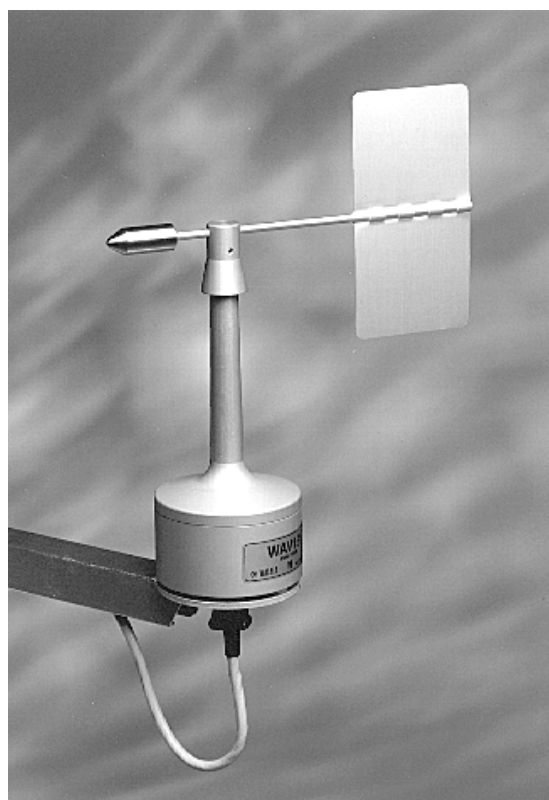


Wind Vane WAV151

USER'S GUIDE

M210294en-A
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CHAPTER 1

GENERAL INFORMATION

About This Manual

This manual provides information for installing, operating, and maintaining the WAV151 Wind Vane.

Contents of This Manual

This manual consists of the following chapters:

- Chapter 1, General Information, provides important safety, revision history, and warranty information for the product.
- Chapter 2, Product Overview, introduces the WAV151 Wind Vane features and advantages.
- Chapter 3, Installation, provides you with information that is intended to help you install this product.
- Chapter 4, Maintenance, provides information that is needed in the basic maintenance of the WAV151 Wind Vane.
- Chapter 5, Troubleshooting, describes common problems, their probable causes and remedies, and contact information.
- Chapter 6, Technical Data, provides the technical data of the WAV151 Wind Vane.

Version Information

Table 1 Manual Revisions

Manual Code	Description
M210294en-A	This manual, the first version of the WAV151 Wind Vane User's Guide.

Related Manuals

Table 2 Related Manuals

Manual Code	Manual Name
M210293en	WAA151 Anemometer - User's Guide

Safety

General Safety Considerations

Throughout the manual, important safety considerations are highlighted as follows:

WARNING	Warning alerts you to a serious hazard. If you do not read and follow instructions very carefully at this point, there is a risk of injury or even death.
----------------	---

CAUTION	Caution warns you of a potential hazard. If you do not read and follow instructions carefully at this point, the product could be damaged or important data could be lost.
----------------	--

NOTE	Note highlights important information on using the product.
-------------	---

Product Related Safety Precautions

The WAV151 Wind Vane delivered to you has been tested for safety and approved as shipped from the factory. Note the following precautions:

WARNING Ground the product, and verify outdoor installation grounding periodically to minimize shock hazard.

CAUTION Do not modify the unit. Improper modification can damage the product or lead to malfunction.

ESD Protection

Electrostatic Discharge (ESD) can cause immediate or latent damage to electronic circuits. Vaisala products are adequately protected against ESD for their intended use. However, it is possible to damage the product by delivering electrostatic discharges when touching, removing, or inserting any objects inside the equipment housing.

To make sure you are not delivering high static voltages yourself:

- Handle ESD sensitive components on a properly grounded and protected ESD workbench. When this is not possible, ground yourself to the equipment chassis before touching the boards. Ground yourself with a wrist strap and a resistive connection cord. When neither of the above is possible, touch a conductive part of the equipment chassis with your other hand before touching the boards.

- Always hold the boards by the edges and avoid touching the component contacts.

