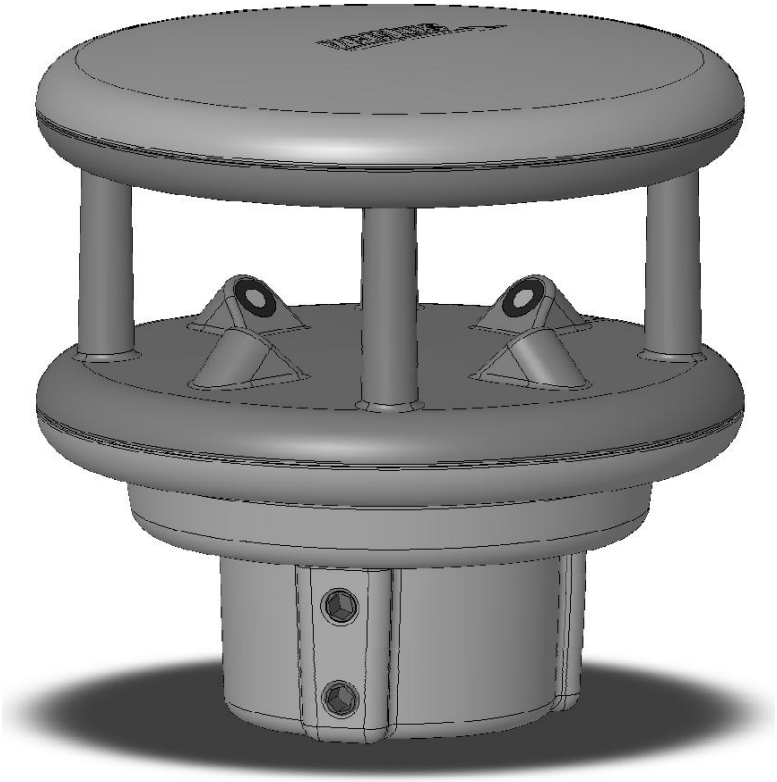
Operating Manual English

Wind Meter

ventus

V200A-UMB



CE UMB

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Contents

1 Please Read Before Use

1.1 Symbols Used

Important information concerning potential hazards to the user

Important information concerning the correct operation of the equipment

1.2 Safety Instructions

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

1.3 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.

1.4 Incorrect Use

- If the equipment is installed incorrectly
- It may not function.
- It may be permanently damaged.
- Danger of injury may exist if the equipment is allowed to fall.

- If the equipment is not connected correctly
- It may not function.
- It may be permanently damaged.
- The possibility of an electrical shock may exist.

1.5 Guarantee

The guarantee period is 12 months from the date of delivery. The guarantee is forfeited if the designated use is violated.

1.6 Brand Names

All brand names referred to are subject without limitation to the valid trademark and ownership rights of the respective owner.

2 Scope of Supply

- Equipment
- Jack for connection cable
- Operating manual

3 Order Number

8371.UM	ventus-UMB (metal)
8371.UA01	V200A-UMB (plastics)

- Wind direction
- Wind speed
- Virtual temperature

4 Accessories

ISOCON-UMB	8160.UISO
Surge protection	8379.USP-V
Power supply unit	Recommended power supply unit: Phoenix contact 2866323 TRIO-PS/1AC/24DC/10
Connector cable	Recommended cable: 8371.UK015 15m 8371.UK050 50m

5 Additional Documents and Software

You can download the following documents and software via the Internet at www.lufft.com.

Operating Manual	• This document
UMB-Config-Tool	• Windows® software for testing, firmware updates and configuration of UMB devices
UMB Protocol	• Communications protocol for UMB devices
Firmware	• The current device firmware

6 Equipment Description

ventus is a seawater-resistant wind meter which in addition to determining wind direction and wind speed is also capable of calculating virtual temperature.

The equipment is connected by way of an 8 pole screw connector.

The measured values can be requested over a variety of interfaces:

- RS485 interface in half or full duplex
  - UMB binary protocol
  - UMB ASCII protocol
  - NMEA protocol
- Analog data output of 2 adjustable channels with 4-20 mA

During commissioning, configuration and measurement polling takes place using the UMB-Config-Tool (Windows® PC software).

6.1 Wind

The wind meter uses 4 ultrasound sensors which take cyclical measurements in all directions. The resulting wind speed and direction are calculated from the measured run-time sound differential.

6.2 Virtual Temperature

Due to the physical relationship between the velocity of propagation of sound and the air temperature, the approximate ambient temperature can be determined with the aid of ultrasound sensors.

6.3 Heating

ventus is heated for winter operation.

7 Generation of Measurements

7.1 Current Measurement (act)

In accordance with the specified sampling rate, the value of the last measurement is transmitted when the current measurement value is requested. Each measurement is stored in a circular buffer for the subsequent calculation of minimum, maximum and average values.

7.2 Minimum and Maximum Values (min and max)

When requesting the minimum and maximum values, the corresponding value is calculated - via the circular buffer at the interval specified in the configuration (1 - 60 measurements) - and transmitted.

Note: In the case of wind direction, the minimum / maximum value indicates the direction at which the minimum / maximum wind speed was measured.

7.3 Average Value (avg)

When requesting the average value, this is calculated - via the circular buffer at the interval specified in the configuration (1 - 60 measurements) - and transmitted. In this way moving averages can also be calculated.

7.4 Vectorial Average Value (vct)

In the specific case of wind measurement, measurements are calculated vectorially. To this end, the average values of the vectors are generated internally. Hence the value (wind speed) and angle (wind direction) of the vector are calculated.

Note: On delivery, the interval for the calculation of minimum, maximum and average values is set at 60 measurements. If necessary, this can be adjusted to the particular requirements with the aid of the UMB-Config-Tool (see page 19).

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8 Measurement Output

The factory default setting for the transmission of measurements is UMB binary protocol.

You can find an example of a measurement request for the various protocols and a complete summary of the list of channels in the Appendix.

8.1 Virtual Air Temperature

Sampling rate 1 – 10 seconds

Generation of average value 1 – 60 measurements

Units °C; °F

Request channels:

UMB Channel					Measuring Range		
act	min	max	avg	Measurement Variable	min	max	unit
100	120	140	160	Virtual air temperature	-50.0	70.0	°C
105	125	145	165	Virtual air temperature	-58.0	158.0	°F

Note: In order to transmit the current measurement value the second measurement values are averaged over the sampling rate.

8.2 Wind Speed

Sampling rate 1 – 10 seconds

Generation of average value 1 – 60 measurements

Generation of maximum value 1 – 60 measurements based on the internal second measurement values

Units m/s; km/h; mph; kts

Response threshold 0.1 m/s (metal) or 0.3 m/s (plastics)

Request channels:

UMB Channel						Measuring Range		
act	min	max	avg	vct	Measurement Variable	min	max	unit
400	420	440	460	480	Wind Speed	0	65.0	m/s
405	425	445	465	485	Wind Speed	0	234.0	km/h
410	430	450	470	490	Wind Speed	0	145.4	mph
415	435	455	475	495	Wind Speed	0	26.35	kts

Note: In order to transmit the current measurement value the second measurement values are averaged over the sampling rate.

8.3 Wind Direction

Sampling rate 1 – 10 seconds

Generation of average value 1 – 60 measurements

Generation of maximum value 1 – 60 measurements based on the internal second measurement values Unit °

Response threshold 0.1 m/s (metal) or 0.3 m/s (plastics)

Request channels:

UMB Channel						Measuring Range		
act	min	max	avg	vct	Measurement Variable	min	max	unit
500	520	540		580	Wind Direction	0	359.9	°

Note: In order to transmit the current measurement value the second measurement values are averaged over the sampling rate.

The minimum / maximum wind direction indicates the direction at which the minimum / maximum wind speed was measured.

8.4 Wind Measurement Quality

Sampling rate 1 – 10 seconds

Units %

Request channels:

UMB Channel						Measuring Range		
act	min	max	avg	vct	Measurement Variable	min	max	unit
805					Wind measurement quality	0	100	%

Note: The value is updated every 1-10 seconds and transmits the minimum wind measurement quality for the last minute.

This value allows the user to assess how well the measurement system is functioning in the respective ambient conditions. In normal circumstances the value is 90 - 100%. Values up to 50% do not represent a general problem. If the value falls towards zero the measuring system is reaching its limits.

If during critical ambient conditions the system is no longer able to conduct reliable measurements, error value 55h (85d) is transmitted for wind speed and wind direction (device unable to execute valid measurement due to ambient conditions).

9 Installation

The sensor bracket is designed to be installed on the top of a mast with a diameter of 50mm or 2”.

