound Pattern			
On (ms)	**Off (ms)**	**Repeat**	**Description**
1000	0	1	ECN boot process successful System Manager is now running
4000	0	1	ECN boot process failed
1000	500	2	WAN connection to cell tower successful
4000	200	2	WAN connection to cell tower failed
1000	500	3	Connection to System Software successfully established
4000	200	3	Connection to System Software failed

As the table shows, a successful installation should include several 1 second sound bursts, some with a repeated pattern (1 s on, 0.5 s off) to indicate successful network connections. If you receive a 4 s sound burst, the ECN boot process failed. If you receive the repeated pattern (4 s on, 0.2 s off), a network connection failed; check the network cable connection and verify that the network is operational.

After installation is verified successful, use the COS Web page interface for the ECN to verify additional functionality. You might also want use the command-line interface to disable the internal audio indicator so that subsequent resets or power events do not cause the audio indicator to output its audio indicator patterns. You can also change the audio indicator patterns by modifying the controller configurable file (CCF); see the *COS User's Guide* for information about modifying the audio indicator patterns.

[4] dBA measures sound pressure levels relative to 20 µPa (rms) at 1 m.

5

Field Replacement for an ECN 7000 Series Device

This chapter describes how to replace an ECN or an ECN's battery pack after the ECN has been installed in the field.

Overview

The ECN 7000 Series of products is designed to allow you to easily replace an ECN unit in the field after installation. For ECN units with the backup battery option, you can also easily replace the battery in the field.

Because an ECN is typically installed in a location that exposes it to weather and other hazards, you might need to replace ECN units from time to time. In addition, you might want to replace a working unit with one that includes additional or different expansion cards to provide additional services for your customers.

Because the ECN's cover is not designed to be removed in the field (the cover is secured with one-way screws), you generally cannot perform in-field service for an ECN. If an ECN becomes non-operational, you should replace it in the field with a similarly equipped model to maintain operational service for your customers. You can return the non-operational ECN to your service center for maintenance; see *Troubleshooting* on page 25 for additional information.

Replacing a Pole-Mounted ECN

Important: Before replacing an ECN in the field, visually inspect the unit and its surroundings to ensure that the unit is not damaged and that it is safe to handle.

You do not need to reinstall the Pole Mounting Bracket to replace an ECN unit.

To remove a pole-mounted ECN:

1. If possible, use the COS system software to shut down the unit remotely, before beginning field replacement.
2. Remove all network connections from the bottom of the unit.
3. Remove the power connection from the unit.
4. Remove the screws at the bottom of the unit. These screws will remain attached to the ECN.
5. Lift the ECN from the Pole Mounting Bracket.
6. Attach a carabiner hook to the ECN carry loop to safely transport it to the ground.

To install a replacement pole-mounted ECN:

1. Attach the ECN to the Pole Mounting Bracket, as described in *Attach ECN to Pole Mounting Bracket* on page 30.
2. Secure the ECN to the Pole Mounting Bracket using the screws at the bottom of the unit, as described in *Secure ECN to Pole Mounting Bracket* on page 31.
3. Connect the ECN to power and to the network, as described in *Connect the ECN to Power and the Network* on page 32.
4. Verify successful installation, as described in *Verifying Successful Installation* on page 33.

Replacing a Pad-Mounted ECN

Important: Before replacing an ECN in the field, visually inspect the unit and its surroundings to ensure that the unit is not damaged and that it is safe to handle.

You do not need to reinstall the Pad Mounting Bracket to replace an ECN unit.

To remove a pad-mounted ECN:

1. If possible, use the COS system software to shut down the unit remotely, before beginning field replacement.
2. Unlock the Conduit Housing and open the Conduit Housing door.
3. Remove all network connections from the bottom of the unit.
4. Remove the power connection from the unit.
5. Remove the screws at the bottom of the unit. These screws are captive, and remain attached to the ECN.
6. Lift the ECN from the Pad Mounting Bracket.

To install a replacement pad-mounted ECN:

1. Attach the ECN to the Pad Mounting Bracket, as described in *Attach ECN to Pad Mounting Bracket* on page 42.
2. Secure the ECN to the Pad Mounting Bracket using the screws at the bottom of the unit, as described in *Secure ECN to Pad Mounting Bracket* on page 43.
3. Connect the ECN to power and to the network, as described in *Connect the ECN to Power and the Network* on page 44.
4. Close the Conduit Housing and lock the door, as described in *Close and Lock the Conduit Housing* on page 45.
5. Verify successful installation, as described in *Verifying Successful Installation* on page 48.

Replacing the Battery Pack

To allow the ECN to run continuously, regardless of external power conditions, the ECN includes a backup battery option. If your ECN includes this option, you will occasionally need to replace the batteries.

