

OPTOEMU SENSOR USER'S GUIDE

**OPTOEMU-SNR-3V
OPTOEMU-SNR-DR1
OPTOEMU-SNR-DR2**

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OPTOEMU-SNR-3V
OPTOEMU-SNR-DR1
OPTOEMU-SNR-DR2

Form 1932-170413—April 2017

OPTO 22
Automation made simple.

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Refer to manual for information on potential hazards
wherever this symbol is used

OptoEMU Sensor User's Guide
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1: Introduction

About OptoEMU Sensors

OptoEMU Sensor™ Energy Monitoring Units monitor the electrical energy used in your facility and then deliver that data to online software applications, control systems, and business systems—using your existing wired or wireless Ethernet network. OptoEMU Sensors give you the detailed, real-time data you need to analyze energy consumption and reduce energy costs.

Why Monitor Energy?

Typically, managers approve major expenditures only when they know exactly where the money is going. By managing energy in the same way as other business costs—such as people, assets, and inventory—commercial and industrial businesses increasingly find that they can significantly reduce energy costs. Energy management represents a real opportunity to improve the bottom line.

Saving money on energy does not require complex or expensive technology; it requires basic information. That information starts with gathering detailed, real-time data through an OptoEMU Sensor. For more about how energy is delivered in the U.S. and ways you can start saving now, see our white papers, *Automation and the Smart Grid: Energy Management Today* (form 1914) and *Energy Monitoring for Profit: Introducing Demand Response* (form 1993), both available on the Opto 22 website.

Viewing and Using Energy Data

You can view real-time and historical energy data gathered by the OptoEMU Sensor online, through a secure software service such as [Pulse Energy](#), Powerit Solutions, or [eSight](#). You choose the service that's best for your business. The OptoEMU Sensor sends energy data directly to the service you choose, and you can view the data from any authorized computer or mobile device in accordance with the service you purchase. You can analyze the data, eliminate assumptions, and pinpoint energy trouble spots.

You can also incorporate data from the OptoEMU Sensor in control systems based on Opto 22's PAC Project™ software or Modbus/TCP, or use it with OPC clients, SQL databases, or custom programs you develop using the Microsoft .NET Framework. First install and configure the Sensor using this guide; then see the *OptoEMU Sensor Communication Guide*, form 1958, for instructions on integrating data with other systems.

In addition, you can use Opto 22's *groov* to build and view operator interfaces to energy data from the OptoEMU Sensor. Entirely browser-based, groov requires no additional software and no plugins

Taking Advantage of Demand Response Programs

Analyzing energy data and making smart decisions about usage will reduce energy costs. But it's also possible to make energy a source of revenue for your company by taking advantage of demand response (DR) programs from your local energy company. Programs vary depending on your location, but most require you to take action to shed load when a DR "event" is called.

The OptoEMU Sensor DR is designed to make response easy. This Sensor includes outputs that can signal existing energy or building management systems to perform load shedding, or respond to a DR event by signalling equipment such as HVAC fans, chillers, and other electrical loads to turn on or off, either manually or automatically. Outputs can also be set to shed loads on predefined usage thresholds.

Available Models

Three models are available: OPTOEMU-SNR-3V, OPTOEMU-SNR-DR1, and OPTOEMU-SNR-DR2.

OPTOEMU-SNR-3V—Use the Sensor 3V to connect directly to electrical circuits using current transformers (CTs) with a 0.333 VAC secondary. Direct connections can be made to main electrical panels, subpanels, and individual pieces of equipment such as chillers, boilers, and compressors. The unit can also connect to pulsing devices and Modbus devices (serial or Ethernet). This unit monitors usage and provides energy data but does not control equipment.

OPTOEMU-SNR-DR1 and **OPTOEMU-SNR-DR2**—These small-footprint, less expensive units are ideal for monitoring pulsing meters and Modbus devices of all kinds. You can also use Sensor DRs to respond to a demand response (DR) event by signaling equipment to turn on or off or signaling energy or building management systems to shed loads. Both units connect to pulsing devices or Modbus devices, but not directly to panels or equipment using CTs. The OPTOEMU-SNR-DR1 communicates over both standard wired Ethernet and a wireless LAN. The OPTOEMU-SNR-DR2 offers wired Ethernet but not wireless.

The main features of each are summarized below. See the following pages for more information; complete specifications start on [page 52](#).

	OPTOEMU-SNR-3V	OPTOEMU-SNR-DR1	OPTOEMU-SNR-DR2
Gets data from:			
Main electrical panels	X		
Subpanels	X		
Electrical equipment (chillers, compressors, etc.)	X		
Pulsing devices (utility meter or sub-meter)	X	X	X
Modbus devices over serial	X	X	X
Modbus/TCP devices over Ethernet	X	X	X
Sends data to:			
Online software service	X	X	X
Opto 22 PAC Control & PAC Display	X	X	X
Modbus/TCP systems	X	X	X

	OPTOEMU-SNR-3V	OPTOEMU-SNR-DR1	OPTOEMU-SNR-DR2
OPC clients	X	X	X
SQL databases	X	X	X
Custom systems developed with .NET Framework	X	X	X
Communicates using:			
Standard wired Ethernet	X	X	X
Wireless LAN	X	X	
Demand response capability:			
Four signal relay outputs		X	X

Data In and Data Out: OptoEMU Sensor 3V

OptoEMU Sensor 3V monitors:

- Pulsed outputs from pulsing meter or submeter
- Energy devices that communicate over a serial network using the Modbus protocol
- Ethernet energy devices that communicate using Modbus/TCP
- Direct voltage and current from:
 - Main electrical panel
 - Electrical subpanels
 - Electrical equipment such as chillers, boilers, compressors, elevators, and air handling units (AHUs)



OptoEMU Sensor 3V provides data for:

- Online energy monitoring applications
- PAC Control strategies
- PAC Display HMIs
- OPC 2.0-compliant clients
- Standard databases (SQL Server, MySQL, Microsoft Access)
- Modbus/TCP systems
- Custom systems you've developed, for example using our .NET Toolkit

Data In and Data Out: OptoEMU Sensor DR

OptoEMU Sensor DR monitors:

- Pulsed outputs from pulsing meter or submeter
- Energy devices that communicate over a serial network using the Modbus protocol
- Ethernet energy devices that communicate using Modbus/TCP



OptoEMU Sensor DR provides data for:

- Online energy monitoring applications
- PAC Control strategies
- PAC Display HMIs
- OPC 2.0-compliant clients
- Standard databases (SQL Server, MySQL, Microsoft Access)
- Modbus/TCP systems
- Custom systems you've developed, for example using our .NET Toolkit

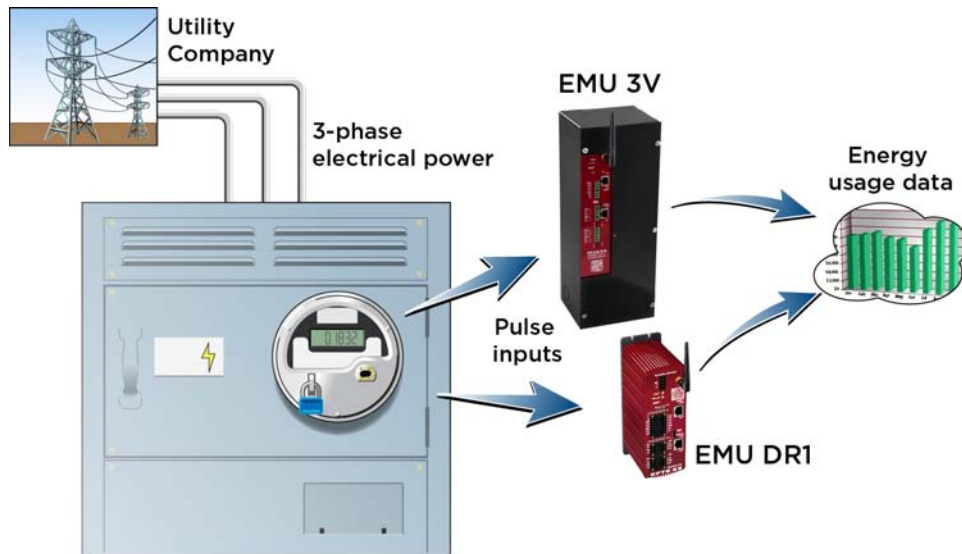
Connecting to Electrical Devices

The OptoEMU Sensor can connect to a variety of metering devices that emit pulses or that communicate using Modbus or Modbus/TCP. In addition, the Sensor 3V (but not the Sensor DR) can also connect directly to electrical circuits using current transformers (CTs) with a 0.333 VAC secondary.

OptoEMU Sensors can monitor energy devices in multiple ways, simultaneously:

- **Pulse**—The Sensor 3V can monitor up to four electrical devices that emit a pulse, such as a utility meter or submeter. The Sensor DR can monitor up to two such pulsing devices.

Connecting to a pulse input

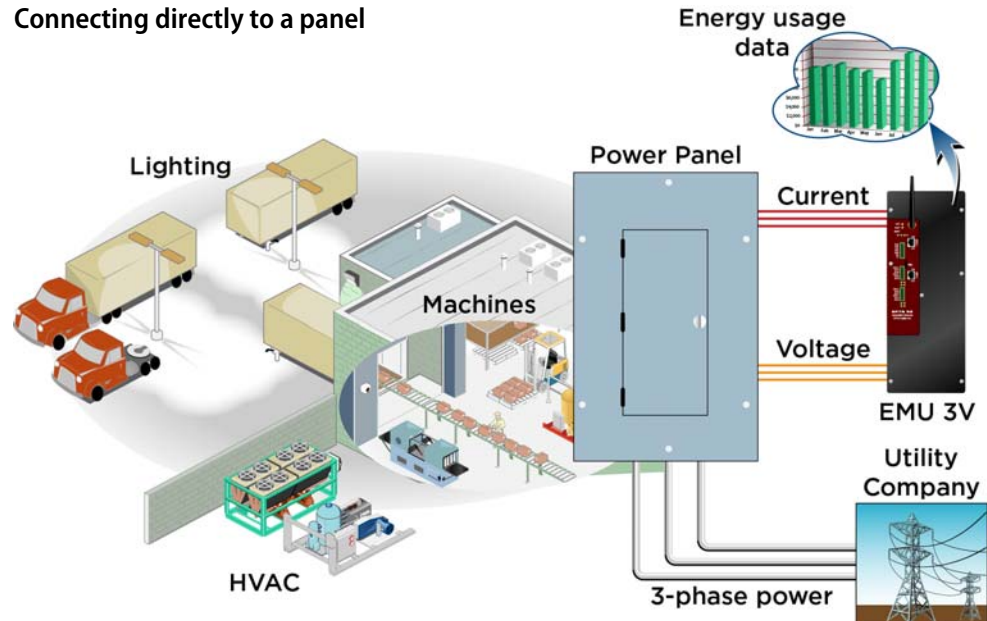


- **Ethernet**—The Sensor can monitor energy devices that connect over an Ethernet network using Modbus/TCP.
- **Serial**—The Sensor can monitor energy devices that connect over a serial network and communicate using the Modbus protocol. The serial interface on the unit is configurable for RS-232 or RS-485. When collecting data from Modbus devices, the Sensor acts as the Modbus master, and the devices act as slaves.

A total of 64 Modbus data items (over serial and Ethernet) can be monitored.

- **Direct (Sensor 3V only)**—Using suitable current transformers (CTs) with a 0.333 VAC secondary, the Sensor 3V can monitor voltage and current directly from the main power load panel on a building or facility. It can also monitor loads from individual subpanels or electrical equipment such as chillers, boilers, compressors, elevators, and air handling units.

Connecting directly to a panel



One Sensor 3V can connect to one 3-phase electrical panel or device, or to a maximum of three single-phase panels or devices. The Sensor 3V measures line-to-neutral voltage and is suitable for systems up to 600 volts (346 VAC wye).

If you need a fusible disconnect or plan to power the Sensor 3V from the monitored panel instead of using a standard 120 or 240 VAC wall outlet, also purchase the **OPTOEMU-PT600** auxiliary box, which contains a transformer and fusible disconnect.

Delivering Data to Online Energy Monitoring Applications

When the OptoEMU Sensor sends energy usage data to an online energy monitoring application, it does so using standard Internet methods, just like a computer accessing the Internet. If you can browse the web on a PC or laptop from the same network that the Opto EMU Sensor is on, then uploading energy data to an online application is simple:

- The Opto EMU Sensor uploads energy data via port 80, the same port that web browsers use. This port is left open by IT departments to allow web browsing.
- Energy data is sent out at the configured interval using standard HTTP Post commands.
- No inbound port openings are required. All traffic is outbound and no changes are required to the corporate firewall.

This means that except for obtaining a static IP address for the EMU, no other settings or configuration changes are required from your IT Department.

The Sensor was specifically designed to conform with standard Internet usage so that sending energy data would be easy to do and just as secure as the rest of your network.

From Monitoring to Control

After you analyze energy data and reduce energy use through simple steps like adjusting cycles on equipment or running a high-energy process at a different time of day, you may want to automate control of some devices.

The OptoEMU Sensor DR has four signal relay outputs that can be used to automatically turn on or off equipment such as HVAC fans and chillers, either in response to a DR event or preset conditions. These outputs can also be used to signal existing energy or building management systems to perform load shedding. Each output can be wired for normally open or normally closed.

For additional control, all OptoEMU Sensors are fully compatible with Opto 22's SNAP PAC System and other control systems.

You can:

- Use data from the Sensor in PAC Control strategies and PAC Display HMIs.
- Share Sensor data with OPC clients or with common SQL databases.
- Use a system based on Modbus/TCP to read OptoEMU Sensor data.
- Incorporate data into a custom .NET program you develop.
- Control outputs on a Sensor DR using any of these systems.

For more information, see the [OptoEMU Sensor Communication Guide](#), form 1958.

For Help

If you have problems installing or using the OptoEMU Sensor and cannot find the help you need in this guide, contact Opto 22 Product Support.

Phone: 800-TEK-OPTO (800-835-6786
toll-free in the U.S. and Canada)
951-695-3080
Monday through Friday,
7 a.m. to 5 p.m. Pacific Time

NOTE: Email messages and phone calls to Opto 22 Product Support are grouped together and answered in the order received.

Fax: 951-695-3017

Email: support@opto22.com

Opto 22 website: www.opto22.com

Note for Experienced Opto 22 Customers

Since OptoEMU Sensors are appliances designed for a specific purpose, their construction and operation differ from the Opto 22 PACs and I/O you normally use. While some specifications and behaviors are similar, others are quite different. Please read the information in this guide carefully, especially when wiring and troubleshooting.

Get Sensor Information with Your Smart Phone

On the OptoEMU Sensor's front panel is a QR (quick response) code that can provide basic specs, wiring, and troubleshooting information. All you need is a smart phone with an app.

If you don't have this guide with you when you're near the Sensor, you can scan the QR code with your smart phone to get the information.

Here's how it works:

1. Get a QR reader for your smart phone.
Google Goggles is ideal for Android; Red Laser is great for the iPhone. Or search your App Store for "QR reader."
2. Scan or take a photo of the code on the OptoEMU Sensor with your phone.
3. Follow the link.



2: Installation: OPTOEMU-SNR-3V

In the Box

You've already unpacked the box and found:

- Quick Start card and this User's Guide
- OptoEMU Sensor 3V
- CD
- Ethernet cable
- Black connectors for inputs
- Information form for configuring the Sensor

Assigning an IP Address for Communication

We recommend you assign an IP address before installing the OptoEMU Sensor 3V to simplify configuration. Although the Sensor 3V can be used on either a wired or a wireless Ethernet network, **initial setup requires a wired network.**

You can use a temporary power cable to supply power to the Sensor 3V while assigning the IP address. Temporary cables are available separately if needed (part number CBL-PWR-120VUS for North America or CBL-PWR-240EU for Europe).

Requirements:

- Computer running Microsoft Windows 7 Professional (32-bit or 64-bit), Windows Vista Business (32-bit), or Windows XP Professional (32-bit, with SP2 or higher), located on the same subnet as the OptoEMU Sensor.
- Current Web browser installed on the PC
- OptoEMU Sensor CD

Get Communication Information

Most Ethernet networks have a DHCP server that automatically assigns IP addresses to devices on the network. But the OptoEMU Sensor is not a computer and cannot respond to a hostname, so it must have a static, fixed IP address. A dynamic address will cause communication problems.

NOTE: If you are using a laptop PC to assign an IP address, make sure you disable Windows' Internet Connection Sharing (ICS). If you don't, the laptop will act like a router and assign a dynamic address.

Find the Sensor's MAC 1 address, located on a label on the bottom of the OptoEMU box, and write it down (you can use the information form that was shipped with the Sensor). From your IT Department, get the following networking information:

- **IP address**—must be a unique, fixed (static) IP address
- **Subnet mask**—mask that divides the local network into subnetworks
- **Gateway**—IP address of the computer that connects the local network to the Internet
- **DNS Server**—IP address of the computer that locates resources on the local network or Internet

NOTE: If you will not be using an online software service to see data—for example, if you will use the Sensor's data only with PAC Project—you do not need the Gateway or DNS Server IPs. However, Gateway and DNS are recommended so that the Sensor can sync its clock to Internet-based time servers and timestamp error and information messages in the message log.

