USER MANUAL

PROFESSIONAL-IX 3.0 Modbus

Wind Sensors

aem | LAMBRECHT meteo

Contents

1 Features of the PROFESSIONAL-IX 3.0 Modbus

- Robust sensor for reliable measurement of wind direction and wind speed at extremely low temperatures
- Non-contact measuring principle for wear-free, precise measured value acquisition
- Maximum load capacity and durability thanks to double high-performance bearings and special alloys
- Special wind vane and three-armed cup rotor made of dimensionally stable and break-proof Aluminum
- Simple mounting principles for mast, flange, or borehole for a high degree of flexibility

2 Warranty

Note the loss of warranty and exclusion of liability in the event of unauthorized access to the system. Modifications or interventions in the system components may only be carried out by qualified personnel with the express permission of LAMBRECHT meteo GmbH.

The warranty does not include:

1. Mechanical damage due to impact from outside (e.g. ice chipping, stone chipping, vandalism)
2. Effects or damage caused by power surges or electromagnetic fields that go beyond the standards and specifications referred to in the technical data.
3. Damage caused by improper handling, such as the use of incorrect tools, incorrect installation, incorrect electrical installation (reverse polarity) etc.
4. Damage that can be attributed to operation of the devices outside the specified conditions of use.

3 Introduction

PROFESSIONAL-IX 3.0 Modbus is a very robust, compact, and extremely reliable wind sensor. The system is specially designed for use under extremely low temperatures. The wind sensors acquire the horizontal air flow and processes the measured data into the meteorological parameters wind speed or wind direction. All measuring parts and the other system components are integrated in the splash- and water-proof housing.

The PROFESSIONAL-IX 3.0 Modbus wind sensor is particularly designed for use under extreme climate conditions. The 125 W heating of the sensor head allows the operation of the sensor within a wide temperature range of -40 to +70 °C.

4 Setting to work

The wind can be represented by a vector quantity. For a complete description of the wind it is necessary to specify its speed and direction. The two components are subject to spatial and temporal variations, thus, strictly speaking, they are valid only for the site where the measuring instrument is installed. Therefore, we recommend to select the place of installation very carefully.

4.1 General installation conditions

Generally, wind measuring instruments should not measure the specific wind conditions of a limited area, but indicate the typical wind conditions of a wider terrain. The values measured at different places must be comparable. Thus, when installing the sensor you should make sure that the place of installation is not under the lee of great obstacles. The distance between the obstacles and the sensor should be 10 times the height of the obstacles (this corresponds to the definition of an *undisturbed terrain*).

If an *undisturbed terrain* of this kind does not exist the sensor must be put up at a height of at least 5 m above the obstacle height. If the sensor is installed on a roof top the place of installation must be in the middle of the roof to avoid predominant wind directions. If you want to measure both wind direction and wind speed, the sensors should be installed at the same measuring point and any mutual influence of the sensors should be avoided. The sensor pair PROFESSIONAL-IX 3.0 Modbus with its arrangement of sensors next to each other easily meets this requirement.

The sensor must not be installed onto transmitting plants or antennas or close to them. A minimum distance of 2 m is to be kept for interference-free signal transfer.

4.2 Tools and installation material

There are no special tools or materials required for the installation and maintenance works. All works can be carried out with standard tools available in the specialized trade.

4.3 Unpacking the sensor

The sensor is packed in a separate box, carefully protected against mechanical influences during the transport.

Please verify that the following parts and documents are enclosed:

- 1 sensor PROFESSIONAL-IX 3.0 Modbus
- 1 user manual

Accessories: (in accordance with the order separately packed)

- Connecting cable with plug

4.4 Incoming goods inspection

Please verify in detail the delivery with regard to completeness and eventual transport damages. In case of eventual claims please contact us in writing immediately.

4.5 Energy supply

The sensor requires a 24 volt nominal DC power source (20...28 VDC) for operation. The heating of the PROFESSIONAL-IX 3.0 Modbus has to be supplied with 24 volt DC and has a power consumption of 125 W.

5 Installation

As installation is generally carried out at heights, the installation personnel must follow the relevant safety regulations during installation.

5.1 Mast or pipe mounting

Make sure the device is easily accessible so that you can set up the north direction for the wind direction sensor and perform eventual maintenance works. For access to the sensors use a ladder of the appropriate length or a telescope working platform of the appropriate height, if applicable.

