

OSSILA UNIT–X200 USER MANUAL



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SOURCE MEASURE UNIT-X200 USER MANUAL

Manual Version: 2.0.E

Product Code: P2005A

Product Version: 2.0

Firmware Version: 2.4

Software Version: 1.2



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1. Overview

The Ossila Source Measure Unit (SMU) incorporates two voltage sources for measuring current and two voltage meters for measuring voltage. With it, you can measure a wide range of research devices including photovoltaics, LEDs and OLEDs, transistors, and more.

The ability to control instruments is a key skill for experimental scientists and engineers. We have designed the SMU so that no matter what your skill level is, you can access affordable, precise instrumentation.



1.1 Features

- Dual Source Measure (SMU) channels
- Dual Voltmeter channels
- ± 10 V source
- Up to ± 200 mA source/sink current per channel
- Five software controlled current ranges (10 nA – 200 mA)
- Shutter control or trigger input
- Serial and I²C extension
- PC software front panel
- USB & Network control
- Simple text-based interface

2. EU Declaration of Conformity (DoC)

We

Company Name: Ossila Limited

Postal Address: Solpro Business Park, Windsor Street.

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: Source Measure Unit – X200 (P2005A2)

Serial number: P2005A2-xxxx

Object of declaration:

Source Measure Unit – X200 (P2005A2)

**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.

[Čeština] Prohlášení o shodě EU

Výrobce: Ossila Ltd., Solpro Business Park, Windsor Street, S4 7WD, Spojené Království

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

[Dansk] EU-overensstemme Iserklæring

Producent: Ossila Ltd., Solpro Business Park, Windsor Street, S4 7WD, UK

Erklærer herved, at vi alene er ansvarlige for, at det nævnte udstyr er i overensstemmelse med den relevante EU-harmoniseringslovgivning, der er anført på den/de foregående side(r) i dette dokument.

[Deutsch] EU-Konformitätserklärung

Hersteller: Ossila Ltd., Solpro Business Park, Windsor Street, S4 7WD, Vereinigtes Königreich

Wir erklären in alleiniger Verantwortung, dass das aufgeführte Gerät konform mit der relevanten EU-Harmonisierungsgesetzgebung auf den vorangegangenen Seiten dieses Dokuments ist.

[Eesti keel] ELi vastavusavaldus

Tootja: Ossila Ltd., Solpro Business Park, Windsor Street, S4 7WD, UK

Kinnitame oma ainuvastutust, et loetletud seadmed on kooskõlas antud dokumendi eelmisel leheküljel / eelmistel lehekülgedel ära toodud asjaomaste ELi ühtlustamise õigusaktidega.

[Ελληνικά] Δήλωση πιστότητας ΕΕ

Κατασκευαστής: Ossila Ltd., Solpro Business Park, Windsor Street, S4 7WD, Ηνωμένο Βασίλειο

Δηλώνουμε υπεύθυνα ότι ο αναφερόμενος εξοπλισμός συμμορφώνεται με τη σχετική νομοθεσία εναρμόνισης της ΕΕ που υπάρχει στις προηγούμενες σελίδες του παρόντος εγγράφου.

[Español] Declaración de conformidad UE

Fabricante: Ossila Ltd., Solpro Business Park, Windsor Street, S4 7WD, Reino Unido

Declaramos bajo nuestra única responsabilidad que el siguiente producto se ajusta a la pertinente legislación de armonización de la UE enumerada en las páginas anteriores de este documento.

[Français] Déclaration de conformité UE

Fabricant: Ossila Ltd., Solpro Business Park, Windsor Street, S4 7WD, Royaume-Uni

Déclarons sous notre seule responsabilité que le matériel mentionné est conforme à la législation en vigueur de l'UE présentée sur la/les page(s) précédente(s) de ce document.

[Hrvatski] E.U izjava o sukladnosti

Proizvođač: Ossila Ltd., Solpro Business Park, Windsor Street, S4 7WD, Velika Britanija

Izjavljujemo na vlastitu odgovornost da je navedena oprema sukladna s mjerodavnim zakonodavstvom EU-a o usklađivanju koje je navedeno na prethodnoj(nim) stranici(ama) ovoga dokumenta.

[Italiano] Dichiarazione di conformità UE

Produttore: Ossila Ltd., Solpro Business Park, Windsor Street, S4 7WD, UK

Si dichiara sotto la propria personale responsabilità che l'apparecchiatura in elenco è conforme alla normativa di armonizzazione UE rilevante indicata nelle pagine precedenti del presente documento.

[Latviešu] ES atbilstības deklarācija

Ražotājs: Ossila Ltd., Solpro Business Park, Windsor Street, S4 7WD, UK

Ar pilnu atbildību paziņojam, ka uzskaitītais aprīkojums atbilst attiecīgajiem ES saskaņošanas tiesību aktiem, kas minēti iepriekšējās šī dokumenta lapās.

