

ECOP User Document

Version 1.0

Absolute Power & Control, LLC

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I. Introduction to the ECOP User Interface

a. What is ECOP?

ECOP, the name, stands for Energy Conservation Observation Platform. It is a modular, configurable, secure system for monitoring environmental variables that can help people learn how to better manage their systems. To interact with this product, users utilize a modern browser from their computer. The user interface is the visible part of ECOP and the purpose of this document is to acquaint you with its features and functionality. For more information on ECOP itself, visit our website at www.absolutecontrol.com.

b. The ideas behind the ECOP User Interface

The ECOP user interface (UI) is designed to be easily accessible, informative without being overwhelming, and adaptive to future needs. These criteria allow us to provide a monitoring solution that can be used by many people without a need for much training, while still being able to add features that address more complex monitoring scenarios.

To make it easily accessible, we built it as a web application. This means, that if the user so chooses, they can access their system from anywhere in the world that has Internet access, with commonly available browsers. This accessibility puts you in a position to make the most of the data you collect using ECOP.

To make it informative, we have tried to keep the information as high-level as possible. For example, rather than showing a line graph of all of the measured circuits in the summary view, we show only the worst offending circuits, since those are the ones you're most likely interested in anyway. If you need to see information about other circuits, you can certainly just navigate to them and view it. The idea is to have a good idea of system health at a glance, with the capability of getting to the details as needed.

To make it adaptive, we have built upon the modular design of the core ECOP system. The UI is designed so the pieces are like widgets that the user can move around to create a customized view of their data. Tabs can be reordered or hidden from view. New ECOP modules can include their own UI components that can be dynamically added to the system¹.

¹ In the 1.0 version, the ability to move things is disabled for licensing

Our ultimate goal is to have a user interface with enough building blocks in it that a user can create a customized monitoring dashboard that solves their problem in a way that makes sense to them. In this way, we have to just support a basic platform's features and the user can compose the application they need, the way they like it.

II. ECOP Concepts

ECOP is built on a few simple concepts centered around measuring and monitoring. This section discusses those concepts so the user can benefit from this background information while learning to use the system. These same constructs are used in the internal design of the system, so speaking with a user or an engineer will result in mostly the same terminology being used, which eases the support process should troubles arise.

There are several parts involved when setting up ECOP, and they build upon each other cumulatively, from basic building blocks to complex ones, all used toward creating meaningful Measurements. These pieces are defined by the person installing the system, and can be manipulated by the user to define the Measurements they want to track to achieve their monitoring goals. All of these concepts are present in the user interface and used to construct a custom monitoring solution for the environment at hand.

a. Units

Units would be more properly stated as 'units of measure'. These are the descriptive labels that give Measurements meaning. Storing the value '1.5' means very little unless you know what '1.5' represents. Is it amperes, volts, or kumquats? Units are an important part of the design of ECOP and they are built in to every aspect of configuration, so users do not need to define them.

b. Sensors

Sensors describe the pieces of equipment that are attached to ECOP that provide information about the environment. This is one of the most important constructs because without these being accurately established, ECOP has no way of knowing what the incoming signals are supposed to represent. Properly set up Sensors are the most basic building block when configuring ECOP.

reasons, but in a future release this will be activated, once we figure out how to manage licensing for these different modules.

c. Readings

Readings are raw data values that ECOP obtains mostly from Sensors. These have no real value as data until they are processed in a way that is appropriate to the source sensor. That appropriate context is achieved with proper Sensors. Users do not directly create readings, but rather 'shuffle them around' to create the desired Measurements.

d. Constants

One caveat to the association of Readings and Sensors is that some Readings can be defined as constant values. This is appropriate when a formula requires a value that can change from installation to installation, or usage to usage, but is mostly static for the context in which it is used. These constant values are considered readings as well, but do not require a sensor to obtain.

e. Formulas

Formulas are used to create Measurements. They can take Readings, Constants, and even other Measurements as inputs and produce Measurements as outputs. The Formula is where the interpretation of Readings occurs. This implies that specific Formulas are applicable only for certain Sensor outputs, and that is completely correct. Sending mismatched Sensor output to a Formula will result in questionable output, often in aborted Measurements which means no tracked data. One of the main purposes of the ECOP UI is to eliminate the possibility of these mismatches as we will see shortly.

f. Measurements

Measurements are the heart and soul of ECOP. It's sole purpose is to create, store, and analyze Measurements obtained from Sensors that provide Readings about the real world. All Measurements are tracked over time and recorded, and all Measurements are averaged over time and those averages are recorded. This gives ECOP the ability to analyze very fine-grained data as well as very long-term trends in the data. Further analysis of this as it streams through the system can provide other important data points about the variations that occur in a system over long periods of time.

g. Thresholds

Thresholds are user-defined watermarks set for Measurement values. A threshold can be set for a high end or low end value. If the value of a Measurement becomes greater than the high end

setting or less than the low end setting of a Threshold, that Threshold is said to be 'broken' and an appropriate action can be taken. The default action in these cases is to create an alert that shows in the ECOP UI for as long as the Threshold remains broken.

h. Actions

Actions are activities that can be triggered by events in the system. At this time, the only trigger that can cause an action is a broken or normalized Threshold and the only action that can be taken (aside from the default alert) is to send an email (which can also result in SMS/Text message). As time and demand dictate, other actions will be added, such as those that will allow controlling physical devices based on system conditions.

