GEM & DashBox System

System 2
Installation Manual

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GEM & DashBox System

INTRODUCTION

IMPORTANT NOTE

This manual is for installation on **single phase or split single phase 120V/240V electrical systems only**. The CT installation described in this manual **will not work for three phase service**. This also applies to 120V/208V panels which uses two phases of a three phase source.

THEORY OF OPERATION

The system is composed of two main devices:

- The GreenEye Monitor (GEM)
- The DashBox

The **GEM** monitors the voltage and current from each sensed panel circuit, calculates the energy for each circuit. It then creates data packets to send to a data host (the **DashBox** in this case) at a defined interval.

The **DashBox** receives the data packets from the GEM and stores them in its database. The DashBox then provides the user with the ability to view the consumption using graphs and reports using a web browser.

There are two main methods to get the data packets from the GEM to the DashBox:

- **RS-232** cable connection between the GEM and DashBox
- Over the network with both the GEM and DashBox connected to the same **network**

The **RS-232** cable connection method is preferred because data collection is not dependent on the network being up and operational. This is the only option available for "Base Model GEMs". The next section explains how to distinguish each GEM model.

The GEM can connect to the **Network** via Ethernet cable or WiFi, depending on the communication options installed on the GEM. The DashBox uses an Ethernet connection.

DETERMINE GEM MODEL

Determine which communication option (if any) is installed in your GreenEye Monitor: **"GEM"**, **"GEM-WE"** or **"GEM-E"**. This is important to determine the installation location for the DashBox. The three models are shown on the following page.

Base model "GEM"

The "Base model GEM" strictly uses RS-232 for communication with the DashBox or other data host. All GEM models have RS-232 by default.

Identifiable by:
- Black circuit board and cover plate
- No Ethernet jack on circuit board
- No antenna connector such as "GEM-WE" model
- No reddish circuit board like the "GEM-E".

See picture on the right
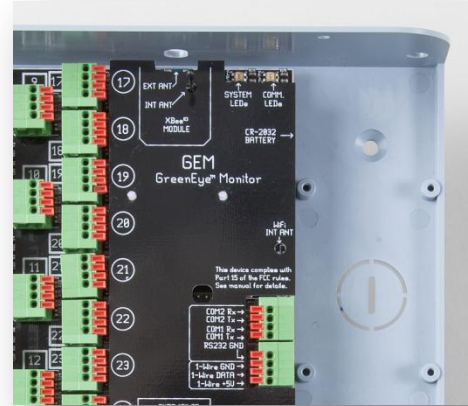
Base model GEM

WiFi/Ethernet "GEM-WE"

The "WiFi/Ethernet GEM" model possesses the option of WiFi, Ethernet or RS-232 for communication with the DashBox or other data host.

Identifiable by:
- Has a WiFi antenna connector
- Blue circuit board and cover plate

See picture on the right

WiFi/Ethernet GEM model

Ethernet Only "GEM-E"

The "Ethernet Only GEM" model may use Ethernet and/or RS-232 for communication with the DashBox or other data host.

Identifiable by:
- Reddish colored Ethernet circuit board installed. See picture on the right

Notes:
1. *The Ethernet connection is done on the red module and NOT the jack on the blue GEM board*
2. *The black barrel jack on the module is not used or functional*
3. *May have black or blue circuit board (mostly black)*

Ethernet Only GEM model

IMPORTANT SAFETY INFORMATION

<div style="border: 3px solid yellow;">

⚠️ **WARNING !**

Read All Safety Rules Before Installing!

</div>

All safety rules described below must be obeyed. Read safety information carefully before proceeding with the installation of the GreenEye Monitor and associated current transformer.

The GREENEYE MONITOR (GEM) is a low voltage device. This requires that all external connected signals be a low voltage (<50V) and provided by Class II approved power supply.

All of our power supplies are UL, CSA or UL/c approved for use in USA and Canada. Our current transformers (CT) are UL/c listed. No direct line connections to the GEM are allowed. All signals must be galvanic isolated from the power-line.

Never install the GEM inside an electrical panel. A separate "low voltage" panel may be used when needed.

The GREENEYE MONITOR (GEM) installation requires the installation of current transformers (CT) installed inside the electrical service panel. This portion of the installation MUST be performed by a qualified electrician or individual. The installer must follow all local safety codes and use proper safety practices and equipment.

The qualified installer must be aware that main panels may still contain dangerous voltage levels even though the main breaker is in the "OFF" position.

The following rules MUST be obeyed!

- **Any work performed inside the electrical panel must be done by an electrician or qualified individual. This individual will be familiar with the local electrical code and perform the installation accordingly.**
- **NEVER install the GreenEye Monitor (GEM) inside the electrical panel. Only low voltage (12VAC or less) galvanic isolated connections are to be made to the GREENEYE MONITOR (GEM) terminals.**
- **The current transformer (CT) leads must exit the electrical panel through an appropriate box connector, strain relief or bushing. The CT leads must be properly anchored on the outside of the panel.**
- **The portion of the CT leads inside the panel must not have any damage, cuts or wear to the outside insulation.**
- **The CT leads inside the electrical panel must be routed in such a way that its insulation will not be rubbing against live terminals. Care must be exercised not to pinch the CT leads especially when re-installing the panel cover.**
- **Do not install the CTs in panels with voltages greater than 300V.**
- **Do not install the GREENEYE MONITOR (GEM) in a wet location.**

COMPLIANCE

FCC COMPLIANCE

The GreenEye Monitor models GEM-W and GEM-E have been tested to Comply with FCC Standards for Home and Office Use. The processor board inside the DashBox has also been tested to comply with FCC Part 15.

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions:
   (1) this device may not cause harmful interference, and
   (2) this device must accept any interference received, including interference that may cause undesired operation.

Wireless Versions:
   Contains FCC ID: OUR-XBEE2 (USA) (Wireless Versions Only)
   Contains Model XBee® ZNet 2.5 Radio, IC: 4214A-XBEE2 (Canada)
   May Contain Roving Networks WiFly Module FCC ID: T9J-RN171
   May Contain FCC ID: AZYHF-A111

WHAT'S IN THE PACKAGE

GreenEye Monitor

DashBox

STS Cable

Split-core CTs for main panel feed from Power Company

200A CTs

Donut style CTs for panel circuits

40A CT   80A CT

Split-core style CTs for panel circuits

30A CT   60A CT

CT Model and Quantity Depends on System

12Vac Wall Transformer (PT)

Two 5Vdc Power Adaptor

GEM MOUNTING LOCATION

Find suitable mounting location for the GEM. **Do not mount the GEM inside breaker panel!**

⚠️ **WARNING !**

NEVER Install the GREENEYE MONITOR (GEM) Unit Inside the Electrical Panel

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Make sure the CT lead will reach the furthest circuit breaker.

Determine the best mounting location for the GEM taking into consideration the length of the CT leads.

Some CT models have longer leads than others. The two large main panel CTs such as SPLIT-100 or SPLIT-200 have longer leads than Micro-CTs do, so it may be preferable to locate the GEM at the opposite end of the panel feed where the large CTs are installed. See diagrams below.

Main Panel

SPLIT-200 CTs have longer leads than Micro CTs

GEM

Main Panel

GEM

SPLIT-200 CTs have longer leads than Micro CTs
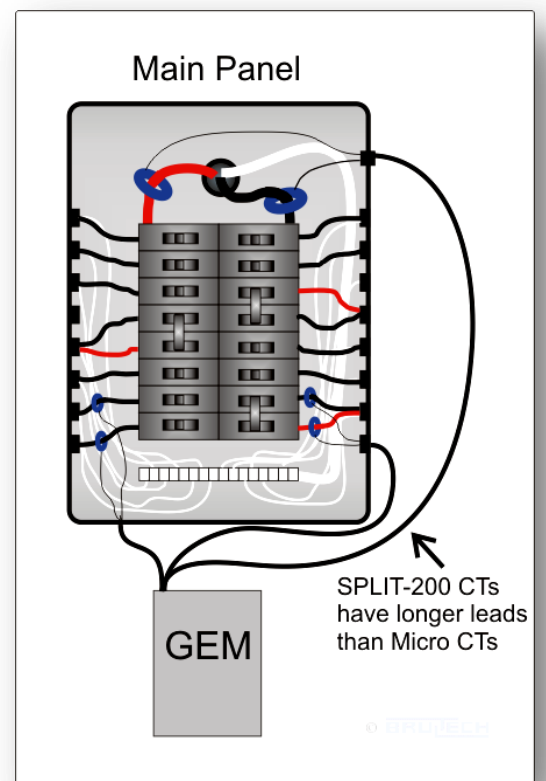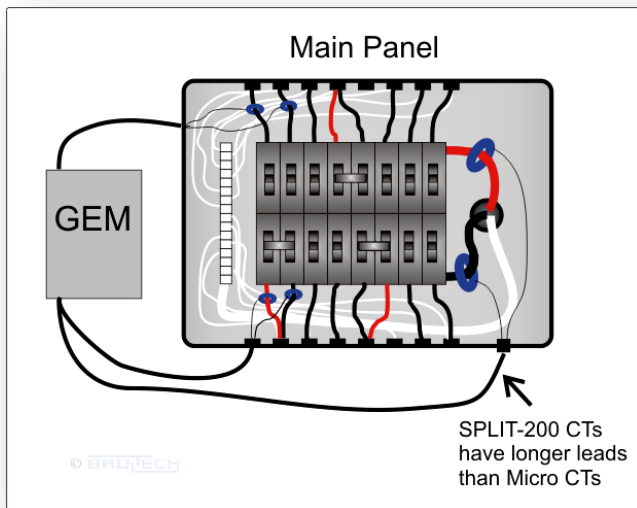
DASHBOX LOCATION

The possible location for the DashBox depends on the GEM's communication options (if any) installed. All GEM models have RS-232 ports and qualify for "Option 1". This option is recommended because it allows the DashBox to collect data independent of the network status or even without a network.

OPTION 1: RS-232 CABLE (RECOMMENDED)
Model: GEM / GEM-WE / GEM-E

This option uses RS-232 communication between the GEM and the DashBox. All GEM models are compatible with option.

The STS Cable is 3 feet long therefore the DashBox should be mounted within two feet of the GEM.

The STS Cable may be extended to allow the DashBox to be located in another room. It is recommended to use CAT 5 or CAT 6 network cable to extend the RS-232 STS cable.
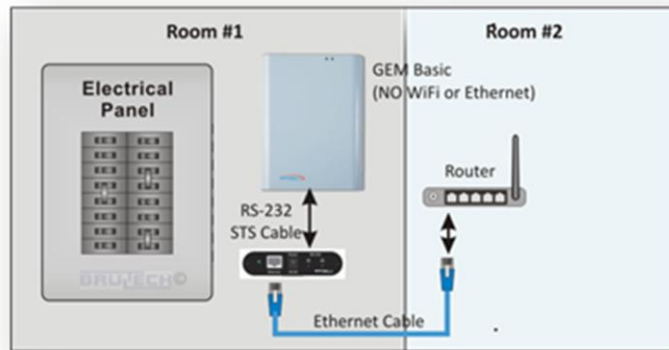
The DashBox is located within two feet from the GEM
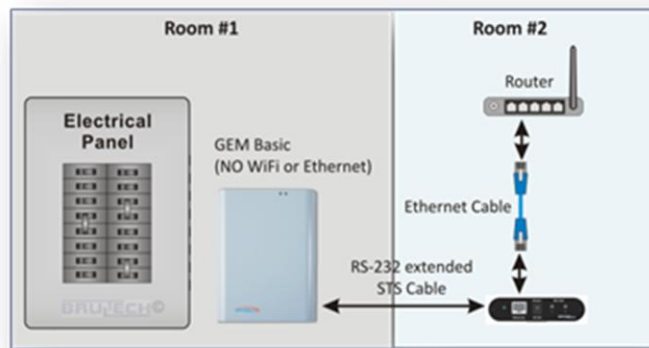
DashBox is located a distance from the GEM by extending the STS Cable

OPTION 2: TCP CONNECTION
Model: GEM-WE / GEM-E

Option 2 uses the network as the path for data from the GEM to be sent to the DashBox. This option is only possible with GEM models listed above.

