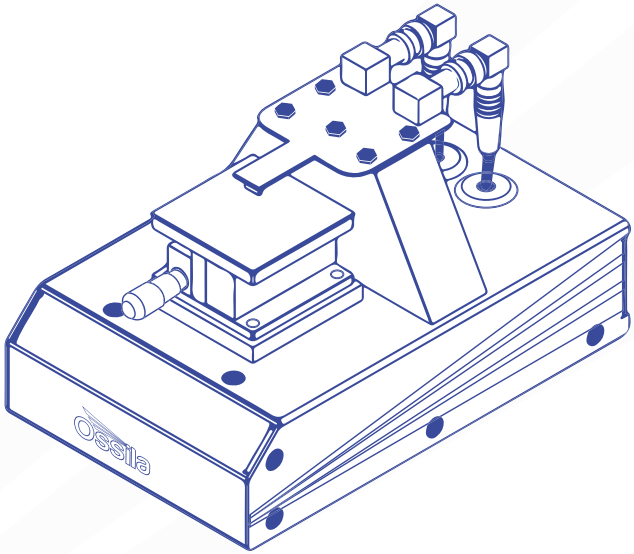
Ossila

FOUR-POINT PROBE
USER MANUAL

Manual Version: 3.1.D
Product Code: T2001A3
Product Version: 3.0
Software Version: 1.0



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Contents

1. Overview

The Ossila Four-Point Probe System is part of the Institute of Physics award-winning Solar Cell Prototyping Platform*. It is a low-cost solution for rapid and reliable measurement of the sheet resistance, resistivity, and conductivity of materials.

The system includes a four-point probe, source measure unit, and easy-to-use PC software — enabling more laboratories to measure sheet resistance for an affordable price. The probe head uses gentle spring-loaded contacts instead of sharp needles, minimising damage to delicate samples (e.g. polymer films that are only a few nanometres thick).

The system is operated via the specifically-designed PC software, which automatically calculates appropriate geometrical correction factors for the sample to give accurate values for the sheet resistance. If the sample thickness is provided, the software will further calculate resistivity and conductivity.

*The Ossila Solar Cell Prototyping Platform is a complementary collection of substrates, materials, and equipment as part of a high-performance standard photovoltaic reference architecture. This platform enables researchers to produce high-quality, fully-functional solar cells which can be used as a reliable baseline.

For more information: **ossila.com/pages/solar-cell-prototyping-platform**

2. EU Declaration of Conformity (DoC)

We

Company Name: Ossila Limited
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Postcode: S4 7WB
City: Sheffield
Telephone number: +44 (0)114 2999 180
Email Address: info@ossila.com

declare that the DoC is issued under our sole responsibility and belongs to the following product:

Product: Four-Point Probe System (**T2001A3**)
Serial number: T2001A3-xxxx

Object of declaration:

Four-Point Probe System (**T2001A3**)

The object of declaration described above is in conformity with the relevant Union harmonisation legislation:

EMC Directive 2014/30/EU
RoHS Directive 2011/65/EU

Signed:

Name: Dr James Kingsley
Place: Sheffield
Date: 01/10/2018

[Декларация] за съответствие на ЕС
Производител: Ossila Ltd., Solpro Business Park, Windsor Street, S4 7WD, Великобритания
Декларира с цялата си отговорност, че посоченото оборудване съответства на приложимото законодателство на ЕС за хармонизиране, посочено на предходната(-ите) страница(-и) на настоящия документ.

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Prohlašujeme na vlastní odpovědnost, že uvedené zařízeni je v souladu s příslušnými harmonizačními předpisy EU uvedenými na předchozích stranách tohoto dokumentu.

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Vakuutamme täten olevamme yksin vastuussa siitä, että tässä asiakirjassa luetellut laitteet ovat tämän asiakirjan sivuilla edellisillä sivuilla kuvattujen olennaisten yhdenmukaistamista koskevien EU-säädösten vaatimusten mukaisia.

[Svenska] **EU-försäkran om överensstämmelse**
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3. Safety

3.1 Warning

> Absolute maximum input voltage is ±12 volts. DO NOT apply input while not powered.

3.2 Use of Equipment

The Ossila Four-Point Probe System is designed to be used as instructed. It is intended for use under the following conditions:

- Indoors in a laboratory environment (Pollution Degree 2)
- Altitudes up to 2000m
- Temperatures of 5°C to 40°C; maximum relative humidity of 80% up to 31°C.

The unit is supplied with an 24 V / 2 A power adapter with a power cord for the country of purchase, in accordance with European Commission regulations and British Standards. Use of any other electrical power cables, adaptors, or transformers is not recommended.

3.3 Hazard Icons

The following symbols can be found at points throughout the manual. Note and read each warning before attempting any associated operations associated with it:

Table 3.1. Hazard warning labels used in this manual.

