ELEVATE
Future Faster

TECHNICAL GUIDE

Elevate Intelligent PDUs

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General

1.1. Purpose and Scope

The purpose of this specification is to define the IPT PDU-SNMP Advanced Control Unit based PDU product. Definitions will cover electrical and operational characteristics.

1.2. Product Purpose

The IPT Power Distribution Unit [PDU] is installed into a data centre server cabinet and distributes a single or three-phase power supply to up to 48 socket outlets. The PDU is a meter grade product [Accuracy ± 1%] that monitors and records total voltage, current, power and energy usage to all socket outlets and also individually monitors and records each socket outlet current/power. The recorded information is made available over an Ethernet network via an internal web server and SNMP registers.

The PDU-SNMP Advanced Control Unit replaces the current control board within the PDU system and provides enhanced features including, USB ports, internal high-capacity log storage, IPv6 and SNMPv3 support, SNMP manager functionality etc.

1.3. Variants

There are two product variants that use the control board:

1. Strip version (Version that can be fitted within a PDU strip for the monitoring of a single or three-phase supply, control/monitoring up to 48 socket outlets, present an Ethernet port, MODBUS port for the monitoring of multiple PDU's, external contact monitoring, door entry/control, temperature and humidity sensor ports. Power is derived from an incoming mains phase.)

2. Rack-mount version (Version that is mounted within a 1-6U sub-rack enclosure for the monitoring of a single or three-phase supply, control/monitoring up to 48 socket outlets, present an Ethernet port, MODBUS port for the monitoring of multiple PDU's, external contact monitoring, door entry/control, temperature and humidity sensor ports. Power is derived from an incoming mains phase.)

1.4. Glossary

PCB Print Circuit Board, also called Printed Wiring Board. Fibre glass board with copper wiring layers forming electrical circuit in conjunction with mounted components.

ETHERNET Ethernet is a family of computer networking technologies for local area networks (LANs) commercially introduced in 1980. Standardized in IEEE 802.3, Ethernet has largely replaced competing wired LAN technologies. Systems communicating over Ethernet divide a stream of data into individual packets called frames. Each frame contains source and destination addresses and error-checking data so that damaged data can be detected and re-transmitted. The standards define several wiring and signalling variants. The original 10BASE5 Ethernet used coaxial cable as a shared medium. Later the coaxial cables were replaced by twisted pair and fibre optic links in conjunction with hubs or switches. Data rates were periodically increased from the original 10 megabits per second, to 100 gigabits per second.

SNMP Simple Network Management Protocol (SNMP) is an "Internet-standard protocol for managing devices on IP networks. Devices that typically support SNMP include routers, switches, servers, workstations, printers, modem racks, and more. It is used mostly in network management systems to monitor network-attached devices for conditions that warrant administrative attention. SNMP is a component of the Internet Protocol Suite as defined by the Internet Engineering Task Force (IETF). It consists of a set of standards for network management, including an application layer protocol, a database schema, and a set of data objects.

SNTP Simple Network Time Protocol (SNTP) is a simplified version of Network Time Protocol (NTP) that is used to synchronize computer clocks on a network. This simplified version of NTP is generally used when full implementation of NTP is not needed.

HTML HyperText Markup Language (HTML) is the main markup language for web pages. HTML elements are the basic building-blocks of webpages. HTML is written in the form of HTML elements consisting of tags enclosed in angle brackets (like <html>), within the web page content. HTML tags most commonly come in pairs like <h1> and </h1>, although some tags, known as empty elements, are unpaired, for example <img>. The first tag in a pair is the start tag, the second tag is the end tag (they are also called opening tags and closing tags). In between these tags web designers can add text, tags, comments and other types of text-based content.

PDU PDU [Power Distribution Unit] is a product which allows the distribution of a single or three phase mains supply to a number of mains powered devices. Each output to a device, or socket, may be individually controlled by the PDU by activating or deactivating its associated relay which is placed in series with the mains supply. In this way externally connected devices may be switched on or off as required by the application.

MODBUS Modbus is a serial communications protocol published by Modicon in 1979 for use with its programmable logic controllers (PLCs). It has become a de facto standard communications protocol in industry, and is now the most commonly available means of connecting industrial electronic devices.

Technical Requirements

2.1. PDU-SNMP Advanced Control Unit based PDU

2.1.1. Overview

The IPT Power Distribution Unit [PDU] is a meter grade power distribution product that can be supplied in power strip or 19" sub-rack format.

The main function of the product is to distribute a single or three-phase power supply to up to 48 socket outlets while monitoring and recording total voltage, current, power and energy usage to a meter grade accuracy of ± 1%. Additionally the product can monitor external environmental conditions, such as temperature or humidity, voltage free contacts and provide a complete cabinet door card entry control system. The product is controlled remotely over an Ethernet network using the integrated web server or SNMP registers.

The product provides the following features:

1. ARM based system supporting IPv4/6, HTTP(s), SNMPv2 & v3 trap alarms, SNTP time stamping, SMTP email alarms and SysLog alarms.
2. Highly flexible build configuration consisting of 'Control', 'Meter' and 'Socket' PCB sub-assemblies.
3. Universal input voltage range 85-264VAC on-board SMPS.
4. Real Time Clock (RTC) with capacitor backup.
5. Single or three phase 63A capable ± 1% accuracy metering modules.
6. Monitoring and recording of VRMS, IRMS, kW, kWh, Power factor, kVA, kgCO2, BTU/h, kJ/h and frequency measurements.
7. Internal USB2.0 host port for USB flash drive storage of log data.
8. Ethernet port [IEEE 802.3 with full 10/100Base-T network compatibility].
9. External USB2.0 host port with HTML/ SNMP power control.
10. High-speed MODBUS RS485 port for local daisy-chaining of up to 31 PDU slaves.
11. Pluggable 16x2 LCD panel with RGB backlight support and full colour LCD touch panel support.
12. Temperature sensor bus port [8x chained].
13. Humidity sensor port.
14. External contact monitoring ports x3.
15. Cabinet door contact monitoring port.
16. Cabinet door lock control port.
17. Cabinet door Wiegand card reader port.
18. 48 socket outlet support with current monitoring and/or switching using 4way socket module with automatic searching [Phase configuration on socket module].
19. Remote monitoring and configuration [HTML webserver and SNMP registers].

2.1.2. Power

Operational power is derived from one of the incoming phases [85-264VAC] which is connected to the board via a screw terminal connection.12VDC power is distributed to all connected Socket boards.

2.1.3. Operation

The PDU product is energised when supplied with AC power.

When a LCD panel is connected to the LCD port the product displays the welcome screen and then toggles between a screen showing the voltage [VRMS], amps [IRMS], kW's, Power factor and Energy used in kWh and a screen showing environmental parameters, see section 2.1.6.

Dependant on the number of Meter boards connected the system will collect data from each and store this for access via the Web server, SNMP registers or Modbus requests.

MODBUS connection

The PDU product may be configured as a 'Master' and connected to up to thirty-one [31] other PDU's, via a 2 wire RS485 interface, that are configured as 'Slaves' to allow the master PDU to collect measurements from the slaves for query over the masters SNMP interface.

Ethernet connection

The PDU product may be connected to a PC or laptop using a cross-over CAT5 Ethernet cable or to a router using a straight through CAT5 Ethernet cable. The GREEN LED on the Ethernet connection port indicates that the product is connected to a valid device, the YELLOW LED indicates data traffic to/from the unit.

The product, as default, is not configured for DHCP [Dynamic Host Configuration Protocol] which allows a connected Ethernet router to assign an IP address to the product for Ethernet communication. DHCP may be configured using the 'Network Configuration' button within the Web server, see Appendix A 'Web server HTML page description' for more information.

External USB2.0 port

The product provides a USB2.0 host port with configurable power activation for external USB device such as USB flash drives, cameras, input devices and additional WIFI/Bluetooth network support.

Web server access

The PDU product supports full HTTP and HTTPS access of the internal HTML web pages using any standard internet browser ie. Internet Explorer (pre-Edge), Firefox, Google Chrome etc.

Please see Appendix A 'Web server HTML page description' for more information on accessing this service.

SNMP register access

The PDU product is provided with a MIB [Management Information Base] for use with any SNMP manager. This MIB outlines all the accessible registers, there type and description. The file is called 'PDUSNMP_Vx.xx.xx.mib'. For more information please look at the MIB file.

Please see Appendix B 'SNMP register description' for more information.

NTP time update

The PDU product supports Network Time Protocol (NTP) time and date synchronisation with a pool of NTP time servers when it has network access. The built in Real Time Clock (RTC) stores this time/date and recalls it on every boot so if network access is down the clock for logging functions will always be correct. The NTP server or time/date may be configured in the webserver, see Appendix A 'Web server HTML page description' for more information.

USB flash drive configuration update

The PDU product supports the update of system configuration using a standard USB flash drive. This allows a set of default configuration options to be setup on the USB flash drive and this drive used on a number of systems.

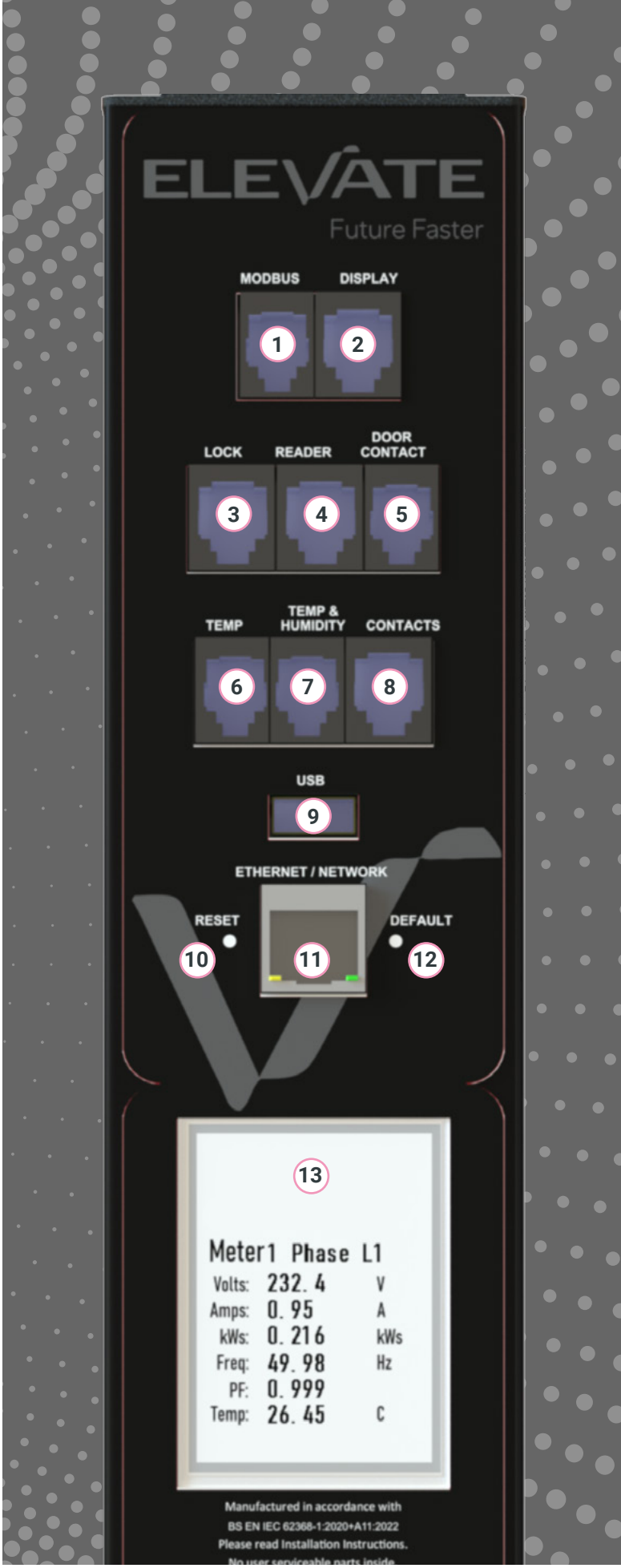
When the front panel USB is configured for power output (default) a USB flash drive containing a modified copy of the current 'config.ini' file may be inserted and within 10 seconds the key values contained in the config.ini file will be copied to the system.

Additionally if the key value 'dhcpenabled = 0' is configured within the config.ini on the USB flash drive and the 'ipaddress' field is set to an IP address value other than the one currently configured on the system ('192.168.1.70' default) then the system will be re-configured for this IP address and an automatic reboot undertaken.

2.1.4. Connections

IP1, 2, 3, 4 (ACU) – Port Identification.

1. **Modbus Port**
   High Speed MODBUS RS 485, Daisy chain up to 32 PDUs
2. **Remote Display Port**
   Connect a secondary RGB display for ease of viewing
3. **Cabinet Lock Control Port**
   Connect Electronic Handles
4. **Cabinet Door Card Reader Port**
   Connect Card Reader or Electronic Handle Card Reader aspect
5. **Cabinet Door Contact Monitoring Port**
   Connect door contacts
6. **Temperature Sensor Port**
   Connect up to 8 daisy chained sensors
7. **Humidity Sensor Port**
   Connect Humidity / Temperature Sensor
8. **Voltage Free Contacts**
   3 sets of Volt Free Contacts for connection of any accessory such as leak detection
9. **USB 2.0 Port**
   Used for small PIN camera or Automatic Config upload
10. **Reset Button**
11. **Ethernet Port**
    IEEE 802.3 with full 10/100 Base-T network capability
12. **Default Button**
    Enables a “Factory Reset”. Please contact us for correction operation.
13. **Local TFT “Touch Screen Display”**
    IEEE 802.3 with full 10/100 Base-T network capability



LCD panel function

The PDU can provide visual system status if a LCD panel is connected to the system. The 'Touch keypad output enable' option must be unchecked for the LCD panel output to work. Indication as follows:

Power on welcome message

The LCD displays the following welcome message for five [5] seconds after initialisation:

PDU Vn.nn.nn
2020 IPT Limited

Single phase mode

The display provides status information for a number of parameters and is updated every <LCD rotation period> [default 3] seconds, as follows:

Single phase mode screen 1:

xxx.xxx.xxx.xxx
11023.0 kWh

Single phase mode screen 2:

L1 240.3V 6.35A
1.50 kW 0.736PF

If environmental sensors are connected then screen 2, see below, is displayed otherwise

Single phase mode screen 3, then returns to screen 1:

Humidity 58.45%
Temp 23.56ºC

Three phase mode

The display provides status information for a number of parameters and is updated every second, as follows:

Three phase mode screen 1:

```
xxx.xxx.xxx.xxx
11023.0 kWh
```

Three phase mode screen 2:

```
L1 240.3V  6.35A
1.50 kW 0.736PF
```

Three phase mode screen 3:

```
L2 238.1V  4.56A
1.12 kW 0.834PF
```

Three phase mode screen 4:

```
L3 239.5V 12.67A
3.03 kW 0.986PF
```

If environmental sensors are connected then screen 4, see below, is displayed otherwise screen 1 is re-displayed.

Three phase mode screen 4, then returns to screen 1:

```
Humidity 58.45%
Temp 23.56ºC
```

Touch LCD panel function

The PDU can also provide visual system status if a Touch LCD panel is connected to the system. The 'Touch keypad output enable' option must be checked for the LCD panel output to work. Indication as follows:

Welcome message

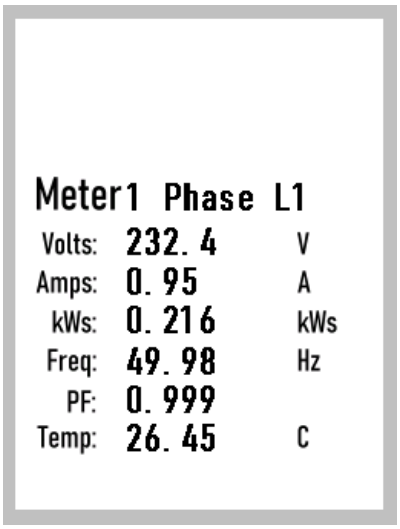
The LCD displays the following welcome message until system initialisation:

Single phase mode

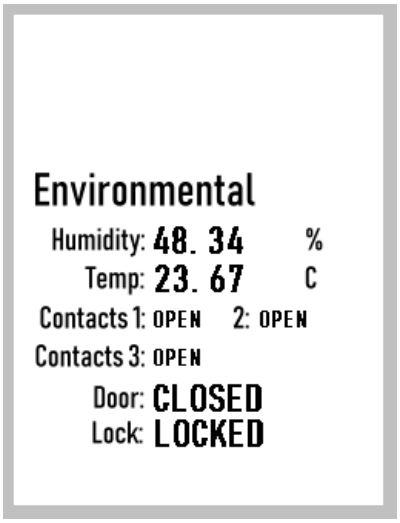
The display provides status information for a number of parameters and is updated every <LCD rotation period> [default 3] seconds, as follows:

Single phase mode screen 1:

Single phase mode screen 2:



Single phase mode screen 3, then returns to screen 1:



Three phase mode

In three phase mode screen 3 & 4 show meter 2 & 3 measurements respectively.

2.1.5. Configuration

All board configuration is undertaken via the web server, SNMP registers or using the a USB flash drive.

2.1.6. Control

Reset button

The RESET button allows the PDU to be restarted. Momentarily press the 'RESET' button to reboot the PDU.

Default button

The DEFAULT button allows the PDU to reset to factory defaults. Press and hold the 'DEFAULT' button and momentarily press the 'RESET' button to reset configuration to factory defaults.

2.2. Operating Environment

The product shall operate in a temperature range of 0 – +60oC and a humidity of up to 80% non-condensing.

