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Contingency Base Energy Management System (CB- EMS)

User Manual for Operations Staff

September 2026

JC Tucker
JK Goddard



U.S. DEPARTMENT
of ENERGY

Prepared for the U.S. Department of Energy
under Contract DE-AC05-76RL01830

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Abstract

Contingency bases, also known as expeditionary bases and forward operating bases, are used by the Army at temporary sites to allow military forces to perform expeditionary warfare, humanitarian efforts, and disaster relief. Because of their remote locations, contingency bases are often powered by generators, which require a considerable amount of fuel. The high cost of delivering fuel to these sites, along with the risk to personnel delivering that fuel, makes energy efficiency a high priority.

The Contingency Base Energy Management System (CB-EMS) is a software application that enables the camp manager to monitor camp energy operations and identify issues that can cause excessive energy consumption. It also gives camp managers real-time visibility of the fluid levels for all camp fuel and water tanks, as well as the consumption to estimate how long the current reserves will last. Instrumentation throughout the camp provides information to the system. These include the structure temperature, energy usage, and generic metering to monitor other parameters. Generators are monitored for performance to maintain system efficiency. Solar photovoltaic arrays are monitored by CB-EMS to allow efficient operation of those resources.

CB-EMS is built using Ignition by Inductive Automation as the Supervisory Control and Data Acquisition (SCADA) platform. Ignition runs using Java within their Vision Client Launcher. CB-EMS uses instrumentation throughout the camp to create an energy “dashboard” to enable the camp manager to view the camp and identify areas where the camp is outside operational guidelines.

This user manual is intended to enable camp managers to work with the system. A separate manual for the CB-EMS administrator details how the camp dashboard is configured for a new site and how to apply changes to an existing site, and a third manual is provided to document how to set up a new system head end.

Acronyms and Abbreviations

CB-EMS	Contingency Base Energy Management System
SCADA	Supervisory Control and Data Acquisition

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1.0 Introduction

The Contingency Base Energy Management System (CB-EMS) is a government-owned expert system designed to integrate site operations and energy management at contingency bases. Contingency bases, or base camps, are nonenduring locations outside the United States that support and sustain operations during contingencies or other operations and are categorized by mission life-cycle requirements as initial, temporary, or semipermanent. CB-EMS enables base camp managers to operate and manage their camps in the most effective and efficient manner.

CB-EMS provides detailed information on camp operations that allows the camp manager to identify issues related to important functions such as power, fuel consumption, water consumption, and equipment maintenance. The main “dashboard” screen provides a quick visual representation of the camp and highlights areas that are outside operational parameters. Once an issue is identified, CB-EMS provides the camp manager with detailed information that enables them to identify the problem and act accordingly. CB-EMS also monitors fuel and water supplies, offers the camp manager an indication of how much of these resources the camp is consuming, and predicts the amount of time left before the available fuel and water are consumed.

When deployed, CB-EMS provides detailed information for the camp manager to run the base efficiently. In addition to reducing energy use (and thus energy consumption) at the camp, it also provides the following benefits:

- Fuel and water consumption information improves camp readiness.
- Efficient operation of generators extends equipment life.
- Maintenance staff workload is reduced.
- Maintenance parts and labor costs are reduced.

CB-EMS is designed to be user configurable to allow the CB-EMS administrator to add new resources during operations and remove them as the camp changes. This plug-and-play capability allows the software to be customized on the fly as the camp changes. A separate manual for the CB-EMS administrator provides instructions for changing the camp dashboard as equipment is added or removed from the camp.

2.0 Logging on to CB-EMS

Note: It is assumed that all users are familiar with standard Microsoft Windows functions, such as opening, closing, and resizing windows and using the mouse.

CB-EMS is a client-based application running from a server location. Any desktop computer with access to the server and running Ignition Vision Client Launcher can access the system. All software will be installed by the system administrator prior to use.

CB-EMS is accessed via Ignition Vision Client Launcher. Once CB-EMS has been installed, follow the site-specific instructions on starting the software (typically an icon on the desktop similar to Figure 2.1).



Figure 2.1. CB-EMS icon.

No username or password is required to open the software and operate CB-EMS. Certain pages within CB-EMS do require an administrator username and password, but access to those pages is not necessary for routine operations.

