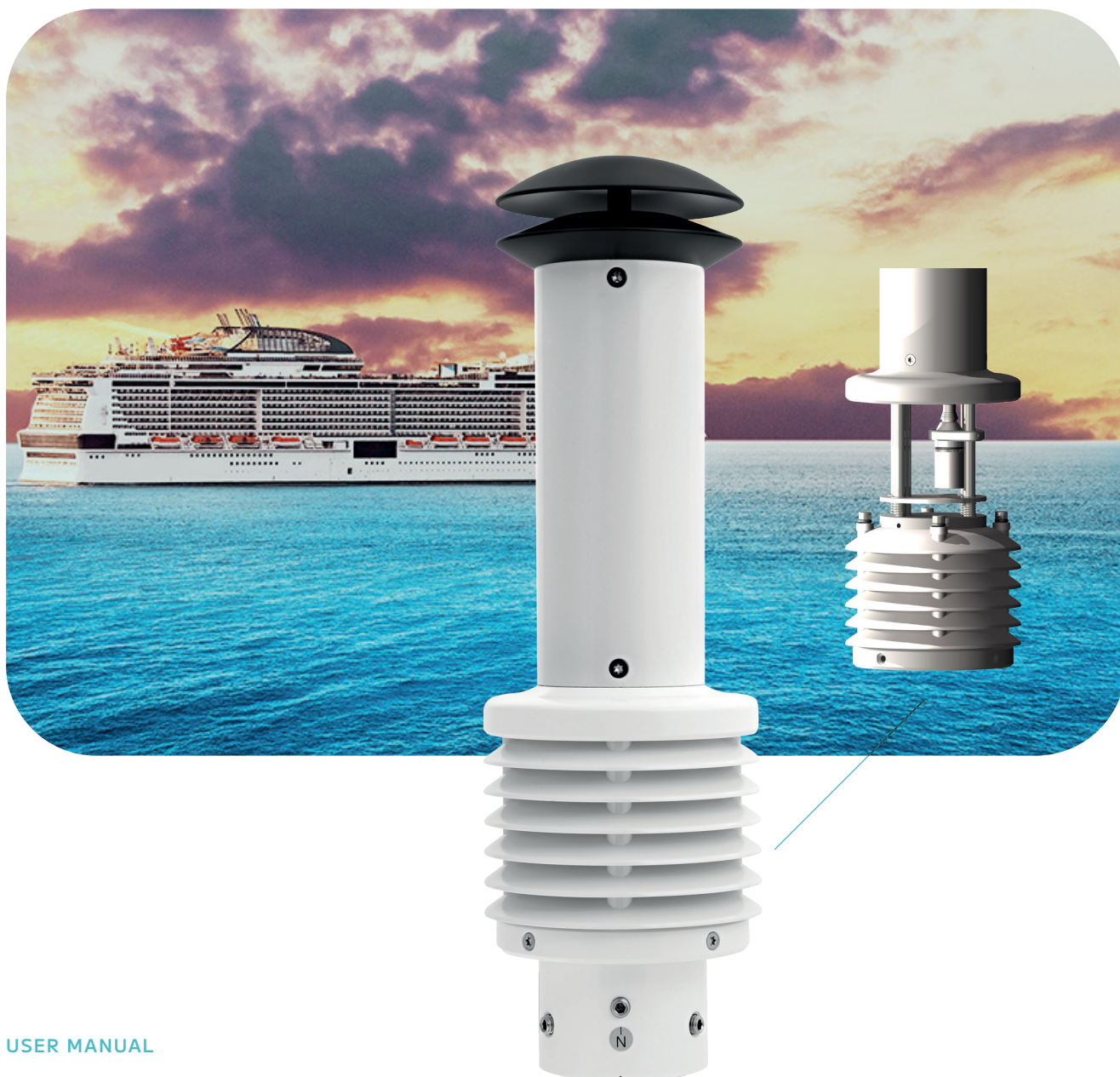




USER MANUAL

EOLOS-NAV2

Static Weather Sensor



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1. Safety instructions

This system is designed according to the state-of-the-art accepted safety regulations. However, please note the following rules:

- Before putting into operation please read all respective manuals!
- Please observe all internal and state-specific guidelines and/or rules for the prevention of accidents. If necessary ask your responsible safety representative.
- Use the system only as described in the manual.
- Always have the manual at hand at the installation site.
- Use the system within the specified operating condition. Eliminate influences, which might impair the safety.
- Prevent the ingress of unwanted liquids into the devices.

2. Warranty

Please note the loss of warranty and non-liability by unauthorized 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 (e.g. false polarity) etc.
4. Damages which are caused by using the device beyond the specified operation conditions.

3. About EOLOS-NAV2

- 5 + 1 parameters in one and at the same time:
 - Wind direction
 - Wind speed
 - Air temperature
 - Air humidity
 - Barometric pressure
 - + Dew point temperature (calculated value)
- With independent, integrated sensors for high accuracy of each individual parameter
- No moving measuring elements, i.e. no wear, low maintenance, and very service-friendly
- For very high wind speeds up to 85 m/s

ADVANTAGES AT A GLANCE

- Extremely robust, compact weather sensor with high-quality, pollutant-resistant housing made of anodized aluminium
- Integrated heating system for ice-free operation all year round
- Lamella shelter for precise measurements of the temperature/humidity sensor
- Static-thermal measuring principle for wind parameters with permanent air density compensation for wear-free, reliable measurements
- Standard RS-422 interface with ESD protection
- ASCII data protocols according to NMEA 0183
- Supply voltage 24 VDC with integrated overvoltage protection
- Simple visualization of the measured values via METEO-LCD display
- Easy, space-saving installation on 50 mm standard pipe

4. Introduction

The sensors of the EOLOS family are very robust, compact and extremely reliable. When developing these sensors particular consideration has been given to highest quality for fulfilment of meteorological requirements. The system acquires the horizontal air flow and processes the measuring data to the meteorological parameters wind speed and wind direction.

