MARWAY
POWER SOLUTIONS

Optima RCM™ User Guide

Software and Basic Controls Reference

Firmware Version 2.3.x

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Global Support Contacts

Web: www.marway.com
Email: support@marway.com
sales@marway.com
Phone: 800-462-7929 (7am–5pm PST)

There may be updates to this documentation and the software it describes at:
www.marway.com/software

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Prepare PDU Panel Controls

Ideally the first setup should be done without any equipment plugged into the PDU. This way the operation of the breakers and outlets can be confirmed without any impact to the attached equipment.

Set Switch Positions

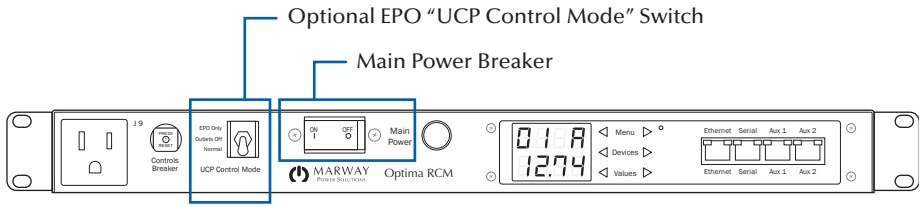
With the PDU unplugged, or powered off at a facility power safety switch, the initial preparation for product configuration includes:

- Identify and set the Main Power or Main Breaker to On.
- For units with additional circuit breakers, switch each of these into the On position as well (this does not include the small Controls Breaker).
- For units with the remote EPO option, the remote mode switch needs to be set in the down or up position based on whether the UCP will be connected or not during setup. The details are in the next section. (Note: the switch labeling has changed over the years. Regardless of the labeling, the relative switch positions do the same thing.)

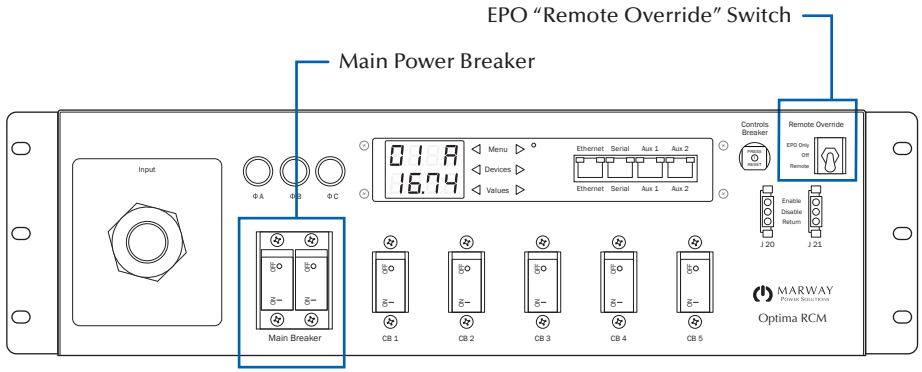
Connect or Bypass the Remote EPO Bus

If your PDU does not include the remote EPO system, you can skip this section. Otherwise, for PDUs with the remote EPO interface, a remote EPO panel such as Marway's Commander UCP can be connected, or can be bypassed during the PDU setup.

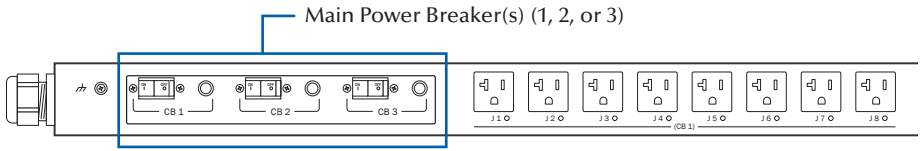
Optima 820 Series Controls



Optima 833 Series Controls



Optima 829/839 Series Controls



Connect the EPO Bus Before PDU Setup

Before the PDU is powered for configuration, connect the remote EPO panel such as Marway's Commander UCP. A couple of examples using the standard Optima 8 Series are diagrammed to the right.

- Find an EPO bus 3-pin connector labeled with Enable, Disable, and Return pins. (Some units may label Return as Common.)
- 1U PDUs may have only a connector in the back. Larger PDUs may have connectors in the back and front. When there is more than one connector, it doesn't matter which one you use (on either the UCP or on the PDU).
- Put the PDU's remote mode switch in the Remote or Normal position (down). Note that the switch name and position labels may be different. Regardless, the normal operating position is down.
- Power the UCP, and put the UCP in the On condition.

Continue with "Prepare for Software Configuration" on page 12.

Bypass the EPO Bus During PDU Setup

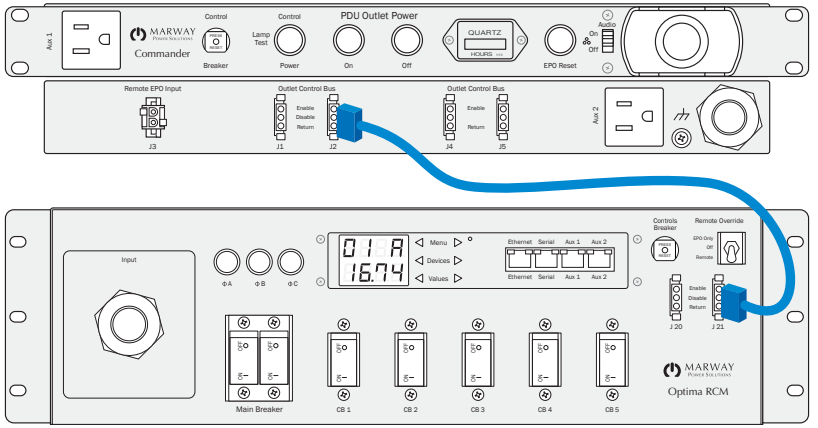
If the PDU has the remote EPO system, but the remote EPO panel will not be connected during PDU setup, the system has to be bypassed.

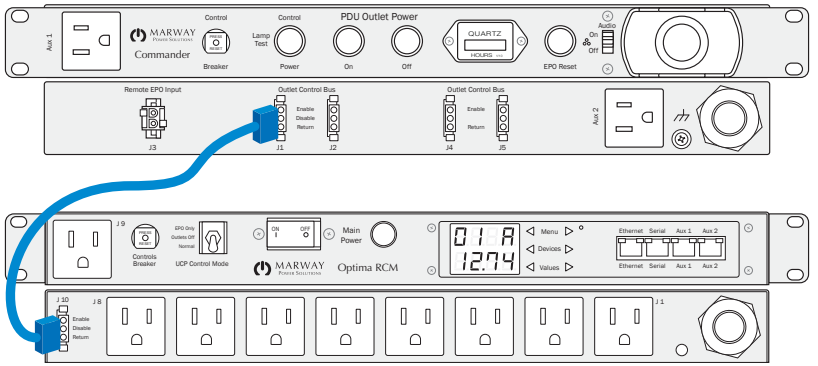
You need to know specifically whether the PDU has a normally open (NO), normally closed (NC), or latching (LT) EPO connection. For Optima 8 series units, the dash value in the part number tells us. For custom units, the dash number does not always indicate the EPO type. You'll have to determine the EPO system type based on the PDU's original design requirements.

- For an NO EPO (Optima 8 Series -000) — When the UCP will not be connected, the remote mode switch needs to be in the EPO Only (up) position. The switch name and position labels may be different.

Connect the Remote EPO Panel to the PDU

- Find an EPO bus 3-pin connector labeled with Enable, Disable, and Return pins. (Some units may label Return as Common.)
- 1U PDUs may have only a connector in the back. Larger PDUs may have connectors in the back and front. When there is more than one connector, it doesn't matter which one you use (on either the UCP or on the PDU).





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- For an NC EPO (Optima 8 Series -001) — When the UCP will not be connected, the remote mode switch needs to be in the EPO Only (up) position. The switch name and position labels may be different. Additionally, pins 2 & 3 on the PDU's EPO connector must be jumpered.
- For an LT EPO (Optima 8 Series -002) — When the UCP will not be connected, the remote mode switch needs to be in the EPO Only (up) position. The switch name and position labels may be different. Additionally, pins 2 & 3 on the PDU's EPO connector must be jumpered.

Continue with "Prepare for Software Configuration" on page 12.

Understanding Breakers, Outlets, and EPO

It is important to understand what behavior to expect with the various components which affect power delivery to the outlets. Depending on the features of the PDU model, the following components all affect outlet power state.

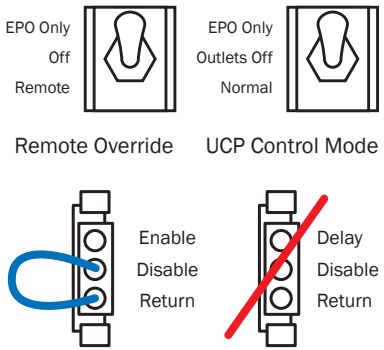
- Main breaker
- Branch/circuit breaker or switch
- EPO panel
- Remote EPO mode switch
- Software switching

Prior to performing first-time setup, or re-commissioning the PDU, be sure to follow the "Prepare PDU Panel Controls" on page 9 above.

To understand how these component impact outlet behavior during operation, see "EPO and Breaker Influence on Outlets" on page 61.

Bypassing the EPO System:

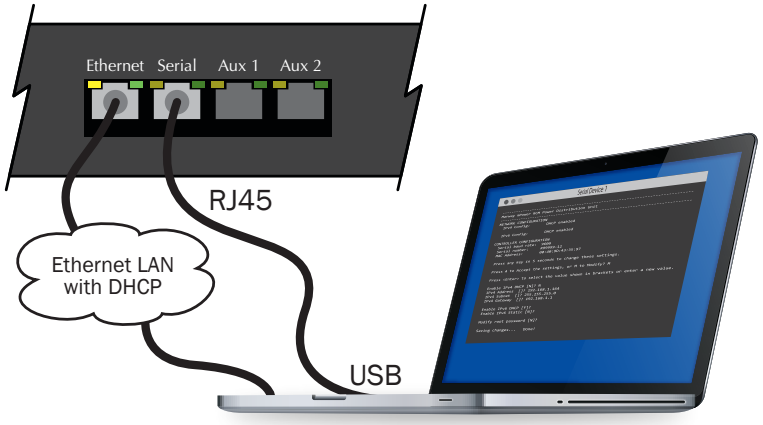
- Put the remote mode switch in the EPO Only (up) position. Some units may have a different label, but the up position does the same thing.
- The NC and LT EPO types also need one of the EPO connectors jumpered.
  - Find any EPO 3-pin connector labeled with Enable, Disable, and Return pins. (Some units may label Return as Common.)
  - Connect pins 2 and 3.
  - Note: do not do this with 3-pin connectors labeled with a Delay pin.
- The NO EPO type does NOT need a jumper.



Prepare for Software Configuration

To prepare for initial networking setup, you will need:

- A computer with either a USB or DB9 port and an Ethernet port.
- An Ethernert LAN ready for manual or DHCP connectivity.
- Two Ethernet cables (one for the PDU, one for the computer) to connect to the LAN (usually by connecting to a switch, hub, or router).
- A serial console cable to connect the RJ45 serial port to the serial input of your computer (USB or DB9). See the sidebar *Console Cables*.
  - You may need to install the FTDI USB to RS232 driver for the cable. (See "FTDI Driver Installation" on page 22.)
- A software application for terminal emulation.
  - We like CoolTerm for Windows or macOS (there are many others). (See "CoolTerm Serial Console Software" on page 21 for setup.)
- The serial port configured for 9600 baud, 8 data bits, 1 stop bit, no parity. (Baud rate can be changed up to 115,200 baud during setup.)



TCP/IP NETWORKING IS ON BY DEFAULT.

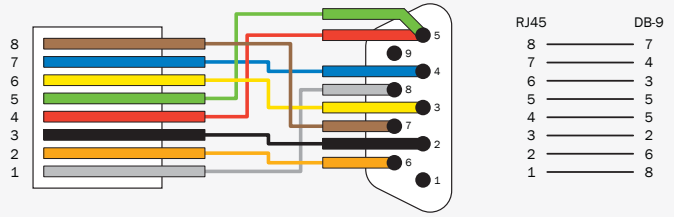
Be aware that TCP/IP is enabled by default. Therefore, as soon as the RCM product is connected to a network, communication with it technically possible. However, since each unit requires setup using the Serial console to start with, each unit ships with a randomized root user password which will be changed durimg the setup process. This random password, in theory, helps prevent access to devices even if they don't get properly configured after being connected.

Console Cables (USB to RCM Serial)

Marway Part No.: 311118-000 — RJ45 to USB Serial Cable, 6 feet long

To source your own cables, here's what you need to know. The Marway PDU includes an RJ45 "Cisco-style" serial console port. Even though it uses an RJ45, this is not an Ethernet port. There are specialized RJ45 to USB Cisco cables. This is what Marway's cable noted above is. To find your own source, do a web search for "cisco compatible console USB to RJ45 cable" and you should find multiple options.

If you need to use a DB-9 cable, you will need a Cisco 72-3383-01 compatible cable. These cables have RJ45 on one end and DB-9 on the other end wired as shown below.



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Next, with the power distribution product powered off, follow these steps.

- Connect the Ethernet cables.
- Connect the serial cable between the computer and the PDU.
- Open the serial communication application on the computer, and start a new serial session (make sure the configuration settings are correct).
- Plug the power distribution product into its power source.

Setup with the Serial Dialog

Within 10–15 seconds after startup, the serial display should be similar to the screen illustration shown at the top right.

- When you see the "Press any key..." prompt, press either Return, the space key or, as it says, any other key. This enters what is called the Serial Dialog which is used to configure TCP/IP, the serial baud rate, and the root user password. (Technically, these things can also be configured using CLI commands in the serial console after startup has completed, but the Serial Dialog provides a guided process.)
- As a confirmation, a second prompt will ask that you type M to make modifications. Pressing M (or m) will then start a series of prompts as shown on the next few pages.

If you miss the 5-second window to change settings, wait for the startup process to complete—the phrase "Ready. Press return to start entering commands." will be displayed. Then, type `restart` and press Return.

The first step in the Serial Dialog provides an opportunity to restore factory defaults. During the first setup of a new product, you do *not* need to do this—it takes several minutes to reformat the system. Accept the default N response by simply typing Return to move on. (You might want to use Y when you're re-provisioning a previously used PDU for a new application.)

```
--------------------------------------------------------------------------------
Marway RCM Power Distribution Unit
--------------------------------------------------------------------------------
NETWORK CONFIGURATION
  MAC Address:        00:40:9D:A1:B1:C1
  IPv4 Mode:          Static
  IPv4 Address:       10.100.100.101
  IPv4 Subnet:        255.255.255.0
  IPv4 Gateway:       10.100.100.100

  Press any key in 5 seconds to change these settings.
```

You will see different MAC numbers. As of 2.3.1, RCM software ships with a default static IP address (before 2.3.1, DHCP was enabled), but these details can be changed in the next few steps. On the following pages, we'll show the set of steps in the Serial Dialog, with previous steps in gray, and the current step being discussed in black.

```
  IPv4 Mode:          Static
  IPv4 Address:       10.100.100.101
  IPv4 Subnet:        255.255.255.0
  IPv4 Gateway:       10.100.100.100

  Press any key in 5 seconds to change these settings.
  Type M to Modify the settings, or C to Cancel: M

  For each setting, enter a new value, or type Return to accept the default.

MODIFY SETTINGS

  RESTORE FACTORY DEFAULTS

  The next prompt allows erasing all user settings (except the root password
  and IP settings) to restore factory values. User settings are NOT exported
  first. Use the web or CLI to export settings before resetting them.

  Reset all settings to factory defaults [N]?
```

Serial Dialog: TCP/IP Setup

Configuring TCP/IP the first time, or any time it is moved to a new network, should be done using the serial port as the unit starts up. Follow the steps in the *Getting Started* section above to enter the Serial Dialog, and advance to the section titled Modify Ethernet Settings.

The first TCP/IP prompt will be presented (with either a `[Y]` or a `[N]` depending on the current configuration):

`Use DHCP for IPV4 [Y]?` — indicates that DHCP is currently enabled
`Use DHCP for IPV4 [N]?` — indicates that DHCP is currently disabled

To set the IPv4 mode:

- Type N and press Return to manually define a static IP address, subnet mask, and gateway address. (Recommended.)
- Type Y and press Return to have DHCP assign the IP address, subnet mask, and gateway address. (Not recommended unless a reserved address is configured based on MAC address.)

It is highly recommended that a static IPv4 address be used so that the address will always be known when logging into the PDU by web or by command line.

It is possible to use DHCP, and have a predictable address, but your IT administrator will need to reserve an address in the DHCP server based on the PDU's MAC address. Using DHCP without a reserved address is not recommended as the address can change, and you won't know what address to use for a browser or command line connection.

When manually entering static IP details, a separate prompt will appear for each of the PDU's IP address, subnet mask, and gateway address settings. In the sample session to the right, a static IPv4 address was manually entered. The pre-existing defaults for the subnet was accepted as is by pressing Return with no new value typed. Normally you will enter the IP and Gateway, but this view shows what it looks like to accept existing values.

```
--------------------------------------------------------------------------------
Marway RCM Power Distribution Unit
--------------------------------------------------------------------------------

NETWORK CONFIGURATION
  MAC Address:        00:40:9D:75:A8:17
  IPv4 Mode:          Static
  IPv4 Address:       10.100.100.101
  IPv4 Subnet:        255.255.255.0
  IPv4 Gateway:       10.100.100.100

  Type any key in 5 seconds to change startup settings.
  Type M to Modify the settings, or C to Cancel: M

  For each setting, enter a new value, or type Return to accept the default.

MODIFY SETTINGS

  RESTORE FACTORY DEFAULTS

  The next prompt allows erasing all user settings (except the root password
  and IP settings) to restore factory values. User settings are NOT exported
  first. Use the web or CLI to export settings before resetting them.

  Reset all settings to factory defaults [N]?

  MODIFY ETHERNET SETTINGS

  Use DHCP for IPv4 [N]? N
  IPv4 IP address  [10.100.100.101]? 192.168.1.10
  IPv4 Subnet mask  [255.255.255.0]?
  IPv4 Gateway address  [10.100.100.100]? 192.168.1.1
```

The default numbers you see, and the numbers you enter will be different than those shown here. When using static addressing, you'll want to get the address from an IT administrator who knows which addresses are available.

Static vs. DHCP

As of this writing, there is a shortcoming with the DHCP system. If Ethernet is not plugged in, or the DHCP server is offline, during a startup, the RCM software will stall waiting for a DHCP address.

Therefore, even though DHCP with a reserved address via MAC ID in the DHCP server can be used to ensure a known IP address, we still recommend that the static IP mode be used. With a static address assignment, the RCM firmware will continue its startup process even if the Ethernet connection is lost.

Serial Dialog: Serial Port Baud

Continuing the Serial Dialog setup from the previous section, the serial console baud rate is the next setting to be presented. The shipping default will be 9600 because that's been a universal default for serial ports for many kinds of equipment a very long time.

The serial console is much more responsive when run at the maximum speed of 115200. If you're connecting to the PDU directly from a laptop, then it is recommended that you update the setting to 115200. If you have a broader serial interface infrastructure, the rate you choose may need to be compatible with other equipment.

Since changing the baud rate will impact your serial connection, you will need to modify the serial software connection settings after the PDU restarts. Don't change them just yet, while this serial dialog session completes, the existing baud rate is still in effect.

```
MODIFY ETHERNET SETTINGS

Use DHCP for IPv4 [N]? N
IPv4 IP address  [10.100.100.101]? 192.168.1.10
IPv4 Subnet mask  [255.255.255.0]?
IPv4 Gateway address  [10.100.100.100]? 192.168.1.1

SERIAL CONSOLE PORT SETTINGS:

Rate options: 1200, 2400, 4800, 9600, 19200, 38400, 57600, or 115200.

Serial port baud rate [9600]? 115200
```

Serial Dialog: root User Password

For new systems, or systems which have been configured before, and the root password or any other password with full privileges is not known, the root password will have to be changed using the serial port connection.

If you're not already continuing with the Serial Dialog setup started in the previous sections, then follow the steps starting in the *Getting Started* section above to enter the serial dialog.

Press Return for each prompt to accept the current value (or change them if needed) until you get to the Modify Root User section.

When prompted to modify the root password, type Y and press Return. The new password will need to be entered twice.

The system will automatically save the updated settings, then restart. If you changed serial baud rate, now is the time to update the serial software's conection setting as well.

FACTORY DEFAULT USER ACCOUNT

Account name: root.

Password: There is no default password. A random password has been created at the time of shipment, and even the factory does not know what it is. You MUST use the serial dialog to change the root password to something you will continue to use.

```
MODIFY ETHERNET SETTINGS

Use DHCP for IPv4 [N]? N
IPv4 IP address  [10.100.100.101]? 192.168.1.10
IPv4 Subnet mask  [255.255.255.0]?
IPv4 Gateway address  [10.100.100.100]? 192.168.1.1

SERIAL CONSOLE PORT SETTINGS:

Rate options: 1200, 2400, 4800, 9600, 19200, 38400, 57600, or 115200.

Serial port baud rate [9600]? 115200

MODIFY ROOT USER

Update the Root Password [N]? Y

Password must include:
  at least one upper case from A-Z
  at least one lower case from a-z
  at least one numeral from 0-9
  at least 8 characters
  at least 4 letters (cannot be mostly numerals)

Enter the new Root Password:    ********
Re-enter the new Root Password: ********

SAVING CHANGES...

Done.

RESTARTING RCM...
```

Startup TCP/IP Troubleshooting

If the PDU has begun a normal startup, but the PDU is not reachable to log into via web browser or command line (and the PDU's on board display is either blank or shows dashes even after several minutes), return to the serial interface, and restart the PDU again.

The normal startup appearance through the serial console is shown to the right when DHCP is active (just because it makes for shorter example output). If static addressing is being used, you will see the IPv4 static parameters listed instead of the DHCP mode line.

Wait for the "Press return..." message at the end of startup, then try entering the command `getSystem`. The PDU should respond with a number of descriptive details about the PDU. This lets us know the PDU is at least responsive to commands. Note that PDUs with a high number of outlets (> 24) and with a large number of log entries (> 200), will take longer to be ready.

If the PDU is still not reachable at the IPv4 address displayed in the Connecting line, enter the command `ifconfig` in the serial console. If the PDU has connected to the network, you should see a response similar to the second window shown to the right—a full address is listed for both `IpAddr` and `GW`.

If the PDU has not connected to the network, you may see a response similar to the third window shown to the right which indicates that the connection "is down." This could mean either the TCP/IP setup done in the serial dialog has a misconfigured value, that there is a conflict with another device which is already using the address that was assigned, or there is a disconnect somewhere in the cabling.

```
--------------------------------------------------------------------------------
Marway RCM Power Distribution Unit
--------------------------------------------------------------------------------

NETWORK CONFIGURATION
  MAC Address:        00:40:9D:43:35:97
  IPv4 Mode:          DHCP

  Press any key within 5 seconds to change startup settings.

--------------------------------------------------------------------------------
Marway RCM Command Line
--------------------------------------------------------------------------------
#> Starting up...
   Connecting... (192.168.1.10)
   Loading log and settings... (takes 1-2 minutes)
   Application ready. (v2.3.0)

   Press return to start entering commands (? or help).

#>
```

```
#> ifconfig

Interface list (2):
1: lo:  flags=1 mtu 1500 Phy 41:ec:00:36:41:c8
   IpAddr:127.0.0.1 GW: 0.0.0.0
2: eth0:  flags=21 mtu 1500 Phy 00:40:9d:43:35:97
   IpAddr:192.168.1.10 GW: 192.168.1.1
```

```
#> ifconfig

Interface list (2):
1: lo:  flags=1 mtu 1500 Phy 41:ec:00:36:41:c8
   IpAddr:127.0.0.1 GW: 0.0.0.0
2: eth0: flags=22 Phy 00:40:9d:43:35:97 is down
```

Additional Setup

In addition to the setup steps in the Serial Dialog, you may want to configure a few more details before beginning to operate the PDU's power and/or switching capabilities.

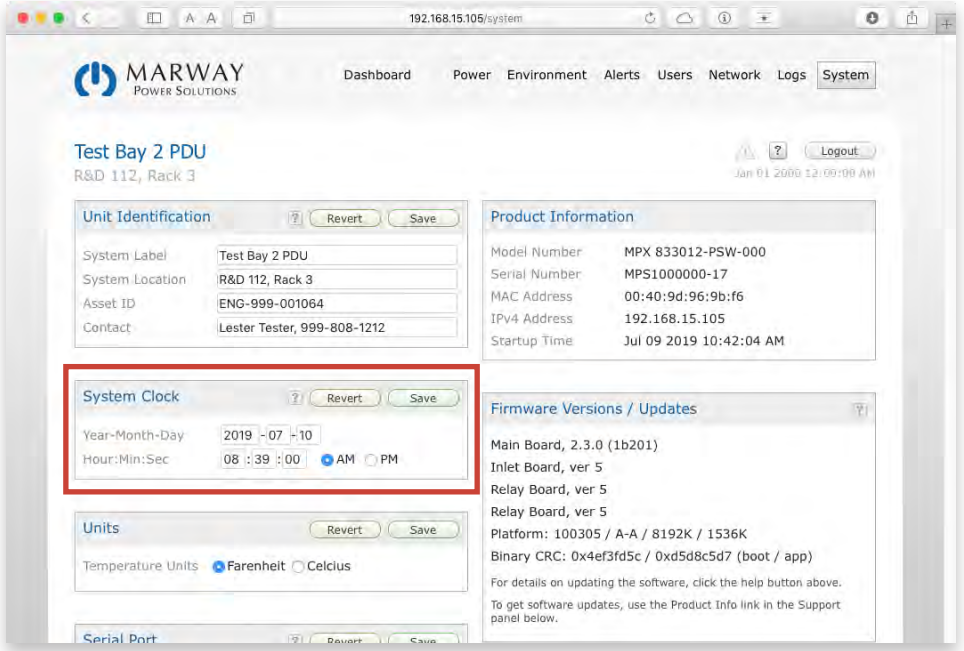
Set the Current Date and Time

After having TCP/IP configured and the root user password changed, the next task should be to verify that the PDU is aware of the current time. An accurate time is not crictical for basic operations, but having the correct time will provide the logging system and the alert system with accurate time stamps.

There are two ways to have the PDU aware of the correct time. The "best" way is to configure the PDU to connect to a network time service known as SNTP. This method is best if the PDU will be connected to the internet, or to a local network which has a time server available. This will keep the PDU's time updated and accurate, and will ensure that the PDU's time is coordinated with other equipment on the network.

If a network time server is not available to the PDU, then you can manually set the PDU's internal clock with the current date and time. All computer-based clocks like the one in the PDU will run a little fast or slow, and may need adjusting weekly or monthly if you want it to be as accurate as possible. Without SNTP, the clock must be reset every time the PDU is powered off.

- When SNTP cannot be used, the internal clock is configured in the System page of the web interface. (If the PDU is connected to an SNTP server, the local clock will not be manually editable since SNTP will be automatically keeping the time updated.)



- When SNTP is available, configuration is done in the Network page of the web interface.

Log into the web site at the PDU's IP address using the root account and password. Then open the Network or System page to edit the SNTP settings. If a time server is not going to be used, change the addresses of the two time servers to be 0.0.0.0 or blank. For details on time zone settings, find the settings in the section "Network Settings" on page 90.

Enable/Disable Network Services

You may want to consider which network services to enable or disable. By default, HTTP (web), Telnet, SSH, and FTP are all enabled.

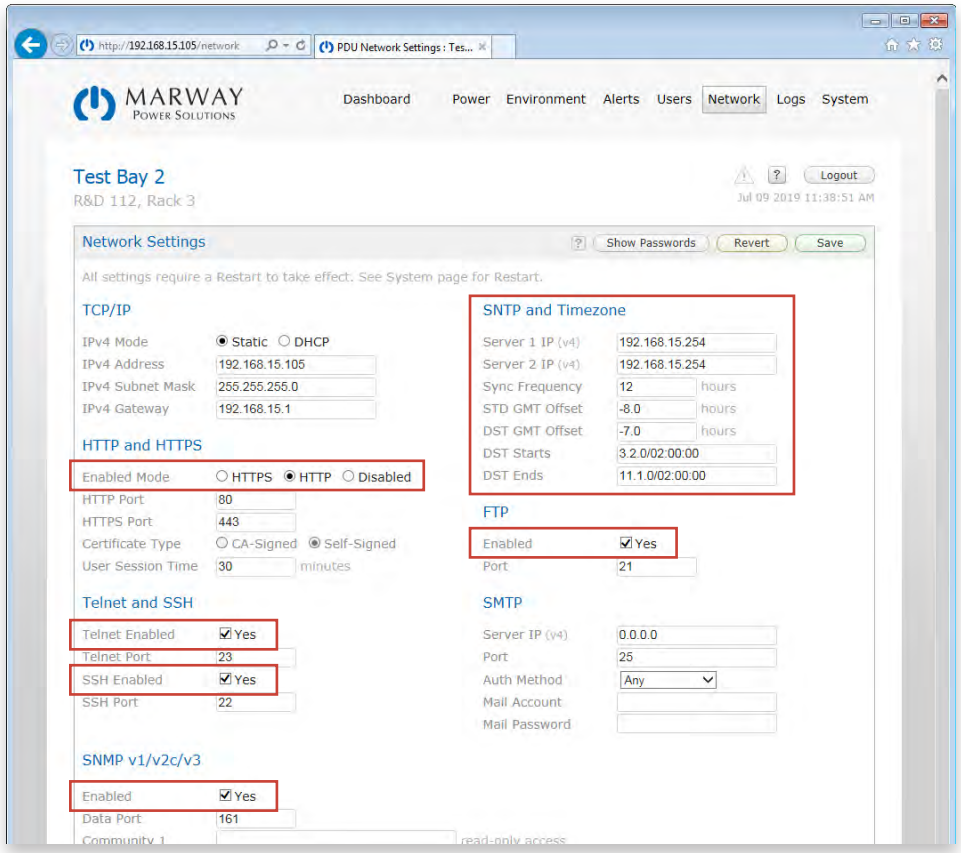
Log into the web site at the PDU's IP address using the root account and password. Then open the Network page. Edit the network services to suit your environment and policies.

Event Log Configuration

While you're setting up the PDU for the first time, now would a good time to consider your logging needs. Read the section about "Log Settings" on page 72 and make adjustments to suit your needs.

Outlet Startup State

If your PDU has switched outlets, you have some configurable options. When the PDU itself is powered off, the internal relays controlling power to the outlets are also shut off. Each outlet can be configured to remain off after startup, or be turned on during startup. By default, systems shipped with version 2.3 software will have all outlets turned on during startup. To make adjustments to this



startup state and other outlet settings, open the web Power > Outlets page. More information about these settings can be found in “Power Settings” on page 105.

System Identification

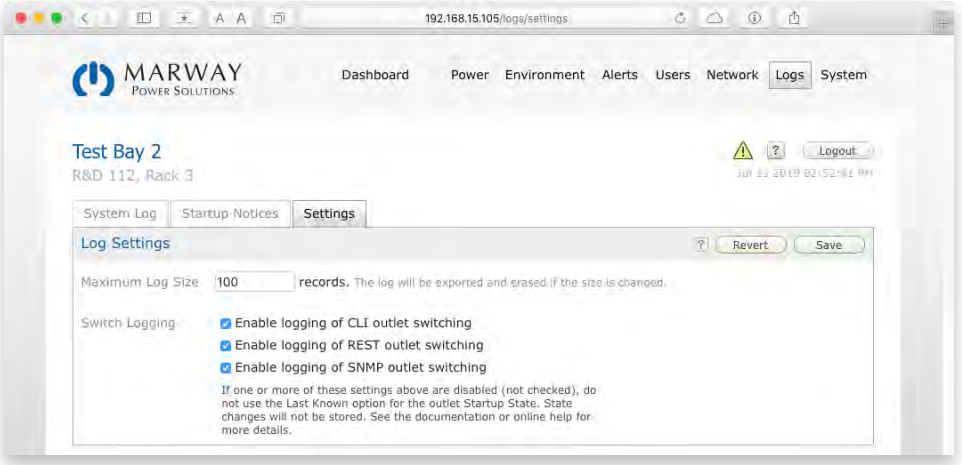
To help differentiate one PDU from another, or even identify just one PDU as to where it is, the System settings include giving the PDU a name, location, asset ID, and contact. These values are available via the web, CLI, and SNMP. To adjust these settings, open the System web page.

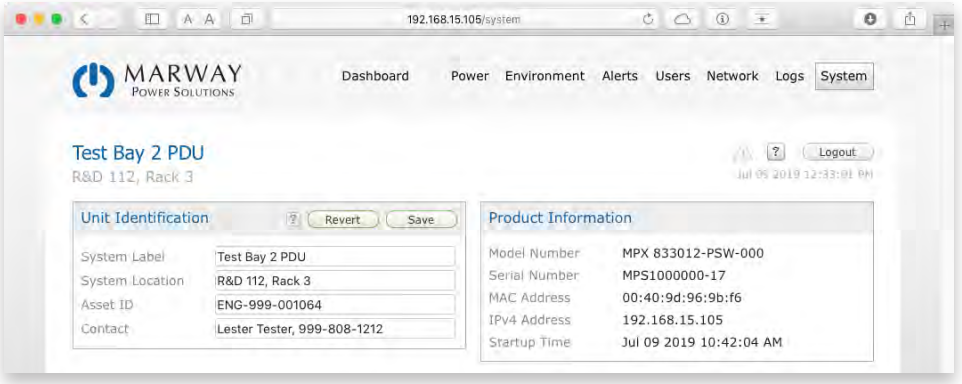
And More... for Later

The settings described in the above section are ones you might want to consider adjusting during your initial setup. Later, once you get familiar with the PDU, and have your application need well defined, there are more settings which you may want to take advantage of: setpoints, alerts, additional user profiles, and more.

Up-to-Date Release Notes

Be aware that in the FTP file system is a ReadMe file which contains release notes as of the software installation at the factory (and may be kept up to date with updates from the Marway web site). There may be details offering new or corrected information not included in this User Guide.





CoolTerm Serial Console Software

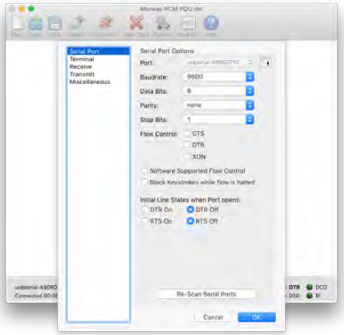
Marway has no affiliation with the authors or publishers of CoolTerm. However, in the interest of providing as much assistance as we can in this *User Guide*, we've opted to provide some information on how to use at least one of the possible terminal emulation software options. We find CoolTerm to be an easy-to-use option which is available for Windows, Mac, and Linux.

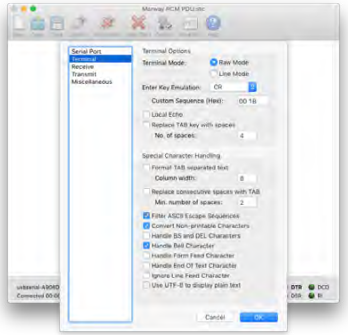
As of this writing, CoolTerm can be found on the author's web site at:
http://freeware.the-meiers.org

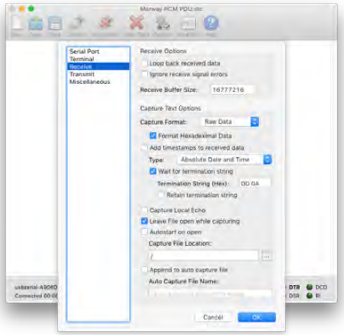
After you have downloaded and installed the software, create a new CoolTerm document and save it with a name like "RCM Console" (or whatever you want). Click the Options tool bar button, and configure it to match the screen captures shown to the right. There may be differences based on the version you end up with. You will have to Re-scan Serial Ports, and select the correct COMx or usbserial-N device (may require trial and error to know which one to use). Save the document after the settings are adjusted. Reuse this document whenever you are connecting to an RCM product.

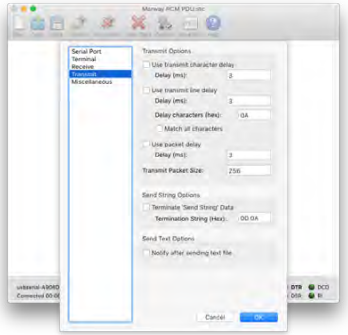
When starting a serial console session, be sure the cables are installed, and that the CoolTerm document is "connected"—press the Connect tool bar button. The button will be disabled when the connection has started. Then power up the RCM product. If you see a bunch of periods or garbage-y characters, the baud rate of the CoolTerm settings does not match the baud rate of the RCM hardware. Make adjustments until you get the correct looking text (usually either 9600 or 115200).

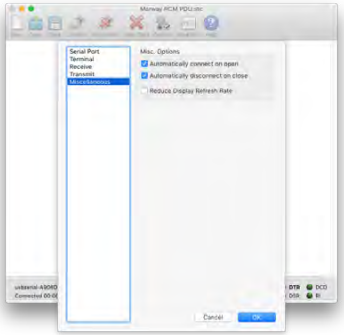
Note that the names of the Ports vary by OS. Windows reports them as COM[N], whereas the Mac shows usbserial-[NNNNNNNN].











FTDI Driver Installation

In order to use the serial console with a laptop or other computer, a USB to RJ45/RS-232 cable is needed. These cables have a tiny microcircuit at the USB end to convert between USB and RS-232. Most computers will require a driver for this cable to work. Some may have already had it installed.

Windows Update

For Windows 10 computers, if the computer is connected to the internet when the cable is first plugged into the computer, Windows 10 will typically try to connect to Windows Update and load reference drivers on its own. Windows should indicate that it has started installing the required drivers for the new device, and then also indicate when it has completed.

FTDI Driver Installer

Another way to install the drivers for WIndows, macOS, or Linux, is to use FTDI's own installer application. As of this writing, the web page with these installers is located at https://ftdichip.com/drivers/vcp-drivers/ in a table part way down the page.

For Windows — select the "setup executable" link in the Comments column. The links under X86 and X64 do not include installers.

For macOS — for any modern Mac less than 12 years old, use the link in the X64 column. (Very early Intel Macs would need the X86 drivers).

For Linux — the FTDI site indicates the drivers should be included in most recent distributions. Check their TN-101 document for more details.

As of this writing, the FTDI web site organizes driver downloads in a table like this. Windows users should download the link in the Comments column. macOS users using recent versions should use the Mac OS X 10.9 and above link.

		Processor Architecture				
Operating System	Release Date	X86 (32-Bit)	X64 (64-Bit)	PPC	ARM	Comments
Windows*	2017-08-30	2.12.28	2.12.28	-	-	WHQL Certified. Includes VCP and D2XX. Available as a setup executable Please read the Release Notes and Installation Guides.
Linux	-	-	-	-	-	All FTDI devices now supported in Ubuntu 11.10, kernel 3.0.0-19 Refer to TN-101 if you need a custom VCP VID/PID in Linux VCP drivers are integrated into the kernel.
Mac OS X 10.3 to 10.8	2012-08-10	2.2.18	2.2.18	2.2.18	-	Refer to TN-105 if you need a custom VCP VID/PID in MAC OS
Mac OS X 10.9 and above	2019-12-24	-	2.4.4	-	-	This driver is signed by Apple

Optima RCM

Feature Tour

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Feature Tour

Marway's Optima RCM power distribution units offers multiple interfaces to monitor and/or control the unit. There are three user interfaces: a web browser graphical interface ("web UI"), a command line interface ("CLI"), and an on-board LED display to show power data and relay state.

Additionally, the system may be monitored and controlled through SNMP and a RESTful API.

Lastly, a serial console is used for initial setup of the root user account and IP network settings. Upon startup, the serial console will display startup status information, and prompt the user for changes. If there are no changes to be made, the serial console presents the standard CLI.

This section of the *User Guide* is an introductory tour of the major features of the web UI and CLI. It presents interface images along with short descriptions of several of the interface and functional features of the PDU.

Web Browser Interface

The browser interface has been designed for reasonably broad compatibility with most commonly used browsers in versions released within the past few years. If you notice any specific compatibility problems causing incorrect renderings of the interface, please report them to Marway support.

The browser interface can be used over HTTP or HTTPS. It allows for power data monitoring, outlet switching, user management, and editing all adjustable settings of the PDU. Note that many UI elements (fields and buttons) will display help tips if you let the mouse pointer hover over the element for a second or two. Additionally, many display panels on the web views have their own help button on the right side of the panel title bar.

Command Line Interface

The command line interface works over Telnet, SSH, and the serial port. It allows for power data monitoring, outlet switching, user management, and editing all adjustable settings of the PDU.

Power Terms

In Marway's RCM products, the following terms are used throughout the documentation and interfaces.

- Outlet : a power connector used to provide point-of-use power for the user's application (usually a female receptacle).
- Circuit : a branch in the power distribution usually protected by a circuit breaker (unless an outlet is wired as a pass-through from the main breaker).
- Phase : in the power industry, this same term often describes two possible objects: a pair of conductors (wires) across which exists a voltage potential, or a single conductor on which a current flows. Voltage phases will be shown with two letters such as AB, AN, or LN. Current phases will have a single letter (A, B, C, L).
- Inlet : for alternating current power, an inlet is comprised of the phase conductors, whereas for direct current power, an inlet is comprised of the positive and negative conductors.

A PDU will have one or more power Inlets. Phases are the wires directly connected to the power source. Each phase may be branched into one or more Circuits, and each circuit would have one or more Outlets (with a variety of possible connector styles). Throughout the various software user interfaces, Circuits are rarely seen as separately visible objects.

Power and Switching Data

The table to the right identifies the data values available in various PDU configurations. These values are available to view on the web Dashboard, and through the `getOutlet` and `getPhase` CLI commands.

Power Monitored systems include measuring of voltage and current of the inlet phases. From this, the other values are derived, providing a more complete power data set.

Current Monitored systems measure only the current of the inlet phases. This is useful for understanding the total loads present at the inlet connector.

Switched Outlets do not include any power monitoring of the outlets, but provide control of on/off switching each individual outlet.

Any given PDU may have a mixture of these capabilities. An RCM PDU by definition is a networkable PDU, so there will be either inlet monitoring, or switching, or both. However, all features are not necessarily present in all PDUs.

Value (units)	Power Monitored Inlet	Current Monitored Inlet	Switched Outlets
Rated Volts (V)	✓	✓	
Volts (V)	✓		
Rated Amps (A)	✓	✓	
Amps (A)	✓	✓	
Consumed Amps (%)	✓	✓	
Watts (W)	✓		
VoltAmps (VA)	✓		
VA Reactive (VAR)	✓		
Power Factor (PF)	✓		
Frequency (Hz)	✓		
Switch State (on/off)			✓

Browser Interface Tour

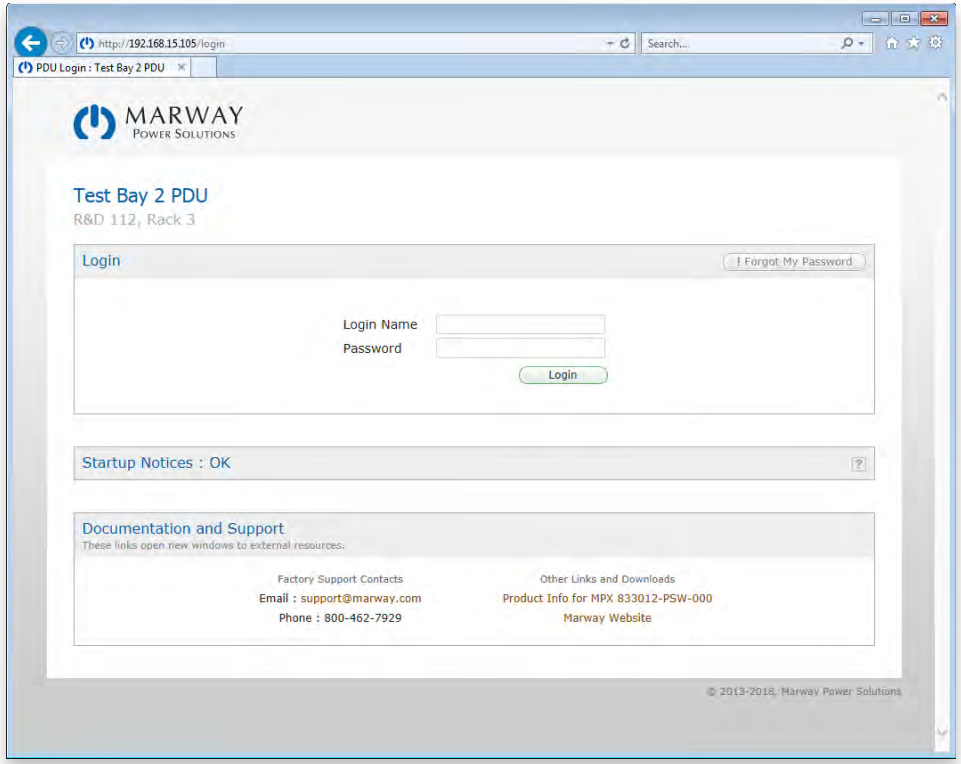
Login

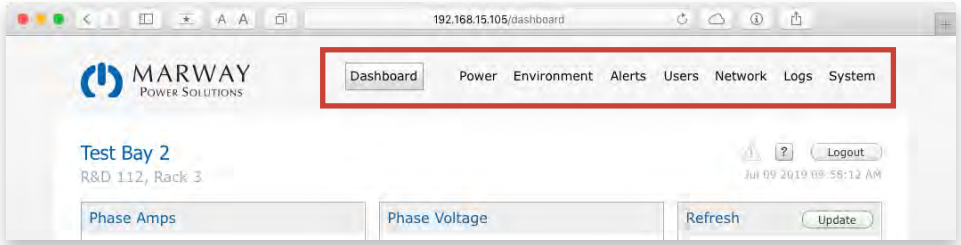
The login page is fairly straight forward. One noteworthy feature aside from the obvious login functionality is the Startup Notices panel. Any errors or warnings generated during startup will be listed in this panel. If startup went as expected, the “OK” will be displayed as shown in this window.

