OTT HydroMet

Lufft
an OTT HydroMet brand

ARS31Pro Active Road Sensor

Operational Manual

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Table of contents

1 Scope of supply

The following items are included with delivery:

- Active road sensor
- Installation aid

2 Order numbers and variant code

2.1 Product variants

Variant	Order number
ARS31Pro-UMB, 50 m cable length	8810.U051
ARS31-UMB, 50 m cable length	8610.U050

2.2 Accessories and spare parts

2.2.1 Accessories

Item	Order number
Power supply unit 24 V/100 VA	8366.USV1
ISOCON-UMB	8160.UISO
Surge protection	8379.USP
DACON8-UMB	8160.UDAC

2.2.2 Spare parts

Item	Order number
ARS31 sensor cap	8610.DEC
ARS31Pro sensor cap	8810.DEC
Sensor housing with cable ARS31	8610.G050
Sensor housing with cable ARS31Pro	8810.G051
External passive road surface temperature sensor WST1	8160.WST1

2.3 Calibration

Item	Order number
ISO calibration ARS31	I.0204

3 About this manual

3.1 Other applicable documents and software

The following documents contain further information on installation, maintenance and calibration:

- Operating Manual UMB ISO Converter ISOCON
- Operating instructions surge protection

The following documents and software can be downloaded at www.lufft.com:

- ConfigTool.NET
- UMB protocol description
- Firmware

3.2 Abbreviations

Abbreviation	Description
Tg	Freezing temperature that the sensor identified
Tu	Road surface temperature, ambient temperature
Toi	Threat of icing

3.3 General signs and symbols

The signs and symbols used in the operational manual have the following meaning:

Practical tip

i This symbol indicates important and useful information.

Action

✓ Prerequisite that must be met before performing an action.

▸ Step 1

⇨ Intermediate result of an action

▸ Step 2

⇨ Result of a completed action

List

- List item, 1st level
  - List item, 2nd level

3.4 Explanation of warnings

To avoid personal injury and material damage, you must observe the safety information and warnings in the operating manual. The warnings use the following danger levels:

WARNING

WARNING

This indicates a potentially hazardous situation. If the hazardous situation is not avoided, it may result in death or serious injuries.

CAUTION

CAUTION

This indicates a potentially hazardous situation. If the hazardous situation is not avoided, it may result in moderately serious or minor injuries.

NOTICE

NOTE

This indicates a situation from which damage may arise. If the situation is not avoided, products may be damaged.

4 General safety instructions

4.1 Intended use

The active road sensor is used for outdoor measurements only. For operation, the sensor is permanently embedded in the asphalt or concrete surface, leveled with the surface and casted. It determines freezing point temperatures of a liquid on the road surface independent from its composition.

4.2 Potential misuse

Any use of the product that does not comply with the intended use, be this intentional or negligent, is forbidden by the manufacturer.

- Use the product only as described in the operational manual.

4.3 Personnel qualification

The equipment described in this manual must be installed, operated, maintained and repaired by qualified personnel only.

- Obtain training from OTT HydroMet if necessary.

4.4 Operator obligations

The installer is responsible for observing the safety regulations. Unqualified personnel working on the product can cause risks that could lead to serious injury.

- Have all activities carried out by qualified personnel.
- Ensure that everybody who works on or with the product has read and understood the operational manual.
- Ensure that safety information is observed.
- File the operational manual together with the documentation of the entire system and ensure that it is accessible at all times.
- The operational manual is part of the product, forward the operational manual together with the product.

4.5 Personnel obligations

To avoid equipment damage and injury when handling the product, personnel are obliged to the following:

- Read the operational manual carefully before using the product for the first time.
- Pay attention to all safety information and warnings.
- If you do not understand the information and procedure explanations in this manual, stop the action and contact the service provider for assistance.
- Wear the necessary personal protective equipment.

4.6 Correct handling

If the product is not installed, used and maintained correctly, there is a risk of injury. The manufacturer does not accept any liability for personal injury or material damage resulting from incorrect handling.

- Install and operate the product under the technical conditions described in the operational manual.
- Do not change or convert the product in any way.
- Do not perform any repairs yourself.
- Get OTT HydroMet to examine and repair any defects.
- Ensure that the product is correctly disposed of. Do not dispose of it in household waste.

4.7 Working on roadways

The device is installed in road- and runways. Special safety regulations apply to prevent accidents and injuries.

- Observe the national and local safety regulations for construction work.

4.8 Certification

4.8.1 Europe, USA and Canada

CE (EU)

The equipment meets the essential requirements of EMC Directive 2014/30/EU.

FCC (US)

FCC Part 15, Class "B" Limits

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions:

1. This device may not cause harmful interference.
2. This device must accept any interference received, including interference that may cause undesired operation.

IC (CA)

Canadian Radio Interference-Causing Equipment Regulation, ICES-003, "Class B"

This Class B digital apparatus meets all requirements of the Canadian Interference-Causing Equipment Regulations.

Cet appareil numèrique de la classe A respecte toutes les exigences du Règlement sur le matériel brouilleur du Canada.

5 Product description

5.1 Design and function

The active road sensor determines the freezing temperature of a liquid on the road surface through active cooling and heating. The device can be used to measure the salt concentration (NaCl, CaCl and MgCl), product concentration (potassium acetate, potassium) and freezing temperature (independent of mixture of salt).

ARS31Pro-UMB additionally determines the threat of icing through direct measurement or the freezing temperature. The device has an external temperature sensor which measures the exact road surface temperature.

The equipment is connected by way of a 4-core connection cable standard length (length 50 m). The measured values are requested over the RS485 interface in accordance with UMB protocol. During commissioning, configuration and verification takes place using the ConfigTool.NET software.

5.2 Product overview

ARS31-UMB/ARS31Pro-UMB

ARS31Pro-UMB with external temperature sensor WST1

6 Transport, storage, and unpacking

6.1 Unpacking

- Carefully remove the product from the packaging.
- Check that the delivery is complete and undamaged.
- If you find any damage or if the delivery is incomplete, then immediately contact the supplier and manufacturer.
- Keep the original packaging for any further transportation.

6.2 Storage

- Store within specified temperature ranges.
- Store in dry area.
- Store in original box where possible.