III. The ECOP Web User Interface (Web UI)

This is the help section for the user interface of ECOP, which provides detailed information on operation of the system. After all of the background information covered previously, it is likely that this section won't be needed at all. Still, it's nice to have a reference for all of the pieces that make up the user's window into their monitoring data.

The boring and nerdy description:

The ECOP Web User Interface is a javascript based application that runs in your web browser that uses JSON over HTTP to communicate with the ECOP hosted web API to render a feature rich user experience.

The normal human description:

The ECOP Web User Interface uses your web browser you access to the ECOP system as easily as asking Google who invented pants.

The ECOP Web User Interface provides the user access to all the information and data generated by the ECOP system and allows the user to change configuration from wherever they have reach it with a web browser.

Some of user features include:

1. Configure Sensors and name Measurements.
2. Define Measurements by matching Readings with Formulas.
3. Set Thresholds and Actions
4. Admire your hard work via Summary and Details views.

5. Review the complete historical record of every Measurement

HOW TO ACCESS THE ECOP UI:

To access the ECOP User Interface you will need to start your favorite web browser. At this time ECOP is tested with Internet Explorer 9+, Firefox, and Chrome.

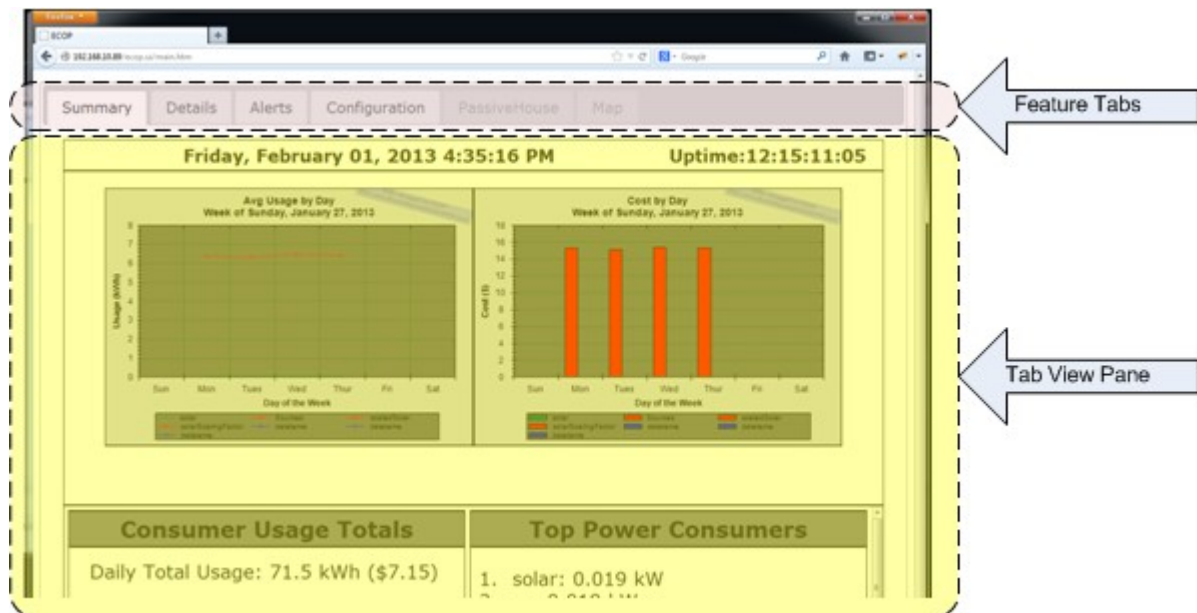
In the Address bar type and press enter:

`http://<ipaddress>/ecop.ui/Main.htm`

<ipaddress> must be replaced with the IP ADDRESS set when the ECOP server was configured.

**** Special Note:** the URL above is case-sensitive. This means that `"/ecop.ui/Main.htm"` must be typed exactly as seen with a capital 'M' for Main.

