UV Radiometer SXL 55

Measuring device for the determination of the UV irradiance

GENERAL FEATURES

Features of the UV Radiometer SXL 55

The Radiometer SXL 55 is a UV measuring instrument with dosimeter and data logger function. It consists of a calibrated UV sensor based on a SiC photodiode, which is available in different versions. In most cases the "UV-Surface" sensor shown in the picture is used. The radiometer is configured and calibrated in coordination with the customer to his individual measuring task with regard to the sensor type, the measuring range (dynamic range) and the spectral sensitivity. The user's smartphone (Android version 6.0 or higher) serves as the display and control unit, on which a supplied app is installed. The delivery time of an UV Radiometer SXL 55 is three weeks. The sensor can be calibrated to different UV radiation sources. Also the app is able to manage different sensors with e.g. different spectral sensitivity. After plugging in the sensor, this sensor and its calibration(s) are automatically recognized accordingly.

MEASURING UV WITH THE UV RADIOMETER SXL 55

Reliable UV measurement requires the optimal interaction of calibration, configuration, hardware, app, and user behavior.

Configuration and Calibration

The SXL 55 radiometers serve as a reference in industry and research. This requires, in cooperation with the customer, a prior thorough customization. Accordingly, after reception of the order, we determine a suitable entrance optics, measuring range and spectral sensitivity of the sensor with regard to the customer's individual measuring task. After completion, the radiometer is to be calibrated. Our laboratory manager discusses the intended use of the radiometer with you and develops an optimal calibration individually adapted to the application.

Hardware

A precise measurement is mainly influenced by the photodiode used and the components that are directly connected to the photodiode, i.e. the transimpedance amplifier as well as the AD converter. The SXL 55 radiometers are equipped with highly reliable SiC photodiodes from our own production. The other components are carefully selected, assembled and tested by us, based on 20 years of experience. Less decisive for the quality of the measurement are the properties of the display or control unit. Here we have decided to use the user's smartphone, which is available anyway. This approach is economically sensible and conserves resources. If the user's own smartphone is not to be used, an inexpensive, pre-configured smartphone can be purchased from us.

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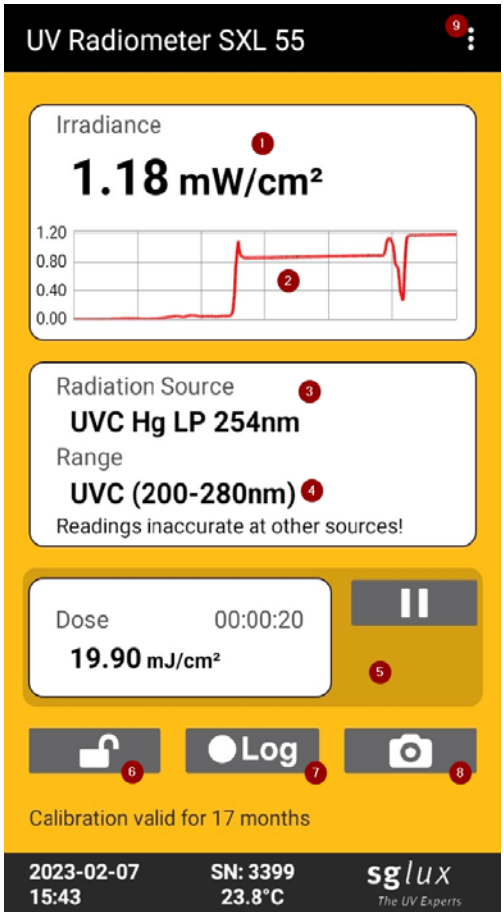
App

The app supplied runs on all Android smartphones from version 6.0. During development, we placed great emphasis on intuitively understandable display and operation. An easy-to-understand display and operating logic reduces the risk of interpretation errors and thus increases the reliability of the measurement.

