USER Manual
Visibility Sensor VS2k-UMB / VS20k-UMB

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Inhaltsverzeichnis

1 Read before use

Before using the equipment, please read the operating manual carefully and follow the instructions in every detail.Verwendete Symbole

Important information concerning potential hazard for the user

Important information concerning the correct operation oft he equipment

1.1 Safety instructions

- Installation and commissioning must only be carried out by suitably qualified specialist personnel.
- Never take measurements on or touch live elctrical parts.
- Pay attention to the technical data and storage and operating conditions

1.2 Designated use

- The equipment must only be operated within the range of the specified technical data.
- The equipment must only be used under the conditions and for the purposes for which it was designed.
- The safety and operation of the equipment can no longer be guaranteed if it is modified or adapted.

1.3 Guarantee

The guarantee period lasts 24 months from the date of delivery on. The guarantee is forfeited if the designated use is violated.

1.4 Incorrect use

- If the equipment is installed incorrectly
  - It may not function
  - It may be permanently damaged
  - It may fall down and hurt someone
- If the equipment is not connected correctly
  - It may not function
  - It may be permanently damaged
  - You may risk an electric shock

2 Scope of delivery

Visibility sensor
VS2k-UMB /
VS20k-UMB

Connection cable 10 m no *ill.*

3 Part numbers

3.1 VS2k-UMB / VS20k-UMB

8366.U70.....Visibility sensor VS2k-UMB

8366.U90.....Visibility sensor VS20k-UMB

3.2 Accessories

Interface converter ISOCON-UMB..... 8160.UISO

Power supply 24V/4A 8366.USV1

Surge protection 8379.USP

Calibration kit 8366.UKAL2

3.3 Spare parts

Connection cable 10 m..... 8366.UKAB10

Connection cable 20 m..... 8366.UKAB20

3.4 Additional documents and software

The following documents and software are available for download on www.lufft.com:

- Operating manual ..... this document
- UMB protocol..... Communication protocol for UMB devices
- Firmware..... latest firmware for the equipment
- UMB Config Tool ..... PC configuration software for UMB sensors

4 Equipment description

The VS2k-UMB / VS20k-UMB is a visibility measurement device for the determination of optical visibility in the range of 0 – 2000m / 0 – 20000m (32 – 6500 ft / 32 – 65617 ft), as needed e.g. in the realm of environmental data acquisition in traffic management equipment.

4.1 Operation mode

Visibility is determined by measuring reflectance in accordance with the 45° forward scattering principle.

The particles in the field of measurement (e.g. fog droplets) scatter the infrared light emitted by the transmitter. The receiver measures the rate of scattered light from which the reflectance is calculated. Visibility is then computed taking account of the set border contrast.

The measurements are polled via the RS485 interface or transmitted as an analogue signal via the current output.

The device is connected by means of an 8-pole screw-in connector using the associated connection cable.

Windows PC software is available for configuration and measurement polling during commissioning.