2.3. Safety Integrity

The product shall be designed in accordance with relevant safety standards [5] [6]

2.4. International Standards

The product shall be designed in accordance with relevant International standards [7]

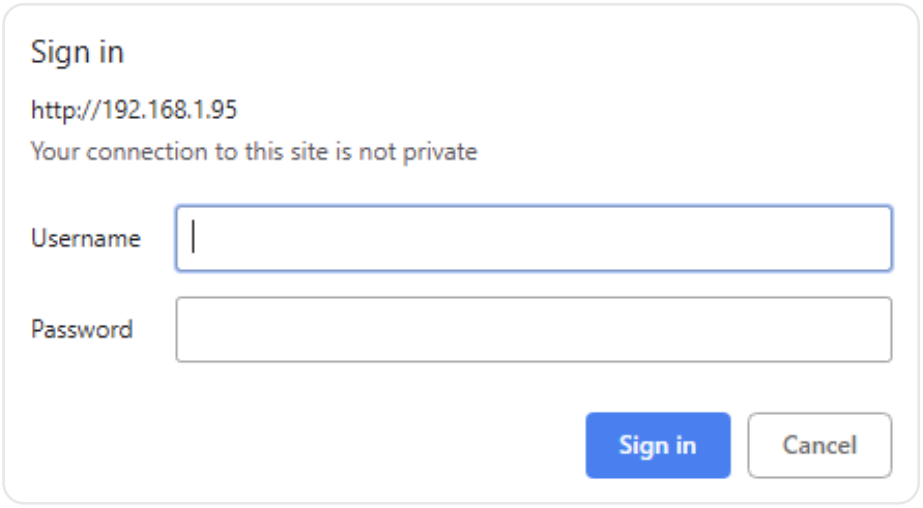
Appendix A. Web server HTML page description

Web server HTML page description

The PDU HTTP web server service provides a set of HTML pages that can be viewed within any HTML compatible web browser [ie. Internet Explorer, Firefox, Google Chrome etc.].

Logging into the web server

The HTTP service provides Domain Name Service [DNS] resolution so that the PDU IP address does not need to be known, entering 'PDUSNMP' into the browsers URL bar will contact the web server and initiate the authentication process to allow entry into the PDU system. The following authentication screen will be displayed:



At this point the operator may enter the system as a User, Administrator or Factory operator. The default User name and Password for the default administrator account is 'admin', both are case sensitive.

New accounts may be configured under the 'Configuration' tab settings, see later in this appendix.

User account

A User account prevents access to the all configuration options and most other operations that could compromise PDU SNMP operation.

Administrator account

An Administrator account allows the operator to re-configure any aspect of the PDU SNMP configuration. This configuration includes re-naming of the PDU client name, location, cabinet ID, Phase names, socket equipment names and changes to default parameters including kgCO2 conversion factor, cost per kWh, currency symbol, LCD colours, Slave modbus address, timeout and retry values, alarm threshold values and configuration, network and SNMP settings etc.

The Administrator also has access to buttons that allow the PDU to turn individual ports ON/OFF and reset currently stored energy levels etc.

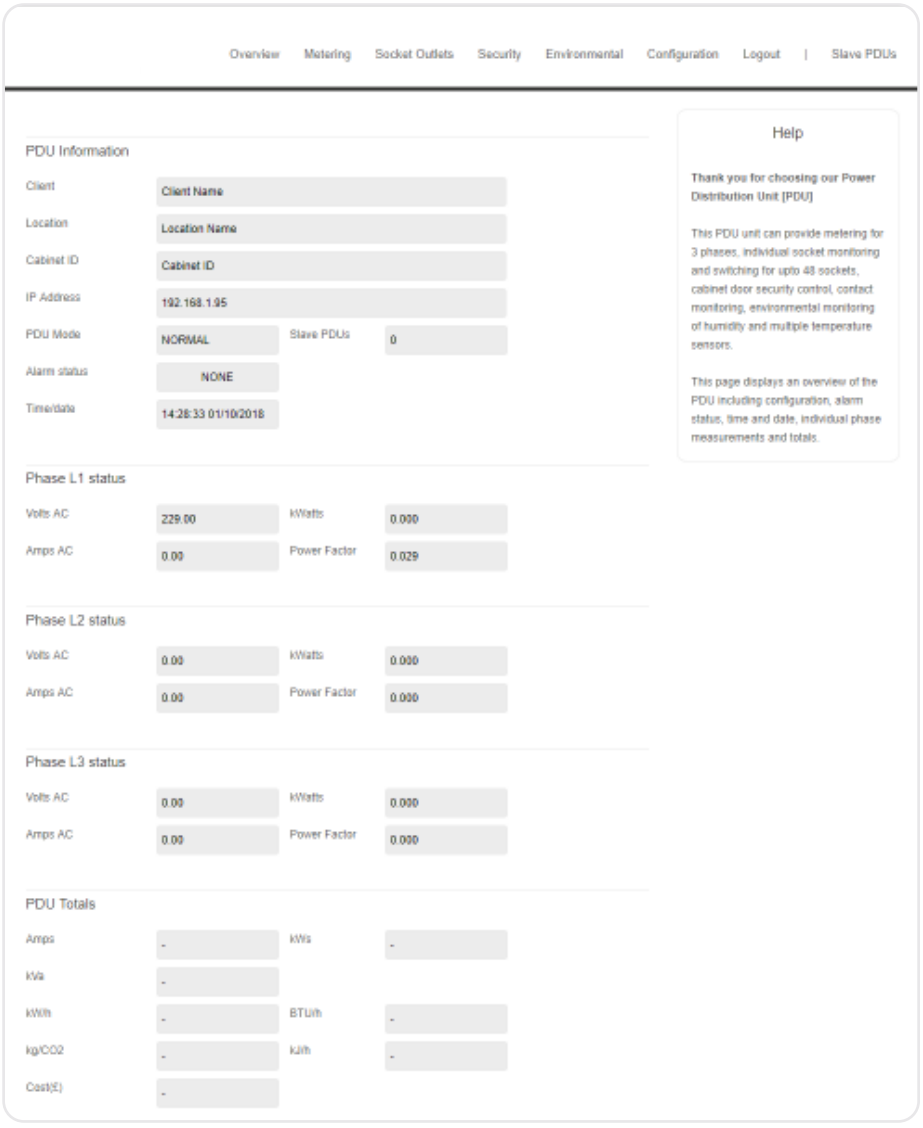
Factory account

As the Administrator account but allows chnages to made to the Advanced Configuration page

Overview page

After successful authentication the operator is presented with the initial Overview page which provides an overview of the PDU unit.

The following screen shot shows a single phase application:



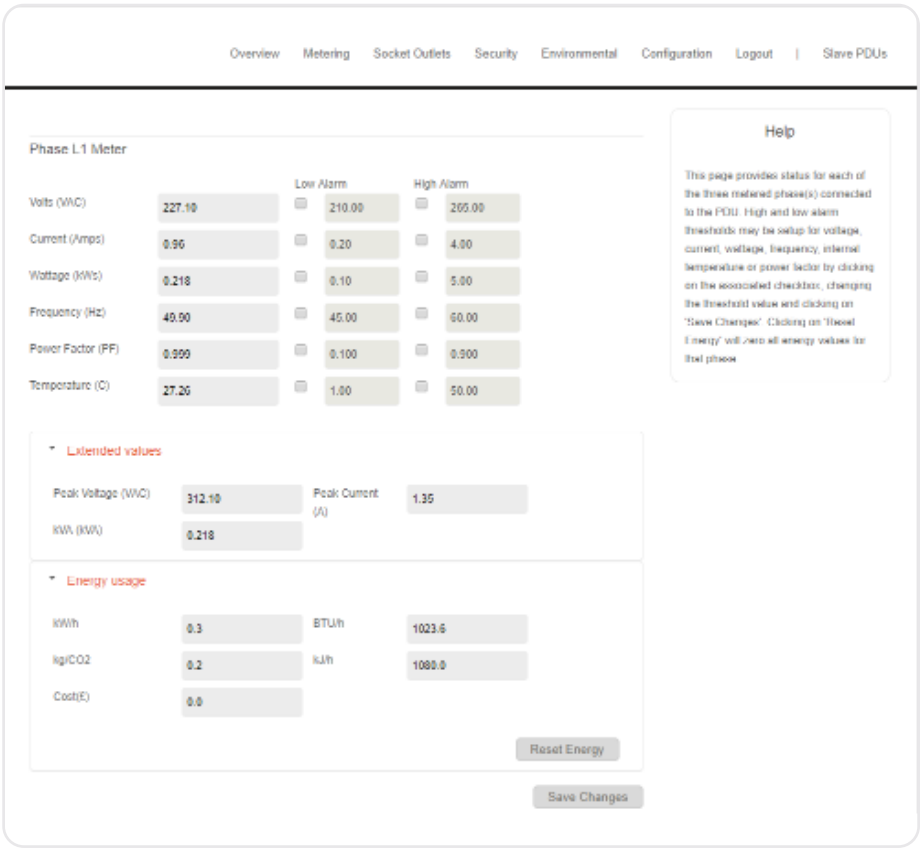
On all pages there is a help box on the right of the screen, this giving relevant information about the page and its controls.

The PDU Information provides an overview of the location and client to which the PDU belongs, its IP address, the mode of operation (NORMAL, MASTER or SLAVE), the alarm status and the real time clock current time/date.

Below this an overview of the connected meters is given along with totals for all the connected meters.

Metering page

Clicking on the **Metering button** the operator is presented with the metering page which contains details of the individual meters connected to the system. The following screen shot shows the first meter (the other two are identical):



The PDU's RMS volts, amps, kW's, frequency, power factor and internal temperature are shown along with check boxes and threshold level to configure alarms against these parameters. Please see later topic for alarm setup.

The Extended values box shows additional parameters for the PDU including Peak volts and amps and the VA that the meter is delivering.

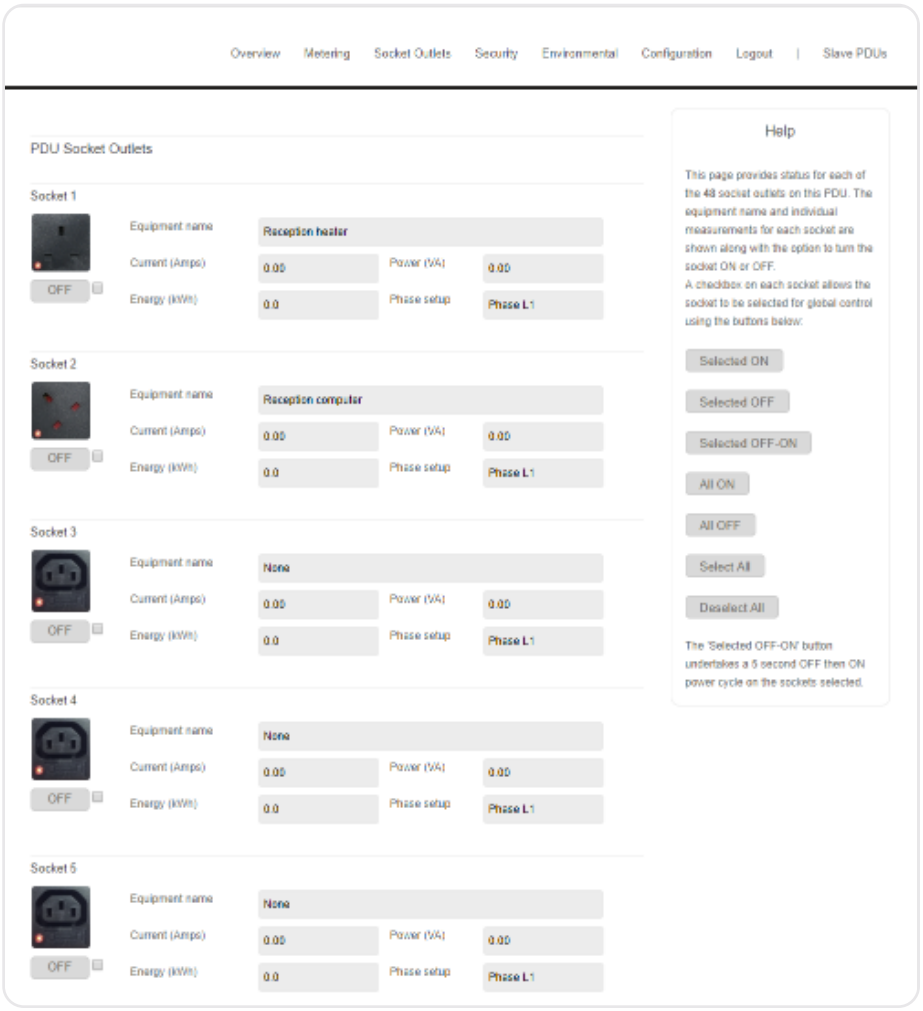
The final box provides the total energy usage on this PDU, including relevant conversions such as kgCO2, and the total cost based on the currently configured cost per kWh.

Buttons on this page allow the alarm thresholds to be saved and the energy consumption to be reset if required.

Configuration of the meter shunt used on the meter board to allow current measurements above 32A may be configured under the Advanced Configuration page.

Sockets page

Clicking on the **Socket Outlets button** the operator is presented with the sockets status page which contains details of each individual socket connects to the system. The following screen shot shows the first five sockets on a 48 socket system:

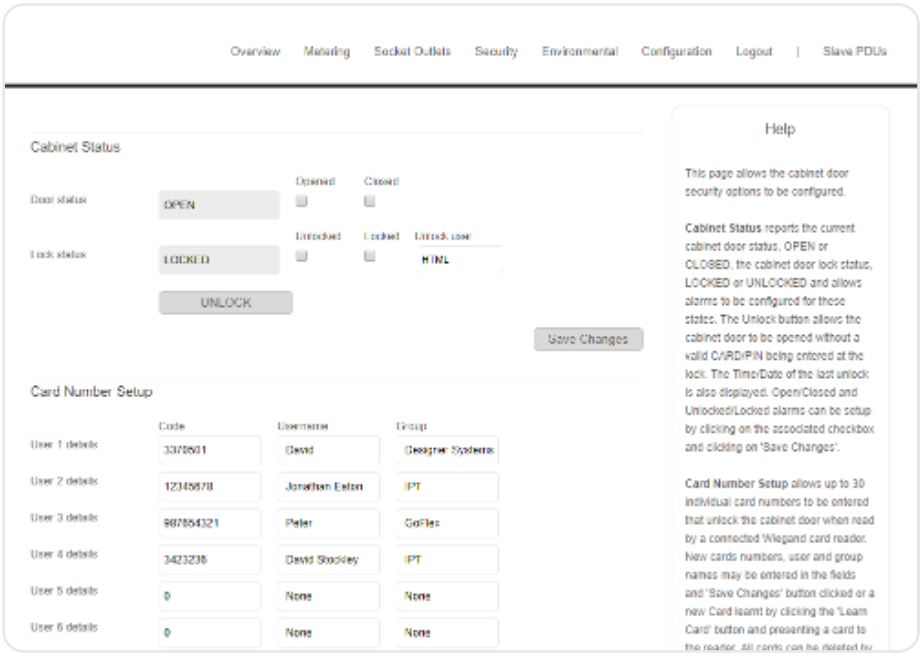


Each socket is displayed with an associated picture of the sockets type installed [Please see Configuration page for socket setup] the equipment name, the current and VA being drawn from the socket, the energy used by the socket and its associated phase. If the socket is currently ON then the RED neon indicator is lit on the graphic and switching button indicates that you can turn the socket 'OFF'.

Other buttons on this page allow the selected sockets, check box on each socket, to be turned ON or OFF, all the sockets turned ON or OFF or all the check boxes to be selected or unselected.

Security page

Clicking on the **Security button** the operator is presented with the security status page which contains all Cabinet door, lock and Card number information for the PDU. The following screen shot shows the cabinet door open, the door locked with the last unlock user and a four card numbers stored:



The cabinet status dialog provides the door and lock status along with check boxes to configure alarms for door OPEN/CLOSED and lock UNLOCKED/LOCKED conditions. The last user that the lock was unlocked is also displayed. The operator can unlock the lock at any time by clicking 'UNLOCK'. Please see later topic for alarm setup.

The Card Number Setup dialog provides a list of the currently stored card numbers that can unlock the door when presented to the card reader at the cabinet location. Any of these numbers can be changed, along with the Username and Group and the PDU updated by clicking 'Save Changes'. The 'Clear All' button clears all the current Card numbers to zero. The 'Learn Card' button activates the card reader learn function during which the reader LED will flash. If a card is swiped within 30 seconds this card will be stored in the next available slot otherwise learn will timeout and the reader LED turn off.

The 'Wildcards' checkbox can be used to enable/disable the Card/PIN wildcard feature The wildcard feature allows a pre-learnt Card/PIN number to be modified or a new one entered that will respond to a range of Card/PIN numbers when presented/entered.

The wildcard value is represented by using trailing full stops in the Card number starting in the units column and continuing into the tens, hundreds, thousands columns as required.

Example

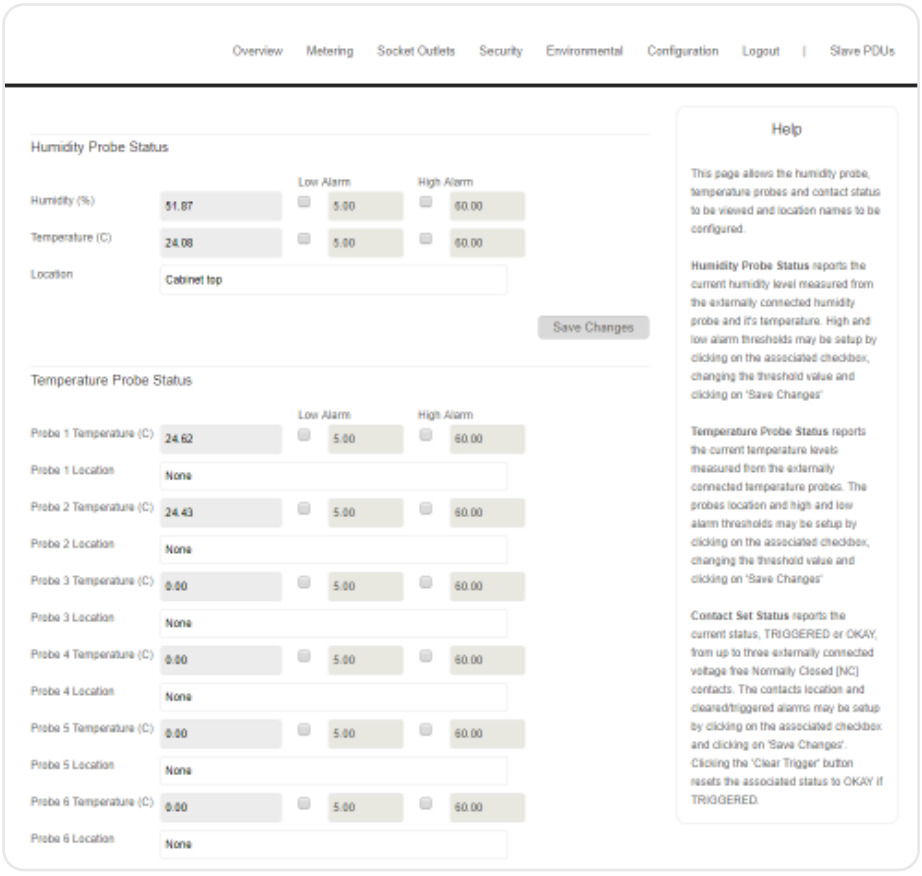
Pre-learnt card number modified to support wildcard function on digits 5 to 8.