Main Menu

After the login page, the web browser interface is organized into topical sections which are labeled in the browser’s main menu:

- Dashboard : Outlet control, power monitoring, and alarm monitoring. Other than Logs, Dashboard is where virtually all information viewing is performed. All other pages are primarily for adjusting settings.
- Power : Settings for power device labels, setpoints, and outlet delays.
- Environment : Settings for temperature/humidity labels and setpoints.
- Alerts : Settings for notifications when specific events occur such as setpoint trips.
- Users : Settings for user profiles, authentication, and authorization.
- Network : Settings for supported networking protocols and features.
- Logs : Display of the system and startup logs.
- System : Settings for unit labeling and clock, command for restart, and miscellaneous system-level information.





Web Dashboard

The Dashboard is where all power monitoring, alarm monitoring, and outlet switching capabilities are located. Other than logs, Dashboard is where virtually all information viewing is performed. All other main menu views are primarily for adjusting settings.

Below the main menu, the top of the dashboard includes a user-defined unit label and location on the left. These are defined on the System page, and allow the PDU to have a unique and meaningful identification. On the right, a caution icon will be colored with yellow if there are any setpoint alarms which should be attended to. This very top section of the page is common to all pages in the web browser interface.

Phase Current and Voltage

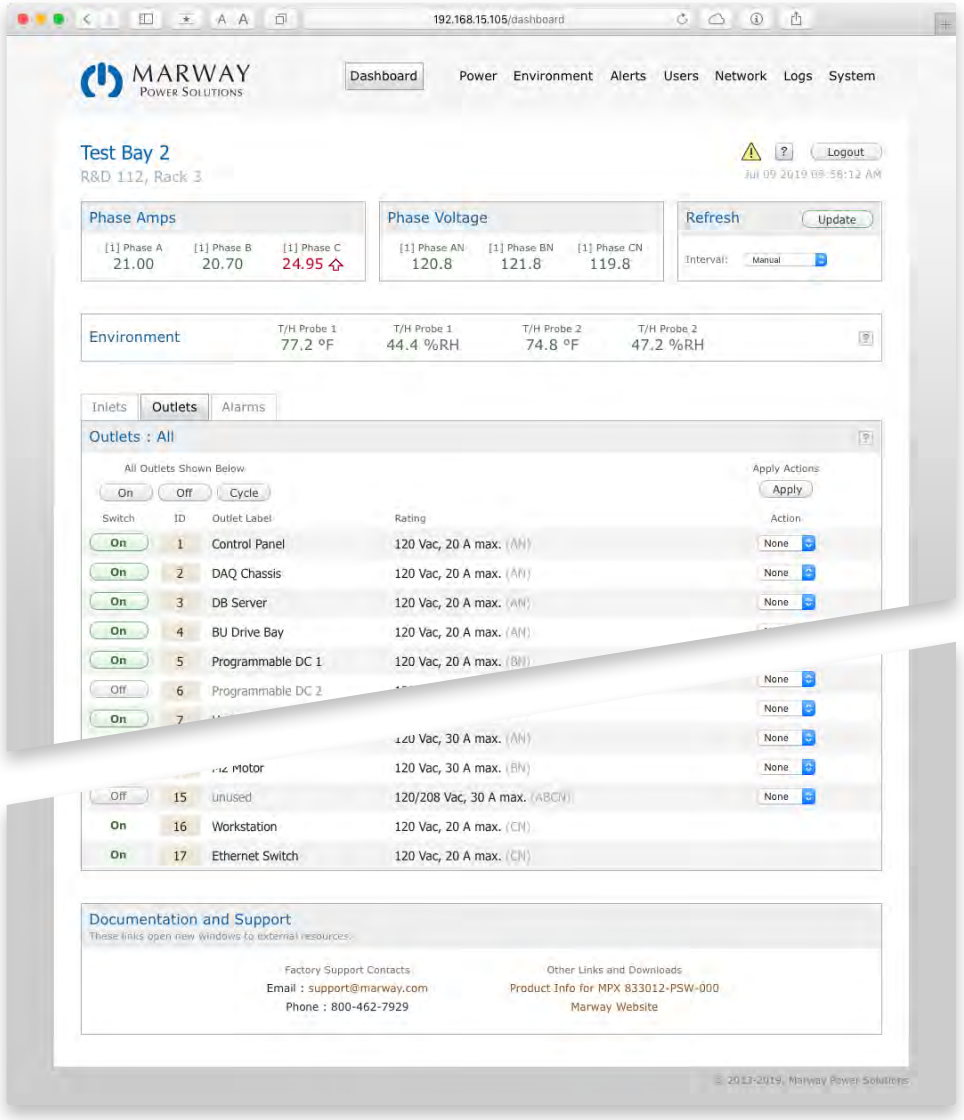
The first two data panels show the load on each phase, and the voltage of each phase. The number in the brackets [1] show which power inlet the phases are from. On most units, there will be only one inlet. Units wthout inlet power monitoring will display the inlet rating.

Auto Refresh

The third panel along the top provides controls to have the page auto refresh manually, or automatically on a time interval selected from the popup menu.

Dashboard Outlets Panel

The large tabbed panel provides the detailed monitoring of power objects and alarms. The Outlets panel is the default view when the Dashboard is selected from the main menu at the top of the page. This dashboard shows an Optima 833 Series 3U unit with 17 outlets.



When switched outlets are available, each outlet has it's own on/off button, a user-defined label, and a rating information column. Hovering over the label will reveal the Panel Name which identifies the outlet label on the PDU chassis. The Rating provides basic capacity ratings and which phase the outlet is connected to. The last column is a popup/dropdown menu allowing multiple outlet states to be set then switched with a single command using the Apply button.

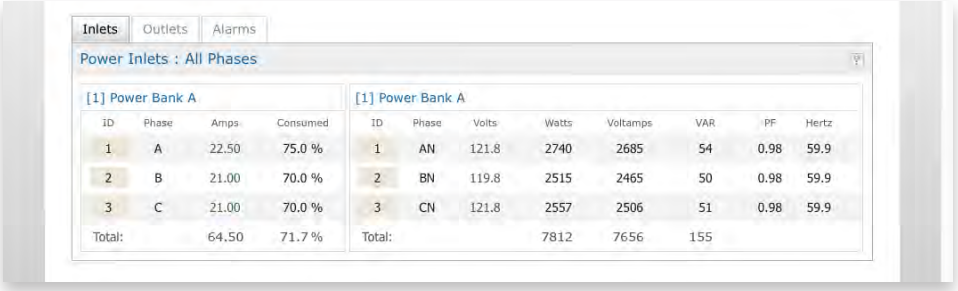
Dashboard Inlets Panel

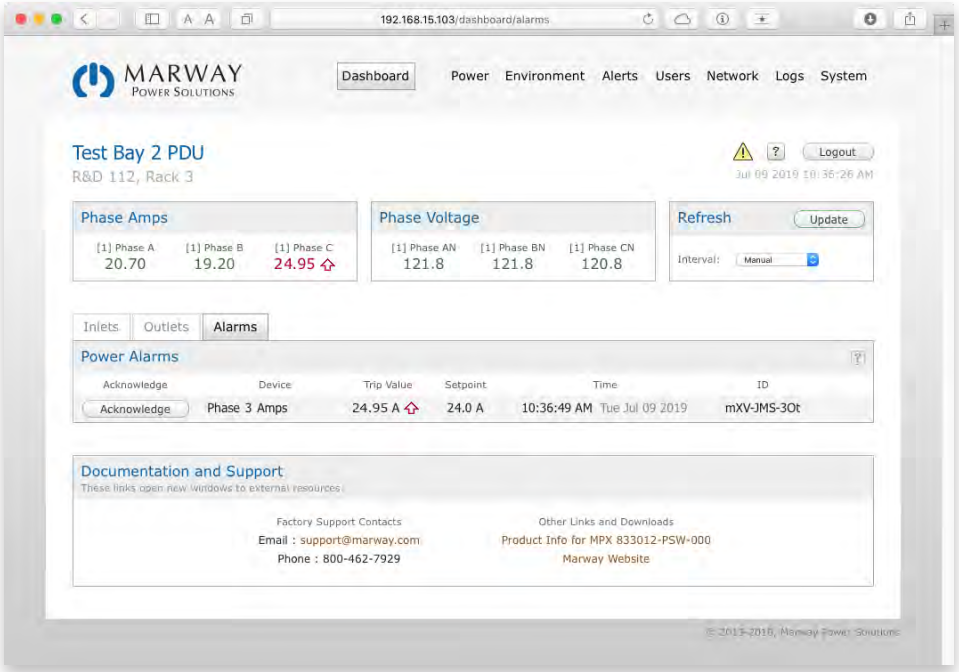
The Inlets panel will be available for power monitored systems, and provides a detailed view of power data for each phase. This will include all data collected by the power-monitoring sensors which is not visible at the top of the Dashboard.

Dashboard Alarms Panel

If phases are equipped with either current or power monitoring, each phase has alarm setpoints which can be used to trigger indicators and user notifications if current values (or voltage if measured) get outside desired limits. The Alarms panel provides a list of active alarms, and when they were first tripped. The main menu Alerts page is used to define whether users receive notifications of these alarms by email and/or by SMS (text message), and whether they are to be broadcast as SNMP traps/notifications.

If there is at least one alarm, the caution icon in the upper right of the page will change from a dimmed gray to a bold yellow. This will be visible on every web page. Clicking this alarm indicator from any web page will open the Dashboard > Alarms page.





Power Settings

The main menu Power page displays the adjustable settings for all power devices. Each device has slightly different settings.

Device Labels

Outlets and Inlets can have user-defined labels to better identify what each device is connected to, or user for. If the user does not enter labels, or sets one empty, the system will substitute a default label such as Outlet 3, Inlet 1, etc.

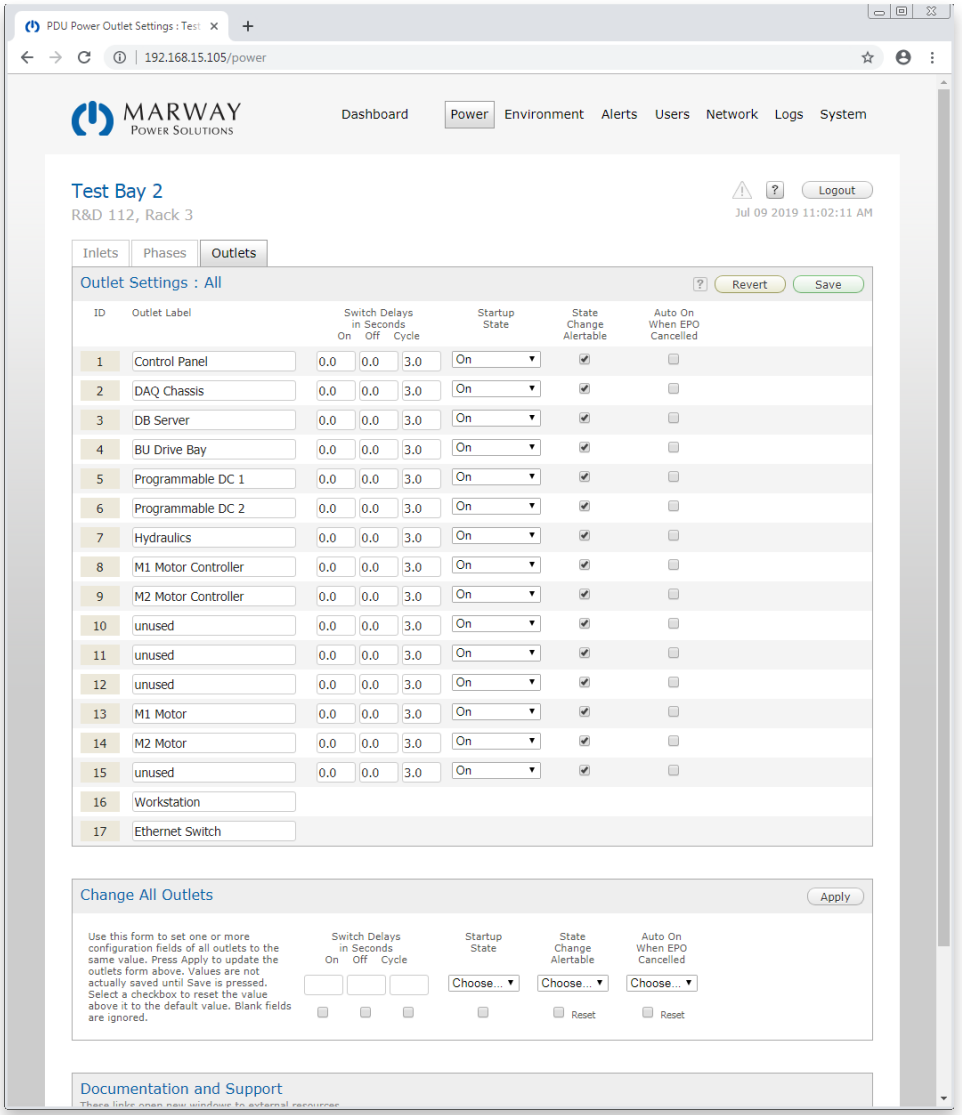
Phases do not have user labels. Their labels are fixed with LN in single-phase systems, and AN, BN, and CN in three-phase wye systems. Single-letter labels are used to identify current phases, two-letter labels are use for voltage phases.

Outlet Options

Each outlet has delay timing option. When the PDU is powered up, the On Delay is applied before the outlet is enabled. If several outlets are enabled with the Dashboard outlet Action menus, the On Delay timing is also applied. Whenever a single outlet is turned on or off, the action is immediate.

When the PDU is powered up, each outlet can be set to a specific Startup State of on, off, or whatever the last known state was before the PDU was powered down. Each time an outlet is switched on or off, the state of the outlet is saved. That value is used to restore the “last known” state.

Each outlet can also be configured to trigger an alert or not. In some applications it may be very unusual for an outlet to be switched, and if one is switched, administrators may want an alert. The State Change Alertable setting in combination with configurations on the Alerts page can create flexible alert rules applied to all outlets, or only specific ones.



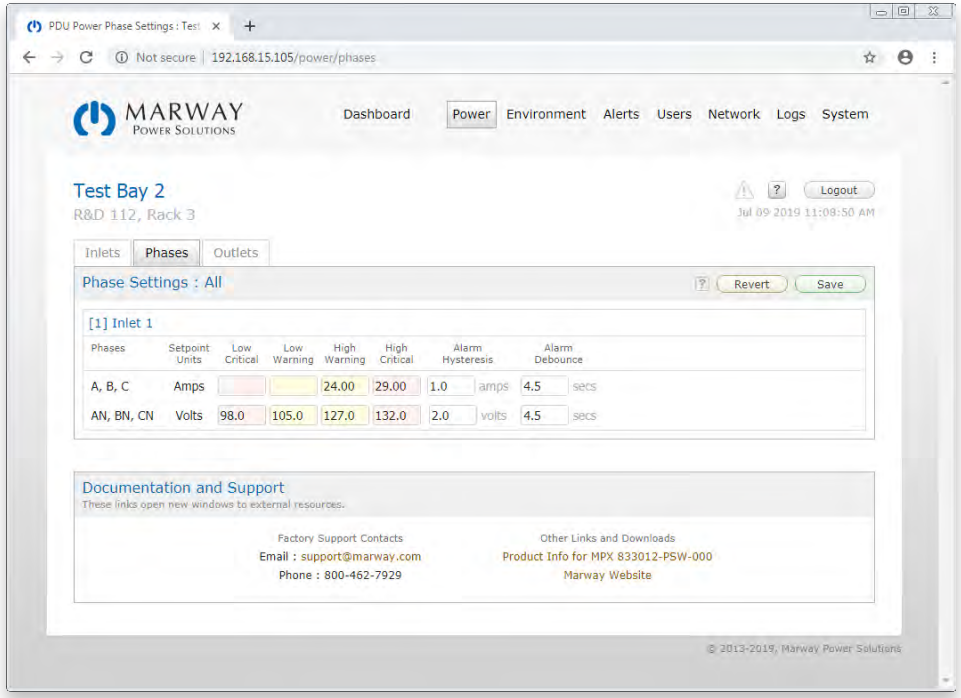
Setpoints

A setpoint is a user-adjustable value which is constantly compared to an actual measured data value. So, a setpoint value for a phase current would be compared to the measured current value each time that value is updated. If the measured value exceeds the setpoint value, we can generate a response to that, generically known as an event. The RCM software uses such events to show indicators on the Dashboard, send alerts to users, and generate other responses.

Phases may have setpoints for amps and/or volts (depending on the model and what sensor hardware is included).

Each setpoint has four trigger values and two additional values named hysteresis and debounce. A trigger value is the user's setting value which is compared to the measured value. The four triggers are known as Low Critical, Low Warning, High Warning, and High Critical. Each trigger can be disabled or have a value. Not all four must have values. Only the ones which you're interested in having generate an event need to have values.

Hysteresis and debounce help to define exactly how the trigger behaves when a measured value rises through or falls through the trigger value. For example, if a trigger exists for 24.0 amps, and the measured value oscillates between 23.98 and 24.02, you probably don't want the setpoint event to be repeatedly triggered—perhaps sending an email every time. Helping to prevent those cases are what hysteresis and debounce are for.



Environment Settings

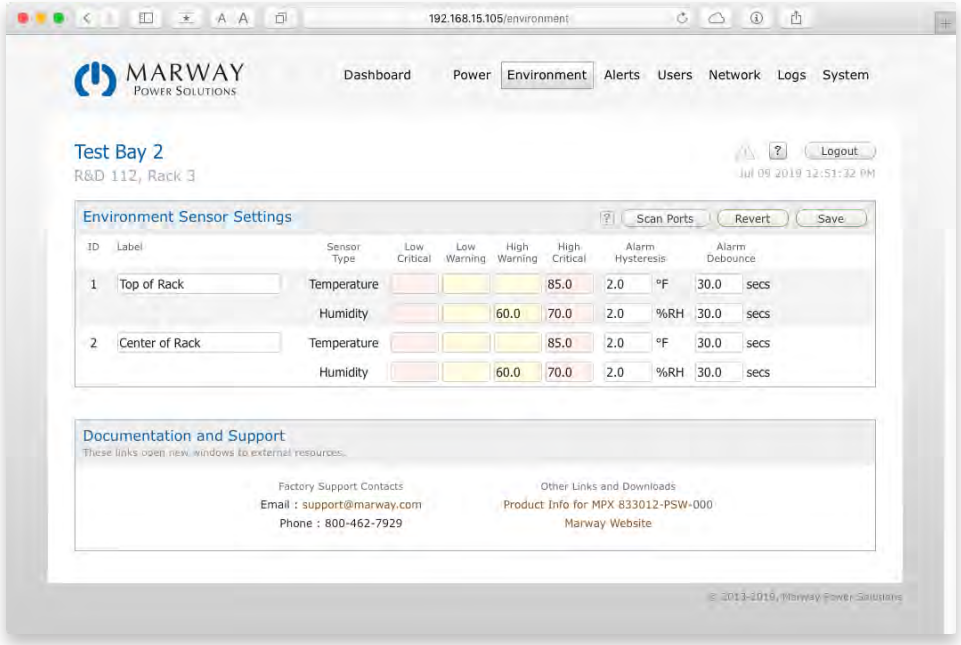
The main menu Environment page displays the adjustable settings for the temperature and humidity sensors.

Sensor Labels

RCM temperature and humidity (T/H) sensors come with one temperature and one humidity sensor combined into one physical housing. This combined unit can have a user-defined label to better identify the location or purpose of the unit. If the user does not enter labels, or sets one empty, the system will substitute a default label. Most RCM units will accept two sensor units. Each may have its own label.

Sensor Setpoints

Temperature and humidity of each sensor has its own setpoint. Like the power setpoints, each setpoint has four trigger values and two additional values named hysteresis and debounce. The four triggers are known as Low Critical, Low Warning, High Warning, and High Critical. Each trigger can be disabled or have a value. Not all four must have values. Only the ones which you're interested in having generate an event need to have values.



Alert Settings

This page is used to define event alerts—the optional email, SMS, and SNMP notifications which can be sent when an event occurs.

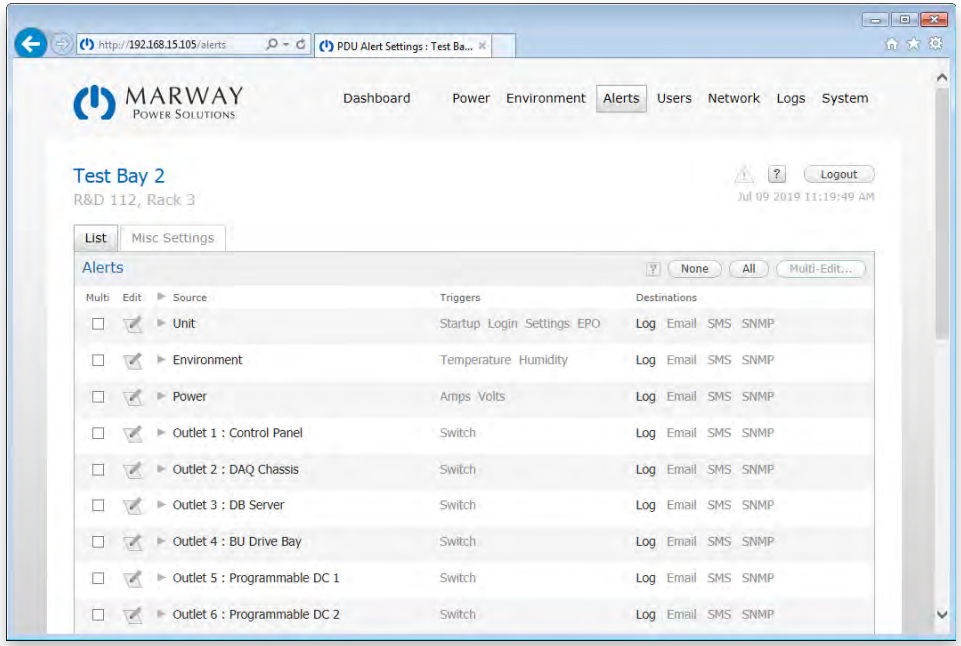
Each alert can be defined individually. Selecting the Edit icon will open a form to edit that one alert.

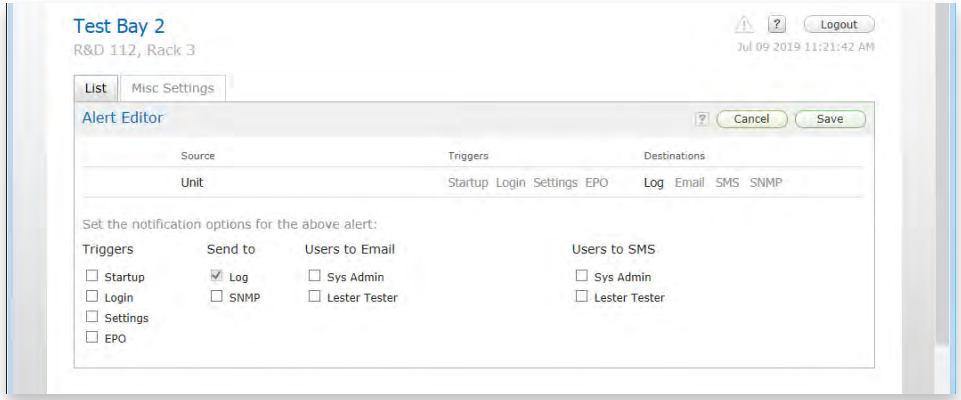
Alerts can also be edited in groups. Select the Multi checkbox of several events and click the Multi-edit button. The All button can be used as a shortcut.

The alert editor lists the alerts which will be changed, and presents the settings options. All events are automatically logged*, so the user interface displays the Log as a preselected default. Alerts can be sent by email, SMS, and SNMP. To send emails and/or SMS alerts, select which users are to receive the alert messages.

---

* Switch events triggered by the web UI are always logged. However, switch events triggered by CLI, SNMP, and REST can be disabled to prevent repeated, automated switching from filling the logs. These preferences are configured in the Log settings.





Back in the alerts list, the reveal triangles can be selected to show which users are getting which alerts. Select the triangle in the list header to reveal alert details for all events. Notice also that when an event is configured to send alerts, the labels in the Destination column will change from being inactive (dimmed) to active (not dimmed).

Notification Behavior Settings

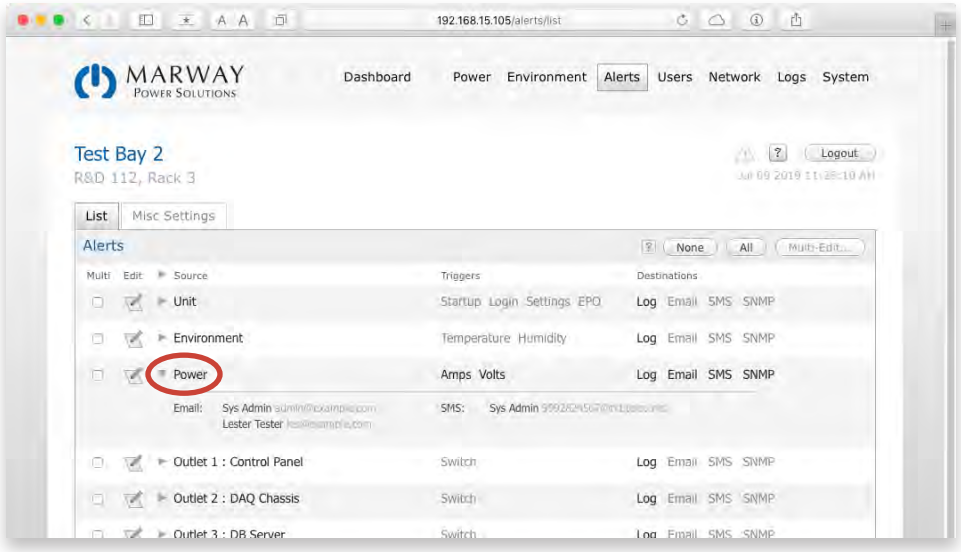
The Misc Settings panel presents two options: Re-Alert Interval and Silence Duration.

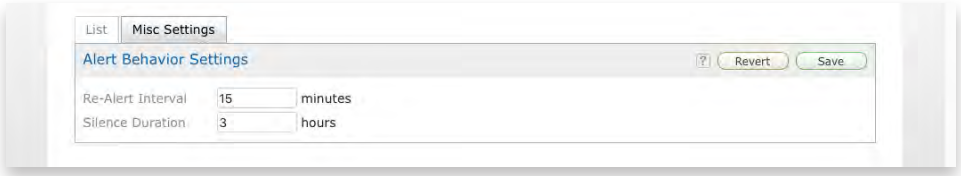
When an alarm type event (essentially, a setpoint) is triggered, and is set to send an email, that email is sent immediately. How do we know the user got the email? Each email and SMS message includes a web link for the user to acknowledge the alert. The user needs to open that link to inform the RCM software that the message was received.

Before that acknowledgment happens, there's some possible problem scenarios including the user may not get the email due to some technical problem. To help work around that and other scenarios, the alert system will repeat the email message until it is acknowledged. How often should it repeat? That's what the Re-Alert Interval is. As shown on the right, the email (and/or SMS) would be repeated every 15 minutes.

When an alert is acknowledged, that will stop the re-alerts. So, what if the user acknowledges the message and is distracted or prevented from addressing the problem? When do we "worry" that an alarm which continues to persist has been forgotten about? That's what the Silence Duration is for. An acknowledgment silences the re-alert for that period of time, after which the re-alerts will start up again.

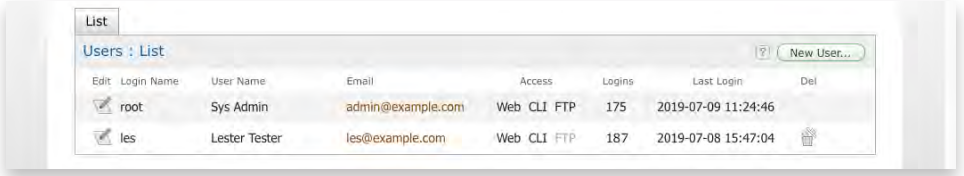
SNMP traps/notifications are sent one time only. It is assumed the SNMP Manager will be handling the details of keeping people and/or systems informed. Part of the SNMP message will be the RCM acknowledge ID.





User Settings

There are several features packed into the user settings. Only the highlights will be covered here. Selecting a user from the list, or starting a new user, presents the user editor form. That form has four main sections (five when editing an existing user).



Authentication

Authentication determines the credentials used to login into the PDU (via web or CLI). This is a login name and a password.

Access Methods

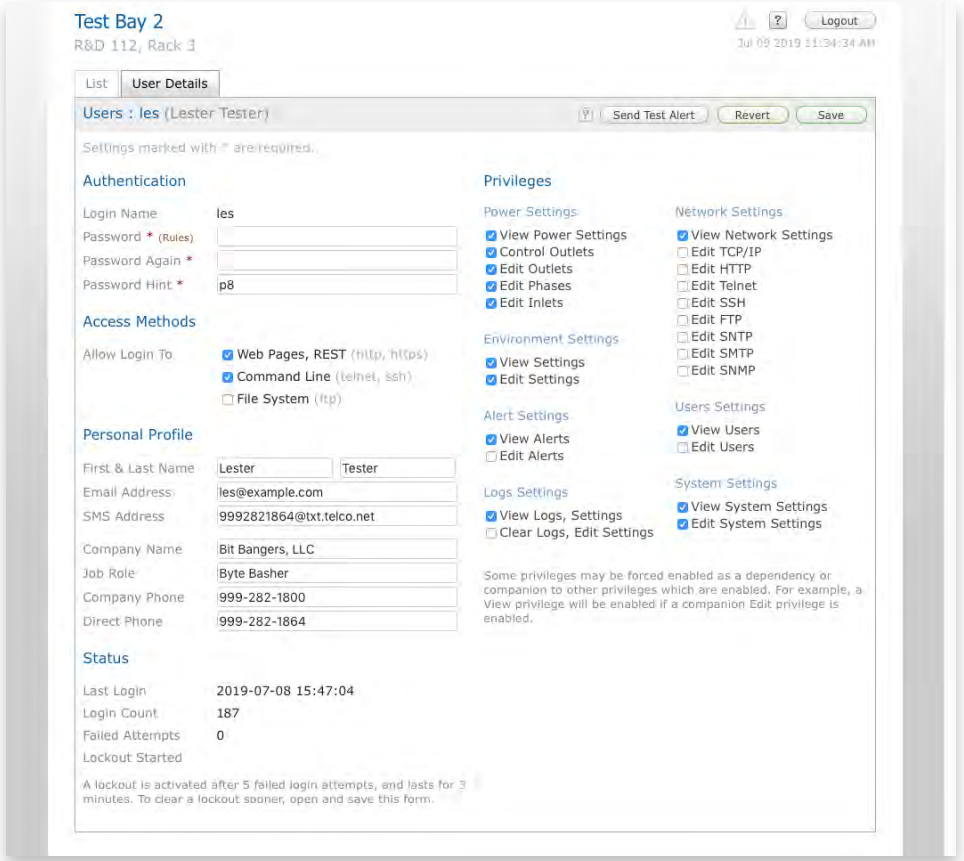
The Access Methods section determines whether the user can access the system via the web UI, the CLI, and the file system. If the none of the options are selected, this effectively disables a user record without having to delete it.

Personal Profile

This section is optional. It allows an administrator to store basic contact information. The Company and Job Role field can be useful to identify third-party vendors who may be allowed access—perhaps for support. The email address and SMS address (which is the mobile phone number in an email address format specific to the phone's carrier) are, of course, essential if the user wants to receive event alerts.

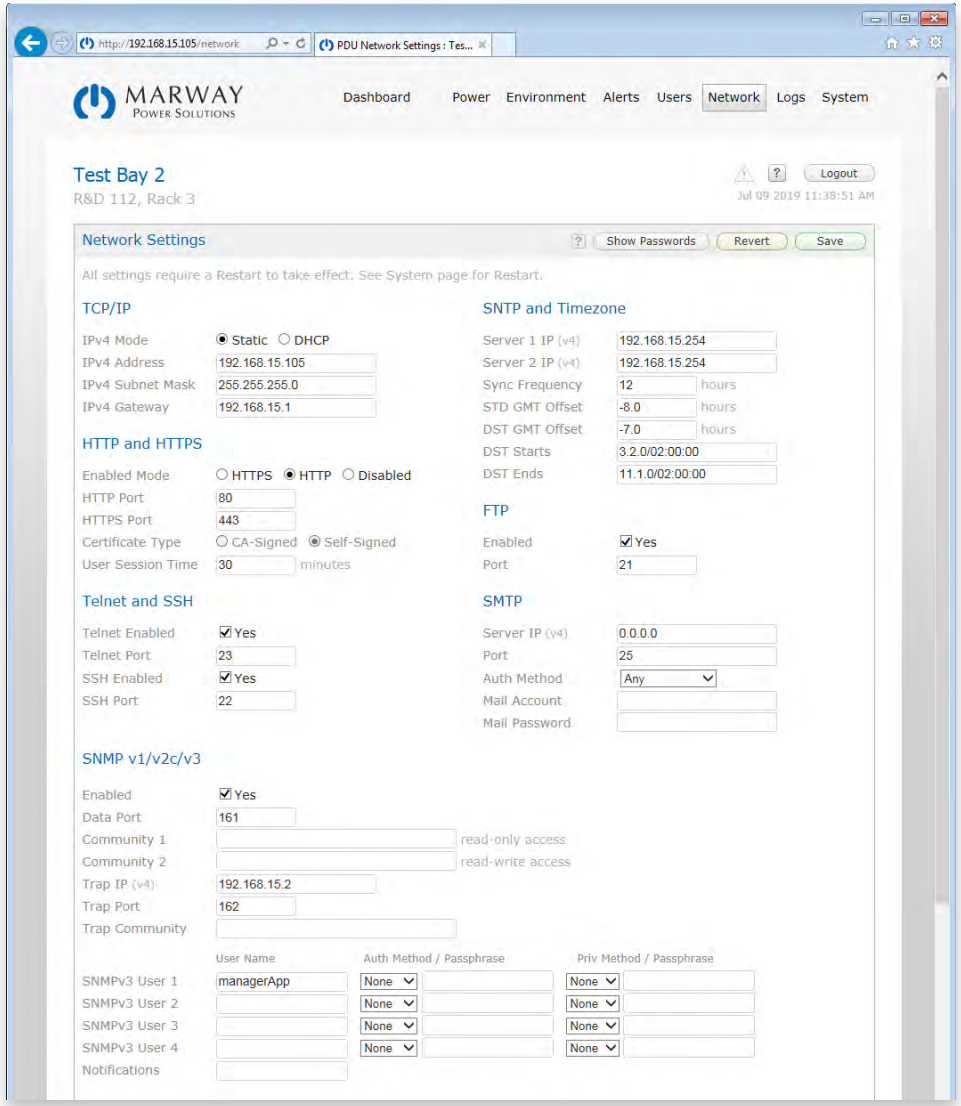
Privileges

The RCM software does not assign privileges based on user groups. Rather, each user is assigned distinct privileges to allow greater flexibility.



Network Settings

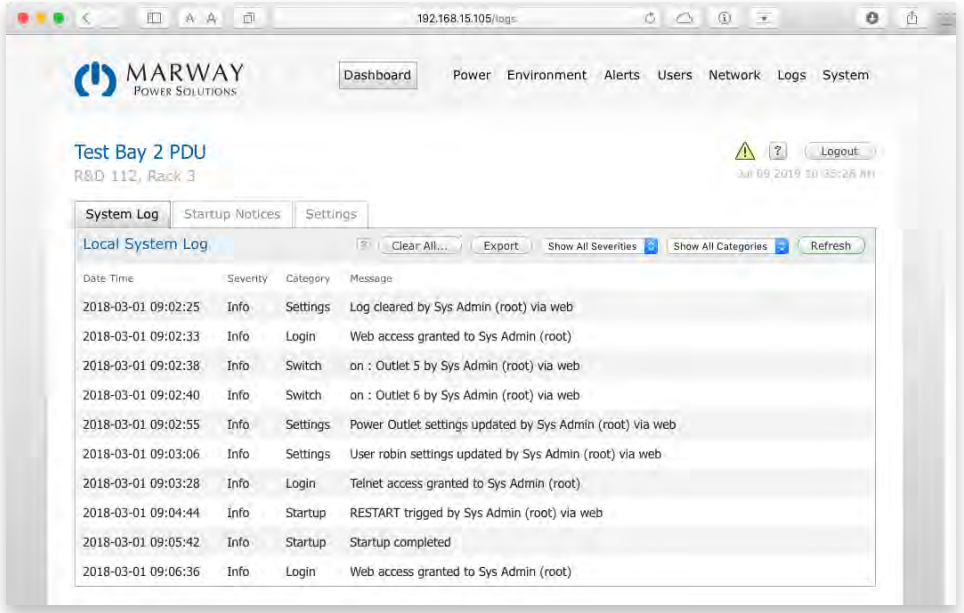
This page presents the settings details for all supported network protocols. Assuming you're familiar with these protocols, most settings should be self explanatory.

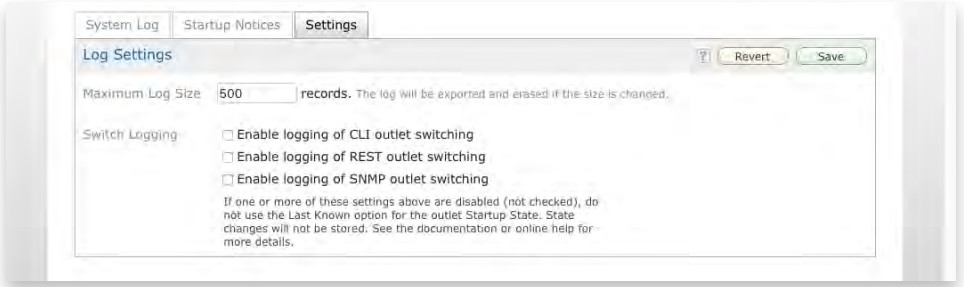


Log

On board logging can record up to 1000 events. User actions as logins, editing settings, and trigger software restarts are recorded including identifying the user and the protocol used. Power setpoint events are recorded as well as the process of sending alerts. Outlet switching is always records when performed through the web interface. Switching is optionally recorded if performed by CLI, REST, or SNMP. Disabling logging over these protocols would be used to prevent the flooding of logs with expected switching events triggered by automated scripts.

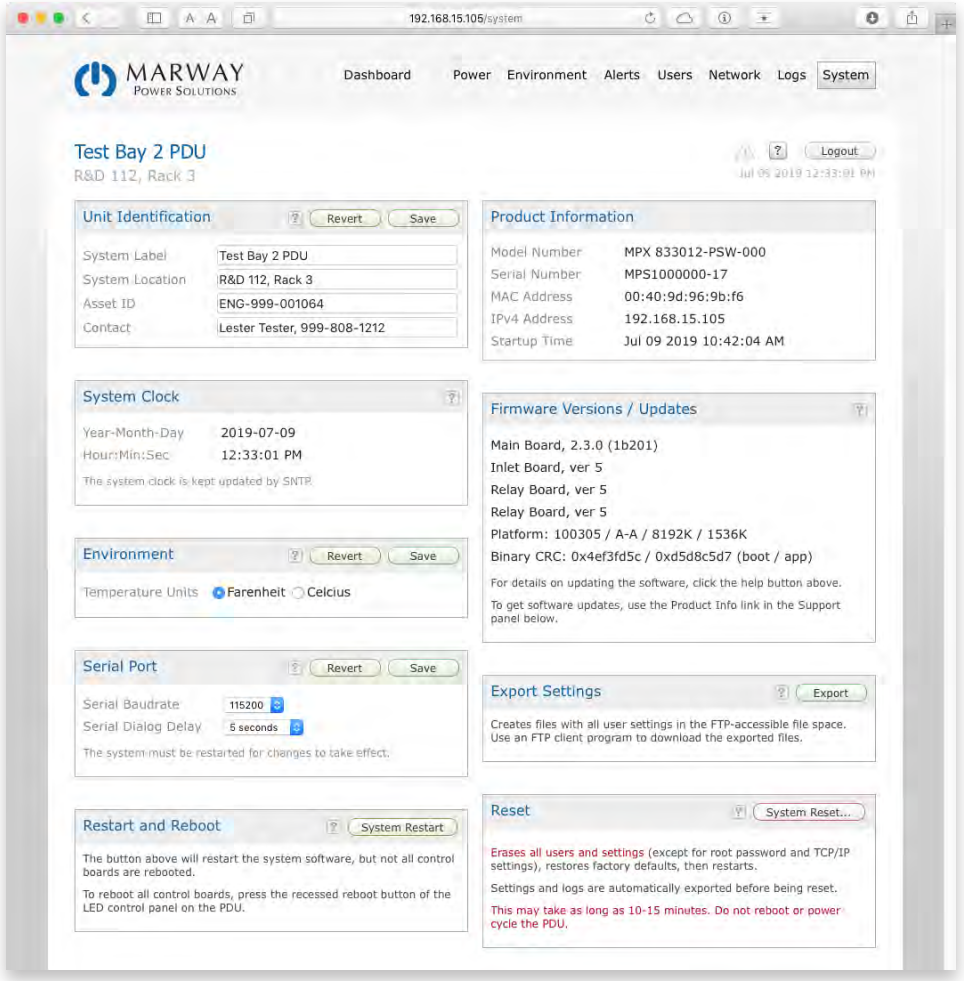
The Startup Notices are events which occur specifically during the startup process. These will also be shown in the Login window of the web interface. They're shown separately in these places so they're more likely to be noticed.





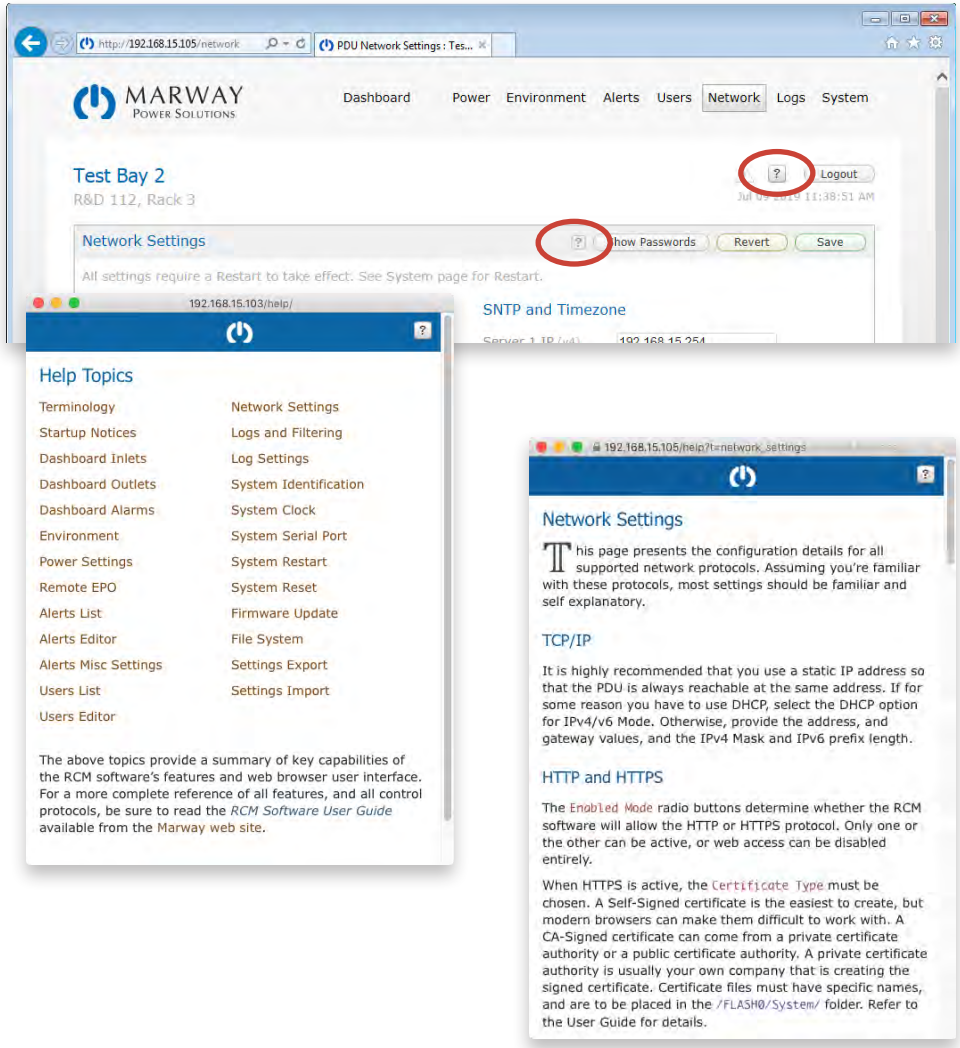
System Settings

The System page displays a number of unit-wide details about the product, as well as edit general purpose settings like the system label and location, the time, and a few others. All user settings can be exported from the System page to save those for documentation or even to import into other units.



