

OPERATION AND INSTALLATION MANUAL

Structural integrity sensor - ULTRA TempHu

V1.0.4 Published on 2026-04-15

General information

ULTRA TempHu sensor

The ULTRA TempHu is advanced technology heavy duty outdoor sensor applied for the full sensing of temperature with 4x temperature probes. ULTRA TempHu is enclosed in a room sensor box and is designed to be wall mounted. ULTRA TempHu is completely wireless and powered by 2x “D cell” lithium batteries. The integrated advanced intelligent (AI) computational algorithm enables reliable capability of the measurement the magnitude of the temperature and constant auto self or manual calibration through the downlink messaging. The data transmitted from the sensor is based on Class A LoRaWAN® wireless network.



Device is especially useful for:

- Outdoor heavy duty temperature measurement
- Mission critical applications
- Industrial factories
- Heat pumps
- Renewable power plants
- Heat substations and stations

General Parameter

Battery Voltage

Indicates the current battery voltage level of the device. This parameter is used for monitoring the power condition of the sensor and estimating maintenance or battery replacement needs.

Specific Parameters

Temperature (probe 1 to 4)

Indicates temperature at the probe in Celsius (MSB byte -128 to +128 C, LSB byte, value after decimal point)

Markings

On the backside of the sensor there will be a label indicating sensor name, serial number, production date and QR code.

Applications

The ULTRA TempHu sensor is designed for wireless multi-point temperature monitoring in industrial, commercial, energy, and critical infrastructure applications. Equipped with four independent temperature probes, it enables simultaneous monitoring of multiple measurement points from a single device, providing continuous temperature data for predictive maintenance, process optimization, and equipment protection.

The sensor is particularly suitable for harsh outdoor and industrial environments where reliable long-term temperature monitoring is required.

Typical Application Areas

HVAC and Heat Pump Monitoring

The sensor can be installed on:

- heat pumps
- HVAC systems

- boilers
- chillers
- heating circuits
- cooling systems

Typical applications include:

- supply and return temperature measurement
- compressor temperature monitoring
- heat exchanger monitoring
- pipeline temperature measurement
- system performance verification

This enables:

- improved energy efficiency
- fault detection
- preventive maintenance
- optimized HVAC operation

Industrial Equipment Monitoring

The sensor can be installed on:

- industrial machinery
- process equipment
- production lines
- manufacturing systems
- compressors
- pumps
- motors

It is used to monitor:

- equipment operating temperature
- bearing temperature
- motor housing temperature
- process temperatures
- abnormal temperature rise
- thermal operating trends

This enables early identification of:

- overheating components
- cooling system failures

- abnormal operating conditions
- equipment degradation

Industrial Process Temperature Monitoring

The device is suitable for monitoring:

- production processes
- industrial tanks
- pipelines
- reactors
- processing equipment
- manufacturing systems

It is used for:

- continuous process temperature monitoring
- multi-point temperature measurement
- thermal process verification
- abnormal temperature detection

This provides:

- improved process stability
- higher product quality
- reduced process interruptions
- enhanced operational safety

Cold Chain and Storage Monitoring

The sensor can be deployed in:

- refrigerated warehouses
- cold storage rooms
- food processing facilities
- pharmaceutical storage
- industrial freezers
- logistics facilities

Typical monitored parameters include:

- storage temperature
- multiple zone temperatures
- cooling system performance
- temperature deviations

This supports:

- product quality assurance
- regulatory compliance
- early failure detection
- reduced product losses

Building and Infrastructure Monitoring**The sensor is suitable for installation on:**

- commercial buildings
- industrial facilities
- utility buildings
- public infrastructure
- technical rooms
- outdoor installations

It is used to monitor:

- ambient temperature
- equipment room temperature
- heating system performance
- environmental conditions
- outdoor temperature

This enables:

- remote environmental monitoring
- improved facility management
- preventive maintenance planning
- optimized energy management

Smart Industry and IIoT Applications

The sensor supports industrial digitalization by providing reliable wireless temperature monitoring through LoRaWAN® networks.