7 Installation

7.1 Mechanical installation

7.1.1 Preparing a site

> Special local, state or national regulations apply for working in and on roadways. Observe these regulations and prepare the intended installation area for the sensor accordingly .

The device must be installed in the center of the road lane. On two-lane roads the device is installed in the left-hand lane.

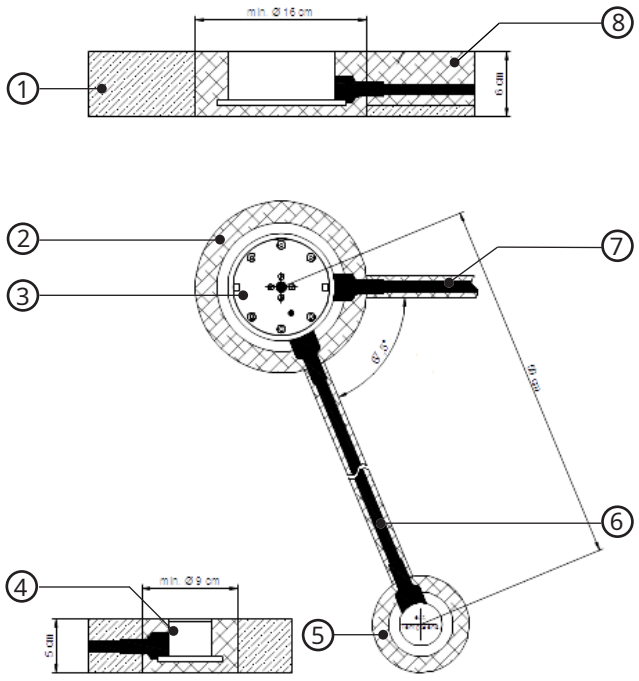
Holes and slits are required in the road surface for the sensor, the connection cable(s) and, if applicable the external temperature sensor.

NOTICE

Damage to sensor insulation due to incorrect installation depth!

If the sensor is not installed in the correct depth, the insulation layer can be damaged and water can penetrate the sensor. This can lead to malfunctions of the sensor.

- Ensure that a depth of 6 cm can be maintained.



Sensor installation in the road

1	Road surface	5	Hole for temperature sensor (only ARS31Pro-UMB)
2	Hole for active road sensor	6	Slit for connection cable to the temperature sensor (only ARS31Pro-UMB)
3	Active road sensor	7	Slit for connection cable
4	External temperature sensor (only ARS31Pro-UMB)	8	Casting resin concrete

- For the device: mark and drill a hole with a diameter of 16 cm and depth of 6 cm into the road surface.
- For the connection cable: cut a slit with the width of 2 cm and depth of 5 cm into the road surface.

For the ARS31Pro-UMB an external temperature sensor is installed:

- For the temperature sensor: drill a hole with a diameter of 9 cm and depth of 5 cm into the road surface.
- For the connection cable to the temperature sensor: cut a slit with the width of 2 cm and depth of 5 cm into the road surface. The slit is required at an angle of approx. -67,5° in relation to the slit for the connection cable of the road sensor.

- Clean the road surface.
- Clean the device hole, ensure there is enough space for the sensor housing and the external cable joints.
- Clean the road surface again using compressed air to ensure the surface is clean and dry.

7.1.2 Installing device

CAUTION

Risk of injury due to sharp edges!

The device has slightly sharp edges that can cause injury.

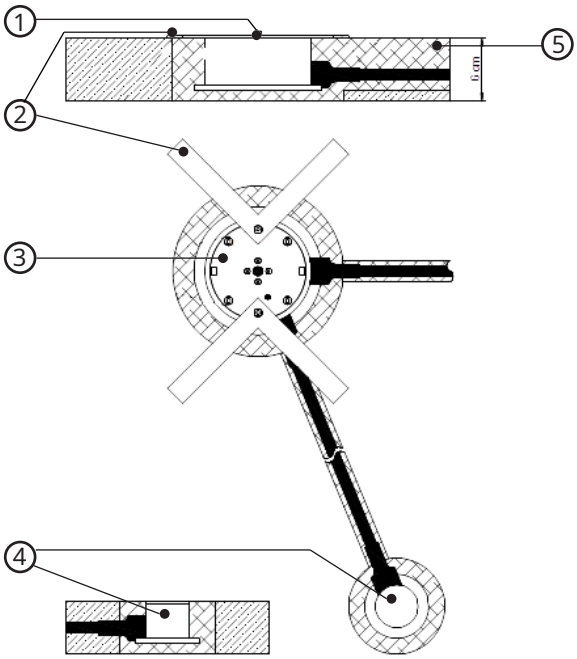
- Wear protective gloves during installation.

NOTICE

Damage to device due to uneven installation!

Winter service vehicles can damage the device, if it is above the road surface.

- Ensure that the device is flush with the road surface.



1	Fixing screw	4	External temperature sensor
2	Installation aid	5	Casting resin concrete
3	Active road sensor		

- Insert the device into the designated drill hole.
- Level the device with the road surface with the help of the installation aid. If necessary, bend the installation aid.
- Fill the cavities with casting resin concrete. Follow the manufacturer's instructions of the casting resin concrete.

i Use concrete casting systems, in which the temperature during the curing process remains below 80 °C (176 °F), as otherwise the device will be damaged.

- As soon as the casting resin concrete has hardened, remove the installation aid and the green protective foil.
- Insert the fixing screws of the installation aid into the holes of the device and fasten with a torque of 2 Nm.

7.2 Electrical installation

7.2.1 Installing supply cable

NOTICE

Damage due to defective cable sheathing or temperature sensor!

