

# Quick Reference Guide analog Silicon Irradiance Sensor



## Main data

Irradiance measurement:	up to 1400 W/m <sup>2</sup>
Working temperature:	-35 to 80°C
Weight:	appr. 0.44 kg
Measurement cell temperature:	optional

## Types

Type	Voltage supply	Irradiance		Cell temperature Signal
		Signal	Temperature compensation	
SiS-01TC-DMM	Internal Lithium Battery	0 to 1.4 V for 0 to 1400 W/m <sup>2</sup>	yes	./.
SiS-01TC	5 to 28 VDC	0 to 1.4 V for 0 to 1400 W/m <sup>2</sup>	yes	./.
SiS-01TC-T	5 to 28 VDC	0 to 1.4 V for 0 to 1400 W/m <sup>2</sup>	yes	0 to 2 V for -123.5 to +76.5°C
SiS-02	./.	ca. 80 mV for 1400 W/m <sup>2</sup>	no	./.
SiS-02-Pt100	./.	ca. 80 mV for 1400 W/m <sup>2</sup>	no	Pt100
SiS-02-Pt1000	./.	ca. 80 mV for 1400 W/m <sup>2</sup>	no	Pt1000
SiS-13TC	12 to 28 VDC	0 to 10 V for 0 to 1300 W/m <sup>2</sup>	yes	./.
SiS-13TC-T	12 to 28 VDC	0 to 10 V for 0 to 1300 W/m <sup>2</sup>	yes	0 to 10 V for -26.1 to +89.0°C
SiS-420TC	12 to 25 VDC	4 to 20 mA for 0 to 1200 W/m <sup>2</sup>	yes	./.
SiS-420TC-T	12 to 25 VDC	4 to 20 mA for 0 to 1200 W/m <sup>2</sup>	yes	4 to 20 mA for -123.5 to +76.5°C

### Measurement uncertainty over all aspects (not SiS-02, SiS-02-XX only with external temperature compensation), according to GUM (Guide to the Expression of Uncertainty in Measurement), k = 2

Irradiance	<b>±5 W/m<sup>2</sup> ± 3.5 % of MV</b>	valid perpendicular incidence of the light, spectrum AM 1.5
Cell temperature	<b>2.0 K IEC 60751, class A</b>	Range -20 to 70°C, all sensors except SiS-02-Pt100(0) Range -35 bis 80°C / only SiS-02-Pt100(0)

## User information

The guarantee is for 1 year from the date of the invoice for the intended use. M&T does not accept any liability for possible losses or damage due to the incorrect usage of the sensor. Liability for consequential damages is excluded.

**Special note: The housing for the Si sensors is not allowed to be opened by the installer or user because, as a consequence, the housing will no longer be sealed after it is closed. If the housing is opened, the manufacturer's warranty will be rendered void.**










## Maintenance

Scope of the regularly check (at least every 2 years): Cleaning of solar cell, external damage, mechanical fastening, cable laying and any damage to the cable.

In the report IEA-PVPS T13-03:2014 "Analytical Monitoring of Grid-connected Photovoltaic Systems" an interval of 1 to 2 weeks is recommended.

Should damage be found that degrades the function or safety, the sensor is to be replaced.

A recalibration is recommended at least every 3 years.