Typical applications include:

- Industry 4.0 deployments
- predictive maintenance systems
- remote asset monitoring
- smart factory platforms
- cloud-based temperature monitoring
- enterprise IoT systems

This supports:

- continuous remote monitoring
- reduced maintenance costs
- improved operational visibility
- data-driven maintenance planning
- long-term asset health management

Electrical Equipment Monitoring**The device is suitable for monitoring:**

- electrical cabinets
- switchgear
- circuit breakers
- transformers
- busbars
- cable terminations
- power distribution equipment

Typical monitored parameters include:

- conductor temperature
- terminal temperature
- transformer surface temperature
- hotspot development
- abnormal thermal conditions

This helps prevent:

- electrical failures
- insulation degradation
- overheating events
- unplanned downtime

Installation Manual recommendations for typical installation**1. Installation Principle**

The ULTRA TempHu sensor is designed for fixed installation in industrial and outdoor environments where reliable long-term temperature monitoring is required.

The system consists of:

- ULTRA TempHu enclosure
- four external temperature probes

- integrated LoRaWAN® wireless communication

The enclosure should be mounted close to the monitored equipment while ensuring that the temperature probes can be routed safely to the required measurement locations.

2. Temperature Probe Installation

2.1 Probe Mounting Recommendations

Each temperature probe should be installed directly on or inside the object whose temperature is to be monitored.

Typical measurement points include:

- pipes
- motors
- bearings
- pumps
- heat exchangers
- electrical busbars
- transformers
- electrical terminals
- metal structures
- industrial machinery

For best measurement accuracy:

- ensure good thermal contact between the probe and the monitored surface
- install the probe firmly to prevent movement
- avoid air gaps between the probe and the monitored object
- avoid placing probes near unintended heat sources unless they are the measurement target

2.2 Surface Mounting

For surface temperature measurements, it is recommended to:

- clean the mounting surface before installation
- use an appropriate thermal interface material when required
- secure the probe using suitable clamps, brackets, or metal fasteners
- insulate the probe if necessary to minimize the influence of ambient air temperature

The fastening method should not damage the probe cable or sensing element.

2.3 Cable Protection

Temperature probe cables should be routed carefully to prevent mechanical damage.

Recommendations:

- avoid excessive pulling force
- avoid sharp bends
- protect cables from abrasion
- secure cables using cable ties or mounting clips
- keep cables away from moving machinery whenever possible

Where necessary, protective conduit or flexible cable protection should be used.

3. Enclosure Installation

3.1 Mounting Location

The ULTRA TempHu enclosure should be mounted:

- on a rigid wall
- on industrial equipment
- inside electrical cabinets (when permitted by the application)
- on structural elements close to the monitored equipment

The enclosure should be positioned to minimize cable length while allowing convenient access for maintenance.

Avoid installation in locations where the enclosure may be exposed to:

- continuous mechanical impact
- excessive vibration
- standing water
- direct flame
- temperatures outside the specified operating limits

3.2 Fastening Method

The enclosure is designed for permanent installation using its integrated mounting holes.

Recommended fastening:

- stainless steel screws
- metal bolts
- wall anchors when mounting on concrete or masonry

Typical specification:

- screw diameter: 4–5 mm
- screw length: 30–40 mm
- stainless steel washers recommended

3.3 Installation Procedure

1. Select an appropriate mounting location.
2. Mark the enclosure mounting holes.
3. Drill holes if required.
4. Install anchors where necessary.
5. Position the enclosure.
6. Secure the enclosure using suitable screws.
7. Verify that the enclosure is rigidly mounted.

Important:

- Do not mount the enclosure on unstable or vibrating surfaces unless vibration monitoring is intended.
- Ensure the enclosure remains accessible for battery replacement and servicing.

4. Cable Routing

Route all temperature probe cables carefully between the enclosure and measurement points.

Recommendations:

- keep cable runs as short as practical
- avoid routing near high-voltage power cables where possible
- protect cables against mechanical damage
- use cable trays or conduits where appropriate

- secure cables to prevent movement caused by vibration

Avoid excessive bending or twisting of the probe cables.