User behavior

The motto of the sglux UV radiometers featured by an intuivive handling and a thorough customization is "measure - understand - evaluate". This generates the best conditions for permanently precise and reliable UV measurement. However, expert operation and care are required. Accordingly, the radiometer must be protected from shocks and dirt and should be recalibrated every 18 months. Furthermore, it should be noted that the measured value is only valid for the UV radiation source documented in the calibration certificate. Before using the device, it should therefore be ensured that the "radiation source to be evaluated" shown in the display of the device is actually measured. If it should turn out during the use of the radiometer that other sources have to be measured, the sensor can be sent to our calibration laboratory, where a further calibration will be stored in the sensor. If differenct calibrations are stored, the matching the UV light source must be selected before starting the measurement.

DISPLAY FUNCTIONS OF THE RADIOMETER



(1) Display of irradiance with the area unit cm² . The displayed irradiance unit is specified by the measuring range of the sensor and can be nW/cm², µW/cm², mW/cm², or W/cm².

(2) The course of the irradiance within the last minute is displayed in the diagram. The subdivision of the time axis is 10s. The axis of the irradiance dynamically adapts to the highest measured value to be displayed. The unit corresponds to the unit of the measured value as shown on the display.

(3) The radiation source to be evaluated is the UV source to which the connected sensor was calibrated in the calibration laboratory of sglux. Sensors can be calibrated to multiple sources. The switchover is made in the "burger menu" (9).

(4) The range indicates which wavelength range of the source contributes to the displayed irradiance. For sensor calibrations that perform a weighting or evaluation, e.g. of the hazard potential of the radiation, the heading "Range" is replaced by "Weighting" under which the associated standard or guideline is specified.

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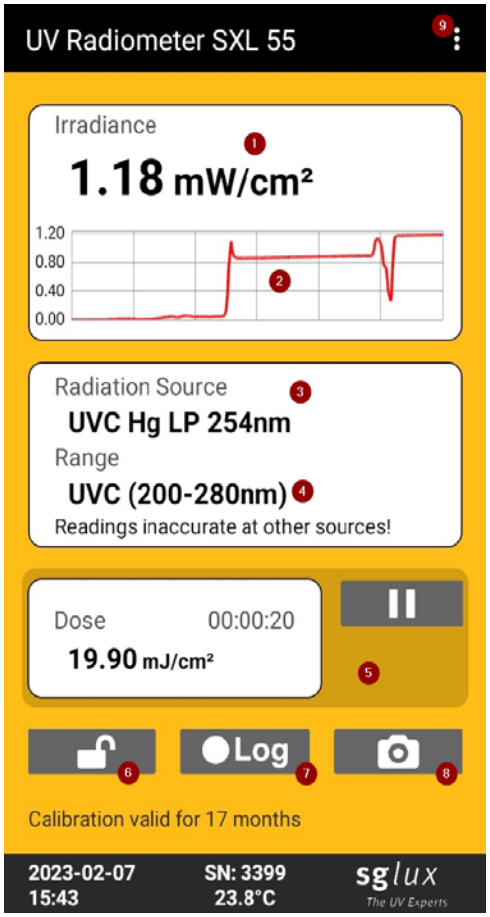
USING THE DOSIMETER FUNCTION AND THE LOGGING FUNCTION



(5) All functions for dose measurement are located here. The dose is the integration of the irradiance over time. If a dose measurement runs over a very long period of time, the unit changes (in the picture e.g. from mJ/cm² to J/cm²). On the picture the measurement has been started 20s ago. This can be stopped with the pause function. The characters "Play" and "Repeat" then follow, with which the measurement can be continued (Play) or reset (Repeat).

(6) With this function, the measured value of the irradiance can be stopped; a red "hold" appears there. Dose measurement and logging function are unaffected by this.

(7) This button can be used to log the measured values (irradiance, dose, temperature) with a time stamp. After activation, a dialog window opens in which a file name for the logging file can be defined. Further information on this can be found on page 6.

