



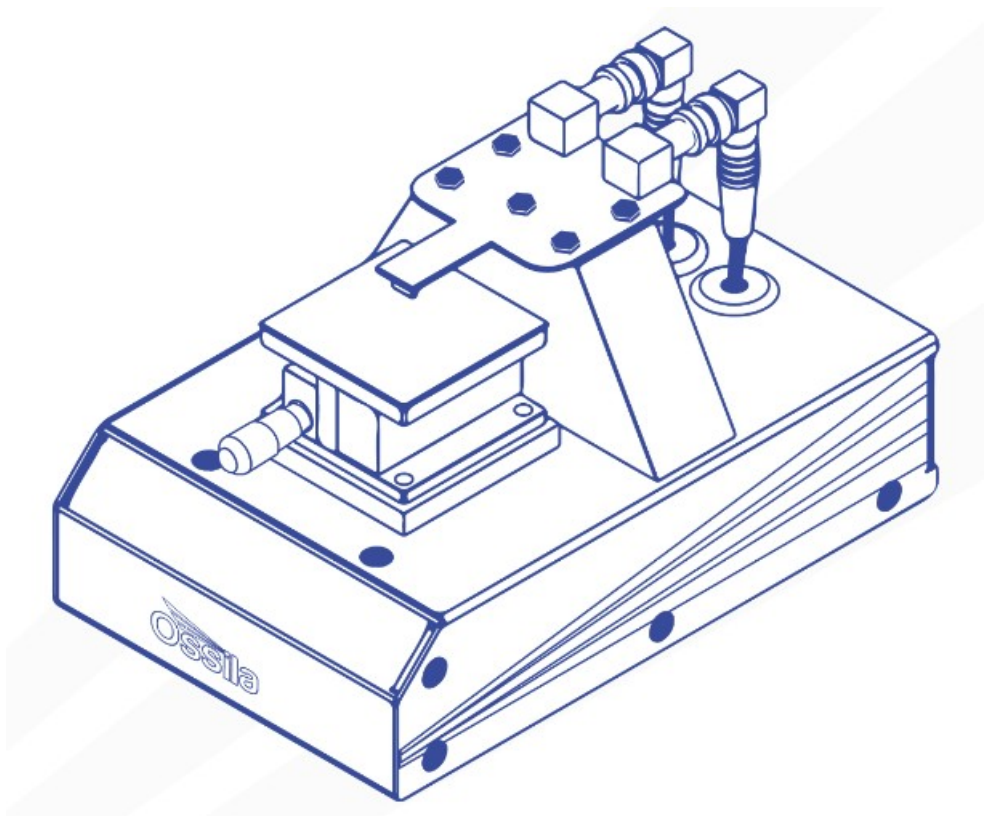
Ossila T2001A3 Four-Point Probe User Manual

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FOUR-POINT PROBE USER MANUAL

Manual version: 3.1.H
Product code: T2001A
Product Version: 3.0
Software version: 1.0



[Ossila.com](https://www.ossila.com)

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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).

It 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.



EU Declaration of Conformity (DoC)

We

Company Name: Ossila BV

Postal Address: Bio partner 3 building, Galileiweg 8

Postcode: 2333 BD Leiden

Country: The Netherlands

Telephone number: +31 (0)71 3322992

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 harmonization legislation:

EMC Directive 2014/30/EU

RoHS Directive 2011/65/EU

Signed:



Name: Dr James Kingsley

Place: Leiden

Date: 16/11/2021

Safety

Warning

- The absolute maximum input voltage for the Vsense channels is ± 12 V. Do NOT apply input while not powered.

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 a 24 VDC 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.

Hazard Icons

The following symbols can be found at points throughout the rest of 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

General Hazards

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

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.

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.

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.

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 requirements.

Power	24 VDC
Operating Systems	Windows 10 or 11 (32-bit or 64-bit)
CPU	Dual Core 2 GHz
RAM	2 GB
Available Hard Drive Space	194 MB
Monitor Resolution	1440 x 900
Connectivity	USB 2.0
	Ethernet (requires DHCP)

Unpacking

Packing List

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

- The Ossila Four-Point Probe.

- 24 VDC power adapter.
- USB-B cable.
- USB memory stick pre-loaded with the user manual, software installer, QC data, and USB drivers.
- 400 450 nm FTO coated glass substrate (60 x 60 x 2.2 mm).
- 10 k resistor test head.

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.

Specifications

The Four-Point Probe System measurement specifications are shown in Table 6.1 and **Table 6.2**, and the physical specifications are shown in **Table 6.3**.

Table 6.1. Four-Point Probe System measurement specifications.

