New Family of Heated Wind Sensors

Snow and ice gathering on sensor surfaces can disturb any meteorological measurement – no matter how good, accurate and sensitive the sensor may be. This is particularly true when sensing the wind. To overcome the problems caused by ice and snow, Vaisala has recently launched a brand new family of heated wind sensors – the WAA252 Heated Anemometer and the WAV252 Heated Wind Vane.

According to the recent studies, it has been found out that even a slight frost formation on the rotating cups may cause dramatic errors in the measurement results of the anemometers. Wind vanes have been seen with so much ice on the vane and tail that they were spinning in the wind – hardly the right conditions for reaching the required accuracy!

WA252 wind sensor family solves the freezing problem

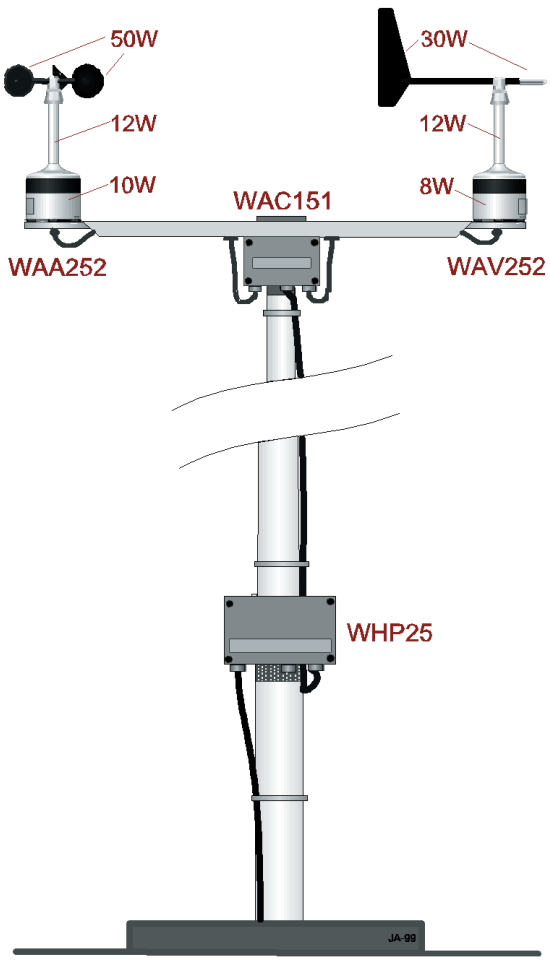
To overcome the problems caused by ice and snow Vaisala has recently launched a brand new family of heated wind sensors – the WAA252 Heated Anemometer and the WAV252 Heated Wind Vane. Both of these gauges feature a lightweight construction that leads to fast responses and excellent linearity. They also offer maximum protection against freezing, because the heating is concentrated right where it is needed – in the anemometer cups or in the vane and tail assembly. The body and neck parts of the sensors are also heated, in order to keep the whole system clear of any icy contamination that would disturb the sensor characteristics.

The transmission of heating power to the rotating parts of the sensors is carried out by a unique design of the high frequency rotary transformer. This is to avoid any slip rings or brushes that would remarkably shorten the lifetime and impair the sensitivity characteristics of the gauges.

The whole sensor family operates from 24 VDC power delivered, for example, by a WHP25 Mains Power Supply, which is mast mountable and complies with the same harsh climate specifications as the sensors do. A typical installation is shown in Figure 1, which also gives the approximate wattage numbers for heating power distribution to the various sensor elements.

The signal interface of the WA252 sensors is compatible with that of the regular WA151 family. An installation of the heated sensor pair to the WAC151 crossarm requires only a minor alteration of wiring in the crossarm's junction box.

Figure 1. Typical mast installation of the WA252 family sensors with the WHP25 power supply (only the head and base of the mast shown).



WAA252 replaces the old WAA251

The field-proven WAA251 will now be replaced with the new Heated Anemometer WAA252, which has plenty of novel design features improving the gauge's overall performance and facilitating its installation and deployment. Some of these are discussed below:

- The height of the sensor body has been decreased by 5 millimeters. This improves its aerodynamic properties and reduces the mechanical stress caused by the rotating transformer, hence extending the lifetime of the bearings.
- There is no further need for a separate temperature sensor with complicated wiring in the junction box. Now the gauge has an integral ambient temperature sensor located on the bottom of the device (see Figure 2), inside a special metal button elastically attached to the bottom plate. Hence, it is automatically forced into good thermal contact with the sensor crossarm, after being tightened into place by the mounting screws.
- The sensor signal circuits have now been galvanically isolated from the heating electricity, giving good protection against overvoltage transients, which is particularly important in remote measurement sites, when wind transmitters are used to disseminate wind data through long telecommunication lines.
- Sensor excitation can now be optionally taken from an external device like the WT521 or WAT12 Wind Transmitter. This gives an opportunity to provide a no-break power supply for the sensor electronics alone, no matter what happens to the heating power. The sensor operates from a wide input voltage range of 4.8 – 15.5 V. For low-power applications, the excitation can be given in pulse mode as with the regular WA151 series gauges.

