

E-1500 | E-1000

Smart I-V curve tracer
Entec Solar

Quick Start Guide.



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1 Important security information



IMPORTANT: Entec Solar does not take any responsibility on the damage to the device or people due to an incorrect usage of the devices. It is responsibility of the user to follow all the indications stated on the manual to make a proper use of the devices.

- Read and keep the manual and follow all the instructions stated on it.
- Use the device only on solar photovoltaic installations.
- Make use of the Personal Protection Equipment (PPE) recommended for electrical measurements as well as the connection and disconnection of the electrical circuit under test.
- Disconnect the photovoltaic circuit under test from any other circuit, p.e. inverter, combiner box, grounding and other string on parallel before connecting the I-V curve tracer.
- Make sure that the photovoltaic circuit does not surpass the technical limit of the device used. In the case of E-1000, the limits are 1000V and 20A.
- Never disconnect the measurement wires while performing a measurement.
- Do not perform measurements under moisture conditions or under the rain. Make sure that no liquid enters inside the device.
- Do not perform measurements under the presence of gas, explosives or dust in the environment.
- Protect the wires from the power and measurement, from the damage and pressure.
- Use the product only with the products and accessories provided or allowed by the manufacturer.

- In order to improve the quality of the measurements, use the I-V curve tracer only with the battery. This means, not connected to the power charging cable.
- Under no conditions open the case of the device. If you do it the warranty will immediately void. Dangerous voltages may still be present in the equipment even after disconnecting to the test circuit.
- In order to perform any maintenance operation on the device, make contact with the technical support of Entec Solar.

1.1. Symbols used



- **Double electrical isolation** (class of protection II).



- **Attention danger! Pay attention to the documentation!** This symbol appears in front of the instructions that need special attention to avoid damage to materials or people.



- **Keep in mind all the documentation attached to the measuring device.**



- **Attention, high voltage, danger of death.**



- **Measurement devices can not be treated as waste, they have to be eliminated as electronics**

2 Technical specifications

Specifications E-1500

| | |
|-----------------------|------------------------------|
| Input voltage range | 0-1500 V |
| Input current range | 0.1-20A (up to 35A optional) |
| Operating temperature | -10 a +65 °C |

Specifications E-1000

| | |
|-----------------------|--------------|
| Input voltage range | 0-1000 V |
| Input current range | 0.1-20 A |
| Operating temperature | -10 a +65 °C |

Specifications E-Sens

| | |
|-----------------------|--|
| Voltage Inputs | Channel for measuring solar radiation MAX 2V |
| Temperature Inputs | 1 x PT-1000 reference cell 3 x PT-1000 |
| Operating temperature | -10 a +65 °C |

3 External connectors and parts description

E-1500

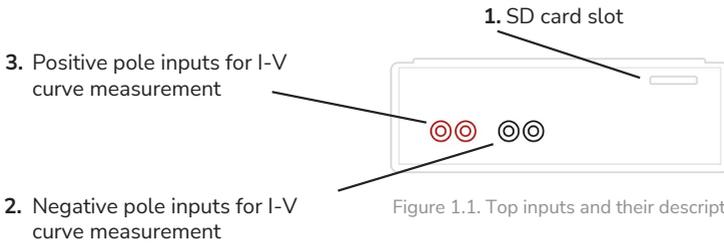


Figure 1.1. Top inputs and their description.

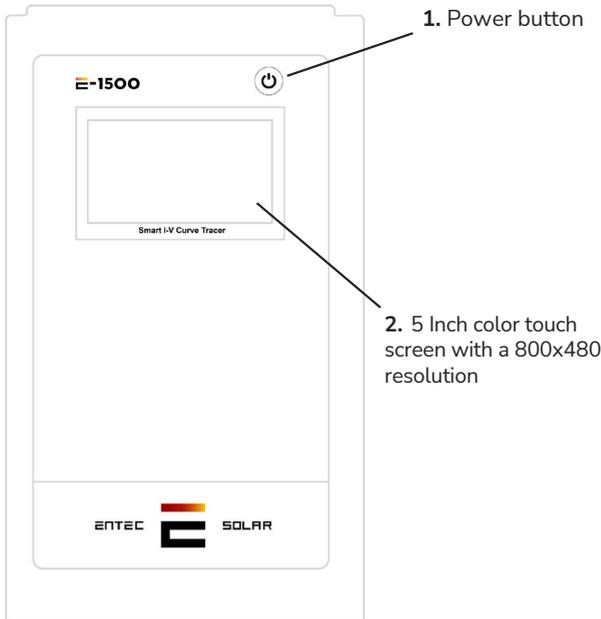


Figure 1.2. Frontal inputs and their description

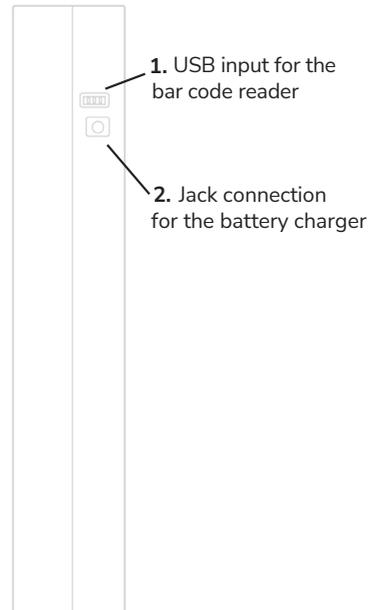


Figure 1.3. Lateral inputs and their description



ATTENTION: Do not expose the device to direct sunlight for long periods of time

3 External connectors and parts description

E-1000

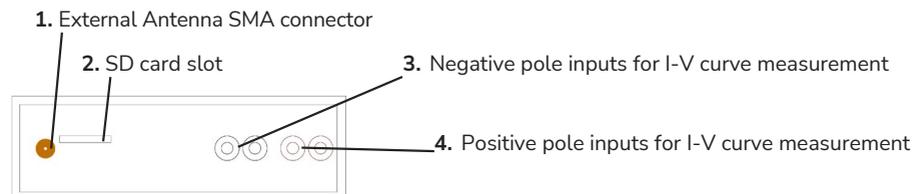


Figure 2.1. Top inputs and their description.

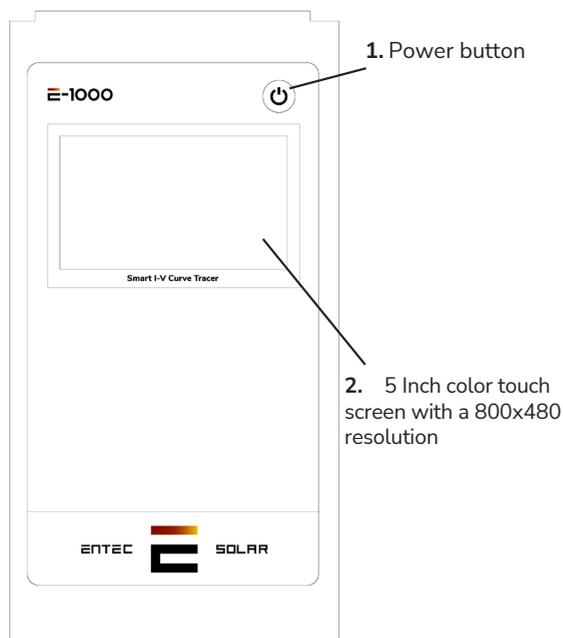


Figure 2.2. Frontal inputs and their description

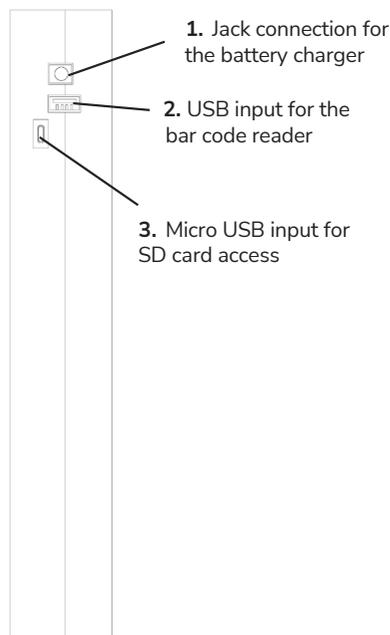


Figure 2.3. Lateral inputs and their description



ATTENTION: Do not expose the device to direct sunlight for long periods of time

3 External connectors and parts description

E-Sens

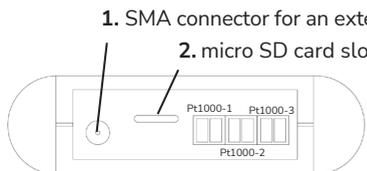


Figure 3.1. Top inputs and their description

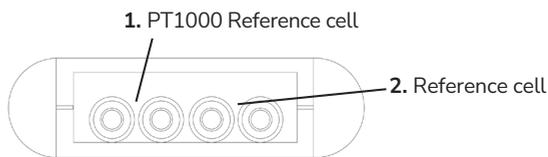


Figure 3.2. Shows bottom inputs and their description

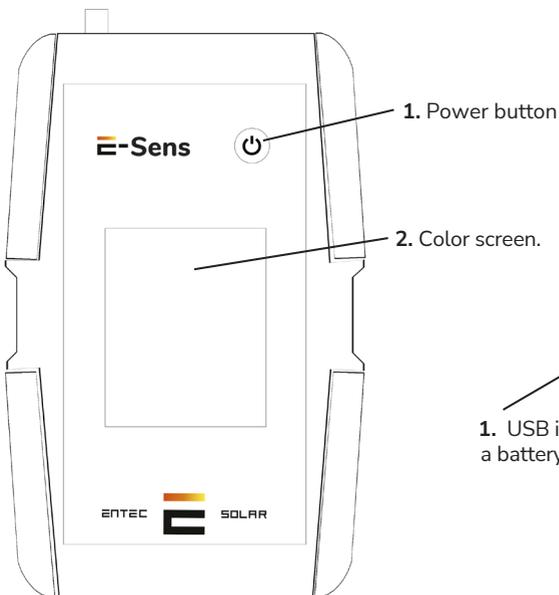


Figure 3.3. Frontal inputs and their description

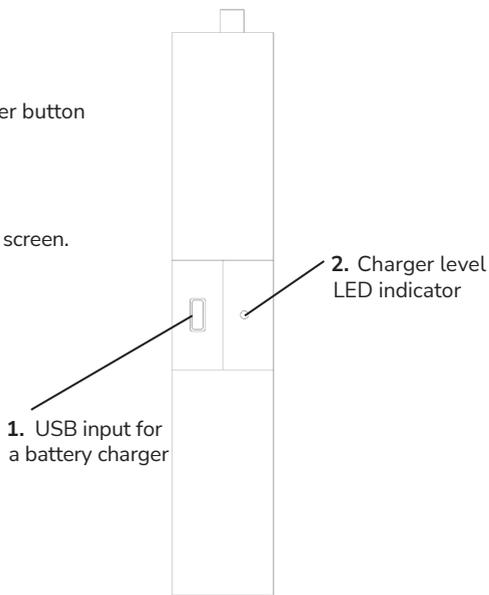


Figure 3.4. Lateral inputs and their description



ATTENTION: Do not expose the device to direct sunlight for long periods of time

4 General recommendations



The interface of the E-1500 / E-1000 is designed based on rectangles as buttons. You may press the desired button to use the associated function.

There are functions, like for example “Autosave”, that when they are pressed they change the background to the red color. This means that the function is active. Press on it again to disable it and the color will change to blue.

When numbers are introduced to set up a parameter, all the gaps must be filled, even if the value of them are zero.

5 Quick Start Guide



5.1 Configuration previous to the measurements

It is strongly recommended to fully read the manual before proceeding with the measurements and check the corresponding section in case of doubt.

1. Turn on the device.
2. Check that the battery levels of the devices are correct as well as the SD cards are all in place. (Section 4.2 and 4.3).
3. Place the radiation and temperature sensors in a location that is representative of the circuit under test and make sure that the calibration cell is on the same plane as the solar cell. Also make sure you make no shadow on the solar cell.
4. Connect the reference cell, as well as all the PT1000 used to the corresponding channel inputs.
5. Connect the barcode scanner to the device (optional) (Section 5.5.10)

6. Adjust date and time, and synchronize with the E-Sens. Select Settings -> Other -> Adjust Date/Time (Section 5.5.11A)

 **IMPORTANT:** Before starting with a new season of measurements, make sure that the configuration values of the device are properly set up and that they match the circuit under test.

 **IMPORTANT:** It is mandatory to introduce the values on all the empty gaps, even if they are zeros.

7. Set up the characteristic module under test (VOC, ISC, VM, IM, α , β y NS). Settings-> Module Settings (Section 5.5.4). Save the configuration in a memory slot formodules (Section 5.5.4.B).

8. Set up the generator settings (number of modules on series and parallel). Settings -> Generator settings (Section 5.5.5).

9. Verify the radiance sensor calibration (reference cell) Settings -> Sensor settings (Section 5.5.6.A).

10. Select E-Temp or PT1000 depending on the temperature sensor you want to use. You can do this on the main screen or inside the sensor settings menu. (Section 5.5.6.B).

11. Set up the tolerance threshold. For Isc, Voc y Pm. Settings -> Other -> Tolerance. (Section 5.5.11.C)

12. Select the file name to store the data. (Section 5.2.2.E)

13. Select and set up the measurement options (manual measurement, auto measure, continuous measurement). (Section 5.5.7 5.5.9)

14. Select the saving options (manual save or autosave). (Section 5.5.8)

5.2 Conections set up

Reference cell

The radiance sensor is a calibrated solar cell made out of silicon, that need to be placed on the same plane as the solar module. It is connected with the E-Sens with some banana plugs to measure ISC on the 2V connector located on the lower right part of the device. Additionally, you may connect the PT-1000 of the reference cell to correct radiance using the temperature measurement of the calibrated cell. These banana plugs are connected on the lower left side of the device.

Module or generator

The user must disconnect the test circuit from any other element that it may be connected. Not doing this may cause serious damage to the device or the test circuit. Use the cables provided with the device to connect it to the test circuit. It is made out of two red wires and two black wires that make a 4-point connection.

First connect the four banana plugs (two red and two black) to the device. The red color is the positive pole of the test circuit and the black color is the negative pole. The provided wires have an MC4 ending to direct connect to solar photovoltaic modules.

The cables provided with the device have been manufactured with the proper material to allow to connect them directly. As a result, the positive pole (red wire) has a female MC4 terminal, and the negative pole (black wire) has a male MC4 terminal.

There is also a special adapter with crocodile endings to connect to other elements, like for example a bus-bar from a combiner box, if it may be necessary.

⚠ IMPORTANT: A wrong connection of the positive or negative pole of the test circuit with the device may cause permanent damage to the device. The red color means the positive pole of the test circuit and the black color means the negative pole of the test circuit.

⚠ ATTENTION: During these maneuvers there is risk of electrical shock. It is mandatory to use the personal protection elements to reduce this risk to the minimum and properly perform the established sequence to disconnect the test circuit from the rest of the elements.

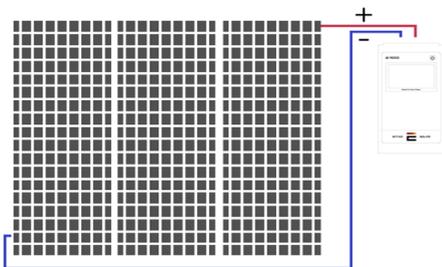


Figure 4. Connection of E-1000 to the test circuit.



Figure 5. Proper connection to E-1000.

Curve measurement:

Before starting with this procedure, make sure you follow the steps to configure and connect the device properly.

Also, it is recommended to perform the measurements with the following considerations:

- Perform the measurements during clear sky and no wind.
- Make sure the calibrated cell is on the same plane as the modules of the test circuit without making shadows to it.
- Measure the temperature on different points of the test circuit.
- Perform the measurements with a radiation level between 800 and 1200 W/m², and never under 600 W/m².
- Avoid an angle of incidence of the sun superior to 40 °.

Temperature measurement:

Temperature measurement is a process that can be performed in several ways (Section 5.5.6.B). Anyway, Entec Solar always recommends to use the E-Temp as it is faster, easier and more accurate.

To power on the E-Temp, press lightly and only one time the power on button, and wait a couple of seconds for it to show the start screen. In order to power off the device, keep pressed the power button for 5 seconds.



IMPORTANT: During the start of the device, it is important to not press several times the power on button, and not to press it for too long, as this may turn off the device.

On the standby screen, you can perform measurements pressing one time the power button located on the center of the device. When you measure an I-V curve, if you have the E-Temp selected (Section 5.5.6.B), the device will beep and a message will show on screen stating that it is waiting for the E-Temp temperature measurement.

Perform the temperature measurement to proceed with the measurement.

After performing the measurement the data will show on the screen for a few seconds. After that, the device will go back to the standby mode.

Keep in mind that the same button is used to power on, measure and power off the device, so you have to be cautious when pressing it. It is important that you do not press the button several times or for way too long.

