

Visibility Sensor VS2k-UMB / VS20k-UMB

Operational Manual



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1 Scope of supply

The following items are included with delivery*:

- Visibility sensor
- Clamp for mast mounting
- Mounting accessories
- Functional Grounding Kit
- Manufacturing Certificate
- Information Sheet

*Scope of delivery applies only to device version ≥ 20 . The device version can be identified by the last three digits of the product serial number.

2 Order numbers and variant code

2.1 Product variants

Variant	Order number
Visibility sensor VS2k-UMB	8366.U70
Visibility sensor VS20k-UMB	8366.U90

2.2 Accessories and spare parts

Item	Order number
Calibration kit	8366.UKAL2
Power supply unit 24 V/100 VA	8366.USV1
ISOCON-UMB	8160.UIISO
Surge protection	8379.USP
Connection cable 10 m	8370.UKAB10
Connection cable 20 m	8370.UKAB20

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



The device can be operated with the protocols UMB Binary or UMB-ASCII.

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 visibility sensor is used to determine optical visibility in meteorological applications, including road traffic.

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.

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 Risk due to invisible IR radiation



The device emits invisible IR radiation and is classified into risk group 1 (low risk) according to IEC 62471:2006 "Photobiological safety of lamps and lamp systems". An exposure of more than 500 s can lead to damage to the eye.

- ▶ Do not look into the beam directly.
- ▶ Avert the eyes for at least 60 s after a long exposure to the beam.
- ▶ Do not view the IR beam or exit optics with any optical aid, such as a magnifying glass, lens, microscope, binoculars or telescope.

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

CE (EU)

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

FCC (US)

FCC Part 15B, 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.

5 Product description

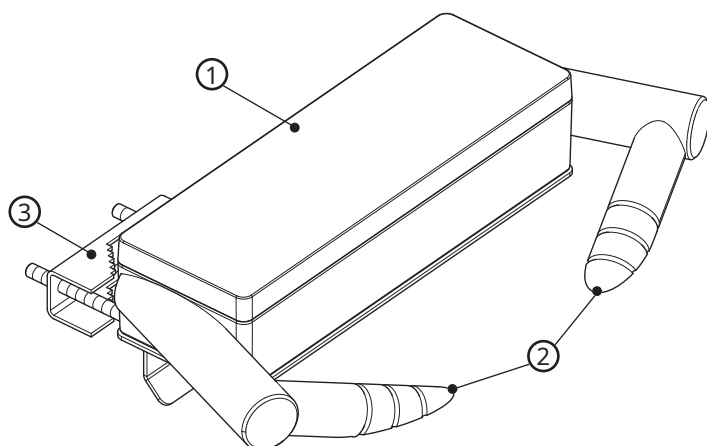
5.1 Design and function

Visibility is determined by measuring the intensity of scattered light using the principle of forward scattering, measured in the horizontal plane.

The particles in the field of measurement (e.g. fog droplets) scatter the infrared light emitted by the transmitter. The receiver detects the intensity of the light scattered at an angle of approx. 42° , from which a scattering coefficient is calculated. Taking into account a defined contrast threshold, the meteorological optical range (MOR) is derived. The evaluation is based on the Koschmieder law, which describes the relationship between light extinction and visibility. Soiling of transmitter and receiver is detected with proximity sensors.

The equipment is connected by way of an 8 pole screw-in connector and associated connection cable. The measured values are requested over the RS-485 interface in accordance with UMB protocol. In addition the device provides an analog output. For device version ≥ 20 , refer to the Appendix covering proper functional grounding [► 34] to achieve the most adequate EMC-compatibility. During commissioning, configuration and measurement polling takes place using the ConfigTool.NET software.

5.2 Product overview



- 1 Housing
- 2 Optics

- 3 Mounting bracket

6 Transport, storage, and unpacking

6.1 Transport

- ▶ Transport the product always in its original packaging.
- ▶ Ensure that the product is not mechanically stressed during transport.

6.2 Storage

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

6.3 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 your supplier or manufacturer.
- ▶ Keep the original packaging for any further transportation.

7 Installation

7.1 Risks during installation



WARNING

Risk of eye injury due to IR beam!

Looking directly into the IR beam can injure the eyes.

- ▶ Do not look directly into the IR beam.
 - ▶ Observe the IR beam indirectly.
-

For more detail, refer to Risk due to invisible IR radiation [▶ 11].

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.

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.

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.

