OPERATING MANUAL

TP32MTT.03

Soil thermal profile

EN

V1.0

senseca

Contents

1 Introduction

The temperature probe **TP32MTT.03** is equipped with seven Pt100 sensors for the measurement of temperature at depth: +5 cm, 0, -5 cm, -10 cm, -20 cm, -50 cm, -1 m with respect to the soil level, according to the indications of the World Meteorological Organization (WMO).

The probe **TP32MTT.03.1** is equipped with six Pt100 sensors for the measurement of temperature at depth: +5 cm, 0, -5 cm, -10 cm, -20 cm, -50 cm with respect to the soil level.

The fiberglass tube ensures perfect impermeability and a high thermal insulation along the vertical axis.

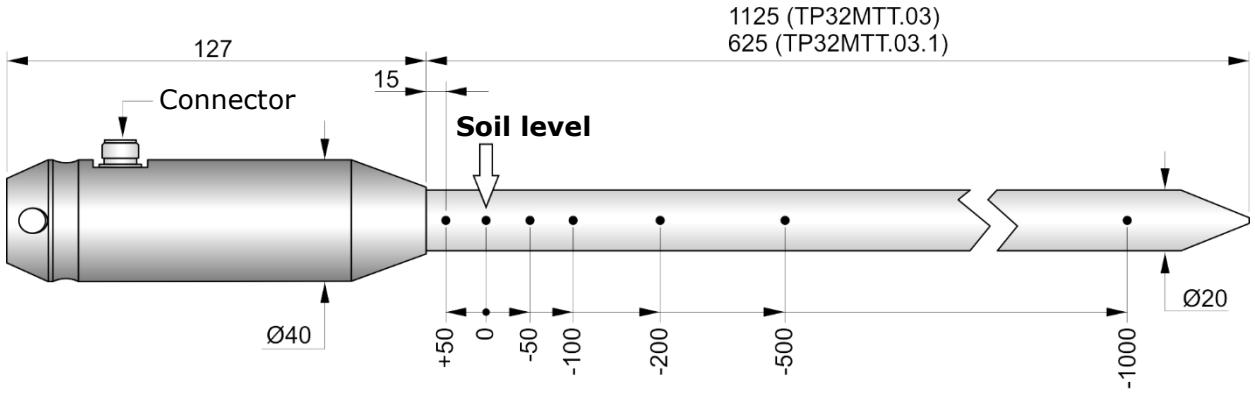
The RS485 Modbus-RTU digital output allows even very long connection cables to be used.

The M12 connector on the probe handle allows easy connection of the cable (optional).

2 Technical specifications

Sensors	Pt100 1/3 DIN
Resolution	0.01 °C
Accuracy	± 0.1 °C @ 0 °C
Operating temperature	Stem: -40…+125 °C Hand grip: -40…+85 °C
Temperature drift	0.003 %/°C @ 20 °C
Power supply	6…30 Vdc
Consumption	5 mA @ 12 Vdc
Output	RS485 Modbus-RTU
Connection	8-pole M12 male connector
Materials	Tube: fiberglass Tip: stainless steel Handle: anodized aluminium alloy with stainless steel top end
Protection Degree	IP 68

Dimensions (mm)