The ECOP User Interface will load into the browser and you will be presented with the main window with multiple Feature tabs laid out horizontally across the top. Each Feature tab will display its own content pane when active. The active Feature tab is white while the inactive tabs are a muted gray.



a. Summary Tab

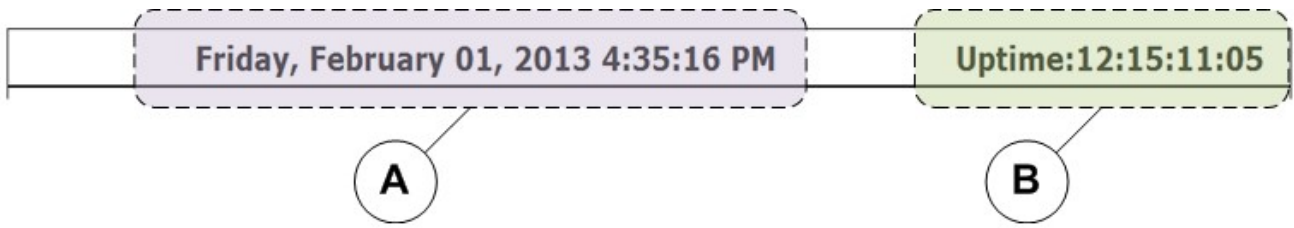
Let's dive deeper into the Summary Tab as it is the tab that is displayed by when the Web User Interface starts. The Summary Tab displays the Measurements defined by the owner in several

forms:

1. Date Bar
2. Weekly Report
3. Daily Usage Report
4. Monthly Report
5. Yearly Report

Date Bar

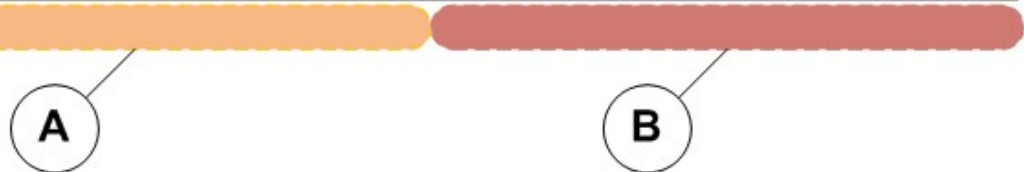
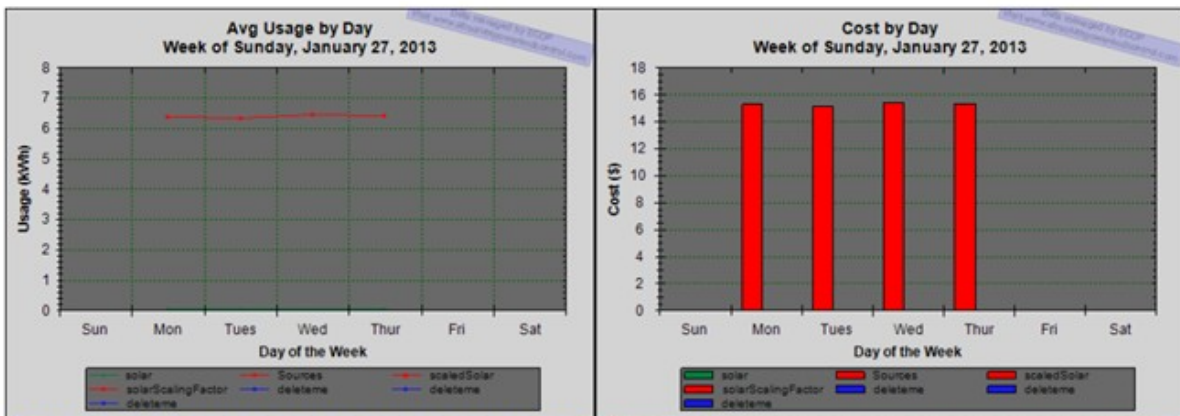
This section displays the Date and Time the report (Report Timestamp - **A**) was last refreshed and how long it has been since the system rebooted (System Uptime - **B**), and **C**) the outside temperature, if the system is so configured.



Weekly Report

This report consists of two charts. Each chart shows the weekly trend for power measurements. These charts are dynamically generated such that as you add new measurements, they will be reflected automatically on these charts.

- A** - "Avg Usage by Day" graph shows the average usage for each day of the week by measurement. The legend defines which color represents which measurement
- B** - "Cost By Day" is a graph of how much each money each day your are spending based on your measurements. The cost/KW is set on the Configuration Tab discussed later.

