



## Owner's Manual

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# 1 Introduction

Thank you and congratulations to your purchase of an eGauge device! Properly installed, the device will be able to record and report energy usage and production for years to come.

The first section of this manual describes installation of the product. The second section provides operating instructions and is followed by a section on equipment maintenance. The appendices provide the device specifications and a reference to troubleshooting information.

# 2 Installation

Installation must be performed by a licensed electrician according to all applicable local, national, and international codes.

## 2.1 What's included in the box

- 1× eGauge device
- 1× Power plug (5-position 7.62mm plug)
- 0–12× Current Transformers (CTs) w/8ft wires & 2-position plugs (as ordered)
- 1× HomePlug wall-outlet adapter w/5ft Ethernet cable (if ordered)

## 2.2 Materials required for installation

- Per phase: 1× 15A circuit breaker or single multi-pole breaker
- Black, red, and white stranded AWG14 wire; length depending on installation location
- Electrician's tape
- Conduit and couplings as needed

## 2.3 Tools required for installation

- #0 slotted screw driver (needed if length of CT-wires needs to be adjusted)
- Circuit-breaker finder (ring-out tool)
- Voltage meter

## 2.4 Nomenclature and Symbols

In the US, residences typically receive power through split-phase power distribution which is provided through two hot legs, a neutral, and a protective ground.

Most commercial and industrial buildings receive power through 3-phase power distribution provided through 3 hot phases, a neutral and protective ground.

Throughout the rest of this document, we use the term “phase” to refer both to the phases of 3-phase power distribution as well as the two legs used in split-phase power distribution.

The table below describes the symbols used on the device:

Symbol:	Description:
	Caution, risk of danger.

### 2.4.1 Measurement Category

Measurement Category III is for measurements performed in the building installation. Examples are measurements on distribution boards, circuit-breakers, wiring, including cables, bus-bars, junction boxes, switches, socket-outlets in the fixed installation, and equipment for industrial use and some other equipment, for example, stationary motors with permanent connection to the fixed installation.

## 2.5 Safety Warnings

Please follow the installation instructions in this manual for wiring diagram and proper selection of CTs.

To reduce the risk of electric shock:

- Do not connect device to a circuit operating at more than 277 Volts to ground.
- Always open or disconnect circuits from Power Distribution System of building before installing or servicing the unit or attached current sense transformers.

## 2.6 Installation Location

eGauge is usually installed near the power-distribution panel of a building, where there is easy access to the power circuits to be measured.

eGauge is permanently connected equipment. A 15A circuit-breaker shall be included (one per phase) in close proximity of the device and within easy reach of the operator. The breakers shall be marked as the disconnecting device for eGauge. The breakers shall be wired to the device in compliance with the NFPA 8 National Electrical Code using a conductor size of at least AWG14.

eGauge is a component and must be installed inside a suitable enclosure. The enclosure eGauge is installed in must be rated according to the environment it is used in. For example, outdoor installations require an outdoor-rated enclosure (e.g., IPX4/NEMA4).

Select an installation location that is not exposed to direct sunlight or the elements. Otherwise, the warranty may be voided.

Do not install the device in a way that would make it difficult to operate the disconnecting device (circuit breakers).

## 2.7 Device Overview

As shown in Figure 1, eGauge has two input connectors: the **Power Connector** is a 5-pin connector used to wire the device to the building supply. The **CT Connector** is used to connect up to 12 Current Transformers (CTs).



Figure 1: eGauge inputs and outputs

There are no output connections.

The **Status LED** is an installation aid. When powered on, the LED will briefly turn **yellow**, then **blue**. The **blue** color indicates that the device is powered up and recording data. When **green**, it indicates that the device is able to communicate with the HomePlug adapter at sufficiently high speed ( $\geq 2$ Mbps). When **blinking blue** or **green**, it indicates that the device is accessible from the Internet (see Section 3.2). If the LED is **blinking red**, the internal temperature is high. It may be necessary to let the device cool off by powering it off by turning off the circuit breakers labeled “eGauge Disconnect.”

If the device is unable to automatically obtain an IP address via DHCP, the LED color will alternate between **blue** and **cyan** (HomePlug link speed  $< 2$ Mbps), or **green** and **cyan** (if the HomePlug link speed is  $\geq 2$ Mbps).

