User Manual

ES1000 Series EnergySwitch

Contents

Introduction

Features

The EnergySwitch PDU Family, EnergyOS and its included EnergyDNA deliver power within the data center along with the energy utilization and capacity optimization features you demand. These next-generation PDUs are a step into the future of data center energy management, leveraging leading-edge EnergyDNA for highly granular visibility into rack-based energy quality and consumption.

Main Features:
- Real-Time, True RMS measurements
- Metered and Switched per outlet
- Serial out-of-band management ports
- Role-based Authentication
- Usage and Access Event Logging
- Instant-On technology
- Physical and Logical current protection
- Sequential Outlet startup
- Programmable Thresholds and alarms
- Support for Racktivity's EnergySensor family
- Flash Upgradable
- Ultra-Low power consumption

Applicable Models

Unless specified otherwise, all information in this document is applicable to the following Racktivity EnergySwitch ES1000 models:

- **ES1008-16**

Specifications

Electrical Ratings

Input:

Voltage	100V - 240V
Frequency	50/60Hz
Current	16A

Output:

Connection	8x C13
Voltage	100V - 240V
Current total	16A
Current per C13	8A

The model number, input and output ratings and certification information for the EnergySwitch are also shown on the label found on the case of the unit.

Operating Environment

Operating temperature	0°C to 50°C	32°F to 122°F
Storage temperature	-10°C to 60°C	14°F to 140°F
Humidity	5% to 85% RH	non-condensing

Dimensions

Dimensions cm (WxHxD)	48.55 x 4.45 x 14.20
Dimensions inch (WxHxD)	19.00 x 1.75 x 5.59

User Account Overview

The EnergySwitch has 3 types (levels) of user accounts: **admin**, **restricted** and **guest**. The following table shows an overview of the functionality of each type:

	admin	restricted	guest
Open website	Yes	Yes	Yes
Open CLI session	Yes	Yes	Yes
View current status (states, data & values)	Yes	Yes	Yes
Toggle outlets	Yes	Yes	No
Edit thresholds	Yes	No	No
Edit outlet names	Yes	No	No
Change SNMP notification settings	Yes	No	No
Edit device settings	Yes	No	No
View & download logs	Yes	No	No
Default user name	admin	restricted	guest
Default password	1234	1234	1234

The same features and options apply to both the website and the Command Line Interface (CLI). To change the login credentials for the users please refer to the Device Settings chapter.

RS232 Specifications

The RS232 ports on the EnergySwitch have the following pin lay-out:

Pin	Function
1	-
2	-
3	RxD
4	GND
5	GND
6	TxD
7	-
8	-
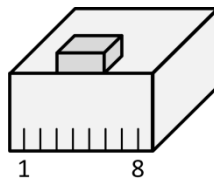
CLI Specifications

The CLI port on the EnergySwitch has the following pin lay-out:

Pin	Function
1	-
2	-
3	TxD
4	GND
5	GND
6	RxD
7	-
8	-
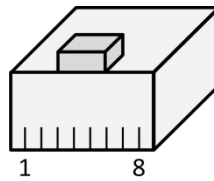
Safety

 Save these instructions!

This Safety Information contains important instructions that should be followed during installation and maintenance of the EnergySwitch. It is intended for Racktivity customers who set up, install, relocate, or maintain Racktivity equipment. Changes and modifications to this unit not expressly approved by Racktivity could void the warranty.

 Electrical Hazard!

Read the following information before installing or operating your EnergySwitch:
- Do not work alone under hazardous conditions.
- High current through conductive materials could cause severe burns.
- Follow all local and national codes when installing the EnergySwitch.
- To avoid possible electrical shock and equipment damage, use only the supplied hardware.
- The EnergySwitch should be connected to a single-outlet dedicated circuit, protected by a circuit breaker with the same current rating as the EnergySwitch.
- The plug serves as the disconnect for the EnergySwitch. Make sure the utility power outlet for the EnergySwitch will be close to the EnergySwitch and readily accessible.
- Make sure the utility power outlet and the EnergySwitch power cord and plug are in good condition.
- Do not connect the EnergySwitch to an ungrounded utility power outlet.
- Do not operate your EnergySwitch with any covers removed or when it is damaged.
- This EnergySwitch contains potentially hazardous voltages. There are no user serviceable parts inside the EnergySwitch. All repairs and service should be performed by authorized service personnel only.
- The power requirement for each piece of equipment connected to the EnergySwitch must not exceed the individual outlet's load rating.
- The EnergySwitch provides convenient multiple power outlets, but it does not provide surge or line noise protection for connected equipment.
- The EnergySwitch is designed for indoor use only in a controlled environment away from excess moisture, temperature extremes, conductive contaminants, dust, direct sunlight or magnetic sources.
- The total power requirement for equipment connected to the EnergySwitch must NOT exceed the maximum load rating for the EnergySwitch.
- Do not attempt to mount the EnergySwitch to an insecure or unstable surface.
- Never attempt to install electrical equipment during a thunderstorm.
- Use of this equipment in life support applications or any medical applications is strictly prohibited since failure of this equipment can reasonably be expected to cause the failure of the life support equipment or to significantly affect its safety.
- Putting several EnergySwitch units in cascade is NOT allowed.

- **CAUTION:**
  The Rack Controller contains a lithium battery and should not be disposed of with general refuge. Dispose of the lithium battery in accordance with all local codes and regulations for products containing lithium batteries. Contact your local environmental control or disposal agency for further details. The battery is not intended to be user replaceable.

Certifications

Not all certifications are applicable to every model. Please check the label on your device.

- **CE / FCC**

This device is designed in compliance with the requirements of the 4 following regulations: EN 55022: Class B, EN 61000-3-2, EN 6100-3-3 and EN 55024. This device is certified to comply with Part 15 of the FCC rules.

- **UL (US & Canada)**

This device is in the certification process to comply with rule UL /CSA 60950-1 (2nd Edition) safety of Information Technology Equipment (ITE) Part 1.

ITE E334605

Compliance

- **WEEE**

Waste Electrical and Electronic Equipment

- **RoHS**

Restriction of Hazardous Substances

Recycling

The materials used for shipping the EnergySwitch are recyclable, please save them for later use or dispose of them appropriately.

Servicing & Repair

There are no user serviceable parts inside the EnergySwitch. All repairs and service should be performed by authorized service personnel only.
Please refer to the Service manual for RMA procedure.

Additional Documentation

Additional documentation regarding the following subjects is available on the Racktivity Support Website http://www.racktivity.com/support/.

- API
    - Manual
    - GUID Overview
    - (python) examples
- Energy Sensor User Manual
- Servicing (RMA)

Getting Started

Receiving Inspection

Inspect the package (see INVENTORY section) and contents for shipping damage and make sure that all parts were received. Report any damage immediately to the shipping agent and report missing contents, damage, or other problems immediately to your reseller.

