INDUSTRY Modbus · Advantages

The INDUSTRY Modbus wind sensors are very economical to purchase. The sensors also impress with their high accuracy, simple mounting principles and seawater-resistant, very robust materials.

The thermal decoupling of the housing shaft enables optimum heating of the sensor head and minimum power requirement of the system.

- proven sensor technology
- very good starting values
- large measuring and temperature application ranges
- easy mast mounting
- optimal heating concept

Content

1. Initial operation

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 put up. We therefore recommend to select the place of installation very carefully.

Selecting the place of installation

Generally, wind measuring instruments should not measure the specific wind conditions of a limited area, but indicate the typical wind conditions of a wider area. The values measured at different places must be comparable. Thus, when installing the sensor you should make sure 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 must be 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, install the sensors at the same measuring point, if possible, and make sure to avoid any mutual influence of the sensors. A wind sensor pair easily meets this requirement since the sensors are set up side by side. Their horizontal distance should be approximately 1.5 m. The two sensors must be staggered vertically so that the lower edge of the upper wind speed sensor is 0.1 to 0.5 m above the upper edge of the lower wind direction sensor.

2. Principles of installation

Attention!

Because the installation takes place in a dangerous height, the assembly personal must follow the rules for prevention of accidents.

I. Traverse with bore (e.g. Id-No. 32.14627.010000)

Material thickness for installation of the sensor between the nuts may be max. 10 mm.

2. The sensor is led without cable into the bore and fastened by the opposite side with the loose nut.
3. Attach the sensor with the flat side of detached nut from the lower side. Tighten with a suitable tool (wrench size 36), until a twisting safety of the sensor aligned to the north is given.

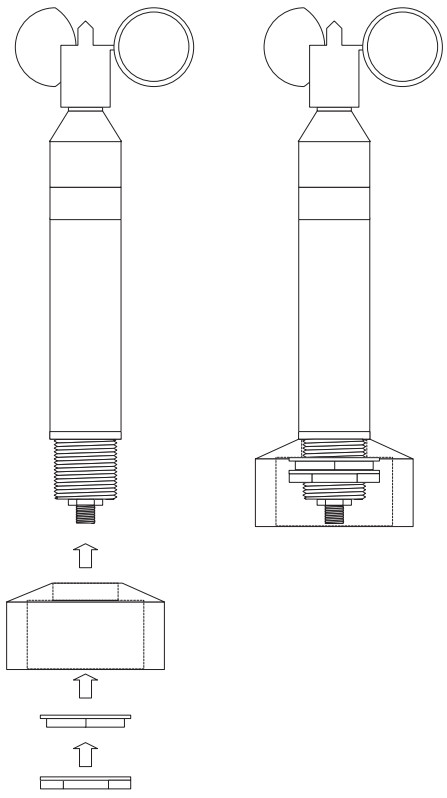
II. Mast or pipe mounting

Make sure the device is easily accessible so that you can set up the north direction for the wind direction sensor and perform any maintenance work. To reach the sensors use a ladder of the appropriate length or a telescoping working platform of the appropriate height.

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

Mount the sensors at the top of grounded tube with an outer diameter Ø 48-50 mm. The mast adapter (see accessories) is obligatory.

1. Remove both thread nut from the sensor.
2. The sensor is inserted without cable into the bore (Ø 30 mm) of the adapter and locked from the opposite side with a loose nut in the direction of the adapter.
3. And finally we recommend to lock the second nut with its plane side ahead against the first nut (see drawing).



If wind speed and wind direction are measured at the same time, the measurement generally takes place not only at the top of a mast but also at the ends of a cross arm. The arms must stay torsion-free and vibration-proof even at high wind speeds and they must be accessible for you to perform mounting and maintenance work.

When you install the connecting cables make sure not to excessively shorten the cable leading to the connector in the lower part of the sensor casing so that you can later maintain or dismounting the sensor. Put further a cable loop as sensor protection against water under the sensor.