### 2.7.1 Power Connector

This connector is shown in Figure 2 and the pin-out is as follows:

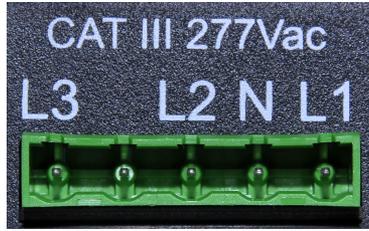


Figure 2: Power Connector

Pin:	Name:	Description:
1	L1	Wire to phase 1 of building supply.
2	N	Wire to building's Neutral.
3	L2	Wire to phase 2 of building supply for split- and three-phase installs.
4		Unused. Leave unconnected.
5	L3	Wire to phase 3 of building supply for three-phase installs.

The Power Connector is CAT III rated (for measurements performed in the building installation, such as circuit breakers). Pin L1 serves three purposes: it powers the device (3W typical, 7.5W maximum), it carries the power-line signal for communicating with the HomePlug wall-plug adapter, and the voltage on the line is measured to calculate power used/generated on phase L1. The pin must be wired to the building's power supply with a voltage in the range from 85–277Vac (to neutral). In contrast, pins L2 and L3 are used purely as voltage-taps so power used/generated on phases L2 and L3 can be calculated. Wiring these pins is necessary only if there are CTs measuring current(s) on L2/L3. The voltage on these lines can be 0-277Vac or 0-277Vdc. The input impedance for L2 and L3 is approximately 927kΩ at 60Hz. By connecting L2 or L3 to a DC-voltage, it becomes possible to monitor, for example, the voltage on a battery backup.

**CAUTION:** Note that L1, L2, and L3 are all coupled together through Neutral. Thus, when using L2 and/or L3 to monitor, e.g., the voltage on a backup-battery, ensure that it is safe to wire the other pole of the battery to Neutral (pin N).

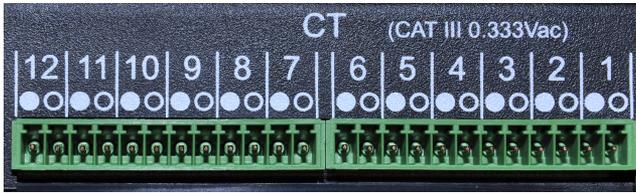


Figure 3: CT Connector

### 2.7.2 CT Connector

This connector is shown in Figure 3. It provides 12 positions for the CT plugs illustrated in Figure 5. The silk-screened numbers indicate which CT should be connected to which pair of pins. Pins that are to receive the black wire of the CTs are marked with a circle with black interior, pins for the white wires are marked with a circle with white interior. The CT Connector is rated for wiring one to twelve units of the CTs listed in Section B.3. The input voltage rating is 0.333V at the rated current. The input impedance is approximately 10k $\Omega$  at 60Hz.

**CAUTION:** The pins of the CT Connector are at a potential of 2.5V relative to Neutral (pin N on the Power Connector). Do not connect these pins to any of the Power Connector pins or the device may be damaged!

**NOTE:** There is no risk of damage if a CT plug is accidentally inserted such that it straddles the pins for two different CTs. If this happens, eGauge will not be able to measure power properly but otherwise there are no ill effects. To correct the problem, simply remove and re-insert the plug at the right position.

### 2.7.3 Time Reference

During normal operation, eGauge maintains accurate time by synchronizing with the NTP servers available at [ntp.org](http://ntp.org). Since these servers provide atomic-clock accuracy, there is usually no need to set the time manually.

When the Internet is not accessible, either temporarily (e.g., after a power failure) or permanently (e.g., at a remote site), eGauge relies on a battery-backed real-time clock to maintain proper time.