Ladders or other lifting helps must be absolutely in order and must be guarantee a secure support! Follow the rules for prevention of accidents.

Suitable masts or tubes (earthed) have an outer diameter of 48-50 mm. A mast adapter (see accessories) is required for installation.

MOUNTING THE ADAPTER TO THE WIND SENSOR

1. Remove both thread nuts from the sensor.
2. Insert the sensor into the bore (Ø 30 mm) of the adapter.
3. Fasten the sensor with the flat side of a detached nut from the lower side. Tighten with a suitable tool (wrench size 36), until a twisting safety of the sensor is given.

MOUNTING THE WIND SENSOR TO THE MAST

1. Install the cable with plug connection inside the mast.
2. Connect the cable with the sensor and screw down the locking nut of the cable gland.
3. Put the sensor on the mast (tube). With regard to the wind direction sensor the north mark on the sensor must be aligned to the geographical north direction acc. to 5.4. Afterwards fasten the locking screw in the mast adapter to give the sensor a fixed and torsion-free fit.

Proceed analogously when mounting the sensor on a tube traverse.

5.2 Mounting on traverse with slotted borehole

The traverse (ID 32.14627.010000) has a slotted hole with Ø 30 mm at each end.

1. Remove the lower nut from the sensor.
2. Put a sensor with assembled cable sidewise into the bore.
3. Fasten the sensor with the flat side of the detached nut from the lower side. Tighten with a suitable tool (wrench size 36), until a twisting safety of the sensor is given.

5.3 Mounting on traverses with 30 mm borehole

The general requirements for a sensor mounting device include flat material with a maximum thickness of 10 mm, in which a 30 mm hole is drilled.

The sensor is installed in the following steps:

1. Remove the lower thread nut from the sensor.
2. The sensor has to be inserted into the bore and fastened by the opposite side with the loose nut (removed as under 1.). With regard to the wind direction sensor the north mark on the sensor must be aligned to the geographical north direction acc. to chapter 5.4 before finally fastening the nut.

5.4 Aligning the wind vane

For wind direction measurements the north mark on the sensor must be aligned to the geographical north direction. To set up the sensor's north orientation select a landmark which is as far as possible up north with regard to the final position of the wind direction sensor. The reference point can be selected using a topographical map (1:25000). The exact position of the reference point is determined using an amplitude compass that can be adjusted horizontally on a stand.

You have to turn the wind vane's marking exactly over the marking at the sensor shaft. When you have aligned the marks, you may fix the wind vane with e.g. a piece of adhesive tape. When you have fixed the wind vane you can locate the reference point by aiming at it over the axis. Now you must turn the sensor casing on the mounting tube until the tip of the wind vane points to the reference point in the north. This requires that the sensor is easily turnable on the mounting part. The sensor has to be fixed in this position.

Forcibly turning the permanently mounted sensor can damage the sensor.

After alignment, the adhesive strips must be removed.

For precise alignment, please pay attention to the compass readings.

Follow all relevant safety instructions when mounting a sensor on a mast.

5.5 Earthing

To improve the operating security in lightning-prone areas we suggest an additional earthing of the sensors via the integrated earthing screw of the PROFESSIONAL-IX 3.0 Modbus.

The following illustration shows the steps of installation of an earthing connection with a cable clip and earthing screws onto the sensor.