The following tools are required for the installation:

- Hexagon socket 4.0
- Compass for aligning ventus to the North

9.1 Fastening

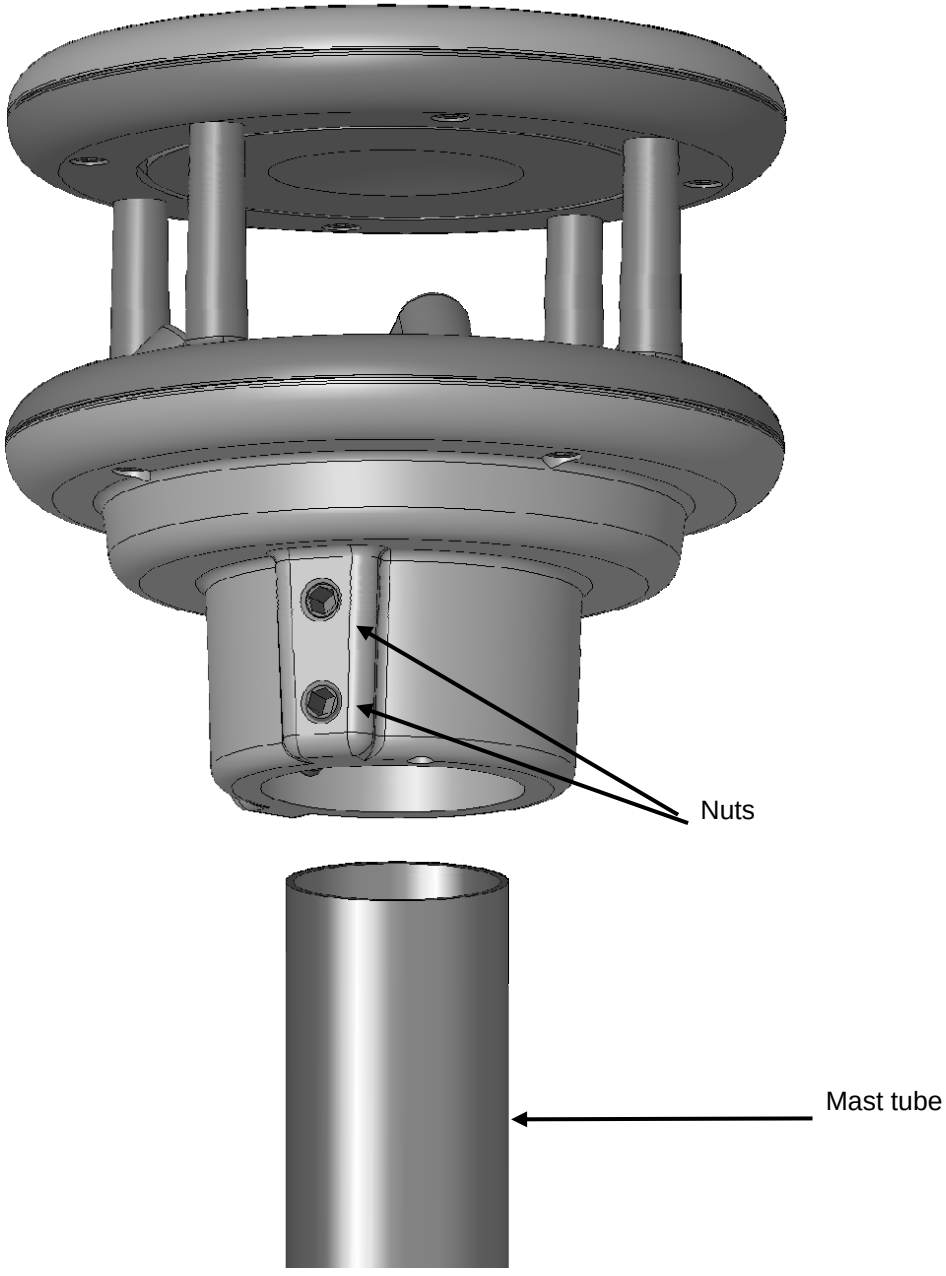


Figure 1: Fastening to the Mast

- Loosen nuts
- Push the sensor onto the top of the mast from above
- Align the sensor to the North
- Tighten both nuts evenly

9.2 North Alignment

In order for the wind direction to display correctly, the sensor must be aligned to the North. The sensor has a number of directional arrows and a North drill hole for this purpose.

Figure 2: North Markings

Procedure:

- If the sensor is already installed, first loosen both nuts evenly until you can turn the sensor easily
- Using the compass, identify the North and fix a point of reference on the horizon
- Position the sensor in such a way that the South and North sensors are in alignment with the fixed point of reference in the North
- Tighten both nuts evenly

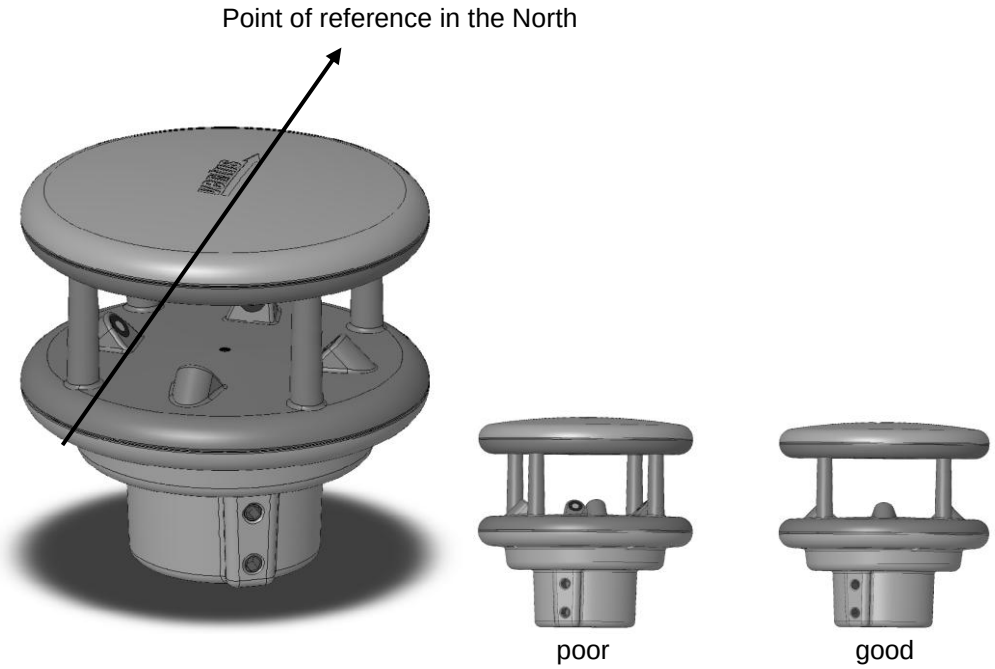


Figure 3: Alignment to North

Note: As the magnetic North Pole indicated by the compass differs from the Geographic North Pole, account must be taken of the declination (variation) at the location when aligning the sensor.

Depending on the location, the variation can be more than 15° (in North America for example). In Central Europe the variation can be largely ignored at present (< 3°). You can find further helpful information on this subject on the Internet.

9.3 Selecting the Installation Location

In order to guarantee long service life and correct equipment operation, please pay attention to the following points when selecting the installation location.

9.3.1 General Instructions

- Stable subsurface for installing the mast
- Free access to the equipment for maintenance works
- Reliable power supply for permanent operation
- Good network coverage when transmitting over a mobile communications network

Note: The computed measurements specifically apply to the equipment location only. No conclusions can be drawn with regard to the wider environment or a complete road section.

ATTENTION:

- Only approved and tested appliances (conductors, risers etc.) should be used to install the device on the mast.
- All relevant regulations for working at this height must be observed.
- The mast must be sized and anchored appropriately.
- The mast must be **earthed** in accordance with regulations.
- The corresponding safety regulations for working at road side and in the vicinity of the road carriageway must be observed.

If the equipment is installed incorrectly

- It may not function.
- It may be permanently damaged.
- Danger of injury may exist if the equipment is allowed to fall.

9.3.2 ventus

- Installation at the top of the mast
- Installation height at least 2m above the ground
- Free field around the sensor

Note: Buildings, bridges, embankments and trees may corrupt the wind measurement. Equally, passing traffic may cause gusts which may influence the wind measurement.

9.3.3 Installation Sketch

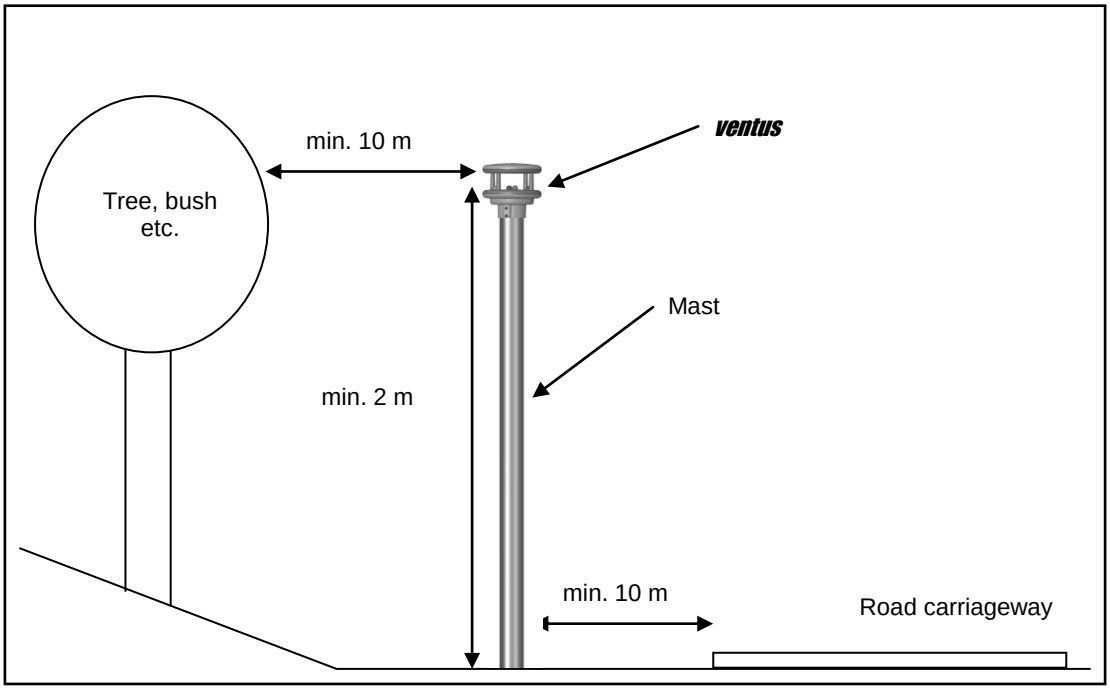
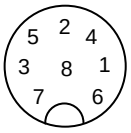


Figure 4: Installation Sketch

10 Connections

There is an 8 pole screw connector on the underside of the equipment. This serves to connect the supply voltage and interfaces by a connection cable.

