OTT HydroMet

Lufft
an OTT HydroMet brand

WS100 Smart Weather Sensor

Operational Manual

48.7230-WS100EN | 01-052024

OTT HydroMet Fellbach GmbH
Gutenbergstr. 20
70736 Fellbach
Germany

+49 711 51822 -0
met-info@otthydromet.com
www.otthydromet.com

Table of contents

1 Scope of supply

The following item is included with delivery:

– Smart weather sensor

2 Order numbers and variant code

2.1 Product variants

Variant	Order number	Authorized region	Frequency range
WS100-UMB (EU)	8367.U03	EU	24,0 – 24,075 GHz
WS100-UMB (US, CA)	8367.U04	US, CA	24.075 – 24.175 GHz

2.2 Accessories and spare parts

Item	Order number
Mast 4.5 m	8357450
Surge protection	8379.USP
Traverse	8367.TRAV1
ISOCON-UMB	8160.UISO
Power supply unit 24 V/100 VA	8366.USV1
Connection cable 10 m	8370.UKAB10
Connection cable 20 m	8370.UKAB20
Connection cable 50 m	8370.UKAB50

3 About this manual

3.1 Other applicable documents and software

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

- User Manual Smart Weather Sensors
- 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

> The device can be operated with various protocols, e.g. UMB-ASCII. Further information on the protocols and the full description of UMB channels, SDI-12 and Modbus protocol can be found in the User Manual Smart Weather Sensors.

3.2 General signs and symbols

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

Practical tip

> 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

3.3 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 radar sensor is used outdoors to measure and report all forms of precipitation including rain, freezing rain, hail, snow and sleet. The sensors are mounted on a stable mast or side bracket and aligned to look vertically upwards. The meteorological measurement values provided are typical used in professional road traffic management systems, renewable energy systems, air quality stations and for different hydro-meteorological applications.

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.
- Pay attention that the device generates an electromagnetic field that can be harmful to health and can cause cardiac pacemakers to malfunction.

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 Health hazards

4.7.1 Risk of electrical shock

Live parts can cause electric shocks in the event of contact.

- Never take measurements on live electrical parts.
- Never touch live electrical parts.

4.7.2 Beware of hot surfaces

As soon the device is connected to power the dome gets heated up to approximately 40 °C. Touching the dome can be painful.

- Do not touch the dome.
- Wear protective gloves if necessary.

4.8 Working outdoor

4.8.1 Installation and maintenance at great heights

It is advised to mount the product in a certain height. Therefore, there is a risk of falling down.

- Observe and follow the local safety regulations.
- Use suitable safety equipment.
- Inspect the safety equipment before use.
- Secure the person mounting or maintaining the device against falling down.
- Secure the device against falling down.

4.8.2 Using long cables

Long cables are required to mount the product at great heights. Therefore, there is a risk of strangulation.

- Use long cables properly.
- Observe manufacturer's instructions.
- Observe safety regulations.

4.8.3 Working at roadside

The device can be installed on a mast at the roadside. Special safety regulations apply to prevent accidents and injuries.

- Observe the safety regulations for working at the roadside and in the vicinity of the road carriageway.

4.9 Certification

Devices with precipitation radar are subject to approval regulations which differ between countries. The radar modules have been certified for use in EU, USA and Canada.

If the devices are operated in other jurisdictions, the following must be observed:

- Clarify and ensure compliance with any additional regulatory requirements.
- Obtain any required approvals or certificates at own risk and cost.

CE (EU)

The equipment meets the essential requirements of RED Directive 2014/53/EU.

FCC (US)

FCC Part 15C – Statement intentional radiator.

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.

> Unauthorized modification or changes to this wireless communication equipment will void the right to use it. Changes or modifications to this unit not expressly approved by the party responsible for compliance will void the user's authority to operate the equipment. Any change to the equipment will void the Industry Canada grant.

IC (CA)

Canadian Radio Interference-Causing Equipment Regulation, ICES- 001

This device complies with Industry Canada license-exempt RSS stan- dard(s). 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.

> Unauthorized modification or changes to this wireless communication equipment will void the right to use it. Changes or modifications to this unit not expressly approved by the party responsible for compliance will void the user's authority to operate the equipment. Any change to the equipment will void the Industry Canada grant.

5 Product description

5.1 Design and function

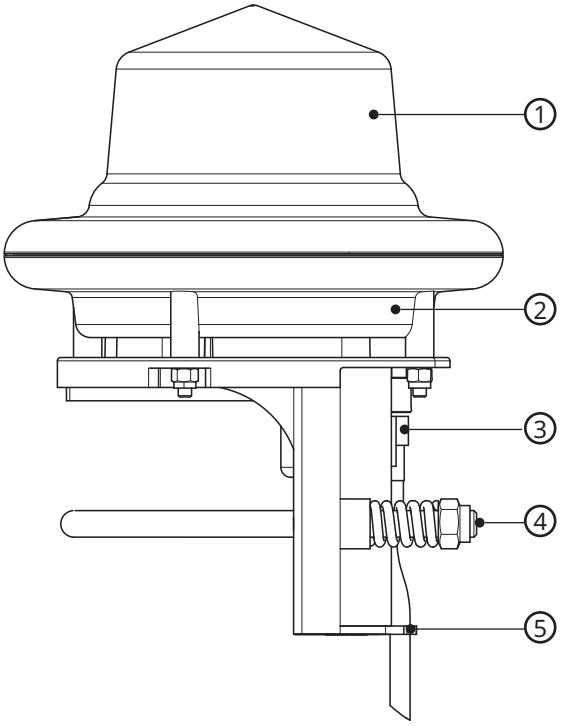
The precipitation sensor measures the quantity, intensity and type of precipitation such as rain, freezing rain, hail, snow and sleet. Radar technology is used for measurements.

The sensor is suitable for meteorological observations in particular in the following applications:

- Transportation safety as road weather
- Renewable energy
- Building automation

The equipment is connected by way of an 8 pole screw connector and associated connection cable (length 10 m). The communication can be realized over the RS485 or SDI-12 interface. Different protocol formats are available for communication as Modbus, SDI-12 or UMB. During commissioning, configuration and and for tests the ConfigTool.NET software is recommended.

5.2 Product overview



1	Precipitation sensor (heated)	4	Mounting bracket
2	Air pressure sensor	5	Notch for attaching connection cable
3	Connector		

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 Required tools and aids

The following tools and aids are required:

– open-end or ring spanner, SW 13

7.1.2 Choosing a site

WARNING

Risk of injury due to improper installation!

If the mast or the device is installed improperly, damage to the device and injury to people may result.

- Ensure that the mast stands on a stable surface.
- Ensure that the mast is sized and anchored appropriately.
- Ensure that the mast is earthed in accordance with the regulations.
- Use only approved and tested appliances (conductors, risers etc.) to install the device on the mast.

- Ensure the following at the site:

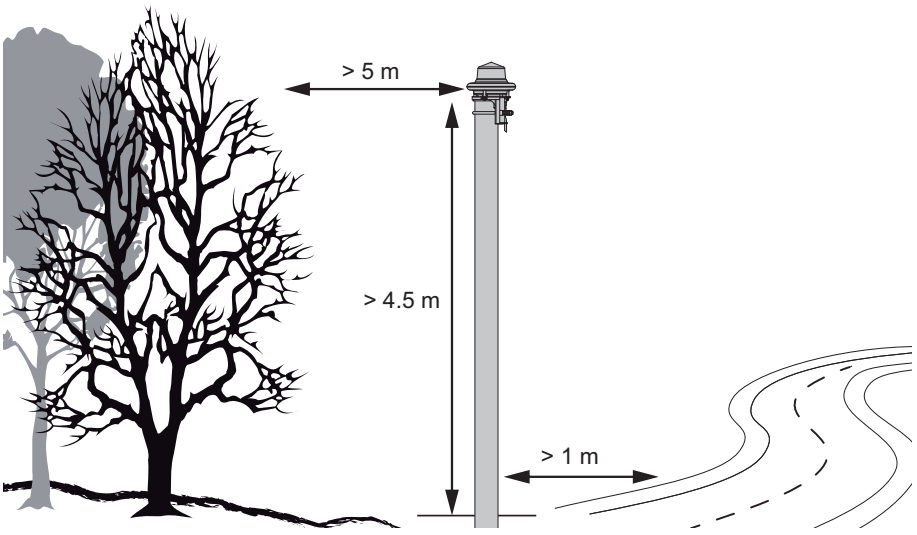
– Free access to the equipment for maintenance works

– Reliable power supply for permanent operation

– Good network coverage when transmitting over a mobile communications network

7.1.3 Installing device

When selecting the installation site, take care that the device is set up at an appropriate distance from other systems with a 24 GHz radar sensor, e.g. traffic counting devices on overhead gantry signs. Otherwise, cross effects and system malfunctions may occur. The distance to other measuring systems depends on their range of coverage and signal strength.