Furthermore the weather-module of the EOLOS-NAV2 acquires the meteorological parameters air temperature, relative humidity and barometric pressure. Based on the measured data EOLOS-NAV2 calculates the dew point temperature and provides for its serial output along with the measuring data. The sensors and further system components are mounted in a splash water- and dust proof metal housing.

The measuring data are automatically transmitted via serial interface RS-422 in talker mode, when power supply is switched on. Due to their shock- and vibration proof construction the sensor EOLOS-NAV2 is particularly qualified for use under severe environmental conditions. The housing is made of anodized seawater resistant aluminium. An electronically controlled heating device enables the sensor to operate in between the wide range of -40 up to 70 °C.

4.1. Advantages of the static measurement principle

The sensor EOLOS-NAV2 is a modern system to carry out precise and reliable measurements under hardest application and environmental conditions. The wind measurements take place according to the principle "TAV" (thermal aura field variation), i. e. static, without moving parts.

WHAT IS THE STATIC MEASURING PRINCIPLE FOR WIND MEASUREMENT?

- Determination of data works without moving measuring elements, i.e. none abrasion, least maintenance and none recalibration because of this method.
- The wind parameter can be measured also in winter time accurate and precise, because of the electronic controlled heating for the immovable measuring elements. This heating is particularly effective against ice and snow in all climatic zones.
- Lightweight mass and immovable measuring elements to enable very low starting values, distance- and



attenuation constants as well as a very high repetition accuracy.

- The sensor rapidly can be installed. Due to the special measuring principle minor changes from the angle of pitch can be disregarded.

WHAT ARE THE ADVANTAGES OF THE SENSOR?

- Additional integrated sensors for air temperature, relative humidity, and barometric pressure. The dew point temperature is calculated accordingly.
- The built-in test function of the station, enabled by the tight integration of the meteorological sensors into the enclosure, can perform cyclic self-testing and notify the user of erroneous data or failure.
- The compact design of the EOLOS-NAV2 sensor significantly reduces the number of components and their installation times compared to conventional solutions with individual devices for the 5 parameters.

5. Start-up

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. We therefore recommend selecting the place of installation very carefully.

5.1. Installation conditions

5.1.1. General

For professional wind measurements according to meteorological standards (e. g. VDI 3786, Part 2) location and height of the wind sensor are important for representative and accurate results. 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. To obtain results which are representative for a wider area and comparable to values measured at different places, the sensor must not be mounted under the lee of higher obstacles. The distance to any obstacle should be at least 10 times the obstacle's height (corresponding to the definition of an undisturbed area). In general a measuring height of 10 m above ground is regarded ideal.

If an undisturbed terrain of this kind does not exist the sensor have to be put up at an height of at least 6 m above the obstacle height. If the above mentioned requirements are not feasible e. g. on mobile measurements at vehicles or at measuring containers compromises have to be found and documented.

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, it is recommended to mount both sensors at the same spot, where any interaction between the sensors should be avoided. The sensor EOLOS-NAV2 easily meets this requirement.



The place of installation should not be in the operation fields of radar devices (radar scanners or radar transmitters), generators or antennas. We recommend a minimum distance of 2 m to these installations. Furthermore a minimum distance of 5 m to MF-/ HF- and Satcom- (e. g. Inmatsat, VSat) antennas has to be kept. The maximum electric field intensity may not exceed 10 V/m (tested according to EMC standard). When indicated a greater distance should be kept.

To avoid possible measurement errors due to heat sources as hot or warm fumes, hot surfaces etc. next to the sensor, the mounting site should be chosen accordingly.

5.2. Tools and installation material

No special tools are required for the upcoming installation and maintenance work. All work can be carried out using standard tools such as screwdrivers, open-end wrenches and Allen keys.

5.3. Unpacking the sensor

The sensor is supplied in separate packaging, carefully protected against mechanical impact to prevent damage during transportation.

The package contains the following items:

- 1 Sensor EOLOS-NAV2
- 1 User manual

Accessories: (depending on order size, packed separately)

Connection cable with cable plug and core cable ends

5.4. Incoming goods inspection

Please check the scope of delivery for completeness and any transport damage. Please report any complaints immediately in writing.

5.5. Power supply

The compact sensor requires 24 VDC as a power supply for the electronics. The sensor heating must be supplied with 24 VDC and has a power consumption of 70 W (max. 3 A).



5.5.1. Power consumption

The current consumption of the EOLOS-NAV2 is highest during the warm-up phase (switch-on phase) and is max. 2.5 A. During normal operation, the average current consumption is significantly lower (see table). It depends, among other things, on the flow rate.

Wind speed	Ø Power consumption
0 m/s	500 mA
5 m/s	650 mA
20 m/s	900 mA
38 m/s	1100 mA
Measured at a supply voltage of 24 VDC and 20 °C (without heating)	

5.5.2. Protection

It is not usually necessary to protect the secondary side of the power supply (24 VDC) of the EOLOS. As a rule, only the primary side is protected. However, if the power supply is to be protected separately, we recommend using a 3.15 A miniature fuse – medium time-lag.

5.6. Installation work (brief description)

The sensor is installed in three steps:

1. Attach the cable plug to the sensor and pull the cable through the mast if necessary.
2. Place the sensor on the mast and align it to the north before tightening the fixing screws.
3. Connect the sensor connections for power supply and signal output.

5.7. Mounting the sensor

The sensor is mounted on a mast section (tube) with an outer diameter of 50 mm and an inner diameter of at least 40 mm.

Before fastening the device with the two 8 mm Allen screws, connect the cable, feed it through the pipe section and align the sensor to the north or in the forward direction of motion. There is a corresponding marking on the appliance housing for this purpose (see dimensional drawing). Align the sensor to the north before tightening the screws.



Please ensure that the sensor is firmly attached to the mast!

5.8. Sensor alignment

For wind direction measurements the north mark on the sensor must be aligned with the geographical north direction. To adjust the wind sensor in a firm and correct manner into the north direction this item is equipped with an integrated mounting aid. Inside the inner bottom of the sensor a small bolt pointing to the North is integrated to be set into a corresponding slot of the mounting pipe (if available). Thus the sensor is safely attached. If needed you can turn in or unscrew the pin by means of Allen key.

