SEVEN 3S-MT-PT1000 Temperature Sensor Module User Manual

3S-MT-PT1000
Module Temperature Sensor

USER MANUAL

Contents

Introduction

Module Temperature Sensor is a product of the SEVEN meteorological sensors series, which consists of professional and intelligent measurement sensors with digital interface for environmental and industrial applications. 4 types of module temperature sensors are available. The product list with item codes is given in Table 1.

| Type	Item Code	Name	Usage Area	Output
1	**3S-MT-PT1000-MB**	Module Temperature Sensor-PT1000 with Modbus RTU Output	Module	Modbus RTU
2	**3S-MT-PT1000-U**	Module Temperature Sensor-PT1000 with 0-10V Output	Module	Analog 0-10 V
3	**3S-MT-PT1000-I**	Module Temperature Sensor-PT1000 with 4-20mA Output	Module	Analog 4-20 mA
4	**3S-MT-PT1000**	Module Temperature Sensor-PT1000	Module	PT1000
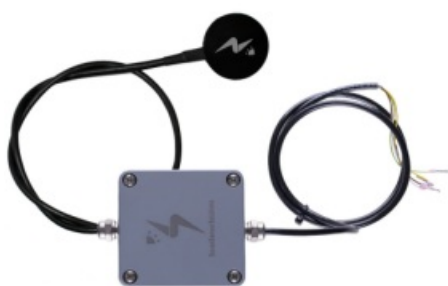
Figure 1 – 3S-MT-PT1000-MB/I/U   Figure 2 – 3S-MT-PT1000

For products with Modbus output, measured module temperature data is transmitted to data loggers and receiving units via a 2-wire RS485 bus with Modbus RTU protocol, while devices with analog output transmit data as 4-20mA or 0-10 V.

Module Temperature Sensors Installation

It is suggested that the system be operated at ground level to make sure that all components are working properly prior to installation. A general diagram of the progress of the installation steps is given below.
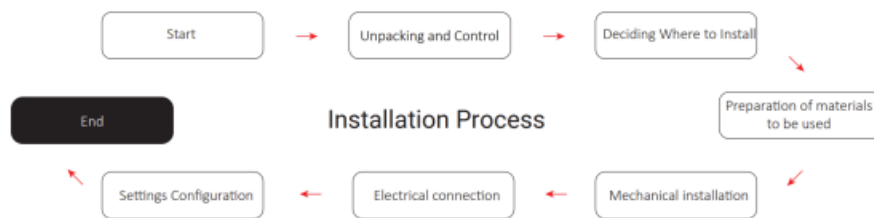
Figure 4 – Installation Process

⚠️ **Note:** SEVEN has the right to make modifications on this documentation without notice.

2.1. Unpacking and Control

Upon receipt of the product, it must be carefully checked whether the package content is complete. SEVEN Sensor Solutions must be contacted if any of the components are missing, damaged or defective.

| A | Qty: 1 | B | Qty: 4 | C | Qty: 4 |
| Module Temperature Sensor | | Self Adhesive Cable Clips | | Plastic Black Clamps | |

Figure 5 – 3S-MT-PT1000

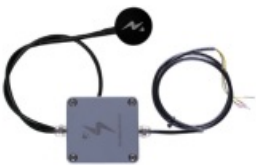| A | Qty: 1 | B | Qty: 4 | C | Qty: 4 |
| Modbus or Analog Module Temperature Sensor | | Self Adhesive Cable Clips | | Plastic Black Clamps | |

Figure 6 – 3S-MT-PT1000-MB/I/U

2.2. Site Requirements and Considerations

Each site is different and has its own unique challenges. For this reason, the installation of the product may differ in each site. First of all, it should be decided where the product will be installed. Module Temperature can be affected by obstructions, shading source and local topography.

The Module Temperature Sensor must be installed at the exact midpoint of the PV module. A sensor location should be chosen in the center of the cell closest to the exact midpoint of the module, avoiding the boundaries between cells.

The area where the Module Temperature Sensor will be installed must be completely dry and clean. Dew residues on the PV modules during the winter months may prevent the Module Temperature Sensor from sticking.

Note: To facilitate sensor maintenance, it should be installed in an easily accessible location, especially in roof projects.

2.3. Installation

Step 1- The area where the module temperature sensor will be adhered to the back of the PV module is determined.

Step 2- The area to be adhered to is thoroughly cleaned and dried.