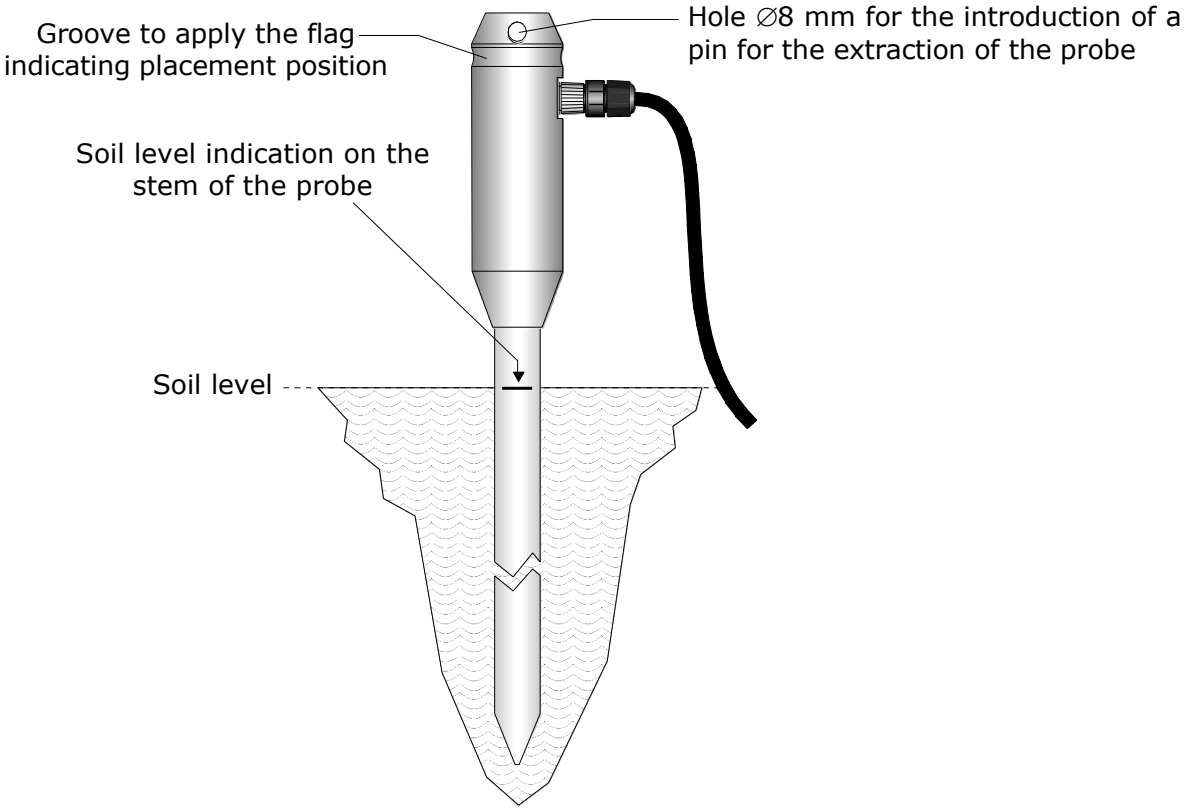
3 Installation

By means of an accessory, perform a hole into the soil deep enough to accommodate the stem of the probe.

Caution!
Never use the probe to make the hole in the soil, to avoid mechanical damage to the probe itself.

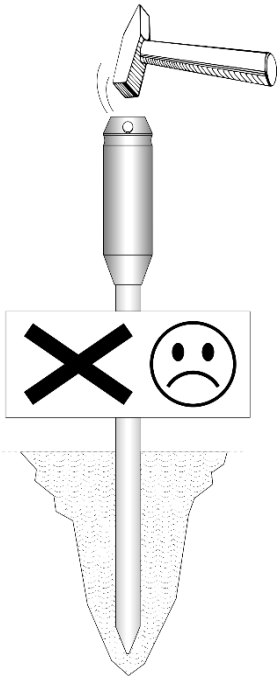
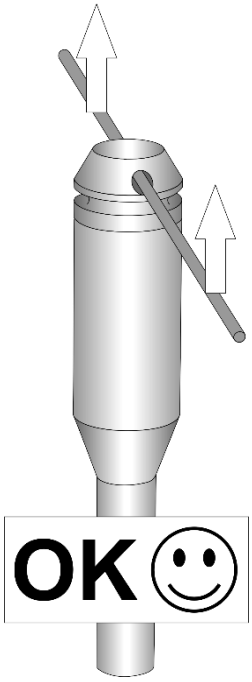
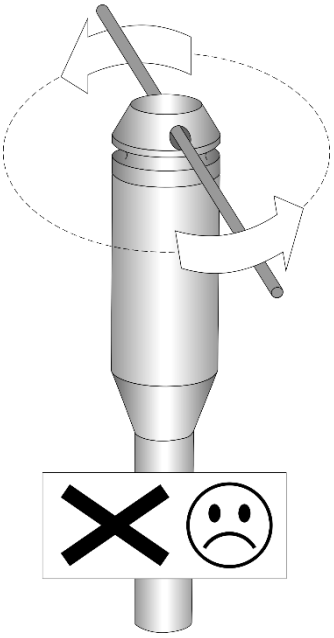
Once the hole has been performed in the soil, insert the stem of the probe so that the indicator of the zero level is in correspondence with the surface of the soil. The probe must be stable in a vertical position.

After the introduction of the probe into the hole, fill in the empty spaces between the soil and the stem of the probe with some soil made powder. To obtain accurate measurements, the soil should be in contact with the stem.