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.



Pay attention to compass misdirections!

To align the sensor ahead of the ship (on ships), you can aim at a prominent point outside the ship that is in the forward direction of the ship or in the bow-stern line; if the sensor is far away from the centerline, it can also be a line parallel to it. Once the sensor is aligned, it can finally be secured with the two hexagon head screws. Finally, the grounding screw must be connected to the ship's ground. The use of an acid-free contact grease is recommended to protect against corrosion.



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

5.8.1. Power supply and signal cable



The warranty for the device is excluded if damage occurs due to improper handling. This particularly includes the absence of proper grounding. Correct grounding according to DIN VDI/VDE 0100 is essential for the safety and functionality of the device. If you have any questions regarding installation, please contact us.

A 12-pin bayonet cable plug is required for the electrical connection of the sensor. The shielding of the cable must be connected to the protective earth conductor (PE) at both ends.



To reduce the risk of inductive interference, the sensor must be correctly earthed.

The external connection is via central connector which is located in housing base. For further details about electrical connection please see chapter „Connecting diagrams“. If the sensor is mounted in correct manner and connected with the right cable (accessory), you can attach the wires to power supply and signal outputs to data acquisition equipment (computer).

The typical power supply requirements of the EOLOS-NAV2 sensor are 24 Volts with a maximum current drain of 2.5 A. The input range is max. 18...32 V DC. The heater of the EOLOS-NAV2 is to supplied with 24 V DC and has a heating power of 70 W (max. 3 A).

The serial digital output of the sensor uses differential line drivers with high common mode noise rejection. The signal levels and timings conform to the requirements of EIA/RS-422 / Talker. The line drivers are capable of transmitting data over cable lengths up to 1,220 meters (4,000 feet). This maximum distance will vary depending upon the operational environment, the wire gauge used, and the baud- rate of the attached devices.



When the power supply of the sensor is switched on, after 30 seconds (in order to reach operating temperature) the sensor cyclically starts sending data protocols.

5.8.2. Safety regulations



Because the wind sensor often is mounted on exposed locations in dangerous heights the installation personnel has to pay attention to the relevant safety regulations for such works. During the electrical installation and termination works the external circuit-breaker must be switched off. The housing may only be opened by authorized persons!

6. Maintenance

6.1. Regular maintenance and calibration

The EOLOS-NAV2 sensor requires very little maintenance and is designed for a long service life. We recommend that you carry out regular visual inspections for weather-related surface dirt and cleaning if necessary. A regular visual and functional check of the wind sensors is recommended.



If reference measurements should be necessary stringently must be noted that a comparability of the measured values is given only if the measurements take place under same conditions. I.e. the reference equipment must be used very close to the sensor!

The sensor is a measuring instrument and thus apply user specific standards regarding period of recalibration (Recommendation: 2 years). We recommend to have the filter cap of the humidity-temperature sensor every two years exchanged in our plant. Depending on the application shorter maintenance cycles could be necessary.

6.2. Visual checks and cleaning

The use of the sensor under the respective environmental conditions requires corresponding steps. It is advisable to clean the outside of the housing and the protective housing at certain intervals. The intervals depend on the environmental conditions and the degree of soiling. A regular visual inspection and functional test is recommended.

If problems arise during the tests that you cannot solve, please contact the LAMBRECHT meteo service at:

Tel: +49-(0)551-4958-0

E-Mail: support-lambrecht@aem.eco

7. Transports

If the sensor is to be shipped or transported by you, it must be securely packaged to prevent mechanical impact or other damage.

