

# TESS Photometer Manual



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# STARS4ALL



# Contents

1. Calibration report
2. Installation and configuration
  - 2.1 General information
  - 2.2. Setting up TESS photometer
  - 2.3 Where and how to install TESS photometer
3. Online data access
  - 3.1. Sky brightness
  - 3.2. Checking TESS data online
    - 3.2.1 Visualizing active and inactive photometers on the map
    - 3.2.2 Plots in real time
    - 3.2.3 Downloading the data

# 1. Calibration report

<b>Project</b>	Stars4All
<b>Test site</b>	LICA-UCM
<b>Tester</b>	Carlos Eugenio Tapia Ayuga
<b>Date</b>	23/10/2018
<b>Model</b>	TESS-W (USB)
<b>Name</b>	stars242
<b>Filter</b>	UV-IRcut
<b>Acelerometer</b>	No
<b>Zero Point</b>	20.45
<b>Ambient temperature</b>	21.0°C
<b>Power consumption &gt;10°C</b>	60 mA
<b>Power consumption &lt;10°C</b>	400 mA

## 2. Installation and configuration

### 2.1 General information

TESS photometer has been designed to be installed in a fixed location, measure sky brightness and to monitor its evolution throughout the night. In order to function properly, the station needs to be installed on an elevated spot -preferably on a roof-, with a power outlet and WIFI coverage allowing access to the previous night's results online.

After installation the TESS photometer will form part of STARS4ALL's photometers network monitoring sky brightness. The data is open and everyone can access to it in real time through the webpage <http://tess.stars4all.eu/>

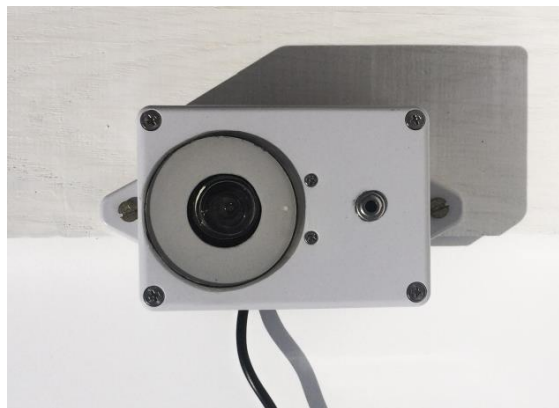


Figure 1. Fixed TESS Photometer

TESS photometer is designed to serve as a fixed station measuring night brightness and cloudiness. **Make sure it is properly configured before installing it.**

## 2.2 Setting up TESS photometer

A local and active WIFI network will be necessary for the photometer to send the data. If your WIFI is not active the first time the photometer is plugged it will be necessary to reboot TESS.

The first time the photometer TESS is plugged in, it creates its own WIFI network called *TESS-W* which can be accessed freely from a computer or a mobile device. After connecting to the *TESS-W* network we will need to open a browser and enter the address:

<http://192.168.4.1>

The Settings option can be found by clicking on the link "Wi-Fi TESS Settings"