3.0 General Navigation and Features

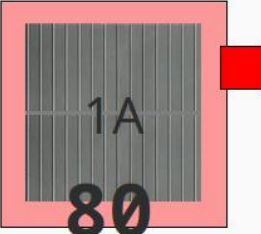
When the software is opened, a window will appear, showing a general map in the center, the tree structure on the left to access detailed information, and the command menu on the top menu bar that allows configuration of the software. Clicking on the general map will open a pop-up window of the site map. The Site window gives the overall status of the installation and shows the critical operating parameters of the monitored systems. For convenience, all monitored systems are shown in a topographical display.

Figure 3.1 shows an example of the primary Site screen. Selecting items from the menu tree in the left pane will bring up detailed screens on Buildings, Power Generation, Tanks, and Weather. For this example, generators are shown with the current electrical output displayed and an indicator that turns green when a generator is operating efficiently. Fuel storage tanks are shown as status icons with the fuel level displayed as a percentage of full. The details of the status indicators are shown in Table 3.1.



Figure 3.1. CB-EMS Site screen.

Table 3.1. Status icons.

Status Icon	Description	Information Displayed
	Each structure status template shows the structure name, indoor temperature, temperature status, and status of the environmental control unit.	- Indoor Temperature (°F) - Temperature Status (background) - Light Red: Above High Temp Limit - Light Blue: Below Low Temp Limit - Environmental Control Unit Status - Dark Blue: Cooling - Red: Heating - Light Blue: Fan Only - White: Off
	Each generator status icon displays the generator name and current electrical output, along with an indicator showing whether it's being run within specifications.	- Electrical Output (kW) - Operating Status (as a percentage of the rated capacity) - White: Off - Red: Less than 50% or greater than 100% - Yellow: Between 50% and 75% - Green: Between 75% and 100%
	Each fuel storage tank status icon shows the fuel level as the percent full and a highlight for tanks that are low.	- Tank Percent Full - Tank Status - Light Red: Below Low Limit

3.1 Common Features

The following are features that are found on many, if not most, CB-EMS windows.

- Print Screen.**  The window may have a Print Screen button. Click the button to launch the Print dialog box.
- Close Window.**  In the upper right corner is the Close Window button.
- Window Control.**  The window may have a button in the upper left corner to allow easy manipulation of the window.
- Export Data.**  Click this button to export the data displayed in a graph to a file for analysis outside of CB-EMS.
- Maximize Window.**  When available, this button in the upper right corner allows a child window to be maximized to fill the main window.

3.2 Graphing

Most of the data values in CB-EMS can be graphed to allow further analysis. Several windows provide preconfigured graph types to allow common comparisons of recorded data. The graph

in Figure 3.2 shows the power and current for each phase of a building circuit. This is useful for comparing phase loading to ensure that there isn't a significant phase imbalance.

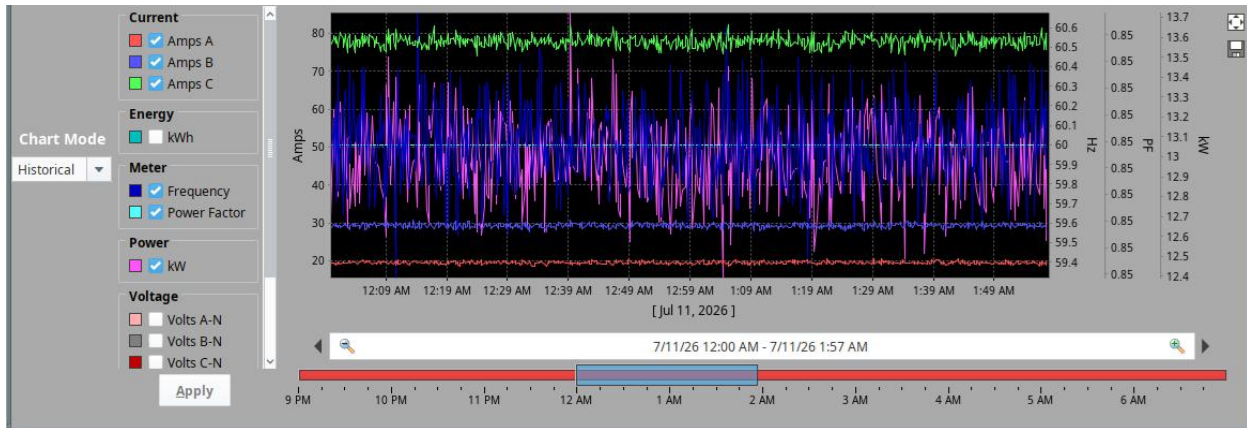


Figure 3.2. Graph of a structure's power.