8. Illustrated parts catalog

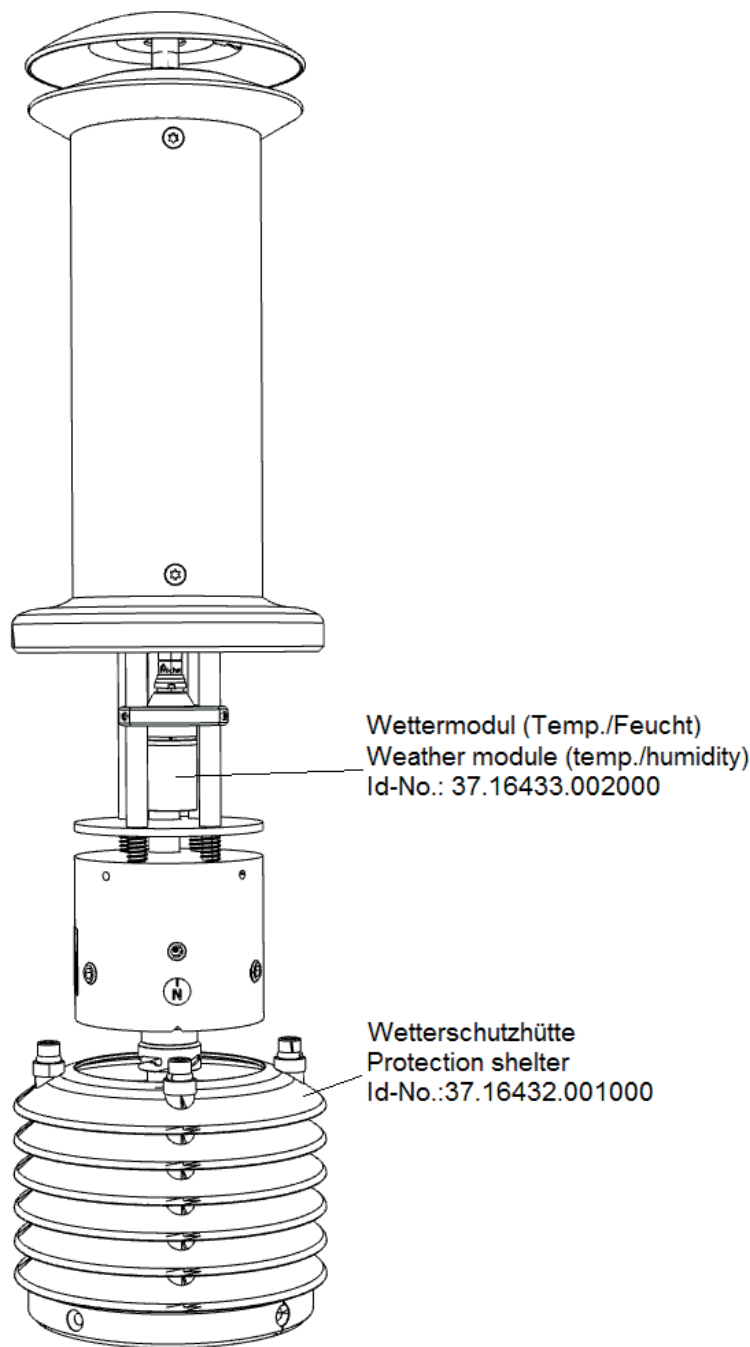


Figure:
Spare parts and consumables

SPARE PARTS LIST

No.	Description	Part no.	Quantity per unit
1	Protection shelter with lamellas	37.16432.001000	1
2	Weather module (temperature/humidity)	37.16433.002000	1
3	Sinter cap weather module	37.08095.100001	1

9. Disassembly and assembly of the lower sensor section

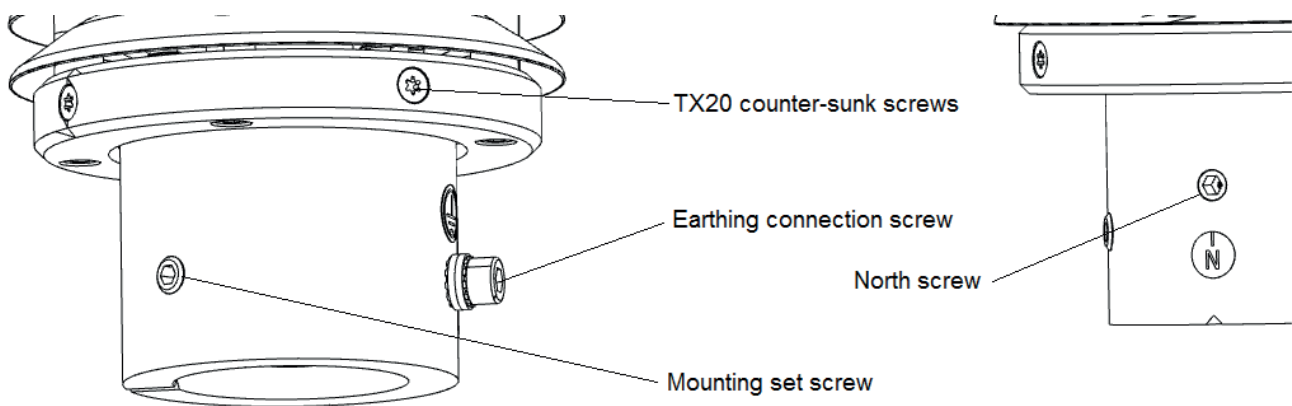
To get access to the sensor elements for temperature, relative humidity and air pressure the protection shelter and lamellae have to be dismantled.

TOOLS AND SUPPLIES

- Allen key: 1,5
- Allen key: 4,0
- Allen key: 5,0
- Torx key with TX20 drive
- LOCTITE Assembly Adhesive No. 274

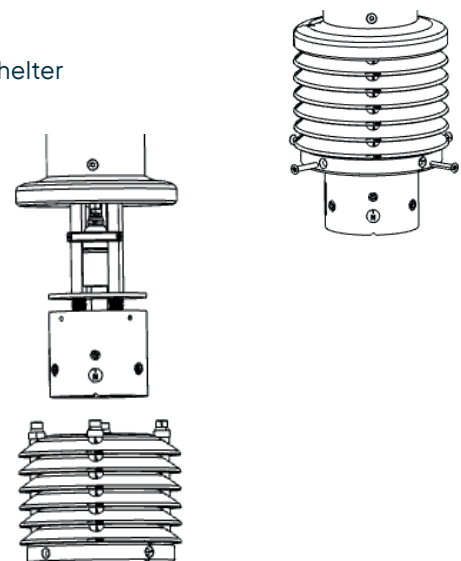
DISMANTLING THE SENSOR SHELTER

1. Remove the earthing connection screw with a size 5 Allen key



2. Use a size 4 Allen key to unscrew the mounting set screw and the north screw or screw them in until they no longer protrude from the sensor base.
3. Unscrew the 4 countersunk screws from the lower ring of the sensor shelter using a TX20 Torx key.

4. Carefully push the sensor shelter down and remove it.



DISMANTLING OF THE WEATHER MODULE

(5. After the protection shelter was dismantled the weather module can be removed and exchanged.