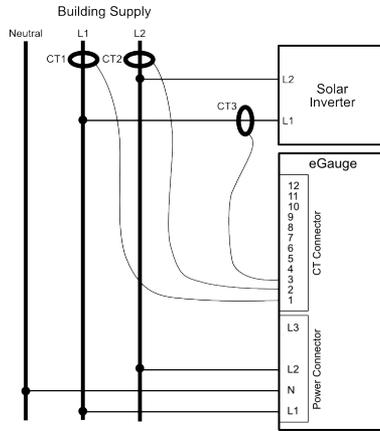


Figure 4: Wiring Diagram for a Typical Split-Phase Installation

The battery backup is designed only to cover relatively short power outages. Specifically, after a week of charging, the battery is able to maintain proper time for about one day. It takes about two months to fully charge the battery and, once fully charged, the battery is able to maintain proper time for about a week. Should eGauge remain without power for longer than that, proper time will be lost. When power is restored after such an event, eGauge will attempt to restore proper time via the Internet. If the Internet is not accessible, it will fall back to using the time that was in effect when the last data item was recorded prior to the power failure. The proper time must then be restored later on, either manually via the device's "Settings" menu or by connecting the device to the Internet.

## 2.8 Wiring Diagram

### 2.8.1 Typical Residential (Split-Phase) Installation

Figure 4 is a schematic wiring diagram showing a typical split-phase installation where eGauge is used to measure the amount of power being supplied by the power utility (CTs 1–2) and the power supplied by a single-phase solar inverter (CT 3). For simplicity, circuit-breakers are not shown.

### 2.8.2 Other Installations

For commercial three-phase installation as well as many other installation and configuration-scenarios, please refer to the manual called “Configuration Guide,” available at:

<http://egauge.net/support/>

## 2.9 Installation steps

1. If the building does not have a HomePlug network already (normal case):
  - (a) Find a power outlet near an available Ethernet port.
  - (b) Plug the HomePlug adapter into the outlet near the Ethernet port.
  - (c) Connect the HomePlug adapter to the Ethernet port with the supplied Ethernet cable.
2. Use a circuit-breaker-finder to locate the breaker for the outlet into which the HomePlug adapter is plugged into. Designate the breaker's phase as L1. In split-phase installations, label the other phase L2. In 3-phase installations, label the other two phases L2 and L3 (order does not matter, as long as the labeling is applied consistently throughout the installation).
3. Install the new breaker(s) in the power-distribution panel such that they provide access to all phases.
4. Open the breakers so there is no power on the breaker contacts.
5. Mount the eGauge either inside the power-distribution panel (if permitted and space is available) or inside a suitable enclosure near the power distribution panel.
6. Wire the 5-position plug as follows:
  - (a) Black wire: pin labeled L1 to breaker for phase L1.
  - (b) White wire: pin labeled N to Neutral.
  - (c) Red wire: pin labeled L2 to breaker for phase L2.
  - (d) Blue wire: pin labeled L3 to breaker for phase L3 (3-phase installations only).



Figure 5: Correct wiring for 2-pin CT plug

7. Insert the 2-pin CT plugs into the CT Connector on the eGauge according to the “CT Connection Table” listed on the separate document entitled “eGauge Installation Sheet”.

**NOTE:** Ensure that the stickers on the CTs point towards what is being measured.

If it is necessary to shorten or lengthen the CT wires, ensure that the CT wires are connected as shown in Figure 5.

8. Close the newly installed breakers. This should cause eGauge to power up and within a few seconds, the Status LED should turn **blue**. The LED will turn **green** if communication with the HomePlug adapter is sufficiently fast ( $\geq 2$ Mbps). If the Status LED fails to turn green after 30 seconds, see trouble-shooting instructions in Appendix C. The Status LED will start to **blink** when the device is able to connect to [egauge.net](http://egauge.net/). At that point, the device can be found in the device-list at <http://egauge.net/>. Note that the Status LED may blink blue or green, depending on whether or not the HomePlug adapter speed is above or below 2Mbps. We recommend to always install the device such that the LED turns green, but in some cases (e.g., long cable-runs), this may not be possible. When this happens, a blue blinking LED may be sufficient, though we would recommend accessing the device’s web page and verifying that everything works reliably and speedily.
9. Label the newly installed breakers as “eGauge Disconnect” so the customer can readily find them if it becomes necessary to power-cycle or turn off the eGauge device for any reason.

**IMPORTANT:** Labeling the breaker(s) is essential. Do not skip that step. Occasionally, it may be necessary to power-cycle the device. The breaker(s) provide the only safe way to do that, so for safety-reasons, it is important that

the end-customer is able to identify the eGauge breaker(s) without having to open any enclosures.