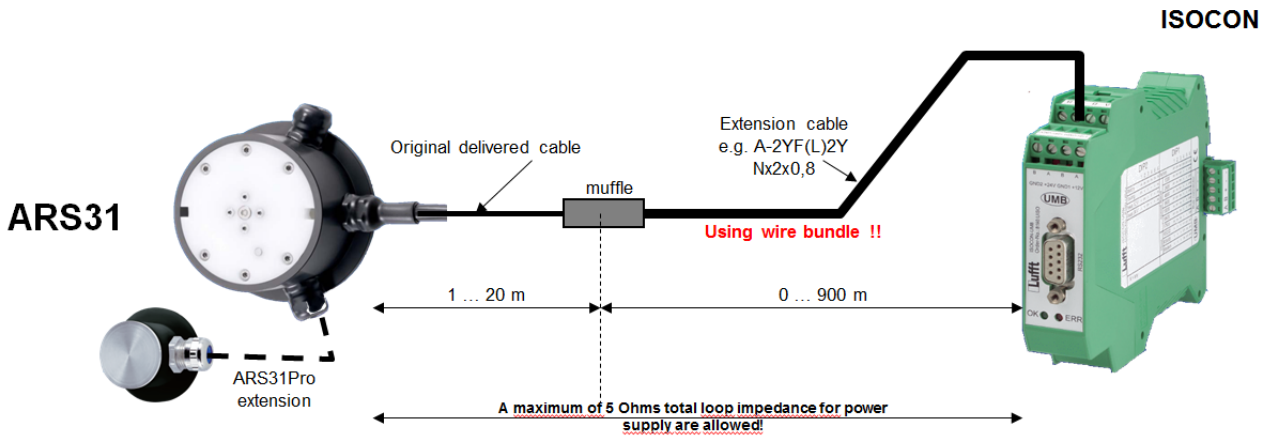
If the cable sheathing or the temperature sensor is defective, water can enter the device and damage it.

- Ensure that the cable connections are neither opened nor damaged.
- Do not install the device with a damaged cable.
- Have repairs carried out by OTT HydroMet service personnel.

- Place the supply cable in a protective tube.
- Avoid tensile stress on the cables.

7.2.2 Extending supply cable

Shortening the supply cable is only permitted at the cabinet end of the cable. The loop impedance of the entire cable must not exceed 5 Ohm.



- Shorten the original cable after the shortest possible distance (curbside 5 m).
- Extend the cable by attaching an extension cable to the original cable.

Example

Extension to 100 m with a 0.5 mm^2 cable with loop impedance of 73.2 Ω/km and parallel connection of 4 wires in each case:

- At 100 m the result per wire is a loop impedance of 7.3 Ω.
- By connecting 4 wires in parallel the result is a loop impedance of 7.3 Ω / 4 = 1.83 Ω.

Recommended cable extension

Total distance (wire range)	RS485 terminator required[1]	Original cable	Extension cable[2]		
		0.5 mm²	0.8 mm²	Power supply wire bundle	Total wire pairs
				x times	N
50 m	–	Max. 50 m	–	–	–
100 m	–	Max. 20 m	Up to 80 m	2x	4 N
200 m	–	Max. 20 m	Up to 180 m	5x	6 N
300 m	–	Max. 20 m	Up to 280 m	7x	10 N
400 m	x	Max. 20 m	Up to 380 m	10x	20 N
500 m	x	Max. 20 m	Up to 480 m	12x	20 N
600 m	x	Max. 20 m	Up to 580 m	15x	20 N
700 m	x	Max. 20 m	Up to 680 m	17x	20 N
800 m	x	Max. 20 m	Up to 780 m	20x	30 N
900 m	x	Max. 20 m	Up to 880 m	22x	30 N

[1]RS485 termination resistance required means that a resistance of 120 Ohm should be connected parallel to the RS485 2-wire interface, either at the sensor input port or at muffle position.
[2]Recommended extension cable: A-2YF(L)2Y Nx2x0.8 or similar.
Core pair 2x (2 times) means 2 pair of wires, e.g. 2x2x0.8, because 2 individual wires are 1 pair for the power supply (+ and -).

7.2.3 Connecting power supply

The road sensor supply cable is connected to the power supply in the control panel. The cable shielding must be attached to the earthing connection in the control panel.

- Connect the brown, white, green and yellow wires to the power supply unit.
- Do not connect the negative supply voltage (GND2) with the cable shield of the sensor.

7.2.4 Electrical connections

WARNING

Electric shock due to incorrectly connected device!

If the device is not connected correctly, it may be permanently damaged and an electric shock may result.

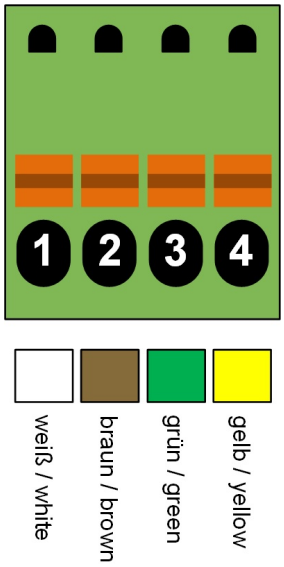
- Ensure that the device is connected correctly.
- Ensure that the cable shielding is connected to earth in the control cabinet.

There is a single 4-pole terminal block on the underside of the plastic insert. It is used to connect the supply voltage and the interface to the associated cable.

Pin assignment for supply voltage and RS485

Number	Color	Assignment
1	White	Negative supply voltage
2	Brown	Positive supply voltage
3	Green	RS485_A (+)
4	Yellow	RS485_B (-)

Supply voltage and RS485 (uncoded)



Connection of color or numerically coded cables

7.2.5 Supply voltage

The minimum supply voltage for the device is 24 V DC ± 10 % (for a cable length ≤ 15 m) and the maximum is 28 V DC. Depending on the cable length, the power supply varies:

Cable length	Recommended power supply
□ 15 m	24 V DC
20 m	24,6 V DC
25 m	25,1 V DC
30 m	25,7 V DC
35 m	26,3 V DC
40 m	26,8 V DC
45 m	27,4 V DC
50 m	28 V DC

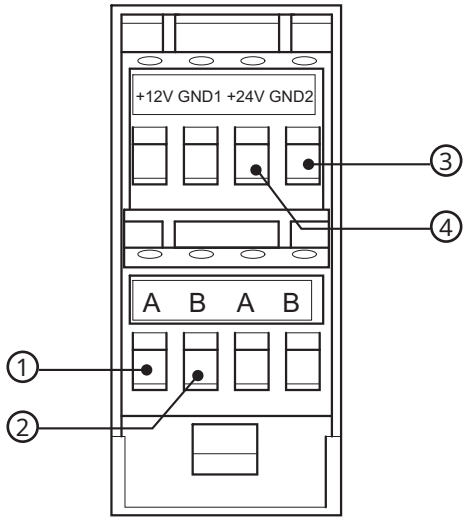
The power supply unit used must be approved for operation with equipment of protection class III (SELV).