6. Unscrew the set screws at the sensor stabilization of the protection shelter with hex-wrench 1.5.

7. Move the sensor stabilization upwards (maybe fix it by slight screwing of a cylindrical screw).

8. Grab the weather module at the detach ring of the plug lock with thumb and forefinger.

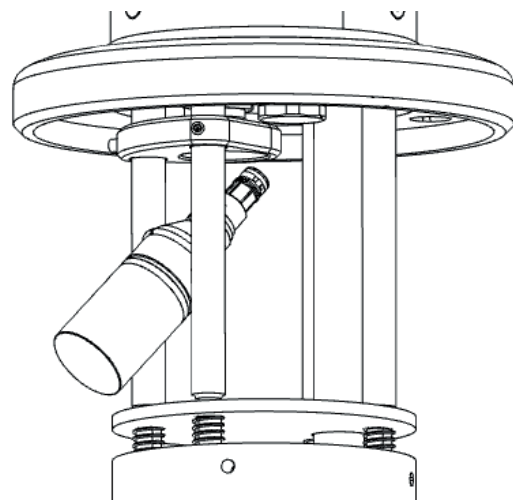
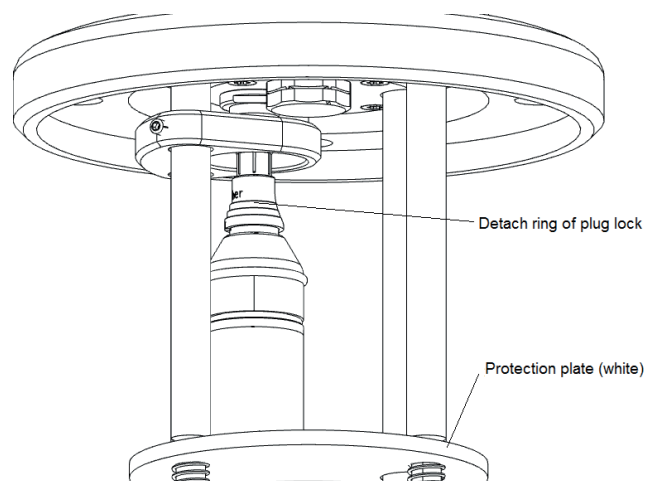
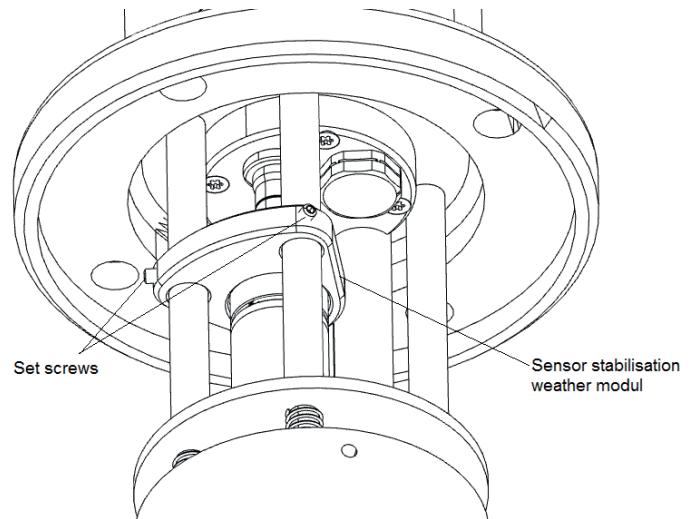
9. Push down the spring-loaded protection plate (white) and dismantle the weather module.



The weather module can only be detached by grabbing the detach ring.

10.) Remove the weather module by tilting it out sideways. At the same time hold the protective plate (white) down.

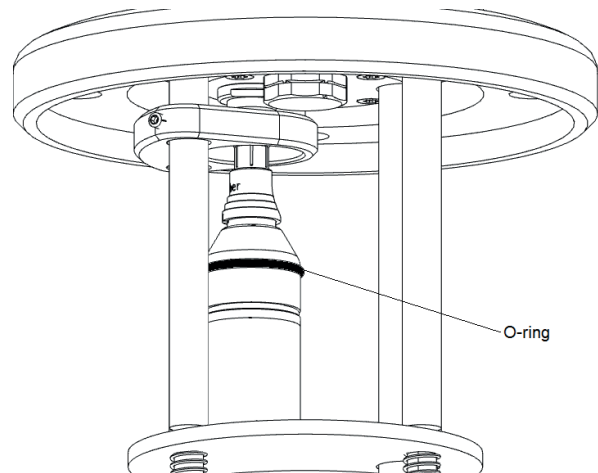
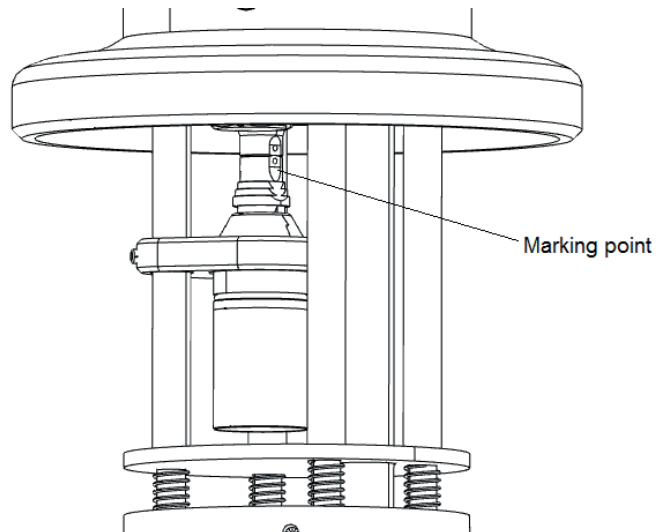
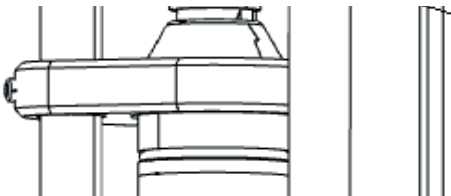
After this the sinter cap of the weather module can be cleaned. For this unscrew the sinter cap carefully from weather module. The sinter cap can be cleaned in an ultrasonic bath or with water and a mild detergent. After cleaning the sinter cap should be washed up with clear water. Before it will be screwed on the weather module it has to be completely dried. We suggest working with an exchange cap to assure that the weather module isn't unprotected for too long.