## 3 Operation

### 3.1 Accessing your eGauge for the first time

Once eGauge is installed, you can access it from any computer on your Local Area Network (LAN) with a compatible web-browser (see spec-sheet). To start, enter the following Web address into your web-browser:

*Microsoft Windows:* `http://devname/`  
*All other computers:* `http://devname.local/`

where *devname* is the name of the device (e.g., eGauge53). For example, to access device eGauge53, you would enter the following URL into your browser:

*Microsoft Windows:* `http://egauge53/`  
*All other computers:* `http://egauge53.local/`

**NOTE:** If you wish to use the `.local` names on Microsoft Windows computers, it is necessary to install Apple's Bonjour technology to enable multi-cast DNS (mDNS). This technology can be downloaded and installed free of charge from the following URL:

`http://support.apple.com/downloads/Bonjour_for_Windows`

An example of the eGauge dashboard can be seen in Figure 6.

Details on how to operate the device can be viewed by clicking on the "Help" link on the top right of the page.

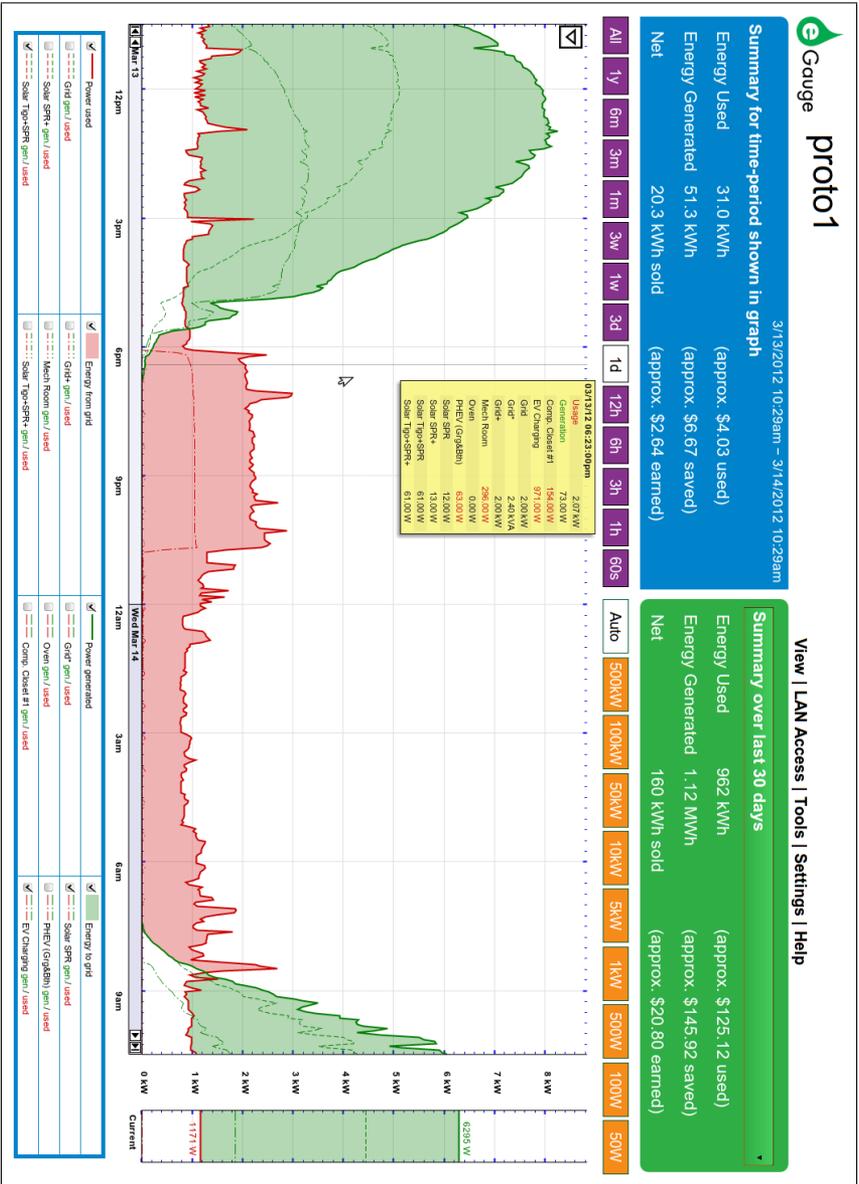


Figure 6: eGauge dashboard

## 3.2 Accessing eGauge from the Internet

To access eGauge from the Internet, open a compatible web-browser and then visit the Web page at:

```
http://egauge.net/devices/
```

