Initial Configuration

Configuration steps that must be performed after installation!

- Installation Overview Tips (START HERE)
- Initial Configuration Steps
- eGauge Configuration Guide
- Accessing eGauge Interface
- Register a device, remote access, and password resets
- Configuring CTid-enabled sensors
- Commissioning readings with the Channel Checker
- NTP (Network Time Protocol) and Date and Time Configuration

Installation Overview Tips (START HERE)

Process and Tips for a successful installation

1. Download and read the EG4xxx **Owner's Manual** here for safety and general installation information.
2. Physical Installation (*Diagrams for common setups can be found in: eGauge Installation examples.
   Voltages: First available breaker may not be on the system L1. Ensure the eGauge's L1 breaker is on the same phase as the system L1. Use a volt-meter to check voltage between the eGauge L1 and system L1, zero volts is the correct phase. More information on panel phasing here. Always connect the N terminal appropriately or damage may occur. Never connect a ground to the N terminal.
   CTs: Install the CT oriented in the proper direction around the conductors to be measured:

Model	Orientation
J&D (JSxxxx models)	Point the sticker towards what is being measured
Orange Rope CTs	Point the arrow towards what is being measured
eGauge ECS20 CTs	Current should flow in the same direction the arrow points

> Some CTs require two clicks to close fully.

   Network: Visit this KB article for how to confirm network connections are up and device interface can be accessed.

3. Connect to eGauge interface for configuration via this KB article. Note if you are not on the local network of the eGauge, you will need to register the device and enable remote administration and possibly reset the password. Visit this KB article for more information. **NOTE**: You may need to click "**LAN Access**" before configuring if accessing via the proxy server.

4. In the eGauge interface, navigate to Settings -> Installation and configure the unit. Visit this KB article for more information on how to configure.
   For meters purchased on or after Jan 2021, the default credentials are printed on the side of the meter (side opposite CT inputs).
   For meters purchased prior to Jan 2021, the default username is "owner" and password "default".

   > eGauge support cannot provide the password currently set on a meter or the default password on meters shipped on or after Jan 2021.

   NOTE: If an error stating you are unauthorized to change settings, enable remote administration or click **LAN Access** in the top right corner of the page and try again.

5. After configuration, commission the system by verifying readings in the channel checker. This article has information on identifying and correcting installation or configuration issues.
   - Verify amperage readings are accurate with a multimeter (Use fresh batteries! The eGauge may be more accurate!)
   - Verify voltages are accurate with a multimeter
   - Ensure power polarities are correct (applies to system with a neutral)
     - Grid is positive when there is no production back-feeding
     - Generation is positive when producing (negative when in standby)
     - Individual loads can be negative
   - Ensure power factors look good (applies to systems with a neutral)

6. Make sure Date and Time is correct in Settings -> Date & Time.

7. Optional: update firmware in Tools -> Firmware Update.

Linked Articles

Accessing the eGauge interface

Register device, remote access and reset password

Initial Configuration Steps

Commissioning readings with the Channel Checker

Initial Configuration Steps

The eGauge must be configured for the system monitored or data will be invalid.

> Meters sold after June 1, 2023 may default to the Modern User Interface. After logging into the eGauge meter, choose **Setup >> Other Settings** from the main menu to access the configuration settings and continue as outlined below.

To configure the eGauge, log on to it (see this KB article) and navigate to Settings -> Installation.

Image not found or type unknown

Image not found or type unknown

The full configuration guide can be accessed at egauge.net/help/config. Line diagrams with example configurations can be found in Section 2 Configuration Examples, starting on page 13 (as of time of writing this article).

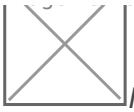
Potential Transformers

Image not found or type unknown

If step-down transformers are used, select the appropriate transformer ratio or type here. E.g., 480:120 for a generic 480V to 120V transformer, or FDT-480-120 for the Functional Devices transformer provided by eGauge Systems.

If eGauge is connected directly to the systems voltage, leave this as "direct (no PT)"

Sensors/CTs



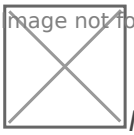
Note: in firmware v4.0 and greater, "CT" has been changed to "S" for Sensor. For example, CT5 = S5, and CT12 = S12.

The current transformers in each slot are selected here. See this KB article for how to understand the drop-down menu options

Remote Devices

This can be left alone if no remote devices are used.

Registers



Note: in firmware v4.0 and greater, "CT" has been changed to "S" for Sensor. For example, CT5 = S5, and CT12 = S12.

Registers can be deleted by clicking the [x] to the right of the register name. For each measurement, add a register. Click "Add Component" to add a CTxLine combination.

This example shows three-phase Grid being monitored by CT1, CT2, and CT3.

Solar 1 is monitored by CT4 and CT5, and is feeding on L1 and L2.
Solar 2 is monitored by CT6 and CT7, feeding on L3 and L1.

It is vital for CTxLine combinations to be correct. Visit this KB article on information on phase checking with a volt-meter.