If the device is used to observe the weather for road and traffic control systems, carry out the following installation steps:

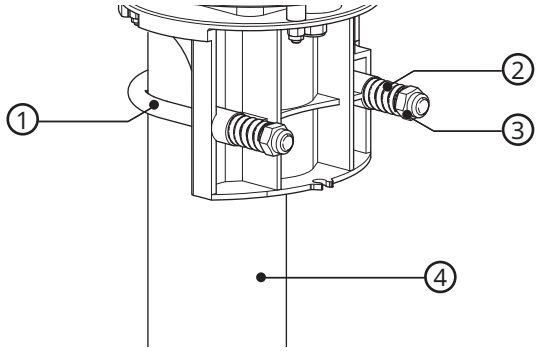
- Install the device at the top of the mast or on a suitable mast crossbeam with a clear view at least 4.5 m above the ground. If there are no moving objects in wider circumference of the device, a lower installation height is possible.
- Keep at least 1 m distance to the road carriageway and another WS100 radar sensor.
- Keep at least 5 m distance at the height of the device from moving objects, e.g. trees, bushes and bridges.

Falling or moving objects, e.g. falling leaves or leaves blowing in the wind, may cause false measurements, e.g. incorrect precipitation types are measured.

Strong wind may affect the accuracy of the precipitation measurement. Installation locations where wind turbulence is to be expected, e.g. due to buildings, are not suitable.

7.1.4 Fastening

The mounting bracket is designed to be installed on top of a mast with a diameter of 60 to 76 mm or on a suitable mast crossbeam.



1	Mounting bracket	3	Nut with washer
2	Spring	4	Mast

- Loosen the nuts.
- Push the device onto the top of the mast or crossbeam from above.
- Tighten the nuts evenly until they touch the springs but the device can still be moved easily.
- Tighten both nuts with 3 revolutions.

7.2 Electrical installation

7.2.1 Electrical connections

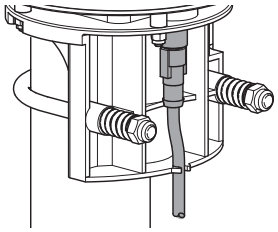
WARNING

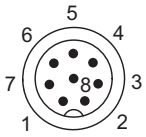
Electric shock due to incorrectly connected device!

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 electrical cabinet.
- Remove the yellow protective cap before plugging the device in.

There is an 8-pole screw connector on the underside of the device. This serves to connect the supply voltage and the interfaces via the connection cable.





Pin assignment

Number	Color	Assignment
1	White	Supply voltage ground and SDI-12_GND
2	Brown	Positive supply voltage (through 2.5 A fuse)
3	Green	RS485_A (+)
4	Yellow	RS485_B (-) or SDI-12 data line
5	Gray	Impulse output Uout
6	Pink	Not connected
7	Blue	Heating voltage ground
8	Red	Positive heating voltage (through 2.5 A fuse)

The supply voltage and the heating voltage are protected against polarity reversal.

7.2.1.1 Connecting devices in SDI-12 mode

- Connect the signal ground (SDI-12_GND) to line 1 (white), if the data logger and device supply voltage are DC-isolated.
- Do not connect the line 3 (green).

7.2.2 Supply voltage

The supply voltage is 12 to 30 V DC. The power supply unit used must be approved for operation with equipment of protection class III (SELV). Operation with a supply voltage of 24 V is recommended if a single power supply for heating and electronic power supply is used.

7.2.2.1 Limitations in 12 V mode

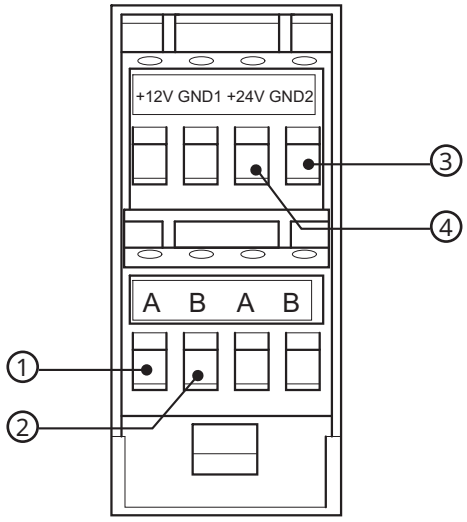
If the heating is operated on 12 V DC, the functional restrictions in winter operation has to be kept in mind. A heating voltage of 24 V DC is recommended to guarantee full heating duty.

7.2.3 RS485 Interface

The device has an electrically isolated, half-duplex, 2 wire RS485 interface for configuration, measurement polling and the firmware update.

7.2.4 Connecting ISOCON-UMB converter

The ISOCON-UMB communication module converts RS485 into RS232.



1	Green: RS485 interface A	3	White: supply voltage ground 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.
- Connect the red and blue wire direct to the power supply unit, not to the ISOCON-UMB converter.
- Refer to the operating manual UMB ISO converter ISOCON.

7.2.5 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.

7.2.6 Connecting impulse output for rain gauge simulation

The device provides a digital impulse output for simulation of a rain gauge. Depending on configuration settings the output is pulsed once for each 1.0 mm, 0.5 mm, 0.2 mm, 0.1 mm or 0.01 mm (default) of precipitation.

i If the device is configured for impulse output, the serial interface is not available for communication in UMB or other serial protocols.

The digital impulse output is available between pin 5 (gray wire) Uout and pin 1 (white) GND. In idle state the voltage level at Uout is approximately equal to the supply voltage. Each time the configured amount of precipitation is reached, Uout is pulsed for about 50 ms to GND level.

- Activate the rain gauge simulation mode in the ConfigTool.NET software and set the resolution selection.

8 Commissioning for UMB data format

The device can be operated with various protocols, e.g. UMB-ASCII. Further information on the protocols and the full description of UMB channels, SDI-12 and Modbus protocol can be found in the User Manual Smart Weather Sensors.

8.1 Device set-up

After the equipment has been installed and connected correctly, the device begins autonomously to take measurements. No protective cover needs to be removed from the device.

The following is required for configuration and testing purposes:

- Windows® PC with serial interface
- ConfigTool.NET software
- Interface cable: RS485 – USB interface adapter

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.
- If several smart weather 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 UMB-Config-Tool is not suitable for the configuration settings. The ConfigTool.NET software must be used for configuration settings. Attempts to modify the settings by UMB-Config-Tool can render the device inoperative.

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	7 (cannot be modified)
Device ID	1 (gives address 7001h = 28673d) 200
Baudrate	19200
RS485 protocol	Binary
Calculation interval	10 measurements
Local altitude	0 m

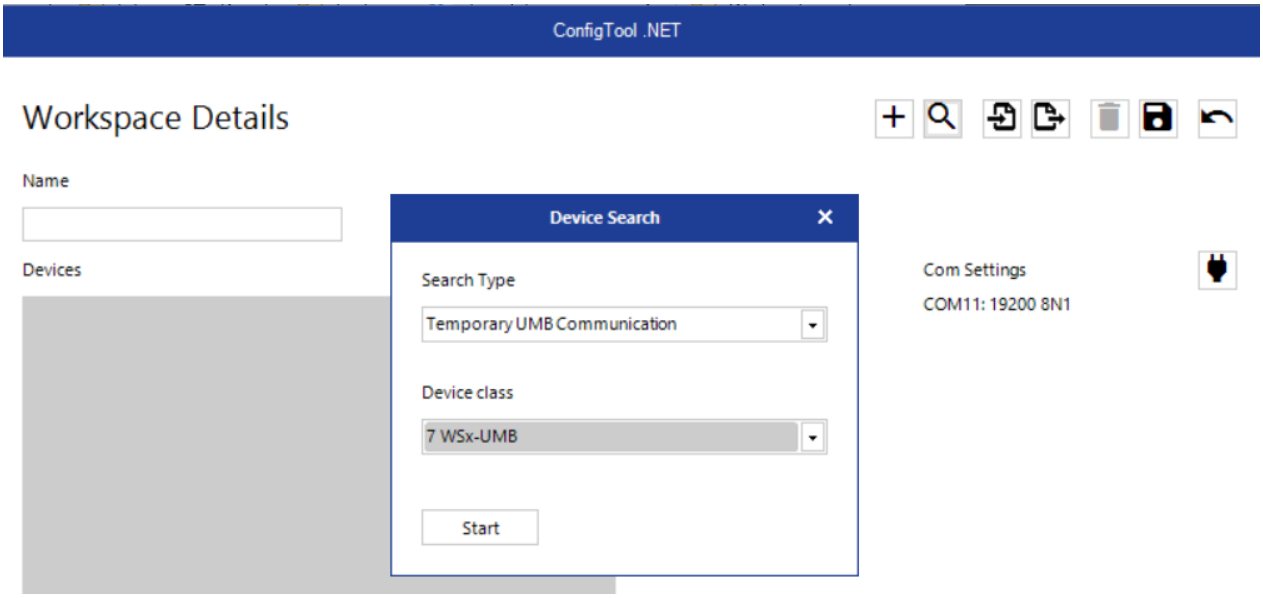
8.3 Configuration using UMB binary protocol

When the device is using UMB binary protocol the baudrates and the parity can be adjusted in the ConfigTool.NET software. The interface is operating in standard UMB mode (19200 8N1) and responds to the ID 200 for the first 5 seconds after power up or reset. If a valid UMB telegram is received within these 5 seconds, the device will stay in UMB mode for the configured time (several minutes) so that the configuration can be modified.