Tip: Install the sensors on ground to the traverse and align you the wind vane parallel to the traverse. You go only then upward, in order to accordingly align the sensors with traverse under assistance of a partner on ground.

3. Setting up the North Direction for the wind direction sensor

For wind direction measurements the north mark on the sensor must be aligned with the geographical north direction.

You have to turn the 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 this way 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.

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.

Please make sure there is no magnetic deviation of the compass.

When the north direction is set up for the wind direction sensor, you can mounting it like under point "Principle of installation". Remove any adhesive tape.

If you cannot select a northern reference point owing to local conditions, you can proceed analogously using a reference point in the south. In this case, however, you have to make sure the north mark on the sensor does not point to the reference point but in the opposite direction.

4. Electrical connection

Sensors INDUSTRY are connected to a data measuring system via the open cable end. The sensors have a cable-plug connection to the cable.

The connecting cable is suitably led along the mast between the data evaluation device (indicating instrument or data acquisition system) and the sensor. The cable must be fastened using appropriate cable ties (their length depends on the mast diameter).

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.

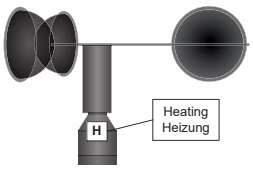
Please note that the cable on the data processing side is protected against moisture, e.g. by using suitable cable glands.

If the mast is prepared accordingly, the connection cable can also be laid completely in the pipe sections of a mast.

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

5. Heating

The sensor disposes of an electronically controlled 18 W-heating within the sensor head. The heating is supplied together with the sensor electronics.

