

Safester UVI

Mobile instrument for measuring the UV-Index according to ISO 17166



GENERAL



Ultraviolet (UV) sunlight is ionizing radiation. Absorbed by human or animal tissue, it frees electrons and causes chemical reactions. UV radiation plays an essential role in the formation of vitamin D and is helpful in many cases, such in mood improvement and the treatment of psoriasis.

However, not all chemical reactions that UV radiation induces are beneficial. UV radiation absorbed by DNA can lead to genetic mutation. Skin reddening, termed sunburn or erythema, is linked to skin cancers. In addition, UV radiation increases the risk of developing eye damage such as photokeratitis and cataracts. Nowadays, stratospheric ozone-layer depletion increases UV-levels at the earth surface.

The UV-Index [1], defined by the ISO 17166 standard, quantifies the risk of erythema at a given solar UV-exposure spectrum. The arbitrary definition of one UV-Index equals to an erythema weighted irradiance of 25 mW/m². Accordingly, the UV-Index value two corresponds to 50 mW/m².

The typical UV-Index ranges from 0 to 11. The higher the index value, the greater the potential for harmful damage and the less time it takes for harm to occur. As most of the UV-related health risks could be avoided by reducing exposure to UV radiation, detailed information about the actual UV-Index is essential for being able to take appropriate measures.

FEATURES

With **Safester UVI** sglux developed a compact portable measurement system, which is able to precisely detect the UV-Index according to ISO 17166 [2]. The system consists of a sensor unit and a standard edition Smartphone used for visualisation of the measured values and displaying of protective measures, as recommended by the World Health Organization (WHO).

The entrance optic of the sensor unit is equipped with an optimal cosine-corrected diffusor, which allows detection of sun radiation from the upper hemisphere. The core of the sensor consists of a silicon-carbide (SiC) based diode, which is an intrinsic visible blind photodetector. In other words the sensor is insensitive for visible and infrared light, which makes over 90 % of the solar radiation, and it only detects UV radiation. This eliminates the need for efficiency-limiting optical filters to remove out-of-band visible or infrared photons. In order to achieve an optimal adaption of the erythema action spectrum, a specially designed interference filter is applied [3]. In this way, a UV-Index determination with a low measurement uncertainty of ± 6 % for values between 3 and 8 can be achieved, while for values higher than 8 **Safester UVI** offers an even lower uncertainty of just ± 3 %. Please note that WHO recommends UV-protective actions for UV-Index values over 3.



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Furthermore, a standard Android Smartphone is used for displaying the measured values and the appropriate protection measures, which should be implemented. The sensor unit is connected to the Smartphone via micro-USB cable. The whole system, consisting of sensor unit and Smartphone, weighs around 260 g, which makes it ideal for portable and in real time UV-Index detection.

Anyway, **Safester UVI** is not the only device made by sglux, which is equipped with the above-described SiC-based photodiode. Other sglux sensors such as **UV-Cosine_UVI** and UV-Index sensor **TOCON_UVI** are also equipped with this SiC-based photodiode. Furthermore, the outstanding quality of sglux-sensors has been published in a number of scientific papers [4,5,...].

Please note that **Safester UVI** is designed only for detection of solar UV radiation measurements [1]. sglux offers a broad range of measuring equipment for UV-Index determination including artificial UV radiation light sources. Please do not hesitate to contact us if you are interested in any other kind of UV-measurement equipment.

MEASUREMENT IMPLEMENTATION

In order to measure the UV-Index according to the ISO 17166, **Safester UVI** sensor should be placed at a shadow-free position. Please take care that the sensor is not shaded due to nearby buildings, plants or reflections of mirroring surfaces, which would interfere with the **Safester UVI** measurements. The measurement should be performed at an elevated location with a free 360° view of the horizon. During measurement the sensor should be placed horizontally.

In case of every day applications, when you want to find out what kind of protective measures are needed for avoiding erythema, the **Safester UVI** sensor should be placed at the same location as the user. Shadows and reflections are permitted, but during this kind of measurement the sensor should be placed horizontally. Thus, UV-Index values comparable to ISO 17166 can be measured. Afterwards, the sensor can be placed at the same orientation as the irradiated person to determine the actual UV-Index values, which might be higher than the ones of the horizontal measurement. In order to implement the necessary protection, measurements at different body parts can be taken under consideration.

