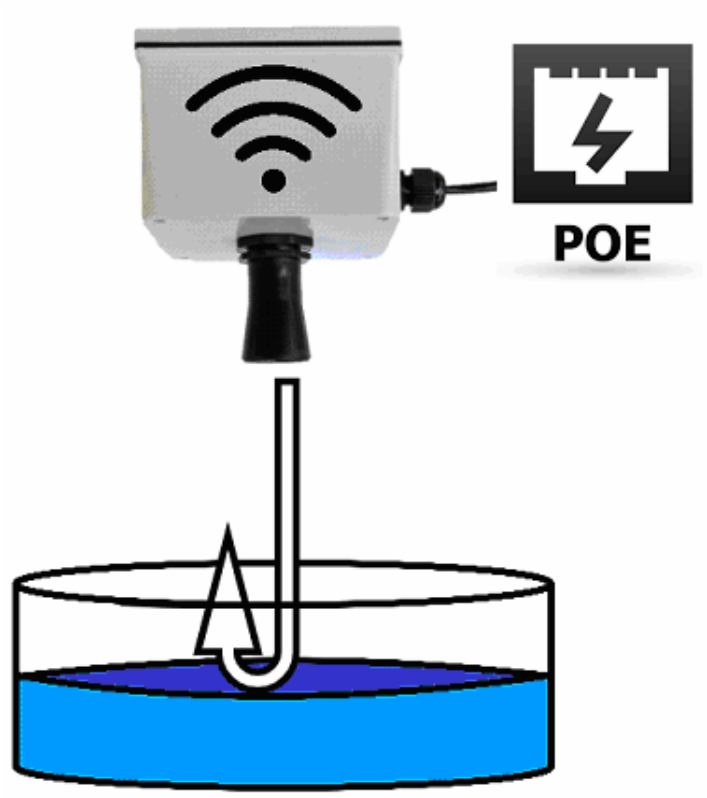
UBWH Australia

Smart WiFi/Ethernet Gauge Range

with PoE Ethernet



SG-RANGE-ETH
User Guide

V20220401

Latest Version of this document available at:
https://github.com/UBWH/ubwh.github.io/blob/master/assets/UserGuides

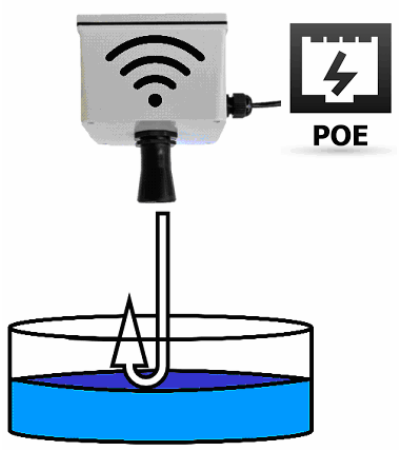
Table of Contents

Quick Operating Instructions

To quickly get started, see section Getting Started, page 10.

Introduction

The SG-RANGE-ETH is an Ultrasonic Range sensor with built-in smart IoT[1] technology, and both Power-over-Ethernet (PoE) and WiFi network interfaces.



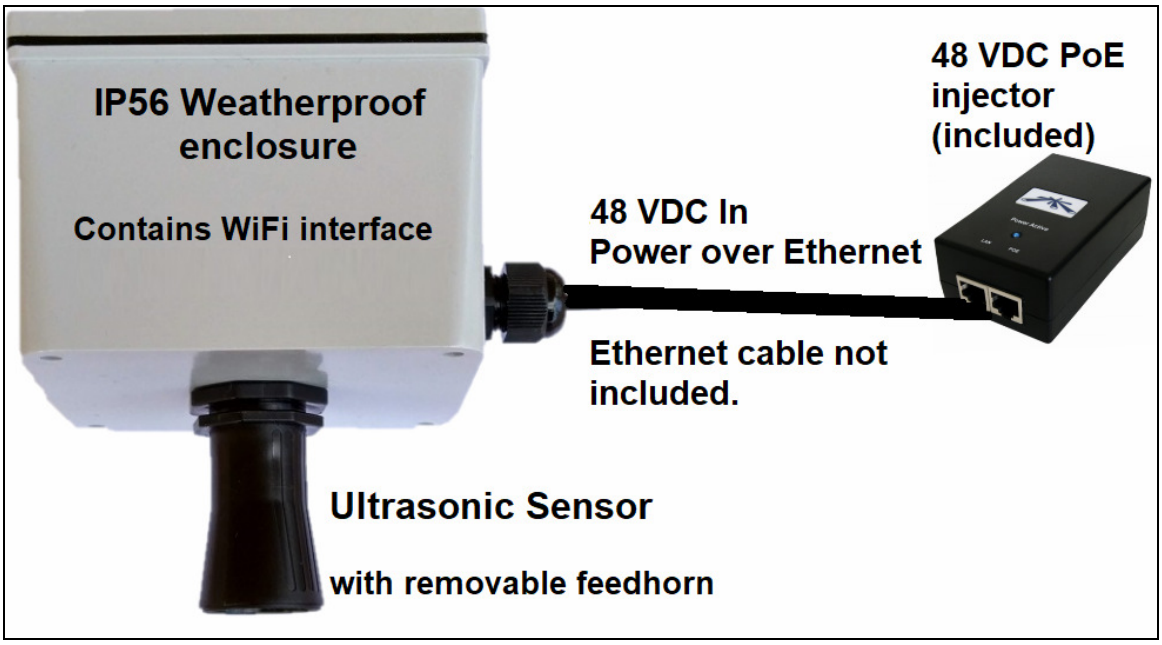
Features

Distance measuring	Distance is measured and presented in millimetres (mm). Distances can be measured in any direction to any flat surface that is perpendicular to the sensor axis.
Calculation	In many cases, the desired measurement is in some other units: for example litres of liquid in a tank. This product allows distance to be converted into some other value. Regular & irregular shaped containers are supported.
Stand-alone operation	Real-time measurements can be viewed locally, or from anywhere in the world[2], accessible by any web browser.
Centralised Management and Control	When combined with an IoT platform[3], real-time & past measurements are accessible by any web browser.
Alarms/Actions	When combined with an IoT platform, trigger points can be set to trigger events such as: • Send an alarm email • Turn a smart relay on/off • etc.
Low voltage DC power supply	This device is powered by 48 DC, over an Ethernet cable. (Power supply included). No electrician required for installation.

Table 1 – Available Features

[1] Internet of Things
[2] Requires Internet firewall port forwarding
[3] Examples: https://openhab.org & https://www.home-assistant.io/

Hardware



The **SG-RANGE-ETH** comes pre-assembled and tested. It consists of:

1. A weatherproof enclosure containing:
    - Smart WiFi wireless interface.
    - Smart PoE wired interface
    - An ultrasonic sensor. The removable feed horn makes it easy to mount this device in the lid/cover of a tank, or on a suitable bracket.
2. A 48 VDC PoE injector. This plugs into a 240 VAC power point.

Requirements

The SG-RANGE-ETH requires:

- **Initial Setup**
  - A device with a Web Browser connected to the local Network (LAN). A smart-phone, laptop, PC, or tablet will usually be sufficient.
- **Operation – Option A (Wired Ethernet Network Connection)**
  - A 48V PoE Injector, or Switch, on the local LAN.
  - A DHCP[4] server on the LAN.
- **Operation – Option B (Wireless Network Connection)**
  - A WiFi Access Point (AP) connected to the local LAN[5], within the WiFi range[6] of the SG-RANGE-ETH.
  - A DHCP server on the LAN.
- **Operation – Option C (Wireless & Wired Network Connection)**
  - The device can operate with both the Wired and Wireless interfaces active. It will have two IP addresses and both interfaces are functionally identical. Note: The device will NOT pass network traffic between the two interfaces, so no network loop will be created.
- **Ongoing Management**
  - Any device with a Web browser and connected to the same LAN as the SG-RANGE-ETH.