Equipment connector:



View on cable socket solder connection

Figure 5: Connections

Pin assignment full duplex:

1	Y	Serial interface RXD-	pink
2	B	Serial interface TXD-	yellow
3		Control connection	red
4	Z	Serial interface RXD+	grey
5	A	Serial interface TXD+	green
6		Analog ground	blue
7		Supply voltage -	white
8		Supply voltage +	brown

Pin assignment half duplex/analog interface:

1		Analog interface A: 4-20 mA	pink
2	B	Serial interface RXD/TXD-	yellow
3		Control connection	red
4		Analog interface B: 4-20 mA	grey
5	A	Serial interface RXD/TXD+	green
6		Analog ground	blue
7		Supply voltage -	white
8		Supply voltage +	brown

The connection cable screen must NOT be laid to ground in the control panel!

If the equipment is not connected correctly

- It may not function
- It may be permanently damaged
- The possibility of an electrical shock may exist under certain circumstances

10.1 Supply Voltage

The supply voltage for ventus is 24V DC ± 10%. The power supply unit used must be approved for operation with equipment of protection class III (SELV).

10.2 RS485 Interface

The equipment has an electrically isolated RS485 interface for configuration, measurement polling and the firmware update.

The RS485 interface is designed as optionally half or full duplex, 2 or 4 wire connection.

The following operating restrictions exist depending on the half or full duplex operation setting:

Full duplex	Half duplex[1]
Autonomous telegram transmission is possible	No autonomous telegram transmission possible
Transmission of values via current output is not possible	Transmission of values via current output is possible
Heating control via control pin is possible	Heating control via control pin is possible
Triggering of NMEA telegram transmission over Control-PIN is possible	Triggering of NMEA telegram transmission over Control-PIN is not possible
Firmware update possible	Firmware update not possible

Restrictions in full and half duplex operation

See page 25 for technical details.

10.3 Interface circuits

2 interface circuits with a range of 4-20 mA are provided for analog data transmission. The channels to be transmitted by way of these interfaces can be adjusted with the aid of the UMB-Config-Tool. The default values are Channels 400 (current wind speed in m/s (A)) and 500 (current wind direction (B)).

The scaling of the outputs is also adjustable.

The maximum load on the current output is 300 Ω.

10.4 Control line

The respective function can be adjusted using the UMB-Config-Tool. The control line can be used either to control heating in half or full duplex operation or to control telegram transmission in full duplex mode. In this case control is possible by means of a volt-free switching contact.

Control line at “high” when control and analog ground are not connected.

Control line at “low” when control and analog ground are short-circuited.

10.4.1 Control line disabled

The control line level has no effect.

10.4.2 Heating control

- Heating is disabled when control line is at “high” level, otherwise automatic
- Heating is disabled when control line is at “low” level, otherwise automatic

10.4.3 Control of telegram transmission in NMEA protocol

- Telegram transmission triggered on rising edge of control voltage
- Telegram transmission triggered on falling edge of control voltage
- Telegram transmission while control voltage is “high”
- Telegram transmission while control voltage is “low”

[1] Factory setting

10.5 Connection to ISOCON-UMB (8160.UISO)

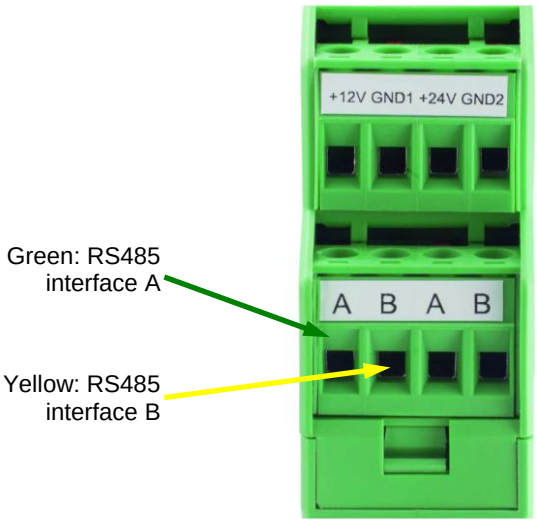


Figure 6: Connection to ISOCON-UMB

Warning: The power supply is **not** connected to the ISOCON-UMB but is wired direct to the power supply unit, as the ISOCON-UMB is not designed for the 200W heating duty of the *ventus* device.

Please pay attention to the ISOCON-UMB operating manual when building the equipment.

10.6 Use of surge protector (8379.USP-V)

Please refer to the connection example in the operating manual when using the surge protector (Order no.: 8379.USP).

11 Commissioning

After the equipment has been installed and connected correctly, the sensor begins autonomously to take measurements. A Windows® PC with serial interface, UMB-Config-Tool software and interface cable (SUB-D 9 pole; jack - socket; 1:1) are required for configuration and test purposes.

Attention must be paid to the following points:

- Check for correct equipment operation on site by carrying out a measurement with the aid of the UMB-Config-Tool (see page 22).
- The device must be aligned to the North in order to ensure correct wind measurement (see page **Fehler! Textmarke nicht definiert.**).
- If several *ventus* devices are operated on a UMB network, a unique device ID must be assigned to each device (see page 20).

There is no protective cover to remove on the sensor itself.

12 Configuration and Test

Lufft provides Windows® PC software (UMB-Config-Tool) for configuration purposes. The sensor can also be tested and the firmware updated with the aid of this software.

12.1 Factory Settings

The *ventus* device is delivered with the following settings:

Class ID:	**8** (cannot be modified)
Device ID:	1 (gives address 7001h = 28673d)
Baud rate:	19200
RS485 protocol:	Binary / half duplex
Measurement interval:	10 seconds
Average value generation:	60 measurements
Analog interface:	Channels 400 (current wind speed in m/s (A)) and 500 (current wind direction (B))
Scaling digital:	0 - 65 m/s bzw. 0° - 3593,9°
Scaling analog:	4 – 20 mA
Error current:	4 mA
Control line:	Disabled
Heating:	Automatic

Note: The device ID must be changed if several *ventus* devices are operated on a UMB network, as each device requires a unique ID. It makes sense to start from ID 1 and continue in ascending order.

12.2 Configuration with the UMB-Config-Tool

The operation of the UMB-Config-Tool is described in detail in the operating instructions for the Windows® PC software. For this reason only the menus and functions specific to the *ventus* devices are described here.

12.3 Sensor Selection

The *ventus* is shown here with sensor selection *ventus* (Class ID 8).

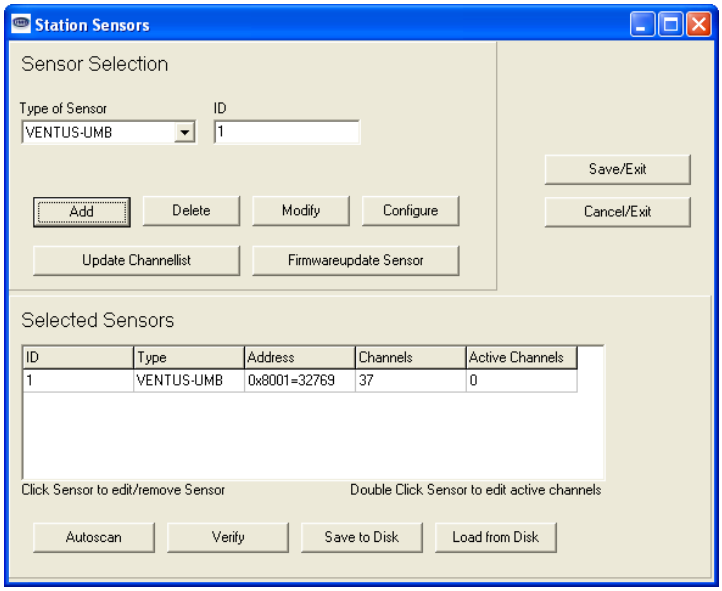


Figure 7: Sensor Selection

Note: If the UMB-Config-Tool does not recognize the *ventus* sensor type, select the number '8' under 'Sensor Type'. With *ventus* connected, click on 'Update Channel List'. You can then request measurements in order to test the sensor.

However, you do require the current version of the UMB-Config-Tool to configure *ventus*.

Note: All other devices which are used in the polling process, e.g. modems, LCOM etc., must be disconnected from the UMB network during configuration.

12.3.1 Configuration

After a configuration has been loaded, all relevant settings and values can be adjusted. Depending on the device type, only the settings pertinent to the respective available sensors are relevant.

12.3.2 General Settings

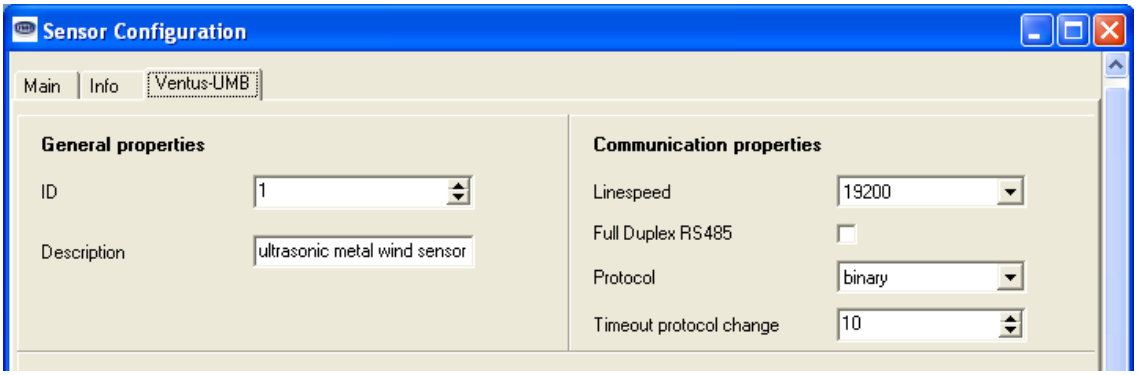


Figure 8:General Settings

ID: Device ID (factory setting 1; assign device IDs to additional devices in ascending order).