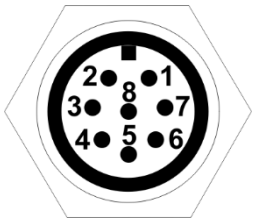


Attention!
Indicate the presence of the probe during the maintenance operations of the soil (e.g. lawn mowing, ploughing, mechanized harvesting, etc.).

To remove the probe from the soil, insert a pin into the ∅ 8mm hole at the top of the handle and pull it upwards. **Remove the probe vertically, avoiding its inclination or rotation during extraction** to avoid damaging the stem.

			
USE AN ACCESSORY TO MAKE THE HOLE IN THE SOIL	**DO NOT USE THE PROBE TO MAKE THE HOLE IN THE SOIL**	**TO REMOVE THE PROBE INSERT A PIN AND PULL UPWARDS**	**DO NOT ROTATE THE PROBE**

3.1 Electrical connections

Probe male connector (external view)		Function	CPM12-8D… wire color
	1	GND (Power supply negative)	Blue
	2	+Vdc (Power supply positive)	Red
	3	NC	--
	4	DATA – (RS485)	Brown
	5	DATA + (RS485)	White
	6	Metal handle	Shield (Black)
	7	NC	--
	8	NC	--

Before connecting the probe to the network, set the address and the communication parameters, if different from the factory preset (see "Setting of RS485 Modbus-RTU parameters" on page 8).

4 Setting of RS485 Modbus-RTU parameters

By default, the probe has Modbus address **1** and communication parameters 19200, 8E1. The address and the communication parameters can be changed as shown below.

1. Connect the probe to the PC by using the optional **CP24** cable, with built-in RS485/USB converter, which also allow the pyranometer to be powered via the USB port. To use the CP24 cable, the related USB drivers must be installed in the PC.

   Alternatively, it is possible to use a standard RS485/USB or RS485/RS232 converter, powering the probe separately.
2. Start a standard serial communication program and set the communication parameters "57600, 8N2" and the COM port number to which the probe is connected.
3. Power cycle the probe (if the CP24 cable is used, disconnect it for a few seconds from the PC USB port, then reconnect it) and send the command **@** within 10 seconds from power on (the probe replies **&|** if the command @ is recognized).

   Note: if the probe does not receive the **@** command within 10 seconds, the Modbus mode is activated.
4. Send the command **CAL USER ON** to enable the configuration change. The command CAL USER ON is not required only for reading the settings. The command CAL USER ON is automatically disabled after a few minutes of inactivity.
5. Send the following serial commands.

Command	Reply	Description
CMAn	&|	Sets the Modbus-RTU address (1…247) to n. Default=1
RMA	n|	Reads the Modbus-RTU address.
CMBn	&|	Sets the Baud Rate: ▪ 9600 if n=0 ▪ 19200 if n=1 (*default*)
RMB	n|	Reads the Baud Rate setting (0 ⇒ 9600, 1 ⇒ 19200).
CMPn	&|	Sets parity and stop bits (data bits = 8 fixed): ▪ 8N1 if n=0 ▪ 8N2 se n=1 ▪ 8E1 if n=2 (*default*) ▪ 8E2 se n=3 ▪ 8O1 if n=4 ▪ 8O2 se n=5
RMP	n|	Reads the parity/stop bits setting (e.g., 2 ⇒ 8E1).
CMWn	&|	Sets waiting time after transmission with Modbus-RTU protocol: ▪ Immediate reception if n=0 (violates protocol) ▪ Waiting 3.5 characters if n=1 (respects protocol) *Default* : Waiting 3.5 characters (n=1)
RMW	n|	Reads the waiting time setting (e.g., 1 ⇒ wait 3.5 char.).

5 Modbus-RTU protocol

The probe enters RS485 Modbus-RTU mode after 10 seconds from power on.

Below is the list of registers.