The battery module is located in its own dedicated compartment accessible from the outside of the ECN enclosure, as shown in **Figure 26** on page 52. Within this compartment, a blind-mate electrical connector allows easy installation of the battery module. This separate compartment is weather tight and provides shielding from sensitive electronics and transceivers.

Important: Removing any of the front panels compromises the factory seal. You must use the replacement gaskets and sealing screws included with the battery kit to reestablish a proper seal.

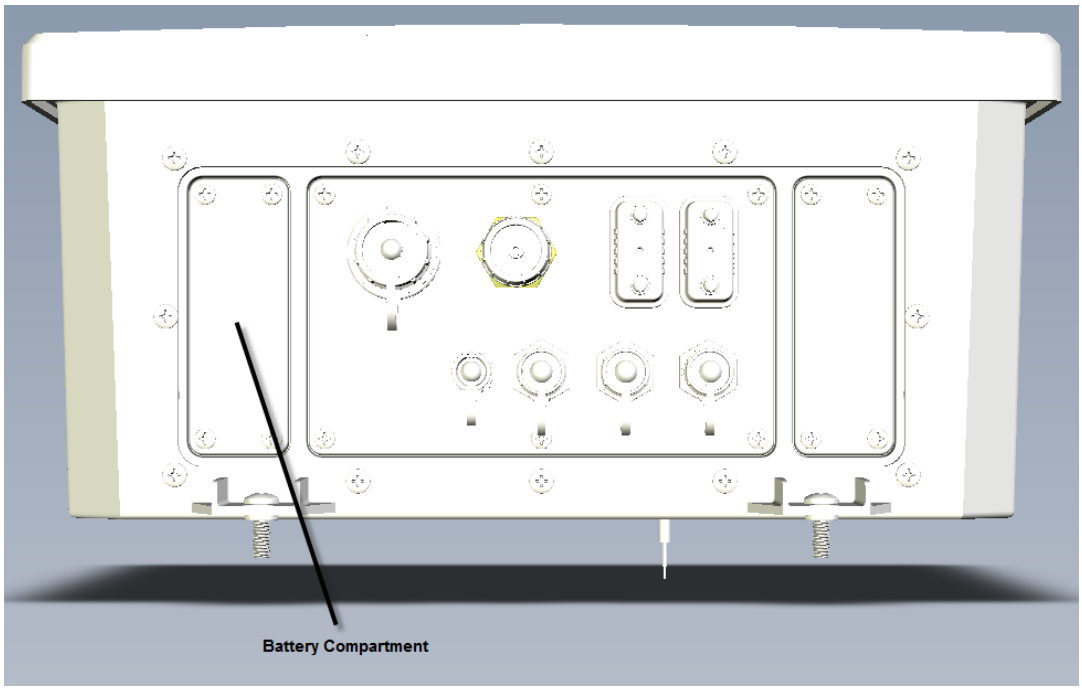

Figure 26. ECN Battery Compartment Location

Required tools for replacing the battery pack:

- A standard Phillips screwdriver, Point Size 2
- The battery replacement kit, which includes the battery pack and four sealing screws

To remove the battery pack:

1. Loosen and remove the four screws at the edges of the battery compartment.
2. The battery pack is held in place by a restraining tab, as shown in **Figure 27** on page 53. Gently press the tab to release the battery pack.
3. Remove the battery pack from the ECN.