Card/PIN registers contain value '12345678' due to pre-learn are modified to '1234....'

Cards swiped/scanned in the range '12340000' to '12349999' will activate the door lock.

Environmental page

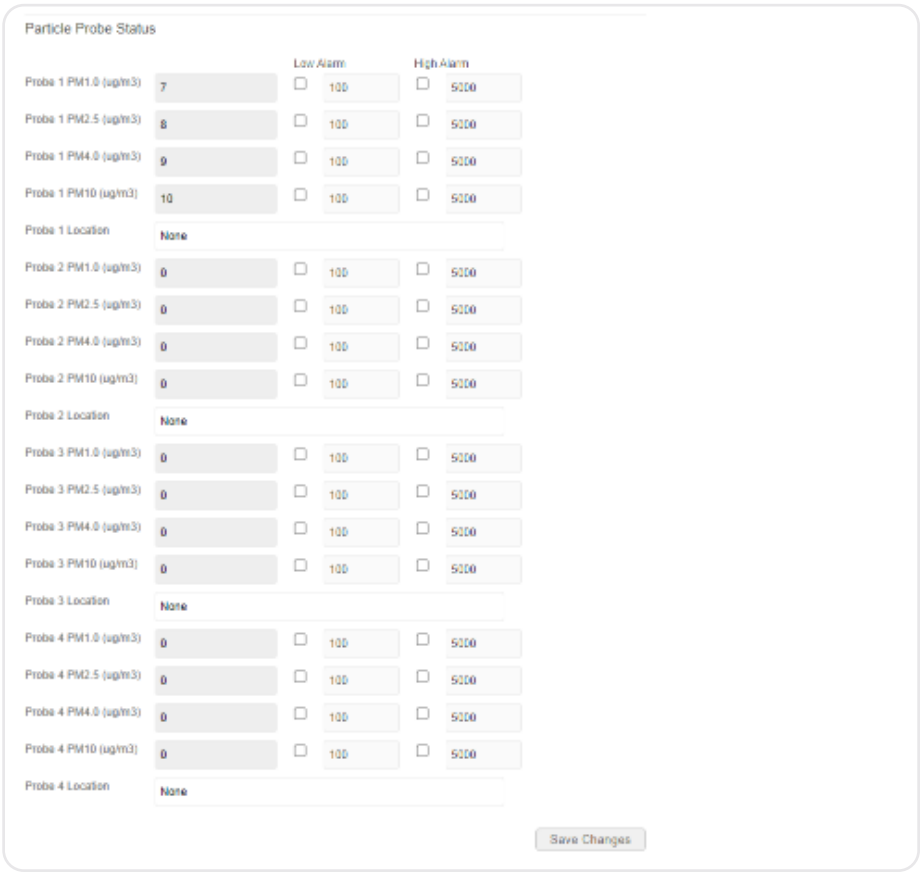
Clicking on the **Environmental button** the operator is presented with the environmental status page which contains details of any humidity probe, temperature probes, particle sensors and contacts connected to the system. The following screen shot shows both a humidity probe and two temperature probes connected:



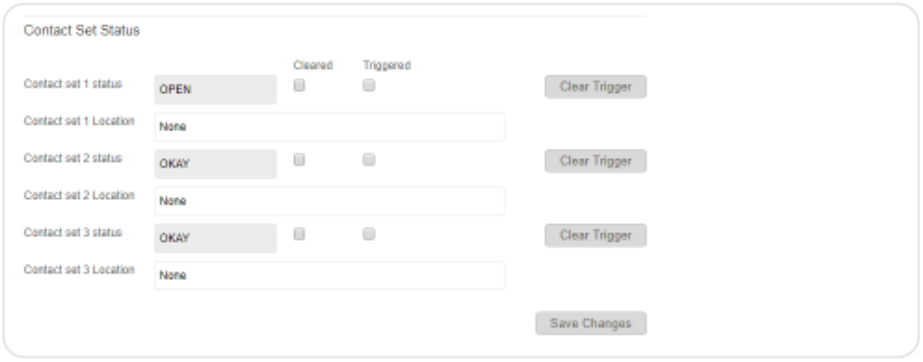
The humidity probe status box provides the temperature and humidity output from any connected humidity probe along with location name and check boxes and threshold levels to configure alarms against these parameters. Please see later topic for alarm setup.

The temperature probe status box(s) provide the temperature output from up to eight temperature probes along with location name and check boxes and threshold levels to configure alarms against these parameters. Please see later topic for alarm setup.

The following screen shot shows a particle sensor connected mid page:



The following screen shot shows the Contact Set Status at the bottom of the page:



The contact set status box provides the status [OPEN, OKAY or TRIGGERED] and label of any switch, contact etc. connected to the three contact inputs along with check boxes to configure alarms against these inputs. Please see later topic for alarm setup. The contact inputs are ‘sticky’ which means that when triggered into an TRIGGERED condition they will hold this condition until cleared using the associated ‘Clear’ button.

Buttons on this page allow the alarm thresholds and status to be saved as required.

Alarm setup and generation

Individual pages allow various low, high and event alarms to be configured.

To setup a low threshold alarm click on the Low Alarm checkbox and enter a threshold level at which an alarm should be generated if the reported value drops below i.e. for a temperature alarm enter 5.00 if you want an alarm to be generated if the temperature drops below 5.00C.

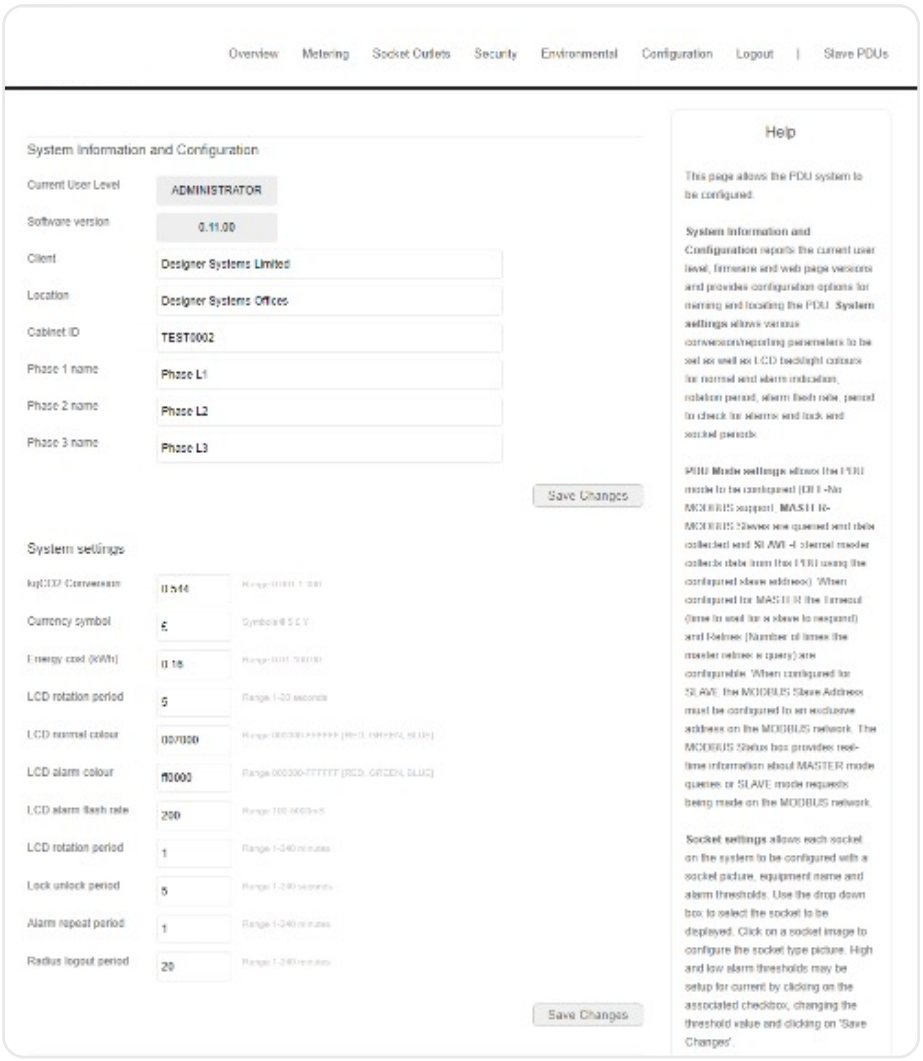
To setup a high threshold alarm click on the High Alarm checkbox and enter a threshold level at which an alarm should be generated if the reported value rises above i.e. for a temperature alarm enter 40.00 if you want an alarm to be generated if the temperature rises above 40.00C.

Click on the **'Save Changes'** button to update the alarm setting. Note: An alarm comparision is immediately undertaken on configuring a new alarm.

The normal alarm check repeat period of 1 to 240 minutes can be configured on the Configuration page. On every alarm repeat period timeout all configured alarm thresholds are re-compared with the currently report value and if found to be above or below the threshold and if the **SNMP trap N enabled** checkbox is selected an SNMP trap generated, see SNMP Trap Host Setup in Appendix B, and if the **Email alarms enabled** checkbox is selected on the Configuration page and alarm email will also be generated to the configured email address and if the SysLog enabled checkbox is selected a SysLog message generated.

Configuration page

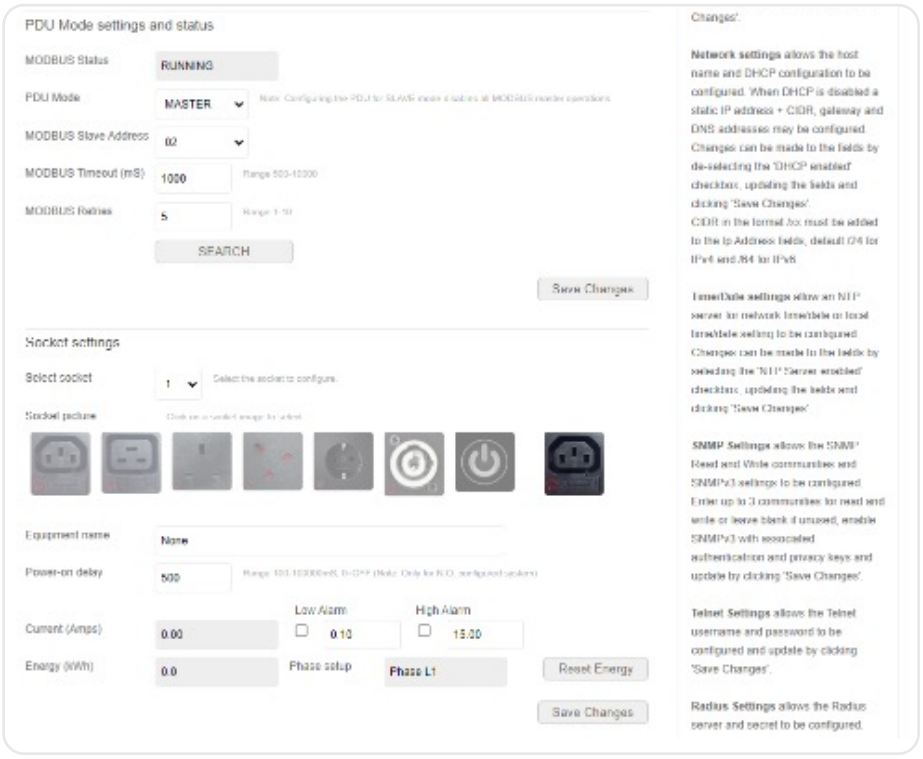
Clicking on the **Configuration button** the operator is presented with the Configuration page which contains configuration details. The following screen shot shows the System Information and configuration dialog and System Settings dialog at the top of the page:



The System Information and Configuration box shows the currently logged in operator level, USER, ADMINISTRATOR or FACTORY, client name, location and cabinet ID names and the names to be used for the three phases.

The System Settings box shows all the parameters that can be configured within the system.

The second section of the page contains the PDU Mode settings and Socket settings dialogs:



The PDU Mode settings dialog allows the PDU mode to be configured (**NORMAL**-No MODBUS support, **MASTER-MODBUS** Slaves are queried and data collected and **SLAVE**-External master collects data from this PDU using the configured slave address).

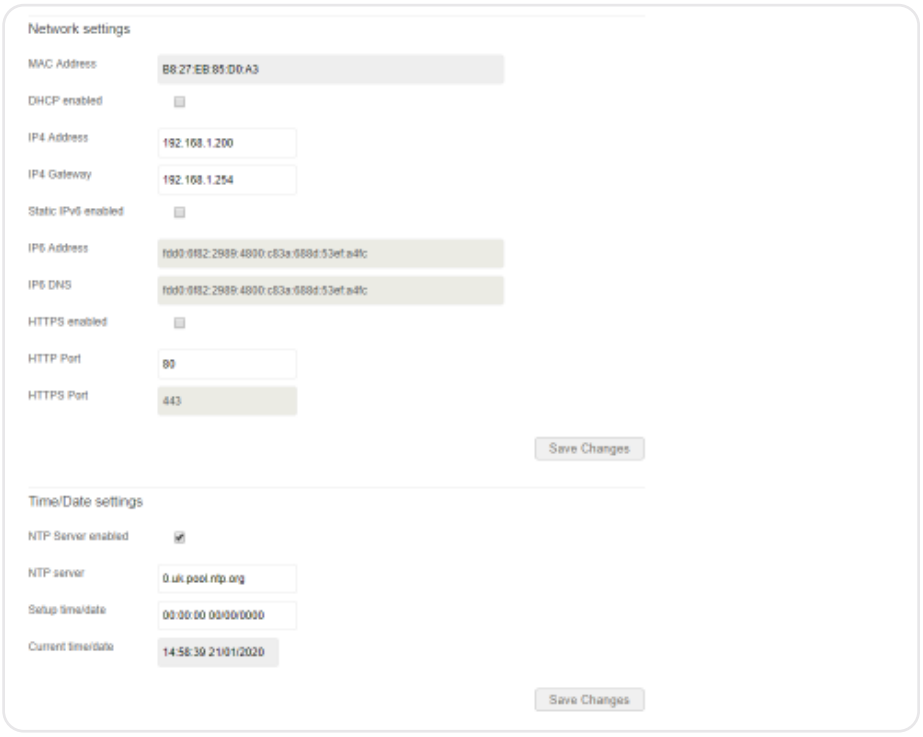
When configured for **MASTER** the Timeout (time to wait for a slave to respond) and Retries (Number of times the master retries a query) are configurable. Additionally, the SEARCH button is available to allow all connected Slave to be re-searched without rebooting the system.

When configured for **SLAVE** the MODBUS Slave Address must be configured to an exclusive address on the MODBUS network. The MODBUS Status box provides real-time information about MASTER mode queries or SLAVE mode requests being made on the MODBUS network.

The Socket settings dialog allows each socket on the system to be configured with a socket picture, equipment name and alarm thresholds. Using the drop down box the socket to be displayed can be selected. Clicking on a socket picture allows it to be selected. High and low alarm thresholds may be setup for current by clicking on the associated checkbox, changing the threshold value and clicking on the 'Save Changes' button.

Socket energy may also be reset by clicking the 'Reset Energy' button.

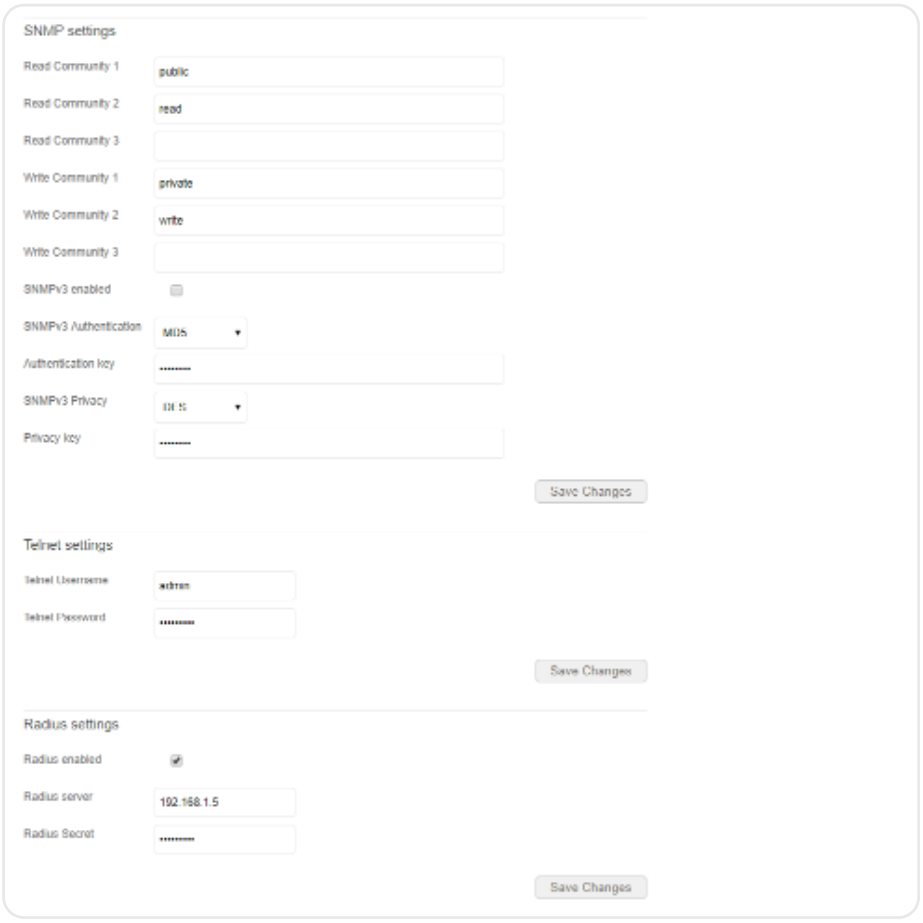
The third section of the page contains the Network settings and Time/Date settings dialogs:



The Network settings dialog allows IPv4/IPv4 DHCP to be enabled and the webserver port and secure (https) access to be configured. When DHCP is disabled a static IPv4 or IPv6 address and Gateway/DNS address may be configured. When DHCP is enabled the IPv4 and IPv6 addresses are allocated and displayed. Changes can be made to the fields by selecting/de-selecting the checkboxes, updating the fields and clicking the 'Save Changes' button.