[4] Dynamic Host Configuration Protocol: See https://en.wikipedia.org/wiki/Dynamic_Host_Configuration_Protocol

[5] Local Area Network. See https://en.wikipedia.org/wiki/Local_area_network

[6] See Specifications, page 29

Web Browser Interface

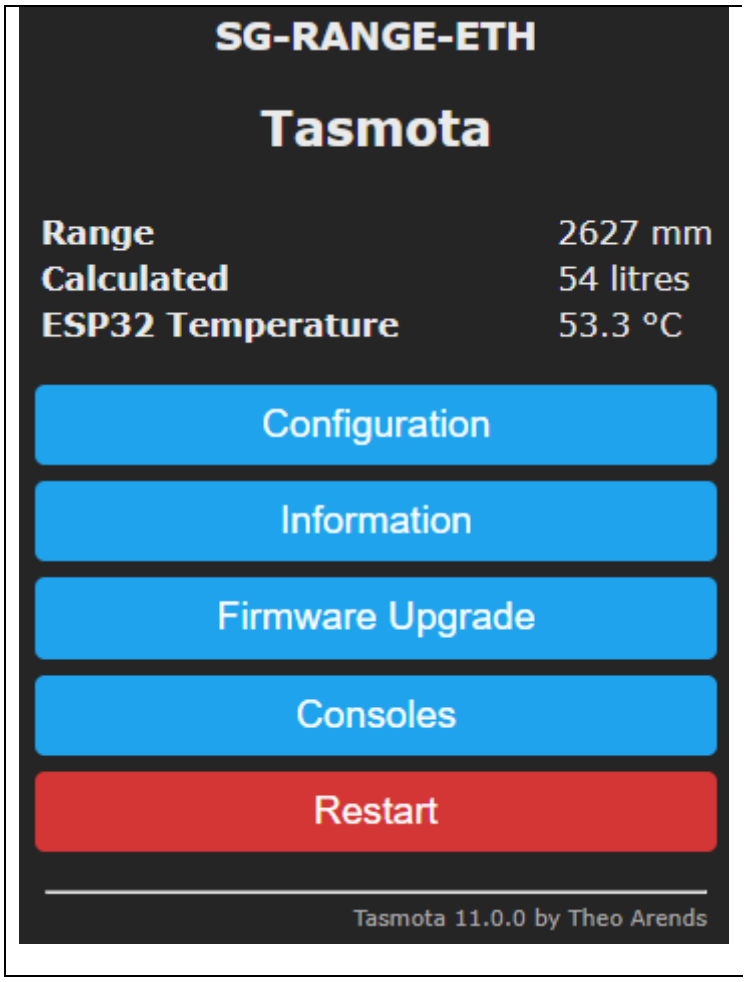


Figure 1 - The Tasmota Web Interface is available from any Web browser

Simply use any web browser to open the web page
`http://<device.ip.address>/`

See documentation here: `https://tasmota.github.io/docs/WebUI/`

Power

The SG-RANGE-ETH is powered by 48 VDC, delivered by Power over Ethernet (PoE).

The installer provides the Ethernet cable. The PoE power supply is included.

Ethernet Cable

Not Included.

Outdoor installation (sun/rain damage possible)	Suitable Outdoor LAN cable is required. e.g. https://ubwh.com.au/Accessories/367
Indoor installation	Normal LAN cable (e.g. Cat5e, Cat6) is sufficient

PoE Power Supply

Included.

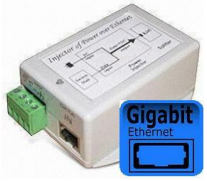
The SG-RANGE-ETH accepts either:

- PoE-Mode A: Power on conductors 1,2(+) & 3,6(-), or
- PoE-Mode B: Power on conductors 4,5(+) & 7,8(-)

It is also compatible with these PoE sources:

- Passive (always ON)
- Active (only ON if connected to a suitable powered device), such as 802.3af or 802.3at.

The PoE source could be:

An AC PoE injector		e.g. https://ubwh.com.au/POE-48-24W Included
A DC PoE injector		e.g. https://ubwh.com.au/POE-DC-48-24W-G
A PoE LAN switch		e.g. https://ubwh.com.au/WI-PS305G

Mounting

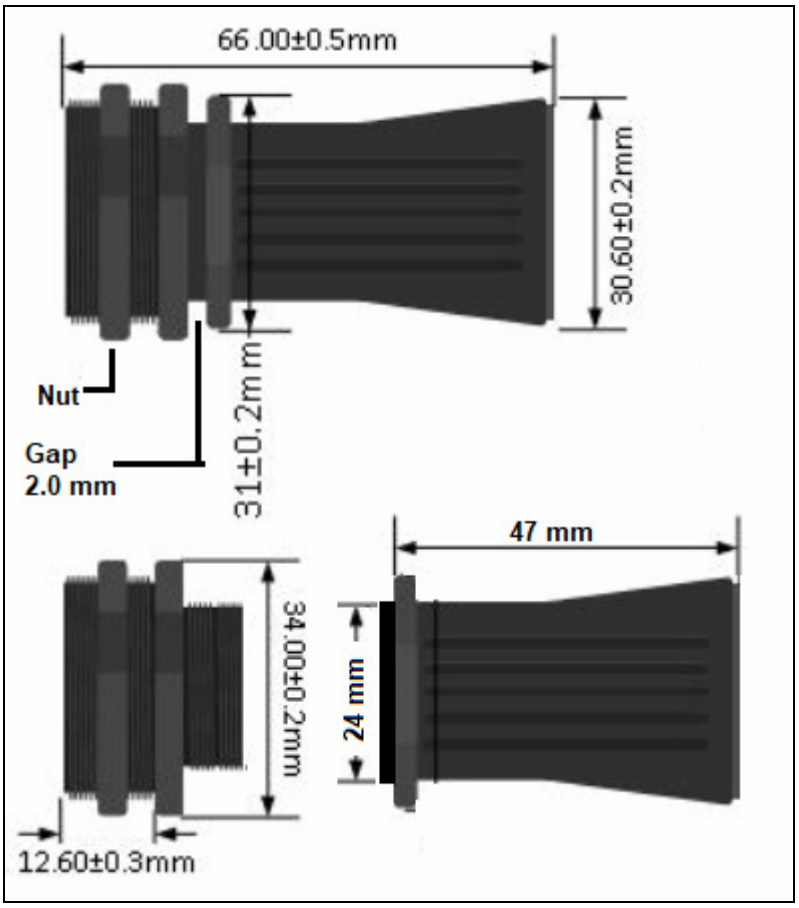


Figure 2 – Sensor Dimensions

The sensor is comprised of 2 parts:

- The sensor body, which is permanently mounted in the SG-RANGE-ETH enclosure.
- The Feed horn, which unscrews.