Description: In order to differentiate the devices you can enter a description here, e.g. the location.

Baud rate: Transmission speed of the RS485 interface (factory setting 19200 (DO NOT CHANGE for operation with ISOCON-UMB).

Protocol: Communications protocol of the sensor (binary, ASCII, NMEA or terminal)

Timeout: In the event of a temporary changeover of the communications protocol, the system switches back to the configured protocol after this time (in minutes) (no function at present).

12.3.3 Wind Settings

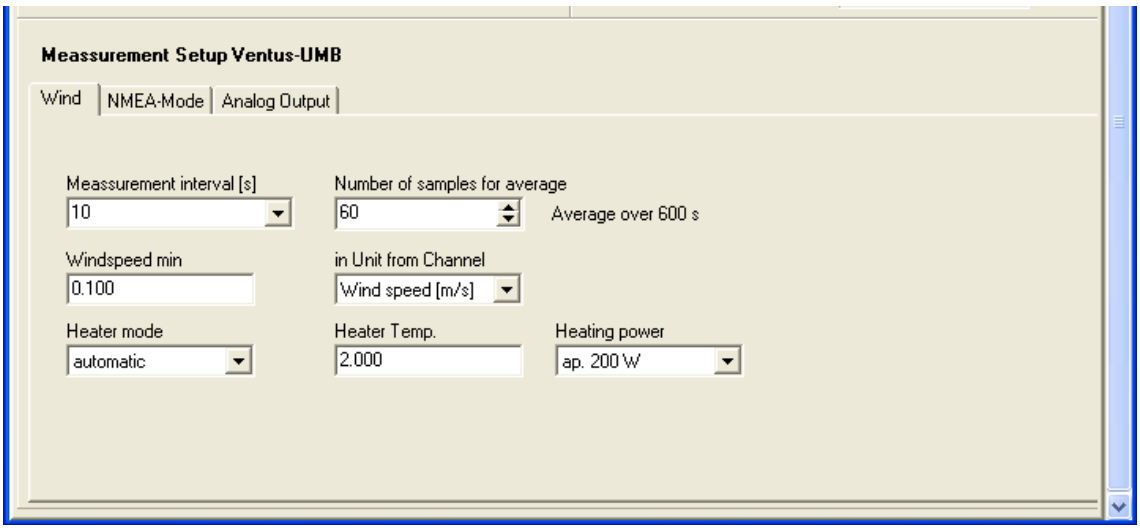


Figure 9:Wind Settings

Interval/average: Adjustment how often a new value is measured and how many values are part of average calculation.

Windspeed min: Approach velocity onto the wind meter with effect from which a measurement is transmitted, in the unit of the accompanying channel.

Heater mode: The device can be configured for heating in different operating modes. You can find a precise description of the operating modes on page 23.

12.3.4 NMEA Settings

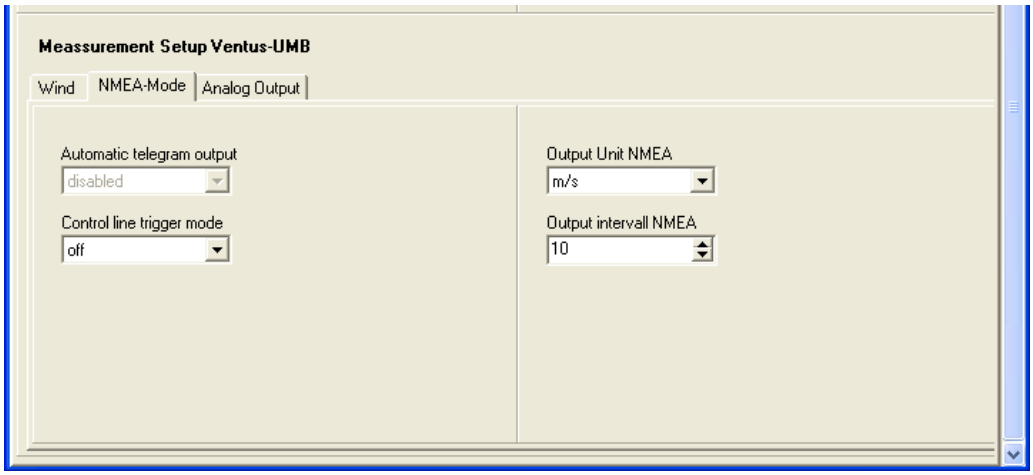


Figure 10:NMEA Settings

Here it is possible to adjust the NMEA-specific values for TT (Independent telegram transmission), OS (Scaling of wind speed), TG (Control line trigger property) and OR (Output interval).You can find a precise description of the operating modes on page 38.

12.3.5 Analog output Settings

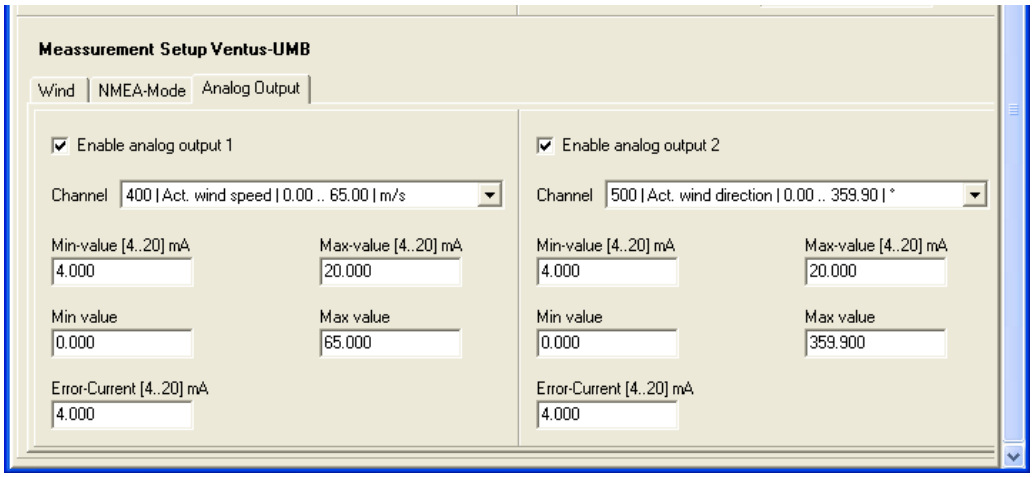


Figure 11:Analog output Settings

Here you can select the channels for the analog output and adjust the scaling. For the analog limits (default 4-20 mA) you have to set the digital limits (for example 0 – 65 m/s).

Example:

With the above limits the analog value for a wind speed of 10 m/s will be (20mA-4mA) / (65m/s-0m/s) * 10m/s + 4mA = 6,46mA.

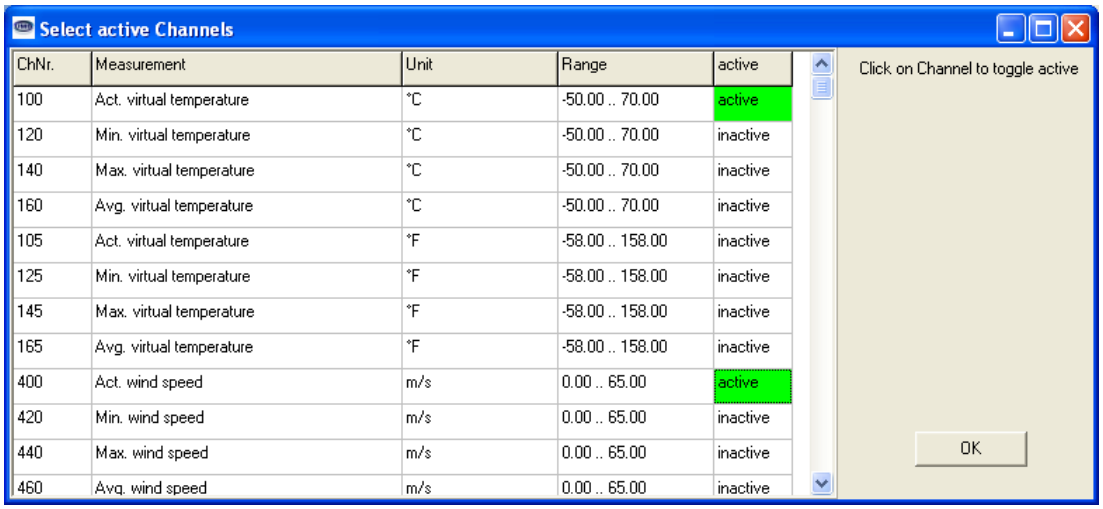
12.4 Function Test with UMB-Config-Tool

The functions of the ventus can be tested with the UMB-Config-Tool by polling various channels.

Note: All other devices which are used in the polling process, e.g. modems, LCOM etc., must be disconnected from the UMB network during the function test.

