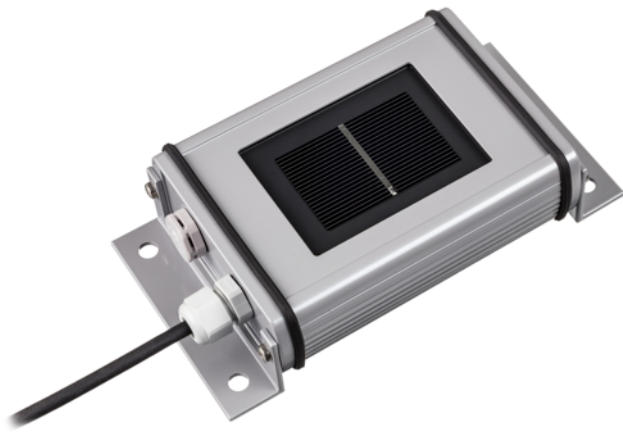


# Quick Reference Guide for analog Silicon Irradiance Sensors



## Main data

Irradiance Measurement:	Up to 1500 W/m <sup>2</sup>
Working Temperature:	-35 to 80°C
Weight:	Approx. 0.4 kg
Measurement Cell Temperature:	Optional

## Type Overview

Type	Voltage Supply	Irradiance		Cell Temperature
		Signal (0 to 1500 W/m <sup>2</sup> )	Temperature Compensation	Signal (-40 to +90°C)
Si-V-1.5TC-batt-D / -E	Battery	0 to 1.5	yes	./.
Si-V-1.5TC	4 to 28 VDC	0 to 1.5 V	yes	./.
Si-V-1.5TC-T	5.5 to 28 VDC	0 to 1.5 V	yes	0 to 2 V
Si-mV-85	./.	0 to approx. 85 mV	no	./.
Si-mV-85-Pt100(-4L)	./.	0 to approx. 85 mV	no	Pt100
Si-mV-85-Pt1000(-4L)	./.	0 to approx. 85 mV	no	Pt1000
Si-V-10TC	12 to 28 VDC	0 to 10 V	yes	./.
Si-V-10TC-T	12 to 28 VDC	0 to 10 V	yes	0 to 10 V
Si-I-420TC	12 to 28 VDC	4 to 20 mA	yes	./.
Si-I-420TC-T	12 to 28 VDC	4 to 20 mA	yes	4 to 20 mA

## Measurement uncertainty over all aspects,

according to GUM (Guide to the Expression of Uncertainty in Measurement),  $k = 2$

Irradiance <sup>1</sup>	<b>IEC 61724-1 Class A<sup>1</sup></b> <b>IEC 61724-1, Class B</b>	Si-mV-85-Pt100(0), Si-mV-85-Pt100(0)-4L Si-V-1.5TC(-T), Si-V-10TC(-T), Si-I-420TC(-T)
Cell Temperature (-35 to +85°C)	<b>1.1 K</b> <b>1.3 K</b> <b>IEC 60751, class A</b>	Si-V-1.5TC-T and Si-V-10TC-T Si-I-420TC-T Si-mV-85-Pt100(-4L) and Si-mV-85-Pt1000(-4L)

<sup>1</sup> Not valid for Si-mV-85-Pt100/-Pt1000 without external temperature compensation.

## User Information

The irradiance sensor is designed for the measurement of the natural solar irradiance. The warranty 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