[Lietuvių k.]**ES atitikties deklaracija**

Gamintojas: Ossila Ltd., Solpro Business Park, Windsor Street, S4 7WD, UK

atsakingai pareiškia, kad išvardinta įranga atitinka aktualius ES harmonizavimo teisės aktus, nurodytus ankstesniuose šio dokumento

[Magyar]**EU-s megfelelőségi nyilatkozat**

Gyártó: Ossila Ltd., Solpro Business Park, Windsor Street, S4 7WD, UK

Kizárólagos felelősségünk mellett kijelentjük, hogy a felsorolt eszköz megfelel az ezen dokumentum előző oldalán/oldalain található EU-s összehangolt jogszabályokra vonatkozó rendelkezéseinek.

[Nederlands]**EU-Conformiteitsverklaring**

Fabrikant: Ossila Ltd., Solpro Business Park, Windsor Street, S4 7WD, UK

Verklaart onder onze uitsluitende verantwoordelijkheid dat de vermelde apparatuur in overeenstemming is met de relevante harmonisatiewetgeving van de EU op de vorige pagina(s) van dit document.

[Norsk]**EU-samsvarserklæring**

Produsent: Ossila Ltd., Solpro Business Park, Windsor Street, S4 7WD, UK

Erklærer under vårt eneansvar at utstyret oppført er i overholdelse med relevant EU-harmoniseringslovverk som står på de(n) forrige siden(e) i dette dokumentet.

[Polski]**Deklaracja zgodności Unii Europejskiej**

Producent: Ossila Ltd., Solpro Business Park, Windsor Street, S4 7WD, UK

Oświadczamy na własną odpowiedzialność, że podane urządzenie jest zgodne ze stosownymi przepisami harmonizacyjnymi Unii Europejskiej, które przedstawiono na poprzednich stronach niniejszego dokumentu.

[Português]**Declaração de Conformidade UE**

Fabricante: Ossila Ltd., Solpro Business Park, Windsor Street, S4 7WD, Reino Unido

Declara sob sua exclusiva responsabilidade que o equipamento indicado está em conformidade com a legislação de harmonização relevante da UE mencionada na(s) página(s) anterior(es) deste documento.

[Română]**Declarație de conformitate UE**

Producător: Ossila Ltd., Solpro Business Park, Windsor Street, S4 7WD, Regatul Unit

Declară pe proprie răspundere că echipamentul prezentat este în conformitate cu prevederile legislației UE de armonizare aplicabile prezentate la pagina/paginile anterioare a/ale acestui document.

[Slovensky]**Vyhlasenie o zhode pre EÚ**

Výrobca: Ossila Ltd., Solpro Business Park, Windsor Street, S4 7WD, Spojené kráľovstvo

Na vlastnú zodpovednosť prehlasuje, že uvedené zariadenie je v súlade s príslušnými právnymi predpismi EÚ o harmonizácii uvedenými na predchádzajúcich stranách tohto dokumentu.

[Slovenščina]**Izjava EU o skladnosti**

Proizvajalec: Ossila Ltd., Solpro Business Park, Windsor Street, S4 7WD, UK

s polno odgovornostjo izjavlja, da je navedena oprema skladna z veljavno uskladitveno zakonodajo EU, navedeno na prejšnji strani/ prejšnjih straneh tega dokumenta.

[Suomi]**EU-vaatimusten mukaisuusvakuutus**

Valmistaja: Ossila Ltd., Solpro Business Park, Windsor Street, S4 7WD, UK

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**

Tillverkare: Ossila Ltd., Solpro Business Park, Windsor Street, S4 7WD, Storbritannien

Vi intygar härmed att den utrustning som förtecknas överensstämmer med relevanta förordningar gällande EU-harmonisering som finns på föregående sidor i detta dokument.

3. Safety

3.1 Warning

- Do NOT connect external voltage sources to either SMU channel.
 - The absolute maximum input voltage for the Vsense channels is $\pm 12\text{ V}$. DO NOT apply input while not powered.

3.2 Use of Equipment

The Ossila Source Measure Unit 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 / 2A 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 Source Measure Unit, there are several health and safety precautions which must be followed and executed 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. Software Requirements

The Ossila SMU is compatible with our Front Panel software which is included with the system. It allows for simple operation of the SMU and precision voltmeter channels.

Table 4.1 details the minimum computer specifications for the Ossila Front Panel software

Table 4.1. Ossila Front Panel requirements.

Operating System	Windows 10
CPU	Dual-core 2 GHz
RAM	2 GB
Hard Drive Space	100 MB
Connectivity	USB 2.0 or newer, Ethernet

5. Unpacking

5.1 Packing List

The standard items included with the Ossila Source Measure Unit are:

- The Ossila Source Measure Unit.
- 24 VDC / 2 A DC power adapter with a cord set specifically for country of operation (plug type A, F, G, or I).
- USB-B cable.
- USB memory stick pre-loaded with the user manual, USB drivers, QC data, and software Front Panel installer.
- Printed copy of the user manual.