To mount the SG-RANGE-ETH

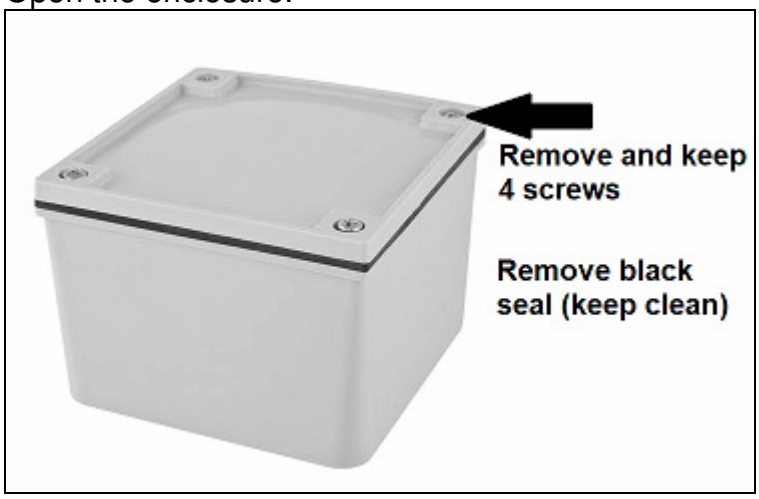
- Drill a 24 mm hole in a mounting plate (e.g. water tank lid)
- Remove Feedhorn
- Insert sensor body into hole
- Screw on feedhorn

Note that the sensor has a *Blind Zone* of 250 mm. (See Specifications). All ultrasonic sensors work on measuring the time of an echo. For that reason they can not measure very short distances. The SG-RANGE-ETH can not measure less than 250 mm. For echo distances between zero and 250 mm, the reported value will always be “250 mm”

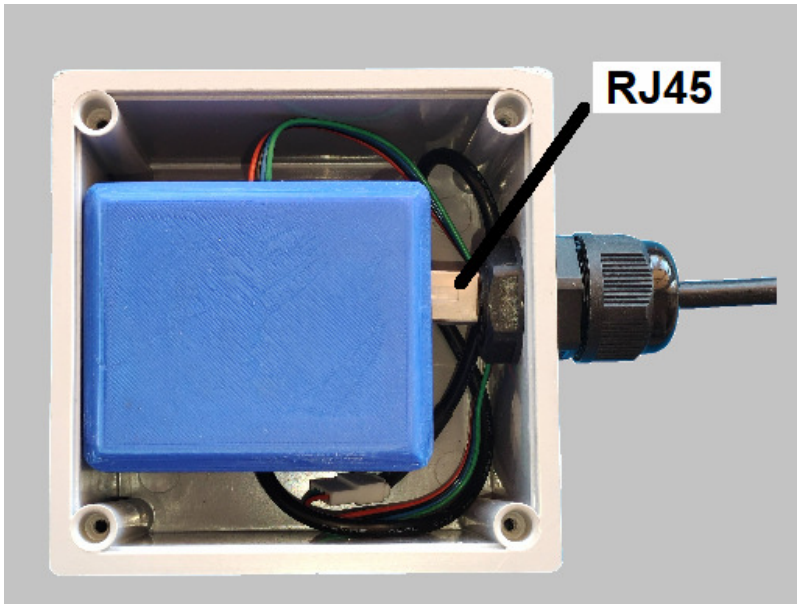
Getting Started

Connect PoE Cable

1. Open the enclosure.



2. Loosen the ***Feed-Through Cable Gland***.
   Pass your PoE cable through the gland, and click the RJ45 connector into the electronics housing.



3. *Optional: If used outdoors*
   - Gently tighten the cable gland.
   - Mark the cable at the end of the cable gland.
   - Remove the cable.
   - Add the provided cable sealant so it will protrude a few mm outside the gland. See the instructions provided with the sealant.
   - Pass the PoE cable through the gland and click into the electronics.

4. Tighten the cable gland to make weatherproof.

5. Clean the square black seal, and where it touches the enclosure/lid.
   Re-attach the enclosure lid and tighten screws to make weatherproof.

Power the SG-RANGE-ETH

Connect the included 48 V PoE injector as follows:

- **AC Power**: AC Power cable (included) to a power point.
- **POE Port**: PoE cable (not included) to the SG-RANGE-ETH.
- **[Optional] LAN port**: Normal LAN cable (not included) to the local area network; e.g. to a LAN switch or spare LAN port on the back of your Internet router. If nothing is connected to the LAN port of the PoE injector, then the SG-RANGE-ETH MUST be configured using WiFi only. (see below)

If you put your ear close to the black ultrasonic sensor, you should the ultrasonic pulses as faint, rapid clicking. This confirms the sensor is powered.

Access the Configuration Web page

The SG-RANGE-ETH has two network interfaces:

- Wired (PoE)
- Wireless (WiFi)

Both can operate at the same time. The instructions below discuss initial setup via both interfaces. Either option can be used.

Wired (PoE) Interface

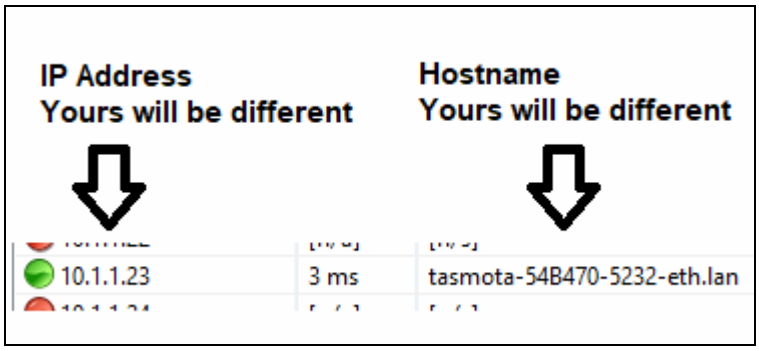
To access the Wired interface, the SG-RANGE-ETH must be connected (via the PoE cable) to a Local Area Network (LAN) that has a DHCP server. Most home/office networks have a DHCP server.

Note: Connecting the PoE cable (via a PoE injector) to a spare LAN port on your PC/Laptop will NOT work.

The hardest part of this is finding the IP address of the SG-RANGE-ETH, but there are many free tools on the Internet to help with this. One of them (which runs on most computers) is ***Angry IP Scanner***.

1. Using a computer (PC/MAC/Linux) connected to the same Local Area Network (LAN) as the SG-RANGE-ETH. Download and install ***Angry IP Scanner*** from: https://angryip.org/