Symbol	Associated Hazard
	Electrical shock

3.4 General Hazards

Before installing or operating the Ossila Four-Point Probe System, there are several health and safety precautions which must be observed to ensure safe installation and operation.

3.5 Power Cord Safety

Emergency power disconnect options: use the power cord as a disconnecting method and remove from wall. To facilitate disconnect, make sure the power outlet for this cord is readily accessible to the operator.

3.6 Servicing

If servicing is required, please return the unit to Ossila Ltd. The warranty will be invalidated if:

- Modification or service has been carried out by anyone other than an Ossila engineer.
- The Unit has been subjected to chemical damage through improper use.
- The Unit has been operated outside the usage parameters stated in the user documentation associated with the Unit.
- The Unit has been rendered inoperable through accident, misuse, contamination, improper maintenance, modification, or other external causes.

3.7 Health and Safety – Servicing

Servicing should only be performed by an Ossila engineer. Any modification or alteration may damage the equipment, cause injury, or death. It will also void your equipment's warranty.

4. Requirements

Table 4.1 details the power requirements for the system, and the minimum computer specifications for the Ossila Sheet Resistance software.

Table 4.1. Four-Point Probe System and Ossila Sheet Resistance software requirements.

Power	24 VDC / 2A (supplied with the system)
Operating Systems	Windows 10
CPU	Dual Core 2 GHz
RAM	2 GB
Available Hard Drive Space	160 MB
Monitor Resolution	1440 x 900
Connectivity	USB 2.0 or newer, or Ethernet (requires DHCP)

5. Unpacking

5.1 Packing List

The standard items included with the Ossila Four-Point Probe System are:

- The Ossila Four-Point Probe.
- 24 V / 2 A power adapter with a cord set specifically for country of operation (UK, USA, EU, or AU).
- USB-B cable.
- USB memory stick pre-loaded with the user manual, QC data, and software installer.
- Printed copy of the user manual.
- 100 nm ITO coated glass substrate (20 x 15 mm).

5.2 Damage Inspection

Examine the components for evidence of shipping damage. If damage has occurred, please contact Ossila directly for further action. The shipping packaging will come with a shock indicator to show if there has been any mishandling of the package during transportation.

6. Specifications

The Four-Point Probe System measurement specifications are shown in **Table 6.1**, and the physical specifications are shown in **Table 6.2.**

Table 6.1. Four-Point Probe System measurement specifications.

Voltage range	±100 µV to ±10 V
Current range	±1 µA to ± 200 mA
Sheet resistance range	100 mΩ/square to 10 MΩ/square

Table 6.2. Four-Point Probe System accuracy and precision specifications.

Sheet resistance	Accuracy*	Precision**	Measured at range
100 mΩ/square	±8%	±3%	1
1 Ω/square	±2%	±0.5%	1
10 Ω/square	±1%	±0.5%	1
100 Ω/square	±1%	±0.05%	2
1 kΩ/square	±1%	±0.03%	2
10 kΩ/square	±1%	±0.02%	3
100 kΩ/square	±2%	±0.05%	4
1 MΩ/square	±8%	±0.5%	5
10 MΩ/square	±30%	±5%	5

*Accuracy is the maximum deviation from the true value.

** Precision is the maximum deviation between identical measurements (useful for comparative measurements).

Table 6.3. Four-Point Probe System physical specifications.

Probe Spacing	1.27 mm
Rectangular Sample Size Range	Long Edge Minimum: 4 mm Short Edge Maximum: 60 mm
Circular Sample Size Range (Diameter)	4 mm to 76.2 mm
Maximum Sample Thickness	10 mm
Overall Dimensions	Width: 145 mm Height: 150 mm Depth: 240 mm

7. System Components

The Four-Point Probe System comprises three items: the Ossila Four-Point Probe System (**Figure 7.1**), power adaptor (**Figure 7.2**), and the Ossila Sheet Resistance Software (**Figure 7.3**).

Figure 7.1. The Ossila Four-Point Probe System.

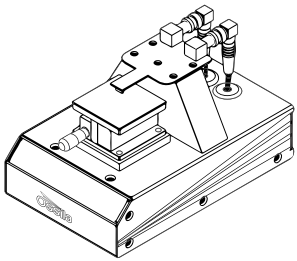


Figure 7.2. The 24 V DC power adapter

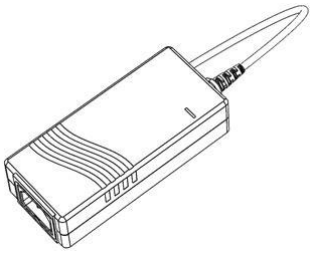


Figure 7.3. The Ossila Sheet Resistance Lite software.