5. Environmental Considerations

To ensure reliable temperature measurements:

- protect probes from unnecessary mechanical damage
- avoid exposing cables to sharp edges
- prevent water accumulation around cable entries
- avoid unnecessary exposure to aggressive chemicals unless the probes are designed for such environments
- ensure cable glands remain properly tightened to maintain enclosure protection

6. Installation Verification

After installation:

- verify that all probes are securely attached
- inspect cable routing for mechanical stress
- verify enclosure mounting
- confirm LoRaWAN® communication
- compare measured temperatures with a reference thermometer if required
- ensure all four measurement channels report valid values

7. General Notes

- Installation shall be performed by qualified personnel.
- Follow all applicable electrical and industrial safety regulations.
- Do not modify the sensor enclosure or temperature probes.
- Do not exceed the specified operating temperature range of the sensor or probes.
- Inspect the installation periodically for cable damage, loose fasteners, or environmental wear.
- Replace damaged cables or probes immediately to ensure reliable operation.

Push button and LED indicator description:

- Once sensor is installed reset button will be pushed in the sensor, it will automatically attempt to connect to the LoRaWAN network and the LED indicator will start to be blinking / flashing for 15 seconds.
- In case of the successful connection to the LoRaWAN network LED indicator will stay on for 3 seconds and LED indicator will stop flashing and go dark. This means sensor successfully connected to the LoRaWAN network.
- If the sensor will not connect on the initial try, it will attempt to connect to the LoRaWAN network after 10 seconds, then after 60 seconds, then after 10 minutes, then after 1 hour, then after 24 hours till successful connection to the LoRaWAN network.
- The sensor will restart by pressing the button on the sensor and it will attempt instantly to connect the LoRaWAN network.

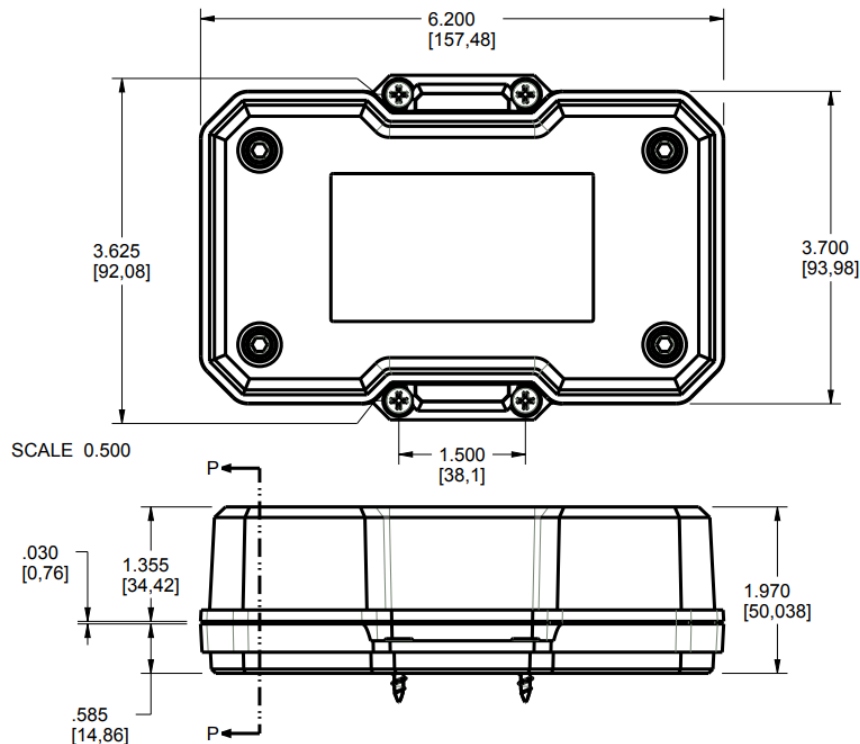


The ULTRA TempHu sensor is maintenance free except replacement of the batteries.