7.2.6 RS485 Interface

The device has an electrically isolated, half-duplex, 2 wire RS485 interface for configuration, measurement polling and the firmware update. The RS485 interface has a default baud rate of 19200 (no parity, 8 data bits, 1 stop bit), but other baud rates are supported (adjustable baud rates: 1200, 2400, 9600, 38400).

7.2.7 Connecting ISOCON-UMB converter

The ISOCON-UMB communication module converts RS485 into RS232.



1	Green: RS485 interface A	3	White: negative supply voltage GND2
2	Yellow: RS485 interface B	4	Brown: positive supply voltage +24 V

- Connect the brown, white, green and yellow wires to the ISOCON-UMB converter.
- Refer to the operating manual UMB ISO converter ISOCON.

7.2.8 Installing surge protection

The surge protection serves to protect the device against voltage spikes.

- Install the surge protection between the device and ISOCON-UMB converter.
- Refer the operating instructions of the surge protection.

8 Commissioning

8.1 Device set-up

After the equipment has been installed and connected correctly, the device begins autonomously to take measurements.

The following is required for configuration and testing purposes:

- Windows® PC with serial interface
- ConfigTool.NET software

Proceed as follows for commissioning:

- Check for correct equipment operation on site by carrying out a measurement request with the aid of the ConfigTool.NET software.
- Check the road condition with dry and wet sensor.
- If several road sensors are operated on a UMB network, assign a unique device ID to each sensor.

8.2 Configuration and testing

For configuration and testing OTT HydroMet Fellbach GmbH provides the proprietary software ConfigTool.NET. ConfigTool.NET can also be used to update the firmware of the device.

- Download the ConfigTool.NET software: www.lufft.com/resources/
- Install the software on the computer.
- Get familiar with the software in general.
- Ensure to always use the latest version of ConfigTool.NET.
- During configuration and testing, disconnect other devices that poll the UMB-Bus, e.g. modem or LCOM.
- Ensure that the connection settings of ConfigTool.NET are conform to the settings of the device.

> The operation of the ConfigTool.NET is described in detail in the help function of the Windows® PC software. For this reason only the menus and functions specific to the device are described below.

8.2.1 Factory settings

The device is delivered with the following settings:

Specification	Value
Class ID	4 (cannot be modified)
Device ID	1 (gives address 4001h = 16385d)
Baud rate	19200
RS485 protocol	UMB binary

8.3 Selecting device

- Select the type of sensor.
  - ⇨ The active road sensor appears in the selection menu as *Active-Road-Sensor ARS31-UMB* or *Active-Road-Sensor ARS31Pro-UMB*.
- Confirm with **Save/Exit**.

8.4 Specific settings for ARS31Pro-UMB

Device Settings ARS31Pro #1

Reboot | Configuration

General device description	
Running number	5
Tested	220
Project number	1104
Rev. bom	3
Rev. schematic	3
Rev. hardware	3
Rev. software	111
Rev. config	20
Rev. product	20
Device type	4
Device identification	
Class-ID	4
Device-ID	1
Name	ARS31/ARS31Pro-UMB
Description	**Active-Road-Sensor ARS31Pro-UMB**
Device parameters	
Baudrate	19200 Bd
Protocol	UMB-Binary
Timeout for protocol change	10
Measurement parameters	
Measurement interval	20
Ft data hold after measurement max.	40
Ft smoothing operator	0.4
Freezing temperature limit	0
Temperature setpoint for heating	**1**
Detection of threat of icing	Off
Expanded freezing temperature status	Off [0...5]
Model parameters	
Road Temperature Threshold	5
Dry threshold	800
Dynamic dry threshold	800
Threat of Icing	
Time x	540
Delta T	2
Delta LFM	2
Delta T2	2

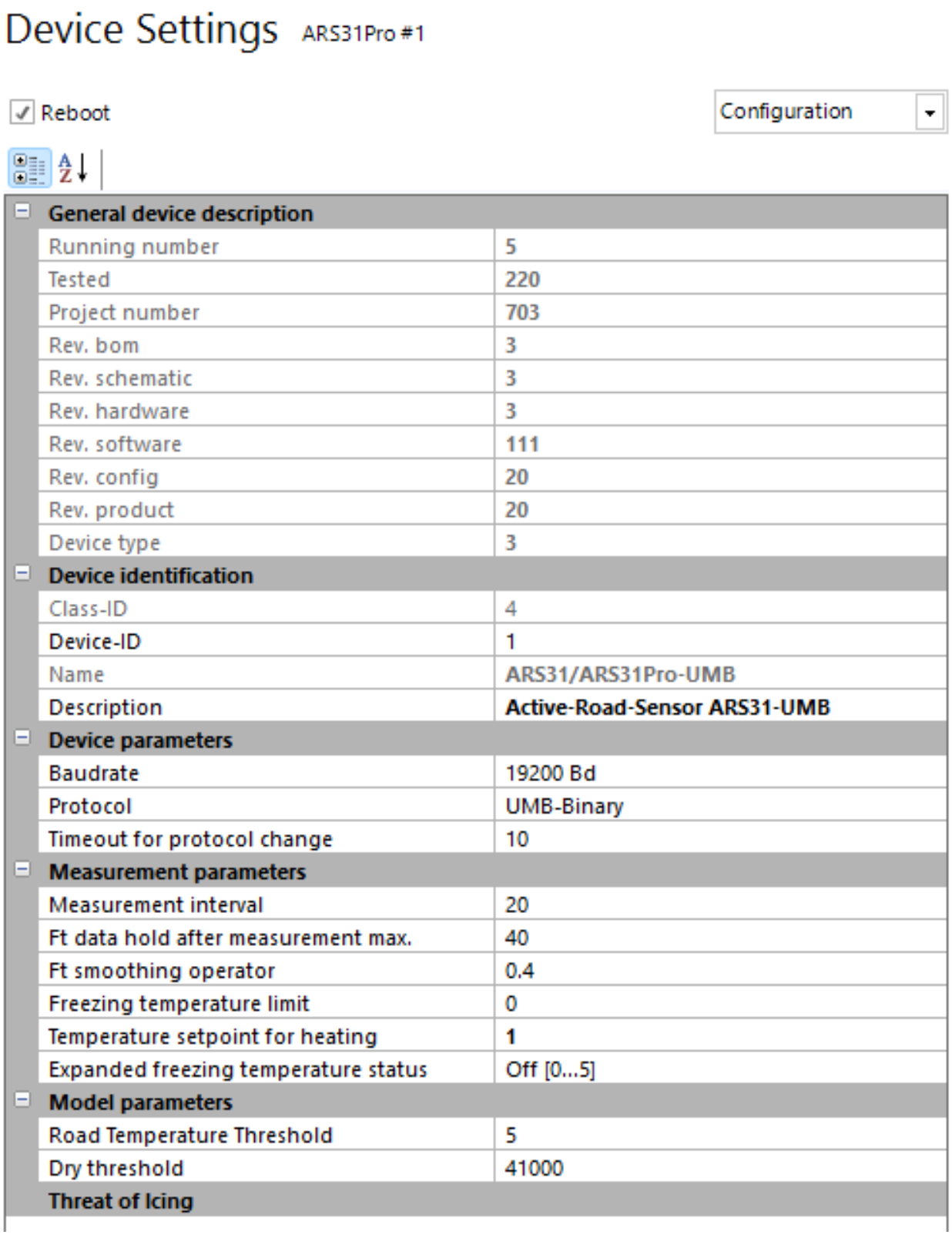
Parameter	Description
Measurement interval	The measurement interval indicates how often a new measurement cycle is started. This value is configurable and can be set at 20, 30 or 60 minutes. Factory setting: 20 minutes
Ft data hold after measurement max. [min.]	The last identified freezing temperature is delivered for a set interval. During this interval the freezing temperature can only move to 0 if the device definitely detects clear water on the road. This value is configurable and the interval can be set