If the Sensor will communicate on a wireless network, also get the following:

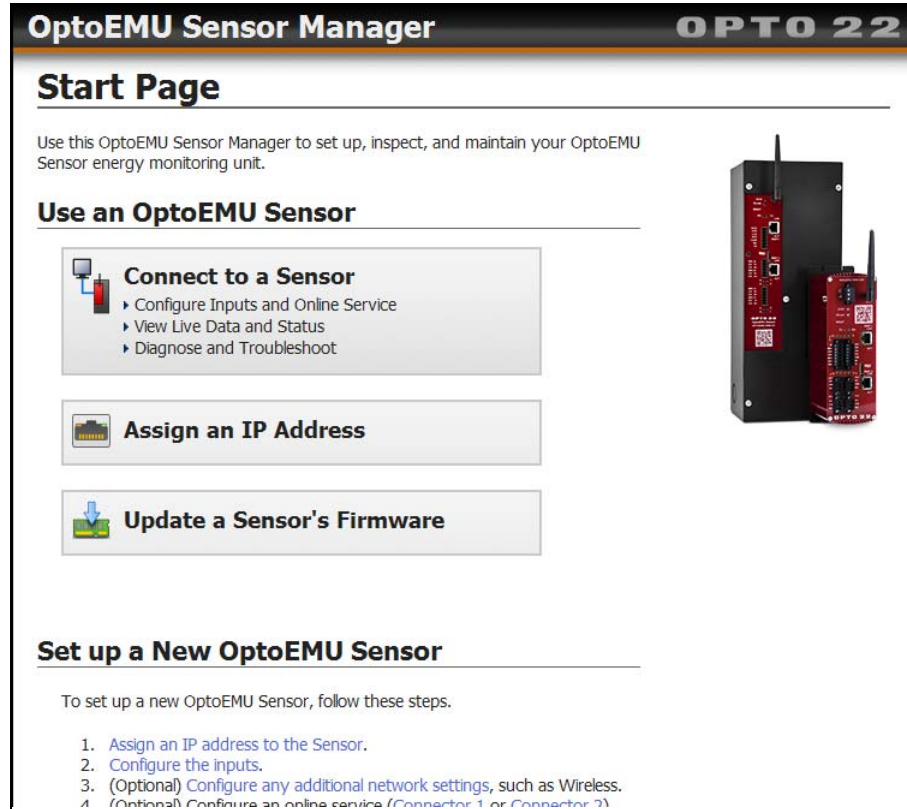
- **SSID**—name of the wireless network
- **Security**—encryption type (WPA or WPA2) and network key input type (hex or ASCII)
- **Password**—to access the wireless network

Open Manager Software

1. At the PC, insert the CD that came with the OptoEMU Sensor 3V.
2. The CD should automatically run. If it doesn't, navigate to the CD-ROM drive and double-click `EmuManager.exe`

If you do not have the CD, you can run or download this file from the Opto 22 website at http://www.opto22.com/site/downloads/dl_drilldown.aspx?aid=4237

3. If a Windows Firewall message appears, click Unblock to allow the software tool to run.
The OptoEMU Sensor Manager opens:



4. Under Set up a New OptoEMU Sensor, click “Assign an IP address to the Sensor.”
5. Plug one end of the provided Ethernet cable into the Sensor 3V’s ENET 1 network interface. Plug the other end into the Ethernet network (or directly into the computer).

Apply Power

Cat II power is required: 100–240 VAC (47–63 Hz, 0.4 A maximum, 8 W). CAT II applies to both plug-connected and permanently connected equipment intended to be supplied from the building wiring, with a nominal supply voltage up to 300 V (see IEC 61010).



WARNING: DANGER. Hazardous voltage. Use caution when wiring. All electrical wiring to the unit must be done by a qualified electrician.

If this equipment is used in a manner not specified by Opto 22, the protection provided by the equipment may be impaired.

1. Remove the Sensor 3V’s black front cover. Save cover and screws.
2. Attach a temporary grounded power cable to the Sensor 3V: using wire nuts, connect 100–240 VAC (47–63 Hz, 0.4 A maximum, 8 W) Load to the black wire, and connect Neutral to the white wire. Secure ground to chassis ground according to the label on the inside of the unit.

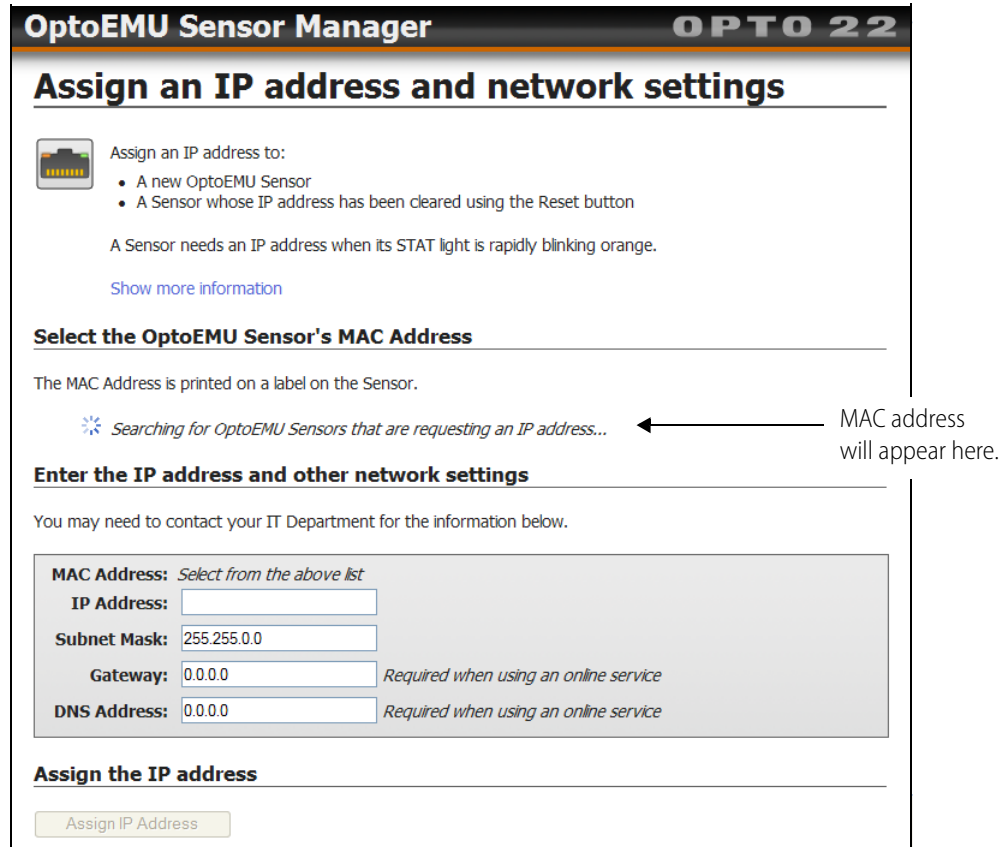
NOTE: Temporary cables are available separately if needed for this purpose (part number CBL-PWR-120VUS for North America or CBL-PWR-240EU for Europe).

3. When the temporary power cable is properly connected, plug it into a standard wall outlet.

There is no on/off switch; as soon as power is applied, the OptoEMU Sensor begins working. On the ENET 1 connector, the ACT and LNK LEDs light up to indicate that the Sensor is on the network. The Sensor begins broadcasting a message requesting an IP address. The STAT light blinks orange while the Sensor is broadcasting.

Assign IP Address

1. Back at the computer, watch for the Sensor 3V's MAC address to appear.



2. When you see a MAC address, make sure it matches the MAC 1 address of the OptoEMU Sensor 3V. (The OptoEMU Manager will find all Opto 22 devices on your network that need IP addresses, so make sure you are assigning an address to the correct device.)

If the Sensor's MAC address does not appear, the Sensor may have been requesting an IP address for too long (for example, if the Sensor was powered on earlier). In that case, carefully insert a straightened paperclip or stiff wire into the small hole labeled RESET on the Sensor's red panel and quickly press and immediately release the reset button. (See page 52 for more about resetting.) Then come back to the PC and watch for the MAC address again.

3. Follow instructions on the screen to enter the IP address and other network information.

NOTE: If you will use an online software service such as Pulse Energy or eSight to see the Sensor's data, you must enter the Gateway and DNS IP addresses. Gateway and DNS are recommended in any case,

so that the Sensor can sync its clock to Internet-based time servers and timestamp error and information messages in the message log.

4. Click the Assign IP Address button. Scroll down and watch the process.
The IP address is assigned, the OptoEMU Sensor 3V reboots, and the EMU Manager pings the Sensor to check communication. The STAT LED blinks green twice, and then after a few seconds turns solid green and blinks briefly once every five seconds to indicate normal operation.
5. When the green check mark appears next to Done, write the Sensor 3V's IP address on the white label, next to the MAC 1 address.
6. Click the Return to Start Page button.
7. If you will use the Sensor 3V only on a wireless network once it is installed, follow the steps in [“\(Optional\) Configure Additional Wired or Wireless Networks” on page 37](#) to set up WLAN communications now.
8. Unplug the temporary power cord and disconnect it from the unit. Replace the unit's front panel using the saved screws.

Choosing a Location

Locate a suitable wall or panel near the electrical panel or equipment you are monitoring and near a source of 120 VAC or 240 VAC power.

NOTE: If you need to power the Sensor 3V from panel or equipment with a voltage higher than 240 VAC, or if you need a fusible disconnect, use the Auxiliary box with stepdown transformer (sold separately). See [“\(Optional\) Installing and Wiring the Auxiliary Box” on page 19](#).

Make sure to allow enough room around the OptoEMU Sensor 3V to wire power and equipment through the sides and bottom of the box. Make sure you can see the MAC and IP address label on the bottom of the box.

Make sure the Sensor can be connected to a standard Ethernet network. You should have already assigned the unit an IP address ([page 9](#)), which requires a wired network. After that initial setup, the Sensor can use either a wired 10/100 Mbps network or a wireless 802.11a, b, or g network.

Installing the OptoEMU Sensor 3V Box

Required: Screwdriver and four #10 screws suited to the wall or panel where the box will be mounted.

1. Remove the six screws holding on the OptoEMU Sensor 3V's cover and take off the cover. Save the screws.
2. Use the mounting template (shipped with the Sensor) to mark and drill the four holes for mounting the box.
3. Using appropriate #10 hardware for the wall or panel construction, attach the box securely through the four holes.

Wiring Devices to the OptoEMU Sensor 3V



WARNING: DANGER. Hazardous voltage. Use caution when wiring. All electrical wiring to the unit must be done by a qualified electrician.

If this equipment is used in a manner not specified by Opto 22, the protection provided by the equipment may be impaired.

To wire pulsing devices, see below. For serial wiring, see [page 15](#). For direct wiring to CTs, see [page 16](#).

Wiring Pulse Devices

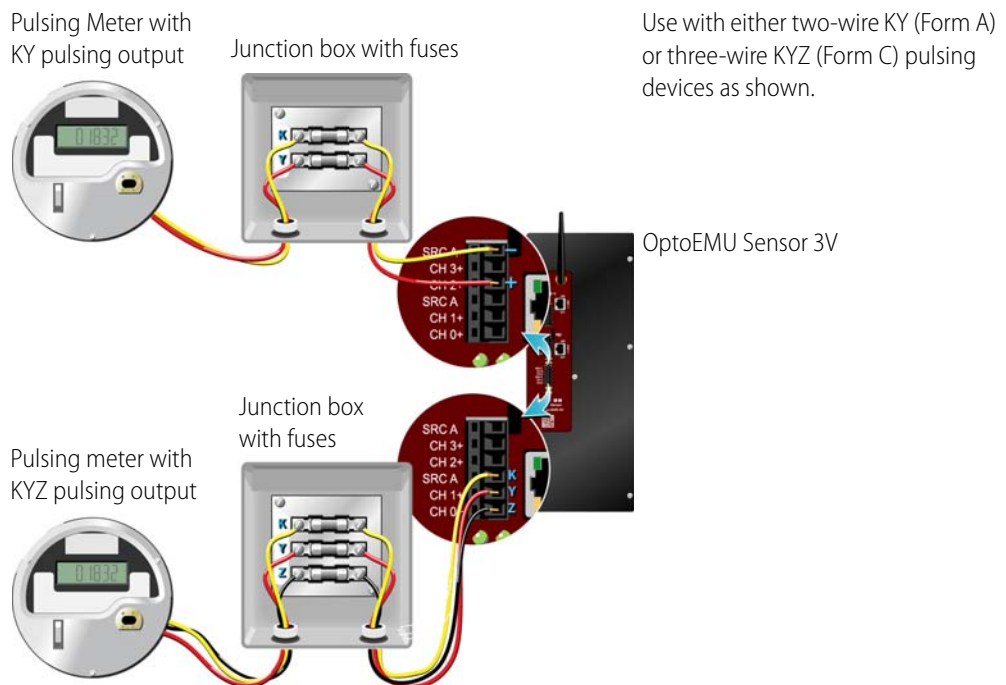
Four devices that output digital pulses can be wired to the two pluggable connectors on the faceplate of the OptoEMU Sensor 3V. The pulses produced may vary:

- Two-wire (Form A, or KY) devices produce a single momentary pulse from a normally open dry contact relay.
- Three-wire (Form C, or KYZ) devices act more like a single-pole, double-throw relay. They change the position of the relay from open to closed (from KZ to KY) or closed to open (KY to KZ) each time a unit of power is measured.

Note that for both types of devices, the Sensor sources power for the relay or switch.

1. Run wires from the pulse device, through a junction box with fusing, to the faceplate of the Sensor. Provide strain relief if needed.
2. Wire as shown in the following diagram, using the connections shown for either KY or KYZ, as required by your pulse device. For additional pulse devices, use the second connector.

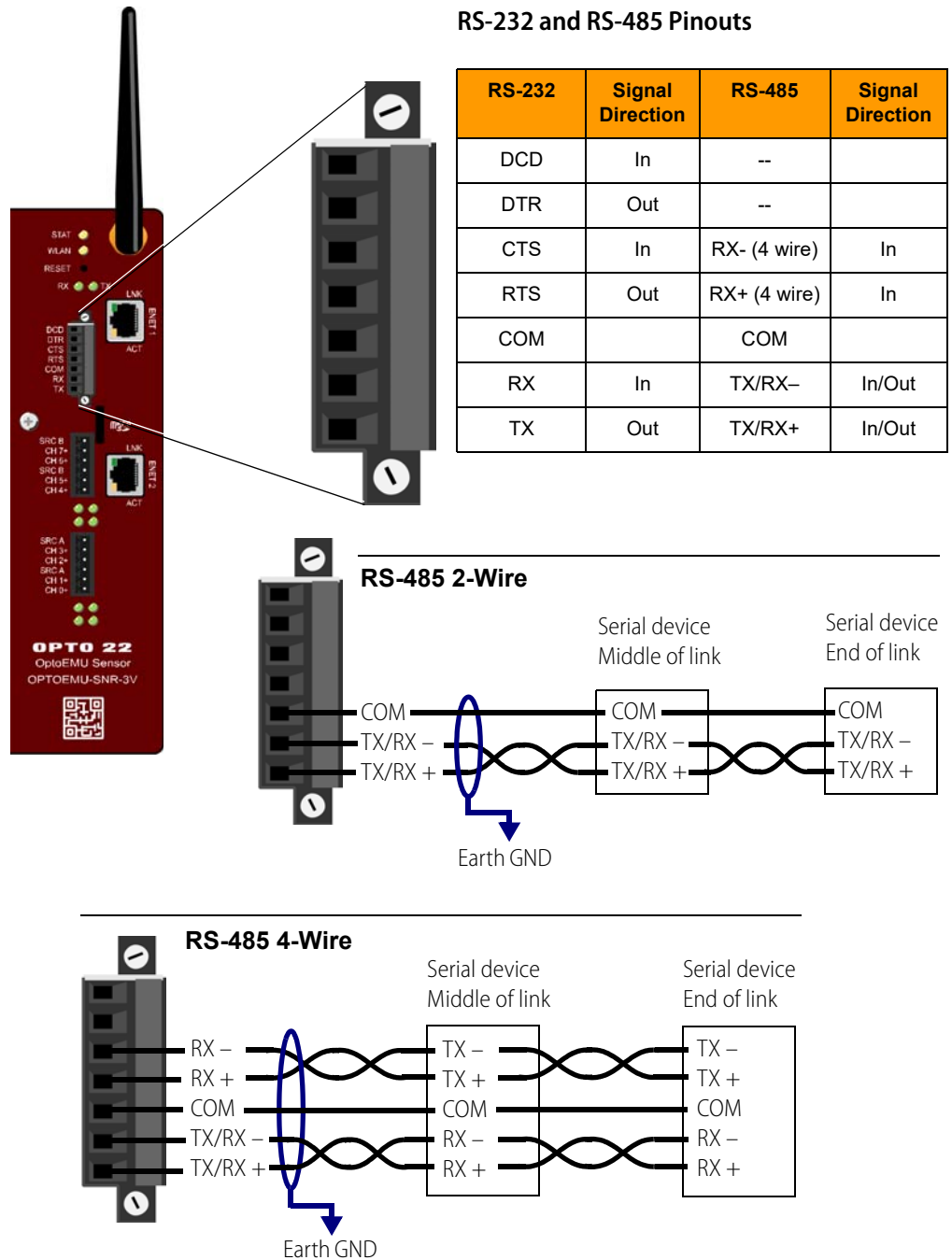
CAUTION: If connections are not immediately apparent, contact your local utility company.



Wiring Serial Devices

Serial devices that communicate using the Modbus protocol can be monitored by the OptoEMU Sensor 3V. The Sensor can monitor a total of 64 data inputs from Modbus devices connected through serial and Ethernet networks. These data inputs can come from one or more devices; each piece of data is considered a data input.

Wire serial devices to the serial port on the Sensor's front panel as shown below. Use RS-232 or RS-485 (2-wire or 4-wire, with optional termination and biasing. You will configure termination and biasing using software, in [Chapter 4: Configuration](#)).



Direct Wiring Using CTs



WARNING: DANGER. Hazardous voltage. Direct wiring involves high voltages and must be done by a qualified electrician.