(8) Here a screenshot of the current screen content can be taken. A popup appears briefly in which the storage location is named.

(9) The "burger menu" allows the selection of different calibrations. Additionally information about the firmware release and how to contact sglux are available.

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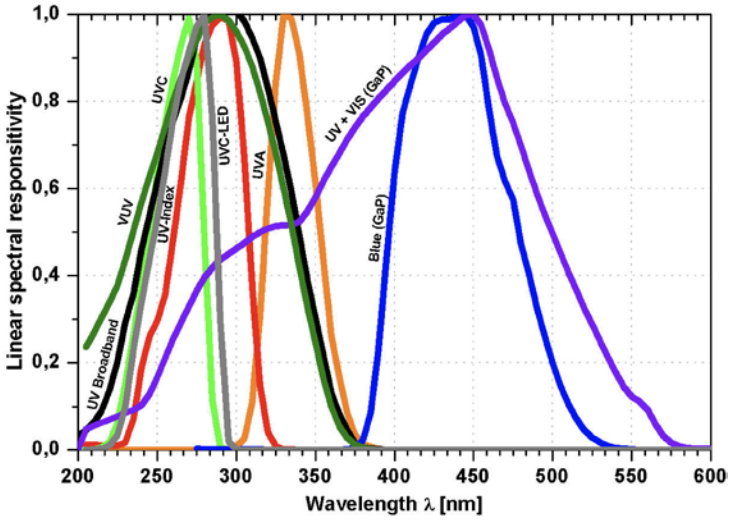
FEATURES OF THE SENSOR PROBE "UV-SURFACE"

The "UV-Surface" probe is a universal radiometer sensor for calibration and reference measurements. A diffuser with dome enables an almost perfect cosine shaped field of view. The UV Radiometer SXL 55 is mainly used with this probe. However, it can also be set up with any other sglux probe. Figure 1 shows our standard selection of different spectral sensitivities which we choose together with the customer during the individual configuration of the SXL 55. Table 1 lists the position of the sensitivity maximum as well as the positions where the sensitivity is still 10% of the maximum. Usually SiC photodiodes with or without optical filter are used. For measurements in the wavelength range above 390nm, a GaP photodiode is used.



Picture 1: available spectral responsivity options

Table 1: position of the peak maximum and position of sensitiviy = 10% of peak

SR	Peak	λ_S_{low}	λ_S_{high}
BroadB	280	221	358
UVA	331	309	367
UVB	280	231	309
UVC	275	225	287
UVC-LED	285	225	298
VUV	280	170	355
UV+VIS	445	240	560
BLUE	445	390	515

General Characteristics	**Value**
Connection	USB-C, also available as µ-USB
Weight	56 g
Temperature coefficient (30 to 65°C)	0.05 to 0.075%/K
Operating temperature	-20 to +80°C
Storage temperature	-40 to +80°C
Humidity	< 80%, non condensing

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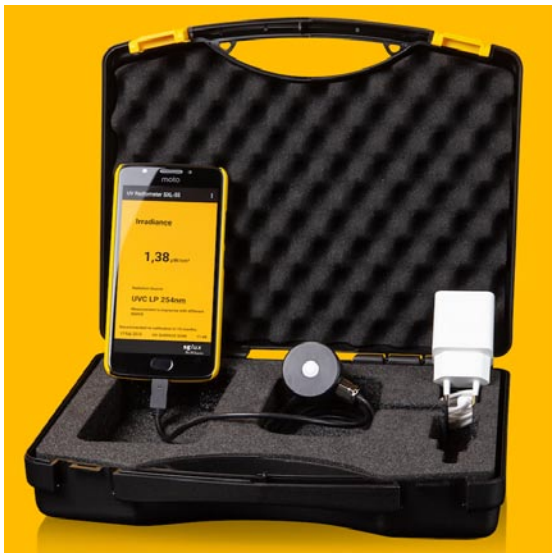
OPTIONAL ACCESSORY: CASE WITH OR WITHOUT A SMARTPHONE

Optionally, a transport case is available in which a smartphone, the sensor, a battery charger and the calibration certificate can be stowed. Furthermore, there is the possibility to purchase a smartphone with the radiometer app (e.g. Motorola MOTO E4 or comparable models).