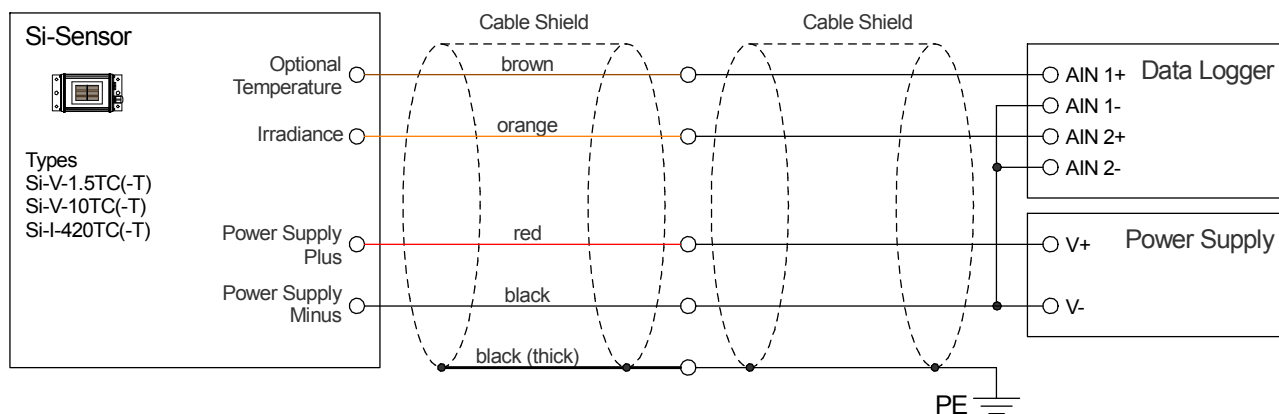
Scope of the regularly check (at least every 2 years): Cleaning of solar cell, external damage, mechanical fastening, cable laying and any damage to the cable.

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.

Wiring Diagram of Analog Si Sensors



Maximum Additional Cable Length of Si Sensors with 3 m Connection Cable

Sensor Type	Cable Cross Section						
	0.14 mm <sup>2</sup>	0.25 mm <sup>2</sup>	0.34 mm <sup>2</sup>	0.5 mm <sup>2</sup>	0.75 mm <sup>2</sup>	1.0 mm <sup>2</sup>	1.5 mm <sup>2</sup>
Si-mV-85	20 m	20 m	20 m	20 m	20 m	20 m	20 m
Si-mV-85-Pt100 <sup>1</sup>	/	/	/	/	/	/	/
Si-mV-85-Pt100-4L	20 m	20 m	20 m	20 m	20 m	20 m	20 m
Si-mV-85-Pt1000 <sup>2</sup>	5 m	10 m	10 m	15 m	20 m	20 m	20 m
Si-mV-85-Pt1000-4L	20 m	20 m	20 m	20 m	20 m	20 m	20 m
Si-V-1.5TC <sup>3</sup>	50 m	50 m	50 m	50 m	50 m	50 m	50 m
Si-V-1.5TC-T <sup>3</sup>	15 m	30 m	40 m	50 m	50 m	50 m	50 m
Si-V-10TC <sup>3</sup>	100 m	100 m	100 m	100 m	100 m	100 m	100 m
Si-V-10TC-T <sup>3</sup>	50 m	100 m	100 m	100 m	100 m	100 m	100 m
Si-I-420TC <sup>4</sup>	200 m	200 m	200 m	200 m	200 m	200 m	200 m
Si-I-420TC-T <sup>4</sup>	150 m	200 m	200 m	200 m	200 m	200 m	200 m

- <sup>1</sup> Maximum 2 K error of temperature measurement due to cable resistance (2 wire connection); cable extension not possible.
- <sup>2</sup> Maximum 1 K error of temperature measurement due to cable resistance (2 wire connection).
- <sup>3</sup> Connection of all Si sensors with voltage output with separate cable per sensor.
- <sup>4</sup> Maximum internal resistance of data logger 200 Ω.
- All In case of voltage supply of several Si sensors from a single supply reduction of the possible cable length according to the number of sensors.