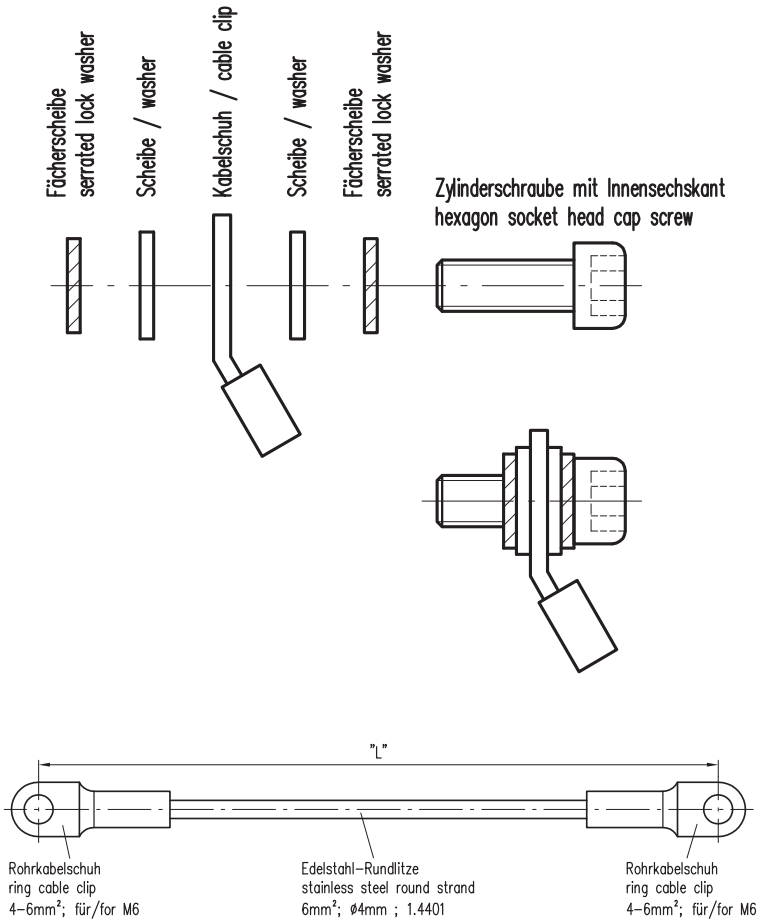


Illustration: Example of an earthing cable

5.6 Power and signal connection

The PROFESSIONAL-IX 3.0 Modbus sensors have separate connections for the heating supply and for the supply and signal transmission of the sensor.

5.7 Connection of sensor electronics

PROFESSIONAL-IX 3.0 Modbus sensors will be connected to a data measuring system via the open cable end (see connection diagrams). The connecting cable is suitably installed along the mast between the data evaluation device

(indicating instrument or data acquisition system) and the sensor. The cable must be secured using appropriate cable ties (length depends on the mast diameter). The cable routing should be arranged in accordance with the installation site. Make sure that the cable is secured by suitable cable binders. .

For further details about the electrical connection of the sensor please see chapter 10 “Dimensional drawings and connections“.

Lead the cable in a wide curve from the mast to the bottom of the casing so that you can later easily dismount the cable.

Please make sure the cable is protected from humidity on the side of the data processing system resp. the power supply. Generally, cable sockets that use a rubber joint to prevent humidity from penetrating into the terminal box of the data processing system provide sufficient protection.

To reduce the risk of inductive interference the cable must be properly grounded (screening on both sides).

5.8 Safety regulations

As the sensor is often mounted at considerable heights, the appropriate safety instructions need to be observed in the course of mounting. During electrical installation works the respective AC/DC must be switched off.

Please note that the sensor head can be very hot!
The housing must not be opened by unauthorized personnel!

6 Maintenance

The sensor design permits long periods of maintenance-free operation. We recommend a regular visual verification and functional test of the wind sensors. In case of specific problems or difficulties do not hesitate to contact our LAMBRECHT service under:

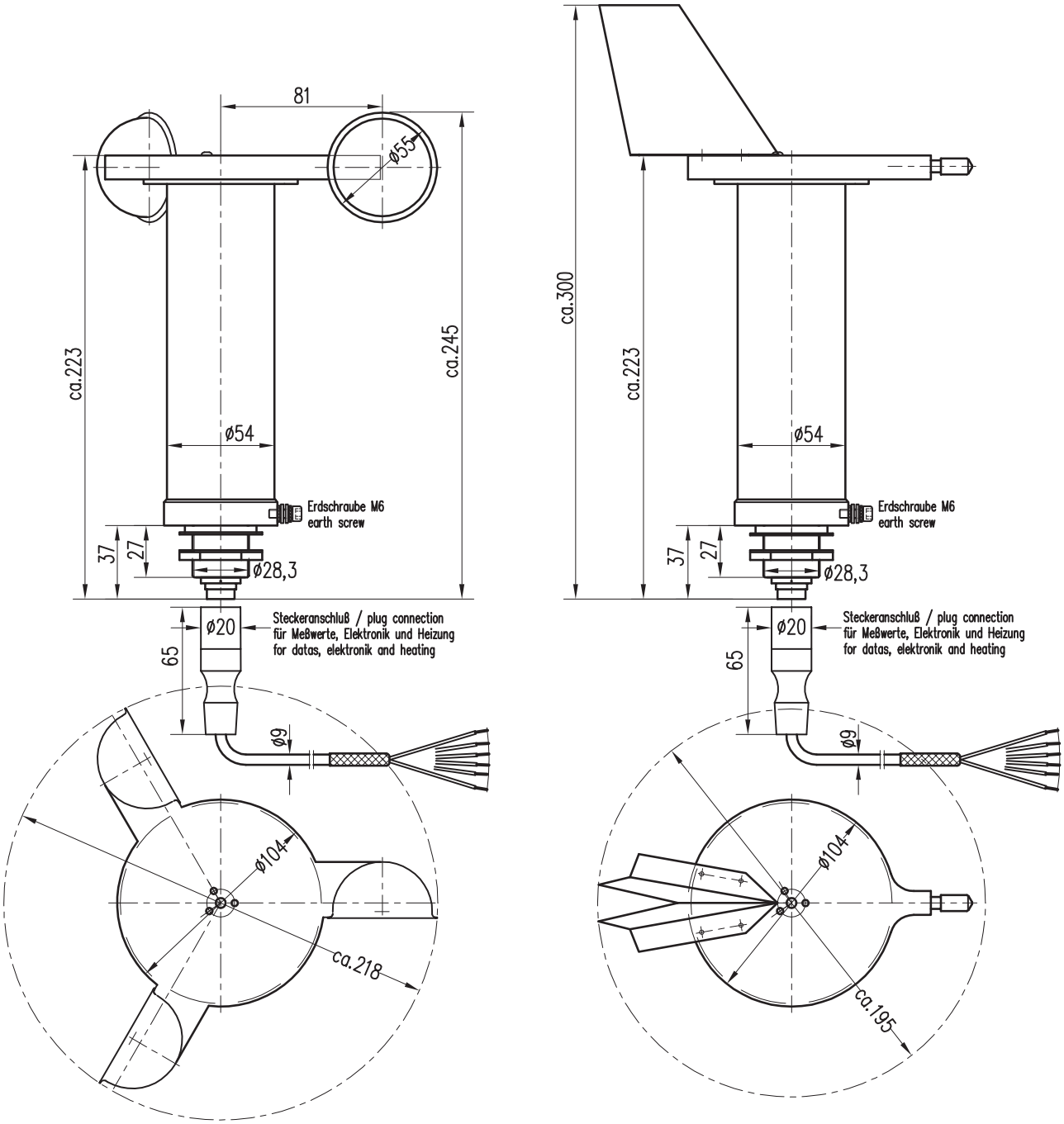
Tel: +49-(0)551-4958-0
Email: support@lambrecht.net

For the long-term assurance of the function and accuracy of the proposed components, we are pleased to offer you our professional maintenance and calibration services.