Built-in Web Help

In the header of every web page is a Help button. This will open the built-in help system for the RCM software and display a topical index to explore further. Additionally, many of the individual panels on the web pages, such as the Network Settings panel shown to the right, will have a help button. This button will open directly to the help topic for that panel.



Command Line Interface Tour

After login, the CLI is organized into several get/set command sets such as these examples listed below, along with other miscellaneous commands:

- getOutlet / setOutlet
- getPhase / setPhase
- getEnvTemp/setEnvTemp
- getAlarm / ackAlarm
- getAlert / setAlert
- getUser / setUser, and addUser / deleteUser
- getTcp / setTcp
- getHttp / setHttp
- getSntp / setSntp
- getSmtp / setSmtp
- getSnmp / setSnmp
- getLog / getStartupLog
- getSystem / setSystem

Login

The login task is fairly straight forward, for Telnet and SSH, enter a user login name at the prompt, and a password. Using the CLI from the serial port does not require a login.

```
Marway RCM Command Line
------------------------------------------------------------------------------
Login: root
Password: ********
#> ?
------------------------------------------------------------------------------
Workspace      Get Commands    Set Commands      Misc Commands
------------------------------------------------------------------------------
POWER *        getOutlet       setOutlet         getOutlets
               getPhase        setPhase          getPhases
               getInlet        setInlet          getInlets

ENVIRONMENT *  getEnv                            scanEnvPorts
               getEnvTemp      setEnvTemp
               getEnvHumidity  setEnvHumidity

ALARMS *       getAlarm        ackAlarm          getAlarms, ackAlarms

ALERTS *       getAlert        setAlert          getAlerts
               getAlertMisc    setAlertMisc

USERS          getUser         setUser           getUsers, addUser, deleteUser
                                                 makeLoginPswd, randomizeRoot

NETWORK        getNetwork
               getTcp          setTcp            verifyTcp
               getHttp         setHttp
               getTelnet       setTelnet
               getSsh          setSsh
               getFtp          setFtp
               getSntp         setSntp
               getSmtp         setSmtp
               getSnmp         setSnmp
               getSnmpUsm      setSnmpUsm        verifyUsm, clearUsm

LOG            getLog          setLog            viewLog, exportLog
                                                 viewStartupLog

SYSTEM         getSystem       setSystem         exportSettings, updateExportKey
                                                 restart, quit, help, ?
------------------------------------------------------------------------------
Type 'help' before a command, or type '?' after a command for more details.
* Depending on the PDU configuration, some commands may not be supported.
------------------------------------------------------------------------------
#>
```

Built-in CLI Help

At any point after login, typing `help` or `?` at the prompt will display the top-level help which is a list of commands.

Each command can also be followed by a `?` such as `getSystem?` (with or without a space) to display detailed usage help for that command. The command help will identify the syntax of the command, various attribute options, and some examples.

Command Syntax

The majority of commands follow a common set or get pattern. The following are typical get commands:

- `getOutlet 8 switch`
- `getPhase 1 high_critical_amps`
- `getUser lester email`
- `getSystem location`

These are typical set commands:

- `setOutlet 1 switch on`
- `setPhase 1 high_critical_amps 14.5`
- `setUser lester email “les@example.com”`
- `setSystem location “Aisle 6 Rack 4”`

You’ll notice the pattern of get and set are identical except for the last parameter of the set command which passes the new value. Otherwise, both use the same syntax of:

commandName instanceID attribute [setValue]

Where *commandName* is something like `getOutlet`, `getUser`, `setPhase`, etc. The *instanceID* is going to be the numerical ID of a power device such as an

```
#> help getSystem

-------------------------------------------------------------------------------
  Syntax:  getSystem [attribute]

   Where:
     []            : indicates an optional parameter
     attribute     : is one of the following (or its alias):

       label             --
       location          (loc)
       asset_id          (asset)
       contact           --
       model_number      (model, model_no)
       serial_number     (serial, serial_no)
       web_link          (link)
       mac_address       (mac, mac_addr)
       dialog_baudrate   (baud)
       dialog_delay      (delay)
       version           --
       platform          --
       degrees           --
       start_time        (started)
       time              --

   Examples:
     getSystem label     : gets one attribute of the system
     getSystem           : gets all attributes of the system
     getSystem export    : exports user settings to FTP file space
-------------------------------------------------------------------------------

#> ▌
```

outlet, phase, etc., or the login name of a user. A few commands do not need an instance ID such as `getSystem`/`setSystem` where there's always one implied instance. The *attribute* is the specific detail being requested or set. Finally, if the command is a `set`, the fourth parameter is the new value.

Aliases and Variants

Commands are flexible in two ways. First, many command attributes have aliases. These aliases are revealed in the command help. For example, the `getSystem` command has an attribute `model_number`. That attribute name may be substituted with `model_no` or even `model`. So, `getSystem model` is the same command as `getSystem model_number`.

The second flexible feature is command variants. These are different ways of using the command to get different results—namely whether to get/set information for a single instance or multiple instances.

A get command used like these examples:

```
getOutlet 4 switch
getUser lester email
```

will return one attribute for one specific instance.

A get command used like these examples:

```
getOutlet 4
getUser lester
```

will return all attributes for one specific instance.

A get command used like these examples:

```
getOutlet
getUser
```

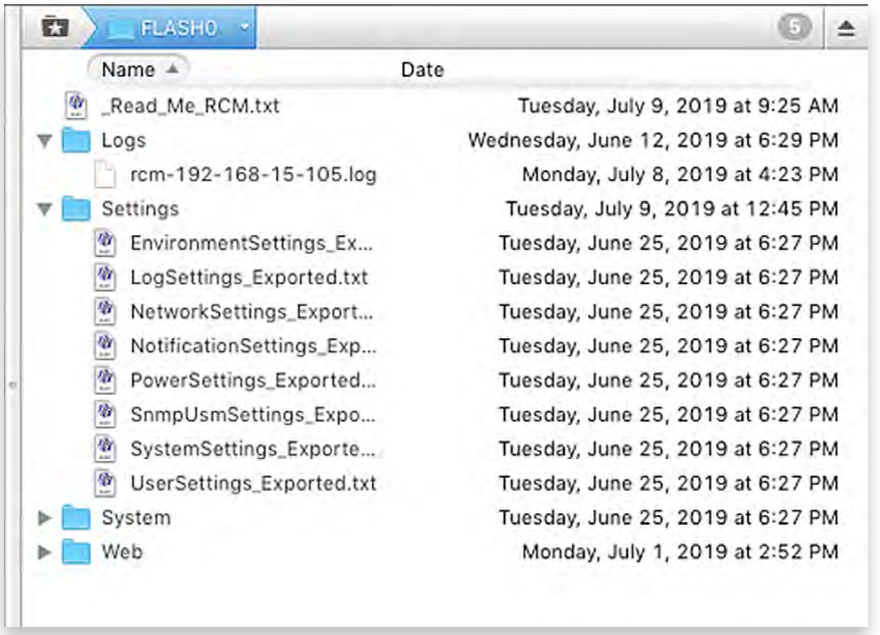
will return all attributes for all instances.

```
#> getOutlet 1 switch

   Outlet ID             = 1: Control Panel
   Panel Name            = J1
   Switch State Now      = off

#> getOutlet 1

   Outlet ID             = 1: Control Panel
   Panel Name            = J1
   Rated Volts           = 120 Vac (AN)
   Rated Amps Maximum    = 20 A (A)
   Rated Amps Continuous = 16 A
   Connector             = 5-20R
   Switch State Now      = off
   Switch Startup State  = off
   Switch On Delay       = 0.0 s
   Switch Off Delay      = 0.0 s
   Switch Cycle Delay    = 5.0 s
   Alert Relay Change    = yes

#> ▌
```

FTP and the File System

An on-board file system is used to store exported settings and logs, SSL files, and web files. This file system is accessible through FTP.

Settings files can be exported then downloaded for archiving. They may even be edited and uploaded to another unit. This allows preconfiguration of many details (particularly for users and network settings) which can then be uploaded to multiple products.



Local LED Display

The LED display and keypad (optional on some models) is used to display power values, switch states, and environment sensor values.

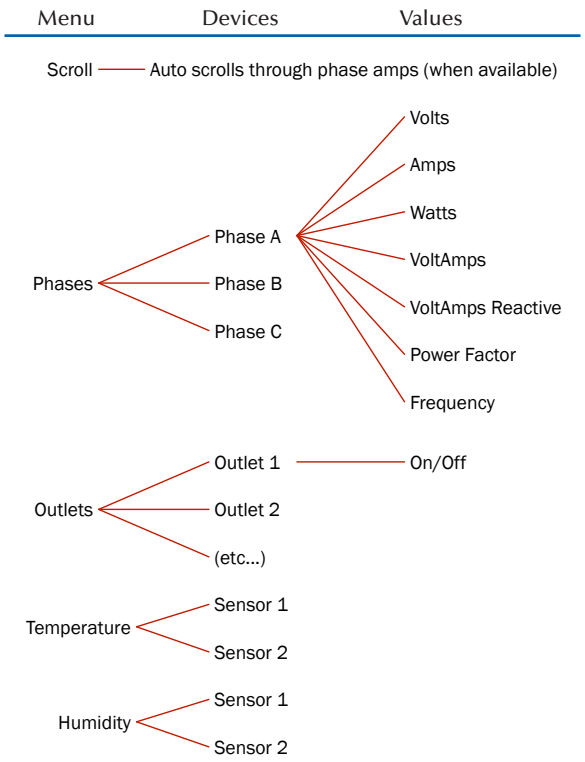
The display defaults to auto-scrolling through each phase's amps when there's no user interaction. Otherwise, the user can manually select any of the available values by using the six pushbuttons on the keypad.

The Menu buttons cycle through the main display sections of Scroll, Phases, and Outlets. With either Phases or Outlets chosen, the display will show the first value of the first device such as Phase A Volts.

The Devices buttons cycle through the list of instances. So, if Phases was chosen, the display would start at Phase A Volts. A press of the Devices right arrow would update the display to Phase B Volts, then Phase C Volts, and back to Phase A Volts.

The Values buttons cycle through the values of the selected device. So, if Phases was chosen, the display would start at Phase A Volts. A press of the Values right arrow would update the display to Phase A Amps, then Phase A Watts, etc.

At this point, pressing the Devices right arrow would update the display from Phase A Watts to Phase B Watts, thus allowing easy scrolling through the same value for all device instances.



Scripting

Automating data collection and outlet switching can be accomplished using three distinct techniques: the SNMP interface, the command line interface over Telnet or SSH, or the RESTful API.

Of these, the RESTful API (commonly just called REST), is likely the newest technique to most people. Scripting with REST is similar to scripting the command line, but the commands and responses are more efficient as they're intended for machine to machine data exchange whereas the command line interface has a verbosity to it designed for human reading.

With the command line, your scripting language includes a built-in Telnet or SSH library. You create a connection, formulate a command as a string to send to the target device, and you get a string response which must be parsed to extract the piece of data needed.

Using REST is similar except you use an HTTP library instead of Telnet. Commands are crafted as URLs and form fields. The response is also a string, but requires little or no parsing (other than type casting), because the reply is formatted as data only—there's no extra human-oriented text in the response.

The result of using REST is a more efficient dialog between the systems as each is using an interface designed for machine-to-machine data exchange.

```
def connect(host, account, pswd)
  @last_command = ''
  @rcm = Net::HTTP.new(host)
  session_id = send_command("POST /session?account=#{account}&password=#{pswd}")
  return session_id
end


def send_command(command)
  @last_command = ''
  request = parse_command_string(command) if command.kind_of?(String)
  request = parse_command_task(command) if command.kind_of?(Hash)
  rest_result = ''
  @last_command = "#{request[:method]} #{request[:url]} #{request[:query]} "
  @rcm.start if !@rcm.started?
  case request[:method]
    when :GET;    rest_result = send_get(request)
    when :POST;   rest_result = send_post(request)
    when :PUT;    rest_result = send_post(request)
    when :PATCH;  rest_result = send_post(request)
    when :DELETE; rest_result = send_post(request)
    when :HEAD;   rest_result = send_post(request)
  end
  result_body = ''
  result_body = rest_result.body if rest_result.code == '200'
  return result_body
end
```

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Software Operation

This chapter covers the most commonly used operational features of the RCM software which primarily revolves around the web interface Dashboard page, and a few CLI commands. If you have not yet read them, you may want to read to these sections for an overview:

- For Setup instructions, refer to "Setup with the Serial Dialog" on page 13.
- For an overview of the organization and features of the web browser interface refer to "Web Browser Interface" on page 24.
- For an overview of the command line interface refer to "Command Line Interface Tour" on page 39.

Login

Full access to the software's features and settings is available using HTTP, HTTPS, Telnet, or SSH. Limited feature access is available through SNMP and the HTTP RESTful API. Additionally, access to the file system (not needed during normal operation) is available using FTP.

Each protocol has a unique login interface, but all use the same login name and password except for SNMP which uses it's own access pass names and codes. The login name is sometimes referred to as the user account name. Regardless of the label used, it refers to the PDU authentication credentials as entered in the User Settings form.

For discussion purposes, assume the PDU has been configured with an IP address of 192.168.15.105. We will further assume the predefined user root will be used for the examples.

FEATURES AND IMAGES WILL VARY.

Not all products include all features discussed in this Guide. The descriptions and product images throughout this Guide come from a variety of products and models featuring the RCM software. Various product models and custom products will include different combinations of power monitoring and switching control. You will need to understand which features your PDU model has in order to identify which feature discussions are applicable to the model you have.

DNS Names vs IP Addresses

Your network administrator may have a domain name assigned to the PDU IP address, and you may have been instructed to use that name. It may be something like www.pduname.com or pdu.company.com to access a PDU across the Internet, or something like deptserverspdu.local to access the PDU on your local building network. These are DNS names, and can be used instead of the numeric IP address to connect to the PDU. However, in the PDU's own network settings, IP addresses must be used, not DNS names.

HTTP/HTTPS (“Web”) Login

To access a PDU by the web, type the IP address in a web browser’s address field such as http://192.168.15.105. If the PDU has been configured to use https, then use https:// instead of http:// at the start of the address.

The web login form includes four panels of information. Below the Marway logo, the top of the main white panel identifies the PDU’s label and location. In the example screen capture, the label displays as Test Bay 2 PDU. This label and the location description below it are assigned by a PDU administrator.

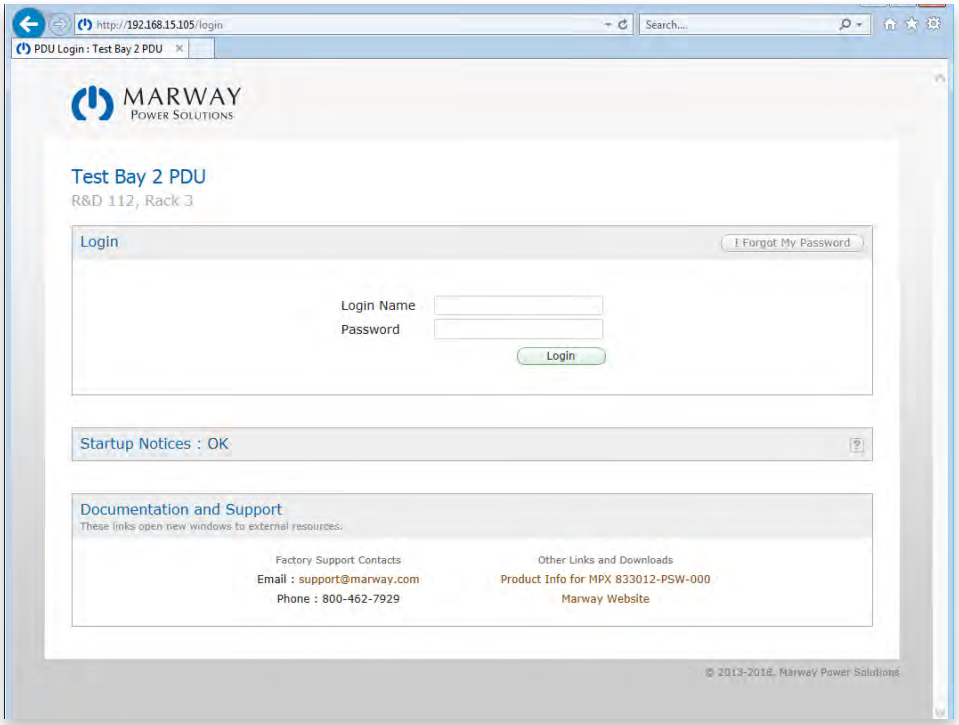
Below the PDU label is the Login panel which includes the form to enter the user’s login name and password. The login name is a unique name assigned to the user specifically for logging in. There is one default login name of root which automatically has access to every feature and setting. The root account must be used to do the initial setup of all settings since there would be no other users defined yet.

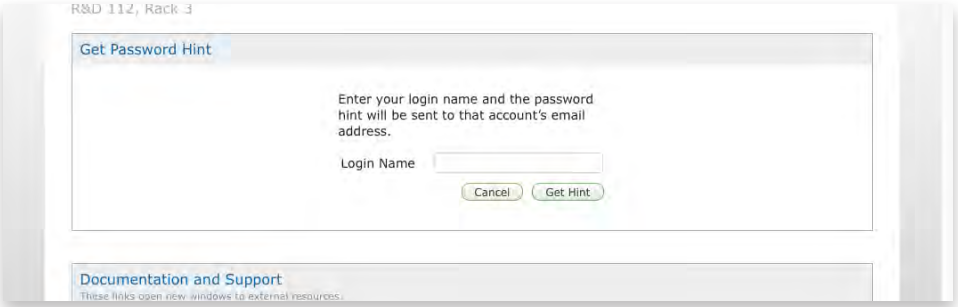
I forgot my password

The I forgot my password button opens a form where the user enters an email address. Each user setup includes a Password Hint field. This field accepts a short text entry intended to help the user remember what the password is, or how to find it. This hint is emailed to the user by the Get Password Hint form. The email address must match an existing user’s address.

If the user still cannot remember the password, another PDU user allowed to edit user settings will have to create a new password. This may be the root account holder, or another user.

If the root user password is forgotten, there are two possible ways to change it. First, if another user is allowed to edit users, that person can update the root password on the Users setting web page. Otherwise, use the setup process described in “Serial Dialog: root User Password” on page 16 to reset the root password.





Startup Notices

This panel will show any errors encountered during the startup of the PDU. The sample login page above did not have any startup errors, and the panel title shows an “OK” status. The sample login page to the right shows one message.

The types of messages that may show up here would include problems with missing or malformed settings, or hardware errors detected by the system.

Documentation and Support

This panel is repeated on every page of the web interface for the PDU. It simply offers links to support services and online reference material.

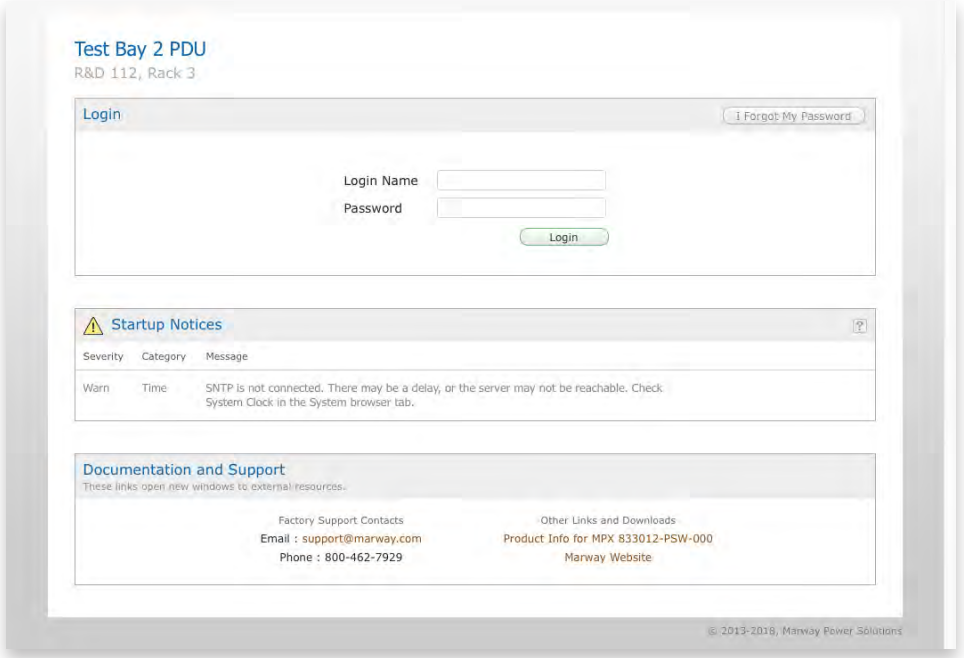
Telnet Login

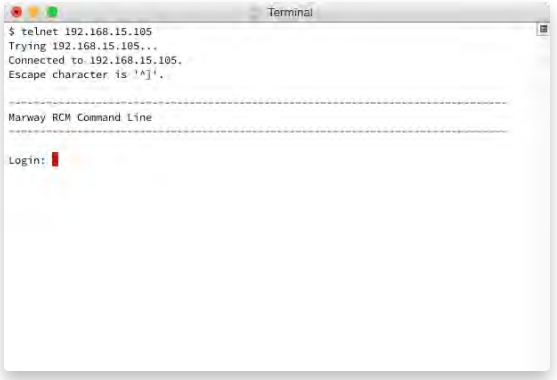
Telnet is a command line program already installed on most computers. It must be enabled on Windows (search the internet for “enable Telnet on Windows”). Since version 10.13 High Sierra, Telnet has been removed from macOS (it can be installed through a package manager like `homebrew` or `ports`).

To log into the PDU using Telnet, open your operating system’s command line interface. Type the word `telnet` followed by an IP address or DNS name for the PDU like these examples:

```
telnet 192.168.15.105
telnet pdu3.mycompany.com
telnet testbay2pdu.local
```

Once connected, you will be prompted for a Login (the login name) and a Password.





SSH Login

SSH is a command line program already installed on most Linux, Unix, macOS, and Windows 10 computers. For versions of Windows before 10, you will need to install an SSH program. There are several popular programs for this. Consult your IT or network administrator if you have one. The rest of this discussion assumes the installation has been completed.

To log into the PDU SSH, open your operating system's command line interface. Type the word `ssh` followed by a space, the PDU login name, an @ symbol, and an IP address or DNS name for the PDU like these examples:

```
ssh root@192.168.15.105
ssh lester@pdu3.mycompany.com
ssh jsmith@testbay2pdu.local
```

You will be prompted for the user password (the user name was already provided in the command above). Given the small, embedded operating system driving the RCM software, the use of key authentication is not available.

SSH Client Configuration

You may get an error like "No Matching MAC found" trying to log into SSH. When trying to connect via SSH, if you see an error message similar to this, you may have to manually specify a Message Authentication Code (MAC) for the connection. Recent OSes may not support the legacy MACs of the RCM embedded OS. Try the following -m option in your connection string:

```
ssh root@x.x.x.x -m hmac-md5
```

If you get another error indicating `hmac-md5` is not available, you can do a web search for discussions of restoring legacy MACs on your particular OS.

The Difference Between Telnet and SSH

The short version is that SSH is more secure than Telnet. With Telnet, the information exchanged between your computer and the PDU is not encrypted. It is possible, under very specific circumstances, for a skilled person to intercept that information. A worst case scenario would allow them to capture your login credentials and gain access to the PDU as though they were you.

With SSH, all traffic including the login is encrypted. This makes interception of the information pretty much useless (though nothing in the digital world is ever absolutely secure).

The Difference Between HTTP and HTTPS

If you substitute HTTP for Telnet above, and HTTPS for SSH, the story is pretty much identical. HTTPS is encrypted, where HTTP is not. However, the PDU determines whether you need to use HTTP or HTTPS based on the Network settings.

Which Should You Use?

Wherever possible, using SSH and HTTPS are the more secure choices. Yet, the others still exist. Many people choose to use Telnet and HTTP over the more secure options when they communicate over a closed, local network where the risk of someone capturing data to perform an attack is low (depending on the environment of course). If you're accessing the PDU across the Internet, use HTTPS and SSH. If you choose to use HTTP or Telnet, we assume you know why you're doing that.

However, rather than rely on modifications to the system-wide ssh config, which your network admninistrator may not appreciate, you can be more specific to the user and RCM device as possible.

On most *nix systems, edit the file ~/.ssh/config for the specific user who will be using ssh (create the folder and file if needed). The location of this file on Windows will depend on which ssh system you install. Edit the config file to include the following:

```
01  Host x.x.x.x           # replace with RCM IP
02    Ciphers aes128-cbc   # or aes192-cbc, or aes256-cbc
03    MACs hmac-md5        # only option RCM has
```

Where:

- In line 01, specify the IP address of a specific the RCM PDU.
- In line 02, specify the exact cipher you want to use. There are a few options to choose from.
- In line 03, specify the exact MAC you want to use. RCM's OS offers only the one MD5 option.

If you have multiple RCM devices to connect to, you can list multiple IP addresses separated by a space, or repeat the set of lines for each RCM IP address you'll be using.

Refer to https://www.ssh.com/ssh/config/ for more information.

Five Strikes / Three Minutes

If a user fails to enter the correct password 5 times in a row, that account will be blocked for about 3 minutes. This means that even if on the 6th try, the password is entered correctly, the PDU will reject the login. The user must wait for 3 minutes before trying again.

This is done to prevent a certain type of attack where an automated system tries password guesses as quickly as possible.

Viewing Power Data

The Dashboard

The Dashboard web page is the focal point for reviewing all active data on the PDU—providing the most convenient way to see the most data at one time.

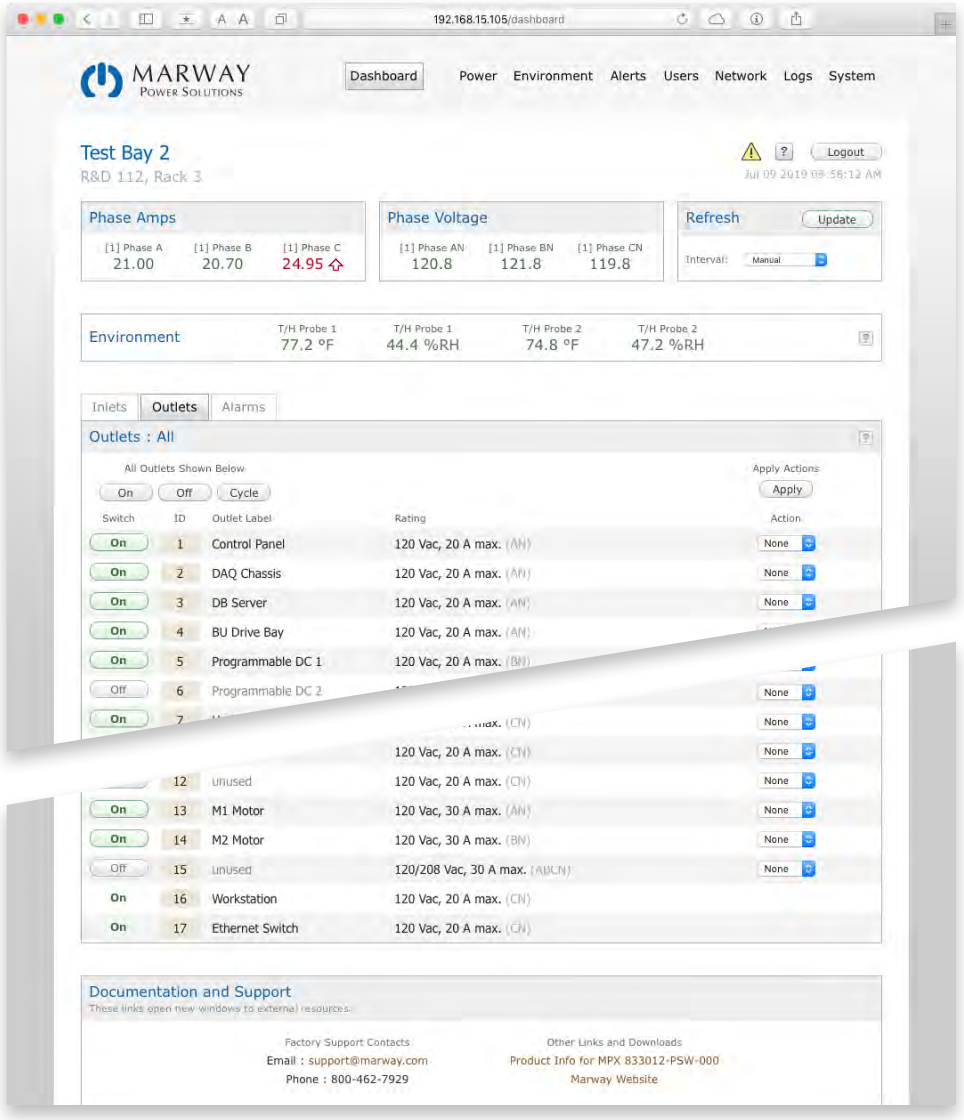
This browser view shows the default Dashboard layout for a three-phase inlet power-monitored system with outlet switching for a number of outlets. It also shows two connected temperature/humidity sensors. Everything above the three panels titled Phase Amps, Phase Voltages, and Refresh is common to all web pages. This includes the main menu tabs at the top, the PDU label and location (which are defined in the System tab), and the cluster of items by the Logout button.

Inlet Data

An Inlet is the combination of conductors providing power to the PDU. In RCM terminology, this comprises the current phases (individual conductors), and voltage phases (pairs of conductors).

A current Phase is a single conductor (a wire) from an Inlet. Inlet current Phases carry the full current load of the PDU, which can be measured. These values are useful for understanding how close the PDU is operating to the limit of an upstream circuit breaker.

A voltage Phase is a pair of conductors across which voltage can be measured. Knowing this value indicates how stable the incoming power is which may be critical to some types of equipment powered from the PDU.



Depending on the model, the PDU inlet may be equipped with power monitoring, current monitoring, or no monitoring.

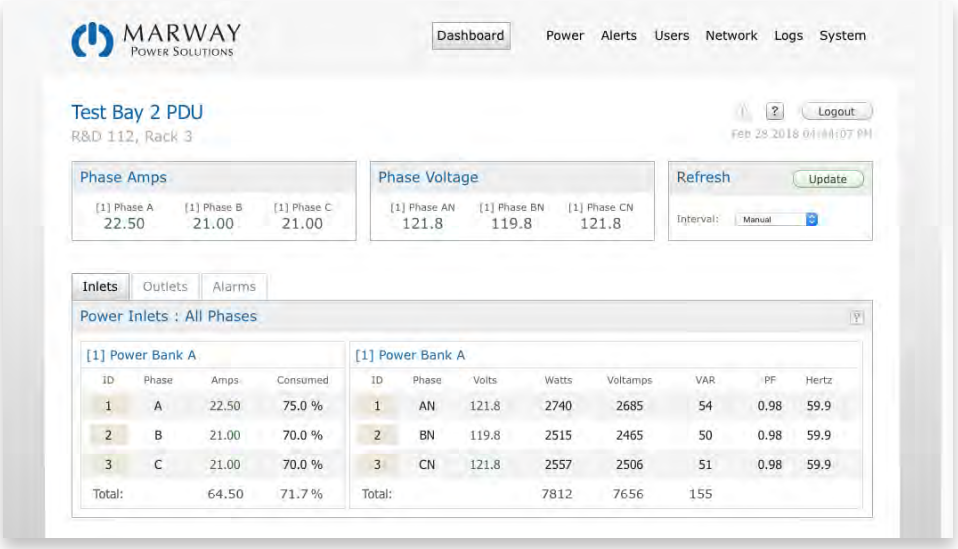
- Power monitoring measures both current and voltage at the inlet(s), and is able to derive power data such as watts, voltamps, power factor, and more. With inlet power monitoring, the Phase Amps and Phase Voltage panels will show measured data. Additionally, the Dashboard will have an Inlets tab in the sub panels as shown in the top right image.
- Current monitoring measures only current for one 1ϕ or 3ϕ inlet. The Phase amps panel will show measured data. The Phase Voltage panel will display the rating for reference, but not data. There will not be an Inlets tab in the sub panels.
- If there is no inlet monitoring at all, there may still be inlet ratings available for viewing as seen in the lower image.

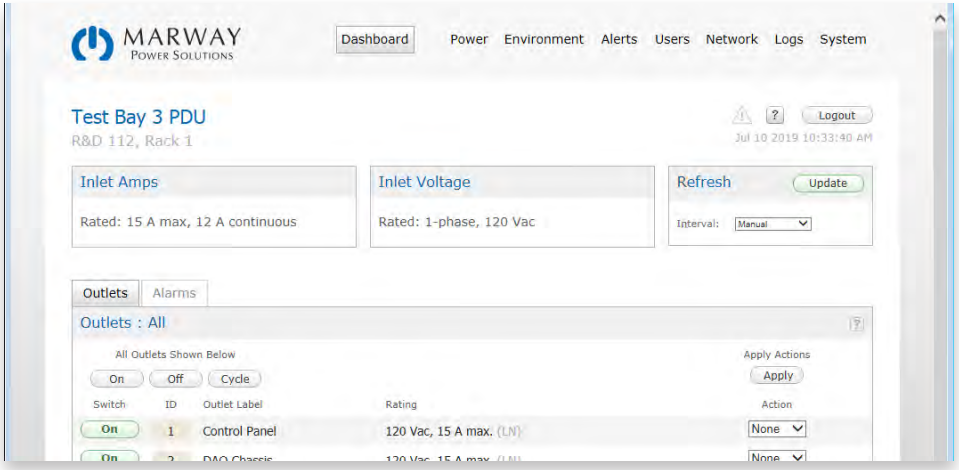
If the PDU is equipped with inlet monitoring, data values are available to view on the web Dashboard, through the CLI command `getPhase`, through SNMP, and through the RESTful API. This section will discuss the human interfaces for the web and CLI. See "SNMP Support" on page 172 for details about SNMP, and "RESTful API Reference" on page 159 for details about the RESTful API.

Since various models and options will have different power monitoring capabilities (or even none at all in switched-only systems), the software views displayed throughout this user guide may vary from your actual unit.

Inlet Data via Web Dashboard

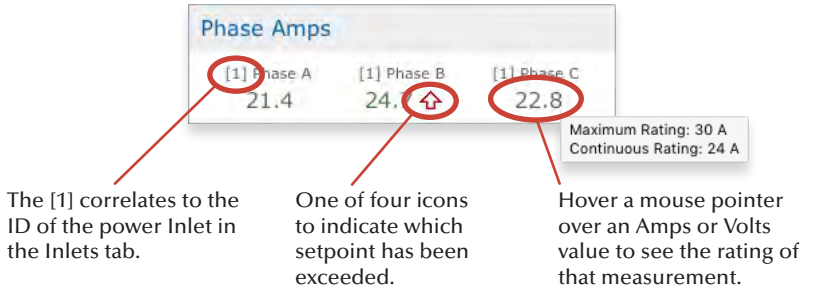
If the PDU includes power or current inlet monitoring, the Dashboard will display the top three data panels shown in the Dashboard screen captures of this guide. The left panel provides a summary of the current loads on all phases of the inlet(s). The center panel shows the voltages of all phases. For current-monitored systems, the voltage panel will display the rating of the power inlet.





Web Dashboard Inlet Summary

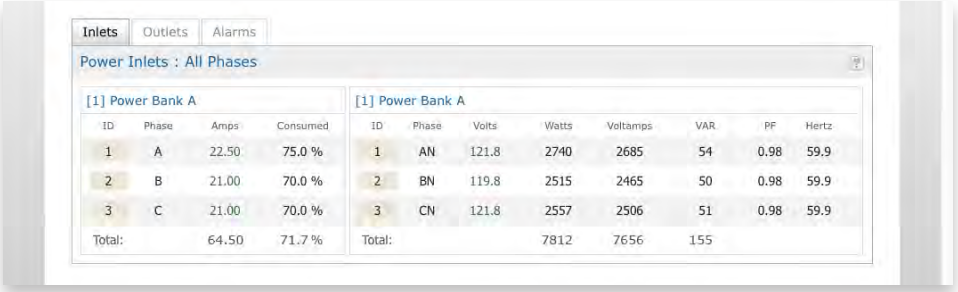
If included on your PDU, the Inlet Amps and Inlet Voltages panels provide an overview of amps and volts as measured at the inlet. Current Monitored systems will show rated volts instead of measured volts. Regardless of which of the lower tabbed views is visible (Inlets, Outlets, Alarms), the top panels remains visible as a system summary. These panels will also show the status of setpoint alarms. See "Dashboard Setpoint Status Display" on page 67 for examples of how alarm status is displayed with amps and volts values.



Web Dashboard Inlet Details

The Inlets tab displays details of all Phases. The data includes the measured current, voltage, and derived power data of each Phase. Amps and Volts have setpoints, and the display of these values may include an icon depicting an alarm status. See "Dashboard Setpoint Status Display" on page 67 for examples of how alarm status is displayed with amps and volts values.

The label for each Inlet (shown as "Inlet 1" by default) can be edited, but the labels for each Phase are fixed using the phase identifiers. See "Power Settings" on page 105 for details on changing the Inlet label as well as the Phase setpoint settings.



Inlet Data via Command Line

Access to power data on the command line comes in the form of four commands, each one specific to a power device: `getInlet`, `getPhase`, `getCircuit`, and `getOutlet`.

Each command may be used in various forms to extract data in a variety of ways. Review "Command Syntax" on page 118 for details of CLI get command syntax patterns.

CLI Inlet Data

The command `getInlets (pg.120)` displays a number of ratings details for the power inlet, as well as some power data for three-phase units (data which can be summed from measured phases). Use `setInlet (pg.121)` to change the inlet label.

CLI Phase Data

Within the electrical power industry, the term Phase gets used to mean two things. It can be a single conductor (a wire) of a power source on which current is measured, and it can be a pair of conductors across which voltage is measured.

In the RCM software, single-phase conductors are labeled L(ine) and N(eutral). Therefore, the system will use the labels Phase L and Phase LN to refer to the current and voltage phases.

For three-phase systems, current phases are labeled A, B, and C. For delta configurations, voltage phases are labeled AB, BC, and CA. For wye configurations, voltage phases are labeled AN, BN, and CN.

In the RCM software, a Phase object is inherently a component of the inlet. Therefore, the current Phase measurements are the full current load of the PDU. This value is useful for understanding how close the PDU is operating to the limit of its capacity, and to the limit of the upstream facility circuit breaker.

Commands to view power data.

```
Login: root
Password: ********

#> ?

-------------------------------------------------------------------------
Workspace    Get Commands     Set Commands       Misc Commands
-------------------------------------------------------------------------
POWER        getOutlet        setOutlet
             getPhase         setPhase
             getInlet         setInlet
```

From a 3-ph wye inlet with power monitoring.

```
#> getInlet

   Inlet ID              = 1: Inlet 1
   Panel Name            = Main Power
   Configuration          = 3-phase Wye (ABCN)
   Rated Volts           = 120/208 Vac
   Rated Amps Maximum    = 30 A
   Rated Amps Continuous = 24 A
   Connector             = L21-30P
   Amps RMS              = 18.60 A
   Consumed Max Amps     = 62.0 %
   Watts                 = 3869 W
   Voltamps              = 3791 VA
   Voltamps Reactive     = 77 VAR
```

From a 1-ph inlet with no monitoring.

```
#> getInlet

   Inlet ID              = 1: Inlet 1
   Panel Name            = Main Power
   Configuration          = 1-phase (LN)
   Rated Volts           = 100 to 240 Vac
   Rated Amps Maximum    = 20 A
   Rated Amps Continuous = 16 A
   Connector             = C20
```

The `getPhase` command displays a range of possible values depending on the supported features. Refer to `getPhase (pg.122)` for additional command details, but the basic command formats to view power data are:

`getPhase [id]`	returns all power data and settings
`getPhase [id] power`	returns only power data

For current-monitored inlets, the system will provide measured amps. For power-monitored inlets, the system will provide measured amps and volts, and a number of derived calculations such as watts, voltamps, power factor and more.

When phase volts and/or amps measurements are included, they will have setpoints. The display of measurement values may include an alarm indicator. See "CLI Setpoint Status Display" on page 68 for examples of the various ways which data and alarm status are displayed.

The label for each Phase is fixed to the phase name, however see `setPhase (pg.122)` for details on changing the amps setpoint settings.

Outlet Data

A power Outlet is a single power connector mounted to the PDU chassis for providing power to a connected piece of electrical equipment. It may be a female receptacle, one or more pins in a multi-pin connector, or even a screw terminal—anything which conveys power from inside the PDU to a piece of equipment connected to the PDU.

Depending on the model, the PDU may or may not be equipped with outlet switching (or even a mix of some outlets being switched, and some not as shown to the right). Regardless of the presence of switching, outlet devices are still defined with ratings and user labels which can be viewed and altered.

```
#> getPhase 1

   Phase ID               = 1: AN
   Rated Volts            = 120 Vac (AN)
   Rated Amps Maximum     = 30 A (A)
   Rated Amps Continuous  = 24 A
   Amps RMS               = 18.4 A
   Consumed Max Amps      = 61.3 %
   Volts RMS              = 120.3 Vac
   Frequency              = 59.9 Hz
   Watts                  = 2213 W
   Voltamps               = 2305 VA
   Voltamps Reactive      = 619 VA
   Power Factor           = 0.96 leading
   High Critical Amps     = disabled
   High Warning Amps      = disabled
   Low Warning Amps       = disabled
   Low Critical Amps      = disabled
   Hysteresis Amps        = 0.5 A
   Debounce Amps          = 10.0 s
   High Warning Volts     = disabled
   High Warning Volts     = disabled
   Low Warning Volts      = disabled
   Low Critical Volts     = disabled
   Hysteresis Volts       = 4.0 V
   Debounce Volts         = 10.0 s
```

```
#> getPhase 1 power

   Phase ID               = 1: AN
   Amps RMS               = 18.4 A
   Consumed Max Amps      = 61.3 %
   Volts RMS              = 120.3 Vac
   Frequency              = 59.9 Hz
   Watts                  = 2213 W
   Voltamps               = 2305 VA
   Voltamps Reactive      = 619 VA
   Power Factor           = 0.96 leading
```

Outlet Data via Web

The Outlets tab is often “command central” of the dashboard (assuming outlet switching is the most common control task). In this section, we’ll focus on the layout of the Outlets panel. For outlet switching details, refer to “Outlet Control” on page 58.