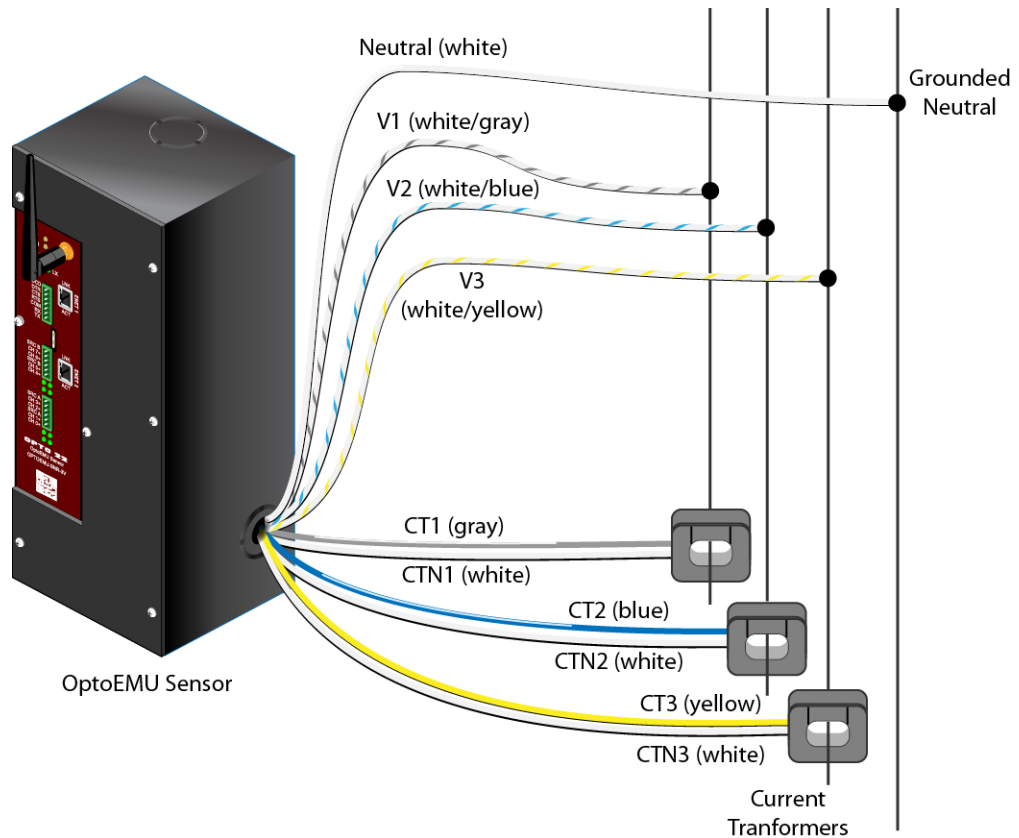
You can monitor one 3-phase electrical panel or piece of equipment, or you can monitor three single-phase panels or pieces of equipment.

1. Determine the maximum current to be measured. Choose a CT with a 0.333 VAC secondary and a primary current that handles both wire size and maximum current.

UL requires CTs to be CAT III approved. Category III is for measurements performed in the building installation, for example circuit breakers, wiring, distribution boards, equipment for industrial use, etc.; see IEC 61010.

UL also requires that CTs be **UL Listed Energy Monitor Current Transformers**. Suitable CTs can be obtained from Sentran Corporation—for example, part numbers LN4F-300-333 (300 A, 1.25" window), LN3F-150-333 (150 A, 0.70" window), or LN2F-100-333 100 A, 0.40" window). See the manufacturer for other ranges and window sizes.

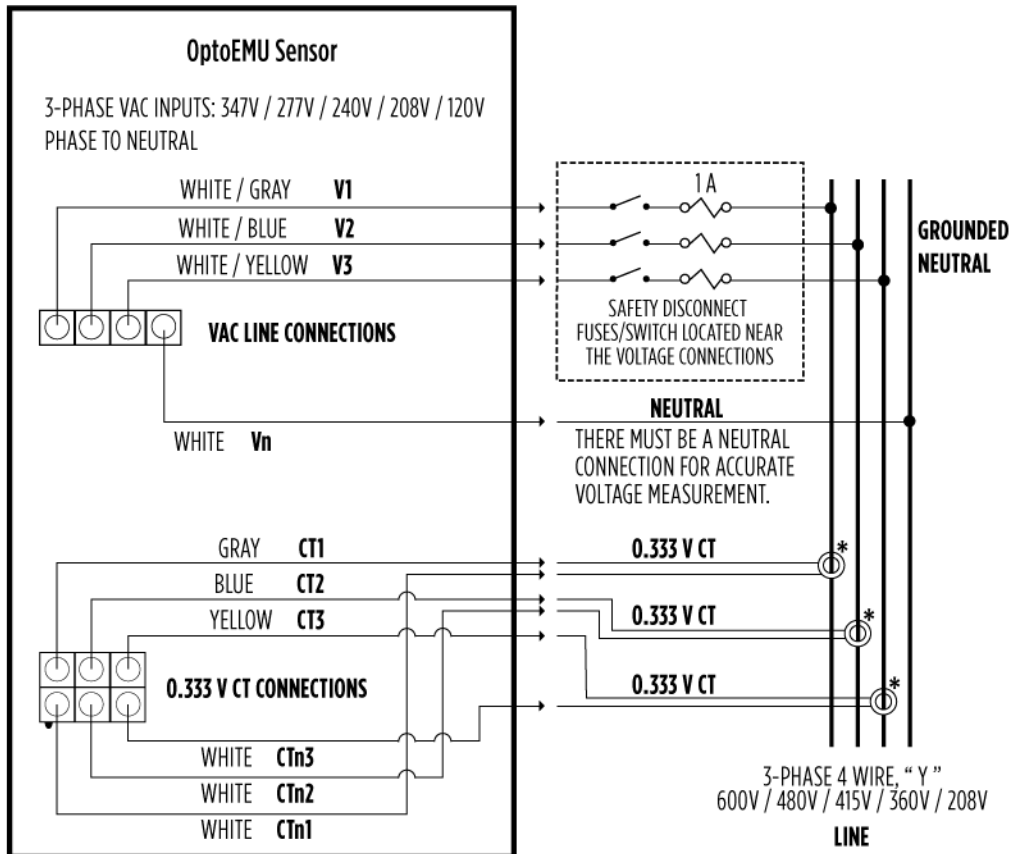
2. Using wirenuts, connect wires from the CTs to the solid-colored wires inside the OptoEMU Sensor box, going through a nearby knockout. See diagrams below and on the following page.
3. Also connect voltage wires to the Sensor's white-striped wires, providing safety fuses.
4. If you are connecting to single-phase devices and have fewer than three of them, connect the unused CT and voltage inputs to their respective neutral (white wire).



NOTE: If you see negative power values after configuring inputs (see page 31), reverse the CT connections.



WARNING: DANGER. Hazardous voltage. All electrical wiring to the unit must be done by a qualified electrician.



*ARRANGE ALL OF THE 0.333 V CTs THE SAME WAY ON THE LOAD CABLES AND CONNECT THE CT SIGNAL WIRES IDENTICALLY (LABELED OR COLORED) TO THE WHITE WIRES.
 IF FEWER THAN 3 PHASES, CONNECT UNUSED CT AND VOLTAGE INPUTS TO THEIR RESPECTIVE NEUTRAL (WHITE WIRE)
 CTs MUST BE CAT III APPROVED.

Providing Power to the OptoEMU Sensor

NOTE: If you need a fusible disconnect, or if you need to power the Sensor from panels or equipment with voltage higher than 240 VAC, purchase the separate OPTOEMU-PT600 and follow instructions in “(Optional) Installing and Wiring the Auxiliary Box” on page 19.



WARNING: DANGER. Hazardous voltage. Use caution when wiring. All electrical wiring to the unit must be done by a qualified electrician.

Cat II power is required: 100–240 VAC (47–63 Hz, 0.4 A maximum, 8 W). CAT II applies to both plug-connected and permanently connected equipment intended to be supplied from the building wiring, with a nominal supply voltage up to 300 V (see IEC 61010).

1. Make sure that power is turned off before beginning.

The OptoEMU Sensor does not have a power switch. The unit starts working as soon as power is applied.

2. Remove a convenient knockout in the bottom or side of the OptoEMU Sensor box.
3. Run wires from the power source to the inside of the box.



4. Connect Load to the black wire and Neutral to the white wire. Connect ground to the grounded chassis (see label inside box).
5. Provide strain relief as necessary.
6. Replace the Sensor’s cover and secure it with the six saved screws.
7. If you are using a wired Ethernet network, plug the Ethernet cable into the ENET 1 network interface on the unit’s faceplate.
8. Apply power to the unit.

There is no on/off switch; as soon as power is applied, the OptoEMU Sensor begins working.

If you have already assigned an IP address (see [page 9](#)), the STAT LED blinks green twice and then remains green, blinking once every five seconds. If you have not yet assigned an IP address, the STAT LED blinks orange; follow instructions beginning on [page 9](#) to assign it.

If the Sensor is monitoring pulse inputs, the numbered LEDs light up when the pulse occurs. For Form A devices, the odd-numbered LED lights up; for Form C (KYZ) devices, odd and even-numbered LEDs light up alternately.

If the Sensor is monitoring devices through the serial port, the RX LED lights up whenever data is being received.

If you're using a wired network, the ACT and LNK LEDs on the ENET 1 connector light up to indicate that the Sensor is on the network. If you are using a wireless LAN, the WLAN LED lights orange while the unit scans, associates, and authenticates the wireless network; when the unit is connected to the network, the WLAN LED turns green.

If you have any questions on LEDs, see ["Blink Codes" on page 47](#).

9. Continue with [Chapter 4: Configuration](#).

(Optional) Installing and Wiring the Auxiliary Box

If you need a fusible disconnect to the OptoEMU Sensor or plan to power the Sensor from the monitored panel or device rather than through standard 120/240 VAC connections, purchase the auxiliary box (part number OPTOEMU-PT600).

The auxiliary box contains a transformer and is suitable for voltage sources up to 600 VAC. The box is the same size and shape as the OptoEMU Sensor.

WARNING: *Wiring the auxiliary box involves high voltages; wiring must be done by a **qualified electrician**.*

Required: Screwdriver and five #10 screws suited to the wall or panel where the box will be mounted

1. Locate a suitable wall or panel close to and in between the OptoEMU Sensor and the power source.
2. Remove the box's cover and save the screws.
3. Use the provided template to mark and drill mounting holes. Using screws suited to the mounting surface, attach the box to the wall or panel.
4. Connect voltage and CTs as illustrated on the following page.

UL requires CTs to be CAT III approved. Category III is for measurements performed in the building installation, for example circuit breakers, wiring, distribution boards, equipment for industrial use, etc.; see IEC 61010.

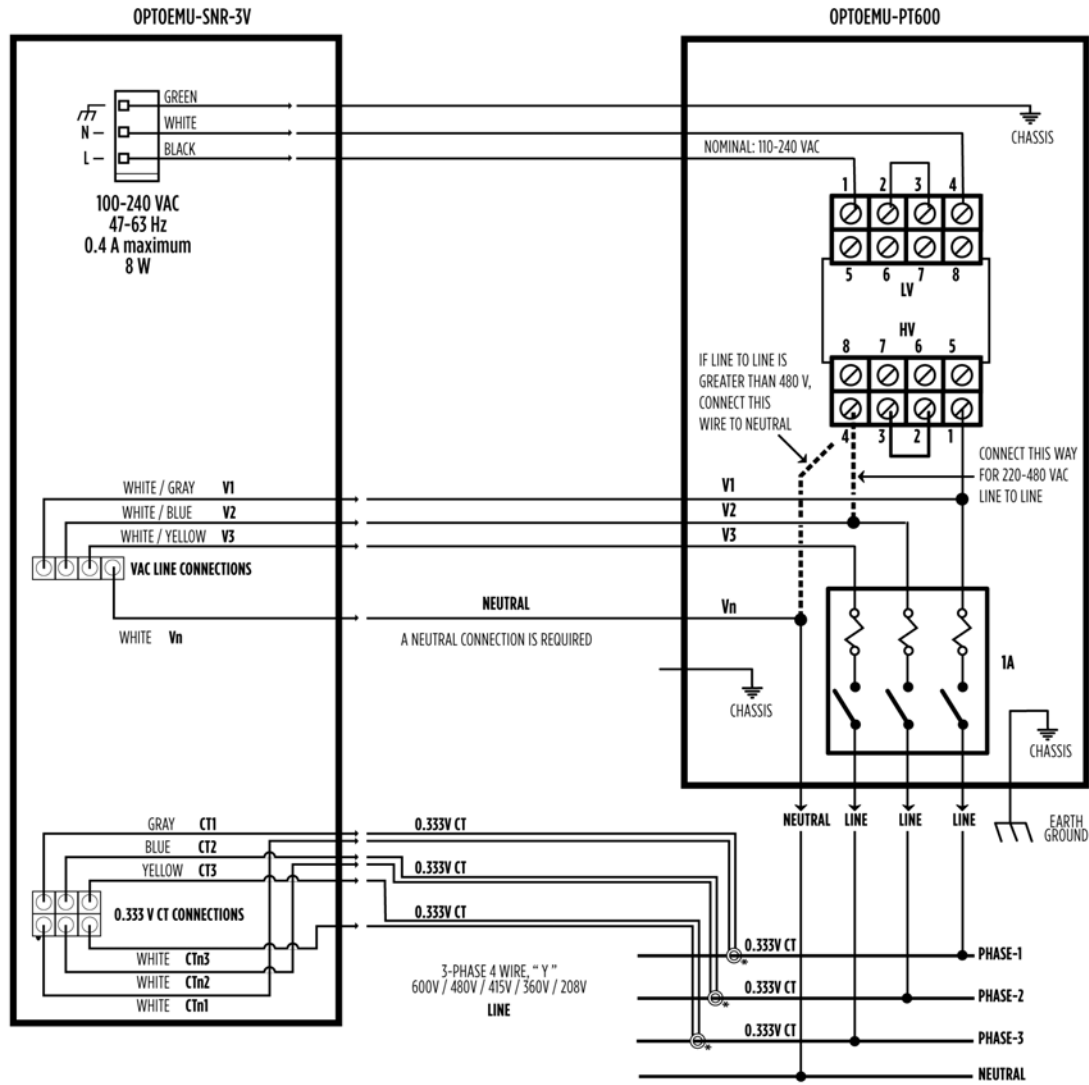
UL also requires that CTs be **UL Listed Energy Monitor Current Transformers**. Suitable CTs can be obtained from Sentran Corporation—for example, part numbers LN4F-300-333 (300 A, 1.25" window), LN3F-150-333 (150 A, 0.70" window), or LN2F-100-333 100 A, 0.40" window). See the manufacturer for other ranges and window sizes.



OPTOEMU-PT600



WARNING: DANGER. Hazardous voltage. All electrical wiring to the unit must be done by a qualified electrician.



*ARRANGE ALL OF THE 0.333 V CTs THE SAME WAY ON THE LOAD CABLES AND CONNECT THE CT SIGNAL WIRES IDENTICALLY (LABELED OR COLORED) TO THE WHITE WIRES. IF FEWER THAN 3 PHASES, CONNECT UNUSED CT AND VOLTAGE INPUTS TO THEIR RESPECTIVE NEUTRAL (WHITE WIRE). CTs MUST BE CAT III APPROVED.

5. When you have finished wiring, replace the box's cover and secure it with the saved screws.
6. Continue with "Installing the OptoEMU Sensor 3V Box" on page 13.

3: Installation: OPTOEMU-SNR-DR1 and -DR2

In the Box

You've already unpacked the box and found:

- This User's Guide
- OptoEMU Sensor DR
- CD
- Ethernet cable
- Antenna (OPTOEMU-SNR-DR1 only)
- Black connectors for power, inputs, and outputs

Choosing a Location

Find a suitable location near the pulsing or serial devices you are monitoring and near a source of 120 VAC or 240 VAC power. The Sensor DR must be mounted in an industrial control panel.

Make sure to allow enough room to wire power and equipment to the Sensor DR's front panel. Also, make sure you can clearly see the MAC and IP address label on the side of the unit.

Make sure the Sensor can be connected to a standard Ethernet network. Initial setup requires a wired network. After initial setup, the Sensor DR1 can use either a wired network or a wireless LAN; the DR2 uses only a wired network.

Installing the OptoEMU Sensor DR

Required: Screwdriver and four #10 screws suited to the industrial control panel surface where the unit will be mounted.

1. Use the mounting template (shipped with the Sensor) to mark and drill the four holes for mounting the unit.
2. Using appropriate #10 hardware for the panel construction, attach the unit securely through the four holes.

Wiring Devices to the OptoEMU Sensor

NOTE: If this equipment is used in a manner not specified by Opto 22, the protection provided by the equipment may be impaired.

Wiring Pulse Devices

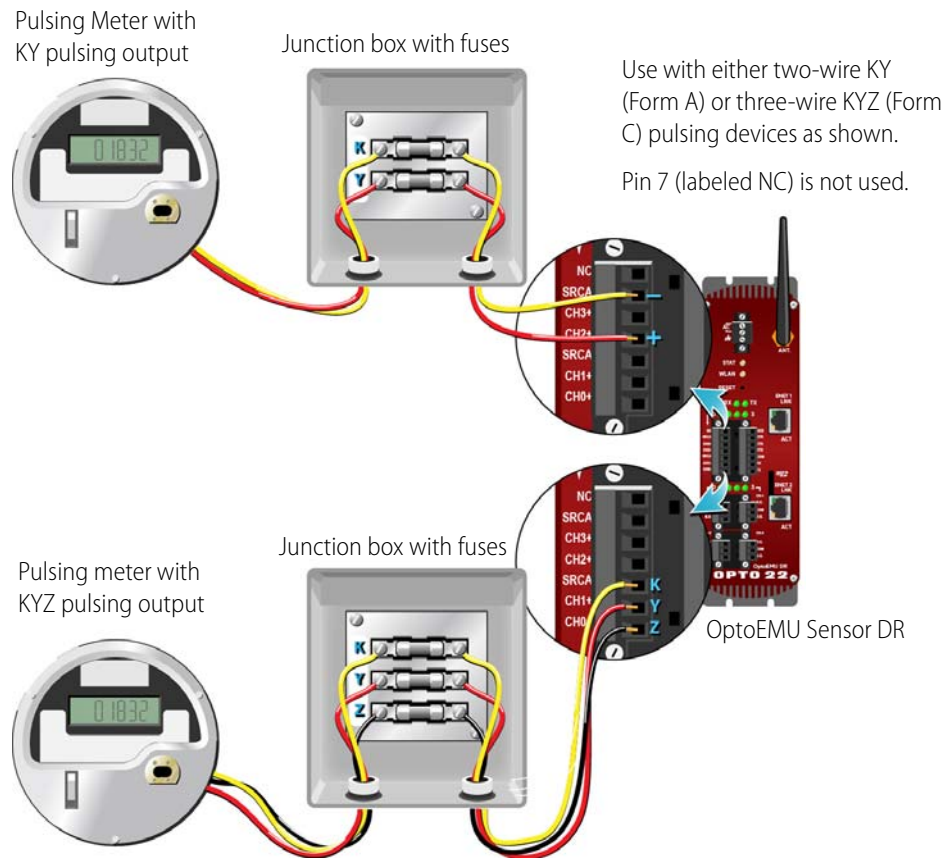
Two devices that output digital pulses can be wired to the pluggable connector on the faceplate of the OptoEMU Sensor. The pulses produced may vary:

- Two-wire (Form A, or KY) devices produce a single momentary pulse from a normally open dry contact relay.
- Three-wire (Form C, or KYZ) devices act more like a single-pole, double-throw relay. They change the position of the relay from open to closed (from KZ to KY) or closed to open (KY to KZ) each time a unit of power is measured.