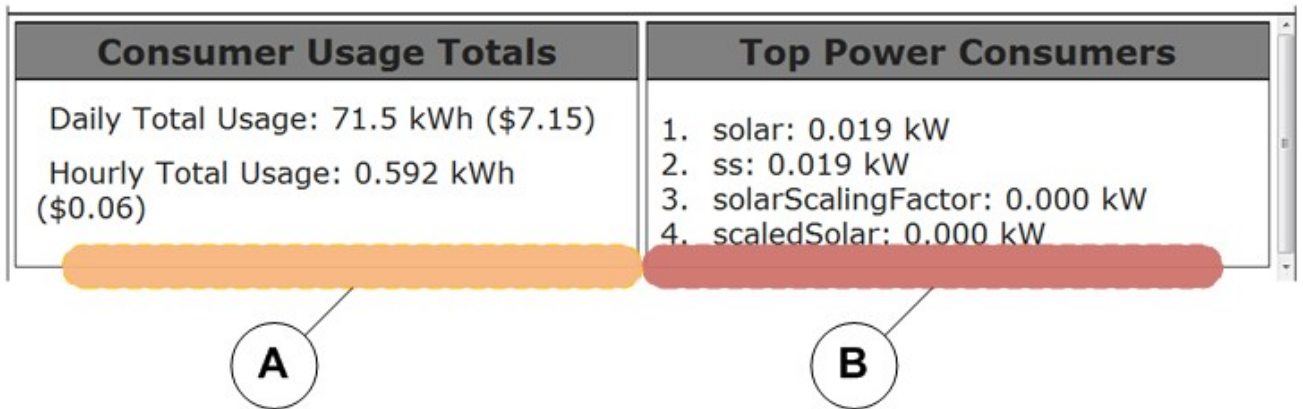


Daily Usage Report

These reports help the user better understand how much energy they have consumed so far this day and which Measurements are the largest consumers.

- A** - "Consumer Usage Totals" describes the total power usage for this day (so far) with its calculated cost. The same calculation is done for the past hour as well.
- B** - "Top Power Consumers" describes the Measurements that are currently consuming the most power. This helps

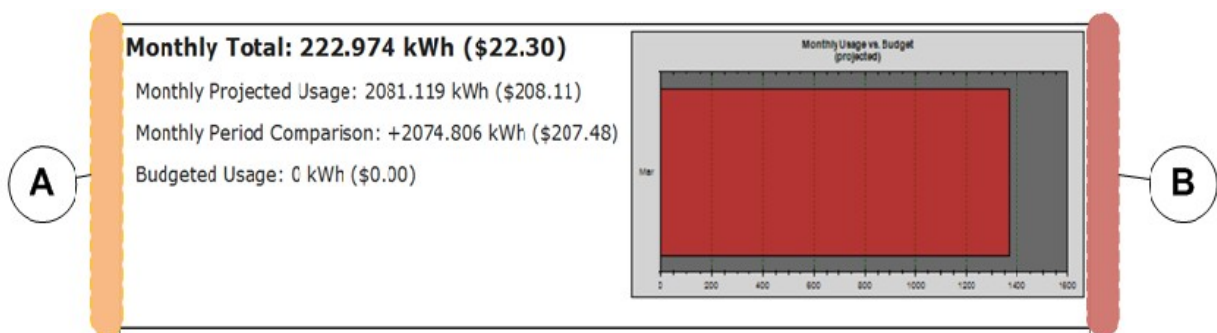
users better understand areas that may be addressed to bring about the largest savings.



Monthly Report

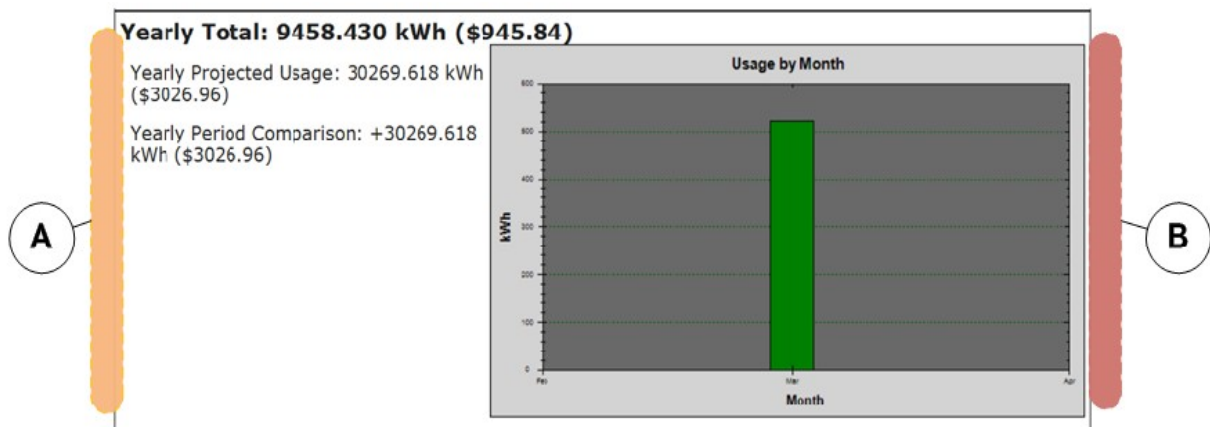
This report is very useful in that it not only shows what you have consumed, but based on your rate of consumption, projects how much power you will consume by the end of the month. ECOP has a feature that allows you to set a "Power Budget" (see "Budgeted Monthly Usage (kWh)", defined on the Configuration Tab) and section projects if you will remain under or exceed your budgeted consumption.