DC load monitoring

If monitoring DC loads using the Ldc voltage input, choose "Ldc" instead of L1, L2 or L3. If monitoring DC loads using an EV1000 voltage sensor, choose the appropriate sensor input (e.g., "S4") instead of Ldc or a line input.

Total and Virtual Registers

The Usage and Generation totaling registers determine the red and green areas on the main graph, as well as summary information for Usage and Generation.

For Usage in a back-fed system, positive values of Solar (e.g., Solar 1+) are added to Grid. In a line-side feed, the negative values would be added to Usage (e.g., Solar 1-).

Generation consists of all Generating loads.

eGauge Configuration Guide

The eGauge is a powerful, highly accurate piece of monitoring hardware. However, it is essential to configure the eGauge properly, or the readings obtained will not be correct. Even on **identical** installations the exact settings may vary, depending on how the eGauge and CTs are installed. The document below covers the various aspects of basic eGauge configuration (assuming monitoring is done exclusively with CTs and voltage taps - remote devices are only briefly covered in this document).

Technical support is available to assist with configuration, but there is no guarantee the device configuration will be set correctly. Ensuring a device is correctly configured falls on the owner or installer of that device.

To determine your firmware version, visit **View -> Status** in the device interface.

Configuration Guide for firmware v4.x

Configuration Guide for firmware v3.x

Accessing eGauge Interface

If the credentials need to be reset or remote configuration enabled, visit this KB article.

There are two methods to access the eGauge graphical interface.

Remote Access via Proxy-server

First, if the device has internet access and is able to connect to the proxy-server, it can be accessed at:

http://***DEVNAME***.d.egauge.net or http://*DEVNAME*.egaug.es

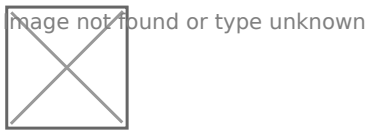
Where ***DEVNAME*** is the eGauge device name, found on the sticker with the unit or the LCD screen.

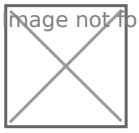
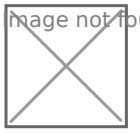
> Devices sold after January 1,2024 should be accessed at: https://DEVNAME.egauge.io

A "Not Found" response means the eGauge is not connected to the proxy server. The eGauge requires outbound connections to port TCP 8082 and 8084 of d.egauge.net for the remote connections to work. See this article for more information about network connections.

Local access via hostname or IP

If the eGauge does not have internet access, or is not allowed to access the proxy server, it can be accessed from the local IP address or device name. The device name and IP address can be found on the EG4xxx LCD screen by depressing the toggle switch to get to the main menu, toggle to "Info" and depress the switch, and toggle left or right to see "Name" and "IP address":



In this example, the device can be accessed at http://10.1.90.133

On some networks, the device can also be accessed at http://eGauge99999/ or http://eGauge99999.local/

Configuration Note for older meters:

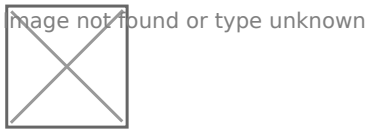
If you are on the same local network where the eGauge is installed and are configuring for the first time, you may need to click "**LAN Access**" in the top right of the page to redirect to the local IP address of the eGauge. This is *required* on meters shipped before January 2021.

For meters purchased on or after Jan 2021, the factory credentials are printed on the side of the meter.

For meters purchased prior to Jan 2021, the factory credentials are user: **owner** pass: **default**.

Note that these credentials may have been changed.

> eGauge support cannot provide the password currently set on a meter or the default password on meters shipped on or after Jan 2021.



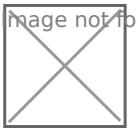
If you are not on the same local network and need to make changes, or reset the password visit this KB article.

Register a device, remote access, and password resets

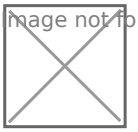
To only access a device interface, visit this KB article.

To register a device and get access, log in or create an eGauge.net account at https://egauge.net/login.

After being logged in, hover over eGuard, and click "Register a Device":

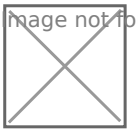


Enter the registration date, device name, and MAC address. The MAC address should start with F8-2F-5B. Enter the MAC without colons, dashes or spaces:



If you administrate an existing group, you will have the option to add the device to the group you admin. If the device being registered belongs to another group, after pressing Register Device it will tell you it cannot be moved but has been registered.

Next, visit eGauge.net/eGuard or hover your mouse over eGuard and click on Portfolio:



Locate the newly registered device in the portfolio and click the notepad icon to the left of the device name:

Note: the "Name" to the right of the notepad icon is a link to the eGauge proxy-server URL

In the device details page, locate Remote Administration Control and press the Enable button:

Image not found or type unknown

The first username in the eGauge Access Control Settings now has remote administration enabled. Assuming the meter configuration hasn't been modified:

For meters purchased on or after Jan 2021, the factory credentials are printed on the side of the meter.