Input Registers:

Address	Description	Format
0	Temperature in °C at -1 m from the soil [x100] *Not available in TP32MTT.03.1 model*	16-bit Integer
1	Temperature in °C at -50 cm from the soil [x100]	16-bit Integer
2	Temperature in °C at -20 cm from the soil [x100]	16-bit Integer
3	Temperature in °C at -10 cm from the soil [x100]	16-bit Integer
4	Temperature in °C at -5 cm from the soil [x100]	16-bit Integer
5	Temperature in °C at the soil level [x100]	Intero 16 bit
6	Temperature in °C at +5 cm from the soil [x100]	Intero 16 bit
7	Temperature in °F at -1 m from the soil [x100] *Not available in TP32MTT.03.1 model*	Intero 16 bit
8	Temperature in °F at -50 cm from the soil [x100]	Intero 16 bit
9	Temperature in °F at -20 cm from the soil [x100]	Intero 16 bit
10	Temperature in °F at -10 cm from the soil [x100]	Intero 16 bit
11	Temperature in °F at -5 cm from the soil [x100]	Intero 16 bit
12	Temperature in °F at the soil level [x100]	Intero 16 bit
13	Temperature in °F at +5 cm from the soil [x100]	Intero 16 bit

In case of measurement error, -9999 is returned.

Holding Registers:

Address	Description	Format
2	Status register	16-bit Integer

The 16-bit status register gives the following information:

Bit	Description
0…8	If equal to 1, a functional error with the circuit board or an error in the calibration data occurred
9	If equal to 1, measurement error of the sensor at -1 m
10	If equal to 1, measurement error of the sensor at -50 cm
11	If equal to 1, measurement error of the sensor at -20 cm
12	If equal to 1, measurement error of the sensor at -10 cm
13	If equal to 1, measurement error of the sensor at -5 cm
14	If equal to 1, measurement error of the sensor at 0 cm
15	If equal to 1, measurement error of the sensor at +5 cm

The register is cleared after reading. If the error condition persists, the value 1 is restored.

6 Maintenance

The sensor does not require special maintenance.

It is recommended to perform periodic verification of proper leveling with respect to the ground and correct verticality. Keep the connector area clean.

7 Safety instructions

The probe proper operation and operating safety can be ensured only in the climatic conditions specified in this manual and if all standard safety measures as well as the specific measures described in this manual are followed.

Do not use the probe in places where there are:

- Corrosive or flammable gases.
- Direct vibrations or shocks to the instrument.
- High-intensity electromagnetic fields, static electricity.

User obligations

The instrument operator shall follow the directives and regulations below that refer to the treatment of dangerous materials:

- EU directives on workplace safety.
- National law regulations on workplace safety.
- Accident prevention regulations.

8 Accessories ordering codes

The probe is supplied with M12 female free connector, if the optional cable is not ordered.

The cables must be ordered separately.

CPM12-8D...	Cable with 8-pole M12 connector on one end, open wires on the other end. Length 5 m (CPM12-8D.5) or 10 m (CPM12-8D.10).
CP24	PC connecting cable for the configuration of the Modbus parameters. With built-in RS485/USB converter. 8-pole M12 connector on probe side and A-type USB connector on PC side.

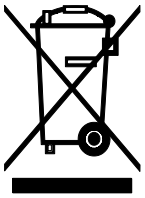
WARRANTY

The manufacturer is required to respond to the "factory warranty" only in those cases provided by Legislative Decree 6 September 2005 - n. 206. Each instrument is sold after rigorous inspections; if any manufacturing defect is found, it is necessary to contact the distributor where the instrument was purchased from. During the warranty period (24 months from the date of invoice) any manufacturing defects found will be repaired free of charge. Misuse, wear, neglect, lack or inefficient maintenance as well as theft and damage during transport are excluded. Warranty does not apply if changes, tampering or unauthorized repairs are made on the product. Solutions, probes, electrodes and microphones are not guaranteed as the improper use, even for a few minutes, may cause irreparable damages.
The manufacturer repairs the products that show defects of construction in accordance with the terms and conditions of warranty included in the manual of the product. For any dispute, the competent court is the Court of Padua. The Italian law and the "Convention on Contracts for the International Sales of Goods" apply.

TECHNICAL INFORMATION

The quality level of our instruments is the result of the continuous product development. This may lead to differences between the information reported in the manual and the instrument you have purchased.
We reserve the right to change technical specifications and dimensions to fit the product requirements without prior notice.

DISPOSAL INFORMATION



Electrical and electronic equipment marked with specific symbol in compliance with 2012/19/EU Directive must be disposed of separately from household waste. European users can hand them over to the dealer or to the manufacturer when purchasing a new electrical and electronic equipment, or to a WEEE collection point designated by local authorities. Illegal disposal is punished by law.

Disposing of electrical and electronic equipment separately from normal waste helps to preserve natural resources and allows materials to be recycled in an environmentally friendly way without risks to human health.

CE RoHS

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