SAFESTER UVI UTILISATION

Connect the sensor to the USB-port of your Smartphone and turn the Smartphone on. The measurement app starts automatically. Place the sensor in the measuring position to determine the current UV-Index. The display shows the UV-Index and coloured background display. The colours correspond to the WHO nomenclature. In addition, the erythema-weighted irradiance value given in mW/m^2 is indicated in the lower right corner of the display. By pressing the hold button, the continuously measured UV-Index can be interrupted and the last read value is displayed. The screenshot function saves the current displayed values as images to the Smartphone.



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UNDERSTANDING OF THE UV-INDEX VALUES

Typical UV-Index values are in the range between 0 and 11. **Safester UVI** presents the UV-Index values in large figures and coloured background display. The colours correspond to the nomenclature of WHO.

The following table includes WHO's concrete recommendations of action for UV-Index values between 3 and 11 [1]. :

UV-Index 1-2	low UV-Index	No protection required
UV-Index 3-5	moderate UV-Index	Put on a shirt, put on a hat, cover-up with sun cream
UV-Index 6-7	high UV-Index	Put on a shirt, put on a hat, wear sunglasses, cover-up with sun cream; seek shade during midday hours
UV-Index 8-10	very high UV-Index	UV resistant shirt, hat, sunglasses and sunscreen are a must; avoid being outside during midday hours
UV-Index 11	extreme UV-Index	UV resistant shirt, hat, sunglasses and sunscreen are a must; avoid being outside

TECHNICAL DATA

Brief description	broadband radiometer handheld device for UV-Index determination
Main features	portable, compact measurement system consisting of UV-Index sensor with SiC-based photodiode, filter in accordance with the UV erythema action spectrum and Smartphone for data collection and monitoring
Measuring ranges	wavelength: 290 nm ... 390 nm UV-Index: 0... 25+ erythema relevant UV radiation intensity: 0 ... 625 mW/m ²
Input optics	diffusor with a diameter of 11 mm, cosine corrected field of view
Photodiode	SiC erythema photodiode
Calibration	PTB-traceable factory calibration
Measurement uncertainty	<= UVI 2 ± 12 %, >UVI 2: ± 6 %, >UVI 8: ± 3%
Interface	USB 2.0
Temperature range	-5°C ... + 45 °C
Power supply	via Smartphone USB
Weight	260 g

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SOURCES

1. WHO: Global solar UV index - A Practical Guide, <https://www.who.int/uv/publications/en/UVIGuide.pdf>
2. ISO 17166:1999(en), <https://www.iso.org/obp/ui/#iso:std:iso:17166:ed-1:v2:en>
3. McKinlay AF, Diffey BL, A reference action spectrum for ultraviolet induced erythema in human skin. CIE J 1987; 6: 17-22.
4. A.W. Schmalwieser, J. Gröbner, M. Blumthaler, B. Klotz, H. De Backer, D. Bolsée, R. Werner, D. Tomsic, L. Metelka, P. Eriksen, N. Jepsen, M. Aun, A. Heikkilä, T. Duprat, H. Sandmann, T. Weiss, A. Bais, Z. Toth, A. M. Siani, L. Vaccaro, H. Diémoz, D. Grifoni, G. Zipoli, G. Lorenzetto, B. H. Petkov, A. Giorgio di Sarra, F. Massen, C. Yousif, A.A. Aculinin, P. den Outer, T. Svendby, A. Dahlback, B. Johnsen, J. Bieszczuk-Jakubowska, J. Krzyscin, D. Henriques, N. Chubarova, P. Kolarz, Z. Mijatovic, D. Groselj, A. Pribulova, J. Ramon Moreta Gonzales, J. Bilbao, J. M. Vilaplana Guerrero, A. Serrano, S. Andersson, L. Vuilleumier, A. Webb and J. O'Hagan (2017) UV Index monitoring in Europe. Photochem. Photobiol. Sci., 16, 1349-1370, DOI 10.1039/C7PP00178A
5. Dae-Hwan Park, Seung-Taek Oh, and Jae-Hyun Lim: Development of a UV Index Sensor-Based Portable Measurement Device with the EUVB Ratio of Natural Light, Sensors 2019, 19(4), 754; doi:10.3390/s19040754