Inventory

Please verify the contents of the box:

Standard Package

Item	Quantity
EnergySwitch	1
Power cable	1
Mounting bracket	2
Mounting bracket screws	4
Installation Manual	1

Installation

Rack Mounting Instructions

- Elevated Operating Ambient
  When installed in a closed or multi-unit rack assembly, the operating ambient temperature of the rack environment may be greater than room ambient. Therefore, consideration should be given to installing the equipment in an environment compatible with the maximum ambient temperature (Tma) of 50 ºC.

- Reduced Air Flow
  Installation of the equipment in a rack should be such that the amount of air flow required for safe operation of the equipment is not compromised. It is recommended that 2.5cm (1 inch) of clearance be supplied around the sides of the unit.

- Mechanical Loading
  Mounting of the equipment in the rack should be such that a hazardous condition is not achieved due to uneven mechanical loading. The unit should be mounted with screws suitable for up to 10kg (22lbs).

- Circuit Overloading
  Consideration should be given to the connection of the equipment to the supply circuit and the effect that overloading of the circuits might have on overcurrent protection and supply wiring. Appropriate consideration of equipment nameplate ratings should be used when addressing this concern.

- Reliable Earthing
  Reliable earthing of the unit should be maintained. Particular attention should be given to supply connections other than direct connections to the branch circuit (e.g. use of power strips).

Mounting the EnergySwitch

Attach the EnergySwitch to a vertical rail in your rack. Position the EnergySwitch, align the buttons with the rack mounting slots and fix the EnergySwitch with the required screws (not included in the package).

Connecting the EnergySwitch

1. The EnergySwitch has a detachable power cord. Attach the included power cord to the EnergySwitch by inserting the input cable in to the power inlet.

   Note: Optionally, a user-supplied power cord can be attached to the EnergySwitch by connecting it to the IEC inlet. The cord-set should be a UL Listed type SJT or better rated minimum 14 AWG (1.5mm^2) rated 125V or 250V.

2. Connect the input plug to a compatible AC power outlet.

   Note: The AC power source should not share a circuit with a heavy electrical load.

3. When using the device for the first time all OUTPUT LEDs will light up consecutively indicating that the outlets are being activated.

4. The POWER LED (blue) will become active

Connect your equipment's input plugs to the outlet plugs of the EnergySwitch.

Overview

Front Panel
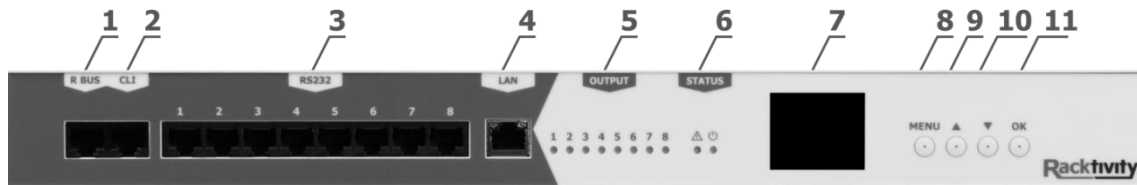
1	R BUS	RS485 peripheral bus connector (for external modules)
2	CLI	RS232 Command Line Interface connector
3	RS232	8 x RS232 Out-of-Band management connectors
4	LAN	Ethernet connector (with connectivity indicator LEDs)
5	OUTPUT LEDs	8 blue outlet status LEDs
6	STATUS LEDs	Alarm and power LEDs
7	TFT	Color graphics TFT display
8	MENU	Access menu function or return to the previous screen
9	UP	Move to the previous page or to browse upwards in a list
10	DOWN	Move to the next page or to browse downwards in a list
11	OK	Enter or validate

Rear Panel
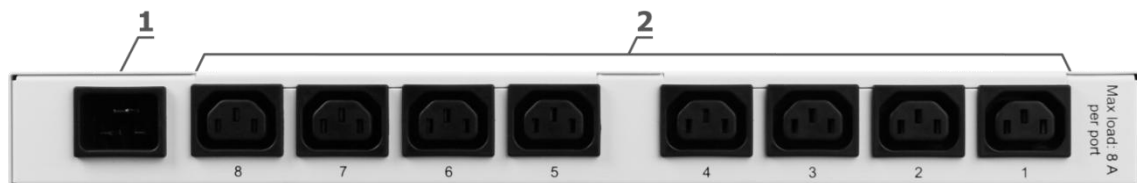
1	INLET	Power inlet
2	OUTLET	8 Power outlets

Status LEDs

Output LEDs (1-8)

ON	The corresponding outlet is turned on
OFF	The corresponding outlet is turned off and the connected device is not receiving input power

Alarm LED

ON	Warning, at least one alarm: visit the Web Interface for more info
OFF	OK, no alarms triggered

Power LED

ON	The EnergySwitch is receiving input power
OFF	The EnergySwitch is unpowered

Quick Configuration

Using the TFT Panel Display

Activating the Display

When the Power LED is lit and the screen is black, push any of the 4 navigation buttons next to the TFT Display to activate it. The TFT Panel standby delay can be set at the Settings page on the Web Interface (the default value is 10 minutes).

Controlling the Display

The TFT Panel is controlled using the **UP, DOWN, MENU** and **OK** buttons next to the screen.
Use the **UP** and **DOWN** buttons to navigate through the reporting screens or through a selection list in the menus. Press **OK** to select the highlighted item and **MENU** to go back.
When in a menu, the ">" symbol indicates that clicking this item will open a submenu. The "●" symbol indicates that this menu item leads directly to a setting.

Hot Keys

Several Hot Key combinations are available by using the navigation buttons next to the display. To activate the functions, press the necessary buttons **simultaneously for 4 seconds** (until a notification is shown on screen).

Hot Key	Buttons	Action
Hot Reset	MENU + DOWN	Reboots the device No outlets toggled, no settings changed
Credential Reset	UP + DOWN	Resets the login credentials No outlets toggled, login credentials set to default
Factory Reset	MENU + OK	Resets all **non-power** related settings to factory defaults (network, …), no outlets are toggled

Network Settings

There are two methods for setting up the IP address: Dynamic IP address assignment and Manual Assignment. If you are uncertain which method to use, contact your network administrator for assistance before continuing the installation process.

Note: As of firmware version v1.2 the EnergySwitch has secure HTTP (**HTTPS**) enabled by default. Use 'https://' instead of 'http://' in your browser to access the web portal.

Firmware version 1.2 or higher

Dynamic IP Address Assignment (DEFAULT)

1. Press the **MENU** button until the **MAIN** menu appears, select **Network Settings** using the **DOWN** button and press **OK**.
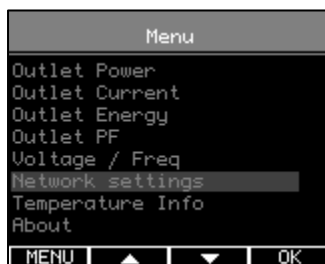
2. Within the **Network Settings** menu, select **DHCP**. When the value at the bottom of the screen shows **Enabled**, the device already has dynamic IP assignment enabled (skip to step 4). If not, press **OK** and verify that **Enabled** is displayed at the bottom of the screen.
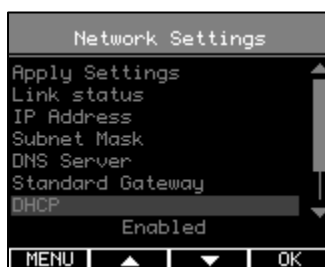
3. Use the **UP** button to select **Apply Settings** and press **OK.** Press the **MENU** button to cancel or the **OK** button to apply the settings.