Regulatory Compliances

The WAV151 complies with the following performance and environmental test standards:

- Wind tunnel tests per ASTM standard method D5366-96 (for starting threshold, damping ratio, overshoot ratio, and delay distance; refer to technical data)
- Exploratory vibration test per MIL-STD-167-1
- Humidity test per MIL-STD-810E, Method 507.3
- Salt fog test per MIL-STD-810E, Method 509.3

Warranty

For certain products Vaisala normally gives a limited one year warranty. Please observe that any such warranty may not be valid in case of damage due to normal wear and tear, exceptional operating conditions, negligent handling or installation, or unauthorized modifications. Please see the applicable supply contract or conditions of sale for details of the warranty for each product.

CHAPTER 2

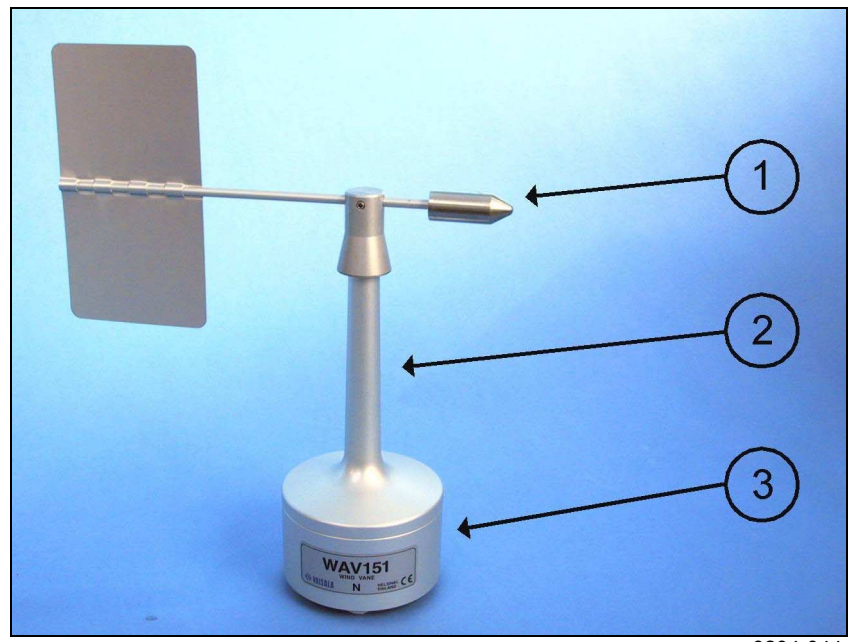
PRODUCT OVERVIEW

This chapter introduces the WAV151 Wind Vane features and advantages.

Introduction to WAV151 Wind Vane

The WAV151 Wind Vane is a counter-balanced, low-threshold optoelectronic wind vane. Infrared LEDs and phototransistors are mounted on six orbits on each side of a 6-bit GRAY-coded disc. Rotated by the vane, the disc creates changes in the code received by the phototransistors. The code is changed in steps of 5.6°, one bit at a time to eliminate any ambiguities in the coding.

A heating element in the shaft tunnel keeps the temperature of the bearings above the freezing level in cold climates. Nominally, it provides 10 W of heating power. It is recommended to use a thermostat switch in the sensor cross arm for switching the heating power on below +4 °C.



0204-044

Figure 1 WAV151 Wind Vane

The following numbers refer to Figure 1 above:

- 1 = Vane assembly
- 2 = Sensor shaft
- 3 = Lower body

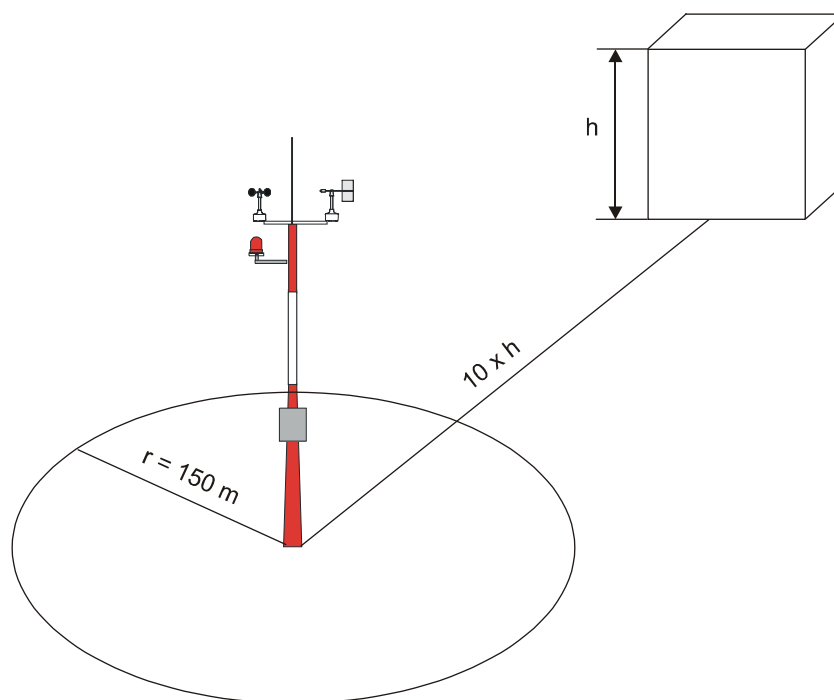
CHAPTER 3

INSTALLATION

This chapter provides you with information that is intended to help you install this product.

Selecting Location

Allow sufficient clearance for the wind sensors. Wind sensors should not be located next to a building or any other object that might affect the flow of air.



0204-040

Figure 2 Recommended Mast Location in Open Area

In general, any object of height (h) will not remarkably disturb wind measurement at a minimum distance of $10 \times h$. There should be at least 150 m open area in all directions from the mast. Minimum distance between the mast and obstacles is ten times the height of an obstacle. Refer to Figure 2 on page 9.

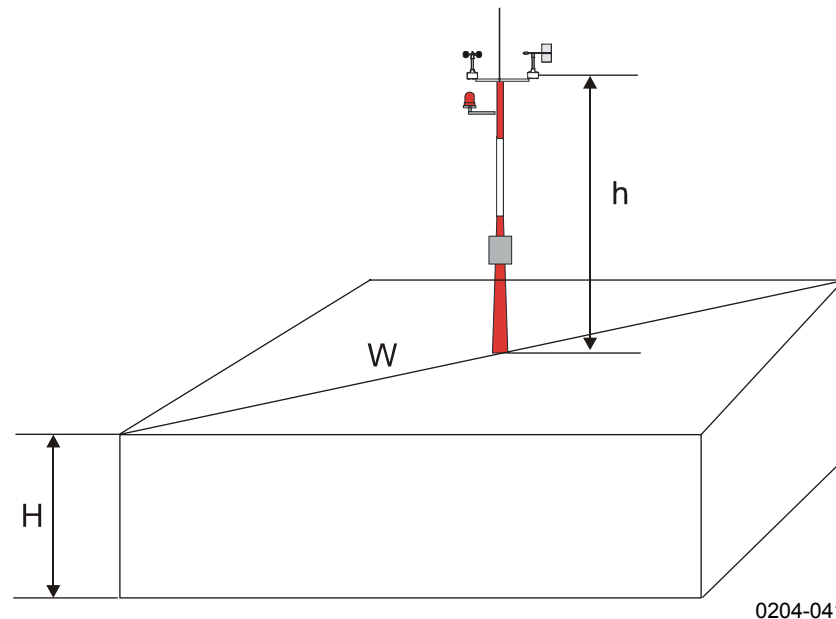


Figure 3 Recommended Mast Length on the Top of Building

The recommended minimum length (marked with the letter h in Figure 3 above) for the mast that is installed on the top of a building is 1.5 times the height of the building (H). When the diagonal (W) is less than the height (H) the minimum length of the mast is $1.5 \times W$.

Installation Procedure

Mounting

Sensor installation is most convenient when you use a Vaisala manufactured cross arm for mounting the sensor.

Always mount the WAV151 Wind Vane to the northern end of the cross arm.

1. It is recommended that you remove the vane assembly to ease installation.
2. Fit the 10-pin cable plug through the mounting flange at the end of the cross arm, then connect it to the sensor. See Figure 4 below.
3. The sensor fits to the cross arm in one position only. Face the product label north and mount the sensor to the flange by twisting. Note that the plastic washers (1) should be inserted between the flange and the sensor. See Figure 4 below.
4. Finally, tighten the screws (2) with an Allen key (3). See Figure 4 below.
5. Mount the vane assembly and tighten its fixing screw.

