

SILICON IRRADIANCE & TEMPERATURE SENSOR

Measurement of Solar Irradiance



Since 1994 we have been developing and producing different types of silicon irradiance sensors. Until now several 10000 sensors were sold worldwide. Our silicon sensor is an affordable solution for measurement of solar irradiance. The powder-coated aluminium case in conjunction with the solar cell laminated between glass and Tedlar foil builds a very reliable and rugged sensor.



General Information

Mode of operation

A silicon solar cell can be used as an irradiance sensor, because the short-circuit current is proportional to irradiance. Our sensors are built out of a monocrystalline solar cell connected to a shunt. Due to the low resistance of the shunt the cell operates next to short-circuit.

The temperature coefficient of the short-circuit current creates a small error. Therefore all of our silicon sensors with the extension „TC“ have an active temperature compensation, which reduces this error by factor 20. The compensation is realized by using a specific temperature sensor mounted to the rear side of the solar cell. The electronic circuit integrated has a very low power consumption. The current consumption of the SiS-13TC is only 90µA at an irradiance of 1000 W/m².

Our silicon sensors are manufactured in several types with an external power supply, with different output signals and with an optional sensor output for the cell temperature.

All sensors are calibrated in simulated sunlight against a reference cell of the same type. The reference cell is periodically calibrated against a reference cell calibrated by Fraunhofer ISE, Freiburg.

Mechanical Construction

The solar cell is embedded in Ethylen-Vinyl-Acetat (EVA) between glass and Tedlar. The laminated cell is integrated into a case of powder-coated aluminium. Therefore the sensor construction is comparable to that of a standard PV module. The electrical connection is realized by a 3 m cable or a waterproof (IP67) connector.

Optional Temperature Measurement

Additionally to the irradiance measurement our silicon sensors with the extension “-T” are able to measure the temperature of the solar cell. Therefore a temperature sensor is mounted to the rear side of the cell to detect the correct cell temperature.

Published by and copyright © 2011:

Sat Control d.o.o.
Poženik 10,
SI-4207 Cerklje
Slovenia

For more information, please contact
our Customer Support Center.

Phone: +386 4 281 62 15

Fax: +386 4 281 62 13

(Charges depending on provider)

E-mail: support@sat-control.si

All rights reserved.

Trademarks mentioned in this document
are the property of Sat Control d.o.o., its affiliates,
or their respective owners.

Subject to change without prior notice.

The information in this document contains
general descriptions of the technical options
available, which may not apply in all cases.

The required technical options should therefore
be specified in the contract.

SILLICON IRRADIANCE & TEMPERATURE SENSOR

Tecnical Data

SI-SENSOR

General information

- Solar cell: Monocrystalline Silicon (20 mm x 34 mm)
- Current shunt: 0,27 Ω (TC = 20 ppm / K) with 1 V and 20 mA output
- Operating temperature: -20 °C to 70 °C
- Electrical connection done via shielded cable, length 3 m
- Case, protection mode: Powder-coated aluminum, IP 67
- Dimension, weight: 138mm x 64mm x 40mm, appr. 440 g

ACCURACY

Irradiance

- Error with temperature compensation compared to pyranometer within the operating range of -20 °C to 70 °C and vertically beam of irradiance: $\pm 5 \%$ at 1000 W/m²

Temperature

- Non-linearity of the electronic circuit: $\pm 0,3\%$ from reading for 50 to 1300 W/m²
- Accuracy at 25 °C: $\pm 1,5$ °C
- Non-linearity: $\pm 0,5$ °C
- Error (over operating temperature range of -20...-70°C): $\pm 2,0$ °C

Customs number

for all silicon irradiance sensors: 85 41 40 90

Sensor Type:

Power Supply

Irradiance

Cell Temperature

Temperature
Compensation

Output
Signal

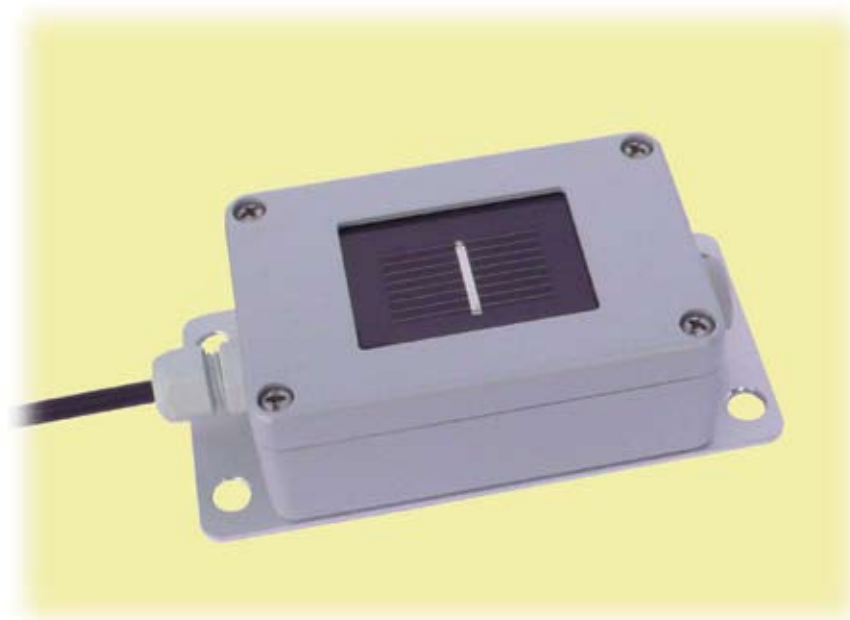
Output
Signal

12 to 28 VDC

Yes

0 to 10V per
0 to 1300 W/m²

2,268V +
86,9mV/°C*T



EXTEND OF SUPPLY

Options

- Silicon sensor with shielded cable, 0,14 mm², UV- and weather resistant, 3 m length with ferrules
- Ready-made cable of the requested length
- Version with waterproof connector