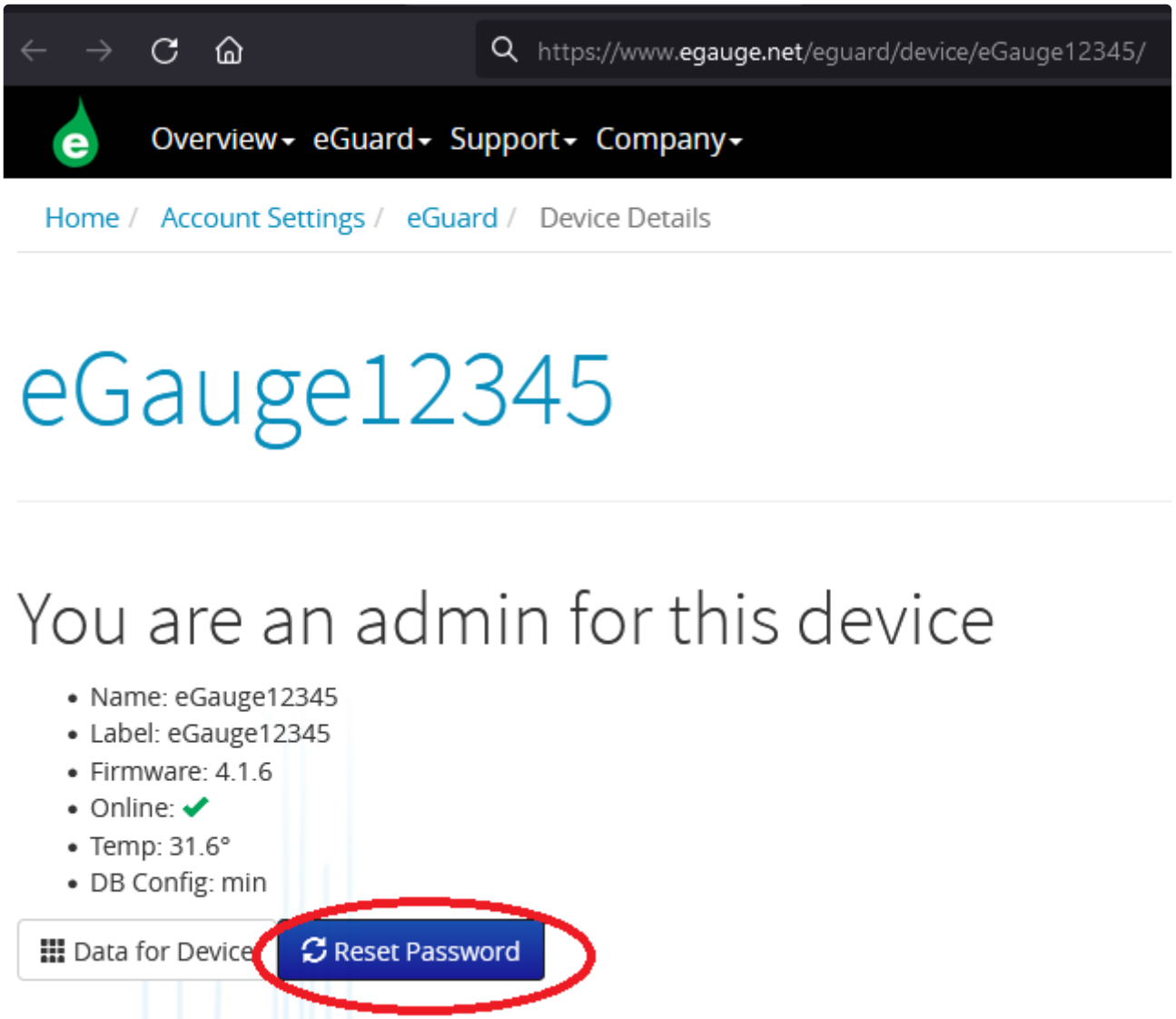
For meters purchased prior to Jan 2021, the factory credentials are user: **owner** pass: **default**.

Note that these credentials may have been changed.

> eGauge support cannot provide the password currently set on a meter or the default password on meters shipped starting January 2021.

Make sure to change the password to something secure in **Settings -> Access Control**.

If you administrate a group and the device was moved to it during registration (or automatically placed during the order process), there is also an option to reset a password for a user on the device:


https://www.egauge.net/eguard/device/eGauge12345/
Overview
eGuard
Support
Company
Home / Account Settings / eGuard / Device Details
eGauge12345
You are an admin for this device
Name: eGauge12345
Label: eGauge12345
Firmware: 4.1.6
Online:
Temp: 31.6°
DB Config: min
Data for Device
Reset Password

Configuring CTid-enabled sensors

What is CTid?

CTid is a technology created by eGauge which allows the eGauge meter to obtain information about a connected CT or Sensor. This information can include model, manufacturer, serial number, amperage rating (if CT), and other information about the sensor. The information is stored on a chip embedded in the CT or Sensor, and can only be read by EG4xxx model units (eGauge Core and eGauge Pro). When inputs are scanned for CTid sensors, they are automatically configured instead of the user's traditional drop-down selection box.