In this example, the budgeted usage is 0 kWh, thus all the monthly usage is over budget and the bar is red.



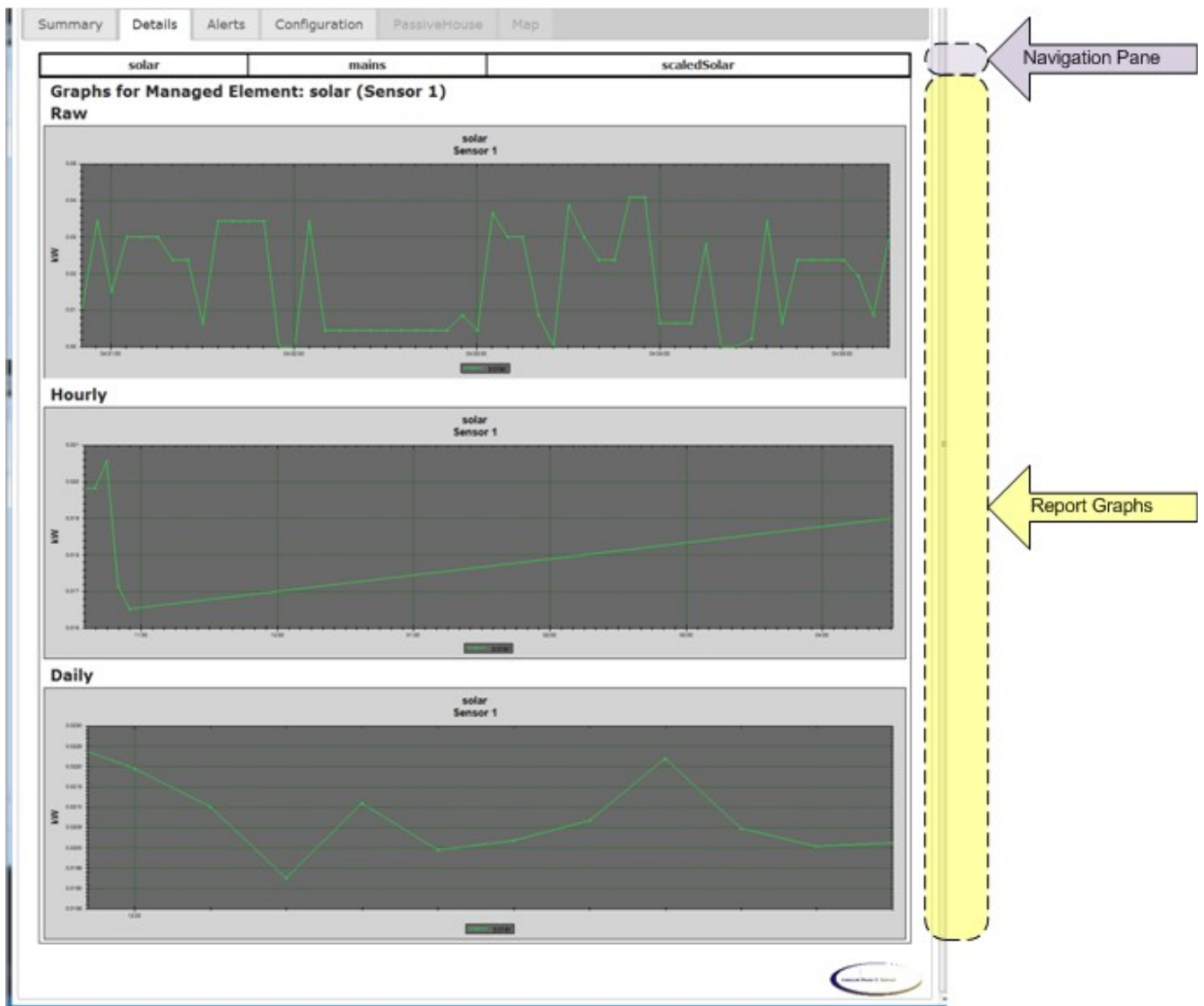
Yearly Report

This report shows the current yearly total usage, the projected yearly usage, and a comparison with the previous year's usage. The graph shows usage by month for the current year.