Parameter	Description
	between 20 and 120 minutes. Factory setting: 40 minutes Deactivate the setting by unticking *Ft data hold enabled*
Ft smoothing operator	A smoothing function for the freezing temperature is activated. This value is configurable and can be set between 0 (= maximum smoothing, no change in the FT) and 100 (no smoothing). Factory setting: 40 Deactivate the setting by unticking *FT smoothing operator enabled*
Road Temperature Threshold	When road temperatures are lower than the road temperature threshold, freezing temperature / threat of icing is detected. When road temperatures are higher than the threshold, freezing temperature / threat of icing is not detected. The value is adjustable between 2 and 10 °C.
Dry Threshold	The dry threshold defines a measured value on the device assuming a dry road and detection of threat of icing takes place (instead of the freezing point measurement). Factory setting: The sensor adjusts its dry threshold daily. If the setting is deactivated by unticking *Dynamic dry threshold enabled*, the set dry threshold applies. If this value is too high, the device measures during dry conditions, which may lead to incorrect measurements caused by condensation on the device.
Freezing temperature limit	The freezing temperature limit can be adjusted. After the activation of the freezing temperature limit, the smoothed freezing temperature can transitionally be under the temperature limit (if the freezing temperature was under the configured limit directly before the activation). Factory setting: 0 (= no limit for freezing temperature)
Temperature setpoint for heating	Measurement cycle starts with heating when the road temperature is below this value at the start of the measurement cycle.
Expanded freezing temperature status	See status of freezing temperature measurement, Measuring range and accuracy [▶ 34].

Configure detection of threat of icing

Parameter	Description
Time x	The parameter describes the time in which the sensor cools down in order to cause formation of dew or frost.
Delta T	This is the temperature difference by which the road surface temperature cools down in order to measure the threat of icing through the formation of dew or frost.
Delta T2	If the threat of icing is detected through the temperature difference between the road and freezing temperature, this parameter describes the temperature difference for which, upon lower deviation, threat of icing is transmitted. A value of -50 °C deactivates the calculation of threat of icing, using the freezing temperature.
Delta LFM	The parameter describes the required change in the critical measurement variable for the detection of the threat of icing. Higher numerical values reduce the probability of the sensor transmitting the threat of icing and increase the stability of this function.

8.5 Specific settings for ARS31-UMB



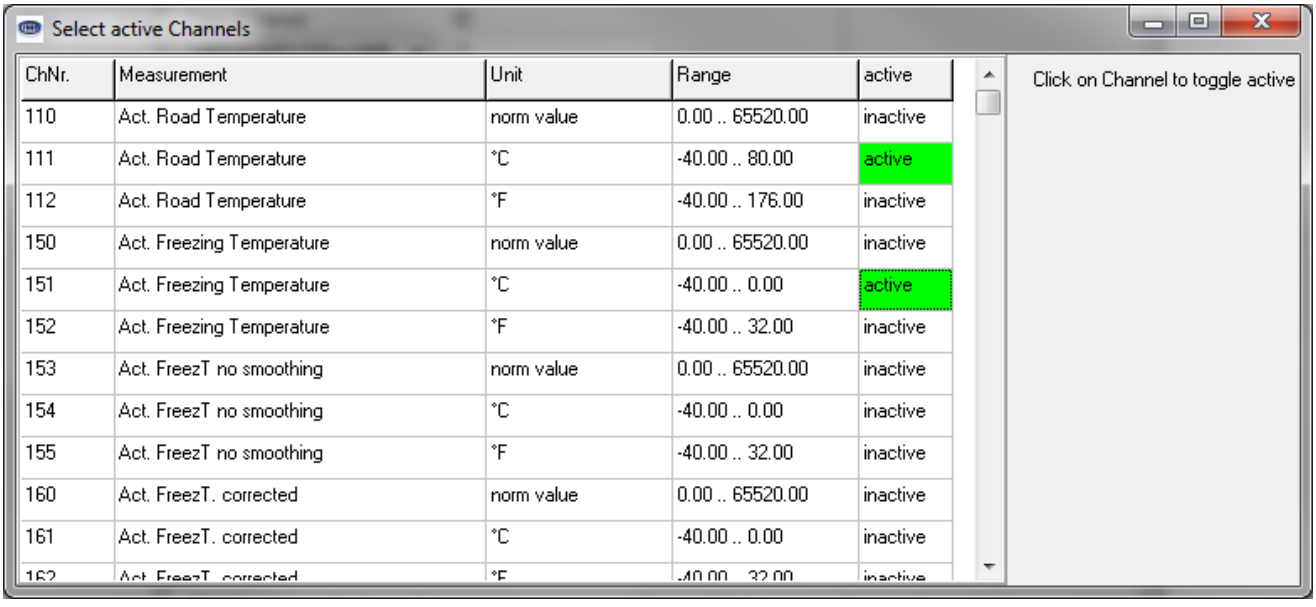
Parameter	Description
Measurement interval	The measurement interval indicates how often a new measurement cycle is started. This value is configurable and can be set at 20, 30 or 60 minutes. Factory setting: 20 minutes
Ft data hold after measurement max. [min.]	The last identified freezing temperature is delivered for a set interval. During this interval the freezing temperature can only move to 0 if the device definitely detects clear water on the road. This value is configurable and the interval can be set