8.3.1 Configuration using ConfigTool.NET Version 1.5.1693 or newer

With ConfigTool.NET Version 1.5.1693.0 or newer, the communication in UMB standard mode is as follows:

- Connect the PC to the device through a RS485 converter.
- Start the ConfigTool.NET software and create a new workspace with communication parameters set to 19200Bd, 8N1.
- On *Workspace Details* page click the magnifier button to open the *Device Search* window.



- In the *Search Type* section, select *Temporary UMB Communication*.
- In the *Device class* section, select *7 WSx-UMB*.
- Click on the **Start** button and restart the device (power off / on).

⇨ ConfigTool.NET establishes a connection (ID 1 or ID 200) within a few seconds and reads the channel list.

⇨ The device is ready for configuration work.

8.3.2 Configuration using older versions of ConfigTool.NET

When using older versions of ConfigTool.NET or other tools the communication can be opened by the following procedure:

- Connect the PC to the device through a RS485 converter.
- Start ConfigTool.NET and create a WSx00-UMB with ID 200.
- Open the page *Device Settings*.
- Alternatively, start the measurement with at least one channel and with 1 second polling rate.
- Restart the device (power off / on).

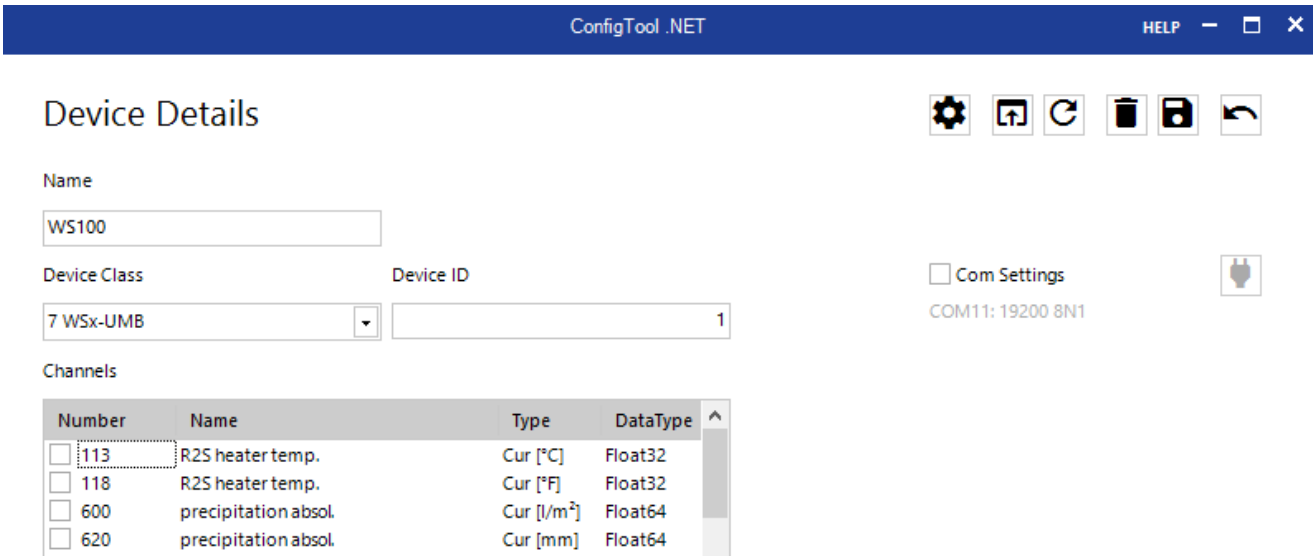
⇨ The device establishes the connection (green indicator, "Connected") within a few seconds.

⇨ When using the alternative method valid measurement values will be indicated within a few seconds. The ConfigTool.NET measurement can then be stopped.

⇨ The interface is now open for configuration.

8.3.3 Selecting device

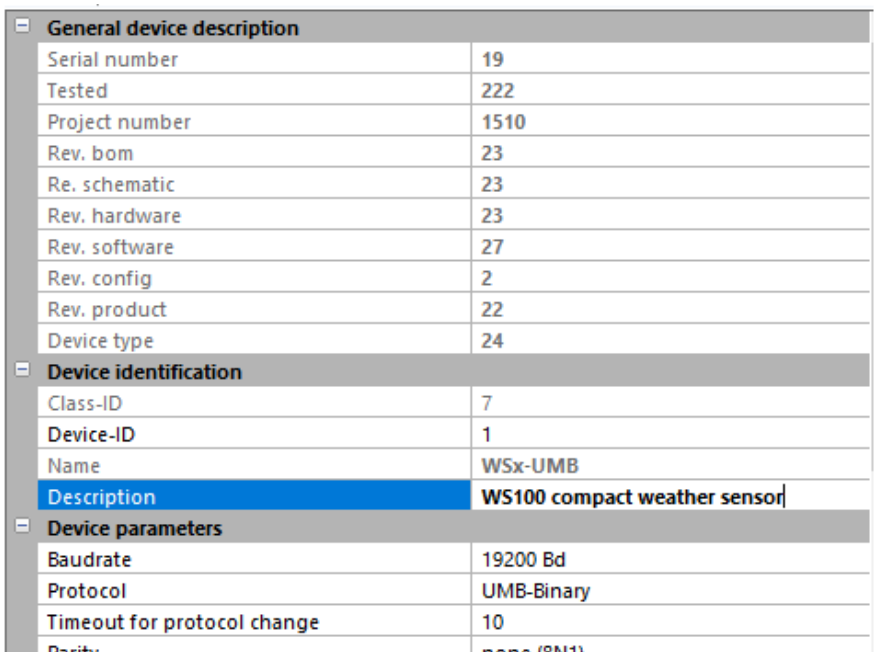
- Select an existing workspace or create a new one.
- Click the  button to add a new device to the workspace.



⇨ The device appears in the selection menu as *WSx-UMB* (Class ID 7).

- Enter a *Name* for the new device and adjust the *Device ID* if necessary.
- Confirm with **OK**.

8.3.4 General settings

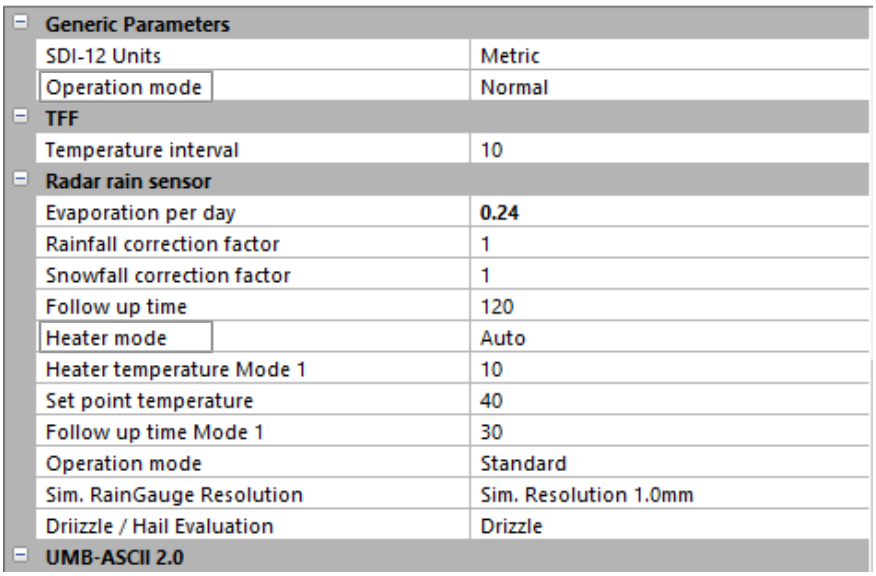


Parameter	Description
Device-ID	Factory setting: 1 Assign the IDs for the devices in ascending order.
Description	To differentiate the devices enter a description, e.g. the location.
Baudrate	Transmission speed of the RS485 interface Factory setting: 19200 DO NOT change for operation with ISOCON-UMB.
Protocol	Communication protocol of the device: UMB-Binary, UMB-ASCII, SDI-12, MODBUS-RTU, MODBUS-ASCII, Terminal-Mode
Timeout for protocol change	In the event of a temporary changeover of the communication protocol, the system switches back to the configured protocol after this time (in minutes).