2. Run ***Angry IP Scanner.***
   Look for a Hostname like `tasmota-xxxxxx-xxxx-eth`

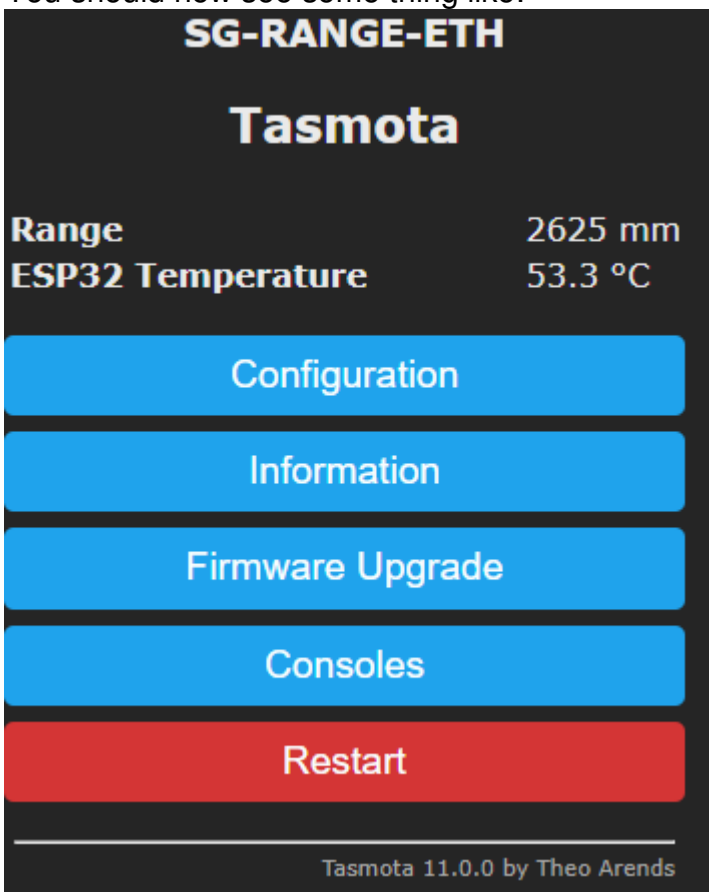


3. Note the Ethernet IP address here:_____

4. Using your favourite web browser, go to `http://xxx.xxx.xxx.xxx` where xxx.xxx.xxx.xxx is the IP address.

   In the example above, the installer would go to `http://10.1.1.23`

5. You should now see some thing like:



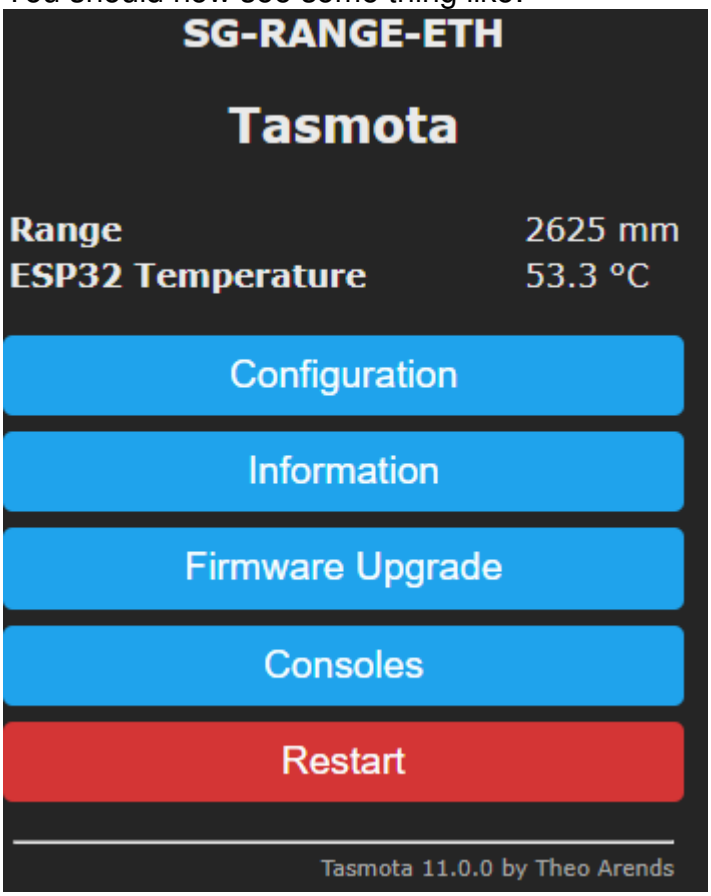
Wireless (WiFi) Interface

Follow the instructions here:
https://tasmota.github.io/docs/Getting-Started/#initial-configuration

During the WiFi configuration steps, the IP address of the WiFi network interface will be displayed.
Note the WiFI IP address here:_____

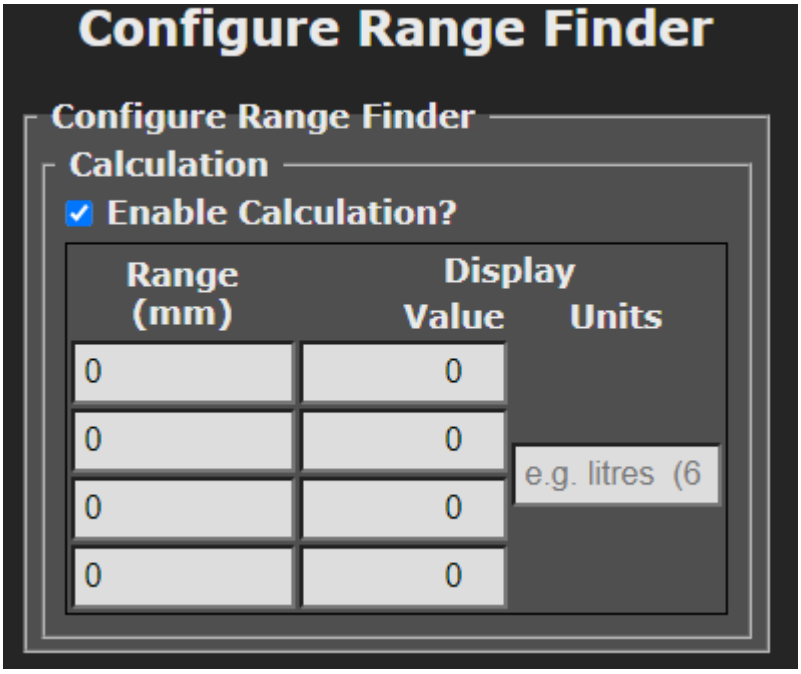
Using your favourite web browser, go to http://xxx.xxx.xxx.xxx where xxx.xxx.xxx.xxx is the IP address.

You should now see some thing like:



Configuration Settings

The SG-RANGE-ETH has a Configuration setting:



Calculation

Calculations are a convenient way to convert the raw distance measurements (mm) to a more meaningful value if using this device to measure (e.g.) water tank volume.

Regular Shapes

To demonstrate this feature, consider the example water tank shown below.

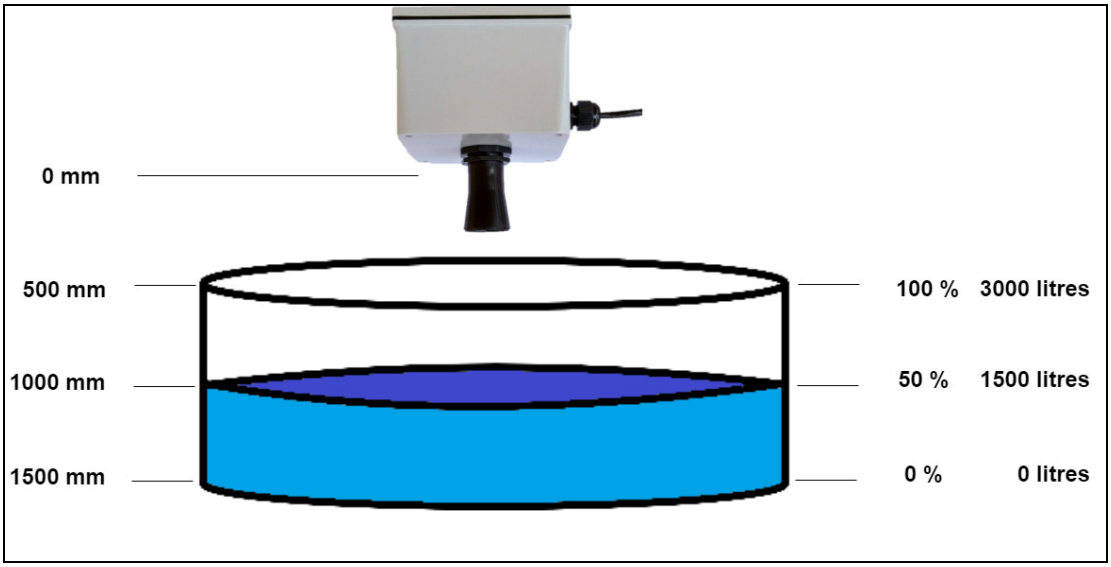
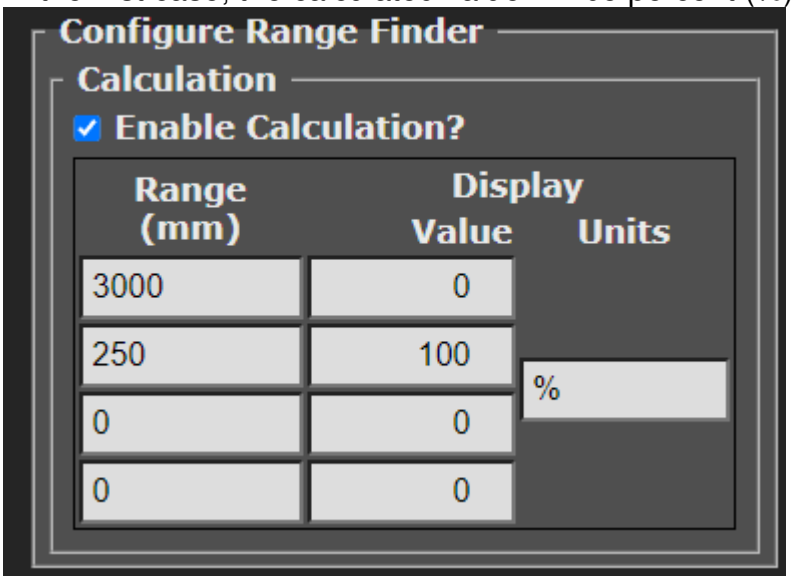