On the left side of the graph, multiple data series may be available to graph together. Selecting a checkbox adds that value to the current graph. To the left of each checkbox is the pen color for that data series on the graph. Each pen color can be changed by clicking on the pen color box. Clicking on the + and – buttons on the graph bar will zoom the graph in and out. In the default zoom mode, drawing a box around a specific area of interest in the graph will zoom in on that part of the graph.

In the Historical Graph mode, a date range can be selected by moving the slider back and forth and extending it as needed to show the range of values desired. Grabbing the slider and moving it left or right will move the date range forward or backward. Grabbing one side or the other will expand the date range to include a larger dataset to display in the graph. The red bar in the date range bar indicates where valid data exist. In the Real Time Graph mode, you can display the current data for a selected amount of time in the graph. Graph data generally can be saved to a file for processing by Excel or another application.

3.3 Other Navigation Options

A navigation option is available using the menus provided at the top of the main window. The function of each of these is described in following subsections.



Figure 3.3. CB-EMS menu bar.

3.3.1 Command Menu

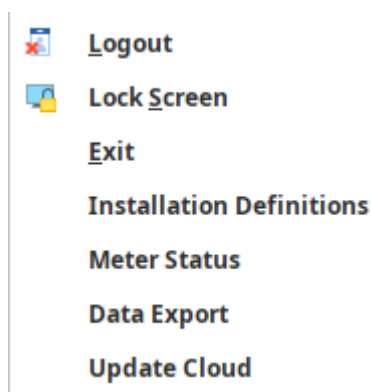


Figure 3.4. Command menu.

The Command menu contains seven items:

- Logout – Log out of CB-EMS but leave the application running.
- Lock Screen – Leave the application running, but lock out all input.
- Exit – Close the application.
- Installation Definitions – Specify the properties of the systems that are monitored by CB-EMS. Access to this page requires an administrator password. This menu item is covered in the administrator's guide.
- Meter Status – View the status of the meters reporting to CB-EMS. This is useful for determining whether meters are reporting properly to the system.
- Data Export – Export data to a .csv file. This can be used to send data to external programs, such as Excel, for further analysis.
- Update Cloud – Update the cloud configuration database. For systems that are connected to a cloud server, this is necessary whenever changes are made to the site configuration.

3.3.1.1 Installation Definitions

Installation Setup is used by the system administrator. Refer to the system administrator's guide for information about this item.

3.3.1.2 Meter Status

The Meter Status menu item brings up a status display (Figure 3.5) that shows the connection status of all items that CB-EMS is communicating with for its displays. White indicates that the system is functioning normally, and red indicates that the device is not currently communicating with CB-EMS.

Each meter connection point is displayed with a status indicator showing whether that device is communicating properly with the system. A green indicator for all items indicates that all systems are functioning normally. Red indicators show a meter that hasn't provided data recently, and the time and date stamp shows the last time data were received from the meter.

