Echelon’s Lumewave Power Line RF Gateway (LPG) Installation Guide identifies the devices in the LPG and explains the installation procedure. A troubleshooting chapter describes methods for remote and on-site maintenance.
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Welcome

This document describes how to install Echelon’s Lumewave Power Line RF Gateway without Enclosure, model 100199, called the LPG.

Purpose

This document is intended for system installers and IT professionals. It details the required components and how to install them.

Related Documentation

Other documentation is available on the Echelon Web site at www.echelon.com.

Technical Support

If you have technical questions that are not answered by this document, or by the related documentation, you can obtain technical support via e-mail to support@echelon.com. See www.echelon.com/support for more information on Echelon’s support services.
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Introduction

The Lumewave Power Line RF Gateway (LPG) adds support for power line communications to a Lumewave by Echelon based lighting system and allows for the use of power line communication-based devices such as the Echelon CPD 3000 outdoor lighting controller with the Lumewave system.
What is the LPG

The Lumewave Power Line RF Gateway consists of several hardware and software components:

- The LPG application, which runs on a CloudGate embedded Linux device,
- the Echelon SmartServer hardware and software,
- a three-phase coupler, PLC277-3PH,
- a power line filter, Schaffner EMC FN2060-1-06,
- a power supply, Minmax AJM-24S09C,
- an optional 277 to 120/240V stepdown transformer, RIB TR40VA013,
- and the CloudGate device.

The LPG devices are shown in Figure 1.

A description of these devices follows.
**Three-phase Coupler PLC277-3PH**

The three-phase coupler connects the system to a single-phase or three-phase power distribution system. The coupler is connected to the lights’ power supply rails and has a low-voltage connection to the Echelon SmartServer using a short wire pair, as seen in Figure 2. Many lighting cabinets are powered by a split phase 240VAC service. If your lighting cabinets have this configuration, the Neutral terminal is connected to one of the line conductors.

**Echelon SmartServer**

The SmartServer provides resilient power line communication to the LPG. It is connected to the three-phase coupler (by twisted pair cable) and to the CloudGate computing device by CAT 5e/6 networking cable, as seen in Figure 2.

**Minmax Power Supply AJM-24S09C**

The Minmax powers the CloudGate computing device, as shown in Figure 2.

**CloudGate Device**

The CloudGate device houses an embedded computing platform and the LPG core software. The CloudGate device communicates with the SmartServer through a short network cable. Echelon recommends the CAT 5e or CAT 6 networking cable with standard RJ-45 connectors, as shown in Figure 2.

The CloudGate includes a Lumewave radio, which receives and transmits Control-M packets. The device is connected to the provided bulkhead mount 900MHz antenna (tamper proof) for Lumewave radio frequency communication, marked 915MHz (green tag). The antenna is connected to the Cloudgate, as shown in Figure 2.

**Power Requirements**

The Lumewave Power Line Gateway, as shown in Figure 2, can be used with mains power in the 110-240VAC range. A stepdown transformer is necessary for installation into cabinets with a power supply exceeding 240VAC, such as cabinets using 270VAC.

When a stepdown transformer is used, connect the filter’s load terminals to the stepdown transformer’s secondary side (the 240VAC), as shown in Figure 3.
Installation Instructions

Now that you understand the power requirements and the devices of the LPG, here are the steps to install those devices.

Wiring Diagram

The wiring diagram when the mains power exceeding 240VAC is different.

![Wiring Diagram](image)

**Figure 2.** Wiring Diagram when Mains Power is in the 110-240VAC Range
Preparations

Review the cabinet and make sure it has sufficient room for all LPG components and wiring.

Review the available mains voltage. The LPG’s SmartServer is limited to 100..240VAC operation; the stepdown transformer, discussed in Power Requirements, may be required to supply the SmartServer with the correct voltage.

Turn off power when you start component installation.

DIN Rail

Affix a DIN rail to the cabinet wall. The most successful orientation for the SmartServer is horizontal.

Attach Devices

Attach the three-phase coupler, SmartServer, power supply, power line filter, and CloudGate devices to the DIN rail. If a stepdown transformer is required, mount the transformer into a suitable location and make the primary connection.
Pay close attention to the diagrams showing the filter connection. The Earth ground lug side connects to the LPG power supply line input. It is marked as the line side, which implies it is connected to the electric service. If the orientation is reversed, power line performance will be affected.

