



WattmonPRO Installation Manual

CHAPTER 3

Rev 1.0

2016

Standard Compliance

WattmonPRO is classified as a device for Industrial use. The device complies with the following standards:

IEC-61000-4-2 – Electrostatic Discharge

IEC-61000-4-4 – EFT Immunity - 1kV

IEC 61000-4-5 – EMC Immunity – 1kV

CISPR-22 Class A – EMC

CISPR-11 Class A – EMC

International Article Number (EAN) - 0640350191555



Chapter 3

Using your WattmonPRO

3.1 Logging into WattmonPRO

If you have completed steps 2.1 or 2.2 properly, you will see a page similar to Figure 3.1. In the corresponding boxes, enter *admin* as the username and *admin* as the password, and click *Login*.

Welcome to Wattmon

Please login with your Username and Password.

Figure 3.1 Login page of Wattmon

Once you are logged in, you will see the main Wattmon page or dashboard, as shown in figure 3.2.

3.2 Wattmon Dashboard

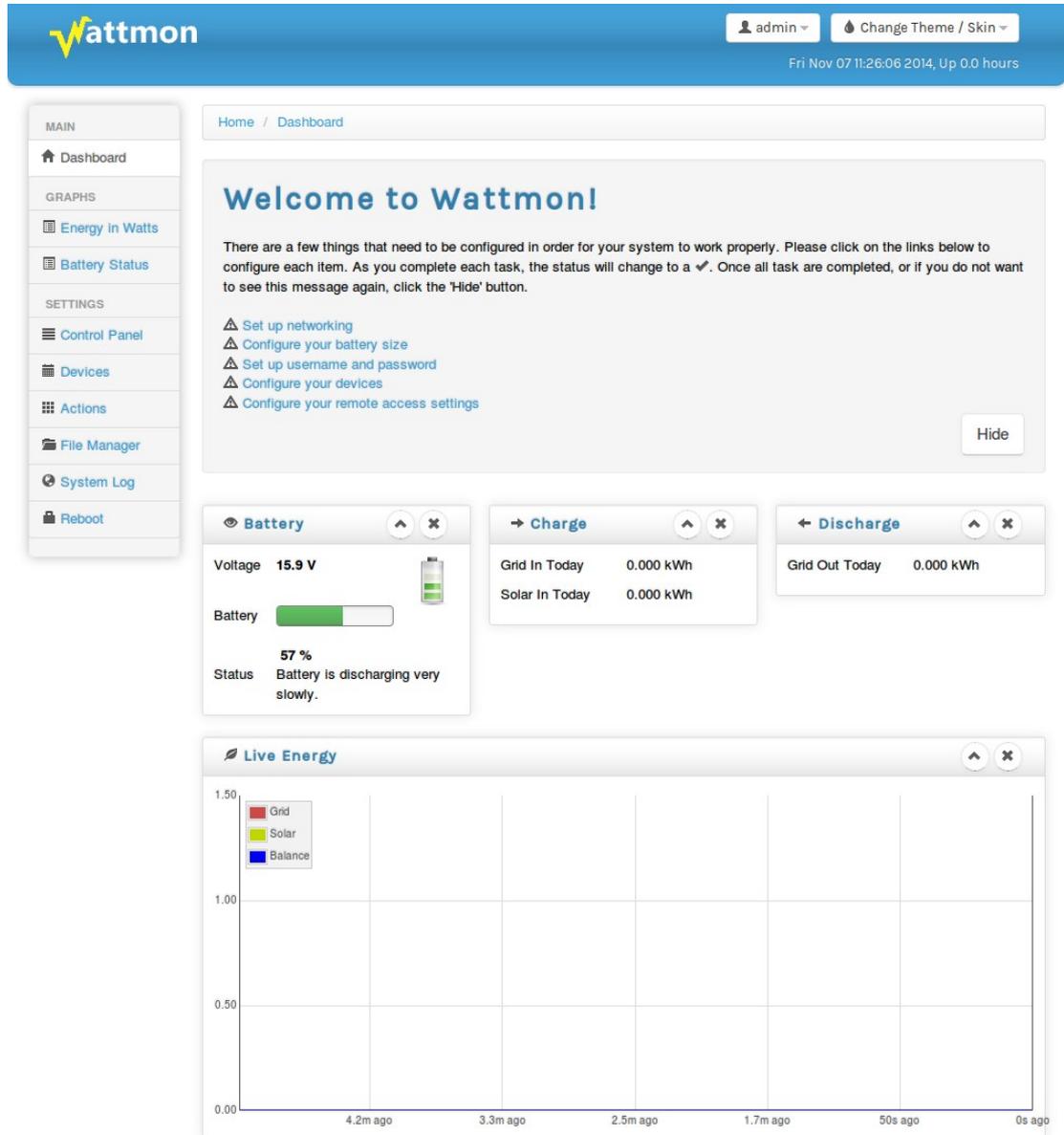


Figure 3.2 Wattmon Dashboard page

The Wattmon dashboard page provides relevant information about the current state of your battery bank and energy flow values for the day. The *Welcome To Wattmon* panel gives you an easy way to configure important system parameters. Once you have completed the setup of each of these items, the alert sign will be replaced with a tick mark. At this point you can click the *Hide* button to remove this panel in future. See the following sections for information on how to configure the various WattmonPRO

options for correct functioning.

Battery Widget

The Battery widget displays battery voltage and battery state of charge. Initially, the state of charge will be wrong – the WattmonPRO needs the battery to reach full before it can re-calibrate the state-of-charge value. See the Battery Configuration section for more information on this.

Charge Widget

The Charge Widget displays information on energy flowing into your battery bank from Solar or Grid. Grid energy is the energy that your inverter is producing to charge your batteries from the mains grid.

Energy is accumulated and the total energy in kWh for the day is shown in the widget, allowing you to ascertain whether for example your solar panels are functioning optimally.

Discharge Widget

The discharge widget shows all energy leaving the battery through your inverter or other load. The accumulated discharge energy is shown in kWh (for the current day) as well.

Live Energy Widget

Live energy is shown in the form of a graph. The individual energy inputs (Solar, grid charge, grid discharge) are shown in different colors and the energy balance (sum of all input and output energy) is shown in purple. The graph is updated once a second and show the last 5 minutes of energy usage when the Wattmon dashboard is kept open in the browser. Upon re-opening the window this will be blank, and build up slowly, you will see the graph appear from right to left. Energy below 0 indicates a discharge, and energy above 0 indicates a charge.

Admin button

At the top of the window, the Admin button has two three options: Rotate Logs, Clear Cache, Logout

Rotate Logs

This option will rename the log file in the Logs folder and create a blank log file

Clear Cache

This will force delete all .cgc compiled files, and needs to be done if some pages do not appear properly or if you are making changes to the page source code.

Logout

Disconnects the session

Change Theme/Skin button

This drop down contains different skins, and lets you load a different style sheet to modify the color scheme of your Wattmon.

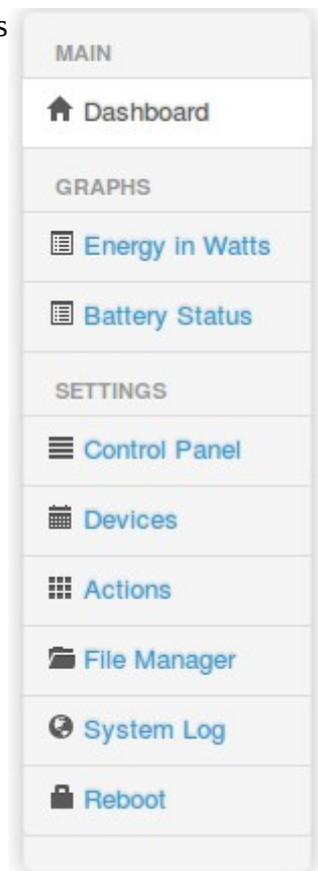
Date & Time Field

The Wattmon real time clock keeps track of system time and this time is displayed just below the *Admin* and *Change Theme/Skin* buttons in the top part of the window. And in case you lose connectivity between the browser and the Wattmon, you will see a message here indicating how long ago the last successful connection happened.

Main Navigation Menu

The main navigation at the left hand side of the dashboard lets you navigate to important pages, described below.

Menu	Description
<i>Dashboard</i>	Returns to the dashboard page
<i>Energy In Watts</i>	Displays the daily and monthly graphs of energy generated and consumed
<i>Battery Status</i>	Displays battery status (voltage and percentage) on a daily or monthly basis
<i>Control Panel</i>	Settings page with buttons to configure Wattmon
<i>Devices</i>	Devices page with options to configure your modules
<i>Actions</i>	Action management to automate Wattmon
<i>File Manager</i>	Access to file system with options to edit and delete files
<i>System Log</i>	System log view
<i>Reboot</i>	Reboots the Wattmon



Additional Widgets

Additional widgets can be added to the dashboard from the control panel. Some plugins will also have dashboard widgets that appear, such as the Scheduler plugin. See the *Configuring Widgets* section for more information.

3.3 Graph Pages

Wattmon displays data from CSV files in intuitive graphs. By default, two types of graph are provided with Wattmon – the *Energy in Watts* graph and the *Battery Status* graph. These can be accessed from the navigation menu on the left of the window.

Every graph page has a navigation bar at the top, where you can click the < and > buttons to switch between days (or months, in month mode). The *Select* button lets you choose a day to view from a drop-down calendar. You can switch between *Day View* mode and *Month View* mode by clicking the respective buttons – See figure 3.3 and 3.5 for images showing both of these modes.

3.3.1 Energy In Watts Graph

The Energy In Watts (Figure 3.3) shows *Solar charge* (green), *grid charge* (blue) and *load* (red). The total kWh for each type are shown above the graph.

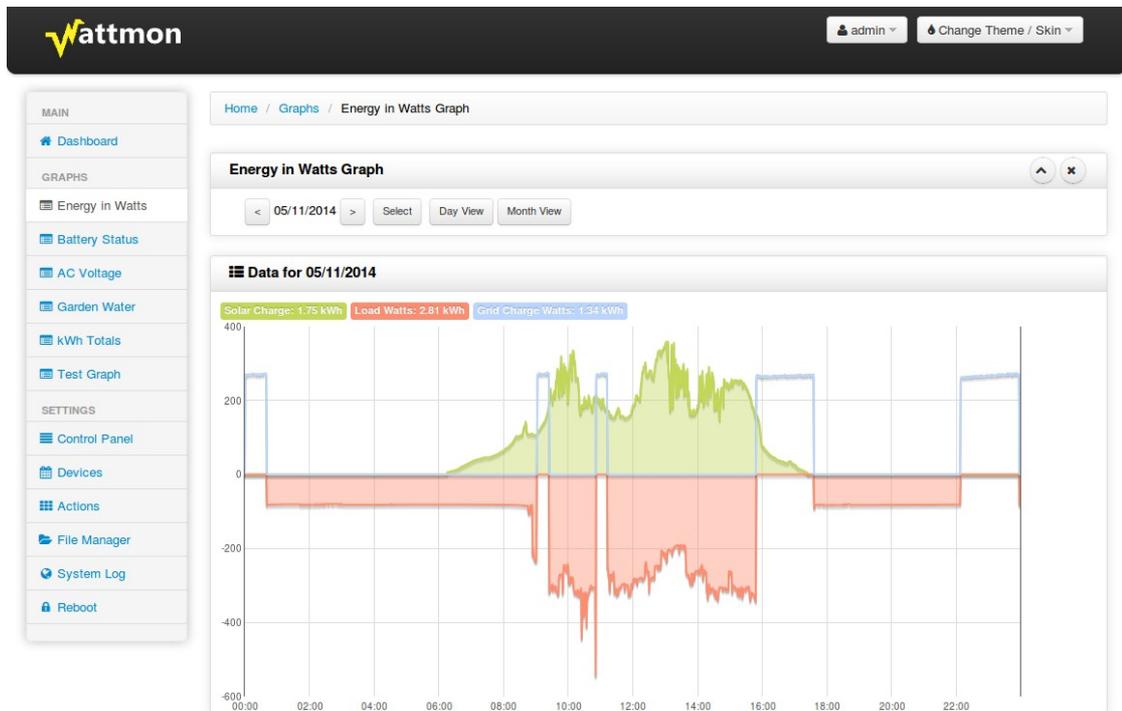
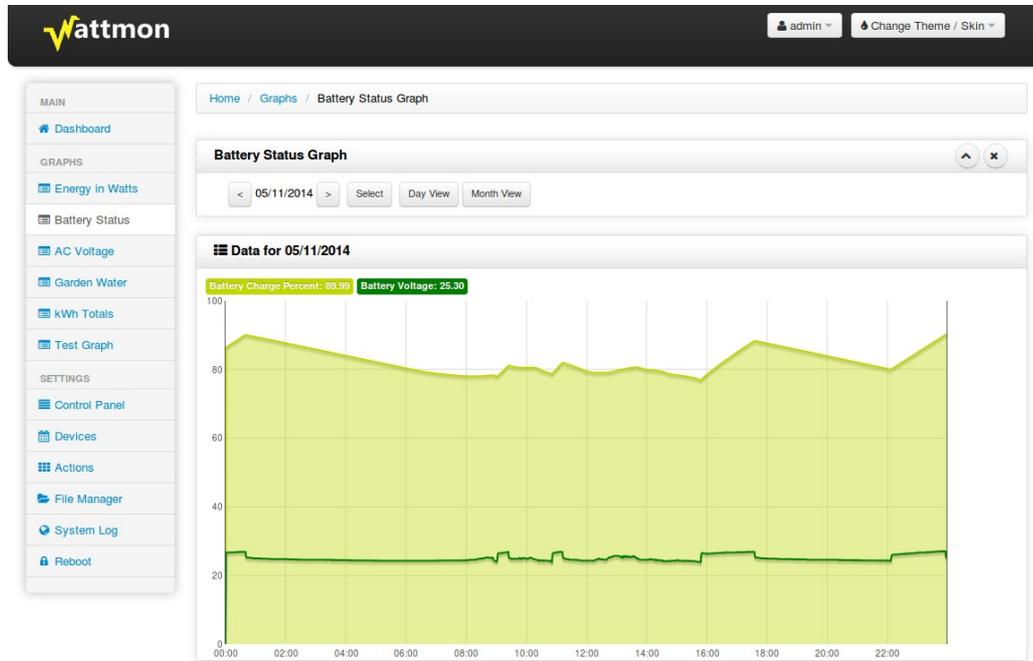