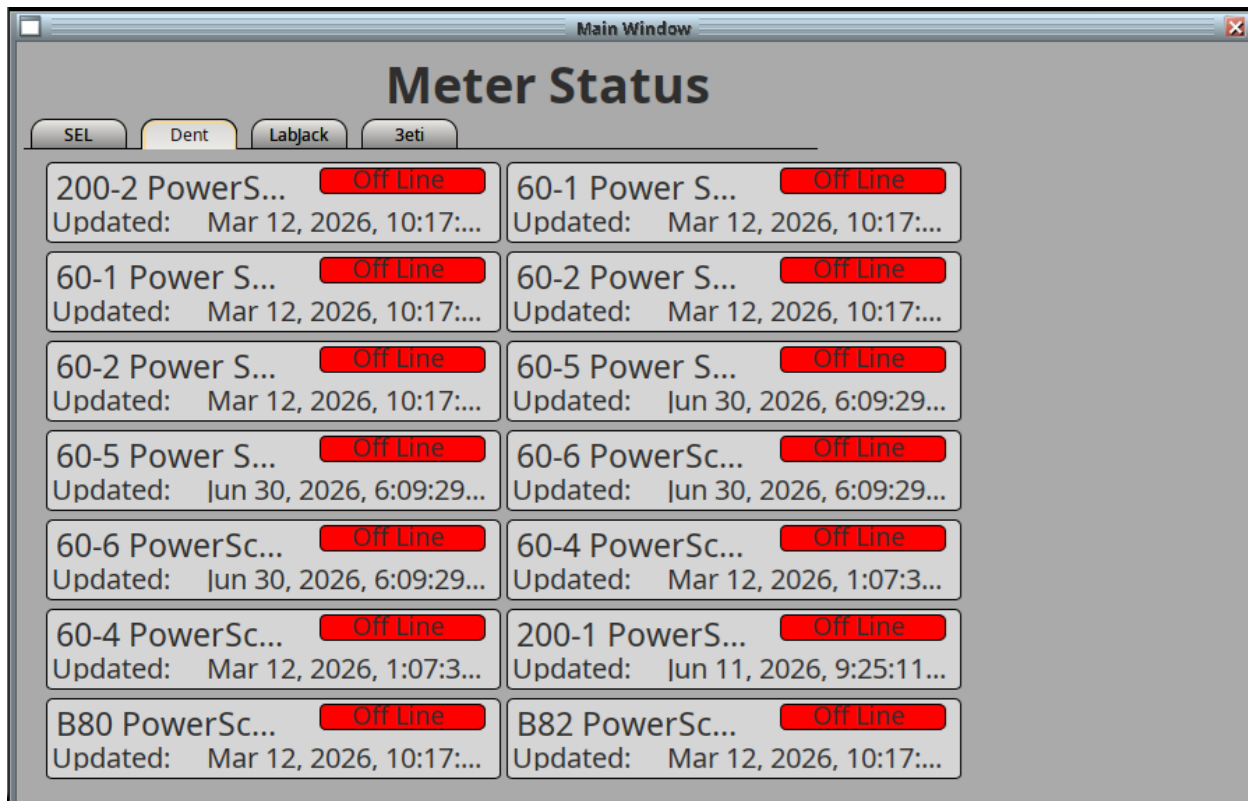


Figure 3.5. Meter Status window.

3.3.1.3 Data Export

The Data Export window (Figure 3.6) allows the user to export data for analysis using other software, such as Excel. The user can create lists of items to include in the exported .csv file. Once a list is created, it can be reused to produce the same export file when new data arrive.

Creating a New Data List

To create a new data list, click on the add list button under the Export File Data List dropdown. This will bring up a prompt to name the list, and the new list will be created.

Deleting a List

If a list is no longer needed, select the list and press the Delete List button.

Adding Items to a List

With a list selected, the user can select any items to be added to the export file list. First, select Structure, Generator, Tank, or Weather as the type of data to add. Next, select the specific Structure, Generator, or Tank to add data from if one of those types is selected. Next, select the checkbox for each data item that should be added to the export file list. Finally, press the Add ... button to add data from the Structure, Generator, Tank, or Weather.

Deleting Items and Updating the Table

The data points that are listed in the table will be exported to a named file. To change the data points, use the three icons to the right of the table to delete, refresh, and delete the entire table. The  button is used to delete the entire table. The  button is used to delete the selected row in the table. The  button is used to refresh the table from the database.