If the baudrate is changed, after saving the configuration on the device, the device communicates at the new baudrate. When operating the device in a UMB network with ISOCON-UMB, this baudrate must not be changed; otherwise the device is no longer addressable and can no longer be configured.

8.3.5 Energy management

The energy consumption of the device can be adapted to the circumstances of the installation by setting the following parameters:



Generic Parameters	
SDI-12 Units	Metric
Operation mode	Normal
TFF	
Temperature interval	10
Radar rain sensor	
Evaporation per day	**0.24**
Rainfall correction factor	1
Snowfall correction factor	1
Follow up time	120
Heater mode	Auto
Heater temperature Mode 1	10
Set point temperature	40
Follow up time Mode 1	30
Operation mode	Standard
Sim. RainGauge Resolution	Sim. Resolution 1.0mm
Driizzle / Hail Evaluation	Drizzle
UMB-ASCII 2.0	

Parameter	Description
Operation mode	The power consumption of the device can be adjusted to the properties of the individual installation. The operation of the power save modes has certain constraints.
Heater mode	The heating is set to *Auto* on delivery. This is the recommended operating mode.

8.3.5.1 Normal operation mode

In normal operation mode, all specified properties of the devices are available. The power consumption is mainly determined by heating and fan operation.

8.3.5.2 Power saving mode 1

In power saving mode 1, the heater is switched off. The device is not working continuosly, it is activated every 5 seconds for one second. If precipitation is detected, it remains turned on until the end of the event. Otherwise the sensor is deactivated again after this second.

Power saving mode 1 restricts rain detection, it can be delayed up to 2 minutes. Short events are possibly not detected. Thus, deviations in the accuracy of the precipitation quantity are possible.

8.3.6 Specific settings

8.3.6.1 Precipitation sensor settings (radar)

Radar rain sensor	
Evaporation per day	**0.24**
Rainfall correction factor	1
Snowfall correction factor	1
Follow up time	120
Heater mode	Auto
Heater temperature Mode 1	10
Set point temperature	40
Follow up time Mode 1	30
Operation mode	Standard
Sim. RainGauge Resolution	**Sim. Resolution 0.01mm**
Driizzle / Hail Evaluation	Drizzle

Parameter	Description
Heater mode	The device can be configured for heating in different operating modes. Select *Auto* in normal operating mode.
Follow up time	Shows the detected precipitation type for this time in seconds. To cover all events, this time must be adjusted to the poll rate.

The other parameters, e.g. evaporation or correction factors, can be used to adapt the precipitation detection to special local conditions. They should only be modified after consultation with OTT HydroMet Fellbach GmbH, as they have a major influence on the functioning and accuracy of the sensor.

8.3.6.2 Rain gauge simulation settings

While the rain gauge simulation is active communication through the serial interface in UMB or another serial protocol is not possible. To still allow access to the device for modification of settings the UMB protocol will be active during the first 5 seconds after power on.

- Set the protocol to *Sim. Rain Gauge*.

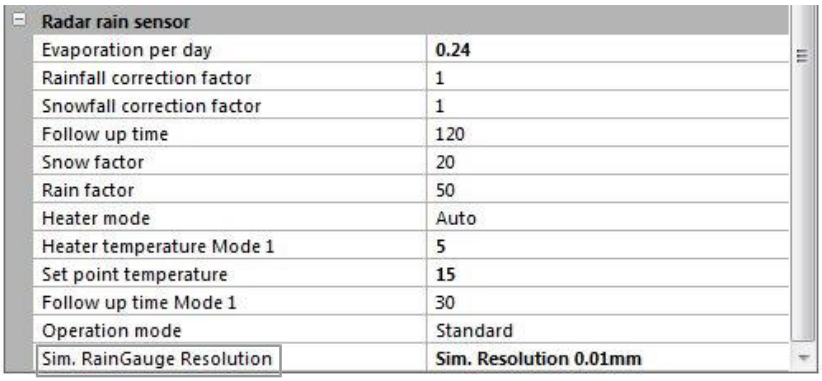
ConfigTool .NET

Device Settings WS100

Reboot

Device identification	
Class-ID	7
Device-ID	1
Name	WSx-UMB
Description	**compact weather station WS100-UMB**
Device parameters	
Baudrate	19200 Bd
Protocol	**Sim. Rain Gauge**
Timeout for protocol change	10

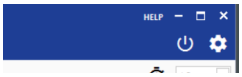
- Select the resolution of the simulated rain gauge. Factory setting is 0.01 mm.



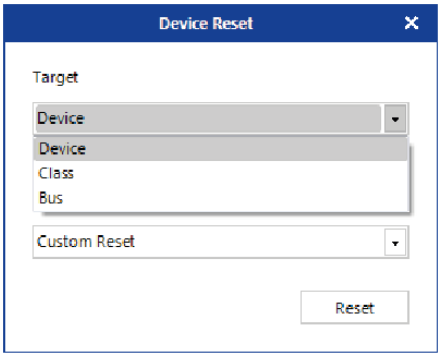
8.3.6.3 Reset precipitation quantity

To reset the accumulated absolute precipitation quantity, proceed as follows:

- Click the reset symbol in the ConfigTool.NET software, top right of the window header.

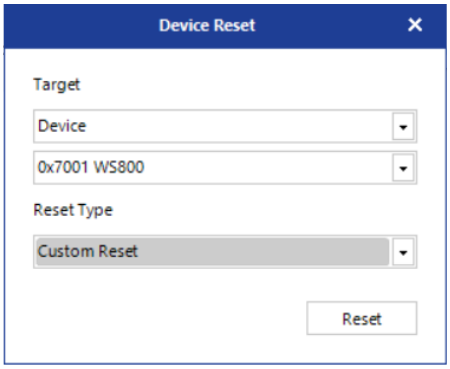


- In the *Target* section, select a new target from the drop-down menu.



Parameter	Description
Device	Currently used device
Class	Class of devices
Bus	All devices connected to the UMB network

- In the *Reset Type* section, select *Custom Reset*.

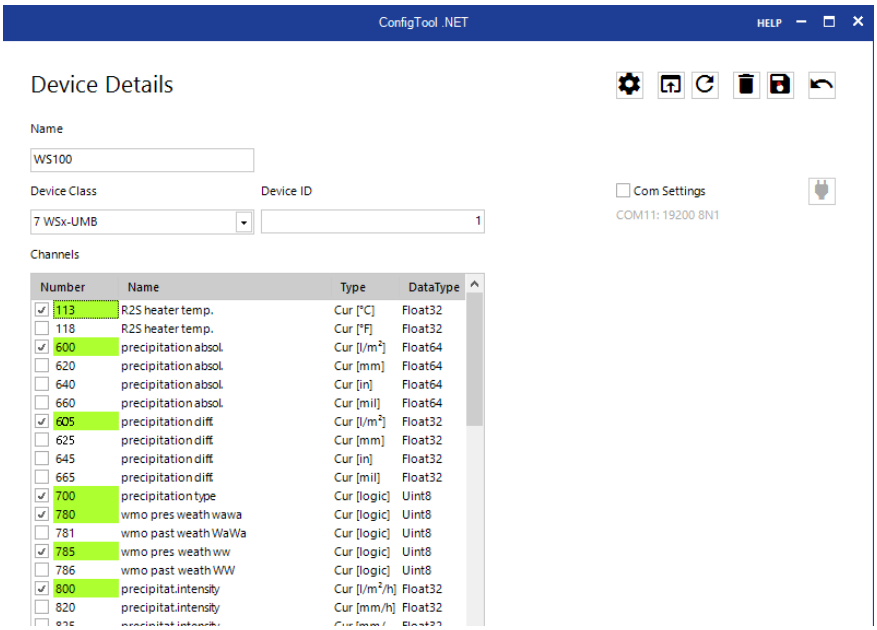


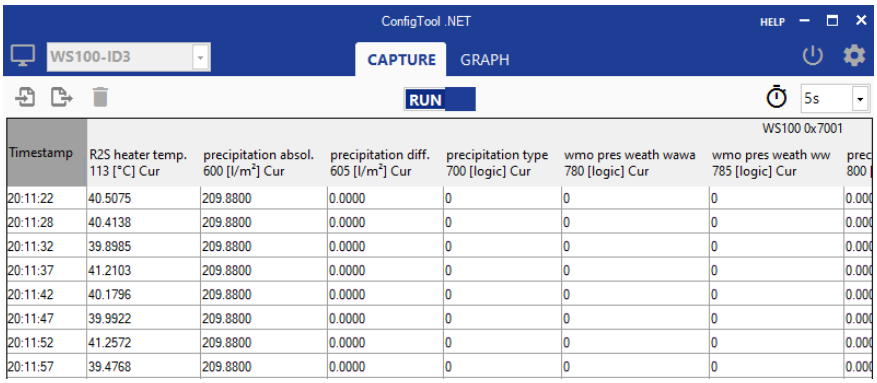
- Click the **Reset** button.