SILLICON IRRADIANCE & TEMPERATURE SENSOR

Electrical connection and Pin numbers

ELECTRICAL CONNECTION

Colors of cable

Irradiance: Orange

Power Supply (Plus): Red

Power Supply / Signal (Minus): Black

Temperature: Brown; only versions with „-T“

Shield: Black (bigger diameter)

SPECIALS

- **Attention:** The maximum load at the output signals with the Si-420TC(-T) is 400 Ω
- **Attention:** Horizontally mounting leads to increased reflexion on the glass surface and therefore to higher measurement errors.

HANDLING AND INSTALLATION

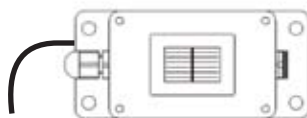
MECHANICAL INSTALLATION

The Si sensor has two tounge with each two M8 drills. The installation at a suitable construction must use at least one M8 screw with washers at each mounting bracket.

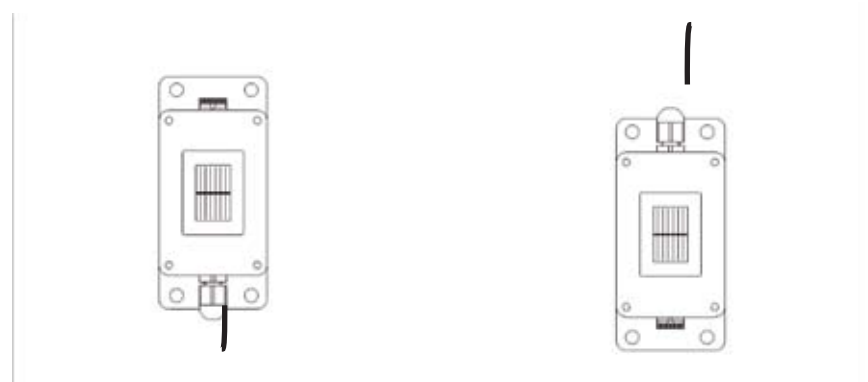
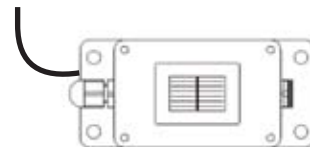
During installation the pressure compensation element near the electrical connection must not be damaged.

MECHANICAL INSTALLATION

Recommended Installation



Installation not permitted



Permitted, but not recommended

HANDLING CASE

The SiS sensor can be cleaned using a smooth cotton cloth, water and a mild cleaning fluid.

An opening of the sensor case by the user or installation staff is not necessary. If the case is opened, we can not guarantee the seal of the case anymore.

* Minus signals of all sensors are identical to supply ground

Calibration Certificate Silicon Irradiance & Temperature Sensor

Calibration with artificial light and vertical irradiance in comparison with a reference cell

Sensor Type: 0200
Serial No.: 13-10003-09-14470198
Remark 1:
Remark 2:
Calibrated by: Huhnstock - Breuer
Date / Time: 24.11.2014 09:28:48

G_target	G_read	T_amb	G_mon	T_mon	T_ir
W/m²	W/m²	°C	W/m²	°C	°C
921,2	921,3	43,6	602,8	64,7	26,0

Reference Cell	Cal_G_Ref	TC_Ref	U_lamp
	µV/W/m ²	1/°C	V
SiS-Ref mono-DEL ISE-2	21,977	0,0007	16,81

Datalogger

Manufacturer	Type	Serial no.	Signals
Gantner Instruments	IDL100	191368	G_mon T_mon T_ir T_amb U_lamp PT100 PT1000 G_100mV
Gantner Instruments	ISM112	082552	G_10V T_10V G_20mA T_20mA

G_mon	Irradiance monitoring cell (W/m ²)
T_mon	Temperature monitoring cell (°C)
T_ir	Infrared temperature of irradiance sensor (°C)
T_amb	Ambient temperature of sensors within the simulator (°C)
U_lamp	Voltage for lamps within the simulator (V)
G_target	Desired value of irradiance (W/m ²)
G_read	Reading value of irradiance (W/m ²)
Reference Cell	Name of reference cell
Cal_G_Ref	Calibration factor of reference cell (mV/(W/m ²))
TC_Ref	Temperature coefficient of reference cell (1/°C)
G_100mV	Voltage irradiance sensor (mV)
G_10V	Voltage irradiance sensor (V)
T_10V	Voltage temperature irradiance sensor (V)
G_20mA	Current irradiance sensor sensor (mA)
T_20mA	Current temperature irradiance sensor (mA)
PT100	Cell temperature Sensor PT100 (°C)
PT1000	Cell temperature Sensor PT1000 (°C)