7.2 Mechanical installation

7.2.1 Required tools and aids

The following tools and aids are required:

- open-ended wrench, 17 mm or adjustable wrench

7.2.2 Choosing a site



WARNING

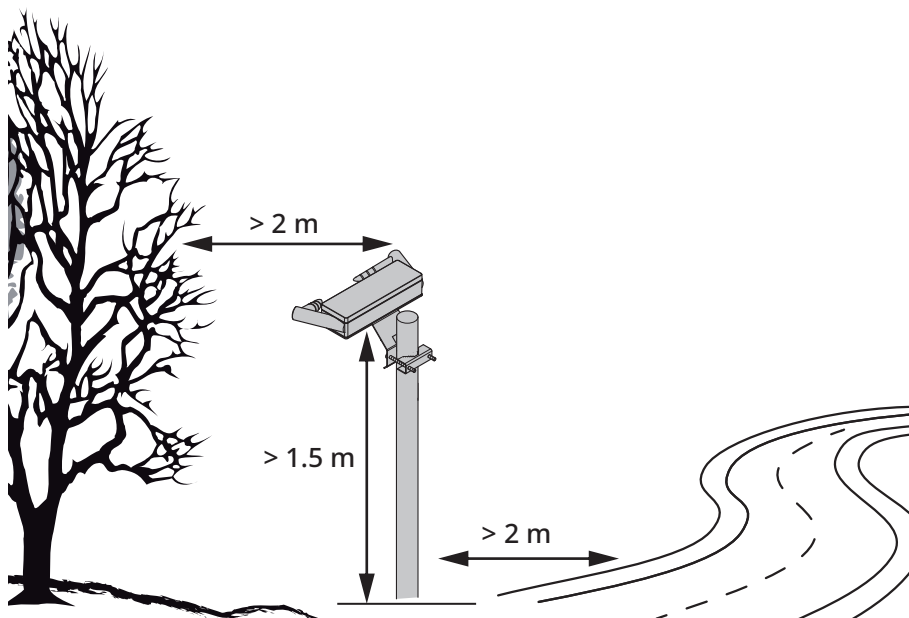
Risk of injury due to improper installation!

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

7.2.2.1 Installing device



- ▶ Install the device on the mast at least 1.5 m (4.9 ft) above the ground.
- ▶ Turn away the measurement aperture from the road.
- ▶ Keep at least 2 m (6.5 ft) distance to the road carriageway.
- ▶ Keep at least 2 m (6.5 ft) distance at the height of the device (in front of the measurement aperture) from objects, e.g. masts, trees, bushes and grass.
- ▶ Keep at least 50 cm (1.6 ft) distance to other devices above and below the device.

7.3 Electrical installation

7.3.1 Electrical connections



WARNING

Electric shock due to incorrectly connected device!

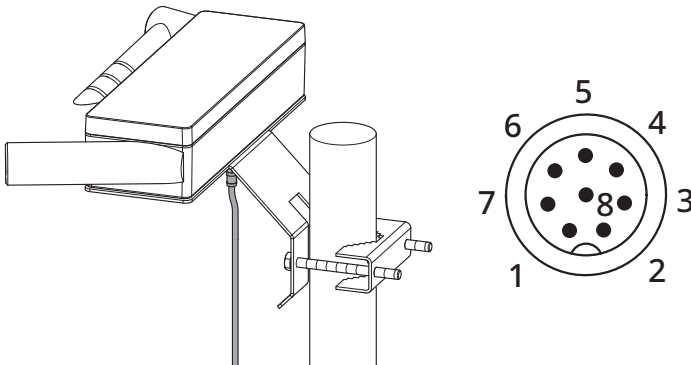
If the device is not connected correctly, it may be permanently damaged and an electric shock may result, if improper power supply is used.

- Ensure that the device is connected correctly.



For device version ≥ 20 , ensure proper functional grounding and connect the cable shielding to earth in the electrical cabinet to achieve optimal electromagnetic compatibility performance, see Appendix Functional grounding [► 34].

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	Negative supply voltage
2	Brown	Positive supply voltage
3	Green	RS-485_A (+)
4	Yellow	RS-485_B (-)
5	Gray	*
6	Pink	*
7	Blue	Active current loop output (- pol)
8	Red	Active current loop output (+ pol)

*Do not use unconnected wire and isolate the wires in the cabinet with adequate terminal blocks.

7.3.2 Supply voltage

The supply voltage is 20 to 30 V DC (typical 24 V DC). The power supply unit used must be approved for operation with equipment of protection class III (SELV).

7.3.3 RS-485 interface

The device has an electrically isolated, half-duplex, 2 wire RS-485 interface with the following settings:

Setting	Value
Data bits	8
Stop bit	1
Parity	none
Baud rate* ¹	1200, 2400, 4800, 9600, 14400, 19200* ² , 28800, 57600

*¹The baud rates vary according to the cable length and the RS-485-RS-232 converter. With cable lengths > 10 m the baud rate may need to be reduced.

*²Factory setting and baud rate for firmware update

7.3.4 Current output

The current output is isolated and can be configured as follows:

- current output off: The output transmits 0 mA
- 4 - 20 mA (default): the output transmits the visibility in accordance with the configuration
- 20 - 4 mA: inverts the visibility output

In case of a fault of the device the fault current indicated during configuration is transmitted. The load resistance on the current output must be less than 285 Ohm.

8 Configuration for UMB protocol

 The device can be operated with the protocols UMB Binary or UMB-ASCII.