CTid enabled sensors also contain a locator LED that can be blinked from the eGauge configuration interface. This can be used to identify which sensor is connected to which port, in the event the leads were switched or untraceable.

> The CTid LED is OFF unless temporarily activated through the CTid configuration page in the meter interface.

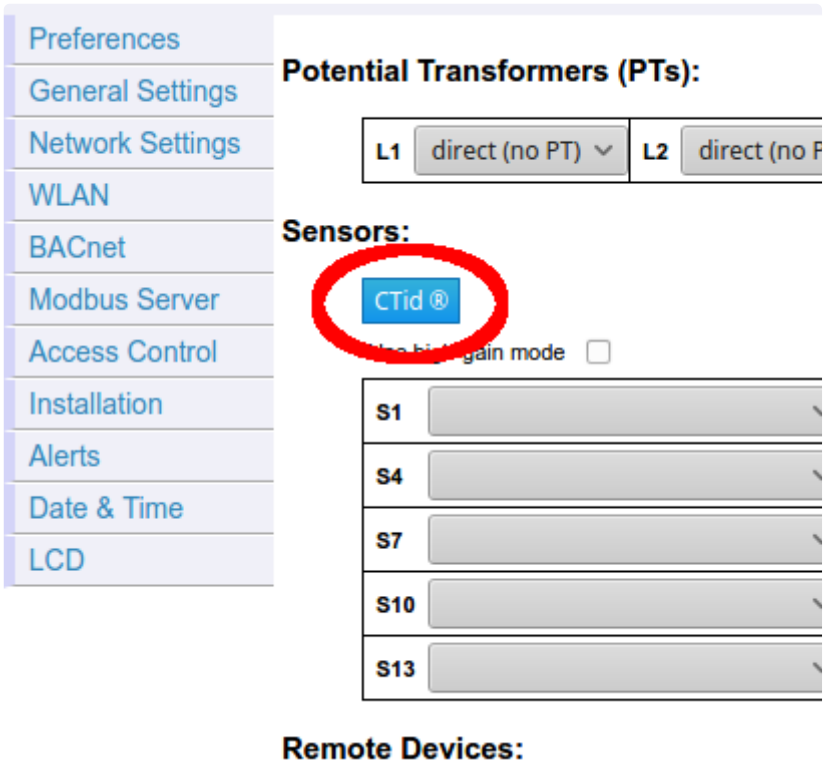
Prerequisites

If you are not familiar with programming the eGauge, please refer to the overview help page and ensure access and permissions to configure the eGauge before continuing.

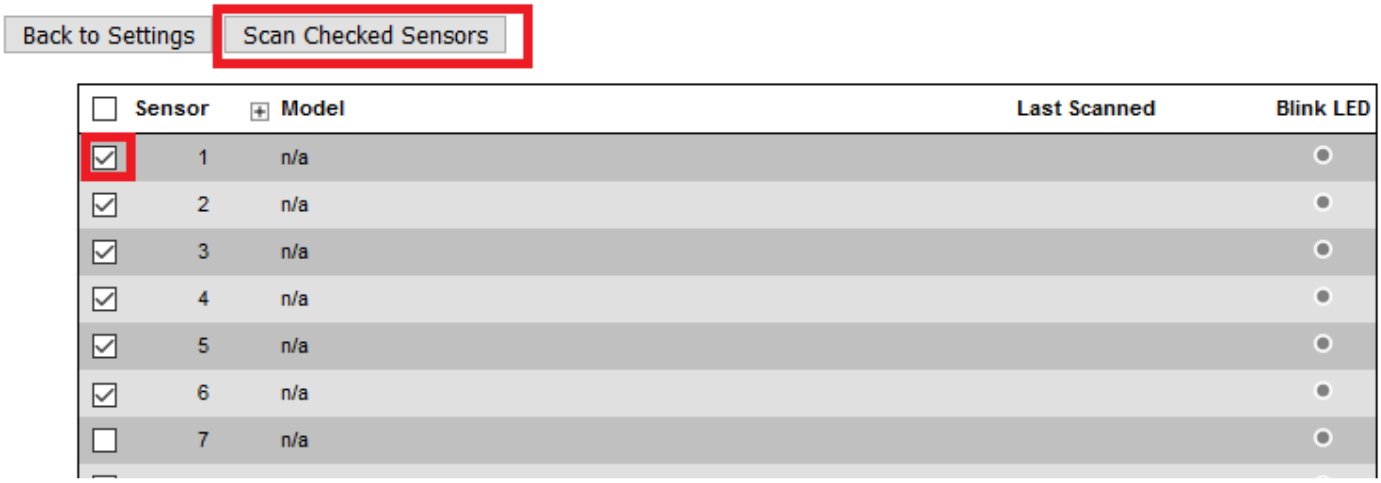
Ensure the sensors and Sensor Hub are installed correctly before continuing.