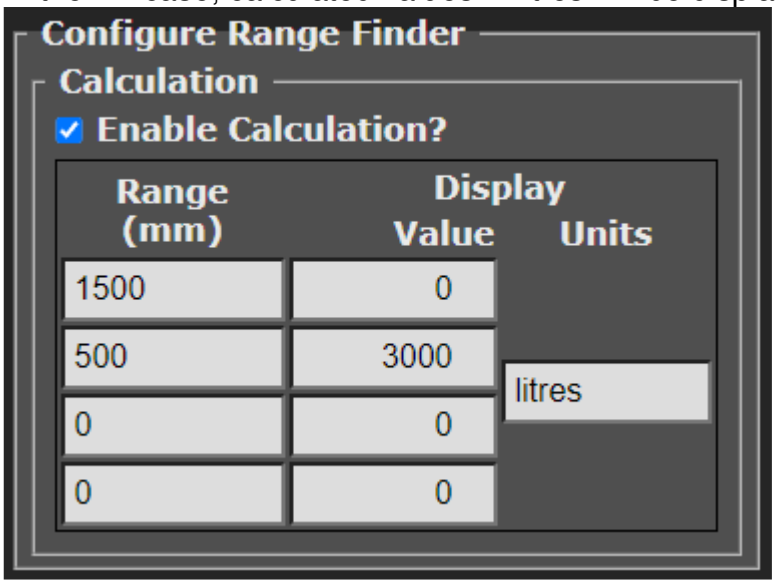
Figure 3 - Example Water Tank - Regular shape

Because this is a ***Regular*** shaped tank (straight sides), only 2 calibration pairs need to be entered.

In the first case, the calculated value will be percent (%).



In the 2nd case, calculated values in litres will be displayed.



Irregular Shapes

Consider the case of an **Irregular** shaped water tank. In this case we can enter up to 4 calibration pairs to approximate the volume of water in the tank.

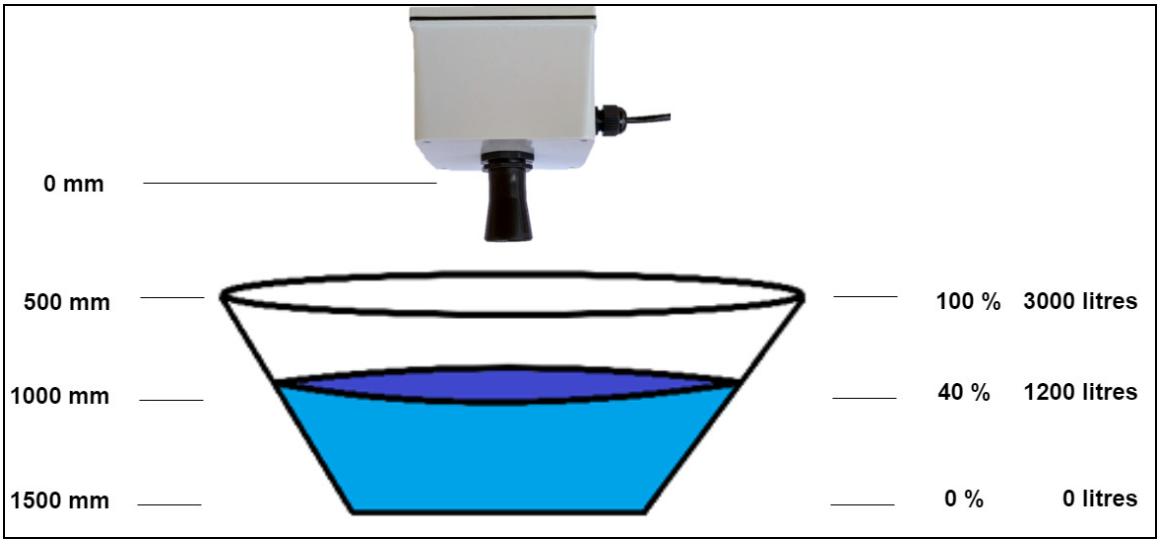
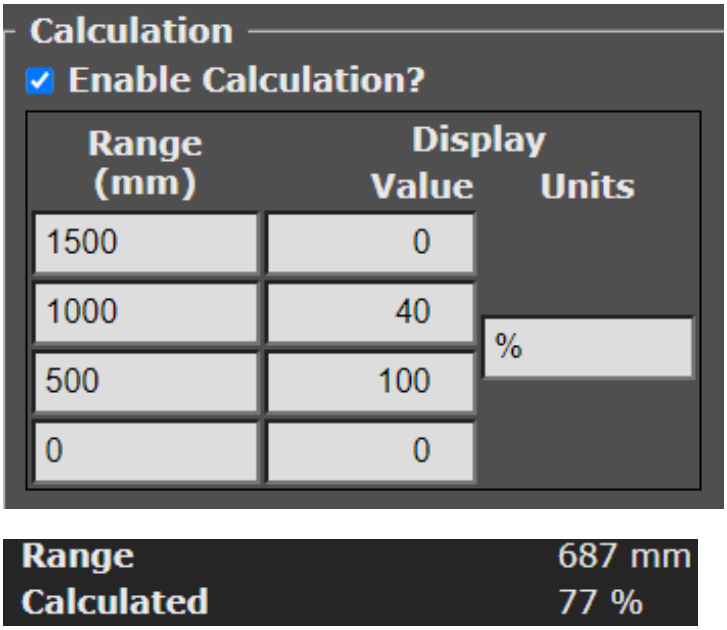
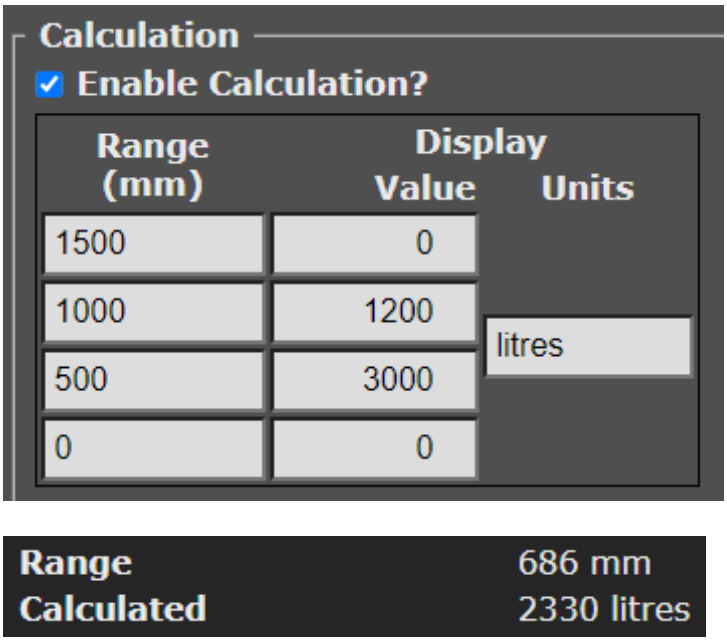


Figure 4 - Example Water Tank - Irregular shape

Displaying calculated Percentage.