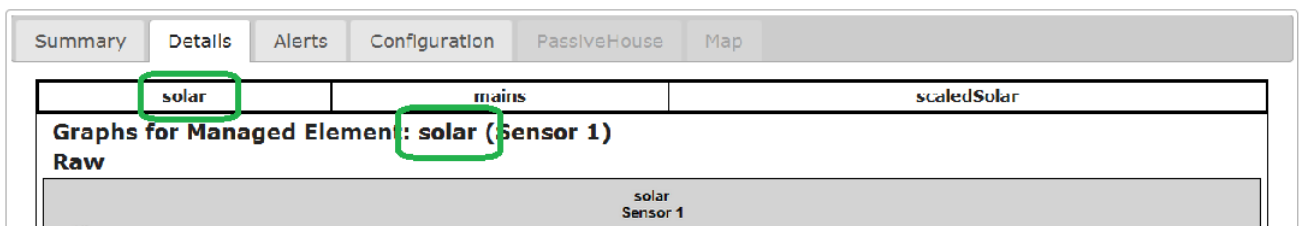


b. Details Tab

This Tab allow the user to drill into individual Measurements and observe how the measurement behaves over time. As Measurements are defined (see Configuration Tab - Measurements) and ECOP starts to record the values, the new Measurement will be visible on the Details Report Navigation Pane.



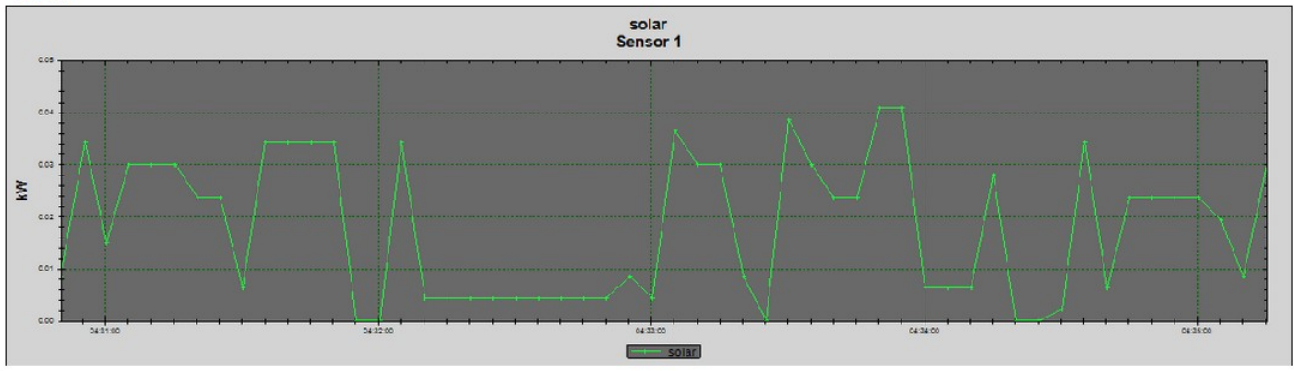
To change between measurements click the BOX with the Name of the Measurement you wish to view. Note in the example below that the Raw Graph is titled "solar" as the solar navigation box had been clicked.