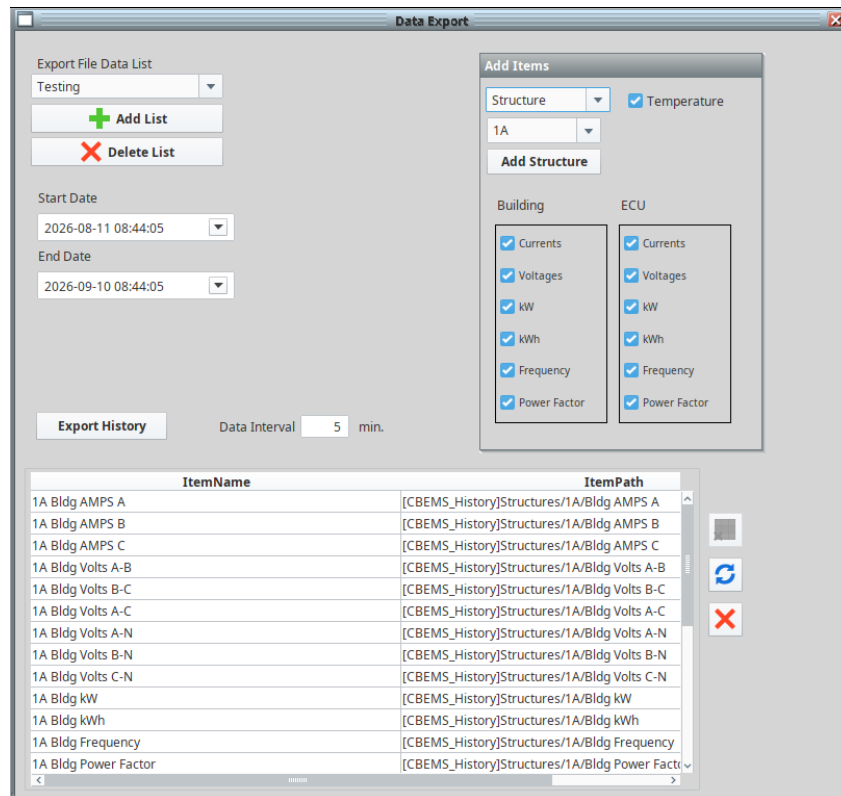


Figure 3.6. Data Export window.

Export History

Once the list has been created and selected, a file can be exported with the desired data. First, select the Start Date, End Date, and Data Interval for the data to be exported. With those parameters specified, press the Export History button, which will bring up a dialog (Figure 3.7) to name the file to be saved and create the file.

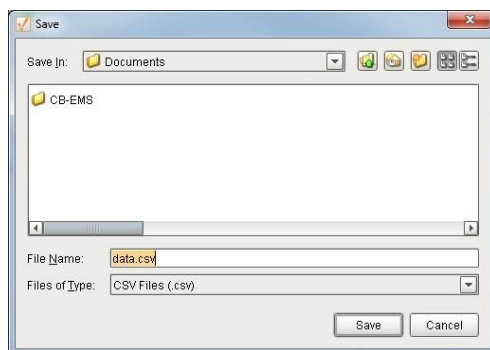


Figure 3.7. Exporting a data file.

3.3.1.4 Update Cloud

For systems that are monitored by a cloud server, the cloud server database must be updated to match the site whenever the site is updated. Changes can include new items, a change in item mappings, or any other configuration change to the system. This can be done by selecting Update Cloud. Selecting this item will update the cloud database to ensure that all data are available to the cloud system.

3.3.2 Windows Menu

The Windows menu allows you to do the following:

- Close the window currently displayed.
- Close all open windows.
- Select, via a button, the active window to display on top.

3.3.3 Help

The Help options show the version numbers of the Ignition Supervisory Control and Data Acquisition (SCADA) engine, as well as the CB-EMS contact information. A diagnostics page is also available for an advanced user to help troubleshoot performance.

4.0 Normal Operations

From the CB-EMS Over Site screen, you can move to any specific area of interest to determine the system's health. Selecting an item in the menu tree (Figure 4.1) brings up the details for that area. Within those detailed pages, you can drill down further into the system to determine how the system is operating.

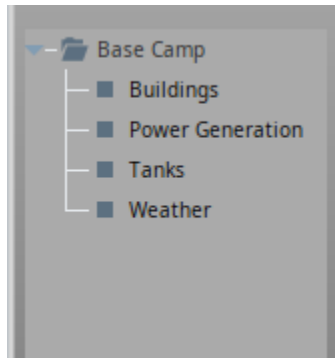


Figure 4.1. Menu tree.

4.1 Buildings

The Buildings page (Figure 4.2) is designed to show the loads that each building is consuming from the site power systems. A group dropdown allows the user to select a group of buildings defined on the Installation Setup page by the administrator. Each building is shown with all associated power meters and their current consumption rates. For buildings with multiple meters, all meters are shown individually.



Figure 4.2. Buildings page.

Clicking the magnifying glass icon  will open a detailed window of the selected structure (Figure 4.3). This screen shows the details of building operations and allows you to plot all building-related details on the graph in the lower part of the window. The window also shows the real-time values for all mapped parameters as well as the daily and weekly consumption for the structure. A radio status button can be used to check the historical status of the radio that services the building meter.