8.1 Set up device

 VS2k-UMB (8366.U70) and VS20k-UMB (8366.U90) are equipped with spider defense, which is switched on together with the device and then used sporadically. When the device is connected to the power supply, a rattling sound coming from the spider defender must be heard.

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
- Interface cable
- RS-485 converter for connection to PC/notebook (e.g. ISOCON-UMB)

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 devices 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.otthydromet.com/en/software_firmware
- ▶ 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:

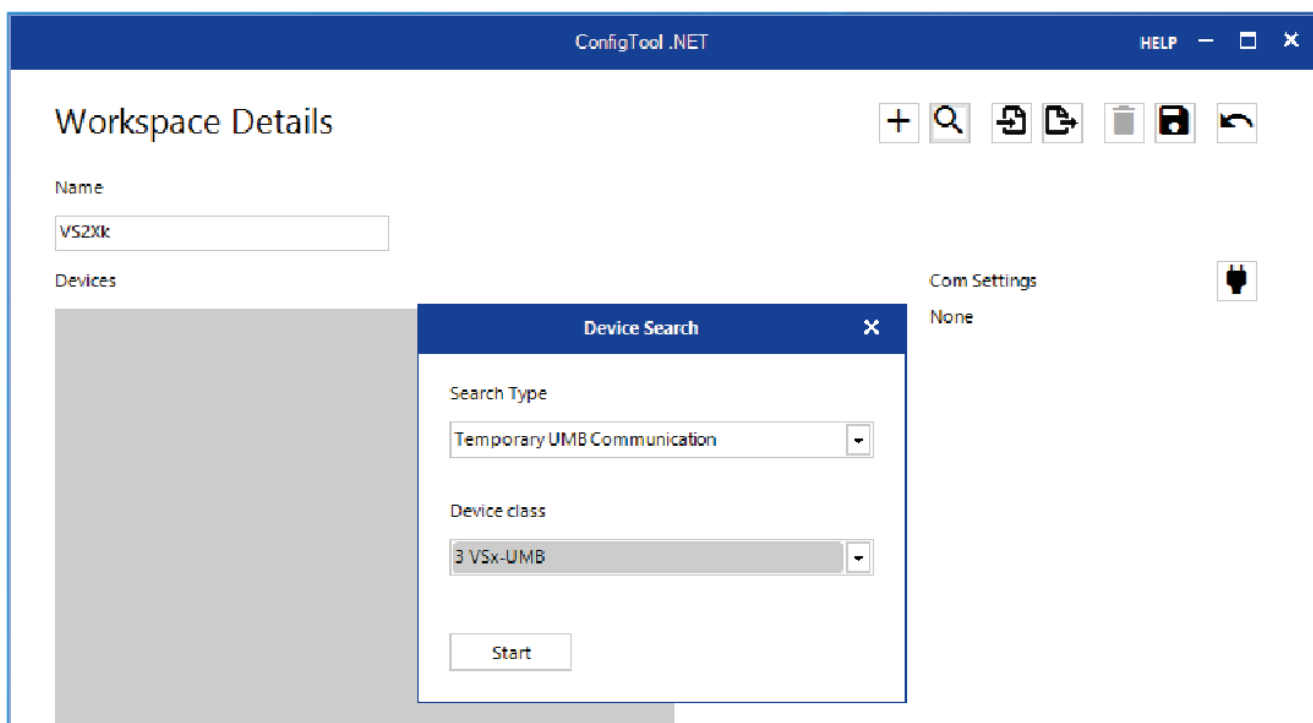
Specification	Value
Class ID	3
Device ID	1
Baud rate	19200

Specification	Value
RS-485 protocol	Binary
Current output VS2k-UMB	4 - 20 mA corresponding to 0 - 2000 m (linear)
Border contrast	5 %
Averaging interval	5 min

8.3 Configuration using UMB binary protocol

8.3.1 Configuration using ConfigTool.NET

- ▶ Connect the PC to the device through a RS-485 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.