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 Ossila Source Measure Unit contains four channels: two source measure units (SMUs) and two precision voltmeters. There is also a general-purpose shutter/trigger to allow other instruments to be controlled or control the unit.

6.1 Specification Conditions

The specifications and information in this document are for the Ossila Source Measure Unit. All units meet these standard specifications when dispatched to the end-user.

The accuracy of both source and measurement of the unit are specified under the following conditions:

- Ambient temperature of $23\text{ }^{\circ}\text{C} \pm 5\text{ }^{\circ}\text{C}$, < 60% relative humidity.
- After a 30-minute warm-up period.
- Default measurement speed (OSR 5) unless specified.
- No filter.

6.2 Source Measure Units (SMU 1 and SMU 2)

The source measure units output a voltage and then measure both the voltage and current. The output voltage is always measured at the output of the BNC (rather than assuming it is at the set voltage) in case of any load effects (for example short circuiting the output or low impedances causing a small drop in voltage). Each source measure unit has manually selectable ranges so that both high and low currents can be measured accurately.

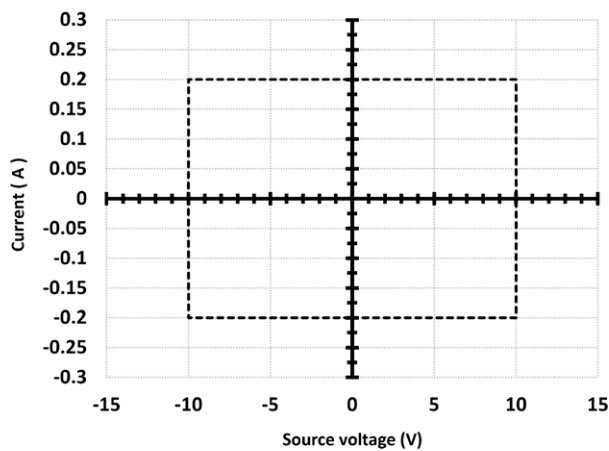
6.2.1 Power Specifications

The unit is specified for a maximum operation power as in Table 6.1. Figure 6.1 shows the four-quadrant safe operation zone of the unit.

Table 6.1. DC power specification.

Power per SMU channel (continuous)	
Four-quadrant Operation Source / Sink	2W (± 10 V at ± 200 mA)

Figure 6.1. The four-quadrant safe operation zone.



There is some allowance for being beyond these limits ($\pm 10\text{ V}$ and $\pm 200\text{ mA}$). The unit has internal voltage and current limits set at $\pm 10.5\text{ V}$ and $\pm 225\text{ mA}$. If a voltage or current greater than these values is measured on either SMU, the red error LED next to the SMU will turn on and the output voltage of the SMU will be set to 0 V . This is a measure to reduce the possibility of damaging the unit due to excessive voltages or currents. The voltage and current limits can be changed programmatically, but they should not be increased past the default values as this will increase the possibility of damaging the unit.

6.2.2 Measurement Speed

The Ossila Source Measure Unit utilises a high-speed, 24-bit no Latency $\Delta\Sigma^{\text{TM}}$ ADC. It provides ten speed/resolution combinations (6.9 Hz/200 nV RMS noise to 3.5 kHz/25 μV RMS noise) which can be selected, with no latency between conversion results. Additionally, a double-speed mode can be selected, enabling output rates up to 7 kHz with one cycle latency. These modes are linked to a single variable called OSR (Oversampling Rate) which is used to program the unit and take the measurement. **Table 6.2** lists the various speed settings of the unit, with maximum measurement rates for both SMU and voltmeter channels.

Table 6.2. Measurement speed modes.

OSR ¹ Index	ADC mode	ADC (samples/ data point)	ADC ² RMS Noise	SMU 1/2 ³ (data points/sec)	Vsense 1/2 ³ (data points/ sec)
0	x1	64	23 μV	N / A	N / A
1	x1	128	3.5 μV	525	785
2	x1	256	2 μV	276	414
3	x1	512	1.4 μV	142	213
4	x1	1024	1 μV	72	108
5	x1	2048	750 nV	36	55
6	x1	4096	510 nV	18	27
7	x1	8192	375 nV	9	12
8	x1	16384	250 nV	4.5	6
9	x1	32768	200 nV	2.2	3

- ¹ OSR 10-19 will set the ADC in 2x mode with the same parameters of OSR 0-9, this will approximately double the unit's measurement rate.
- ² ADC noise increases by approximately $\sqrt{2}$ when OSR is decreased. Note that this is not the unit measurement noise levels.
- ³ Values based on 1000 data points per measurement.

6.2.3 Voltage Source and Measurement Specifications

Table 6.3. Voltage measurement specifications.