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4. Press **DOWN** to select **IP Address**. The assigned IP-address is shown at the bottom of the TFT.

5. On a computer in the same network, use a browser to open the assigned IP-address, for example https://192.168.14.250

6. When surfing to the web portal, a login screen appears. The default user name is **admin** and the default password is **1234**

Manual IP Address Assignment

1. Obtain the correct IP address, standard gateway, DNS Server IP and subnet mask from your network administrator.
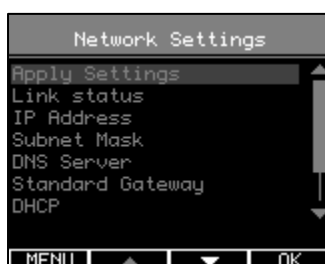
2. Press the **MENU** button until the **MAIN** menu appears, select **Network Settings** using the **DOWN** button and press **OK**.
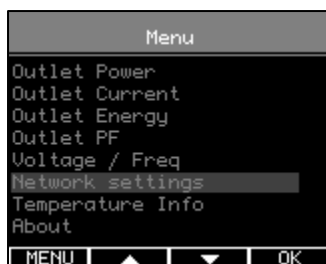
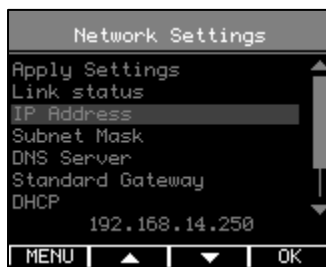3. Within the **Network Settings** menu, select **DHCP**. When the value at the bottom of the screen shows **Disabled**, the device already has manual IP assignment enabled (skip to the next step to enter a different IP). If not, press **OK** and verify that **Disabled** is displayed at the bottom of the screen.
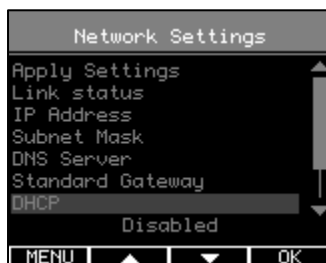
4. Use the **UP** button to select **IP Address** and press **OK**.
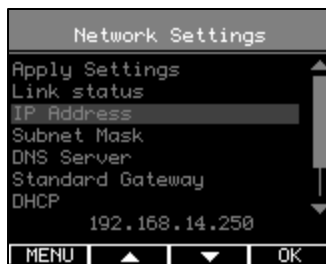
5. Use the **UP** and **DOWN** buttons to change the currently selected value and press **OK** to select the next value. When holding the **UP** and **DOWN** buttons changing the values speeds up. When ready press **MENU** to confirm and return to the **Network Settings** menu.

6. Repeat the last two steps for the **Subnet Mask**, **Standard Gateway** and **DNS Server** settings.

7. Use the **UP** button to select **Apply Settings** and press **OK.** Press the **MENU** button to cancel or the **OK** button to apply the settings.

8. On a computer in the same network, use a browser to open the chosen IP-address, for example https://192.168.14.250

When surfing to the web portal, a popup appears requesting a username and password. The default username is **admin** and the default password is **1234**

Firmware version 1.1 or lower

Dynamic IP Address Assignment (DEFAULT)

1. Press the **MENU** button until the **MAIN** menu appears, select **NETWORK** using the **UP** and **DOWN** buttons and press **OK**.
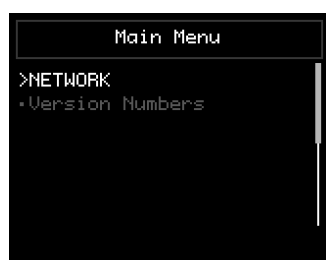
2. Within the **NETWORK** menu, select **Use DHCP**. When the value in yellow at the bottom of the screen shows **yes**, the device already has dynamic IP assignment enabled; if not, press **OK**.

```
          Network Settings
 MAC
 Current IP-address
 USE DHCP
 DHCP Reset
 Set IP-address
 Subnet mask

              yes
```

3. Use the **UP** and **DOWN** buttons to change the setting. Select **yes** and press **MENU** to confirm and return to the **NETWORK** menu.

4. Use the **UP** and **DOWN** buttons to select **Save IP Settings** and press **OK.** Use the **UP** and **DOWN** buttons to change the setting. Select **yes** and press **MENU** to save and return to the **NETWORK** menu.

```
          Network Settings
 DHCP Reset
 Set IP-address
 Subnet mask
 Std gateway
 DNS server
 SAVE IP SETTINGS
```

5. Press **UP** to select **CURRENT IP-ADDRESS**. The assigned IP-address is shown in yellow at the bottom of the TFT.

```
          Network Settings
 .MAC
 .CURRENT IP-ADDRESS
 .DHCP (on)
 .DHCP Reset
 .Set IP-address
 .Subnet mask
        192.168.14.215
```

6. On a computer in the same network, use a browser to open the assigned IP-address, for example http://192.168.14.250

7. When surfing to the web portal, a login screen appears. The default user name is **admin** and the default password is **1234**

Manual IP Address Assignment

1. Obtain the correct IP address, standard gateway, DNS Server IP and subnet mask from your network administrator.

2. Press the **MENU** button until the **MAIN** menu appears, select **NETWORK** using the **UP** and **DOWN** buttons and press **OK.**
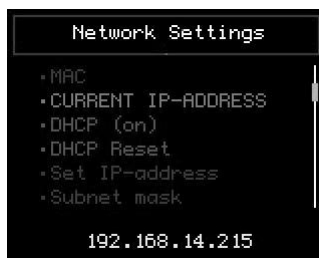
```
        Main Menu
>NETWORK
▪Version Numbers
```

3. Within the **NETWORK** menu, select **Use DHCP**. When the value in yellow at the bottom of the screen shows **no**, the device already has a fixed IP; if not, press **OK**.

```
      Network Settings
MAC
Current IP-address
USE DHCP
DHCP Reset
Set IP-address
Subnet mask

            no
```

4. Use the **UP** and **DOWN** buttons to change the setting. Select **no** and press **MENU** to confirm and return to the **NETWORK** menu.

5. Use the **UP** and **DOWN** buttons to select **SET IP-ADDRESS** and press **OK**.

```
      Network Settings
MAC
Current IP-address
Use DHCP
DHCP Reset
SET IP-ADDRESS
Subnet mask

      192.168.250.250
```

6. Use the **UP** and **DOWN** buttons to change the currently selected value and press **OK** to select the next value. When holding the **UP** and **DOWN** buttons changing the values speeds up. When ready press **MENU** to confirm and return to the **NETWORK** menu.

```
      Set IP-address

           ▲
      192.168.250.250
           ▼


      Press Menu to save
```

7. Repeat the last two steps for the **Subnet mask**, **StdGateway** and **DNS Server** settings.

8. Use the **UP** and **DOWN** buttons to select **Save IP Settings** and press **OK.** Use the **UP** and **DOWN** buttons to change the setting. Select **yes** and press **MENU** to save and return to the **NETWORK** menu.