	<p>Si sensors that are used for monitoring PV installations must be installed with the <b>same alignment and inclination as the PV generator</b>. The mounting location should be free of shading as far as possible. To facilitate <b>maintenance and cleaning</b> of the Si sensor, the Si sensor should be mounted in an easily accessible place (e.g. near roof windows or skylights).</p>
	<p>The <b>mounting location</b> at a PV generator must be selected such that snow cannot jeopardise the Si sensor as it slides off. For this reason do not mount along the drip edge on the PV generator.</p>
	<p>The <b>connecting cable</b> should always be laid separated from, e.g. main DC cables or AC cables. The connecting cable is to be laid so it is fixed. The minimum bending radius of 15 x cable diameter (ø approx. 5 mm) is to be observed. The voltage drop at the cable has to be considered when calculating the maximum cable length.</p>
	<p>The pressure equalisation element must not be damaged. <b>The cable gland is not allowed to be undone or tightened by the user.</b> It is not necessary for the installer or user to open the Si sensor. <b>If the housing is nevertheless opened, no liability for the sealing can be accepted.</b></p>
	<p>The <b>surge protection concept</b> must be adapted to the specific local situation. This means, for instance, that the measuring cables must be equipped with a separate surge arrester at the entry to a building. The sensor must be integrated into the <b>lightning protection concept</b>.</p>
	<p>The sensors are designed for <b>safety extra-low voltage (SELV)</b> operation. Reversing the polarity or mixing up the connections on the Si sensor may cause irreversible damage to the sensor. The cable shield is to be connected to PE during installation.</p>
	<p><b>The installation and assembly of electrical equipment must be carried out by electrically qualified persons.</b> The sensor may not be used with equipment whose direct or indirect purpose is to prevent human death or injury, or whose operation poses a risk to humans, animals or property.</p>
	<p><b>Mortal danger due to electrical power</b> On the connection of the Si sensor to an inverter, dangerous voltages are present on the inverter.</p>
	<p>Should it be necessary to <b>clean the Si sensor</b>, a soft cotton cloth, water and a mild cleaning agent can be used for this purpose.</p>

**Wire colour**

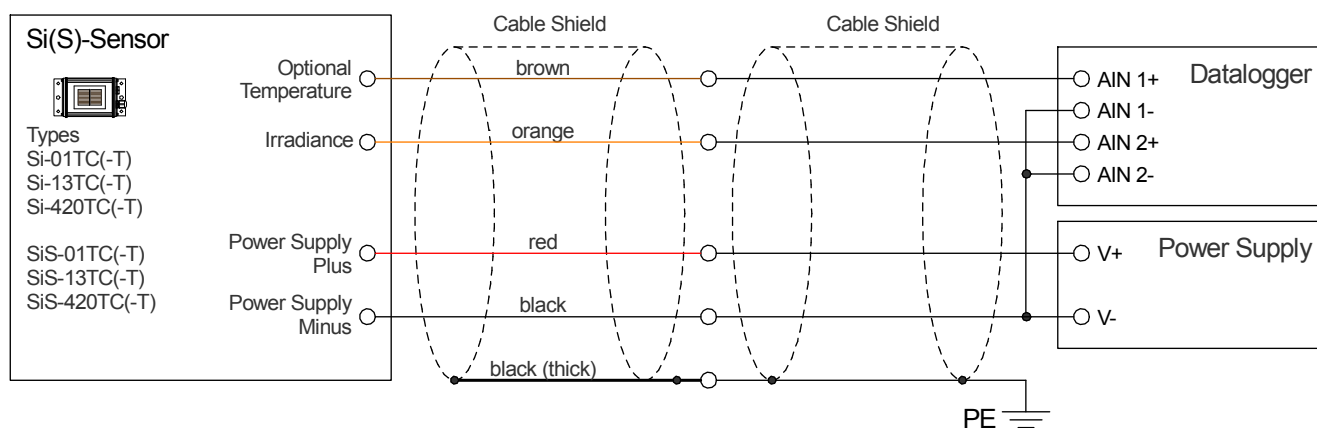
Wire colour	SiS-01TC(-T), SiS-13TC(-T), SiS-420TC(-T)	SiS-02, SiS-02-Pt100, SiS-02-Pt1000
Orange	Irradiance (positive)	Irradiance (positive)
Brown	Temperature (positive)	Temperature - 1
Black	Signal (negative) and supply (negative)	Irradiance (negative)
Red	Supply (positive)	Temperature - 2
Black (thick)	Shield	Shield

**Cable resistance (outward and return conductor) for calculating the maximum cable length**

Cable cross-section	Spezific cable resistance	Cable length				
		10 m	20 m	50 m	100 m	200 m
0.14 mm <sup>2</sup>	150.0 Ω/km	3.0 Ω	6.0 Ω	15.0 Ω	30.0 Ω	60.0 Ω
0.50 mm <sup>2</sup>	36.7 Ω/km	0.7 Ω	1.5 Ω	3.7 Ω	7.3 Ω	14.7 Ω