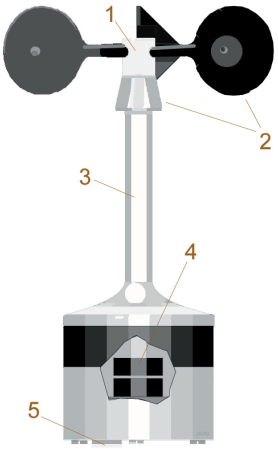


Figure 2. Main properties and operating principles of the WAA252 Heated Anemometer

1. *The heatable cupwheel assembly is removable for maintenance purposes*
2. *Heaters are inserted in each cup and also in the cupwheel hub*
3. *Separate, non-rotating shaft heater (12W) for keeping the bearings warm*
4. *Non-contact transfer of 50 W heating power to the rotor via a rotary transformer*
5. *Ambient temperature sensor for heating control*

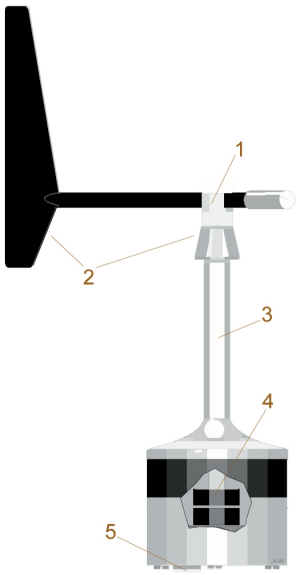


Figure 3. Main properties and operating principles of the WAV252 Heated Wind Vane

1. *The heatable vane & tail assembly is removable for maintenance purposes*
2. *Heaters are inserted in all individual elements of the vane & tail assembly*
3. *Separate, non-rotating shaft heater (12 W) for keeping the bearings warm*
4. *Non-contact transfer of 30 W heating power to the rotor via a rotary transformer*
5. *Ambient temperature sensor for heating control*

The main properties and operating principles of the WAA252 Heated Anemometer are shown in Figure 2.

The WAV252 – an unprecedented wind vane

The Vaisala heated anemometer has long been waiting for a good companion providing reliable measurement of wind direction, even in extreme climates. Now the waiting is over. The WAV252 satisfies the increasing need for an all-weather wind vane.

The wind is one of the most important weather parameters reported to aircraft pilots prior to landing or take-off, and therefore a non-freezing wind vane is a major requirement in all airports where precipitation of snow or supercooled water may occur. The same requirement applies to wind power applications – in order to estimate the available power resources, and in order to control the wind generator. Reliable wind measurement even in mountainous terrain is possible provided that non-freezing, low-inertia gauges are used, such as WAA252 and WAV252. Synoptic measurement stations in the polar regions and nearby need non-freezing wind gauges as well. And so do all the road weather stations, as they are specifically located in cold regions. The list of applications is endless.

Best performance and stability even in turbulent atmosphere

The WAV252's heatable vane and tail assembly was carefully considered and tested in a wind tunnel for its shape and inertia, in order to find the best possible performance and stability even in the turbulent conditions of mountainous regions. During the research and development

period numerous prototype and preproduction units were submitted to environmental tests, some in severe mountain climate. The sensor survived the tests very well.

Like all Vaisala equipment, the heated vane also has successfully passed EMC, ESD and transient surge tests, which are required for receiving a CE approval as a sign of compliance with the relevant rules and regulations of the European Community. Passing successfully the tests was already guaranteed by design – for example, radiated interference was cut to minimum by using sine-wave (instead of square-wave) excitation for heating of the rotating parts. Also, precautions were taken and tests made beforehand for the new 500-volt surge test, passing of which will not be required until the year 2001.

All the previously mentioned improvements made to the WAA252 (compared to the WAA251) apply to the WAV252 as well. Its main properties and operating principles are presented in Figure 3.

The vane requires less heating power than the anemometer

Only 30 watts of heating power is applied to the vane and tail assembly (compared to 50 W for the WAA252). This is because the vane is always aligned with the wind, with only its narrow front edge facing towards the airflow. This is a minimal area for the snow to get stuck to. Also, the total surface area of the vane and tail assembly is smaller than that of the cup-wheel.

The heating elements in the vane and tail assembly have been arranged so that the vane's frontal area and the tail's counterweight are given relatively more heating power than the other parts, as they are the most exposed to the wind. In addition, the air passing these parts will catch some of their heat and therefore will not have the same cooling effect when passing the rest of the vane surface.

The WAV252Y – a heated yaw vane for windmills

A special version of the heated vane is available for applications in which only simple yaw information is required. The WAV252Y is solely intended for windmill direction control purposes. It has three output signals indicating whether the windmill deviates excessively from the prevailing wind direction and, if it does, whether the deviation is to the left or the right. ■

WAA252 Heated Anemometer.

WAV252 Heated Wind Vane.