The GEM can be connected to the network via Ethernet Cable or in the case of WiFi/Ethernet GEM models, WiFi connected.

Option 2 is not as reliable as Option 1 which consists of an RS-232 connection since any network downtime will affect data collection.

NOTE: GEM-E is not capable of WiFi connection.
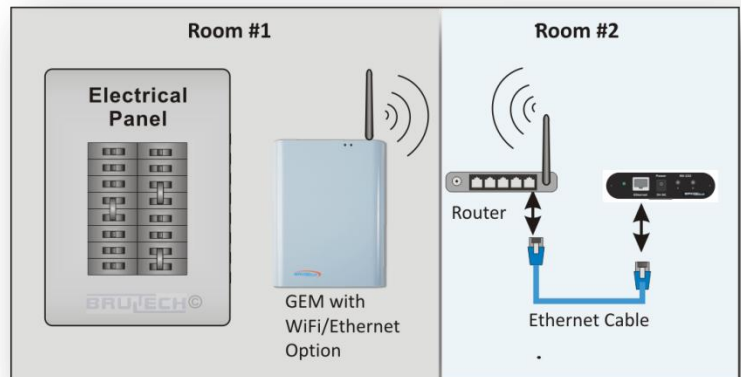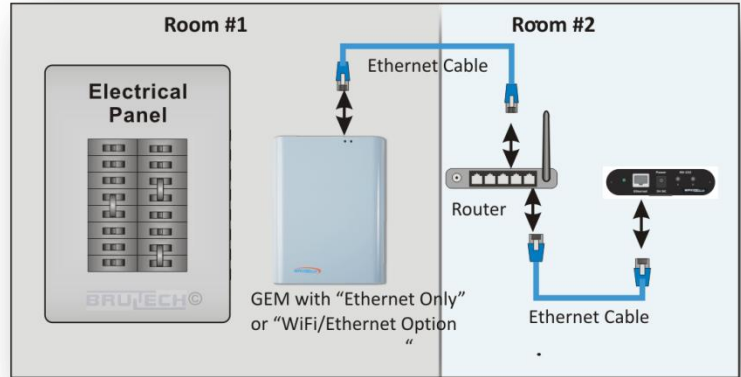
PANEL LAYOUT

A generalized "**Panel Layout Sheet**" is located on the last page of this document. Print a copy and fill in the information for each breaker. This will greatly simplify setting up the GEM CTs and DashBox channels later. Each field is defined below.

Panel Layout Sheet	Associated Breakers

FIELDS

Panel

"Panel #" is the breaker slot number on the panel itself

Load Description

"Load Description" is the name of the appliance, outlet, light, etc. connected to this breaker

CT

"CT #" is the number on the CT leads. This allows the installer to know which CT leads represent each channel when it comes time to connecting the leads to the GEM.

Not all CTs have numbered labels attached. If this is the case, it is advisable to put a small piece of masking tape at the end of the CT leads after the CT has been installed and the leads have been routed outside of the panel

CT Model

"CT Model" is the Brultech model number of the CT

Amps

"Amps" is the amperage rating of the circuit breaker

240V-120V-240V

Circle the voltage that represents the breaker. If it's a 240V breaker it is typically coupled with a breaker adjacent to it. In this case, circle the two together as shown in the picture above.

CT INSTALLATION

⚠️ **WARNING !**

Read and understand the safety information before the CT installation!

Read the Important Safety Information chapter at the beginning of this document before proceeding with CT installation!

CT ORIENTATION

The CT orientation matters only for GEM channels with more than one CT. If only one CT is connected to a given channel the orientation does not matter.

The term "**orientation**" refers to which direction the CT is installed. The diagram on the right shows two instances of a CT clamped on to the wire connected to the circuit breaker. Notice that one CT is installed in one direction and the other in the opposite direction. One instance the CT leads faces toward the circuit breaker and in the other case, away from the breaker.

Examples for other type of CTs are shown in the pictures below.

All CTs may be installed in any direction but once the CTs have been installed, make note of the CT orientation for both CTs which will connect to a single channel.
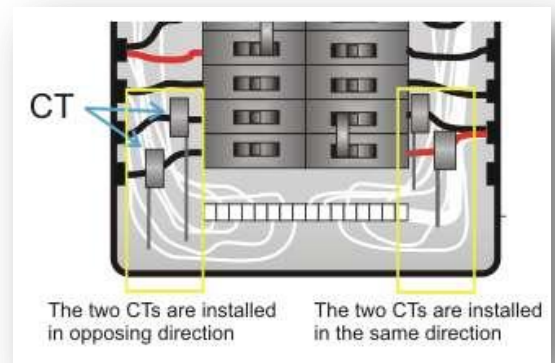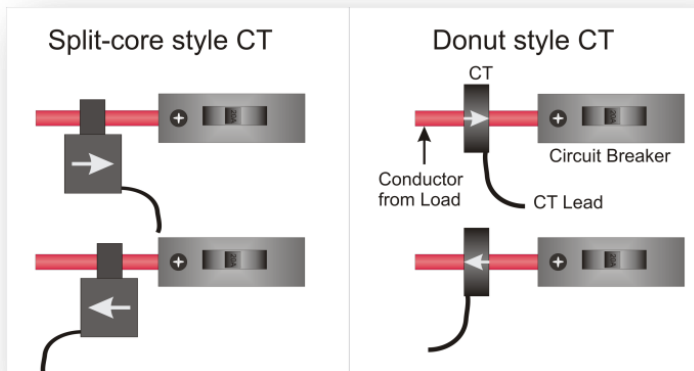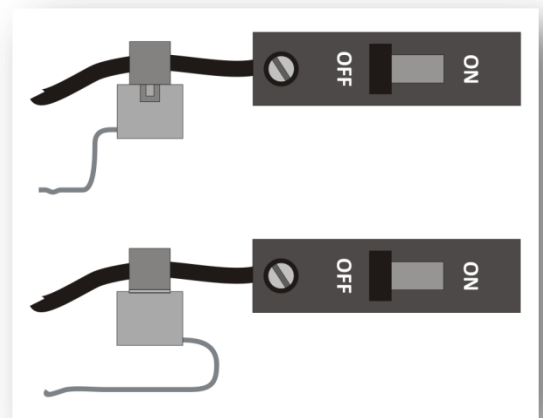
240V LOADS

You can monitor a 240V load with only one CT **if the load is balanced**. A balanced load is one that does not use a neutral conductor therefore the current which flows through one line is identical to that which flows through the other. If you are not sure if the load is balanced, use two CTs. If using a single CT for the 240V load, orientation is irrelevant.

Typical 240V Balanced Loads

A balanced load will have no neutral connection. Example balanced loads are listed below. There may be some exceptions. If you're not sure, check for the absence of the neutral (white) conductor to the load.

- HVAC
- Water heater
- Baseboard heater
- Water pump

Typical 240V Unbalanced Loads

- Clothe dryer
- Electric range
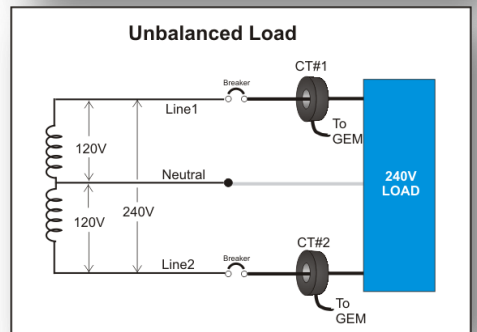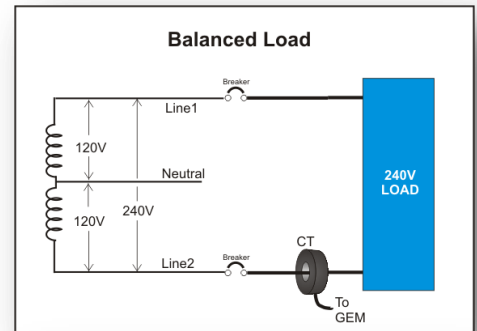
CT INSTALLATION SAFETY

The GREENEYE MONITOR (GEM) installation requires the installation of current transformers (CT) installed inside the electrical service panel. This portion of the installation MUST be performed by a qualified electrician or individual. The installer must follow all local safety codes and use proper safety practices and equipment.

The qualified installer must be aware that main panels may still contain dangerous voltage levels even though the main breaker is in the "OFF" position.

The following rules MUST be obeyed!

- **Any work performed inside the electrical panel must be done by an electrician or qualified individual. This individual will be familiar with the local electrical code and perform the installation accordingly.**
- **NEVER install the GreenEye Monitor (GEM) inside the electrical panel. Only low voltage (12VAC or less) galvanic isolated connections are to be made to the GREENEYE MONITOR (GEM) terminals.**
- **The current transformer (CT) leads must exit the electrical panel through an appropriate box connector, strain relief or bushing. The CT leads must be properly anchored on the outside of the panel.**
- **The portion of the CT leads inside the panel must not have any damage, cuts or wear to the outside insulation.**
- **The CT leads inside the electrical panel must be routed in such a way that its insulation will not be rubbing against live terminals. Care must be exercised not to pinch the CT leads especially when re-installing the panel cover.**
- **Do not install the CTs in panels with voltages greater than 300V.**
- **Do not install the GREENEYE MONITOR (GEM) in a wet location.**

CT INSTALLATION TIPS

1. Print a copy of the panel layout sheet located at the end of this document (see previous chapter "Panel Layout") and fill in the fields.
2. As each CT is installed in the panel make note of the CT orientation on the sheet.
3. Label the lead end of the CTs with the breaker number that it is installed on.

ROUTE THE CT LEADS

Neatly route all of the CT leads through one of the many "knock-out" holes of the GEM enclosure. In some installations, the leads may enter the GEM through the back of the GEM enclosure.

