Vaisala Weather Transmitter WXT510
The Most Essential of Weather

The Vaisala Weather Transmitter WXT510 is a compact and lightweight multi-sensor instrument that measures the most essential weather parameters. It is a configurable product that can measure wind speed and direction, liquid precipitation, barometric pressure, temperature and relative humidity — all in one transmitter.

Affordable weather intelligence
The demand for accurate weather information is constantly increasing. In addition to professional meteorology, there are also numerous businesses that are weather sensitive.

To meet the growing needs for easy-to-access weather data, the Vaisala Weather Transmitter WXT510 has been developed. It combines the modern sensor technology, advanced design and decades of experience in environmental measurements resulting in a high quality instrument that reliably measures all essential weather parameters.

The WXT510 is truly flexible and it can be configured to meet most user requirements. Easy and fast installation, as well as low power consumption make it ideal for use in weather stations or applications where light weight and compactness are an advantage. As the WXT510 has no moving parts, it is durable and has long maintenance intervals. The materials used are also highly resistant against UV radiation and corrosion.

Wind measurement
Both wind speed and direction are measured using the advanced Vaisala WINDCAP® Sensor. The sensor uses ultrasound to determine horizontal wind speed and direction. The array of three equally spaced ultrasonic transducers on a horizontal plane is an ideal, Vaisala proprietary design. It ensures accurate wind measurement from all wind directions, without blind angles or corrupted readings.

Precipitation measurement
The precipitation measurement is based on the Vaisala RAINCAP® Sensor, which detects the impact of individual rain drops. The signals exerting from the impacts are proportional to the volume of the drops. Hence, the signal from each drop can be converted directly to the accumulated rainfall.

Compared to traditional precipitation gauges, the Vaisala RAINCAP® Sensor gives more detailed information about precipitation. The WXT510 measures accumulated rainfall, rain intensity and duration of the rain — all in real time. Due to the measurement method, flooding, clogging as well as wetting and evaporation losses in rain measurement are eliminated.

Features/Benefits
- Six most essential weather parameters combined in one instrument
- Accurate and stable measurement
- Proven Vaisala sensor technology:
  - Vaisala WINDCAP® Ultrasonic Wind Sensor for wind speed and direction
  - Vaisala RAINCAP® Sensor for advanced precipitation measurement
  - Vaisala BAROCAP® Sensor for barometric pressure
  - Vaisala THERMOCAP® Sensor for temperature
  - Vaisala HUMICAP® Sensor for relative humidity
- No moving parts
- Low power consumption
- Compact and light weight
- Fast and simple to install
- Low maintenance
- Vaisala Configuration Tool for PC
Accurate and Stable Measurement

The Vaisala RAINCAP® Sensor is the only maintenance-free precipitation sensor on the market.

**PTU module for barometric pressure, temperature and humidity**

Barometric pressure, temperature and humidity measurements are combined in an advanced PTU module utilizing capacitive measurement method for each parameter.

Barometric pressure is measured using the silicon-based Vaisala BAROCAP® Sensor. The sensor has minimal hysteresis and excellent repeatability, as well as outstanding temperature and long-term stability. The measurement range for pressure is from 600 to 1100 hPa.

Temperature measurement is based on the ceramic Vaisala THERMOCAP® Sensor. The measurement range is from -52 to +60 °C.

Humidity measurement is based on the Vaisala HUMICAP® technology. The Vaisala HUMICAP® Sensor is highly accurate and it offers excellent long-term stability in a wide range of environments and negligible hysteresis. The measurement range for humidity is 0...100 %RH.

The whole PTU module is replaceable and available as a spare part.

**Heating to ensure constant data availability**

In order to have measurement data constantly available and ensure correct measurement also during snowfall, the WXT510 offers heating for the wind and rain sensors. The heating circuit is separate from the operational power, which makes it possible to use separate supplies. The nominal input level for heating voltage is 12 V or 24 V (with automatic switch-over), either DC, AC or rectified AC. The WXT510 has an automatic control circuit that switches the heating on only at low temperatures.

**Low power consumption and wide input voltage range**

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 less than 0.1 mA.

The WXT510 has a wide input voltage range. Any 5... 30 VDC power supply can be used as long as it meets all applicable safety regulations.

**Easy settings, installation and maintenance**

The WXT510 is supplied pre-configured from the factory. If the factory settings need to be altered, the Windows® based Vaisala Configuration Tool, is available.

The WXT510 can be mounted either on top of a pole mast or on to a cross arm. For facilitating the installation to the pole mast and eliminating the risk of misalignment during the use an optional mounting kit is available. With the mounting kit the north alignment needs to be performed only once.