9. On a computer in the same network, use a browser to open the chosen IP-address, for example http://192.168.14.250

When surfing to the web portal, a popup appears requesting a username and password. The default username is **admin** and the default password is **1234**

Web Interface

Getting Started

Supported Web Browsers

The following browsers have been tested and certified to work with the EnergySwitch Web Interface (on all platforms):

- Internet Explorer 8 or higher
- Firefox 3.6.16 or higher
- Chrome 11.0.696.71 or higher
- Opera 11.11 or higher
- Safari 5.0.5

Other available web browsers may work with the EnergySwitch but have not been fully tested by Racktivity.

Logging in

For instructions on how to set up the TCP/IP settings to connect to the Web Interface, please see the Network Settings chapter.
To recover from a lost password, please refer to the Troubleshooting chapter.

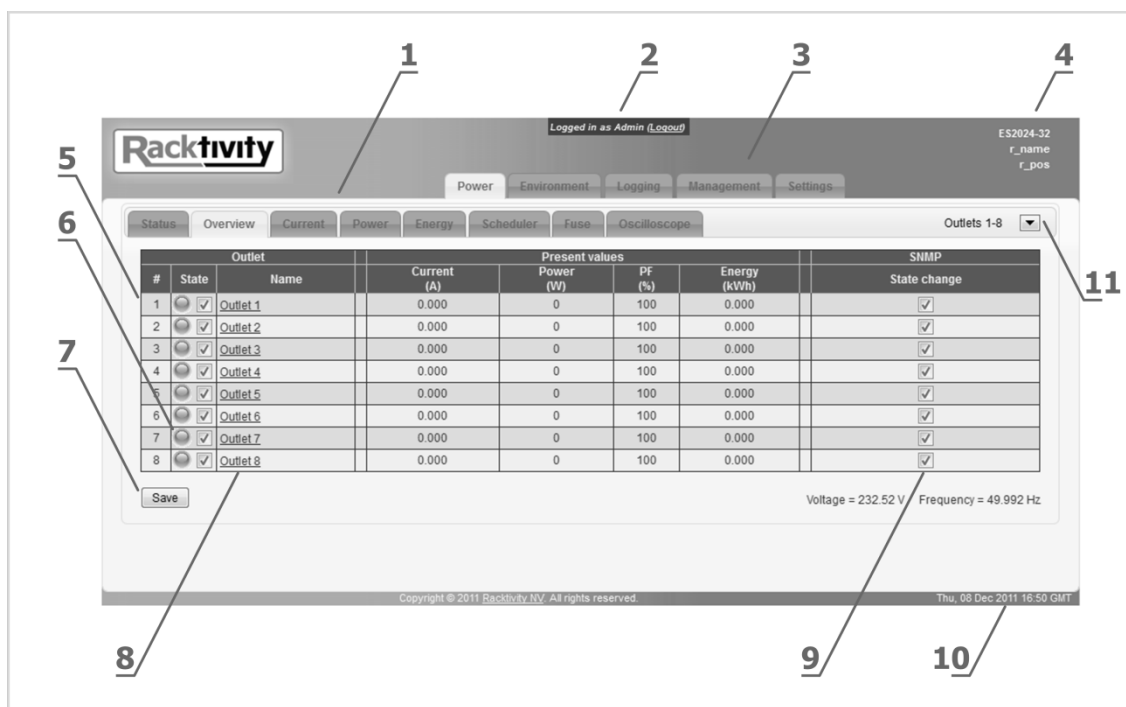Use an internet browser to open the EnergySwitch IP address. You will be asked for login credentials, the default values for the **administrator** account are:

User name	admin
Password	1234

To find out everything about the different types of user accounts see the User Account Overview chapter. If you are presented with a warning about the connection being untrusted (self-signed certificate) it can be ignored.

Layout

1	Sub tabs	Displays the different sections of the selected main tab
2	User account	Displays which type of User Account is currently logged in
3	Main tabs	Displays the different functions of the EnergySwitch
4	Device info	Displays the device name, rack name & rack location. Can be changed at the settings tab
5	Outlet status	Displays the current status of each outlet: **GREY**: the outlet is turned off **GREEN**: the outlet is on and working normally **ORANGE**: a warning threshold has been crossed, but the port state has not yet changed (only visible on the Overview tab and the affected parameter's tab) **RED**: an off threshold has been crossed, port state has changed **BLUE**: the outlet will be toggled after the set delay has expired (during boot and whilst power cycling)
6	Outlet toggle	Toggle the outlet state (ON/OFF/CYCLE)
7	Save	Save any changes made on this page
8	Outlet name	Change the outlet's name
9	SNMP	Toggle a specific SNMP notification for that outlet
10	Device time	The time set on the Settings tab (either manual or through an NTP server)
11	Banks	Power bank/module selection (only on 0U models)

Tabs

Power

Use the Power Tab for the following:
- See the load and general status of both the EnergySwitch's individual outlets and the totals:
  - Amps
  - Wattage
  - Power Factor
  - Energy (kWh)
  - Apparent Energy (kVAh)
  - Voltage
- Control and manage outlets
- Configure thresholds for connected loads, banks (as applicable)
- Resetting measurements
- Change SNMP notifications for power related parameters (outlet toggle, amps, wattage)
- Manage outlet scheduling
- Control fuse and/or line currents
- Oscilloscope view for an outlet
- Overview of connected Agents

Environment

Use the Environment Tab to monitor and manage:
- Internal sensors (as applicable)
- Voltage: status, history and management

Logging

The logging tab provides access to both the **Event** and the **Detailed** logging. After selecting the desired module and time-range the log can be downloaded or viewed inside the browser.
For more information regarding this subject, please refer to the Logging chapter.

Modules

Use this tab to control connected Energy Sensors.
For more information regarding the modules tab, please see the Energy Sensor documentation.
Note: This tab is available as of firmware version 1.2 and above; and with a managed Energy Sensor.

Management

The management tab is used to manage the modules in an EnergySwitch setup, including Energy Sensors.
For more information regarding the managing of Energy Sensors, please see the Energy Sensor documentation.
Available as of firmware version 1.2

Settings

Use this tab to configure the following settings:
- Network
- SNMP
- Telnet
- Device and User Accounts
- NTP (Network Time Protocol)
- Startup delay and priority
- Overheat protection
- Energy Cloud Sentinel

Network Configuration

path: Settings > Network Settings

The Network Settings contains both the Network and the SNMP related settings. The SNMP related settings can be found in the SNMP Configuration chapter. The following Network settings are editable:

- **Device IP Address**
  - The IP address of the EnergySwitch*****
- **Subnet Mask**
  - The subnet mask of the EnergySwitch
- **Standard Gateway**
  - The IP address of the default node on the network
- **DNS Server**
  - The IP address of the Domain Name System (DNS) server
- **Enable DHCP**
  - Check to enable DHCP
- **Force secure web access (HTTPS)**
  - Check to force secure HTTP web access
- **Force secure telnet access (SSL)**
  - Check to force SSL telnet access

* Note: When DHCP is enabled, the Network Settings are not necessarily the ones shown here, since they are provided by the DHCP server. Disabling DHCP will force the EnergySwitch to use the provided Network Settings.

