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Multiple Measurements in a Single Instrument

New Possibilities for Weather Measurement

The Vaisala Weather Transmitter WXT510 is a revolutionary multi-sensor targeted for numerous applications in weather sensitive businesses outside professional meteorology. The WXT510 measures all the six most essential weather parameters: barometric pressure, relative humidity, temperature, liquid precipitation, wind speed and wind direction. Due to the user friendly configuration tool and numerous interface alternatives, the weather transmitter is easily connected to data loggers or controllers.

Never before has it been so easy to set up a weather station incorporating all essential weather parameters. Before the introduction of the WXT510, the incorporated sensor technology has only been available in weather stations aimed for true professionals. World class measurement performance is brought to a new attractive price level due to high level of integration.

The Weather Transmitter concept is unique and will change the way weather is being measured

The Vaisala Weather Transmitter WXT510 is a result of systematic analysis of different target markets and their customer needs. Thorough fundamental research into sensor technology by Vaisala's research unit followed by determined R&D phase created a product to match the customers' needs and expectations.

For the pressure, temperature and humidity measurements, this product relies on Vaisala's long and proven experience from numerous applications, where as for precipitation and wind measurements Vaisala introduces new technologies.

Systematic analysis of customer needs

The WXT510 is designed to be used with automated weather stations in various applications where logistics, installation and maintenance issues as well as costs are critical.

In the beginning of the development project, a thorough analysis of the key success factors for the weather transmitter design was carried out. The key findings of the analysis were:

- the product should be easy to configure to match the needs of numerous different applications
- product should have self diagnostics operation
- there should be an option for protected connectors
- it should have mainten- ➤



The Vaisala Weather Transmitter WXT510 combines six most essential weather parameters in one instrument. The WXT510 is only 24 cm tall, has no moving parts and is therefore maintenance-free.

- ance interval longer than 1 year
- it should have resistance against corrosive environments and,
 - it should be capable of maintaining its accuracy over a period of two years

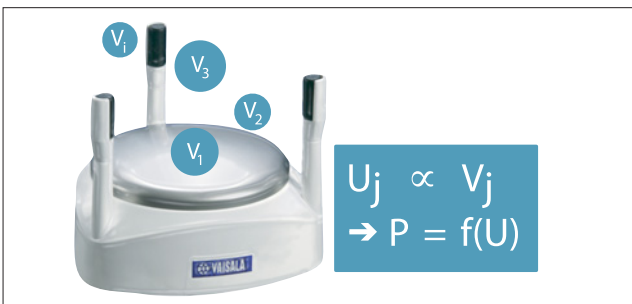
The Weather Transmitter

WXT510 has been designed to meet these needs.

For weather sensitive businesses requiring compact, affordable and durable instruments

Meteorological data is very sel-

Operating principle of the Vaisala RAINCAP® Sensor



The precipitation sensor detects the impact of individual raindrops. The voltage signals U_j resulting from the impacts are proportional to the volume of the drops V_j and therefore, the signal of each drop can be directly converted to accumulated precipitation P .

dom useful as such. It needs to be translated into actionable information which is available on a timely fashion at an affordable price. This is typically done by an automated weather station or a network of stations. This data / information transfer can also take place in the personal computer, process controller or a display device. Technically the application software could run in the mobile phone, PDA or some other type of portable terminal device. The Weather Transmitter is intended to be the heart of such systems.

The Weather Transmitter is designed for weather sensitive businesses, where the user of the weather information is a professional whose daily business depends on weather information. It is also typical for these businesses that the user does not need the weather information continuously, but the information has to be easily available in timely fashion. The weather sensitive businesses are numerous. To name just a few: agriculture with its different applications like irrigation, pesticide control or disease modeling, wind turbine control, air quality measurements and forecasting, boat marina services, ski resort services are typical examples of weather sensitive businesses.

The Weather Transmitter is not targeted for those professional meteorologists who require the highest achievable measurement accuracy. The high absolute accuracy is compromised in favor of durability and maintenance issues as well as affordability. On the other hand the measurement accuracy of the Weather Transmitter is clearly better than the measurement performance of the low-end weather stations targeted for consumer use.

The Weather Transmitter WXT510 is an ideal building block for dense networks because it is compact, is totally based on solid state technology and has competitive price com-

pared to present instruments with similar performance.

Proven Vaisala sensor technology combined with revolutionary innovations

Accurate measurement begins with sensors. Vaisala has decades of experience in designing and manufacturing sensors and meteorological instruments with field proven reliability and accuracy. Now Vaisala has combined the most important weather measurements in one transmitter, the Vaisala Weather Transmitter WXT510.

Pressure temperature and humidity measurement

Barometric Pressure, temperature and relative humidity are integrated into one measurement unit, so called PTU module. Very similar PTU module is in use in Vaisala's radiosondes. Using the same components as the radiosonde allows us to benefit from economies of scale. In addition to economical benefits the technology which is already in use in radiosondes gives a very strong contribution to the reliability of the PTU measurement.

Care in calibration

The final calibration of the PTU module takes place in the Vaisala's calibration machine CAL4.

The calibration machine CAL4 carries out individual calibration of each sensor. It has stable and accurately characterized calibration chambers and high precision reference equipment that are internationally traceable. The Vaisala Measurement Standards Laboratory (MSL) is responsible for managing the calibration of the reference equipment used in CAL4. The MSL maintains a Measurement Equipment Database, which contains the calibration history of all the measurement equipment used in conjunction with CAL4. The calibration coeffi-

ponents of the PTU module are stored in the module itself and the whole PTU module is replaceable and available as a spare part.