Calibration

Factory calibrates the ULTRA TempHu sensor when it is produced. The ULTRA TempHu sensor is maintenance-free in normal indoor environments due to the Nano sensorics integrated intelligent computational algorithms (AI) and Automatic Baseline Correction (ABC) technology.

Sensor dimensions:



Important safety information

Read this manual before attempting to install the device. UAB „ Nano sensorics” will not accept responsibility for any damage or injury resulting from not following the instructions in this manual.



- The sensor is for indoor or outdoor use;
- Do not disassemble, crush, puncture, short internal circuits;
- Remove batteries if the sensor is not used, discharged battery has to be removed from the battery sensor, in this case left batteries might leak and damage the sensor;
- Keep the battery or device dry and away from water or any liquid as it may cause a short circuit;
- Replace batteries only with the same or equivalent type recommended by the manufacturer;
- Discard used batteries according to the manufacturer's instructions;
- Do not bend, deform, shred, microwave, paint the sensors, or other hardware;
- Do not insert external material into any opening on the sensors;
- Disassembling or puncturing the battery (whether integrated or removable) can cause an explosion or fire;
- Do not dry the sensors or battery with an external heat source such as a microwave oven or hairdryer;
- Observe proper precautions when handling batteries. Batteries may leak or explode if improperly handled;
- The sensor is not applied as a metrological, commercial accounting purposes and UAB „Nano sensorics“ will not be held liable for any damage which may result from inaccurate readings;
- Do not use any detergent or alcohol to clean the device;
- Clean gently with softly moisture cloth.

Regulations

UAB “Nano sensorics” is the company which develops and produce highly innovative sensors with integrated intelligent computational algorithms (AI) enabling extremely low power data transmission. Declaration of conformity Hereby, UAB „Nano sensorics“ declares that BRIDGE.AI complies with the essential requirements and other relevant provisions of Directive CEM 2014/30/UE, BT 2014/35/UE, RED 2014/53/UE, CE, RoHS

This document contains proprietary technical information which is the property of UAB „Nano sensorics“. All information must not to be disclosed through any means is prohibited unless expressed, written consent of authorized representative of UAB „Nano sensorics“ is obtained.

All information, including but not limited to the technical specification are subject to change without notice. UAB „Nano sensorics“ reserves all rights to change, modify, update software, firmware, documentation without any obligation to notify any individual or entity. In the event that any changes are made, the revised Information shall be posted on this website, manuals, technical specification. Please check the latest information posted herein to inform yourself of any changes. Nano sensorics and Nano sensorics. All products, UAB “Nano sensorics” names, logos, trademarks are property of UAB „Nano sensorics.

Waste disposal

The sensor disposed according to the Waste Electrical and Electronic Equipment Directive, (WEEE Directive) 2012/19/EU. The sensor and its individual parts has to be disposed according to local laws and regulations your product should be disposed of separately from household waste and industrial waste. When this product reaches its end of life, you have to bring the sensor, its components to the collection point designated by local authorities in order to protect the environment and to reduce waste through recycling. The battery must be disposed of separately.