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UV Sensor "UV-Surface_UVI"

Top looking surface-mount UV sensor for UV-Index measurements



GENERAL FEATURES



Properties of this sensor

This UV sensor is designed for very high accuracy UV-Index measurements. The measurement uncertainty of this sensor is 5% only. The spectral response curve and the field of view (cosine type) are in near perfect accordance with the requirements defined in the ISO 17166 standard. The sensor contains integrated electronics and is shielded against electromagnetic interference. The sensor can be configured as a voltage of 0 to 5 V, a current of 4 to 20 mA, CAN bus interface or USB. The UV sensor is available with a PTB traceable calibration.

Page 3 of this datasheet allows to enter the signal output requirements of the needed sensor. After selection you may forward this document to factory or agent, or alternatively use the sensor probe online configurator at www.sglux.com. Please contact us for assistance.

SPECIFICATIONS

FIXED SPECIFICATIONS

Parameter	Value
Dimensions	please refer to drawing on page 2
Weight	56 g
Spectral Sensitivity	UV-Index (erythema curve) according to ISO 17166, measurement uncertainty 5 %
Temperature Coefficient (30 to 65°C)	0.05 to 0.075%/K
Operating Temperature	-20 to +80°C
Storage Temperature	-40 to +80°C
IP Protection Class	< 80%, non condensing

CONFIGURABLE SPECIFICATIONS

Parameter	Value (page 3 shows more detailed information)
Signal Output	0 to 5 V or 4 to 20 mA or CAN bus signal (125kbit/s) or USB
Current Consumption	for 0 to 5 V = < 30 mA / for 4 to 20 mA = signal out / digital = < 17 mA
Connections	cable = 2 m cable with tinned leads on free end CAN = 2 m cable with 8 pin male connector (to converter or else) USB = with 1.5 m cable with USB-A plug
Measuring Range	up to UVI 30

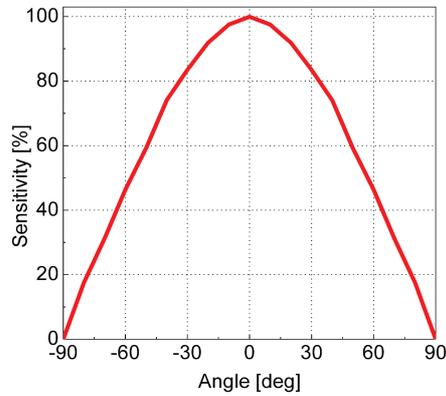
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UV Sensor "UV-Surface_UVI"

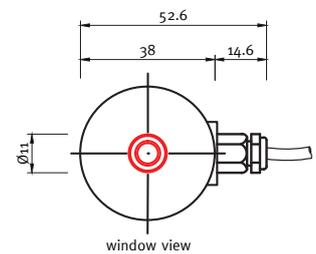
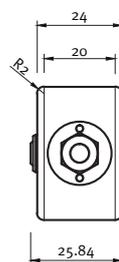
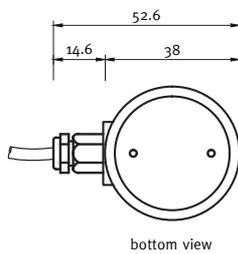
Top looking surface-mount UV sensor for UV-Index measurements

FIELD OF VIEW

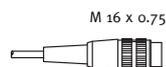
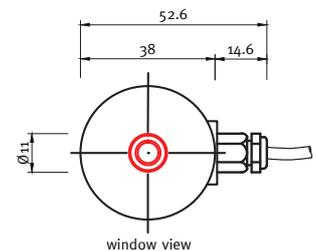
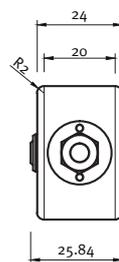
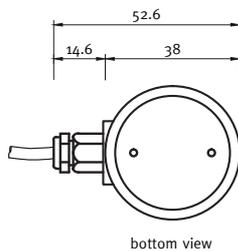