SNMP Configuration

The EnergySwitch offers SNMPv2 communication (GETs, SETs and traps). Notifications (traps) can be enabled or disabled for many of the device's functions:

- Outlet state change
- Outlet thresholds (current, power, …)
- Totals thresholds (current, power, …)
- Temperature thresholds
- Voltage thresholds
- Overheat protection
- …

To toggle SNMP for a specific parameter or function, (un)check that parameter's checkbox and press the Save button. The SNMP checkboxes can be found next to most measurements.

SNMP Settings

path: Settings > Network Settings

The Network Settings contains both the Network and the SNMP related settings. The network related settings can be found in the Network Configuration chapter. The following SNMP settings are editable:

- **SNMP Community read**
  The community read string for GET requests
- **SNMP Community write**
  The community write string for SET requests
- **SNMP Trap Community string**
  Community string used when sending SNMP traps
- **SNMP Trap Receiver port**
  The port (1 - 65535) on which traps will be sent
- **SNMP Trap Receiver IP**
  IP address of the trap receiver
- **Enable SNMP write protection**
  Check this box to disable SNMP write (SET) access to the EnergySwitch completely
- **Enable SNMP Traps for device**
  The EnergySwitch will not send any traps when unchecked, regardless of individual settings
- **Use ECS authentication**
  Toggles the use of an external authentication server
- **ECS Authentication server IP**
  The IP address of the authentication server
- **ECS Authentication server port**
  The port (1 - 65535) of the authentication server on which the connection will be made

Device Settings

The Device Settings give access to

- EnergySwitch identification
    - **Device name**: the name of the EnergySwitch
    - **Rack name**: the name of the rack where the EnergySwitch is located
    - **Rack position**: the identifier of the position in the rack
- User account settings (see the User Account Overview chapter)
    - **Admin**
    - **Restricted user**
    - **Guest**
- TFT settings
    - **TFT timeout**: the idle time in minutes after which the TFT goes into standby
    - **TFT display lock**: when checked the TFT (and buttons) cannot be used to change settings. All changes must be made through the website.
- Temperature
    - **Temperature unit**: degrees Celsius (°C) or Fahrenheit (°F)
- Clock settings (see the Network Time Protocol (NTP) chapter)
    - **Date & Time Settings**: The real-time clock dialog features several options. Uncheck the *Use NTP* checkbox to be able to set a custom date & time. Uncheck the *Use default NTP* checkbox to not use an NTP server from pool.ntp.org and enter the custom IP address into the *NTP address* field.
    Note: Making changes to the date/time settings might clear all logged data!

Thresholds

Thresholds can be configured and used so that you are notified through SNMP at certain events. Many of the EnergySwitch's parameters have settable thresholds. To configure a specific threshold, open the tab where the appropriate parameter is shown.

Threshold (A)		SNMP Warning/switch off
Warning	Switch off	
6.000	8.000	☑ / ☑
6.000	8.000	☑ / ☑

At least the following parameters have one or more settable thresholds:

- **Amperage**
    - path: Power > Current
- **Wattage**
    - path: Power > Power
- **Voltage**
    - path: Environment > Voltage
- **Ambient**
    - path: Environment > Ambient
- **External modules**
    - path: Environment > External Modules

- **Overheat Protection**
  - path: Settings > Overheat Protection

Depending on the parameter one or more of the following types of thresholds will be available:

- **Warning**:   The outlet state is not changed, only an SNMP notification is sent
- **Switch Off**: The designated outlet is toggled off and an SNMP notification is sent
- **Low**:   When the measurement goes below this value an SNMP notification is sent
- **High**:   When the measurement goes above this value an SNMP notification is sent

To change a threshold enter the desired value into the appropriate input area and press the Save button. If the background of the input area turns red an incorrect value has been entered.

Note: Most thresholds have corresponding SNMP checkboxes that enable/disable the notification. Please ensure both the threshold **and** the appropriate SNMP notifications are set correctly.

Resetting Measurements

For many parameters the minimum, maximum and/or total is saved to give an easy overview of load activity. These values van be easily reset by pressing the Reset link for that value.

#	State	Name	Current (A) Min	Current (A) Now	Current (A) Max	Min/max Reset
1	☐ ☑	Outlet 1	0.000	0.000	0.000	Reset
2	☐ ☑	Outlet 2	0.000	0.000	0.000	Reset

The following parameters have resettable values:

- **Individual & total amperage**
    - path: Power > Current
- **Individual & total wattage**
    - path: Power > Power
- **Individual & total power factor**
    - path: Power > Power
- **Individual & total real energy (kWh)**
    - **Note:** The **Accumulated kWh** counter is not resettable!
    - path: Power > Energy
- **Individual & total Apparent Energy (kVAh)**
    - **Note:** The **Accumulated kVAh** counter is not resettable!
    - path: Power > Energy
- **Temperature**
    - path: Environment > Ambient
- **Voltage**
    - path: Environment > Electrical

Note: Clicking a Reset link in the column header will reset all values in that column, except for the value in the Total row.

Startup Delay

path: Settings > Startup Delay & Outlet Importance

The **startup delay** shown in the table is the time in seconds at which the designated outlet will switch on after boot. By default the delay is set incrementally over the outlets to reduce the overall power peaks of booting loads.

Outlets 1-8	Startup delay (sec)	Importance (1=high)
Outlet 1	0	4 ▼
Outlet 2	1	4 ▼

Note: An outlet will only switch on at boot if it was on before the EnergySwitch was powered down.

Priority

path: Settings > Startup Delay & Outlet Importance

The **Importance** column gives a rating from 1 to 8 to each outlet. A rating of 1 indicates the highest importance, whilst 8 is the lowest.
When the Total (device) off threshold for the amperage and/or wattage is crossed (but none of the individual off thresholds) the EnergySwitch will use the importance rating to determine which outlet to switch off first.
If two or more outlets have the same rating, the outlet with the last peak load will be switched off first.

Overheat Protection

path: Settings > Overheat Protection

The EnergySwitch has built in temperature sensors that can help prevent overheating. For more information regarding the thresholds and event notifications please refer to the Thresholds and SNMP Configuration chapters.

Note: The EnergySwitch has a built-in safety that switches off all ports when the temperature hits 60°C (140°F) **regardless** of the settings in the Overheat Protection section.

Network Time Protocol (NTP)

path: Settings > Device Settings

The Network Time Protocol (NTP) is a protocol for synchronizing the clocks of computer systems over networks. The EnergySwitch is equipped with an onboard clock that can be setup to sync with:

- pool.ntp.org (default)
- a custom NTP server
- date & time picker

For more information regarding the configuration of the onboard clock please refer to the Device Settings chapter.

CLI

The EnergySwitch has a built in Command Line Interface that can be accessed through both the CLI connector on the front or via Telnet.