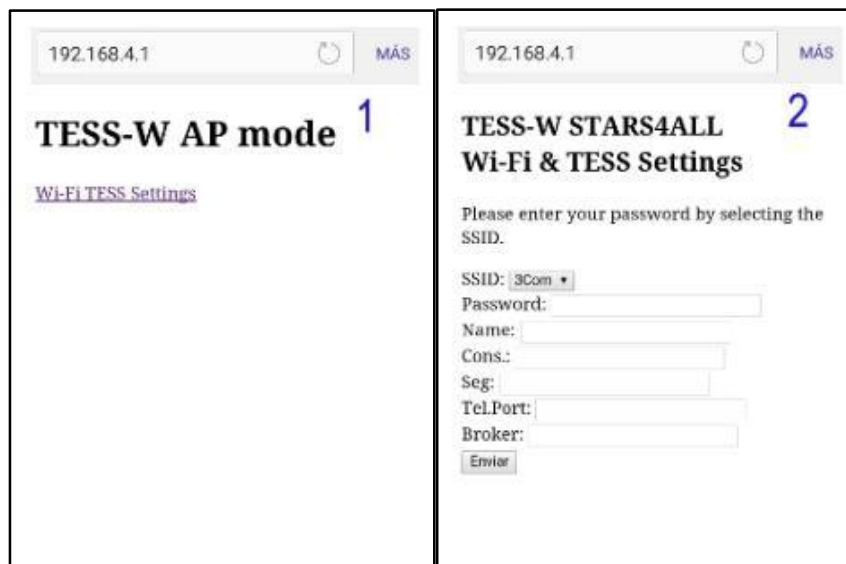


Figure 2. TESS Setting as seen from a mobile device or a computer.

You will need to set the parameters, using lowercase letters, as follows:

- SSID:** Select the WIFI you want your photometer to be connected to
- Password:** Enter the password that is required to connect to that WIFI
- Name:** Give your photometer a name. It must be the word **stars** in lowercase followed by the serial number
- Cons.** Add the zero value of the photometer. Check this value on the calibration report at the beginning of this manual. Please mind your computer is probably configured to use a dot as decimal symbol, if not please change this symbol as needed.
- Seg.** This parameter determines the frequency the photometer is to take measures. Please set this value to **60**.
- Tel. Port:** Local access port. **23** by default.

**Broker:** To enable the remote observatory please set **astrix.fis.ucm.es** as server.

Once this part of the configuration is done it will be then necessary to unplug the photometer from the electricity outlet and plug it in again after 30 seconds. The configuration is completed now and TESS should take measurements and send the data to the Broker. **Before taking the photometer TESS to the place where it will be finally installed it is advisable to check out with the UCM researchers if the data is being sent and whether they are duly received.**

In case you want to change the settings, such as after a password change in the wireless network, the photometer needs to be turned on in an environment in which the network is not available. To do this you can either switch off the network, or inhibit the WIFI signal, or uninstall the photometer from its location and switch it on out of the reach of the network signal.

Once you have plugged the photometer again, on the page <http://192.168.4.1> a reset message will appear asking you to do so. After the reset you will be able to access the "WIFI Tess Settings" menu if you unplug the photometer again and plug it within the range of the new wireless network. It is possible that the photometer will need a few minutes to find it.

### 2.3. Where and how to install TESS photometer

Both the brightness sensor and the clouds sensor must point to the sky. Please point both vertically to the zenith so the box is placed horizontally.



Figure 5. Possible installation of TESS photometer (left). It must be in horizontal position so the sensors point toward the zenith. You can also see the top view (right) and appreciate the brightness sensor on the left and cloudiness on the right.

Any direct or indirect light reaching the sensor will disrupt the measures. We recommend the installation place to be selected on the night previous to installation to ensure that the photometer will receive no direct or indirect light of any kind. It is also necessary to be sure that nothing is blocking the photometer's view of the sky, like a building or a tree. The optimal place for installation is usually a flat roof.

You will need to connect TESS photometer to electricity through a plug protected from rain. Make sure to choose a place within the range of your WIFI network.

The most updated version of this manual should be available at:

<http://tess.stars4all.eu/manual/>

### 3. Online data access.

This photometer is part of the STARS4ALL photometers network monitoring the night sky brightness.

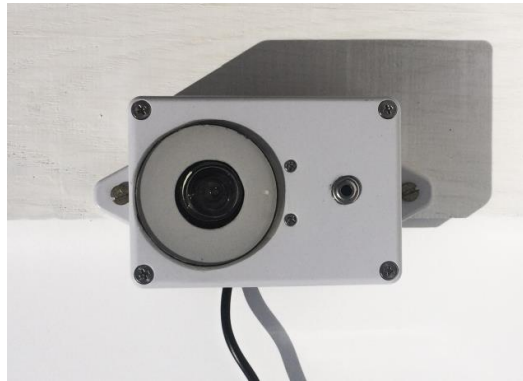


Figure 1. Fixed TESS Photometer

#### 3.1 - Sky brightness

The ancient Greek astronomers called the brightest stars the first magnitude stars. Those stars would be the first ones to appear after the sunset. Then they rated the rest of the stars so the weakest were called the sixth magnitude stars. The modern magnitude scale has evolved since then and now we have magnitude 0 stars, but we keep the idea that the brightest celestial bodies are of the lowest magnitudes, therefore the Sun has a negative magnitude of -26.74.