12.4.1 Channels for Measurement Polling

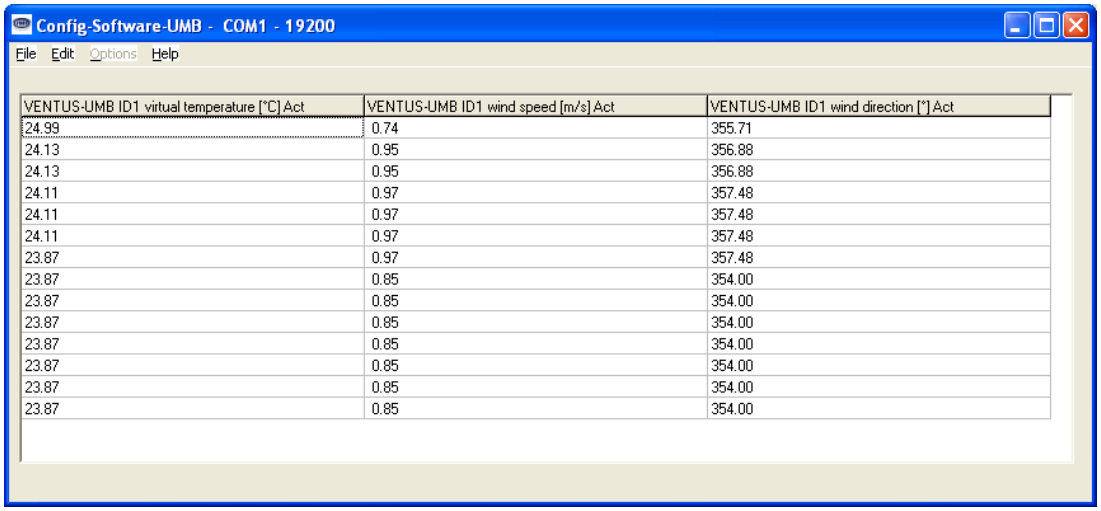
You can select the channel for measurement polling by the UMB-Config-Tool by clicking on the respective channel.



ChNr.	Measurement	Unit	Range	active
100	Act. virtual temperature	°C	-50.00 .. 70.00	active
120	Min. virtual temperature	°C	-50.00 .. 70.00	inactive
140	Max. virtual temperature	°C	-50.00 .. 70.00	inactive
160	Avg. virtual temperature	°C	-50.00 .. 70.00	inactive
105	Act. virtual temperature	°F	-58.00 .. 158.00	inactive
125	Min. virtual temperature	°F	-58.00 .. 158.00	inactive
145	Max. virtual temperature	°F	-58.00 .. 158.00	inactive
165	Avg. virtual temperature	°F	-58.00 .. 158.00	inactive
400	Act. wind speed	m/s	0.00 .. 65.00	active
420	Min. wind speed	m/s	0.00 .. 65.00	inactive
440	Max. wind speed	m/s	0.00 .. 65.00	inactive
460	Avg. wind speed	m/s	0.00 .. 65.00	inactive

Figure 12:Measurement Polling Channels

12.4.2 Example of Measurement Polling



VENTUS-UMB ID1 virtual temperature [°C] Act	VENTUS-UMB ID1 wind speed [m/s] Act	VENTUS-UMB ID1 wind direction [°] Act
24.99	0.74	355.71
24.13	0.95	356.88
24.13	0.95	356.88
24.11	0.97	357.48
24.11	0.97	357.48
24.11	0.97	357.48
23.87	0.97	357.48
23.87	0.85	354.00
23.87	0.85	354.00
23.87	0.85	354.00
23.87	0.85	354.00
23.87	0.85	354.00
23.87	0.85	354.00
23.87	0.85	354.00

Figure 13:Example of Measurement Polling

Note: The UMB-Config-Tool is provided for test and configuration purposes only. It is not suitable for the permanent acquisition of measurement data. We recommend the use of professional software solutions for this purpose, e.g. SmartView3.

12.5 Equipment Heating

ventus has 2 heating elements (one element only on plastic version) to keep the sensor free of snow and ice. One element is in the cover (metal version only) and the other is built into the ultrasonic sensors.

12.5.1 Heating mode

The heating of the device can be operated in 4 different modes:

0x00: Heating always off

0x01: Automatic heating control[1]

The heating switches on when the housing temperature falls below +2°C (adjustable between 2°C and 10°C) and switches off at a housing temperature of >+7°C (set temperature +5°C) ***(metal)***

The heating switches on when the housing temperature falls below +50°C (adjustable between 2°C and 70°C) and switches off at a housing temperature of >+55°C (set temperature +5°C) ***(plastics)***

0x02: The switch-on temperature is adjusted to +40°C; in this condition the heating switches on at room temperature (for test purposes only)

0x03: Heating control is disabled when the control line is at the “high” level, else automatic

0x04: Heating control is disabled when the control line is at the “low” level, else automatic

12.5.2 Heating capacity

The heating capacity can be set in accordance with the following modes:

0x00: Full heating capacity (ca. 200W)[1]

0x01: Alternating heating:

Cover plate alternating to base plate (ca. 100W)

The next level of heating switches in if the pre-set temperature for the respective level is not reached within 4 minutes.

[1] Factory setting

13 Firmware Update

To keep the sensor in accordance with the latest state-of-the-art, it is possible to carry out a firmware update on site with no need to remove the sensor and return it to the manufacturer.

The firmware update is carried out with the aid of the UMB-Config-Tool.

The firmware update is only possible in half-duplex mode.

The description of the firmware update can be found in the instructions for the UMB-Config-Tool. Please download the latest firmware and UMB-Config-Tool from our website www.lufft.de and install it on a Windows® PC. You can find the instructions here:

14 Maintenance

In principle the equipment is maintenance-free.

However, it is recommended to carry out a functional test on an annual basis. When doing so, pay attention to the following points:

- Visual inspection of the equipment for soiling
- Check the sensors by carrying out a measurement request

15 Technical Data

Power supply:	24VDC ± 10%
Current consumption and power input - sensor:	ca. 50mA / 1.2VA at 24VDC
Current consumption and power input with heating (metal):	ca. 8.75A / 210VA at 24VDC
Current consumption and power input with heating (plastics):	ca. 900mA / 21.6VA at 24VDC
Dimensions including mounting bracket:	Ø 150mm, height 145mm
Weight including mounting bracket, excluding connection cable:	ca. 1.63 kg
Fastening:	Mast with Ø 50mm
Protection class:	III (SELV)
Protection type:	IP65

Storage conditions

Permissible storage temperature:	-55°C ... +80°C
Permissible relative humidity:	0 ... 95% RH Non-condensing

Operating conditions

Permissible operating temperature:	-40°C ... +60°C (with heating)
Permissible operating temperature:	-20°C ... +60°C (without heating)
Permissible relative humidity:	0 ... 100% RH
Permissible altitude above sea level:	N/A

RS485 interface, 2[1] or 4 wire, half[1] or full duplex

Data bits:	8
Stop bit:	1
Parity:	No
Tri-state:	2 bits after stop bit edge
Adjustable baud rates:	1200, 2400, 4800, 9600, 14400, 19200[1], 28800, 57600

Interface circuits:	4 - 20mA
Maximum load:	300 Ω
Resolution:	16 bits
Channels:	Adjustable
Update rate:	1-10 seconds
Housing:	Seawater-resistant aluminum AlMg3Si

[1] Factory setting and baud rate for firmware update

15.1 Measuring Range / Accuracy

15.1.1 Wind Speed

Measurement process:	Ultrasound
Measuring range:	0 – 65m/s
Resolution:	0.1m/s
Accuracy:	±0.2 m/s (< 5m/s) RMSE ±2% (> 5m/s) RMSE
Response threshold (adjustable):	0.1 m/s (metal) 0.3 m/s (plastics)
Sampling rate:	1-10 seconds
Units:	m/s; km/h; mph; kts

15.1.2 Wind Direction

Measurement process:	Ultrasound
Measuring range:	0 – 359.9°
Resolution:	0.1°
Accuracy:	< 2° (> 1m/s) RMSE
Response threshold (adjustable):	0.1 m/s (metal) 0.3 m/s (plastics)
Sampling rate:	1-10 seconds

15.1.3 Virtual Temperature

Measurement process:	Ultrasound
Measuring range:	-50°C ... +70°C
Resolution:	0.1°C
Sensor accuracy:	+/- 2.0 K (unheated and without solar irradiation)
Sampling rate:	1-10 seconds
Units:	°C; °F