Commands are typically sent to the separate modules. An EnergySwitch consists of exactly 1 Master module and 1 or more Power modules, controlled by the Master. Each module is of a specific type: 'M' for master module, 'P' for power module, 'A' for sensor module. The Master will always have address M1, power modules can have addresses P1, P2, P3, ….

Connecting

- **CLI connector**
  Connect a standard cat. 5e patch cable to both the CLI connector and your pc (i.e. by using an RS232 to USB adapter). For the CLI Specification, see the CLI Specifications chapter.
  Connection settings: 115200/8-N-1 (115200Bd, 8 data bits, no parity, 1 stop bit)

- **Telnet**
  Connect to the device IP on port 23 over Telnet. Please note that only Telnet over SSL is enabled by default. This can be changed on the Settings tab.

- **Telnet-SSL**
  Connecting to Telnet over SSL can be achieved through several 3rd party tools. Some examples include:
  - **Windows** (using stunnel)
    Create a config file for stunnel called stunnel.conf containing the following:
      client = yes
      [pdu]
      accept = 127.0.0.1:23
      connect = [DEVICE_IP]:992

      (with [DEVICE_IP] being the IP address of the PDU)
    Start stunnel with this config:
      # stunnel stunnel.conf

    If you now telnet to localhost stunnel will tunnel the traffic over SSL to the PDU.

  - **Linux** (using telnet-ssl)
    Use the following command using telnet-ssl to connect to the PDU (with [DEVICE_IP] being the IP address of the PDU):
      telnet-ssl -z ssl [DEVICE_IP] 992

Once connected, you will be presented with a log-in screen. Use the admin credentials to gain full access. From here it is possible to access the majority of the EnergySwitch's functions.
Type "help" for more information.

Note: The complete CLI interface is available as from firmware version 1.1.x.x Version 1.0.x.x and below only have a reduced interface (or less). For more information regarding a firmware upgrade see the Upgrade Firmware chapter.

RS232

The RS232 ports on your EnergySwitch can be used to connect to the RS232 connectors of external devices (CONSOLE port on a switch, …). Depending on your firmware version the means of establishing a connection will vary. The firmware version is shown on the Web Interface or TFT display.

Please note that only 1 RS232 port can be used/active at a time. Opening a second RS232 port on the EnergySwitch will close the first connection.

Versions

Firmware version 1.0.1.3 or lower

- Connect to the CLI Interface (see the CLI chapter)
- The "OPENCOM" command can now be used to open a specific RS232 port
- Use the HELP command for more detailed info (to open RS232 port 4 at 19200 Baud the command would be "OPENCOM -c4 -b19200")
- Open a new telnet session to the EnergySwitch on port 2000 and login
- You are now connected to the desired RS232 port

Firmware version 1.0.1.11

- Connect to the CLI Interface (see the CLI chapter)
- Use the command "SET M1 UARTMUXBAUD X" (with 'X' being the baud rate (max 115200Bd)
- Use the command "SET M1 UARTMUXPORT X" (with 'X' being the port number (from 1 to 8))
- Open a new telnet session to the EnergySwitch on port 2000 and login
- You are now connected to the desired RS232 port

Firmware version 1.2

- Please follow the instructions from firmware version 1.0.1.11
- After setting up the RS232 port open a new telnet session to the EnergySwitch on port 200**X** (with 'X' being the port number (from 1 to 8) that was used in the previous steps). From this firmware version on the CLI port numbers are fixed values ranging from 2001 for CLI port 1 to 2008 for CLI port 8.

UPS Integration

As of firmware version 1.3, your EnergySwitch PDU features UPS integration functionality.
This enables the EnergySwitch to receive vital battery information from a connected UPS and perform actions when set parameters and rules are met.
In order to use the full capabilities of the functionality, 2 components need to be installed and configured correctly:

- **UPS Integration**
  The link with the UPS in the rack, as explained in this chapter.

- **Agent Communication**
  Communication with the Agent service on connected servers (for more details see the Agent Communication chapter).

Configuration

Compatible Devices

The following UPS models can be linked to your EnergySwitch PDU:

- Most APC Smart-UPS® models (except Microlink enabled devices)

Connecting the UPS

The EnergySwitch and the UPS are connected using the following cable configuration:

On the side of the **EnergySwitch**: a standard RJ45 plug (with the pin layout as described in the

- CLI Specifications chapter) connected to the CLI connector on the front of the unit.

- On the side of the **UPS**: a DB9 male connector.

RJ45			DB9	
Function	**Pin**		**Pin**	**Function**
Tx	3		1	Rx
GND	4		9	GND
GND	5			
Rx	6		2	Tx

Enabling the Link

Once the EnergySwitch and UPS are physically connected it is necessary to enable the functionality on the Web Interface of the EnergySwitch.

1. Open the EnergySwitch' Web Interface
2. Click the Settings tab, followed by the Device Settings subtab
3. Select the appropriate option from the list under Uninterruptible Power Supply (UPS)
4. Press the Save button
5. The Uninterruptible Power Supply (UPS) subtab is now available on the Settings tab

Note: When UPS integration is enabled the CLI connector on the front of the EnergySwitch can no longer be used to access the Command Line Interface. CLI over Telnet remains accessible. To restore CLI functionality over the CLI connector, UPS Integration must be disabled.

<u>WARNING</u>: If both UPS Integration is enabled and Agent Communication is correctly configured the EnergySwitch will perform automated actions according to strict pre-defined rules (based on battery level, UPS status, etc.). **Please review these rules and actions carefully to avoid unexpected behavior.**

Operation

Once the UPS communication has been configured and established successfully, the following items are available on the Settings > Uninterruptible Power Supply (UPS) sub tab:

Communication status	UPS running on battery	Battery level (%)	UPS emergency threshold (%)	UPS recovery threshold (%)	UPS recovery power threshold (W)	SNMP warning
✓	☐	100.0	50.0	90.0	25	✓

- **Communication status**
  - o <u>Checked</u>: The communication between the EnergySwitch and UPS is operational
  - o <u>Unchecked</u>: No communication with the UPS, the settings below can be ignored

- **UPS running on battery**
  - o <u>Checked</u>: The connected UPS is running on battery power (batteries draining)
  - o <u>Unchecked</u>: The connected UPS is running on mains power (batteries charging)

- **Battery Level**
  The current level of battery power left in the connected UPS (in %), refreshed every 10 seconds.

- **UPS Emergency Threshold**
  The emergency battery level threshold of the connected UPS (in %). When the UPS battery is draining and this level is crossed certain actions will be performed automatically.

- **UPS Recovery Threshold**
  The recovery battery level threshold of the connected UPS (in %). When the UPS battery

is charging and this level is crossed certain actions will be performed automatically.

- **UPS Recovery Power Threshold**
  The powered outlets and outlets marked as AlwaysOn with respective power consumptions below the recovery power threshold (in W) will be power cycled when the UPS is running on mains power and the battery level goes above the Battery Recovery Threshold (assuming that the battery level dropped below the Battery Emergency Threshold first). For more information see the Rules chapter.