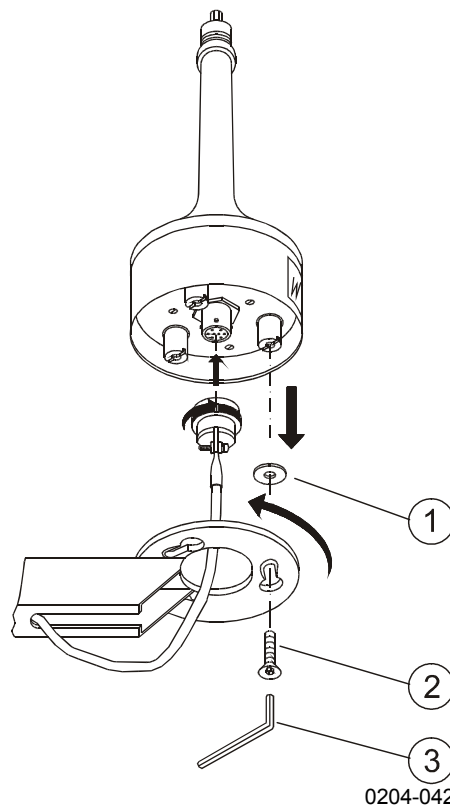


Figure 4 Mounting of Wind Sensor

Alignment

The wind vane does not need any alignment after mounting when a Vaisala cross arm is used. The mounting screws are located at the bottom of the sensor so that you can mount the sensor in one position only to the flange.

Verification

If your sensor is connected to the data collection system and powered up, check that the directional readings are correct by holding the vane in a few fixed angles and verifying data.

Connector

The connector for the WAV151 Wind Vane is shown in Figure 5 below. The heating element in the shaft tunnel is connected between pins J and K. You can supply the heating element with 20 VDC or VAC.

The recommended cable connector for the sensor is SOURIAU MS3116F12-10P.

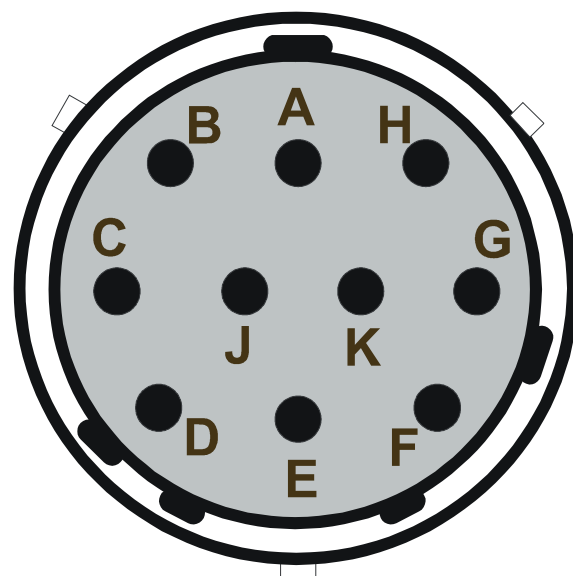


Figure 5 WAV151 Connector

The following letters refer to Figure 5 on page 12.

- A = D+, power input from 9.5 to 15.5 VDC
- B = GND, common ground
- C = G5, signal output
- D = G4, signal output
- E = G3, signal output
- F = G2, signal output
- G = G1, signal output
- H = G0, signal output
- J = HTNG, 20 VDC or VAC
- K = HTNG, 20 VDC or VAC

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CHAPTER 4

MAINTENANCE

This chapter provides information that is needed in the basic maintenance of the WAV151 Wind Vane.

Periodic Maintenance

Cleaning

Heavy contamination in the vane, such as bird droplets or ice will deteriorate the accuracy of the wind vane. Clean the vane when necessary.

Testing Proper Operation

The sensor will hold its accuracy in all conditions for 1 year. If the rains are mostly casual and moderate, and the atmospheric corrosion is typical, the sensor accuracy will remain for 2 years.

However, the ball bearings must be checked once a year and the sensor shaft rotated manually. To do this, remove the vane assembly. To ensure proper operation, the shaft should spin smoothly and it should not create any detectable noises.

Replacing Consumables

Replacement of the bearings should only be done by a trained technician. To replace the ball bearings, follow the procedure below and refer to Figure 6 on page 19.

1. Open the vane assembly fixing screw with a 2-mm Allen key. The correct screw is the lower one shown in Figure 6 on page 19. Remove the assembly.

