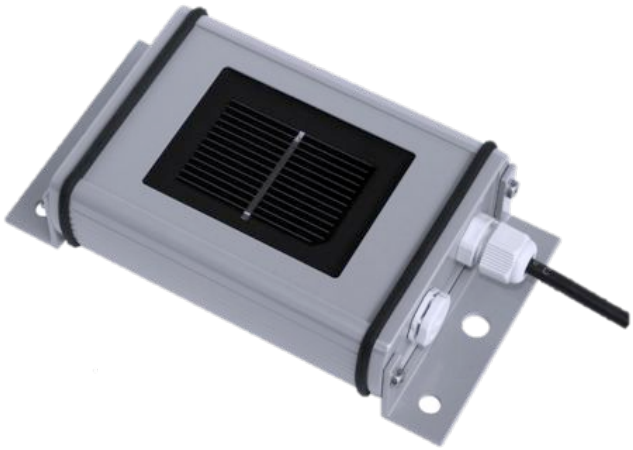
Quick Reference Guide
analog Silicon Irradiance Sensor



Main data

Irradiance measurement:	up to 1400 W/m²
Working temperature:	-35 to 80°C
Weight:	appr. 0.4 kg
Measurement cell temperature:	optional

Types

Type	Voltage supply	Irradiance		Cell temperature
		Signal	Temperature compensation	Signal
Si-01TC-Batt Si-01TC-DMM	Internal Lithium Battery	0 to 1.4 V for 0 to 1400 W/m²	yes	./.
Si-01TC	5 to 28 VDC	0 to 1.4 V for 0 to 1400 W/m²	yes	./.
Si-01TC-T	5 to 28 VDC	0 to 1.4 V for 0 to 1400 W/m²	yes	0 to 2 V for -123.5 to +76.5°C
Si-02	./.	ca. 80 mV for 1400 W/m²	no	./.
Si-02-Pt100	./.	ca. 80 mV for 1400 W/m²	no	Pt100
Si-02-Pt1000	./.	ca. 80 mV for 1400 W/m²	no	Pt1000
Si-13TC	12 to 28 VDC	0 to 10 V for 0 to 1300 W/m²	yes	./.
Si-13TC-T	12 to 28 VDC	0 to 10 V for 0 to 1300 W/m²	yes	0 to 10 V for -26.1 to +89.0°C
Si-420TC	12 to 25 VDC	4 to 20 mA for 0 to 1200 W/m²	yes	./.
Si-420TC-T	12 to 25 VDC	4 to 20 mA for 0 to 1200 W/m²	yes	4 to 20 mA for -123.5 to +76.5°C

Measurement uncertainty over all aspects (not Si-02, Si-02-XX only with external temperature compensation), according to GUM (Guide to the Expression of Uncertainty in Measurement), k = 2		
Irradiance	**±5 W/m² ± 2.5 % of MV**	valid perpendicular incidence of the light, spectrum AM 1.5
Cell temperature	**2.0 K**	Range -20 to 70°C, all sensors except Si-02-Pt100(0)
	IEC 60751, class A	Range -35 bis 80°C / only Si-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.

	Si sensors that are used for monitoring PV installations must be installed with the s**ame alignment and inclination as the PV generator**. The mounting location should be free of shading as far as possible. To facilitate **maintenance and cleaning** of the Si sensor, the Si sensor should be mounted in an easily accessible place (e.g. near roof windows or skylights).
	The **mounting location** 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.
	The **connecting cable** 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.
	The pressure equalisation element must not be damaged. **The cable gland is not allowed to be undone or tightened by the user.** It is not necessary for the installer or user to open the Si sensor. **If the housing is nevertheless opened, no liability for the sealing can be accepted.**
	The **surge protection concept** 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 **lightning protection concept**.
	The sensors are designed for **safety extra-low voltage (SELV)** 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.
	**The installation and assembly of electrical equipment must be carried out by electrically qualified persons.** 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.
	**Mortal danger due to electrical power** On the connection of the Si sensor to an inverter, dangerous voltages are present on the inverter.
	Should it be necessary to **clean the Si sensor**, a soft cotton cloth, water and a mild cleaning agent can be used for this purpose.

