Wattmon Installation Manual

Rev 1.0

July 2013

WattmonSolar Package

Chapter 1

Hardware Installation

If you have just purchased your Wattmon device, you will need to go through several steps before you can start using it. The default WattmonSolar kit comes with all the parts necessary to hook the device into your existing battery bank. The first chapter of this guide explains the steps necessary to physically connect your Wattmon up. You will require a pair of pliers, a wire stripper and cutter and the right spanner size for your battery terminal in order to complete this part of the installation.

The Wattmon kit comes with the following components:

- 1 x Wattmon Device
- 1 x Wattmon C752 Current Sensor
- 1 x Battery power cable
- 2 x 2M Ethernet patch cable
- 2 x 16mm2 Lugs

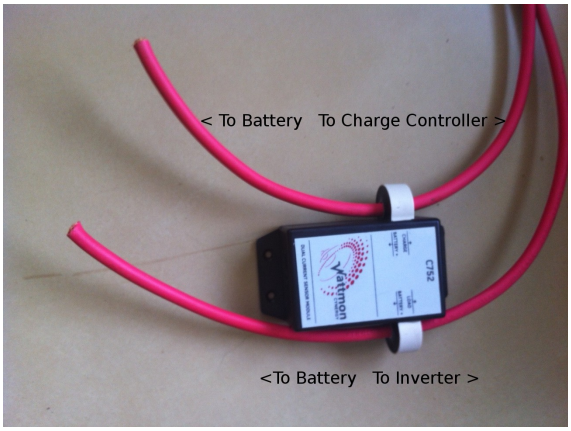
Figure 1.1 Wattmon components prior to hooking up with the battery

Your battery bank will already have cables connected to the positive and negative terminals. The positive terminal is marked by a + sign or a red dot, and usually a red cable connects to this. If you also have a solar charger attached, you would typically have two cables going to the + terminal. One of these will connect to the solar charge controller and the second will go to the inverter.

Warning: Before disconnecting the cables from the battery, make sure you switch off the inverter and the DC breaker for the charge controller.

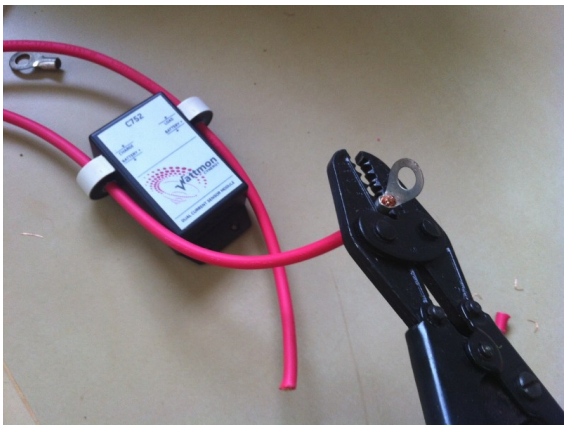
Hooking Up The Current Sensor

The Wattmon device requires at least one current sensor in order to collect data and compute battery capacity. The C752 Current Sensor is a dual hall-effect sensor which is used to monitor both solar input and load. For setups without solar, and a grid charger integrated into the inverter, you can hook up the load side only.



After removing the two cables from the positive terminal, cut off the lugs at the end of the cables, and insert them through the holes in the wattmon C752 current sensor as shown in the picture above.

Figure 1.2 C752 Sensor with cables



Next, strip the ends of both cables, insert the lugs, and crimp it with a crimping tool or a pair of strong pliers.

Warning: High currents will be flowing through this so make sure that the contact between the cable and the lug is very good or it could result in sparks or corrosion.

Figure 1.3 Crimping on the lugs

Loosen the negative battery terminal (black one, marked with a -) and remove the nut. Fix on the black wire of the wattmon power cable to this and re-tighten.

Figure 1.4 Negative battery terminal connection

Next, connect both of the thick cables together with the red end of the wattmon power cable to the positive terminal of the battery, and tighten.

Figure 1.5 Positive battery terminal connection

Warning: Be very careful when reconnecting the cables to the positive battery terminal, especially at higher voltages, because you will get a strong spark as the internal capacitors of the inverter charge up. Once you make contact again with the battery terminal, do not remove the lug or else it will spark again upon contact each time.

Figure 1.6 Final setup of your Wattmon hardware

The final setup should look something like the image above. The stickit notes indicate the connections to be made.

One blue patch cable connects between the Device plug on the Wattmon to the C752 current sensor device (you can plugin it in to either of the two ports on the current sensor). The second blue patch cable goes from the LAN plug on the Wattmon device to your Internet router. If your router is further than 2 meters away, you will need to buy a longer cable. The device will work at up to 100 meters from the router.

Note: Make sure you connect a straight through cable and not a crossover cable. Connecting a computer directly to the watttmon device over a crossover may not work properly.

Finally, plug in the power jack and make sure the *Power* light comes on. The *Script* light should start blinking to indicate activity. The *LAN* light should also come on.

The hardware portion of the Wattmon setup is now complete. In the next chapter, you will learn about the various software steps to setting up the device.

Chapter 2

Software Installation

This chapter assumes you are using Microsoft Windows. If you are on any other operating system, the procedure will vary slightly but you will most probably be able to follow the logic and find similar options in your operating system.

There are several steps involved in getting your Wattmon configured the first time. The first step is to make sure you can ping your Wattmon device. Wattmon uses a static IP address, and the default IP address 192.168.0.55. If you are comfortable with networking you can just skim through the following sections and pick out the relevant information.

2.1 Computer Network Configuration

Most machines connect to the network using a mechanism called DHCP which automatically assigns your computer an IP address. These IP addresses come in different IP subnets dependign on the manufacturer of your router. The most common IP ranges are 192.168.0.x and 192.168.1.x. If your IP address range is different from the Wattmon default IP address range, you will need to temporarily reconfigure your computer's IP address using the following guide in order to set up Wattmon.

2.1.1 Determine Your IP Address

If you are unsure of your IP address, run cmd.exe (Click the *Start* button in Windows, and in the search box type *cmd.exe* and press enter). In the window that appears, type in:

```
ipconfig
```

and press Enter.

You should see something similar to the figure below.

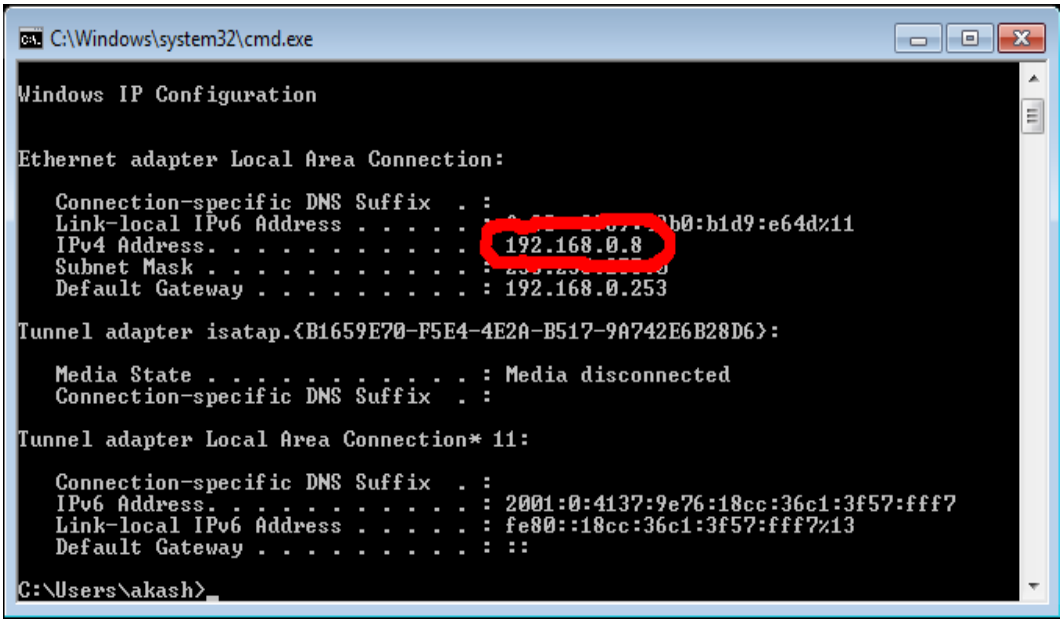


Figure 2.1 Results of ipconfig command showing your IP address

The *IP Address* is in this case **192.168.0.8** which is in the same range (**192.168.0**) as the Wattmon, so you can skip the step where you need to set your IP temporarily. If for example your IP address would be 192.168.1.7 (192.168.1 range) you would need to temporarily change the IP address to configure Wattmon.

2.1.2 Configure Your IP Address

In order to set your IP Address, you need to open the network and sharing center as follows:

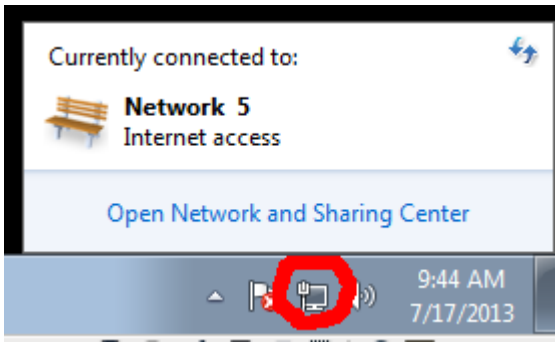


Figure 2.2 Opening the Network and Sharing Center

On the lower right hand corner of the task bar, click the *Network* icon, and then click *Open Network and Sharing Center*.