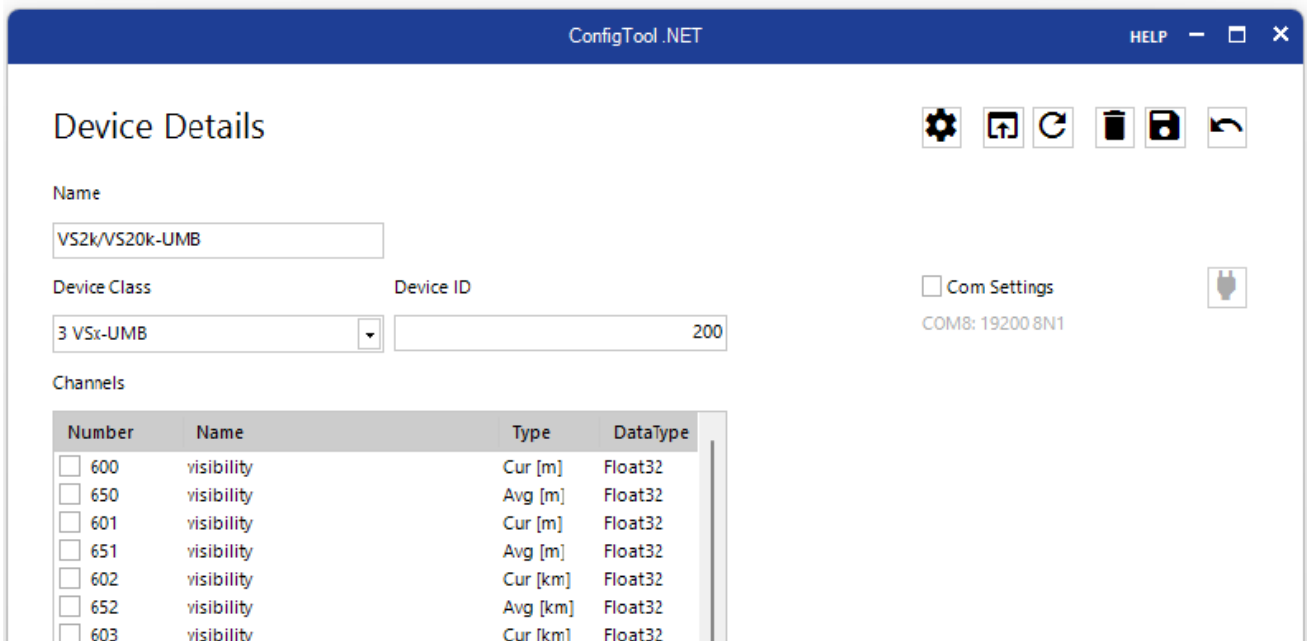
- ▶ In the *Search Type* section, select *Temporary UMB Communication*.
 - ▶ In the *Device class* section, select *3 VSx-UMB*.
 - ▶ Click on the **Start** button and restart the device (power off / on).
- ⇒ ConfigTool.NET establishes a connection (ID 1 or ID 200) within a few seconds and reads the channel list.
- ⇒ The device is ready for configuration work.

8.3.2 Selecting device

- ▶ Select an existing workspace from the workspace list at the top left of the main page.



- For a new device, select *New workspace*.
- Click the  button to edit the workspace.
- On the *Device Details* page, click the  button to open the *Device Settings* page.



Device Details

Name: VS2k/VS20k-UMB

Device Class: 3 VSx-UMB Device ID: 200

Channels

Number	Name	Type	DataType
☐ 600	visibility	Cur [m]	Float32
☐ 650	visibility	Avg [m]	Float32
☐ 601	visibility	Cur [m]	Float32
☐ 651	visibility	Avg [m]	Float32
☐ 602	visibility	Cur [km]	Float32
☐ 652	visibility	Avg [km]	Float32
☐ 603	visibility	Cur [km]	Float32

Com Settings: COM8: 19200 8N1

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

8.3.3 General settings

General device description	
Running number	40
Date of production	222
Project number	1508
BOM version	4
Schematic version	4
HW rev.	4
Software version	22
Setup version	11
Device rev.	16
Setup calibration version	11
Device type	3
Device identification	
Class-ID	3
Device-ID	1
Name	VS2k/VS20k-UMB
Device description	Visibility-Sensor VS2k/VS20k-UMB
Device parameters	
Baudrate	19200 Bd
RS485 protocol	UMB-Binary
Proximity measurement	ON
Number of averaging values	5
Border contrast	5
Current output	
Scaling	0...2000 m
Enable DAC output	ON
Spider defender	
Spider defender	ON
PWM (MIN)	40
PWM (MAX)	100
Vibration interval (MIN)	60
Vibration time (MIN)	1
Vibration time (MAX)	10
Vibration interval (MAX)	600

Parameter	Description
Device-ID	Factory setting: 1 Assign the IDs for the devices in ascending order, starting with 1. If the visibility sensor with ID 200 is detected, assign the correct ID.
Device description	To differentiate the devices enter a description, e.g. the location.
Baudrate	Transmission speed of the RS-485 interface Factory setting: 19200 DO NOT change for operation with ISOCON-UMB.
RS485 protocol	Communication protocol of the device: UMB-Binary, UMB-ASCII
Proximity measurement	Factory setting: ON turns soiling detection for transmitter and sender on.
Spider defender	Factory setting: ON (parameter available for 8366.U70 and 8366.U90)

- i** 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.