**Three Phase Coupler**

Connect the three-phase coupler to the lighting segment circuit supply. In a split-phase system, connect N and L1. In a three-phase system, connect N, L1, L2, and L3.

Connect the PLT- and PLT+ terminals to the SmartServer’s PLT- and PLT+ terminals (terminals 17 and 18) with a short piece of twisted-pair cable. This makes a low-voltage, low-current connection.

**Filter**

Connect the filter’s load terminals (Neutral and P) to the mains supply in the 110-240VAC range, as shown in Figure 2.

If the L-N voltage of the service exceeds 240VAC, a stepdown transformer is used. Connect the filter’s load terminals to the stepdown transformer’s primary side (the 277VAC), as shown in Figure 3.

Connect the filter’s line terminals (N and P) to the SmartServer’s mains terminals (Neutral: 3 and Line: 4) and to the Minmax power supply (AC(N) and AC (L)), as shown in Figures 2 and 3. The SmartServer’s mains terminal (Earth) and the filter’s line terminal (PE) are connected to the ground.

**SmartServer**

Connect the SmartServer’s mains terminals (Neutral: 3, Line: 4) to filter’s line terminals (N and P), as shown in Figures 2 and 3. Check the PLT+ and PLT- connection to the three-phase coupler.

Now connect the SmartServer’s LAN port (top right) to the CloudGate’s LAN port using a short CAT 5e or CAT 6 networking cable.

**Power Supply**

Connect the power supply to the same filter’s line terminals as the SmartServer.

Connect the +Vo and -Vo terminals to the CloudGate power supply cord, as shown in Figure 2 and 3.

**CloudGate**

Check the power connection. Then check the networking connection (LAN cable). Now mount the antenna with drill-through hole in the cabinet wall. Be sure to use the gasket supplied with the antenna and mount them securely.

Connect the SMA-RP to SMA adapter. Next connect the 915 MHz antenna to the SMA-RP to SMA adapter and then to the Lumewave radio port, as shown in Figures 2 and 3.
Warning: Using the SMA adapter is not optional. If you connect the antenna directly to the CloudGate 915MHz connector, the system will not work. These connectors can be easily damaged if roughly handled. Be careful. It is important to use a torque wrench to tighten to 3-5 in-lbs for reliable, long-term operation.

Finish Installation

Check all your connections and the power supply requirements. Make sure the correct seals have been used for antenna mounting and that the mounting is secure.

Power up the cabinet.

It can take several minutes before the LPG is fully operational. Once it is working, the LPG is transparent to the LumInsight Desktop Central Management Software (CMS) (formerly known as LumeStar).

Installing Power Line Lighting Controllers with LumInsight Desktop CMS

Now that the LPG is installed, you can install power line lights that are controlled by LumInsight Desktop CMS.

Installation of CPD 3000 Light Controllers

Echelon’s Power Line based lighting controller, the CPD 3000, controls outdoor streetlights that support proportional level control using 0-10V or PWM control. See the CPD 3000 Lighting Controller Integration Guide (078-0485-01B) for a description of hardware installation and wiring specifications for the CPD 3000, plus the lighting controller interface.

Each CPD 3000 device includes barcode stickers to document NID. Each sticker associates with a pole asset ID and/or GPS coordinates where each device is installed. Careful tracking of this information is essential for managing service operations across the system.

If the CPD 3000 is pre-wired in the fixture, the fixture manufacturer should adopt a specific location for installers to retrieve the sticker from the fixture when it is installed.

The cardboard shipping box of the CPD 3000 also includes the bar code sticker and may be used by installers to track device locations for field-installed CPD 3000 devices.

Echelon recommends adopting a field ledger format to associate pole IDs to CPD 3000 NID when devices are installed. The importance of careful record keeping at installation time cannot be understated. Field installers need to understand that noting the installation information reduces problems when a device in the system needs attention.
Installation of CPD 3000 within the LumInsight Desktop Software

You must use LumInsight Desktop CMS version 5 or higher when you use the Lumewave by Echelon Power Line Gateway and Echelon CPD 3000 outdoor lighting controllers. Information for the LumInsight product is available on the Echelon Web site at www.echelon.com.

Installation can be a slow process. It can take several hours between installation and the lights being operational and controllable from the LumInsight Desktop CMS.