Figure 3.3 Energy Graph view by day

3.3.2 Battery Status Graph

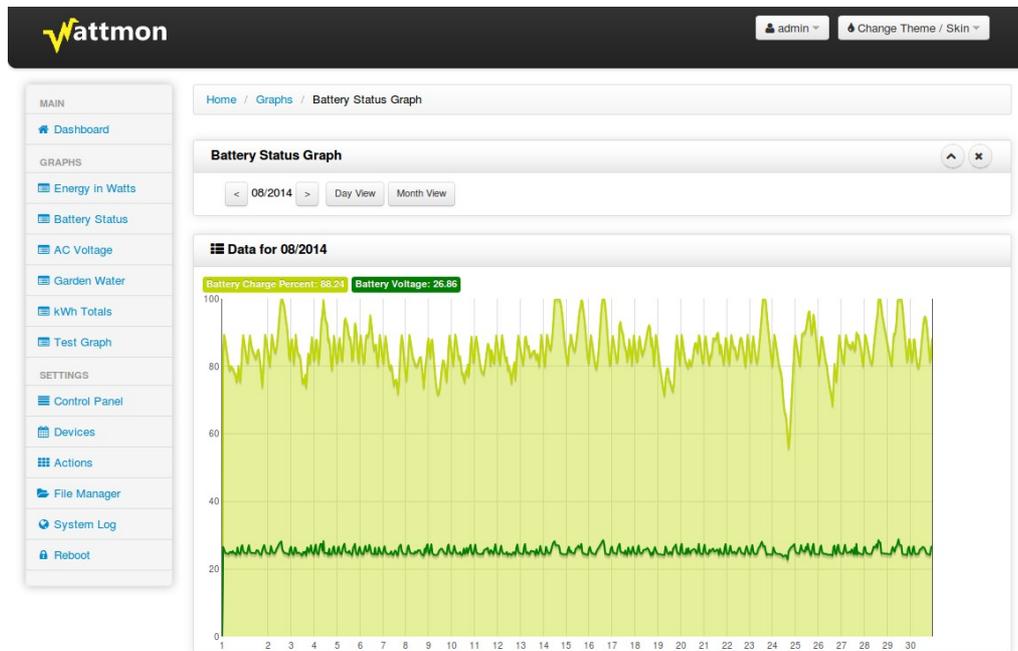
This graph displays both battery voltage and the calculated state of charge (SOC).



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Firmware Rev. 1.901 - WattmonOS 2.7 (WM-60)

Figure 3.4 24-hour view of Battery status



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Figure 3.5 Month overview of battery status

3.4 Control Panel

The *Control Panel* provides you with buttons to all the important configuration options available on the WattmonPRO. A detailed explanation of each of the buttons can be found in the following sections.

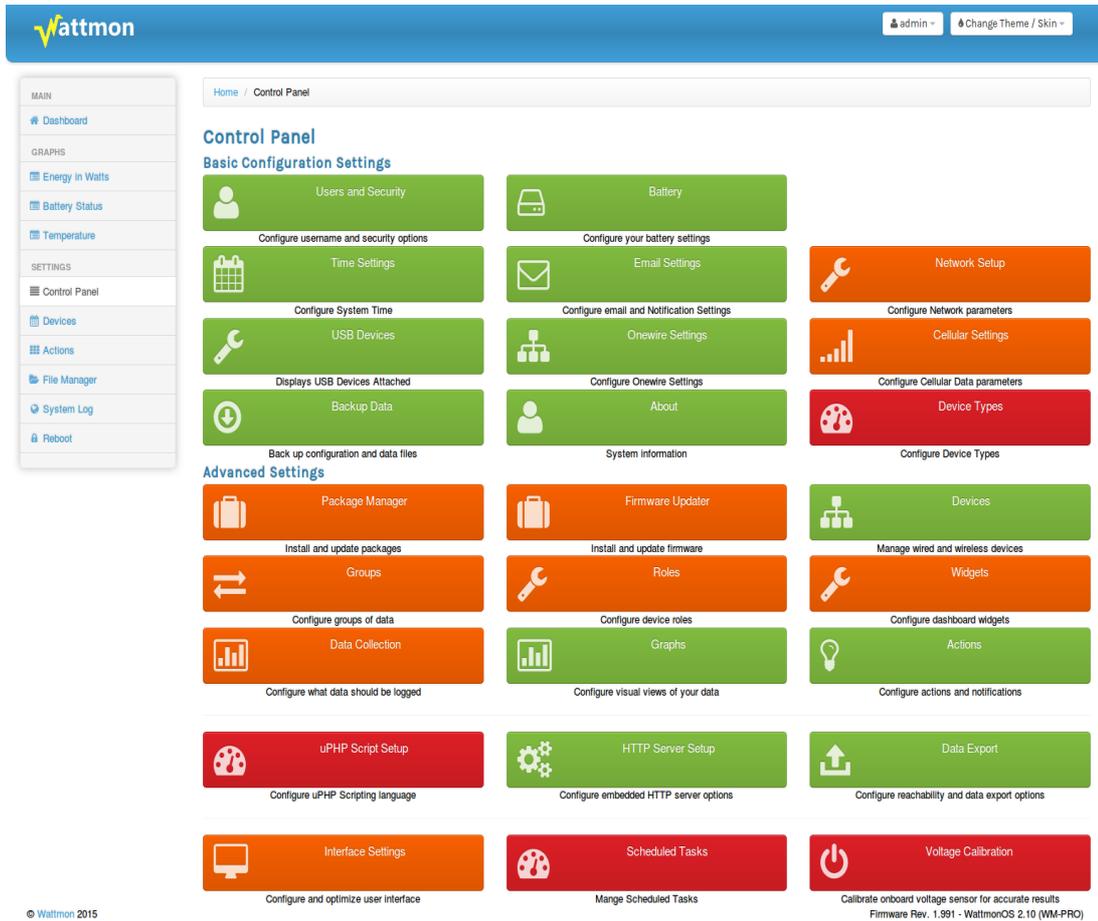


Figure 3.6 Control Panel page

3.4.1 Users and Security

There are two different security levels for Wattmon: admin mode and guest mode. *Admin User* mode allows you to make changes to any part of the system whereas *Guest User* mode lets you only view the dashboard and graphs.

Figure 3.7 shows the *User Settings* page. There are three boxes on the page – *Admin User Settings*, *Guest User Settings* and *Device Settings*. The default usernames and passwords are: *admin / admin* for the *Admin User*, and *guest / guest* for the *Guest User*.

The *Device Settings*. field is used to specify the name of your Wattmon. This is used both in the title of the page and as the NetBIOS name. The default name is *Wattmon*. You could then open up your wattmon just by its name from Windows – for example: <http://wattmon/> or from a command line: `ping wattmon`. The second option is for

WattmonPRO Installation Manual

Language, which as of now, the Wattmon offers English, Spanish and German. The default language is English.

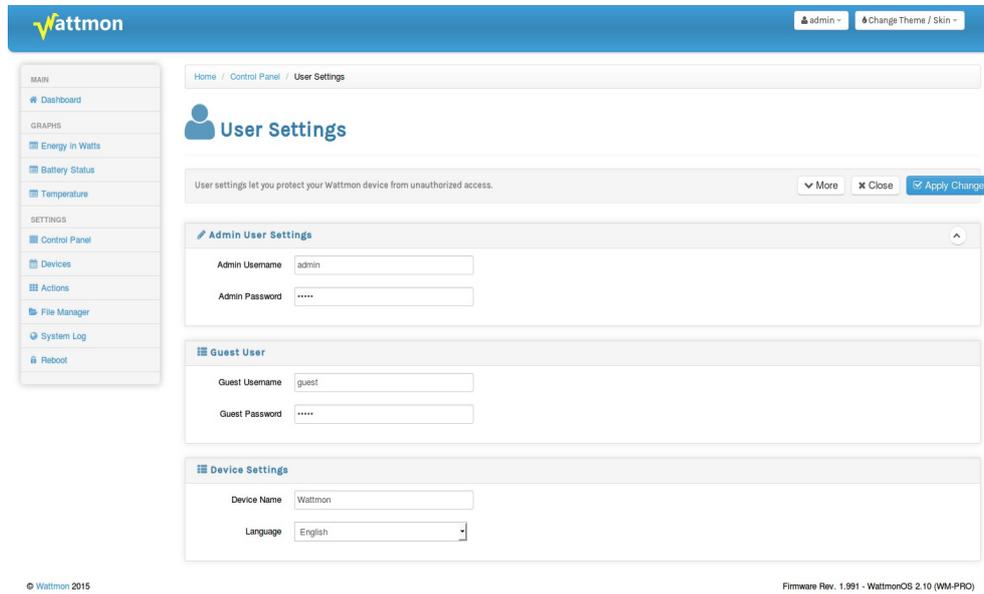


Figure 3.7 Security Settings page

3.4.2 Battery

The Battery and Charge settings page lets you specify your battery voltage and size. This is a required setup step in order to obtain correct state of charge calculations.

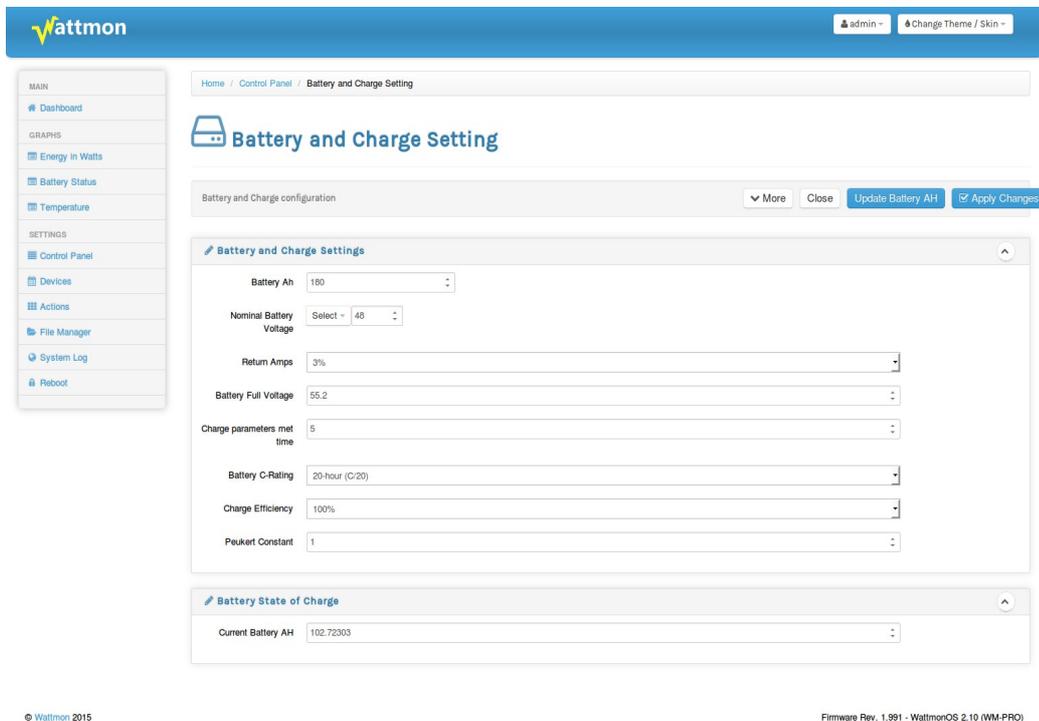


Figure 3.8 Battery and Charge Settings page

The settings are as follows :

Battery AH field

Enter the Amp Hour setting of your battery bank here. This could be 100, 200, 300, etc.

Nominal Battery Voltage

Enter the battery voltage of your battery pack – this will usually be in multiples of 12. The WattmonPRO can run directly off a battery bank of up to 48V DC through its primary input A1. It also has a high voltage socket A2, which enables the WattmonPRO to run directly off on a current of upto 330V DC.

Return Amps

This is used in the battery recalibration algorithm. Enter a percentage here – or select not used. When the battery is greater or equal to the battery full voltage, and the charge amps drop to below this percentage of the total battery capacity, the battery state of charge will be automatically reset to 100%.

Battery Full Voltage

The *Battery Full Voltage* field is automatically updated when you change the system voltage. The default is 13.8V DC per 12V battery, but this can be modified based on your charger settings.

This field is important for the automatic battery percent calculation. Whenever the battery voltage reaches the Battery Full Voltage preset, it will reset the battery percent to 100% regardless of what it was previously. This is useful if your system is not completely full very often and some errors get introduced into the system over time, but be sure to not put this too low as it will affect the calculations.

Charge Parameters Met Time

This lets you specify how long (in minutes) you wish the above parameters to hold true for before the battery gets reset to full.

Battery C-Rating

The *Battery C-Rating field* is used for the Peukert calculations if that is activated. This is the discharge rate at which the battery AH is calculated. Normally this is *20-hour (C/20)*.

Charge Efficiency

The State of charge algorithm can be tweaked if required. By default, it is suggested to leave the charge efficiency at 100% unless you notice inconsistencies. This value is

used to update the state of charge.

For example, if you set the *Charge Efficiency* to 90%, and you charge at 10A DC, the battery will be updated as if it is only getting 9A DC, assuming that there are losses in the electrolytes, etc.

Peukert Constant

The *Peukert constant* can be set for the battery and will affect the discharge current vs state of charge. For low discharge currents in relation to the battery Ah, this can be left at 1. For high discharge rates, you can set up the peukert constant if you know it (Typically 1.05-1.15). This will adjust the way the battery percent is calculated.