8.3.4 Data framing

The data frame is structured as follows:

1	2	3 – 4	5 – 6	7	8	9	10	11 ... (8 + len) optional	9 + len	10 + len 11 + len	12 + len
SOH	<ver>	<to>	<from>	<len>	STX	<cmd>	<verc>	<payload>	ETX	<cs>	EOT

SOH	Control character for the start of a frame (01h) 1 byte
<ver>	Header version number, e.g.: V 1.0 □ <ver> = 10h = 16d; 1 byte
<to>	Receiver address, 2 bytes
<from>	Transmitter address, 2 bytes
<len>	Number of data bytes between STX and ETX; 1 byte
STX	Control character for the start of the payload data transmission (02h); 1 byte
<cmd>	Command; 1 byte
<verc>	Version number of the command; 1 byte
<payload>	Data bytes; 0 – 210 byte
ETX	Control character for the end of the payload data transmission (03h); 1 byte
<cs>	Check sum, 16 bit CRC; 2 byte
EOT	Control character for the end of the frame (04h); 1 byte
Control characters	SOH (01h), STX (02h), ETX (03h), EOT (04h)

8.3.5 Addressing with class and device ID

Addressing is done with a 16 bit address. It is divided into a sensor class ID and a device ID.

Adress (2 bytes = 16 bit)				
Bit 15 – 12 (upper 4 bits)			Bit 11 – 8	Bit 7 – 0 (lower 8 Bit)
Class ID (0 bis 15)			Reserve	Device ID (0 – 4095)
0	Broadcast		–	0
				Broadcast

Adress (2 bytes = 16 bit)				
Bit 15 – 12 (upper 4 bits)			Bit 11 – 8	
Class ID (0 bis 15)			Reserve	
Class ID (0 bis 15)			Device ID (0 – 4095)	
3	Visibility (VS2k-UMB / VS20k-UMB)		–	1 – 4095 available
15	Master or control devices		–	–

For classes and device ID = 0 is assigned to a broadcast. It is thus possible to send a broadcast on a specific class. However, this will only make sense if there is only one single device of the respective class on the bus.

8.3.6 Examples for the formation of addresses

Addressing e.g. a VS2k-UMB with the device ID (serial number) 0001 works as follows:

Class ID for visibility is 3d = 3h

Device ID (serial no.) is e.g. 001d = 001h

By compiling the class with the device ID the following address will result: 3001h (12289d).

8.3.7 Example of a binary protocol request

If for example a visibility sensor with the device ID (serial number) 0001 is to be polled from a PC according to the current visibility (0 – 2000m), this takes place as follows:

Sensor The class ID for the **visibility sensor** is 3 = 3h
The device ID (serial number) is 0001 = 0001h
Putting the class and device ID's together gives a target address of 3001h

PC The class ID for the PC (master unit) is 15 = Fh
PC-ID is for example 22 = 016h
Putting the class and PC ID's together gives a sender address of F016h
The length <len> for the online data request command 4d = 04h
The command for online data request is 23h
and the version number of the command is 1.0 = 10h
The channel number is shown under <payload>; as can be seen from the channel list, the current visibility 0 – 2000 m in channel 601d = 259h
The calculated CRC is D40Dh

Request to the device

SOH	<ver>	<to>		<from>		<len>	STX	<cmd>	<verc>	<channel>		ETX	<cs>		EOT
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
01h	10h	01h	30h	16h	F0h	04h	02h	23h	10h	59h	02h	03h	0Dh	D4h	04h

Answer of the device

SOH	<ver>	<to>		<from>		<len>	STX	<cmd>	<verc>	<status>	<channel>		<typ>
1	2	3	4	5	6	7	8	9	10	11	12	13	14
01h	10h	16h	F0h	01h	30h	0Ah	02h	23h	10h	00h	59h	02h	16h

<value>				ETX	<cs>		EOT
15	16	17	18	19	20	21	22
00h	00h	FAh	44h	03h	5Eh	11h	04h

<status> Device o.k.

<typ> Data type of the following value; 16h = Float (4 Byte, IEEE Format)

<value> 44FA0000h corresponds to the float value 2000.00

The visibility is therefore 2000 m.

The Checksumme (115Eh) will help to check if the data transmission was correct.

i Little endian (Intel, lowbyte first) applies when transmitting word and float variables, of addresses or CRC for example. This means first the LowByte and then the HighByte.

8.3.8 CRC calculation

The Cyclic Redundancy Check (CRC) is calculated according to the following rules:

Specification	Value
Norm	CRC-CCITT
Polynomial	$1021h = x^{16} + x^{12} + x^5 + 1$ (LSB first mode)
Start value	FFFFh

i The start value for CRC calculations is FFFFh according to CCITT.

Further information can be found in the description of a CRC in the UMB Protocol V1_0.

8.4 Configuration using ASCII protocol

The ASCII protocol serves exclusively for online data requests and is not protected by a CRC. The device does not respond to unintelligible ASCII commands.

8.4.1 Composition of ASCII commands

An ASCII command is introduced with the character '&' and ended with the character CR (0Dh). There is an empty character (20h) between the individual blocks; displayed with an underscore '_'. Characters which represent an ASCII value are in simple inverted commas.

8.4.2 Example of an ASCII request

If for example a visibility sensor with the device ID (serial number) 0001 is to be polled from a PC according to the current visibility (0 – 2000 m), this takes place as follows:

A measurement value from a specific channel is polled with the command "M".