1. Fill in "Panel Layout" sheet.
2. Turn off the breaker.
3. Install the CT on the lead going to the circuit breaker. Verify that the CT leads will reach the CT terminals once the leads are neatly routed.
4. For each installed CT make note of the CT orientation. For example you can put a "B" on the panel layout sheet when the CT leads are facing the breaker or an "L" if the leads are facing the load.
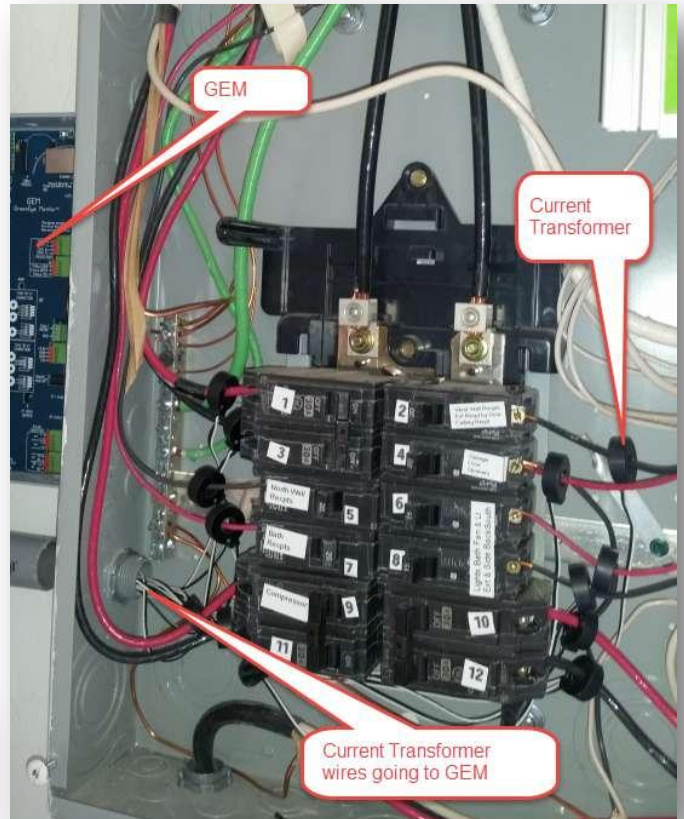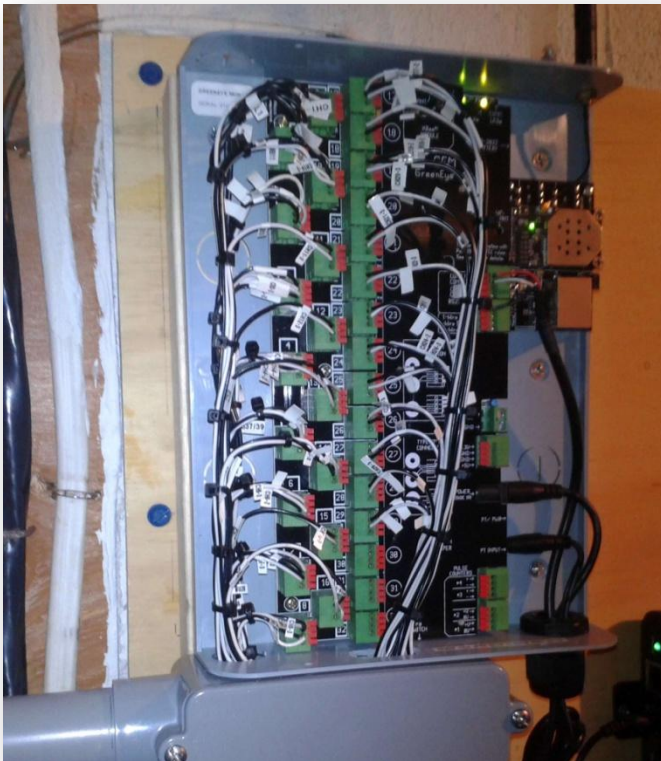
5. Once the CT is installed on a given breaker, route the CT leads outside the panel and attach a label to the end of the leads. Write the breaker number on this label. You can use a small piece of masking tape as a label.
6. Once all CTs have been installed, proceed to the next chapter to terminate the leads on to the GEM terminal blocks.

CT TERMINATION

GEM TERMINAL STRIPS

NOTE: The CT leads must be stripped approximately 10mm (0.4") and have a gauge size between 18 and 26 AWG.

The GEM uses spring loaded terminal blocks. The CT leads must be stripped the proper length. If the leads have stranded wire, it is preferable to "tin" the wire beforehand to prevent dealing with frayed ends. *(Tinning is the process of adding solder to bond all of the strands together)*.

The CT leads are inserted into terminal block while pressing down on the corresponding orange tab (see picture below).
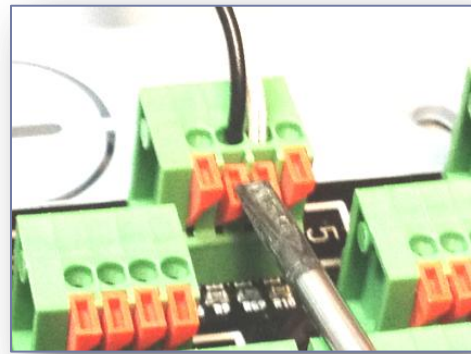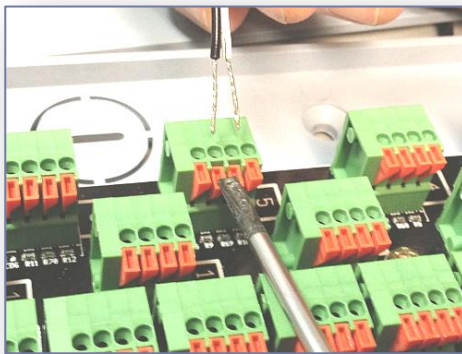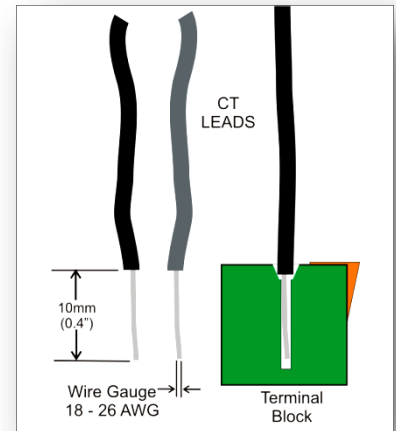
1. Align the two lead ends with the terminal holes. This can be done one lead at a time however it may be easier inserting both leads at the same time, providing they are tinned with no frayed ends.

2. Press down on the orange TAB(s) corresponding to the lead or leads to be inserted, using a small "flat blade" screwdriver.

3. Insert the leads into the terminal block while making sure the leads are perpendicular. In most cases, both CT leads can be inserted at the same time. If the lead was stripped back 10mm, then the stripped section should be entirely inside the block with only the insulation visible.

4. Release the pressure to the spring tab.

5. Finally, tug slightly on the leads to make sure they are secure.

CT TERMINATION

The picture on the right shows the terminal block. Each block has four terminals. Terminal 1 is at the bottom. The terminals that the CT will be connected to are dependent on the type of CT used.
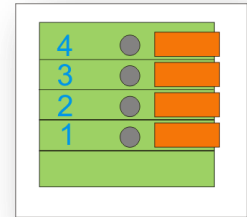
Two types of current transformers are used with the GEM: Types A and Type B.
The difference between each type has to do with the type of signal which represents the sensed current:

TYPE A CT: The measured current is represented by a <u>voltage</u> output signal.

- **SPLIT-60**
- **SPLIT-100**
- **SPLIT-200**
- **SPLIT-400/600**
- **SPLIT-170**

TYPE B CT: The measured current is represented by a <u>current</u> output signal.

- **Micro-40**
- **Micro-50**
- **Micro-80**
- **Micro-100**

SINGLE CT CONNECTION
When only one CT is connected to the GEM it doesn't matter which color lead goes to each terminal.
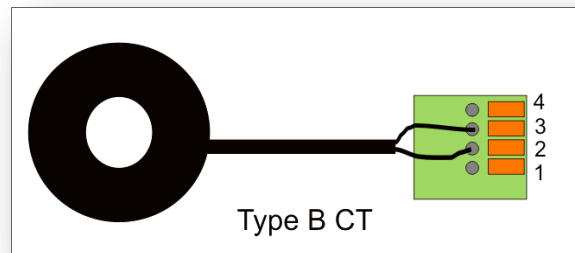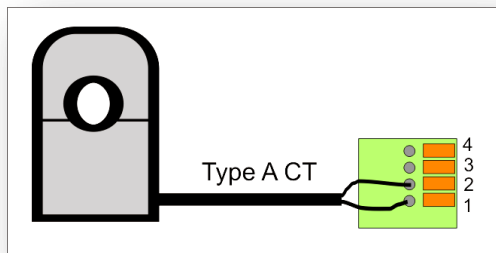
CONNECTING TWO CTS ON ONE CHANNEL

Two Type "A" CT Connection

The following CT models are "Type A": SPLIT-60, SPLIT-100, SPLIT-200, SPLIT-400/600, SPLIT-170
When connecting two CTs to a given channel, the CT orientation and lead color needs to be taken into account to prevent the signal of one CT from subtracting from the other.

When two CTs from a 240V load are connected to the GEM as shown in the diagram to the right, the rule for the CT lead color code is as such:

> **Two CTs installed <u>facing opposite directions</u>:**
> > Terminals 1 & 3 will have the same color lead
> >
> > Terminals 2 & 4 will have the same color lead
>
> **Two CTs installed <u>facing the same direction</u>:**
> > Terminals 1 & 4 will have the same color lead
> >
> > Terminals 2 & 3 will have the same color lead

This rule is based on a 240V load which means that one CT is on phase A and the other on phase B**.**
If both CTs are connected to two different loads which happen to be on the same phase, then the rule described is the opposite!

Type A CT Connection
(For single or split phase only)
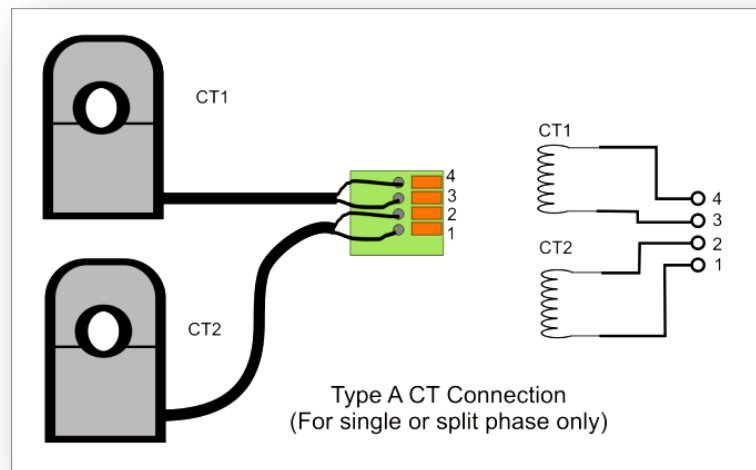
<u>Example:</u>
> Two SPLIT-200 CTs are connected to the main feeder. They are installed with both CTs facing the main panel breaker.
> - The solid black lead of CT#1 is connected to terminal #1 and the other lead to terminal #2
> - The solid black lead of CT#2 is connected to terminal #4 and the other lead to terminal #3

Two Type "B" CT Connection

The following CT models are "Type B": SPLIT-30, Micro-40, Micro-50, Micro-80, Micro-100

When two CTs from a 240V load are connected to the GEM as shown in the diagram to the right, the rule for the CT lead color code is as such:

Two CTs installed <u>facing opposite directions</u>:
>   Terminals 2 will have the same color lead from each CT
>   Terminals 3 will have the same color lead from each CT

Two CTs installed <u>facing the same direction</u>:
>   Terminals 2 will have dissimilar color lead from each CT
>   Terminals 3 will have dissimilar color lead from each CT
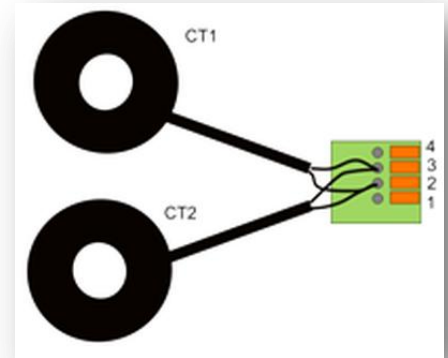
This rule is based on a 240V load which means that one CT is on phase A and the other on phase B**.**
If both CTs are connected to two different loads which happen to be on the same phase, then the rule described is the opposite!

Example: Two Micro-80 CTs are connected to the electric stove. They are installed with both CTs facing the breaker.
- The white lead of CT#1 and the black lead from CT #2 are connected together to terminal #2
- The black lead of CT#1 and the white lead from CT #2 are connected together
  to terminal #3

SPLIT-30 CT Connection

The **SPLIT-30** is a "**Type B**" CT and the connection method for Type B described above applies.
The only difference is the addition of a capacitor inserted in terminals 1 and 4.
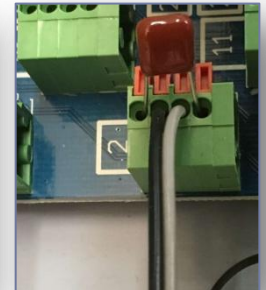
POWER SUPPLY AND WALL TRANSFORMER

Plug the 5Vdc power supply and the 12Vac wall transformer into a receptacle near the panel.