Parameter	Description
	between 20 and 120 minutes. Factory setting: 40 minutes Deactivate the setting by unticking *Ft data hold enabled*
Ft smoothing operator	A smoothing function for the freezing temperature is activated. This value is configurable and can be set between 0 (= maximum smoothing, no change in the FT) and 100 (no smoothing). Factory setting: 40 Deactivate the setting by unticking *FT smoothing operator enabled*
Road Temperature Threshold	When road temperatures are lower than the road temperature threshold, freezing temperature is detected. When road temperatures are higher than the threshold, freezing temperature is not detected. The value is adjustable between 2 and 10 °C.
Dry Threshold	The dry threshold defines a measured value on the device assuming a dry road and the freezing point temperature is no longer measured. If this value is too high, the device measures during dry conditions, which may lead to incorrect measurements caused by condensation on the device.
Freezing temperature limit	The freezing temperature limit can be adjusted. After the activation of the freezing temperature limit, the smoothed freezing temperature can transitionally be under the temperature limit (if the freezing temperature was under the configured limit directly before the activation). Factory setting: 0 (= no limit for freezing temperature)
Temperature setpoint for heating	Measurement cycle starts with heating when the road temperature is below this value at the start of the measurement cycle.
Expanded freezing temperature status	See status of freezing temperature measurement, Measuring range and accuracy [▶ 34].

8.6 Testing

The functions of the device can be tested with the software ConfigTool.NET by polling various channels.

- Activate the desired channels.



ChNr.	Measurement	Unit	Range	active
110	Act. Road Temperature	norm value	0.00 .. 65520.00	inactive
111	Act. Road Temperature	°C	-40.00 .. 80.00	active
112	Act. Road Temperature	°F	-40.00 .. 176.00	inactive
150	Act. Freezing Temperature	norm value	0.00 .. 65520.00	inactive
151	Act. Freezing Temperature	°C	-40.00 .. 0.00	active
152	Act. Freezing Temperature	°F	-40.00 .. 32.00	inactive
153	Act. FreezT no smoothing	norm value	0.00 .. 65520.00	inactive
154	Act. FreezT no smoothing	°C	-40.00 .. 0.00	inactive
155	Act. FreezT no smoothing	°F	-40.00 .. 32.00	inactive
160	Act. FreezT. corrected	norm value	0.00 .. 65520.00	inactive
161	Act. FreezT. corrected	°C	-40.00 .. 0.00	inactive
162	Act. FreezT. corrected	°F	-40.00 .. 32.00	inactive

Channels for measurement polling

The ConfigTool.NET software is provided for test and configuration purposes only. The tool is not suitable for the permanent acquisition of measurement data. For this purpose the use of professional software is recommended, e.g. Lufft SmartView3.

9 Maintenance

9.1 Maintenance schedule

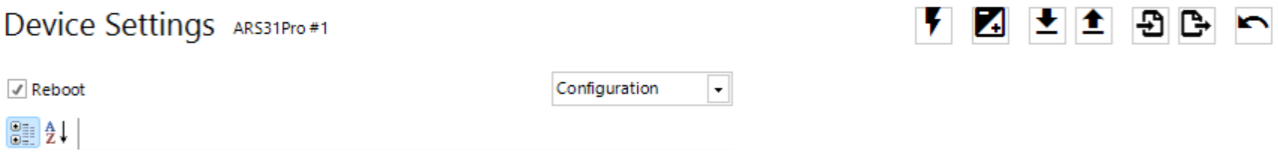
The frequency of cleaning is dependent upon the local weather and environmental conditions.

The following maintenance intervals are recommended:

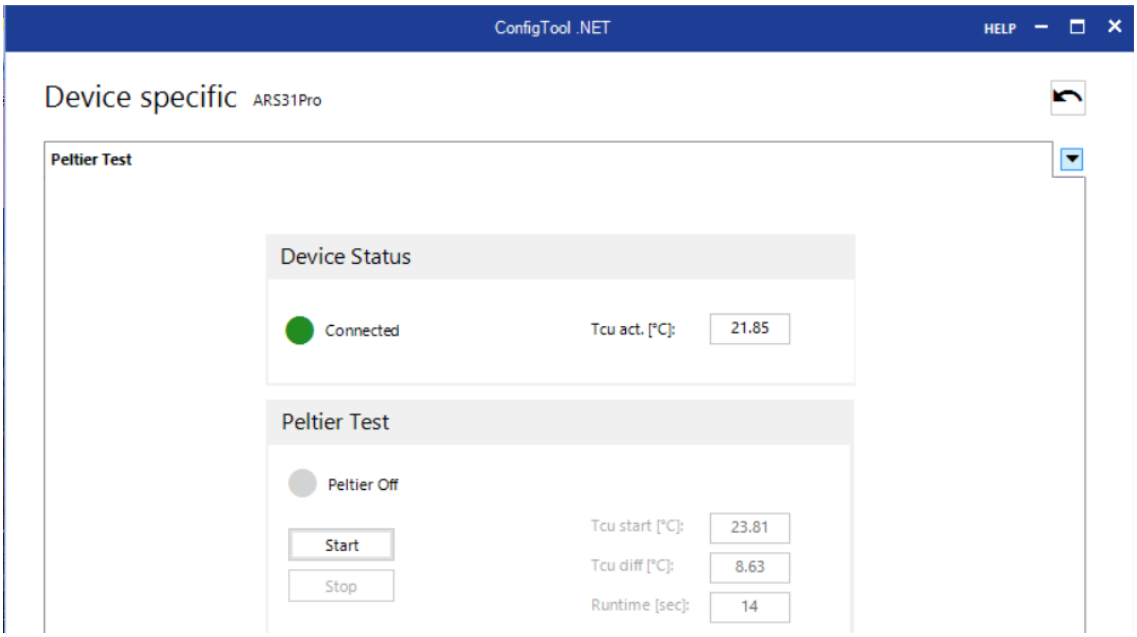
Interval	Activity	Performed by
Annually	▸ Carry out a visual inspection of the housing. ▸ Clean the sensor surface using isopropanol and a lint-free cloth if dirty. ▸ Never process the electrodes with sandpaper or wire brush.	Operator