- **SNMP Warning**
  - <u>Checked</u>: SNMP traps will be sent when:
    - UPS Communication status changes
    - UPS switches between battery or mains
    - UPS Emergency Threshold is crossed
    - UPS Recovery Threshold is crossed
  - <u>Unchecked</u>: No SNMP traps are sent

To enable the EnergySwitch to perform actions based on the UPS Integration data please also refer to the Agent Communication chapter.

Rules

If both UPS Integration is enabled and Agent Communication is correctly configured the EnergySwitch will perform automated actions according to strict pre-defined rules (based on battery level, UPS status, etc.).

Please review the following rules and actions carefully to avoid unexpected behavior.

1. When the EnergySwitch boots, communication with the UPS is OK and the **Battery Level** is above the **UPS Recovery Threshold** the outlets will be powered as configured by the user.

2. When the EnergySwitch boots, communication with the UPS is OK and the **Battery Level** is below the **UPS Recovery Threshold** only outlets marked with **Prevent Outlet Shutdown** (see the EnergySwitch Configuration chapter) will be powered.

3. When the EnergySwitch boots and communication with the UPS fails, only outlets marked with **Prevent Outlet Shutdown** will be powered.

4. When the UPS is running on battery and the **Battery Level** drops below the **UPS Emergency Threshold** the EnergySwitch will send a **shutdown** command to all associated agents.

5. When the communication with the UPS fails for 5 minutes a **shutdown** command is sent to all associated agents of powered outlets.

6. When the UPS switches from mains to battery power while the **Battery Level** is below the **UPS Emergency Threshold** a **shutdown** command is sent to all associated agents of powered outlets.

7. After the **Battery Level** dropped below the **UPS Emergency Threshold** and the UPS is running on mains power again and the **Battery Level** goes above the **UPS Recovery Threshold**: All powered outlets and outlets marked with **Prevent Outlet Shutdown** will be power cycled if their respective power consumptions are below the **UPS Recovery Power Threshold**.

Agent Communication

As of firmware version 1.3, your EnergySwitch PDU features Agent Communication functionality. This enables the EnergySwitch to communicate to installed Agents on connected devices (servers, etc.) and perform actions when set parameters and rules are met. The Agent will also monitor the system it is installed on. In order to use the full capabilities of the functionality, 2 components need to be installed and configured correctly:

- **Agent Communication**
  Communication with the Agent service on connected servers.

- **UPS Integration**
  The link with the connected UPS in the rack (for more details see the UPS Integration chapter).

When UPS Integration is not enabled, communication to connected Agents will be limited to manual actions only.

Configuration

Setting up Agent Communication is a 2-step process:

1. Installing and configuring the Agent service on the connected devices.
2. Configuring the EnergySwitch to communicate to the installed Agent.

WARNING: If both UPS Integration is enabled and Agent Communication is correctly configured the EnergySwitch will perform automated actions according to strict pre-defined rules (based on battery level, UPS status, etc.). **Please review these rules and actions carefully to avoid unexpected behavior.**

Agent Service

The Racktivity Agent service can be installed on both physical and virtual machines and is used to monitor certain system parameters and to allow the EnergySwitch or the user to perform a graceful shutdown or restart.
The system monitoring is performed at a 30 second interval and collapsed every 5 minutes.
The collapsed data can be retrieved from the Agent or sent to a predefined URL. This data will allow the Racktivity DCPM platform to provide very detailed and accurate power consumption down to application level.

The current version (v1.0) of the Agent service monitors the following:
- Global CPU usage
- Total number of processes
- Top 10 processes according to CPU usage
- Disks and their storage info: mount point, used bytes, available bytes

Future releases will add the following monitored items:
- Network interfaces and their info: IP, transmitted bytes, received bytes
- CPUs and their info: speed, cores, sockets, cores per socket, load
- All processes and their info: name, CPU usage, memory usage, connections (src IP, src port, dst IP, dst port, duration, amount)

Installation

The Agent installation package can be obtained by contacting Support and is available for the following operating systems and distributions:
- Windows
- Linux
- Debian

After installation, the Agent configuration file (agent.ini) can be found at:

- **Windows**
  C:\Program Files\Racktivity\agent.ini or
  C:\Program Files (x86)\Racktivity\agent.ini

- **Linux**
  /etc/racktivity/agent.ini

Configuration

The agent.ini file contains the following sections and editable parameters:

MAIN
- **host:** The IP on which the Agent listens
  0.0.0.0 means listen on any available IP address.
  Default: 0.0.0.0
- **port:** The port on which the Agent listens
  Default: 6666
- **workers:** The amount of worker threads that are used to handle the connections.
  Don't change this setting
  Default: 4
- **allowed:** A comma separated list of IPs (cannot contain whitespace characters) that are allowed to communicate with the Agent. If the IP is not in the list the connection is closed instantly.
  Default: an empty list
- **debug:** Whether or not the Agent adds debug information to the logs and/or console. Set to 1 to enable.
  Default: 0

SHUTDOWN
- **url:** The URL of the web page that will be called when the shutdown command is received. When this value is left empty the machine on which the Agent is running will be

shut down. When this value is set to 'disabled' no action will be performed.
Default: disabled

REBOOT
- **url:** The URL of the web page that will be called when the restart command is received. When this value is left empty the machine on which the Agent is running will be restarted. When this value is set to 'disabled' no action will be performed.
Default: disabled

MONITOR
- **interval:** The interval (in milliseconds) at which the system is monitored.
Default: 30000
- **pushurls:** A comma separated list of URLs that receive the data that is collapsed every 5 minutes. The data is sent in JSON format to the URLs by POST as the data parameter.
Default: an empty list
- **backlogsize:** The amount of collapsed monitored data points sets that are kept in memory.
Default: 6

Additional Commands

The following binary commands are accepted by the Agent service:
- **shutdown**: Calls the shutdown URL or shuts down the machine (depending on the configuration).
Example: shutdown
- **reboot**: Calls the reboot url or reboots the machine (depending on the configuration).
Example: reboot
- **reconfigure**: Sets a configuration parameter on the agent side.
Example: reconfigure:shutdown.url=disabledA0B1C2D3E4F5G6H7I8J9
In the example we set the URL parameter of the shutdown section to disabled. *"A0B1C2D3E4F5G6H7I8J9"* is the SHA1 hash of *"reconfigure:shutdown.url=disabled"* appended with the IP where the command is coming from. For instance if we send the command from 192.168.1.1 the SHA1 hash is calculated from *"reconfigure:shutdown.url=disabled192.168.1.1"*.
- **configuration**: Gets a configuration parameter from the agent.
Example: configuration:shutdown.urlA0B1C2D3E4F5G6H7I8J9
In the example we get the URL parameter of the shutdown section. *"A0B1C2D3E4F5G6H7I8J9"* is the SHA1 hash of *"configuration:shutdown.url"* appended with the IP where the command is coming from. For instance if we send the command from 192.168.1.1 the SHA1 hash is calculated from *"configuration:shutdown.url192.168.1.1"*.

For more information regarding the binary commands, please contact Support.