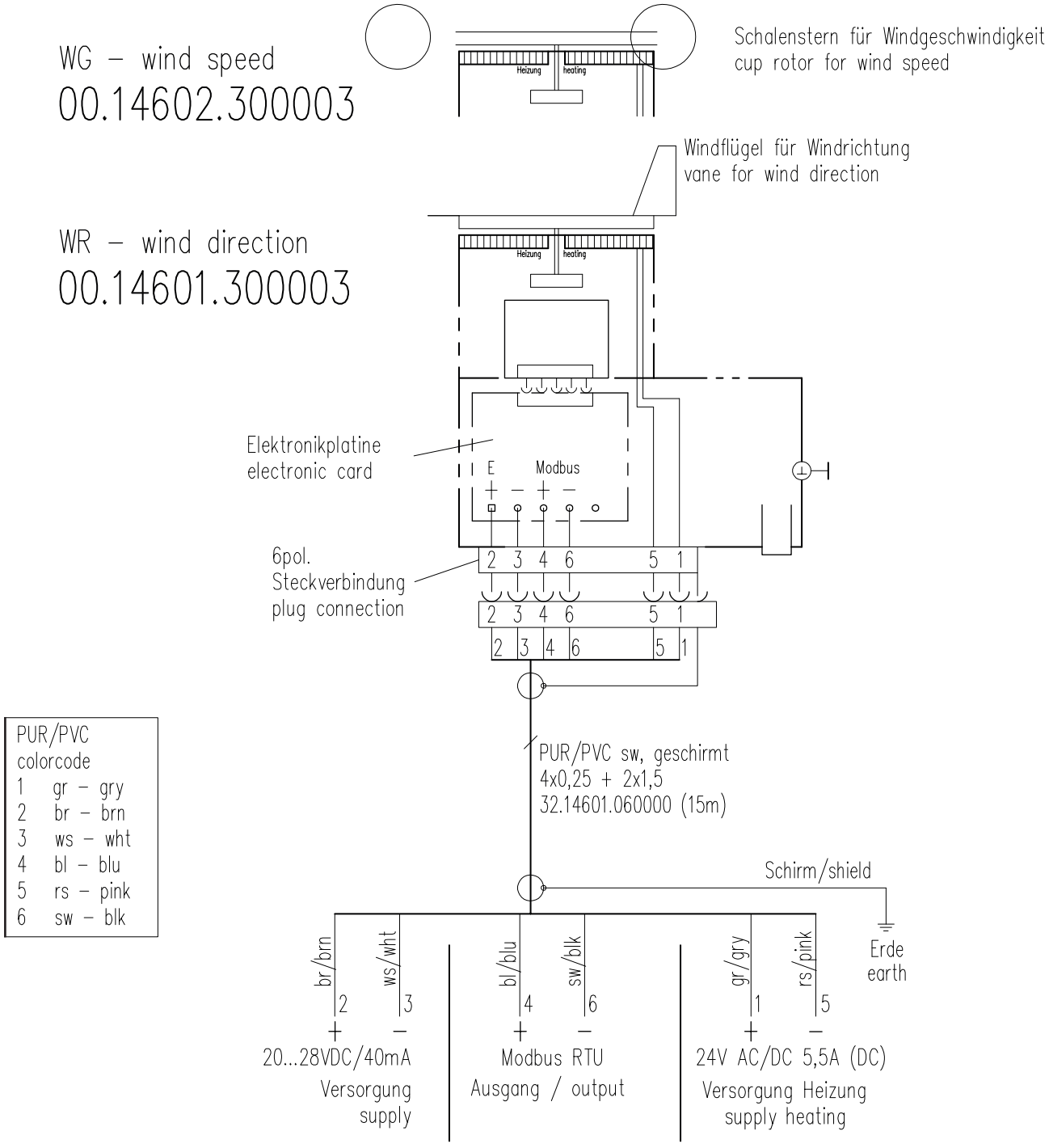
7 Transports

In case it is necessary to ship or to transport the sensor, the instrument must be carefully packed to prevent mechanical influences or other damages. It is recommended to use the original packing.

8 Dimensional drawings and connections



9 Connection diagrams



10 Modbus protocol

The LAMBRECHT meteo Modbus sensors and the met[LOG] follow the specification of the Modbus organization: "MODBUS APPLICATION PROTOCOL SPECIFICATION V1.1b3" (see www.modbus.org).

10.1 Data encoding

MODBUS uses the "big-endian" format for addresses and data. This means that if a value is transmit-ted with a number format that is larger than a single byte, the "most significant byte" is sent first. For values that go beyond one register (e.g. 32 bit) this is not clearly specified for the Modbus. In these cases (32 bit or 64 bit) the LAMBRECHT Modbus sensors follow the big-endian number format.

Example Big-Endian:

Register size value
16 - bits 0x1234 is transmitted in the order: 0x12 0x34.

Example Big-Endian (32 bit or 64 bit):

Register size value
32 - bits 0x12345678 is transmitted in the order: 0x12 0x34 0x56 0x78.

10.2 Device address

The addresses 1...247 are permitted for Modbus.

10.3 Standard configuration - Default

Baud rate:	19200 Baud
Byte frame:	8E1 (1 start bit, 8 data bits, 1 parity bit (even parity), 1 stop bit)
RTU Sensor address:	(1) Wind speed sensor
	(2) Wind direction sensor

DEFAULT ADDRESSES OF THE LAMBRECHT SENSORS

Address	Sensor
1	Wind speed
2	Wind direction
3	Precipitation rain[e]
4	THP
5	EOLOS IND; u[sonic]WS6
6	com[b]
7	PREOS
8	ARCO
9	u[sonic]
10	Pyranometer 2nd Class
11	Secondary standard Pyranometer
12	PT100 to Modbus converter (temperature)
13	u[sonic]WS7

10.4 Available Modbus commands

The LAMBRECHT Modbus sensors support the following commands:

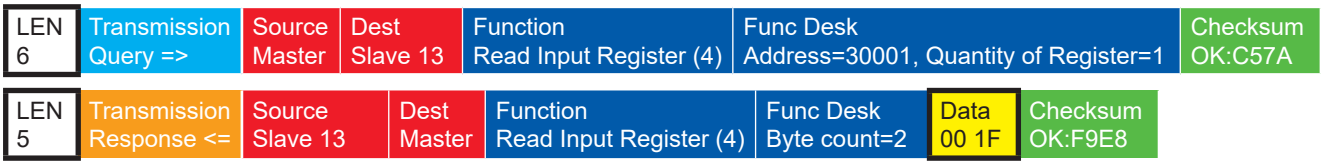
- "Read Holding Register" command: 0x03 (descriptive sensor data registers)
- "Read Input Register" command: 0x04 (measured values registers)
  (every measured value is to be requested individually)
- "Write Multiple Register" command: 0x10 (write to configuration registers)

10.5 Instantaneous values / realtime values (Input Register)

The following measured values are provided:

Register address	Parameter name	Unit	Divisor	Quantity of registers	Access type
30001	Wind speed	m/s	10	1	Read only
30201	Wind direction	°	10	1	Read only

Example: Retrieve wind speed



10.6 Period data - Average, maximum and minimum (Input Register)

Register	Parameter name	Unit	Divisor	Quantity of registers	Access type
30002	Wind speed average	m/s	10	1	Read only
30003	Wind speed maximum	m/s	10	1	Read only
30004	Wind speed minimum	m/s	10	1	Read only
30202	Wind direction average	°	10	1	Read only
30203	Wind direction maximum	°	10	1	Read only
30204	Wind direction minimum	°	10	1	Read only

The data are valid for the period between the current request and the previous request. The maximum range of a period is 1 hour. Recalling the average value of a minimum, maximum and average group will erase the appropriate registers.

Retrieve the values of a group in the sequence minimum, maximum, average.
Use command: 0x03

Example: Retrieve wind speed (min. max. avr.) and delete the register content

01	04	75	34	00	01	6A	08	01	04	02	00	00	B9	30	01
04	75	33	00	01	DB	C9	01	04	02	00	D6	38	AE	01	04
75	32	00	01	8A	09	01	04	02	00	14	B9	3F			

LEN 6	Transmission Query =>	Source Master	Dest Slave 1	Function Read Input Register (4)	Func Desk Address=30004, Quantity of Register=1	Checksum OK:86A
LEN 5	Transmission Response <=	Source Slave 1	Dest Master	Function Read Input Register (4)	Func Desk Byte count=2	Data 00 00 / Checksum OK:30B9
LEN 6	Transmission Query =>	Source Master	Dest Slave 1	Function Read Input Register (4)	Func Desk Address=30003, Quantity of Register=1	Checksum OK:C9DB
LEN 5	Transmission Response <=	Source Slave 1	Dest Master	Function Read Input Register (4)	Func Desk Byte count=2	Data 00 D6 / Checksum OK:AE38
LEN 6	Transmission Query =>	Source Master	Dest Slave 1	Function Read Input Register (4)	Func Desk Address=30002, Quantity of Register=1	Checksum OK:98A
LEN 5	Transmission Response <=	Source Slave 1	Dest Master	Function Read Input Register (4)	Func Desk Byte count=2	Data 00 14 / Checksum OK:3FB9

10.7 Descriptive sensor parameter registers (Holding Register)

Register	Parameter name	Quantity of registers	Remark	Access type
40050	Device identification number (15 characters)	8 (2 characters in each register)	The returned data are in form of a 16 byte null terminated string	Read only
40100	Serial number (11 characters)	6 (2 characters in each register)	The returned data are in form of a 12 byte null terminated string	Read only
40150	Firmware version (up to 25 characters)	13 (2 characters in each register)	The returned data are in form of a 26 byte null terminated string	Read only

Example: Retrieve the device identification number (the identification number shown in the example is sensor-dependent. It is only used here for demonstration purposes)

0D	03	9C	72	00	08	CA	8B	0D	03	10	30	30	2E	31	36
34	38	30	2E	30	30	31	31	33	30	00	E8	6B			

□□□□□□□□□□□□□□□□□
00.16480.000130□□□

LEN 6	Transmission Query =>	Source Master	Dest Slave 13	Function Read Holding Register (3)	Func Desk Address=40050, Quantity of Register=8	Checksum OK:8BCA
LEN 19	Transmission Response <=	Source Slave 13	Dest Master	Function Read Holding Register (3)	Func Desk Byte count=16	Data 30 30 2E 31 36 34 38 30 2E 30 30 31 31 33 30 00 / Checksum OK:6BE8