1. Plug the 5Vdc cable into the barrel jack (top right of picture)
2. Fully plug the 12Vac cable into the 3.5mm jack (bottom right of picture *Make sure that the plug is fully inserted!*
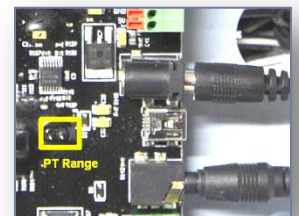
COMMUNICATION

Choose one of the following communication options: **RS-232, Ethernet or WiFi**

RS-232 CABLE INSTALLATION
Model: GEM / GEM-WE / GEM-E

For GEMs with WiFi/Ethernet or Ethernet only option, connect the STS Cable (RS-232 cable) to COM 2 otherwise use COM 1 for basic GEM model.

1. Connect the STS Cable terminals to the GEM
   a. Red wire to GEM's **Rx** terminal
   b. White wire to GEM's **Tx** terminal
   c. Black wire to **GND** terminal
2. Plug the STS Cable 3.5mm plug into port #1 of the DashBox
3. Connect an Ethernet Cable between the DashBox and the Network Router
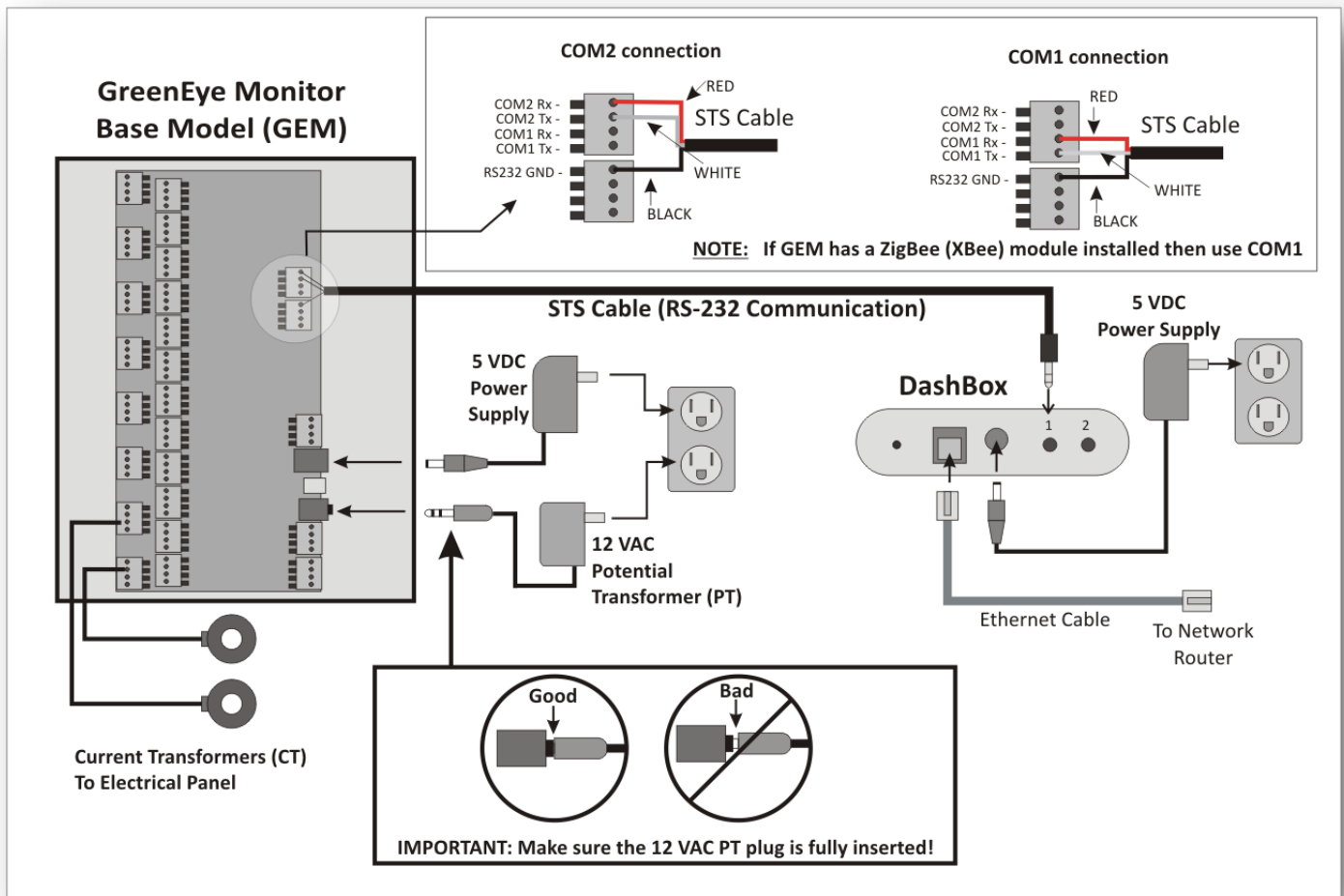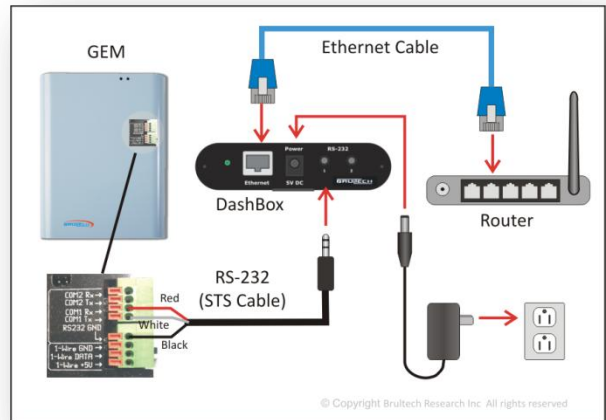
ETHERNET CABLE COMMUNICATION
Model: GEM-WE / GEM-E only

1. Connect an Ethernet Cable between the GEM and the Network Router
2. Connect an Ethernet Cable between the DashBox and the Network Router

Two GEM models have an Ethernet connector. The GEM-E (Ethernet Only model) has an additional circuit board installed and a dedicated Ethernet jack. The GEM-WE (WiFi/Ethernet model) has no additional circuit board but does have a WiFi antenna connector. Its Ethernet jack is on the GEM board.
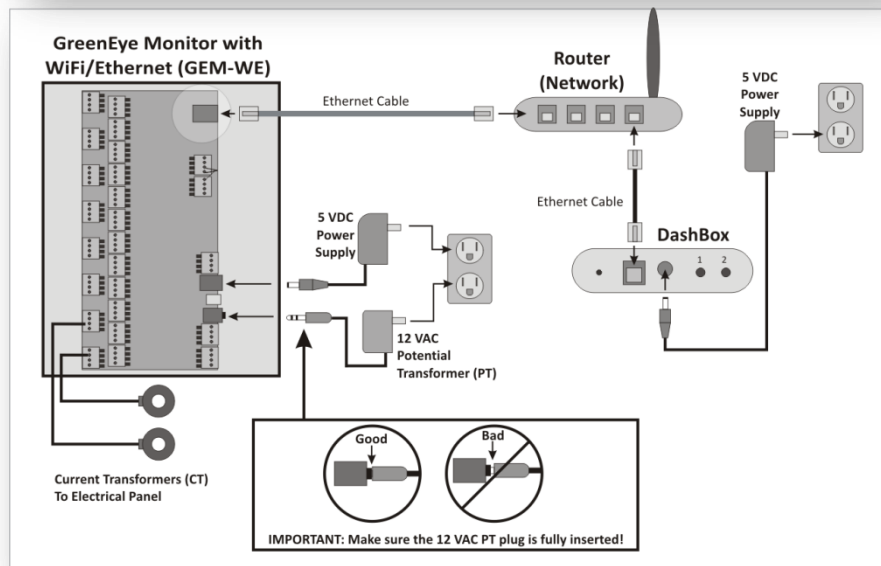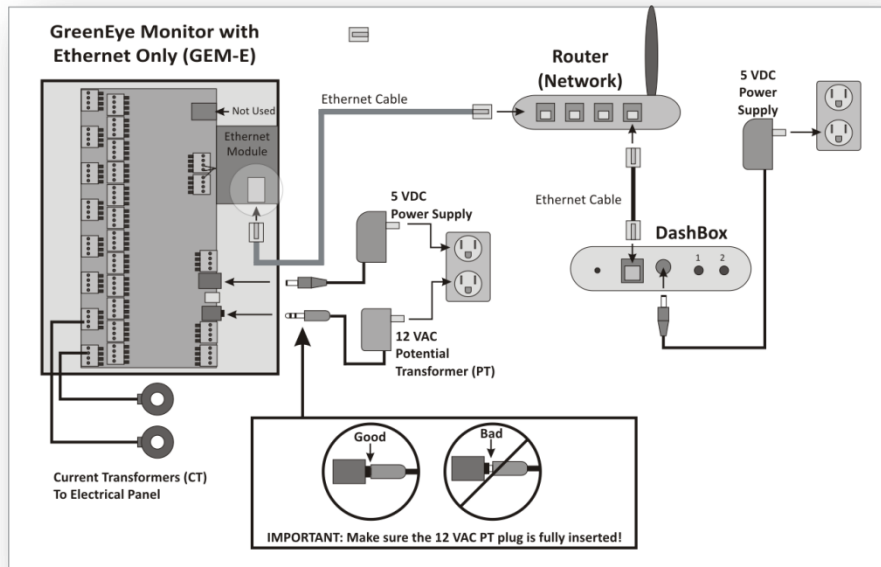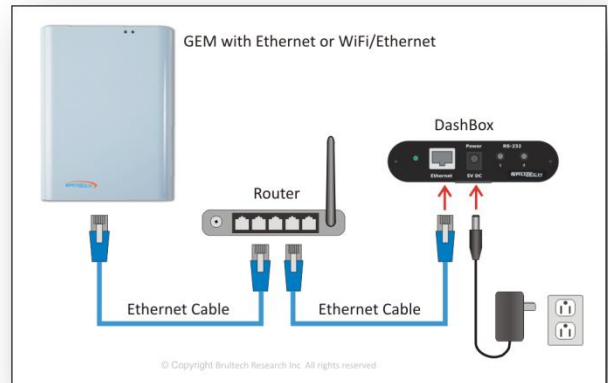
WIFI COMMUNICATION
Model: GEM-WE only

1. Connect an Ethernet Cable between the DashBox and the Network Router

The procedure to establish a wireless connection is explained later in this manual.