The following HTTP command is also accepted by the Agent service:
- **/getlast5min**: Gets the monitored data of the last 5 minutes in a JSON format. Make sure that the IP requesting the command is added to the allowed list of the Agent configuration.
Example: http://192.168.14.250:6666/getlast5min

EnergySwitch Configuration

To configure Agent Communication on the EnergySwitch: login to the web interface and open the Power > Agent sub tab.

#	Outlet State	Outlet Name	Prevent outlet shutdown	Agent IP	Agent port	Agent SNMP flag	Clean Shutdown	Restart
1	☑	Outlet 1	☐	0.0.0.0	6666	☑	Shutdown	Restart
2	☑	Outlet 2	☐	0.0.0.0	6666	☑	Shutdown	Restart
3	☑	Outlet 3	☐	0.0.0.0	6666	☑	Shutdown	Restart
4	☑	Outlet 4	☐	0.0.0.0	6666	☑	Shutdown	Restart
5	☑	Outlet 5	☐	0.0.0.0	6666	☑	Shutdown	Restart
6	☑	Outlet 6	☐	0.0.0.0	6666	☑	Shutdown	Restart
7	☑	Outlet 7	☐	0.0.0.0	6666	☑	Shutdown	Restart
8	☑	Outlet 8	☐	0.0.0.0	6666	☑	Shutdown	Restart

For each outlet the following options are available:

- **State**
  Toggle the state of the outlet. Outlets can be switched on, off or power cycled.

- **Name**
  Change the name of the outlet.

- **Prevent Outlet Shutdown**
  When checked the outlet can no longer be toggled off manually and - with UPS integration enabled - will be managed differently (see the Rules chapter for more information). Mostly used for vital rack equipment.

- **Agent IP**
  IP of the machine where the Agent for that outlet is installed. Shutdown and/or restart commands will be sent to this IP.

- **Agent Port**
  Network port of the machine where the Agent for that outlet is installed.

- **Agent SNMP Flag**
  When checked, SNMP traps are sent when the command was sent successfully or unsuccessfully.

- **Clean Shutdown**
  Clicking the Shutdown link will send the shutdown command to the configured Agent of that outlet.

- **Restart**
  Clicking the Restart link will send the shutdown command to the configured Agent of that outlet.

A Shutdown or Restart command can also be sent to an associated agent manually through the use of an HTTP API (when logged in as administrator):

- https://[DEVICE_IP]/agent.cgi? ADDR=P[X]&INDEX=[Y]&CMD=[z]
  - [DEVICE_IP]: IP of the PDU
  - [X]: Number of the power module
    - ES1000 Series: 1
    - ES2000-6000 Series: 1-3
  - [Y]: Number of the outlet (1 - 8)
  - [Z]: Command switch:
    - 0 = shutdown command
    - 1 = restart command

Logging

There are currently 2 types of logging available. Both can be downloaded from the Web Interface or through the API for your convenience.

Event

path: Logging > Event

The Event log is used to keep a history of all important events. Fill in the available fields and view the log in your browser or download it for offline use.

- **Module**
  The module for which to request the Event log.
- **Start time**
  The starting date & time for the log.
- **End time**
  The ending date & time for the log.
- **Download**
  Download the log as a text file.
- **Show**
  View the log in your browser.

The Log is displayed as a table with the following columns (from left to right):

- **Timestamp**
  The timestamp of the event.
- **Event type**
  The type of event: outlet toggle, threshold violation, …
- **GUID**
  The GUID of the control. For more info regarding GUIDs please refer to the *ES Series - API Manual*.
- **Value**
  The value that was returned by the event (voltage, temperature, etc)

Measurement

path: Logging > Measurement

The Measurement log returns a binary file with monitoring data of the selected module. For interpretation of the data in this file, refer to the manual of the selected device.

It's possible to select a specific Measurement log file by configuring the following options:

- **Type**
  The type of Measurement log

- **Module**
  The module for which to request the log.
- **Start time**
  The starting date & time.
- **End time**
  The ending date & time.
- **Download**
  Download the log as a text file.

Management Information Base (MIB)

A **management information base (MIB)** is a virtual database used for managing the entities in a communications network and is most often associated with the Simple Network Management Protocol (SNMP). The EnergySwitch features a built-in mib file which can be found at the following location:

- For firmware version **v1.3.x.x and above:**   https://[DEVICE_IP]/ES-RACKTIVITY-MIB.txt
  A direct link to the MIB file is also available under Settings > Network Settings

- For firmware version **v1.2.x.x and above:**   https://[DEVICE_IP]/ES-RACKTIVITY-MIB.txt

- For firmware version **v1.1.x.x and above:**   http://[DEVICE_IP]/ES-RACKTIVITY-MIB.txt

- For firmware version **v1.0.1.x and below:**   http://[DEVICE_IP]/ES100816-MIB.txt

Where [DEVICE_IP] is the IP of your EnergySwitch (i.e.: 192.168.14.250).

Use this file to translate the OIDs (Object IDentifiers) to a more human-readable state. For more information on how to use the MIB file, please refer to the documentation of your network monitoring software.

Upgrade Firmware

Racktivity is always working on improving and fine-tuning its products. It is possible that a new firmware is available for your device. During a firmware update the device continues working as normal.

Note: Make sure all active connections to the EnergySwitch - such as the website, telnet and SNMP - **are closed before updating**. Open connections might result in a failed update!

Obtaining Files

If you are unsure whether a firmware update is available for your device, have a look at http://www.racktivity.com/support or contact Racktivity Support (see Support chapter). If applicable the necessary files and instructions will be provided.

Troubleshooting

Downloading the diagnostics

As of firmware version 1.3 it is possible to download a diagnostics file (diag.txt) directly from the device containing a lot of vital system information.
To download the file:

- Login to the Web Interface
- Change the URL in the address bar to the following and press Enter:
  https://[DEVICE_IP]/diag.txt

Resetting Login Credentials

In case of lost login credentials, resetting them can be done on the device itself:

- Press and hold the **UP** and **DOWN** buttons simultaneously for 3 seconds until a notification is shown on the display.
  The credentials will now be reset to their default settings:

	Default login credentials
User name	admin
Password	1234

Connecting to the Web Interface

If you are unable to connect to the Web Interface please try one or more of the following options:

- Ping the device on its IP address. When unsuccessful, the EnergySwitch is most likely not on the same network as your PC, or communication is blocked by a network device.
- Connect the EnergySwitch directly to your computer (please note that for this both devices need to have a valid fixed IP).
- Try opening the Web Interface with another browser.
- Connect to the EnergySwitch using a different computer.
- If possible, power cycle the EnergySwitch.

Knowing your EnergySwitch' IP address

If you want to easily find out the IP address of your EnergySwitch, use the navigational buttons next to the TFT on the front.

- If the TFT is black, press any button once to activate it.

- Press MENU to enter the Menu.
- Select *Network* or *Network Settings* (v1.2) and press OK.
- Press the DOWN button and select *Current IP address* or *IP Address* (v1.2).
- The IP of your EnergySwitch is displayed in yellow at the bottom of the TFT.

Support

Feel free to contact us if you need any support or have any other questions or remarks:

Online   www.racktivity.com/support

E-mail   support@racktivity.com

Phone   003293242095 (GMT+1)