Offset and Gain for Connection to a Datalogger

Units: Irradiance G in W/m<sup>2</sup>; Voltage V in V (only mV with Si-mV-85(-PT100(0))); current I in mA; F<sub>1</sub> in mV / (1000 W/m<sup>2</sup>); T in °C

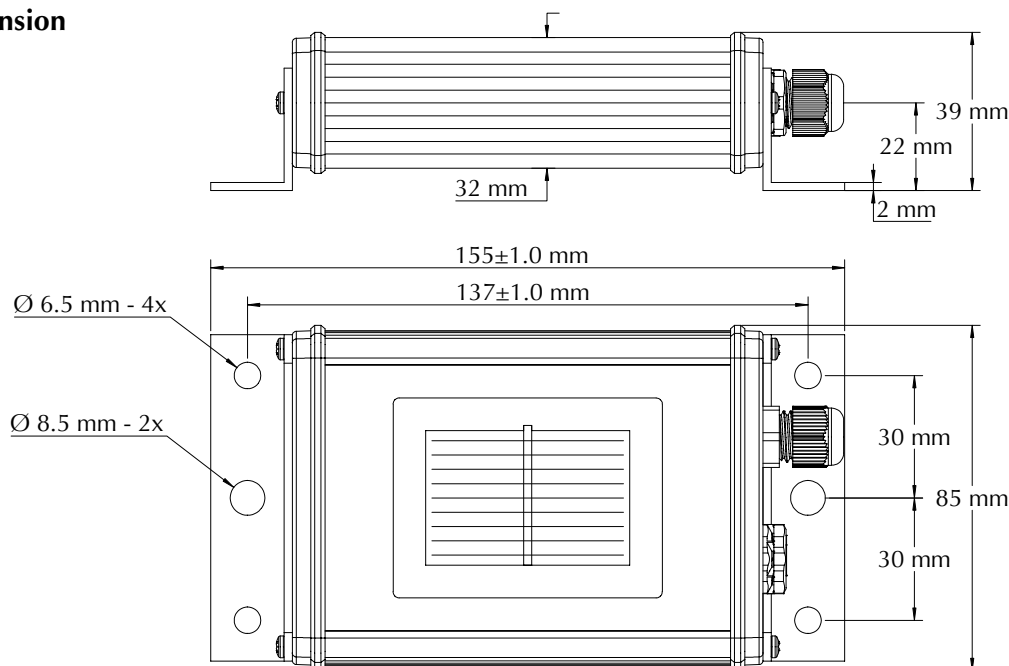
Sensor Type	Irradiance	Temperature (only with „-T“ or „-Pt100(0)“)
Si-mV-85 Si i-mV-85-Pt100(0)	$G = V / F_1$ with $F_1$ calibration factor $V = F_1 * G$	Pt100 or Pt1000
Si-V-1.5TC Si-V-1.5TC-T	$G = 1.000 * V$ $V = 0.001 * G$	$T = 65 * V - 40 = 65 * (V - 0.6154)$ $V = 0.0154 * T + 0.6154 = 0.0154 * (T - 40)$
Si-I-420TC Si-I-420TC-T	$G = 93.75 * I - 375 = 93.75 * (I - 4)$ $I = 1/93.75 * G + 4 = (G + 375) / 93.75$	$T = 8.125 * I - 72.5 = 8.125 * (I - 8.923)$ $I = 0.1231 * T + 8.9231 = 0.1231 * (T + 72.5)$
Si-V-10TC Si-V-10TC-T	$G = 150 * V$ $V = 1/150 * G$	$T = 13 * V - 40 = 13 * (V - 3.0769)$ $V = 0.0769 * T + 3.0769 = 0.0769 * (T + 40)$

Correction equation for external temperature compensation of Si-mV-85(-PT100/-PT1000) with voltage U in mV:

$$G = U / \{F_1 * [1 + 0.0005 * (T - 25°C)]\}$$

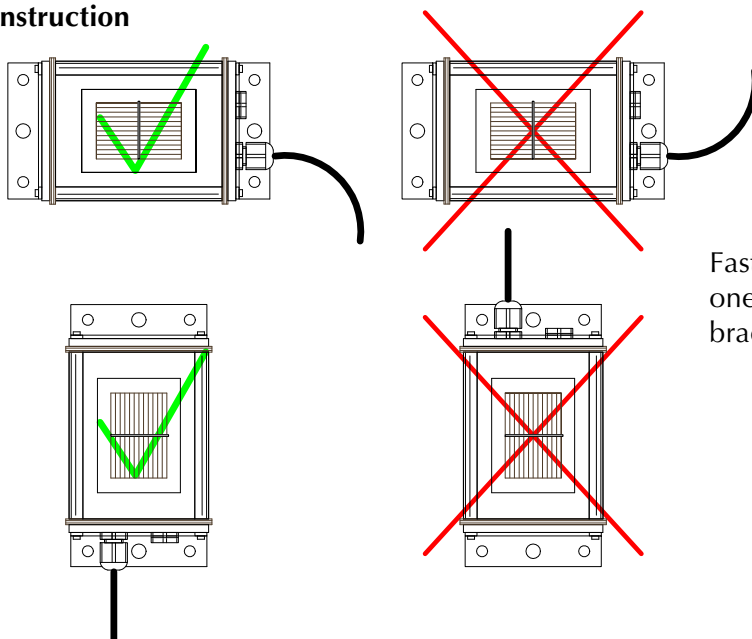
	<p>Si sensors used for monitoring of PV installations must be installed with the <b>same alignment and inclination as the PV generator</b>. The mounting location should be free of shading as far as possible. To facilitate <b>maintenance and cleaning</b> of the Si sensor, the Si sensor should be mounted 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 (disconnection, secure against switching, follow inverter manual).</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>

**Dimension**



**Mounting Instruction**

Ø 6,5 mm  
 Ø 8,5 mm  
 Ø 6,5 mm



Fastening with at least one screw per wall bracket

**Technical Data**

General Data				
Solar cell	Monocrystalline Silicon; 50 mm x 33 mm			
Housing Material	Powder-coated aluminium			
Dimension / Weight	155 mm x 85 mm x 39 mm / approx. 350 g			
Degree of Protection	IP 65			
Operating Temperature	-35 to +80°C			
Sensor Cable	LiYC11Y 4 x 0.14 mm <sup>2</sup> UL20233; length typical 3 m			
Customs Tariff Number	90 15 80 20			
Electrical Data of Si-V-1.5TC, Si-V-1.5TC-T and Si-mV-85(-Pt100/-Pt1000)				
	Si-V-1.5TC	Si-V-1.5TC-T	Si-mV-85-XXX	
Supply Voltage	24 VDC (4 to 28 VDC)	24 VDC (5.5 to 28 VDC)	None	
Max. Current Consumption	1 mA	2 mA	./.	
Load	Minimum 10 kΩ (for Si-V-1.5TC-batt minimum 1 MΩ)			
Electrical Data of Si-V-10TC, Si-V-10TC-T, Si-I-420TC and Si-I-420TC-T				
	Si-V-10TC	Si-V-10TC-T	Si-I-420TC	Si-I-420TC-T
Supply Voltage	24 VDC (12 to 28 VDC)		24 VDC (12 to 28 VDC)	
Max. Current Consumption	1 mA	1 mA	25 mA	50 mA
Load	Minimum 100 kΩ		Maximum 400 Ω	
Wire Colour	Si-V-XXX, Si-I-XXX		Si-mV-85(-Pt100/-Pt1000)	Si-mV-85-Pt100-4L / -Pt1000-4L
Orange	Irradiance (plus)		Irradiance (plus)	Irradiance (plus)
Brown	Temperature (plus)		Temperature - 1	Temperature - 1
Black	Minus		Irradiance (Minus)	Irradiance (Minus)
Red	Supply (plus)		Temperature - 2	Temperature - 2
Black (thick)	Shield		Shield	Shield
Yellow (only „-4L“)	./.		./.	Temperature - 1
Green (only „-4L“)	./.		./.	Temperature - 2

**Items Supplied:**

- Si sensor incl. pre-assembled connecting cable or suitable male connector
- Calibration Certificate
- Quick Reference Guide