Note that for both types of devices, the Sensor sources power for the relay or switch.

1. Run wires from the pulse device, through a junction box with fusing, to the faceplate of the Sensor. Provide strain relief if needed.
2. Wire as shown in the following diagram, using the connections shown for either KY or KYZ, as required by your pulse device. The single connector accommodates two pulsing devices.

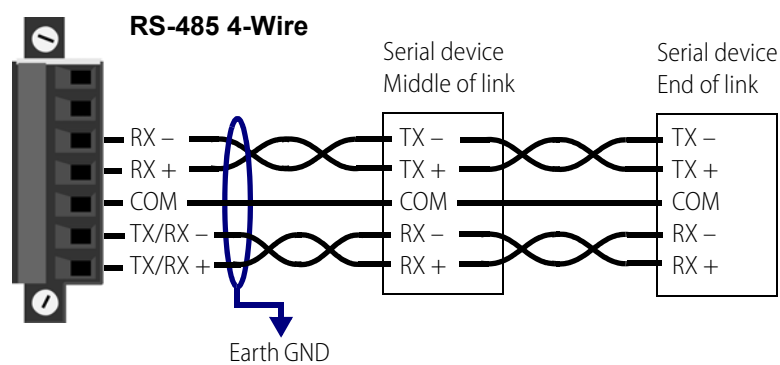
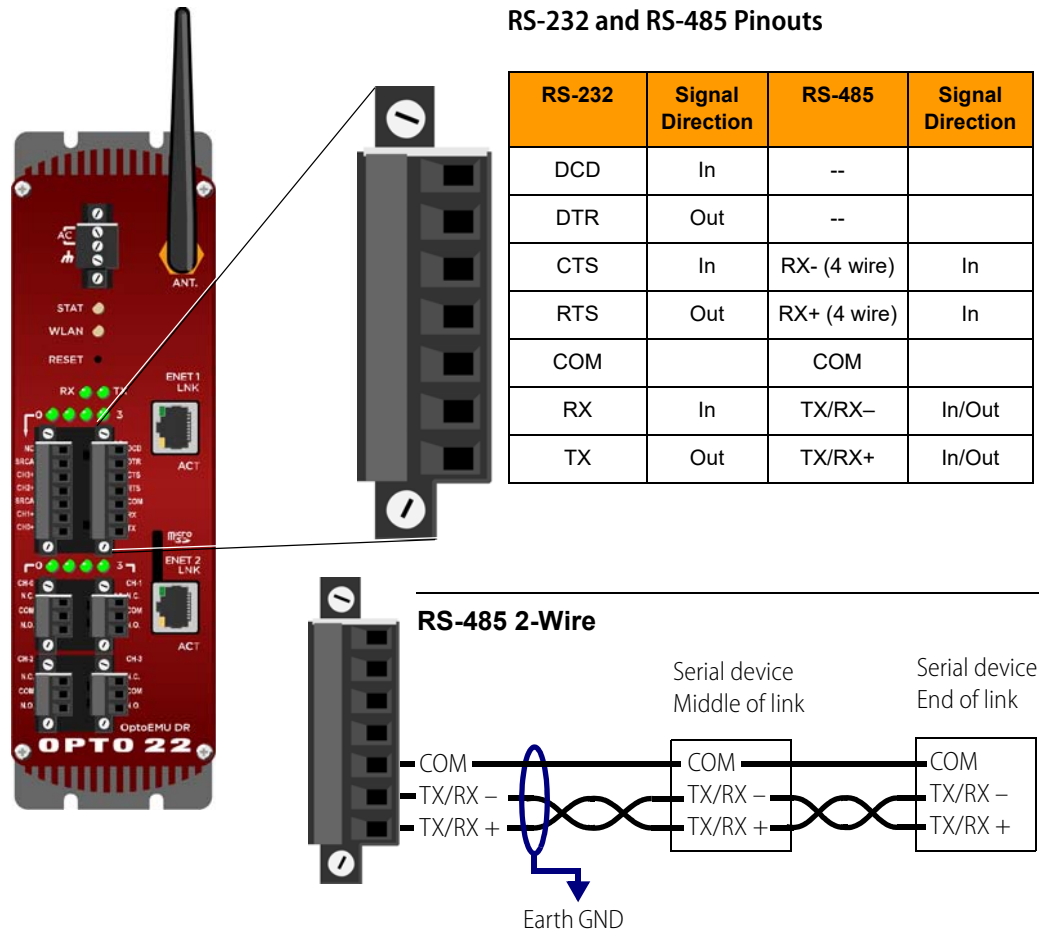
CAUTION: *If connections are not immediately apparent, contact your local utility company.*



Wiring Serial Devices

Serial devices that communicate using the Modbus protocol can be monitored by the OptoEMU Sensor DR. The Sensor DR can monitor a total of 64 data inputs from Modbus devices connected through serial and Ethernet networks. These data inputs can come from one or more devices; each piece of data is considered a data input.

Wire serial devices to the serial port on the Sensor DR's front panel as shown below. Use RS-232 or RS-485 (2-wire or 4-wire, with optional termination and biasing. You will configure termination and biasing using software, in [Chapter 4: Configuration](#)).



Wiring Outputs

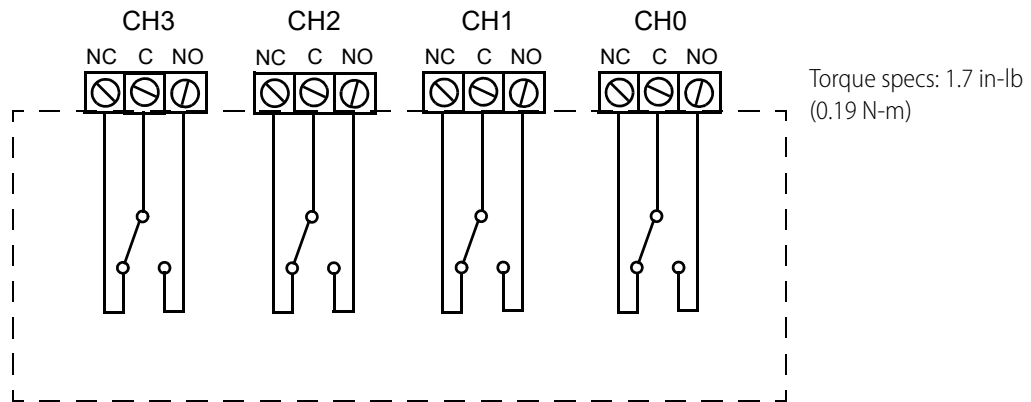
The Sensor DR has four signal relay outputs that you can use to signal equipment to turn on and off or to signal control systems to shed load. Each Form C output can be wired for normally open or normally closed.



Current rating is 100 mA maximum switching @ 250 VAC/VDC maximum.
Using wire size 24–14 AWG, wire outputs as shown below. Provide fusing.

Note: You must provide fusing.

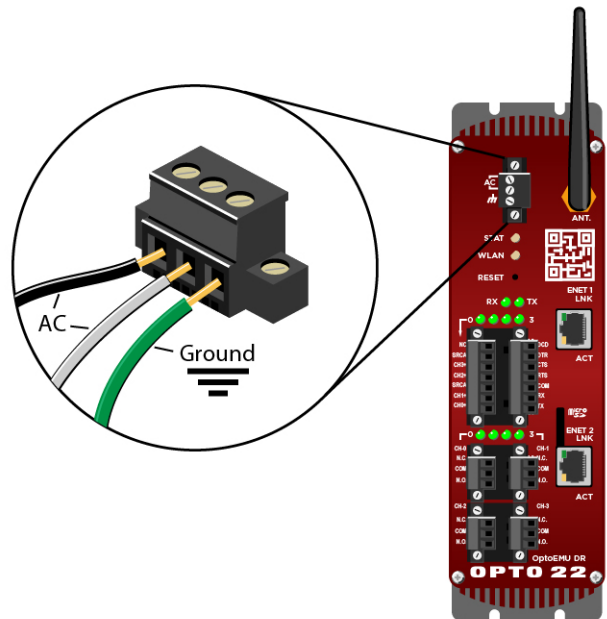
NOTE: Transient protection must be used on inductive loads.



Providing Power to the OptoEMU Sensor DR

Cat II power is required: 120–240 VAC (47–63 Hz, 0.4 A maximum, 8 W). CAT II applies to both plug-connected and permanently connected equipment intended to be supplied from the building wiring, with a nominal supply voltage up to 300 V (see IEC 61010).

1. Make sure that power is turned off before beginning.
2. Connect 120–240 VAC power to the Sensor DR using the provided plug, following the diagram at right.
3. Provide overcurrent protection by means of a maximum 5 A, Edison type HCLR Class CC 600 VAC or equivalent nominal fuse or circuit breaker. Place the circuit breaker in close proximity to the Sensor DR and within easy reach of the operator.
4. Clearly mark the circuit breaker as the disconnecting device for the Sensor DR.



5. Secure the plug to the Sensor DR with the integral screws. Provide strain relief for the power cable as necessary.
6. Do not apply power yet. Continue with the next section.

Assigning an IP Address for Communication

IMPORTANT: Initial setup requires a standard wired Ethernet network. Other requirements:

- Computer running Microsoft Windows 7 Professional (32-bit or 64-bit), Windows Vista Business (32-bit), or Windows XP Professional (32-bit, with SP2 or higher), located on the same subnet as the OptoEMU Sensor DR.
- Current Web browser installed on the PC
- OptoEMU Sensor CD

Get Communication Information

Most Ethernet networks have a DHCP server that automatically assigns IP addresses to devices on the network. But the OptoEMU Sensor DR is not a computer and cannot respond to a hostname, so it must have a static, fixed IP address. A dynamic address will cause communication problems.

NOTE: If you are using a laptop PC to assign an IP address, make sure you disable Windows' Internet Connection Sharing (ICS). If you don't, the laptop will act like a router and assign a dynamic address.

Find the Sensor's MAC 1 address, located on a label on the side of the OptoEMU unit, and write it down (you can use the information form that was shipped with the Sensor). From your IT Department, get the following networking information:

- **IP address**—must be a unique, fixed (static) IP address
- **Subnet mask**—mask that divides the local network into subnetworks
- **Gateway**—IP address of the computer that connects the local network to the Internet
- **DNS Server**—IP address of the computer that locates resources on the local network or Internet

NOTE: If you will not be using an online software service to see data—for example, if you will use the Sensor's data only with PAC Project—you do not need the Gateway or DNS Server IPs. However, Gateway and DNS are recommended so that the Sensor can sync its clock to Internet-based time servers and timestamp error and information messages in the message log.

If the Sensor will communicate on a wireless network, also get the following information:

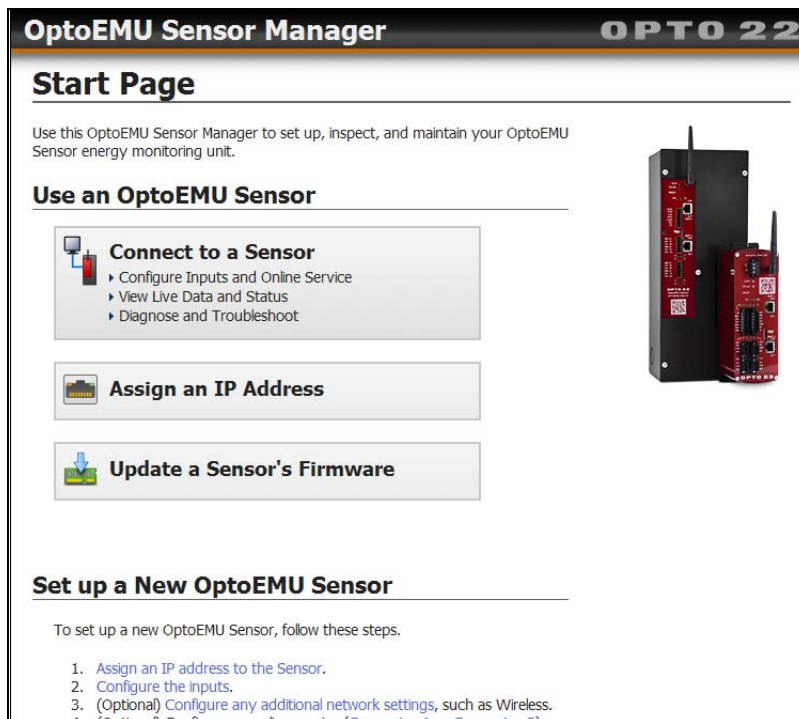
- **SSID**—name of the wireless network
- **Security**—encryption type (WPA or WPA2) and network key input type (hex or ASCII)
- **Password**—to access the wireless network

Open Manager Software

1. At the PC, insert the CD that came with the OptoEMU Sensor.
2. The CD should automatically run. If it doesn't, navigate to the CD-ROM drive and double-click `EmuManager.exe`

If you do not have the CD, you can run or download this file from the Opto 22 website at http://www.opto22.com/site/downloads/dl_drilldown.aspx?aid=4117

3. If a Windows Firewall message appears, click Unblock to allow the software tool to run. The OptoEMU Sensor Manager opens:



4. Under Set up a New OptoEMU Sensor, click "Assign an IP address to the Sensor."
5. Plug one end of the provided Ethernet cable into the OptoEMU Sensor DR's ENET 1 network interface. Plug the other end into the Ethernet network.
6. Apply power to the Sensor DR.

The Sensor DR does not have a power switch. The unit starts working as soon as power is applied. On the ENET 1 connector, the ACT and LNK LEDs light up to indicate that the Sensor is on the network. The Sensor begins broadcasting a message requesting an IP address. The STAT light blinks orange while the Sensor is broadcasting.

Assign IP Address

1. On the computer, watch for the Sensor's MAC address to appear.

OptoEMU Sensor Manager **OPTO 22**

Assign an IP address and network settings

Assign an IP address to:

- A new OptoEMU Sensor
- A Sensor whose IP address has been cleared using the Reset button

A Sensor needs an IP address when its STAT light is rapidly blinking orange.

[Show more information](#)

Select the OptoEMU Sensor's MAC Address

The MAC Address is printed on a label on the Sensor.

✳ Searching for OptoEMU Sensors that are requesting an IP address... ← MAC address will appear here.

Enter the IP address and other network settings

You may need to contact your IT Department for the information below.

MAC Address: *Select from the above list*

IP Address:

Subnet Mask:

Gateway: *Required when using an online service*

DNS Address: *Required when using an online service*

Assign the IP address

2. When you see a MAC address, make sure it matches the MAC 1 address of the OptoEMU Sensor. (The OptoEMU Manager will find all Opto 22 devices on your network that need IP addresses, so make sure you are assigning an address to the correct device.)

If the Sensor's MAC address does not appear, the Sensor may have been requesting an IP address for too long (for example, if the Sensor was powered on earlier). In that case, carefully insert a straightened paperclip or stiff wire into the small hole labeled RESET on the Sensor's front panel and quickly press and immediately release the reset button. (See [page 52](#) for more about resetting.) Then come back to the PC and watch for the MAC address again.

3. Click Select Device next to the correct MAC address. Then enter the IP address and other network information.

NOTE: If you will use an online software service such as Pulse Energy or eSight to see the Sensor's data, you must enter the Gateway and DNS IP addresses. Gateway and DNS are recommended in any case, so that the Sensor can sync its clock to Internet-based time servers and timestamp error and information messages in the message log.

4. Scroll down and click the Assign IP Address button. Watch the progress.

The IP address is assigned, the OptoEMU Sensor reboots, and the EMU Manager pings the Sensor to check communication. On the Sensor, the STAT LED blinks green twice, and then after

a few seconds turns solid green and blinks briefly once every five seconds to indicate normal operation.

The Sensor starts monitoring data immediately. If the Sensor is monitoring pulse inputs, the numbered LEDs light up when the pulse occurs. For Form A (KY) devices, the odd-numbered LED lights up; for Form C (KYZ) devices, odd and even-numbered LEDs light up alternately.

If the Sensor is monitoring Modbus devices through the serial port, the RX LED lights up. If you have any questions on LEDs, see ["Blink Codes" on page 47](#).

5. Back in the OptoEMU Manager, when the green check mark appears next to Done, write the Sensor's IP address next to the MAC 1 address on the Sensor's label, for future reference.
6. Click the Return to Start Page button. Continue with [Chapter 4: Configuration](#).

