

TESS Photometer Manual



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1. Introduction

The TESS-W photometer is a scientific device designed to measure continuously from a fixed location for monitoring the evolution of the night sky brightness along numerous continuous nights. The absolute calibration is performed at *Laboratorio de Instrumentación Científica Avanzada* at Universidad Complutense de Madrid (LICA-UCM). The calibration results are sent to the users in a separate report.

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

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

2. Installation and configuration

2.1 General information

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 to send the measurements on real time. TESS-W has a USB connector that allows it to be powered with a normal mobile phone charger. The charger must be placed in a covered outlet protected from the elements. A DC power source of 5V is needed. The intensity of the current ranges from 50 to 100 mA (for different WiFi signal) when the ambient temperature is over 10°C. For lower temperatures, $T < 10^{\circ}\text{C}$, the resistance is activated to increase the internal temperature of the photometer in order to prevent fog in the window and also to melt frost. In this situation the current ranges from 500 to 600mA. The power consumption varies from 0,25W y 3W depending on the external temperature..

After installation the TESS-W photometer will form part of STARS4ALL's photometers network monitoring sky brightness. The measurements sent by the photometers of the network are archived in the repositories that allow free access to the data. In the page <http://tess.stars4all.eu/> there are the links to download the data files and to visualize the graphs of the whole series of measures including those that were sent at that moment in real time.

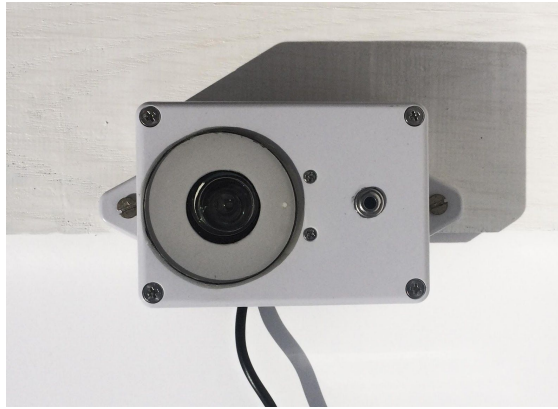


Figure 1. Fixed TESS-W Photometer

TESS-W 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-W photometer

A local and active WIFI network will be necessary for the photometer to send the data. Once installed it will no need more human interaction as measurements will be sent automatically in real time to the repository.

Step 1) The first time the photometer TESS-W is plugged in, it creates its own WIFI network called *TESS-W* which can be accessed freely from a computer or a mobile device.

Step 2) After connecting to the TESS-W network please open a browser and enter the address:
<http://192.168.4.1>

Step 3) You should get this screen and click on the link "Wi-Fi TESS Settings". If your WIFI is not active the first time the photometer is plugged it will be necessary to reboot TESS-W.