Configuring CTid Sensors

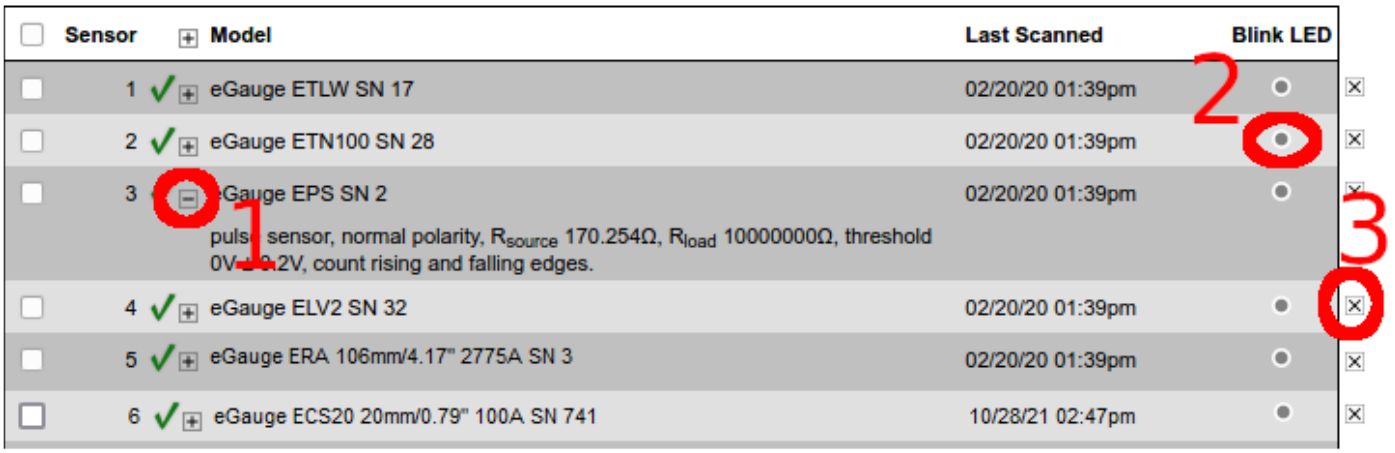
To configure a CTid-enabled sensor, navigate to the Installation Settings page (Settings -> Installation). Locate the blue "CTid" above the sensor drop-down menus:



Next, select the sensor ports that have CTid-enabled sensors connected, and press "Scan Checked Sensors":



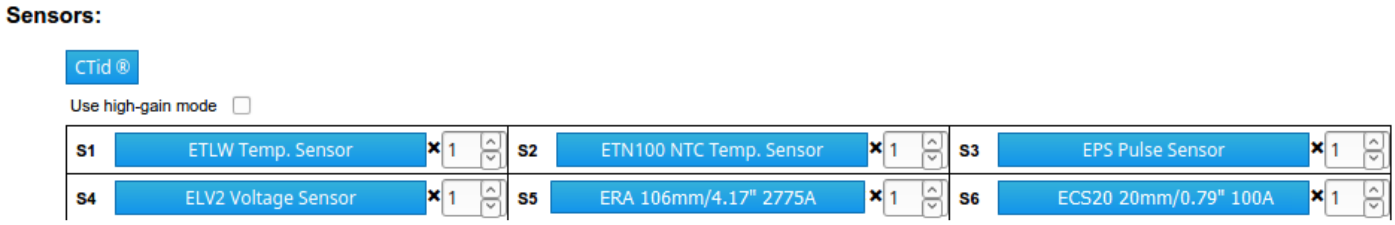
A green check-mark will show for each successfully detected sensor. The model and serial number is displayed for each sensor. Press the plus or minus sign (1) to expand or collapse additional information for the sensor. Every CTid sensor has an LED, which can be blinked by clicking the "Blink LED" button (2). To delete a configured sensor, press the "x" button (3). When finished, press "Back to Settings" to the left of the "Scan" button:



In the above image, an ambient temperature sensor (ETLW) is connected to Sensor port 1. Port 2 contains a temperature probe sensor (ETN100), port 3 contains a pulse sensor (EPS), port 4 contains a low voltage or dry contact sensor (ELV2), port 5 contains a Rope CT (ERA-1206-2775) and port 6 contains a split-core CT (ECS20 20mm 100A).

> The CTid blink LED function can also be activated via the LCD menu by choosing Tools > CTid. Move the toggle switch to choose which port to blink, then press the toggle switch to begin blinking the port. Press the toggle switch again to stop the blinking function.

Back in the Installation Settings page, the inputs will show the sensor detected in blue to indicate it was programmed via CTid:



Finally, configure registers to record the data from these sensors:

Registers (9 of 64 in use):

Name:	Recorded value/formula:				
Ambient Temperature	=	S	S1	normal value	
Probe Temperature	=	S	S2	normal value	
Pulse Count	=	S	S3	normal value	
Dry Contact Status	=	S	S4	normal value	
CT5 Power	=	P	= S5 × L1		Add Component
CT5 Amperage	=	S	S5	normal value	
CT6 Power	=	P	= S6 × L2		Add Component
CT6 Amperage	=	S	S6	normal value	
CT6 Frequency	=	S	S1	frequency	

Add Register

Choosing "S" (Sensor) for the type will record the value of the sensor. Temperature sensors record °C, pulse counts are unit-less, dry contact (low voltage sensor) records voltage and CTs record amperage.