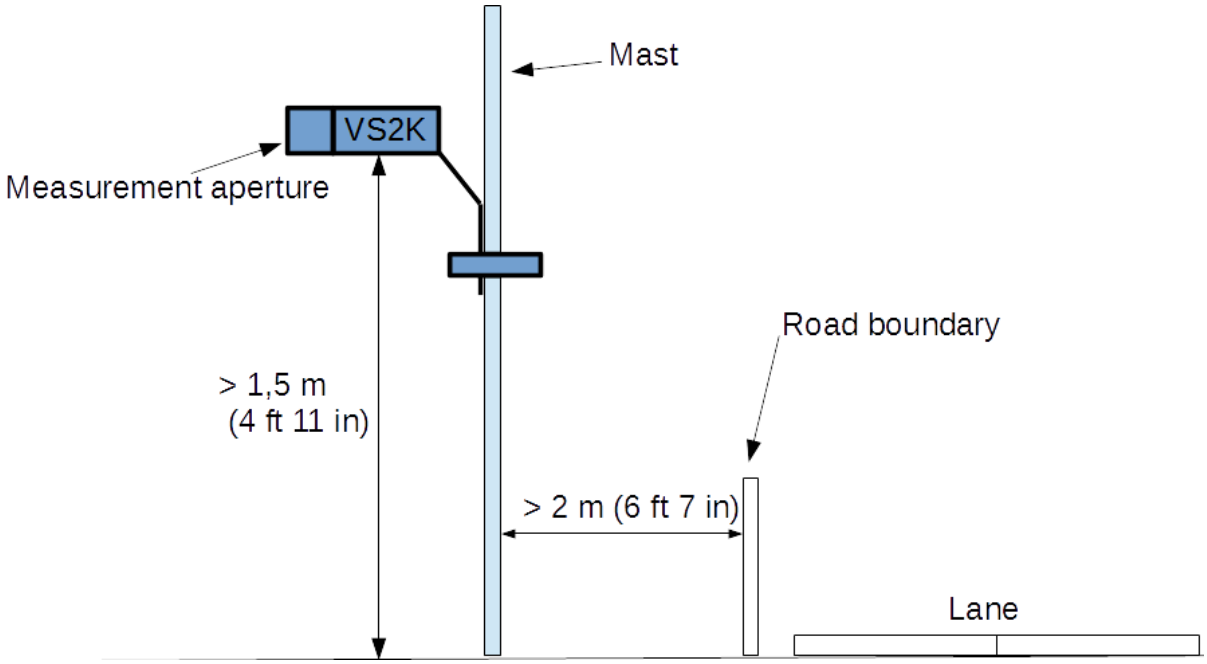
5 Installation

The device is installed on a mast (diameter 40mm ... 80mm) using the mast fitting provided.

In order to have your instrument work properly and for a long time, adhere to the following points:

- Installation height above ground min. 1.5 m (4.9 ft)
- Turn away the measurement aperture from the road
- Distance to the road > 2 m / 6,5 ft
- Do not mount any other devices within 50 cm (1.6 ft) above or below the VS2k-UMB / VS20k-UMB
- Make sure that a distance of 2 m (6.5 ft) in front of the measurement aperture is free of any kind of objects (masts, trees, grass, bushes etc.)

Installation sketch:



WARNING:

- Only approved and tested appliances (conductors, risers etc.) must be used to install the device on the mast.
- All relevant regulations for working at this height must be observed.
- Es müssen alle geltenden Vorschriften bei der Arbeit in dieser Höhe beachtet werden.
- The mast must be sized and anchored appropriately.
- The mast must be earthed in accordance with the corresponding regulations.
- Safety regulations concerning work next to or on a traffic lane must be observed.

If the equipment is installed incorrectly

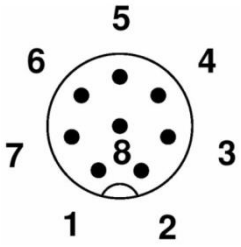
- it may not function
- It may be permanently damaged
- It may fall down and hurt someone

6 Connections

6.1 Screw-in connector

There is an 8-pole screw-in connector on the underside of the device. It serves to connect the power supply and the interfaces using the corresponding connection cable.

1 .... white ..... negative power supply
2 .... brown ... positive power supply
3 .... green .... RS485_A
4 .... yellow ... RS485_B
5 .... grey ..... not assigned
6 .... ping ..... not assigned
7 .... blue ..... current output (-)
8 .... red ..... current output (+)



The cable marking is in accordance with DIN 47100

The screening of the connection cable must NOT be laid to earth in the control cabinet!

If the equipment is not connected correctly

- It may not function
- It may be permanently damaged
- You may risk an electric shock

6.2 Power supply

The VS2k-UMB / VS20k-UMB is powered by 24VDC. The power supply unit must be approved for operation with equipment of protection class III (SELV).

6.3 RS485 interface

The device has a DC-isolated half-duplex 2-wire RS485 interface with the following settings:

Data bits: 8
Stop bit: 1
Parity: ..... none
Settable baud rates: 1200, 2400, 4800, 9600, 14400, 19200*, 28800, 57600

* = factory setting and baud rate for firmware update

6.4 Current output

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

off ..... the output transmits 0 mA
4 ... 20 mA* .... the output transmits the visibility in accordance with the configuration
20 ... 4 mA ..... inverts the visibility output

In case of a fault on the device the fault current indicated during configuration is transmitted.
The load resistance on the current output must be less than 300 Ohms.