The Time/Date settings box allows the NTP and time/date settings to be configured. Enter the NTP server you wish to use and check NTP Server enabled to specify a particular NTP server or uncheck NTP Server enabled and enter a time and date in the format shown and update by clicking 'Save Changes'.

The fourth section of the page contains the SNMP settings, Telnet settings and Radius settings dialogs:



The SNMP settings box allows the SNMP Read and Write communities and SNMPv3 settings to be configured. Enter up to 3 communities for read and write or leave blank if unused, enabel SNMPv3 with associated authentication and privacy keys and update by clicking ‘Save Changes’.

The Telnet settings box allows the Telnet server Username and Password to configured. Enter a username, password and update by clicking ‘Save Changes’.

The Radius settings box allows the radius authentication server to be configured. See Appendix I for more information.

The fifth section of the page contains the Alarm and Logging settings dialog:

The Email setting dialog allows the email address and mail server to be configured for email alarms. Select the 'Email enabled' checkbox, enter the destination email, from email and the email server information and click 'Save Changes'.

The SysLog setting dialog allows the SysLog port and server to be configured for SysLog alarms. Select the 'SysLog enabled' checkbox, enter the SysLog port, normally 514, and SysLog server information and click 'Save Changes'.

The SNMP Trap settings dialog allows the two trap destinations to be configured for SNMP trap alarms. Select either or both the 'SNMP trap N enabled' checkboxes, enter the SNMP trap destination and community and click 'Save Changes'.

The General settings dialog allows the auto log period to be configured i.e. the period at which an email and SysLog message are routinely sent to confirm system operation. Enter a minute value and click 'Save Changes'.

Slave PDUs page

Clicking on the **Slave PDUs button** the operator is presented with the Slave page which contains information about the connected slave PDUs. The following screen shot shows the Site Totals, Slave PDU Status, PDU Information and Meter Status dialogs at the top of the page:

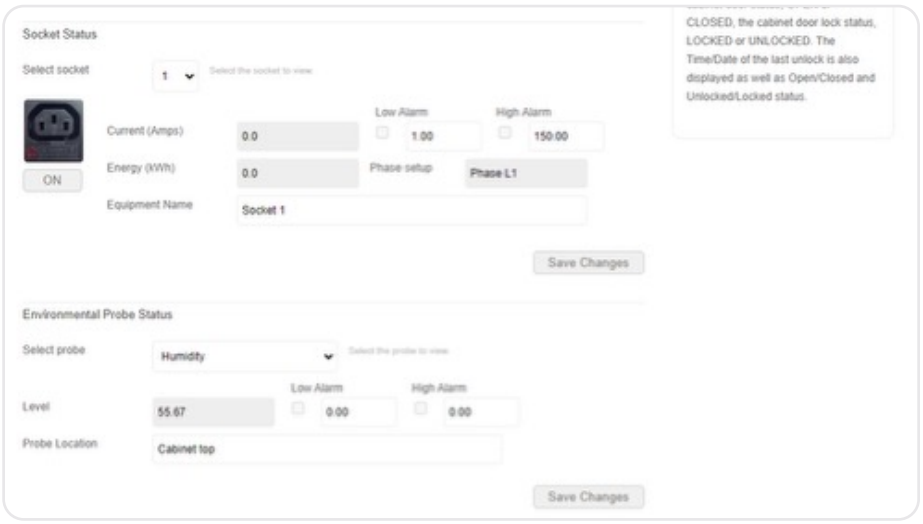
The Site Totals dialog shows the totals associated with this PDU and all slave PDUs connected to the system.

Selecting a slave PDU address from the Select PDU Slave drop down allows any slave to be selected with its information appearing under the PDU Information dialog.

A Cabinet ID and Phase names for the current slave may be entered and saved using the ‘Save Changes’ button.

The Meter Status dialog shows the meter status for the selected meter (1,2 or 3) along with the currently configured alarm thresholds and enable status.

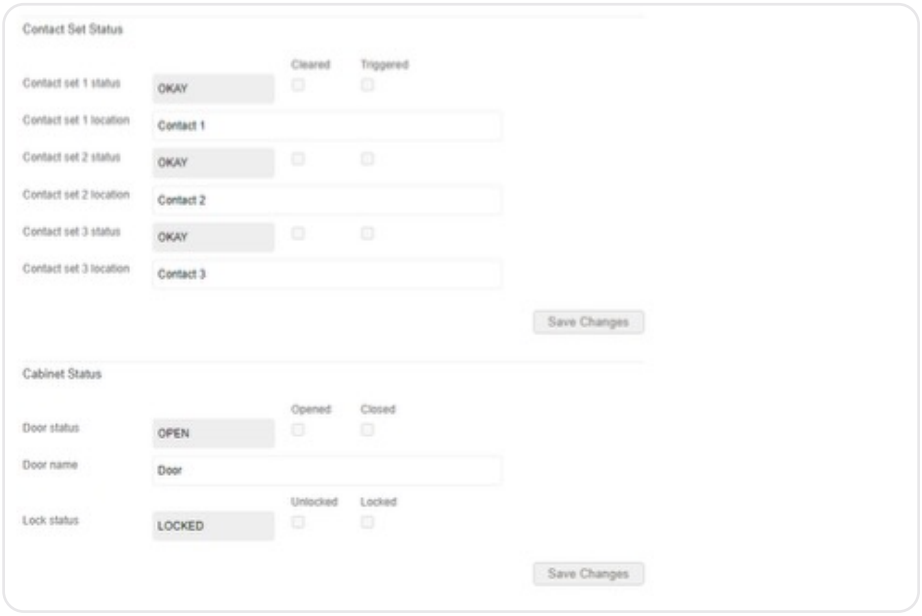
The bottom section of the page contains the Socket Status, Environmental Probe Status, Contact Set Status and Cabinet Status settings dialogs:



The Socket Status dialog allows the socket status to be viewed for the selected socket (1..32) along with the currently configured alarm thresholds, enable status, phase name and the equipment name may be entered and saved using the ‘Save Changes’ button.

The socket on/off status is also show along with a button that allows the socket output to be switched on or off.

The Environmental Probe Status dialog allows the humidity/temperature probe and temperature sensor status to be viewed and the probe location names may be entered and saved using the ‘Save Changes’ button.

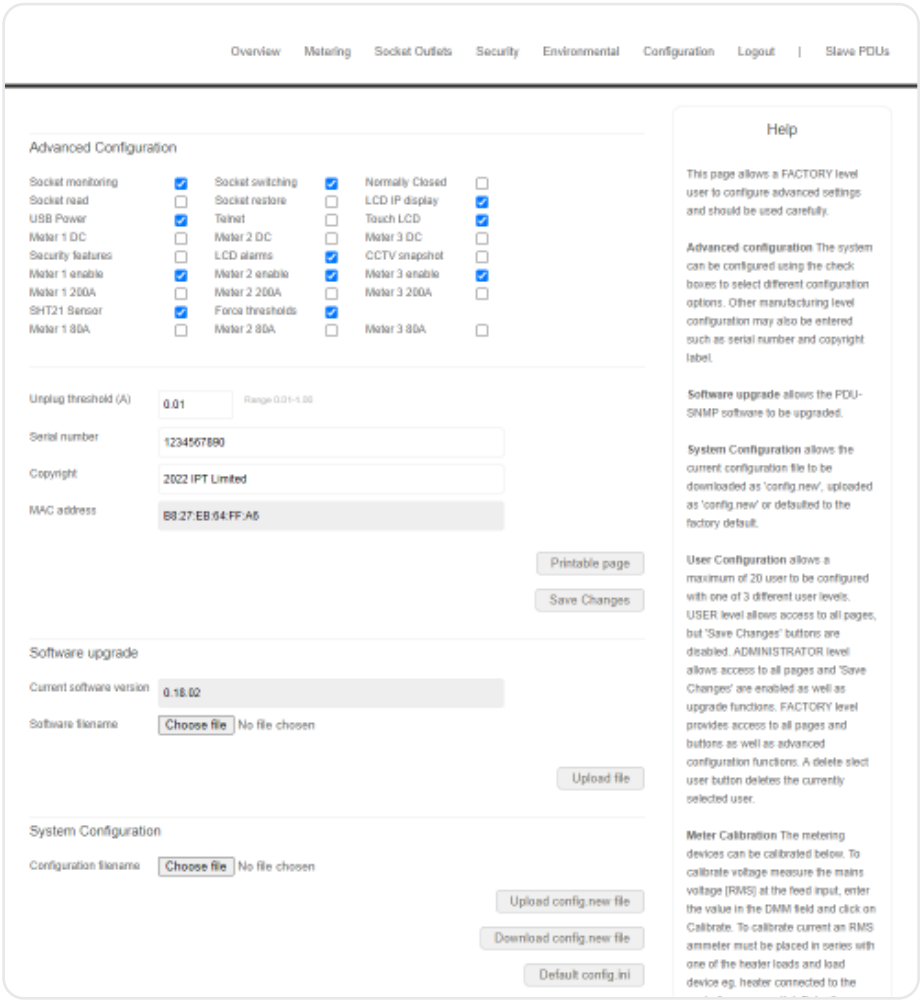


The Contact Ser Status dialog allows the state of the three [3] contacts to be viewed and the contatc location names may be entered and saved using the 'Save Changes' button.

The Cabinet Status dialog allows the door and lock status to be viewed along with the currently configured alarm enable status and the door name may be entered and saved using the 'Save Changes' button.

Advanced Configuration page (hidden)

On entering the IP address followed by /config.html in the top bar the operator is presented with the Advanced Configuration page which contains advanced configuration details. The following screen shot shows the top section of the page showing the Advanced Configuration and Software upgrade configuration dialogs:

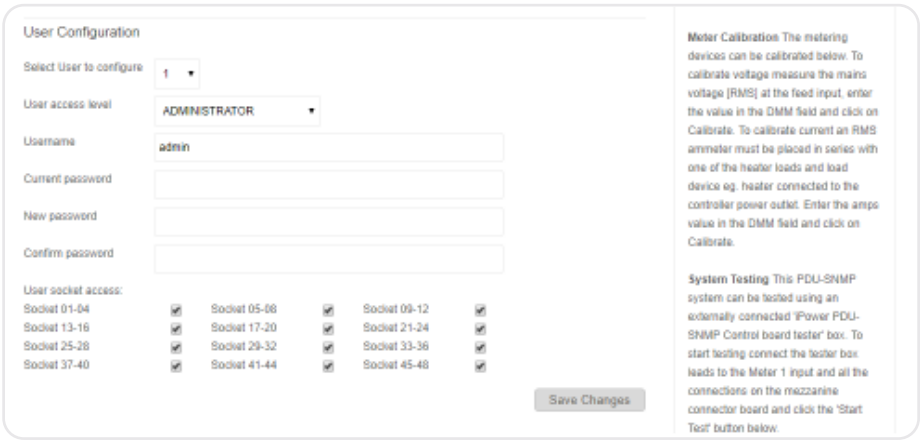


The Advanced Configuration box allows a number of factory configurable settings to be changed, induding: Socket unplug threshold, System serial number, page copyright notice and a printable page can also be generated containing this information along with the system MAC address.

The Software upgrade dialog allows the PDU software to be upgraded by choosing the ‘update.tar.cpt’ supplied by IPT and click ‘Upload file’. On upload completion the new software will be installed and the PDU will reboot. NOTE: That the webserver will go off-line during this reboot.

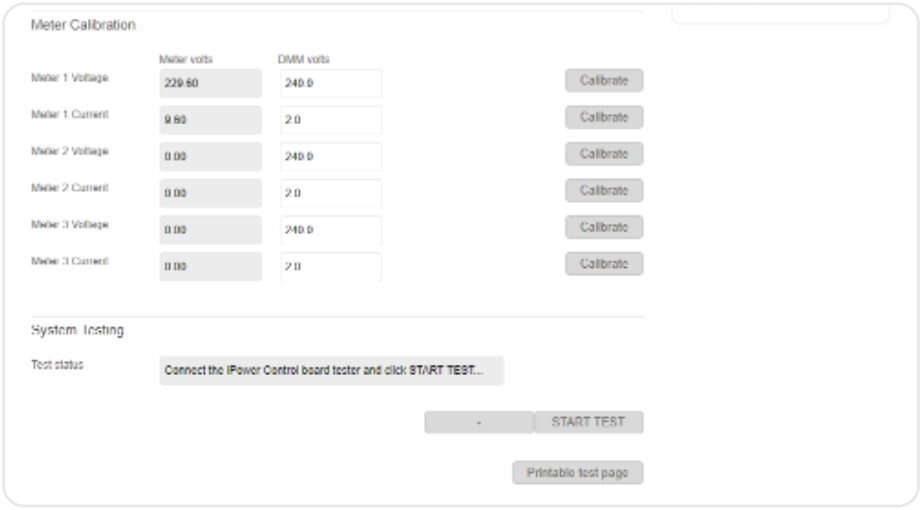
The System Configuration dialog allows the current configuration to be downloaded as a ‘config.new’ file, uploaded (eg. from another system downloaded file) as ‘config.new’ or defaulted to the factory defaults.

The centre section of the page contains the User Configuration dialog:



The User Configuration dialog allows a maximum of 20 users to be configured with one of 3 different user levels. USER level allows access to all pages, but ‘Save Changes’ buttons are disabled. ADMINISTRATOR level allows access to all pages and ‘Save Changes’ are enabled as well as upgrade functions. FACTORY level provides access to all pages and buttons as well as advanced configurations on the config.html page.

The botton section of the page contains the Meter Calibration and System Testing dialogs:



The Meter Calibration dialog allows each of the three meters to be individually calibrated. To calibrate voltage measure the mains voltage [RMS or DC] at the feed input, enter the value in the DMM field and click on Calibrate. To calibrate current a RMS ammeter must be placed in series with one of the heater loads and load device eg. heater connected to the controller power outlet. Enter the amps value in the DMM field and click on Calibrate.

The System Testing box allows the PDU to be tested. Connect an IPT PDU-SNMP Control board tester to the relevant interfaces and click START TEST.

Logout button

Clicking on the Logout button the operator is presented with a blank page with the authentication screen displayed.

Appendix B. SNMP trap setup and register description

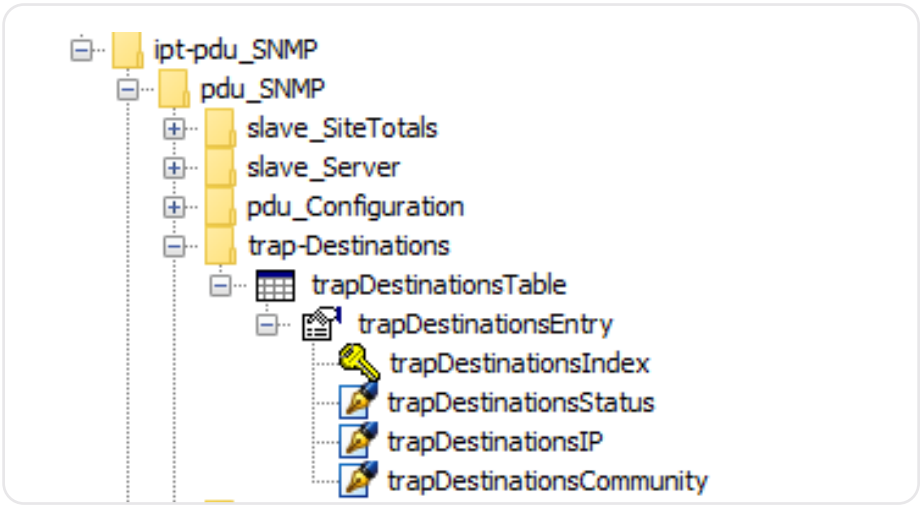
Overview

The PDU supports multiple SNMP registers which can be accessed through its MIB file definition [IPT-PDU_Vx.mib] by any SNMP manager. The product supports all standard SNMP operations such as GET, SET, GET NEXT, GET SUBTREE, GET BULK and WALK along with table viewing for some sets of registers and global registers.

The product is also capable of generating SNMP traps when previously setup alarm thresholds or alarm conditions are encountered. Traps consist of the client name and location followed by the PDU label that generated the trap, the current level/condition that caused the alarm and the trap alarm description.

SNMP trap host setup

The PDU supports two SNMP host IP addresses allowing two different host systems to be sent trap alarm information. The host destination enable status, destination IP address and SNMP community string are setup through a table view of the TRAPDestinationsTable:



Which when viewed as a table will look like this:

	trapDestinatio...	trapDestinatio...	trapDestinatio...	trapDestinatio...	Index Value
1	1	enabled	192.168.1.66	trap	1
2	2	disabled	0.0.0.0	trap	2

The destination IP address should be set to the IP of the host that is to receive the trap notifications and the trap destination status set to '1' for ENABLED. The SNMP trap community can also be changed if required. Once configured any alarms generated by the system will be sent as traps every <AlarmPeriod> minutes.

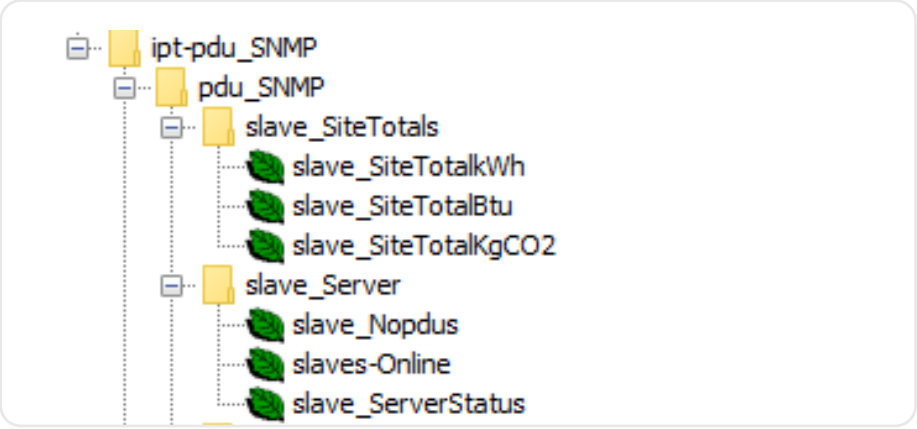
SNMP register definitions

The PDU-SNMP register set can be broken into three [3] functional categories, PDU-SNMP, Slave-PDUs and Slave-Global.