Find the name of your device (e.g., eGauge53) on that page and click on it. This will connect you to your device. Alternatively, you can directly enter the following Web address into your browser:

```
http://devname.egaug.es/
```

where *devname* is the name of your device (e.g., “eGauge53”).

You can also use the above URL as an alternative means to connect to your device directly through your LAN. To accomplish that, click on the “LAN Access” link on the top right of the page, once the device’s dashboard has loaded. This directs your browser to access the device directly (through your LAN rather than going through `egauge.net`). This is both faster and allows you to access the device even at times when your Internet-connection may not be working properly. Please bookmark the address displayed in the browser after the page referred to by the “LAN Access” link has finished loading.

**NOTE:** From time to time, the address of your eGauge may change and the bookmark will stop working. Should this happen, repeat the above steps and update the bookmark with the new address. Usually, this happens infrequently, if at all. However, since it *can* happen, we recommend using the connection-methods described in the previous section whenever possible. Alternatively, a static (fixed) address can be configured for the device. See the next section for details.

## 3.3 Configuring a Static IP Address

eGauge normally automatically obtains its IP address and associated information through a service called Dynamic Host Configuration Protocol (DHCP). If you cannot or do not wish to run this service on your LAN, the device will default to using IP address 192.168.1.88, so the device can be accessed as:

<http://192.168.1.88/>

However, if another device ends up using the same address, a conflict would occur and neither device could be accessed reliably. For this reason, we recommend configuring a static IP address if DHCP is not available. To do so, visit the above URL and then click on “Settings” then on “Network Settings”. Uncheck the box labeled “Automatically obtain address with DHCP” and then enter the appropriate values into the newly enabled fields (you may need to consult your IT specialist to determine appropriate values). Once the values are entered, click on “Save.” You may be prompted for the authorization to make the change. Enter “**owner**” (without quotes) as the user-name and the password noted on your Installation Sheet, then click on “OK” (by default, the password is “**default**”, again without quotes) This will save the new settings and restart the device as necessary. After making these changes, the device can be accessed as

<http://staticip/>

where *staticip* is the static IP address you just configured.

### 3.4 Verifying the Proper Time

When the Internet is not available to eGauge, it may be necessary to set the date and time manually. To verify that eGauge has the proper time, use a browser to go to the device’s dashboard (see previous sections), then click on “Settings”, then on “Date & Time”. If the displayed date and/or time is wrong, please enter the correct values and then click on “Save”. Please repeat this step from time to time, especially after prolonged power outages lasting more than a few hours.

## 4 Maintenance

eGauge is designed to be maintenance free. No preventive maintenance or inspections are required.

Should it become necessary to clean the eGauge, disconnect it from the building supply by turning off the breakers labeled “eGauge Disconnect”, remove the

device, and clean it with a soft cloth. If a cleaning fluid is needed, use 70% isopropyl alcohol. Wait until all cleaning fluid has evaporated before reinstalling the device and turning the breakers back on.

The device has no replaceable batteries and no replaceable fuses.

## A FCC Compliance

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

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

**CAUTION:** Changes or modifications to the equipment not expressly approved by eGauge Systems LLC could void the user's authority to operate the equipment.

## B Specifications

### B.1 Electrical Rating of the Product

85-277Vac, 1-3 phases, 50-60 Hz, 7.5W peak (3W normal)

### B.2 Environmental Conditions

Suitable for indoor and outdoor use (with proper enclosure), Pollution Degree 2, Measurement Category III. Not to be used at altitudes above 4000m. Voltage fluctuations not to exceed  $\pm 10\%$ . Temperature range:  $-30$ – $50^{\circ}\text{C}$  ( $-22$ – $122^{\circ}\text{F}$ ). Maximum relative humidity 80% up to  $31^{\circ}\text{C}$ , decreasing linearly to 50% at  $40^{\circ}\text{C}$ .