Mode	OSR	Range	Accuracy	Noise	Resolution
Sourcing	N / A	$\pm 10\text{ V}$	$\pm 10\text{ mV}$	$333\text{ }\mu\text{V}$	$1.7\text{E-}4$
Measuring	1 to 4	$\pm 10\text{ V}$	$\pm 10\text{ mV}$	$100\text{ }\mu\text{V}$	$1.0\text{E-}4$
	5 to 9	$\pm 10\text{ V}$	$\pm 10\text{ mV}$	$50\text{ }\mu\text{V}$	$1.0\text{E-}5$

Warning: Do NOT attach external voltage sources to either SMU module as this may result in damage to the unit.

6.2.4 Current Measurement Specifications

The current measurement of the Ossila Source Measure Unit is spread over 5 ranges. Each range has a different maximum current, accuracy, and resolution. As the range number increases, the maximum measurable current decreases, but the accuracy and resolution increase.

Table 6.4. Current measurement specifications.

Range	Max current	Accuracy ¹	Noise ²	Resolution	Burden
1	$\pm 200\text{ mA}$	$\pm 500\text{ }\mu\text{A}$	$10\text{ }\mu\text{A}$	$1\text{ }\mu\text{A}$	$< 10\text{mV}$
2	$\pm 20\text{ mA}$	$\pm 10\text{ }\mu\text{A}$	$1\text{ }\mu\text{A}$	100 nA	$< 10\text{mV}$
3	$\pm 2\text{ mA}$	$\pm 1\text{ }\mu\text{A}$	$100\text{ }\mu\text{A}$	10 nA	$< 10\text{mV}$
4	$\pm 200\text{ }\mu\text{A}$	$\pm 100\text{ nA}$	10 nA	1 nA	$< 10\text{mV}$
5	$\pm 20\text{ }\mu\text{A}$	$\pm 10\text{ nA}$	1 nA	100 pA	$< 10\text{mV}$

¹ Accuracy has been measured at the maximum current of that range.

² Noise measurement at the highest OSR (9).

Warning: Do NOT apply currents to a SMU that are greater than the maximum current of the range that is active, as this may result in damage to the unit.

6.3 Voltmeter (Vsense1 and Vsense2)

The Ossila Source Measure Unit has two additional voltage measurement channels marked as Vsense1 and Vsense2. They are designed to accurately detect small voltages while simultaneously having a wide dynamic range of ± 10 V. **Table 6.5** lists the specifications of these additional channels.

Note: the Vsense module shares a ground plane with the SMU module of the same number (i.e. Vsense 1 shares a ground plane with SMU 1) and hence is not isolated.

Table 6.5. Voltmeter specifications.

OSR	Range	Accuracy	Noise	Resolution
1 to 4	1 to 5	± 10 mV	100 μ V	1.0E-4
5 to 9	1 to 5	± 10 mV	50 μ V	1.0E-5

6.4 Measurement Non-Linearity

The non-linearity in the measurement of the Ossila Source Measure Unit is kept well below the measurement accuracy of every range. Such non-linearity is common due to different amplification stages and analogue digital conversion processes.

6.5 Shutter/Trigger

The Shutter/Trigger can be used either as an input or an output. It can be used to send a trigger signal to other instruments or configured to wait for a trigger from other instruments. The voltage level of the Shutter/Trigger is 5 volts and can source and sink up to 30 mA of current; higher currents may result in damage to the unit.

6.6 Physical Specifications

Table 6.6. Physical specifications of the Source Measure Unit.

Channels (BNC connectors)	2 x source measure units (SMU) 2 x voltmeters (Vsense) 1 x shutter/trigger
Connectivity	USB and Ethernet
Dimensions	Width: 125 mm Height: 55 mm Depth: 185 mm
Weight	0.55 kg
Power supply	24VDC/2A

7. System Components

The Ossila Source Measure Unit P2005A comprises three items: the Ossila Source Measure Unit (**Figure 7.1**), power adapter (**Figure 7.2**), and the Ossila Front Panel software (**Figure 7.3**).

Figure 7.1. Source Measure Unit.



Figure 7.2. The 24 VDC power adapter

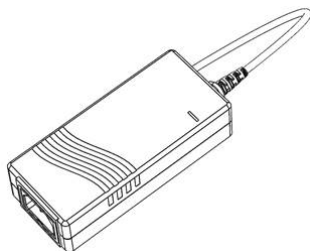


Figure 7.3. The Ossila Front Panel PC software.



8. Installation

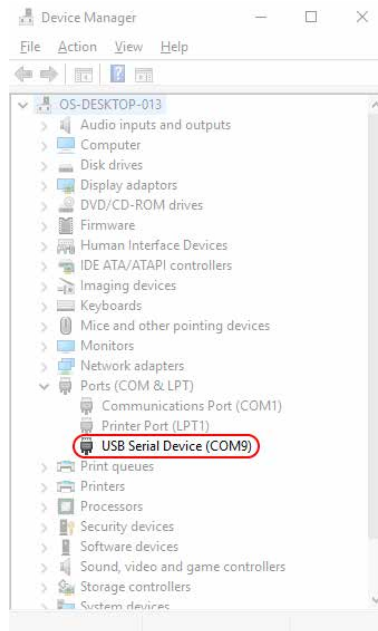
8.1 Power On

1. Connect the power supply first to the mains outlet, and secondly to the unit.
 - I. The red and green power LED (at the back of the unit) and the fan will both switch on.
2. Leave for 30 minutes to warm up before performing any measurements.