Wind measurement with no moving or wearing parts

Sonic anemometry is gaining popularity not only within professional meteorology but also within other weather sensitive businesses. This is mainly because of sonic technology is becoming more affordable as well as other undeniable benefits of the sonic anemometers. The mechanical sensors have parts that wear with use. The performance of the mechanical sensors is also degraded by contamination of natural sources like: salt, dust or sand. In addition to limitations mentioned above, the mechanical sensors have the threshold wind speed below which they fail to respond. Finally mechanical sensors give slower respond to rapid changes because of their mechanical inertia.

In the WXT510, both wind speed and direction are measured using an advanced ultrasonic sensor, the Vaisala WINDCAP® Sensor. The same technology is used in the WS425, Vaisala's high-end sonic wind sensor. The WINDCAP® Sensor uses ultrasound to determine horizontal wind speed and direction.

The Vaisala sonic technology has an additional unique benefit; namely an equilateral triangle configuration, which allows the use of turbulence-free measurement path regardless of the wind direction.

Vaisala RAINCAP® Sensor has no moving parts and therefore requires minimum maintenance

The precipitation measurement is based on the Vaisala's proprietary RAINCAP® technology. The sensor comprises of a steel cover and a piezo electrical sensor mounted on the bottom surface of the cover. The precipitation sensor detects the impact of

individual raindrops and the signal exerting from the impact is proportional to the volume of the drops. Vaisala RAINCAP® Sensor gives more detailed information about precipitation - in addition to accumulated rain fall it also measures, rain intensity and duration of the rain - all this in real time.

Because the rainfall is measured drop by drop, the precipitation measurement of the Weather Transmitter is not affected by evaporation or wetting losses. The weather transmitter is also immune to flooding induced errors, because the sensor does not collect water.

Rainfall is known to be very local phenomenon. In other words large spatial differences exist in rainfall distribution. For this reason large enough number of measurement points contributes far more to the overall accuracy of precipitation measurement than the accuracy of one individual rain gauge.

Easy to interface with other devices or systems

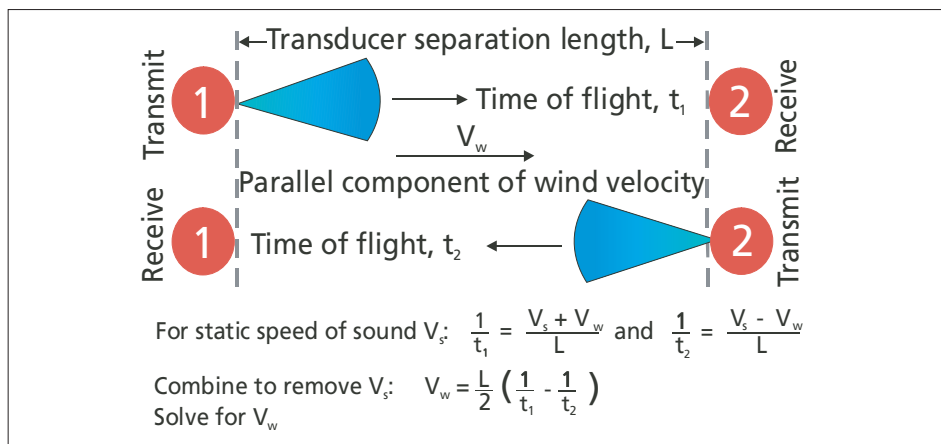
The Vaisala Weather Transmitter WXT510 is an excellent choice for applications where power consumption is a critical factor. During the idle mode the device typically consumes only 0.1 mA.

Very wide input voltage range from 5.3 to 30 VDC makes the product very easy to integrate to almost any system on the field.

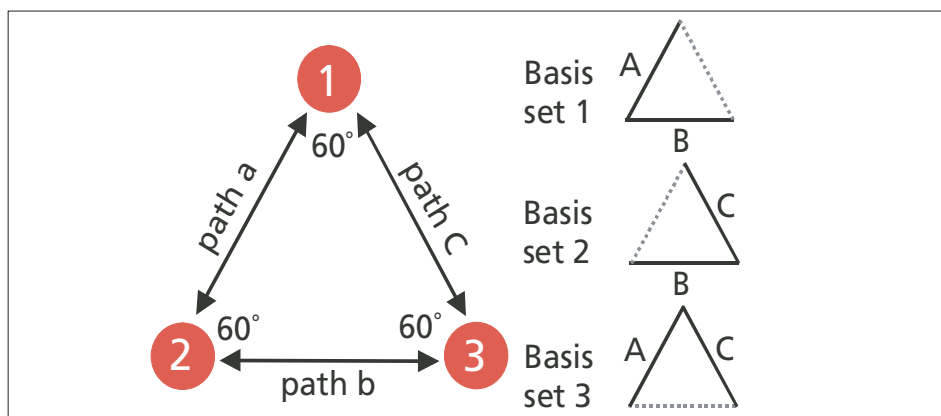
The WXT510 communicates with the host via a bi-directional serial line. It allows a choice of four configurable data communication modes: SDI-12, RS-232, RS-485 and RS-422.

The WXT510 is a compact, durable and easy-to-use multi-sensor, which requires minimum maintenance. It is easy to purchase, install and use and therefore it opens new possibilities in weather measurement. The Vaisala Weather Transmitter changes the way you measure weather. ●

Operating principle of the Vaisala WINDCAP® Sensor



Time-of-flight for a sonic impulse from the transmit transducer to the receive transducer is determined for both directions. Simple algebra allows solving for the parallel component of wind velocity independently of the static speed of sound.



The equilateral triangle configuration of the three transducers provides three possible sets of basic vectors. The combinations yield bi-directional measurements on the paths labeled A, B and C. These measurements are used to determine the wind velocity components parallel to each of the three paths.