To record power, use "P" (Power) and choose the CT input (S5 iand S6 n this example) and the voltage line it is on.

Instantaneous values may be found in the channel checker:

Channel	AC+DC (RMS)	AC (RMS)	DC (Mean)	Frequency
S1	23.494 °C	0.000 °C	23.494 °C	0.00 Hz
S2	18.021 °C	0.000 °C	18.021 °C	0.00 Hz
S3	0.000	0.000	0.000	0.00 Hz
S4	1.967 V	0.000 V	1.967 V	0.00 Hz
S5	67.967 A	67.967 A	0.000 A	60.00 Hz

Register Name	Value	Power Factor
CT5 Power (L1*S5)	7349.90 W	0.906

Commissioning readings with the Channel Checker

After configuring the eGauge, it is necessary to commission the readings to ensure accuracy using the channel checker. The channel checker can be accessed via **Tools -> Channel Checker**.

Image not found or type unknown

Image not found or type unknown

The Channel Checker tool provides instantaneous readings of all the inputs of the eGauge including voltage, amperage, watts, frequency and power factor.

Example: Good 3-phase solar

Image not found or type unknown

The left-side shows the channel inputs: the Line-Line voltages are ~500V, Line-Neutral are ~288V. Currents on CT1, CT2, and CT3 are between 640A and 660A. Only channels that are configured in a register will appear here.

The right-side shows the registers and calculated power. Each leg of the solar inverter is outputting ~183kW, and have a good power factor of ~.98 (as expected by a solar inverter).

> For information on common physical issues that cause bad AC (RMS), DC (Mean) or frequency readings, view this article.

Example: Negated value on main usage

Image not found or type unknown

If a system with a neutral does not have any solar or other power back-feeding through the CTs, all power polarities should be the same. In this example, CT7*L3 shows a negative value (-2259.8W), while CT8*L2 and CT9*L1 show positive power values. When these are added together in the register, CT7*L3 reduces the overall power and will give inaccurate power values.

Cause	Fix
The CT is physically reversed (MOST COMMON)	Physically reverse the CT, or negate it in the Installation Settings register component (e.g., CT7*L3 to -CT7*L3)
Phase mix-up (MOST COMMON USUALLY W/ BAD POWER FACTOR)	Locate the correct phase and move the CT to it, or change the association in the Installation Settings register component (e.g., CT7*L3 to CT*L2). Visit this KB article for more information on phasing.
The CT black/white leads have been swapped	Swap the leads, or negate it in the Installation Settings register component. This is more common with CT extensions.
Multiple conductors in CT of different phases, or different directions	If multiple conductors are run through the CT with different phases, or different directions, it can cause polarity to randomly shift or stay at an unexpected polarity. Ensure only conductors of the same phase are in the CT.
Bad CT splices	If CTs have been extended or modified, sometimes they are mistakenly wired different on each end which can lead to combined signals that cause bad data. Ensure twisted pair wire is used.
CT not connected or insufficient amperage	If the CT is not connected the signal will bounce and can switch polarity. If there is no or insufficient amperage, noise can cause bad readings.
Wrong CT selected	Configuring with the wrong CT can cause the power to be negated or wrong.

False Positives	Reason

There is bidirectional power or back-feeding active	Power flowing through a CT in one direction gives a positive polarity, and if power reverses direction (like in back-feeding) the polarity negates. Make sure there is no back-feeding when troubleshooting polarity.

Example: Poor power factors

Image not found or type unknown

In a system with a neutral, power factors are between 0 and 1. Higher power factors usually indicate better performance, resistive loads (like a heater, hot water heater, solar inverter, etc) generally have high power factors, while capacitive or inductive loads (like motors, pumps, switching power supplies, CFL lighting, etc) will have lower power factors.

Generally, standard equipment tends to have a .6 power factor or higher, but it's not always the case.

Cause	Fix
Phase mix-up (MOST COMMON, USUALLY W/ NEGATED VALUES)	Locate the correct phase and move the CT to it, or change the association in the Installation Settings register component (e.g., CT7*L3 to CT*L2). Visit this KB article for more information on phasing.
CT not clamped fully, or other damage	Ensure CT is fully clamped and undamaged. Some CTs take two clicks to fully close.
CT not configured correctly	If the type of CT is wrong (Rope, DC CT, AC CT), it can cause poor power factors and incorrect amperages.