9.2 Testing of heating and cooling

- Connect the sensor to the ConfigTool.NET (21.01.2025 or newer).
- Select the device settings:

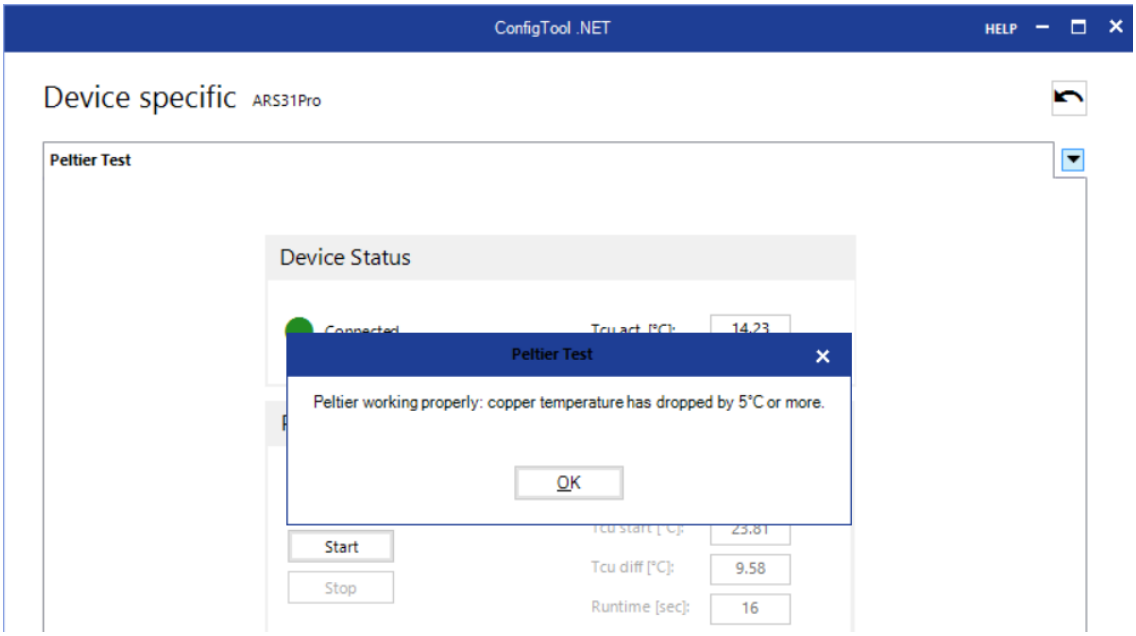


- Click  to open the Device specific page.
- On the device specific page click the **start** button to start the Peltier Test.



⇨ The test takes a few minutes, depending on the road condition - on a dry road faster than on a wet road.

⇨ The result is presented after the test has been completed:



9.3 Replacing sensor

If water gets into the housing of the sensor, the sensor with housing and cable must be replaced. If the sensor cap (white sensor element) becomes unusable due to mechanical damage or the sensor electronics are damaged, the sensor cap can be replaced without changing the entire housing.

ℹ Replace the sensor only, when the road is dry.

- Unscrew all 6 hexagonal screws.
- Insert a screwdriver into the small opening on the edge of the cover of the plastic assembly.
- Lift the plastic assembly out.
- Remove the plug connections. Do not touch the electronics of the sensor.
- Clean the housing and protect from moisture.
- Remove the sealed protection cover of the new drying agent bag. The sticker indicates its functionality (blue: ok; pink: the drying agent is spent).
- Immediately, insert the drying agent bag in the housing.
- Cover the new seal with silicone grease.
- Fit the seal into the housing.
- Connect the plug connectors to the new sensor. Do not touch the electronics of the sensor.
- Insert the plug connections. Do not touch the electronics of the sensor.
- Carefully insert the plastic cover plate without canting the seal.
- Grease the thread of the new fixing screws.
- Lightly fasten the screws and then tighten evenly with a torque of 2 Nm.

9.4 Updating firmware

The firmware can be updated with the ConfigTool.NET software. The firmware is valid for all types of the device. The description of the update can be found in the ConfigTool.NET software.

- Download the latest version of the firmware and the ConfigTool.NET software: www.otthydromet.com/en/software_firmware.

- Install the update on a Windows® PC.

i During firmware upload the operating temperature must be between 0 to +60 °C .

10 Troubleshooting

10.1 Error elimination

Error	Possible cause	Corrective action
Device does not allow polling or does not respond	Dummy cover installed	▸ Check if the sensor cap is installed.
Device does not allow polling or does not respond	Device does not work properly	▸ Check the power supply. ▸ Check the interface connection.
Device does not allow polling or does not respond	Incorrect device ID is applied	▸ Check if the correct device ID is assigned. Devices are delivered with ID 1.
Device does not allow polling or does not respond	RS485 cables A and B are reversed	▸ Connect the cables in the correct order.
Device does not allow polling or does not respond	False baud rate is set	▸ Adjust the baud rate.
Device does not allow polling or does not respond	False protocol is set	▸ Select the appropriate protocol.
Device does not transmit the freezing temperature	Start conditions not fulfilled, because the road temperature is above the set temperature	–
Device does not transmit the freezing temperature	The sensor is dry	–
Device does not transmit the freezing temperature	Measurement cycle not yet completed (lasts up to 20 minutes)	–
Device does not transmit the freezing temperature	External influences in critical phases of measurement cycle interfere in calculation of freezing temperature	–
Device does not transmit the freezing temperature	Sensor surface is heavily soiled	▸ Clean the sensor surface with water.
Device does not transmit the freezing temperature	Green protective foil not removed	▸ Remove the green protective foil.
Determined freezing temperature is reset after a few minutes	Sensor is resetting	▸ Query channel 20001 and check wether the value is incremented. ⇨ After reaching 60000 the counter starts again from 0. If the value goes to 0 earlier, the sensor has made a restart. ▸ Check the power supply.
Determined freezing temperature is reset after a few minutes	Power supply is overloaded or is unstable	▸ Check the power supply.
Determined freezing temperature is reset after a few minutes	Misconfiguration of LCOM	▸ Check the configuration of the LCOM.