Step 3- The adhesive protection on the module temperature sensor is removed, and it is adhered to the designated area.
Step 4- After the sensor is installed, its cable should be fixed to the back of the panel with the self-adhesive cable clips and clamps provided in the package by SEVEN Sensor
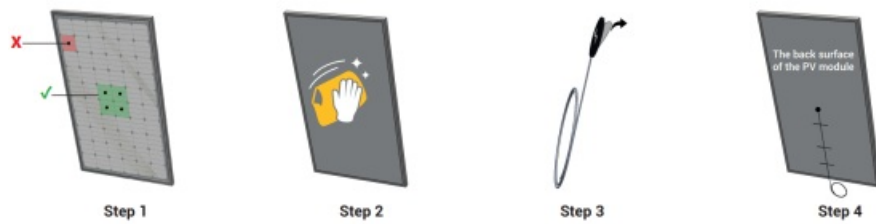

Figure 7 – Installation

⚠️ **Note:** The adhesive used in the area where the Panel Temperature Sensor is bonded to the PV Panel is a special adhesive that enables heat conduction. If this adhesive is damaged, it can be requested by contacting Seven Sensor.

2.4. Inspection and Maintenance

Sensors and electrical enclosures should be periodically checked for damage, deterioration or disconnection, evidence of moisture or vermin in the enclosures, loose wiring, disconnection of temperature sensors, brittle joints and other potential problems.
According to IEC 61724-1:2021, the monitoring system should be inspected at least annually and preferably at more frequent intervals.

Connections

The sensor box has waterproof and UV-resistant connectors. The minimum bending radius of the cables is 5 mm. The supply voltage for Modbus and Analog models of Module Temperature Sensors is 12-30 V DC. The recommended supply voltage is 24 V DC.

The Module Temperature Sensors with Modbus RTU Output have an electrically isolated, half-duplex, 2-wire RS485 interface for configuration, communication and firmware update.
The communication and power cable of the Module Temperature Sensors must always be laid separately from the AC/ DC cables.

⚠️ **Note:** The installation and electrical connections of SEVEN sensors should be carried out by a qualified electrician.

3S-MT-PT1000-MB	
RS485 A / Data (+)	Green
RS485 B / Data (-)	Yellow
RS485 Data Ground	Pink
Power Supply (+)	Brown
Power Supply (-)	White
Earth Ground	Black
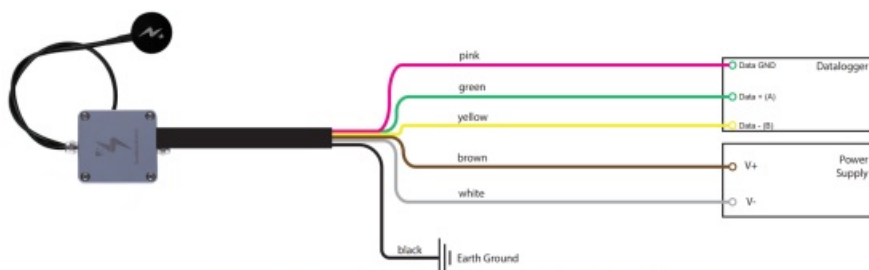
Figure 8 – Connection of 3S-MT-PT1000-MB with Datalogger

3S-MT-PT1000-I	
4…20 mA Current (I+)	Green
4…20 mA Current (I-)	Yellow
Power Supply (+)	Brown
Power Supply (-)	White
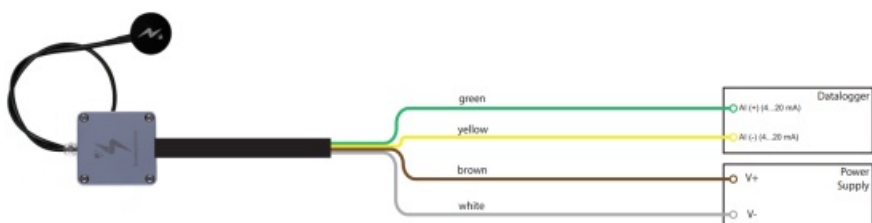
Figure 9 – Connection of 3S-MT-PT1000-I with Datalogger

3S-MT-PT1000-U	
0-10 V (+)	Green
0-10 V (-)	Yellow
Power Supply (+)	Brown
Power Supply (-)	White
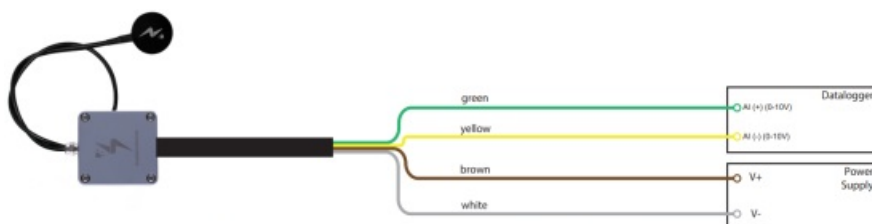
Figure 10 – Connection of 3S-MT-PT1000-U with Datalogger
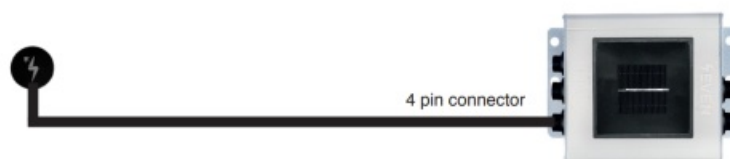
Figure 11 – Connection of the 3S-MT-PT1000 with Irradiance Sensor