There are 3 graphs

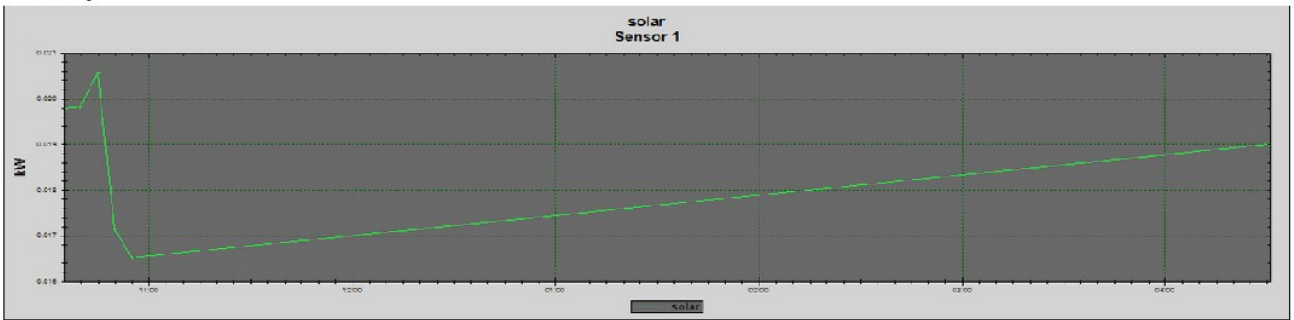
RAW

Raw



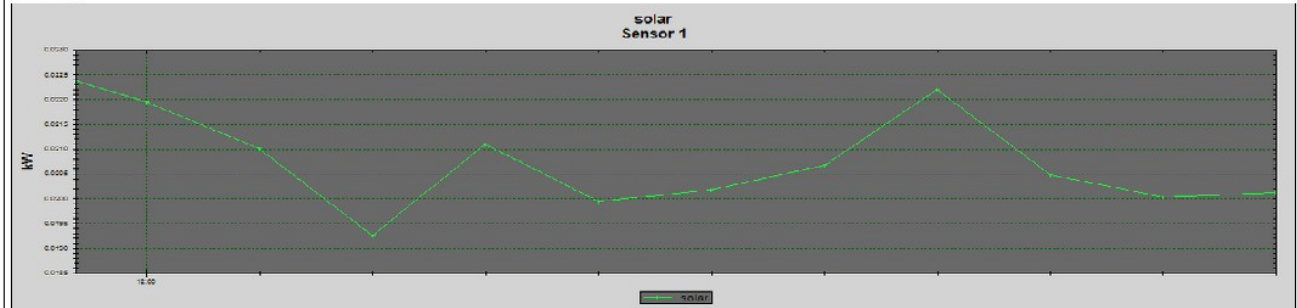
Hourly

Hourly



Daily

Daily



c. History Tab

This tab allows the user to review the entire history of each measurement. It provides an index to all historical reports and this index is used to select data based on the week that the user wants to view. The index is displayed in reverse chronological order, newest reports first, and is organized by year and month.

TODO

d. Alerts Tab

This tab allows the user to check up on the system as it displays both system errors and user defined Thresholds.

What is an Alert?

An Alert can represent a system error (ie something that failed on the ECOP system and must be fixed) or a Threshold crossing.

Thresholds are arbitrary water marks set by the user to trigger an "ALERT" when it is crossed.

For example:

You may be a Restaurant owner and have a Temperature sensor set in your cooler and you would like the system to ALERT when the temperature rises above 40 degF.

The Alert table has a Search feature. Should you have difficulty finding the alert you want to view, you can type in the Search text box. The Table will only show rows that match your text.

Element Name	
solar	Lower limit of 0.1000

Search: solar

e. Configuration Tab

The Configuration Tab is where the customization is done of the ECOP system to the environment in which it is installed. It allows the user to define Sensors, create Measurements, set Thresholds and to set global system settings.

This tab is broken up into sub-categories that are grouped on left with a Vertical Navigation bar.

The screenshot shows the Configuration Tab interface. On the left is a vertical navigation bar with a yellow arrow pointing to it labeled "Navigation Bar". The navigation bar contains four items: "Controllers", "Sensors", "Measurements", and "Settings". The "Controllers" item is selected. On the right is the "Configuration Pane" with a blue arrow pointing to it. The pane contains a search bar and a table with the following data:

Name	Poll Frequency	Delay Duration	Description	Resolution Bits	Sensor Id
mockery 1	1	25	Configuration for the controller that generates random numbers.	1024	0,1,2,3,4,5,6,7,8,9,10,11,12,13,14,15,16

The selected sub-category will fill in data on the right in the Configuration Pane

i. Controllers

This tab is a read-only view of the controllers attached to the ECOP system. At this time, the addition, removal and adjustment of the actual controllers are done directly on the ECOP server. See the Installer's guide for more details.

Name: The name for the this controller as configured by the installer

Polling Frequency: How often the ECOP server will take its measurements for this controller

Delay Duration: How long the controller software delays when checking its polling cycle mark.

Description: Description of the controller

Resolution Bits: Used by the ECOP server to when converting

RAW readings into Measurements. The number of bits determines the accuracy of the readings. It is important to note that unless you are a nuclear physicist bent on measuring electron spin, 1024 bits of resolution are plenty for house-hold measurements.

Sensor Id: Addressable identifiers for use when configuring sensors.

ii. Sensors

This tab is where the installer identifies the sensors that have been wired up to ECOP. This set of sensors provides the building blocks used to make Measurements. Without changing the physical wiring (adding, removing, or moving sensors), this data is unlikely to need to be changed.

Controllers

Sensors

Measurements

Settings

Sensor Definitions

Controller	Sensor ID	InUse	Description	Lower Output Limit	Upper Output Limit
mockery	0	false	unused	0	0
mockery	0	false	unused	0	0
mockery	0	false	unused	0	0
mockery	1	true	solar sensor	0	20
mockery	10	true	main1	0	200
mockery	11	true	main2	0	200

Search:

NEW

Click on new button on the Action Bar.

New Sensor Information

Controller:

Sensor:

In Use:

Sensor Range
 Lower Limit: Upper Limit:

Description:

iii. Measurements

This tab is where the Sensors are used as input to formulas to create the work product of ECOP, Measurements. All of the previous setup is done to support the work performed in this part of the UI. Here, also, is where user customization is most available in that specific name, descriptions, colors, and symbols can be selected for each measurement. All of these inputs then affect the data when it is presented in the other parts of the UI.

Controllers

Sensors

Measurements

Settings

Refresh Edit New Delete

Measurement Definitions

Name	Description	Source	Color	Plot Style	Formula Name	Units Type	Category
solar	Sensor 1	false	008040	Plus	Amps to kW	Kilowatts	Power
mains	Sum of both mains (sensor 2+ 3)	true	ff0000	Square	Amps to kW	Kilowatts	Main Power
scaledSolar	solar + solarScalingFactor	false	ff0000	Star	Amps to kW	Kilowatts	Power
solarScalingFactor	some scaling factor	false	ff0000	Square	Amps to kW	Kilowatts	Power
delete	sdfd	false	1515d1	circle	Amps to kW	Kilowatts	Power

Search:

Select a Measurement will display the measurement mappings and its threshold.