False Positives	Reason
Active production from inverter on back-fed system (does not have to be actively back-feeding)	Solar and other inverters put out all real power, so as production increases on a back-fed system less real power is demanded from the utility and more reactive power, bringing the grid power factors down. This is normal. Run tests without any active production.
Insufficient amperage	When there is insufficient amperage on a CT (especially rope CTs), noise can cause higher than real amperage readings, and that noise is cancelled out when power is calculated resulting in a lower than real power factor. This is normal.

False Positives	Reason
Equipment uses a lot of reactive power	Some equipment like HVAC systems can have a power factor of ~.5.

NTP (Network Time Protocol) and Date and Time Configuration

Overview

All eGauge meters use NTP (Network Time Protocol) to obtain the current date and time. The exact process used depends on the meter hardware version (eGauge2, EG30xx, EG4xxx). Access to an NTP server isn't required, but it is **highly recommended** to ensure the meter keeps the correct date and time. For 99% of installation scenarios, NTP works just fine with the default settings. However, it may be necessary to manually verify NTP synchronization is working, use different NTP settings, or troubleshoot problems with NTP.

This document is intended to provide a general overview of NTP functionality as it pertains to eGauge meters. However, in the interest of brevity many advanced concepts will be simplified or ignored. For more information on general NTP concepts, please refer to this article.

> When first installing a meter, it is **strongly recommended** to check the meter date and time (under **Settings -> Date & Time**) and manually update if necessary.

Contents

Quick Troubleshooting Suggestions

If the meter date and time is incorrect or the meter isn't syncing with an NTP server:

1. Navigate to **Settings -> Date & Time** and ensure the meter date and time is correct and a valid NTP server is entered.
2. Verify the meter is on the latest firmware.
3. Reboot the meter (either via the UI under **Tools -> Reboot** or by manually power cycling the meter) and wait 5 minutes.

See the Checking Status section of this document for more information on checking NTP synchronization status.

If you do not know your meter password, visit this article.

Why do I need NTP?

The eGauge meter features an internal clock which can keep (approximate) time over short a short duration. However, without an active NTP connection the meter's internal clock may drift by as much as a few minutes per month. This may be acceptable for some users, but many monitoring scenarios require time-accurate data (e.g., for billing purposes).

Furthermore, if the meter experiences an extended power outage the internal battery or capacitor which maintains the internal clock will be depleted. This will cause the meter to use the last known date and time when power is restored - meaning data recorded after that point will have the wrong timestamps. If the meter can connect to an NTP server when it's brought back online, it should automatically adjust the date and time *before it starts recording.*

The amount of time a meter can maintain the correct date and time without power depends on the meter model:

Model	Charge Time	Run Time
EG4xxx	5 minutes	8 hours
EG30xx and eGauge2	~1 month	~1 day

In cases where an NTP server isn't available (e.g., locations without an Internet connection), the user must take care to keep the meter date and time updated manually. It's especially important to

check the date and time *immediately* after any power outages.

To summarize, NTP is a convenience feature and helps ensure the collection of accurate data. Although it's possible to use a meter without NTP, doing so is not recommended.

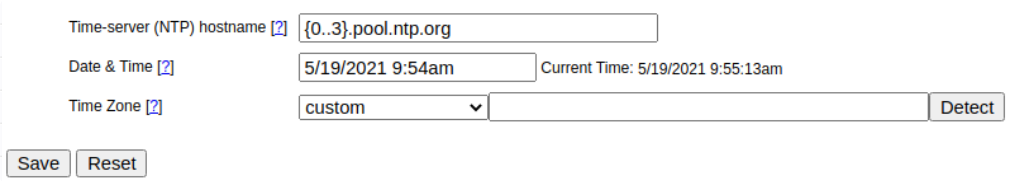
Configuration

By default, all eGauge meters ship with the default NTP server of {0..3}.north-america.pool.ntp.org. The {0..3} at the beginning of the URL indicates this can be expanded to 0.north-america.pool.ntp.org, 1.north-america.pool.ntp.org, and so on - in other words, this address describes four possible NTP servers.

Despite the "north-america" in the address, this is typically this is a suitable configuration option for meters anywhere in the world. However, it may be desirable to instead use {0..3}.pool.ntp.org (which should return up to four of the closest servers). It is also possible to point the eGauge to a locally hosted NTP server. This is common in more secure environments where external access to the internet isn't allowed. In this case, the local IP address of the NTP server may be used.

> eGauge Systems LLC cannot offer assistance or advice on creating or maintaining a local NTP server.

The NTP server hostname is configured under **Settings -> Date & Time**. In the following example, the meter is set to use the {0..3}.pool.ntp.org option mentioned previously:



> Make sure to click "Save" after making changes on this page. The meter will typically reboot after this step.

Checking Status

Although there is not a hard linked NTP status page built into the meter UI, it is possible to check the NTP status of a meter by appending /cgi-bin/get?ntp to the end of the meter URL. For example:

DEVNAME.egaug.es/cgi-bin/get?ntp

DEVNAME.egauge.io/cgi-bin/get?ntp

HOSTNAME.local/cgi-bin/get?ntp

LOCAL_IP_ADDR/cgi-bin/get?ntp

Each meter hardware version uses a different method to obtain this data, and has a different output style:

Meter Version	Method Used
EG4xxx	ntpctl -s all (OpenNTPD)
EG30xx	/usr/bin/ntpq -p (ntpq)
eGauge2	N/A (no data returned)

> For best results, ensure your meter is on the latest firmware version.