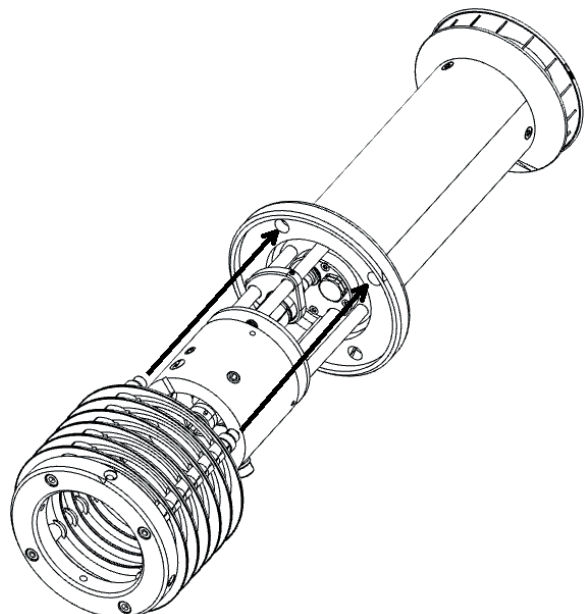
ASSEMBLY OF THE SENSOR

INSTALLATION OF THE WEATHER MODULE

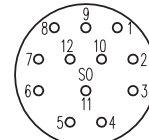
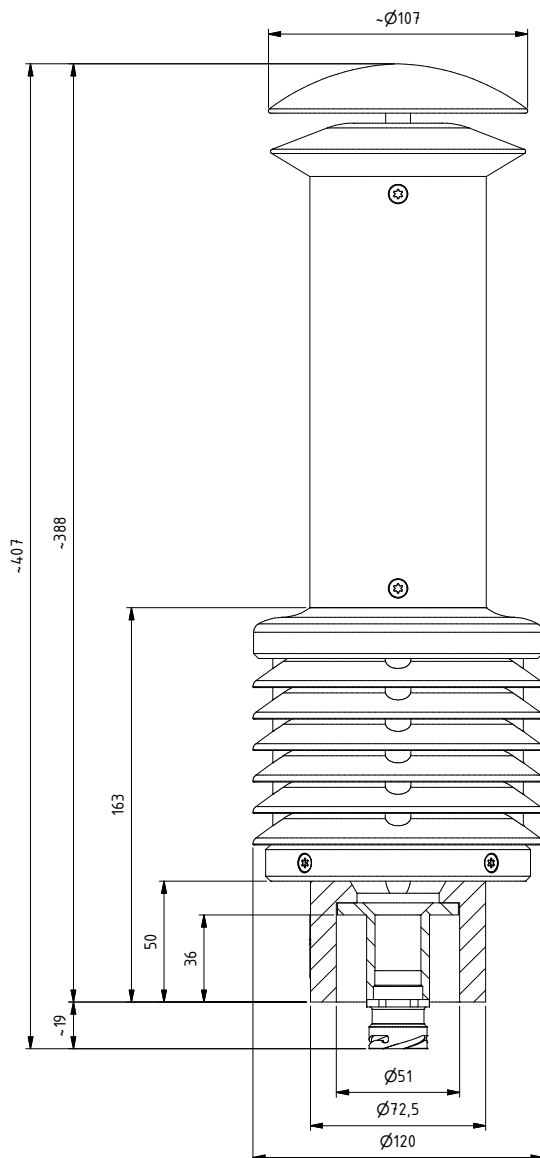
1. Sideway insertion of the weather module in sensor stabilization. For this push the protection plate (white) down continuously.
2. The point marking of the module plug and the sleeve shall be coincided and the weather module shall be plugged in until it makes "CLICK".
3. Pull the sensor stabilization again onto the weather module that the O-ring of the weather module is in the middle of the sensor stabilization (maybe unscrew set screw before).
4. Fix set screws (hex-wrench 4) of the sensor stabilization.



5. Push the protection shelter from downwards onto the sensor. Please note that the upper heads of the cylindrical head screws are fixed in the appropriate pilot holes.
6. Fix the protection shelters with 4TX20 counter-sunk screws.
7. Screw the mounting set screws and the north screw as far as the sensor can be placed on the mast.
8. Fix the earthing screws.

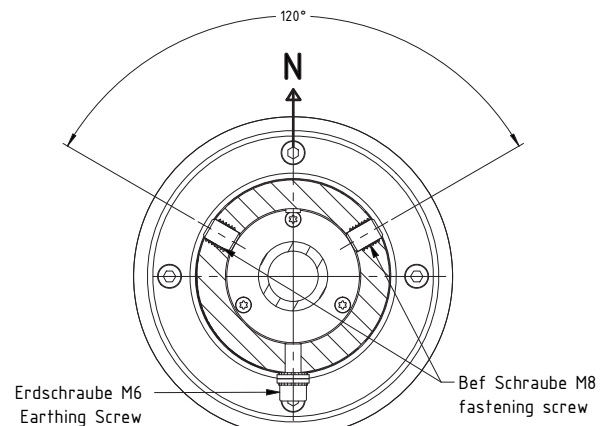
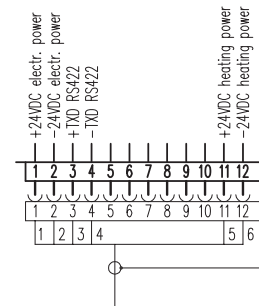


10. Dimensional drawings and connection diagrams



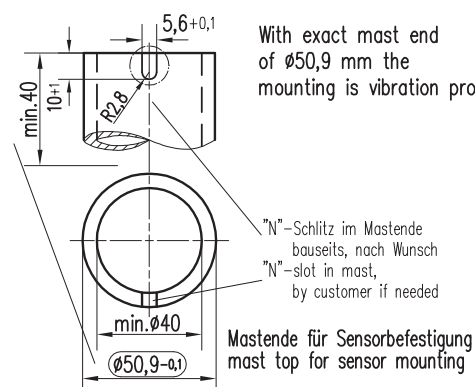
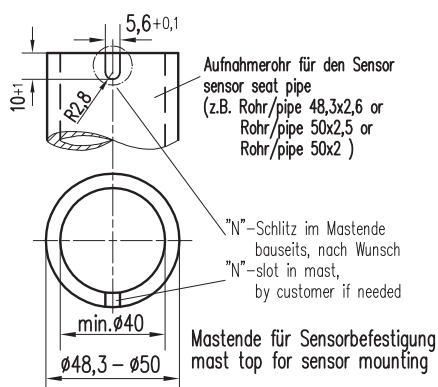
Steckerbelegung
pin assignment