15.2 Drawing

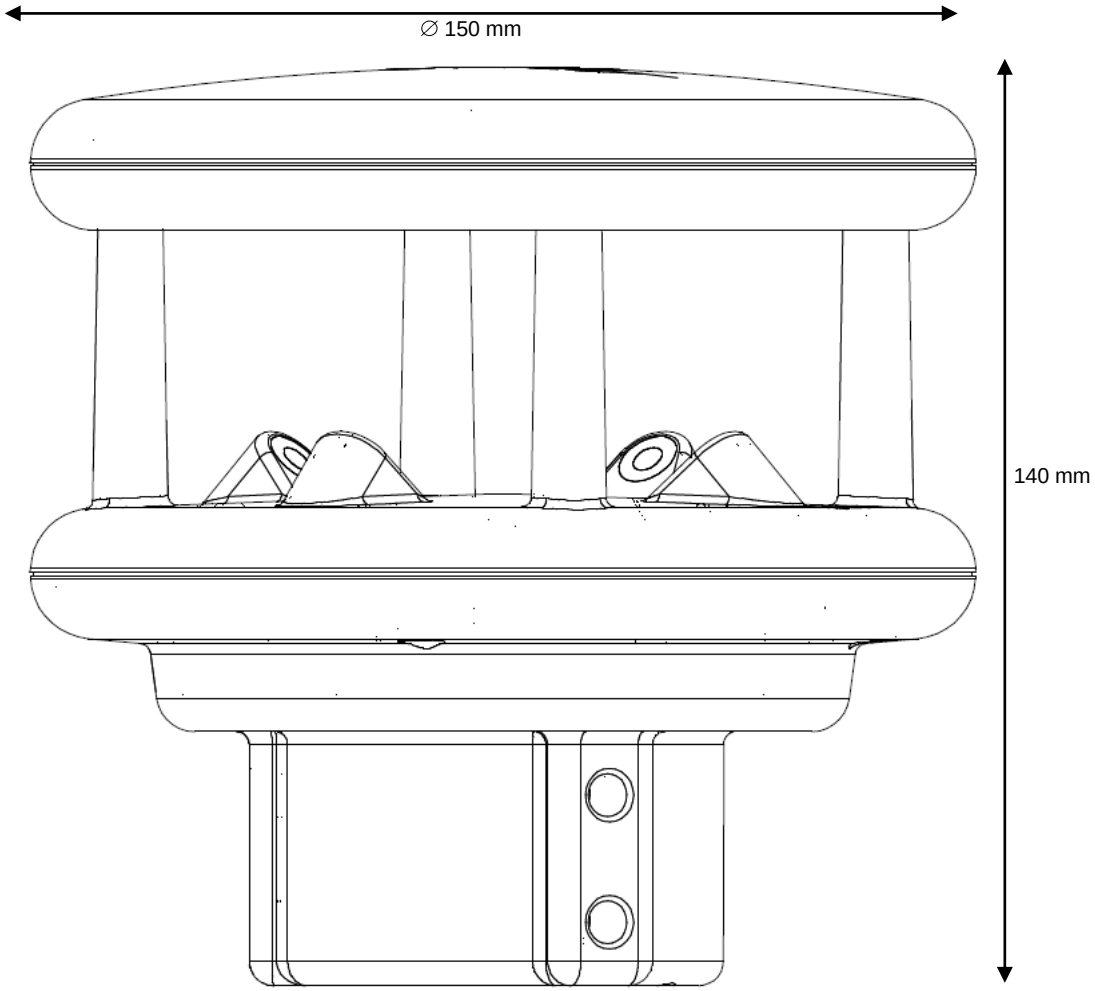


Figure 14: ventus

16 EC Certificate of Conformity

Product: Wind Meter

Type: *ventus* (Order No.: 8371.UM)

We herewith certify that the above mentioned equipment complies in design and construction with the Directives of the European Union and specifically the EMC Directive in accordance with 89/336/EC and the Low Voltage Directive in accordance with 73/23/EC.

The above mentioned equipment conforms to the following specific EMC Standards:

EN 61000-6-2:2005 Part 6-2: Generic Standards - Immunity for Industrial Environments

EN 61000-4-2	ESD
EN 61000-4-3	Radiated electromagnetic field
EN 61000-4-4	Burst
EN 61000-4-5	Surge
EN 61000-4-6	Conducted disturbances
EN 61000-4-8	Magnetic field 50Hz

EN 61000-6-3:2001 Part 6-3: Generic Standards - Emission Standard for Residential, Commercial and Light Industrial Environments

EN 55022:1998 +A1:2000 +A2:2003	Line-conducted disturbances
prEN 50147-3:2000 IEC / CISPR 22 Class B	Radiated emission
IEC 60945	vibration check
MIL-Std 810 Verfahren 509.3	Saline mist check

Fellbach, 01.10.2009 Axel Schmitz-Hübsch

17 Fault Description

Fault Description	Cause - Remedy
The device does not allow polling or does not respond	- Check supply voltage - Check interface connection - False device ID → check ID; devices are delivered with ID 1.
Wind direction transmits incorrect values	Device not correctly aligned → check alignment of device to North.
Device transmits error value 28h (40d)	Device is in initialization phase after start-up → device delivers measurement values after ca. 10 seconds
Device transmits error value 50h (80d)	Device is being operated above the specified measuring range
Device transmits error value 51h (81d)	Device is being operated below the specified measuring range
Device transmits error value 55h (85d) for wind measurement	Device unable to carry out valid measurement due to ambient conditions. There may be several causes for this: - Device is being operated above the specified measuring range - Very strong horizontal rain or snowfall - ventus sensors are heavily soiled → clean sensor - ventus sensors are iced up → check heating mode in configuration and verify function / connection of heating - There are foreign bodies in the ventus measuring section - One of the ventus sensors is faulty → return device to manufacturer for repair
The quality of the wind measurement is not always 100%	The device should always transmit 90 – 100% in normal operation. Values of up to 50% do not represent a general problem. When error value 55h (85d) is transmitted, this value is 0%. The device may be faulty if it permanently transmits values below 50%.
Device transmits an error value not listed here	There may be several reasons for this behavior → contact the manufacturer's technical support service.

18 Disposal

18.1 Within the EC

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.

18.2 Outside the EC

Please comply with the applicable regulations for the proper disposal of waste electrical and electronic equipment in your respective country.

19 Repair / Corrective Maintenance

Please arrange for any faulty equipment to be checked and, if necessary, repaired by the manufacturer exclusively. Do not open the equipment and do not under any circumstances attempt to carry out your own repairs.

In matters of guarantee or repair please contact:

G. Lufft Mess- und Regeltechnik GmbH

Gutenbergstraße 20
70736 Fellbach

Postfach 4252
70719 Fellbach
Germany

Tel: +49 711 51822-0
Hotline: +49 711 51822-52
Fax: +49 711 51822-41

E-Mail: info@lufft.com

or your local distributor.

19.1 Technical Support

Our Hotline is available for technical questions via the following e-mail address:

hotline@lufft.de

You can also consult frequently asked questions at http://www.lufft.com/ (menu header: FAQs).

20 Appendix

20.1 Channel List Summary

The channel assignment described here applies to online data requests in binary and ASCII protocol.

UMB Channel						Measuring Range		
act	**min**	**max**	**avg**	**special**	**Measurement Variable (float)**	**min**	**max**	**unit**
Temperature								
100	120	140	160		virtual temperature	-50.0	70.0	°C
105	125	145	165		virtual temperature	-58.0	158.0	°F
Wind								
				vect. avg				
400	420	440	460	480	wind speed	0	65.0	m/s
405	425	445	465	485	wind speed	0	234.0	km/h
410	430	450	470	490	wind speed	0	145.4	mph
415	435	455	475	495	wind speed	0	126.3	kts
500	520	540		580	wind direction	0	359.9	°
805					wind value quality	0	100,0	%

20.2 Channel List Summary per TLS2002 FG3

The following channels are available specifically for data requests for further processing in TLS format. These channels are available in binary protocol only.

DE Type	UMB Channel	Meaning	Format	Range	Resolution	Coding
48	1048	Result message Air Temperature AT	16 bit	-30 ... +60°C	0.1°C	60.0 = 600d = 0258h 0.0 = 0d = 0000h -0.1 = -1d = FFFFh -30.0 = -300d = FED4h
56	1056	Result message Wind Direction WD	16 bit	0 ... 359°	1°	0° (N) = 0d = 0000h 90° (O) = 90d = 005Ah 180° (S) = 180d = 00B4h 270° (W) = 270d = 010Eh FFFFh = not definable
57	1057	Result message Wind Speed. (average) WSA	16 bit	0.0 ... 60.0 m/s	0.1 m/s	0.0 = 0d = 0000h 60.0 = 600d = 0258h
64	1064	Result message Wind Speed (peak) WSP	16 bit	0.0 ... 60.0 m/s	0.1 m/s	0.0 = 0d = 0000h 60.0 = 600d = 0258h

20.3 Communication in Binary Protocol

Only one example of an online data request is described in this operating manual. Please refer to the current version of the UMB Protocol for all commands and the exact mode of operation of the protocol (available for download at www.lufft.com).

Note: Communication with the sensor takes place in accordance with the master-slave principle, i.e. there may only be ONE requesting unit on a network.

20.3.1 Framing

The data frame is constructed 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>	Sender address; 2 bytes
<len>	Number of data bytes between STX and ETX; 1 byte
STX	Control character for the start of payload transmission (02h); 1 byte
<cmd>	Command; 1 byte
<verc>	Version number of the command; 1 byte
<payload>	Data bytes; 0 – 210 bytes
ETX	Control character for the end of payload transmission (03h); 1 byte
<cs>	Check sum, 16 bit CRC; 2 bytes
EOT	Control character for the end of the frame (04h); 1 byte

Control characters: SOH (01h), STX (02h), ETX (03h), EOT (04h).

20.3.2 Addressing with Class and Device ID

Addressing takes place by way of a 16 bit address. This breaks down into a Class ID and a Device ID.

Address (2 bytes = 16 bit)				
Bits 15 – 12 (upper 4 bits)		**Bits 11 – 8 (middle 4 bits)**	**Bits 7 – 0 (lower 8 bits)**	
Class ID (0 to 15)		**Reserve**	**Device ID** (0 – 255)	
0	Broadcast		0	Broadcast
8	ventus		1 - 255	Available
15	Master or control devices			

ID = 0 is provided as broadcast for classes and devices. Thus it is possible to transmit a broadcast on a specific class. However this only makes sense if there is only one device of this class on the bus; or in the case of a command, e.g. reset.

20.3.3 Examples for Creating Addresses

If, for example, you want to address ventus with the device ID 001, this takes place as follows:

The class ID for the ventus is 8d = 8h;

the device ID is e.g. 001d = 01h

Putting the class and device IDs together gives the address 8001h (32769d).