Please refer to Appendix A – Web server HTML web page description for more information about the individual values available as registers.

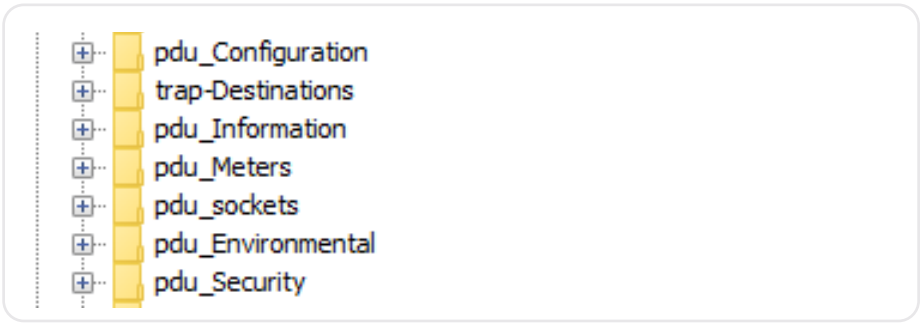
pdu_SNMP Slave total registers

The pdu_SNMP register category contains registers that allow the PDU-SNMP Slave site totals to be read and the slave status read. The following MIB tree shows the registers available:



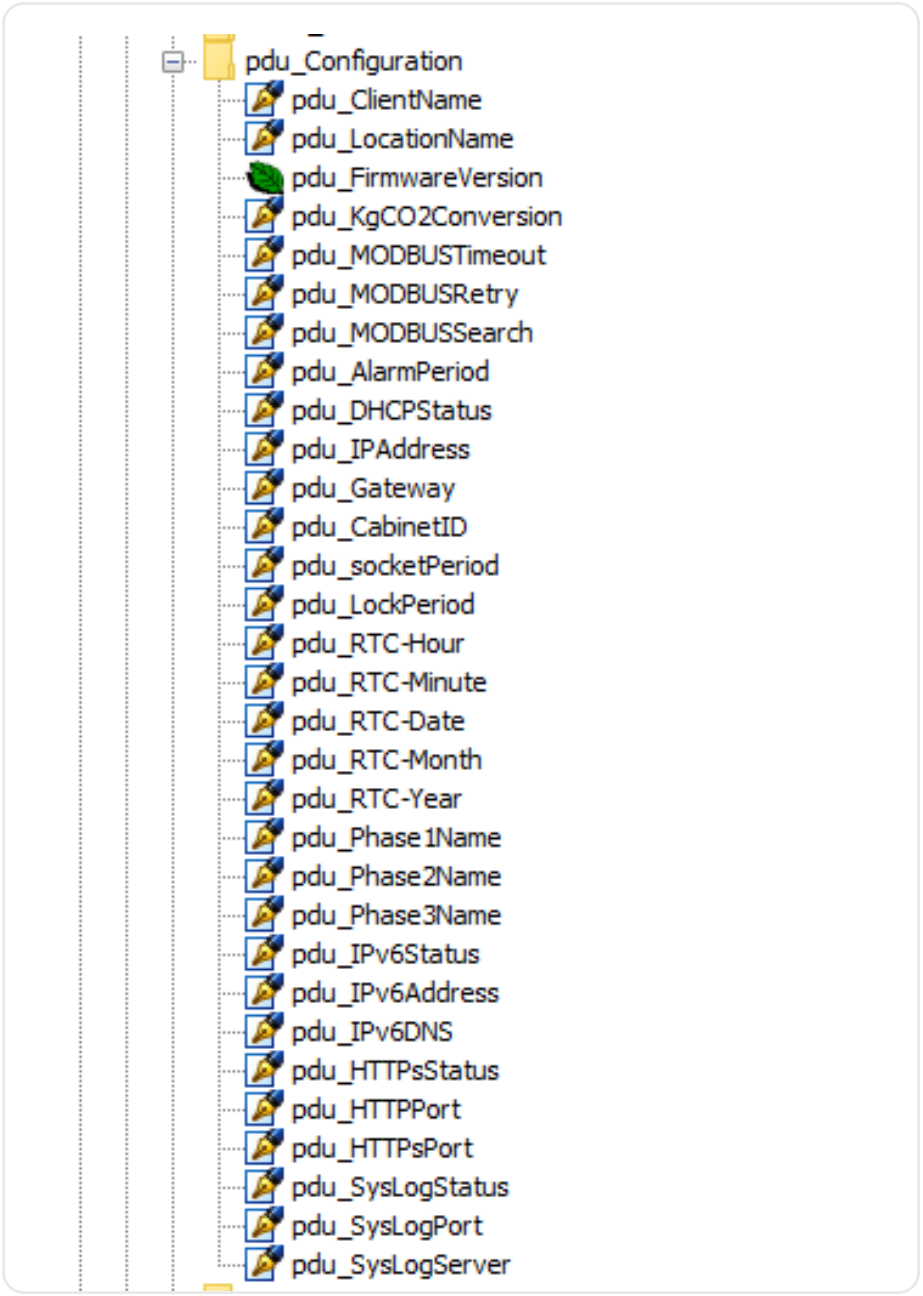
pdu_SNMP PDU registers

The pdu_SNMP PDU register category contains registers that allow the master PDU (When the PDU is configured for NORMAL or MASTER) status registers to be read (Meters 1-3, RTC, Sockets, Environmental and Security), allow the PDU to be configured and trap thresholds to be setup. The following MIB tree shows the registers available:



pdu_Configuration sub-category

The pdu_Configuration sub-category contains relevant configuration information for the master PDU as follows:



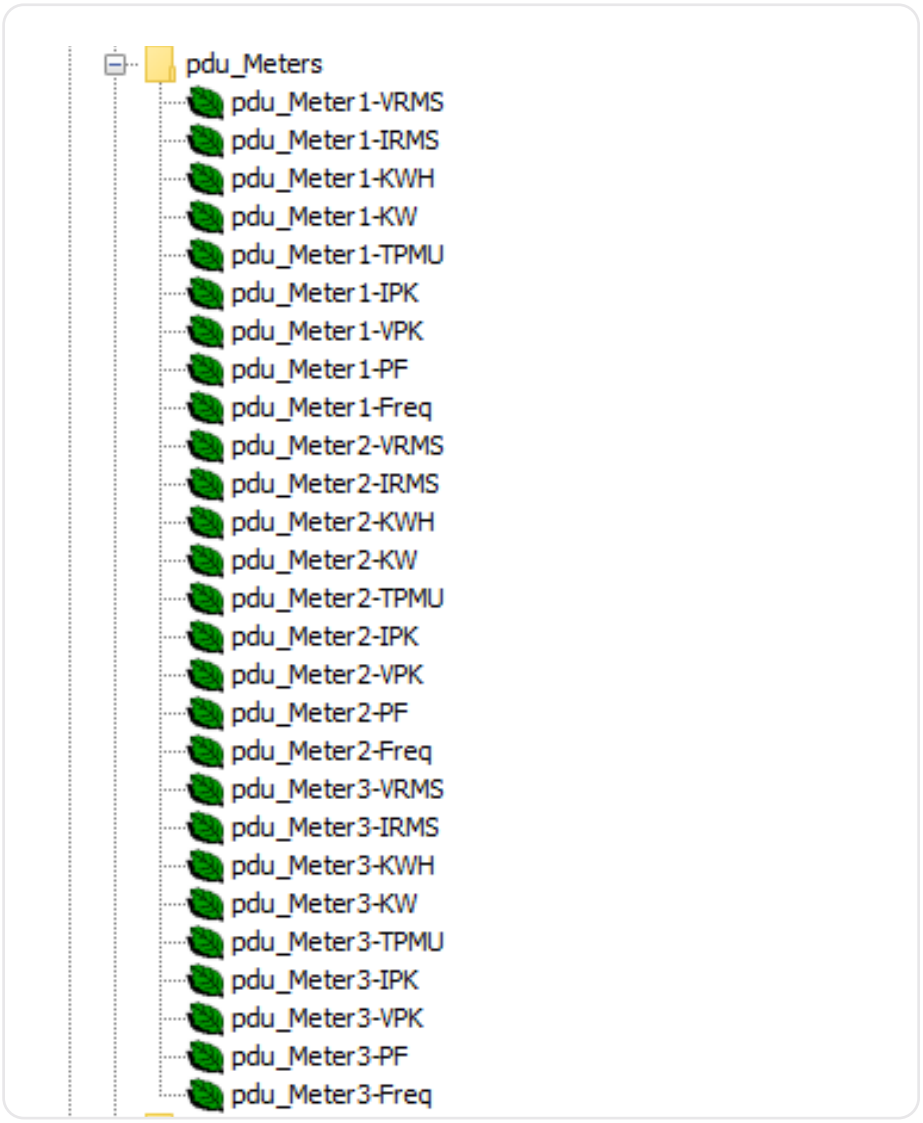
pdu_Information sub-category

The pdu_Information sub-category contains relevant information for the master PDU as follows:

pdu_ProductName and pdu_SerialNumber are set at factory.

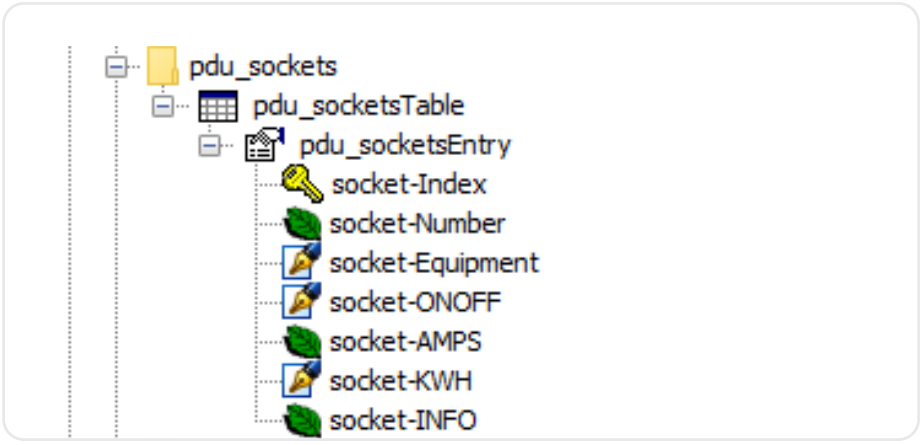
pdu_Meters sub-category

The pdu_Meters sub-category contains meter measurements for the master PDU as follows:



pdu_Sockets sub-category

The pdu_Sockets sub-category contains socket status and measurements for the master PDU as follows:

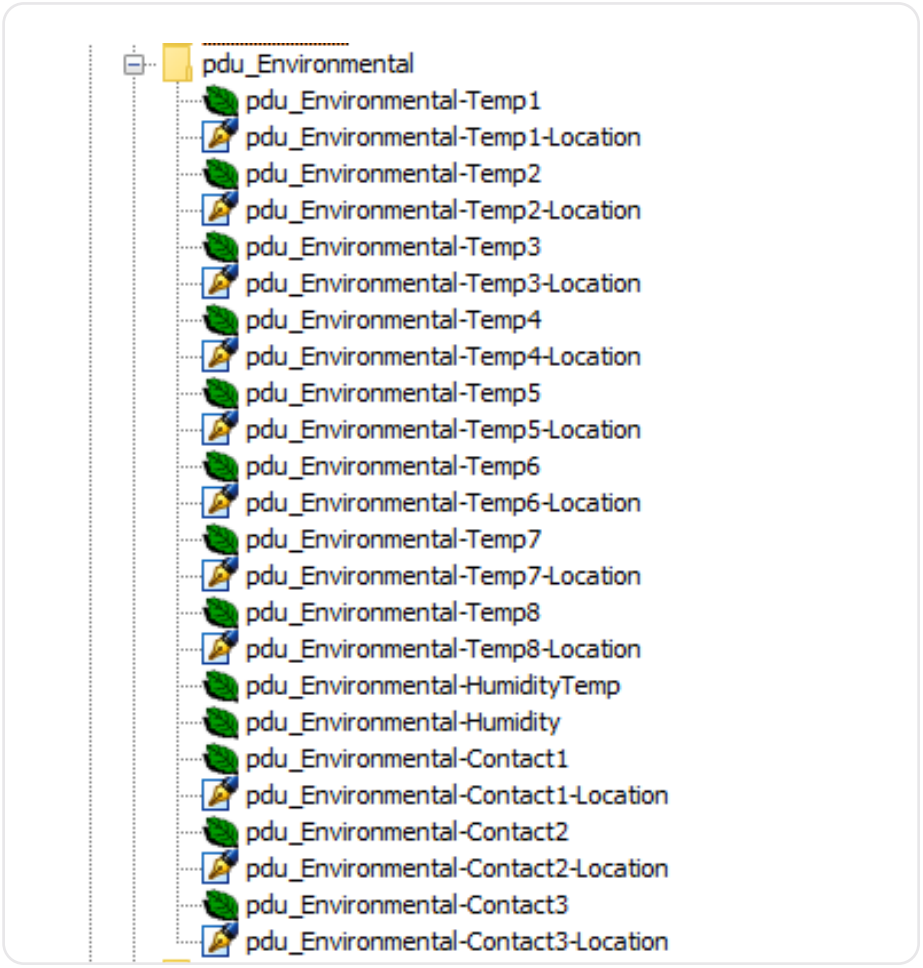


Which when viewed as a table will look something like this:

	socket-Index	socket-Number	socket-Equipm...	socket-ONOFF	socket-AMPS	socket-KWH	socket-INFO	Index Value
1	1	1	Reception heater	on	0	0	17	1
2	2	2	Reception computer	on	0	0	25	2
3	3	3	None	on	0	0	1	3

pdu_Environmental sub-category

The pdu_Environmental sub-category contains humidity probe, temperature probe status and measurements and Contact status for the master PDU as follows:



pdu_Security sub-category

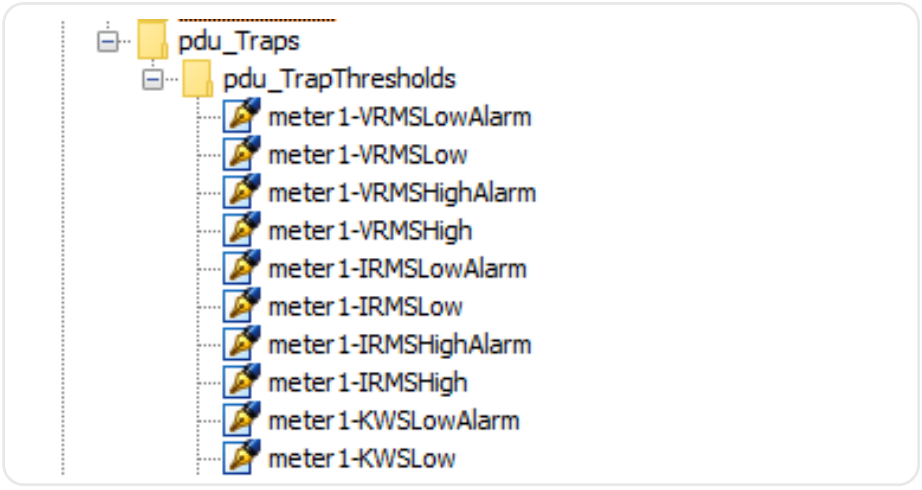
The pdu_Security sub-category contains door and lock status and the security card/PIN numbers for the master PDU as follows:

The pduSecurityTable when viewed as a table will look something like this:

	pdu_Security-...	pdu_Security-...	pdu_Security-...	pdu_Security-...	Index Value
1	1	3370501	David	Designer Systems	1
2	2	12345678	Jonathan Eaton	IPT	2
3	3	987654321	Peter	GoFlex	3
4	4	3423236	David Stockley	IPT	4

pdu_Traps, pdu_TRAPThresholds sub-category

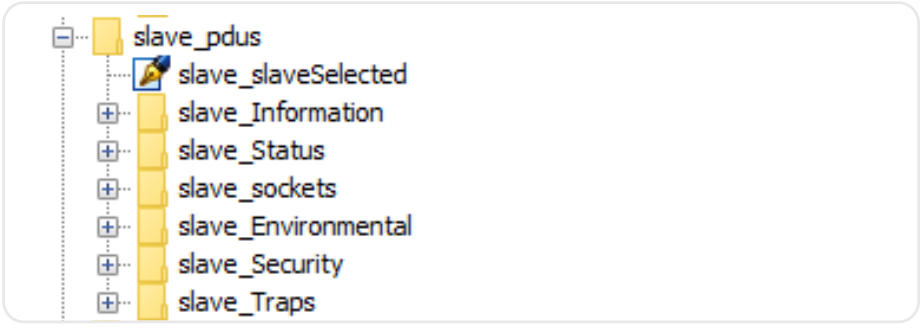
The pdu_TRAPThresholds sub-category allows the master PDU alarm thresholds and conditions to be configured. The first few can be seen as follows:



Please refer to Appendix A – Web server HTML web page description for more information about the individual values available as registers.

slave_PDUs registers

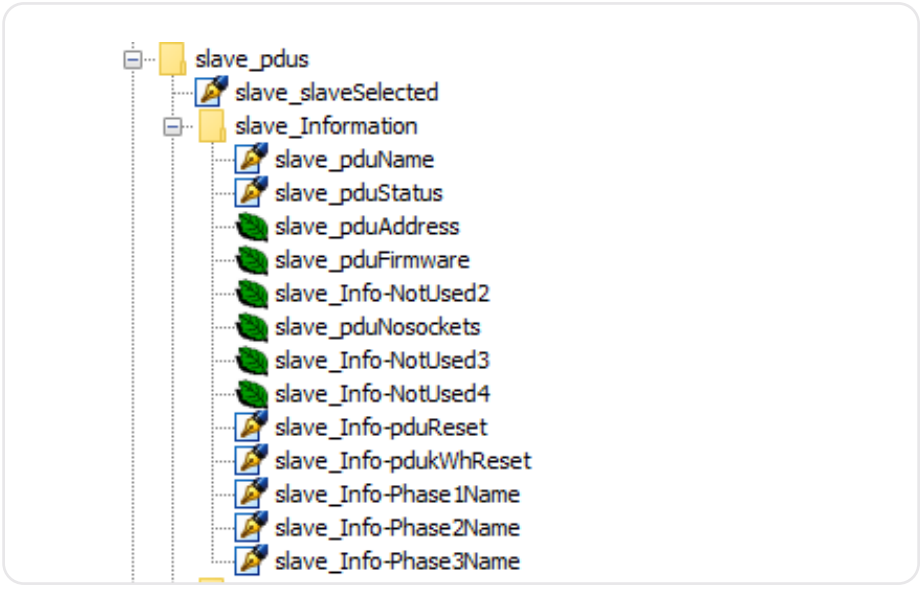
The slave_PDUs register category contains registers that allow individual Slave PDU's in the installation to be queried. A Slave PDU can be selected by writing an index value [1 to number of Slave PDU's in system] to the slave_SlaveSelected register as follows:



Subsequent GET's and SET's target this selected Slave PDU for each of the sub-categories above.

slave_Information sub-category

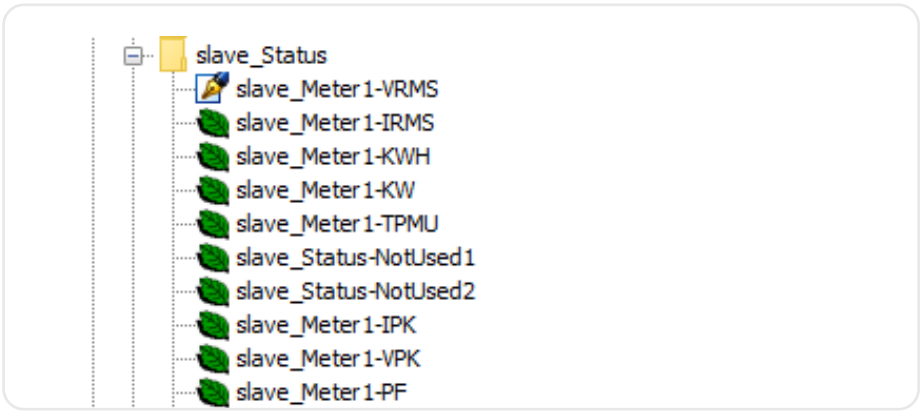
The slave_Information sub-category contains relevant configuration information for the selected PDU as follows:



Note: NotUsed registers are for system compatibility.