The sky brightness works the same way the stars brightness does. In the middle of a city where the sky brightness is more affected by light pollution the numbers are lower than they are in places where the sky is darker because there are only a few sources of artificial light at night. The sky brightness as measured by TESS is expressed in magnitudes / arcsecond<sup>2</sup>:

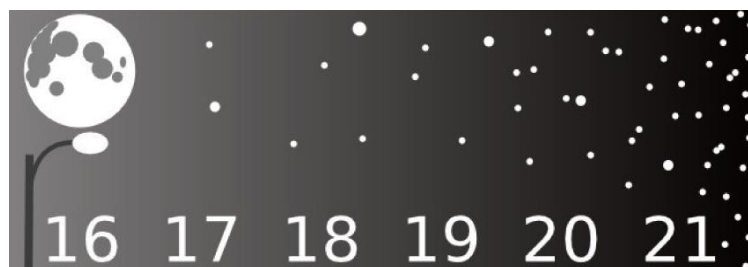


Figure 2. Sky brightness values are contrary to intuition since a place strongly light-contaminated will be given 17, while a very dark one will obtain 21.

Data gathered by your new photometer can be consulted in several ways:

### 3.2. Checking TESS-W data online

Once your TESS-W photometer joins the network you will be able to check de data using the portal:

<http://tess.stars4all.eu/>



TESS

Home Map Plots Data Manual Software Team

## TESS-W Photometer

Designed by astronomers, compact, inexpensive

- The Telescope Encoder and Sky Sensor (TESS-W) is the first model of TESS photometers, compact devices to monitor sky brightness every night.
- Designed by astronomers and calibrated on LICA laboratory at [Universidad Complutense de Madrid](#) the quality of the data is scientifically accurate.
- TESS photometer is mounted on a weatherproof enclosure. Wherever there is electricity and WiFi you can install it and get the measures online trough the [remote observatory](#).
- Its temperature and IR sensor will let you know whether the sky is clear or cloudy.
- Check the article describing the device on the International Journal of Sustainable Lighting by Jaime Zamorano et al

PAPER. NIGHT SKY BRIGHTNESS PHOTOMETER

#### 3.2.1 Visualizing active and inactive photometers on the map

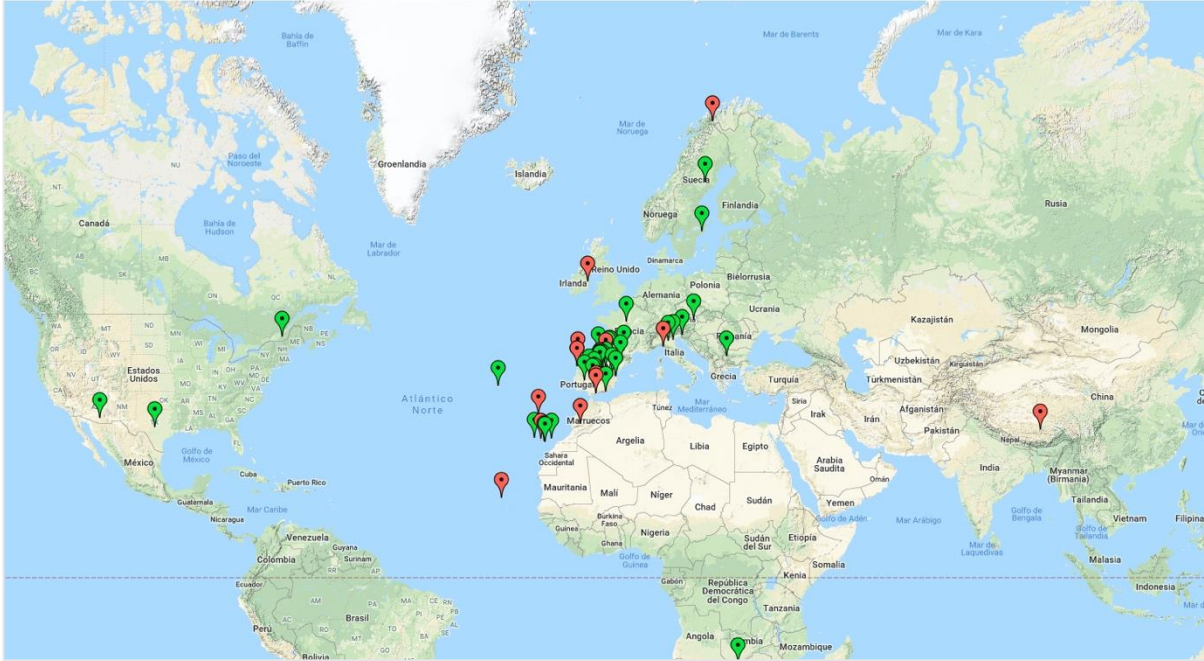
The map tab (<http://tess.stars4all.eu/map/>) shows active photometers in green and inactive in red. The marker of a new photometer is registered in this map manually so unfortunately it's not a way cheking a new installation, however, it is a quick way to check that a photometer already installed is still working correctly after any event like a power failure.