DRAWING

ANALOG CABLE



DIGITAL



KFV 80 plug



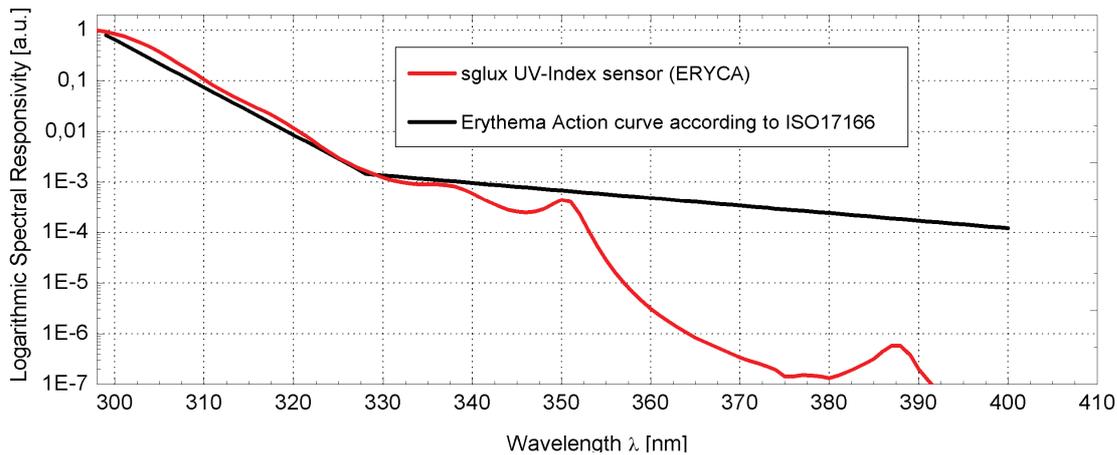
pin layout

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UV Sensor "UV-Surface_UVI"

Requirements questionnaire sheet

STEP 1 → Normalized Spectral Responsivity



STEP 2 → Signal Output Type Selection

Please tick your selection. The pin configuration is shown in drawings on page 2.

Output Type	Description	Connection = "cable"
<input type="checkbox"/> 0 to 5 V	0 to 5 V voltage output proportional to radiation input. Supply voltage is 7 to 24VDC, current consumption is < 30 mA.	<input type="checkbox"/> V ₋ = brown, V ₊ = white, V _{out} = green, shield = black
<input type="checkbox"/> 4 to 20 mA	4 to 20 mA current loop for PLC controllers. The current is proportional to the radiation, supply voltage is 24VDC.	<input type="checkbox"/> V ₋ = brown, V ₊ = white, shield = black
<input type="checkbox"/> CAN bus signal	VSCP protocol according to the following specifications: http://download.sglux.de/probes-digital/digiprobe-can/	Pins 1 & 7 = CAN low Pins 3 & 8 = CAN high Pins 2 & 4 & 5 = GND
<input type="checkbox"/> USB	The signal is transmitted via standard USB-A plug to a computer. Software and 1.5 m cable are included. Other cable lengths on request. Programming guide available: http://download.sglux.de/probes-digital/digiprobe-usb/digiprobe_USB_Programming_Guide.pdf	

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Products for UV-Index measurements



▶ PHOTODIODES AND SENSORS (MEASUREMENT UNCERTAINTY < 5%)



SiC UV photodiodes

UV-Index photodiodes, different active chip areas and housings, with erythema filter



SiC TOCONs

UV-Index hybrid sensor in a TO5 housing with 0 - 5 V signal output, with erythema filter



TOCON_PTFE24V_UVI

UV-Index hybrid sensor (TOCON) in PTFE housing (male thread M12x1), EMC safe, with erythema filter



TOCON_UVI

UV-Index hybrid sensor (TOCON) in PTFE housing (with G1/4" thread), EMC safe, with erythema filter



UV-Surface_UVI

top looking surface-mount UV sensor probe with cosine FOV, EMC safe, with erythema filter



UV-Cosine_UVI

waterproof UV-Index sensor probe with cosine FOV, EMC safe, for outdoor use, with erythema filter

▶ UV-INDEX DISPLAYS AND NETWORK COMPUTERS



UV-Index reference radiometer

Reference radiometer for UV-Index measurements, incl. calibrated (PTB traceable) UVI sensor probe



Skylink UV transmitter

network computer with UV-Index sensor

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