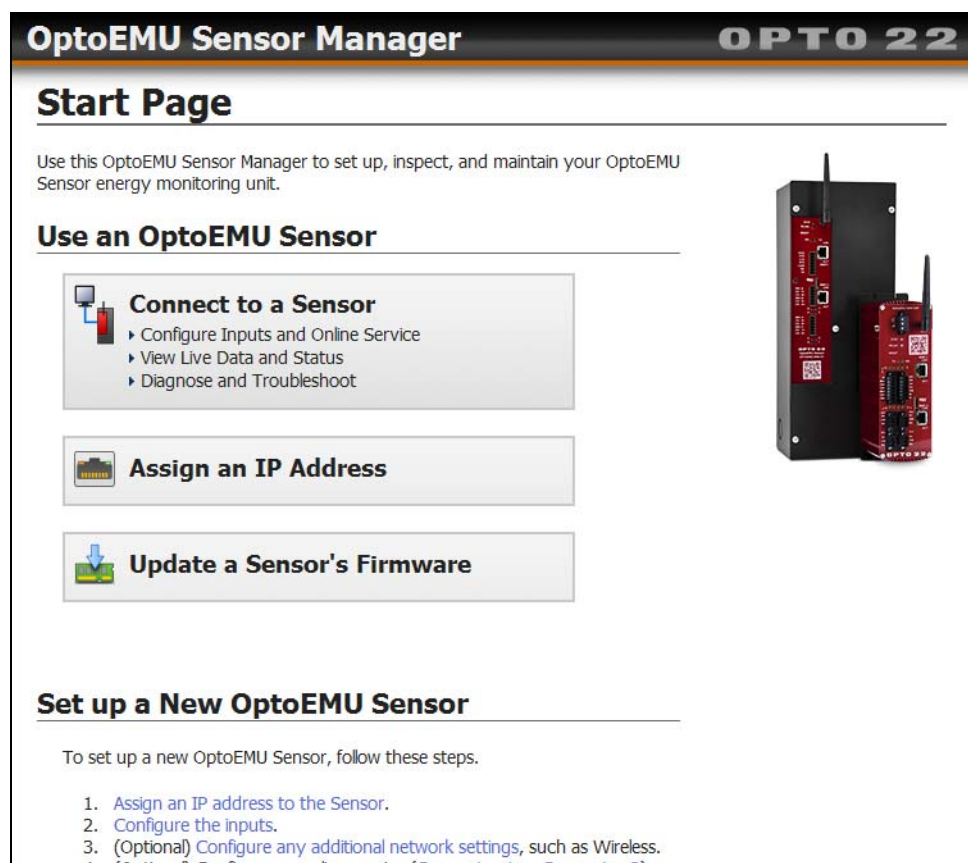
4: Configuration

(Optional) Configuring the Serial Port

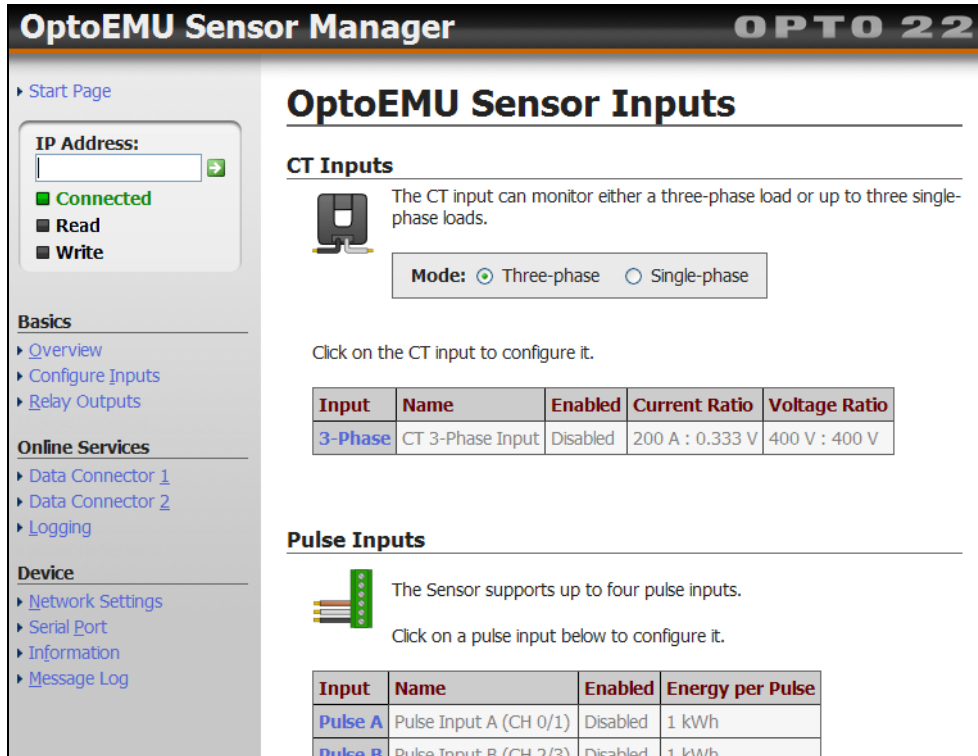
Follow the steps in this section only if you will be using the serial port on the OptoEMU Sensor or Sensor DR to connect to Modbus devices. If you are not using the serial port, skip to [“Configuring Inputs” on page 31](#).

NOTE: The Sensor will restart when you configure the serial port. You must be on a PC on the same network segment as the Sensor.

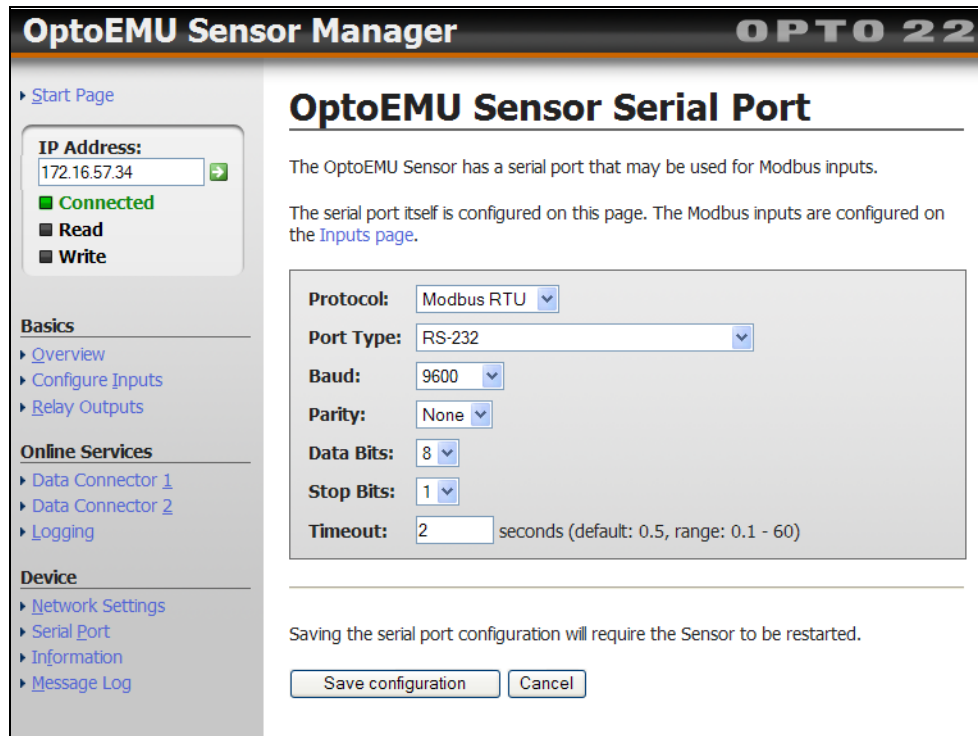
1. If the OptoEMU Manager is not already running, open it now.



2. In the start page under Set up a New OptoEMU Sensor, click “Configure the inputs.”



3. Enter the OptoEMU Sensor's IP Address in the upper left and press Enter (or click the arrow in the green box).
4. In the left-hand navigation bar under Device, click Serial Port.



5. In the Protocol dropdown list, choose RTU or ASCII.
6. In the Port Type field, select RS-232 or RS-485, 2-wire or 4-wire, and set termination and biasing.

Termination—Both ends of the serial link need to be terminated. If the EMU is at one end of the link, choose Termination. If the EMU is in the middle of the link, choose No Termination.

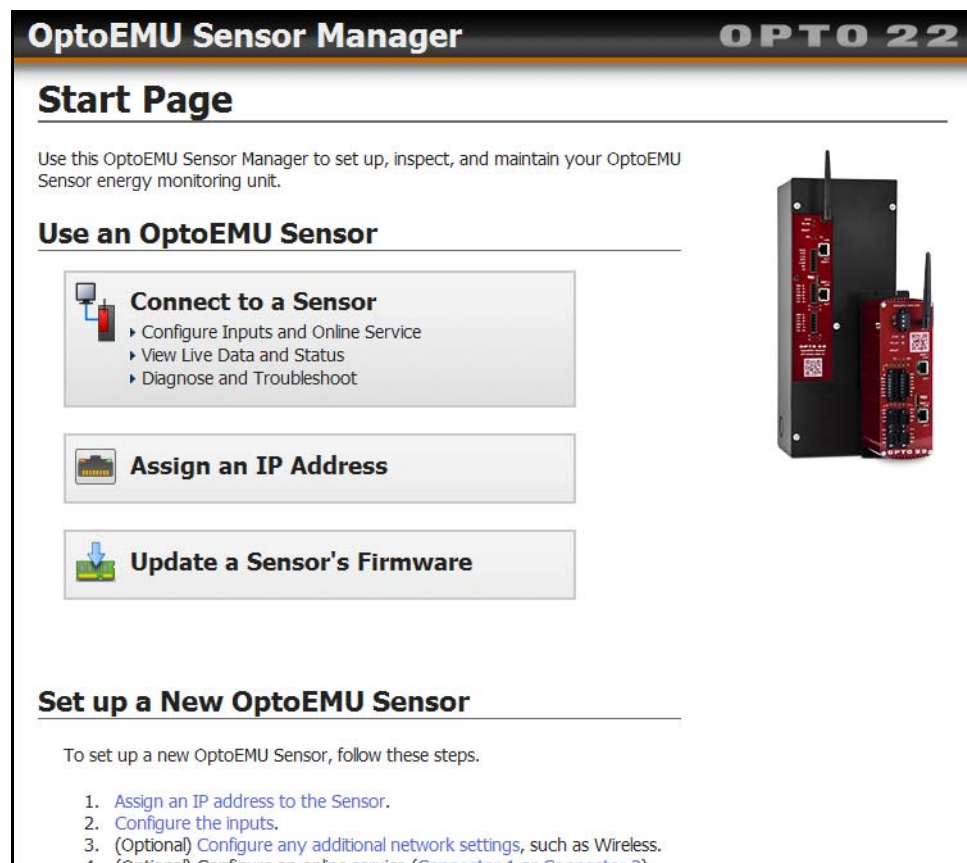
Biasing—Only one device on a serial link should be biased, typically the master. The EMU is acting as the master, so you would normally choose Bias.
7. Enter Baud rate, Parity, Data Bits, and Stop Bits.
8. Set a Timeout suited to your serial network.
9. When all fields are correct, click the Save configuration button.

The OptoEMU Sensor restarts and the configuration is saved. Continue with the next section, Configuring Inputs.

Configuring Inputs

You must be on a PC on the same network segment as the Sensor.

1. If the OptoEMU Manager is not already running, start it now.






OptoEMU Sensor Manager OPTO 22

Start Page

Use this OptoEMU Sensor Manager to set up, inspect, and maintain your OptoEMU Sensor energy monitoring unit.

Use an OptoEMU Sensor

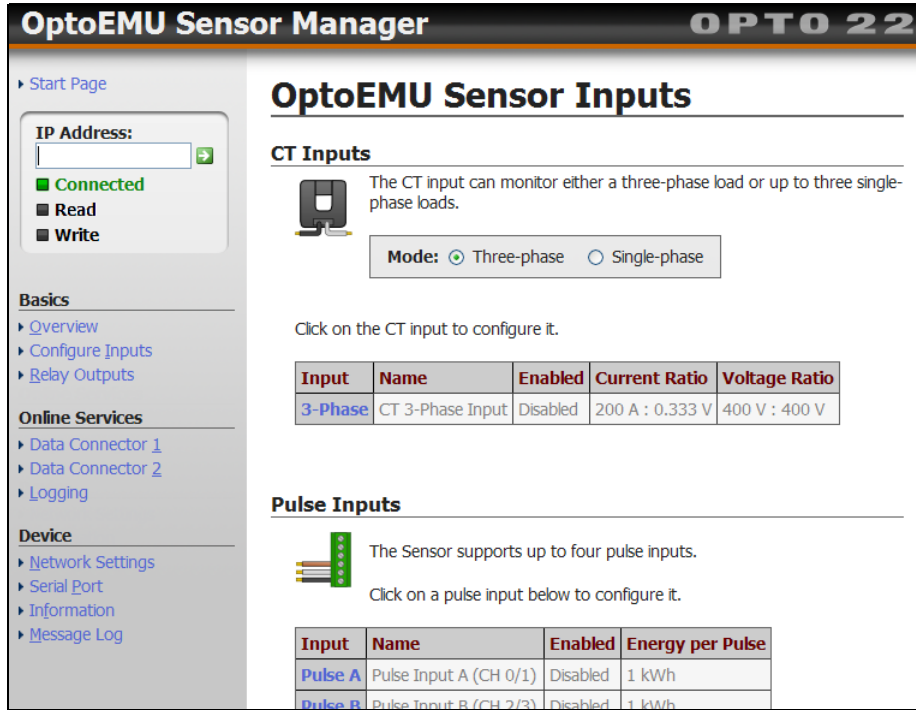
-  **Connect to a Sensor**
 - ▶ Configure Inputs and Online Service
 - ▶ View Live Data and Status
 - ▶ Diagnose and Troubleshoot
-  **Assign an IP Address**
-  **Update a Sensor's Firmware**

Set up a New OptoEMU Sensor

To set up a new OptoEMU Sensor, follow these steps.

1. Assign an IP address to the Sensor.
2. Configure the inputs.
3. (Optional) Configure any additional network settings, such as Wireless.
4. (Optional) Configure an online service (Connector 1 or Connector 2).

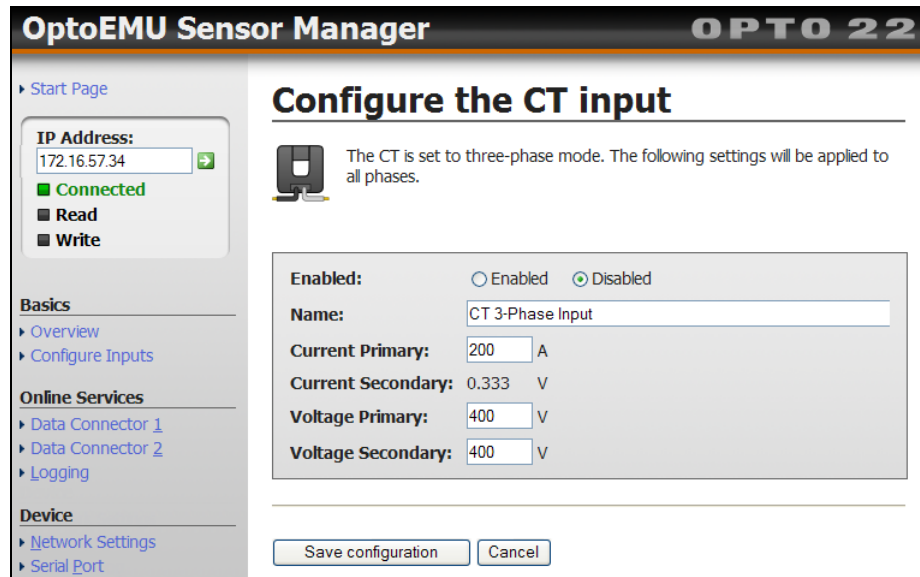
2. In the start page under Set up a New OptoEMU Sensor, click “Configure the inputs.”



3. Enter the OptoEMU Sensor’s IP Address in the upper left and press Enter (or click the arrow in the green box).

NOTE: If you have an OptoEMU Sensor DR, your screen will not show CT Inputs. Skip to step 5.

4. **For direct connections using CTs (does not apply to Sensor DR):**
 - a. Choose whether you are monitoring a Three-phase load or Single-phase loads.
 - b. In the Input column, click the one you want to configure (Phase A or 3-Phase, for example).

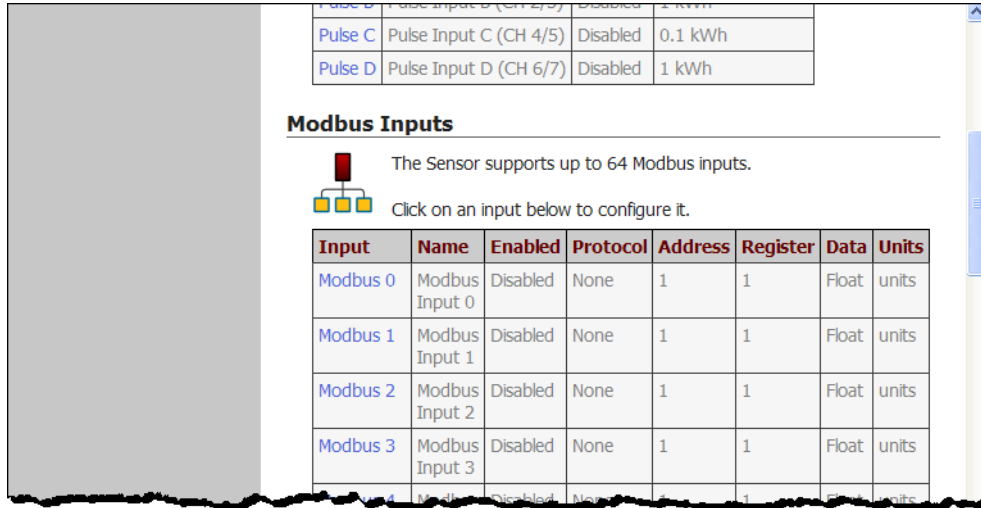


- c. Click Enabled.