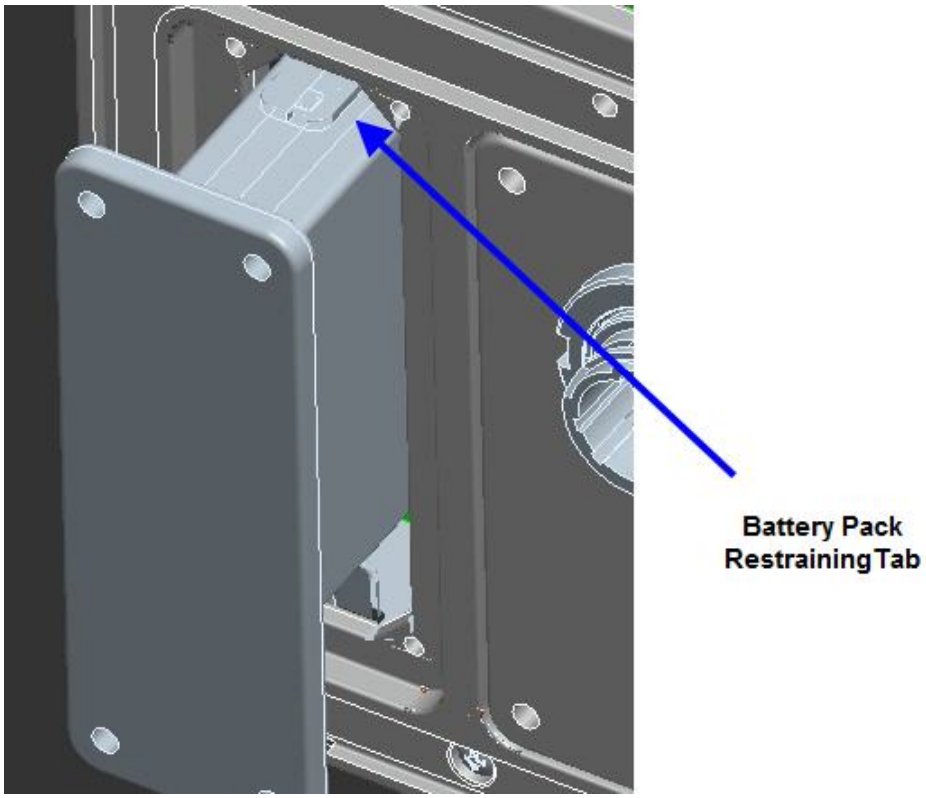

Figure 27. Battery Pack Restraining Tab

To replace the battery pack:

1. Insert the battery pack into the battery compartment. The restraining tab must be oriented toward the ECN cover. The restraining tab will click into place.
2. Ensure that the battery pack's gasket makes a good seal with the battery compartment.
3. Insert and tighten the four sealing screws. Tighten the screws in a diagonal "X" pattern (alternating top-left, bottom-right, top-right, bottom-left). Tighten the screws to no more than 9.1 (±0.4) lbf-in (10.4 [±0.5] kgf-cm) torque.

A

ECN 7000 Series Specifications

This appendix lists the specifications for the ECN 7000 Series of products.

General Specifications

Table 5 summarizes the general specifications for ECN 7650 devices.

Table 5. General Specifications

Category	Rating
Input Voltage: Single Phase (Non-network) Single Phase (Network)	 3-wire 120/240 V ±20% 60 Hz ±2%, 1 A L1/L3 to N: 120 V; L1 to L3: 240 V 3-wire 120/208 V ±20% 60 Hz ±2%, 1 A L1/L3 to N: 120 V; L1 to L3: 208 V
Maximum Voltage	L1/L3 to N: 176 V L1 to L3: 305 V
Battery Power Input (Optional)	Battery backup module (15 minutes) Uninterruptible Power Supply (UPS) interface module (input 12 V or 24 V)
Power Consumption	5 W typical 30 W maximum
Phase Coupling	Connections for 3 phases (L1Φ, L2Φ, L3Φ) and Neutral.
Dimensions	H: 34.7 cm – W: 37.5 cm – D: 19.1 cm (H: 13.67 in – W: 14.75 in – D: 7.52 in)
Weight	<6.4 kg (<14 lb)
Enclosure	UV stable plastic (grey or green); rated NEMA4
Connectors	IP67 rated
Mounting	Separate mounting kit
Security	Impact- and vandal-resistant metal High-security screws Tamper detection (operates whether powered or unpowered) Optional tilt detector
Serial Number Indication	Text and barcode

Category	Rating
Clock	Real-time clock accurate to better than ±1 minute per month; corrected by System Software. Maintained by backup battery.

Environmental Rating Specifications

Table 6 summarizes the environmental rating specifications for ECN 7650 devices.

Table 6. Environmental Rating Specifications

Category	Rating
Operating Temperature Range	–40 °C to +70 °C (–40 °F to +158 °F) Certain options (for example, radios) could have additional limits. ANSI C12.1 2008 4.7.3.16 168 hrs –40 °C to +70 °C
Storage Temperature Range	–40 °C to +85 °C –40 °F to +185 °F) ANSI C12.1 2008 4.7.3.15 168hrs –40 °C to +85 °C
Effective Relative Humidity	0% to 95%, non-condensing As per ANSI C12.1 2008 ANSI C12.1 2008 4.7.3.22 in accordance with ASTM G155
Weather Simulation Test	ANSI C12.1 2008 4.7.3.22 in accordance with ASTM G155
Salt Spray Test	ANSI C12.1 2008 4.7.3.23 in accordance with ASTM B117
Raintightness	NEMA 4 and ANSI C12.1 2008 4.7.3.24 in accordance with UL 50 E
Solar Radiation	As per ANSI C12.1 2008
Salt Fog	As per ANSI C12.1 2008

Mechanical Specifications

Table 7 on page 58 summarizes the mechanical specifications for ECN 7650 devices.