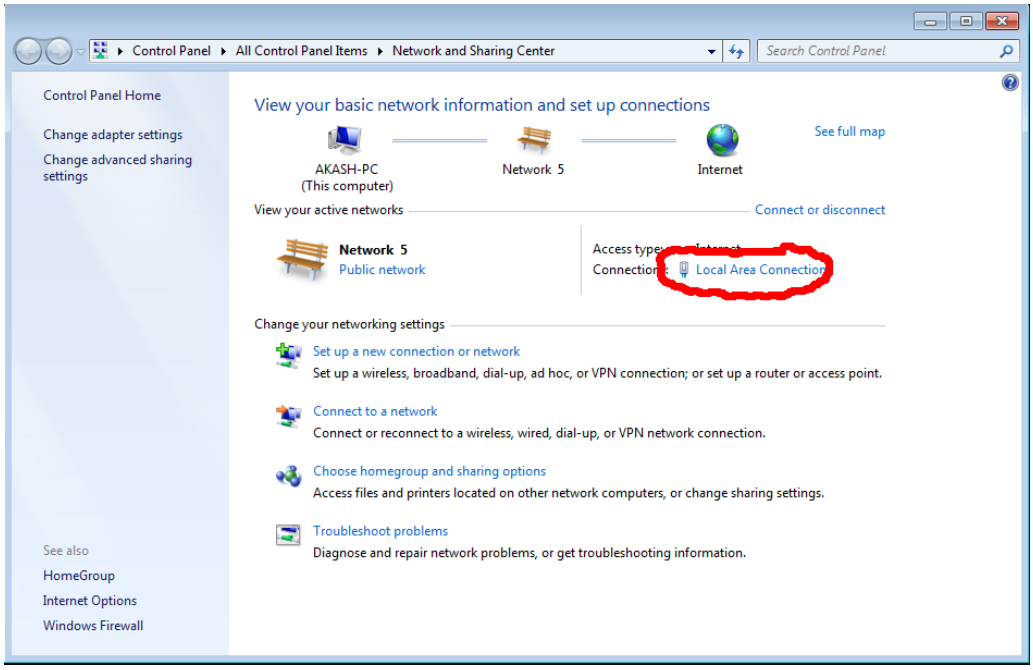
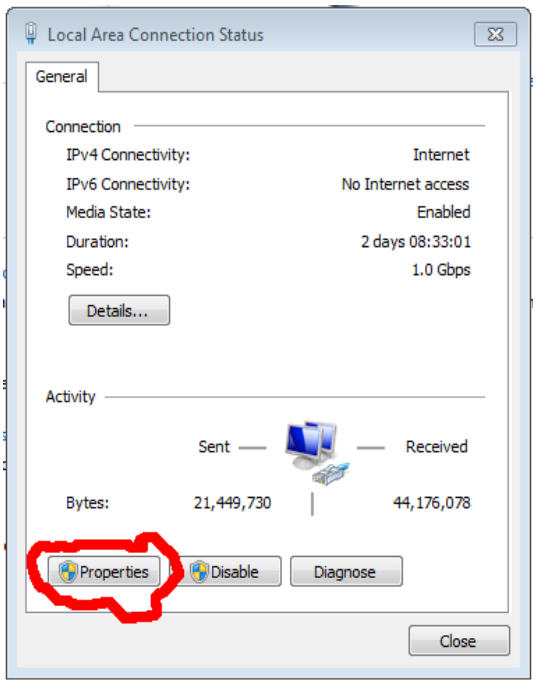


Figure 2.3 Nework and Sharing Center

Next, click the *Local area Connection* or Wireless connection settings in a similar location on the screen to the red circled area.The *Connection Status* window appears (Figure 2.4). Click the *Properties* button.



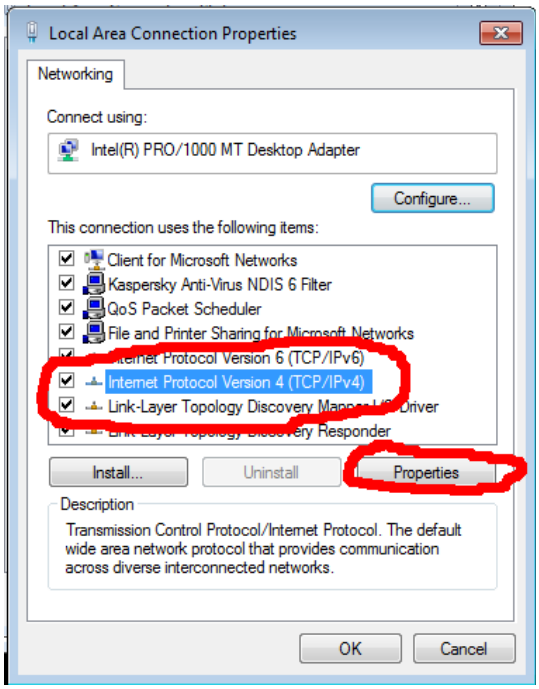


Figure 2.4 Connection Status Window *Figure 2.5 Connection Properties Window*

Next, in the *Properies* window, Select *Internet Protocol Version 4* in the list and click *Properties*.

Now copy over the exact information you see in the *Properties* window, including which radio buttons are checked and the values in all the fields so you can restore this later.

Warning: If you do not properly reconfigure your connection after you finish setting up Wattmon, your Internet connection may not work anymore.

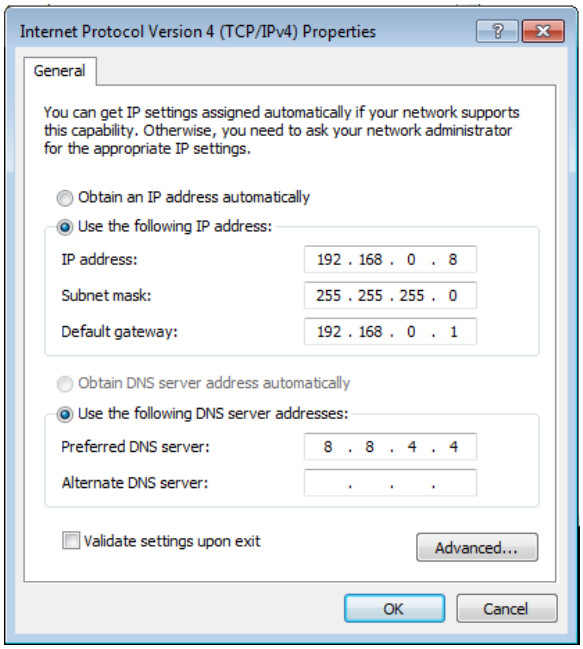


Figure 2.6 TCP/IP Properties Window

Enter the following information into the corresponding fields:

- If Obtain an IP Address is selected, check the User the Following IP address before you see the right fields.
- IP Address: 192.168.0.8
- Netmask: 255.255.255.0
- Gateway: 192.168.0.1

You can ingore the DNS section.

Click *OK* until the settings are applied.

Your internet connection will now be unusable until you restore the settings to their original values. Follow the same instructions to reach this page and then just re-enter the settings you noted down previously to restore your Internet connection once the Wattmon IP address is properly configured.

2.1.3 Ping Wattmon

Once you have an IP address in the same range, run *cmd.exe* again, and this time type in:

```
ping 192.168.0.55
```

and press *Enter*. You should see something similar to what is shown below and there should be a reply from the device.

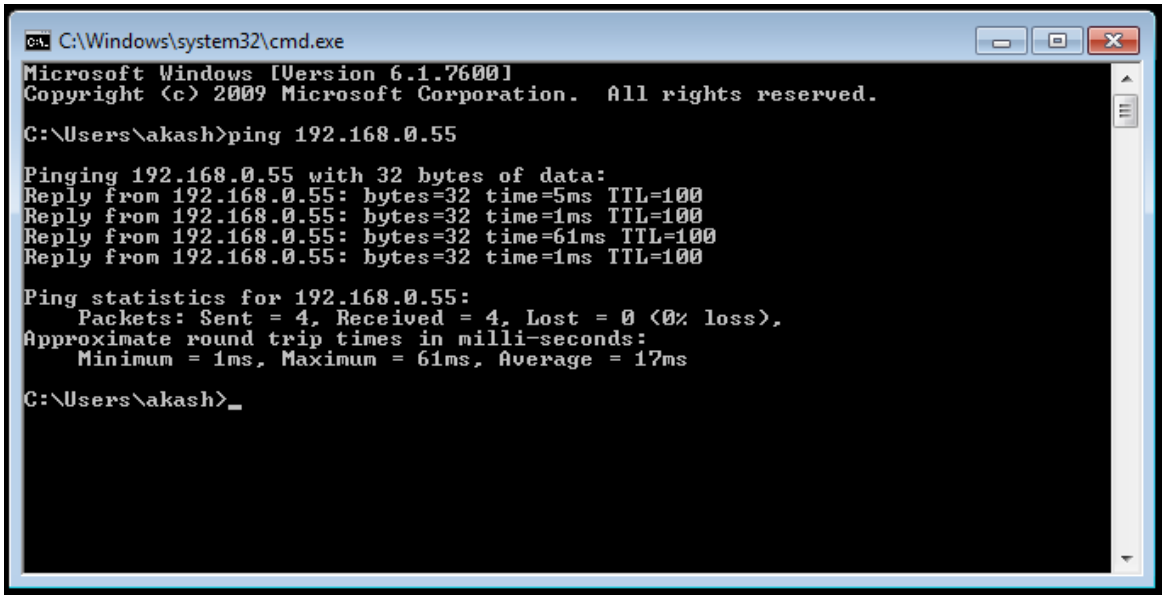


Figure 2.7 Ping response showing successful connection to the Wattmon device

If instead you see a response as shown in Figure 2.8 it means that you have either not switched on the Wattmon or connected it properly, or that you may have missed a step when trying to set the IP. Check your cabling, and finally verify that the IP address matches 192.168.0.8 if you set it manually in the previous step. If not, repeat the previous step until this matches.