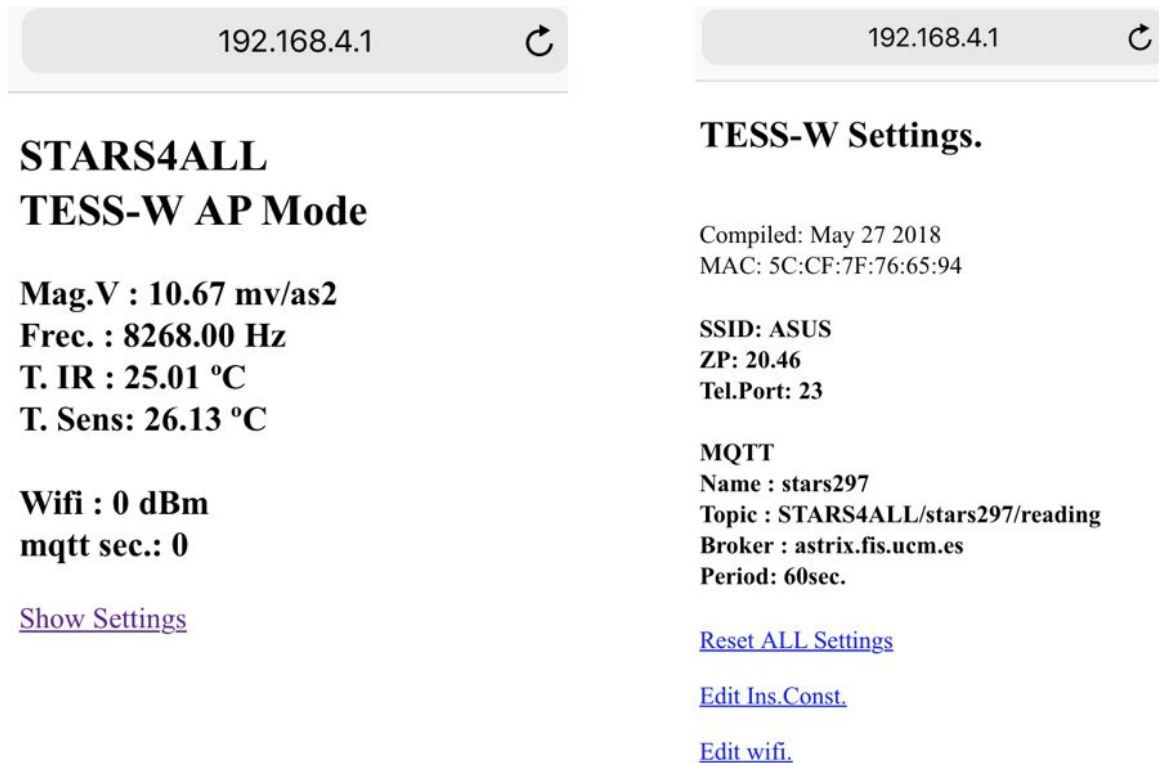


Figure 2. TESS-W Setting as seen from a mobile device or a computer.

In the most recent versions the photometer name and the calibration zero point (stars297 and ZP=20.46 in the example) are already stored in the device.

Step 4) 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

If necessary, you could reset all the photometer information and insert it from the beginning (Reset all settings).

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. Every photometer has its own. 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.
(astrix, not asterix).

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-W should take measurements and send the data to the Broker. Please check that your photometer is in the "Sending Data" list along with a green heart at the address: <http://tess.stars4all.eu/plots/>

If you cannot find your photometer on the list, it appears in the "Without data" list along with a broken red heart or you have any questions, please contact the researchers of the UCM before continuing with the next step.

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-W 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. Some examples at the webpage gallery <http://tess.stars4all.eu/gallery/>



Figure 4. Possible installation of TESS-W photometer It must be in horizontal position so the sensors point toward the zenith.

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-W photometer to electricity through a plug protected from rain. Make sure to choose a place within the range of your WIFI network.

3. Online data access.

This instrument is part of the STARS4ALL photometers network monitoring the night sky brightness. Photometers monitor sky brightness to estimate light pollution and study its evolution.

3.1. Checking TESS-W data online

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

TESS-W Photometer

**Designed by astronomers,
compact, inexpensive**

If you want to purchase one photometer contact us:
jzamorano@fis.ucm.es or ceta@ucm.es

The Telescope Encoder and Sky Sensor (TESS-W) is the first model of TESS photometers, compact devices to monitor sky brightness every night developed under [Stars4All](#) project.

STARS4ALL

TESS-W photometer sending data today

N/A



- Designed by astronomers and calibrated on LICA laboratory at [Universidad Complutense de Madrid](#) the quality of the data is scientifically accurate. "Absolute Radiometric Calibration of TESS-W and SQM Night Sky Brightness Sensors" Bará, Tapia & Zamorano (2019) *Sensors* 2019, 19(6), 1336; <https://doi.org/10.3390/s19061336>
- TESS photometer is mounted on a weatherproof enclosure (83x60x32 mm). Wherever there is electricity and WIFI you can install it and get the measures online through the [remote observatory](#).
- Its temperature and IR sensor will let you know whether the sky is clear or cloudy.
- Browse the [poster presented during the IAU 2018 in Vienna](#)
- Or check the article describing the device by Jaime Zamorano et al. 2016 *The International Journal of Sustainable Lighting* 35 (2016) 49-54 <http://doi.org/10.22644/ijsl.2016.35.1.049>

Figure 6. TESS-W photometer website as seen at <http://tess.stars4all.eu/>

3.2 Visualizing active and inactive photometers on the map

The map tab 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 checking 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.