Once settings have been updated, click *Apply Changes* to save them. A reboot is required for the settings to take effect, but this can be done once all other settings are configured.

Current Battery AH

This is the calculated value of the remaining AH in the battery bank. You can manually set this to the battery AH value to reset the battery status to full when installing the system. Click the *Update battery AH* button to save the changes.

3.4.3 Time Settings

The WattmonPRO has an internal Real Time Clock (RTC) with a lithium battery that should keep accurate time for years when not in use. The time can be manually updated from the *Time and Date Settings* page when the *Do not use SNTP* option is selected. **If you wish to automatically update the system time from the Internet regularly, select the *Use SNTP* option. This will also update the internal RTC clock, so you could do this at first system boot and then disable it.**

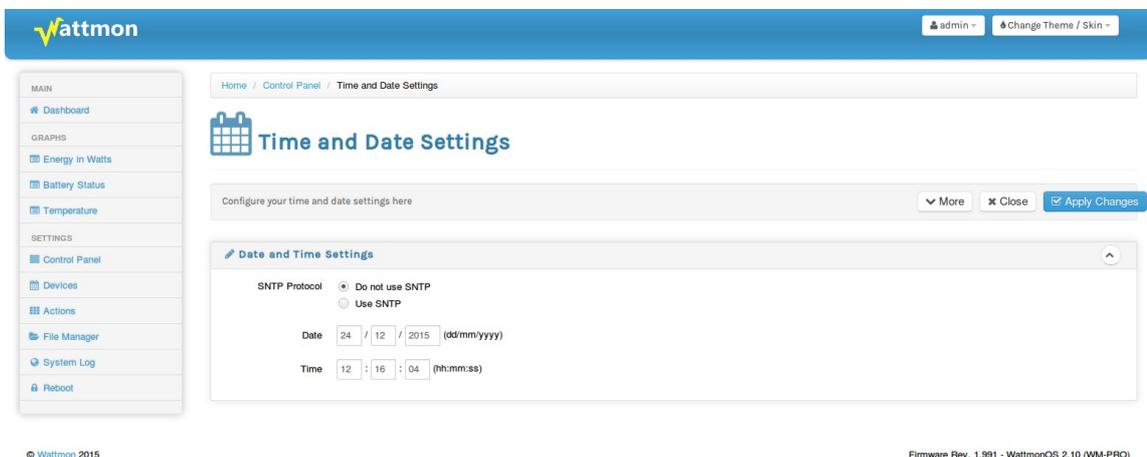


Figure 3.9 Time and Date Settings

3.4.4 Email Settings

WattmonPRO actions can be configured to alert you by email when certain conditions are met. In order for this to work, you will need to enter accurate SMTP server details. SSL with upto 2048 bit encryption is supported. If you are using gmail, use the following parameters:

SMTP Server: smtp.gmail.com

Username: your gmail email address

Password: your gmail password

Use SSL: yes

SMTP Port: 465

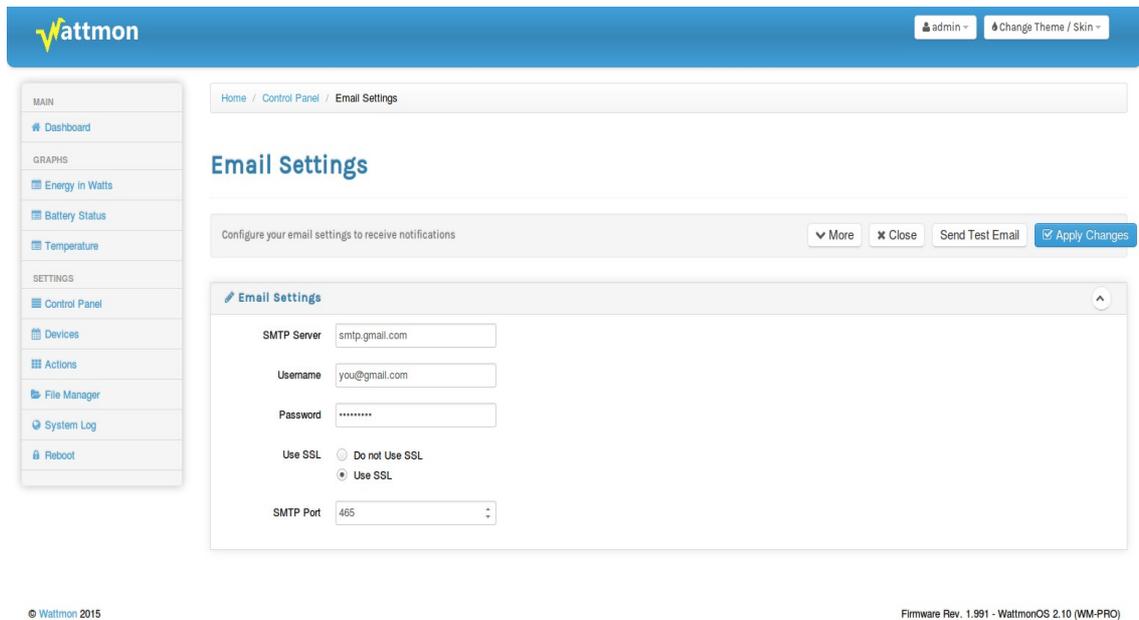


Figure 3.10 Email Settings page

Click the *Apply Changes* button to save changes. In order to test out the settings, click the *Send Test Email* button and enter your email address in the popup window. You will see a message indicating success or failure, and you should get a test mail in your inbox if everything went well.

3.4.5 Network Settings

The LAN port can operate in two modes: *Static IP* and *Dynamic IP (DHCP)*. Static IP is the default mode when you get your new WattmonPRO, as shown in figure 3.11. The default IP address with which you WattmonPRO ships is 192.168.0.55. In DHCP mode, the WattmonPRO will automatically obtain an IP address from the router or DSL modem. For details on configuring DHCP or Static IP, look at Chapter 2.

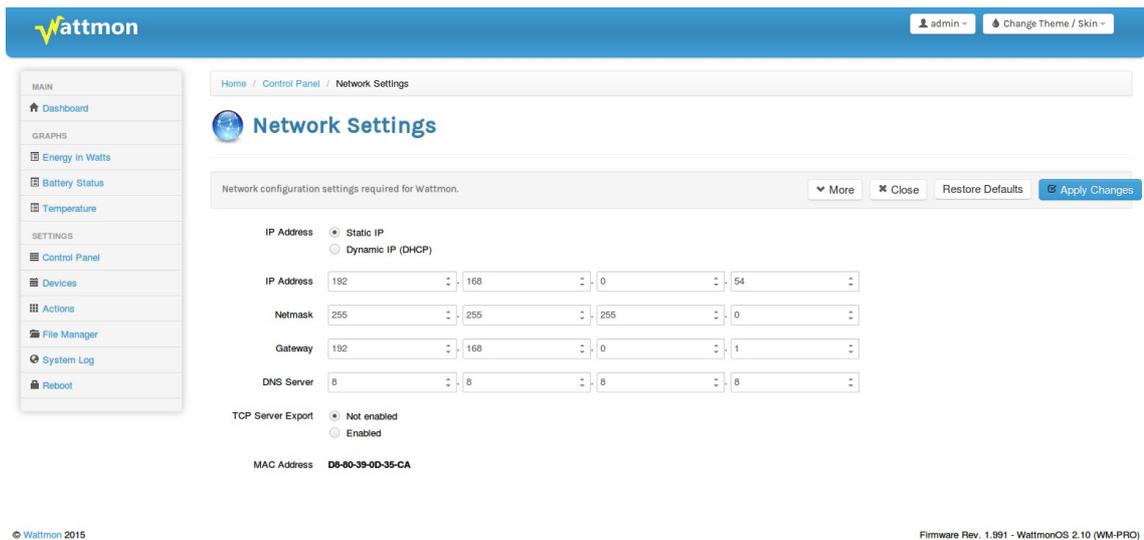


Figure 3.11 Network Settings Page

IP Address

The default IP Address is 192.168.0.55. If you wish to change it, enter an IP address which is in your local subnet. (Most DSL routers will work in a range of 192.168.0.2 to 192.168.0.254.)

Netmask

Enter the netmask, usually 255.255.255.0

Gateway

This is the address of your DSL modem, and is normally equal to your IP address with a 1 in the last field. For example, if your IP is 192.168.0.55 then your gateway will be 192.168.0.1

DNS Server

Enter a public DNS server such as google (8.8.8.8) or OpenDNS (208.67.222.222) in order for Wattmon to be able to reach the server.

Mac Address

The unique MAC address for the Wattmon is used as the device key when accessing it from the Internet. You will use this in the *Data Export* settings page.

3.4.6 USB Devices

The WattmonPRO can also connect to the Internet through a USB dongle. Currently supported devices are the Huawei E303F and Huawei E3531 devices. Several other devices could be made to work – the next section provides instructions on connecting a new dongle if you don't have a supported one. The dongle needs to support the AT command set and enumerate properly.

If you plan on connecting a 3G Dongle, you can enable *USB Support* in this page. If you are not using USB, it is recommended to disable it to save memory.

The *Connected Devices* panel shows information about the currently plugged-in device. If you have an unrecognised USB device, you will need to configure it. There is a tutorial on the website called “Installing a USB 3G Dongle” which explains the procedure.

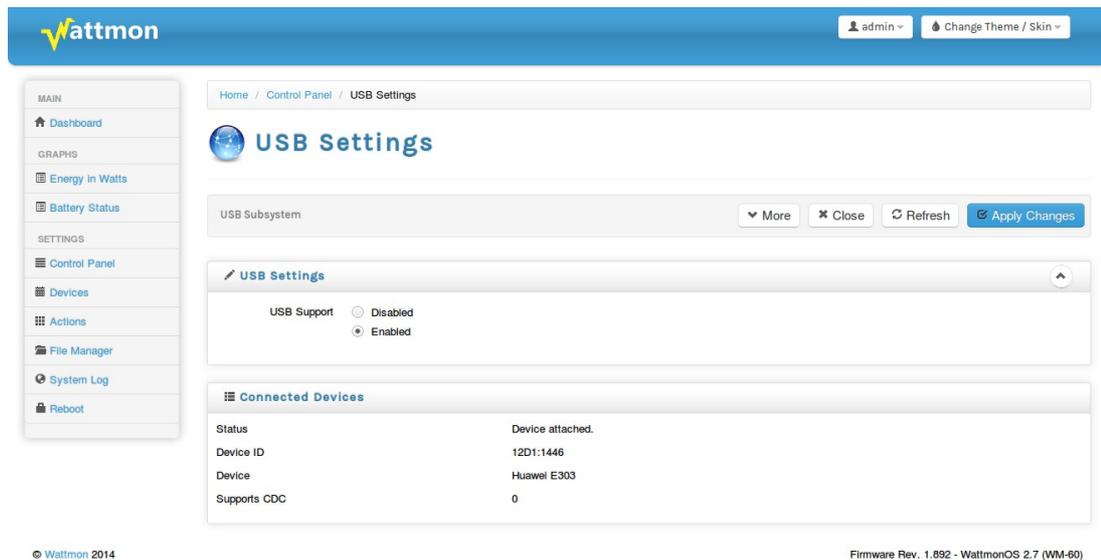
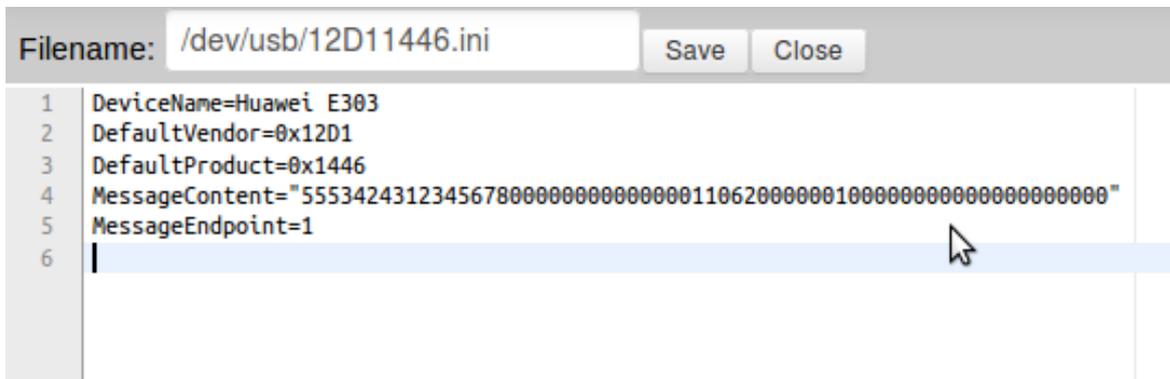


Figure 3.12 USB Settings Page

Click the *Refresh* button on the page to reload the information – this will be used when configuring your driver configuration file for unsupported models.

USB devices need to support the CDC class in order to work properly – no other type is presently supported. This means that plugging in a USB Flash drive will not work, for example. USB Support is only intended to be able to interface with low cost USB cellular dongles that support the AT command set, in order to provide an affordable remote monitoring solution. Before purchasing a dongle, make sure that it does support

In the *Filename* field, replace the 8 hexadecimal digits with the ones you wrote down, in our example this is 12D11446 (Remove the : character). Now edit the various fields to match your device settings.