3S-MC-M-PT1000_v2.1 Configuration and Communication

Once the Module Temperature Sensor is installed and connected correctly, the sensor begins autonomously to take measurements.

Attention must be paid to the following points:

- A measurement request should be made to the Module Temperature Sensor with the 3S Configuration Tool and it should be checked whether it correctly operates in the site.
- If several Modbus Devices are operated on a network, a unique device ID must be assigned to each device. Follow SEVEN instructions to configure the Temperature Sensor on dataloggers.

4.1. 3S-MC-MT-PT1000 Configuration Tool

3S-MC-MT-PT1000 Configuration Tool is a software tool for testing communication and adjusting Modbus parameters of the Module Temperature Sensor with Modbus RTU Output (3S-MT-PT1000-MB).
A Windows® PC with a serial bus interface set as a serial COM port, 3S-MC-M-PT1000 Configuration Tool software, and USB to RS485 Converter are required for configuration and testing purposes.
Follow the instructions in 3S-MC-M-PT1000 Configuration Tool User Manual:
https://www.sevensensor.com/files/d/en/3S-PT1000_Configuration_Tool_v2.1.pdf

4.2. Modbus RTU Specifications
4.2.1. Supported Bus Protocol
The 3S-MT-PT1000-MB is equipped with an RS-485 communication port that supports Modbus RTU commands. The Temperature Sensor can be configured to operate in different communication parameters. The table that follows describes each supported bus protocol.

Baud Rate	4800, 9600, 19200, 38400
Parity	None
Stop Bit	1, 2
Factory Default	9600 Baud, 8N1, Address:1

4.2.2. Supported Function Codes
The Temperature Sensor supports a specific subset of Modbus RTU commands. The table that follows lists each supported function code.

0x03	Read Holding Registers
0x04	Read Input Registers
0x46	Read & Change Parameters
0x08	Diagnostics

⚠️ **Note:** All checksums of the Modbus protocol are omitted in this document. These checksums must always be calculated and sent during communication.
4.2.2.1 Read Holding Registers (0x03)
Master Request:

Address	1 Byte	1 to 247
Function Code	1 Byte	0x03
Start Register	2 Byte (Big Endian)	see the register table below
Number of Registers	2 Byte (Big Endian)	see the register table below

Slave Response:

Address	1 Byte	1 to 247
Function Code	1 Byte	0x03
Number of Bytes	1 Byte	0 to 255 (2xN) N = Number of Registers
Data	2 Byte x N (Big Endian)	see the register table below

Holding Register Map
The Module Temperature Sensor holding register map is based on the "SunSpec Alliance" communication standards.
All data marked in bold below are defined for the Module Temperature Sensor.

Start	End	Value	Type	Units	Scale Factor	Constant
40000	40001	SunSpec ID	uint32	N/A	N/A	"SunS"
40002	40002	SunSpec Device ID	uint16	N/A	N/A	0x0001
40003	40003	SunSpec Length	uint16	Registers	N/A	65
40004	40019	Manufacturer	String (32)	N/A	N/A	"SevenSensor"
40020	40035	Model	String (32)	N/A	N/A	"3S-MT-PT1000-MB"
40036	40043	Hardware Version	String (16)	N/A	N/A	" HW4 "
40044	40051	Software Version	String (16)	N/A	N/A	" SW2 "
40052	40067	Serial Number	String (32)	N/A	N/A	"23.12.345.65.0013"
40068	40068	Device ID	uint16	N/A	N/A	1
Back of Module Temperature Registers						
40089	40089	Block ID	int16	N/A	N/A	303
40090	40090	Length	int16	Registers	N/A	9
40091	40091	Effective Module Temp	int16	°C	0.1	Measured
40092	40092	Module Temp 1	int16	°C	0.1	Measured
End of Block Registers						
40107	40107	End of Sunspec Block	uint16	N/A	N/A	0xFFFF
40108	40108	Length	uint16	Registers	0	0
Device Address Read/Write Register						
40109	40109	Modbus ID – Write Register	uint16	N/A	N/A	1

4.2.2.2. Read Input Registers (0x04)
Master Request:

Address	1 Byte	1 to 247
Function Code	1 Byte	0x04
Start Register	2 Byte (Big Endian)	see the register table below
Number of Registers	2 Byte (Big Endian)	see the register table below

Slave Response:

Address	1 Byte	1 to 247
Function Code	1 Byte	0x04
Number of Bytes	1 Byte	0 to 255 (2xN) N = Number of Registers
Data	2 Byte x N (Big Endian)	see the register table below

Input Register Map
The following Modbus data can be read individually or in blocks.