Example voltage drop on cable for Si-420TC-T, 200 m cable 0.5 mm<sup>2</sup>:  $\Delta U = 14.7 \Omega \times 50 \text{ mA} = 0.74 \text{ V}$

Wiring diagram of analog Si sensors



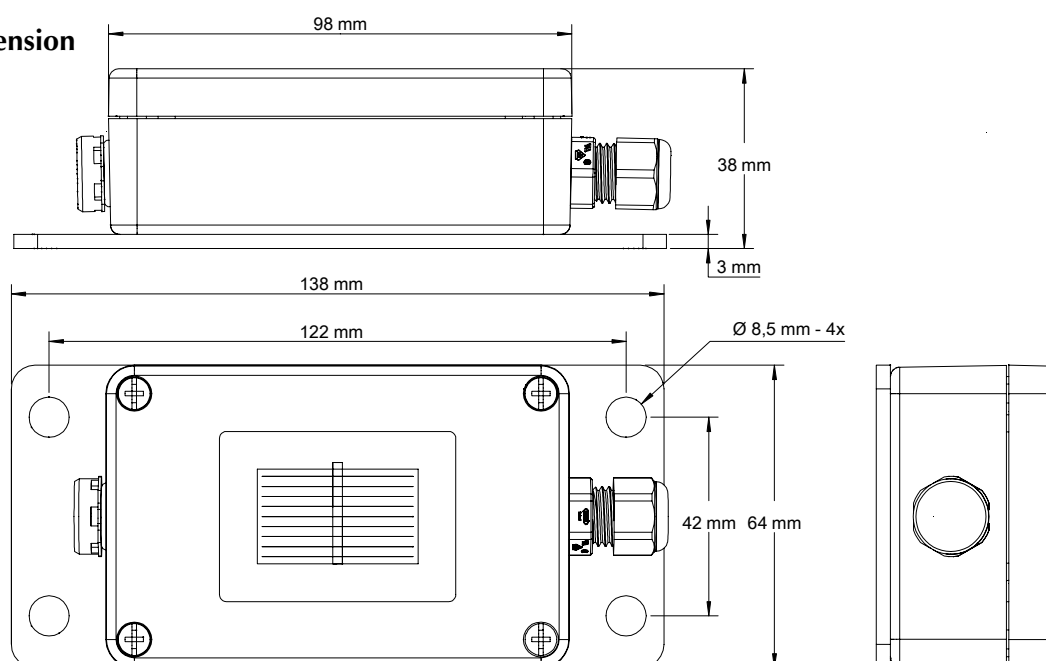
Offset and gradient for connection to a datalogger

Sensor type	Irradiance	Temperature (only Sensor with „-T“ bzw. „-PtXX“)
SiS-02 SiS-02-Pt100(0)	$G = 1000 * U / F_1$ with $F_1$ calibration factor $U = 0.001 * F_1 * G$	Pt100 or Pt1000
SiS-01TC SiS-01TC-T	$G = 1000 * U$ $U = 0.001 * G$	$T = 100 * U - 123,5 = 100 * (U - 1.235)$ $U = 0.01 * T + 1.235 = 0,01 * (T - 123.5)$
SiS-420TC SiS-420TC-T	$G = 75 * I - 300 = 75 * (I - 4)$ $I = 1/75 * G + 4 = (G + 300) / 75$	$T = 12.5 * I - 173.5 = 12,5 * (I - 13.88)$ $I = 0.08 * T + 13.88 = 0.08 * (T + 173.5)$
SiS-13TC SiS-13TC-T	$G = 130 * U$ $U = 1/130 * G$	$T = 11.51 * U - 26.1 = 11.51 * (U - 2.268)$ $U = 0.087 * T + 2.268 = 0.087 * (T + 26.1)$