CAUTION

The vane assembly fixing screw has been treated with sealant. Do not remove the fixing screw to ensure perfect sealing.

2. Loosen the hex nut of the connector with a 27-mm tool.

CAUTION

Be careful not to bend the connector pins.

3. Loosen the three pan head screws at the bottom of the sensor body with a 7-mm tool.
4. Remove the lower body assembly by pulling it straight outwards.
5. Loosen the spacer screws with a 7-mm tool and disconnect the heating element outlet.
6. Remove the printed circuit board.

CAUTION

Do not twist or bend the connector. This may break the pins.

7. Loosen the fixing screw of the code disc with a 2-mm Allen key and remove the disc.
8. Remove the external retaining ring (using narrow-pointed pliers).
9. Remove the spacer ring.

10. Remove the internal retaining ring at the bottom of the shaft (using narrow-pointed pliers).
11. Remove the lower bearing.
12. Push out the shaft downwards through the upper body.
13. Remove the top bearing.

To reassemble the sensor, reverse the above work order. The numbers in parenthesis refer to Figure 6 on page 19.

1. Take the previous steps in opposite order until assembling the code disc.

NOTE

Be careful when handling the new ball bearings. Do not drop them or force them onto the shaft.

2. Attach the code disc (7) back onto the shaft. The disc has to be positioned so that it does not touch the opto-coupler on the printed circuit board (6). Tighten the fixing screw of the code disc.

CAUTION

Assure that the code disc does not touch the opto-coupler.

3. Attach the heating element outlet to the printed circuit board. Put the printed circuit board in place and fasten it with spacers (5).
4. Put the lower body assembly (4) carefully into place. Fasten the three screws (3) at the bottom of the sensor. Make sure that the bigger O-ring (14) is correctly positioned between the upper and the lower sensor bodies. Check also that the connector O-ring (14) is in place. The O-ring is recommended to be replaced with a new one after each opening.

NOTE

When placing the lower body assembly, make sure that the O-ring is correctly positioned between the upper and lower bodies. It is recommended to replace the O-rings with new ones before reassembling.

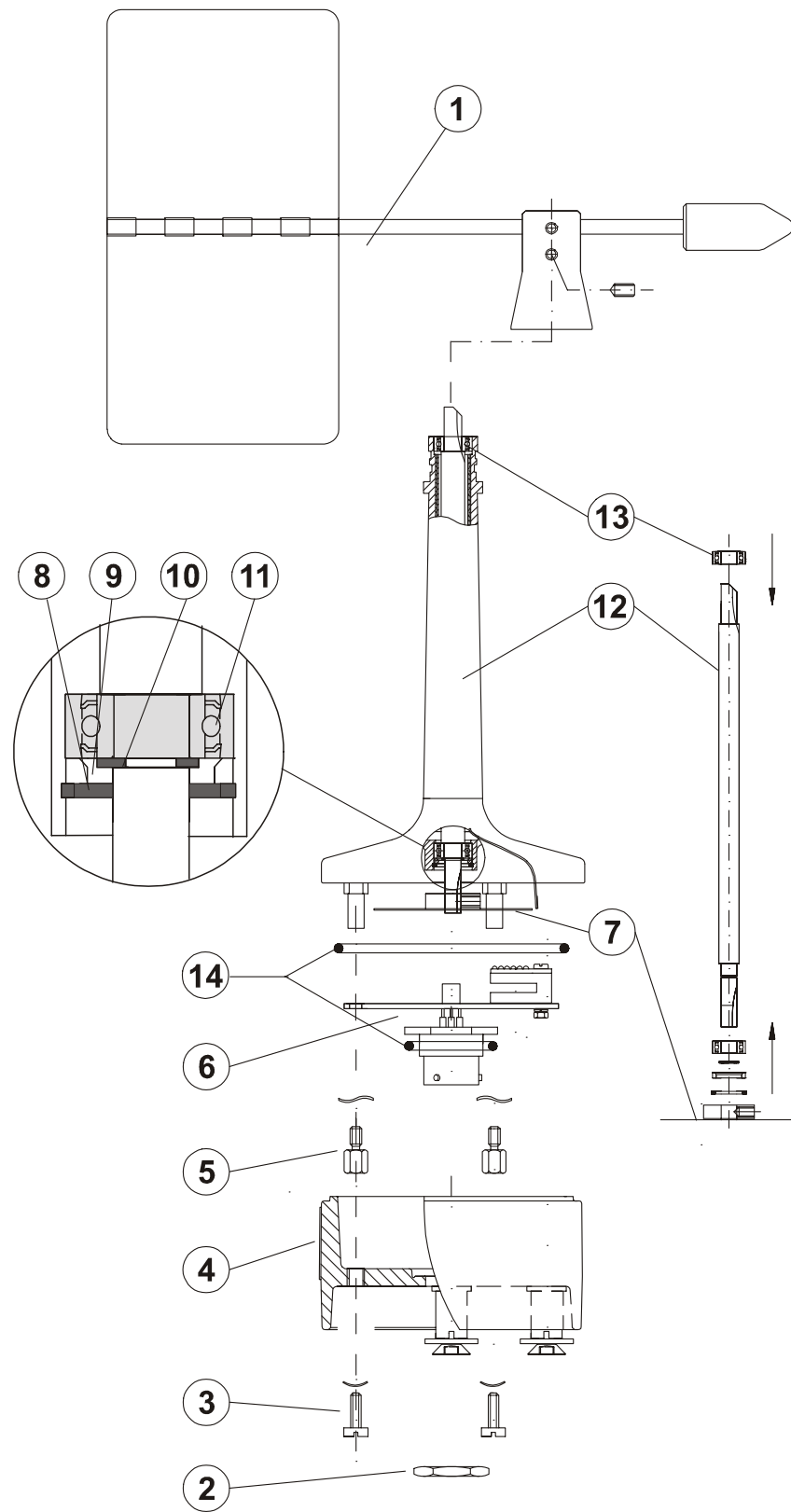
5. Tighten the hexagon nut of the connector (2).
6. Connect the cable plug to the sensor body connector. Fasten the sensor body on the crossarm with three screws.
7. Mount the vane assembly onto the sensor body. Tighten the screw.