7 Commissioning

When the VS2k-UMB / VS20k-UMB is connected to the power supply a rattling sound must be heard. It comes from the spider defender which is switched on together with the device in the first place and again later sporadically in order to deter spiders from attaching their webs to the sensor.

8 Configuration

Lufft provides a PC software for configuration purposes. It allows the user to set up the device according to his necessities.

8.1 Factory settings

The VS2k-UMB / VS20k-UMB is supplied with the following settings:

Device ID:..... 1
Baud rate:..... 19200
RS485 protocol..... UMB binary
Current output VS2k-UMB..... 4 – 20 mA corresponding to 0 – 2000 m (linear)
Border contrast..... 5 %
Averaging interval..... 5 min

In case several VSx devices are operated in one UMB network, the ID must be changed since each device requires a unique ID. It makes sense to use ascending IDs starting from 1.

8.2 Configuration with PC software UMB Config Tool

The basic functioning of the PC software UMB-ConfigTool.Net as well as all single steps for the configuration are described in detail in the online help of the software.

8.3 Firmware update

The description of the firmware update can be found in the manual of the UMB-ConfigTool.Net.

9 Calibration / Adjustment

The device has undergone a calibration in the factory when deliverd. The recommended calibration interval is 12 months. An on-site calibration kit can be purchased.

9.1 Preconditions

- Visibility must be at least 2000m / 6562 ft
- No precipitation
- PC / Laptop with serial interface
- UMB-Config-Tool.Net (PC-Software)
- Calibration kit (Lufft ref.-no.: 8366.UKAL2)

The exact description of how to carry out the calibration can be found in the online help of the software UMB-ConfigTool.Net

10 Communication

Depending on the configuration of the device, the visibility can be requested in binary or ASCII-protocol.

10.1 Binary-Protocol

This operating manual will show you an example of an online data request. For more information about the protocol please download the document ‘UMB Protocol’ on www.lufft.de.

10.1.1 Framing

Der Daten-Frame ist wie folgt aufgebaut:

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).

10.1.2 Addressing with class and device ID

Addressing is done with a 16 bit address. It is divided inot 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
3	Visibility (VS2k-UMB / VS20k-UMB)		1 - 4095	available
15	Master or control devices			

For classes and deviced 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.

10.1.3 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).

10.1.4 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 – 2000m in channel 601d = 259h

The calculated CRC is D40Dh

The 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

The 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 2000m.

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

WARNING: 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.

10.1.5 CRC Calculation

CRC is calculated according to the following rules:

Norm: CRC-CCITT

Polynomial: 1021h = $x^{16} + x^{12} + x^5 + 1$ (LSB first mode)

Start value: FFFFh

(Warning! In contrast to earlier Lufft protocols, in this case the start value for CRC calculations is not 0h but FFFFh according to CCITT!!)

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

10.2 ASCII Protocol

The ASCII protocoll allows to communicate easily with the devices.

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!

10.2.1 Composition

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.

10.2.2 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

10.3 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.

Channel		Data type	Measurement unit	Measurement rante	Description
Current	Average				
Visibility					
600	650	float	in metres	10 – 1000 Meter	
601	651	float	in metres	10 – 2000 Meter	
602	652	float	in kilometres	0.01 – 1.000 km	
603	653	float	in kilometres	0.01 – 2.000 km	
604	654	float	in feet	32 – 3000 feet	
605	655	float	in feet	32 – 6500 feet	
606	656	float	in miles	0.006 – 0.600 miles	
607	657	float	in miles	0.006 – 1.200 miles	
608	658	unsigned short	in the mapping standard	20 – 4000	
609	659	float	m	10 – 20000	
610	660	float	km	0.01 – 20.00	
611	661	float	ft	32 – 65000 ft	
612	662	float	miles	0.006 – 12.400 miles	
Ambient temperature					
100	150	float	in °C	-40 - +80 °C	
101	151		in °F	-40 - +176 °F	
102	152	unsigned short	in the mapping standard		
Service					
4000	---	unsigned char	logical	0 - 100.255	Pollution degree sender
4001	---	unsigned char	logical	0 - 100.255	Pollution degree receiver