Displaying calculated litres.

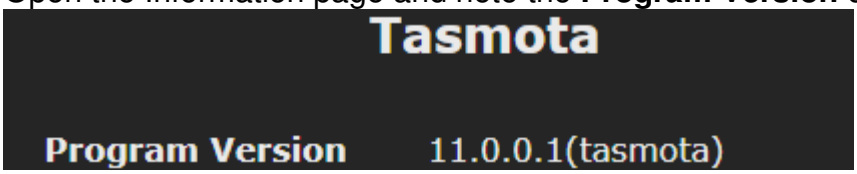


Firmware

From time to time, new firmware for the SG-RANGE-ETH may be released.

Checking the installed version

Open the Information page and note the **Program Version** currently installed.



Checking the latest released version

Use your web browser to visit:
https://ubwh.com.au/tasmota/SG-RANGE-ETH/ReleaseNotes.php

Updating

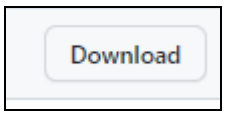
1. Visit this URL
   https://ubwh.com.au/tasmota/SG-RANGE-ETH/ReleaseNotes.php
2. Click Download

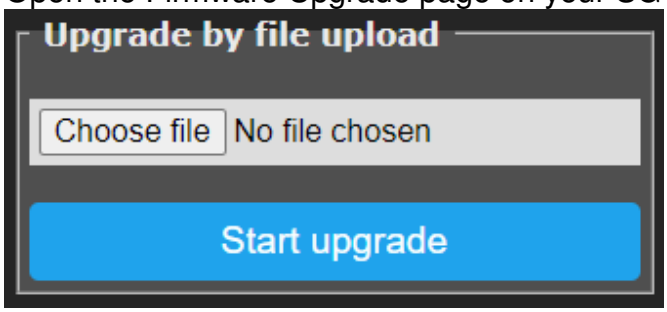
3. Click tasmota32-SG-RANGE.bin

4. Click Download

5. Save the file on your local computer.
6. Open the Firmware Upgrade page on your SG-RANGE-ETH.

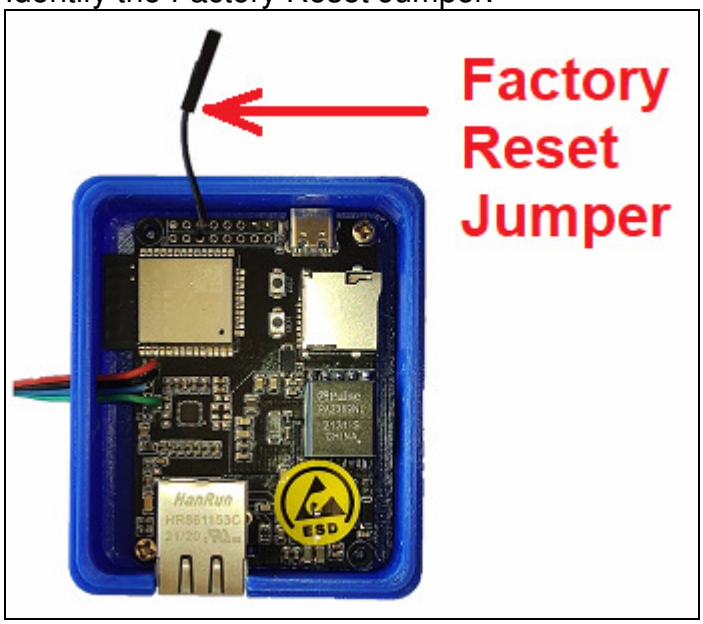
   

7. Choose the file just downloaded, and Click **Start upgrade**

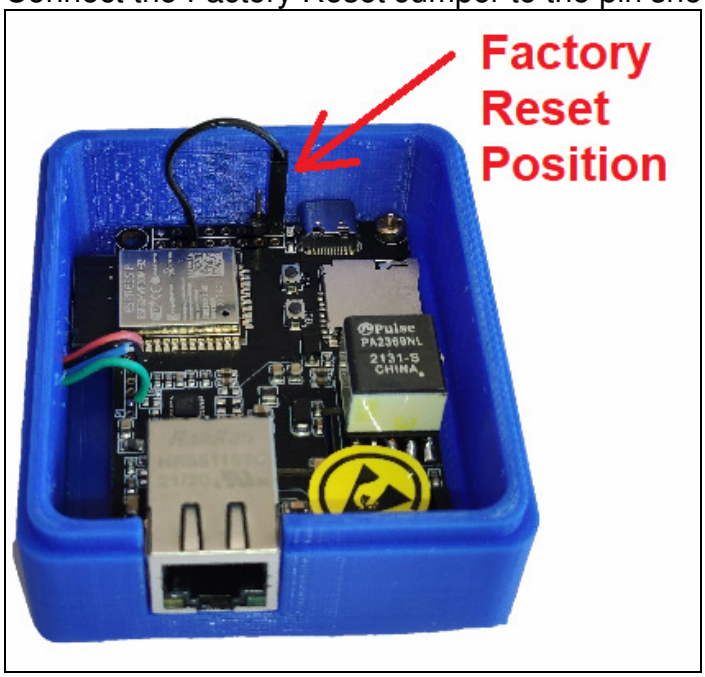
Factory Reset Procedure

In the unlikely event that the SG-RANGE-ETH cannot be accessed in any way and needs to be reset to Factory Defaults:

1. Open the enclosure
2. Loosen the PoE cable gland, unclick the RJ45 connector and remove the PoE cable
3. Remove the top part of the electronics enclosure.
4. Identify the Factory Reset Jumper.



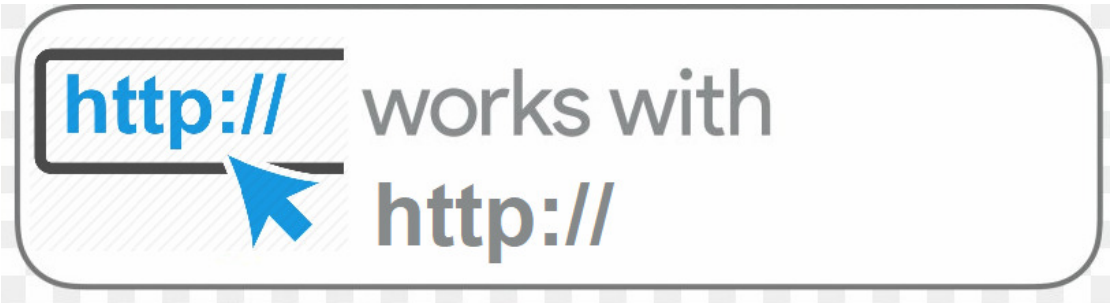
5. Connect the Factory Reset Jumper to the pin shown below.



6. Power the electronics for 45 seconds by connecting the PoE cable and 48V PoE source. Then remove the PoE cable.
7. Disconnect the Factory Reset Jumper.
8. Re-power the electronics.