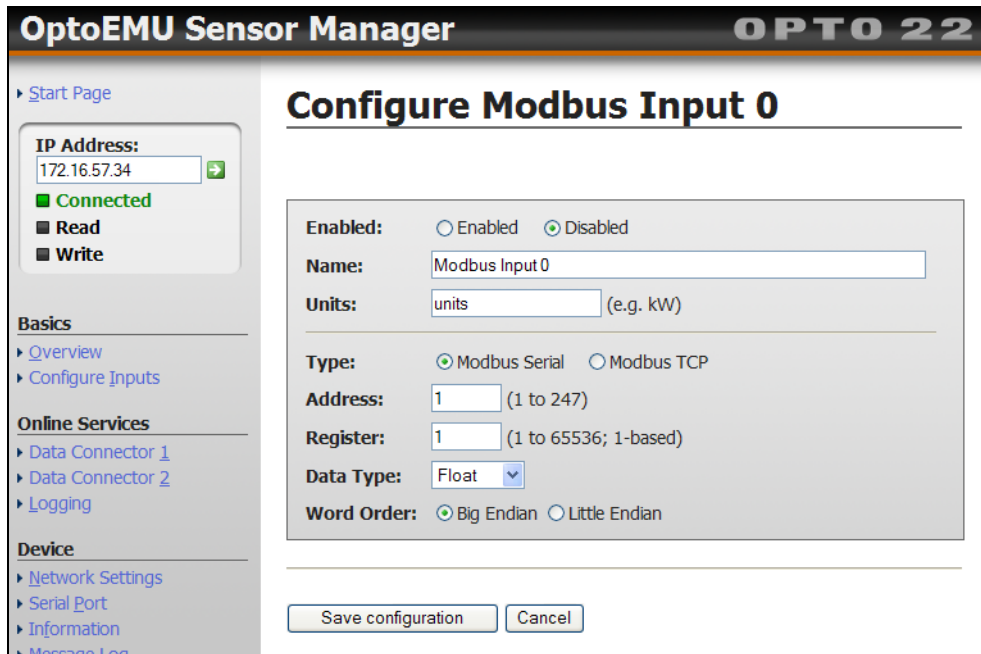
- d. In the Name field, enter a descriptive name for the CT input.
The name can be long, but it's best to limit it to about 20 characters. Make the first few characters distinctive, in case you later want to view data on a small-screen mobile device.
 - e. In the Current Primary field, enter the CT's primary. (The secondary must be 0.333 VAC.)
 - f. If you are using a potential transformer, enter values for the transformer's Voltage Primary and Secondary. If you are not using a PT, leave these values at 400.
 - g. Click Save configuration.
 - h. Repeat for additional CT inputs, if you have them.
- 5. For pulse inputs:**
- a. In the Input column, click the Pulse (A, B, C, or D) that the pulsing device is wired to.

The screenshot shows the 'OptoEMU Sensor Manager' web interface. The main title is 'OPTO 22'. On the left is a navigation sidebar with sections: 'Start Page', 'Basics' (Overview, Configure Inputs), 'Online Services' (Data Connector 1, Data Connector 2, Logging), and 'Device' (Network Settings, Serial Port). The main content area is titled 'Configure pulse input A'. It includes a status bar showing 'Connected' and buttons for 'Read' and 'Write'. Below this, the 'Enabled' section has radio buttons for 'Enabled' and 'Disabled' (selected). The 'Name' field contains 'Pulse Input A (CH 0/1)'. The 'Quantity Per Pulse' field is set to '1 kWh'. The 'Minimum Sample Period' field is set to '5 seconds (default: 5, range: 0 - 30)'. At the bottom are 'Save configuration' and 'Cancel' buttons.

- b. Click Enabled.
 - c. In the Name field, enter a descriptive name for the pulse input.
The name can be long, but it's best to limit it to about 20 characters. Make the first few characters distinctive, in case you later want to view data on a small-screen mobile device.
 - d. In the Quantity per Pulse field, enter the number of kWh each pulse represents.
 - e. Leave the Minimum Sample Period at 5 seconds.
The Minimum Sample Period is the amount of time that the pulse input is measured before the power reading is updated. The lower the sample period value, the faster the power value is updated, but the more it will fluctuate. With a higher value, it is updated less frequently but is more accurate. We recommend a value no less than 5 and no greater than 30 seconds. You can come back and change it at any time.
 - f. Click Save configuration.
 - g. Repeat for additional pulse inputs if you have them.
- 6. For Modbus inputs (over serial or Ethernet):**
- The OptoEMU Sensor operates as the Modbus master. The devices being monitored are Modbus slaves.
- a. Scroll down to the Modbus Inputs section.



b. Click the first unconfigured input.



- c. Click Enabled.
- d. In the Name field, enter a descriptive name for the Modbus data input.
The name can be long, but try to limit it to about 20 characters. Make the first few characters distinctive, so you can view data on a small-screen mobile device.
- e. Enter the units for this data input (for example, kW, kWh, or any other unit that is appropriate for the data).
- f. Choose Modbus serial or Modbus/TCP (Ethernet).
- g. If you chose Modbus/TCP, enter the device's IP address in the field that appears.
- h. In the Address field, enter the serial address of the input device. (For an Ethernet Modbus device, use 1 as the address.)

- i. Consult the documentation for your Modbus device and determine the register, data type, and word order for the data item you want; then enter this information in the appropriate fields.

IMPORTANT: Each Modbus device is different. Some devices' registers are zero-based and some one-based. Some are Big Endian (least significant byte at the highest address), some Little Endian (most significant byte at the highest address). Data types vary; they may be 16-bit or 32-bit integers or 32-bit floats, and some data needs scaling. To get accurate data, check the documentation for your device and make sure all of these fields are correct for each device and data input you are using.

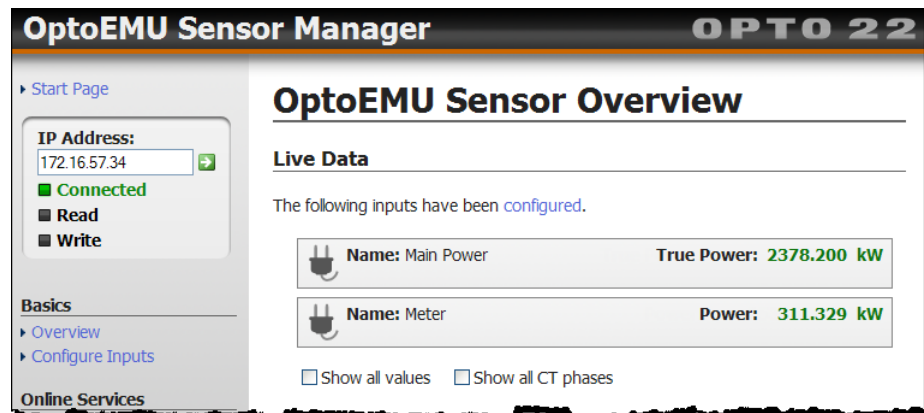
Use the first register from the input device's documentation. Note that OptoEMU Sensor Modbus registers are one-based. If your Modbus device is zero-based, add 1 to your device's register number. Some Veris devices have registers that start at 40,000 but are one-based. For these, subtract 40,000 from the register.

- j. When all fields are correctly filled, click Save configuration.
- k. Repeat from [step b](#) for additional Modbus data inputs.

Test Configuration

Now that your inputs are configured, you can test to make sure the OptoEMU Sensor is getting data.

1. In the left-hand navigation pane, click "Overview".



Data should appear here in green within several seconds after you configure an input. For 3-phase monitoring, you can check the boxes to see additional data.

NOTE: If data values are negative on a CT input, CT wiring connections are reversed. Go back to "Direct Wiring Using CTs" on page 16 and switch wires.

If data does not appear, see [Chapter 5: Troubleshooting and Maintenance](#).

2. To configure Sensor DR outputs, continue with the next section. If you don't have a Sensor DR, go to "[\(Optional\) Configure Additional Wired or Wireless Networks](#)" on page 37. Or if you're using only the ENET 1 network interface, see "[Configure Online Service](#)" on page 39.

Configure Outputs (Sensor DR only)

The OptoEMU Sensor DR has four signal relay outputs that you can use to signal equipment to turn on or off, manually or automatically, or to signal building or control systems to shed load. Action can be based on a preset condition or a DR event. Each output can be wired for normally open or normally closed.

Program automatic control of outputs using any of the methods in the [OptoEMU Sensor Communication Guide](#) (form 1958), available on our website. Configuring the outputs here tells the Sensor DR where instructions will come from.

1. In the left-hand navigation pane, click Digital Outputs. (Digital Outputs appears in the navigation pane only when you're communicating with a Sensor DR.)

OptoEMU Sensor Manager OPTO 22

Start Page

IP Address: 172.16.57.34
 Connected
 Read
 Write

Basics

- Overview
- Configure Inputs
- Relay Outputs

Online Services

- Data Connector 1
- Data Connector 2
- Logging

Device

- Network Settings
- Serial Port
- Information
- Message Log

Relay Outputs

This OptoEMU Sensor has four relay outputs.

Relay Status

Each relay output can be wired as either Normally Open (N.O.) or Normally Closed (N.C.). The following table shows the current state of each relay.

Output	Current State if N.C.	Current State if N.O.	Manual Control
Channel 0	Closed	Opened	Toggle
Channel 1	Closed	Opened	Toggle
Channel 2	Closed	Opened	Toggle
Channel 3	Closed	Opened	Toggle

Configure the Relay Outputs

Configure how the relays are controlled. Options include manually from within this page or remotely from another device or computer.

Relay Control Mode: Manual

Save configuration Cancel

2. **Manual Control**—To manually activate or deactivate an output (for example, in response to a DR event notification), follow these steps:
 - a. Note the current state of the relay output in the table. To do so, you need to know whether the channel is wired for normally closed (N.C.) or normally open (N.O.).
 - b. Make sure Relay Control Mode is set to Manual. If it is not, change it to Manual and click the Save Configuration button.
 - c. In the Manual Control column, click the word Toggle next to the channel number you want to change.

Toggle changes the channel from its current state to the opposite state. When you activate the output, its LED lights up. When you de-activate it, the LED goes off.

3. **Automated Control**—To automate control of the DR's outputs, follow these steps. (For more information, see the *OptoEMU Sensor Communication Guide*.)
 - a. From the Relay Control Mode dropdown list, choose the method of automated control:
 - To control outputs through PAC Display, OPC, or a SQL database using OptoDataLink, choose Public Interface - Strategy Tags.
 - To control outputs using PAC Control (peer-to-peer from a SNAP PAC controller), a Modbus/TCP system, or a custom program you develop using our free .NET Toolkit, choose Public Interface - Scratch Pad.
 - b. When Mode shows the correct method of control, click the Save configuration button. The configuration is saved.

(Optional) Configure Additional Wired or Wireless Networks

OptoEMU Sensors have three independent network interfaces:

ENET 1	Primary 10/100 Mbps wired Ethernet interface
ENET 2	Secondary 10/100 Mbps wired Ethernet interface
WLAN	Wireless LAN interface, 802.11a, b, or g and 802.11i security standards (WPA2-AES or WPA-TKIP)

You can use one network interface or any combination of the three to connect the Sensor to devices being monitored and devices that need to receive data. For example, you could send data to an online software service over ENET 1 and use ENET 2 to collect data from a Modbus/TCP device. Or you could send data to a SNAP PAC System over ENET 1 and send data to an online service over a wireless LAN.

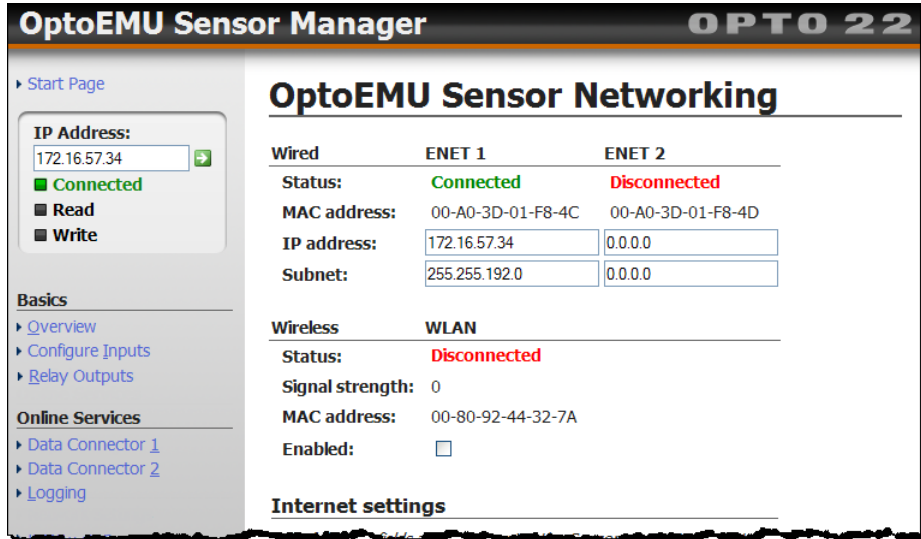
Because the network interfaces are independent, each must have its own static IP address and each must be on a separate IP subnet. Networks cannot be identical nor overlapping.

NOTE: The Sensor will restart after you configure wireless communication or make other changes to network settings.

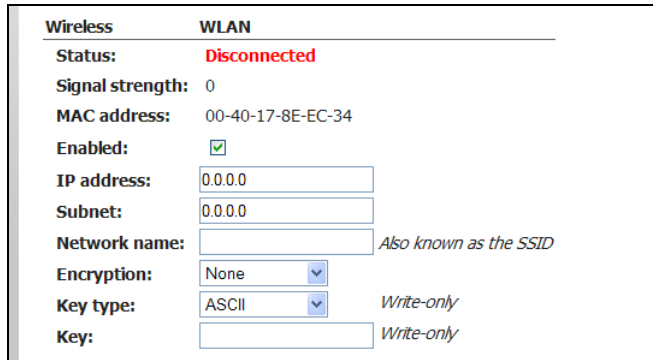
Setting Up Wireless Communication

Configure wireless communication only if the OptoEMU Sensor or Sensor DR will communicate over a wireless LAN. The success of a wireless network depends on your specific site and the location of walls, machinery, and other obstacles that may interfere with wireless reception. Work with your IT Department to set up a reliable and secure wireless network.

1. In the left-hand navigation pane, click "Network Settings."



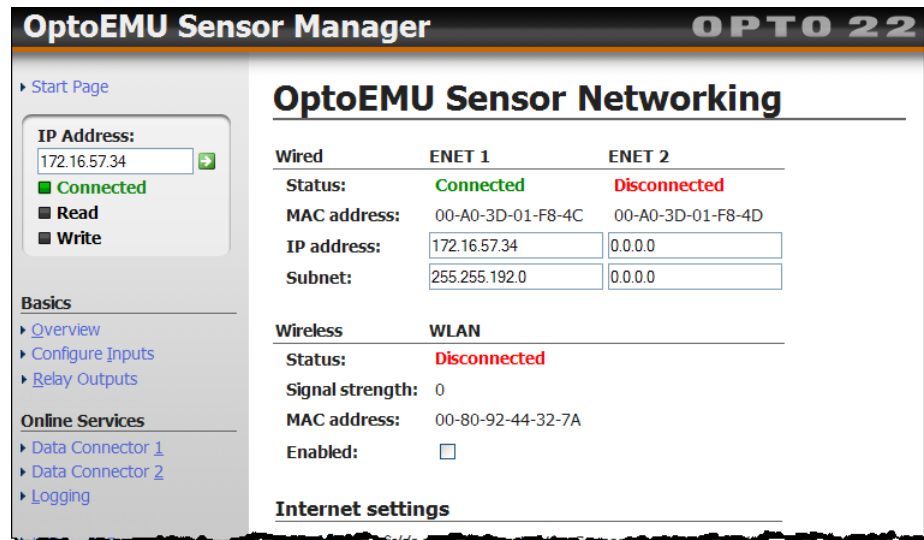
2. In the Wireless area, click the Enabled box to put a check mark in it.
Additional fields appear:



3. Enter the fixed IP address and subnet mask for the wireless LAN.
4. Enter the name of the wireless network (SSID).
5. Choose the Encryption type.
6. Choose the Key type, either Hexadecimal or ASCII (WPA and WPA2 are often ASCII).
7. Enter the network Key (the password for the wireless network).
This field shows the password when you enter it; however, if you look later, the field will show only asterisks.
8. Scroll down and click the Save configuration button.
The changes are saved and the OptoEMU Sensor restarts. The WLAN LED turns orange to indicate that the interface is searching for or authenticating the wireless network. Once the network is found, the LED turns solid green.
9. Write the WLAN IP address on the Sensor's white label near the Wireless MAC address.

Adding a Second Wired Network

1. In the left-hand navigation pane, click “Network Settings.”



2. Under ENET 2, enter the IP address and subnet mask for the second wired network.
3. Scroll down and click Save configuration.
The changes are saved and the OptoEMU Sensor restarts. The ENET 2 LNK LED lights up green, and activity on the network will make the ENET 2 ACT LED blink orange.
4. Write the ENET 2 IP address on the Sensor’s white label near the ENET 2 MAC address.

Changing Network Settings

You can change network settings at any time, for example to change the Gateway and DNS server for access to the Internet. Remember that the Sensor or Sensor DR will restart when you change network settings.

1. In the left-hand navigation pane, click “Network Settings.”
2. Make the necessary changes and click Save configuration.

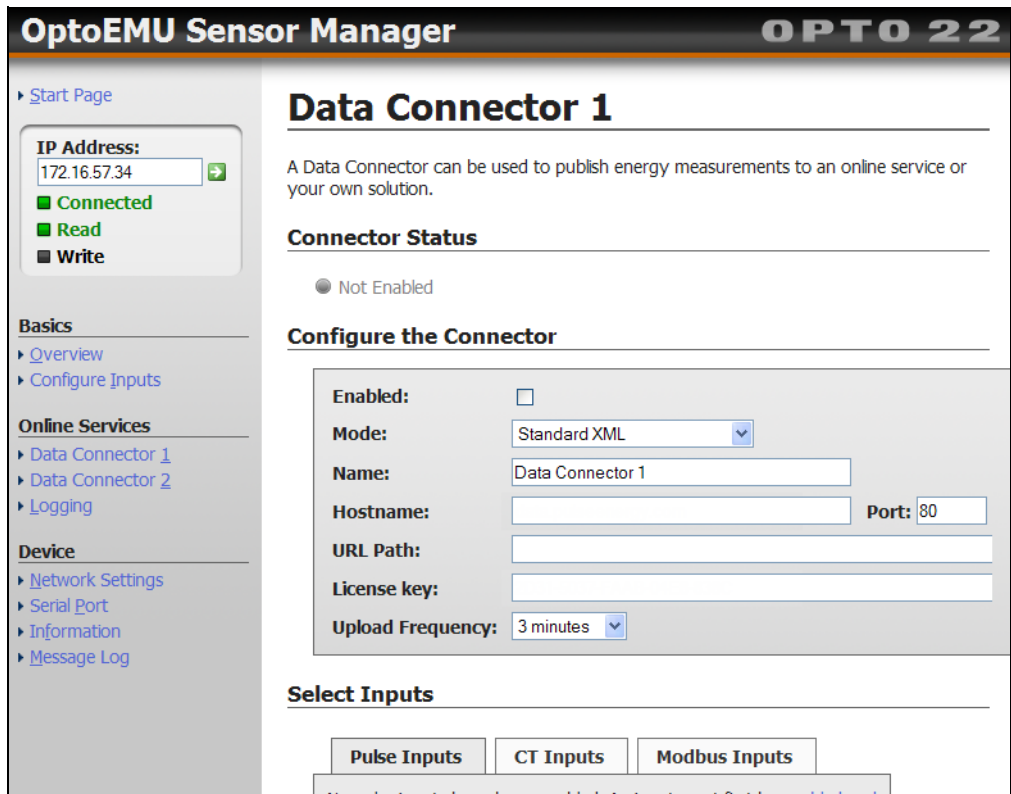
The changes are saved and the OptoEMU Sensor restarts.

