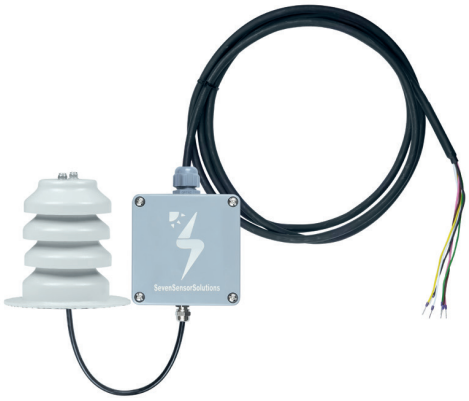
SEVEN
SENSOR SOLUTIONS



3S-AT-PT1000

Ambient Temperature Sensor

USER MANUAL

USER MANUAL TABLE OF CONTENTS

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1. Introduction

Ambient 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 Ambient temperature sensors are available. The product list with item codes is given in Table 1.

Type	Item Code	Name	Usage Area	Output
1	**3S-AT-PT1000-MB**	Ambient Temperature Sensor-PT1000 with Modbus RTU Output	Ambient	Modbus RTU
2	**3S-AT-PT1000-U**	Ambient Temperature Sensor-PT1000 with 0-10 V Output	Ambient	Analog 0-10 V
3	**3S-AT-PT1000-I**	Ambient Temperature Sensor-PT1000 with 4-20 mA Output	Ambient	Analog 4-20 mA
4	**3S-AT-PT1000**	Ambient Temperature Sensor-PT1000	Ambient	PT1000

Table 1 : Product List and Item Codes

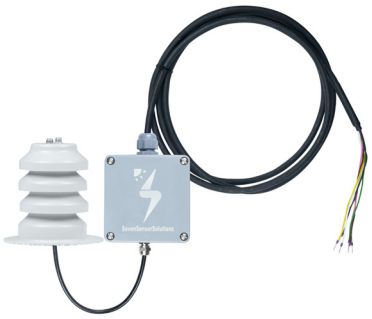

Figure 1 – 3S-AT-PT1000-MB/I/U

Figure 2 – 3S-AT-PT1000

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

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

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2. Ambient 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.

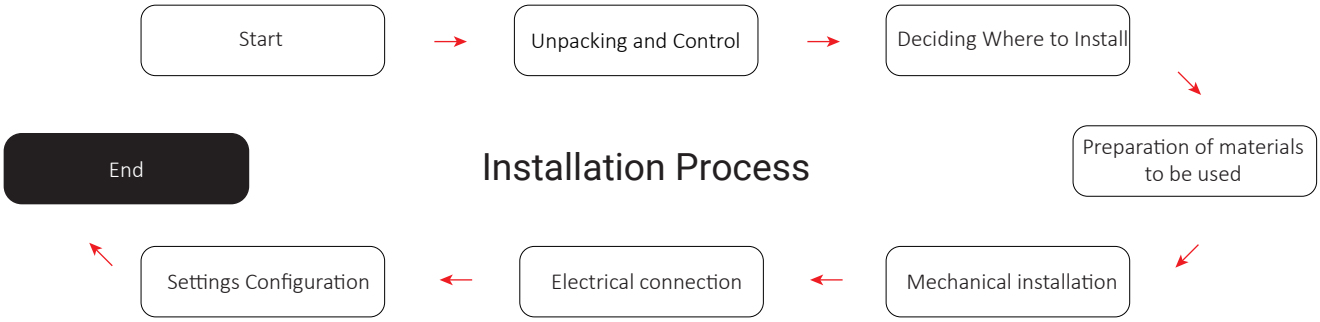

Figure 3 – Installation Process

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.

Figure 4 – 3S-AT-PT1000

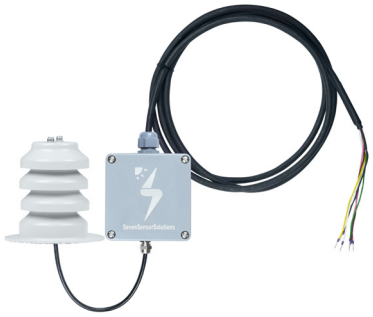

Figure 5 – 3S-AT-PT1000-MB/I/U

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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. Ambient Temperature can be affected by obstructions, shading source and local topography.

To achieve accurate measurements with ambient temperature sensors, the temperature probe should not be exposed to direct sunlight. The SEVEN Sensor Ambient Temperature Sensor is provided with a shield to ensure easy installation and to block direct sunlight.

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

2.3. Installation

The Ambient Temperature Sensor comes with a pre-mounted shield, which is also used to mount the sensor on a flat surface.

The shield is secured to the ground with screws through the mounting holes on it.

Figure 6 – Installation

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.