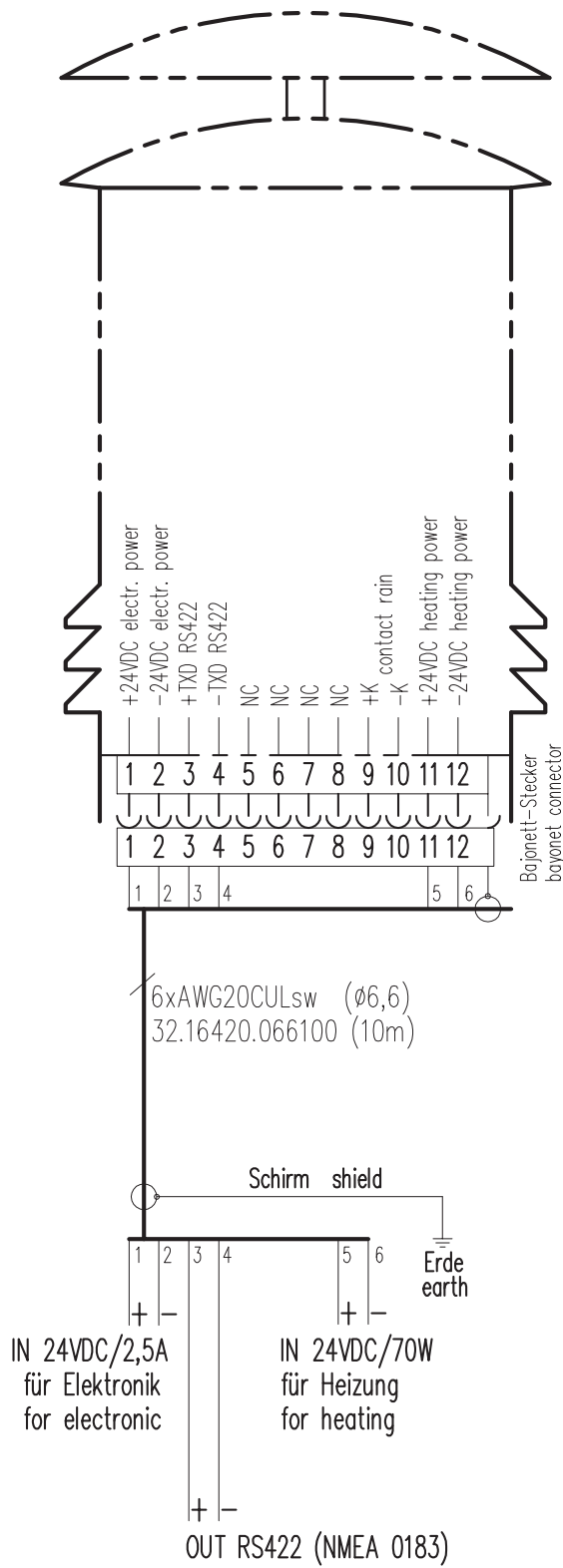
AWG-cable colorcode	
1	blk-black
2	brn-brown
3	red-red
4	ora-orange
5	yel-yellow
6	grn-green
7	blu-blue
8	vio-violet



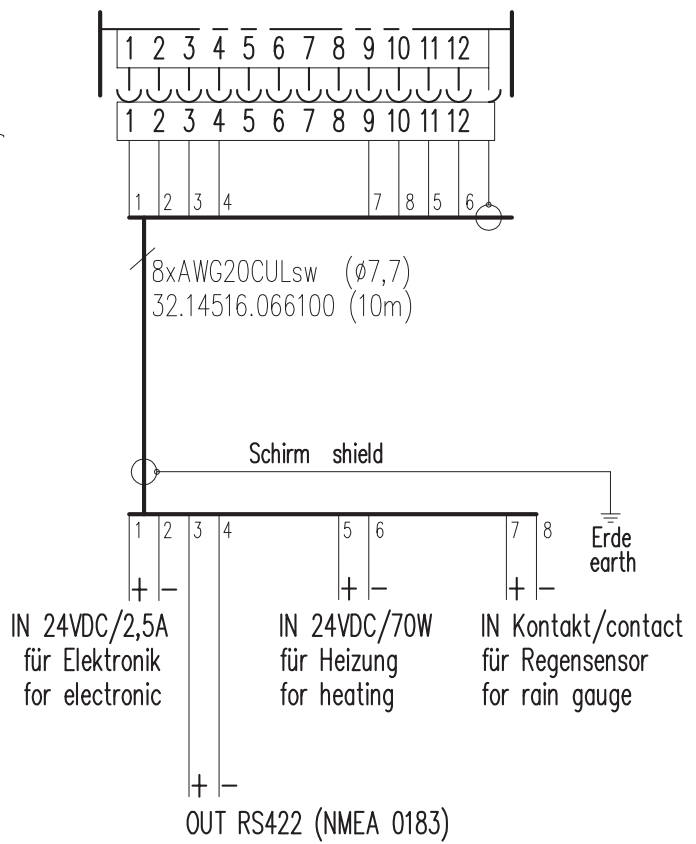
Ausschnitt von unten
Bottom view

Bei exaktem Mastende
von $\varnothing 50,9$ mm ist die
Befestigung vibrationsgeprüft.