Voltage range	±100 µV to ±10 V
Current range	±1 µA to ±200 mA (5 ranges)
Sheet resistance range	100 mΩ/square to 10 MΩ/square

Table 6.2. Accuracy and precision of the Four-Point Probe System at each resistance range. Accuracy is the maximum deviation from the true value. Precision is the maximum deviation between identical measurements (useful for comparative measurements).

Sheet Resistance	Accuracy	Precision	Measured at Range
100 mΩ/square	±8%	±3%	200 mA
1 Ω/square	±2%	±0.5%	200 mA
10 Ω/square	±1%	±0.5%	200 mA
100 Ω/square	±1%	±0.05%	20 mA
1 kΩ/square	±1%	±0.03%	20 mA
10 kΩ/square	±1%	±0.02%	2 mA
100 kΩ/square	±2%	±0.05%	200 µA
1 MΩ/square	±8%	±0.5%	20 µA
10 MΩ/square	±30%	±5%	20 µA

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

System Components

The Four-Point Probe System is comprised of: the Ossila Four-Point Probe System (Figure 7.1) and the Ossila Sheet Resistance Software (Figure 7.2).



Figure 7.1. The Ossila Four-Point Probe.



Figure 7.2. The Ossila Sheet Resistance Lite software.

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 VDC 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 and Source Measure Unit USB drivers can also be downloaded from ossila.com/pages/software-drivers

Operation

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. Ossila Sheet Resistance Lite software.

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**.

Basic Settings


System Address	 COM4
Sample Geometry	Rectangular
Long Side (mm)	60.00
Short Side (mm)	60.00
Diameter (mm)	25.00
Thickness (μm)	0.000

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.

(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.

Saving Results

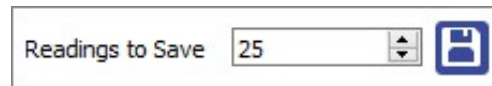


Figure 9.3. Save settings.

(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.

(III) 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.

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.

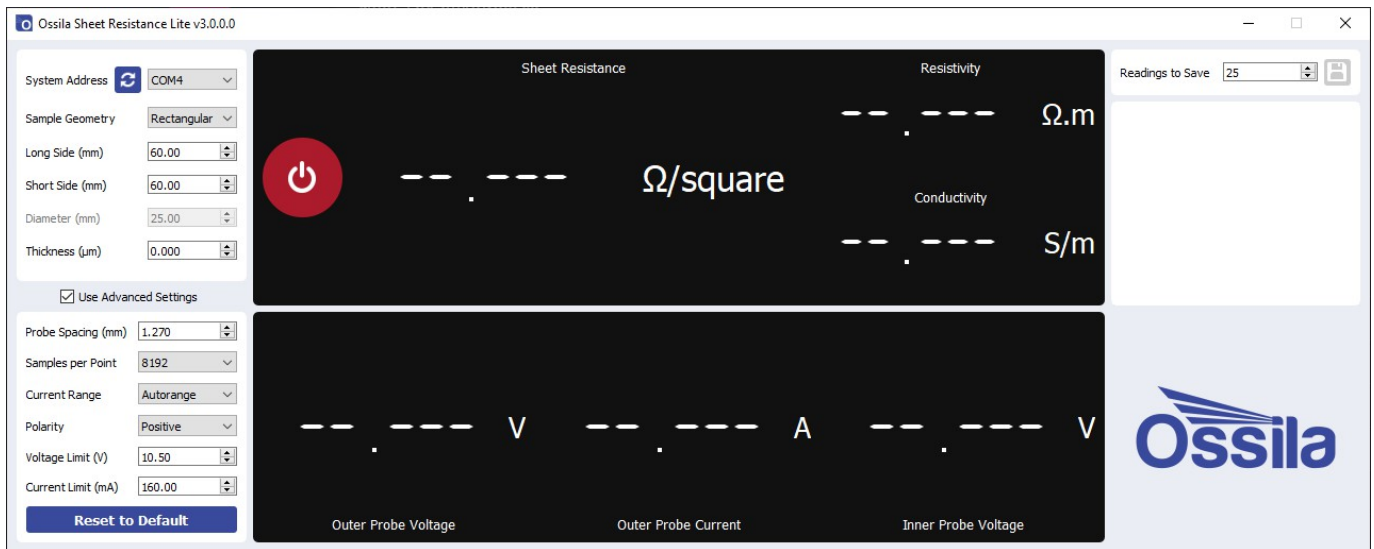


Figure 9.4. Ossila Sheet Resistance software showing advanced settings options.