8.2 USB Driver Installation

1. Connect the unit to the computer using a USB cable.
2. On computers running Windows 10, the USB drivers will be installed automatically.
 - I. The unit will appear in the Device Manager under the Ports (COM & LPT) section as USB Serial Device (COMX) as shown in **Figure 8.1**.

Figure 8.1. Ossila Source Measure Unit in the Device Manager.



3. Alternatively, the USB drivers can be installed by running the 32-bit or 64-bit installation file found on the USB memory stick provided with the unit.

8.3 Connecting to a Network

The Ossila Source Measure Unit is designed to work with any network that supports DHCP. When the ethernet cable is plugged in, the unit will automatically detect and identify the network and register itself within a few seconds.

For most networks, the unit will need no further work – simply plug in and wait for the DHCP to work, and it is ready to go. However, there are two situations where more steps are required:

(I) Networks Requiring Registering Devices

Some large corporate networks (such as universities) have increased security levels and will only allow “known/registered” devices onto the network. If this is the case for your network, you will need to register the MAC address first. After this, the unit should be allowed on the network and will work as normal via DHCP (fully automatically from this point with no intervention). Many institutions have their own registration systems for computers and printers, and usually have online instructions on how to register a device. If needed, the MAC address of the unit can be obtained by connecting to it with the Front Panel software over USB.

(II) Static IP Networks

For a network without DHCP support, a static IP address must be set manually. This can be done by following these steps:

1. Connect the Source Measure Unit to a PC using a USB cable.
2. Disable the DHCP client of the device using the command *“eth0 set dhcp false”*.
3. Set the IP address and other network parameters using the command *“eth0 set network ip-address subnet-mask gateway-ip dns-ip”*.
4. Save the changes to the board so that they are loaded when the device powers on using the command *“eth0 save network”*.
5. Disconnect the USB cable, then connect the Ethernet cable and the device should connect after a few seconds.

Alternatively, an external network router that supports DHCP can be used to connect to a static IP network.

8.4 Front Panel Software Installation

1. Run the file ‘Ossila-Front-Panel-Installer-vX-X-X-X.exe’ on the USB memory stick provided.
2. Follow the on-screen instructions to install the software.

Note: The Ossila Front Panel and Source Measure Unit USB drivers can also be downloaded from ossila.com/pages/software-drivers

9. Front Panel Software

1. Start the program “Ossila Front Panel” and the window shown in **Figure 7.3** will open.
2. There are 6 main areas of the UI which are detailed below:
 - I. Connection controls
 - II. Utility controls
 - III. Front Panel tab
 - IV. Data Plot tab
 - V. Logged Data tab
 - VI. IV Curve tab

9.1 Connection Controls

Figure 9.1. Connection controls before and after connecting to a Source Measure Unit.



(I) Connected SMUs

- Select the connected Source Measure Unit that you want to use.
 - I. This box will be populated automatically with the connection address (COM port or IP address) of any Ossila Source Measure Units connected to the computer.
 - II. To rescan for connected units, click the blue refresh button next to the drop-down box.
 - III. This box is disabled whilst connected to a Source Measure Unit.

(II) Connect

- Connects to the Source Measure Unit currently selected in the “Connected Systems” drop-down box.
- Once connected, all other elements of the software will be enabled.
 - I. This box is disabled whilst connected to a Source Measure Unit.

(III) Reset

- Remotely resets the connected Source Measure Unit and reconnects to it.
 - I. This resets all settings to their default values.

(IV) Disconnect

- Safely disconnects from the connected Source Measure Unit.
 - I. SMU 1, SMU 2, Vsense 1, and Vsense 2 will also be disabled.

9.2 Utility Controls

Figure 9.2. Utility controls.



(I) Fan

- Toggles the fan of the connected Source Measure Unit on and off.

(II) SMU Lights

- Toggles whether the status LEDs of the SMUs turn on when the channels are enabled.

(III) Shutter

- Toggles the shutter output on and off.
 - I. The shutter outputs 5 V DC when switched on.

(IV) Log Data

- Records the values of all channels in the logged data table, along with the current date and time.
 - I. Records 0.0 for channels that are switched off.