8. Installation

1. Install the Ossila Sheet Resistance Lite software on your PC.
    I. Run the file 'Ossila-Sheet-Resistance-Lite-Installer-vX-X-X-X.exe' on the USB memory stick provided.
    II. Follow the on-screen instructions to install the software.
2. Connect the 24 V DC power adaptor to the power socket on the rear of the unit.
3. Connect the unit to your PC using the provided USB-B cable, or an Ethernet cable if preferred.
    I. If you are using a USB connection and the unit is not detected, please refer to the SMU USB Driver Installation Guide found on the USB memory stick.

Note: The Ossila Sheet Resistance Lite software can also be downloaded from **ossila.com/pages/downloads**

9. Operation

9.1 Taking a Measurement

1. Place your sample in the centre of the vertical stage.
2. Raise the platform until the probes have retracted approximately half-way into their housing.
    I. One full turn of the micrometer (after initial contact is made) is a good way to ensure that there is good electrical contact between the probes and your sample.
    II. Ensure that the probes make contact with the centre of the sample.
    III. For rectangular samples, the longest edge should be aligned parallel to the probes.
3. Start the Ossila Sheet Resistance Lite software. The window shown in **Figure 9.1** will open.

4. Set the appropriate settings in the software (explained in more detail in **Section 9.2**).
5. Click the on/off toggle button.
    I. The system will attempt to pass a current between through the sample.
    II. If a current can be passed though the sample, the system will measure the **sheet resistance**, which will be displayed in the program.
    III. If a thickness has been provided, the **resistivity** and **conductivity** will also be displayed.
    IV. The measurement will continue until the on/off toggle button is clicked or the software is closed.

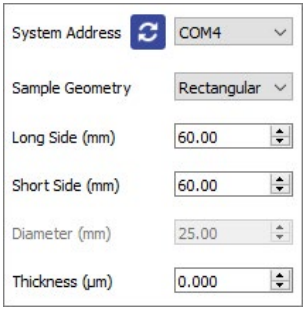
Figure 9.1. The Ossila Sheet Resistance Lite software.

9.2 Software Settings

There are several settings in the program which must be filled in before taking a measurement. These are found in the column on the left of the window, as shown in **Figure 9.1**.

9.2.1 Basic Settings

Figure 9.2. Basic settings.



(I) System Address

- Select the COM port or IP address of the connected unit you intend to use (USB and Ethernet connection respectively).
    I. This box will be populated automatically with the addresses of any units connected to the computer or network when the software starts.

(II) Geometry

- Select the geometry of the sample being measured.
    I. This is required to calculate the geometrical correction factor for the current sample.
    II. If the shape of the sample is irregular, consider whether it is closer to rectangular or circular and then estimate what size of that shape could fit within the sample.

(III) Long Side (Rectangular Sample)

- Sets the length of the long side of the sample in mm (if the sample is rectangular).
    I. This is required for calculating the appropriate geometrical correction factor.

(IV) Short Side (Rectangular Sample)

- Sets the length of the short side of the sample in mm (if the sample is rectangular).
    I. This is required for calculating the appropriate geometrical correction factor.

(V) Diameter (Circular Sample)

- Sets the diameter of the sample in mm (if the sample is circular).
    I. This is required for calculating the appropriate geometrical correction factor.

(VI) Thickness (Optional)

- Sets the thickness of the conductive layer being measured in µm.
    I. This enables the calculation of the resistivity and conductivity of the sample, as well as calculating a thickness correction factor for samples with a thickness greater than 40% of the probe spacing.
    II. It is not needed for sheet resistance measurements of samples with a thickness less than 40% of the probe spacing, thus can be set to 0 if not known.

9.2.2 Saving Results

Figure 9.3. Save settings.

(I) Readings to Save

- Set the number of measurements to save.

(II) Save

- Opens a file dialog window to choose where to save the data.

(II) Saved Data Format

- The applied current, measured voltage, and measured sheet resistance are saved to the file.
- The mean and standard deviation of the sheet resistance measurements are saved to the same file, placed after the data readings.
- If a thickness is provided, the resistivity and conductivity values are also saved.

9.2.3 Advanced Settings

Advanced settings can be found by checking the "Use Advanced Settings" box below the basic settings. This will also show the voltage and current set between the outer probes, and voltage measurements between the inner probes. Note that these settings will only be used whilst "Use Advanced Settings" box is ticked, default settings will be used when not ticked.

Figure 9.4. Ossila Sheet Resistance software showing advanced settings options.