Sensor technical details

Sensing characteristics		
Temperature	-40 to 180 °C	
Temperature Accuracy	Max '+/-1°C@ -40— -10°C Max '+/-0.4°C@ -10°C— 180°C	
Temperature sensing options	4x temperature probes	
Sensing cable length	From 1 - 2 m depending on temperature sensing option	
Mechanical specification		
Weight	200 g without batteries	
Enclosure	Plastic ASA+PC-FF	
Storage Temperature	-40 to 85 °C	
Sensor Power Supply		
Battery Type	2x D cell Lithium batteries	
Expected Battery Life	<15 years (Depending on configurations and environment)	
Sensor logging Function		
Sampling Interval	Configurable via downlink, NFC configuration is optional	
Data Upload Interval	Configurable via downlink, NFC configuration is optional	
Radio / Wireless specification		
Wireless Technology	LoRaWAN® 1.0.3	
Wireless Security	LoRaWAN® End-to-End encryption (AES)	
LoRaWAN Device Type	Class A End-device	
Supported LoRaWAN® features	OTAA, ABP, ADR, Adaptive Channel Setup	
Supported LoRaWAN® regions	US902 – 928 Optional: EU863 – 870, AU915 – 928, EU433, RU864, IN865	
Link Budget	137 dB (SF7) to 151 dB (SF12)	
TX Power	14dBm±1dBm (Region specific)	
Rx Sensitivity	132 dBm (LoRa, Spreading Factor=12, Bit Rate=293bps) -118 dBm (FSK, Frequency deviation=5kHz, Bit Rate=1.2kbps)	
Communication range	10 km (line-of-sight, actual transmission distance depends on the environment)	
Data sizes		
Measurement	Data size	Elaboration
Temperature (1 st probe)	2	MSB byte -128 to +128 C, LSB byte, value after decimal point
Temperature (2 nd probe)	2	MSB byte -128 to +128 C, LSB byte, value after decimal point
Temperature (3 rd probe)	2	MSB byte -128 to +128 C, LSB byte, value after decimal point
Temperature (4 th probe)	2	MSB byte -128 to +128 C, LSB byte, value after decimal point

Battery	2	MSB byte represent Volts before decimal point , LSB byte represents two digits after decimal point expressed as unsigned 2 byte value, first byte – integer Volts, second byte – Volts (two digits after decimal point).
---------	---	--

Downlink messages

The downlink data messages must be sent via port No. 3 in the specific format. Minimal data size is 3 bytes.

Header	Payload length	Payload	
Settings ID	Settings data		
0xBA	1 byte	1 byte	0-n bytes

The downlink data messages are as follows:

Setting ID	Setting Length	Comment
0x1A	2 bytes	Set sensors measurement time (Tx) period in seconds. Minimum value is limited to 30 s. Minimum value is 65536 s (1092 min / 18.2)
0x1B	1 byte	LED control: • 0x00 – green LED OFF • 0x01 – green LED ON • 0x02 – green LED toggle for 5 s
0x1C	0 byte	Reset device

The examples of the downlink single messages:

- BA031A0384 – set measurement time to 15 minutes (900 s);
- BA021B01 – green LED ON.
- BA011C – Reset device.

It is recommended to send downlink data messages each by each after setting actual operational validation. When downlink message is sent for the setting of the Tx, the new Tx setting is deployed after time interval which is equal to the previous Tx value plus 30 s. The forced new Tx setting deployment can be performed after resetting the sensor in order to shorten new Tx deployment time duration.

In case if downlink message is sent to the sensor working on “ABP” mode, the Tx change will take effect only after the time interval equal to the previous Tx value.

The multiple settings can be sent through the downlink single message. The sum of the bytes has to be indicated without counting of the header.

Header	Total Payloads length	Payload 1		...	Payload n		
Setting ID	Settings data	Setting ID n		Settings data n			
0xBA	1 byte	1 byte		0-n bytes	...	1 byte	0-n bytes

Multiple commands:

* BA051A03841B02 – Set measurement time to 15min and toggle green LED for 5s

The example to send the downlink message through the “Things Of The Network”:

Uplink

Downlink

Schedule downlink

Insert Mode

☐ Replace downlink queue

☒ Push to downlink queue (append)

FPort *

3

Payload type

☒ Bytes

☐ JSON

Payload

BA 03 1A 03 84 |

The desired payload bytes of the downlink message

☐ Confirmed downlink

Schedule downlink

Transportation and Storage

Packed sensors may be transported in any type of covered vehicle. Equipment should be anchored reliably to avoid shock and possibility to shift inside vehicle. Sensors should be protected against mechanical damage and shock. No aggressive chemical substances should be stored together because of corrosion hazard.

Warranty

Manufacturer gives warranty that sensor parameters will meet the technical requirements, listed in the “Sensor technical details” paragraph of this document, if transportation, installation, storage and operation conditions will be followed. Warranty period is 12 month from manufacturing date, with additional possibility to extend it for additional charge. Warranty apply, when device is used as intended and if there was no tampering done with the device or other external damage done to the device from outside sources.