The Installed LPG

The LumInsight Desktop CMS knows of CPD 3000 devices, but does not recognize the LPG or power line communications. The LPG is completely transparent to the LumInsight Desktop CMS. Some diagnostic functions within LumInsight Desktop CMS can diagnose the CPD 3000 devices, but LPG performs most of the operations. The Troubleshooting chapter of this guide offers helpful information for an installed system.

Figure 4 illustrates a complete Lumewave by Echelon hybrid outdoor lighting system with one LPG. A single Lumewave by Echelon hybrid outdoor lighting system can include multiple LPG (multiple cabinets), but will have only one LumInsight Desktop CMS.

Figure 4. Installed LPG
Troubleshooting

This chapter provides methods for remote and on-site diagnosis and error recovery for the LPG.
Identifying a CPD 3000

All devices managed by an LPG use a device ID value greater than hexadecimal 800000000 (or decimal 2147483648).

CPD 3000 Feature Limitations

**Photocell**

There is no on-board photocell for daylight harvesting or schedules driven by ambient light levels in the CPD 3000. However, you can configure the CPD 3000 as a photocell slave, whereby it accepts another device’s photocell readings as its own.

To do this, enable the *Use master photocell level* in CPD 3000’s operation parameters. You also need to enable the *Act as master photocell* on a suitable device, such as a TOP900, in the vicinity.

**Motion**

The CPD 3000 does not have an on-board motion detector for motion- or occupancy-controlled lighting events; however, you can configure the CPD 3000 as a motion slave, whereby it accepts another device’s motion detection messages as its own.

You can do this by enabling the *Accept Motion Messages from other devices* setting in the CPD 3000’s Motion Parameters. You also need to enable the *Originate Motion Messages* setting on a suitable device, such as a TOP900, in the same vicinity.

**Logs**

The combination of CPD 3000 and LPG do not currently support the data log feature supported with native Lumewave devices. Attempts to read those logs will not yield a response.

**Repeating**

The CPD 3000 does not support repeating of arbitrary messages or repeating of motion messages, which are two different settings. This is because the radio frequency communication is handled by the LPG, whose location may be far removed and not representative of the light fixtures controlled by the CPD 3000. If you attempt to enable repeating on the CPD 3000 there will be no effect.

LumInsight Diagnostics

Because the LPG is transparent to LumInsight, some device diagnostics available through LumInsight may behave slightly different compared to the same diagnostics performed on native Lumewave devices such as the TOP900.
**Strobe**

The *Strobe* command yields a CPD 3000 *wink*, which consists of 10 slow bright-to-dim cycles that take place over several seconds. Similar to a native Lumewave device, this provides a method to visually identify a particular device or a group of devices.

The *Strobe* diagnostic, if visual verification is possible, is a good LumInsight Desktop CMS diagnostic to attempt communication over both the radio-frequency part (to LPG) and the power line part (to the CPD 3000).

**Request Firmware Version**

LumInsight provides a tool to request a device’s firmware version. [Diagnostics / Send Message / 02 Request Firmware Version]

For devices managed by LPG, this returns the following details:

```
Sending 0205020903 - 02 - Request Firmware Version to Gateway Received A1 from Gateway - Rx Data packet - Data = ...
82 - Version LPG 1.00.023 CPD V2.01.016 DOM $89.D2.01.15.9C.CF STS Up Ok
```

LPG 1.00.023 is the three-part LPG version number showing version number 1, minor version 00, and build number 23.

CPD V2.01.016 is the lighting controller’s three-part version number. If the version number is unavailable, this may read as all zero.

DOM $... is the zero, one, three, or six byte primary LonTalk Domain ID used by this device. The domain ID reported with a given device’s firmware is used to identify the managing LPG. All devices managed by the same LPG share the primary LonTalk Domain ID.

STS Up OK provides two more items of status information. The first can be ‘Up’, ‘Dn’, or ‘Nt’ which mean *up*, *down*, and *nascent*. This indicates the LPG’s view of the device’s status within the SmartServer. The second status detail can show as ‘Pd’, ‘Ok’, or ‘--’ which mean *pending*, *or done with success*. This denotes the LPG RNI commissioning status. A status of ‘--’ means that an RNI commissioning status is not yet available. A device can be discovered and ‘Up’ for a while until the LPG decides to start its RNI commissioning.