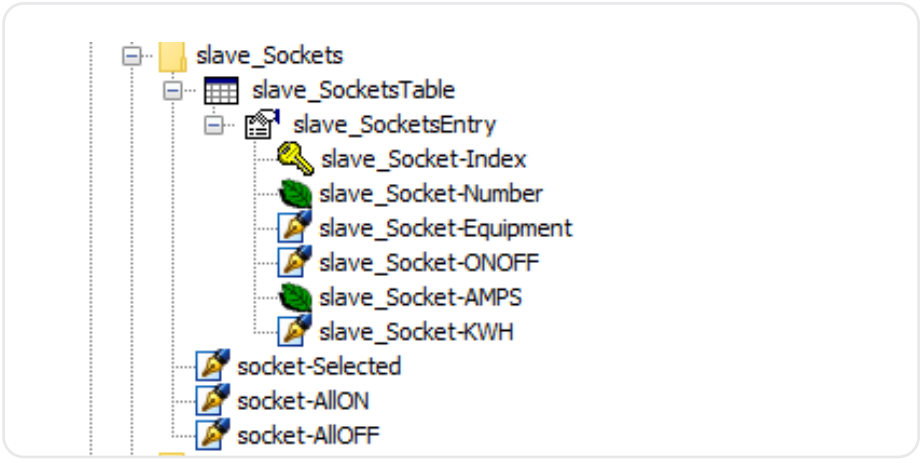
slave_Status sub-category

The slave_Status sub-category contains relevant status information for the selected. The first few can be seen as follows:



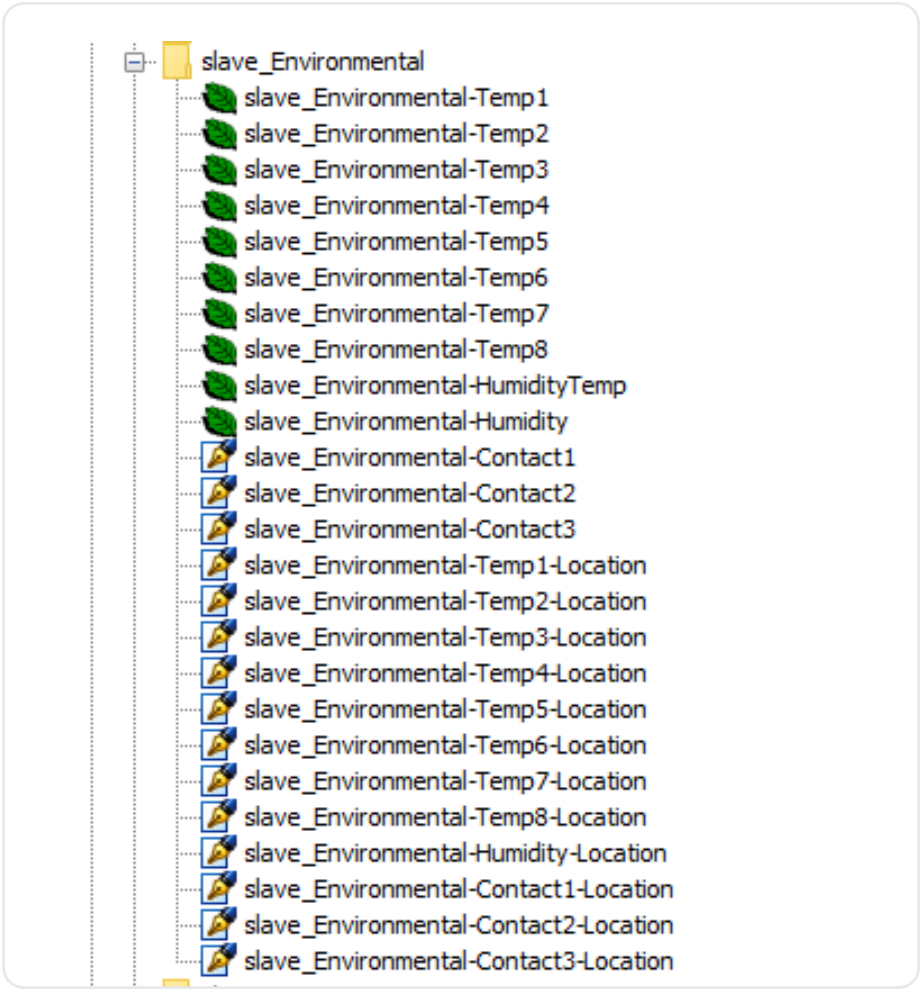
slave_Sockets sub-category

The slave_Sockets sub-category contains relevant status information for the selected PDU individual sockets as follows:



slave_Environmental sub-category

The slave_Environmental sub-category contains humidity and temperature status and measurements for the selected PDU as follows:

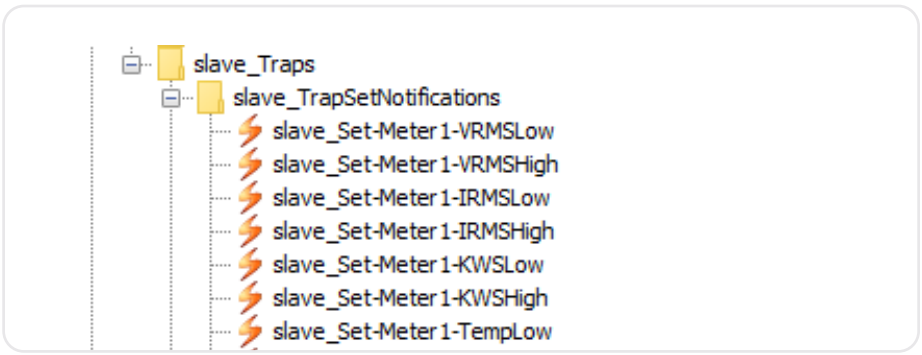


slave_Security sub-category

The slave_Security sub-category contains door and lock status for the selected PDU as follows:

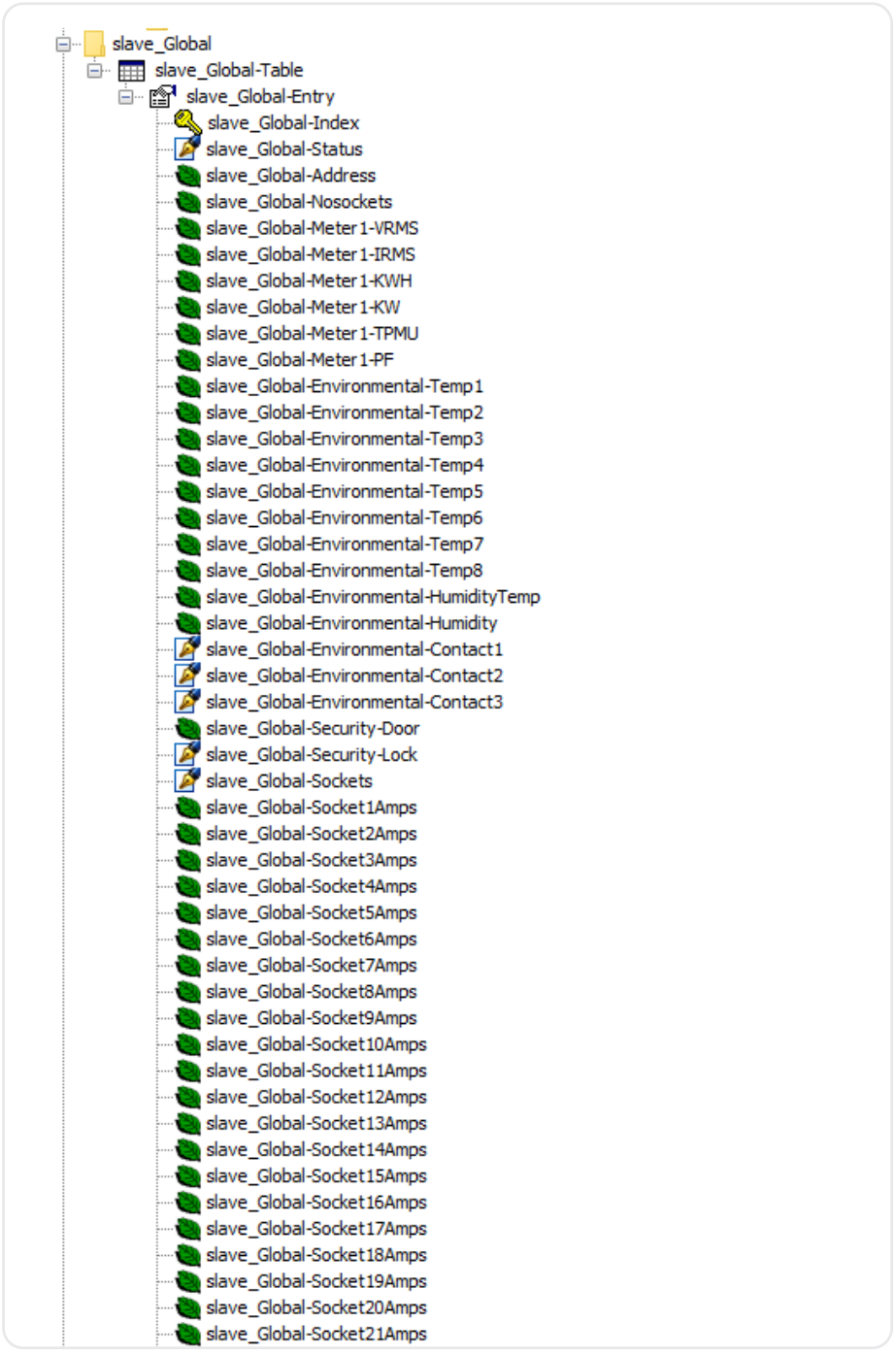
slave_Traps sub-category

The slave_Traps sub-category contains Set and Clear trap definitions for all slave traps, a small sample of the Set traps are as follows:



slave_Global registers

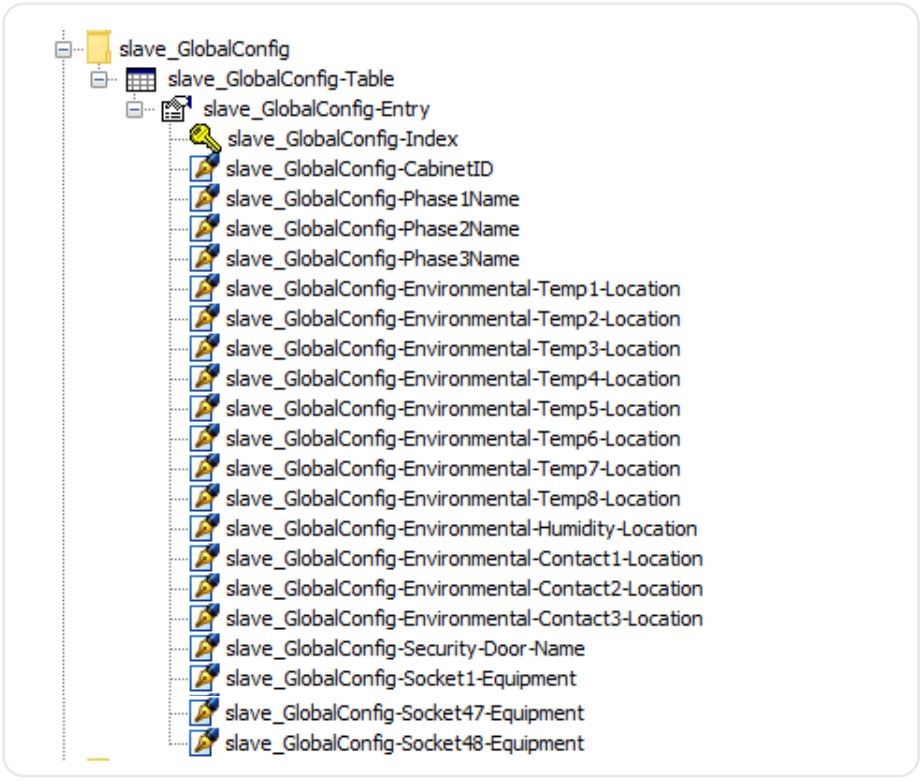
The slave_Global register category contains registers that allow all PDU's in the installation to be viewed as follows:



Please refer to Appendix A – Web server HTML web page description for more information about the individual values available as registers.

slave_GlobalConfig registers

The slave_GlobalConfig register category contains registers that allow all PDU's in the installation to have their names read and configured:



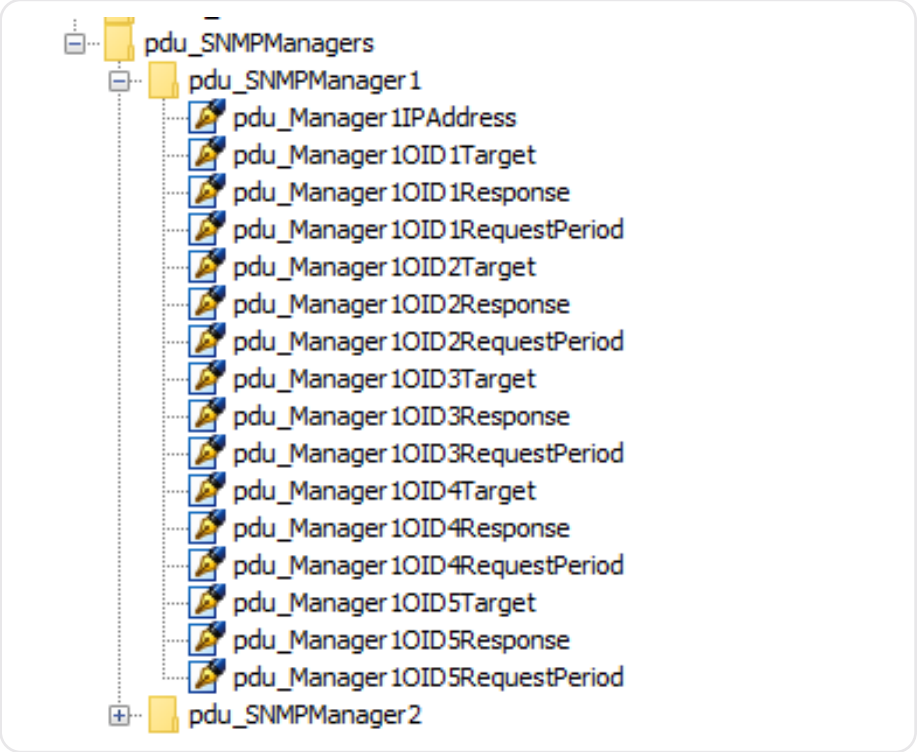
Appendix C. SNMP manager description

Overview

The PDU-SNMP supports a SNMP manager that can be configured to request data OIDs from other SNMP compliant equipment.

There are two managers, pdu_SNMPManager1 and pdu_SNMPManager2, that can be configured with individual destination IP addresses and up to 5 OID targets can be configured under each manager.

The pdu_SNMPManagers sub-category contains the two managers with each formatted as follows:



Once the IP Address of the destination SNMP agent has been configured the manager generates GET requests to the Target every RequestPeriod seconds. The response to this GET request is then stored in the Response register which can be read at any time.