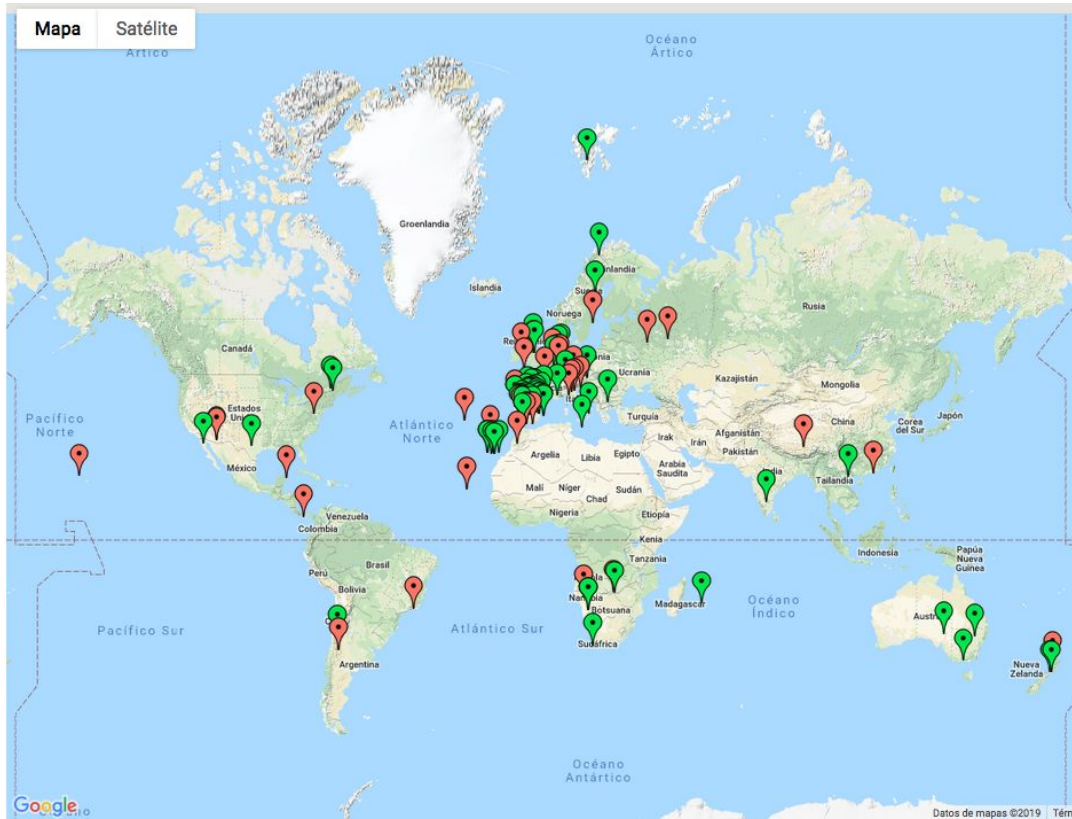


Figure 7. TESS-W photometer network as showed at: <http://tess.stars4all.eu/map/>

3.3 Plots in real time

The Plots tab 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.