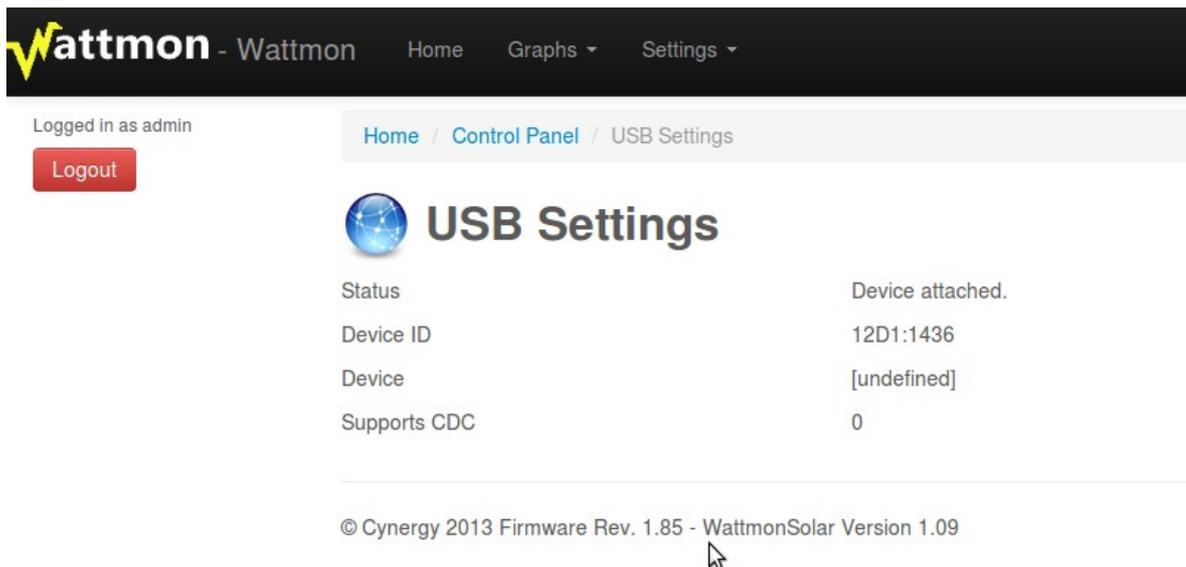


Above is the modified file. We replaced the *DefaultVendor* and *DefaultProduct* with the new IDs, and replaced the whole *MessageContent* line with the one we copied from the net. We also updated the *DeviceName* field to reflect the 3G dongle we have. Once you have made the changes, click *Save*.

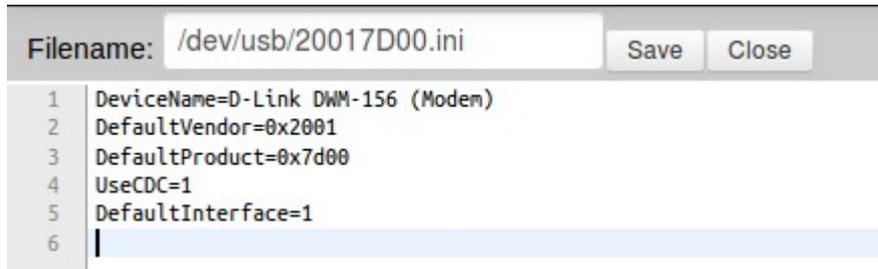
Now, remove the 3G dongle and re-insert it.

Configuring the USB Modem Device

Go to Settings > Control Panel > USB Devices. If everything went well, you will now see a different ID in the page as shown in the image below:



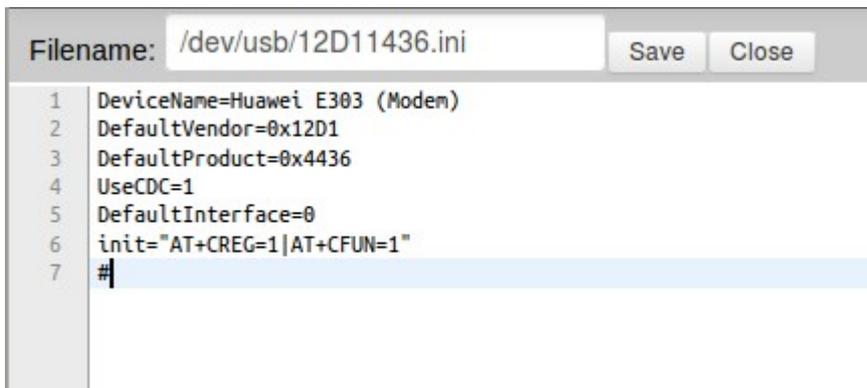
This indicates that the modeswitch was successful but we still need to configure the device driver for modem mode. Note down the new ID (12D1:1436). Now go back to the *File Manager* and again navigate to the `/dev/usb/` folder. This time, open the file **20017D00.ini**. The contents of this file is shown below:



```
Filename: /dev/usb/20017D00.ini Save Close
1 DeviceName=D-Link DWM-156 (Modem)
2 DefaultVendor=0x2001
3 DefaultProduct=0x7d00
4 UseCDC=1
5 DefaultInterface=1
6 |
```

Now replace the *Filename* with your new ID, in this case 12D11436.

Next, replace the *DeviceName*, and *DefaultVendor* and *DefaultProduct* fields. Set the *DefaultInterface* to 0 unless you have documentation that says it should be otherwise.



```
Filename: /dev/usb/12D11436.ini Save Close
1 DeviceName=Huawei E303 (Modem)
2 DefaultVendor=0x12D1
3 DefaultProduct=0x4436
4 UseCDC=1
5 DefaultInterface=0
6 init="AT+CREG=1|AT+CFUN=1"
7 #|
```

Also, enter any device specific init commands in the `init=` line. You should put the following line in:

`init="AT+CREG=1|AT+CFUN=1"` - this will enable automatic network registration which is required on some dongles. If it is not supported, it will just be ignored. Make sure you have a blank line or `#` character on the last line.

Now click save, remove the USB device and re-insert it. Verify that it is properly detected in the USB page.



Now, your 3G dongle has been successfully installed. The next step is to configure your access details.

3.4.7 1-Wire Settings

The Dallas 1-Wire allows you to interface with a variety of sensors and chips. WattmonPRO presently only supports the DS18B20 temperature sensor. Extensive information on configuring a 1-Wire sensor is available on the website.

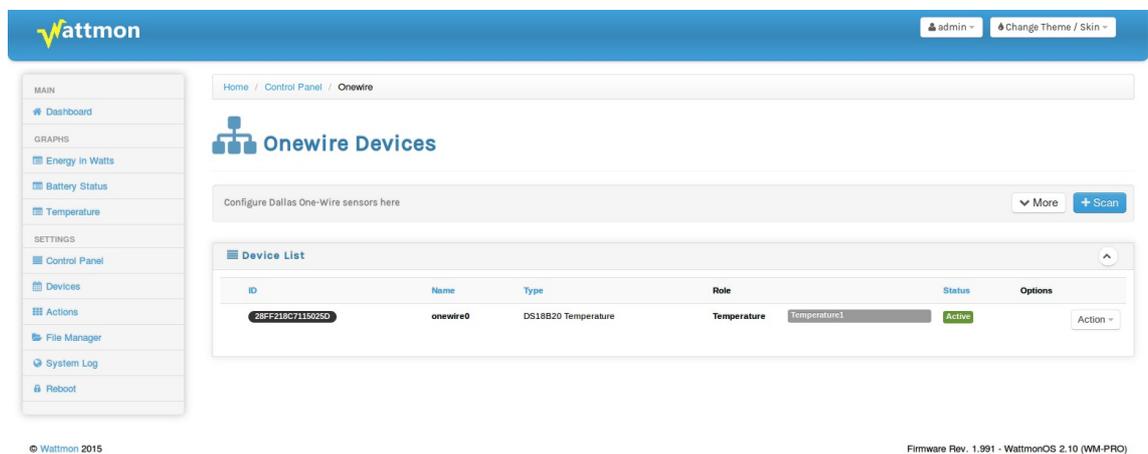


Figure 3.13 1-Wire Devices page

All 1-Wire devices are shown in the Device List. After plugging in a new device, click the Scan button to detect the new sensor(s). The ID of the device in the list is the unique 1-Wire device ID. In order to configure the sensor to be used in WattmonPRO, click *Action* > *Configure* in the list.

3.4.7.1 Configuring a 1-Wire Sensor

The 1-Wire sensor configuration page lets you change settings per 1-Wire device. The **Device ID** is automatically detected and should not be changed.

The other fields in the window are described below:

Device Name

This should be a unique name for the device, and will be automatically assigned when the device is detected after a scan. You can change this if required.

Poll Interval

Enter the interval in milli-seconds between device polls – this determines how often the temperature value is read. A value below 1 second may be unrealistic if you have multiple devices, since each device requires a minimum of about 500 ms to read.

Status

You can enable or disable the device here.

Configure roles

The configure roles lets you assign a system role to the device. For 1-Wire sensors there is only one role: temperature. This can be assigned to any of the preset roles, or you can use the *Roles* editor to create a new role beforehand to be assigned to this.

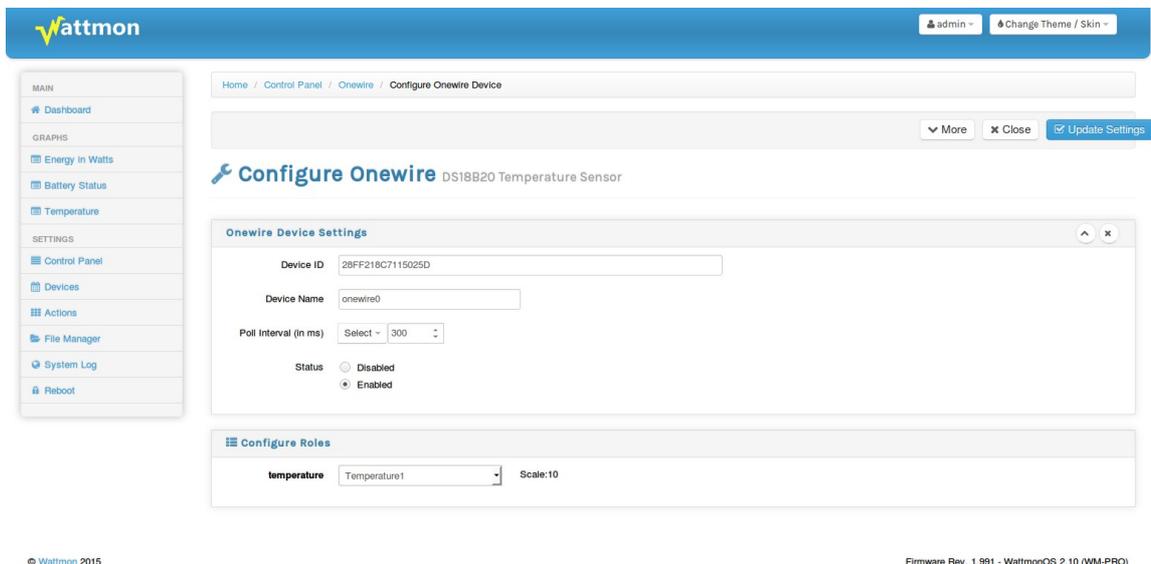


Figure 3.14 1-Wire Device Edit page

3.4.8 Cellular Settings

Figure 3.15 shows the Cellular settings page. For E303C and compatible models, use the Connection mode list to select the preferred connection method (Edge or 3G).

In the APN field, enter the APN for your provider.

In the Number field, enter the number to dial, usually *99# or similar.

Username & password are normally left blank for most providers, fill in if necessary. Wattmon currently only supports PAP authentication.

The MTU (Maximum Transmit Unit) is the number of bytes that can be send per packet. If you are experiencing poor connectivity, try decreasing this number to see if it helps. The suggested range is 536 – 1000 bytes.

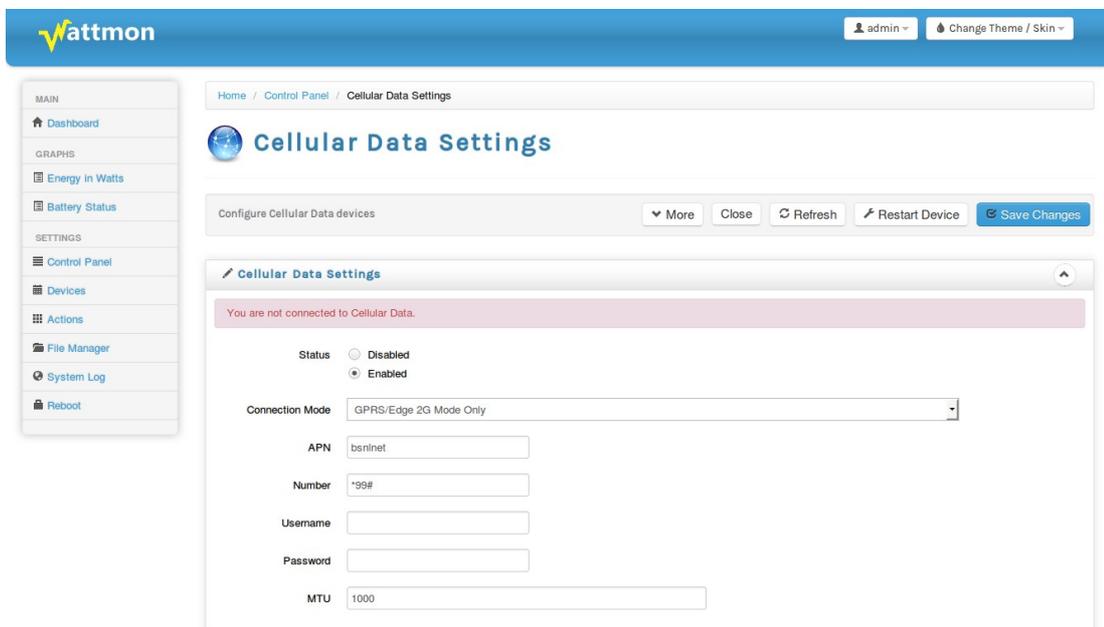


Figure 3.15 Cellular Data Settings page

3.4.9 Backup Data

It is recommended to take regular backups of your data if you are not exporting data to an online server. You can back up configuration settings or month logs through this interface. Data is stored in a TAR file which can be read by most standard compression tools today. Once the backup is completed, you can download the backup file to your computer.