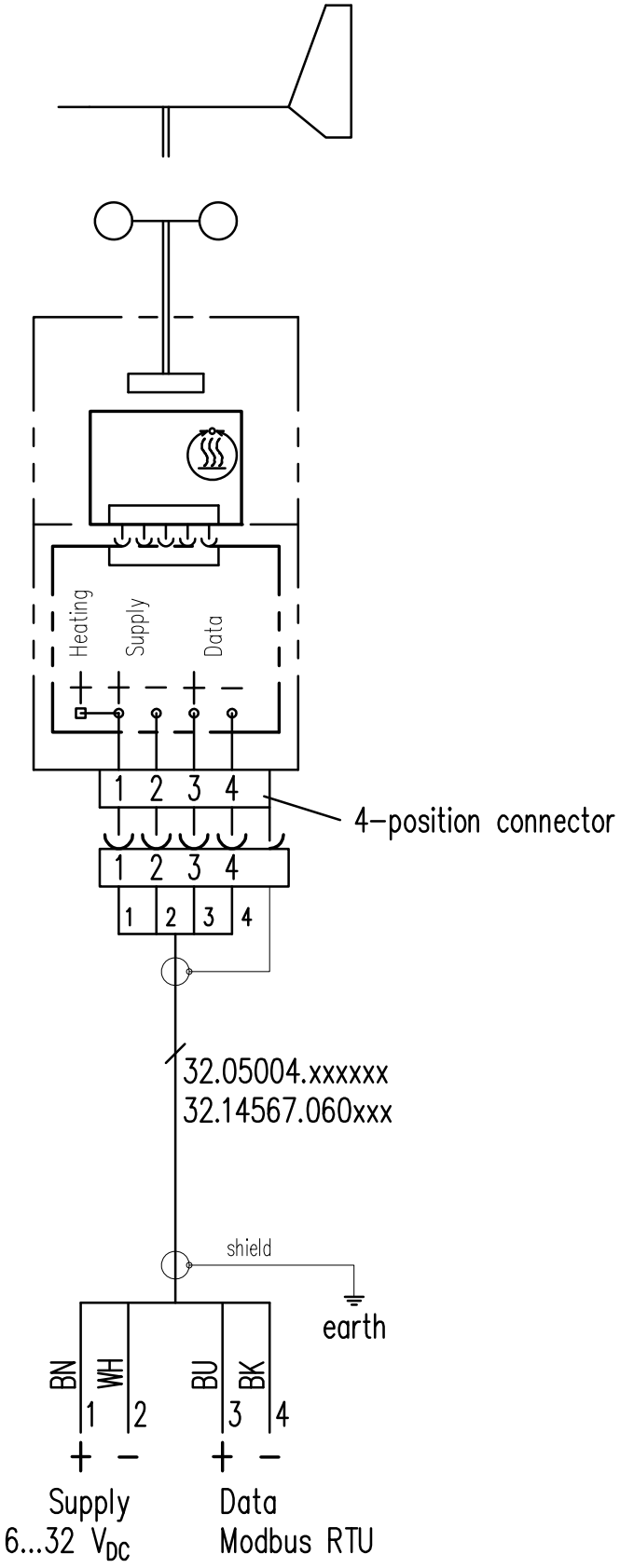


Under most climatological conditions the heating prevents blocking of the moving sensor parts (see illustration). The cup rotor or the wind vane are not heated. In case of icing or formation of ice at the moving sensor element the function is restricted for the period of icing.