GEM with WiFi/Ethernet Option

Network Router

DashBox

Ethernet Connection

GreenEye Monitor with WiFi/Ethernet (GEM-WE)

Router

5 VDC Power Supply

Ethernet Cable

5 VDC Power Supply

12 VAC Potential Transformer (PT)

DashBox

1   2

Current Transformers (CT) To Electrical Panel

Good   Bad

IMPORTANT: Make sure the 12 VAC PT plug is fully inserted!
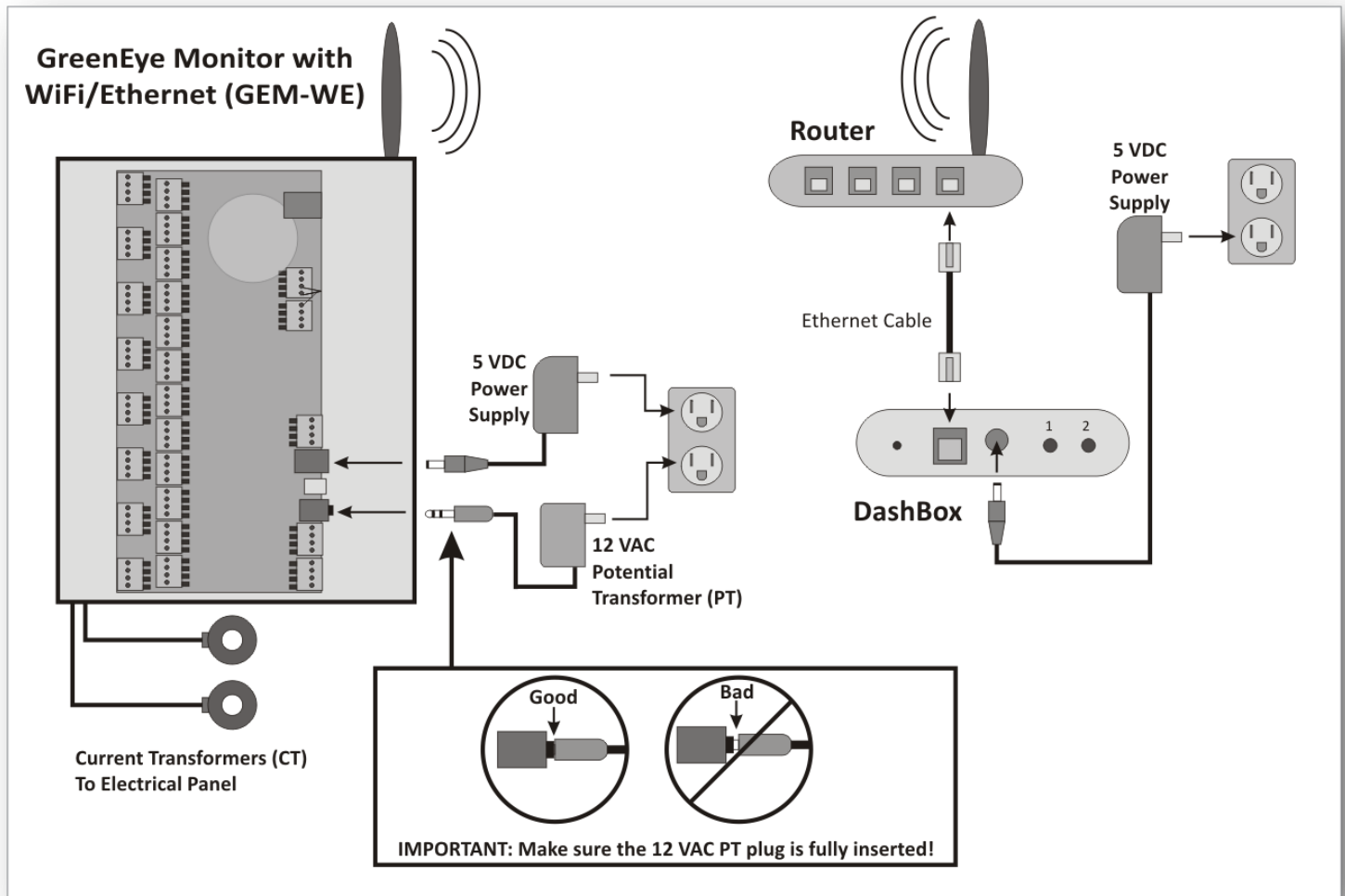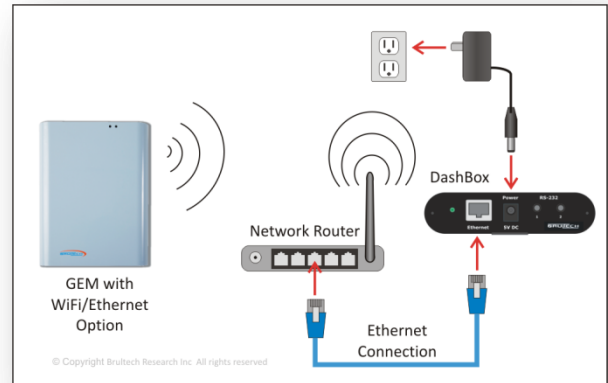
DASHBOX SETUP

DASHBOX POWER UP

1. Connect a network cable between the network router and the DashBox
2. Connect the 5Vdc power supply adapter to the DashBox then plug it into a local receptacle
3. Observe the LED color sequence:
    a. Reddish/pink glow for several seconds indicating that the system is booting up
    b. Red flashing LED for 30 seconds while the super-capacitor charges
    c. Green flashing LED for a few seconds while the system starts all processes
    d. Green solid. System is started and ready

DASHBOX WIFI ADAPTER SETUP

If the DashBox is connecting to the network via Ethernet Connection then proceed to the next chapter: "Locate DashBox on the Network".

By default the USB/WiFi adapter will be in "Access Point" mode.

1. Make sure the DashBox has booted up with the USB/WiFi adaptor plugged into the USB jack
2. Search and connect to the WiFi network named "DashBox..." there may be a number following the name
3. Open your internet browser and enter http://192.168.6.1. This will connect to the DashBox web interface
4. If this is the first time connecting to the DashBox:
    a. Set your "Time Zone" and "Locale"
    b. Assign the DashBox a login name and password
    c. Set the rate in $ per kilowatt-hour (kWh). This can be done by taking the total cost of the electric bill and dividing it by the total kWh used during the billing period. If you're in a rush, accept the default ($0.20) and change this later.
    d. Read and accept the License Agreement
    e. Click "Save Settings"
5. Click "Network" on the left side menu, then click "WiFi USB"
6. In the "Network Configuration" box, click the "Network Mode" radio button.
7. In the "Network" box, enter the name (SSID) of the wireless network you wish to connect to
8. Enter the password for the WiFi network in the "Password" box and select the security type from the "Security" drop-down menu
9. Set "IP Type" to DHCP. This will allow the router to assign an IP address to the DashBox
10. Click the blue "Save Settings" button at the bottom. The system must be rebooted to take effect
11. Click "System" from the left menu then Click "Reboot System"

DashBox with Optional USB-WiFi Adapter
The DashBox will only work with TP-LINK TL-WN722N wireless adaptor or any other type using the AR9271 chipset

Your computer should now disconnect from the Access Point since the DashBox is switch from Access Point to Network mode. Connect to the network now to discover the DashBox which should now be connected to the WiFi network.

LOCATE DASHBOX ON THE NETWORK

The DashBox IP Address needs to be determined. If you are computer savvy and know how to discover the DashBox IP Address from the network router go ahead and do so then skip to the next chapter "Set a Static IP Address".

Windows users

1. Download the "GEM Network Utility" program from http://brultech.com/software and install
2. Use **"Run as administrator"** option and start the program
3. Click the "Network" tab
4. Click "Search" on the bottom right

The "GEM Network Utility" will discover the IP address for the DashBox as shown below.

Double click on the IP address. This will open the DashBox web page in a browser.
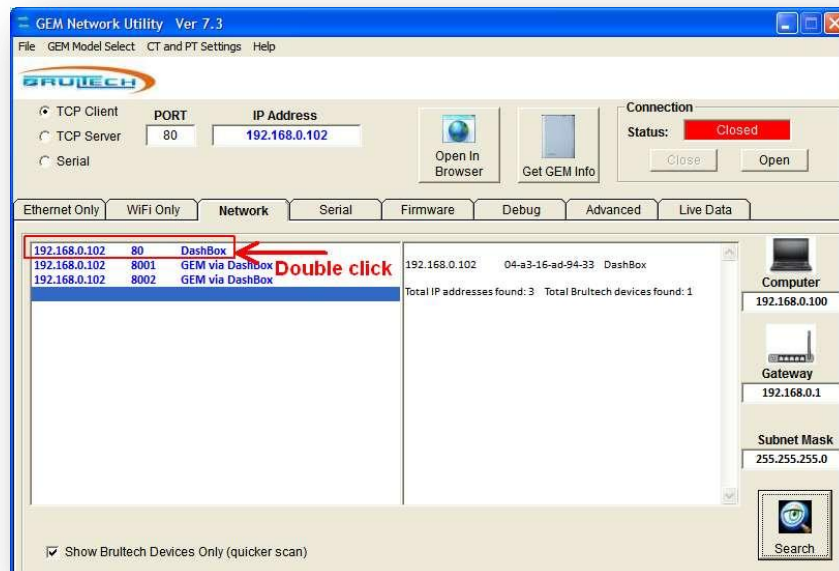
Proceed to the next chapter "Set a Static IP Address"

Mac or Linux users

If you are using a Mac or Linux system, you can download a free "Network Scanner" program called Fing (https://www.fing.io/) or you can connect to your router to view the devices on the network. Look for an IP address associated with the name **"TP-Link" (**if you are using the USB to WiFi adaptor). Make note of the IP Address.

Enter this IP Address into your internet browser's address bar then press "Enter". This should take you to the DashBox web page.

SET A STATIC IP ADDRESS

The DashBox network setting needs to be modified from "DHCP" to "Static" so that the assigned IP address doesn't change. Take note of this IP Address since this will be the set IP address used to view the Dashboards.

Ethernet Connected

Follow these steps if the DashBox is connected to the network using an Ethernet cable.

1. Make sure you are connected to the DashBox with your browser
2. Click "Network" on menu, then click "Ethernet"
3. Click the "Static" box (#1 in the screen shot below)
4. Using the values from the "Current Ethernet Settings" box enter the values in box 2, 3, 4 & 5
5. Click "Save Settings"
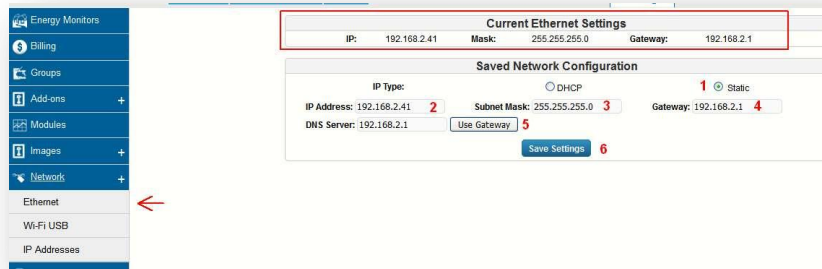
WiFi Connected

Follow these steps if the DashBox is connected to the network using a USB to WiFi adaptor.

1. Make sure you are connected to the DashBox with your browser
2. Click "Network" on menu, then click "WiFi USB"
3. Click the "Static" box (#1 in the screen shot below)
4. Using the values from the "Current Ethernet Settings" box enter the values in box 2, 3, 4 & 5
5. Click "Save Settings"
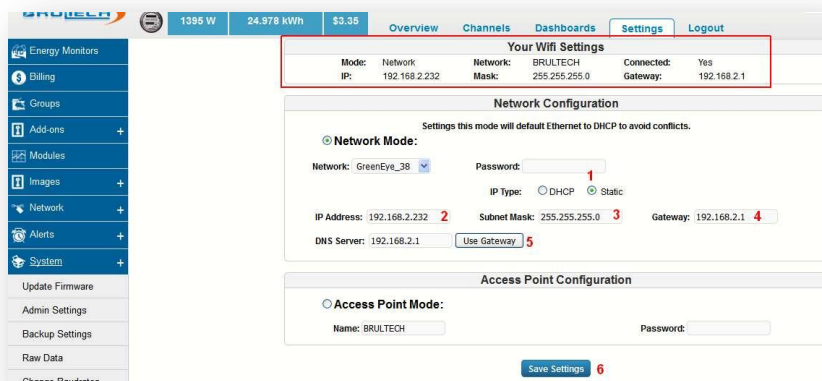
GEM SETUP PAGE

The GEM has a browser based "Setup Page". The procedure to access the "Setup Page" depends on the communication method, **RS-232** or via the **TCP (network)**. Follow the steps (below) for the option that applies to you.

GEM CONNECTED VIA RS-232 (STS CABLE)

The "GEM Setup Page" is accessed using a browser and entering the DashBox IP address and appending a colon then the port number. Use ":8001" if the STS Cable is plugged into port "1" of the DashBox or ":8002" if plugged into port "2". For example: "192.168.xx.xx:8001" if using port "1".
If you cannot access the GEM Setup Page then refer to the Troubleshooting chapter at the end of this manual as there could be a baud conflict.

GEM CONNECTED VIA NETWORK (ETHERNET OR WIFI)

Model: GEM-WE / GEM-E
If the GEM is "WiFi/Ethernet" model or "Ethernet Only" model, access to the GEM setup page is accomplished over the network. The procedure varies depending on which of the two options ("WiFi/Ethernet" or "Ethernet Only") is installed on the GEM.