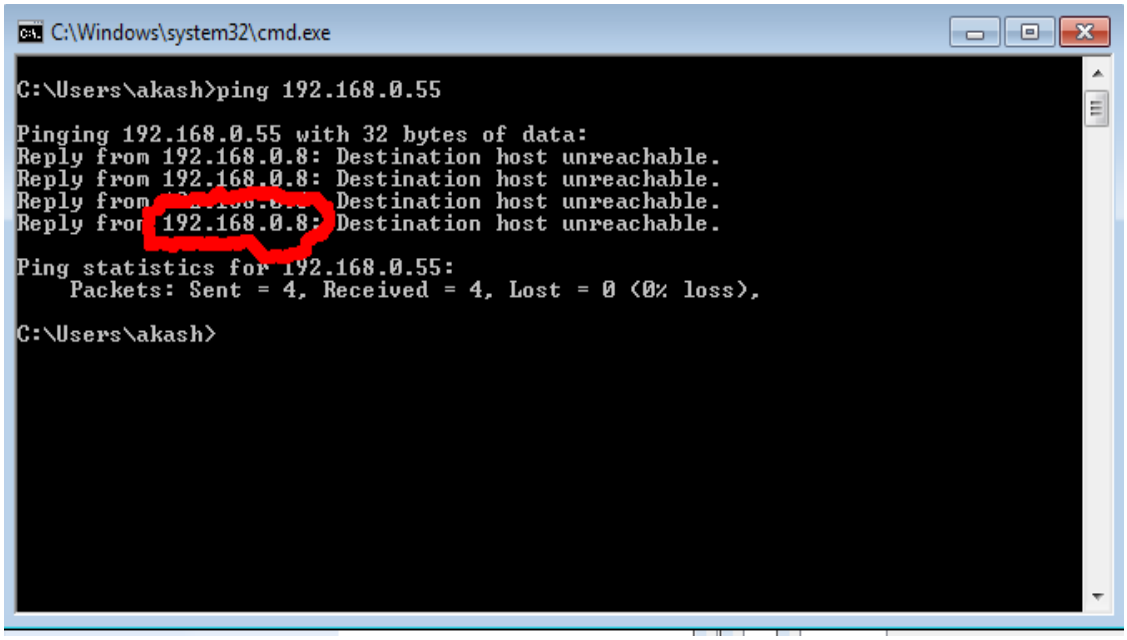


Figure 2.8 Ping response showing a connection problem

Once you get the ping successfully working you can connect to your device through a browser and start the next part of the setup.

2.2 Connecting Through a Browser

Open your favorite browser (Chrome, Safari and Firefox are recommended) and type in http://192.168.0.55 in the address bar, then press *Enter*. You should see the page as shown in Figure 2.9. In the *Log in* box, enter *admin* as the username and *admin* as the password, and click *Sign In*.

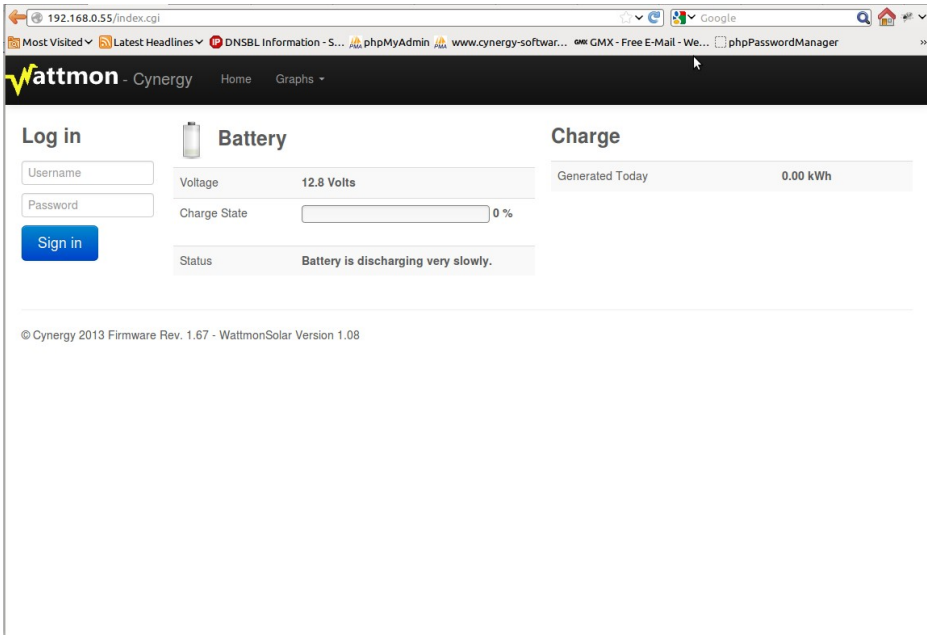


Figure 2.9 Login page of Wattmon

Once you are logged in, you will see the main Wattmon home page as shown below.

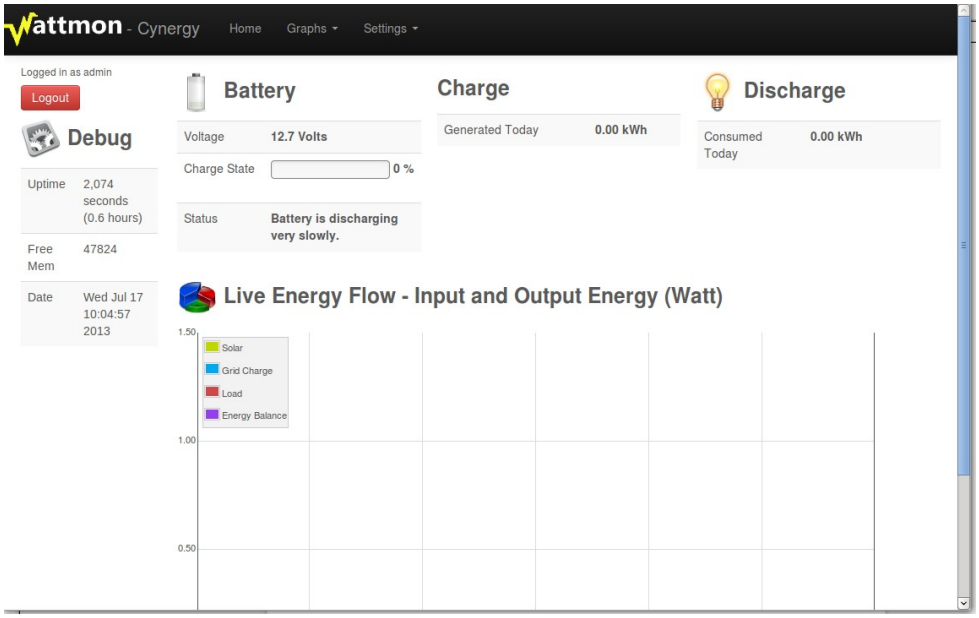


Figure 2.10 Watton home page

Next, you will need to configure your IP address properly.

2.2.1 Configuring Your Wattmon

All configuration changes in the Wattmon happen via the Control Panel. On the *Settings* menu in the Wattmon page, click *Control Panel*.

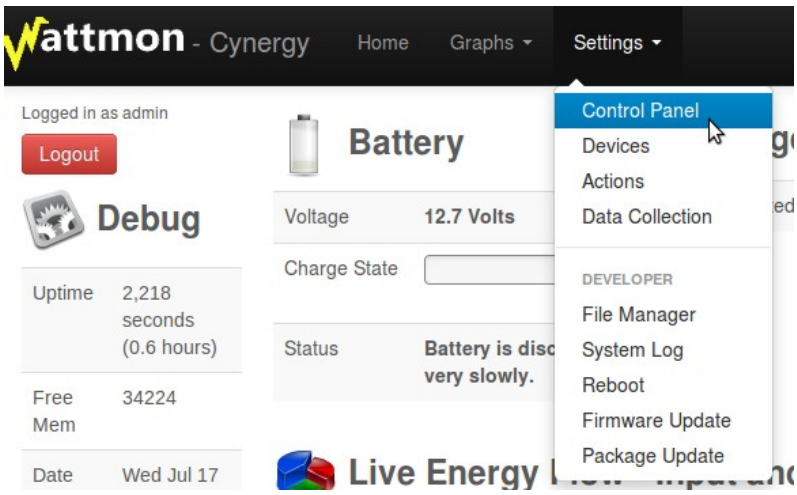


Figure 2.11 Settings Menu

You will see the *Control Panel* window shown below. In all future sections whenever referring to the *Control Panel* we are referring to this page and the buttons on the page.