3. 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 Ambient Temperature Sensor is 12-30 V DC. The recommended supply voltage is 24 V DC.

The Ambient 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 Ambient 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.*

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3S-AT-PT1000-MB	
RS485 A / Data (+)	Green
RS485 B / Data (-)	Yellow
RS485 Data Ground	Pink
Power Supply (+)	Brown
Power Supply (-)	White
Earth Ground	Black

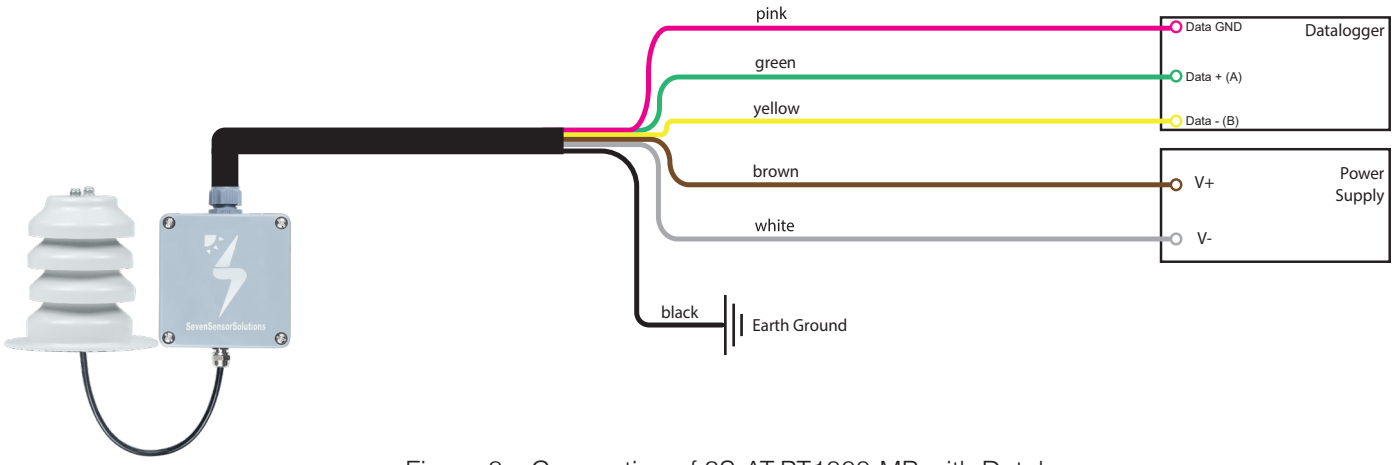

Figure 8 – Connection of 3S-AT-PT1000-MB with Datalogger

3S-AT-PT1000-I	
4...20 mA Current (I+)	Green
4...20 mA Current (I-)	Yellow
Power Supply (+)	Brown
Power Supply (-)	White

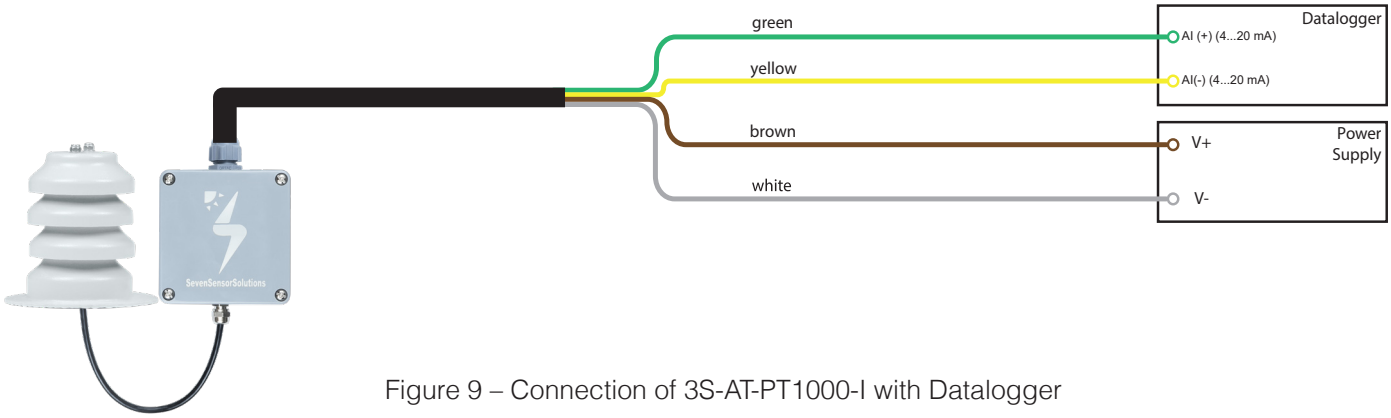

Figure 9 – Connection of 3S-AT-PT1000-I with Datalogger

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3S-AT-PT1000-U	
0-10 V (+)	Green
0-10 V (-)	Yellow
Power Supply (+)	Brown
Power Supply (-)	White