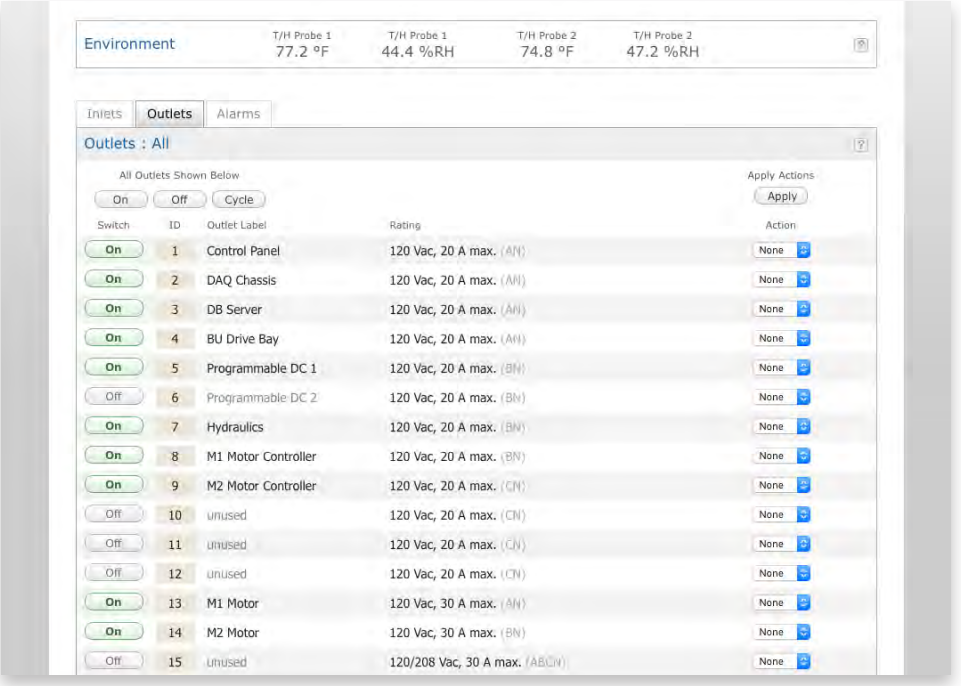
Each outlet is shown with its switch state. Outlets which are not switchable will still be displayed, but with a permanent On state and no button (such as outlets 16 and 17 in the Dashboard view to the right).

The ID column is a simple incremental ID for each outlet which corresponds to the ID value required for command line and other interfaces. In most models, hovering the browser pointer over the ID or Label column reveals the Panel Name which is the name on the PDU chassis for that outlet. For standard products, this is typically a “J number” with the same value as the ID (J1, J2, etc.). Custom units may have different panel names.

The label for each Outlet (set to “Outlet 1” etc. by default) can be edited either on the web UI Power > Outlets tab, or using the `setOutlet` CLI command.

The Rating column identifies the voltage and current rating, as well as the voltage phase(s) the outlet is connected to.

The Action column provides access to a cycle command for outlets, and allows multiple outlets to be preset to turn on, off, or cycled with a single press of the Apply button at the top of the column.



Outlet Data via Command Line

A power Outlet is a single power connector mounted to the PDU chassis for providing power to a connected piece of electrical equipment.

The `getOutlet` command displays the ratings of the outlet and it's switch state and settings (if switchable).

Refer to `getOutlet (pg.123)` for additional command details, but the basic command formats to view power data are:

`getOutlet [id]`	returns all power ratings and settings
`getOutlet [id] switch`	returns only switch state
`getOutlet [id] switch_info`	returns switch state and delay settings

The label for each Outlet may be edited. See `setOutlet (pg.123)` for details on changing the label and delay settings.

```
#> getOutlet 1

   Outlet ID             = 1: Control Panel
   Panel Name            = J1
   Rated Volts           = 120 Vac (AN)
   Rated Amps Maximum    = 20 A (A)
   Rated Amps Continuous = 16 A
   Connector             = 5-20R
   Switch State Now      = off
   Switch Startup State  = off
   Switch On Delay       = 0.0 s
   Switch Off Delay      = 0.0 s
   Switch Cycle Delay    = 5.0 s
   Alert Relay Change    = yes
```

Outlet Control

Outlets may be controlled using the web Dashboard, the CLI command `setOutlet`, SNMP, and the RESTful API. Each outlet configured for remote switching can be switched on, off, and cycled.

A cycled outlet first switches off, then back on with a single command. If an outlet was already off, it will be switched on.

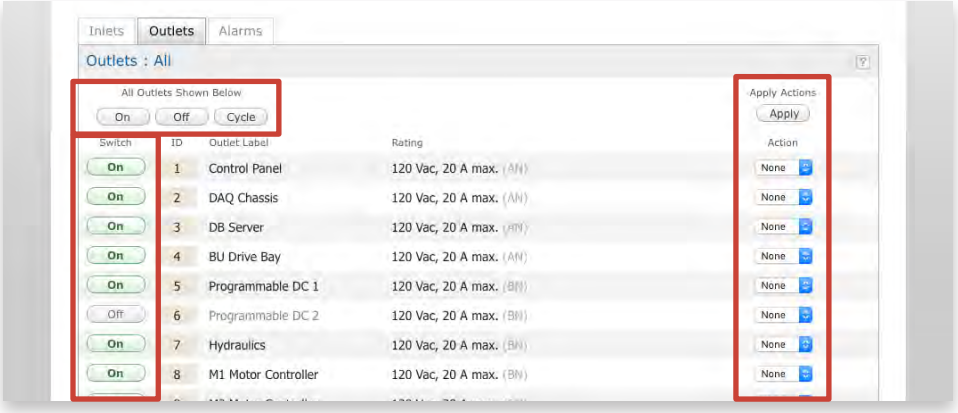
In addition to the obvious on and off actions, switching also includes the ability to add delays to these actions.

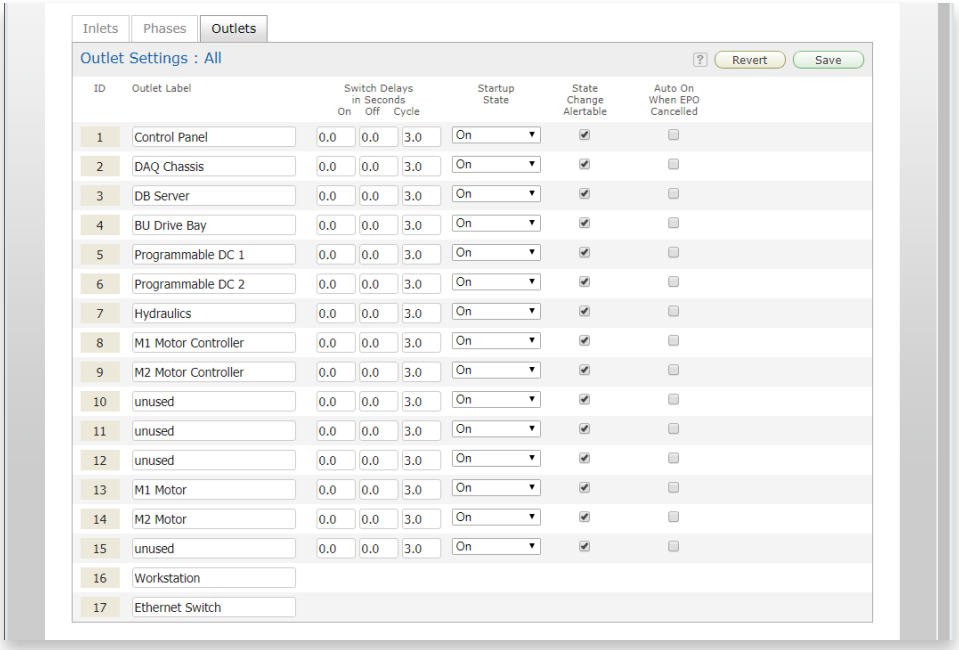
Outlet Switching Delays

Each remotely switchable outlet includes On Delay, Off Delay, and Cycle Delay settings. Even when configured with values greater than zero, these delays do not always get applied.

When any one outlet is switched on or off alone (by any of the network interfaces), the delay values are ignored, and the outlet is switched on or off immediately. However, when all outlets or multiple outlets are switched as a set, then On Delay and Off Delay values are utilized. If outlets 2, 4 and 7 were selected in the web Action column to be turned on, On Delay settings for those three outlets would be executed before each of the outlets was switched.

Cycle Delay is always applied, however, the actual delay between off and on steps can be influenced by On Delay. During a Cycle command involving multiple outlets, on step will be delayed by the larger of On Delay or Cycle Delay. This can be confusing, but the intent is to make sure the larger of either the On Delay or Cycle Delay value is used in case there was specifically adjusted startup dependencies defined by On Delay. A single outlet which is cycled on its own is switched off immediately and uses Cycle Delay before switching on.





Staggering Startups to Curb Inrush

There is generally no need to use on delays to stagger outlets to minimize inrush current. At startup, there is inherently a small time gap between turning each outlet on already.

Staggering Startups for Dependencies

A primary use of On Delay is to intentionally connect several devices in sequential outlets, then stagger the on times to meet the needs of a startup dependency between those particular pieces of equipment.

For example, suppose we have 3 devices. Device A depends on Device B, and Device B depends on Device C, and each device should be powered for 20 seconds before the next unit is started. Set the devices as follows:

- Device C in Outlet 1 with an On Delay of 0.
- Device B in Outlet 2 with an On Delay of 20 seconds.
- Device A in Outlet 3 with an On Delay of 20 seconds.

The PDU powers each outlet in sequence. Therefore, in the above scenario, after the PDU is powered or rebooted, the sequence of events will be:

- Outlet 1 is switched on immediately
- A delay of 20 seconds elapses for the On Delay of Outlet 2.
- Outlet 2 is switched on.
- A delay of 20 seconds elapses for the On Delay of Outlet 3.
- Outlet 3 is switched on.

Using Cycle Delay

The Cycle Delay is most typically used to ensure that when a piece of equipment is switched off, enough time passes that capacitors are fully discharged, that hard drives have stopped spinning, and other factors come to a "full stop" before power is reapplied. For example, we commonly hear that computers should be switched off for 10 seconds before turning them on again. Those details and the time needed, if any, are specific to the equipment. Check owner's manuals for power cycling guidelines.

Switching Sets of Outlets

When multiple outlets are targeted to be switched, each outlet is handled in sequence. That is, outlet 1 will be addressed first, then outlet 2, 3, etc. With each outlet, any applicable delay is handled in sequence. The delays build up cumulatively from a starting point. Assume outlets 1 through 4 each have a 5 second On Delay. If these outlets start out as off, and are all commanded at one time to turn on, then after 5 seconds outlet 1 is turned on, after 10 seconds outlet 2 is turned on, after 15 seconds outlet 3 is turned on, etc.

Outlet Control via Web

Outlet Switching

The web Dashboard offers three ways to manipulate outlet state. The first is an All Outlets set of buttons to affect all outlets with a single command to turn them on, turn them off, or cycle them. When using these controls, each outlet is handled in sequence as described in "Switching Sets of Outlets" above.

The second method for switching outlets is the Action column of the Dashboard Outlets panel. Each outlet has a popup menu to choose On, Off, or Cycle. Each outlet can be set to any of these options. When all choices have been made, pressing the Apply button at the top of the column will issue each command in sequence.

The third method for switching outlets is the Switch column buttons which provide simple and immediate manual On and Off switching control.

Outlet Control via Command Line

Outlet Switching

For all outlet actions, the command line offers the `setOutlet` command. Using the available variants and attributes, the following commands are possible:

- `setOutlet 1 switch on` — affects only the identified outlet number
- `setOutlet 1 switch off`
- `setOutlet 1 switch cycle`
- `setOutlet switch on` — affects all outlets
- `setOutlet switch off`
- `setOutlet switch cycle`

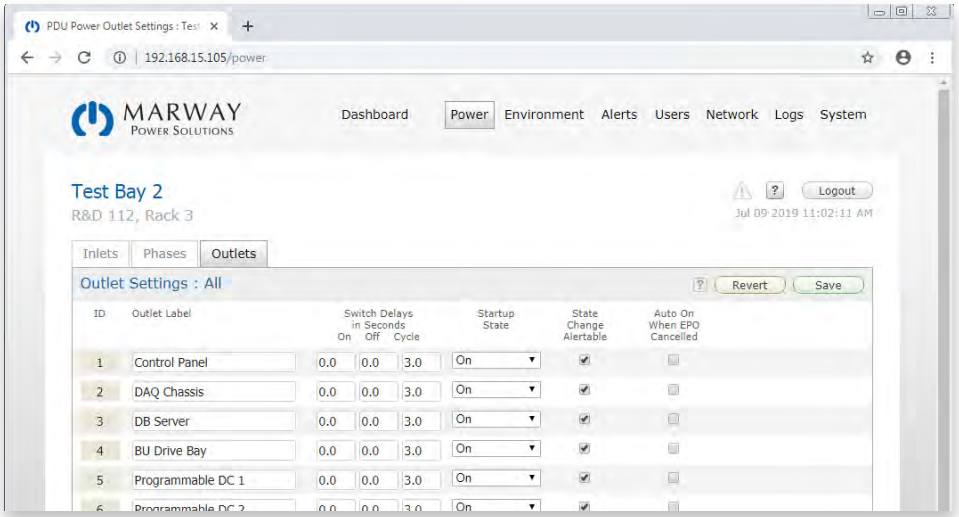
Whenever a specific outlet is identified, the command is issued immediately. That is, `setOutlet 1 switch off` works just like a manual switch, and the on/off/cycle delays are ignored. However, when switching all outlets, the on/off/cycle delays are honored. As of this version, there is not the ability to list a set of arbitrary outlets in `setOutlet`.

Outlet Delays

Adjusting outlet delays is also done using the `setOutlet` command.

- `setOutlet 3 on_delay 2` — sets only the identified outlet value
- `setOutlet 3 off_delay 0`
- `setOutlet 3 cycle_delay 15`
- `setOutlet switch on_delay 2` — sets all outlets to the same value
- `setOutlet switch off_delay 0`
- `setOutlet switch cycle_delay 15`

See `setOutlet (pg.123)` for details.




```
#> setOutlet 6 switch off

   Setting switch of Outlet 6 to: off... OK : ON.

#> setoutlet switch on

   Setting switch of Outlet 1 to: on... OK : ON.
   Setting switch of Outlet 2 to: on... OK : ON.
   (etc...)

#> setOutlet 6 on_delay 0.5

   Setting on_delay of Outlet 6 to: 0.5... OK.

#> setOutlet cycle_delay 8.0

   Setting cycle_delay of Outlet 1 to: 8.0... OK.
   Setting cycle_delay of Outlet 2 to: 8.0... OK.
  (etc...)
```

EPO and Breaker Influence on Outlets

It is important to understand what outlet behavior to expect with the various components which affect power delivery to the outlets. This simplified schematic shows a number of components which might be in a PDU depending on the model and customized options included.

Assuming we're looking at a switched PDU, all models include a main breaker, main controller, outlet relay, and relay sense. A PDU with the remote EPO feature (standard on some models, optional on others) will have the three dashed outlined features in the center: remote mode switch, EPO shutoff circuit, and a remote EPO panel. Lastly, some models have individual branch circuit breakers, or maybe even switches on custom models, controlling just a few or even one outlet.

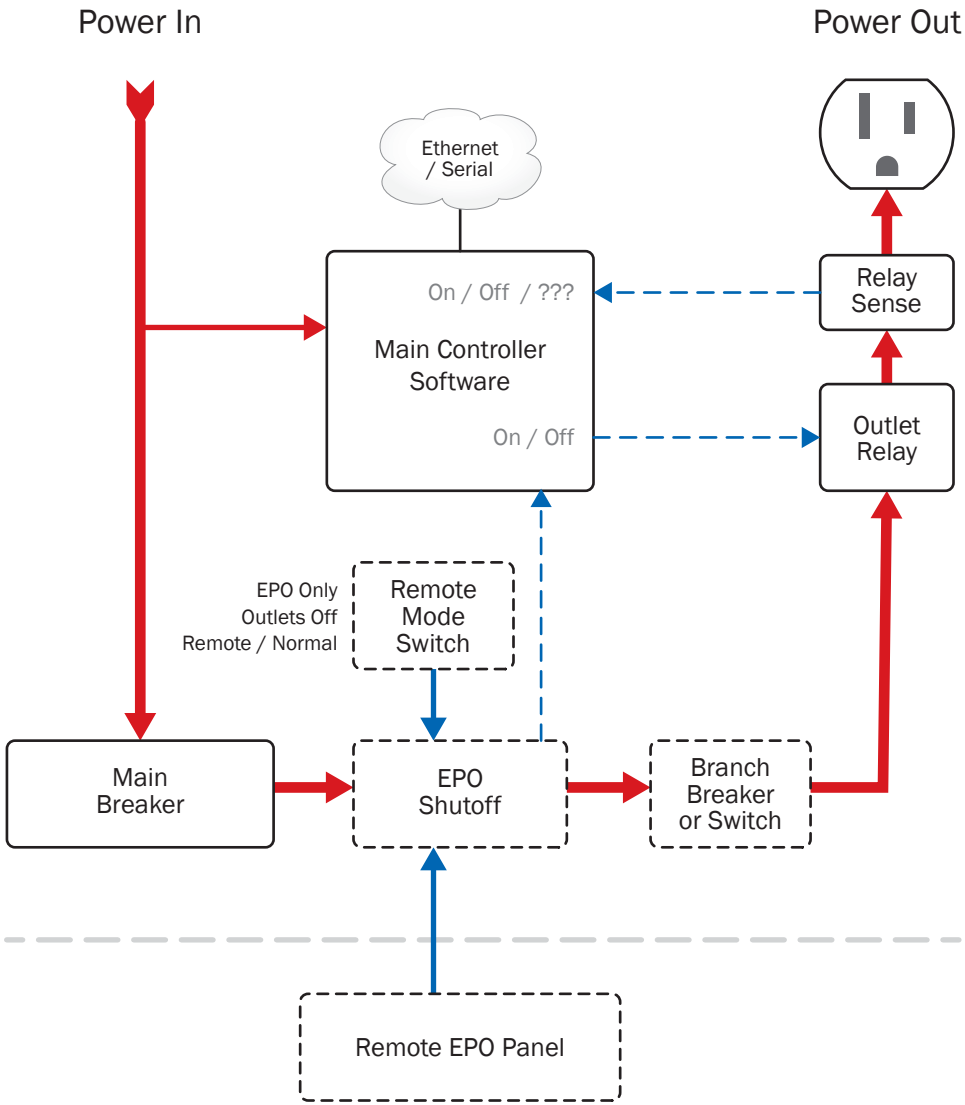
Relay Sense

Before we dig into the circuits, it's useful to understand one of the built-in features of RCM outlet switching—relay sense. This is an internal circuit used to confirm that a relay controlling an outlet has switched on or off as expected.

The software sends a command to turn an outlet on, which actually turns the relay on. The software then checks the relay sense circuit which detects whether there is live voltage between the relay and outlet. This confirms that the relay, and thus the outlet is on.

If there's a case where the relay was commanded to be on, but there is no voltage, the software reports this as an "on error" condition, and displays ??? in the web page outlet button.

In a standard simple system, we might suspect a hardware failure as the reason there is no voltage at the outlet. However, with extra circuit breakers, switches, and the EPO system capable of interrupting power before it even gets to the switching relay, they can also be the cause of "on error" messages.



The software's outlet On commands cannot override the relays and breakers which can interrupt the power source to the outlet relay. So, if something before the outlet relay has been switched off, there will be no power to the outlet no matter what the software tries to do.

Main Breaker

Looking at the schematic, note that main power coming into the system branches to the main controller before the main breaker. If power is supplied to the PDU, the main controller (and therefore the software) is always active. The main breaker does not shut off the software controller.

This is how the vast majority of systems will be wired—though a custom modification if it was requested is always a possibility.

Remote EPO Control System

First it should be understood what the remote EPO system includes in a typical RCM PDU. At a simple level, the option adds four key features.

- Remote Mode Switch — a mode switch on the front of the PDU governing a mix of control over the remote control panel and the PDU outlets. (The exact labeling may vary based on date of manufacture and customization.)
- EPO Shutoff Relay — the PDU's input power is routed through this relay (or contactor, or other switching device) before being connected to the outlet distribution. When this relay is On, power is available to the next stage of power delivery (either the outlet's own dedicated sotware-controlled relay, or perhaps to branch specific breakers or switches). When Off, power cannot be delivered to the outlets, even if the RCM software commands an outlet to be switched on.
- EPO Control Board — the hardware needed to intepret control signals, and control the EPO shutoff relay. (Not shown in the diagram.)
- Connector(s) to the EPO Control Bus — depending on the PDU model, one or more connectors are provide to connect to the remote control panel, and/or daisy chain to additional PDUs.

Note that some outlets are not controlled by switching, and not controlled by the EPO system, and are always on. This is true of the front outlet on the Optima 820 series, or the J1 outlets of the Optima 833 series. Custom units may or may not have any. Such outlets are after the main breaker (which will cut power to them), but before the EPO shutoff relay.

Remote Mode Switch

The remote mode switch ("Remote Override," "UCP Control Mode" or other label) primarily controls the interaction of Marway's Commander universal control panel (UCP), a.k.a. remote EPO panel, with the PDU. The role of the Commander is to control whether the EPO shutoff relay in the PDU is on or off. The remote mode switch has three positions.

When a Commander is connected to the PDU

EPO Only or Local/On (up)

- This switch position allows the PDU to function fully.
- The PDU's EPO shutoff relay is ON, thus power is available to the outlets.
- RCM software controls the on/off powered state of each outlet.
- On the Commnder, only the EPO button has any control over the PDU. The Commander's Outlet Power On and Off buttons have no affect on the PDU outlets. These buttons are essentially disabled.

Off or Outlets Off (middle)

- This switch position disables power to the PDU outlets.
- The PDU's EPO shutoff relay is OFF, thus power cannot be delivered to the PDU outlets.
- RCM software can still switch the per-outlet relays, and this may appear to control the on/off powered state of each outlet, but the software will report switching failures due to the lack of voltage detected in an internal sense circuit. (See "Relay Sense" on page 61.)
- On the Commnder, no button has any control over the PDU.
- This mode is provided for safety so that an operator at the PDU can make changes to the outlet equipment connections, and a remote panel cannot be used to power the PDU.

Remote or Normal (down)

- This switch position allows the PDU to function fully.
- The PDU's EPO shutoff relay is ON, thus power is available to the outlets.
- RCM software controls the on/off powered state of each outlet.
- On the Commnder, all buttons have control over the PDU. The Commander's PDU Outlet Power On and Off buttons DO affect the PDU outlets. These buttons control whether the EPO shutoff relay is on or off. In this mode, either the Off or EPO button of the Commander will cut power to the outlets.
- When the EPO shutoff relay is OFF (regardless of which Commander button triggered it) RCM software can still switch the per-outlet relays, and this may appear to control the on/off powered state of each outlet, but the software will report switching failures due to the lack of voltage detected in an internal sense circuit. (See "Relay Sense" on page 61.)

When a Commander is NOT connected to the PDU

The same behaviors as above are true for normally open EPO systems. For normally closed or latched EPO systems, it is necessary to jumper pins 2 and 3 of one of the EPO connectors on the PDU in order for outlets to operate. This is shown in "Bypass the EPO Bus During PDU Setup" on page 10.

EPO Shutoff Relay

The EPO shutoff relay can be controlled in two ways: from the PDU using the remote mode toggle switch, or from the remote Commander UCP panel using the Off or EPO buttons.

To switch the EPO Shutoff Relay OFF

- From the PDU, put the remote mode switch into the middle position.
- Or, from the Commander UCP, press the EPO button.

To switch the EPO Shutoff Relay ON

- At the PDU, ensure the remote mode switch is in the up or down position.
- At the Commander UCP, reset / clear any pre-existing EPO, and press the Outlet Power On button.

PDU Response to EPO Button

When the EPO button is pressed, two key actions are triggered in an RCM PDU. This applies only to the EPO button being pressed—not to the UCP's Command Outlets Off button, and not to a change in the PDU's remote mode switch position.

- An RCM EPO event is triggered. This event is logged, and can be used to send an alert over email, over SMS (text message), and/or as an SNMP trap/notification by configuring the alert setting in the RCM software.

- The RCM switched outlets are configured by default to all switch off in response to an EPO. When the EPO is cleared the outlets will still be off. This behavior can be changed with outlet settings (see next section).

Configuring Outlets to Switch Off or Stay on Upon EPO

The RCM switched outlets are configured by default to all switch off in response to an EPO. This puts the state of the outlet relay (off) in sync with the state of power (off) at the outlets.

A byproduct of this behavior is that when the EPO condition is cancelled/reset, the outlets will still be switched off.

To allow the outlets to automatically power back up when the EPO state is reset, the outlet switching settings can be changed.

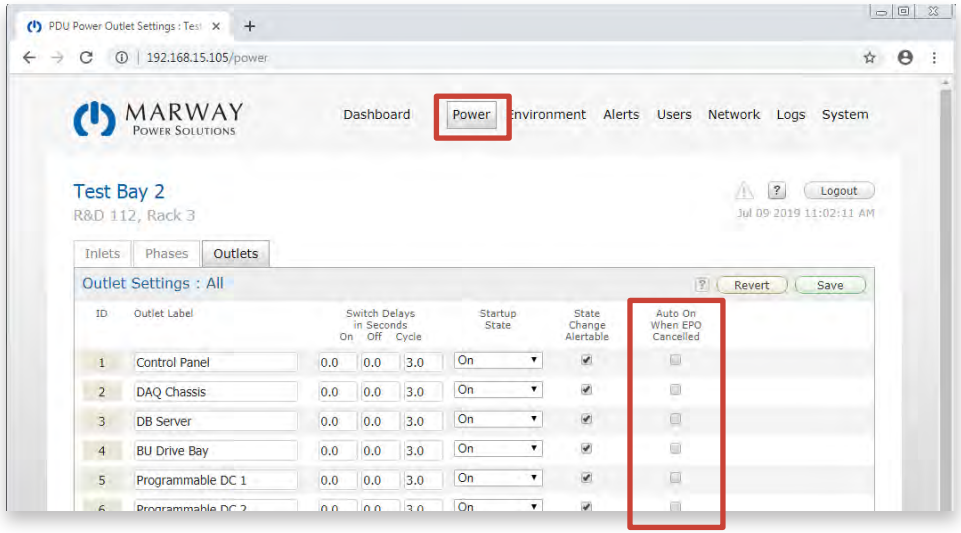
With the web interface, open the Power page Outlets tab. There is a column named Auto On When EPO Cancelled with a checkbox for each RCM switched outlet.

When checked, that specific outlet's software controlled relay will not be switched off—power is still cut by the EPO system, but the individual outlet's relay stays in the "on" position. When the EPO condition is cleared, all outlets with this checkbox checked will automatically resume being powered.

When not checked, that outlet's relay will be switched off. When the EPO condition is cleared, the outlet will remain off, and will have to be switched on (either manually or from a script).

From the command line, this is the equivalent of changing the checkbox:

- `setOutlet 1 ignore_epo true` — affects the identified outlet number
- `setOutlet 1 switch false` —sames a unchecking the checkbox
- `setOutlet ignore_epo true` — affects all outlets



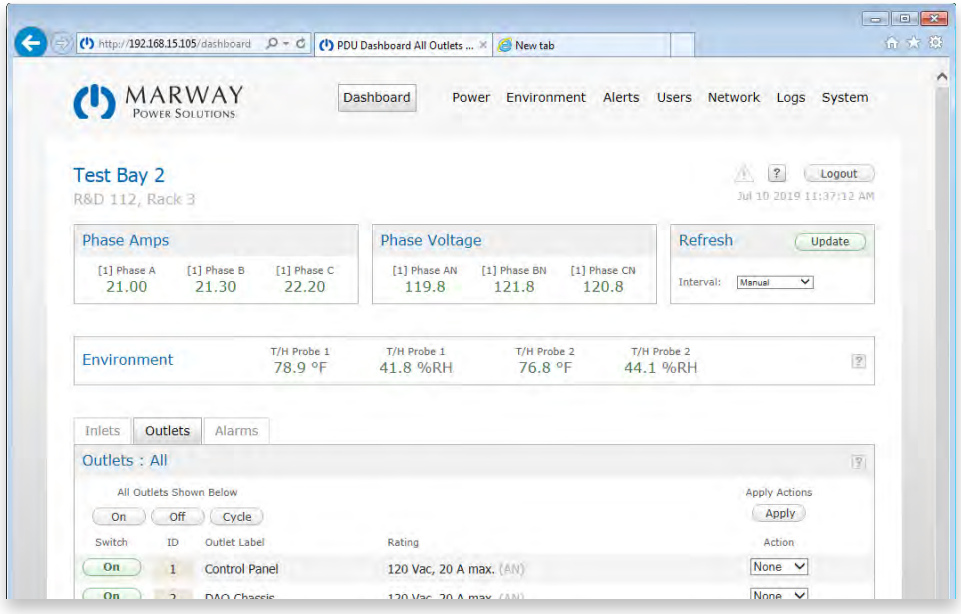

```
#> setOutlet 6 ignore_epo true

   Setting ignore_epo of Outlet 6 to: true... OK.

#> setoutlet ignore_epo true

   Setting ignore_epo of Outlet 1 to: true... OK.
   Setting ignore_epo of Outlet 2 to: true... OK.
   Setting ignore_epo of Outlet 3 to: true... OK.
   (etc...)
```

Viewing Environment Data

Most RCM units have two ports labeled Aux1 and Aux2 (next to the Ethernet and serial ports) which accept an RCM-specific temperature/humidity probe. The probes should be connected before the PDU software is started. If needed, a port rescan can be triggered using the Scan Ports button on the Environment settings page. The CLI command `scanEnvPorts` can also be used. Temperature units of °F or °C can be selected from the Units panel on the System web page.

Web Dashboard Environment Data

When one or both sensors are connected, the Dashboard will display the Environment panel below the Phase data panels. If there are no sensors connected, the panel is not displayed. Both temperature and humidity have setpoints, so as with power data, setpoint status arrows will be visible when needed. Hovering the mouse pointer over the temperature value will show the value using the units not shown.



Command Line Environment Data

The `getEnv` command displays the sensor values. The more specific commands of `getEnvTemp` and `getEnvHumidity` show the values and settings.

`getEnv`	returns all sensor values
`getEnvTemp [id]`	returns temperature values and settings
`getEnvHumidity [id]`	returns humidity values and settings

```
#> getEnv

   Temperature
     1: Top of Rack                  = 78.9 F
     2: Center of Rack               = 76.8 F

   Humidity
     1: Top of Rack                  = 41.8 % RH
     2: Center of Rack               = 44.1 % RH
```

Viewing Alarm Data

Alarms are available to view on the web Dashboard, and through the CLI command `getAlarm` (or `getAlarms`). Alarm data will only be available if one or more setpoints have first been configured for a supported object (power or environment value), and then one of these setpoints has been tripped. Section "Setpoints and Alarms" on page 78 covers in detail the terminology and operation of setpoints and their resulting alarms.

Web Dashboard Alarm Data

The figure to the right shows the web Dashboard Phase Amps panel with Phase C in an alarm condition. When a value is displayed in red and has an up or down arrow either solid or outlined, that value has crossed an alarm setpoint. To see more information about that alarm, open the Dashboard Alarms panel.

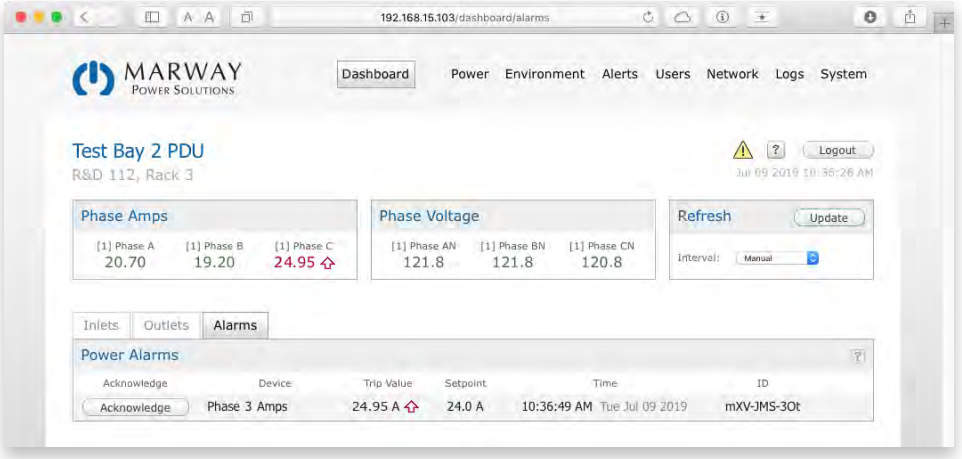
The Dashboard Alarms panel lists all active alarms. It is possible for an alarm to subside, so refreshing the page will always provide the most recent alarm information. The Alarm table includes the following information:

Acknowledge: If the Alerts Settings has been set up to send an alert about the alarm to one or more users, that alert will repeat until the alarm has been acknowledged. An acknowledgment is made by clicking a link in an alert message (delivered by email or SMS), or by pressing this button.

Device: The object type, its ID, and its measurement units.

Trip Value: This is the value that was first detected as having crossed the setpoint. The icons correspond to those shown in the sidebar "Dashboard Data and Alarm Indication" on page 67.

Setpoint: The value of the setpoint which has been tripped. The icon in the Value column indicates which specific setpoint was tripped.



Shown is a phase current power alarm, but triggered temperature and humidity setpoints are displayed in the Alarms tab as well.

Time and *Date*: The time and date the setpoint trip was first detected.

AlarmID: This is a random ID unique to the specific instance of the current alarm. If another alarm happens for the same device and the same trip point, it will have a different ID. The ID is used for logging, and for acknowledgment links.

Dashboard Setpoint Status Display

Phase amps and volts, temperature, and humidity have setpoints which can be used to trigger an alarm. The status of a data value and setpoint alarm are indicated using color and icons as shown in the sidebar on the right.

Command Line Alarm Data

When viewing power or environment data, values with alarms will be followed by a setpoint acronym such as HWA, LCV or others as indicated in "CLI Setpoint Status Display" on page 68 and shown the figure to the right.

To view all alarms, use the command `getAlarm (pg.127)`. This will list all alarms. The command can also be used to get specific device alarms as with the command `getAlarm phase` which would display alarms for phases only.

To acknowledge a specific alarm using the command line, which would then start the Silence Duration to prevent realerts (see "Notification Settings" on page 102), use the command `ackAlarm (pg.127)` followed by the desired alarm ID. To acknowledge all alarms, use `ackAlarm` with no ID.

Dashboard Data and Alarm Indication

8.6 A	Normal data status in green, no icon.
8.6 A ⬆	High Critical setpoint has been triggered.
8.6 A ⇧	High Warning setpoint has been triggered.
8.6 A ⇩	Low Warning setpoint has been triggered.
8.6 A ⬇	Low Critical setpoint has been triggered.
--- A	Data is not available.

This example shows amps, but the same symbols are used for all setpoints

```
#> getAlarm

   Device       = Phase 1
   Setpoint     = 24.0 A, High Warning
   Trip Value   = 24.7 A
   Time         = 05:05:17 AM (Wed Mar 29 2017)
   AlarmID      = 8Bn-80Q-d6h
   Acknowledged = No

#> ackAlarm 8Bn-80Q-d6h

   Acknowledging alarm 8Bn-80Q-d6h... OK

#> getAlarm

   Device       = Phase 1
   Setpoint     = 24.0 A, High Warning
   Trip Value   = 24.7 A
   Time         = 05:05:17 AM (Wed Mar 29 2017)
   AlarmID      = 8Bn-80Q-d6h
   Acknowledged = Yes
```

CLI Setpoint Status Display

Phase amps and volts, temperature, and humidity have setpoints which can be used to trigger an alarm. The status of a data value and setpoint alarm are indicated using acronyms after the measured value. An example of a phase amps alarm as shown in the sidebar on the right.

For legacy reasons, the power value status includes an explicit (though now redundant) A or V to indicate amps or volts.

The status shown in the `getEnv` display would be just HW, LW, etc.

```
#> getPhase 1 power

  Phase ID              = 1: AN
  Amps RMS              = 24.7 A  HWA
  Consumed Max Amps     = 82.3 %
  Volts RMS             = 120.4 Vac
  (etc...)
```

Command Line Data and Alarm Indication

Normal data status shows only the data value and units. If the value is followed by one of these acronyms, it indicates which alarm setpoint has been tripped.

Amps:

HCA	High Critical Amps setpoint has been triggered.
HWA	High Warning Amps setpoint has been triggered.
LWA	Low Warning Amps setpoint has been triggered.
LCA	Low Critical Amps setpoint has been triggered.

Volts:

HCV	High Critical Volts setpoint has been triggered.
HWV	High Warning Volts setpoint has been triggered.
LWV	Low Warning Volts setpoint has been triggered.
LCV	Low Critical Volts setpoint has been triggered.

```
Amps RMS      = 16.87 A

Amps RMS      = 18.32 A HCA

Volts RMS     = 109.8 V LCV
```

The first example is a normal condition with no alarm. The next two examples have alarms.

Viewing Log Data

Log entries are viewable on the web interface using the main menu item Logs where three tabs are available: System Log, Startup Notices, and Settings. Additionally, the CLI commands `viewLog` and `viewStartupLog` may be used.

Logged Events

The RCM software maintains an event log intended for tracking recent event history. Logged events include:

- System startup
- Successful user login
- Failed user login
- Settings updated
- EPO pressed
- Outlet state change
- Alarm trip
- Alert preparation
- Alert sent
- Internal errors

Exported Log Format

An exported log file is an ASCII text file with tab delimited fields and "Windows-style" line endings (\r\n). Each log entry includes the following data:

- DateTime
- Severity
- PDU IP
- PDU Location
- Category
- Message
- PDU Model
- PDU Version

The Severity field describes an escalating scale of importance using these keywords:

Info : normal event activity information

Warn : something which is not a problem, but may be more important to know about than Info (e.g. a failed user login)

Error : errors are not expected. An error message is an indication of something not working correctly. Occasional errors may not be a sign of a larger problem, but multiple errors should be investigated.

Critical : a serious error has occurred. The system should be restarted as soon as possible.

The DateTime field will be in the format of YYYY-MM-DD HH:MM:SS using 24-hour time. This format is naturally sortable.

The PDU IP field is the IPv4 address of the PDU. This will be the same for all entries, but allows logs to be combined, and keeps logs distinct if the IP address changes.

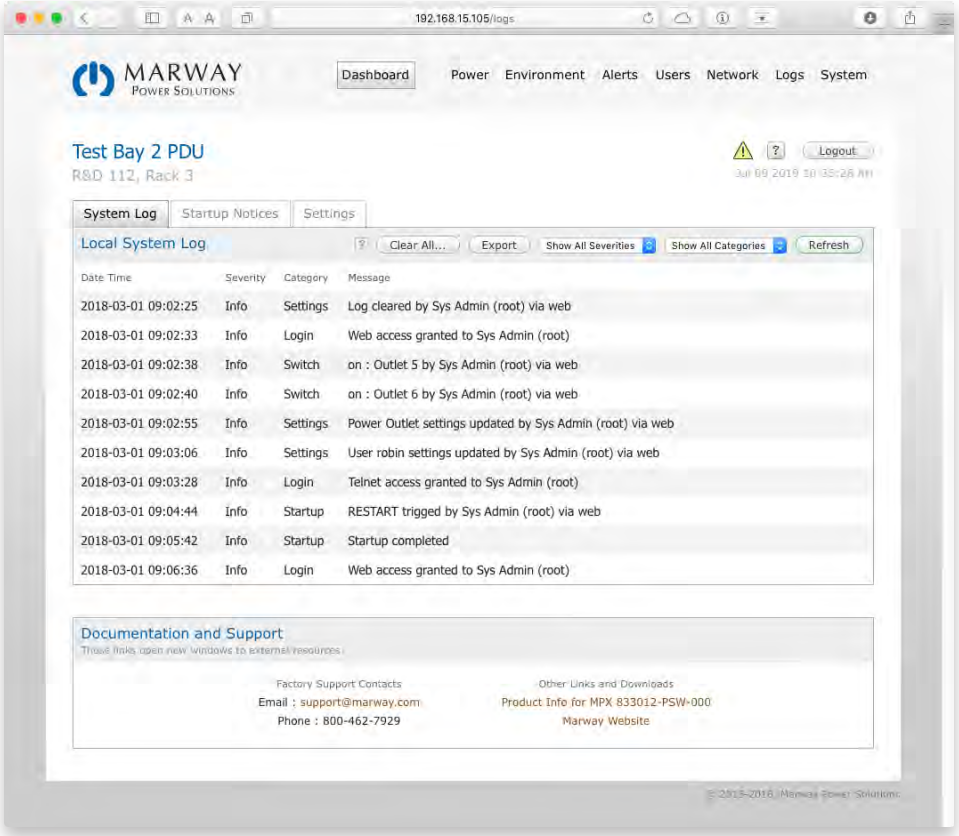
The PDU Location field is the user-entered location field.

The Category field is a set of keywords useful for searching or filtering the log for specific types of events. The keywords, in no particular order, include:

Startup : used when recording that a user issued a startup command, and also the startup event itself.

Login : used when recording successful and failed login attempts.

Alarm : used when recording that a setpoint or other alarmable condition has been triggered.



Email : used when logging alert preparations, and other activities of the SMTP system.

Switch : used when recording changes to an outlet state (on, off, or cycled).

Settings : used when recording changes to any of the setting files.

Time : used when logging activities of the internal clock system and SNTP protocol.

Files : used when logging activities of the file system, which will almost always be for an error.

System : used when logging activities of the core operating system, which will almost always be for an error.

The Message field is the text of the event message.

The PDU Model field is the model number of the PDU.

The PDU Version field is the version number of the PDU software.

System Log vs. Startup Log

The system log has a fixed number of allowed entries. Once the available log space becomes full, the oldest message is deleted to make room for the newest message. The number of messages saved is adjustable from 0 to 1000. The advantage of a small log is quicker startup time. The advantage of a larger log is a longer history of events.

How long a period of time the log covers depends on the maximum log size settings, and how many events have been recorded. A session which includes a number of settings changes, switch state changes, etc. will write more events to the log, so the total period of time covered could be shortened to hours or even minutes if the maximum log size is small. Periods where the PDU is operating normally with little or no settings changes, and no alarm events could cover weeks or months.

With such a system, it's possible that any error messages logged during the PDU startup process could be pushed out of the log at some point. To prevent this, an error message which occurs during the startup process is also logged to a separate "startup log."

The startup log is retained until the system is restarted. The startup log is visible on the PDU web login page, the Logs section of the web interface, and by using the `viewStartupLog` command. The events in this log remain viewable at any time until the next startup, during which the startup log is replaced by that startup's events (if any).

It is normal for the startup log to be empty.

Web Viewing of Log Data

The Logs section of the web interface include three tabs: System Log, Startup Notices, and Settings. The System Log list is not sortable, but the log viewer allows filtering based on the Severity and Category fields making it easier to seek out specific events. Selecting an option from one or both of the filters will remove from the display (not from the log itself) everything except those items matching the selected options.

Command Line Viewing of Log Data

Use the command `viewLog (pg.144)` to view the system log, and `viewStartupLog (pg.144)` to view the startup notices. The `viewLog` command accepts filter parameters to help seek out a specific type of log message.

Log Settings

There are a few settings which control the system event log. First, the size of the log in number of records can be adjusted from 20 to 1000. A setting of 0 prevents logging. The advantage of a small log is quicker startup time. The advantage of a larger log is a longer history of events.

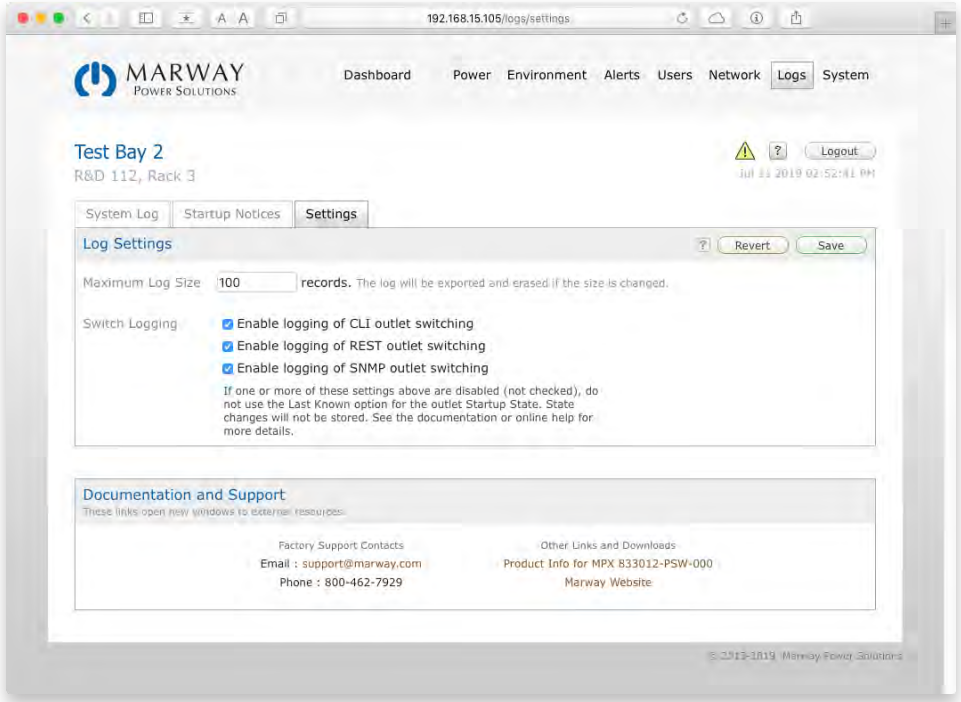
A log of 1000 records can add a couple of minutes to the PDU startup time. If the PDU is rarely power cycled, then perhaps the expanded history is worth the extra startup time on rare occasion the PDU is powered off.