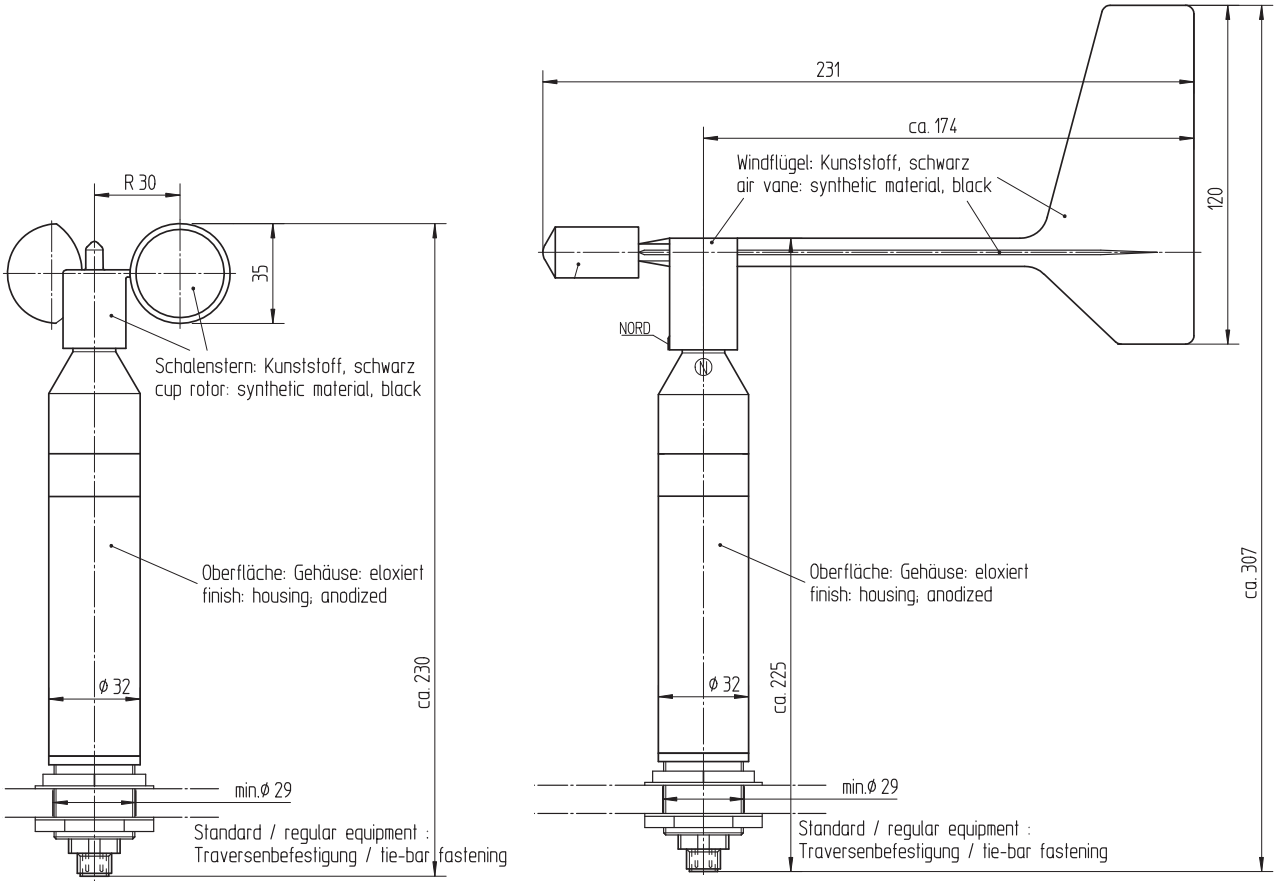
6. Maintenance

The sensor design permits long periods of maintenance-free operation. We therefore recommend a regular visual verification of the north setup of the wind direction sensor as well as a sensor calibration of both sensor types in the distance of 2 years.

7. Wiring diagram



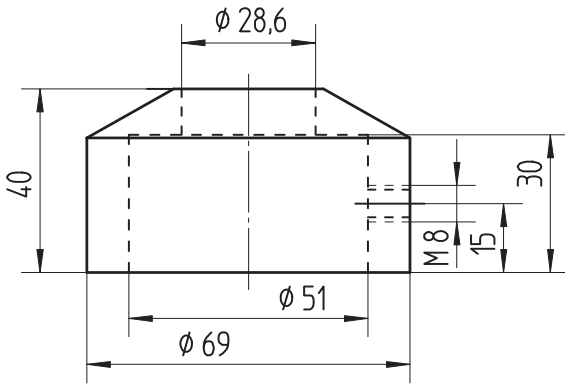
8. Dimensioned drawings



Accessories (optional):

(14567 U6) Mast adapter

Id-No. 32.14567.006 000



9. 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).

9.1 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.

9.2 Device-address

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

9.3 Standard configuration - Default

Baud rate: 19200 Baud

Address: Each sensor type (or family) has its own default address.

Default addresses of the LAMBRECHT sensors:

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

Byte frame according to MODBUS standard for RTU mode:

8E1 (1 start bit, 8 data bits, 1 parity bit (even parity), 1 stop bit)

9.4 Modbus command set

The LAMBRECHT Modbus sensors support the following commands:

- Read Input Register" command: 0x04 (measured data)
- Write Multiple Register" command: 0x10 (Write sensor data)

9.5 Measured value and parameter registers

The register range 30001 to 35000 of the LAMBRECHT sensors is intended for measured values.

Register for the wind speed sensor 00.14577.110030

Register address	Parameter name	Unit	Factor	Description	
30001	Wind speed instantaneous value	m/s	10	1 decimal place	INT
30002	Wind speed average value since last retrieval	m/s	10	1 decimal place	INT
30003	Wind speed maximum value	m/s	10	1 decimal place	INT
30004	Wind speed minimum value	m/s	10	1 decimal place	INT

Note: The values from the registers with the maximum values and minimum values are automatically reset as soon as the register with the average values has been read out.

Register for the wind direction sensor 00.14567.110030

Register address	Parameter name	Unit	Factor	Description	
30201	Wind direction instantaneous value	°	10	1 decimal place	INT
30202	Wind direction average value since last retrieval	°	10	1 decimal place	INT
30203	Wind direction maximum value	°	10	1 decimal place	INT
30204	Wind direction minimum value	°	10	1 decimal place	INT

Note: The values from the registers with the maximum values and minimum values are automatically reset as soon as the register with the average values has been read out.

The registers addresses 30001 to 35000 apply to all LAMBRECHT meteo Modbus sensors, but are only available or valid if the respective sensor supports the corresponding values (e.g. a pure temperature sensor does not provide any wind speed)..
The LAMBRECHT sensors give 0xD8F1= 9999(16bit) as error code or invalid value.