Table 7. Mechanical Specifications

Category	Rating
General Mechanical Requirements	IEC 60068-2-11
Mechanical Tests:	
Mechanical Shock	ANSI C12.1 2008 4.7.3.18 in accordance with IEC 60068-2-27
Transportation Drop	ANSI C12.1 2008 4.7.3.19 in accordance with ISTA procedure 1A As per ANSI C12.1 2008
Mechanical Vibration	ANSI C12.1 2008 4.7.3.20 in accordance with IEC 60068-2-6 As per ANSI C12.1 2008
Transportation Vibration	ANSI C12.1 2008 4.7.3.21 in accordance with ISTA procedure 1A
Resistance to Heat and Fire	IEC 60695-2-11
Mechanical Wind Shear	Can withstand a 190 Pa (4 lb/sq-ft) wind simultaneously with (12 mm) ½" thick ice

Electrical Specifications

Table 8 summarizes the electrical specifications for ECN 7650 devices.

Table 8. Electrical Specifications

Category	Rating
Specified Operating Range	240 V_{AC} ± 20%
Internal Fuse	Littelfuse® 215SP Series, 250VAC Time-Lag Fuse (0215063MXESPP); Amperage rating 6.3 A. Interrupting rating 1500 A @ 250 VAC. Designed in accordance with IEC60127-3.
Insulation Resistance	ANSI C12.1 2008 4.7.3.1 2.5kV for 1 minute
Voltage Interruptions	ANSI C12.1 2008 4.7.3.2

Category	Rating
High Voltage Surge	ANSI C12.1 2008 4.7.3.3.1 100kHz Ring Wave in accordance with ANSI C62.41 (Category B) ANSI C12.1 2008 4.7.3.3.2 Combination Wave in accordance with ANSI C62.41 (Category B)
Effect of Current Surge in Ground Conductor	ANSI C12.1 2008 4.7.3.7

Safety Specifications

Table 9 summarizes the safety specifications for ECN 7650 devices.

Table 9. Safety Specifications

Category	Rating
Safety	UL 60950, EN 60950, CSA 60960 CE Marking RoHS-compliant

EMC Specifications

Table 10 summarizes the electromagnetic compatibility (EMC) specifications for ECN 7650 devices.

Table 10. EMC Specifications

Category	Rating
Immunity to Electrostatic Discharge:	
Contact Discharge	IEC 62052-11 (7.5.2), IEC 61000-4-2: 8 kV
Air Discharge	IEC 62052-11 (7.5.2), IEC 61000-4-2: 15 kV
Immunity to Electromagnetic RF Fields (80MHz to 2000 MHz)	IEC 62052-11 (7.5.3), IEC 61000-4-3: 30 V/m
Fast Transient Burst	IEC 62052-11 (7.5.4), IEC 61000-4-4: 4 kV common mode

Immunity to Conducted Disturbances:	
150 kHz to 80 MHz	IEC 62052-11 (7.5.5), IEC 61000-4-6: 10 Vrms
Surge Immunity	IEC 62052-11 (7.5.6), IEC 61000-4-5: 6 kV common mode, 4 kV differential mode
Power frequency magnetic field	IEC 61000-4-8, IEC 61000-4-12, IEC-61000-4-13, IEC 61000-4-16: 1000 A/m
Radiated Emissions	EN 55022 – Class B
Conducted Emissions with PLC	EN 50065-1 – Class B

FCC Specifications

This equipment has been tested and found to comply with the limits for a Class B digital device pursuant to Part 15 of the FCC Rules, per sections 15.107 and 15.109. See also the *FCC Notice* on page iv.

This equipment also complies with the limits for wireless devices per FCC sections 15.203, 15.205, 15.207, 15.209, 15.247, and 15.407. It uses frequency 2.4 GHz per Institute of Electrical and Electronics Engineers (IEEE) standard 802.15.4-2006, and uses a frequency bandwidth from 2400 MHz to 2483.5 MHz. See also *RF Statements* on page iv.

Communication Specifications

Table 11 summarizes the communications specifications for ECN 7650 devices.

Table 11. Communications Specifications

Category	**Rating**
Power line Network	LV CENELEC 50065-1 Line Communication (PLC) LV 150/IEC 14908-3 PLC (CENELEC 50065 C-Band)
Wide Area Network	Ethernet Dual-band 3G CDMA (EV-DO) with main and diversity antenna (North America) Quad-band GPRS (GSM) (worldwide)

Category	Rating
Local Networks (optional)	ISO/IEC 14908-2 Twisted Pair Communication Ethernet High-power 2.4/5GHz IEEE 802.11b/g/n access point and neighborhood-area intercommunication network (supports IEEE 802.11i and IEEE 802.11s (draft))

External Connection Specifications

Table 12 summarizes the external connection specifications for ECN 7650 devices.