However, a smaller log of up to perhaps 200 records may provide plenty of history for a PDU which sees a daily shutdown, and would start up more quickly.

Outlet State Change Logging

There are also settings to determine whether outlet switching events are logged. All switch events triggered through the web interface are always logged. However, the logging of switching triggered through the CLI, SNMP, and RESTful API can be disabled.

If a PDU's outlets are controlled by an automated script, and the event rate is frequent, the log may fill up with switch events the user already knows will happen. This could obscure more rare, and therefore useful, event records. By disabling logging of switch events through the automation API, the log is not over run with repetitive data.



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Events Management

Events, Alarms, and Alerts

The RCM software and documentation will refer to events, alarms, and alerts. Before reading this section, it is best to get some definitions cleared up.

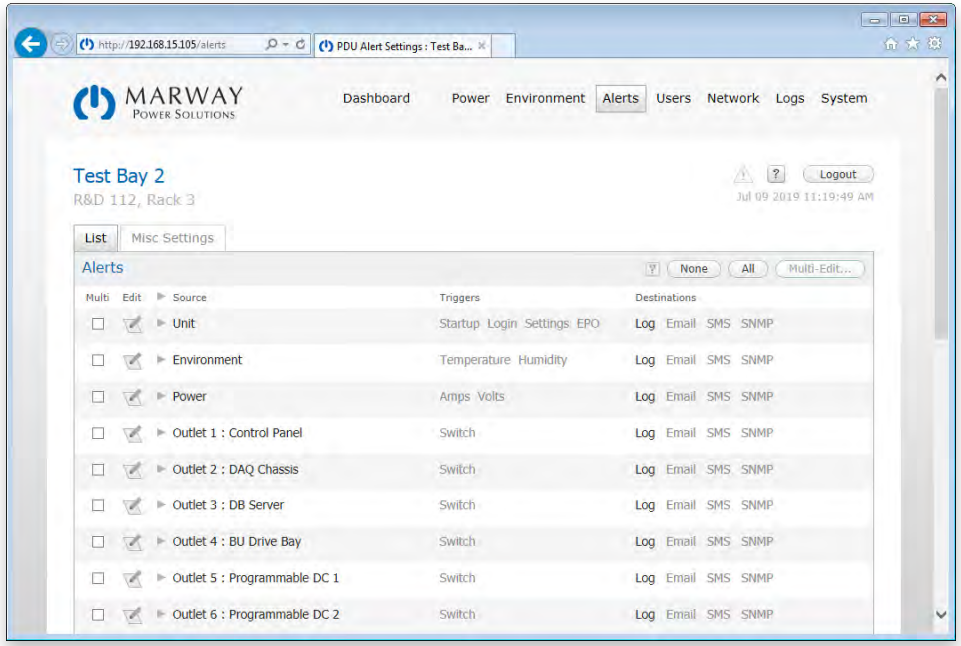
An *event* is any discernible action or change of state in something. Of all these terms, event is the most general.

An *alarm* is a type of event which carries the connotation of something being not normal. The power setpoints define alarm conditions. When a setpoint is crossed, that event activates an alarm.

An *alert* is a notification. That notification could be an illuminated bulb on a control panel, or an automated email message sent from a machine. An alert may come as a result of an alarm, or a non-alarm event. For example, an email sent because a setpoint was crossed would be in response to an alarm. However, an email sent at the startup of the PDU is an alert, but the PDU startup event itself is not an alarm.

The RCM software provides user interface displays of alarms, and provides for configuration of several predefined alerts.

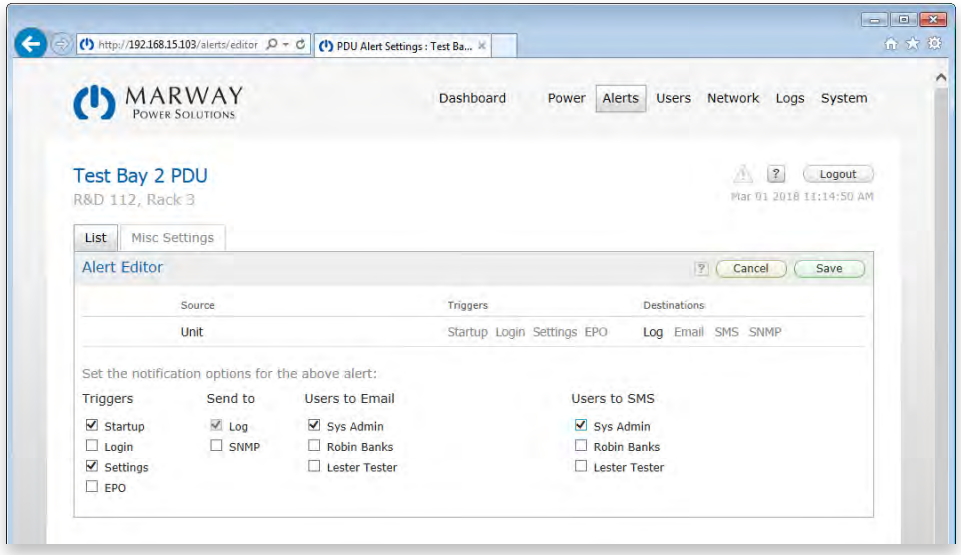
Additionally time periods for relart intervals and alert silence duration are adjuatable.

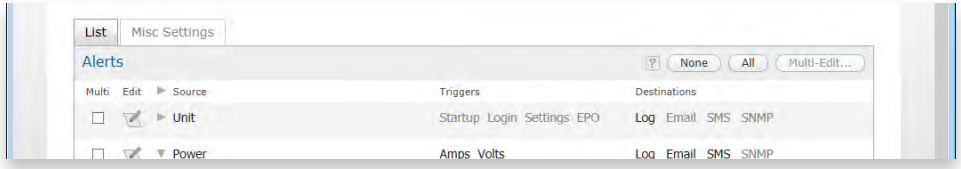


Adjusting Alert Settings

An alert can be configured by either the web interface or command line to send an email, SMS text message, and/or SNMP trap in response to several events.

The web interface for editing power alerts is shown to the right. Alerts can be edited individually, allowing each one to be unique, or multiple alerts can be selected an edited to have identical settings. The same is possible using the command line command `setAlert`.





Unit Alerts

There are a number of event triggers which are grouped into a single Alert named Unit. The following events will generate an alert if configured to do:

Startup Alert :: this is sent whenever the PDU goes through a startup process whether caused by having power applied, being restarted by a software command, or being rebooted from the keypad button.

Login Alert :: this is sent whenever a user logs into the PDU via the web interface, command line, or FTP service.

Settings Alert :: this is sent whenever any setting has been edited.

EPO Alert :: this is sent whenever a local or temore EPO button has been pressed.

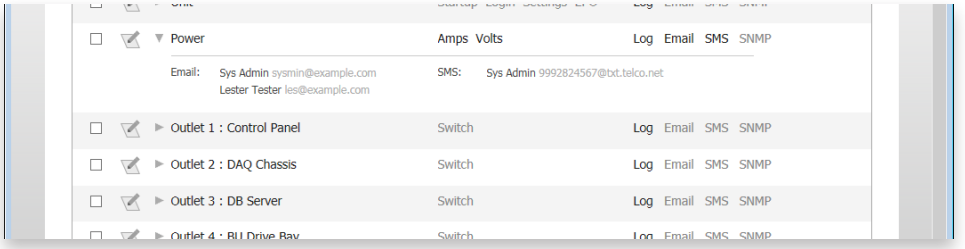
Power Alerts

If a PDU is configured with power-monitored or current-monitored inlets or circuits, it will also have configurable setpoints, and a configurable alert named Power. The Power alert is triggered by the setpoint alarms for amps or volts from any one of the phases or circuits which are monitored (depending on what the PDU hardware supports).

For example, the four possible setpoint alarms for Phase A are combined into the alert named Power. If any of the four setpoints are tripped, the same Power alert will be sent (assuming it has been configured to be sent). Depending on the features of the PDU, the following alerts may be available:

Setpoint for Phase Amps :: sent whenever one of the four setpoints of a current phase has been triggered.

Setpoint for Phase Volts :: sent whenever one of the four setpoints of a voltage phase has been triggered.



Outlet Alerts

If a PDU is configured with switched outlets, each outlet can be independently configured to send an alert if the switch state changes.

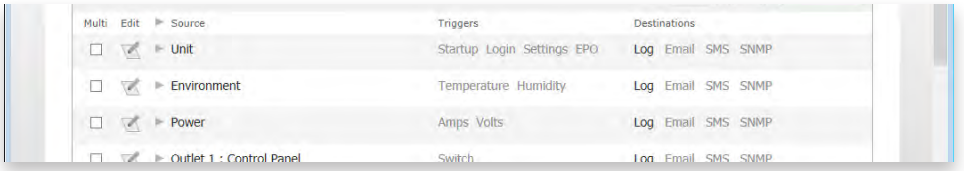
Environment Alerts

If a PDU is configured with the Aux1 and Aux2 ports (next to the Ethernet and serial ports) for environment sensors, it will also have configurable setpoints, and a configurable alert named Environment. The Environment alert is triggered by the setpoint alarms for temperature or humidity from one of up to two sensor probes which are monitored.

For example, the four possible setpoint alarms for Temperature 1 are combined into the alert named Environment. If any of the four setpoints are tripped, the same Environment alert will be sent (assuming it has been configured to be sent). Depending on the features of the PDU, the following alerts may be available:

Setpoint for Temperature :: sent whenever one of the four setpoints of a temperature sensor has been triggered.

Setpoint for Humidity :: sent whenever one of the four setpoints of a humidity sensor has been triggered.



Setpoints and Alarms

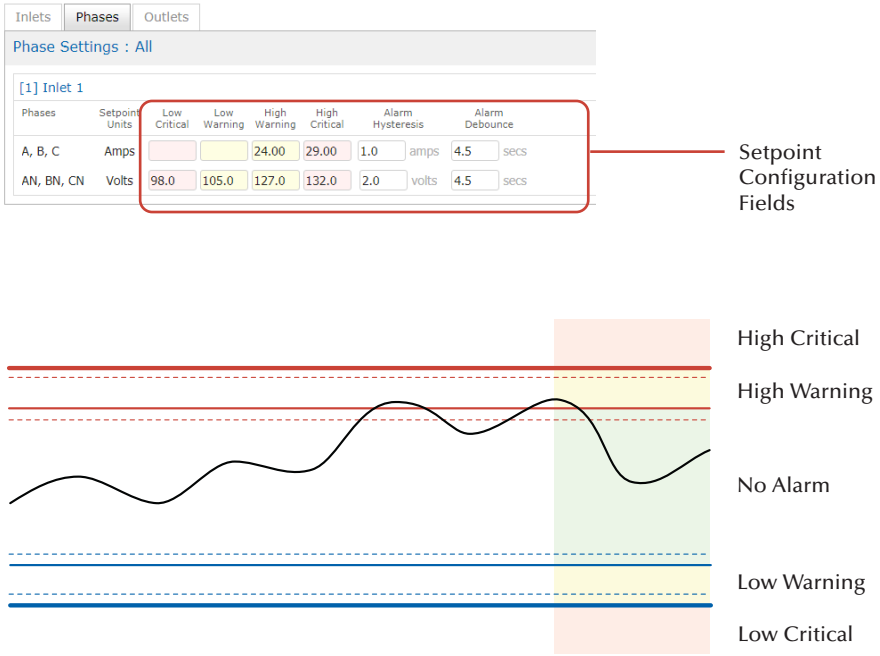
A setpoint is an adjustable value which means something specific to a process monitoring or process control system. A simple example is the thermostat in your home. When you change the temperature setting, that temperature value is a setpoint. In your home, that value is used to control the temperature by turning the heater either on or off.

In a PDU, setpoints are often used to monitor the voltage and current of inlets, circuits, and outlets. When a setpoint value is reached, we can use that signal to send an alert to one or more people by email or SMS, or to external equipment through SNMP. This section will explain the features of RCM setpoints.

Four Setpoints Per Measurement

The thermostat example above is good for its simplicity, but setpoints can have several adjustable features. First, any one parameter we're interested in monitoring, such as the current of a power inlet, has four separate setpoints.

Let's assume we have a PDU with an inlet rating of 20 amps, and an upstream facility circuit breaker servicing the PDU rated for 20 amps. We'd want a setpoint set to maybe 18.5 or 19.0 amps. This would let us know when we're approaching the maximum limit of the breaker. While that's a useful data point, it might also be useful to get a warning a little sooner. A second setpoint could do that. We might set that one to 16 amps (using the 80% de-rating rule). These values depend, of course, on how large the load swings are with the monitored equipment, and how quickly the load can escalate from 16 to 18.5 amps. Maybe these settings could be closer together, or lower overall. The point is, there are two setpoints to differentiate a *warning* condition from a *critical* condition, whatever those conditions are for any given system.



That example was about reaching the high limits of a circuit breaker. It's also common to want to know about the low limits. If a set of attached equipment on a specific inlet phase is expected to be drawing 13.0 amps, where even 11.5 is normal, but anything less than 10.0 indicates something is not quite right, it may be useful to have *low warning* and *low critical* setpoints to send alerts. Others examples for the low value setpoints are low voltage, low temperature, or low humidity.

Therefore, to be useful for a multitude of possible setups and scenarios, all setpoints in the RCM software are actually four setpoints in one.

RCM's four setpoints are labeled high critical, high warning, low warning, and low critical. In the software, for legacy compatibility, power setpoints may be abbreviated using a pattern like HCA for high critical amps, or LWV for low warning volts. Temperature and humidity do not include an extra letter for the measurement type. They use just HC, LW, etc.

Various PDU models are equipped with various sensors, so not all setpoints may be available on any one particular model, but the following are potential setpoints available on a system with this version of software:

Phase amps :: each power conductor on the inlet cord (or connector) has its own four setpoints for amps (HCA, HWA, LWA, LCA).

Phase volts :: each pair of power conductors (such as LN, or AB, BC, CB) has its own four setpoints for volts (HCV, HWV, LWV, LCV).

Temperature :: each sensor has its own setpoint (HC, HW, LW, LC).

Humidity :: each sensor has its own setpoint (HC, HW, LW, LC).

Hysteresis and Debounce

In addition to multiple setpoints, there are two adjustable features which can modify how the monitoring system reacts to the actual setpoint value: hysteresis and debounce. In the RCM software, each measured parameter has its own settings for hysteresis and debounce, but those settings are the same for each of the four setpoints. So, a debounce value of 2 seconds applies to high critical, high warning, low warning, and low critical. In the illustration on the next page, you can see the four setpoints, and the labels for hysteresis and debounce.

If we return to the home thermostat example, you're no doubt aware that when the setpoint is 68 degrees, the heater doesn't come on until the temperature reads 67 degrees, and probably doesn't shut off until the temperature reads 69 degrees. This seeming inaccuracy is on purpose. If the system treated 68 degrees precisely as the on/off point, you could have a case where the temperature oscillates between 67.95° and 68.05°. The heater would be switched on and off quite frequently, and house heaters don't like that. If we translate that to our PDU, it would send an email every few seconds while the current oscillated around the setpoint, and *people* don't like *that*.

Hysteresis

To minimize the scenario of repeated activations, each setpoint has hysteresis—a buffer zone, or band, around the setpoint which fine tunes when that setpoint is actually considered to be activated and deactivated. Since hysteresis is a band, technically there can be a setting for the high side of the setpoint and the low side. Your home thermostat has just such a band (our example had 1 degree on each side). In the RCM software, hysteresis exists on only one side of the setpoint. In the figures on the next page, the dashed lines represent the hysteresis band on the "normal side" of the setpoint (the side towards what would be a normal value between the warning setpoints).

The setpoint is activated as soon as the parameters exceeds the setpoint value (solid line). If Phase amps high warning amps has a setpoint of 14.5, then

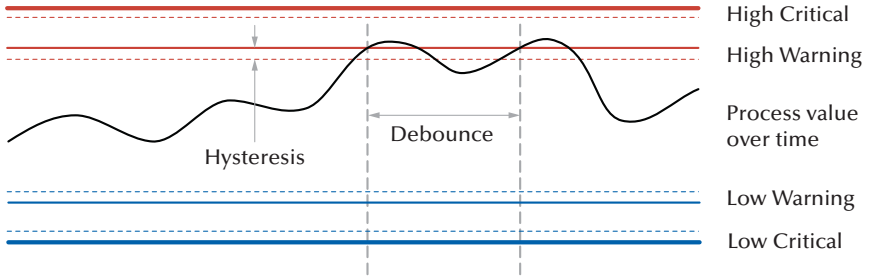
the setpoint will trigger at 14.51 (or whatever the smallest resolution of the measurement is). The setpoint is deactivated when the value recedes towards normal and crosses the hysteresis line (dashed line). Where is that line exactly? That's adjustable by the PDU administrator. If the attached equipment has large current swings, the hysteresis might need to be 1/2 amp, or even 2 amps. Equipment with very narrow operating ranges, or clear stepped increments, may be able to use 0.2 amps. The tighter the hysteresis, the more potential for extra alerts. Finding an ideal setting will take experimentation.

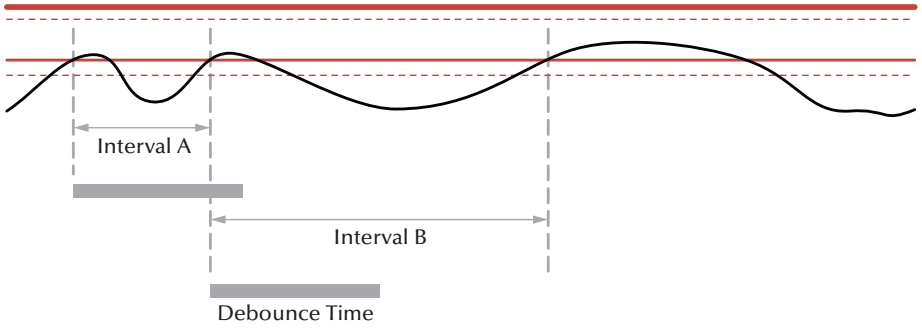
Debounce

Even with a hysteresis setting, it's possible with our Phase example above that a load could oscillate just above the setpoint, and just below the hysteresis point. Even when both a setpoint value and hysteresis value are selected where that's not likely, it is possible. To fend off repetitive alert activations that hysteresis alone does not prevent, we have another adjustment called debounce to use.

Where hysteresis concerns itself with how far away the measured value is from the setpoint value, debounce concerns itself with how long it has been since the setpoint or value was crossed. In the lower figure to the right, the measured value (the black wavy line) exceeds the high warning setpoint three times. Debounce concerns itself with the time interval between these three points. The first crossing would trigger an alarm. However, the value recedes and crosses the line again. These first two crossings at Interval A happen in less time than the Debounce Time (the gray bar).

The RCM software considers multiple crossings within the debounce time as a single event. Each time a setpoint is crossed, a time value is noted. If the measured value recedes and crosses again before the debounce time expires, the second crossing is not considered a new alarm. The measured value could oscillate around the setpoint, but so long as each oscillation is shorter than the debounce time, the system determines those are really the same event, and there's no point in generating a new alarm (and therefore not a new email alert) for the second crossing.

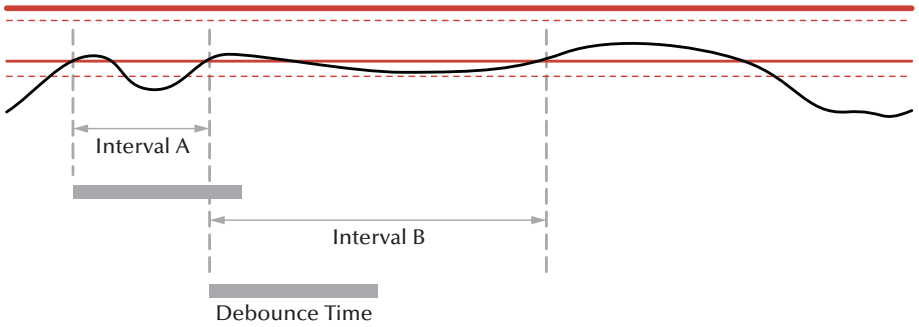




However, in that same illustration, the interval between the second and third crossings is longer than the debounce time, so those two crossings at either end of Interval B are considered to be separate events. There will be an additional alarm for the third crossing.

While, it has not been illustrated this way, be aware that the debounce time also impacts how long it takes for the system to determine that an alarm has occurred. The discsussion above has over-simplified when the first alarm occurs. It does not happen as soon as a setpoint has been exceeded. The setpoint must be exceeded for more than the duration of the debounce time. Let's consider a 15 second debounce time. If the high warning setpoint were exceeded, and then the measured value recedes below the setpoint hysteresis after 12 seconds, there would be no alarm. So, debounce impacts how long it takes for an alarm to be activated and deactivated. Sometimes, it may be desirable to have a quick-to-activate, but a slow-to-deactive alarm. This would require two debounce values. The RCM software has only one, so the needs will have to be balanced.

There's one final scenario to consider. Let's take an almost identical illustration as before. However, between the second and third crossings at each end of Interval B, let's assume the value doesn't drop low enough to cross the hysteresis line. Would that third crossing generate a new alarm? It would not. The measured value must drop below the hysteresis band to clear the alarm, even though Interval B is longer than Debounce Time. *Both* hysteresis and debounce must be cleared in order to clear the alarm. In this illustration, the entire view shown is a single alarm started at the first crossing.



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User Management

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User Management

An RCM PDU user record includes several features:

- authentication (a login name and password),
- access methods (which network protocols the user is allowed to login to),
- a personal profile (name, company, email, and phone information),
- privileges (specific capabilities the user is allowed to use), and
- status (last login time, login count, and more).

A PDU will store up to 20 locally-defined user records. One of those records is predefined as the root user which cannot be deleted.

Root User

A user with a login name of "root" is predefined. This user cannot be deleted, and the login name cannot be changed. The privileges cannot be edited (all privileges are permanently allowed). However, the password and profile for the user may be edited. The password can be updated through the web interface, command line, or through the serial dialog.

If the password is forgotten, and there is no other user with the permission to edit user passwords, the root password can be changed through the startup dialog on the serial port as described in "Serial Dialog: root User Password" on page 16. It can also be changed in the seriakl console after startup completes by using the CLI command:

```
#> setUser root password "NEW_PASSWORD"
```

Authentication

Generally speaking, authentication deals with the identification of a user through some means of information that only the user should have. In the RCM software, this means having both a login name and a password.

Name and Password

Authentication requires user name and password credentials. The name is an arbitrary text value. The password requirements help to enforce moderately strong passwords, and with up to 32 characters, allows for very strong passwords.

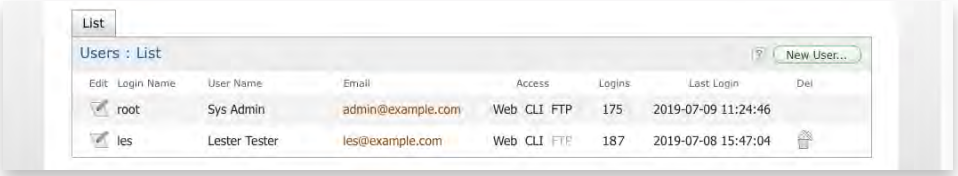
Forgotten Passwords

Given the limited resources of a small embedded processing environment, password recovery techniques are also limited. However, to provide at least some aid to users who have forgotten their password, the Password Hint field allows the user to enter some description to help their recall. Of course, this could be misused to store the actual password, and since the software does not know the password, there's little which can be done to effectively prevent that misuse.

Upon entering their account email address in the forgotten password form of the web interface (linked to from the login page), the hint will be emailed to that user. If that is ineffective, the user will have to contact the PDU admin to change the password.

Passwords in the Settings File

The settings file stores passwords salted and hashed. It is not possible to simply edit a user's password in the settings file. To generate a salt and hash for the settings file, use the command line command `makeLoginPswd`. See "makeLoginPswd" on page 130 for details.



Authorization

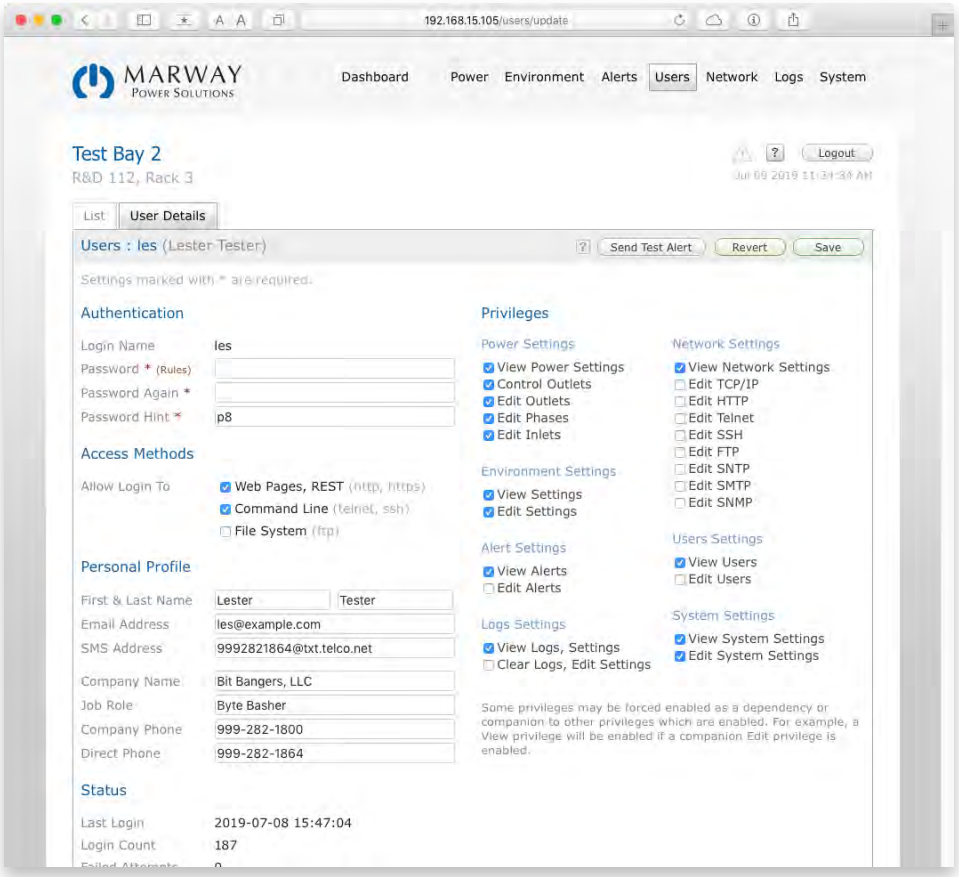
Authorization deals with allowing the user to see, utilize, or edit specific data in, or features of, the software. In the RCM software, authorization includes whether the user in enabled to use one or more protocols to log into the PDU, and a specific set of selected privileges once logged in.

Access Methods

The root user is inherently allowed to use all login protocols. All other users can be enabled to use the web interface (which includes RESTful API), the command line (Telnet and SSH), and the file system (FTP). Disabling all access methods essentially disables a user without having to delete the record.

Privileges

A number of specific privileges have been predefined in the software to allow an administrator to have granular control over what each user is allowed to see and do. Users do not have "roles" or belong to "groups." These paradigms are useful for batch editing of users, but our experience in user management suggests there are always exceptions to these paradigms which results in the over-prescribing of privileges to many users. Given the relatively few users needing access to a PDU,



the assignment of explicit permissions uniquely to each user allows for more control. The exact available privileges will vary based on the available features of any given PDU model.

Auditing

Auditing deals with logging user activity so that an audit trail is available to identify exactly what a user has done in the system.

Activity Logging

The RCM software keeps track of several user-triggered activities, and is able to log those activities. Actions are stamped with user identification as well as the interface protocol used (web, CLI, SNMP).

Logged user events include user login, settings changes, outlet switching (unless specifically disabled—see "Outlet State Change Logging" on page 72), and invoking restarts via software.

Profile

The Personal Profile fields of the user record allow a user to be identified by name, the company represented, and with email and phone contact information.

Adding, Deleting, Editing Users

Users can be added, deleted, and edited using either the web interface or command line. Using the web interface, press the Add User button or select a user to edit or delete from the users list. The web interface for adding and editing users is shown on the previous page. Deleting a user via the web interface is a two-step process. First press the trash button for the user to be deleted. A non-editable form will display the details of that user, and provide a set of confirmation Delete and Cancel buttons.

Separate commands on the command line are used to add, delete, edit, and display user records. Refer to the `addUser`, `deleteUser`, `setUser`, and `getUser` commands in "User Commands" on page 130.

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Software Settings

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Software Settings

Adjustable values for alarms, alerts, network protocols, etc. are called settings, and are accessible through the web UI and command line. They can also be exported in files, accessed through FTP, to be imported to other PDUs.

In this chapter, the purpose and acceptable values of each setting will be identified. Additionally, how to use the web UI, CLI, and files to edit them will also be covered.

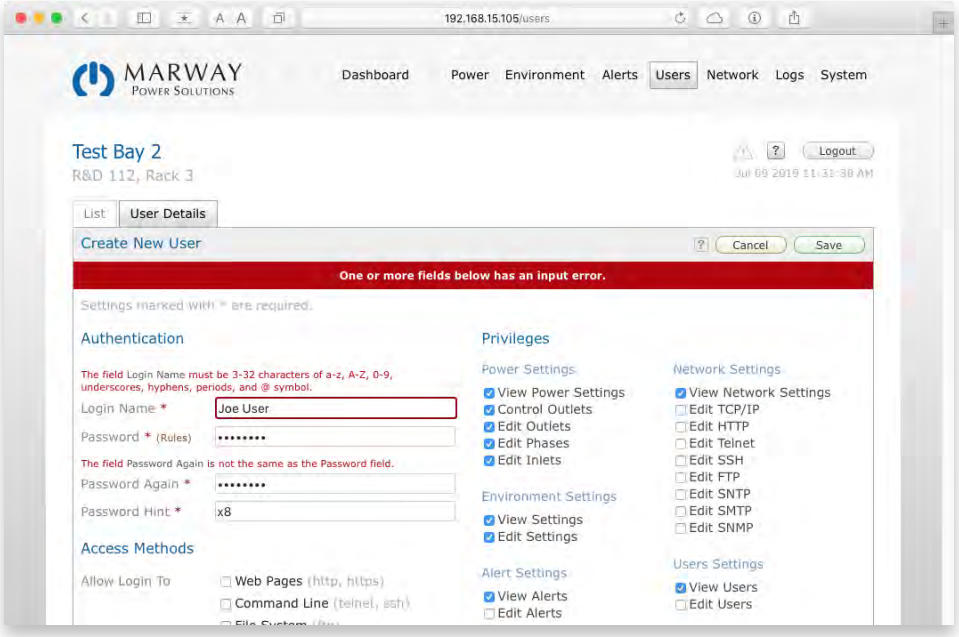
Adjust Settings with the Web UI

Settings are adjusted in all sections of the web interface except the Dashboard. Changing settings is done through web forms. Values can be edited, and the form must be saved. If invalid values are entered, the web interface will highlight those entries and explain valid entry options. Additionally, many fields will display a range and/or default value tooltip by hovering the browser pointer over the field and pausing for a short time.

Adjust Settings with the CLI

Settings are adjusted on the command line using various `set` commands specific to the setting being set (e.g. `setOutlet` or `setUser`). If an invalid value is submitted, the CLI will usually offer some text as to the valid entry requirements, and at least provide feedback that the value was not valid. Note that the CLI can be used to set multiple objects to the same value. For example:

```
setOutlet startup_state off
```



Entering invalid data in the web forms will be flagged with a red banner at the top of the page, and details at each field which has invalid data.

will set `startup_state` for every outlet whereas

```
setOutlet 1 startup_state last_known
```

will set the `startup_state` for outlet 1 only. See "Command Syntax" on page 118 for other command line options.

Exporting and Importing Settings Files

Settings may be exported to text files. This is primarily intended to document and archive the setup of the PDU. However, exported files may be imported to a PDU to restore settings, or even to transfer settings to multiple PDUs.

Use this chapter as the reference for each setting name and value, but refer to "Settings Files Reference" on page 149 for details about the formatting of each settings file.

Configuring Multiple PDUs

If there are multiple PDUs to be configured with identical or very similar settings, there are two approaches to make that process easier than configuring each one manually.

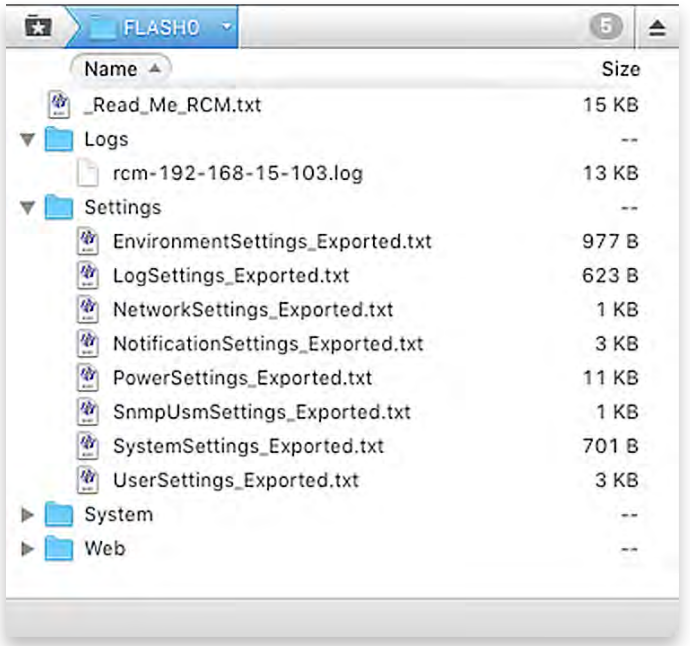
First, one PDU could be configured, the settings exported, then imported to additional units. See "Settings Files Reference" on page 149 for more details.

Second, a series of CLI commands can be automated through Telnet or SSH with a scripting language (Ruby, Python, PERL, or others). The script can send all configuration details. Use "Command Line Reference" on page 118 or the built-in CLI help as a reference.

```
#> setOutlet 1 startup_state random

   Setting startup_state of Outlet 1 to: random... ERROR.

   Error: the switch state value is not valid.
```



System Settings

System settings are for items universal to the whole PDU. Refer to the web UI view in "System Settings" on page 89.

Setting	Description	CLI Command / Attribute	File / Setting	Type	Validation
Label	A label to uniquely identify the PDU. It is displayed on all web pages just below the logo, and in response to the getSystem CLI command.	setSystem label	SystemSettings.txt label =	Text	All English letters, numerals, and punctuation except double quotes and the tilde.
Location	A label to uniquely identify the location of the PDU. It is displayed on all web pages just below the system label at the top of the page, and in response to the getSystem CLI command.	setSystem location	SystemSettings.txt location =	Text	All English letters, numerals, and punctuation except double quotes and the tilde.
Asset ID	A label intended to display an ID assigned by a corporate asset accounting system.	setSystem asset_id	SystemSettings.txt assetId =	Text	All English letters, numerals, and punctuation except double quotes and the tilde.
Contact	An arbitrary label intended to include a person or department name and contact phone or email. This is also used for SNMP's sysContact field.	setSystem contact	SystemSettings.txt contact =	Text	All English letters, numerals, and punctuation except double quotes and the tilde.
Time	Date and time values for when the PDU is not connected to a networked time server (SNTP).	setSystem time	(none)	Time	YYYY-MM-YY HH:MM:SS (24 hr)
Temperature Units	The choice of °F or °C for temperature probe data.	setSystem temp_units	SystemSettings.txt temperatureUnits =	Text	Farenheit or Celcius or even just F or C (case insensitive)
Dialog Baud Rate	The data rate for the serial console port.	setSystem dialog_baudrate	SystemSettings.txt dialogBaudRate =	Integer	1200, 2400, 4800, 9600, 19200, 38400, 57600, or 115200
Dialog Delay	The delay in seconds the startup process waits for a user to press a ket to enter the setup dialog.	setSystem dialog_delay	SystemSettings.txt dialogDialogDelay =	Integer	5 or 10 (seconds)

Network Settings

Network settings define the network protocols such as IP addresses, ports, and other values. This guide will not attempt to explain the protocols themselves. Assistance from an experienced network administrator may be necessary to help with unfamiliar protocols or settings. Refer to the web UI image in "Network Settings" on page 90.

HTTPS Certificate Files

RCM software supports HTTPS with TLS 1.2. Auto-generated, self-signed and externally-generated, certificate-authority-signed ("CA-signed") certificates can be used. CA-signed certificates can be signed by a third-party certificate authority, or by a private certificate authority.

Self-Signed Certificate Files

When HTTPS is configured to use self-signed certificates, the RCM software will auto generate a key and certificate file if they do not already exist.

CA-Signed Certificate Files

When creating CSR's for CA-signed certificates, follow these parameters:

- key length is 2048
- key hash is SHA256
- key format is PEM
- final certificate format is PEM
- CA's certificate format is PEM

To use a CA-signed certificate, there are three required files to be uploaded through FTP to the /System folder.

- trusted_rcm_key.pem — the original private key created for the CSR
- trusted_rcm_cert.pem — the signed CSR certificate from the CA
- trusted_ca_cert.pem — the CA's certificate

Be sure that the Network settings has HTTPS enabled, and that the Certificate Type is CA-Signed. You can then use FTP to upload the above files into the RCM's file system at /FLASH0/System/. After the uploads are complete, restart the RCM software.

Setting	Description	CLI Command / Attribute	File / Setting	Type	Validation
IPv4 DHCP Enabled	Deteremines whether the TCP/IPv4 address will be supplied by a DHCP server (“on”) or entered manually (“off”).	setTcp ipv4_dhcp	NetworkSettings.txt (tcpip) v4Dhcp =	Text	“true” or “false”
IPv4 Address	The TCP/IPv4 address. Leave empty for DHCP.	setTcp ipv4_address	NetworkSettings.txt (tcpip) v4Address =	Text	0.0.0.0 format
IPv4 Subnet Mask	The TCP/IPv4 subnet mask. Usually something like 255.255.255.nnn (where nnn depends on the IP address range of the subnet). On large networks, the 3rd element may not be 255.	setTcp ipv4_subnet	NetworkSettings.txt (tcpip) v4Subnet =	Text	0.0.0.0 format
IPv4 Gateway	The TCP/IPv4 subnet gateway address.	setTcp ipv4_gateway	NetworkSettings.txt (tcpip) v4Gateway =	Text	0.0.0.0 format
HTTP Mode	Indicates whether the internal Web UI server should be enabled with HTTP, HTTPS, or neither.	setHttp mode	NetworkSettings.txt (http) mode =	Text	“disabled” or “http” or “https”
HTTP Port	The TCP port for the service.	setHttp http_port	NetworkSettings.txt (http) httpPort =	Integer	1–65535 (default = 80)
HTTPS Port	The TCP port for the service.	setHttp https_port	NetworkSettings.txt (http) httpsPort =	Integer	1–65535 (default = 443)
HTTPS Certificate Type	Indicates whether HTTPS should use a Self-Signed or CA-Signed certificate.	setHttp cert_type	NetworkSettings.txt (http) certType =	Text	“self_signed” or “ca_signed”
HTTP Session Time	The maximum time in minutes a web session can be inactive before the login session is flagged as invalid.	setHttp session_minutes	NetworkSettings.txt (http) sessionMins =	Integer	15–1440 (default 30) 0 = disabled (no expiration)

Setting	Description	CLI Command / Attribute	File / Setting	Type	Validation
SNTP Server 1 IP	The TCP/IPv4 address of a network time server.	setSntp server1	NetworkSettings.txt (sntp) serverIp1 =	Text	0.0.0.0 format
SNTP Server 2 IP	The TCP/IPv4 address of a network time server.	setSntp server2	NetworkSettings.txt (sntp) serverIp2 =	Text	0.0.0.0 format
SNTP Sync Frequency	Defines how often in hours the PDU should contact the SNTP server for an updated time.	setSntp sync_interval	NetworkSettings.txt (sntp) syncIntervalHrs =	Integer	1–168 hours (default = 12) 0 = disabled
Timezone STD GMT Offset	Defines the local standard time offset in hours from Greenwich Mean Time (GMT).	setSntp std_offset	NetworkSettings.txt (sntp) stdOffsetHrs =	Text	GMT-H.H or GMT+H.H Where H.H is the offset in hours such as GMT-8.0 or GMT+9.5
Timezone DST GMT Offset	Defines the local daylight savings time offset in hours from Greenwich Mean Time (GMT).	setSntp dst_offset	NetworkSettings.txt (sntp) dstOffsetHrs =	Text	GMT-H.H or GMT+H.H Where H.H is the offset in hours such as GMT-8.0 or GMT+9.5
Timezone DST Starts	Defines when daylight savings time starts.	setSntp dst_starts	NetworkSettings.txt (sntp) dstStartsAt =	Text	Enter format like 11.1.0/02:00:00 (month. ordinal of week.weekday/ hour:min:sec.
Timezone DST Ends	Defines when daylight savings time ends.	setSntp dst_ends	NetworkSettings.txt (sntp) dstEndsAt =	Text	Enter format like 11.1.0/02:00:00 (month. ordinal of week.weekday/ hour:min:sec.

Setting	Description	CLI Command / Attribute	File / Setting	Type	Validation
FTP Enabled	Determines whether FTP is enabled or not.	setFtp enabled	NetworkSettings.txt (ftp) enabled =	Text	“true” or “false”
FTP Port	The TCP port for the service.	setFtp port	NetworkSettings.txt (ftp) port =	Integer	1–65535 (default = 21)
Telnet Enabled	Determines whether Telnet is enabled or not.	setTelnet enabled	NetworkSettings.txt (telnet) enabled =	Text	“true” or “false”
Telnet Port	The TCP port for the service.	setTelnet port	NetworkSettings.txt (telnet) port =	Integer	1–65535 (default = 23)
SSH Enabled	Determines whether SSH is enabled or not.	setSsh enabled	NetworkSettings.txt (ssh) enabled =	Text	“true” or “false”
SSH Port	The TCP port for the service.	setSsh port	NetworkSettings.txt (ssh) port =	Integer	1–65535 (default = 22)

Setting	Description	CLI Command / Attribute	File / Setting	Type	Validation
SMTP Server IP	The TCP/IPv4 address of an SMTP server.	setSmtp server	NetworkSettings.txt (smtp) serverIp =	Text	0.0.0.0 format
SMTP Port	The TCP port for the service.	setSmtp port	NetworkSettings.txt (smtp) port =	Integer	1–65535 (default = 25)
SMTP Authentication Method	Determines how the account and password are communicated to the server.	setSmtp auth_method	NetworkSettings.txt (smtp) authMethod =	Text	One of these values: “Any,” “Plain,” “Login,” “CRAM-MD5,” “DIGEST-MD5”
SMTP Account	The SMTP account user name which is authorized to send emails through the server.	setSmtp account	NetworkSettings.txt (smtp) account =	Text	Usually an email address, but may another value depending on the server.
SMTP Password	The password for the SMTP account user name which is authorized to send emails through the server.	setSmtp password	NetworkSettings.txt (smtp) password =	Text	All English letters, numerals, and punctuation except double quotes and the tilde.

Setting	Description	CLI Command / Attribute	File / Setting	Type	Validation
SNMP Enabled	Determines whether SNMP is enabled or not.	setSnmp enabled	NetworkSettings.txt (snmp) enabled =	Text	“true” or “false”
SNMP Data Port	The TCP port for reading data values.	setSnmp data_port	NetworkSettings.txt (snmp) dataPort =	Integer	1–65535 (default = 161)
SNMP Community 1	The community string for read-only access to SNMP v1 and v2	setSnmp community1_string	NetworkSettings.txt (snmp) community1 =	Text	Lower case letters, numerals, and symbols (24 max)
SNMP Community 2	The community string for read-write access to SNMP v1 and v2	setSnmp community2_string	NetworkSettings.txt (snmp) community2 =	Text	Lower case letters, numerals, and symbols (24 max)
SNMP Trap Server IP	The IP address of the server to send Traps to.	setSnmp trap_ip	NetworkSettings.txt (snmp) trapServerIp =	Text	0.0.0.0 format
SNMP Trap Port	The TCP port for the trap server.	setSnmp trap_port	NetworkSettings.txt (snmp) trapPort =	Integer	1–65535 (default = 162)
SNMP Trap Community String	The community string for to access the trap server.	setSnmp trap_community	NetworkSettings.txt (snmp) trapCommunity =	Text	All English letters, numerals.
SNMP Notifications User Name	The SNMP v3 notifications user name.	setSnmp notifications_user	NetworkSettings.txt (snmp) notifUserName =	Text	All English letters, numerals.