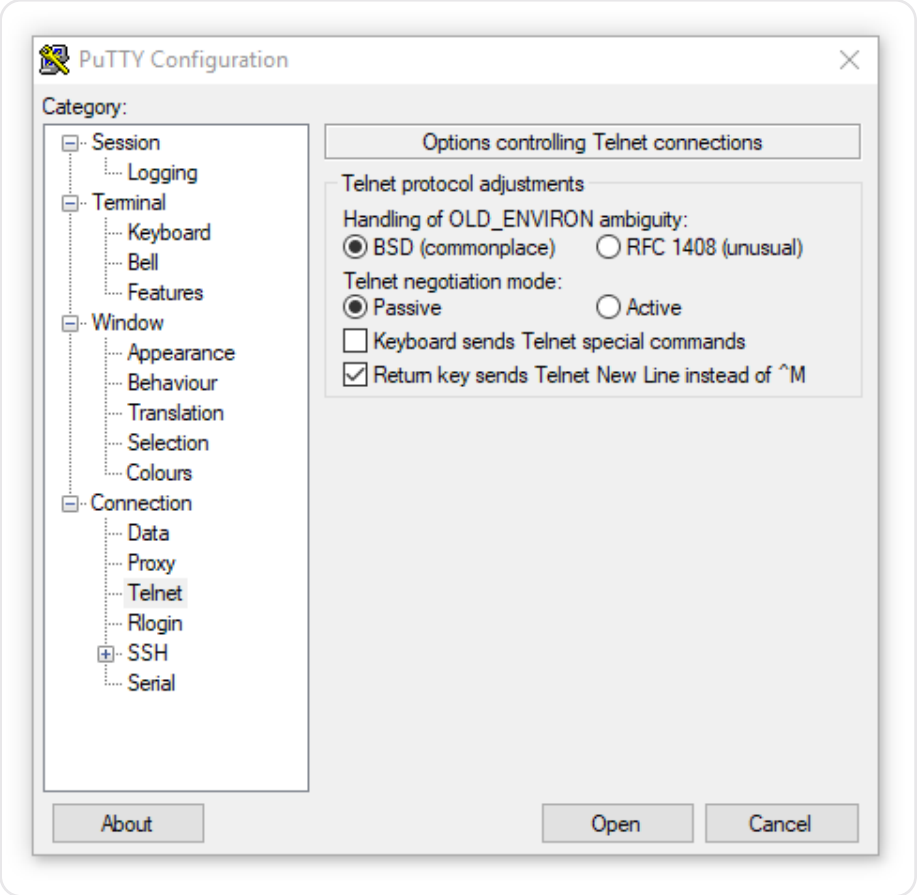
Appendix D. Telnet command line interface description

Telnet server

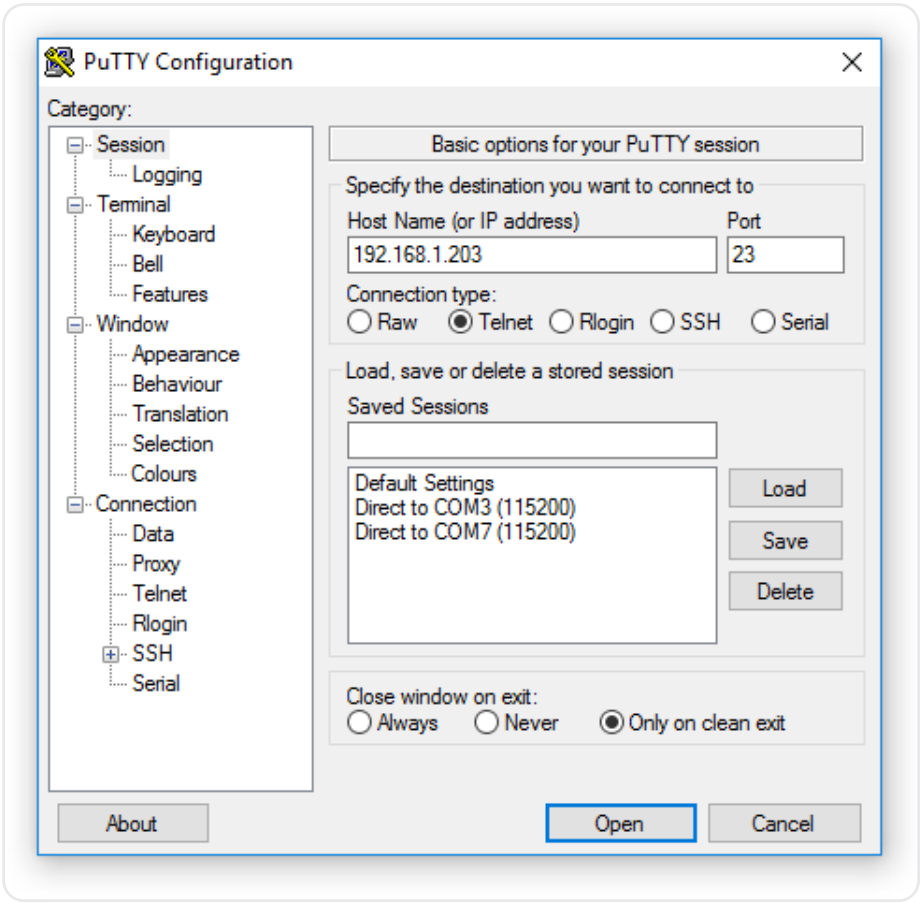
The PDU-SNMP supports a Telnet command line interface that allows a user to control/monitor system settings and measurements.

Logging into the Telnet server

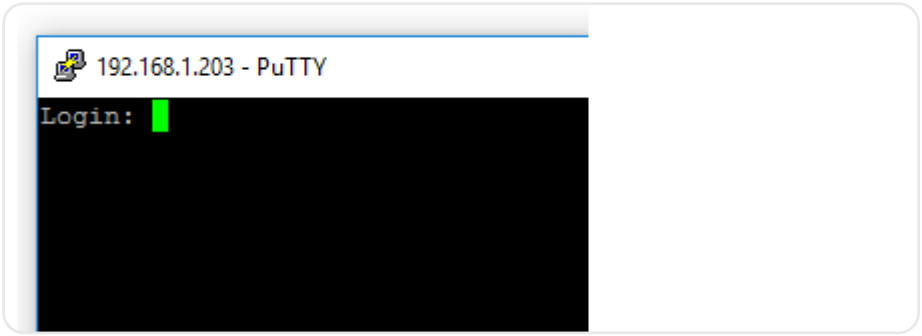
The Telnet server can be logged into using any Telnet compatible application. For clarity the following description uses the Putty application (http://www.chiark.greenend.org.uk/~sgtatham/putty/latest.html) as the client as it is available as a free download. After starting the application click on the 'Telnet' branch under 'Connection' and select the 'Passive' radio button under the 'Telnet negotiation mode:' as follows:



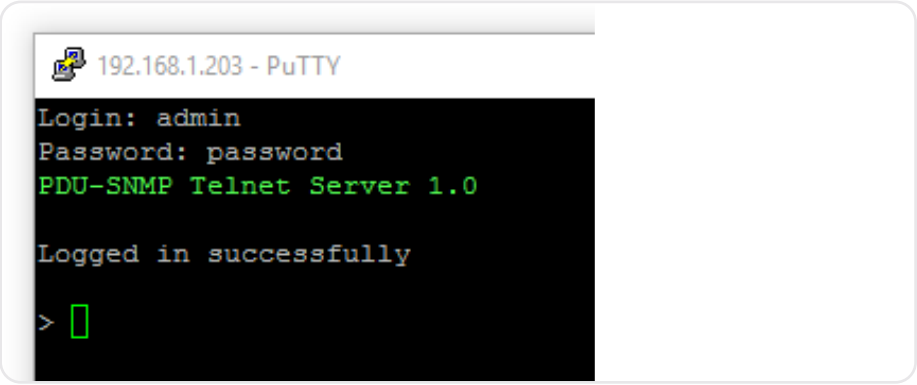
Click on ‘Session’ select the ‘Telnet’ radio button and enter the PDU-SNMP IP address into the ‘Host Name’ box as follows:



Click the ‘Open’ button and if a connection is made you will be presented with the following screen:



Enter the default user name ‘admin’ and password ‘password’ and the following screen will be displayed:



Telnet server commands

The Telnet server supports a number of commands that allow the slave PDU-SNMP to be selected, outlets read and set and metering/environmental measurements to be read.

Set slave command

The set slave command allows the slave PDU-SNMP to be set ready for other read/set commands, the format being:

ss xx

Where xx is the slave address 01-31, replies with:

Slave xx set

Set meter command

The set meter command allows the meter number to query on the slave PDU-SNMP to be set ready for other read/set commands, the format being:

sm xx

Where xx is the meter number 01-03, replies with:

Meter xx set

Read status command

The Read status command allows the status of a socket to be returned, the format being:

read status oxx

Where xx is the socket number 01-48, replies with:

Socket xx: ddd

Where ddd is ON if the socket is on, OFF if the socket is off.

Switch socket command

The Switch socket command allows a socket to be switched on/off instantly or with a delay and be rebooted (off/on with a delay), the format being:

sw oxx tttt

Where xx is the socket number 01-48 and tttt is as follows:

on imme

Turns the socket on immediately.

off imme

Turns the socket off immediately.

on delay

Turns the socket on after 2 seconds.

off delay

Turns the socket off after 2 seconds.

reboot

Turns the socket off and then on again after 2 seconds.

Replies with:

Socket xx updated

Where xx is the socket number.

Read meter command

The Read meter 'dev' command returns the voltage, current, power, power factor, frequency or dissipation for the currently selected meter, the format being:

read meter dev volt

Replies with:

Meter volts: vvv.vVAC

Where vvv.v is the current AC voltage.

read meter dev curr

Replies with:

Meter current: aa.aaA

Where aa.aa is the current AC amperage.

read meter dev pow

Replies with:

Meter power: ww.wwwkWs

Where ww.www is the current power in kWs.

read meter dev freq

Replies with:

Meter frequency: ff.fHz

Where ff.f is the current frequency in Hz.

read meter dev pf

Replies with:

Meter PF: p.ppp

Where p.ppp is the current power factor.

read meter dev pd

Replies with:

Meter dissipation: eeeee.ekWh

Where eeeee.e is the current energy dissipation in kWhs.

The Read meter 'olt' command returns the current or dissipation for the requested socket, the format being:

read meter olt oxx curr

Where xx is the socket number 01-48 and replies with:

Socket xx current: aa.aA

Where aa.a is the current AC amperage.

read meter olt oxx pd

Where xx is the socket number 01-48 and replies with:

Socket xx dissipation: eeeee.ekWh

Where eeeee.e is the current energy dissipation in kWhs.

Read sensor command

The Read sensor command returns the current humidity or temperature measured by the probes connected to the system, the format being:

read sensor oxx

If xx is 01, replies with humidity probe level:

Humidity: hh.hh% Temperature: tt.ttC

Where hh.hh is the humidity in percent and tt.tt is the temperature in celsius.

If xx is 02-09, replies with the selected temperature probe level:

Temperature probe xx: tt.ttC

Where tt.tt is the temperature in celsius.

Quit command

The Quit command exits the Telnet session, the format being:

quit

Appendix E. XML and CGI protocol description

XML protocol

The PDU-SNMP supports Extensible Markup Language (XML) status protocols to allow the web server to provide system configuration and measurement data.

XML status files

XML status consist of webserver accessible files with the .xml extension and are formatted in the following manner:

```
<response>

        <field>data</field>

</response>
```

Where:

field is the human readable description of the data within.
data is the configuration or measurement data

status.xml

The status.xml file provides system configuration and meter measurement values and id formatted as follows:

```
<response>

<PDU_client>Designer Systems Limited</PDU_client>

<PDU_location>Designer Systems Offices</PDU_location>

<PDU_cabinetID>DES001</PDU_cabinetID>

<PDU_software>0.10.00</PDU_software>

<PDU_timedate>12:19:40 06/12/2019</PDU_timedate>

<PDU_Alarm_Status>NONE</PDU_Alarm_Status>

<PDU_Meter1_Vrms>230.2</PDU_Meter1_Vrms>

<PDU_Meter1_Irms>0.08</PDU_Meter1_Irms>

<PDU_Meter1_kWs>0.005</PDU_Meter1_kWs>
```

<PDU_Meter1_Freq>49.8</PDU_Meter1_Freq>

<PDU_Meter1_PF>0.302</PDU_Meter1_PF>

<PDU_Meter1_Temperature>23.60</PDU_Meter1_Temperature>

<PDU_Meter1_Vpeak>317.8</PDU_Meter1_Vpeak>

<PDU_Meter1_Ipeak>0.15</PDU_Meter1_Ipeak>

<PDU_Meter1_kWhs>0.6</PDU_Meter1_kWhs>

<PDU_Meter2_Vrms>230.7</PDU_Meter2_Vrms>

<PDU_Meter2_Irms>0.06</PDU_Meter2_Irms>

<PDU_Meter2_kWs>0.005</PDU_Meter2_kWs>

<PDU_Meter2_Freq>49.8</PDU_Meter2_Freq>

<PDU_Meter2_PF>0.409</PDU_Meter2_PF>

<PDU_Meter2_Temperature>25.68</PDU_Meter2_Temperature>

<PDU_Meter2_Vpeak>318.3</PDU_Meter2_Vpeak>

<PDU_Meter2_Ipeak>0.16</PDU_Meter2_Ipeak>

<PDU_Meter2_kWhs>0.3</PDU_Meter2_kWhs>

<PDU_Meter3_Vrms>230.4</PDU_Meter3_Vrms>

<PDU_Meter3_Irms>0.00</PDU_Meter3_Irms>

<PDU_Meter3_kWs>0.004</PDU_Meter3_kWs>

<PDU_Meter3_Freq>49.8</PDU_Meter3_Freq>

<PDU_Meter3_PF>0.506</PDU_Meter3_PF>

<PDU_Meter3_Temperature>25.38</PDU_Meter3_Temperature>

<PDU_Meter3_Vpeak>318.6</PDU_Meter3_Vpeak>

<PDU_Meter3_Ipeak>0.15</PDU_Meter3_Ipeak>

<PDU_Meter3_kWhs>0.3</PDU_Meter3_kWhs>

<PDU_No_Slaves>0</PDU_No_Slaves>

<PDU_Slave_Total_kWs>0.014</PDU_Slave_Total_kWs>

<PDU_Slave_Total_kWhs>1.2</PDU_Slave_Total_kWhs>

</response>

CGI protocol

The PDU-SNMP supports Common Gateway Interface (CGI) control protocols to allow the web server to accept and decode commands sent over the HTTP GET. These commands allow the configuration of settings and the control of power outlets.

CGI commands

CGI commands consist of HTTP GET formatted ASCII textual command lines in the format:

http://xxx.xxx.xxx.xxx/page.html?id=id&param1=value1&param2=value2....

Where:

xxx.xxx.xxx.xxx is the IP address of the PDU-SNMP unit
page.html is the webpage used by the command
id is the command description
param is the parameter to be set
value is the parameter value

Note: There is no syntax checking of parameter values, please ensure that values adhere to the ranges defined within the web server. Additionally textual names should not use ampersand '&' or commas ',' within their definitions.

Set meter alarm thresholds command

The set meter alarm thresholds command allows the voltage, current, kilowatt, frequency, power factor and temperature high and low alarm thresholds and activation to be set for meters 1,2 or 3, the format being:

meter.html?id=meter_param&meter=meter&voltslow=var1&voltshigh=var2&voltslowen able= var 3&volt shighenable=var4&ampslow=var5&ampshigh=var6&ampslowenable= var7&ampshighenable =var8&k wslow=var9&kwshigh=var10&kwslowenable= var11&k wshighenable=var12&frequencylow=var13& frequencyhigh=var14&frequencylowenable =var15&frequencyhighenable=var16&pflow= var17&p fhigh=var18&pflowenable= var19&p fhighenable=var20&temperaturelow= var21&temperature high=var22&temperaturelowena ble=var23&temperaturehighenable=var24

Where:

meter = Meter number , range 1..3 (1..3)
var1 = Volts low threshold x10, range 10..3000 (0.1..300.0V)
var2 = Volts high threshold x10, range 10..3000 (0.1..300.0V)
var3 = Volts low alarm enable, range 0..1 (1 = alarm enabled)
var4 = Volts high alarm enable, range 0..1 (1 = alarm enabled)
var5 = Current low threshold x10, range 10..1000 (0.1..100.0A)
var6 = Current high threshold x10, range 10..1000 (0.1..100.0A)

var7 = Current low alarm enable, range 0..1 (1 = alarm enabled)
var8 = Current high alarm enable, range 0..1 (1 = alarm enabled)
var9 = Kilowatts low threshold x10, range 10..1000 (0.1..100.0kw)
var10 = Killowatts high threshold x10, range 10..1000 (0.1..100.0kw)
var11 = Kilowatts low alarm enable, range 0..1 (1 = alarm enabled)
var12 = Kilowatts high alarm enable, range 0..1 (1 = alarm enabled)
var13 = Frequency low threshold x10, range 100..900 (10.0..90.0Hz)
var14 = Frequency high threshold x10, range 100..900 (10.0..90.0Hz)
var15 = Frequency low alarm enable, range 0..1 (1 = alarm enabled)
var16 = Frequency high alarm enable, range 0..1 (1 = alarm enabled)
var17 = PF low threshold x1000, range 0..1000 (0.000..1.000)
var18 = PF high threshold x1000, range 0..1000 (0.000..1.000)
var18 = PF low alarm enable, range 0..1 (1 = alarm enabled)
var20 = PF high alarm enable, range 0..1 (1 = alarm enabled)
var21 = Temperature low threshold x10, range 10..1000 (0.1..100.0C)
var22 = Temperature high threshold x10, range 10..1000 (0.1..100.0C)
var23 = Temperature low alarm enable, range 0..1 (1 = alarm enabled)
var24 = Temperature high alarm enable, range 0..1 (1 = alarm enabled)

Set humidity/temperature probe alarm thresholds command

The externally connected humidity/temperature probe alarm thresholds and activation can be set, the format being:

enviro.html?id=enviro_hum&templow=var1&temphigh=var2&templowen=var3&temphigh en=var4&humlow=var5&humhigh=var6&humlowen=var7&humhighen=var8&location=var9

Where:

var1 = Temperature low threshold x100, range 1..15000 (0.01..150.00C)
var2 = Temperature high threshold x100, range 1..15000 (0.01..150.00C)
var3 = Temperature low alarm enable, range 0..1 (1 = alarm enabled)
var4 = Temperature high alarm enable, range 0..1 (1 = alarm enabled)
var5 = Humidity low threshold x100, range 1..10000 (0.01..100.00%)
var6 = Humidity high threshold x100, range 1..10000 (0.01..100.00%)
var7 = Humidity low alarm enable, range 0..1 (1 = alarm enabled)
var8 = Humidity high alarm enable, range 0..1 (1 = alarm enabled)
var9 = Location name, range 1..50 characters.