9.6 Sensor parameters / Configuration parameters

Register address 40001 to 46000 contains the configuration parameter of the sensor.

Register address	Parameter name	Unit	Divisor	Description	
40001	Modbus device address		1	The addresses 1...247 are allowed.	
40200	Baud rate		0,01	96=9600 192=19200 384=38400	
46000	Number of mapping registers		1	Contains the number of occupied mapping registers for the autoconfiguration	INT

9.7 Mapping register for autoconfiguration

Registers address 46001-49000 containing for each sensor the available registers with measured values and sensor data from the range 30001-35000.

The registers can only be read out as a block! The length of the block or the number of available mapping registers is in holding register 46000.

For example, in the INDUSTRY Modbus wind speed sensor, registers 46001 to 46004 contain valid addresses. The holding register 46000 contains the number of registers 4. All 4 registers must be read out in the block with the instruction **0x04**. Too many registers or too few lead to an error message.

9.8 Autoconfiguration

The Modbus sensors from LAMBRECHT meteo offer the possibility of auto-configuration. This is supported e.g. by the data logger met[LOG].

For the autoconfiguration, the register addresses of the measured values and sensor data available in the register range 30001 to 35000 are listed as consecutive values in the LAMBRECHT sensors in register range 46001 to 49000. Registers 46001 to 49000 can only be read out as a block! The length of the block or the number of available mapping registers is in holding register 46000.

Since the addresses from the range 30001 to 35000 apply to all LAMBRECHT sensors, an address from this range is also representative of a measured value type.

For example, register 30401 always contains the current value of the air temperature. If this register address is not included in the list in register range 46001 to 49000, the connected Modbus sensor does not supply an air temperature.

If the autoconfiguration is started with the data logger met[LOG], it queries the available mapping registers on each COM interface in the device address range 1...25. For this purpose, the number of mapping registers is read from register 46000 and the register range from 46001 is read out as a block.

The following table contains the assignment of the configuration to the individual (possible) instantaneous value registers of the sensors. Some sensors deliver registers with mean, minimum and maximum values or additional values beyond this specification. Unknown register addresses (or registers that are not required) must therefore be ignored during autoconfiguration.

Register address	Parameter name	Unit	Factor	Description	Data type	Function code	Storage-type >16 bit
30001	Wind speed instantaneous value	m/s	10	1 decimal place	INT	0x04	Big-Endian WORD
30201	Wind direction instantaneous value	°	10	1 decimal place	INT	0x04	Big-Endian WORD
30401	Air temperature instantaneous valuet	°C	10	1 decimal place	INT	0x04	Big-Endian WORD
30601	Humidity instantaneous value	% r.F.	10	1 decimal place	INT	0x04	Big-Endian WORD
30701	Dew point instantaneous value	°C	10	1 decimal place	INT	0x04	Big-Endian WORD
30801	Air pressure instantaneous value	hPa	10	1 decimal place	INT	0x04	Big-Endian WORD
31001	Precipitation amount total	mm	10	1 decimal place	INT	0x04	Big-Endian WORD
31101	Precipitation amount total (High-WORD)	mm	1000	3 decimal places Registers 31101 + 31102 can only be read out together. (function code 0x04)	uLONG	0x04	Big-Endian WORD
31102	Precipitation amount total (Low-WORD)					0x04	Big-Endian WORD
31201	Precipitation intensity 1-minute (sliding)	mm/min	1000	= average (1-min.) 3 decimal places Time base = 1 min. Meas. rate = 6x per min.	INT	0x04	Big-Endian WORD
31401	Global radiation instantaneous value	W/m²	10	1 decimal place	INT	0x04	Big-Endian WORD