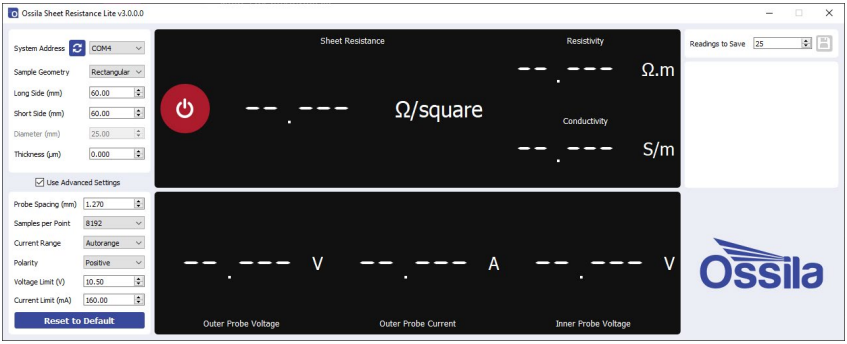
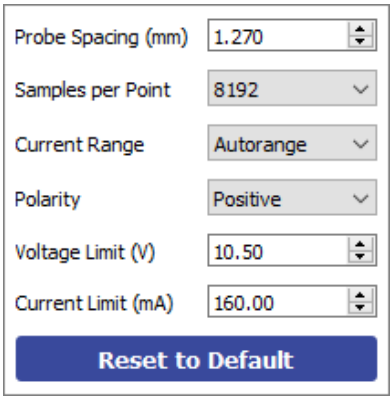


Figure 9.5. Advanced settings.



(I) Probe Spacing

- Sets the spacing between each of the probes in mm.
    I. This is required to determine the appropriate geometric correction factors for the sample being measured.

(II) Current Range

- Select whether the appropriate range should be automatically determined or whether a specific range of currents is used.
    I. This defines the upper limit and accuracy of current measurements that can be performed by the unit.
    II. Autorange will enable the measurement to automatically switch ranges as needed.
    III. The maximum current values for each range are shown in the range selection box.

(IV) Polarity

- Sets whether the measurement polarity is positive or negative.

(V) Voltage Limit

- Sets the maximum voltage the measurement can apply to the sample in volts.
    I. If the voltage limit is exceeded the measurement will stop.

(VI) Current Limit

- Sets the maximum current the measurement can apply to the sample in mA.
    I. If the current limit is exceeded the measurement will stop.

(VII) Reset to Default

- Clicking this button will reset all advanced settings to their default values.

10. Troubleshooting

Most of the issues that may arise will be detailed here. However, if you encounter any issues that are not detailed here, then contact us by email at **info@ossila.com**. We will respond as soon as possible.

Table 10.1. Troubleshooting guidelines for the Ossila Four-Point Probe

Problem	Possible cause	Action
No power / display	a. The power supply may not be connected properly. b. The power supply adaptor has a fault.	a. Ensure the system is firmly plugged into the power supply, and that the plug is connected to both the adaptor and a working power socket. b. Contact Ossila for a replacement power supply adaptor.
Software does not start	a. The wrong version of Windows is installed on the computer. b. The software has not installed properly.	a. Install the software on a computer with Windows. b. Try reinstalling the software.
Cannot connect to the system via USB	a. The USB cable may not be connected properly. b. The USB cable may not be connected to a working USB port. c. The USB cable is defective.	a. Ensure the USB cable is firmly plugged in at both ends. b. Try connecting the unit to a different USB port on the computer. c. Use a different USB-B cable, and contact Ossila if necessary.
Cannot connect to the system via network	a. The MAC address of the unit is not registered with the internal network. b. The Ethernet cable may not be connected properly. c. The Ethernet cable is defective.	a. Register the system on the network using the MAC address obtained via a USB connection (see Source Measure Unit manual). b. Ensure the Ethernet cable is firmly plugged in at both ends. c. Try using a different Ethernet cable.

11. Related products

11.1 Related Consumables

ITO Coated Substrates

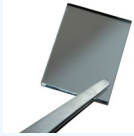
Our range of 15 x 20 mm ITO substrates for OPV, OLED and sensing applications.

Product codes: S111 / S101 / S211 / S281 / S171

Flat Tip Tweezers

Provides a good substrate grip without scratching.

Product codes: C121



FTO Coated Substrates

Designed to be used in the fabrication of transparent electrodes for thin-film photovoltaics.

Product code: S301 / S302 / S303 / S304

Substrate Cleaning Rack

Holds 20 substrates for a variety of processing techniques.

Product code: E101

11.2 Related Equipment

Spin Coater

Produce high-quality coatings without any substrate warping. Perfect for busy labs with limited space.

Product code: L2001A3

Syringe Pump

High-precision, programmable single and dual syringe pumps for the automatic dispensing of solutions.

Product codes: L2003S1 / L2003D1

UV Ozone Cleaner

For removing contamination on the surface of samples, providing you with ultraclean surfaces within minutes.

Product code: L2002A2

Source Measure Unit

Source voltage, measure current, get data. Simplify and accelerate your data collection!

Product code: P2005A2

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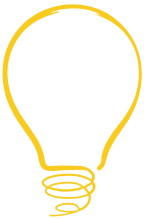

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