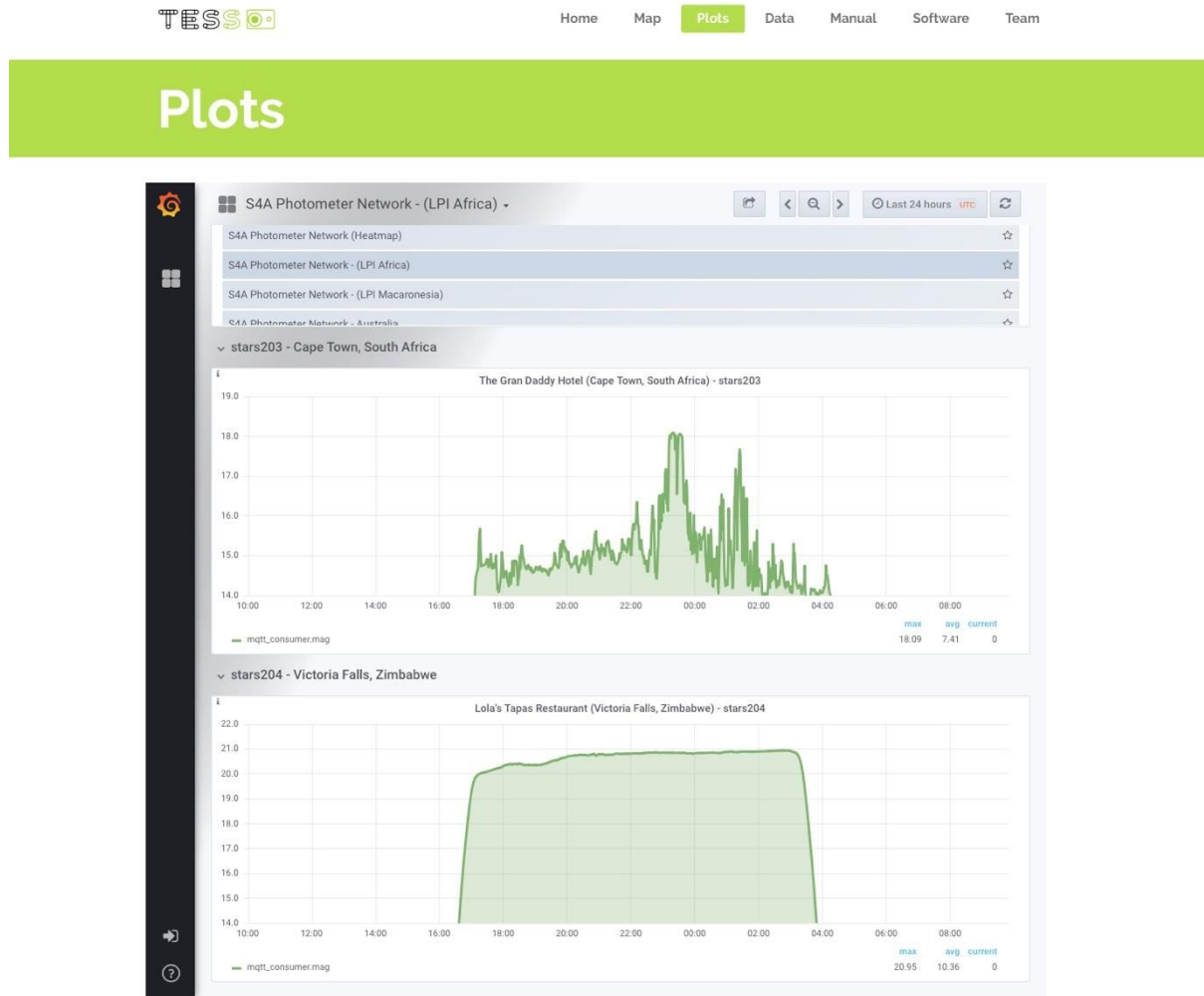


Figure 8. TESS-W photometer network plots accessible at: <http://tess.stars4all.eu/plots/>

3.4 Downloading the data

You can download the data taken by any photometer by selecting the data tab.

TESS

Home Map Plots **Data** Manual Software Team

Data

All measurements day by day

CLICK HERE TO DOWNLOAD FOLDERS

stars1 - stars50 stars51 - stars101 stars201 - stars250

Stars1 - Coslada, Spain

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

Stars2 - Villaverde del Ducado, Spain

Stars3

Figure 9. TESS-W data can be download at <http://tess.stars4all.eu/data/>

To download more than one file at the same time just press the button: “click here to download folders”

<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

Figure 10. Folders are available at <https://tess-data.stars4all.eu/>

TESS-W manual was originally written in Spanish. You will find the full version in this language written by Cristobal Garcia at: <http://www.observatorioremoto.com/tess/tess.pdf>

The use of TESS-W in local mode is explained in that manual.

If you find any mistake or would like to suggest any improve on this manual please report them at izamorano@fis.ucm.es