20.3.4 Example of a Binary Protocol Request

If, for example, a ventus with the device ID 001 is to be polled from a PC for the current temperature, this takes place as follows:

Sensor:

The class ID for the ventus is 8 = 8h;

the device ID is 001 = 01h

Putting the class and device IDs together gives a target address of 8001h.

PC:

The class ID for the PC (master unit**)** is 15 = Fh;

the PC ID is e.g. 001d = 01h

Putting the class and device IDs together gives a sender address of F001h.

The length <len> for the online data request command is 4d = 04h;

the command for the online data request is 23h;

the version number of the command is 1.0 = 10h.

The channel number is in <payload>; as can be seen from the channel list (page **Fehler! Textmarke nicht definiert.**), the current temperature in °C in the channel is 100d = 0064h.

The calculated CRC is 540Bh.

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	80h	01h	F0h	04h	02h	23h	10h	64h	00h	03h	0Bh	54h	04h

The response from 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	01h	F0h	01h	80h	0Ah	02h	23h	10h	00h	64h	00h	16h

<value>				ETX	<cs>		EOT
15	**16**	**17**	**18**	**19**	**20**	**21**	**22**
00h	00h	B4h	41h	03h	1Fh	94h	04h

Interpretation of the response:

<status> = 00h device o.k. (≠ 00h signifies error code; see page 35)

<typ> = Data type of the following value; 16h = float (4 bytes, IEEE format)

<value> = 41B40000h corresponds to a float value of 22.5

The temperature is therefore 22.5°C.

The correct data transmission can be checked with the aid of the check sum (941Fh).

Note: Little Endian (Intel, low byte first) applies when transmitting word and float variables of addresses or the CRC, for example. This means first the low byte and then the high byte.

20.3.5 Status and Error Codes in Binary Protocol

If a measurement request delivers the <status> 00h, the sensor is working correctly. You can find a complete list of additional codes in the description of the UMB protocol.

Extract from list:

<status>	Description
00h (0d)	Command successful; no error; all o.k.
10h (16d)	Unknown command; not supported by this device
11h (17d)	Invalid parameter
24h (36d)	Invalid channel
28h (40d)	Device not ready; e.g. initialization / calibration running
50h (80d)	Measurement variable (+offset) is outside the set display range
51h (81d)	
52h (82d)	Measurement value (physical) is outside the measuring range (e.g. ADC over range)
53h (83d)	
54h (84d)	Error in measurement data or no valid data available
55h (85d)	Device /sensor unable to carry out valid measurements due to ambient conditions

20.3.6 CRC Calculation

CRC is calculated according to the following rules:

Norm: CRC-CCITT

Polynomial: 1021h = x16 + x12 + x5 + 1 (LSB first mode)

Start value: FFFFh

You can find further information in the description of a CRC calculation in UMB Protocol.

20.4 Communication in ASCII Protocol

Text-based communication with devices is possible using ASCII protocol.

To do this, in the device configuration, interface settings, the protocol mode must be set to ASCII (see page 20).

ASCII protocol is network-compatible and serves exclusively for online data requests. The device will not respond to incomprehensible ASCII commands.

Note: The use of binary protocol is recommended for lengthy transmission routes (e.g. network, GPRS/UMTS), as ASCII protocol is unable to detect transmission errors (not CRC-secured).

Note: TLS channels are not available in ASCII protocol.

20.4.1 Structure

An ASCII command is introduced by the '&' character and completed by the CR (0Dh) sign. There is a space character (20h) between the individual blocks in each case; this is represented by an underscore character '_'. Characters that represent an ASCII value are in ordinary inverted commas.

20.4.2 Summary of ASCII Commands

Command	Function	BC	AZ
M	Online data request		l
X	Switches to binary protocol		k
R	Triggers software reset	●	k
D	Software reset with delay	●	k
I	Device information		k

These operating instructions describe the online data request only. You can find the description of the other commands in the UMB protocol.

20.4.3 Online Data Request (M)

Description: By way of this command, a measurement value is requested from a specific channel.

Request: '&'_<ID>[5]_'M'_<channel>[5] CR

Response: '$'_<ID>[5]_'M'_<channel>[5]_<value>[5] CR

<ID>[5] Device address (5 decimal places with leading zeros)

<channel>[5] Indicates the channel number (5 decimal places with leading zeros)

<value>[5] Measurement value (5 decimal places with leading zeros); a measurement value standardized to 0 – 65520d. Various error codes are defined from 65521d – 65535d.

Example:

Request: &_32769_M_00100

By way of this request, channel 100 of the device with address 32769 (ventus with device ID 001).

Response: $_32769_M_00100_34785

This channel outputs a temperature from –40 to +60°C; this results in the following calculation:

0d	corresponds to	-50°C
65520d	corresponds to	+70°C
36789d	corresponds to	[+70°C – (-50°C)] / 65520 * 34785 +(-50°C) = 13,7°C

Note: TLS channels are not available in ASCII protocol.

20.4.4 Standardization of Measurement Values in ASCII Protocol

The standardization of measurement values from 0d – 65520d corresponds to the measuring range of the respective measurement variable.

Measurement Variable	Measuring Range		
	min	max	unit
Temperature			
Temperature	-50.0	70.0	°C
	-58.0	158.0	°F
Wind			
Wind speed	0.0	65.0	m/s
	0.0	234.0	km/h
	0.0	145.4	mph
	0.0	126.3	kts
Wind direction	0.0	359.9	°
Quality of wind measurement	0.0	100.0	%

20.4.5 Status and Error Codes in ASCII Protocol

Various error codes are defined from 65521d – 65535d in addition to the standardization of measurement values.

Codes:

<code>	Description
65521d	Invalid channel
65523d	Measurement value outside measuring range (too high)
65524d	Measurement value outside measuring range (too low)
65525d	Measurement data error or no valid data available
65526d	Device / sensor unable to execute valid measurement due to ambient conditions
65534d	Invalid calibration
65535d	Unknown error

20.5 Communication in NMEA Protocol

Wind direction and wind speed in accordance with NMEA protocol can be requested via the NMEA protocol.

To do this, in the device configuration, interface settings, the protocol mode must be set to NMEA (see page **Fehler! Textmarke nicht definiert.**).

NMEA protocol is network-compatible and serves exclusively for online data requests. The device will not respond to incomprehensible NMEA commands.

Note: The use of binary protocol is recommended for lengthy transmission routes (e.g. network, GPRS/UMTS), as NMEA protocol is unable to detect transmission errors (not CRC-secured).

Note: In the NMEA protocol, data output is available by means of NMEA telegram only.

In the NMEA protocol, it is possible to control the telegram output by means of the control line when using full duplex operation (see page 16).

20.5.1 Structure

An NMEA command is initiated by the ID and concluded with the CR sign (0Dh). Characters that represent an ASCII value are in ordinary inverted commas.

20.5.2 ID

The NMEA-ID is derived from the UMB-ID, by deducting 1.

Example: UMB-ID: 1
NMEA-ID: 0

20.5.3 Summary of NMEA commands

Command	Function
TR	Telegram request
TT	Independent telegram transmission
KY	Access mode (read only/admin)
DM	Duplex mode
HP	Heating duty
HT	Heating mode
ID	Device ID
MD	Measurement interval
OR	Output interval
OS	Scaling of wind speed
RS	Triggers software reset
TG	Control line trigger property
XX	Switches to binary protocol

Differentiation is made between 2 authorization levels when sampling:

- Read only and
- Admin

The settings for all parameters can be requested in both modes but can only be changed in “Admin” mode. In “Read only” mode it is only possible to enable automatic telegram transmission and to trigger a software reset.

20.5.4 Telegram request (NMEA)

Description: This command requests the NMEA telegram.

Request:	<ID>'TR4'(CR)
<ID>	Device address (2 decimal places with leading zeros)
Response:	$WIMWV,xxx.x,R,xxx.x,M,A*xx(CR)(LF)
$WIMWV,	fix
xxx.x	Wind direction
,R,	fix
xxx.x	Wind speed
,	fix
M	Possible values K,N,M,S for km/h, Knots, m/s, mph
,	fix
A	A=valid value, V= invalid value
*	Check sum identifier
xx	Check sum (high byte first)
CR	Carriage Return
LF	Line Feed

Response in case of error

Request:	<ID>'TR4'(CR)
<ID>	Device address (2 decimal places with leading zeros)
Response:	$WIMWV,,R,,M,V*(CR)(LF)
$WIMWV,	fix
,R,	fix
,	fix
M	Possible values K,N,M,S for km/h, Knots, m/s, mph
,	fix
V	V= invalid value
*	Check sum identifier
xx	Check sum (high byte first)
CR	Carriage Return
LF	Line Feed

Example:

Request: 01TR4

Response: $WIMWV,230.6,R,003.4,N,A*23

This means that the wind is coming at a speed of 3.4 knots from 230.6°

20.5.5 Independent telegram transmission (NMEA)

Description: This command is used to disable/enable independent transmission of the NMEA telegram. Independent transmission can be enabled in full duplex mode only.

Response: <ID>'TT'<value>(CR)

<ID>	Device address (2 decimal places with leading zeros)
<value>	0…disabled
	4…enabled

The current setting is delivered as the response if no entry is made for <value>.

Response: $WIMWV,xxx.x,R,xxx.x,M,A*xx(CR)(LF) every 1-10 seconds (depending on MD)

$WIMWV,	fix
xxx.x	Wind direction
,R,	fix
xxx.x	Wind speed
,	fix
M	Possible values K,N,M,S for km/h, Knots, m/s, mph
,	fix
A	A=valid value, V= invalid value
*	Check sum identifier
xx	Check sum (high byte first)
CR	Carriage Return
LF	Line Feed

Response in case of error

Request: <ID>,'TT'<value>(CR)

<ID>	Device address (2 decimal places with leading zeros)
<value>	0…disabled
	4…enabled

Response: $WIMWV,,R,,M,V*(CR)(LF)

$WIMWV,	fix
,R,	fix
,	fix
M	Possible values K,N,M,S for km/h, Knots, m/s, mph
,	fix
V	V= invalid value
*	Check sum identifier
xx	Check sum (high byte first)
CR	Carriage Return
LF	Line Feed

20.5.6 Access mode

Description: This command is used to switch between Read only and Admin modes.