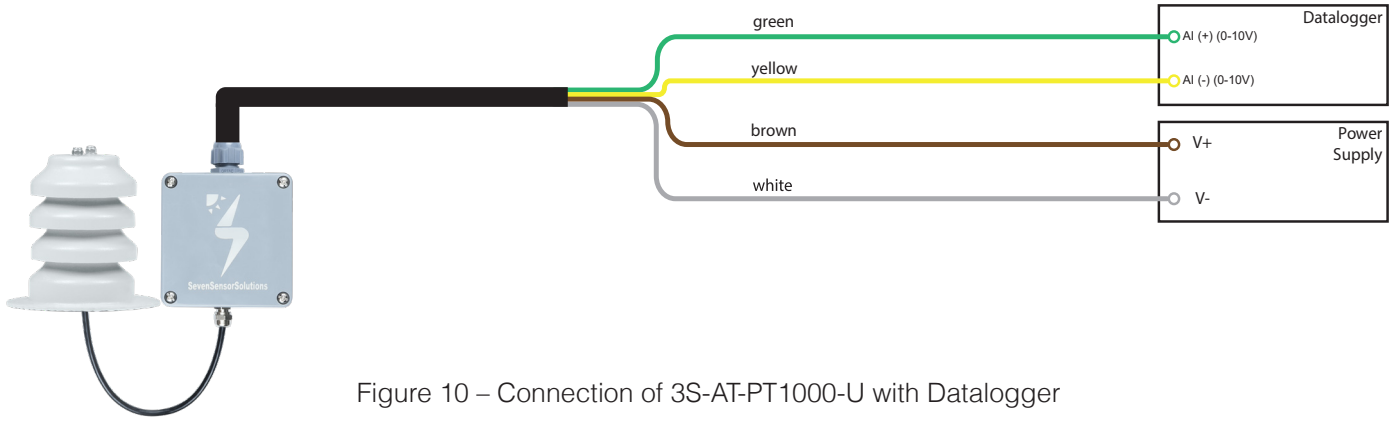

Figure 10 – Connection of 3S-AT-PT1000-U with Datalogger

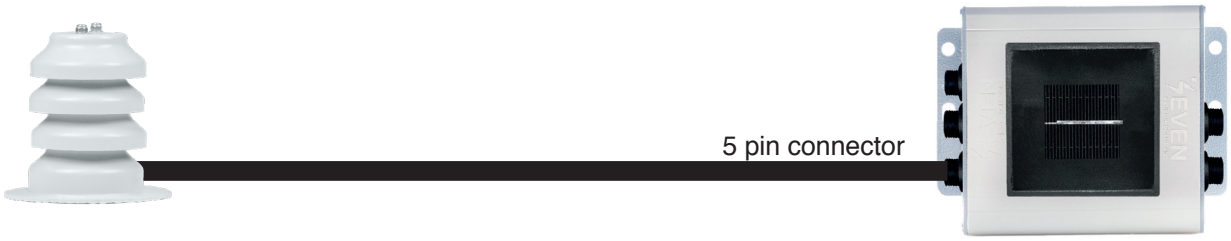

Figure 11 – Connection of the 3S-AT-PT1000 with Irradiance Sensor

4. 3S-MC-M-PT1000 Configuration and Communication

Once the Ambient 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 Ambient Temperature Sensor with the 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 Ambient Temperature Sensor on dataloggers.

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

3S-MC-M-PT1000 Configuration Tool is a software tool for testing communication and adjusting Modbus parameters on the Ambient Temperature Sensor with Modbus RTU Output (3S-AT-PT1000-MB).

A Windows® PC with a serial bus interface set as a serial COM port, 3S-AT-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-MC-M-PT1000_Configuration_Tool_v2.1.pdf

4.2. Modbus RTU Specifications

4.2.1. Supported Bus Protocol

The 3S-AT-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 Ambient 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.*

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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 Ambient Temperature Sensor holding register map is based on the “SunSpec Alliance” communication standards. All data marked in bold below are defined for the Ambient 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-AT-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
Sunspec Device Model Measurement Registers						
40069	40069	Block ID	int16	N/A	N/A	307
40070	40070	Length	int16	Registers	N/A	11
40071	40071	Air Temperature	int16	°C	0.1	Measured
Device Model Measurement Registers						
40100	40100	Block ID	int16	N/A	N/A	308
40101	40101	Length	int16	Registers	N/A	4
40106	40106	Air Temperature	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

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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
30029	**0x1D**	**Ambient Temperature**	**-40…+85 °C**	**0.1°C**

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

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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.*

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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

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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

5. Contact Details

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

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