Set temperature probe name and alarm thresholds command

The externally connected temperature only sensor probes (1 to 8) name/location, alarm thresholds and activation can be set, the format being:

enviro.html?id=enviro_temp&probe=var1&templow=var2&temphigh=var3&templowen=var4&temphighen=var5&location=var6

Where:

var1 = Probe number , range 1..8
var2 = Temperature low threshold x100, range 1..15000 (0.01..150.00C)
var3 = Temperature high threshold x100, range 1..15000 (0.01..150.00C)
var4 = Temperature low alarm enable, range 0..1 (1 = alarm enabled)
var5 = Temperature high alarm enable, range 0..1 (1 = alarm enabled)
var6 = Location name, range 1..50 characters.

Set contact alarm triggers command

The externally connected contacts (1 to 3) alarms and name/location can be set, the format being:

enviro.html?id=enviro_contact&contact=var1&cleareden=var2&triggereden=var3&location=var4

Where:

var1 = Contact number, range 1..3 (1..3)
var2 = Contact cleared alarm enable, range 0..1 (1=alarm enabled)
var3 = Contact triggered alarm enable, range 0..1 (1=alarm enabled)
var4 = Location name, range 1..50 characters.

Set door/lock alarm trigger command

The door and lock open/close alarm activation can be set, the format being:

security.html?id=security_door&dooropenen=var1&doorcloseen=var2&lockunlockeden=var3&locklockeden=var4

Where:

var1 = Door open alarm enable, range 0..1 (1 = alarm enabled)
var2 = Door close alarm enable, range 0..1 (1 = alarm enabled)
var3 = Lock unlocked alarm enable, range 0..1 (1 = alarm enabled)
var4 = Lock locked alarm enable, range 0..1 (1 = alarm enabled)

Activate unlock command

The lock can be unlocked, the format being:

security.html?id=security_unlock&pin=var1

Where:

var1 = Product serial number

Set new card number command

A new card can be added, the format being:

security.html?id=security_card&card=var1&cardnum=var2&carduser=var3&cardgrp=var4

Where:

var1 = Card slot number, range 1..30 (1..30)
var2 = Card number, range 0..9999999999999999
var3 = Card username, range 1..50 characters.
var4 = Card group name, range 1..50 characters.

Activate card learn command

A new card can be learnt by activating the card learn function, the format being:

security.html?id=security_cardlearn

Clear all cards command

All cards can be cleared, the format being:

security.html?id=security_clearcards&pin=var1

Where:

var1 = Product serial number

Set socket outlet ON command

A socket outlet may be turned on, the format being:

sockets.html?id=socket_switch_on&socket=var1

Where:

var1 = Socket outlet number, range 1..Number of outlets(N) (1..N)

Set socket outlet OFF command

A socket outlet may be turned off, the format being:

sockets.html?id=socket_switch_on&socket=var1

Where:

var1 = Socket outlet number, range 1..Number of outlets(N) (1..N)

Set all socket outlets to ON command

All socket outlets may be turned on, the format being:

sockets.html?id=socket_switch_all_on

Set all socket outlets to OFF command

All socket outlets may be turned off, the format being:

sockets.html?id=socket_switch_all_off

Set system information command

The set system information command allows the client name, system location, cabinet ID and phase names to be configured, the format being:

setup.html?id=setup_info&client=var1&location=var2&cabid=var3&phase1name=var4&phase2name=var5&phase3name=var6

Where:

var1 = Client textual name, range 1..50 characters
var2 = Location textual name, range 1..50 characters
var3 = Cabinet ID textual name, range 1..50 characters
var4 = Phase 1 textual name, range 1..50 characters
var5 = Phase 2 textual name, range 1..50 characters
var6 = Phase 3 textual name, range 1..50 characters

Set system parameter command

The set system parameter command allows the system to be configured, the format being:

setup.html?id=setup_param&kgco=var1&costsymbol=var2&unitcost=var3&lcdrotateperiod=var4&lcdnormalcolour=var5&lcdalarmcolour=var6&lcdalarmrate=var7&alarmrepeatperiod=var8&lockactivateperiod=var9

Where:

var1 = kgCO2 conversion value x1000, range 1..1000 (0.001..1.000)
var2 = Currency symbol, single character.
var3 = Cost per kWh x100, range 1..10000 (0.01..100.00)
var4 = LCD rotation period, range 1..20 seconds
var5 = LCD normal colour, range 0..16777215 (0x000000..0xFFFFFF)
var6 = LCD alarm colour, range 0..16777215 (0x000000..0xFFFFFF)
var7 = LCD alarm flash period, range 100..5000 milliseconds
var8 = Alarm repeat period, range 1..240 minutes
var9 = Lock unlock period, range 1..240 seconds

Example. Default parameter setup.

setup.html?id=setup_param&kgco=544&costsymbol=£&unitcost=15&lcdrotateperiod=3&lcdnormalcolour=65280&lcdalarmcolour=16711680&lcdalarmrate=250&alarmrepeatperiod=1&lockactivateperiod=5

Set PDU mode and modbus parameter command

The set PDU mode and modbus parameter command allows the current operational mode, NORMAL, MASTER or SLAVE and the Modbus parameters to be configured, the format being:

setup.html?id=setup_mode&mode=var1&slaveaddress=var2&modbustimeout=var3&modbusretry=var4

Where:

var1 = Mode setup, range 0..2 (0=NORMAL, 1=MASTER, 2=SLAVE)
var2 = Modbus slave address in SLAVE mode, range 2..32
var3 = Modbus timeout period, range 500...10000 milliseconds
var4 = Modbus retries, range 1..10

Reset socket outlet energy command

The socket outlet to be reset must firstly be selected, the format being:

setup.html?id=config_socketselect&select=var1

Where:

var1 = Socket outlet number, range 1..48

The energy on the selected socket may then be reset, the format being:

setup.html?id=setup_socketreset

Set socket outlet parameters and alarm thresholds command

The socket outlet to be configured must firstly be selected, the format being:

setup.html?id=config_socketselect&select=var1

Where:

var1 = Socket outlet number, range 1..48

The parameters on this socket outlet may then be named and the current high and low alarm thresholds and activation may be set, the format being:

setup.html?id=setup_socket&equipment=var1&picture=var2&timedelay=var3&ampslowenable=var4&ampslow=var5&ampshighenable=var6&ampshigh=var7

Where:

var1 = Socket outlet equipment textual name, range 1..50 characters
var2 = Socket picture select, range 0..6
var3 = Timedelay period to switch on after startup, range 100..100000 mS, 0=off
var4 = Current low alarm enable, range 0..1 (1 = alarm enabled)
var5 = Current low threshold x10, range 10..1000 (0.1..100.0A)
var6 = Current high alarm enable, range 0..1 (1 = alarm enabled)
var7 = Current high threshold x10, range 10..1000 (0.1..100.0A)

Set network parameter command

The set network parameter command allows the network system to be configured, the format being:

setup.html?id=setup_network&dhcpenable=var1&ipv4address=var2&ipv4gateway=var3&staticipv6enable=var4&ipv6address=var5&ipv6dns=var6&httpsenable=var7&httpport=var8&httpsport=var9

Where:

var1 = DHCP enable, range 0..1 (1 = DHCP enabled)
var2 = IPv4 static IP address, range 000.000.000.000 to 255.255.255.255
var3 = IPv4 gateway IP address, range 000.000.000.000 to 255.255.255.255
var4 = IPv6 static IP enable, range 0..1 (1 = IPv6 static IP enabled)
var5 = IPv6 static IP address, range 00:00:00:00:00 to FFFF:FFFF:FFFF:FFFF:FFFF
var6 = IPv6 DNS address, range 00:00:00:00:00 to FFFF:FFFF:FFFF:FFFF:FFFF
var7 = HTTPS enable, range 0..0 (1 = HTTPS enabled)
var8 = HTTP webserver port number, range 0..10000
var9 = HTTPS webserver port number, range 0..10000

Set Telnet parameter command

The set Telnet parameter command allows the Telnet system to be configured, the format being:

setup.html?id=setup_telnet&username=var1&password=var2

Where:

var1 = Telnet username, range 1..20 characters
var2 = Telnet password, range 1..20 characters

Set SNMP parameter command

The set SNMP parameter command allows the SNMP system to be configured, the format being:

setup.html?id=setup_snmp&readcomm_1=var1&readcomm_2=var2&readcomm_3=var3&writecomm_1=var4&writecomm_2=var5&writecomm_3=var6

Where:

var1 = Read community 1, range 1..50 characters
var2 = Read community 2, range 1..50 characters
var3 = Read community 3, range 1..50 characters
var4 = Write community 1, range 1..50 characters
var5 = Write community 2, range 1..50 characters
var6 = Write community 3, range 1..50 characters

Set logging parameter command

The set logging parameter command allows the logging/alarm system to be configured, the format being:

setup.html?id=setup_logging&emailenable=var1&emailexchangeenable=var2&emailsecureenable=var3&emailserver=var4&emailport=var5&emailuser=var6&emailpassword=var7&emailfrom=var8&emailto=var9&syslogenable=var10&syslogserver=var11&syslogport=var12&trap1enable=var13&trap1destination=var14&trap1community=var15&trap2enable=var16&trap2destination=var17&trap2community=var18&trap3enable=var19&trap3destination=var20&trap3community=var21&autologgingperiod=var22

Where:

var1 = Email alarms enable, range 0..1 (1 = Email enabled)
var2 = Email exchange server enable, range 0..1 (1 = Email exchange server enabled)
var3 = Email secure server enable, range 0..1 (1 = Email secure server enabled)
var4 = Email server name, range 1..50 characters
var5 = Email server port number, range 0..10000
var6 = Email server username, range 1..50 characters
var7 = Email server password, range 1..50 characters
var8 = Email from address, range 1..50 characters
var9 = Email to address, range 1..50 characters
var10 = SysLog alarms enable, range 0..1 (1 = SysLog enabled)
var11 = SysLog server name, range 1..50 characters
var12 = SysLog server port number, range 0..10000
var13 = SNMP trap destination 1 enable, range 0..1 (1 = Destination enabled)
var14 = SNMP destination 1 IP address, range 000.000.000.000 to 255.255.255.255
var15 = SNMP destination 1 community name, range 1..50 characters
var16 = SNMP trap destination 2 enable, range 0..1 (1 = Destination enabled)
var17 = SNMP destination 2 IP address, range 000.000.000.000 to 255.255.255.255
var18 = SNMP destination 2 community name, range 1..50 characters
var19 = SNMP trap destination 3 enable, range 0..1 (1 = Destination enabled)
var20 = SNMP destination 3 IP address, range 000.000.000.000 to 255.255.255.255
var21 = SNMP destination 3 community name, range 1..50 characters
var22 = Auto logging period, range 1..1000 minutes (0 = off)

Set user configuration command

The set user configuration command allows a users level, username, password and user rights to be configured, the format being:

config.html?id=config_users&slot=var1&level=var2&username=var3&password=var4&newpass=var5&confpass=var6&userrights=var7

Where:

var1 = Slot, range 1..20 (user slot to change)
var2 = Level, range 0..3 (0 = None, 1 = User, 2 = Administrator, 3 = Factory)
var3 = Username, range 1..40 characters
var4 = Current password or new for creation, range 1..40 characters
var5 = New password, range 1..40 characters
var6 = New password confirmation, range 1..40 characters
var7 = Userrights, range 0x0000..0x0F00 as follows:

0x0001	Sockets 1..4
0x0002	Sockets 5..8
0x0004	Sockets 9..12
0x0008	Sockets 13..16
0x0010	Sockets 17..20
0x0020	Sockets 21..24
0x0040	Sockets 25..28
0x0080	Sockets 29..32
0x0100	Sockets 33..36
0x0200	Sockets 37..40
0x0400	Sockets 41..44
0x0800	Sockets 45..48

Example, to configure user access to sockets 9..12 and 17..20 = 0x0004 + 0x0010 = 0x0014

Delete user configuration command

The delete user configuration command allows a user to be deleted, the format being:

config.html?id=delete_users&slot=var1&username=var2&password=var3

Where:

var1 = Slot, range 1..20 (user slot to delete)
var2 = Username, range 1..40 characters
var3 = Current password, range 1..40 characters

Default configuration command

The system can be defaulted back to factory configuration, the format being:

config.html?id=setup_default

Appendix F. Email and Syslog alarm message formats

Outgoing messages

Email message

The PDU-SNMP compiles and sends an alarm email to a set of up to five [5] pre-defined email addresses as an asynchronous response to changes in system alarm status. The email takes the following format:

Customer: {Customer}
Location: {Location}
Cabinet ID: {CabinetID}
Date: [Date]
Time: [Time]
SlaveID: [SlaveID]
Message: [Status]
Firmware: <Firmware_Version>

Format description:
< > parameters are factory programmed.
{ } parameters are programmable via the internal webserver.
[ ] values are from internal registers.

Parameter: {Customer}
Description: Customer name text
Format: Variable length ASCII string, range 0 to 40 characters

Parameter: {Location}
Description: Location text
Format: Variable length ASCII string, range 0 to 40 characters

Parameter: {CabinetID}
Description: CabinetID text
Format: Variable length ASCII string, range 0 to 40 characters

Parameter: [Date]
Description: Current date text.
Format: Variable length ASCII string, format DD/MM/YY eg. 10/04/18

Parameter: [Time]
Description: Current time text.
Format: Variable length ASCII string, format HH:MM eg. 10:45

Parameter: [SlaveID]
Description: Slave address value
Format: Variable length ASCII string, format SS eg. 01

Parameter: [Status]
Description: Human readable status text.
Format: Variable length ASCII string.

Value:

Value	Description	Sent
Starting	PDU-SNMP starting log	On Power-up
Periodic	Periodic log	Every {Auto log period} minutes
Alarm:	Alarm message	On configured alarm event

Parameter: <Firmware_Version>
Description: System firmware version.
Format: 5 decimal digits, range 0.00.00 to 9.99.99.

SysLog (RFC5424) message

The system compiles and sends an alarm Syslog message to a pre-defined web address as an asynchronous response to changes in alarm status. The message takes the following format:

<9>1 [Date]T[Time] {IP_Address} PDU 0000 Customer:{Customer} Location:{Location} CabinetID:{CabinetID} SlaveID:[SlaveID] Message:[Status] Firmware:<Firmware_Version>

Format description:
< > parameters are factory programmed.
{ } parameters are programmable via the internal webserver.
[ ] values are from internal registers.

Parameter: <9>1
Description: Syslog RFC5424 facility code = 1 & severity = 0 or 1

Parameter: [Date]
Description: Current date text.
Format: Variable length ASCII string, format YYYY-MM-DD eg. 2014-08-15

Parameter: [Time]
Description: Current time text.
Format: Variable length ASCII string, format HH:MM:SS eg. 10:46:36

Parameter: {IP_Address}
Description: Currently configured IP address
Format: 4 decimal values of 0 to 255 separated by full stops, range 0.0.0.0 to 255.255.255.255

Parameter: {Customer}
Description: Customer name text
Format: Variable length ASCII string, range 0 to 40 characters

Parameter: {Location}
Description: Location text
Format: Variable length ASCII string, range 0 to 40 characters

Parameter: {CabinetID}
Description: CabinetID text
Format: Variable length ASCII string, range 0 to 40 characters

Parameter: [SlaveID]
Description: Slave address value
Format: Variable length ASCII string, format SS eg. 01

Parameter: [Status]
Description: Human readable status text.
Format: Variable length ASCII string.

Value:

Value	Description	Sent
Starting	PDU-SNMP starting log	On Power-up
Periodic	Periodic log	Every {Auto log period} minutes
Alarm:	Alarm message	On configured alarm event

Parameter: <Firmware_Version>
Description: System firmware version.
Format: 5 decimal digits, range 0.00.00 to 9.99.99.

Appendix G. RADIUS Client description

RADIUS Client service

The PDU can provide a RADIUS client service that allows a user to be verified and authorised by an internal/external RADIUS server.

RADIUS Configuration

The HTTP service provides a RADIUS configuration option under the 'Configuration' tab settings. The option allows the RADIUS Server IP or DNS address to entered, the Shared secret entered and RADIUS authentication to be enabled as follows:

The RADIUS Server must be an active reachable IP or DNS address that has been pre-configured with the user information, the PDU's IP address and shared secret.

As an example to add a PDU IP address of 192.168.1.42 and the default shared secret 'pdusnmp' to a FreeRADIUS server you must edit the /etc/raddb/clients.conf file on the server to add the following:

```
client pdusnmp {
    ipaddr          = 192.168.1.42
    secret          = pdusnmp
}
```

Then to add a new user 'charlie' with password 'brown' and user level administrator ("1"-User, "2"-Administrator "3"-Factory [see below]) to the server you must edit the /etc/raddb/users file on the server to add the following:

```
charlie     Cleartext-password := "brown"
            Class = "2"
```

The server must then be started using the command 'radiusd –X' before login can be undertaken.

NOTE: It may be necessary to open port 1812 for RADIUS communication on the server !!

RADIUS Login

When RADIUS has been enabled on the PDU basic authentication is disabled and replaced with RADIUS Server authentication. This means that any HTTP requests for web pages within the server are always replaced with a login page until the RADIUS authentication process has been completed successfully. The initial login page displayed is as follows:

The user must then enter their Username, Password and as an additional security measure the Shared secret that has been pre-configured within the PDU Configuration and RADIUS Server configuration. Clicking 'Login' will start the authentication process with the RADIUS server displaying 'CONTACTING SERVER' and after a short period the Status should change.

RADIUS Server acceptance:

If the server accepts the user credentials the following is displayed:

After 3 seconds the page will automatically redirect to the normal ACU front page.

RADIUS Server rejection:

If the server rejects the user credentials due to incorrect username, password or shared secret the following is displayed:

In this case correct the credentials and check that the shared secret is the same on the RADIUS server as it is on the PDU and click 'Login' again.

RADIUS Server failed:

If the server request times out twice or some internal process fails the following is displayed:

In this case the RADIUS server status should be determined to ensure that it is running and 'Login' clicked again to re-try.

rev 1.0 - 17/11/25

ELEVATE

Future Faster

elevate@excel-networking.com

elevate.excel-networking.com

an excel solution