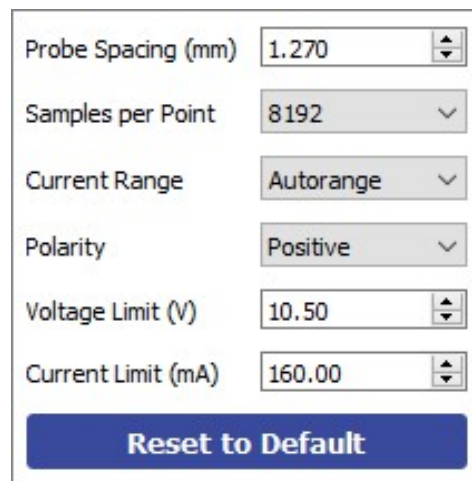


Figure 9.5. Advanced settings.

(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) Samples per Point

- Select the number of samples to be taken for each measurement.
 - I. A higher number of samples per point will improve the accuracy and precision of the measurement. However, this will increase the time taken for it to be performed.

(III) 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.

Test Head

The system is shipped with a test head that can be used to verify the correct operation the system by providing a reference measurement. It is designed to give a response of 10 k when a sheet resistance measurement is performed on it using the system.

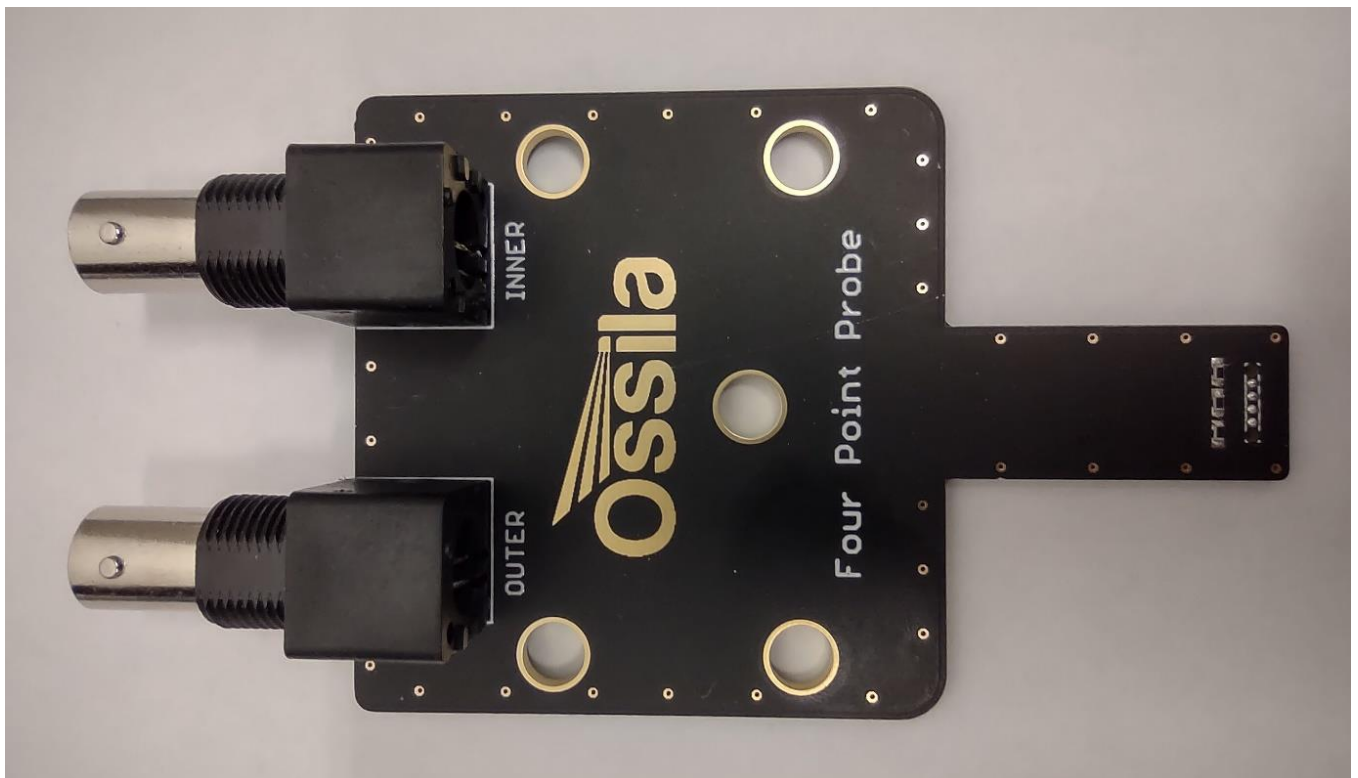
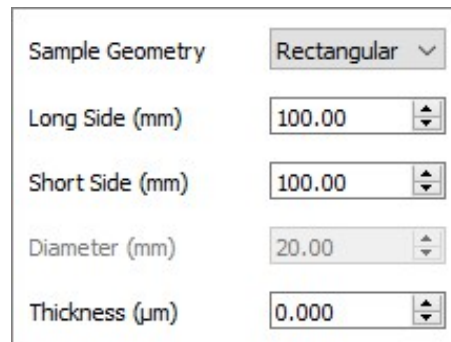


Figure 10.1. Four-point probe test head.