10.8 Configuration registers (Holding Register)

Register	Parameter name	Allowed values	Quantity of registers	Access type
40001	Modbus device address		1	Write only
40200	Baud rate	96 = 9600 192 = 19200 384 = 38400	1	Write only
40201	Parity	1 = even 0 = none	1	Write only

The device must be restarted after each change of a setting!

Example: Change the RTU address from 4 to 1

05	10	9C	41	00	01	02	00	01	06	48	05	10	9C	41	00
01	7E	09													

LEN 9	Transmission Query =>	Source Master	Dest Slave 5	Function Write Multiple Register (16)	Func Desk Address=40001, Quantity=1	Byte count 2	Register values 00 01	Checksum OK:4806

LEN 6	Transmission Response <=	Source Slave 5	Dest Master	Function Write Multiple Register (16)	Func Desk Address=40001, Quantity=1	Checksum OK:097E

11 Autoconfiguration

All LAMBRECHT Modbus sensors offer experienced users the option of implementing an auto-configuration in their Modbus master based on additional information stored in the sensor. The necessary information can be found in the document “Lambrecht_Modbus_Autoconfiguration”.

12 Disposal

LAMBRECHT meteo GmbH is recorded and registered at the Stiftung Elektro-Altgeräte Register ear under:

WEEE reg. no. DE 45445814

In the monitoring and control instrument category, type of device: “Monitoring and control instruments for exclusively commercial use.”

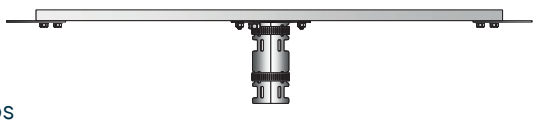
Within the EU

The device must be disposed of in accordance with European directives 2002/96/EC and 2003/108/EC (waste electrical and electronic devices). Waste devices must not be disposed of with household garbage! For environmentally friendly recycling and disposal of your waste device, please contact a certified disposal company for electronic waste.

Outside the EU

Please observe the regulations applicable to the proper disposal of waste electronic devices in each country.

13 Technical data

GENERAL		
Measuring principle	non-contact; “Hall Sensor Array”	
Range of application	Temperature: -40...+70 °C heated; Wind speed: 0...60 m/s; Humidity: 0...100 % r. h.	
Heating	125 W heating; electronically controlled (The heating within the sensor head prevents blocking of the moving parts under most climatological conditions.)	
Supply voltage	Sensor: 24 VDC (20...28 VDC), 312 mW; Heating: 24 VDC, 125 W	
Power consumption of electronics	max. 13 mA at 24 VDC	
Housing	seawater-resistant aluminum, specially coated; IP 65 in vertical operating position	
Dimensions	see dimensional drawings	
Weight	0.8 kg	
Scope of delivery	1 sensor (without cable)	
	PROFESSIONAL-IX 3.0 Modbus Wind Direction Sensor	**PROFESSIONAL-IX 3.0 Modbus Wind Speed Sensor**
ID	00.14601.300003	00.14602.300003
Parameter	Wind direction in °	Wind speed in m/s
Measuring element	wind vane; dimensionally stable; Aluminum specially coated	three-armed cup rotor; Aluminum specially coated
Measuring range	0...360°	0.4...50 m/s
Accuracy	± 1°	± 2 % FS at 0,4...50 m/s
Resolution	< 1°	< 0.1 m/s
Starting value	0.4 m/s	0.4 m/s
Interface	RS485	RS485
Protocol	Modbus RTU	Modbus RTU
ACCESSORIES (please order separately)		
32.14601.060000	15 m cable, one-sided with plug (Please only use this original cable, as it has a reinforced wire cross-section for supplying the heating!)	
32.14627.010000	Set wind traverse, consisting of: 1 x 33.14627.001010 Traverse 750 mm 1 x 32.14627.007000 Set of two cover caps 2 x 32.14627.002000 Set sensor holder, round D30 1 x 32.14627.001000 Set mast bracket	

1460x_3.0_Modbus_b-de.indd 24.24
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