TOCON_E1 (TOCON_ERYCA series)
Pre-amplified SiC UV-Index Photodetector

General Features

Properties of the TOCON_E1

- Pre-amplified SiC UV detector for UV-Index measurements
- DIN5050/ CIE087 UVI measurement with very small error <± 3%
- 1 UVI result a voltage of approx. 1,7 V
- RoHS compliant

The TOCON_ERYCA pre-amplified UV photodetectors

The TOCON devices are using modern hybride technology to cancel unwanted signal disturbances caused by moisture or electromagnetic radiation. The stable 0...5V output voltage can be directly connected to a SPC controller or a voltage multimeter. No external amplifier is needed.

Information about the UV-Index (UVI)

The UV index is an international standard measurement of how strong the ultraviolet (UV) radiation from the sun is at a particular place on a particular day. It is a scale primarily used in daily forecasts aimed at the general public. The UV-Index is calculated by integrating the sun's UV spectrum multiplied with the Erythema action curve (fig. 1, black curve and fig. 2, formula 1). That integral is divided by 25 mW/m^2 to generate a convenient index value, which becomes essentially a scale of 0 to 10. The Erythema action curve is a wavelength resolved measure of the sunburn danger. It is maximised at 297nm (UVB) and then strongly decreases towards UVA radiation. Literature: A. F. McKinlay and B. L. Diffey, "A reference action spectrum for ultraviolet induced erythema in human skin" CIE Journal, 6-1, 17-22 (1987)

About the sglux TOCON_ERYCA sensors

The ERYCA is designed for accurate measurement of the UV-Index. ERYCA's error is <3% only which is sufficiently small for scientific and high performance commercial applications.

How ERYCA's <3% error is calculated?

A good erythema sensor's response needs to follow the Erythema Action curve (fig 1) as close as possible. Additionally the visible blindness needs to be extremely high as the visible part of sun's radiation exceeds the erythema causing radiation by five orders of magnitude. ERYCA works with a 4H SiC detector chip providing a visible blindness of more than ten orders of magnitude. That means that absolutely no visible light interferes the sensors output value. Sensors with a visible blindness of less than six orders of magnitude are unsuited for UVI measurement even if they match with the CIE curve. ERYCA's curve (fig. 1, red curve) has a near perfect match from 295nm to 320nm. From 320nm a leakage of approx. 0,1% is seen. To find out how that leakage negatively influences the UVI measurement a closer look at different sun spectra (varying tilt angle and ozone layer thickness) is needed. Fig. 4 shows different sun UV spectra issued by the Swiss governmental institute of meteorology. In total nine different sun spectra calculating an UVI from 1,12 to 10,92 were used. For error calculation the different sun spectra were integrated with the Erythema action curve and subsequently the integral of the same spectra with ERYCA's response curve (fig. 2, formula 1 and 2) were calculated. Finally the error was calculated by using formula 3 (fig. 2). As shown by the blue curve (fig. 3) the error of all UVI is less than 3%.