CAUTION

The heating resistance element cannot be removed without special tools. To avoid any damages, it is recommended that replacement of the heating element be carried out by the manufacturer.

The following numbers refer to Figure 6 on page 19:

- 1 = Vane assembly
- 2 = Hex nut of the connector
- 3 = M6 x 16 DIN7991 (3 pcs)
- 4 Lower body
- 5 Spacer (3 pcs)
- 6 Printed circuit board (PCB)
- 7 Code disc
- 8 External retaining ring, body
- 9 Spacer
- 10 Internal retaining ring, shaft
- 11 Ball bearings
- 12 Shaft and Upper body assembly
- 13 Ball bearings
- 14 O-rings, 2 pcs



0204-045

Figure 6 WAV151 Assembly

The wind vane has been counter-balanced at the factory but can be readjusted, if necessary. To do this, loosen the vane assembly and place it on its side on the table. A correctly balanced vane will stay in horizontal position.

Parts List for Consumables

Table 3 Available Spare Parts

Spare Part	Order Code
Vane assembly (wind tail)	6389WA
Set of bearings and gasket	16644WA
Sensor board (PCB)	1434WA

CHAPTER 5

TROUBLESHOOTING

This chapter describes common problems, their probable causes and remedies, and contact information.

Common Problems

Table 4 Some Common Problems and their Remedies

Problem	Probable Cause	Remedy
The data is not received from the sensor.	The sensor is mechanically damaged.	Check the cables and connectors.
	After removing the connector's hexagon nut, the connector is bent, which breaks the connection wires.	Check the connector.
	The sensor is not powered properly.	Check that the supply voltage is from 9.5 to 15.5 VDC
	Some Vaisala products, for example, WAT12, switch power on to the sensor only for a very short period (200 μ s to 500 μ s).	Check that the sensor output rises above ($U_{IH} - 1.5$ V) at the end of the power pulse.

Problem	Probable Cause	Remedy
The sensor shaft is covered with ice and snow.	The heating element does not function.	Send the sensor to Vaisala for repair. See section Return Instructions on page 23 for details.
	The heating element is not properly connected.	Open the sensor and check that the heating element outlet is connected to the connector on the printed circuit board. Refer to the instructions given in section Replacing Consumables on page 16 for details.
The output from the connector pins C to H do not have the right code or are not at the proper level.	The printed circuit board is damaged.	Replace the printed circuit board. Refer to the instructions given in section Replacing Consumables on page 16. See Table 3 on page 20 for spare part number.
Current consumption is either less than 17 mA or more than 25 mA when the shaft is rotated mechanically.		