9. Confirm you can now access the Main page via ether the Wired (PoE) or Wireless interface. See section Access the Configuration Web page, page 11.
10. Reassemble the enclosure with PoE cable installed.

http:// Command Interface



Simple commands as below will return the distance, and calculated values

Note: %20 in a URL = Space character

From Web Browser

```
http://<device.ip.address>/cm?cmnd=status%208
```

From Windows or Linux command/terminal window

```
curl http://<device.ip.address>/cm?cmnd=status%208
```

From a Windows Batch file (*.bat file)

```
curl http://<device.ip.address>/cm?cmnd=status%%208
```

Note: need double **%** characters in a batch file

From a PHP script (*.php file)

```
file_get_contents(
 'http://<device.ip.address>/cm?cmnd=status%208');
```

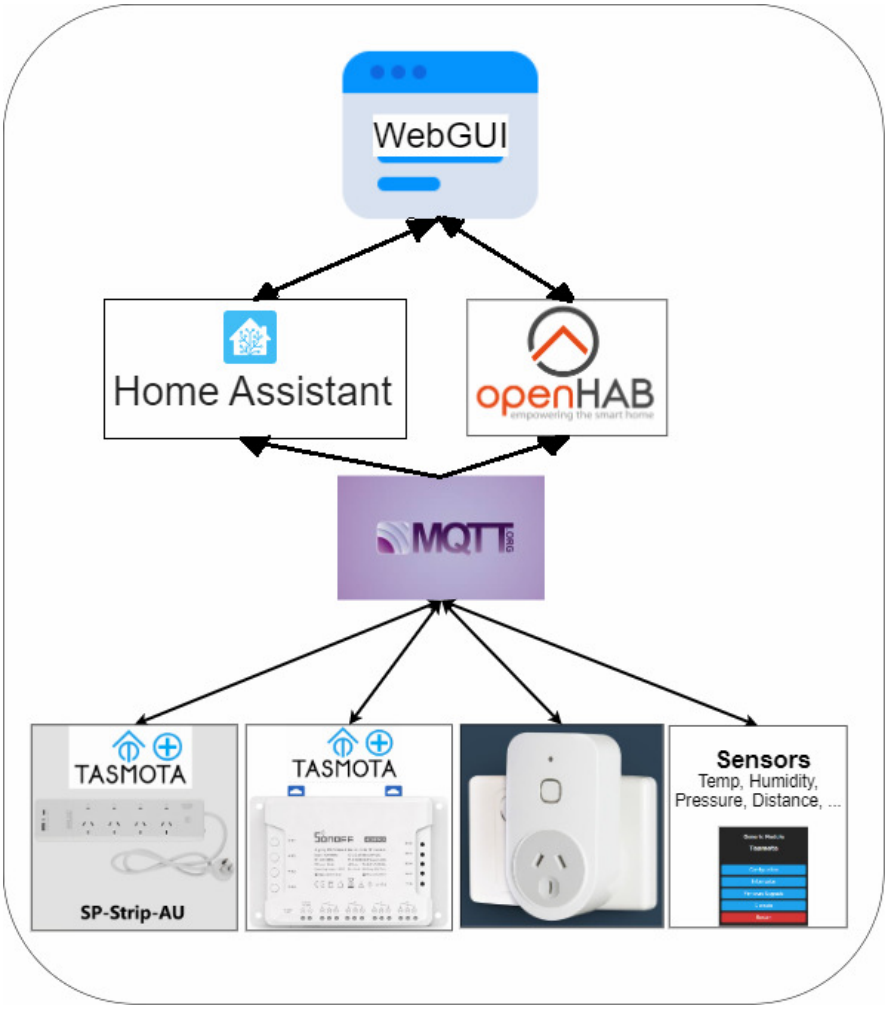
A typical JSON response looks like:

```
{"StatusSNS":
    {
    "Time":"2022-03-23T06:06:10",
    "mm":2633,
    "computed":301,
    "units":"litres",
    "ESP32":{
            "Temperature":55.6
    },
    "TempUnit":"C"}
}
```

More information:

https://tasmota.github.io/docs/Commands/#management

Centralised Monitoring & Control



While this device can operate 100% stand-alone, it can also be monitored and controlled, along with multiple other devices, from a single management platform.

Two popular management platforms are **openHAB**[7] (page 23) and **HomeAssistant**[8] (page 27).

In simple terms:

- MQTT compatible devices (e.g. Tasmota) connect to an **MQTT** Broker[9] .
  Status information is sent TO the MQTT broker.
  Commands are received FROM the MQTT broker.

- The management platform connects to the same MQTT broker.
  Status information is received FROM the MQTT broker.
  Commands are sent TO the MQTT broker.

- Users interact with the management platform via web pages (WebGUI)

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[7] https://www.openhab.org/ (Freeware, Open source)
[8] https://www.home-assistant.io/ (Freeware, Open source)
[9] https://mqtt.org/ (Freeware, Open source)

OpenHAB

WebGUI Interfaces

openHAB supports a number of User Interfaces (UIs). Each UI is highly customisable.

The images below show example visualisations.

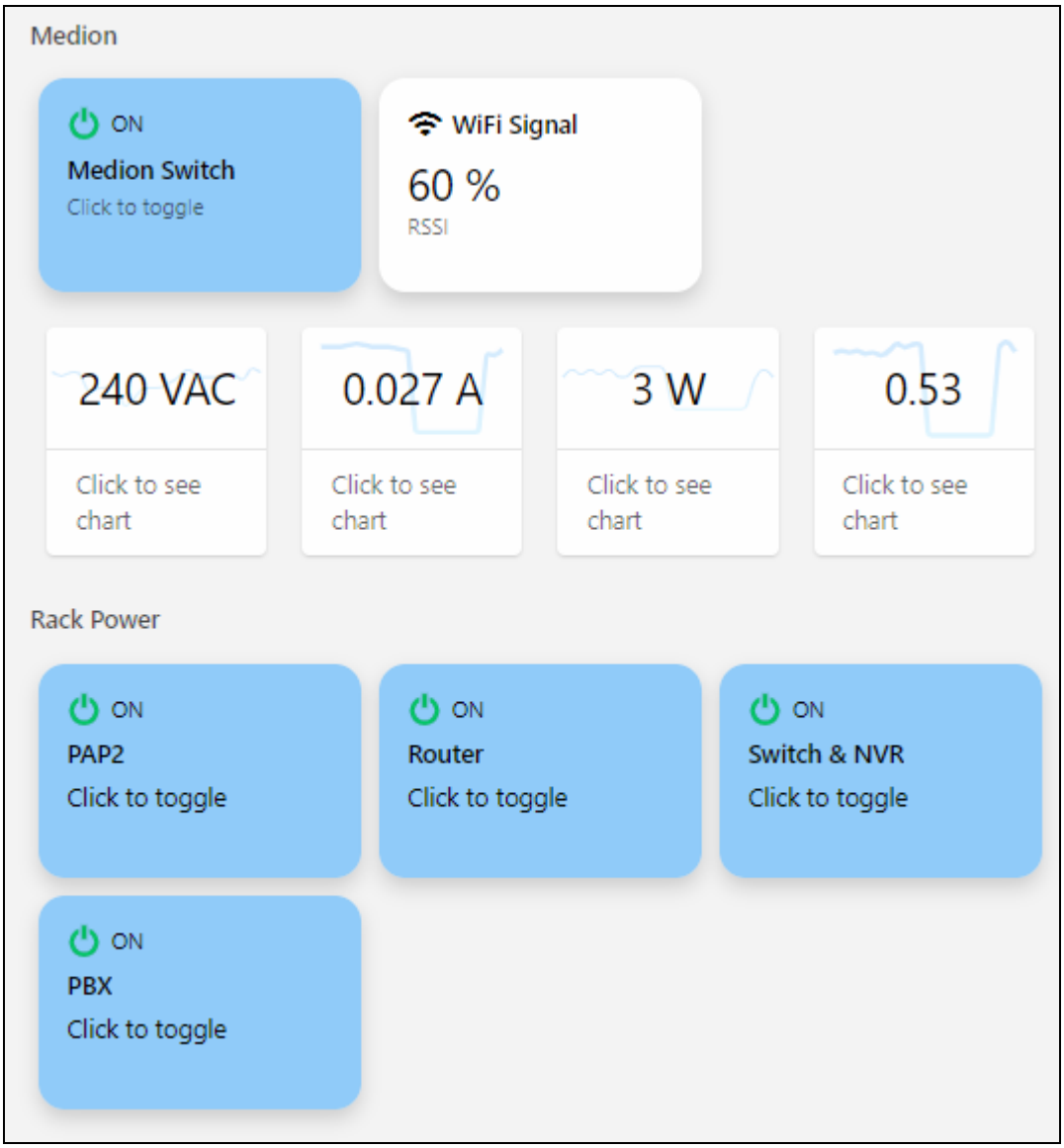

Figure 5 - Classic UI. Mobile friendly.