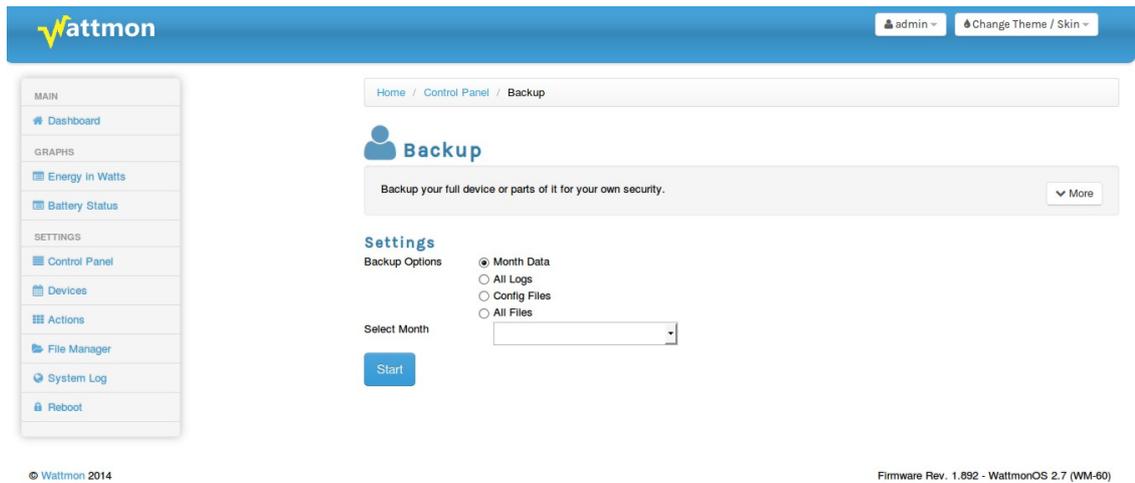


Figure 3.16 Backup data page

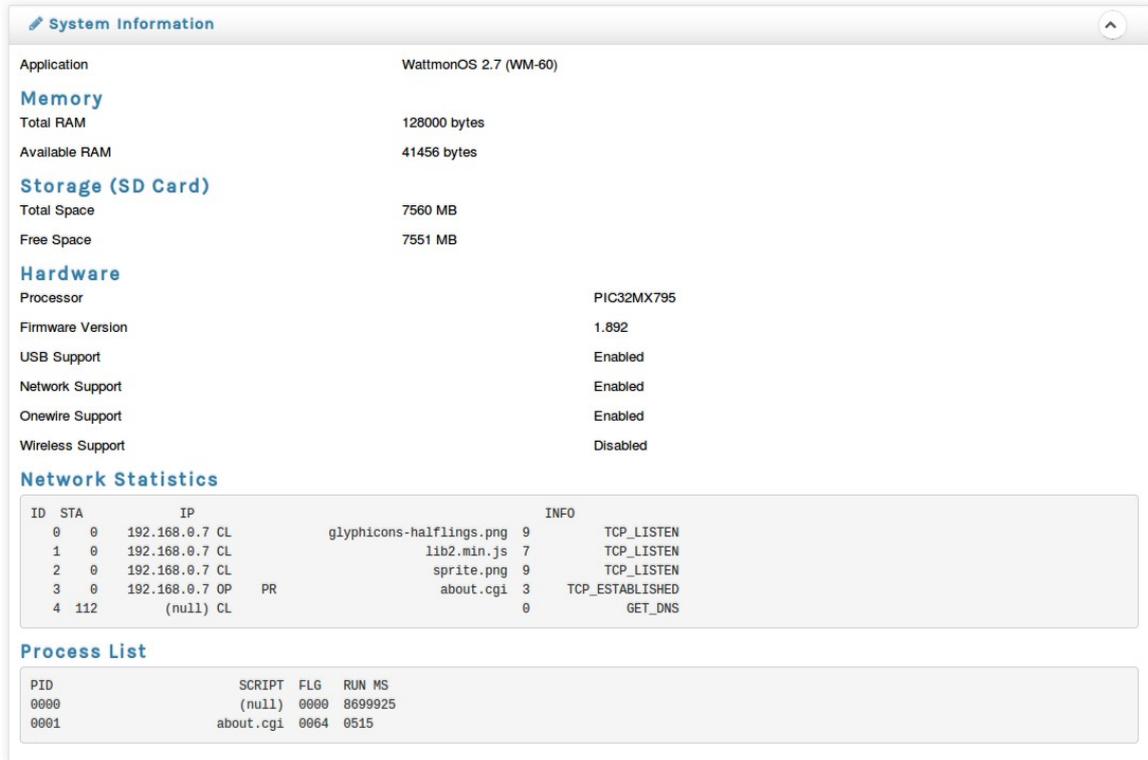
Select the *backup type*. *Month data* will populate the *Select Month* list to let you download a particular month. *All logs* will backup the entire logs folder which could be quite large. *Config files* only back up the config folder which is required for re-installing using similar settings. *All files* will make a backup of the entire sd card.

3.4.10 Rotate Logs

This will rotate the system log (create a new blank version, and rename the old one to log_DDMMYYYY.txt – use this if you are debugging something and do not want to download a large log every time.

3.4.11 About

About



System Information

Application: WattmonOS 2.7 (WM-60)

Memory

Total RAM: 128000 bytes
Available RAM: 41456 bytes

Storage (SD Card)

Total Space: 7560 MB
Free Space: 7551 MB

Hardware

Processor: PIC32MX795
Firmware Version: 1.892
USB Support: Enabled
Network Support: Enabled
Onewire Support: Enabled
Wireless Support: Disabled

Network Statistics

ID	STA	IP		INFO
0	0	192.168.0.7	CL	glyphicons-halfplings.png 9 TCP_LISTEN
1	0	192.168.0.7	CL	lib2.min.js 7 TCP_LISTEN
2	0	192.168.0.7	CL	sprite.png 9 TCP_LISTEN
3	0	192.168.0.7	OP PR	about.cgi 3 TCP_ESTABLISHED
4	112	(null)	CL	0 GET_DNS

Process List

PID	SCRIPT	FLG	RUN MS
0000	(null)	0000	8699925
0001	about.cgi	0064	0515

Figure 3.17 About page

The *About* page shows system information such as available space, status of the network ports and which processes are running.

3.4.12 Package Manager

The Package manager provides a way to install and update packages in the system. Packages can be of two types – a system package such as a general WattmonOS update, or a plugin that does a particular thing. The latest WattmonOS usually includes the subpackages or plugins that are installable. These can be activated using the *Downloaded Package List* section at the lower part of the screen.

In order to install a main package, click the Install button for the corresponding item in the *Available package list*. You can click the Package Types list to select different packages to download from the Wattmon website. Clicking *Install* will cause the file to be downloaded to your local browser, and then uploaded onto the WattmonPRO device. It will then be uncompressed. A restart is usually necessary for the change to take effect.

The screenshot shows the Wattmon Package Manager interface. At the top, there is a blue header with the Wattmon logo and user options like 'admin' and 'Change Theme / Skin'. A left sidebar contains navigation links for MAIN (Dashboard), GRAPHS (Energy in Watts, Battery Status), and SETTINGS (Control Panel, Devices, Actions, File Manager, System Log, Reboot). The main content area is titled 'Update and Install Packages - Package Updates' and includes a breadcrumb 'Home / Control Panel / Package Manager'. Below the title, there is a section for 'Available Package List' with a table of packages and an 'Install' button for each. Below that is a section for 'Downloaded Package List' with a table of installed packages and an 'Action' dropdown for each.

ID	Name	Version	Size	Date	Options
53	WattmonSolar	1.10	1689600	2013-10-07 05:18:58	Install
65	WattmonOS WattmonOS is the new version of WattmonSolar for the Wattmon Platform	2.0	4044800	2014-01-31 06:28:52	Install
107	WattmonOS 2.6 UPDATE Upgrade to version 2.6 from 2	2.6	1044480	2014-09-09 10:59:04	Install
115	WattmonOS 2.7 UPDATE Minor UI improvements, added a scheduler package that can optionally be installed	2.7	1320960	2014-11-03 10:09:48	Install

ID	Name	Author	Version	Status	Options
1	BatteryWidget Battery management plugin	Akash Heimlich	1.0	Uninstalled	Action
2	BatteryWidgetAjax			Uninstalled	Action
3	SysInfoWidget System Information Widget	Akash Heimlich	1.0	Uninstalled	Action
4	TestWidget			Uninstalled	Action
5	VariableWidget Variable widget for the front page	Akash Heimlich	1.0	Uninstalled	Action
6	Scheduler Schedule actions on daily, weekly or month intervals	Akash Heimlich	1.0	Uninstalled	Action

Figure 3.18 Package Manager

In order to modify individual package options, click the *Action > Configure* button in the corresponding item of the *Downloaded Package List*.

3.4.13 Firmware Updater

New WattmonPRO firmware versions are released regularly onto the Wattmon website. These can be installed through the *Firmware Updater* page. The list of available firmware versions will be automatically downloaded. Click the *Install* button to download and install the latest firmware.

The screenshot displays the 'Update Firmware' page in the Wattmon web interface. The page title is 'Update Firmware' and the breadcrumb is 'Home / Control Panel / Firmware Updater'. A message states: 'Update your Wattmon firmware to the latest version to ensure that all features are up to date. Click [More](#) for info on getting the firmware.' Below this is a table of available firmware versions:

ID	Name	Version	Size	Date	Options
108	Wattmon Firmware 1.893	1.893	1095680	2014-08-26 11:04:12	Install
109	Wattmon Firmware 1.894 This has an option for custom modbus rates and parity settings	1.894	1095680	2014-09-09 10:10:30	Install
110	Wattmon Firmware 1.895 Added a new action type and updated modbus settings	1.895	1095680	2014-09-16 11:03:57	Install
111	Wattmon Firmware 1.896 Bug fixes in modbus digital output which sometimes cause erratic switching of devices	1.896	1105920	2014-09-23 06:30:36	Install
112	Wattmon Firmware 1.897 This version has an additional action type to allow for delays in actions	1.897	1105920	2014-10-04 06:21:20	Install
113	Wattmon Firmware 1.898 This fixes a small bug introduced in 1.897 related to adding new devices.	1.898	1105920	2014-10-06 06:53:18	Install
114	Wattmon Firmware 1.900 This has several new features and improvements and solves some old bugs such as intermittent reboots when viewing web pages	1.900	1157120	2014-11-03 06:47:41	Install
116	Wattmon Firmware 1.901 Minor but important update to 1.900 which caused potential reboots when upgrading firmware	1.901	1157120	2014-11-03 11:50:20	Install

At the bottom of the table, there is a link: 'Do you want to upload a file from your computer instead?' with an 'Upload File' button.

Figure 3.19 Firmware Update page

Sometimes it may be necessary to install a firmware from a HEX file emailed to you – in this case, click the *Upload File* button, and then select and upload the HEX file from your computer.

3.4.14 Devices

The devices in WattmonPRO are Modbus-compatible and are defined using a driver setting file. All installed devices are displayed in the *Device List*. In order to configure a device, click *Action > Configure* for the corresponding device in the list.

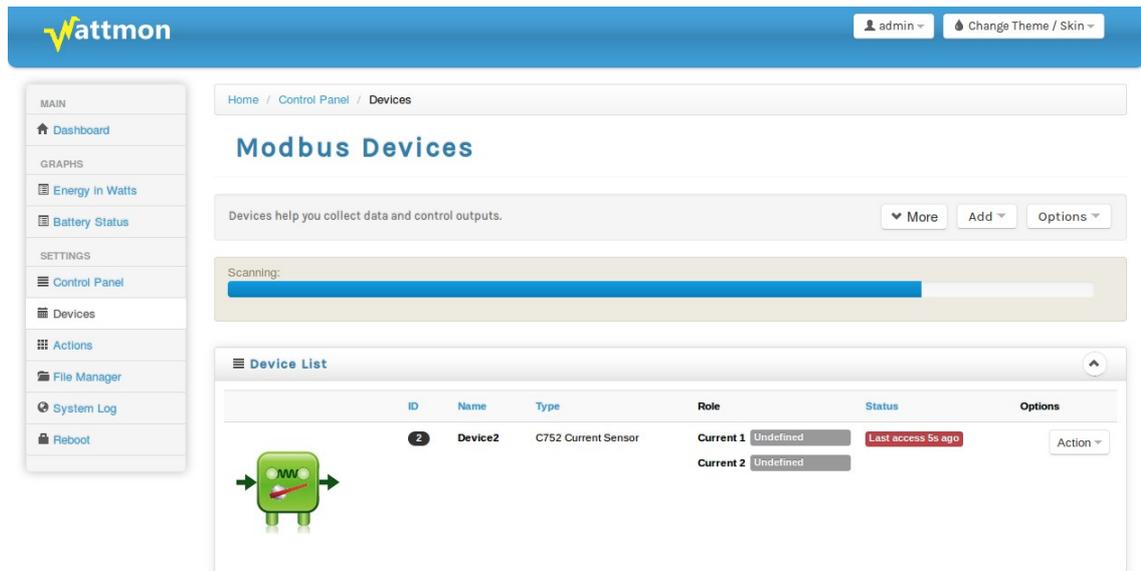


Figure 3.20 Devices page

Adding a New Device

All Wattmon modules are automatically installable using the *Add > Quick Scan Wired bus for New Devices* button. A scan will take place, that status will be shown using a progress bar as shown in figure 3.20. If the device is found, it will appear in the list.

If you have a 3rd party device, click *Add > Manually add a device*. This will bring a page that will let you enter the device ID, and select the device type from a predefined list of compatible devices. If your device is not shown in the list, you will need to first create a driver descriptor file. Do this from *Control Panel > Device Types*. A more comprehensive description of the procedure follows in the next section.