Configure Online Service

Most people view the energy data from the OptoEMU Sensor online, using an online energy monitoring service such as Pulse Energy (<http://www.pulseenergy.com>) or eSight Energy (<http://www.esightenergy.com>). (For other ways to see and use the data, see the *OptoEMU Sensor Communication Guide*, form 1958.)

When you are ready, follow these steps to set up communication between the Sensor and the data service.

1. In the left-hand navigation pane under Online Services, click Data Connector 1.



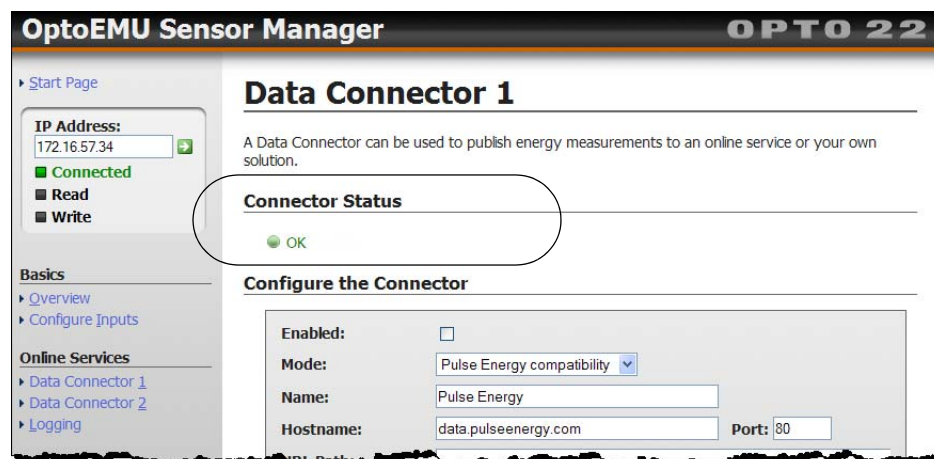
2. Click to put a check in the Enabled check box.
3. In the Mode dropdown list, if you are using Pulse Energy or eSight, choose the one you are using. If you are using another service or your own data connector, choose Standard XML.
4. Enter the following:

Name	Enter a name you'll recognize as the data connector
Hostname	Domain name or IP address for the connector; obtain from the online service you're using.
Port	Default port is 80.
URL Path	Portion of the URL after the hostname; starts with the first slash. Obtain the path from the online service you're using.
License key	Required for Pulse Energy; optional for your own XML connector. For Pulse Energy, contact them to obtain the key.
Upload Frequency	(Minutes) How often the Sensor or Sensor DR will send data to the connector. Default is 1 minute; you can change the frequency to limit the amount of data or as required by the online service you're using.

5. Scroll down to select the inputs to send to this data connector. Click the tab for the type of input you want to send: Pulse Inputs, CT Inputs, or Modbus Inputs.
NOTE: The CT Inputs tab does not appear for a Sensor DR.
6. In the tab, put a checkmark in the box for each piece of data you want to send to this data connector.

7. Note the codes for each item of data in the right-hand column.
 - a. For Standard XML, use the Input ID to identify the data when you're parsing the XML file. Even though the name of the input may change, the Input ID does not.
 - b. For Pulse, you see the System ID on their website along with the input name. If you change the input name, the System ID remains the same.
 - c. If you're using eSight, copy down the import codes for each piece of data you are sending to them. Go to their website, log into your account, and use eSight - Configuration to enter the codes.
8. Scroll down and click the Save configuration button.
9. Scroll back up and watch the Connector Status area near the top of the screen.

When communication is established, status appears as "OK" in green:



If communication is not established, make sure you have entered Gateway and DNS address information (see [“Changing or Verifying Network Information”](#) on page 51).

Once communication is established, you can go to the online service's website, log into your account, and begin viewing and analyzing data.

Change Data Logging Frequency

The OptoEMU Sensor logs energy data regularly (the default is once every minute) and stores the data in persistent memory. You already set how frequently the Sensor should upload data to the data connector (Upload Frequency, [step 4](#) in [“Configure Online Service,”](#) above).

Uploading data to the data connector may not occur as often as data is logged, but no data is lost. For example, if the upload frequency is every three minutes, and data is logged every minute, the Sensor sends three data values each time it communicates with the data connector.

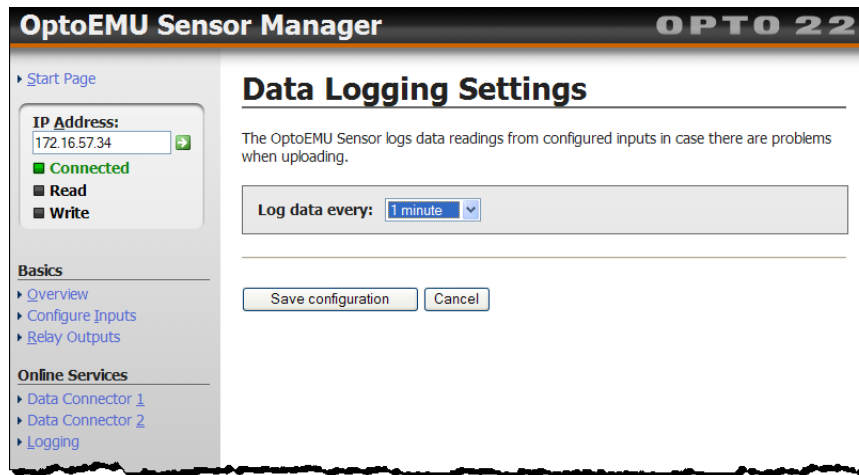
If communication is delayed for any reason, the Sensor uploads the logged values as soon as communication is resumed.

The value for each input can be logged 240 times. After that, the oldest value is replaced by the newest. The length of time these 240 values represent depends upon the Data Logging Settings, which you can change. If you choose to log data every minute (the default), those 240 values represent four hours. If you choose to log data every 15 minutes (the maximum), those 240 values represent 60 hours.

NOTE: Logged data is available only to a data connector and cannot be viewed in any other way.

Follow these steps if you want to change data logging frequency. The default is to log data every minute; this interval gives you detailed usage data that is sufficient for accurate analysis and for use in demand response programs. However, if you don't need data this detailed or have communication problems with your data connector, you may want to lengthen the interval.

1. In the left-hand navigation pane under Online Services, click Logging.



2. Choose the logging frequency from the "Log data every:" dropdown list.
3. Click Save configuration.

5: Troubleshooting and Maintenance

Use the QR Code for Quick Reference

Remember that if you don't have this guide with you but you are near the OptoEMU Sensor itself, you can use your smart phone to get basic troubleshooting, wiring, and specification information. Make sure you have a QR reader on your phone. Then scan the QR code on the Sensor's front panel and follow the link. (See more details on [page 7](#).)

Troubleshooting

If you cannot communicate with the OptoEMU Sensor using OptoEMU Sensor Manager, check the following:

- Make sure that no red LEDs on the Sensor are lit. (A red LED could indicate a voltage supply problem; see blink codes on [page 47](#).) Have a qualified electrician make sure the Sensor's power supply is properly connected.
- If the Sensor is on a wired network, make sure the Ethernet cable is firmly connected to ENET 1. Also check the Sensor's LEDs: both the ENET 1 LNK LED and the STAT LED should be green. (The STAT LED will briefly blink once every five seconds. See blink codes on [page 47](#).)
- If the Sensor is on a wireless LAN, the Sensor's WLAN LED should be green. (See blink codes on [page 47](#).)
- Verify that you typed in the correct IP address for the Sensor. Check the label on the outside of the Sensor box, where the IP address should be written. If the Sensor is on a wired network, you normally use the IP address for ENET 1. If the Sensor communicates wirelessly, use the IP address for the wireless interface.
- Make sure the Sensor has been assigned a valid IP address and subnet mask. Ask your IT Department for assistance.
- Make sure the IP address and subnet mask of your computer are compatible with the IP address and subnet mask of the Sensor.

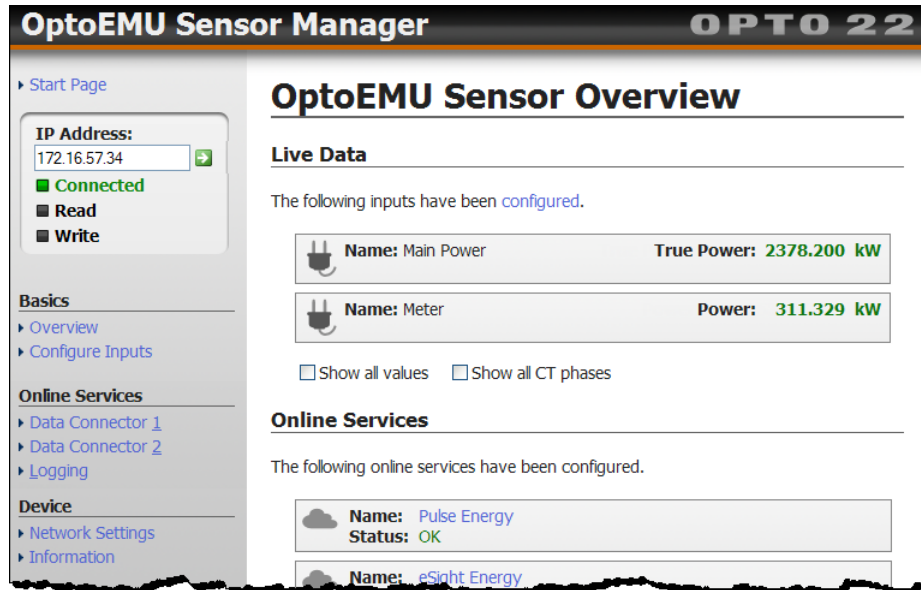
If you still cannot communicate with the Sensor, contact Opto 22 Product Support. (See ["For Help" on page 6](#).)

NOTE: Some earlier versions of the Sensor 3V were accessed using a browser. Once you have upgraded your Sensor 3V, however, you can no longer use a browser to communicate with it. You must use OptoEMU Sensor Manager for communication with the Sensor.

Checking System Status

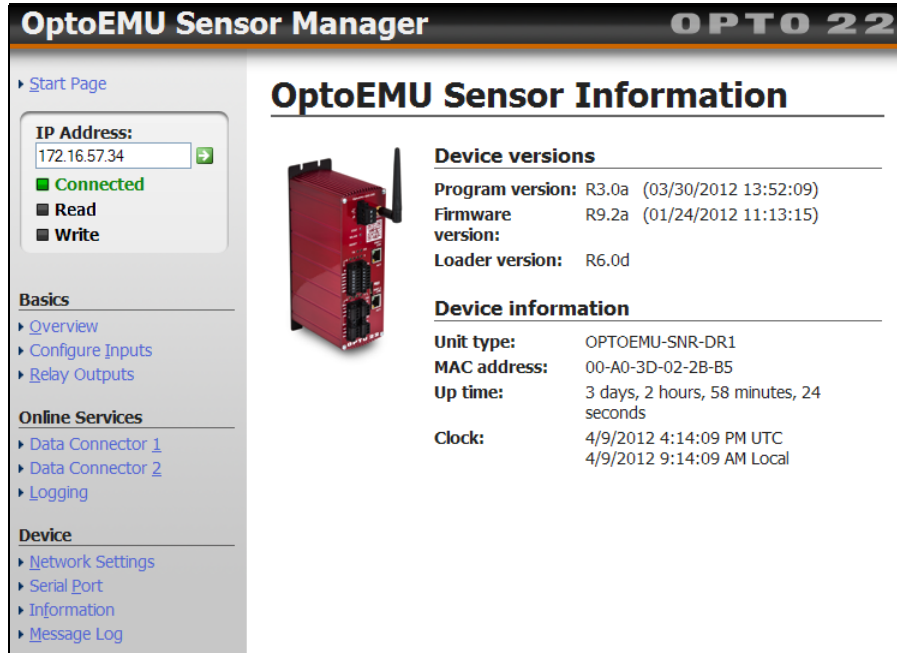
Opto 22 Product Support may ask you to check system status, for example to determine the firmware version on your OptoEMU Sensor or view any error messages. Here's how:

1. Open OptoEMU Sensor Manager. In the Start Page, click the large Connect to a Sensor button to open the Overview page:

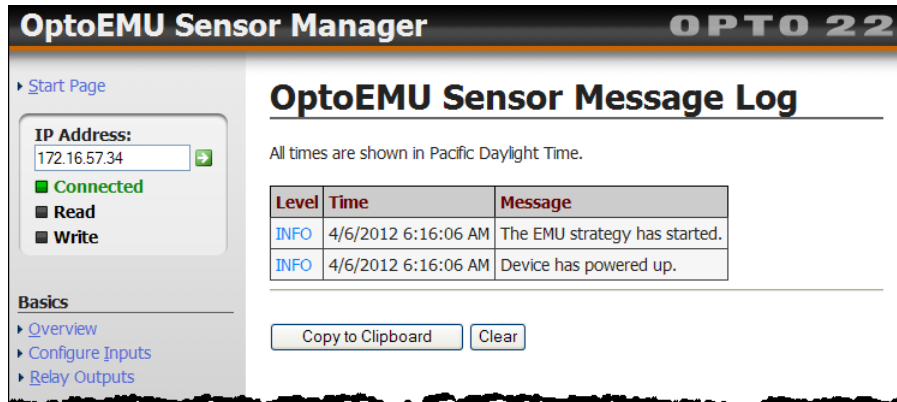


2. Make sure the correct Sensor's IP address appears in the upper left. If it's the wrong address, enter the correct one and press Enter. Use the IP address (usually ENET 1 or wireless) the Sensor is using for communication.
3. In the left-hand navigation pane, under Device, click Information.

Here you see the software and firmware versions, how long the Sensor has been running, and other information that may be useful in troubleshooting.



4. To see a log of information and error messages, under Device, click Message Log.



5. If you want to copy the entire message log, click Copy to Clipboard. You can then paste the log into another program (such as Excel).

Information and Error Messages in the Message Log

The following table is not a complete list but includes the most common messages you may see. Contact Opto 22 Product Support with any questions (see “For Help” on page 6).

Message	Comments
General Information and Error Messages	
[INFO]: Device has powered up.	OptoEMU Sensor has restarted.
[INFO]: The EMU strategy has started.	OptoEMU Sensor software has started running.
[ERROR]: Could not synchronize the system clock.	When it starts, OptoEMU Sensor synchronizes its internal clock against an official time server on the Internet. If you see this error, verify the DNS and Gateway addresses to make sure the Sensor has Internet access (see page 51). The Sensor automatically retries every 15 seconds until it is successful.
[ERROR]: (-5) OBJECT: CT_Inputs CHART: Powerup BLOCK: 5 LINE: 10	If you see a message that looks like this example, contact Product Support (see page 6).
Pulse Energy Errors*	
[ERROR]: Could not post data to data.pulseenergy.com:80. DNS could not resolve hostname.	The Sensor was unable to connect with Pulse. Check the DNS and Gateway addresses to make sure the Sensor has Internet access (see page 51).
[ERROR]: Could not post data to data.pulseenergy.com:80. Timeout while opening socket connection.	The hostname was resolved, but the data upload was not completed. The Sensor stores the data and automatically tries to upload every 3 minutes.
[ERROR]: Could not post data to data.pulseenergy.com:80. SendStatus = XXX; HttpStatus = YYY	SendStatus shows a number representing an error in the OptoEMU Sensor. HttpStatus shows a number representing an error from the web server at Pulse. Contact Product Support to resolve this error (see page 6). Possible HttpStatus values: 400 - Problem parsing XML data from Sensor 401 - License key is not valid or has been revoked 500 - Server problem that Pulse tech support will fix 501 - Incorrect HTTP command sent by Sensor 503 - Sensor has sent too many posts in the last hour
eSight Energy Errors*	
[ERROR]: Could not post data to data.esightenergy.com:80. DNS could not resolve hostname.	The Sensor was unable to connect with eSight. Check the DNS and Gateway addresses to make sure the Sensor has Internet access (see page 51).
[ERROR]: Could not post data to data.esightenergy.com:80. Timeout while opening socket connection.	The hostname was resolved, but the data upload was not completed. The Sensor stores the data and automatically tries to upload every 3 minutes.

* Errors that appear in the log for Pulse and eSight also appear in the OptoEMU Manager (from the Start Page, click the large Connect to a Sensor button).

LED Descriptions

The following LEDs are located on the OptoEMU Sensor's red faceplate.

Indicator	Description
STAT	Startup status, operational status, MicroSD card access
WLAN	Wireless network connection status and network activity (not present on OPTOEMU-SNR-DR2)
RX	Serial port receive
TX	Serial port transmit
LNK	Link established with Ethernet network
ACT	Ethernet network activity
[numbered]	Pulse input indicators
[numbered]	Signal relay output indicators (Sensor DR only)

Blink Codes

The WLAN and STAT LEDs on the OptoEMU Sensor use blink codes to indicate status conditions. The following blink codes can provide useful troubleshooting information.

WLAN LED

Not present on OPTOEMU-SNR-DR2.