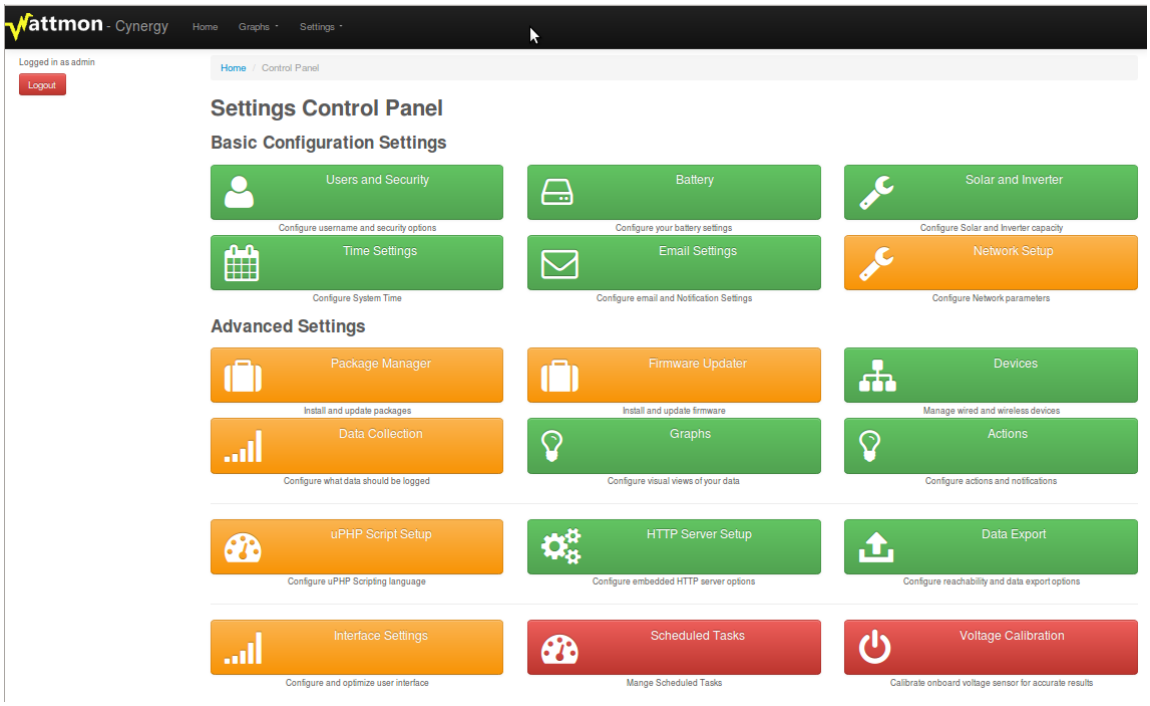


Figure 2.12 Control Panel page of Wattmon

2.2.2 Configuring the Wattmon IP Address

This step explains how to set your network IP address properly to ensure it is in the range of your DSL router. Different routers have different IP ranges. The most common ranges are 192.168.0.x and 192.168.1.x. Look at the IP Address, gateway and netmask you noted down previously before changing your IP Address. In case your router is on 192.168.0.x you will need to verify your settings and ensure the gateway is set properly to 192.168.0.1.

If your DSL modem's gateway is 192.168.1.1 (check the settings you wrote down earlier) then you will need to change all instances of 192.168.0 with 192.168.1 in the screenshot below.

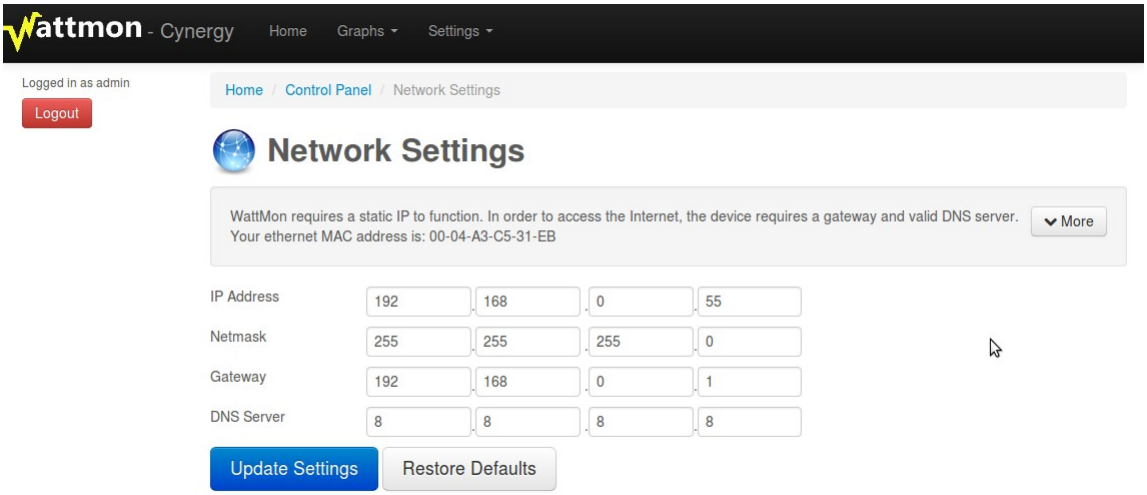


Figure 2.13 Network Settings Page

These are the settings for a 192.168.0 network. If your router address is 192.168.1.1, then change IP address to 192.168.1.55, and your gateway to 192.168.1.1. Click *Update Settings*, and then click *Settings* > *Reboot* to activate the settings.

If you have changed your IP address on your computer in a previous step to access the device, go back to that part of the tutorial and restore the original settings. Make sure you can ping the wattmon device on 192.168.1.55 or the new IP you assigned it before continuing.

From now on, whenever we refer to the Wattmon IP address, even if 192.168.0.55 is mentioned, replace this with the new IP you assigned it such as 192.168.1.55.

2.3 Configuring Wattmon

There are several configuration steps that need to be followed to get your Wattmon fully set up.

In order to configure add-on devices such as the current sensor, click *Settings* > *Control Panel* from the main wattmon page, then click *Devices*.

2.3.1 Devices Page

The Devices page lets you view and configure add on devices. The WattmonSolar kit only includes one device, which needs to be configured. If you have multiple devices to connect, plug them in one by one and run the scan command for each device.

> Connecting multiple unconfigured devices and trying to scan them all at the same time will result in errors

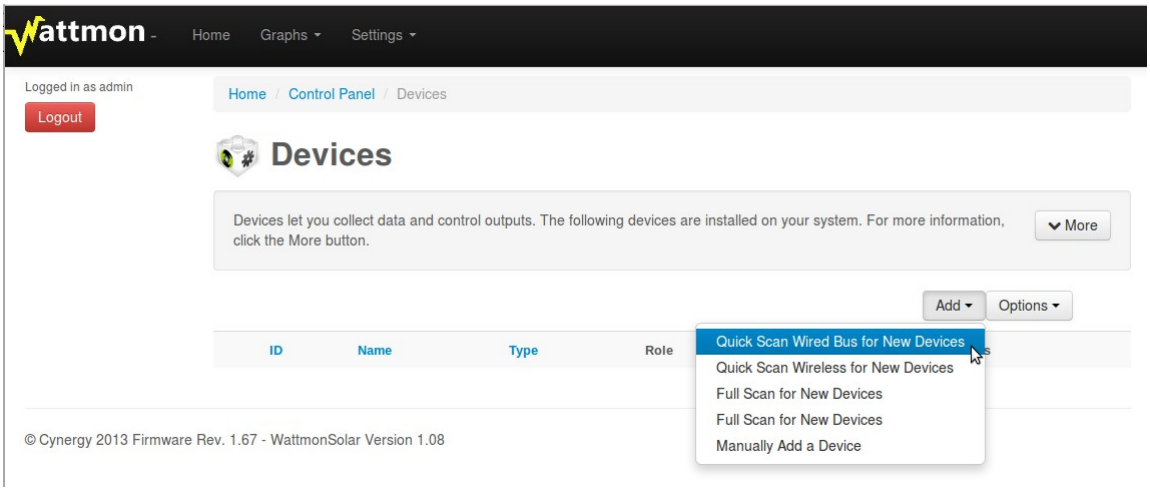


Figure 2.14 Devices tab

Initially the devices list is blank. In order to search for the newly connected current sensor, click the *Add* button and click *Quick Scan Wired Bus for New Devices*.

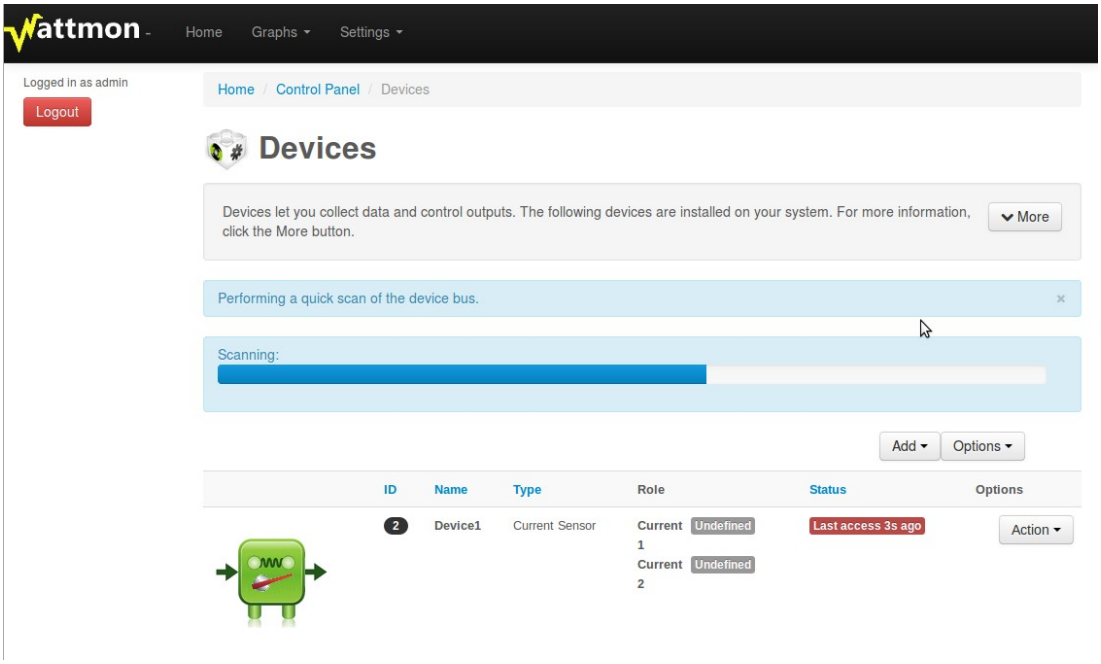


Figure 2.15 Devices tab showing a scan in progress

The device bus will be scanned as shown above, and the current sensor will be installed with ID 2 as shown. The device needs to be assigned roles so Wattmon knows how to treat the inputs.

Once the scan has completed, click the *Action* button to the right of the device, and click *Configure*.

> If the device does not appear, make sure the cable between the Wattmon device plug and the C752 sensor is properly connected and that there is a light on at the back of the C752 device. Then repeat the scan until the device appears in the list.

2.3.2 Configure Device Page

The *Configure Device* page is shown below.

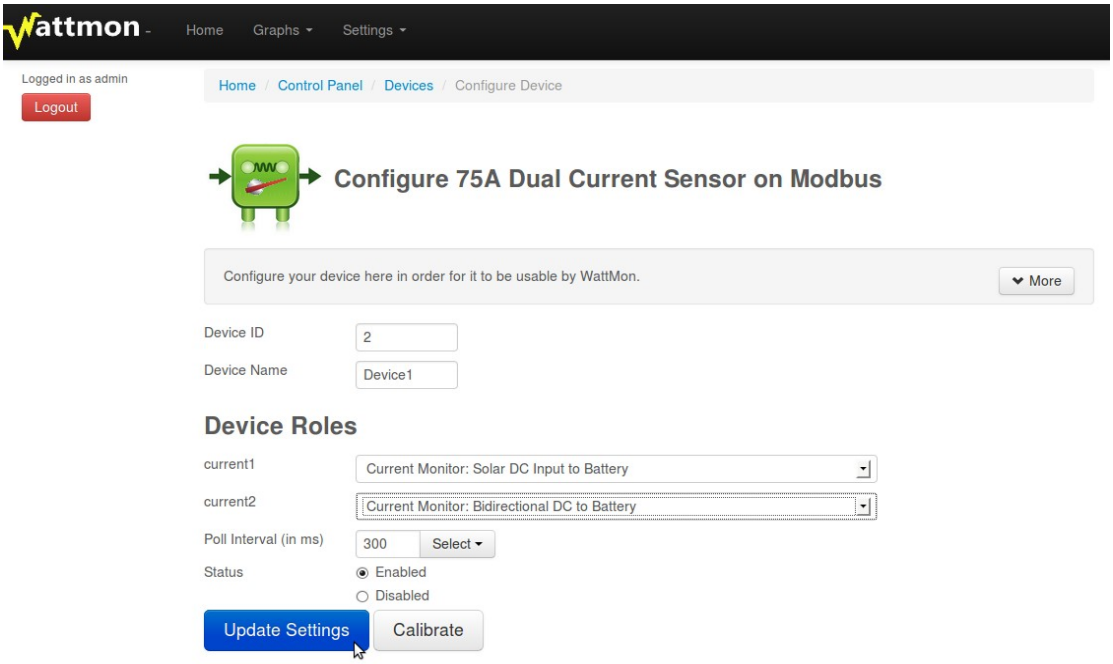


Figure 2.16 Device Configuration page

The *current1* role is associated with the left current sensor, used to measure solar input. In the drop down, select *Current Monitor: Solar DC Input to Battery*.

In the *current2* drop down, select *Current Monitor: Bidirectiona DC to Battery*. Finally, click *Update Settings* to save.

For the settings to take effect, click *Settings* > *Reboot* from the menu, and log in again.

> In some older packages, you may not see options in the drop down list for measuring wind. If you are connecting a sensor that monitors wind, update your wattmon to the latest package which contains options for wind monitoring as well. Updating your device can be done by going to Settings > Package Manager. Look for the latest package version and click Install. Wait for the operation to complete, after which the device will reboot. You can see the new version number at the bottom of every page.

2.3.3 Configure Battery Size

Open the *battery* page by clicking the *Battery* button in the *Control Panel*.

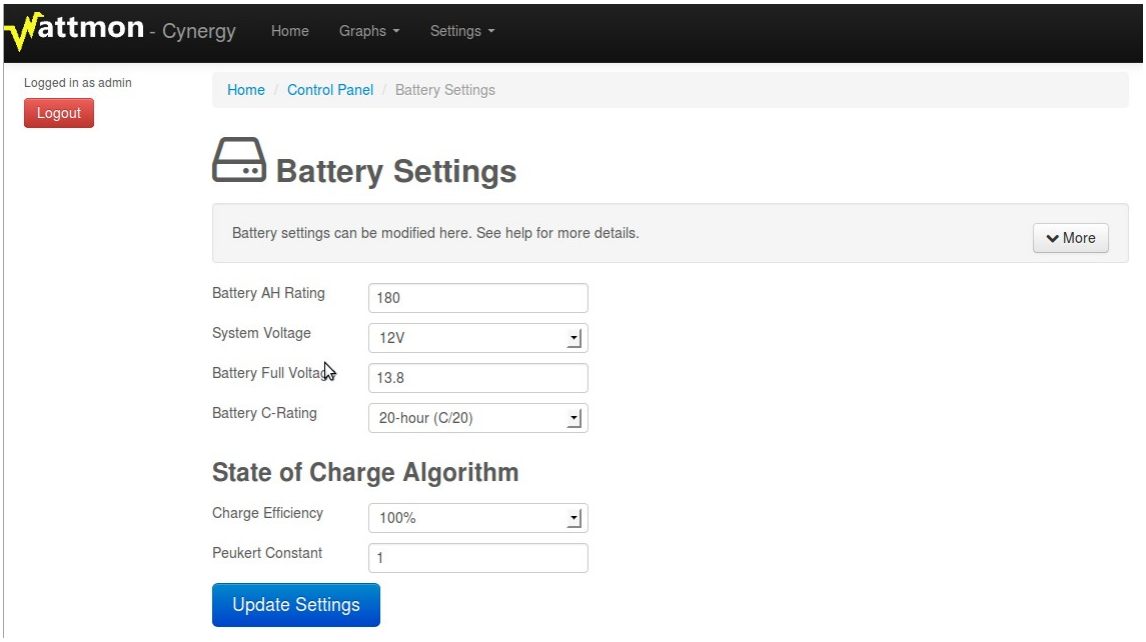


Figure 2.17 Battery settings page

The following describes the various fields:

- Enter the *AH rating* of your battery bank in the first field.
- Choose the *System voltage* from the drop down list (12V, 24, and 48V).
- 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.

The *Battery C-Rating field* is used for the Peukert calculations if that is activated.

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.

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 *Update Settings* to save them. A reboot is required for the settings to take effect, but this can be done once all other settings are configured.

2.3.4 Solar and Inverter Settings

Open the *Solar and Inverter* page by clicking the corresponding button in the *Control Panel*.

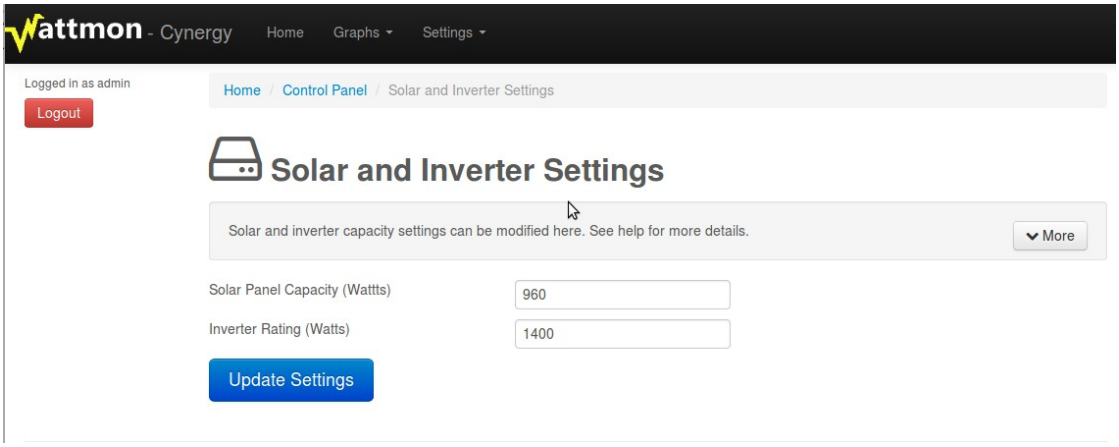


Figure 2.18 Solar and Inverter Settings page

These values are used purely for the percentage bars on the home page in order for you to gauge visually your generation and consumption. Enter the solar panel rating in watts, and the inverter rating in watts, and click *Update Settings* to save.

2.3.5 User Settings and Device Name

This page controls access to your Wattmon device, and it is important to set this up if your device is accessible over the Internet. Click *Users and Security* in the *Control Panel*.

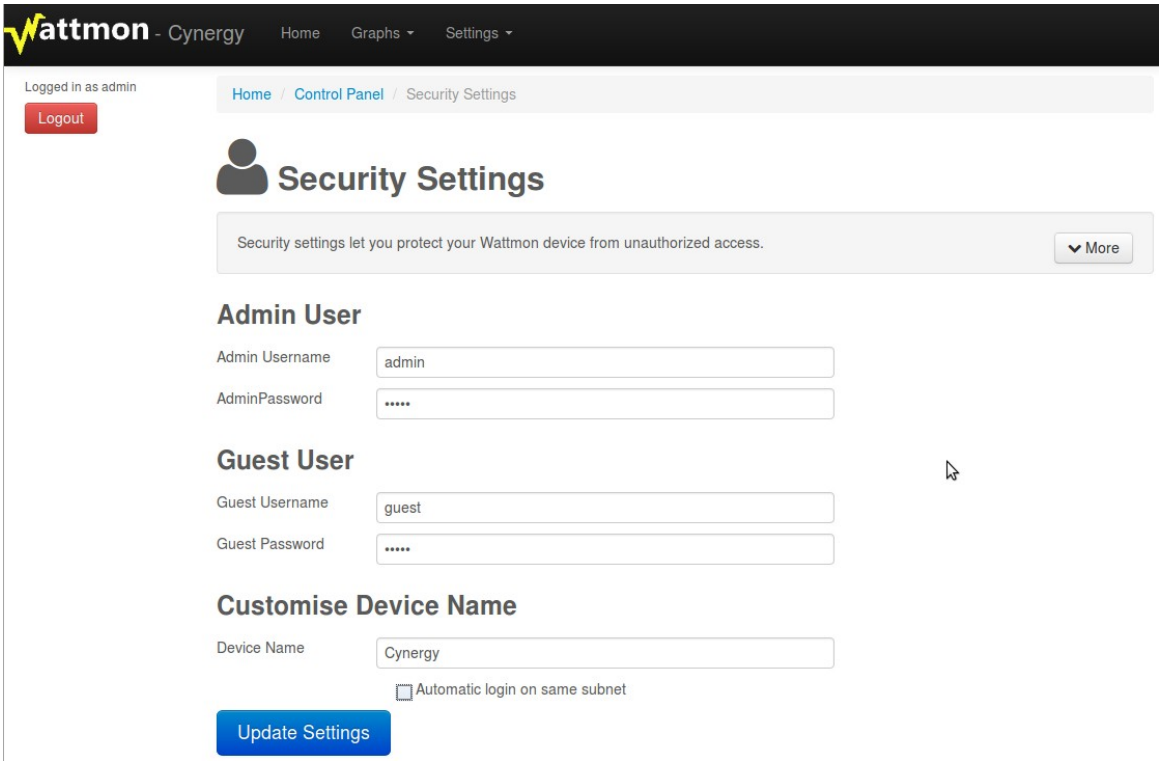


Figure 2.19 Security Settings page

You can enter a different username and password to access the wattmon if required.

Change the *Device Name* to your desired name – this is shown in the title bar of all pages. These settings will only be active after a reboot.

2.3.5 Set System Time

In order to set up your system time, open the *Time and Date Settings* page by clicking the *Time Settings* button in the control panel.

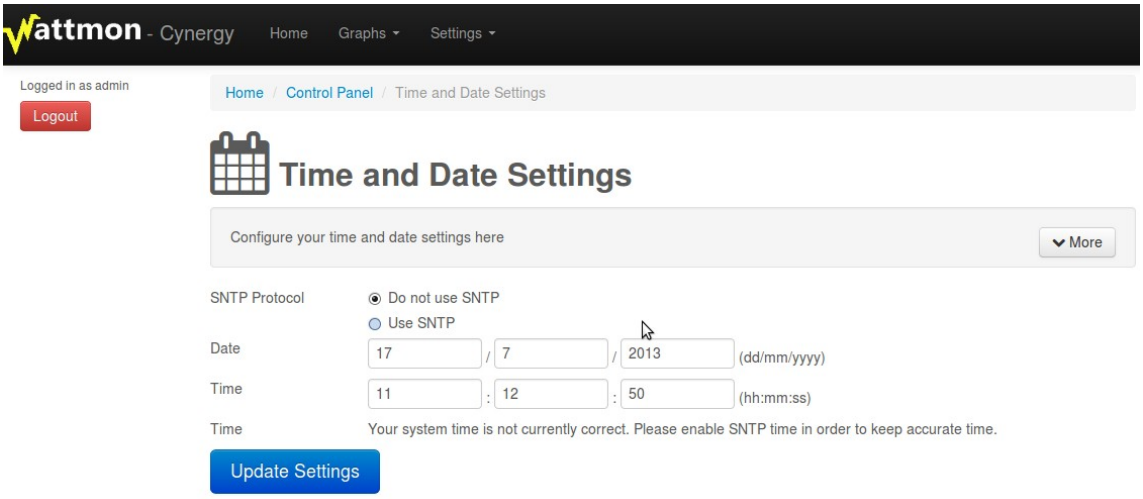


Figure 2.20 System Time page

Enter the date and time manually, or click Use SNTP and choose your time zone.

> If you are setting this up to work over a slow link, it is suggested not use SNTP as this will make frequent updates incurring higher traffic.

2.3.6 Interface Settings for 2G and 3G Links

If you are planning on accessing wattmon via a remote link over 2G or 3G, open the interface settings via the *Interface Settings* button in the *Control Panel*.

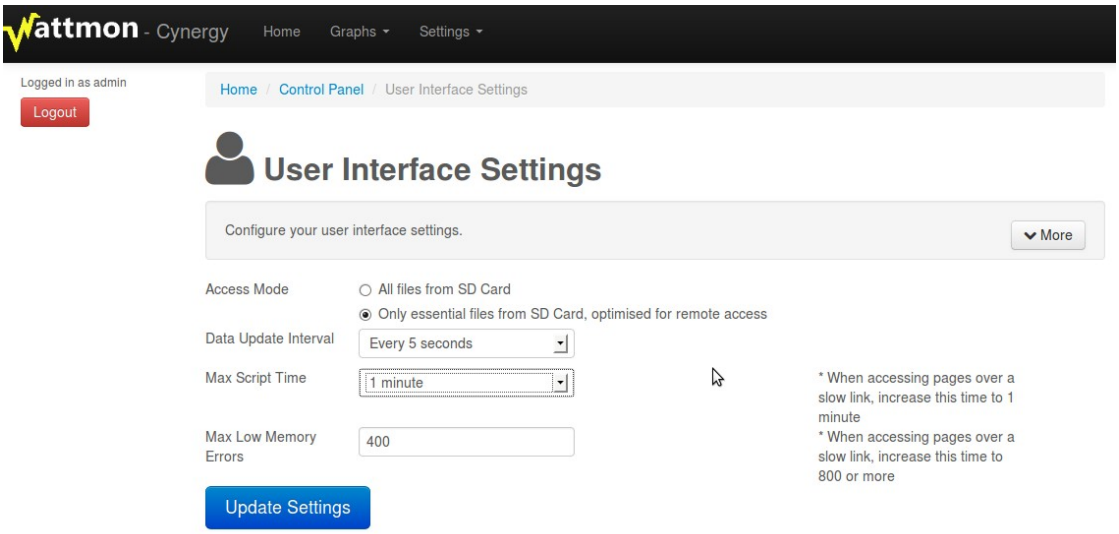


Figure 2.21 Interface Settings Page

In *Access Mode*, choose *Only essential files from SD Card*, optimised for remote access. This will speed up access over slow links, taking all libraries from www.wattmon.com instead of the device itself.

In the *Data Update Interval*, select *5 seconds*, *10 seconds*, or *30 seconds* depending on how frequently you want the data to update on the home page.

Set the *Max Script Time* to 1 minute, to ensure pages load properly without timing out over a slow link.

You can leave the *Max Low Memory Errors* at 400.

Click *Update Settings* and reboot for changes to take effect.

> If you are only planning on accessing the Wattmon device locally and do not have an always-on Internet connection, make sure Access Mode is set to All files from SD Card otherwise you will not be able to access your Wattmon correctly when the Internet is not present.

2.4 Setting Up Remote Access

There are several steps involved with making your Wattmon device accessible from the Internet. Every Wattmon device requires a unique key to be able to update its IP Address on the Wattmon.com site, which you will use to reach it by. This key can be obtained from wattmon.com, and entered into your local device. Finally, you will need to set up port forwarding on your router to make the wattmon reachable.

2.4.1 Registering with Wattmon.com

First, register yourself on http://www.wattmon.com.

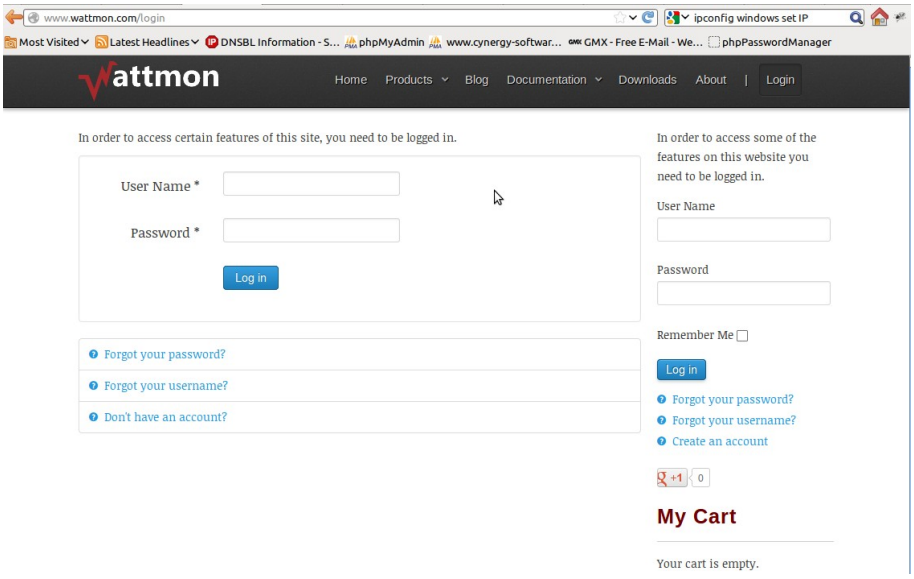


Figure 2.22 Wattmon.com registration page

Once you have signed up, Go to My Account > Live Access

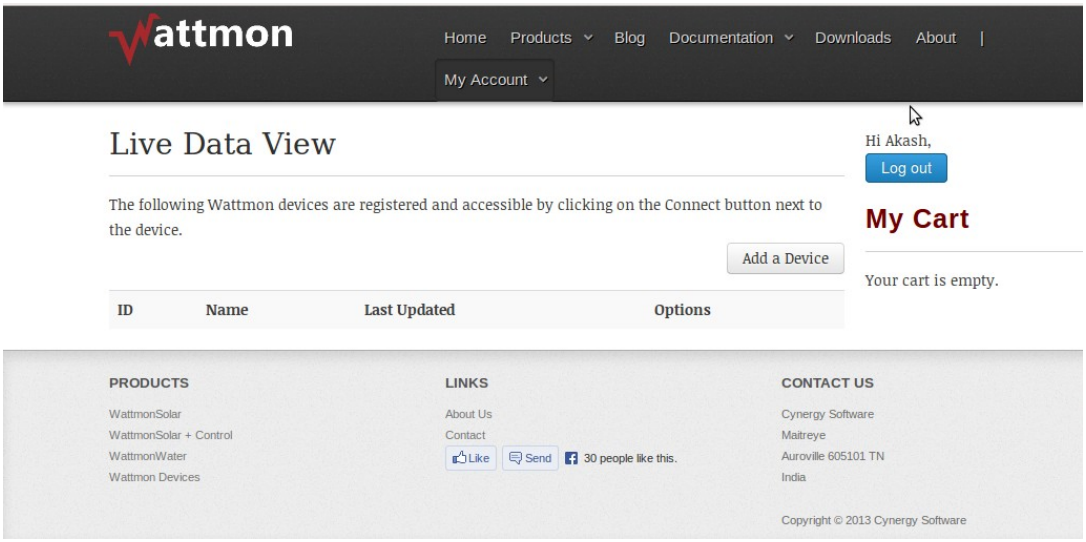


Figure 2.23 Wattmon.com Live Access page

2.4.2 Adding a Device

To add a device, click the *Add a Device* button in the Live Data view page.

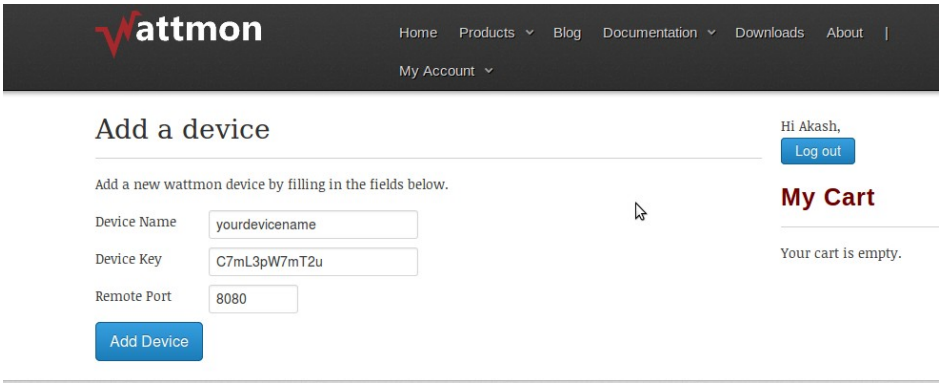


Figure 2.24 Add device Page on wattmon.com

In the *Device Name*, put in the name of your device or location. Do not use any spaces or special characters.

The *Device Key* is generated randomly. This needs to be copied to the clipboard or written down as this will be used in the next step to identify the wattmon device with the server.

The *Remote Port* can be set to whatever you require, by default it is 8080. This will need to be configured in the Port Forwarding section later on.

Click *Add Device* to save. Then click *return to list*.

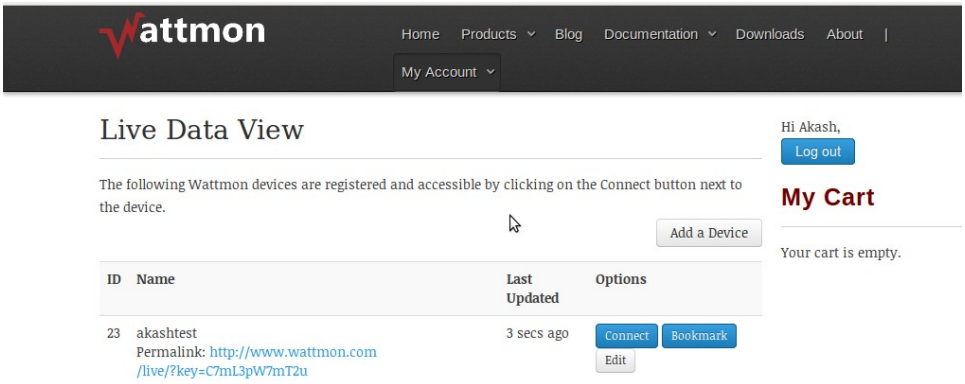


Figure 2.25 Live Data List with new device added

The *Live Data View* list now shows your device name, and the last update time. The time will indicate whether or not your wattmon is connected. It automatically updates once every 5 minutes once configured, and if this time shows more than 5 minutes, it could mean connectivity issues.

Once your wattmon has been configured, you will use this page to access your wattmon, by clicking the *Connect* button. Alternatively, you can bookmark the permalink which will take you straight to your device every time without needing to log in to www.wattmon.com. Next, return to your wattmon to complete the next step of the installation.

2.4.3 Wattmon Data Export Settings

From the Wattmon device main page, click *Settings* > *Control Panel* and click *Data Export Settings*.

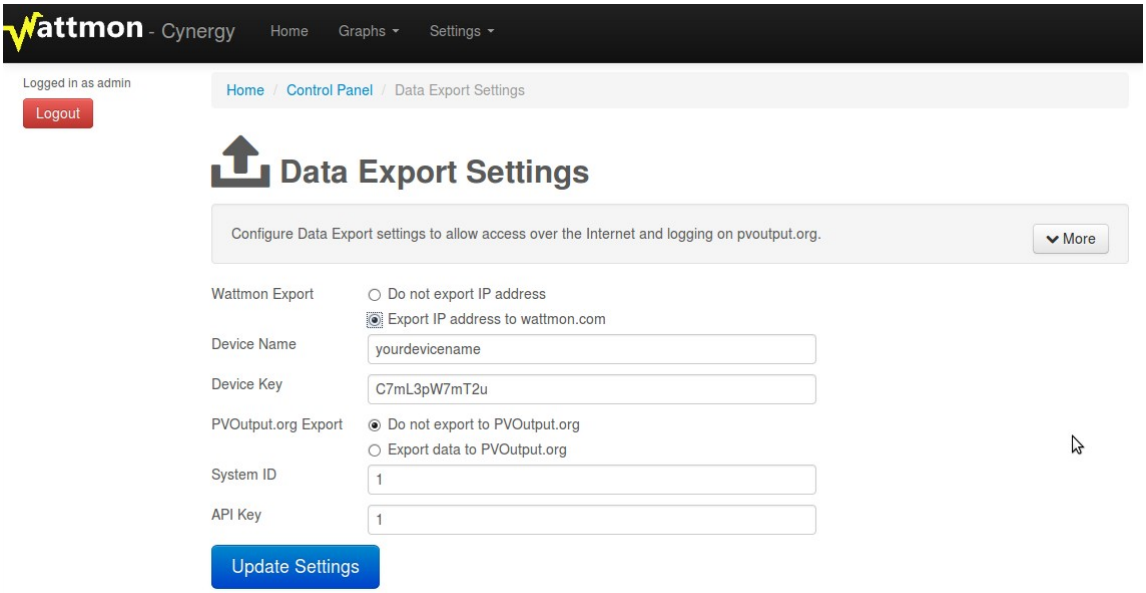


Figure 2.25 Data Export page

Select the *Export IP address to wattmon.com* radio button

In the *Device Name* field, enter a name for the device. Do not put spaces in the name.

Paste the value from www.wattmon.com into the *Device Key* field.

If you are planning on using PVOutput.org to monitor your setup, you can also enter the system ID and API key here.

Click *Update Settings* to save.

Your device will now export its IP address to the wattmon server every 5 minutes. The final step in the process is to enable port forwarding on your router to ensure that requests from the Internet are forwarded to your wattmon device.

2.5 Port Forwarding On Router

Every router is different and there will be multiple tutorials on the net explaining this process in detail. However we will show you how we did it on our router.

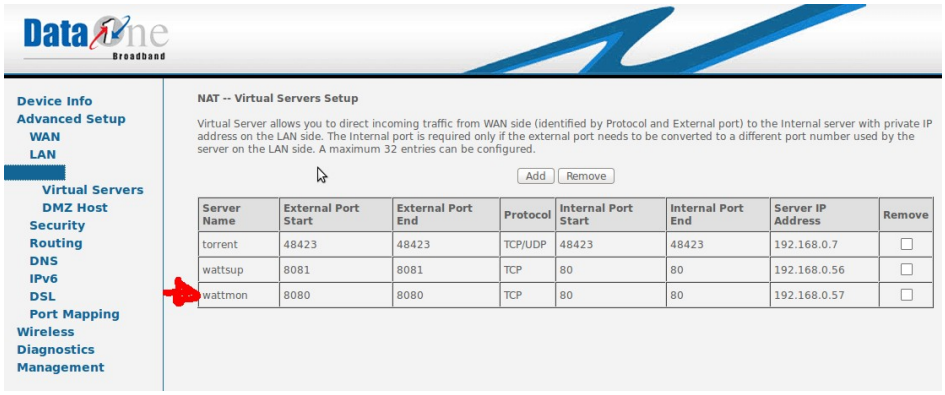


Figure 2.26 Port Forwarding overview in NAT page of router

This setting is usually found under *Advanced Setup* - > *NAT* (short for Network Address Translation) > *Virtual Servers*.

In the above example we are forwarding port 8080 to the local port 80 on 192.168.0.57 (our wattmon IP address).

To configure yours, click *Add*.

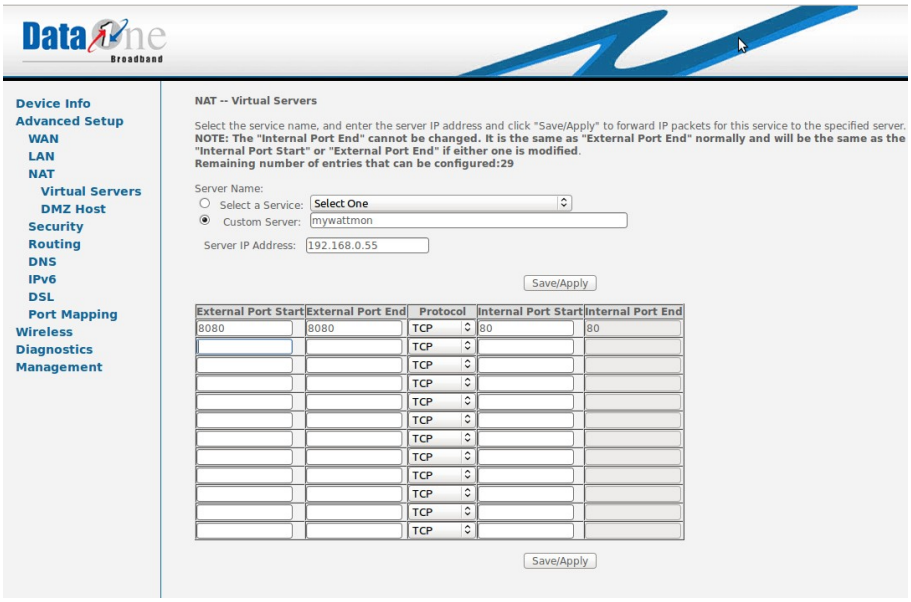


Figure 2.27 Add a forwarding port page

Choose *Custom Server*, enter your device name, and in the *Server IP Address* enter your local wattmon IP (192.168.0.55). Next, in the *External Port Start*, enter 8080. In the *External Port End*, enter 8080 or 8081 (some routers won't allow the same number). In the *Internal Port Start*, enter 80. Click *Save/Apply*, and your setup is complete.

Chapter 3

Viewing Data

Once your wattmon is configured properly, your home page will show you meaningful data.

3.1 Home Page

This screenshot is taken from a 24V setup with 2.5kW of panels and a 1.4 kVA inverter.

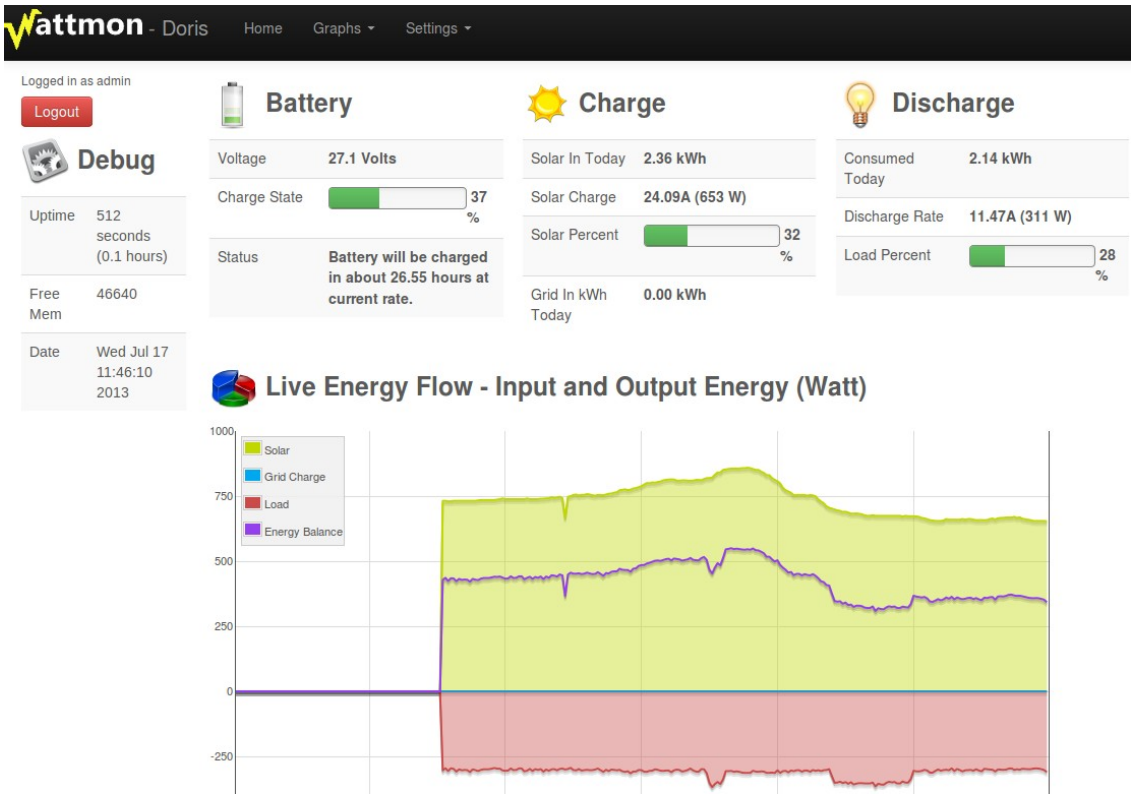


Figure 3.1 Home page of wattmon showing live data

The column at the left shown debug information such as system time and the uptime of the device.

The Battery column shows the battery voltage, the state of charge in percentage as calculated by wattmon, and a status text indicating when the battery will be full or empty.

The Charge column shows all inputs from solar, wind or the grid depending on how many current sensors are installed. The counters are reset at midnight every day. The Solar In Today shows the kWh generated, and the Solar Charge column shows the

current charge amps and watts. The Solar Percent shows the amount in relation to the maximum capacity of the panels.

The Discharge column shows the kWh consumed today, along with the Discharge rate in amps and watts. The Load percent graph shows the load on the inverter in relation to maximum inverter rating.

The live energy flow graph updates once a second by default (can be set in the Interface settings) and show an overview of energy flow over the last 5 minutes.

3.2 Historical Data

Wattmon stores data in a CSV file once a minute and can generate graphs based on this data.

Click *Graphs* > *Energy In an Out In Watts* to bring up a historical view of the watts generated and consumed.

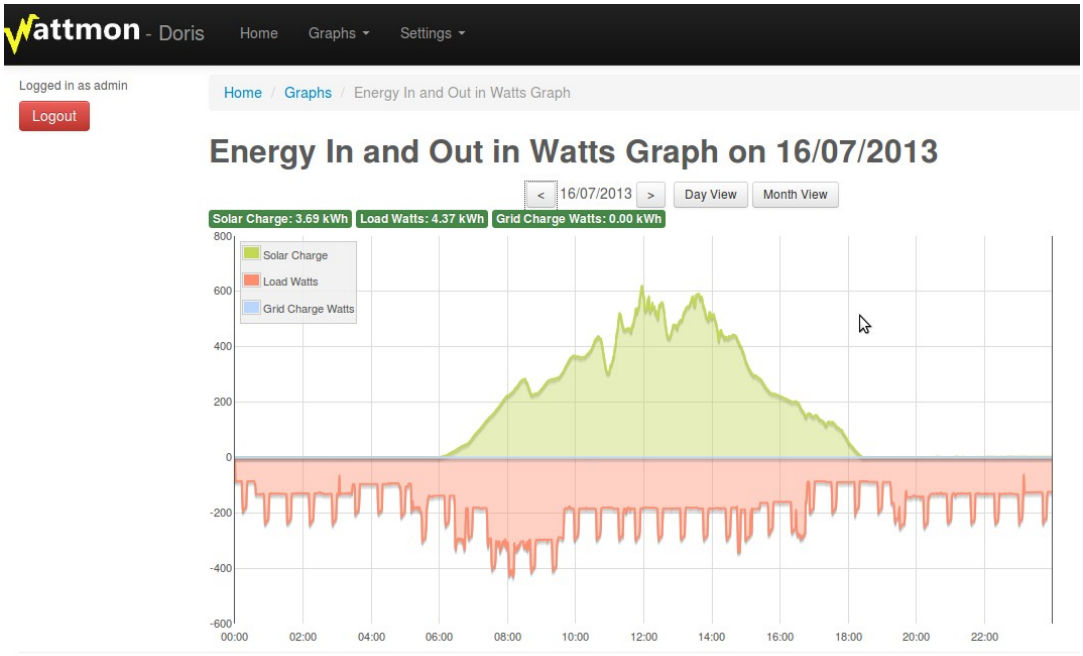


Figure 3.2 Energy in and out graph

This graph shows the overview per day. On the 16th, 3.69 kWh were generated, and 4.37kWh were consumed, indicating that it was probably a cloudy day. A month overview button shows a view per month.

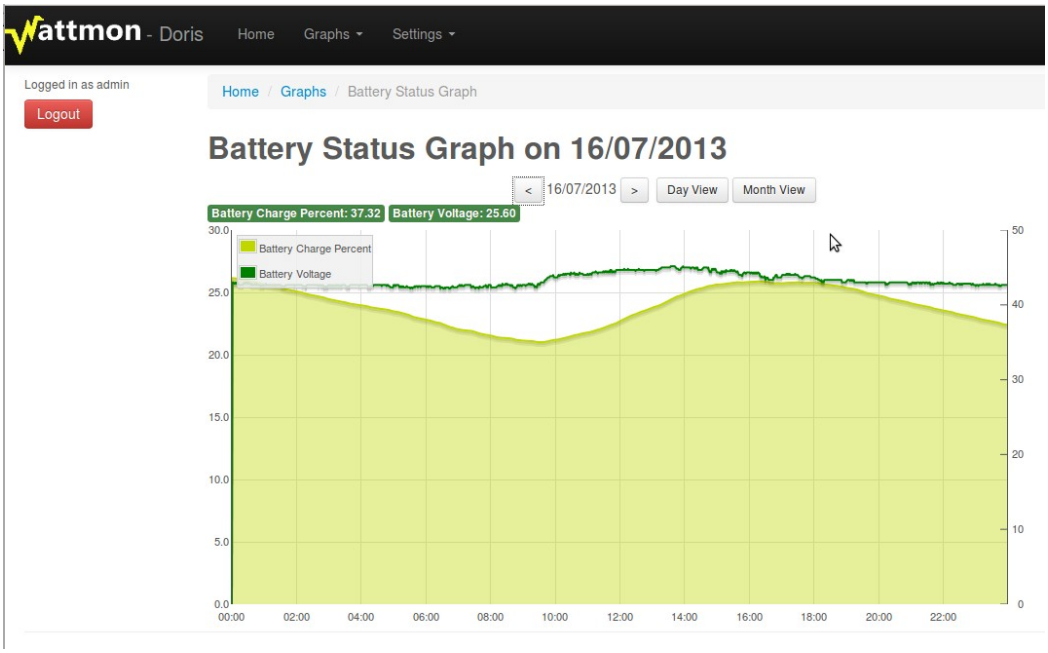


Figure 3.3 Battery Status graph

The *Battery Graph* shows the battery status over time and can be used to assess the overall health of the system.