Taking a Measurement

1. Replace the four-point probe head on the system with the test head.
 - I. To do this first disconnect the cables, then remove the 5 screws attaching the head to the system.
 - II. Remove the four-point probe head and place the test head on the system.
 - III. Attach the test head using the screws, then connect the cables.
2. Plug in and switch on the system.
3. Allow at least 30 minutes for the system to warm up.
4. Start the Sheet Resistance Lite software and enter the settings in Figure 10.2.
 - I. Note, Long Side and Short Side can be any value greater than 55 mm, this is to ensure that no correction factor is applied to the measurement.



Sample Geometry	Rectangular
Long Side (mm)	100.00
Short Side (mm)	100.00
Diameter (mm)	20.00
Thickness (μm)	0.000

Figure 10.2. Measurement settings for the test head.

5. Start the measurement.
6. The system should measure a sheet resistance between 9.9 and 10.1 k/square (within

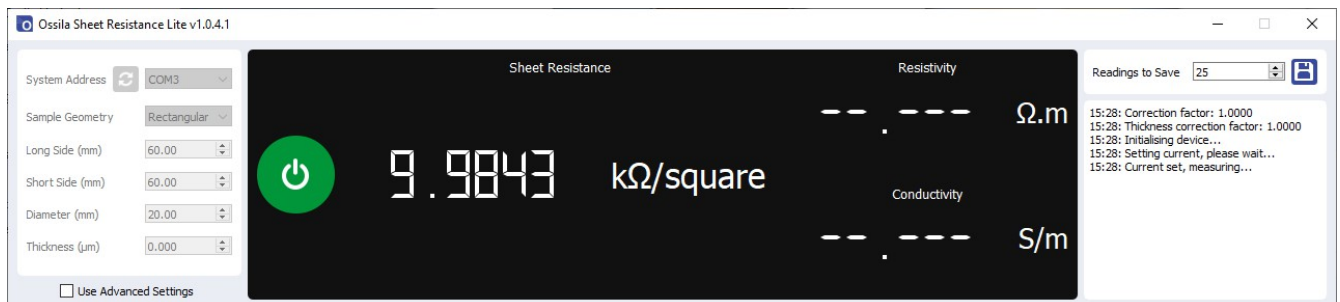


Figure 10.3. Example measurement of the test head.

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.

Installation and Setup





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

Error Messages and Warnings





Message	Description
Current limit exceeded	The measured current is greater than the set current limit.
Voltage limit exceeded	The output voltage is greater than the set voltage limit.
Unable to measure sample, resistance outside of measurable range	The system is unable to pass a current through the sample under test.
Long edge must be able to fit all probes	The long edge of a rectangular sample is shorter than 3 times the probe spacing.
Diameter must be able to fit all probes	The diameter of a circular sample is shorter than 3 times the probe spacing.
Short edge cannot be longer than the long edge	The short edge is greater than the long edge for a rectangular sample.
Sample removed, stopping measurement	The system has detected that the sample has been removed.
Error communicating with system	The software is unable to connect to the system.
Unable to open file: permission was denied	The software does not have the necessary permissions to access the given file path, or the file is already open in other software.
Unable to save file: permission was denied	The software does not have the necessary permissions to access the given file path, or the file is already open in other software.

Related Products

Related Consumables

	ITO Coated Substrates Our range of 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 code: C121
	FTO Coated Substrates Designed to be used as transparent electrodes for thin-film photovoltaics. Product codes: S301 / S302 / S303 / S304		Substrate Cleaning Rack Holds 20 substrates for a variety of processing techniques. Product code: E101

Related Equipment

	<p>Spin Coater Product high-quality coatings without any substrate warping. Perfect for busy labs with limited space. Product code: L2001A3</p>		<p>Syringe Pump High-precision, programmable single and dual syringe pumps for automatic dispensing of solutions. Product codes: L2003S1 / L2003D1</p>
	<p>UV Ozone Cleaner For removing contamination on the surface of samples, providing you with ultraclean surfaces within minutes. Product code: L2002A2</p>		<p>Source Measure Unit Source voltage, measure current, get data. Simplify and accelerate your data collection! Product code: P2005A2</p>



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Documents / Resources

	<p>Ossila T2001A3 Four-Point Probe [pdf] User Manual T2001A3, Four-Point Probe, T2001A3 Four-Point Probe</p>
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References

-  [Lab Equipment, Chemicals & Supplies for Materials Science | Ossila](#)
-  [Software and Drivers | Ossila](#)
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