LED color	Means
Red	The Sensor is disconnected from the wireless LAN.
Orange	The wireless LAN interface is scanning, associating, and authenticating the wireless network.
Green	The Sensor is connected to the wireless network.
Blinking green	Wireless LAN activity

STAT LED

Color	Number of Blinks	Speed of Blinks	Means
Green	continuous	every 5 sec	Normal operation
Green	2	fast	Normal startup; loading firmware from Flash memory
Green	5	fast	At startup; default settings have been successfully restored
Orange	continuous	every 5 sec	Sensor is running but no tasks are being executed. If you just reset the Sensor, you held down the Reset button too long. See Caution on page 52 to recover.
Orange	continuous	every 1 sec	Bootloader problem. Contact Product Support.
Orange	continuous	fast	Sensor does not have an IP address; see page 9 .
Red and green, alternating	continuous	fast	Sensor is in failsafe bootloader mode; see page 52 .
Red	2	slow	Flash programming failure. Contact Product Support.
Red	3	slow	Firmware CRC check failed. Contact Product Support.
Red	4	slow	Invalid MAC address or hardware revision. Contact Product Support.
Red	5	slow	Fatal error. Contact Product Support.
Red	6	slow	RAM error. Contact Product Support.
Red	7	slow	Loader problem. Contact Product Support.
Red	11	slow	Communication error on ENET 1. Contact Product Support.
Red	12	slow	Communication error on ENET 2. Contact Product Support.
Red	13	slow	Real-time clock failure. Contact Product Support.

To contact Product Support, see [“For Help” on page 6](#).

Maintaining the OptoEMU Sensor

Updating the Sensor

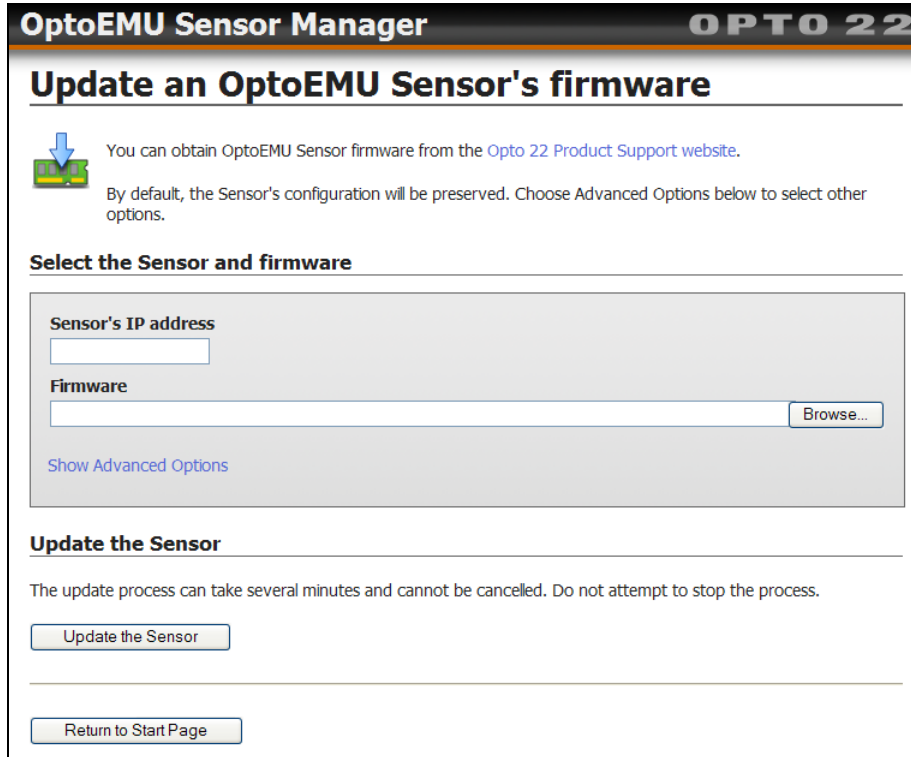
From time to time we may update the firmware or software programs that run on the OptoEMU Sensor. You do not need to update your Sensor unless you want the new features in a release or are having problems. (If you're having problems, an Opto 22 Product Support Engineer may ask you to update.) To update, follow these steps.

Before you begin: You will need to know the IP address of the OptoEMU Sensor. The address should be written on a label on the bottom or side of the Sensor box. If the Sensor communicates over a wired network, use the IP address for ENET 1. If it communicates wirelessly, use the WLAN IP address.

1. Download two files from the Opto 22 website at <http://op22.co/optoemu-snr-3v>:
 - OptoEMU Sensor Manager utility software (You already have this, but it's important to use the most recent version.)
 - OptoEMU update file
2. Open the OptoEMU Sensor Manager.



3. Click Update a Sensor's Firmware.



4. Enter the Sensor's IP address (ENET 1 if it communicates over a wired network, or WLAN if it communicates wirelessly). Make sure the IP address is correct!
5. Click Browse and navigate to the update file you downloaded. Highlight the filename and click Open.

The Sensor's current configuration will be saved. If you want to revert to the factory default configuration, or if a previous attempt to update failed, click Show Advanced Options and choose an option. (Note that for updating, reverting to factory defaults does not change the IP address or other network settings; but it does mean you will have to configure inputs and online services again.)

IMPORTANT: The update process takes several minutes. Once it begins, you cannot cancel it. Do not try to stop the process or turn off power to the Sensor; doing so will cause problems with the Sensor.

6. Scroll down and click the Update the Sensor button.
7. Watch the progress as the Sensor is updated.
When the update is done, the Sensor is ready for use.
If you chose to revert to the factory default configuration, remember to configure the Sensor using the steps in [Chapter 4](#).
8. Click Close and then click the Return to Start Page button.

NOTE: Some earlier versions of the Sensor 3V were accessed using a browser. Once you have upgraded your Sensor 3V, however, you can no longer use a browser to communicate with it. You must use OptoEMU Sensor Manager for communication with the Sensor.

Changing or Verifying Network Information

If you need to change or verify network information for the OptoEMU Sensor—such as an IP address or the Gateway or DNS it uses to send data to your online service—here’s how.

NOTE: The Sensor will restart after you make changes.

1. Open the OptoEMU Sensor Manager. In the Start Page, click the large Connect to a Sensor button.
2. In the navigation pane on the left side, under Device, click Network Settings.
Network status and address information appear:

OptoEMU Sensor Manager OPTO 22

Start Page

IP Address:
172.16.57.34

Connected
 Read
 Write

Basics

- Overview
- Configure Inputs

Online Services

- Data Connector 1
- Data Connector 2
- Logging

Device

- Network Settings**
- Serial Port
- Information
- Message Log

OptoEMU Sensor Networking

Wired	ENET 1	ENET 2
Status:	Connected	Disconnected
MAC address:	00-A0-3D-01-F8-4C	00-A0-3D-01-F8-4D
IP address:	<input type="text" value="172.16.57.34"/>	<input type="text" value="0.0.0.0"/>
Subnet:	<input type="text" value="255.255.192.0"/>	<input type="text" value="0.0.0.0"/>

Wireless **WLAN**

Status: Disconnected

Signal strength: 0

MAC address: 00-80-92-44-32-7A

Enabled:

Internet settings

The following fields are used to give the Sensor access to the Internet. They are required when using an online service. They are recommended in stand-alone mode so that the Sensor can sync its clock to Internet-based time servers.

Gateway:

DNS server 1:

DNS server 2:

3. Verify information or make necessary changes. If you’re using wireless communication, make sure the Enabled box under WLAN is checked.
4. If you have made changes, click the Save Configuration button.
The changes are saved to Flash memory and the OptoEMU Sensor restarts.

Resetting the OptoEMU Sensor

If Product Support tells you to reset the Sensor, follow these steps:

1. On the Sensor’s red panel, carefully insert a straightened paperclip or stiff wire into the small hole labeled RESET.
2. Press and hold down the RESET button as described below. DO NOT hold it too long!

To perform this kind of reset...	...do this...	Result
Simple reset	Quickly press and release the RESET button. OR cycle power to the Sensor.	The Sensor restarts.
Clear IP addresses	Press and hold the RESET button until the STAT LED turns solid green, and then immediately release the button.	The Sensor restarts. IP addresses are reset to 0.0.0.0 and subnet masks to 255.255.255.0. (To assign a new IP address, see page 9 .) Strategy, configured inputs, and file system remain intact.

CAUTION: Do not hold the RESET button too long. If you hold it down longer than five seconds, the Sensor’s software will fail (indicated by the STAT LED blinking green for about 30 seconds, and then blinking red slowly). If this happens, cycle power. Then follow instructions in “Updating the Sensor” on [page 49](#), using the Advanced Option “Restore the Sensor to the default configuration.” The Sensor will be restored to its factory default settings, and you will need to assign it an IP address (see [page 9](#)) and configure it again (see [Chapter 4](#)).

If you hold down the Reset button less than five seconds but longer than needed to restore the factory default settings, the Sensor will restart in failsafe bootloader mode, indicated by the STAT LED blinking red/green continuously. This is not a problem; if it happens, cycle power. The Sensor will restart normally.

Specifications: OPTOEMU-SNR-DR1 and OPTOEMU-SNR-DR2

Overall Unit Specifications

	OPTOEMU-SNR-DR1	OPTOEMU-SNR-DR2
Power Requirements	100–240 VAC, 47–63 Hz, 0.4 A maximum, 8 W	100–240 VAC, 47–63 Hz, 0.4 A maximum, 8 W
Dimensions	Overall 2.45" w x 8.08" h x 4.76" d (6.23 cm x 20.53 cm x 12.09 cm)	Overall 2.45" w x 8.08" h x 4.76" d (6.23 cm x 20.53 cm x 12.09 cm)
Enclosure	Sturdy metal case	Sturdy metal case
Removable storage	MicroSD card slot (for future use)	MicroSD card slot (for future use)
Backup battery	Rechargeable (recharges whenever the unit has power), 3-year power-off data retention	Rechargeable (recharges whenever the unit has power), 3-year power-off data retention

	OPTOEMU-SNR-DR1	OPTOEMU-SNR-DR2
Ethernet Communication (wired)	Two independent 10/100 Mbps Ethernet network interfaces (RJ-45 connectors), each with a separate IP address (separate subnets).	Two independent 10/100 Mbps Ethernet network interfaces (RJ-45 connectors), each with a separate IP address (separate subnets).
Ethernet Comm (wireless)	<p>Wireless LAN interface with separate IP address (separate subnet).</p> <p>Security: AES - Compatible with WPA2 Personal (802.11i); TKIP - Compatible with WPA Personal</p> <p>Frequency 802.11a: 5.180–5.240 GHz, 5.745–5.825 GHz</p> <p>Frequency 802.11b/g: 2.412–2.472 GHz, 2.484 GHz</p> <p>Transmit Power: 15 dBm maximum</p> <p>Antenna Connector: Reverse polarity SMA (RP-SMA or RSMA)</p> <p>Roaming: Supported within an SSID (Service Set Identifier) only</p>	No wireless capability
Serial Communication	One serial port, software configurable for RS-232 (TX, RX, COM, DTR, DCD, RTS, CTS) or RS-485 (2-wire, 4-wire, optional termination, optional biasing).	One serial port, software configurable for RS-232 (TX, RX, COM, DTR, DCD, RTS, CTS) or RS-485 (2-wire, 4-wire, optional termination, optional biasing).
Indicators	Status of unit Wireless: WLAN activity Serial: Receiving, Transmitting (future use) Ethernet interfaces (2): Link, Activity Pulse inputs: On/Off status Mechanical relay outputs: On/Off status	Status of unit Serial: Receiving, Transmitting (future use) Ethernet interfaces (2): Link, Activity Pulse inputs: On/Off status Mechanical relay outputs: On/Off status
Other features	Real-time clock	Real-time clock
Operating Temperature	0 to 60 °C (32 to 140° F)	0 to 60 °C (32 to 140° F)
Storage Temperature	-25 to 85 °C (-13 to 185° F)	-25 to 85 °C (-13 to 185° F)
Humidity	0% to 95% relative humidity, non-condensing	0% to 95% relative humidity, non-condensing
Agency Approvals	UL, cUL, CE, RoHS, DFARS Wireless: U.S., FCC Part 15 Subpart C; Canada, IC RSS-210	UL, cUL, CE, RoHS, DFARS
Warranty	30 months	30 months

Dry Contact Pulse Inputs

OptoEMU Sensor DR supplies 15 volts to each external dry contact switch and senses switch closure.

Open Circuit Voltage (Switch Open)	15 VDC typical (supplied by OptoEMU Sensor DR)
Short Circuit Current (Switch Closed)	7 milliamps nominal
Minimum Off Resistance	>20 K ohms
Maximum Allowable ON Resistance (Wire + Contact Resistance)	500 ohms
Turn-on Time	5 milliseconds
Turn-off Time	25 milliseconds
Input-to-output Isolation	1500 VAC/VDC
Minimum Pulse Width	>= 7 milliseconds
Maximum Frequency	<= 30 Hz
Status indicators	1 LED per channel

Signal Relay Outputs

Contact Configuration	SPDT relay (with NO and NC contacts)
Line Voltage - Range	0–240 VAC or 0–30 VDC
Current Rating	100 mA switching @ 0–240 VAC or 0–100 VDC
Surge Current	600 mA
Minimum Load	0.1 VDC, 5 mA
Contact Resistance	≤ 100 milliohms
Peak Blocking Voltage	250 VAC/VDC
Channel-to-channel isolation	300 VAC (1500 V transient)
Turn-on Time	6 milliseconds
Turn-off Time	6 milliseconds
Temperature	0 to 70 °C, operating -30 to 85 °C, storage
Mechanical Life	5 x 10 ⁶ operations
Operational Life	1 x 10 ³ operations
Status indicators	1 LED per channel

Specifications: OPTOEMU-SNR-3V

Overall Unit Specifications

Power Requirements (without auxiliary box)	100–240 VAC, 47–63 Hz, 0.4 A maximum, 8 W	
Power Requirements (with auxiliary box)	100–240 VAC (single phase) or 277–346 VAC (line to neutral from 480–600 VAC panels)	
Dimensions	6.0"w x 13.5"h x 4.5"d (15.2 cm x 34.3 cm x 11.4 cm)	
Enclosure	Sturdy metal enclosure with standard knockouts for wiring	
Removable storage	MicroSD card slot (for future use)	
Backup battery	Rechargeable (recharges whenever the unit has power), 3-year power-off data retention	
Ethernet Communication (wired)	Two independent 10/100 Mbps Ethernet network interfaces (RJ-45 connectors), each with a separate IP address.	
Ethernet Communication (wireless)	<p>Wireless LAN interface with separate IP address.</p> <p>Security: 802.11i: AES - Compatible with WPA2 Personal; TKIP - Compatible with WPA Personal.</p> <p>Roaming: Supported within an SSID (Service Set Identifier) only</p>	<p>Frequency 802.11a: 5.180–5.240 GHz, 5.745–5.825 GHz</p> <p>Frequency 802.11b/g: 2.412–2.472 GHz, 2.484 GHz</p> <p>Transmit Power: 5 dBm maximum</p> <p>Antenna Connector: Reverse polarity SMA (RP-SMA or RSMA)</p>
Serial Communication	One serial port, software configurable for RS-232 (TX, RX, COM, DTR, DCD, RTS, CTS) or RS-485 (2-wire, 4-wire, optional termination, optional biasing).	
Indicators	<p>Status of unit</p> <p>Wireless: WLAN activity</p> <p>Serial: Receiving, Transmitting</p> <p>Ethernet interfaces (2): Link, Activity</p> <p>Pulse inputs: On/Off status</p>	
Other features	Real-time clock	
Operating Temperature	0 to 60 °C (32 to 140° F)	
Storage Temperature	-25 to 85 °C (-13 to 185° F)	
Humidity	0% to 95% relative humidity, non-condensing	
Agency Approvals*	<p>UL, cUL, CE, RoHS, DFARS</p> <p>Wireless: U.S., FCC Part 15 Subpart C; Canada, IC RSS-210</p>	
Warranty	30 months	

Dry Contact Pulse Inputs

OptoEMU Sensor supplies 15 volts to each external dry contact switch and senses switch closure.

Open Circuit Voltage (Switch Open)	15 VDC typical (supplied by OptoEMU Sensor)
Short Circuit Current (Switch Closed)	7 milliamps nominal
Minimum Off Resistance	>20 K ohms
Maximum Allowable ON Resistance (Wire + Contact Resistance)	500 ohms
Turn-on Time	5 msec
Turn-off Time	25 msec
Channel-to-channel Isolation	8 channels isolated in groups of two
Input-to-output Isolation	1500 V AC/DC
Minimum Pulse Width	>= 7 milliseconds
Maximum Frequency	<= 30 Hz
Status indicators	1 LED per channel

3-Phase Power Monitoring

Voltage Inputs (each voltage channel)	
Input Range	0 to 400 VAC RMS (line to neutral—347 V for a 600 V 3-phase system or 277 V for a 480 V 3-phase system)
Input Over Range	To 440 volts
Resolution	10 mV
Accuracy (47 to 63 Hz)	± 0.2 V plus $\pm 0.2\%$ reading (at full scale = ± 0.2 V + ± 0.8 V = ± 1.0 V)
RMS Integration Time/ Data Freshness	1000 ms (synchronous with current measurement)
Input Resistance – Single Ended	1 Megohm NOTE: Because both channels share the same reference terminal, polarity must be observed when connecting the current channel.
Maximum Input	600 V non-operating
Current Inputs (each current channel)	
Input Range	0 to 333 mV AC input from current transducer
Input Over Range	To 416 mV AC
Input Overload	5 VAC continuous, non-operating
Resolution	15.1 μ V AC
Accuracy (47 to 63 Hz)	± 266 microvolts plus 0.2% of reading (at full scale = 266μ V + 667μ V = 933μ V = 0.28%)
RMS Integration Time/ Data Freshness	1000 ms (synchronous with voltage measurement)
Input Resistance – Single Ended	500 K Ohms NOTE: Because both channels share the same reference terminal, polarity must be observed when connecting the voltage channel.
Maximum Input	5 VAC continuous, non-operating

Auxiliary Box (OPTOEMU-PT600)

The OPTOEMU-PT600 is an optional auxiliary box. Use it only if you are powering the OptoEMU Sensor from a monitored panel or device rather than from a standard wall outlet.

Input voltage range	220–600 VAC line-to-line
Output voltage	110–240 VAC (power for OptoEMU-SNR-3V)
Fuses	1 amp, class CC, 600 VAC (Edison part number HCLR1)
Dimensions	6.0" w x 13.5" h x 4.5" d (15.2 cm x 34.3 cm x 11.4 cm)
Enclosure	Sturdy metal enclosure with standard knockouts for wiring
Agency Approvals*	CE, RoHS, DFARS
Warranty	30 months