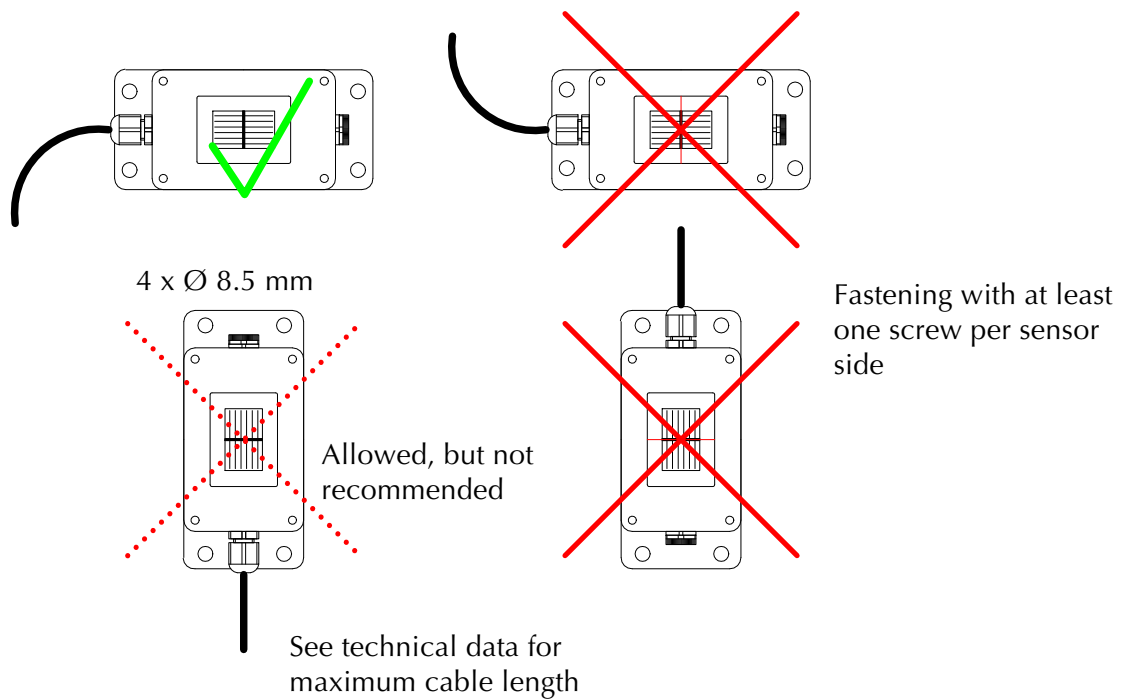
Correction equation for external temperature compensation of SiS-02-Pt100(0):

$$G = 1000 * U / \{F_1 * [1 + TK * (T - 25^\circ C)]\}$$

Dimension



**Mounting instruction**



**Technical data**

General data						
Solar cell	Monocrystalline silicon; 20 mm x 34 mm					
Housing	Material	Powder-coated aluminium				
Dimension / Weight	138 mm x 64 mm x 40 mm / appr. 440 g					
Degree of protection	IP 67					
Operating temperature	-35 to +80°C					
Sensor cable	LiYC11Y 4x0.14mm <sup>2</sup> UL20233; length typical 3m					
Customs tariff number	85 41 40 90					
Electrical data						
	SiS-01TC	SiS-01TC-T	SiS-13TC	SiS-13TC-T	SiS-420TC	SiS-420TC-T
Supply voltage	24 VDC (5 ... 28 VDC)		24 VDC (12 ... 28 VDC)		24 VDC (12 ... 25 VDC)	
Max. current consumption	1 mA	1 mA	1 mA	5 mA	25 mA	50 mA
Maximum load	./.		./.		400 Ω	
Minimum load	10 kΩ		10 kΩ		20 Ω	
Maximum cable length <sup>1</sup>	appr. 50 m		appr. 100 m		appr. 200 m	
Electrical data of SiS-02 and SiS-02-Pt100(0)						
Supply voltage	None					
Typ. current consumption	./.					
Minimum load	10 kΩ					

<sup>1</sup> Note for Si-01TC-T and Si-13TC-T: Maximum cable length with a cable diameter of 0.14 mm<sup>2</sup> is 30 m. For cable length bigger then 30 m use at least 0.5 mm<sup>2</sup>.

**Items supplied:**

- Si sensor incl. pre-assembled connecting cable or suitable male connector
- Data sheet
- Calibration record

**Please read also the installation and operating instruction (newest version on [www.ib-mut.de](http://www.ib-mut.de)).**