Figure 6 - Basic UI. Mobile friendly.

Figure 7 - Panel UI. Ideal for touch screens.

openHAB Channel Definition (Example)

Below is shown the channel definition for an SG-RANGE-ETH correctly integrated into openHAB.

Values that will be different for each installation have been replaced with XXXXXX.

```
UID: mqtt:topic:xxxxxxxx
label: SG-RANGE
thingTypeUID: mqtt:topic
configuration:
  payloadNotAvailable: Offline
  availabilityTopic: tele/tasmota_xxxxxx/LWT
  payloadAvailable: Online
bridgeUID: mqtt:broker:xxxxxxxx
channels:
  - id: Range
    channelTypeUID: mqtt:number
    label: Range
    description: ""
    configuration:
      stateTopic: tele/tasmota_xxxxxx/SENSOR
      transformationPattern: JSONPATH:$.mm
      unit: mm
  - id: Litres
    channelTypeUID: mqtt:number
    label: Litres
    description: ""
    configuration:
      stateTopic: tele/tasmota_xxxxxx/SENSOR
      transformationPattern: JSONPATH:$.computed
```

openHAB Sample History Plot

The plot below shows an example history from an SG-RANGE-ETH sensor mounted above a water tank.

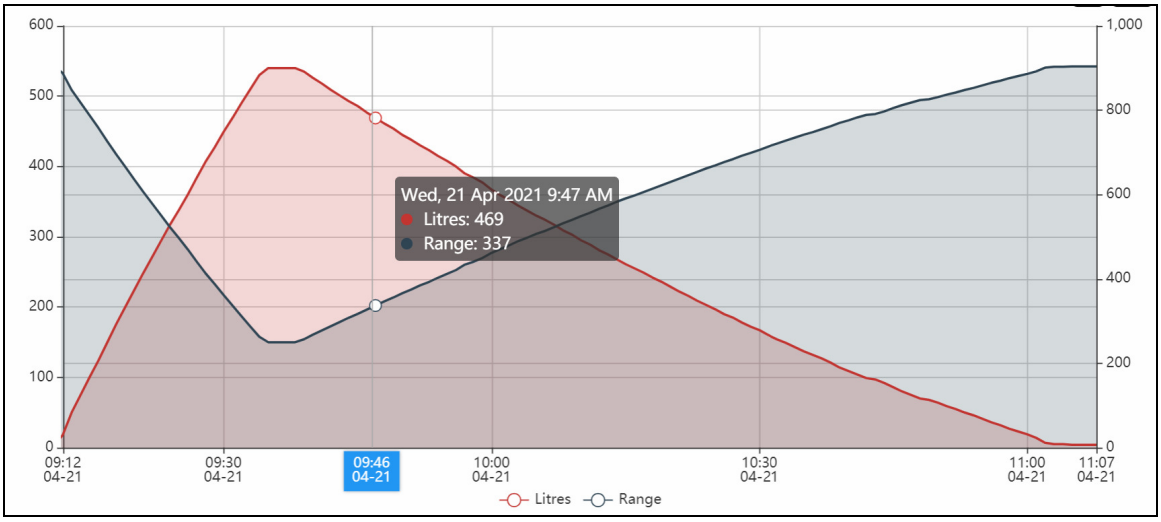

Figure 8 - Water tank: filling and emptying

Left axis: Blue line. Range (mm). Note the blind zone limits measurements to 250mm.

Right axis: Red line. Computed (litres) value.

HomeAssistant

HomeAssistant is an easy to use IoT platform that is well documented and well supported.

WebGUI Interfaces

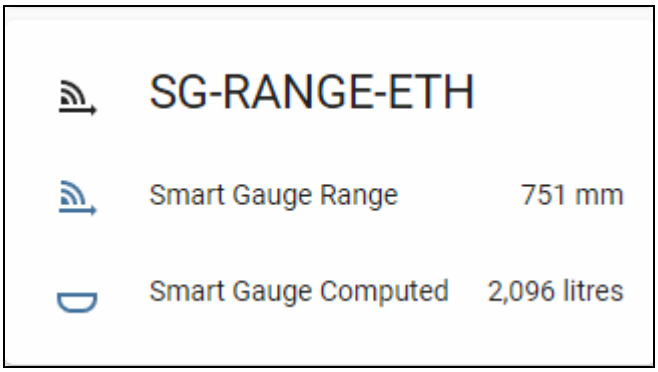

Figure 9 - Sample HomeAssistant Entities card

HomeAssistant Sample History Plots

Figure 10 - Sample mm (distance) and litres (computed) plots

HomeAssistant Definitions (Example)

Below is shown are the definitions for an SG-RANGE-ETH correctly integrated into HomeAssistant.

Values that will be different for each installation have been replaced with XXXXXX.

```
type: entities
icon: mdi:signal-distance-variant
entities:
  - entity: sensor.smart_gauge_range
    icon: mdi:signal-distance-variant
  - entity: sensor.smart_gauge_computed
title: SG-RANGE-ETH
```

Figure 11 - Entities Card

```
- platform: mqtt
  name: "Smart Gauge Range"
  unique_id: 'sgrange'
  state_topic: "tele/tasmota_XXXXXX/SENSOR"
  unit_of_measurement: "mm"
  value_template: "{{ value_json.mm }}"
- platform: mqtt
  name: "Smart Gauge Computed"
  unique_id: 'sgrangecomp'
  state_topic: "tele/tasmota_XXXXXX/SENSOR"
  unit_of_measurement: "litres"
  value_template: "{{ value_json.computed }}"
```

Figure 12 - sensor.yaml

Specifications

Sensor	Type:	A01NYUB
	Blind zone:	0 to 250 mm
	Operating range	250 to 6000 mm
	Resolution	1 mm
	Operating temperature	-15 to +60 ℃
	Storage temperature	-25 to +80 ℃
	IP Rating[10]	IP67 (Dust-tight, Immersion up to 1 meter)
Enclosure	Material	PVC
	Dimensions	108 x 108 x 76 mm (W x L x H)
	Weight	410 g (including sensor)
	IP rating	IP56 (Protected from: Dust & Powerful water jets)
WiFi	Standards	802.11b/g/n 2.4 GHz
	Range	20 m (Typical, no walls) 10 m (Typical, walls)
Power Supply (included)	Input Voltage	110 to 240 VAC
	Output Voltage	48 VDC
	Output Pins	4,5 (+) and 7,8 (-)
	Output DC Power	12 W / 12000 mW (max.)
	Output DC Current	500 mA (max.)
Ethernet PoE input (Power over Ethernet)	Voltage	48 VDC (42 to 54 V)
	Current	4 mA (typ.)
	Power consumption	200 mW (typ.)
	Cable length	100 m (max. Not included)
	Compatibility	802.3af/at

[10] https://en.wikipedia.org/wiki/IP_Code