AWG-cable colorcode	
1	blk-black
2	brn-brown
3	red-red
4	ora-orange
5	yel-yellow
6	grn-green
7	blu-blue
8	vio-violet
9	gry-grey
10	wht-white
11	wht/blk
12	wht/brn



11. Data protocols

WIND DIRECTION AND WIND SPEED

Example of data sequence with comma separated fields: \$WIMWV,357.0,R,5.2,M,A*CS<CR><LF>

field delimiter: , (comma)

header: \$WIMWV

wind direction: 0.0...360.0

R: relative wind direction

wind speed: 0.1...85.0

M metric units m/s

status A (valid) / V (not valid)

stop delimiters: <CR> <LF>

error code: WD 999.9

error code: WS 999.9

MESSAGE STRING WIMTA AIR TEMPERATURE

Example of data sequence with comma separated fields: \$WIMTA,-25.0,C*CS<CR><LF>

field delimiter: , (comma)

header: \$WIMTA

temperature: -40.0...+70.0

C: °C

stop limiters: <CR> <LF>

error code: 999.9

MESSAGE STRING WIMMB BAROMETRIC PRESSURE

Example of data sequence with comma separated fields: \$WIMMB,,1050.0,B*CS<CR><LF>

field delimiter: , (comma)

header: \$WIMMB

barometric pressure: 600.0...1100.0

B: air pressure in hPa

stop limiters: <CR> <LF>

error code: 9999.9

MESSAGE STRING WIMHU RELATIVE HUMIDITY

Example of data sequence with comma separated fields: \$WIMHU,100.0,, -40.0,C*CS<CR><LF>

field delimiter: , (comma)

header: \$WIMHU

rel. humidity: 000.0...100.0

dew point temp.: -40.0...+70.0

C: °C

stop limiters: <CR> <LF>

error code: 999.9

IMPORTANT - PLEASE NOTE!

FIELD LENGTH

The development of a NMEA decoder should not be proceeded from firm field lengths. The NMEA definition proceeds from a variable field length. The comma character (",") serves as field disconnecting switch. Numeric values in a field can be presented differently.

In case a field is not sent, it has a length of 0 characters (,,) [comma-comma].

CHECK SUM

The check sum "CS" is covered to two ASCII characters hexadecimal value. "CS" calculated by XOR operation of each character in the sentence between "\$" and "*", but excluding "\$" and "*".

ERROR CODE

In case, that the sensor cannot generate a measuring value because e.g. a sensor element is defect or implausible (raw) values are collected the sensor outputs in the corresponding data protocol the above mentioned error code (e.g. 999.9) and sets the status from "A" (valid) to "V" (not valid).

Example: \$WIMWV,999.9,R,999.9,M,V*OE<CR><LF>

SPECIAL FEATURE WIND DIRECTION VALUE

Theoretically the value for the wind direction can take any value between 0.0° and 360.0°. It should be noted, that in a full circle the values "0.0" and "360.0" are describing the same direction. According to the international valid recommendations of the WMO (World Meteorological Organization) in the "Guide to Meteorological Instruments and Methods of Observation" (WMO-No.8) the wind direction value 0.0° just has to be output at calm. The EOLOS follows the recommendation of the WMO and outputs at wind from the north the value "360.0" respectively "0.0" at calm (lull).



12. Technical data

(16432) Static Weather Sensor EOLOS-NAV2	
Id-No.	00.16432.210002
Range of application	Temperature: -40...+70 °C; wind speed: 0...100 m/s Rel. humidity: 0...100 % r. h.
Parameters	
Wind direction	
Measuring range	0...360°
Accuracy (RMS)	± 3°
Resolution	1°
Wind speed	
Measuring range	0.1...85 m/s
Accuracy (RMS)	± 0.5 m/s ± 5 % of the measured value
Resolution	0.1 m/s
Temperature	
Measuring range	-40...+70 °C
Accuracy	± 0.8 °C (v > 2 m/s) ¹⁾
Resolution	0.1 °C
Relative humidity	
Measuring range	0...100 % r. h.
Accuracy	± 3 % (10...90 %) r. h. ²⁾³⁾ ± 4 % (0...100 %) r. h.
Resolution	0.5 % r. h.
Barometric pressure	
Measuring range	600...1100 hPa :
Accuracy	± 2 hPa (-40...+85 °C); ± 0.5 hPa at 25 °C
Resolution	0.1 hPa
Further specifications	
Protocols	NMEA 0183; WIMWV; WIMHU; WIMMB; WIMTA
Supply voltage	18...32 VDC ⁴⁾ ; max. 2.5 A heating: 24 VDC/ 70 W (max. 3 A); electronically controlled
Housing	Aluminum; anodized; IP66
Dimensions	H 388 mm; Ø 120 mm; mast adapter Ø 50 mm for mounting on standard pipe
Weight	Approx. 2.5 kg
Interface	Serial; RS-422/Talker; Baud rate 4800, 1 Hz (measurement cycle of 4 Hz); 8N1

(16432) Static Weather Sensor EOLOS-NAV2	
Standards	• NMEA 0183 • Standard of construction: VDE 0100 • Low voltage guide line: 72/23 EWG • EMC/EMI: DIN EN 60945 and DIN EN 61000-4-2, 3, 4, 6, 11 • Salt fog: EN 60945 • Protection class: DIN EN 60529 • Vibration: BV 0240
Accessories (please order separately)	
Id-No. 32.16420.066100	Sensor cable, 10 m; 12-pole bayonet plug

¹ Temperature influence of the shelter: accuracy $\pm 1.5^\circ\text{C}$ at $v < 2\text{ m/s}$ and intensive solar radiation

² Temperature influence of the shelter: $\pm < 0.1\%$ r.h. at $+10\ldots+40^\circ\text{C}$

³ Shelter inaccuracy: $< 4\%$ r.h. dependant on $v > 2\text{ m/s}$ and solar radiation

⁴ At sensor connector; when connected to a LAMBRECHT standard cable (15 m) the supply voltage range on the side of the power supply switches to 18.7...32 VDC. When using other cables and cable lengths the individual voltage drop has to be considered.

13. Disposal

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

WEEE-Reg.-Nr. DE 45445814

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

Within the EU



The device has to be disposed according to the European Directives 2002/96/EC and 2003/108/EC (Waste Electrical and Electronic Equipment). Do not dispose the old device in the household waste! For an environmentally friendly recycling and disposal of your old device, contact a certified disposal company for electronic waste.

Outside the EU

Please follow the regulations in your country regarding the appropriate disposal of waste electronic equipment.

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LAMBRECHT meteo GmbH
Friedländer Weg 65
37085 Göttingen
Germany

Tel +49-(0)551-4958-0
E-Mail info-lambrecht@aem.eco
Internet www.lambrecht.net