Table 12. External Connection Specifications

Category	Rating
AC Power Mains Input	The three-phase AC input power connection serves two purposes: (a) AC input power for the ECN is provided from the Neutral and any phase. (b) LONWORKS power line channel signaling using three-phase, Line-to-Neutral coupling.
EIA-232 Serial Ports	EIA-232C serial port protocol operating up to 115.2 kbps per second when used with a Hayes-compatible cellular (CSD/CDMA/GPRS) or landline modem. Optionally, 9.6 kbps in direct serial connection (null-modem) mode. All modes operate with 8 data bits, 1 stop bit and no parity. Configured as DTE (Data Terminal Equipment).
Optional Three-Phase Current Transformer (CT) Inputs	LV or MV, 0.333 V standard, include external connectors
Optional Digital Inputs	Include external connectors
Optional Temperature Input	Includes external connector
Optional GPS Receiver	Active antenna, 12 channel
Expansion Card Type A	Maximum card dimensions: 129 mm x 85 mm (5.1 in x 3.3 in). The expansion slot includes card guides, USB data and power interconnect with +1.8 VDC to +12 VDC variable voltage input, up to 3 W maximum power dissipation.

Category	Rating
Expansion Card Type B	Maximum card dimensions: 104 mm x 85 mm (4.1 in x 3.3 in). The expansion slot includes card guides, USB data and power interconnect with +1.8 VDC to +12 VDC variable voltage input, up to 3 W maximum power dissipation.
Expansion Card Type C	Maximum card dimensions: 129 mm x 85 mm (5.1 in x 3.3 in). The expansion slot includes USB data and power interconnect with +1.8 VDC to +12 VDC variable voltage input, up to 5 W maximum power dissipation. The slot supports up to four antenna connections.
Expansion Card Type D	Maximum card dimensions: 143 mm x 106 mm x 15 mm (5.6 in x 4.2 in x 0.6 in). The expansion slot supports up to 3 W maximum power dissipation and up to four antenna connections.
Expansion Card Type E	Maximum card dimensions: 204 mm x 151 mm x 15 mm (8 in x 5.9 in x 0.6 in). The expansion slot supports up to 15 W maximum power dissipation and up to four antenna connections.

Life Expectancy

Table 13 summarizes the life expectancy specifications for ECN 7650 devices.

Table 13. Life Expectancy Specifications

Category	Rating
Life Expectancy	The Data Concentrator has been designed for a life expectancy of at least 10 years, at annual average ambient temperatures less than or equal to 35 °C and greater than or equal to –40 °C.

B

Safety and High-Voltage Warnings

This appendix provides the safety and high-voltage warnings for the ECN 7000 Series of products.

Safety and High-Voltage Warning

Safety and High Voltage Warning

Ensure that the AC input power is turned OFF before removing the front cover, handling the input power wiring, or connecting any input power cabling to the ECN 7650 device.

The ECN is not equipped with a power disconnect device. When the ECN is installed and mounted, the installer must provide a means to safely remove power and install a circuit breaker with a maximum rating of 16 A.

The high-voltage terminal block has a plastic cover protecting the screw terminals used to connect the high-voltage inputs. This cover MUST be replaced after the power wires are connected and before the power is activated.

DO NOT under any circumstances connect the ECN to mains voltages outside of the range 100 to 240 VAC, -10% to +20%, 50/60 Hz.

DO NOT under any circumstances connect the ECN to a modem whose required operating voltage is not 14 VDC (300 mA maximum).

Alerta de Seguridad y Alto Voltaje

Asegúrese que la red eléctrica de corriente alterna (CA) este DESENERGIZADA antes de: retirar la cubierta frontal, manipular los cables de alimentación o conectar cualquier cableado al dispositivo ECN 7650.

El ECN no está equipado con un dispositivo de desconexión de energía. Cuando el dispositivo está instalado y montado, el instalador debe proporcionar medios para remover la energía de manera segura e instalar un interruptor de energía con un valor nominal máximo de 16 A.

El bloque de terminales de alta tensión tiene una cubierta de plástico que protege los terminales de tornillo para conectar las entradas de alto voltaje. Esta cobertura DEBE ser reemplazado después de los cables de alimentación están conectados y antes de que el poder se activa.

Bajo NINGUNA circunstancia opere el dispositivo ECN en redes eléctricas con voltajes fuera del rango 100 to 240 VAC, -10% to +20%, 50/60 Hz.