(V) Save Live Data

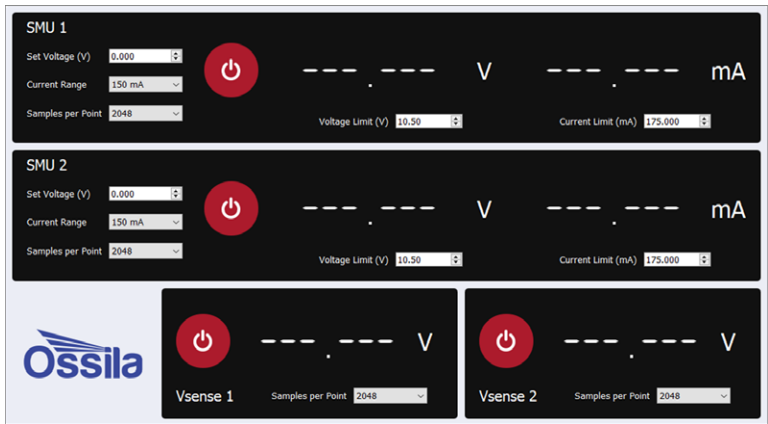
- Toggles whether data will be continuously saved while a channel is switched on.
 - I. The data will be saved to the comma separated value (.csv) or text (.txt) file set in the "Save Data Path" field.

(VI) Save Data Path

- Sets the directory and file name for saving live data.
 - I. If the selected file does not exist, it will be created.

9.3 Front Panel

Figure 9.3. The Front Panel tab.



The Front Panel tab consists of a control panel for each of the channels on the Source Measure Unit: SMU 1, SMU 2, Vsense 1, and Vsense 2.

Figure 9.4. Control and output panel for the SMUs.



Each SMU panel contains an on/off toggle button, voltage (left) and current (right) measurement displays, and the settings, which are detailed below.

(I) Set Voltage

Sets the output voltage of the SMU (maximum of ± 10 V).

(II) Current Range

- Sets the current range of the SMU to be used.
 - I. This defines the upper limit and sensitivity of current measurements that can be performed by the SMU. These values for each range are given in **Table 6.4**.

(III) Samples per Point

- Select the number of samples to be taken for each data point.
 - I. A higher number of samples per point will improve the accuracy of a measurement but will increase the time taken for it to be performed.

(IV) Voltage Limit

- Sets the maximum voltage that the SMU can source (default 10.5 V).
 - I. If the measured voltage is above the voltage limit, the output voltage will be set to 0 V.

(V) Current Limit

- Sets the maximum current that the SMU will measure.
 - I. If the measured current is above the set current limit, the range will automatically be switched to Range 1 to prevent damage to the SMU.
 - II. If the SMU is already at Range 1, the output voltage will be set to 0 V.

Figure 9.5. Control and measurement for the Vsenses.



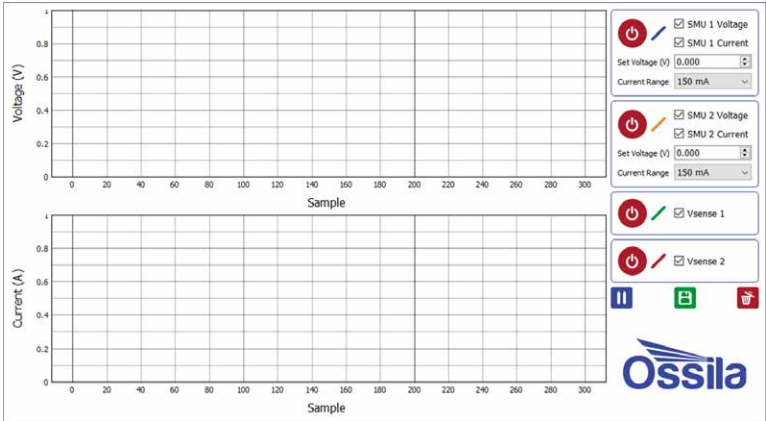
Each Vsense panel contains an on/off toggle button, the voltage measurement display, and the settings, which are detailed below.

(VI) Samples per Point

- Select the number of samples to be taken for each data point.
 - I. A higher number of samples per point will improve the accuracy of a measurement but will increase the time taken for it to be performed.

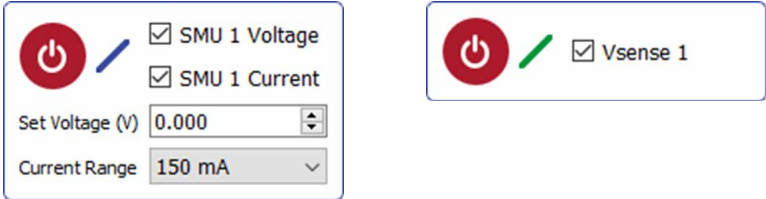
9.4 Data Plots

Figure 9.6. The Data Plots tab.



The Data Plots tab contains a pair of plots that display the last 300 live voltage and current readings from each of the channels on the Source Measure Unit. The upper plot displays voltage readings, and the lower plot displays current readings. Controls for channels and plotting can be found in the sidebar.

Figure 9.7. Control panels for the SMUs and Vsenses.