31501	Global radiation instantaneous values (High-WORD) (temperature compensated)	W/m²	100	2 decimal places Registers 31501 + 31502 can only be read out together (function code 0x04)	LONG	0x04	Big-Endian WORD
31502	Global radiation instantaneous values (Low-WORD) (temperature compensated)					0x04	Big-Endian WORD
31591	Global radiation instantaneous values (High-WORD) (uncompensated)	W/m²	100	2 decimal places Registers 31591 + 31592 can only be read out together (function code 0x04)	LONG	0x04	Big-Endian WORD
31592	Global radiation instantaneous values (Low-WORD) (uncompensated)					0x04	Big-Endian WORD

9.8.1 Mapping register INDUSTRY Modbus

Register address	Register value	Unit	Factor	Description	
46001	30001	Register address	1	Wind speed instantaneous value	INT
46002	30002	Register address	1	Wind speed average value since last retrieval	INT
46003	30003	Register address	1	Wind speed maximum value	INT
46004	30004	Register address	1	Wind speed minimum value	INT
46005	30201	Register address	1	Wind direction instantaneous value	INT
46006	30202	Register address	1	Wind direction average value since last retrieval	INT
46007	30203	Register address	1	Wind direction maximum value	INT
46008	30204	Register address	1	Wind direction minimum value	INT

10. Technical data

Measuring principle:	Hall Sensor Array, non-contact
Range of application:	temperatures -30...+70 °C heated * • wind speed 0...60 m/s
Heating:	18 W heating • electronically controlled • The heating within the sensor head prevents blocking of the moving parts under most climatological conditions.
Supply voltage:	24 VDC (6...32 VDC)
Current consumption:	max. 800 mA at 24 VDC and max. heating • 13 mA at 24 VDC and inactive heating (Note: The heating can be deactivated via software tool. This allows the current consumption to be reduced to 8.5 mA at 24 VDC.)
Housing:	seawater-resistant Aluminium · anodized · IP 55 · shaft-Ø 32 mm · for mounting-bore Ø 30 mm at max. 10 mm material thickness
Dimensions:	see dimensioned drawings
Included in delivery:	1 sensor (without cable)
For connection to:	Lambrecht meteo data processing systems · power supplies · user specific evaluation systems (not included in delivery)
Accessory:	Id-No. 32.14567.060000 · sensor cable with M12, 4 pin female connector, length: 12 m (please order separately)

Parameters	**Wind direction Id-No. 00.14567.110030**	**Wind speed Id-No. 00.14577.110030**
Measuring elements:	wind vane • stably fibre-reinforced plastics	3-armed cup anemometer • fail-safe plastics
Measuring ranges:	0...360°	0.7...50 m/s
Accuracy:	± 2°	0.5 m/s at 0.7...5 m/s and 2 % FS at 5.02...50 m/s
Resolution:	1°	< 0.02 m/s
Starting value:	< 0.7 m/s	< 0.7 m/s
Interface:	RS485	RS485
Protocol:	Modbus RTU	Modbus RTU
Weight:	0.35 kg	0.25 kg
Measured values:	instantaneous value · average value · max. value of the average value · min. value of the average value	

*) [Note: In the event of possible icing and ice formation on the moving sensor element, the function is limited for the duration of the icing. We offer specially heated sensors for use in locations with acute icing hazards.]

Please note the loss of warranty and non-liability by unauthorised manipulation of the system. You need a written permission of the LAMBRECHT meteo GmbH for changes of system components. These activities must be operated by a qualified technician.

The warranty does not cover:

1. Mechanical damages caused by external impacts (e. g. icefall, rockfall, vandalism).
2. Impacts or damages caused by over-voltages or electromagnetic fields which are beyond the standards and specifications in the technical data.
3. Damages caused by improper handling, e. g. by wrong tools, incorrect installation, incorrect electrical installation (false polarity) etc.
4. Damages which are caused by using the device beyond the specified operation conditions.

Quality System certified by DQS according to DIN EN ISO 9001:2008 Reg. No. 003748 QM08

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