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Fig. 1 Spectral Response

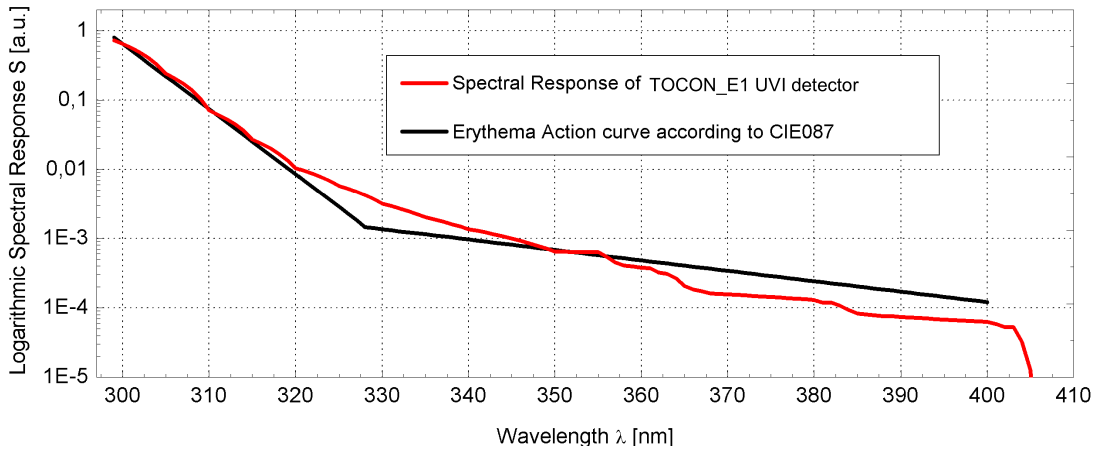

Fig. 2 Calculation Formulae

$$UVI_{ideal} = \int_{\lambda=297\,nm}^{\lambda=400\,nm} \frac{S(\lambda)\cdot CIE(\lambda)}{25mW/m^2} d\lambda \qquad (1)$$

$$UVI_{real} = \int_{\lambda=297\,nm}^{\lambda=400\,nm} \frac{S(\lambda)\cdot ERYCA(\lambda)}{25mW/m^2} d\lambda \qquad (2)$$

$$E = \frac{(UVI_{ideal} - UVI_{real})\cdot 100}{UVI_{ideal}} \qquad (3)$$

Legend

S(λ)=	sun UV spectrum
CIE(λ)=	CIE087 standard curve
ERYCA(λ)=	ERYCA response curve
E=	error in %

