Ultrasonic Anemometer 2D

Measurement of Wind direction and Wind velocity

- highest precision
- maintance-free / with heating
- digital and analogue outputs

1. Range of Application

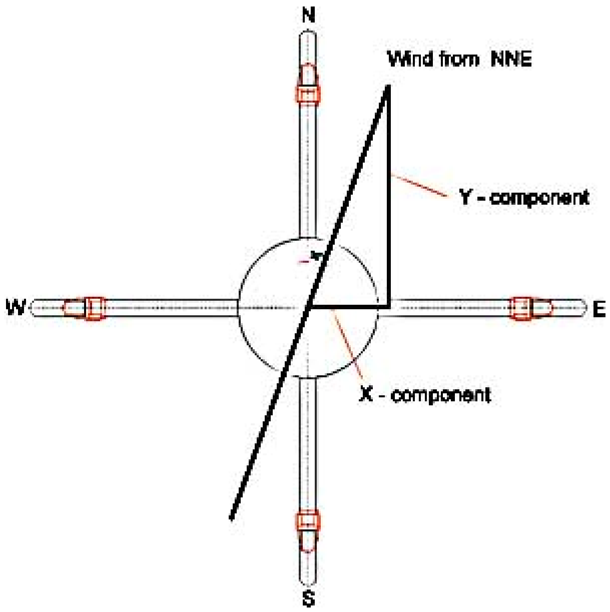
The **Ultrasonic Anemometer 2D** is designed to detect the horizontal components of wind velocity and wind direction as well as the virtual temperature in two dimensions. Due to its very short measurement intervals, the instrument is ideal for the inertia free measurement of gusts and peak values.
The accuracy of the air temperature measurement (virtual temperature) surpasses that one of the classic method where the temperature transmitter is used in a weather and thermal radiation shield.
The measured data are available as analogue signals or as a data telegram over a serial interface. The anemometer is equipped with an automatic heating for the instrument body as well as for the sensors so that the measuring results, in case of critical ambient temperatures, are not affected by ice, snow or rainfall.

2. Mode of Operation

The **Ultrasonic Anemometer 2D** consists of 4 ultrasonic transformers, in pairs of 2 which are opposite each other at a distance of 200 mm.
The two measurement paths thus formed are vertical to each other.
The transformers act both as acoustic transmitters and acoustic receivers.
The respective measurement paths and their measurement direction are selected via the electronic control. When a measurement starts, a sequence of 8 individual measurements in all 4 directions of the measurement paths is carried out at maximum speed.
The measurement directions (acoustic propagation directions) rotate clockwise, first from south to north, then from west to east, from north to south and finally from east to west.
The mean values are formed from the 8 individual measurements of the path directions and used for further calculations.
A measurement sequence takes approx. 20 msec at +20°C.

3. Measurement Principle

3.1 Wind velocity and direction



The speed of propagation of the sound in calm air is superposed by the velocity components of an air flow in wind direction.
A wind velocity component in the direction of the propagation of the sound supports the speed of propagation, thus leading to an increase in the speed. A wind velocity component opposite to the direction of propagation, on the contrary, leads to a reduction of the speed of propagation.
The speed of propagation resulting from the superposition leads to different propagation times of the sound at different wind velocities and directions over a fixed measurement path.
As the speed of sound is very dependent on the air temperature, the propagation time of the sound is measured on both of the measurement paths in **both** directions. In this way, the influence of the temperature dependent speed of sound on the measurement result can be eliminated by subtracting the reciprocals of the measured propagation times.
By combining the two measuring paths which are at right angles to each other, one obtains the measurement results of the sum and the angle of the wind velocity vector in the form of rectangular components.
After the rectangular velocity components have been measured over the measurement path, they are then transformed by the µ-processor of the anemometer into polar coordinates and output as sum and angle of wind velocity.

3.2 Virtual Temperature

As previously mentioned, the speed of the propagation of sound is highly dependent on the air temperature, but is hardly affected by air pressure and humidity. Thus these physical properties of gases can be used to measure air temperature.
As this is a measurement of gas temperature which is made without thermal coupling to a measurement sensor, it is called the "virtual temperature".
The advantages of this measured variable is, on the one hand, its inertia free reaction to the actual gas temperature, and, on the other, the avoidance of measurement errors such as those which occur when a solid state temperature sensor is heated up by radiation.
Measuring sensors in a weather and thermal radiation shield show values which are, on the one hand, too high, due to sun irradiation, and on the other hand too low, due to evaporation cooling with rain and wind.

The measuring errors of those thermometers in practice can be up to ± 2 °K.
The 2D-Anemometer achieves a measuring accuracy of ± 1 °K over the entire temperature range from 40 °C to + 70°C, thus offering a very precise determination of the air temperature without the disadvantages caused by the use in a weather and thermal radiation shield.

Technical Data:

Wind velocity

Measuring range	0...60 m/s
Resolution	0.1 m/s
Accuracy	± 0,1 m/s at, 0 ... 5 m/s resp. 2% ±0,1 m/s from meas. value > 5 m/s

Wind direction

Measuring range	0...360°
Resolution	1°
Accuracy	± 1.5°

Data output digital

Interface	RS 422/485
Baud rate	1200, 2400, 4800, 9600, 19200 adjustable
Output	Instantaneous value
Direction vectorial	Gliding mean values 1 sec.; 10 sec.; 1 min.; 2 min.; 10 min.
Output rate	10 per second
Status identification	heater, transformer, electronic

Data output analogue

Electr. output	0...10 V or 0/4...20 mA
Resolution	12 bit
Output rate	1 Hz

Windcom Messtechnik GmbH
Tel.:+49 (0) 40 68 28 39 29 • Fax: +49 (0) 40 68 28 59 36
www.windcom.de
windcom@windcom.de

General

Internal meas. rate	ca. 400 Hz at 25 °C
Operating voltage:	
electronic	12...24 V AC/DC, max. 3 VA
heater	24 v AC/DC, max. 70 VA
Temperature range	- 40 ... +70 °C
Mounting	to a mast tube 1½", for ex. DIN 2441
Type of connection	16 pole plug connection in the shaft
Weight	approx. 2.5 kg

Virtual Temperature

Meas. range	- 40...+70 °C
Accuracy	± 1 °C (-30...+50 °C ±0.5 °K)
Resolution	0.1 °C