Temperature Sensor

User Manual

UNISENSE
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Temperature Sensor User Manual

UNISENSE A/S

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1. WARRANTY AND LIABILITY

1.1 Notice to Purchaser

This product is for research use only. Not for use in human diagnostic or therapeutic procedures.

1.2 Warning

Microsensors have very pointed tips and must be handled with care to avoid personal injury and only by trained personnel. Unisense A/S recommends users to attend instruction courses to ensure proper use of the products.

1.3 Warranty and Liability

The Temperature sensor is covered by a 90 days (glass sensor) or a one year (Temp UniAmp + TP2000) limited warranty. Microsensors are a consumable. Unisense will only replace dysfunctional sensors if they have been tested according with the instructions in the manual within 14 days of receipt of the sensor(s).
The warranty does not include repair or replacement necessitated by accident, neglect, misuse, unauthorized repair, or modification of the product. In no event will Unisense A/S be liable for any direct, indirect, consequential or incidental damages, including lost profits, or for any claim by any third party, arising out of the use, the results of use, or the inability to use this product.

Unisense mechanical and electronic laboratory instruments must only be used under normal laboratory conditions and a dry and clean environment. Unisense assumes no liability for damages on laboratory instruments due to unintended field use or exposure to dust, humidity or corrosive environments.

1.4 Repair and Adjustment

Sensors and electrodes cannot be repaired. Equipment that is not covered by the warranty will, if possible, be repaired by Unisense A/S with appropriate charges paid by the customer. In case of return of equipment please contact us for return authorization.

For further information please see the document General Terms of Sale and Delivery of Unisense A/S as well as the manuals for the respective products.

2. CONGRATULATIONS WITH YOUR NEW PRODUCT!

2.1 Support, ordering, and contact information

If you wish to order additional products or if you encounter any problems and need scientific/technical assistance, please do not hesitate to contact our sales and support team. We will respond to your inquiry within one working day.

E-mail: sales@unisense.com
Unisense A/S
Langdyssen 5
DK-8200 Aarhus N, Denmark
Tel: +45 8944 9500

Further documentation and support is available at our website www.unisense.com.

3. REPLACEMENT OF SENSORS

Unisense will replace sensors that have been damaged during shipment provided that:

- The sensors were tested within 2 weeks after receipt in accordance with the delivery note and the manual.
- The seal is still intact (TP-type sensors, Table 1).
- The sensors are returned to Unisense for inspection within two weeks (contact the sales team before returning).
- The sensors are correctly packed for return to Unisense, in accordance with the note included in the sensor shipping box.

A sensor with sign of physical damage and with a broken seal, indicating that it has been removed from the protection tube, will not be replaced (TP-type sensors, Table 1).

Sensor	Amplifier	Calibration	Principle
Temp-UniAmp	UniAmp	Pre-calibrated	PT1000
Opto-Temp Field	FOM-UniAmp	Pre-calibrated	PT1000
Op-Temp	MOM	Pre-calibrated	PT1000
Op-Temp Field	FOM	Pre-calibrated	PT1000
TP-200	UniAmp, MMM, FMM, In situ	Calibration by user	Thermocouple
TP-500	UniAmp, MMM, FMM, In situ	Calibration by user	Thermocouple
TP-MR	UniAmp, MMM, FMM, In situ	Calibration by user	Thermocouple
TP-N	UniAmp, MMM, FMM, In situ	Calibration by user	Thermocouple
TP-NP	UniAmp, MMM, FMM, In situ	Calibration by user	Thermocouple
TP-2000	MMM, FMM	Calibration by user	Thermocouple

Table 1: Sensor types

Amplifier types:
UniAmp = UniAmp laboratory amplifiers
MMM = Microsensor Multimeter and Microsensor Monometer
FMM = Field Multimeter
In Situ = In Situ UniAmp and In Situ Amplifier
FOM-UniAmp = Field Opto UniAmp
MOM = MicroOptode Meter
FOM = Field Optode Meter

NOTE: Opto-F1 and Opto-F4 UniAmp are only compatible with Temp-UniAmp, not any other temperature sensor

See https://www.unisense.com/temperature for detailed specifications and customizations.

4. OVERVIEW

This manual covers all Unisense temperature sensors as listed in Table 1.

WARNING: Unisense sensors are neither intended nor approved for use in humans

All sensors based on a PT1000 element (see Table 1) are pre-calibrated and the temperature will be shown in °C in the uSense software.

Sensors based on thermocouple elements will give mV signals in the uSense software and will need to be calibrated to show the temperature in °C.

The TP2000 and the PT1000 based temperatures sensors are all robust sensors with a tip diameter of 2 mm (see Table 2). They are general purpose sensors and can be used in many applications where temperature measurements are needed for monitoring or temperature compensation of other sensor signals.

TP-2000

The Unisense glass temperature microsensor consists of a thermocouple inside a tapered glass capillary. This sensor can be used to determine temperature micro gradients in different environments e.g. hot spring biofilms, compost piles, and sediments with steep temperature gradients due to volcanic activity. With tip diameters down to 200 µm, the Unisense temperature microsensor is ideal for temperature measurements with a very high spatial resolution.

TP-200

Temp-UniAmp

5. GETTING STARTED

5.1 Unpacking a new sensor

The sensors must be tested within 2 weeks after receipt to verify that they have survived the transport in order to maintain the warranty (please see 1.3 Warranty and Liability).

The PT1000 based sensors (Temp-UniAmp, Opto-Temp Field, Op-Temp, Op-Temp Field) can be used right out of the box without calibration.

When receiving a new microsensor remove the shock-absorbing grey plastic net.