8.4 Testing

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

- Click on the desired channel.





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 Commissioning for SDI-12 data format

The device can be operated with various protocols, e.g. UMB-ASCII. Further information on the protocols and the full description of UMB channels, SDI-12 and Modbus protocol can be found in the User Manual Smart Weather Sensors.

9.1 Device set-up

Preconfigured devices with the SDI-12 protocol are available on inquiry.

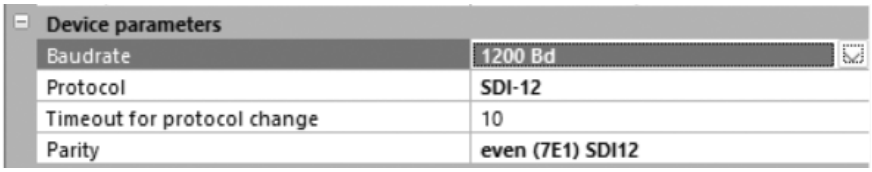
The communication in SDI-12 mode is conform to the standard defined in "SDI-12 A Serial-Digital Interface Standard for Microprocessor-Based Sensors Version 1.3 January 12, 2009" for all devices. SDI-12 version 1.4 is supported from firmware version v24. The device may be operated in bus mode together with other SDI-12 sensors, connected to one SDI requester (logger).

With firmware version v29, or higher an option for SDI-12 communication over RS485 is available. If this feature is also permitted by the SDI-12 logger in use, it allows communication over longer distances and reduces the susceptibility to electromagnetic interferences compared to the hardware interface defined by the SDI-12 standard.

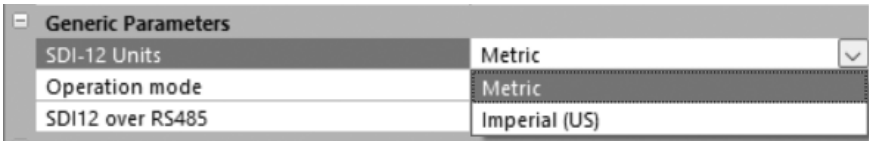
9.2 Configuration and testing

The parameters for SDI-12 must be set in the ConfigTool.NET software.

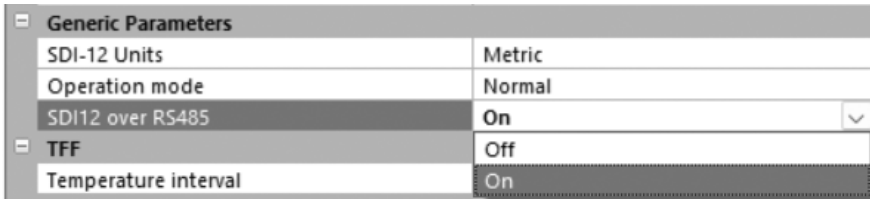
- Set the *Device Parameters* as follows:
  Baudrate: 1200 Bd
  Protocol: SDI-12
  Parity: 7E1



- Select the unit *Metric* or *Imperial (US)* of the transmitted measurement data.



- Select whether to communicate via the RS485 standard.



Using the ISOCON-UMB for SDI-12 over RS485 does not work because the RS485 interfaces of ISOCON-UMB are fixed to 19200 bd.

9.3 Command set

The commands listed below are available for the device. Due to the applied measurement process the device measures continuously in normal operation mode.

This causes the following special properties while in this mode:

- The device does not need a “Wakeup” and does not have a sleep mode. So the reactions to “Break” signals and any related timings are inapplicable. “Break” will be ignored by the devices.
- Data requested with M-commands or C-commands are always available immediately. The device will always respond with a000n resp. a000nn. This means the device will not send any service request and will ignore measurement abort signals. The logger should request the data immediately.
- M-command and C-command only differ in the number of values made available in the buffers (in both cases the maximum permitted by the standards of 9 resp. 20).
- The commands for continuous measurement (R-commands) are used to request the data.

Command	Function	Details
?!	Address search (Wildcard request, one device only on bus!)	Standard
a!	Request device active?	Standard
aI!	Request device identification	–
aAb!	Address change to b (0 ... 9, A ... Z, a ... z)	Standard
aM!	Measurement basic minimal data set	–
aM6!	Measurement precipitation	–
aMC!	Measurement, basic minimal data set, transmit values with CRC	–
aMC6!	Measurement wind, transmit values with CRC	–
aC!	Concurrent measurement, full basic data set	–
aC6! and aC7!	Concurrent measurement, assignment of values as for aMn! commands, partly extended data sets	–
aCC!	Concurrent measurement, transmit values with CRC	–
aCC6! and aCC7!	Concurrent measurement, assignment of values as for aMn! commands, partly extended data sets, transmit values with CRC	–
aD0!	Data request buffer 0	Standard
aD1!	Data request buffer 1	Standard
aR0!	Data request from continuous measurement, data set 0	–
aR1!	Data request from continuous measurement, data set 1	–
aRC0!	Data request from cont. meas., data set 0 with CRC	–
aRC1!	Data request from cont. meas., data set 0 with CRC	–
aV!	Command verification: Evaluate sensor status and heating temperatures, data request with aD0!, aD1!	–
aXU<m/u>!	Change the unit system for SDI data	–
aXH+nnnn!	Set local altitude of the device for calculation of rel. air pressure	–

Command	Function	Details
aXD+nnn.n!	Set local compass deviation	–
aXW<c/u>!	Activate / deactivate compass correction	–
aXL<n/s/w>!	Set power saving mode	–
aXMn!	Set the heating mode of the device	–
aXK+n!	Set rain gauge resolution	–
aXA<t/p/w>+nn!	Integration time for average and min/max evaluation	–
aXC!	Clear the abs. precipitation amount (includes a device reset)	–
aXR!	Device reset	–
aXVd!	Read device version	–
From device version 24 (SDI-12 v1.4)		
aIM!, aIMC!, aIMn!, aIMCn!, aIC!, aICC!, aICN!, aICCn!, aIVn!	Request number of measurement values	–
aIM_00m!, aIMC_00m!, aIMn_00m!, aIMCn_00m!, aIC_00n!, aICC_00n!, aICn_00m!, aICCn_00m!, aIR_00n!, aIV_00n	Request measurement value identification	–

Address configuration
The UMB device-ID and SDI-12 address are connected. The different address ranges and the fact that UMB IDs are integer numbers, while SDI-12 addresses are ASCII characters, have to be considered.

The SDI-12 address is built from the UMB device ID as follows: UMB device ID 1 (default) corresponds to SDI-12 address ‘0’ (SDI-12 default).

Changing the SDI-12 address by SDI-12 setting command also modifies the UMB device ID accordingly.

UMB (dec)			SDI-12 (ASCII)		
1	to	10	'0'	to	'9'
18	to	43	'A'	to	'Z'
50	to	75	'a'	to	'z'

Valid address ranges

9.4 Data messages
To simplify the evaluation, the assignment of measurement values to data buffers '0' ... '9' has been defined uniformly for all measurement commands. The responses to C-requests have been restricted to 35 characters. Buffers '0' to '1' are currently in use. A maximum of 9 values can be transferred; the basic data set of 9 values has been assigned to buffers ‘0’ and ‘1’.

The buffer assignment depends on the device variant. The complete set of measurement values defined for the UMB protocol is available in the SDI-12 environment and can be called up via the additional M-commands and C-commands: aM1! ... aM8!, aMC1! ... aMC8!, aC1! ... aC8!, aCC1! ... aCC8!.

If the sensor type requested with the measurement command is not available with the actual variant of the smart weather sensor, the device will respond as follows:
a0000<CR><LF> resp.
a00000<CR><LF>

If the measurement value is not available, e.g. through sensor failure, this is indicated by a value of +999.0. or -999.9. Using an aV! verification query, the logger evaluates the reason for failure. The following table shows the measurement values in the sequence they are arranged in the telegram (see example). Depending on the configuration of the device the values will be transmitted in metric or imperial US units.

i The configured system of units is not indicated in the data messages. The logger may request this setting with the I-command and adjust the evaluation of the data messages accordingly.

i The example uses italics to print the requests from the logger (*0M!*).