WiFi/Ethernet Model

Model: GEM-WE
Determine whether to use WiFi or Ethernet for communication. Follow the instructions for your selected method.

Ethernet

This section is for "**WiFi/Ethernet**" GEM model. If your GEM is "Ethernet Only" model then jump to the next section (Ethernet Only GEM). The Ethernet Only GEM uses a different module and setup.

Make sure that an Ethernet cable is connected between the Ethernet jack on the GEM and the network router. By default, the GEM should connect to the router via DHCP.
If you cannot get an Ethernet connection, your router may need to be set for 100Mbit communication as most modern routers operate at 1Gbit. Proceed to "View GEM Setup Page".

WiFi

Make sure the GEM module is reset to factory defaults. If your GEM is new, it will have factory default loaded. If not then, press the switch located next to the Ethernet jack on the GEM circuit board. Hold the switch for 5 seconds then release. It will take approximately 30 seconds for the module to reboot with the factory default settings.

1. Make sure there is no Ethernet cable plugged into the GEM
2. Search for wireless networks with your computer
3. Connect to the "GreenEye_*xx*" wireless network
4. Once connected to the network, open a browser and enter 1.2.3.4 or http://1.2.3.4 in the address bar
5. The default username and password is "admin" for both
6. Select "STA Interface Setting" from the menu
7. In the "STA Interface Parameters" box, click "Search"
8. After a few seconds, a box will open displaying the available WiFi networks available to connect to, select your Network and provide "Security Mode" and "Passphrase" (password) for the WiFi network you are connecting to

9. Click "Apply"
10. Select "Device Management" from the menu
11. Click "Restart" for the changes to take effect

Wait a few seconds for the module to reboot and connect to the network. In the meantime, connect to the network with your computer.

View GEM Setup Page (WiFi/Ethernet)

Run the "GEM Network Utility" (Windows)
Click the "Network" tab then click the "Search" button

The program will find the GEM device and IP address as displayed below

Result from "Search" using the "GEM Network Utility" program

Result from using the "Fing" application (free)
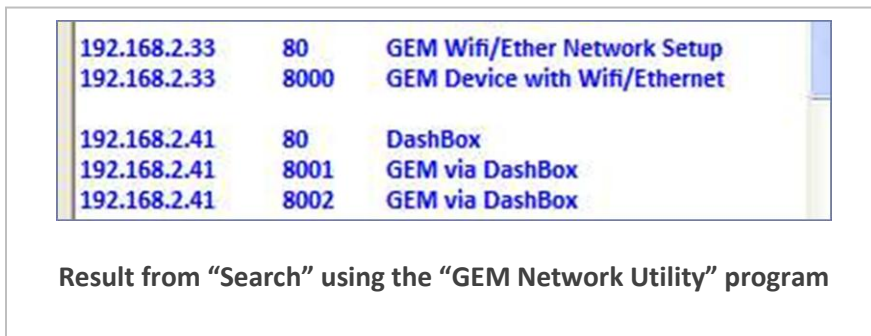
If a Windows computer is not available, download and install "Fing" network tool or get the Fing App free (iOS & Android). Once installed, perform a network scan.

The screen on the right shows an example of the Fing scan. The GEM (WiFi/Ethernet model) is discovered based on the "Hi-Flying electronics" device name. The DashBox is discovered based on the "Texas Instruments" device name.
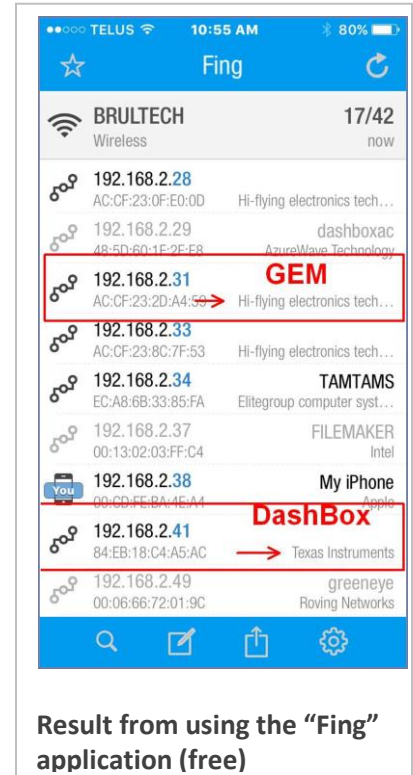
1. If using the "GEM Network Utility", double-click the line displaying "GEM Device with WiFi/Ethernet". If using "Fing" or searching the router's "Connected Devices", look for "HiFlying Electronics Tech". Use the IP Address for this device and insert it into a browser's address bar and append ":8000" to it. Ex: 192.168.2.33:8000

You should now have the GEM's "Enter Setup" page opened (screen shot below). You may need to refresh the page a couple of times to open this page.
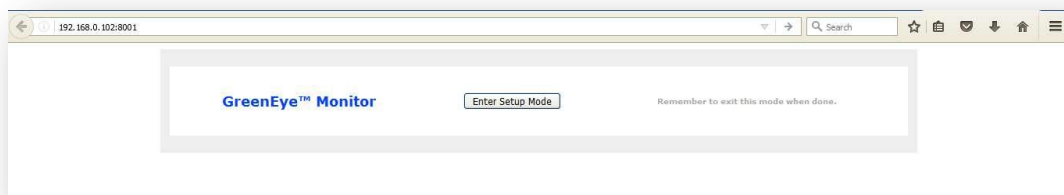
WiFi/Ethernet Reset to Factory Default
Model: GEM-WE

If you experience any problems or improperly configure the WiFi/Ethernet module, you can reset it to default settings using the push button switch located just **to the left of the network jack on the GEM's circuit board**. Procedure to reset the module to factory default settings:

1. Press and maintain the switch for 5 or more seconds then release
2. Wait 15 seconds for the module to reboot itself after releasing the switch

Ethernet Only Model
Model: GEM-E

View GEM Setup Page (GEM with Ethernet Only)

Refer to the screen shot on the right.

1. Run the "GEM Network Utility" software (run as administrator)
2. Click the "Ethernet Only" tab
3. Click "Search" (bottom right)
4. Set to DHCP (1)
5. Click "Normal" button (2)
6. Set "Local Port" to "8000" (3)
7. Set the "Remote Port" to "80" (4)
8. Enter the IP Address of the DashBox into the "Server IP" box (5)
9. Select "Mixed" option (6)
10. Click "Save Settings" (7)
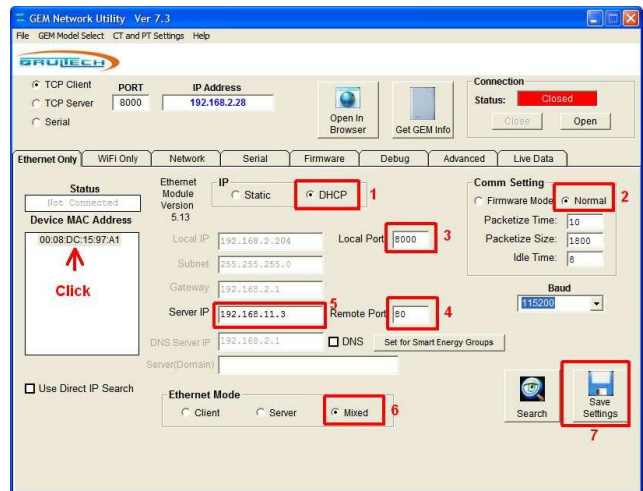
Click the Mac Address in the "Device Mac Address" box then click "Open" (top right)

You should now have the GEM's "Enter Setup" page opened (screen shot below). You may need to refresh the page a couple of times to open this page.
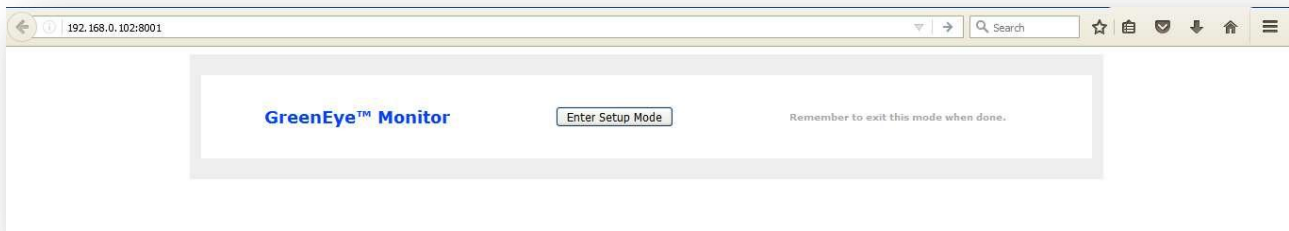
GEM SETUP PROCEDURE

Based on the previous steps, the "GEM Setup" page should now be opened in your browser (see screen shot below). **Note:** The GEM exits setup mode automatically after a few minutes so you may have to re-enter if there is too much idle time between executing settings

CONFIGURING CTS

For each channel with a connected CT, you will enter the CT Model connected to it.

1. Click "Enter Setup Mode"

Note: *The GEM exits setup mode automatically after a few minutes so you may have to re-enter if there is too much idle time between executing settings. All settings are saved immediately when executed.*

Refer to the screen shot below

CT Settings

1. Click "Chan CT" from the menu
2. In the "CT Settings" box, enter the channel number
3. Select the CT model connected to the channel
4. Click "Save"
5. Repeat steps 2, 3, 4 for all connected channels

The table below will refresh displaying the new CT model for the given channel.

Multiply by Two

If monitoring a 240V balanced load using **only one CT** instead of two (see diagram on the right), use the "Multiply by Two" option.

1. Enter the channel number the single 240V CT is connected to
2. Click: **"1"= Multiply by Two** radio button
3. Click "Save" (within that same section)
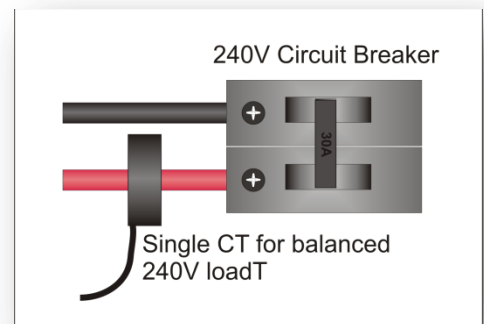
HTTP POST SETUP
Model: GEM-WE / GEM-E

<u>**Skip this section if using RS-232 (STS Cable) communication.**</u>

If the GEM sends data to the DashBox over the network (Option 2 Ethernet or WiFi GEM), then connect to the GEM setup page and follow these steps (refer to screen shot on next page):