When measuring strings of modules, it is recommended to measure the temperature of at least three modules of the string. One module close to the ending and two modules on the enter of the string. It is also recommended to measure the sport indicated in the following picture:



Figure 6. An example of temperature measurement locations within a module according to IEC 61853-1.

6 Report generation

At the end of the day, after finishing measuring, it is recommended to generate a report with all the measurements performed that day.

The report is generated as a '.csv' file and includes the most important values of the measured curves.

To generate a daily report, you may follow these steps:

1. Make sure that all the curves are on the SD card, and that the card is properly inserted into the device.
2. Inside the Settings menu, press "Report generation"
3. Select the date you wish to create the report.
4. Press the generate button and wait for it to be generated. Once it is done, it will be automatically saved to the SD card.

7 Download data to the PC



In order to obtain the measurement data extracting the SD card of the device follow these steps:

1. Make sure the device is turned off.



IMPORTANT: The extraction of the SD card with the device turned on, may cause irreversible damage to the card and permanent loss of the data.

2. Push lightly the SD card to the inside of the device until you hear *click*. In the case of the E-Sens it is necessary to use an object that allows to push it to the inside of the device.

3. Release the pressure and wait for the card to slide out of the slot.

4. Extract the card from the device.

5. Insert the card inside a card reader on your laptop or PC or use a USB card reader.

6. The Pc will detect the inserted card automatically.

7. Open the file explorer on your PC and sear the SD card directory.

8. Copy the files from the card directory to your desired folder on your computer.

9. Open the files with a spreadsheet program like Excel.

8 Common errors and solutions



1. Booting your device displays the message “SD card error”:
 - a. Make sure there is an SD card inserted into the device slot.
 - b. If the SD card is absent, turn off the device, insert an SD card and restart the device.
 - c. If the error message persists once the card is inserted, try another SD card.
 - d. If the message persists, contact the technical service.
2. The radiation value shown in the E1500 / E-1000 device is not correct or it is not showing anything.
 - a. Make sure that there is communication between E-Sens and the E-1500 / E-1000. For a proper communication the colour shown in the background of the radiation has to be yellow or green.
 - b. Check that the sensor configuration is properly set up. Select Settings -> Sensor Settings, and check that the values of Isc and Alpha are correct. If not, modify them.
 - c. If there is no communication, shut down and turn on the device. It may also be an issue with the distance. Check again with both devices close together and make sure the antennas are installed properly.
 - d. It may also be the case that several E-Sens and E-1500 / E-1000 are working together in the same place. This may result in noise between the communications. As a result, you should only use one E-Sens, despite working with several I-V curve tracers at the same time.
 - e. In the situation that the error still persists, please contact with the technical service.

3. The value of the temperatura shown is not correct.

a. Make sure that there is communication between E-Sens and the E-1500 / E-1000. For a proper communication the colour shown in the background of the radiation has to be yellow or green.

b. Check that the sensor configuration is properly set up. Select Settings -> Sensor Settings, and check that the temperature mode selected is the one you actually use (PT1000, IR Sens, Mod Ref) and with the proper configuration. Check the section 5.5.6.B of the manual.

c. If there is no communication, shut down and turn on the device. It may also be an issue with the distance. Check again with both devices close together and make sure the antennas are installed properly.

d. It may also be the case that several E-Sens and E-1500 / E-1000 are working together in the same place. This may result in noise between the communications. As a result, you should only use one E-Sens, despite working with several I-V curve tracers at the same time.

e. In the situation that the error still persists, please contact with the technical service.

4. After pressing the button to measure, the device beeps and does not show the curve and buttons do not work on the screen.

a. Check just above the settings button if the E-Temp option is selected. Also check if there is a message on the screen stating that the device made a measurement and it is waiting for the temperature value of the E-Temp. If that is the case, the device is in the standby mode and it is waiting for the E-Temp data to make the extrapolation of the curve values to continue measuring. If you do not own an E-Temp or you do not need to use it, you have to disable it inside the sensor settings before starting to measure.

5. The device does not save the barcode scanner data inside the csv files, even if it is shown on the device screen.

a. When you are going to make a measurement saving the barcode scanner data, you have to use the scanner only when the device asks for it through a message on the screen. Otherwise, if you use the scanner too soon, you will still see the code on the screen but it will not be saved on the csv file as it will not be associated with the measurement performed.

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