Each SMU panel contains an on/off toggle button, a legend line indicating the line colour for the device data, checkboxes for toggling whether SMU data are displayed in the plots, and controls for Set Voltage and Current Range as described in **Section 9.3**. Vsense panels contain an on/off toggle, a legend line, and a checkbox for toggling Vsense data display.

Below the device control panels are 3 plot control buttons. From left to right these are: pause/resume plotting, save data, clear plots.

(I) Pause/Resume Plotting

- Pauses or resumes updating the plots with new data.
 - I. Plotting will automatically pause if all channels are switched off, and resume when a device is switched on.

(II) Save Data

- Data in the plots can be saved by clicking the green save button.
- This opens a dialog box to navigate to the desired save directory and name the file.
 - I. The desired file type (comma separated value (.csv) or text (.txt)) can be selected using the drop-down box to the right of the file name field.

(III) Clear Plots

- The plots can be cleared by clicking red clear button.

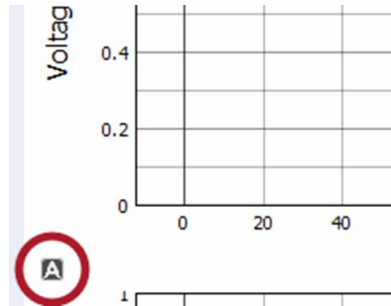
(IV) Graph Display Controls

By default, the plots will automatically scale the axes of the graph to display all the data within it. The view can be controlled manually using the following mouse controls:

- Left/Middle click and drag – pan the axes.
- Right click and drag – scale the axes.
- Scroll wheel – scale the axes.

A specific axis can be controlled by using these controls on the axis labels. The axes can be reset by clicking the 'A' button in the bottom-left of the plot, as shown in **Figure 9.8** (note, this button will only appear whilst the mouse cursor is over the plots).

Figure 9.8. Button to reset the plot axes.



9.5 Logged Data

Figure 9.9. The Logged Data tab.

	Time	SMU 1 V (V)	SMU 1 I (A)	SMU 2 V (V)	SMU 2 I (A)	Vsense 1 V (V)	Vsense 2 V (V)
1							
2							
3							
4							
5							
6							
7							
8							
9							
10							
11							
12							
13							
14							
15							

The Logged Data tab contains a table which stores the data recorded when the 'Log Data' button is clicked. There are two buttons to the left of the table.

(I) Saving Data

- Data in the table can be saved by clicking the upper green button.
- This opens a dialog box to navigate to the desired save directory and name the file.
 - I. The desired file type (comma separated value (.csv) or text (.txt)) can be selected using the drop-down box to the right of the file name field.

(II) Copying Data

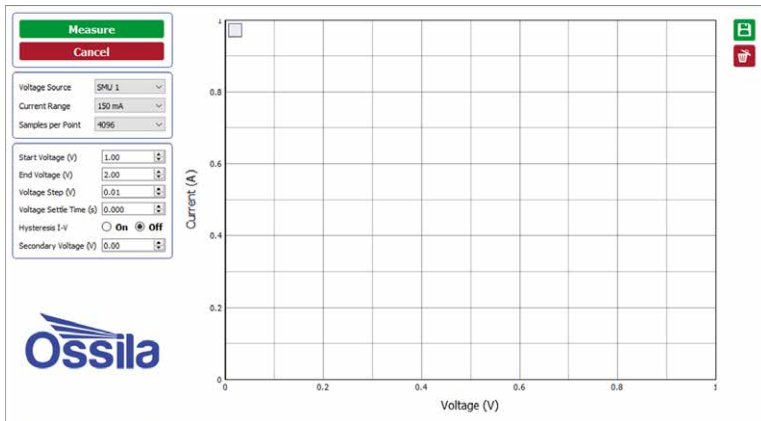
- Select the data to be copied.
- Then either:
 - I. Right-click on the highlighted data and select 'Copy' from the menu.
 - II. Alternatively, the keyboard shortcut CTRL+C can be used.

(III) Deleting Data

- The entire table can be cleared by clicking the lower red button.
- Individual rows can be deleted by highlighting at least one cell in each row for deletion.
- Then either:
 - I. Right-click on the highlighted data and select 'Delete Row' from the menu.
 - II. Alternatively, the keyboard shortcut Delete can be used.
- A confirmation box will appear before any data is deleted.

9.6 IV Curve

Figure 9.10. The IV Curve tab.



The IV Curve tab contains controls for perform current-voltage (IV) measurements. The measurement can be customised with the following settings:

(I) Voltage Source

- Select which SMU channel will be used for measurement.

(II) Current Range

- Set the current range of the SMU to be used.
 - I. This defines the upper limit and sensitivity of current measurements that can be performed by the SMU. These values for each range are given in **Table 6.4**.

(III) Samples per Point

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

(IV) Start Voltage

- Set the voltage in volts at which to start the current-voltage measurement.
 - I. This can be set between -10 V and +10 V.

