

# Modbus Specification for Irradiance Sensors Si-RS485...-MB

## Validity of this Document

This document describes the Modbus functionality of the sensor series Si-RS485...-MB with the firmware version 2.01. In addition, the previous firmware versions 1.51 to 1.55 are also covered in this document. Variations between firmware versions are mentioned using numbered notes.

### Supported Bus Protocol

Baud rate	1200, 2400, 9600, 19200, 38400, 57600 <sup>3)</sup>
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.

## 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

- 0x03: Read Holding Register
- 0x04: Read Input Register

Register	Value	Gain	Offset	Phys. Range	Data Range	Data Type
0	Irradiance in W/m <sup>2</sup>	0.1	0	0...1500 W/m <sup>2</sup> <sup>1)</sup>	0...15000	UINT16
3	Wind Speed in m/s	0.1	0	0...80 m/s	0...800	UINT16
7 <sup>2)</sup>	Cell Temperature in °C	0.1	0	-40...+90°C	-400...900	INT16
8 <sup>2)</sup>	External Temp. no. 1 in °C	0.1	0	-40...+90°C	-400...900	INT16
9 <sup>3)</sup>	External Temp. no. 2 in °C	0.1	0	-40...+90°C	-400...900	INT16

1) Up to Firmware Version 1.52 range is 0...1400 W/m<sup>2</sup>

2) Only available from Firmware Version 1.53

3) Only available from Firmware Version 2.01

Please note:

The Register 3, 8 and 9 are optional for some sensor types. If your sensor does not support this register, it will return the value 0 for this register.

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

Register	Value	Gain	Offset	Phys. Range	Data Range	Data Type
1	Cell Temperature in °C	0.1	0	-25...+75°C	0...1000	UINT16
2	External Temperature in °C	0.1	0	-25...+75°C	0...1000	UINT16
4	reserved	-	-	-	-	-
5 <sup>4)</sup>	Cell Temperature in °C	0.1	0	-40...+90°C	600...1900	UINT16
6 <sup>4)</sup>	External Temperature in °C	0.1	0	-40...+90°C <sup>5)</sup>	600...1900 <sup>5)</sup>	UINT16

4) Only available from Firmware Version 1.52

5) -40...+85°C for Firmware Version 1.52 / -40...+90°C from Firmware Version 1.53

Please note:

The Register 2 and 6 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 5 to 9.

#### → 0x08: Diagnostics

- Sub function 0x00: Return Query Data
- Sub function 0x01: Restart Communication 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 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
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	0x06
Response			
00	Address	1 Byte	1 to 247
01	Function Code	1 Byte	0x46
02	Sub Function Code	1 Byte	0x06
03	Baud rate	1 Byte	0 to 4, see table below
04	Parity /Stop Bit	1 Byte	0 to 3, see table below

### 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

### 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 <sup>1)</sup>	Serial Number	30 Byte	Char

<sup>1)</sup> In Firmware Version 1.54 and 1.55 the length of the serial number is defined as 20 bytes. If the serial number is less than 20 characters, the output is filled with "blank" (0x20)

The response for the Read Serial Number Function are 30 character with a structure as followed:

- All characters “-” printed on the sensor lable are leaved out
- For serial numbers with less than 30 characters the output is filled with null bytes “\0” (0x00)

**Example:**

Serial number printed on the sensor label:

485-12003-17-20311234

Output of Read Serial Number Function:

485120031720311234\0\0\0\0\0\0\0\0\0\0\0\0

Output of Read Serial Number Function in hex:

3438 3531 3230 3033 3137 3230 3331 3132 3334 0000 0000 0000 0000 0000 0000

**Identifying the sensor type by the serial number:**

Serial number, beginning with	Sensor Type	Active Register
485-1	Si-RS485TC-T-MB	0, 7
485-2	Si-RS485TC-2T-MB	0, 7, 8
485-3	Si-RS485TC-2T-v-MB	0, 3, 7, 8
485-4	Si-RS485TC-T-Tm-MB	0, 7, 8
485-5	Si-RS485TC-3T-MB	0, 7, 8, 9

Exception codes:

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

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