**Local Access with LAN**

The cabinet in Figure 5 shows a laptop connected to the internal LAN network. This installation requires (temporary) installation of an Ethernet hub or switch.
To access the LPG-internal LAN network, configure your laptop to use DHCP, which is typical for most users. If you are not certain you have DHCP access, go to the network settings control panel applet in Windows, and review the properties for TCP/IPv4 network settings, as shown in Figure 6.
For a static IPv4 address of 192.168.1.x (where x is any value except 1 or 222) and a subnet mask of 255.255.255.0.

You can now verify the LAN configuration with this command:

```plaintext
ping 192.168.1.1
```
which ‘pings’ the CloudGate device, or

```plaintext
ping 192.168.1.222
```
which ‘pings’ the SmartServer.

**Accessing LPG**

Once you access the LPG’s internal network (via direct local connection or remote access via VPN), you can access the LPG in two different ways, described below.

- Access via web interface
- Access the Secure Shell (SSH) console

**Web Interface**

To visit the web interface, point your browser to the LPG’s internet address. When using local access via LAN, the address is [http://192.168.1.1](http://192.168.1.1). The CloudGate user name and password are required for this access.
**SSH Access**

You can also use a secure shell connection (SSH) to examine the LPG. This allows for live access to the system log and trace data from a running system. For a Linux user, the address is ssh root@192.168.1.1.

As with the Web interface, you need a login name and password. The password is unique to each LPG. The password is based on the CloudGate Serial Number. You can access the serial number from the Web UI, or you can find it on the sticker included with your CloudGate. Once you know your serial number:

1. Convert all letters in the serial number to lower case.
2. Add an “e” to the front of this value.

Once you are logged in, enter the `top` command to see some of the running processes. You will see LPG listed. Exit the top command with Ctrl-C.

Open the LPG Console. Enter the `lpgcon` command. You can now watch trace output (if enabled) and diagnostics from the LPG as they occur. You cannot access historical data.

Type `exit` to leave the LPG Console, or type `help` for a list of available commands.

You can review and edit some of the LPG’s operating parameters by editing the `/overlay/lpg.cfg` file using the `linux vim` editor. Changes to this configuration file are not in effect until the LPG application restarts. Type `killall lpg` to stop the LPG. The built-in application monitor automatically restarts the LPG application. It can take several minutes for the restart, so go ahead and open the LPG Console and wait for the connection with the LPG to resume.

---

**SmartServer DCI Console**

The SmartServer console is accessed using `telnet` to the IP address 192.168.1.222. The username and password for the `telnet` session are both `ilon`. The DCI console is accessed when you issue a `consoleexit` command from the initial SmartServer console that comes up when first booting or accessing the SmartServer via `telnet`, and then issuing the `startDciConsole` command, which is case sensitive.

To return to the initial SmartServer console from a DCI console, use the `quit` command to leave the DCI console and then type `console` to return to the SmartServer console. This step is **important**. If you terminate your `telnet` session in the DCI console you will be locked out of creating a new session for 30 minutes, or until the SmartServer completes a reboot.
DCI Console Commands

The following list explains the DCI console commands. The commands are not case sensitive.

- **help** – Shows the list of dcx commands
- **dcxp ?** – Show the list of possible dcxp resources
- **dcxpshowdevice** – Shows the list of devices available, including device number, state, agent, pending communication, flags, subnet/node ID and Neuron ID
- **dcxp f.18** – Shows information on the Discover Devices function such as when the function was last started and completed
- **dcxp f18, Trace, true** – Turns on tracing for the Discover Devices function
- **dcxp Device.X** – Presents more detailed information on device X where X is the device number obtained with the dcxshowdevice command. You can see a list of devices using the dcxp Device.* command.
- **dcxp DiscoveredDevice.*** – Presents a list of the discovered devices that have yet to be commissioned
- **dcxp DiscoveredDevice.X** – Shows additional information on the discovered device where X is the device number obtained by dcxp DiscoveredDevice.*
- **dcxp** – Shows additional information for the dcx

All function and device properties can be changed with the **dcxp Y.X, [property], [value]** command where Y is the resource type (Device, DiscoveredDevice, f for function) and X is the number of the device or function.

The properties can found by listing out the individual resource.