Request: '&'_<ID>⁵_M'_<channel>⁵ CR

Response: '\$'_<ID>⁵_M'_<channel>⁵_<value>⁵ CR

<ID>⁵ Device address (5-point decimal with leading noughts)

<channel>⁵ Indicates the channel number (5-point decimal with leading noughts)

<value>⁵ Measurement value (5-point decimal with leading noughts); a value scaled to 0 – 65520d. From 65521d – 65535d various error codes are defined.

Example

Request: &_12289_M_00601

With this request, channel 601 of the device with address 12289 (VS2k-UMB with the device ID 0001) is polled.

Response: \$_12289_M_00601_03456

With the scaling for visibility the following calculation then results:

0d corresponds to 0 metres

65520d corresponds to 32760 metres

03456d corresponds to $32760 / 65520 * 03456 = 1728$ metres

8.5 Channel assignment for data requests

The following channel assignment is valid for online data request in binary protocol. In the ASCII protocol all channels are transmitted in the mapping standard.

The current value transmits the current measurement. For the average value, the measurements are averaged over the configured time period.

Visibility

Channel		Data type	Measurement unit	Measurement range
Current	Average			
600	650	float	in m	10 – 1000
601	651	float	in m	10 – 2000
602	652	float	in km	0.01 – 1.000
603	653	float	in km	0.01 – 2.000
604	654	float	in ft	32 – 3000
605	655	float	in ft	32 – 65 000

Channel		Data type	Measurement unit	Measurement range
Current	Average			
606	656	float	in mi	0.006 – 0.600
607	657	float	in mi	0.006 – 1.200
608	658	unsigned short	in the mapping standard	20 – 4000
609	659	float	in m	10 – 20 000
610	660	float	in km	0.01 – 20.00
611	661	float	in ft	32 – 65 000
612	662	float	in mi	0.006 – 12.400

Ambient temperature*

Channel		Data type	Measurement unit	Measurement range
Current	Average			
100	150	float	in °C	-40 to +80
101	151	float	in °F	-40 to +176
102	152	float	in the mapping standard	–

*The sensor provides ambient temperature reading which is primary intended only for general monitoring. While this value is accessible, it is not calibrated for precision and should not be used as a reference.

Service

Channel		Data type	Measurement unit	Measurement range	Description
Current	Average				
4000	–	unsigned char	logical	0 – 100, 255	Sender soiling level
4001	–	unsigned char	logical	0 – 100, 255	Receiver soiling level
4002	–	unsigned char	logical	0/1	Long time soiling recognition value sender
4003	–	unsigned char	logical	0/1	Long time soiling recognition receiver
4030	–	unsigned char	logical	0 = OFF 1 = AUTO-Motor on 2 = AUTO-Motor off	Spider defender status
4040	–	unsigned long	in seconds	0 ... 4 294 967 295	Elapsed time since system start

Long time soiling is only measured in the darkness in order to exclude any influence of scattered light. Additionally the long time soiling is verified at each start of the device in order to avoid unnecessary maintenance actions. For this reason the corresponding channels cannot be read out during the first 15 minutes after the start of the device. (BUSY). This kind of verification allows a quick maintenance without having to carry out manual changes in the configuration. The current soiling level can be read out at any time in the corresponding channels (4000 and 4001).

TLS FG3

Channel		Data type	Measurement unit	Measurement range
Current	Average			
1060		3 Byte	TLS-Code FG3	10 – 1000 m
			Byte 1: Typ der DE-Daten (Typ 60)	10 = 10d = 000Ah
			Byte 2: Measured value low byte	1000 = 1000d = 03E8h
			Byte 3: Measured value high byte	–

8.6 Mapping standard

Mapping standard	Value	Value range
0 – 65520	Visibility	0 – 32 760 m
		0 – 32.76 km
		0 – 107 480,315 ft
		0 – 20,3561203 miles
	Ambient temperature	-40 to +80 °C
		-40 to +176 °F
	Dirt recognition	0 – 100 %
	Spider defender status	0 – 1, „0“, „1“, Error

9 Maintenance

9.1 Maintenance schedule

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

The following maintenance intervals are recommended:

Interval	Activity	Performed by
Every 30 days or immediately if soiling is detected in channels 4000 and 4001	▶ Clean the optics using a lint-free cloth and distilled water or pure alcohol. ▶ Ensure that no streaks or deposits are left on the optics.	Operator
Annually	▶ Check all cables and the housing for damage.	Operator
Annually	▶ Have a calibration check performed.	Operator or OTT HydroMet

The frequency of the maintenance intervals will depend on the sensor's location and environmental conditions.

9.2 Calibration

To calibrate the device, the following is required:

- Visibility must be at least 2000 m (6562 ft).
- No precipitation
- PC or Laptop with serial interface
- ConfigTool.NET software
- Calibration kit (8366.UKAL2)

The information about the calibration procedure can be found in ConfigTool.NET in the online help section under <Device specific pages>.

9.3 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.