Setting	Description	CLI Command / Attribute	File / Setting	Type	Validation
USM User Name	SNMP v3 USM user name.	setSnmpUsm [id] name	SnmpUsmSettings.txt (usm) name =	Text	All English letters, numerals.
USM Authentication Method	SNMP v3 USM user authentication method.	setSnmpUsm [id] auth_method	SnmpUsmSettings.txt (usm) authMethod =	Text	“none” or “md5”
USM Authentication Passphrase	SNMP v3 USM user authentication passphrase.	setSnmpUsm [id] auth_passphrase	SnmpUsmSettings.txt (usm) authPassphrase =	Text	All English letters, numerals.
USM Privacy Method	SNMP v3 USM user privacy method.	setSnmpUsm [id] priv_method	SnmpUsmSettings.txt (usm) privMethod =	Text	“none” or “md5”
USM Privacy Passphrase	SNMP v3 USM user privacy passphrase.	setSnmpUsm [id] priv_passphrase	SnmpUsmSettings.txt (usm) privPassphrase =	Text	All English letters, numerals.

User Settings

User settings define the authentication, profile, and permissions of each PDU user. Most of these settings are adjustable through the web or command line interfaces. Refer also to "User Management" on page 83.

Setting	Description	CLI Command / Attribute	File / Setting	Type	Validation
Login Name	The account name a user will provide to login into the PDU.	getUser auth addUser	UserSettings.txt loginName =	Text	3-32 characters of a-z, A-Z, spaces, or underscores
Login Password	The password for the account name a user provides to login into the PDU. The UserSettings.txt file requires an encrypted version of the password and a salt. Use the command line utility `makeLoginPswd` to generate the encrypted loginPswd value and the pswdSalt value to create a new user in the file.	addUser setUser [name] password	UserSettings.txt loginPswd =	Text	8-32 characters, at least one from A-Z, at least one from a-z, at least one from 0-9. A minimum of four letters (i.e. it can't be mostly numerals). Should include one from !@#$%^&* but no other punctuation marks.
Password Salt	This value is generated internally when passwords are added or updated via the web UI or command line and saved to the settings file. However, to manually add to or modify the UserSettings.txt file use the command line utility `makeLoginPswd` to generate the encrypted loginPswd value and the pswdSalt values.	(no get command) (no set command) Use makeLoginPswd to create values for the settings file.	UserSettings.txt pswdSalt =	Text	12 random characters from a-z, A-z, 0-9
Password Hint	A text value with some meaning for the user which will help them remember their password.	getUser [name] hint setUser [name] hint	UserSettings.txt pswdHint =	Text	All English letters, numerals, and punctuation except double quotes and the tilde.

Setting	Description	CLI Command / Attribute	File / Setting	Type	Validation
First Name	The user's first name (given name).	getUser [name] profile setUser [name] first_name	UserSettings.txt firstName =	Text	0–24 characters of a-z, A-Z, spaces, periods, hyphens, and apostrophes.
Last Name	The user's last name (surname).	getUser [name] profile setUser [name] last_name	UserSettings.txt lastName =	Text	0–24 characters of a-z, A-Z, spaces, periods, hyphens, and apostrophes.
Company Name	The company name the user represents.	getUser [name] profile setUser [name] company_name	UserSettings.txt companyName =	Text	All English letters, numerals, and punctuation except double quotes and the tilde.
Job Role	A descriptive title or role the user performs for the PDU or for the company he represents.	getUser [name] profile setUser j [name] ob_role	UserSettings.txt jobRole =	Text	All English letters, numerals, and punctuation except double quotes and the tilde.
Company Phone	A general phone number for the company the user represents.	getUser [name] profile setUser [name] company_phone	UserSettings.txt companyPhone =	Text	Up to 29 characters of 0-9, spaces, periods, and +()-/x (write extensions like x000).
Direct Phone	A direct phone number to reach the user.	getUser [name] profile setUser [name] direct_phone	UserSettings.txt directPhone =	Text	Up to 29 characters of 0-9, spaces, periods, and +()-/x (write extensions like x000).
Email	An email address to reach the user. This same address is used to send the user alerts (subject to the Alerts Settings).	getUser [name] profile setUser [name] email	UserSettings.txt email =	Text	A valid email address.
SMS	A mobile phone number in an email addressable form to send the user alert messages by SMS. This is generall in the form of mobile_number@carrier.tld such as 2125551212@txt.att.net	getUser [name] profile setUser [name] sms	UserSettings.txt sms =	Text	A valid email address.
Login Via Web	Determines whether the user is allowed to access the PDU via the web interface.	getUser [name] permissions setUser [name] login_via_web	UserSettings.txt loginViaWeb =	Text	"true" or "false"

Setting	Description	CLI Command / Attribute	File / Setting	Type	Validation
Login Via CLI	Determines whether the user is allowed to access the PDU via Telnet and SSH. Note: as of this version, only the root user can access Telnet and SSH. Changing this setting for other users is ignored.	getUser [name] permissions setUser [name] login_via_cli	UserSettings.txt loginViaCLI =	Text	“true” or “false”
Login Via FTP	Determines whether the user is allowed to access the PDU via FTP. Note: as of this version, only the root user can access FTP. Changing this setting for other users is ignored.	getUser [name] permissions setUser [name] login_via_ftp	UserSettings.txt loginViaFTP =	Text	“true” or “false”
View Power Settings	Determines whether the user is allowed to view power settings. If any of the power setting edit permissions is true, then this will be forced true as well.	getUser [name] permissions setUser [name] view_power	UserSettings.txt viewPowerSettings =	Text	“true” or “false”
Control Outlets	Determines whether the user is allowed to switch outlets on/off.	getUser [name] permissions setUser [name] control_outlets	UserSettings.txt controlOutlets =	Text	“true” or “false”
Edit Outlet Labels	Determines whether the user is allowed to edit outlet settings.	getUser [name] permissions setUser [name] edit_outlets	UserSettings.txt editOutlets =	Text	“true” or “false”
Edit Circuit Labels	Determines whether the user is allowed to edit circuit settings.	getUser [name] permissions setUser [name] edit_circuits	UserSettings.txt editCircuits =	Text	“true” or “false”
Edit Phases	Determines whether the user is allowed to edit phase settings.	getUser [name] permissions setUser [name] edit_phases	UserSettings.txt editPhases =	Text	“true” or “false”
Edit Inlets	Determines whether the user is allowed to edit inlet settings.	getUser [name] permissions setUser [name] edit_inlets	UserSettings.txt editInlets =	Text	“true” or “false”

Setting	Description	CLI Command / Attribute	File / Setting	Type	Validation
View Users	Determines whether the user is allowed to view user settings.	getUser [name] permissions setUser [name] view_users	UserSettings.txt viewUsers =	Text	“true” or “false”
Edit Users	Determines whether the user is allowed to edit user settings.	getUser [name] permissions setUser [name] edit_users	UserSettings.txt editUsers =	Text	“true” or “false”
View Network Settings	Determines whether the user is allowed to view network protocol settings.	getUser [name] permissions setUser [name] view_network	UserSettings.txt viewNetworkSettings =	Text	“true” or “false”
Edit TCP/IP	Determines whether the user is allowed to edit TCP/IP protocol settings.	getUser [name] permissions setUser [name] edit_tcpip	UserSettings.txt editTCPIP =	Text	“true” or “false”
Edit SNTP	Determines whether the user is allowed to edit SNTP protocol settings.	getUser [name] permissions setUser [name] edit_sntp	UserSettings.txt editSNTP =	Text	“true” or “false”
Edit HTTP	Determines whether the user is allowed to edit HTTP(S) protocol settings.	getUser [name] permissions setUser [name] edit_http	UserSettings.txt editHTTP =	Text	“true” or “false”
Edit FTP	Determines whether the user is allowed to edit FTP protocol settings.	getUser [name] permissions setUser [name] edit_ftp	UserSettings.txt editFTP =	Text	“true” or “false”
Edit Telnet	Determines whether the user is allowed to edit Telnet protocol settings.	getUser [name] permissions setUser [name] edit_telnet	UserSettings.txt editTelnet =	Text	“true” or “false”
Edit SSH	Determines whether the user is allowed to edit SSH protocol settings.	getUser [name] permissions setUser [name] edit_ssh	UserSettings.txt editSSH =	Text	“true” or “false”
Edit SMTP	Determines whether the user is allowed to edit SMTP protocol settings.	getUser [name] permissions setUser [name] edit_smtp	UserSettings.txt editSMTP =	Text	“true” or “false”
Edit SNMP	Determines whether the user is allowed to edit SNMP protocol settings.	getUser [name] permissions setUser [name] edit_snmp	UserSettings.txt editSNMP =	Text	“true” or “false”

Setting	Description	CLI Command / Attribute	File / Setting	Type	Validation
View Alerts	Determines whether the user is allowed to view alert settings.	getUser [name] permissions setUser [name] view_alerts	UserSettings.txt viewAlerts =	Text	“true” or “false”
Edit Alerts	Determines whether the user is allowed to edit alert settings.	getUser [name] permissions setUser [name] edit_alerts	UserSettings.txt editAlerts =	Text	“true” or “false”
View Logs	Determines whether the user is allowed to view log entries.	getUser [name] permissions setUser [name] view_logs	UserSettings.txt viewLogs =	Text	“true” or “false”
Edit Logs	Determines whether the user is allowed to edit log settings.	getUser [name] permissions setUser [name] edit_logs	UserSettings.txt editLogs =	Text	“true” or “false”
View System Settings	Determines whether the user is allowed to view system settings.	getUser [name] permissions setUser [name] view_system	UserSettings.txt viewSystemSettings =	Text	“true” or “false”
Edit System Settings	Determines whether the user is allowed to edit system settings.	getUser [name] permissions setUser [name] edit_system	UserSettings.txt viewSystemSettings =	Text	“true” or “false”

Notification Settings

Notification settings determine who, if anyone, will receive notifications of alarms and certain events, and the form of the notification (e.g. email, SMS, or SNMP trap/notification). Refer also to "Events Management" on page 74.

Setting	Description	CLI Command / Attribute	File / Setting	Type	Validation
Realert Minutes	Determines the re-alert interval. Some alerts (e.g. setpoint excursions) require that they be acknowledged. If not acknowledged, the alert will be re-sent after Realert Minutes has transpired.	setAlertMisc realert	AlertSettings.txt realertMinutes =	Integer	5–60 mins (default 15) 0 = disabled (no re-alert)
Silence Hours	Determines the silence duration. When an alert is acknowledged, re-alerts will be disabled for that alert for the duration indicated. If that duration passes, and the alarm condition continues, re-alert will resume. Disabling Silence, in effect means realert will happen until the alarm subsides regardless of acknowledgments. Disabling Silence would be suitable only if the re-alert intervals are lengthy enough to not be a nuisance.	setAlertMisc silence	AlertSettings.txt silenceHours =	Text	1–24 hours (default 2) 0 = disabled
Unit Triggers	Identifies which general events will trigger an alert.	getAlert unit setAlert unit triggers	AlertSettings.txt (unit) triggers =	Text	Keywords: startup, login, settings, epo
Unit Email Users	A comma separated list of user login names. Each name listed will be emailed an alert if that user has an email address defined.	getAlert unit setAlert unit email_to	AlertSettings.txt (unit) emailToUsers =	Text	User login names
Unit SMS Users	A comma separated list of user login names. Each name listed will be sent an SMS alert if that user has an SMS address defined.	getAlert unit setAlert unit sms_to	AlertSettings.txt (unit) smsToUsers =	Text	User login names

Setting	Description	CLI Command / Attribute	File / Setting	Type	Validation
Unit SendTrap	Defines whether active triggers will send SNMP trap and notification messages (v1, v2, v3 are all sent).	getAlert unit setAlert unit send_snmp	AlertSettings.txt (unit) sendSnmpTrap =	Text	“true” or “false”
Power Triggers	Identifies which power events will trigger an alert. Power applies to all inlet, phase, and circuit objects.	getAlert power setAlert power triggers	AlertSettings.txt (power) triggers =	Text	Keywords: amps, volts
Power Email Users	A comma separated list of user login names. Each name listed will be emailed an alert if that user has an email address defined.	getAlert power setAlert power email_to	AlertSettings.txt (power) emailToUsers =	Text	“true” or “false”
Power SMS Users	A comma separated list of user login names. Each name listed will be sent an SMS alert if that user has an SMS address defined.	getAlert power setAlert power sms_to	AlertSettings.txt (power) smsToUsers =	Text	“true” or “false”
Power SendTrap	Defines whether active triggers will send SNMP trap and notification messages (v1, v2, v3 are all sent).	getAlert power setAlert power send_snmp	AlertSettings.txt (power) sendSnmpTrap =	Text	“true” or “false”
Environment Triggers	Identifies which environment events will trigger an alert. This applies to temperature and humidity sensors.	getAlert environment setAlert environment triggers	AlertSettings.txt (environment) triggers =	Text	Keywords: temperature, humidity
Environment Email Users	A comma separated list of user login names. Each name listed will be emailed an alert if that user has an email address defined.	getAlert environment setAlert environment email_to	AlertSettings.txt (environment) emailToUsers =	Text	“true” or “false”
Environment SMS Users	A comma separated list of user login names. Each name listed will be sent an SMS alert if that user has an SMS address defined.	getAlert environment setAlert environment sms_to	AlertSettings.txt (environment) smsToUsers =	Text	“true” or “false”
Environment SendTrap	Defines whether active triggers will send SNMP trap and notification messages (v1, v2, v3 are all sent).	getAlert power setAlert environment send_snmp	AlertSettings.txt (environment) sendSnmpTrap =	Text	“true” or “false”

Setting	Description	CLI Command / Attribute	File / Setting	Type	Validation
Outlet Triggers	Identifies which power events will trigger an alert. Power applies to all inlet, phase, and circuit objects.	getAlert outlet [id] setAlert outlet [id] triggers	AlertSettings.txt (outlet) triggers =	Text	Keywords: switch
Outlet Email Users	A comma separated list of user login names. Each name listed will be emailed an alert if that user has an email address defined.	getAlert outlet [id] setAlert outlet [id] email_to	AlertSettings.txt (outlet) emailToUsers =	Text	“true” or “false”
Outlet SMS Users	A comma separated list of user login names. Each name listed will be sent an SMS alert if that user has an SMS address defined.	getAlert outlet [id] setAlert outlet [id] sms_to	AlertSettings.txt (outlet) smsToUsers =	Text	“true” or “false”
Outlet SendTrap	Defines whether active triggers will send SNMP trap and notification messages (v1, v2, v3 are all sent).	getAlert outlet [id] setAlert outlet [id] send_snmp	AlertSettings.txt (outlet) sendSnmpTrap =	Text	“true” or “false”

Power Settings

Power settings include labels, setpoints, and in the case of outlets, some items specific to switching behavior. Not every device has every possible setting. Refer also to the web UI images in “Power Settings” on page 105.

Labels

The RCM software defaults to labeling each power device by its device name (Outlet, Circuit, Inlet) along with a sequential numerical identification. This results in default labels such as Outlet 1, Outlet 2, Circuit 1, Circuit 2, etc.

To allow labels with more meaningful descriptions, the labels for Outlets, Circuits, and Inlets can be changed. The labels for Phases are not editable. They remain fixed with their associated conductor labels (A, B, C, N).

Valid characters for labels include all English letters, numerals, and most standard keyboard punctuation marks. Quotes are not allowed in a label, nor are extended range, escaped, or Unicode characters.

Outlet Switch Delays

Outlet switches feature three action delay settings. Details about these features can be found in “Outlet Control” on page 58. In summary:

The On Delay causes a delay between the moment when an On action is initiated and when the outlet actually switches on.

The Off Delay causes a delay between the moment when an Off action is initiated and when the outlet actually switches off.

The Cycle Delay causes a delay in the cycle process after the outlet is switched off before it is switched on.

The values for these delays are in seconds with a valid range of 0 to 60. A decimal value in tenths such as 0.2 is acceptable.

Outlet Startup State

When the PDU itself is powered off (or is rebooted with the recessed Reboot button on the control panel), the internal relays controlling power to the outlets are also shut off. Each outlet can be configured to remain off after startup, or be turned on during startup. By default, systems shipped with version 2.3 software will have all outlets turned on during startup. Defining whether the outlet is on or off after startup is the role ofthe Startup State setting.

Startup State has three values: on, off, and last known. When set to “on,” the outlet will be switched on during the startup process as the power controls come back online. When “off,” the outlet will be left off.

The “last known” option can restore the same state the outlet was in before power was removed—with some conditions. The accuracy of the last known settings option is affected by the Switch Logging options found on the web page Logs > Settings. When any of these options are disabled, the tracking of the Last Known state is also disabled and becomes inaccurate. If one of those settings is disabled, don’t use the Last Known option for Startup State. See the discussion about those option in “Log Settings” on page 114.

Outlet EPO Response

On PDUs equipped with an EPO circuit, switched outlets have an Ignore EPO setting. On the Power > Outlets web pag, the option is labeled Auto On When EPO Cancelled. By default, when the PDU receives an EPO signal, the software will send an explicit Off command to every switched outlet. The software knows only when an EPO is triggered. It does not know when an EPO condition subsides (a.k.a. cancelled), and normal operation can resume. The outlets,

having been explicitly turned off will remain off. This behavior is for safety considerations.

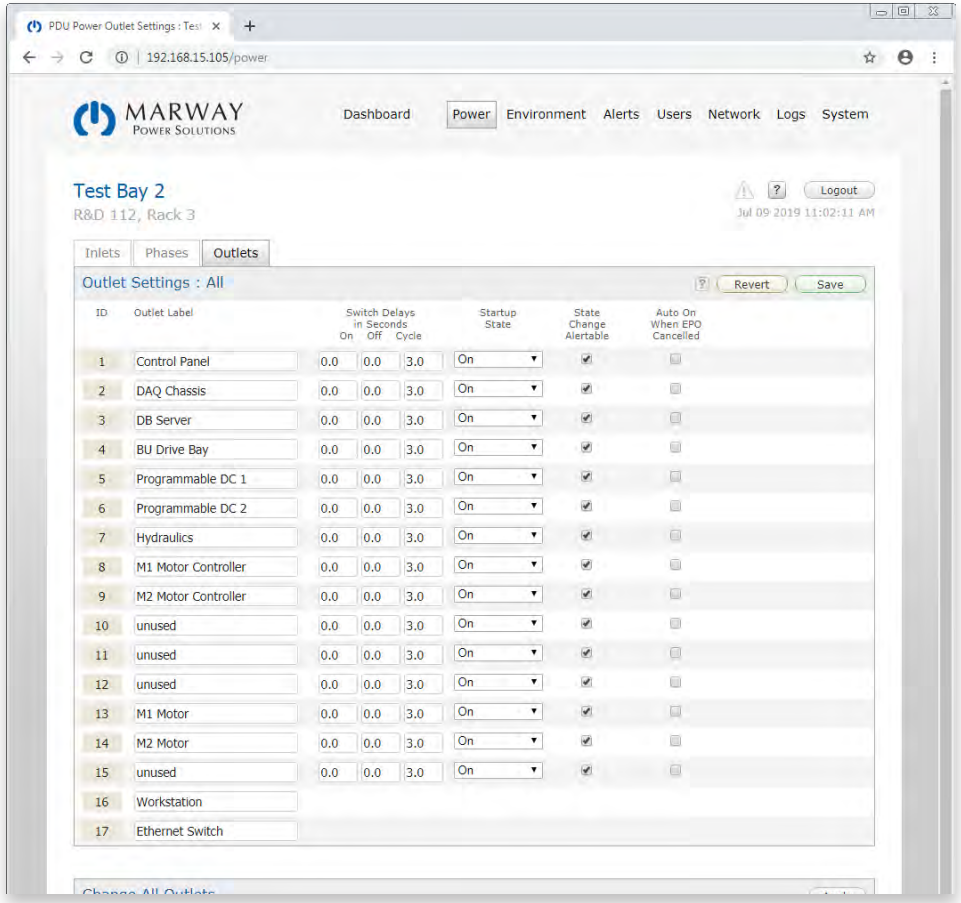
However, it may be desirable to have one or more of the switched outlets automatically resume powered status when the EPO condition subsides. To accomplish this, we have the Ignore EPO setting for each outlet. When enabled, the outlet will not receive the Off command. Therefore, the outlet relay will remain engaged ("on"). The EPO contactor circuit will still disable power from reaching the outlet, but the software will consider the outlet to still be on. When the EPO condition subsides, and the EPO contactor restores power, then the outlets marked for Ignore EPO, will automatically have power to them. Outlets which do not have this setting enabled will have to be manually switched back on by an operator (or script).

Alarm Setpoints, Hysteresis, Debounce

These items determine the alarm behavior for all power devices. Understanding alarm management can be a complex topic. The section "Setpoints and Alarms" on page 78 provides some reference information. Assistance from someone experienced in alarm management may also be suitable if needed.

For the setting adjustments identified in the table below, setpoint values will be in the units of the measurement being monitored such as amps or volts. Hysteresis values are also in the measured units, whereas Debounce is entered in units of seconds.

One thing to be aware of is the difference between zero and disabled. A setpoint setting of zero means an alarm will trigger using that as a comparison value. Disabled means there is no alarm. On the web interface, disabled is an empty field, and on the command line an empty value or the word "disabled" is used with a `set` command.



Setpoint Accuracy and Limits

It is important to keep in mind certain practical limits of setpoints at the extreme ends of their theoretical ranges. For amps, the software will allow a value from zero to the Maximum Rating value of the device (refer to the PDU electrical specifications for detailed values). However, it is not practical to have setpoint settings at the extreme ends of this range. First, all sensors, like those being used to measure the amps and volts within the PDU, lose accuracy at their lower and upper limits. How close to those limits is practical? This can be affected by the built-in tolerances of the electronics, and by environmental factors such as temperature. There is not a single value that will always work at all times, and in all PDUs even of the same model.

For RCM PDUs with power monitoring, under ideal conditions, detecting the difference between some current and zero current is less than a tenth of an amp. This means that a Low Warning Amps setting could drop as low as 0.1A and still be considered not zero by the RCM software. Feel free to experiment, but understand that monitoring equipment at such low limits is not the primary intent of the product.

For RCM PDUs with current monitoring, the lowest detectable limit is aproximately 0.3 amps.

At the upper limit, a more important factor to be aware of than accuracy is the legal impact of local electrical safety laws. Within the USA, Canada, Europe, and many other areas of the world, there is a legal requirement that continuous duty electrical loads must not exceed 80% of the Maximum Rating of the circuit devices. For example, an outlet, fuse, or circuit breaker with a 15 amp Maximum Rating cannot have more than 12 amps (15 amps x 80%) of continuous duty load. “Continuous duty” is defined in the National Electrical Code (of the USA) as being 3 hours and longer. Therefore, for current, a practical maximum limit for the High Warning Amps setpoint is always going to be 80% of the Maximum Rating value of the device being measured (80% of the receptacle rating for outlets, 80% of the circuit breaker rating for circuits, and 80% of the plug rating for Inputs). However, a more pragmatic and informative limit is going to be closer to what you would expect the normal operating current to be.

It is legal to run closer to the example 15 amp limit for “intermittent” periods (which are not well defined). Therefore, the High Critical Amps setpoint could be set closer to the Maximum Rating value. At that point, the inherent loss of accuracy at the limits becomes a factor. Relying on a value within only a few tenths of an amp to the limit may not have the accuracy and repeatability desired for reliable alarm management. Circuit breakers too have some variability. Therefore, trying to get very close to the limit of the breakers may not yield consistent results either—some breakers may trip sooner than others.

The exact legal requirements and definitions of electrical safety code in your locale should be understood by anyone installing and operating this equipment.

As stated earlier, while the software may allow setpoint ranges of X to Y, best practices result in values much closer to the operating range of the equipment, not the range of the power circuit.

Setting	Description	CLI Command / Attribute	File / Setting	Type	Validation
Inlet Label	A label to identify the power inlet (defaults to “Power Inlet 1”).	getInlet [id] setInlet [id] label	PowerSettings.txt (inlet) label =	Text	All English letters, numerals, and punctuation except double quotes and the tilde.
Phase High Critical Amps	Defines the High Critical setpoint of the measured value, which for inputs is amps.	getPhase [id] settings setPhase [id] high_critical_amps	PowerSettings.txt (inlet) highCriticalAmps =	Decimal	0 up to the Maximum Rating value of the phase. To disable an alarm, set it to empty (not zero) or the keyword “disabled”
Phase High Warning Amps	Defines the High Warning setpoint of the measured phase amps.	getPhase [id] settings setPhase [id] high_warning_amps	PowerSettings.txt (inlet) highWarningAmps =	Decimal	0 up to the Maximum Rating value of the phase. To disable an alarm, set it to empty (not zero) or the keyword “disabled”
Phase Low Warning Amps	Defines the Low Warning setpoint of the measured phase amps.	getPhase [id] settings setPhase [id] low_warning_amps	PowerSettings.txt (inlet) lowWarningAmps =	Decimal	0 up to the Maximum Rating value of the phase. To disable an alarm, set it to empty (not zero) or the keyword “disabled”
Phase Low Critical Amps	Defines the Low Critical setpoint of the measured phase amps.	getPhase [id] settings setPhase [id] low_critical_amps	PowerSettings.txt (inlet) lowCriticalAmps =	Decimal	0 up to the Maximum Rating value of the phase. To disable an alarm, set it to empty (not zero) or the keyword “disabled”
Phase Amps Hysteresis	Defines the setpoint hysteresis in amps for phase amps.	getPhase [id] settings setPhase [id] hysteresis_amps	PowerSettings.txt (inlet) hysteresisAmps =	Decimal	0.1 to 2.0 amps
Phase Amps Debounce	Defines the setpoint debounce in seconds for phase amps.	getPhase [id] settings setPhase [id] debounce_amps	PowerSettings.txt (inlet) debounceAmps =	Decimal	Up to 60 seconds. Lowest setting is hardware dependent.

Setting	Description	CLI Command / Attribute	File / Setting	Type	Validation
Phase High Critical Volts	Defines the High Critical setpoint of the measured value, which for inputs is volts.	getPhase [id] settings setPhase [id] high_critical_volts	PowerSettings.txt (inlet) highCriticalVolts =	Decimal	0 up to the Maximum Rating value of the phase. To disable an alarm, set it to empty (not zero) or the keyword “disabled”
Phase High Warning Volts	Defines the High Warning setpoint of the measured phase volts.	getPhase [id] settings setPhase [id] high_warning_volts	PowerSettings.txt (inlet) highWarningVolts =	Decimal	0 up to the Maximum Rating value of the phase. To disable an alarm, set it to empty (not zero) or the keyword “disabled”
Phase Low Warning Volts	Defines the Low Warning setpoint of the measured phase volts.	getPhase [id] settings setPhase [id] low_warning_volts	PowerSettings.txt (inlet) lowWarningVolts =	Decimal	0 up to the Maximum Rating value of the phase. To disable an alarm, set it to empty (not zero) or the keyword “disabled”
Phase Low Critical Volts	Defines the Low Critical setpoint of the measured phase amps. volts	getPhase [id] settings setPhase [id] low_critical_volts	PowerSettings.txt (inlet) lowCriticalVolts =	Decimal	0 up to the Maximum Rating value of the phase. To disable an alarm, set it to empty (not zero) or the keyword “disabled”
Phase Vots Hysteresis	Defines the setpoint hysteresis in volts for phase volts.	getPhase [id] settings setPhase [id] hysteresis_volts	PowerSettings.txt (inlet) hysteresisVolts =	Decimal	0.5 to 20.0 volts
Phase Volts Debounce	Defines the setpoint debounce in seconds for phase volts.	getPhase [id] settings setPhase [id] debounce_volts	PowerSettings.txt (inlet) debounceVolts =	Decimal	Up to 60 seconds. Lowest setting is hardware dependent.

Setting	Description	CLI Command / Attribute	File / Setting	Type	Validation
Outlet Label	A label to identify the outlet (defaults to “Outlet 1”).	getOutlet [id] settings setOutlet [id] label	PowerSettings.txt (outlet) label =	Text	All English letters, numerals, and punctuation except double quotes and the tilde.
Outlet On Delay	Defines the length of a delay between the moment when an On action is initiated and when the outlet actually switches on (applies only when more than one outlet is being switched).	getOutlet [id] settings setOutlet [id] on_delay	PowerSettings.txt (outlet) onDelay =	Decimal	0–60.0 seconds
Outlet Off Delay	Defines the length of a delay between the moment when an Off action is initiated and when the outlet actually switches off (applies only when more than one outlet is being switched).	getOutlet [id] settings setOutlet [id] off_delay	PowerSettings.txt (outlet) offDelay =	Decimal	0–60.0 seconds
Outlet Cycle Delay	Defines the length of a delay in the cycle process after the outlet is switched off and before it is switched on.	getOutlet [id] settings setOutlet [id] cycle_delay	PowerSettings.txt (outlet) cycleDelay =	Decimal	0–60.0 seconds
Outlet Startup State	After the PDU is rebooted (or power is restored after a facility power loss), this setting determines whether the outlet should be switched on, off, or set to the last known state.	getOutlet [id] settings setOutlet [id] startup_state	PowerSettings.txt (outlet) startupState =	Text	One of the keywords: “on,” “off,” or “last known”
Outlet IsAlertable	Determines whether the switching action of an outlet will generate an alert event. Configuration of outlet alerts is still required to define who gets the alertas and how.	getOutlet [id] settings setOutlet [id] alert_switch_change	PowerSettings.txt (outlet) switchIsAlertable =	Text	“true” or “false”
Outlet Ignore EPO	Determines whether the outlet will be switched off upon the unit receiving an EPO event.	getOutlet [id] settings setOutlet [id] ignore_epo	PowerSettings.txt (outlet) switchIgnoresEpo =	Text	“true” or “false”

Environment Settings

Environment settings include labels and setpoints for temperature and humidity sensors. Not every device has every possible setting.

Labels

The RCM software defaults to labeling each power device by its device name (Temperature, Humidity) along with a sequential numerical identification. This results in default labels such as Temperature 1, Humidity 2, etc.

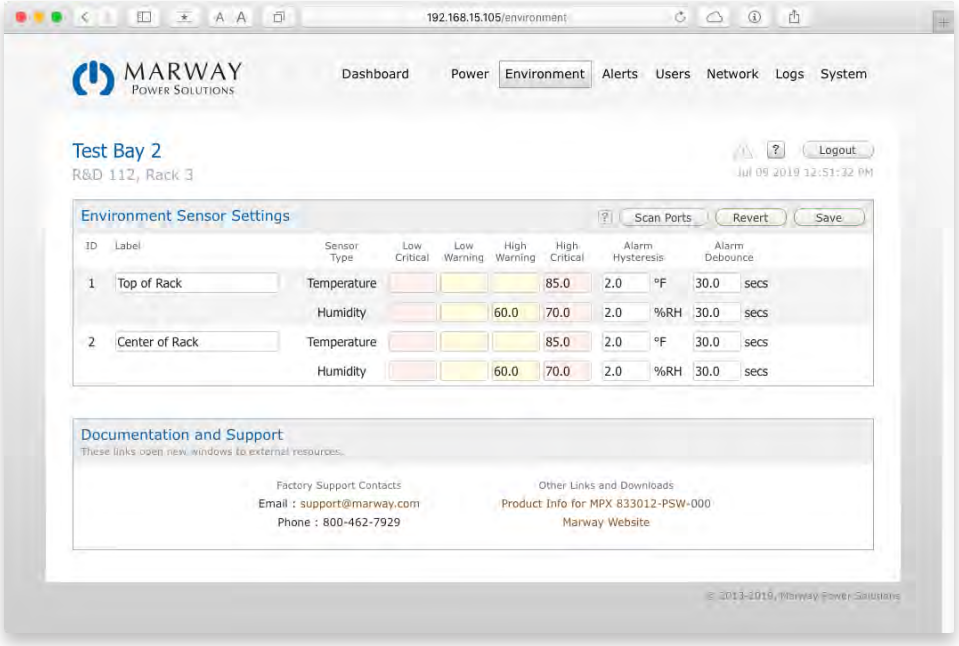
To allow labels with more meaningful descriptions, the labels for these sensors can be changed. Valid characters for labels include all English letters, numerals, and most standard keyboard punctuation marks. Quotes are not allowed in a label, nor are extended range, escaped, or Unicode characters.

Alarm Setpoints, Hysteresis, Debounce

These items determine the alarm behavior for all power devices. Understanding alarm management can be a complex topic. The section "Setpoints and Alarms" on page 78 provides some reference information. That refers mostly to power, but all the same ideas apply to environment sensors.

For the setting adjustments identified in the table below, setpoint values will be in the units of the measurement being monitored such as amps or volts. Hysteresis values are also in the measured units, whereas Debounce is entered in units of seconds.

One thing to be aware of is the difference between zero and disabled. A setpoint setting of zero means an alarm will trigger using that as a comparison value. Disabled means there is no alarm. On the web interface, disabled is an empty field, and on the command line an empty value or the word "disabled" is used with a `set` command.



Setting	Description	CLI Command / Attribute	File / Setting	Type	Validation
Temperature Label	A label to identify the sensor (defaults to “Temperature 1”).	getEnvTemp [id] label setEnvTemp [id] label	EnvironmentSettings.txt (temperature) label =	Text	All English letters, numerals, and punctuation except double quotes and the tilde.
Temperature High Critical	Defines the High Critical setpoint of the measured value, which is either °F or °C depending on the System Temperature Units setting.	getEnvTemp [id] high_critical setEnvTemp [id] high_critical	EnvironmentSettings.txt (temperature) highCritical =	Decimal	0 up to the Maximum Rating value of the unit. To disable an alarm, set it to empty (not zero) or the keyword “disabled”
Temperature High Warning	Defines the High Warning setpoint of the measured value, which is either °F or °C depending on the System Temperature Units setting.	getEnvTemp [id] high_warning setEnvTemp [id] high_warning	EnvironmentSettings.txt (temperature) highWarning =	Decimal	0 up to the Maximum Rating value of the unit. To disable an alarm, set it to empty (not zero) or the keyword “disabled”
Temperature Low Warning	Defines the Low Warning setpoint of the measured value, which is either °F or °C depending on the System Temperature Units setting.	getEnvTemp [id] low_warning setEnvTemp [id] low_warning	EnvironmentSettings.txt (temperature) lowWarning =	Decimal	0 up to the Maximum Rating value of the unit. To disable an alarm, set it to empty (not zero) or the keyword “disabled”
Temperature Low Critical	Defines the Low Critical setpoint of the measured value, which is either °F or °C depending on the System Temperature Units setting.	getEnvTemp [id] low_critical setEnvTemp [id] low_critical	EnvironmentSettings.txt (temperature) lowCritical =	Decimal	0 up to the Maximum Rating value of the unit. To disable an alarm, set it to empty (not zero) or the keyword “disabled”
Temperature Hysteresis	Defines the setpoint hysteresis in either °F or °C depending on the System Temperature Units setting.	getEnvTemp [id] hysteresis setEnvTemp [id] hysteresis	EnvironmentSettings.txt (temperature) hysteresis =	Decimal	0.1 to 2.0 amps
Temperature Debounce	Defines the setpoint debounce in seconds for the sesnor.	getEnvTemp [id] debounce setEnvTemp [id] debounce	EnvironmentSettings.txt (temperature) debounce =	Decimal	Up to 60 seconds. Lowest setting is hardware dependent.

Setting	Description	CLI Command / Attribute	File / Setting	Type	Validation
Humidity Label	A label to identify the sensor (defaults to “Humidity 1”).	getEnvHumidity [id] label setEnvHumidity [id] label	EnvironmentSettings.txt (humidity) label =	Text	All English letters, numerals, and punctuation except double quotes and the tilde.
Humidity High Critical	Defines the High Critical setpoint of the measured value, which is % relative humidity.	getEnvHumidity [id] high_critical setEnvHumidity [id] high_critical	EnvironmentSettings.txt (humidity) highCritical =	Decimal	0 up to the Maximum Rating value of the unit. To disable an alarm, set it to empty (not zero) or the keyword “disabled”
Humidity High Warning	Defines the High Warning setpoint of the measured value, which is % relative humidity.	getEnvHumidity [id] high_warning setEnvHumidity [id] high_warning	EnvironmentSettings.txt (humidity) highWarning =	Decimal	0 up to the Maximum Rating value of the unit. To disable an alarm, set it to empty (not zero) or the keyword “disabled”
Humidity Low Warning	Defines the Low Warning setpoint of the measured value, which is % relative humidity.	getEnvHumidity [id] low_warning setEnvHumidity [id] low_warning	EnvironmentSettings.txt (humidity) lowWarning =	Decimal	0 up to the Maximum Rating value of the unit. To disable an alarm, set it to empty (not zero) or the keyword “disabled”
Humidity Low Critical	Defines the Low Critical setpoint of the measured value, which is % relative humidity.	getEnvHumidity [id] low_critical setEnvHumidity [id] low_critical	EnvironmentSettings.txt (humidity) lowCritical =	Decimal	0 up to the Maximum Rating value of the unit. To disable an alarm, set it to empty (not zero) or the keyword “disabled”
Humidity Hysteresis	Defines the setpoint hysteresis in % relative humidity.	getEnvHumidity [id] hysteresis setEnvHumidity [id] hysteresis	EnvironmentSettings.txt (humidity) hysteresis =	Decimal	0.1 to 2.0 amps
Humidity Debounce	Defines the setpoint debounce in seconds for the sesnor.	getEnvHumidity [id] debounce setEnvHumidity [id] debounce	EnvironmentSettings.txt (humidity) debounce =	Decimal	Up to 60 seconds. Lowest setting is hardware dependent.

Log Settings

Log settings determine how many log records are recorded, and which APIs to log outlet switch events from.

Outlet Switch Logging

Logging of switching events always happens when those events are triggered through the web user interface. However, logging of switch events is configurable for switching initiated through CLI, RESTful API, and SNMP.

The Log CLI Switching setting enables or disables the logging of outlet switching events when those events are triggered through a CLI command (Telnet, SSH, or serial). Additionally, when this option is disabled, the on/off state of the outlet is *not* saved. This affects the accuracy of the outlet's Startup State settings.

The Log RESTful Switching setting enables or disables the logging of outlet switching events when those events are triggered through a RESTful API call. Additionally, when this option is disabled, the on/off state of the outlet is *not* saved. This affects the accuracy of the outlet's Startup State settings.

The Log SNMP Switching setting enables or disables the logging of outlet switching events when those events are triggered through the SNMP protocol (via manager, browser, or script). Additionally, when this option is disabled, the on/off state of the outlet is *not* saved. This affects the accuracy of the outlet's Startup State settings.

Read the "Outlet Switch Logging" on page 114 for more details about the relationship of these settings to the Startup State setting.

Why Disable Switch Logging?

When the outlet switch logging options are enabled, every time the outlet state is changed, the status of that change is stored in settings data, and the event is written to the log. The performance cost is slight, but if switching happens frequently enough, it could flood the log with essentially useless information—if switching is that frequent, then you expect a lot of switching, and you don't need a historical log of the event. With many switch events in the log, this reduces the space available for tracking more useful events (and puts excessive wear on the internal non-volatile memory hardware).

Disabling the logging, and the status saving of the switch state, maximizes performance of switching in an automated test or control environment, but more importantly helps improve the usefulness of the log (and preserves the EEPROM memory).

Setting	Description	CLI Command / Attribute	File / Setting	Type	Validation
Max Records	Defines how many log records to maintain. More records increases history, but adds to startup time.	setLog max_records	LogSettings.txt masRecord =	Integer	0 to 1000
Log CLI Switching	Detemines whether switching events triggered through the CLI are logged.	setLog cli_switching	LogSettings.txt logCLISwitching =	Text	“true” or “false”
Log RESTful Switching	Detemines whether switching events triggered through the RESTful API are logged.	setLog rest_switching	LogSettings.txt logRESTfulSwitching =	Text	“true” or “false”
Log SNMP Switching	Detemines whether switching events triggered through SNMP are logged.	setLog snmp_switching	LogSettings.txt logSNMPSwitching =	Text	“true” or “false”

Optima RCM

Command Line Reference

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Command Line Reference

This chapter includes an overview of the command line syntax, and the entire contents of the built-in help for every command.

Built-in Help

At any point after login, typing `help` or `?` at the prompt will display the top-level help which is a list of commands.

Each command can also be followed by a `?` such as `getSystem?` (with or without a space) to display detailed usage help for that command. The command help will identify the syntax of the command, various attribute options, and some examples.

Typing `?` after a command name will redisplay the command after the help info, ready to accept the rest of the command. Typing help before the command will display the help only.

Command Syntax

The majority of commands follow a common set or get pattern. The following are typical get commands:

- `getOutlet 8 switch`
- `getPhase 1 high_critical_amps`
- `getUser lester email`
- `getSystem location`

```
Login: root
Password: ********
#> ?
-------------------------------------------------------------------------------
Workspace      Get Commands     Set Commands      Misc Commands
-------------------------------------------------------------------------------
POWER *        getOutlet        setOutlet         getOutlets
               getPhase         setPhase          getPhases
               getInlet         setInlet          getInlets

ENVIRONMENT *  getEnv                             scanEnvPorts
               getEnvTemp       setEnvTemp
               getEnvHumidity   setEnvHumidity

ALARMS *       getAlarm         ackAlarm          getAlarms, ackAlarms

ALERTS *       getAlert         setAlert          getAlerts
               getAlertMisc     setAlertMisc

USERS          getUser          setUser           getUsers, addUser, deleteUser
                                                  makeLoginPswd, randomizeRoot

NETWORK        getNetwork
               getTcp           setTcp            verifyTcp
               getHttp          setHttp
               getTelnet        setTelnet
               getSsh           setSsh
               getFtp           setFtp
               getSntp          setSntp
               getSmtp          setSmtp
               getSnmp          setSnmp
               getSnmpUsm       setSnmpUsm        verifyUsm, clearUsm

LOG            getLog           setLog            viewLog, exportLog
                                                  viewStartupLog

SYSTEM         getSystem        setSystem         exportSettings, updateExportKey
                                                  restart, quit, help, ?
-------------------------------------------------------------------------------
Type 'help' before a command, or type '?' after a command for more details.
* Depending on the PDU configuration, some commands may not be supported.
-------------------------------------------------------------------------------
```

These are typical set commands:

- `setOutlet 1 switch on`
- `setCircuit 1 high_critical_amps 14.6`
- `setUser lester email “les@example.com”`
- `setSystem location “Aisle 6 Rack 4”`

You'll notice the pattern of get and set are identical except for the last parameter of the set command which passes the new value. Otherwise, both use the same syntax of:

```
commandName instanceID attribute [setValue]
```

Where `commandName` is something like `getOutlet`, `getUser`, `setPhase`, etc. Command names are not case sensitive. The `instanceID` is going to be the numerical ID of a power device such as an outlet, or phase, or the login name of a user. A few commands do not need an instance ID such as `getSystem`/`setSystem` where there's always one implied instance. The `attribute` is the specific detail being requested or set. Attributes names are not case sensitive. Finally, if the command is a `set`, the fourth parameter is the new value. Values will be stored with the same case they are entered with.

Command Aliases

Many command attributes have aliases (synonyms). These aliases are revealed in the command help. For example, the `getSystem` command has an attribute `model_number`. That attribute name may be substituted with `model_no` or even `model`. So, `getSystem model` is the same command as `getSystem model_number`. The idea behind aliases is to enable commands to be flexible so people can use words and phrases they might naturally think of (without going overboard and having aliases for every word).

Command Variants

Most commands have variants, which are different ways of using the command to get different results. This primarily applies to get/set commands to address whether the command applies to a single instance or multiple instances of the command target.

A get command used like these examples:

```
getOutlet 4 switch
getUser lester email
```

will return one attribute for one specific instance.

A get command used like these examples:

```
getOutlet 4
getUser lester
```

will return all attributes for one specific instance.

A get command is used like these examples:

```
getOutlet
getUser
```

will return all attributes for all instances.