Editing a Device

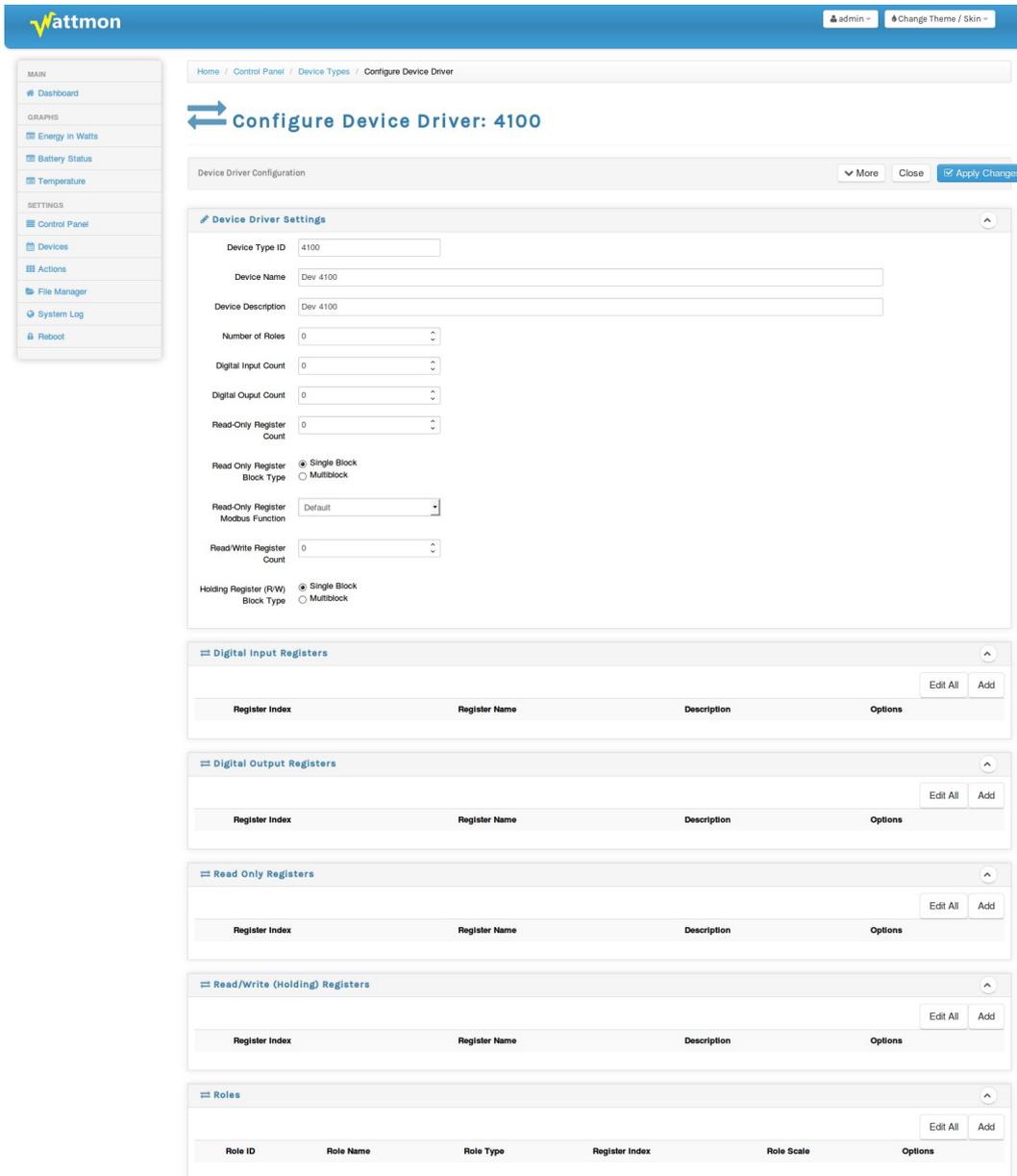
Click *Action > Edit* to bring up the *Device Editor* as described in the following section.

Calibrating a Device

Some devices require periodic calibration, such as the C752 hall effect current sensors. Different sensors respond differently to environmental conditions, cable length, etc. In order to calibrate a sensor, click the *Action > Calibrate* button. This is also described in the following sections.

3.4.14.1 Installing A New Modbus Device

If you have a 3rd party device that you wish to connect to a WattmonPRO via modbus, you will need to create a driver descriptor file for it. To do this go to Control Panel > Device Types and click the Create Device button.



The blank page is shown above. A description of the various parts is described in the following sections.

Device Type ID

The Device Type ID is an arbitrarily defined unique number between 1 and 9999. Make sure that you select a number that is not already used (see the main Device Types list and look for a free number).



Warning: Special processing is applied to device type IDs between 4000 and 7000: If the *Read Only Register Modbus function* is set to *Default*, then the read only registers will be read using the Read Holding Register (03) function. Otherwise, they will be read using the Read Input Register (04) function.

Device Name

The device name is a short name (32 characters max) that can be used to identify a device in the list.

Device Description

Fill in a custom description for this device

Number of Roles

The number of roles that this device describes. This is automatically calculated as you add roles in the roles section

Digital Input Count

The number of digital inputs defined. Automatically calculated.

Digital Output Count

The number of digital outputs defined. Automatically calculated.

Read Only Register Count

The number of read only registers defined. Automatically calculated.

Read Only Register Block Type

Possible values are: Single Block/Multiblock.

Single Block

For simple device with just a few contiguous registers, you can set this to Single block. Just below this a Read Only Register Start address box will appear after you add the first Read Only register. This will be the modbus address used for the first register, and all consecutive registers will be read using a Read Multiple Registers function (03 or 04) depending on the Device ID (see above) and the Read Only Register Modbus function (see below).

Multiblock

Each individual register you add in the read only register block will have a modbus register address field which will need to be entered. Wattmon will optimize reads by reading all contiguous blocks in one go, but will transparently read all blocks sequentially using the polling engine. When defining registers, put them in sequential order to allow the polling engine to do this otherwise it will result in multiple unnecessary reads. For example if you wish to read two registers, i.e. 4000 and 4001 and you enter them in that order a single read

operation will take place. If you however order them as 4001 and 4000, then two reads will happen.

Depending on the Device ID and the Read only Register Modbus function either the Read Holding or Read Input Register functions will be used.

Read Only Register Modbus Function

Described above, this determines whether to use the Read Holding Register or Read Input Register function for all Read Only variables. Setting it to Default will then use the Device ID rules described above.

Read/Write Register Count

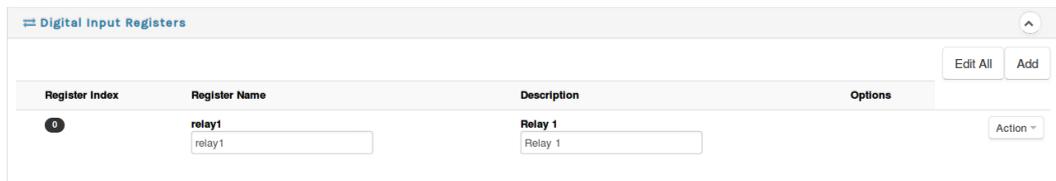
Number of read/write registers. Automatically calculated

Holding Register block Type

Possible Values: Single Block and Multiblock. Please see description for the read only registers above to understand how this works.

Digital Input Registers

Define the digital input registers here – this uses Modbus function 01 – Read Coil Status to get the values.

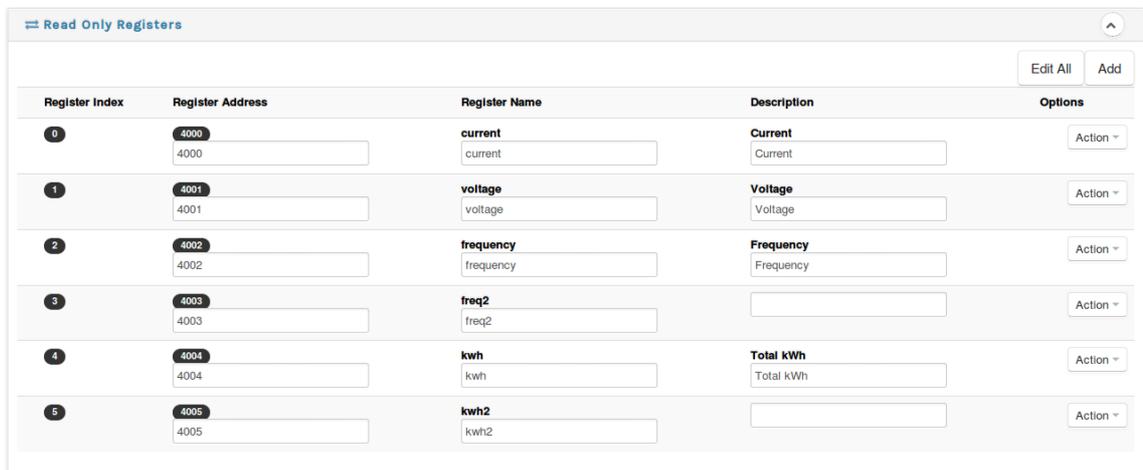


Enter a name and description for each register after clicking the *Add* button. You can always re-edit a register by clicking the *Action > Edit* button next to the register.

Digital Output Registers

Add digital output registers here. Wattmon will use the Modbus function 15 (Force multiple coils) to set the outputs of the coils in the device.

Read Only Registers



In multiblock mode, enter the modbus register address followed by a name and description for each register you wish to poll. See the description above on multiblock mode to see how to order the variables.



Warning: Certain Modbus register maps describe variables starting a 40001 which would be the equivalent of address 0 in Wattmon. The register address entered in Wattmon is the *exact* address used in the function call and no offset is added. For those register maps, to calculate the actual address, subtract 40001 from the value.

To adjust the order of the variables use the *Action > Move Up* and *Move Down* options for the row. To delete a register, click *Action > Delete*.

Read Write Registers

This works the same was as the read only registers.

Roles

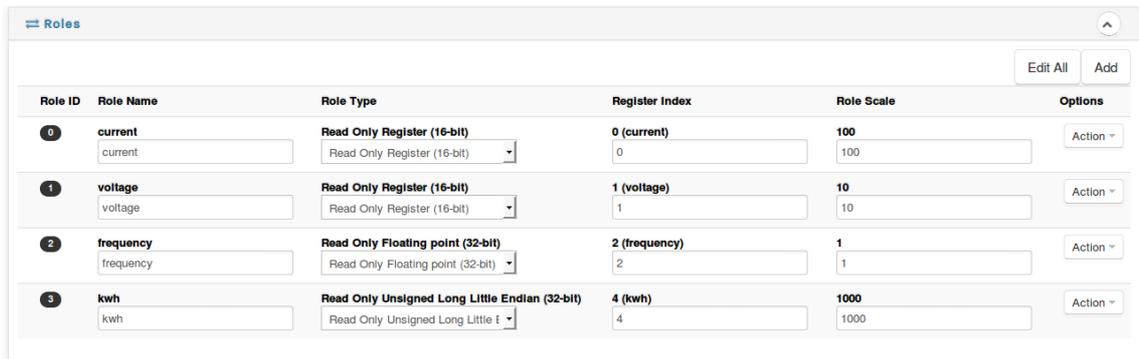
This section maps the various registers in the four previous sections into a structure that can be used by Wattmon. All read only and read write registers are 16 bit in Modbus, and sometime extra manipulation needs to be done in order to process them, such as taking 2 registers and combining them into a floating point or long integer value. This can all be done in this section.

In the ficticious example shown above, 4 registers were defined: current, voltage, frequency and freq2. Let's say for example that your driver register map gives you the following description:

Address	Name	Type	Scale	Description
4000	Current	INT (16 bit)	0.01	Current
4001	Voltage	INT (16 bit)	0.1	Voltage
4002	Frequency	Floating Point	1	Frequency
4004	Kwh	UINT (32 bit)	0.001	Total kWh

You would then need to define 4 roles to accomodate this, but in fact you would be using 6 registers since two of the roles will be using 2 registers each.

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The image above shows what a register map could look like. In the role name, enter a name that you wish to be shown in Wattmon when configuring your device (you will still need assign a role to the role variable defined here). Then in the role type select from the various options:

Role Type	Description
Digital Output	Digital Output role from the Digital Output section
Digital Input	Value from the Digital input section
Read Only Register (16 bit)	A 16-bit register value from the read only section
Holding Register (16 bit)	A 16-bit value from the Read/Write section
Read Only Floating Point (32)	Two registers from the Read Only section in Big-Endian format converted to an IEE754 float
Read Only Float Little Endian (32-bit)	Two read only registers in Little Endian format converted to a IEE754 float
Read/Write (Holding Register) Floating point	Two registers from the Read/Write section in Big-Endian format converted to an IEE754 float
Read Only Unsigned Long Little Endian (32-bit)	Two read only registers combined as an unsigned int in little endian format
Read Only Unsigned Long Big Endian (32-bit)	Two read only registers combined as an unsigned int in big endian format
Read Only Signed Long Little Endian (32-bit)	Two read only registers combined as a signed int in little endian format
Read Only Signed Long Big Endian (32-bit)	Two read only registers combined as a signed int in big endian format
Read/Write (Holding) Float Little Endian	Two read write registers in Little Endian format converted to a IEE754 float
Read/Write (Holding Register) Big Endian (32-bit)	Two read write registers in Big Endian format converted to a IEE754 float



Warning: Due to memory issues on Wattmon, it may not be possible to save a new device when adding many roles and registers a one go. In order to work around this, save the device driver every time you add about 10 roles or variables and reload the page (F5)..

Adding the Device

Once you have finished creating and defining your device, save the file and go to the Devices page as shown below.

Home / Control Panel / Devices / Add Device

Add New Device

Configure your device here in order for it to be usable by WattMon. [More](#)

Device ID: 2

Device Name: Device2

Device Type: My Custom Device (2010)

Poll Interval (in ms): 1000

Status: Enabled Disabled

[Update Settings](#)

Figure 3.23 Add New Device page

Your device will appear in the list now. Enter the device ID and poll interval, and click Update Settings to create the device. Now reboot the WattmonPRO for changes to take effect.

Now, in the device list, you should see your device.



Figure 3.24 Device list

You should see that the device is active (not showing error as in the image above) if the link is properly establish.

Configuring your device

Finally, you need to click Action > Configure to assign the roles from your new

variables to Wattmon roles, as shown in the following figure:

Initially, you will not see any possible roles in the drop down list because they have not yet been assigned in the role Manager.