Error	Possible cause	Corrective action
Salt concentration channel delivers error message	Start conditions not fulfilled, because the road temperature is above the set temperature	–
Salt concentration channel delivers error message	The sensor is dry	–
Salt concentration channel delivers error message	Measurement cycle not yet completed (lasts up to 20 minutes)	–
Salt concentration channel delivers error message	External influences in critical phases of measurement cycle interfere in calculation of freezing temperature	–
Salt concentration channel delivers error message	Sensor surface is heavily soiled	▸ Clean the sensor surface with water.
Salt concentration channel delivers error message	Green protective foil not removed	▸ Remove the green protective foil.
Threat of icing channel transmits error FC:36	Threat of icing is disabled or not supported (concerning ARS31-UMB)	–
Sensor provides FT status code 3 on channel 900 for 12 hours* and UMB error code 0x54 on uncorrected freezing temperature channels	Sensor has detected an internal error and tries to fix the problem.	▸ If this behavior occurs several times, the sensor must be replaced. ▸ Check if water has penetrated the sensor. ▸ Run Peltier Test with ConfigTool.NET.
Device transmits an unknown error value	–	▸ Report any malfunction to the representative of OTT HydroMet.

*available from firmware version 10.9.

11 Repair

11.1 Customer support

- Have repairs carried out by OTT HydroMet service personnel.
- Only carry out repairs yourself, if you have first consulted OTT HydroMet.
- Contact your local representative: www.otthydromet.com/en/contact-us
- Include the following information:

– instrument model
– instrument serial number
– details of the fault or problem
– examples of data files
– readout device or data acquistion system
– interfaces and power supplies
– history of any previous repairs or modifications
– pictures of the installation
– overview of the local environment conditions

12 Notes on disposing of old devices

Member States of the European Union

In accordance with the German Electrical and Electronic Equipment Act (ElektroG; national implementation of EU Directive 2012/19/EU), OTT HydroMet takes back old devices in the Member States of the European Union and disposes of them in the proper manner. The devices that this concerns are labeled with the following symbol:

- For further information on the take-back procedure contact OTT HydroMet:

OTT HydroMet Fellbach GmbH
Service & Technical Support
Gutenbergstraße 20
70736 Fellbach
Germany
phone: +49 711 518 22 0
email: met-support@otthydromet.com

All other countries

- Dispose of the product in the proper manner following decommissioning.
- Observe the country-specific regulations on disposing of electronic equipment.
- Do NOT dispose of the product in household waste.

13 Technical data

13.1 General technical data

Specification	Value
Protection class	III (SELV)
Protection type	IP68
Operating temperature range	-40 to +80 °C[1] 0 to +60 °C for firmware update only
Temperature range for measurement of freezing temperature and threat of icing in the road surface	-30 to +5 °C (adjustable up to 10 °C)
Humidity range	0 to 100 %
Altitude above sea level	3000 m
Storage temperature range (in packaging)	-40 to +70 °C
Humidity range (non-condensing, in packaging)	0 to 98 %

[1]The sensor only measures freezing temperature and threat of icing in the road surface in the temperature range up to +5 °C. Above 60 °C an error code is transmitted.

13.2 Electrical data

Specification	Value
Power supply (cable length ≤ 15 m)	24 V DC ± 10 %[1]
Power consumption	Approx. 30 W at 24 V DC[2]
Current consumption	Approx. 1.25 A at 24 V DC[2]

[1]The power supply is dependent of the cable length, but must not exceed 28 V DC, see Supply voltage [▶ 18].
[2]Depending on the cable length, the power and current consumption change, see Extending supply cable [▶ 16].

13.3 Data transfer

Specification	Value
Interfaces/ protocols	RS-485 half-duplex two-wire interface / UMB protocol
Cable	Cable type LI-2YCYv2X2X0.5

13.4 Dimensions and weight

Specification	Value
Dimensions (diameter x height)	120 x 50 mm
Weight ARS31Pro-UMB (without cable)	Approx. 1100 g
Weight ARS31-UMB (without cable)	Approx. 900 g

13.5 Measuring range and accuracy

Freezing temperature

Specification	Value
Measuring range	-40 °C to 0 °C, however Tg ≥ Tu - 20 °C
Resolution	0.1 °C
Accuracy	±0.5 °C for Tg > -15 °C (with NaCl, according to CEN/TC 15518-4) ±1.5 °C for Tg > -15 °C (with NaCl, according to CEN/TC 15518-4)
De-icing agent	Any desired de-icing agent; however, the electrical conductivity of the solution must be > 1 mS/cm (ARS31Pro-UMB: > 0.1mS/cm)

Saline concentration

Specification	Value
Measuring range	0 to 100 %
Resolution	0.1 %
Accuracy	Computed from the freezing temperature according to CEN/TC 15518-4
De-icing agent	Any desired de-icing agent; however, the electrical conductivity of the solution must be > 1 mS/cm (ARS31Pro-UMB: > 0.1mS/cm)

Status of freezing temperature measurement

Specification	Value
Channel 900	0 = Start conditions not fulfilled 1 = Sensor surface dry 2 = Freezing temperature was calculated 3 = Freezing temperature was not calculated 4 = Too cold to measure 5 = Freezing temperature below road temperature minus 20 °C (Tg < (Tu - 20 °C)) 6 = Currently no valid freezing temperature available, but freezing temperature is currently being determined (if configured) 7 = Sensor is in regeneration mode, currently no freezing temperature is measured (if configured)

Status of "threat of icing"

Specification	Value
Channel 901*	0 = No threat of icing 1 = Threat of icing 2 = Threat of icing was not determined

*The channel 901 is only available with an ARS31Pro-UMB sensor.

Road surface temperature ARS31Pro-UMB

Specification	Value
Measurement process	NTC
Measuring range	-40 °C to +80 °C
Resolution	0.1 °C
Accuracy	±0.2 °C (-10 °C to +10 °C), otherwise ±0.5 °C

Road surface temperature ARS31-UMB

Specification	Value
Measurement process	NTC
Measuring range	-40 °C to +80 °C
Resolution	0.1 °C
Accuracy	Quantitative statement only as errors arise due to self-heating

OTT HydroMet

Contact Information