WARNING: Do not remove the seal and protective plastic tube before these steps and calibration are succesfully completed.

5.2 Connecting the temperature sensor

The temperature sensors must be connected to the temperature connector on the amplifier:

- Laboratory UniAmp, Multimeter, and Monometer: Connector is labelled T.
- Field Microsensor Multimeter: Channel 8.
- Field Opto UniAmp and Field Optodemeter: Connector for temperature sensor (only shallow version, deep version has built in temperature sensor).
- In Situ UniAmp and In Situ Amplifier: Directly mounted on an in situ temperature amplifier.

5.3 Calibration

The thermocouple-based temperature sensors respond linearly to changes in temperature and only a two-point calibration is required.

Prepare two solutions with known temperature, one below and one above the temperature range where the measurements will be done. Measure the temperature of these solutions with a high accuracy thermometer and perform a two-point calibration in the uSense software. Please see the uSense Solutions User Manual which can be downloaded from: unisense. com/manuals/

6. MEASUREMENTS

6.1 Microsensors

The glass microsensors with a tip diameter of 200 or 500 µm (TP-200, TP-500) are fragile and should be positioned with a Micromanipulator. We recommend that measurements are performed in a stabilized set-up fixed on a sturdy table, free of moving or vibrating devices. We recommend the Unisense Lab Stand (LS) and the Unisense micromanipulator MM-33 or MM33-2 for laboratory use. For in situ use we recommend our In Situ Stand (IS19) and a micromanipulator.

The needle type sensors are glass sensors mounted in a needle and should be treated with care. It is important not to bend the needle as this may cause the glass sensor inside to break.

The TP-MR is designed for use with the Unisense Microrespiration System which will safely guide the sensor into the respiration chambers.

WARNING: Always introduce and retract the temperature microsensor axially using a micromanipulator and a stable stand when measuring in solid or semisolid substrate like sediment, tissue, biofilms, microbial mats etc.

6.2 Macrosensors

The macro temperature sensors (Temp-UniAmp, Opto-Temp Field, Op-Temp, Op-Temp Field, TP-2000) may be used as a normal temperature sensor.

6.3 Electrical noise

The electrical current generated by the high-impedance temperature microsensor is very small and may be affected by electrical noise. The Unisense temperature microsensor is shielded against electrical noise, however, strong electrical fields may interfere with the sensor signal. Minimize this by switching off unnecessary electrical/mechanical equipment and avoid touching sensor or cables during operation. On suspicion of sensor damage, repeat calibration and see Troubleshooting.

7. STORAGE AND MAINTENANCE

7.1 Storage

Store the sensor the same way it was shipped. Mechanical shock should be avoided for the glass sensors.

7.2 Cleaning the sensor

The glass sensors can be cleaned with different solutions. The standard method is to rinse it with ethanol, followed by 0.01 M HCl and finally water. This will remove most substances. Alternatively, it is possible to rinse with 0.1M NaOH, isopropanol or a detergent.

The macro sensors may be cleaned in a similar way as the glass sensor but the exposure to acidic or alkaline solutions should be brief, followed by rinsing with water.

REFERENCES

Revsbech, N. P., and B. B. Jørgensen. 1986. Microsensors: Their Use in Microbial Ecology, p. 293-352. In K. C. Marshall (ed.), Advances in Microbial Ecology, vol. 9. Plenum, New York.

TROUBLESHOOTING

Problem	Sensor signal drifts.
Possible cause	Sensor tip is broken.
Solution	Replace the sensor.

Problem	Noisy signal.
Possible cause	Electrical interference.
Solution 1	Turn off other equipment in the vicinity that could possibly emit electrical noise.
Solution 2	Move the setup to a room without such equipment e.g. an office. If the noise disappears, it is likelythat there is equipment in the original location that emits noise.
Problem	The sensor tip is broken.
Solution	Replace the NO microsensor.

If you encounter other problems and need scientific/technical assistance, please contact sales@unisense.com for online support (we will answer you within one workday).

SPECIFICATIONS

	TP2000	Temp-UniAmp*	Glass
Outside tip diameter	2 mm	2 mm	TP-200 (180-220µm) TP-500 (400-600µm) TP-N (1.1 x 40 mm) TP-NP (1.6 x 40 mm) TP-MR (400-600 µm)
Diameter 20 mm from tip	2 mm	2 mm	<2 mm
Diameter 50 mm from tip	-	2 mm	8 mm
Total length	40 mm	50 mm	150-250 mm
Shaft diameter	8 mm	6 mm	8 mm
Cabling etc.			
Cable	Habia	4-wire PTFE	Standard thermocouple cable (type T)
Cable length	1.5-2 m	2 m	1.5-2 m
Connector	Lemo	Lemo	Standard thermocouple connector (type T)
Characteristics			
Type	Mineral insulated thermocouple	PT1000	Thermocouple, copper/ constantan (type T)
Waterproof	Yes	Yes	Yes
Temperature range	-40°C-80°C	-40°C-80°C	-10°C-70°C
Temperature range tip	-40°C-100°C	-40°C-80°C	-20°C-100°C
Guaranteed lifetime	1 year	1 year	3 months
Expected lifetime	Years	Years	>1 year
Spatial resolution	N/A	N/A	About 2 times outside tip diameter
Output	40 µV per °C	40 µV per °C	40 µV per °C
Resolution	0.1°C	<0.1°C	0.1°C
Response time (90%)	< 3 s	< 3 s	< 3 s

Table 2: Temperature sensor specifications

*Temp-UniAmp, Opto-Temp Field, Op-Temp, Op-Temp Field have same specifications but different connectors.

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