Bajo NINGUNA circunstancia conecte el dispositivo ECN a un módem cuyo voltaje de funcionamiento esté fuera del rango 14 VDC @ 300 mA.

Sécurité et Avertissement Haute Tension

Assurez-vous que l'interrupteur Marche Arrêt est dans la position Arrêt avant d'enlever le capot avant ou de manipuler les câbles d'alimentation, ou bien quand vous branchez un cordon secteur au ECN 7650.

L' ECN ne possède pas d'interrupteur pour son alimentation. Lorsque l'ECN est installé et monté, l'installateur doit fournir un moyen de couper cette

alimentation de manière sécurisée et d'installer un interrupteur externe d'un valeur maximale de 16 A.

Le bloc terminal haut tension a un couvercle plastique pour protéger le bornier à vis recevant la puissance. Ce couvercle DOIT être remplacé correctement à son emplacement d'origine après les câbles sont vissés et avant que la puissance ne soit activée.

Il ne faut JAMAIS connecter l'ECN à une tension d'alimentation hors de la plage 100 to 240 VAC, -10% to +20%, 50/60 Hz.

Il ne faut JAMAIS connecter l'ECN à un modem dont la tension de fonctionnement requis n'est pas 14 VDC (300 mA au maximum).

Sicherheitshinweis: Vorsicht Hochspannung

Schalten Sie die Stromversorgung AUS bevor Sie den Gehäusedeckel entfernen, die Stromführenden Kabel berühren, oder jegliche Netzverbindung mit dem Gerät ECN 7650 hergestellt wird.

Der ECN besitzt keinen eigenständigen Stromunterbrechungsmechanismus. Bei der Installation muss der Installateur für eine sichere Möglichkeit der Stromunterbrechung sorgen und einen Sicherungsautomaten mit einen Höchstnennstrom von 16 A anbringen.

Die Hochspannungs-Klemmenleiste besitzt eine Plastik Haube und schützt die Schrauben die zum Anschluss der Hochspannung dienen. Diese Haube MUSS wieder angebracht werde, nachdem die Stromkabel angeschlossen und bevor die Stromzuführung wieder freigeschaltet wurde.

Unter KEINEN UMSTÄNDEN darf das Gerät ECN mit einer Eingangsspannung außerhalb des Bereichs 100 to 240 VAC, -10% to +20%, 50/60 Hz betrieben werden.

Unter KEINEN UMSTÄNDEN darf das Gerät ECN an ein Modem angeschlossen werden, dessen vorgeschriebene Betriebsspannung außerhalb folgender Bereiche 14 VDC @ 300 mA.

Säkerhets- och högspänningsvarning

Kontrollera att nätspänningen är FRÅN innan höljet tas bort, nätledningarna vidrörs eller nätkablar ansluts till ECN 7650 enheten.

ECN är inte utrustad med en frånkopplingsenhet till nätet. När ECN installeras och monteras, måste installatören se till att det går att stänga strömmen på ett säker sätt och montera en huvudströmbrytare med max 16 A spänning.

Kopplingsplinten till högspänningen har ett plastskydd som skyddar skruvkontakterna som används för att ansluta ingående högspänning. Detta skydd MÅSTE sättas tillbaka efter det att nätkablarna anslutits och innan nätspänningen slås på.

ECN enheten får under inga omständigheter anslutas till nätspänningar som inte ligger inom intervallen 100 to 240 VAC, -10% to +20%, 50/60 Hz.

ECN enheten får under inga omständigheter anslutas till ett modem vars driftspänning ligger utanför intervallen 14 VDC @ 300 mA.

Avvertenza sulla Sicurezza e sull'Alta Tensione

Assicurarsi che la rete elettrica sia SPENTA prima di rimuovere il coperchio frontale, maneggiare i cavi di alimentazione, o connettere qualsiasi cavo al dispositivo ECN 7650.

Il ECN non viene fornito con un dispositivo di disconnessione dell'alimentazione. Quando il ECN viene installato e montato, l'installatore deve predisporre un sistema per poter staccare l'alimentazione in sicurezza e installare un interruttore del circuito con una potenza massima di 16 A.

Il blocco terminale ad alta tensione ha una copertura in plastica protegge i morsetti usati per collegare gli ingressi ad alta tensione. Tale copertura deve essere sostituito dopo i cavi di alimentazione siano collegati e prima che l'alimentazione è attivata.

NON connettere mai per nessun motivio il ECN a tensioni al di fuori del range 100 to 240 VAC, -10% to +20%, 50/60 Hz.

NON connettere mai per nessun motivio il ECN ad un modem la cui alimentazione sia al di fuori del range 14 VDC @ 300 mA.