Measurement value	UMB channel	Minimum	Maximum	Unit
Buffer '0' in metric units				
Amount of precipitation absolute	620	0.0	100000.0	mm
Amount of precipitation difference	625	0.00	100000.00	mm
Precipitation intensity	825	0.0000	3.3333	mm/min
Precipitation type	700	0, 60, 70 67, 69, 90		
Buffer '0' in imperial US units				
Amount of precipitation absolute	640	0.000	3937.000	in
Amount of precipitation difference	645	0.0000	3937.0000	in
Precipitation intensity	845	0.0000	0.13123	in/min
Precipitation type	700	0, 60, 70 67, 69, 90		
Buffer '1'				
WMO Synop Code 4680 wawa	780	For WMO codes, see WMO Codes [▶ 46]		
WMO Synop Code 4680 WaWa	781			
WMO Synop Code 4677 ww	785			
WMO Synop Code 4680 WW	786			

Example: Request Buffer '0'
0D0!
0+23.5+0.2+3.24+60+0.0540<CR><LF>
Precipitation abs. 23.5 mm, precipitation difference 0.2 mm, precipitation intensity 3.2 mm/h, precipitation type 60 (rain), precipitation intensity 0.0540 mm/min

9.5 Message device identification

The device responds to the identification request with following message ():

Example: SDI-12 device address ‘0’
0I!
013Lufft.deWSx00ynnn
x: device type (4, 5, 6, 2, 3)
y: Metric / US units (m = metric, u = US)
nnn: Software version

Example: WS100, configured for imperial US units
0I!
013Lufft.deWS100u029

9.6 Message verification

> Further information can be found in the User Manual Smart Weather Sensors.

The command verification aV! is used to evaluate status information of the device.

The device responds to the request as follows:
a0005<CR<LF>, i.e. 5 values are available in the buffers

The first 3 or 4 measurement values, transmitted in buffer ‘0’ contain the status information of the measurement channels.

Buffer '0', status information:

Measurement channels	Measurement values	Comment
Status group1: +nnnn	not used	–
Status group1: +nnnnnn	not used	–
Status group 2: +nnnnnn	not used	–
Status group 3: +nnnnnn	Air pressure, air pressure buffer, wind, wind buffer, compass, precipitation	WS100 reports precipitation only on position 6
Status group 4: +nnnn	not used	–

The status data of the channels are assembled to form “fake measurement values”, where each digit represents one status.

Sensor status codes:

Sensor status	Code
OK	0
Invalid channel	1
E2_CAL_ERROR E2_CRC_KAL_ERR FLASH_CRC_ERR FLASH_WRITE_ERR FLASH_FLOAT_ERR	2
MEAS_ERROR	3
MEAS_UNABLE	4
INIT_ERROR	5
VALUE_OVERFLOW CHANNEL_OVERRANGE	6
VALUE_UNDERFLOW CHANNEL_UNDERRANGE	7
BUSY	8
Other sensor status	9

Generally each sensor has two status values, one for the direct value and another for the measurement value buffer used for the evaluation of the average, minimum, and maximum values.

The last two values, transmitted in buffer '1', show the heating temperatures of wind and precipitation sensor.

Buffer '1', device configured for metric units (°C):

Measurement value	UMB channel	Minimum	Maximum
Heating temperature precipitation sensor	113	-50.0	150.0

Buffer '1', device configured for imperial US units (°F):

Measurement value	UMB channel	Minimum	Maximum
Heating temperature precipitation sensor	118	-58.0	302.0

Example: WS100, SDI-12 address '0', no error
0V!
00005<CR><LF>
0D0!
0+0000+000000+00000<CR><LF>
0D1!
0+0.0+65.3<CR><LF>

10 Commissioning for MODBUS format

The device can be operated with various protocols, e.g. UMB-ASCII. Further information on the protocols and the full description of UMB channels, SDI-12 and Modbus protocol can be found in the User Manual Smart Weather Sensors.

10.1 Device set-up

Preconfigured smart weather sensors with the MODBUS protocol are available upon request.

With the MODBUS communication protocol, the smart weather sensors can be simply integrated into a PLC environment.

Measurement values are mapped to MODBUS input registers. The range of values available is the same as for the UMB protocol, including different unit systems. The use of register pairs for floating point numbers or 32-bit integers, which are not part of the MODBUS standard, has been dispensed with. All measurement values are mapped to 16 bit integers using suitable scaling factors.

10.2 Configuration and testing

The smart weather sensors can be configured for MODBUS-RTU or for MODBUS-ASCII.

The base configuration must be set in the ConfigTool.NET software.

- Select under *Device parameters* the *Protocol MODBUS-RTU* or *MODBUS-ASCII*.
  - ⇨ The following communication parameters will be preselected: 19200 Bd, even parity.
- Select the *Baudrate*: 19200, 9600, 4800 or lower.
- Select the *Interface*: 8E1, 8N1, 8N2.

The MODBUS communication has been tested for a poll rate of 1 second. The proper function of the device with higher MODBUS poll rates has not been tested.

We suggest to set the poll rate to 10 seconds or slower. The update rate of the data is ≥10 seconds. For most of the weather data, significant changes have to be expected in the range of minutes.

10.3 Addressing

The MODBUS address is deducted from the UMB device ID .

A device with UMB device ID 1 also has the UMB address 1.

The valid address range of MODBUS from 1 to 247 is smaller than that of the UMB device IDs. If a UMB device ID > 247 has been selected, the MODBUS address will be set to 247.

10.4 MODBUS functions

Further information can be found in the User Manual Smart Weather Sensors.

For the smart weather sensors, the functions of conformance class 0 and 1 have been implemented, which operate at register level.

Starting with device version 227 / firmware version v60 additional coil functions are available.

Command	Function	Comment
Conformance Class 0		
0x03	Read holding registers	Selected configuration settings
0x16	Write multiple registers	Selected configuration settings
Conformance Class 1		
0x01	Read Coils	Selected additional operations (from device version 227)
0x04	Read input registers	Measurement values and status information
0x05	Write single coil	Selected additional operations (from device version 227)
0x06	Write single register	Selected configuration settings
0x07	Read exception status	Currently not used
Conformance Class 2		(partly)
0x0F	Write multiple coils	Selected additional operations (from device version 227)
Diagnostics		
0x11	Report responder ID	(responds also to broadcast address)

10.4.1 Function 0x04 read input registers

The input registers are containing the measurement values of the smart weather sensor and the related status information.

The measurement values are mapped to the 16 bit registers using the following scaling factors:

- 0 ... 65530 for unsigned values
- -32762 ... 32762 for signed values

The values 65535 (0xffff) and 32767 are used for the indication of erroneous or not available measurement values. A more detailed specification of the error can be evaluated from the status registers.

The assignment of the values to the register addresses (0 ... 124) has been arranged in a way so that the most frequently used data can be read out with just a few register block requests.

The following blocks have been defined:

- Status information
- Frequently used values which are independent of the unit system (metric / imperial) in use.
- Frequently used values in metric units
- Frequently used values in imperial units
- Other measurement values

When using the metric unit system the first three blocks can supply all data required with one request. There is no difference in the register assignment between the product variants. If, dependent on the variant, some value is not available, this will be indicated by setting the register to the error value.

i The following tables mainly show average values. Further values can be found in the User Manual Smart Weather Sensors.