10 Troubleshooting

10.1 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 does not allow adjustment	The device is very dirty	▶ Clean the sensor.
Device transmits calibration error 0 during calibration	The startup of the device is not finished	▶ Wait for at least 90 seconds after switching on or resetting the device and the start of the calibration.

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
 - firmware version
 - details of the fault or problem
 - examples of data files
 - readout device or data acquisition system
 - interfaces and power supplies
 - history of any previous repairs or modifications
 - pictures of the installation
 - overview of the local environment conditions



OTT HydroMet repair service

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
Fastening	Fitting for masts with diameter 40 – 80 mm
Protection class	III (SELV)
Protection type	IP66
Operating temperature range	-40 to +60 °C (-40 to +140 °F)
Humidity range	0 to 100 %
Storage temperature range	-40 to +70 °C (-40 to +158 °F)
Humidity range (non-condensing, during storage)	0 to 100 %
Humidity range (with packaging)	0 to 98 %

13.2 Electrical data

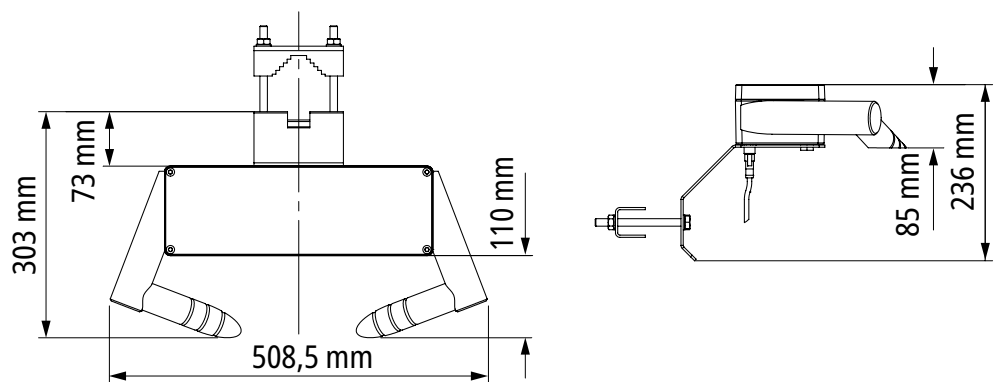
Specification	Value
Power supply voltage	20 to 30 V DC; typical 24 V DC; internally galvanically isolated
Inrush current at device startup and during normal operation when Active Spider Defense (ASD) is starting to run*	at 20 V DC: max. 2.5 A at 30 V DC: max. 4 A
Static current with running ASD with active RS-485 and current loop*	at 20 V DC: max. 600 mA at 30 V DC: max. 850 mA
Static current without active ASD with active RS-485 and current loop*	at 20 V DC: max. 200 mA at 30 V DC: max. 150 mA

*In all environmental conditions listed in section General technical data [► 32].

13.3 Data transfer

Specification	Value
Interfaces/protocols	Two-wire RS-485 half-duplex with UMB protocol, additionally active analog current loop RS-485 is opto-isolated against continuous 500 V AC or 625 V DC (short transients less than 1 s are about 1.5 kV AC or 1.875 kV DC) RS-485 and current loop are galvanically isolated against each other with continuously 500 V AC or 625 V DC (short transients less than 1 s are about 1 kV AC or 1.25 kV DC) ASD is not galvanically isolated and powered by the external supply!

13.4 Dimensions and weight



Specification	Value
Weight (without holder)	Approx. 4000 g
Weight (with holder)	Approx. 5900 g

13.5 Measuring range and accuracy

Visibility

Specification	Value
Measuring principle	42° forward scattering (measured in the horizontal plane)
Measurement	Visibility
Measuring range VS2k-UMB	10 to 2000 m (32 to 6500 ft)
Measuring range VS20k-UMB	10 to 20 000 m (32 to 65 616 ft)
Accuracy	±10 % visibility

14 Appendix

14.1 Functional grounding

The following applies only to device version ≥ 20 .

To achieve proper EMC-compatibility, it is mandatory to connect the sensor to local ground. Fixing the sensor's mounting clamp does not achieve proper EMC-compatibility, thus the sensor has a functional grounding terminal next to the common connection interface on the bottom of the device. This terminal is marked with the following label for "functional ground terminal":