Безопасности и высокого напряжения Предупреждение

Убедитесь, что мощность переменного тока выключен, прежде чем снимать переднюю крышку, обработки проводки входной мощности, или подключения любого входа силовых кабелей к ECN 7650 устройств.

ECN не оборудован власти отключить устройство. Когда ECN установлена и смонтирована, установщик должен обеспечить средства для безопасного удаления власть и установить выключатель с максимальным рейтингом 16 A.

высоковольтных терминальный блок имеет пластиковую крышку защиты винтовые клеммы используются для подключения высоковольтного входа. Это покрытие должны быть заменены после силовые провода подключены и перед властью активирован.

Ни при каких обстоятельствах связаться ECN для напряжения сети за пределы диапазона от 100 до 240 В переменного тока, -10% до +20%, 50/60 Гц.

Ни при каких обстоятельствах связаться ECN для модема которого требуется рабочее напряжение 14 В постоянного тока не (300 мА максимум).

安全和高电压警告

确保交流输入电源被拆除之前关闭前盖，处理输入功率布线，或连接任何电缆输入功率的ECN的7650设备。

该ECN是没有配备电源断开设备。当ECN是安装和安装，安装程序必须提供一种方法来安全地切断电源，并安装了16A条，最大容量的断路器。

高电压端子块有一个塑料盖保护螺丝用来连接高电压输入端子。此盖后必须更换电源

线连接电源之前被激活。

不要在任何情况下联络的范围以外的100至240VAC，-
10％至+20％，50/60Hz的主电源电压的ECN的。

任何情况下做不连接到调制解调器的ECN的要求的工作电压不14VDC（300mA的最大值）
。

安全性と高電圧警告

確認は、AC入力電源は、入力電源配線を取り扱う場合や、電子証券取引ネットワーク7650デバイスにケーブル接続、任意の入力電源を接続して、フロントカバーを取り外す前にオフになっていること。

ECNは、装置の電源を切断が装備されていない。
ECNがインストールされている場合、マウント、インストーラは安全に電源を削除して、16Aの最大定格を持つ回路ブレーカをインストールする手段を提供する必要があります。

高電圧端子台は、高電圧入力を接続するためのネジ留め式端子を保護するプラスチック製のカバーを持っています。電源コードが接続された後、電源がアクティブになる前にこのカバーしなければ置き換えられます。

どのような状況は、240VACの範囲100、-
10％～+20％、50/60Hzの外の電源電圧にECNを登録の下にしないでください。

その必要な動作電圧（300ミリアンペア最大）抵抗値をされていないモデムにECNを登録どのような状況の下でしないでください。

Safety Warning

Safety Warning

The ECN uses three Littelfuse® 215SP Series, 250VAC Time-Lag Fuse (0215063MXESPP) fuses (F1, F2, and F3), one for each phase. Amperage rating 6.3 A.

Advertencia de Seguridad

El ECN utiliza tres Littelfuse 215SP Series, 250VAC Time-Lag Fuse (0215063MXESPP) fusibles (F1, F2, y F3), uno para cada fase. Amperaje 6,3A calificación.

Avertissement Sécurité

L'ECN utilise trois Littelfuse 215SP Series, 250VAC Time-Lag Fuse (0215063MXESPP) fusibles (F1, F2, et F3), un pour chaque phase. 6,3A Ampérage.

Sicherheitshinweis

Die ECN verwendet drei Littelfuse 215SP Series, 250VAC Time-Lag Fuse (0215063MXESPP) Sicherungen (F1, F2, und F3), eine für jede Phase. Amperezahl 6,3A.

Säkerhetsvarning

ECN använder tre Littelfuse 215SP Series, 250VAC Time-Lag Fuse (0215063MXESPP) säkringar (F1, F2, och F3), en för varje fas. Strömstyrka 6,3A.

Avviso di sicurezza

Il ECN utilizza tre Littelfuse® 215SP Series, 250VAC Time-Lag Fuse (0215063MXESPP) fusibili (F1, F2, e F3), uno per ogni fase. Amperaggio valutazione 6,3A.

Безопасность Предупреждение

ECN использует три Littelfuse 215SP Series, 250VAC Time-Lag Fuse (0215063MXESPP) предохранителей (F1, F2, и F3), по одному для каждой фазы. 6,3A значением тока.

安全警告

该ECN使用三个Littelfuse 215SP系列250VAC Time-Lag (0215063MXESPP）熔断器（为F1，F2和F3），每个阶段之一。额定电流 6.3A。

安全警告

ECNは、3つのLittelfuse 215SPシリーズ250VAC Time-Lag（0215063MXESPP）ヒューズは（F1、F2、およびF3）、各フェーズのいずれかを使用します。定格電流の6.3A。

C

ESD and Battery Warnings

This appendix provides the electrostatic discharge (ESD) and battery warnings for the ECN 7000 Series of products. The battery is end-user serviceable, and the ECN device will continue to operate even if the battery fails.