Request: <ID>'KY'<key>(CR)

<ID> Device address (2 decimal places with leading zeros)

<key> 0 Read only

4711 Admin

It is possible to set all parameters in Admin mode only. The parameters are effective immediately after setting; however they are only stored permanently in the sensor in Read only mode **after** quitting Admin mode. Parameters that were changed in error but not yet saved can be reset by briefly disconnecting the sensor from the power supply.

Response on change from Read only mode to Admin mode:

!00KY04711

Setting rights -> ADMIN

Save new configuration with 'idKY00'

Response on change from Admin mode to Read only mode:

!00KY00000

Setting rights -> READ ONLY

Configuration saved.

20.5.7 Duplex mode

Description: This command is used to switch between half and full duplex.

Note: Switchover takes place immediately, i.e. a suitable communication module must then be connected to the sensor. If the switchover is made in error, the previous setting can be restored by briefly disconnecting the sensor from the power supply.

Request: <ID>,'DM'<value>(CR)

<ID> Device address (2 decimal places with leading zeros)

<value> 0 …half duplex

1…full duplex

The current setting is delivered as the response if no entry is made for <value>.

Response: !<ID><value>(CR)

20.5.8 Heating duty

Description: This command is used to switch between full and half heating duty.

Request: <ID>,'HP'<value>(CR)

<ID> Device address (2 decimal places with leading zeros)

<value> 0 …full heating duty

1… alternating heating

The current setting is delivered as the response if no entry is made for <value>.

Response: !<ID><value>(CR)

20.5.9 Heating mode

Description: This command is used to switch between 4 heating modes. The trigger property TG is automatically set to 0 (disabled) when the setting values are 3 or 4.

Request: <ID>'HT'<value>(CR)

<ID> Device address (2 decimal places with leading zeros)

<value> 0: Heating is always off

1: Heating is automatically controlled[1]

Heating switches on when the housing temperature falls below +2°C (adjustable between 2°C and 10°C) and switches off at a housing temperature of >+7°C (set temperature +5°C)

2: The switch-on temperature is shifted to +40°C; thus the heating switches on at room temperature (for test purposes only)

3: Heating is disabled when the control line is at "high" level, otherwise automatic

4: Heating is disabled when the control line is at "low" level, otherwise automatic

The current setting is delivered as the response if no entry is made for <value>.

Response: !<ID><value>(CR)

20.5.10 Device ID

Description: This command is used to set the sensor ID.

Request: <ID>'ID'<value>(CR)

<ID> Device address (2 decimal places with leading zeros)

<value> New ID

The current setting is delivered as the response if no entry is made for <value>.

Response: !<ID><value>(CR)

20.5.11 Measurement interval

Description: This command is used to set the measurement interval.

Request: <ID>'MD'<value>(CR)

<ID> Device address (2 decimal places with leading zeros)

<value> 0..10 seconds

The current setting is delivered as the response if no entry is made for <value>.

Response: !<ID><value>(CR)

20.5.12 Output interval

Description: This command is used to set the time interval for telegram transmission when independent telegram transmission (TT) is enabled.

Request: <ID>'OR'<value>(CR)

<ID> Device address (2 decimal places with leading zeros)

<value> 0..10 seconds

The current setting is delivered as the response if no entry is made for <value>.

Response: !<ID><value>(CR)

[1] Factory setting

20.5.13 Scaling the wind speed

Description: This command is used to set the unit for wind speed.

Request: <ID>'OS'<value>(CR)

<ID> Device address (2 decimal places with leading zeros)

<value> 0 …m/s
1…km/h
2…miles/h
3…knots

The current setting is delivered as the response if no entry is made for <value>.

Response: **!**<ID><value>(CR)

20.5.14 Control line trigger property

Description: This command is used to set the trigger property when independent telegram transmission (TT) is enabled. If when enabling the function the heating control setting is 3 or 4 (control via control line), this (automatically) switches to 1.

Request: <ID>'TG'<value>(CR)

<ID> Device address (2 decimal places with leading zeros)

<value> 0: Disabled/heating control
1:Telegram transmission triggered on rising edge of control voltage
2:Telegram transmission triggered on falling edge of control voltage
3:Telegram transmission while control voltage is "high"
4:Telegram transmission while control voltage is "low"

The current setting is delivered as the response if no entry is made for <value>.

Response: !<ID><value>(CR)

20.5.15 Software reset

Description: This command is used to trigger a software reset

Request: <ID>'RS1'(CR)

<ID> Device address (2 decimal places with leading zeros)

Response: !<ID><value>(CR)

20.5.16 Switchover to binary protocol

Description: This command is used to temporarily switch over to UMB protocol. If the switchover is to be permanent, the sensor must be configured accordingly with the aid of the UMB-Config-Tool.

Request: <ID>'XX'(CR)

<ID> Device address (2 decimal places with leading zeros)

Response: '!'<ID>'XX'(CR)

20.5.17 CRC Calculation

The CRC is calculated in accordance with the following rule:

The check sum is exclusive or an (XOR) of all characters of the telegram including the separators ´,´ but excluding ´$´ and ´*´. The hexadecimal value of the upper and lower 4 bits of the result are converted into two ASCII characters (0-9,A-F) for transmission. The high byte is transmitted first.

Further information on the description of a CRC calculation is available in the NMEA 0183 protocol.

20.6 Communication in Terminal Mode (tbd.)

Not yet implemented but planned for future firmware versions

It is possible to communicate with a device in a very simple text-based manner using the terminal mode.

To do this, in the device configuration, interface settings, the protocol mode must be set to terminal (see page **Fehler! Textmarke nicht definiert.**).

Note: In the case of communication in the terminal mode, only one single unit may be connected to the interface, as this protocol is **NOT** network-compatible. It is used for very simple measurement value requests.

Note: The use of binary protocol is recommended for lengthy transmission routes (e.g. network, GPRS/UMTS), as it is not possible to detect transmission errors in terminal mode (not CRC-secured) .

Note: In the terminal mode, measurement values are not available in all units. Furthermore, status and error messages are not transmitted.

20.6.1 Structure

A terminal consists of an ASCII character and a numeric character. The command is completed with the <CR> sign. There is no echo on entry.

The individual values in the response are separated by a semi-colon (;). The response is completed with <CR><LF>.

An invalid terminal command is acknowledged with ‘FAILED’. Control commands are acknowledged with ‘OK’.

The command to which the response relates is given at the beginning of each response.

Note: No response times are specified in the terminal mode.

20.6.2 Terminal Commands

The terminal commands output the following values or have the following functions:

E0<CR>	Temperature in °C	Ta	C	(Channel 100)
Wind speed in m/s	Sa	M		(Channel 400)
Wind direction in °	Da	D		(Channel 500)
E1<CR>	Temperature in °F	Ta	F	(Channel 105)
Wind speed in mph	Sa	S		(Channel 410)
Wind direction in °	Da	D		(Channel 500)
E2<CR>	actual wind speed in m/s	Sa	M	(Channel 400)
min. wind speed in m/s	Sn	M		(Channel 420)
max. wind speed in m/s	Sx	M		(Channel 440)
avg. wind speed in m/s	Sg	M		(Channel 460)
vct. wind speed in m/s	Sv	M		(Channel 480)
actual wind direction in °	Da	D		(Channel 500)
min. wind direction in °	Dn	D		(Channel 520)
max. wind direction in °	Dx	D		(Channel 540)
vct. wind direction in °	Dv	D		(Channel 580)
E3<CR>	actual wind speed in mph	Sa	S	(Channel 410)
min. wind speed in mph	Sn	S		(Channel 430)
max. wind speed in mph	Sx	S		(Channel 450)
avg. wind speed in mph	Sg	S		(Channel 470)
vct. wind speed in mph	Sv	S		(Channel 490)
actual wind direction in °	Da	D		(Channel 500)
min. wind direction in °	Dn	D		(Channel 520)
max. wind direction in °	Dx	D		(Channel 540)
vct. wind direction in °	Dv	D		(Channel 580)

Mx<CR> Delivers the same values as Ex<CR>, however without additional information such as measurement variable and unit

I0<CR> Serial number; date of manufacture; project number; parts list version; SPLAN version; hardware version; firmware version; E2 version; equipment version

I1<CR> Outputs the equipment description

R0<CR> Executes a device reset

R1<CR> Resets cumulative rain quantity and executes a device reset

X0<CR> Switches temporarily to UMB binary protocol

Examples:

E0<CR> E0;Ta+024.9C;Sa+005.1M;Da+156.6D;

M0<CR> M0;+024.9;+012.2;+026.8;+045.0;+0980.6;
+005.1;+156.6;+00042.24;+060;+002.6;

E2<CR> E2;Sa+005.1M;Sn+001.1M;Sx+007.1M;Sg+005.1M;Sv+005.0M;
Da+156.6D;Dn+166.6D;Dx+176.6D;Dv+156.6D;

M2<CR> M2;+005.1;+001.1;+007.1;+005.1;+005.0;
+156.6;+166.6;+176.6;+156.6;

I0<CR> I0;001;0109;0901;004;005;001;016;011;00002;<CR><LF>

R0<CR> R0;OK;<CR><LF>

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