EG4xxx

For an EG4xxx meter, the output will have a summary area at the top, along with some specific information for each peer:

```
2/4 peers valid, clock synced, stratum 3

peer
   wt tl st  next  poll          offset       delay      jitter
45.55.58.103 0.pool.ntp.org
    1  2  - 2492s 3064s             ---- peer not valid ----
216.240.36.24 1.pool.ntp.org
    1 10  2   13s   34s        -1.537ms    48.121ms     0.460ms
69.89.207.199 2.pool.ntp.org
    1  2  - 2474s 3046s             ---- peer not valid ----
72.5.72.15 3.pool.ntp.org
 *  1 10  2   10s   33s        -0.411ms    46.456ms     6.319ms
```

At the top of the page, the meter will list the number of valid peers. In this case, 2 of the four peers are valid. As long as one peer is valid, NTP synchronization should work as expected.

Also at the top of the page, "clock synced" indicates the eGauge's internal clock is synchronized with the NTP server. It is normal for this to show "unsynced" for some time (up to five minutes) after a reboot.

If the summary area is completely blank, it means the NTP daemon is not running. A reboot may resolve this issue.

For more information on this output, see the ntpctl manpage.

EG30xx

For an EG30xx meter, the output will simply contain information on each connected peer (no summary area):

```
     remote           refid      st t when poll reach   delay   offset  jitter
==============================================================================
+ntp17.doctor.co 50.205.244.27    2 u  862 1024  377   49.962   -0.388   1.802
*ntp.nyy.ca      .PPS.            1 u   95 1024  377   79.102   -4.200   0.762
 2606:5580:30a:7 58.180.158.150   3 u  15d 1024    0   63.037   -5.829   0.000
+voipmonitor.wci 216.218.254.202  2 u  790 1024  337   59.775    4.503   1.395
```

Valid peers (technically, peers marked for consideration) are preceded by a "+". The peer currently used for synchronization is preceded with a "*". As long as at least one peer has a *, NTP synchronization should work as expected. In the above example, three peers are valid and the meter is synced with one peer. This status page may be blank or not show any + or * symbols for some time (up to five minutes) after a reboot.

If the summary area is completely blank, it means the NTP daemon is not running. A reboot may resolve this issue.

For more information on this output, see the ntpq documentation.

eGauge2

eGauge2 meters use NTP to sync their internal clocks, but they do not provide a summary of connected peers. This is expected behavior and will not be changed due to meter hardware limitations.

NTP Functionality and Behavior

NTP timekeeping is a complex subject, and it would go beyond the scope of this article to fully explain. However, there are some basic concepts which are worth discussing here. For a more

complete discussion of the subject, refer to this article.

Functionality

Put simply, an NTP server works by obtaining the correct date and time from a reference clock and making that date and time information available to a device. Reference clocks are generally extremely accurate (and as a result, extremely expensive). The internal clocks of most computing devices are generally *inexpensive*, but also not very accurate. NTP serves as a software-based solution to this problem. NTP servers may be run and hosted by anyone, including home users.

The NTP software running on the eGauge uses several criteria to determine the quality of an NTP server. The criteria for this is too complex to detail here, but the takeaway is that the meter will automatically handle sever selection and use the best (most accurate and accessible) available servers. This is where the **strata** statistic comes in - strata indicates the quality of a server, with 1 being the best quality.

Typically, all of this happens "behind the scenes" (this is also true for other computing devices, including personal computers). However, in certain cases it may be necessary to check the meter's NTP status (to ensure it's reaching a valid server) or modify settings (if the default servers can't be reached).

General Behavior

On bootup (e.g., after a reboot or when first installed), the eGauge will attempt to establish a connection to an NTP server. At this point, the meter may make a long jump to the correct date and time. This is technically referred to as a "step", using the settimeofday() function. This jump happens **instantaneously**, but it may *only* happen immediately after a reboot. However, if it takes too long to find an NTP server (e.g., because the network is not ready, because the NTP server is not resolvable, etc.) the meter may "miss" its chance to do this. Often, rebooting the meter will allow it to sync on the second try.

At any time during normal operation, the eGauge may attempt to slowly adjust the meter date and time to match the date and time provided by the NTP server. This is known as a "slew", using the adjtime() function. Unlike a "step", a "slew" will slowly change the date and time at a rate of about 1 ms per second. For example, a clock offset of 1 second would take about 1000 seconds or 16 minutes to sync up. Obviously this is much slower than a "step", but "slew" is really only intended to handle small changes. This is also part of the reason a meter may take several minutes to show "synced" status after a reboot - a reboot introduces about a 120ms offset into the date and time, which would take about 2 minutes to sync back up using "slew".