Wire colour

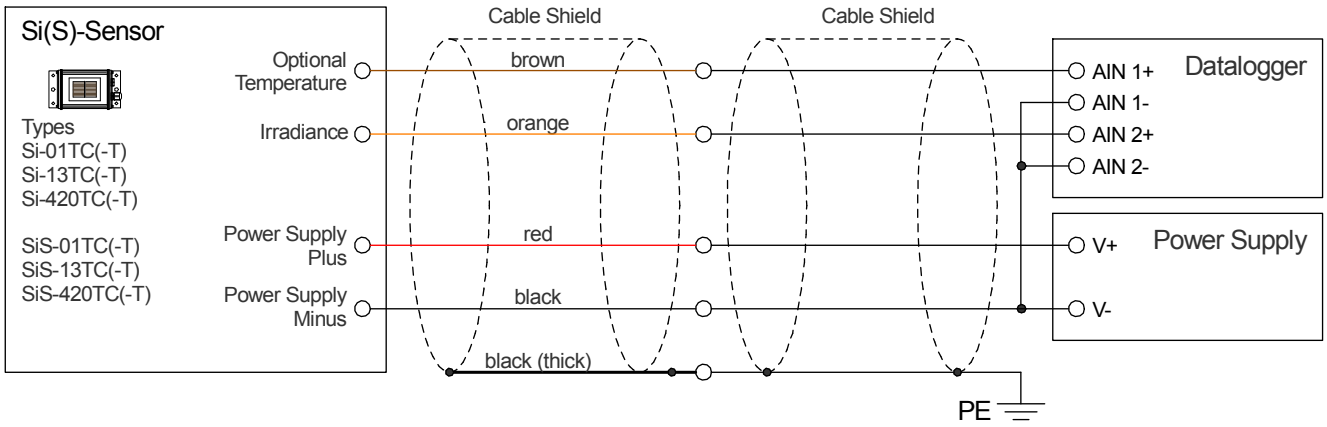
Wire colour	Si-01TC(-T), Si-13TC(-T), Si-420TC(-T)	Si-02, Si-02-Pt100, Si-02-Pt1000
Orange	Irradiance (positive)	Irradiance (positive)
Brown	Temperature (positive)	Temperature - 1
Black	Signal (negative) and supply (negative)	Irradiance (negative)
Red	Supply (positive)	Temperature - 2
Black (thick)	Shield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

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

Cable cross-section	Spezific cable resistance	Cable lenght				
		10 m	20 m	50 m	100 m	200 m
0.14 mm^2	150.0 Ω/km	3.0 Ω	6.0 Ω	15.0 Ω	30.0 Ω	60.0 Ω
0.50 mm^2	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^2: $\Delta U = 14.7\ \Omega \times 50\ mA = 0.74\ V$

Wiring diagram of analog Si sensors



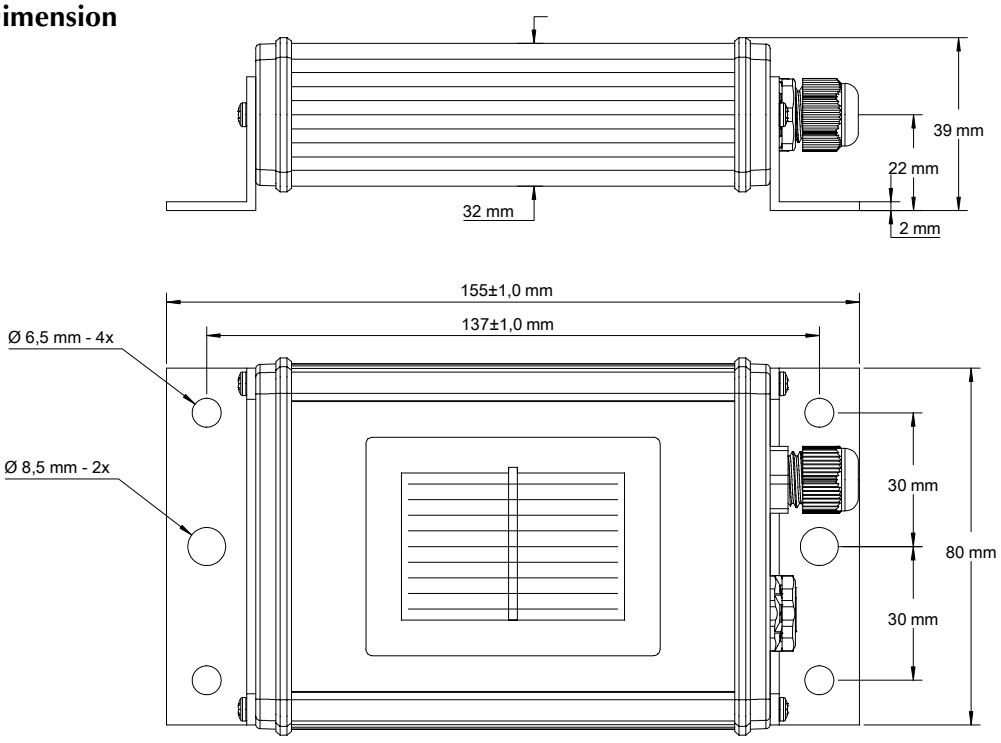
Offset and gradient for connection to a datalogger