Command variants are explained with each command's built-in help by identifying optional parameters in square brackets like `[object]` in the example help display below:

```
#> getOutlet ?

-------------------------------------------------------------------
   Syntax:  getOutlet [id] [attribute]
```

Power Commands

getInlets

```
-------------------------------------------------------------------------------
   Syntax:    getInlets

   Examples:
     getInlets    : displays list of all inlets with select power information
-------------------------------------------------------------------------------
```

getPhases

```
-------------------------------------------------------------------------------
   Syntax:    getPhases

   Examples:
     getPhases    : displays list of all phases with select power information
-------------------------------------------------------------------------------
```

getOutlets

```
-------------------------------------------------------------------------------
   Syntax:    getOutlets

   Examples:
     getOutlets    : displays list of all outlets with select information
-------------------------------------------------------------------------------
```

```
#> getInlets

   ID      Amps    Volts  Watts  VA     VAR    PF     Hz    Rated
   ------  ------  -----  -----  -----  -----  -----  ----  ---------
   1-ABCN   18.60    n/m   3869   3791     77    n/m   n/m  30/24 A
   ------------------------------------------------------------------
   n/m = not meaningful, use `getPhases` command to get power details.


#> getPhases

   ID    Amps       Volts     Watts  VA     VAR    PF     Hz    Rated
   ----  ---------  --------  -----  -----  -----  -----  ----  ---------
   1-AN   19.20     119.8      2300   2254     46  0.98   59.9  30/24 A
   2-BN   20.40     122.8      2505   2455     50  0.98   59.9  30/24 A
   3-CN   19.80     121.8      2412   2363     48  0.98   59.9  30/24 A
   ------------------------------------------------------------------------
   HC, HW, LW, LC are setpoint alerts; PF+ is lagging, PF- is leading.


#> getOutlets

   ID   State      Label                          Rating
   ---  ---------  -----------------------------  -------------------------
   1    on         Outlet 1                       20 A, 120 Vac (AN)
   2    on         Outlet 2                       20 A, 120 Vac (AN)
   3    on         Outlet 3                       20 A, 120 Vac (AN)
   4    on         Outlet 4                       20 A, 120 Vac (AN)
   5    on         Outlet 5                       20 A, 120 Vac (BN)
   6    on         Outlet 6                       20 A, 120 Vac (BN)
   ...
   11   off        Outlet 11                      20 A, 120 Vac (CN)
   12   off        Outlet 12                      20 A, 120 Vac (CN)
   13   off        Outlet 13                      30 A, 120 Vac (AN)
   14   off        Outlet 14                      30 A, 120 Vac (BN)
   15   off        Outlet 15                      30 A, 120/208 Vac (ABCN)
   16   ON         Outlet 16                      20 A, 120 Vac (CN)
   17   ON         Outlet 17                      20 A, 120 Vac (CN)
```

getInlet

```
-------------------------------------------------------------------------------
   Syntax:  getInlet [id] [attribute|group]

   Where:
     []            : indicates an optional parameter
     id            : is the number of the Inlet (e.g. 1 or 3, etc.)
                     or leave it empty to refer to all Inlets
     attribute     : is one of the attributes below (or its alias):
     group         : is one of the attribute groups below (or its alias):

   Attributes:
     label                 --
     phase                 --
     rated_amps            (ra, ratedamps, max_amps, maxamps)
     amps                  (a, amps_rms, ampsrms, arms)
     consumed_amps         (ca, amps_used, amps)
     voltamps              (va, kva)
     voltamps_reactive     (var, kvar)
     watts                 (w, kw)

   Attribute Groups:
     rating                --
     power_info            (power, pwr)

   Examples:
     getInlet 3 phase      : gets one attribute for one Inlet
     getInlet 2            : gets all attributes for one Inlet
     getInlet phase        : gets one attribute for all Inlets
     getInlet              : gets all attributes for all Inlets
-------------------------------------------------------------------------------
* Some attributes may not be available on certain models.
```

setInlet

```
-------------------------------------------------------------------------------
   Syntax:  setInlet [id] attribute value

   Where:
     []            : indicates an optional parameter
     id            : is the number of the Inlet (e.g. 1 or 3, etc.)
                     or leave it empty to refer to all Inlets
     attribute     : is one of the following (or its alias):

       label                --

     value for label         : is a quoted string (30 chars max)

   Examples:
     setInlet 1 label "Power Bank A"     : sets one label
     setInlet label default              : resets all to the default value
-------------------------------------------------------------------------------
* Some attributes may not be available on certain models.
```

getPhase

```
Syntax:  getPhase [id] [attribute|group]

Where:
  []            : indicates an optional parameter
  id            : is the number of the Phase (e.g. 1 or 3, etc.)
                  or leave it empty to refer to all Phases
  attribute     : is one of the attributes below (or its alias):
  group         : is one of the attribute groups below (or its alias):

Attributes:
  phase                 --
  rated_volts           (rv, ratedvolts)
  rated_amps            (ra, ratedamps, max_amps, maxamps)
  amps                  (a, amps_rms, ampsrms, arms)
  consumed_amps         (ca, amps_used, amps)
  volts                 (v, volts_rms, voltsrms, vrms)
  frequency             (f, freq)
  voltamps              (va, kva)
  voltamps_reactive     (var, kvar)
  watts                 (w, kw)
  power_factor          (pf, powerfactor)
  power_factor_mode     (pf_mode, pfmode)
  setpoint_status_amps  (ssa)
  high_critical_amps    (hca)
  high_warning_amps     (hwa)
  low_warning_amps      (lwa)
  low_critical_amps     (lca)
  hysteresis_amps       (hysa)
  debounce_amps         (dba)
  setpoint_status_volts (ssv)
  high_critical_volts   (hcv)
  high_warning_volts    (hwv)
  low_warning_volts     (lwv)
  low_critical_volts    (lcv)
  hysteresis_volts      (hysv)
  debounce_volts        (dbv)

Attribute Groups:
  rating                --
  power_info            (power, pwr)
  setpoints_info        (setpoint_info)
  settings              --
```

* Some attributes may not be available on certain models.

setPhase

```
Syntax:  setPhase [id] attribute value

Where:
  []            : indicates an optional parameter
  id            : is the number of the Phase (e.g. 1 or 3, etc.)
                  or leave it empty to refer to all Phases
  attribute     : is one of the following (or its alias):

    high_critical_amps     (hca)
    high_warning_amps      (hwa)
    low_warning_amps       (lwa)
    low_critical_amps      (lca)
    hysteresis_amps        (hysa)
    debounce_amps          (dba)
    high_critical_volts    (hcv)
    high_warning_volts     (hwv)
    low_warning_volts      (lwv)
    low_critical_volts     (lcv)
    hysteresis_volts       (hysv)
    debounce_volts         (dbv)

  value for setpoints     : is a decimal, an empty quoted
                            string "" to disable it, or: disabled
  value for hysteresis    : is a decimal, or: default
  value for debounce      : is a decimal of seconds, or: default

Note: setting any one phase of an inlet, updates all phases of that inlet.

Examples:
  setPhase 1 high_warning_volts 129.0 : sets all hwv of the parent inlet
  setPhase high_warning_volts 129.0   : sets all hwv values of all inlets
  setPhase low_critical_volts ""      : disables lcv of the parent inlet
  setPhase hysteresis 0.5             : sets all hysteresis to 0.5 volts
  setPhase 1 debounce default         : resets to the default value
```

* Some attributes may not be available on certain models.

getOutlet

```
-------------------------------------------------------------------------------
   Syntax:  getOutlet [id] [attribute|group]

   Where:
     []            : indicates an optional parameter
     id            : is the number of the Outlet (e.g. 1 or 3, etc.)
                     or leave it empty to refer to all Outlets
     attribute     : is one of the attributes below (or its alias):
     group         : is one of the attribute groups below (or its alias):

   Attributes:
     label                 --
     phase                 --
     switch                (relay)
     startup_state         (startup)
     on_delay              --
     off_delay             --
     cycle_delay           --
     alert_switch_change   (alertable)
     ignore_epo            --

   Attribute Groups:
     rating                --
     switch_info           (relay_info)

   Examples:
     getOutlet 3 phase       : gets one attribute for one Outlet
     getOutlet 2             : gets all attributes for one Outlet
     getOutlet phase         : gets one attribute for all Outlets
     getOutlet               : gets all attributes for all Outlets
-------------------------------------------------------------------------------
* Some attributes may not be available on certain models.
```

setOutlet

```
-------------------------------------------------------------------------------
   Syntax:  setOutlet [id] attribute value
            setOutlet [id] {on|off|cycle} -- is a shortcut for switching

   Where:
     []            : indicates an optional parameter
     id            : is the number of the Outlet (e.g. 1 or 3, etc.)
                     or leave it empty to refer to all Outlets
     attribute     : is one of the following (or its alias):

       label                 --
       switch                (relay)
       startup_state         (startup)
       on_delay              --
       off_delay             --
       cycle_delay           --
       alert_switch_change   (alertable)
       ignore_epo            --

     value for label         : is a quoted string (30 chars max)
     value for switch        : is one of: on, off, reboot|cycle|bounce
     value for startup_state : is one of: on, off, last_known|last
     value for delays        : is a decimal of seconds, or: default
     value for alertable     : is one of: true, false

   Examples:
     setOutlet 2 label "Web Server ws01"  : sets one label
     setOutlet label default              : resets all to the default value
     setOutlet 6 switch on                : sets one outlet
     setOutlet 6 on                       : shortcut to switch an outlet on
     setOutlet cycle_delay 2.5            : sets all outlets to 2.5 secs
     setOutlet 3 on_delay default         : resets to the default value
-------------------------------------------------------------------------------
* Some attributes may not be available on certain models.
```

Environment Commands

getEnv

```
--------------------------------------------------------------------------------
   Syntax:  getEnv

   Examples:
     getEnv           : displays data values for all sensors
--------------------------------------------------------------------------------
```

scanEnvPorts

```
--------------------------------------------------------------------------------
   Syntax:  scanEnvPorts

   Description:
     Use this command after inserting or removing a device from
     one of the environment sensor ports. This will scan the ports
     to determine what is installed.
--------------------------------------------------------------------------------
```

getEnvTemperature

```
--------------------------------------------------------------------------------
   The purpose of getEnvTemperature vs. getEnv is to provide a command
   which reveals all details of a sensor, whereas getEnv is focused on data.

   Syntax:  getEnvTemperature [id] [attribute]
       or:  getEnvT [id] [attribute]

   Where:
     []            : indicates an optional parameter
     id            : is the number of the sensor (1, 2, etc.)
                     or leave it empty to refer to all sensors.
     attribute     : is one of the following (or its alias):

   Attributes:
     data           --
     status         (alarm)
     high_critical  (hc)
     high_warning   (hw)
     low_warning    (lw)
     low_critical   (lc)
     hysteresis     (hys)
     debounce       (db)

   Examples:
     getEnvT 1 data    : gets one attribute of the specified sensor
     getEnvT data      : gets one attribute of all sensors
     getEnvT           : gets all attributes of all sensors
--------------------------------------------------------------------------------
```

setEnvTemperature

```
--------------------------------------------------------------------------------
  Syntax:  setEnvTemperature [id] attribute value
       or:  setEnvT [id] attribute value

   Where:
     []            : indicates an optional parameter
     id            : is the number of the sensor (e.g. 1 or 3, etc.)
                     or leave it empty to refer to all sensors
     attribute     : is one of the following (or its alias):

       label             --
       high_critical     (hc)
       high_warning      (hw)
       low_warning       (lw)
       low_critical      (lc)
       hysteresis        (hys)
       debounce          (db)

     value for label          : is a quoted string (30 chars max)
     value for setpoints      : is a decimal F (or C), an empty quoted
                                string "" to disable it, or: disabled
     value for hysteresis     : is a decimal F (or C), or: default
     value for debounce       : is a decimal of seconds, or: default

   Examples:
     setEnvT 1 label "Top of Rack"    : sets one label
     setEnvT label default            : resets all to the default value
     setEnvT 1 high_warning 80.0      : sets one hw setpoint
     setEnvT high_warning 80.0        : sets all hw setpoints
     setEnvT low_critical ""          : disables all lc setpoints
     setEnvT hysteresis 2             : sets all hysteresis to 2 F (or C)
     setEnvT 1 debounce default       : resets to the default value
--------------------------------------------------------------------------------
```

getEnvHumidity

```
--------------------------------------------------------------------------------
   The purpose of getEnvHumidity vs. getEnv is to provide a command
   which reveals all details of a sensor, whereas getEnv is focused on data.

   Syntax:  getEnvHumidity [id] [attribute]
       or:  getEnvH [id] [attribute]

   Where:
     []            : indicates an optional parameter
     id            : is the number of the sensor (1, 2, etc.)
                     or leave it empty to refer to all sensors.
     attribute     : is one of the following (or its alias):

   Attributes:
     data           --
     status         (alarm)
     high_critical  (hc)
     high_warning   (hw)
     low_warning    (lw)
     low_critical   (lc)
     hysteresis     (hys)
     debounce       (db)

   Examples:
     getEnvH 1 data    : gets one attribute of the specified sensor
     getEnvH data      : gets one attribute of all sensors
     getEnvH           : gets all attributes of all sensors
--------------------------------------------------------------------------------
```

setEnvHumidity

```
--------------------------------------------------------------------------------
  Syntax:  setEnvHumidity [id] attribute value
       or:  setEnvH [id] attribute value

   Where:
     []            : indicates an optional parameter
     id            : is the number of the sensor (e.g. 1 or 3, etc.)
                     or leave it empty to refer to all sensors
     attribute     : is one of the following (or its alias):

       label             --
       high_critical     (hc)
       high_warning      (hw)
       low_warning       (lw)
       low_critical      (lc)
       hysteresis        (hys)
       debounce          (db)

     value for label          : is a quoted string (30 chars max)
     value for setpoints      : is a decimal % RH, an empty quoted
                                string "" to disable it, or: disabled
     value for hysteresis     : is a decimal % RH, or: default
     value for debounce       : is a decimal of seconds, or: default

   Examples:
     setEnvH 1 label "Top of Rack"    : sets one label
     setEnvH label default            : resets all to the default value
     setEnvH 1 high_warning 60.0      : sets one hw setpoint
     setEnvH high_warning 60.0        : sets all hw setpoints
     setEnvH low_critical ""          : disables all lc setpoints
     setEnvH hysteresis 2             : sets all hysteresis to 2 % RH
     setEnvH 1 debounce default       : resets to the default value
--------------------------------------------------------------------------------
```

Alarm Commands

getAlarm

```
--------------------------------------------------------------------------------
   Syntax:  getAlarm [object|count]
   Where:
     []            : indicates an optional parameter
     object        : is the word system, input, line, circuit, or outlet
     count         : is the number of active alarms

   Examples:
      getAlarm outlet   : shows details for outlet alarms
      getAlarm          : shows details for all alarms
      getAlarm count    : shows how many alarms are currently active
--------------------------------------------------------------------------------
* Some attributes may not be available on certain models.
```

ackAlarm

```
--------------------------------------------------------------------------------
   Syntax:  ackAlarm [ID]

   Where:
     []            : indicates an optional parameter
     ID            : is the case-sensitive ID of the alarm
                     (use getAlarm to see the ackID)

   Examples:
      ackAlarm abc-123-xyz  : Acknowledge the alarm abc-123-xyz
      ackAlarm              : Acknowledge all alarms
--------------------------------------------------------------------------------
```

Alert Commands

getAlert

```
--------------------------------------------------------------------------------
   Syntax:  getAlert [object] [id] [command "value"]

   Where:
     []            : indicates an optional parameter
     object        : is one of the following:
                     unit, environment, power, outlet
     id            : is the ID number of the object (e.g. 1 or 3, etc.)
                     or leave it empty to refer to all objects
     command       : is one of the following (or its alias):

       triggers        --
       send_to         (send)
       email_to        (email)
       sms_to          (sms)
       send_snmp       --

     value for triggers is as follows (depends on model features):
       : for unit - startup, login, settings, epo
       : for environmemnt - temperature, humidity
       : for power - amps, volts
       : for outlet - switch

     value for email/sms is any user login name

     value for send_snmp is true|false or yes|no

   Examples:
     getAlert outlet 2           : shows the alert details for only Outlet 2
     getAlert outlet             : shows the alert details for all outlets
     getAlert send_to "lester"   : shows alerts which lester will recieve
     getAlert triggers "switch"  : shows alerts with switch enabled
--------------------------------------------------------------------------------
* Some attributes may not be available on certain models.
```

setAlert

```
--------------------------------------------------------------------------------
   Syntax:  setAlert [object] [id] [command "value"]

   Where:
     []            : indicates an optional parameter
     object        : is one of the following:
                     unit, environment, power, outlet
     id            : is the ID number of the object (e.g. 1 or 3, etc.)
                     or leave it empty to refer to all objects
     command       : is one of the following (or its alias):

       triggers        --
       send_to         (send)
       email_to        (email)
       sms_to          (sms)
       send_snmp       --
       add             --
       email_add       (add_email)
       sms_add         (add_sms)
       delete          --
       email_delete    (delete_email)
       sms_delete      (delete_sms)

     value for triggers is as follows (depends on model features*):
       : for unit - startup, login, settings, epo
       : for environmemnt - temperature, humidity
       : for power - amps, volts
       : for outlet - switch

     value for email/sms is any user login name
     value for send_snmp is true|false or yes|no

   Examples:

    setAlert outlet send_to "root,lester"
        : sets all outlet object alerts to go to only these two users,
          to both email and sms addresses (if they're defined)

    setAlert unit triggers "startup,login"
        : enables alerts for the startup and login events of a Unit

    (many more examples shown in software)
--------------------------------------------------------------------------------
* Some attributes may not be available on certain models.
```

getAlertMisc

```
--------------------------------------------------------------------------------
   Syntax:  getAlertMisc [attribute]

   Where:
     []            : indicates an optional parameter
     attribute     : is one of the following (or its alias):

        realert        --
        silence        --

   Examples:
      getAlertMisc realert     : shows only the realert attribute value
      getAlertMisc silence     : shows only the silence attribute value
      getAlertMisc             : shows all atributes
--------------------------------------------------------------------------------
```

setAlertMisc

```
--------------------------------------------------------------------------------
   Syntax:  setAlertMisc attribute [value]

   Where:
     []            : indicates an optional parameter
     attribute     : is one of the following (or its alias):

        realert        --
        silence        --

     value for realert    : is minutes (default is 15)
     value for silence    : is hours (default is 2)

   Examples:
     setAlertMisc realert 20   : realerts every 20 minutes
     setAlertMisc silence 4    : acknowledged alerts are quiet for 4 hours
--------------------------------------------------------------------------------
```

User Commands

makeLoginPswd

```
--------------------------------------------------------------------------------
   Syntax:  makeLoginPswd "string"

   Where:
     string    : is a plain-text string, presumed to be a password, which will be
                 salted and hashed (both values are returned).

   Examples:
     makeLoginPswd "mP9ur2T$gk"

   Description:
     The purpose of `makeLoginPswd` is to create the loginPswd (the pswd output)
     and the pswdSalt (the salt output) values used in the UserSettings file.
     If users are created through the web or command line interfaces, the hash
     and salt are created automatically. If, however, you want to create users
     by creating a file to import, then `makeLoginPswd` can be used to generate
     these values from the desired passwords you want to use.
--------------------------------------------------------------------------------

#> makeLoginPswd "abc123"

   salt = 8BnM0Qd6hCTJ
   pswd = 6f23b84a083fbbbf08ae1d7d4c7c5e4d9590543d
```

randomizeRoot

```
--------------------------------------------------------------------------------
   Syntax:  randomizeRoot

   Description:
     Creates a new, random password for the root user.
     To change the root password, connect to the system using the serial port,
     then restart the system, pressing any key when prompted to invoke the
     Serial Dialog settings. See the Getting Started section of the User Guide.
--------------------------------------------------------------------------------
```

getUsers

```
--------------------------------------------------------------------------------
   Syntax:    getUsers


   Examples:
     getUsers    : displays list of all users and their login information
--------------------------------------------------------------------------------
```

getUser

```
-------------------------------------------------------------------------------
   Syntax:  getUser [name] [attribute|group]

   Where:
     []            : indicates an optional parameter
     name          : is the login name of the user (e.g. john_doe)
                     or leave it empty to refer to all users
     attribute     : is one of the attributes below (or its alias):
     group         : is one of the attribute groups below (or its alias):

   Attributes:
     enabled, password_hint (hint),
     first_name, last_name,
     company_name, job_role,
     company_phone, direct_phone,
     email, sms
     login_via_web (enable_web)
     login_via_cli (enable_cli)
     login_via_ftp (enable_ftp)
     view_power
       control_outlets
       edit_outlets
       edit_phases
       edit_inlets
     view_environment
       edit_environment
     view_alert
       edit_alert
     view users
       edit_users
       view_network
         edit_http,   edit_tcpip
         edit_telnet, edit_sntp
         edit_ssh,    edit_smtp
         edit_ftp,    edit_snmp
       view_logs
         edit_logs
       view_system
         edit_system

     Attribute Groups:
       status      = user authentication status
       profile     = user profile details
       privileges  = user privileges details

     Examples:
       getUser john_doe edit_http   : gets one attribute for one user
       getUser john_doe             : gets all attributes for one user
       getUser edit_http            : gets one attribute for all users
       getUser                      : gets all attributes for all users
-------------------------------------------------------------------------------
```

setUser

```
--------------------------------------------------------------------------------
   Syntax:  setUser [name] attribute "value"

   Where:
     []            : indicates an optional parameter
     name          : is the login name of the user (e.g. john_doe)
                     or leave it empty to refer to all users
     attribute
       : is one of the following profile attributes:
            password      - following these rules:
                            - minimum of 8 characters,
                            - maximum of 32 characters,
                            - must include at least 4 letters (case sensitive),
                            - must include at least 1 digit (0-9),
                            - should have one or more symbols from !@#$^&*
                              for higher security, but not required
            hint          - text to help remember the password
            first_name    - the user's first name
            last_name     - the user's last name
            company_name  - the user's companyname
            job_role      - the user's job role or title
            company_phone - 888-555-1818 x12345
            direct_phone  - 212-555-1010
            email         - the user's email address
            sms           - address for SMS (e.g. 2125551010@txt.carrier.net)
     lockout         - use the value 'clear' to clear a login lockout

       : or one of the following privilege attributes
         with a value of true/false or yes/no:
            login_via_web (enable_web)
            login_via_cli (enable_cli)
            login_via_ftp (enable_ftp)
            view_power
              control_outlets
              edit_outlets
              edit_phases
              edit_inlets
              view_environment
                edit_environment
              view_alert
                edit_alert
              view users
                edit_users
              view_network
                edit_http,   edit_tcpip
                edit_telnet, edit_sntp
                edit_ssh,    edit_smtp
                edit_ftp,    edit_snmp
              view_logs
                edit_logs
              view_system
                edit_system

     Examples:
       setUser john_doe password "Qwer!234"
       setUser webadmin login_via_web true
       setUser john_doe company_name "Silicon Farmers"
       setUser dbAdmin job_role "Server Support Contractor"
       setUser webadmin edit_system true
--------------------------------------------------------------------------------
```

addUser

```
--------------------------------------------------------------------------------
   Syntax:    addUser "name" with_password "loginPswd"

   Where:
     name          : the account name, following these rules:
                     - minimum of 3 characters,
                     - maximum of 32 characters,
                     - letters (case sensitive), numerals, underscores,
                       hyphens, periods, and @ symbols.
                     - leading/trailing spaces will be trimmed,
                     - the name cannot already be used.
     loginPswd     : the account password, following these rules:
                     - minimum of 8 characters,
                     - maximum of 32 characters,
                     - must include at least 4 letters (case sensitive),
                     - must include at least 1 digit (0-9),
                     - should have one or more symbols from !@#$^&*
                       for higher security, but not required

   Examples:
     addUser "JohnDoe" with_password "Qwer!234"
     addUser "mail_admin" with_password "wu7jsKhgr3poi"
     addUser "admin@example.com" with_password "wu7jsKhgr3poi"
--------------------------------------------------------------------------------
```

deleteUser

```
--------------------------------------------------------------------------------
   Syntax:    deleteUser name

   Where:
     name          : is the login name of the user (e.g. john_doe)

   Examples:
     deleteUser john_doe

     Be careful, there is no 'are you sure' check.
--------------------------------------------------------------------------------
```

getTcp

```
-------------------------------------------------------------------------------
   Syntax:  getTcp [attribute]

   Where:
     []            : indicates an optional parameter
     attribute     : is one of the following (or its alias):

       ipv4_dhcp          (dhcpv4, dhcp)
       ipv4_address       (ipv4, ip)
       ipv4_subnet        (subnet, mask)
       ipv4_gateway       (gateway)

   Examples:
     getTcp           : displays all attributes
     getTcp subnet    : displays a single attribute's value
-------------------------------------------------------------------------------
```

verifyTcp

```
-------------------------------------------------------------------------------
   Syntax:  verifyTcp [attribute]

   Where:
     []            : indicates an optional parameter
     attribute     : is one of the following:

       v4          : to verify IPv4 static settings

   Examples:
     verifyTcp v4  : verifies only IPv4
-------------------------------------------------------------------------------
```

setTcp

```
-------------------------------------------------------------------------------
   Syntax:  setTcp attribute value


   Where:
     []            : indicates an optional parameter
     attribute     : is one of the following (or its alias):

       ipv4_dhcp          (dhcpv4, dhcp)
       ipv4_address       (ipv4, ip)
       ipv4_subnet        (subnet, mask)
       ipv4_gateway       (gateway)

     value for ipv4_dhcp      : is on|off
     value for ipv4_address   : is formatted like N.N.N.N (8-bit integers)
                                where each N is an 8-bit integer
     value for ipv4_subnet    : is formatted like N.N.N.N
     value for ipv4_gateway   : is formatted like N.N.N.N


   Examples:
     setTcp ip 192.168.0.15       : sets the ipv4 address
     setTcp subnet 255.255.255.0  : sets the ipv4 subnet mask
-------------------------------------------------------------------------------
```

getHttp

```
--------------------------------------------------------------------------------
   Syntax:  getHttp [attribute]

   Where:
     []            : indicates an optional parameter
     attribute     : is one of the following (or its alias):

       mode              --
       http_port         (port)
       https_port        --
       cert_type         (cert)
       session_minutes   (session, session_mins)

   Examples:
     getHttp             : displays all attributes
     getHttp http_port   : displays a single attribute's value
--------------------------------------------------------------------------------
```

setHttp

```
--------------------------------------------------------------------------------
   Syntax:  setHttp attribute value

   Where:
     []            : indicates an optional parameter
     attribute     : is one of the following (or its alias):

       mode              --
       http_port         (port)
       https_port        --
       cert_type         (cert)
       session_minutes   (session, session_mins)

     value for mode              : is a string: disabled | http | https
     value for http_port         : is an integer (default is 80)
     value for https_port        : is an integer (default is 443)
     value for cert_type         : is a string: self_signed | ca_signed
     value for session_minutes   : is an integer of minutes. Applies to both
                                   http and https user sessions.
                                   (default is 30, min is 15, max is 1440)

   Examples:
     setHttp http_port 8080 : binds HTTP to port 8080
     setHttp session 45     : session invalid after 45 mins of inactivity
--------------------------------------------------------------------------------
```

getSntp

```
-------------------------------------------------------------------------------
   Syntax:  getSntp [attribute]

   Where:
     []            : indicates an optional parameter
     attribute     : is one of the following (or its alias):

       server1           (ip1)
       server2           (ip2)
       sync_interval     (sync)
       std_gmt_offset    (std, std_gmt, std_offset)
       dst_gmt_offset    (dst, dst_gmt, dst_offset)
       dst_start         (start)
       dst_end           (end)

   Examples:
     getSntp             : displays all attributes
     getSntp server1     : displays a single attribute's value
-------------------------------------------------------------------------------
```

setSntp

```
-------------------------------------------------------------------------------
   Syntax:  setSntp attribute value

   Where:
     []            : indicates an optional parameter
     attribute     : is one of the following (or its alias):

       server1           (ip1)
       server2           (ip2)
       sync_interval     (sync)
       std_gmt_offset    (std, std_gmt, std_offset)
       dst_gmt_offset    (dst, dst_gmt, dst_offset)
       dst_start         (start)
       dst_end           (end)

     value for servers        : is an IPv4 address
     value for sync           : is between 0 and 168 hours (default is 12)
     value for gmt offset     : is from -12 to +14
     value for dst_start/end  : is in format of 3.2.0/02:00:00
                                which means March, 2nd week, Sun, 2am

   Examples:
     setSntp sync_interval 12   : updates local clock time every 12 hours
     setSntp dst_zone GMT-7     : sets DST to 7 hrs before GMT
-------------------------------------------------------------------------------
```

getFtp

```
--------------------------------------------------------------------------------
   Syntax:  getFtp [attribute]

   Where:
     []            : indicates an optional parameter
     attribute     : is one of the following (or its alias):

       enabled     enable
       port        --

   Examples:
     getFtp            : displays all attributes
     getFtp enabled    : displays a single attribute's value
--------------------------------------------------------------------------------
```

setFtp

```
--------------------------------------------------------------------------------
   Syntax:    setFtp attribute value

   Where:
     []            : indicates an optional parameter
     attribute     : is one of the following (or its alias):

       enabled     enable
       port        --

     value for enabled     : is true|false or on|off
     value for port        : is an integer (default is 21)

   Examples:
     setFtp enabled true   : enables FTP service
     setFtp port 2100      : binds FTP to port 2100
--------------------------------------------------------------------------------
```

getTelnet

```
--------------------------------------------------------------------------------
   Syntax:  getTelnet [attribute]

   Where:
     []            : indicates an optional parameter
     attribute     : is one of the following (or its alias):

       enabled     enable
       port        --

   Examples:
     getTelnet            : displays all attributes
     getTelnet enabled    : displays a single attribute's value
--------------------------------------------------------------------------------
```

setTelnet

```
--------------------------------------------------------------------------------
   Syntax:    setTelnet attribute value

   Where:
     []            : indicates an optional parameter
     attribute     : is one of the following (or its alias):

       enabled     enable
       port        --

     value for enabled     : is true|false or on|off
     value for port        : is an integer (default is 23)

   Examples:
     setTelnet enabled true   : enables Telnet service
     setTelnet port 2100      : binds Telnet to port 2100
--------------------------------------------------------------------------------
```

getSsh

```
--------------------------------------------------------------------------------
   Syntax:  getSsh [attribute]

   Where:
     []            : indicates an optional parameter
     attribute     : is one of the following (or its alias):

       enabled     enable
       port        --

   Examples:
     getSsh            : displays all attributes
     getSsh enabled    : displays a single attribute's value
--------------------------------------------------------------------------------
```

setSsh

```
--------------------------------------------------------------------------------
   Syntax:    setSsh attribute value

   Where:
     []            : indicates an optional parameter
     attribute     : is one of the following (or its alias):

       enabled     enable
       port        --

     value for enabled     : is true|false or on|off
     value for port        : is an integer (default is 22)

   Examples:
     setSsh enabled true   : enables Ssh service
     setSsh port 2100      : binds Ssh to port 2100
--------------------------------------------------------------------------------
```

getSmtp

```
-------------------------------------------------------------------------------
   Syntax:  getSmtp [attribute]

   Where:
     []            : indicates an optional parameter
     attribute     : is one of the following (or its alias):

       server           --
       port             --
       auth_method      --
       account          --
       password         --

   Examples:
     getSmtp           : displays all attributes
     getSmtp account   : displays a single attribute's value
-------------------------------------------------------------------------------
```

setSmtp

```
-------------------------------------------------------------------------------
   Syntax:  setSmtp attribute value

   Where:
     []            : indicates an optional parameter
     attribute     : is one of the following (or its alias):

       server           --
       port             --
       auth_method      --
       account          --
       password         --
       test_email       (email, email_test)
       test_sms         (sms, sms_test)

     value for server       : is an IPv4 address
     value for port         : is an integer (default is 25)
     value for auth_method  : is none|any|plain|login|cram|digest
     value for account      : is an email address on the SMTP server
     value for password     : is the account's password
     value for test_email   : is a quoted comma list of one or more
                              user login names or email addresses
     value for test_sms     : is a quoted comma list of one or more
                              user login names or sms phone@gateway addresses

   Examples:
     setSmtp account pdu@xxx.com
     setSmtp server 192.168.0.124
     setSmtp test_email "root,me@example.com"
     setSmtp test_sms "root,8885551212@txt.carrier.net"
-------------------------------------------------------------------------------
```

getSnmp

```
-------------------------------------------------------------------------------
   Syntax:  getSnmp [attribute]

   Where:
     []            : indicates an optional parameter
     attribute     : is one of the following (or its alias):

       enabled              --
       data_port            --
       community1_string    (comm1)
       community2_string    (comm2)
       trap_ip              --
       trap_port            --
       trap_community       (trap_comm)
       notifications_user   (notif_user)

   Examples:
     getSnmp             : displays all attributes
     getSnmp trap_port   : displays a single attribute's value
-------------------------------------------------------------------------------
```

setSnmp

```
-------------------------------------------------------------------------------
   Syntax:  setSnmp attribute value

   Where:
     []            : indicates an optional parameter
     attribute     : is one of the following (or its alias):

       enabled              --
       data_port            --
       community1_string    (comm1)
       community2_string    (comm2)
       trap_ip              --
       trap_port            --
       trap_community       (trap_comm)
       notifications_user   (notif_user)

     value for enabled            : is true|false or on|off
     value for data_port          : is an integer (default is 161)
     value for community strings  : is a passphrase of 6-32 characters
     value for trap_ip            : is an IPv4 address
     value for trap_port          : is an integer (default is 162)
     value for trap_community     : is a passphrase of 6-32 characters
     value for notifications_user : is a passphrase of 6-32 characters

   Examples:
     setSnmp data_port 161
     setSnmp trap_ip 192.168.0.124
     setSnmp comm1 "read-only-w5dK-u#d9"
-------------------------------------------------------------------------------
```

getSnmpUsm

```
-------------------------------------------------------------------------------
   Syntax:  getSnmpUsm [id] [attribute]
            alternate form 'getUsm' also allowed

   Where:
     []             : indicates an optional parameter
     id             : is the the ID of the USM record (1-4)
                      or leave it empty to refer to all records
     attribute      : is one of the following (or its alias):

       name               --
       auth_method        authm
       auth_passphrase    authp
       priv_method        privm
       priv_passphrase    privp

   Examples:
     getSnmpUsm 1 name    : gets one attribute for one user
     getSnmpUsm 1         : gets all attributes for one user
     getSnmpUsm name      : gets one attribute for all users
     getSnmpUsm           : gets all attributes for all users
-------------------------------------------------------------------------------
```

setSnmpUsm

```
-------------------------------------------------------------------------------
   Syntax:  setSnmpUsm [id] attribute "value"
            alternate form 'setUsm' also allowed

   Where:
     []             : indicates an optional parameter
     id             : is the the ID of the USM record (1-4)
                      or leave it empty to refer to all records
     attribute      : is one of the following (or its alias):
       name               --
       auth_method        authm
       auth_passphrase    authp
       priv_method        privm
       priv_passphrase    privp

     value for name              : is a quoted string identifying the user
                                   (4-32 printable ASCII chars, but not ~ or =)
     value for auth_method       : is either 'none' or 'md5'
     value for auth_passphrase   : is a quoted password/passphrase
                                   (6-32 printable ASCII chars, but not ~ or =)
     value for priv_method       : is either 'none' or 'des'
     value for priv_passphrase   : is a quoted password/passphrase
                                   (6-32 printable ASCII chars, but not ~ or =)

   Examples:
     setSnmpUsm 1 name "managementApp"    : sets one record's name
     setSnmpUsm 1 auth_method MD5         : sets one record
     setSnmpUsm 1 authp "mngrpP8*word"    : sets one record
-------------------------------------------------------------------------------
```

verifyUsm

```
-------------------------------------------------------------------------------
   Syntax:  verifyUsm

   Verifies that all USM records have valid configurations, which includes:
   - name with both auth and priv methods as none, and empty passphrases.
   - name with non-none auth method and auth passprhrase, but no priv settings.
   - name with non-none auth and priv methods, and both non-empty passphrases.
   - all settings with empty values (to leave the record unconfigured).
-------------------------------------------------------------------------------
```

clearUsm

```
-------------------------------------------------------------------------------
   Syntax:  clearSnmpUsm id
            alternate form 'clearUsm' also allowed

   Where:
     id     : is the the ID of the USM record (1-4)

   Examples:
     clearSnmpUsm 4   : clears only USM record 4 to empty values
-------------------------------------------------------------------------------
```

getNetwork

```
-------------------------------------------------------------------------------
   Syntax:    getNetwork

   Examples:  getNetwork : displays all network settings attributes
-------------------------------------------------------------------------------
```

Log Commands

viewLog

```
--------------------------------------------------------------------------------
   Syntax:  viewLog [severity option] [category option]
            alternate form 'showLog' also allowed


   Where:
     []            : indicates an optional parameter
     attribute     : is one of the following (or its alias):

       severity      (sev)
       category      (cat)
       count

     severity option is one of the following:
       critical, error, warn, info, debug

     category option is one of the following:
       alarm, email, switch, config, startup, login,
       files, time, log, system, kernel

   Examples:
     viewLog                     : shows all log lines
     viewLog severity error      : shows error entries for all categories
     viewLog category switch     : shows only switch category log lines
     viewLog sev error cat files : shows only errors related to the file system
--------------------------------------------------------------------------------
```

viewStartupLog

```
--------------------------------------------------------------------------------
   Syntax:  viewStartupLog [count]
            alternate form 'showStartupLog' also allowed

   Examples:
      viewStartupLog       : shows all log lines
                             (doesn't use severity & category filters)

      viewStartupLog count : shows startup log record count
--------------------------------------------------------------------------------
```

exportLog

```
--------------------------------------------------------------------------------
   Syntax:  exportLog

   Description:
      Exports the internal event log to a tab-delimited text file in the FTP
      file system at FLASH0/Logs/. (Startup log records are included.)
--------------------------------------------------------------------------------
```

getLog

```
-------------------------------------------------------------------------------
   Syntax:  getLog attribute

   Where:
     []            : indicates an optional parameter
     attribute     : is one of the following:

       max_records
       cli_switching
       rest_switching
       snmp_switching

   Examples:
     getLog                    : shows all log setting attributes
     getLog cli_switching      : shows the cli_switching attribute value
-------------------------------------------------------------------------------
```

setLog

```
-------------------------------------------------------------------------------
   Syntax:  setLog attribute [value]

   Where:
     []            : indicates an optional parameter
     attribute     : is one of the following:

       max_records
       cli_switching
       rest_switching
       snmp_switching
       reset!!!

     value for max_records  : 0 to disable all logging, or
                              an integer between 20 and 1000
     value for switching    : either yes/no or on/off
     value for reset!!!     : no value

   Examples:
     setLog max_records 250    : Erases all log entries, and sets a
                                 new limit of 250 records. There is NO
                                 "are you sure" step.
     setLog cli_switching on   : enables logging of CLI switch commands
     setLog reset!!!           : Erases all log entries. There is NO
                                 "are you sure" step.
-------------------------------------------------------------------------------
```

System Commands

getSystem

```
--------------------------------------------------------------------------------
   Syntax:  getSystem [attribute]

   Where:
     []            : indicates an optional parameter
     attribute     : is one of the following (or its alias):

       label             --
       location          (loc)
       asset_id          (asset)
       contact           --
       model_number      (model, model_no)
       serial_number     (serial, serial_no)
       web_link          (link)
       mac_address       (mac, mac_addr)
       dialog_baudrate   (baud)
       dialog_delay      (delay)
       version           --
       platform          --
       crc               --
       degrees           --
       start_time        (started)
       time              --

   Examples:
     getSystem label     : gets one attribute of the system
     getSystem           : gets all attributes of the system
     getSystem export    : exports user settings to FTP file space
--------------------------------------------------------------------------------
```

setSystem

```
--------------------------------------------------------------------------------
   Syntax:  setSystem attribute [value]

   Where:
     []            : indicates an optional parameter
     attribute     : is one of the following (or its alias):

       label             --
       location          (loc)
       asset_id          (asset)
       contact           --
       dialog_baudrate   (baud)
       dialog_delay      (delay)
       degrees           --
       time              --
       restart           --
       reset!!!          --

     value for label      : is a quoted string (30 chars max)
     value for location   : is a quoted string (22 chars max)
     value for asset_id   : is a quoted string (30 chars max)
     value for contact    : is a quoted string (80 chars max)
     value for baudrate   : is an integer from the options of:
                            1200, 2400, 4800, 9600, 19200, 38400, 57600, 115200
     value for delay      : is an integer from the options of: 10 or 5
     value for degrees    : is either F or C
     value for time       : is formatted like "YYYY-MM-DD HH:MM:SS" (24 hr)
                            (applicable only when not connected to SNTP)
     value for restart    : none
     value for reset      : none (be careful)

   Examples:
     setSystem label "WWW Servers"   : sets label of the system
     setSystem asset "19-12-27-032"  : sets label of the system
     setSystem restart               : restarts the system software
     setSystem reset!!!              : erases all settings and restores
                                       factory defaults. There is NO extra
                                       "are you sure" step. Be careful!
--------------------------------------------------------------------------------
```

exportSettings

```
--------------------------------------------------------------------------------
   Syntax:  exportSettings

   Description:
      Exports user-defined settings to tab-delimited text files in the FTP
      file system at FLASH0/Settings/.
--------------------------------------------------------------------------------
```

updateExportKey

```
--------------------------------------------------------------------------------
   Syntax:  updateExportKey

   Description:
     This command generates a new export key.
     Any exports created prior to this new key will not be importable.
--------------------------------------------------------------------------------
```

restart

```
--------------------------------------------------------------------------------
   Syntax:  restart

   Description:
   Restarts the RCM main board software. Does not reset peripheral boards
   running power sensors or outlet relays. Power to outlets will continue.
--------------------------------------------------------------------------------
```

* Synonymous with the command `setSystem restart`

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Settings Files Reference

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Settings Files Reference

Settings may be exported to text files. This is primarily intended to document and archive the setup of the PDU. However, exported files may be imported to a PDU to restore settings, or even to transfer settings to multiple PDUs.

Since settings files are just text files, they can be edited. This can be taken advantage of by exporting one PDU's settings, and creating multiple slightly different variations of settings for different PDUs.

If a handful of PDUs are to be configured once and rarely changed, then working with settings files is not likely a productive option. However, multiple new PDUs are frequently provisioned for identical or similar applications, then learning how to export/edit/import settings files may be a faster way to get them configured compared to editing via the web UI or CLI. (Scripting the Telnet interface is also a productive alternative.)

Exporting Settings Files

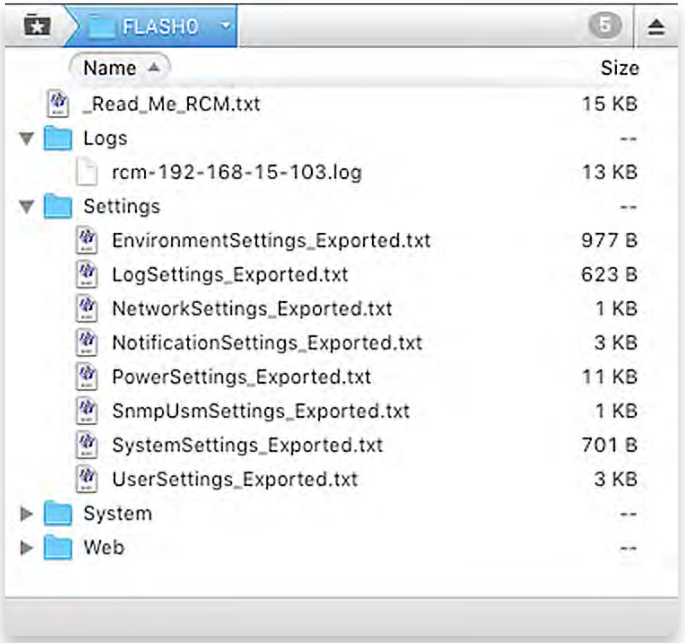
Files can be exported using the web interface or command line.

To export settings using the web interface, open the System page, and find the User Settings panel. Press Export.

To export settings using the command line, log into Telnet or SSH (or use the Serial CLI) and execute the command `exportSettings`.

All settings will be exported to the FTP file system /FLASH0/Settings/ folder. Each file name will have an _Exported suffix and .txt file extension.

Additionally, a file named ExportKey.txt will be exported to /FLASH0/System/ which should also be copied and stored (through separately from the settings files). See the next two sections to understand the use of the ExportKey file.



Export Key File

Some files, such as NetworkSettings, may have sensitive data fields. These fields are encrypted in the exported text files. One component of that encryption is called the Export Key. When files are exported, that key is also exported in the /FLASH0/System/ExportKey.txt file.

This key will be needed to import settings into other PDUs, and will be useful for importing back to the same PDU if the key had changed, or the PDU has been reset to default settings.

The ExportKey.txt file should be removed from the FTP file system after a settings export and kept separately from the settings files. Anyone with access to the exported settings file and the key could potentially use another RCM PDU to important those settings—thus decrypting them. As with all encryption keys, keep the Export Key value safe and separate from the data it is used to encrypt.

The key is created automatically. It can be forced to change using the CLI command `updateExportKey`.

Importing Settings Files

To import settings, put the settings files into the /FLASH0/Settings/ folder of any PDU, and remove the _Exported suffix from each file. The file names must be as follows:

- EnvironmentSettings.txt
- LogSettings.txt
- NetworkSettings.txt
- NotificationSettings.txt
- PowerSettings.txt
- SnmpUsmSettings.txt
- SystemSettings.txt
- UserSettings.txt

Next, also upload the ExportKey.txt file to the /FLASH0/Settings/ folder. If you know the key has not changed, the key file is not needed to import settings into the same PDU from which they were exported. If the correct key is not available, affected fields will be decrypted incorrectly, and will need updated manually via CLI or web UI.

