

TEMPERATURE SENSOR USER MANUAL



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UNISENSE A/S



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WARRANTY AND LIABILITY

NOTICE TO PURCHASER

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

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.

WARRANTY AND LIABILITY

The Temperature sensor is covered by a 90 days (glass sensor) or a two year (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 in 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.

REPAIR OR 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.

CONGRATULATIONS WITH YOUR NEW PRODUCT!

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

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DK-8200 Aarhus N, Denmark
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Further documentation and support is available at our website www.unisense.com.

REPLACEMENT OF SENSORS

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

- *The sensors were tested immediately upon receipt in accordance with the delivery note and the manual*
- *The seal is still intact.*
- *The sensors are returned to Unisense for inspection within two weeks.*
- *The sensors are correctly packed for return to Unisense, in accordance with the note included in the sensor box.*

RECOMMENDED AMPLIFIERS

The TP2000 temperature sensor is for use with the Unisense Microsensor Multimeter or Microsensor Monometer.

The TP200 and TP-MR sensors must be used with a Unisense T301 thermocouple meter.

OVERVIEW

This manual covers all the Unisense temperature sensors: TP2000, TP200, and TP-MR (built into a guide).

The standard Unisense thermosensor, TP2000, is a mineral insulated thermocouple with a tip diameter of 2 mm. The thermosensor can be used for most applications where a temperature measurement is required for monitoring or temperature compensation purposes.

The Unisense glass thermo 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 springs biofilms, compost piles, and sediments with steep temperature gradients due to volcanic activity. With tip diameters down to 200 microns, the Unisense temperature microsensor facilitates temperature measurements with a very high spatial resolution.

WARNING

*Unisense sensors
are neither
intended nor
approved for use
on humans*



Left: a TP-MR and a TP200 glass temperature sensor



Right: A TP2000 temperature sensor

GETTING STARTED

UNPACKING A NEW SENSOR

When receiving a new microsensor remove the shock-absorbing grey plastic net. **Please do not remove the seal and protective tube before the following steps are successfully completed.**

WARNING

Do not remove seal and protective plastic tube before the following steps are successfully completed.

CONNECT THE TEMPERATURE SENSOR

Connect the Unisense temperature microsensor to the input terminal of the T301 or the Microsensor Multimeter or Monometer.

CALIBRATION

Without calibration, the Unisense temperature sensor in combination with the Unisense T301 thermometer has a precision of $\pm 1^\circ\text{C}$. To verify the function and/or to achieve an even better precision (down to $\pm 0.1^\circ\text{C}$), perform the following calibration procedure: Prepare two solutions with well defined temperature, one slightly above and one slightly below the temperature range in which the measurements are expected to be performed.

To ensure that the calibration temperatures are well-defined, use for instance boiling water versus ice-water, or monitor the temperature of the solutions with an independent thermometer with a better precision than 1°C .

Microsensor Multimeter/Monometer: Perform the calibrations in the software. Please consult the relevant software manual.

T301: If the display of the T301 deviates from the independent thermometer, you can correct subsequent measurements by adding the difference to the display value.



The Unisense T301 thermocouple meter which is used for the TP-MR and TP200 temperature microsensors.

MEASUREMENTS

MOUNTING THE SENSOR

Although the Unisense microsensors are made of glass, the tip is flexible and can adjust slightly around physical obstacles. However, large obstacles like stones or coarse lateral movements of the sensor when the tip is in contact with a solid substrate may cause the tip to break.

Due to the small size of the microsensor tip and to the steepness of gradients in many environments, even a displacement of the sensor tip of few microns may change its environment.

Therefore 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 LS18 and the Unisense micromanipulator MM-33 (MM33-2 double) for laboratory use. For in situ use we recommend our in situ stand (IS19) and a micromanipulator.

ELECTRICAL NOISE

As well as the physical size, the electrical current generated by the high-impedance temperature microsensor is very small. Although the Unisense temperature microsensor is quite resistant to electrical noise from the environment, electrical fields may interfere with the sensor signal. Minimize this by switching off unnecessary electrical/mechanical equipment and avoid touching sensor or wires during operation.

On suspicion of sensor damage, repeat calibration and consult “Troubleshooting”.

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.

STORAGE AND MAINTENANCE

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

CLEANING THE SENSOR

Depending on which substance is present on the sensor tip, the glass sensors can be cleaned with different solutes. The standard method is to rinse with 96% 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 other detergent.

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.

TROUBLE SHOOTING

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

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)





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