Sensor type	**Irradiance**	**Temperature** (only Sensor with „-T“ bzw. „-PtXX“)
Si-02 Si-02-Pt100(0)	G = 1000 * U / F_1 with F_1 calibration factor U = 0.001 * F_1 * G	Pt100 or Pt1000
Si-01TC Si-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)
Si-420TC Si-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)
Si-13TC Si-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)

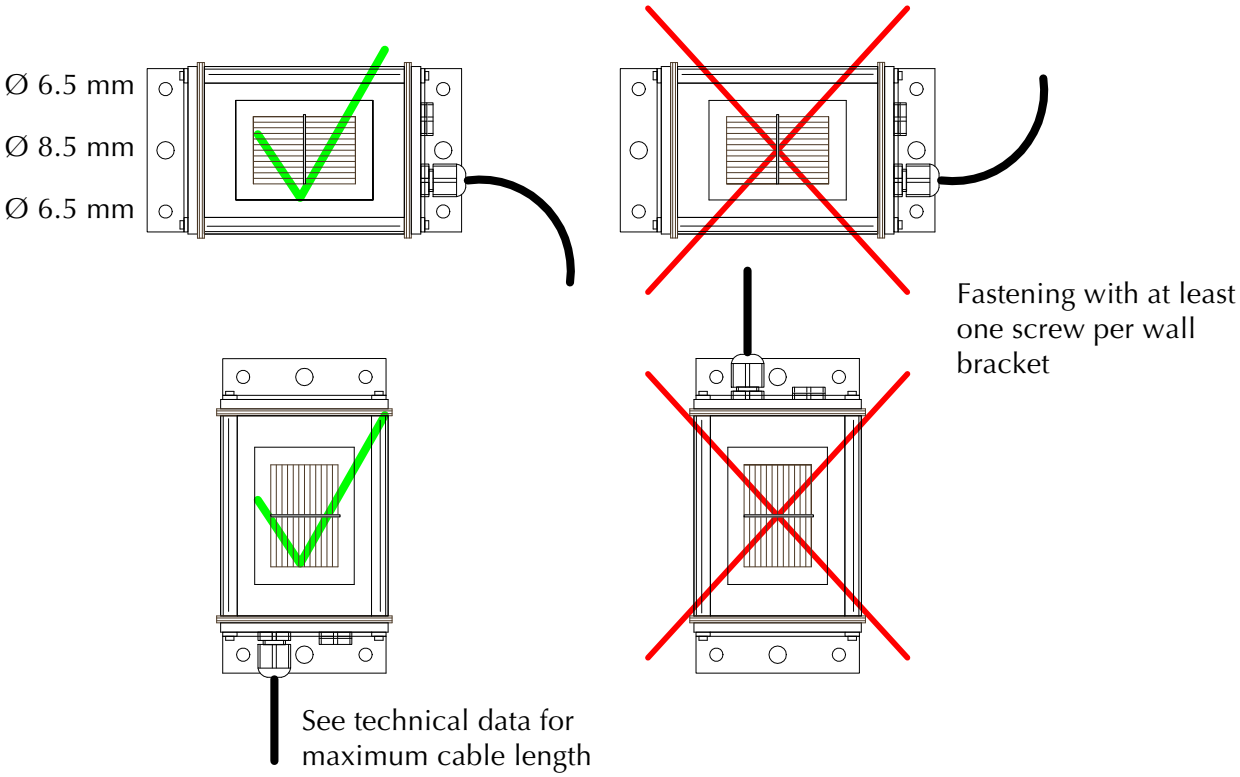
Correction equation for external temperature compensation of Si-02-Pt100(0):

$$G = 1000 * U / \{F1 * [1 + TK * (T - 25°C)]\}$$

Dimension



Mounting instruction



Technical data

General data						
Solar cell	Monocrystalline silicon; 50 mm x 33 mm					
Housing Material Dimension / Weight Degree of protection	Powder-coated aluminium 155 mm x 86 mm x 39 mm / appr. 350 g IP 65					
Operating temperature	-35 to +80°C					
Sensor cable	LiYC11Y 4x0.14mm² UL20233; length typical 3m					
Customs tariff number	85 41 40 90					
Electrical data						
	Si-01TC	Si-01TC-T	Si-13TC	Si-13TC-T	Si-420TC	Si-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[1]	appr. 50 m		appr. 100 m		appr. 200 m	
Electrical data of Si-02 and Si-02-Pt100(0)						
Supply voltage	None					
Typ. current consumption	./.					
Minimum load	10 kΩ					

[1] **Note for Si-01TC-T and Si-13TC-T**: Maximum cable length with a cable diameter of 0.14 mm2 is 30 m. For cable lenght bigger then 30 m use at least 0.5 mm².

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).