The Vaisala Weather Transmitter WXT510 is calibrated at the factory and requires very little maintenance. The only maintenance actions are cleaning the transmitter when necessary and replacing the PTU module. Both rain and wind measurements are practically calibration free. The PTU unit has a recommended calibration interval of two years.
Technical Data

**Wind**

**Wind speed**
- Range: 0...60 m/s
- Response time: 0.25, 0.50, 1.00 s
- Average, maximum and minimum available variables
- Accuracy: ±0.3 m/s or ±3% whichever is greater for the measurement range 0...35 m/s, ±5% for the measurement range 36...60 m/s
- Output resolution: 0.1 m/s (km/h, mph, knots)
- Units available: m/s, km/h, mph, knots

**Wind direction**
- Azimuth: 0...360°
- Response time: 0.25, 0.50, 1.00 s
- Average, maximum and minimum available variables
- Accuracy: ±3°
- Output resolution: 1°

**Measurement frame**
- Averaging time: 1...3600 s (= 60 min), at one second steps
- Update interval: 1...3600 s (= 60 min), at one second steps

**Liquid Precipitation**

**Rainfall**
- Collecting area: 60 cm²
- Output resolution: 0.01 mm (0.001 in)
- Accuracy: 5% *
- Units available: mm, in

**Rain duration**
- Counting each ten second increment whenever droplet detected
- Output resolution: 10 s

**Rain intensity**
- One minute running average in ten second steps
- Range: 0...200 mm/h
- (broader range with reduced accuracy)
- Output resolution: 0.1 mm/h (0.01 in/h)
- Units available: mm/h, in/h

**Hail**
- Cumulative amount of hits against collecting surface
- Output resolution: 0.1 hits/cm² (1 hits/in²)
- Units available: hits/cm², hits/in²

**Hail duration**
- Counting each ten second increment whenever hailstone detected
- Output resolution: 10 s

**Hail intensity**
- One minute running average in ten second steps
- Output resolution: 0.1 hits/cm² (1 hits/in²)
- Units available: hits/cm², hits/in²

* Due to the nature of the phenomenon, deviations caused by spatial variations may exist in precipitation readings, especially in short time scale. The accuracy specification does not include possible wind induced error.

**PTU module = Barometric Pressure, Air Temperature and Relative Humidity**

**Barometric Pressure**
- Range: 600...1 100 hPa
- Accuracy: ±0.5 hPa at 0...+30 °C (+32...+86 °F), ±1 hPa at -52...+60 °C (-60...+140 °F)
- Output resolution: 0.1 hPa, 10 Pa, 0.0001 bar, 0.01 mmHg, 0.01 inHg
- Units available: hPa, Pa, bar, mmHg, inHg

**Air Temperature**
- Range: -52 ... +60 °C (-60...+140 °F)
- Accuracy (for sensor element) at +20 °C (+68 °F): ±0.3 °C (±0.5 °F)
- Accuracy over temperature range (see graph)

**Relative Humidity**
- Range: 0...100 %RH
- Accuracy: ±3 %RH within 0...90 %RH, ±5 %RH within 90...100 %RH
- Output resolution: 0.1 %RH

**PTU Update Interval**
- Update interval: 1...3 600 s (= 60 min), at one second steps
Technical Data, Dimensions

**General**
- **Self-diagnostic**: separate supervision message, unit/status fields to validate measurement quality
- **Start-up**: automatic, <10 seconds from power on to the first valid output
- **Communication protocols**: SDI-12 v1.3, ASCII automatic & polled, NMEA-0183 v3.0 with query option
- **Port H/W**: SDI-12, RS-232, RS-485, RS-422
- **Baud rate**: 1 200, 2 400...115 200
- **Operating temperature**: -52...+60 °C (-60...+140 °F)
- **Storage temperature**: -60...+70 °C (-76...+158 °F)
- **Operating humidity**: 0...100 %RH

**Dimensions**
- **Height**: 240 mm (9.4 in)
- **Diameter**: 120 mm (4.7 in)
- **Weight**: 650 g (1.43 lbs)

**Power Supply**
- **Input Voltage**: 5...30 VDC
- **Power consumption on average**
  - minimum: 0.07 mA @ 12 VDC (in SDI-12 mode)
  - maximum: 13 mA @ 30 VDC (with continuous measurement of all parameters)
  - typical: 3 mA @ 12 VDC (with default measuring intervals)
- **Heating voltage options**: DC, AC, full wave rectified AC
- **Recommended ranges**
  - 12 VDC ±20%, 1.1 A max.
  - 24 VDC ±20%, 0.6 A max.
  - 68 V_{pp} ±20% (AC), 0.6 A_{max} max.
  - 34 V_{pp} ±20% (f/w rect. AC), 0.6 A_{max} max.
- **Absolute max**
  - 30 VDC
  - 84 V_{pp} (AC)
  - 42 V_{pp} (f/w rect. AC)

**Electromagnetic compatibility**
Incorporates Latest Sensor Technology

Operating Principles of Wind and Rain Measurement

**Vaisala WINDCAP® Sensor**

The Vaisala WINDCAP® Sensor enables wind measurement with no moving or wearing parts. The measurement of wind speed and direction is based on sonic technology.

The Vaisala WINDCAP® technology is used in all Vaisala Ultrasonic Wind Sensors.

\[ V = \frac{1}{2} \left( \frac{1}{t_1} - \frac{1}{t_2} \right) \]

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.

**Vaisala RAINCAP® Sensor**

The precipitation measurement used in the Vaisala Weather Transmitter WXT510 is based on Vaisala’s proprietary RAINCAP® technology. This acoustic rain measurement technology measures rainfall literally drop by drop, which means that the measurement is not affected by evaporation or wetting losses. In addition, the measurement is immune to flooding induced errors, because the sensor does not collect water.

The Vaisala RAINCAP® Sensor has no moving parts and therefore it requires practically no maintenance.

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 \( P \).

\[ U_j \propto V_j \]

\[ P = f(U) \]