(V) End Voltage

- Set the voltage in volts at which to end the current-voltage measurement.
 - I. This can be set between -10 V and +10 V.

(VI) Voltage Increment

- Set the step size in volts for changing the voltage during current-voltage measurement.

(VII) Voltage Settle Time

- Set the time in seconds between applying a voltage and measuring the current.
 - I. This has a maximum of 10 seconds.

(VIII) Hysteresis I-V

- Set whether to perform a reverse current-voltage measurement after the forward current-voltage measurement has completed.
 - I. This reverses the set 'start' and 'end' voltages and uses the same voltage increment and settle time as the forward measurement.

(IX) Secondary Voltage

- Set the voltage in volts to be output by the SMU not selected in the Voltage Source field.
 - I. This can be set between -10 V and +10 V.
 - II. If the voltage is set to 0 V, the secondary SMU will not be used.

There are 2 buttons to the left of the plot, these allow for data to be saved and the plot to be cleared.

(I) Saving Data

- Data in the plot can be saved by clicking the green save button to the right of the plot.
- This opens a dialog box to navigate to the desired save directory and name the file.
 - I. The desired file type (comma separated value (.csv) or text (.txt)) can be selected using the drop-down box to the right of the file name field.

(II) Clear Plot

- The plot can be cleared of all data by clicking the red delete button to the right of the plot.

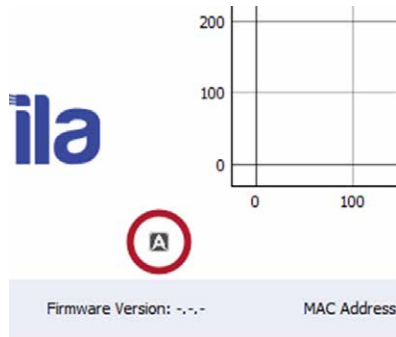
(III) Graph Display Controls

By default, the plots will automatically scale the axes of the graph to display all the data within it. The view can be controlled manually using the following mouse controls:

- Left/Middle click and drag – pan the axes.
- Right click and drag – scale the axes.
- Scroll wheel – scale the axes.

A specific axis can be controlled by using these controls on the axis labels. The axes can be reset by clicking the 'A' button in the bottom-left of the plot, as shown in **Figure 9.11** (note, this button will only appear whilst the mouse cursor is over the plots).

Figure 9.11. Button to reset the plot axes.



10. Advanced Measurements

If you want to perform a measurement that is not covered by the Front Panel software, you can control the Source Measure Unit directly using a variety of programming languages. More information and the available commands can be found in the Programming Documentation:

downloads.ossila.com/manuals/source-measure-unit-programming-documentation-v2-4.pdf

11. Troubleshooting

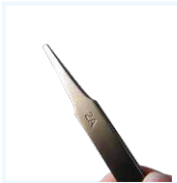
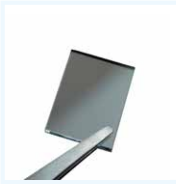
Most of the issues that may arise will be detailed here. However, if you encounter any issues that are not detailed here, then contact us by email at info@ossila.com. We will respond as soon as possible.

Table 11.1. Troubleshooting guidelines for the Ossila Source Measure Unit

Problem	Possible cause	Action
No power	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 the plug is connected to both the adaptor and a working power socket. b. Contact Ossila for a replacement power supply adaptor.
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 drivers may not be installed or may not have installed properly. d. The USB cable is defective.	a. Ensure the USB cable is firmly plugged in at both ends. b. Try connecting the system to a different USB port on the computer. c. Try installing or reinstalling the drivers, they can be downloaded from the address given in the Software Installation section. d. Try using a different USB cable (any should work) and contact Ossila if necessary.
Cannot connect to the system via Network	a. The MAC address of the system 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.
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 10. b. Try reinstalling the software.

12. Related products

12.1 Related Consumables

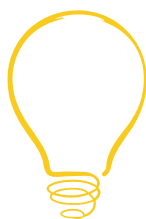
	ITO Substrates Our range of 15 x 20 mm ITO substrates for OPV, OLED and sensing applications. Product codes: S111 / S101 / S211 / S281 / S171		Flat tip tweezers Provides a good substrate grip without scratching. Product codes: C121
	FTO Coated Glass Substrates Designed to be used in the fabrication of 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

12.2 Related Equipment

	Four-Point Probe An easy-to-use tool for the rapid measurement of sheet resistance, resistivity, and conductivity of materials. Product code: T2001A3		Solar Cell I-V Test System Reliable and accurate characterisation of photovoltaic devices – no programming knowledge necessary. Product codes: T2003B2
	OLED Lifetime System Provides a long-term and low-cost solution to OLED lifetime testing to optimise the stability of your devices. Product code: T2004/T2005		Push-Fit Test Board for 25mm Square Substrates For fast and secure electrical connections, this product makes PV and OLED device testing easy. Product code: P2011A1



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