# Map

## Photometer network

Check last night graph by clicking in any photometer

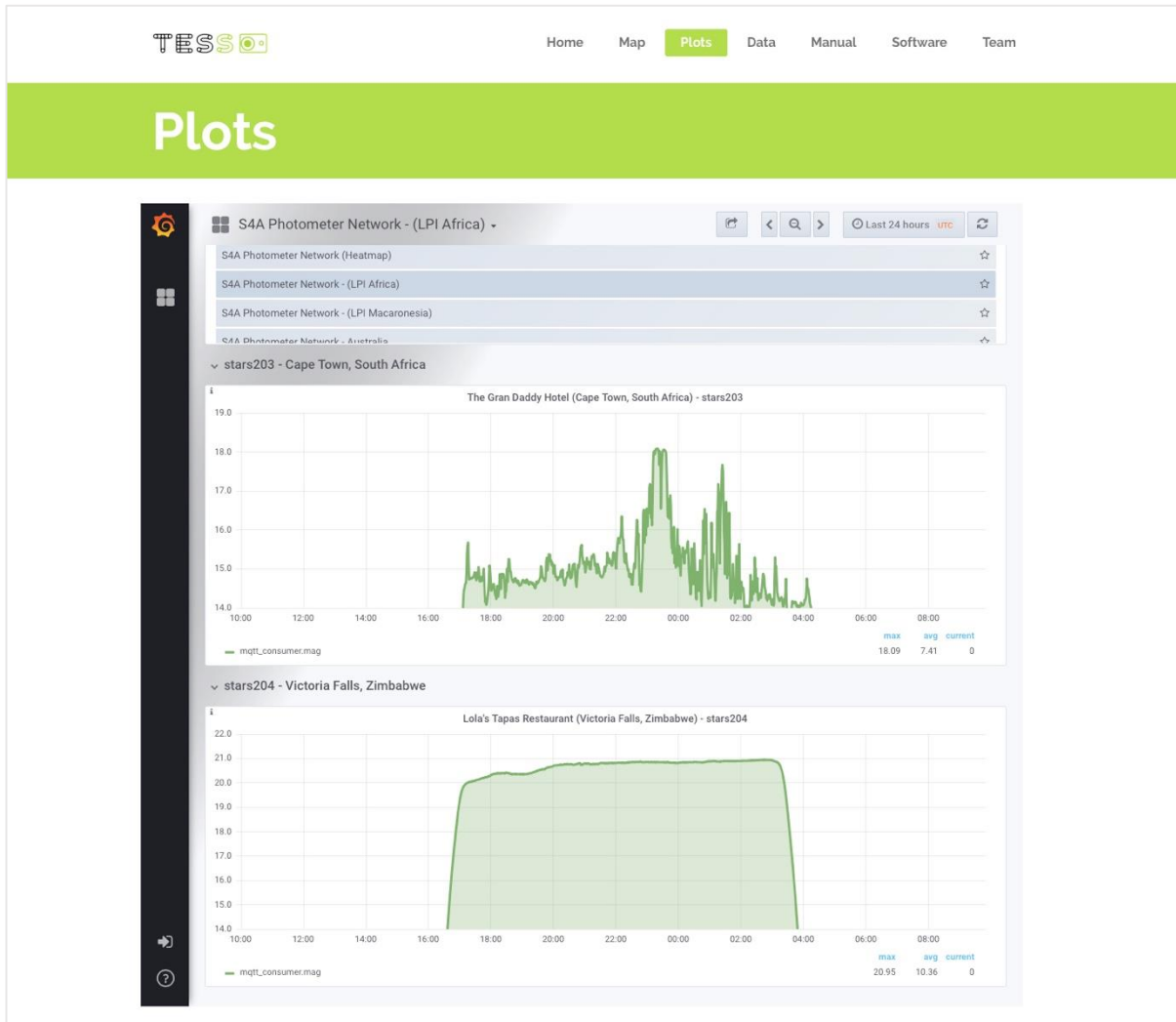


### 3.2.2 Plots in real time

The Plots tab (<http://tess.stars4all.eu/plots/>) allows you visualizing data in real time. You can select a specific photometer, as well as groups of photometers that belong to a country or an initiative.

Select the time range in the menu by clicking on "Last 24 hours" or click and drag the mouse pointer over the graph.

If you want to refresh the data you can click the top right button.



### 3.2.2 Downloading the data

You can download the data taken by any photometer following the link (<http://tess.stars4all.eu/data/>)

The screenshot shows the TESS Data website interface. At the top, there is a navigation menu with links for Home, Map, Plots, Data (highlighted), Manual, Software, and Team. Below the navigation is a large green banner with the word "Data" in white. Underneath the banner, the heading "All measurements day by day" is displayed. A button labeled "CLICK HERE TO DOWNLOAD FOLDERS" is centered below the heading. Below the button, there are three tabs: "stars1 - stars50" (selected), "stars51 - stars101", and "stars201 - stars250". Under the "stars1 - stars50" tab, there is a sub-tab for "Stars1 - Coslada, Spain". Below this, a table lists measurement files for "stars1".