4002	---	unsigned char	logical	0/1	Long time pollution recognition value sender[1]
4003	---	unsigned char	logical	0/1	Long time polllution recognition receiver
4030		unsigned char	logical	0 = AUS 1 = AUTO-Motor on 2 = AUTO-Motor off	Spider Defender Status
4040	---	unsigned long	in s	0…4294967295	Elapsed time since system start
4000	---	unsigned char	logical	0…100.255	
TLS FG3					
1060		3 Byte	TLS-Code FG3:	10 – 1000 Meter	
			Byte 1: Typ der DE-Daten (Typ 60)	10 = 10d = 000Ah	
			Byte 2: Messwert low byte	1000 = 1000d = 03E8h	
			Byte 3: Messwert high byte		

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

10.4 Mapping standard

Mapping standard	Visibility value range
0 - 65520	0 – 32760 m
	0 – 32,76 km
	0 – 107480,315 feet
	0 – 20,3561203 miles
	Ambient temperature value range
	-40 - +80 °C
	-40 - +176 °F
	Dirt recognition
	0 – 100 %
	Spider Defender Status
	0 – 1 „0“, „1“, Error

11 Technical Data

11.1 Visibility

Measuring principle: ..... 45° forward scattering
Measurement: ..... Visibility
Measuring range VS2k-UMB: ..... 10m - 2000 m; 32 - 6500 feet; 0.006 – 1.200 miles
Measuring range VS20k-UMB: ..... 10m - 20000 m; 32 - 65616 feet; 0.006 – 12.00 miles

[1] Long time pollution is only measured in the darkness in order to exclude any influence of scattered light. Additionally the long time pollution 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 pollution degree can be read out at any time in the corresponding channels (4000 and 4002).

Accuracy: ..... +/- 10% visibility

11.2 Storage conditions

Permissible storage condition:..... -40°C ... +70°C (-40ºF…158ºF)
Permissible relative humidity: ..... 0 ... 100% r.H. (non condensing)
..... 0 … 98% (inside packaging)

11.3 Operating conditions

Permissible operating temperature:... -40°C ... +60°C (-40ºF….140ºF)
Permissible rel. humidity:..... 0 ... 100% r.H.

11.4 Electrical Data

Voltage supply:..... 20 ... 30 VDC; typical 24 VDC
Current consumption: ..... < 200 mA (motor running and current outputs active)
about 100 mA in normal mode and RS485 output
Power consumption..... 3 W (typical), 10 W (max.)
Protection class:..... III (SELV)

11.5 Interfaces

RS485 (2-wire, half duplex) for configuration and measurement polling
Analogue output (4 – 20mA) for measurement value output.

11.6 Mechanical Data

Dimensions (W x H x D): ..... approx. 550 x 80 x 230 mm
Weight:..... approx. 4 kg without holder
..... approx.. 5.6 kg with holder
Protection class:..... IP66

12 Possible failures

Description	Reason / Steps to resolve
The instrument always measures the maximum visibility	- Transport protection is still in place → Remove protection caps
The device does not respond	- Check power supply - Check interface connection - wrong device ID → check ID
The device does not allow adjustment	- check if device is very dirty
„Calibration error 0“ during calibration with the UMB Config Tool	Startup of the VS2k-UMB / VS20k-UMB not finished. Waiting time between switching on / resetting and start of the calibration must be at least 90 s

13 Service and maintenance

In order to have the instrument work smoothly we suggest to regularly carry out the following checks and maintenance jobs:

- Check if the optics is dirty and cleanse it if necessary using a lintless cloth, possibly with alcohol or demineralised water
- Check cables and housing for damages and have them changed if necessary
- Recalibrate the sensor in the recommended interval. Make sure to take account of the environmental preconditions for a recalibration.

During maintenance works, the instrument has to be disconnected from the power supply.

Service and maintenance jobs which require the instrument to be opened must only be carried out by trained specialist personnel.

14 Disposal

The device must be disposed of in accordance with European Directives 2002/96/EC and 2003/108/EC (waste electrical and electronic equipment). Waste equipment must not be disposed of as household waste! For environmentally sound recycling and the disposal of your waste equipment please contact a certified electronic waste disposal company.

15 Manufacturer

For warranty or repair requests contact your local dealer or:

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