THE EXPORT KEY SHOULD BE STORED SEPARATELY FROM THE EXPORT SETTINGS FILES.

Anyone with access to the exported settings file and the key could potentially use another RCM PDU to important those settings—thus decrypting them.

As with all encryption keys, keep the Export Key value safe and separate from the data it is used to encrypt.

Once all files are uploaded, restart the PDU. During startup, the RCM software will import each file. This will result in the PDU startup taking longer than normal—depending on the number of settings details being imported, the extra delay can be several minutes. Be patient, do not interrupt the process, and wait for the PDU to indicate that it is ready. If the PDU has an on-board display, the display will provide indication of the progress through the imports and normal startup steps.

After the files have been imported, the file names will be automatically changed to have _Imported suffixes so they don't get imported again at the next startup. The ExportKey.txt file will have been automatically deleted (as there's no need to keep it there).

After the PDU has completed startup, check the log for any errors which may have been noted.

Know What You're Doing

Read the warning at the right!

The safest way to change settings on an RCM PDU is to use the built-in web interface or command line. However, it is understood that making changes to multiple PDUs this way can be time consuming.

Making settings available in user-editable files is an advanced capability. It is intended for people with experience in managing server-like configuration files, and who are practiced at learning and recognizing the format, syntax, and requirements of such files.

Not every suitable scenario for or consequence of editing files directly are explained in this guide.

File Format and Syntax

Settings files are ASCII text files saved with "Windows-style" line endings (that is, the \r\n sequence). Files may be copied, opened, and edited before moving them to another PDU to be imported.

Use a text editor, not a word processor, to edit these files. On Windows, the simple Notepad utility will work (though a more sophisticated text editor will provide better editing tools). Do not use WordPad, or any of the "office" type applications like Microsoft Word, OpenOffice Writer, Apple Pages, etc.

The settings files are generally not white-space sensitive (other than needing a line ending at the end of the file). White spaces between delimited items on a line can be tabs or spaces, or mixes of both. The format of each file is detailed in the sections below, however, refer to "Software Settings" on page 87 for details about the internal settings of each file.

IMPORTING EDITED SETTINGS FILES CAN RESULT IN A MISCONFIGURED PDU WHICH DOES NOT OPERATE AS EXPECTED.

It is highly recommended that if you plan to edit files directly, that you have a non-mission-critical PDU available to experiment, practice, and learn with. Only after you're comfortable (and perhaps your boss is comfortable) that you know what you're doing should you import files into PDUs in service.

Marway has attempted to make the RCM software self-healing from the affects of malformed files. However, we cannot guarantee that every conceivable malformed variation within a file or combination of files will not result in a PDU which must be returned to the factory to restore it to complete operation.

Be careful. Test your changes on a non-mission-critical PDU before deploying.

AFTER UPLOADING SETTINGS FILES, THE PDU MUST BE RESTARTED FOR THE CHANGES TO TAKE EFFECT.

```
A block like this will be used to show a whole file (if it can fit on the
page).
```

```
A block like this will be used to show a fragment of a file (that is, the
whole file is not being shown, only a portion of it).
```

Name-value Pairs

All files include name-value pairs where a setting name is followed by an = and the setting value. The whitespace surrounding the = is not significant. Most files have whitespace before = in order to neatly align the setting values, but this spacing is not meaningful. Likewise, settings which are subordinate to a named group may be indented. The indentation is not significant. Examples of name-value pairs:

```
loginName = root
onDelaySeconds = 5.0
```

Any valid setting name which does not have a valid value, will be reverted to the factory default for that setting.

Objects and IDs

Some files include named objects with IDs in the format of `object~N` where object is a label such as outlet, http, user (and others), and where N is a simple incremental integer (1, 2, 3, etc.), The whitespace around the ~ is not significant. Examples of objects and IDs:

```
outlet~3
user~1
http~1
```

Object Groups of Settings

Files using named objects will have groups of settings for that object listed under the object name. The start of the group is a line with an `object~id`. The end of the group is defined when a line with another named object is reached, or the end of the file is reached. The grouped settings may be indented, but these spaces are not meaningful.

Some files have a mixture of "root level" settings (name-value pairs which are not part of named object group) as well as group level settings. In these files, all root level settings must be be above the first named object group. Here's an example of ungrouped settings followed by an object group and its settings from NotificationSettings.txt:

```
// root-level settings
realertMinutes = 20
silenceHours   = 4

// named object with group-level settings
unit~1
  triggers      = startup, epo
  emailToUsers  = root,lester
  smsToUsers    = root,lester
  sendSnmpTrap  = true

power~1
  triggers      = amps, volts
  emailToUsers  = root
  smsToUsers    = root,lester
  sendSnmpTrap  = true
```

The order of root-level name-value pairs is not significant. In the above example, `silenceHours` could be listed first.

The order of named groups within a file *may be significant*. This will be detailed in the sections below.

However, the order of the name-value pairs within any one group is not significant. In the above example, the `triggers` setting within each group could be first, second, last—it doesn't matter. However, a name-value pair which belongs to a specific group must be within its group (after the group name, and before another group name).

File Identity and Version

The first two lines of a settings file are critical to identifying the contents of the file. The first line identifies the file type, and the second line identifies the format version of the file (not the version of the RCM software).

Being a part of the text file, theses values are technically editable, therefore it is critical to ensure they remain correct. Be sure they are correct for the target PDU before importing. The best way to assure the correct version and formatting is being used is to export settings from a PDU and verify the identity and version data of those files.

Comments

Comment lines are allowed. Comments must begin at the start of the line—that is, be on a line all to themselves, and not be on the same line as a settings definition. Comments can start with either # or //.

Exported File Comments

Files which have been exported will have a block of commented lines near the top of the file. These lines identify details of the source of the exported file.

```
  (a fragment of NetworkSettings.txt)


identity = RCM_NETWORK_SETTINGS
version  = 2.0.0

# This file was exported from the Marway product indicated below.
# See the User Guide for details about how to import it to other units.
#
# Export Date: ..... 2017-04-11 08:33:50
# Model No: ........ MPD 833012-PSW-000
# Serial No: ....... MPS 000000-00
# MAC ID: .......... a1:b2:c3:d4:e5:f6
# Unit Label: ...... Test Bay 2 PDU
# Unit Location: ... R&D Building 112
# Unit Asset ID: ... ENG 999-001084


tcpip~1
  v4Dhcp          = false
  v4Address       = 192.168.15.6
  v4Subnet        = 255.255.255.0
  v4Gateway       = 192.168.15.1
  v6Dhcp          = true
  v6Address       = ::
  v6Gateway       = ::
  v6PrefixLength   = 0
```

SystemSettings.txt

Refer to "System Settings" on page 89 for details about the settings.

This is a simple file consisting of a relative few settings. The entire file is shown at the right. The formatting of the file consists entirely of root-level name-value pairs. There are no named object groups.

SystemSettings can be shared across all PDU models running the same version of RCM software.

```
identity = RCM_SYSTEM_SETTINGS
version  = 2.0.0

label              = Test Bay 2 PDU
location           = R&D Building 112
assetId            = ENG 999-001084
contact            = Robin Banks, 999-888-5555
temperatureUnits   = Farenheit
dialogBaudRate     = 115200
dialogDelay        = 5
```

LogSettings.txt

Refer to Log Settings on page XX for details about the settings.

This is a simple file consisting of a relative few settings. The entire file is shown at the right. The formatting of the file consists entirely of root-level name-value pairs. There are no named object groups.

LogSettings can be shared across all PDU models running the same version of RCM software.

```
identity = RCM_LOG_SETTINGS
version  = 2.0.0

maxRecords            = 100
logCLISwitching       = false
logRESTfulSwitching   = false
logSNMPSwitching      = false
```

NetworkSettings.txt

Refer to "Network Settings" on page 90 for details about the settings.

This file consists of name-value pairs organized under named object groups corresponding to the protocols. Note the object ID of each protocol is 1. The order of the named protocol groups is not significant.

NetworkSettings can be shared across all PDU models running the same version of RCM software—however, the `tcpip` named group should not be included in files to be imported. These values are exported for documentation purposes, but since each PDU should have its own IP settings, this group will be ignored during import.

SnmpUsmSettings.txt

Refer to "Network Settings" on page 90 for details about the settings.

The order of the named groups *is* significant.

This file consists of name-value pairs organized under named object groups corresponding to a fixed number of user objects matching the SNMPv3 USM user settings. The object ID of each protocol is sequential starting with 1.

SnmpUsmSettings can be shared across all PDU models running the same version of RCM software.

UserSettings.txt

Refer to "User Settings" on page 97 for details about the settings.

This file consists of name-value pairs organized under named object groups corresponding to each user. Each user has a sequential object ID starting with 1, and is followed by several settings (not all are shown).

There is one required user whose loginName must be root. The root user must be the first user in the file, and have an ID of 1.

```
  (a fragment of NetworkSettings.txt)


identity = RCM_NETWORK_SETTINGS
version  = 2.0.0

http~1
  mode            = HTTPS
  httpPort        = 80
  sslPort         = 443
  certType        = CA-Signed
  sessionMins     = 30

sntp~1
  serverIp1       = 192.168.15.254
  serverIp2       = 192.168.15.254
  syncIntervalHrs = 12
  stdOffsetHrs    = -8.0
  dstOffsetHrs    = -7.0
  dstStartsAt     = 3.2.0/02:00:00
  dstEndsAt       = 11.1.0/02:00:00
```

```
  (a fragment of SnmpUsmSettings.txt)


identity = RCM_USM_SETTINGS
version  = 2.0.0

usm~1
  name              = managerApps
  authMethod        = MD5
  authPassphrase    =
  privMethod        = DES
  privPassphrase    =
```

After the root user, the order of the users must each have an ID incremented by one relative to the user before it (1, 2, 3, etc.).

If you need, but do not know, the root user password, the correct way to update the root user password is to use the serial interface. See the section "Serial Dialog: root User Password" on page 16. Re-export the users file to get the password hash and salt.

To create a new password hash and salt for a new user (other than root), use the CLI command `makeLoginPswd`. (otherwise the exported values of existing users will propagate that user's password to imported PDUs).

NotificationSettings.txt

Refer to "Notification Settings" on page 102 for details about the settings.

NotificationSettings can be transferred only to other PDUs of the same model. The order of the named groups *is* significant.

This file consists of name-value pairs organized under named object groups corresponding to a set of internally created notification objects specific to a PDU model's features.

The order of the named groups *is* significant. Each notification object has a sequential object ID for its object type starting with 1, and is followed by several settings. Therefore, there may be a `unit~1`, `power~1`, `outlet~1`, `outlet~2`, etc. depending on the PDUs hardware features.

(a fragment of UserSettings.txt)

```
identity = RCM_USER_SETTINGS
version  = 2.0.0

user~1
  loginName      = root
  loginPswd      = c33e6f892497cc56e25e8159834a0db299e27c8b
  pswdSalt       = l5bGJrjQpJmm
  pswdHint       = uncle billy
  // (big piece cut out of this example)

user~2
  loginName      = lester
  loginPswd      = c122bc8666ec22658f35cb0f0b438d85d56d8ade
```

(a fragment of NotificationSettings.txt)

```
identity = RCM_NOTIFICATION_SETTINGS
version  = 2.0.0

realertMinutes = 20
silenceHours   = 4

unit~1
  triggers      = sartup,epo
  emailToUsers  = root
  smsToUsers    = root
  sendSnmpTrap  = false
```

PowerSettings.txt

Refer to "Power Settings" on page 105 for details about the settings.

PowerSettings can be transferred only to other PDUs of the same model. The order of the named groups *is* significant.

This file consists of multiple structurally nested objects. Each layer of nested objects has its own series of sequential object IDs starting with 1. For example, a three-phase powered unit will have three `currentPhases` numbered 1, 2, and 3 as well as `voltagePhases` numbered 1, 2, and 3. There may be Circuits, and there will also be Outlets with IDs of 1, 2, and 3. The incremental numbering starts over with each change of object type. Each object is followed by several settings (not all are shown in the sample at the right).

(a fragment of PowerSettings.txt)

```
identity = RCM_POWER_SETTINGS
version  = 2.0.0

inlet~1
  label             = Power Bank A

currentPhase~1
  highCriticalAmps  = disabled
  highWarningAmps   = disabled
  lowWarningAmps    = disabled
  lowCriticalAmps   = disabled
  hysteresisAmps    = 0.50
  debounceSeconds   = 10.00

voltagePhase~1
  highCriticalVolts = disabled
  highWarningVolts  = disabled
  lowWarningVolts   = disabled
  lowCriticalVolts  = disabled
  hysteresisVolts   = 5.00
  debounceSeconds   = 10.00

outlet~1
  label             = Control Panel
  onDelaySeconds    = 0.00
  offDelaySeconds   = 0.00
  cycleDelaySeconds = 3.00
 startupState       = on
  switchIsAlertable = true

outlet~2
  label             = DAQ Chassis
  onDelaySeconds    = 0.00
  offDelaySeconds   = 0.00
  cycleDelaySeconds = 8.00
  startupState      = on
  switchIsAlertable = true
```

EnvironmentSettings.txt

Refer to "Environment Settings" on page 111 for details about the settings.

This file consists of name-value pairs organized under named object groups corresponding to the sensor type and ID.

The order of the named groups *is* significant. Each sensor type has a sequential object ID for its object type starting with 1, and is followed by several settings. Each instance of a sensor type should be listed before changing sensor types. Therefore, all temperature sensors should be listed in sequence, followed by all humidity sensors in sequence.

```
identity = RCM_ENVIRO_SETTINGS
version  = 2.0.0

temperature~1
  label              = Top of Rack
  highCritical       = disabled
  highWarning        = disabled
  lowWarning         = disabled
  lowCritical        = disabled
  hysteresis         = 3.00
  debounceSeconds    = 45.00

temperature~2
  label              = Middle of Rack
  highCritical       = disabled
  highWarning        = disabled
  lowWarning         = disabled
  lowCritical        = disabled
  hysteresis         = 3.00
  debounceSeconds    = 45.00

humidity~1
  label              = Top of Rack
  highCritical       = disabled
  highWarning        = disabled
  lowWarning         = disabled
  lowCritical        = disabled
  hysteresis         = 2.00
  debounceSeconds    = 45.00

humidity~2
  label              = Middle of Rack
  highCritical       = disabled
  highWarning        = disabled
  lowWarning         = disabled
  lowCritical        = disabled
  hysteresis         = 2.00
  debounceSeconds    = 45.00
```

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RESTful API Reference

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RESTful API Reference

This chapter includes an overview of what a RESTful API is, and the details of using the RCM Software implementation.

The RESTful API for RCM Software is designed to support optimized machine-to-machine control of a PDU by a remote script, primarily in the application of automated test and evaluation ("ATE"). Therefore, the focus of the API is to provide access to power management features such as switching outlets and collecting power data where available. The API does not support access to non-power-related resources such as Users, Logs, configuration settings, etc. It is possible to automate access to these resources using Telnet commands.

What is REST and RESTful API?

The Gist of REST

REST is an acronym for REpresentational State Transfer which at an academic level boils down to being an architectural style of how to represent information on a distributed hypermedia system. In other words, it's a particular style of how to design links and connections to information resources on a computer network (such as the internet).

It was originally described in 2000 (see the reference material sidebar), but has gained rapid popularity in recent years. During that time, there's been significant chatter amongst software developers about the academic and pragmatic nuances. For the purposes the RCM software, the objectives and implications are far simpler than what has to be considered for more complex applications.

Reference Materials for REST

The canonical academic paper which defined REST:
http://www.ics.uci.edu/~fielding/pubs/dissertation/rest_arch_style.htm

Some additional internet discussions about REST:
http://en.wikipedia.org/wiki/Representational_state_transfer
https://developer.ibm.com/articles/ws-restful/

One pedantic point to cover is the difference between the terms REST and RESTful. REST is an architecture not a protocol (such as HTTP, FTP, etc.). Therefore, a system does not access information via REST. Rather, the data is accessed in a REST-like or RESTful manner. The latter term has the broader usage, and thus we end up with the term RESTful API—a programmer's interface to something using a RESTful design style.

Programming for a RESTful API

Since the REST architecture was originally conceived in the context of hypermedia (i.e. the world wide web), a fundamental tenet of REST is the use of HTTP as the communication protocol.

There are plenty of good resources online describing REST and RESTful API design. However, the bottom line for the RCM software is that messages are sent to the PDU using a combination of HTTP URIs, verbs, and form data. For example to switch an outlet on, the URL

```
PATCH http://192.168.1.10/outlets/3/switch
```

would be sent along with name-pair form data of an existing session, and the new state value for the outlet switch like this:

```
session_id=Ygv0PkCheJrl4UuyPfd1OFUpD807XQ4Y
new_value=on
```

The response to this request will be a standard HTTP response with the body having a simple string. Many responses to RCM requests are single values, so the HTTP content type will be text/plain rather than incur unneeded overhead of XML or JSON parsing (common formats for RESTful responses).

Programming for a RESTful API involves using an HTTP library for your programming language of choice in order to deliver an HTTP request to the PDU, and acquire HTTP responses which are usually already parsed into their header and body components. Again, there are plenty of online resources to help overcome the learning curve.

Why Use the RESTful API?

The RESTful API is provided as an alternative to the common practice of scripting to a Telnet interface or even SNMP. Telnet is intended to be a human interface. From the machine perspective, there's a lot of wordy noise to parse out to acquire just the facts needed. The RCM RESTful API eliminates all that noise. While SNMP is designed as a machine-to-machine interface, it can be complex to develop scripts with, and difficult for people to read. Since a RESTful API is basic HTTP, and is more human readable than SNMP, it can be both quicker to develop custom automation scripts with, and more efficient to for the machine-to-machine dialog.

Request Syntax

Each request will be made of up elements in the URL as well as additional HTTP form parameters. We refer to the key URL elements as the verb, noun, instance ID, and attribute. The form of a request URL like this:

```
POST https://192.168.0.10/outlets/1/switch?session_id=x
```

can be represented generically as this:

```
:verb https://192.168.0.10/:noun/:id/:attribute?:form_parameter(s)
```

The noun is what REST refers to as the resource.

API Verbs

The RCM Software RESTful API makes use of GET, POST, PATCH, and DELETE behaviors. There is no need for PUT, and HEAD is not utilized in any meaningful way. However, the embedded web server, like most web servers, supports only GET, POST, and HEAD request methods. Since HEAD is not used, there's no conflict there. However, to provide support for PATCH and DELETE, the API uses a common technique of creating a pseudo-verb through a form parameter.

Whenever a URL needs GET or POST, the standard HTTP request method can be specified. However, when PATCH or DELETE are needed, the URL must be submitted with POST, and the request must include a form parameter named `rest_method` along with a string value of "`PATCH`" or "`DELETE`" as needed. For example, while the following would be ideal:

```
PATCH https://192.168.0.10/outlets/1/switch?
new_value=on&session_id=abcxyz
```

it is necessary to accomplish that message this way:

```
POST https://192.168.0.10/outlets/1/switch?
new_value=on&session_id=abcxyz&rest_method=PATCH
```

This form-parameter technique is quite common in RESTful APIs since many web servers (and browsers) do not support all HTTP verbs. The world wide web got started with GET, POST, and HEAD, and thus we are left to create a work around for those verbs not widely supported yet.

API Nouns / Resources

The target or object of a RESTful API request is a resource. This is the noun of the request. In the RCM software, supported resources include: session, system, inlets, phases, circuits, outlets, temperature, and humidity. Not all objects are supported on every PDU.

API Attributes

Attributes are the details about an object (noun). For an RCM `system` object, that includes the label, location, asset ID, contact, and more. For an `outlet` object, attributes include label, switch, rated_volts, and others.

For the most part, any object available in the RESTful API will support all of the attributes supported by the command line for that same object. Sometimes, the CLI includes attribute groups such as `power`, `rating`, or `switch_info`, but these are not individual data point attributes, and would not be supported in the RESTful API.

API Form Parameters

These are request parameters passed as HTTP form parameters. In a POST, these will usually be part of the header, and in a GET they would normally be part of the URL, but either style works.

Common form parameters will be `session_id` and `rest_method`. Though some requests may have others.

Responses

As of this release, the API does not support discovery of the PDU power architecture (how many power inlets, phases, outlets, etc.). That is, it does not support requesting collections which could be parsed to navigate or "walk" available resources. It is assumed the power architecture of the PDU is a known entity which will remain stable over the life of a given script of automated tasks.

While these limitations might been seen as restrictive from the traditional RESTful API perspective, it helps to focus the limited resources of an embedded controller on the most value-added capabilities for the majority of applications.

Given the API's focus on working with specific individual attributes, responses are single-value text strings with the `Content-Type` of `text/plain` (the API does not adapt to requests for specific formats), and there should be no need to parse the HTTP response body.

If a request fails, or was malformed to start with, a value in the form of a negative number is returned. Additionally, the HTTP content type will be set to `text/html` to indicate the body is an error (see side bar "RCM REST Error Codes"). Therefore, while the body should not need parsed, the HTTP `Content-Type` header needs to be tested to determine if the response is an error or valid data.

Authentication API

RCM resources are not public. A conversation over the RESTful API must be initialized with an authentication which results in the creation of a session. Each subsequent request must be authenticated with a session ID.

A session ID is obtained with a POST to /session with parameters account=&password=. A 32-character string is returned. That string has to be submitted as part of all other requests in a parameter named session_id=.

The user can be any RCM user allowed access via the web. It is beneficial to define a user specific to each script using the RESTful API. Two sources logging into the PDU using the same name and password will interrupt each others sessions.

Reminder: for enhanced security on any open network, the PDU should have HTTPS enabled to encrypt the authentication dialog which occurs between the automation script and the PDU web server.

RCM REST Error Codes

All responses are returned with an HTTP status code of 200 (limitations in the underlying embedded HTTP server make it impractical to return meaningful status codes for the REST implementation). Therefore, to avoid having to parse the response body to determine if the content is an error, we're using the work around of returning error codes with a Content-Type of text/html (whereas data is returned as text/plain).

-902	Request command was too long (field data too long).
-903	Invalid rest_method value.
-904	Submitted rest_method not supported by requested resource.
-911	Invalid session_id. Start a new session.
-912	Invalid login: name or password was not recognized.
-913	Session login failed (internal error, try again).
-922	Invalid instance ID.
-923	Invalid attribute name.
-924	Invalid new_value.
-932	Requested attribute not supported by the requested resource. Note that some instances of a resource may not support all valid attributes.

If the response starts with `<!DOCTYPE` or `<html` then a request was made to a non-RESTful API resource.

API Resources

Available API resources are focused on providing remote switching, and reading power data, environment data, and system identification.

The following sections identify the available RESTful resources and the API requirements for each. Remember that all requests require authentication. See the section above for details.

/session

A session must be created before any other PDU resource can be requested. Then, the session id must be passed to all subsequent requests, and when the session's use is no longer needed, it should be deleted (which is essentially the same as a logout).

The RESTful API session space is shared with the regular web user space. If a script makes use of a specific user login, then a human (or another script) subsequently uses the same login credentials, the originally running script will be blocked because its session will have been destroyed (overwritten by the second session). Each script and each human should have unique user login credentials.

More than one script should not be running at the same time.

POST /session

URI Parameters

- None

Form Parameters

- `account` — The user account name.
- `password` — The password for the account (be sure this is URL encoded).

Response

- The `session_id` as a 32-character string which must be saved to send along with future requests.

DELETE /session

URI Parameters

- None

Form Parameters

- `session_id` — The previously acquired ID from `POST /session`.
- `rest_method` — Must be "DELETE" in upper case.

Response

- A string of 32 zeros.

/inlets

Even though the PDU itself will always have a power inlet, there may or may not be inlet REST resources based on the PDU model. If the PDU is either power monitored or current monitored, there will be at least one inlet. As of this version, `GET /inlets` does not return a collection. The script must specify inlet 1 in the request.

GET /inlets/:id/:attribute

`URI :id`

- The PDU's numeric instance of the Inlet (values start at 1).

`URI :attribute`

The following attributes respond with a text/plain version of their respective values.

- `phase` [string]
- `label` [string]

Form Parameters

- `session_id` — The previously acquired ID from `POST /session`.

Response

- The response should be the text version of the value of the attribute.
- Note that the value of the phase response provides an indication of the power form of the inlet. LN is a single-phase power source. ABC is a three-phase delta, and ABCN is a three-phase wye.

/phases

There may or may not be phase resources based on the PDU model. If the PDU is either power monitored or current monitored, there will be at least one phase (depending on the power form and number of monitored inlets). Even if a phase is available, some attributes listed below may not be supported. As of this version, `GET /phases` does not return a collection. The script must know which phase of the PDU to request.

GET /phases/:id/:attribute

`URI :id`

- The PDU's numeric instance of the Phase (values start at 1).

`URI :attribute`

The following attributes (and their aliases) respond with a text/plain version of their respective values.

- `phase` [string]
- `rated_volts` (rv, ratedvolts) [decimal]
- `rated_amps` (ra, ratedamps, max_amps, maxamps) [decimal]
- `amps` (a, amps_rms, ampsrms, arms) [decimal]
- `consumed_amps` (ca, amps_used, amps) [decimal]
- `volts` (v, volts_rms, voltsrms, vrms) [decimal]
- `frequency` (f, freq) [decimal]
- `voltamps` (va, kva) [integer]
- `voltamps_reactive` (var, kvar) [integer]
- `watts` (w, kw) [integer]
- `power_factor` (pf, powerfactor) [decimal]
- `setpoint_status_amps` [string]
- `high_critical_amps` (hca) [decimal]
- `high_warning_amps` (hwa) [decimal]
- `low_warning_amps` (lwa) [decimal]
- `low_critical_amps` (lca) [decimal]
- `hysteresis_amps` (hysa) [decimal]
- `debounce_amps` (dba) [decimal]
- `setpoint_status_volts` [string]
- `high_critical_volts` (hcv) [decimal]
- `high_warning_volts` (hwv) [decimal]
- `low_warning_volts` (lwv) [decimal]
- `low_critical_volts` (lcv) [decimal]
- `hysteresis_volts` (hysv) [decimal]
- `debounce_volts` (dbv) [decimal]

Form Parameters

- `session_id` (required) — The previously acquired ID from `POST /session`.

Response

- The response should be the text version of the value of the attribute. Units are not included with numeric values. Decimal precision is meaningful. An empty response for a setpoint value means it is disabled.

/outlets

There will always be one or more outlets, however not all outlets are necessarily switched nor have power data. Therefore, some outlets may not support all attributes listed below. As of this version, the resource GET/outlets does not return a collection. The script must know which outlet of the PDU to request.

GET /outlets/:id/:attribute

`URI :id`

- The PDU's numeric instance of the Outlet (values start at 1).

`URI :attribute`

The following attributes (and their aliases) respond with a text/plain version of their respective values.

- `label` [string]
- `phase` [string]
- `switch` (relay) [string]
- `startup_state` (startup) [string]
- `on_delay` [decimal]
- `off_delay` [decimal]
- `cycle_delay` [decimal]
- `alert_switch_change` (alertable) [true|false]
- `ignore_epo` [true|false]

Form Parameters

- `session_id` (required) — The previously acquired ID from `POST /session`.

Response

- The response should be the text version of the value of the attribute. Units are not included with numeric values. Decimal precision is meaningful.

Response to `switch`

- a value of "on" or "off" would be normal
- a value of "unknown" means the outlet status cannot be determined (this may require an All On / All Off cycle of the outlets to clear, or restart of the controller).
- a value of "fail on" or "fail off" means the actual outlet status is out of sync with what the RCM controller expects it to be. This may indicate a hardware failure or an active EPO state preventing power flow.

PATCH /outlets/:id/switch

Sent as a POST, but identified as a PATCH through a form parameter.

`URI :id`

- The PDU's numeric instance of the Outlet (values start at 1).

Form Parameters

- `session_id` (required) — The previously acquired ID from `POST /session`.
- `rest_method` — Must be "PATCH" in upper case.
- `new_value` — A value of "on" turns the outlet on (apply power to it), a value of "off" turns the outlet off (remove power from it), and a value of "cycle" turns the outlet off, pauses for cycle_delay time, then turns the outlet back on. Regardless of whether the first state is on or off, the cycle command is always off-on (it never cycles on-off).

Response

- The response is the ending state of the outlet switch after the state change, which should be "on" or "off," but could be "fail on" or "fail off" is there was an error.

PATCH /outlets/:id/startup_state

Sent as a POST, but identified as a PATCH through a form parameter.

`URI :id`

- The PDU's numeric instance of the Outlet (values start at 1).

Form Parameters

- `session_id` — The previously acquired ID from `POST /session`.
- `rest_method` — Must be "PATCH" in upper case.
- `new_value` — A value of "on" or "off" or "last known" corresponding to the Startup State options.

Response

- The response should be the same string as what was submitted.

PATCH /outlets/:id/on_delay

Actually sent as a POST, but identified as a PATCH through a form parameter. URI

`URI :id`

- The PDU's numeric instance of the Outlet (values start at 1).

Form Parameters

- `session_id` — The previously acquired ID from `POST /session`.
- `rest_method` — Must be "PATCH" in upper case.
- `new_value` — A numeric string such as 0.5, 2.0, or 1 representing a decimal number of seconds.

Response

- The response should be the same string as what was submitted.

PATCH /outlets/:id/off_delay

Actually sent as a POST, but identified as a PATCH through a form parameter. URI

`URI :id`

- The PDU's numeric instance of the Outlet (values start at 1).

Form Parameters

- `session_id` — The previously acquired ID from `POST /session`.
- `rest_method` — Must be "PATCH" in upper case.
- `new_value` — A numeric string such as 0.5, 2.0, or 1 representing a decimal number of seconds.

Response

- The response should be the same string as what was submitted.

PATCH /outlets/:id/cycle_delay

Actually sent as a POST, but identified as a PATCH through a form parameter. URI

`URI :id`

- The PDU's numeric instance of the Outlet (values start at 1).

Form Parameters

- `session_id` (required) — The previously acquired ID from `POST /session`.
- `rest_method` — Must be "PATCH" in upper case.
- `new_value` — A numeric string such as 0.5, 2.0, or 1 representing a decimal number of seconds.

Response

- The response should be the same string as what was submitted.

PATCH /outlets/:id/alert_switch_change

Sent as a POST, but identified as a PATCH through a form parameter.

`URI :id`

- The PDU's numeric instance of the Outlet (values start at 1).

Form Parameters

- `session_id` — The previously acquired ID from `POST /session`.
- `rest_method` — Must be "PATCH" in upper case.
- `new_value` — A value of "true" or "false"

Response

- The response should be the same string as what was submitted.

PATCH /outlets/:id/ignore_epo

Sent as a POST, but identified as a PATCH through a form parameter.

`URI :id`

- The PDU's numeric instance of the Outlet (values start at 1).

Form Parameters

- `session_id` — The previously acquired ID from `POST /session`.
- `rest_method` — Must be "PATCH" in upper case.
- `new_value` — A value of "true" or "false"

Response

- The response should be the same string as what was submitted.

/temperature

RCM units can have temperature and humidity sensors. The sensors may be combined into a single probe, but the values are retreived based on the sensor type, not the physical probe design.

GET /temperature/:id/:attribute

`URI :id`

- The PDU's numeric instance of the temperature sensor (values start at 1).

`URI :attribute`

The following attributes respond with a text/plain version of their respective values.

- `label` [string]
- `farenheit` [decimal]
- `celcius` [decimal]
- `setpoint_status` [string]
- `high_critical` [decimal]
- `high_warning` [decimal]
- `low_warning` [decimal]
- `low_critical` [decimal]
- `hysteresis` [decimal]
- `debounce` [decimal]

Form Parameters

- `session_id` (required) — The previously acquired ID from `POST /session`.

Response

- The response should be the text version of the value of the attribute.

/humidity

RCM units can have temperature and humidity sensors. The sensors may be combined into a single probe, but the values are retreived based on the sensor type, not the physical probe design.

GET /humidity/:id/:attribute

`URI :id`

- The PDU's numeric instance of the temperature sensor (values start at 1).

`URI :attribute`

The following attributes respond with a text/plain version of their respective values.

- `label` [string]
- `rh` [decimal]
- `setpoint_status` [string]
- `high_critical` [decimal]
- `high_warning` [decimal]
- `low_warning` [decimal]
- `low_critical` [decimal]
- `hysteresis` [decimal]
- `debounce` [decimal]

Form Parameters

- `session_id` (required) — The previously acquired ID from `POST /session`.

Response

- The response should be the text version of the value of the attribute.

/system

System identification can be useful for automated logging. The script will already know which IP address is being connected to, but the System label and location can provide addition arbitrary user description of the PDU.

GET /system/1/:attribute

`URI :id`

- Always set to 1.

`URI :attribute`

The following attributes respond with a text/plain version of their respective values.

- `label` [string]
- `location` (loc) [string]
- `asset_id` (asset) [string]
- `contact` [string]
- `degrees` [Farenheit|Celcius]
- `version` [string]
- `crc` [string]
- `model_number` (model, model_no) [string]
- `serial_number` (serial, serial_no) [string]
- `web_link` (link) [string]
- `mac_address` (mac, mac_addr) [string]
- `serial_baudrate` (baud) [integer]
- `dialog_delay` (delay) [integer]
- `start_time` (started) [M D Y H:M:S xM]
- `time` [M D Y H:M:S xM]

Form Parameters

- `session_id` (required) — The previously acquired ID from `POST /session`.

Response

- The response should be the text version of the value of the attribute.

SNMP Support

SNMP Support

The RCM software includes support for SNMP v1/v2c/v3. Configuration of SNMP is done on the Network web page or using the `setSnmp` CLI command.

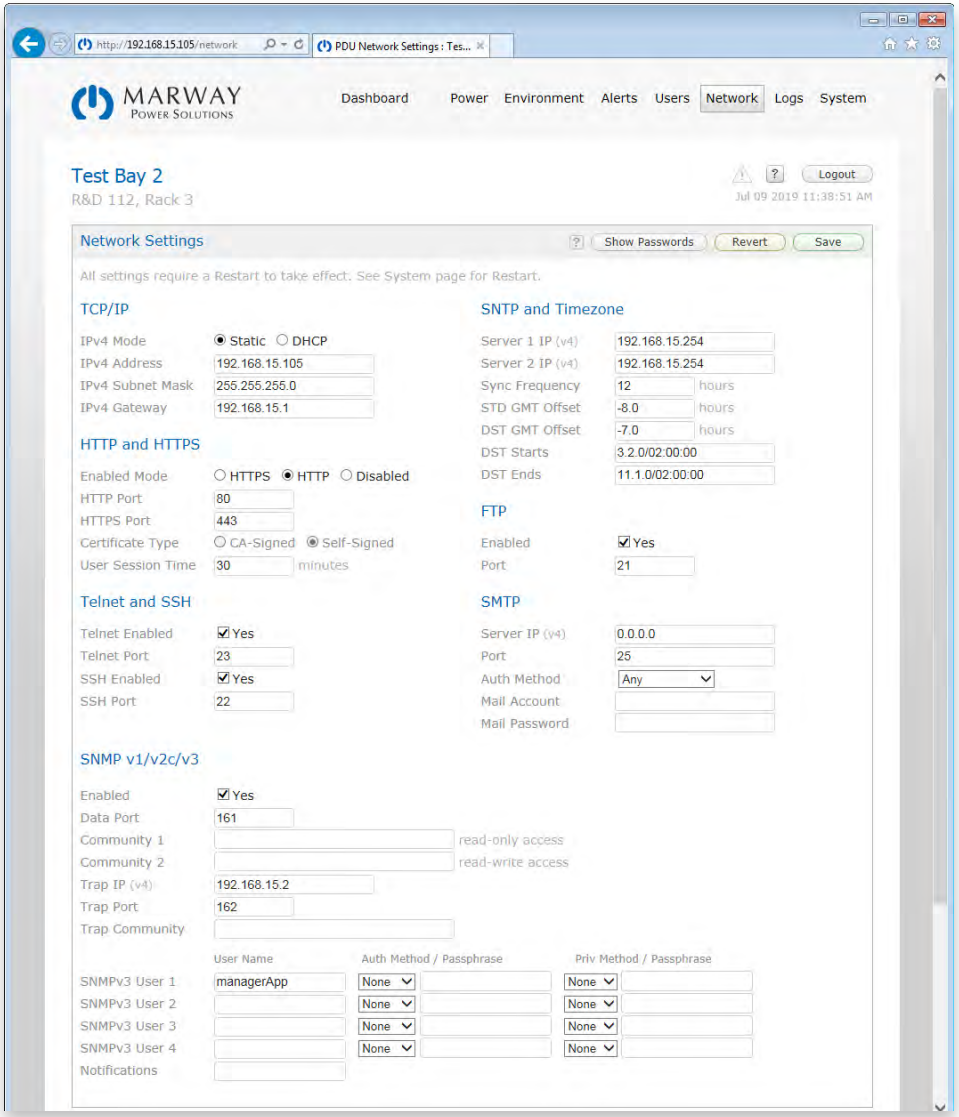
RFC style documentation for the SNMP interface, as well as MIBs for managers and browsers are available at http://www.marway.com/software/, and consist of the following documents:

- Marway-MIB-Memo-SMI.pdf
- Marway-MIB-Memo-AgentCaps.pdf
- Marway-MIB-Memo-Chassis.pdf
- Marway-MIB-Memo-Sensor.pdf
- Marway-MIB-Memo-Power.pdf

Generally, the capabilities supported through SNMP include power data reading, outlet switching, power alarm status, and traps/notifications covering all key event alerts available to the web UI.

Given the nature of the small embedded environment of the RCM software, there are some limits to SNMP support. There is no support for the sysOR table, there's a limit of four distinct USM users, and encryption for v3 includes the original v3 requirements of MD5 for authentication and DES for privacy. Traps/notifications are not encrypted.

Note that v1/v2 community strings are limited to 24 characters, and that letters must be lower case. Numerals are valid as are most ASCII typeable symbols (except for = and ~ which are reserved characters).



Firmware Updates

Firmware Updates

Should there be a need to update the firmware in the RCM PDU, there's a very simple way to do that. There's two possible firmware files which may need to be updated:

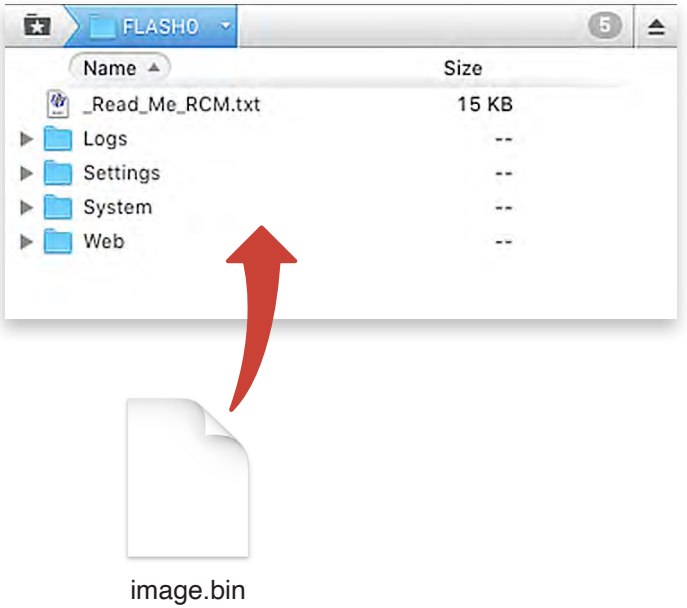
image.bin is the main application for the PDU. The file will be enclosed in a folder identifying its version and accompanied by release notes, but the upload file will always be named simply image.bin.

rom.bin is the bootloader for the PDU. This may or may not be included in an update. If present, the file will be enclosed in a folder identifying its version and accompanied by release notes, but the upload file will always be named simply rom.bin.

With either of these files, use an FTP client to upload them to the on-board FLASH0 volume of the PDU. (What you see with your FTP program may look different to what's shown on the right). Wait approximately 2 minutes after each upload to ensure each file has been successfully copied and installed, then restart the PDU using the web interface or command line, or reboot the PDU using the recessed button on the keypad.

NOTE: If you connect to the Serial port, there will be output indicating when the uploads have completed (shown in red in the example to the right).

After the files are uploaded, they are moved to another location, so they won't remain visible in the FTP file listing.




```
------------------------------------------------------------------------------
Marway RCM Command Line
------------------------------------------------------------------------------

#> Starting up...
   Connecting... (192.168.15.105)
   Loading log and settings... (takes 1-2 minutes)
   Application ready. (v2.3.0)

   Press return to start entering commands (? or help).

#>
   Checksum passed, writing to flash...

   Firmware updated, quit the session to restart.
```

Display Operation

Display and Keypad Operation

Optionally mounted to the PDU is an LED display and keypad used to display power data.

If the PDU has current or power monitored inlets, the display defaults to auto-scrolling through each phases's amps when there's no user interaction. However, the user can manually select any of the available power values by using the six pushbuttons on the keypad.

The diagram on the right shows the typical display options for a power-monitored, 3-phase unit. The exact options will vary based on a specific PDU's features.

The Menu buttons cycle through the list of the options shown under the Menu column: Auto Scroll (AUTO), Phases (PHAS), Outlets (OUTL), Temperature (TEMP), and Humidity (HUMD). Once the desired menu item is displayed, press the Devices ► button to show the first power data item.

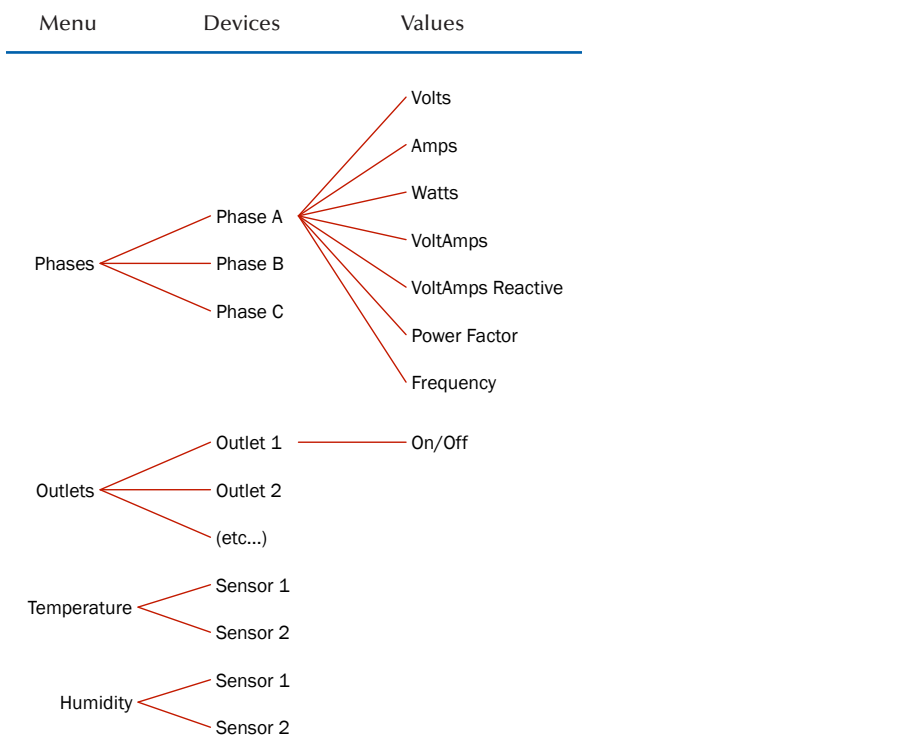
Each power data item identifies the device ID and measurement on the top line, and the value on the bottom line. In the example display shown at the right, assume we selected PHAS from the menu, then pressed the right Devices button. The top line includes 01 A which is Phase 1 amps. The bottom line displays the value: 12.74.

The Devices buttons cycle through each of the items selected by the menu. Using the above example again, if PHAS was chosen from the Menu options, the display would start at 01 V, phase 1 volts. A press of the Devices right button would update the display to 02 V, phase 2 volts, then 03 V, phase 3 volts, and back to 01 V, phase 1 volts.

The Values buttons cycle through the data values of the selected device. So, if PHAS was chosen, the display would start at phase1 volts. A press of the Values right arrow would update the display to phase 1 amps, then phase 1 watts, etc.

Reboot — press recessed button with a pencil tip, paper clip, or other small-tipped object.

POWER TO OUTLETS WILL NOT BE LOST DURING A REBOOT



MARWAY Power Solutions

At this point, pressing the Devices right arrow would update the display from phase 1 watts to phase 2 watts, thus allowing easy scrolling through the same value for all device instances.

Navigating Power Data

Press Menu ► until the desired option is visible.

Press Devices ► to see the first instance of that device.

Press Devices ► again to see the next instance of that device.

Press Values ► to see the next power data value of that device.

RCM Software™
for Optima RCM™ Networked PDUs

Software Version: 2.3.x
Owner's Guide P/N: 501014-2.3.x-E

Marway Power Solutions
1721 S. Grand Ave., Santa Ana, CA 92705
800-462-7929 • marway@marway.com