TOCON_F

UV Sensor for flame detection in novel hydrogen burners

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The UV Experts

GENERAL FEATURES

- SiC based UV photodetector with integrated logarithmic amplifier
- SiC based junction diode increases the linear range to 2.100mV. The linear range using a conventional Si diode ends at 300mV.
- designed for flame detection in hydrogen burners
- 0...1V signal output, also available with 4...20mA current loop
- typical irradiation intensity 0.05 nW/mm² bis 10 nW/mm².
- complies with the standard EN289

About the TOCON_F for flame detection in novel hydrogen burners

Pursuing the goal of decarburization of the energy use, the substition of petroleum gas by hydrogen gas produced with renewable energy is a very promising approach.
This requires a certain modification of the heaters. A major change will be the modification of the EN298 compliant flame sensing feature. Currently, sensing petroleum gas flames, electric ionization sensors are used – a rugged, reliable and inexpensive method. However, if hydrogen gas is added to the petroleum gas or if the gas entirely consists of hydrogen these ionization sensors can not be further applied. The reason is a changed reaction kinetics where the ionization effect can not be detected by these conventional sensors. This challenge can be mastered by use of opto-electronic UV sensors. These sensors reliably detect all kind of flames while “seeing” their characteristic emission spectrum in the ultraviolet light range. As UV sensors are more expensive than ionization detectors currently the UV sensors are only applied in highly priced industrial burners but not in household burners. However, according the current state of the knowledge, no other method than opto-electronic UV sensors are able to reliably detect a hydrogen flame.

Since 2006 we produce the TOCONs ABC1 and ABC2 for the EN298 compliant detection of petroleum gas flames in household burners. Our new TOCON_F series is designed for the detection of hydrogen flames.
The difference of the new TOCON_F to the standard ABC1 and ABC2 TOCONs is a reduced off dead-time. This off dead-time occurs with the standard TOCONs when they are saturated and can extend to several 100 milliseconds. The TOCON_F with its logarithmic amplifier shrinks this dead-time to less than 70 milliseconds. Accordingly the reaction time after the flame’s (unwanted) distinction could be strongly increased. Even if the standard TOCONs ABC1 and ABC2 are fast enough (compliant with EN298) to be applied in flame sensing modules (EN298 claims a reaction time of less than 1000 milliseconds) – the requirements of the EN298 standard could be tightened in the future. The reason of this assumption is the significantly higher rate of spread and ignition range of a hydrogen flame compared with a petroleum gas flame. Hence a UV sensor module that works with a TOCON_F offers shorter reaction times than currently required by the standard. This makes these flame sensing modules future-proof in case of a possible revision of the standard.

For the first time in the world, a SiC-based junction diode is used on the TOCON_F- This increases the linear measuring range to 2.100mV compared to a conventional Si diode (300mV). This new approach ideally combines the advantages of a linear circuit (linear measuring range) and a logarighmic circuit (short off-dead-time).

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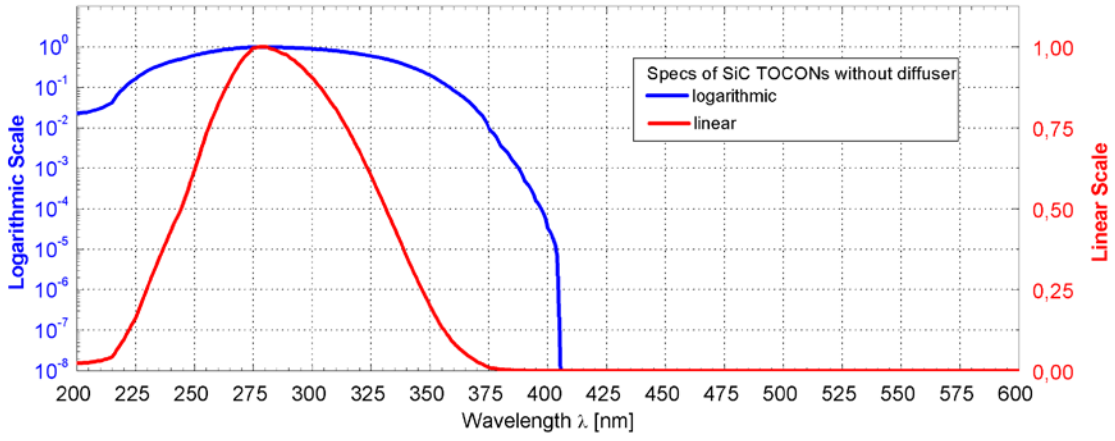
SPECIFICATIONS

Parameter	Symbol	Wert	Unit
Spectral Characteristics			
Typical sensitivity at 313nm	V_{OH}	5200	mV/nW/mm²
Wavelength of max. Spectral Responsivity	λ_{max}	280	nm
Responsivity Range (S=0.1*S_{max})	–	221 ... 358	nm
Visible Blindness (S_{max}/S_{405nm})	VB	> 10^{10}	–
General Characteristics (T=25°C, V_{supply}=+5 V)			
Supply Voltage	V_{Supply}	2.5 ... 5	V
Dark offset voltage at 1 MOhm load	V_{Offset}	1	mV
Typical temperature Coefficient at Peak	T_c	< +-0.3	%/K
Current Consumption	I_{max}	35	µA
Typical rise time (10-90%)	t_{rise}	0.01 12	ms
Typical falltime (90-10%)	t_{fall}	4 70	ms
Maximum Ratings			
Operating Temperature	T_{opt}	–40 ... +85	°C
Storage Temperature	T_{stor}	–40 ... +100	°C
Maximum soldering temperature (for 3 seconds)	T_{sold}	300	°C

NORMALIZED SPECTRAL RESPONSIVITY



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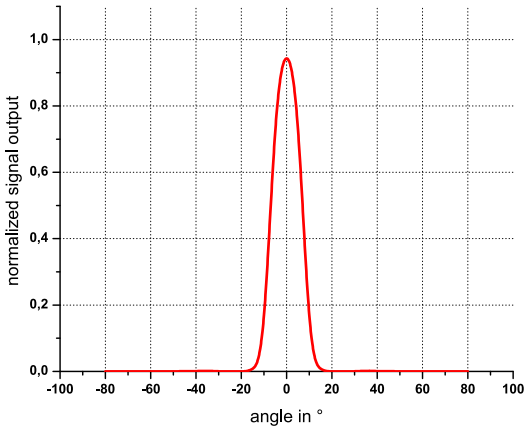
FIELD OF VIEW



Measurement Setup:

lamp aperture diameter: 10 mm
distance lamp aperture to second aperture: 17 mm
second aperture diameter: 10 mm
distance second aperture to detector: 93 mm

pivot level = top surface of the detector window

DRAWINGS