Fig. 3 Error Graph

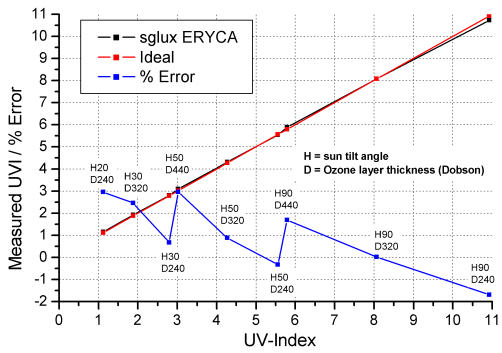

Fig. 4 Sun Spectra Issued by the Swiss Meteo Institute

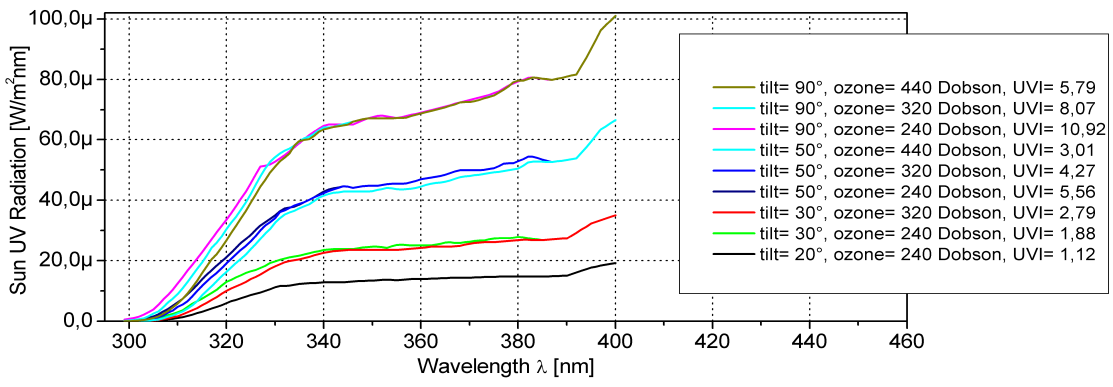

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Fig. 5 Specifications

Parameter	Symbol	Value	Unit
Maximum Ratings			
Operating Temperature Range	T_{opt}	*-25 … +85*	*°C*
Storage Temperature Range	T_{stor}	*-40 … +100*	*°C*
Soldering Temperature (3s)	T_{sold}	*300*	*°C*
General Characteristics (*T*=25°C)			
Supply voltage	V_{supply}	*2,5 … 5,0*	*V*
Saturation voltage	V_{sat}	V_{supply}	*V*
Dark offset voltage	V_{offset}	*0,05*	*mV*
Temperature coefficient	*Tc*	*<+0,3*	*%/K*
Current	*I*	*0,8*	*mA*
Bandwidth (-3 dB)	*Θ*	*15*	*Hz*
Risetime (63%) *(other risetimes on demand)*	t_{rise}	*10*	*ms*
Spectral Characteristics (*T*=25°C)			
Approx. sensitivity *(unit is not calibrated)*	S_{max}	*1,7*	*V/UVI*
Visible blindness (S_{max} / $S_{>405nm}$)	*VB*	$>10^{10}$	-

Fig. 6 Drawing

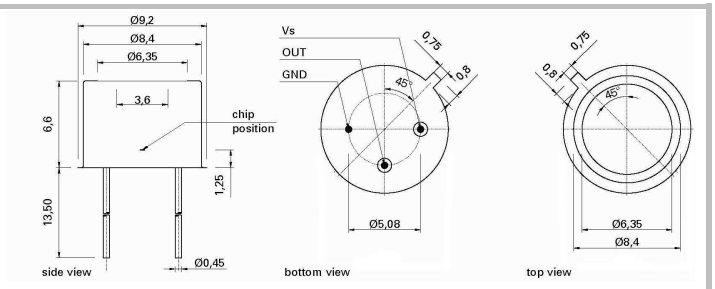

Fig. 7 Field of View

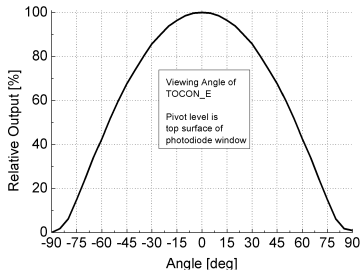

Fig. 8 TOCON Product Portfolio

Selection of TOCONs with UV Index sensitivity:

Option	Approx. max irradiance (V_{out} = 5 V)
TOCON_E1	**3 UVI** *this device, needs sunlight attenuator*
TOCON_E2	30 UVI
TOCON_E3	0,75 mW/cm^2

TOCONS are also available with other spectral sensitivity (UVA, UVB, UVC, UV broadband).

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Upgrades

TOCON housings for easy mounting of the TOCON_E1

TOCON_housing

Advantages of the TOCON_housing

- Easy to mount and connect
- Robust stainless steel M12x1 thread body, length 32 mm
- Integrated sensor connector (Binder 5-Pin plug)
- Comes with 2 m connector cable

TOCON_PTFE_housing

Advantages of the TOCON_PTFE_housing

- Easy to mount and connect, cleanable
- Dirt-repellant, water proof at wetside (IP 68)
- Teflon (PTFE) M12x1 thread body, length 31 mm
- Wide field of view
- Integrated sensor connector (Binder 5-Pin plug)
- Comes with 2 m connector cable

The PTFE housing reduces the signal output by 95 %.

Sensor Monitor 5.0 for monitoring, datalogging and process control with TOCON_E1

The **Sensor Monitor 5.0** series are measurement and control modules for monitoring and automation of irradiation processes. They display radiation, dose and state information.

A selection of devices with one or two channels, optional USB & RS232 data output and computer software is offered.

UVMICROLOG for datalogging and permanent measurements with TOCON_E1

The **UV*MICROLOG*** is designed for logging of ultraviolet radiation, temperature, pressure and acceleration.
Sophisticated microcontroller technology and low noise SiC TOCON based UV detectors allow up to 3 months of permanent measurement and logging without battery charging. The miniature UV datalogger for long-time monitoring of moving goods, persons or animals can be mounted with a belt or screws.

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