TITLE	LAST MODIFIED
stars1_2016-05.dat	5 Jun JAIME ZAMORANO CALVO
stars1_2016-06.dat	5 Jun JAIME ZAMORANO CALVO
stars1_2016-07.dat	5 Jun JAIME ZAMORANO CALVO
stars1_2016-08.dat	5 Jun JAIME ZAMORANO CALVO
stars1_2016-09.dat	5 Jun JAIME ZAMORANO CALVO
stars1_2016-10.dat	5 Jun JAIME ZAMORANO CALVO
stars1_2016-11.dat	5 Jun JAIME ZAMORANO CALVO
stars1_2016-12.dat	5 Jun JAIME ZAMORANO CALVO

To download more than one file at the same time just press the button:

“click here to download folders”

It redirects to: (<https://delicias.dia.fi.upm.es/nextcloud/index.php/s/VeU1YVuzK16hpls>) where you can select and download any folder.



<input type="checkbox"/>	Nombre	Tamaño	Modificado
<input type="checkbox"/>	stars1	41 MB	hace 16 horas
<input type="checkbox"/>	stars2	20.6 MB	hace 16 horas
<input type="checkbox"/>	stars4	42.6 MB	hace 12 horas
<input type="checkbox"/>	stars5	36 MB	hace 16 horas
<input type="checkbox"/>	stars6	265 KB	hace 2 meses
<input type="checkbox"/>	stars7	21.7 MB	hace 16 horas
<input type="checkbox"/>	stars8	15 MB	hace 16 horas
<input type="checkbox"/>	stars9	20.8 MB	hace 16 horas
<input type="checkbox"/>	stars11	12.2 MB	hace 16 horas
<input type="checkbox"/>	stars12	2.6 MB	hace 16 horas
<input type="checkbox"/>	stars15	16.4 MB	hace 16 horas