1. Select "Data Post" from the menu
2. Select "DashBox / Stand Alone Software" button
3. Under URL address, enter the DashBox IP address determined in the first step Ex: 192.168.0.45
4. Click "Save"
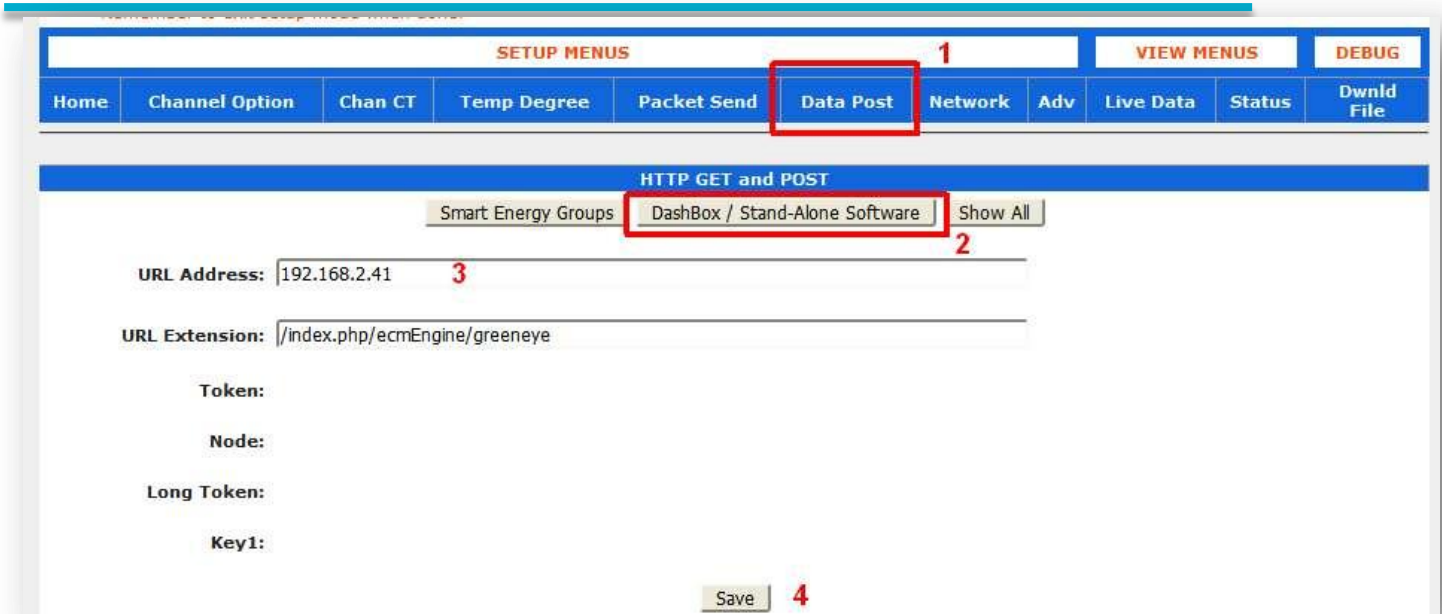
PACKET SETUP

This section sets up the packet format being sent from the GEM to the DashBox. This differs based on whether communicating using RS-232 (STS Cable) or via Network.

For RS-232 Serial Communication

1. Select the "Packet Send" menu
2. Set "Primary (Com1) Packet Format" to "4 Bin48-NET-Time"
3. Set the "Packet Send Interval" to 5 seconds
4. Set the "Secondary (Com2) Packet Format" to disable
5. Click "Save

For WiFi or Ethernet Communication
Model: GEM-WE / GEM-E
This procedure applies only for GEM devices communication with the DashBox over the network

1. Select the "Packet Send" menu
2. Set "Realtime Status" to "ON"
3. "Primary (Com1) Packet Format" to "3 HTTP GET"
4. "Packet Send Interval" to 8 seconds
5. "Secondary (Com2) Packet Format" to disable
6. Click "Save

NETWORK SETUP (GEM WITH WIFI/ETHERNET)

If the GEM is connected to the DashBox using RS-232 (STS Cable), then skip this chapter.

The next step is to have the GEM send packets directly to the DashBox which are both connected to the same network. The GEM needs to know the IP address and port number of the DashBox. The DashBox IP was determined earlier.

For GEM with WiFi/Ethernet option

Model: GEM-WE

Perform the next steps ONLY if the GEM uses a WiFi/Ethernet module!
1. Select the "Network" menu
2. Enter the DashBox IP address (determined earlier) in the "Host IP Address or URL Address:" box
3. Enter "80" for the port number (don't include the quotation marks)
4. Click "Save"

GEM with Ethernet only option

Model: GEM-E

Perform the next steps ONLY if the GEM uses an Ethernet only module!
1. Open the GEM Network Utility program downloaded from the Brultech website
2. Select the "Ethernet Only" tab
3. Click "Search". The GEM will be discovered and the fields populated
4. Enter the DashBox IP address (determined earlier) in the "Server IP" box. Ex: 192.168.0.48
5. Enter 80 for the "Remote Port" number
6. Click "Save"

Having completed these steps, the GEM is now sending data packets to the DashBox over the network.

NET METERING

SETTING CHANNEL POLARITY

By default, all GEM channels will display a positive value regardless of CT polarity. Grid connected solar or wind power generation may generate more power than consumed. This results in a reversal of the electrical flow. The GEM can read the direction of flow and show it as a positive amount when consuming and a negative amount when selling to the grid.

To allow the GEM to net meter, the "Main Panel" and "Solar" inverter channels need to be set to "Polarized". The screen shot below shows channels "1" and "27" set to "Net Metering" which will make the channels power polarized.
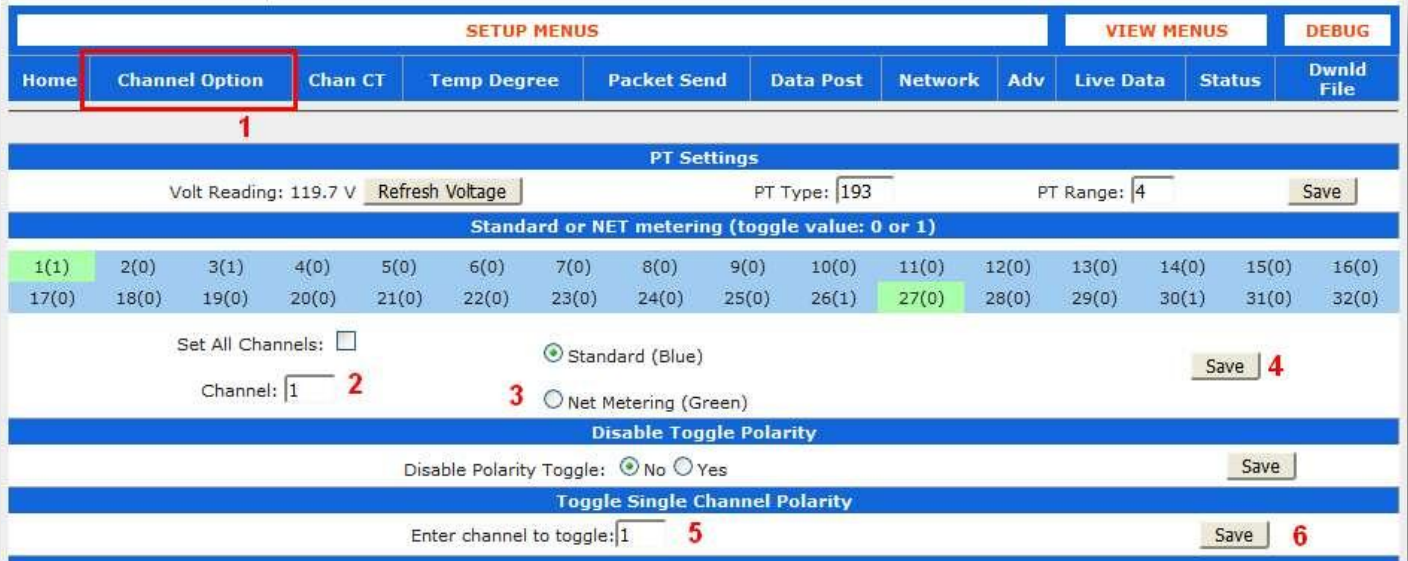
Procedure to change a channel to "Net Metering" (refer to screen shot above):

1. On the GEM Setup page, click the "Channel Option" menu
2. Enter the channel number for the "Main Panel" feed
3. Click the "Net Metering" radio button
4. Click "Save"

The area indicating the channel number will now change from blue to green. You can click "Live Data" to see if the main panel channel is displaying the proper polarity. The watt value should be positive if consuming power and negative if selling generated power. There is a 50/50 chance that the polarity is wrong. If so, then toggle the polarity(next).
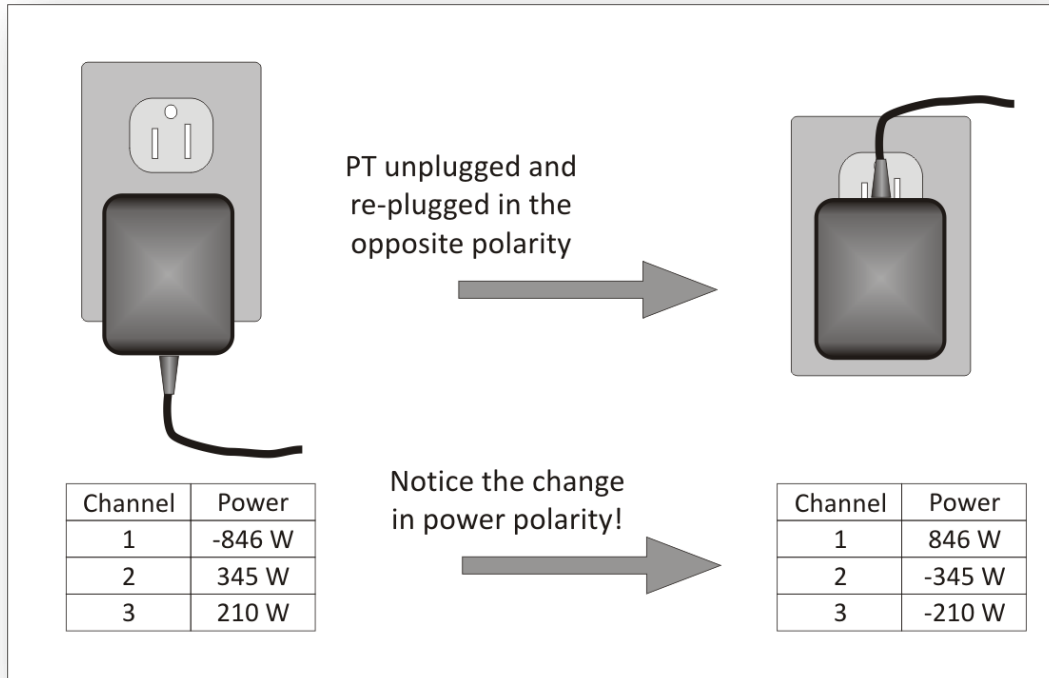
TOGGLING THE POLARITY

In the "Toggle Single Channel Polarity" box:
1. Enter the channel number that is showing the wrong polarity
2. Click "Save"

Notice next to the channel number, the value in the brackets has now changed from "0" to "1" or from "1" to "zero". Once you have set your polarized channels, be aware that the PT (12Vac wall transformer) can affect this. See next

EFFECT OF THE PT ON POLARITY

It is important to understand that the polarity of the PT (12Vac wall transformer) will change the polarity of any channel that is "net metering" enabled (highlighted in green). For instance, if the wall transformer (PT) is unplugged turned 180 degrees and re-plugged such that the 120V receptacle blades are reversed, all net metering enabled channel polarities will change. See **Error! Reference source not found.** below.

PT unplugged and re-plugged in the opposite polarity

Notice the change in power polarity!

Channel	Power
1	-846 W
2	345 W
3	210 W

Channel	Power
1	846 W
2	-345 W
3	-210 W

TEMPERATURE SENSORS

1-WIRE BUS

The GEM reads temperature using a "1-Wire" bus network. This system requires only three wires to address many temperature sensors connected to a common line (see diagram below). The GEM design accommodates up to eight sensors.
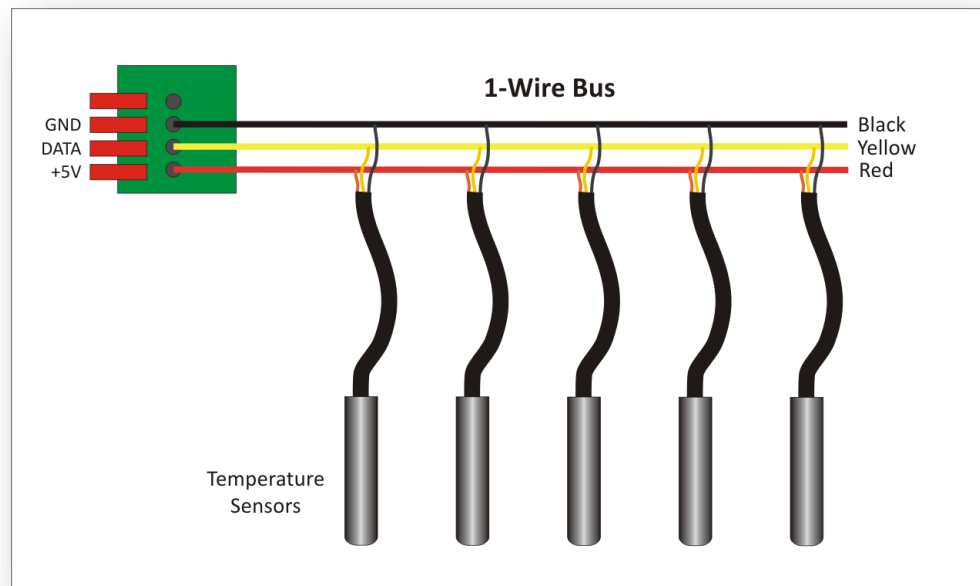
COMPATIBLE SENSORS

The GEM can accept the following two very common temperature sensors:

1. DS18B20
2. DS18S20

These are both very common and low cost. The DS18B20 is the most popular type.