Register number	Register address	Value (UMB channel)	Range	Scaling factor	Comment
		Status information			
1	0	Identification	High byte: WS-Type (2,3,4,5,6) Low byte: Software Version	Type coding	See Status and type coding [▶ 37]
2	1	Device Status	–	–	See Status and type coding [▶ 37]
3	2	Sensor Status 1	Air temperature buffer, air temperature, dew point buffer, dew point(high byte -> low byte)	Coding 4 bit per status	See Status and type coding [▶ 37]
4	3	Sensor Status 2	Relative humidity buffer, relative humidity, absolute humidity buffer, absolute humidity (high byte -> low byte)	Coding 4 bit per status	See Status and type coding [▶ 37]
5	4	Sensor Status 3	Mixing ratio buffer, mixing ration, air press. buffer, air pressure (high byte -> low byte)	Coding 4 bit per status	See Status and type coding [▶ 37]
6	5	Sensor Status 4	Wind buffer, wind, precipitation, compass (high byte -> low byte)	Coding 4 bit per status	See Status and type coding [▶ 37]
7	6	Sensor Status 5	Global radiation buffer, global radiation, reserved, reserved (high byte -> low byte)	Coding 4 bit per status	See Status and type coding [▶ 37]
8	7	Sensor Status 6	External temperature / external rain gauge, lightning sensor, lightning sensor buffer	Coding 4 bit per status	See Status and type coding [▶ 37]
9	8	Reserved	–	–	–

Register number	Register address	Value (UMB channel)	Range	Scaling factor signed/unsigned	Comment
		Values independent of the unit system			
26	25	700	Precipitation type	Factor 1, s	–
		Values in metric units			
42	41	113	Heating temperature R2S °C	Factor 10, s	–
49	48	620	Precipitation absolute mm	Factor 100, u	Limited to 655.34 mm
50	49	625	Precipitation different mm	Factor 100, u	Limited to 100.00 mm

Register number	Register address	Value (UMB channel)	Range	Scaling factor signed/unsigned	Comment
51	50	820	Precipitation intensive mm/h	Factor 100, u	Limited to 200.00 mm/h
		Values in imperial US units			
62	61	118	Heating temperature R2S °F	Factor 10, s	–
69	68	640	Precipitation absolute in	Factor 1000, u	Limited to 25.800 in
70	69	645	Precipitation different in	Factor 10 000, u	Limited to 3.9370 in
71	70	840	Precipitation intensive in/h	Factor 10 000, u	Limited to 6.5534 in
		Further values			
113	112	780	WMO SYNOP Code 4680wawa	Factor 1, u	–
114	113	781	WMO SYNOP Code 4680WaW	Factor 1, u	–
115	114	785	WMO SYNOP Code 4677ww	Factor 1, u	–
116	115	786	WMO SYNOP Code 4677WW	Factor 1, u	–
130	129	4600	Precipitation: Total particles	Factor 1, u	–
131	130	4601	Precipitation: Total_Drops	Factor 1, u	–
132	131	4602	Precipitation: Drizzle particles	Factor 1, u	–
133	132	4603	Precipitation: Snow particles	Factor 1, u	–
134	133	4604	Precipitation: Hail particles	Factor 1, u	–
135	134	4620	Precipitation: Drop class 0	Factor 1, u	–
136	135	4621	Precipitation: Drop class 1	Factor 1, u	–
137	136	4622	Precipitation: Drop class 2	Factor 1, u	–
138	137	4623	Precipitation: Drop class 3	Factor 1, u	–
139	138	4624	Precipitation: Drop class 4	Factor 1, u	–
140	139	4625	Precipitation: Drop class 5	Factor 1, u	–
141	140	4626	Precipitation: Drop class 6	Factor 1, u	–
142	141	4627	Precipitation: Drop class 7	Factor 1, u	–
143	142	4628	Precipitation: Drop class 8	Factor 1, u	–
144	143	4629	Precipitation: Drop class 9	Factor 1, u	–
145	144	4630	Precipitation: Drop class 10	Factor 1, u	–
146	145	4631	Precipitation: Drop class 11	Factor 1, u	–
150	149	4100	Air Temperature °C ACT	Factor 10, s	–
151	150	4120	Air Temperature °C MIN	Factor 10, s	–
152	151	4140	Air Temperature °C MAX	Factor 10, s	–
153	152	4160	Air Temperature °C AVG	Factor 10, s	–
154	153	4105	Air Temperature °F ACT	Factor 10, s	–
155	154	4125	Air Temperature °F MIN	Factor 10, s	–
156	155	4145	Air Temperature °F MAX	Factor 10, s	–
157	156	4165	Air Temperature °F AVG	Factor 10, s	–
160	159	700	Precipitation type	Factor 1, u	–
161	260	620	Total precipitation mm	Factor 100, u	–
162	161	625	Precipitation difference mm	Factor 100, u	–

Register number	Register address	Value (UMB channel)	Range	Scaling factor signed/unsigned	Comment
163	162	820	Precipitation intensity mm/h	Factor 100, u	–
164	163	113	Heating temperature °C	Factor 10, s	–
165	164	640	Total precipitation in	Factor 1000, u	–
166	165	645	Precipitation difference in	Factor 1000, u	–
167	166	840	Precipitation intensity in/h	Factor 1000, u	–
168	167	118	Heating temperature °F	Factor 10, s	–
169	168	780	WMO Synop Code 4680 wawa	Factor 1, u	–
170	169	781	WMO Synop Code 4680 WaWa	Factor 1, u	–
171	170	785	WMO Synop Code 4677 ww	Factor 1, u	–
172	171	786	WMO Synop Code 4677 WW	Factor 1, u	–

10.5 Status and type coding

i Further information can be found in the User Manual Smart Weather Sensors.

Device status

Under normal operating conditions, the device status is 0. If the device status is not 0, this may indicate a serious system error. Exception: Code 48 after performing a reset to factory settings.

- Perform another reset.
- If the device status is not 0, contact the Lufft support team.
- Consider measurement values collected during or after a non-zero device status to be unreliable.

Sensor status

Each register holds 4 sensor states, coded with 4 bits per state, which together form a 16-bit number. The sequence is defined from the most significant half-byte to the least significant half-byte. Most sensors have 2 status values, one for the sensor and the current measurement value, another one for the buffer, from which the average value and the minimum and maximum values are evaluated.

Example

High Byte		Low Byte	
High	Low	High	Low
Temperature buffer	Temperature	Dewpoint buffer	Dewpoint
5	3	0	7

The example values above are combined to the register value 0x5307 = 21255. The values are for illustration only, the given combination will not occur in reality.

The single status are retrieved from the register as integer part:

Status 1 = register / 4096

Status 2 = (register / 256) AND 0x000F

Status 3 = (register / 16) AND 0x000F

Status 4 = register AND 0x000F

The following table shows the sensor status coding:

Sensor status	Code
OK	0
UNGLTG_KANAL	1
E2_CAL_ERROR E2_CRC_KAL_ERR FLASH_CRC_ERR FLASH_WRITE_ERR FLASH_FLOAT_ERR	2
MEAS_ERROR MEAS_UNABLE	3
INIT_ERROR	4
VALUE_OVERFLOW CHANNEL_OVERRANGE VALUE_UNDERFLOW CHANNEL_UNDERRANGE	5
BUSY	6
Other sensor state	7

11 Maintenance

11.1 Maintenance schedule

The frequency of cleaning is dependent upon the local weather and environmental conditions. Ideally, the dome of the device should be cleaned at regular intervals.

The following maintenance intervals are recommended:

Interval	Activity	Performed by
Twice a week	▸ Clean the dome using a dry and lint-free cloth. ▸ For persistent soiling, use additional distilled water. If the soiling is servere, pure alcohol can be used. ▸ Ensure that no streaks or deposits are left on the dome.	Operator
Annually	▸ Check the device for cleanliness. ▸ Check the device by carrying out a measurement request.	Operator
Annually	▸ Have a calibration check performed.	OTT HydroMet

11.2 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.lufft.com/resources/.
- ▸ Install the update on a Windows® PC.

12 Troubleshooting

12.1 Error elimination

Error	Possible cause	Corrective action
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 measures precipitation, but it is not raining	Device installed incorrectly	▸ Check that the device was installed correctly in accordance with the instructions.
Measured temperature appears too high / measured humidity appears too low	Fan does not work properly	▸ Check whether the fan on the underside of the device is working.
Wind direction values are incorrect	Device is not aligned correctly	▸ Check that the device is aligned to the north.
Device transmits error value 24h (36d)	A channel is being polled that is not available on this device type	–
Device transmits error value 28h (40d)	Device is in the initialization phase following startup	▸ Wait for approx. 10 seconds. The device delivers measurements after approx. 10 seconds.
Device transmits error value 50h (80d)	Device is being operated above the limit of the specified measuring range	–
Device transmits error value 51h (81d)	Device is being operated below the limit of the specified measuring range	–
Device transmits error value 55h (85d) during wind measurement	Device is being operated well above the limit of the specified measuring range	–
Device transmits error value 55h (85d) during wind measurement	Very strong horizontal rain or snow	–
Device transmits error value 55h (85d) during wind measurement	There are foreign objects within the measuring section of the wind meter	–
Device transmits error value 55h (85d) during wind measurement	Wind meter sensors are very dirty	▸ Clean the sensor.
Device transmits error value 55h (85d) during wind measurement	Wind meter sensors are iced over	▸ Check the heating mode in the configuration and check the heating function / connection.
Device transmits error value 55h (85d) during wind measurement	One of the wind meter's sensors is faulty	▸ Return the device to the manufacturer for repair.

Error	Possible cause	Corrective action
Quality of the wind measurement is not always 100 %	In normal operation the device should always transmit 90 – 100 %. Values up to 50 % do not represent a general problem. When the error value 55h (85d) is transmitted, this value is 0 %. If the device permanently transmits values below 50 %, this may mean that there is a fault.	–
Device transmits an unknown error value	–	▸ Report any malfunction to the representative of OTT HydroMet.