OPTIONAL ACCESSORY: SENSOR MOUNTING

The picture shows the optionally available magnetic sensor mounting with which the sensor can be attached to any steel surface, even suspended. Sensor and mounting are also attached to each other by magnets. This allows convenient removal of the sensor from the mount. At the bottom of the mount there is a 1/4" 20 UNC - threaded hole, which can be connected e.g. to a camera tripod.

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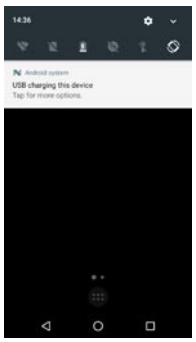
EXPORT AND USE OF THE DATA LOGGING VALUES TO A COMPUTER

First the csv file stored in the smartphone is to be copied to the computer by connecting the smartphone and the computer with a USB-C cable. Then top down wiping on the screen activates the screen shown at the left hand side picture. Then press on "tap for more options" and then on "transfer files" (right hand picture). This mounts the smartphone as an external volume (e.g. Moto E4) visible at the computer's explorer. Finally navigation to the external volume's "download" folder shows all yet stored data logging files and screenshots. Alternatively the logging file can also be transmitted via email, cloud, Wifi oder Bluetooth.



The below table shows the structure of a logging file after having it imported into an Excel file.

	A	B	C	D	E	F	G	H	I
1	SN	HW_REV	FW_REV	PROD_DATE	CAL_DATE	CAL_SET	CAL_SOURCE	CAL_WEIGHT	COMMENTS
2	9990001	256	3	01. Apr 19	21. Jan 21	4	Sun Berlin	erythemal weighting according to ISO 17166	
3	Date	Time	CYCLE	STATUS	TIMESTAMP	TEMP (degC)	RAD (W/m2)	DOSE (J/m2)	EVENT
4	11.05.21	17:10:17.928	512	0	38631	27.0	0.0038216	0	
5	11.05.21	17:10:18.004	513	0	38706	27.0	0.0034512	0	
6	11.05.21	17:10:18.059	514	0	38781	27.0	0.0029216001	0	
7	11.05.21	17:10:18.116	515	0	38856	27.0	0.0029608	0	
8	11.05.21	17:10:18.227	516	0	38935	27.0	0.0031296	0	dose started
9	11.05.21	17:10:18.288	517	0	39010	27.0	0.0035648001	0.0002287816846743226	
10	11.05.21	17:10:18.348	518	0	39085	27.0	0.003788	0.0012571916846958064	
11	11.05.21	17:10:18.467	519	0	39169	27.0	0.0037304	0.00288527044467628	
12	11.05.21	17:10:18.529	520	0	39243	27.0	0.0038504	0.0031702000433579086	

The headlines 1 and 2 show information about the sensor and the calibration. The cell A2 show the sensor's serial number, B2 is the revision of the sensor's hardware and C2 the revision of its software. D2 shows the date of production of the sensor and E2 the date of calibration. F2 shows the calibration factor selected for the measurement. G2 is the source used for this calibration. H2 shows the measurement range or the weighting of the calibration (if applicable). The data logging starts from row 4. Column A and B store date and time. Column C stores the ascending number of the value. Column D protocolls the status of the AD converter, e.g. an eventual overmodulation. Column E is the ms timestamp of the value. The internal temperature of the sensor electronic is stored in column F. Column G protocols the measured irradiance in W/m². Column H stores the dose value if the dose measurement has been activated. Column I protocolls the status of the dose measurement - if activated and informs about an eventual irregular stop of the dose measurement e.g. by removing the sensor from the app or by stopping the app without having pressed on "DOSE STOP" or "DOSE RESET".