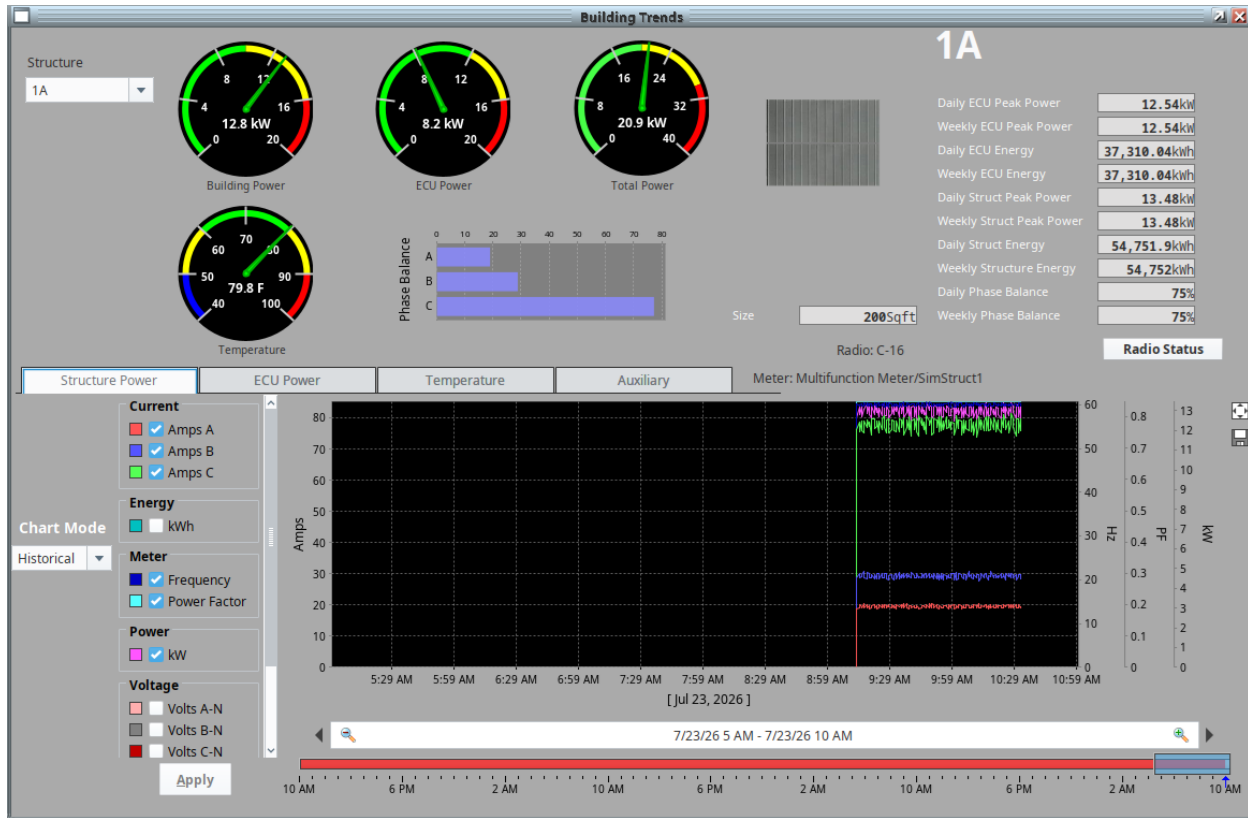


Figure 4.3. Building details.

4.2 Power Generation

Selecting *Power Generation* from the Menu Tree (Figure 4.1) brings up a detailed view of the power generating system for the base. Similar to the structures page, this page shows the available generators and a method to select a group of generators previously mapped by administrators. Selecting the magnifying glass icon  will show the details from each generator, including the power delivery (Figure 4.4). For optimum efficiency, generators should run between 75% and 100% of the rated output as indicated by the green band in the graph on this page (Figure 4.5).



Figure 4.4. Power generation.



Figure 4.5. Generator details.

Selecting the meters icon  (Figure 4.4) will display the current meter readings for each generator (Figure 4.6). By monitoring each phase from a generator individually, you can quickly check for a phase imbalance and respond accordingly to resolve the issue.