13 Repair

13.1 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

14 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.

15 Technical data

15.1 General technical data

Specification	Value
Fastening	Stainless steel bracket for mast with diameter 60 – 76 mm
Housing	Plastic (PC)
Protection class	III (SELV)
Protection type	IP66
Operating temperature range	-40 to +60 °C
Storage temperature range	-50 to +70 °C
Humidity range	0 to 100 %
Survival wind speed	75 m/s

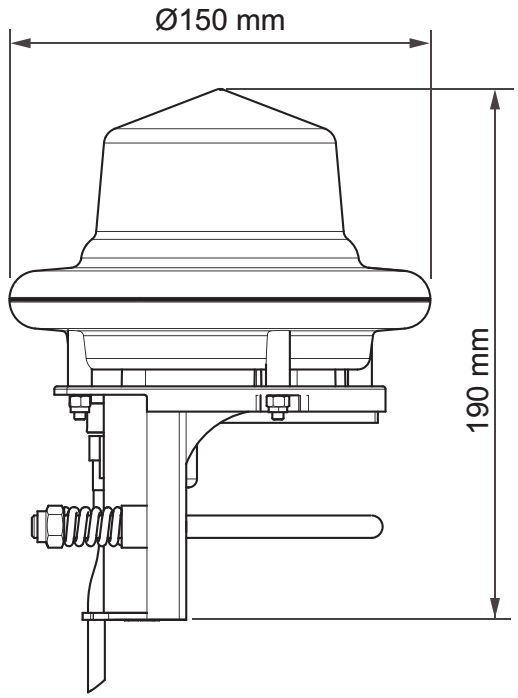
15.2 Electrical data

Specification	Value
Power supply	10 to 28 V DC
Power consumption without heating	1 VA / 0.4 VA (low power mode)
Heating power	9 VA

15.3 Data transfer

Specification	Value
Interfaces/ protocols	RS-485 semi-duplex two-wire, SDI-12, pulse interface / UMB protocol, MODBUS analog output
(Pluggable) cable length	10 m
Transmission frequency	24 GHz

15.4 Dimensions and weight



WS100-UMB, 600 g

15.5 Measuring range and accuracy

Measuring range

Specification	Value
Measuring range (drop size)	0.3 to 0.5 mm
Drop size distribution	11 drop size classes with bandwidth of 0.5 mm
Precipitation intensity	0.01 to 200 mm/h (0 to 7.874 inch/h)
Solid precipitation	5.1 to 30 mm

Precipitation

Specification	Value
Measurement surface	9 cm^2
Precipitation types	Rain, snow, sleet, freezing rain, hail, drizzle; no precipitation (SYNOP 4677)
Measurement process	Doppler radar
Accuracy	±0.16 mm or ±10 % of the measured value for liquid precipitation
Liquid precipitation resolution	0.01 / 0 .1 / 0.2 / 0.5 / 1.0 mm (pulse interface)

15.6 Measurement output

Measurements are transmitted in accordance with UMB binary protocol (factory settings).

i Further information can be found in the User Manual Smart Weather Sensors.

15.6.1 WMO Codes

Sampling rate: 1 minute (10 minute floating average)

Response threshold: 0.1 mm/h

Request channels:

UMB channel	Measurement variable (uint8)	Coding		
		No	**Description**	**Limits**
780	WMO Synop Code 4680 wawa (present weather, automated station)	00	No significant weather	–
		51	drizzle, not freezing, slight	0.1 mm/h
		52	drizzle, not freezing, moderate	≥ 0,1 mmh to < 0 .5 mm/h
		53	drizzle, not freezing, heavy	≥ 0.5 mm
		57	drizzle + rain, slight	< 2.5 mm/h
		58	drizzle + rain, moderate/heavy	≥ 2.5 mm/h
		61	rain not freezing, slight	< 2.5 mm/h
		62	rain, not freezing, moderate	≥ 2.5 mm/h to < 10 mm/h
		63	rain, not freezing, heavy	≥ 10 mm/h
		67	rain/drizzle + snow, slight	< 2.5 mm/h
		68	rain/drizzle + snow, mod./heavy	≥ 2.5 mm/h
		71	snow, slight	< 1 mm/h
		72	snow, moderate	≥ 1 mm/h to < 4.0 mm/h
		73	snow, heavy	> 4.0 mm/h
		89	hail	–
781	WMO Synop Code 4680 WaWa (currently not avalailable)	Same coding as channel 780		
		No	**Description**	**Limits**
785	WMO Synop Code 4677 ww (present weather, manned station)	00	no cloud development observed	–
		51	drizzle, not freezing, continuous, slight	< 0.1 mm/h
		53	drizzle, not freezing, continuous, moderate	≥ 0.1 mmh to < 0.5 mm/h
		55	drizzle, not freezing, continuous, heavy	≥ 0.5 mm
		58	drizzle and rain, slight	< 2.5 mm/h
		61	rain, not freezing, continous, slight	< 2.5 mm/h
		63	rain, not freezing, continous, moderate	≥ 2.5 mm/h to < 10 mm/h
		65	rain, not freezing, continuous, heavy	≥10 mm/h
		68	rain/drizzle + snow, slight	< 2.5 mm/h

UMB channel	Measurement variable (uint8)	Coding		
		69	rain/drizzle + snow, moderate/heavy	≥ 2.5 mm/h
		71	continuous fall of snow, slight	< 1 mm/h
		73	continuous fall of snow, moderate	≥ 1 mm/h to < 4.0 mm/h
		75	continuous fall of snow, heavy	> 4.0 mm/h
		89	hail shower, slight	< 2.5 mm/h
		90	hail shower, moderate/heavy	≥ 2.5 mm/h
786	WMO Synop Code 4677WW (currently not available)	Same coding as channel 785		

The code lists only include synop codes supported by WS100. For the complete synop tables 4680 and 4677 and for more details, see the related WMO documents (e.g. Manual on Codes (WMO-No.306), Volume I.1, Part A –Alphanumeric Codes).

15.6.2 Drop diameter distribution

Drop diameters of precipitation detected by the radar sensor are shown as distribution of drop diameter classes. Diameters are calculated as volume equivalent ball diameter.

Sampling rate: Event dependent

Unit: Number of events

Request channels:

UMB channel	Measurement variable (uint32)	Unit
4600	Total precipitation particles	Events
4601	Total drops	Events

UMB channel	Measurement variable (uint16)	Unit
4602	Drizzle particles	Events
4603	Snow particles	Events
4604	Hail particles	Events
4620	Cl. 0: Drops < 0.5 mm equiv. diameter	Events
4621	Cl 1: Drops 0.5 to 1.0 mm equiv. diameter	Events
4622	Cl 2: Drops 1.0 to 1.5 mm equiv. diameter	Events
4623	Cl 3: Drops 1.5 to 2.0 mm equiv. diameter	Events
4624	Cl 4: Drops 2.0 to 2.5 mm equiv. diameter	Events
4625	Cl 5: Drops 2.5 to 3.0 mm equiv. diameter	Events
4626	Cl 6: Drops 3.0 to 3.5 mm equiv. diameter	Events
4627	Cl 7: Drops 3.5 to 4.0 mm equiv. diameter	Events
4628	Cl 8: Drops 4.0 to 4.5 mm equiv. diameter	Events
4629	Cl 9: Drops 4.5 to 5.0 mm equiv. diameter	Events
4630	Cl 10: Drops 5.0 to 5.5 mm equiv. diameter	Events
4631	Cl 11: Drops > 5.5 mm equiv. diameter	Events

The accumulated sum of events of each channel will be reset to 0 after transmission. For consistent results, all related channels must be requested in one run.

If the response from the device is lost due to a transmission error (e.g. poor GPRS connection), the quantity accumulated to date is also lost. The quantity accumulated to date is also reset each time the equipment is rebooted.

15.6.3 Service messages

Service channels are available for the surveillance of the operation.

Request channels:

UMB channel					Measuring range		
act	min	max	avg	Measurement variable (float32)	min	max	unit
10000	–	–	–	Supply Voltage V	0.0	50.0	V
11000	–	–	–	Rain Drop Volume µ	0.0	500.0	µl

Air temperature (without radiation shield)

Sampling rate:	1 minute
Generation of average value:	1 to 10 minutes
Unit:	Number of events

Request channels:

UMB channel					Measuring range		
act	min	max	avg	Measurement variable (float32)	min	max	unit
4100	4120	4140	4160	Air temperature	-50.0	60.0	°C
4105	4125	4145	4165	Air temperature	-58.0	140.0	°F

OTT HydroMet

Contact Information