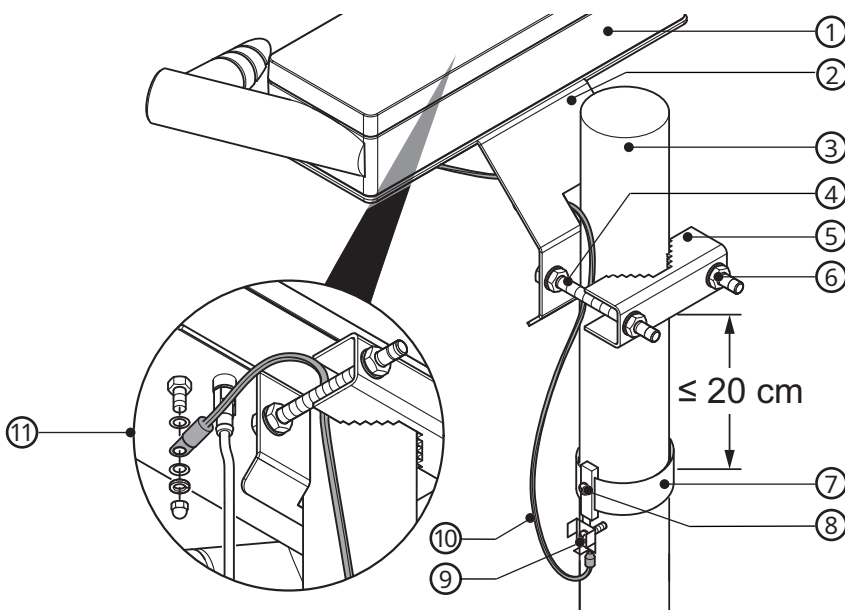
The following tools and aids are required:

- open-ended wrench, 17 mm or adjustable wrench
- Hex wrench or Hex bit, 7 mm with compatible bit driver
- Crosshead PZ2 screwdriver or PZ2 bit with compatible bit driver

i For proper cable dressing, especially for temperatures below $-35\text{ }^{\circ}\text{C}$, use UV-resistant and outdoor proven cable ties, for wide temperature ranges (polyamide). Add at least three cable ties along the total cable length.

14.1.1 Recommended installation

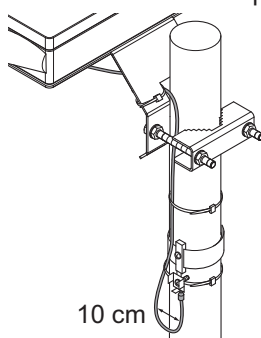
It is recommended to install the provided functional grounding cable before fixing the device to the mast. The following steps provide the necessary information to ensure that the device is properly grounded:



Functional grounding

1	Device	7	Terminal strap
2	Mounting plate	8	Strap screw
3	Mast	9	Terminal screw
4	Mounting plate washer, nut and screw	10	Green yellow grounding cable
5	Clamp	11	Functional grounding on the device
6	Clamp washer and nut		

- ▶ Ensure there are two people at the installation site.
- ▶ Unpack the device and its accessories and place all parts on a clean and even surface.
- ▶ Unscrew the Hex nut from the functional grounding terminal with a 7 mm Hex wrench or 7 mm Hex bit with the appropriate bit driver and remove the upper washer.
- ▶ Take the green yellow grounding cable and place the ring terminal end onto the functional grounding terminal of the device. Place the removed washer back over the ring terminal of the cable.
- ▶ Secure the cable and washer with the previously removed Hex nut and torque the fastener between 1.6 Nm - 2 Nm. Ensure that the cable direction does not block space needed for the calibration set.
- ▶ If there are only two nuts and four washers in the accessory bag, continue with mounting the device on the mast.
- ▶ Otherwise, fit the two screws, four washers and two nuts from the accessory bag to the mounting plate so that the washers are on both sides of each hole and fix all by hand-tightening with the nut.
- ▶ If the screws have not yet been mounted, place a washer over both screws and insert the screws into the two holes in the mounting plate underneath the device.
- ▶ A second person should hold the device at the intended height on the mast to attach the prepared device to the mast.
- ▶ To fix the device to the mast, use a 17 mm open-end wrench, the two remaining washers, the two remaining Hex nuts and the clamp: put the clamp over the screws so that the inner serrated edges are touching the mast.
- ▶ Now place the last two washers and the Hex nuts onto the screws and fasten the device on the mast. Turn the Hex nuts tight enough so the sensor can no longer be turned around the mast and then turn one more complete turn. Avoid over-torquing the clamp.
- ▶ Mount the terminal strap from the accessory bag a maximum of 20 cm below the already attached device.
- ▶ Ensure that the terminal for the functional earth cable is facing downwards to prevent water, ice, dust or other harmful substances from penetrating the ferrule at the end of the cable.
- ▶ Fasten the screw in the middle of the strap hand-tight with a PZ2 screwdriver or PZ2 bit along with the appropriate bit driver.
- ▶ Put in the ferrule at the end of the cable from the bottom side into the terminal of the fixed grounding band and fasten the terminal screw until it cannot be twisted anymore by hand.
- ▶ If temperatures below -35 °C are expected, use appropriate cable ties to dress and fix the cable at least every 10 cm to achieve compliance to a fully unmovable fixed installation:



- ▶ If the temperature remains above -35 °C, it can be smoothly routed as approved by the manufacturer for flexible installation.
- ▶ After basis installation, now proceed with the proper installation, connection and dressing of the Phoenix Contact cable from between the connection cabinet to the device.
- ▶ Be aware of proper grounding of the screen of the system cable in the shortest possible way in the cabinet.



Contact Information