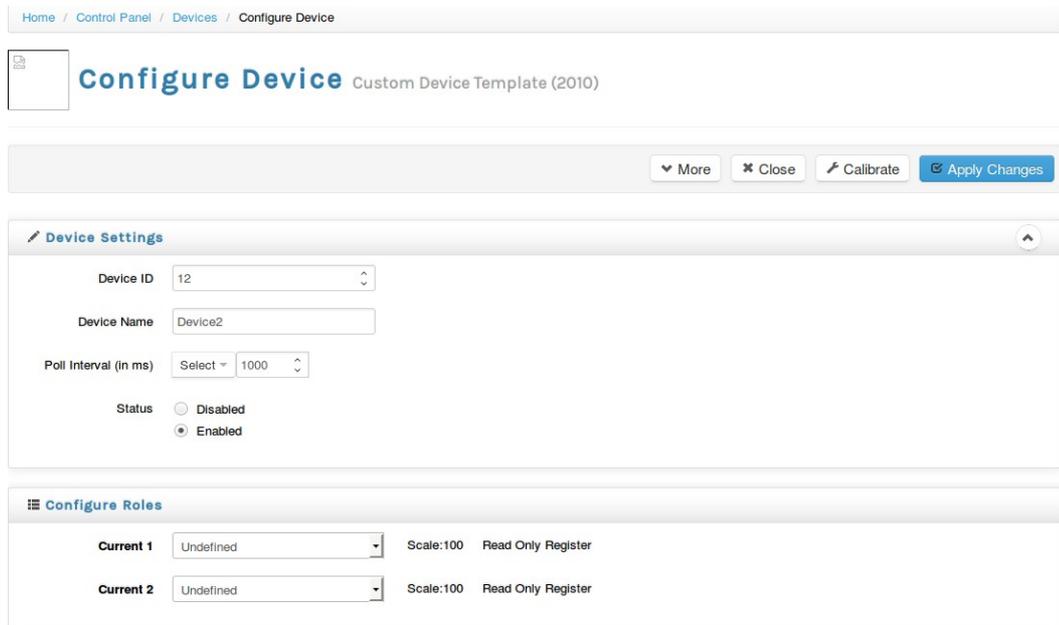


Figure 3.25 Configure Device page

Modifying or Creating a new Role

Go to Control Panel > Roles to bring up the list of current system roles.

If your device (2010) has a current sense channel, you can use an existing current sensor role such as role 3. Click *Edit*.

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Home / Control Panel / Roles

Roles

System roles More Add Role

Role List

ID	Role Name	Type	Group	Devices	Options
1	Solar DC Input to Battery	Read Only Value	3	1001,1100,1002	Edit
2	Current Monitor: Charger Input to Battery	Read Only Value	2	1001,1100,1002	Edit
3	Bidirectional DC to Battery	Read Only Value	2	1001,1100,1002	Edit
4	Current Monitor: DC Output Only from Battery	Read Only Value	2	1001,1100,1002	Edit
5	Current Monitor: External Sensor 1 not connec	Read Only Value	1	1001,1100	Edit
6	AC Current Monitor	Read Only Value	0	1001,1100,1101,1190	Edit
7	Relay for Main Inverter Input	Digital Out	2	1005,1006	Edit

Figure 3.26 Roles page

The role editor will appear as shown below:

Wattmon admin Change Theme / Skin

Home / Control Panel / Roles / Configure Device

Configure Role: Bidirectional DC to Battery

Roles configuration More Close Save As New Apply Changes

Role Settings

Role ID: 3

Role Name: Bidirectional DC to Battery

Display on dashboard: No

Group ID: Inverter DC

Role Type: Device: Read Only Value

Role Definition: Current

Assign Role to Devices

ID	Device	Options
1	C501 Current Sensor	Action
2	Current Sensor	Action
3	C752 Current Sensor	Action

All that's left to do is to add the device to your role. Click the *Add* button in the *Assign Role to Devices* pane:



Figure 3.28 Assign Role to Devices page

Select your device from the list, and click *Apply Changes*.

If you are creating a new role, make sure the fields at the top of the role box are properly filled in. You can duplicate an existing role by changing the name and clicking *Save as New*.

3.4.14.2 Configure Device Page

The *Configure Device* page lets you change important information about a device. This includes setting the *Device ID* for Wattmon modules, and setting poll time. You also need to link device roles to system roles in order for Wattmon to properly recognise the device values.

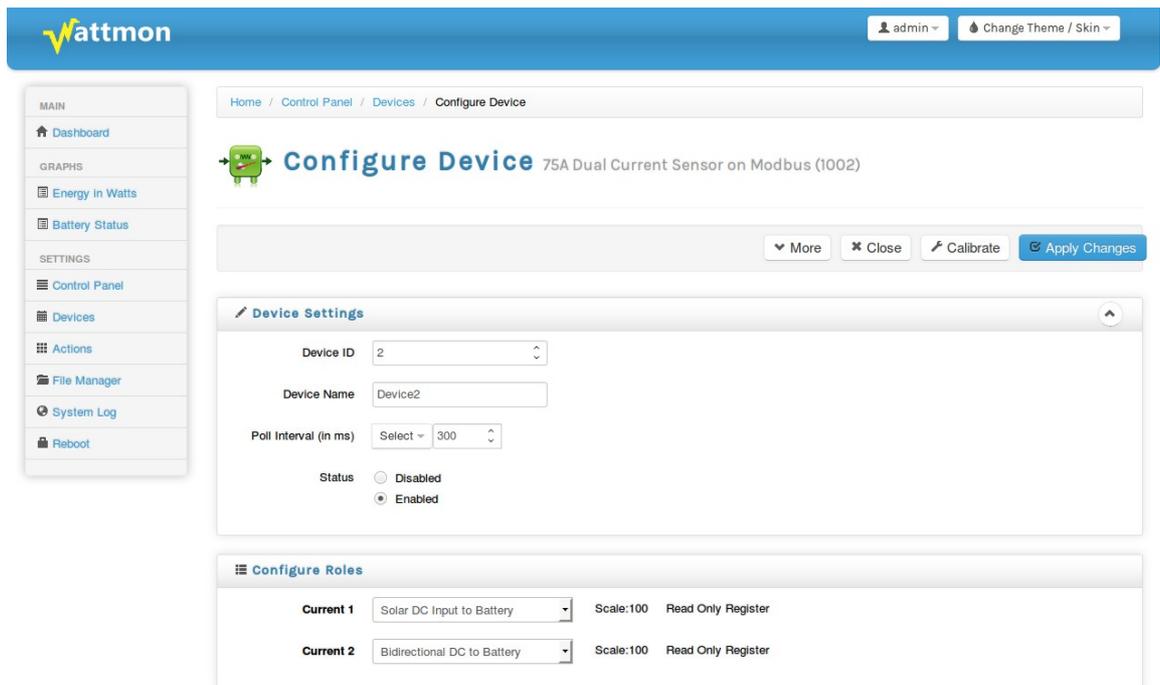


Figure 3.29 *Configure Device* page

In the *Device Settings* pane, the *Device ID* lets you view or change the device's ID. If the device is a Wattmon module, it will update the ID in the module's EEPROM. If the device is a 3rd party device, you will also need to manually change the ID in the device itself in order for communication to work properly.

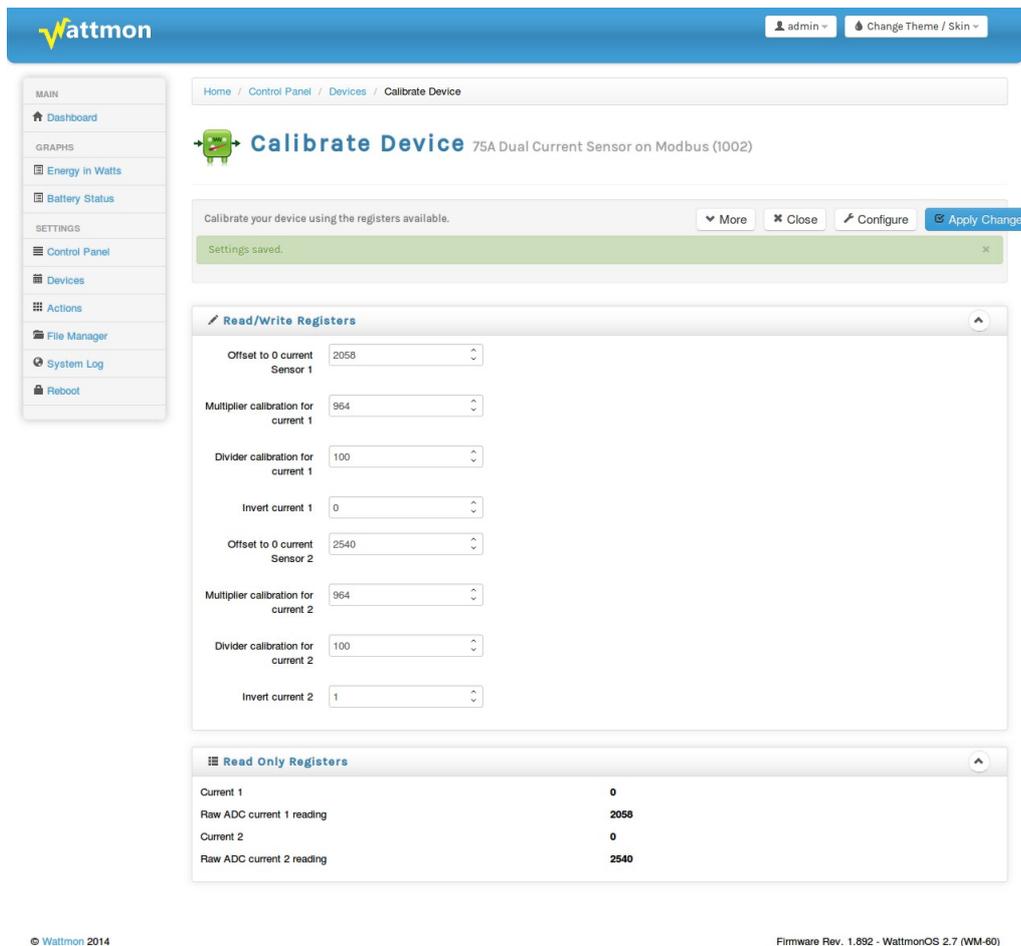
You can assign a unique *device name* to the device – this can be used if you are creating custom scripts that reference the device by its name – or as an easy identifier for the device, such as 'currentsensor1'.

By setting a device's *status* to Disabled, the device will no longer be polled – this could be done when for example a device needs to be physically removed from the system for a while. It can easily be re-enabled at a later time.

The *Configure Roles* pane lets you assign device-specific variables to system roles. For example, figure 3.21 shows the C752 module which is a current sensor device. This has 2 roles that can be assigned – the left (current1) and right (current2) sensors on the device. WattmonPRO initially does not know what each is connected to and therefore would not be able to properly integrate the sensor. By assigning the role *Solar DC Input to Battery* for the *current1* role and *Bidirectional DC to Battery* for the *current2*

role, WattmonPRO will be able to intelligently calculate your battery capacity by monitoring all inbound and outbound energy. For 3rd party devices, you will need to use the *Role Manager* to assign specific roles to your device for it to appear in the drop-down list of roles.

3.4.14.3 Calibrate Device Page



Calibrating a device is a way to write values into the read/write memory of the device itself. All read/write register values associated with the device will be shown in the top pane of the page. Read only register values will be automatically updated every second at the lower part of the page. This makes it easy to calibrate values for current sensors for example. In order to recalibrate the C752 current sensor 0-offset, open the calibrate page and make sure no current is flowing through the hall sensor. Then, for the left channel, take the *Raw ADC current 1* reading value (2058 in this example), and enter it into the *Offset to 0 current sensor 1* field in the read/write pane. Click *Apply Changes*, and ensure the *current1* field in the read only area is now 0. Repeat this for the right channel (current2) if necessary.

Figure 3.30 Calibrate Device Page

3.4.15 Groups

Groups lets you consolidate data from various inputs together for data collection and graphing purposes. The default series of groups listed are *Wind*, *Grid* and *Solar*, each representing the electricity input into the WattmonPRO.

In the Group List, the ID number, the group name, type and status are displayed. The type shows where the data source is consolidated and the status shows whether the data is visible or hidden.

A fifth column, *Options*, provides the option to edit a group, which is explained in the following section. There is an option to *Add Groups* as well, through which a new data group can be created.

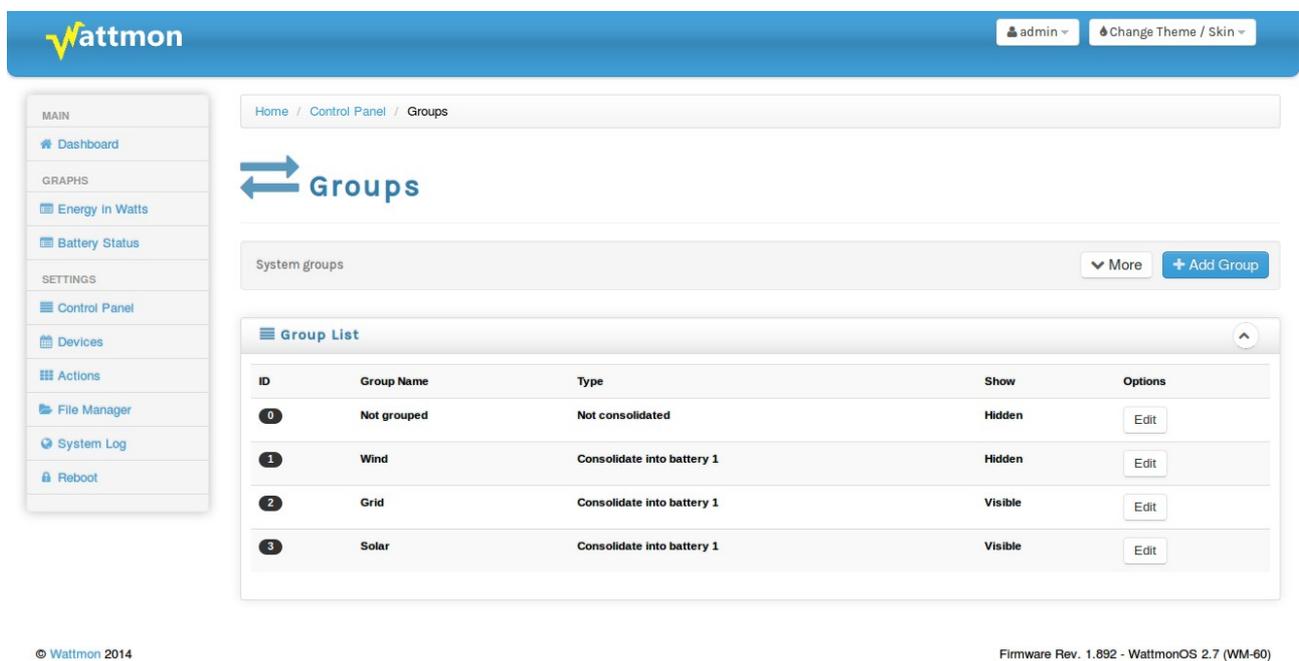


Figure 3.31 Groups Page

3.4.15.1 Add or Edit Group

In order to create or configure a preexisting data group, click on *Add Group* to create a new group or *Edit* to configure an existing one.

