

MODBUS Specification for Irradiance Sensors Si-RS485 Series

From Firmware Version 1.51



1. Supported Bus Protocol

Baud Rate: 1200, 2400, 9600, 19200, 38400
Parity: No, even, odd
Stop Bit: 1, 2 (only at no parity)
Factory Default: 9600 Baud, 8N1, address: 1

For setting the bus protocol parameter the sensor offers the function code 0x46 of the MODBUS protocol. Alternative you can use the software tool Si-MODBUS-Configurator (free download on our website) for setting the bus parameter and testing the communication.

2. MODBUS Specification

References:

- MODBUS over Serial Line Specification and Implementation Guide V1.02
- MODBUS Application Protocol Specification V1.1b

Transmission mode: MODBUS RTU

The Sensors will start MODBUS operation 4 seconds after power up.

Supported function codes:

- 0x04: Read Input Register

Register	Value	Gain	Offset	Phys. Range	Data Range	Data Type
0000	Irradiance in W/m ²	0.1	0	0...1500 W/m ² ¹⁾	0...15000 ¹⁾	UINT16
0003	Wind Speed in m/s	0.1	0	0...80 m/s	0...800	UINT16
0007 ²⁾	Cell Temperature in °C	0.1	0	-40...+90°C	-400...900	INT16
0008 ²⁾	External Temperature in °C	0.1	0	-40...+90°C	-400...900	INT16

¹⁾ Up to Firmware Version 1.52 range is 0...1400 W/m²

²⁾ Only available from Firmware Version 1.53

Please note: The Register 0003 and 0008 are optional for some sensor types. If your sensor does not support this register, it will return the value 0 for this register.

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To keep compatibility to old firmware versions, additional registers are available:

Register	Value	Gain	Offset	Phys. Range	Data Range	Data Type
0001	Cell Temperature in °C	0.1	-25	-25...+75°C	0...1000	UINT16
0002	External Temperature in °C	0.1	-25	-25...+75°C	0...1000	UINT16
0004	<i>reserved</i>	<i>./.</i>	<i>./.</i>	<i>./.</i>	0	UINT16
0005 ³⁾	Cell Temperature in °C	0.1	-100	-40...+90°C	600...1900	UINT16
0006 ³⁾	External Temperature in °C	0.1	-100	-40...+90°C ⁴⁾	600...1900 ⁴⁾	UINT16

³⁾ Only available from Firmware Version 1.52

⁴⁾ -40...+85°C for Firmware Version V1.52 / -40...+90°C from Firmware Version V1.53

Please note: The Register 0002 and 0006 are optional for some sensor types. If your sensor does not support this register, it will return the value 0 for this register.

For using the full temperature measurement range of -40...90°C use register 0005 and 0006 resp. 0007 and 0008.

- 0x08: Diagnostics

- Sub function 0x00: Return Query Data
- Sub function 0x01: Restart Communications Option
- Sub function 0x04: Force Listen Only Mode
- Sub function 0x0A: Clear Counters
- Sub function 0x0B: Return Bus Message Count
- Sub function 0x0C: Return Bus Communication Error Count
- Sub function 0x0D: Return Slave Exception Error Count
- Sub function 0x0E: Return Slave Message Count
- Sub function 0x0F: Return Slave No Response Count
- Sub function 0x10: Return Slave NAK Count
- Sub function 0x11: Return Slave Busy Count
- Sub function 0x12: Return Bus Character Overrun Count

- 0x46: Communication Parameter

Please note: These settings will take effect after restart of the sensor by power on reset or restart communication command (function 0x08, Sub function 01).

- Sub function 04: Write Module Address

Request:

00	Address	1 Byte	1 to 247
01	Function Code	1 Byte	0x46
02	Sub Function Code	1 Byte	0x04
03	New Address	1 Byte	1 to 247

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Response:

00	Address	1 Byte	1 to 247
01	Function Code	1 Byte	0x46
02	Sub Function Code	1 Byte	0x04
03	New Address	1 Byte	1 to 247

- Sub function 05: Read Communication Parameter

Request:

00	Address	1 Byte	1 to 247
01	Function Code	1 Byte	0x46
02	Sub Function Code	1 Byte	0x05

Response:

00	Address	1 Byte	1 to 247
01	Function Code	1 Byte	0x46
02	Sub Function Code	1 Byte	0x05
03	Baud rate	1 Byte	0 to 4, see table below
04	Parity / Stop Bit	1 Byte	0 to 3, see table below

- Sub function 06: Write Communication Parameter

Request:

00	Address	1 Byte	1 to 247
01	Function Code	1 Byte	0x46
02	Sub Function Code	1 Byte	0x05
03	Baud Rate	1 Byte	0 to 4, see table below
04	Parity / Stop Bit	1 Byte	0 to 3, see table below

Response:

00	Address	1 Byte	1 to 247
01	Function Code	1 Byte	0x46
02	Sub Function Code	1 Byte	0x05
03	Baud Rate	1 Byte	0 to 3, see table below
04	Parity / Stop Bit	1 Byte	0 to 3, see table below

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- Communication Parameter Setting Sub Function 05 and 06:

Baud Rate	Value
1200	0
2400	1
9600	2
19200	3
38400	4

Parity / Stop Bit	Value
8N1 (10 Bit)	0
8N2 (11 Bit)	1
8E1 (11 Bit)	2
8O1 (11 Bit)	3

- Sub function 07: Hardware and Firmware Version

Request:

00	Address	1 Byte	1 to 247
01	Function Code	1 Byte	0x46
02	Sub Function Code	1 Byte	0x07

Response:

00	Address	1 Byte	1 to 247
01	Function Code	1 Byte	0x46
02	Sub Function Code	1 Byte	0x07
03	Hardware Version	2 Byte	0 to 65535
04	Firmware Version	2 Byte	0 to 65535

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- Sub function 08: Read Serial Number (from Firmware Version 1.54)

Request:

00	Address	1 Byte	1 to 247
01	Function Code	1 Byte	0x46
02	Sub Function Code	1 Byte	0x08

Response:

00	Address	1 Byte	1 to 247
01	Function Code	1 Byte	0x46
02	Sub Function Code	1 Byte	0x08
03	Serial Number	20 Byte	Char

The response for the Read Serial Number Function are 20 character with a structure as followed:

- All characters "-" printed on the sensor label are leaved out
- For serial numbers with less than 20 characters the output is filled with „blank“ (0x20)

Example:

Serial number printed on the sensor label:

485-12003-17-20311234

Output of Read Serial Number Function:

485120031720311234 _ _

Output of Read Serial Number Function in hex:

3438 3531 3230 3033 3137 3230 3331 3132 3334 2020

Identifying the sensor type by the serial number:

Serial Number, beginning with	Sensor Type	Active Registers
485-1	Si-RS485TC-T-MB	0000, 0007
485-2	Si-RS485TC-2T-MB	0000, 0007, 0008
485-3	Si-RS485TC-2T-v-MB	0000, 0003, 0007, 0008
485-4	Si-RS485TC-T-Tm-MB	0000, 0007, 0008

Exception Codes:

- 01: Illegal Function
- 02: Illegal Data Access
- 03: Illegal Data Value
- 04: Slave Device Failure