ESD Warning

Electrostatic Discharge Warning

This product contains components which are sensitive to static electricity. Before installing or removing the serial cable, touch earth ground with your hand to discharge any static electricity which may have accumulated.

Aviso de descarga electrostática

Este producto contiene componentes que son sensibles a la electricidad estática. Antes de instalar o de retirer el cable serie, asegúrese de tocar un contacto a tierra para descargar cualquier electricidad estática que pudiera haberse acumulado.

Attention aux décharges électrostatiques

Ce produit contient des composants qui sont sensibles à l'électricité statique. Avant de brancher ou de débrancher le cordon série, veuillez placer la main sur la borne de terre pour évacuer toute électricité statique accumulée.

Elektrostatische Entladungen Warnung

Dieses Produkt beinhaltet Komponenten, die empfindlich für eine statische Aufladung sind. Bevor Sie serielle Kabel installieren oder entfernen, müssen Sie für eine ordnungsgemäße Entladung der statischen Aufladung sorgen, in dem Sie mit der Hand eine Erdungsstelle berühren.

Elektrostatisk urladdning Varning

Denna produkt innehåller komponenter som är känsliga för statisk elektricitet. Innan seriekabeln ansluts eller tas bort, vidrör markjord med handen för urladdning av eventuell statisk elektricitet som kan ha uppstått.

Attenzione alle scariche elettrostatiche

Questo prodotto contiene componenti sensibili all'elettricità statica. Prima di installare o rimuovere il cavo seriale, assicurarsi che si tocca un contatto a terra per scaricare l'elettricità statica che potrebbe essersi accumulata.

Электростатического разряда Предупреждение

Этот продукт содержит компоненты, которые чувствительны к статическому электричеству. Перед установкой или снятием последовательный кабель,

убедитесь, что вы нажмете контакта с землей, чтобы заряд статического электричества, которые могут накапливаться.

静电放电警告

本产品含有敏感元件对静电。在安装或拆卸串行电缆，请确保您点击一个接触到地面的静电放电可能积累。

静電放電警告

この製品は、静電気に敏感なコンポーネントが含まれています。インストールまたはシリアルケーブルを取り外す前に、放電し蓄積している可能性のある静電気を接地して連絡先をタップしてください。

Battery Warning

Battery Warning

The ECN contains a backup battery for the real-time clock. There is a risk of explosion if this battery is replaced with an incorrect type. Please dispose of the used batteries in accordance with the manufacturer's instructions.

Advertencia de la Batería

El ECN contiene una batería de reserva. Hay un riesgo de explosión si esta batería se substituye por una del tipo incorrecto. Disponga por favor de las baterías usadas de acuerdo con las instrucciones del fabricante.

Avertissement relatif aux batteries

L' ECN contient une batterie pour les sauvegardes. Il y a un risque d'explosion dans le cas ou cette batterie est remplacée par un modèle non conforme. Merci jeter les piles usagées conformément aux instructions du fabricant.

Sicherheitshinweis: Vorsicht Batterie!

Die ECN enthält eine Batterie für die Echtzeituhr. Es besteht die Gefahr einer Explosion, falls diese Batterie durch einen falschen Batterietyp ersetzt wird. Bitte, entsorgen Sie die gebrauchten Batterien entsprechend den Herstellerhinweisen.

Batterivarning

ECN har ett backup-batteri. Om batteriet byts ut mot ett batteri av fel typ föreligger explosionsrisk. Se till att batteriet förstörs enligt tillverkarens anvisningar.

Avvertenza sulla Batteria

Il ECN contiene al suo interno una batteria di backup. Se la batteria viene sostituita con un tipo non conforme, ci potrebbe essere pericolo di esplosione. Si prega di eliminare le batterie usate in accordo con quanto specificato nelle istruzioni del costruttore.

Предупреждение на аккумуляторе

ECN содержит резервную батарею. Существует риск взрыва при этом батарея заменена неправильного типа. Утилизация отслуживших аккумуляторов осуществляется в соответствии с инструкциями производителя.

电池警告

在ECN的包含一个备份电池。有爆炸的危险，如果这种电池是一个不正确的取代。请说明处理废旧电池与制造商的说明。

バッテリーの警告

ECNは、バックアップバッテリが含まれています。このバッテリーは、不適切なタイプと交換すると、爆発の危険があります。製造元の指示に従わずに使用済みの電池は処分してください。

ECHELON®
www.echelon.com