ID-Dec	ID-Hex	Value	Range	Resolution
30022	0x16	Module Temperature	-40…+85 °C	0.1°C

ID-Dec	ID-Hex	Value	Range
30301	0x12D	Hardware Version	
30302	0x12E	Software Version	
30342	0x156	Production Year	
30343	0x157	Production Code	**Manufacturer Parameters Read Only**
30344	0x158	Cell Serial Number	
		Serial Number	
30345	0x159	Board Serial Number	
30346	0x15A	Box Serial Number	
30347	0x15B	Sensor Serial Number	

4.2.2.3. Read & Change Parameters (0x46)
Sub Function (0x04): Write Device Address
Master Request:

Address	1 Byte	1 to 247
Function Code	1 Byte	0x46
Sub Function Code	1 Byte	0x04
New Address	1 Byte	1 to 247

Slave Response:

Address	1 Byte	1 to 247
Function Code	1 Byte	0x46
Sub Function Code	1 Byte	0x04
New Address	1 Byte	1 to 247

Sub Function (0x06): Write Communication Parameters
Master Request:

Address	1 Byte	1 to 247
Function Code	1 Byte	0x46
Sub Function Code	1 Byte	0x04
New Address	1 Byte	1 to 247
New Parity / Stop Bit	1 Byte	0 to 3, see table below

Slave Response:

Address	1 Byte	1 to 247
Function Code	1 Byte	0x46
Sub Function Code	1 Byte	0x06
New Baud Rate	1 Byte	0 to 3, see table below
New Parity / Stop Bit	1 Byte	0 to 3, see table below

⚠️ **Note:** When the "Write Communication Parameters" command is used, the "Write Device Address" command must also be used before the restart of communication command.

Baud Rate	Value	Parity / Stop Bit	Value
4800	0	None/1	0
9600	1	None/2	1
19200	2	Odd	2
38400	3	Even	3

Sub Function (0x07): Read Hardware & Software Versions
Master Request:

Address	1 Byte	1 to 247
Function Code	1 Byte	0x46
Sub Function Code	1 Byte	0x07

Slave Response:

Address	1 Byte	1 to 247
Function Code	1 Byte	0x46
Sub Function Code	1 Byte	0x07
Hardware Version	2 Byte (Little Endian)	0 to 65535
Software Version	2 Byte (Little Endian)	0 to 65535

Sub Function (0x07): Read Hardware & Software Versions
Master Request:

Address	1 Byte	1 to 247
Function Code	1 Byte	0x46
Sub Function Code	1 Byte	0x08

Slave Response:

Address	1 Byte	1 to 247
Function Code	1 Byte	0x46
Sub Function Code	1 Byte	0x08
Production Year	1 Byte	0 to 99
Production Code	1 Byte	0 to 99

Slave Response:

Cell Serial Number	2 Byte (Little Endian)	0 to 999
Board Serial Number	1 Byte	0 to 99
Box Serial Number	1 Byte	0 to 99
Sensor Serial Number	2 Byte (Big Endian)	0 to 9999
Production Day	1 Byte	1 to 31
Production Month	1 Byte	1 to 12
Production Year	1 Byte	0 to 99

4.2.2.4. Restart Communication Command (0x08)
Master Request:

Address	1 Byte	1 to 247
Function Code	1 Byte	0x08
Restart Code	4 Byte	0x00000000

Slave Response:

Address	1 Byte	1 to 247
Function Code	1 Byte	0x08
Restart Code	4 Byte	0x00000000

Contact Details

Please feel free to contact us if you face any difficulties during installation or configuration.

SEVEN
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Documents / Resources

	SEVEN 3S-MT-PT1000 Temperature Sensor Module [pdf] User Manual 3S-MT-PT1000 Temperature Sensor Module, 3S-MT-PT1000, Temperature Sensor Module, Sensor Module, Module

References

- ⚡ **Seven Sensor for solar PV plants | Seven Sensor**
- **User Manual**