PULSE COUNT

The GEM has four pulse count inputs. Pulse counter #1 and #2 are totally isolated from the GEM ground and circuit. If using any of these inputs, a DC pulse signal between 3V and 24VDC is required.

Pulse Counter Terminal Block
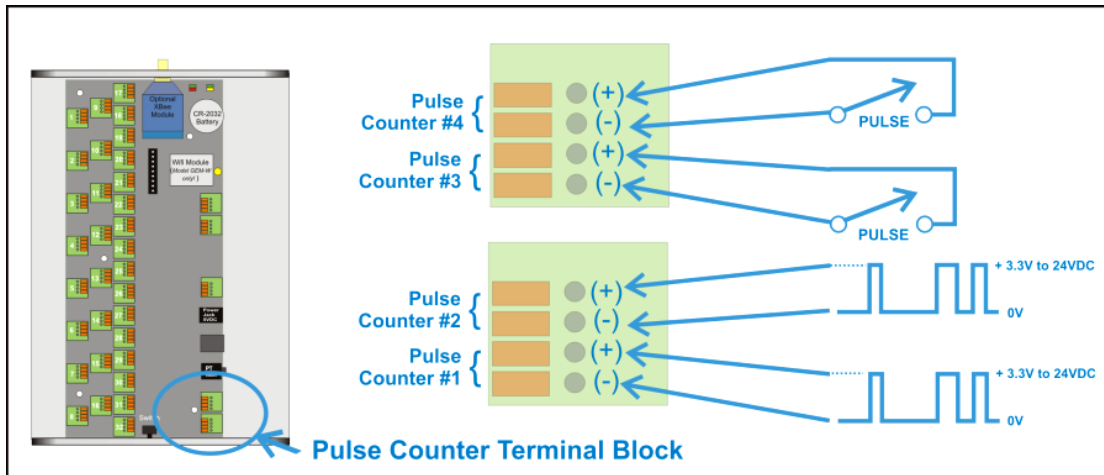
Pulse counters #3 and #4 are "dry" contact type counters. These inputs require switch contacts not connected to any power source, such as relay contacts or magnet switch contacts. Very low voltage from the circuit (5VDC) is used to complete the circuit.

CONNECTION
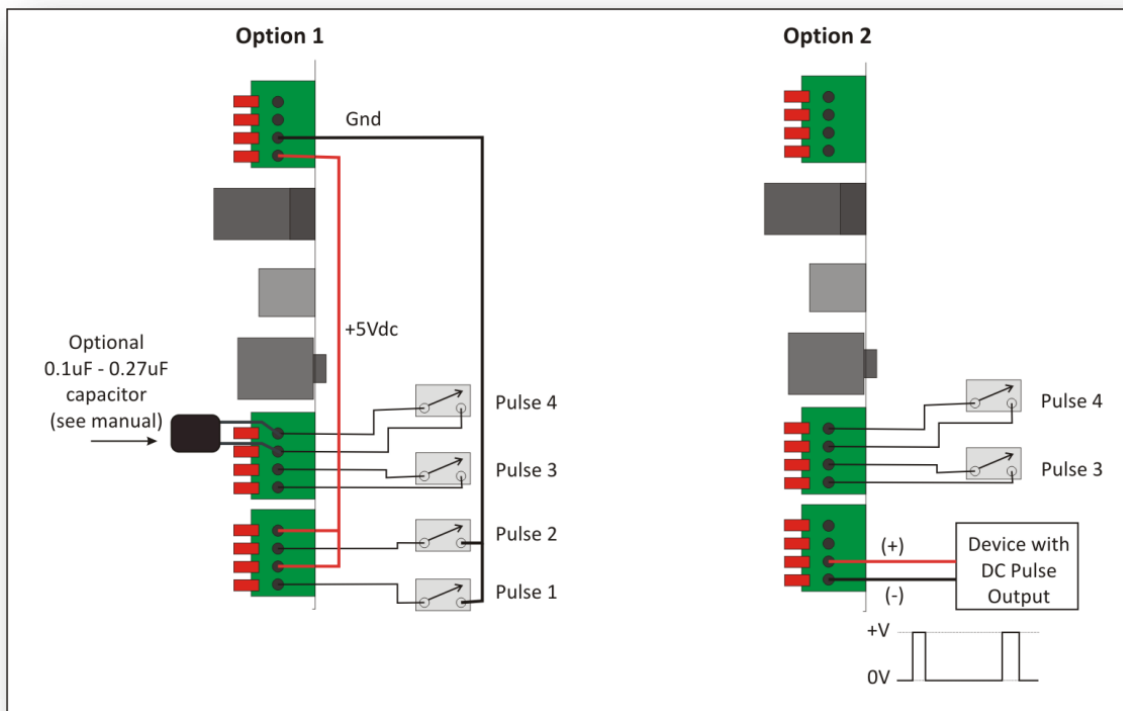
TROUBLESHOOTING

CANNOT ACCESS GEM SETUP PAGE

It should be noted that sometimes it could take a couple or more tries to access the GEM Setup page. You may need to refresh the browser page a couple of times.

Connected via STS Cable

If the GEM is connected to the DashBox via the STS Cable, verify the color code. RED to Rx, WHITE to Tx and BLACK to Gnd.
If you are using COM 2 port of the GEM, there is a possibility that it is set to 19,200 baud while the DashBox is set to 115,200 baud. To resolve this:

1. Move the STS cable terminals from COM2 on the GEM to COM1 of the GEM
2. Access the GEM Setup Page as described above
3. Click "Adv" menu and scroll down mid page. See screen shot below
4. Under the COM2 Port Options, click "115200" (1)
5. Click "Save" (2)
6. Re-connect the STS Cable to the GEM's COM 2 port
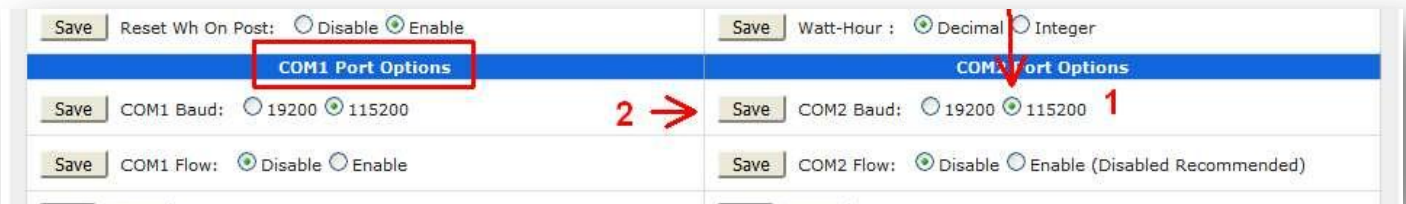
APPENDIX A

IMPORTANT SECURITY INFO

Model: GEM-WE

This applies to "**GEM-WE" WiFi/Ethernet models only**!

The GEM will always have "Access Mode" activated. Once the GEM has been connected to your network, someone can access your network through the Access Point. It is recommended to setup AP Security for the GEM's access point (AP).

Connect to the GEM network setup page
1. Search for WiFi networks and connect to "GreenEye_xx" network
2. Open a browser and type "1.2.3.4" in the address bar. The sign-in page will appear
3. Type "admin" for both, the user name and password.

Steps to set WiFi Access Point security

1. Select "AP Interface Setting" from the menu
2. In the "Security Mode" drop down option, select your mode of choice; WPA2-PSK in this example
3. Select the "Algorithm". "TKIP-AES" was selected in this example
4. Enter a "Pass Phrase"
5. Click apply
6. Select "Device Management" from the menu
7. Click "Restart"
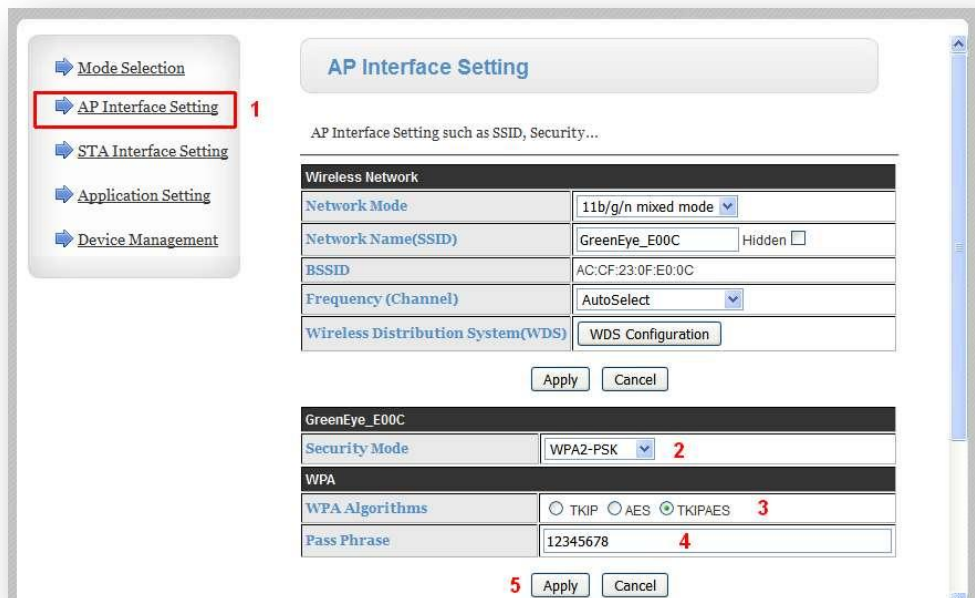
It should be noted that the assigned security and password is reset when resetting module using the push button switch next to the Ethernet jack on the GEM.

APPENDIX B

DASHBOX SWITCH FUNCTION

The DashBox has a small recessed switch in the back. This switch has various functions. Press and release the recessed switch then notice the LED sequence.

1. Red briefly
2. Green (separator)
3. Orange briefly
4. Green (separator)
5. Dark briefly
6. Back to normal Green LED

Pressing the switch during the **Red**, **Orange** or **Dark** sequence will cause one of the following functions to take place:

Red = Reboot DashBox

Press the switch while the LED is <u>Red</u>. This will cause the LED to turn green and the DashBox will **re-boot**.

Orange = Reset Network Settings

Press the switch while the LED is <u>Orange</u>. This will cause the DashBox "**Network Settings**" to reset to its default settings then automatically re-boot the DashBox so that the settings take effect.

Dark = Reset Dashboard Administration User/Pass.

Press the switch while the LED is <u>Dark</u>. This will cause the DashBox to reset the administration and password to the following:

Username: **admin**

Password: **pass1**   (revised Feb 28, 2019. Previous versions (up to ver 2.5) improperly stated "Brultech" as the password.)

Panel #	Load Description	CT #	CT Model	Amps	240V / 120V / 240V	240V / 120V / 240V	Amps	CT Model	CT #	Load Description	Panel #