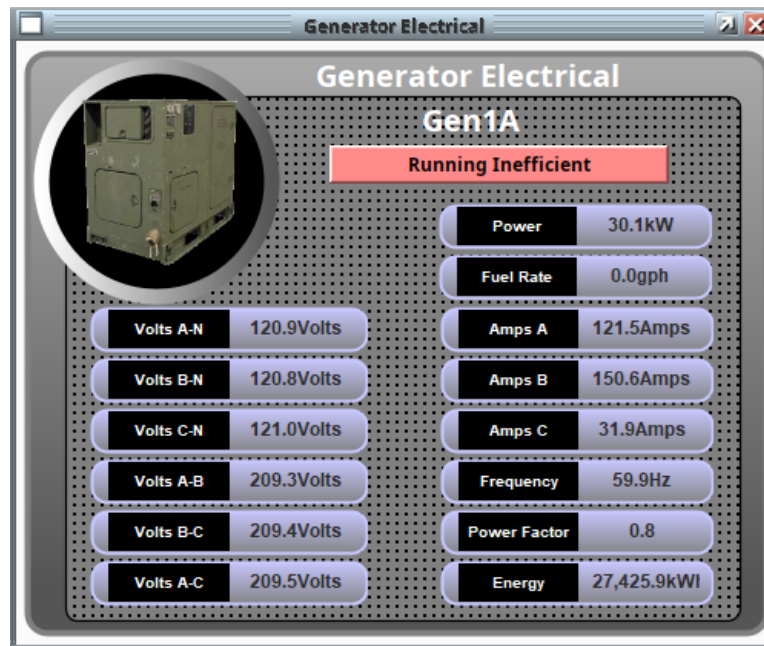


Figure 4.6. Generator meter readings.

4.3 Tanks

The Tanks page displays the status of all tanks configured for the system (Figure 4.7). Tanks are displayed, showing the capacity, level, and available volume of the tank.

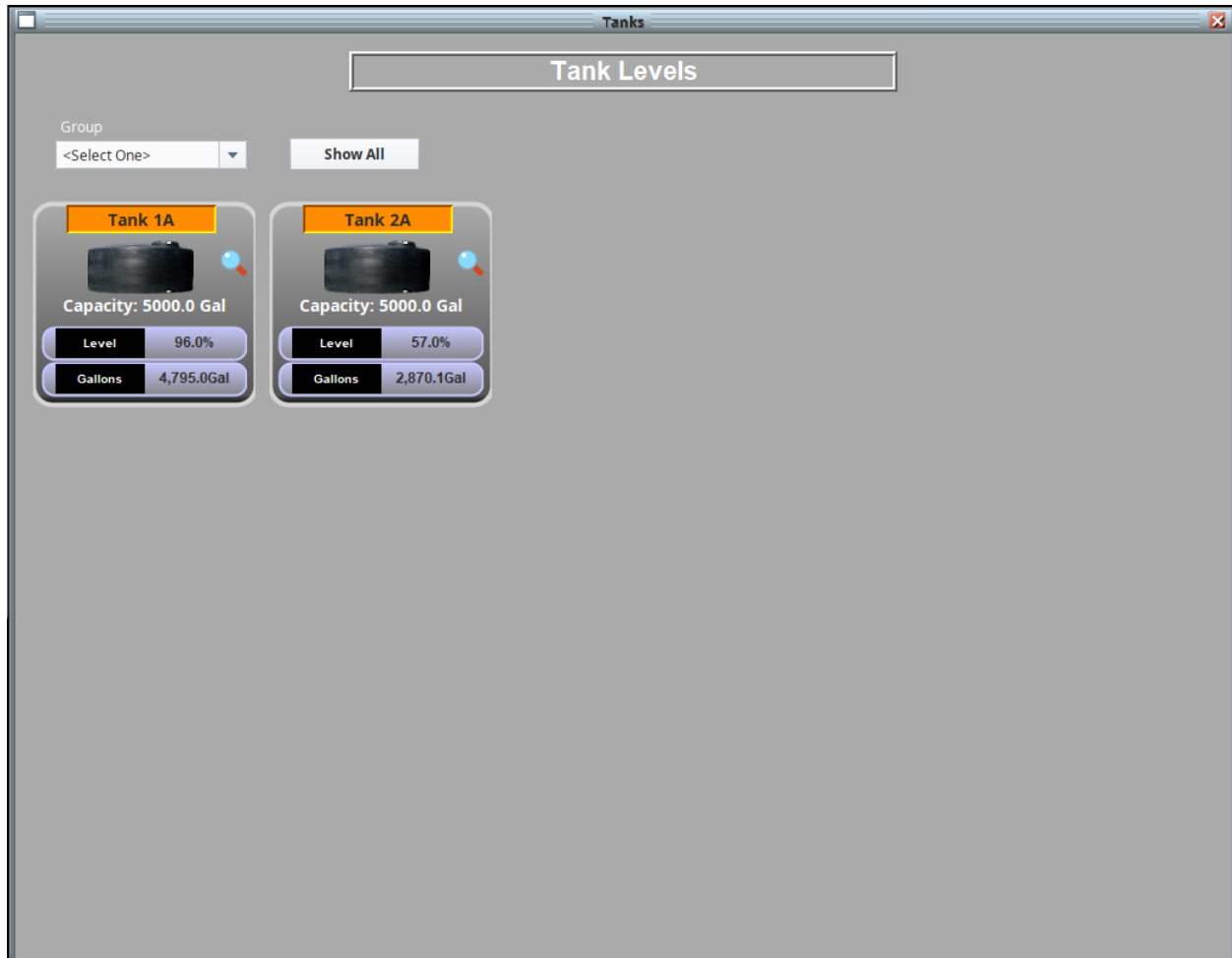


Figure 4.7. Tanks page.