Getting Help

For technical questions or for comments on the manuals, contact the Vaisala technical support:

E-mail helpdesk@vaisala.com

Telephone +358 9 8949 2789

Fax +358 9 8949 2790

Return Instructions

If the product needs repair, please follow the instructions below to speed up the process and avoid extra costs.

1. Read the warranty information.
2. Write a Problem Report with the name and contact information of a technically competent person who can provide further information on the problem.
3. On the Problem Report, please explain:
 - What failed (what worked / did not work)?
 - Where did it fail (location and environment)?
 - When did it fail (date, immediately / after a while / periodically / randomly)?
 - How many failed (only one defect / other same or similar defects / several failures in one unit)?
 - What was connected to the product and to which connectors?
 - Input power source type, voltage and list of other items (lighting, heaters, motors etc.) that were connected to the same power output.
 - What was done when the failure was noticed?
4. Include a detailed return address with your preferred shipping method on the Problem Report.
5. Pack the faulty product using an ESD protection bag of good quality with proper cushioning material in a strong box of adequate size. Please include the Problem Report in the same box.
6. Send the box to:
Vaisala Oyj
SSD Service
Vanha Nurmijärventie 21
FIN-01670 Vantaa
Finland

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CHAPTER 6

TECHNICAL DATA

This chapter provides the technical data of the WAV151 Wind Vane.

Specifications

Table 5 WAV151 Wind Vane Specifications

Property	Description/Value
Sensor/Transducer type	Vane/Optical code disc
Measuring range	0 ... 360°
Starting threshold	< 0.4 m/s
Resolution	5.6°
Damping Ratio	0.19
Overshoot Ratio	0.55
Delay Distance	0.4 m
Accuracy	Better than $\pm 3^\circ$
Output	6-bit parallel GRAY code
Transducer output level ($I_{out} < +5$ mA) ($I_{out} > -5$ mA)	High state $> U_{in} - 1.5$ V Low state < 1.5 V
Settling time after power turn-on	< 100 μ s
Operating power supply	9.5 ... 15.5 VDC, 20 mA typical
Heating power supply	20 VDC or VAC, 500 mA typical
Electrical connections	MIL-C-26482 type; 10-wire cable
Recommended connector at cable end	SOURIAU MS3116F12-10P
Operating temperature	-50 ... +55 °C (with shaft heating)
Storage temperature	-60 ... +70 °C

Property	Description/Value
Housing material	AlMgSi, gray anodized
Vane material	AlSi 12, anodized
Dimensions	300 (h) × 90 (Ø) mm Swept radius of vane: 172 mm
Weight	660 g

Table 6 Output from Connector Pins C to H

(°)		Output CDEFGH	(°)		Output CDEFGH	(°)		Output CDEFGH	(°)		Output CDEFGH
N	0	000000	E	90	011000	S	180	110000	W	270	101000
	6	000001		96	011001		186	110001		276	101001
	11	000011		101	011011		191	110011		281	101011
	17	000010		107	011010		197	110010		287	101010
	23	000110		113	011110		203	110110		293	101110
	28	000111		118	011111		208	110111		298	101111
	34	000101		124	011101		214	110101		304	101101
	39	000100		129	011100		219	110100		309	101100
	45	001100		135	010100		225	111100		315	100100
	51	001101		141	010101		231	111101		321	100101
	56	001111		146	010111		236	111111		326	100111
	62	001110		152	010110		242	111110		332	100110
	68	001010		158	010010		248	111010		338	100010
	73	001011		163	010011		253	111011		343	100011
	79	001001		169	010001		259	111001		349	100001
	84	001000		174	010000		264	111000		354	100000

MTBF

According to the standard MIL-HDBK-217F calculated mean times between failures are listed in Table 7 below. Actually, the last column provides the failure frequency during 10^6 hours of use.

Table 7 MTBF Values

Abbreviation	Installation	f/10 ⁶ h
Gf	Permanent installations	2.87
Gm	Mobile installations	7.02
Nu	Ship equipments	13.15

MTTR

Mean time to repair is 0.3 h.