Controllers

Sensors

Measurements

Settings

Refresh Edit New Delete
Measurement Definitions

Name	Description	Source	Color	Plot Style	Formula Name	Units Type	Category
solar	Sensor 1	false	008040	Plus	Amps to kW	Kilowatts	Power
mains	Sum of both mains (sensor 2+ 3)	true	ff0000	Square	Amps to kW	Kilowatts	Main Power
scaledSolar	solar + solarScalingFactor	false	ff0000	Star	Amps to kW	Kilowatts	Power
solarScalingFactor	some scaling factor	false	ff0000	Square	Amps to kW	Kilowatts	Power
delete	sdfd	false	151500	circle	Amps to kW	Kilowatts	Power

Search:

Mapping Definitions for the selected measurement.

InputTag	Mapping Type	Constant	Source Element	SensorID	Description
Reading	Sensor	0		1	solar sensor

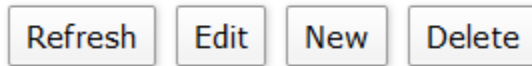
Search:

Threshold Definitions for the selected measurement.

Active	Measurement Type	UpperBound	UpperBound Actions	LowerBound	LowerBound Actions
true	Measurement	100	CriticalUpperThresholdBroken CriticalUpperThresholdNormal	0.100000001490116	CriticalLowerThresholdBroken CriticalLowerThresholdNormal

Search:

Action Bar



NEW action button

✕

Mapping general information...

Name:

Description:

Is this measurement a source value?

Category: ▾

<< Previous
Cancel
Next >>

Page 1 of 4

Set Formula and define inputs...

Formula Type:
DS1820 Temp Converter (C) ▾

Formula Inputs:

InputTag	MapType	Value
ScaleFactor	constant	0
RawInput	constant	0

<< Previous Cancel Next >>

Page 2 of 4

Set Formula and define inputs...

Formula Type:
Amps to kW ▾

Formula Inputs:

InputTag	MapType	Value
ScaleFactor	constant	0
Reading	constant	0
Reading	constant	0
Reading	constant	0
Reading	constant	0

<< Previous Cancel Next >>

Page 2 of 4

Set Formula and define inputs...

Formula Type:
Amps to kW

Formula Inputs:

InputTag	MapType	Value
ScaleFactor	constant	0
Reading	constant	0
Reading	constant	0
Reading	constant	0
Reading	constant	0

Name

Mapping Type: Constant

Constant

Page 2 of 4

Name

Mapping Type: Sensor

Sensor

✕

Set Formula and define inputs...

Formula Type:

Formula Inputs:

InputTag	MapType	Value
ScaleFactor	constant	0
Reading	sensor	mockery:Garage Circuit
Reading	constant	0
Reading	constant	0
Reading	constant	0

Page 2 of 4

✕

Set Thresholds...

IsActive:

Upper Boundary:

Break Event:

Action:

Normal Event:

Action:

Lower Boundary:

Break Event:

Action:

Normal Event:

Action:

Page 3 of 4

✕

Set graph styling...

Plot Style:

Color:

Page 4 of 4

Measurement Definitions

Name	Description	Source	Color	Plot Style	Formula Name	Units Type	Category
solar	Sensor 1	false	ff0000	Plus	Amps to kW	Kilowatts	Power
mains	Sum of both mains (sensor 2+3)	true	ff0000	Square	Amps to kW	Kilowatts	Main Power
scaledSolar	solar + solarScalingFactor	false	ff0000	Star	Amps to kW	Kilowatts	Power
solarScalingFactor	some scaling factor	false	ff0000	Square	Amps to kW	Kilowatts	Power
delete	sdfd	false	1515D1	circle	Amps to kW	Kilowatts	Power

Search:

← NEW Garage Power Measurement

Set graph styling...

Plot Style: Circle

Color: 1515D1

<< Previous Cancel Finish...

Page 4 of 4

iv. Settings

Controllers	<input type="button" value="Refresh"/> <input type="button" value="Edit"/>				
Sensors					
Measurements	Nominal Voltage	Cost/Kw (\$)	Budgeted Monthly Usage (kWh)	Monitored Area (ft²)	Loop Pump (gal/min)
Settings	110	0.1	2000	0	0

Edit

Configuration | PassiveHouse | Map

Nominal Voltage:
110

Cost / kW (\$): 0.1

Budgeted Monthly Usage (kWh):
2000

Monitored Area (ft²):
0

Loop Pump Rate (gal/min):
0

Cancel Finish