Clicking the magnifying glass icon  will open a detailed window of the selected tank (Figure 4.8). This screen shows the details of building operations and allows you to plot all building-related details on the graph in the lower part of the window. The window also shows the real-time values for all mapped parameters as well as the daily and weekly consumption for the structure. A radio status button can be used to check the historical status of the radio that services the building meter.



Figure 4.8. Tank details.

4.4 Weather

The Weather page is designed to show recent site weather to aid in determining if changes in the power load are the result of weather or a malfunction of a system (Figure 4.9). The page shows the current weather conditions as well as a customizable graph to allow several items to be displayed simultaneously.

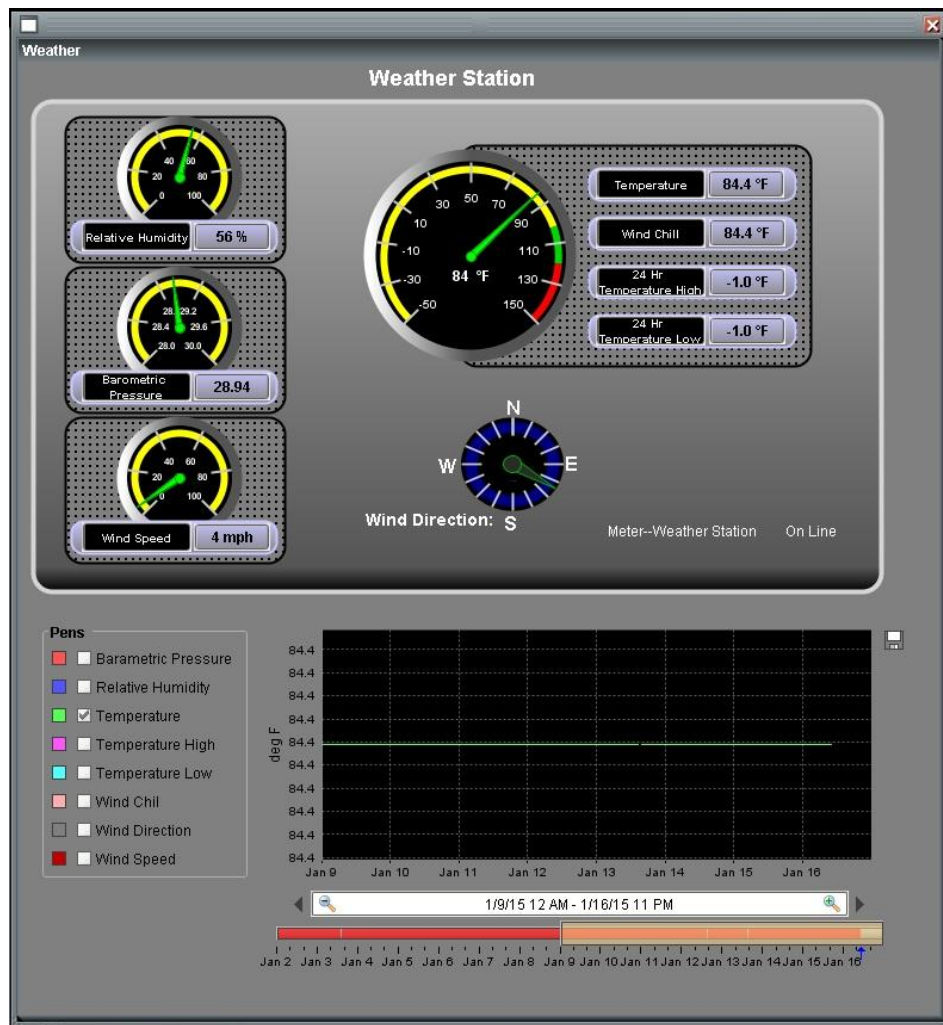


Figure 4.9. Weather page.

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