### B.3 Current Transformers (CT)

The CTs used in conjunction with eGauge must be ETL or UL recognized with an output of 0.333V at the rated current. Specifically, the following CT models are approved for use with eGauge:

Manufacturer:	Model:	Rating:	ID:
Magnelab Inc	SCT-0750-030	30A	0.75"
Magnelab Inc	SCT-0750-050	50A	0.75"
Magnelab Inc	SCT-0750-070	70A	0.75"
Magnelab Inc	SCT-0750-100	100A	0.75"
Magnelab Inc	SCT-0750-150	150A	0.75"
Magnelab Inc	SCT-0750-200	200A	0.75"
Magnelab Inc	SCT-1250-100	100A	1.25"
Magnelab Inc	SCT-1250-200	200A	1.25"
Magnelab Inc	SCT-1250-400	400A	1.25"
Magnelab Inc	SCT-1250-600	600A	1.25"
Magnelab Inc	SCT-2000-200	200A	2.00"
Magnelab Inc	SCT-2000-400	400A	2.00"
Magnelab Inc	SCT-2000-600	600A	2.00"
Magnelab Inc	SCT-2000-800	800A	2.00"
Magnelab Inc	SCT-2000-1000	1000A	2.00"
Magnelab Inc	SCT-2000-1200	1200A	2.00"
Magnelab Inc	SCT-2000-1500	1500A	2.00"
Continental Control	CTB-1.5x3.5-0600	600A	3.5×1.5"
Continental Control	CTB-4.0x4.0-0800	800A	4.0×4.0"
Continental Control	CTB-4.0x4.0-1200	1200A	4.0×4.0"
Continental Control	CTB-4.0x4.0-2000	2000A	4.0×4.0"
Continental Control	CTB-4.5x4.0-2000	3000A	4.5×4.0"

## C Troubleshooting and Support Information

### C.1 Status LED fails to turn green

The Status LED turns green only when eGauge can communicate with the Home-Plug wall-outlet adapter at a speed sufficiently high to ensure reliable operation ( $\geq 2$ Mpbs). If the LED fails to turn green:

1. Verify that the wall-adapter is plugged directly into a wall-outlet or, if that is not possible, into a simple power-strip. Do *not* plug wall-adapter into a

power-strip with built-in surge suppressor, since the surge-suppressor filters out the HomePlug signal.

2. Verify that the outlet into which the wall-adaptor is plugged in is on the same phase as the wire labeled L1 on the Power Connector of the eGauge.
3. Verify that the outlet is within about 40 feet of the eGauge installation location.

## **C.2 eGauge fails to show up at `http://egauge.net/` or does not blink green**

1. Verify that the Status LED on the eGauge device is green. If not, see previous trouble-shooting item. If it is green, try power-cycling the eGauge device and wait for the Status LED to turn green again.
2. Using a web-browser, try connecting to `http://egauge.net/`. If page cannot be loaded, there may be a temporary outage which will prevent eGauge from connecting to `http://egauge.net/`.
3. Using a web-browser, access the device as explained in Section 3.1. Once connected, click on “Settings”. Ensure that box labelled “Proxy-server hostname” contains the text `d.egauge.net`.

## **C.3 Status LED alternates between green/cyan or blue/cyan**

The cyan color indicates eGauge was unable to obtain an IP address through DHCP. If the Status LED is alternating between blue and cyan, the HomePlug link speed is too low and that is preventing eGauge from connecting to the DHCP server. See Section C.1 on how to resolve this issue.

If the Status LED is alternating between green and cyan, eGauge is unable to obtain an IP address through DHCP even though the HomePlug link speed is fine. Most likely, this indicates that there is no DHCP server available on the LAN. Either configure a static IP address (see Section 3.3) or enable a DHCP server on a router and/or computer.

If these suggestions do not resolve the problem or if there are any other issues with the device, please see the support section of the eGauge web site for frequently asked questions and additional troubleshooting tips:

<http://egauge.net/support/>

## D Installation Information

Devicename:

CT #	Amperage [A]	Phase/Line	Measured item
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			
11			
12			

Notes: