Wattmon

A Product of CYNERGY

QUICK START GUIDE

for WattmonOS v3.xx

Index

Welcome to Wattmon!

The Wattmon hardware and software platform is the most flexible in the industry, which can be used for monitoring Grid-Tie, Hybrid and Off-Grid setups, Solar Water Pumping and Building Loads, featuring a manufacturer-agnostic Zero Export and Diesel Generator Protection solution compatible with the leading inverter brands.

This guide takes you through the Wattmon data logger's in-built web server interface and provides you with the basic know-how to configure it for your specific requirement. For more information, visit the **Wattmon Documentation Wiki**.

(Note: WattmonMEGA and WattmonPRO support RS-485 Modbus RTU/TCP and RS-232 Serial interfaces and feature several I/Os. The WattmonMINI supports only RS-485 Modbus RTU/TCP.)

Technical Specifications

Power Requirement

WattmonMEGA / WattmonPRO: 6 to 60V DC

WattmonMINI: 8-24V DC / 220V AC (Consumption: 2W without accessory devices)

Connectivity

LAN: Built-in LAN port for direct connection to computer or router

USB: 2G/3G/4G via USB Stick

Body

WattmonMEGA / WattmonPRO

Dimensions: 130 x 70 x 75mm

Weight: 200g

WattmonMINI

Dimensions: 112 x 40 x 90mm

Weight: 150g

Inputs and Output Ports (Applies to WattmonMEGA & WattmonPRO)

Analog Inputs: Three analog input channels with a 10-bit ADC

1-Wire: Dallas 1-Wire bus for DS18B20 Temperature Sensors

RS-232: Serial port to interface with various third-party devices

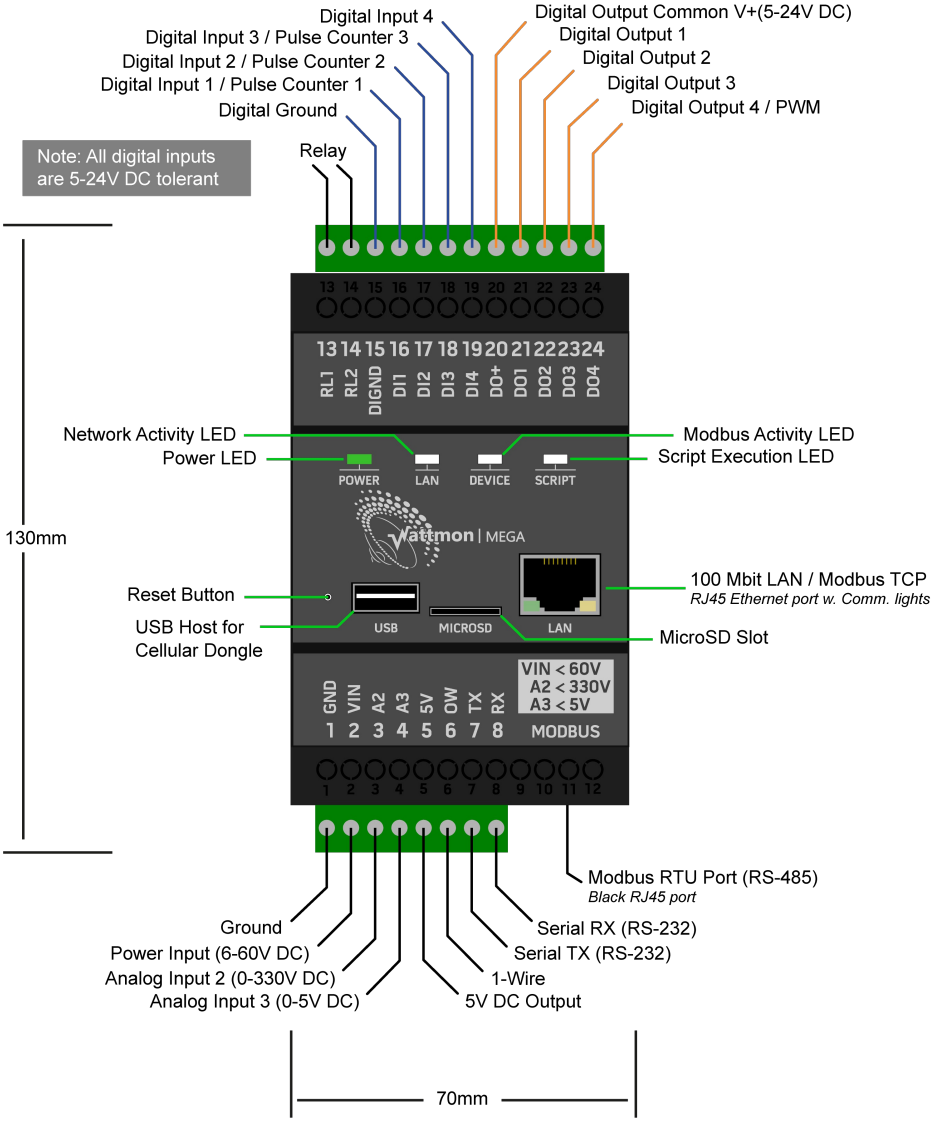
RS-485: Modbus RTU/TCP to interface with various Wattmon and third-party devices

On-board Relay: Latching relay to switch DC or AC loads of upto 5A

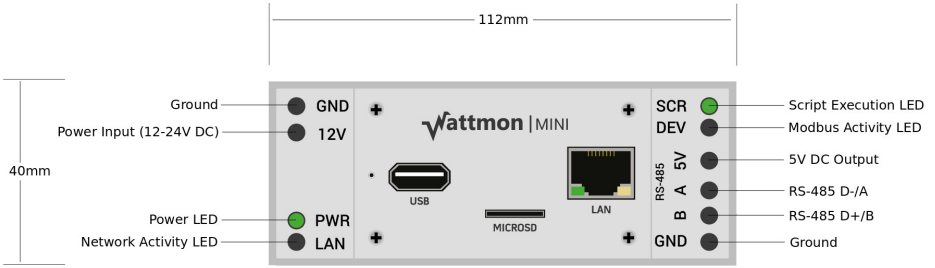
Digital Inputs: Opto-Isolated, handle between 4 to 24V DC

Digital Outputs: Four digital input channels can handle upto 500mA per pin

Pinout Diagram – WattmonMEGA (common to WattmonPRO)



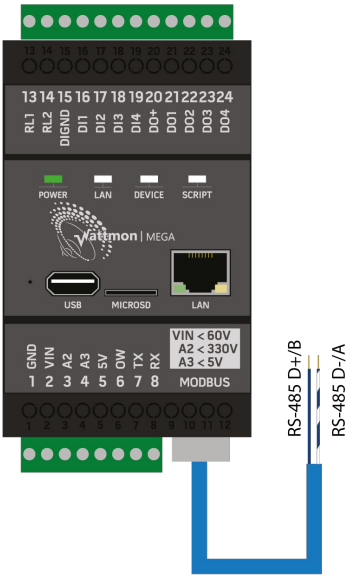
Pinout Diagram – WattmonMINI



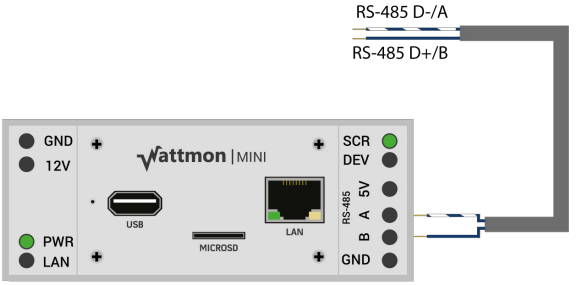
Connection Diagrams

Connections to your Wattmon can differ based on the device(s) they are connected to. Third party Modbus devices such as inverters and energy meters connect to a Wattmon with either a custom Modbus cable which features a RJ45 jack on one end, or a two-core cable. All Wattmons are supplied with a compatible one-metre long Modbus cable.

RS-485 Modbus RTU (WattmonMEGA/WattmonPRO)



RS-485 Modbus RTU (WattmonMINI)



The Wattmon modules connect to the WattmonMEGA or WattmonPRO using a standard CAT5e cable, but then feature their own connections to batteries or I/Os. The WattmonMEGA and WattmonPRO can also monitor DC voltages natively.

Battery Monitoring (WattmonMEGA/WattmonPRO)

i. A10 -

ii. C252h/C1002s -

iii. Battery Bank (<60V DC) - *http://wattmon.com/images/wattmonpro_c752.png*

iv. Battery Bank <330V DC) - *http://wattmon.com/images/wattmonpro_c752hv.png*

The WattmonMEGA and WattmonPRO can also interface with Serial devices over RS-232, as well as with weather sensors, both analog and digital, which connect to the various I/Os on the Wattmons.

RS-232 & Analog/Digital I/Os (WattmonMEGA/WattmonPRO)

i. RS-232 Serial Interface - *http://wattmon.com/images/wattmonpro_rs232.png*

ii. 1-Wire Temperature - *http://wattmon.com/images/wattmonpro_temperature.png*

iii. Pyranometer (Analog Sensors) - *http://wattmon.com/images/wattmonpro_pyra.png*

iv. Anemometer (Digital Sensors) -

Connecting to your Device

Switch on your Wattmon by connecting it to the adapter supplied with the device. Once powered on, connect your device via an Ethernet cable to your computer. The device comes preconfigured to use a static IP address of *192.168.0.55*.

If the IP address range of your computer is the same as that of the Wattmon, you can access the Wattmon by opening a web browser and typing in *192.168.0.55* in the address bar. To determine your IP address, run *cmd.exe* and type in ***ipconfig*** and press *Enter*. When using Microsoft Windows, if the IP address is in a different range, you will need to temporarily change your IP by following these steps :

1. Open *Network and Sharing Centre*, and click on *Local Area Connection.*
2. In the *Local Area Connection Status* window, click on *Properties.*
3. In the *Properties* window, select *Internet Protocol Version 4 (TCP/Ipv4)* and click on *Properties.*
4. Make a note of the information displayed so you can restore this later. (If you do not reconfigure your connection after you setup the Wattmon device, your Internet connection may not work.)
5. Enter the following values into their respective places, and save.

   IP address : 192.168.0.10

   Netmask : 255.255.255.0

   Default Gateway : 192.168.0.1
6. Open your browser and type in *192.168.0.55* and press enter. You should see the *Welcome to Wattmon* page.
7. After entering the network settings of your choice, as shown in **Basic Configuration Settings – Network Setup**, save the changes and reboot. If the settings are successfully applied, you will not be able to reach the login screen of your Wattmon.
8. Return your computer to the original network settings by following steps 1-4.
9. Open a browser and type in the new IP Address assigned by you to your Wattmon and press *Enter*. If you see the *Welcome to Wattmon* page, the network setup for your device is completed.

In order to reset the IP address on your Wattmon device to the default, press and hold the reset button (located to the left of the USB port - you will need a pin to access it) for about 5 seconds until the *Script* light stops blinking, and re-power your device.

Understanding the Wattmon Operating System

The Wattmon devices run on our proprietary operating system, called the WattmonOS, which is written in C and uses the FreeRTOS task scheduler. It features an interpreter that can process uPHP, our custom scripting language based on PHP. The WattmonOS is best described into two parts – the firmware layer and the application layer. The firmware layer is embedded on the Wattmon flash memory, whereas the application layer is stored on a microSD card. The firmware reads configuration files at power-up off the microSD card and initialises the system accordingly.

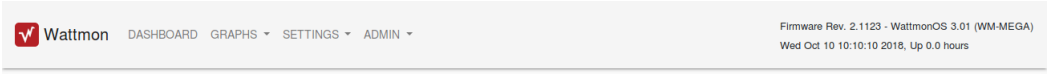
Do note, while the 'OS' version can be updated by replacing certain files on the microSD card externally, the firmware update is always performed on the Wattmon device. For more details on the procedure, go to **Advanced Settings** or **FAQs**.

For those of you familiar with the WattmonOS v2.xx interface, do note that OS v3.00 brings significant changes to the overall functionality of the device, and adds several new features, which are discussed later. So we do recommend that you look through this new guide, as it sheds light on most of the updates.

WattmonOS Interface

Upon logging into your Wattmon, you will reach the Dashboard. The GUI on the Dashboard will vary based on the monitoring configuration. However, irrespective of configuration, the menu bar is present at the top of every page, as is the control bar, which is found on all pages except the dashboard.

The menu bar displays the Wattmon logo on the left, followed by four options – *DASHBOARD*, *GRAPHS*, *SETTINGS*, and *ADMIN*. On the right, the menu bar displays the firmware version as well as the OS version of the Wattmon. The device type is mentioned in brackets – *WM-MEGA* for WattmonMEGA, *WM-PRO* for WattmonPRO, and *WM-MINI* for WattmonMINI. Below the firmware and OS versions is noted the date and time set on the Wattmon, as well as the time elapsed since the last power-up.

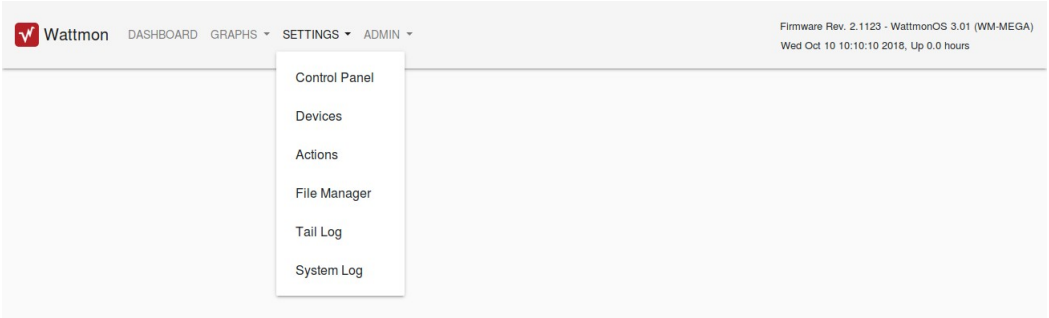


The first of the four options, *DASHBOARD*, returns you from your current page to the main graphical interface of your Wattmon, which consists of various widgets displaying either graphs or variables in an intuitive manner.

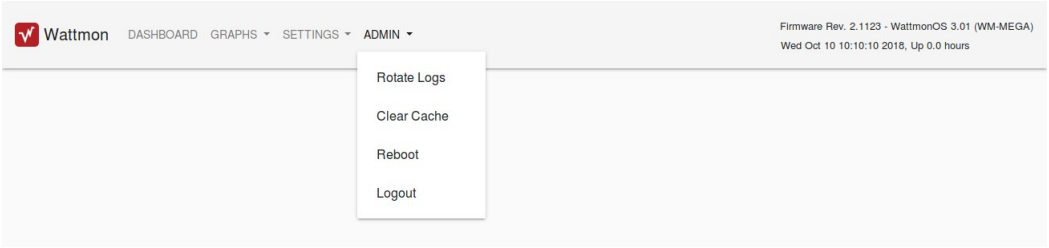
The second option is *GRAPHS*, which reveals a drop-down that leads to dedicated graphs for the data you are monitoring. These graphs can be configured to display the logged variables of your choice.

The third option, *SETTINGS,* is also a drop-down, which consists of *Control Panel*, *Devices*, *Actions*, *File Manager*, *Tail Log* and *System Log*. The *Control Panel* takes you

to the main settings page of the Wattmon. *Devices* takes you to the page of the same name, wherein you can add, remove, or configure Wattmon modules or 3rd party devices connected to your Wattmon. *Actions* lets you set custom commands for automated functions or alerts. For more details on how to configure actions on your Wattmon, refer to the more detailed ***Using your Wattmon*** **Guide**. *File Manager* allows you to access the root folder of the microSD card and view/edit all the loaded scripts. *Tail Log* and *System Log* provide a log of runtime functions on the Wattmon, differing in the number of lines displayed; the former displays a portion of the current log, whereas the latter displays the complete current log file.



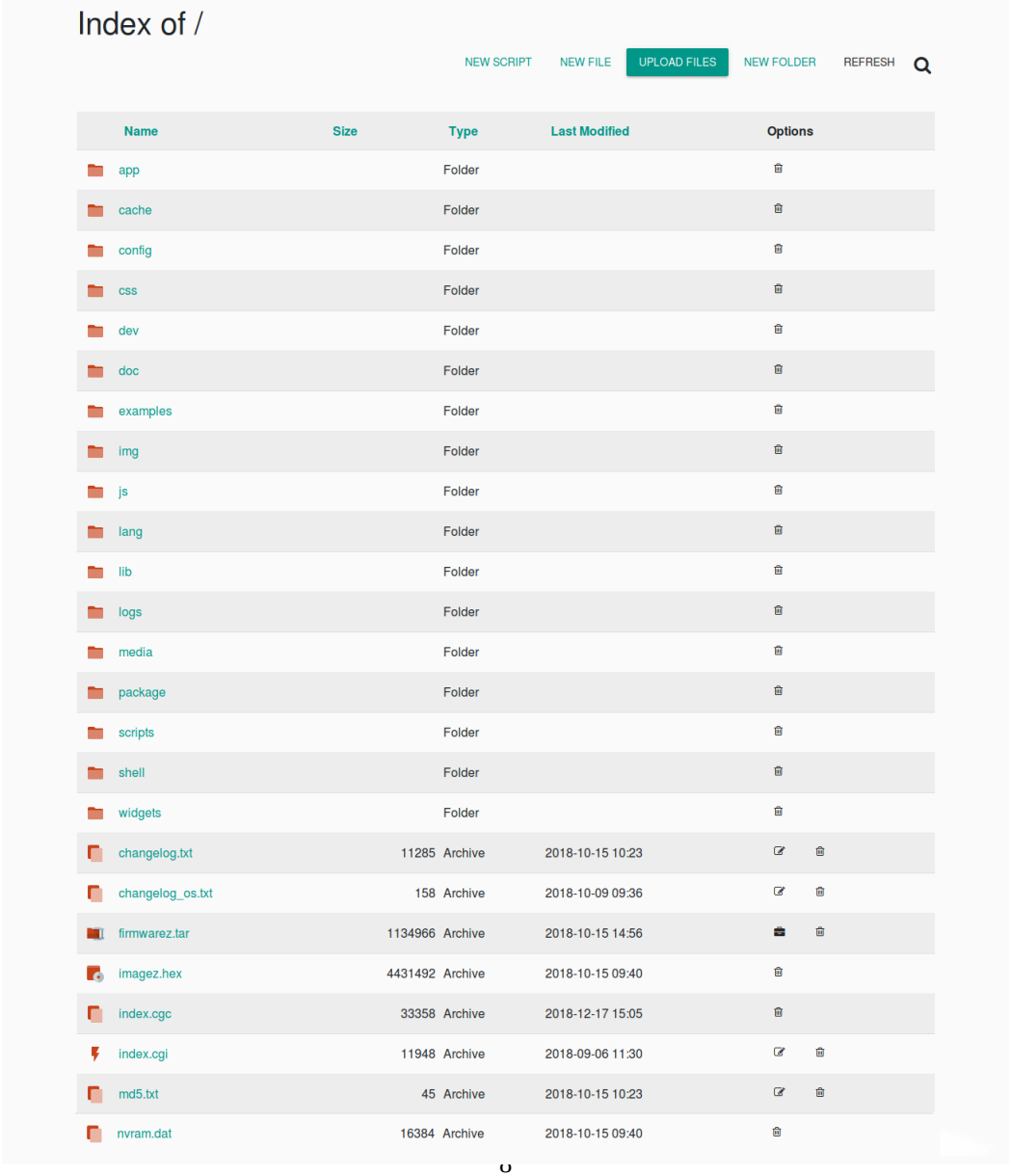
The fourth option is *ADMIN*, a drop-down that is as per the user login name; if the default Admin user of the Wattmon is called wattmon, the option is displayed as *WATTMON*. Upon clicking on the login name, a drop-down menu displays *Rotate Logs*, *Clear Cache*, *Reboot* and *Logout*. *Rotate Logs* replaces the system log to a new file, *Clear Cache* clears the cached scripts and settings on the device, *Reboot* restarts the Wattmon and returns you to the login page, and *Logout* just signs out the current user and returns you to the login page.



The control bar is visible on all of the pages accessed via the menu bar, located a little below the title of a page. The functions on the control bar can vary from page to page. However, it always features a *More* button which displays details for that particular page, and commonly features a *Restore Defaults* and an Apply *Changes* button, which either restore the settings on that page to the WattmonOS default, or save the current settings.

File Manager

The contents of the WattmonOS on the microSD card can be accessed from your Wattmon using the built-in *File Manager*, which is used to upload, download, modify or write configuration files, device drivers or script files locally or remotely, and also to restore backed-up data. It is particularly useful when small updates or customizations are provided by us to you directly, which are not available as an over-the-air update.

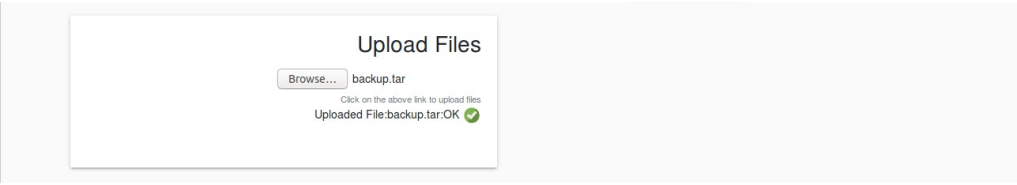


To open the *File Manager*, click on *SETTINGS* in the menu bar present on the top of all pages, and select *File Manager* from the drop-down.

All files are listed with details such as *Name*, *Size*, *Type*, *Last Modified* and *Options*. *Options* consists of four options that can vary between files, which are *Edit*, *Design*, *Uncompress* and *Delete*, each denoted by an icon of a notepad, gears, briefcase and bin respectively, as shown in the image below. Even though the files are easily editable, users have to be very careful to not modify any as that can seriously damage the setup on your Wattmon, corrupting the settings, the functionality, as well as the logged data.

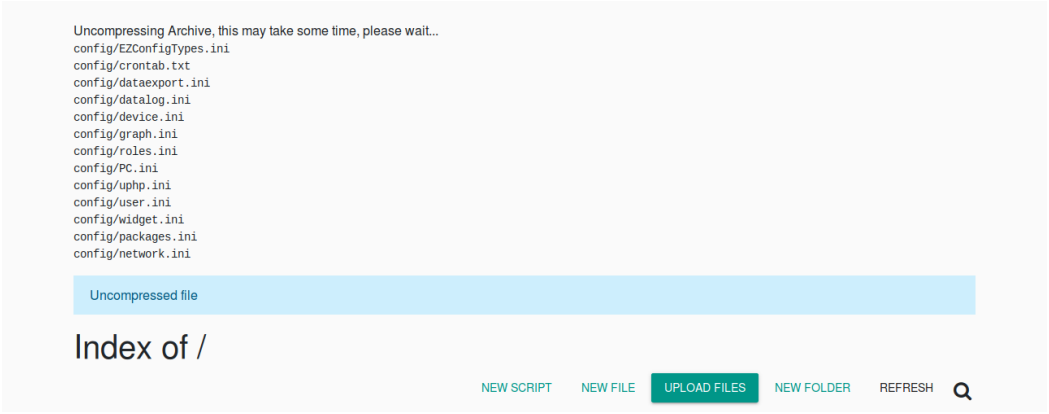
The *File Manager* control bar features four options – *New Script*, *New File*, *Upload Files*, *New Folder*, *Refresh* and *Search*. *New Script* features one of the latest additions to the WattmonOS, ***Blockly***, which is an open-source visual editor that "*represents coding concepts as interlocking blocks, and outputs syntactically correct code in the programming language of your choice.*" *New File* opens the built-in programming editor, where you can write your custom scripts for the Wattmon. *Upload Files* allows you to upload files to the root of the microSD card. *New Folder* creates a new folder in the root of the microSD card. *Refresh* allows you to refresh just the contents of the *File Manager* without having to refresh the entire page in your browser, which allows the directory to load faster without using much bandwidth. And *Search* allows you to search for a particular file located in the microSD card.

To upload a file to your Wattmon's microSD card, first go to the *File Manager*, and then proceed to the folder to wish to upload it do, such as *config* or *scripts*, and click on *Upload Files* on the control bar. If you wish to upload it to the root folder, then and click on *Upload Files* once the *File Manager* page loads. When a little windows containing the *Browse* button appears, select the file(s) you wish to upload but clicking *Browse*, or by dragging and dropping the files onto it. All configuration or back-up files on the WattmonOS are compressed in a *.tar* format, the scripts are in a *.cgi* or *.inc* format and individual config files are usually in a *.ini* format. When the uploading process starts, the file name will display next to the *Browse* button. Once the file has been uploaded successfully, you will be greeted with a message saying *Uploaded file:backup.tar:OK*, where *backup.tar* will be the file you uploaded.



To extract the uploaded file, in this case *config.tar*, wait for it to show in the File Manager list, or *Refresh* the page, then click on the *Uncompress* icon next to it, and wait for the

extraction to complete. While extracting, the *File Manager* will display all the files being extracted at the top of the page, and at the end of extraction process will give a confirmation message stating *Uncompressed file*.



Tail Logs and System Logs

The *Tail Log* and *System Log* contain a log of all the potentially relevant information from the runtime functions of the Wattmon, specifically the scripts running on it and any errors or warning. Do note that the *System Logs* only display the Wattmon's error codes, and not those of the devices interfaced with it. Log files are located in the */logs/* folder.

The *System Log* file is rotated automatically to a new file every midnight at 00:00:00, to make it easier to manage each day worth of logs. The active *System Log* is always called *log.txt*, while historic *System Log* files have the format *logYYYYMMDD.txt* or *logYYYYMMDD-X.txt* if multiple log rotations have been initiated within a particular day.

The *Tail Log* displays only the last ten thousand characters in the log file, making it the quickest to load, and the easiest to look through when searching for recent errors while debugging. In order to view more logs older than the last 10000 characters, you can modify the address link in your browser by adding *?size=10000&page1* to it. For example, if your browser address bar displays *192.168.0.55/scripts/taillog.cgi* when you are on the Tail Log page, change the address to *192.168.0.55/scripts/taillog.cgi?size=10000&page1*. In order to view the 10000 characters before the second last batch of 10000, or those even before that, the end of the link, *page1*, can be modified to say *page2*, *page3* and so and on.

Each entry in a log file contains 1 log message, starting with a human-readable date and time followed by the alert level (Error, Warning) in most cases.

Detecting Reboots

There are several reasons why a Wattmon may reboot: Physical power cycle, software initiated restart, watchdog timeout, or access violation. In order to determine the cause, search through the log for the following lines:

```
Wed Mar 14 10:36:00 2018: Warning: RCON=8000040 (or RCON=40 on PRO)
Wed Mar 14 10:36:00 2018: Warning: Software initiated reset
Wed Mar 14 10:36:00 2018: System booted
```

The first line gives you the RCON register (in the chip) value and the second line gives the human-readable interpretation of that value. In the above example the user most likely pressed the reset button in the WattmonOS web interface.

```
Wed Mar 14 10:40:03 2018: Warning: RCON=C8000003 (or RCON=3 on PRO)
Wed Mar 14 10:40:03 2018: Warning: Normal power up
Wed Mar 14 10:40:03 2018: System booted
```

In the above example, power was physically removed and restored to the Wattmon such as what would be typical with a power cut.

```
Fri Mar 09 10:57:59 2018: Warning: RCON=C8000010 (or RCON=10 on PRO)
Fri Mar 09 10:57:59 2018: Warning: Reset after watchdog timeout
Fri Mar 09 10:57:59 2018: System booted
```

In the above example, a code error or memory corruption caused the chip to get stuck in a loop forcing a restart. A firmware update with patch for the issue may be required if you see this regularly.

When a software exception occurs, usually the address of the issue is also included in the log file for debugging purposes as with the following example:

```
Fri Mar 09 11:01:19 2018: Exception at 9D079F68
Fri Mar 09 11:01:19 2018: bus error (load/store)
Fri Mar 09 11:01:20 2018: Warning: RCON=40
Fri Mar 09 11:01:20 2018: Warning: Software initiated reset
```

Establishing Connectivity

The Wattmon connects to the internet through both LAN and USB dongles. In the *System Log*, preference is given to a USB dongle. Depending on the log level you will see more or less messages pertaining to connection status, especially while the dongle is connecting. Setting the log level to *Verbose* will result in most PPP connection messages to be logged, allowing for more detailed debugging.

A typical connection for a 3G/4G dongle would appear as follows. See comments inline:

```
Sat Mar 10 16:11:49 2018: Notice: Init PPP module
Sat Mar 10 16:12:01 2018: Notice: PPP connecting
Sat Mar 10 16:12:11 2018: Notice: ppp: Error in connect - memFree=15904
Sat Mar 10 16:12:11 2018: Notice: ppp: [out] LCP REQ
```

^ This initiates the LCP protocol. If this line is present, the dongle is properly recognized and the USB CDC channel is configured.

```
Sat Mar 10 16:12:11 2018: Notice: ppp: [in] LCP REQ
Sat Mar 10 16:12:11 2018: Notice: Opt 8=7 2
Sat Mar 10 16:12:11 2018: Notice: Opt 7=2 6
Sat Mar 10 16:12:11 2018: Notice: Opt 2=0 0
Sat Mar 10 16:12:11 2018: Notice: Opt 1=5 DC
Sat Mar 10 16:12:11 2018: Notice: Opt 5=0 0
```

```
Sat Mar 10 16:12:11 2018: Notice: Opt 3=C2 23
Sat Mar 10 16:12:11 2018: Notice: BAD 1=5 DC
Sat Mar 10 16:12:11 2018: Notice: BAD 5=0 0
Sat Mar 10 16:12:11 2018: Notice: BAD 3=C2 23
Sat Mar 10 16:12:11 2018: Notice: ppp: [out] LCP REQ REJ
Sat Mar 10 16:12:11 2018: Notice: ppp: [in] LCP ACK
Sat Mar 10 16:12:11 2018: Notice: ppp: LCP layer UP
Sat Mar 10 16:12:11 2018: Notice: ppp: [in] LCP REQ
Sat Mar 10 16:12:11 2018: Notice: Opt 8=7 2
Sat Mar 10 16:12:11 2018: Notice: Opt 7=2 6
Sat Mar 10 16:12:11 2018: Notice: Opt 2=0 0
Sat Mar 10 16:12:11 2018: Notice: BAD 7=2 6
Sat Mar 10 16:12:11 2018: Notice: ppp: [out] LCP REQ REJ
Sat Mar 10 16:12:11 2018: Notice: ppp: [in] LCP REQ
Sat Mar 10 16:12:11 2018: Notice: Opt 8=2 6
Sat Mar 10 16:12:11 2018: Notice: Opt 2=0 0
Sat Mar 10 16:12:12 2018: Notice: ppp: [out] LCP REQ ACK
```

^ The above sequence takes care of LCP protocol negotiation. We do not support CHAP and hence it goes through two cycles, until PAP (Password Authentication Protocol) is activated.

```
Sat Mar 10 16:12:12 2018: Notice: ppp: [in] IPCP REQ [seq=1] [len=4]
[type=187]
Sat Mar 10 16:12:12 2018: Notice: ppp: [out] IPCP ACK [2.0.8.10]
[seq=1]
Sat Mar 10 16:12:16 2018: Notice: ppp: [out] IPCP REQ [0.0.0.0]
Sat Mar 10 16:12:16 2018: Notice: ppp: [in] IPCP NAK
Sat Mar 10 16:12:16 2018: Notice: ppp: [in] IPCP NAK IP=[2.0.8.10]
Sat Mar 10 16:12:18 2018: Notice: ppp: [in] IPCP REQ [seq=2] [len=4]
[type=223]
Sat Mar 10 16:12:18 2018: Notice: ppp: [out] IPCP ACK [2.0.8.10]
[seq=2]
Sat Mar 10 16:12:20 2018: Notice: ppp: [out] IPCP REQ IP [2.0.8.10]
Sat Mar 10 16:12:21 2018: Notice: ppp: [in] IPCP NAK
Sat Mar 10 16:12:21 2018: Notice: ppp: [in] IPCP NAK IP=[2.0.8.10]
Sat Mar 10 16:12:24 2018: Notice: ppp: [in] IPCP REQ [seq=3] [len=4]
[type=3]
Sat Mar 10 16:12:24 2018: Notice: ppp: [out] IPCP ACK [2.0.8.10]
[seq=3]
Sat Mar 10 16:12:25 2018: Notice: ppp: [out] IPCP REQ IP [2.0.8.10]
Sat Mar 10 16:12:27 2018: Notice: ppp: [in] IPCP NAK
Sat Mar 10 16:12:27 2018: Notice: ppp: [in] IPCP NAK IP=[2.0.8.10]
Sat Mar 10 16:12:30 2018: Notice: ppp: [in] IPCP REQ [seq=4] [len=4]
[type=6]
Sat Mar 10 16:12:30 2018: Notice: ppp: [out] IPCP ACK [2.0.8.10]
[seq=4]
Sat Mar 10 16:12:31 2018: Notice: ppp: [out] IPCP REQ IP [2.0.8.10]
Sat Mar 10 16:12:31 2018: Notice: ppp: [in] IPCP NAK
Sat Mar 10 16:12:31 2018: Notice: ppp: [in] IPCP NAK IP=[10.17.101.47]
Sat Mar 10 16:12:31 2018: Notice: ppp: [out] IPCP REQ IP [10.17.101.47]
Sat Mar 10 16:12:31 2018: Notice: ppp: [in] IPCP ACK
```

```
Sat Mar 10 16:12:31 2018: Notice: ppp: [in] IP = 10.17.101.47  [seq=5]
Sat Mar 10 16:12:31 2018: Notice: ppp: [in] DNS = 218.248.112.72 [seq=5]
Sat Mar 10 16:12:31 2018: Notice: ppp: IPCP layer UP
```

The final part of the negotiation happens at the IPCP layer while an IP address is obtained. The temporary IP address of *2.0.8.10* is just a dummy IP address and it will keep requesting a new address until it obtains a valid one, in this case *10.17.101.47*, at which point the IP Layer is fully established and the default route is set to the new interface.

Detecting Connectivity Issues

Assuming a connection is properly established as in the example above, at some point the provide may decide to terminate the connection without warning, or the signal may drop. At this point, the Wattmon won't be able to connect to remote sockets, and you will see a pattern as below:

```
Thu Mar 08 11:56:50 2018: Warning on ip.cgi line 378: Socket open timed
out!
Thu Mar 08 11:58:02 2018: Warning on ip.cgi line 378: Socket open timed
out!
Thu Mar 08 11:59:13 2018: Warning on ip.cgi line 378: Socket open timed
out!
Thu Mar 08 12:00:22 2018: Warning on ip.cgi line 378: Socket open timed
out!
Thu Mar 08 12:01:49 2018: Warning on ip.cgi line 378: Socket open timed
out!
Thu Mar 08 12:01:49 2018: Notice on ip.cgi line 612: Cellular link seems
to have died, restarting USB power
```

It will try reconnecting several times and eventually will reboot the dongle. Unless there is a connectivity issue on site where the network signal is not present, this will allow for a new IP address to be obtained and bring up the connection again.

In some cases, the dongle actually terminates the connection in which case the Wattmon will immediately try to re-negotiate a new IP address.

```
Fri Mar 09 10:35:26 2018: Notice: ppp: [in] LCP TERM
Fri Mar 09 10:35:26 2018: Notice: usb: Device detached
```

Miscellaneous Issues

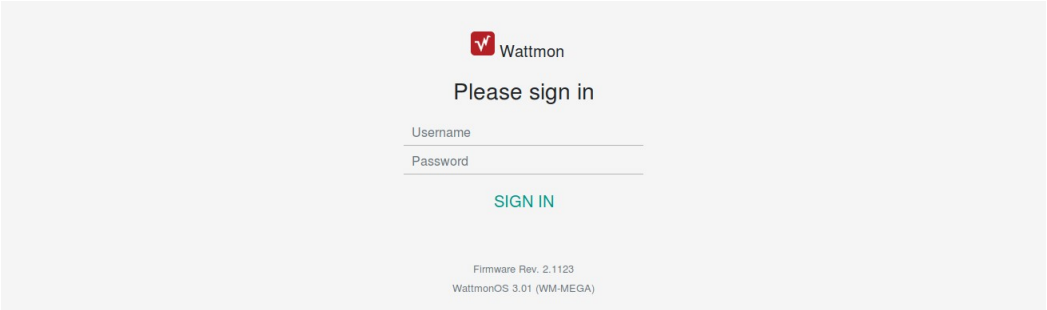
When a non-recoverable script errors, it will show the type of error in the script and the line number as shown below:

```
Fri Mar 09 09:37:16 2018: Error on cronsec.cgi line 238: Missing } in
include file
Fri Mar 09 09:37:16 2018: [uphp] Force recompile cronsec.cgc
```

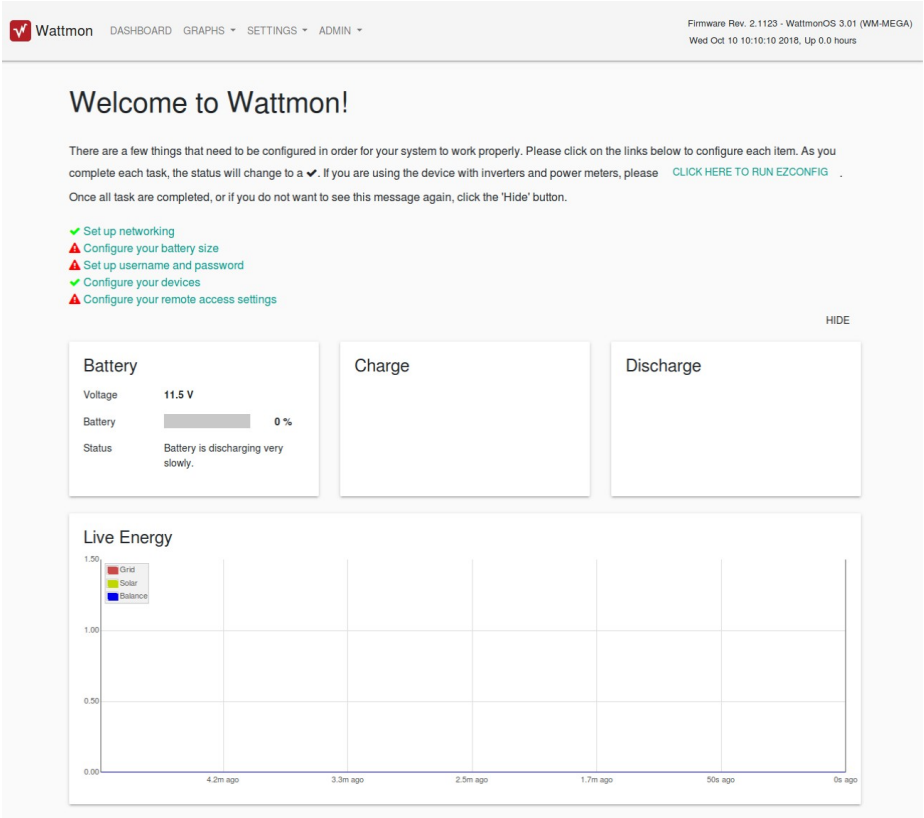
The *Force recompile* line indicates that the script file, in this case *cronsec.cgi,* will be recompiled the next time it is run – this will resolve any issues of a corrupted compiled file.

Basic Configuration Settings

Once you boot into your Wattmon device on the computer, you will reach the *Welcome to Wattmon* page, on which you need to enter your login credentials. The default username and password of your Wattmon are *admin* and *admin* respectively.



Upon logging in, you will see the Wattmon Dashboard. For more details on the layout of the Dashboard, refer to the previous section, **Understanding the WattmonOS**.



At the Dashboard, you will find the menu bar at the very top of the window, with several options including *SETTINGS* drop-down menu. Select *Control Panel* from the *SETTINGS* drop-down, and you will come to a page with a large variety of colour-coded blocks, marking the importance of each setting type – the red being critical, the orange being important, and the green being safe to change. In this section of the quick start guide we shall look at some of the essential basic settings to edit, such as User details, Time, Network, enabling a USB dongle, etc.

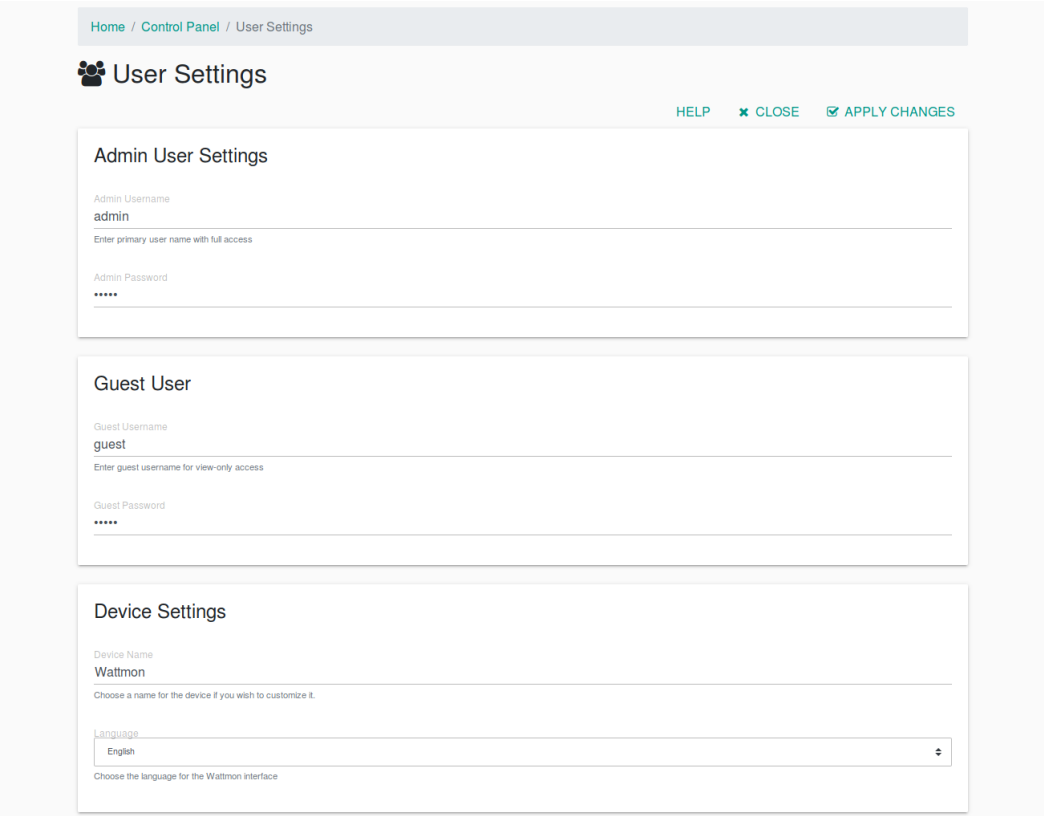
Users and Security

The *User Settings* allow you to change your default login credentials, set up a Guest account, change the name of your Wattmon device, and set the default language.

The default credentials for the Admin account are *admin* and *admin*. The default credentials for the Guest account are *guest* and *guest*.

The languages supported by Wattmon as of now are English, Spanish, German, French, Hindi and Tamil. The interface is changed into the aforementioned languages in varying degrees, while the actual settings and scripts stay unchanged.

To save the settings, click *Apply Changes* and wait for a confirmation message. You will need to reboot the Wattmon for the changes to take effect.



Date and Time Settings

If you find the Date and Time Settings on your device to be erroneous, or wish to change the time zone, you can change settings of your Wattmon as shown in this section.

There are several options such as *Use SNTP Protocol*, *System Date*, *System Time*, *Use Wattmon Time Server*, and *UTC Offset*.

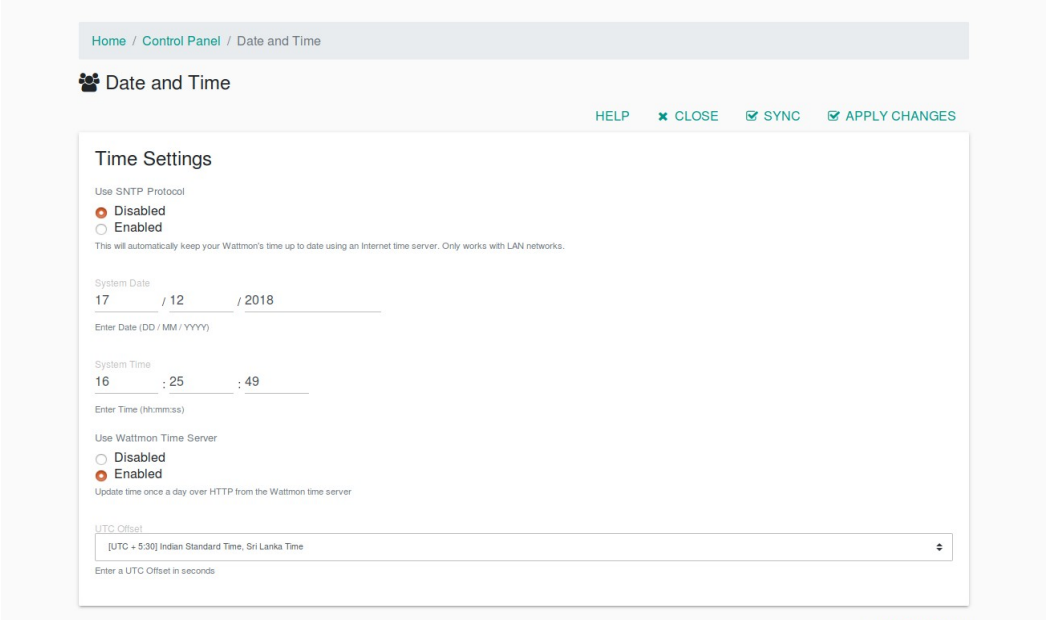
If *Use SNTP Protocol* (Simple Network Time Protocol) is set to *Enabled*, you will only be able to change the *UTC Offset*, to select the time zone of your choice. If *Use SNTP Protocol* is *Disabled*, you will be able to manually change the time and date on your device.

The *System Date* is entered in the DD/MM/YYYY format. The *System Time* is entered in the hour format, which is hh:mm:ss.

We recommend that your keep the option *Use Wattmon Time Server* as *Enabled*, as that allows the Wattmon to automatically check and update the time on your device on a daily basis. This is the default setting. <u>If you are using a USB stick for network access, we recommend disabling SNTP as that works only on an Ethernet connection.</u>

The default time zone on a Wattmon is Indian Standard Time (UTC +5:30), however it certain cases can come pre-configured to the time zone you are in.

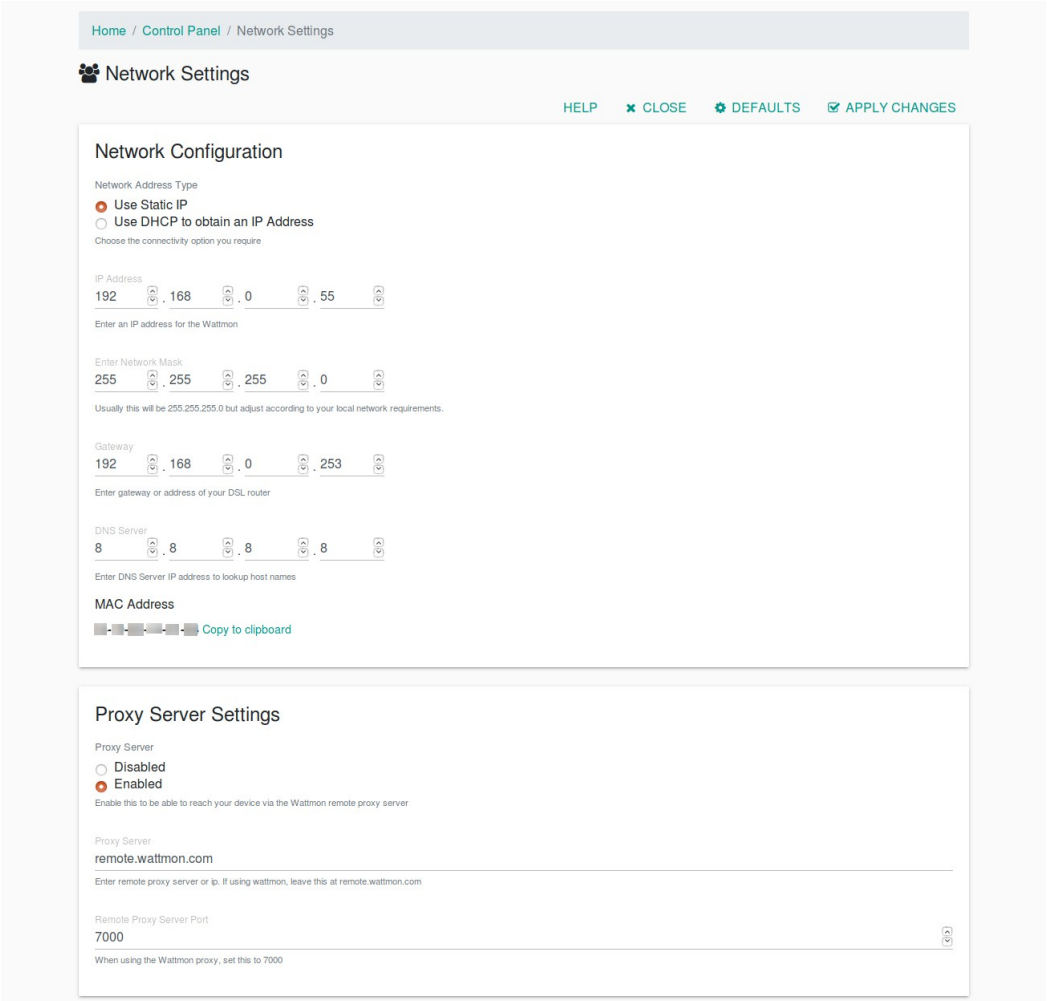
Alternatively, if the default settings have not been changed, and you can select the *Sync Time* option from the control bar to force a time update from the Wattmon Server.



Network Setup

These settings allow you to access your Wattmon device over a particular IP address on your network. It is split into two parts : *Network Configuration* and *Proxy Server Settings*.

The default setup uses a *Static IP* configuration, which can be changed to *Dynamic IP (DHCP)* if needed. Your Wattmon comes preconfigured to work on the *IP Address 192.168.0.55*, with the *Netmask* set to *255.255.255.0* and the *Gateway* to *192.168.0.1*. The *DNS Server* is set to *8.8.8.8*.



The last option in the *Network Configuration* portion is the MAC Address (media access control address) of your Wattmon device, which is a 12 digit alpha-numeric unique

identifier assigned to network interfaces for communications at the data link layer of a network segment. The unique MAC address for the Wattmon is used as the device key when accessing it from the Internet using port forwarding or through the Wattmon Proxy. You will use this in the **Data Export** settings page.

The second part of Network Settings is *Proxy Server Settings*. hese settings enable the outbound access to the Wattmon, and should not be changed from the default. There are three options, *Proxy Server Status*, *Proxy Server*, and *Proxy Server Port*. T, which are set to *Enabled*, *remote.wattmon.com* and *7000*, respectively, as displayed in the image above.

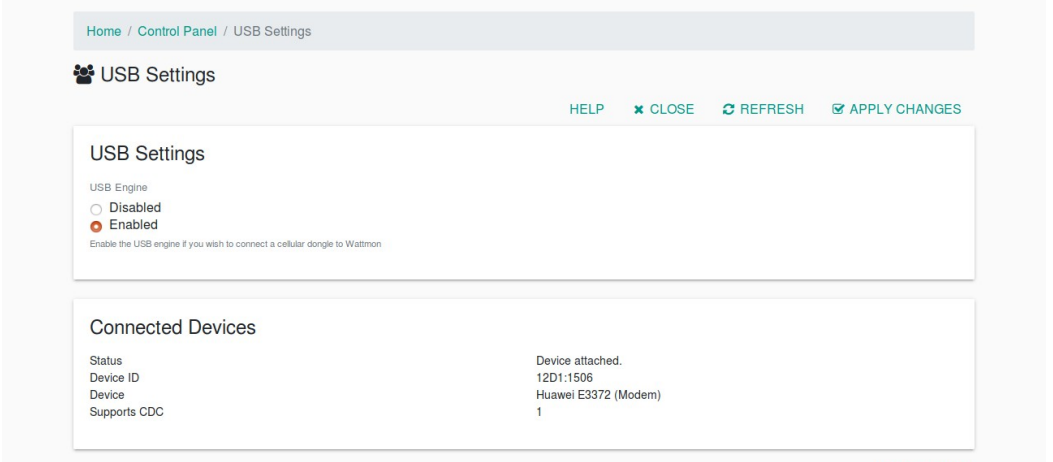
To configure your Wattmon to work on an IP address of your choice, enter the *Netmask*, *Gateway* and *DNS* settings by referring to your on-site modem, and assign the Wattmon a unique static *IP Address*. Save the settings by selecting *Apply Changes* and wait for a confirmation message. You will need to reboot the Wattmon to see your changes in effect. Do note, once the Wattmon reboots, it will not log in via the default IP if it has been changed; you will need to update the IP address in the address bar of your browser. To reset the IP address of your Wattmon to its default, select the *Defaults* option, and then *Apply Changes*.

For more details to access your Wattmon step by step, go to **Connecting to your Device**. And if you are facing issues in accessing the device, go to the **Troubleshooting** page.

USB Devices

In *USB Settings*, you have the option to enable the use of a USB stick to connect to the Internet.

The default setting will display USB Engine as *Disabled*. Select *Enabled* and perform a reboot after applying the changes. Insert the Stick into the USB slot on the Wattmon.



Upon logging in to your Wattmon, return to the *USB Devices* page and check the message displayed under *Connected Devices*. If the Stick is detected, the *Status* will

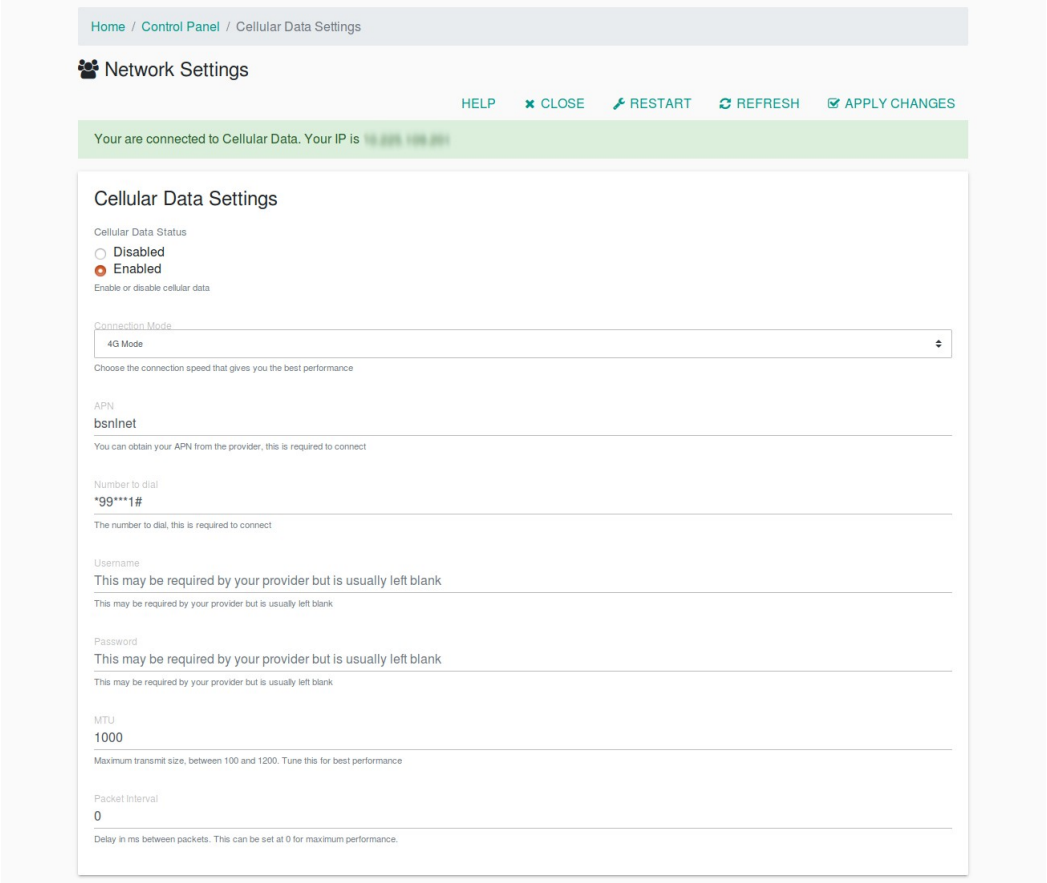
say *Device attached*, along with details of the USB Stick, such as *Device ID*, *Device* model, and if it *Supports CDC*.

If the USB Stick is attached and not detected, the *Status* will be *Ready, no device attached*. Click on the *Refresh* button till this status changes. If the stick is still not detected, verify that it is compatible with the Wattmon.

Only a select number of USB Stick models are supported : *Huawei E303F*, *Huawei E3531*, *Huawei E3531i*, *Huawei E3372* and *Huawei E3276*. Once the device is connected to the Internet, the LED on the stick will glow solid blue or green. If it is blinking, it could either be in the process of connecting or facing a network-related issues.

Cellular Settings

While the previous settings page enables the USB Stick option, the *Cellular Data Settings* page configures the connection mode and APN based on the type of USB stick connected and the network provider.



The status of the connection is displayed above the modifiable settings – in a green overlay stating You are connected to Cellular Data. Your IP is xx.xx.xx.xx if your Wattmon is connected to the internet; and if unable to connect to the internet, you will see a message stating *You are not connected to Cellular Data*.

There are 8 settings available on the page as seen above – *Cellular Data Status*, *Connection Mode*, *APN*, *Number to Dial*, *Username*, *Password*, *MTU* and *Packet Interval*, which are all visible only when the *Cellular Data Status* is set to *Enabled*.

The *Connection Mode* drop-down offers five options - *GPRS/Edge 2G Mode Only*, *3G Mode Only*, *Prefer GPRS/Edge 2G Mode*, *Prefer 3G Mode* and *4G Mode*. The default is set to *Prefer 3G mode*, as that automatically connects to 3G or 4G when available and otherwise automatically shifts to GPRS/EDGE, thereby choosing the optimum speeds. Alternatively, the 4G Mode forces the stick to work on 4G LTE depending on the availability of bandwidth in the region.

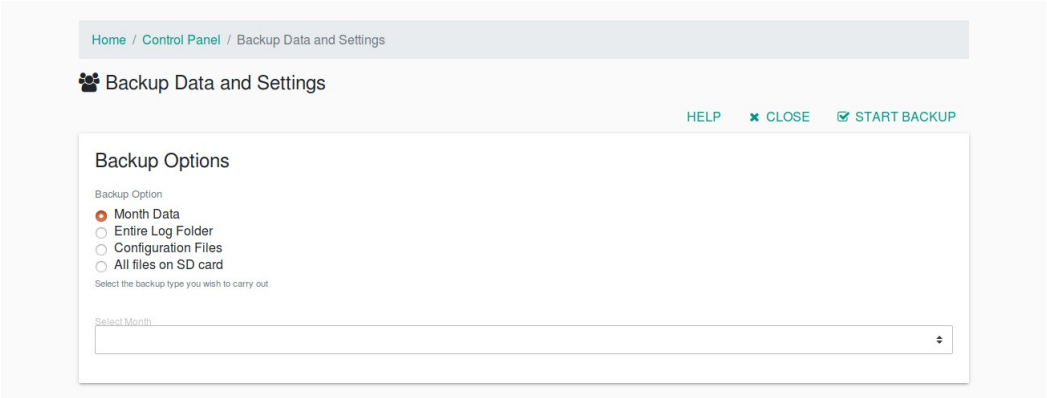
The remainder of the settings are network provider dependant, and with the exception of the APN, are identical for most providers. The *Number to Dial* field should be set to **99***1#*. The *Username* and *Password* fields can be left blank. The *MTU* or maximum transmission unit is set by default to *1000*, but can be set to anywhere between 100 and 1200and the *Packet Interval* to *1*.

The APN for some of the network providers in India are as follows: Airtel – *airtelgprs.com*; Vodafone – *www*; BSNL – *bsnlnet*; Reliance Jio – *jionet*.

Backup Data

Backup Data and Settings enables you to back up your configurations and logged data on the Wattmon. You can choose to backup entire data or specific parts of it.

There are four *Backup Options* : *Month Data*, *Entire Log Folder*, *Configuration Files*, and *All Files on SD Card*.



Month Data backs up the logged data for a specific month. If you select it, a drop-down allows you to select the month you wish to download the data for.

The *Entire Log Folder* option downloads the logs folder, as seen in the File Manager, which includes the complete logged data as well as the System Logs recorded since your Wattmon was setup and running.

Selecting *Configuration Files* backs up the configuration settings of your Wattmon. These are most essential as they are very often unique to your device based on your setup.

All Files on SD Card backs up everything on the microSD card, as is visible in the File Manager.

Upon selecting any of the four provided options, you can click on *Start Backup* and the download link of the back up of your choice will show in a pop-up window. Download the *backupxxxxxx.tar* file onto your computer and keep it safe, in case a restore is ever required. *All Files on SD Card* and *Entire Log Folder* could result in a very large file and may take a while to generate and download.

We recommend that you make a backup of your configuration once you have set your system up, or even in case you received it preconfigured, so that restoring it, if required, will be a very straightforward process.

All backup files created are saved on the microSD card and can be accessed from the backup folder using the File Manager. They can be downloaded from there and then loaded onto the Wattmon to restore any old configuration settings or logged data.

Advanced Settings

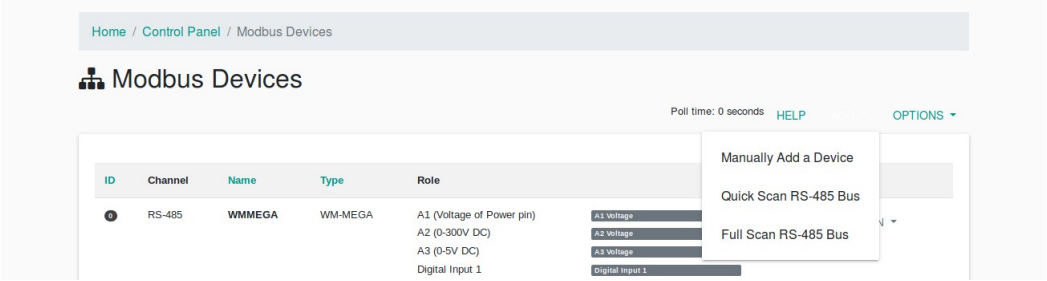
On the lower half of the *Control Panel* page, you will find a large variety of red and orange colour-coded options, as earlier mentioned, so marked to showcase the importance of those settings. In this part, we shall look at some of the advanced settings to edit, such as device and data export.

Devices

The *Modbus Devices* page can be accessed through the *Settings* drop-down on the menu bar, or through the *Control Panel*. It displays all the active and inactive devices connected to the Wattmon, and allows you to add, remove, or customize any devices.

There are three options given on control bar – *HELP*, *ADD*, and *OPTIONS*. *HELP*, like on all other pages, displays details on the page.

The *ADD* button reveals three drop-down options - *Manually Add a Device*, *Quick Scan RS-485 Bus*, and *Full Scan RS-485*. The *Manually Add a Device* option is used when connecting a 3rd party Modbus device to your Wattmon. The entire setting up process for inverters and meters is detailed in **Modbus Device Setup – Third Party Devices**. The latter options, *Quick Scan* and *Full Scan,* are used to scan Wattmon modules once they have been physically connected to the Wattmon; *Quick Scan* searches for Wattmon modules on ID 1 to 10, while the Full Scan function searches for Wattmon modules on ID 1 to 100, and so is only used when the first option is unable to detect a device. This process is explained in **Modbus Device Setup – Wattmon Modules**.

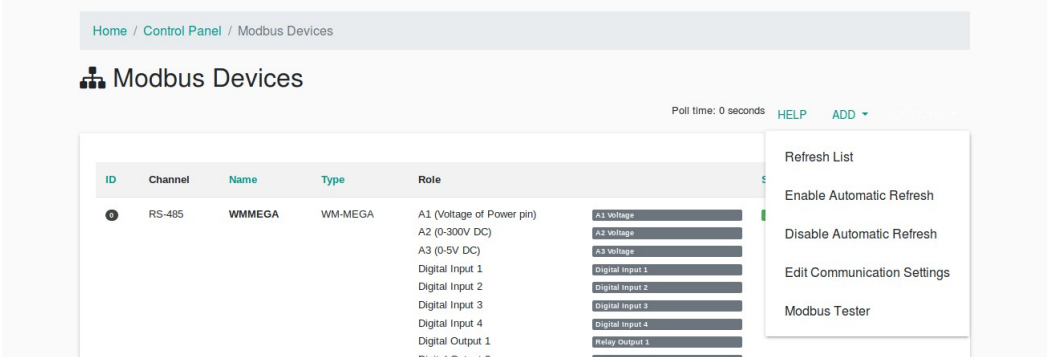


The *OPTIONS* drop-down offers five functions – *Refresh List*, *Enable Automatic Refresh*, *Disable Automatic Refresh*, *Edit Communication Settings* and *Modbus Tester*.

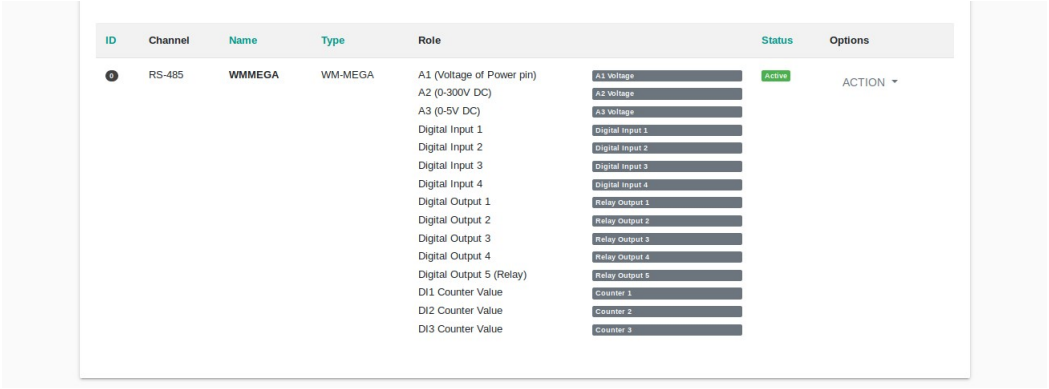
Refresh List refreshes the list of devices displayed, and notifies you of the total polling duration. *Enable Automatic Refresh* and *Disable Automatic Refresh* allow you to select whether you wish to have the refreshing done automatically or manually.

The fourth option, *Edit Communication Settings* allows you to enable or disable communication over RS-485, change the Baud Rate, Parity, and configure the Modbus TCP Settings. This is explained in detail in **Modbus Communication Settings**.

The fifth option, *Modbus Tester*, is for advanced users, to manually test the Modbus communication port based on the Baud Rate, Device ID and the Register numbers; the Modbus testing procedure is described in the **Modbus Tester** section.



The device list displays relevant data in columns, such as device *ID*, *Channel*, *Name*, *Type*, *Role*, *Status* and *Options*. *ID* represents the Modbus ID; for the WattmonMEGA and WattmonPRO, named as *WMMEGA* and *WMPRO60*, the *ID* is always *0. T*he WattmonMINI however is not displayed in this list.



Channel shows the Modbus channel used for communication. When a device is connected using Modbus RTU, the Channel is *RS-485*; the WattmonMEGA can also be connected to Modbus using the Serial port, in which case the *Channel* is *RS-232*. If a device is connected using Modbus TCP, it is displayed as per *TCP Channel* used; the WattmonMEGA has ten channels, whereas the WattmonPRO and WattmonMINI have a single TCP channel.

The *Name* column features the name of the device as allocated on the Wattmon, which can be set by you. For certain third-party devices, such as inverters and energy meters, which allow for the model number and serial number to be polled using Modbus

registers, the relevant details are displayed under the device *Name*. The *Type* column reveals the device name and model as saved on the Wattmon.

Role lists each of the variables that are polled or logged from a particular device, divided into two parts. The first list displays the values that are logged by name, such as the voltage input on the WattmonMEGA called *A1 (Voltage of Power Pin)*, or the *Lifetime Generation* from an inverter. The second list is shaded, and features the actual names of the variables as they are logged on the Wattmon; the voltage input on the WattmonMEGA is logged as *A1 Voltage*, or the total generation from an inverter is logged as *inverter1_kWh_Total_Active*.

Next to the *Type* of a device is the *Status* – if online and connected, it will display as **Active**, and if not detected, then as **Error**.

The *Options* column features the *ACTION* drop-down that reveals four options – *Configure*, which allows you to edit the name, channel and choose the logged variables of a particular device; *Disable*, which lets you temporarily halt any communication with the device; *Delete*, which permanently removes the device from the Wattmon; and *Calibrate*, which is for recalibrating or resetting a Wattmon Module. The last option must only be used if specifically asked by the Wattmon team.

Data Collection

The *Data Collection* page allows you to select the variables you wish to log to .csv files on the Wattmon's microSD card, as well as push to the cloud portal.

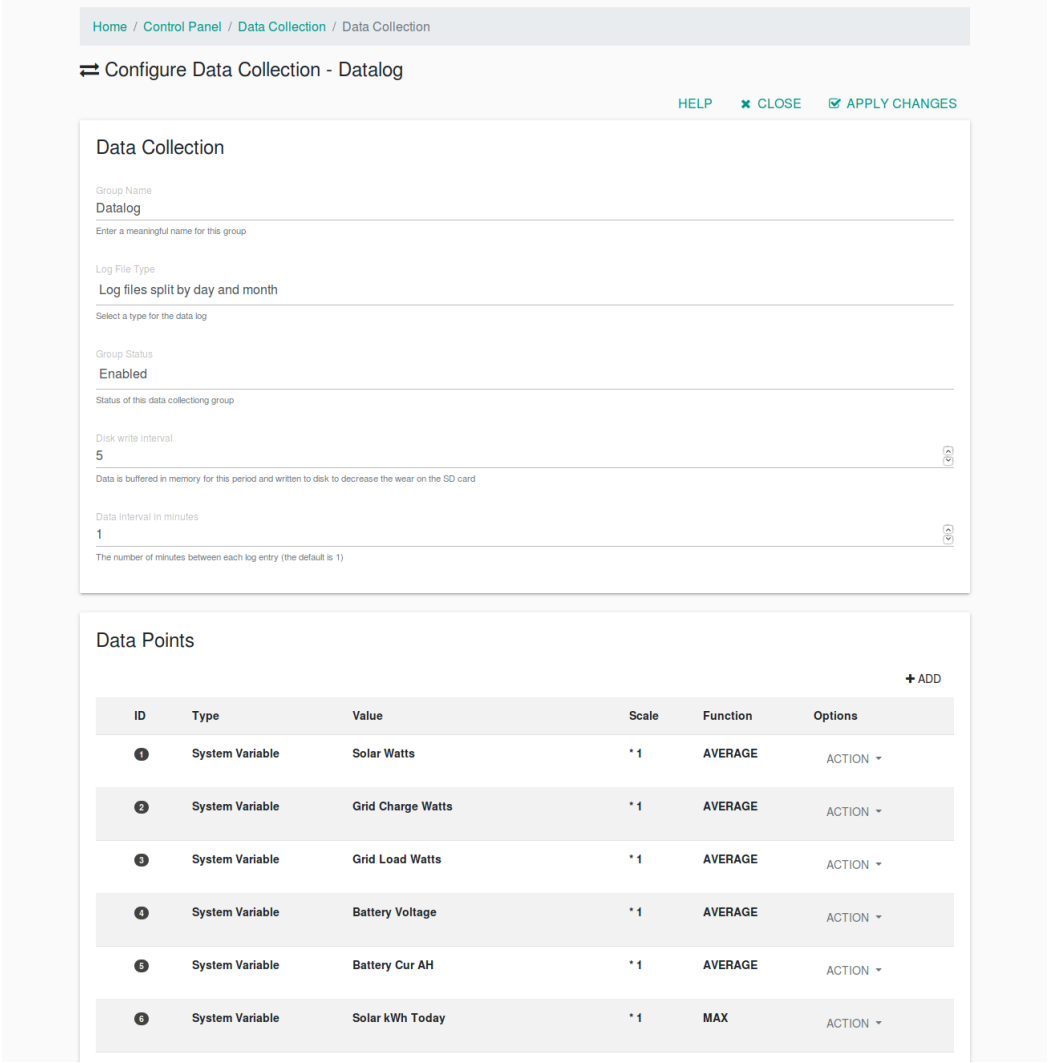
Upon selecting the *Data Collection* option in the *Control Panel*, you will proceed to a page which displays the *Data Collection Groups* list. The default data group name is *Datalog* or *CSV Log*, depending on your configuration method, and all variables you wish to add or remove for the data log can be found in there. A second group, called *Test Log* may also be listed, disabled by default. This is for advanced users who wish to specific variables during testing and debugging. We recommend leaving this disabled. To edit the *Datalog* group, select the *Action* drop-down, and then select *Configure*.

The *Configure Data Collection - Datalog* is split into two categories – *Data Collection Settings* and *Data Points*. *Data Collection Settings* features information such as *Group Name*, *Log File Type*, *Group Status*, *Disk Write Interval*, and *Data Interval in Minutes*. While these are editable by the user, we recommend leaving these at the default values unless specified by us or by advanced users.

The *Group Name* is set by default to *Datalog* or *CSV Log*, but can be changed if the user desires. The *Log File Type* drop-down lets you choose if you wish to have the *Log files split by day and month*, or a *Single log file*; the default is set as *Log files split by day and month* given that *Single log file* creates a single large file which is more susceptible to read/write issues. The *Group Status* drop-down allows you to either *Enable*, *Disable* or *Delete* the data collection group – the default is set at *Enabled* and should not be changed, as this affects the actual data push to a server. The *Disk Write Interval* option allows you to choose the time interval, in minutes, in which each log file is written to the micro SD card; we recommend that the log interval be set at *5* minutes to allow for the

writing of larger log files while not constantly writing data which reduces the life of a micro SD card. The time interval can be optimized based on the users' requirement. The *Data Interval in Minutes* options allows you to set the number of minutes between each log entry; the default is set to *1*.

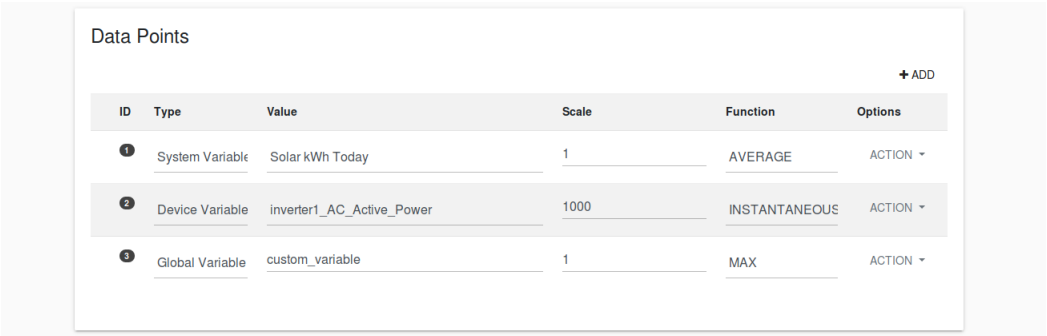
To save changes made to any of the aforementioned options, you need to select *Apply Changes* like on all other settings pages on the Wattmon, followed by a device reboot.



The *Data Points* section features all the variables that are logged on the Wattmon and written to the on-board microSD card as well as uploaded to a cloud portal if that is

enabled; for more details, go to the **Data Export** settings page in this guide. The section displays each data point with the following details – *ID*, *Type*, *Value*, *Scale*, *Function* and *Options*.

To add a new data point click on the *+ADD* button in the upper right corner of the section. To edit, stop editing, or delete an existing data point, click on the *Action* drop-down next to the data point of your choice and choose from the three options – *Edit*, *Stop Edit* and *Delete*.



When adding a new data point, *ID*, which is the numerical order of the variable, is allotted automatically.

The *Type* drop-down presents three options – *System Variable*, which is value calculated by the Wattmon from a role and its associated types; *Device Variable*, which is the actual role value from a connected device; and *Global Variable,* which is a calculated value generated by a custom script running on the Wattmon. For Modbus devices, both third-party and the Wattmon Modules, the logged value type is *Device Variable*.

The *Value* option reveals the names of the values or roles based on your selection of the value *Type. F*or *System Variables* you may choose from a drop-down list of calculated values, while for *Device Variables* you may choose from a drop-down list of uncalculated polled values; for a *Global Variable*, you will need to enter the name manually, as shown above.

The *Scale* option allows for the scaling of values as a float value (0.0, 0.00, etc.). For Wattmon generated values this is always *1* – for Modbus devices, this needs to be verified with the proprietary Modbus registers. For example, the AC_Active_Power value is in watts, but if you wish to log it in kilowatts, the scale would be set to *1000*, as can been seen in the image above.

The *Function* drop-down reveals four options – *Average*, *Min*, *Max* and *Instantaneous*, which can be selected to approximate the values according to the user. For most *System Variables*, the *Average* option applies best. The *Instantaneous* option is used for values that represent a specific function, such as alerts or a device status, or for values that are obtained from another device, such as in *Device Variables*.

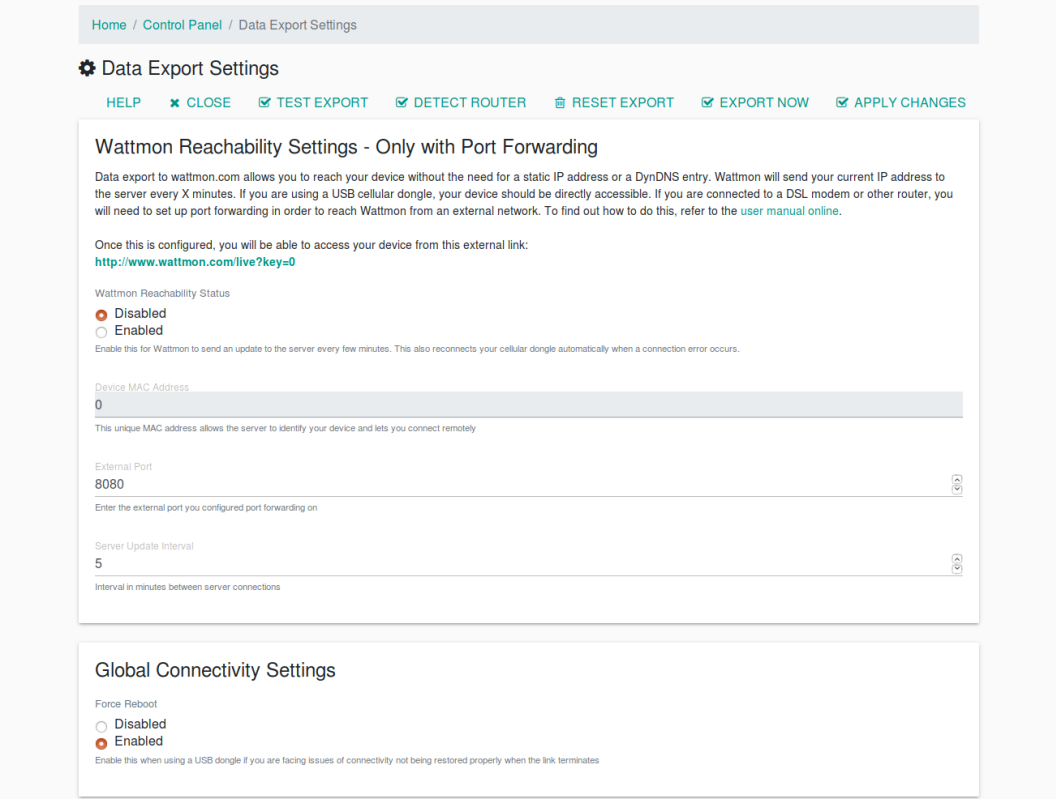
To save the changes or additions, click on Apply Changes on the top right corner of the page. Note that a reboot will be required for the Wattmon to commence logging new values or applying any modifications to the existing values.

Data Export

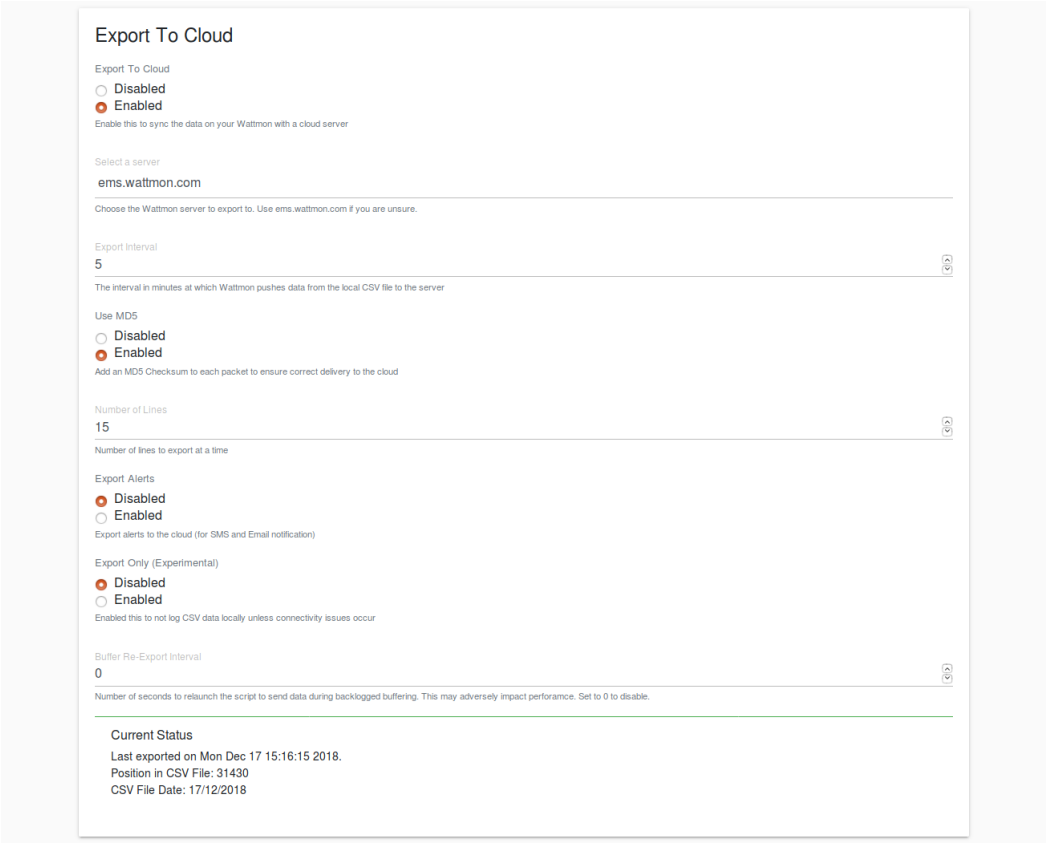
The *Data Export Settings* is split into four parts, and allow you to configure *Port Forwarding*, *Global Connectivity Settings*, *Export to Wattmon Cloud*, and *Custom Server Data Export*.

The control bar features several buttons, two of which are *Reset Export* and *Export Now*. The *Reset Export* option aborts the exporting of backlogged data, clearing data log issues. *Export Now* runs the data export script, forcing the upload of data.

The *Wattmon Reachability Settings – Only with Port Forwarding*, allows you to reach your device without the need for a static IP address or a DynDNS entry. Once the *Wattmon Reachability Status* is *Enabled*, with the *External Port* and *Server Update Interval* set correctly (default – *8080* & *5*), you will need to *Apply Changes* and *Reboot*. After this, you will be able to reach your device from the following link - *http://www.wattmon.com/live?key=A1-B2-C3-D4-E5-F6*, where *A1-B2-C3-D4-E5-F6* will be the MAC address of your Wattmon device.



The *Global Connectivity Settings* is an option to automatically reboot a connected USB dongle in case issues of connectivity are faced, forcing a fresh network connection. Set *Force Reboot* to *Enabled* to activate this option.



To set up *Export to Wattmon Cloud*, first set *Export To Cloud* to *Enabled.* The next option, *Select a Server*, lets you select the server you have been allotted, which is most likely to be Wattmon EMS, *ems.wattmon.com*, unless your Wattmon portal was set up otherwise, in which case you may choose from *my,wattmon.com*, *mycloud.wattmon.com* or *beta.wattmon,com*.

The *Export Interval* is set by default to *5*, which is the interval in minutes at which the Wattmon pushes data from the local CSV file to the server. You may increase or reduce the interval if you wish to have the data pushed at less frequent or more frequent intervals.

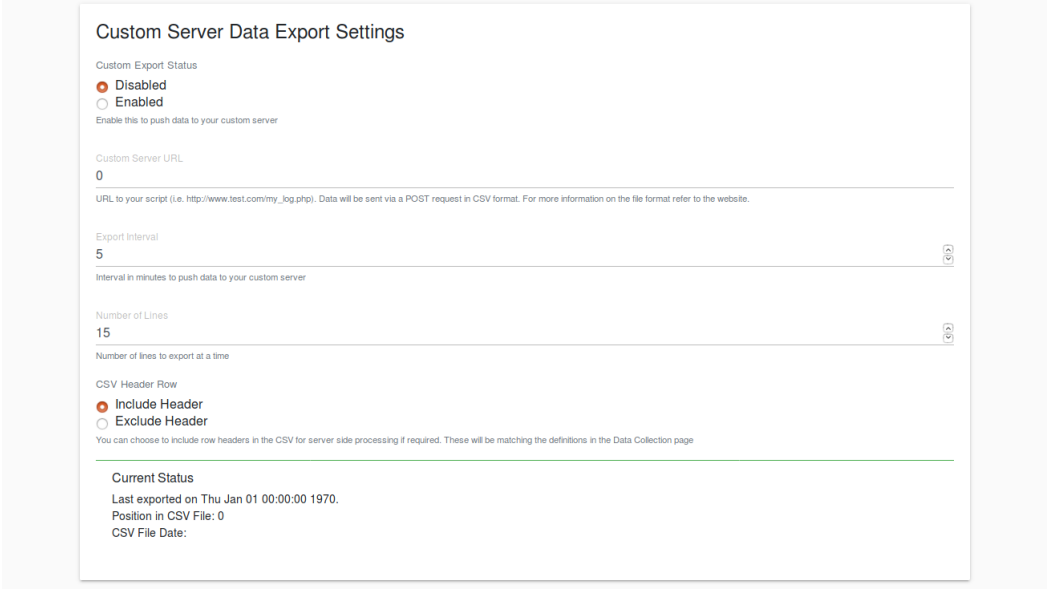
Use MD5 can be set to *Enabled* to ensure correct delivery of the data by adding a MD5 checksum to each packet.

Number of Lines sets the number of data lines that are exported at a time. It is set by default to *15*, but may be reduced if you experience data export issues when pushing larger amounts of data.

If you require Email and SMS notifications through the EMS server, set *Export Alerts* to *Enabled*.

The *Export Only* option allows you to toggle between storing all data locally in CSV files if set to *Disabled*, or only storing CSV data when exporting fails when set to *Enabled*. The latter doesn't save the logged data on the Wattmon's micro SD card, an option that should only be selected if specified. If you are using the *Custom Server Data Export Settings*, you will need to set this option to Disabled, as the CSV data has to be stored locally.

The *Current Status* of the data export is always displayed at the bottom of the section, detailing the date and time of the last exported data, the position of the data in the stored CSV file, and the date of the CSV file from which the data was exported.



To export the logged data to a custom server, go to the fourth section called *Custom Server Data Export Settings*, and follow the same instructions as shown for *Export to Wattmon Cloud*. You will first need to enter a Custom Server URL for where the Wattmon must upload the data to in a CSV file. To learn more on the data export file format, visit the ***Exporting Data to a Custom Server*** page on our website.

The *Export Interval*, in minutes, can be set to *5* and *Number of Lines* per export to *15*, the same as when exporting to the Wattmon Cloud. A *CSV Header Row* can be included

or excluded from the data log file by selecting *Include Header* or *Exclude Header*, for ease on server side processing.

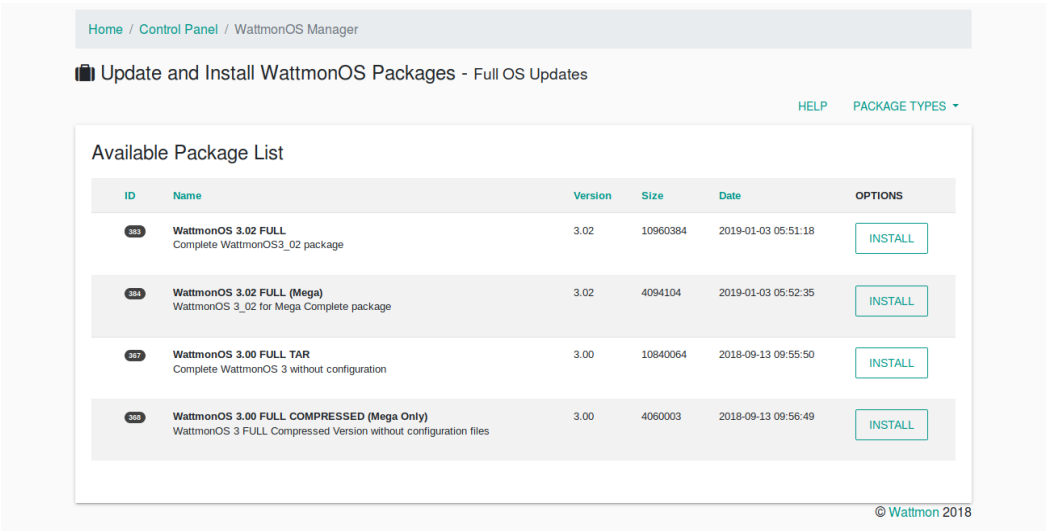
The *Current Status* of the data export is always displayed at the bottom of the section, detailing the date and time of the last exported data, the position of the data in the stored CSV file, and the date of the CSV file from which the data was exported.

WattmonOS Updater

In order to update the WattmonOS, head to *WattmonOS Updater* in the *Control Panel*, consists of updates, both incremental and complete, to the Wattmon OS.

The *Update and Install WattmonOS Packages* setting defaults to *Incremental OS Update*s once you open it. Incremental updates are to update from consecutive OS versions, such as from 3.00 to 3.01, or small additions to the current version of your OS. *Incremental OS Updates* regularly feature minor upgrades or fixes to the Wattmon operating system, such as the improvement of the languages supported, or added options to an existing setting. Due to the nature of an incremental update, they are particularly small in size, usually up to 1 MB, allowing them to be easily downloaded even in an area with poor network connectivity.

The *Available Package List* showcases the details of all the available updates, which are classified by their *ID*, *Name*, *Version*, *Size*, *Date* and *Options*. *ID* denotes the sequence of the update. *Name* details the update along with a short description of the changes therein. *Version* displays the OS version that the update is designated for. *Size* details the size of the update in bytes. *Date* shows the date and time that the public build of the update was made available for downloading. *Options* offers a single option, to *Install* the update.



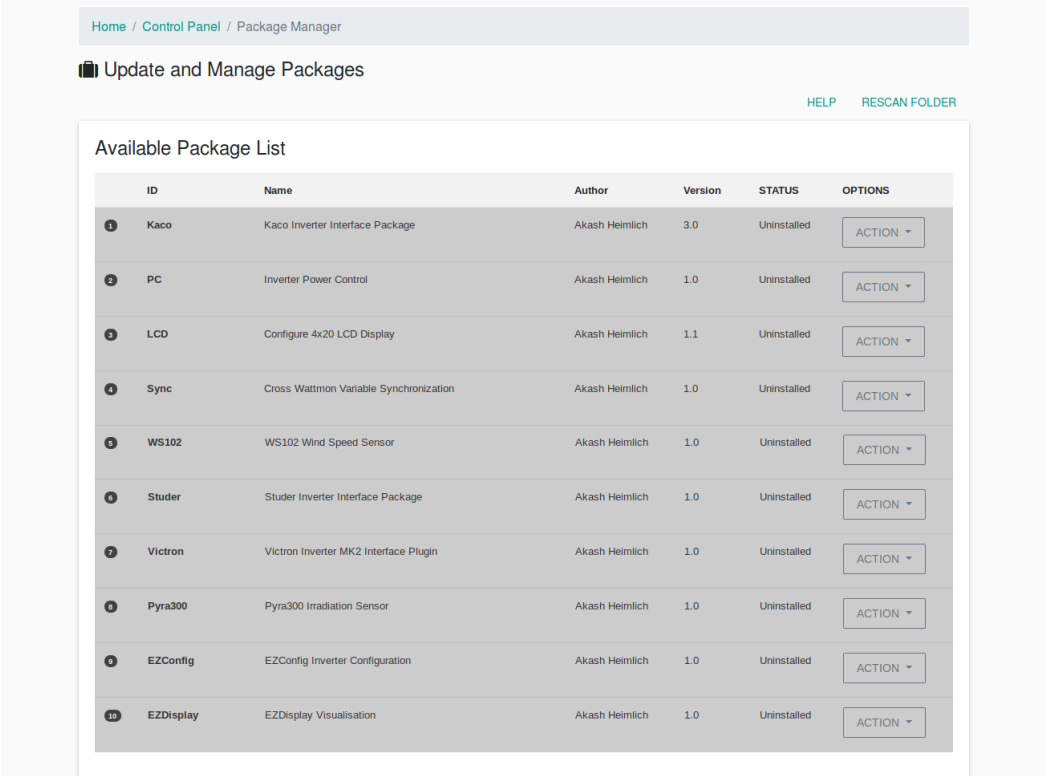
When updating from non-consecutive OSes, or if you wish to reinstall the existing OS, select the *PACKAGE TYPES* drop-down, and select the second option to go to *Full OS Updates*. In order to return to the incremental update packages, click on *Incremental OS Updates* from the package types drop-down from the *Full OS Updates* screen.

The *Full OS Updates* displays options that will be the full OS, which can be downloaded to either update from a much older OS version, or when reinstalling an OS. The *Available Package List* is laid out like on the *Incremental OS Updates* page. You will notice that the update size is consistently larger, exceeding 10 MBs in some cases. Some of the updates are specifically for the WattmonMEGA or WattmonMINI, in which case the *Version* will be the same, but the name will state the difference; make sure you download the correct complete OS for your device.

Click *Install* for the WattmonOS update to download. This may take a while, so we recommend not to use the device during that time. Updating the OS install will not override the configuration settings of your Wattmon, unless otherwise specified. But we recommend that you do back up your *Configuration Files*, as detailed in **Backup Data**.

Package Manager

The *Update and Manage Packages* setting consists of configurations for various setups, such as inverters that communicate over RS232, certain weather sensors, and



optional features of the WattmonOS, that need to be installed to be put into effect on your device.

Upon first opening, the *Available Package List* will display no items. Click on *RESCAN FOLDER* to reveal all the optional packages available on your device. The available packages are displayed, in grey-scale, with details such as *ID*, *Name*, *Author*, *Version*, *Status* and *Options*.

ID defines the display name of the package, whereas *Name* shows the complete name of the package.

The *Author* column indicates who wrote a particular package for the Wattmon.

Version states the software build number of a package.

Status details whether the package is *Uninstalled*, which means it needs to installed; the status is *Disabled* if the scripts from it have been installed but are temporarily stopped from running; or *Enabled*, if the package is installed and active. The *Options* column features a drop-down called *Action*, which allows you to *Install*, *Uninstall*, *Disable* or *Enable* a package.

To install a particular configuration package, select the *Action* button next to the package name, and choose the *Install* option. Once the package has been successfully installed, the package will not appear in a grey highlight and the status will be changed to *Enabled*.

Firmware Updater

The *Firmware Manager* allows you to update your Wattmon to the latest firmware, making sure you are up to date with the latest features and bug-fixes.

The *Update and Manage Firmware* displays several firmware versions on the page, along with details about the changes contained in them, and their dates of compiling. A blue overlay details the current firmware version of your device.

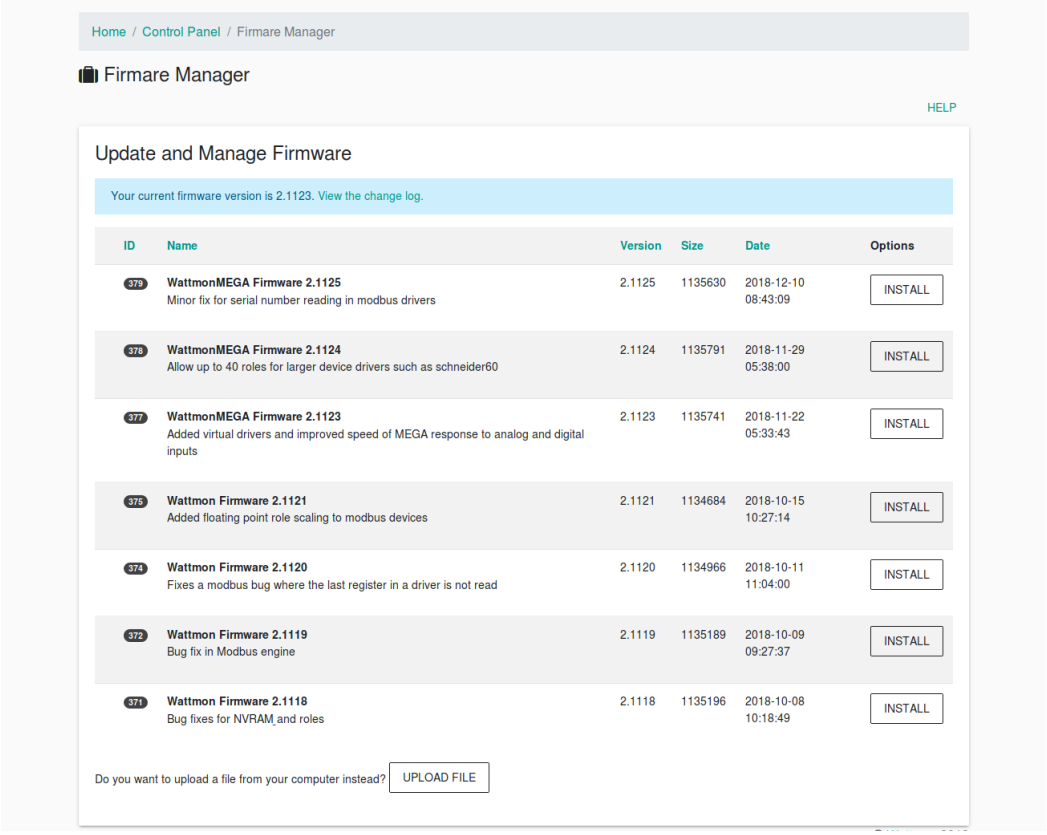
The firmware builds are common between the WattmonPRO and WattmonMINI, but not the WattmonMEGA. The first differentiator between the firmwares of the WattmonPRO/MINI and WattmonMEGA is that the former's firmware versions are classified as *1.xxxx* whereas the latter's are classified as *2.xxxx*. The second differentiator is that the firmware file for the WattmonPRO and WattmonMINI is called *image.hex*, but for the WattmonMEGA is called *imagez.hex*.

In order to install a firmware, whether to upgrade or downgrade the current version, first verify if you have an active internet connection. The Wattmon's firmware can be be installed either from the Wattmon server, or locally, depending on the network settings of your Wattmon or that of the computer you are using to connect to the Wattmon,

If either the Wattmon or your computer has an active Internet connection, to install a firmware, proceed to the *Update and Manage Firmware* page and click on *InstallI* next to the firmware version you wish to install. We recommend that you update the firmware to the latest one, unless you have been instructed otherwise by us. After you select *Install*,

you will be greeted with a notification requiring a confirmation of your firmware installation process. Click on *Continue*, and the firmware will commence downloading, with a progress bar appearing just underneath the control bar options. Once the firmware has downloaded, the Wattmon will automatically begin uploading the firmware file, which, once completed, will be uncompressed. At the end of the uncompression process, a notification will ask you to reboot the Wattmon to complete the firmware process. Click *OK* and the Wattmon will reboot and reappear to the login screen, marking the completion of the firmware installation.

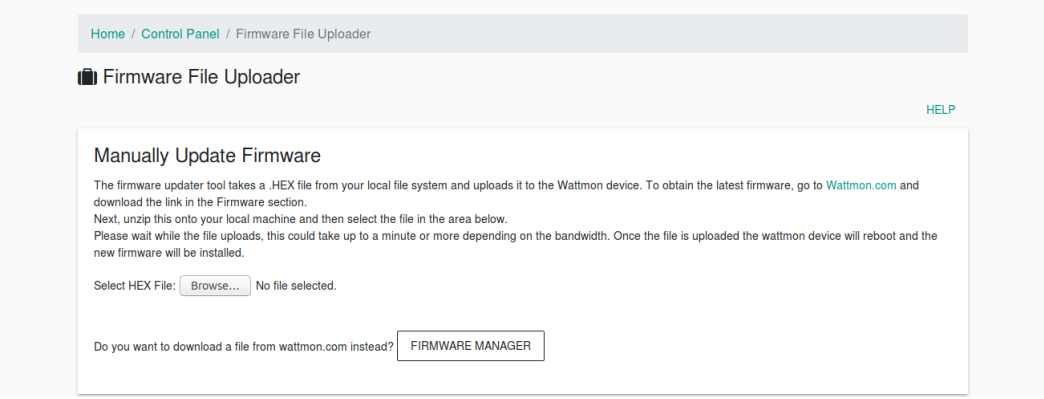
To ensure a smooth firmware update, do not use keep the device open in other tabs on your browser, and make sure the device maintains a connection to the internet as well as to it's power source. Powering-off your Wattmon device during a firmware update can cause major issues to the functionality.



If neither your computer nor the Wattmon is configured for network access, scroll to the bottom of the *Firmware Manager* page, and you will find an option which says - *Do you want to upload a file from your computer instead?* This allows you to upload an *imagez.hex* (firmware file for WattmonMEGA) or an *image.hex* (firmware file for

WattmonPRO and WattmonMINI) directly to your Wattmon, locally from your computer. The firmware files can be obtained either via the Wattmon website or by contacting us.

Click on *UPLOAD FILE* to proceed to the Firmware File Uploader page which provides an option to *Select HEX File: Browse*, using which you can upload the *imagez.hex* or *image.hex* file to your Wattmon from your computer; make sure to upload the correct firmware file to your device. While the *Update and Manage Firmware* page automatically displays the right firmware update based on your Wattmon device, the Manually Update Firmware page does not automatically detect the file version that you are uploading. Flashing a Wattmon with the wrong firmware build will corrupt your device and render it non-functional.



In order to perform this function, your Wattmon needs to be connected directly to a computer using a LAN cable. Be sure to upload the file properly and not to power off your Wattmon during a firmware update. Interrupting a firmware update can cause your Wattmon to stop functioning properly.

Modbus Device Setup

Your Wattmon data logger may have come preconfigured to an inverter, energy meter or any other Modbus device of your choice, if you have made that request at the time of the order. However, if you did not receive a configured device and need to set up your Wattmon from the default settings, or if you wish to re-write the setup, this part of the guide walks you through the various procedures to set up your device.

This guide deals with four different aspects of configuring a Wattmon for Modbus communication. The first is for Wattmon Modules, the second is for third-party Modbus devices such as inverters and energy meters, the third is for using Wattmon's smart configuration tool called EZConfig, and the fourth deals with certain particulars of Modbus Communication and Modbus TCP Setup.

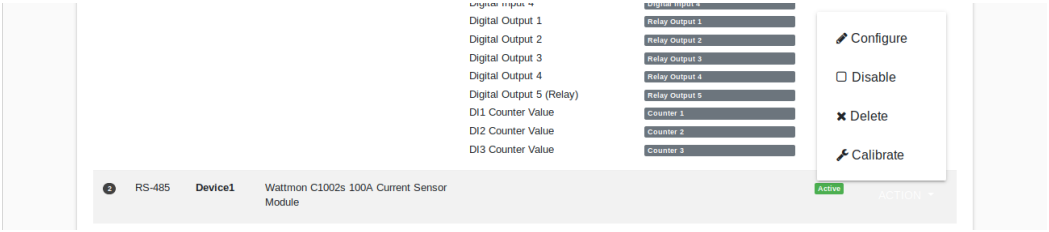
Wattmon Modules

The Wattmon Modules communicate using Modbus RTU, and have a fixed setting of *9600* for *Baud Rate*, and *None* for *Parity*. The default *ID* on each device is set to *1*, but can be changed once connected to a Modbus Master device. The setup process for all the Wattmon modules is identical. This guide focuses on the setup for the C1002s 100A Current Sensor Module.

All Wattmon Modules are supplied with a CAT5e networking cable, using which they need to be connected to the Modbus RTU (RJ45) port on the WattmonMEGA or WattmonPRO. Once a module is physically connected to the Wattmon, log into the device and proceed to the *Modbus Devices* page. As detailed earlier in **Advanced Settings – Devices**, run the *Quick Scan RS-485 Bus* option and the module will appear in the devices list after running a scan. If the device does not appear, run the *Quick Scan RS-485 Bus* option again, or else you can use the *Full Scan RS-485 Bus* option.

Once the module is added on your Wattmon, it will be displayed in the device list. You may notice that the *ID* of the module is shown as *2*, even though the default is usually set to *1*. This is due to the fact that the Wattmon uses ID 1 to commence a scan and therefore requires ID 1 to be unoccupied at all times to successfully carry out a Modbus scan. Upon finding the module, the Wattmon shifts it to the next unoccupied ID, in this case ID *2*. If ID 2 is occupied, then the Wattmon shifts the module to ID 3, and so on.

To customize and set up the roles to be logged, select *Configure* from the *ACTION* drop-down next to the module name. You will come to the *Configure Device* page.



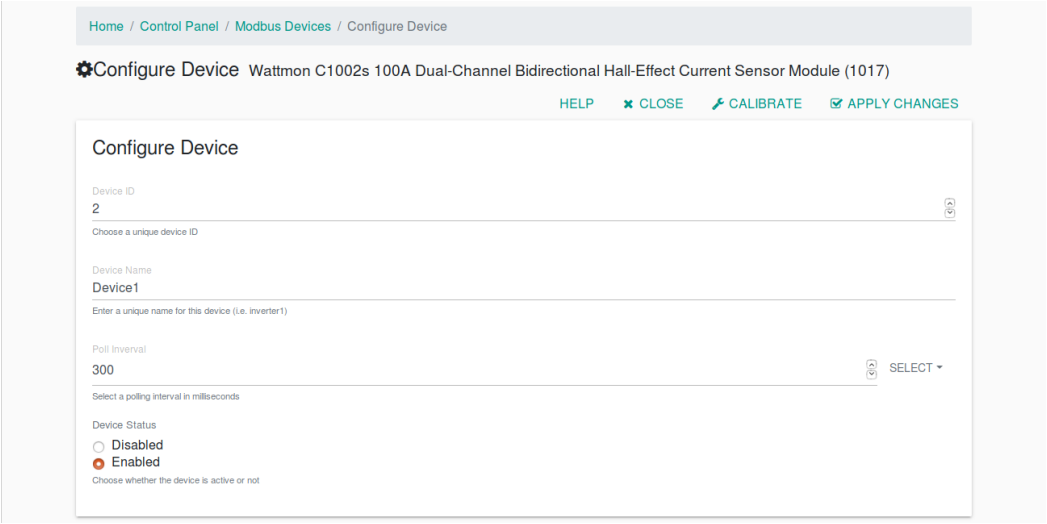
The *Configure Device* page is split into two portions – *Configure Device* and *Configure Roles*. *Configure Device* allows you to view and edit several particulars of your Wattmon module, while *Configure Roles* allows you to select the variables you wish to log and you wish to link them.

Configure Device has four options – *Device ID*, *Device Name*, *Poll Interval* and *Device Status*. *Device ID* allows you to change the Modbus ID of your module. Although the Wattmon modules ship with a default ID of *1*, it is changed to *2* once added to the Wattmon. The ID can be set within a range of *2* to *255*.

The *Device Name* is automatically provided to a device, but can be changed as per your liking. It is used as a prefix in the naming of new roles. For example, if the module name is *currentsensor*, a newly created role for *current1* for the module would be called *currentsensor_current1*.

The *Poll Interval* sets the Modbus polling time in milliseconds, the interval at which the Wattmon polls the module for data. The default for the modules is set at *300*.

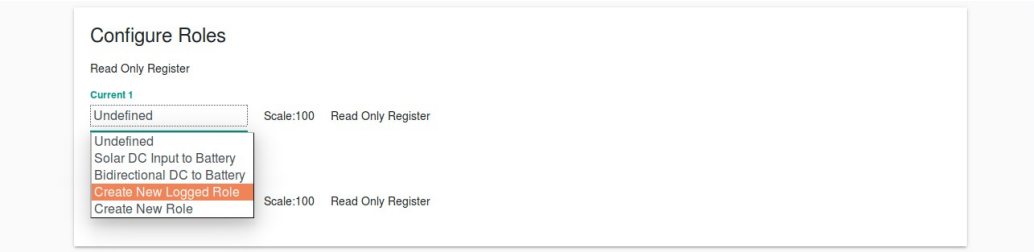
The *Device Status* lets you set the module either to an *Enabled* or *Disabled* state. In the *Enabled* state, the module functions normally, being polled as per the previous setting. If *Disabled*, the module is not polled by your Wattmon, and so no data is logged.



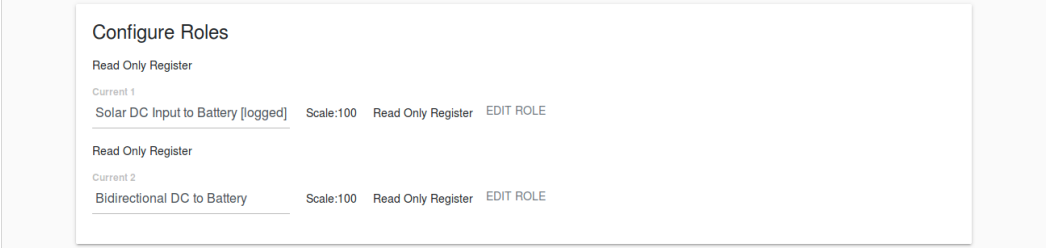
In *Configure Roles* for your module, you have the option of either creating new roles or selecting from existing ones for each of the channels on the module. In this example, the C1002s features two channels for current, which are represented as *Read Only Registers*.

Each channel features a drop-down that lists a standard three options which are common to all modules and devices – *Undefined*, *Create New Logged Role*, and *Create New Role*. *Undefined* is the default after adding the module, where the role has not yet

been configured. *Create New Logged Role* allows you to add a new role for the channel, which is automatically added to the data log on the Wattmon, as detailed in the **Data Collection** section. The third option *Create New Role* lets you allocate a role to the channel, which allows you to view the live values without logging it on the Wattmon's memory card.



Besides the aforementioned three role options, you may also find more options listed in the drop-down, which are specific to the module. You may select any of the options and then select *APPLY CHANGES* from the control bar, which will set the role of your choice for each channel. If the role is being saved in the Wattmon's data logs, the role name will be shown in *Configure Roles* with *[logged]* displayed along with it, as shown below. If the role is linked to the channel, but not saved in the data log, it will display just the role name.



After saving the changes on the *Configure Device* page, reboot the Wattmon and return to the *Devices* page. You will now find that the module is visible in the list as earlier, but with the available channels and the linked roles displayed as well. Your module has been successfully configured to work with your Wattmon.

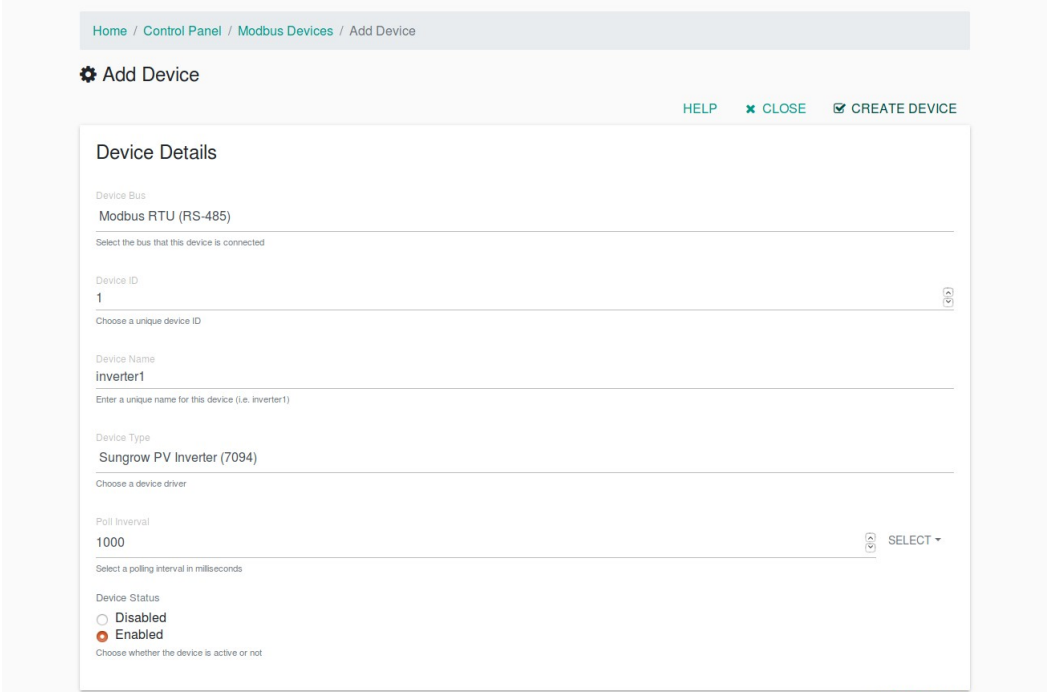
Third-Party Devices

The Wattmon data loggers are compatible with most leading manufacturers of inverters and energy meters. To ensure a successful Modbus connection, please refer to both the Wattmon and the third-party manufacturers' connection diagrams. You will also need to revisit some of the settings on the Modbus device you wish to interface the Wattmon with. Most manufacturers have varying settings for default IDs, Baud Rate and Parity settings; to verify that the settings match or to modify the settings on the Wattmon itself, go to **Modbus Communication Settings**.

In order to add a third-party Modbus device to your Wattmon, proceed to the *Devices* page and select *Manually Add a Device* as shown in **Advanced Settings – Devices**.

In the *Add Device* page, you will notice several options such as *Device Bus*, *Device ID*, *Device Name*, *Device Type*, *Poll Interval* and *Device Status*. *Device Bus* selects the physical bus that the third-party device is connected to; the options available are *Modbus RTU (RS-485)*, *Modbus RTU (RS-232)*, *Virtual Bus*, and *TCP Channels 1* through *10*, depending on your Wattmon. The drop-down option is only visible if the *Modbus RTU (RS-232) Settings* or *Modbus TCP Settings* are enabled in the **Modbus Communication Settings**, or else the Wattmon defaults to *Modbus RTU (RS-485)*.

Set the *Device ID* so that it does not conflict with any existing Modbus ID on the Wattmon, and so that it matches with the ID set on the device itself. The default on most devices is *ID 1*, but can sometimes also be *ID 3*, so please check with the technical manual of your device to confirm.



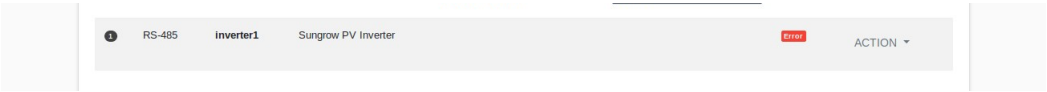
The *Device Name* must be unique to each device you add – the logged roles use this name to differentiate similar values. For example, if you have two devices and name them *inverter1* and *inverter2*, the Active Power values for both devices will be called *inverter1_AC_Active_Power* and *inverter2_AC_Active_Power* respectively. We suggest that you name the devices as *inverter1*, *inverter2*, *inverter3* and so on for inverters, and *meter1*, *meter2*, *meter3* and so on for energy meters; this allows for ease of accessing and understanding the logged data for multiples devices both locally and especially on the online Wattmon EMS portal.

The *Device Type* is a drop-down list that displays all the devices compatible with your Wattmon. Each device name displays the make and model followed by a four-digit number, which is a unique device type code given by Wattmon to identify and communicate with a particular device. Failure to select the correct *Device Type* would result in the Wattmon not being able to communicate with the Modbus device, as the Wattmon uses the registers of the selected device to communicate. In this case, we will be selecting the *Sungrow PV Inverter (7094)*.

The *Poll Interval* sets the Modbus polling time in milliseconds, which can be left at the default *1000* unless otherwise specified by the manufacturer.

Set the *Status* to *Enabled* and then click on *CREATE DEVICE*. You will be greeted with a pop-up reading *Created the device. Click here to return to the list of devices. The device will only be usable after a system reboot*. Click on *OK*, reboot your Wattmon and then return to the *Devices* page. Make the physical connection between the inverter and Wattmon using the supplied Modbus Connector Cable. For more instructions on how to connect your Wattmon to a Modbus device, refer to **Connection Diagrams**.

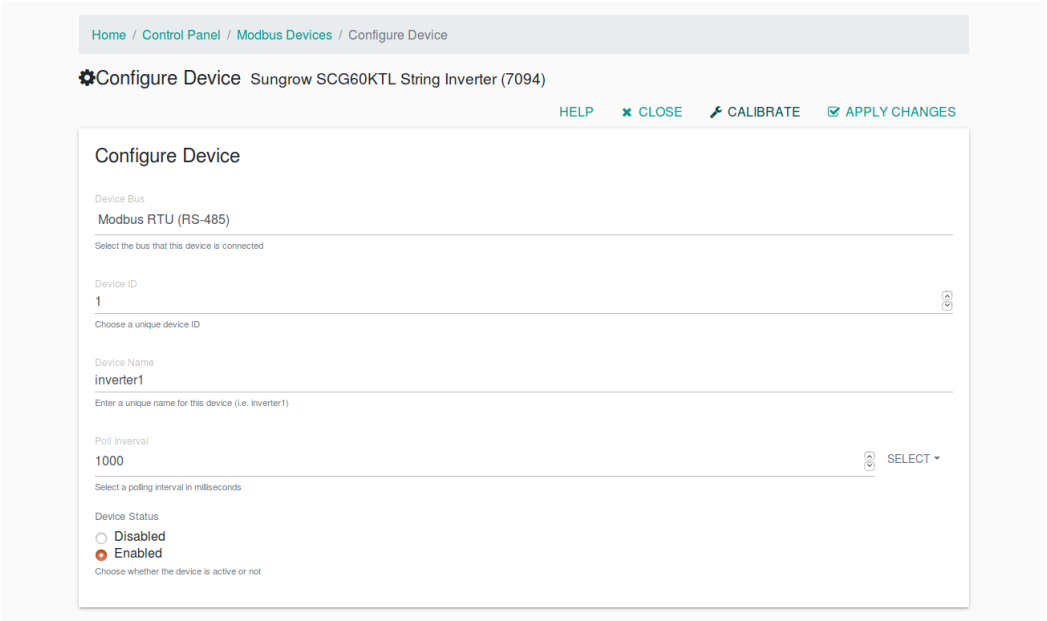
Once you return to the *Devices* page, you will notice that the *Sungrow PV Inverter* is listed. If you have correctly configured the inverter with the Wattmon, there will be an **Active** status. If you are met with the **Error** status, check the physical connections between the inverter and Wattmon. If the connection is proper, the Modbus settings such as the Modbus ID, Baud Rate and Parity setting may need to be verified. You may also poll the inverter using the **Modbus Tester** to confirm the communication settings.



Regardless of the *Status* of the inverter, you will notice that there are no *Roles* or variables displayed next to the device *Name* and *Type*, since the inverter parameters to be logged are yet to be selected. To configure the parameters you wish to log, click on the *ACTION* drop-down next to the *Sungrow PV Inverter* on the Wattmon, and select the first option *Configure*.

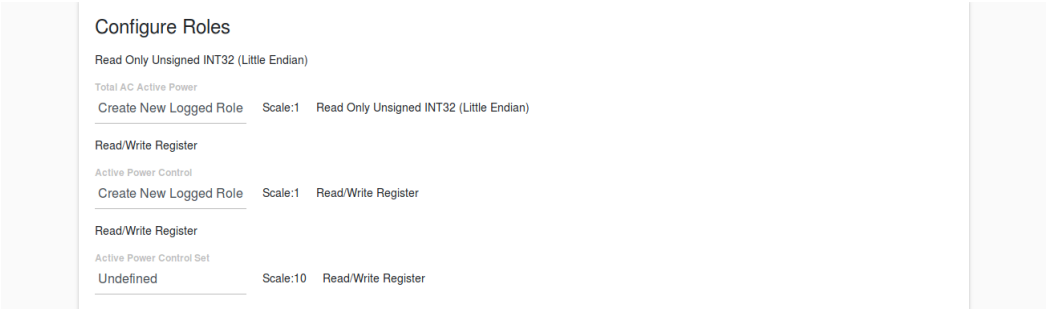
The *Configure Device* page is split into two portions – *Configure Device* and *Configure Roles*. *Configure Device* allows you to view and edit several particulars of your Modbus device which were chosen at the time of setup in the *Add Device* page. The Device Bus option if displayed, will allow you to change the bus for Modbus communication. If the

device is communicating over Modbus TCP, you may select the correct channel, which will be listed along with the TCP/IP settings.

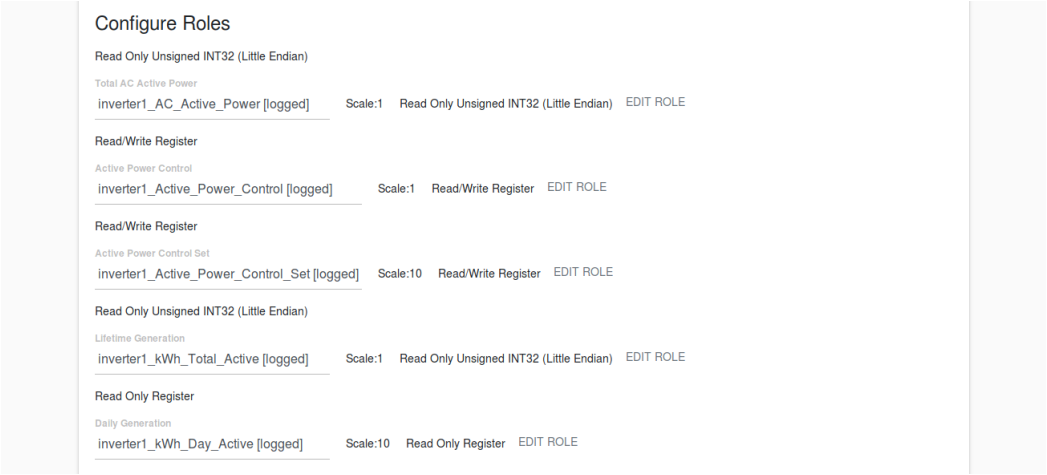


The Modbus ID of your inverter as set on the Wattmon can be modified in the *Device ID* option to match that currently set on your inverter. You can also change the *Device Name*, *Poll Interval* and *Device Status* settings.

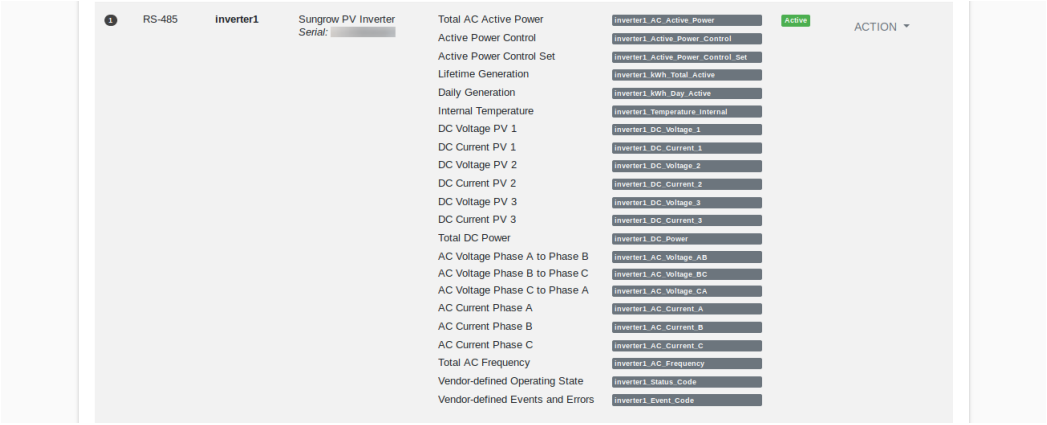
Configure Roles portion lists all the data parameters available on the inverter, allowing you to select the variables you wish to log or view. Under each available parameter features a drop-down menu that lists a standard three options – *Undefined*, *Create New Logged Role*, and *Create New Role*. *Undefined* is the default option, where the role has not yet been configured. *Create New Logged Role* allows you to add a new role which is automatically added to the data log on the Wattmon, as detailed in the **Data Collection** section. The third option *Create New Role* lets you allocate a role to view the live values, without logging it on the Wattmon's memory card.



After selecting the roles of your choice, click on *APPLY CHANGES*. A pop-up will say *Need to refresh this page, data was saved*. Select *OK*, the page will refresh automatically, and will display the role names for the parameters selected by you. If a role is being saved in the Wattmon's data logs, it will be shown with *[logged]* displayed along with it, or else it will just display the role name of a view-only parameter.



After saving the changes on the *Configure Device* page, reboot the Wattmon and return to the *Devices* page. You will now find that the inverter is visible in the list as earlier, but with the available *Roles* displayed. If the inverter has been successfully connected and configured, the *Status* shall be **Active** and the *Serial* number of the device may be visible as well.

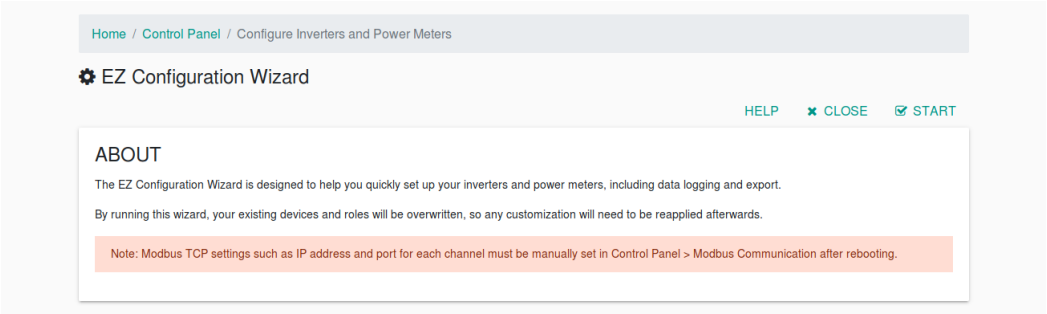


In order to add another Modbus device to communicate with the Wattmon, repeat the same procedure. Make sure that the *Device ID* is not conflicting and that the *Device Name* is as per the recommended format.

EZConfig – Quick Configuration Tool

If you are using a WattmonMEGA, then you can use the built-in quick configuration tool called *EZConfig*, that allows you to set up your Wattmon within a span of a few minutes, configuring your device for a range of inverters, energy meters, weather sensors and also for Wattmon Power Control, which is our solution to enforce the zero-export of energy and perform diesel generator synchronisation and protection.

If you are configuring a new WattmonMEGA, you may access the *EZConfig* tool either from the *Welcome to Wattmon!* overlay on the dashboard by selecting *CLICK HERE TO RUN EZCONFIG*, or from the *Control Panel*. Choosing either of the aforementioned methods will lead you to the *EZ Configuration Wizard*. To commence the process to set up your WattmonMEGA, select *START*.



The EZConfig Wizard features 4 steps – *Choose Inverters and Power Meters*, *Choose Data Points to Log*, *Review Your Configuration*, and *Implementation*. Each of these is detailed below.

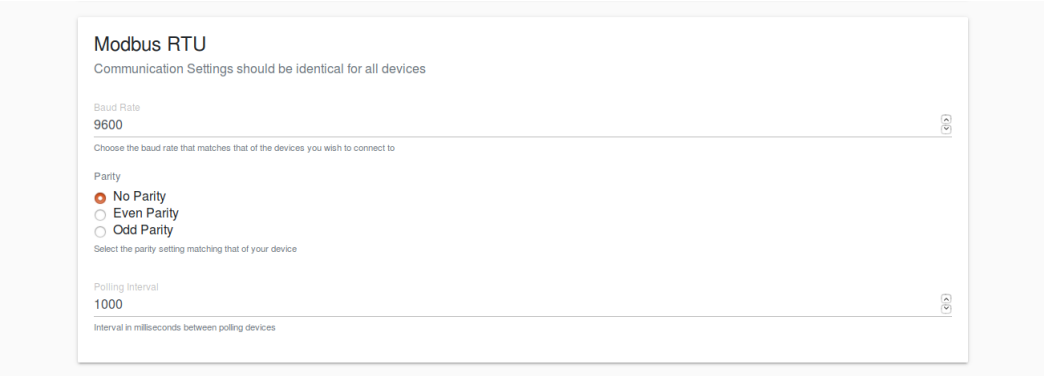
Step 1 / 4: Choose Inverters and Power Meters

The first step allows you to set some of the Modbus communication settings, select the inverters and energy meters supported by the Wattmon, and also configure the local data display.

The *Modbus RTU* section lists the *Baud Rate*, *Parity* and *Polling Interval* settings, which should be identical for all the Modbus devices connected to the Wattmon.

The *Baud Rate* determines the speed of communication and can be set to anything between 1200 and 115200. The default is set to *9600*. For *Parity*, select any one of the three available options, which are *No Parity*, *Even Parity* and *Odd Parity*. The *Poll Interval* sets the Modbus polling time in milliseconds, the interval at which the Wattmon polls for data. The default is set at *1000*.

While the *Baud Rate* and *Parity* settings can be changed on most Modbus devices to match, the required polling interval may vary. If one of your devices requires a different interval, you can change that from the *Devices* page once the EZConfig tool has been run.



The next two sections are *Power Meters* and *Inverters*. They follow the same layout, allowing you to add a number of energy meters and inverters. Each of the sections features five columns – *Device*, *Address*, *Bus*, *Name* and *Options*. To add a meter or inverter, select the +ADD button above the respective list and a device will be displayed, with all five columns editable.

The *Device* column features a drop-down list which contains the names or device types of each of the energy meters and inverters the Wattmon is compatible with. The list automatically selects the first device on it, but you can change it to the device of your choice.

The *Address* column lets you set the Modbus ID on each meter or inverter. The Modbus ID will be unique to each Modbus RTU device, so make sure that there are no conflicting IDs. In the case of Modbus TCP devices, the IDs may be identical between multiple devices, but again cannot conflict the existing IDs of Modbus RTU devices. Once you set an ID in the Address column, each consecutive device will automatically select the next ID.

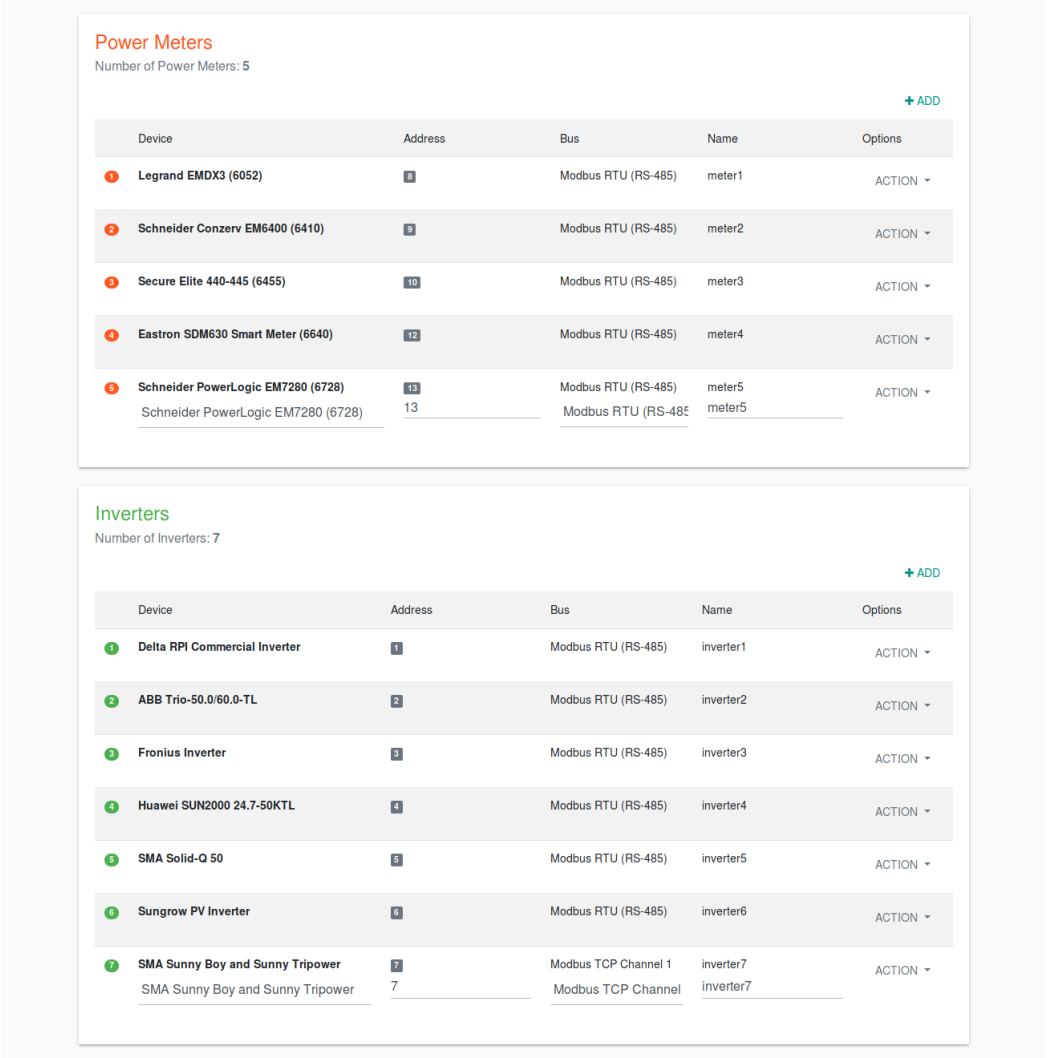
The *Bus* drop-down allows you to select from any one of the various communication buses supported, on which your device is going to be interfaced with the Wattmon. The drop-down lists nine options – *Modbus RTU (RS-485)*, *Modbus TCP Channel 1*, *Modbus TCP Channel 2, Modbus TCP Channel 3, Modbus TCP Channel 4, Modbus TCP Channel 5, Modbus TCP Channel 6*, *Modbus TCP Channel 7*, *Modbus TCP Channel 8*, *Modbus TCP Channel 9* and *Modbus TCP Channel 10*. Visit the **Modbus Communication Settings** to link the TCP/IP address of an inverter or energy meter to the corresponding TCP channel selected in *EZConfig*.

The *Name* column displays the name allocated to each meter or inverter, which is used as a suffix to the logged parameters for each device. Like the Address column, the names are allocated automatically in a successive manner, The Power Meters are named *meter1*, *meter2*, *meter3* and so on, while the inverters are named *inverter1*, *inverter2*, *inverter3* and so on. While the name is editable at the time of adding a new device, we strongly recommend that you do not modify the automatically allotted names, since the Wattmon Power Control Software relies on the preset naming convention.

Changing the names will also affect the data display locally as well as on the Wattmon EMS dashboards.

The *Options* column features the *ACTION* button, which allows you to either *Edit* or *Stop Editing* a particular device, and also *Delete* an added device.

Once all the devices types have been added and selected, each section will display the *Number of Meters* or *Number of Inverters*, and will list each of the added *Devices* with the particulars of *Modbus Address*, the communication *Bus*, and *Name*. Before proceeding further, make sure there are no errors in any of the categories, since that will affect the functionality of the whole system.



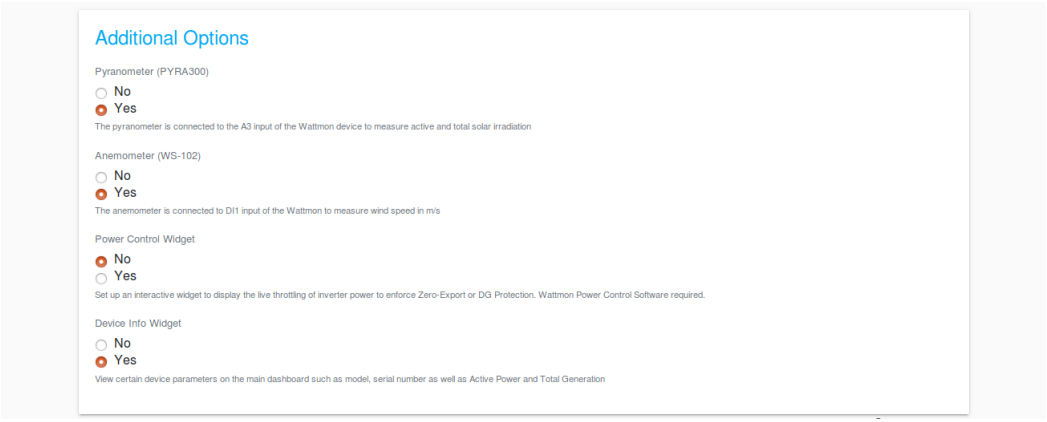
The fourth and final section in Step 1 is *Additional Options*. Here you can setup a *Pyranometer*, *Anemometer*, and also the *Power Control* and *Device Info* widgets.

The *Pyranometer* option allows you to add an analog irradiation sensor with an output of 0-5V DC to monitor both active and total solar irradiance values. The output from the pyranometer has to be connected to the A3 input on the WattmonMEGA, the power input for the pyranometer has to be taken from the 5V output, and the ground wire from the pyranometer will go to the Digital Ground input. For more details on the WattmonMEGA's I/Os, go to **Pinout Diagrams – WattmonMEGA**. To enable the recording of irradiation values, select *Yes*.

The *Anemometer* option allows you to add a digital pulse-based anemometer to measure the wind speed in meters per second, or m/s. The anemometer needs to be connected to the 5V output and Digital Ground input of the WattmonMEGA. To enable the recording of wind speed values, select *Yes*.

The *Power Control Widget* is an interactive display widget that is placed on the *Dashboard*, which allows you to view the live throttling of your inverters while enforcing either Zero-Export of Energy or Diesel Generator Protection, or both. In order to use the Wattmon Power Control Solution, you will need to have purchased a licence, which is then included on all devices obtained from us. Without the Power Control software, the widget may set up, but you will not be able to view any values for the devices. If you do not have a licence, we recommend that you set the widget to *No*, which will not set it up to be displayed. If you do have a valid licence, and wish to use power control on the site, then you may select *Yes*.

The *Device Info Widget* is a dynamic display widget that too is placed on the *Dashboard*, and allows you to view the *Serial Number*, *Model Number*, *Active Power*, *kWh Total* and *Status Code* for each of the inverters connected to your Wattmon. If your WattmonMEGA does not require power control, we recommend that you enable this by setting it to *Yes*. While the *Device Info Widget* is not required along with the *Power Control Widget*, if you wish to have both, you may set them both to *Yes*.

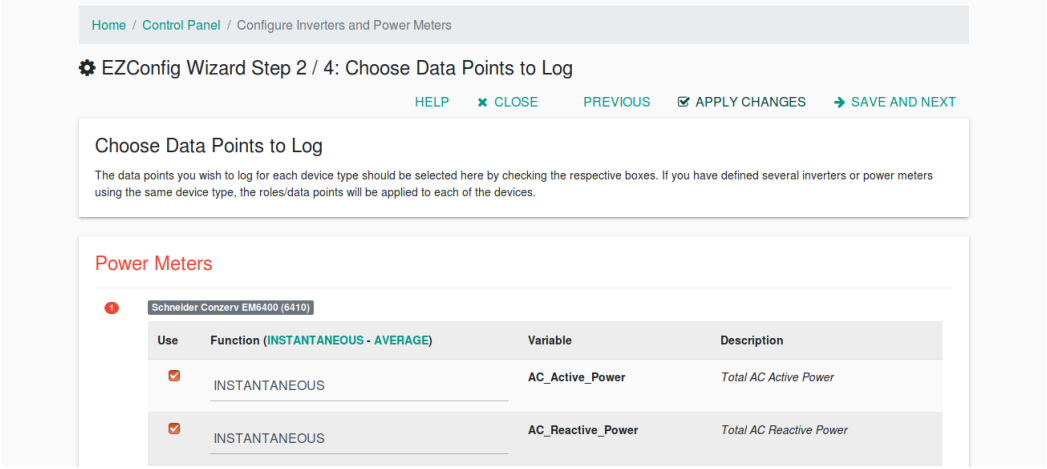


To save your settings, select *APPLY CHANGES* from the *Control Bar*. Proceed to the next step by clicking on *SAVE AND NEXT*.

Step 2 / 4: Choose Data Points to Log

The second step builds on the setup from step 1, requiring you to select the data points or variables you wish to log for each of your selected *Power Meters* and *Inverters*. Each of the device types are listed along with the parameters that can be logged on the WattmonMEGA. If you define several power meters or inverters using the same device type or model, the roles/data points will be applied to each of them.

The page displays the devices separated into the *Power Meters* and *Inverters* sections like in the previous step. The devices are shown with a serial number, red in colour for power meters and green for inverters, along with the name of the device and device type code. Each section displays the device particulars such as *Use*, *Function*, *Variable* and *Description*.

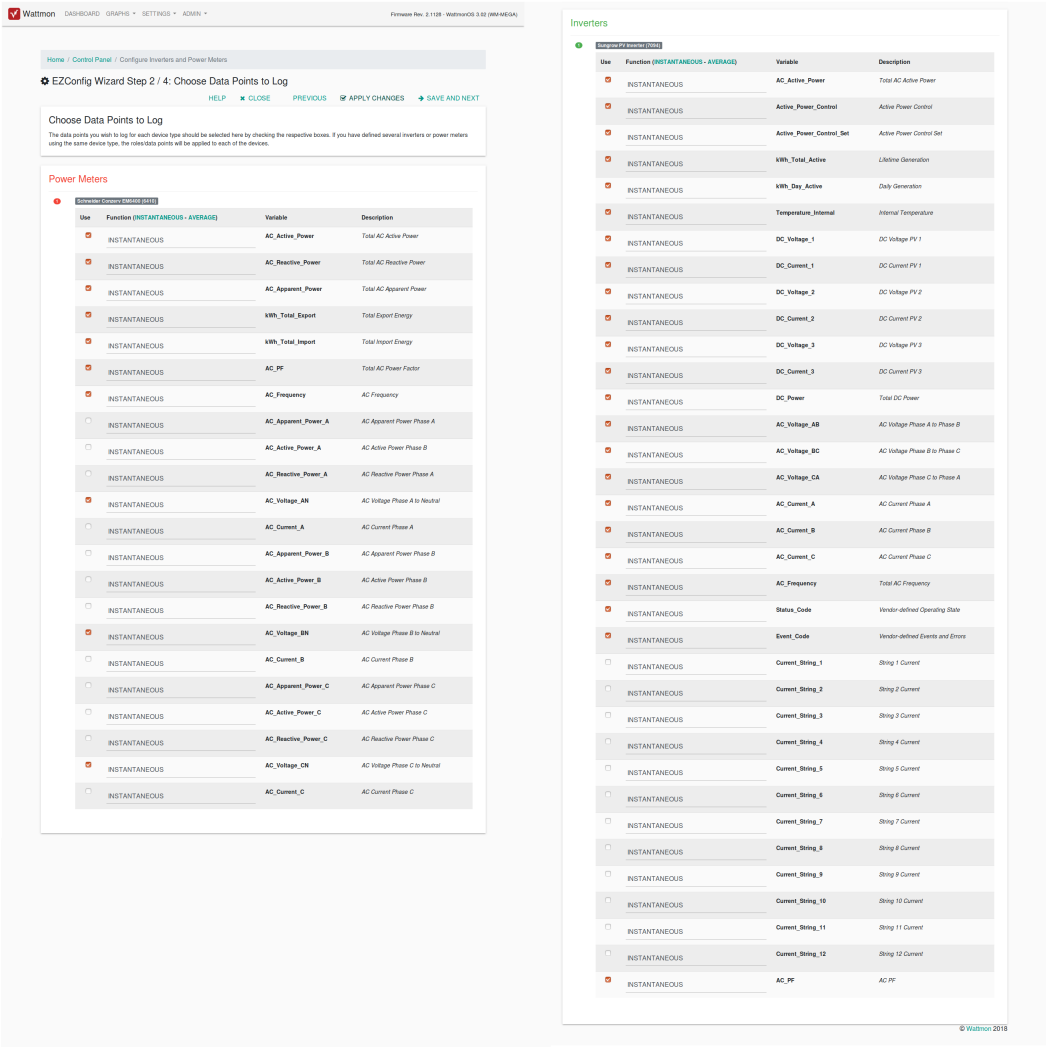


The *Use* column features a check-box, which needs to be ticked if the parameter is to be logged. If left unselected, the parameter will not be logged or polled by the WattmonMEGA.

The *Function* column lets you select the calculated approximation for each value. While the Wattmon polls each of data points of the devices based on the *Polling Interval* set in the previous step, the value for each data point is written to the Wattmon once a minute. Therefore, the function of the calculation can be *Average*, where an average of the polled value is logged; *Min*, where the smallest polled value is logged, *Max*, where the highest polled value is logged; and *Instantaneous*, where the last polled value is recorded. The column name *Function* is followed by *(**INSTANTANEOUS** - **AVERAGE**)* which allows you to set the function for all the values within a section to *Instantaneous* or *Average*, by clicking on either of them. We recommend that most values be set to instantaneous, especially any State, Event or Error codes.

The *Variable* column lists the name of the role as logged in the Wattmon. This is what the variable is called, however, as mentioned earlier in the *Modbus Device Setup*, the final logged role is named by combining these role names with each device's name, which were set in Step 1.

The last column is *Description*, which details what the *Variable* names mean, since the variable names are set as per the Wattmon's algorithms, and may not be intelligible.



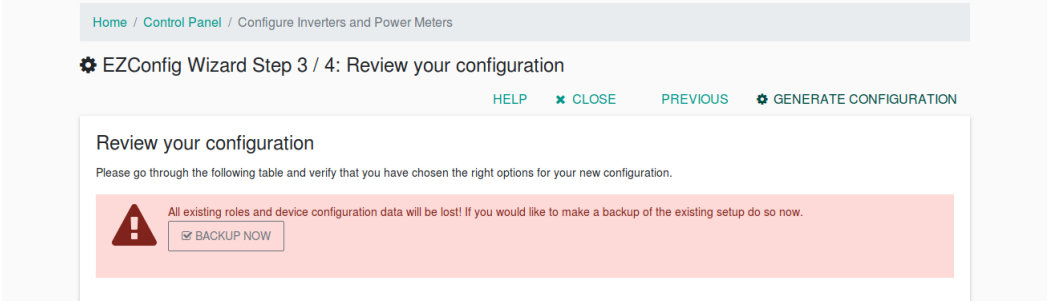
To complete the second step, select each of the variables you wish to log for each of the devices connected. If you have multiple energy meters of different make connected, they will all be listed in the *Power Meters* section. To log the values, tick the check-box in

the use column next to the parameters you wish to log. Repeat the same process for the inverter values that you wish to log as well. Save your settings by selecting *APPLY CHANGES* from the *Control Bar*. Proceed to the next step by clicking on *SAVE AND NEXT*.

Step 3 / 4: Review Your Configuration

The third step of the *EZConfig* process allows you to view the results of your settings in step 2, and verify if the configuration is ready to be generated. At this step, if you find something out of place, you can easily modify the previously saved settings by clicking on *PREVIOUS* in the *Control Bar*.

At the top of the page, in the *Review Your Configuration* section you will notice a large pink area, which states - *All existing roles and device configuration data will be lost! If you would like to make a backup of the existing setup do so now*. This message is a reminder that this is the second last step to the EZConfig tool, and proceeding to the fourth step will overwrite any existing device configurations on the WattmonMEGA. It is followed by a *BACKUP NOW* button, which downloads your entire configuration, in case you wish to store that.



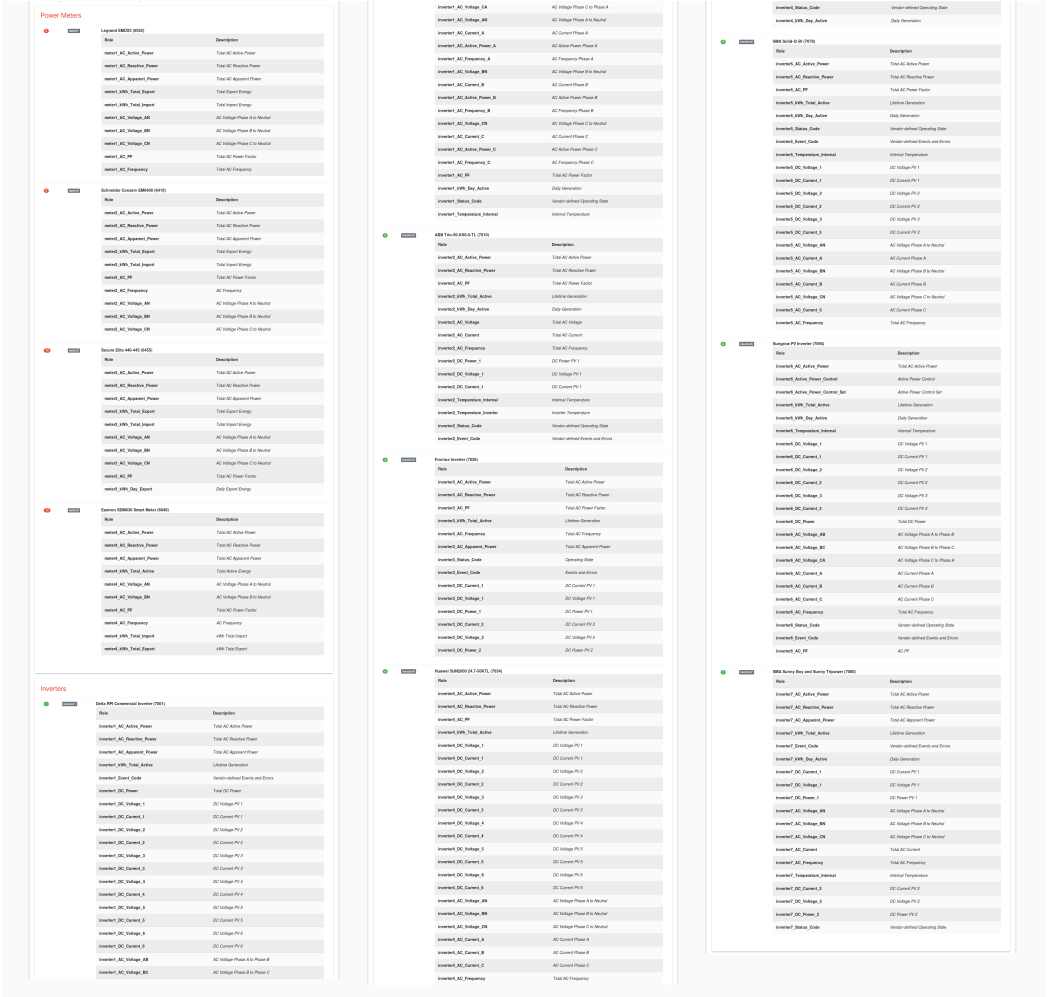
Below the Review Your Configuration section is the Your Configuration section, which lists each of the meters and inverters selected in *Step 1*, along with their variables or roles that you wish to have logged, as selected in *Step 2*.

The device are listed under their respective section, *Power Meters* or *Inverters*, with first their *Address* or ID number displayed, encircled in red for energy meters and green for inverters. Next to the ID number is the device *Name*, as set in Step 1. Next to that is the *Device Type* name, followed by a table with the final *Role* name, a combination of the device and variable names, and the *Description* of that role.

Since this is the final step before the generation of the configuration for the WattmonMEGA, we strongly suggest that you review the settings presented on the page. The Modbus *Address* should not be conflicting between any of the Modbus RTU devices. While the ID may stay the same in the case of Modbus TCP devices, the IDs may not be identical between Modbus RTU and Modbus TCP devices.

The device *Name* will also be shown in all the *Roles*, which should be verified to be correct. If the inverters or meters have been renamed, make sure that the Roles are

accordingly set. Note that the naming convention should be as per the Wattmon guidelines, or the default names attributed by EZConfig if the Wattmon Power Control Software is to be used.

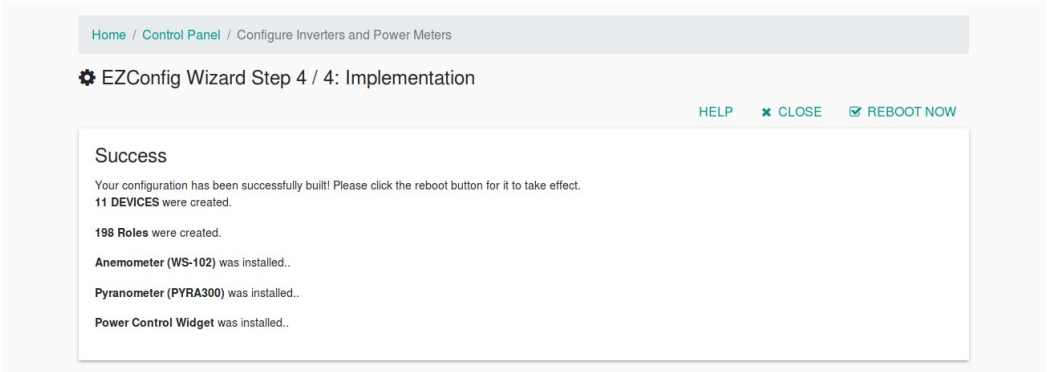


If all the allocated *Roles* are correct, then click on *GENERATE CONFIGURATION* to proceed to the final step of the *EZConfig Wizard*.

Step 4 / 4: Implementation

The final step is a confirmation of the configuration process, and it lists all the particulars of your configuration, such as the number of Modbus *Devices* to be interfaced with the WattmonMEGA, the total number of Roles created which is the total count of the number of roles which will be exported to either the Wattmon EMS or a third-party server, along

with any of the additional packages installed such as the Anemometer, Pyranometer or the Power Control Widget. The confirmation will appear as shown below.

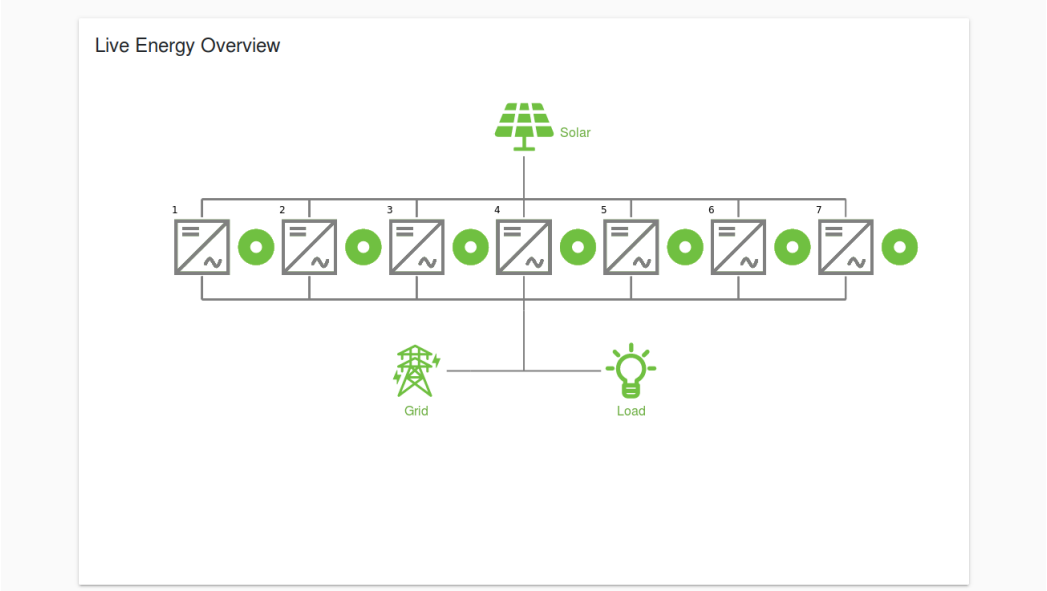


If the Power Control Widget has not been activated, and instead the Device Info Widget was installed, the success message with then omit the *Power Control Widget was installed...* message and will instead display Device Info *Widget was installed…*

To complete the *EZConfig Wizard*, click on *REBOOT NOW*, which will restart your WattmonMEGA and apply all the new configuration changes.

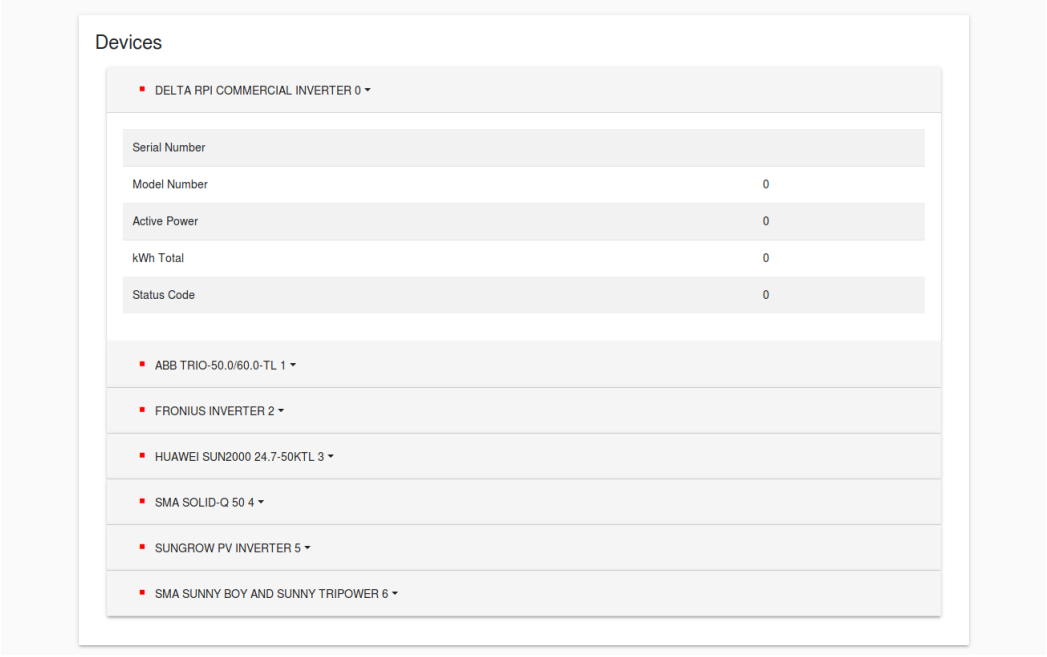
EZDisplay

After rebooting the WattmonMEGA and logging back into you, you will find that the *Dashboard* has been adapted as per your selection of the *Power Control Widget* or *Device Info Widget* in the *EZConfig Wizard*.



The *EZDisplay* for *Power Control* purposes lays out all the inverters in a single line, displaying their Modbus *Address* or IDs, and the *AC Active Power* in Watts; also displayed is the Solar input to the inverters and the Grid and Load. To enforce zero-export or DG protection, further setup is required, which is explained in the **Wattmon Power Control Solution** guide.

If you chose the *Device Info Widget* during the *EZConfig* setup, the *Dashboard* lists the devices selected by you along with a drop-down revealing the *Serial Number*, *Model Number*, *Active Power*, *kWh Total* and *Status Code* for each of the inverters connected to your WattmonMEGA.



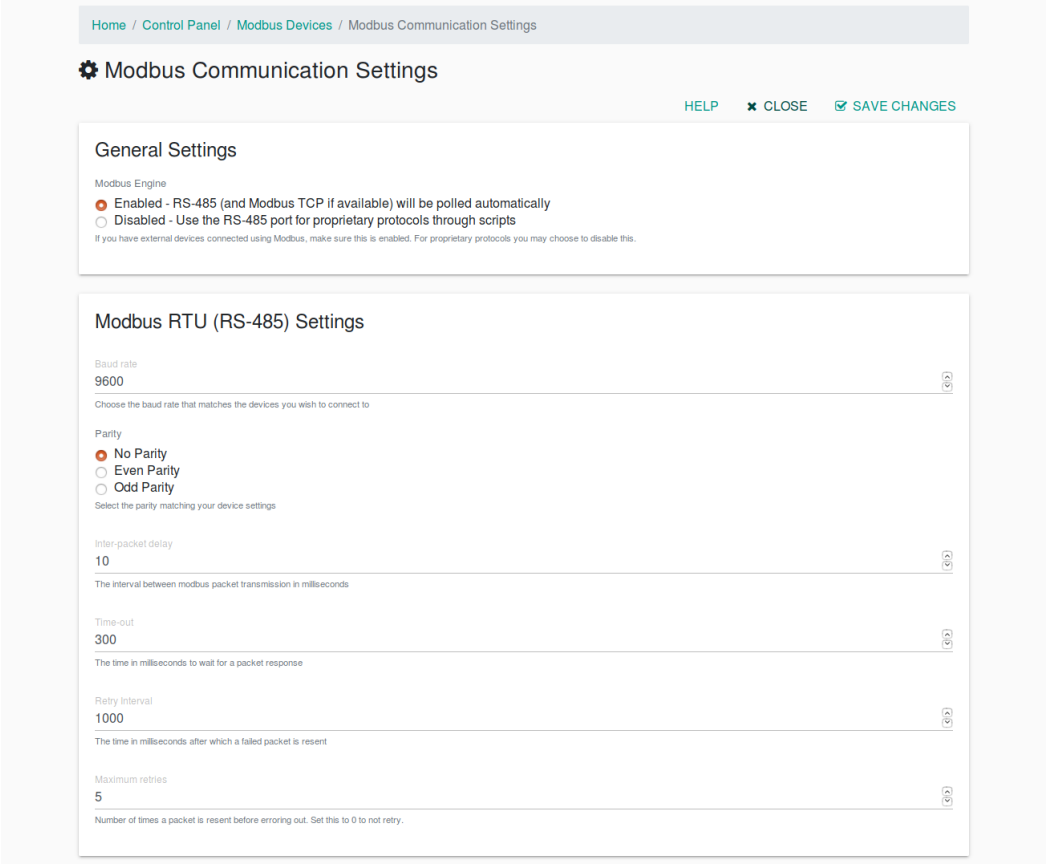
Each of the devices are listed with a small dynamic icon right before their name, which is colour-coded to display the communication status of the inverter. If the icon is red in colour, then the device is inactive or has not communicated with the WattmonMEGA in over two minutes. If the device is active and communicating with the WattmonMEGA, then the icon is green in colour.

Modbus Communication Settings

To modify the Modbus settings on your Wattmon to match those of the devices you wish to interface with, you need to configure the Modbus Communication Settings. You may access these settings through the *Manage Devices* page as described earlier in the manual, or you may configure the *Modbus Communication* setting through the *Control Panel*.

The *Modbus Communication Settings* are set essentially in three sections – *Modbus RTU (RS-485) Settings*, *Modbus RTU (RS-232) Settings*, and *Modbus TCP Settings*, which are all the communication channels offered on your Wattmon.

The first section, *General Settings*, is for enabling the Modbus engine on the Wattmon, which allows for communication with devices over RS-485 Modbus RTU. If the *Modbus Engine* is set to *Enabled*, Modbus devices on the RS-485 port will be polled automatically, at a particular polling interval. If the *Modbus Engine* is *Disabled*, the RS-485 port can be used for polling devices over proprietary protocols through custom scripts or packages. If you are interfacing the Wattmon with Modbus devices, set it to *Enabled*.



If the *Modbus Engine* is set to *Enabled*, a section called *Modbus RTU (RS-485) Settings* will be visible. Here you can set the *Baud Rate*, *Parity*, *Inter-packet delay*, *Time-out*, *Retry Interval* and *Maximum retries*.

The *Baud Rate* is a common measure of symbol rate, which specifies the speed at which information is communicated over a data channel. The Baud Rate (in bps) is

indirectly proportional to the distance of the cable - the higher the baud rate, the more sensitive the cable becomes to quality of installation, and so the lower the length needs to be. Choose a rate that matches the devices you wish to connect to; the default on the Wattmon is set to *9600*.

The *Parity* is a check bit which is applied to the smallest units of the communication protocol, and serves as the simplest form of error detecting code. There are two variants of parity bits - *Even Parity* and *Odd Parity*, both of which are supported by the Wattmon. But given that the Wattmon has a checksum added to each Modbus poll, the default *Parity* setting is *No Parity*.

Inter-packet delay sets the interval in milliseconds between the Modbus packets of data transmission. The default is set to *10*.

Time-out sets the time in milliseconds the Wattmon waits for a Modbus packet response. If a Modbus device does not respond within the stipulated time, that packet is timed-out. The default is set to *300*.

The *Retry Interval* sets the time in milliseconds after which a failed or timed-out Modbus packet is resent. The default is set to *1000*.

Maximum retries sets the number of times a failed or timed-out Modbus packet is resent before being cancelled. If you wish to not retry any failed packet, set this to *0*. The default is set to *5*.

The next section is *Modbus RTU (RS-232) Settings*, which is almost identical to the previous section, except it is for enabling the communication engine for interfacing with devices over RS-232 Modbus RTU. If the *Modbus Engine* is set to *Enabled*, Modbus devices on the RS-232 port will be polled automatically, at a particular polling interval. If the *Modbus Engine* is *Disabled*, the RS-232 port can be used for polling devices over serial or proprietary protocols. If you are using the RS-232 port for interfacing the Wattmon with Modbus devices, set it to *Enabled*.

Like the previous section, if the *Modbus RTU (RS-232) Settings* is set to *Enabled*, a new section will be visible, where you can set the *Baud Rate*, *Parity*, *Inter-packet delay*, *Time-out*, *Retry Interval* and *Maximum retries* for devices communicating over Modbus RS-232.

The *Baud Rate* is a common measure of symbol rate, which specifies the speed at which information is communicated over a data channel. The Baud Rate (in bps) is indirectly proportional to the distance of the cable - the higher the baud rate, the more sensitive the cable becomes to quality of installation, and so the lower the length needs to be. Choose a rate that matches the devices you wish to connect to; the default on the Wattmon is set to *9600*.

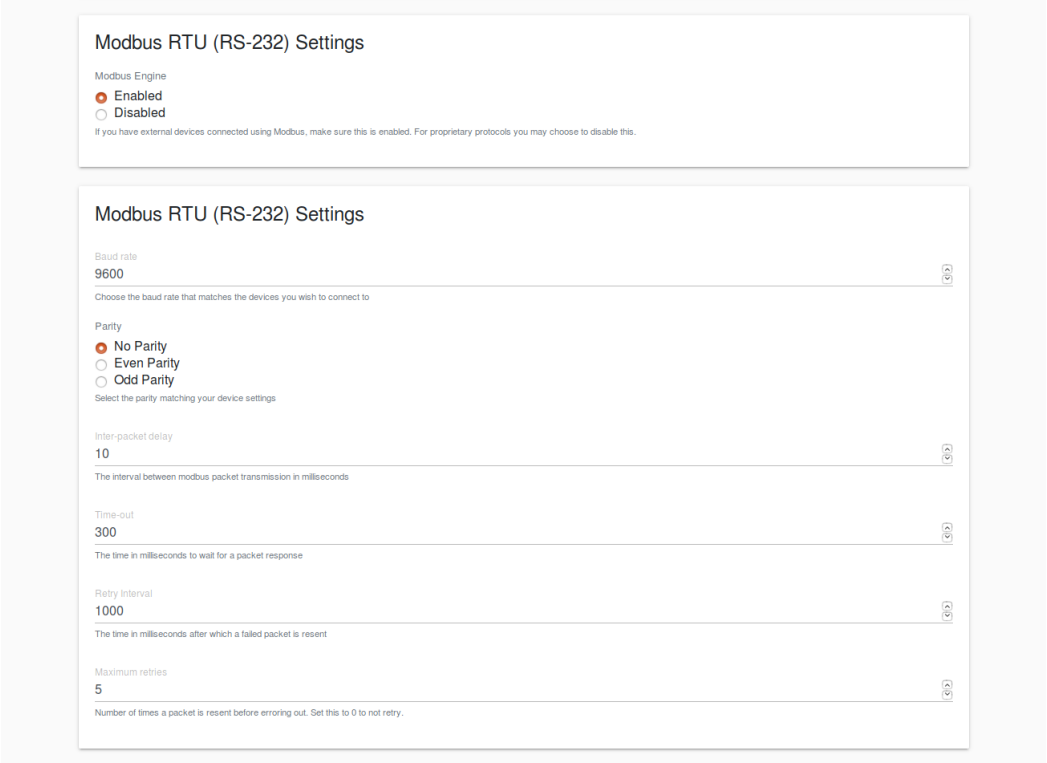
The *Parity* is a check bit which is applied to the smallest units of the communication protocol, and serves as the simplest form of error detecting code. There are two variants of parity bits - *Even Parity* and *Odd Parity*, both of which are supported by the Wattmon. But given that the Wattmon has a checksum added to each Modbus poll, the default *Parity* setting is *No Parity*.

Inter-packet delay sets the interval in milliseconds between the Modbus packets of data transmission. The default is set to *10*.

Time-out sets the time in milliseconds the Wattmon waits for a Modbus packet response. If a Modbus device does not respond within the stipulated time, that packet is timed-out. The default is set to *300*.

The *Retry Interval* sets the time in milliseconds after which a failed or timed-out Modbus packet is resent. The default is set to *1000*.

Maximum retries sets the number of times a failed or timed-out Modbus packet is resent before being cancelled. If you wish to not retry any failed packet, set this to *0*. The default is set to *5*.



The last section is *Modbus TCP Settings*, which is for enabling the TCP communication engine for interfacing with devices over Modbus TCP. The most basic difference between Modbus TCP and Modbus RTU is that Modbus TCP runs on an Ethernet physical layer (TCP/IP), whereas Modbus RTU is a serial level protocol.

If you have devices which need to be interfaced over Modbus TCP, set the *Modbus TCP Engine* to *Enabled*. Once *Enabled*, you can configure the *Inter-packet delay*, *Time-out*, *Retry Interval* and *Maximum retries* settings as well.

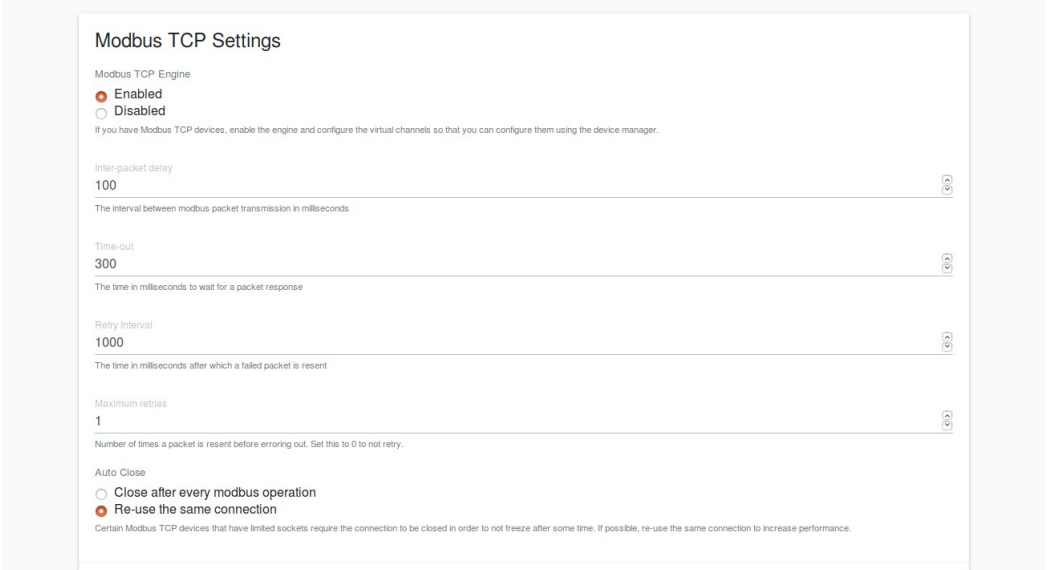
The *Inter-packet delay* is the interval in milliseconds between the Modbus packets of data transmission. The default is set to *100* for Modbus TCP.

Time-out sets the time in milliseconds the Wattmon waits for a Modbus packet response. If a Modbus TCP device does not respond within the stipulated time, that packet is timed-out. The default is set to *300*, much like for Modbus RTU devices.

The *Retry Interval* sets the time in milliseconds after which a failed or timed-out Modbus packet is resent. The default is set to *1000*.

Maximum retries sets the number of times a failed or timed-out Modbus packet is resent before being cancelled. If you wish to not retry any failed packet, set this to *0*. The default is set to *1*.

Auto Close is a setting for certain Modbus TCP devices that have limited sockets and require the connection to be closed in order to not freeze data transmission. There are two options provided here – *Close after every Modbus operation* and *Re-use the same connection*. If possible, re-use the same connection to increase performance.



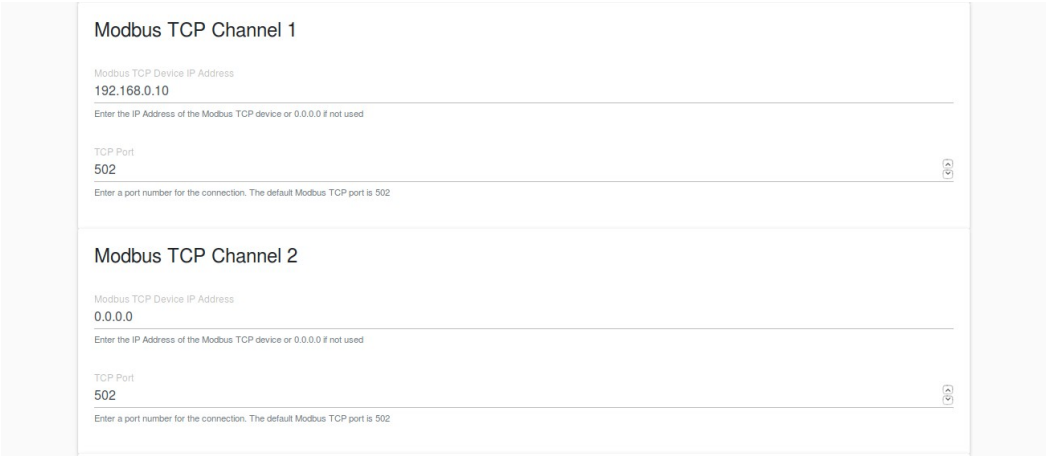
After the aforementioned settings are listed the Modbus TCP Channels. There are ten channels available on the WattmonMEGA, while the WattmonPRO and WattmonMINI have only one TCP channel each.

The *Modbus TCP Channels* are shown by name, along with two options each – *Modbus TCP Device IP Address* and *TCP Port*.

In the *Modbus TCP Device IP Address* option, enter the IP Address of the Modbus TCP device you wish to interface with. If there is no device being interfaced on the channel, leave the IP address as *0.0.0.0*.

The *TCP Port* is the port number for the Modbus TCP connection. The default port for most connections is *502*, which is the default on the Wattmon, but can be changed if it does not match that of your inverter.

As shown in the image below, if just *Modbus TCP Channel 1* is used for a device with a TCP/IP address of *192.168.0.10*, the IP address of that device in entered in the *Modbus TCP Device IP Address* option. The TCP Port is left at the default of 502, since that is the most commonly used port number in Modbus TCP. The consecutive channels, if any, which are not being used, are left at the default IP address of *0.0.0.0*, with the port number also left at the default *502*, as seen here for *Modbus TCP Channel 2*.

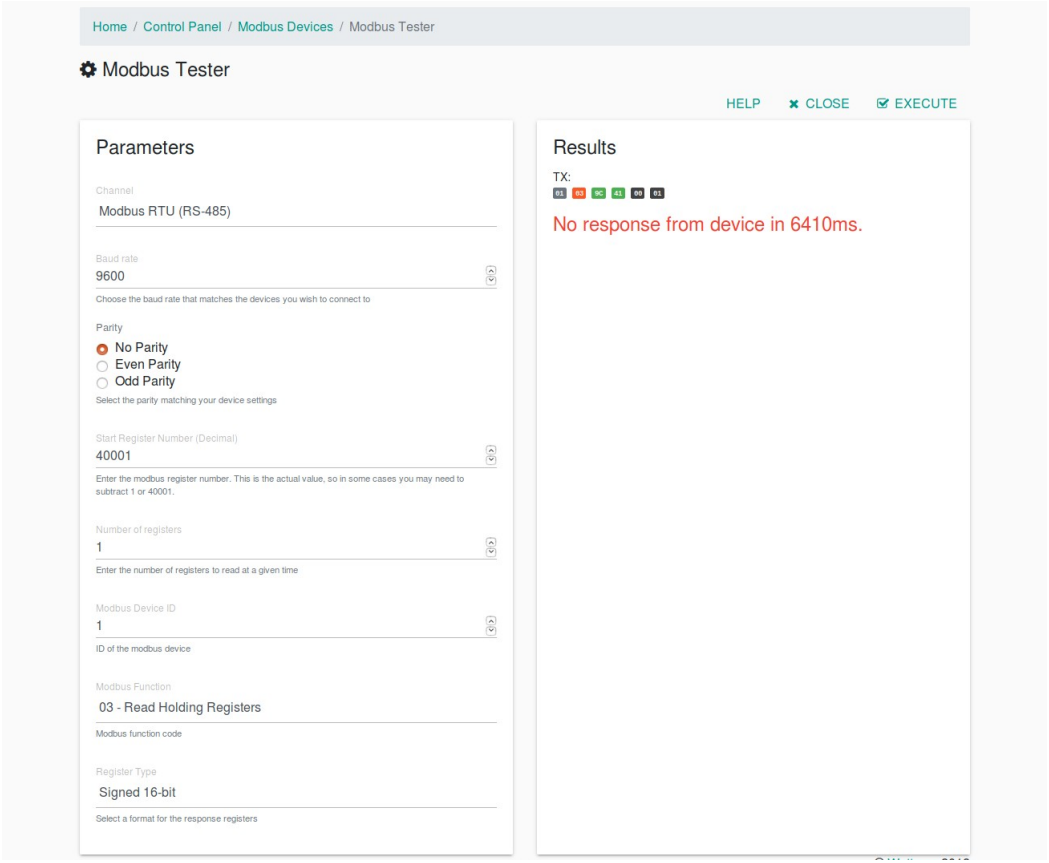


Upon applying the settings of your choice for *Modbus RTU (RS-485) Settings*, *Modbus RTU (RS-232) Settings*, and *Modbus TCP Settings*, click on *SAVE CHANGES* to apply your settings. You will be greeted with a message saying Saved Settings, and another one saying You may need to reboot the device for changes to take effect! Proceed to reboot your device for the changes to take effect.

Modbus Tester

The Wattmons now come with a built-in *Modbus Tester*, which allows you to test a Modbus connection with your devices by polling certain Modbus Registers. In order to poll a particular device and perform a Modbus test, make sure to keep handy as much Modbus-related information you have concerning that particular device, such as the Modbus ID, Baud Rate, Parity, etc. It is particularly important to have the Modbus Register Mapping from the manufacturer, as without the actual Modbus Registers, it is impossible to obtain a specific value through the Modbus Tester.

To access the *Modbus Tester*, either follow the instructions as shown in the *Manage Devices* page earlier, or from the *Control Panel*. The *Modbus Tester* page is displayed in two columns, one which lists the Modbus *Parameters* you wish to test, and the other displays the *Results* from that Modbus poll.



The Parameters section lists the options for *Channel*, *Baud Rate*, *Parity*, *Start Register Number*, *Number of Registers*, *Modbus Device ID*, *Modbus Function* and *Register Type*.

The *Channel* option contains a drop-down that lists the various physical buses supported by the Wattmon, that a Modbus device is connected to. The options available are *Modbus RTU (RS-485)*, *Modbus RTU (RS-232)*, and *TCP Channels 1* through *10*, depending on your Wattmon. The Modbus TCP Channels are displayed along with their IP address and port number. Select the bus your device is connected to and then proceed to the next option.

The *Baud Rate* determines the speed of communication between two devices. To ensure that the Modbus device you wish to communicate with is able to receive a Modbus poll, set the Baud rate to match that of the device you wish to connect to. If uncertain of the *Baud Rate* of your device, try both *9600* and *19200*, which are the most commonly used ones.

Parity is presented with three options – *No Parity*, *Even Parity* and *Odd Parity*. Like the previous option, to ensure a reply from the Modbus device you are connected to, set the

Parity settings to match that of your device. No Parity is the most commonly used one, but it does differ from manufacturer to manufacturer.

In the *Start Register Number (Decimal)* option, you need to enter the Modbus Register number in Decimal form. You will be required to enter the actual value of the register here, so in some cases you may need to subtract 1 or 30001 or 40001 from the register value presented in by the device manufacturer. We showcase this later in the examples.

In the *Number of Registers* option, you need to enter the number of registers to read at a given time. This too will be as per the Modbus Register Mapping.

The *Modbus Device ID* option requires for you to enter the Modbus ID of the device you wish to communicate with.

The next option is again a drop-down, called Modbus Function. The function code is the number which decides which function to perform when reading or writing data from a device. The Wattmon supports five function codes – *01 Read Coil Status*, *02 Read Digital Input Status*, *03 Read Holding Registers*, *04 Read Input Registers*, and *06 Write Single Register*. The function code for your device will be again as per the Modbus Register Mapping.

The last option is *Register Type*, which is for selecting the formatting of the data from the device you are connected to. For most single registers, the commonly used format is *Unsigned 16-bit*, while for double registers the commonest is *Unsigned 32-bit (Big Endian)*. However, the correct format of each register will be mentioned in the Modbus Register Mapping.

The *Results* section shows the Modbus command sent by the Wattmon as per the particulars selected in the *Parameters* section, as well as the response from the Modbus device you are connected to.

Modbus Test Examples

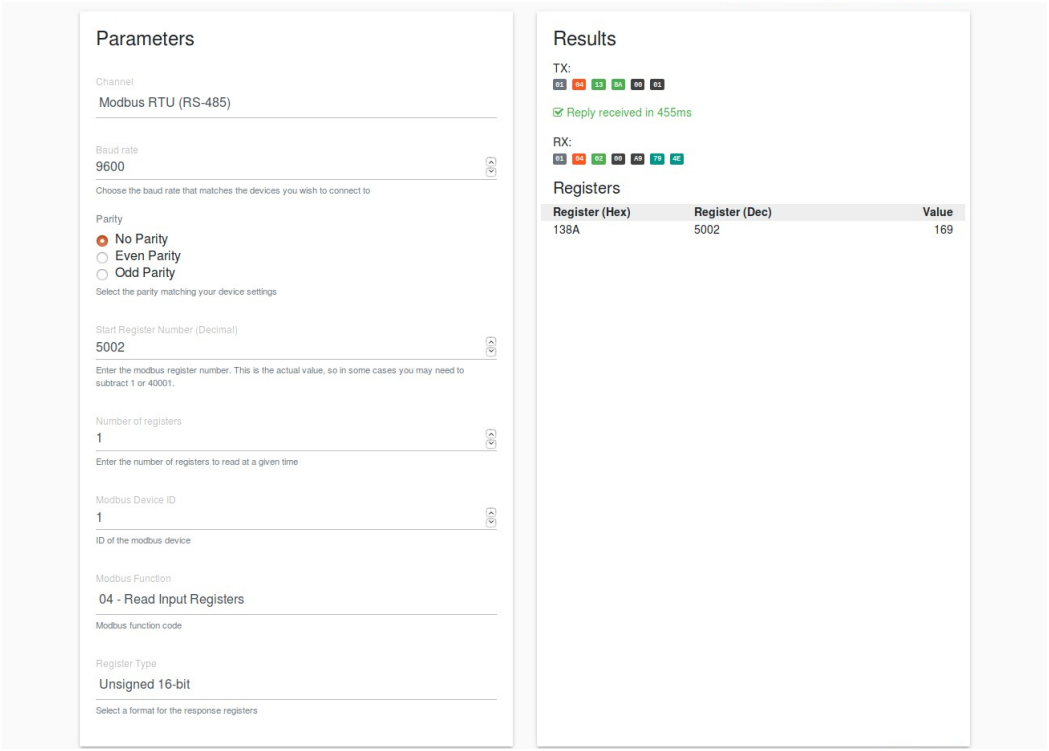
If the Modbus device connected to the Wattmon is a Sungrow SG60KTL PV inverter, you would first need to verify the Modbus *Channel*, *Baud Rate*, *Parity* and *Modbus ID*. Once those are known enter them on the *Modbus Tester* page. Then refer to the Modbus Register mapping from Sungrow for the remaining details, as shown below.

SUNGROW 阳光电源 Green and Effective

No.	Name	Address	Data	Data range	Unit	Remark	Address
4	Daily energy	5003	U16		0.1kWh		3x
5	Total energy	5004 ~ 5005	U32		kWh		3x

In the case of Sungrow, the actual registers are known by subtracting 1 from the shared Address. So when polling today's generation, or *Daily energy* values, set the *Start Register Number (Decimal)* as *5002*. The function code is 04 as per the register mapping, so the *Modbus Function* is set as *04 Read Input Registers*. The final option is the *Register Type*, which is detailed in the image above as U16, which is *Unsigned 16-bit*. Once all the values are filled in the Parameters column, click on EXECUTE to poll

the Modbus device, which is the Sungrow Inverter. The *Parameters* entered correctly, and the *Result*, if successful, will look like in the following image.



If the same Wattmon has another device connected to that needs to be tested, in that case, repeat the procedure as above, while noting the differences in certain settings. If the second Modbus device connected to the Wattmon is a SMA Solid-Q 50 inverter, you would first need to verify the Modbus *Channel*, *Baud Rate*, *Parity* and *Modbus ID*. Note that the *Channel* can be the same, but does not have to. The *Baud Rate* and *Parity* have to be the same as the previous device, and the *Modbus ID* has to be different. Once those are known enter them on the *Modbus Tester* page. Then refer to the Modbus Register mapping from SMA New Energy for the remaining details, as shown below.

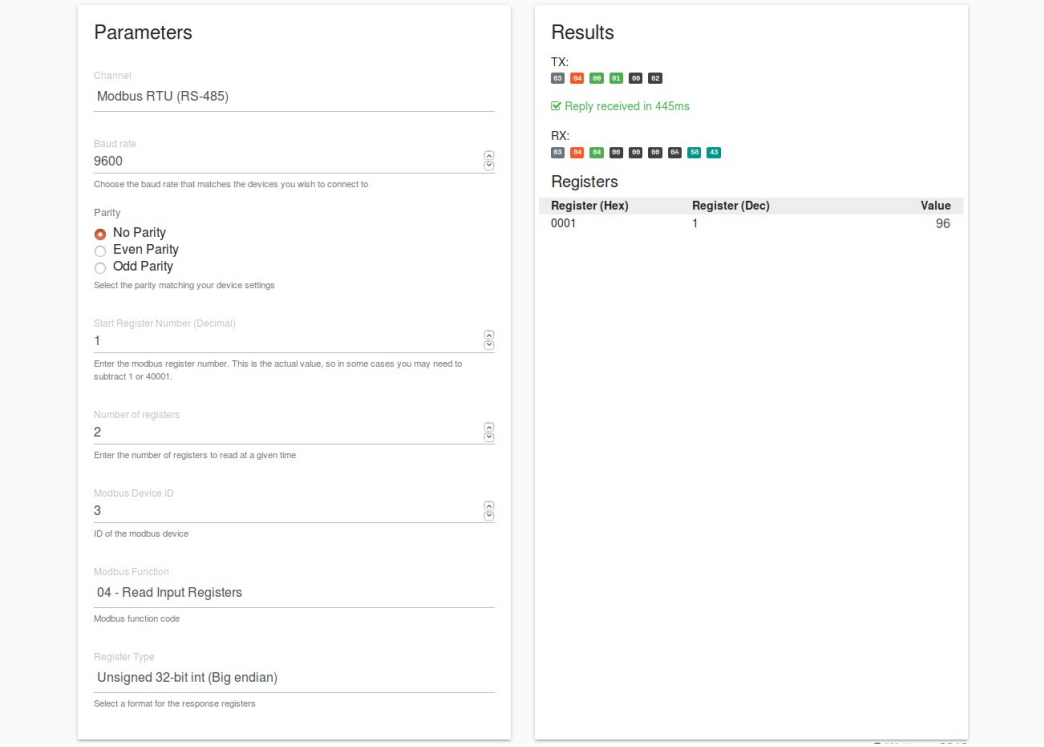
3.3 SMA-China Modbus Profile - Register Overview

Read-Only Registers

ADR (DEC)	Description/number code	Type	Unit	Gain	Access
30002	E-Today	U32	kwh	0.1	RO
30004	E-Total	U32	kwh	0.1	RO

In the SMA Solid-Q register mapping, the actual registers are known by subtracting 30001 from the shared Address. So when polling today's generation or *E-today* values, set the *Start Register Number (Decimal)* as *1*. The function code is 04 as per the register mapping, so the *Modbus Function* is set as *04 Read Input Registers*. The final option is the *Register Type*, which is detailed in the image above as U32, which can be either *Unsigned 32-bit (Big Endian)* or *Unsigned 32-bit (Little Endian)*. Check within the registers document to confirm which of the two it is.

Once all the values are filled in the Parameters column, click on EXECUTE to poll the Modbus device, which is now the SMA Inverter. The *Parameters* entered correctly, and the *Result*, if successful, will look like in the following image.



If the Modbus poll is unsuccessful, you will be greeted with the message saying No response from the device in 0000ms, in which case you need to verify if the device is properly connected and if the *Baud Rate*, *Parity* and *ID* is correctly set.

If the Modbus poll says Modbus Exception, the device is connected and responding, but the *Start Register Number (Decimal)*, or the *Modbus Function*, or the *Register Type* is erroneous and needs to be corrected.

Troubleshooting your Wattmon

Wattmon does not Work

There are several things which can cause an issue in the functioning of your Wattmon. We look at the common ones below:

a) Check that your Wattmon has power. If the *Power* / *PWR* light on the Wattmon is switched on and glowing, the power supply is fine. If not, use a multimeter to measure the voltage between pin 1 and 2 of your Wattmon. If you do not get a voltage, identify and correct the cabling or change the adapter. If you do get a voltage greater than 6V DC at the input, then your Wattmon has sustained damaged and would need to be returned to us for repair.

b) Make sure the supplied microSD card is properly inserted in the slot. Without a properly configured microSD card, your Wattmon will not work. If you have lost the card or if it is damaged, download a WattmonOS .zip file from the website ***here*** and unzip it onto a blank microSD card of at least 8 GB capacity. Insert the new card into the microSD slot of the Wattmon before powering up.

c) Perform a firmware update on the Wattmon by downloading the latest Firmware for the WattmonMEGA from ***here*** and for the WattmonMINI/WattmonPRO from ***here***. Place the file (*imagez.hex* or *image.hex*) into the root folder of the microSD card and insert it into the Wattmon. Press and hold the reset button and then power up the Wattmon to re-flash your device. You should notice the *Script* / *SCR* light flash rapidly for a few seconds, then slower for a few seconds, and then finally stop. Once it resumes blinking once per second, the firmware update has been successfully completed.

d) If the *Device* / *DEV* and *Script* / *SCR* lights are flashing simultaneously and rapidly, the microSD card is not inserted properly or is damaged. To solve this, go to steps (b) and (c).

e) If the *Script* / *SCR* light is not blinking approximately once per second, the most likely issue is software-related. To be sure it is a software or configuration issue, follow steps (b) and (c) above and see if it resolves the issue.

f) Connect the Wattmon to your laptop via a LAN cable. If you see the green LAN light solid and orange LAN light on the RJ45 jack blinking, the LAN connection is proper. To connect to the device, follow the instructions on the **Connecting to your Device** page.

Unable to connect to the Wattmon over Ethernet

The procedure to connect to your Wattmon is very straightforward. It is described on the **Connecting to your Device** page in various steps. Follow the settings and your Wattmon will be easily accessible over an Ethernet connection. If however, you find the instructions difficult to follow, you may download the more detailed ***Connecting to your Wattmon* guide** which explains the entire procedure in a very comprehensive manner, along with several screenshots of each step.

Frequently Asked Questions

- What is the default IP address of my Wattmon? How do I reset my Wattmon to the default IP?

  - The default IP address of your Wattmon is *192.168.0.55*. It is printed on the label on the right side of the device. In case you forget the IP address you have assigned to your Wattmon, you can return it to the default by pressing down the reset button on the Wattmon for five seconds, till the *Scripts* light stops blinking for a few seconds and then resumes blinking. Switch your Wattmon off and on, and it will return it to the default IP.

  Alternatively, if you are logged into your Wattmon, you can reset its IP address by selecting *Defaults* from the **Network Setup** page.

- What is a MAC address? Where do I find the MAC of my Wattmon?

  - A media access control address (MAC address) of a computer is a 12 digit alpha-numeric unique identifier assigned to network interfaces for communications at the data link layer of a network segment. MAC addresses are used as a network address for most IEEE 802 network technologies, including Ethernet and Wi-Fi.

  The MAC of your Wattmon can be found printed on the right side of the device along with the serial number. Alternatively, it can be found on the **Network Setup** page on your Wattmon.

- What are the default log-in credentials?

  - The default username and password are *admin* and *admin* respectively.

- How do I check the Wattmon OS version on my Wattmon?

  - Log-in to your Wattmon, and at the top right corner of each page, you will find the OS and Firmware version of your device. You can see the OS and Firmware version on the bottom right corner on the login page as well.

- How do I check the Wattmon Firmware version on my Wattmon?

  - Log-in to your Wattmon, and at the top right corner of each page, you will find the OS and Firmware version of your device. You can see the OS and Firmware version on the bottom right corner on the login page as well.

- How do I reflash the Wattmon Firmware?

  - Download the latest Firmware for the WattmonMEGA from ***here*** and for the WattmonMINI/WattmonPRO from ***here***. Place the file (*imagez.hex* or *image.hex*) into the root folder of the microSD card and insert it into the Wattmon. Press and hold the reset button and then power up the Wattmon to re-flash your device. You should notice the *Script* / *SCR* light flash rapidly for a few seconds, then slower for a few

seconds, and then finally stop. Once it resumes blinking once per second, the firmware update has been successfully completed.

- How do I update the Wattmon OS?

  - If you are logged into your Wattmon device, download and install the latest OS from the **Package Manager** page. If you need to install the OS on a fresh microSD card, you may obtain a compressed version from ***here*** and then extract the contents in the root of the microSD card.

- Is there a more detailed guide for the Wattmon, explaining all the functions of the device, or is there a guide for legacy devices or WattmonOS?

  - Yes. You can now view the technical specifications of the existing and legacy devices and find how-tos on the **Wattmon Documentation Wiki**. You can also download the Wattmon Guide from our website. It is in various parts: **Introduction**, **Hardware Installations**, **Connecting to your Wattmon** and **Using your Wattmon**, all of which deal with the legacy software, but are very comprehensive and have a significant amount of information which is relevant to the new Wattmon hardware and software.

- How do I configure my Wattmon for use with multiple inverters and/or energy meters?

  - You can follow the guidelines in the *Modbus Device Setup* depending on the model of your Wattmon. If you have a WattmonMEGA, you may use the **EZConfig** tool, or the follow the instructions as in **Third-Party Devices**.

- I have completed the configuration on my device and have connected the devices I wish to interface with the Wattmon, but I still do not see any data. How can I test my Modbus connection?

  - To test the various Modbus devices connected to your Wattmon, you can use the built-in **Modbus Tester**, which allows you to poll each of your devices regardless of their settings, as long as they are physically interfaced with the Wattmon.

Quick Start Guide, Rev. 1.0 – WattmonOS v2.15
Quick Start Guide, Rev. 1.1 – Includes WattmonMEGA and WattmonOS v2.23 features
Quick Start Guide, Rev. 1.2 – Added WattmonOS v2.25 features
Quick Start Guide, Rev. 1.3 – Updated for WattmonOS v2.26
Quick Start Guide, Rev. 1.4 – Updated for WattmonOS v2.27 & Modbus Tester
Quick Start Guide, Rev. 1.5 – Updated for WattmonOS v2.27 & EZConfig
Quick Start Guide, Rev. 2.0 – Major update for WattmonOS v3 & EZConfig Wizard

Wattmon

Standard Compliance

WattmonMEGA and WattmonPRO are classified as devices for Industrial use.
The devices comply with the following standards:
***IEC-61000-4-2** – Electrostatic Discharge*
***IEC-61000-4-4** – Electrical Fast Transient*
***IEC 61000-4-5** – Surge Immunity*
***CISPR-22 Class A** – Emissions*
***CISPR-32 Class A** – Emissions (WattmonMEGA)*
***CISPR-11 Class A** – Emissions (WattmonPRO)*

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