In *Configure Group*, you will find the several group settings, as can be seen in figure 3.32, which are to be configured as follows :

Group ID

The WattmonPRO automatically assigns a Group ID, depending on the ID numbers in use. This cannot be changed by you.

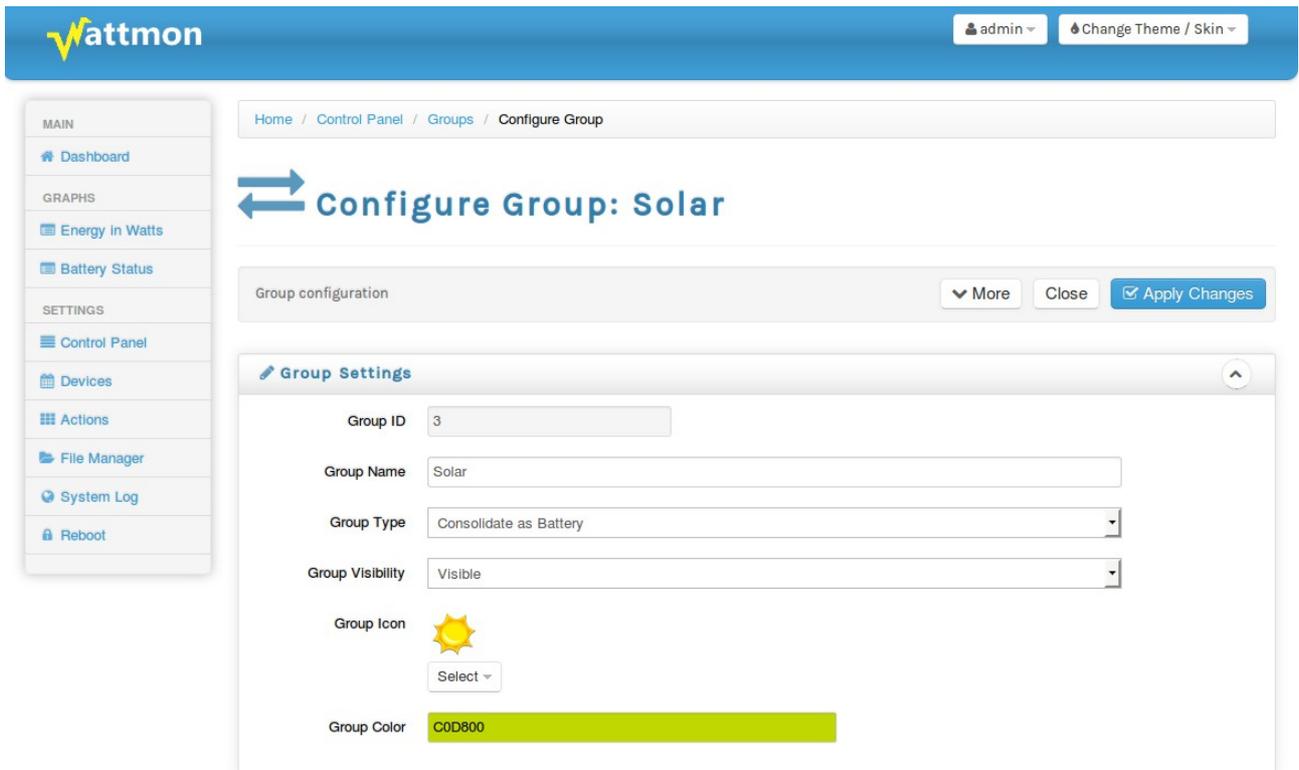


Figure 3.32 Configure Groups Page

Group Name

You may name your new group as you like. For a preexisting group, the name will again be provided by default by the WattmonPRO, and will not need to be changed.

Group Type

There are three options provided in the drop down menu – *Not Consolidated*, *Consolidate as Battery* and *Tank*. If you select *Not Consolidated*, energy values will be accumulated but will not affect the battery state of charge.

For the preconfigured groups such as Wind, Grid and Solar, *Consolidate as Battery* is selected as default, and the data is collated together into one field.

The *Tank* option is used for automated tank level control, and will let you assign a high, mid and low role to the group which will be used with the tank widget to display the tank levels on the front end.

Rated Watts

You can adjust the rated watts for your input. The default for the Wind, Grid and Solar is 0 which means unlimited. This can be used if your sensors provide erroneous readings occasionally. For example if your temperature sensor should never go above 50 degrees, but sometimes gives you a value of 85 by mistake, you can set this to 50 to ensure the reading will become 0 when the happens to not mess up the graphs.

Group Visibility

There are two options here – *Hidden* or *Visible*, selecting which will either hide or display your input device and the data logged by it. The default for Grid and Solar is *Visible*, while for Wind is *Hidden*, but these can be changed based on your requirement.

Group Icon

There are five group icons to select from.

Group Color

The group colour represents the colour of the *Live Energy* graph on the Wattmon dashboard. It can be changed by entering a Hex color code for a colour of your choice. Alternatively, upon clicking on the group colour field a colour picker will pop up, where you can select a colour and shade of your choice.

3.4.16 Roles

A role is a variable that has a specific type and purpose. Each role can be linked to one device or system variable and can then be used by the data collector, the action task or in a script. A role needs to be defined before it can be associated - this is done in the Roles page of the *Control Panel* or with the *Create New Role* option in the device configuration page. There are certain important things that need to be defined for each role, namely the Role Name, the role type and the role function. For example, a role that will be used to read a current from a device would be set to Read Only Value, and not say Digital Input. Its type would be set to Current and not Watts or Voltage.

Roles lets you configure the various functions that you wish for your WattmonPRO to carry out and log.

In the role list, each role is displayed by name, along with an unique ID number, and classified into type, group and devices deployed for that particular role.

A sixth column, *Options*, provides the option to edit a role. And there is an option to *Add Role* as well, through which a new role can be created.

The screenshot shows the WattmonPRO interface. At the top, there is a blue header with the 'wattmon' logo on the left and 'admin' and 'Change Theme / Skin' on the right. Below the header is a navigation menu on the left with categories: MAIN (Dashboard), GRAPHS (Energy in Watts, Battery Status), SETTINGS (Control Panel, Devices, Actions, File Manager, System Log, Reboot). The main content area has a breadcrumb trail 'Home / Control Panel / Roles' and a large 'Roles' heading with a double-headed arrow icon. Below this, there is a 'System roles' section with a 'More' dropdown and an 'Add Role' button. The 'Role List' table is as follows:

ID	Role Name	Type	Group	Devices	Options
1	Solar DC Input to Battery	Read Only Value	3	1001,1100,1002	Edit
2	Current Monitor: Charger Input to Battery	Read Only Value	2	1001,1100,1002	Edit
3	Bidirectional DC to Battery	Read Only Value	2	1001,1100,1002	Edit
4	Current Monitor: DC Output Only from Battery	Read Only Value	2	1001,1100,1002	Edit
5	Current Monitor: External Sensor 1 not conn	Digital Out	1	1001,1100	Edit
6	AC Current Monitor	Digital Out	0	1001,1100,1101,1190	Edit
7	Relay for Main Inverter Input	Digital Out	2	1005,1006	Edit
8	Relay Output 1	Digital Out	0	1005,1006	Edit
9	Mains Voltage	Digital Out	0	1005,1006,1190	Edit
10	Relay Output 2	Digital Out	0	1005,1006	Edit

3.4.16.1 Edit Role

The Role Settings page lets you create and edit a role. The *Role Name* is a unique name for the role that will be used in the Data Export via CSV to the portal as well as on the display on the dashboard. The *Display On Dashboard* option determines whether or not the variable is shown on the Variables widget on the dashboard. When you have many roles, it would save memory to set this option to *No*.

The screenshot displays the Wattmon web interface. At the top, there is a blue header with the Wattmon logo and user controls for 'admin' and 'Change Theme / Skin'. A breadcrumb trail shows 'Home / Control Panel / Roles / Configure Device'. The main heading is 'Configure Role: Current Monitor: Charger Input to Battery'. Below this, there are buttons for 'More', 'Close', 'Save As New', and 'Apply Changes'. The 'Role Settings' section contains the following fields:

- Role ID: 2
- Role Name: Current Monitor: Charger Input to Battery
- Display on dashboard: No
- Group ID: Grid
- Role Type: Device: Read Only Value
- Role Definition: Current

Below the settings is the 'Assign Role to Devices' section, which contains a table with three rows:

ID	Device	Options
1	C501 Current Sensor	Action
2	Current Sensor	Action
3	C752 Current Sensor	Action

The *Group ID* lets you select from the list of groups defined. If the role is not meant to be linked to a group, select *Undefined*. Assigning a role to a group and setting the *Role Definition* will have different effects depending on the definition, this is described in detail below.

The *Role Type* determines which device variables this role can be assigned to. For example, a Modbus power meter may have a read-only role called voltage – in this case the role would be of type Device: Read Only to signify a variable in the Read Only block.

Role Types

Role Type	Description
Device: Digital Input	Can be assigned to any Modbus device that has a digital input defined
Device: Digital Output	Can be assigned to any Modbus device that has a digital output defined
Device: Read Only Value	Can be assigned to a Modbus device variable in the Read Only section. This can be an input register or a holding register depending on the device type configuration.
Device: Read and Write Value	Can be assigned to a device variable which has a read/write variable
Onewire: Temperature	Can be assigned to a Onewire temperature sensor
Global Variable	Defines the role as a global variable. In this case, the <i>Role Name</i> is the actual global variable name.

Role Definition

The role definition plays an important part in how Wattmon calculates energy. The table below explains each of the functions in detail.

Role Definition	Description
Value	No processing, treat the role as-is
Current	If the role is not linked to any group, nothing is processed. However, if a group is defined, then this will be used to calculate the ampere-hours and kWh of energy in that group. The sum of all currents assigned to a group are added together (respecting the polarity of the current, a negative current is a discharge and a positive current is a charge). This is then multiplied by the voltage for the group (see below) and the total watts, kW today and total kWh for the group are calculated. If the group type is set to Consolidate as battery, the ampere hours from this current sensor will also be used to calculate the battery state of charge.
Voltage	If no group is set, the role value will be used as the battery voltage and used to calculate watts (voltage * current). If the group ID is set, then

	the voltage will be used for watt calculations of the current group only. For example, if a current role and a voltage role are assigned to the Solar group, then the solar watts will be calculated by multiplying those roles together.
Temperature	Does not currently have any functionality
Pressure	Does not currently have any functionality
Flow Rate	Does not currently have any functionality
Wind Speed	Does not currently have any functionality
Watts	If no group id is set, nothing specific will happen. If a group ID is set, the role value will be used to calculate total kWh and daily kWh for the group. This could be used with energy meters that have a watt register for example.
Kilowatts	No functionality presently.

Role Logging

In order for a role to be exported to the portal or viewed in a graph it needs to be logged. Wattmon fully supports a single data log file for exporting and viewing graphs, but multiple data log files can be created if needed. However, only the first one will ever be used to export data, and the secondary files can only be used in the local graphing or if CSV data files will later be manually exported. Make sure to click on the log (KwH Log) otherwise it will not enable logging for the role. In order to remove the variable from the data log, go to *Control Panel > Data Collection* and remove it there.

Role Devices

In order for a role to be available for a particular device, you need to add the device type to the list of devices in the *Assign Role To Devices* section. For example, a current role may be assignable to various types of current sensors depending on the setup. If you wish to use one of the existing Wattmon roles such as '*Bidirection current from battery*' you can simply add your new device type to the list rather than creating an additional role.

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3.4.17 Widgets

The screenshot shows the Wattmon web interface. At the top, there is a blue header with the Wattmon logo on the left, a user profile 'admin' in the center, and a 'Change Theme / Skin' button on the right. Below the header is a sidebar menu with categories: MAIN (Dashboard), GRAPHS (Energy in Watts, Battery Status), SETTINGS (Control Panel, Devices, Actions, File Manager, System Log, Reboot). The main content area has a breadcrumb trail 'Home / Control Panel / Widgets' and a 'Widgets' header with a double-headed arrow icon. Below this is a 'Widgets' section with a 'More' dropdown and an 'Add Widget' button. The 'Widget List' table contains the following data:

ID	Title	Template	Icon	Width	Options	
0	Battery	/widgets/widget_battery.inc	icon-eye-open	4	Visible Hide	Action ▾
1	Charge	/widgets/widget_charge.inc	icon-arrow-right	4	Visible Hide	Action ▾
2	Discharge	/widgets/widget_discharge.inc	icon-arrow-left	4	Visible Hide	Action ▾
3	Live Energy	/widgets/widget_flotr.inc	icon-leaf	12	Visible Hide	Action ▾